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United States Department of Energy

WILDLIFE MITIGATION AND MONITORING REPORT GUNNISON, COLORADO, SITE

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Uranium Mill Tailings Remedial Action Project

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WILDLIFE MITIGATION AND MONITORING REPORT GUNNISON, COLORADO, SITE

April 1997

Prepared for
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LIST OF ACRONYMS

Acronym	Definition
CDOW	Colorado Department of Wildlife
DOE	U.S. Department of Energy
EA	environmental assessment
UMTRA	Uranium Mill Tailings Remedial Action

1.0 INTRODUCTION

The Uranium Mill Tailings Remedial Action (UMTRA) Project is administered by the U.S. Department of Energy (DOE); its purpose is to cleanup uranium mill tailings and other contaminated material at 24 UMTRA Project sites in 10 states. This report summarizes the wildlife mitigation and monitoring program under way at the Gunnison UMTRA Project, Gunnison, Colorado. Remedial action at the Gunnison site was completed in December 1995 and is described in detail in the Gunnison completion report (DOE, 1996a). The impacts of this activity were analyzed in the Gunnison environmental assessment (EA). These impacts included two important game species: the pronghorn antelope (*Antilocapra americana*) and sage grouse (*Centrocerus urophasianus*) (DOE, 1992). Haul truck traffic was predicted to limit antelope access to water sources north of the Tenderfoot Mountain haul road and that truck traffic along this and other haul roads could result in antelope road kills. Clearing land at the disposal cell, haul road and borrow site activities, and the associated human activities also were predicted to negatively impact (directly and indirectly) sage grouse breeding, nesting, loafing, and wintering habitat. As a result, an extensive mitigation and monitoring plan began in 1992 (BLM, 1992). Most of the monitoring studies are complete and the results of these studies, written by different authors, appear in numerous reports. This report will:

- Analyze existing impacts and compare them to predicted impacts.
- Summarize mitigation measures.
- Summarize all existing monitoring data in one report.
- Analyze the effectiveness of the mitigation measures.

2.0 STUDY SITE AND EXISTING CONDITIONS

2.1 STUDY SITE

The study site consists of habitat that was directly and indirectly impacted by the cleanup of uranium mill tailings and other contaminated material at the Gunnison UMTRA Project site. It includes the landfill disposal cell, Six-Mile Lane and Chance Gulch borrow sites, Tenderfoot Mountain haul road, and haul roads to the two borrow sites (Figure 2.1). This does not include the former processing site in Gunnison. The study site also includes riparian areas fenced to exclude livestock, riparian areas created in sagebrush habitat (Figure 2.2), the Tomichi Allotment on BLM land (Figure 2.1), and sage grouse leks and riparian areas examined during the monitoring studies.

Most of the study areas are within the Gunnison Basin in a plant community dominated by big sagebrush (*Artemisia tridentata*). An estimated one-third of the basin is covered with sagebrush (BLM, 1980). Big sagebrush growth form is variable, depending on site conditions. On the dry south slopes it is short, usually less than 12 inches (30 centimeters [cm]) tall and has a canopy coverage of less than 20 percent. Big sagebrush on wetter sites is taller, typically over 20 inches (51 cm) and is not so widely spaced (canopy coverage greater than 30 percent) (Hupp, 1987). Along drainages, big sagebrush grows taller and denser than at other sites in the Gunnison Basin. An ecological study of 1920-acre (ac) (780-hectare [ha]) area just west of the landfill disposal site estimated a total vegetative cover in big sagebrush habitat of 36.9 percent. The remainder is bare ground, rock, and litter. Big sagebrush accounted for 77 percent of this vegetative cover and there were an estimated 16,700 stems per ac (41,300 per ha); big sagebrush comprised an estimated 95 percent of these stems (CDM, 1981). Other common shrubs in this habitat are rabbitbrush (*Chrysothamnus* sp.), broom snakeweed (*Gutierrezia sarothrae*), and black sagebrush (*Artemisia nova*).

Dry grassland habitat occurs in small areas within the big sagebrush habitat. It is common on the upper south-facing slopes as well as in some flat areas. Blue gramma (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), squirreltail (*Sitanion hystrix*), and Indian ricegrass (*Oryzopis hymenoides*) dominate these grasslands. Low-lying, widely-scattered shrubs such as big sagebrush, rabbitbrush, and winter fat (*Eurotia lanata*) also are present (CDM, 1981).

During the biological surveys at the Gunnison study site, 141 species of plants were identified in the upland plant communities in the disposal cell area, borrow sites, and haul roads (see Table A.1 in Appendix A). The 141 plant species include 27 grass species, 28 tree and shrub species,, and 86 forb species (EES, 1992, 1991, 1986).

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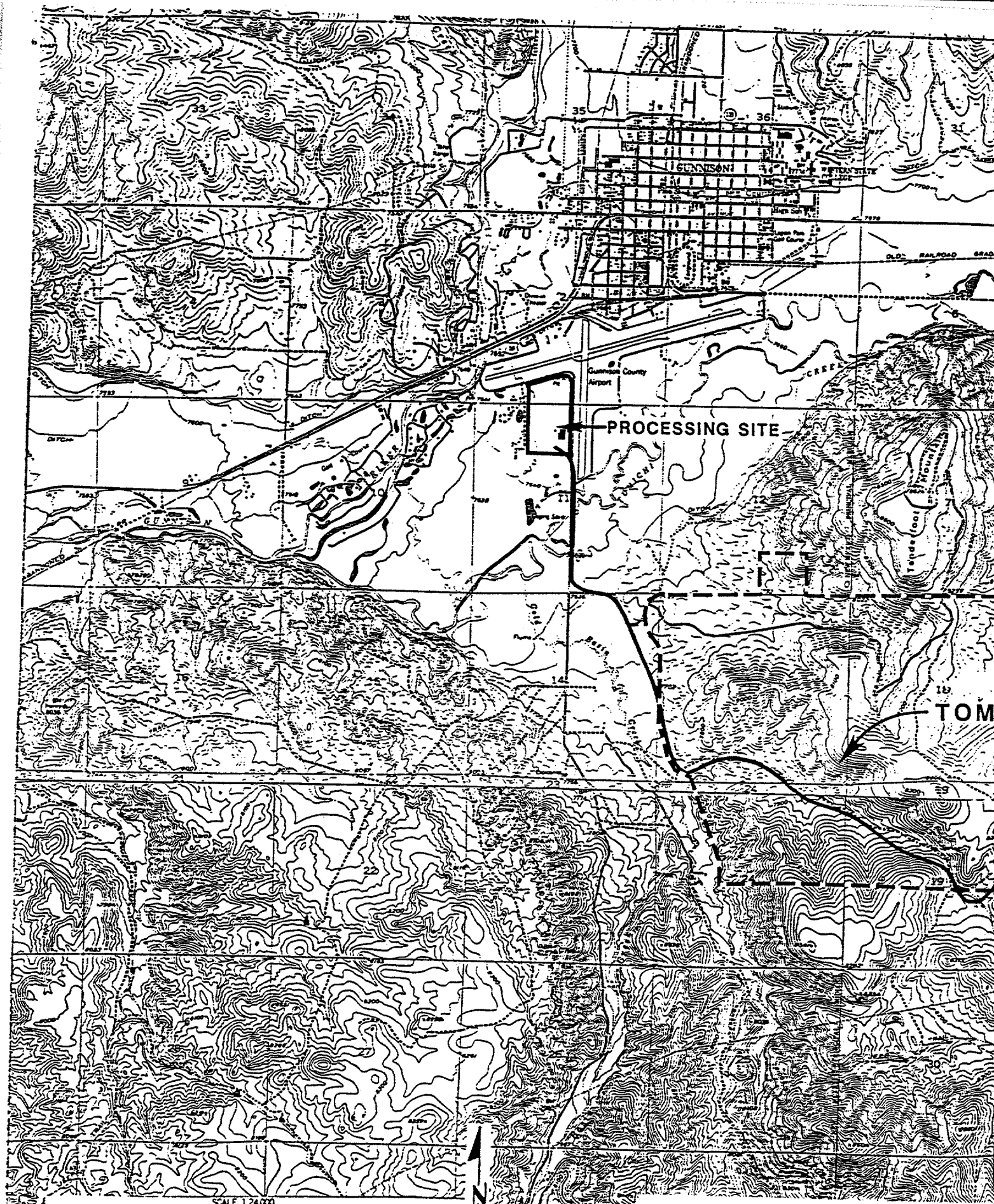
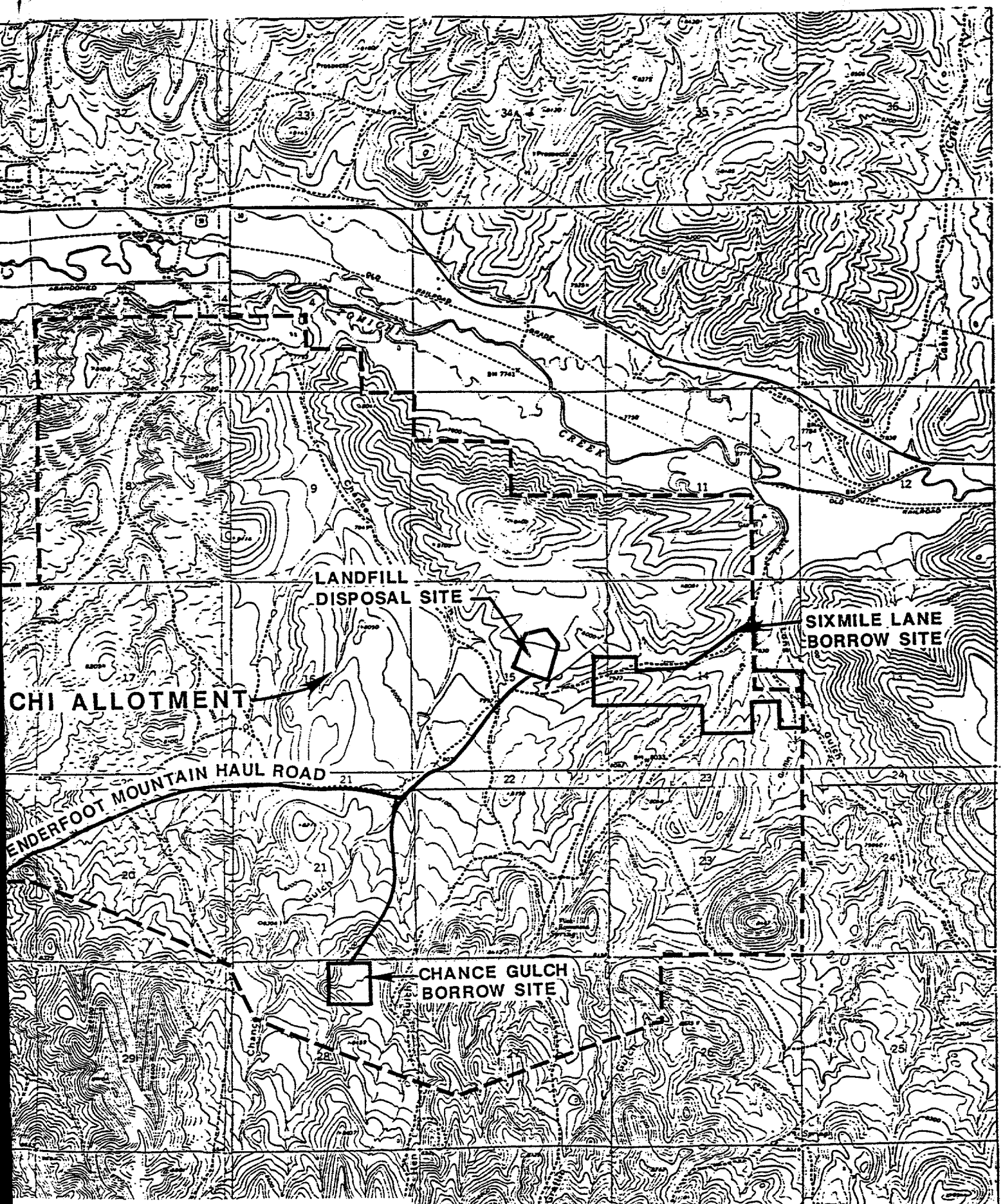


FIG
LOCATIONS OF LANDFILL
AND CHANCE BULCH BORROW SITE
AND TOMICHI ALLOTMENT, GUNNISO



URE 2.1
DISPOSAL CELL, SIX-MILE LANE
S, TENDERFOOT MOUNTAIN HAUL ROAD,
N AND SAGUACHE COUNTIES, COLORADO

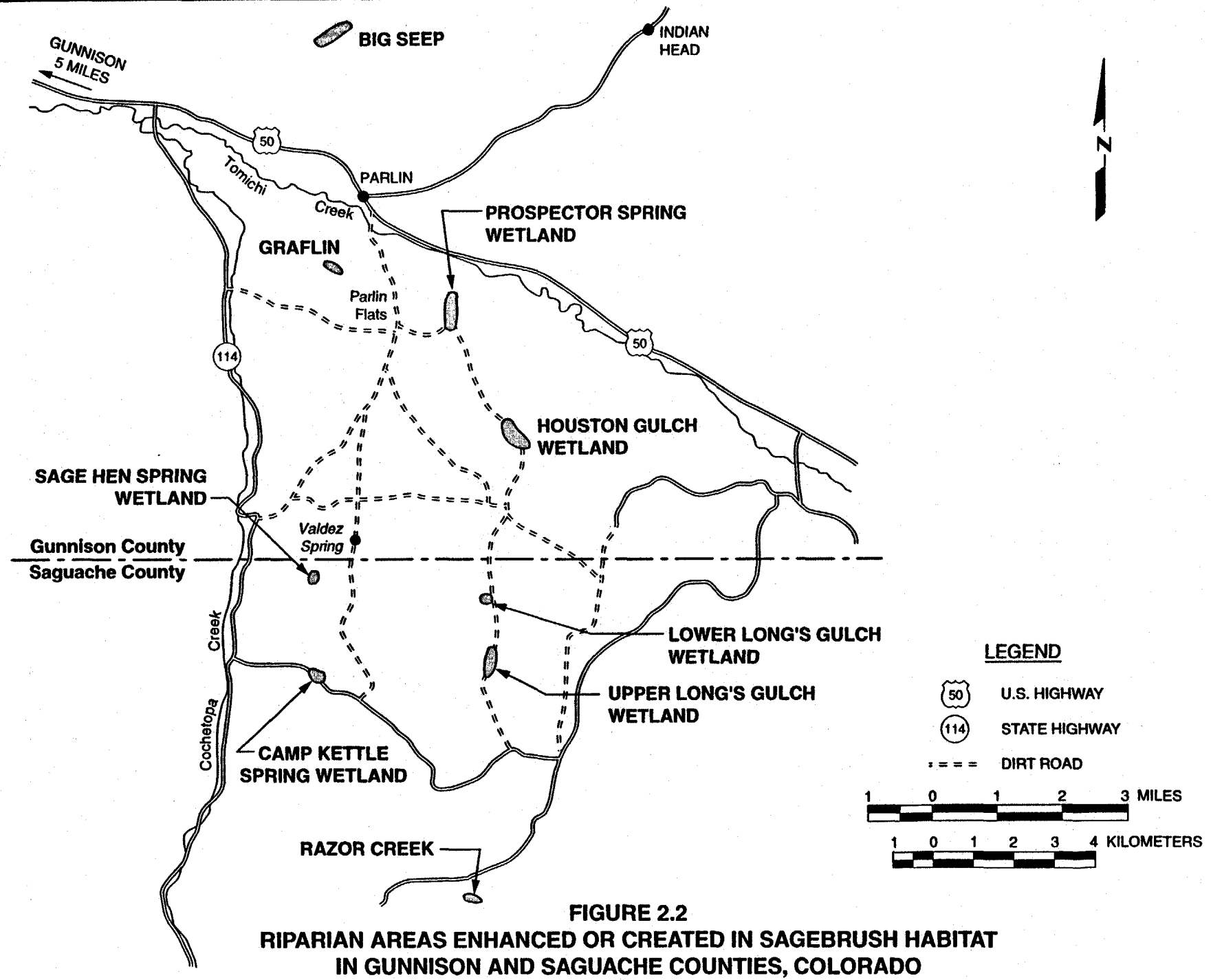


FIGURE 2.2
RIPARIAN AREAS ENHANCED OR CREATED IN SAGEBRUSH HABITAT IN GUNNISON AND SAGUACHE COUNTIES, COLORADO

MAC: SITE/GUN/WETLAND11-96/SIXWETLANDS

Wildlife and wetlands mitigation for the Gunnison project includes the enhancement of spring-fed riparian areas. Enhancement occurred when livestock were excluded from these areas. Floristic surveys and quantitative vegetation sampling have been conducted at six of these sites on BLM land. Plant communities were separated according to the availability of water. The lower riparian plant communities generally had surface or near-surface water available from the springs. Because less water was available to them, upper riparian plant communities were drier. Sampling before the sites were fenced to exclude livestock showed the vegetation was grazed heavily and plants in the dominant species were typically 2 to 5 inches (5 to 8 cm) tall. Percent bare ground in the lower riparian plant communities ranged from 3 to 44 and averaged 20 percent. In the upper riparian plant communities the range was 4 to 29 percent with an average of 24 percent (DOE, 1994).

Vegetation was monitored along 17 permanent transects for 3 years after the sites were fenced, before the 1994 grazing season. By 1996, the average plant height had increased substantially. In the lower riparian grassland plant communities, plant height was almost 20 inches (51 cm) and in the upper riparian types it was 10 inches (25 cm). Percent bare ground had decreased; it ranged from 0 to 14 percent and averaged about 5 percent in the lower riparian plant communities. In the upper riparian plant communities, plant height ranged from 13 to 22 percent and averaged about 17 percent (DOE, 1997).

A floristic survey of the six wetland mitigation areas identified 177 plant species (see Table A.2 in Appendix A). Most of these species are grasses and forbs, with a few woody species such as willow (*Salix* sp.), big sagebrush, rabbitbrush, whitestem gooseberry (*Ribes inerma*), and prickly current (*Ribes lacustre*) (DOE, 1994).

2.2 PREREMEDIATION CONDITIONS

The Gunnison EA provides a general description of the biological resources in the disposal cell area, borrow sites, and haul roads (DOE, 1992). The following is a more detailed description of the pronghorn antelope and sage grouse populations prior to remedial action. In addition, since the Project had more potential impact to the sage grouse, pertinent information is provided (DOE, 1992).

2.2.1 Pronghorn antelope

Historically, the pronghorn antelope existed on the Gunnison Basin but was eliminated from the area in the early 1900s. It is not known why the pronghorn disappeared although a complete die-off during a severe winter is possible. In 1980, the BLM and Colorado Department of Wildlife (CDOW) proposed transplanting a population to the Gunnison Basin in the Chance Gulch area (BLM, 1989). Analysis of the range-carrying capacity in the Chance Gulch area

indicated it could support a population of 250 antelope. To establish this population, a transplant of 200 antelope over a 3-year period was proposed.

On 21 December 1989, 105 pronghorn antelope were released in the Chance Gulch area. A study of herd movement patterns during their first year revealed the animals stayed in the Chance Gulch area until they dispersed from the wintering grounds in April; by summer, the herd had dispersed over a fairly wide area. Most of the heard returned to the Chance Gulch area for their second winter. This report concluded that transplanting the pronghorn antelope into the Chance Gulch area likely will be successful because the herd apparently established a wintering area and it increased slightly during the first year (Nicholl, 1991). The planned second and third releases of antelope did not occur because the CDOW hoped to determine the effects on to the herd of UMTRA Project-related activities in the Chance Gulch area.

2.2.2 Sage grouse

The historic sage grouse range included 26 counties in Colorado; this species currently occurs in 19 counties, including Gunnison and Saguache Counties. The elimination of the sage grouse from parts of its range is the result of "habitat type conversion, overgrazing, road and power development, and isolation from other grouse populations" (Braun, 1991). Within Colorado, there may be two subspecies of sage grouse. Grouse in the Gunnison Basin, when compared to grouse in northern Colorado, were found to be significantly smaller and to exhibit distinctly different acoustical and visual characteristics while displaying on the leks (Hupp and Braun, 1991).

The landfill disposal cell, borrow sites, and haul roads are located within the CDOW Small Game Management Unit 66. Sage grouse is the principal small game species in this area. Critical habitat features for the grouse include display grounds or leks used during the reproductive period (principally April and May in the Gunnison Basin); feeding and loafing habitat near the leks used during the display period; nesting habitat (May through July); brood habitat (May through August); and wintering areas (December through March).

Leks

Hupp (1987) identified four active leks in the Chance Gulch area. The estimated maximum number of male sage grouse attending these four leks in 1985 was 60; 10 were counted at lek A, 25 at lek B, 10 at Lek C, and 15 at lek D (Hupp, 1985). These four lek areas are referred to as the Chance Gulch leks. The Chance Gulch leks have been surveyed from 1957 to the present. For the last 15 years, the maximum number of male sage grouse has ranged from a low of 4 in 1984 to a high of 97 in 1992 (CDOW, 1995; Young, 1993; Zadra, 1994, 1995, 1996) (Table 2.1). Starting in 1992, at least four lek counts were conducted consistent with the recommendations of Emmons and Braun (1984).

Table 2.1 Population estimates for the Chance Gulch sage grouse population, Gunnison, Colorado, site

Year	Maximum lek count	Number of uncounted males	Number of females	Total
1985	53	53	212	318
1986	36	36	144	216
1987	45	45	180	270
1988	49	49	196	294
1989	55	55	220	330
1990	60	60	240	360
1991	60	60	240	360
1992	97	97	388	582
1993	69	69	276	414
1994	43	43	172	258
1995	70	70	280	420
1996	34	34	136	204

Ref.: CDOW, 1995; Young, 1993; Zadra, 1994, 1995, 1996.

Prior to 1992, the number of lek counts varied. For example, Hupp (1987) conducted two to four counts from 1984 through 1986.

Population estimates based on lek counts have been used in sage grouse management for a number of years, although a relationship between lek counts and population size has not been demonstrated (Emmons and Braun, 1984). The sage grouse population size data provided below allow yearly comparisons and do not necessarily represent the actual population size. The following population estimates are based on maximum lek counts, Braun's (1991b) assumptions above that there are twice as many uncounted males, and that hunter kill data indicate twice as many females as males in the population. Studies show that even if counts took place during the peak attendance periods, nonbreeding and nonterritorial males at the leks can be overlooked easily in the counts (Dunn and Braun, 1968; Jenni and Hartzler, 1978). During the preremediation phase, the Chance Gulch population varied from 216 in 1986 to 582 in 1992. During remedial action, the population varied from 204 in 1996 to 420 in 1995 (Table 2.1).

Feeding and loafing habitat

Wallestad (1975) identified sage grouse feeding and loafing habitat around leks during the breeding season as a critical habitat feature. In Montana, daytime movements of male sage grouse of up to 0.8 mi (1.3 km) from the lek were common; 83 percent of all locations fell within 0.2 mi (0.3 km) of the lek (Wallestad and Schladweiler, 1974). In Utah, male sage grouse disperse 0.3 to 0.5 mi (0.5 to 0.8 km) from the lek to day-use areas (Ellis et al., 1989). Male

grouse in the Gunnison Basin are most frequently found within 0.6 mi (1 km) of the lek (Hupp, 1987).

Nesting habitat

Sage grouse typically nest within 2 mi (3 km) of the leks (Berry and Eng, 1985; Hoffman, 1979), although some nest up to within 5 mi (8 km) of the lek. Long-distance moves of up to 20 mi (32 km) to favorite nesting habitat are known to occur (Rogers, 1964). The average distance from the probable breeding grounds for 13 nests in the Gunnison basin was 2.6 mi (4.2 km) and ranged from 0.4 to 5.1 mi (0.6 to 8.2 km) (Hupp, 1987).

Studies show that sage grouse usually nest under sagebrush (Wallestad and Pyrah, 1974; Klebenow, 1969; Gregg et al., 1994). Connelly et al. (1991) found 64 nests under sagebrush and 18 under other plant species. The success rate for nests under sagebrush was 53 percent while the success rate for nests under other species was 22 percent. Gregg et al. (1994) determined shrub cover of medium height (16 to 31 inches [40 to 80 cm]) was greater in nonpredated versus predated nests. Klebenow (1969) found nests were in areas of greater shrub cover than the surrounding habitat. In Montana, the average height of sagebrush cover at nest sites was 15.9 inches (40.4 cm) compared to the average height of 9.2 inches (23.4 cm) in the surrounding habitat. The importance of grass cover in conjunction with sagebrush cover has been documented. Gregg et al. (1994) determined that tall-grass cover (7 inches [greater than 18 cm]) was greater in nonpredated nests than predated nests; there was no significant difference in grass cover in predated nests and at random locations. The greater amount of grass and sagebrush cover "likely provide the lateral and overhead concealment needed for security from predators." In addition, livestock grazing is the principal factor that affects grass cover and height (Gregg et al., 1994). DeLong et al. (1995) determined that a greater amount of grass cover 6 inches (greater than 15 cm) tall, average of 18 percent at nonpredated nests) and medium shrub cover (16 to 31 inches [40 to 80 cm] tall, average of 41 percent at nonpredated nests) together resulted in a lower probability of nest predation. Areas with adequate tall grass cover but inadequate medium sagebrush cover (average of 29 percent at predated nests) and areas with adequate medium sagebrush cover but inadequate tall grass cover (average of 5 percent at predated nests) had higher rates of nest predation.

Data regarding nest density is limited. Klebenow (1969) searched thirty-four 40-ac (16-ha) plots in 1965. He also searched sixteen 40-ac (16-ha) plots and an additional four hundred 60-ac (186 ha) in 1966. The nest density for both years was 1 per 65 ac (26 ha). Nest density was clumped and the density in the best areas was 1 per 10 ac (4 ha).

Food and brood habitats

Sage grouse rely on invertebrates and forbs for food. Klebenow and Gray (1967) found that insects comprised 52 percent of the total diet during a chick's first week of life. Thereafter, the percent of insects in the chicks diet decreased and was replaced by forbs. Plant species such as common dandelion (*Taraxacum officinale*), milk vetch (*Astragalus* sp.), and other forbs made up 83 percent of the chicks' diet. Peterson (1970) also found insects to be the most important food item during the chicks' first week (60 percent of diet). The percent of insects in the diet dropped to 33 by the second week and forbs became the most common food items. Common dandelion and salisfly (*Tragopogon porrifolius*) were the most common forbs consumed. Feeding trials with sage grouse chicks show that to survive, they require insects in their diet for the first 3 weeks. For the next 3 weeks they require insects in their diet to grow normally (Johnson and Boyce, 1990). Adult sage grouse feed almost exclusively on sagebrush in the winter but forbs account for over 50 percent of their diet in the summer (Wallestad et al., 1975).

Sage grouse broods may remain in sagebrush habitat all summer, if succulent forbs are available, in areas of relative high annual moisture (12 inches [greater than 30 cm]) (Dunn and Braun, 1986) or dryer areas that receive above-average moisture (Klebenow, 1982; Hoffman, 1979; Wallestad, 1971). Various studies document the movements of sage grouse broods to wet areas such as streams, stock tanks, irrigated fields, and springs when the forbs in the upland habitat dry out (Connelly, 1982; Dalke et al., 1963; Drut et al., 1994; Hoffman, 1979; Peterson, 1970; Wallestad, 1971). Limited data indicate sage grouse broods in the Gunnison Basin occurred in sagebrush habitat adjacent to moist sites (Hupp, 1987). The Gunnison Basin contains large areas of apparently suitable sage grouse habitat. The lack of riparian habitat in these areas may explain why the sage grouse are not found (Hupp, 1987).

3.0 IMPACTS, MITIGATION, AND MONITORING

This section describes the amount of land affected directly and indirectly by remedial action at the landfill disposal site, Tenderfoot Mountain haul road, Six-Mile Lane borrow site, Chance Gulch borrow site, and associated haul roads (these areas are referred to as the disposal site area). This analysis does not include the land disturbed at the former processing site in Gunnison. The predicted impacts of remedial action in the disposal site area on the pronghorn antelope and sage grouse, the agreed-upon mitigation and monitoring plan, and the results of the monitoring program are presented below.

3.1 PROJECT-RELATED IMPACTS

Remedial action resulted in direct and indirect impacts to the pronghorn antelope, sage grouse, and other wildlife species. Direct impacts resulted from activities such as clearing land and loss of usable habitat. Indirect effects resulted from human activities that created dust and noise. The impacts of dust are assumed to be minimal because the UMTRA Project used dust suppressants to comply with its air quality permit. The impacts of noise on wildlife affect hearing (such as masking, the inability to hear important environmental cues). These effects can be compounded by the presence of humans, and the effects are often hard to separate. The impact of noise on wildlife is poorly understood, but many species seem to be capable of adjusting to relatively constant noise levels of up to 70 decibels (dB) (DuFour, 1980). Therefore, it was assumed that wildlife in areas where noise levels reach 70 dB or greater would be affected by remedial action.

Remedial action began in 1991 with the demolition of the mill buildings and other structures at the former Gunnison processing site. Activities at the disposal site began in 1992 with the construction of the Tenderfoot Mountain haul road and site preparation at the disposal cell. The contaminated material at the former processing site was hauled to the disposal cell in 1993 and 1994. The cover was placed on the disposal cell in 1995. The Six-Mile Lane borrow site was used as the source of radon-barrier and frost-protection material and the Chance Gulch borrow site provided rock for the rock cover. Site restoration, including reseeding disturbed ground, was accomplished in 1995. The Gunnison EA predicted an estimated 273 ac (111 ha) of land would be cleared in the disposal site area (Table 3.1) (DOE, 1992). The actual number of acres of land cleared was somewhat less (224 ac [91 ha]). All the cleared land is in the sagebrush plant community.

<u>Predicted impacts - pronghorn antelope</u>

Minimal impacts of remedial action on wintering pronghorn antelope were predicted because construction activities halted during most of the winter. Remedial action activities usually were discontinued by November and did not start until after mid-May. However, antelope tend to remain near the wintering

Table 3.1 Acres disturbed at the landfill disposal site, Six-Mile Lane and Chance Gulch borrow sites, and associated haul roads, Gunnison, Colorado, site

Area	Estimated disturbance 1992[a]	Actual disturbance[b]
Landfill disposal site	122[c]	78[c]
Six-Mile Lane borrow site[d]	64.5	65.5
Chance Gulch borrow site	39	29
Tenderfoot Mountain haul road	47.5	51.5
Total	273	224

[a]From DOE, 1992.
[b]From Guros, 1997.
[c]Includes 28-ac (11-ha) disposal cell.
[d]Includes haul road.

area during fawning season (mid-May through June) so construction could have resulted in a minor disruption to female antelope during this time.

Clearing 224 ac (91 ha) of land would reduce the range carrying capacity for antelope. However, reseeding most of this land (except the 28-ac [11-ha] disposal cell) would mitigate this loss; this mitigation measure is described in greater detail below.

CDOW identified another possible impact: the possibility that truck traffic along the Tenderfoot Mountain haul road might impede antelope movement to water sources on the north side of the road. In addition, truck traffic along this and other haul roads might result in pronghorn mortality.

Predicted impacts - sage grouse

The sage grouse is the game species considered to be most potentially affected by remedial action in the landfill disposal site area. Direct impacts included 1) potential land disturbance in the Chance Gulch and East Gold Basin leks, and 2) the destruction of grouse feeding and loafing habitat near the leks, nesting habitat, and wintering habitat as a result of clearing the sagebrush plant community. Noise and other human activity would also indirectly impact grouse from 1992 through 1995 during disposal cell construction.

Predicted impacts - leks

Construction of the Tenderfoot Mountain haul road could have resulted in clearing land in the East Gold Basin lek and lek B at the Chance Gulch leks. As part of the mitigation plan, the Tenderfoot mountain haul road was constructed to avoid the two leks.

Remedial action activities could take place while sage grouse were in attendance at the leks. Noise levels greater than 70 dB would extend

approximately 1000 ft (305 m) from the disposal site during periods of maximum equipment use. Conservative estimates assumed noise would emanate from the southern boundary of the site, resulting in levels greater than 70 dB at lek A and less than 70 dB at the other Chance Gulch leks (Table 3.2). In addition, traffic along the Tenderfoot Mountain haul road would disrupt the grouse at lek B. Male sage grouse are relatively tolerant of disturbance. However, studies indicate that yearling male sage grouse avoid leks within 1.8 mi (2.9 km) of a disturbance source and that if the disturbance continues 4 to 6 years, use of a lek may cease due to lack of recruitment (Braun, 1986). Since all Chance Gulch leks are within 1.8 mi (2.9 km) of the disposal site, construction activities may reduce male sage grouse attendance at these leks.

Table 3.2 Noise impacts at the Chance Gulch sage grouse leks, landfill disposal site area, Gunnison, Colorado, site

Lek	Distance from landfill disposal site (ft)	Noise level at lek due to remedial action
A	750	> 70 dB
B	2000	< 70 dB
C	3000	< 70 dB
D	4000	< 70 dB

< - less than.
> - greater than.

Note: Figure 2.1 shows lek locations.

Another possible impact of human disturbance on sage grouse lek use is that females may avoid a lek even though males are displaying. This has been observed with the sharp-tailed grouse (*Tympanuchus phasianellus*) where males continued using the leks near a source of disturbance, but females moved to another lek outside the disturbance zone (Baydack and Hein, 1987). Therefore, the number of nesting females in the area of the Chance Gulch leks could have been reduced during remedial action. However, noise and human activity impacts at the leks were avoided during remedial action through the implementation of the mitigation measure described below.

In this study, lek counts were used to assess population trends at the Chance Gulch and control leks. Emmons and Braun (1994) used radiotelemetry to determine that most male sage grouse attended leks sometime during the breeding season and that interlek movement was more common than previously reported. In addition, peak male attendance at the leks was 25 to 37 days after peak female attendance. Emmons and Braun (1994) recommended conducting four lek counts and, because of interlek movements, counting all leks in one area on the same day. Jenni and Hartzler (1978) also found that peak male attendance occurred after peak female attendance. They predicted that three lek counts spaced 3 weeks apart after peak female attendance would yield the maximum number of males. Starting in 1992, sage grouse lek counts at the Chance Gulch and control leks were conducted consistent with Emmons and

Braun's recommendations (Emmons and Braun, 1984). Prior to 1992, two to three counts were made at the Chance Gulch and control leks.

Predicted impacts - loafing and feeding habitat

Assuming that grouse use all sagebrush habitat within 0.6 mi (1 km) of a lek as feeding and loafing habitat during the breeding season, remedial action resulted in clearing 82 ac (33 ha) of this type of habitat (78 ac [32 ha] at the disposal site and 4 ac [1.6 ha] along the Tenderfoot Mountain haul road). This loss is permanent at the 28-ac (11-ha) disposal cell and long-term for the rest of the land (Table 3.3).

Table 3.3 Acreage of sage grouse habitat potentially impacted by remedial action activities in the landfill disposal site area near Gunnison, Colorado

Habitat type/duration[a]	Construction area: Landfill disposal site	Six-Mile Lane borrow site[b]	Chance Gulch borrow site[b]	TM haul road	Total
Loafing and feeding					
Short-term	170	0	0	28	198
Long-term	50	0	0	4	54
Permanent	28	0	0	0	28
Total	248	0	0	32	280
Nesting					
Short-term	129	69	34	133	365
Long-term	50	66	29	7	152
Permanent	28	0	0	0	28
Total	207	135	63	140	545
Winter					
Short-term	0	0	0	0	0
Long-term	50	66	29	10	155
Permanent	28	0	0	0	28
Total	78	66	29	10	183

[a]Short-term impacts are indirect impacts to undisturbed habitat due to human activity and noise. Long-term impacts result from clearing land. Land has been reseeded. Permanent impacts represents loss of habitat from the disposal cell (28 ac).
[b]Includes borrow sites and associated haul road.
TM - Tenderfoot Mountain.
Note: Estimates assume no mitigation occurred.

Human disturbance could negatively impact the sage grouse use of feeding and loafing habitat around the leks during the strutting season. Assuming sage grouse would stop using habitat within the 70-dB noise zone, an estimated 170 ac (69 ha) would not be used around lek A and 29 ac (12 ha) along the Tenderfoot Mountain haul road (Table 3.3). The total amount of feeding and loafing habitat affected directly and indirectly during remedial action could have been 280 ac (114 ha). Assuming the grouse use 723 ac (293 ha) for feeding and loafing habitat around a lek (based on the area of a circle with a radius of 0.6 mi [1 km]), remedial action could have directly and indirectly impacted 39 percent of this type of habitat around lek B. This could have markedly reduced

the number of sage grouse attending lek B since Wallestad (1975) found that clearing 31 percent of this type of habitat near a lek resulted in a 63 percent reduction in male grouse attendance. However, implementing the wildlife mitigation measures described below halted remedial action during the breeding season and, therefore, no indirect impacts occurred. Clearing 82 ac (33 ha) of grouse feeding and loafing habitat (11 percent of this habitat at lek A) probably had only minimal impact on the Chance Gulch sage grouse. Wallestad (1975) determined that clearing 11 percent of the habitat around a lek did not significantly impact the number of male sage grouse attending the lek.

Predicted impacts - nesting sage grouse

As indicated in Section 2.0, female sage grouse typically nest within 2 mi (3.2 km) of a lek. Using this distance, the disposal cell, borrow sites, and their haul roads, and 2 mi (3.2 km) of the Tenderfoot Mountain haul road represent 180 ac (73 ha) of sage grouse nesting habitat that was impacted (Table 3.3).

The indirect impacts of noise affected an estimated 365 ac (148 ha) of nesting habitat in the landfill disposal site area during the 4-year remedial action period (Table 3.3). This indirect impact was predicted to last for the life of the Project around the disposal site and Tenderfoot Mountain haul road and 1 year at the borrow sites. No mitigation was available for the indirect impacts of noise and human activity on nesting sage grouse.

To estimate the potential reduction in the Chance Gulch sage grouse population as a result of remedial action impacts on nesting sage grouse, the following assumptions were made:

- The density of nesting sage grouse ranged from 1 nest per 10 ac (4 ha) to 1 per 65 ac (26 ha) (Klebenow, 1969).
- Sixty-one percent of the nesting hens successfully raised broods (Braun, 1991c).
- Each successful hen raised an average of 4.14 chicks (Braun, 1991c).
- The annual turnover rate is 50 percent (Braun, 1991c).

The first 3 years of remedial action took place at the landfill disposal site and Tenderfoot Mountain haul road. During these activities, 85 ac (34 ha) of land were cleared and an additional 262 ac (106 ha) were affected (total 350 ac [142 ha]) (Table 3.3). This clearance potentially could displace 4 to 26 nesting hens. Assuming a 61 percent nesting success and an average of 4.14 chicks per successful nest, 10 to 66 fewer chicks may have been recruited into the population during the first year of remedial action. Assuming 50 percent of these chicks survive their first year, the Chance Gulch population would have 5

to 33 fewer yearlings at the beginning of the second construction year (1993). Taking this logic through the year 2000 and assuming a 50 percent reduction each year in each class, the greatest impact to the Chance Gulch sage grouse population would have been seen at the leks in 1996 (Table 3.4). This is because the greatest amount of habitat was impacted in 1995 due to increased activities at the two borrow sites.

Table 3.4 Estimated reduction of Chance Gulch sage grouse population as a result of remedial action impacts on nesting habitat, Gunnison, Colorado, site

Reproduction	Construction and postconstruction years									
(yearlings)	(1993)	(1994)	(1995)	(1996)	(1997)	(1998)	(1999)	(2000)	(2001)	(2002)
1992[a]	5-33	3-17	2-8	1-4	0-2	0-1	-	-	-	-
1993[a]	-	5-33	3-17	2-8	1-4	0-2	0-1	-	-	-
1994[a]	-	-	5-33	3-17	2-8	1-4	0-2	0-1	-	-
1995[b]	-	-	-	8-55	4-28	2-14	1-7	0-3	0-2	-
1996[c]	-	-	-	-	3-18	2-9	1-4	0-2	0-1	0-1
1997[c]	-	-	-	-	-	3-18	2-9	1-4	0-2	0-1
1998[c]	-	-	-	-	-	-	3-18	2-9	1-4	0-2
1999[c]	-	-	-	-	-	-	-	3-18	2-9	1-4
2000[c]	-	-	-	-	-	-	-	-	3-18	2-9
2001[c]	-	-	-	-	-	-	-	-	-	3-18
Total	5-33	8-50	10-58	14-84	10-60	8-45	7-41	6-37	6-36	6-35

[a]85 ac cleared plus 262 ac affected indirectly = 347 ac.
[b]180 ac cleared plus 365 ac affected indirectly = 545 ac.
[c]180 ac cleared.

Notes: 1. Assume 1 nest/10 to 65 ac, 61 percent nests successful, 4.14 chicks/successful nest, 50 percent turnover/year.
2. Numbers (e.g., 5-33) show estimated range reduction.

The impacts of remedial action on nesting sage grouse should be reduced starting in 1997 because disposal cell construction is complete and project-related indirect impacts from human activity and noise no longer occur. All disturbed ground in the landfill disposal site area was reseeded in 1995 and 1996, and sagebrush and sage grouse nesting habitat are expected to reestablish. Studies of sage grouse use of areas where sagebrush was eliminated due to fire or spraying generally show grouse use is greatly reduced (Klebenow, 1970; Benson, 1989). Klebenow found that sprayed areas were not used by nesting grouse for at least 5 years and 10 years may pass before sagebrush cover is adequate (greater than 10 percent cover) to support the original grouse nesting density. Johnson (1969) found that on grazed land young and mature sagebrush plants were common on the sprayed area after 5 years; within 14 years more plants grew on the sprayed than unsprayed areas. For this analysis, sagebrush is assumed to invade the cleared areas, with marginal nesting habitat available 5 to 6 years later. After 10 years, it is assumed that nesting density in the cleared areas will be similar to the uncleared areas. Also, some of the cleared areas will be planted with sagebrush and Richardson et al. (1984) have shown that such plantings can be successful. For

example, some plantings produced 2200 to over 7600 sagebrush per acre (0.4 ha) after 7 years.

Predicted impacts - winter habitat

Project activities eliminated a total of 183 ac (74 ha) of sage grouse winter habitat (Table 3.3). This loss would be permanent at the 28 ac (11 ha) disposal cell and long-term in the remaining 155 ac (62 ha).

3.2 MITIGATION AND MONITORING

The DOE, BLM, and CDOW developed a mitigation and monitoring plan for potential and probable Project-related impacts to the pronghorn antelope and sage grouse (BLM, 1992). Many of the individual mitigation and monitoring studies are complete and the remainder likely will be completed in 1999.

Pronghorn antelope

The following mitigation measures were implemented to reduce or eliminate potential Project-related impacts to the pronghorn antelope:

- Water sources (guzzlers) were provided to ensure adequate water supplies.
- Speed limits were reduced to prevent or minimize road kills.
- Fencing was installed to minimize pronghorn injury.
- Riparian areas and upland areas in the Tomichi Allotment were enhanced by excluding livestock.

Also, partial to complete herd replacement may be provided if remedial action activities result in a sizable herd reduction.

Four guzzlers were installed on 24 November 1994 and are holding water.

No pronghorn antelope were hit by Project-related traffic along any haul roads. In addition, all fencing installed by DOE met BLM specifications regarding antelope safety (the lowest strand is smooth wire at least 18 inches (46 cm) above the ground. Upland and riparian habitat enhancement projects were an important part of the mitigation program. This included fencing nine riparian areas (Figure 2.2) and excluding cattle from the 9300-ac (3700-ha) Tomichi Allotment for 7 years (Figure 2.1). The Tomichi Allotment contains an estimated 100 ac (40 ha) of riparian habitat; the rest is sagebrush habitat (Capodice, 1997). A total of 133.5 ac (54 ha) of riparian habitat and 9656 ac (3883 ha) of upland habitat have been enhanced by excluding livestock (Table 3.5).

Table 3.5 Riparian and upland habitat enhanced by excluding livestock, Gunnison, Colorado, site

Location	Habitat[a]		
	Riparian	Upland	Total
Tomichi Allotment	100	9200	9300
Prospectors Spring	9	352	361
Houston Gulch	4	20	24
Upper Long's Gulch	2	24	26
Lower Long's Gulch	0.5	11	11.5
Sage Hen Spring	1	14	15
Camp Kettle Spring	2	9	11
Big Seep	5	20	25
Razor Creek	5	1	6
Graflin Gulch	5	5	10
Total	133.5	9656	9789.5

[a]Reported in acres.

According to the mitigation plan, if the postremedial action pronghorn antelope herd contains 119 animals or less, DOE would provide funds to return the herd to 160 (BLM, 1992). To determine the status of the herd during remedial action, aerial winter and spring surveys were conducted over a 4-year period starting in 1992. These flights were conducted in a Bell helicopter. One count took place in August and the other in the January-February time frame. The number of antelope counted during the winters of 1993 through 1996 varied from 170 to 210 and never approached the 119-animal lower limit (Table 3.6). The number counted during the summers of 1992 through 1995 ranged from 45 to 160. The counts during this time period are lower because the animals are dispersed over a much wider area in summer than winter. Comparing Chance Gulch herd counts with control site counts shows similar trends over time (Table 3.6). These data indicate the Chance Gulch pronghorn antelope herd remained healthy during remedial action and no significant Project-related impacts were evident.

Table 3.6 Pronghorn antelope counted during the summers and winters of 1992 through 1996 in the Chance Gulch area, Gunnison, Colorado, site

Year	Winter[a]	Summer[b]
1992	Not surveyed	70
1993	210	45
1994	170	146
1995	209	160

[a] Winter surveys took place in January 1993, February 1994, and January 1995.
[b] All summer surveys took place in August.

Ref.: Naugle, 1992, 1993, 1994, 1996.

Sage grouse

As Section 3.1 indicates, remedial action had the potential to impact lek A at Chance Gulch and the East Gold Basin lek (by clearing land). Human activity and noise had the potential to impact all the Chance Gulch leks. Land in lek A would have been cleared if the north side of the Tenderfoot Mountain haul road had been widened. To avoid these impacts, the road was aligned to avoid the East Gold Basin lek and widened only on its south side in the area of Chance Gulch lek A. To avoid human activity and noise impacts during the breeding season, it was agreed that remedial action activity would not take place in the landfill disposal site, borrow site, or Tenderfoot Mountain haul road areas from 1 March through May 15 of each construction year. Therefore, remedial action activities are believed to have had no impact on the sage grouse while in attendance at the East Gold Basin and Chance Gulch leks. In addition, the Tenderfoot Mountain haul road was reclaimed to its original width of 14 ft (4 m) in some areas and completely reclaimed in others. The Six-Mile Lane borrow site haul road was reclaimed to its original width and the Chance Gulch haul road was completely reclaimed. These measures will reduce casual use of the area, especially the Chance Gulch lek areas.

Another potential impact identified in Section 3.1 is the potential for human activity and noise to disrupt sage grouse use of feeding and loafing habitat around the leks during the breeding season. However, this impact did not occur because remedial action was not allowed in the landfill disposal site area until after completion of the breeding season on 15 May of each construction year. In addition, human use of the area is limited since remedial action was completed, due to haul road reclamation.

The most significant Project-related impact on sage grouse was the destruction of 180 ac (73 ha) of nesting habitat and, during remedial action, precluding the use of an estimated additional 365 ac (148 ha) due to noise and human activity. The loss of nesting habitat is believed to be the major contributor to the reduction in Chance Gulch sage grouse population, as indicated by the lek data. The magnitude of this impact is based on the baseline lek count data used to compare lek count data from the remedial action period (1993 through 1996). The 1992 maximum lek count was 97, the highest number since 1974 (CDOW, 1995). The maximum lek count data for the previous 5 years (1987 through 1991) ranged from about 50 to 60 males (CDOW, 1995). The large increase in male grouse at the Chance Gulch leks may be a result of using the more intensive Emmons and Braun (1984) technique. This technique also was used at the four control leks, where the maximum number of males counted in 1992 decreased (CDOW, 1995). This is opposite of what one would expect. The high degree of interlek movement, particularly among juvenile male sage grouse, may be reason for the increase in the number of sage grouse at the Chance Gulch leks (Emmons and Braun, 1984). Unfortunately, four of the six leks in the East Gold Basin zone were not surveyed in 1992, so movement cannot be determined (CDOW, 1995).

Given that the 1992 sage grouse count at the Chance Gulch leks may be somewhat anomalous, a range of 50 to 97 male sage grouse at the Chance Gulch leks was used in this analysis. Analyzing Project-related impacts on the sage grouse as a result of impacts to nesting habitat showed that the greatest impact likely occurred in 1995 (Table 3.4). The estimated 1996 population would have 14 to 84 fewer sage grouse, based on the assumption used for nest density. As with the lek data, these data provide population level trends and are not intended to represent the actual population reduction. These data, however, are consistent with data that showed the lowest number of males at the leks occurred in 1996. The 1996 population decline ranged from 32 percent (using a lek count of 50 males) to 65 percent (using a lek count of 97 males).

The reduction in the Chance Gulch sage grouse population was mitigated by the enhancement of upland and riparian habitat (excluding livestock and reseeding disturbed ground) (BLM, 1992).

Excluding cattle from an estimated 9800 ac (3970 ha) of sagebrush habitat resulted in the enhancement of potential sage grouse nesting habitat. Assuming most sage grouse nest within 2 mi (1.3 km) of the lek, approximately 2600 ac (1050 ha) of nesting habitat were enhanced in the Tomichi Allotment in the Chance Gulch lek B area. Specifically, excluding cattle from the Tomichi Allotment resulted in more robust and taller grass growth in many areas (Hays, 1997). As discussed in Section 2.2.2, Gregg et al. (1994) and DeLong et al. (1995) determined that sage grouse nesting success increased in areas with taller grass cover. Although nesting success studies have not been conducted on the Chance Gulch sage grouse population, the enhancement of nesting cover likely resulted in higher nesting success, which probably helps mitigate the population reduction during remedial action and speeds population recovery.

The enhancement of 134 ac (54 ha) of riparian habitat likely benefits sage grouse by contributing to increased survival of sage grouse broods. As indicated in Section 2.2.2, sage grouse broods often use riparian areas when the forb food supply in the uplands dries up. In the Gunnison Basin, most leks are near the major drainages, indicating the importance of riparian areas to sage grouse (Hupp, 1987). Klebenow (1982) noted that sage grouse will use heavily grazed wet meadows if water and cover are present. The birds tended to stay near the edges of the riparian areas and flushed to the sagebrush habitat if disturbed. If tall grasses and forbs provided cover, the grouse tended to scrunch down, flatten themselves in the grass, and hide rather than flush to surrounding sagebrush habitat. Vegetation studies at six riparian areas showed the sites were heavily grazed. Also, heavily grazed conditions likely occurred in the riparian area in the Tomichi Allotment before cattle were excluded.

The enhancement of riparian areas provides more cover and greater growth of herbaceous plants. To assess the use of riparian areas by sage grouse, brood flush counts were conducted starting in 1993 (Young, 1993b; Hurkel, 1994; DOD, 1996c; Gaskill, 1996). Few grouse were observed during these counts. CDOW

has acknowledged "problems" with using sage grouse brood counts (Jones, 1996). These problems may include the surveyors' methods, survey interpretations, failure to flush all birds, timing inconsistencies (times the surveys were conducted each year), and yearly grouse population fluctuations (Gaskill, 1996). Also, meaningful analysis is prevented by the lack of baseline data for the riparian sites and changes in grouse flushing behavior with changing vegetation height and density (Klebenow, 1982).

4.0 LIST OF CONTRIBUTORS

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APPENDIX

PLANT SPECIES OBSERVED
IN THE UPLAND AND RIPARIAN PLANT COMMUNITIES
GUNNISON AND SAGUACHE COUNTIES, COLORADO

Table A.1 Plant species observed in upland plant communities near the UMTRA Project landfill disposal site, borrow sites, and haul roads, Gunnison, Colorado, site

Scientific name	Common name
Grasses	
Agropyron cristatum	crested wheatgrass
Agropyron riparium	wheatgrass
Agropyron smithii	Smith's wheatgrass
Aristida purpurea	red threeawn
Bouteloua gracilis	blue grama
Bromus inermis	smooth brome
Bromus polyanthus	polyanthus brome
Bromus tectorum	cheatgrass
Elymus condensatus	giant wild rye
Elymus glaucus	blue wild rye
Hordeum Jubatum	foxtail barley
Koeleria cristata	junegrass
Muhlenbergia asperifolia	scratch grass
Oryzopsis hymenoides	Indian ricegrass
Phleum pratense	timothy grass
Poa agassizensis	rhizomatous bluegrass
Poa fendleriana	muhangrass
Poa nervosa	wheeler bluegrass
Poa pratensis	bluegrass
Sitanion hystrix	bottlebrush squirreltail
Sitanion longifolium	squirreltail
Sporobolus airoides	alakali sacaton
Sporobolus crytandrus	sand dropseed
Stipa comato	needle and thread
Stipa lettermanii	Letterman's needlegrass
Stipa occidentalis	western needlegrass
Stipa pinetorum	pine needlegrass
Trees and shrubs	
Abies lasiocarpa	alpine fir
Amelanchier alnifolia	serviceberry
Apocynum cannabmum	dogbane
Artemisia frigida	fringed sagebrush
Artemisia ludoviciana	sagebrush
Artemisia nova	black sagebrush
Artemisia tridentata	big sagebrush
Atriplex canescens	four-winged saltbush
Cercocarpus montanus	mountain mahogany