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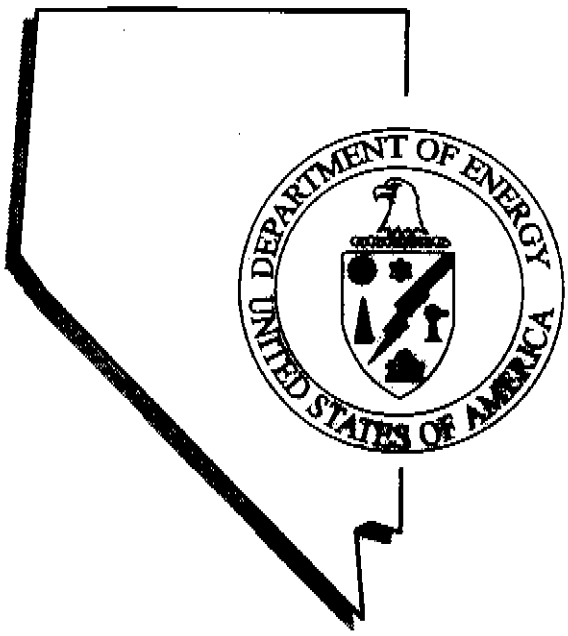

Sensitive Species Survey Results for the Gasbuggy and Gnome-Coach Sites, New Mexico

December 1993

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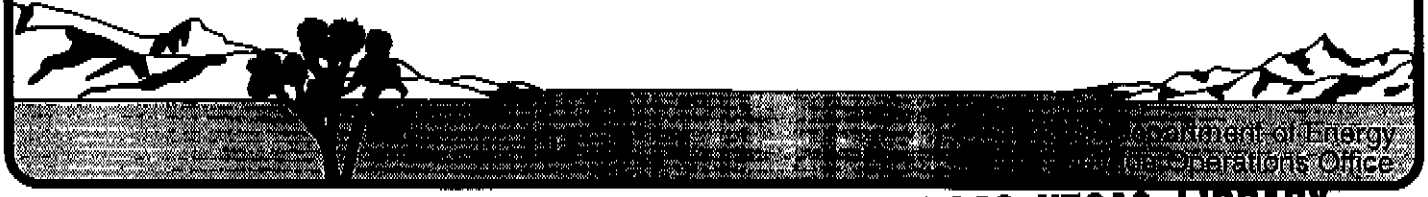

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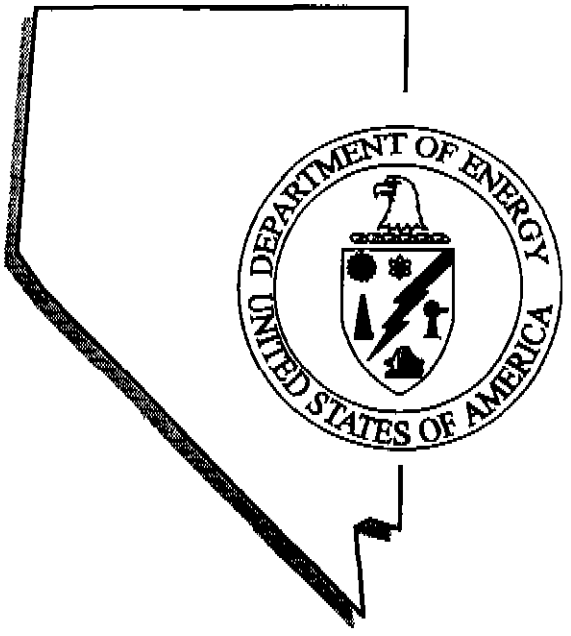

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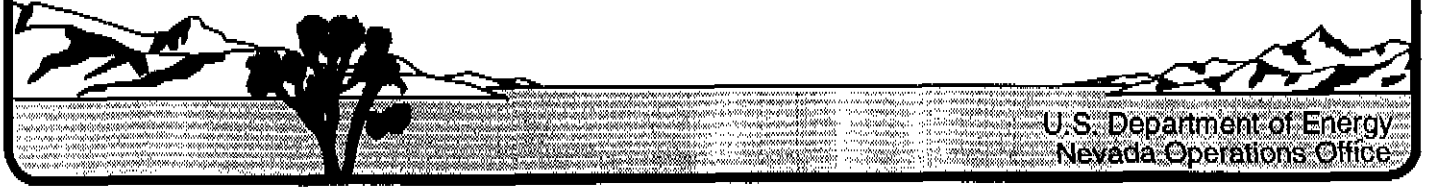

U.S. Department of Energy
Nevada Operations Office

DOE/NV/10972--54

Sensitive Species Survey Results for the Gasbuggy and Gnome-Coach Sites, New Mexico

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List of Acronyms and Abbreviations

AEC	Atomic Energy Commission
BLM	Bureau of Land Management
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FSS	Forest Service Sensitive
km	kilometer(s)
m	meter(s)
mi	mile(s)
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
RI/FS	Remedial Investigation/Feasibility Study
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WIPP	Waste Isolation Pilot Plant

1.0 Introduction

The Plowshare Program was initiated by the Atomic Energy Commission (AEC) to explore peaceful uses of nuclear explosives. In the 1960s, two tests under this program were conducted in New Mexico—Project GASBUGGY and Project GNOME (Figure 1-1). A third test, Project COACH, was planned for the same site where the Gnome test had been conducted but was later cancelled. The U.S. Department of Energy's Nevada Operations Office (DOE/NV), formerly the AEC, plans to conduct a Remedial Investigation/Feasibility Study (RI/FS) at each site to determine the extent of residual subsurface contamination resulting from these nuclear detonations.

Before a RI/FS can be initiated, the National Environmental Policy Act (NEPA) of 1969 requires that the DOE to evaluate the potential impacts that may occur as a result of performing remedial activities. DOE Order 5440.1E implementing NEPA requires that the presence of environmentally sensitive resources such as cultural resources, sensitive species, wetlands, and floodplains be determined at such sites so that the appropriate level of NEPA documentation can be established. To this end, plans to conduct field surveys for these resources at the Gasbuggy Site and the Gnome-Coach Site, as well as five other locations outside of New Mexico, were developed and presented in *Survey Plans for DOE/NV Sites Outside of Nevada* (DOE, 1993a), hereafter referred to as the "survey plan.".

This report presents the results of the sensitive species surveys outlined for the Gasbuggy and Gnome-Coach Sites in the survey plan. Level I reconnaissance surveys were conducted to assess the existing biological resources and to obtain data that may be used to design subsequent surveys for specific species. These surveys cover the entire area of the sites as defined in the plan. The results include descriptions of habitat types and lists of species (plants and wildlife) observed during the surveys. Actually- and potentially-occurring sensitive species are discussed. Sensitive species include those that are afforded legal protection by a Federal or state agency (i.e., listed as endangered, threatened, or proposed for listing), as well as species designated as candidates for listing, species under investigation, and species whose populations are being monitored by a state or Federal agency.

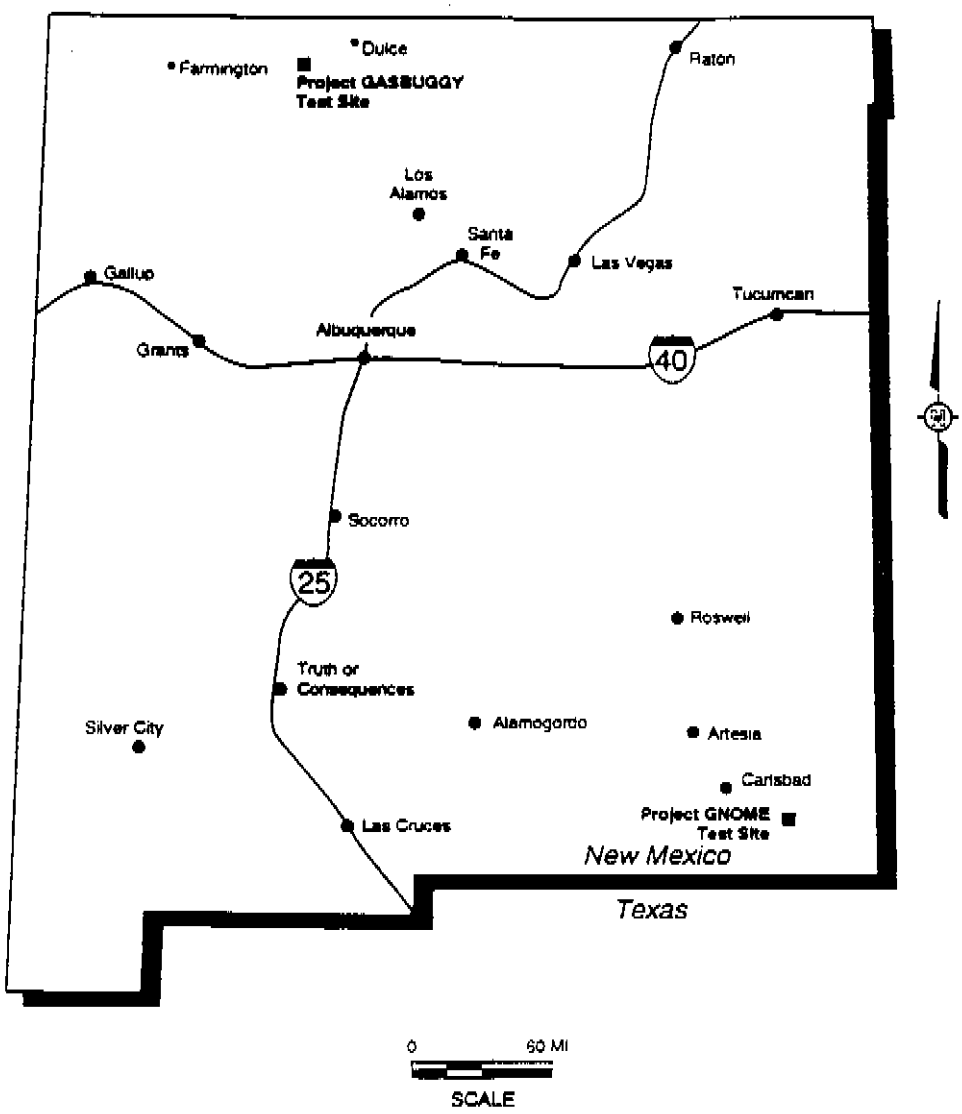

FIGURE 1-1
Locations of the Project GASBUGGY and Project GNOME Test Sites in New Mexico

2.0 Background

2.1 Definition of Sensitive Species

For the New Mexico surveys, sensitive species listed by four separate government agencies were considered, two Federal and two state. The U.S. Fish and Wildlife Service (USFWS) has authority under the Endangered Species Act (ESA) to list plant and animal species as either endangered or threatened, thereby affording the species legal protection from being further imperiled through human impacts. The USFWS listing process results in two other categories of species, proposed and candidate species, which are included under the definition of sensitive species. Proposed species are those for which a formal proposal for listing has been published in the Federal Register, but a Final Rule has not yet been made. Proposed species are afforded legal protection under ESA. Candidate species are listed as such in the Federal Register and comprise those species under consideration for listing. Two categories of candidate species are defined. C1 species are those for which it is felt that enough information currently exists to support listing. C2 species are those for which additional information is required to determine the species' status. A species status designation 3C is used by the USFWS when additional information shows that the species is more abundant than previously thought or that no threat to the species' survival exists. In addition to the USFWS listing, the U.S. Forest Service (USFS) maintains a list of Forest Service Sensitive (FSS) plants, which are considered sensitive to some land-use practices and may require special management considerations.

The State of New Mexico separates the protection of plant and animal species under two state agencies. The listing and protection of animal species is within the purview of the New Mexico Department of Game and Fish (NMDGF). Two categories of listing are used by the NMDGF, Endangered Group 1 and Endangered Group 2, which are roughly equivalent to endangered and threatened, respectively, as used by the USFWS. The NMDGF also affords protection to some groups of wildlife species from unauthorized collection or harm. Raptors (birds of prey) and horned lizards are two such groups.

The responsibility for listing endangered plant species in New Mexico is under the New Mexico Forestry and Resources Conservation Division of the Energy, Minerals and Natural Resources Department. This agency currently maintains four lists of plants. List 1 contains those species that are considered in danger of extinction or extirpation in New Mexico and are, therefore, given legal protection under the New Mexico Endangered Plant Species Act.

List 2 contains those species that are rare due to a restricted range or very low population densities and, therefore, may become endangered. List 3 contains those species for which current information is insufficient to determine the species' status. List 4 contains species once considered, but currently dropped from consideration. Although the species in Lists 2 and 3 are being monitored, they are not given legal protection under the New Mexico Endangered Plant Species Act (Sivinski and Lightfoot, 1992).

2.2 Background for the Gasbuggy Site Survey

Project GASBUGGY was one of three experiments under the Plowshare Program to test the feasibility of using underground nuclear explosions to stimulate natural gas production. The 65-hectare (160-acre) Gasbuggy Test Site comprises the southwest 1/4 of Section 36, Township 29 North, Range 4 West, Rio Arriba County, New Mexico. The detonation of the nuclear device at Gasbuggy was on December 10, 1967. Site demobilization was conducted during August and September 1978. The site is owned by the Federal government and the site surface is currently managed by the USFS. The principal land use is grazing, although a USFS picnic ground is located on the site.

A review of Federal and state lists of sensitive wildlife and plant species was conducted to identify species that may be encountered during the survey. In addition, Kamela Hooley, the biologist for the Jicarilla Ranger District (Carson National Forest), was consulted for site-specific information on sensitive species and habitats. Relatively few species of wildlife were identified through this process. Those identified include the following:

Bald eagle (*Haliaeetus leucocephalus*)—Federal status: Endangered; State status: Endangered, Group 2. Bald eagles are known to winter throughout the area and may occasionally be found roosting on dead trees (snags). They are not known to use the Gasbuggy Site (K. Hooley, 1993).

Mexican spotted owl (*Strix occidentali lucida*)—Federal status: Proposed Threatened; State status: Endangered, Group 2. Mexican spotted owls are known to occur in the Jicarilla Ranger District, but are not known from the vicinity of the Gasbuggy Site (K. Hooley, 1993).

Southwestern willow flycatcher (*Empidonax traillii extimus*)—Federal status: Candidate (C1); State status: Endangered, Group 2. This species breeds in riparian habitats typically dominated by cottonwoods and willows. It is documented in widely scattered locations throughout western and northern New Mexico.

Gray vireo (*Vireo vicinior*)—Federal status: none; State status: Endangered, Group 2. Gray vireos inhabit pinyon/juniper woodlands and occur locally in northern New

Mexico. Recent information on this species' status, however, do not support continued listing as endangered (Montoya, 1990).

In addition to these species, all species of raptors and all horned lizards (genus *Phrynosoma*) are considered sensitive due to their special protected status given by the NMDGF. No sensitive species of mammals or amphibians were identified for the Gasbuggy Site.

The New Mexico Forestry and Resource Conservation Division's recently published *Inventory of Rare and Endangered Plants of New Mexico* (Sivinski and Lightfoot, 1992) which provides a thorough and up-to-date treatment of sensitive plant species and their status in New Mexico. Because this report also provides individual listings of sensitive species by county and gives habitat information, it was used as the primary source for identifying sensitive plant species potentially occurring at the Gasbuggy Site. The following is a list of these species:

Sessile-flowered false carrot (*Aletes sessiliflorus*)—Federal status: none; State status: List 2.

Cyanic milkvetch (*Astragalus cyaneus*)—Federal status: none; State status: List 2.

Violet milkvetch (*Astragalus iodopetalus*)—Federal status: none; State status: List 2.

Chaco milkvetch (*Astragalus micromeris*)—Federal status: none; State status: List 2.

Arborales milkvetch (*Astragalus oocalycis*)—Federal status: 3C; State status: List 2.

Aztec milkvetch (*Astragalus proximus*)—Federal status: none; State status: List 2.

Ripley's milkvetch (*Astragalus ripleyi*)—Federal status: C2, FSS; State status: List 2.

Golden lady's slipper (*Cypripedium pubescens*)—Federal status: FSS; State status: List 1.

Bare-stemmed buckwheat (*Eriogonum lonchophyllum* var. *nudicaules*)—Federal status: none; State status: List 2.

Catchfly gentian (*Eustoma exaltatum*)—Federal status: none; State status: List 1.

Prairie gentian (*Eustoma grandiflora*)—Federal status: none; State status: List 1.

Durango gumweed (*Grindelia decumbens* var. *subincisa*)—Federal status: none; State status: List 3.

Mountain lily (*Lilium philadelphicum* var. *andinum*)—Federal status: FSS; State status: List 1.

Little Simpson's cactus (*Pediocactus simpsonii* var. *minor*)—Federal status: none; State status: List 1.

Pagosa phlox (*Phlox caryophylla*)—Federal status: 3C; State status: List 2.

Grama grass cactus (*Toumeya papyracantha*)—Federal status: C2, FSS; State status: List 1.

2.3 Background for the Gnome-Coach Site Survey

Project GNOME was the prototype experiment under the Plowshare Program. Detonated on December 10, 1961, in a bedded salt formation, the purpose of the experiment was to test whether the heat and materials produced by the explosion could be geologically contained for later recovery. The 259-hectare (640-acre) test site comprises Section 34, Township 23 South, Range 30 East, Eddy County, New Mexico, with an additional 16-hectares (40-acres) in Section 10 of that township, which was used as a command post. Surface contamination resulting from the testing program required later decontamination of parts of the site. Some construction activities were begun for a second test named Project COACH; however, this test was ultimately cancelled. In 1963, a radionuclide mobility experiment was conducted at this site by injecting into the Salado salt formation through monitoring wells water containing tritium, iodine-131, strontium-90, and cesium-137. Since 1972, the U.S. Environmental Protection Agency (EPA) has annually monitored water by testing from surrounding wells. The site surface is currently managed by the Bureau of Land Management (BLM) and is used for grazing.

A review of Federal and state lists of sensitive wildlife and plant species was conducted to identify species that may be encountered during the survey. The identification of potentially occurring sensitive species at the Gnome-Coach Site was greatly enhanced by the fact that the Waste Isolation Pilot Plant (WIPP), a DOE facility for testing the geologic disposal of transuranic waste, is located approximately 12-kilometers (km) (7-miles [mi]) northeast of the Gnome-Coach Site and has been conducting ecological monitoring in very similar habitat types as those found at the Gnome-Coach Site since 1984. Of particular note is the Cooperative Raptor Research Program, which has been closely monitoring raptor populations

throughout the Los Medaños area, including the Gnome-Coach Site, since 1985 (Hayden and Bednarz, 1989; DOE, 1992). These studies have identified the Los Medaños area of New Mexico as having a uniquely rich concentration of raptors, with 20 species of hawks, eagles, falcons, and owls having been recorded in the area. Of this list, species of special note include the following:

Harris' hawk (*Parabuteo unicinctus*)—Federal status: none; State status: none. Although not considered threatened or endangered, Harris' hawks are common breeding raptors in the Los Medaños area. The species commonly nests in mesquite trees, and nest success can be impacted by human activities as far away as a quarter of a mile (Hayden and Bednarz, 1989).

Swainson's hawk (*Buteo swainsoni*)—Federal status: 3C; State status: none. Swainson's hawks are not currently considered threatened or endangered but were previously identified as a candidate species. As a raptor, they are protected by the state. Swainson's hawks are one of the most common breeding raptors in the Los Medaños area (Hayden and Bednarz, 1989). The species nests in mesquite trees and may be impacted by field activities associated with the RI/FS work.

Ferruginous hawk (*Buteo regalis*)—Federal status: C2; State status: none. Ferruginous hawks are occasional nonbreeding visitors in the Los Medaños area.

Golden eagle (*Aquila chrysaetos*)—Federal status: none; State status: none. Golden eagles are not known to breed in the vicinity of the Gnome-Coach Site but are occasionally observed hunting in the Los Medaños area. Although not considered threatened or endangered, they are protected federally by the Bald and Golden Eagle Protection Act and by the state for being a raptor.

Peregrine falcon (*Falco peregrinus*)—Federal status: Endangered; State status: Endangered, Group 1. After near extinction from the effects of DDT, this high-profile endangered species is an occasional visitor in the Los Medaños area.

Aplomado falcon (*Falco femoralis*)—Federal status: Endangered; State status: considered extinct in New Mexico. A sighting of this species was made during the course of the Raptor Research Program in the vicinity of the Gnome-Coach Site (Hayden and Bednarz, 1989).

Burrowing owl (*Athene cunicularia*)—Federal status: none; State status: none. Although not considered threatened or endangered, burrowing owls are protected by the state for being a raptor. The species is included here because they have an affinity for nesting at the edge of caliche-paved roads and pads, such as those at the Gnome-Coach Site, and therefore have a higher probability of being impacted by site work than most other raptors.

Great horned owl (*Bubo virginianus*)—Federal status: none; State status: none. Although not considered threatened or endangered, great horned owls are protected by the state for being a raptor. The species commonly nests in mesquite trees throughout the Los Medaños area, and active nests may be impacted by field activities at the Gnome-Coach Site.

Other sensitive wildlife species that may occur at the Gnome-Coach Site are as follows:

Bell's vireo (*Vireo vicinior*)—Federal status: none; State status: Endangered, Group 2. Bell's vireos are occasional breeders in the Los Medaños area.

Baird's sparrow (*Ammodramus bairdii*)—Federal status: C2; State status: Endangered, Group 2. Baird's sparrow is an uncommon migrant in eastern New Mexico and has been observed in the Los Medaños area by the WIPP environmental monitoring program (DOE, 1992).

Texas horned lizard (*Phrynosoma cornutum*)—Federal status: C2; State status: none. This species is not uncommon in the Los Medaños area. Although not considered endangered by the state, it is protected for being a horned lizard.

Sand dune sagebrush lizard (*Sceloporus graciosus arenicolus*)—Federal status: C2; State status: Endangered, Group 2. This species has not been recorded in the Los Medaños area; however, the similarity in habitat between the Los Medaños area and sites where it is known to occur require that it be included here as a potentially occurring sensitive species.

The least tern (*Sterna antillarum*) is mentioned in the survey plan as a potential, federally listed endangered species for the Gnome-Coach Site (DOE, 1993a); however, it is not included here due to the absence of habitat suitable for terns at this site. No sensitive species of mammals or amphibians were identified for the Gnome-Coach Site.

The New Mexico Forestry and Resource Conservation Division's *Inventory of Rare and Endangered Plants of New Mexico* (Sivinski and Lightfoot, 1992) provides a thorough and up-to-date treatment of sensitive plant species and their status for Eddy County, New Mexico. This report was used as the primary source for identifying sensitive plant species potentially occurring at the Gnome-Coach Site. The following is a list of these species:

Tharp's blue-star (*Amsonia tharpii*)—Federal status: C1; State status: List 1.

Gypsum milkvetch (*Astragalus gypsodes*)—Federal status: 3C; State status: List 2.

Waterfall milkvetch (*Astragalus waterfallii*)—Federal status: none; State status: List 2.

Scheer's pincushion cactus (*Coryphantha scheeri*)—Federal status: none; State status: List 1.

Texas gourd (*Cucurbita texana*)—Federal status: none; State status: List 3.

Devil's head cactus (*Echinocactus texensis*)—Federal status: none; State status: List 3.

Lloyd's hedgehog cactus (*Echinocereus lloydii*)—Federal status: Endangered; State status: List 1.

Button cactus (*Epithelantha micromeris*)—Federal status: none; State status: List 1.

Gypsum wild buckwheat (*Eriogonum gypsophilum*)—Federal status: Threatened; State status: List 1.

Havard's gumweed (*Grindelia havardii*)—Federal status: none; State status: List 3.

Rock bluet (*Hedyotis agulata*)—Federal status: none; State status: List 2.

Wright's justica (*Justica wrightii*)—Federal status: C2; State status: List 2.

Dune unicorn plant (*Proboscidea sabulosa*)—Federal status: 3C; State status: List 2.

Although some of these plants, e.g., Tharp's blue-star, gypsum milkvetch, and gypsum wild buckwheat, are not known from the vicinity of the Gnome-Coach Site, they are strongly associated with gypsum soils and are included here as potential species, due to the presence of highly calcic and gypsiferous soils at the Gnome command post site. It should also be noted that Lloyd's hedgehog cactus, though still listed by the USFWS as endangered, has recently been found to be a sporadic hybrid and not a valid species. It is expected that it will be removed from both the state and Federal lists of protected species (Sivinski and Lightfoot, 1992).

3.0 Procedure

3.1 Procedure for the Gasbuggy Site Survey

The sensitive species field survey at the Gasbuggy Site was conducted over a 2 1/2-day period (June 22 to June 24, 1993) by two biologists experienced with New Mexico sensitive species and with the biological communities of northwestern New Mexico. The survey was limited in scope to the 65-hectare (160-acre) area defined in the survey plan (DOE, 1993a). Because the boundaries of the Gasbuggy Site are not physically marked, the survey boundaries were estimated using a U.S. Geological Survey (USGS) 7.5 minute topographic map (the Leandro Canyon quadrangle) and 1:12,000 color aerial photograph from 1990. Where this information could not resolve questions of site boundary, the survey was extended beyond the probable site boundary to ensure site coverage.

The principal survey method entailed walking straight-line transects across the site. The transects were spaced approximately 40-meters (m) apart and generally oriented in an east-west direction. Each person was equipped with a Brunton compass so that corrections to the line of travel could be made intermittently. In areas of dense, woody vegetation and difficult terrain, some modifications to this pattern were required. Figure 3-1 shows the pattern of transects walked during the survey.

A total of approximately 16-km (10-mi) of transects were walked. During the survey, observations of plant species, vegetation types, and wildlife use were made and recorded on Field Activity Daily Logs. Field work was extended into the early evening (about 2000 hours) on June 22 and was begun between 0630 and 0700 on the mornings of June 23 and 24, in order to observe early morning and evening wildlife activity. In addition to the regular transects shown in Figure 3-1, observations of bird species were made at areas of higher activity and by less formal sweeps through the wooded habitat.

3.2 Procedure for the Gnome-Coach Site Survey

The sensitive species field survey at the Gnome-Coach Site was conducted over a 2 1/2-day period (June 25 to June 27, 1993) by two biologists experienced with New Mexico sensitive species and with the biological communities of southeastern New Mexico. The survey included the entire 275-hectare (680-acre) area defined in the survey plan (DOE, 1993a).

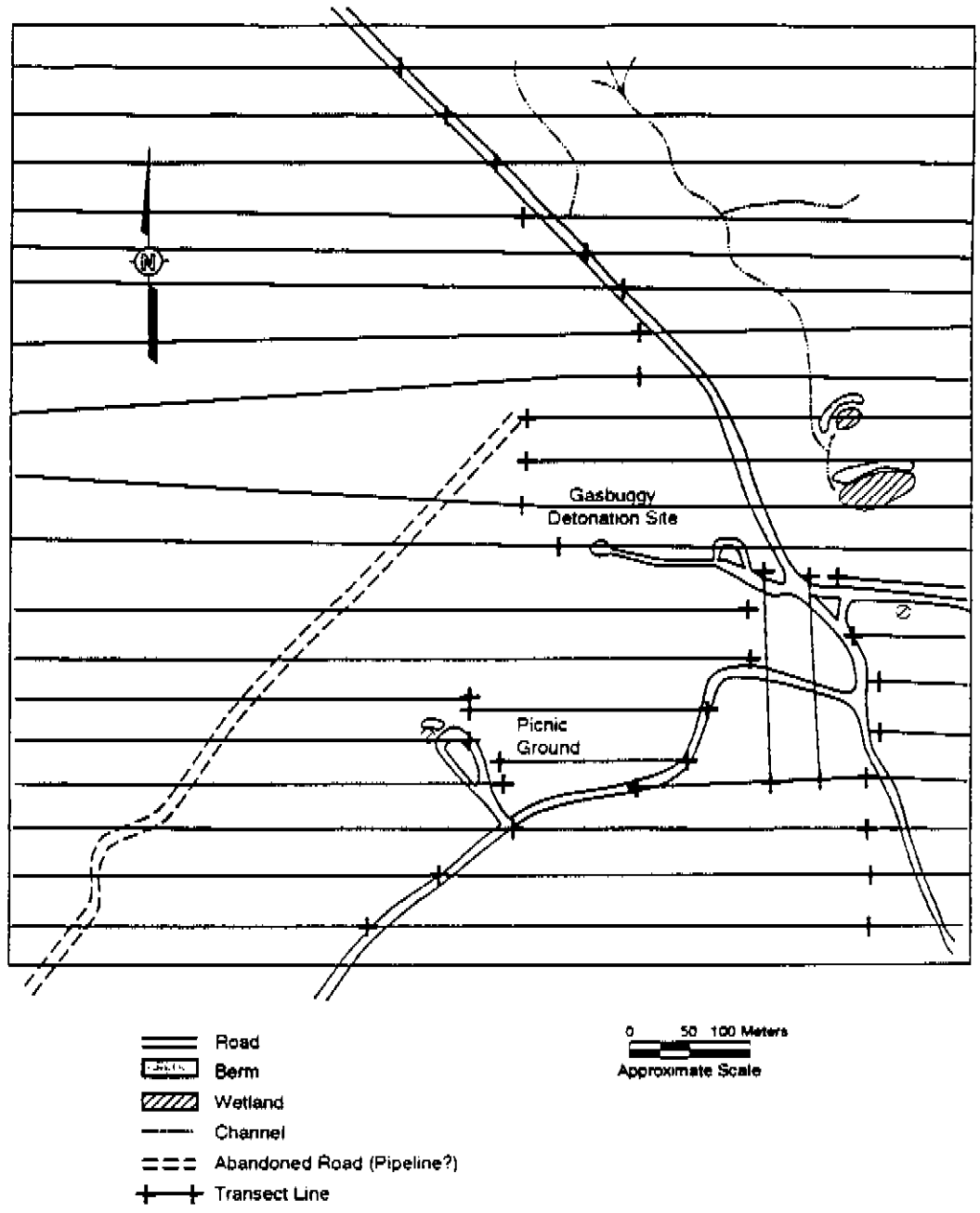

FIGURE 3-1
Pattern of transects used in the sensitive species survey at the Gasbuggy Test Site, New Mexico

The principal survey method entailed walking straight-line transects across the site. The transects were spaced approximately 80-m apart, and each person was equipped with a Brunton compass so that corrections to the line of travel could be made intermittently. Roads were used to divide Section 34 into three survey areas. Figure 3-2 shows the pattern of transects walked during the survey of this section. The command post area was surveyed by walking a large circular pattern through the interior of the site.

A total of approximately 33-km (20-mi) of transects were walked. During the survey, observations of plant species, vegetation types, and wildlife use were made and recorded on Field Activity Daily Logs. USGS 7.5 minute topographic maps (the Los Medaños and Remuda Basin quadrangles) and a 1:10,000 black-and-white aerial photograph from 1977 were used in locating ground positions. Field work was begun between 0630 and 0700 on the mornings of June 26 and 27 in order to observe early morning wildlife activity. By early afternoon, most wildlife activity was suppressed by high temperatures.

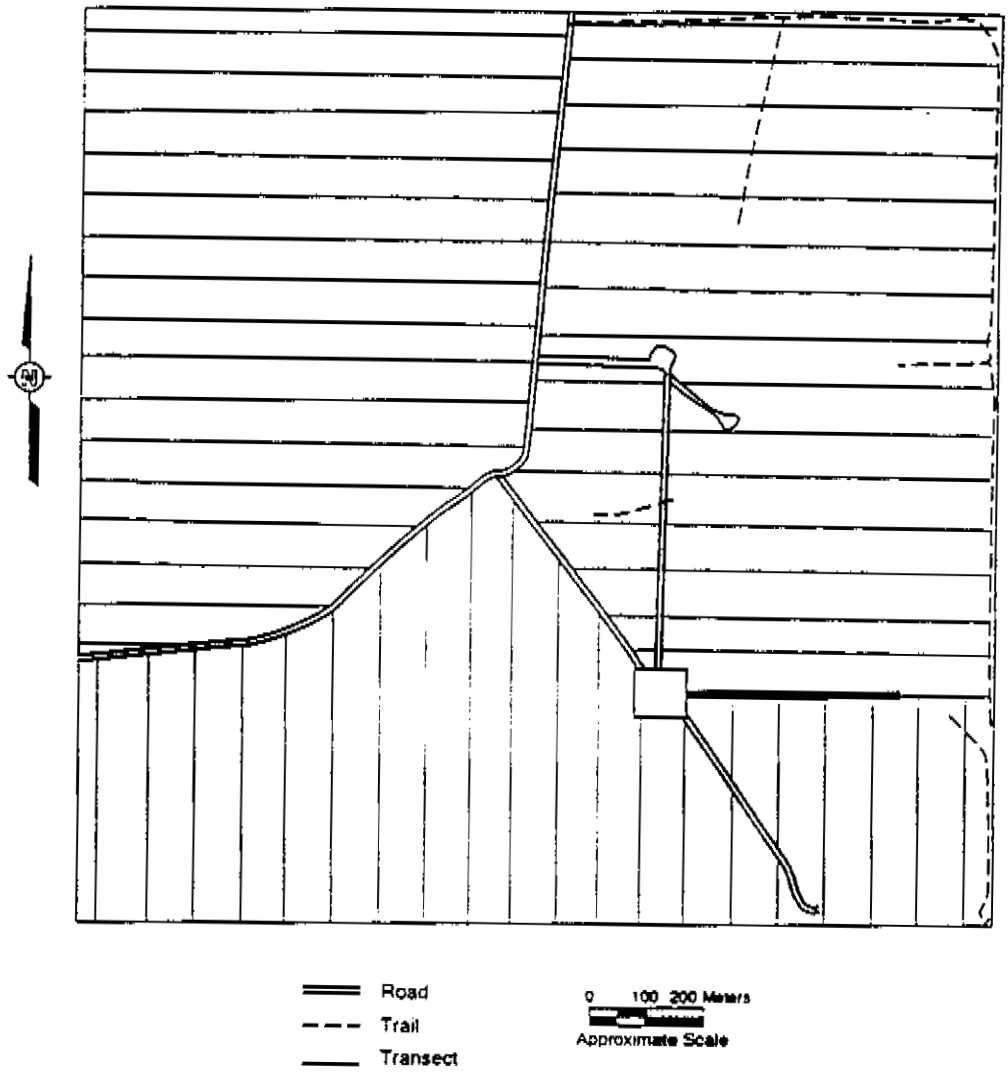

FIGURE 3-2
Pattern of transects used in the sensitive species survey at the Gnome-Coach Test Site (Section 34), New Mexico

4.0 Results

4.1 Results of the Gasbuggy Site Survey

Based on the hierarchical classification system of Brown et al. (1979), the Gasbuggy Site lies within the Cold Temperate climatic zone. The vegetation is divisible into three community types representing three formations: forest, scrubland, and grassland. The grassland type is further divided into two distinct series. The approximate areal extent of these types is shown in Figure 4-1. Descriptions of the types are as follows:

Rocky Mountain Montane Conifer Forest. This community type is dominated by ponderosa pine (*Pinus ponderosa*). Both pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are common, especially in more open areas along the margins of the type. Understory shrubs are largely the dominant species from adjacent community types, including Gambel's oak (*Quercus gambelii*), big sagebrush (*Artemisia tridentata*), and mountain mahogany (*Cercocarpus montanus*). Although the understory is fairly open over most of this type, the understory shrubs occasionally form impenetrable thickets. The Rocky Mountain Montane Conifer Forest is typically found along the steeper slopes of the site, forming a band around the drainage areas.

Great Basin Montane Scrub. This community type is found along hilltops, above the Rocky Mountain Montane Conifer Forest, where the shallow, rocky soils are probably too dry to support dense stands of conifers. The dominant species are Gambel's oak, mountain mahogany, and antelope brush (*Purshia tridentata*). These species sometimes form nearly monotypic stands. Ponderosa and pinyon pines are scattered throughout the type. Natural mortality among these plants leaves scattered snags that may be important roosting sites for raptors.

Great Basin Shrub-Grassland, Sagebrush-Grass Series. This community type is distinguished by the presence of big sagebrush as a codominant species with grasses, typically wheatgrasses (*Agropyron* spp.). This type is typically found along the lower margin of the Rocky Mountain Montane Conifer Forest, where the soils are probably too heavy to support trees. The transition between these two community types is gradual, and the boundary is indistinct. This community was probably the dominant vegetation type in the drainage area of the Gasbuggy Site, but has since been modified to a purer grassland through range development.

Great Basin Shrub-Grassland, Wheatgrass Series. Field evidence indicates that this community type is the result of range development, by which sagebrush has been removed and wheatgrasses seeded. The dominant grasses in this type are western wheatgrass (*Agropyron smithii*) and crested wheatgrass (*Agropyron*

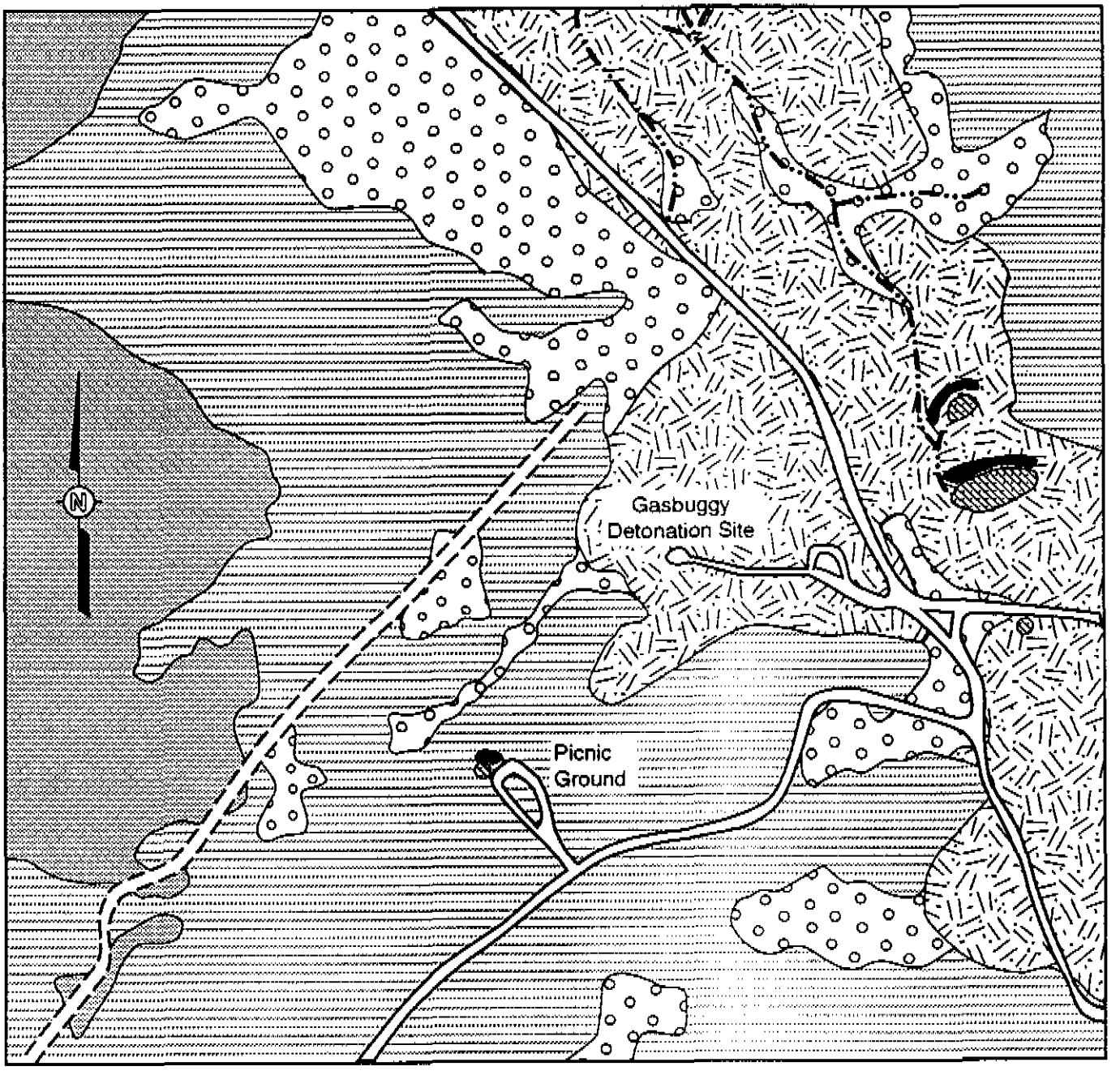

Figure 4-1

Vegetation Communities at the Gasbuggy Test Site, New Mexico

cristatum), two species commonly used to reseed rangelands in northwestern New Mexico. Legumes, such as alfalfa (*Medicago sativa*) and yellow sweet clover (*Melilotus officinalis*), are also common in seed mixes and are prevalent in this vegetation. The type is found through the center of the drainage area along the east side of the Gasbuggy Site and in the area disturbed by the test program itself. Although the type appeared in good condition for rangeland, the intensity of grazing probably inhibits the growth of some native plant species and certainly inhibited the observation and identification of some species. The effect of grazing was evidenced by a one-meter-square (three-foot-square) grazing exclosure at the north end of the survey area that contained a dense growth of grasses and alfalfa, in stark contrast to the grazed exterior areas.

Three cattle watering tanks have been created on the Gasbuggy Site by the construction of earth berms across drainage ways. All three of these tanks are heavily impacted by cattle, although one, which is nearly silted in and appears to function as a sediment retention pond for a downstream tank, is dominated by wetland vegetation, including pale spikerush (*Eleocharis macrostachya*), mousetail (*Myosurus minimus*), and (probably) cocklebur seedlings (*Xanthium strumarium*). Because of the limited extent of this vegetation type (less than 0.5-hectare [1 acre]), it is not considered a significant community type. The wetland community is described in more detail in the wetland and floodplain survey report (DOE, 1993b).

Tables 4-1 and 4-2 list the species of plants and wildlife, respectively, that were observed during the survey. Of these, only the elk (*Cervus canadensis*) is included based solely on evidence other than direct observation. This evidence included the remains of shed antlers and fecal pellet groups. It must be kept in mind that these results are from a Level I reconnaissance survey and probably represent a third to a half of the species actually on the site through the course of a year.

4.2 Results of the Gnome-Coach Site Survey

In attempting to apply the hierarchical classification system of Brown et al. (1979), it becomes apparent that the Gnome-Coach Site is not easily classified into major climatic zones and biotic communities. The site lies on the boundary between the Warm Temperate and Cold Temperate climatic zones, and the species present at the site have a mix of affinities between the Great Plains to the north and east and the Chihuahuan Desert to the south and west. The vegetation in Section 34 of the Gnome-Coach Site is divisible into three community types that

Table 4-1
List of Plant Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Class: Gymnospermae	
Family: Pinaceae	
Pinus edulis	Colorado Pinyon
Pinus ponderosa	Ponderosa Pine
Family: Cupressaceae	
Juniperus osteosperma	Utah Juniper
Juniperus scopulorum	Rocky Mountain Juniper
Class: Angiospermae	
Subclass: Monocotyledoneae	
Family Poaceae:	
Agropyron cristatum	Crested Wheatgrass
Agropyron smithii	Western Wheatgrass
Bouteloua gracilis	Blue Grama
Bromus tectorum	Downy Chess ("Cheatgrass")
Elymus canadensis	Canada Wild Rye
Oryzopsis hymenoides	Indian Ricegrass
Poa sp.	Bluegrass
Sitanion hystrix	Squirreltail
Stipa comata	Needle-and-Thread
Family: Cyperaceae	
Eleocharis macrostachya	Pale Spikerush
Family: Liliaceae	
Calochortus gunnisonii	Gunnison Mariposa Lily
Yucca angustissima	Fineleaf Yucca
Subclass: Dicotyledoneae	
Family: Fagaceae	
Quercus gambelii	Gambel Oak
Family: Polygonaceae	
Eriogonum jamesii	Antelope-sage
Rumex crispus	Curly Dock
Family: Chenopodiaceae	
Atriplex canescens	Four-wing Saltbush
Salsola kali	Russian Thistle
Family: Ranunculaceae	
Myosurus minimus	Tiny Mousetail
Family: Berberidaceae	
Berberis fremontii	Fremont Barberry

Table 4-1
List of Plant Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Family: Brassicaceae	
Rorippa curvipes	Watercress
Erysimum capitatum	Western Wallflower
Lepidium medium	Peppergrass
Family: Saxifragaceae	
Ribes sp.	Gooseberry
Family: Rosaceae	
Cercocarpus montanus	Mountain Mahogany
Purshia tridentata	Antelope Brush
Family: Fabaceae	
Astragalus sp.	Locoweed
Astragalus ceramicus	Painted Milkvetch
Astragalus humistratus	Ground Milkvetch
Astragalus oocalycis	Arborales Milkvetch
Lotus wrightii	Wright Deervetch
Lupinus caudatus	Lupine
Lupinus kingii	King Lupine
Medicago sativa	Alfalfa
Melilotus officinalis	Yellow Sweet Clover
Family: Geraniaceae	
Erodium cicutarium	Red-stemmed Filaree
Family: Anacardiaceae	
Rhus trilobata	Skunkbush
Family: Rhamnaceae	
Ceanothus fendleri	Buckbrush
Family: Malvaceae	
Sphaeralcea coccinea	Red Globemallow
Family: Cactaceae	
Coryphantha vivipara	Plains Pincushion Cactus
Opuntia erinacea	Prickly Pear
Family: Onagraceae	
Gaura coccinea	Scarlet Gaura
Oenothera albicaulis	Evening Primrose
Family: Asclepiadaceae	
Asclepias sp.	Milkweed
Family: Convolvulaceae	
Convolvulus arvensis	Field Bindweed

Table 4-1
List of Plant Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Family: Polemoniaceae	
Phlox hoodii	Woolly Phlox
Family: Verbenaceae	
Verbena bracteata	Prostrate Vervain
Family: Scrophulariaceae	
Castilleja sp.	Indian Paintbrush
Orthocarpus luteus	Yellow Owl-clover
Penstemon crandallii	Crandall's Beardtongue
Penstemon jamesii	James Beardtongue
Verbascum thapsus	Miner's Candle
Family: Asteraceae	
Achillea lanulosa	Western Yarrow
Artemisia frigida	Fringed Sagebrush
Artemisia tridentata	Big Sagebrush
Chrysopsis villosa	Hairy Golden Aster
Chrysothamnus nauseosus	Rabbitbrush
Cirsium neomexicanum	New Mexican Thistle
Erigeron sp.	Fleabane
Gutierrezia sarothrae	Snakeweed
Hymenoxys acaulis	Barestem Rubberweed
Leucelene ericoides	White Aster
Xanthium strumarium	Cocklebur
Senecio wootonii	Wooton's Butterweed
Tragopogon dubius	Goat's Beard

Table 4-2
List of Wildlife Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico

(from Stebbins, 1985, and Peterson, 1990)

Scientific Name	Common Name
Reptiles and Amphibians	
Order: Squamata	
Suborder: Lacertilia	
Family: Iguanidae	
Phrynosoma douglassii	Short-horned Lizard
Suborder: Serpentes	
Family: Colubridae	
Thamnophis elegans vagrans	Western Terrestrial Garter Snake
Birds	
Order: Falconiformes	
Family: Cathartidae	
Cathartes aura	Turkey Vulture
Family: Accipitridae	
Accipiter striatus	Sharp-shinned Hawk
Order: Columbiformes	
Family: Columbidae	
Zenaida macroura	Mourning Dove
Order: Caprimulgiformes	
Family: Caprimulgidae	
Chordeiles minor	Common Nighthawk
Order: Apodiformes	
Family: Apodidae	
Aeronautes saxatalis	White-throated Swift
Family: Trochilidae	
Archilochus alexandri	Black-chinned Hummingbird
Birds (Continued)	
Order: Piciformes	

Table 4-2
List of Wildlife Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico
(from Stebbins, 1985, and Peterson, 1990)

Scientific Name	Common Name
Family: Coraciiformes	
Colaptes auratus	Northern Flicker
Picoides villosus	Hairy Woodpecker
Order: Passeriformes	
Family: Tyrannidae	
Contopus sordidulus	Western Wood-pewee
Myiarchus cinerascens	Ash-throated Flycatcher
Tyrannus sp.	Kingbird (Western/Cassin's)
Family: Corvidae	
Corvus corax	Common Raven
Cyanocitta stelleri	Steller's Jay
Family: Paridae	
Parus gambeli	Mountain Chickadee
Family: Sittidae	
Sitta carolinensis	White-breasted Nuthatch
Sitta pygmaea	Pygmy Nuthatch
Family: Muscicapidae	
Myadestes townsendi	Townsend's Solitaire
Sialia mexicana	Western Bluebird
Sialia currucoides	Mountain Bluebird
Turdus migratorius	American Robin
Family: Emberizidae	
Subfamily: Parulinae	
Vermivora virginiae	Virginia's Warbler
Subfamily: Thraupinae	
Piranga ludoviciana	Western Tanager
Subfamily: Emberizinae	
Pipilo erythrophthalmus	Rufous-sided Towhee
Spizella passerina	Chipping Sparrow
Subfamily: Icterinae	
Molothrus ater	Brown-headed Cowbird
Mammals	
Order: Lagomorpha	

Table 4-2
List of Wildlife Species Found During the Sensitive Species Survey of the Gasbuggy Test Site, New Mexico

(from Stebbins, 1985, and Peterson, 1990)

Scientific Name	Common Name
Family: Leporidae	
Sylvilagus nuttalli	Mountain Cottontail
Order: Rodentia	
Family: Sciuridae	
Citellus variegatus	Rock Squirrel
Cynomys ludovicianus	Blacktail Prairie Dog
Eutamias quadrivittatus	Colorado Chipmunk
Sciurus aberti	Tassel-eared Squirrel
Order: Artiodactyla	
Family: Cervidae	
Cervus canadensis	Elk
Odocoileus hemionus	Mule Deer

are determined by soil conditions. The approximate areal extent of these types is shown in Figure 4-2. Descriptions of the types are as follows:

Plains Grassland, Oak-Grass Series. This community is associated with deep, sandy soils that form dunes over portions of the site. Although Brown et al. (1979) classify this community as the Bluestem Series, this name is misleading in that bluestem (*Andropogon scoparius*) comprises only a small portion of the vegetation. Shinnery oak (*Quercus havardii*) is the dominant species, along with a variety of grasses, including fall witchgrass (*Leptoloma cognata*), sand dropseed (*Sporobolus cryptandrus*), and giant dropseed (*Sporobolus giganteus*). Other common species include honey mesquite (*Prosopis glandulosus*), sandsage (*Artemisia filifolia*), and yucca (*Yucca campestris*). Many of the species in this community have affinities to the southern Great Plains rather than the Chihuahuan desert but are allowed to survive in this arid climate by the favorable moisture conditions provided by the deep, sandy soil. All of these species are adapted to surviving an environment of shifting sands. Several, such as shinnery oak and honey mesquite, stabilize the sand into coppice dunes. (Note: Shinnery oak is a true oak, but typically grows no more than 0.5-m [20-inches] tall, while covering large areas through the growth of underground runners.)

Semidesert Grassland, Black Grama Series. This is the dominant community type in Section 34 of the Gnome-Coach Site and is found where the soils are loamier and, therefore, more stable but drier than the Oak-Grass areas. The dominant species in this type is black grama (*Bouteloua eriopoda*). Common shrubs include honey mesquite, sandsage, wait-a-bit (*Mimosa biuncifera*), javelina bush (*Microrhamnus ericoides*), and desert Christmas cactus (*Opuntia leptocaulis*). Subshrubs are also common in this type, including small-head snakeweed (*Gutierrezia microcephala*), plains blackfoot (*Melampodium leucanthum*), and groundsel (*Senecio douglasii*).

Chihuahuan Desertscrub. The Gnome-Coach Site lies near the western edge of a large, natural depression called Nash Draw. The slopes that descend into Nash Draw typically have shallower, more calcic soils and are often devoid of the dune sands that typify the Los Medaños surface. In places along this topograghic boundary there are surface exposures of the underlying caliche layer and bedrock. In these soil conditions, shrub species of the Chihuahuan Desert are found and may become dominant in the vegetation community. These species include javelina bush, creosote bush (*Larrea tridentata*), whitethorn acacia (*Acacia constricta*), and range ratany (*Krameria parvifolia*). Honey mesquite is also an important shrub in this community. In Section 34 of the Gnome-Coach Site, development of Chihuahuan Desertscrub vegetation is limited to a calcic slope in the northwestern corner of the section. The 16-hectare command post site, however, is situated on a site of exposed caliche and gypsiferous bedrock. On this harsh substrate, Chihuahuan Desert scrub is well developed and includes crucifixion-thorn (*Koeberlinia spinosa*) as a codominant shrub.

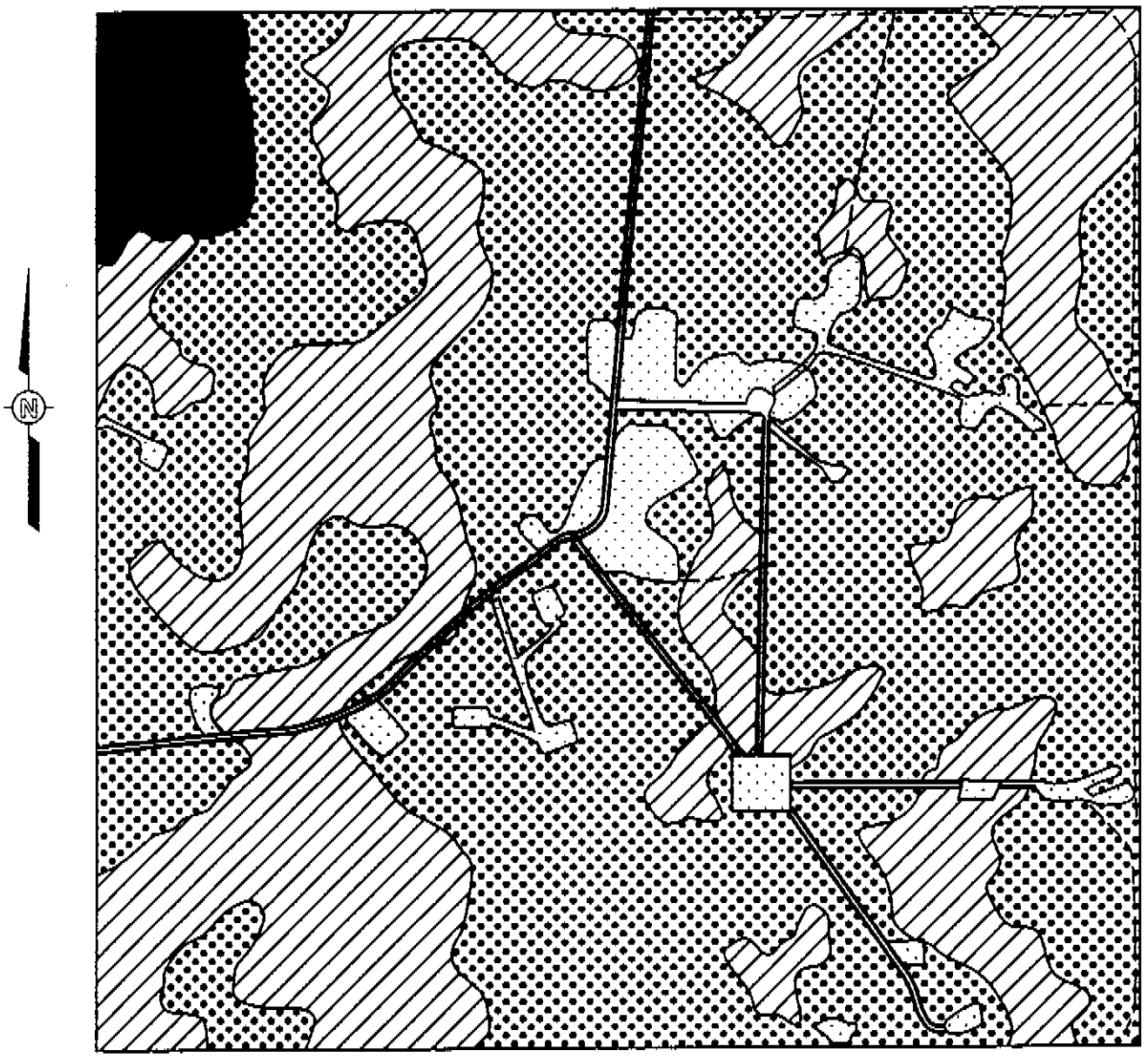

Figure 4-2

Vegetation Communities at the Gnome-Coach Test Site (Section 34), New Mexico

Tables 4-3 and 4-4 list the species of plants and wildlife, respectively, that were observed during the survey. Again, these results are from a Level 1 reconnaissance survey and probably represent a third to a half of the species actually on the site through the course of a year.

Table 4-3
List of Plant Species Found During the Sensitive Species Survey of the Gnome-Coach Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Class: Gymnospermae	
Family: Ephedraceae	
Ephedra torreyana	Mormon Tea
Class: Angiospermae	
Subclass: Monocotyledoneae	
Family: Poaceae	
Andropogon scoparius	Little Bluestem
Aristida purpurea	Purple Three-awn
Bouteloua eriopoda	Black Grama
Chloris virgata	Feathery Fingergrass
Leptoloma cognatum	Fall Witchgrass
Muhlenbergia porteri	Bush Muhly
Munroa squarrosa	False Buffalograss
Paspalum stramineum	Knotgrass
Setaria macrostachya	Plains Bristlegrass
Sporobolus cryptandrus	Sand Dropseed
Sporobolus giganteus	Giant Dropseed
Tridens pulchellus	Fluffgrass
Family: Cyperaceae	
Cyperus uniflora	Flatsedge
Family: Commelinaceae	
Commelina erecta	Whitemouth Dayflower
Family: Liliaceae	
Yucca campestris	Yucca
Subclass: Dicotyledoneae	
Family: Fagaceae	
Quercus havardii	Shinnery Oak
Family: Polygonaceae	
Eriogonum annuum	Annual Wild Buckwheat
Family: Chenopodiaceae	
Salsola kali	Russian Thistle
Family: Portulacaceae	
Talinum aurantiacum	Flame Flower

Table 4-3
List of Plant Species Found During the Sensitive Species Survey of the Gnome-Coach Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Family: Brassicaceae	
Dithyrea wislizenii	Spectaclepod
Lesquerella gordonii	Bladderpod
Family: Fabaceae	
Acacia constricta	Whitethorn Acacia
Astragalus sp.	Locoweed
Hoffmanseggia jamesii	Hog Potato
Krameria parvifolia	Range Ratany
Mimosa biuncifera	Wait-a-Bit
Prosopis glandulosa	Honey Mesquite
Family: Zygophyllaceae	
Larrea tridentata	Creosote bush
Family: Euphorbiaceae	
Croton dioecus	Croton
Euphorbia missurica	Lace Spurge
Euphorbia glyptosperma	Ridge-seed Spurge
Family: Rhamnaceae	
Microrhamnus ericoides	Javelina Brush
Family: Koeberliniaceae	
Koeberlinia spinosa	Crucifixion-thorn
Family: Loasaceae	
Mentzelia pumila	Common Stickleaf
Family: Cactaceae	
Coryphantha vivipara	Plains Pincushion Cactus
Echinocactus texensis	Devils Head Cactus
Echinocereus fendleri	Fendler Hedgehog Cactus
Opuntia imbricata	Tree Cholla
Opuntia leptocaulis	Desert Christmas Cactus
Opuntia phaeacantha	Sprawling Prickly Pear
Opuntia violacea	Prickly Pear
Family: Onagraceae	
Calylophus hartwegii	Hartweg Evening Primrose
Gaura coccinea	Scarlet Gaura
Oenothera albicaulis	Evening Primrose

Table 4-3
List of Plant Species Found During the Sensitive Species Survey of the Gnome-Coach Test Site, New Mexico

(from Martin and Hutchins, 1980, 1984, and 1986)

Scientific Name	Common Name
Family: Asclepiadaceae	
Asclepias sp.	Milkweed
Family: Solanaceae	
Physalis sp.	Groundcherry
Solanum elaeagnifolium	Horse Nettle
Family: Martyniaceae	
Proboscidea sabulosa	Sand Dune Unicorn Plant
Family: Rubiaceae	
Hedyotis houstonia	Bluets
Family: Cucurbitaceae	
Ibervillea tenuisecta	Cutleaf Globeberry
Family: Asteraceae	
Artemisia filifolia	Sand Sagebrush
Chrysothamnus pulchellus	Southwest Rabbitbrush
Dyssodia pentachaeta	Dogweed
Gutierrezia microcephala	Snakeweed
Haplopappus spinulosus	Spiny Yellow Aster
Helianthus petiolaris	Prairie Sunflower
Hymenopappus flavescens	White Ragweed
Melampodium leucanthum	Plains Blackfoot
Palafoxia rosea	Pink Palafoxia
Psilostrophe tagetina	Paper Daisy
Senecio douglasii	Threadleaf Groundsel
Verbesina encelioides	Golden Crownbeard

Table 4-4
List of Wildlife Species Found During the Sensitive Species Survey of the Gnome-Coach Test Site, New Mexico

(from Stebbins, 1985 and Peterson, 1990)

Scientific Name	Common Name
Reptiles and Amphibians	
Order: Testudines	
Family: Emydidae	
Terrapene ornata ornata	Western Box Turtle
Order: Squamata	
Suborder: Lacertilia	
Family: Teildae	
Cnemidophorus tigris marmoratus	Western Whiptail
Family: Iguanidae	
Uta stansburiana	Side-blotched Lizard
Phrynosoma cornutum	Texas Horned Lizard
Suborder: Serpentes	
Family: Viperidae	
Crotalus viridis viridis	Western Rattlesnake
Birds	
Order: Falconiformes	
Family: Cathartidae	
Cathartes aura	Turkey Vulture
Family: Accipitridae	
Buteo swainsoni	Swainson's Hawk
Order: Galliformes	
Family: Phasianidae	
Callipepla squamata	Scaled Quail
Colinus virginianus	Northern Bobwhite
Order: Columbiformes	
Family: Columbidae	
Zenaida macroura	Mourning Dove

Table 4-4
List of Wildlife Species Found During the Sensitive Species Survey of the Gnome-Coach Test Site, New Mexico

(from Stebbins, 1985 and Peterson, 1990)

Scientific Name	Common Name
Birds (continued)	
Order: Cuculiformes	
Family: Cuculidae	
Geococcyx californianus	Greater Roadrunner
Order: Passeriformes	
Family: Tyrannidae	
Tyrannus forficatus	Scissor-tailed Flycatcher
Tyrannus verticalis	Western Kingbird
Family: Mimidae	
Mimus polyglottos	Northern Mockingbird
Family: Laniidae	
Lanius ludovicianus	Loggerhead Shrike
Family: Emberizidae	
Subfamily: Cardinalinae	
Cardinalis sinuatus	Pyrrhuloxia
Subfamily: Emberizinae	
Aimophila cassinii	Cassin's Sparrow
Amphispiza bilineata	Black-throated Sparrow
Subfamily: Icterinae	
Sturnella magna	Eastern Meadowlark
Molothrus ater	Brown-headed Cowbird
Mammals	
Order: Rodentia	
Family: Cricetidae	
Neotoma micropus	Southern Plains Woodrat
Order: Lagomorpha	
Family: Leporidae	
Lepus californicus	Blacktail Jackrabbit
Sylvilagus auduboni	Desert Cottontail
Order: Artiodactyla	
Family: Cervidae	
Odocoileus hemionus	Mule Deer

5.0 Discussion

5.1 The Gasbuggy Site Survey

Of the sensitive species listed in Section 2.2, only one was actually observed at the Gasbuggy Site, the arborales milkvetch. A small population of arborales milkvetch (New Mexico List 2) was found in a rocky draw in the northeast corner of the survey area. This species is an indicator of seleniferous soils (Sivinski and Lightfoot, 1992) and, therefore, may indicate that favorable habitat conditions exist for the presence of Aztec milkvetch, another New Mexico List 2 sensitive species that occurs in selenium-bearing soils.

A plant species that may be present in the Sagebrush-Grassland community is Ripley's milkvetch, a USFWS C2 candidate species, FSS species, and New Mexico List 2 species. Habitat modifications and grazing pressure in the shrub-grassland community reduce the probability of this species occurring. Little Simpson's cactus (New Mexico List 1) may also occur in the wooded areas of the Gasbuggy Site. This small cactus would be easily missed in a Level I survey and should be considered if further site work involves new ground disturbances in the wooded areas. Based on the survey results, the other sensitive plant species identified in Section 2.2 cannot be ruled out as potential species at the Gasbuggy Site; however, habitat conditions are marginal for most, and their occurrence, if later verified, would probably be casual.

No threatened or endangered wildlife species were observed at the site during the survey. Both the sharp-shinned hawk and short-horned lizard observed fall under the blanket protection of raptors and horned lizards provided by the NMDGF. The site did not appear suitable for regular use by wintering bald eagles, Mexican spotted owls, or southwestern willow flycatchers, although accidental occurrences of any of these species is always possible. Gray vireos may occur in the denser, wooded areas, but the current data do not support special consideration for this species on the grounds of relatively poor habitat quality and low sensitivity of the species.

5.2 The Gnome-Coach Site Survey

Although only a single Swainson's hawk was observed during the survey, raptors, as a group, represent a high-profile, sensitive biological resource in the Los Medaños area. In addition to the occasional sightings of peregrine falcons in the area and the recent record of an aplomado

falcon, a number of raptor species that use the area throughout the year and the nesting density of Harris' hawks, Swainson's hawks, and great horned owls in the area make this an area of special concern to state and Federal resource managers. Of the non-raptor wildlife species listed as sensitive in Section 2.3, the Texas horned lizard (USFWS C2 candidate species) was observed during the survey.

Of the sensitive plants listed in Section 2.3, the sand dune unicorn plant (New Mexico List 2) was observed in the sand dune habitat, and the devil's head cactus (New Mexico List 3) was fairly numerous in the command post area. The possible occurrence of Scheer's pincushion cactus (New Mexico List 1) in the black grama grassland and Chihuahuan Desertscrub communities cannot be ruled out.

Finally, the calcic and probably gypsiferous nature of the substrate at the command post site creates a very unfavorable habitat for plants. Species that can survive the harsh conditions of these substrates require special adaptations that make them unable to compete against plants on more favorable sites. For this reason, species that are found on gypsiferous soils are often restricted in distribution to the small areas of gypsum outcrops and are therefore found to be sensitive due to rarity and potential habitat destruction. As noted in Section 2.3, some sensitive species are considered potentially occurring at the Gnome-Coach Site because they are found on gypsiferous soils in other parts of Eddy County. It is recommended that this area be more intensively surveyed prior to any activities that will cause significant ground disturbance.

6.0 Conclusion

6.1 The Gasbuggy Site

The Gasbuggy Site was found to be of low sensitivity with regard to biological resources, with only one, the arborales milkvetch, observed. The likelihood of any adverse impacts to Federally- or state-protected threatened or endangered species resulting from RI/FS field activities is very small. The following recommendations should be followed to protect sensitive species and other biological resources during field activities at this site:

- The Field Supervisor should consult with the Jicarilla Ranger District biologist prior to the initiation of field activities to ensure that there have been no recent developments at the site with regard to sensitive species for which impact mitigation measures would need to be implemented.

- Sites of new ground disturbance, particularly in the wooded areas, should be surveyed by an experienced biologist to ensure that sensitive species will not be impacted by the action.

- Field personnel should be instructed against handling or in any other way molesting or harming horned lizards, cacti, game animals, and birds and/or their nests.

- Unusual sightings made during field activities, such as an active raptor nest, a suspected bald eagle or Mexican spotted owl, or an unusual number of deer or elk should be reported to the Jicarilla Ranger District at the earliest convenient time.

6.2 The Gnome-Coach Site

The likelihood of any adverse impacts to Federally- or state-protected species resulting from RI/FS field activities at the Gnome-Coach Site is small; however, the site is considered biologically sensitive due to the high use by raptors and the presence of gypsiferous soils. The following recommendations should be followed to protect sensitive species and other biological resources during RI/FS activities at the Gnome-Coach Site:

- The Field Supervisor should consult with the biologist at the Carlsbad Resource Area Office of the BLM prior to the initiation of field activities to ensure that there have been no recent developments at the site with regard to sensitive species for which impact mitigation measures would need to be implemented.

- Sites of new ground disturbance, particularly at the command post site, should be surveyed by an experienced biologist to ensure that sensitive species will not be impacted by the action.

- Field personnel should be instructed against handling or in any other way molesting or harming horned lizards, cacti, and birds and/or their nests.

- Unusual sightings made during field activities, such as an active raptor nest near a work site, should be reported to the BLM at the earliest convenient time.

7.0 References

Brown, D. E., C. H. Lowe, and C. P. Pase, 1979, "A Digitized Classification System for the Biotic Communities of North America, with Community (Series) and Association Examples for the Southwest," *Arizona-Nevada Academy of Science 14 (Supplement 1)*, pp. 1-16.

Burt, W. H., and R. P. Grossenheider, 1980, "A Field Guide to the Mammals of North America North of Mexico," *Peterson Field Guide Series No. 5*, 3rd. ed., Houghton Mifflin Company, Boston, Massachusetts.

DOE. See U.S. Department of Energy.

DOE/NV. See U.S. Department of Energy, Nevada Operations Office.

Endangered Species Act of 1973, Public Law No. 93-205, 42 U.S.C. 1531 et seq., Washington, D.C.

Findley, J. S., 1987, *The Natural History of New Mexican Mammals*, New Mexico Natural History Series, University of New Mexico, Albuquerque, New Mexico.

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones, 1975, *Mammals of New Mexico*, New Mexico Natural History Series, University of New Mexico, Albuquerque, New Mexico.

Hayden, T. J., and J. C. Bednarz, 1989, *The Los Medaños Cooperative Raptor Research and Management Program, 1988 Annual Report*, (submitted to U.S. Department of Energy, Carlsbad, New Mexico), University of New Mexico, Albuquerque, New Mexico.

Hooley, Kamela, 1993, Jicarilla Ranger District Biologist, U.S. Forest Service, Personal Communication with N. Timothy Fischer, IT Corporation.

Martin, W. C., and C. R. Hutchins, 1980, *A Flora of New Mexico*, Volumes I and II, J. Cramer.

Martin, W. C., and C. R. Hutchins, 1984, *Spring Wildflowers of New Mexico*, New Mexico Natural History Series, University of New Mexico, Albuquerque, New Mexico.

Martin, W. C., and C. R. Hutchins, 1986, *Summer Wildflowers of New Mexico*, New Mexico Natural History Series, University of New Mexico, Albuquerque, New Mexico.

Montoya, B., 1990, *Revision of the List of Endangered Species*, New Mexico Department of Game and Fish, Santa Fe, New Mexico.

National Environmental Policy Act of 1969, Public Law No. 91-190; 83 Stat, 852; 42 U.S.C. 4321, Washington, D.C.

New Mexico Native Plants Protection Advisory Committee, 1984, *A Handbook of Rare and Endemic Plants of New Mexico,* University of New Mexico, Albuquerque, New Mexico.

Peterson, R. T., 1990, "A Field Guide to Western Birds," *Peterson Field Guide Series No. 2,* 3rd. ed., Houghton Mifflin Company, Boston, Massachusetts.

Sivinski, R. and K. Lightfoot (eds.), 1992, New Mexico Forestry and Resource Conservation Division, *Inventory of Rare and Endangered Plants of New Mexico,* Santa Fe, New Mexico.

Stebbins, R. C., 1985, "A Field Guide to Western Reptiles and Amphibians," *Peterson Field Guide Series No. 16,* Houghton Mifflin Company, Boston, Massachusetts.

U.S. Department of Agriculture, 1978, *Field Guide to Native Vegetation of the Southwest Region,* U.S. Department of Agriculture, Forest Service Southwest Region.

U.S. Department of Energy, 1992, *Waste Isolation Pilot Plant (WIPP) Site Environmental Report for Calendar Year 1991,* DOE/WIPP 92-007, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy Nevada Operations Office, 1993a, *Survey Plans for U.S. Department of Energy/Nevada (DOE/NV) Sites Outside of Nevada,* DOE/NV10972--27, Las Vegas, Nevada.

U.S. Department of Energy Nevada Operations Office, 1993b, *Floodplains and Wetlands Survey Results for the Gasbuggy and Gnome-Coach Sites, New Mexico,* DOE/NV/10972--58, Las Vegas, Nevada.