CHAPTER 10
WILDLIFE

10.1 INTRODUCTION

Commencing in 1973, several wildlife surveys were conducted on all or portions of the Navajo Mine leasehold in response to new laws (i.e., National Environmental Policy Act of 1969, Endangered Species Act of 1973, Surface Mining Control and Reclamation Act 1977) regulating the operation and expansion of mining and mineral development activities.

Site specific wildlife data are presented in this chapter. The chapter also provides an assessment of the impacts on wildlife that will result from the continued operation of the Navajo Mine. Mitigation for long-term and short-term adverse impacts to wildlife are outlined. A fish and wildlife monitoring plan is also presented.

10.2 SURVEY METHODS

Material presented in this chapter was compiled through a review of the reports based on previous wildlife studies conducted on or adjacent to the Navajo Mine since 1973. In addition, interviews with personnel of the Navajo Fish and Wildlife Department (NFWD), U.S. Fish and Wildlife Service (USFWS), New Mexico Department of Game and Fish (NMDGF), and the Bureau of Land Management (BLM) were used. The Navajo Nation, which was familiar with the studies that had been conducted previously and had knowledge of information requirements, also aided in the compilation of this chapter.

The entire Navajo Mine lease area and a considerable amount of adjacent area have been surveyed for wildlife. Results of the surveys and pertinent information obtained during interviews and correspondence with biologists and mine personnel were compiled and organized to provide a comprehensive description of the wildlife and fisheries resources on the Navajo Mine.

Previous wildlife studies on the lease and surrounding area include:

- Westinghouse Electric Corporation (Westinghouse 1975),
- Battelle (1975),
- Hinton (1980),
- Mariah (1983, 1984, 1985, 1986, 1987 and 1989),
- Woyewodzic (1987)
- Ecosphere Environmental (Dixon Extension) 2001
- Ecosphere Environmental (Area 4 North) 2004

A discussion of the methods used, species inventoried, and areas surveyed during each of the surveys is provided below.

10.2.1 Westinghouse Surveys

Westinghouse conducted terrestrial surveys of the North Area and Areas II, and III (EXHIBIT 10-1) in 1973 and 1974 to document existing conditions of the flora and fauna on areas that remained to be mined and to document the progress of reclamation (Westinghouse, 1975). The emphasis of the faunal survey was to obtain quantitative data on small mammals, birds, and reptiles. In addition to these animal groups, all wildlife observed throughout the study was recorded to provide an inventory of the species on the area. See Permit NM-0003C, Chapter 17, Appendix 17-A and 17-D for survey reports.

To characterize small mammal populations on undisturbed sites, Westinghouse biologists conducted live trapping on three range sites (EXHIBIT 10-1) during August 1974. One trapping grid was located on a sandy saline site, one was on a choppy sands type, and the third was on a shaley saline site. Each sampling grid consisted of eight rows of eight traps spaced at 50-foot intervals. One half of the interval between the trap sites (25 feet) was added to each end of each row in determining the affected area sampled by the grid. The total sampling grid in each open range site was, therefore, a square with 400 foot sides.

Small mammals were captured in 3" x 3" x 10" sheet metal sherman traps set at one per trap site. Bait consisted of a mixture of peanut butter and oatmeal. Traps were set on August 23, 1974, and checked daily each morning through August 28, 1974, for a total of five days of trapping, or 320 trap-nights (64 traps x 5 nights) for each of the grids.

When an animal was captured, it was identified as to species, sexed, examined for reproduction status, toe clipped for permanent identification, and released. Data were recorded on-site and analyzed daily to evaluate the effectiveness of the trapping techniques and to better determine the number of trapping nights necessary for valid population analyses.

Westinghouse also surveyed small mammal populations on revegetated areas to characterize the species present and determine population estimates. Small mammal trapping was conducted on one-acre grids within each of four revegetated plots on the north end of the lease (EXHIBIT 10-1). On two of the plots, the sampling grids consisted of two rows of 13 traps spaced at 50-foot intervals, with the rows 33 feet apart. One-half the interval between the trap sites (25 feet) was added to each end of each row, and one-half the space

between the rows (16.5 feet) was added to the outside of each row in determining the area sampled by the grid, resulting in a 66-foot x 650-foot sampling grid. The sampling scheme on the other two revegetation plots consisted of four rows of six traps spaced at 50 foot intervals. Thirty-three feet separated each row. Hence, the sampling grids on the last two revegetation plots were 132 feet x 300 feet in size. Traps were set and checked during the same five-day period between August 23 and 28, 1974, as on the undisturbed areas, which resulted in 130 trap-nights on the large grids and 120 trap-nights on the small grids. Other field procedures, data recording, and analysis were the same as previously described for the undisturbed areas. Daily recordings of all mammals observed on the grid and on routes between grids allowed total mammal characterization of the open range habitat and relative population analyses of not only small mammal species, but also of larger rodent, herbivore, and carnivore populations.

Standard roadside bird counts were used by Westinghouse in August 1974 to obtain information on bird species composition, habitat distribution, and relative abundance of avifauna on the Navajo Mine lease. The method consisted of stopping at one-half mile intervals along a predetermined route and counting all birds seen or heard within one-quarter mile of the observer during a three minute period. A route was established with 36 stops extending from mined areas in Area I to unmined sites in Area III (EXHIBIT 10-1). The northern portion consisted of stops 1-23, and the southern portion consisted of stops 24-36. Each portion was run twice during 1974: the northern on August 21 between 07:38 and 11:42 a.m., and on August 23 between 06:44 and 08:51 a.m.; and the southern on August 22 between 06:47 and 10:40 a.m., and on August 24 between 06:53 and 08:40 a.m.. Data were grouped by the habitats sampled.

Birds in the vicinity of the four revegetation plots were surveyed by walking along the axis of each plot and enumerating each individual that was flushed or observed overhead. Each of the revegetation plots was surveyed twice during August 1974.

Westinghouse surveyed reptiles, primarily lizards, by systematically walking along transects at favorable times in a series of locations representative of the habitat variation on undisturbed portions of the lease. The sampling was standardized by walking 500 steps during each survey. A total of 20 survey sites were selected (EXHIBIT 10-1); all were sampled once, and 10 were surveyed twice. Herpetafauna in the revegetation plots were surveyed simultaneously with the bird species using the techniques discussed above. Vegetation along the transect route was searched and shaken to promote flushing of herptiles.

Opportunistic observations of all other species were recorded by Westinghouse biologists during the field work for the standardized surveys discussed above.

10.2.2 Battelle Surveys

Battelle (Duke and Cornaby, 1975) conducted studies in 1973 and 1974 to describe the pre-construction biological and ecological conditions at Western Gasification Company's (WESCO's) proposed Coal Gasification Project and BHP's associated anticipated expansion of the Navajo Mine into Areas IV and V (jointly referred to as the WESCO study area). The studies encompassed Areas IV and V of the Navajo Mine plus an area to the west, including the Chaco River where WESCO's Gasification plants were proposed for construction, and a pump station site on the San Juan River (EXHIBIT 10-1). Battelle identified six major habitats on the WESCO study area and sampled small mammals, avifauna, and aquatic organisms during the

inventory. The exact location of sample sites could not be ascertained during review of the reports, consequently, the Battelle study site locations are not portrayed on EXHIBIT 10-1. See Permit NM-0003C, Chapter 17, Appendix 17-B and 17-C for survey reports.

Several methods were used to document the baseline condition of mammals during the Battelle study (Cornaby et al., 1975). Removal trapping and mark-recapture trapping were used to sample small mammals, while reconnaissance and observations were used to inventory prairie dogs, rabbits, and other intermediate and large-sized mammals. TABLE 10-1 lists the habitats, location, and number of station nights for 24-hour small mammal trapping sessions on the WESCO study area in 1973 and 1974. At the proposed San Juan River pump site, a total of six traplines were laid in the river flood plain and river bluff habitats during both years. The mine and gasification plant sites were sampled with a total of 32 traplines.

Each trapline in 1973 consisted of 20 stations, with three traps placed approximately three feet apart; stations were 50 feet apart. Exceptions include one trapline at the Gasification Plant site and one trapline at the San Juan River in June and the two River Stations in October which were all 30 feet apart. This was modified slightly in May and October 1974 by using traplines consisting of 25 stations. Traps were placed 50 feet apart for most of the traplines, but because of limited area, two of the lines were spaced 30 feet apart. Museum Special traps were baited with either peanut butter or a mixture of rolled oats and peanut butter. Each trapline was monitored daily for five consecutive days in June and four days in October 1973 and for three days in May and three in October 1974. Each small mammal captured was identified as to species, sex, age, and reproductive status and weighed to the nearest gram.

TABLE 10-1

SAMPLING INTENSITIES FOR VARIOUS HABITATS SAMPLED DURING SMALL MAMMAL TRAPPING IN THE WESCO STUDY AREA, NORTHWESTERN NEW MEXICO, 1973 AND 1974.[1]

Habitats	Location	(Station nights[2] by Month) Jun 1973	Oct 1973	May 1974	Oct 1974
Upland Dune	On lease.	-	-	75	75
Upland Flats	Northern part of lease.	120	160	75	-
	Southern part of lease.	-	-	225	-
	Central part of lease.	-	-	150	75
Playas	On lease.	-	80	-	-
Transition	Gasification Plant - Site 1.	60	80	-	-
	Near big pond.	60	-	-	-
	Badlands.	-	-	150	150
Lowland Flats	Gasification Plant - Site 1.	120	80	-	-
	Gasification Plant - Site 2.	-	-	75	75
	Cottonwood Plain.	-	-	75	-
Riparian Lands	Chaco Dunes.	-	80	-	-
	Sarcobatus Community.	-	-	75	-
	Chaco Floodplain.	-	-	75	-
	Pinobete Wash.	-	-	75	-
	Cottonwood Wash.	-	-	-	75
San Juan River	Floodplain.	60	80	75	75
	Bluff.	60	80	-	-
	TOTALS:	480	640	1125	525

[1]Cornaby et al. (1975).

[2]A station night is defined as the presence of an available trap or traps (Museum special) within a 3 - 4 foot circular area at each sample point during a 24-hr period.

Two live-trap grids were also used to sample small mammals in May 1974. Each grid consisted of eight lines with eight trapping points per line. Sherman live traps baited with rolled oats were placed 50 feet apart. One grid was placed in upland dunes; the other was located in upland flats. Also, in October 1974, 20 large live-traps were placed in various habitats and baited with ground beef and sardines to attract and inventory carnivores such as foxes. Additionally, during the October 1974 reconnaissance, prairie dog colonies were located and holes were counted on all but large colonies, where hole density was estimated. All other mammals observed during all study visits to the WESCO study area were recorded in field notes.

Birdlife at the WESCO study area was surveyed by Battelle using three methods during June 1 to 7, 1974 (Tolle, 1975). These methods included roadside surveys, reconnaissance surveys around stock ponds and arroyos, and a helicopter survey of cliff-nesting raptors. Transect surveys of the pumping station site at the San Juan River were also conducted. Alan P. Nelson (President, Four Corners Bird Club) assisted with species identification.

The roadside survey methods developed by the U.S. Department of the Interior (USDI, 1973) were used on four mornings to obtain an index for abundance of breeding birds. The survey provided information on the distribution and relative abundance of birds on the mine lease. Each of the four roadside surveys began at one-half hour before sunrise and continued for an average of seven hours each day along the same 25 mile route (50 stops at one-half mile intervals) within the WESCO mine lease. The seven hour period is considerably longer than the 4.5 hours normally allotted by the USDI (1973) but was necessary due to the rough roads and backtracking required to reach representative portions of the mine lease. The route was run from north to south on June 1 and 3, and in reverse order on June

2 and 6. Birds were counted at each stop for exactly three minutes. All birds heard and seen within a one-quarter mile radius were recorded on standard forms.

Five stock ponds (only one had water) and their adjacent vegetation, plus five arroyos (including the dry Chaco River), were surveyed for birds during eight hours of reconnaissance in the mid-afternoon by two observers. The walking surveys were conducted after each of the four roadside surveys, and during the afternoon of June 5, 1974. A special effort was made to locate nests.

Four hours were spent by Battelle personnel on June 4, 1974, searching for nests of large raptors with the aid of a Bell B-1 helicopter. The survey area included all of the large cliffs and arroyos on the WESCO study area, plus adjacent cliffs along the project's water pipeline corridor. A total of about 70 miles of suitable cliff nesting areas were searched using the helicopter. The flight was made at a time when most of the raptors in the area had finished incubation, but before the majority of the nestlings fledged. During this period, the adult raptors are least likely to desert the nest. Two observers participated in the survey. Nest locations were plotted on topographic maps. The number and description of eggs or nestlings, nest materials, nest diameter, and nest height were recorded for inactive nests or nests where adults were absent. Photos were taken of nearly all of the nests.

In addition to the breeding birds surveys in June 1974, Battelle conducted migratory waterfowl surveys and recorded use of the area by all other nonwaterfowl species during fall and winter. Waterfowl surveys were conducted during the following four periods: (1) November 13-16, 1973, (2) February 20-24, 1974, (3) September 22-25, 1974, and (4) November 11-14, 1974. The November and February survey periods were chosen to coincide with the peak period of both waterfowl numbers and variety of species migrating through San Juan County. The September period was chosen to coincide with peak populations of early migrants.

Nine waterfowl observation sites were chosen on the WESCO study area. Six of these sites were at natural or man made stock watering ponds on the mine and gasification plant lease areas. When one of the ponds was dry or frozen during a survey period, no count was made at that location. One intermittent pond was dry during all of the survey periods. A second site (at plant sites 1 and 2) included both a spring-fed stock pond and a marsh formed by overflow from the pond. The four remaining ponds were created by dams across arroyos. Three of the nine waterfowl observation sites were at the proposed pumping station site on the San Juan River. Observations were made from the bluffs which overlook the river and an oxbow marsh. Although the river levels were slightly different during each of the survey periods, the marsh always had areas with open water due to the presence of beaver dams. One-half hour observation periods were conducted at each of the sites, beginning at 30 minutes before sunrise. During the November 1973 survey period the stock ponds were surveyed first. Waterfowl were recorded as flying over the site or resting on the water.

Morgan Lake and tailing ponds built by Arizona Public Service (APS) were surveyed during September and November 1974, to compare waterfowl use of these water bodies with those found on the WESCO study area.

During each waterfowl survey, records were kept of all other birds observed in the area. An accurate census during these periods was not possible, due to the non-territorial, flocking behavior of most nonbreeding birds. However, the total number of each species observed, on both the mine lease and the pumping station site, was recorded. These data were used to prepare tables of the relative frequency of observation of all non-waterfowl species. Obviously, small birds not associated with the ponds or the river were unlikely to be included in these tables. A special effort was made to record all raptors observed while driving between survey sites. During the first survey period, assistance in species identification was received from Greg Schmitt (NMDFG), who had recently completed a study of the breeding birds of the San Juan River Valley (Schmitt, 1973).

10.2.3 Hinton Surveys

A survey for unique and endangered species on the entire 31,400 acre Navajo Mine leasehold (EXHIBIT 10-1) and adjacent areas was conducted during summer 1976 (Hinton, 1980). The survey was conducted to determine the status of unique and endangered wildlife on the lease, document how they use the area, assess potential impacts, and identify potential mitigation measures (Hinton, 1980). The species addressed were peregrine falcon, prairie falcon, golden eagle, ferruginous hawk, "prairie pigeon hawk" (merlin), burrowing owl, whitefaced ibis, mountain plover, black-footed ferret, and kit fox. The study began in mid-June 1976 and continued for three months. See Permit NM-0003C, Chapter 25, Appendix 25-A for survey

report.

The first month of the study emphasized locating and enumerating the raptors on the leasehold. Potential raptor nesting areas were systematically searched for birds or nests with the aid of binoculars and spotting scope. Locations of nests and raptor observations were plotted on base maps. Pertinent information was recorded in field notes.

Prairie dog towns, which are potential habitat for the burrowing owl and black-footed ferret, were also inventoried and mapped during the 1976 survey. All areas on the lease were systematically covered by four-wheel drive vehicle or on foot as necessary. Prairie dog colonies were searched for signs of black-footed ferret. A track visitation circle (an olfactory attractant placed in the center of a circular track bed of sifted soil) was placed in three of the prairie dog colonies to attract and inventory animals in the area. The track stations were checked for two consecutive mornings. Observations of any of the species of concern made during other field work were recorded.

10.2.4 Mariah Surveys

Surveys for black-footed ferret were conducted annually from 1983 through 1987 and 1989 by Mariah Associates, Inc. on specific areas within the lease that needed to be cleared for mining activities during that year (Mariah 1983, 1984, 1985, 1986, 1987 and 1989). The locations of all areas surveyed for black-footed ferrets during this five year period are shown on EXHIBIT 10-1. The area surveyed each year varied in response to the progress of mining after the previous survey and the mining or exploration plans for the next 12 months. Some areas near active mining have been surveyed for several years, while other areas were surveyed only once for a

specific activity. See Permit NM-0003C, Chapter 25 for report years 1983 - 85 (Appendices 25-B through 25-D) and Chapter 17 for report year 1989, Appendix 17-F.

Standard black-footed ferret survey procedures as approved by the NFWD and USFWS were employed during all surveys. The survey involved the mapping of all prairie dog colonies in the various annual study areas to identify potential black-footed ferret habitat, followed by night spotlighting and morning scan searches to look for ferrets and ferret sign. Night spotlighting was conducted by a team of two observers slowly driving a four-wheel drive vehicle through a unit of approximately 320 acres of prairie dog colonies and sweeping the beam of a 200,000 to 400,000 candles power spotlight in 360^0 arcs to search for green eye shine of the black-footed ferret. Surveys were started at dusk and continued through dawn for three consecutive nights on each survey unit. After completing spotlight searches each morning, the observers also searched the colonies for ferrets active above ground and for ferret sign (e.g., fresh trenching). The morning surveys were conducted on foot. Observations of all species observed during the night spotlighting and morning searches for sign were recorded on standard data forms. A summary of black-footed ferret survey efforts expended during the 1983-1987 period (not including time to map the prairie dog colonies) is provided in TABLE 10-2. The only addition to the survey effort is the completion of a 1989 Black-footed Ferret Survey for the Block B area by Mariah Associates, Inc. The report is titled "Black-footed Ferret Survey on Block "B" Amendment Area, Navajo Mine 1989" and found in Permit NM-0003C, Chapter 17, Appendix 17-F.

TABLE 10-2

SUMMARY OF BLACK-FOOTED FERRET SURVEY EFFORT ON THE NAVAJO MINE, NORTHWESTERN NEW MEXICO, 1983-1987

Date	Acres of Prairie Dog Colonies Searched	Night Spotlight (Person hours[2])	Morning Searches (Person hours[2])
Oct 3-14, 1983	457	176.0	108.0
Sep 10-24, 1984	1552	281.9	26.6
Jun 21 through Jul 20, 1985	1630	278.6	28.5
Aug 8-11, 1986	483	164.7	9.8
Jun 23-29, 1987	355	108.5	6.0
TOTALS:	4477	1009.7	178.9

[1]Mariah Surveys 1983 through 1987, (reports 1983 - 85 found in Permit NM-0003C, Chapter 25, Appendices 25-B - 25-D).

[2]Does not include time spent locating or mapping colonies within the area surveyed on the lease each year.

10.2.5 Woyewodzic Surveys

In 1987, BHP and the Bureau of Indian Affairs (BIA) Shiprock Agency entered in to a cooperative agreement for the BIA wildlife biologist (Robert Woyewodzic) to conduct a raptor survey to update the raptor information for lease area (Woyewodzic, 1987). Methods for the survey and inventory were based on standard raptor inventory procedures as outlined by Call (1978) and others, and were reviewed by BHP, BIA, NFWD, Office of Surface Mining (OSM), BLM, and USFWS prior to initiating field work. The study area for the 1987 raptor survey included all five mine areas and an adjacent one-quarter mile wide buffer zone around the lease perimeter (EXHIBIT 10-1). See Permit NM-0003C, Chapter 17, Appendix 17-E for survey report.

On May 4, 5, 7, 8, and 11, 1987, the study area was ground-checked to establish landmarks and coordinates on the field survey maps to be used during the aerial survey to locate raptor nests. Approximately 14.5 hours of aerial survey from a helicopter were spent searching for raptors on the study area on May 14 and 15. In addition to Mr. Woyewodzic, observers from BHP and the NFWD participated in the aerial survey. The locations of raptor nests and territories recorded during the aerial surveys were verified by subsequent ground observations commencing on May 18. All nests that contained young were monitored through the remainder of the 1987 breeding season to determine the number of young, fledged date, and number fledged. Additional data on nest location, substrate, construction materials and dimensions, aspect, height, prey remains, presence of parasites, and other pertinent information were also recorded. Ferruginous hawk nestlings were banded during June 1987.

10.3 RESULTS AND DISCUSSION

The following material provides a description of wildlife and fish and their habitats on and adjacent to the Navajo Mine lease. This information is presented in several sections starting with an overall area and habitat description followed by the presentation of data on the fish and wildlife species, which are addressed in various taxonomic groups (e.g., mammals, avifauna) or other categories as appropriate (e.g., threatened or endangered species). Finally, pertinent information is summarized regarding habitats and areas of most importance for consideration relative to impacts, mitigation, and monitoring.

10.3.1 Habitat Description

The area addressed in this report encompasses all of the North Area and Areas II, III and IV North (EXHIBIT 10-1). However, wildlife information for the entire lease and lands adjacent to the lease boundary is presented to provide a comprehensive description of wildlife resources and habitat in the entire area that may be influenced by the current and future operation of the mine.

The lease area is approximately 2-4 miles east to west and 25-30 miles north to south (EXHIBIT 10-1). Descriptions of the topography, soils, hydrology, climate, and vegetation are provided in detail in previous chapters of the permit application package. A short summary of the important aspects of each is presented below.

Various wildlife habitats are provided through different combinations of topography, soils, and water, all of which influence the vegetation present; habitats are often described and mapped based on an area's vegetation. Wildlife habitats on the lease were described in terms of range sites by Westinghouse (1975) and topographic position and erosion characteristics by Battelle (1975). Hinton (1980) based the description of habitats in his report on the range sites used by Westinghouse. The vegetation surveys (CHAPTER 9) identified eight range sites plus river wash on the undisturbed portions of the lease. The following description of wildlife habitats was based on information presented in the previous wildlife reports, the latest vegetation survey and observations made during black-footed ferret surveys throughout the lease in 1983 - 1987 and 1989. Please refer to the range site maps in CHAPTER 9 for specific information on the location and distribution of the sites mentioned in the following habitat description.

The undisturbed portions of the lease and permit area are dominated by gently rolling upland habitat that is comprised of several comparatively well vegetated range sites such as calcareous sands, dunes, sands, and saline sands and sparser vegetated thinbreak range sites. Intermingled within the upland habitat are less productive habitats of badlands sites. The uplands are dissected by drainages that provide another habitat composed of alkali wash range sites. Arroyo shrub habitat occurs adjacent to the larger washes in the area, and the unvegetated bottoms of the large washes are classified as river wash sites. Transition between the uplands and large drainages is often dominated by steep slopes and rock outcrops with sparse vegetation which is included in the badlands habitat. Each of the habitats plus the reclaimed area on the lease is briefly described below. The various habitat types that were used during the previous wildlife surveys are identified under the appropriate habitat description. Habitat descriptions are outlined in CHAPTER

9, VEGETATION, Section 9.5.

10.3.2 Wildlife and Fish

10.3.2.1 Mammals

Numerous species of mammals were observed during the various studies in the area, and additional species potentially occur based on the presence of suitable habitat on the lease (TABLE 10-3). A description of the large mammalian herbivores and discussion of the other mammals occurring in the area are presented below.

Large Mammals

Mule deer are occasionally observed on or near the Navajo Mine lease, but there are so few and sightings are so infrequent that observations of this species on the permit area proper are the dominant topic of the miner's conversation whenever one is sighted. Mule deer appear to be more frequent off the lease along the San Juan River bottoms and on the Navajo Agricultural Products Industries (NAPI) lands east of the mine (personal communication with Sam Diswood, NFWD, 1987). The mule deer occasionally observed on the permit area may be transients from those adjacent areas, or there may be a very small number residing on the lease; whatever the case, mule deer use of the area is extremely light. The lack of tall, dense shrubs or other forms of suitable cover may preclude frequent use of the permit area by mule deer. No sighting of pronghorn, the only other big game animal that potentially occurs in the area, has been recorded within the vicinity of the Navajo Mine lease to date. Domestic livestock such as horses, cattle, sheep, and goats occur throughout the lease.

TABLE 10-3

MAMMAL SPECIES OBSERVED ON AND ADJACENT TO THE NAVAJO MINE LEASE, AND OTHER SPECIES THAT MAY OCCUR IN NORTHWESTERN NEW MEXICO.[1]

Common Name	Scientific Name
(Rabbits:)	(Lagomorpha)
Desert Cottontail	Sylvilagus auduboni
Black-tailed Jackrabbit	Lepus californicus
(Rodents:)	(Rodentia)
White-tailed Antelope Squirrel	Amnospermophilus leucurus
Spotted Ground Squirrel	Spermophilus spilosoma
Rock Squirrel	Spermophilus variegatus
Gunnison's Prairie Dog	Cynomys gunnisoni
Botta's Pocket Gopher	Thomomys bottae
Silky Pocket mouse	Perognathus flavus
Apache Pocket Mouse	Perognathus apache
Western Harvest Mouse	Reithrodontomys megalotis
Deer Mouse	Peromyscus maniculatus
Canyon Mouse	Peromyscus cirnitus
Northern Grasshopper Mouse	Onychomys leucogaster
House Mouse	Mus musculus
White-throated	Neotoma albigula
Ord's Kangaroo Rat	Dipodomys ordii
Bannertail Kangaroo Rat	Dipodomys spectabilis
Beaver	Castor canadensis
Muskrat	Ondatra zibethicus
Porcupine	Erthrizon dorsatum
(Carnivores:)	(Carnivora)
Coyote	Canis latrans
Red Fox	Vulpes vulpes
Kit Fox	Vulpes macrotis
Gray Fox	Urocyon cinereoargenteus
Badger	Taxidea taxus
Striped Skunk	Mephitis mephitis
(Even-toes Hoofed Mammals:)	(Artiodactyla)
Mule Deer	Odocoileus hemionus
(Domestic Mammals:)	
Dog	Canis familiaris
Cat	Fedis domestica
Cow	Bos taurus
Horse	Equus caballus
Sheep	Ovis aires
Goat	Capra hircus

(Other Species That May Be Present:)	
Voles	Microtus species
Big Brown Bat	Eptesicus fiscus
Silver-haired Bat	Lasionycteris noctivagans
Yuma Myotis	Myotis yumanensis
Fringed Myotis	Myotis thysanodes
California Myotis	Myotis californicus
Small-footed Myotis	Myotis leibii
Hoary Bat	Lasiurus cinereus
Pallid Bat	Antozous pallidus
Big Green-tailed Bat	Tadarida brasiliensis
Western Pipistrel	Pipistrellus hesperus
Western Big-eared Bat	Pelotus townsendi
Mexican Free-tail Bat	Tadarida brasiliensis
Racoon	Procyon lator
Long-tailed Weasel	Mustela frenata
Mink	Mustela vision
Black-footed Ferret	Mustela nigripes
Spotted Skunk	Spilogale putorius
Pronghorn	Antilocopra americana

[1]List completed from Westinghouse 1975, Battelle 1975, Cornaby et al. 1975, Utah International Inc. 1985, and Mariah 1983 - 1987 and 1989.

Small, Medium-Sized, and Other Mammals

A summary of the small mammal species captured in the various habitats on and near the Navajo Mine during trapping in 1973 and 1974 is presented in TABLE 10-4. For purposes of discussion, the data are presented as number of animals captured per 100 trapnights because of (1) the difficulty in calculating adequate density estimates of small mammals populations, and (2) the variability in sampling effort and procedures among the areas and periods sampled.

The deer mouse and silky pocket mouse were the most abundant and widespread small mammal species trapped on and adjacent to the lease. Deer mice were captured in all habitats, and silky pocket mice were captured in all but the playa habitat, on which only a single deer mouse was captured. Deer mice were the most abundant small mammal in six of the areas sampled and silky pocket mice were the most abundant in the three of the areas sampled. Deer mice are widely distributed throughout most of North American (Whitaker, 1980) and are frequently the most common small mammal in grassland-brush habitats. Silky pocket mouse habitat occurs in sandy to rocky areas with sparse vegetation (Whitaker, 1980), which is characteristic of most of the Navajo Mine lease. The other six species of small mammals captured were much less abundant overall and were observed in fewer areas than deer mice and silky pocket mice. One northern grasshopper mouse was captured in each of the upland dunes, lowland flats, and riparian areas. Northern grasshopper mice are widely distributed throughout the prairies and southwest desert areas from Canada to northern Mexico and prefer open country covered by grass, sagebrush, or greasewood with sandy or gravelly soil (Burt and Grossenheider, 1964). One Apache pocket mouse was also captured in the each of the riparian, lowland flats, and upland flat areas. Apache pocket mice usually occur in sparse

TABLE 10-4

RELATIVE ABUNDANCE OF SMALL MAMMALS (#/100 TRAPNIGHTS) TRAPPED IN SEVERAL HABITATS ON AND NEAR THE NAVAJO MINE LEASE, NORTHWESTERN NEW MEXICO, 1973 AND 1974.

	Number of Animals Captured per 100 Trapnights by Habitat Type										
	Upland					Badlands			Alkali Wash		Arroyo Shrub
Species (Trapnights)	Dunes[1] (150)	Choppy Sands[2] (320)	Flats[1] (805)	Sandy Saline[2] (320)	Upland Mean	Trans-ition[1] (500)	Shaley Saline[2] (320)	Badlands Mean	Lowland Flats[1] (425)	Playa[1] (80)	Ripar-ian[1] (380)
Deer mouse	4.67	0.31	1.61	0.31	1.73	3.80	0.63	2.22	2.82	1.25	11.31
Silky pocket mouse	0.67	1.25	0.50	3.13	1.39	0.60	4.69	2.64	0.24	0	0.53
Northern grasshopper mouse	0.67	0	0	0	0.17	0	0	0	0.24	0	0.26
White-tailed antelope squirrel	0	0.31	0	0	0.08	0	0	0	0	0	0.79
Spotted ground squirrel	0	0.31	0	0.31	0	0	0	0	0	0	0
Apache pocket mouse	0	0	0.12	0	0.03	0	0	0	0.24	0	0.26

Ord's kangaroo rat	0	0	0	0	0	0	0	0	0	0	0.53
Western harvest mouse	0	0	0	0	0	0	0	0	0	0	0.53
TOTAL:	6.01	2.18	2.23	3.75	3.56	4.40	5.32	4.86	3.54	1.25	14.21
# of species per habitat	3	4	3	3	-	2	2	-	4	1	7

[1]Data from Battelle 1975.

[2]Data from Westinghouse 1975.

brush at 5000 to 7200 feet elevation in the Four Corners region (Burt and Grossenheider, 1964). One white-tailed antelope squirrel was captured in the upland habit (choppy sands area) and three were captured in the riparian habitat (TABLE 10-4). These ground squirrels live in sparse vegetation of the low deserts and foothills of the southwest (Burt and Grossenheider, 1964). The spotted ground squirrel, which prefers sandy soil (Burt and Grossenheider, 1964), was captured only in the sandy upland areas while Ord's kangaroo rat and western harvest mouse were captured only in riparian habitat (TABLE 10-4). The small mammal species captured on the Navajo Mine lease and adjacent areas typically occur in habitats with sparse vegetation or exhibit a wide range of habitat tolerance.

The riparian habitat, in which seven species and 14.21 small mammals per 100 trapnights were captured, had the highest number of both species and individuals of the habitats sampled. Most of the riparian areas sampled by Battelle (1975) were located along the Chaco River and other off-lease washes, which inflated the habitat diversity of the type relative to the diversity actually present on the arroyo shrub habitat on the Navajo Mine permit area. The number of species and relative abundance were also probably inflated relative to the actual situation on the lease. Nevertheless, the increased abundance of vegetation and shrubs provided in larger washes relative to the surrounding uplands and badlands supports both higher number of species and individuals and a higher small mammal diversity than the other habitats on the lease. In contrast, the barren playas on the lease yielded a very low number of only one species, the ubiquitous deer mouse.

Three to four species were trapped in the various upland habitat areas sampled on and near the Navajo Mine lease (TABLE 10-4). Relative abundance of small mammals in the upland habitats averaged 3.56 captures per 100 trapnights, with a range of 2.18 to 6.01 captures per 100 trapnights depending on the area sampled (TABLE 10-4). The lowland flats habitat with four species and 3.54 captures per 100 trapnights exhibited similar small mammal diversity and abundance to the upland areas (TABLE 10-4). The diversity of small mammals on badlands, where only two species were captured, was less than the upland areas; however, the average relative abundance (4.86 captures per 100 nights; range 4.40-5.32) was higher than on the uplands.

Numerous other species of mammals were observed on the lease in addition to the small mammals captured during the trapping studies. Mammals observed during all studies conducted on and adjacent to the lease plus other species that could be present in the general area based on availability of potential habitat are identified in TABLE 10-3. Desert cottontail and black-tailed jackrabbit are common lagomorphs on the lease. Both species were observed in upland flats, badlands, and floodplain areas and were considered "very frequent" by Battelle biologist (Cornaby et al., 1975).

Gunnison's prairie dog occurs throughout many of the upland areas on the lease; however, the distribution and extent of colonies and number of prairie dogs on the lease fluctuate widely. Battelle (1975) considered the prairie dog to be the most commonly observed mammal on the lease, but Hinton (1980) reported considerably fewer sightings and indicated that plague may have caused a drastic decline in the population. The prairie dogs appear to have undergone a recovery and then declined again since Hinton's study. In 1983 and 1984, prairie dogs were abundant and widespread on upland areas of the lease (Mariah, 1983, 1984); however, in 1985,

they started to decline (Mariah, 1985) and have continued to decline in 1986 and 1987. Large areas that supported prairie dogs in 1983 no longer contained active burrows in 1987 (Mariah, 1987). A few of the prairie dogs were drowned in floods, and some of the areas that contained prairie dogs have been mined, but plague is probably responsible for the current decline in prairie dog colonies in undisturbed portions of the lease. Kangaroo rats appear to have taken over some of the old prairie dog burrows, and burrowing owls also occupy old burrows throughout the lease.

The distribution of active prairie dog colonies on the lease in the areas surveyed during 1987 is shown on EXHIBIT 10-2. The 1987 survey was conducted on areas that may be disturbed during the next 12 months in the North Area and Areas II, III, and IV North, and did not cover areas on the lease that had been surveyed in previous years that would not be subject to disturbance in 1987. Therefore, north and west portions of the lease that were not resurveyed in 1987 may contain active prairie dog colonies that are not shown on EXHIBIT 10-2.

Only two kangaroo rats (both Ord's) were captured during the small mammal sampling efforts in 1973 and 1974 (TABLE 10-4); however, both Ord's and bannertails were frequently observed during the night spotlight surveys for black-footed ferrets in the mid-1980's (Mariah 1983 - 1987). It is not known if the populations have increased during that time or whether the lack of kangaroo rats in the animals captured, especially in the sandy upland habitats preferred by these nocturnal rodents, was an anomaly or sample bias. Kangaroo rat burrows are common in the sandy upland areas, and kangaroo rats would currently be considered common inhabitants of the Navajo Mine lease.

Common predators observed on the lease include coyote, red fox, kit fox, badger, and striped skunk. During night spotlighting conducted for black-footed ferrets, red foxes were more frequently observed in the northern portion of the lease (North Area and Area II) while kit foxes were more frequently observed in sandy upland habitat in Area III and IV North (Mariah, 1983 - 1987 and 1989). Kit foxes prefer open, level, sandy ground with low vegetation throughout the lease; these larger canids use a wider variety of habitats than the foxes. Badger diggings are most frequent in small mammals colonies (e.g., prairie dog and kangaroo rat concentrations), where animals frequently search for prey. Badger diggings have also been observed on reclaimed areas. Striped skunks were occasionally observed in a variety of habitats on the lease. Domestic or feral dogs and cats were also observed on the lease during surveys.

The beaver and muskrat observations reported by Battelle (1975) and Westinghouse (1975) were for areas off the lease along the San Juan and Chaco Rivers and possibly Morgan Lake. Only minimal habitat for these species occurs in the Bitsui Wash impoundment (pre-law area) on the lease proper.

10.3.2.2 Avifauna

Numerous bird species have been observed during the wildlife studies conducted on and adjacent to the lease (TABLE 10-5). The major groups of avifauna are discussed below.

TEXT CONTINUES ON PAGE 10-31

TABLE 10-5

BIRDS OBSERVED ON OR NEAR THE NAVAJO MINE LEASE AND OTHER SPECIES THAT MAY OCCUR IN NORTHWESTERN NEW MEXICO.[1]

Common Name	Scientific Name
(Bird Observed:)	
Eared Grebe	Podicepts caspicus
Pied-billed Grebe	Podilymbus podiceps
Great Blue Heron	Ardea herodias
Black-crowned Night Heron	Nycticorax nycticorax
Green Heron	Butorides virescens
American Bittern	Botaurus lentiginosus
Snowy Egret	Egretta thula
Great Egret	Casmerodius albus
White-faced Ibis	Plegadis chihi
Canada Goose	Branta canadensis
White-fronted Goose	Anser albifrons
Snow Goose	Chen caerulescens
Mallard	Anas platyrhynchos
Gadwall	Anas strepera
Pintail	Anas acuta
Green-winged Teal	Anas crecca
Cinnamon Teal	Anas cyanoptera
Blue-winged Teal	Anas discors
American Wigeon	Anas americana
Northern Shoveler	Anas clypeata
Ring-necked Duck	Aythya collaris
Bufflehead	Bucephala albeola
Ruddy Duck	Oxyura jamaicensis
Common Merganser	Mergus merganser
Turkey Vulture	Cathartes aura
Cooper's Hawk	Accipiter cooperii
Red-tailed Hawk	Buteo jamicensis
Rough-legged Hawk	Buteo lagopus
Swainson's Hawk	Buteo swainsoni
Ferruginous Hawk	Buteo regalis
Golden Eagle	Aquila chrysaetos
Merlin	Falco comumbarius
Prairie Falcon	Falco mexicanus
American Kestrel	Falco sparverius
Northern Harrier (Marsh Hawk)	Circus cyaneus
Gambel Quail	Callipepla gambelii
Scaled Quail	Callipepla squamata
Ring-necked Pheasant	Phasianus colchicus
Viginia Rail	Rallus limicola

Sora	Porzana carolina
American Coot	Fulica americana
Semi-palmated Plover	Charadrius semipalmatus
Killdeer	Charadrius vociferus
Mountain Plover	Charadrius montanus
Common Snipe	Capella gallinago
Spotted Sandpiper	Actitis macularia
Greater Yellowlegs	Tringa melanoleuca
Lesser Yellowlegs	Tringa flavipes
Pectoral Sandpiper	Calidris melanotos
Western Sandpiper	Calidris mauri
American Avocet	Recurvirostra americana
Wilson's Phalarope	Phalaropus tricolor
Red-necked Phalarope	Phalaropus lobatus
Herring Gull	Larus argentatus
Ring-billed Gull	Larus delawarensis
Bonaparte's Gull	Larus philadelphia
Black Tern	Chlidonias niger
Mourning Dove	Zenaida macroura
Great Horned Owl	Bubo virginianus
Burrowing Owl	Athene cunicularia
Barn Owl	Tyto alba
Common Nighthawk	Chordeiles minor
Black-chinned Hummingbird	Archilochus alexandir
Belted kingfisher	Megaceryle alcyon
Common Flicker	Colaptes auratus
Western Kingbird	Tyrannus verticalis
Ash-throated Flycatcher	Myiarchus cinerascens
Say's Phoebe	Sayornis saya
Western Flycatcher	Empidonax difficilis
Western Wood Pewee	Contopus sordidulus
Horned Lark	Eremophila alpestris
Rough-winged Swallow	Stelgidopteryx serripennis
Violet-green Swallow	Tachycineta thalassina
Bank Swallow	Riparia riparia
Barn Swallow	Hirundo rustica
Cliff Swallow	Hirundo pyrrhonota
Tree Swallow	Tachycineta bicolor
Black-billed Magpie	Pica pica
Common Raven	Corvus corax
Black-capped Chickadee	Parus atricapillus
Mountain Chickadee	Parus gambeli
Rock Wren	Salpinctes obsoletus
Canyon Wren	Catherpes mexicanus
Marsh Wren	Telmatodytes palustris
Northern Mockingbird	Mimus polyglottos
Sage Thrasher	Oreoscoptes montanus
American Robin	Turdus migratorius
Mountain Bluebird	Sialia currucoides
Loggerhead Shrike	Lanius ludovicianus
Blue-gray Gnatcatcher	Polioptila caerulea
Ruby-crowned Kinglet	Regulus calendula
Starling	Sturnus vulgaris
Common Yellowthroat	Geophylpis trichas
Yellow-breasted Chat	Icteria virens

Yellow-rumped Warbler	Dendroica coronata
Virginia's Warbler	Vermivora virginiae
MacGillivray's Warbler	Oporornis tolmiei
Wilson's Warbler	Wilsonia pusilla
Western Meadowlark	Sturnella neglecta
Yellow-headed Blackbird	Xanthocephalus xanthocephalus
Red-winged Blackbird	Agelaius phoeniceus
Brown-headed Cowbird	Molothrus ater
Northern Oriole	Icterus galbula
Cassin's Finch	Carpodacus cassinii
House Finch	Carpodacus mexicanus
Black-headed Grosbeak	Pheucticus melanocephalus
Blue Grosbeak	Guiraca caerulea
Green-tailed Towhee	Pipilo chlorura
Rufus-sided Towhee	Pipilo erythrophthalmus
Brown Towhee	Pipilo fuscus
Vesper sparrow	Pooecetes gramineus
Lark Sparrow	Chondestes grammacus
Black-throated Sparrow	Amphispiza bilineata
Sage Sparrow	Amphispiza belli
Chipping Sparrow	Spizella passerina
Clay-colored Sparrow	Spizella pallida
Brewer's Sparrow	Spizella breweri
White-crowned Sparrow	Zonotrichia leucophrys
Song Sparrow	Melospiza melodia
Savannah Sparrow	Passerculus sandwichensis
Dark-eyed Junco	Junco hyemalis
(Other Species That May Be Present:)	
Common Loon	Gavia immer
Western Grebe	Aechmophorus occidentialis
Tundra Swan	Cygnus columbianus
Redhead	Aythya americana
Canvasback	Aythya valisineria
Lesser Scaup	Athya affinis
Goshawk	Accipiter gentilis
Sharp-shinned Hawk	Accipiter striatus
Peregrine	Falco peregrinus
Sanderling	Calidris alba
Black-necked Stilt	Himantopus mexicanus
Franklin's Gull	Larus pipixcan
Forster's Tern	Sterna forsteri
Common Crow	Corvus brachythynchos
Brewer's Blackbird	Euphagus cyanocephalus
Black-bellied Plover	Pluvialis squatarola
Long-billed Curlew	Numenius americanus
Solitary Sandpiper	Tringa solitaria
Willet	Catoptrophorus semipalmatus
Baird's Sandpiper	Calidris bairdii
Long-billed Dowitcher	Limnodromus scolopaceus
Marbled Godwit	Limosa fedoa

[1]From species lists in Westinghouse (1975), Battelle (1975), Tolle (1975), Hinton (1980), and Mariah (1983 - 1987).

Breeding Birds

Results of the roadside breeding bird surveys conducted on Lease Areas IV and V and off-lease habitat along the Chaco River by Battelle (Tolle, 1975) during June 1974 and on the North Area and Areas II and III by Westinghouse (1975) during August 1974 are presented in TABLES 10-6 and 10-7, respectively. Six hundred thirty seven individuals and 26 species were observed in June (TABLE 10-6); 327 individuals and 20 species were observed in August (TABLE 10-7). Horned larks are by far the most abundant and widespread bird species on the area. These common passerines prefer terrain with short vegetation (Ligon, 1961; Fautin, 1946) that is typical of the lease. Horned larks had 1.6 to 3.3 average individuals per stop and were observed on 42 to 61 percent of the stops (TABLE 10-6 and 10-7). Mourning doves were the second most abundant birds (0.4 individuals per stop) and were the second most abundant in the Westinghouse study area during August. Mourning doves were relatively widespread (observed on over 25 percent of the stops) while the rough-winged swallows occurred on only one of the stops. The mourning dove is the most widely distributed game bird in New Mexico and is the game bird least affected by drought and destruction of cover by livestock and other abuses of the land (Ligon, 1961). Several species of birds were more widely distributed among the stops during the June survey than during the August survey; five species occurred on at least 10 percent of the stops in June while only horned lark and rock wren were the widely distributed in August.

TEXT CONTINUED ON PAGE 10-36

TABLE 10-6

SUMMARY OF ROADSIDE BREEDING BIRD SURVEYS CONDUCTED ON AREAS IV AND V OF THE NAVAJO MINE LEASE AND ADJACENT AREAS IN NORTHWESTERN NEW MEXICO.[1]

Species	Total Individuals[2]	Individual Per Stop	Stops Per Species[3]	Percent of Stops
Horned lark	320	1.60	121	60.5
Mourning dove	79	0.40	53	26.5
Black-throated sparrow	44	0.22	27	13.5
Rock wren	30	0.15	25	12.5
House finch	30	0.15	20	10.0
Loggerhead shrike	25	0.12	8	4.0
Mockingbird	22	0.11	17	8.5
Red-winged blackbird	20	0.11	4	2.0
Say's phoebe	15	0.08	13	6.5
Cinnamon teal	8	0.04	4	2.0
Common raven	7	0.04	2	1.0
Killdeer	7	0.04	6	3.0
Brown-headed cowbird	7	0.04	2	1.0
Green-winged teal	4	0.02	3	1.5
Ferrugenous hawk	3	0.02	2	1.0
Spotted sandpiper	3	0.02	1	0.5
Mountain plover	2	0.01	2	1.0
Mallard	2	0.01	1	0.5
Lark sparrow	2	0.01	1	0.5
Great egret	1	<0.01	1	0.5
Pintail	1	<0.01	1	0.5
Golden eagle	1	<0.01	1	0.5

American kestrel	1	<0.01	1	0.5
Burrowing owl	1	<0.01	1	0.5
Empidonax flycatcher	1	<0.01	1	0.5
Tree swallow	1	<0.01	1	0.5
TOTALS:	637	3.18	-	-

[1]Data from Tolle (1975), 50 three-minute stops were made at 0.5 mile intervals beginning at 0.5 hour before sunrise on June 1, 2, 3, and 6, 1974, for a total of 200 stops.

[2]Number of birds observed at all 200 stops.

[3]Indicates the number of stops, out of a possible 200, when one or more individuals of a species were observed.

TABLE 10-7

SUMMARY OF ROADSIDE BREEDING BIRD SURVEYS CONDUCTED ON AREAS I, II, AND III OF THE NAVAJO MINE LEASE IN NORTHWESTERN NEW MEXICO.[1]

Species	Total Individuals[2]	Individual Per Stop	Stops Per Species[3]	Percent of Stops
Horned lark	235	3.26	30	41.7
Rough-winged swallow	12	0.17	1	1.4
Rock wren	11	0.15	7	9.7
Brewer's swallow	10	0.14	3	4.2
Bank swallow	10	0.14	1	1.4
Cliff swallow	9	0.12	3	4.2
Mourning dove	7	0.10	4	5.6
Common raven	5	0.07	3	4.2
Loggerhead shrike	4	0.06	4	5.6
Tree swallow	4	0.06	2	2.8
Say's phoebe	3	0.04	2	2.8
Barn swallow	3	0.04	1	1.4
American kestrel	3	0.04	3	4.2
Red-tailed hawk	2	0.03	1	1.4
Prairie falcon	2	0.03	2	2.8
Burrowing owl	2	0.03	2	2.8

Hummingbird	2	0.03	2	4.2
Ferruginous hawk	1	0.01	1	1.4
Killdeer	1	0.01	1	1.4
Savannah sparrow	1	0.01	1	1.4
TOTALS:	327	4.54	-	-

[1]Data from Westinghouse (1975); three-minute stops were made at 0.5 mile intervals with the route divided into two sections. The northern section (stops 1-23) was run on the mornings of August 21 and 23, 1974, and the southern section (stops 24-36) was run on the mornings of August 22 and 24, 1974, for a total of 72 stops.

[2]Number of birds observed at all 72 stops.

[3]Indicates the number of stops, out of a possible 72, when one or more individuals of a species were observed.

Nine species of birds recorded during the June roadside survey were observed only at an overflow marsh near the Chaco River (Tolle, 1975), which is over one mile from the Navajo Mine lease. These species included the great egret, mallard, pintail, green-winged teal, cinnamon teal, killdeer, spotted sandpiper, tree swallow, and brown-headed cowbird. Only two other stops on the June survey were within one-quarter mile of open water. Of the above nine bird species, only the killdeer and brown-headed cowbird were observed elsewhere on the mine lease during general reconnaissance surveys. Five additional species were seen at the overflow marsh after the three minute survey period was over: savannah sparrow, hummingbird (species undetermined), American coot, western meadowlark, and rough-winged swallow. These five birds were not observed during June at any other location on the mine lease. A small marsh type habitat has formed in the Bitsui wash impoundment (pre-law area) on the northern part of the North Area as a result of excess irrigation water from the NAPI lands adjacent to the lease. This is the only wetland habitat currently found on the lease that could support species similar to the ones observed at the overflow marsh. Species usually associated with wetland habitat would not have been expected to occur on the dry upland habitats present on most of the lease. The other species observed during the surveys typically occur in grassland and sparse brush habitats throughout their range. The numbers of species and individuals observed during the bird surveys were considered typical of the region (Westinghouse, 1975). Habitat complexity, primarily associated with density and stature of shrubs or proximity to water, had the greatest influence on number of birds. Low numbers of birds occurred at sites with low vegetation cover. All sites where high numbers of birds were observed were either close to water or near stands of tall shrubs with herbaceous understory; however, well-developed vegetation cover did not guarantee high bird numbers (Westinghouse, 1975).

General reconnaissance surveys conducted during midday in June 1974 around five stockponds (only one of which had water) and along five arroyos on the lease and nearby habitats associated with the WESCO Coal Gasification Project resulted in the observation of a total of 21 species (TABLE 10-8). Most of the species had also been observed during the roadside surveys; however, the reconnaissance yielded six additional species that were not observed on the standardized survey. Only one or two individuals of these additional species (great horned owl, western kingbird, ash-throated flycatcher, western wood pewee, northern oriole, and blue grosbeak) were observed. Horned larks, mourning doves, and house finches were considered abundant, which is consistent with the results of the standardized road count.

Birds Migrating and Wintering in the Area

A list of non-waterfowl birds observed on the WESCO study area and Morgan lake during fall and winter 1973-1974 is provided in TABLE 10-9. The bulk of the passerine fall migration takes place in late August through early October (Hayward, 1967), so many of the species observed during the September survey were birds moving through the area. The resident horned lark was the most abundant bird on the mine area during September, and the other 31 species observed on the lease were considered uncommon or rare (TABLE 10-9; Tolle, 1975). Killdeer (21 birds) was the most frequently observed species on or around Morgan Lake during September. Nine of the 15 species observed at Morgan Lake were not observed on the mine lease proper during September. Most of those nine species are associated with water and would not be expected to occur on the lease property during September. Fewer bird species were observed on the lease during the November 1973 and 1974 surveys than during the summer

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TABLE 10-8

SPECIES OF BIRDS OBSERVED DURING GENERAL RECONNAISSANCE AROUND STOCK PONDS AND ARROYOS ON THE NAVAJO MINE LEASE AND ADJACENT HABITATS, NORTHWESTERN NEW MEXICO.[1]

Comman Name	Frequency of Observation
Red-tailed hawk	U
Ferruginous hawk	R
Killdeer	R
Mourning dove	A
Great horned owl	R
Burrowing owl	R
Western kingbird	R
Ash-throated flycatcher	R
Say's phoebe	C
Empidonax flycatcher	R
Western wood pewee	R
Horned lark	A
Cliff swallow	R
Common raven	U
Rock wren	U
Mockingbird	U
Northern oriole	R
Brown-headed cowbird	R
Blue grosbeak	R

House finch	A
Black-throated sparrow	C

[1]Data from Tolle (1975), represents eight hours of mid-afternoon walking surveys by two observers on June 1, 2, 3, 5 and 6, 1974. Includes surveys at five stock ponds (only one pond had water), and five arroyos (including the dry Chaco River) on the WESCO Lease.

[2]The approximate numbers of birds observed are indicated as follows:

A = abundant, 20+;
C = common, 8-19;
U = uncommon, 3-7;
R = rare, 1-2.

TABLE 10-9

NUMBER AND RELATIVE ABUNDANCE OF NON-WATERFOWL BIRDS OBSERVED ON THE NAVAJO MINE LEASE AND ADJACENT HABITATS, NORTHWESTERN NEW MEXICO.[1]

Name	Frequency of Observations by Date and Area[2]				
	Nov 13-16, 1973 Lease[3]	Feb 20-24, 1974 Lease[4]	Sep 22-25, 1974 Lease[5]	Sep 22-25, 1974 Morgan Lake[6]	Nov 11-14, 1974 Lease[7]
Eared grebe	-	-	-	6-U	-
Pied-billed grebe	-	-	-	7-U	-
Great blue heron	-	-	-	3-R	-
Turkey vulture	2-R	-	-	-	-
Cooper's hawk	-	-	1-R	-	-
Golden eagle	-	1-R	-	-	-
Ferruginous hawk	1-R	-	4-R	-	6-U
Rough-legged hawk	-	1-R	-	-	-
Red-tailed hawk	1-R	1-R	2-R	-	6-U
Swainson's hawk	-	2-R	-	-	-
Praire falcon	2-R	1-R	1-R	-	2-R
Merlin	1-R	-	-	-	-
American kestrel	1-R	-	1-R	1-R	-
Northern harrier	-	1-R	2-R	-	1-R
Scaled quail	56-C	-	-	-	-

Semi-palmated plover	-	-	-	1-R	-
Killdeer	-	-	12-U	21-U	-
Lesser yellowlegs	-	-	-	3-R	-
Pectoral sandpiper	-	-	4-R	-	-
American avocet	-	-	8-U	-	1-R
Wilson's phalarope	-	-	2-R	-	-
Northern phalarope	-	-	-	2-R	-
Herring gull	-	-	-	1-R	-
Ring-billed gull	-	-	-	1-R	-
Black tern	-	-	-	6-R	-
Mourning dove	-	-	2-R	-	-
Great horned owl	1-R	-	-	-	1-R
Burrowing owl	-	-	1-R	-	-
Say's phoebe	-	-	1-R	-	-
Western wood pewee	-	-	1-R	-	-
Horned lark	1900+-A	1400+-A	100+-A	5-U	107-C
Barn swallow	-	-	1-R	-	-
Bank swallow	-	-	1-R	-	-
Common raven	33-C	9-U	13-U	2-R	11-U
Rock wren	-	-	1-R	-	-
Sage thrasher	-	-	1-R	-	-

American robin	-	-	1-R	-	-
Loggerhead shrike	2-R	1-R	-	-	5-U
Blue-gray gant catcher	-	-	8-U	-	-
Ruby-crowned kinglet	-	-	4-R	-	-
Yellow-rumped warbler	-	-	3-R	-	-
Wilson's warbler	-	-	8-U	-	-
Western meadowlark	-	-	-	-	4-R
Yellow-headed blackbird	-	-	12-U	-	-
Red-winged blackbird	3-R	-	-	1-R	1-R
Cassin's finch	3-R	-	-	-	-
House finch	2-R	2-R	2-R	-	3-R
Green-tailed towhee	-	-	5-U	-	-
Black-throated sparrow	1-R	-	-	-	-
Vesper sparrow	-	-	1-R	-	-
Sage sparrow	27-U	53-C	2-R	-	11-U
Clay-colored sparrow	-	-	3-R	-	-
Brewer's sparrow	-	-	8-U	-	-

White-crowned sparrow	3-R	-	-	-	1-R
Dark-eyed junco	-	20-U	-	-	-

[1]Observations by Tolle (1975), during four fall and winter periods in 1973 and 1974.

[2]Birds were not censused. Letters indicate frequency of observation during waterfowl surveys. The approximate number of observations are indicated as follows:

A = abundant, 200+;
C = common, 30-199;
U = uncommon, 5-29;
R = rare, 1-4.

[3]Includes observations at six pond sites on the mine lease.

[4]Includes a general reconnaissance of the WESCO Lease (particularly around cliffs near the Chaco River). Ponds were frozen.

[5]Includes 0.5 hour observation periods at two stock ponds plus, observations along roads in the mine lease.

[6]Includes 0.5 hour observation periods at two sites around Morgan Lake (NW and SE sides).

[7]Four ponds were surveyed all four days; the fifth pond was surveyed on the last three days. Observations were made for 0.5 hours per day at each pond.

breeding season or fall migration. Seventeen species were observed on the lease in November 1973, and 15 species were observed during 1974 (TABLE 10-9). Horned lark was the most abundant species; scaled quail and common raven were considered common in 1973. Five to six raptor species were observed on the lease during the November surveys.

The number of species observed on the WESCO study area declined to 12 in February (TABLE 10-9). Horned lark was by far the most abundant species during winter with over 1400 birds observed, followed by sage sparrow (53) and dark-eyed juco (20). One or two individuals of six raptor species were also observed on the WESCO study area during the winter (TABLE 10-9). Ponds on the lease were frozen during the February survey so that habitat was not AS available as it was during the other periods.

Waterfowl

A summary of waterfowl observed on natural or man-made stock ponds on or near the Navajo Mine lease during four periods in 1973-1974 is presented in TABLE 10-10. The data from the waterfowl observed on the San Juan River pumping station site are not presented because the area is several miles off-lease and the area's habitat is quite dissimilar from that on the lease.

TABLE 10-10

SUMMARY OF WATERFOWL OBSERVED ON NATURAL OR MAN-MADE STOCK PONDS ON OR ADJACENT TO THE NAVAJO MINE LEASE, NORTHWESTERN NEW MEXICO.[1]

Species	Number Observed By Date				
	Nov 13-16, 1974[2]	Feb 20-24, 1974[3]	Sep 22-25, 1974[4]	Nov 11-14, 1974[5]	Total All Dates
Mallard	8	0	0	1	9
Pintail	0	0	12	0	12
Green-winged teal	2	0	20	0	22
Blue-winged or Cinnamon teal[6]	0	0	198	0	198
Cinnamon teal	0	0	3	0	3
Northern shoveler	0	0	35	0	35
Gadwall	2	0	0	0	2
Bufflehead	11	0	0	6	17
Ruddy duck	2	0	0	0	2

American coot[7]	1	0	0	0	1
TOTALS:	26	0	268	7	301

[1]Data from Tolle (1975), 1973-74.

[2]One pond out of six possible was dry during the survey period.

[3]Ponds were frozen during the survey period; no survey was conducted.

[4]Two ponds were surveyed.

[5]Four ponds were surveyed on all four days; the fifth pond was surveyed on the last three days.

[6]Males were in eclipse plumage; consequently, species could not be determined.

[7]Coots are not in the waterfowl family; however, their habitat requirements are similar to ducks, and they are included herein.

Substantial numbers of ducks are present in the San Juan Valley proper during the migratory season, due in part to the concentrated production of food crops in the valley (Huey, 1967). Waterfowl in the area also use the water sources such as stock ponds and impoundments on the lease in variable amounts as they migrate through the area. Blue-winged or cinnamon teal were by far the most common of the 10 species of waterfowl observed on the stock pond (TABLE 10-10; Tolle, 1975). The birds were in eclipse plumage when they were observed using the area as a stopover during migration; consequently, species could not be positively identified. Most of the teal were observed on the "overflow pond" along the Chaco River over one mile west of the lease. Teal prefer to feed in shallow water and use small ponds more frequently than rivers or large lakes (Sprunt and Zim, 1961). Northern shovelers, another species that prefers shallow water, were the second most abundant duck observed, and green-winged teal were the third (TABLE 10-10). Peak use of the area by waterfowl depends on weather conditions. Most (89 percent) of the waterfowl were observed during the September survey, and only a few remained during November. All ponds were frozen during February, and no waterfowl were observed in the lease area.

Very little waterfowl production occurs on the ponds or impoundments on the lease. Eight cinnamon teal were observed during the June 1984 surveys (TABLE 10-6), but the report did not indicate if they were adults or young. Mine personnel report that a brood of ducks is occasionally raised on some of the ponds in the lease area; however, the paucity of suitable nesting and brood rearing habitat on these mine ponds limit the potential waterfowl production on the lease. The small marsh at Bitsui provides about the only suitable waterfowl habitat on the lease. Most of the other ponds currently on the lease are little more than shallow puddles that intermittently contain runoff water but do not support wetland type vegetation.

Approximately 2200 to 3200 American coots were observed on Morgan Lake during fall 1974 (TABLE 10-11). Although coots are not in the waterfowl family, their habitat requirements are similar to ducks, and they are generally included in the discussion on waterfowl. Relatively large numbers of bluewinged or cinnamon teal also used Morgan Lake during September, but these early migrants had moved on by the mid-November survey. The other eight species of waterfowl observed on Morgan Lake included common species such as mallard, pintail, and northern shoveler and less common species such as snow geese and ring-necked duck.

Raptors

Battelle (Tolle, 1975) reported active nests of two golden eagles, two great horned owls, two red-tailed hawks, one ferruginous hawk, one prairie falcon, and one common raven in the vicinity of the lease and WESCO's Gasification Project during 1974. The raven is not technically a raptor, but it is often addressed in the raptor section of reports due to the similarity of nests and habits. An additional 21 inactive raptor nests were also recorded during the 1974 survey, which covered a large amount of cliff habitat along the Chaco River west of the lease. Only one of the red-tailed hawks, one of the great-horned owls, the ferruginous hawk, and the common raven successfully raised young that year. All nests were on the side of cliffs except the ferruginous hawk nest, which is located on the ground (Tolle, 1975). The prairie falcon nest was located on a rock column along the Chaco River, west of the Navajo Mine lease. The exact location of the other nests relative to the Navajo Mine lease was not revealed in the report; however, most were believed to have been along "The Hogback" west of the lease.

TABLE 10-11

SUMMARY OF WATERFOWL OBSERVED ON MORGAN LAKE, ADJACENT TO THE NAVAJO MINE LEASE, NORTHWESTERN NEW MEXICO.[1]

Species	Number Observed By Date	
	Sep 22-25, 1974	Nov 12-14, 1974
Snow goose	0	2
Mallard	14	31
Pintail	41	5
Green-winged teal	1	0
Blue-winged or Cinnamon teal[2]	325	0
American pigeon	32	1
Northern shoveler	70	0
Ruddy duck	6	0
Ring-necked duck	0	4
American coot[3]	3168	2200
TOTALS:	3657	2243

[1]Data from Tolle (1975).

[2]Males were in eclipse plummage; consequently, species could not be determined.

[3]Coots are not in the waterfowl family (Anatidea); however, their habitat requirements are similar to ducks, and they are included herein.

Hinton (1980) reported that two active prairie falcon nests, one active golden eagle nest, and three active burrowing owl nests were found during 1976. The ferruginous hawk nest previously reported by Battelle was inactive. The burrowing owls were located in prairie dog colonies on the lease and the other active raptor nests were approximately one-quarter to two miles west of the lease. Red-tailed hawks, great horned owls, turkey vultures, and common ravens were also reported as successfully nesting in that same area west of the lease but were not studied in detail because they were not the species of concern for that study.

Woyewodzic (1987) recently completed the first comprehensive inventory of the Navajo Mine lease and adjacent habitat specifically for raptors. He reviewed all existing information obtained during the previous studies during his preparation for the intensive raptor surveys in the 1987 breeding season and spent considerable time locating and monitoring raptor nests in the area. His data are currently the best available for the area, and his report was the source for the following detailed description of raptor nesting activity on the lease.

Four raptor species were reported nesting within the lease and adjacent one-quarter mile buffer zone during 1987. These species were ferruginous hawk, red-tailed hawk, American kestrel, and burrowing owl. In addition to the active nests of these species, frequently used hunting perches were located for the ferruginous hawk, golden eagle, red-tailed hawk, prairie falcon, northern harrier, and American kestrel.

One active ferruginous hawk nest was located within the lease while three active ferruginous hawk nests were located within approximately one-quarter mile of the lease (TABLE 10-12, EXHIBIT 10-2). The ferruginous hawk nesting site on the lease (Middle Cottonwood Site) is located in the northeast corner of Area IV approximately two-thirds of a mile east of the permit area (EXHIBIT 10-2). One young was fledged on July 1, and one egg in the nest was unhatched. The nest contained a considerable number of avian lice and mites, which probably had a significant detrimental effect on the vigor of the nestling. The young was banded with USFWS Band Number 43120. Active ferruginous hawk nests beyond the lease boundary but within approximately one-quarter mile include the Northeast Mine Site 2, Ruin, and Coal Corral Site (TABLE 10-12, EXHIBIT 10-2). The nests produced two or three young each. Ferruginous hawks are birds of the semi-arid plains and intermountain areas that breed in relatively open areas (Evans, 1983). Nests are located on a variety of substrates; nest sites in the vicinity of the Navajo Mine ranged from the ground to cliffs. Ferruginous hawks are considered rare to uncommon in New Mexico (Hubbard, 1978).

Prey remains collected from ferruginous hawk nesting territories indicated that the birds were feeding primarily on prairie dogs, pocket gophers, black-tailed jackrabbits, and cottontails with secondary prey comprised of horned lark, insects, and various small reptiles (Woyewodzic, 1987).

TABLE 10-12

RAPTOR NESTS ON THE NAVAJO MINE LEASE WITHIN APPROXIMATELY ONE-QUARTER MILE OF ADJACENT AREA, NORTHWESTERN NEW MEXICO.[1,2]

Species	Site Name	Location[3]	Status
Ferruginous hawk	Middle cottonwood	NE corner of Area IV	1 fledged 7/01; 1 unhatched.
Ferruginous hawk	NE mine site 2	1200' East of Area I	2 fledged 7/02; 1 dead.
Ferruginous hawk	Coal corral site	300' West of Area V	2 fledged 6/25; 1 fledged 7/06.
Ferruginous hawk	Ruin	1200' West of Area V	Active.
Red-tailed hawk	Yazzie point	SW corner of Area I	1 fledged between 7/01 and 7/07.
Red-tailed hawk	Area III powerline	E side of Area III	Undetermined.
Red-tailed hawk	Navajo Mine powerline	N side of Area IV North	2 fledged 6/25/
American kestrel	Yazzie point	SW corner of Area I	Unknown number of young.

[1]Survey by Woyewodzic (1987).

[2]Does not include burrowing owl nests that occurred in prairie dog colonies on the lease for which specific location of nests was not determined.

[3]Refer to EXHIBIT 10-2 for mapped location.

Three red-tailed hawk nests were observed on the lease during 1987: the Yazzie Point Site (one young), the Navajo Mine Powerline (two young), and the Area III powerline (status undetermined) (TABLE 10-12, EXHIBIT 10-2). Red-tailed hawks are a common raptor throughout the United States (Robbins et al., 1983) and have the widest ecological tolerance of any buteo in North American (Brown and Amadon, 1968). Red-tails are considered rare to fairly common in New Mexico, depending on the specific location (Hubbard, 1978).

An active American kestrel aerie was also located in the Yazzie Point area during the 1987 breeding season (TABLE 10-12, EXHIBIT 10-2). No data on number of young were recorded for this nest. American Kestrels are the most common falcon in open and semi-open country (Robbins et al. 1983) and are considered rare to fairly common in New Mexico, depending on the exact location (Hubbard, 1978). These birds nest in cavities or holes in trees or cliffs (Call, 1978); the rock outcrops and rimrocks in the lease provide potential nesting habitat for this species.

Populations of burrowing owls were located in active and inactive prairie dog colonies within the North Area and Areas III, IV and V (EXHIBIT 10-2). Approximately 51 individual burrowing owls, both adults and juveniles, were observed in those areas during August 1987. Burrowing owls are typically restricted to habitats that contain burrows, in which they nest and raise young. Although burrowing owls are on the list of Species of High Federal Interest for the United States, they are not considered or treated as a Species of High Federal Interest in the San Juan Basin by the BLM (personal communication in letter from Ron Fellows, Farmington Resource Area Manager, to Robert Woyewodzic, September 10, 1987) or as a species of special concern by the Navajo Nation (personal communication in letter from Larry Benallie, Sr., NFWD Director, to Robert Woyewodzic, October 15, 1987). This is because of their

fairly widespread occurrence in the area. Burrowing owls in the San Juan Basin are treated in the same manner as other relatively common raptors (e.g., American kestrel) in regard to assessing impacts of mining.

Several raptor perches were also identified on the lease during the 1987 survey. Although no golden eagle nests occurred within the lease of buffer zone, golden eagles had recently used a large spoil pile in the northeast part of the North Area as a perch. The eagles using the perch hunt on NAPI land east of the lease. The powerline located just west of Yazzie Point was used as a perch site by American kestrels continuously from late February through October. Red-tailed hawks, ferruginous hawks, and prairie falcons were also observed perching on this powerline at various times throughout the year. The two mesas on the eastern edge of Area IV were frequently used as perch sites by ferruginous hawks, especially during the nesting season. Most ledges and other protruding landforms were observed to display accumulations of whitewash from excrement; however, most whitewash was probably from ravens, which are relatively common on the lease and surrounding area.

In addition to the species identified above, northern harrier, bald eagle, barn owl, and great horned owl were reported to have been observed within the lease at various times throughout the year. Nests for these species were not located on or within the lease during the 1987 raptor nest survey.

Nests of several other ferruginous hawks, red-tailed hawks, golden eagles, and prairie falcons are located west of the lease along "The Hogback" and other suitable sites beyond the one-quarter mile buffer (EXHIBIT 10-2). Active barn owl nests were also observed in area beyond the buffer during the 1987 survey (Woyewodzic, 1987).

Battelle (Tolle, 1975) reported that turkey vulture, Cooper's hawk, golden eagle, ferruginous hawk, rough-legged hawk, red-tailed hawk, Swainson's hawk, prairie falcon, merlin, American kestrel, and northern harrier were observed in the lease or nearby areas during fall migration and winter periods (TABLE 10-9). Migrating and wintering raptors are very opportunistic in response to availability of prey and weather conditions and no specific high use areas have been identified or are anticipated on the lease property.

Upland Game Birds

Mourning doves and scaled quail were the most frequently recorded upland game birds observed on the Navajo Mine lease during the various wildlife surveys. Gambel's quail and ring-necked pheasant were on species lists of birds observed in the area during previous surveys but they were apparently isolated observations.

As reported during the breeding bird surveys, mourning doves were abundant on the area during the breeding season but migrated out of the area during winter. Scaled quail were not observed on any stops during the 1974 roadside breeding bird survey (Westinghouse, 1975; Tolle, 1975) but a few coveys were observed during fall 1973 and the species was recorded during other work in 1974 (Tolle, 1975). A total of 56 quail observations was made during November 1973; most quail were associated with stock ponds. Tolle (1975) suggested that the extremely dry spring of 1974 may have caused the scaled quail to move elsewhere during summer 1974. Campbell et al. (1973) reported that scaled quail numbers characteristically fluctuate greatly in response to seasonal precipitation. Navajo Mine personnel report an increase in quail observations in areas adjacent to NAPI fields and water sources during the last couple of years.

10.3.2.3 Herptiles

Two species of amphibians and 13 species of reptiles were observed on the lease and adjacent areas during the 1973-1974 surveys (TABLE 10-13, Pomeroy et al., 1975; Westinghouse, 1975). The paucity of suitable habitat associated with ponds on the lease limits amphibians. A tiger salamander was caught in a stock pond off the lease near the Chaco River. Gopher snakes were the most frequently observed snake on the lease; however, snakes as a group were infrequently observed.

On the other hand, lizards were commonly observed. The most frequently observed species were the lesser earless lizard, western whiptail, and sagebrush lizard (TABLE 10-13, Pomeroy et al., 1975). Upland dunes and other habitats with sandy soils and scattered shrubs that provide escape cover and good foraging areas appeared to be the most productive areas for lizards.

Lizards in the badlands and upland and lowlands flats tended to be concentrated around the vegetation and rocks. Areas with heavy clay soils are not conductive to burrowing by lizards, and areas with sparser vegetation do not provide good cover or food sources. Consequently, few lizards are expected in those areas of the lease.

10.3.2.4 Fish

The Navajo Mine lease does not encompass any streams or ponds that support fish or other important aquatic resources. Drainages in the lease contain water only intermittently in response to precipitation or runoff from the NAPI irrigation project while ponds and impoundments are small and shallow without proper habitat to support fisheries.

TABLE 10-13

RELATIVE ABUNDANCE OF AMPHIBIANS & REPTILES OBSERVED ON AND ADJACENT TO THE NAVAJO MINE LEASE & OTHER SPECIES THAT MAY OCCUR IN NORTHWEST NEW MEXICO.[1]

Common Name	Scientific Name	Relative Abundance[2]
(Species Observed):		
Tiger salamander	Ambystoma tigrium	I
Woodhouse toad	Bufo woodhousei	I
Shorthorned lizard	Phrynosoma douglassi	F
Lesser earless lizard	Holbrookia maculata	VF
Plateau whiptail	Cnemidophorus velox	F
Western whiptail	Cnemidophorus tigris	VF
Little striped whiptail	Cnemidophorus inornatus	I
Collared lizard	Crotophytus collaris	F
Sagebrush lizard	Sceloporus graciosus	VF
Side-blotched lizard	Uta stansburiana	F
Leopard lizard	Crotophytus wislizenii	I
Gopher snake	Pituophis melanoleucus	F
Glossy snake	Arizona elegans	I
Garter snake	Thamnophis spp.	I
Prairie rattlesnake	Crotalus viridus virdis	I
(Other species that may occur):		
Western spadefoot toad	Scaphiopus hammondi	
Red-spotted toad	Bufo punctatus	
Canyon tree frog	Hyla arenicolor	
Western painted turtle	Chrysemys picta	
Orange-headed spiny lizard	Sceloporus magister cephalofavus	
Northern plateau lizard	Sceloporus undulatus elongatus	
Tree lizard	Urosaurus orantus	
Desert side-blotched lizard	Uta stansburiana stejnegeri	
Southern many-lined skink	Eumeces multivirgatus epipleurotus	
Striped whipsnake	Masticophis taeniatus	
New Mexico milky snake	Lampropeltis triangulum celaenops	
Black-necked garter snake	Thamnophis cyrtopsis	
Western terrestrial garter snake	Thamnophis elegans vagrans	
Night snake	Hysiglena torquata	
Hopi rattlesnake	Crotalus viridis nuntius	

[1]List from Pomeroy et al. (1975) and Westinghouse (1975).

[2] I = infrequent, 1-2 individuals seen during all field work;
F = frequent, 3-8 individuals seen during all field work;
VF = very frequent, 9-60 individuals seen during all field work.

Morgan Lake is located off the lease adjacent to BHP's main office and approximately 2000 feet from the west side of the mined area within the lease in the North Area. This impoundment was formed to provide cooling waters for the Four Corners Power Plant, which warms the waters as they cycle through the facility. The 1200 acre lake was stocked with channel catfish and bass by the NFWD and now provides a recreational fishery as authorized by the Navajo Tribal Council, which control activities allowed on the lake.

The San Juan River is located approximately one-half mile from the lease at its closest point. An interagency team of biologists from the NMDGF, University of New Mexico, USFWS, NFWD, and U.S. Bureau of Reclamation is currently involved in an inventory of fishes in the San Juan River from Shiprock to the Colorado border (personal communication with Dave Probst, NMDGF, 1987). The inventory involves seasonal sampling, which will not be completed until data indicates that species in the river include flannelmouth sucker, bluehead sucker, red shiner, channel catfish, carp, sturgeon, sculpin, speckled dace, fathead minnow, mosquito fish, Rio Grande killfish, green sunfish, and Colorado chub (Burkett et al., 1975; personal communication with Dave Probst, NMDGF, 1987). Probably the most significant result of the interagency inventory so far has been the capture of Colorado squawfish, a Federally listed endangered species. It is not known if the squawfish are reproducing in the stream, but additional investigations are planned to more fully document the status of the species. The Chaco River is located approximately one mile from the lease at its closest point. This intermittent river does not provide a game fishery.

10.3.2.5 Threatened, Endangered, or Other High Interest Species

Species or habitats for species that are considered threatened or endangered (e.g., black-footed ferret) or of high interest (e.g., Migratory Birds of High Federal Interest) in the area are addressed in the following section. These species were briefly mentioned in the preceding discussion of the various taxa, however all are specifically addressed in this section.

Threatened and Endangered Species

Federally listed endangered wildlife species that may occur on the lease area are black-footed ferret, southwestern willow flycatcher and bald eagle, (US Fish and Wildlife Service, Federal Endangered and Threatened Species List, March 2004).

Prairie dog colonies within the lease are potential habitat for the black-footed ferret, whose distribution was formerly closely associated with the rodent that are its preferred prey. The only known remaining individuals of this species are in a captive breeding facility in southwestern Wyoming. The last confirmed black-footed ferret sighting in New Mexico occurred in 1940 near Mexican Springs, approximately 60 miles southwest of the lease area (Jobman and Anderson, 1981). Hubbard and Schmitt (1984) list observations of black-footed ferrets in San Juan County 1901-1982 as either indeterminate or unverified. Sheepherders, mine workers, and others on the Navajo Reservation occasionally report observations of black-footed ferrets; the most recent sighting report was off-lease during July 1987. None of the sighting reports have been confirmed (personal communication with Sam Diswood, NFWD, 1987).

Intensive black-footed ferret surveys using the procedures required by the NFWD and USFWS have been conducted on various portions of the lease for the past five years (Mariah 1983 - 1987 and 1989). During this period, over 1000 person-hours of night spotlighting and over 175 person-hours of morning searches for sign have been expended while searching a total of approximately 4500 acres (includes multiple recordings of some of the same acres searched each year) of prairie dog colonies. No black-footed ferret or positive sign suggesting the presence of black-footed ferret has been found.

The prairie dog populations that provide the potential habitat for the black-footed ferret on the lease fluctuate, probably due to outbreaks of plague (Hinton, 1980; Mariah, 1987). Although ferrets are not precluded from living in abandoned prairie dog colonies, they would not likely remain in the absence of prey. Therefore, the potential ferret habitat on the lease also probably fluctuates from year to year depending on the prairie dog populations.

Bald eagles generally nest in tall trees within one-half mile of permanent water (Snow, 1973); successful nesting usually requires a dependable and readily available food supply consisting of fish (Spencer, 1976). No suitable areas for nesting occur on the lease. The San Juan River north of the lease could provide potential nesting habitat, but no bald eagles presently nest in New Mexico (USFWS, 1987). Wintering and transient birds are highly mobile and opportunistic in their search for food. Bald eagles could use the lease during migration and winter periods; such use would likely be short-term as the birds move around the area searching for food. Peregrine falcons occur in areas with rocky, steep cliffs, often near water where populations of other birds, which are their primary prey, concentrate. They may be found from 3500 to 9000 feet elevation but prefer the transition life zone from 6500 to 8500 feet in New Mexico (USFWS, 1987). No suitable nesting habitat in the

form of steep rock cliffs exceeding 100 feet in height within one mile of water such as the type usually used by peregrines for nesting (Call, 1978) occurs on the lease. The "Hogback", located approximately 3.5 to 5.0 miles west of the lease, could provide potential nest sites for peregrine falcons. Peregrine falcons may occur in the lease area during migration and winter periods. Such use would likely be temporary and short-term as the highly transient birds move through the area. No peregrine falcon observation has been reported on the lease area.

Other High Interest Species

Migratory birds of high federal interest have been identified on a regional basis relative to the coal production regions in the western United States (BLM, 1980). The migratory birds of high federal interest for the San Juan River Coal Production Region (BLM, 1980) that have been observed on or near the lease are ferruginous hawk, mountain plover, white-faced ibis, great blue heron, and marsh wren. The species that are of primary concern relative to breeding populations in the region are ferruginous hawk and mountain plover. The white-faced ibis is of interest during migration (personal communication with Jim Ramakka, BLM, 1987).

One active ferruginous hawk nest occurred on the lease, and several other active ferruginous hawk nests were located within approximately one-quarter mile of the lease during 1987 (TABLE 10-12, Woyewodzic, 1987); additional territories that were active and inactive during 1987 also occur in the area beyond the one-quarter mile buffer around the lease. Detailed discussion of ferruginous hawks in the area is presented in the Raptor section.

Three adult mountain plovers and a mountain plover nest were observed in the central portion of Area V during June 1974 (Tolle, 1975, 1976). There may have been additional nests in the area that were not located. At the time the nesting was considered a westward extension in the breeding range of the species (Tolle, 1976) but subsequent observations (Johnson and Spicer, 1981) indicated that this and additional observations farther west represent only an apparent increase of breeding range. Johnson and Spicer (1981) indicated that the presence of breeding mountain plovers in western New Mexico and eastern Arizona had probably been overlooked in the past and speculated that they may be scattered by locally common breeders in the short grass prairie habitats in the region. Mountain plovers are known to nest in other ares within the San Juan Basin, but not to any great extent (personal communication with Jim Ramakka, BLM, 1987).

The mountain plovers and the nest on the lease area were in flat to slightly rolling terrain, with sparse, overgrazed, shrubby vegetation inter-spread with bare areas. The Area V locale was the only area in which the mountain plovers were observed during 1974, and they were not observed by Hinton (1980) during the 1976 survey of the lease. Mountain plovers generally occur in the short grass prairie on high dry plains with the birds or nests having been associated with variety of habitats including heavily grazed pastures, short grass, mixed grass, midgrass, and basin sagebrush, in which those on the lease were observed. Their nests are a simple scrape on flat ground. Predation by various hawks and loggerhead shrikes is probably an important mortality factor (Graul, 1975; Sutton and Van Tyne, 1937). The sparsely vegetated uplands, particularly sites with bare areas and short vegetation growth, which are more common on the south end of the lease, provide potential nesting habitat for mountain plovers. Mountain plovers were not observed on any of the upland habitats on the North Area

and Areas II, III, IV, and IV North during the prairie dog colony mapping for the black-footed ferret surveys (Mariah, 1983 - 1987 and 1989). The birds migrate to the southern border of the United States and south into Mexico during fall and winter.

White-faced ibis were included on the species list of birds observed in the WESCO study area (Tolle, 1975) but no details of the observation are given. The bird was not listed on any of the results of the standard surveys so it was an opportunistic observation. White-faced ibis migrate through the region and are occasionally observed at stockponds or other water sources (personal communication with Jim Ramakka, BLM, 1987). Migrating birds have been observed by mine personnel at ponds on the lease. Use of the lease by white-faced ibis is infrequent and temporary while the birds migrate through the area.

Loggerhead shrikes are on the overall list of migratory birds of high federal interest but they are not included on the list for the San Juan River Coal Production Region (BLM, 1980); however, OSM requested additional information on the species in the lease area. Loggerhead shrikes occur year-round on the lease. Shrikes were ranked sixth based on frequency of observation recorded on the roadside breeding bird surveys during June 1974 (TABLE 10-6, Tolle, 1975) and ninth during August 1974 (TABLE 10-7, Westinghouse, 1975). The species was also observed in the area during February 1974, (TABLE 10-9, Tolle, 1975) indicating that they also winter in the area at least during some years. Loggerhead shrikes were considered relatively rare during winter; this is consistent with observations reported by Hubbard (1978), who indicated that during winter they are less numerous and less widespread in the northern part of the state. Opportunistic observations of shrikes during the diurnal portions of the black-footed ferret surveys conducted annually during 1983 through 1987 were common to uncommon. Most loggerhead

shrikes were observed in relatively open areas near shrubs or fence lines upon which the birds perch. Loggerhead shrikes construct their nests in trees or bushes in open country, which is required for foraging habitat (Bystrak, 1983). The relatively open uplands interspersed with greasewood, tamarisk, and large saltbush shrubs within the type or in adjacent washes throughout the lease provides good habitat for shrikes.

The NFWD had developed initial draft lists of species of concern to the Navajo Nation which includes numerous species that potentially may be included on official lists at a later date (personal communication with Kathleen McCoy, NFWD, 1987). A category listing resident species of high interest for the San Juan River Coal Production Area includes the following species that have been reported in or near the lease area: mule, dear, scaled quail, Gambel's quail, ferruginous hawk, prairie falcon, golden eagle, burrowing owl, and red-tailed hawk. Status of these species relative to the lease was discussed in the respective wildlife sections above.

The most updated information available from USFWS (Threatened, Endangered, Candidate Species, and Species of Concern Rio Arriba and San Juan counties, New Mexico Species March, 2004) and NFWD (Navajo Endangered Species List Update March, 2001) indicate there has been no significant changes listing status for specific wildlife species which may occur on or near Navajo Mine.

In May 2001 Ecosphere Environmental Services conducted a Threatened and Endangered species survey of 654 acres referred to as the Dixon Pit Extension area. The survey area was previously surveyed in 1983 and 1987. OSM personnel decided that since the last time the area was surveyed was 14 years ago, the area should be resurveyed to update for species added to Federal and Navajo Nation Threatened and Endangered species listings since the previous survey. The results of this survey found no federal or Navajo Natural Heritage program listed threatened, endangered, or sensitive species or critical habitats of listed species. The report for this survey is found combined with a plant species survey in Appendix 9-A of this permit application document.

In May - June 2004 Ecosphere Environmental Services conducted a Threatened and Endangered species survey of Area IV North. This survey area was also previously surveyed in 1983 and 1987. OSM personnel decided this area also required a resurvey to update for species that may have been added to Federal and Navajo Nation Threatened and Endangered species listings. The results of this survey found no federal or Navajo Natural Heritage program listed threatened, endangered, or sensitive species or critical habitats of listed species. The 2004 Ecosphere report is located in Appendix 10-A.

10.3.2.6 Important Wildlife Habitat

For purposes of this discussion, important wildlife habitat includes habitat critical to the support of important wildlife species (i.e., threatened or endangered animals, other vertebrates of special concern, those protected by law, and certain game animals) and habitat offering environmental situations that contribute to maximum wildlife diversity for the region. Important wildlife habitats on the Navajo Mine lease include:

- raptor nest sites and rock outcrops providing potential nest sites,
- prairie dog colonies that could support black-footed ferrets, and
- stands of dense or tall shrubs.

Detailed discussion of some of these important habitats was presented in previous sections and will only be summarized below; others will be addressed entirely within the following material. Locations of those important habitats that can be specified at this time (e.g., known raptor nest sites) are shown on EXHIBIT 10-2.

Raptor Nesting Sites and Rock Outcrops

Raptor nesting activity was conducted on at least eight sights and in several prairie dog colonies on and within one-quarter mile of the lease during 1987 (EXHIBIT 10-2). Other sites that had been

used previously were inactive during 1987 but could be used again, and other potential nesting habitat in the form of larger rock outcrops and rimrocks throughout the area could be used for nest sites in the future. Rock outcrops and rimrocks occur most frequently along the edges of mesas and buttes in the lease; however, smaller outcrops are also present within relatively flat upland areas and along arroyos. Relatively large areas in Area III and Area IV North are gently rolling or flat uplands that contain few outcrops.

The raptor species nesting on or near the lease were ferruginous hawk, red-tailed hawk, American Kestrel, and burrowing owl. Nests of raptor species are protected by Federal and Tribal laws and regulations; special permits and mitigation measures must be employed if they are disturbed by mining activities.

In addition to providing raptor perches and additional potential raptor nesting sites, rimrocks and rock outcrops on the lease have a greater potential to support maximum numbers of different wildlife species than found on the less diverse uplands. The broken terrain and variety of slopes and aspects affect vegetation diversity on a micro-scale and provide good nesting, denning, and cover opportunities for a number of wildlife species that prefer such types. Denning opportunities for mammalian predators, cover for cottontails and woodrats, and nesting habitats for passerines such as rock wren and Say's phoebe are provided by the rock outcrops and rimrocks.

Prairie Dog Colonies

Prairie dog colonies, which provide potential habitat for black-footed ferret and are used for nesting by burrowing owls, occur throughout the uplands on the lease. The number, extent, and distribution of active prairie dog colonies on the lease fluctuate considerably from year to year, probably in response to population fluctuations caused by plague. Locations of prairie dog colonies that were active in the areas surveyed for black-footed ferret during 1987 are shown on EXHIBIT 10-2. Ferret surveys were conducted only on those areas that may be impacted during the next 12 months; therefore, additional active prairie dog colonies are likely occur on other portions of the lease that were not surveyed in 1987. Both active and inactive prairie dog towns were observed in those other

areas on the lease during previous black-footed ferret surveys, but the current activity status is not known and therefore these colonies are not mapped.

Water Sources

Water sources are considered wildlife habitats, particularly in the arid region within which the lease occurs. The vegetation around water sources may be more vigorous or comprised of different species than found in the surrounding area. Ponds and impoundments presently occur on the lease and nearby areas (EXHIBIT 10-3); many of them were formed as the result of mining associated activity or as replacement of water sources in the mined area. These small ponds only contain water after rains and are dry most of the time. Most of the off lease water sources are stock ponds that depend on runoff for their water supply. Several of these stock ponds were constructed by the BIA and BHP to replace livestock watering sources lost due to mining on the lease.

Stands of Dense or Tall Shrubs

Stands of taller or dense shrubs are important habitats due to the variety and abundance of wildlife that occur in such areas. Higher numbers of avifauna were associated with tall or dense shrubs (Tolle, 1975) and small mammal diversity and abundance were also greatest on habitats that had tall and dense shrubs (Battelle, 1975). Taller or dense shrubs most often occur in the arroyo shrub range sites, which occur on approximately 260 acres (one percent) of the permit area. Location of the arroyo shrub sites on the lease is shown on the range site maps in CHAPTER 9. These sites occur along the washes where the additional moisture is concentrated during rain showers or where subsurface moisture is available to the plants. Such areas are called riparian by some individuals, however that term often carries the connotation of much more lush, dense, and verdant vegetation than is present in the washes on the lease. The arroyo shrub sites on the lease are dominated by saltbush, greasewood, rabbitbrush, saltbush, and tamarisk.

10.3.2.7 Wildlife Oriented Recreation

Limited hunting is the primary wildlife oriented recreation on the lease. Hunting on the permit area near active mining operations is prohibited for safety considerations, but it is not restricted on undeveloped portions of the lease. Most hunting on the lease proper is most likely for coyotes, prairie dogs, or cottontails. Waterfowl and doves are probably the primary species hunted along the San Juan River and Morgan Lake. No figures on hunting pressure are available for the area. Deer populations are so low that the area is closed to deer hunting.

10.4 SUMMARY AND CONCLUSIONS

Wildlife and their habitats on and adjacent to the Navajo Mine lease have been surveyed during several studies conducted at various times since 1973 through 1987 and 1989. Pertinent information from these studies was compiled, synthesized, and presented in this report to provide a comprehensive and updated description of the wildlife resources on the lease.

Mule deer are the only big game animal that have been reported on the lease, though they are infrequently observed. Deer mice and silky pocket mice are the most abundant small mammals throughout most of the habitats on the lease. Prairie dogs and kangaroo rats are relatively common on the upland habitats on the lease. Black-tailed jackrabbits and cottontails are common medium-sized mammals. Common predators include red fox, kit fox, coyote, and badger.

Horned larks are by far the most abundant passerine bird species throughout the year. Other common breeding birds are mourning doves and rough-winged swallows. Mourning doves were the most frequently observed game bird. The small ponds and impoundments on the lease are used by migrating waterfowl. Blue-winged or cinnamon teal were the most common species observed using the small ponds. Morgan Lake and the San Juan River, which are located off lease, provide more suitable waterfowl habitat than is available on the lease. Raptors nesting within the lease and adjacent buffer zone during 1987 were ferruginous hawk, red-tailed hawk, American kestrel, and burrowing owl. One active ferruginous hawk nest was located on the lease and several were located within approximately one-quarter mile of the lease boundary. Three red-tailed hawk nests were located on the lease during 1987. Burrowing owls nested on several of the active and abandoned prairie dog colonies on the lease. Additional raptors nesting beyond the one-quarter mile buffer include ferruginous hawk,

red-tailed hawk, golden eagle, prairie falcon, and barn owl.

The lesser earless lizard, western whiptail, and sagebrush lizard were the most frequently observed herptiles on the lease. The paucity of suitable water sources on the lease limits the potential habitat for amphibians. The lease does not contain any streams or ponds with fish. Morgan Lake and the San Juan River, both off lease, are the two closet water bodies that provide fisheries.

The prairie dog colonies on the lease provide potential habitat for the endangered black-footed ferret. No black-footed ferret has been found during over 1000 hours of night spotlight surveys conducted on the lease during the past five years. Other endangered species that may use the area are bald eagle and peregrine falcon. Neither of the species nests on the lease and no suitable nesting habitat for either of them occurs on the lease. Both species may occasionally use the area during the migration or winter periods. Other species of high interest that breed on the lease are ferruginous hawk and mountain plover.

Important wildlife habitat on and adjacent to the lease includes the raptor nest sites, rock outcrops and rimrocks, prairie dog colonies that could support black-footed ferrets, water sources, and stands of dense or tall shrubs.

Limited hunting for coyotes, prairie dogs, or cottontail rabbits is the primary wildlife oriented recreation on the lease. Waterfowl and mourning dove hunting is provided adjacent to the lease at Morgan Lake and the San Juan River.

10.5 ASSESSMENT OF IMPACTS TO WILDLIFE

Two matrices were used during the evaluation of impacts to wildlife due to mining activities on the Navajo Mine. FIGURE 10-1 displays a matrix that generally depicts the sensitivities of wildlife resources to mining related disturbance. FIGURE 10-2 details the expected site specific impacts to wildlife resulting from particular mining related environmental change. FIGURE 10-2 forms the framework for all subsequent discussions of impacts to wildlife.

Impacts to wildlife from mining activities may be classified according to their duration, proximity, and extent. Short-term impacts would be those that result directly from and occur during mining operations but would terminate after reclamation. Long-term impacts are those that would persist even after reclamation. Long-term impacts are often indirect and more subtle, which makes them more difficult to identify and evaluate. Most of the impacts identified for the Navajo Mine will be short-term in nature. Most impacts are also considered to be localized to a small area while it is actually being disturbed.

Impacts may be directed at a number of different levels of population organization (i.e., individuals, localized herds or colonies, regional population, entire population). Most of the anticipated impacts at the Navajo Mine will be of a short-term nature and will be confined to a small area; therefore, no significant effects are anticipated at the regional population level or above. Accordingly, the individual or groups of individuals and their habitats were the primary focus of the following impact assessment.

		WILDLIFE RESOURCE VALUES			
		VERY HIGH Unique and/or Protected (e.g, T&E or high interest species)	HIGH Uncommon to Unique and/or High-Moderate Quality (e.g., most game species, common raptors)	MODERATE Generally Un-Common or with Moderate Quality (e.g.,lagomorphs & medium-sized mammals)	LOW Generally Common with Moderate-Low Quality (e.g., most small mammals & passerines)
EXPECTED DEGREE OF CHANGE	HIGH Intense disturbance which is long-term over a large area	VERY HIGH IMPACT	VERY HIGH IMPACT	VERY HIGH IMPACT	VERY HIGH IMPACT
	MODERATE Moderately intense disturbance which is long-term over large area	VERY HIGH IMPACT	HIGH IMPACT	MODERATE IMPACT	LOW IMPACT
	LOW Short-term and localized	HIGH TO LOW IMPACT	MODERATE TO LOW IMPACT	LOW IMPACT	LOW IMPACT
	NONE	NO IMPACT	NO IMPACT	NO IMPACT	NO IMPACT

FIGURE 10-1

Matrix Used to Identify Relative Impact Levels for Wildlife on the Navajo Mine Permit area, Northwestern New Mexico.

	WILDLIFE RESOURCES	Threatened, Endangered, and Protected Species	Other High Interest Species	Big Game (Mule Deer)	Medium-Sized Mammals and Mammalian Predators	Small Mammals	Passerine Birds	Raptors	Upland Game Birds	Waterfowl	Herptiles	Important Wildlife Habitat
	WILDLIFE RESOURCE VALUE	VH(1)	VH	H	M	L	L	H	H	H	L	H
IMPACTORS	Expected Degree of Change Caused by Impactors	I M P A C T R A T I N G S										
Vegetative Disturbance	L	L	L	L	L	L	L	L	L	L	L	L
Topographic Change	L	L	L	L	L	L	L	L	L	L	L	L
Change in Water Sources	L	L	L	L	L	L	L	L	L	L	L	L
Increased Human Presence	L	L	M-L	L	L	L	L	M-L	L	L	L	L
Direct Wildlife Mortality	L	L	L	L	L	L	L	L	L	L	L	L
Noise, Dust, and Airborne Emission	L	L	L	L	L	L	L	L	L	L	L	L

(1) VH = Very High, H = High, M = Moderate, L = Low

FIGURE 10-2

Impact on Wildlife Caused by the Navajo Mine Northwestern New Mexico.

10.5.1 Threatened or Endangered Species

Threatened or endangered species that may occur in the area are black-footed ferret, bald eagle, peregrine falcon, southwestern willow flycatcher, and Colorado squawfish. Potential habitat for the black-footed ferret is present in the prairie dog colonies on the permit area; however, intensive surveys have not resulted in the finding of this endangered animal. Bald eagles and peregrine falcons may use the permit area during migration or winter periods, but such use is very infrequent. Several areas of potential habitat for the southwestern willow flycatcher, which were identified by BHP/Mariah on December 5-8, 1994, and are present on or within 1.0 miles of the Navajo Mine permit area, were surveyed in the summer of 1995. No individuals were observed or heard during formal southwestern willow flycatcher surveys as conducted in 1995. The Colorado squawfish occurs in the San Juan River, which is approximately one-half mile from the permit area at its closest point.

A threatened species of high regional interest in recent years, the Mexican Spotted Owl (Strix occidentalis lucida), occurs in varied habitat, consisting primarily of mature old-growth forests, conifers, and wooded canyons. In forested habitat, uneven-aged stands with a high multilayered canopy closure, high tree density, and a terrain with slopes greater than 15 degrees appear to be key habitat characteristics. The native vegetation of the permit area and adjacent areas is characteristic of the Colorado Plateau Salt-Desert shrub ecotype. The permit area is delineated into five (5) wildlife habitat types: 1) Uplands, 2) Badlands, 3) Alkali Wash, 4) Arroyo Shrub, and 5) Reclaimed areas. See CHAPTER 9, Section 9.5, for additional discussion on each type found at Navajo Mine. The closest owl habitat in proximity to the permit area, i.e., forests, conifers, and wooded canyons are located approximately 20

miles west on the Chuska Mountain Range along the New Mexico / Arizona border. The Mexican Spotted Owl sightings are considered unlikely, due to lack of habitat requirements found at and adjacent to the permit area.

Expected impacts on threatened or endangered species due to the Navajo Mine are low to none, primarily because there is low or no use of the site by these animal species. Surveys of prairie dog colonies will be conducted in the future as necessary as determined through consultation with the Navajo Fish and Wildlife Department (NFWD) to ensure that the proper safeguards are taken to prevent impacts to black-footed ferrets. Bald eagle and peregrine falcon use of the site during migration and winter periods is infrequent and the highly mobile birds are wide ranging and opportunistic so the mine will have little impact to the endangered raptors.

OSM prepared a biological assessment for the Colorado Squawfish (Ptychochelilus lucius) and the Mesa Verde Cactus (Sclerocactus mesae-verdae) on August 8, 1990 and forwarded it to the USFWS when it was discovered that the permit request to add Block B to the Navajo Mine permit could potentially affect the two species. The biological assessment for the Colorado squawfish stated that in 1984, OSM prepared a Cumulative Hydrological Impact Assessment (CHIA) of the effects of coal mining in the San Juan River Basin. In 1989, the CHIA was amended to bring it up to date for issuance of the Navajo Mine permit. The CHIA stated of Navajo Mine that:

1. Regarding surface water quality, minimal impacts are projected due to the relatively poor quality of ephemeral stream flow in the immediate channels that drain most of the mining area;

2. Minimal impact to flow of the Chaco and San Juan Rivers would occur due to the replacement of high runoff badlands which occur on 65% of the Navajo Mine permit area by sandy topdressed reclamation areas from which little surface runoff will occur. Water quantity impacts would be minimal owing to the relatively small amount of each river basin that is affected by total containment at the mine; and

3. During mining, there are no impacts expected from the Navajo Mine to groundwater. There is little potential for cumulative groundwater impacts because of the low permeabilities and thus, low quantity of water in the Fruitland formation, in which the coal mining occurs.

Based on the conclusions of the amended 1989 CHIA for the San Juan River Basin and for the Navajo Mine in particular, OSM concluded that with water quantity and quality changes at the above described minimal levels, no adverse impact is anticipated to the habitat of the Colorado squawfish in the San Juan River downstream from the Navajo Mine.

OSM submitted an updated biological assessment on November 2, 1990, and initiated the formal Section 7 consultation period. On November 15, 1990 the USFWS met with Navajo Mine representatives and OSM officials on this issue. On November 16, 1990, USFWS notified OSM that the addition of the Block B area to the Navajo Mine permit area would not affect the continued existence of the Colorado squawfish and thereby concluded the formal consultation process.

In regards to the potential impacts to the razorback sucker, (Xyrauchen texanus) and the roundtail chub, (Gila robusta robusta), from the Navajo Mine, the conclusions reached by the Section 7 consultation for the Colorado squawfish, should apply to these two species since they all occupy the same habitat in the San Juan River.

10.5.2 Other High Interest Species

Other species of high federal interest that are of concern relative to coal development in the San Juan Basin and that also occur on the permit area are ferruginous hawk, mountain plover, and white-faced ibis.

No active ferruginous hawk nests are located on the permit area. The only active nest on the lease area is in the Cottonwood arroyo approximately two-thirds mile east of the permit area (EXHIBIT 10-2). One other active ferruginous hawk nests occurs off-lease but within approximately one-quarter mile of the permit area (EXHIBIT 10-2). Human disturbance of ferruginous hawks and other raptors during the breeding season, particularly during the pre-laying, laying, and incubation periods, may cause the birds to desert their nest (Fyfe and Olendorff, 1976). The active ferruginous nest located approximately 1,200 feet east of the boundary of the North Area is probably not going to have abandoned eggs or chicks if mining activity advances toward the permit boundary. The mining operation is a constant and predictable activity within the permit boundary so, if the birds return and start to nest, they will do so with the slowly advancing mining activity already in the area. Rather than deserting eggs or young, the birds may decide not to nest at the site during a particular year if the activity is too close. Individual birds display different levels of tolerance to activity (Thurow et al., 1980) so the critical distance for a

specific pair is not known. White et al. (1979) recommended a buffer distance of 1.6 km for construction activity; however, several of the nests in the vicinity of the mine currently successfully raise young at much closer distances. The impact, if any, of the mining activity relative to these specific nests would be during the time that the mine is operating in the specific area adjacent to the nest.

Another potential impact on ferruginous hawks would be through reduction in the prey base due to disturbance of habitats that support the small mammals and reptiles upon which the hawks feeds. Productivity of ferruginous hawks is dependent on the availability of prey (Woffinden and Murphy, 1977; Smith and Murphy, 1979). Given the relatively large amount of undisturbed habitat in the vicinity of the nests, this potential impact would likely be severe only if populations of prey were low throughout the region. Prey will be reduced while the permit area is disturbed, but small mammals apparently re-invade reclaimed areas on the Navajo Mine soon after vegetation is reestablished as demonstrated by the results of the small mammal sampling on reclaimed areas by Westinghouse (1975), which indicated higher densities on reclaimed areas than undisturbed sites. Potential impact of reduction in prey would likely occur only while the mine is operating in the area used for hunting.

BHP will be monitoring the status of raptor nests in the area as part of the wildlife monitoring program so that appropriate actions can be taken to minimize any adverse affects that develop. The impact of the mine on ferruginous hawks nesting near the permit area is expected to be short-term and localized while the mining activity is occurring and overall will probably have minor effects.

Three mountain plovers and a mountain plover nest were observed in sparse vegetation on Area V within the lease during 1974. Mountain plovers were not observed during 1976 surveys conducted by Hinton (1980), and they have not been reported subsequently. The sparsely vegetated uplands sites with bare areas and short vegetation growth are potential habitat for the species. This type of habitat is more common on the southern portion of the lease (Areas IV and V) than in the permit area currently under consideration. Mountain plovers are known to nest in other areas within the San Juan Basin but not to any great extent (personal communication with Jim Ramakka, BLM, 1987). Johnson and Spicer (1981) speculated that mountain plovers may be scattered but locally common breeders occurring in appropriate habitats in the region. Mining will temporarily remove potential nesting habitat of mountain plovers, but the low use of the area and reclamation of the site will yield a low overall impact to this bird species.

Impacts to white-faced ibis that migrate through the area are expected to be low due to the infrequent and opportunistic use of the permit area by highly mobile and transient individuals.

10.5.3 Large Mammals

The only large mammal that has been observed on the lease is the mule deer; however, sightings are infrequent, and most of the permit area is not currently used by mule deer. Low to no impacts on mule deer are anticipated due to the very low levels of mule deer use of the mine.

10.5.4 Medium-sized Mammals, Mammalian Predators, Small Mammals, Passerine Birds, Herptiles, and Fish

The primary impacts on medium-sized mammals and mammalian predators are/will be: 1) removal of vegetation that provides habitat, and 2) direct mortality of a small number of animals resulting from earth disturbing operations or road kills. These impacts are expected to be low and will occur on the disturbed area and roadways during the operation of the mine. Medium-sized mammals will reoccupy the reclaimed areas as these areas are revegetated and mammalian predators will reoccupy the areas as the prey species provide food sources.

Small mammals and herptiles will be impacted in the same manner described for medium sized mammals and mammalian predators. This low impact will be short-term and localized and is not mitigable in the short term. Small mammals and herptiles will repopulate the reclaimed ares as vegetation is reestablished and provides suitable habitat. Westinghouse (1975) reported that deer mice, silky pocket mice, spotted ground squirrels, white-tailed antelope ground squirrels, black-tailed jackrabbit, and desert cottontails occurred on reclaimed areas on the mine two years after reseeding. In fact, the density of small mammals on revegetated areas was higher than on the undisturbed sites, probably due to the greater production of vegetation on the revegetation plots compared to the native sites.

The species present and numbers of individuals will be dependent on the habitat, primarily vegetation, that is provided on the reclaimed area.

Surface disturbance occurring during the nesting period will destroy passerine nests, eggs, and nestlings. This impact is not mitigable. Removal of vegetation will reduce habitat for passerines during the time that the mine is operating until the reclaimed area is revegetated. The species present will be dependent on the habitat provided on the reclaimed area. Horned larks are the overwhelmingly dominant species on the area and the revegetated areas will likely produce open grass land conditions that are preferred by horned larks; habitats for some of the other species will be replaced with the shrubs to be planted on the reclaimed area. Impacts on passerine birds are expected to be low.

The permit area does not encompass any streams or lakes that support fish; therefore, no impact to fisheries due to the mine is anticipated. Morgan Lake on the border of the permit area and the San Juan River approximately one-half mile from the permit area contain fish. No toxic discharges are expected to enter these waters as a result of mining activities, so no impacts of fisheries are expected.

10.5.5 Raptors

The permit area provides nesting habitat for several other raptors in addition to the ferruginous hawks discussed in Section 10.5.2. Red-tailed hawks currently nest on the rimrock at Yazzie Point and on power poles at two other locations (east side of Area III and between Areas III and IV) on the permit area. The same impacts as described for ferruginous hawks also apply to red-tailed hawks. The rimrock at Yazzie Point will probably not be mined, and no increase in other activity (e.g., traffic on the road) beyond that which is currently occurring is anticipated, so no additional impact is expected on that nest. The Yazzie Point nest demonstrates the adaptability of the species to mine activity in the immediate vicinity of the nest, as long as the activity does not pose a threat to the nest. The red-tailed hawk nest on the east side of Area III is located on the switch pole for the stubline in that area. The birds established a nest on the pole despite the human activity associated with switching power on the stubline. The red-tailed hawk nest on the power line pole between Areas III and IV is located within the transportation corridor that will be built when Area IV is developed. BHP will monitor the situation and develop a mitigation plan, if necessary, to limit the impact of the transportation corridor on the nest.

American kestrels nest on Yazzie Point, and additional potential nesting habitat is found on other rock outcrops and rimrocks in the area. The Yazzie Point site will probably not be mined, and no additional active kestrel nests are currently known to occur on the permit area. Impacts to kestrels due to mining are expected to be low.

Burrowing owls that nest in the active and inactive prairie dog colonies on the lease will be displaced as those areas are disturbed by mining activity. No direct mortality would be expected, provided that areas potentially containing burrowing owls are disturbed before or after the breeding season.

Other raptors such as golden eagle and prairie falcon that nest on various sites surrounding the permit area are far enough from the mine that they will not likely be disturbed by the activities. Potential prey used by these breeding birds and by other raptors that migrate through or winter in the area will be temporarily lost while habitats for small and medium-sized mammals are disturbed. Impacts on raptor species associated with the temporary reduction in prey are expected to be short term and localized in the specific area while it is disturbed.

BHP will monitor nesting activities and comply with laws and regulations governing the disturbance or taking of raptors or their nests, so the overall impact of the mine on raptors is expected to be low. In contrast to the potential adverse impacts that the mine could have on raptors, there are potential positive impacts associated with the mine. The presence of mine personnel and the fact that the nests in the vicinity of the mine are monitored may deter unauthorized disturbance or poaching of raptors from those nests. Another positive impact is providing additional perches and nest sites while the mine is in operation. Golden eagles frequently perch on a spoil pile in the northern part of the North Area. The spoil pile, and consequently the perch, will be eliminated during reclamation. Poles that are frequently used as perches or nest sites by raptors in the lease area may be retained during reclamation to provide habitat for raptors.

10.5.6 Upland Game Birds and Waterfowl

The mourning dove is a migratory game bird that is relatively abundant throughout the permit area during the breeding season. Scaled quail have been occasionally observed. Mining related impacts to these upland species are expected to be short-term and localized while the mine is operating. Habitats used by these species that were removed during mining will be replaced during reclamation.

The ponds and impoundments on the permit area are used intermittently by waterfowl migrating through the region, and only a very limited amount of waterfowl breeding takes place on the permit area. Impacts to waterfowl due to mining are expected to be low. Alternate water sources for ponds and impoundments that were removed during mining are currently provided by the temporary ponds and impoundments formed to control runoff on the mine and additional water sources developed off lease to replace livestock watering sources. Additional discussion of water sources is presented in the Important Wildlife Habitat section below.

10.5.7 Important Wildlife Habitat

Important wildlife habitats identified on the permit area are the known raptor nesting sites and additional potential raptor nesting areas on rimrocks and rock outcrops, water sources, prairie dog colonies as potential habitat for endangered species, and areas with dense or tall shrubs.

Impacts to raptor nest sites are addressed in the High Interest and Raptor Species Section (10.5.2 and 10.5.5, respectively). Major rock outcrops and rimrocks on the permit area that will be destroyed by mining are located primarily in southern Area III and northwestern Area IV North (note topographic contours in these areas on EXHIBIT 10-4). Neither of these areas is intensively used by raptors at the present time. Mining of rimrocks and large rock outcrops will reduce the amount of potential raptor nesting habitat in the area, but not necessarily reduce the amount of nesting that occurs if the outcrops removed are not used as raptor nest sites. Reduction in this type of habitat will reduce the overall diversity of the wildlife habitats in the general area, particularly for those species that require rock outcrops or rimrock habitat.

Impacts to water sources on the permit area due to mining present an interesting situation. The need to control runoff on active mine areas probably results in the presence of more ponds and water sources than were present in the pre-mine conditions. Sediment ponds, ponds to control runoff into pits, and other ponds formed by embankments along roads provide water sources where there were none prior to mining. There were 32 water sources on the lease during spring 1987; prior to mining there were approximately 8 water sources on the permit area (EXHIBIT 10-3). Although these water sources are often adjacent to mine activity, wildlife use them. Both the pre-mine and mine associated water sources on the permit area depend on precipitation and runoff for the water supply - so they are all ephemeral. Impoundments and ponds developed off lease to provide alternate water sources for livestock also provide additional water sources for wildlife. There were 27 off lease sources, plus Morgan Lake, that contained water in spring 1987. Reclamation plans include ponds for livestock water, which will also provide water sources for wildlife on the permit area subsequent to mining. The exact location of those ponds will only be determined as the

postmining grazing plan is developed through consultation with the local permittees and the Navajo Nation.

The prairie dog colonies are considered important wildlife habitat only if they support black-footed ferrets and while burrowing owls are breeding/nesting.

BHP will confer with the NFWD and conduct surveys as may be necessary to assure that no adverse impacts occur to black-footed ferrets. Prairie dog colonies that contain nesting burrowing owls will not be disturbed, unless authorized, during the breeding/nesting season in order to limit mining related impacts to active nests.

Areas with tall or dense shrubs are important habitats for the variety of wildlife species and numbers of individuals they support. Approximately 266.3 acres of the arroyo shrub range site, which contains tall or dense shrubs, will be disturbed by mining. This is approximately one percent of the arroyo shrub habitat on the permit area. The area will be temporarily lost as wildlife habitat during mining, but shrubs will be reestablished during revegetation, and impacts associated with the temporary loss of this habitat are considered to be low.

10.6 FISH AND WILDLIFE MITIGATION PLAN

Mitigation to prevent or substantially reduce significant impacts to wildlife resources is discussed in the following material. Some of the mitigation measures will be employed to prevent or lessen potentially serious impacts to wildlife as a general group, and other measures will be directed at specific species. Certain mitigation measures will be necessary only while the mine is operating, and the effects of other mitigation measures will persist long after the mine ceases operation.

10.6.1 Long-term Mitigation

The primary long-term mitigation measure is the reclamation of disturbed sites to provide the habitat components necessary to support wildlife species that inhabited the site prior to mining. The effectiveness of this mitigation measure is a function of the success achieved in reclamation. From a wildlife standpoint, the primary factors to be reestablished are topography, vegetation, and water sources. The reclamation approaches used are based on experience gained during many years of reclamation of disturbed areas on the Navajo Mine and methods that have been successfully employed to reestablish wildlife habitat on other mines in the western United States.

10.6.1.1 Topography

The postmine topography is important for providing specific types of habitat components preferred by certain species (e.g., open plains preferred by horned larks and rock outcrops preferred by rock wrens), but it is probably more important for the influence it will have on the vegetation that ultimately becomes established on the reclaimed area. Certain vegetation grows best on uplands, other species dominate side slopes, and others are more adapted to growth on lowlands or along washes. The types and distribution of vegetation that will ultimately occur on the reclaimed site will be partially determined by site topography as the process of vegetation succession allows certain species to grow on one portion of the site, while other species are favored on another portion. More variable topography provides the conditions that promote establishment of a diversity of vegetation types and distribution.

The topography established on a reclaimed area is constrained somewhat by regulatory requirements that currently do not allow retention of highwalls, internal depressions, or conditions that allow erosion, which form some of the diverse topography on unmined lands in the area. The spoils are blended into the surrounding topography to reestablish drainage. The post-mine topography is similar to the pre-mine situation with more relief in the northern portion and larger areas with less relief in the southern portion as shown on the postmine topography maps (see CHAPTER 12, RECLAMATION PLAN). The steep slopes in the pre-mine condition are not restored, but minor undulations are present on the surface of the reclaimed areas, which replaces some of the variability in topography.

Rock piles are placed on the reclaimed areas to increase topographic diversity and replace some of the rock outcrop type of habitat lost during mining. Wildlife use of reclaimed areas on surface mines in Wyoming and Montana is significantly related to the presence and configuration of rock piles (Stoecker et al., 1985). Rock piles placed on reclaimed areas on the Navajo Mine currently provide perches for birds and cover for small and medium-sized mammals and reptiles as shown by white-wash, trails, and observations of animals. Rock piles of various configurations are placed in a variety of locations relative to the topography to promote use by a variety of species. Rock piles along bottoms and other protected areas promote use by mammals (Tessman, 1982; Green and Salter, 1987) while rock piles near, but not on the top of, hills and ridges and protected from prevailing winds serve as perching and nesting sites for raptors (personal communication with Robert Phillips, USFWS, Sheridan, Wyoming; Tessman, 1982; Green and Salter, 1987).

The density and composition of the rock piles on the reclaimed areas are dependent on the kind and amount of suitable material that is available from the mining operations. Rock piles of variable lengths comprised of a core of large boulders (i.e., greater than three feet diameter) surrounded by rocks of one to three foot diameter have been recommended by Tessman (1982) and Green and Salter (1987). Rock piles constructed on the reclaimed areas on the Navajo Mine generally correspond to those recommendations. The Office of Surface Mining (OSM) has recommended a minimum density of one rock pile covering an area of 500 square feet per 80 acres. Navajo Mine may not be able to achieve this standard because the actual size and number of rock piles will be dictated by the availability of suitable material. Based on past experience, much of the overburden material is not resistant to weathering and quickly breaks down when exposed to erosional elements. Only the more resistant material will be used for rock piles.

10.6.1.2 Revegetation

Vegetation is one of the primary habitat components that influences the suitability of an area for wildlife. The primary use of the area after mining will be for livestock grazing; however, provision for wildlife habitats is also incorporated in the mine's revegetation plan. A detailed description of the revegetation program is presented in the reclamation plan (CHAPTER 12). Specific items relative to replacing wildlife habitat are summarized below.

The seed mix for revegetation of the area is outlined in CHAPTER 12, RECLAMATION PLAN). The selection of the seed mix was based on adaptability of the species to the revegetation requirements of the mine based on results of previous revegetation efforts on the mine. Most of the species are palatable to various wildlife species, and all, particularly shrubs, provide cover for wildlife. Methods of seeding reclaimed areas are described in CHAPTER 12. Shrub density, as prescribed in CHAPTER 12, reflects the emphasis put on establishment of herbaceous species in the early stages of reclamation and to promote the land use of livestock grazing. Experience with vegetation establishment on the mine's reclaimed areas to date indicates that shrubs will become established in the drainage bottoms and small swales in the topography and the herbaceous species will dominate the upland areas to simulate the distribution pattern of habitat types on undisturbed areas. Shrubs in the drainages will become dense and tall commensurate with the availability of moisture. These areas of high shrub density will mitigate for the arroyo shrub habitat lost to mining activity in the major washes. Tamarisk has been observed on some of the previously reclaimed areas and will likely invade the bottom of the reconstructed drainages that provide suitable moisture just as it has in arroyos in the undisturbed portions of the surrounding area.

10.6.1.3 Water Sources

EXHIBIT 10-3 shows the location and approximate configuration of the known water sources (livestock ponds) which occurred on the Navajo Mine Permit Area before mining started. The source of this information was obtained by reviewing 1" = 1000' scale maps which were produced from two aerial surveys conducted before mining started. The first aerial survey was conducted by Jack Ammann, Inc., Engineering & Surveyors of San Antonio, Texas in 1960 and covered the permit area from Watson Pit to Barber Pit. The second aerial survey was conducted by Fairchild Aerial Surveys of Los Angeles, California in 1964 and covered from Barber Pit through Area IV North. The water sources were constructed for livestock watering by local people, Tribal or Federal agencies.

During the life of the mine, those ponds shown on EXHIBIT 10-3 which have not been impacted to date, will be impacted by mining, except for Pond P1. TABLE 10-14 lists all the ponds found before mining and their approximate size (area & volume). Replacement of impacted ponds is discussed in CHAPTER 12, RECLAMATION PLAN, Section 12.3.4.

In addition to replacement of the pre-mining ponds, the combined effects of the development of the Navajo Indian Irrigation Project (NIIP) and the Navajo Mine, has greatly increased the availability of water just off-lease of the mine permit area. The increase in water availability comes about because of the reconstruction of new ponds for surface water control, relocation of ponds off lease (EXHIBIT 10-3), and the creation of surface run-on from irrigation.

TABLE 10-14

WATER SOURCES - PONDS

POND I.D.	LOCATION	SURFACE AREA[1]	VOLUME[2]
P1	East Dodge	1.3 ac	2.50 ac. ft. (field estimate)
P2 (a +b)	East Doby	0.7 ac	1.19 ac. ft. (extrapolated)
P3 (a +b)	West Hosteen	0.2 ac	0.34 ac. ft. (extrapolated)
P4 (a +b)	East Barber	1.4 ac	2.38 ac. ft. (extrapolated)
P5	East Lowe	0.4 ac	0.68 ac. ft. (extrapolated)
P6	East Dixon	1.0 ac	1.70 ac. ft. (extrapolated)
P7	North Area IV	0.6 ac	0.11 ac. ft. (field estimate)
P8	South Area IV	3.8 ac	6.94 ac. ft. (field estimate)

[1]Surface areas were calculated by estimating approximate size of the pond from the average size of the pond found on the map.

[2]Volumes were calculated by establishing an average volume per surface area from three known undisturbed ponds (P1, P7 and P8), then using the average to extrapolate a total volume of each of the remaining ponds. The average volume was calculated at 1.7 ac. ft. of water per surface area of pond.

The increased water availability will be beneficial for livestock and will be a positive effect on wildlife. The combination of the water sources created by the development of NIIP and the Navajo Mine and the reconstruction of pre-mining ponds should exceed the water sources which were available before mining to wildlife.

10.6.2 Short-term Mitigation

Procedures employed to minimize or prevent impact to wildlife during the operation of the mine will include (1) limiting the amount of vegetation and topography disturbed to only that necessary to conduct mining; (2) designing facilities, such as transmission lines, to prevent mortality of raptors; and (3) monitoring important wildlife habitat, such as raptor nests, so appropriate plans to avoid significant undesirable impact can be developed and implemented.

Minimizing the area disturbed to only that necessary to safely conduct mining and avoiding important wildlife habitat that will be disturbed is a desirable mitigation measure. Limiting the extent of the disturbed area is not only a conservation measure for wildlife habitat that currently exists, it is economically advantageous since areas that are not disturbed do not require reclamation. Location of important wildlife habitats (such as rimrocks, raptor nests, water sources) will be considered when planning the location of haul roads and ancillary facilities so that they can be avoided as much as practicable.

To protect raptors from direct mortality due to electrocution, the design and construction of electric powerlines and other transmission facilities on the permit area will meet the guidelines set forth in "Suggested Practices for Raptor Protection on Powerlines - the State of the Art in 1996" (Avian Power Line Interaction Committee (APLIC. 1996).

Significant mortality has not been observed for any wildlife species as a result of the current operations, and none is expected in the future; however, if monitoring studies identify an adverse change, appropriate mitigation plans will be developed and implemented at that time to remedy the specific problem.

Buffer zones will be established around active raptor nests located on and adjacent to the permit area. The buffer zones will be established through consultation with the BIA and NFWD on a site and species specific basis as necessary. Activity not currently being conducted in the buffer zones will be restricted while the nest is active to prevent desertion of the nest. Raptor nests will be monitored to identify potential problem areas relative to the mining operations on the permit area. If raptor nesting success is affected by mining activity, BHP will consult with the NFWD, BIA, and USFWS to develop plans to limit impacts. Such plans will be developed on a site by site basis and could include rescheduling of mining activities and moving or taking of nests as necessary. Any work involving the handling of raptors or their nests will require special permits and would be closely coordinated with the NFWD and USFWS to the safety of the birds and promote the use of the breeding territory in the future. [Commitment statement found in CHAPTER 11, 11.2.9].

Raptors currently use certain power poles at Yazzie Point, on the east edge of Area III, and between Areas III and IV North as perches and nest sites. Frequently used poles will be left or reestablished during reclamation to allow continued use of these sites (or other sites used frequently during the life of the mine) by raptors.

Unless authorized, prairie dog colonies with active nesting burrowing owls will not be disturbed during the nesting season (late March through July) (Marks and Ball, 1983) to avoid active nests. Reoccupation of the reclaimed area by prairie dogs and other burrowing mammals will be monitored to determine if burrows will be available for use by burrowing owls. If no burrows are present on reclaimed areas, BHP will consult with the NFWD and BIA to determine if artificial burrows are necessary on the reclaimed area to promote use by burrowing owls. Burrowing owls have readily accepted artificial burrows (Collins and Landry, 197;, Henry and Blus, 1981), but the acceptance of artificial burrows on reclaimed areas has not been proven (Marks and Ball, 1983). [Commitment statement found in CHAPTER 11, 11.2.9].

10.7 MONITORING PLAN

BHP conducts periodic monitoring of wildlife on the permit area to assure that the mitigation measures are limiting the impact of mining as intended; to identify the presence of additional important wildlife habitats that may occur (e.g., new raptor nests); to identify additional unanticipated impacts that require development of specific mitigation measures; to describe and characterize the wildlife use of reclaimed areas; and to generally keep track of important wildlife activities on the area.

Starting with a raptor monitoring program, on the first year, all raptor nesting habitat on and within a one mile buffer zone of the permit area are surveyed once every three years by aerial means. On years two and three, all raptor habitat on and within one mile buffer zone of the most active mining areas (active pits, coal stockpiles, shop and office areas, major topdressing stockpiles,and future mining pits) for the next 16 years, are surveyed on the ground by a combination of walking and vehicles. These areas to be surveyed are those areas where the majority of the noise and disturbance by mining or mine personnel activity will take place and would be of most concern. The areas not surveyed in years two and three, within one mile of the permit, are surveyed every third year so that raptor nesting activity will be monitored. Fields disturbed and operated by the NAPI which are within either the aerial or ground buffer zones, will not be surveyed at any time since the fields are managed and controlled by a different private entity. Concerns from this area should be directed to NAPI. The surveys will be conducted during the breeding season (April through June) to document the status of known and unknown nests (e.g., active, inactive). Potential raptor nesting habitat that does not currently support nesting raptors will also be examined to determine if and where new nests are established relative to mining activities. Monitoring and surveying for raptors during the aerial survey will be conducted between April 01 and 15 (or closest date a suitable aircraft is available) as part of the initial survey for that year. A second follow-up survey will be done on the ground between May 15 and June 15 of those areas determined as active territories during the aerial survey. The initial surveys conducted during years two and three will be conducted on all raptor habitat areas, as described above, between March 15 and April 15 and a follow-up survey of the active territories, discovered during the initial survey, will be conducted between May 15 and June 15. EXHIBIT 10-2 delineates the areas to be surveyed during the aerial and ground

surveys as described above. [Commitment statement found in CHAPTER 11, 11.2.9].

All ground surveys in years two and three and the follow-up for the aerial survey will be conducted by driving though existing and accessible roads. Wherever possible, vistas and high ground will be used to view larger areas with binoculars so that enough overlapping will take place and good coverage of the survey area will be accomplished. On EXHIBIT 10-2 the areas designated by shading do not have good vehicle road access. In these areas, a zig-zag walking transect, using higher grounds, and inspecting mesa cliffs and steep arroyo embankments will be made during this survey. Historic and current active prairie dog towns will also be checked carefully for possible burrowing owl (Athene cunicularia) sightings. The prairie dog towns will be walked by using a zig-zag transect which will allow better survey coverage of the area.

Annual raptor survey results are compiled into a report. The report is organized to outline the methods, results, and to summarize the historical and new active breeding areas. Mapping of nesting site locations is maintained by the NFWD. Permits required to conduct off lease monitoring activities under this plan will be obtained from the NFWD. Distribution and reporting date of the annual report is explained in CHAPTER 11, Section 11.2.9. [Paragraph also found in CHAPTER 11, 11.2.9].

Annual mine operation plans are reviewed to identify potential conflicts with raptor nesting so that consideration can be made for mitigation. Early identification of conflicts is desirable to allow flexibility in resolving the conflicts with the least possible impact to the birds or the mines activities. For example, it is much easier and less costly to move a raptor nest before or after the nesting season than when it contains young. Any moving of raptors or their nests will require special purpose permits and will be closely coordinated with the NFWD and USFWS as necessary. The raptor nest monitoring program gathers data on the species using each nest, activity status, and number of young produced. If any golden or bald eagle nest are found on the mine permit area, its discovery and location will be reported to OSMRE/Denver. [Paragraph also found in CHAPTER 11, 11.2.9].

Prairie dog colonies will be surveyed for the black-footed ferret, as determined necessary after consultation with the NFWD. Reporting of survey results will be conducted as described in CHAPTER 11, Section 11.2.9. Also, if topdressing stripping activities (as described in CHAPTER 11, Section 11.2.1), are scheduled, the area to be disturbed will be examined prior to disturbance to determine if burrowing owls are nesting in the area. If burrowing owls are nesting, activities that would disturb the site would be rescheduled to prevent destruction of an active nest, or other appropriate measures employed after consultation with the regulatory authorities. [Paragraph also found in CHAPTER 11, 11.2.9].

The southwestern willow flycatcher was officially listed as an endangered species by the USFWS on March 29, 1995, under the authority of the Endangered Species Act of 1973, as amended (60 FR 10694). USFWS has determined that at least two years of survey data are necessary to make a negative determination of occurrence. To meet USFWS recommendations BHP has taken and will take the following steps:

1. Potential habitat surveys were conducted in December 5-8, 1994, where several areas of potential southwestern willow flycatcher breeding/nesting habitat were identified. Identified were three small ponds scattered throughout the permit, the lower section of Chinde Wash before it leaves Navajo Mine Lease, and two alluvium areas along the Cottonwood arroyo.

2. During on site inspections on May 22, 1995, of the potential habitat surveys, the Chinde Wash area was determined to be the only potentially suitable southwestern willow flycatcher habitat for which surveys are necessary. Thus in 1995 and 1996, surveys will be conducted in this area. The site inspections were made by Mr. Dave Mikesic (Zoologist, NFWD Navajo Natural Heritage Program), Mr. Pete Guernsey (Project Manager, TRC Mariah Associates Inc.), and Mr. Orlando Estrada (Environmental Specialist, BHP Navajo Mine).

3. Formal surveys (following protocol described in Tibbitts et al. [1994]) were conducted by Eric Meyer (sub-permit 95-25 under the authority of permit PRT-704930, and permit PRT-803203, USFWS; permit 940-517-041, NFWD) in June and July 1995. No southwestern willow flycatchers were observed or heard during the 1995 surveys of the Chinde Wash area. Formal results for 1995 surveys are presented in the 1995 General Wildlife survey report (see CHAPTER 11, Section 11.2.9 for reporting). Formal survey results for the 1996 breeding season, were provided to OSM in a brief status report sent August 7, 1996 (Mariah 1996). A detailed account of these surveys and results are provided in the Annual General Wildlife survey reports.

4. Positive identification of one or more individuals occurs at any time, the appropriate agencies (i.e., USFWS, New Mexico Ecological Services State Office, NFWD) will be notified immediately, and consultation with USFWS and NFWD will be initiated, as stated above, to determine the conditions under which BHP may proceed in areas of southwestern willow flycatcher occurrence.

General wildlife monitoring activities are conducted constantly by the BHP environmental staff as they travel around the mine during their daily activities and note wildlife on the area. Particular attention is paid to documenting any use of the permit area by threatened or endangered species or other species of high interest. Sightings of threatened or endangered species will be reported as outlined in CHAPTER 11, Section 11.2.9. [Paragraph also found in CHAPTER 11, 11.2.9]

Specific surveys to monitor wildlife use of reclaimed areas are discussed in CHAPTER 12, Section 12.1. The procedure involves vehicle or on foot survey during which the species and numbers of wildlife observed on the reclaimed area are recorded. Results of these monitoring activities will be distributed as indicated in CHAPTER 12, Section 12.1. These studies will be periodically evaluated relative to their utility in monitoring wildlife use of reclaimed areas. [Paragraph also found in CHAPTER 12, 12.1].

It is generally accepted that if the native vegetation can be replaced and if suitable cover similar to undisturbed areas is provided, then small and medium-sized mammals, predators, and birds will be restored. The studies by Westinghouse (1975) indicate that many of the small and medium-sized mammal species had returned to reclaimed areas within two years after seeding. Primary importance will be placed on the revegetation monitoring program to identify and correct any problems in establishing vegetation on the reclaimed area. Limited small mammal trapping and breeding bird surveys will be conducted during the last year prior to bond release to identify the species and relative abundance of wildlife using the reclaimed area. These data and results of the periodic wildlife surveys on the reclaimed area will be used as the basis for discussion regarding reestablishment of wildlife habitat and wildlife populations for bond release.

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APPENDIX 10-A

Wildlife Baseline Report
(for Area IV North)

BHP Billiton – Navajo Mine

WILDLIFE BASELINE REPORT

BHP BILLITON - NAVAJO MINE

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1.0 INTRODUCTION

This wildlife resource baseline report has been prepared to update permitting information pertinent to the continuation of coal extraction into Area IV North of Navajo Mine on the Navajo Nation, approximately 15 miles southwest of Farmington, New Mexico. Specifically, this wildlife baseline report addresses the entire existing Area IV North lease area and approximately a 1-mile radius buffer around this portion of the current lease. In total, about 11,100 acres were surveyed and evaluated. This baseline data has been collected to provide the Office of Surface Mining (OSM) with current wildlife data necessary to prepare National Environmental Protection Act (NEPA) documentation for continued coal extraction in Area IV North. The baseline surveys consisted of general characterization of area habitats, regionally common wildlife, and species with special protection or conservation status according to Federal, State, and Navajo Nation wildlife management agencies.

2.0 STUDY AREA

The study area includes Area IV North plus a 1-mile buffer, comprising approximately 11,100 acres of Great Basin desert-scrub habitat (Dick-Peddie 1993) (Figure 1). Great Basin desert-scrub habitat is a cold desert ecosystem dominated by shrubs with a sparse understory and of forbs and grasses; bare ground occurs in poor, alkaline soils (Fitzgerald et a. 1994, Dick-Peddie 1993). Galleta (*Hilaria jamesii*) and dropseeds (*Sporobolus* spp.) are sparsely represented among forbs and shrubby vegetation. Broom snakeweed (*Gutierrezia sarothrae*) is abundant, as is saltbush (*Atriplex* spp.), rabbitbrush (*Chrysothamnus* spp.), sage (*Artemisia* spp.), milkvetch (*Astragalus* spp.), and greasewood (*Sarcobatus* spp.). Salt cedar (*Tamarix* spp.), cottonwood (*Populus* spp.), and Russian olive (*Elaeagnus angustifolia*) are sparse in the study area and occur only within several intermittent drainages. The study area is part of the Colorado Plateau consisting of flats and tablelands with moderate to considerable relief. The study area is within the Chaco Wash watershed with shallow soils, steep hills, and rock outcrops. The project area supports a few strips of riparian vegetation; willows (*Salix* spp.) occur at the confluence of Pinabete Wash and Chaco Wash. Although this area is intersected by several drainages, the drainages are dry during much of summer. A stock pond exists at the southern border of the study area at UTM coordinates 12 E 4040156\N 723257 (NAD 27 CONUS). During peak season, this shallow stock pond is approximately 25 m × 30 m, but by late summer is reduced to

only about 7 m × 5 m. Most precipitation occurs from July through October in localized, short-duration, high-intensity thunderstorms. A small prairie dog (*Cnyonomys gunnisoni*) town also occurs in the western portion of the study area at UTM coordinates 12 E 4042293/ N 0718518 (NAD 27 CONUS). Area IV North is located about 15 miles (linear distance) southwest of Farmington, New Mexico (Figure 1) and is found on the Hogback S, Kirtland SW, Newcomb NE, and The Pillar NW 7.5-minutes USGS Quadrangles (Figure 2).

3.0 OFF-SITE METHODS: T&E WILDLIFE

3.1 Threatened, Endangered, and Sensitive Wildlife with Potential to Occur in the Study Area

Prior to conducting fieldwork, Ecosphere biologists compiled a list of federally listed, New Mexico state listed, Navajo Nation listed, and other sensitive and special management species (i.e. Bureau of Land Management sensitive species) and evaluated the habitat requirements of each species to determine if they were likely to occur in the study area. Federally listed species were obtained from the U.S. Fish and Wildlife Service (http://ifw2es.fws.gov/EndangeredSpecies/lists/ListSpecies.cfm) Southwest Region endangered species list. The Navajo Nation listed species were obtained through informal consultation with the Navajo Natural Heritage Program (NNHP). Bureau of Land Management (BLM) sensitive species and New Mexico state listed fauna were compiled from the New Mexico Department of Game and Fish and the New Mexico Natural Heritage Program (http://nmnhp.unm.edu/bisonm/bisonquery.php, http://nmnhp.unm.edu/).

Fifteen wildlife species listed as threatened, endangered, or sensitive by the Federal, State, or Navajo Nation have the potential to exist in the study area (Table 2). Species-specific surveys were conducted to determine presence or absence of the following species: Chisel-tooth Kangaroo rat (*Dipodomys microps*), banner-tailed kangaroo rat (*Dipodomys spectabilis*) (David Mikesic, Zoologist, Navajo Natural Heritage Program, pers. comm.), kit fox (*Vulpes macrotis*), big free-tailed bat (*Nyctinomops macrotis*), small-footed myotis (*Myotis ciliolabrum*), spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Plecotus townsendii pallescens*), Mountain Plover (*Charadrius montanus*), Southwestern Willow Flycatcher (*Empidonax traillii extimus*), bald eagle (*Haliaeetus leucocephalus*), Ferruginous hawk (*Buteo regalis*), Golden eagle (*Aquila chrysaetos)*, Peregrine falcon (*Falco peregrinus*), Black-footed ferret (*Mustela nigripes*). The protection status of each of these species is included in Table 2. No specific surveys were

conducted for Pronghorn antelope (*Antilocapra americana*). All of these species are listed as threatened or endangered or as a species of concern by the either the U.S. Fish and Wildlife Service (USFWS), the State of New Mexico, the Navajo Nation, or are concerned species of concern or sensitive by the BLM New Mexico State Office.

Qualified biologists developed scientific protocols to survey for these target species in coordination with the NNHP species-specific guidelines, or conducted surveys in accordance with scientific standards or guidelines. The results of these surveys were compared to published literature, previous wildlife surveys cited by the New Mexico Natural Heritage Program database of species accounts (http://nmnhp.unm.edu/bisonnm/bisonquery.php), and to the most recent edition of the existing Navajo Mine SMCRA permit (1992) that summarizes all field studies conducted on or adjacent to the Navajo Mine since 1973, including Area IV North.

4.0 ON-SITE METHODS: T&E WILDLIFE

4.1 Chisel-tooth Kangaroo Rat and Banner-tail Kangaroo Rat

Small mammal surveys were conducted to determine the presence or absence of the Navajo Nation listed chisel-tooth kangaroo rat (*Dipodomys microps*), and banner-tail kangaroo rat (*Dipodomys spectabilis*). Because small mammal inventories have historically been conducted within portions of the lease area (SMCRA 1992), the Area IV North surveys extended beyond the target species to include a sampling of habitat types present. Six microhabitats within Area IV North were identified and trapped for small mammals: arroyo-shrub, saline sand, thin break, alkali wash, dune, and badland (Figure 3). In the more suitable habitat such as arroyo-shrub areas that provided more cover and forage opportunities, trapping webs were established and monitored. For cost efficiency in less suitable and generally poor small mammal habitat, such as badlands, a simple trapping grid was utilized (Table 1).

Each trapping web covered 3.14 ha and consisted of 12 100-m transects spaced 30° from a central point, similar to the spokes of a wheel. Each web contained 148 Sherman (8 × 9 ×23 cm; H.B. Sherman Trap Company, Tallahassee, FL) at 12 trap stations along each radiating spoke. The first four trap stations were at 5-m intervals and the remaining eight at 10-m intervals. Four Sherman traps were placed around the central point (Figure 4). Each trap was baited with rolled oats, molasses, and raisins; polyester fiberfill was placed inside each trap to provide nesting material and reduce trap-associated deaths. Each trap was baited and set in the evening and closed again every morning. Each trapping web and grid was run for two consecutive

nights. Additionally, two trapping grids were set up in arroyo-shrub habitat to increase the trapping effort in the most suitable habitats where small mammal burrows had been identified. Badland was also identified as a habitat type, but due to its lack of suitability as habitat for small mammals (i.e. no vegetative cover or forage potential), only trapping grids were used to sample this habitat type. Trapping grids consisted of 4 transects of 12 traps, each row 10 m apart and each trap spaced 10 m apart for a size of 0.3 ha (Figure 5). Captured animals were identified, sexed, and uniquely marked with a Sharpie pen. Animals were handled by experienced field biologists according to standardized health procedures (Mills et al. 1995) and immediately released into the same area they were captured. All mark-recapture data were collected for purposes of density estimation.

4.2 Black-footed Ferret

Ecosphere biologists conducting vegetation surveys incidentally passed by the prairie-dog town on several occasions in May 2004 and anecdotally reported the size of the prairie-dog town <4 ha with no prairie-dogs observed. In July 2004 the size of the prairie-dog was confirmed to be <4 ha, the required size to support black-footed ferrets (US Fish and Wildlife Service 1989). Therefore, no further surveys for black-footed ferrets were necessary.

4.3 Kit Fox

Night spotlighting was conducted by 1-2 observers driving slowly in a 4 × 4 vehicle on passable roads in the study area. While one observer operated the vehicle, the other used a 2 million-candlepower spotlight (The Brinkmann Corporation and Dallas Manufacturing Company, Inc, Dallas, Texas, USA) to scan for eye-shine. Surveys were conducted for 2-4 hours after midnight on two occasions in June 2004 and on a third occasion in September 2004. In addition, scent posts were established in sandy areas where canid tracks were identified. Scent posts were marked with fox urine and beaver castor, and the surrounding area was swept with a household broom to identify the tracks of any visitors. Predator calls (Primos® Hunting Calls, Flora, Missouri, USA) were used at the end of each spotlighting session to attract any canids in the area, which could then be identified with spotlights.

4.4 Mountain Plover and Southwestern Willow Flycatcher

A general avian survey was conducted on 6 June 2004 along two miles of Chaco Wash between the confluence of Pinabete Wash and Cottonwood Wash, the most suitable avian habitat in the

study area. Two individuals conducted pedestrian surveys using high-powered binoculars (8 x 42, 6.3°, Pentax, Asahi Optical Company, Japan) from 0545-1030-hr. No FWS protocol surveys were conducted for either of these species due to absence of suitable habitat within the Area IV North lease area.

4.5 Golden Eagle, Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

Surveys for the nests of raptorial species on and within 1 mile of the perimeter of all existing BHP leases north of the proposed project area have been required throughout the life of Navajo Mine. This survey area includes 33,379 acres within the existing mine lease and an additional 23,620 acres around the perimeter (D. Mikesic, pers. comm.). A survey using a fixed-wing aircraft (Hickman 1972, Boeker 1970) for active raptor nests was conducted on the morning of 7 May 2004. Surveys were conducted from a Cessna 206 airplane, at 150-200 feet out and above cliffs. Average airspeed of 110 mph was not as slow as recommended (Boeker 1970) for Golden eagles, but was a compromise that allowed reasonable viewing of cliffs at safe heights, distances, and speed. Rotor-winged aircraft are more suited for smaller species (Fuller and Mosher 1987) but we did not use this method due to high costs and the history of previous coverage of the study area. All rocky points and cliffs identified as potential habitat for raptors were visited by flying systematically across the study area and an area extending 3 miles beyond their boundaries. All muted ledges and stick nests were repeatedly checked until it was ascertained if they were occupied by an incubating or brooding adult raptor or raven. Areas within a 1-mile radius of Area IV North were revisited on the ground on the afternoon of 7 May 2004 and during the course of all other wildlife surveys.

Coordination with BHP Billiton and NNHP personnel was also initiated on 7 May. Because of the sensitivity of nesting raptors, particularly Ferruginous hawks to human disturbance (Grier and Fyfe 1987) ground surveys were limited due to the occupancy of known nest sites in the area. BHP Billiton has contracted with Hawks Aloft, Inc., to annually inventory the Navajo Mine lease for raptors. The results of results of previous surveys, including those conducted in 2004 were not immediately available for inclusion in this report.

4.6 Small-footed Myotis, Spotted Bat, Townsend's Big-eared Bat

Surveys for sensitive bat species were conducted in order to document the presence of State of New Mexico and federally listed species of concern. Bats often navigate using distinct topographic features, such as cliff faces, washes, and roadways. Sites within the study area with

these characteristics were identified and standard 32-ft mist nests (Northeastern Bird Banding Association) were used to capture and identify bats. Shortly before dusk, mist nets were set up between two 20-ft lengths of PVC piping supported by rebar. Two to three observers silently waited at either end of the mist net for bats to become active and inadvertently fly into the mist nets. Upon tangling themselves in the mist net, bats were carefully removed with gloved hands, identified, sexed, and released. When no bats had been captured by midnight, nets were taken down.

Two mist nets were run from sunset to midnight on 6 June 2004 and on 23 June 2004 near the stock pond. On 2 June 2004 four nets were set in a dry wash that runs roughly along the eastern boundary of the study area.

4.7 Pronghorn antelope

No systematic surveys for pronghorn were conducted. Rather the presence/absence for this species was ascertained from on-going area searches for sightings and tracks or scat as part of everyday visits to the study area.

4.8 Fishes and Amphibians

No surveys were conducted for fishes or amphibians due to the lack of perennial water resources or wetlands in the study area.

5.0 METHODS: GENERAL WILDLIFE

Baseline wildlife surveys were conducted during summer 2004; the results are reported in this document. Documentation of wildlife common to desert scrub habitats in the Four Corners Region was conducted during the course of intensive vegetation baseline surveys, raptor surveys and during species-specific surveys conducted for Federal, State and Navajo Nation listed or sensitive species. Because of the magnitude of survey days in the field associated with these targeted surveys, no systematic general wildlife surveys were warranted. Any incidental wildlife observations made within the study area, irrespective of the target species, were recorded. Wildlife documented during the 2004 field season is described in the results section of this report (Table 1).

6.0 RESULTS: T&E WILDLIFE

6.1 Chisel-tooth Kangaroo Rat and Banner-tail Kangaroo Rat

No chisel-tooth kangaroo rats or banner-tail kangaroo rats were captured in 3,344 trap nights.

6.2 Black-footed Ferret

No surveys for the presence of black-footed ferrets were conducted after preliminary field surveys determined that the prairie dog colony in the study area was too small (<4 ha) to support black-footed ferrets and no further investigations were warranted.

6.3 Kit Foxes

Although no kit foxes were spotlighted, scat and tracks were identified in the study area, and burrows were common throughout the study area. None of the burrows showed current occupation; however, several indicated recent use because no spider webs or debris obscured the entrances. A fresh scat, along with fresh tracks, was identified at UTM E 4041570/N 723385 (NAD 27 CONUS). A scent post was set up at this sight; however, subsequent checks showed no indication of a canid visiting the scent post.

6.4 Mountain Plover and Southwestern Willow Flycatcher

No Mountain Plover or Southwestern Willow Flycatcher was documented in our avian surveys.

6.5 Golden Eagle, Bald Eagle, Peregrine Falcon and Ferruginous Hawk

The report on the results of the 2004 breeding season surveys by Hawks Aloft is not completed and is therefore unavailable. Navajo Natural Heritage Program surveys for 2004 found that the one known Golden eagle territory within the study area had no active nests and was not known to be occupied by adult eagles. Ferruginous hawks occupied at least 2 of 5 territories within or near the survey buffer area. One hawk fledged two young; the other hawk produced young but they were apparently killed by a mammalian predator (D. Mikesic, pers. comm.).

In 2003 on the 57,000-acre Navajo Mine raptor monitoring area, one Northern Harrier, two Red-tailed hawks, nine Ferruginous hawk, three American Kestrels, one Prairie Falcon, one Barn Owl, two Great Horned Owl, and four Burrowing owl nest sites were occupied (Hawks Aloft 2004). Of these, three Ferruginous hawks and two Great-horned owl nests successfully

fledged young. The results of cavity and underground nesting attempts of American Kestrels and Burrowing owls were not ascertained.

Within the study area, the following territories have been documented as occupied at least once during 28 years of monitoring: four Red-tailed Hawks, five Ferruginous hawks, one Golden eagle, five American Kestrels, three Prairie falcons, three Great-horned owls, and one Burrowing owl (Hawks Aloft 2004).

Several other important bird observations were made while in the study area by Ecosphere biologists. Two juvenile Bald eagles were identified on two, different occasions: 7 August 2004 in the west-central portion of the study area and 14 August 2004 at the northern boundary of the study area. Four Burrowing Owls (*Athene cunicularia*) were seen on several occasions within the prairie dog town. A Burrowing Owl was heard at the stock pond on 5 June 2004 while netting for bats and observed in the same area again on 22 June 2004. Gamble's Quail (*Callipepla gambelii*) was seen on two occasions in the west-central portion of the study area: 10 July and 5 August 2004. Two American Avocets (*Recurvirostra americana*) and several Killdeer (*Charadrius vociferus*) were noted at a stock pond on the south boundary of the study area in early June; neither was present in late June.

6.6 Small-footed Myotis, Spotted Bat, Townsend's Big-eared Bat

No sensitive bat species were captured in our mist-netting efforts.

6.7 Pronghorn antelope

No individual pronghorn antelope or tracks or scat was sighted while in the study area.

7.0 RESULTS: GENERAL WILDLIFE

Eleven small mammals were captured in 3,344 trap nights (Table 3). All captures of small mammals were in arroyo-shrub habitat. Seven of those small mammals were captured on trapping web A2: four Ord's kangaroo rats (*Dipodomys ordii*), one deer mouse (*Peromyscus maniculatus*), one pocket mouse (*Perognathus apache*), and one recaptured Ord's kangaroo rat (Table 1). One deer mouse was captured on trapping web A1 and 3 Ord's kangaroo rats were captured on trapping grid A4 in arroyo-shrub habitat (Figure 1). No small mammals were captured in any other habitat type; all eleven captures were made in arroyo-shrub habitat (Table 3).

Although estimates of abundance ($\hat{N}$) could not be estimated due to low capture success, density estimates can be calculated using minimum number alive (MNA) (Krebs et al. 1986, Slade and Blair 2000) in arroyo-shrub habitat (Table 4). However, our approach does not incorporate the effective area trapped, only the area of trapping web or grid. Density estimation is not simply $\hat{D} = \hat{N}/A$, where A is the area of the trapping grid and $\hat{N}$ is the number of individuals (Wilson and Anderson 1985). While demographic closure (no birth, deaths, immigration or emigration) is easily met or approximated in most studies, geographic closure (a physical boundary to the population) is more difficult to attain, unless the study area is a small island or an isolated woodlot (White et al. 1982). Geographic closure is rarely met in trapping-grid studies of snowshoe hares because of edge effect. Small mammals may have home ranges that overlap the trapping grid or lie outside the trapping grid and are attracted to it by bait (Wilson and Anderson 1985); therefore, the actual area trapped is larger than just the area of the trapping grid. Therefore, the density estimates reported in this report (Table 4) may dramatically overestimate density. Although actual densities are probably much lower, densities in this report do represent numbers for future comparison if field and calculation methods are repeated.

Prairie dogs were observed at the town in early June; however, no prairie dogs were seen in later summer. No coyotes (*Canis latrans*) were seen or heard during the spotlight or any other surveys, but tracks were identified and several scats were found. Jackrabbits (*Lepus californicus*) were occasionally seen in desert shrub areas. Several desert cottontails (*Sylvilagus auduboni)* were observed in the study area, especially during the spotlight surveys. A white-tailed antelope squirrel (*Ammospermophilus leucurus*) and a ground squirrel (*Spermophilus spilosoma*) were seen in rocky draws on separate occasions within the west-central portion of the study area. Bobcat (*Lynx rufus*) tracks were also identified in Chaco Wash. The study area apparently supports a small population of mule deer (*Odocoileus hemionus*) as a few tracks were identified, mostly in Chaco Wash.

Livestock grazing occurs in the study area. Six horses roam the area near the stock pond; several cattle graze on the north end of Area IV North near Cottonwood Wash and numerous horse and cow tracks were seen in Chaco Wash. Tracks of domestic dogs and domestic cat were also seen.

Bird species heard or observed while conducting avian surveys were as follows: White-crowned Sparrow (*Zonotrichia leucophrys*), Sage Sparrow (*Amphispiza belli*), Song Sparrow (*Melospiza melodia*), Black-throated Sparrow (*Amphispiza bilineata*), Cassin's Finch (*Carpodacus cassinii*), Horned Lark (*Eremophila alpestris*), Ash-throated Flycatcher (*Myiarchus*

cinerascerns), Cassin's Kingbird (*Tyrannus vociferans*), Say's Phoebe (*Sayornis saya*), Brown-headed Cowbird (*Molothrus ater*), Rock Wren (*Salpinctes obsoletus*), Common Nighthawk (*Chordeiles minor*), Northern Mockingbird (*Mimus polyglottos*), Mourning Dove (*Zenaida macroura*), and Common Raven (*Corvus corax*). The Sage Sparrow is the only species noted in the Partners in Flight (PIF) Bird Conservation Plan as a high priority species for the Colorado Plateau.

Mist-netting resulted in the capture of numerous individuals of several bat species: 22 pregnant female and 10 male western pipistrelles (*Pipistrellus hesperus*), one pregnant female and 6 male Pallid bats (*Antrozous pallidus*), one non-reproductive female Silver-haired bat (*Lasionycteris noctivagans*), and one non-reproductive female Hoary bat (*Lasiurus cinereus*).

8.0 DISCUSSION: T&E WILDLIFE

8.1 Chisel-tooth Kangaroo Rat and Banner-tail Kangaroo Rat

Although no sensitive species were captured during our live-trapping surveys, they do have the potential to exist in the study area. Multiple burrows were observed in sandy areas under shrubs in the central portion of the study are (UTM 404118/723450, NAD 27 CONUS) and near the southern boundary at the confluence of Pinabete and Chaco Wash (UTM 4041854/0718825 NAD CONUS 27). However, these burrows were typically no larger than 1 m × 1m - typical of the burrow of an Ord's kangaroo rat (Fitzgerald et al. 1994). Banner-tail kangaroo rats usually construct larger burrows, as high as 1.2 m above the surrounding terrain and 1.5 to 4.5 m in diameter (Hoffmeister 1986). Chisel-tooth kangaroo rats also construct burrows with similar vegetation as that found in the study area. Although Chisel-tooth kangaroo rats are thought to be absent from the study area (Hoffmeister 1986, D. Mikesic, Zoologist, comm.), they were a common sighting in spotlight surveys for black-footed ferrets in the mid-1980s (SMCRA Report 1992). Previous surveys reported deer mice and silky pocket mice (*Perognathus flavus*) as the most abundant and widespread small mammal species trapped in the study area (SMCRA Report 1992). Further, in 1973 and 1974, on and near the Navajo Mine Lease, 11.31 deer mice and 0.53 silky pocket mice were captured per 100 trap-nights in arroyo-shrub habitat (SMCRA 1992). Although these numbers incorporate a more intense trapping effort throughout the entire Navajo Mine lease, they are significantly greater than the capture rate in Area IV North; we captured 11 small mammals total in 1,080 trap-nights in arroyo-shrub habitat. The lack of abundance and species diversity represented in the small mammal

population in Area IV North (see Results) compared with documented species in similar habitat (Table 1), may have to do with the high amount of disturbance from cattle and sheep grazing. Indeed, Zou et al. (1989) found that habitat disturbance negatively impacted Great Basin pocket mice (*Perognathus parvus*) and deer mice (*Peromyscus maniculatus*) in treatment experiments of their habitat.

8.2 Black-footed Ferrets

Black-footed ferrets, a federally endangered mustelid, typically occupy large prairie dog towns >80 ha with complex burrow systems or ≥20 burrows/ha (Mikesic and Hystedt 2001*a*). Although there are no known black-footed ferrets on the Navajo Nation, there may be prairie dog towns of sufficient size to support ferrets that simply have never been surveyed (Mikesic and Hystedt 2001*a*).

8.3 Kit foxes

Kit foxes are found throughout most of New Mexico except for the northeastern corner of the state (Findley et al. 1975, unm.edu/bisonm/bisonquery.php). They prefer soft, sandy or alluvial soils where they can dig their dens, often in desert-scrub or desert grassland similar to our study area (Hoffmeister 1986). Kit foxes are known to prey upon Ord's kangaroo rats, cottontails, jackrabbits, and other small mammals (Findley et al. 1975), as well as crickets, grasshoppers, lizards, and birds (Hoffmeister 1986). Kit foxes were previously documented in Area IV North (SMCRA 1992), and while our study also found significant signs of kit fox in the study area, their densities remain unknown.

8.4 Mountain Plover and Southwestern Willow Flycatcher

There is minimal habitat in the study area for either Mountain Plover or Southwestern Willow Flycatcher. In previous breeding bird surveys, Horned Larks were the most abundant species in Area IV N, while Mourning Doves were the second most abundant bird observed (SMCRA 1992).

8.5 Golden Eagle, Bald Eagle, Peregrine Falcon, and Ferruginous Hawk

The study area includes historic and recently active nest sites of seven species of raptorial birds. Two of these, Golden eagle and Ferruginous hawk, are listed on the Navajo Nation Endangered Species list and must be protected against disturbance. One Ferruginous hawk

territory consists of five nests northwest of the Area IV North survey buffer area. The most recently active (1999) Golden eagle nest site is approximately one mile from Area IV North. The federally threatened Bald eagle may migrate through the planning area, although there is limited wintering habitat and virtually no water resources. Ferruginous hawks reportedly used two mesas on the eastern edge of Area IV, especially during the breeding season (SMCRA 1992). The SMCRA (1992) report listed active nests of two Golden eagles, two Great-horned owls (*Bubo virginianus*), two Red-tailed hawks (*Buteo jamaicensis*), one Ferruginous hawk and one Prairie falcon (*Falco mexcianus*) in Area IV, but since more detailed locations of the nests were not provided, direct comparisons are not justified. Burrowing owls were also observed in Area IV North, but apparently were more abundant in previous surveys than the few individuals we observed (SMCRA 1992).

8.6 Small-footed Myotis, Spotted Bat, Townsend's Big-eared Bat

The presence of numerous Pipistrelles is not surprising; these bats dwell singly or in small groups in shallow cliff crevices, which are numerous throughout the project area. Pallid bats, a colonial species, probably inhabit the few deeper crevices or deeper wind-eroded pockets available in area cliffs. Female pallid bats live apart from males from advanced pregnancy though young-rearing; therefore, the presence of both sexes in the planning area strongly suggests at least two roosting sites. The presence of a silver-haired bat was unexpected because these bats generally occur in small groups in forested habitats, roosting under tree bark or in snags. They are, however, nomadic and migratory, which probably accounts for the capture. Finley (1975) documented one other silver-haired bat specimen from San Juan County in the Chuska Mountains. The hoary bat was also unexpected, although they have been documented in San Juan County (Finley 1975). Hoary bats generally feed along riparian corridors and roost in cottonwoods or other riparian trees. They are, however, strong fliers capable of covering long distances. The captured bat may have come from the San Juan River area.

8.7 Pronghorn Antelope

No pronghorn sightings have been recorded in the study area to date (SMCRA Report 1992). In the late 1950's and early 1960's, pronghorns were a common sight on public lands within a 30-40 mile radius of Farmington. They were hunted until 1974 when numbers began to decline in the San Juan Basin. The preferred vegetation type used by antelope in the San Juan Basin is primarily big sagebrush (*Artemisia tridentata*) with varying understory grasses and forbs. The plant communities on the project area may have the wrong species of sage and

insufficient grasses to support pronghorns (Donna Howell, independent bat biologist, pers. comm.). Further, in Arizona, pronghorn antelope are not known to occur in Great Basin desert-scrub habitat (Hoffmeister 1986).

9.0 DISCUSSION: GENERAL WILDLIFE

The presence of carnivores (e.g. kit foxes, coyotes, and badgers) indicates a prey base large enough to support them. These carnivores are most likely supported by lagomorphs, kangaroo rats, squirrels and other small mammals, and perhaps an occasional mule deer fawn. The prairie dog town in the study area was <1 ha; black-footed ferrets are usually associated with medium to large prairie dog towns >80 ha. According to the Navajo Nation survey guidelines, such a small area is not warranted for black-footed ferret surveys (Navajo Fish and Wildlife Department 1985). Although this was determined an active prairie-dog town, prairie dog sightings were rare in June, and no prairie dogs were observed in late summer. It is not uncommon for prairie dogs to severely denude the vegetation around their towns and eventually desert them (Fitzgerald et al. 1994) or to be devastated by the plague. In previous surveys conducted in Area IV North (SMCRA 1992), prairie dogs were the most abundant mammals observed in the study area. Several statewide and San Juan County efforts are underway to establish protection for this mammal (http://www.nativeecosystems.org/prairiedogs/gunnisons/040223_release.htm). A petition was filed in February 2004 to list the Gunnison's prairie dog under the federal Endangered Species Act. Badgers, also commonly associated with prairie dog towns, were also previously reported in the SMCRA (1992) report.

Occasional mule deer may be transients wandering from the San Juan River corridor but they are not common residents of Great Basin desert-scrub habitat (Hoffmeister 1986). Domestic livestock such as cattle, horses, and sheep occur throughout the study area.

10.0 DISCUSSION: POTENTIAL IMPACTS TO ENDANGERED, THREATENED, AND SENSITIVE WILDLIFE

The continuation of coal extraction in Area IV North of Navajo Mine on the Navajo Nation has the potential to directly impact all wildlife species documented in the area, including three Navajo Nation listed species: Golden eagle, Ferruginous hawk, and kit fox. Coal extraction

will result in the loss of thousands of acres of wildlife habitat potentially destroying nesting sites of Golden eagles, Ferruginous hawks and kit fox burrows. Wildlife movement and dispersal in the area would also be affected by the presence of human activity, heavy machinery, and increased road traffic. The removal of arroyo-shrub habitat will have potentially dramatic impacts to small and medium-sized mammal populations indirectly impacting these listed species as well. Of the six microhabitats we surveyed within the study area, all small mammals were captured in arroyo-shrub habitat. These small mammal populations provide a prey base for Golden eagles, Ferruginous hawks, and kit foxes which will undoubtedly be indirectly impacted if these prey resources decline. Avian species are also closely associated with dense vegetative cover found in arroyo-shrub habitat and coal extraction would results in direct habitat loss.

Nesting by Golden eagles, a Navajo Nation Group 3 species (Mikesic and Nystedt 2001*b*) has been documented in the study area and may be directly impacted by habitat destruction, avoidance of the project area, and indirectly by habitat destruction resulting in the loss of small mammal species for food. Most Golden eagle nests on the Navajo Nation are found on steep cliffs > 30 m high, but nests have also been documented in shorter cliffs (~10 m) (Mikesic and Nystedt 2001*b*). Nests are also commonly found adjacent to cottontail and jackrabbit habitat, namely arroyo-shrub habitat in our study area. Golden eagles often use multiple nests within their territory and rotate their use annually (Watson 1997); therefore, nests should be monitored >1-yr to assess their activity status. Golden eagles are sensitive to disturbance by loud, long-term activity, especially during the incubation period beginning in February until the fledglings are 20 days old in early June (Johnsgard 1990). Mitigation measures approved by the Navajo Nations should be employed to avoid disturbing any future area nesting sites.

Ferruginous hawks, also a Navajo Nation Group 3 species (Mikesic and Nystedt 2001*c*), should be provided similar considerations. Nests on the Navajo Nation are typically found on clay or rock pinnacles, small buttes or cliffs <30 m high (Mikesic and Nystedt 2001*c*). Populations of desert cottontails, black-tailed jackrabbits, and ground squirrels are required in habitats surrounding their nest sites; therefore, destruction of habitat by coal extraction would directly reduce this prey base. Further, Ferruginous hawks are especially prone to nest abandonment during the incubation period from mid-March to mid-May (Mikesic and Nystedt 2001*d*). Mitigation measures approved by the Navajo Nations should be employed to avoid disturbing any future area nesting sites.

Kit foxes, listed as a Group 4 species by the Navajo Nation (Mikesic and Nystedt 2001*d*), are a small canid found in north-central New Mexico. Kit foxes are semifossorial and dig their

own dens, which usually have several, key-shaped openings. Kit foxes commonly have multiple dens that they use simultaneously, especially throughout the summer when rearing pups (Armstrong et al. 1994). It is important to avoid destruction and disturbance of these dens not only for pup-rearing, but also for protection from predation by coyotes, a high cause of mortality for kit foxes (O'Farrell 1987). Kit foxes rely heavily on cottontails and jack rabbits for food (Armstrong et al. 1994), and their abundance is dependent upon prey availability. Therefore, in order to avoid adversely affecting kit foxes, efforts to maintain their food supply should also be considered. Mortality from motor vehicles has also been documented as a significant source of mortality for kit foxes; therefore, construction of any new roads and the increase in motor vehicle traffic should be minimized (O'Farrell 1987).

The Bald eagle, a federally and New Mexico state listed raptor species may migrate through the study area. Because there is no suitable wintering habitat for bald eagles within the study area, no mitigation measures are warranted.

In conclusion, if coal extraction continues in Area IV North, management and mitigation for protection of the Navajo listed species should be a high priority. BHP Billiton plans to follow reclamation guidelines in order to minimize any negative impacts discussed above. Additionally, reclamation activities by BHP Billiton will include positive impacts to the study area such as restoration and improvement of wildlife habitat.

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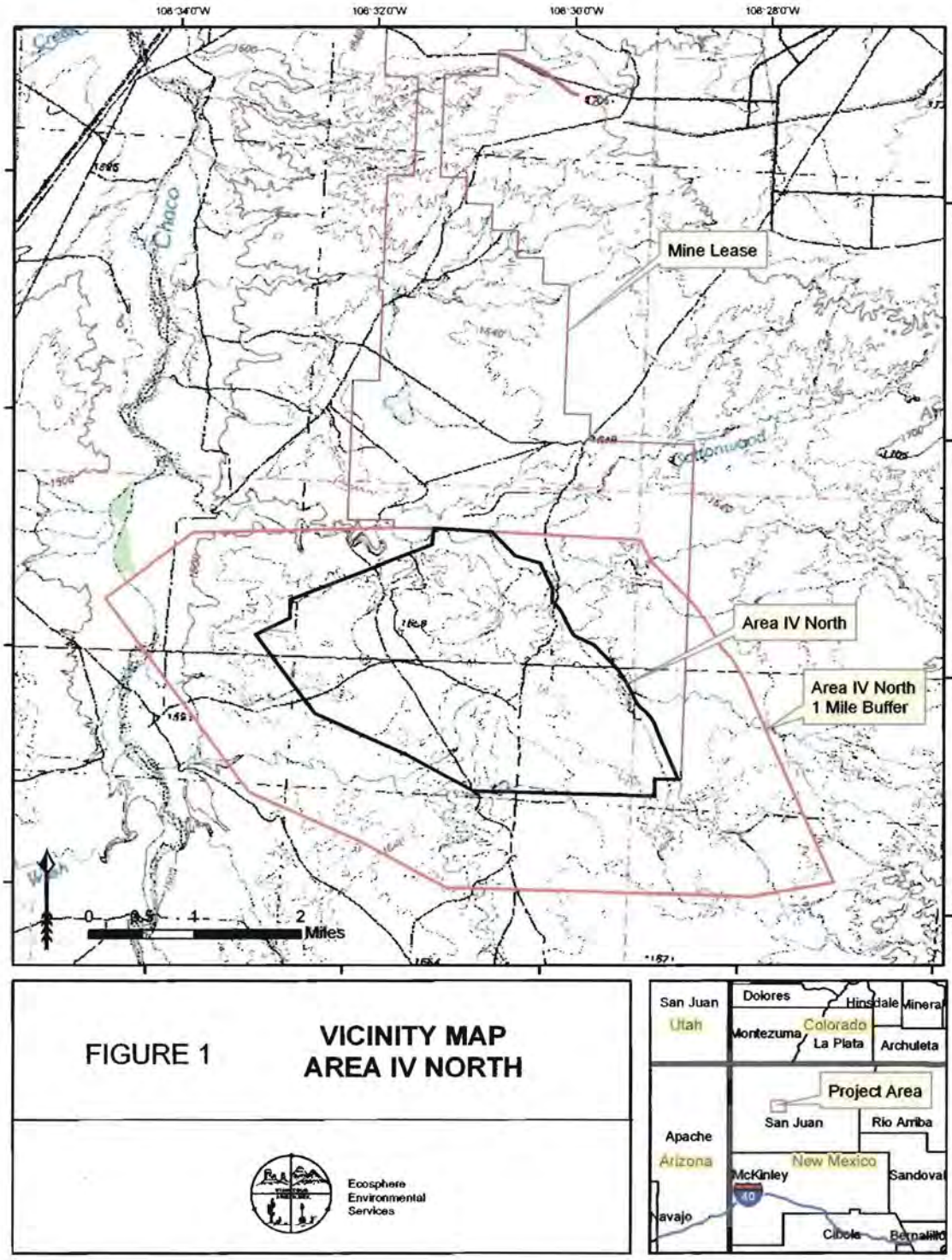

Figure 1. General vicinity map of study area showing Area IV N (within the greater mine lease area) plus a 1-mile buffer, Summer 2004.

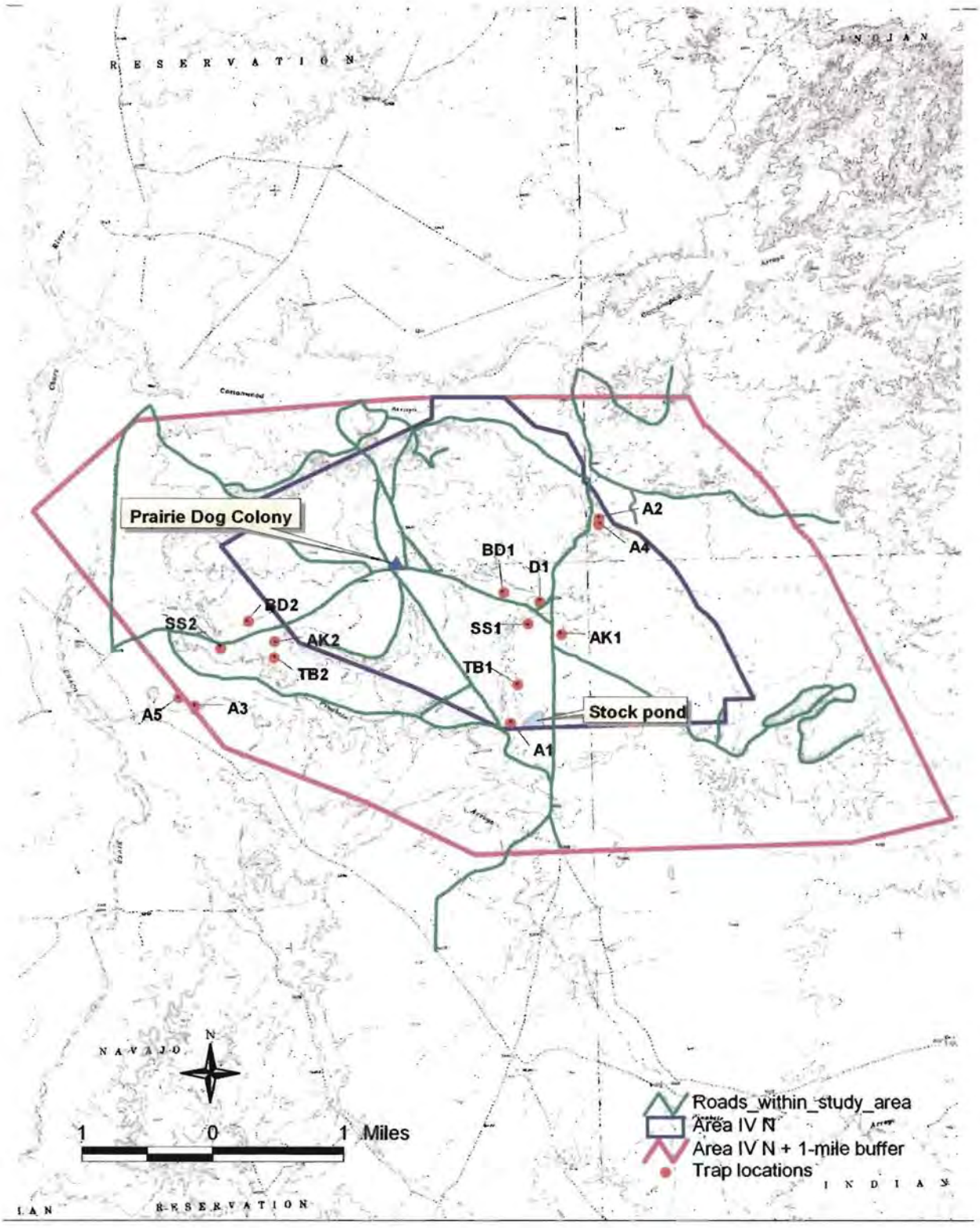

Figure 2. Map of study area of Area IV North plus a 1-mile buffer (rounded), including spotlight routes along drivable roads within the study area, all small mammal trap locations, as well as the location of the stock pond and the prairie dog colony, plotted on the Hogback S, Kirtland SW, Newcomb NE, and The Pillar NW 7.5-minutes USGS quadrangles, Summer 2004. (See Table 3 for description of trap locations.)

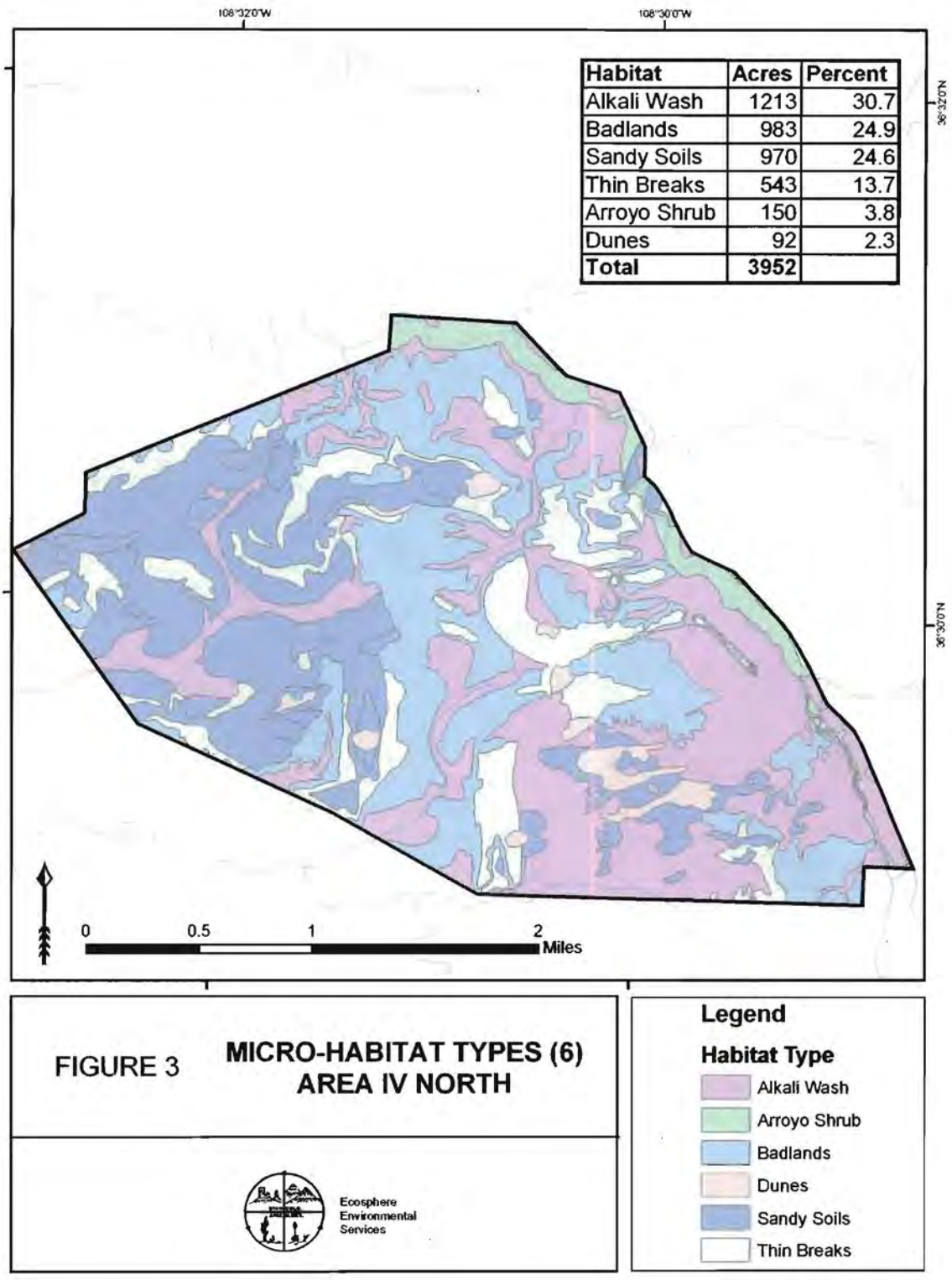

Figure 3. Map of the distribution of the six micro-habitat types found in the Area IV N study area, along with a table of their respective acreage and proportion of total acreage, Summer 2004.

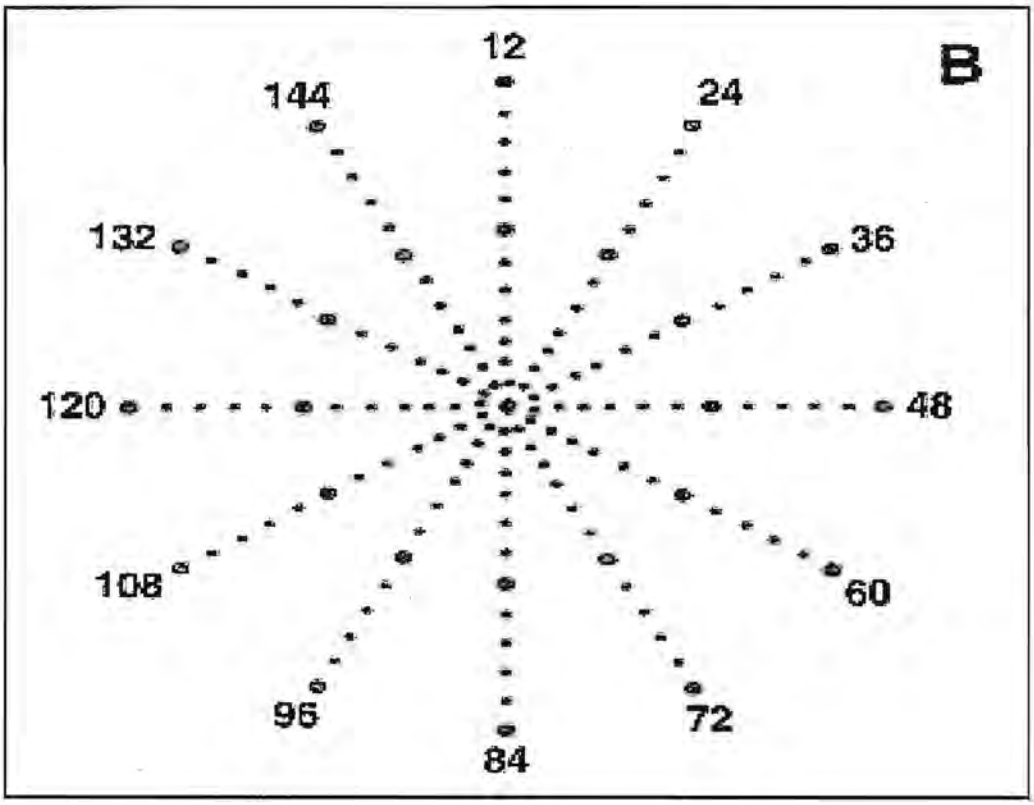

Figure 4. Schematic representation of a trapping web showing 148 trap locations along 12 spokes 30° apart with the first 4 traps spaced 5 m apart and the subsequent 8 traps spaced 10 m apart for a total trapping web size of 3.14 ha (Parmenter et al. 1998).

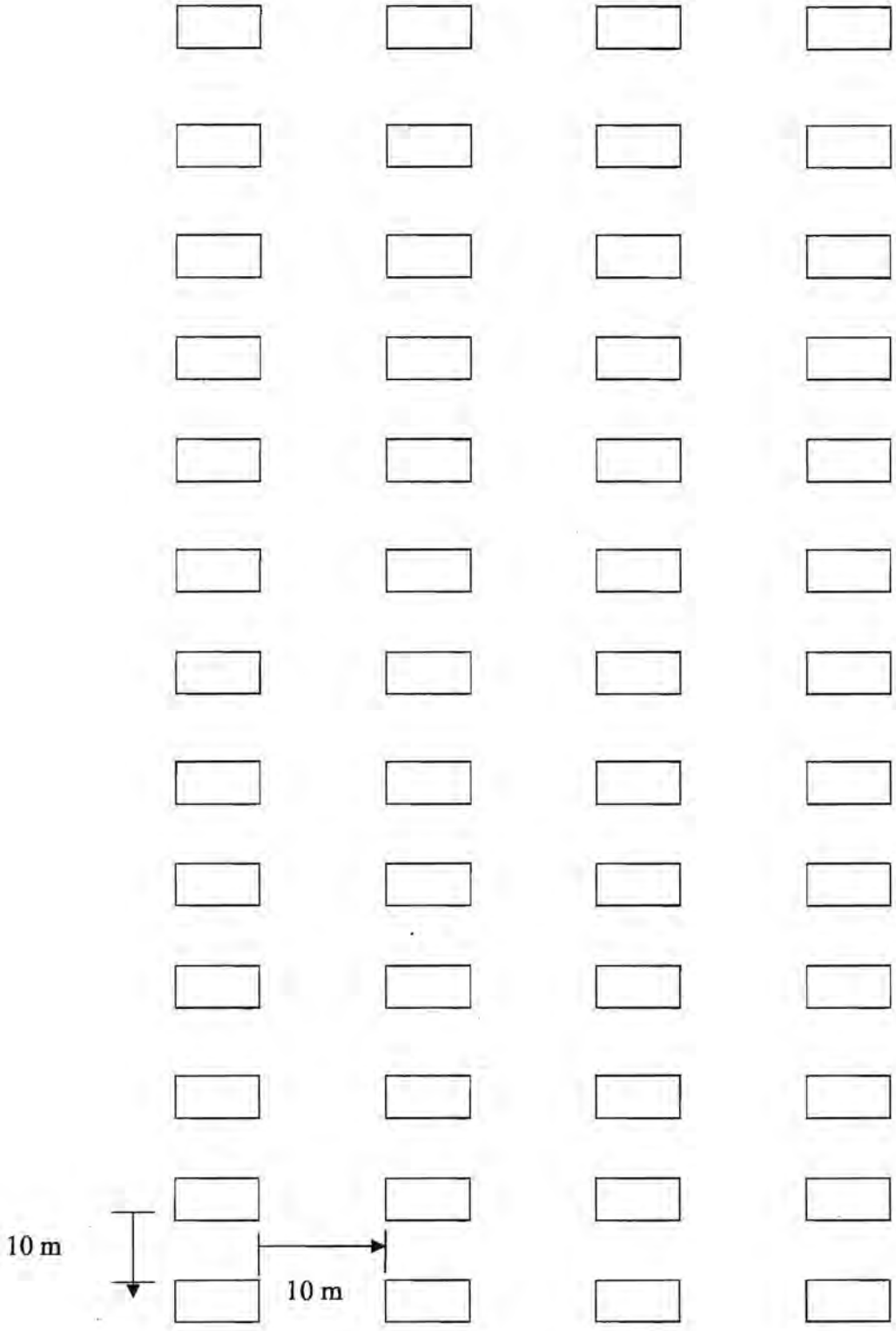

Figure 5. Trapping grid schematic using 4 transects spaced 10 m apart with 12 traps in each transect also 10 meters apart for a total trapping grid area of 0.33 ha. Each ▭ represents a Sherman live-trap, Area IV North, summer 2004.

Table 1. List of all wildlife and raptor species that have been documented to occur in Great Basin desert-scrub habitat, the dominant vegetation community found in the Area IV North study area, summer 2004 (Dick-Peddie 1993, Hoffmeister 1986, Findley et al. 1975). The wildlife species we documented in the study area from this list are indicated by an asterisk (*). Other wildlife species we observed in the study are also indicated below.

Scientific Name	Common Name
Notiosorex crawfordi	desert shrew
Myotis yumanensis	yuma myotis
Myotis californicus	California myotis
Myotis leibii	small-footed myotis
**Pipistrellus hesperus*	western pipistrelle
Eptisecus fuscus	big brown bat
Lasiurus cinereus	hoary bat
Plecotus townsendii	Townsend's big-eared bat
**Antrozous pallidus*	pallid bat
Tadarida brasiliensis	Brazilian free-tailed bat
**Lepus californicus*	black-tailed jackrabbit
**Sylvilagus audobonii*	desert cottontail
**Cynomys gunnisoni*	Gunnison's prairie dog
**Spermophilus spilosoma*	spotted ground squirrel
Spermophilus variegates	rock squirrel
**Ammopermophilus leucurus*	white-tailed antelope squirrel
Thomomys bottae	Botta's pocket gopher
Perognathus flavus	silky pocket mouse
Perognathus flavescens	plains pocket mouse
**Perognathus apache*	Apache pocket mouse
Dipodomys spectabilis	banner-tailed kangaroo rat
**Dipodomys ordii*	Ord's kangaroo rat
Dipodomys microps	chisel-toothed kangaroo rat
Reithrodontomys megalotis	western harvest mouse
Peromyscus eremicus	cactus mouse
**Peromyscus maniculatus*	deer mouse
Onychomys leucogaster	northern grasshopper mouse
Neotoma albigula	white-throated woodrat
Neotoma lepida	desert woodrat
Microtus mexicanus	Mexican vole
Erethizon dorsatum	porcupine
**Canis latrans*	coyote
**Vulpes macrotis*	kit fox
Mustela frenata	long-tailed weasel
**Taxidea taxus*	badger
Mustela nigripes	black-footed ferret
Spilogale putorius	western spotted skunk
Mephitis mephitis	striped skunk
Felis concolor	mountain lion
Felis rufus	bobcat
Circus cyaneus	Northern harrier
Buteo jamiacensis	Red-tailed hawk
Buteo regalis	Ferruginous hawk

**Aquila chrysaetos*	Golden eagle
Falco sparverius	American kestrel
Falco mexicanus	Prairie falcon
Tyto alba	Barn owl
Bubo virginianus	Great-horned owl
**Athene cunicularia*	Burrowing owl
**Corvus corax*	Raven

Other wildlife and raptors species observed in the study area:

**Haliaeetus leucocephalus*	Bald eagle
**Odocoileus hemionus*	mule deer

Table 2. Species with special conservation status according to Federal, State of New Mexico, and Navajo Nation with potential to occur in the study area and their habitat associations (Fitzgerald et al. 1994, Hoffmeister 1986, http://nmnhp.unm.edu/bisonm/bisonquery.php). Species we documented in the study area are indicated by an asterisk (*).

Species	Federal	State of NM	Navajo Nation	Habitat Association
Raptors				
*Bald eagle (*Haliaeetus leucocephalus*)	T	T		Forests, river bottoms, or canyon rims with available water source
Ferruginous hawk (*Buteo regalis*)			Group 3	Badlands, flat or rolling desert-grassland, desert-scrub in clay or rock pinnacles, buttes, or cliffs
*Golden eagle (*Aquila chrysaetos*)			Group 3	Steep cliffs adjacent to foraging habitat of desert- grassland or desert-scrub
Peregrine falcon (*Falco peregrinus*)			Group 4	Steep cliffs in scrapes or ledges with nearby forest or wetland habitat
Birds				
Mountain plover (*Charadrius montanus*)			Group 4	Flat to rolling grassland, semi-desert, or badland habitat with short, sparse vegetation, typically disturbed
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	E	E		Dense riparian cover, with surface water or moist soils, with or without canopy
Mammals				
Banner-tailed kangaroo rat (*Dipodomys spectabilis*)			Proposed Group 4	Desert or semi-desert grasslands with some barren ground
Black-footed ferret (*Mustela nigripes*)	E		Group 2	Prairie dog towns > 4 ha
Big free-tailed bat (*Nyctinomops macrotis*)		S	S	Mid-elevation grasslands and desert scrub. Requires tall cliffs for roosting and open water for drinking
Chisel-tooth kangaroo rat (*Dipodomys microps*)			Group 4	Open, sandy areas in desert scrub habitat with rock or gravel; sensitive to grazing
*Kit fox (*Vulpes macrotis*)			Group 4	Sandy areas in desert-scrub or desert-grassland habitat with sparse shrubs
Small-footed myotis (*Myotis ciliolabrum*)		S		Wide variety of habitat types
Spotted bat (*Euderma maculatum*)	S	T	Group 4	Mostly forested habitat with cliffs, also at lower elevations in semi-desert shrublands
Townsend's big-eared bat (*Plecotus townsendii pallescens*)		S	Group 4	Closely tied to presence of mine tunnels or caves
Pronghorn antelope (*Antilocapra americana*)			Group 3	Grassland or desert-scrub habitat with rolling hills or mesas with scattered trees and shrubs

Table 3. The total number of trap-nights and captures using two different trapping methods in five habitat types, Area IV N, Summer 2004. No. trap-nights is the number of traps x the number of nights they were set.

Trap No.	Trapping method	Habitat type	No. trap-nights	No. captures/recaptures
A1	web	Arroyo-shrub	296	1/0
A2	web	Arroyo-shrub	296	6/1
A3	web	Arroyo-shrub	296	0/0
A4	grid	Arroyo-shrub	96	3/0
A5	grid	Arroyo-shrub	96	0/0
SS1	web	Saline sand	296	0/0
SS2	web	Saline sand	296	0/0
TB1	web	Thin break	296	0/0
TB2	web	Thin break	296	0/0
AK1	web	Alkali wash	296	0/0
AK2	web	Alkali wash	296	0/0
D1	web	Dune	296	0/0
BD1	grid	Badland	96	0/0
BD2	grid	Badland	96	0/0
TOTAL			3,344	10/1

Table 4. Density estimates for two trapping webs and one trapping grid in arroyo-shrub habitat using minimum number alive (MNA) as a surrogate for abundance (*N*) due to the lack of capture success. No variance is associated with MNA.

Trap No.	Trapping method	Habitat type	Area (ha)	MNA	Density (mammals/ha)
A1	web	Arroyo-shrub	3.14	1	0.3
A2	web	Arroyo-shrub	3.14	6	1.9
A4	grid	Arroyo-shrub	0.33	3	9.1

Photo Gallery

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BHP-UTAH INTERNATIONAL INC.

NAVAJO MINE

FRUITLAND, NEW MEXICO

WILDLIFE SURVEY AREAS 1973-1987

DRAWN BY Walsh / Associates, Inc. | SCALE 1" = 2000' | EXHIBIT 10-1

APPROVED BY | DATE 07-21-87

DRAWING NO | LOCATION No.

REV. NO.	DATE	REVISIONS	DRAFT BY	ENGR.	CHIEF ENGR.	PROJECT MGR.
	10-87	WILDLIFE INFORMATION	GS			
A	12-87	Added 12' bdy & Burial Boundary and Cultural Areas by Walsh Associates, Inc. in this space	JB			
2	2-28-96	Midterm update, change exh 17-1 to exh 10-1	PJF			

APPROVALS

LEGEND

PERMIT AREA (this area is also part of the leasehold)

LEASEHOLD AREA

AREA DESIGNATION

DISTURBED AREA

WESTINGHOUSE SMALL MAMMAL TRAPPING UNDISTURBED AREA

WESTINGHOUSE SMALL MAMMAL TRAPPING REVEGETATED AREA

WESTINGHOUSE AVIAN SURVEY

WESTINGHOUSE REPTILE SAMPLING AREA

BATTELLE STUDY AREA

MARIAH BLACK-FOOTED FERRET SURVEY AREA

WOYEWODZIC RAPTOR SURVEY AREA

NAVAJO RESERVATION

INDIAN

South end of permit boundary

Gallup

Window Rock

Fort Defiance

Ganado

Chinle

Black Mesa

Kayenta

Tuba City

Page

Flagstaff

Winslow

Holbrook

Petrified Forest National Park

Painted Desert

Cameron

Grand Canyon

Navajo Lake

Shiprock

Farmington

Bloomfield

Aztec

Durango

Cortez

Monticello

Blanding

Bluff

Mexican Hat

Monument Valley

Kayenta

Tuba City

Page

Flagstaff

Winslow

Holbrook

Petrified Forest National Park

Painted Desert

Cameron

Grand Canyon

Navajo Lake

Shiprock

Farmington

Bloomfield

Aztec

Durango

Cortez

Monticello

Blanding

Bluff

Mexican Hat

Monument Valley

CONFIDENTIAL

BHP-UTAH INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

IMPORTANT WILDLIFE HABITATS

APPROVALS				
	DRAFT BY	ENGR.	SUPT.	PROJECT MGR.

REV. NO.	DATE	REVISIONS	
	10-87	WILDLIFE INFORMATION	CS
△	12-87	Current Area Of Navajo Reservation Boundary Use this Drawing for Public Distribution Only Do not Use for Legal Purposes	JD
	9-29-90	Use and Distribution Restrictions Do not Delete	CJC
		Midterm update, change oxh 17-2 to oxh 10-2	FJH

DRAWN BY Wayne Sessions/BHI, Inc. | SCALE 1" = 2000' | EXHIBIT 10-2

APPROVED BY | DATE 07-21-87 | LOCATION No.

DRAWING NO.

APPROVED
MAY 1988
U.S.D.I. B.I.A. NAVAJO AREA OFFICE

LEGEND

PERMIT AREA (this area is also part of the leasehold)

LEASEHOLD AREA

AREA DESIGNATION

DISTURBED AREA

WATER SOURCES, SPRING - 1987

ACTIVE PRAIRIE DOG COLONIES - 1987

RAPTOR NESTS -

SPECIES:
FERRUGINOUS HAWK
RED-TAILED HAWK
PRAIRIE FALCON
GOLDEN EAGLE
AMERICAN KESTREL
BURROWING OWLS

STATUS 1987:
ACTIVE
INACTIVE

INDIAN RESERVATION
NAVAJO

LEGEND

- P-6 — Pre-Mining Stock Watering Pond
- Stock Watering Pond
- Permit Boundary

Note: Pond surface area not to scale.

I, W. BENALLY, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING, EXHIBIT 10-3, IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

W. BENALLY NEW MEXICO 11952 REGISTERED PROFESSIONAL SURVEYOR

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	E.G.	E.G.	P.E.	RPLS	CHIEF ENG.
A	9-29-98	PJF	MID TERM SUBMITTAL TO OSM FOR REVIEW AND APPROVAL.	GW	MC			

EXHIBIT 10-3

BHP NAVAJO COAL COMPANY

NAVAJO MINE — SAFETY — PRIDE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

STOCK WATERING POND SITES ON AND NEAR THE PERMIT AREA

PREPARED BY GW/PJF	DRAWN BY PJF	SCALE 1" = 2000'
APPROVED BY	DATE SEPT. 21, 1998	MYLAR LOC.

G:\Departments\Gs\OSM_SUBM\PER_PROG\Ch_10-STOCK WATER PONDS\EXH 10-03.pro

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FRUITLAND QUADRANGLE
NEW MEXICO - SAN JUAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Seventh Standard Parallel Line

T 29 N
T 28 N
T 27 N
T 26 N
T 25 N

R 16 W
R 15 W

MORGAN LAKE

INDIAN RESERVATION
NAVAJO

3,060,000
2,050,000
2,040,000
2,030,000
2,020,000
2,010,000
2,000,000
1,990,000
1,980,000
1,970,000
280,000
290,000
300,000
310,000
320,000

SCALE 1:24 000
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

- GROUND SURVEY YEARS 2 AND 3 OF 3
- AERIAL SURVEY YEAR 1 OF 3
- LIFE OF MINE DISTURBANCE AREA (NEXT 16 YEARS)
- WALKING TRANSECTS AREAS

APPROVED
MAY 1999

EXHIBIT 10-4

BHP MINERALS INTERNATIONAL INC.
NAVAJO MINE
FRUITLAND, NEW MEXICO

NAVAJO MINE
PERMIT AND BUFFER ZONE
RAPTOR SURVEY AREA

REV. NO.	DATE	REVISIONS	BY	APPROVALS ENGR.	CHIEF ENGR.	
1	9-12-93	CHANGE EXHIBIT NO.	PJP			
2	9-21-93	Midterm update change exh 10-2 to exh 10-4	PJP			

DRAWN BY PFOSTER | SCALE 1" = 4000' | PREPARED BY S.J. ESTRADA
APPROVED BY [illegible] | DATE DEC. 28, 1992
DRAWING NO. 92-1230 | LOCATION NO. ME-C1