ENVIRONMENTAL ASSESSMENT
OF
OIL AND GAS LEASING AND DEVELOPMENT
ON
SOUTHERN UTE INDIAN RESERVATION

Prepared by:
Department of the Interior
Bureau of Indian Affairs
Albuquerque Area Office

September 28, 1990

DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
SOUTHERN UTE AGENCY
ARCHULETA, LA PLATA AND MONTEZUMA COUNTIES

Project Description: **Environmental Assessment of Oil and Gas Leasing and Development on Southern Ute Indian Reservation - La Plata, Archuleta, Montezuma Counties, Colorado**

All approvals of leases/permits/mineral agreements are based upon an Environmental Analysis of Oil and Gas Leasing for the Southern Ute Reservation, issued January 28, 1974. The proposed action is the continued leasing/permitting or issuance of mineral agreements on the Southern Ute Indian Reservation for the purpose of explor-ation, development and production of natural gas, coalbed methane gas, oil and/or other associated products. This activity is a reflection of the Southern Ute Indian Tribe's desire for full development of their mineral resources for the economic benefit of the Tribe's members. The proposed action includes all Southern Ute Indian trust lands (tribal and allotted) within the confines of the Reservation. Oil and gas development is in conformance with the Southern Ute Indian Tribe's "Natural Resources Management Plan, 1990-2010."

Finding of No Significant Impact

Based on the Environmental Assessment of Oil and Gas Leasing and Development on the Southern Ute Indian Reservation dated September 28, 1990, prepared by the Bureau of Indian Affairs (BIA), it has been determined that the proposed action will not have a significant impact on the quality of the human environment; therefore, an environmental impact statement is not required.

The justification in support of this action is that the referenced environmental assessment adequately addresses and describes:

1. The purpose and need for the proposed action (Attachment A).
2. The two alternatives to the proposed action:
    a. The "No Action" alternative (Alternative B), and
    b. The "Limited Development" alternative (Alterntive C).
3. The affected environment.
4. Cultural resources and threatened and endangered species.
5. Environmental consequences and mitigation measures.

6. Consultation and coordination.

Alternative B, the No Action Alternative, was discounted due to the fact that it would preclude the Tribe from developing its natural resources for the benefit of its members.

The selection of Alternative A (full development) over Alternative C (limited or restricted development) is based upon the conclusion that the cumulative impacts of these alternatives are basically the same. Under Alternative C, although parts of the reservation that would be restricted would be restricted due to archeological, cultural, historical, human or environmental concerns. It has been determined that the present federal regulations in place adequately protect the archeological, historical and cultural resources. The federal government, through its field agencies (BIA, Bureau of Land Management, United States Fish and Wildlife Service, Environmental Protection Agency, etc.) are responsible for the protection of the environment and other resources of the Tribe. With the implementa-tion of all mitigation measures as described within this Environ-mental Assessment and the enforcement of federal regulations and laws by those federal agencies responsible for such enforcement, the selection of Alternative A will allow the Tribe to develop their mineral resources while at the same time protecting the other resources that will be affected by this action.

The primary source of revenue for the Southern Ute Tribal Government is the oil and gas operations. Proper management of the Tribe's resources will assure prosperity and an environmentally sound reservation in the future. The Notice of Availability has been posted in three public places for 30 days.

This Finding of No Significant Impact (FONSI) Statement has been developed under the requirements of the National Environmental Policy Act of 1969, as amended, (42 U.S.C. 4371 et. seq.); Council of Environmental Quality Regulations (40 CFR Parts 1500-1508), Department of the Interior procedures (516 D.M. 1-6), and the Bureau of Indian Affairs Handbook (30 BIAM, Supp. 1).

John Montgomery, Realty Officer — NOV [illegible] 1990 — Date

James Formea, Natural Resource Mgr. — [illegible] — Date

Ralph R. Pensoneau, Superintendent — NOV [illegible] 1990 — Date

SUMMARY

The Southern Ute Indian Reservation (see Figure 1) lies in Southwest Colorado, in the southern part of LaPlata and Archuleta counties, with a small acreage in Montezuma County. The southern boundary coincides with the Colorado-New Mexico state line.

The reservation is a rectangle approximately 75 miles long East to West and 15 miles wide South to North.

The reservation boundary encompasses approximately 700,000 acres or approximately 1,080 square miles. About 308,000 acres are Tribal trust lands and 4,000 acres are allotted Indian lands for a total of 312,000 acres of trust lands. The remaining 388,000 acres are privately owned or administered by other government agencies. Of the 310,382 acres of private surface, there are 222,362 acres of land that are private oil and gas subsurface ownership. This is the result of homesteading from 1899 to 1938. Thus, the Southern Ute reservation is a patchwork of Indian and non-Indian land.

The area is accessible from the south and north by U.S. Highway 550; from the east and west by U.S. Highway 160; and from the southeast by U.S. Highway 84. Colorado Highways 172 and 151 traverse the reservation eastward from Durango, Colorado, to the vicinity of Chimney Rock, Colorado, where Highway 151 rejoins U.S. 160. Colorado Highway 140 crosses the western portion of the reservation in a north-south direction from Farmington, New Mexico, to Hesperus, Colorado, joining Highway 160 at Hesperus. A vast network of primary and secondary county-maintained gravel roads allow access from the main highways.

Natural gas was discovered on the Southern Ute Indian Reservation at Ignacio Dome in 1950. Gas and oil exploration, development and production has since proceeded in a standard industry fashion. Today approximately 1,650 gas wells and 50 oil wells produce within the exterior boundaries of the reservation. Most of the production is natural gas from the Ignacio Blanco gas field in the Colorado portion of the San Juan Basin. In its 37 year history, the Ignacio Blanco Field has produced over 815 billion cubic feet (BCF) of gas. Statistics predict that at the present decline rates, production from the Dakota Sandstone and Mesaverde Group reservoirs will continue for another 20 years. Recent success in the unconventional development and production of coal-bed methane gas from the vast coal reserves of the Fruitland Formation insure a long and prolific life for the Ignacio Blanco Field.

The center of the reservation lies in the Colorado portion of the San Juan Basin, a structural depression of sedimentary rocks roughly circular in shape, which covers northwestern New Mexico and southwestern Colorado. West of the San Juan Basin, but within the reservation, lies the Four Corners Platform, the boundary between the San Juan Basin to the east and the Paradox Basin to the west. The eastern third of the reservation extends onto the Archuleta Anticlinorium, a 10- to 25-mile wide system of folds and faults which defines the northeastern boundary of the San Juan Basin. All three of these geologic regions of the reservation contain rock units with untested hydrocarbon potential (see Appendix B -- Geologic Maps).

Southern Ute mineral ownership consists of approximately 166,000 acres of leased and producing oil and gas properties. Unleased and mostly untested, Tribal oil and gas properties slightly exceed 167,000 acres. Tribal coal ownership, a separate mineral estate from oil and gas, is 520,000 acres and contains over 16 billion short tons of high-volatile "A" bituminous and medium-volatile bituminous Fruitland Formation coal. This coal is not currently being produced from the Southern Ute Indian Reservation. Potential strippable reserves, primarily found along the western edge of the San Juan Basin where the Fruitland outcrops, exceeds 500 million short tons. Most of the coal is more than 500 feet beneath the surface.

As previously mentioned, conventional sandstone gas reservoirs have produced for over thirty-seven years within the Southern Ute Indian Reservation and gas production is expected to continue for twenty more years at the present rate of decline. In the next twenty years, the field is most likely to produce an additional 300 billion cubic feet of gas. Under existing leases, the Southern Ute Indian Tribe receives an aggregate beneficial interest of just over nine percent, which translates into Tribal conventional reserves of 27 billion cubic feet over twenty years.

Recently published estimates of the coal-bed methane potential of the San Juan Basin tremendously overshadow estimates of the conventional gas reserves. The fact that in the contiguous 48 states, the San Juan Basin is second in reserves only to the giant Hugoton gas field of Kansas, Oklahoma and Texas, underscores the significant magnitude of the new and unconventional resource.

Many of the geological conditions that are favorable for coal-bed methane generation and production are found within the Southern Ute Indian Reservation. Kelso and Wicks (1988) estimate that over 14.5 trillion cubic feet (TCF) of gas are contained within the deeply buried (greater than 500 feet) Fruitland coals on the reservation. Assuming a very conservative recovery factor of 25 percent, and the same Tribal aggregate beneficial interest of nine percent, Tribal coal-bed methane reserves are estimated at 326 billion cubic feet. Such large reserves are difficult to comprehend. The inclining gas production runs completely counter to conventional gas well in which production would start initially high and then decline over time. Coal-bed methane wells show improved production after the initial producing (dewatering) phase.

The conventional gas reservoirs, the Dakota, Mesaverde and the Pictured Cliffs horizons, have produced more than half their estimated total reserves. The unconventional Fruitland coal-bed methane development, as well as the recent discovery of reserves on the Morrison sandstone, a horizon which is deeper than generally targeted, and by oil discoveries in the southern part of the San Juan Basin, indicate that the San Juan Basin's mineral resources will provide an important economic resource base from which the Tribe can prosper.

Today, oil and gas exploration, development and production contribute to a substantial portion of the Tribe's economic and social environment. Future mineral development of oil, gas, coal and other undiscovered mineral resources will provide an important

economic base from which the Tribe can prosper. Proper planning and management of the Tribal resources today will assure prosperity in the future.

The purpose of this document is to determine the viability of the proposed action, it's acceptability, if there is an acceptable alternative and/or the mitigation necessary. The objective of this environmental assessment is to assess the economic impact on the Southern Ute Indian Tribe (Tribe) as opposed to the environmental, socioeconomic, archeological and other natural resource use impacts on the Southern Ute Indian Reservation and to determine whether an environmental impact statement should be written.

TABLE OF CONTENTS

I. PURPOSE OF AND NEED FOR ACTION

A. Project Description

All approval of leases/permits/mineral agreements is based upon an Environmental Analysis of Oil and Gas Leasing for the Southern Ute Reservation, issued January 28, 1974. The proposed action is the continued leasing/permitting or issuing mineral agreements on the Southern Ute Indian Reservation (Figure 1) for the purpose of exploration, development and production of natural gas, coalbed methane gas, oil and/or other associated products. This activity is a reflection of the Southern Ute Indian Tribe's desire for full development of their mineral resources for the economic benefit of the Tribes members. The proposed action includes all Southern Ute Indian lands (Tribal and allotted) within the confines of the reservation. Oil and gas development is in conformance with the Southern Ute Indian Tribes Natural Resources Management Plan, 1990-2010.

B. Decision Needed

The purpose of this document is to determine the viability of the proposed action, its acceptability, if there is an acceptable alternative and/or the mitigation necessary. The objective of this environmental assessment is to assess the economic impact on the Southern Ute Indian Tribe as opposed to the environmental, socioeconomic, archeological, and other resources impact on the Southern Ute Indian Reservation and to determine whether an environmental impact statement should be written.

C. Scoping Summary

1. Objectives

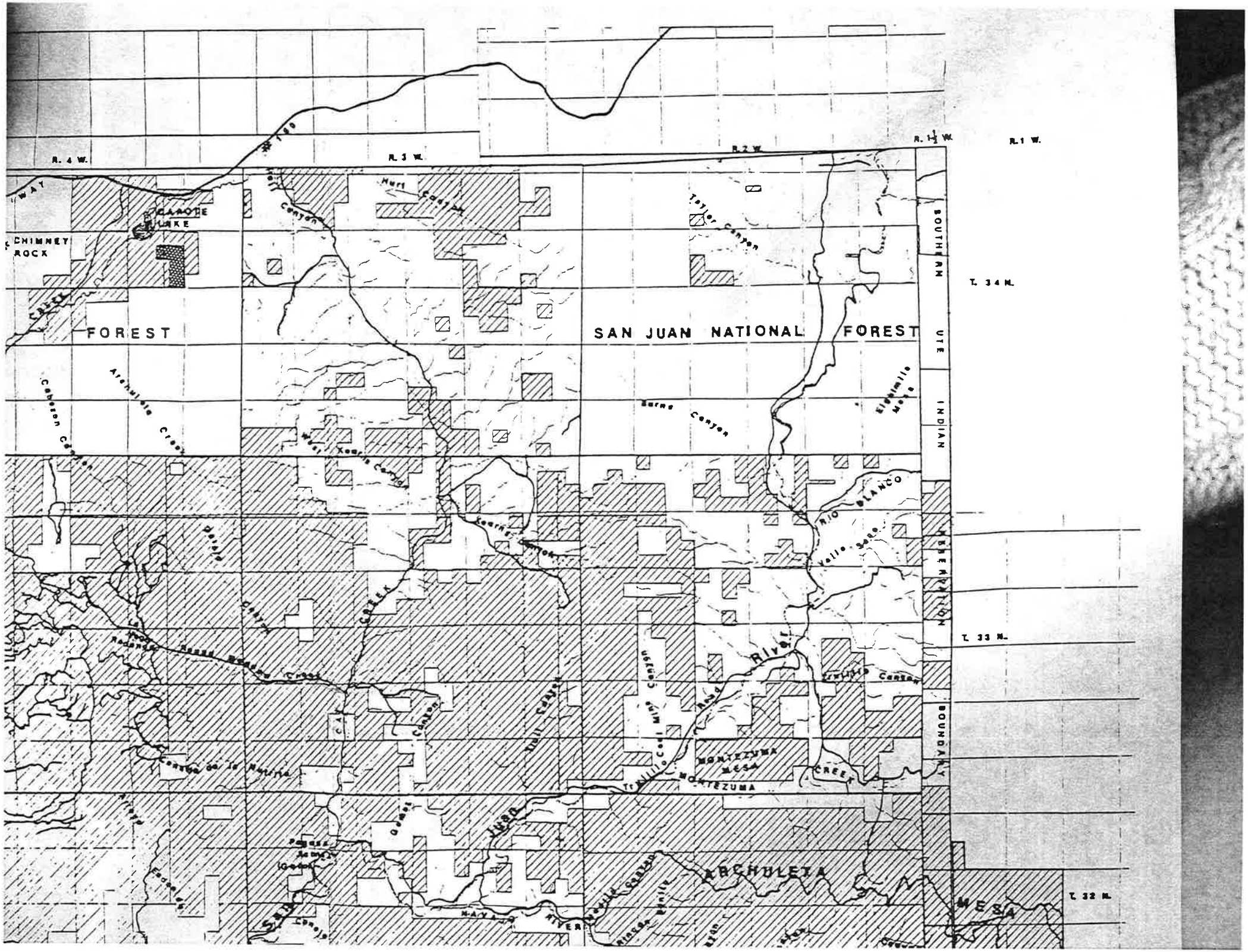
The approval of this document will give the Southern Ute Indian Tribe and the Bureau of Indian Affairs (BIA) the ability to evaluate leasing, permitting or issuing of mineral agreements within the exterior boundaries of the reservation.

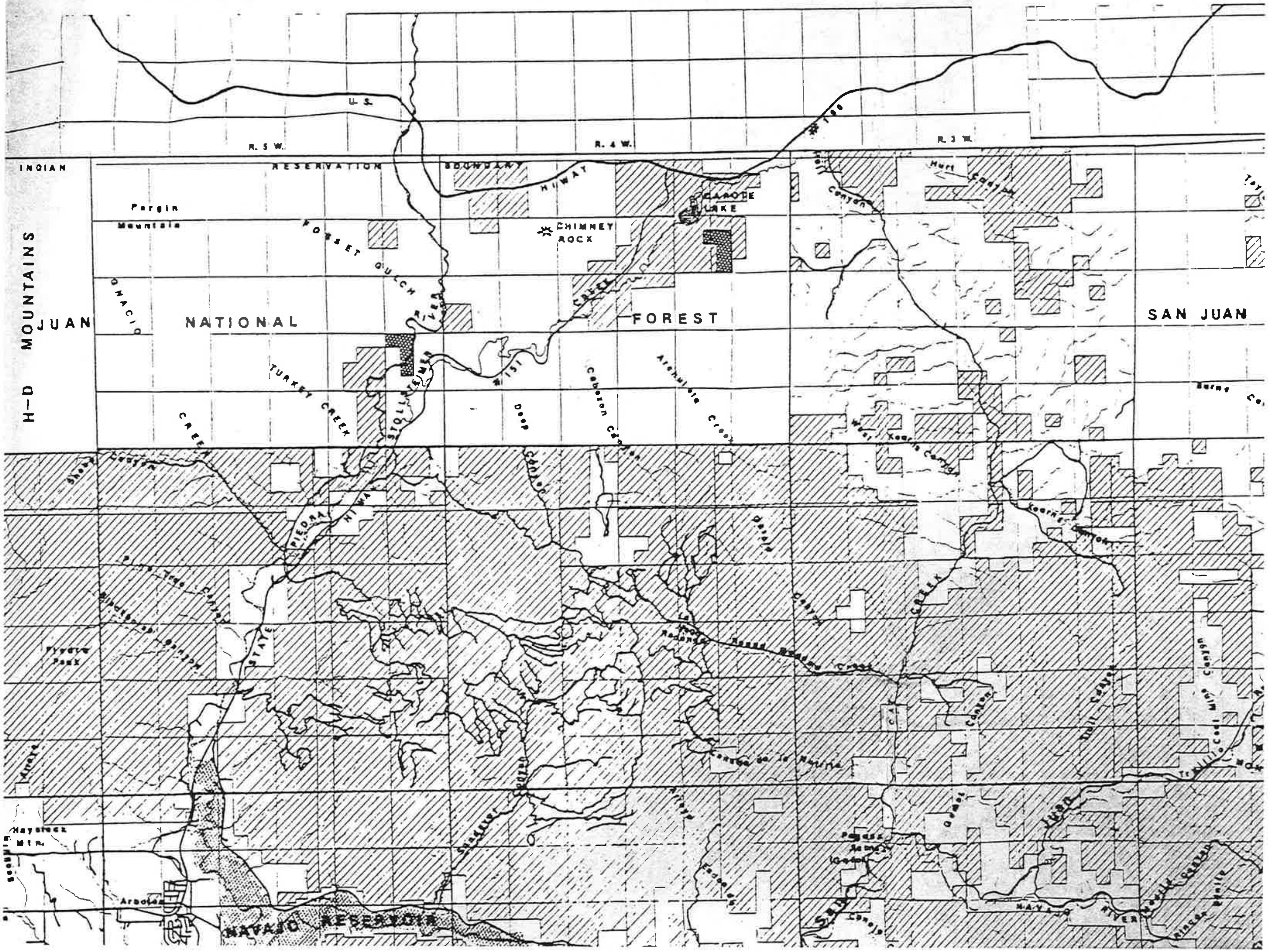
2. Opportunities

Today oil and gas exploration, development and production contributes 94 percent of the Tribes revenue, making it the substantial portion of the Tribe's economic and social environment. Future mineral development of oil, gas, coal and other undiscovered mineral resources will provide an important economic base from which the Tribe can prosper. Proper planning and management of the Tribal resources today will assure prosperity in the future.

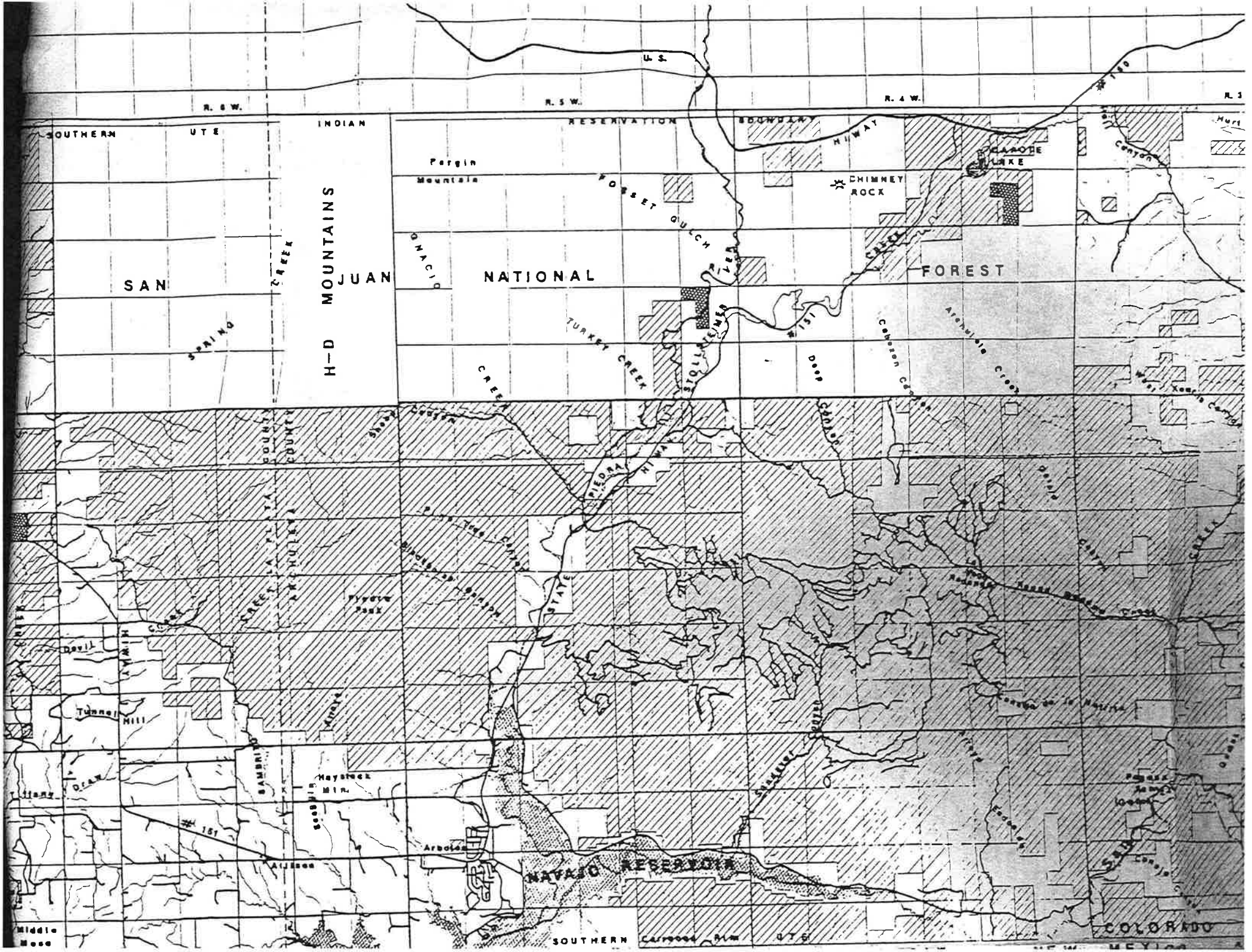
3. Issues and Concerns

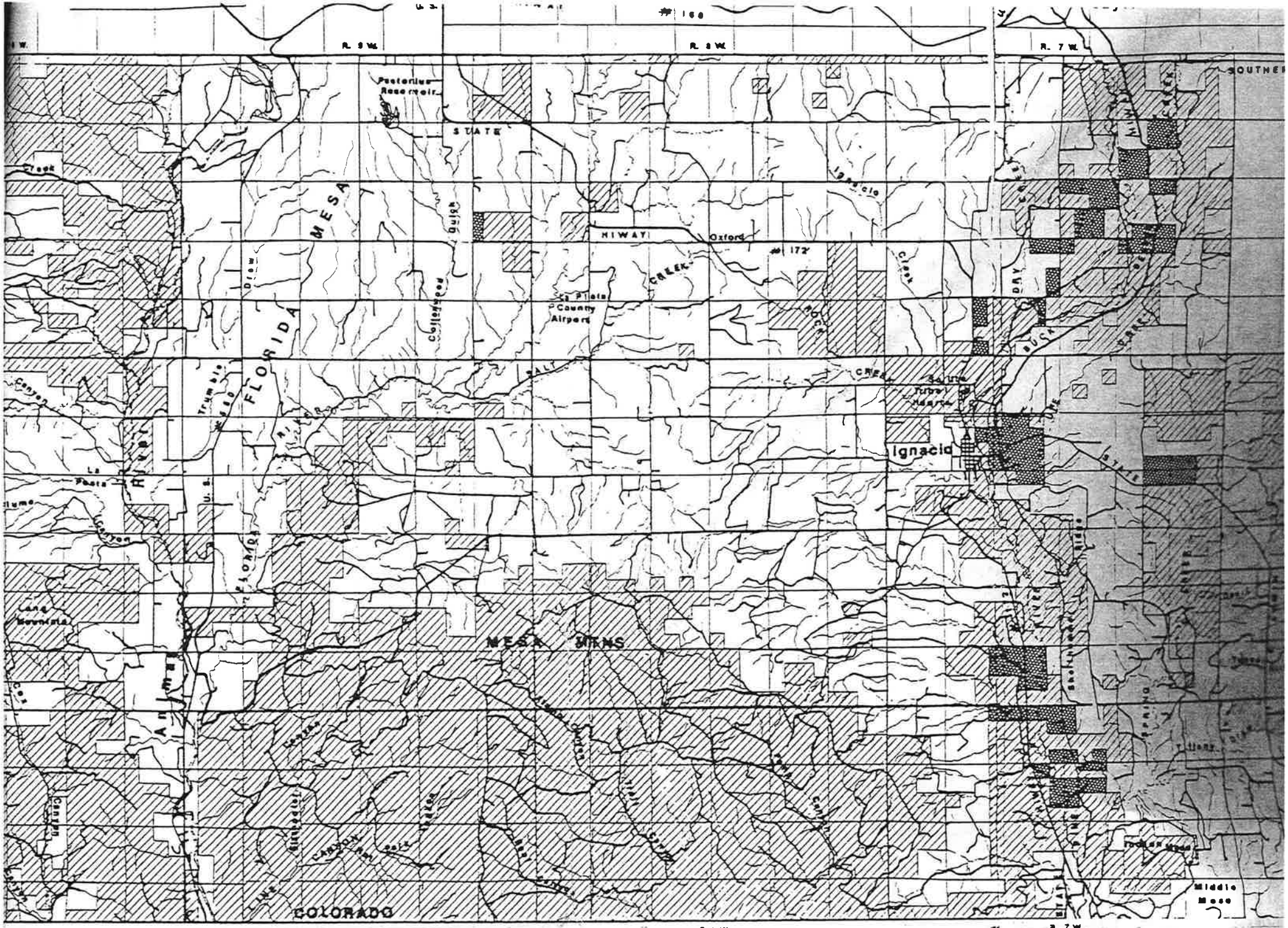
The main issues and concerns are the other resources that will be effected by the proposed action e.g., other minerals, human, air quality, hydrology, soils, vegetation, land use, wildlife, riparian environments, visual resources, and cultural resources.

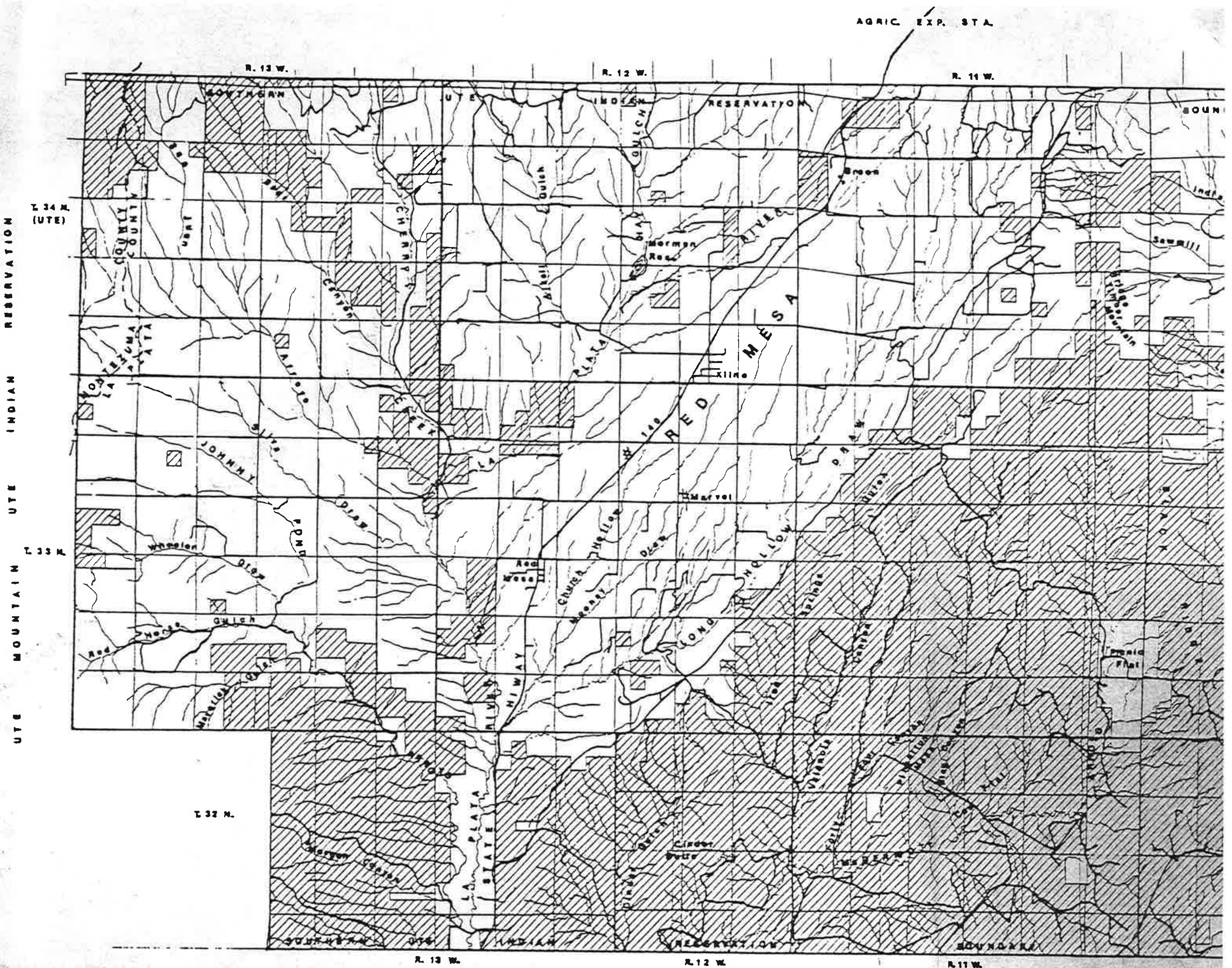

R. 4 W.
R. 3 W.
R. 2 W.
R. 1½ W.
R. 1 W.
T. 34 N.
T. 33 N.
T. 32 N.
SAN JUAN NATIONAL FOREST
FOREST
CHIMNEY ROCK
CAROTE LAKE
SOUTHERN UTE INDIAN RESERVATION BOUNDARY
RIO BLANCO
MONTEZUMA MESA
MONTEZUMA
ARCHULETA
MESA
River
CREEK
Canyon



U.S.
160
R. 5 W.
R. 4 W.
R. 3 W.
INDIAN
RESERVATION
BOUNDARY
HIWAY
CHIMNEY ROCK
Pargin
Mountain
FOSSET GULCH
H-D MOUNTAINS
JUAN
NATIONAL
FOREST
SAN JUAN
RIVER
STOLLSTEIMER
151
TURKEY CREEK
CREEK
Deep Canyon
Cabezon Canyon
Archuleta Creek
West Kearns Canyon
Kearns Canyon
Hurt Canyon
Hell Canyon
PIEDRA
HIWAY
STATE
Pine Tree Canyon
Pyeatte Park
Haystack Mtn.
Arboles
NAVAJO RESERVOIR
Round Meadow Creek
CREEK
Cañada de la Mutria
Ojo de Canyon
Trujillo Coal Mine Canyon
NAVAJO RIVER
Rincon Bonito
Cañada
Sandoval Canyon


R. 6 W.
R. 5 W.
R. 4 W.
R. 3
SOUTHERN UTE INDIAN RESERVATION
BOUNDARY
U. S. HIWAY
160
SAN JUAN MOUNTAINS
NATIONAL FOREST
Fergin Mountain
CHIMNEY ROCK
CLARKE LAKE
FOREST QUCH
ONACIO CREEK
SPRING CREEK
TURKEY CREEK
STOLLSTEIMER CREEK
DEEP CREEK
CABRESTO CREEK
ARCHULETA CREEK
151
PIEDRA HIWAY
STATE
LA PLATA COUNTY
ARCHULETA COUNTY
Tunnel Hill
Haystack Mtn.
Arboles
NAVAJO RESERVOIR
SOUTHERN UTE
COLORADO
NEW MEXICO


R. 9 W.
R. 8 W.
R. 7 W.
Pastorius Reservoir
STATE
Ignacio
HIWAY
Oxford
CREEK
La Plata County Airport
FLORIDA MESA
MESA VERDE
NEW MEXICO
COLORADO
San Juan County
Middle Mesa



AGRIC. EXP. STA.
R. 13 W.
R. 12 W.
R. 11 W.
SOUTHERN
UTE
INDIAN
RESERVATION
T. 34 N.
(UTE)
T. 33 N.
T. 32 N.
UTE MOUNTAIN UTE INDIAN RESERVATION
MONTEZUMA COUNTY
LA PLATA COUNTY
CHERRY CREEK
LA PLATA RIVER
RED MESA
DRAW
Kline
Marvel
Red Mesa
Mormon Res.
Sawmill
Bridge Timber Mountain
Johnny
Wheeler Draw
Red Horse Gulch
Canyon
Long Hollow
Church Hollow
Mahoney Draw
Pinkerton
Cinder Butte
Morgan Canyon
LA PLATA STATE
HIWAY
Prairie Flat
SOUTHERN UTE INDIAN RESERVATION BOUNDARY

D. Federal Permits, Agreements, Licenses, etc.

This document, when approved, will be the Environmental Compliance documentation that the Bureau of Indian Affairs (BIA) and the Southern Ute Tribe will use for assessing and approving all future leases/permits/mineral agreements.

Oil and gas operations are dependent upon valid existing Indian oil and gas leases/permits/minerals agreements approved by the BIA under the authority of the Indian Minerals Leasing Act of May 11, 1938, 52 Stat. 348, 25 U.S.C. 396a-396q (tribal), the Act of March 3, 1909, Chapter 263, 35 Stat. 783, 25 U.S.C. 396, and the 1982 Indian Mineral Development Act (IMDA), 25 U.S.C. 2102.

Lease administration is the responsibility of the BIA. Operational administration of these leases/permits/mineral agreements, once approved, is the responsibility of the Bureau of Land Management (BLM) under the authority of Federal Oil and Gas Royalty Management Act of 1982 (43 CFR 3160 series). The Minerals Management Service is responsible for royalty accounting and collection of production reports (3160's).

E. Overview of Environmental Assessment

The Southern Ute Indian Reservation has a wide array of natural resources - water, wildlife, farmlands, rangelands, forests and woodlands, gas and oil, gravel, coal and other minerals. Other values, such as archaeological, cultural and human, may be adversely affected by natural resource uses, if they are not considered prior to development.

This EA is a guide and direction setting document. It is not a detailed "blueprint" that prescribes the exact action to be taken in a given spot at a certain time. All site specific oil and gas exploration, development and production (wells, seismic lines, compressor station, pipelines, etc.) will require site specific environmental documentation. The purpose of this document is to determine what areas of the reservation are open for such development and to determine what, if any, mitigating factors need to be addressed.

II. ALTERNATIVES INCLUDING PROPOSED ACTION

Alternative A (Proposed Action)

The proposed alternative is to continue to issue oil and gas exploration, development and or production leases/permits/mineral agreements on the Southern Ute Indian Reservation.

Alternative B (No Action)

The leasing/permitting/issuing mineral agreements would not be approved. This action would preclude the Tribe from developing their mineral resources for their own use as well as for economic gain or development.

Alternative C (Limited or Restricted Development)

The proposed alternative is to issue oil and gas exploration, development and or production leases/permits/mineral agreements on the Southern Ute Indian Reservation. However, certain areas of the reservation will be restricted from oil and gas development.

Evaluation and Comparison of Alternatives

	A	B	C
Minerals	++	--	++
Soils	-	00	-
Water Resources	0-	00	0-
Wildlife	0-	00	0-
Vegetation	-	00	0-
Forestry	0-	00	0-
Air Quality	-0	00	-0
Resource Use Patterns	0-	0	0-
Threatened and/or Endangered Species	0-	0	0-
Socioeconomic	++	--	++
Archeological	--	00	--
Resource Related Pests	--	00	--
Other Values	0-	0	0-

0	--	No Impact
00	--	No Additional Impact
+	--	Short Term Positive Impact
-	--	Short Term Negative Impact
++	--	Long Term Positive Impact
--	--	Long Term Negative Impact
0-	--	Minimal Long term Additional Impact
-0	--	Minimal Short Term Additional Impact

Identification of Preferred Alternative

The preferred alternative is Alternative A. The preferred alternative is to continue to issue oil and gas exploration, development and production leases/permits/mineral agreements on the Southern Ute Indian Reservation.

This selection is in accordance with the Southern Ute Tribe's desire for full development of their mineral resources for the economic benefit of the Tribe's members. This EA has evaluated the economic impact on the Tribe as opposed to the environmental, socioeconomic, archeological and other resources impact on the reservation. The majority of the cumulative impacts that have occurred on the reservation since the 1950's have been related to the development of the Tribe's and intermixed fee land energy resources. It has been determined that the additional cumulative impact of additional oil and gas development over the next 20 years will represent a very small contribution to the already present impact on the reservation. The additional land disturbed (1,000 acres) over the next 20 years, from an additional 400-500 new wells and accompanied facilities, will amount to approximately 0.3 percent of the Tribal lands within the exterior boundaries of the reservation. This does not take into account those disturbed areas that will be reclaimed over the next 20 year period.

In addition, it has been determined that the present federal regulations in place adequately protect the archeological, historical and cultural resources. The Federal Government through its field agencies (BIA, BLM, USFW, EPA, etc.) is responsible for the protection of the environment and other resources of the Tribe.

With the implementation of all mitigation measures as described within this EA and the enforcement of federal regulations and laws by those federal agencies responsible for such enforcement, the selection of Alternative A will allow the Tribe to develop their mineral resources while at the same time protecting the other resources that will be affected by this action.

Proper management of the Tribe's resources will assure prosperity and an environmentally sound reservation in the future.

III. AFFECTED ENVIRONMENT

The reservation has been divided into five major climatic zones. These zones have different climatic environments which are reflected in the different vegetative associations they produce. The affected resources will be evaluated by the following zones:

Zone	Elevation	General Vegetative Formations
1	<6000'	Semi-Desert grasslands
2	6000-6200'	Sagebrush savanna
3	6000-7200'	Pinyon-Juniper woodland
4	6100-8400'	Pinyon-Juniper/Mtn. browse
5	6500-8800'	Ponderosa Pine
6	6600-9000'	Fir-Spruce-Aspen

The Southern Ute Tribe has separated the reservation into 10 management areas which have

some common land use and management requirements (see Figure 2). By separating the reservation into areas with similarities of use, topography, and land ownership, more effective management strategies can be developed. Also, the Tribe can set differing priorities for management between the units.

The 10 management areas* are:

Unit #	Unit Name	% Tribal	% Allotted
1	Animas-LaPlata	15.3	0.2
2	Morgan	65.3	---
3	Picnic Flats	59.9	---
4	Florida Mesa	7.2	<.1
5	Mesa Mountain	75.3	---
6	Pine River	33.3	5.5
7	Sambritos	42.0	---
8	Piedra	19.2	0.8
9	Vega-Sandoval	82.0	---
10	San Juan	48.5	---

* see appendix G for description of management areas

Two units (No. 1 and 4) are dominated by private lands with Tribal holdings consisting of mostly isolated tracts. Unit 4 has existing irrigation projects works which can serve Tribal lands now. Unit 1 needs the completion of the Animas-LaPlata Project before new irrigated Tribal lands can be developed; likely a decade or more in the future.

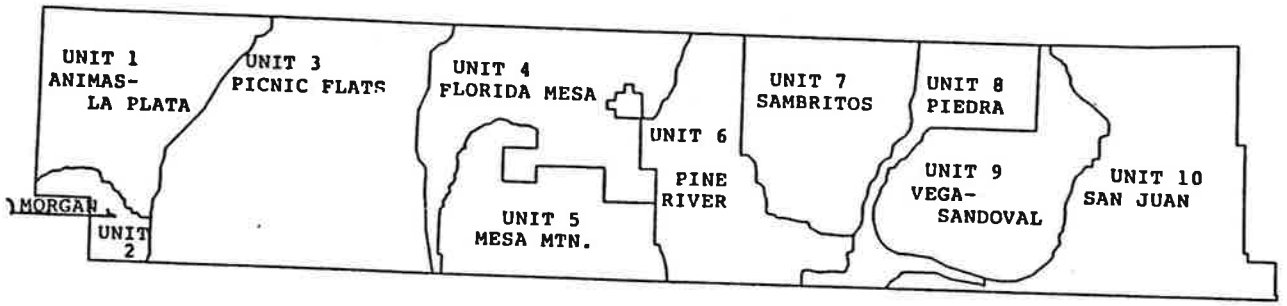
Management units 3 and 5 are both predominately rangeland but unit 5, Mesa Mountain, is summer range and has had extensive vegetation treatments and now needs grazing management developments such as crossfencing, water devices and grazing systems. Unit 3, Picnic Flats, used as winter range, has substantial areas which can be treated to improve vegetation and needs extensive water development; then it would need crossfencing and installation of grazing systems.

For a detailed description of the management units please refer to the Southern Ute Indian Tribes Natural Resource Management Plan, Planning Period 1990-2010.

A. Minerals

Natural gas was discovered on the Southern Ute Indian Reservation at Ignacio Dome in 1950. Gas and Oil exploration, development and production has since proceeded in a standard industry fashion. Today approximately 1,650 (900 Tribal) gas wells and 50 (2 Tribal) oil wells produce within the exterior boundaries of the reservation. Most of the production is natural gas from the Ignacio Blanco gas field in the Colorado portion of the San Juan Basin. In its 37 year history, the Ignacio Blanco Field has produced over 815 billion cubic feet (BCF) of gas. Statistics predict that the present decline rates in production from the Dakota Sandstone and Mesaverde Group reservoirs will continue for

SOUTHERN UTE INDIAN RESERVATION



GENERAL MAP OF ALL MANAGEMENT PLANNING UNITS

SOUTHERN UTE ANA / NRMP PROJECT

N

Figure 2

another 20 years. Recent success in the unconventional development and production of coal-bed methane gas from the vast coal reserves of the Fruitland Formation insure a long and prolific life for the Ignacio Blanco Field.

The center of the reservation lies within the Colorado portion of the San Juan Basin, a structural depression of sedimentary rocks roughly circular in shape, which covers northwestern New Mexico and southwestern Colorado. West of the San Juan Basin, but within the reservation, lies the Four Corners Platform, the boundary between the San Juan Basin to the east and the Paradox Basin to the west. The eastern third of the reservation extends onto the Archuleta Anticlinorium, a 10- to 25-mile wide system of folds and faults which defines the northeastern boundary of the San Juan Basin. All three of these geologic regions of the reservation contain rock units with untested hydrocarbon potential.

The Southern Ute Reservation boundaries enclose about 700,000 acres. However, within these boundaries 310,382 acres is private surface and 222,362 acres are oil and gas subsurface ownership as a result of homesteading from 1899 to 1938. Thus, the Southern Ute Reservation, with about 45 percent of the land in trust, is a patchwork of Indian and non-Indian land.

Southern Ute mineral ownership consists of approximately 166,000 acres of leased and producing oil and gas properties. Unleased and mostly untested Tribal oil and gas properties slightly exceed 167,000 acres. Tribal coal ownership, a separate mineral estate from oil and gas, is 520,000 acres and contain over 16 billion short tons of high-volatile "A" bituminous and medium-volatile bituminous Fruitland Formation coal. This coal is not currently being produced from the Southern Ute Indian Reservation. Potential strippable reserves, primarily found along the western edge of the San Juan Basin where the Fruitland outcrops, exceeds 500 million short tons. Most of the coal is more than 500 feet beneath the surface.

As previously mentioned, conventional sandstone gas reservoirs have produced for over 37 years within the Southern Ute Reservation and gas production is expected to continue for 20 more years at the present rate of decline. In the next 20 years the field is most likely to produce an additional 300 billion cubic feet of gas. Under existing leases the Southern Ute Tribe receives an aggregate beneficial interest of just over nine percent, which translates into Tribal conventional reserves of 27 billion cubic feet over 20 years.

Recently published estimates of the coal-bed methane potential of the San Juan Basin tremendously overshadow estimates of the conventional gas reserves. The fact that in the contiguous 48 states, the San Juan Basin is second in reserves only to the giant Hugoton gas field of Kansas, Oklahoma and Texas, underscores the significant magnitude of the new and unconventional resource.

Many of the geological conditions that are favorable for coal-bed methane generation and production are found within the Southern Ute Indian Reservation. Kelso and Wicks (1988) estimate that over 14.5 trillion cubic feet (TCF) of gas are contained within the deeply buried (greater than 500 feet) Fruitland coals on the reservation. Assuming a very conservative recovery factor of 25 percent, and the same Tribal aggregate beneficial

interest of nine percent, Tribal coal-bed methane reserves are estimated at 326 billion cubic feet. Such huge reserves are difficult to comprehend. The inclining gas production runs completely counter to conventional gas well in which production would start initially high and then decline over time. Coal-bed methane wells show improved production after the initial producing (dewatering) phase.

In 1953, Phillips Petroleum Company drilled and completed the 6-17 well in Section 17, T 31 N, R 7 W, San Juan County, New Mexico. The well was completed within the Fruitland coals but it was only recently recognized as a coal-bed methane well. In its 36-year history, production rates have either increased or remained constant. In addition, the original shut-in pressure, after 34 years of production has declined less than three percent. Such data supports giant methane reserves from the Fruitland coals on the Southern Ute Indian Reservation.

Basic differences between coal-bed methane development and conventional development are the comparatively larger size well pads needed for drilling and production, the production of large amounts of water, the need for well pad compressors and frequent human visits to maintain and monitor the wells.

The conventional gas reservoirs, the Dakota, Mesaverde and the Pictured Cliffs horizons, have produced more than half their estimated total reserves. The unconventional Fruitland coal-bed methane development as well as the recent discovery of reserves on the Morrison sandstone, a horizon which is deeper than generally targeted, and by oil discoveries in the southern part of the San Juan Basin, indicate that the San Juan Basin's mineral resources will provide an important economic resource base from which the Tribe can prosper.

Within the Southern Ute Indian Reservation, as defined within each management unit, oil and gas development is as follows:

Unit 1 -- There is little actual production in this unit.

Unit 2 -- There is little actual production in this unit.

Unit 3 -- The lower portion of this unit has had extensive oil and gas development and there is a vast array of roads in this area. The northeast portion of this unit is in the process of gas development.

Unit 4 -- Most of the lands have been impacted by gas development, with wells or pipelines.

Unit 5 -- There is intensive gas development in the area with a large network of roads, pipelines and wellpads.

Unit 6 -- There is intensive gas development in this unit with most Tribal lands under lease to oil and gas companies.

Unit 7 -- There is limited gas development on the lower footslopes in the southern and western portions of the Tribal lands. There is considerable coal-gas development on the Forest Service lands adjoining the Tribal lands on the north; and fairly extensive gas developments on the private lands along the western part of the unit.

Unit 8 -- Virtually all of the private lands along the Piedra River have been leased for oil and gas. Tribal lands within this unit have not been leased. If the private leases are developed, it could lead to drainage of adjacent Tribal properties.

Unit 9 -- There is no production in this unit.

Unit 10 -- There is no production in this unit.

B. Soils

The following general soil map units as mapped by the Soil Conservation Service are found inside the reservation boundaries. Additional information can be obtained from the LaPlata County Soil Survey. The general soil map units found within Archuleta and Montezuma Counties are similar to those found within LaPlata County (verbal communication with Soil Conservation Service).

1. Warm soils on mesas, foothills and breaks in upland valleys.

This group consists of seven map units. It makes up about 62 percent of the survey area.

A. Witt-Lazear-Pulpit

Shallow to deep, well drained, gently sloping to steep, medium textured soils; on mesas, uplands, and breaks.

This map unit is in the west-central and southwestern parts of LaPlata County and Montezuma County, in the vicinity of Red Mesa and Kline, Colorado. It is in gently sloping to sloping areas on uplands and mesas and in sloping to steep areas on breaks and edges of mesas. Slope is 1 to 65 percent. The native vegetation is pinyon, juniper, sagebrush, and grasses. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 45 to 50 degrees Fahrenheit. The frost-free season is 110 to 130 days.

Witt soils are on mesas and uplands. These soils are deep and well drained. They formed in silty calcareous loess derived dominantly from red-bed sandstone. The surface layer is loam, the subsoil is silty clay loam, and the substratum is loam.

Lazear soils are on breaks, mesa tops, and edges of mesas. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone. The surface layer is stony loam, and the underlying material is loam. Sandstone is at a depth of 10 to 20 inches.

Pulpit soils are on mesas. These soils are moderately deep and well drained. They formed in loess derived dominantly from red-bed sandstone. The surface layer is loam, the subsoil is silty clay loam, and the substratum is loam. Sandstone is at a depth of 20 to 40 inches.

Of minor extent in this unit are deep, moderately well drained Umbarg soils on alluvial fans and upland valley bottoms; deep well drained Vosburg soils in upland swales and on foot slopes; Simpatico soils in upland swales; and Vernal soils on terraces. Also included are Rock outcrop, Ustic Torriorthents, and Ustollic Haplargids on breaks, mesa edges, and hillsides.

This unit is used for nonirrigated crops, irrigated crops, livestock grazing, and wildlife habitat.

B. Arboles-Bayfield-Zyme

Shallow and deep, well drained, nearly level to moderately steep, moderately fine textured soils; on foothills, and in upland valleys.

This map unit is in the eastern and southeastern parts of LaPlata County, in the vicinity of Ignacio and Tiffany. It is in gently sloping to sloping areas in upland valleys and on valley sides and in sloping to moderately steep areas on hills and ridges. Slope is 1 to 25 percent. The native vegetation is pinyon, juniper, shrubs, and grasses. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 13 to 18 inches, and the average annual air temperature is 46 to 50 degrees Fahrenheit. The frost-free season is 110 to 130 days.

Arboles soils are in upland valleys and on valley sides. These soils are deep and well drained. They formed in alluvium derived dominantly from shale. The surface layer and subsoil are clay, and the substratum is clay loam.

Bayfield and similar soils are in broad upland valleys. These soils are deep and well drained. They formed in alluvium derived dominantly from shale. The surface layer is silty clay loam. The similar soils are in the Sili series.

Zyme soils are on hills and ridges. These soils are shallow and well drained. They formed in residuum derived from shale. The surface layer and underlying material is clay loam. Shale is at a depth of 6 to 20 inches.

Of minor extent in this unit are the moderately deep, well drained Bodot soils on shale hills.

This unit is used for irrigated field crops, irrigated pasture, and rangeland.

C. Falfa-Ustic Torriorthents

Deep, well drained and somewhat excessively drained, gently sloping to steep, moderately

fine textured and moderately coarse textured soils; on mesas and breaks.

This map unit is in the central part of the LaPlata County area and includes Florida Mesa. It is in gently sloping to sloping areas on mesas and moderately steep to steep areas on mesa edges. Slope is 1 to 65 percent. The native vegetation is pinyon, juniper, shrubs, and grasses. Elevation is 6,500 to 7,000 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 45 to 50 degrees Fahrenheit. The frost-free season is 100 to 130 days.

Falfa soils are on mesas. These soils are deep and well drained. They formed in loess derived dominantly from red-bed sandstone. The surface layer is clay, and the substratum is clay loam.

Ustic Torriorthents are on mesa edges and breaks. They are deep and are well drained and somewhat excessively drained. They formed in gravelly and cobbly alluvium. The surface layer is gravelly loam, cobbly loam, or fine sandy loam. The underlying material is mixed alluvium that is very gravelly or cobbly.

Of minor extent in this unit are deep, well drained Simpatico soils in swales on mesa tops and Ustollic Haplargids on mesa edges and hillsides.

This unit is used for irrigated crops, nonirrigated crops, rangeland, and wildlife habitat.

D. Dulce-Travessilla-Rock outcrop

Shallow, well drained, sloping to steep, moderately coarse textured soils, and Rock outcrop; on foothills and ridges.

This unit is in the southern part of the reservation area, bordering the state line. It is in sloping to steep areas on foothills and ridges and is characterized by escarpments of Rock outcrop and many canyons. Slope is 6 to 50 percent. Native vegetation is pinyon, juniper, shrubs, and grasses. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 13 to 16 inches, and the average air temperature is 45 to 50 degrees Fahrenheit. The frost-free season is 115 to 140 days.

Dulce and similar soils are on foothills and ridges. These soils are shallow and well drained. They formed in residuum derived from sandstone. The surface layer and underlying material are sandy loam. Soft sandstone is at a depth of 10 to 20 inches. The similar soils are in the Zyme series.

Travessilla and similar soils are on foothills and ridges. These soils are shallow and well drained. They formed in residuum derived from sandstone. The surface layer and underlying material are sandy loam. Hard sandstone is at a depth of 6 to 20 inches.

Rock outcrop is on cliffs, ridges, breaks, and ledges. It consists of exposures of sandstone. The similar soils are in the Lazear series.

Of minor extent in this unit are deep, well drained Buckle, Yenio and Florita soils in upland valleys and deep, well drained Mikim soils on alluvial fans and in foothill valleys.

This unit is used mainly as rangeland and wildlife habitat. Low precipitation and shallow soils depth limit the kind and amount of forage plants produced.

E. Zyme-Rock outcrop-Ustic Torriorthents

Shallow and deep, well drained and somewhat excessively drained, gently sloping to steep, moderately fine textured and moderately coarse textured soils, and Rock outcrop; on foothills, ridges, terrace escarpments, and breaks.

This map unit is in the central and southern part of the LaPlata County and includes parts of Mesa Mountain, Basin Mountain, and Black Ridge. It is in gently sloping to steep areas on hills and ridges and in moderately steep to steep areas on terrace edges. Slope is 3 to 65 percent. The native vegetation is pinyon, juniper, shrubs, and grasses. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 14 to 17 inches, and the average annual air temperature is 45 to 50 degrees Fahrenheit. The frost-free season is 110 to 130 days.

This unit makes up about 15 percent of the survey area. It is about 50 percent Zyme and similar soils, 20 percent Rock outcrop, and 15 percent Ustic Torriorthents soils. The remaining 15 percent is components of minor extent. The similar soils are in the Picante and Lazear series.

Zyme soils are on hills and ridges. These soils are shallow and well drained. They formed in residuum derived from shale. The surface layer and underlying material are clay loam. Shale is at a depth of 6 to 20 inches.

Rock outcrop is on cliffs, ridges, breaks, and ledges. It consists of exposures of sandstone.

Ustic Torriorthents and similar soils are on terrace edges, mesas edges, and hillsides. They are deep and are well drained and somewhat excessively drained. They formed in gravelly and cobbly alluvium. The surface layer is gravelly loam, cobbly loam, or fine sandy loam. The underlying material is mixed alluvium that is very gravelly or cobbly. Similar soils are Ustollic Haplargids.

Of minor extent in this unit are the deep, well drained Arboles soils on valley sides and in upland valleys; deep, well drained Mikim and Sili soils on alluvial fans and toe slopes and in upland valleys; and shale Badland.

This unit is used for livestock grazing and wildlife habitat.

Low precipitation, shallow soil depth, and low soil fertility limit the kind and amount of forage plants produced.

F. Panitchen-Yenio-Dominquez Variant

Deep well drained, gently sloping, moderately fine textured and moderately coarse textured soils; in upland valleys.

This map unit is in the southwestern part of LaPlata County area bordering the state line. It is in gently sloping areas along drainageways and on valley bottoms. Slope is 1 to 6 percent. The native vegetation is mainly shrubs and grasses. Elevation is 6,000 to 6,600 feet. The average annual precipitation is 12 to 15 inches, and the average air temperature is 47 to 52 degrees Fahrenheit. The average frost-free season is 120 to 130 days.

The Panitchen and similar soils are in drainageways and on valley bottoms. These soils are deep and well drained. They formed in alluvium and derived dominantly from sandstone and shale. The surface layer is silty clay loam, and the underlying material is silty clay loam stratified with thin layers of sandy loam, loamy sand, and gravelly sandy loam. The similar soils are in the Mikim series.

The Yenio and similar soils are in upland valleys. These soils are deep and well drained. They formed in alluvium derived dominantly from sandstone and shale. The surface layer is sandy loam, the subsoil is sandy clay loam, and the substratum is sandy loam. The similar soils are in the Florita series.

The Dominquez Variant and similar soils are along drainageways and on upland valley bottoms. These soils are deep and well drained. They formed in alluvium derived from shale. The surface layer is silty clay loam, and the subsoil and substratum are clay. The similar soils are in the Arboles and Sili series.

Of minor extent in this unit are the deep, well drained Buckle soils in upland valleys and the shallow, well drained Picante soils on cuestas and hills.

This unit is used as rangeland and wildlife habitat.

G. Durango-Zyme-Rock outcrop

Shallow and deep, well drained, gently sloping to steep, moderately fine textured to moderately coarse textured soils, and Rock outcrop; on mesas, foothills, and ridges.

This map unit is in the southern part of the LaPlata County and includes part of Mesa Mountain. It is in gently sloping to moderately steep areas on mesa tops that are dissected by drainageways and in moderately steep to steep areas on hills and ridges. Slope is 3 to 65 percent. The native vegetation is pinyon, juniper, shrubs, and grasses. Elevation is 6,600 to 7,400 feet. The average annual precipitation is 14 to 18 inches, and the average annual air temperature is 45 to 50 degrees Fahrenheit. The frost-free season is 100 to 130 days.

The Durango soils are on mesa tops and ridge tops. These soils are deep and well drained. They formed in glacial outwash. The surface layer is cobbly loam, the subsoil

is clay loam, and the substratum is clay loam over clay.

The Zyme soils are on hills and ridges. These soils are shallow and well drained. They formed in residuum derived from shale. The surface layer and underlying material are clay loam. Shale is at a depth of 6 to 20 inches.

Rock outcrop is on cliffs, ridges, breaks, and ledges. It consists mostly of barren exposures of sandstone. Of minor extent in this unit are deep, well drained Buckle soils in upland valleys and deep, well drained Sili soils on side slopes, fans, and bottoms of upland valleys.

This unit is used as rangeland and wildlife habitat.

2. Warm and cool soils on flood plains, terraces, and alluvial fans.

This group consists of two map units. It makes up about five percent of the survey area.

A. Pescar-Tefton-Fluvaquents

Deep, somewhat poorly drained and poorly drained, nearly level to gently sloping, moderately coarse textured and medium textured soils; on flood plains, low terraces, and alluvial valley floors.

This map unit is throughout the survey area. It is in nearly level to gently sloping areas on flood plains, low terraces, alluvial valley floors. Slope is 0 to 3 percent. The native vegetation is sedges, rushes, grasses, willows, and cottonwoods. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 22 inches, and the average annual air temperature is 42 to 53 degrees Fahrenheit. The average frost-free season is 90 to 130 days.

Pescar soils are on flood plains, low terraces, and alluvial valley floors. These soils are deep, somewhat poorly drained, and frequently flooded. The surface layer and underlying material are fine sandy loam. Very gravelly sand is at a depth of 18 to 30 inches.

Tefton soils are on flood plains and alluvial valley floors. These soils are deep, somewhat poorly drained, and occasionally flooded. The surface layer is loam, and the underlying material is stratified loam and sandy loam.

Fluvaquent are on alluvial valley floors and along major drainageways. The soils are deep, poorly drained and somewhat poorly drained, and frequently flooded. The surface layer is gravelly loam, cobbly loam, or sandy loam. The underlying material is sand and gravel.

Of minor extent in this unit are deep, well drained Hayness and Hesperus soils on valley sides and alluvial fans; deep, well drained Pastorius, Sedillo, and Sycle soils on high river terraces; and deep, poorly drained Alamosa soils on alluvial valley floors, fans, and bottoms. This unit is used mainly for irrigated field crops and pasture, rangeland, and wildlife habitat.

B. Shalona-Sedillo-Mikim

Deep, well drained, nearly level to sloping, medium textured soils; on river terraces and alluvial fans.

This map unit is mostly in the southern part of the reservation area, along a river valley. It is in nearly level to gently sloping areas on old high terraces and in gently sloping to sloping areas on alluvial fans. Slope is 0 to 12 percent. The native vegetation is sagebrush, grasses, pinyon, and juniper. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 13 to 18 inches, and the average annual air temperature is 45 to 52 degrees Fahrenheit. The average frost-free season is 110 to 130 days.

Shalona and similar soils are on high river terraces. These soils are deep and well drained. They formed in mixed alluvium derived dominantly from sandstone and shale. The surface layer is loam, the subsoil is clay loam, and the substratum is loam. Similar soils are in the Harlan and Arboles series.

Sedillo and similar soils are on high river terraces. These soils are deep and well drained. They formed in cobbly glacial outwash. The surface layer is gravelly loam, the subsoil is very cobbly sandy clay loam, and the substratum is very cobbly sandy clay loam. The similar soils are in the Pastorius and Nehar series.

Mikim soils are on alluvial fans. These soils are deep and well drained. They formed in alluvium derived dominantly from sandstone and shale. The surface layer and underlying material are loam.

Of minor extent in this unit are deep, somewhat poorly drained Tefton soils on flood plains and alluvial valley floors; deep, well drained Aqua Fria and Sycle soils on high river terraces; and deep well drained Ustic Torriorthents and Ustollic Haplargids on terrace edges. This unit is used for irrigated field crops and pasture, nonirrigated crops, and rangeland, and wildlife habitat.

3. Cool soils on hills and mountains and in intermontane valleys.

This unit consists of one map unit. It makes up about 23 percent of the survey area.

A. Archuleta-Goldvale-Hesperus

Shallow and deep, well drained, gently sloping to steep, medium textured and moderately coarse textured soils; on hills, ridges, and mountainsides and in valleys.

This map unit is in the eastern part of the reservation. It is in moderately steep to steep areas on hills, ridges, and mountainsides and in gently sloping to sloping areas on alluvial fans, valley sides, and valley bottoms. Slope is 3 to 65 percent. The native vegetation is ponderosa pine, oak brush, and other shrubs, and grasses. Elevation is 7,000 to 8,500 feet. The average annual precipitation is 18 to 25 inches, and the average annual air

temperature is 40 to 45 degrees Fahrenheit. The average frost-free season is 90 to 110 days.

Archuleta and similar soils are on hills, ridges, and mountainsides. These soils are shallow and well drained. They formed in residuum derived dominantly from interbedded sandstone and shale. The surface layer is loam, and the underlying layer is clay loam. Interbedded sandstone and shale are at a depth of 10 to 20 inches. The similar soils are in the Valto and Sanchez series.

Goldvale and similar soils are on mountainsides. These soils are deep and well drained. They formed in alluvium derived dominantly from interbedded sandstone and shale. The surface layer is very stony fine sandy loam, and the subsoil to a depth of 60 inches or more is stony clay. The similar soils are in the Pinata, Zau, and Fortwingate series.

Hesperus and similar soils are on alluvial fans and valley bottoms. These soils are deep and well drained. They formed in medium textured alluvium derived dominantly from sandstone and shale. The surface layer is loam, the subsoil is clay loam, and the substratum is loam. The similar soils are in the Nutriosa and Herm series.

Of minor extent in this unit are deep, poorly drained Alamosa and Big Blue soils on alluvial fans, valley bottoms, and low terraces; deep well drained Anvik soils on mountainsides; Plome soils on mesas; and Haploborolls, Rubble Land, and Rock outcrop on mountainsides and mesa edges.

This unit is used as woodland and for livestock grazing, irrigated and nonirrigated crops, and wildlife habitat.

4. Cold soils on mountains and in intermontane valleys.

This group consists of two map units. It makes up about 10 percent of the survey area.

A. Horsethief-Uinta-Rock outcrop

Deep, well drained, gently sloping to steep, medium textured and moderately coarse textured soils and Rock outcrop; on mountainsides and on alluvial fans of intermontane valleys.

This map unit is in the eastern part of the reservation. It is in moderately steep to steep areas on mountainsides, cuestas, and hogbacks and in gently sloping to sloping areas on alluvial fans. Slope is 5 to 65 percent. The native vegetation is dominantly spruce, fir, aspen, shrubs, and grasses. Elevation is 7,800 to 10,400 feet. The average annual precipitation is 18 to 30 inches, and the average annual air temperature is 35 to 40 degrees Fahrenheit. The average frost-free season is 50 to 90 days.

Horsethief and similar soils are on cuestas, hogbacks, and mountainsides. These soils are deep and well drained. They formed in stony colluvium derived dominantly from sandstone and shale. The surface layer is very stony fine loam. The subsoil is extremely

stony clay loam. The substratum is very stony clay loam. The similar soils are in the Leadville and Nordicol series.
Uinta and similar soils are on mountainsides and alluvial fans. These soils are deep and well drained. They formed in alluvium derived dominantly from interbedded red sandstone and shale. The surface layer is loam, the subsoil is sandy clay loam, and the substratum is loam. The similar soils are in the Anvik series.

Rock outcrop is on cliffs, ridges, and escarpments. It consists mostly of exposures of limestone and sandstone.

Of minor extent in this unit are deep, well drained Chris soils on mountainsides; deep, well drained Clayburn soils in mountain valleys and on valley sides; shallow, well drained Coni soils on mountainsides; and Haploborolls and Rubble Land on mountainsides.

This unit is used as woodland and for livestock grazing and wildlife habitat. Most of this unit is used for the production of spruce, fir, and aspen.

B. Valto-Clayburn Nordicol

Shallow and deep, well drained, medium textured and moderately coarse textured soils; on mountainsides and in narrow intermontane valleys.

This map unit is in the eastern part of the reservation. It is in sloping to steep areas on mountainsides, ridges, and breaks and in gently sloping to sloping areas in mountain valleys on toe slopes. Slopes are 3 to 65 percent. The native vegetation is spruce, fir, ponderosa pine, aspen, shrubs, and grasses. Elevation is 7,500 to 9,000 feet. The average annual precipitation is 20 to 35 inches, and the average annual air temperature is 36 to 42 degrees Fahrenheit. The average frost-free season is 60 to 95 days.

Valto soils are on mountainsides, ridges, and breaks. These soils are shallow and well drained. They formed in material weathered mainly from sandstone. The surface layer and underlying material is very stony fine sandy loam. Hard bedrock is at a depth of 6 to 20 inches.

Clayburn soils are in narrow mountain valleys on toe slopes. These soils are deep and well drained. They formed in medium textured alluvium from nearby hills. The surface layer is loam, the subsoil is clay loam, and the substratum is fine sandy loam and loam.

Nordicol soils are on mountainsides. These soils are deep and well drained. They formed in colluvium and alluvium derived dominantly from sandstone. The surface layer is very stony sandy loam, and the subsoil is stony sandy clay loam that extends to a depth of 60 inches or more.

Of minor extent in this unit are deep, well drained Anvik soils on mountainsides and Rock outcrop.

This unit is used as woodland and for livestock grazing and wildlife habitat.

Much of this unit is used for the production of spruce, fir, aspen, and ponderosa pine.

The reservation has six climatic zones. These zones have different climatic environments which are reflected in the different vegetative associations they produce. However, Zone one (<6000', Semi-Desert grasslands) make up only a few acres on the reservation and is usually not mapped, it will not be discussed.

C. Water Resources

The potentially affected water resource environments may be divided in this report into surface water and ground water resources.

Surface Water

Eight rivers cross the reservation (LaPlata, Animas, Florida, Los Pinos, San Juan, Navajo, Piedra and Rio Blanco), only three (Los Pinos, Piedra and Animas) cross a substantial portion of Tribal lands. The drainage is predominately from north to south. All flow southerly except the Navajo, Rio Blanco and a portion of the San Juan which flows westerly.

There are a large number of creeks that feed into the major drainages. The north end of the Navajo Reservoir on the San Juan and Piedra Rivers extends into the reservation east and north of Arboles, Colorado, crosses over the New Mexico-Colorado border. In addition, the Tribe has a shallow, spring-fed reservoir (Capote Lake) which is used for recreation and fishing. A large number of developed stock ponds and undeveloped springs occur within the reservation boundaries.

Ground Water

Ground water on the reservation is present in sandstone, shale and alluvial aquifers.

The ground water quality appears to depend on the rock type, with floodplains and terrace aquifers being calcium-bicarbonate and shale aquifers being sodium-bicarbonate. the observed dissolved solids concentrations vary between and within geologic units from 100 to over 7,000 mg/l (Brogden et al., 1979). Background concentrations of arsenic, chloride, fluoride, dissolved salts, iron, manganese, nitrite, selenium and sulfate have been observed at levels exceeding recommended limits for drinking water (Brogden et al., 1979).

The aquifers of primary interest are the shallow unconfined aquifers having high permeability (represented by high water yields). These would be present along stream valleys and alluvial fans where the material is primarily sand and gravel, although the other geologic units also have water yields sufficient for various water uses. Thus, the main concern for potentially affected shallow ground water environments is the location of shallow ground water wells. Most well depths vary between approximately 25 and 300 feet, with a few wells less than 25 feet and a few up to approximately 600 feet. The

wells uses are primarily domestic and household only, with some livestock and domestic use.

With respect to the deep geologic formations (Mesaverde or deeper Entrada, Bluff and Morrison), where produced water is proposed to be injected, there are no major users of that geologic formation for water at present. Analysis of the ground water from that formation indicates that the water quality is worse or similar to the produced water. In the San Juan Basin water quality of deep formations generally range from fair to poor. In most places total dissolved solids exceed 10,000 mg/l. The water is hard to very hard, with actual chemical composition depending on the aquifer and location within the aquifer. The predominate ions present are calcium, sodium, bicarbonates and sulfates.

D. Wildlife

Wildlife known to inhabit the area include elk, deer, porcupine, coyote, foxes, raccoons, badgers, skunks, squirrels, rabbit, prairie dog, field mice, Kangaroo rats, bobcats, mountain lion, black bear, as well as a variety of other small mammals, snakes and other reptiles.

Birds include raptors, magpies, pinyon and scrub jays, wild turkeys, crows, robins, meadowlarks, sparrows, morning doves, hummingbirds, as well as a variety of transient species.

Principal fish that may be found in Navajo Reservoir, Capote Lake, and the rivers and streams are: black bullhead, channel catfish, largemouth and smallmouth bass, northern pike, carp, white suckers, roundtail chub, bluegill, fathead minnow, rainbow trout, cutthroat trout, brown trout, crappie, squawfish, razorback chub, Kokanee and coho salmon.

Various amphibians that may be found around stockponds include frogs, toads, and salamanders.

A complete listing of flora and fauna that may be present on the Southern Ute Reservation is found in Appendix C.

E. Vegetation

Zone 1 is shown in the table above but it occupies only a few acres and is generally not mapped on the reservation. Characteristic vegetation consists of galleta (Hija), alkali sacaton (Spai), Indian ricegrass (Orhy), and saltbrushes (Atriplex). Big sagebrush (Artr) usually does not occur.

Zone 2. Vegetation characteristic of this zone consists of mixed grasses with a sparse stand of big sagebrush (Artr). Major grasses are Indian ricegrass (Orhy), salina wildrye (Elsa), western wheatgrass (Agsm), galleta (Hija), blue grama (Bogr), and squirreltail (Sihy). In deteriorated range, sagebrush is usually dominant. Stands of stunted pinyon pine (Pied) and mostly juniper (Jumo, Juut) are found on shallow and stoney soils.

Zone 3. The dominant vegetation in this zone is pinyon pine and juniper woodland. The woodland, however, is not found in valley bottoms or in some upland areas (parks). Vegetation in noncanopied areas include ricegrass, needle and thread (Stco), galleta and blue grama, with scattered big sagebrush, which becomes dominant in deteriorated range. Muttongrass (Pofe) and bitterbrush (Putr) are the major species growing under the pinion-juniper canopy, with bitterbrush and mountain mahogany (Cemo) prominent on steep, shallow or stony soils.

Zone 4. Dominant vegetation is pinyon pine and juniper woodland, with pinyon usually more abundant. Valley and upland parks are found, as in Zone 3. Herbaceous vegetation in noncanopied areas include western wheatgrass, needle and thread, blue grama, sideoats grama (Bocu) and ricegrass. With overgrazing, big sagebrush usually invades, and these areas become difficult to distinguish from similar Zone 3 sites.

These same park species grow under the "A" canopy of pinyon and juniper, but in much lesser amounts. Under the canopy muttongrass, Junegrass (Kocr), elk sedge (Cage) and various perennial forbs are most important. Mountain browse plants including gambel oak (Quga), serviceberry (Amal) and mountain mahogany are found throughout the zone. These are usually sparse on deep, gently sloping soils and prominent on steep, shallow or stoney soils, where they often also include considerable fendlerbush (Feru) and other brush species.

Zone 5. Ponderosa pine is the climax dominant in this zone. Under the pine canopy mountain muhly (Mumo), pine dropseed (Bltr), needle and thread, muttongrass, slender wheatgrass (Agtr) and scattered oak (with its associated elk sedge) are the most common species. Some of the areas of this zone, usually on steep slopes, no longer have a canopy of pine. These are usually dominated by "mountain browse" shrubs including oak, serviceberry, mountain mahogany and fendlerbush. Rocky mountain juniper (Jusc) is important in some areas, especially on the finer-textured and more eroded shale derived soils. Park areas are usually confined to park bottoms. Wheatgrasses, needlegrasses, and mountain muhly are the most important plants there, but big sagebrush often invades as range conditions decline.

Zone 6. This zone is dominated by a coniferous forest of Douglas-fir (Psme), white fir (Abco) and some spruce (Pipu). Quaking aspen (Potr) is a subdominant which forms pure stands in local areas. The main understory vegetation consists of elk sedge, Arizona fescue (Fear), mountain muhly, mountain brome (Bran), bluegrasses (Poa spp.), snowberry (Syor) and various perennial forbs. On the reservation open park areas are very small.

F. Forestry

Four management zones on the reservation contain woodlands. They are delineated below:

Acreage*: (W/WO Refers to Potential for Economical Harvest and Sustained Growth)

ZONE	TYPE	TOTAL	W/POTENTIAL	W/OUT POTENT.
3,4	PJ	123,345	103,050	20,295
5,	PINE	70,249	67,032	3,217
6,	MC	7,731	7,731	0

(PJ Refers to Pinion/Juniper Woodland)
(MC Refers to Mixed Conifer Timberland)

* as of September 13, 1990

The present volumes and growth for the management zones are:

ZONE	TYPE	CF/ACRE ($)	CF/AC/YR ($)	BF/AC ($)	BF/AC/YR ($)
3,4	PJ	451.42/338.56	7.17/5.38	---	---
5,	PINE	---	---	2,259.4/203.3	36.70/3.30
6,	MC	---	---	3,095.0/278.55	61.70/5.55

Product Value --($/CORD = 60.00, 80 CF/CORD, $0.75/CF (CUBIC FT.))
Stumpage --($/MBF = 90.00, $0.09/BF (BOARD FT.))

G. Topography

The reservation elevation ranges from a low of approximately 5,940 feet in the Cinder Buttes Gulch and McDermott Arroyo to 9,159 feet on Archuleta Mesa. The drainage is predominately from north to south and the reservation is crossed by eight rivers. All flow southerly except the Navajo, Rio Blanco and a portion of the San Juan which flows westerly.

The terrain is predominately mountainous but also has several alluvium-capped mesas (Red Mesa, Florida Mesa, Mesa Mountains) which appear to be nearly level tables. The valleys are mostly narrow and often relatively sloping. They are usually deeply gullied. Headcuts often dissect the valleys as they proceed from the main arroyo up the side drainages. Drainage is rapid and erosion is relatively high during spring runoff or any period of extended flows.

H. Climate

The reservation has been divided into five major climatic zones. These zones have different climatic environments which are reflected in the different vegetative associations they produce. Some of the characteristics of the zones follow:

Zone	Precipitation	Elevation	General Vegetative Formations
1	<12"	<6000'	Semi-Desert grasslands
2	12-13"	6000-6200'	Sagebrush savanna
3	13-17"	6000-7200'	Pinion-Juniper woodland
4	14-20"	6100-8400'	Pinion-Juniper/Mtn. browse
5	16-23"	6500-8800'	Ponderosa pine
6	18-27"	6600-9000'	Fir-Spruce-Aspen

Zone 2. Normal frost-free growing seasons are 140-162 days in uplands, to as few as 120 days in valleys. Precipitation is nearly equally divided between the growing season and winter, but the winter moisture is much more effective.

Zone 3. Normal frost free growing periods are 125 to 150 days. They may be as short as 100 days in valleys. Approximately 60 percent of the precipitation comes in winter, and April through June is the driest period. August is the wettest month, and late summer growth usually takes place.

Zone 4. Normal frost free growing seasons are 110 to 135 days, or as short as 80 days in valleys. Approximately 65 percent of the precipitation falls in the winter, and most of the remainder falls in late summer. This pattern favors cool-season grasses and deep-rooted species (shrubs and trees).

Zone 5. Normal frost free growing seasons are 95 to 125 days, or as low as 60 days in valleys. About 30 percent of the precipitation falls during the growing season. Most of the remainder falls as winter snow, which inhibits winter grazing. Deep-rooted woody species are favored by the winter moisture, but an herbaceous understory usually occurs.

Zone 6. Normal frost free growing periods are quite short, usually less than 100 days uplands, and may be less than 50 days in valleys. Most of the precipitation comes as snow, but showers are frequent during the growing season, especially late summer.

I. Air Quality

Air quality is generally influenced by natural terrain and emissions. Better dilution and dispersion of pollutants occurs along ridges and high elevation areas than in valleys and low elevation areas. The air quality of the Southern Ute Indian Reservation is generally good, meeting Colorado standards, as it is in attainment for all criteria pollutants.

A moderate amount of particulate matter (dust) will rise into the air when the vegetation is removed. Dust will also be generated during the construction phase of operations. Total dust generation, when considered for the general area, should not be significant. Hydrocarbons from operation of internal combustion engines may be locally evident during daylight hours. The area has good air drainage and is remote, therefore, the total impacts will be of low significance. Temporary or short term equipment noise will also be present during the operations at the site.

J. Resource Use Patterns

The Southern Ute Indian Tribe practices multiple use management on all Tribal lands within the reservation. However, some areas will continue to be dedicated to only one primary use. Some examples of primary uses are: gravel pits, sewage treatment areas, parking lots, gas well pads, roads.

Based upon the BIA's 1988 Inventory and Production Report, Southern Ute Tribal Lands were used in the following ways:

Land Use	Acres	%	Indian Use (%)
Irrigated Farming	14,736	4.8	39.9
Dryland Farming	300	0.1	0
Livestock Grazing*	126,407	41.1	70.2
Commercial Forest	77,980	21.2	100.0
Non-Commercial Forest & Woodland	147,610	49.2	100.0
Wildlife Lands**	19,786	6.4	74.9
Other Uses***	2,365	0.8	0
Idle****	7,870	2.5	92.9
Total	388,175	126.1 *	

* These figures include forest and woodlands also used for grazing.
** These lands are designated wildlife areas only, not to be grazed by livestock.
*** Other uses includes roads, residential, municipal and designated recreation areas.
**** These figures represent only isolated tracts of Tribal land for which no land use is designated.

Besides primary land uses, Tribal members use much of the reservation land areas for hunting, recreation and gathering activities. Firewood, fence posts, chokecherries, pinyon nuts, crafts and ceremonial materials are gathered.

Oil and gas activities generally use only small areas but have wide-spread effects where wells are numerous. Most of the surface land areas are still useable for other purposes, so there is no acreage given for oil and gas uses.

Agriculture

Farming inside the reservation boundaries consists of both irrigated and non-irrigated agriculture. Non-irrigated crops include winter wheat, dry beans, barley, dryland oats and alfalfa. Hay crops consisting of alfalfa and grass are by far the most important irrigated crops, however, corn for silage, oats and barley are also grown.

In 1988, $850,000 worth of hay and pasture crops were grown on Tribal lands.

The Southern Ute Tribe owns and operates a custom farm operation which makes farming feasible for many small operators of Tribal assignments.

Irrigated Lands

There are 14,786 acres of Tribal irrigated lands within the reservation.

Existing Water	Units Served	Current Usage
PRIIP (Pine River Indian Irrigation Project)	14,504 ac.	10,035 ac.
Animas-Citizens	1,280 ac.	38 ac.
Florida Project	785 ac.	785 ac.
Carr Ditch	140 ac.	140 ac.
ME & M	70 ac.	35 ac.
Ignacio Creek	112 ac.	0 ac.
Total	16,504 ac.	11,033 ac.

Under the Colorado Ute Water Settlement Agreement the following irrigation is planned.

Water Source	Planned Unit
PRIIP (Pine River Indian Irrigation Project)	14,504 ac.
Animas-Citizens	1,800 ac.
Florida Project	1,600 ac.
Stollsteimer Creek	600 ac.
Piedra River	535 ac.
Devil Creek	61 ac.
San Juan River	510 ac.
Round Meadow Creek	325 ac.
Cat Creek	482 ac.
Total	20,417 ac.

Domestic Livestock

Cattle and horses are the principal livestock on the reservation. There are about 1,200 head of cattle with individual units varying from as few as ten head of cattle to as many as 150 head. Sheep numbers have decreased in the last ten years due to management, economics and additional labor involved. Tribal sheepmen now run about 250 ewes. Several Tribal families also keep small flocks of chickens and a few goats.

The reservation has a total of 198,490 acres included in range units with 11,208 authorized

animal unit months (AUMs). Almost all of the grazing is accomplished with the use of cattle, although some range units are set aside for wildlife.

Typical utilization of AUMs on Tribal properties is about 30 to 40 percent of authorized stocking. This low figure is due both to lack of demand for the range areas and lack of water development and fencing.

Recreation

Regional recreation opportunities are extensive. Much of the reservation-based recreation occurs out-of-doors, such as hunting, fishing, hiking, picnicking, Tribal dances and pow-wows. On the reservation, Lake Capote Park has been developed as a recreation area. In addition to Lake Capote, seven principal rivers create recreational opportunities within the reservation boundaries. The San Juan, Pine, Piedra, Florida, Animas, LaPlata and Navajo provide 110.3 miles of stream fisheries, although only 42.95 miles are actually on Indian lands.

The demand for recreation in southwestern Colorado is increasing every year. In 1986, over 1 million tourists visited Durango. There were over 100,000 fisherpersons in the San Juan River below Navajo Dam in 1986.

In contrast, on the reservation, guest registration totaled 4,000 at Sky Ute Lodge, 5,049 people bought permits to fish at Lake Capote, another 326 fishing permits were sold for reservation streams.

Big game hunting is a major recreational activity on the reservation and generates revenues. The Tribe issued 120 big game hunting permits last year to non-Tribal members.

Minerals

Today oil and gas exploration, development and production contribute to a substantial portion of the Tribe's economic and social environment. Future mineral development of oil, gas, coal and other undiscovered mineral resources will provide an important economic base from which the Tribe can prosper.

The Tribe has also begun to exploit the large sand and gravel deposits within the reservation.

K. Threatened and/or Endangered Species

According to the U.S. Fish and Wildlife Service (see Appendix D) the Southern Ute Indian Reservation contains verified or potential habitat for the Federal listed endangered species including:

FEDERALLY LISTED SPECIES

Peregrine falcon (Falco peregrinus)
Bald Eagle (Hailiaeetus leucocphalus)
Blackfooted Ferret (Mustela nigripes)
Colorado Squawfish (Ptychocheilus)
Razorback Sucker (Xyrauchen texanus) - Proposed for listing June 1990
Knowlton Hedgehog Cactus (Pediocatus knowltonii)

FEDERAL CANDIDATE SPECIES

Ferruginous Hawk (Buteo regalis)
Mountain Plover (Charadrius montanus)
Long-billed Curlew (Numenius americanus)
Mexican Spotted Owl (Strix occidentalis lucida)
Southwestern Willow Flycatcher (Empidomax trailii extimus)
Schmoll Milk-vetch (Astragalus schmolliae)
Frosty Bladderpod (Lesquerella pruinosa)
Skyrockets (Ipomopsis polyantha var. polyantha)

Two threatened and endangered species have been documented within the boundaries of the reservation. The Bald Eagle is a wintertime resident and the Knowlton Hedgehog Cactus occurs on the ridge on the southern border of the reservation. Neither species should be affected by the oil and gas operations. The Knowlton Hedgehog Cactus has been identified at only one location which overlaps, by only a few feet, into the State of Colorado. The Knowlton Cactus has not been identified at any other site in LaPlata County outside of the one aforementioned site on the Colorado-New Mexico line.

The Bald Eagle is a winter-time resident of the reservation. Present oil and gas activities on the Southern Ute Indian Reservation seem to have no detrimental effects on the wintering Bald Eagle population. The black-footed ferret is usually found in association with prairie dog towns in grassland plains and surrounding mountain basins up to 10,500 feet. The black-footed ferret's historic range included Colorado and the upper two-thirds of New Mexico. No known records of black-footed ferrets on the reservation have been reported this century. Also, recent investigations have failed to confirm the existence of the species on the reservation.

L. Socioeconomic

The reservation covers approximately 1,080 square miles and is traversed by five major river drainages. These are from east to west, the LaPlata, Animas, Los Pinos, Piedra and San Juan. Population centers within each of these drainages, except the San Juan, are expected to grow and develop within the next 20 years.

Both present and projected socioeconomic conditions were evaluated to determine the potential effects of the continued oil and gas development on the Southern Ute Tribe and its Tribal members. Issues considered in the socioeconomic impact assessment are

population, income and employment and Tribal services and finance. In the case of the continued oil and gas exploration, development and production, the following considerations apply: (1) the sequential nature of the construction process, (2) the relatively small construction and operation workforce required and (3) the use of local workforce. Given these considerations, this analysis focuses primarily on the availability of workforce and the Tribal financial impacts.

The 1986 estimated population for LaPlata County is 30,180 (Picasso, 1988). Three towns (Durango, Ignacio and Bayfield) are located in or in proximity of the reservation. The 1986 estimated populations for these cities are 12,274 (Durango), 688 (Ignacio) and 870 (Bayfield) (Picasso, 1988). In 1986, the total civilian workforce of LaPlata County was 16,338. The employed labor force was 14,894, with the primary employment sectors in services, retail trade and government. The unemployment rate for the county was 8.8 percent, or 1,444 unemployed persons (Picasso, 1988).

The primary source of revenue for the Southern Ute Tribal Government is the oil and gas operations and enterprises on Tribal lands (royalties, rentals, bonuses, severance taxes, fees, etc). This source of income makes up 94 percent of the Tribal government budget. Today, the Tribe persists in the goal of making the lands productive and the people economically and socially successful. The Tribe's assets, its natural resources and its people are committed to this goal.

M. Archeological

Cultural and archaeological resources have the potential to provide a wealth of information concerning the history and prehistory of a region. These resources may also have significant religious or cultural values to existing Indian tribes, as in the case of human remains or traditional use areas. These are non-renewable resources which may be preserved and protected for the benefit of present and future generations.

The continued existence of archaeological and cultural resources can be endangered by vandalism and unauthorized collections, as well as unintentional damage resulting from other natural resource management practices and land altering activities. Any project which involves excavation or alteration of previously undisturbed land surfaces has the potential to damage these resources.

Federal regulations exist to provide protection for archaeological resources. Archaeological resources on Indian trust lands are protected by the Antiquities Act of 1906, the Archaeological Resources Protection Act of 1979 and the National Historic Preservation Act of 1966. The first two acts are designed to provide protection from looting and vandalism as well as regulate professional scientific investigation through a permit system. The National Historic Preservation Act of 1966 protects archaeological resources from damage or destruction from federally sponsored, approved, licensed or permitted activities. If not previously disturbed or surveyed for archaeological resources, the project area must be surveyed for archaeological resources, and a report of that survey must be prepared for review. The BIA must then consider the effects of the proposed activities on all National Register eligible properties located in the project area and must consider

reasonable alternatives to avoid or mitigate potential adverse impacts to such properties. Site avoidance through project redesign, relocation, or use of protective measures is the preferred alternative. A letter from the Albuquerque Area Director granting clearance should be received before projected site specific actions are initiated.

The Tribe has known archaeological and cultural resources on Tribal lands in virtually every management unit described in this document. Surveys have been done on the reservation as part of the Navajo Reservoir and Animas-LaPlata projects, road, pipeline and powerline projects, all timber sale areas and all oil and gas development. However, these do not represent a complete inventory of the reservation.

N. Resource Related Pests

There are several pests which create problems on the reservation. One is noxious weeds, but also included are insects, rodents and other animals which require control. Most are natural resource related, either inhibiting production or use of resources; or are an undesirable side-effect from resource use.

Noxious Weeds

If man did not exist there would be no weeds. A weed is simply a plant that interferes with the environment man has imposed upon the earth. A weed has also been termed as "a plant growing out of place".

Some of these plants are more troublesome and harder to control than others, these are often referred to as noxious weeds. The Colorado seed law was passed to control the introduction and spread of noxious weeds. Noxious weed seeds are classed as "prohibited" or "restricted". A prohibited weed seed is from a perennial, biennial or annual weed which is highly detrimental and especially difficult to control. It's against Colorado law to sell agricultural seed which contains one or more of the following seeds:

Bindweed, field	Convolvulus arvensis L.
Halogeton	Halogeton glomeratus (M. Bieb.) C.A. Mey.
Horsenettle,Carolina	Solanum carolinense L.
Horsenettle, white	Solanum elaeagnifolium Cav.
Johnson grass	Sorghum halepense (L.) Pers.
Knapweed, Russian	Centaurea repens L.
Povertyweed, silverleaf	Franseria discolor Nutt.
Povertyweed, woollyleaf	Franseria tomentosa Gray
Sorghum almum	Sorghum almum Parodi
Sowthistle, perennial	Sonchus arvensis L.
Spurge, leafy	Euphorbia esula L.
St. Johnswort	Hypericum perforatum L.
Thistle, Canada	Cirsium arvense (L.) Scop.
Toadflax, dalmation	Linaria dalmatica (L.) Mill
Toadflax, yellow	Linaria vulgaris Hill
Whitetop	Cardaria draba (L.) Desv.

Whitetop, hairy	Cardaria pubescens (C.A. Mey.) Rollins
Whitetop, tall	Lepidium latifolium L.

Restricted noxious weed seeds are from weeds which are very objectionable but can be controlled by good cultural practices, they include:

Dock curly	Rumex crispus L.
Dodder	Cuscuta spp.
Fanweed	Thlaspi arvense L.
Groundcherry, purpleflower	Physalis lobata Torr.
Lettuce, blue	Lactuca pulchella (Pursh) DC.
Mustards	Brassica spp.
Oat, wild	Avena fatua L.
Peaweed, Austrian	Swainsona salsula (Pall.) Taub.
Plantain, buckhorn	Plantago lanceolata L.
Povertyweed	Iva axillaris Pursh
Puncturevine	Tribulus terrestris L.
Quackgrass	Agropyron repens (L.) Beauv.

Many plants classified by the State of Colorado as noxious weeds are present on the Southern Ute Indian Reservation.

Weeds can cause problems in a number of different ways. Some weeds are poisonous to livestock, some have sharp awns, burs or heavy spines that can cause injury to the eyes, mouth, tongue, feet or hide of an animal often resulting in the loss of weight or death. The following is a listing of these plants found on the Southern Ute Indian Reservation.

Plants poisonous to livestock:

Common Name	Species	Animals Affected
Monkshood	Aconitum columbianum spp.	Sheep and horses
Cocklebur	Xanthium spp.	Hogs; cattle and sheep at times
Deathcamas	Zygadenus spp.	Sheep; cattle and horses at times
Brackenfern	Pteridium Aquilinium (L.) Kuhn	Cattle, horses, and sheep when fed in hay
Greasewood	Sarcobatus vermiculatus (Hook) Torr.	Cattle and sheep
Western-hemlock	Cicuta douglasii (DC.) Coult. & Rose	All classes of livestock
Horsetail	Equisetum arvense L. hylophilus (Rydb.) Barneby	Chiefly young horses
Jimsonweed	Datura stramonium L.	Generally poisonous in large quantities

White loco	Oxytropis sericea	Horses
Woolly loco	Astragalus mollissimus Torr.	Horses
Low larkspur	Delphinium nelsonii Greene	Cattle, horses at times
Lupines	Lupinus spp.	Sheep, other animals at times
Milkvetch	Astragalus bisulcatus	Hook Sheep, cattle at times
Whorled milkweed	Asclepias subverticillata (Gray) Vail	Sheep, cattle, horses
Sneezeweed	Helenium hoopessi Gray	Sheep, cattle at times
Leafy Spurge	Euphorbia esula	Horses, cattle

Plants that can cause mechanical injury to animals:

Sandbur	Cenchrus incertus M.A. Curtis
Wildoats	Avena fatua L.
Downy Bromegrass	Bromus tectorum L.
Wild barley	Hordeum jubatum L.
Cocklebur	Xanthium spp.
Russian Thistle	Salsola kali L. var tenuifolia Taush
Needle and Threadgrass	Stipa comata Trin. and Rupr.

Most weeds will out compete crops and thus reduce the quality or quantity of a yield. Some will make an area useless for recreational activities or destroy the esthetics of an area.

Many weeds found on the Southern Ute Indian Reservation have been either intentionally or unintentionally imported from other countries. Many of these plants are not considered especially troublesome in the country of origin because their native natural ecosystem had a natural balance which kept them under control. When these plants were imported to new environments, many had few, if any, natural enemies.

There is no area on the Southern Ute Indian Reservation that can be generally considered weed free, however, the areas that have had the least disturbance by man have fewer weed problems. Agricultural areas, well pads, and pipelines, roads and even intensively used rangelands are all locations where new infestations can start. We have several areas on the reservation that have especially high populations of one or more variety of noxious weeds.

The LaPlata drainage has several weed species that are causing problems. The biggest concern has been the spread of Leafy Spurge which was introduced to the area (possibly by hunters) 15 to 20 years ago. Leafy Spurge is a noxious perennial weed originating in Asia and imported from Europe. Leafy Spurge can reduce the carrying capacity of a piece of rangeland by up to 75 percent.

The Mesa Mountain and Picnic Flats area are badly infested with weeds due to the many

years of gas well activity in the area.

Canada and Musk Thistle are especially troublesome in these areas: The Pine River Valley and the Florida Mesa not only have gas well activity to contend with, but many years of agricultural production and the many miles of irrigation ditches that serve these lands have provided an ideal climate for very serious weed problems. Russian and Spotted Knapweed, Canada and Musk Thistle, Bindweed and Whitetop provide a constant threat to agricultural production in these areas.

The Round Meadow area of the Vega range unit has had a developing Musk Thistle problem over the last few years.

Agriculture is not the only activity that has suffered from weed infestation. The Lake Capote recreation area and the Sundance Grounds both have serious infestations of Thistle which hamper activities in these areas.

Weed control can take a number of directions: mechanical, biological, chemical, cropping techniques, fire and combinations of these control methods can be effective.

Mechanical control involves the use of tools or equipment to cut off, cover or remove unwanted plants. Most perennials require multiple tillage operations before any degree of control is achieved.

Biological control utilizes natural enemies of the weed to help control it. This often results in a new balance between the plant and its environment rather than a complete eradication of the weed species.

Cropping techniques involve the use of competitive crops to out compete unwanted plants.

Chemical control involves the use of chemicals to control one or more plant species. The use of herbicides dates back to almost 100 years ago. Generally, the use of chemicals incorporated with one or more other control methods has proven the most effective type of weed control. Herbicides, generally, are not highly toxic to animals.

Fire can be a tool to remove dried plant species from ditchbanks and fields. Burning can also kill some weed seeds and emerging weedy vegetation. Fire is usually not effective against established perennial species.

The most effective weed control techniques usually incorporate a number of weed control methods. Persistence is the key ingredient in any weed control program. Early control of any new infestation is important. Attacking a new infestation when the patch is small and the plants have not incorporated a large energy reserve is much more cost effective than waiting for the patch to become an economic liability before action is taken.

The real responsibility for weed control lies not with any government but with the land user. Unless land users take the responsibility for weed control on assigned and leased

land, neither the Tribal government or the BIA will have enough time or money to make any real progress in the control of noxious weeds on the reservation except in isolated areas.

Other Pests

Burrowing animals (prairie dogs, rock squirrels, pocket gophers, etc.) disturb ground surfaces with their burrows and mounds of earth. They can have considerable impact when they form a concentrated population. These rodents also host disease spreading fleas. Skunks and other small animal predators dig out burrows of rodents and can cause failures of structures (i.e., dams, dikes, canals, laterals, etc.).

Most insect problems are recurrent, rather than constant. Mosquitos are the most persistent insect pest and they are fostered by flood irrigation. Grasshoppers occasionally infest rangeland. There are also a number of agricultural related pests. An insect problem associated with the woodlands is ticks. In addition, there are a number of insects that attack and can devastate woodland areas (i.e., bark beetles, etc.).

O. Other Values

Visual Impacts

Scenic characteristics of the Southern Ute Indian Reservation is evaluated by the landscape's scenic quality, its use volume or frequency of travel and the distance it can be viewed.

The variety of landscape elements, including the rare water resources of the rivers flowing through the reservation, the wetland and riparian vegetation blanketing the valley floors and the topographic contrast of the surrounding terraces and mountains create an aesthetically pleasing environment.

Noise

Woodward-Clyde Consultants measured existing daytime and nighttime sound levels at several background locations at a variety of existing oil and gas facilities in the Cottonwood Gulch and Ignacio areas. Average day/night sound levels ranged from approximately 41 to 50 decibels, A-weighted scale (dBA), for the undeveloped background areas and from 49 to 69 dBA for the developed areas, including sound levels measured at a distance of 500 feet from existing oil and gas facilities. Sound levels in the undeveloped areas are typical of rural areas.(for more details see Environmental Planning Document, San Juan Basin Coal Degas Project, Woodwards-Clyde Consultants).

IV. ENVIRONMENTAL CONSEQUENCES

Environmental impacts are identified and discussed for resource components that will be affected by the proposed oil and gas exploration, development and production. Generally, impacts from

the proposed actions are expected to be very minimal, for the following reason. The oil and gas exploration, development and production will be in existing areas of development or adjacent to such areas. Therefore, most of the disturbance associated with the oil and gas exploration, development and production would occur in areas which have been previously disturbed. Those areas of development outside of previously disturbed areas will constitute very small acreage in the overall development.

A. Minerals

The surface developments associated with oil and gas exploration, development and production (well pads, access roads, pipelines, surface facilities, compressor stations, cathodic protection systems, powerlines, etc.) can disrupt the use of other natural resources.

Fruitland gas development will not have an adverse effect on other mineral resources due to the presently enforced casing and cementing programs for all new wells. Present technology makes underground mining of coal uneconomical. Extraction of the methane and dewatering of the formation would be beneficial should mining become feasible in the future.

Basic assumptions for evaluating impacts.

1. State Spacing: 320 acre spacing with 1 in-fill well allowed (effectively 160 acre spacing) for the Pictured Cliffs (PC) and Mesaverde (Mv) formations; 640 acre spacing with 3 in-fill wells allowed (effectively 160 acre spacing) for the Dakota (Dk) formation; and 320 acre spacing for the Fruitland (Fr) formation (2 wells per section).

2. Leased acreage is 166,000 acres, comprising 260 sections of land.

3. Each section of land has a maximum potential of 14 wells (4 PC, 4 Mv, 4 Dk, and 2 Fr), or for 260 sections: a potential of 3,640 wells, or 3,120 potential PC, Mv, Dk wells and 520 potential Fr wells (assuming all wells are for one formation only, i.e., no dual or triple completion wells).

4. Presently (January 1990) there have been 891 PC, Mv, Dk, Gallup, and Paradox wells drilled: 3,120 potential wells minus 891 existing wells leaves 2,229 potential wells yet to be drilled. Likewise, there have been 116 Fruitland wells drilled: 520 potential wells minus 116 existing wells leaves 404 potential wells yet to be drilled. This leaves a total of 2,633 (2,229 + 404) wells yet to be drilled.

5. We have determined each new well, on the average, represents two acres of new disturbance. For 2,633 new wells, a surface disturbance of 5,266 acres (8.2 square miles) will occur. However, based on information provided by industry and historical data, it is estimated that over the next 20-year period, 500 new wells (approximately 400 coal-bed methane wells), will be drilled.

6. Drilling began on the Southern Ute Reservation in 1950 and by 1990 about 1,000 wells had been drilled; this averages approximately 25 wells per year. However, a Federal tax incentive under Section 29 of the Internal Revenue Code has made the drilling and production of non-conventional fuel sources,such as coal-bed methane profitable for industry. Based upon information provided by industry, it appears that the number of coal-bed methane wells that will be drilled, in addition to the 420 wells drilled or in the process of being drilled, is approximately 400.

7. Depletion of the resource.

There will be no adverse impact on other mineral resources if the operator/lessee complies with all requirements of lease/permit/mineral agreement stipulations and the regulations procedures, requirements and orders, as specified by BLM in regards to operational protection of the minerals and water.

Alternative A -- Long term positive impact.

Alternative B -- Long term negative impact.

Alternative C -- Long term positive impact.

B. **Soils**

Soils on wellpads and pipelines are stockpiled for future reclamation procedures, and suffer some degradation due to disturbance and storage in piles. Soils are compacted in place on roads and suffer degradation for the life of the road. Some soils will be lost due to surface runoff during heavy rains, and to airborne dust during high winds and vehicular traffic.

Indirect impacts, like spills of toxic materials on wellpads and roadways, is always a possibility for the lifetime use of these projects and can be detrimental to soil productivity in the short term.

A cumulative impact can be soils in stockpiles and in a compacted state which effectively removes the vegetative habitat for the life of these projects (about 30-50 years). The area lost for vegetation (and resultant animal habitat) is on the order of 1,000 acres (1.6 square miles).

During movement of soil material for fills and stockpiling, naturally developed soil horizons will be destroyed. The mixing of subsoils with topsoils would result in a combination of various soil types. This could cause a potential reduction in soil productivity and result in a loss of vegetation production. Unless all plant species present prior to disturbance are reestablished, species diversity and vegetation stability may be lost. Failure of reclamation may result in weed invasion and soil erosion. Soil lost to erosion will not be recovered.

Alternative A -- Short term negative impact.

Alternative B -- No additional impact.

Alternative C -- Short term negative impact.

C. **Water Resources**

The potentially affected water resource environments may be divided in this report into surface water and ground water resources. Impacts may occur from various facilities (i.e., well facilities, injection stations, compressor stations, gas and water flow lines, access roads, etc.) during the construction and operation phases of oil and gas exploration, development and production.

The potential magnitude and other characteristics of impacts on water resources are highly dependent on the location of facilities in relation to various water resources. Facility locations that may increase the potential for impacts on water resources are:

1. Facilities located within a short distance of streams, rivers, ponds, lakes and drainage and irrigation ditches would decrease the travel time of water, sediments and contaminants.

2. Access road and pipeline crossings of surface water resources.

3. Facilities located in floodplains (e.g., 100 year floodplains).

4. Well pad and other facilities located on steep slopes where excavation (e.g., cut and fill) must be performed.

5. Facilities located in ground water recharge areas.

6. Facilities located near ground water wells used for domestic or stock watering purposes.

7. Adherence to all Federal laws and regulations concerning water resources (Corp of Engineer Section 404 requirements, Clean Water Act, etc.).

It is unlikely that oil and gas development will result in any significant long-term impacts on water resources. One cause of potential water resource impacts from the proposed development is from accidental spills and releases of equipment fuels, lubricants, oil, grease and solvents. These spills may include leaks from storage facilities, fittings, joints, pump jacks, pumps, separators and engines; and potential construction and operation accidents. However, due to the infrequent nature of accidents and the very low volumes of equipment fuels and similar substances used, there appears to be a relatively low probability of substantial impacts to water resources resulting from these types of accidental spills and releases.

Surface Water

Potential surface water impacts would be primarily short-term and result from construction of well pads and other facilities near surface water features, and construction of access roads and pipelines across perennial streams and irrigation facilities. Increased stream flow could result in some channel scour, stream bank erosion and stream alteration. Increased sediment concentrations could decrease water flow capacities of surface water features and increase transport of sediment-based contaminants. However, if all stream and river crossings are completed during low flow periods and appropriate facility locations selected, the magnitude of these potential impacts is not expected to be high.

Additional short-term impacts could result from accidental spills and releases of fuels and lubricants at well pads, compression stations and injection facilities, although such impacts on surface water resources would probably be relatively minor, if any, given the small volumes of materials which are likely to be accidently spilled. The potential impacts on surface water of any proposed surface discharge of produced water will probably be insignificant because the discharge water quality is required to meet applicable water quality standards. There will probably be insignificant increases in stream flows given the fairly low volume discharge of produced waters anticipated for surface discharge. Thus, it is considered likely that continued implementation of oil and gas development would not result in any significant short-term or long-term impacts for both individual or combined facilities. In addition, each site specific project (e.g., well, compression station, pipeline, etc.) will have a site specific environmental document to discuss the specific environmental questions associated with it.

There will be some alteration in stream flow characteristics due to land surface disturbances for construction of roads, drillpads, and pipelines, but the magnitude of such changes will be undetectable in the present flow regimes if proper mitigative measures are followed. Quality changes resulting from increased sediment will occur but again will not be detectable from natural conditions and variability. An unquantified amount of seepage from mud pits may occur, but if the use of toxic or hazardous mud additives is prohibited, there will be minimal impact to groundwater and surface water.

Over the 20 year period of construction of 500 new wells (approximately 400 coal-bed methane wells), it is possible that an accidental release of oil/gas might occur. The potential impacts on water resources from an oil spill is greater than from a gas release. The magnitude of such spills would depend on the location of the release, the quantity of material released, and the timely response to cleanup operations.

Ground Water

Although unlikely, there are three types of potential impacts to ground water resources which may be associated with oil and gas wells, underground injection wells and other associated facilities. These include: (1) impacts on deep ground water quality and changes in potentiometric head in receiving formations due to injection of produced water; (2) cross-contamination between geologic strata; and (3) contamination of shallow water aquifers due to surface activities. The impacts of produced water injection into deep

geologic formations will be insignificant for the following reasons: (1) the produced water quality is good (low dissolved solids and sulfates); (2) there will be fairly large geographic separation between injection wells; (3) there are no nearby wells. Potential cross-contamination of aquifers is unlikely because of the required use of appropriate well construction (i.e., cased well bores, etc.), restrictions on injection pressures, completion of mechanical integrity testing and completion of detailed monitoring of produced and injected water volumes. It is considered unlikely that potential accidental spills would result in any significant effects on shallow groundwater because of the probable low volumes of spilled materials and localized geographic extent of such spills. Thus, it appears likely that the continued development of Tribal lands, both in terms of individual and combined facilities, will have minor, if any, short and long-term impacts on ground water.

At present, disposal wells are completed into the Bluff/Entrada Formation at a depth of 8,500+ feet. Since all disposal wells are designed for "well injection" of waste water, they are subject to the permitting and regulatory control provisions of the Federal Safe Drinking Water Act's UIC program (40 CFR Part 144). The Environmental Protection Agency (EPA) administers and implements the UIC program on the Southern Ute Indian Reservation. A permit from EPA is required prior to drilling of a disposal well. Injection pressures and volumes will be monitored to assure that potable aquifers are not adversely affected by injection of produced water.

Effects to shallow groundwater quality and quantity from dewatering of the Fruitland Formation coalbeds is not expected to be a problem, nor is the injection of these produced waters into deep formations expected to become a problem; however, in some local situations, there may be some deterioration of the groundwater due to these operations (see Appendix E -- BLM study: Report on Impacts to Groundwater in the Northern San Juan Basin from Coal Bed Methane Development). Only close monitoring of water quality and gas well integrity will indicate the development of a problem in the future.

Surface waters may have a slight increase in sediment load due to run off from freshly constructed well pads, roads, and pipelines. Groundwater should not be affected as all freshwater zones penetrated by the well bore are cased and cemented. Withdrawal of produced waters from oil and gas horizons will not affect upper zones as these are effectively sealed off by intervening shale horizons.

There has been considerable controversy in the Bayfield and Bondad, Colorado, area (off reservation) concerning potential impacts to groundwater due to development in the Fruitland Formation, and these same concerns do extend to Fruitland development on the Southern Ute Indian Reservation. The primary concern is the withdrawal of large amounts of produced water from coal seams in the Fruitland Formation, and the reintroduction of these waters into underground formations via injection wells. These concerns have been analyzed in a BLM study entitled "Report on Impacts to Groundwater in the Northern San Juan Basin from Coal Bed Methane Development (see Appendix E)."

The possibility of degradation of fresh water aquifers occurring, if cathodic protection wells are not installed correctly or if they are in communication with adjacent well(s) due to poor

construction, exists.

Leaking reserve pits and trucks carrying produced waters making unauthorized discharges into washes and rivers are always a potential hazard.

There will be siltation of adjacent stream channels due to surface runoff from newly disturbed surfaces due to well development. As mitigative measures tend to minimize siltation downstream, the cumulative effect would be negligibly incremental. There have been no identified impacts to the groundwater.

Alternative A -- Minimal long term additional impact.

Alternative B -- No additional impacts.

Alternative C -- Minimal long term additional impact.

D. **Wildlife**

With few exceptions, the construction of and operation of the physical facilities of oil and gas development (well pads, roads, compressor stations, pipelines, etc.), pose little threat to wildlife. Wildlife is stressed in the areas during immediate construction and during the drilling phases of operations. The main problem that directly impacts wildlife is hunter access, both legal and illegal, via the roads constructed for oil and gas development. The effect of human disturbance on big game has not been well documented. Deer apparently readily adapt to roads and regular human activity. Elk are less tolerant of human disturbance. While they readily adapt to a regular pattern of human activity, elk seem to prefer to maintain a one-half mile buffer between themselves and regular activity such as vehicle traffic, camping and other recreational activities. The BLM studies conducted (1984) on 50 miles of reseeded pipeline showed that more deer and elk were found to associate with pipelines than other open areas. The impact of oil and gas development on non-game species cannot be quantified at present.

Although the potential loss of 1,000 acres may appear large, individual wellsites will be scattered over the entire reservation and will not be grouped into concentrated areas. The cumulative effect will be primarily the reduction of available forage and shelter, with the resultant reduction in animal populations. With the attendant human access and vehicular traffic, increases in animal stress can be expected. However, reseeded areas will tend to have increased animal association due to increased forage, edge effect and increased hunting pressure.

Activities associated with vegetation removal will destroy wildlife habitat in varying degrees and could result in a decrease of certain species. Siltation of streams and other surface impoundments that provide fish habitat may occur with the onset of activities associated with land clearing. Surface waters that now support fish populations may experience water quality degradation, thus resulting in lowered productivity of selected fish species. Additionally, new access roads open up areas to human accessibility putting additional stress on wildlife as well as facilitating hunting and poaching activities.

Alternative A -- Minimal long term additional impact.

Alternative B -- No additional impacts.

Alternative C -- Minimal long term additional impact.

E. Vegetation

Impacts on vegetation results from construction and operation of oil and gas exploration, development and production facilities and use (e.g., wellpads, pipelines, access roads, etc.). Impacts could be positive or negative, long-term or short-term and direct or indirect.

The following specific aspects of construction and operation of oil and gas facilities could result in impacts on vegetation:

1. Construction

    a. Clearing of areas for facilities (site preparation).

    b. Generation of fugitive dust.

    c. Release of gaseous emissions (exhaust) from construction equipment.

    d. Accidental release of fuels, lubricants and similar materials.

    e. Air drilling without a mister on "blooie line" resulting in the vegetation being covered with dust leading to death of vegetation.

2. Operations

    a. Emissions from oil and gas facilities (pump jacks, compressor stations, etc.).

    b. Accidental release of fuels, lubricants and similar materials.

    c. Blow down lines cover vegetation with condensate.

The indirect impacts are that the loss of 1,000 acres of vegetation would reduce the available forage for livestock and wildlife.

The cumulative impact is the net loss of 1,000 acres for 30-50 years. Both short-term and long-term removal of the natural vegetation or crop and forage plant species will probably increase noxious weed infestation.

Well, pipeline, support facilities and road development activities will result in the short term removal of approximately 1,000 acres of vegetation. The majority of the areas where vegetation is removed will be reseeded and should begin revegetation within two years

Alternative A -- Minimal short term additional impacts.

Alternative B -- No additional impacts.

Alternative C -- Minimal short term additional impacts.

H. Resource Use Patterns

Effects on general land use would result if oil and gas exploration, development and production activities substantially:

1. Displace, alter or otherwise physically affect any existing, developing or planned residential, agricultural, commercial, industrial or institutional use or activity.

2. Displace, alter or otherwise physically affect any existing or planned utility line or facility.

3. Displace, alter or otherwise physically affect any existing or planned communications facility or communications-related facility.

4. Displace, alter or otherwise physically affect any existing or planned air facility or air travel-related facility.

5. Affect applicable general and regional plans and/or approved, adopted or officially stated policies, goals or operations of communities or government agencies.

The terrain of the Southern Ute Indian Reservation is predominately mountainous with elevation ranging from a low of 5,940 feet to 9,159 feet. The drainage is predominately north/south. The valleys are mostly narrow and often relatively sloping. Due to the nature of the land, development of the reservation (Tribal and fee) tends to be concentrated in these valleys. Man made improvements (major roads, powerlines, pipelines, communications lines, etc.) have been aligned along these corridors. This has resulted in the use of the available water courses, irrigated and arable lands being utilized due to construction convenience.

Information on certain direct effects of constructing individual and combined facilities on agricultural lands, including grazing, irrigated croplands and non-irrigated croplands is presented in the soils and vegetation sections. The primary direct effect evaluated includes coverage of these types of land use areas with oil and gas facilities.

Relatively minor short-term effects may also occur, including minor interference with farming operations caused by vehicular use of existing roads and access roads (increase in traffic volumes and in traffic disruption, road degeneration, generation of dust and dirt, etc.), inappropriate opening and closing of gates resulting in the unintended movement

after development. The degree and extent of reclamation success is highly variable and is again dependent on a number of variables (i.e., soil type and condition, type, time and amount of precipitation, slope, north and south exposure, etc.). Additionally, little if any vegetation is likely in areas that were previously limited in the type and amount of vegetation occurring at that site or location.

Alternative A -- Short term negative impact.

Alternative B -- No additional impacts.

Alternative C -- Short term negative impact.

F. Forestry

The environmental consequences of the proposed action can lead to loss of woodland acreage within management units 3, 4, and 6. This could lead to a possible loss of acreage and the loss of cash returns for use of that acreage. Forest products that come from road construction, wellpads, right-of-ways and other oil and gas development should be rated for their cash returns to the Tribe.

Slash treatment, fuel build-up and insect build-up in debris from clearing land for oil and gas development needs to be dealt with.

Alternative A -- Minimal long term additional impacts.

Alternative B -- No additional impacts.

Alternative C -- Minimal long term additional impacts.

G. Air Quality

The direct impacts to air quality are that the air quality would be lowered because of exhaust emissions from moving vehicles and operating drilling rigs, from vehicular traffic on dirt roads, dust from drilling and blowing dust from all disturbed surfaces such as well pads, access roads, and newly constructed pipelines.

At any given time, drilling rigs could be miles apart from one another and resultant degradation of air quality would be minimal and of short duration (usually 7 to 14 days). With storm systems traveling through the area any accumulating pollutants will be dispersed to below detection limits.

Some short-term air pollution emissions of total suspended particulates, hydrocarbons, and hydrogen sulfide are expected in the development and production phases of oil/gas activities. Additional minor automotive and engine exhaust emissions are expected. The impact of these emissions on the ambient air is limited, and proposed mitigation measures and the use of best available operating practices will minimize their impact.

of domestic livestock, and similar types of effects.

Regional recreational resources are also not considered likely to be adversely affected to a substantial degree.

Alternative A -- Minimal long term additional impact.

Alternative B -- No additional impacts.

Alternative C -- Minimal long term additional impact.

J. Threatened and/or Endangered Species

The only threatened, endangered or candidate species which could be affected by the proposed development are the bald eagle and the Knowlton Hedgehog Cactus.

Alternative A -- Minimal long term additional impact.

Alternative B -- No additional impacts.

Alternative C -- Minimal long term additional impact.

K. Socioeconomic

While the overall size of the project is large, the actual number of workers is small. Local inhabitants would be employed in a few new job positions, primarily for maintenance of facilities. Some local inhabitants may be unhappy with oil and gas development near their residences, and some may be unhappy with the overall development.

The Tribal government will receive tax revenues from severance tax and other taxes and fees on production.

The cumulative impact if all 500 wells were developed, considerable tax revenues would be generated. Individuals having new jobs would be benefited. Individuals who felt they were being negatively impacted would be unhappy with the reduction in their quality of life.

Alternative A -- Long term positive impacts.

Alternative B -- Long term negative impacts.

Alternative C -- Long term positive impacts.

L. Archeological

Although archaeological surveys are held prior to approval, hidden subsurface materials may be inadvertently destroyed during construction activity.

The indirect impacts are that during construction activities any nearby archaeological sites may be vandalized by individuals visiting the work areas. Even after construction the area may be visited by unauthorized individuals intent on searching for new archaeological materials for their own personal use.

The cumulative impact can be, depending on the density of archaeological materials in the 1,000 acres of expected surface disturbance, some loss of archaeological materials can be anticipated over the 20 year period.

New roads open up areas to human accessibility which will allow potential access to archaeological sites. Although oil/gas operators prohibit their personnel and contractors from disturbing archaeological materials, and non-Indians not having business on the reservation are prohibited from entry on Indian lands, archaeological disturbance as "pot-hunting" occurs on occasion.

Alternative A -- Long term negative impacts.

Alternative B -- No additional impacts.

Alternative C -- Long term negative impacts.

M. Resource Related Pests

Most weeds will out compete crops and thus reduce the quality or quantity of a yield. Some will make an area useless for recreational activities or destroy the esthetics of an area.

Many weeds found on the Southern Ute Indian Reservation have been either intentionally or unintentionally imported from other countries. Many of these plants are not considered especially troublesome in the country of origin because their native natural ecosystem had a natural balance which kept them under control. When these plants were imported to new environments, many had few, if any, natural enemies.

There is no area on the Southern Ute Indian Reservation that can be generally considered weed free, however, the areas that have had the least disturbance by man have fewer weed problems. Agricultural areas, well pads, and pipelines, roads and even intensively used rangelands are all locations where new infestations can start. We have several areas on the reservation that have especially high populations of one or more variety of noxious weeds.

Various insects (e.g., bark beetles) spreading from road clearing debris, pipeline clearing debris and other land clearing activities that produce piles of debris can cause serious problems.

Alternative A -- Long term negative impacts.

Alternative B -- No additional impacts.

Alternative C -- Long term negative impacts.

N. **Other Values**

Visual Resources/Noise.

Visual and noise impacts will increase significantly during lease/permit/mineral agreement development. Although most of these impacts will stop or be significantly decreased after wells are drilled and completed, some long term impacts will remain. Greatest impacts will be in the few previously undisturbed areas and developed recreation areas. Noise generated by compressors could result in a decreased visitor enjoyment of recreation areas. Although mitigation measures will be implemented to limit the visual location of wells, it is projected that a limited number of well pads, facilities and/or roads could result in a significant break in line, color, topographic features and vegetative cover. Once constructed, these impacts could not be mitigated and are, therefore, considered irreversible visual impacts. The extent of the impact will be dependent on the final location of either the well pad, facility and/or road.

It must be pointed out that the total acreage involved in this possibility is very small and cumulatively insignificant.

Alternative A -- Minimal long term additional impact.

Alternative B -- No additional impact.

Alternative C -- Minimal long term additional impact.

<IMPACTS QUANTIFIED>

Cumulative impacts from oil and gas development in the New Mexico portion of the San Juan Basin have been recently evaluated by BLM (BLM, 1990). A similar analysis has been conducted by BLM for Tribal lands on the Southern Ute Indian Reservation (BLM, 1990). Both studies have determined, based upon the oil and gas development being conducted within an already developed area, that additional cumulative impacts are minimized to the point of being negligible.

The majority of the cumulative impacts that have occurred on the Southern Ute Indian Reservation since the 1950's (and in the foreseeable future) have been related to the development of the Tribe's energy resources. Within the exterior boundaries of the reservation there are approximately 1,700 wells, of which approximately 1,000 (60 percent), and all the related support facilities (roads, pipelines, powerlines, gathering systems, etc.) have been constructed on Tribal and allotted lands within the reservation. Utilization of presently disturbed areas for well pads, pipelines, powerlines and other support facilities as well as the continued reclamation effort, will minimize additional cumulative impacts to the point of being negligible.

Residual impacts are those which remain after reclamation of abandoned wells, facilities and roads. They would consist primarily of small areas which would not successfully revegetate. There is no way of estimating total acreage which would not return to native vegetation. However, the significance of this impact in relation to the value of the oil/gas extracted is considered very small.

Visual impacts of wells, facilities and pipelines places in areas of extreme topography will remain for an unknown period of time.

The additional 400-500 new wells predicted to be drilled over the next 20 years will represent a very small contribution to cumulative impacts on the Southern Ute Indian Reservation. While an additional 400-500 wells seem to be a major impact, the impact is expected to be minimal for the following reasons: 1. The oil and gas exploration, development and production will be in existing areas of development or adjacent to such areas, and 2. Those areas of development outside of previously disturbed areas will constitute very small acreage in the overall development.

Alternative B, the No Action Alternative has been discounted due to the fact that it would preclude the Tribe from developing its natural resources for the benefit of its members.

The selection of Alternative A (full development) over Alternative C (limited or restricted development) is based upon the conclusion that the cumulative impacts of these alternatives are basically the same (see Evaluation and Comparison of Alternatives on page 8). Under Alternative B, though parts of the reservation that would be restricted would be restricted due to archeological, cultural, historical, human or environmental concerns. It has been determined that the present federal regulations in place adequately protect the archeological, historical and cultural resources. The federal government through its field agencies (BIA, BLM, USFW, EPA, etc.) are responsible for the protection of the environment and other resources of the Tribe. With the implementation of all mitigation measures as described within this EA and the enforcement of federal regulations and laws by those federal agencies responsible for such enforcement, the selection of alternative A will allow the Tribe to develop their mineral resources while at the same time protecting the other resources that will be affected by this action.

The primary source of revenue for the Southern Ute Tribal Government is the oil and gas operations and enterprises on Tribal lands. Proper management of the Tribe's resources will assure prosperity and an environmentally sound reservation in the future.

V. MITIGATION

Post lease/permit/mineral agreement mitigation is implemented through stipulations attached to the lease/permit/mineral agreement and the site-specific environmental documentation (i.e., APD, specific seismic permit EA, Right-of-Way EA). As impacts are identified in the site specific environmental documentation, changes in the proposal are considered and implemented if possible: pads are rotated to avoid major cuts and fills, corners of pads are rounded to avoid large cuts, pads and roads are moved to avoid archaeological sites, pads and roads are moved to take out a minimum of trees, locations are moved to save rangeland, locations are moved to

use existing nearby pads and roads, steep hillsides are avoided when feasible, tree screens are left in place to hide locations from distant viewing, existing operable stockponds are left undisturbed, riparian and wetlands are avoided at almost all costs and reserve pits are prohibited near such areas (steel tanks substitute), locations are moved away from nearby residences, locations and access roads are moved so that irrigated fields are not unduly disrupted, major drainages are protected by adequate culverts or bridges, locations are protected from floodwaters by adequate drainage ditches around the location and reserve pits, 6 to 8 inches of topsoils are required to be stockpiled for use in later reclamation of the wellpad, proposed wellpads and reserve pits are reduced in size where applicable, and timber is required to be salvaged by cutting into post and firewood lengths with slash to be chipped and scattered.

In addition to site-specific Tribal stipulations being attached to each lease/permit/minerals agreement as conditions of approval for surface use, in those instances where subsurface archaeology is suspected, archaeological monitoring is required for all initial surface disturbing activity. Also required is 48 hour notification to the Tribe, BIA, and BLM prior to initial surface disturbing activity so that this work can be monitored.

A general mitigation recommendation is that a comprehensive monitoring program be developed for the reservation, by BIA and BLM, to assess the effectiveness of mitigation in the oil and gas program.

Although well pad dimensions vary, an average size is 300 feet long by 250 feet wide, disturbing about 1.7 acres. An average new access road would be about 300 feet long and 20 feet wide, disturbing an additional 0.2 acre. Associated pipelines would parallel existing roadways for an additional disturbance of 0.2 acre. This totals to about an average of 2 acres surface disturbance for each new well.

On any given site, the order of construction is:

1. Remove all salvageable wood products for fence posts and firewood.
2. Chip and scatter all slash material (limbs and small branches).
3. Strip and stockpile 4 to 6 inches of topsoil.
4. Construct wellpad, reserve pit, and access road.

The drill rig is moved onto location and drilling operations begin. Upon completion of drilling, well casing is set, and drill rig moves out.

A smaller drilling rig (completion rig) moves on location to complete the well (usually perforates the casing in the production zones, fractures the producing formations if needed, and sets production tubing).

Generally, after the completion rig moves off location, production equipment (heater treaters, dehydration units, water and/or oil storage tanks, compressor units, and meter runs) are set up and made operational. Pipelines are constructed to the well site so that produced gas and

produced water can be removed from location.

When the reserve pit is dry, it is reclaimed (filled in, contoured, topsoil spread, and reseeded), and those portions of the wellpad not needed for production are also reclaimed.

When the well is exhausted, it is plugged downhole with cement, all surface equipment is removed, and a dry hole marker is placed over the wellbore. Stockpiled topsoil is spread across the wellpad and reseeded, and the access road is reclaimed by similar procedures.

A. **Minerals**

No additional mitigation measures are required.

B. **Soils**

Reclamation and erosion control measures can be used to mitigate high to low levels of impacts on soils resulting from construction and operation of proposed facilities. The following mitigation measures should be employed on a site/soil-specific basis. Soils that are identified as being susceptible to high levels of impact. Those occupying steep slopes, have high susceptibility to erosion, and/or being poorly suited for reclamation/revegetation should receive particular emphasis. Possible measures to minimize disturbance, stabilize disturbed soil materials to reduce soil loss due to erosion, revegetate disturbed areas and restore soil productivity during and following facility construction are:

1. Selective salvage and replacement of topsoil for agricultural lands and those lands for which the landowner requests that topsoil be salvaged and replaced.

2. Construction or placement of erosion control features to limit the steepness and length of slope (e.g., water bars, terraces, rip rap, sand bags, or straw bales for temporary control).

3. Grading of disturbed areas to contour.

4. Soil which has been excavated during construction and not used should be evenly backfilled into the cleared area or removed from the site. The soil should be graded to conform within the terrain and the adjacent land.

5. Dumping of excess material or material on downhill slopes should be minimized.

6. Replacement of earth adjacent to water crossings should be at slopes less than the normal angle of repose for the soil type involved.

7. Cut and fill slopes should be rounded to break sharp unnatural edges formed at the contact point between the constant-pitch out-slope and the rounded

natural landform (BLM, 1982).

8. Preparation of the surface soil to receive seed, including ripping/chiseling, surface roughing and tilling across slope.

9. Seeding with a seed mixture of adapted grass or other plant species approved by BIA.

10. Addition of soil amendments, including fertilizer, and use of appropriate seeding methods (e.g., drill seeding and broadcast seeding) to aid in the development of a positive growth medium.

11. Mulching with straw, hay or wood fiber.

12. Crimping of hay or straw mulch on the contour into the soil or tacking netting over an organic mulch on steeper, more erodible slopes to hold the mulch, soil and soil moisture.

13. Monitoring of disturbed areas to identify potential soil instability or erodible areas and to implement the necessary mitigation measures to restabilize the soils.

14. Mandatory control of noxious weeds on all disturbed areas.

Reclamation and revegetation will be done as rapidly as possible to protect the soil.

No surface disturbance will be allowed in areas with slopes exceeding 25 percent unless the lessee/operator and BIA arrive at an acceptable plan for mitigation of anticipated impacts. The plan must be prepared prior to development of the site and will become a condition for approval when authorizing the action.

C. Water Resources

Potential mitigation measures for surface and ground water resources are grouped together based on their interdependence, but have been divided into six categories: general, construction, operation, control measures, monitoring and spills. The potential mitigation measures are presented below.

General

1. Ensure that all applicable water quality standards are met.

2. In accordance with existing regulations, monitoring and mitigation of injected water remains under EPA control (a permit for a disposal well is required from EPA).

Construction

1. Witness casing cementing to ensure that the fresh water zones are protected.

2. Avoid construction activities near or through irrigation systems during the growing season.

3. Minimize time of construction and any temporary water diversions and revegetate as quickly as possible.

4. Avoid construction activities near or through streams during high flows or rainfall events.

5. For road and pipeline stream crossings, minimize the time and area of disturbance and stabilize immediately.

6. Cathodic protection wells monitored and placed in deeper zones to protect fresh potable water zones and cement other zones.

7. Divert all surface runoff around facilities.

8. Utilize special erosion control measures for all well pads cut into hillslopes.

9. Route surface runoff from drilling locations into reserve pits.

10. Use fabric filter of various types as appropriate, to reduce erosion and sedimentation.

11. Well pits should be placed on the upslope (cut) portion of the pads.

12. All pits on Fruitland wells will be sealed or lined.

13. Stay out of floodplains -- Floodplains Protection Act.

Operation

1. Use care when conducting fuel or chemical transfers within 0.25 mile of streams, rivers, ponds or lakes.

2. Place strict control on materials placed in reserve pits used for drilling.

3. Since snowmelt can contribute significant material input into streams, contain all spills during winter months.

Control Measures

1. Riprap stream beds as needed for road (culvert) crossings of ditches and streams.

2. Maintain or seed vegetation on runoff ditches.

3. Riprap stream beds and seed vegetation as needed.

4. Gravel all roads that have heavy truck traffic.

Monitoring

1. Sample and analyze water quality of produced water on a routine basis.

2. Conduct site inspections during periods of high rainfall, runoff and stream flow to evaluate potential effects of erosion, sedimentation, leaks and spills.

3. Conduct routine maintenance checks and site inspections of facilities to examine for potential erosion problems and spills or leaks.

4. For buried produced water pipelines, provide control/evaluation to ensure no leakage is occurring.

5. Monitor injection wells for integrity and compliance.

6. Witness casing and plug and abandon cementing jobs.

Spills

1. Develop and implement a Spill Contingency and Response Plan, including specific containment, clean-up and mitigation procedures.

2. Provide spill control measures.

D. **Wildlife**

In addition to the use of good construction practices, implementation of the following mitigation measures is recommended:

1. Compliance with regulatory requirements of the U.S. Fish and Wildlife Service and other relevant resources management agencies.

2. If practicable, avoid conducting exploration, development or production operations in important wildlife habitat types.

3. If practicable, avoid conducting activities during wildlife critical use periods in important habitat types.

4. Revegetate all disturbed areas following disturbance according to BIA requirements.

5. Conduct work in streams in a manner that minimizes siltation and erosion, including minimization of areal and temporal disturbance, and use of specific control measures.

6. If practicable, avoid placement of facilities in habitat that support special plant species and sensitive and valuable vegetation types, including wetland/riparian areas.

7. Limit construction clearing in woodland areas to trimming or crushing whenever possible.

8. During construction in shrubland and woodland areas, pile some of the cleared or clipped vegetation from construction areas in small thickets located off of the area to provide cover for displaced animals.

9. Utilize erosion controls during construction activities.

10. Limit off-road vehicle use.

11. Prohibit the use of firearms to reduce potential poaching activities by workers.

12. Complete revegetation of disturbed areas with fast-growing plant species as appropriate for short term soil stabilization.

13. Control dust during operations.

14. Avoid placement of construction lay-down areas at stream crossings, and wetland/riparian and other sensitive areas.

15. Install pipelines in a manner to restore the topsoil and associated seed source when backfilling.

16. Minimize the spread of noxious weeds with annual mandatory control measures.

17. Potential adverse construction impacts to streams and irrigation ditches and rivers may be significantly reduced by completing during periods of little or no flow.

18. Minimize erosional processes at streams and river crossings by stockpiling trench spoils above full-bank elevations.

19. Stabilize excess material at streams and rivers in place or remove off-site.

20. Place pipe below channel scour depths in streams and rivers to avoid partial diversion of channel discharges.

21. Complete fueling and lubrication away from aquatic environment.

22. Periodically check all equipment for leakage to avoid spills. Employ off-site mitigation where needed to compensate for habitat lost to oil and gas development.

The basic premise of off-site mitigation is that the impacts from oil and gas development extends beyond the immediate area of surface disturbance. Therefore in order to compensate for the reduction of habitat quality caused by the development, habitat improvements are conducted elsewhere to increase habitat values to offset values lost.

E. Vegetation

Existing stipulations provide for the reclamation of disturbed areas. Increased monitoring is required to determine if reclamation is successful.

Some general stipulations for minimization of disturbance:

1. During construction, clearing of land for facilities or structures should create curvilinear boundaries instead of straight lines and minimize disturbance of the landscape (BLM, 1982). Grading should be done in a manner which will minimize erosion and conform to the natural topography (USFS, 1977).

2. The clearing of trees and vegetation for oil and gas facilities should be limited to the minimum area required. Feather and thin edges of vegetation.

3. To the extent possible, all foliage adjacent to the site should remain undisturbed to provide maximum screening of the facility.

4. Brush or small trees cleared and not otherwise disposed of may be spread in a way to provide cover habitat for small animals, reptiles and birds. Woody materials should be randomly placed particularly in downslope fill areas to conform to adjacent vegetation patterns. It should be noted that material larger than 6" will provide breeding areas for bark beetles.

5. All timber and other vegetation material without value should be mechanically chipped and spread in a manner that will aid seedling establishment and soil stabilization.

F. Forestry

In woodland areas all exploration, development and production sites are to be regenerated (or portion thereof) as work is completed.

G. Air Quality

Mitigation measures:

1. Require a mister on the Blooie line.

2. Require an ignitor on the Blooie line.

H. **Resource Use Patterns**

Mitigation measures:

1. Comply with all BIA, BLM and tribal lease/permit/mineral agreement requirements concerning general agricultural and other land use issues.

2. Avoid placement of oil/gas facilities in areas of irrigated agriculture to the maximum extent possible.

3. Locate facilities on the edges of irrigated and non-irrigated agricultural lands to the maximum practicable extent to reduce direct and indirect effects on agricultural resources and operations.

4. Minimize crossings or other direct effects on agricultural irrigation facilities, including water canals, ditches, pipelines and other water conveyances to the maximum practicable extent.

5. If irrigation and other agricultural (e.g., fences, gates) facilities are damaged, repair or replace the facilities according to landowner requirements.

6. Minimize oil/gas-related construction equipment movement off specific access roads to avoid disturbance of agricultural and other lands.

7. Repair, maintain and gravel all access roads used for project related traffic.

I. **Threatened and/or Endangered Species**

Current stipulations as applied are adequate to protect Federal threatened or endangered species as no actions are allowed which would result in a Section 7 "jeopardy opinion". All site specific environmental documents will address protection for all known habitat of threatened and/or endangered (T/E) species on the reservation.

J. **Socioeconomic**

Given the positive socioeconomic effects of the project, mitigation, enhancement and protective measures are not pertinent. An effort will be made to use the Tribal work force and local materials and supplies whenever possible.

K. **Archeological**

The Albuquerque Area Office, BIA, policy with regard to compliance with Section 106 of the National Historic Preservation Act and the Archeological Resources Protection Act will

be adhered to prior to specific oil and gas development activities. This includes Application Permit to Drill (APD), access roads, pipelines, gathering systems, re-injection wells, waterlines, compressor stations, storage tanks, and all other related activities. The third party applicants will provide for all cultural resources surveys of project areas of impact to identify cultural resources. This will include acceptable reports of these surveys. All activities necessary to protect, monitor or test identified sites will be provided by the applicant. The report review and compliance process will be completed by the Albuquerque Area Office.

All known cultural resources will be protected by providing a buffer zone, and if necessary, temporary protective fencing will be placed around a portion of identified sites. Operators who damage sites outside of designated project areas or right-of-ways, or who fail to take proper site avoidance measures as prescribed, may be subject to civil penalty assessments for site damages under the provisions of the Archeological Resources Protection Act. If any previously unidentified cultural resources are encountered during construction activities, then all work in the immediate vicinity of the find must be halted, and the Albuquerque Area Archaeologist notified.

L. Resource Related Pests

Possible solutions to the weed problem:

1. The Land Use Code must require that the land user make a conscientious effort to control weeds. A way must be achieved to enforce this provision.

2. Weed control around wells, pipeline, oilfield access routes and right-of-ways will be mandatory for gas and oil companies inside the Reservation boundary.

3. Provide education to land users in cultural and mechanical techniques that along with chemical, are part of a well rounded weed control program.

4. Improve cooperation with adjacent land users and weed control district where a joint weed problem exists.

5. Encouragement of land users to utilize the counties' chemical cost share program.

M. Other Values

The following stipulations will be employed to reduce visual impact:

1. To the maximum extent possible roads and facilities will be:

   a. Located away from populated areas, parks, scenic areas, hilltops, natural and man-made structures and prominent natural features such as distinctive rock or land forms, rivers, stream or arroyo crossings and other landmarks.

   b. Located to avoid crossing hills and ridges to avoid silhouetting unless

alternative location will result in greater disturbance.

c. Facilities should be located to use natural screens of vegetation or existing topographic features.

d. For sloping terrain, a multiple level, terraced facility plan should be considered to minimize excavation and provide a facility that would blend effectively. Near travel routes, facilities should be located part way up the slopes to provide a background of topography and/or natural cover when possible. Screen these facilities from highways and other areas of public view with natural vegetation and terrain.

e. Where placement of a facility is necessary in a hilltop area, consider locations on the slope or brow of a hill to allow minimum silhouette or skylining.

f. Facilities in general should be placed strategically to make maximum use of existing topography and vegetation for screening. Utilize the edge effect for facility placement along natural vegetation breaks.

g. Facilities should be located at the base of slopes when feasible to provide a background of topography and/or natural cover.

2. Within recreation areas all equipment with engines or motors will be equipped with quiet design mufflers (hospital grade or dual dissipative) or other noise abatement equipment or housed in acoustically insulated structures.

3. On roads with high potential for vehicle accidents, it is recommended that signs be placed warning public of heavy truck traffic.

4. Color (hue) of facilities is most effective within 1,000 feet (Johnson et. al., 1970). Beyond that point, the hue becomes indistinguishable and only the value of the color can be expected to have any appreciable effect. When viewed from the shaded side, a facility structure appears a dark silhouette and generally its color is indistinguishable. Consideration should be given to coloring facilities to blend with the landscape. This is particularly significant in or near areas of high scenic value.

V. CONSULTATION AND COORDINATION

A. Personnel

George R. Tetreault, Jr.
Chief, Minerals Section
Albuquerque Area Office

Ken Young
Petroleum Engineer
Albuquerque Area Office

Don Wickman
Soil Scientist
Southern Ute Agency

John Montgomery
Realty Officer
Southern Ute Agency

Charles Recker
Supervisory Forester
Southern Ute Agency

Fredrick Ellenbecker
Range Conservationist
Southern Ute Agency

Jim Formea
Natural Resource Manager
Southern Ute Agency

B. Consultation/Coordination

Southern Ute Indian Tribe
Ignacio, Colorado

Southern Ute Agency
Ignacio, Colorado

Bureau of Land Management
San Juan resource Area
Durango, Colorado

Bureau of Indian Affairs
Albuquerque Area Office
Branch of Natural Resource Services

Bureau of Indian Affairs
Albuquerque Area Office
Branch of Regional Water Rights Protection

Bureau of Indian Affairs
Albuquerque Area Office
Environmental Quality

C. Bibliography

Environmental Analysis of Oil and Gas Leasing - Southern Ute Reservation, January 28, 1974

Assessment, Inventory and Marketing of the Oil, Gas and Coal Resources of the Southern Ute Indian Reservation, Southern Ute Indian Tribe, Colorado, The Southern Ute Indian Tribe Energy Resource Division, Year One Final Report, June 30, 1989

Southern Ute Indian Tribe Natural Resource Management Plan, Planning Period 1990-2010, ANA Planning Committee, March 27, 1990

Final Comprehensive Natural Resource Analyses, Southern Ute Indian Reservation, Ignacio, Colorado, Dames and Moore, Golden, Colorado, December 7, 1987

Fruitland Coal Gas EA, Farmington Resource Area, Bureau of Land Management, Farmington, New Mexico, November 8, 1988

Environmental Planning Document, San Juan Basin Degas Project, Amoco Production Company, Woodward-Clyde Consultants, Denver, Colorado, March 1988

Environmental Assessment, Northwest Pipeline Corporation San Juan Basin Project, Bureau of land Management, Bureau of Indian Affairs, Southern Ute Agency, May 1990
Environmental Analysis, Oil and Gas Development, Southern Ute Indian Reservation, Archuleta, LaPlata and Montezuma Counties, Colorado, Bureau of Land Management, San Juan Resource Area, January 25, 1990

Preliminary Environmental Assessment for Proposed Seismograph Lines, Straw Dome 1-5; Barker Dome 1-2, Southern Ute Indian Reservation, LaPlata County, Colorado, Conducted for Reliable Exploration, Ecosphere Environmental Services, March 30,1988

Environmental Assessment, Pinkerton Mesa Gas Development, Southern Ute Indian Tribe, Energy Resource Department, March, 1988

Bowen/Edwards Associates, Inc., Indian Creek and Bridge Timber Mountain Coal-bed Methane Projects Environmental Assessment, Southern Ute Agency, BIA, July 1990

Soil Survey of LaPlata County Area, Colorado, United States Department of Agriculture, Soil Conservation Service

Coal Resources of Upper Cretaceous Fruitland Formation in the Southern Ute Indian Reservation, Archuleta and LaPlata Counties, Colorado, Administrative Report BIA-19 II D, 1988

Geologic Framework of Precambrian to Jurassic Rocks, Southern Ute Indian Reservation, Southwest Colorado, Administrative Report BIA-19 II A, 1987

Framework Geology of Cretaceous and Tertiary Rocks on the Southern Ute Indian Reservation and Adjacent Areas in the Northern San Juan Basin, Southern Colorado, Administrative Report BIA-19 II B, 1987

Distribution of Coal Beds in the Upper Cretaceous Menefee Formation in the Southern Ute Indian Reservation, Archuleta and LaPlata Counties, Colorado, Administrative Report BIA-19 K, 1988

Composition and Origin of Natural Gases, Southern Ute Indian Reservation and Vicinity, Southwestern Colorado, Administrative Report BIA-19 II J, 1988

Geology and Coal-Bed Methane Resources of the Northern San Juan Basin, Colorado and New Mexico, S.U.I.T.-R.M.A.G.--Coal-Bed Methane--1988

VII. LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

Southern Ute Indian Tribe
Ignacio, Colorado

Southern Ute Agency
Bureau of Indian Affairs

Bureau of Land Management
San Juan Resource Area

Bureau of Land Management
Montrose District

Bureau of Land Management
Colorado State Office

Bureau of Indian Affairs
Albuquerque Area Office
Branch of Natural Resource Services

Bureau of Indian Affairs
Albuquerque Area Office
Branch of Regional Water Rights Protection

Bureau of Indian Affairs
Albuquerque Area Office
Environmental Quality

Bureau of Land Management
Farmington Resource Area

U. S. Forest Service
San Juan National Forest
Durango, Colorado

Bureau of Reclamation
Durango, Colorado

Division of Energy and Minerals
Bureau of Indian Affairs
Golden, Colorado

U. S. Fish and Wildlife Service
Department of the Interior
Denver, Colorado

Prepared By:

George R. Tetreault, Jr.
Chief, Minerals Section
Albuquerque Area Office

Concurred By:

John Montgomery
Realty Officer
Southern Ute Agency

Concurred By:

James J. Formea
Natural Resources Manager
Southern Ute Agency

Approved By:

Ralph R. Pensoneau NOV 2 0 1989
Superintendent
Southern Ute Agency

VIII. APPENDIX

APPENDIX A

ENVIRONMENTAL ANALYSIS OF OIL AND NATURAL GAS LEASING AND DEVELOPMENT ON SOUTHERN UTE INDIAN RESERVATION

I. DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the leasing of Federal Trust, Southern Ute Indian lands for the purpose of exploration and extraction of natural gas and/or oil. The proposed action includes Southern Ute lands extending north about 15 miles from the New Mexico state line, from the La Plata County Colorado western edge easterly to the middle of Archuleta County Colorado into Range 1 West. Please refer to enclosed reservation map.

Environmental degradation may result from one or more of the following phases of oil and gas exploration and development.

A. Exploration. Searching for oil and gas is either by drilling and dynamiting holes or by using vibrating machinery on the surface. Both methods use a straight-line technique which requires a certain amount of trail construction for equipment movement.

B. Drilling for Production. If exploration indicates the presence of gas or oil, drilling will likely follow. Bringing heavy drilling equipment, requiring secondary road construction and the leveling of a drilling site, involving an area of 300 feet by 200 feet for gas and up to a 2 acre site for oil drilling.

C. Harvesting the Gas or Oil. If the well is a producer, transportation of the gas or oil from the well to the refinery will be necessary. This will involve truck hauling or the laying of a pipeline about three feet beneath surface to an existing collecting system for gas or new pipelines should adequate pools of oil be found.

D. Abandonment. After production declines below economical levels, facilities will be removed and the surface restored.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non-Living Components. The area generally lies in the foothills of the San Juan Mountains which lie to the north of the eastern half, with elevations as high as 8500 feet, and the foothills of the La Plata Mountains which lie to the north of the western half, with elevations as low as 5000 feet. The topography of the eastern half is generally low mountains, disected by moderately wide stream valleys and some small rolling topped mesas.

The western half is marked by steep to rolling topography with broad stream valleys and broader flatter topped mesas. This area presently has a proven producing gas field, one unproducing oil well and one low production oil well near the settlement of Marvel, not on Southern Ute lands.

The Reservation is disected by five clear watered rivers; the San Juan, Piedra, the Pine, Florida, Animas and the La Plata, all originating in San Juan and La Plata Mountains to the north and flowing generally southward into New Mexico.

The high crags and escarpment tops are known to have ruin remnants and areas of ancient artifacts from previous inhabitants, probably segments of the Anasazi Culture.

Generally, the major geologic formations exposed are the Mancos and Lewis shales. Alternate thick layers of sandstone, clay and shale are exposed with occasional coal beds outcropping. Some mesas have mantels several feet thick of Aeolian deposits.

Many of the high river benches as well as the flood plains of rivers are bolder, gravel, soil mixtures. The soils are thinly developed and mostly are fine textured with occasional areas of medium textures.

Many of the upland narrow valleys have arroyos or vertical sided gullies advancing up their bottoms with their soil materials being highly erosive.

B. Living Components. The eastern half of the reservation is characteristically steeper sloped with elevations conducive to ponderosa pine, douglas fir, white fir, and some areas with spruce, with lower lying slopes of pinon-juniper. An understory of browse species and native grasses fill in under the forested hills. Valleys of native grasses and sagebrush are normally found. This area is dominantly used for grazing of domesticated livestock and some logging.

The western half of the reservation has lower elevation levels and less steep slopes. The rougher topography is covered by pinon-juniper, gambel oak, forbes and browse species. The unirrigated gently rolling hills, valleys and flatter lands are covered with a wide variety of native grasses, shrubs, forbes and introduced grasses. The majority of the area is used for grazing of domesticated livestock.

The irrigated areas, primarily the Pine and Florida river valleys, are devoted to the livestock industry in the production of hay and pasture grasses for cattle, horses and sheep.

Over the entire reservation deer, elk, bear, and other game animals are found. The live streams have plenty of fish as bass, trout, cat and others. Other wildlife as fox, Marten, beaver, and an increasing number of coyote. Smaller wildlife species as jackrabbit, gray squirrel, coon, porcupine, gopher, pheasant, rattlesnake, bobcat, skunk, prairie dog and other species of small animal life are common. Many species of song birds, game birds, wild turkey and raptors are found.

People live primarily in the Pine River valley with the small town of Ignacio being the largest concentration of people with a population of about 650.

C. Ecological Interrelationships. The reservation setting, climatically and topographically, is not conducive to intense agriculture. Twenty to 30,000 acres, mainly river valleys, are cultivated. These areas are mostly devoted to alfalfa, grass alfalfa, dryland wheat and very little row cropping to corn or other ensilage crops. The rest of the 307,000 acre reservation area is used for grazing of sheep, cattle and wildlife. Domesticated animals at the present management level do not interfere with wildlife of the area. The coyote has increased to a level of an economic threat to the sheep industry and tipping the balance against small animals. The development of gas fields has not visibly affected wildlife and it is expected that oil is not likely to be extensively important in the area.

The steeper more rugged terrain provides good cover and a wide selection of browse for winter habitat of game animals. Pheasant, grouse and turkey are not in great numbers probably due to the small acreage of grain cropping. There are areas of shale outcropping with sufficient selenium to be hazardous to livestock and humans especially if most food and water are derived from these areas, however this is in no way prevalent. Several thousand acres of pinon-juniper have been chained, burned and seeded to crested wheatgrass, intermediate wheatgrass, tall wheatgrass and Indian rice grass. Gambel oak is, after 10 years, on the increase in the area. This activity has, however, improved the traffic of game animals in the area since there is vastly

more grass for grazing in summer months and the desirable browse is more plentiful for winter feed of game.

D. Aesthetics. The setting of the Southern Ute Reservation is provided with exceptionally beautiful vistas of the snowcapped peaks to the north. The air is clear, clean, and exceptionally free of pollutants of a modern industrial society. Fall colors of the Aspen, Oak, Cottonwood and other deciduous vegetation are an endless array of beauty for the shutter bug as well as for the artist's brush. The artifacts and ruins of past cultures have been located and mapped and will be avoided in exploration and development. A feeling of open spaces is always present. Snows of winter provide winter sports, fishing is good in the rivers and hunting of game animals is plentiful. In summer, nights are cool and day temperatures pleasant due to elevation and aridity.

E. Human Interest Values. In general the Anasazi Culture ruins and remnants as found by surveys are clustered along the La Plata, Animas, Pine Piedra and San Juan rivers. The mesas were fairly well populated. From the Pine River eastward to the San Juan River, only the river drainages and lower south facing slopes were occupied. These people had a basic economy of agriculture supplemented with hunting and fishing. Seldom are ruins found above 8000 feet, those above 8000 feet are believed to have been temporary summer quarters for hunting. Ruins sites will be avoided during exploration and development.

The Reservation area was opened to homesteading so that within the original boundaries the Indian ownership is "checkerboarded." The Spanish descent, the Southern Ute, and the Anglo influx is about evenly divided. The influences of all three cultures and backgrounds are

blended and yet each is distinguishable. Cattle and sheep, natural gas production and recreation are the major industries. There are several billion tons of known low sulphur coal reserves neath the surface and energy demands may very will provide another major industry. The major sources of employment are natural gas company, Southern Ute Tribe, public school system, Bureau of Indian Affairs, and to a lesser extent lumber industry, livestock production, and to a minor extent retail stores. The average per capital annual income, around $2,000 is far below the national average and natural gas production being a major employer it seems reasonable to expand this industry especially in view of the energy needs of the nation.

III. ENVIRONMENTAL IMPACTS OF PROPOSAL

The economic impact of a major development will be a boom to the area. The overall impact to the aesthetic, clean air, noise level, or other noxious effects to clear water, air and like attributes of the area will very likely not be noticed since the presently already developed gas fields are not big impacts upon the environment. Of course any activity in the area will have an impact.

1. Soil Erosion. Much of the area soil material is clay or fine textured and thus highly erosive and especially so with removal of protective vegetation for road construction. The net result may not be as great as one may suspect since careful alignment with erosion prevention in mind is becoming the rule. Often arroyos or deep gullies are plugged and a culvert installed several feet from the bottom, thus effecting a sediment barrier.

2. The road system required to monitor producting wells has a two fold effect. Greater accessability is provided. Indian stockmen in the

range areas and Indian law and game personnel can patrol the areas easier. By the same token, unauthorized traffic is heavier. The unauthorized traffic often is game poachers, pot hunters as well as would be rustlers and occasionally illegal contraband traffic.

3. The laying of pipelines exposes a corridor 50 to 100 feet wide over hill and dale. This activity also has a two fold effect. During construction and revegetation soil is exposed to erosive elements and where treed areas are traversed, of course, there is left a break in the continuity of the natural vista. However, as soon as the area has revegetated, there generally is a more desirable and more productive strip for wildlife and livestock grazing, since improved grasses replace pinon-juniper and sagebrush with sparce native grass understories.

4. The increase of noise or fumes into the environment will be only casually noticed since nearly all activity will be in very thinly or non-populated areas. Some unavoidable trash will be generated by workers in the area. However, recently developed well sites have been finished with all such trash removed or buried and except for earth work necessary in preparation of the site little to no evidence of man's presence is remaining.

5. Increased Tribal income in the amount of bonus bid, annual rental payment and royalties on any production as well as potential future employment in the general overall area should be a benefit.

6. Road construction for exploration shall at all times be treated as an integral system for any future production so that this activity will not produce unnecessary duplications getting to the same point nor produce abandonment while access to near producing sites is necessary.

7. Should oil be discovered, the ever present fear of a major oil spill is a possibility. On land based drilling operations and pipeline transportation, modern oil field techniques are negating this possibility. Since the area is fringe to tourism, scenic value and agriculture is not intensive, the effects should not be as serious as in other locales.

8. Tree removal for pipelines, roads, well sites, an unavoidable impact to the environment will not be extensive and except where possibly commercial stands may be encountered is not considered adverse. Many thousands of acres of pinon-juniper stands have been "chained" to improve range conditions for livestock grazing. This clearing coupled with reseeding of grasses usually reduces soil erosion.

9. The rivers and live tributaries should receive little impact. Hard surface roads presently parallel these and crossings are often enough that no new bridges need be constructed. Any potential spills along these streams will be doubly safeguarded.

   The USGS has stringent regulations where danger exists to rivers and live streams from pollutants of drilling and development operations. The Southern Ute Tribal employees and the Agency Resource employees frequently check drilling sites and will doubly check any occurring along rivers and live tributaries.

10. Artifact locations could be disturbed or obliterated by drilling site preparation or road construction. These sites are located and every precaution to avoid them will be taken.

    Should any archeological sites be encountered either in road alignment or site preparation and must be disturbed salvage procedures and clearance to do so will proceed only with the then current Departmental requirements.

Prior to installing any roads or pipelines clearance through Dr. Leland J. Abel, Archaeologist, Bureau of Indian Affairs, P. O. Box 8327, Santa Fe, New Mexico, 87501, is required.

The archaeological ruins sites have been inventoried by the Department of Anthropology, University of Colorado, under the direction of Dr. David A. Breternitz, Director, Archaeological Research Center.

11. Exploration and drilling activities during periods of precipitation to the level of muddy field conditions is an area of concern as this will accelerate soil erosion. Periods of heavy rain or snowfall are normally not long in duration and graveling and hard surfacing of access roads is not common in this area, it is anticipated that activities shall cease while travel condition re-stabilize.

IV. MITIGATING MEASURES IN PROPOSAL

1. Site location and density. The Tribal Resources Coordinator and Land Operations staff review site locations as well as access road alignment and construction, thus reducing the miles of roads and planning of routes to reduce soil erosion and traversing as little range grass as possible. The State of Colorado has strict well spacing laws; Dakota formation 1 per section, Mesa Verde formation 2 per section and Fruitland-Picture Cliff formation 2 per section, for natural gas fields. This spacing will prevent despoiling of the scenic value of the area to some considerable extent.

All necessary road construction shall be oriented to minimize soil erosion. Culverts will be set to effect sediment flow retardation where possible. Pipeline laying areas on erodable slopes will be finished with terracing to prevent accelerated runoff down steeper slopes. These will be installed where required by the Agency Soil Conservationist.

2. All soil disturbances as pipelines, abandonment roads to well sites are required to be established to pre-approved grasses being the most desirable in the area for grazing and soil stabilization.

3. Disturbing of ruins and artifacts sites will be avoided during all phases of exploration, road construction and site section. The Tribal Law and Order personnel, Tribal Game personnel as well as Bureau of Indian Affairs field personnel patrol areas of artifacts to discourage unauthorized pot hunters and poachers.

4. Where possible gathering pipelines and well service roads will be oriented with in the same rights-of-way thus reducing soil exposure to erosive forces and lessening the impact to scenic vistas.

5. Fire and Dust Containment. During extreme dry periods when the fire "Build Up Index" reaches 144 operations will be restricted. Thus reducing the possibility of accidental range or forest fires and slowing air pollution from dust by traffic.

6. Hazards to Ground Water. Any blasting will not be permitted near known ground water sources such as natural springs and wells. Deep holes passing through aquifers will be sealed off to prevent contamination. Mud pits will be adequate to contain all discharge from drilling operations.

7. Hazards to Water Courses. Prevention is the most mitigating measure. Exploration and drilling operations will be restricted where danger of pollution of rivers or live streams is possible. Any soil disturbance will be monitored and so performed to retard sedimentation.

8. Visual Disruption. Clearing of treed areas will be kept to a minimum. Surface disturbances will be designed and performed to blend as much as possible with natural surrounding. Routing of rights-of-way will

be approved only in the least offensive routing keeping in mind erosion hazards.

9. Potential Spills. The USGS has stringent regulations and monitoring schedules. The gas and oil companies have contingency mop up plans and equipment should such accident occur. The Southern Ute Agency has and Oil and Hazardous Substances Pollution Contingency Plan and equipment to contain and mitigate potential accidents.

V. UNAVOIDABLE ADVERSE EFFECTS

Some soil erosion, lowering of the air and water quality will occur even though all mitigating measures are applied. Accidents do occur and nature can send a high intensity storm that negates mans best of management.

Wind can blow long and strong and for extended periods. No practical means of complete control of these processes is available.

Noise, dust and odor changes are viewed as only temporary and not too many people since these areas have thin population to no population.

Destruction of native vegetation on roads, drill sites and pipelines is unavoidable.

Oil and gas operations do affect some animal species which cannot be mitigated. Burrowing animals as snakes, mice, lizards, some insects and prairie dogs may have home or reproduction areas destroyed by construction phases.

The mood of isolation, visual impressions of the landscape, and unaltered naturalness will be lost forever. Some scars of construction will [illegible] heal.

If climate cooperates, and soils, slope and aspect are managed properly over a long period original aesthetics will tend to mask man activities.

Impacts upon archeological and historical artifact sites will be visited more frequently by illegal traffic in the area, thus destroying potentially important educational and scientific bits of information.

VI. RELATIONSHIP BETWEEN SHORT TERM USE AND LONG TERM PRODUCTIVITY

In view of the energy crisis and the Southern Utes need for new capital the permanent unavoidable alterations of the environment are a small price compared with the many fold benefits to society in the form of warm homes, industrial production and employment opportunities for the local population. While gas and possibly oil are being extracted, surface use of the land can continue to provide wildlife habitat, livestock production and nearly all of prior recreation and scenic value. After depletion of gas and/or oil and all abandonment and restoration of all road and well sites production for game and livestock will be better since better producing forage grasses will be used for restoration. If population trends continue the area may well be home sites in the distant future.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The gas and oil products removed will be gone and cannot be replaced.

A certain amount of soil will undoubtedly be lost in spite of any measures taken to preserve it and will take hundreds of years to weather more from rocks.

The wide "open spaces" aspect so loved by many will be reduced.

Irreversible damage to archaeological, historical, ecological and to some extent wildlife will be uncontrollable to some extent from increased illegal seekers.

VIII. ALTERNATIVE TO PROPOSAL

There are no reasonable alternatives for accomplishing the purpose of the action. The purpose being to provide the nation's energy needs as well as

the Southern Ute Tribe exploiting their resources for capital and employment. No leasing for gas or oil is not an alternative but merely a stall, and the pressures may become so great as to reduce ones ability to enforce above mentioned mitigating measures.

IX. INTENSITY OF PUBLIC INTEREST OR CONTROVERSY

There is much public interest locally for exploration and development to proceed as soon as possible for the benefit of the local economy. Locally there seldom is heard a critical remark directed toward gas company activities. On regional and national level there is much concern and controversy in areas of fragile environments as "off shore," Alaska, and swamps of the Southeast. Much of this adversity is the result of oil exploitation errors of the past.

It does not appear that major oil finds are likely. Natural gas exploration and development has not generated the controversy and present fields on the reservation in operation have only a casual impact upon the environment.

X. PERSONS, GROUPS, AND GOVERNMENT AGENCIES CONSULTED

Southern Ute Tribal members, local Soil Conservation Service, United States Geological Survey and Bureau of Indian Affairs staff at the Southern Ute Agency.

The Bureau of Land Management, Durango Office. This office gave freely of advice and provided a copy of their analysis for the Hermosa and Piedra Planning Units, as well as a copy of the analysis on the Sacred Mountain Unit. Both documents pertaining to oil and gas leasing.

XI. RECOMMENDATION WHETHER AN ENVIRONMENTAL STATEMENT SHOULD BE PREPARED

This proposed action will not have a "major" impact upon the environment. An Impact Statement need not be prepared.

Important points to keep in mind and consider when making lease agreements.

1. Distance Operations are from:
   a. Perennial streams
   b. Lakes or stock reservoirs
   c. Natural springs or wells
   d. Outstanding topographic, geologic, educational, scientific, historical and cultural features
   e. Irrigation Works
2. Timing of Operation Shut down:
   a. Extreme fire danger
   b. Periods of extreme moisture
3. On site inspections by Southern Ute Resources Coordinator and Agency technicians for:
   a. Best road routing to prevent erosion
   b. Site situation for drilling. (Avoid as much Range grass & etc.).
   c. Excessive air pollution
   d. Any potential water pollution
   e. Excessive noise levels
   f. Excessive odor levels

XII. SIGNATURES

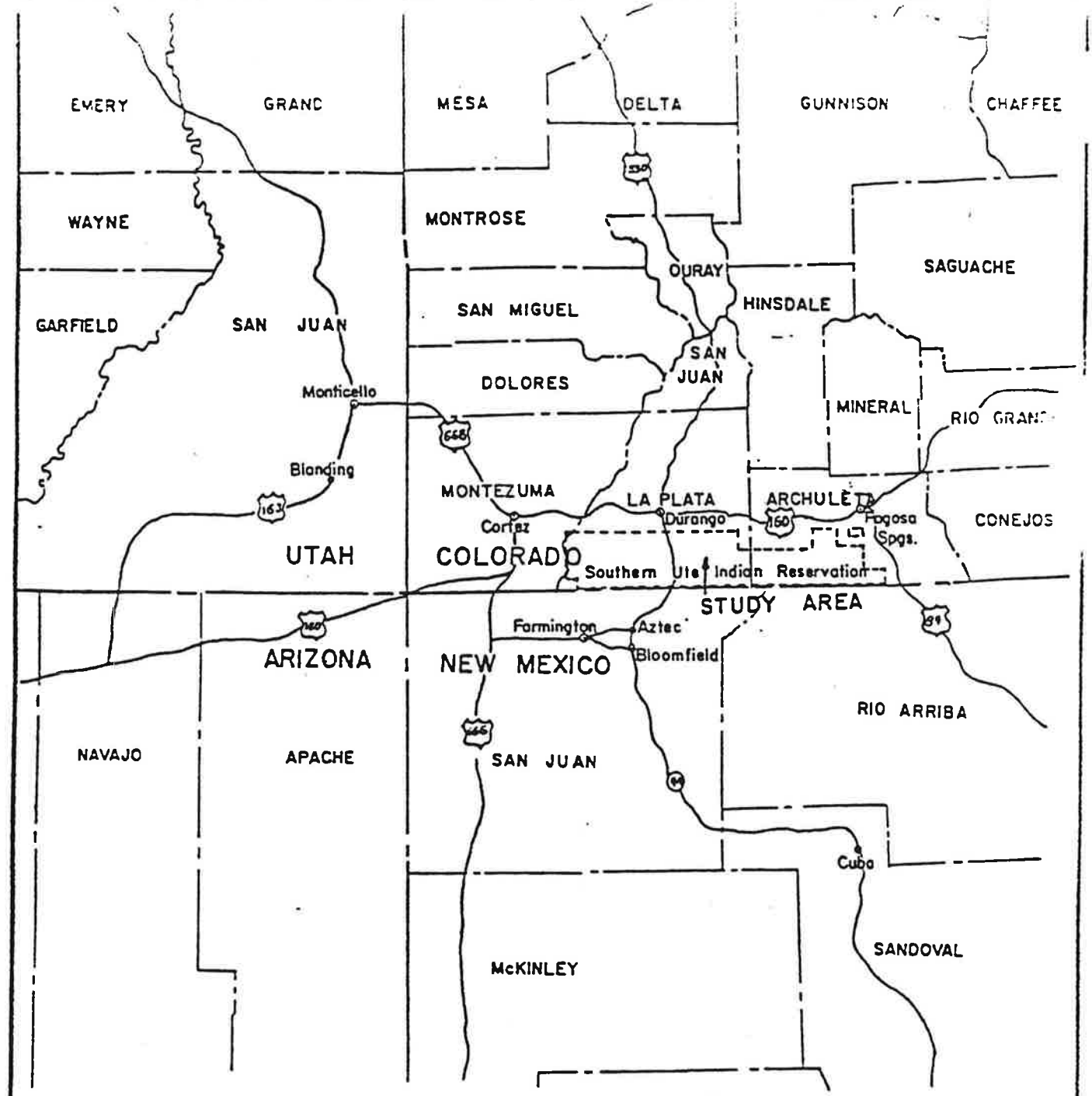
1. Lead Responsibility

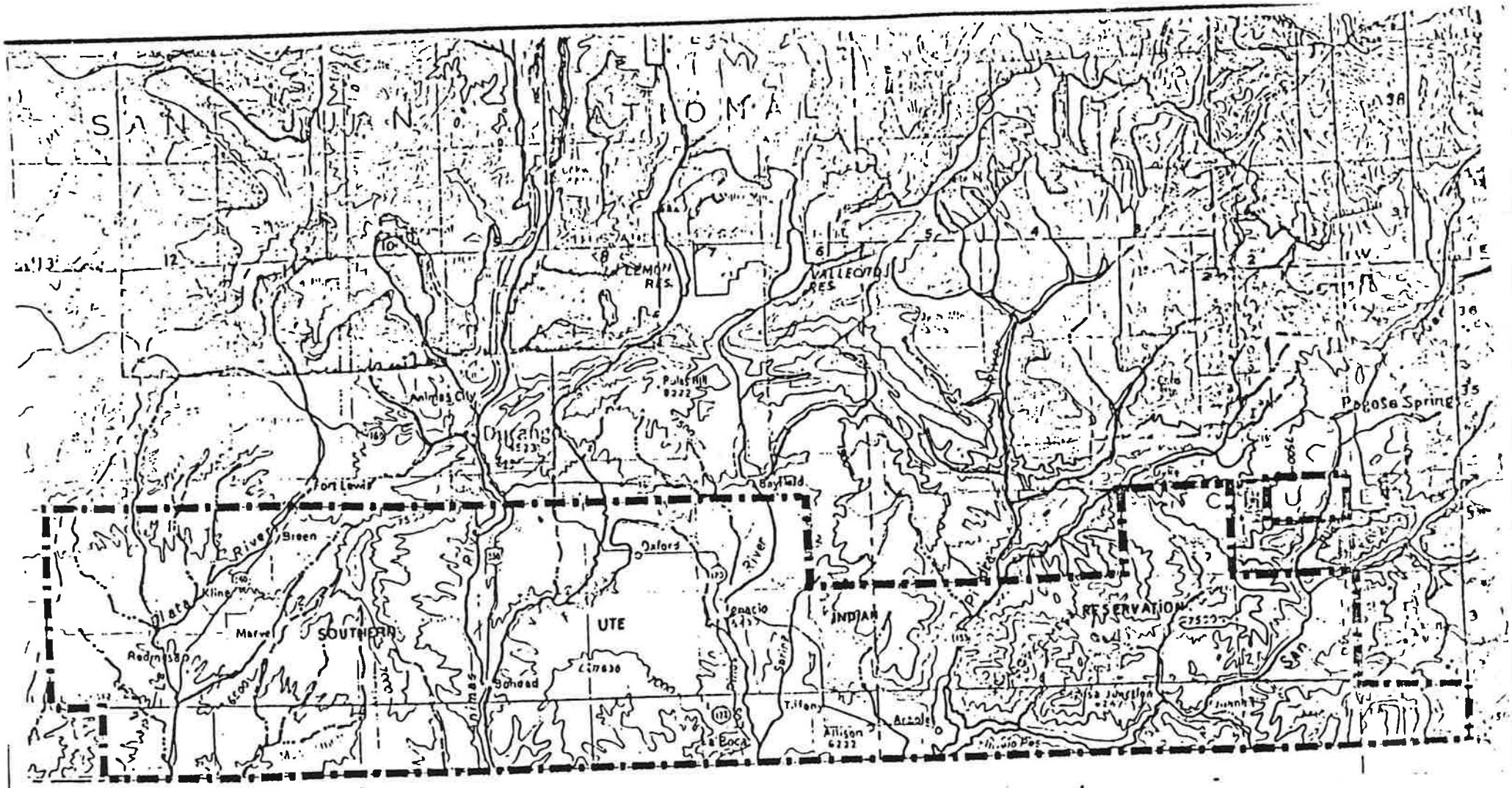
Natural Resources Manager — Date 25 Jan 1974

2. Responsible Official

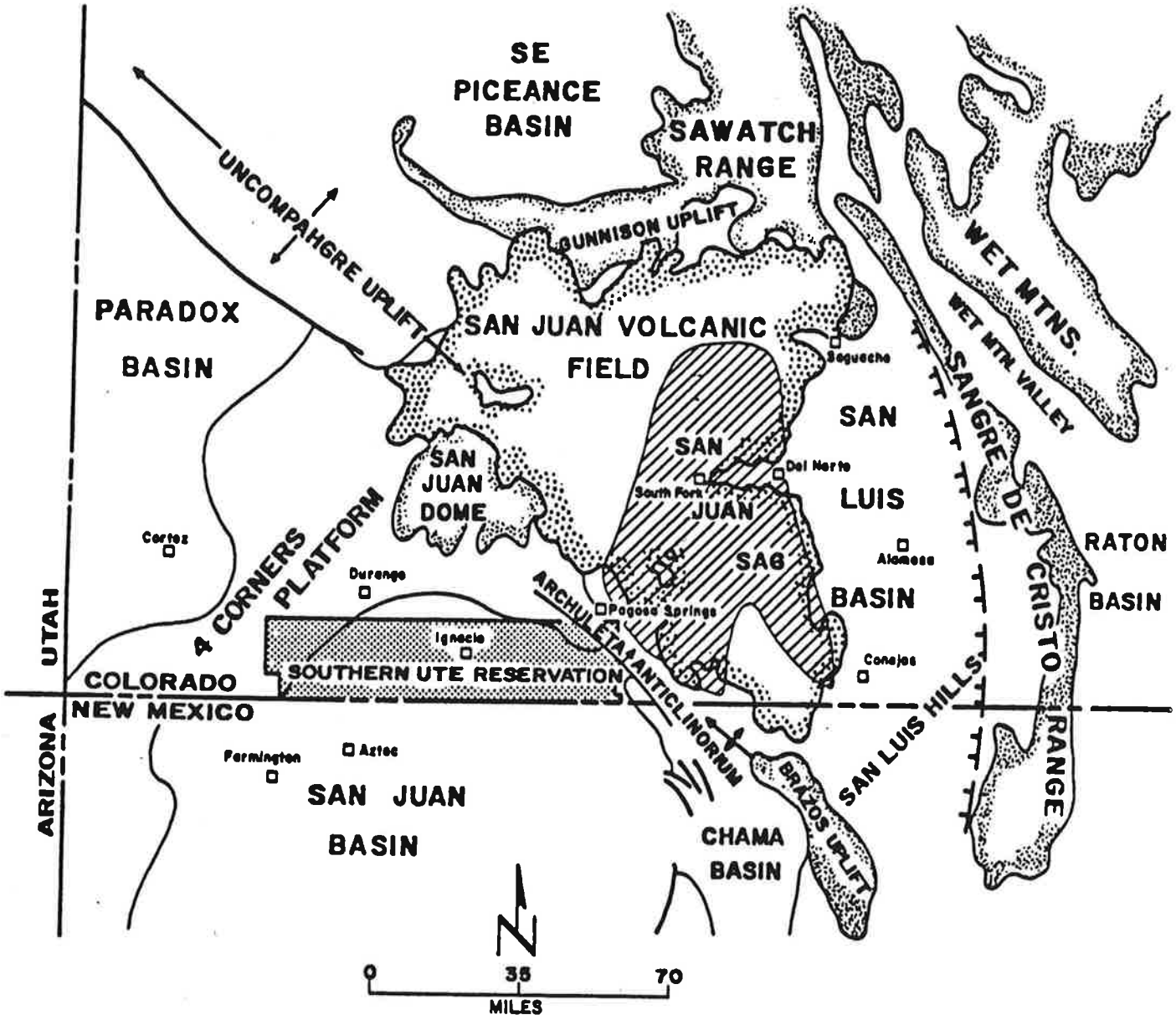
Superintendent — Date 1-28-74

APPENDIX B


EMERY
GRAND
MESA
DELTA
GUNNISON
CHAFFEE
WAYNE
MONTROSE
OURAY
SAGUACHE
GARFIELD
SAN JUAN
SAN MIGUEL
HINSDALE
SAN JUAN
DOLORES
Monticello
MINERAL
RIO GRANDE
Blanding
MONTEZUMA
LA PLATA
ARCHULETA
Cortez
Durango
Pagosa Spgs.
CONEJOS
UTAH
COLORADO
Southern Ute Indian Reservation
STUDY AREA
Farmington
Aztec
Bloomfield
ARIZONA
NEW MEXICO
RIO ARRIBA
NAVAJO
APACHE
SAN JUAN
Cuba
SANDOVAL
McKINLEY
37 0 37 74 Miles
Scale 1 in. = 37 mi. (Approx.)
N
U.S. GEOLOGICAL SURVEY
VICINITY MAP
of the
SOUTHERN UTE RES. AREA
Colorado
3/7
APPENDIX B


SAN JUAN
LEMON RES.
VALLECITO RES.
Animas City
Durango
Pulse Hill
Bayfield
Fort Lewis
Oxford
Ignacio
Marvel
SOUTHERN UTE INDIAN RESERVATION
Redmesa
Johnson
Tiffany
Allison
Arboles
Eoca
Pagosa Springs
10 0 10 20 Miles
Scale 1: 500,000
1 in. = 8 mi.
(Approx.)
Contour Interval 500 Feet
U.S. GEOLOGICAL SURVEY
VICINITY & TOPOGRAPHY M
for the
SOUTHERN UTE RES. A
Colorado
3/79
JLK-0

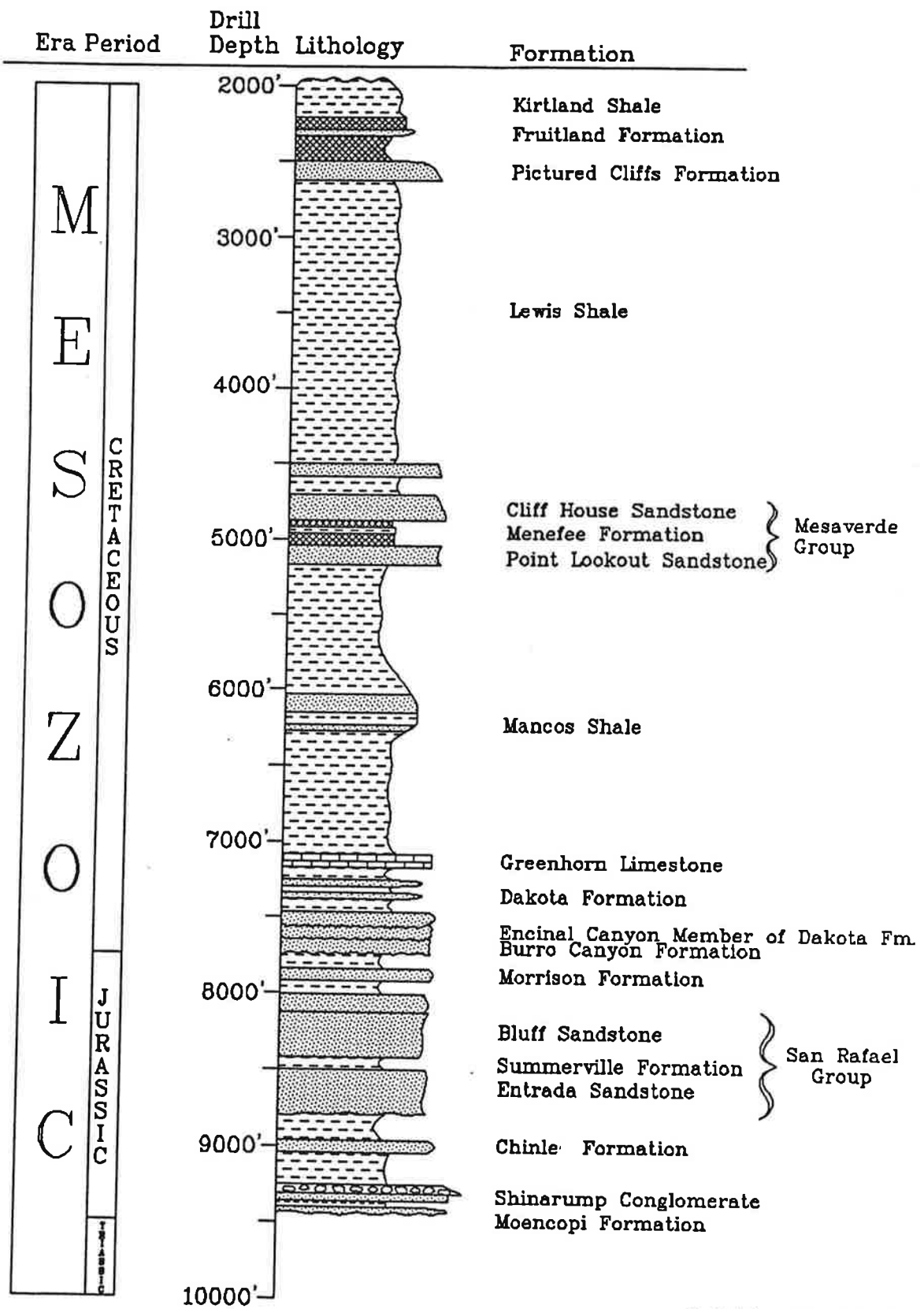
APPENDIX C



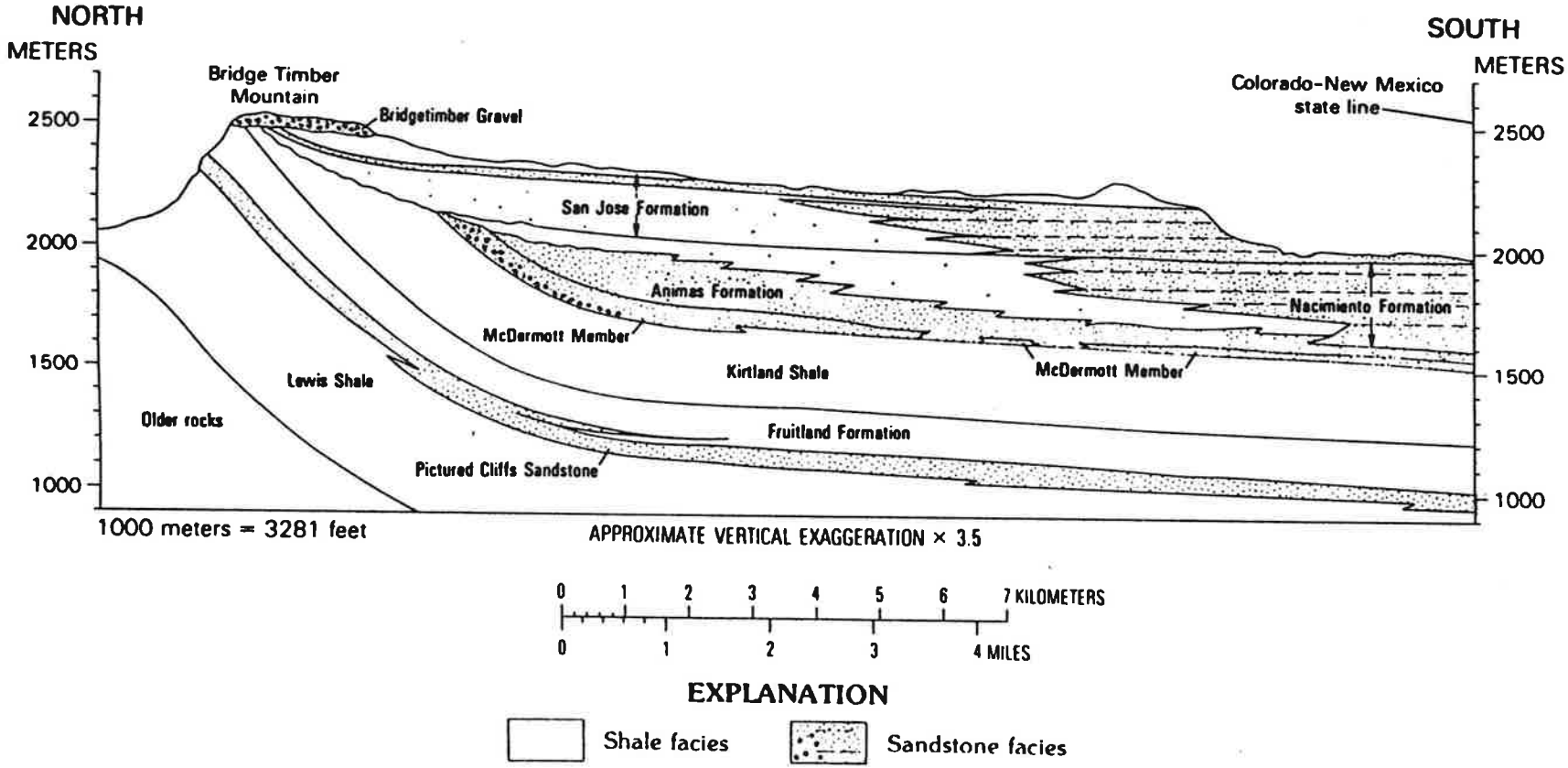
Regional map showing the location of the Southern Ute Indian Reservation in relationship to the structural configuration of southwest Colorado (Modified from Gries, 1985).

IDEALIZED STRATIGRAPHIC COLUMN

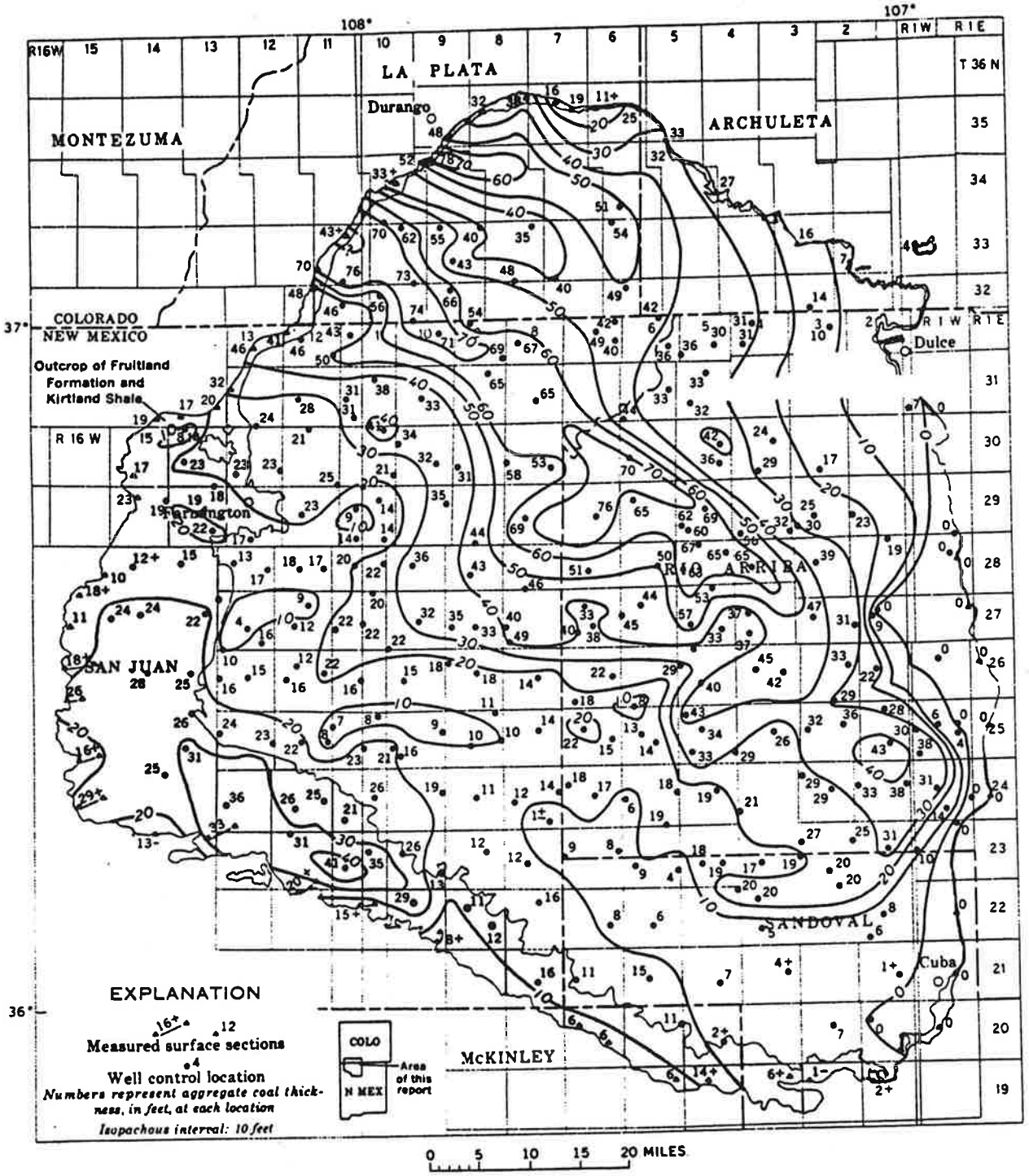
Showing General Depth, Thickness, and Lithology of Mesozoic Rocks Southern Ute Indian Reservation Northern San Juan Basin, Colorado



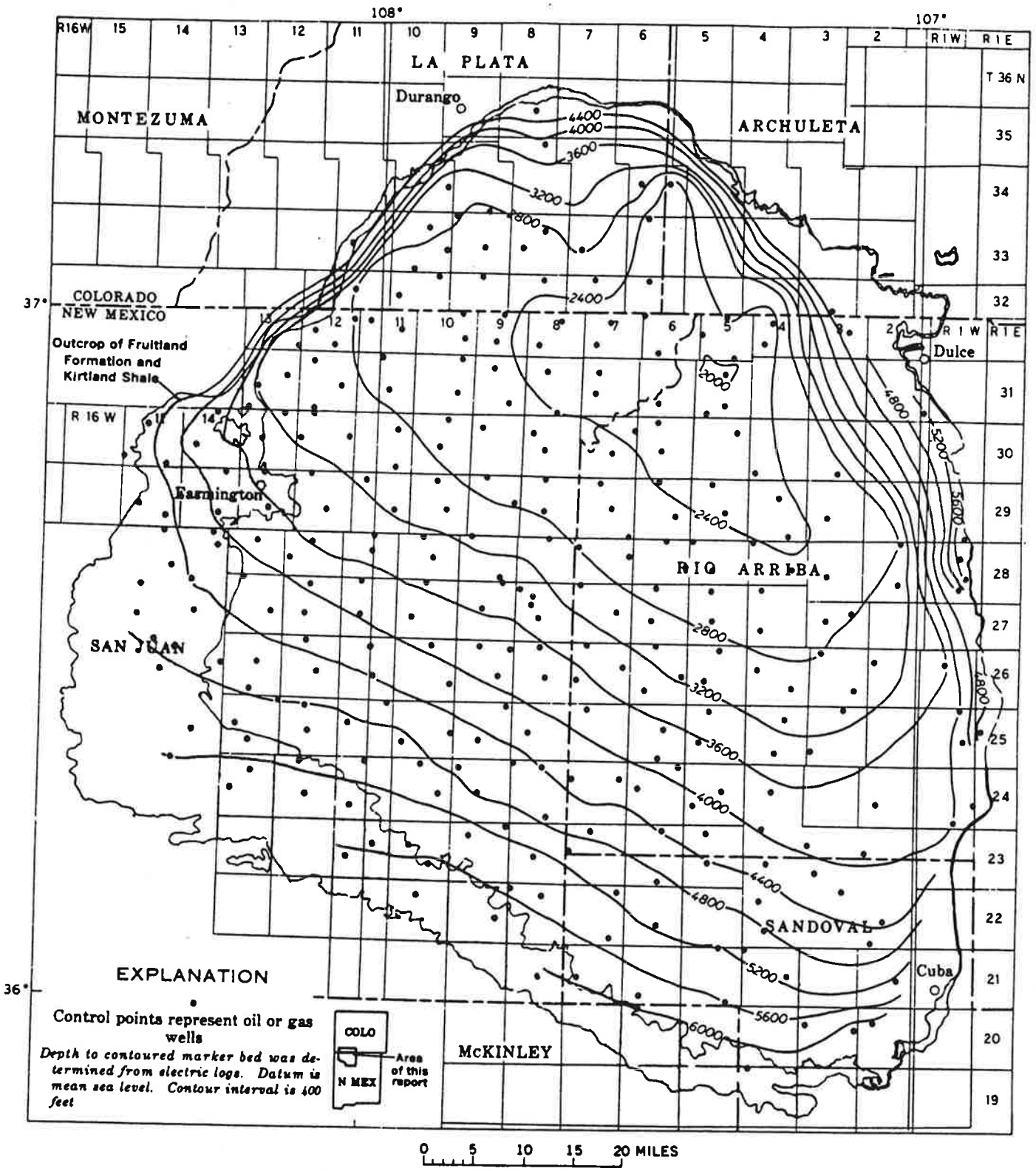
Geologist: Richard Baughman
Drafted By: Mollie C. Hamilton



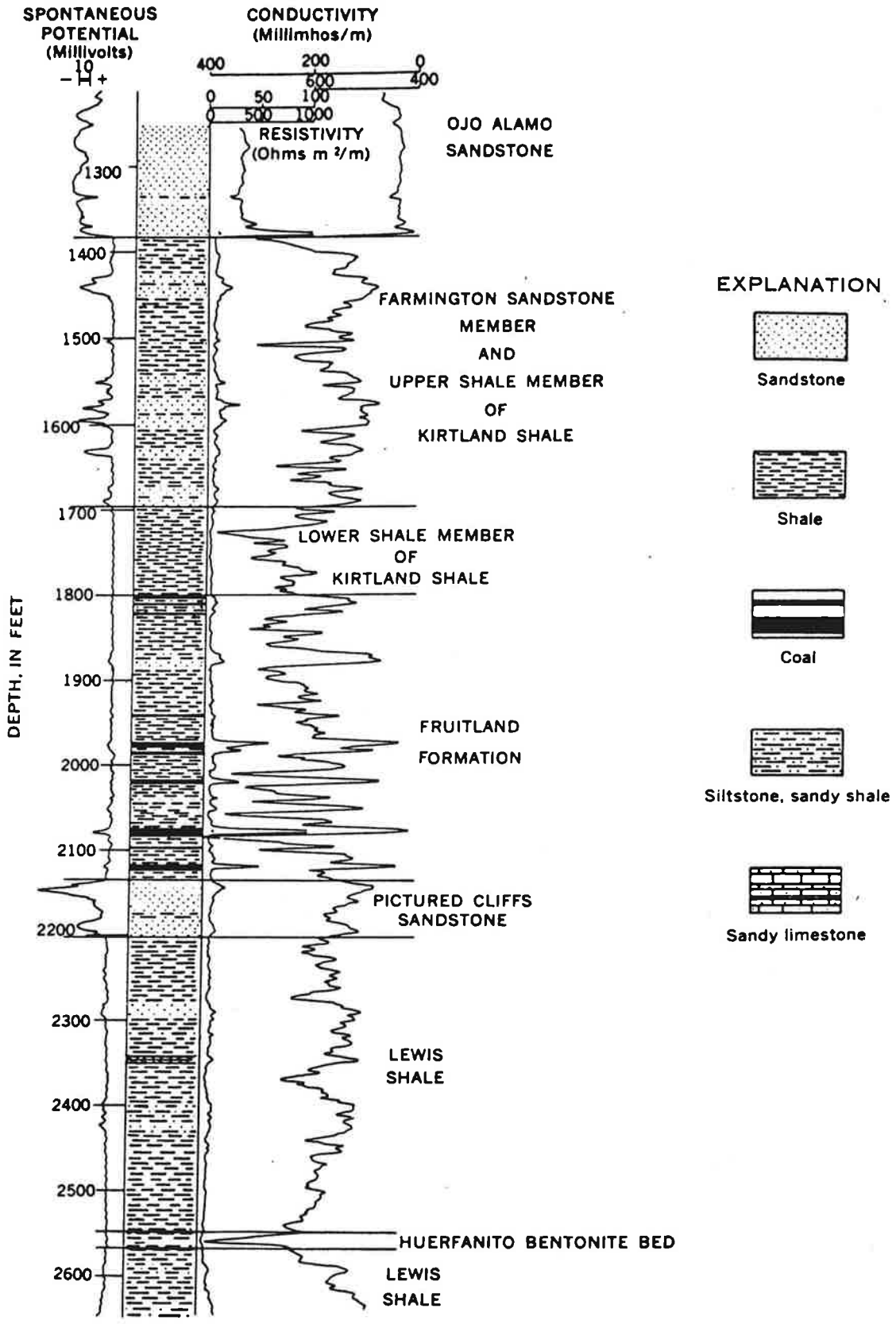
DIAGRAMMATIC CROSS-SECTION SHOWING STRATIGRAPHIC RELATIONSHIPS OF TERTIARY UNITS. Bridge Timber Mountain (Sec. 25, T. 34 N., R. 11 W.) southward to the Colorado–New Mexico state line (modified from Baltz and others, 1966).



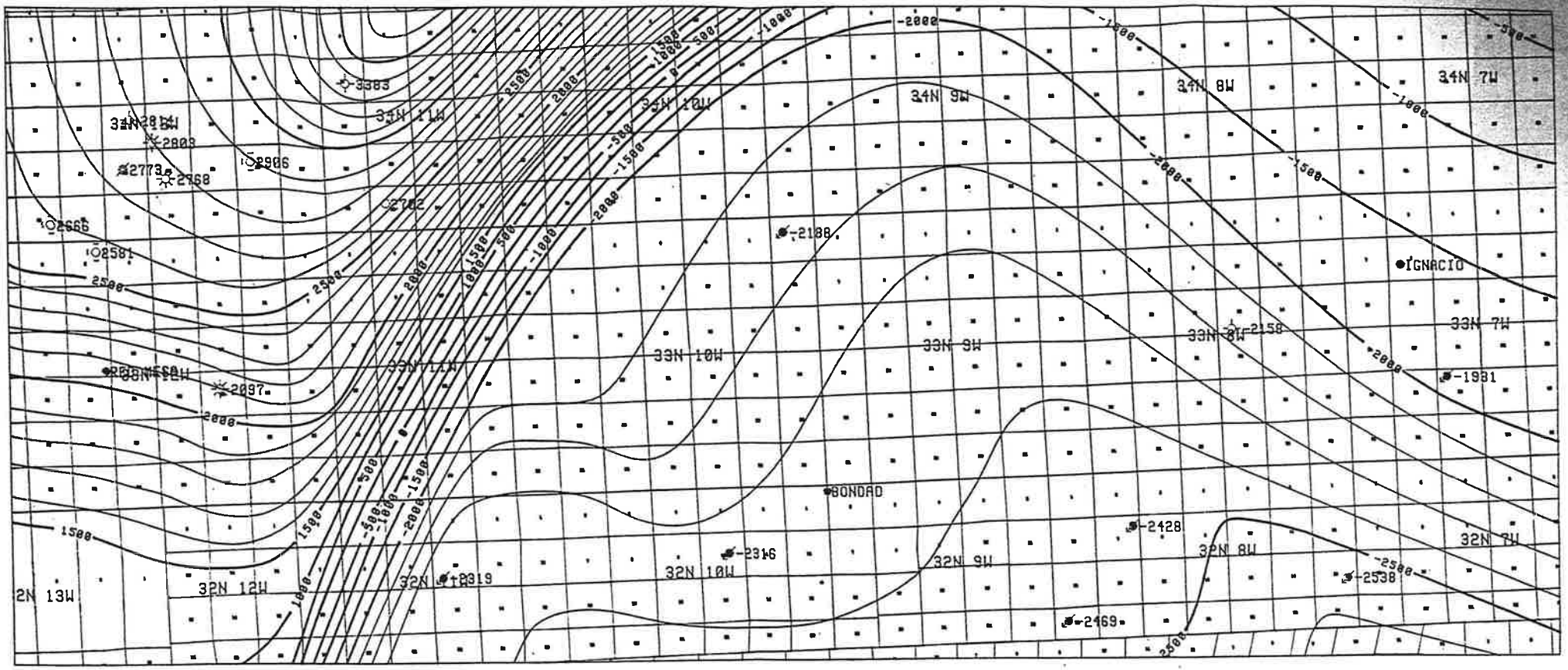
Isopach map of total thickness of coal in the Fruitland Formation (from Fassett and Hinds, 1971).



Contour map of the Huerfanito Bentonite Bed of the Lewis Shale (from Fassett and Hinds, 1971).



Induction-electric log and lithologic column of the type well of the Huerfanito Bentonite Bed of the Lewis Shale showing the interval from below the Huerfanito through the lower part of the Ojo Alamo Sandstone. Lithologies are based on an interpretation of the three curves shown (from Fassett and Hinds, 1971).



SOUTHERN UTE INDIAN TRIBE
ENERGY RESOURCES DIVISION
IGNACIO, COLORADO

STRUCTURAL CONTOUR MAP
DATUM: TOP OF THE ENTRADA SANDSTONE

SOUTHERN UTE INDIAN RESERVATION
NORTHERN SAN JUAN BASIN, COLORADO

GEOLOGIST: RICHARD BROWN	PLOT DATE: 8/31/99
DRAFTED BY: MILLETTE WHITEBEAR	MAP SCALE: 1" = 1.5 MI.
REVISED: 8/31/99	MAP SCALE: 1IN. = 8.000FT.

APPENDIX C

COMMONLY OBSERVED VEGETATION LISTINGS

COMMON NAME	SCIENTIFIC NAME
Ponderosa Pine	Pinus ponderosa
Utah Juniper	Juniperus utahensis
Rocky Mountain Juniper	Juniperus scopulorum
One-seeded Juniper	Juniperus monosperma
Pinyon Pine	Pinus edulis
Mountain Mahogany	Cercocarpus montanus
Three-Leaf Sumac	Rhus trilobata
Common Serviceberry	Amelanchier alnifolia
Antelope Bitterbrush	Purshia tridentata
Black Sagebrush	Artemisia tridentata var. nova
Big Sagebrush	Artemisia tridentata
Broom Snakeweed	Guterrezia sarothrae
Gambel Oak	Quercus gambelii
Rabbitbrush	Chrysothamnus sp.
Yucca	Yucca sp.
Blue Grama Grass	Bouteloua gracilis
Side-Oats	B. curtipendula
Kentucky Bluegrass	Poa pratensis
Galleta Grass	Hilaria jamesii
Indian Rice Grass	Oryzopsis hymenoides
Alkali Sacaton	Sporobolus airoides

Salt Grass	Distichlis stricta
Fendler Three-awn	Aristida fendleriana
Western Wheatgrass	Agropyron smithii
Bottlebrush Squirreltail Grass	Sitanion hystrix
Foxtail	Hordeum jubatum
Downy Chess	Bromus tectorum
Sixweeks Fescue	Festuca octoflora
Four-wing Saltbush	Atriplex canescens
Shadscale	Atriplex confertifolia
Beehive Cactus	Coryphantha vivipara
Prickly Pear Cactus	Opuntia sp.
Plateau Cholla	Cylindropuntia whipplei
Devilclaw Cactus	Sclerocactus spp.
Claret-cup Hedgehog	Echinocereus triglochidiatus
Saltcedar	Tamarix pentandra
Fremont Cottonwood	Populus fremontii
Narrowleaf Cottonwood	Populus angustifolic
Mormon Tea	Ephedra viridis
Winterfat	Eurotia lanata
Greasewood	Sarcobatus vermiculatus
Russian Thistle	Salsola kali
Milkvetch-Locoweed	Astragalus spp.
Sand Dropseed	Sporobolus cryptandrus

Needle-and-Thread Grass	Stipa comata

LIST OF MAMMALS EXPECTED TO OCCUR WITHIN THE AREA

LARGE MAMMALS

Mule Deer	Odocoileus hemionus
Whitetail Deer	Odocoileus virginianus
Pronghorn Antelope	Antilocapra americana
Elk	Cervus canadensis
Mountain Lion	Felis concolor
Black Bear	Ursus americanus

MEDIUM-SIZED MAMMALS

Bobcat	Lynx rufus
Coyote	Canis latrans
Gray Fox	Urocyon cinereoargenteus
Swift Fox	Vulpes velox
Kit Fox	Vulpes macrotis
Red Fox	Vulpes fulva
Badger	Taxidea taxus
Ring-tailed Cat	Bassariscus astutus
Raccoon	Procyon lotor
Black-footed Ferret	Mustela nigripes
Striped Skunk	Mephitis mephitis
Spotted Skunk	Spilogale putorius
Hognose Skunk	Conepatus leucontus

Porcupine	Erethizon dorsatum
Blacktail Prairie Dog	Cynomys ludovicianus
Whitetail Prairie Dog	Cynomys gunnisoni
Blacktail Jackrabbit	Lepus californicus
Eastern Cottontail	Sylvilagus floridanus
Desert Cottontail	Sylvilagus auduboni

SMALL MAMMALS

Desert Shrew	Notiosorex crawfordi
Leafnose Bat	Macrotus californicus
Cave Myotis	Myotis velifer
Arizona Myotis	Myotis occultus
California Myotis	Myotis californicus
Western Pipistrel	Pipistrellus hesperus
Western Big-eared Bat	Plecotus townsendi
Pallid Bat	Antrozous pallidus
Mexican Freetail Bat	Tadarida brasiliensis
Big Freetail Bat	Tadarida molossa
Longtail Weasel	Mustela frenata
Mexican Ground Squirrel	Citellus mexicanus
Spotted Ground Squirrel	Citellus spilosoma
Rock Squirrel	Citellus variegatus
Golden Manteled Squirrel	Citellus lateralis

Least Chipmunk	Eutamias minimus
Mexican Pocket Gopher	Cratogeomys castanops
Northern Pocket Gopher	Thomomys talpoides
Valley Pocket Gopher	Thomomys bottae
Plains Pocket Gopher	Geomys bursarius
Merriam Pocket Mouse	Perognathus merriami
Silky Pocket Mouse	Perognathus flavus
Desert Pocket Mouse	Perognathus penicillatus
Plains Pocket Mouse	Perognathus flavescens
Apache Pocket Mouse	Perognathus apache
Hispid Pocket Mouse	Perognathus hispidus
Bannertail Kangaroo Rat	Dipodomys spectabilis
Ord Kangaroo Rat	Dipodomys ordi
Plains Harvest Mouse	Reithrodontomys montanus
Western Harvest Mouse	Reithrodontomys megalotis
Cactus Mouse	Peromyscus eremicus
Canyon Mouse	Peromyscus crinitus
Deer Mouse	Peromyscus maniculatus
Brush Mouse	Peromyscus boylei
Pinyon Mouse	Peromyscus truei
Rock Mouse	Peromyscus difficilis
Northern Grasshopper Mouse	Onychomys leucogaster
Whitethroat Woodrat	Neotoma albugula
Bushytail Woodrat	Neotoma cinerea

Mexican Woodrat	Neotoma mexicana
Southern Plains Woodrat	Neotoma micropus
Longtail Vole	Microtus longicaudus
Mexican Vole	Microtus mexicanus
Western Jumping Mouse	Zapus princeps

LIST OF BIRDS EXPECTED TO OCCUR WITHIN AND ADJACENT TO THE AREA

Pied-billed Grebe	Podililymbus podiceps
Common Egret	Casmerodius albus
Snowy Egret	Egretta thula
Great Blue Heron	Ardea herodias
Green Heron	Butorides virescens
American Bittern	Botaurus lentiginosus
Lease Bittern	Ixobrychus exilis
Canada Goose	Branta canadensis
Mallard	Anas platyrhynchos
Cinnamon Teal	Anas cyanoptera
Green-winged Teal	Anas carolinensis
Pintail	Anas acute
Ring-necked Duck	Aythya collaris
Common Merganser	Mergus merganser
Redhead Duck	Aythya americana
Lesser Sandhill Crane	Grus canadensis

Virginia Rail	Rallus limicola
Sora Rail	Porzana carolina
Common Gallinule	Gallinula chloropus
American Coot	Fulica americana
American Avocet	Recurvirostra americana
Black-necked Stilt	Himantopus mexicanus
Mountain Plover	Charadrius montana
Snowy Plover	Charadrius alexandrinus
Killdeer	Charadrius vociferus
Common Snipe	Capella gallinago
Turkey Vulture	Cathartes aura
Sharp-shinned Hawk	Accipter striatus
Cooper's Hawk	Accipiter cooperii
Harrier	Circus cyaneus
Rough-legged Hawk	Buteo lagopus
Ferruginous Hawk	Buteo regalis
Red-tailed Hawk	Buteo jamaicensis
Swainson Hawk	Buteo swainsoni
Golden Eagle	Aquila chrysaetos
Bald Eagle	Haliaeetus leucocephalus
Osprey	Pandion haliaetus
American Kestrel	Falco sparverius
Prairie Falcon	Falco mexicanus
Peregrine Falcon	Falco peregrinus

Scaled Quail	Callipepla squamata
Gambel's Quail	Lophortyx gambelii
Blue Grouse	Dendragapus obscurus
Turkey	Meleagris gallopavo
Ring-necked pheasant	Phasianus colchicus
Rock Dove	Columbia livia
Mourning Dove	Zenaida macroura
Yellow-billed Cuckoo	Coccyzus americanus
Roadrunner	Geococcyx californianus
Barn Owl	Tyto alba
Screech Owl	Otus asio
Flammulated Owl	Otus flammeolus
Great-horned Owl	Bubo virginianus
Pygmy Owl	Glaucidium gnoma
Long-eared Owl	Asio otus
Short-eared Owl	Asio flammeus
Burrowing Owl	Speotyto cunicularia
Saw-whet Owl	Aegolius acadicus
Poor-will	Phalaenoptilus nuttallii
Common Nighthawk	Chordeiles minor
Lesser Nighthawk	Chordeiles acutipennis
White-throated Swift	Aeronautes saxatalis
Black-chinned Hummingbird	Archilochus alexandri

Broad-tailed hummingbird	Selasphorus platycercus
Belted Kingfisher	Megaceryle alcyon
Common Flicker	Colaptes auratus
Red-headed Woodpecker	Melanerpes erythrocephalus
Williamson Sapsucker	Sphyrapicus thyroideus
Yellow-bellied Sapsucker	Sphyrapicus varius
Ladder-backed Woodpecker	Dendrocopos scalaris
Lewis' Woodpecker	Asyndesmus lewis
Hairy Woodpecker	Dendrocopos villosus
Downy Woodpecker	Dendrocopos pubescens
Western Kingbird	Tyrannus melancholicus
Eastern Kingbird	Tyrannus tyrannus
Ash-throated Flycatcher	Myiarchus cinerascens
Say's Phoebe	Sayornis saya
Western Wood Pewee	Contopus sordidulus
Horned Lark	Eromophila alpestris
Violet-green Swallow	Tachycineta thalassina
Rough-winged Swallow	Stelgidopteryx ruficollis
Cliff Swallow	Petrochelidon pyrrhonota
Barn Swallow	Hirundo rustica
Mockingbird	Mimus polyglottus
Catbird	Dumetella carolinens's
Sage Thrasher	Oreoscoptes montanus
Crissal Thrasher	Toxostoma dorsale

Pinon Jay	Gymnorhinus cyanocephala
Stellars' Jay	Cyanocitta Stelleri
Scrub Jay	Aphelocoma coerulescens
Common Crow	Corvus corax
Black-billed Magpie	Pica pica
Common Raven	Corvus corax
Black-capped Chickadee	Parus atricapillus
Mountain Chickadee	Parus gambeli
Common Bushtit	Psaltriparus minimus
Plain Titmouse	Parus inornatus
White-breasted Nuthatch	Sitta carolinensis
Pygmy Nuthatch	Sitta pygmaea
Red-breasted Nuthatch	Sitta canadensus
Brown Creeper	Certhia familiaris
Bewicks Wren	Thryomanes bewickii
House Wren	Troglodytes aedon
Dipper Wren	Cinclus mexicanus
Canyon Wren	Catherpes mexicanus
Rock Wren	Salpinctes obsoletus
Robin	Turdus migratorius
Western Bluebird	Sialia mexicanex
Mountain Bluebird	Sialia currucoides
Hermit Thrush	Catharus guttata

Townsend's Solitaire	Myadestes townsendi
Blue-gray Gnatcatcher	Polioptila caerulea
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Cedar Waxing	Bombyeilla cedrofur
Bohemian Waxing	Bombyeilla garrula
Loggerhead Shrike	Lanius ludovicianus
Starling	Sturnus vulgaris
Solitary Vireo	Vireo solitarius
Warbling Vireo	Vireo gilvus
Orange-crowned warbler	Vermivora celata
Virginia's Warbler	Vermivora virginiae
Yellow-rumped Warbler	Dendroica coronate
Yellow Warbler	Dendroica petechia
Grace's Warbler	Dendroica graciae
MacGillivrays Warbler	Oporornis tolmiei
Yellowthroat	Geothlypis trichas
Yellow-breasted Chat	Icteria virens
House Sparrow	Passer domesticus
Eastern Meadowlark	Sturnella magna
Western Meadowlark	Sturnella neglecta
Red-winged Blackbird	Agelaius phoeniceus
Yellow-headed Blackbird	Xanthocephalus xanthocephalus
Brewers Blackbird	Euphagus cyanocephalus

Northern Oriole	Icterus galbula
Brown-headed Cowbird	Molothrus ater
Common Grackle	Quiscalus Quiscula
Western Tanager	Piranga ludoviciana
Hepatic Tanager	Piranga flava
Summer Tanager	Piranga rubra
Black-headed Grosbeak	Pheucticus melanocephalus
Blue Grosbeak	Guiraca caerulea
Evening Grosbeak	Hesperiphona vespertina
Lazuli Bunting	Passerina amoene
House Finch	Carpodacus mexicanus
Cassin's Finch	Carpodacus cassinii
Lesser Goldfinch	Spinus psaltria
American Goldfinch	Spinus tristis
Pine Siskin	Spinus pinus
Brown Towhee	Pipilo fuscus
Green-tailed Towhee	Chlorura chlorura
Rufous-sided Towhee	Pipilo erythophtalmus
Lark Bunting	Calamospiza melanocorys
Lark Sparrow	Chondestes grammacus
Vesper Sparrow	Pooecetes gramineus
Cassin's Sparrow	Aimophila cassinii
Black-throated Sparrow	Ampnispiza bilineata

Brewer's Sparrow	Spizella breweri
Song Sparrow	Melospiza melodia
Baird's Sparrow	Ammodramus bairdii
Dark-eyed Junco	Junco oreganus
McCown's Longspur	Calcarius mccownii
White-crowned Sparrow	Zonotrichic leucophrys

LIST OF AMPHIBIANS AND REPTILES EXPECTED TO OCCUR WITHIN THE AREA

Tiger Salamander	Ambystoma tigrinum
Western Spadefoot Toad	Scaphiopus hammondi
Plains Spadefoot Toad	Scaphiopus bombifrons
Woodhouse's Toad	Bufo woodhousei
Red-spotted Toad	Bufo punctatus
Chorus Frog	Pseudacris triseriata
Canyon Frog	Hyla arenicolor
Leopard Frog	Rana pipiens
Western Box Turtle	Terrapne ornata
Side-blotcher Lizard	Uta stansburiana
Short-horned Lizard	Phrynosoma douglassi
Marbled Whiptail	Cnemidophorus tigris marmaratus
Western Whiptail	Cnemidophorus exsanguis
Collared Lizard	Crotaphytus collaris
Lesser Earless Lizard	Holbrookia muculata
Sagebrush Sanddune Lizard	Sceloporus graciosus

Bull Snake	Pituophis melanoleucus
Texas Blind Snake	Leptotyphlops dulcis
Western Ribbon Snake	Thamnophis proximus
Western Diamondback Rattlesnake	Crotalus atrox
Western Rattlesnake	Crotalus viridis

PARTIAL LIST OF FISH SPECIES EXPECTED TO OCCUR IN THE STREAMS AND RIVERS

	Clupeidae
Gizzard Shad	Dorosoma cepedianum
	Salmonidae
Cutthroat Trout	Salmo clarki
Rainbow Trout	Salmo gairdneri
Brown Trout	Salmo trutta
Brook Trout	Salvelinus fontinalis
Coho Salmon	Oncorhynchus kisutch
Kokanee Salmon	Oncorhynchus nerka
	Esocidae
Northern Pike	Esox lucius
	Cyprinidae
Carp	Cyprinus carpio
Roundnose minnow	Dionda episcopa
Humpback Chub	Gila cypha
Bonytail	Gila elegans

Roundtail Chub	Gila robusta
Proserpine Shiner	Notropis proserpinus
Red Shiner	Notropis lutrensis
Bluntnose Shiner	Notropis simus
Fathead Minnow	Pimephales promelas
Colorado Squawfish	Ptychocheilus lucius
Speckled Dace	Rhinichthys osculus
Longnose Dace	Rhinichthys cataractae

Catostomidae

Flannelmouth Sucker	Catostomus latipinnus
White Sucker	Catostomus commersoni
Bluehead Sucker	Catostomus discobolus
Razorback Sucker	Xyrauchen texanus

Ictaluridae

White Catfish	Ictalurus catus
Black Bullhead	Ictalurus melas
Channel Catfish	Ictalurus punctatus

Cyprinodontidae

Pecos Pupfish	Cyprinodon sp.
Rio Grande Killifish	Fundulus zebrinus
Rainwater Killifish	Lucania parva

	Poeciliidae
Mosquitofish	Gambusia affinis
Pecos Gambusia	Gambusia nobilis
	Centrarchidae
Green Sunfish	Lepomis cyanellus
Bluegill	Lepomis macrochirus
Largemouth Bass	Micropterus salmoides
White Crappie	Pomoxis annularis
Black Crappie	Pomoxis nigromaculatus
	Percidae
Bigscale Logperch	Percina macrolepida
Pecos Darter	Etheostoma lepidum
	Cottidae
Mottled Sculpin	Cottus bairdi

APPENDIX D

Realty — Natural Res

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
Colorado State Office
730 Simms Street, Suite 290
Golden, CO 80401
FTS 776-2675
COMM (303) 236-2675

TAKE PRIDE IN AMERICA

E.A. 7/c

IN REPLY REFER TO:
FWE/CO:BIA:Species List
Mail Stop 65412 Grand Junction

JUL 18 1990

Memorandum

To: Superintendent, Southern Ute Agency, Bureau of Indian Affairs, Ignacio, Colorado

From: Colorado State Supervisor, Fish and Wildlife Enhancement, Fish and Wildlife Service, Golden, Colorado acting

Subject: Threatened and Endangered Species List for Oil and Gas Leasing and Development Environmental Assessment on the Southern Ute Indian Reservation

We have reviewed your letter of June 9, 1990, requesting a list of federally listed threatened and endangered species on the Southern Ute Indian Reservation for your Environmental Assessment on Oil and Gas Leasing and Development. We are furnishing you the following list of species which may be present in the concerned area.

FEDERALLY LISTED SPECIES

Colorado squawfish	Ptychocheilus lucius
*Razorback sucker	Xyrauchen texanus
Bald eagle	Haliaeetus leucocephalus
Peregrine falcon	Falco peregrinus
Black-footed ferret	Mustela nigripes
Knowlton cactus	Pediocactus knowltonii

* Proposed for Listing June 1990

The Fish and Wildlife Service (Service) would like to bring to your attention species which are candidates for official listing as threatened or endangered species (Federal Register, Vol. 54, No. 4, January 6, 1989; Vol. 55, No. 35, February, 21, 1990). While these species presently have no legal protection under the Endangered Species Act (Act), it is within the spirit of the Act to consider project impacts to potentially sensitive candidate species. Additionally, we wish to make you aware of the presence of Federal candidates should any be proposed or listed prior to the time that all Federal actions related to the project are completed.

FEDERAL CANDIDATE SPECIES

Ferruginous hawk	Buteo regalis
Mountain plover	Charadrius montanus
Long-billed curlew	Numenius americanus
Mexican spotted owl	Strix occidentalis lucida
Southwestern willow flycatcher	Empidomax trailii extimus
Schmoll milk-vetch	Astragalus schmolliae
Frosty bladderpod	Lesquerella pruinosa
Skyrockets	Ipomopsis polyantha var. polyantha

If the Service can be of further assistance, please contact John Anderson of the Grand Junction office at (303) 243-2778 or FTS 322-0351.

cc: FWS/FWE, SLC
FWS/FWE, GJ
CDOW, Durango

APPENDIX E

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
SAN JUAN RESOURCE AREA
FEDERAL BUILDING
701 CAMINO DEL RIO
DURANGO, COLORADO 81301

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

July 27,1989

PROBLEMS AND CONSIDERATIONS ASSOCIATED WITH WATER INJECTION AND COAL-BED METHANE DEVELOPMENT AS THEY RELATE TO GROUNDWATER IN THE NORTHERN SAN JUAN BASIN, COLORADO. A RESPONSE TO INQUIRY MADE BY THE HONORABLE BEN NIGHTHORSE CAMPBELL, CONGRESSMAN, THIRD DISTRICT, COLORADO.

INTRODUCTION

The San Juan Resource Area (SJRA) of the Bureau of Land Management (BLM) administers oil and gas operations on over a million acres of public lands, 137,000 acres of Southern Ute Indian mineral estate and nearly 155,000 acres of Ute Mountain Ute Indian mineral estate. In addition, the BLM is responsible for oil and gas operations occurring on lands managed by other federal agencies such as the US Forest Service and US Bureau of Reclamation. Currently the SJRA administers activities on a total of nearly 1500 wells; of these, approximately 1100 are Indian mineral estate, 182 are on public lands, 44 on Forest service, and about 150 are private and state wells which are allocated to jurisdictional lands by some form of agreement.

Recently, coal-bed methane development has increased dramatically in the San Juan Basin. Since 1980, 118 coal-bed methane wells have been completed on jurisdictional lands. Of these, 98 are on Indian mineral estate, 15 on public minerals, and 5 are allocated private (Fee) wells. Favorable geology, comparatively low drilling costs, new and adapted technologies, and federal tax incentives have combined to spur activity in the basin. Several aspects of coal-bed methane production are unique, but most are similar or identical to conventional oil and gas development. It seems that many people unfamiliar with oil and gas activities have confused the application of older (conventional) technologies with some of the "newer technologies" employed in the production of coal-bed methane. Many issues deal with common environmental problems such as visual impairments, noise, dust, loss of habitat, and so on. Two less common environmental issues associated with coal-bed methane development are the need to dispose of large quantities of water and the effects of withdrawing this water from the coal seams. Authority (and responsibility) under the various environmental laws and regulations is split between several entities due to the diverse nature of land and mineral ownership in the basin, making it virtually impossible to produce a single comprehensive environmental document such as a basin-wide environmental impact statement. These complexities have lead to a certain amount of confusion and apprehension in the public and media. Hopefully, this paper will provide information which will help delineate concerns which warrant further study from those that simply need information disseminated.

POTENTIAL GROUNDWATER IMPACTS OF DISPOSAL (INJECTION) WELLS

In recent months public concern has been expressed concerning the apparent degradation of groundwater in the Bondad - Cedar Hill area of Colorado and New Mexico. The recent completion of a "shallow"[1] water disposal well in that area (the Bonds 5-1, S.1, T.33N.,R.10W., La Plata County, Colorado) has led some to speculate that that well may be responsible for the contamination of near-surface aquifers in the area. This water disposal well is located on private surface and private mineral ownership and falls under the jurisdiction of the Colorado Oil and Gas Conservation Commission (COGCC). Therefore the BLM was not involved in the permitting of this well and has no jurisdiction over the operation of the well.

Currently, there are no disposal or injection wells located on Public Lands in the Colorado portion of the San Juan Basin. At this point it should be pointed out that the terms disposal well and injection well are commonly used interchangeably. Under the strictest definition, an injection well is associated with enhanced hydrocarbon recovery projects, while disposal wells are designed to dispose of waste fluids. The wells associated with coal-bed methane are therefore disposal wells and should be referred to as such. There are five deep disposal wells currently permitted on the Southern Ute Indian Reservation (see appendix 1). Injection and disposal are authorized by Underground Injection Control (UIC) permits issued by the Environmental Protection Agency (EPA) and the Colorado Oil and Gas Commission (COGCC) under authority of the Safe Drinking Water Act. The UIC permits dictate mitigative measures for the protection of ground waters. The drilling of these existing wells was approved by the BLM under authority of 43 CFR and the terms of the respective oil and gas leases[2]. The role of the BLM in resource protection with respect to water disposal wells, is to see that all mineral resources (eg, coals, oil, gas, etc.) are protected during the drilling, injection, and abandonment operations. All disposal wells located on jurisdictional lands are considered to be "deep [3] injection" wells and therefore should not impact shallow aquifers.

It seems the apparent concern on the part of citizens is the presence of methane in the groundwater and not the salinity of the waters. Since the Bonds well is a (salt)water disposal well, it seems that the source of the methane (i.e. natural, leaking casing, etc.) must be defined prior to assessing the impacts, if any, of the water disposal.

[1] Shallow injection is loosely defined as those zones above the Fruitland Formation (i.e., those zones above about 2500 feet depth).

[2] Recently, the Southern Ute Tribe has opted to issue special "Water Disposal Agreements" under the authority of the Indian Mineral Development Act, rather than the Mineral Leasing Act to which 43 CFR applies.

[3] Deep injection is loosely defined as those zones below the Fruitland Formation (i.e., those zones below approximately 2500 feet depth).

COAL BED-METHANE DRILLING AND COMPLETION

The technology and methods utilized to drill and complete coal-bed methane wells are essentially the same as those which have been used in the oil and gas industry for many years. The drilling method (rotary), blowout prevention equipment (annular and ram preventers), and casing programs are nearly identical to those used in conventional oil and gas operations. Slight modifications of some techniques have been made to enhance their effectiveness in the coal formations. For example, hydraulic fracturing of low permeability zones has been accomplished for many years. Most coal-bed methane wells are hydraulically fractured. The sand particles used to hold open the fracture may be varied in size and the fluid properties may be altered, but in general a fairly old technology is being applied. Another example is the casing and cementing program. The COGCC has passed order 112-61 which requires "all (coal-bed well) production casing strings shall be cemented from the casing shoe or total depth, whichever is shallower, to the surface by circulation methods". This requirement ensures that the interzonal flow of fluids behind the casing is minimized or precluded. Again, a conventional casing job is modified slightly to include sufficient cement to fill the entire annular space of the well, thereby restricting fluids to their respective zones.

COAL-BED METHANE PRODUCTION

As is the case with drilling and completion, production of coal-bed methane is accomplished with standard methodology and equipment. The water is lifted out of the well by conventional "beam pumps", piston lift, or down hole pumps. Water/gas separators have been modified to handle the larger than normal amounts of water. The produced water is relatively low in salts in the northernmost part of the basin compared to waters associated most with oil and gas production, therefore it has a higher freezing temperature. Heating/insulation modifications have been made to equipment to prevent freezing during winter months. In general existing technology and equipment are utilized in coal-bed methane production.

If there is a new technology involved in coal-bed methane it is the principle of methane desorption from coal through the reduction of pressure. For years miners and drillers have known that methane gas is associated with coals. But not until fairly recently has the idea of pressure reduction through the removal of water (hydrostatic head reduction) been seriously considered as a viable way to produce natural gas. Geologic and engineering studies have shown that huge amounts of gas are adsorbed on the coals, and federal tax incentives allow for the economic recovery of the gas. Business risks are fairly high due to unknowns associated with the incompetent nature of the coals (sometimes difficult to maintain the permeability necessary for production due to closure of fractures) and the lack of sufficient historical data to prove that a large percentage of the gas-in-place can actually be recovered; thus the tax incentives encourage operators to develop this "unconventional" gas resource.

POTENTIAL GROUNDWATER IMPACTS POSED BY COAL-BED METHANE DEVELOPMENT

Two aspects of coal-bed methane production, both dealing with water, are of concern, namely, water depletion effects and water disposal. Aside from the depletion of the intended aquifer, the effects of withdrawal of water from shallow (near surface) aquifers may include subsidence and increased infiltration from surface water courses. The effects of withdrawal from the coal at depth are not as well understood. If aquifers above the coal-beds are in communication with the coal-beds, depletion of those overlying aquifers may occur. However, if the removal of the water allows the formation to subside and reduce the permeability and porosity of the coals, water from zones outside the coals would not be able to enter. The presence of thick intervening shales combined with the depth differential between the coals and the overlying usable aquifers may also preclude the loss of usable groundwaters. Thick shales, which are generally impermeable, lie between the coals and the shallow aquifers. In the absence of large regional fractures and/or faults, it seems unlikely that communication between shallow aquifers and the coals at depth can occur. The exception to this may be near the basin margin where the various formations bend upward and are exposed at the surface.

Water disposal into deep wells is not likely to cause adverse impacts on usable aquifers. It is unclear how shallow disposal affects usable aquifers and may be specific to each site. Evaporation ponds are an alternative disposal method which, if properly constructed provides an environmentally safe method of water disposal. Currently there are no disposal ponds or disposal wells on public land in the Colorado portion of the San Juan Basin. Five deep disposal wells are currently permitted on the Southern Ute Lands with several more planned.

POTENTIAL IMPACTS TO GROUNDWATER POSED BY ACTIVITIES NOT LIMITED TO COAL-BED METHANE DEVELOPMENT

Many other development activities may have impacts on groundwater. Irrigation, bridge and road construction (pylons & piers), seismic shotholes, stratigraphic (geological) test holes, septic systems, and especially water wells can have dramatic effects on groundwater quantity and quality. Often recordation on these types of activities is poor and incomplete. A comprehensive investigation of ground water should include all potentially impacting activities and address the relationships and cumulative impacts of those activities.

Older oil and gas wells are of particular concern as corrosion and related deterioration can cause the loss of mechanical integrity of the well bore. In addition many of the older wells were drilled prior to the implementation of the rigorous standards now enforced.

Possibly the most important factors, and unfortunately the most difficult to pin down with confidence, are the subsurface geology which controls groundwater movement and storage, and climatic variations such as annual rainfall and temperature variations. Natural phenomena may cause problems related to production and contamination of groundwater. These natural occurrences cannot be ignored.

SUMMARY AND RECOMMENDATIONS

Some evidence of groundwater degradation is present in certain areas of the San Juan Basin. It is not known at this time if the degradation is natural or related to human activities. There is also speculation that future activities, such as water withdrawal, may impact groundwater resources.

It appears that the only documented cases of groundwater pollution are found in the Bondad - Cedar Hill area and are due to methane contamination of unknown source. Since this area is largely private surface/private mineral estate, BLM has no jurisdiction in this area. We feel that a joint effort to study the cause(s) of the methane contamination between the COGCC and the New Mexico Oil Conservation Division (NMOCD) is desirable since both agencies are involved in the UIC permitting process and both have jurisdiction over much of the oil and gas activity in that area. Perhaps these agencies could combine the various groups already in existence, such as the Cedar Hill Clean Water Committee and the Animas River Valley Water Contamination Study Group, into a united organization capable of accomplishing the study and recommending mitigative measures. The BLM wishes to support the study in any way it can, however staff and budgetary constraints will likely limit our participation unless additional funding is obtained.

It is recommended that further geological studies be conducted in order to better define the groundwater situation and identify activities which have or may impact usable groundwater. Several studies of limited scope are being initiated by various agencies including BLM. Currently the BLM is in the process of compiling and analyzing all available groundwater related information for the northern San Juan Basin to provide the technical base for future National Environmental protection Act (NEPA) documentation including cumulative impact assessments. At BLM request, the USGS has forwarded a proposal for a groundwater study encompassing the Colorado portion of the San Juan Basin. We plan to submit a request for funding this project in FY 1990. Perhaps a single agency such as the U.S. Geological Survey could take the lead and compile a report on the regional hydrology of the San Juan Basin which would include potential impacts related to the various development activities. The BLM would cooperate to the fullest extent that labor and budgetary constraints will allow and provide all nonproprietary data to the USGS. In all probability, additional funding will be necessary to accomplish this study. Without "outside" funding it is doubtful that any agency can take on the scope of work presented by this situation.

Meanwhile it is suggested that approval of development operations be continued while at the same time requiring the various operators to submit the data and information gained, aiding in the evaluation of the situation. Appendix 2 lists the conditions of approval San Juan Resource Area currently attaches to coal-bed methane Applications for Permit to Drill. These conditions of approval provide additional information increasing our understanding of the hydrology of the area. Geophysical logs and other evaluation techniques could also be required to be performed on older wells suspected of being mechanically unsound.

Since no connection between the drilling of coal-bed methane wells and groundwater degradation has been shown to exist, it is difficult to justify suspending all approvals when valid leases, complete applications, and tax credit time constraints are involved.

The BLM remains committed to the careful management of the resources within our jurisdiction. We are keenly aware of our stewardship of Public Lands and fiduciary responsibility to the Indian tribes. Interaction between the various agencies and groups is essential. Through cooperation and information sharing mitigative measures and alternatives may be developed, resulting in solutions acceptable to the various interests concerned.

Addendum to the July 27, 1989 briefing paper prepared by the Bureau of Land Management for Congressman Campbell

During the time since the initial briefing paper was prepared, additional research of the literature and study of available data have led to the the following conclusions:

- After reviewing all available information and data available, it has been determined that subsidence is not a valid concern. The integrity of the rock units (consolidated strata), combined with the small amount of pore volume available to collapse, makes it virtually impossible for coal-bed methane related production to cause any perceptible subsidence to occur. This particularly true at the surface given the depths and volumes involved.

- The loss of shallow groundwater due to depletion of Fruitland Formation water is unlikely. Evidence such as differing water quality (salinity) and differing reservoir pressures indicate there is a lack of continuity between zones above and below the Kirtland Shale. An exception to this may be in the vicinity of the Fruitland Formation outcrop area along the northern rim of the basin. Insufficient data are currently available to determine the hydrological relationships between the Fruitland and overlying rocks within a 1/2 to 1 mile-wide zone (basinward) along the outcrop.

A report dealing with potential groundwater impacts of coal-bed methane development has been recently prepared by the BLM. It is intended to be used as a reference document for APD reviews and NEPA documentation associated with coal-bed methane development. It is available for public review at the BLM office at 701 Camino del Rio, Durango.

November 1, 1989

Appendix 1
Water Disposal Wells Permitted on Southern Ute Lands
as of July 27, 1989

Operator	Lessor	Well Number	Formation	Depth	Location
ARCO	So. Ute	15-9, 32-9	Pictured Cliffs	3254	SE 15-32N-9W
ARCO	So. Ute	24-6, 32-9	Entrada	9480	NW 24-32N-9W
ARCO	So. Ute	10-2, 32-10	Entrada	8688	NE 10-32N-10W
ARCO	So. Ute	13-8, 32-8	Entrada	9380	SE 13-32N-8W
NCRA	So. Ute	2-2	Mesaverde	4580	SE 14-32N-8W

Appendix 2
Conditions of Approval[1]

1) Temperature survey and/or bond log required should cement fail to circulate to surface on production casing string.

2) Minimum pressure testing requirements are 2000 psi for ram type blow out prevention equipment (BOPE) and 1500 psi for annular BOPE.

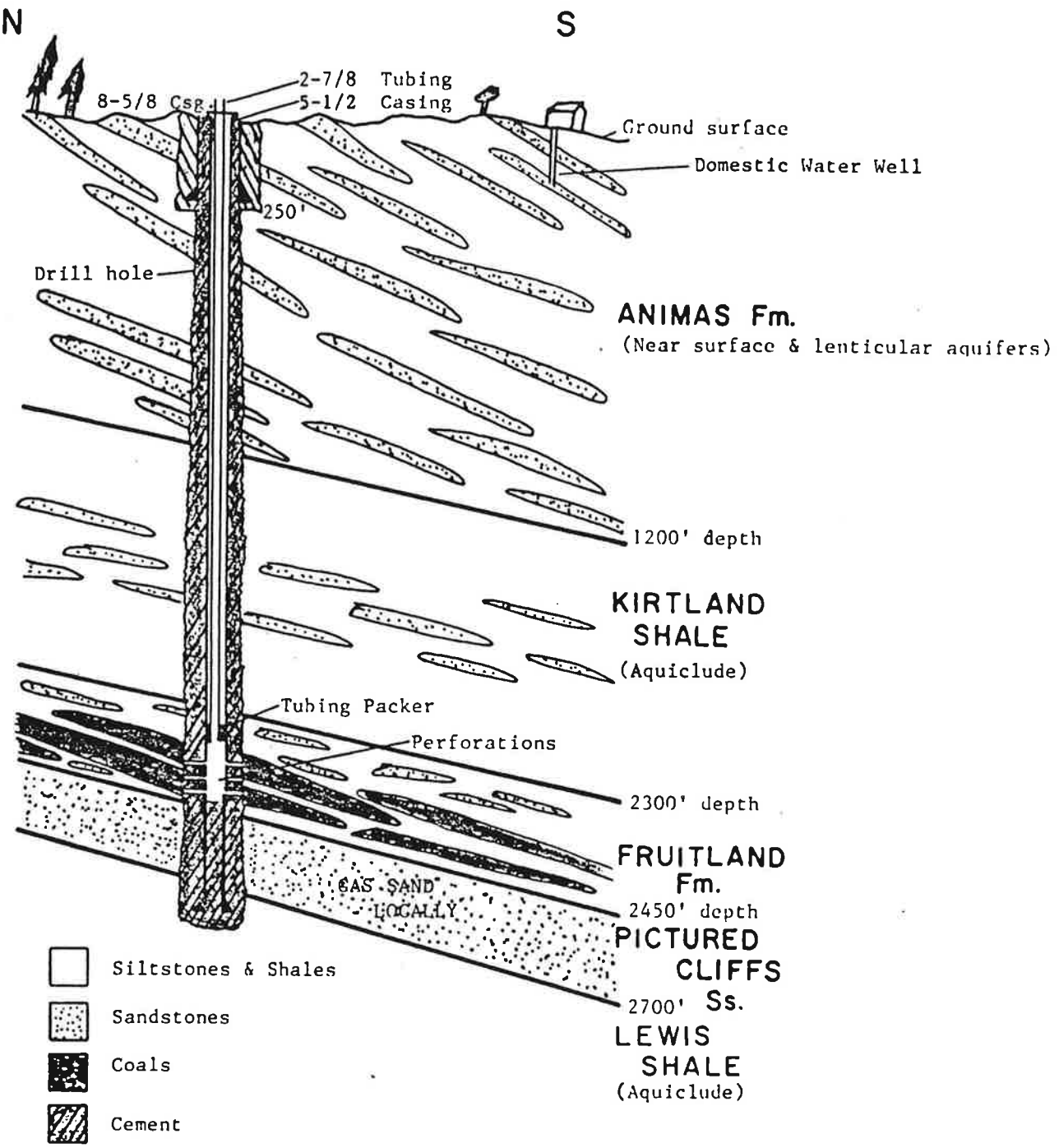
Note: You are cautioned to consider your mud program in connection with surface pressure control equipment when drilling into and beyond the Fruitland Formation.

3) File water analysis of the Fruitland Formation (analysis should include major anions, cations, TDS, and conductance of produced water sample).

4) Record and file static water level with completion report (form 3160-4).

5) Monitor and record cumulative water production.

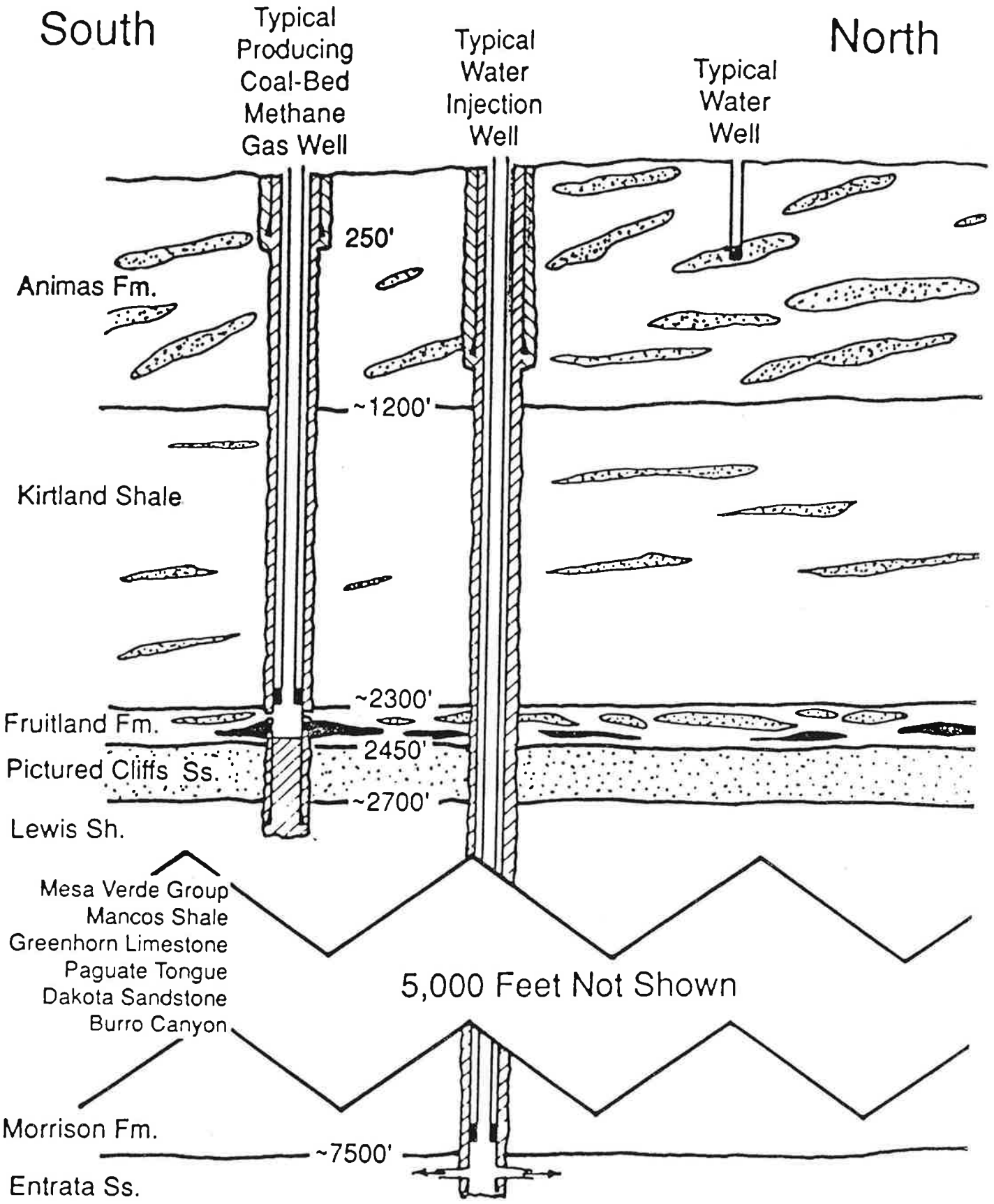
[1] In addition to the specific requirements outlined above, information such as production rates, pressures, and other technical data are routinely submitted on completion reports, sundry notices, and monthly reports of lease operations.



-North South diagrammatic cross-section of a typical coal-bed methane well in the Sauls Creek area. Sketch based on Sauls Creek #1 well, SWNW S.34,T35N,R6W. Injection wells have a similar design except the disposal formation is typically much deeper(7000 to 8000' depth). Note: Depths are to scale, horizontal is exaggerated.

Definitions:

Lenticular-lens shaped, thicker in middle than on edges. Discontinuous.
Aquiclude-body of relatively impermeable rock. Confining layer.


South
Typical Producing Coal-Bed Methane Gas Well
Typical Water Injection Well
Typical Water Well
North
250'
Animas Fm.
~1200'
Kirtland Shale
~2300'
Fruitland Fm.
2450'
Pictured Cliffs Ss.
~2700'
Lewis Sh.
Mesa Verde Group
Mancos Shale
Greenhorn Limestone
Paguate Tongue
Dakota Sandstone
Burro Canyon
5,000 Feet Not Shown
Morrison Fm.
~7500'
Entrata Ss.

Addendum to the July 27, 1989 briefing paper prepared by the Bureau of Land Management for Congressman Campbell

During the time since the initial briefing paper was prepared, additional research of the literature and study of available data have led to the the following conclusions:

- After reviewing all available information and data available, it has been determined that subsidence is not a valid concern. The integrity of the rock units (consolidated strata), combined with the small amount of pore volume available to collapse, makes it virtually impossible for coal-bed methane related production to cause any perceptible subsidence to occur. This particularly true at the surface given the depths and volumes involved.

- The loss of shallow groundwater due to depletion of Fruitland Formation water is unlikely. Evidence such as differing water quality (salinity) and differing reservoir pressures indicate there is a lack of continuity between zones above and below the Kirtland Shale. An exception to this <u>may</u> be in the vicinity of the Fruitland Formation outcrop area along the northern rim of the basin. Insufficient data are currently available to determine the hydrological relationships between the Fruitland and overlying rocks within a 1/2 to 1 mile-wide zone (basinward) along the outcrop.

A report dealing with potential groundwater impacts of coal-bed methane development has been recently prepared by the BLM. It is intended to be used as a reference document for APD reviews and NEPA documentation associated with coal-bed methane development. It is available for public review at the BLM office at 701 Camino del Rio, Durango.

November 1, 1989

APPENDIX F

EA No. CO-030SJ90-36

ENVIRONMENTAL ANALYSIS

OIL AND GAS DEVELOPMENT

SOUTHERN UTE INDIAN RESERVATION

ARCHULETA, LAPLATA, AND MONTEZUMA COUNTIES, COLORADO

BUREAU OF LAND MANAGEMENT

SAN JUAN RESOURCE AREA

701 Camino del Rio, Durango, Colorado 81301

January 25, 1990

INTRODUCTION

Need for the Proposed Action. Oil and gas operations on the Southern Ute Indian Reservation are an on-going activity comprising present day production of existing wells, and proposed new well development. This activity is a reflection of the Southern Ute Indian Tribe's desire for full field development of their energy resources.

Conformance with Land Use Plan. Oil and gas development is in conformance with the Southern Ute Indian Tribe Natural Resources Management Plan, 1990 - 2010.

Relationship to Statutes, Regulations, or Other Plans. Oil and gas operations are dependent upon valid existing Indian Oil and Gas Leases [issued by the Bureau of Indian Affairs (BIA) under the authority of the Indian Minerals Leasing Act of May 11, 1938, 52 Stat. 348, 25 U.S.C. 396a-396q, for extraction of minerals owned for the benefit of tribes, and the Act of March 3, 1909, Chapter 263, 35 Stat.783, 25 U.S.C. 396, as amended, for extraction of minerals owned for the benefit of Tribal Allottees as well as regulations issued pursuant thereto (25 C.F.R. Secs. 211.21 and 212.24], and upon Mineral Development Agreements [issued by the BIA under the authority the 1982 Indian Mineral Development Act (IMDA), 25 U.S.C. 2102].

Administration of these leases and mineral development agreements, once issued,is the responsibility of the Bureau of Land Management (BLM) under the authority of Federal Oil and Gas Royalty Management Act of 1982 (43 CFR 3160 series).

The leaseholder (or his designated agent) must have an approved Application for Permit to Drill (APD) from the BLM prior to commencing operations.

Additional Federal laws and Executive Orders that can apply to protection of surface resources during the issuance and administration of oil and gas leases are:

1. Act for Preservation of American Antiquities of 1906 (34 Stat. 225, 16, U.S.C. 431 et seq.)

2. National Historic Preservation Act of 1966 (80 Stat. 915, 16, U.S.C. 470 et seq.)

3. National Environmental Policy Act of 1969 (83 Stat. 852, 42, U.S.C. 4321 et seq.)

4. Executive Orders 11988 (Floodplain Management), 11990 (Protection of Wetlands), 11514 (Protection and Enhancement of Environmental Quality as amended by Executive Order 12148), 11593

5. Archaeological and Historical Preservation Act of 1974 (88 Stat. 174 16, U.S.C. 469 et seq.)

6. Archaeological Resources Protection Act of 1979 (93 Stat. 721, 16 U.S.C. 470 et seq.)

7. Southern Ute Tribal Resolutions 86-01 and 87-25

8. Policies and Procedures of the Southern Ute Tribe

9. Endangered Species Act of 1973 as amended

10. The Bald Eagle Protection Act (16 USC 668 as amended)

11. The Migratory Bird Conservation Act of 1929 (16 USC 715)

12. The Sikes Act of 1974 (16 USC 670 et seq.)

13. The Taylor Grazing Act of 1934 (43 USC 315)

14. The Clean Water Act (33 USC 404, as amended)

15. The Public Rangeland Improvement Act of 1978 (43 USC 1901 et seq.)

16. The Fish and Wildlife Coordination Act (16 USC 661, as amended)

17. Soil Conservation and Domestic Allotment Act of 1935

18. Watershed Protection and Flood Control Act of 1954

19. Clean Air Act Amendments of 1970 and 1977

20. Noise Control Act of 1972

21. Water Pollution Control Act of 1972, as amended

22. Colorado River Basin Salinity Control Act of 1974

23. Safe Drinking Water Act of 1974

24. Resources Conservation and Recovery Act of 1976

25. Federal Land Management Policy Act of 1976

26. Classification and Multiple-Use Act of 1981

27. Water Quality Act of 1987

28. Underground Injection Control Regulations of the U.S. Environmental Protection Agency (40 USC 124, 144, 146, 147)

29. Rules and Regulations of the Colorado Oil and Gas Conservation Commission

30. Department of the Interior, Bureau of Land Management Onshore Order No. 1 (Approval of Drilling Operations), Onshore Order No. 2 (Performance of Drilling Operations), Onshore Order No. 3 (Site Security), Onshore Order No. 4 (Measurement of Oil), Onshore Order No. 5 (Measurement of Gas), Onshore Order No. 6 (Hydrogen Sulfide Operations), and Notice to Lessees (NTLs)

PROPOSED ACTION AND ALTERNATIVES

Proposed Action. The proposed action is to approve Applications for Permits to Drill (APDs), with appropriate surface protection stipulations, for all anticipated drilling and production of oil and gas wells on Southern Ute Indian tribal and allotted leases/mineral development agreements.

Although well pad dimensions vary, an average size is 300 feet long by 250 feet wide, disturbing about 1.7 acres. An average new access road would be about 300 feet long and 20 feet wide, disturbing an additional 0.2 acre. Associated pipelines would parallel existing roadways for an additional disturbance of 0.2 acre. This totals to about an average of 2 acres surface disturbance for each new well(see Appendix A for a generalized view of a drilling well location).

On any given site, the order of construction is:

1. Remove all salvageable wood products for fence posts and firewood.

2. Chip and scatter all slash material (limbs and small branches).

3. Strip and stockpile 4 to 6 inches of topsoil.

4. Construct wellpad, reserve pit, and access road.

The drill rig is moved onto location and drilling operations begin. Upon completion of drilling, well casing is set, and drill rig moves out.

A smaller drilling rig (completion rig) moves on location to complete the well (usually perforates the casing in the production zones, fractures the producing formations if needed, and sets production tubing).

Generally, after the completion rig moves off location, production equipment (heater treaters, dehydration units, water and/or oil storage tanks, compressor units, and meter runs) are set up and made operational. Pipelines are constructed to the well site so that produced gas and produced water can be removed from location.

When the reserve pit is dry, it is reclaimed (filled in, contoured, topsoil spread, and reseeded), and those portions of the wellpad not needed for production are also reclaimed.

When the well is exhausted, it is plugged downhole with cement, all surface equipment is removed, and a dry hole marker is placed over the wellbore. Stockpiled topsoil is spread across the wellpad and reseeded, and the access road is reclaimed by similar procedures. Alternative Actions.

The No Action alternative is the same as the proposed action, i.e., the present management policy is to approve the proposed action with stipulations attached as conditions of approval, therefore this alternative will not be further considered.

AFFECTED ENVIRONMENT

General Setting. The Southern Ute Indian Reservation is located in Archuleta, LaPlata and Montezuma counties in southwestern Colorado from the New Mexico border on the south to about 15 miles north; from Mancos, Colorado, on the west border to Pagosa Springs, Colorado, on the east border (Appendices B and C), making a rectangle approximately 75 miles long East to West, and 15 miles wide North to South. The area encompasses 700,000 acres of which 312,000 acres are Tribal/Allotted lands; the remainder acreage is privately owned or belongs to Federal agencies.

The area is accessible from the south and north by U.S. Highway 550; from the east and west by U.S. Highway 160; and from the southeast by U.S. Highway 84. Colorado Highways 172 and 151 traverse the reservation eastward from Durango, Colorado, to the vicinity of Chimney Rock, Colorado, where Highway 151 rejoins U.S. 160. Colorado 140 crosses the western portion of the reservation in a north-south direction from Farmington, New Mexico, to Hesperus, Colorado, joining Highway 160 at Hesperus. A vast network of primary and secondary county-maintained gravel roads allow access from the main highways.

The terrain is predominately mountainous (Appendix C) with several alluvium-capped mesas (Red Mesa, Florida Mesa, and the Mesa Mountains). The topography of the area consists of moderate to very steep slopes. The San Juan and LaPlata Mountains are located north of the area with elevations up to 14,000 feet. The most significant topographic features in the western half of the reservation is the Animas River Canyon south of Durango, Colorado, and Bridge Timber Mountain and Black Ridge immediately west of the Animas River Canyon. The eastern half of the reservation is more complex and rugged as a result of the relatively close proximity of tectonic activity on the southern tip of the San Juan Mountains east of Pagosa Springs, Colorado. The Reservation elevation ranges from a low of approximately 5940 feet in Cinder Buttes Gulch and McDermott Arroyo to a high of 9159 feet on

Archuleta Mesa, giving a topographic relief of 3219 feet.

The major drainages within the area are (from west to east): the LaPlata River, the Animas River, the Florida River, the Los Pinos (Pine) River, the Piedra River, the San Juan River, the Rio Blanco River and the Navajo River. All of these streams are perennial and do support aquatic life. The north end of the Navajo Reservoir on the San Juan and Piedra Rivers extends into the Reservation east and north of Arboles, Colorado.

There are some extensive sandstone outcrops visible with the area, however, they are generally not as massive as those visible near Durango, Colorado. The major portion of the area is covered by glacial till remnants that are visible along all of the drainages, generally as gravel and boulder deposits. The more level areas are covered by eolian deposits covering the till as red-colored clay soils.

Geology.

1. Regional structure:

The Reservation is located on the extreme northern edge of the San Juan Basin, with regional dips varying from 1/2 degree to about 8 degrees, generally to the southeast, south, and southwest (Appendix D). Dips become greater than 30 degrees just north of the area at Durango, Colorado, in response to the San Juan and LaPlata Uplifts. Structural relief on the top of the Dakota Sandstone between Hermosa, Colorado, and the Navajo Reservoir area in New Mexico, is about 17,000 feet.

The Hogback Monocline is the dominant structural feature within the area outlining the northern half of the San Juan Basin (Appendix E). Maximum dips of 4 to 8 degrees are developed on this monocline; most major faulting parallels the monocline.

Igneous activity is evident in the extreme southeastern corner of the Reservation. Archuleta Mesa (T. 32 N., R. 1-2 W.) is capped by an augite andesitic sill of late Miocene age, and numerous dikes trending NNE-SSW are located just west of the mesa; age of these dikes range from late Cretaceous to Miocene.

2. Stratigraphy:

With the exception of the Ordovician and Silurian, all ages of geologic time are represented in this area (Appendices F and G). In general, formations exposed at the surface range from the Dakota Sandstone through the San Jose Formation.

3. Economic Geology:

Fresh water can be obtained from shallow surficial gravel deposits and from the Animas Formation; other water-bearing strata in the area contain brakish (400-35,000 TDS) to briny (greater than 35,000 TDS).

The principal coal-bearing zones are the Menefee member of the Mesaverde Formation, the Kirtland shale, and the Fruitland Formation. No coal mining is currently being conducted, although the Southern Ute Tribe is considering coal leasing for about

20,000 acres for strip-mining in T. 32-33 N., and R. 10-11 W.

Major hydrocarbon bearing strata include the Fruitland, Picture Cliffs, Mesaverde, and Dakota formations.

Climate.

The climate is semi-arid, middle latitude steppe, characterized by low (and highly variable) precipitation, abundant sunshine, low relative humidity, and moderate temperatures with large diurnal and annual ranges.

Ignoring slight differences due to variation in elevation, the average monthly temperature in July is 73 degrees Fahrenheit; for January it is 23 degrees; and has an annual average of 48 degrees. The warmest month is July with an average daily maximum of 88 degrees. During the summer for approximately 30-40 days the temperature will exceed 90 degrees, with occasional values over 100 degrees. The coldest month is January with an average daily minimum of 5 degrees. During the winter months for approximately 190-220 days the temperature will drop below 32 degrees, with an occasional value near -25 degrees. These temperatures allow for a growing season of about 150 days.

Depending on elevation, average annual precipitation ranges from 10 to 16 inches in the western half of the area, to 16 to 20 inches in the eastern half of the area. Most of the precipitation comes as rain during the summer and fall months. Thunderstorms of short duration and heavy showers are common and can create flash flooding. Snowfall averages 30 to 60 inches a year. As measured at the Navajo Dam, the mean pan evaporation rate for the seven non-freezing months is 59 inches (which reflects a mean lake evaporation rate of 42 inches).

The predominate winds are westerly with a secondary east-northeasterly flow (local deviations in the wind flow are caused by terrain features). In areas where the air is unevenly cooled, downslope drainage winds result on clear, calm nights; in areas where the air is unevenly heated, upslope winds occur on calm days. The average annual wind speed is 5 to 10 mph, with periods of higher winds during Spring and early Summmer. Occasional gusts in excess of 50 mph occur, generally associated with thunderstorms or cold/warm frontal passages.

Air Quality.

The Clean Air Act of 1970 and its amendments established primary and secondary ambient air quality standards for six pollutants. In addition, Prevention of Significant Deterioration (PSD) Standards have been established with areas classified as Class I, II, or III, depending upon the future air quality degradation desired (Class I is the strictest). The Southern Ute Indian Reservation is Class II.

The air quality of the area is considered good. Development within the area has caused some degradation resulting from oil/gas related activities usually of a short term duration. The annual total suspended particulate (TSP) level is assumed to be about 30-35 ug/m3. No data is available for the other pollutants.

Hydrology.

1. General:

All streams flowing through the area eventually drain into the San Juan River; groundwater flow is assumed to flow southward in response to the regional dip with a flow estimated at 6 feet per year.

Groundwater resources are predominately used for domestic purposes and surface waters are used for this purpose to a lesser degree; the City of Ignacio derives drinking water from the Los Pinos River. Irrigation water is drawn off the Los Pinos River for use within the Reservation boundaries.

Navajo Reservoir at Arboles, Colorado, is used for flood control on the San Juan River, fishing, boating, and for diversion to the Navajo Irrigation Project in New Mexico.

2. Surface Water.

The major drainages for the area are the LaPlata River, the Animas River, the Florida River, the Los Pinos River, the San Juan River, and the Navajo River. Surface water flow rates are irregular, generally peaking during Spring runoff (April through June) and late Summer rains, with diminished flow during the remainder of the year. Momentary maximum flow rates on the Animas River at Durango have been in the 12,000 to 25,000 cubic feet per second (cfs) range, producing disastrous flooding equivalent to the 100 to 500 year flood; average momentary maximum flow is about 4,000 to 6,000 cfs; average annual flow is 859 cfs.

Water quality is generally good, with the major cations being calcium and sodium, and the major anions being bicarbonate and sulfate.

Suspended sediment in surface waters is greatest during Spring runoff and rainy periods.

Riparian environments exist throughout the area as springs and seeps, and can be found on Rock, Salt, Beaver, Spring, Cat, Round Meadow, and Dry creeks, as well as around Lake Capote. Total acreage for riparian environments is estimated at 30.

3. Groundwater.

The depth to groundwater surface (water table) varies with location and geological conditions. Figure 11 shows the major water bearing formations and their water quality. Generally, the surface Quaternary sands and gravels and the Animas Formation provide the best water. Water yields vary from 1 to 200 gallons per minute (gpm) with depths averaging less than 50 feet along stream bottoms to more than 500 feet on mesa tops and stream divides.
Water quality varies with location, but in general the central and northeastern portions of the area have 500 to 1000 parts per million (ppm) total dissolved solids (TDS), while the western third and southeastern portions have 1000 to 3000 ppm TDS. Compared to surface waters, groundwaters are poorer in quality by factors of 4 to 70.

Soils.

The soils of the area are generalized into three associations: soils of cool to cold subhumid mountain regions, soils of warm semiarid to dry subhumid regions, and shallow soils/ rock outcrops/ or badlands (Appendix H).

Soils of cool to cold subhumid mountain regions are located, for the most part, in the eastern portion of the area in the higher elevations and areas of higher precipitation. They are composed of moderately deep to shallow, dark colored soils that overlie shale or sandstone parent material. The slopes on which these soils are found are generally steep to very steep and have a considerable amount of rock fragments included.

The soils of warm semiarid to dry subhumid regions comprise the northern portion of the area and are located on the mesa tops and ridges. They are generally deep to moderately deep dark colored soils, and are derived principally from underlying shale as well as some eolian deposits. The slopes in this association are, for the most part, more gentle than the previous association and do contain some remnants of Wisconsin interglacial deposits. A considerable amount of this association has been established into agricultural cropland, mainly native grass hay, and recently, wheat, barley, and oats.

The shallow soils association is found mainly in the southern portion of the area and are the more rugged nonagricultural lands. This association is comprised of shallow to moderately deep, light colored soils with a considerable amount of rock fragments. For the most part, this association is unsuitable for good agricultural croplands and are utilized mostly for range and livestock grazing. Extensive sandstone ledgerock outcrops are dominant in this association.

Vegetation.

The topographic relief in the Southern Ute Reservation is 3219 feet, ranging from a high of 9159 feet on Archuleta Mesa and a low of 5940 feet in Cinder Buttes Gulch and McDermott Arroyo. This differential allows for 6 major vegetation classifications (Appendix I):

1. Dry cropland: primarily lands planted to winter wheat and pinto beans, or left to pasturage.

2. Irrigated cropland: lands planted to mountain meadow hay, alfalfa, corn, grains, and vegetables.

3. Northern Desert Shrub: lands covered by Big Sagebrush, Black sagebrush, rabbit brush, horse brush, winterfat, broom snakeweed; galleta, blue grama, western wheatgrass, bluebunch wheatgrass and bottlebrush-squirreltail grasses.

4. Grasslands: lands with perennial grasses, shrubs, and forbs. Grasses are western wheatgrass, bluebunch wheatgrass, squirreltail, needle grass, blue grama, and galleta.

5. Pinon/Juniper Woodland and Rangelands: lands between elevations 4000 to

7000 feet; common junipers are Utah, Rocky Mountain, and one-seed; Colorado pinon-pine; associated shrubs and forbs are antelope bitterbrush, big sagebrush, mountain mahogany, cliffrose, blue gramma grass, galleta grass, bluegrass, bromegrass, fescue grass, junegrass, muhlys grass, needle grass, wheatgrasses, Indian ricegrass, Russian thistle, and annual brome.

6. Montaine Forest: lands with Ponderosa pine, intermixed with stands of aspen and Douglas fir. Associated understory plants are: Bromegrass, mountain muhly, timothy, Arizona fescue, Idaho fescue, wheatgrass, oatgrass, big sagebrush, serviceberry, snowberry, mountain mahogany, and bitterbrush.

The eastern third of the area contains the Montaine Forest zone, while the remaining areas are divided among the other zones (Appendix I).

A vegetation listing of the commonly observed species is included in Appendix J.

There are no known threatened and endangered plant species within this study area (Spellenberg Consultants, 1976).

Wildlife.

Wildlife known to inhabit the area include elk, deer, pronghorn antelope, porcupine, coyote, rabbit, prairie dog, field mice, Kangaroo rats, bobcats, mountain lion, black bear, and snakes.

Birds include raptors, magpies, pinon and scrub jays, crows, robins, meadowlarks, sparrows, morning doves, hummingbirds, as well as transient species.

Principal fish that may be found in Navajo Reservoir, Capote Lake, and the rivers and streams are: black bullhead, channel catfish, largemouth and smallmouth bass, northern pike, carp, white suckers, roundtail chub, bluegill, fathead minnow, rainbow trout, brown trout, Kokanee and coho salmon.

Various amphibians that may be found around stockponds include frogs, toads, and salamanders.

A complete listing of fauna that may be present on the Southern Ute Reservation is found in Appendix M.

Rare and endangered species that may be in the area include: Peregrine falcon (Falco peregrinus), Prairie falcon (Falco mexicanus), Mexican duck (Anas diazi), Bald eagle (Hailiaeetus leucoephalus), Osprey (Pandion haliaetus), Blackfooted ferret (Mustela nigripes), and the Spotted bat (Eduderma maculata). The Bald eagle is the only species documented to be present in the area.

Cultural Resources.

Although the southwestern United States has been continuously occupied by human groups since the closing stages of the Pleistocene era, the heaviest habitation occurred from 1 A.D. to about 1300 A.D. by the Anasazi. Prior to this time evidence of human habitation is referred to as Archaic. Sometime during the 1300's the Anasazi abandoned the area.

In the Southern Ute area, the Anasazi occupation occurred in the lower elevations, low rolling hills, and broad floodplains of major drainages. Given sufficient runoff in the broad arroyo floodplains, agriculture was probably an important activity, which had the potential of providing a stable subsistence base. Tops of hills are now forested with pinon/juniper and could have offered a variety of wild plant and game resources. Typically, occupation took advantage of well-drained localities for their surface and subsurface dwellings. Hillocks rising throughout the floodplains are often marked by cultural remains. Mesa top and canyon localities are also prevalent, especially in the far western reaches of the area (32-33 N., 13 1/2-14 W.) immediately adjacent to Mancos Canyon Indian Parkon the Ute Mountain Ute Indian Reservation.

Evidence of the Anasazi can be found in sites exhibiting signs of pithouses (shallow depressions 10-20 feet in diameter), campsites (hearth areas with charcoal), surface dwellings (evidence of stone-walled dwellings), along with numerous scatterings of flint chips (lithic scatters), and pottery sherds.

Occupation of Ute Indians is indicated by Escalante in 1776 by his observations of abandoned Ute campsites within the present-day Southern Ute Indian Reservation. It is to be noted that Escalante encountered Ute indians in the San Miguel drainage 60 miles north of the Southern Ute Reservation.

Land Use and Socioeconomics.

Land use is primarily agriculture in terms of alfalfa hay production on irrigated lands, and livestock grazing. Superimposed on these lands is oil and gas drilling and production activity with the resulting infrastructure of wellpads, access roads, and pipelines. Some recreation use is to be found at Navajo and Capote reservoirs, and big game (deer and elk) hunting occurs in the area during October and November.

Economically, oil and gas development and exploration have proven to be one of the main sources of income for the Southern Ute Tribe: lease rentals and royalty payments from produced oil and gas production provide a major part of the annual income.Drilling operations provide employment for some local people, however most drilling personnel are from the Farmington, New Mexico, area. Production operations employ about 90% local inhabitants.

Northwest Pipeline Corporation operates a gas extraction plant in the north central part of the area (34 N., 8 W.), and employs mostly local inhabitants.

Mineral Development.

The Southern Ute Indian Reservation is checker-boarded with privately owned surface and mineral estates. The Southern Ute area contains approximately 700,080 acres, of which 312,000 acres are Southern Ute Tribal and Southern Ute Allotted lands. The remaining acres are privately owned as follows: 80,027 acres are privately owned minerals; 207,906 acres are "coal-only" reserved to the Federal Government; 24,386 acres are "all-minerals" reserved to the Federal Government; and 2,568 acres are "oil/gas/coal only" reserved to the Federal Government.

Continued oil and gas exploration and development can be expected in the area. The Southern Ute Indian Tribe is diligently pursuing maximum mineral development on their lands via standard oil and gas leases as well as mineral development agreements. Coalbed methane is currently being developed by a number of operators stimulated by the Crude Oil Windfall Profits Tax Act of 1980 as it is applied to wellsdrilled and made capable of producing from non-conventional sources (coal) by Dec. 31, 1990.

Affected Resources.

Resources that will be effected by the Proposed Action are: Air quality, hydrology, soils, vegetation, wildlife, riparian environments, visual resources, and cultural resources.

ENVIRONMENTAL IMPACTS

Basic Assumptions for evaluating Cumulative Impacts.

1. State Spacing for the Pictured Cliffs, Mesaverde, and Dakota Formations 4 wells per section (160 acre spacing); for the Fruitland Formation spacing is 2 wells per section.

2. Leased acreage is 166,000 acres, comprising 260 sections of land.

3. Each section of land has a maximum potential of 14 wells (4 PC, 4 Mv, 4 Dk, and 2 Fr.), or for 260 sections: a potential of 3640 wells, or 3120 potential PC, Mv, Dk wells and 520 potential Fr wells.

4. Presently (January, 1990) there have been 891 PC, Mv, Dk, Gallup, and Paradox wells drilled: 3120 potential wells minus 891 existing wells leaves 2229 potential wells yet to be drilled. Likewise, there have been 116 Fruitland wellsdrilled: 520 potential wells minus 116 existing wells leaves 404 potential wells yet to be drilled. This leaves a total of 2633 (2229 + 404) wells yet to be drilled.

5. In the Proposed Action section we have determined each new well, on the average, represents 2 acres of new disturbance. For 2633 new wells a surface disturbance of 5266 acres (8.2 square miles) will occur.

6. Drilling began on the Southern Ute Reservation in 1950 and by 1990 about 1000 wells had been drilled; this averages about 25 wells per year.

7. This Environmental Analysis will address drilling activity for the next 20 years at the average rate of 25 new wells each year (500 new wells disturbing 1000 acres).

Impacts of the Proposed Action.

Air Quality: Direct Impacts. Air quality would be lowered because of exhaust emissions from moving vehicles and operating drilling rigs, from vehicular traffic on dirt roads, and blowing dust from all disturbed surfaces such as well pads, access roads, and newly constructed pipelines.

Indirect Impacts. None have been identified.

Cumulative Impacts. At any given time, drilling rigs could be miles apart from one another and resultant degradation of air quality would be minimal and of short duration (usually 7 to 14 days). With storm systems traveling through the area any accumulating pollutants will be dispersed to below detection limits.

Hydrology: Direct Impacts. Surface waters may have a slight increase in sediment load due to run off from freshly constructed well pads, roads, and pipelines. Groundwater should not be affected as all freshwater zones penetrated by the well bore are cased and cemented. Withdrawal of produced waters from oil and gas horizons will not affect upper zones as these are effectively sealed off by intervening shale horizons.

There has been considerable controversy in the Bayfield, Colorado, area (off Reservation) concerning potential impacts to groundwater due to development in the Fruitland Formation, and these same concerns do extend to Fruitland development on the Southern Ute Indian Reservation. The primary concern is the withdrawal of large amounts of produced water from coal seams in the Fruitland Formation, and the reintroduced of these waters into underground formations via injection wells. These concerns have been analyzed in a BLM study entitled "Report on Impacts to Groundwater in the Northern San Juan Basin from Coal Bed Methane Development" and is included as Appendix K.

Indirect Impacts. Leaking Reserve pits and trucks carrying produced waters making unauthorized discharges into washes and rivers are always a potential hazard.

Cumulative Impacts. There will be siltation of adjacent stream channels due to surface runoff from newly disturbed surfaces due to well development. As mitigative measures tend to minimize siltation downstream, the cumulative effect would be negligibly incremental. There have been no identified impacts to the groundwater.

Soils: Direct Impacts. Soils on wellpads and pipelines are stockpiled for future reclamation procedures, and suffer some degradation due to disturbance and storage in piles. Soils are compacted in place on roads and suffer degradation for the life of the road. Some soils will be lost due to surface runoff during heavy rains, and to airborn dust during high winds and vehicular traffic.

Indirect Impacts. Spills of toxic materials on wellpads and roadways is always a possibility for the lifetime use of these projects and can be detrimental to soil productivity in the short term.

Cumulative Impacts. Soils in stockpiles and in a compacted state effectively removes the vegetative habitat for the life of these projects (about 30 - 50 years). The area lost for vegetation (and resultant animal habitat) is on the order of 1000 acres (1.6 square miles).

Vegetation: Direct Impacts. Vegetation is destroyed on wellpads, pipelines, and roads.

Indirect Impacts. A vegetation loss of 1000 acres would reduce the available forage for livestock and wildlife.

Cumulative Impacts. The net loss of 1000 acres for 30-50 years.

Wildlife: Direct Impacts. Wildlife is stressed in the areas during immediate construction and during the drilling phases of operations. They avoid these areas, but later move back when quieter production operations ensue. However, new access roads with attendant human access and vehicular traffic cause additional stress.

Indirect Impacts. The presence of newly constructed roads and wellpads reduces habitat and may interfere with areas traditionally used as wintering and/or calving grounds for deer and elk.

Cumulative Impacts. Although the potential loss of 1000 acres may appear large, individual wellsites will be scattered over the entire Reservation and will not be grouped into concentrated areas. The cumulative effect will be primarily the reduction of available forage and shelter, with the resultant reduction in animal populations. With the attendant human access and vehicular traffic, increases in animal stress can be expected.

Cultural Resources: Direct Impacts. Although archaeological surveys are held prior to approval, hidden subsurface materials may be inadvertently destroyed during construction activity.

Indirect Impacts. During construction activities any nearby archaeological sites may be vandalized by individuals visiting the work areas. Even after construction the area may be visited by unauthorized individuals intent on searching for new archaeological materials for their own personal use.

Cumulative Impacts. Depending on the density of archaeological materials in the 1000 acres of expected surface disturbance, some loss of archaeological materials can be anticipated over the 20 year period.

Visual Resources: Direct Impacts. Access roads and pipelines on steep hillsides will present a scar on the landscape for distance viewing.

Indirect Impacts. None have been identified.

Cumulative Impacts. Depending on how much surface-disturbed acreage will be located on steep hillsides, some cumulative effect can be anticipated.

Riparian Resources: Direct Impacts. If development would be in, or adjacent to, any riparian environments, impacts could occur. Such impacts may be detrimental to the plant or animal community inhabiting the area.

Indirect Impacts. Predatory animals depending on food resources from riparian areas would be impacted to the extent of loss of shelter, food, and water.

Cumulative Impacts. Depending on how much disturbance occurred to riparian areas, detrimental impact could occur.

Socio-Economic Resources: Direct Impacts. Local inhabitants would be employed in a few new job positions, primarily for maintenance of facilities. Some local inhabitants may be unhappy with oil and gas development near their residences, and some may be unhappy with the overall development.

Indirect Impacts. Local governments will receive tax revenues from property tax and tax on production.

Cumulative Impact. If all 500 wells were developed, considerable tax revenues and royalties would be generated. Individuals having new jobs would be benefited. Individuals who felt they were being negatively impacted would be unhappy with the reduction in their quality of life.

Mitigation Measures.

During the pre-drill onsite inspections (attended by officials of the Tribal Energy and Natural Resource departments, a BIA specialist inthreatened and endangered species, a contracted archaeologist, the oil and gas operator, and a BLM representative) the location of the wellpad and access road is considered as to the impact of the proposal to all other Tribal resources. As impacts are identified, changes in the location of the proposal are considered and implemented if possible: pads are rotated to avoid major cuts and fills, corners of pads are rounded to avoid large cuts, pads and roads are moved to avoid archaeological sites, pads and roads are moved to take out a minimum of trees, locations are moved to save rangeland, locations are moved to use existing nearby pads and roads, steep hillsides are avoided when feasible, tree screens are left in place to hide locations from distant viewing, existing operable stockponds are left unemployed, riparian and wetlands are avoided at almost all costs and reserve pits are prohibited near such areas (steel tanks substitute), locations are moved away from nearby residences, locations and access roads are moved so that irrigated fields are not unduly disrupted, major drainages are protected by adequate culverts or bridges, locations are protected from floodwaters by adequate drainage ditches around the location and reserve pits, 6 to 8 inches of topsoils are required to be stockpiled for use in later reclamation of the wellpad, proposed wellpads and reserve pits are reduced in size where applicable, and timber is required to be salvaged by cutting into post and firewood lengths with slash to be chipped and scattered.

In addition to site-specific Tribal stipulations being attached to each APD as conditions of approval for surface use (see Appendix L), in those instances where subsurface archaeology is suspected archaeological monitoring is required for all initial surface disturbing activity. Also required is 48 hour notification to the Tribe, BIA, and BLM prior to initial surface disturbing activity so that this work can be monitored.

Residual Impacts.

Air Quality. Some short-term air pollution emissions of total suspended particulates, hydrocarbons, and hydrogen sulfide are expected in the development and production phases of oil/gas activities. Additional minor automotive and engine exhaust emissions are expected. The impact of these emissions on the ambient air is limited, and proposed mitigation measures and the use of best available

operating practices will minimize their impact.

Hydrology. There will be some alteration in stream flow characteristics due to land surface disturbances for construction of roads, drillpads, and pipelines, but the magnitude of such changes will be undetectable in the present flow regimes if proper mitigative measures are followed. Quality changes resulting from increased sediment will occur but again will not be detectable from natural conditions and variability. An unquantified amount of seepage from mud pits may occur, but if the use of toxic or hazardous mud additives is restricted, there will be minimal impact to groundwater and surface water.

Over the 20 year period of construction of 500 new wells, it is possible that an accidental release of oil/gas might occur. The potential impacts on water resources from an oil spill is greater than from a gas release. The magnitude of such spills would depend on the location of the release, the quantity of material released, and the timely response to cleanup operations.

Effects to shallow groundwater quality and quantity from dewatering of the Fruitland Formation coalbeds is not expected to be a problem, nor is the injection of these produced waters into deep formations expected to become a problem; however, in some local situations, there may be some deterioration of the groundwater due to these operations. Only close monitoring of water quality and gas well integrity will indicate the development of a problem in the future.

Soils and vegetation. During movement of soil material for fills and stockpiling, naturally developed soil horizons will be destroyed. The mixing of subsoils with topsoils would result in a combination of various soil types. This could cause a potential reduction in soil productivity and result in a loss of vegetation production. Unless all plant species present prior to disturbance are reestablished, species diversity and vegetation stability may be lost. Failure of reclamation may result in weed invasion and soil erosion. Soil lost to erosion will not be recovered.

Wildlife. Activities associated with vegetation removal will destroy wildlife habitat in varying degrees and could result in a decrease of certain species. Siltation of streams and other surface impoundments that provide fish habitat may occur with the onset of activities associated with land clearing. Surface waters that now support fish populations may experience water quality degradation, thus resulting in lowered productivity of selected fish species. Additionally, new access roads open up areas to human accessibility putting additional stress on wildlife as well as to hunting and poaching activities.

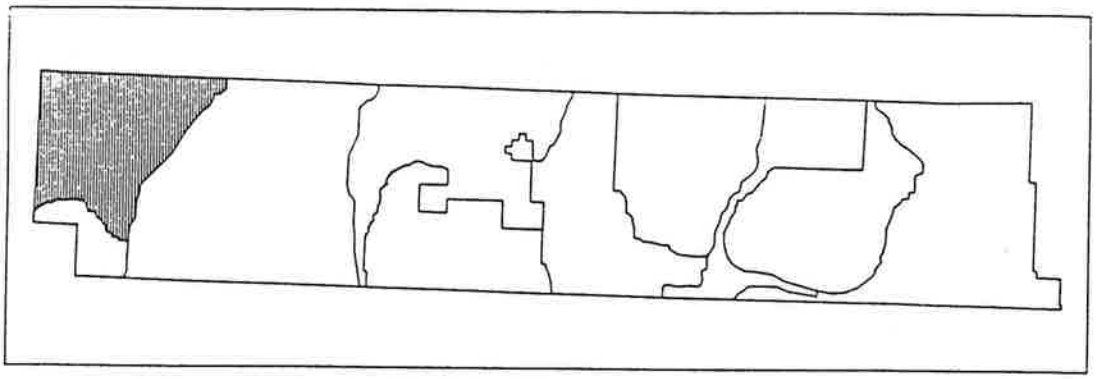
Cultural Resources. New roads open up areas to human accessibility which will allow potential access to archaeological sites. Although oil/gas operators prohibit their personnel and contractors from disturbing archaeological materials, and non-indians not having business on the Reservation are prohibited from entry on Indian lands, archaeological disturbance as "pot-hunting" occurs on occasion.

Visual Resources. There will always be instances where oil/gas activity will be allowed to proceed on steep slopes with visibility to surrounding areas.

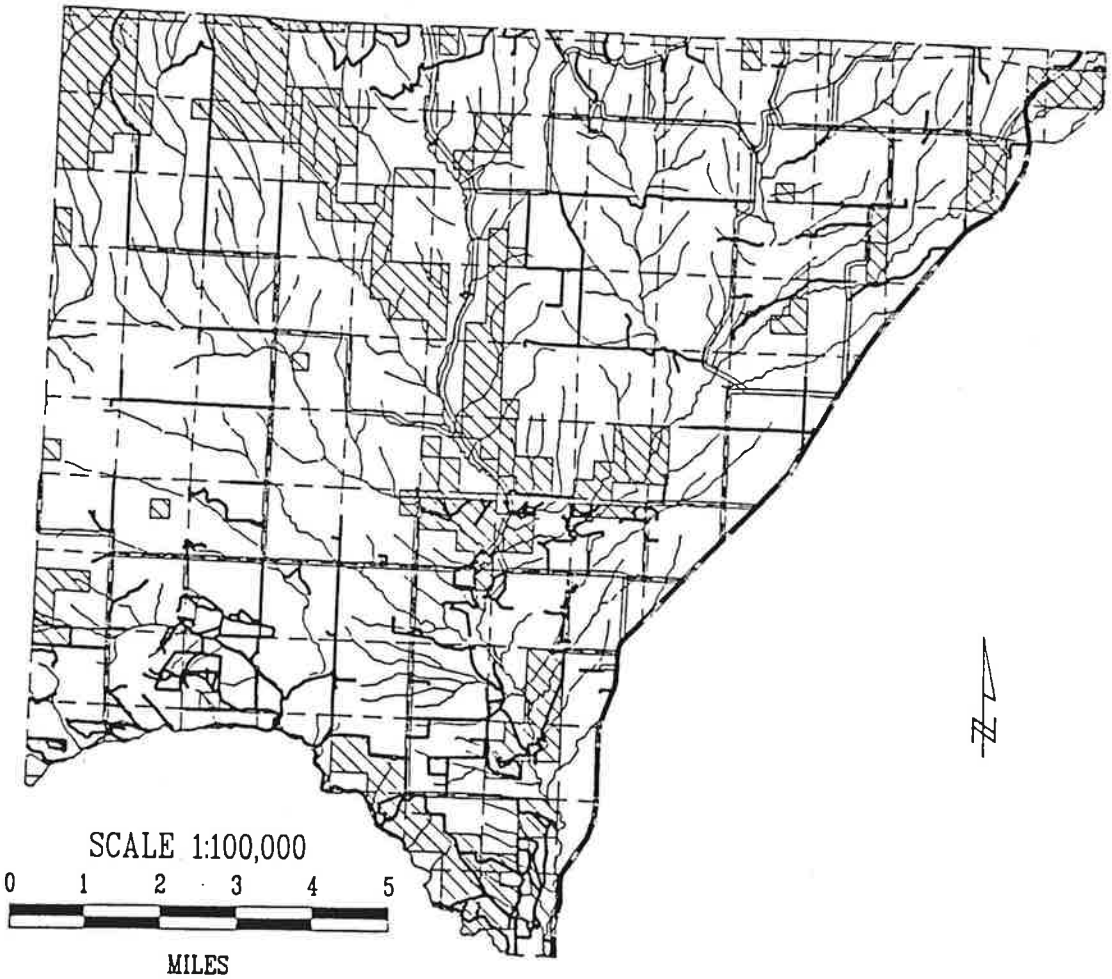
APPENDIX G

SOUTHERN UTE INDIAN RESERVATION

GENERAL MAP OF ANIMAS MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



ANIMAS - LA PLATA
Management Unit #1

This is a large unit in total area, 67,096 acres, but has only 10,384 acres of Tribal and allotted land. The trust land is composed mostly of small disconnected tracts with the majority consisting of the steep hillsides adjacent to Cherry Creek and Bear Canyon.

			Leased & Assign.	%
Tribal	10,228 ac.	15.3%	5,906	58%
Allotted	156 ac.	0.2%	156	100%
Fee & other	56,712 ac.	84.5%		
TOTAL	67,096 ac.	100.0%		

PHYSICAL DESCRIPTION:

Climate & Topography: This unit consists entirely of Life Zones 3 and 4 although some small areas appear to be the chaparral vegetation which often occurs just above the upper pinyon-juniper zone. The topography is mesa-canyon so air drainage is fairly good, lengthening the growing season on the mesas.

Soils & Agriculture: Arable lands are found on the mesa tops, (primarily the Witt series) and in valley bottoms (Umbarg & Vosburg series). (For a more detailed description of soils in Unit One see the Technical Section on page 4 - 7.) Much of the mesa land has been tilled for both dryland (beans, small grains) and irrigated crops. A large portion of this unit will be irrigated under the Animas-La Plata Project, when it is constructed. Only about 30 acres of trust lands are currently irrigated. The Tribe has about 1800 acres which are classed as irrigable under the Animas-La Plata Project.

The remainder of the soils are mostly steep and/or shallow and are suited for wildland management. A moderate pinyon-juniper or brush canopy is found on a majority of these soils.

Vegetation: Where undisturbed by agriculture, the trust land vegetation is typical for Life Zones 3 and 4. At the northern end, the woodland gives way to mountain browse vegetation composed primarily of Gambel oak, serviceberry, mountain mahogany and cliff fendlerbush. The brush grows in clumps with a grass-forb mixture occupying the openings. Other non-canopied areas are usually covered with big sagebrush and a variety of grasses, forbs and other brush (rabbitbrush, snakeweed).

Leafy spurge is invading this unit, primarily along the La Plata River and ditches.

Uses-Developments: Tribal lands are relatively undeveloped; many tracts are unfenced. There are a large number of county roads in the area which gives nearby access to most of the trust land. Colorado Hwy. 140 forms the East boundary of the unit.

There are very few watering devices on the Tribal lands so the range forage is mostly unusable unless operated in conjunction with adjacent private lands.

There are many rural residences scattered throughout the private lands, so there are both power and telephone lines near the Tribal lands. Only one Tribal member lives within this unit but several have recently applied for assignments, and some of these indicate they plan to reside here.

Current assignments total 460 acres with 2 applications still pending. There are 5 leases in the area totaling 5,446 acres which provides a return of $5,270/yr to the Tribe. One parcel (312 ac.) is owned by both an allottee and the Tribe, each having one half undivided interest. The allottment is also under lease.

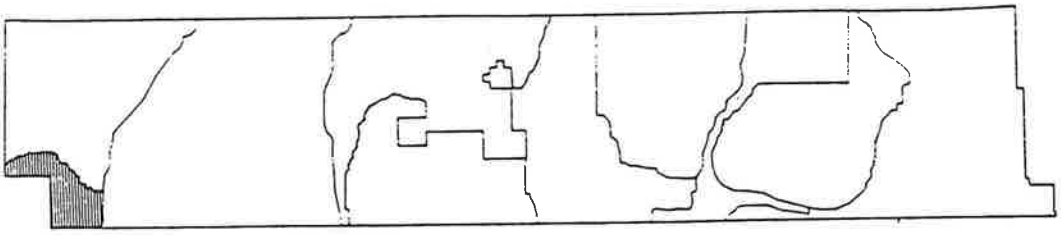
Wildlife: This area has a native population of mule deer, especially in the La Plata River bottom and the larger tracts of woodland and chaparral. Migrant deer and some elk also use the area. The large expanses of cultivated lands restricts the number of big game animals on private lands, but probably concentrates them on many of the undeveloped Tribal tracts.

Gambel quail, mourning dove and a small population of ringneck pheasants are found here. The small mammals and birds associated with farm lands and P-J woodlands are also present here.

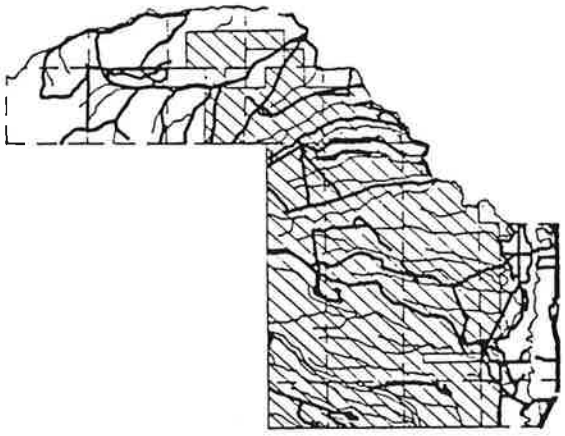
The La Plata River and Cherry Creek are perennial streams, but both are heavily diverted for irrigation. Therefore, there are periods when both have no flow for extended reaches. This limits fish to those species which can exist in small pools. There are a few small wetland areas along these 2 streams but there are only small populations of wetland wildlife. These are primarily species which can tolerate dry periods such as amphibians.

SOUTHERN UTE INDIAN RESERVATION

GENERAL MAP OF MORGAN MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



SCALE 1:100,000

0 1 2 3 4 5

MILES

HIGHWAY
LIGHT DUTY ROADS
UNIMPROVED ROADS
STREAMS
TRIBAL LANDS

R BOX JR. 12-05-89

MORGAN CANYON
Management Unit #2

This is a small unit, with a majority of it Tribal land. The Trust land is a virtually solid block with 2 blocks of privately owned land on the East and Northwest sides of the unit. There are some intermingled blocks of private land along the North side and one long intrusion on the East side of the Tribal lands which complicate trespass control and add greatly to the fencing needs, if the Tribal boundary was to be fenced.

Tribal	8,088 ac.	65.3%
Fee & Other	4,291 ac.	34.7%
TOTAL	12,379 ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: Tribal land in this unit is composed of Life Zones 2 (5%), 3 (59%) and 4 (36%). It is primarily canyon-mesa topography so growing seasons are probably longer than average on mesa areas.

Soils & Agriculture: Arable lands are only about 6% of the total area. There are small acreages of mesa-top deep soils, but the majority of the arable lands are alluvial bottom areas. There is no irrigation water supply and nearly all the arable lands are Zones 2 and 3, which are too dry for dryland farming. Therefore, there is virtually no potential for agricultural use of this unit.

The remainder of the soils (94%), are steep and/or shallow. These areas are producing very little herbaceous vegetation at this time. There is much bare ground under the tree canopy, and many rock outcrops in the shallow areas.

Vegetation: All but 3% of the land normally has a canopy of pinyon-juniper. Approximately 417 ac. of "a" and "b" canopy has been chained and reseeded making a total of 8% without canopy. On much of the shallow and steep-shallow sites, the trees are stunted and scrubby. In canyon areas, especially North-facing slopes and where rock irrigation is present, there is scattered ponderosa pine. Some of the steep slope areas are chaparral covered and have no tree overstory. Here, browse species are much taller and include Gambel oak and serviceberry.

Deep-soiled areas are dominated by big sagebrush; near the South end, greasewood increases. Shallow and steep-shallow areas are dominated by brush - sagebrush, bitterbrush and mountain mahogany in Zone 3; oak and serviceberry join these shrubs in Zone 4.

Major grasses are Indian ricegrass, galleta, and squirreltail with lesser amounts of blue grama, muttongrass, junegrass and western wheatgrass. Pingue and snakeweed occur throughout.

Uses-Developments:

Total herbaceous production is low, a combination of the tree overstory and the shallow soils. Range conditions vary primarily from fair to low good, but there are only about 254 AUM's of forage produced. This would be further reduced because there are large areas which are ungrazable because of a lack of stockwater. Consequently, this area has not been grazed by livestock (except for trespass) for many years.

The boundary along the South (State line) and West (Ute Mountain Ute Reservation) is fenced. The East side of the Tribal land has a fence (mostly not on the property boundary) which limits access to the irrigated lands along the La Plata River. There are no fences along the North and Northeast parts of this unit.

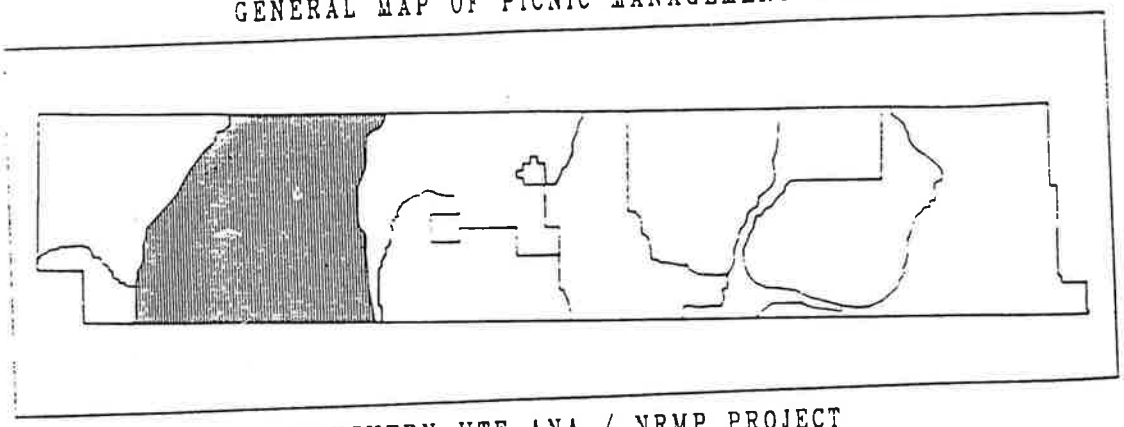
There has been a special limited buck deer hunt in this area for the last 3 years. Before that, it was closed to non-Indian hunting for several years. It used to be included in the Western Hunting Area. Hunting by Tribal members has been very limited as has fire wood harvesting, because of the distance from Tribal populations.

There are 5 small ponds in the North part near Johnny Pond and Red Horse Gulch and game animals water at the La Plata River near the East side. There are no residences on the Tribal lands, but there are several homes in the La Plata River valley. Access is good along the East, but the remainder is served by old oil and gas roads. These are mostly not maintained as there is little actual production in the unit.

Wildlife: There is a native population of mule deer in this area. Some elk may pass through also, and in recent years they are seen much more frequently. It is probable that a small herd has established in this area. The normal populations of birds and small mammals associated with the P-J woodlands are expected here. The populations may be reduced because of the lack of forage and water.

SOUTHERN UTE INDIAN RESERVATION

GENERAL MAP OF PICNIC MANAGEMENT UNIT

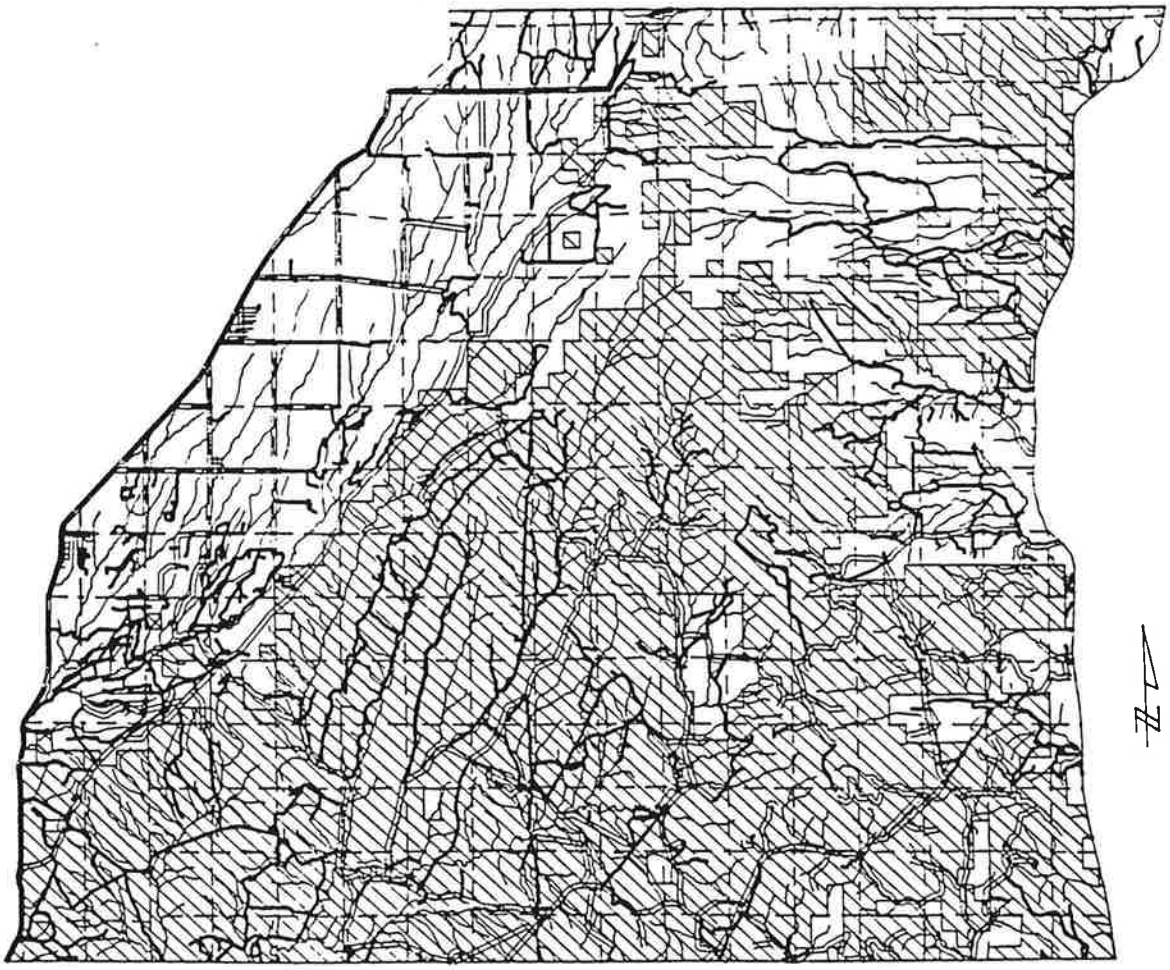


SOUTHERN UTE ANA / NRMP PROJECT

SCALE 1:120,000

0 1 2 3 4 5

MILES



HIGHWAY

LIGHT DUTY ROADS

UNIMPROVED ROADS

STREAMS

TRIBAL LANDS

PICNIC FLATS
Management Unit #3

This is the largest management unit on the reservation. In the Northeast and East parts there are large areas of private lands intermixed with Tribal. Along the Northwest part, on Red Mesa, is a large, nearly solid block of privately owned land. The approximate land status is as follows:

Tribal	80,418 ac.	59.9%
Fee & other	53,807 ac.	40.1%
TOTAL	134,225 ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: The Life Zones making up this unit are as follows:

Zone 2 -	9,700 ac.	11.9%
Zone 3 -	30,656 ac.	37.6%
Zone 4 -	38,000 ac.	46.9%
Zone 5 -	3,200 ac.	3.9%
	81,556 ac.	100.0%

The elevation ranges from 5,940 to 8,360 feet and the topography grades from steep mountain slopes in the north, to mesa-valleys in the southwest. It is intersected by a broad flat along the McDermott Wash area. This area is called Picnic Flats from which the Unit derives its name.

Soils & Agriculture: Approximately 20% of the Tribal portion of this unit consists of arable lands. These are mostly in Zones 2 and 3, with small narrow valley areas in Zone 4. There is little potential for successful dryland agriculture below Zone 4, so an irrigation supply would need to be developed to farm in this unit. There is no known source of irrigation water within the unit. The Animas-La Plata Project will provide no irrigation in this unit, as currently planned, but the Tribe's M & I allocation could possibly be used here if it becomes available. Arable lands in Zone 2 would have a longer growing season than other reservation cropland.

About 20% of the unit consists of Rough-Broken and Barren sites. These areas are too steep or shallow to be used for anything but wildlife. The remaining approximately 60% of the area consists of steep and/or shallow soils, suitable for grazing livestock, raising woodland products and wildlife. Some of the shale derived soil areas are badly eroded and continue to erode. There are large amounts of rock outcrop within some of these otherwise usable soil areas.

Vegetation: Vegetation is fairly typical for the Life Zones except in Zone 2, where there are some small areas without sagebrush. These have semi-desert and salt-desert type vegetation. However, they make up very little area. Much of the Zone 5 area is a chaparral type or very lightly stocked with ponderosa pine. Gambel

oak is often very tall and thick and greatly retards tree establishment in these areas.

Uses-Development: There is only one small assignment in this unit. It adjoins Colorado Hwy 140 near the La Plata River and one Tribal member family resides there. There is a short-term grazing lease in the Cox Canyon area and there are some informal access arrangements with fee land owners in the northeast part.

Currently, there are 2 range permits in the Picnic Flats Range Unit for winter livestock grazing. Only 2 years ago, 7 Tribal members were grazing livestock under range permits.

There is a grazing lease on the area between Long Hollow Rd and Colo Hwy 140. The Tribe also has a formal land-use exchange agreement wherein they allow the grazing use on 160 ac. south of Marvel and obtain grazing use of approximately 400 ac. along the east side of Long Hollow Road.

The fencing pattern employed in some of the north part of the unit results in an informal land-use exchange. A portion of fee land is fenced with a large block of Tribal land and an approximately equal acreage of Tribal land consisting of isolated tracts is fenced with land owned and used by Art Isgar.

Formal grazing units - Cinder Buttes, Picnic Flats, Soda Canyon, Coyote Gulch, and Cox Canyon are established in this area. (See Technical Section on Range, starting on page 6 - 9.) Most of the boundaries on these are fenced or use a natural barrier. The northern boundary of Coyote Gulch and the line between Cinder Buttes and Picnic Flats are not fenced and there is some migration of livestock across these lines when these units are stocked.

Stockwater has been provided mostly by ponds, but many of these structures are old, the reservoirs are shallow, and they are undependable during dry periods. There are several old wells which have not been used for years. Springs exist, especially in the Soda-Iron Springs and McDermott Arroyo areas. Indian Creek and several springs near the northeast part of the unit provide some water there. However, a large portion of the unit does not have an adequate, dependable water supply in balance with the forage and cover.

There have been brush control and reseeding projects on 2 major cover types. Many of the drainages which were dominated by big sagebrush were sprayed to control sage. Initial control of sagebrush was good but about 2/3 of these areas have been fully reinvaded. The P-J was removed on a large part of Pinkerton Mesa and in upper McDermott Arroyo. The reseeded species have persisted here and these areas provide relatively high forage production.

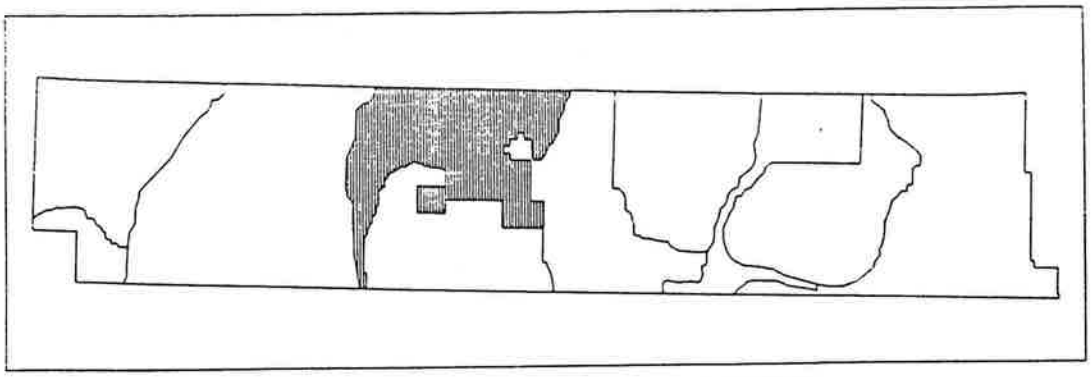
The lower portion of this unit has had extensive oil and gas development and there is a vast array of roads in the area. There are no heavy duty or surfaced roads in the unit however, and travel during wet periods is hazardous and results in road damage. The northeast portion of the unit is slated for gas development within the next few months.

Wildlife: There is a native population of mule deer and probably elk in this area. Migrant big game animals also use this area for winter range. There are a few Gambel quail, mourning doves and many non-game birds in the area.

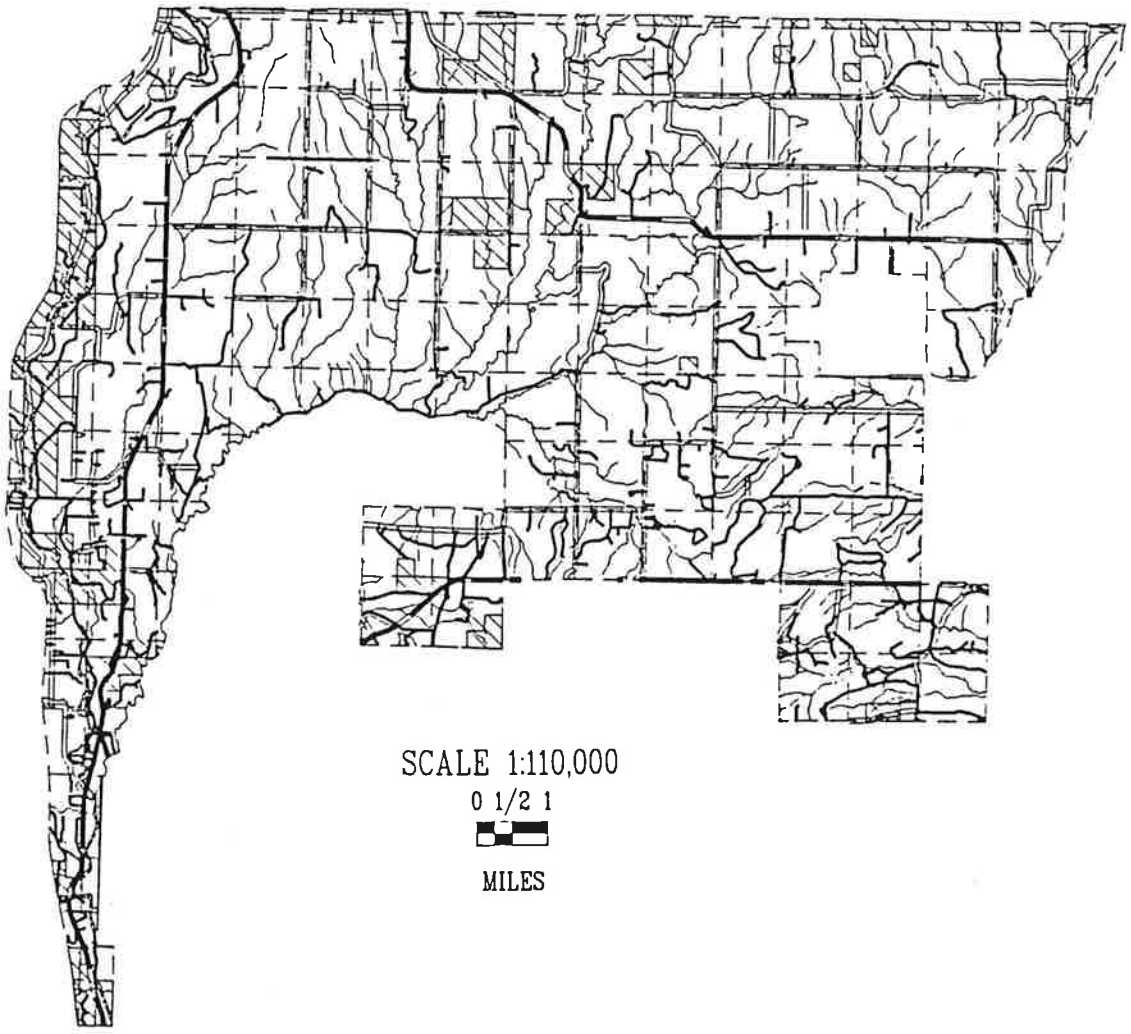
Some of the habitat appears adequate for antelope and possibly sage grouse, but there are none of these animals here now.

There is little open water, almost no wetlands and so only a few waterfowl are found.

GENERAL MAP OF FLORIDA MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



E. BOX JR. 12-05-89

FLORIDA MESA
Management Unit #4

This unit is large in total area (approximately 75,000 ac) but has only about 5,400 acres of Trust lands.

Tribal	5,380 ac.	7.2%
Allotted	58 ac.	<.1%
Fee & Other	69,126 ac.	92.7%
TOTAL	74,564 ac.	100%

PHYSICAL DESCRIPTION:

Climate & Topography: This area includes life Zones 3 and 4. While the topography is primarily mesa-valley, the mesas are wide and air drainage is limited. Therefore, mesa growing seasons are about average for the zones and valley growing seasons are less than average length.

Soils & Agriculture: The majority of the lands in the area have deep soils. The major mesa-top soil is in the Falfa series and most is cultivated. The Tribe has Florida Project water supplies for about 770 acres currently under use (2000 AF allotted). In addition, the Tribe has rights for water for 290 acres which are serviceable from existing systems. There are 9 other tracts totaling 545 acres for which supplies are reserved but are not included in the Florida Project.

Considerable arable lands also occur in the Animas River valley. (For more information, see the Technical Section on Soils, beginning on page 7 - 6.)

Vegetation: Undisturbed areas have vegetation typical for these life zones; big sagebrush in valleys and open areas, moderate to heavy canopies of P-J on uplands. The majority of the areas have been disturbed by farming and other activities.

Uses-Developments: This area is heavily used by Tribal members. There are 18 homesite assignments and 1 homesite lease. There are 7 agricultural assignments. In all, approximately 2000 acres are assigned. In addition, one agricultural lease and a short-term grazing lease also exist.

Most of the lands have been impacted by gas development, with wells located on the property, or pipelines crossing them.

There are 18 separate tracts, so most occur as small individual farms or fields. Those being farmed or those adjacent to non-Indian cultivated fields are usually fenced. Others, where boundaries are adjacent to roads or non-farmed land are either unfenced, or fences are in poor repair.

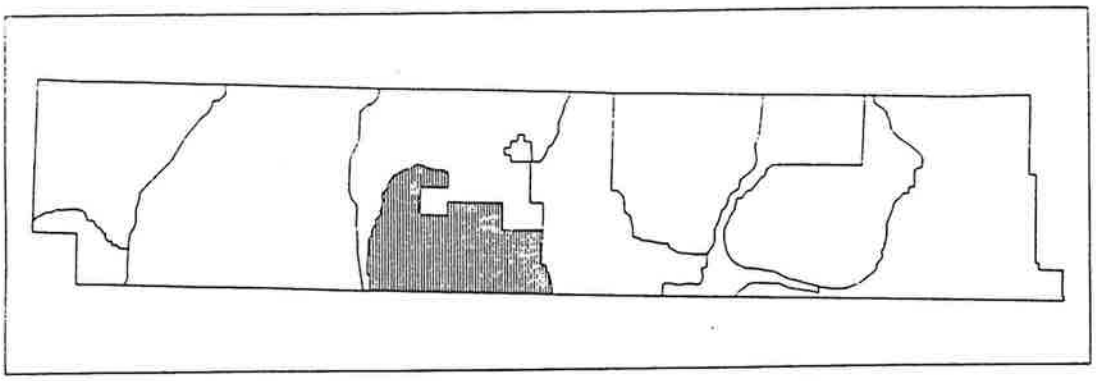
There are many improved roads in this unit, so access is very good for the most part. However, some small parcels especially along the north reservation boundary are without access. This limits their usability and diminishes their value.

Wildlife: There are many residences, roads and human activities in this unit, so big game animals are somewhat restricted. However, deer are found throughout. Animals and birds associated with croplands are very common.

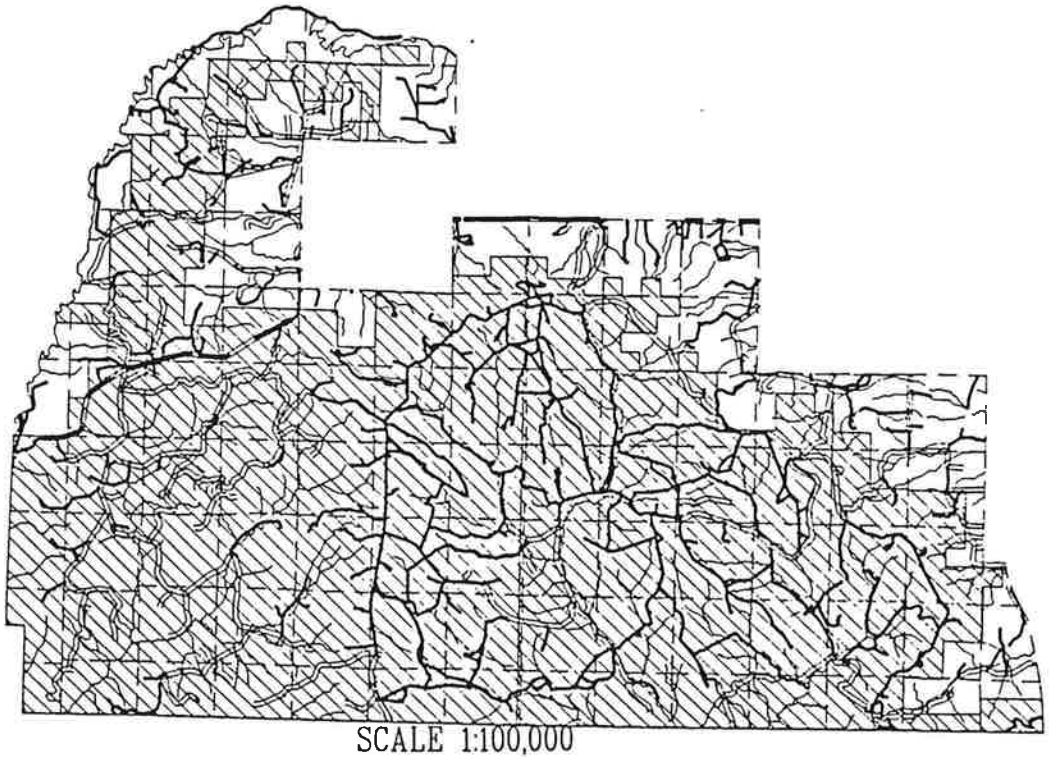
The Animas River is an improving trout fishery, but becomes too warm in the lower part of the unit. Bald eagles commonly use this area. The Florida River is oversubscribed and is subject to extremely low flows nearly every year.

SOUTHERN UTE INDIAN RESERVATION

GENERAL MAP OF MESA MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



SCALE 1:100,000

0 1/2 1

MILES

HIGHWAYS
LIGHT DUTY ROADS
UNIMPROVED ROADS
STREAMS
RIVERS
TRIBAL LANDS

E. BOX JR. 12-05-89

MESA MOUNTAINS
Management Unit #5

This unit is located just Southwest of Ignacio and consists of a nearly solid block of Tribal land, with a narrow rim of private land along the Northern part.

Tribal	41,835 ac.	75.3%
Fee & other	12,175 ac.	22.4%
TOTAL	54,010 ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: This unit is comprised of Life Zones 3 (20%) and 4 (80%). Areas in heads of canyons and receiving rock irrigation have ponderosa pine, but these are usually small and not mapped separately. This unit includes a broad mesa area with relatively shallow valleys, so the growing season is probably about normal for these zones.

Soils & Agriculture: The eastern part of this unit includes a large amount of deep soils on moderate slopes. These areas, along with wider valleys have arable soils, but there is no supply of irrigation water. There are no current plans for cropland agriculture, although dryland farming is possible.

Much of the western and northern parts of this unit are dominated by steep and/or shallow soils. These areas are suitable for range, woodland and wildlife uses.

Vegetation: Undisturbed areas are dominated by P-J woodlands in upland areas and big sagebrush in valleys. Much of the Pump Canyon drainage area was treated to kill sagebrush many years ago. While initially fairly successful, sagebrush has reinvaded most of these areas.

About 10,000 acres of Mesa Mountains has been treated (cabling, chaining and burning) to eliminate the P-J canopy. These areas were reseeded with a mixture of cool season exotic grasses, and these stands still persist. This area is an excellent forage area for both livestock and big game. Elimination of P-J also released the gambel oak, so there is considerable brush cover and browse in much of the treated area. The steep slope (mesa edge) especially on North facing areas, is mostly without trees, and is a chaparral of oakbrush.

Uses-Development: There are 4 range units in this area: Pump, Trail, Beef and Six Shooter Canyons. The Mesa area is an important summer range for livestock. The Six Shooter unit has mostly been

used for wildlife in recent years. There are 2 Tribal member range permits and 1 short term grazing lease on the Mesa area. Current demand for grazing use by Tribal members is down, but 2 years ago all the available carrying capacity of the Mesa units was permitted. The Pump Canyon, Trail Canyon and Beef Canyon Range Units have range fences between them, and along the State line. The exterior boundary of these units is often not fenced, utilizing the mesa edge as a natural barrier which does not always stop livestock.

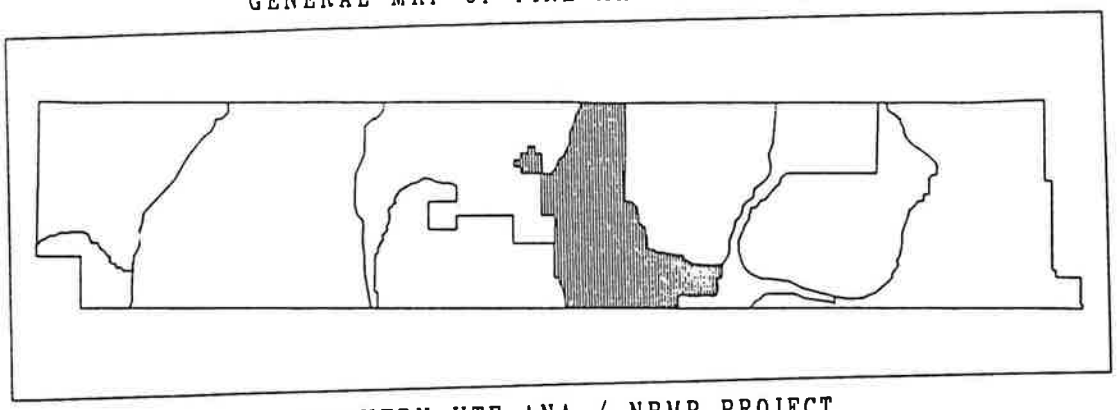
Lack of animal water limits usability of this area. There are 4 catchments, 75 ponds and 10 springs in the area but many are old, have failed or only supply water for a short time. (For more information, see the Technical Section on Range, beginning on page 8 - 7.)

There is intensive gas development in the area with a large network of roads, pipelines and well pads. Both old natural gas and more recent coal-gas wells are present. Development is expected to continue through 1990 and beyond. The bulk of the roads are improved but are unsurfaced. During wet periods (spring thaw, rainy season) ordinary vehicle traffic is often difficult.

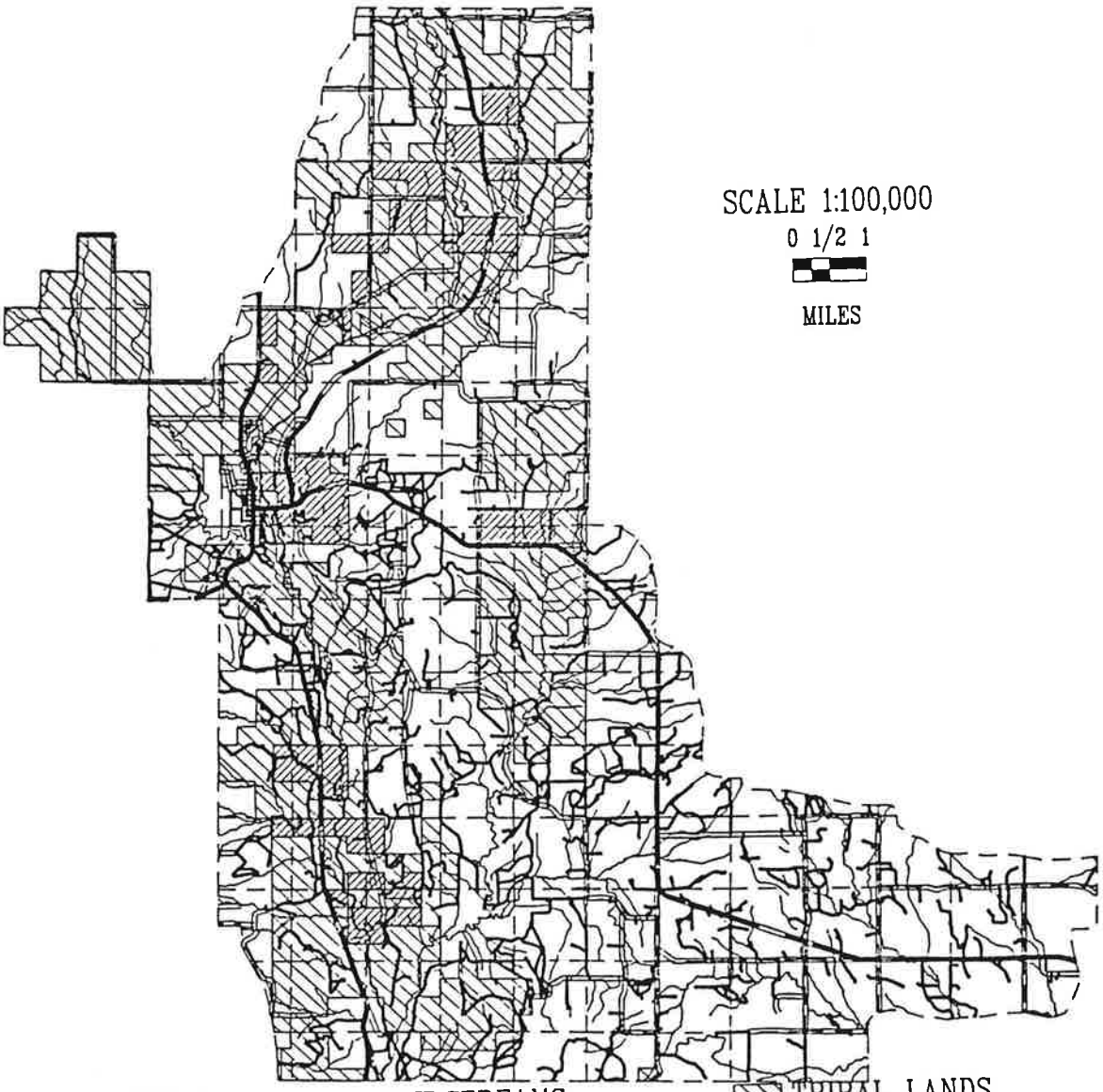
Wildlife: This is an important big game range area, especially for mule deer and a resident elk herd. Animals sometimes spend most of the winter here also, especially in the Six Shooter area, but snow usually forces them off the mesa at least briefly in the winter. There are mountain lions here but no bear sign has been seen in recent years.

Animals associated with P-J woodlands and open prairies are found here. There is only one major water body in the northeast portion and virtually no wetlands, so waterfowl is rare.

GENERAL MAP OF PINE MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



SCALE OF THIS MAP FROM THAT USED IN DATA ENTRY.

PINE RIVER

Management Unit #6

This unit has a total area of approximately 47,500 acres of which roughly one third is Tribal trust lands:

Tribal	21,878 ac.	33.9%
Allotted	3,577 ac.	5.5%
Fee	39,154 ac.	60.6%
TOTAL	64,609 ac.	100.0%

Most of the Tribal land is currently assigned:

		% of Tribal Lands
Agricultural Assignments	15,420 ac.	70%
Homesites	229 ac.	1%

These figures do not include some homesites on agricultural assignments which have not been set aside. Some Tribal lands and a number of assignments are now leased.

PHYSICAL DESCRIPTION:

Climate & Topography: This area consists of Life Zones 3 and 4. The topography is primarily mesas and alluvial valleys with elevations ranging from 6,120 to 7,060 feet.

Soils & Agriculture: Approximately 70% of the soils in this unit are deep and arable. The remainder are mostly shallow and/or steep and are unsuitable for cultivation. For more information, see the Technical Section on Soils, page 9-13. The PRIIP provides water for about 18,478 ac. of land. Of this, approximately 10,035 ac. is presently assessable Indian land. Several Tribal agricultural lands are served by private ditch companies.

Vegetation: The majority of the area has been disturbed by farming and other activities. Undisturbed areas show typical vegetation for these life zones.

Knowlton's Hedgehog Cactus, an endangered species, occurs on a small tract of undisturbed land at the south end of the unit.

Uses-Developments: Most of the Tribal members live in this area. There are many individual homesites as well as several HUD cluster housing projects.

The town of Ignacio (population 720) is located within this unit as are the rural communities of Allison and Tiffany. The Tribal government offices are situated just north of Ignacio. Tribal enterprises include the lodge and convention center, a restaurant, swimming pool, bingo hall and art gallery. The Sky Ute Downs provides facilities for horse training and rodeos.

The land is used primarily for agriculture - raising livestock and cultivated crops of grass and alfalfa. Flood irrigation comprises almost all the irrigated land. Agricultural land is being converted to homesites, oil & gas developments and other uses. The bulk of the Tribal lands have been fenced and nearly all of these lands have been mapped for fence condition and noxious weed invasions.

An extensive road system provides access to virtually every block of Tribal land. Most of the Tribal land in this unit is also under lease to oil & gas companies. Recent years have seen an increase in development of these leases, with wells or pipelines now located on much of the Tribal land.

Several gravel pits have been operated on Tribal lands. Most of these are no longer active and some are completely mined out.

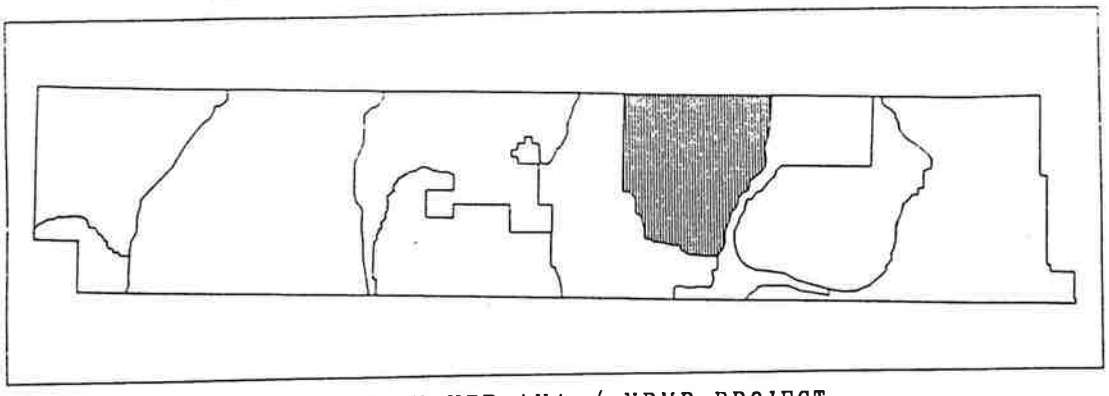
Wildlife: The concentration of people and human activities restricts the wildlife population in the area. However, deer are found year-round and both deer and elk linger in the valley in winter causing some damage to winter crops and haystacks. Animals and birds associated with croplands are relatively common. Pheasants and some upland game birds are limited by the lack of grain crops. Waterfowl are frequently seen in the wetland areas along the Pine River.

Roughly 400 fishing permits are sold each year for reservation streams. The Pine River is a popular trout fishing stream. Low flows during the irrigation season and uniformity of the river environment limit the present fisheries potential.

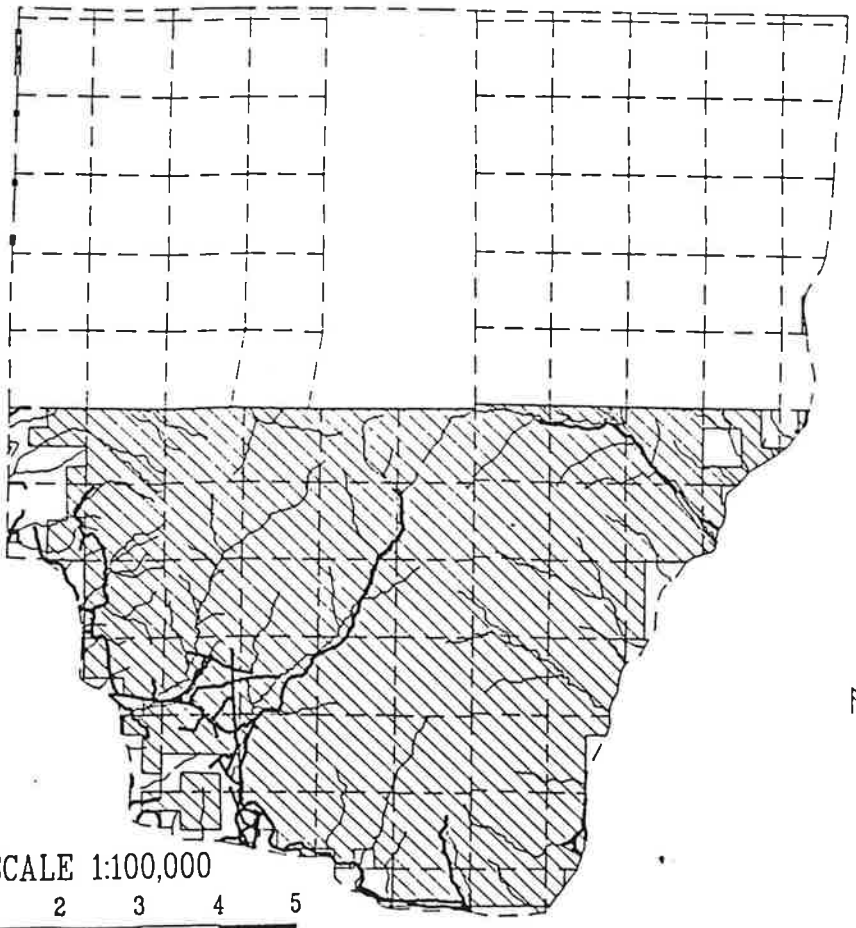
River otters have recently been reintroduced in the Pine River north of the reservation and have since been seen within the reservation.

Livestock & wildlife browsing as well as gathering for cultural uses has depleted the supply of cottonwood seedlings in the Pine River Valley.

GENERAL MAP OF SAMBRITOS MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



SCALE 1:100,000

0 1 2 3 4 5

MILES

HIGHWAYS
LIGHT DUTY ROADS
UNIMPROVED ROADS
STREAMS
TRIBAL LANDS

SAMBRITOS
Management Unit #7

This is a large unit split into two major parts. The Southern portion consists of a nearly solid block of Tribal land. The Northern portion is primarily U.S. Forest Service with a block of privately owned land along the Western edge. Approximate ownership breakdown is as follows:

Tribal	26,844 ac.	42.0%
Fee	7,221 ac.	11.3%
Forest Service	29,799 ac.	46.7%
TOTAL	63,864 ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: Tribal land in this unit is composed of Life Zones 4 (64%) and 5 (36%). It is steep, mountainous terrain with elevation ranging from about 6,200 to 8,730 feet. Growing seasons would vary from normal to less than normal length for these zones.

Soils & Agriculture: About 1,900 acres (7%) are mapped as deep soils on slopes level enough to till. However, these are mostly narrow valley areas where drainages further dissect the lands, so fields would be extremely irregular, small and rolling. There are no irrigation water supplies available without substantial lifts, so there is almost no potential for cropland agriculture.

The remaining area, about 24,000 acres (93%) consists of steep and/or steep shallow sites (59%), or rough-broken lands (34%). About 1/3 of the area is too steep for livestock grazing, but is usable for wildlife.

Vegetation: Vegetation in Life Zone 4 areas are typical for this zone. Most of the deep soil areas are dominated by sagebrush and do not have a canopy of P-J. All the steep and shallow areas have moderately heavy (46%) or heavy (54%) canopies of P-J. Understory vegetation is typical for good to excellent range conditions for these sites.

Zone 5 areas are not typical because approximately 1/3 of these sites do not have a canopy of pine. Instead they are occupied by a chaparral type dominated by Gambel oak, but with significant amounts of serviceberry, cliff fendlerbush, and other browse species. These stands are tall (often 12 to 15 ft.) and thick. They restrict access to livestock and severely hamper stock gathering activities. Much of the browse production in these areas is out of reach of wildlife species. The remainder of the area has only a light canopy of pine. There has been active timber

management in the Ignacio Canyon and Pine Tree Canyon areas only. Thick canopies of pine occur in small pockets and much of the canopied areas, (approximately 3,000 acres) are understocked.

Uses-Developments: There are no assignments or Tribal member residences in this unit. There is a small summer use range permit in Ignacio Canyon and a short term pasture lease in the lower portion of Devil and Sambritos Creeks.

There is limited gas development on the lower footslopes in the Southern and Western portions of the Tribal land. There is considerable coal-gas development on the Forest Service lands adjoining the Tribal land on the North; and fairly extensive gas developments on the private lands along the Western part of the unit.

There are approximately 10 old, small ponds primarily in the lower end of drainages (near the exterior of the Tribal tracts) except for Sambritos Creek, which has water throughout its length. Several springs also exist in Brushy Basin, Ignacio and Sambritos Creeks. These waters are all in steep-sided drainage bottoms which reduce their usability in the broad, steep mountain sides adjacent to them. Thus, there are large expanses of wildlife habitat which are lacking dependable water to utilize the available cover and forage.

Primitive roads occur along the West side and to the TV tower on Piedra Peak. A light-duty road extends up Sambritos and a logging access road is in Ignacio Canyon.

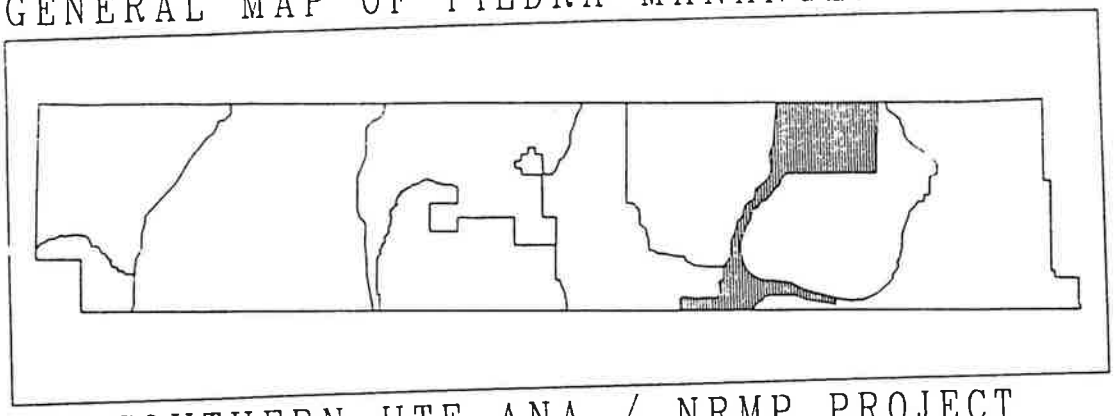
There is a fence along the boundary between Tribal and USFS land. Also, along the West and South side of the Tribal land, there are intermittent fences, mostly not on the exact boundary. These are old and mostly in need of repairs except where immediately above irrigated fields. There are almost no fences along the East side of the unit.

Wildlife: This area has large herds of deer and elk which use the area yearround. Animals migrate into and thru the area and winter on the lower fringes or on adjacent farmlands. There are especially large winter populations. Mountain lions and black bears also are found, probably in a greater concentration than elsewhere on the reservation.

Wild turkeys exist in this area, as do small mammals and birds associated with P-J woods and pine-oak forests. There are no live streams of any size or any wetlands, so there is very little waterfowl or wetland species in this area.

SOUTHERN UTE INDIAN RESERVATION

GENERAL MAP OF PIEDRA MANANGEMENT UNIT

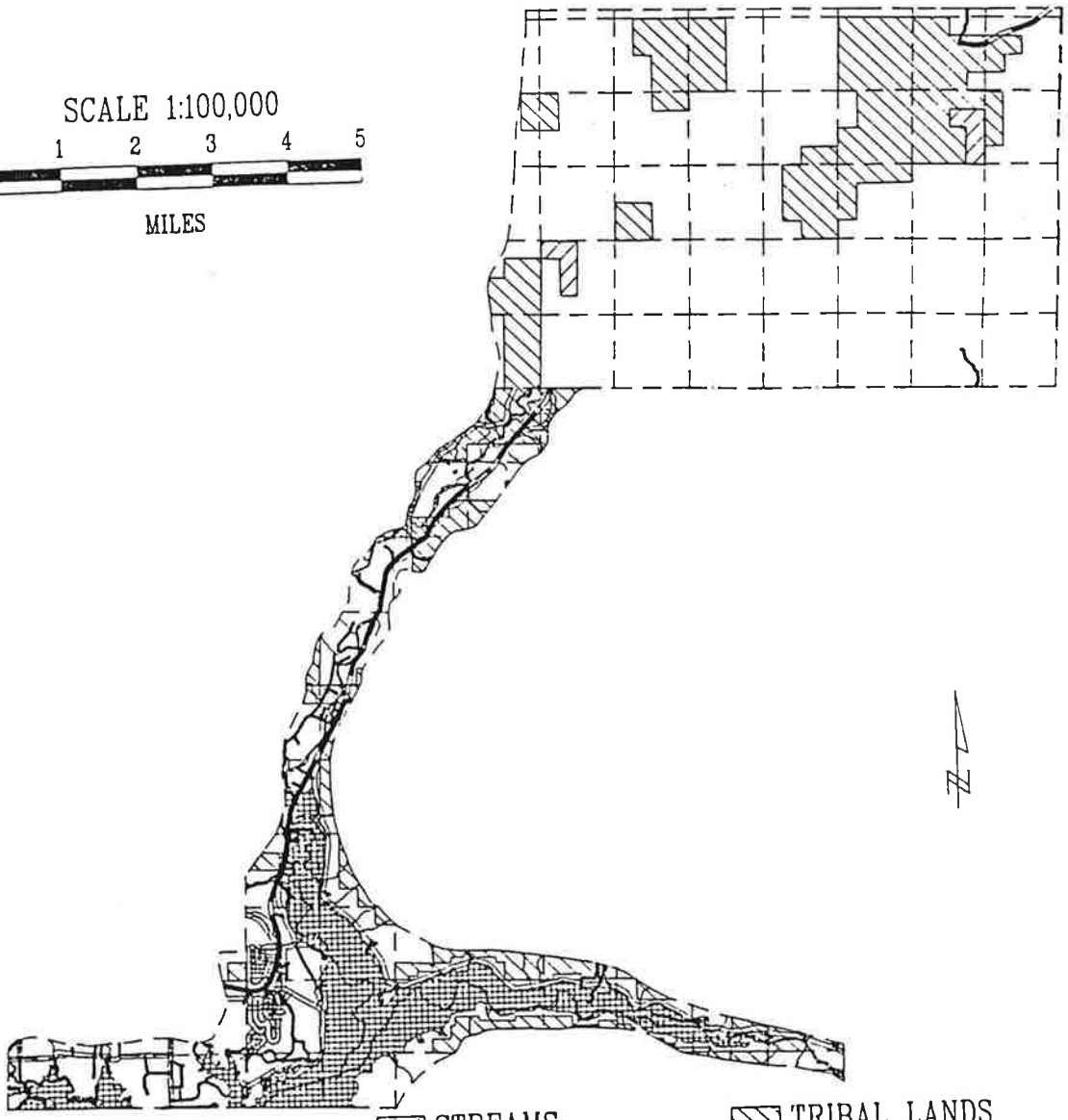


SOUTHERN UTE ANA / NRMP PROJECT

SCALE 1:100,000

0 1 2 3 4 5

MILES



HIGHWAYS
LIGHT DUTY ROADS
UNIMPROVED ROADS
STREAMS
TRIBAL LANDS
ALLOTTED
NAVAJO LAKE

PIEDRA
Management Unit #8

This unit consists of highly intermingled blocks of Tribal, Federal and fee lands. The northern end contains large chunks of mountainous Forest Service land with Tribal & fee lands occupying most of the valleys. The southern end encompasses the Navajo Reservoir and maximum storage area which are owned and operated by the Bureau of Reclamation. The Tribe does not currently own any land adjacent to the reservoir, but is in the process of reacquiring some land just north and east of Archuleta C.R. 500.

Approximate land ownership acreages are as follows:

Tribal	7,190 Ac.	19.2%
Allotted	310 Ac.	.8%
US Forest Service	16,986 Ac.	45.5%
Fee & other	12,858 Ac.	37.9%
TOTAL	37,344 Ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: This area includes life Zones 4 and 5 and a small acreage of Zone 3. Elevations range from 6,100 to 7,300 feet.

Soils & Agriculture: The majority of the lands in the area have deep, alluvial soils. However, the northern end includes some steep, mountainous terrain (the Forest Service lands around Chimney Rock and the north-facing edge of the Vega-Sandoval region). The growing season in this unit is probably somewhat shorter than normal.

Currently there are about 30 ac. of Tribal lands which are under irrigation. Additional water has been allocated for several tracts of Tribal land as a result of the Colorado-Ute Indian Water Settlement.

Vegetation: Undisturbed areas exhibit vegetation typical for these life zones. The small parcel of Zone 3 is an open area of big sagebrush. The pinyon-juniper woodland of Zone 4 gives way to ponderosa pine on the upper slopes and mountainous terrain of the north end of this unit. Mountain browse, consisting of Gambel oak, serviceberry and mountain mahogany is found in both Zones 4 and 5.

Uses-Development: Fishing and big game hunting are the two primary activities on Tribal lands. Lake Capote park offers fishing, rental boats, a campground, a mini-store and Ute cultural demonstrations. The lake provides quality cutthroat and rainbow trout fishing. Over 5,000 people bought permits to fish in Lake

Capote in 1987. The lake is currently under lease to private operators.

Chimney Rock Archaeological Area is a significant archaeological resource owned by the Forest Service. Tours are offered to the ruins either through the USFS or the concessionaires at Lake Capote.

The Tribal Youth Camp lies 4 miles west of Lake Capote Park. Although the camp is not currently in operation, several buildings, including cabins, shower facilities and a mess hall still remain. A new bridge was recently constructed which joins the camp to the main road. Before the camp could be reopened a reliable domestic water supply would need to be obtained.

A small timber sale is being offered across Highway 160 from the Youth Camp. The timbered land surrounding the Youth Camp is also being considered for a tree thinning operation.

Navajo Reservoir is a popular site for fishing, boating, waterskiing, and other water-related activities. Navajo State Recreation Area is on the shoreline adjacent to the town of Arboles. A marina within the recreation area is leased to concessionaires.

The checkerboard land ownership pattern contributes to access & trespass problems in this unit. Virtually all of the private lands along the Piedra River have been leased for oil & gas. If these lands are developed it could lead to drainage of adjacent Tribal energy resources.

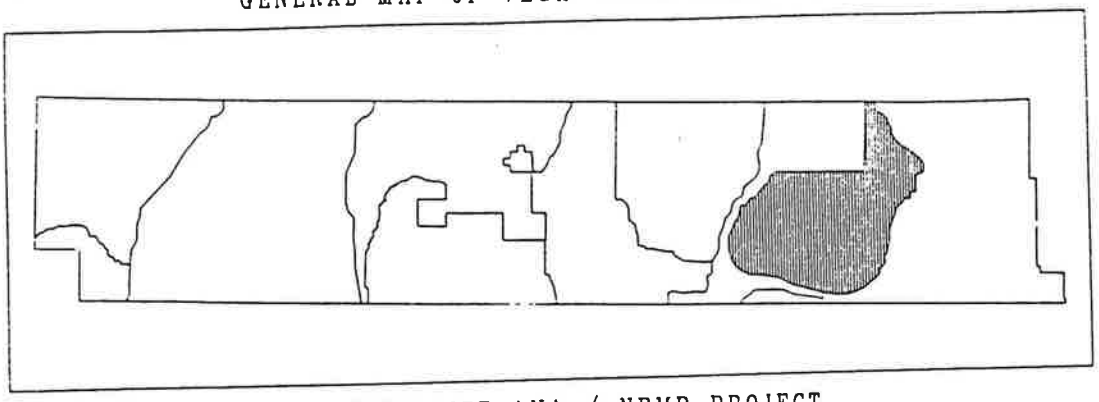
There are currently 5 assignments, totalling 1,035 acres, and 2 allotments of 160 acres each. There is one grazing permit just South of Lake Capote. Also there is 1 tract (160 ac.) on which the Tribe owns 90% of the surface.

Wildlife:

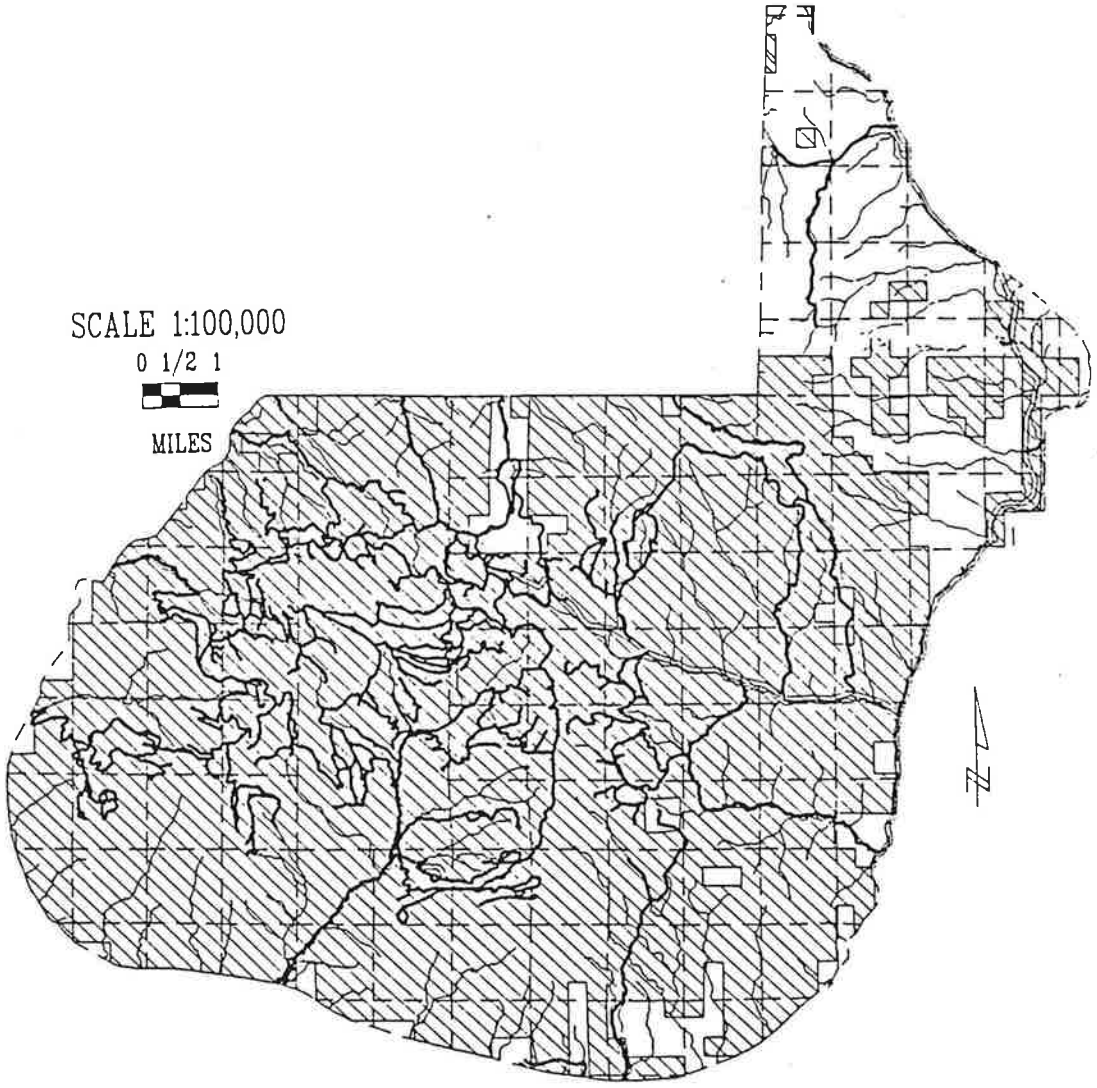
There is a native population of mule deer and elk in this area. The valley also receives heavy winter use from migrant big game animals. Mountain lion and black bear are also found as are smaller mammals commonly associated with riparian areas. A number of waterfowl species migrate through the Lake Capote/Navajo Reservoir corridor. Wild turkeys are being seen more frequently in recent years. Historically, peregrine falcon have nested in the vicinity of Chimney Rock. However, none have been seen nesting in the area in the last five years.

Lake Capote is stocked with trout each month during the summer and Piedra River has a native population of trout.

GENERAL MAP OF VEGA MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



E. BOX JR. 12-05-89

VEGA-SANDOVAL
Management Unit #9

Vega-Sandoval is a large unit consisting of approximately 66,800 acres. More than 80% of this acreage is Tribal land which forms an almost solid block in the Southern portion of the unit with a few isolated inholdings of fee land. The privately owned land is concentrated in the Northeast portion where it is intermingled with several tracts of Tribal land.

The land status breakdown is as follows:

Tribal	54,632 ac.	82%
Fee & Other	11,870 ac.	18%
TOTAL	66,502 ac.	100%

PHYSICAL DESCRIPTION:

Climate & Topography: This unit consists of steep mountainous terrain with elevations ranging from 6,100 feet immediately adjacent to Navajo Reservoir to 8,700 feet on Kearns Peak. Tribal land in this unit is composed of Life Zones 4 (22%) and 5 (76%) with a small area of Zone 3 (2%) just above Navajo Reservoir. Growing season for the valleys would be somewhat less than normal due to the narrow valleys surrounded by steep hillsides and mesas.

Vegetation: Vegetation in this area is typical of Zones 4 and 5. Zone 4 is dominated by a light to moderate canopy of P-J with mountain browse and grasses underneath. Zone 5 has ponderosa pine canopy ranging from patchy (5%) to thick (50%). Mountain browse found in both zones includes oakbrush, bitterbrush and mountain mahogany.

Round Meadow is the only broad, open valley in the unit. The lower end of Round Meadow was reseeded to crested wheat years ago, but much of this has been lost due to heavy grazing. The upper end of Round Meadow has native grasses of western wheat and mutton grass.

Uses-Developments: There are no agricultural or Tribal homesite assignments on this unit. On the East side are 4 summer use grazing permits.

There is a fence along the boundary between Tribal and USFS land. Most of the south, west and east sides are also fenced although these tend to follow county roads and not the Tribal ownership pattern. There is also an interior fence along Sandoval Mesa. These fences are generally in poor condition and need repair.

There are approximately 15 old ponds in this unit which are concentrated around the north end of Sandoval Mesa, Round Meadow and Dipping Vat Canyon. Several springs also water these same areas. Large blocks of land on the north side of Round Meadow, and on the south and west slopes of the unit are virtually without water. Hence, a major portion of potential livestock and wildlife habitat is currently underutilized.

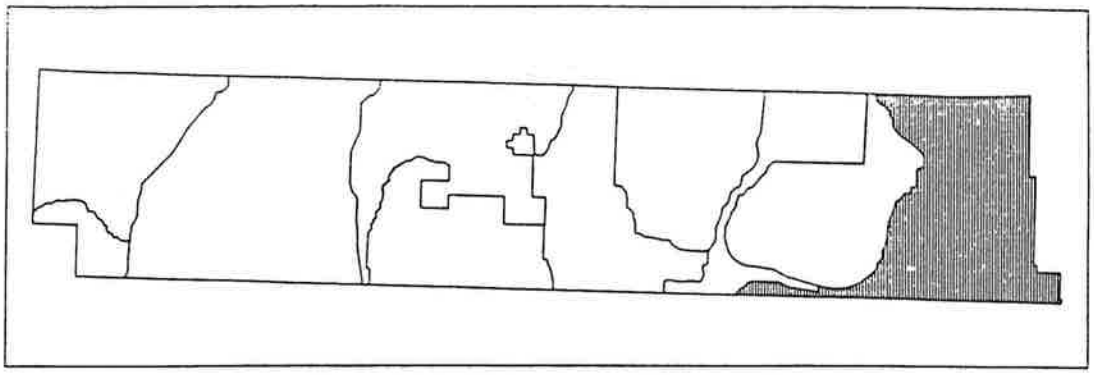
There are several access roads into this unit from the east, west and south. Much of the area was logged in the 1960's and numerous old logging road dissect the central portion of the unit. Most of these are unmaintained and would need improvement to be usable for future logging activities.

A coal seam underlying the eastern edge of the unit has the potential for future coal-bed methane development.

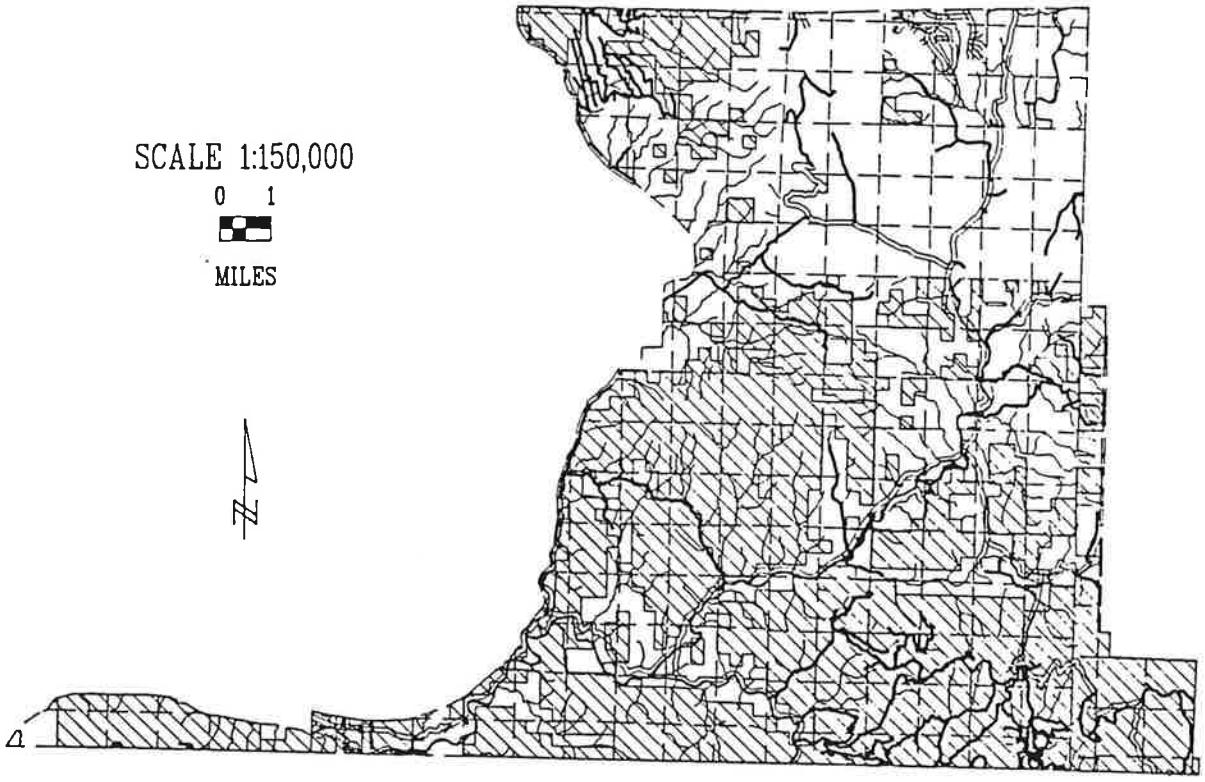
Wildlife: The Vega-Sandoval region is home to a sizable population of mule deer and elk. The area also receives heavy winter use from big game animals migrating into and through the area. Mountain lion and black bear are also found here.

Wild turkeys were once native to the area, but populations declined until the last few years. Turkeys are now returning to the area, especially in Vega and in Deep Canyon. Recently there was an unconfirmed sighting of the Mexican Spotted Owl, an endangered species. There are little waterfowl in Unit 9 because there is virtually no wetland or riparian habitat other than a few small ponds.

GENERAL MAP OF SANJUAN MANAGEMENT UNIT



SOUTHERN UTE ANA / NRMP PROJECT



STATE HIGHWAY 140
LIGHT DUTY ROADS
UNIMPROVED ROADS
STREAMS
RIVERS
TRIBAL LANDS

SAN JUAN
Management Unit #10

This unit has the largest number of separate parcels of Tribal lands and the greatest mixture of private parcels. The land status breakdown is as follows:

Tribal	51,570 ac.	48.5%
Fee & other	44,929 ac.	42.3%
USFS	9,794 ac.	9.2%
TOTAL	106,293 ac.	100.0%

PHYSICAL DESCRIPTION:

Climate & Topography: There are 4 Life Zones in this unit, with the make-up as follows:

Zone 3	1%
Zone 4	25%
Zone 5	64%
Zone 6	10%
	100%

Most valleys are deep and narrow with considerable high elevations surrounding them, so valley growing seasons would be shorter than normal. Uplands would have about normal growing season lengths. Elevation ranges from 6,100 feet at Navajo Reservoir to 9,150 feet on Archuleta Mesa.

Soils & Agriculture: About 15% of this area has deep soils and moderate slopes. However, not all these lands are arable because of heavy textures and very slow permeability. Many of these areas have less than 100 days growing season, so agriculture is severely limited. Irrigation water is available along the major streams only, especially the San Juan River valley. There are small irrigation developments presently in use, including one Tribal member assignment.

The remainder of the soils are a combination of deep soils on steep slopes and shallow, steep areas. Rock outcrops are not as prevalent here as in the western part of the reservation.

Vegetation: Vegetation is typical for these climatic zones, except for the Montezuma Valley area. The very slowly permeable soils now have a big sagebrush dominated stand which is more typical of Zone 3 areas.

Much of the Zone 6 areas are steep Northern slopes which have very thick stands of white fir. Also, the deep-soiled areas on the East

end of Archuleta Mesa have more snowberry and elk sedge than most other Zone 6 areas in the San Juan Basin.

Uses-Developments: Most of the large blocks of Tribal land have been or are currently used for summer livestock grazing and virtually all forest areas which are not too steep have been logged. There has been considerable tree planting in the unit where Ponderosa pine stands were understocked. Grazing permits in the East end of Archuleta Mesa have been cancelled to protect newly planted areas.

There is an abandoned fire lookout tower on Archuleta Mesa which poses potential hazards to humans.

Much of the Tribal land is unfenced although the Reservation boundary on the South and Southeast is fenced. Considerable new fencing has been built in Cat Creek, Gomez Canyon and West of Pagosa Junction in the last 3 years. This was constructed to mark newly surveyed lines in T32 & T33 - R3 areas.

There are 4 assignments in the area totaling 1120 acres. One Tribal member family resides in the unit, one assignment has approximately 150 ac. of irrigated land, the water supply comes from the San Juan River.

Improved roads pass through the area paralleling the rivers but much of the unit has only old trails or is not accessible at all by vehicle. The Tribe owns several developments (bridges, buildings, etc.) abandoned by the Narrow Gauge Railroad in the mid 1960's.

Subdivisions abut Tribal lands in the North part, and sometimes encroach. The Tribe has not developed any housing in the unit.

Coal is common in the area and several inactive mines exist, some on Tribal lands. Sawmills once operated at several locations in the unit, but all are abandoned.

Wildlife: Deer, elk, wild turkey, mountain lion and black bear are native to the area. Big game migrate thru parts of the area and some winter here.

Bald eagles are found along the San Juan River part of the year, and peregrine falcons are expected to use the area for hunting, but not nesting territory. Animals and birds associated with thick coniferous forest are found, while those associated with Pine-oak forest are common.

The Tribe has allowed big game hunting in the area for many years.