

BLM LIBRARY



88013670

TECHNICAL REPORT AND ENVIRONMENTAL ANALYSIS RECORD ON PROPOSED GEOTHERMAL LEASING IN THE LIGHTNING DOCK AREA

RECEIVED
BUREAU OF LAND MANAGEMENT
MARCH 16 1976
SANTA FE DISTRICT

	APPROV.	DATE	INITIALS	NOTE
Dir. Mgr.				
Assoc. Mgr.				
Oper.				
Adm.				
S. Comm.				
Dist.				
Spec.				
Environ.				



UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
LAS CRUCES DISTRICT

TD
195
.64
L57
1976



**TECHNICAL REPORT
AND
ENVIRONMENT ANALYSIS RECORD
ON
PROPOSED GEOTHERMAL LEASING
IN THE LIGHTING DOCK AREA**



**UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
LAS CRUCES DISTRICT**



880/3670

BLM Library
D-863A, Building 50
Denver Federal Center
P. O. Box 25047
Denver, CO 80225-0047

EAR NO. NM-030-76-329

TD
195
.64
L57
1976

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
P. O. BOX 1420
LAS CRUCES, NEW MEXICO
88001

TECHNICAL REPORT
and
ENVIRONMENTAL ANALYSIS RECORD
on
PROPOSED GEOTHERMAL LEASING IN THE LIGHTNING DOCK AREA

PLANNING UNIT 03-01
LAS CRUCES-LORDBURG RESOURCE AREA
LAS CRUCES DISTRICT

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

JANUARY 28, 1976

TABLE OF CONTENTS

I. Description of the Proposed Action	1
A. The Proposal	1
B. The Alternatives	1
C. Background Information	1
1. Setting of New Mexico Geothermal Fields	4
2. Technological Requirements for Geothermal Energy	4
a. Vapor Dominated System	8
b. Hot Water System	8
c. Hot Rock System	8
d. Geopressured Reservoir System	10
3. Geothermal Lease Status in New Mexico	10
4. The Geothermal Steam Act of 1970	10
5. The Process of Acquiring the Right to Develop and Produce Federal Geothermal Resources	11
a. Environmental Analysis Record and Technical Examination	11
b. Pre-lease Exploration	11
(1) Casual Use	11
(a) Geological Reconnaissance	13
(b) Geochemical Survey	13
(c) Airborne Surveys	13
(2) Exploration Operations	13
(a) Shallow Drill Holes	13
(b) Seismic Methods	14
(c) Electrical Resistivity Surveys	14
(d) Gravity Surveys	15
(e) Magnetic Surveys	15
(f) Telluric Surveys	15
c. Leasing	15
(1) Competitive Leasing	15
(2) Non-competitive Leasing	16
(3) Lease Terms	16
d. Post-lease Exploration	16
(1) Geological Information Holes	17
(2) Exploration Wells	18
e. Development	19
(1) Development Wells	19
f. Production	19
(1) Pipelines and Roads	20
(2) Power Plant Construction	21
(3) Transmission Lines	21
(4) Generating Electricity	22
(5) Other Uses	22
g. Close Out	22

	Page
6. Economic Analysis	24
a. Market Study of Mineral Commodity	24
(1) Present and Anticipated Demand	24
(2) Geographic Distribution of Demand	24
(3) Economic Feasibility of Extraction	25
(4) Alternate Sources	25
(5) Transportation Networks	25
b. Short and Long Term Impacts on the Local Labor Market and the Economy	25
II. Description of the Existing Environment	26
A. Non-living Components	26
1. Air	26
a. Air Movement Patterns	26
b. Temperatures	26
c. Particulate Matter	29
d. Noxious Gases	29
e. Radiological Contaminants	29
f. Non-ionizing Radiation	29
2. Land	30
a. Soil Depth	30
b. Soil Structure	30
c. Soil Nutrient Properties	30
d. Soil Pollutant Properties	30
e. Soil Erosion	30
f. Geological Structure	30
g. Land Use Compatibility	44
h. Land Use Suitability	44
3. Water	44
a. Hydrologic Cycle	44
b. Sediment Load	47
c. Dissolved Solids	47
d. Acid Balance	47
e. Temperature	47
B. Living Components	47
1. Vegetation	48
a. Aquatic Plants	48
b. Terrestrial Plants	48
(1) The Peloncillo Mountains	48
(2) The Pyramid Mountains	49
(3) North Animas Mountains	49
(4) The Lordsburg Mesa	58
(5) The Animas Valley	59
(6) The Lordsburg and Playas Valleys	60
(7) San Simon Cienega	60

	Page
2. Animals	60
a. The Peloncillo Mountains - WHA I	62
(1) South Peloncillo Mountains - WHA Ia	63
(a) Aquatic Animals	63
(b) Terrestrial Animals	65
(2) Central Peloncillo Mountains - WHA Ib	68
(a) Aquatic Animals	68
(b) Terrestrial Animals	69
(3) North Peloncillo Mountains - WHA Ic	71
(a) Aquatic Animals	71
(b) Terrestrial Animals	72
b. The Pyramid Mountains - WHA II	73
(1) Aquatic Animals	73
(2) Terrestrial Animals	74
c. North Animas Mountains - WHA III	75
(1) Aquatic Animals	75
(2) Terrestrial Animals	76
d. Animas Valley - WHA IV	78
(1) Alkali Flats - WHA IVa	78
(a) Aquatic Animals	78
(b) Terrestrial Animals	78
(2) Animal Valley Lava Flow - WHA IVb	78
(a) Aquatic Animals	79
(b) Terrestrial Animals	79
(3) Agricultural - Riparian - WHA IVc	80
(a) Aquatic Animals	80
(b) Terrestrial Animals	81
(4) Non-Agricultural - WHA IVd	82
(a) Aquatic Animals	82
(b) Terrestrial Animals	82
e. San Simon Cienega - WHA V	84
(1) Aquatic Animals	85
(2) Terrestrial Animals	86
f. Game Species Harvets	87
g. Endangered Animal Species	89
C. Ecological Interrelationships	98
1. Succession	98
2. Food Relationships	99
3. Community Relationships	100
D. Human Values	101
1. Landscape Character	101
a. Open Space	101
b. Scenic Quality	101
c. Primitive Values	102
2. Land Uses	102
a. Recreation	102

		Page
	b. Grazing	103
	c. Rights-of-Way	103
	(1) Transportation Rights-of-Way	103
	(2) Electric Powerline Rights-of-Way	104
	(3) Gas Pipeline Rights-of-Way	104
	(4) Communication Rights-of-Way	104
	(5) Proposed Rights-of-Way	104
	d. Urban and Suburban	105
	3. Archaeological Values	105
	4. Other Scientific Values	105
	5. Other Considerations	106
	a. Public Utilities	106
	b. Population Centers, Planning & Zoning	106
III.	Analysis of Proposed Action and Alternatives	108
A.	Environmental Impacts	108
1.	Anticipated Impacts	108
a.	Non-living Components	108
(1)	Air	108
(a)	Pre-lease Exploration	108
(b)	Post-lease Exploration	108
(c)	Development	109
(d)	Production	109
(e)	Close Out	110
(2)	Land	110
(a)	Pre-lease Exploration	110
(b)	Post-lease Exploration	110
(c)	Development	110
(d)	Production	111
(e)	Close Out	111
(3)	Water	111
(a)	Pre-lease Exploration	111
(b)	Post-lease Exploration	112
(c)	Development	112
(d)	Production	112
(e)	Close Out	112
b.	Living Components	112
(1)	Vegetation	112
(a)	Pre-lease Exploration	112
(b)	Post-lease Exploration	113
(c)	Development	113
(d)	Production	114
(e)	Close Out	115
(2)	Animals	116
(a)	Pre-lease Exploration	116
(b)	Post-lease Exploration	118
(c)	Development	119
(d)	Production	119
(e)	Close Out	120

	Page
c. Ecological Interrelationships	120
(1) Pre-lease Exploration	120
(2) Post-lease Exploration	120
(3) Development	120
(4) Production	120
(5) Close Out	121
d. Human Interest Values	121
(1) Landscape Character	121
(a) Open Space	121
(b) Scenic Qualities	123
(c) Primitive Values	125
(2) Land Use	126
(a) Grazing	126
(b) Rights-of-Way	127
(c) Recreation	128
(d) Urban and Suburban	128
(e) Archaeological Values	129
(f) Other Scientific Values	130
(g) Other Considerations	130
i. Public Utilities	130
ii. Population Centers	131
2. Possible Mitigating Measures	132
a. Fencing of the Operation	133
b. Compatible Multiple Use of the Surface	133
c. Livestock	133
d. Grazing Permits	133
e. Road Construction	133
f. Protection of Improvements	133
g. Gates and Cattleguards	134
h. Water Bars	134
i. Surface Damage	134
j. Surface Disturbance	134
k. Restoration of Disturbed Areas	134
l. Disposal of Solid and Liquid Wastes	134
m. Consideration of Aesthetic Values	134
n. Air Quality	135
o. Dust	135
p. Use of Impounded Water	135
q. Water Pollution Control	135
r. Noise Pollution	135
s. Protection of Possible National Historic Sites	135
t. Production Water	135
u. Endangered Wildlife	136
v. Endangered Plants	136
w. Archaeological Sites	136
x. Soil Sterilants	136
y. Water Sampling	136

	Page
3. Alternatives	136
a. Limit Lease Areas	136
b. Withhold Entire Area	137
c. Do Not Lease	137
4. Recommendations	137
a. The San Simon Cienega Mexican Duck Habitat Development Project	138
b. The Granite Gap Recreation Area	138
c. The Peloncillo Mountains	140
5. Residual Impacts	146
B. Relationship Between Short-term Use and Long-term Productivity	146
C. Irreversible and Irretrievable Commitment of Resources	147
IV. Persons, Groups, and Governmental Agencies Consulted	148
V. Intensity of Public Interest	156
VI. Participating Staff	157
VII. Signatures	158

TABLES

Number	Page
1. Amount of Producible Geothermal Energy in the United States	5
2. Stages of Implementation, Agency Responsibilities, and Regulations Associated with Geothermal Development	12
3. Monthly Temperatures (1946-1960) and Precipitation (1881-1960), Lordsburg, Hidalgo County, New Mexico	27
4. Annual Averages of Selected Climatological Data, Hidalgo County, New Mexico, for the Period of Record through 1960	28
5. Drillers' Logs of Wells in Animas Valley, Hidalgo County, New Mexico	31
6. General Stratigraphic Section and Rocks of the Gila Planning Unit	37
7. Plant Species Found in the Proposed Lightning Dock Geothermal Lease Area	51
8. An Indication of Current Game Species Harvest in Relation to Past Harvest 1970 thru 1973	88
9. Endangered and Threatened Fauna Occurring, Likely to Occur, or Species Whose Range Includes Portions of the Geothermal Assessment Area, but for which the Likelihood of Occurrence is Unknown.	90
10. Species of Endangered or Threatened Classification (Federal and State Lists) Occurring, Likely to Occur, or Whose Range Includes Portions of the Geothermal Assessment Area, but for which the Likelihood of Occurrence is Unknown	91

	FIGURES	
Number		Page
1.	The Lightning Dock Geothermal Assessment Area in Relation to the State of New Mexico	2
2.	The Area Included in the Lightning Dock Geothermal Assessment Area	3
3.	Map of the United States Showing Relationship of New Mexico to the Various Geological Provinces	6
4.	Schematic Illustrating Relationship of Horsts and Grabens in the Basin and Range Province	7
5.	Diagram of Hot Rock System in Jemez Mountains, New Mexico	9
6.	Schematic Illustrating the Formation of Basin and Range Structures	34
7.	Animas Valley Lava Flow	35
8.	Granite Gap Zenolith	42
9.	Depth to Water, January, 1955, in Lower Animas Valley, Hidalgo County, New Mexico	45
10.	Temperature of Ground Water in Lower Animas Valley, Hidalgo County, New Mexico	46
11.	Biotic Communities (Vegetation)	50
12.	Biotic Communities (Animals)	61

APPENDICES

- A. 1. Geothermal Steam Act of 1970
- 2. Title 30, Chapter II of the Code of Federal Regulations, Part 270 and 271.
- 3. Title 43, Chapter II of the Code of Federal Regulations, Part 3000 and 3200.
- 4. Geothermal Resource Operational Orders 1-4
- 5. Geothermal Resource Lease (Form 3200-21)
- B. Glossary of Terms (Geologic and Wildlife)
- C. Season of Use for Wildlife Species
List of Endangered Wildlife Species for New Mexico
State of New Mexico Regulations on Endangered Wildlife Species
- D. Public Comments

I. DESCRIPTION OF THE PROPOSED ACTION

A. The Proposal

The proposed action is to offer for leasing approximately 190,800 hectares (477,000 acres) of national resource lands within and adjacent to the proposed "Lightning Dock Known Geothermal Resource Area (KGRA)" within Hidalgo County, New Mexico, for the development of Federal geothermal resources (Fig. 1 and 2). Approximately 9,420 hectares (23,550 acres) of Federal lands within the proposed KGRA may be leased by competitive bid on May 20, 1976, following provisions set forth in 43 CFR 3220. Non-competitive lease applications will be considered on lands outside the proposed KGRA following 43 CFR 3210. Pre-lease exploration activities authorized under 43 CFR 3209 are also considered within this document.

Lands described within this Environmental Analysis Record (EAR) were selected because: the geology of the area suggests that there is good geothermal potential; geothermal lease applications suggest interest by industry; and the area is presently going through the Bureau of Land Management (BLM) land use planning system which considers multiple use management.

Geothermal lease applications have been received for approximately 28,000 hectares (70,000 acres) of Federal lands considered in this document. The study area has been expanded to cover adjoining lands not as yet applied for to insure that all resource values are given fair consideration.

B. The Alternatives

1. Limit the acreage to those areas which are least environmentally sensitive until further geological information is gained to determine the potential of the subject area.
2. Withhold the entire area from leasing until further resource information is gathered.
3. Do not lease any of the subject area.

C. Background Information

It has become imperative to explore and develop new sources of energy because of continuous demands for and depletion of low cost fuels used in the production of energy. Presently, geothermal energy is a competitive source of low cost energy. Geothermal power plant generating costs are, in many cases, lower than the costs of generating power derived from nuclear, coal, or fossil fuels (Kruger & Otte, 1973)



 Lightning Dock Geothermal Assessment Area

The Lightning Dock Geothermal Assessment Area in Relation to the
State of New Mexico

Figure 1

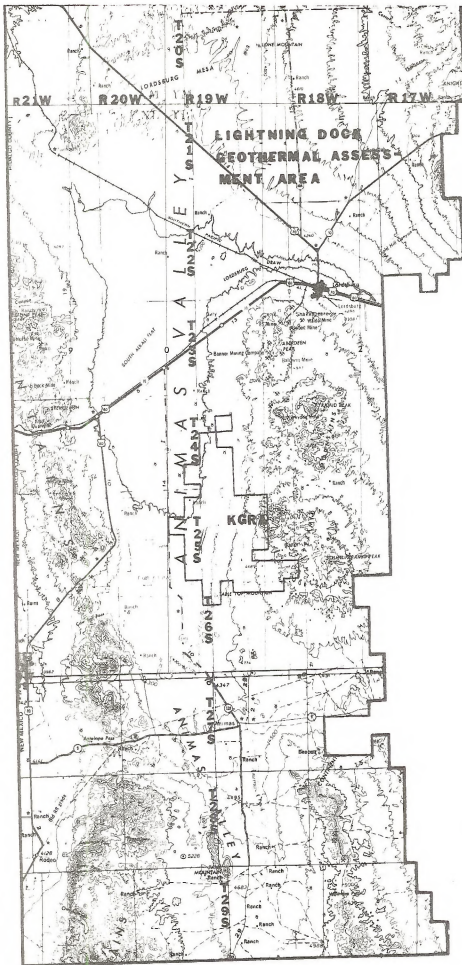


Figure 2

(Table 1). We can expect an increase in activity for the exploration of the earth's heat energy with advances in sophisticated geothermal exploration techniques. The production of geothermal power (electricity), and of commercially valuable by-products, and the utilization of lower temperature geothermal resources in space heating, industrial, and agricultural applications would become important industries in the economy of this State because of the many potential fields.

1. Setting of New Mexico Geothermal Fields

A major portion of New Mexico lies within the Basin and Range Province (Fig. 3). In New Mexico, the Basin and Range Province is bordered by the Rio Grande Rift and the Great Plains Province in the east, the southern Rocky Mountains in the north, and the Colorado Plateau in the northwest.

Characteristics of the Basin and Range Province are a series of en-echelon horsts and grabens, recent volcanic activity, high heat flow, and an anomalously thin crust. Geothermal fields are potentially associated with such features. Hot and warm springs and wells are commonly found within the Rio Grande Rift and along the western border faults adjacent to the eastern margin of the Province (Swanberg, 1975). Such thermal waters are closely associated with late Cenozoic volcanism and intrusion, and normal faulting within the Basin and Range Province (Fig. 4).

2. Technological Requirements for Geothermal Energy

Usable geothermal energy can best be defined as energy which results from anomalous thermal events (e.g., volcanism, rising of molten magma, etc.). For the production of electricity, the following requirements should be met:

- (1) Reservoir temperatures of at least 180°C.(356°F.).
- (2) Depths less than 3 kms(1.9 miles).
- (3) Fluids for transferring the heat to the surface.
- (4) An adequate reservoir volume of greater than 5 kms³ (3³ miles).
- (5) Sufficient reservoir permeability to ensure sustained delivery of fluids to wells at adequate rates (Kruger & Otte,1973) (43 CFR 3200.0-5 (c)).

Presently, geothermal reservoirs can fall within four general systems: vapor dominated, hot water, hot dry rock, and geo-pressured systems.

TABLE I

Amount of Producibile Geothermal Energy in the United States 1/
(Mween of electricity)

Energy Price (Mill/kwhr) ^a	Known Reserves		Probable Reserves		Undiscovered	
	Amount	Areas	Amount	Areas	Amount	Areas
2.90 - 3.00	1,000	1	5,000	1	10,000	1
3.00 - 4.00	30,000	1-2	400,000	1-4	2,000,000	1-5
4.00 - 5.00	--	--	600,000	1-6	12,000,000	1-7
5.00 - 8.00	--	--	--	--	20,000,000 ^b	^d
8.00 -12.00	--	--	--	--	40,000,000 ^c	^d

Areas: 1, Clear Lake - The Geysers; 2, Imperial Valley; 3, Jemez area N.M.; 4, Long Valley, Calif.; 5, remainder of Basin and Range area of western U.S.; 6, Hawaii; 7, Alaska

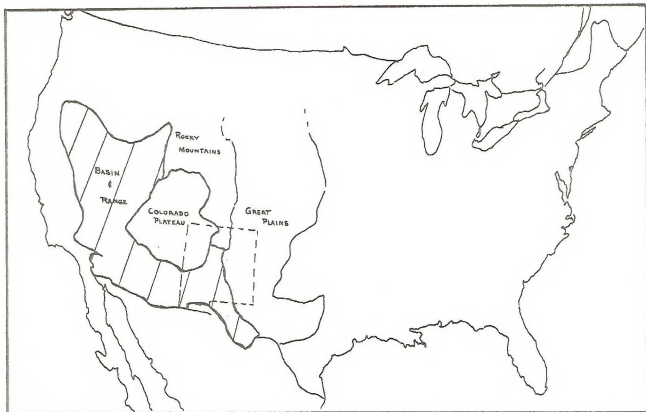
^a In 1972 dollars

^b Hot, dry rock at less than 6.1 km (20,000 ft.) depth.

^c Hot, dry rock at less than 10.7 km (35,000 ft.) depth.

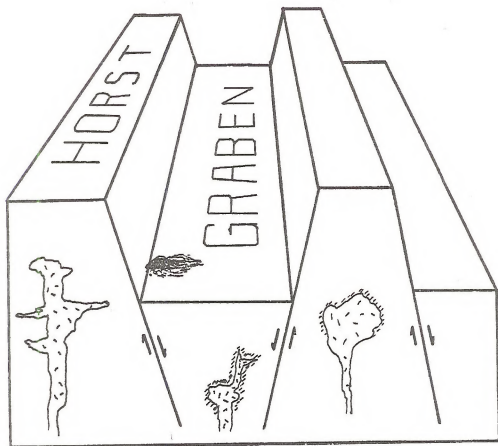
^d Development of hot, dry rock energy is assumed over 5 percent of the area of the western third of the U.S. Hot, dry rock systems development is based on hydraulic fracturing or cost-equivalent technology. Present drilling technology is assumed; new low-cost deep drilling could substantially improve these economics.

1/ Taken directly from Kruger, Paul, and Carel Otte, 1973, Geothermal Energy Resources Production Stimulation, Stanford University Press, Stanford, California, 360 pgs.



Map of the United States Showing Relationship of New Mexico
to the Various Geological Provinces

Figure 3



Schematic Illustrating Relationship of Horsts and Grabens
in the Basin and Range Province





-  geothermal fluids
-  intrusions
-  volcanoe
-  normal fault

Figure 4

a. Vapor Dominated System

This system is dominated by hot gaseous water vapor or steam. Presently, the only commercial geothermal field in the United States is a vapor dominated system located at The Geysers, approximately 128 kms. (80 miles) north of San Francisco, California. Production first began in 1960, and the field is still undergoing development. Over 100 wells have been drilled and approximately 500 MW of electricity are being produced. One megawatt of electricity supplies the needs of about 1,000 people (Kruger & Otte, 1970). Other commercial vapor dominated fields are located at Larderello, Italy, and Matsukawa, Japan.

b. Hot Water System

Present indications are that the hot water system is more common in occurrence than the vapor dominated system. This system involves hot water under pressure. When the pressure is reduced to atmospheric conditions, the hot water flashes (separates) into steam and hot water. After flashing, the steam is used to drive turbines and the hot water is disposed of by reinjection, evaporation, or discharge into nearby waterways. Corrosion, scaling, and disposal of large volumes of water and associated minerals are problems usually associated with this system. Technological advancements in the future will no doubt result in a much more efficient use of the hot water system.

Many nations throughout the world are developing hot water systems. One system within the U.S. is the Valles Caldera Field (Baca Ranch Location) in north central New Mexico. Other nations which are developing hot water systems are: New Zealand, Japan, Iceland, Mexico, and the Soviet Union.

c. Hot Rock System

The hot rock system is presently in the experimental state. The Los Alamos Scientific Laboratory is conducting experiments in the Valles Caldera area, New Mexico, for the Energy Research Development Administration. The purpose of the experiment is to design a working model to determine its feasibility. In theory, the model involves drilling into hot rock; fracturing the rock; drilling a second well into the fracture; then circulating water down one well, through the hot rock, and pumping it from the second well to a generating plant to produce electricity. Presently, the Los Alamos Laboratory has drilled an observation well, hydraulically fractured the hot granite at a depth where the temperature of the rock is about 250°C. (482°F.), and are now drilling the first well of the model. Future plans are to drill the second well and begin circulating water to a 100 KW generator (Fig. 5).

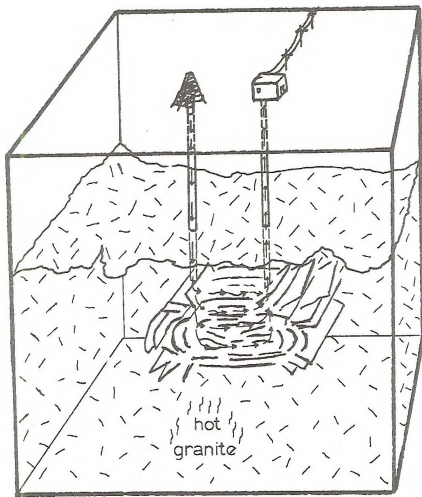


Diagram of Hot Rock System in Jemez Mountains, New Mexico

Figure 5

d. Geopressured Reservoir System

Geopressured reservoirs lie within sedimentary basins (e.g., Gulf coast) which receive continuous accumulations of sediment. The reservoir of trapped water is under increasing pressure because of continuous deposition of material. Such systems are not presently under development because of technological impracticabilities.

3. Geothermal Lease Status in New Mexico

Leases for geothermal development are currently being granted on Federal, State, and private lands within New Mexico. At present, the U.S. Geological Survey has designated seven Known Geothermal Resource Areas (KGRA) {43 CFR 3200.0-5(k)}. These areas consist of: Baca No. 1, Gila Hot Springs, Kilbourne Hole, Kilbourne Hole Addition, Lower Frisco Hot Springs, San Ysidro, and Radium Springs. Each KGRA may or may not contain Federal, State, and private lands. A proposal has been formulated on the designation of an area within the Animas Valley known as the Lightning Dock KGRA. This proposed KGRA was produced by the filing of applications which overlapped one another by one-half or more and produced a competitive interest in the area {43 CFR 3200.0-5(k) (3)}.

Industry has become very interested in geothermal resources on Federal land. On May 15, 1975, 12 tracts of Federal land in the Kilbourne Hole KGRA became available for competitive bidding, nine tracts received bids and leases were issued. In June, 1975, 47 non-competitive geothermal leases were issued outside, but adjacent to, the Kilbourne Hole KGRA. Industry has also become interested in the Lightning Dock area. To date (January 15, 1976), the BLM has accepted 74 applications for geothermal leases from 11 companies and individuals.

The State of New Mexico also issued geothermal leases. In August, 1974, and March, 1975, the State conducted geothermal lease sales; however, bids were received only for lands within or near indicated thermal anomalies, and these lands were subsequently leased.

No information is available concerning the leasing of private lands. Many land owners are refraining from leasing to see what develops in regard to geothermal resources adjacent to their private lands.

4. The Geothermal Steam Act of 1970

The Geothermal Steam Act of 1970, provides for the development of Federally owned geothermal resources. On January 1, 1974, Title 43 of the Code of Federal Regulations (CFR) Group 3200, and Title 30,

CFR, Part 270 and 271 became effective (Appendix A). The purpose of these regulations is to implement the Geothermal Steam Act of 1970. Since then four Geothermal Resource Operations Orders (GRO Orders) have been formulated and passed pursuant to 30 CFR 270.11 (Appendix A). A fifth GRO Order is now being drawn up.

5. The Process of Acquiring the Right to Develop and Produce Federal Geothermal Resources

a. Environmental Analysis Record and Technical Examination

When an area is selected for geothermal leasing, the Director of the Bureau of Land Management or his authorized representative requests that other interested Bureaus and Federal Agencies prepare reports describing, to the extent known, resources contained within the general area and the potential effect of geothermal development upon the resources of the area (43 CFR 3200.0-6(a)). The surface managing agency then makes a thorough evaluation of the environment and the resources through an Environmental Analysis Record (EAR) and a Technical Examination (TE) (43 CFR 3200.0-6(b)). These evaluations consider the impacts of developing geothermal resources during leasing, exploration, development, production, and close out. If the area is leased, the evaluation may recommend special stipulations which are not covered in the lease contract, 43 CFR group 3200, 30 CFR part 270-271, or GRO Orders (Appendix A).

Geothermal development of an area is divided into pre-lease exploration, competitive and non-competitive leasing, post-lease exploration, development, production, and close-out. A discussion of each phase will follow to acquaint the reader with the procedures and regulations associated with each phase (Table 2). A glossary of unfamiliar terms used within this document is presented in Appendix B.

b. Pre-lease Exploration

Pre-lease exploration is divided into "Casual Use" and "Exploration Operations."

(1) Casual Use

"Casual Use" as defined in 43 CFR 3209.0-5(d) means "activities that involve practices which do not ordinarily lead to any appreciable disturbance or damage to lands, resources, and improvements." The activities do not involve use of heavy equipment or explosives, and do not involve vehicle movement except over established roads and trails. Casual use does not require a permit, EAR, or a surface protection technical examination.

TABLE 2

STAGES OF IMPLEMENTATION, AGENCY RESPONSIBILITIES AND REGULATIONS
ASSOCIATED WITH GEOTHERMAL DEVELOPMENT

Stage of Implementation	BLM Responsibilities	USGS Responsibilities	Regulations
Pre-lease Exploration	Environmental Analysis Record	Input (Stipulations)	43 CFR 3200 30 CFR 270-271
Leasing	EAR and Technical Examination (TE)	Input Plan of Exploration	Special Stipulations
Post-lease Exploration	Input	Plan of Operation Environmental Analysis (EA) Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders 1-4
Development	Input	Plan of Development EA Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders 1-4
Production	Input Permits for Powerlines, Pipelines, power plants and roads (Certificate of Public Convenience and Necessity from Public Utility Commission of New Mexico to construct power plant)	Plan of Development EA Permit to Drill	43 CFR 3200 30 CFR 270-271 GRO Orders 1-4
Close-out	Input	Input	43 CFR 3200 30 CFR 270-271 GRO Orders 3-4

(a) Geological Reconnaissance

This survey is usually accomplished by one or more men on foot using a Brunton compass and maps to obtain and record data. The study consists mainly of obtaining information on structure, stratigraphy, and the distribution of volcanic and hydrothermally altered rock.

(b) Geochemical Survey

This survey is made by sampling springs, surface waters, well waters, and volatiles which are present in the area. Temperature, rate of flow, water migration, and chemical analysis of water and gases can be determined in this survey.

(c) Airborne Surveys

Airborne surveys are conducted over the selected area. No surface disturbance occurs during these surveys.

(2) Exploration Operations

The 43 CFR 3209.0-5(a) defines "Exploration Operations" as any activity which requires physical presence upon public land and which may result in damage to public lands or resources. It may include, but is not limited to: geophysical operations; drilling of shallow temperature gradient wells; construction of roads and trails; and cross-country transit by vehicles over public lands.

A "Notice of Intent to Conduct Geothermal Resource Exploration Operations" accompanied by a \$5,000 surety bond or rider to a state wide or nation wide bond must be filed for each "Exploration Operation" (43 CFR 3200.1-1 and 3209.4-1). Before any activity can commence, an EAR is written and the "Notice", which usually requires additional mitigating stipulations, is approved by the authorized officer. The required bond ensures compliance with regulations 43 CFR 3200. The stipulations are then attached to the "Notice." After exploration has been concluded, a "Notice of Completion of Geothermal Exploration Operations" must be filed. Within 90 days after the "Notice of Completion" is filed, a compliance inspection is made of the area and the party is notified whether they have complied with all the regulations and stipulations. Exploration methods conducted under a "Notice of Intent" include:

(a) Shallow Drill Holes

Drill holes involved in exploration to determine geothermal potential of an area can be used to obtain a variety of information. These shallow exploration holes are used

mainly for determining temperature gradients, heat flow, lithology, and shallow geologic structures. Geothermal and geological test holes to determine the presence of geothermal resources are allowed only under a lease. Drill holes of no more than 152 m. in depth (maximum 500 feet) are usually drilled by portable truck-mounted drills and usually require only a short time to complete; thus, the surface disturbance is reduced significantly.

(b) Seismic Methods

Seismic surveys are used to obtain information concerning subsurface geology by generating seismic waves and inducing the energy into the ground. Presently, Vibroseis is the most popular method of obtaining seismic data because of its reduced adverse effects on the environment (Jiracek, 1974, pers. comm.). This method uses a vibrator attached to a truck as an energy source which generates seismic waves of controlled frequencies.

Dinoseis, although not as popular as Vibroseis, is also an efficient method of producing seismic waves. Dinoseis produces about the same minimum surface disturbance as Vibroseis. Dinoseis is a seismic energy source in which a plate is forced against the ground by a confined explosion within a truck mounted drum.

Detonation of explosives (shot-holes) in drill holes to generate seismic energy is a technique which is not normally used unless the prospective area is too remote to enter by truck. This method is not used extensively by industry because of the surface disturbance and the lack of frequency control.

Weight drop seismics are nearly non-existent in industry. This technique uses a small, portable, heavy weight attached to a pulley on a truck. When the weight is released, the impact yields seismic energy.

(c) Electrical Resistivity Surveys

Probably the best technique for locating geothermal fluids is a resistivity survey. This survey, in general, consists of introducing electrical current into the ground as a means for studying the earth's resistivity. Since the resistivity usually decreases with increasing water content and temperature, electrical resistivity makes an excellent technique for geothermal exploration. The method involves driving metal rods into the ground (sheets of aluminum foil can also be used) and transmitting electrical current through the electrodes. This type of survey usually necessitates vehicle movement over surface terrain. In some areas, existing roads are sufficient, so minimum surface disturbance can be anticipated.

Induced polarization and self potential are other types of electrical surveys requiring little surface disturbance.

(d) Gravity Surveys

Gravity surveys are used to define changes in the gravity that result from density changes under the surface. Subsurface igneous masses (intrusives) that may be potential geothermal sources can be located by gravity measurements. Such a survey is conducted with a portable, light weight gravitometer which can be hand carried to lessen the surface disturbance effects. Gravity measurements are made by occupying known stations which are usually located at grid points.

(e) Magnetic Surveys

Magnetic surveys are conducted either by air or on the ground. The survey is used to determine if anomalous magnetic material exists in the subsurface. Igneous rocks commonly contain abundant magnetite (Fe_3O_4) which is easily detected by a magnetometer. Since these types of rocks are associated with geothermal waters; magnetics can be used in conjunction with other geophysical methods to locate and define the geothermal sources.

The survey on land is usually conducted on foot with a portable instrument carried as a back pack. Little to no surface disturbance is caused by this survey.

(f) Telluric Surveys

Telluric surveys involve variations in natural electric currents in the earth by using portable equipment. Surface disturbance should be minimal, depending upon the methods of transporting the instruments.

c. Leasing

The process of leasing Federal geothermal resources is separated into competitive (43 CFR 3200) and non-competitive (43 CFR 3210) leasing. Competitive leases are usually issued to the highest qualified bidder on tracts of land within a KGRA. The tracts of land are selected by surface and subsurface geological features, drill hole log data, chemical analysis of water, or by competitive interest areas.

(1) Competitive Leasing

When a sale is to be conducted, notice is published in a paper of general circulation for four consecutive weeks. The notice

specifies time, place, bidding requirements, land descriptions, royalty, and rental terms. An applications, with one-half of the bonus bid, is filed pursuant to 43 CFR 3220.5(a) and (b). On the date, time, and place of the competitive bid, all bids are opened and displayed. The lessor has 30 days to accept or reject the bids. When a bidder is successful, he is required to sign three copies of the lease contract, to pay the first year's rental, to pay the balance of the bonus bid, to file the required bond or bonds, and to submit a proposed "Plan of Exploration {43 CFR 3220.6(d)}. If these requirements are accomplished in the specified time frame, a geothermal lease contract is issued.

(2) Non-competitive Leasing

Non-competitive leases are issued on any available Federal lands outside of a KGRA. Geothermal resources supposedly have a lower potential in these areas. Available lands are those described in 43 CFR 3201.1-2 through 3201.1-5; however, certain lands are, or may be, withheld from leasing (43 CFR 3201.1-6).

A non-competitive lease is acquired in a manner similar to competitive leasing. An application, bond or bonds, an application fee, and a proposed "Plan of Exploration" are sent to the proper BLM office {43 CFR 3210.2-1(a)-(e)}. No bonus bids are required on non-competitive geothermal leases. When the application is approved, three copies of the lease contract are sent to the applicant. The applicant must sign the lease contracts and return them along with the first year's rent (43 CFR 3205.3-5).

(3) Lease Terms

The "Plan of Exploration" is required by 43 CFR 3210.2-1(d) and 43 CFR 3220.6(d). This plan should describe briefly the activities that will be conducted on the lands within the application.

The Geothermal Resource Lease Contract (BLM Form 3200-21) allows the Federal Government to lease geothermal resources and at the same time provides protection for other natural resources. Provisions within the contract require protection of the environment, antiquities, historic values, etc., in compliance with Federal regulations (43 CFR, parts 3000 and 3200, and 30 CFR 270 and 271; Gro Orders, and any written or oral orders of the geothermal supervisor). In addition, special stipulations needed to protect unique values of a particular area may be incorporated into the lease contract and compliance becomes mandatory.

d. Post-lease Exploration

After a lease is issued, Federal regulations under

30 CFR 270.34 and 43 CFR 3203.6 require that a "Plan of Operation" be filed and approved by the land management agency and the U.S. Geological Survey before any activity other than "casual use" may commence. The "plan" with maps will discuss all exploration activities that will be conducted on the leased lands. The U.S. Geological Survey, the lead agency, studies the "plan" and sends copies to the surface managing agency and other interested agencies for comments.

The USGS must prepare an Environmental Analysis (EA) covering the specific site within the proposed "Plan of Operation." Generally, the proposal is to drill one or more geothermal resource exploratory wells. An on-site inspection with representatives of the lessee, USGS, and the land management agency is then conducted to assess the potential impact of the proposed operation. The "plan" and a draft EA are presented to the Geothermal Environmental Advisory Panel (GEAP). GEAP advises the area Geothermal Supervisor on the environmental aspects of the "Plan of Operation", and recommends mitigating measures to protect the environment. The EA is completed after input is obtained from GEAP. The "Plan of Operation" is then jointly approved by the Area Geothermal Supervisor and the appropriate land management agency after including any special conditions or stipulations deemed necessary to protect the environment, conform with the proper operational procedures, and consider multiple use management.

The lessee's application(s) for "Permit to Drill"(Form 9-331C), including any special stipulations as well as GRO Orders No 2, is then issued to the lessee. The lessee may then commence only those operations authorized under an approved "Plan of Operation." The lessee's authorized operations are continuously monitored and inspected by the Area Geothermal Supervisor to ensure that the lessee complies with the applicable regulations, etc. Any additional exploratory operations proposed by the lessee require another "Plan of Operation" pursuant to 30 CFR 270.34, resulting in a procedure essentially similar to the preceding steps. The resultant procedure may entail the addition of other special stipulations to protect the environment.

Pre-lease exploration methods have been defined previously; however, post-lease exploration uses many of these methods on a more intensive basis. Exploratory drilling methods requiring depths of more than 152 m. (500 feet) also may be used. These include geological information holes and exploration wells.

(1) Geological Information Holes

Deep exploration holes are drilled for subsurface geological information. The holes are drilled with large rigs which

increase surface disturbance. Drill pads of .4 to .8 hectares (1 to 2 acres) are cleared and leveled. A service road is constructed to the drill pad to provide access for men and equipment. Large volumes of drilling fluid or large air compressors are required to remove drill cuttings from the bottom of the hole. Drilling a hole takes from several days to weeks, depending upon depth and hardness of the subsurface strata. The drill holes provide subsurface geological information from geophysical logging, cuttings, and core samples, and may indicate geological and reservoir conditions. If fluids are encountered, chemical analysis may also provide valuable information.

(2) Exploration Wells

A deep exploration well is drilled once the exploration work has determined the best location for geothermal resources. The drilling procedure follows that which is described under geological information holes. The deep drill holes are properly cased and cemented.

Occasionally, zones in the subsurface strata have sufficient pressure to blow drilling fluid out of the hole unexpectedly. Mud temperatures also can cause blowouts. In preparing a drill rig, a blowout preventer is installed beneath the rig floor on the surface casing so that when such a zone is penetrated, the well can be shut in and fluids or gases are not allowed to escape. If the well is not shut in, fluids, gases, and steam could be spread onto the adjacent lands.

If an exploratory well discovers a geothermal reservoir, a series of tests are made to determine flow rates, pressures, temperatures, and chemical content. The purpose of these tests, basically, is to determine if the well can be economically produced. Utility companies require a minimum of 30 years of production capacity before they will build a generation plant (Neilson, 1974, pers. comm.). The chemical analysis of the gases, steam, and water also would provide an insight into possible production problems. Some noxious gases and materials that may be produced, such as ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide, mercury, and methane could be toxic if present in sufficient quantities. The steam and water could contain other minerals also, which would precipitate if the pressure and temperature were reduced below a certain point.

During the testing, steam and fluids would be produced at the surface and proper precautions would be necessary to prevent surface pollution. After the testing is completed, the drilling rig is removed and a "Christmas tree," a series of valves, is attached to the casing head and the disturbed area then is rehabilitated.

e. Development

Once a successful exploratory well is drilled, plans begin to develop the geothermal resource. A new plan called a "Plan of Development" must be filed pursuant to the requirements of 30 CFR 270.34 and .35. No development operations will commence until the "plan" is approved by USGS and the appropriate land managing agency. Another EA covering the activities within the "Plan of Development" is prepared by USGS. GEAP again recommends mitigating measures for protection of the environment, which may result in additional stipulations imposed upon the lessee. The lessee may then commence only those development operations authorized by the "Plan of Development." Again, all activities must be in compliance with the regulations, stipulations, GRO Orders, etc. The development of the geothermal resource requires the drilling of a number of development wells.

(1) Development Wells

The information obtained during the exploratory phase is very helpful in planning field development and well locations. Additional geophysical work may be conducted in order to gain more detailed information. Development wells are drilled and completed basically the same as the exploratory wells and require the same considerations.

The program is modified as new data becomes available, but this is the critical time from the standpoint of environmental impacts and surface disturbance. For instance, if the development wells are to be drilled on 8 hectares (20 acre) spacing, (32 wells/sec.) rather than 16 hectares (40 acres) (16 wells/sec.), the surface disturbance will be greater. There will be more service roads, pipelines, surface equipment, etc. However, if the wells are to be slant drilled from central locations, the impacts will be significantly less. The capability of a company to conduct slant drilling (directional drilling) depends on economical, mechanical, and geological considerations. The variability of these factors from area to area may make slant drilling impractical.

The number of development wells drilled per section will depend on a number of factors, including the type of geothermal resource (steam or hot water), temperature, capacity of the wells, and reservoir conditions.

f. Production

After a sufficient number of development wells are drilled, plans are made for the most economical and feasible use

of the geothermal resource. The "Plan of Development" may be revised and submitted to the USGS for approval and nothing will proceed until the plan is approved. A number of procedures must be followed before production begins within a geothermal field.

Prior to placing the subject wells on prolonged production, the lessee, pursuant to 30 CFR 270.34(k), must collect data concerning the existing air and water quality, noise, seismic and land subsidence activities, and the ecosystem of the leased lands for at least one year prior to the submission of a plan for production. Additionally, the lessee, pursuant to 30 CFR 270.76, must submit an annual report of compliance with environmental protection requirements, giving full account of the actions taken. The use of the leased lands, or other Federal lands, for geothermal production will be authorized only under a separate permit issued by the appropriate agency {43 CFR 3200.0-8(a)}.

An EAR is a prerequisite to the issuance of a permit for the use of the leased lands or other Federal lands for a power generation plant, pipeline, transmission line, or other facility. Granting of a permit pursuant to 43 CFR 3200.0-8(a) is not a license to construct a power generation plant. The construction, operation, and maintenance of a power generation plant can only be accomplished by obtaining a "Certificate of Public Convenience and Necessity." This certificate is granted by the Public Utilities Commission of the State having jurisdiction and regulatory authority over the utility making application.

Stipulations are imposed at this time to protect the environment from the results of construction and operation of a power generation plant and necessary transmission lines. Provided that all the foregoing steps indicate that the construction can be accomplished within all applicable regulations, stipulations, GRO Orders, etc., the public utility can construct its power generation plant.

The production phase is a very active time in the development of a geothermal field. Pipelines, power plants, and transmission lines may be constructed if the resource is such that electricity can be produced. If, because of the reservoir requirements, the production of electricity is not feasible, the geothermal resource may be used for other purposes, such as greenhouses, hot houses, space heating-air conditioning, food processing, etc. These industrial uses may also occur in conjunction with electrical generating plants.

(1) Pipelines and Roads

The number of roads and pipelines, as stated previously, will be directly related to the method of field development and the intensity of the development. Usually, frequency of road use

and the severity of the weather determine how elaborately the roads are constructed. Roads will be associated mainly with drill sites, pipelines, power plants, transmission lines, and other industry.

Pipelines range in size from 25 cm. to 76 cm. (10 to 30 inches) in diameter, and are constructed above ground because the extreme temperature changes cause movement by expansion and contraction. An underground pipeline within another larger pipeline is mechanically possible, but not economically feasible at this time. The drop in pressure and temperature limit the length of the pipelines, and heat loss is reduced by insulating the outside of the pipe. Centrifugal scrubbers are attached to the pipeline to remove rock particles. Mufflers are installed to reduce the noise level. The visual impact of these pipelines may be reduced by painting them to blend with the landscape.

(2) Power Plant Construction

Geothermal energy use and development is just beginning, and there appears to be almost unlimited opportunity for technological advancement. Power plant construction is probably one area that will have significant changes in the future.

At the Geysers, a power plant, cooling towers, and associated structures (parking lots, offices, etc.) occupy an area of approximately 1.2 to 2 hectares (3 to 5 acres). The largest power plant generates approximately 110 MW of electricity. The cooling towers and transmission lines are the tallest structures in the complex. A power plant and associated wells similar to that at the Geysers would occupy about a section of land.

In the hot water system, there could be problems in utilizing and disposing of large volumes of mineralized water. If hot, mineralized water is used directly in turbines, pipelines, and cooling towers, corrosion and precipitation associated with pressure and temperature drops may result in equipment failure.

A "heat exchanger", presently in the experimental state, is a piece of equipment designed to transfer the heat in the hot water to another media, such as Freon or iso-butane, to drive turbines. The hot water is then reinjected into the reservoir. A closed circuit system such as this eliminates, or greatly reduces, the problems of scaling, corrosion, disposal of gases, odors, and excess water.

(3) Transmission Lines

Conventional type power lines mounted on steel or wood structures transmit the electricity to the market. There is some

flexibility on the routing of transmission lines and the construction technique which can reduce visual impacts.

(4) Generating Electricity

After a sufficient number of development wells have been drilled, a power plant and associated equipment is constructed; however, development drilling may continue. The lag time from discovery to ultimate field development probably would be several years.

Repairs will be necessary from time to time on transmission lines, pipelines, cooling towers, buildings, generators, turbines, etc. These repairs should have little impact on the environment after the initial construction is completed.

The life of an average geothermal field is impossible to estimate at this time because production information is very limited. Only two fields have been subjected to high rates of draw-off for periods measurable in decades - the Wairakei Field in New Zealand, and the Larderello Field in Italy. At the Wairakei Field, aquifer pressures declined during the first few years (1957-1964) of production, and at the same time, there was appreciable ground subsidence. By 1970, the ground subsidence and pressure fall had diminished greatly, and by 1973, there was no further net loss of mass from the aquifer. Apparently the draw-off is being replaced by natural recharge. The production wells in Wairakei are relatively shallow in depth, approximately 1034 m. (3,400 ft.), and the excess hot water is not being returned to the geothermal reservoir. During the production period, the water temperature dropped, apparently due to lower pressure; however, there was no marked fall in the enthalpy of hot fluid produced from the wells. Other effects of production on the general area have been complete cessation of former hot spring and geyser activity in the Wairakei Valley, and an increase in the size and number of fumaroles in a natural steam area 4.8 kms. (3 miles) away. At Larderello, Italy, studies over the last few years indicate that average source steam temperatures have increased between 30° and 40° C. (86° and 104° F.), while pressures have stabilized after an initial falling period (Kruger and Otte, 1973).

(5) Other Uses

Other uses of geothermal energy are diversified. At this time, the generation of electricity appears to be the main use and concern; however, this use requires temperatures of approximately 180° C. (356° F.) or above. No doubt many reservoirs will be discovered which have temperatures considerably lower than 180° C. (356° F.) which can be used in many different ways, such as space heating,

product processing, agricultural heating, mineral recovery, air conditioning, desalination, etc. Technological advancements will determine the degree of exploitation and use of geothermal energy.

Approximately 12,800 hectares (32,000 acres) within the Animas Valley (Cotton City-Animas, New Mexico area) are presently under crop production (Allen, 1973). Geothermal resources could enhance this industry immensely. The water may be used to irrigate additional acreage, while the geothermal resource is used in various agriculturally related industries. Hot and green houses may be constructed to enhance food production, although the growing season within the Animas Valley ranges from 180 to 215 days. The geothermal heat under ideal conditions should produce an environment that will increase the growing season to 365 days.

Geothermal energy can also be used in the processing of the various crops. Sugar beet processing and canneries require steam at 140° C. (285° F.). These two industries could benefit from geothermal development.

Waters from geothermal reservoirs may be used to operate a freeze-drying operation. Using a standard ammonia absorption refrigeration method, 151° C. (330° F.) water from geothermal wells can create temperatures of -45° C. (-50° F.) to freeze dry coffee, tomatoes, onions, or other vegetables (Sharp, et al., 1975).

Farmers have used natural gas or propane for crop drying; however, escalating fuel costs are causing financial problems. Geothermal steam or hot water heat may be used as a more economical source of energy in crop drying (Sharp, et al., 1975).

g. Close Out

A sizable geothermal field would be abandoned gradually. In a small field, an abrupt cessation may be likely.

Before the exhausted production wells are plugged and abandoned, they may have other uses. If these wells are strategically located, fluids may be reinjected into the reservoir through the exhausted wells; and this may lengthen the life of the remaining field. If the wells are shut in, tests may reveal that the bottom hole temperatures and fluids have recharged after a lapse of time. Plugging and abandonment of geothermal wells must be done in accordance with GRO Order No. 3.

Close out or abandonment of all or a portion of a geothermal field would take place in three phases: abandonment of the subsurface; removal of the surface installations; and rehabilitation of the surface (30 CFR 270.45, 43 CFR 3204.1(1) and GRO Order No. 4).

The method of abandonment of equipment in the wells would depend upon several factors, such as: the condition, age, method of installation, and the type of equipment. Federal regulations require that all casing on a geothermal well remain in the hole (GRO Order No. 4). The well is properly plugged to protect the fresh water zones in the subsurface. Cement plugs are usually set at various levels, the casing is cut off below ground surface, and a steel cap is welded over the top of the casing. A marker of the well's location may or may not be installed.

Removal of surface installations, such as buildings, roads, foundations, and equipment will be accomplished over a period of time. Many of the installations are used at other locations or have salvage value.

Rehabilitation of the field area probably will take considerable time depending on the topography and the size of the developed area. The obliteration of excess roads will no doubt be difficult to accomplish, particularly where there are cuts and fills in rough terrain. Pits and sumps will be filled, steep areas will be sloped and contoured, and all disturbed areas may be revegetated.

6. Economic Analysis

a. Market Study of Mineral Commodity

(1) Present and Anticipated Demand

The present and anticipated demand for the end product of geothermal energy, whether it be electrical energy or heat energy as applied to greenhouse or other industrial uses, is virtually unlimited. The electrical energy aspect is better known, and will, therefore, be the principal focus of this analysis. Demand, assuming costs are competitive, is evidenced by the recent construction of the giant coal-fired electrical power generating plants in the Farmington, New Mexico, area, and the huge nuclear plants near El Paso, Texas, Belen, New Mexico, and Greenlee, Arizona, on which construction is expected to be substantially completed within the next 20 years. The demand for non-petroleum generated sources of electricity has been greatly accelerated by the national petroleum and natural gas shortage (Western Systems Coordinating Council, 1975).

(2) Geographic Distribution of Demand

The geographic distribution of demand is expected to be the southwestern states in general and especially southern California, Arizona, New Mexico, and Texas.

(3) Economic Feasibility of Extraction

The economic feasibility of extraction will be an unknown factor until extensive exploration drilling and testing has occurred.

(4) Alternate Sources

Alternate sources of electrical energy are from coal, petroleum, natural gas, nuclear energy, solar energy, and wind. Comparative costs, advantages, and disadvantages of the alternatives are beyond the scope of this analysis.

(5) Transportation Networks

The transportation network for distribution of the electric power generated from the geothermal resource would have to be by power lines not presently built. The Greenlee, Arizona, substation or the two 345 KV lines passing near Lordsburg, on which construction is expected to begin soon, are possible distribution outlets.

b. Short and Long Term Impacts on the Local Labor Market and the Economy

All phases of geothermal energy exploration and development would increase the local employment and put new money into the local economy to some extent. The majority of the personnel employed on the exploration phase crews would probably come from outside areas because of the need for technical expertise. Some local hiring would probably take place, however, and the local service industry (motel, cafe, service station, etc.,) would benefit from an increased volume of business.

The development and production phases would bring more or less permanent residents to the area and provide work for local people. Secondary impacts of the new money in the community would be possible school expansion, new home construction, utility expansion, expanded service industries, and a greatly improved tax base for city and county tax income.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. Non-living Components

1. Air

a. Air Movement Patterns

Winds blow from the northwest, southeast, and southwest during certain seasons of the year. In the winter, cold winds blow out of the northwest and are usually associated with cold fronts that occasionally produce snow. The winter winds are usually light and variable with speeds of less than 8 kms. per hour (5 mph). Winds change direction and blow from the southwest in the spring, and average about 11 kms. per hour (7 mph) (Jackson, 1975). Gusty winds causing severe dust storms are most frequent at this time of the year. The winds again change direction in the summer and fall, and blow from the southeast. Winds are very light and variable during the summer and fall, but moderately high, gusty winds usually precede thunderstorms. Dust devils are common during the summer months.

Air inversions are not common in the area, but do occur. Cold air settles on the warm air, causing the inversion in the early morning hours; however, as temperatures increase during the day, the cold air is heated and the inversion dissipates. Pollutants from the smelters at Morenci and Douglas, Arizona, drift into the area at certain times. The pollutants may cause noticeable haze at various times of the day, depending upon air movement and temperatures.

The average annual precipitation varies from 25 cm. (10 inches) in the northern two-thirds of the area to over 50 cm. (20 inches) in the isolated mountains of the south. The rains that occur during the months of July through September account for over half of the annual precipitation. This precipitation normally comes as brief, high intensity thunderstorms; however, occasionally a slow, soaking, rain shower occurs. Monthly precipitation data for Lordsburg, New Mexico, is presented in Table 3, while selected climatological data for certain stations is given in Table 4.

b. Temperatures

Annual average temperatures within the assessment area vary from 14^o to 15^o C. (58^o to 62^o F.) depending upon location. Temperatures fluctuate daily by at least 17^o C. (30^o F.). Winter days are normally mild; however, temperatures reach freezing or below during approximately 75 percent of the winter nights. Winter temperatures rarely reach -18^o C. (0^o F.) or fail to rise above freezing during the day. The daily summer temperatures usually reach 32^o C. (90^o F.) or more, while night temperatures range from 15^o C. to 21^o C. (high 60's or low 70's ^oF.). Monthly temperature data for Lordsburg, New Mexico, is presented in Table 3.

Table 3

Monthly temperatures (1946-1960) and precipitation (1881-1960), Lordsburg, Hidalgo County, New Mexico, elevation 4245 feet ^{1/}

Item	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperatures (F ⁰)												
Average daily maximum	58	64	69	79	87	97	97	95	92	81	68	60
Average daily minimum	27	30	35	42	50	61	66	64	58	46	33	27
Daily mean	43	47	52	61	69	79	82	79	75	64	50	43
Extreme maximum	76	85	86	93	104	108	110	106	104	94	82	75
Extreme minimum	2	8	14	28	30	41	52	48	44	28	12	2
Precipitation												
Average (inches)	.72	.66	.62	.24	.21	.36	1.76	1.92	1.21	.87	.52	.69
Average days 0.10 inch or more (no.)	2	2	2	1	1	1	4	5	3	2	2	2
Average snowfall (inches)	1.1	.9	.7	.1	0	0	0	0	0	0	.4	1.2

^{1/} Taken directly from Maker, H. J., D. N. Cox, and J. U. Anderson, 1970, Soil Associations and Land Classification for Irrigation, Hidalgo County, NMSU Agri. Exp. Sta. Research Report 177, 29 pgs.

Table 4

Annual averages of selected climatological data, Hidalgo County, New Mexico, for period of record through 1960 ^{1/}

Station	Elevation	Temperatures			Precipitation		Last 32°F or Lower in Spring	First 32°F or Lower in Fall	Time Between Dates
		Mean Maximum	Mean Minimum	Yrs. of Record	Mean Annual	Yrs. of Record			
	Feet	°F	°F	No.	In.	No.	- -average date - -	days	
Animas	4415	78	43	21	10.39	37	Apr. 24	Oct. 29	188
Eicks Ranch	5300	73	42	21	15.03	27	Apr. 30	Oct. 27	180
Lordsburg	4245	79	45	13	9.78	80	Apr. 3	Nov. 4	215
Rodeo	4118	79	44	24	10.96	48	Apr. 12	Nov. 3	205
Virden	3775				8.98	19			

^{1/} Taken directly from Maker, H. J., D. N. Cox, and J. U. Anderson, 1970, Soil Associations and Land Classification for Irrigation, Hidalgo County, NMSU Agri. Exp. Sta., Research Report 177, 29 pgs.

The growing season varies from 180 to 215 days, depending upon the selected site. The last spring frost occurs between April 3 and 30, while the first fall frost can be expected between October 27 and November 4. Average annual climatic data for selected sites is presented in Table 4.

c. Particulate Matter

Dust storms in the area are common during the spring and summer months. Vegetation is sparse in many areas and the soils are such that minute soil particles are moved or suspended very easily. Farming in the Cotton City-Animas, New Mexico, area also accounts for dust being introduced into the atmosphere. The smelters at Morenci and Douglas, Arizona, produce pollutants which are suspended in the air and, as the air moves over the area, some of the pollutants settle. No known measurements of solid or liquid material have been made for the assessment area. Measurements of particulate matter may be available near the above mentioned smelters due to anti-pollution laws and regulations.

d. Noxious Gases

Carbon monoxide, hydrocarbons, nitrogen oxides, and sulfur oxides are present in minute quantities throughout the proposed lease area. Many irrigation wells are associated with the agricultural areas around Cotton City and Animas, New Mexico. Water from these wells is drawn to the surface by large gas or diesel powered pumps. The pumps, along with the normal traffic and farming activities of the sparsely populated area, produce noxious gases. The gases are more prevalent in the agricultural region during the growing season when water is needed for crop production. Additional gases are released to the atmosphere by machinery during harvest periods. Gases from the smelters at Morenci and Douglas, Arizona, add pollution to the north and south ends of the proposed lease area. The concentration of these gases depends upon wind direction, speed, and air temperature. Winds may either blow the gases into or away from the assessment area. This in itself will increase or decrease gas concentrations. The speed of the wind and the air temperature determine the speed at which gases mix with other gases and dissipate or precipitate.

e. Radiological Contaminants

There are no known man caused radiological contaminants in the area which will degrade air quality.

f. Non-ionizing Radiation

Non-ionizing radiation is man-made electromagnetic energy created by radio transmitters and high voltage electric

transmission lines. Radio transmitters and a number of high voltage electric transmission lines do exist in or near the assessment area; however, no problems in air quality from non-ionizing radiation are known to exist at the present time.

2. Land

a. Soil Depth

Soil depth throughout the environmental assessment area ranges from 25 to 150 cm. (10 to 60 inches). Soil type is predominantly Hondale-Playas north of Cotton City and Mohave-Stellar south of Cotton City.

b. Soil Structure

The Mohave-Stellar soil is a sandy to silty clay loam with low permeability. Hondale-Playas soils are sandy to silty loams with very low permeability.

c. Soil Nutrient Properties

The Mohave-Stellar soil is well suited as cropland under irrigation. The Hondale-Playas contain high amounts of alkali and salts that are not suitable for croplands.

d. Soil Pollutant Properties

No data was obtained.

e. Soil Erosion

Soil erosion results mainly from catastrophic events (flash floods) which occur generally in the late summer. Many deeply eroded arroyos remain as evidence of these periods of flash flooding.

f. Geological Structure

In 1954, three wells drilled in the Animas Valley were reported to issue boiling water and steam from a sand-gravel-clay aquifer at shallow depths, 25 meters (80 feet). Following this discovery, geothermal investigations ensued.

One of the initial investigations attempted to establish and define the heat source for the boiling water and steam. Drill holes penetrated a mid-to-late Tertiary rhyolite in which one of the holes acted like a geyser when agitated by drilling equipment. A third hole drilled to the upper surface of the rhyolite issued 760 - 1140 liters (200-300 gallons) per minute of boiling water {Table 4 (drill logs)}.

TABLE 5 (Continued)

	Depth		Thick- ness		Depth		Thick- ness
	From	to			From	to	
Well 26.20.10.112				Well 27.19.34.114			
Pit	0	28	28	Top soil	0	5	5
Gravel	26	80	52	Clay, gravel	5	145	140
Clay	80	85	5	Limestone	145	200	55
Gravel, sand	85	120	35	Sand, gravel	200	205	5
Clay	120	123	3	Conglomerate	205	225	20
Sand	123	128	5				
Light gray clay	128	158	30	Well 27.20.2.444			
Streaks of gravel & clay	158	202	44	Top Soil	0	1	1
				Malpais	1	19	18
				Sand	19	29	10
Well 26.20.11.111							
Sandy soil	0	3	3				
Sandy clay, gravel	3	37	34				
Clay, sandy	37	85	48				
Clay	85	92	7				
Sandy clay, gravel	92	100	8				
Clay	100	132	32				
Clay, sandy, gravel	132	207	75				
Clay, sandy	207	215	8				
Red rocks	215	220	5				
Well 26.20.35.110							
Gravelly clay	1	18	17				
Malpais	18	30	12				
Gravelly clay	30	85	55				
Water-bearing gravel	85	90	5				
Gravelly clay	90	150	60				

Reported temperatures ranged between 290 - 1040 C. (840 - 2200 F.) at depths between 23 and 32 meters (74 - 106 feet). Heat conductivity measurements taken over a 64 hectare (160 acre) area in the proposed Lightning Dock KGRA indicate approximately 750 KW flow of energy (Reeder, 1975, Kintzinger, 1956).

Surface manifestations of this hot spot (T. 25S., R. 19W., Sec. 7) had been noted by the Animas Valley ranchers for years. Snows melted more rapidly over the hot ground than in surrounding areas. Cotton plants within the proposed KGRA grew only to about 15 centimeters (6 inches) in height in contrast to the normal height of 66 centimeters, (26 inches) in surrounding fields.

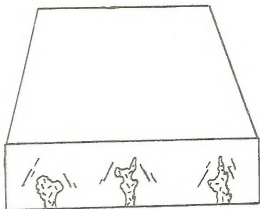
The Lightning Dock geothermal area lies within the Basin and Range Tectonic Province. Typical Basin and Range structures are found surrounding the proposed KGRA in the southwest corner of New Mexico, south of Interstate 10 (Fig. 6).

Basin and Range features were being formed under an extensional stress regime during the mid-Tertiary time (20-26 m.y.) Prior to, and at the beginning of this regime, molten silicic magmas ascended along deep faults and fractures. Intruding to the near surface and extruding with violent explosive eruptions, ash flow tuffs, ignimbrites, and rhyolite flows blanketed the earth's surface. Horst and graben structures resulted from extensional forces applied on the western U.S. and thus formed ranges and basins, separated by normal slip faults. Continuous erosion of the ranges throughout the Cenozoic Era allowed for the deposition of thick accumulations of alluvium in the adjacent basins. Near the end of the Tertiary period, silica "rhyolitic" eruptions began to give way to basaltic magmas (this change in magma type reflects the depth of origin of the molten rock) (Nash & Hausel, 1974). Basaltic flows, ejected from cinder cones, continued to erupt sporadically and cover the older alluvium valley fill throughout the Basin and Range until the present time.

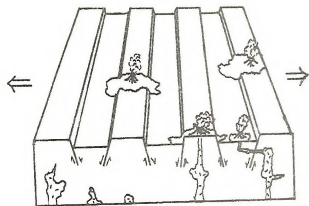
The Animas Valley Lava Flow, west of Animas, is an example of a recent basalt flow. Hand specimen identification indicates the rock type to be a fine-grained vesicular olivine basalt. This flow erupted from a cinder cone located southwest of Animas against the Peloncillo Mountains (Fig. 7, map). Outcrop patterns suggest that lava from this same flow also erupted from fractures and fissures within the Animas Valley parallel to the front of the Peloncillos.

The Peloncillo Mountains are a typical Basin and Range horst block. Monoclinial tilting of Paleozoic carbonates, shales, and sandstones along the high angle north-northwest trending faults dominates the central Peloncillo Mountains (T. 25S., R. 21W.). North of this

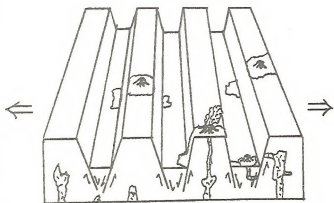
1.



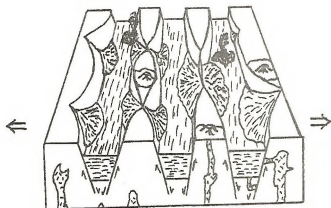
2.



3.

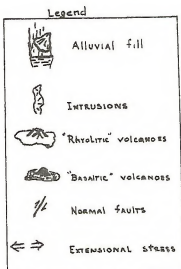


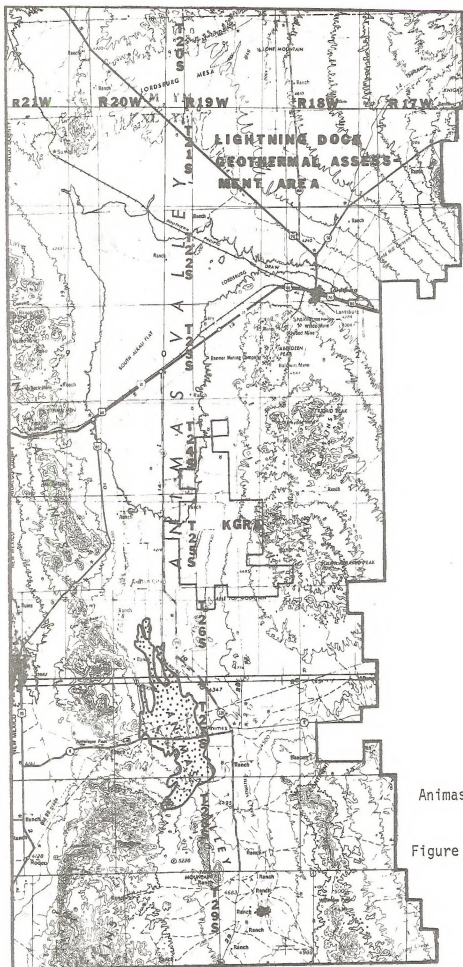
4.



1. Initial intrusion and fracturing of the Basin & Range - Cretaceous.
2. Continued extension with initial explosive volcanism - Early Tertiary.
3. Continued faulting forms deep basins - Mid to Late Tertiary.
4. Erosion of the ranges fills basins with alluvial material. Magma type becomes predominately basaltic - Quaternary.

Figure 6.
Schematic Illustrating the Formation
of Basin and Range Structures





Animas Valley Lava Flow

Figure 7

central block of Paleozoic sedimentary rocks are abundant Tertiary pyroclastics, ignimbrites, quartz latites, and rhyolites, forming the outcrop patterns seen at Stein's Pass (Table 6).

On the south side of the sedimentary section in the center of the central Peloncillos, the rock pattern is formed by a Precambrian granite. This granite is bound on the north and south by east-west trending faults giving rise to the Granite Gap horst. Adjacent to and north of the Granite Gap horst, Cretaceous to Tertiary Cienega Peak granite forms a spectacular outcrop. The Cienega Peak granite is a light brown-pink, silica-rich granite containing a large block of xenolithic light-gray limestone. The limestone shows evidence of thermal metamorphism (Fig. 8). South of Granite Gap, in contact with the Precambrian unit, are extensive hydrothermally altered Paleozoic carbonates. The alteration of these units gives them a brownish-red appearance. Numerous mining claims located on the altered units further demonstrate the extent of the hydrothermal effects of the carbonates. South of these sedimentary units, the Peloncillo Mountains are almost entirely composed of "rhyolitic" volcanics (tuffs and ignimbrites). A Tertiary monzonite porphyry outcrops on the western edge of the Peloncillos in T. 29S., R. 21W.

The Rodeo Cinder Cone lies immediately east of the town of Rodeo, New Mexico, near the Arizona border, T. 28S., R. 21W. This Quaternary basalt (late Cenozoic) is a fine-grained amygdaloidal pyroxene basalt. Olivine phenocrysts rimmed with iddingsite give evidence that a large amount of weathering has taken place since this cinder cone extruded lavas onto the surface.

The eastern boundary of the Animas Valley is terminated by the broad alluvial fans sloping downhill from the Big Burro Mountains in the north, the Pyramid Mountains in the center, and the northern edge of the Animas Mountains in the south.

The Big Burro Mountains that lie within the edge of this environmental assessment area are predominantly metamorphic schistose rocks which finger into the broad alluvial fans sloping to the west. A small outcrop (inselberg) of schistose rock similar to the outcrops of the Big Burros is located in a road cut along Highway 70 (T. 21S., R. 20W.).

South of Lordsburg, the Pyramid Mountains are another example of an upthrown horst block similar to the Peloncillos. Sedimentary rocks probably underlie much of the volcanics which outcrop throughout the range. Even though no surface expression of sedimentary units is found except for limestone fragments contained in a volcanic agglomerate about 12.8 km (8 miles) south of Lordsburg, these fragments are

TABLE 6

General Stratigraphic Section and Rocks of the Gila Planning Unit

Igneous Intrusive Rocks	Age	Rock Unit	Igneous Extrusive and/or Sedimentary Stratigraphic Units	Estimated Thickness (feet)
	Recent (Holocene)	Soils & unconsolidated alluvium	Soils, clays, silts, sands, gravels, and rocks, These clastics are also components of valley fills and alluvial fans	0.1 - 100'
Rhyolite dikes		Basalt	Basalt flows composed of transitional olivine basalt	1' - 60'
	Quaternary	Unconsolidated to semi-consolidated & crudely bedded valley fill (Laucastrine deposits)	Clays, silts, sands, gravels and rocks are components of valley fills that are non-cemented to partially cemented.	5' - 1,000'
Rhyolite plugs, dikes & sills	Tertiary Late	Gila Conglomerate	Sedimentary deposits of continental origin composed mostly of clastics and volcaniclastics. These materials are clays, silts, sands, gravels, and rocks, intermixed and crudely layered with interbedded basaltic andesite flows. This formation is generally semi-consolidated (partially to tightly cemented)	1' - 1,900'
Rhyolite, latite & non-zonite porphyry stocks, sills				

TABLE 6 (Continued)

Igneous Intrusive Rocks	Age	Rock Unit	Igneous Extrusive and/or Sedimentary Stratigraphic Units	Estimated Thickness (feet)
Quartz monzonite stocks, plugs sills Laccoliths, plugs & dikes	Middle	Hidalgo Volcanics	Ignimbrite consisting of ash flow and ash falls tuff & welded tuff with interlayered flows.	3000' - 5000'
			Rhyolite & quartz latite flows	100' - 1000'
			Andesitic basalt flows	1000'
Granite stocks, sills & dikes	Early	Ringbone formation	Rhyolite welded tuff	50' - 1000'
			Andesite & andesite porphyry flows, tuffs, & volcaniclastics	1000' - 5000'
			Basal andesitic and latitic agglomerate breccia and conglomerate	400' - 1000'
Granite (Cienega Peak) Quartz monzonite porphyry stocks, sills, plugs, & dikes	Cretaceous	Mojado formation	Limestone - cobble conglomerate black shale, gray shale, arkose, much fossil wood, chert conglomerate.	3400' - 7500'
		Gray to tan quartz sandstone with shale interbeds & thick lenses of conglomerate	5000' - 5300'	

TABLE 6 (continued)

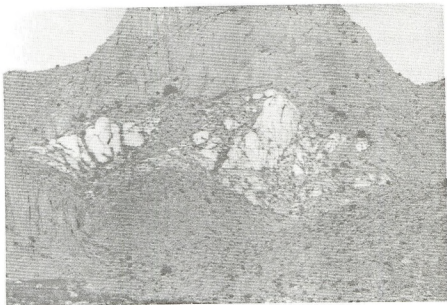
Igneous Intrusive Rocks	Age	Rock Unit	Igneous Extrusive and/or Sedimentary Stratigraphic Units	Estimated Thickness (feet)
		U-Bar Forma- tion	Fossiliferous thin bedded lime- stone, reef limestone, gray to brown shale	1900' - 3500'
		Hell-to-Finish formation	Red beds, arkose, limestone-cobble conglomerate, sandy limestone, lenses of andesite, thin bedded limestones, dolomites, and gypsum	1300' - 6000'
	Permian	Concha limestone	Thick bedded, light gray limestone containing abundant pinkish chert and very fossiliferous	800' - 1300'
		Sherrer formation	Thick bedded, cemented dusky red siltstone	5' - 50'
		Epitaph dolomite	Dolomite and dolomitic limestones, lower part red siltstones and massive gypsum beds	1400' - 1500'
		Colina limestone	Dark gray to black fine grained limestone with few interbedded siltstones, large gastropods & saphropods are characteristic	350' - 500'
		EARP Formation	The upper part is dominantly limestone the lower part consists of mostly siltstones & claystones	800' - 900'

TABLE 6 (Continued)

Igneous Intrusive Rocks	Age	Rock Unit	Igneous Extrusive and/or Sedimentary Stratigraphic Units	Estimated Thickness (feet)
	Pennsylvanian	Horquilla limestone	Thin and thick bedded, dark and light gray limestone with abundant fusulinids - pinkish-gray and black chert is common	1000' - 35000'
	Mississippian	Paradise formation	Alternating beds of black, gray and brown limestone, oolitic limestone, and calcarenite calcareous sandstone and conglomerate. Fossils are abundant.	200' - 300'
	Mississippian	Escabrosa limestone	Upper member consists of thick bedded light gray to dark gray crinoidal limestone with some pinkish chert. Middle member consists of dark gray to black limestone with abundant black chert in nodules and layers. Lower member consists of thin bedded to medium bedded light gray limestone with some thin shale interbeds.	400' - 1200'
	Devonian	Percha shale	Upper part consists of calcereous shales and shaley limestones - the lower part consists of black fossil shale - calcereous shale increases upward.	50' - 280'

TABLE 6 (Continued)

Igneous Intrusive Rocks	Age	Rock Unit	Igneous Extrusive and/or Sedimentary Stratigraphic Units	Estimated Thickness (feet)
	Ordovician	Montoyo dolomite	Composed of rhythmic succession of dark gray dolomitic strata and strata of black chert nodules. Basal member is 10 to 20 feet of dolomitic sandstone	0' - 400'
		El Paso formation	Consists of blue-gray bioclastic limestone - upper beds dolomitized lower beds are dolomite and dolomitic limestone with some beds containing abundant chert nodules	500' - 1000'
	Late Cambrian	Bliss formation (Bolsa quartzite)	Thickness and lithology of strata variable. Upper beds composed of dolomite sand - middle beds are white orthoquartzite. Basal beds are arkose and boulder conglomerate	60' - 330'
	Precambrian	Basement rocks	Coarsely crystalline porphyritic granite and quartzite	



Granite Gap Zenolith

Figure 8

enough evidence to suggest that sedimentary units do lie beneath the volcanics. The northern half of the Pyramids are composed of Cretaceous basalts and a grandiorite porphyry intrusive. Primarily copper prospects are found associated with the porphyry. The southern half of the range is built upon Tertiary basalts, andesites, and rhyolite flows and breccias. Prominent peaks are: North Pyramid Peak, formed from a rhyolite volcano; South Pyramid Peak, formed from a rhyolite breccia; and Lightning Dock Peak, formed from an andesite flow. Adjacent to Lightning Dock Peak and immediately east of the hot wells is an outcrop of Tertiary monozinite porphyry.

The northern Animas Mountains are layered Paleozoic limestone and Cretaceous sandstones and conglomerates. Farther south the rock type is dominantly "rhyolitic" Tertiary volcanics.

The Animas Valley, or graben, separates the upthrown ranges. Bound on both sides by north-south trending upthrown horsts, the Animas Valley is a typical Basin Range graben. The Animas Valley graben is probably filled with several thousand meters of sediments derived from the weathering of the adjacent ranges. A wildcat oil well drilled 3.2 km (2 miles) north of the hot wells did not hit basement granite until 2273 meters (7387 feet) of alluvium and Tertiary volcanics were drilled through, and that location is not at the apex of the valley. Deposition of the valley fill is the result of millions of years of catastrophic erosion (i.e., flash floods) of the adjacent ranges. The valley alluvium is composed of weathered rock fragments that are coarser near the mountain ranges. A surface layer of soils 25 to 152 cms. (10 to 60 inches) in depth covers the valley alluvium.

The San Simon Valley, west of the Peloncillos, is filled with an unknown depth of alluvium. Arizona Oil and Gas Company drilled to a total depth of 2,326 meters (7,560 feet) without reaching bedrock (Gillerman, 1958). Thus, these basins lying between the mountain ranges contain a considerable depth of weathered debris.

Subsurface structural features observable in the proposed KGRA have been determined by geophysical methods. An electrical resistivity survey conducted by the University of New Mexico (Jiracek, et al., in press) shows a high resistive structural ridge at depth trending in a north-northeast direction just east of the hot wells in T. 25S., R. 19W., Sec. 7. A resistivity low (~4 ohmmeters) around the hot wells indicates possible steeply sloping fractures dipping to the west, which act as conduits for the ascension of the thermal waters.

Mining claims throughout the area are located on copper (sulfides, sulfates, and carbonates), silver, gold, fluorspar, lead and zinc sulfides and tungsten ores.

Open mine shafts and adits in the area offer one form of geological value for human interest. Such features are often attractive, but dangerous, playgrounds for the general public.

g. Land Use Compatibility

Land uses on private and national resource lands are, in general, compatible. Lands are used for livestock grazing, hunting, rockhounding, off-road vehicles, wildlife habitat, and watershed. Irrigated croplands are found only on private lands, while mining is usually found only on Federally owned land. All of these uses are compatible, but with an increase in populations, possible conflicts may develop.

h. Land Use Suitability

The lands are suitable for presently existing uses. Numerous unimproved roads exist throughout the area and are used predominantly by ranchers.

3. Water

a. Hydrologic Cycle

Water resources for the Animas Valley are derived from one of two sources, precipitation and ground water. Precipitation from the normal hydrologic cycle provides an average of 25 cms. (10 in.) of moisture annually. The major portion of this precipitation falls from thunderstorms during the late summer and early fall.

Much of this rainfall runs out of the surrounding mountain ranges into the Animas Valley. In the upper Animas Valley, the rainfall collects into Animas Creek, the principal drainageway south of Animas. Two playas, the North Alkali Flat and South Alkali Flat, are the major drainage basins for rainfall north of Animas. In the fall, these playas collect enough water to last 2 to 3 months before complete evaporation occurs.

Groundwater in the lower Animas Valley averages a depth of less than 31 meters (100 feet) below the ground surface. In the northern half of the valley, the water table is as high as 4.5 meters (15 feet) below the surface and becomes progressively deeper southward along the valley axis to approximately 43 meters (140 feet) below the surface at Animas (Fig. 9).

In the upper Animas Valley, groundwater levels continue progressively in depth from approximately 61.5 meters (200 feet) to about 138.5 - 169 meters (450 - 550 feet) at the extreme southern end of the valley where the Animas Valley grades into the San Luis Valley.

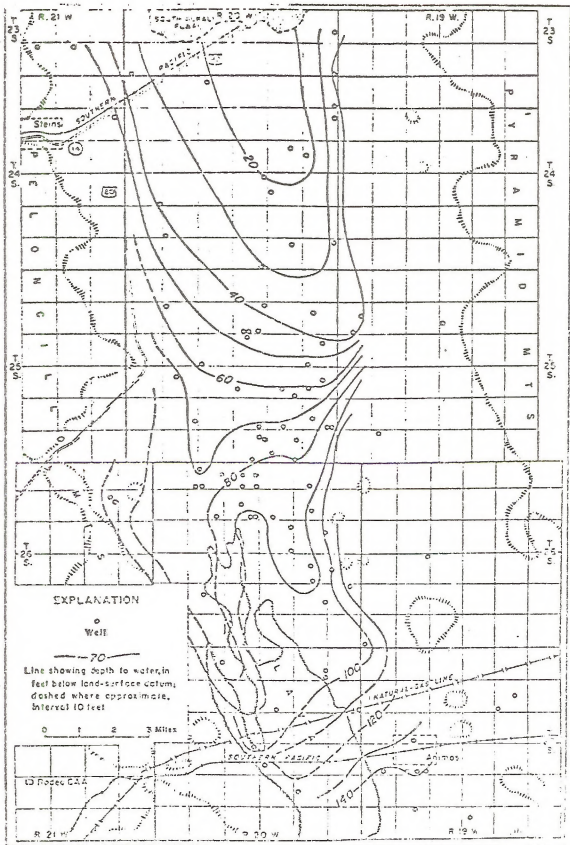


Figure 9 Depth to Water, January, 1955, in Lower Animas Valley
 Hidalgo County, New Mexico
 (Taken directly from Reeder, H.O., 1957, Groundwater in Animas Valley,
 Hidalgo County, N.M., New Mexico State Eng. Tech. Rpt. 11, 101 p.)

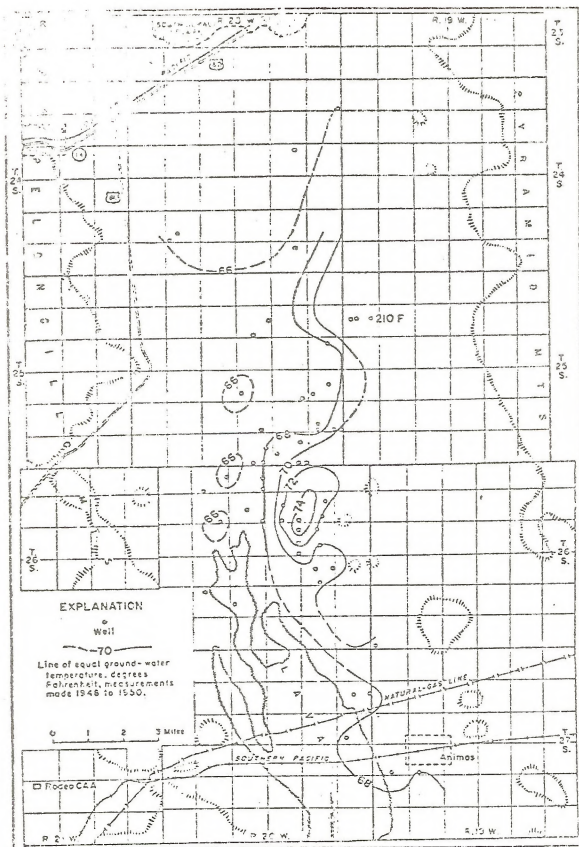


Figure 10 Temperature of Ground Water in Lower Animas Valley, Hidalgo County, New Mexico
 (Taken directly from Reeder, H.O., 1957, Ground Water in Animas Valley, Hidalgo County, N.M., New Mexico State Engr. Tech. Rpt 11, 101 p.)

Chemical analysis of ground water indicates that overall, it is suitable for irrigation. The groundwater in the northern end of the valley (northern half of T. 23S., R. 19W.) is not as suitable for irrigation as the groundwater in the rest of the valley (Reeder, 1975).

b. Sediment Load

No parental streams exist in the area, although flash floods do carry sediment into the basins from higher elevations.

c. Dissolved Solids

No data.

d. Acid Balance

The thermal waters are high in sodium sulfate and are alkaline with $\text{ph} = 8.2$ to 8.4 (Summers, 1965).

e. Temperature

Thermal wells in the Animas Valley, (T. 25S., R. 19W., Sec. 7), give waters with temperatures as high as 115°C . (240°F .). The average groundwater temperature is only about 21°C . (70°F .) (Fig. 10, map). The thermal waters, like the ground waters, are most likely meteoric water that has been heated by a deep source of hot rock.

Analysis of the thermal wells indicates a reservoir base temperature to be near 170°C . (338°F .) as based on Na-K-CA and silica geothermometers. Sampling of non-thermal wells throughout the Animas Valley gives chemical indication of low temperatures (Swanberg, in prep.).

B. Living Components

All organisms within an ecosystem which carry on life are referred to as living components. The living components comprise all of the representatives of the plant and animal kingdoms from the simplest to the most complex. These living organisms form a characteristic association or biotic community. Odum (1956) defines a biotic community as "any assemblage of populations living in a prescribed area or physical habitat." It is a loosely organized unit to the extent that it has characteristics additional to its individual and population components. A biotic community is more concisely defined as "an area where both the fauna and flora of a given geographic location are so closely interrelated as to form an interdependent association" (BLM Manual 6610). Therefore, the biotic communities discussed in

this document will be considered on the basis of geographic location. These geographic locations consist of the Peloncillo Mountains, the Pyramid Mountains, the northern portion of the Animas Mountains, the Lordsburg Mesa, the Animas Valley, the Lordsburg Valley, the Playas Valley, and the San Simon Cienega bottom within the Las Cruces District administration responsibilities. The vegetation (flora) and animals (Fauna) of the biotic communities will be discussed under the appropriate headings.

1. Vegetation

The environmental assessment area is within the Mexican Highland section of the Basin and Range Province (Thornburg, 1965). This Province has characteristics of being among the most arid in the United States with an average rainfall of less than 25 cms. (10 inches). The mountains of the Province are isolated and rise abruptly above adjacent plains. This contrast in topography produces variations in vegetation due to soils, amount of rainfall, steepness of slope, and slope aspect. These vegetative changes will be discussed in relation to topographic variations of the biotic communities found within the proposed lease area.

a. Aquatic Plants

Within the assessment area, aquatic plants are directly related to the presence of standing water. The San Simon Cienega Waterfowl Habitat Development Area, stockwater tanks, irrigation ponds, and playas lakes contain standing water for all or portions of the year.

The stockwater tanks, irrigation ponds, and the San Simon Cienega usually contain water yearlong. Aquatic plants have become established within these areas; however, the production and diversity of vegetation depends upon the kind of tank (dirt vs. steel), the age of the tank, and the nutrient content of the soils and/or water. Cattails, *Typha latifolia*, sedges, *Carex* spp., and rushes, *Juncus* spp. are vascular plants present in association with most tanks. Phytoplankton should be present in all of these waters, but no data is available.

The playas lakes scattered throughout the assessment area generally contain standing waters during and following the rainy season with depths dependent upon the intensity of rain. These areas contain aquatic plant species which have adapted to the harsh environment that exists in these lakes. Phytoplankton, and possibly other aquatic plant species, could be present, but no data is available at this time.

b. Terrestrial Plants

(1) The Peloncillo Mountains

The Peloncillo Mountains enter New Mexico about 16 kms. (10 miles) north of Stein's, New Mexico, and trend southeast

towards Animas, New Mexico, where they bend southwest before leaving the area covered by this document (Fig. 11). These mountains can be divided into three distinct areas: the mountains north of Stein's Pass to the Arizona border (north); the mountains between Stein's Pass and Antelope Pass (central); and the remaining portion south of Antelope Pass to the border of the assessment area (south).

These mountains support a variety of plant species characteristically associated with the pinyon-juniper and desert shrub vegetation types. The north and central portions of the mountains are represented by the desert shrub type, although a few juniper trees may be present at higher elevations. This type consists of many different woody species, but no one species dominates.

The southern mountains are characterized by both pinyon-juniper and oak-woodland communities. The desert shrub type blends with the pinyon-juniper oak-woodland communities and becomes dominant as elevation decreases. The pinyon-juniper type is characterized by representatives of pinyon-pine and one or more species of juniper. The oak-woodlands are represented by a number of oak species, juniper, pine, and various shrubs. Vegetation found in the Peloncillo Mountains is presented in Table 7.

(2) The Pyramid Mountains

The Pyramid Mountains are steep and rocky; however, the peaks are not as high or as rough as those found within the Peloncillo Mountains even though the slopes within the Pyramids range from 15 to 75 percent (Fig. 11). The slopes contain rocky and gravelly loam soils and small areas of exposed bare rock (Maker, et al., 1970). The rough, broken topography and soil characteristics support the characteristic desert shrub type.

The desert shrub type consists of many woody plants with an understory of grasses and forbs. Rock outcroppings contain little or no vegetation. Conifers may be found on the north and east slopes of the high mountain peaks. Cacti, *Opuntia* spp., and ocotillo, *Fouquieria splendens*, may be found in association with shrub species of this type. Shrubs, grasses, forbs, and trees found in the Pyramid Mountains are presented in Table 7.

(3) North Animas Mountains

The low rolling portion of the Animas Mountain Range, located southeast of Animas, New Mexico, is within the assessment area while the higher, more rugged portion lies outside (Fig. 11). These mountains are relatively low in elevation, thus accounting for the dominance of the desert shrub type; however, isolated juniper communities can be found there.

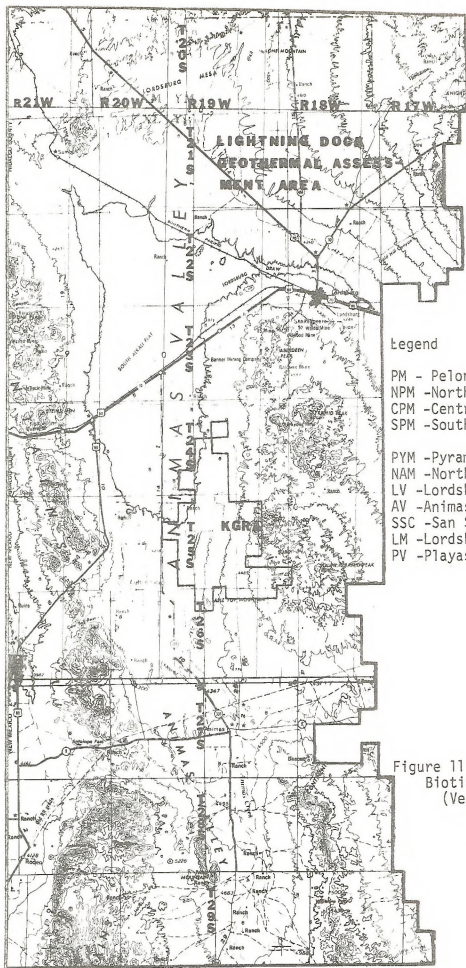


Figure 11
 Biotic Communities
 (Vegetation)

Table 7. Plant Species Found in the Proposed Lightning Dock Geothermal Lease Area 1/

Scientific Name	Common Name	Biotic Communities 2/							
		PM	PYM	NAM	LV	AV	SSC	LM	PV 2/
<u>Grasses and Grass-like Plants</u>									
<i>Andropogon barbinodis</i>	cane bluestem					x			
<i>Andropogon saccharoides</i>	silver bluestem	x		x		x		x	
<i>Aristida divaricata</i>	poverty threeawn	x	x	x	x	x	x	x	x
<i>Aristida longiseta</i>	red threeawn	x	x	x	x	x	x	x	x
<i>Aristida orcuttiana</i>	Orcutt's threeawn	x						x	
<i>B. aristidioides</i>	needle grama							x	
<i>Bouteloua barbata</i>	six-week grama				x			x	x
<i>Bouteloua curtipendula</i>	sideoats grama	x	x	x	x	x		x	x
<i>Bouteloua eriopodia</i>	black grama	x	x	x	x	x		x	x
<i>Bouteloua gracilis</i>	blue grama	x	x	x	x	x		x	x
<i>Bouteloua hirsuta</i>	hairy grama	x				x			
<i>Buchloe dactyloides</i>	buffalo grass	x				x	x		
<i>Carex</i> spp.	sedges						x		
<i>Chloris verticillata</i>	windmill grass							x	
<i>Chloris virgata</i>	feather fingergrass						x		
<i>Cynodon dactylon</i>	Burmuda grass						x		
<i>Digitaria sanguinalis</i>	crab grass						x		
<i>Distichlis stricta</i>	desert saltgrass				x	x	x	x	
<i>Echinochloa</i> sp.	cockspur						x		
<i>Elyonurus barbiculmis</i>	balsam scale	x							
<i>Eragrostis</i> spp.	lovegrass						x		
<i>Eragrostis intermedia</i>	plains lovegrass	x						x	
<i>E. Lehmanniana</i>	Lehmann's lovegrass							x	
<i>Heteropogon contortus</i>	tanglehead							x	
<i>Hilaria mutica</i>	tobosa	x	x	x	x	x	x	x	x
<i>Juncus</i> spp.	rush							x	
<i>Leptochloa</i> spp.	sprangletop						x		
<i>Leptoloma cognatum</i>	witchgrass						x		
<i>Lycurus phleoides</i>	wolftail	x							

Table 7 (continued)

Scientific Name	Common Name	Biotic Communities <u>2/</u>								
		PM	PYM	NAM	LV	AV	SSC	LM	PV <u>2/</u>	
<i>Muhlenbergia emersleyi</i>	bullgrass	x								
<i>M. montana</i>	mountain muhly	x								
<i>Muhlenbergia porteri</i>	bush muhly	x	x	x	x	x		x	x	
<i>M. repens</i>	creeping muhly					x				
<i>Muhlenbergia torreyi</i>	ring muhly	x		x		x				
<i>Oryzopsis hymenoides</i>	Indian ricegrass	x	x	x						
<i>Panicum obtusum</i>	vine mesquite	x		x	x	x	x	x	x	
<i>Paspalum distichum</i>	knotgrass						x			
<i>Piptochaetium fimbriatum</i>	pinyon ricegrass	x								
<i>Poa bigelovii</i>	Bigelow bluegrass	x								
<i>Schizachrium scoparium</i>	little bluestem	x	x	x						
<i>Scirpus</i> spp.	bulrush						x			
<i>Scleropogon brevifolius</i>	burrograss	x	x	x	x	x	x	x	x	
<i>Setaria lutescens</i>	yellow bristlegrass						x			
<i>Setaria macrostachya</i>	plains bristlegrass							x		
<i>Sitanion hystrix</i>	bottlebrush squirreltail						x			
<i>Sporobolus airoides</i>	alkali sacaton	x	x		x	x	x	x	x	
<i>Sporobolus contractus</i>	spike dropseed	x				x		x		
<i>Sporobolus cryptandrus</i>	sand dropseed	x	x	x	x	x		x	x	
<i>Sporobolus flexuosus</i>	mesa dropseed	x				x		x		
<i>Sporobolus giganteus</i>	giant sacaton	x					x	x		
<i>Trichachne californica</i>	Arizona cottontop	x		x	x	x		x	x	
<i>Tridens pulchellus</i>	fluffgrass	x	x	x	x	x		x	x	
<u>Shrubs</u>										
<i>Acacia constricta</i>	whitethorn acacia	x	x	x		x		x		
<i>Acacia greggii</i>	catclaw	x	x			x		x		
<i>Agave</i> spp.	agave	x								
<i>Agave lechuguilla</i>	lechuguilla agave	x	x							

Table 7(continued)

Scientific Name	Common Name	Biotic Communities <u>2/</u>							
		PM	PYM	NAM	LV	AV	SSC	LM	PV <u>2/</u>
<i>Agave palmeri</i>	century plant	x	x						
<i>A. parryi</i>	mescal	x							
<i>Allenrolfea occidentalis</i>	iodine bush				x	x		x	x
<i>Aloysia wrightii</i>	lemon verbena	x	x					x	
<i>Arctostaphylos pungens</i>	pointleaf manzanita	x							
<i>Artemisia filifolia</i>	sand sage	x		x	x	x		x	x
<i>Atriplex canescens</i>	fourwing saltbush	x	x	x	x	x		x	x
<i>Atriplex confertifolia</i>	shadscale				x	x		x	x
<i>A. polycarpa</i>	cattle spinach	x							
<i>Baccharis pterioinoides</i>	yerba-de-pasmo	x							
<i>Baccharis glutinosa</i>	seedweed baccharis	x							
<i>Brickellia</i> spp.	brickel bush	x							
<i>Ceanothus greggii</i>	desert ceanothus	x							
<i>Cercocarpus breviflorus</i>	birchleaf mahogany	x							
<i>Cercocarpus montanus</i>	mountain mahogany	x							
<i>Chrysothamnus nauseosus</i>	rubber rabbitbush	x	x		x	x		x	x
<i>Condalia obtusifolia</i>	graythorn	x	x					x	
<i>Coryphantha orcuttii</i>	coryphantha	x							
<i>Dasylixion wheeleri</i>	sotol	x	x		x				
<i>Echinocereus</i> spp.	hedgehog cactus	x							
<i>E. nevadensis</i>	boundary ephedra		x					x	
<i>Ephedra trifurca</i>	Mormon tea	x	x	x	x	x		x	x
<i>Eriogonum</i> spp.	shrubby buckwheat		x					x	
<i>Eurotia lanata</i>	winterfat	x	x	x	x	x		x	x
<i>Fallugia paradoxa</i>	Apache plume	x	x	x				x	
<i>Fendlera rupicola</i>	Fendler bush	x							
<i>Ferocactus wislizenii</i>	Arizona barrel cactus	x	x						
<i>Flourensia cernua</i>	American tarbush	x	x	x	x	x		x	x

Table 7 (continued)

Scientific Name	Common Name	Biotic Communities <u>2/</u>							
		PM	PYM	NAM	LV	AV	SSC	LM	PV <u>2/</u>
<i>Fouquieria splendens</i>	ocotillo	X	X			X		X	
<i>Garrya wrightii</i>	Wright's silktassel	X							
<i>Gutierrezia sarothrae</i>	broom snakeweed	X	X	X	X	X	X	X	X
<i>Haplopappus laricifolius</i>	turpentine bush	X							
<i>Koeberlinia spinosa</i>	crucifixion thorn	X	X		X			X	
<i>Krameria parvifolia</i>	range ratany							X	
<i>Larrea tridentata</i>	creosote bush	X	X	X	X	X	X	X	X
<i>Lonicera albiflora</i>	white honeysuckle	X							
<i>Lycium berlandieri</i>	wolfberry	X	X	X	X	X		X	X
<i>Lycium pallidum</i>	palid wolfberry	X							
<i>Mammillaria</i> spp.	pincushion cactus	X							
<i>Mimosa biuncifera</i>	catclaw mimosa	X	X					X	
<i>Nolina microcarpa</i>	sacahuista	X	X	X		X		X	
<i>Opuntia</i> spp.	prickly pear cactus	X	X			X		X	
<i>Opuntia arbuscula</i>	pencil cactus		X						
<i>Opuntia engelmannii</i>	Englemann prickly pear	X	X			X		X	
<i>Opuntia imbricata</i>	cholla	X	X			X		X	
<i>Prosopis juliflora</i>	mesquite	X	X	X	X	X	X	X	X
<i>Parthenium incanum</i>	mariola	X	X					X	
<i>Quercus toumeyi</i>	Toumey oak	X							
<i>Rhus coriophylla</i>	Mearn's sumac	X							
<i>Rhus microphylla</i>	littleleaf skunkbush	X	X			X		X	
<i>Rhus trilobata</i>	skunkbush sumac	X	X					X	
<i>Sapindus drummondii</i>	western soapberry	X	X						
<i>Selloa glutinosa</i>	selloa	X							
<i>Senecio longilobus</i>	threadleaf groundsel	X							
<i>Suaeda</i> sp.	seepweed					X			X
<i>Yucca baccata</i>	banana yucca	X	X	X	X	X	X	X	X
<i>Yucca elata</i>	soaptree yucca	X	X	X	X	X	X	X	X
<i>Yucca schottii</i>	Schott's yucca	X							

Table 7 (continued)

Scientific Name	Common Name	Biotic Communities 2/							
		PM	PYM	NAM	LV	AV	SSC	LM	PV 2/
Forbs									
<i>Allium</i> spp.	wild onion						x		
<i>Amaranthus</i> spp.	pigweed						x		
<i>Anemopsis californica</i>	verba-mansa						x		
<i>Argemone platyceras</i>	pricklepoppy	x					x		
<i>Artemisia dracunculoides</i>	false tarragon sagebrush	x							
<i>Asclepias subverticillata</i>	horsetail milkweed						x		
<i>Aster</i> spp.	aster						x		
<i>Baileya multiradiata</i>	desert marigold							x	
<i>Datura meteloides</i>	sacred thornapple	x							
<i>Daucus pusillus</i>	wild carrot							x	
<i>Dithyrea wislizenii</i>	spectaclepod mustard							x	
<i>Draba cuneifolia</i>	white draba	x							
<i>Erodium cicutarium</i>	filaree	x						x	
<i>Helianthus annuus</i>	common sunflower						x		
<i>Hoffmannseggia densiflora</i>	hog potato	x							
<i>Kallstroemia grandiflora</i>	Arizona poppy								
<i>Lappula redowskii</i>	stickseed	x							
<i>Lotus greenei</i>	deervetch	x							
<i>Perezia nana</i>	desert holly		x						x
<i>Polygonum</i> spp.	knotweed						x		
<i>Portulaca oleracea</i>	pursley						x		
<i>Rumex</i> spp.	dock						x		
<i>Sida lepidota</i>	bugbush								
<i>Solanum elaeagnifolium</i>	white horsenettle							x	
<i>Thlaspi fendleri</i>	wild candytuft	x							
<i>Xanthium saccharatum</i>	cocklebur							x	

Table 7 (continued)

Scientific Name	Common Name	Biotic Communities <u>2/</u>							
		PM	PYM	NAM	LV	AV	SSC	LM	PV <u>2/</u>
<u>Trees (Broad leaf)</u>									
<i>Celtis reticulata</i>	netleaf hackberry		X					X	
<i>Chilopsis linearis</i>	desert willow	X	X			X		X	X
<i>Morus microphylla</i>	Texas mulberry	X							
<i>Populus fremontii</i>	Fremont cottonwood	X					X		
<i>Quercus arizonica</i>	Arizona white oak	X							
<i>Quercus emoryi</i>	Emory oak	X							
<i>Quercus gambelii</i>	Gambel oak	X							
<i>Quercus grisea</i>	gray oak	X							
<i>Quercus hypoleucoides</i>	silver leaf oak	X							
<i>Quercus turbinella</i>	shrub live oak	X	X	X		X			
<u>Trees (Conifer)</u>									
<i>Juniperus deppeana</i>	alligator juniper	X	X	X					
<i>Juniperus monosperma</i>	oneseed juniper	X	X	X					
<i>Pinus cembroides</i>	Mexican pinyon pine	X							
<i>Pinus edulis</i>	pinyon pine	X							

Table 7 (continued)

Scientific Name	Common Name	Biotic Communities ^{2/}							
		PM	PYM	NAM	LV	AV	SSC	LM	PV ^{2/}
<u>Crops</u>									
<i>Gossypium thurberi</i>	Cotton				x	x	x		
<i>Medicago sativa</i>	alfalfa				x	x	x		
<i>Phaseolus spp.</i>	beans				x	x	x		
<i>Sorghum sudanese</i>	grain sorghum				x	x	x		
	pasture crops				x	x	x		
	small grains				x	x	x		
	sugar beets				x	x	x		

1/ Gay, Charles W., Jr., Don D. Dwyer, and Robert E. Steger; 1970, New Mexico Range Plants; NMSU Cooperative Extension Service Circular 374, 85 pgs.

Maker, H. J., D. N. Cox, and J. U. Anderson; 1970, Soil Association and Land Classification for Irrigation, Hidalgo County, NMSU Agricultural Experiment Station Research Report 177, 29 pgs.

Moir, William K., 1975, A Vegetation, Soil and Landform Inventory of the Central Portion of the Peloncillo Mountains, Southwestern New Mexico (unpublished data).

U. S. Department of Agriculture, 1974, Field Guide to Native Vegetation of the Southwestern Region, Forest Service, 65 pgs.

2/ PM = Peloncillo Mountains AV = Animas Valley
 PYM = Pyramid Mountains SSC = San Simon Cienega
 NAM = North Animas Mountains LV = Lordsburg Mesa
 LV = Lordsburg Valley PV = Playas Valley

The rolling hills of the northern Animas Mountains contain gentle slopes. The slopes range from 15 to 35 percent and very little bedrock is exposed (Maker, et al., 1970).

Rocky and gravelly loams are associated with these mountains. The soils and topographic features combine to produce the common vegetative type associated with desert mountains.

The desert shrub type dominates this portion of the Animas Mountains. A variety of desert shrub species produce the overstory on the rolling hills. The arroyos contain an increased variety of desert shrubs which are dependent upon an intermittent source of water. Grasses and forbs of varying species and density inhabit the understory. Shrubs, grasses, forbs, and trees found within the northern Animas Mountains are presented in Table 7.

(4) The Lordsburg Mesa

The Lordsburg Mesa is a broad, flat, alluvial basin which extends from the northern border of the assessment area south to Lordsburg, New Mexico, where it decreases in elevation and becomes the Animas Valley (Fig. 11). This broad mesa supports several vegetative types. These are represented by creosote bush, mesquite, yucca, grassland, and dry lake bed types.

The creosote bush type is found in association with the pediments of the Peloncillo and Big Burro Mountains. Creosote bush, *Larrea tridentata*, seems to survive best in a zerophytic (dry) climate. The pediments possess this climate. Creosote bush also has the characteristic of being associated with desert pavement and American tarbush, *Flourensia cernua*. If an understory exists, it contains a variety of annual and perennial grasses and forbs.

The mesquite type is associated with the more mesic (wet) areas of the mesa. The many arroyos that drain from the mountains through the creosote bush type contain mesquite, which is the dominant shrub at lower elevations. A large portion of the mesquite type is associated with loose, sandy soils. These soils are blown by the wind into the shrubs which intercept the sand, producing the sand dunes. The dunes are vegetated by mesquite, *Prosopis juliflora*, and a variety of other plant species. The interdune areas are either barren or support a sparse community of annual and perennial vegetation.

The assessment area lies within the desert grassland type (Humphery, 1958). This grassland is found in southwestern New Mexico and southwestern Texas. The grasslands are localized and typically lie as broad belts around the bases of many southwestern mountains. These areas are commonly associated with broad basins with gradual slopes. The drainages

are nearly flat and may be characterized as dry washes that occasionally have running water.

The grassland type is usually found in the most mesic areas. Many swale bottoms contain almost pure stands of grass. These grasses may vary in species, depending upon land use and soil type. The grassland type is also found in association with mesquite or soap tree yucca, *Yucca elata*, and yucca-grassland. Many annual and perennial grasses and forbs are found in association with this type.

Dry lake beds of varying size are found on the mesa. The lakes are low areas in which water and sediments are deposited during the rainy season. During this time, standing water usually covers any vegetation present on the lake bed. Evaporation removes the water in these lakes. Any minerals that were in solution are left on the lake bed. These minerals usually produce conditions that inhibit plant growth; however, some plants have built up a tolerance for these minerals and can grow and reproduce while other plants become stunted or are eliminated as the mineral concentrations increase. Shrubs, grasses, forbs, and trees found on the Lordsburg Mesa are presented in Table 7.

(5) The Animas Valley

The Animas Valley is a broad basin bordered on the north by the Lordsburg Mesa, on the west by the Peloncillo Mountains, on the east by the Pyramid Mountains and the northern portion of the Animas Mountains, and on the south by the southern border of the assessment area (Fig. 11). The Animas Valley is very broad and covers many square miles. Vegetation types found within this valley consist of creosote bush, mesquite, yucca-grassland, cropland, dry lake bed, and lava flow.

The creosote bush, mesquite, yucca-grassland, and dry lake beds have been discussed previously.

The croplands are located in the Animas Valley around Cotton City and Animas, New Mexico. These lands have been cultivated and produce a wide variety of crops. These irrigated lands produce grain sorghum, cotton, sugar beets, alfalfa, small grains, beans, and pasture crops (Maker, *et al.*, 1970).

The Animas Valley Lava Flow is located west of Animas, New Mexico. The vegetation associated with this flow has been classified as the lava flow type. The flow contains a large amount of soil that has been deposited through wind and water erosion. These soils support a variety of plant species. Certain areas do not contain the soils required for

plant establishment and these areas remain barren. The vegetation of the Animas Valley is presented in Table 7.

(6) The Lordsburg and Playas Valleys

The Lordsburg and Playas Valleys are located on the west side of the Pyramid and Animas Mountains (Fig. 11). Very little of these valleys is inside the assessment area. The portions inside the area are within the creosote bush or yucca-grassland types. A discussion of these types has been presented earlier. Shrubs, grasses, forbs, and trees found in the Lordsburg and Playas Valleys are presented in Table 7.

(7) San Simon Cienega

The San Simon Cienega is an isolated area on the west side of the Peloncillo Mountains within New Mexico. A small portion of Arizona, within the Cienega Ranch, is also under the administration of the Las Cruces District of the Bureau of Land Management, (Fig. 11).

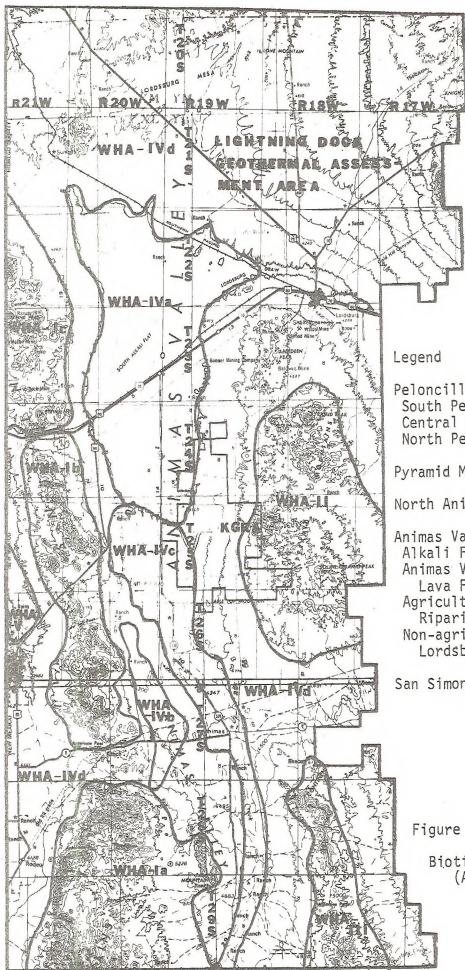
The topography of the area is relatively flat. The west pediments of the Peloncillo Mountains generally slope northwest into the San Simon Valley. These pediments intermingle with the lower swales and arroyos found within the valley.

Soils of this area are alluvial sediments derived from bordering mountains and volcanic debris. The soils are of mixed origin, and consist of clay, silty clay, silty clay loam, and sand loam (Maker, et al., 1970). These soils support a variety of vegetation within the creosote bush, grassland, and desert shrub types. The creosote and desert shrub types have been discussed previously.

The grassland type within the San Simon Cienega is somewhat different than other grassland types within the assessment area. This grassland contains a permanent source of water that is pumped from wells and placed in ponds for the enhancement of the Mexican duck, *Anas diazi*. Many plant species which require additional water are found growing within and adjacent to the ponds. Native and exotic plant species have been planted in this area and plantings may be conducted in the future to enhance Mexican duck habitat. Plant species found within the San Simon Cienega are presented in Table 7.

2. Animals

An extreme diversity of animal species is found within the assessment area. The subject area is located within the Lower and Upper Sonoran Life Zones and borders the Transition Zone associated with the Animas Mountains. Major wildlife habitat areas have been



Legend

- Peloncillo Mountains - WHA I
- South Peloncillo Mts.- WHA Ia
- Central Peloncillo Mts-WHA Ib
- North Peloncillo Mts. -WHA Ic
- Pyramid Mts. - WHA II
- North Animas Mts. - WHA III
- Animas Valley - WHA IV
- Alkali Flats - WHA IVa
- Animas Valley
- Lava Flow - WHA IVb
- Agricultural-
Riparian - WHA IVc
- Non-agricultural-
Lordsburg Mesa - WHA IVd
- San Simon Cienega - WHA V

Figure 12

**Biotic Communities
(Animals)**

identified within the area and these correspond to the major biotic communities discussed in the opening note to this Living Component section. A breakdown of several of these major communities into smaller communities has been made because of variances in floral composition and density as well as physical and climatic differences (Fig. 12).

Five Wildlife Habitat Areas (WHA's) and the appropriate breakdowns identified are as follows:

- Peloncillo Mountains - WHA I
 - South Peloncillo Mountains - WHA Ia
 - Central Peloncillo Mountains - WHA Ib
 - North Peloncillo Mountains - WHA Ic
- Pyramid Mountains - WHA II
- North Animas Mountains - WHA III
- Animas Valley - WHA IV
 - Alkali Flats - WHA IVa
 - Animas Valley Lava Flow - WHA IVb
 - Agricultural - Riparian - WHA IVc
 - Non-agricultural - Lordsburg Mesa - WHA IVd
- San Simon Cienega - WHA V

A list of animal species occurring or likely to occur within the assessment area is found in Appendix C. This table presents the common and scientific name of each species in addition to its season of use (spring, summer, fall, winter, yearlong, or migratory), classification (game, furbearer, predator, endangered, threatened, etc.), habitat (brief description of where the animal lives) and distribution (specific areas within the assessment area where a particular species may be found).

a. The Peloncillo Mountains - WHA I

The Peloncillo Mountains within New Mexico include approximately 112 kms. (70 miles) of extremely diverse topographic variation with elevational variances within the assessment area of 749 meters (2,437 feet) (Fig. 12). Elevations range from 1,323 meters (4,300 feet) above sea level in the foothills area of Stein's Peak, to 2,042 meters (6,637 feet) near the head of Owl Canyon.

Quality wildlife habitat, in terms of vegetative diversity and density decreases from south to north along that portion of the range

located within the assessment area, approximately 67 kilometers (43 miles). As the result of certain physical features as well as various climatic conditions, smaller, easily recognizable biotic communities can be distinguished. Three such areas have been identified: the South Peloncillo Mountains; the Central Peloncillo Mountains; and the North Peloncillo Mountains.

(1) South Peloncillo Mountains - WHA-Ia

The South Peloncillo Mountains provide the greatest diversity in vegetation, which coupled with water and varied topography, provides some of the highest quality habitat for many species of mammals and birds. The community is comprised of approximately 16,000 hectares (40,000 acres) and is that segment of the Peloncillo Mountains located south of State Highway 9 to the south border of the assessment area, approximately 23 kilometers (14 miles) (Fig. 12).

Highly desirable vegetative species found in this area, which provide both food and cover, include: Fendler ceanothus, *Ceanothus fendleri*; mountain mahogany, *Cercocarpus montanus*; Apache plume, *Fallugia paradoxa*; pale wolfberry, *Lycium pallidum*; manzanita, *Arctostaphylos pungens*; skunk bush, *Rhus trilobata*; ephedra, *Ephedra trifurca*; littleleaf sumac, *Rhus microphylla*; pinyon pine, *Pinus edulis*; live oak, *Quercus turbinella*; Emory oak, *Q. emoryi*; white oak, *Q. arizonica* and many other vegetative species including grasses and forbs.

(a) Aquatic Animals

i. Mammals

None have been observed or identified within the Peloncillos; however, they certainly may occur. Although water is an extremely limiting factor within the area, the man-made reservoirs and the few springs that exist normally provide available water on a yearlong basis and offer suitable habitat for such species as the racoon, *Procyon lotor*, and muskrat, *Ondatra zibethica* (Jackson, 1975, pers. comm., field visit).

ii. Birds

Waterfowl - Waterfowl use within the South Peloncillo Mountains is tight when compared to highly productive waterfowl habitat such as Elephant Butte Reservoir, the Rio Grande, etc.; however, waters within the area are extremely important to waterfowl and provide important habitat in an area (New Mexico) where such habitat is relatively scarce. Nearly all of the existing waters

are in the form of stockwater reservoirs. These stockwaters range from .4 to 1.2 hectares (1 to 3 acres) in size, and totally, provide approximately 20 to 24 hectares (50 to 60 acres) of available habitat. Most of these waters have been developed privately and are located on private lands.

Heaviest use of these waters commonly occurs during the fall and winter months at which time migratory movements are occurring. Year-long use by a limited number (figure unknown) continues throughout the spring and summer months, with some nesting and brood rearing taking place.

Species most common include the mallard, *Anas platyrhynchos* blue-winged teal, *Anas discors*; pintail, *Anas acuta*; shovler, *Spatula clypeata*; and the Mexican duck (a Federal endangered species).

Density, natality, and mortality records are unavailable; however, indications are that waterfowl species occurrence within the area has increased, the increase corresponding to the increase in available waters as a result of man's efforts to provide for improved livestock distribution.

Nesting, resting, and brood rearing cover adjacent to the available waters is fair to good. Several reservoirs exhibit denudation as the result of heavy livestock use; however, the majority provide suitable conditions conducive to the accomplishment of these needs. Black grama, *Bouteloua eripoda* sideoats grama, *B. curtipendula*; and alkali sacaton, *Sporobolus airoides*, are some of the grasses or grass-like species which grow adjacent to these waters, providing food as well as cover.

Other Aquatic Birdlife - The killdeer, *Charadrius vociferus*, is perhaps the commonest species associated with aquatic habitat in this area. Use is yearlong; however, increased numbers occur during the winter migration period. Other aquatic birds include: the spotted sandpiper, *Actitis macularia*; Wilson's phalarope, *Steganopus tricolor*; the American coot, *Fulica americana*; and the American avocet, *Recurvirostra americana*. All of these species are migratory and depend extensively upon suitable aquatic habitat for food and cover during the critical winter months.

iii. Amphibians and Reptiles

Various species of toad and frog may occur within the South Peloncillo Mountains, although no confirmed observations have been made. The range of the western spadefoot toad, *Scaphiopus hammondi*; the southwestern toad, *Bufo microcephalus*, and the canyon tree frog, *Hyla arenicolor*, include this area. The toads are associated

with ponds or wet places, while the treefrogs are associated with intermittent or permanent streams with rocky pools.

It is possible that the Arizona alligator lizard, *Gerrhonotus kingi*, occurs in this area. This species is associated with, and includes within its habitat, mountain areas with nearby water.

iv. Fish

There are no known species of fish occupying waters within the South Peloncillo Mountains.

v. Invertebrates

Invertebrates likely to occur throughout the Peloncillo Mountains include such species as the waterstrider, *Gerris* sp.; backswimmer, *Notoneca undulata*; water boatman, *Arctocorixia interrypta*; damsel fly, *Lestes* sp.; dragon flies, *Libellula* sp.; mosquitoes, *Culex pipens*; and giant water bugs, *Abedus* sp. Others would include species of *Hemiptera*, *Diptera*, and others that are commonly found in association with habitats comparable to small mountain springs and stockwater reservoirs (Wilson, 1973) (Appendix C). More intensive inventories are needed to fully determine aquatic invertebrate occurrence.

vi. Zooplankton

There is no information available concerning zooplankton within the area. Zooplankton is likely to occur and undoubtedly includes forms of rotifers, copepods, and cladocerans.

(b) Terrestrial Animals

i. Mammals

Mule deer, *Odocoileus hemionus*, and Coues' whitetail, *Odocoileus virginianus couesi*, are relatively abundant game species within this area. Combined, the current population estimate is 3 deer per section, or approximately 180 head. The present trend in population densities of both species is upward, with carrying capacities estimated between 5 and 6 deer per section.

The combination of topographic variation, climatic factors, and conducive soils has produced a biotic community of considerable vegetative variety and density. Such conditions are highly favorable to populations of both mule deer and Coues' whitetail. Deer foods are abundant as is

exemplified by the presence of mountain mahogany, Apache plume, Fendler ceanothus, ephedra, littleleaf sumac, and other desirable vegetative species. Cover is also provided by these plant species and such other species as oaks, *Quercus* spp.; Fremont cottonwood, *Populus fremontii*; pinyon pine; juniper, *Juniperus* spp.; netleaf hackberry, *Celtis pallida*; beargrass, *Nolina microcarpa*; cholla cactus, *Opuntia imbricata*; etc.

Javelina, *Pecari angulatus*, occur commonly throughout the Peloncillo Mountains. A severe winter storm during the winter of 1967-68 caused the loss of a large number of these animals; however, current numbers are rapidly approaching pre-storm levels (Harvill, 1973). The extreme variations in both topographic and vegetative conditions create habitat highly conducive to favorable javelina populations.

Preferred food of the javelina include prickly pear, *Opuntia engelmannii*; mescal, *Acacia constricta*; cholla, and sacahuista, most of pinon, juniper, oak, and manzanita (Donaldson, 1965). Annuals eaten are: hog potato, *Hoffmannseggia densiflora*; filaree, *Erodium cicutarium*; and wild onion, *Allium* spp., (Moore, 1975).

Mountain lions, *Felis concolor*; bobcats, *Lynx rufus*; and coyote, *Canis latrans*; are common predators. There are especially high numbers of coyote (Jackson, 1975, pers comm.).

Coati, *Nasua narica*, (a State endangered species) and ringtail, *Bassariscus astutus*, have been observed on several different occasions. Current indications are that the coati population is very slowly increasing, and that its range is expanding further north within the Peloncillos (pers. comm. ranchers, BLM personnel & NMG&F personnel).

Two species of bat, the Mexican long-tongued, *Choeronycteris mexicana*, and Sanborn's long-nosed, *Leptonycteris sanborni*, are restricted in their distribution within New Mexico to the southern Peloncillo Mountains-Guadalupe Canyon-Animas Mountain areas. The occurrence of these species is likely in association with shallow caves or crevices in that portion of the Peloncillos located within the assessment areas. Both species are included on the State's endangered species list.

A wide variety of other mammal species also occur, including cottontail rabbit, *Sylvilagus* spp.; jackrabbit, *Lepus* spp.; skunks, *Spilogale putorius*, *Mephitis mephitis*, *Mephitis macroura*, and *Conepatus leuconotus*; chipmunk, *Eutamias* spp.; woodrat, *Neotoma* spp.; and others (Appendix C).

ii. Birds

Gambel's quail, *Lophortyx gambelii*, and scaled quail, *Callipepla squamata*, are especially abundant. Mearns'

quail, *Cyrtonyx montezumae*, also occur, but in considerably fewer numbers. Foods common to these species include oak mast, sunflower seeds, *Helianthus* spp. prickly pear fruits, eriogonum, *Eriogonum* spp., tansy mustard, *Descurainia* spp., and filaree. Animal foods commonly consumed include beetles, grasshoppers, ants, and spiders (Martin, Zim, and Nelson, 1951).

The abundance of small mammals attracts numerous birds of prey. The goshawk, *Accipiter gentilis*, and sharp-shinned hawk, *Accipiter striatus*, are common migrants, while the Cooper's hawk, *Accipiter cooperii*, and golden eagle, *Aquila chrysaetos*, in addition to being migratory, also occur yearlong.

Mourning dove, *Zenaidura macroura*, are present yearlong; however, during the fall months population densities temporarily increase tremendously. Common plant foods include the seeds of pigweed, *Amaranthus* spp.; doveweed, *Cleome serrulata*; Johnson grass, *Sorghum halepense*; filaree, and acacia, *Acacia* spp. (Davis, 1973).

The Mexican turkey, *Meleagris gallopavo mexicana*, (a State endangered species) which occurs within the Coronado National Forest in southwestern New Mexico, is also believed to occur within the South Peloncillos. Favorable habitat is abundant (Zimmerman, 1975, pers. comm.).

The Mexican chickadee, *Parus solateri*, and the Mexican junco, or yellow-eyed junco, *Junco phaeonotos*, may be found in the oak-woodland areas of the South Peloncillos; both species are included on the State's endangered species list. The only documented records of these species occurrence within New Mexico was on Animas Mountain (Zimmerman, 1975, pers. comm.). The Bell's vireo, *Vireo bellii*, (a State endangered species) is likely to occur along the brushy canyon bottoms, especially if water is present.

A tremendous variety of other bird species occur. Included are various species of hummingbird, *Trochilidae*; woodpecker, *Picidae*, flycatcher, *Tyrannidae*; swallow, *Hirundinidae*; warbler, *Parulidae*; wren, *Troglodytidae*; and numerous other songbirds.

iii. Reptiles

Several species of lizard and snake can be found within the South Peloncillo area (Appendix C.) The bunchgrass lizard, *Sceloporus scalaris*, and the mountain skink, *Eumeces calliocephalus*, both of which are on the State list of endangered species, may occur in the South Peloncillos. The Mojave rattlesnake, *Crotalus scutulatus*, also on the State's endangered species list, may occur along the west slopes. No documented sightings of these species of reptile have been reported. Intensive studies are needed to fully determine species of common as well as rare occurrence.

iv. Invertebrates

A wide array of terrestrial invertebrates are common to this area. The diversity of vegetation provides habitat for a corresponding diversity of invertebrates. Included are: grasshoppers, *Acrididae*; yellowjackets, *Polistes* sp.; honey bees, *Apis mellifera*; beetles, *Coleoptera*; polyphemus, *Telega polyphemus*; horse and deer flies, *Silvius* sp.; arphia locust, *Arphia acta*; common centipede, *Scutigera forceps*; tarantula spider, *Aphonopelma* sp.; whiptail scorpion, *Thelyphonus* sp.; and numerous other species (Wilson, 1973).

(2) Central Peloncillo Mountains WHA-Ib

The Central Peloncillo Mountains extend from Highway 9 on the south to I-10 on the north, and include approximately 15,200 hectares (38,000 acres) (Fig. 12). Vegetative diversity and density is low. The topographic relief is significant. Temperatures are high, and precipitation is low.

An intensive inventory of this segment of the Peloncillos was conducted and completed in June, 1975. Twenty-two wildlife transects were completed with each species observed recorded.

(a) Aquatic Animals

i. Mammals

None have been recorded within the area.

ii. Birds

Only passing incidental use of the area by waterfowl and some shorebirds occurs. Water is extremely scarce within this segment of the Peloncillo Mountains, generally available temporarily through stocktanks or reservoirs supplied with water by wells or periodic runoff.

iii. Amphibians and Reptiles

None have been recorded.

iv. Fish

None occur.

v. Invertebrates

Invertebrates likely to occur include such species as the waterstrider, damselfly, mosquito, and giant water bugs

(Wilson, 1973) (Appendix C). More intensive inventories are needed to fully determine aquatic invertebrate occurrence.

vi. Zooplankton

There is no information available.

(b) Terrestrial Animals

i. Mammals

The mule deer, black-tailed jackrabbit, *Lepus californicus*; desert cottontail, *Sylvilagus auduboni*; banner-tailed kangaroo rat, *Dipodomys spectabilis*; javelina, coyote, bobcat, *Urocyon cinereoogreus*; and gray fox are species of mammals which were recorded during the intensive inventory of the Central Peloncillos (Moore, 1975).

Mule deer populations are probably less than 1 head per section. Population levels could be greater (2 deer/section) if adequate water were available. (In an effort to partially mitigate this limiting factor, the BLM installed two inverted umbrella water catchments in the area in the mid 1960's.) Use of the occupied ranges is yearlong, and although food and cover is not as abundant in the Central Peloncillos as in the South Peloncillos, a variety of desirable species adequate to support a small population (60 to 100 head) does exist.

Javelina populations are increasing, reflecting the come-back from the severe winter storms of 1967-68. Sign of javelina activity was observed almost area wide. Preferred foods occurring within this area include prickly pear (abundant), cholla, agave, *Agave spp.* sotol, *Dasylixion wheeleri*, and mescal. Several old mine tunnel entrances located along the slopes of the Central Peloncillos provide desirable cover and protection for the javelina during periods of inclement weather. Extensive use of these gunnels was noted during the survey.

Coyote populations are apparently static with moderate levels being maintained. Although only a few were seen during the survey, sign was observed area wide. Cottontail rabbit concentration areas appeared to be utilized considerably by coyote.

Bobcat and gray fox evidently range through the area. Population levels are at an apparent static low.

Rock squirrels, *Citellus variegatus*, and Harris' antelope squirrel, *Citellus harrisi*, were frequently noted at the higher elevations while an abundance of banner-tailed kangaroo rat dens were noted in the lower foothill areas (Moore, 1975).

ii. Birds

Cooper's, Swainson's, *Buteo swainsoni*, marsh, *Circus cyaneus*, and sparrow hawk, *Falco sparverius*, were observed.

Primary game species observed include the mourning dove, Gambel's quail, and scaled quail. Mourning doves were especially abundant during the fall, at which time southern migrations were occurring. One dove nest was observed; however, many old and abandoned nests were seen.

Gambel's quail and scaled quail preferred the brushy arroyos with a variety of forbs nearby. Mesquite and littleleaf sumac were preferred woody species. (Two quail guzzlers were installed within this area by the New Mexico Game and Fish Department in the 1950's.)

Scaled quail appeared to prefer the eastern exposures, where the first rays of the sun would strike the birds, for roosting sites. Tobosa grass, *Hilaria mutica*, sideoats grama and black grama interspersed with pale wolfberry, *Lycium pallidum*, comprise this bird's typical habitat. Filaree and wild carrot, *Daucus pusillus*, are common forbs grazed extensively during the winter months by scaled quail (Moore, 1975).

A diversity of other bird species also occur (Appendix C.).

iii. Reptiles

The most common reptile observed within the Central Peloncillos during the intensive inventory was the greater earless lizard, *Holbrookia texana*. The dry, gravelly or sandy sections of the arroyo bottoms are preferred habitat. Each evening these lizards bury themselves in the sand and remain there until the next day when they emerge following the sun's warming of the sand.

The Gila monster, *Heloderma suspectum*, (a State endangered species) is known to occur within the Peloncillos; however, the population is undoubtedly small and very localized. The Central and North Peloncillo mountains and the rocky breaks and slopes of the Gila River are the only known locations within New Mexico where this species can be found. This species is commonly associated with extremely rocky country containing crevices and holes or the more gentle terrain of the mountain pediments and in close association with drainage channels (Moore, 1975).

The Arizona coral snake, *Micrurus euryxanthus*, (a State endangered species) has been observed and collected by herpetologists on several different occasions in the Central Peloncillos. This species is an inhabitant of a variety of habitats, but prefers rocky upland desert communities. The status of populations is probably declining, primarily due to indiscriminate killing and intensified collection.

Several other reptile species also occur, some of which include the side-blotched lizard, *Uta stansburiana*; western patch-nosed snake, *Salvadora hexalepis*; prairie rattlesnake, *Crotalus viridus viridus*, and the western diamondback rattlesnake, *Crotalus atrox*, (Appendix C.).

iv. Invertebrates

Numerous terrestrial invertebrates occur: grasshoppers, yellow-jackets, beetles, horse and deer flies, tarantula spiders, black widow spiders, *Latrodectus mactans*, to name a few (Wilson, 1973) (Appendix C.).

(3) North Peloncillo Mountains - WHA 1c

The North Peloncillo Mountains extend from I-10 north to the point where this range of mountains leaves the State, and includes approximately 8,000 hectares (20,000 acres) (Fig. 12). Topographic variations with steep slopes are high, but not as extensive as in the Central Peloncillos. This north segment includes more low, rolling hill terrain with relatively low vegetative density and moderate diversity. Temperatures are high and precipitation low.

(a) Aquatic Animals

i. Mammals

No known aquatic mammals occur.

ii. Birds

Water, in the form of stockwater tanks or reservoirs, is slightly more abundant in the North Peloncillos than in the Central Peloncillos. Killdeer, Wilson's phalarope, water pipit, *Anthus spinoletta*, western sandpiper, *Ereunetes mauri*, common snipe, *Capella gallinago*, and willet, *Catoptropornis semipalmatus*, are some of the shore birds that may occur during periods of migration if these temporary waters are available.

iii. Amphibians and Reptiles

No species of amphibian or aquatic reptile have been recorded; however, the Couch's spadefoot toad, *Scaphiopus couchi*, and the tiger salamander, *Ambystoma tigrinum*, are likely inhabitants.

iv. Fish

None occur.

v. Invertebrates

Invertebrates likely to occur include the waterstrider, damsel fly, mosquito, and giant water bug (Wilson, 1973) (Appendix C). Livestock waters provide the only available habitat. Intensive inventories are needed to fully determine aquatic invertebrate occurrence.

vi. Zooplankton

There is no information available.

(b) Terrestrial Animals

i. Mammals

Mule deer, coyote, blacktailed jackrabbit desert cottontail, and Harris' antelope squirrel were observed during the 1975 intensive inventory. Game species present in the area include mule deer, javelina, and pronghorn antelope, *Antilocapra americana*. Mule deer populations are low, probably less than 1 deer per section. A fair density of desirable browse occurs supporting a static population of approximately 30 to 50 head of deer. Javelina may occur, however, no observations have been recorded. The interstate movement of a small population of pronghorn antelope (20 to 25 head) may involve the northern foothills.

Predator species occurring in the North Peloncillos include the coyote and bobcat. Coyote levels are apparently static with moderate levels being maintained. Bobcats undoubtedly occur, although they were not observed during the survey. The rabbit and rodent populations are static except during periods of normal population fluctuations.

ii. Birds

Swainson's hawks are most prevalent; however, marsh and Cooper's hawks were also observed. During the fall and winter, numbers increase substantially, and include additional species such as the golden eagle, red-tailed hawk, *Buteo jamaicensis*, ferruginous hawk, *Buteo regalis*, and others. The prairie falcon, *Falco mexicanus*, (State endangered species) and sparrow hawk are yearlong residents. Gambel's quail, scaled quail, and mourning dove were observed throughout the area. A diversity of other bird species also occur (Moore, 1975) (Appendix C.).

iii. Reptiles

Several species of reptile are found within the North Peloncillos. The greater earless lizard is common

throughout this area. The Gila monster was observed near Stein's Peak in an extremely rocky area. Other reptile species in the area include the side-blotched lizard, Clark's spiny lizard, *Sceloporus clarki*, and the western diamondback rattlesnake (Moore, 1975) (Appendix C.).

iv. Invertebrates

Numerous terrestrial invertebrates occur: grasshoppers, yellow jackets, beetles, horse and deer flies, tarantula spiders, and scorpions (Order: *Pedipalpi*), to name a few (Wilson, 1973) (Appendix C.).

b. The Pyramid Mountains - WHA II

The Pyramid Mountains, located south of Lordsburg, New Mexico, exhibit considerable topographic variation and range from 1416 meters (4,600 feet) to over 1846 meters (6,000 feet) above sea level (Fig. 12). Approximately 36,000 hectares (90,000 acres) are included in this area which contains a diversity of habitats.

The area is comprised of steep, porous slopes with low vegetative density and composition. Precipitation is low and temperatures are high.

(1) Aquatic Animals

(a) Mammals

None occur.

(b) Birds

Only occasionally occur in conjunction with livestock waters.

(c) Amphibians and Reptiles

None known.

(d) Fish

None occur.

(e) Invertebrates

Likely invertebrates include waterstriders, mosquitoes, and giant water bugs occurring in conjunction with livestock waters (Wilson, 1973) (Appendix C.)

(f) Zooplankton

No data available.

(2) Terrestrial Animals

(a) Mammals

Mule deer occur within the Pyramids, but in very low numbers. Current population levels are estimated at less than 1 deer per section or approximately 100 head. Mule deer habitat is marginal, with only pockets of fair quality habitat occurring in conjunction with north and east facing slopes. In these areas, sparse juniper and oak cover is provided along with such desirable browse species as littleleaf sumac, Apache plume, ephedra, and desert ceanothus, *Ceanothus greggii*. Available water is also a limiting factor, and is present only during the rainy season (July-August) or temporarily at water tanks or reservoirs installed for livestock.

One or two small bands (5 to 6 each) of javelina occur in the Pyramid Mountains (Bangs, 1975, pers. comm.). As in other areas, the population is increasing following the sudden set-back due to the severe winter of 1967-68. Apparently fair to good quality habitat exists within the Pyramids. A few crevices, ledges, and old horizontal mine tunnels are available for cover or shelter. Foods in the form of prickly pear cactus, cholla, agave, and juniper berries occur in relative abundance.

Coyotes are abundant and roam the Pyramids and adjacent Animas and Playas Valley area in constant search for food.

Prevalent small mammals include the rock squirrel, antelope squirrel, pocket mouse, *Perognathus spp.*, kangaroo rat, *Dipodomys spp.*, desert cottontail, and antelope jackrabbit, *Lepus alleni*, (Appendix C).

(b) Birds

Gambel's quail and scaled quail are relatively abundant within the Pyramid Mountains; however, populations fluctuate considerably, and are highly dependent upon good moisture conditions for abundance of food prior to and during the nesting and brood rearing period. Foods in the form of seeds, such as broom snakeweed, *Gutierrezia sarothrae*, sunflower, and mesquite; and the fruits of the prickly pear are relatively abundant.

A few mourning dove occur yearlong, but with the influx of migrants, tremendous increases usually occur during the fall. Most mourning dove are attracted to the Animas Valley area where agricultural crops and water are readily available.

The red-tailed hawk, sparrow hawk, and the prairie falcon are prevalent yearlong birds of prey. The turkey vulture, *Cathartes aura*,

is abundant during the summer months. Common winter migrants include the marsh hawk, ferruginous hawk, and golden eagle. Perching, resting, and nesting sites are fairly numerous within the Pyramid range. Available prey is also abundant within the Pyramids and on the adjacent pediments.

Numerous other birds also occur and include such species as: roadrunner, *Geococcyx californianus*; cactus wren, *Campylorhynchus bruneicapillum*; canyon wren, *Catherpes mexicanus*; horned lark, *Eremophila alpestris*; black-tailed gnat-catcher, *Poliophtila melanura*; loggerhead shrike, *Lanius ludovicianus*; various warblers, and sparrows, *Fringillidae*, and a variety of others (Appendix C.). Some are resident, while other migrate to or through the area during certain seasons of the year.

(c) Reptiles

Common reptiles include the greater earless lizard, spiny lizards, *Sceloporus* spp., western diamondback rattlesnake, and the striped whipsnake, *Masticophis flagellum*, (Appendix C.). Rocky canyons, gullies, or mountain slopes with an abundance of prey comprise favorable habitat for these species.

(d) Invertebrates

Numerous invertebrates occur in the Pyramid Mountains. Grasshoppers, beetles, yellow jackets, tarantula spiders, and scorpions are examples of a few (Wilson, 1973) (Appendix C.).

c. North Animas Mountains - WHA III

That portion of the North Animas Mountains encompassed within the assessment area includes approximately 12,000 hectares (30,000 acres) (Fig. 12). Elevations range from 1538 meters (5,000 feet) in the foothills to over 1,846 meters (6,000 feet) at higher points along the Continental Divide. Moderate vegetative densities and compositions are found in this area. Precipitation is low, yet slightly higher than that occurring in the Pyramids and Central and North Peloncillos. Available water is limited and occurs only temporarily during and following the rainy season or in conjunction with the livestock waters developed privately by livestock operators or by the Bureau of Land Management.

(1) Aquatic Animals

(a) Mammals

None occur.

(b) Birds

Aquatic birdlife occurs only occasionally due to the limited availability of water. The killdeer is the species most commonly associated with the waters of this area. Waterfowl species may occasionally use available waters for resting purposes.

(c) Amphibians and Reptiles

No known species of amphibian or aquatic reptile occurs.

(d) Fish

None occur.

(e) Invertebrates

Certain forms of invertebrates are commonly associated with relatively permanent livestock waters. Waterstriders, mosquitoes, and water boatman are likely common inhabitants (Wilson, 1973).

(f) Zooplankton

No data available.

(2) Terrestrial Animals

(a) Mammals

Mule deer occur in relatively low numbers in comparison to populations in the South Peloncillo Mountains. An estimated 1 to 1.5 mule deer per section, or 50 to 70 head, could be maintained. Current numbers, however, are probably below 50 head because of continual poaching within the area (Croom, 1975, pers. comm.). Fair to good habitat is provided in association with the north and east slopes and along the major drainages. Juniper and oak occur on these slopes in addition to desert ceanothus, littleleaf sumac, and grama grasses which provide fair to good cover and food. The drainages, especially the deeper ones, provide additional cover and contain such important foods as littleleaf sumac, Apache plume, rabbitbush, *Chrysothamnus nauseosus*, desert ceanothus, grama grass, and various forbs. Available water is a highly limiting factor.

Two or three bands of javelina occur, with an estimated population of about 15 head (Croom, 1975, pers. comm.). Suitable cover and shelter may be limiting factors; however, cliff overhangs and some abandoned mines do exist. Foods are generally plentiful and are adequate to support a slightly larger population, provided suitable cover can be obtained.

A fluctuating population of predators includes a moderate number of coyotes and bobcats, and an occasional roaming mountain lion.

Small mammals include: ringtail, *Bassariscus astutus*, gray fox, *Urocyon cinereoargenteus*, badger, skunk, Harris' antelope squirrel, harvest mice, *Reithrodontomys* spp., pocket mice, kangaroo rat, blacktail jackrabbit, desert cottontail, and others (Appendix C).

(b) Birds

Gambel's quail and scaled quail are both abundant. Populations vary considerably as the result of fluctuations in the timeliness of desirable food and moisture immediately prior to and during the nesting and brood rearing periods.

Mourning dove occur yearlong, but there are tremendous increases in population levels when fall migrants pass through or stay. The majority of dove use is within the foothill areas or the Animas Valley where water and food is more plentiful.

Birds of prey also commonly occur, and include residents, such as the golden eagle, Swainson's hawk, red-tailed hawk, and winter migrants such as the marsh hawk and ferruginous hawk.

Numerous other birds occur, including such species as the roadrunner, horned lark, cactus wren, canyon wren, black-tailed gnat-catcher, loggerhead shrike, warblers, sparrows, and a variety of others. Some are resident while others migrate to or through the area during certain seasons of the year (Appendix C).

(c) Reptiles

Reptiles common to the North Animas Mountains include the greater earless lizard, western diamondback rattlesnake, and the mountain patch-nosed snake; however, more intensive studies are needed to fully determine other reptile species occurrence (Appendix C). Consideration should be given to the fact that the Chihuahuan ridge-nosed rattlesnake, *Crotalus willardi silus*, and the bunchgrass lizard associated with the higher elevations, and the Arizona coral snake, associated with the lower elevations, occur on Animas Mountain. Each of these species is on the State of New Mexico's endangered species list (Appendix C).

(d) Invertebrates

Numerous invertebrates occur in the North Animas Mountains. A total inventory of those occurring is unavailable. Those known to occur include grasshoppers, various beetles, digger

wasps, *Bembex* sp., tarantula spiders, scorpions, and deer and horse flies (Wilson, 1973) (Appendix C).

d. Animas Valley - WHA IV

That portion of the Animas Valley within the assessment area includes over 240,000 hectares (600,000 acres) (Fig. 12). Elevational variances are normally 31 to 61 meters (100 to 200 feet) within the valley (1275 to 1354 meters, 4144 - 4400 feet above sea level) except in the southern portion of the valley where it gradually ascends to 1537 meters (5,000 feet). Within this area, four separate biotic communities have been identified. Each of these areas, either individually or in combination, supplies habitat for some animal species. The four communities identified and their approximate contribution in terms of percent of the area covered are: Alkali Flats, 5 percent; Animas Valley Lava Flow, 3 percent; agricultural-riparian, 8 percent; and non-agricultural, 84 percent.

(1) Alkali Flats - WHA IVa

(a) Aquatic Animals

The Alkali Flats, located at the lowest point within the valley, are subject to periodic flooding. The degree of flooding depends upon the amount and intensity of precipitation. During the period of flooding, a considerable area of temporary aquatic habitat becomes available. Significant use of the area is made by aquatic animals and the area supplies an important feeding and resting area for migratory waterfowl and marsh or shore birds. Species observed include the white-faced ibis, *Plegadis chihi*; cattle egret, *Bubulcus ibis*; little blue heron, *Florida caerulea*; Wilson's phalarope, Mexican duck, and a variety of other waterfowl and water dependent bird species.

(b) Terrestrial Animals

During periods of non-flooding, various species of terrestrial animal life frequent the edges, and to a lesser degree the interior of the Alkali Flats. The larger, more mobile species (e.g., coyote, fox, bobcat, etc.) would be more apt to occur in transit within the interior, while the same species, plus various small rodents and reptiles would be found associated with the periphery.

(2) Animas Valley Lava Flow - WHA IVb

The Animas Valley Lava Flow is located 3.2 or 4.8 kilometers (2 or 3 miles) west of the town of Animas, New Mexico on both the north and south sides of State Highway 9 (Fig. 12). This

particular flow appears, at least superficially, to be fairly well along in the various stages of ecological succession. The surface is relatively flat and has a fair density of vegetation, primarily annuals, established. Some wildlife species commonly associated with this biotic community are indicated within this section; however, additional information is needed relative to total faunal inhabitation with special attention being given to endangered or threatened species and species uniquely adapted to such a community. Due to the successional stages of ecological development, the likelihood of species exhibiting melanistic (dark phase) characteristics is questionable.

(a) Aquatic Species

None occur.

(b) Terrestrial Animals (Appendix C.)

i. Mammals

Around the fringes of the area, the kangaroo rat and the antelope ground squirrel are commonly observed. The mule deer, coyote, bobcat, and other mammals occasionally pass through the area. Species of rodent exhibiting various unique characteristics (melanism) may also occur.

ii. Birds

No bird species especially unique to the lava flow have been observed or reported; however, species commonly occurring on adjacent communities may be observed. Quail (Gambel's and scaled), mourning dove, and various species of sparrow as well as birds of prey are commonly sighted.

iii. Reptiles

Specific species of reptiles occurring within the lava flow are not known. Species likely to occur include the lesser earless lizard, *Holbrookia maculata*, eastern fence lizard, *Sceloporus undulatus*, western diamond back rattlesnake, and the prairie rattlesnake.

iv. Invertebrates

A variety of invertebrates occur in the Animas Valley Lava Flow. Grasshoppers, spiders, beetles, and ants are some of the groups represented (Wilson, 1973).

(3) Agricultural - Riparian - WHA IVc

The agricultural-riparian community is found within the Animas Valley (Fig. 12). The agricultural type refers to the cropland areas within the valley (approximately 12,800 hectares, 32,000 acres). Common crops include cotton, barley, sorghum, corn, beans, wheat, alfalfa hay, and irrigated pasture. These areas are especially attractive to many different species of animal life. Food, cover, and water are all provided in abundance during periods of crop productivity. Following crop harvest, cover is greatly reduced, while foods may still be plentiful through residual seeds and other crop material.

The riparian type is that associated with banks of creeks, drainages, arroyos, reservoirs, and ponds. Throughout the croplands, this type occurs in the form of permanent irrigation ponds. The majority of the ponds and reservoirs are encircled by trees, primarily cottonwoods, and all are strong attractors of aquatic and terrestrial animal life. Other riparian communities include those areas along drainages containing trees and a variety of vegetation with varying density.

These particular communities are important simply because of the relative scarcity of such habitat in southwestern New Mexico. Food, in the form of both animal and vegetative matter, as well as cover and water, is abundant.

(a) Aquatic Animals

i. Mammals

The raccoon and ringtail are species that are generally associated with riparian types and water, but may also frequent cropland areas in search of food. The populations of both of these species are low, but generally static.

ii. Birds

Numerous waterfowl and shorebirds occur in the area. The Mexican duck and white-faced ibis have been observed. The Wilson's phalarope, cattle egret, and little blue heron also occur. Periods of aquatic birdlife concentrations are seasonal, with greatest numbers occurring in the fall and throughout the winter. The riparian cropland community is used extensively, both seasonally and yearlong.

iii. Amphibians and Reptiles

The plains spadefoot toad, *Scaphiopus bombifrons*, and the leopard frog, *Rana pipiens*, are likely common

species of amphibians associated with the riparian as well as cropland areas.

Species of reptile also occur and would most commonly include the checkered garter snake, *Thamnophis marcianus*, and possibly the yellow mud turtle, *Kinosternon flavescens*.

iv. Fish

No known species of fish have been reported; however, some of the private irrigation ponds may support various species of warm water fish.

v. Invertebrates

A variety of aquatic invertebrates occur. included are the mosquito, waterstrider, giant water bug, damsel fly, dragon flies, backswimmer, water boatman, and others (Wilson, 1973).

vi. Zooplankton

Specific data is not available.

(b) Terrestrial Animals

i. Mammals

A diversity of terrestrial species are commonly associated with the riparian-cropland community and include such species and groups of species as mule deer, antelope, coyote, bobcat, skunk, badger, *Taxidea taxus*, cottontail rabbit, gray fox, pocket gopher, *Thomomys* spp., harvest mice, woodrat, cotton rat, *Sigmodon* spp., Norway rat, *Rattus norvegicus*, and house mouse, *Mus musculus*.

In most cases, populations associated with these areas are high, but receive continued control action by man through either intentional or unintentional means. These include shooting, poisons, cultivation, crop harvesting, domestic pets, vehicular traffic, etc.

ii. Birds

Terrestrial avian life is richly associated with this area. Birds of prey are numerous and include such species as the red-tailed hawk, Swainson's hawk, barn owl, *Tyto alba*, great horned owl, *Bubo virginianus*, and such uncommon birds of prey as the zone-tailed hawk, *Buteo albonotatus*, prairie falcon, and the ferruginous hawk. The abundance of prey as well as associated perching and resting sites are attractive features.

Quail (Gambel's and scaled) and mourning dove are also abundant. The preponderance of food and cover are, again, the primary attracting features.

A diversity of other species also occur, including swifts, *Apodidae*, hummingbirds, and numerous perching birds, *Passeriformes*, (Appendix C.).

iii. Reptiles

Reptiles occurring in this area include several species of snakes and lizards. The bull snake, *Pituophis melanoleucus*, western diamondback rattlesnake, prairie rattlesnake, southern prairie lizard, *Sceloporus undulatus consobrinus*, and Clark's spiny lizard are fairly common. Additional information is needed relative to the occurrence of species of endangered or threatened classification as well as other species of importance.

iv. Invertebrates

Numerous invertebrates occur including grasshoppers, bees, the black widow spider, tarantula, scorpion, and other invertebrates common to cropland areas (Wilson, 1973). Population levels fluctuate considerably, depending upon the degree of chemical treatment of crops.

(4) Non-Agricultural - WHA IVd

The non-agricultural area comprises the bulk of the Animas Valley (Fig. 12). The area is slightly undulating and is cut by numerous intermittent drainages and arroyos. Included within this area are three major vegetative types, creosote, mesquite, and yucca grassland.

The mesquite type (approximately 20 percent of the area) contains the highest animal population densities while the yucca grassland (approximately 30 percent of the area) and creosote (approximately 50 percent of the area) types support respectively fewer numbers.

(a) Aquatic Animals

Aquatic animal life occurs only occasionally in association with the temporary livestock waters located within the area.

(b) Terrestrial Animals

i. Mammals

The mule deer, antelope, coyote, gray fox,

and bobcat are occasionally seen within this area. The mule deer are more commonly associated with the foothill areas, generally around the perimeter of the area, and occasionally within and around the cropland areas. Travel to and from the cropland areas is generally via drainages offering suitable cover.

Only a few antelope (perhaps 25 to 50 head) occur within the valley. The bulk of these animals are associated with the grasslands and yucca-grassland areas of the Lordsburg Mesa actually move back and forth across the Arizona-New Mexico State line on a periodic basis. A few other antelope have been observed in the southern Animas Valley and within the yucca-grassland areas east of the Pyramid Mountains.

The mesquite type occurring within the Animas Valley is the greatest producer of organisms or animal life (in terms of weight) within the non-agricultural area, and may also be the greatest producer of total biomass. Numerous small rodents are associated with this type, which in turn, provide a staple food source for numerous consumers of small prey (e.g., coyote, bobcat, various reptiles, birds of prey, etc.) (Appendix C.).

ii. Birds

A wide variety of bird species reside either yearlong or seasonally in the non-agricultural area of the Animas Valley. Game birds include Gambel's and scaled quail and mourning dove. The scaled quail is generally associated with the more arid sites, while the Gambel's quail is found closer to drainages where water occurs. These species, however, may frequently be observed together. Quail populations are highly fluctuating with current levels near optimum capacities.

Mourning dove are abundant during the fall and winter, and are generally found in close proximity to water. Resident populations also occur with fair to good hatching success depending upon food and water availability.

Birds of prey are numerous, and occur throughout the area. Species include the rough-legged hawk, *Buteo lagopus*; Swainson's hawk; ferruginous hawk; marsh hawk; sparrow hawk; red-tailed hawk; prairie falcon; and the golden eagle. Most are migratory, with peak numbers occurring during the winter. The red-tailed hawk is the most common yearlong resident. The aplomado falcon, *Falco femoralis*; the American peregrine falcon, *Falco peregrinus*; and the zone-tailed hawk, all species of extremely rare occurrence, may be present either while in transit to other areas or as isolated residents. Observations of each have been recorded, however, not in recent years.

The Baird's sparrow, *Ammodramus bairdii*; pyrrhuloxia, *Pyrrhuloxia sinuata*; varied bunting, *Passerina versicolor*; and burrowing owl, *Speotyto cunicularia*, are uncommon species of birdlife which are associated with specific vegetative types or some physical characteristic associated with a vegetative type.

The Baird's sparrow (a State endangered species) occurs during the winter months in only two areas of New Mexico, the Animas Valley-Lordsburg Mesa area and in an area within southeastern New Mexico (Zimmerman, 1975, pers. comm.). This species is highly dependent upon the grassland community which provides its specific food and cover requirements.

The pyrrhuloxia and varied bunting (a State endangered species) are birds of uncommon occurrence within the United States. The distribution of both of these species includes primarily Mexico, with extensions into southern New Mexico, where the mesquite vegetative type comprises the major portion of its association.

The burrowing owl is associated with burrows created by various rodents. This association is primarily with the grassland type, but may also include the mesquite and creosote type. Appendix C provides a list of other species likely to occur within the Animas Valley.

iii. Reptiles

Numerous reptiles occur within the non-agricultural types of the Animas Valley. The Clark's spiny lizard; desert side-blotched lizard, *Uta stansburiana stejnegeri*; Texas horned lizard, *Phrynosoma cornutum*; prairie rattlesnake; western diamondback rattlesnake; Sonoran gopher snake, *Pituophis melanoleucus affinis*; and numerous others are found. The western box turtle, *Terrepane ornata*, is occasionally observed in grassy areas with sandy soils (Appendix C.).

iv. Invertebrates

As in other areas, invertebrates are numerous with common representatives being grasshoppers; aphids, *Aphididae*; tarantula spiders; scorpions; flies, *Diptera*; beetles; ants; and many others (Wilson, 1973).

e. San Simon Cienega - WHA-V

The San Simon Cienega, designated Wildlife Habitat Area NM-3 WHA-T2, is one of the few remaining areas within the United States where habitat supporting a population of the endangered Mexican duck occurs. The area also possesses increasing national significance for bird watchers.

The wildlife habitat area includes over 18,800 hectares (47,000 acres); however, only a little over 600 hectares (1,500 acres) contain the most desirable present and potential Mexican duck habitat. The majority of the 600 hectares (1,500 acres) are LU or NRL which are not subject to appropriation or mineral entry (Fig. 12).

In addition to providing nesting habitat for the Mexican duck, this area also satisfies the nesting requirements of many species of birds not adapted to living in the adjacent Lower Sonoran Desert communities. Numerous species of mammals, several species of amphibians, reptiles, and fish are also present.

(1) Aquatic Animals

(a) Mammals

The only aquatic mammal identified is the raccoon (Bridges, 1972). Low populations of this species are being maintained through limited control efforts because of its tendency to feed on duck eggs, including those of the endangered duck.

(b) Birds

A resident population of between 25 and 30 Mexican ducks currently exist within the San Simon Cienega. A brood of 4 to 6 Mexican ducklings was recorded during the summer of 1975, (McVicker, McMahan, 1975, pers. comm.). A population high of 47 ducks occurred in 1969, with the additional release of pen-reared ducks (Davis, C.A., V. W. Bevill, 1970).

In addition to the Mexican duck, 18 other species of waterfowl have been recorded (Bridges, 1972). During peak periods, which are the winter months, as many as 1,200 or more ducks occur on the waters within this project area (Davis, C.A., and V. W. Bevill, 1970). Sago pondweed, *Potamogeton pectinatus*; wild millet, *Echinochloa colonum*; smartweed, *Polygonum persicaria*; bulrush, *Scirpus* spp.; spike rush, *Eleocharis* spp.; desert saltgrass, *Distichlis stricta*; and sedges are vegetative species most commonly used by waterfowl for food and cover (Martin, Zim, and Nelson, 1951; Davis and Bevill, 1970).

Many other species of aquatic birdlife also are associated with the San Simon Cienega. The blue heron, marsh hawk, killdeer, belted kingfisher, *Megaceryle alcyon*, three species of swallow, and red-winged blackbirds, *Agelaius phoeniceus*, are associated with wetlands.

(c) Amphibians and Reptiles

The bullfrog, *Rana catesbeiana*; leopard frog; plains spadefoot toad; southwestern Woodhouse's toad, *Bufo woodhousei australis*; and the tiger salamander are common amphibians. The bullfrog has increased tremendously and has become a threat to young ducklings. An annual bullfrog season is held August 1 to September 15 in an attempt to maintain some control; however, the interest in this type of hunting is small in the area and, therefore, has not been effective in controlling bullfrog populations.

(d) Fish

Mosquito fish, *Gambusia affinis*, and black bullhead catfish, *Ameiurus melas*, currently exist in Cienega Lake; however, fishing is not legal at this time. The catfish are not native, but were introduced in the 1950's. The mosquito fish could be native to the San Simon drainage with eventual establishment in the area as a result of periodic floods.

(e) Invertebrates

Numerous invertebrates include the mosquito; mayfly, *Ephemeroptera*; waterstrider; dragon flies; various water beetles; and others. Invertebrates provide an important food supplement to waterfowl and a primary food source to certain aquatic birds, amphibians, and reptiles (Wilson, 1973).

(f) Zooplankton

Information is lacking; however, representative copepods, cladocerans, and rotifers, typical of the limnetic zone (depth of effective light penetration) can be expected to occur in large numbers.

(2) Terrestrial Animals

(a) Mammals

Coyote, bobcat, raccoon, and skunk are commonly observed and are considered predators of waterfowl. The badger, coati, spotted ground squirrel, *Citellus pilosoma*, and Harris' antelope squirrel are often seen. Several species of mice, the porcupine, *Erethizon dorsatum*, blacktailed jackrabbit, and desert cottontail are also common.

Mule deer, javelina, and an occasional antelope may be observed within the area. Populations are generally static, except for increases

noted in javelina. Approximately 25 mule deer, 12-15 javelina, and 2-3 antelope occur as residents in the general vicinity.

(b) Birds

Bird species such as the Swainson's hawk; sparrow hawk; brown creeper, *Certhia familiaris*; many species of warblers; hooded oriole, *Icterus cucullatus*; Bullock's oriole, *Icterus bullockii*; and the blue grosbeak, *Guiraca caerulea*; which prefer to nest in trees (cottonwoods, willows, etc.,) are associated with this riparian habitat. Foods are prevalent in the form of numerous rodents, insects, seeds, etc.

The golden eagle, zone-tailed hawk, ferruginous hawk, prairie and peregrine falcons have been observed (Bridges, 1972). These species are especially unique because of their current levels of endangerment. A list of other species occurring and corresponding habitat preferences can be found in Appendix C.

(c) Reptiles

The zebra-tailed lizard, *Callisaurus draconoides*; desert spiny lizard, *Sceloporus magister*; tree lizard, *Urosaurus ornatus*; and three species of horned lizard, *Phrynosoma* spp.; are common. Several whiptail lizards, *Cnemidophorus* spp., and the Texas blind snake, *Leptotyphlops dulcis*, have been recorded. The western diamondback rattlesnake and the massasauga, *Sistrurus catenatus*, are also present (Bridges, 1972).

The Gila monster and the Mohave rattlesnake, two species of State endangered classification, occur along the extremities of the area and on the west slopes of the Peloncillo Mountains.

(d) Invertebrates

Grasshoppers, spiders, aphids, beetles, moths, *Lepidoptera*, and ants represent some of the most common and abundant groups (Wilson, 1973). All provide food for various animal species.

f. Game Species Harvest

Table 8 presents harvest information (1970 through 1973) for species of game animals within the proximity of the assessment area. Since harvest information is available only by management areas or by county, it is not possible at this time to reduce such information to statistics which apply only to the assessment area.

Deer (Mule deer and Coues' whitetail) harvest and hunter success

Table 8 An indication of current game species harvest in relation to past harvest. 1970 thru 1973

		GAME SPECIES HARVEST							
		1973		1972		1971		1970	
Species	Hunt Area	Harvest	No. hunters* Hunter success**	Harvest	No. hunters* Hunter success**	Harvest	No. hunters* Hunter success**	Harvest	No. hunters* Hunter success**
Mule deer									
Coues' White-tail	57	110	15.5**	174	20.4**	161	17.2**	259	35.28**
Javelina		35	36.5**	11	24.4**	closed		closed	
Antelope	28	closed		closed		closed		closed	
Cougar		----- unknown -----							
8 Quail <u>1/</u>	Hidalgo Co.	19,560	541*	3,366	167*	8,831	462*	1,990	317*
Dove <u>1/</u>	Hidalgo Co.	3,352	252*	1,132	119*	2,860	161*	1,838	146*
Ducks	Hidalgo Co.	no record		262	40*	147	37*	96	38*
Geese <u>1/</u>	Hidalgo Co.	0	9*	15	20*	7	10*	no record	

1/ Information available by county only. Data for these species is for Hidalgo County, New Mexico Department of Game and Fish.

has continued to decline, suggesting rapidly declining population levels; however, various ranchers located within some of the better deer areas have indicated that they believe this downward trend may be shifting, since they have noted increases.

Javelina trends are steadily increasing as is indicated by both harvest and hunter success. The distribution of javelina is also expanding to include once again ranges occupied prior to the severe winter of 1967-68.

Antelope continue to maintain low static populations. Hunting seasons have been closed for this species for a number of years.

Mountain lion trends are reportedly static (Jackson and Croom, 1975, pers. comm.). Harvest data is not available for this area.

Quail harvest data reflects the customary fluctuations associated with these species. Current population levels (1975) are near, if not at optimum.

Dove harvest data, as with quail, reflects population fluctuations. Current population levels are near optimum.

Waterfowl hunting has not been as enthusiastically pursued as have other forms of hunting; however, the trends in harvest have been increasing. This trend is expected to take a sudden jump during the 1975 and 1976 seasons because of the increase in resident population due to the Phelps-Dodge development.

g. Endangered Animal Species

Southwestern New Mexico supports an extremely attractive and abundant wildlife resource; however, a fact which contributes substantially greater significance to this area is the greater abundance of rare fauna occurring here than in most other areas of North America (Zimmerman, 1965). The rare birdlife is the most astounding. Zimmerman, a renowned ornithologist, indicates that "nowhere else in the southwest can one so readily find so many rare birds..." Several of these rare bird species, in addition to numerous other animal species, appear on the Federal and/or State list(s) as endangered or threatened. One Federal and nine State endangered species are known to occur within the assessment area, and two Federal and thirty State endangered species have been identified as likely to occur, or as species whose range includes all or portions of the assessment area, but for which the likelihood of occurrence is unknown. Table 9 lists, according to one of the above categories, the species identified. In addition, Table 10 indicates the season of use, specific Federal and/or State status classification, and the distribution and habitat for each species.

TABLE 9 Endangered and Threatened Fauna Occurring, Likely to Occur, or Species Whose Range Includes Portions of the Geothermal Assessment Area, but for which the Likelihood of Occurrence is Unknown

Occurring	Likely to occur	Likelihood of occurrence unknown
<u>Mammals</u>		
Sanborn's long-nosed bat (-E ₂)* Coati mundi (-E ₂)	Southern Pocket Gopher (-E) White-sided jackrabbit (-E ₁)	Southern yellow bat (-E ₂) Mexican long-tongued bat (-E ₂) Arizona blacktail prairie dog (-E ₂) Jaguar (E-E ₁)
<u>Birds</u>		
06 Mexican duck (E-E ₁) Bell's vireo (-E ₂) Baird's sparrow (-E ₂) McCown's longspur (-E ₂)	Mississippi kite (-E ₂) Southern bald eagle (E-E ₁) American Osprey (-E ₂) Broad-billed hummingbird (-E ₂) Beardless flycatcher (-E ₂) Mexican chickadee (-E ₂) Varied bunting (-E ₂) Mexican junco (-E ₂) Mexican turkey (-E ₂) American peregrine falcon (E-E ₁)	Northern black hawk (-E ₂) Northern aplomado falcon (-E ₁) Ridgeway's whip-poor-will (-E ₂) Western blue-throated hummingbird (-E ₂) Northern violet-crowned hummingbird (E-E ₂) Gila woodpecker (-E ₂) Northern thick-billed kingbird (-E ₂) Sulphur-bellied flycatcher (-E ₁) Buff-breasted flycatcher (-E ₁) Coppery-tailed trogon (-E ₁) Thick-billed parrot (-E ₂) Masked bobwhite quail (E-)
<u>Amphibians and Reptiles</u>		
Bunchgrass lizard (-E ₂) Gila monster (-E ₁) Arizona coral snake (-E ₂)	Mountain skink (-E ₂) Sonora coachwhip snake (-E ₂) Mojave rattlesnake (-E ₂) Narrow-headed garter snake (-E ₂)	Colorado river toad (-E ₂) Giant spotted whiptail (E-E ₂) Chihuahuan ridge-nosed rattlesnake (-E ₁)

* Example: (T-E₁) means species is threatened on the Federal list and endangered, group 1 on the State list. If a designation does not appear on one or the other side of the dash (-) the species does not occur on that list. E = Endangered, T = Threatened, E₁ = endangered group one, E₂ = endangered group two.

TABLE 10 Species of Endangered or Threatened Classification (Federal and State Lists) Occurring, Likely to Occur, or Whose Range Includes Portions of the Geothermal Assessment Area, but for which the Likelihood of Occurrence is Unknown.

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
Mammals 1. Mexican long-tongued bat	<i>Choeronycteris mexicana</i>	M-S	NM - E ₂	Peloncillo Mtns. near Cloverdale	Natural caves, old mine tunnels, buildings.
2. Sanborn's long-nosed bat	<i>Leptonycteris sanborni</i>	M-S	NM - E ₂	Rodeo, Peloncillo Mts. Animas Mts.	Caves, tunnels buildings, woodland and chaparral, below 5,600'
3. Southern yellow bat	<i>Lasiurus ega xanthius</i>	S	NM - E ₂	Observed in Guadalupe Canyon	Wooded areas along streams, as cottonwoods.
4. Coatimundi	<i>Nasua narica malaris</i>	Y	NM - E ₂	Cienega, Guadalupe Canyon, Pine Canyon in Animas Mts.	Open forests
5. Arizona blacktail prairie dog	<i>Cynomys ludovicianus arizonensis</i>	Y	NM - E ₂	Historically occurred in area. Probably completely exterminated there now.	Dry upland prairies
6. Southern pocket gopher	<i>Thomomys umbrinus emotus</i>	Y	NM - E ₂	Higher timbered parts of Animas Mts., possibly Peloncillos.	Oaks and pines, sometimes rocky soils.
7. White-sided jackrabbit	<i>Lepus callotis gaillardi</i>	Y	NM - E ₁	SW Playas Valley, Cloverdale, Burro Mts. (U.S.F.S.)	Grasslands, mesquite and catclaws, creosote desert
8. Jaguar	<i>Felis onca</i>	Y	U.S-E	Historically ranged north to Santa Fe. No NM records since 1904.	Low mountains, open forests, chaparral.

TABLE 10 (continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
<u>Birds</u>					
1. Mexican duck	<i>Anas diazi</i>	Y	US - E NM - E ₁	San Simon Cienega	Fresh water marshes, ponds, streams and rivers.
2. Mississippi Kite	<i>Ictinia mississippiensis</i>	S	NM - E ₂	Cloverdale, Gila river (USFS)	Open foothills, river valleys, marshes
3. Northern black hawk	<i>Buteogallus anthracinus anthracinus</i>	S	NM - E ₂	Gila River	Wooded stream bottoms
4. Southern bald eagle	<i>Haliaeetus leucocephalus</i>	M - S	US - E NM - E ₁	Gila River, Peloncillo Mtns., Cienega, (migration)	Lakes & rivers
5. American osprey	<i>Pandion haliaetus</i>	S, M	NM - E ₂	Gila River, Cienega	Rivers, lakes and reservoirs.
6. Northern aplomado falcon	<i>Falco femoralis septentrionalis</i>	S	NM - E ₁	Last known sightings Alamo Hueco Mtns.	Arid brushy prairies, yucca flats.
7. American peregrine falcon	<i>Falco peregrinus anatum</i>	Y	US - E NM - E ₁	Gila River, Guadalupe Canyon, Peloncillos	Open woodland, in migration, marshes foothills, open country.
8. Mexican turkey	<i>Meleagris gallopavo mexicana</i>	Y	NM - E ₂	Animas and Peloncillos Mtns.	Mountains, forest areas, broken woodlands

TABLE 10 (Continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
Birds (continued)					
9. Ridgway's whip-poor-will	<i>Caprimulgus ridgwayi</i>	M - S	NM - E ₂	Guadalupe Canyon	Rocky, juniper-mesquite slopes
10. Western blue-throated hummingbird	<i>Lampornis clemenciae bessophilus</i>	M - S	NM - E ₂	Guadalupe Canyon	Wooded streams in lower canyons of mountains.
11. Northern violet-crowned hummingbird	<i>Amazilia verticalis ellioti</i>	S	NM - E ₂	Guadalupe Canyon	Riparian groves in canyons
12. Broad-billed hummingbird	<i>Cynanthus latirostris</i>	S	NM - E ₂	Guadalupe Canyon	Desert canyons, mountain slopes, agaves, mesquit
13. Thick-billed parrot	<i>Rhynchopsitta pachyrhyncha</i>	S	US - E	Guadalupe Canyon	Mountains, canyons, deserts
14. Coppery-tailed trogon	<i>Trogon elegans</i>	S	NM - E ₁	Guadalupe Canyon	Mountain forests, pine- or sycamore canyons.
15. Gila woodpecker	<i>Centurus uropygialis</i>	Y	NM - E ₂	Gila River, Guadalupe Canyon	Desert washed, river groves, cottonwoods.
16. Bell's vireo	<i>Vireo bellii</i>	S	NM - E	Guadalupe Canyon, Cienega	Willow thickets along streams, mesquite
17. Northern thick-billed kingbird	<i>Tyrannus crassirostris pompalis</i>	M - S	NM - E ₂	Guadalupe Canyon	Semi-arid canyons sycamores

Table 10 (Continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
Birds (continued)					
18. Buff-breasted flycatcher	<i>Empidonax fulvifrons</i>	S	NM - E ₁	Coronado Nat'l Forest	Canyon groves, oak-pine
19. Beardless flycatcher	<i>Camptostoma imberbe</i>	S	NM - E ₂	Guadalupe Canyon	Low woods, mesquite stream thickets, lower canyons
20. Sulpher-bellied flycatcher	<i>Myiodyanastes luteiventris</i>	S	NM - E ₁	Guadalupe Canyon	Sycamores in canyons
21. Mexican chickadee	<i>Parus sclateri</i>	Y	NM - E ₂	Animas & Peloncillo Mtns.	Conifers, pine-oak forest
22. Varied bunting	<i>Passerina versicolor</i>	S	NM - E ₂	Guadalupe Canyon	Mesquite, stream-side thickets, green areas.
23. Baird's sparrow	<i>Ammodramus bairdii</i>		NM - E ₂	Animas Valley	Long grass prairie
24. Mexican junco	<i>Junco phaeonotus</i>	Y	NM - E ₂	Animas, Peloncillo Mtns.	Conifer forests, tall pine-oak woods
25. McCown's longspur	<i>Rhynchophanes mccownii</i>	W	NM - E ₂	Animas Valley	Plains and prairies
26. Masked Bobwhite Quail	<i>Colinus virginianus ridgwayi</i>	Y	US - E	Animas Valley	Agricultural land; weedy brushy open country. Introduced to Animas Valley in 1950, but it is not known if any remain.

TABLE 10 (continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
Amphibians & Reptiles					
1. Colorado River toad	<i>Bufo alvarius</i>	Y	NM-E ₂	Guadalupe Canyon, Gila	Arid mesquite, creosot bush lowlands to oak-sycamore mt. canyons, usually near permant-water
2. Bunchgrass lizard	<i>Sceloporus scalaris</i>	Y	NM - E ₂	Animas and Peloncillo Mtns. at high elevations	Bunchgrass in open conifer forests
3. Mountain skink	<i>Eumeces callicephalus</i>	Y	NM - E ₂	Guadalupe Canyon	Oak and pine habitats in rocky areas in the mountains.
4. Giant spotted whiptail	<i>Cnemidophorus burti</i>	Y	NM - E ₂	Guadalupe Canyon	Mountain canyon and mesas in semi-arid regions; dense vegetation among rocks
5. Gila monster	<i>Heloderma suspectum</i>	y	NM - E ₁	Peloncillo Mts. Gila River	Lower mountain slopes canyon bottoms with water.
6. Sonora coach-whip snake	<i>Masticophis flagellum cingulum</i>	Y	NM - E ₂	Guadalupe Canyon, maybe west slope of Peloncillo mountains.	Desert brushland and woodland. Avoids dense vegetation.

TABLE 10 (Continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
Amphibians & Reptiles (continued)					
7. Arizona coral	<i>Micruroides euryxanthus</i>	Y	NM - E ₂	Gila River, Peloncillo Mtns. and Animas Mts. at lower elevations	Usually rocky upland desert
8. Chihuahuan ridge-nosed rattlesnake	<i>Crotalus willardisilus</i>	Y	NM - E ₁	Animas Mountains	Usually 6000 - 7000' in creek bottoms near talus slopes. Pine oak or juniper forests
9. Mojave rattlesnake	<i>Crotalus scutulatus</i>	Y	NM - E ₂	West slope of the Peloncillos	High deserts, low mountains; not common in rocky areas or dense vegetation
10. Narrow-headed garter snake	<i>Thamnophis rufipunctatus</i>	Y	NM - E ₂	Gila River drainage	Pinon-juniper along clear, rocky streams; highly aquatic, feeding on fish and amphibians.

TABLE 10 (Continued)

COMMON NAME	SCIENTIFIC NAME	SEASON OF USE	SPECIES STATUS	DISTRIBUTION	HABITAT
1. <u>Fish</u> Roundtail chub	<i>Gila robusta</i>	Y	NM - E ₂	Gila River drainage	Near heads of pools or in riffles
2. Loach minnow	<i>Tiaroga cobitis</i>	Y	NM - E ₂	Gila River drainage	Rocky riffles
3. Spikedace	<i>Meda fulgida</i>	Y	NM - E ₂	Gila River drainage	Over sandy or gravelly bottoms
4. Gila topminnow	<i>Poeciliopsis occidentalis</i>	Y	US - E NM - E ₁	Gila River drainage	Avoid current; in shallows among dense vegetation

C. Ecological Interrelationships

1. Succession

The most complex plant and animal communities within the Lightning Dock Geothermal Environmental Assessment Area occur within the desert mountains and foothills which border the Animas, San Simon, Lordsburg, and Playas Valleys. Trees, shrubs, forbs, and grasses are present. Wildlife species are quite diverse compared to lower elevations within the valleys. Physical factors, such as grazing, mining, recreation, etc., have altered plant succession to some degree; however, it is not within the scope of this assessment to determine the seral stages of ecological succession within this area. Biotic-abiotic relationships found within the desert-mountain communities are a very important consideration when discussing ecological interrelationships. The primary abiotic factor which has aided the development of desert-mountain communities is the increase in precipitation due to the uplift effect the mountains have on frontal weather systems. Other factors which are less obvious include the ability of rocky soils to trap, store, and hold moisture, and the shading effect of north and east slopes which enable increased density and composition of plant species to occur. These abiotic-biotic relationships are very subtle and are impacted through surface disturbance.

The Animas, San Simon, Lordsburg, and Playas Valley biotic communities are less complex. Physical factors injected into the ecosystem by man are more prevalent. General development (roads, fences, pipelines) as well as agricultural use (grazing, cropland, etc.), has had a profound effect on ecological values within these areas. Alteration by man and periodic droughts have contributed to deteriorated vegetative and wildlife habitat conditions. Much of this deterioration can be attributed to the fact that early travelers who settled in the valleys had limited understanding of proper livestock stocking rates, which created considerable competition for available water and forage. Through this competition, the more palatable plant species were selected out by grazing animals, and less desirable species took their place. This selective grazing eventually resulted in nearly monotypic stands of creosote and mesquite in some areas. These species were unable to provide adequate watershed protection, which resulted in increased soil erosion by both wind and water.

It may be assumed that changes instigated by man in vegetative and wildlife resources have resulted in significant alteration and reduction of some plant and animal species within the valleys. Major limiting abiotic factors within these valleys include lack of adequate precipitation; high soil temperature; inability of soils to hold water which is lost as runoff; and depleted soils which are unable to provide for the establishment of desirable vegetative species. Physically

altered areas are slow to recover due to limiting factors described above. When perennial vegetation is removed by surface disturbance, annual vegetation becomes established and secondary succession slowly proceeds from this point.

2. Food Relationships

Food relationships are based on the transfer of energy derived from sunlight, water, and soil nutrients into plants which pass through a series of organisms in a very intricate system referred to as a food chain. In its most basic form, the dependency of plants and animals upon each other can be readily recognized within the predator food chain. Plant eating animals, such as the kangaroo rat, a herbivore, rely on vegetative production for life. The rat may be consumed by a bullsnake, which may be consumed by a red-tailed hawk. It becomes apparent that the hawk, a tertiary consumer, is dependent indirectly upon plant production. In most cases, the food chain from plant to final consumer does not exceed four steps. Less obvious food chains are the parasitic chains which proceed from larger to smaller animals, and the saprophytic chain, which goes from dead matter to microorganisms. Understanding the interconnection of these chains is essential to understanding food relationships which are referred to as the food web. Energy loss in the form of heat occurs at each food transfer within the chain, resulting in the top consumer in the food chain being fairly scarce within the ecosystem. In a natural food chain, the nutrients complete the cycle within the ecosystem. Nutrients which are taken from the soil by plants and incorporated into proteins as the plant grows, are used by the successive components of the food chain and returned to the soil as nutrients when the last member of the chain dies. When livestock are placed in an ecosystem and then marketed, nutrients are removed from the natural ecosystem. Intensive grazing carried on over a period of years may noticeably deplete the nutrients from an ecosystem.

All primary consumers, both wild and domestic, require a variety of vegetative species for healthy maintenance. The availability of certain plant species during different times of the year is essential to some species for good reproduction (example, antelope require succulent grasses and forbs during early spring for fawn production and doe lactation) (BLM, 1970). There are few primary consumers which can sustain themselves on near monotypic stands of vegetation. Due to this, vegetation limits the degree of development of a food chain within a given area. This further clarifies the reason for more complex animal communities within the desert mountains which have a variety of trees, shrubs, forbs, and grasses.

Another limiting factor in regard to food relationships within the desert southwest is the availability of water. In many cases, water

controls the population and distribution of wildlife and livestock within a given ecosystem. Some species, such as scaled quail, have adapted to this type of environment; however, most wildlife species are dependent upon some form of free water (Campbell, 1960). During dry months, normally March through June, and during drought periods, livestock reservoirs, intermittent streams, and natural ponds are often dry and the only available water in many areas is that which has been developed by man. Supplementation of natural waters through the development of windmills, pipeline systems, catchments, and large reservoirs, has aided in maintaining wildlife and livestock during these dry periods.

3. Community Relationships

Basic community relationships within the environmental assessment area are based on food, water, and cover requirements of existing plant and animal species as previously discussed. In ecological theory, a community concept is where diverse organisms usually live together in an orderly manner as independent beings (Odum, 1959).

Desert mountains within the proposed geothermal lease area provide island habitat for numerous biotic communities. Noticeable variations between communities occur within the same mountain range and between mountain ranges. Animal species such as the Gila monster have been observed north of Granite Gap within the Peloncillo Mountains, and as far south as Skull Canyon. A variety and abundance of cacti species occur within this same community which are not common to other areas within the Peloncillo Mountains. Physical disturbance of communities such as this would have a limited effect on those wildlife species capable of moving to other areas which may provide suitable habitat; however, that portion of the biotic community composed of small, less mobile forms of wildlife and immobile plant species will be impacted to a greater degree by actions which alter their environment.

Riparian habitat within the proposed lease area is primarily limited to valley bottoms within the more mountainous areas, dry wash bottoms within the valleys, areas surrounding water developments and dwellings, and the San Simon Cienega. Due to the limited extent of this type of habitat, rather complex biotic communities occur within these areas. Animal species particularly associated with these riparian communities include: mammals, (e.g., raccoon); waterfowl, (e.g., Mexican duck, mallard duck); birds of prey, (e.g., Cooper's hawk, and the great horned owl); song birds, (e.g., house finch and pyrrhuloxia); amphibians (spadefoot toad); and reptiles, (Sonoran mud turtle). Due to the limited occurrence of these riparian communities and the specific nature of associated wildlife species habitat requirements, elimination of all or portions of such communities will directly affect existing populations.

D. Human Values

1. Landscape Character

a. Open Space

The landscape is desert type with vertical variations amounting to approximately 769 meters (2,500 feet). Most of the land is covered with vegetation common to the semi-arid and arid portions of southwestern New Mexico. The Animas Valley contains crop lands, non-crop lands, a lava flow, and desert foothills. The cropland contributes variety to the normal monotone of the desert because of the contrast in color created by the farm crops.

Desert mountains form a perimeter along the Arizona State line to the west of the Animas Valley and north to south along the eastern side of the assessment area. Natural conjection is minimized by the extensive open space. Visibility ranges up to 80 kms (50 miles) from most locations. Man-made intrusions in the assessment area include the communities of Lordsburg, Animas, Cotton City, and Road Forks, New Mexico; Interstate Highway 10; the Southern Pacific Railway; Highways 70 and 90 north of Lordsburg, New Mexico; Highways 80, 9, and 338 south of Interstate 10; ranch headquarters; ranch roads; electric power facilities; and an old railroad bed.

At one time, mining was active in the area. Today, some minor mining activity is taking place. The Federal Resource Products Corporation mine and other mines in the Shakespeare area are most visible. Old structures and shafts can be seen in mountainous areas.

Open space characteristics are dominant primarily because of the size of the total area versus the type and number of intrusions.

b. Scenic Quality

Key factors established for evaluation of scenic quality are land form, color, water, vegetation, uniqueness, and intrusions (BLM, 1970). A numerical value and alphabetical class evaluation score results from using given criteria and making comparisons to regional land areas. The Lightning Dock Assessment Area's scenic value has been given a "C" rating except in mountainous areas which have been given a "B" rating. This means that when this area is compared with regional scenic values, using the criteria, the scenery is rated as below average, except in the mountains, which are average (Kline & Flinn, 1975).

The Peloncillo Mountains in the northwest portion of the area are rugged in structure and appear to be barren. Vegetation is not seen at normal viewing distances. Large shrubs and trees are confined to canyon bottoms where they are difficult to see. Scenic quality is

reduced because of the lack of variety and color. This situation is typical of most national resource lands in the assessment area. Most scenic value is related to the geologic structures or land form rather than to variety, color, or uniqueness.

Geothermal resources are believed to underly private farm lands with Federal minerals reserved in the vicinity of Animas and Cotton City, New Mexico. The landscape is flat, providing a natural location for irrigated farming. The farms contrast with the surrounding environment, providing variety in color and land form. A considerable number of man-made intrusions are associated with the farms, but are considered to affect the open space and scenic values only on a localized basis. The farming area is void of high-rise or massive structures which could be seen from great distances.

c. Primitive Values

Primitive values relating to the Lightning Dock Assessment Area are being considered in the Bureau of Land Management planning system documents for the Gila Planning Unit. Criteria used in evaluating the area include the following factors: (1) intrusions; (2) scenic quality; (3) wildlife; (4) fisheries; (5) water usability; (6) size; (7) uniqueness (BLM Manual 6111).

By rating the mountain areas according to these factors and applying numerical values to quality of the factor, a primitive value score of "C" was established (Kline & Flinn, 1975). The criteria used takes into consideration qualities which are considered pertinent to primitive values. The rating of "C" expresses a low average value when compared to other areas in the region. Large numbers of man-made intrusions and lack of variety and water resources caused the low score.

The Peloncillo Mountains provide the most remote situation in the assessment area. A few roads lead into the foothills and man's intrusions are minimal except for mining claims which are located throughout the mountains.

2. Land Uses

a. Recreation

Driving for pleasure, sightseeing, small game and upland bird hunting, and yearlong casual shooting accounts for most of the recreation in the assessment area. No developed picnic sites or other recreational developments are provided in Hidalgo County (Kline and Flinn, 1975). There is, however, potential for picnicking, hiking, mountain climbing, rockhounding, historical and archaeological study,

bird watching, botanical collecting, and other general leisure activity in the area. Most of the national resource lands are accessible to persons wishing to take advantage of these opportunities. The Peloncillo Mountains are fairly inaccessible because of their vertical structure. They offer sanctuary and solitude. Mountain climbing opportunities here are better than in any other part of the assessment area.

A large, open playa bottom (alkali flat) is located north and south of Interstate 10 in the north central part of the area. Periodically the bottom is flooded with rainwater draining from surrounding slopes. During dry periods, the area could be used for off-road vehicle events and other recreational activities.

Sightseeing is not considered a local recreational pursuit. Tourists passing through enroute to other destinations normally use the main roads, and are inclined to form visual opinions due to the monotonous view of the area (Dorsett, 1975, pers. comm.).

Recreational use of the area is light because the population in Hidalgo County is low and recreational opportunities do not attract residents in large numbers.

b. Grazing

The majority of the land in the subject area is used to some extent for the grazing of livestock. About 12,800 hectares (32,000 acres) of land are used for irrigated farming. Most of this farmland is also grazed when crop aftermath is utilized. Cattle ranching was the most important economic activity in Hidalgo County before World War II, but agriculture, including irrigated farming, now provides about one-fourth of the county's employment and about one-third of the personal income.

c. Rights-of-Way

The subject lands are crossed by a number of interstate rights-of-way of vital importance to the large population centers of southern California and the Las Cruces, New Mexico, and El Paso, Texas, areas.

(1) Transportation Rights-of-Way

The major southern east-west transcontinental rail and highway routes pass through Lordsburg, New Mexico. Interstate 10,

a 4-lane highway, has average daily traffic of 6,150 vehicles (NMSHA, 1971).

The Southern Pacific Railroad goes through Lordsburg, New Mexico, and has daily traffic of about 25 trains (EDD, 1974). Most of the trains are very large freights, but several are AMTRAK passenger trains. A great deal of switching and crew changing is done in Lordsburg, New Mexico, and railroad employment is an important part of the local economy.

There are other paved highways of lesser importance. They include U.S. 80, U.S. 70, NM 90, NM 864, NM 338, and NM 9. Numerous unpaved county roads serve the outlying areas.

(2) Electric Powerline Rights-of-Way

A number of powerlines are found throughout the assessment area. A 115 KV line is almost completed by Plains Coop from their substation 8 km (5 miles) northeast of Lordsburg, New Mexico, (southeasterly) to the new Phelps Dodge Smelter at Playas Lake. Three 69 KV lines run northeasterly from the Community Public Service Company power plant at Lordsburg, New Mexico, to their substation near Central, New Mexico. Columbus Electric Coop lines serve the villages of Cotton City, Animas, Rodeo, New Mexico, and the farms and ranches in that part of the study area.

(3) Gas Pipeline Rights-of-Way

Four major interstate pipelines, all El Paso Natural Gas Company lines, cross the unit east to west. This company provides customer service to Lordsburg, New Mexico. Southern Union Gas Company provides service to Cotton City, Animas, and Rodeo, New Mexico, and many irrigation wells in the area.

(4) Communication Rights-of-Way

Several interstate pole lines and one buried cable telephone line cross the subject area. One micro-wave facility is located on privately owned land about 3.2 kms (2 miles) southwest of Lordsburg, New Mexico. Numerous small lines serve the small villages, farms, and ranches.

(5) Proposed Rights-of-Way

Major new rights of way planned for the immediate future are two 345 KV lines from Greenlee, Arizona to El Paso, Texas. These powerlines are expected to be built within the next 5 years. One of the large El Paso Natural Gas interstate pipelines will probably be converted from gas to crude oil in the next 2 to 3 years to carry Alaskan oil to market.

d. Urban and Suburban

Hidalgo County is one of the most lightly populated areas of New Mexico (1.4 persons per square mile) (Lopez, et al., 1971). The City of Lordsburg's 3,429 people (1970 estimate) are about 75 percent of the county's total population. Other small communities and nearby farming areas which account for most of the remaining population of the subject area are: Animas, Cotton City, Rodeo, and Road Forks, New Mexico. Land actually used for urban and suburban purposes is a very small percentage of the total area of the county.

3. Archaeological Values

Important archaeological sites have been found in the assessment area. The Bureau of Land Management let a contract to New Mexico State University for an archaeological reconnaissance of the area. Several unrecorded prehistoric sites were found. Attempts were made to check the area in order to obtain habitation patterns, however, no attempt was made to make an intensive survey.

Most evidence was scattered and consisted of occasional stone tools, flakes, and scattered potsherds.

High density areas overlook the playa lakes and are in the mountain foothills. Particularly heavy densities are located around the edges of playa lakes and on ridges above major drainages north of Interstate 10. Similar density occurs adjacent to the lava flow southwest of Animas, New Mexico. Low density areas are in the lava flow and in the concentrations of basalt cobbles at the base of the mountains. The report describes the physiography of the area, the prehistory of the area, and the location and description of newly recorded sites. Maps contained in the report show locations of all known archaeological sites and the greatest potential for occurrence of other sites (Beckett, et al., 1976).

4. Other Scientific Values

Other scientific values relate principally to certain small wildlife habitat area that attract an unusual variety of birds during migration, some that are normally Mexican residents (peripheral range) or that contain rare or endangered wildlife species.

The best known of these areas is the San Simon Cienega where the Bureau of Land Management has developed a swampy area into a "pot hole" area where the endangered Mexican duck will propagate. This oasis area also attracts an unusual variety of other bird and animal life.

The Owl Canyon and adjoining areas of the Peloncillo Mountains is seasonally used by a wide variety of migrating bird species and is a northern extension of the range of unusual Mexican tropical birds and other wildlife. The uncommon Coues' whitetail deer is resident in the area.

The Granite Gap area is a highly scenic area which contains unusual rock formations, unique vegetative composition of cacti, and the endangered (State list) Gila monster lizard. Within this area, 192 hectares (480 acres) have been withdrawn for recreational purposes.

5. Other Considerations

a. Public Utilities

These facilities are built on rights-of-way and a partial description of this land use is to be found in that section. The major public utilities' rights-of-way follow the general routes of the major transportation arteries. The small distribution lines to individual farms and ranches do not follow any pattern other than that of "the shortest distance between two points is a straight line." Many farm homes and irrigation pumps are fueled by natural gas (Kleine, et al., 1973).

Limited erosional problems have been caused by these utility rights-of-way. The greatest environmental change to be observed is that of aesthetics.

b. Population Centers, Planning and Zoning

The assessment area is principally sparsely inhabited grazing and farming land. The only population centers are those previously described. The irrigated farm lands have a much higher population per square mile than the grazing areas.

Many farms are on land where minerals were reserved when the patent was issued from the United States; however, a legal battle is currently in progress to determine in the courts whether geothermal steam is a mineral that can be reserved. Subsurface waters have long been subject to adjudication by State law. Inherent problems are apparent if the decision on these mineral reserved lands is in favor of the United States. The farm lands are comparatively valuable, and geothermal operations could be disruptive to farming operations. Some of the known warmer shallow waters are in the vicinity of this farm land.

Hidalgo County completed a document titled "Comprehensive Plan for Development" in 1973. The plan consists of a physical inventory; population and economic analyses and projections; a description of present and planned transportation and utility facilities; agricultural and industrial descriptions and projections; and an analysis of

of regulatory measures and land use recommendations for the next twenty years (Harrison, 1974).

Hidalgo County approved a set of county subdivision regulations in 1973. They appear to be the standard set of regulations recommended and authorized by the State legislature. No specific county zoning exists and the County Commission feels that further enabling legislation would be needed to establish expanded regulatory measures. Specific regulatory measures needed include some for flood plains, garbage and solid waste, water use controls, police power, and land use matters other than those covered by the subdivision regulations.

The adopted County Subdivision Regulations require full disclosure of (1) water quantity and quality, (2) liquid and solid waste disposal means, (3) soils suitability, (4) drainage, (5) roads and access, (6) a description of the subdivider's provisions for terrain management, and (7) a timetable of development.

In addition to the county's subdivision laws, Lordsburg, New Mexico, has planning and platting jurisdiction within its corporate limits plus 3 miles adjacent to its boundaries. In the area lying outside of a municipality's corporate limits, but within its planning and platting jurisdiction, the county and municipality have concurrent jurisdiction. In the area of joint concern, a special six member commission is appointed (State law), three from the city and three from the county. There are national resource lands affected by this extra-territorial area within 4.8 kms. (3 miles) of Lordsburg. A commission has not been formed nor has any planning been done; only general recommendations can be expected from local authorities on national resource lands in the extra-territorial area (Harrison, 1974).

III. ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

A. Environmental Impacts

1. Anticipated Impacts

The issuance of a geothermal lease, in itself, does not produce impacts upon the environment, but once the lease is issued, impacts may occur. The information gathered during exploration may determine the fate of the geothermal field. If a resource is encountered, plans will be made for the most practical use of the resource. The geothermal resource may be used for the production of electricity, space heating, agricultural production, etc., or a combination of these. If, on the other hand, an economical resource is not discovered, industry will withdraw from the area, and no further impacts will result. Anticipated impacts, however, will be analyzed in the following sections for pre and post lease exploration, development, production, and close out, even though the development of the field may never take place.

a. Non-living Components

(1) Air

Impacts upon air quality due to geothermal activities should be minimal. Particulate matter and noxious gases, radiological contaminants, and non-ionizing radiation released during geothermal operations could affect air quality on a local basis.

(a) Pre-lease Exploration

Impacts to the air quality during pre-lease exploration should not be significant. The exploration will be primarily confined to existing roads and trails, so that the dust produced will be in association with perviously disturbed areas. Minor amounts of noxious gas will be released by the exploration equipment.

(b) Post-lease Exploration

Air quality impacts should be minimal during post-lease exploration. An anticipated increase in geophysical surveys, drilling operations, and off-road travel will introduce into the air some noxious gas released from mechanical combustion and dust disturbed by movement of vehicles or wind.

Noxious gases are often associated with hot water and/or steam. These gases may escape into the atmosphere accidentally or during testing and bleeding activity. The release of these gases would cease when the well is plugged.

(c) Development

The development phase generally will be confined to drilling and testing wells within the geothermal field. The number and depths of wells drilled will depend upon the geothermal reservoir volume. Impacts considered under post-lease exploration also will apply during this phase, but may be somewhat greater. Increased drilling activity will increase the amount of noxious gases and particulate matter introduced into the air. If the wells contain hot water, they are shut-in and no gas is allowed to escape. The wells remain shut-in until they are placed in production.

(d) Production

The production phase will be the time of the greatest activity in a geothermal field. Particulate matter and noxious gases will increase on a localized basis. Pipelines, electric transmission lines, additional production wells, and power plants will be needed to produce and transport electricity. Houses, hot houses, canneries, etc., may also utilize geothermal heat in a direct form.

Vehicles and associated machinery release particulate matter and noxious gases into the air during the construction phases. The construction period may run from a few months for pipelines and powerlines, to approximately 2 years for a power plant.

Long term pollution may come from the production wells and power plants themselves. In dry steam systems, steam and non-condensable gases may be released into the atmosphere. If a plant is shut down for repairs, the steam and associated non-condensable gases may be vented to the atmosphere before reaching the plant.

Hydrogen sulfide is the dominant non-condensable gas released into the atmosphere at the Geysers. This, and other gases, may cause long term air pollution, but methods are being tested at the present time in the Geysers to prevent these gases, especially hydrogen sulfide, from escaping into the atmosphere.

In hot water systems, bleed-off is not generally required for the wells. The hot water is brought to the surface, the steam and hot water are separated, the water reinjected into wells or placed in evaporation ponds, and the steam is used in the power plant. Non-condensable gases may be introduced into the air at the power plant and evaporating ponds.

Dry rock systems are still in the experimental states. No data are available regarding their development and effect on air quality at this time. By the time this field is developed, technology may have greatly eliminated air pollution.

Radiological contaminants and non-ionizing radiation may become a problem. Radiological isotopes are used as tracers and are introduced into the reinjection wells at the Geysers to study the reservoir characteristics. None of these isotopes have been recovered as yet. If they ever circulate through the reservoir and escape into the atmosphere from the production wells before the isotopes can be recovered, problems may result.

Non-ionizing radiation may present a problem if a number of high voltage lines (500 KV or larger) are required to transport electricity to population centers. The radiation may dwarf plant species or cause a considerable amount of discomfort to those people and animals that are in close association with the powerline.

If electricity is not produced, green houses, hot houses, canneries, etc., may be constructed to utilize the geothermal resource. The construction activities should be somewhat isolated. A reduction in the number of pipelines may result and no power lines will be required. A desalination plant may be required to purify the water before it is used in certain instances. These activities should have less impact upon the air quality than electrical production.

(e) Close Out

Air pollution should decrease drastically when all activities cease. No more hydrocarbons from vehicles associated with geothermal resources and no more non-condensable gases will be released into the atmosphere. Particulate matter (dust) will remain a problem unless all disturbed areas are successfully revegetated.

(2) Land

(a) Pre-lease Exploration

Impacts due to erosion will be greatest in areas where the vegetation is disturbed or destroyed. Existing roads will be used as much as possible and should be adequate through much of the exploration program. Off-road use definitely will result, but should be minimal.

(b) Post-lease Exploration

Post-lease exploration programs, because of their nature, will be more disturbing to the environment than pre-lease exploration programs. Existing roads, in most cases, will be adequate for the movement of heavy equipment needed for deep exploration holes. Some unimproved roads will be graded in order to move the equipment to the drill site. Once a drill site is established, a strip of vegetation

approximately 29 square meters (650 square feet) will be removed for the placement of a drill pad. Exposure of the soil by the removal of vegetation will allow for increasing erosion. If mud is used during drilling operations, large retention pits will be constructed. Possible oil spills from the drilling rig or vehicles could contribute to soil pollution.

Flash flooding is always a potential hazard. The flooding of the playas in the fall season may also impair exploration operations.

(c) Development

Impact on soils will be essentially the same in this phase as in the exploration phase. During this phase of operation, some areas will receive greater impacts than others. Alteration of soil depth and structure will result from the removal of soil during the construction of pits to hold water from test wells. Little damage will occur to soil where pipelines and transmission lines are constructed. Removal of vegetation for the construction of such features will allow for increasing amounts of erosion. Construction of buildings (i.e., green houses, etc.), also will alter soil characteristics, but should have little effect on increasing erosion. If power plant construction is feasible, an area of approximately 2 hectares (5 acres) will be cleared and leveled. This will expose additional soil to erosion and compaction.

(d) Production

Drill rigs, pipelines, powerlines, power plants, greenhouses, and other similar constructions, including roads, could continue to be developed until the geothermal reservoir is depleted. These developments should have the same impacts upon the soils as discussed in the development phase.

(e) Close Out

Removal of surface equipment, again, will disturb soils and vegetation. By the time of abandonment, however, rehabilitation may be advanced to the state where this southwestern desert environment can be reseeded with favorable and predictable responses.

(3) Water

(a) Pre-lease Exploration

No significant impacts.

(b) Post-lease Exploration

Exploration drilling for geothermal resources should have little effect which would change water quality in the assessment area. Since the assessment area lacks surface water, the potential pollution of these waters can not be significant.

During drilling operations, casing can be cemented within the ground water zone in order to prevent leakage of hot brines into the ground water (GRO Order No. 2). The geothermal reservoir may be contaminated by drilling mud.

(c) Development

Ground water pollution may increase during this phase. Continued depletion of geothermal brines may cause shallow and deep subsidence and associated seismicity. If water were to be withdrawn in large quantities, the water table could drop.

(d) Production

During the production state, it is possible that the ground water level may be lowered below existing irrigation wells and that ground water may become contaminated. ReInjection of waste water will be dependent upon geologic conditions. With the withdrawal of fluids, seismic activity may increase. ReInjection of the fluids could possibly act as a lubricant, which may tend to increase the rate of seismicity.

(e) Close Out

Once the wells are capped and the withdrawal of thermal fluids has ceased, no more impact on the ground water would be anticipated.

b. Living Components

(1) Vegetation

(a) Pre-lease Exploration

i. Aquatic Plants

No significant impact.

ii. Terrestrial Plants

Most pre-lease exploration will be confined to existing roads and trails; however, some off-road activity may occur. Some vegetation may be crushed or broken from off-road vehicle use.

Temperature gradient holes cover an area of about 31 square meters, (100 square feet). The vegetation on these sites will be trampled by the equipment or covered by drill cuttings. These sites are usually associated with roads, thus a very small amount of disturbance will be produced.

(b) Post-lease Exploration

i. Aquatic Plants

No significant impacts

ii. Terrestrial Plants

The off-road activities during post-lease exploration will intensify. Usually, tires crush or break off portions of plants. Future road developments may result in the clearing of this vegetation and the shaping, compacting, and sloping of the soils.

Small mobile drilling rigs do not need a cleared area due to the compact size of the rig. These small rigs usually drill shallow holes which take less than a day to complete. Some vegetation will be damaged or destroyed in the immediate area needed for these activities.

Large drill rigs used in drilling geological and exploration wells require a level drill pad. These areas will be completely cleared of vegetation. The intense activities around the drill rig will restrict vegetative regrowth.

Fluids that inhibit vegetative growth may be used in any of the drilling operations, but such fluids will be confined within the mud pit, mud sump, and the drill hole. Oils and greases are also used at the drill sites. Normally, neither drilling fluids nor oils and greases will reach vegetation. If accidentally spilled onto vegetation and not cleaned up promptly, these substances can eliminate the plant life affected, however, many precautions can be taken to prevent this.

(c) Development

i. Aquatic Plants

No significant impacts.

ii. Terrestrial Plants

Vegetation will be removed from drill pads and roads. The impacts imposed upon vegetation by drilling rigs are discussed in the post-lease exploration section. Drilling will

be likely to continue until the field is fully developed, thus, each drill pad will increase the total impact upon vegetation within the leased area.

The hot water may have impacts upon the vegetation. These waters will probably contain a number of soluble compounds. Some of these compounds, such as excessive amounts of sulfur, boron, or others, will inhibit plant growth. This solution may escape from the development well during drilling and testing; however, many precautions can be taken to prevent this.

Certain non-condensable gases may be released into the atmosphere from steam and hot water systems. Some of these gases will affect vegetative growth. Hydrogen sulfide, carbon monoxide, and other gases will be absorbed into plant tissues and may, temporarily, inhibit some plant growth.

The small residential communities within the area will increase in population. People moving into these areas may consider collecting some of the vegetation in the adjoining area. Problems also may develop with the introduction of exotic plant species. These exotic species may become established, invade and take over range lands in poor condition, thus reducing the forage production of that area markedly.

Exotic plant species (leafy spurge, *Euphorbia esula*, and delmation toadflax, *Linaria dalmatica*) were introduced into the Pacific northwest as ornamental plants. Plant seeds were carried by various means (wind, birds, etc.) to other locations, deposited and became established. These plants spread very rapidly in areas where range condition was poor. Both plants are somewhat palatable, but considerably decreased the forage production of that site. Also, grazing stimulates growth. Leafy splurge can be controlled with sprays over a 3 year period, which is very costly. At the present time (1974) there is no control for dalmation toadflax. Therefore, care must be taken to safeguard against the reoccurrence of this type of introduction.

(d) Production

i. Aquatic Plants

No significant impacts.

ii. Terrestrial Plants

Vegetation will continue to be impacted to some extent as long as any activity associated with geothermal development remains in this area. Pipelines will be needed to carry the energy source to the power plant or agricultural processing

facilities. Power plants, transmission lines, and/or agricultural facilities must be constructed before the geothermal energy can be utilized.

Pipelines connect the producing wells to the power plant, and in the construction activities, vegetation will be either damaged or destroyed. The rights-of-way for pipelines are usually cleared of vegetation and a maintenance road parallels each pipeline. Once a pipeline road is constructed, activities will be conducted on the maintenance road and on portions of the pipeline that need attention; therefore, vegetative regrowth will be hindered by this continued use of the area. Pipelines may leak or break and bleed off from the wells, or other accidents may introduce into the soils toxic compounds that hinder plant growth.

Power plants will be constructed in specific areas, and vegetation will be removed from 2 to 4 hectares (5 to 10 acres) of land. The constant activities around these plants will curtail the regrowth of vegetation. Also, soil sterilants may be placed upon the soils to eliminate vegetation which might become a fire hazard.

Transmission lines will be required to transport electricity from the power plants to population centers. The construction of these lines will disturb the vegetation within the powerline right-of-way. Large vehicles will be needed to transport and erect the materials needed in powerline construction. A bladed road for the maintenance of the power line may result, causing further vegetative disturbance.

Each activity within the production phase will require a road. These roads may be trails used once during an activity, or improved roads to well heads, pipeline, power plants, powerlines, etc. This large network of roads will disturb a considerable amount of vegetation.

If agricultural growing and processing facilities are constructed, vegetation will be impacted. This industry, however, should actually increase the vegetative production of the area. Undesirable vegetation or low producing crops may be replaced by higher yielding crops. Water may become available for uses other than crop production. Thus, the whole way of life may change from livestock ranching to crop production.

(e) Close Out

i. Aquatic Plants

No significant impacts.

ii. Terrestrial Plants

Vegetation will be impacted again in the

close out phase. Each drill pad is rehabilitated when the well is abandoned. When the geothermal field is completely abandoned, all of the surface and subsurface installations will be removed. Any further disturbance during clean up operations should be rehabilitated either naturally or mechanically.

(2) Animals

(a) Pre-lease Exploration

The "casual use" phase of pre-lease exploration, as defined in the Introduction (p.11), should cause little or no significant impact. The temporary presence of human activity (one or two individuals), should cause no deleterious effect to existing animals or their habitat.

The "exploration operations" phase of pre-lease exploration may result in temporary, local, specific site impacts. The magnitude or extent to which animals and their habitat will be affected cannot be fully evaluated at this time since the locations and number of roads, trails, and drill sites, as well as the number and types of vehicles and number of operating personnel is not known.

Variances in vegetative composition and density, topography, water availability, etc., result in comparable variances in animal species distribution, diversity, and density. The magnitude and severity of impacts also may be expected to vary from location to location within the assessment area because of these ecological phenomenon. The relative significance of impacts also will vary between animal species (e.g., species of common occurrence vs species of endangered or threatened classification (Endangered Species Act, 1973).

i. Aquatic Animals

The overall probability of impact is minor, however, the degree to which aquatic animals may be impacted will vary depending upon the proximity and duration of such activity to existing waters and adjacent shorelines. Aquatic animal life will be influenced by any changes in the availability of water and vegetation. Animals of prey, in turn, may be influenced by any changes in the availability of prey species which are associated with water.

Vehicular travel, drilling operations, and other associated activities may cause some temporary displacement and harassment. If such activity were to occur during the nesting season, nests may be abandoned or destroyed and potential reproduction lost. Some species,

such as the killdeer, are flexible in their habitat needs and, therefore, could find suitable habitat elsewhere within the assessment area. Other species, such as the white-faced ibis or Mexican duck, are more specific in their needs, and would be more seriously affected because other suitable habitat is not readily available.

Although the San Simon Cienega Mexican Duck Habitat Development Area has been withdrawn, exploration within the proximity of the periphery of this area could seriously jeopardize breeding and nesting activity as well as duck resting and loafing. The Mexican duck has been categorized as a relatively secretive species, unable to withstand prolonged disruption, and therefore, presumably requiring extremely calm conditions (Davis and Beville, 1970).

ii. Terrestrial Animals

The probability of significant deleterious impacts should be minor if such activity is confined to existing roads, however, travel over undisturbed terrain can cause seriously harmful effects to some animal species. Any concentrated or long term traffic may affect both breeding and nesting activities. Bird nests constructed in low growing shrubs, young birds, and species which have greatly reduced mobile abilities may be destroyed by surface vehicles traveling cross-country during this exploration phase.

Off-road vehicular travel and drilling operations could result in the loss of valuable food and/or cover for various animal species and the possible loss of animal life. The magnitude and severity of such loss will depend upon the location of such activities and the relative importance of these areas to the sustenance of animal species occurring there, as well as the relative importance of the impacted species (e.g., game animal, endangered or threatened species, furbearer, etc.).

Such activities within the South Peloncillos could significantly impact important habitat of the Coues' whitetail deer, mule deer, coatí, javelina, the endangered (State) Sonoran coachwhip snake and bunchgrass lizard. Exploration within the Central and North Peloncillos could significantly affect the habitat and life of the (State) endangered Gila monster and Arizona coral snake. The habitat of the mule deer, javelina, and Gambel's and scaled quail could be affected. Comparable impacts to mule deer, javelina, quail, and various reptiles could be expected within the North Animas and Pyramid Mountains.

Within the Animas Valley proper, moderate impacts upon terrestrial habitat and associated species may occur. The agricultural-riparian areas identified would receive the greatest impact. Such areas are extremely valuable to wildlife. During the exploration phase, local sites of riparian habitat could be altered substantially. Constructed drainage crossings, or any drilling occurring within drainage bottoms

could result in the destruction of important vegetation as well as the disturbance of the soil substrate, disrupting and destroying various soil dwelling organisms. Agricultural areas, although man-caused and man-controlled, are extremely enticing to many forms of wildlife. The ecotone created results in additional diversity in animal life; however, exploration within these areas more than likely will be confined to existing roads and trails so that crop damage will not result. Nevertheless, species may be run over by vehicles in addition to their temporary disturbance and/or displacement due to the activity.

The grassland, mesquite, and creosote types comprise the remaining vegetative communities within the Animas Valley. The burrowing owl and Baird's sparrow (State endangered species) are dependent upon the grassland type. In addition, a few antelope, numerous rodents, and associated birds of prey all depend upon this community for sustenance.

The mesquite type supports numerous rodents, reptiles, and associated birds of prey. The uncommon pyrrhroloxia and the endangered varied bunting are also associated with this type.

The creosote type is the least productive in terms of total biomass; however, habitat for various small rodents, reptiles, and birdlife is provided.

Exploration operations within these areas could result in the loss of limited vegetation in addition to the temporary displacement, harassment, and possible loss of animal life.

Throughout the assessment area, water is a highly limiting component for many animal species. Any alteration in the availability of this essential, life sustaining component could result in devastating effects to associated, dependent animal life.

(b) Post-lease Exploration

Post-lease exploration utilizes many of the same methods indicated during pre-lease exploration; however, all activities will be greatly intensified. Off-road vehicular use; road and trail construction; drilling duration; and site disturbance will all increase. Corresponding increases in the impacts upon animal species and their habitat may occur. However, the amount of acreage involved in post-lease exploration usually is considerably smaller than in pre-lease exploration; therefore, the total impact may be no greater than, or possibly less than that from pre-lease exploration.

(c) Development

Impacts associated with development will be similar to those during exploration with the exception that they will be greatly localized and involve less acreage; and have even greater concentration and intensity. With goals of permanency, intensified road construction, drilling site preparation, and drilling activity will occur. The immediate sites associated with this phase will require permanent clearance of all vegetation. The disturbance and destruction of animal species and habitat will occur.

(d) Production

Construction of power plants and related facilities and/or construction of other facilities (greenhouses, etc.) to utilize the geothermal energy may take place. Permanent vegetative clearance will be required at the immediate sites of certain facilities. Additional animal species and their habitat may be lost. The rehabilitation of disturbed sites associated with the exploration and development phases should occur during the production phase. Eventually, partial revegetation may occur.

As indicated previously, the ultimate impacts resulting from this phase will depend upon the location of the activities associated with the development and production phases. Based upon available information, impacts of greatest significance, in descending order of consequence, would be associated with the San Simon Cienega; Peloncillo, North Animas, and Pyramid Mountains; and the riparian communities located within the Animas Valley.

Immediate and cumulative impacts associated with an increase in population will have wide-ranging effects upon wildlife species and their habitat. The increased population related to development of geothermal resources in conjunction with the expansions and increases associated with the Phelps-Dodge plant may cause an increased degradation of the wildlife resource on a wide-ranging basis. Animal species and their habitat will be greatly affected as the result of indiscriminate shooting, poaching, increased legal harvests, increased ORV activity causing harassment and potential destruction, or other unforeseeable actions. As indicated above, such activities could result in added impacts if they occurred within the San Simon Cienega; Peloncillo, North Animas, and Pyramid Mountains; and the riparian community within the Animas Valley. The impacts associated with people will not stop at the boundaries of the assessment area. Several other areas exhibiting important and unique biota also may be affected. Included will be Animas Mountains, Guadalupe Canyon, the Big Hatchet and Alamo Hueco Mountains, and the Gila River, as well as the Chiricahua Mountains in Arizona. Although the relative concentrations of people may be less because of the distance from their point of origin, the impacts within the area located outside the assessment area may be

equal to or greater than those occurring within the assessment area. Numerous species of endangered, threatened, peripheral, and status undetermined classifications occur within these areas in addition to species of common, uncommon and rare occurrence.

(e) Close Out

During close out, intensified activity may result in noise and activities that might cause some harassment to animal species; however, the complete removal and elimination of the intrusions created by man and the subsequent rehabilitation of all disturbed sites, should result in at least a partial restoration of habitat. Increased water, cover, forage, and living space should occur.

c. Ecological Interrelationships

(1) Pre-lease Exploration

No drastic changes in succession, food relationships, or community relationships will occur during this phase. Slight changes may take place at isolated locations where exploration activities occur.

(2) Post-lease Exploration

Changes in succession, food relationships, and community relationships may occur as the post-lease activities increase. Water, which is a limiting factor within the desert, may become much less available. If water becomes more limited, plants and animals within the area will suffer. Noise and the actual presence of man within the area will disrupt and displace a number of animal species. The destruction of plant species is related to the amount of surface disturbed. The disturbed surface becomes susceptible to erosion or invasion by other plant species, either enhancing or degrading the area.

(3) Development

The impacts to succession, food relationships, and community relationships will intensify during the development phase. These impacts are the same as those discussed in the post-lease exploration section, and will be greater due to the increased activity.

(4) Production

Impacts to succession, food relationships, and community relationships will intensify during the production phase. These impacts are the same as those discussed in the post-lease exploration section. The construction of the various facilities will be localized, but the activities will produce certain impacts throughout the leased area.

Water may become more available during the production phase. This water may be used in the agricultural areas of the Animas Valley. The water may be stored in earthen reservoirs before it is transported to agricultural areas. If water becomes more readily available, plants and animals which rely upon more available water may move or be introduced into the area. This invasion may be beneficial in that more diversified plant and animal communities may become established; however, the increased water may attract plant species that are detrimental to the area. These species may include noxious and/or poisonous plants, thus upsetting the trends of various plant communities.

(5) Close Out

Succession, food relationships, and community relationships may be enhanced or hindered with the close out of a geothermal field. If water is readily available, and is then eliminated during close out, many plant and animal species will move or die out due to the lack of water. The area then may revert toward the condition it was in before any activity began. The removal of facilities and the presence of man may also produce a situation what is more compatible with certain plants and animals. The plant species used in revegetation activities may enhance the present situation and bring the plant community closer to a climax community.

Abiotic (low rainfall, high soil temperatures, sandy moving soils) and biotic (lack of vegetative cover, poor germination) factors produce a situation which does not support revegetation; however, technology in this field may change in the future.

d. Human Interest Values

(1) Landscape Character

(a) Open Space

Open space is an area which provides minimum obstruction to movement and sight. The New Mexico Environmental Institute (Dick-Peddie, 1974) appraised the open space situation in the southwest desert of New Mexico as a distinctive scenic feature. The proposed geothermal lease area has many man-made intrusions affecting open space. The effects, however, are localized because of the vastness of the area with sight distances up to 80 kms (50 miles).

Generally, natural, as opposed to man-made, features do not intrude open space except on a localized basis. The feeling of spaciousness is affected when the ability to see the horizon is restricted by natural or man-made structures. The Peloncillo Mountains on the west side of the assessment area and the Pyramid Mountains and Burro Mountains on

the east side form horizons that can be seen from great distances. Views from within the mountains are restricted by the canyon walls and vegetation as opposed to man-made structures.

The remainder of the area is made up of alluvial valleys and low rolling foothills. Open space will be affected by structures on a very localized basis.

i. Pre-lease Exploration

Temporary intrusions, particularly those facilities and units necessary for geothermal pre-lease exploration, are considered detrimental to the open space characteristics of the area on a temporary basis only.

ii. Post-lease Exploration

Post-lease exploration is similar to pre-lease exploration, but would influence open space to a greater degree because it could be expected to continue during the development and production phases. This exploration will become a part of the total intrusion, but in itself, is temporary.

iii. Development

Drilling rigs will become a fixture located at the well head for the duration of the drilling process. Usually, the process of drilling a well lasts less than 90 days (Union Oil Co. pers. comm., 1974). One company may employ only one, two, or three rigs, depending upon the availability of rigs. The requirement that several wells are needed to support one generating plant implies that the process of drilling wells in an on-going activity continuing over an extended period of time, even though the rigs would be working in various locations. Under this concept, the development process and the equipment required will intrude the open space.

Potential field development, which could result in the construction of several plants, would require that drilling continue until the field is fully developed. Therefore, the intrusion to open space by the drilling phase can be considered equivalent to the life of the production phase and a part of the total impact.

iv. Production

The production phase will begin with the construction of electric generating plants, pipelines, transmission lines, greenhouses, hot houses, etc. This work may begin as soon as

development of the field is sufficient to support such facilities. The production phase will continue for the life of the field, and it will impact open space for that period of time.

v. Close Out

The close out phase will begin sometime during the production phase. As well production declines, the wells which no longer produce will be phased out and shut down. Often a non-productive well can be replaced by a productive one close by. If not, the stature of the field is reduced. Close out can be related to the lifetime of the productive area and can be gradual, partial, or complete abandonment. Only in the case of complete abandonment, which will result in withdrawal of all fixtures, will the imposition on open space be resolved.

(b) Scenic Qualities

Scenic qualities are affected by aesthetically undesirable intrusions. One aspect of the scenery is open space. It can be concluded that any intrusions which are visible and obtrusive would be detrimental to present values. The effect of the intrusion will be less if it is intermingled with other similar structures where the natural scene has previously been disturbed. Structures contrasting with existing fixtures in shape, size, and color will have a greater effect, regardless of their location. An electric generating plant or a greenhouse situated among other large structures will not affect the general scene as much as if the building were to be located by itself in an area of greater open space. For example: if an electric power plant were to be located among farm buildings or other structures, or in the proximity of a community, it will be less obtrusive than it would be if it were located in an open field or in native pasture lands.

The presence of man-made structures invades the natural scene. Often the feature is acceptable aesthetically, but it alters the situation. Sites within the assessment area will be changed by the construction of facilities to develop geothermal resources in relation to the stature of the location concerned. For instance, the Peloncillo Mountains, Burro Mountains, and Pyramid Mountains appear from a distance to be undisturbed by man-made intrusions. A plant complex would change the appearance of the mountains, as it also would change the untouched look of the Playas Lake north of Interstate 10, and the Lava Flow near Animas, New Mexico. Localized intrusions distributed throughout the remainder of the proposed lease area may, or may not, be detrimental to scenic quality, depending upon the opinion of the viewer.

i. Pre-lease Exploration

Pre-lease exploration should not introduce significant undesirable intrusions unless roads are constructed along hillsides. The temporary nature of the pre-lease exploration leads to the conclusion that scenic values will bear minimal influence during the process, except on a very localized basis, and then for a short time only.

ii. Post-lease Exploration

The natural scenic environment will be intruded most significantly by drilling rigs and associated activity. At this time, the general scenic situation will begin to change. The rapidity and amount of change will be dependent upon the magnitude and location of the exploration. Potentially, post-lease exploration will lead to resource development, therefore, it will contribute to the total scenic impact.

iii. Development

Development of a geothermal field usually consists of drilling wells until accumulative pressures are sufficient to support a generating plant. During this period of time, drill rigs will be moved from drill pad to drill pad. The pads will be constructed to support the rig and usually are about .4 to .8 hectares (1 to 2 acres) in size.

After the drilling is completed and the well capped, the rig will be moved to a new location. If the drilling takes place on level ground, the drill pad probably will not be noticeable to a degree sufficient to severely damage scenic values; however, if the drill pad and well head are located on the side of a hill or on the horizon, it will become a visible feature and obvious to a viewer. A series of wells produced during geothermal field development will later scenic situations, particularly in areas where the vegetation cover is sparse or where significant surface damage is required.

iv. Production

The production phase will introduce facilities required to use geothermal energy. Large pipelines carrying steam or hot water, generating plants, and transmission lines will be constructed. As these facilities are developed, the existing scene will be intruded. Curiosity arousing, eye catching aspects of the normal scenery will be transferred to the new structures temporarily until they are considered part of the normal scene. The production phase will change existing scenic characteristics of the landscape.

v. Close Out

Gradual close out of a developed geothermal field probably will not contribute substantially to restoration of the natural setting. Total close-out or abandonment of a single plant complex, or of the entire development will restore an undeveloped remote country atmosphere if all traces of man's activities are obliterated. The lifetime of a plant complex is expected to be 30 years or more. It is presumptuous to expect that a complete withdrawal or mitigation of all intrusions will be achieved, therefore, a lasting impact upon scenic resource can be expected.

Facilities located on farm lands or near other man-made developments could be removed to restore the original condition and make available additional surface for farm use, etc. Scenic conditions would then change from an urbanized, incumbered situation to a rural, farmland situation.

(c) Primitive Values

One element in the evaluation of primitive values is the degree to which an area has been intruded by man-made facilities. The Animas Valley is heavily intruded. Mountainous regions of the assessment area are less intruded, but roads, mines, ranches and support facilities can be seen throughout the region. Any action required to exploit geothermal energy will further reduce primitive values.

i. Pre-lease Exploration

Roads which may be formally constructed or made merely by driving over a surface in a manner which leaves tracks for someone else to follow will be detrimental to primitive values. Exploration of any kind which requires vehicular travel off existing roads will reduce primitive values. The larger a roadless area is, the greater the impact will be, because the opportunity for isolation will be reduced.

ii. Post-lease Exploration.

Encroachment upon primitive values will increase proportionately to exploration.

iii. Development

As development of a geothermal resource area progresses, more primitive values will be lost. Criteria for rating and establishing primitive values specifies that man's influence be minimal and capable of mitigation. The area under consideration

is moderately intruded, but contains areas of open space, natural ecosystems, and primitive appearance. An increase in man's activities will reduce such areas in size and numbers.

iv. Production

The production phase will introduce pipelines, generating plants, transmission lines, other fixtures, and people to the area, and will destroy local primitive qualities.

v. Close Out

The close out of the geothermal production area and complete removal of all traces of man's influence will be necessary to restore primitive values. (See Residual Impacts - Primitive Values.)

(2) Land Use

Crop lands in the subject area are all in private surface ownership. Some of these lands passed from Federal ownership under the Stock Raising Homesteading Act, 1916, which required that minerals be reserved to the United States. A court case in California is now pending to determine whether geothermal hot water or steam is a mineral resource or just a form of water which would accrue to the surface owner. Leasing of these lands will not be considered until a determination is final. If the determination is that the United States owns this resource, a supplement will be added to this assessment to consider the impacts which geothermal energy development and use will bring to these lands.

(a) Grazing

i. Exploration

Grazing use will be moderately impacted due to livestock disturbance caused by vehicular traffic both on and off existing roads and trails. Vegetation will be removed from new, well traveled roads and trails, and from drill pads. Water discovered during drilling may be used for livestock waters. This would be a beneficial impact.

ii. Development

Grazing will be moderately impacted in a local area during the development phase due to the loss of forage production from surface occupancy, the disturbance of animals and interruption of the ranchers' routine operations. Grazing could not

continue in the immediate area of development. If pipelines are not elevated at least 1.5 meters (5 feet) off the ground, they may present a barrier to livestock movement.

iii. Production

Impacts on grazing use will continue during the production phase as more land surface will be taken up by roads, well sites, pipelines, power transmission lines, generating facilities, and other needed facilities, until the field is fully developed. Noise, human and mechanical activities, noxious gases and fluids also will disrupt grazing use during this phase. Cattle graze near well heads at the Geysers Field, California, indicating that they are not greatly disturbed by the production activities. Nevertheless, the facilities used in the production phase will inhibit livestock movement and reduce the quantity of forage available because of surface occupancy.

iv. Close Out

Adverse impact will decrease during the abandonment of the geothermal field as the noxious elements and activity in the area decline. As roads and sites are rehabilitated, forage production should slowly increase.

(b) Rights-of-Way

i. Exploration

Rights-of-way now in use should not be impacted.

ii. Development

Rights-of-way now present will not be adversely affected because they have a prior right. Future rights-of-way will require some route adjustments if they are in conflict with development activities.

iii. Production

Present rights-of-way will probably be crossed by power transmission lines carrying power from the generators to consuming areas during the production phase. The present rights-of-way have prior rights that should be protected. There undoubtedly will be additional adverse impacts from the new lines needed to transport geothermally produced power similar to those encountered in the

operation of major powerlines of the 345 KV class. Greenhouses and related facilities will not be likely to affect rights-of-way.

iv. Close Out

The removal of pipelines, power transmission lines, roads, and other geothermal facilities will eliminate conflicts with other rights-of-way.

(c) Recreation

i. Exploration

Recreation activities will not be seriously affected because of the temporary nature of the exploration phase of development.

ii. Development

Recreation uses of the area will be adversely affected by development activities. Areas where fewer intrusions appear will be affected to a greater degree. Some access may be affected if a road to a geothermal development is closed in order to facilitate development or to protect the public or the site.

iii. Production

Present recreational use would be impacted in a manner similar to the development phase. Visitor days would probably increase due to the public interest and uniqueness of geothermal energy.

iv. Close Out

Present recreational uses of the land would not change greatly as the result of close out of the energy production. If increased populations remained in the area, there would be a constantly expanding demand for additional recreational opportunities.

(d) Urban and Suburban

i. Exploration

The urban and suburban areas will benefit slightly from new jobs.

ii. Development

The development phase will provide employment to residents and generate additional money into these communities. Should good supplies of hot water for home and industrial use be found, communities will be greatly benefited.

iii. Production

The populated areas will benefit from employment opportunities and possibly from cheaper electricity for homes and businesses. If the wells and production facilities are near communities, adverse impacts from noxious air vectors may be present. Other benefits are possible, e. g., the use of geothermal resources for home or industrial heating. The county tax base will be greatly expanded.

iv. Close Out

Any populated areas near a geothermal production field will benefit from the elimination of objectionable sounds and smells; however, it will be impacted by the loss of jobs, more expensive electric power, and loss of county tax base.

(e) Archaeological Values

i. Pre-lease Exploration

Pre-lease exploration will not be damaging to archaeological values unless the exploration inadvertently takes place on an unknown site. This probably will not happen because special stipulations in the "Notice of Intent" lessen the possibility of such an occurrence.

ii. Post-lease Exploration

Post-lease exploration will be similar to pre-lease exploration and the likelihood of damaging archaeological values is further diminished by the fact that an archaeological survey will be required prior to post-lease exploration.

iii. Development

An archaeological clearance survey will be required before development takes place; therefore, no damage to archaeological sites is expected.

iv. Production

An archaeological clearance survey will be required before installation of facilities for electrical production is made; therefore, no damage to prehistoric values is expected.

v. Close Out

Little or no additional impact can be expected. Most damage, if any, will be anticipated during the development and production phases.

(f) Other Scientific Values

i. Exploration

Other scientific values will be adversely affected if exploration takes place in sensitive areas, although severe impacts are not probable during this phase.

ii. Development

Migratory birdlife will be significantly impacted and probably will discontinue use of local areas under development. The scenic beauty of these areas will also suffer.

It is now known whether there are nearby areas which could be satisfactory substitute habitat for migratory birdlife. The Coues' whitetail deer could probably migrate to the Coronado Forest areas.

iii. Production

Most of the adverse impacts will have already taken place during the development phase, however, the continuation of human and mechanical activity will delay the healing of vegetation scars and the return of rare plants and animals to the local ecosystem. Many migratory species will discontinue use of occupied areas.

iv. Close Out

There may be beneficial impacts in that botanical and zoological communities will be under less stress and will have a chance to rehabilitate themselves.

(g) Other Considerations

i. Public Utilities

aa. Exploration and Development

Public utilities will not be impacted if care is used to avoid present installations.

bb. Production

The benefit of large amounts of supplemental electric power to electric utilities in the area is obvious. Other public utilities will not be affected significantly provided that the new transmission lines are located to avoid interference problems.

cc. Close Out

The closing of a field which supplied a public power utility will force the utility company to seek an alternate source of energy.

ii. Population Centers, Planning and Zoning

aa. Exploration

Exploration activities within the planning and zoning jurisdiction of cities should have no significant affect. Planning and zoning should be conducted at this time so that development in sensitive areas will be prevented.

bb. Development

The development phase will call for the enforcement of planning and zoning regulations, if any. Some reevaluation may also be needed as more information is gained. For example, drilling may reveal production pollutants to be more or less severe than expected. A greater tax base which will benefit the county. Some city tax base will begin with development.

cc. Production

The production phase of an area will be a time for refinement of planning and zoning regulations. Counties and cities, at this time, will benefit from their experience and should revise their regulations governing undeveloped geothermal areas within their jurisdiction. The benefits of a greatly expanded tax base will be huge.

dd. Close Out

The close out phase will call for surveillance of areas for compliance with rehabilitation regulations. The tax base will be lost.

2. Possible Mitigating Measures

No geothermal leases have been issued within the assessment area on national resource lands at the present time. "Plans for Exploration" (43 CFR 3210.2(d)) are now being requested from applicants applying for non-competitive leases. Once the "Plans of Exploration" are received and reviewed, approval will contain measures in the form of stipulations to mitigate impacts produced by geothermal developments within the area.

When the lease is issued, post-lease exploration will commence only after a "Plan of Operation" is submitted and approved on each competitive and non-competitive lease. The geophysical surveys are approved after a "Notice of Intent to Conduct Geothermal Resource Exploration Operations" has been received and approved by USGS and BLM. Surface protection stipulations as well as proper operational procedures will be attached to the "Notice" to mitigate any impacts.

Each well site will be examined by the USGS, BLM, and the lessee, and a "Permit to Drill" will be issued before any drilling can begin. The impacts will be discussed and mitigating measures will be proposed to protect the environment during the field examination. The USGS will write an Environmental Analysis (EA), and will include all stipulations that are needed to protect the environment. After BLM and USGS approval, a "Permit to Drill" with attached stipulations will be sent to the lessee.

In the event operations deviate from the approved "Plan of Operations," a new plan must be submitted and the process repeated.

A "Plan of Development," which covers all activities within the development phase, must be submitted, an EA written, and the plan approved by USGS and BLM before any activity can commence. Again, stipulations are attached to the plan in order to protect the environment.

The production phase will require various permits beyond the bounds of a geothermal lease. Permits, or rights-of-way, will be necessary before pipelines, transmission lines, roads, power plants and/or agricultural processing facilities can be constructed on the national resource lands. Environmental Analysis Records (EAR's) will be written on each project by the BLM before any activity begins. Mitigating measures in the form of stipulations will be attached to each permit or right-of-way.

A supplemental "Plan of Development" is presented to the USGS and BLM on any facilities outside of drilling activities. The USGS

then writes an EA, submits it to the GEAP, and then BLM and USGS jointly approve the "Plan."

Once the leases and permits are issued, a working agreement between USGS, BLM, and the lessee or permittee should effectively mitigate impacts and provide for examination of facilities during compliance checks.

The lease contract and the various permits do contain many stipulations, however, other mitigating measures may be attached to the specific approved document to mitigate specific site impacts. These practical and reasonable measures may include, but are not limited to the following:

a. Fencing of the Operation

Any excavation, hazardous area, or modification to a fence associated with or as a result of geothermal development must be fenced or otherwise acceptable to the Authorized Officer.

b. Compatible Multiple Use of the Surface

Where compatible with operations conducted by the lessee, the area included in the lease shall be available for other public uses, including but not limited to: livestock grazing, hunting, camping, and hiking.

c. Livestock

Grazing and resting livestock will not be unnecessarily disturbed.

d. Grazing Permittees

The BLM grazing lessee or permittee shall be informed of the approximate starting and completion dates for any geothermal related activity.

e. Road Construction

All proposed permanent and temporary road construction will be designed to meet the needs of industry and at the same time fit management and environmental needs. These roads must meet all BLM specifications for road construction, sloping, and drainage. All roads will remain open to public use except where access is hazardous to the public or the facility.

f. Protection of Improvements

Appropriate care shall be taken to protect any improvement whether it belongs to the BLM or the private landowner.

g. Gates and Cattleguards

The location of new gates or cattleguards on Federal land must be approved by the Authorized Officer and meet all of BLM's specifications for such projects.

h. Water Bars

Water bars are required to properly drain roads and uphill slopes associated with any geothermal development to the approval of the Authorized Officer.

i. Surface Damage

Surface damage which may induce soil movement and/or water pollution, whether during or after construction, shall be corrected.

j. Surface Disturbance

The lessee shall effect a minimum of vegetation or soil disturbance consistent with practical construction operations and shall smooth all disturbed areas to conform as nearly as practicable with the adjacent terrain.

k. Restoration of Disturbed Areas

After the construction has been completed on an area, the area will be rehabilitated to the extent acceptable to the Authorized Officer and may vary from just reshaping to complete seed bed preparation, seeding, and fertilization.

l. Disposal of Solid and Liquid Wastes

Solid and liquid wastes from all geothermal activities will be disposed of in a manner acceptable to the Authorized Officer.

m. Consideration of Aesthetic Values

To the maximum extent feasible, existing aesthetic, scenic, and natural beauty values inherent in the area will be considered in the planning, construction, and operation of all activities under these leases. This includes the location of roads, excavations, facilities, etc. Where reasonable alternatives are available, the alternative involving the least damage as determined by the Authorized Officer, to these values will be selected. Permanent structures will

be painted a color or colors having a dull or non-reflective finish that will harmonize with the natural setting.

n. Air Quality

Air quality shall be maintained at the present quality, or to standards which meet or exceed State and Federal standards, whichever is greater. In addition to meeting State and Federal standards, the Authorized Officer may impose further requirements to meet special conditions.

o. Dust

Dust is considered an air pollutant, and every effort must be made to minimize dust problems. Where necessary, sprinkling or other means of dust control may be required on roads and trails.

p. Use of Impounded Water

The use of existing impounded water located upon public land will not be permitted unless by specific written agreement between the lessee or his representative and the Authorized Officer

q. Water Pollution Control

The lessee will conduct construction work, operation, and maintenance in a manner to prevent pollution of, or degradation of the quality of water. Toxic material shall not be released in any water drainage. All construction work and subsequent use of the lease must be consistent with Federal and State water quality standards and public health and safety standards.

r. Noise Pollution

In the absence of specific noise pollution standards, the lessee is responsible for keeping noise at or below levels safe and acceptable for humans and animals.

s. Protection of Possible National Historic Sites

Executive Order 11593, May 13, 1971 (26 Fed. Reg. 95, May 15, 1971, pp 8921-8923) requires that historic sites be preserved, pending designation on the National Register of Historic Places. The lessee shall bring to the attention of the Authorized Officer any site on the lease which may be of historic significance. The site shall not be disturbed in any manner pending investigation by BLM of its significance.

t. Production Water

Production water that is saline or otherwise considered

deleterious to public health or aquatic life will not be drained into natural drainages or onto the surface of the land, but will be disposed of by methods approved by the Authorized Officer.

u. Endangered Wildlife

A wildlife biologist shall be engaged by the lessee to ensure that no endangered or threatened wildlife species are present on the leased land that will be jeopardized (Fed. Reg., Vol. 40, No. 78, Tuesday, April 22, 1975).

v. Endangered Plants

A botanist shall be engaged by the lessee to ensure that no endangered or threatened plant species are present on the leased land that will be jeopardized (Fed. Reg., Vol. 40, No. 78, Tuesday, April 22, 1975).

w. Archaeological Sites

Prior to undertaking any ground disturbing activities on lands covered under the provisions of the lease, the lessee shall engage the services of a qualified archaeologist, acceptable to the Authorized Officer, to conduct a thorough and complete survey of areas to be disturbed for evidences of archaeological or historical sites or materials.

x. Soil Sterilants

Soil sterilants should be restricted from use on national resource lands administered by BLM.

y. Water Sampling

If, at any time, animals are found dead or other situations indicate that certain waters are hazardous to public safety, water samples will be taken and analyzed to the approval of the Authorized Officer, after which the water will be disposed of in a proper manner.

3. Alternatives

a. Limit the leases to areas which are not environmentally sensitive until geological information is gained to determine geothermal resource potential for the remainder of the area.

Most interest shown by industry is in areas where the natural environment has been disturbed by roads, farms, and the communities of Animas and Cotton City, New Mexico. If these lands are leased first,

exploration would indicate whether geothermal resource potential is sufficient to warrant leasing additional lands.

The Peloncillo Mountains north of Interstate Highway 10 and the North Alkali Flats (playa) are areas where environmental intrusions are minimal. If these lands are withheld from leasing until a determination is made as to the potential for resource production in the area, the alternative is an acceptable alternative and should be implemented.

If indications show that the potential for geothermal resource production in these areas is sufficient, based on results of exploration on previously leased lands, the withheld lands could then be leased.

b. Withhold the entire area from leasing until further information is gathered.

Geothermal energy has proven to be a source of power for operating electric generating plants. The Lightning Dock Area appears to contain this type of energy. To delay the proposed action while awaiting additional environmental, geologic, and technologic information would probably mean a delay of years. A lengthy delay of this kind would be inconsistent with national policy to develop energy sources and it also would delay needed technology.

Environmental intrusions can be minimized by cooperative efforts to mitigate undesirable situations.

c. Do not lease any of the Area.

Geothermal resources can contribute substantially to the overall demand for energy. To decline to lease would not be in the best interest of the nation and would be contrary to the President's second energy message and the Steam Act.

4. Recommendations

The following suggested measures are intended to form the basis for special lease stipulations which could supplement standard lease requirements contained in Form 3200-1 and the general terms and conditions in the Code of Federal Regulations 43 CFR 3204.0-8 and 30 CFR 270.34-47. General stipulations covering such topics as prevention of air and water pollution, noise abatement, aesthetic considerations, etc., are discussed in the Geothermal Regulations and GRO Orders 1-4.

All national resource lands in which the United States holds the surface and mineral estates within the Lightning Dock Geothermal Assessment Area are available for leasing with the following exceptions (Fig. 13):

a. The San Simon Cienega Mexican Duck Habitat Development Project, which is withdrawn from mineral entry and leasing, should be additionally protected. The following lands may be leased with no surface occupancy for geothermal related activity.

T. 25S., R. 21W., NMPM

Sec. 19: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$
30: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$
31: Lots 1-2, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$

T. 26S., R. 22W., NMPM

Sec. 1: E $\frac{1}{2}$ E $\frac{1}{2}$

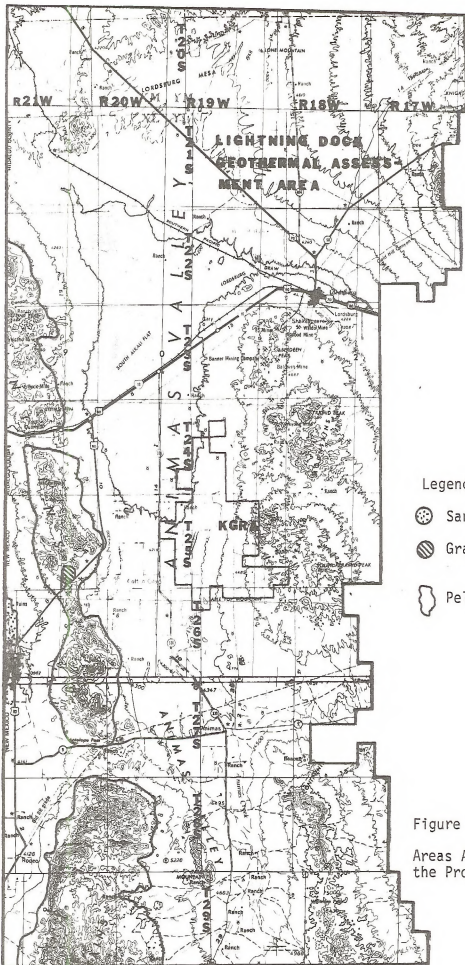
T. 26S., R. 21W., NMPM

Sec. 6, 7, Lots 1-7, SE $\frac{1}{2}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$
Sec. 18: E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$

b. The Granite Gap Recreation Area has been withdrawn from mineral entry and leasing; therefore, no leasing will be allowed on the following lands:

T. 25S., R. 21W., NMPM

Sec. 26: SE $\frac{1}{4}$
Sec. 27: S $\frac{1}{2}$
Sec. 34: N $\frac{1}{2}$
Sec. 35: NW $\frac{1}{4}$



Legend




-  San Simon Cienega
-  Granite Gap Recreation Area
-  Peloncillo Mountains

Figure 13

Areas Associated with
the Proposed Recommendations

c. The Peloncillo Mountains contain a number of endangered and threatened wildlife species protected by the State of New Mexico. The area has potential for certain wildlife species found on the Federal list. The Peloncillo Mountains may also contain a number of endangered and threatened plant species, a Federal list is presently being compiled. For these reasons, special stipulations are needed as follows: "Before each soil disturbing geothermal activity covered by a 'Notice of Intent,' 'Plan of Operation,' or 'Plan of Development,' commences on the leased lands within the Peloncillo Mountains, a field examination of the site will be conducted by the Authorized Officer and the Area Supervisor, or their representatives. This examination will place emphasis on the rare and endangered plant and animal species present in the Peloncillo Mountains, and at the same time, consider the impacts on other natural resources. Relocation of some operations may be required." This stipulation should be attached to geothermal leases within the Peloncillo Mountains as follows:

T. 22S., R. 21W.

- Sec. 17: SW $\frac{1}{4}$ (State Surface) (Federal Minerals)
- Sec. 18: Lots 2-4, SE $\frac{1}{2}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ (Private surface)(Federal Minerals)
- Sec. 19: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, W $\frac{1}{2}$ E $\frac{1}{2}$ (Federal surface and minerals)
E $\frac{1}{2}$ E $\frac{1}{2}$ (Private Surface)(Federal Minerals)
- Sec. 20: W $\frac{1}{2}$ E $\frac{1}{2}$, W $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 28: SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 29: All (Federal surface and minerals)
- Sec. 30: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 31: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)

T. 23S., R. 21W.,

- Sec. 4: W $\frac{1}{2}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 5: S $\frac{1}{2}$, S $\frac{1}{2}$ N $\frac{1}{2}$, NE $\frac{1}{4}$ NE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 6: Lots 2-7, SE $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ Federal surface and minerals
- Sec. 7: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 8 & 9: All (Federal surface and minerals)
- Sec. 10: N $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 17: All except M.S. 1885 (40.316 & 40.316) (Federal surface and minerals)
- Sec. 18: NE $\frac{1}{4}$ (Federal surface and minerals)
N $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$ (Federal surface and minerals)

- Sec. 19: NW $\frac{1}{4}$ NE $\frac{1}{4}$ (Private surface) (Federal minerals)
- Sec. 20: All (Federal surface and minerals)
- Sec. 21: W $\frac{1}{2}$ W $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 33: S $\frac{1}{2}$ NW $\frac{1}{4}$, N $\frac{1}{2}$ SW $\frac{1}{4}$ (Private surface) (Federal minerals)

T. 24S., R. 21W.

- Sec. 3: NE $\frac{1}{4}$, E $\frac{1}{2}$ W $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 4: All (Federal surface and minerals)
- Sec. 9: N $\frac{1}{2}$ S $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 10: S $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 15: W $\frac{1}{2}$ SW $\frac{1}{4}$, E $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
E $\frac{1}{2}$ SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ (State Aid withdrawal)
- Sec. 20: E $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$ (Private surface) (Federal minerals)
NE $\frac{1}{4}$ NE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 21: W $\frac{1}{2}$ W $\frac{1}{2}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$ (Private surface) (Federal minerals)
E $\frac{1}{2}$, E $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 22: E $\frac{1}{2}$ E $\frac{1}{2}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$, W $\frac{1}{2}$ NW $\frac{1}{4}$ (Federal surface and minerals)
SW $\frac{1}{4}$, E $\frac{1}{2}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$ (State Aid withdrawal)
- Sec. 23: W $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 26: W $\frac{1}{2}$ NE $\frac{1}{4}$, W $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 27: E $\frac{1}{2}$, SW $\frac{1}{4}$ (Federal surface and minerals)
NW $\frac{1}{4}$ (State Aid Withdrawal)
- Sec. 28: SE $\frac{1}{4}$ SE $\frac{1}{4}$, N $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$ (Federal surface and minerals)
E $\frac{1}{2}$ NE $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$ (State Aid Withdrawal)
- Sec. 33: E $\frac{1}{2}$ (Federal surface and minerals)
E $\frac{1}{2}$ W $\frac{1}{2}$ (State Aid Withdrawal)
- Sec. 34: All (Federal surface and minerals)
- Sec. 35: All (Federal surface and minerals)

T. 25S., R. 20W.

- Sec. 18: SW $\frac{1}{4}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)

T. 25S., R. 21W

- Sec. 3: Lots 1-9 S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$ (Except Pat. mining claims) (Federal surface and minerals)
- Sec. 4: NE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 9: E $\frac{1}{2}$ E $\frac{1}{2}$ E $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 10: Lots 1-2, NW $\frac{1}{4}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ NE $\frac{1}{4}$, S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$ (Except Pat. mining claims) (Federal surface and minerals)
- Sec. 11: All (Federal surface and minerals)
- Sec. 12: W $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 13-15: All (Federal surface and minerals)
- Sec. 20: E $\frac{1}{2}$ E $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 21-27: All (Federal surface and minerals)
- Sec. 28: E $\frac{1}{2}$ NE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 34: NE $\frac{1}{4}$, NE $\frac{1}{4}$ SE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 35: Lots 1-5, N $\frac{1}{2}$ SE $\frac{1}{4}$, N $\frac{1}{2}$ (Federal surface and minerals)

T. 26S., R. 20W.

- Sec. 30: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$ (Private surface) (Federal minerals)
Sec. 31: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$ (Federal surface and minerals)

T. 26S., R. 21W.

- Sec. 3: Lots 1 & 4, S $\frac{1}{2}$, All of S $\frac{1}{2}$, N $\frac{1}{2}$ except patented mining claims (Federal surface and minerals)
Sec. 10: NE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 11: W $\frac{1}{2}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)
Sec. 12: SW $\frac{1}{4}$ SW $\frac{1}{4}$ (Federal surface and minerals)
Sec. 13: SW $\frac{1}{4}$, N $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$ (Federal surface and minerals)
Sec. 14: All (Federal surface and minerals)
Sec. 15: E $\frac{1}{2}$ E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 22: E $\frac{1}{2}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 23: All (Federal surface and minerals)
Sec. 24: S $\frac{1}{2}$, S $\frac{1}{2}$ N $\frac{1}{2}$, N $\frac{1}{2}$ NW $\frac{1}{4}$ (Federal surface and minerals)
Sec. 25: N $\frac{1}{2}$ N $\frac{1}{2}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$ (Private surface) (Federal minerals)
SW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$ (State surface) (Federal minerals)
Sec. 26: All (State surface) (Federal minerals)
Sec. 27: E $\frac{1}{2}$ E $\frac{1}{2}$, W $\frac{1}{2}$ NE $\frac{1}{4}$ (State surface) (Federal minerals)
W $\frac{1}{2}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 28: SE $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 34: E $\frac{1}{2}$, E $\frac{1}{2}$ W $\frac{1}{2}$ (Federal surface and minerals)
Sec. 35: All (Federal surface and minerals)

T. 27S., R. 20W.

- Sec. 6: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 7: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 17: All (Federal surface and minerals)
Sec. 18: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 19: Lots 1-3, E $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, NE $\frac{1}{4}$, N $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 20: N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$ (Federal surface and minerals)

T. 27S., R. 21W.

- Sec. 1: Lots 1-4, S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$ (Federal surface and minerals)
Sec. 3: Lots 1-7, SE $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 10: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 11-12: All (Federal surface and minerals)
Sec. 13: Lots 1-4, E $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ (Federal surface and minerals)
Sec. 14: Lots 1-4, N $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$ (Federal surface and minerals)
Sec. 15: Lots 4-5, N $\frac{1}{2}$ NE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 23: NE $\frac{1}{4}$ NE $\frac{1}{4}$ (Federal surface and minerals)
Sec. 24: Lots 1-8 (Federal surface and minerals)

T. 28S., R. 20W.

- Sec. 5: S₂S₂ (Private Surface) (Federal Minerals)
 Sec. 6: S₂, SW₂NW₂ (Private surface) Federal minerals)
 SE₂NW₂ (Federal surface and minerals)
 Sec. 7: N₂N₂ (Private surface) (Federal minerals)
 S₂N₂, S₂ (Federal surface and minerals)
 Sec. 8: N₂NW₂, NW₂NE₂ (Private surface)(Federal minerals)
 S₂, S₂N₂, NE₂NE₂ (Federal surface and minerals)
 Sec. 17: E₂E₂, NW₂NE₂, E₂NW₂, W₂W₂ (Private surface)
 (Federal minerals)
 E₂SW₂, W₂SE₂, SW₂NE₂ (Federal surface and minerals)
 Sec. 18: NE₂NW₂, N₂NE₂, S₂N₂, E₂SE₂, (Private surface)
 (Federal minerals)
 W₂SE₂, SE₂SW₂ (Federal surface and minerals)
 W₂SW₂, NE₂SW₂ (State Aid Withdrawal)
 Sec. 19: S₂S₂, N₂SE₂, E₂NE₂ (Private surface) (Federal minerals)
 W₂NE₂, E₂NW₂, NE₂SW₂ (Federal surface and minerals)
 W₂NW₂, NW₂SW₂ (State Aid Withdrawal)
 Sec. 20: N₂, N₂S₂, S₂SW₂ (Private surface) (Federal minerals)
 S₂SE₂ (Federal surface and minerals)
 Sec. 21: N₂N₂, S₂S₂ (Federal surface and minerals)
 S₂N₂, N₂S₂ (Private surface) (Federal minerals)
 Sec. 28: All (Private surface) (Federal minerals)
 Sec. 29: E₂, N₂NW₂ (Private surface) (Federal minerals)
 SW₂, S₂NW₂ (State Aid Withdrawal)
 Sec. 30: N₂N₂, SW₂SW₂ (Private surface) (Federal minerals)
 S₂N₂, N₂S₂, SE₂SW₂, S₂SE₂ (State Aid Withdrawal)
 Sec. 31: W₂, W₂E₂, SE₂SE₂ (Private surface) Federal Minerals)
 Sec. 33: NW₂ (Private Surface) (Federal Minerals)
 SW₂ (State Aid Withdrawal)

T. 28S., R. 21W.

- Sec. 1: All (Private surface) (Federal minerals)
 Sec. 10: SE₂SE₂ (Federal surface and minerals)
 Sec. 11: S₂S₂ (State Aid Withdrawal)
 Sec. 12: W₂W₂ (Private surface) Federal minerals)
 E₂W₂, E₂ (Federal surface and minerals)
 Sec. 13: N₂N₂, SW₂NW₂, W₂SW₂ (Federal surface and minerals)
 E₂SW₂, SE₂NW₂, S₂NE₂, NW₂SE₂ (Private surface)
 (Federal minerals)
 E₂SE₂, SW₂SE₂ (State Aid Withdrawal)
 Sec. 14: All (Federal surface and minerals)
 Sec. 15: N₂, E₂SE₂ (Federal surface and minerals)
 W₂SE₂, E₂SW₂, SW₂SW₂ (State Aid Withdrawal)
 Sec. 22: E₂ (Federal surface and minerals)
 Sec. 23: W₂, W₂E₂, NE₂NE₂, (Federal surface and minerals)
 E₂SE₂, SE₂NE₂ (Private surface) (Federal minerals)
 Sec. 24: S₂, E₂NW₂, SW₂NW₂ (Private surface) (Federal minerals)
 NW₂NW₂ (Federal surface and minerals)
 NE₂ (State Aid Withdrawal)

- Sec. 26: $N\frac{1}{2}$, $N\frac{1}{2}S\frac{1}{2}$, $SE\frac{1}{2}SE\frac{1}{2}$ (Private surface) (Federal minerals)
 $S\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}SE\frac{1}{2}$ (Federal surface and minerals)
- Sec. 27: $N\frac{1}{2}$, $S\frac{1}{2}SE\frac{1}{2}$ (Federal surface and minerals)
 $N\frac{1}{2}S\frac{1}{2}$, $S\frac{1}{2}SW\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 28: $NE\frac{1}{4}$ (Federal surface and minerals)
 $SE\frac{1}{2}$ (Private surface)(Federal minerals)
- Sec. 33: All (Private surface)(Federal minerals)
- Sec. 34: All (Federal surface and minerals)
- Sec. 35: All (Private surface)(Federal minerals)

T. 29S., R. 20W.

- Sec. 5: $W\frac{1}{2}$, $W\frac{1}{2}E\frac{1}{2}$, $E\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{2}SE\frac{1}{2}$ (Private surface)
(Federal minerals)
- Sec. 6: $E\frac{1}{2}$, $NW\frac{1}{4}$ (Federal surface and minerals)
 $SW\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 7: $E\frac{1}{2}$, $E\frac{1}{2}W\frac{1}{2}$, $W\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}SW\frac{1}{4}$ (Private surface)
(Federal minerals)
 $NW\frac{1}{2}SW\frac{1}{4}$ (Federal surface and minerals)
- Sec. 8: $W\frac{1}{2}$ (Federal surface and minerals)
- Sec. 17: $E\frac{1}{2}$, $N\frac{1}{2}NW\frac{1}{4}$ (Federal surface and minerals)
 $E\frac{1}{2}SW\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 18: $N\frac{1}{2}$, $SW\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 19: $N\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}N\frac{1}{2}$, $N\frac{1}{2}S\frac{1}{2}$, $S\frac{1}{2}SE\frac{1}{2}$, $SE\frac{1}{2}SW\frac{1}{4}$ (Private surface)
(Federal minerals)
 $SW\frac{1}{4}SW\frac{1}{4}$ (Federal surface and minerals)
- Sec. 20: All (Private surface)(Federal minerals)
- Sec. 21: $W\frac{1}{2}$ (Private surface)(Federal minerals)
- Sec. 28: $E\frac{1}{2}W\frac{1}{2}$, $NE\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{2}$ (Federal surface and minerals)
 $S\frac{1}{2}SE\frac{1}{2}$ (Private surface)(Federal minerals)
- Sec. 29: $SW\frac{1}{4}$, $W\frac{1}{2}SE\frac{1}{2}$, $W\frac{1}{2}NW\frac{1}{4}$ (Federal surface and minerals)
- Sec. 30: $S\frac{1}{2}$, $E\frac{1}{2}NE\frac{1}{4}$, $W\frac{1}{2}NW\frac{1}{4}$, $SE\frac{1}{2}NW\frac{1}{4}$ (Federal surface and minerals)
 $NE\frac{1}{2}NW\frac{1}{4}$, $W\frac{1}{2}NE\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 31: $N\frac{1}{2}NW\frac{1}{4}$, $SE\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}NE\frac{1}{4}$, $NE\frac{1}{2}SW\frac{1}{4}$, $NW\frac{1}{2}SE\frac{1}{2}$ (private surface) (Federal minerals)
 $W\frac{1}{2}SW\frac{1}{4}$, $SW\frac{1}{4}NW\frac{1}{4}$, $E\frac{1}{2}SE\frac{1}{2}$, $SE\frac{1}{2}NE\frac{1}{4}$
(Federal surface and minerals)
- Sec. 33: $S\frac{1}{2}$, $E\frac{1}{2}NE\frac{1}{4}$, $W\frac{1}{2}NW\frac{1}{4}$ (Private surface)(Federal minerals)
 $E\frac{1}{2}NW\frac{1}{4}$, $W\frac{1}{2}NE\frac{1}{4}$ (Federal surface and minerals)

T. 29S., R. 21W.

- Sec. 1: $NE\frac{1}{4}$, $E\frac{1}{2}NW\frac{1}{4}$, $SW\frac{1}{4}NW\frac{1}{4}$, $SW\frac{1}{4}$, $SW\frac{1}{4}SE\frac{1}{2}$ (Private surface)
(Federal minerals)
- Sec. 3: $NW\frac{1}{4}NW\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{2}$, $SE\frac{1}{2}SE\frac{1}{2}$ (Federal surface and minerals)
 $W\frac{1}{2}$, $S\frac{1}{2}SE\frac{1}{2}$, $SW\frac{1}{4}NE\frac{1}{4}$ (Federal surface and minerals)
 $N\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{2}NE\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{2}$ (Private surface)
(Federal minerals)
- Sec. 4: All (Federal surface and minerals)
- Sec. 9: All (Federal surface and minerals)

- Sec. 10: N $\frac{1}{2}$, W $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)
SE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$ (Private surface)(Federal minerals)
- Sec. 11: S $\frac{1}{2}$, NW $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$ (Private surface)(Federal minerals)
E $\frac{1}{2}$ NE $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 12: N $\frac{1}{2}$, N $\frac{1}{2}$ S $\frac{1}{2}$, S $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$ (Private surface)(Federal minerals)
SW $\frac{1}{4}$ SW $\frac{1}{4}$ (State Aid Withdrawal)
- Sec. 13: E $\frac{1}{2}$ W $\frac{1}{2}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ SW $\frac{1}{4}$ (Private surface)(Federal minerals)
W $\frac{1}{2}$ E $\frac{1}{2}$, NW $\frac{1}{4}$ NW $\frac{1}{4}$ (State Aid Withdrawal)
E $\frac{1}{2}$ E $\frac{1}{2}$, SW $\frac{1}{4}$ SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 14: N $\frac{1}{2}$ S $\frac{1}{2}$, S $\frac{1}{2}$ N $\frac{1}{2}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$ NW $\frac{1}{4}$ (Private surface)
(Federal minerals)
NE $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ S $\frac{1}{2}$ (Federal surface and minerals)
NE $\frac{1}{4}$ NE $\frac{1}{4}$ (State Aid Withdrawal)
- Sec. 15: All (Private surface)(Federal minerals)
- Sec. 21: S $\frac{1}{2}$ S $\frac{1}{2}$ (Private surface)(Federal minerals) N $\frac{1}{2}$ S $\frac{1}{2}$,
N $\frac{1}{2}$ (Federal surface and minerals)
- Sec. 22: All (Private surface)(Federal minerals)
- Sec. 23: N $\frac{1}{2}$ (Federal surface and minerals) S $\frac{1}{2}$ (Private surface)
(Federal minerals)
- Sec. 24: SW $\frac{1}{4}$, NE $\frac{1}{4}$, E $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ SE $\frac{1}{4}$ (Private surface) (Federal minerals)
W $\frac{1}{2}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ SE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 25: W $\frac{1}{2}$, W $\frac{1}{2}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ NE $\frac{1}{4}$ (Private surface)(Federal minerals)
E $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
E $\frac{1}{2}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$ (State Aid Withdrawal)
- Sec. 26: E $\frac{1}{2}$, W $\frac{1}{2}$ W $\frac{1}{2}$, E $\frac{1}{2}$ NW $\frac{1}{4}$ (Private surface)(Federal minerals)
E $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 27: N $\frac{1}{2}$, N $\frac{1}{2}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ SW $\frac{1}{4}$ (Private surface)(Federal minerals)
N $\frac{1}{2}$ SW $\frac{1}{4}$, S $\frac{1}{2}$ SE $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 28: All (Private surface and minerals)
- Sec. 33: E $\frac{1}{2}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$ (Private surface)(Federal minerals)
N $\frac{1}{2}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ SW $\frac{1}{4}$ (Federal surface and minerals)
- Sec. 34: S $\frac{1}{2}$, NW $\frac{1}{4}$ (Private surface)(Federal minerals) NE $\frac{1}{4}$
(Federal surface and minerals)
- Sec. 35: NW $\frac{1}{4}$ NW $\frac{1}{4}$, SE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$ (Federal surface and minerals)
W $\frac{1}{2}$ SW $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$, W $\frac{1}{2}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ NE $\frac{1}{4}$ (Private surface)
(Federal minerals)

Other stipulations which should be contained in each lease are:

(1) Special stipulations should be required to protect all known and unknown archaeological sites. Although the standard terms and conditions of the lease provide for archaeological values, the following additional stipulations are recommended to help insure their proper identification and protection.

(a) A qualified archaeologist acceptable to the Authorized Officer must prepare the certified statement on archaeological

values described in Sec. 18 of the Geothermal Resource Lease Form.

(b) The Authorized Officer and Supervisor retain the prerogative to require the relocation of operations to protect all archaeological values located on the leased lands, or he may require the lessee to have the archaeological site(s) excavated and salvaged by a qualified archaeologist(s) prior to proceeding with operations.

5. Residual Impacts

Residual impacts resulting from the presence of mankind will change the Lightning Dock area. Any buildings, homes, roads, or other facilities left behind from the invasion of man will impact, by their mere presence, primitive values, scenic values, and open space. The abandoned facilities may become an attraction to the variety of people who are enticed by historic ghost towns or abandoned mining camps, which have allured many curiosity seekers for years. The residual impacts on wildlife may lead to the destruction of some species and the weakening of other species. The presence of man in this area may enhance the spreading of many other species. Introduction of foreign plant species which may be compatible to the desert environment and may spread throughout the Animas Valley, may change the vegetation indefinitely. Loss of jobs and tax base due to the close out phase will also be a residual impact on the economics of the surrounding communities.

The withdrawal of thermal waters from the geothermal reservoir may allow for localized subsidence of the overlying stratigraphy, leaving a residual impact on the topography.

B. Relationship Between Short-term Use and Long-term Productivity

Historically, the lands in the proposed leasing area have been used for livestock production. In recent years, public recreation interest in the area has increased due to expanding populations and recreational opportunities available on national resource lands. Public interest is primarily confined to primitive, cultural, scenic, and open space values, and general leisure use of the lands for a variety of participant activities. Off-road vehicle use, rockhounding, and hunting are major participant uses.

Significant geothermal development throughout the potential leasing area would probably immediately affect the livestock and wildlife forage resources as well as recreational resources and opportunities on localized areas. Major effects would be reduced forage, habitat,

and recreational values, plus soil disturbance, noise, and air pollution.

Consumptive year around water use presently is confined to ground water and is used by livestock, wildlife, and ranch families. The need for water for geothermally produced electricity in this area has not been determined; however, if full scale development takes place, and is dependent upon present sources of water, these sources could be depleted.

If exploration does not result in the discovery of a significant geothermal resource, the short-term loss of grazing, wildlife habitat, recreational resources, water resources, and other values will be minimal and the long-term productivity of these resources will not be greatly affected.

C. Irreversible and Irretrievable Commitment of Resources

If a geothermal resource is fully developed and committed to the production of electricity, the resource could be exhausted completely. This would be an irreversible and irretrievable commitment of the resource. However, knowledge of geothermal reservoirs is limited at this time, and it may be that the geothermal resource is rechargeable in this area.

The primitive values, scenic qualities, and open space values of certain areas with scientific zoological value may be permanently degraded if the geothermal resource is completely developed in these areas. The natural environment of the area in general would suffer some permanent degradation because of the degree of surface disturbance and alteration.

IV. PERSONS, GROUPS, AND GOVERNMENTAL AGENCIES CONSULTED

Area Geothermal Supervisor, Conservation Division
U. S. Geological Survey

Area Geologist, Southern Rocky Mountain Area
U. S. Geological Survey

State Director, New Mexico
Bureau of Land Management

United States Department of the Interior
Fish and Wildlife Service (Albuquerque, N.M.)

New Mexico Game and Fish Department
(Gerald Gates and John Hubbard)

Dr. Dale A. Zimmerman, Dept. of Biological Sciences, Western
New Mexico University

Mr. Ken Bull, District Geothermal Supervisor

Dr. William A. Dick-Peddie, Dept. of Biology,
New Mexico State University

Sarah Jane Dodd, Sierra Club

Nan Nalder, Central Clearinghouse

David Foreman, The Wilderness Society

Thomas W. McCants

Jack Kennedy, State Land Office

Dan Nutter, Chief Engineer, Oil Conservation Commission

Ronald Barr, Earth Power Corp.

Bill Dolan, Amax Exploration

Dr. W. J. Stone, New Mexico Bureau of Mines and Mineral Resources

Mary Alice Black, Environmentalist III

Ben Ormand

Federal Agencies, State Agencies, Local Government

Director, NM Dept of State Forestry
Gene Bales, Dist. Supv. NM Dept of Game and Fish
Ralph Little, Area Supv. NM Dept. of Game and Fish
Director, NM Dept of Game & Fish
Bill Huey, NM Dept of Game & Fish
New Mexico State Highway, District 1
N.M. State Highway Department
David P. Hale, Engineer, N.M. Interstate Streams Commission
N. M. State Land Office
O. Garcia, Agriculture Stabilization & Conservation
Environmental Improvement Agency (Las Cruces)
Leo Hogan, County Supervisor, Farmers Home Administration
Wesley Bonsell, U.S. Fish & Wildlife Service
U. S. Forest Service, Gila National Forest
U.S. Geological Survey
Bureau of Reclamation
Bob Bishop, Soil Conservation Service
International Boundary Commission
Frank Kowalski, NM Bureau of Mines and Mineral Resources
Director, NM State Oil Conservation
Director, NM State Planning Office
State of NM Radio Communications Department
Southwest New Mexico Council of Governments
County Extension Service, Luna County
Environmental Improvement Agency (Luna County)
Luna County Clerk
Geological Survey, Water Resources Division
Gila Cliff Dwelling National Monument
New Mexico State Livestock Board
Environmental Improvement Agency (Lordsburg)
Hidalgo County Agent
Hidalgo County Clerk
Bureau of Reclamation, Rio Grande Project
Soil Conservation Service (Deming)
Agricultural Stabilization and Conservation Commission (Deming)
Farmers Home Administration (Deming)
Soil Conservation Service, Resource Development Project (Silver City)
Soil Conservation Service (Silver City)
Forest Service, District Ranger, Gila National Forest
Forest Service, Gila National Forest Supervisor
Farmers Home Administration, County Committee (Silver City)
Agricultural Stabilization & Conservation County Committee (Silver City)
NM Game and Fish Dept. Heart Bar Wildlife Area
Environmental Improvement Agency (Silver City)

County Extension Service, Grant County
Grant County Development
Grant County Commissioners
Agriculture Stabilization & Conservation County Committee (Hidalgo Co.)
Soil Conservation Service (Lordsburg)
Central Mining District, Health Dept. Clinic (Central)
Grant County Clerk & Recorder
Allen Kerr, County Manager (Hidalgo Co.)
Stanley Thygerson, Mayor of Virden
Tom Whatley
Buster Lindley
Don Rauch
Harry O. Sontag
Roy Carson
Lewis Putnam

Mining, Oil and Gas, Geothermal Energy, Physical Land Use

Beard Oil Company
Tom Beard, Consulting Geologist
Eddie Binns
Charles R. Bowman, El Paso Natural Gas Co.
F. J. Brandiger, Vice Pres. C. L. Crowder Investment Company
Leslie Davis
Bob Donegan, Quintana Minerals Corp.
Don Fingado, Hard Rock Mining Company
James Goodrich
B. W. Harold, Exxon Co. U.S.A.
Dr. William King, Department of Earth Sciences, New Mexico State University
Louisiana Land & Exploration Company
George J. Lindenburg, Cities Service Mineral Co.
Mathis & Mathis
J. R. McMahan, Field Boss, Exxon Co., U.S.A.
New Mexico Mining Association
Executive Director, NM Oil and Gas Association
Phelps-Dodge Corporation
B. F. Schaberg
Sierra Milling Co., Walker & Hinkel
American Smelting and Refining Co.
Southwest Fluorspar Co.
Dave Wilson, Allied Chemical Company
Ted H. Eyde, Southwestern Minerals Exploration Association
Henry Davis, Land & Water Resources, Kennecott Copper Corp.
N.M. Oil & Gas Association
Texaco, Inc.
Donnegan and Donnegan
NM Bureau of Mines and Mineral Resources
El Paso Natural Gas Co., Mining Division

Dr. W. J. Stone, NM Bureau of Mines & Mineral Resources
Amax Exploration
Mary Francis Antweil
Burmah Oil and Gas Co.
Chevron Oil Co.
Earth Power Corporation
Livingston International, Inc.
Phillips Petroleum Company
Sun Oil Company (Delaware)
Thermal Resources, Inc.
Union Oil of California
Thermal Exploration Co.
Alan J. Antweil
Calvert Geothermal Resources
Southwest Minerals Exploration Association (SMEA)
W. W. Baltosser
J. Kolessar
W. J. Talley
W. C. Bailey
Jack Morgan
Dan Nutter, Chief Engineer, Oil Conservation Commission
Ronad Barr, Earth Power Corp.
Bill Dolan, Amax Exploration

Environmental and Wildlife Interests

Glen H. Banks
Central Clearing House
Nan Nalder, Central Clearinghouse
Mrs. John S. Eads
Carl M. Jones, Sierra Club
Eddie Chew, Transpecos Audubon Society
Margaret Epps
Paul Garland
Lois E. Hoover
Dr. V. W. Howard, Department of Wildlife Sciences, New Mexico State Univ.
Ronald H. Kezar
Kenneth & Anne Anglemire
Amy Mazza-Scholl
Joann Mazzio
New Mexico Citizens for Clean Air, Jean Ingold
New Mexico Wildlife Federation
Dr. Raymond Paz
Orvil L. Robinson
Chris Schatzman
John W. Colburn
Sierra Club - Rio Grande Chapter, El Paso Regional Group
Carl Larson, Sierra Club
John A McComb, Southwest Representative, Sierra Club

Clarence D. Sykes
 Joseph E. Taylor
 Claude O. Waner
 David Foreman, The Wilderness Society
 Miss Jeanne Wurgler
 Steven M. Baumgern
 Dr. William Dick-Peddie, Biology Department, NMSU
 Dr. D. A. Zimmerman
 Debbie Sease
 Bob Langsekamp
 Wesley Leonard
 Dane G. Johnson
 Janet Baker
 Dan Pursley

Ranchers and Ranching Interests

Catherine Adams & Sons	J. W. Adams Estate, % Bessie Adams
W. H. Adams, Jr.	Charley & Ruther Anderson
Edward J. Bagwell	Bertoglio-Merrill Ranches, % Bill Merrill
Jewel Birtrong	Charles D. Blackey
G. W. Butler	Cienega Ranch Co., % Bill Swift
Francis Clark	Frank T. Croom
Mrs. Joe D. Croom	Sherwood Culbertson Est., % James Culbertson
James S. Cureton	Billy Darnell
Davis Brothers, % John Davis	Robert & Jessie Evans
J. R. and Conrad Donaldson	Mrs. G. M. Dunagan
Mrs. Jeff L. Dunagan	Clifton & Norma Dunagan
Edward Elbrock	Bessie A. Estes, % Velma Washburn
Great Lakes Land & Cattle Co.	George A. Godfrey
% Ben Ormand	Robert & Jessie Evans
Gray Ranch Co., % Bob Burris	Drummond Hadley
Andy & Theda Hall	Addoline Hill
John S. Hamilton	Grant Harper
Rita & Janaloo Hill	Ira Holliday Logging, Inc.,
Mrs. R. W. Holtkamp	% Robert Holliday
J. V. Hooker	Floyd & Sam L. Johns
George Jackson & Sons, Inc	Alfred Johnson
Muriel Johnson	William Kambitch
Fred Kerr, Sr.	Ralph B. Kimble (Kimble Brothers)
Harry K. Klump	Luther Klump
Ted & Nona Larson	Mrs. Garth Lunt
Murel G & Myra K Mahan	Robert C. Martin
Houston Moore	Jackie McCants
Thomas W. McCants	Frank McCauley Estate, % Alice McCauley
Tom McCauley & Sons	John T. Muir Ranch, % William Kipp
Adelbert Nelson	Wallace Opie
H. M. Pace	George Pendleton
Mrs. V. A. Peterson	Oma McCants

Post Office Canyon Ranch
% William C. Miller
R. M. Reynolds Estate
% Robert Reynolds
Darrow E. Richins
Joe H. Rouse - Rouse Cattle
Co., Swallow Fork Peak
Glen & Helen Shay
% Robert Shay
Andrew M. Smith
James G. Urquhart
Wagonrod Partners
% Robert W. Burris
Victorio Land & Cattle Co.
% Peter Wray (44 Ranch)
Richard & Mary Winkler
W. H. Walter, Sr.
% W. H. Walter, Jr.
Weatherby Ranch
% Theda Hall
Mrs. Mary Lunt & Sons
James L. Forehand
Woodrow McNair
Mattice Livestock Co.
% Joe Alder
Dr. J. J. Lovett
E. L. Lunt
A. E. Stevens
Ted Larson
Mr. Charles Blakey
Jay W. Cox
A. D. Brownfield, Jr.
Eldon P. Harvey
Joe L. Pankey
James B. Runyan
Dr. Reldon Beck, NMSU
Dr. Carlton Herbel, NMSU
W. H. Moir
Tom & Judith Pendleton
Delk Ranch Co., % Joe Delk
Jim Culberson
Walt Anderson
Tom Anderson

Pacific Western Land, % Ben Ormand
James F. Richards
Richard C. Richards
W. G. & Ruby Richards
C. E. Roark
C. F. Sanford
Robert T. & Kathryn Scholes
Glen & Fern Johnson, Virginia Slover
S. H. Strange
Iva E. Sworfford
Bill Veck
Clayton Yarbrough
Don Watson
Victorio Land & Cattle Co.
% Bob Burris
J. R. Walter
R. H. Wamel
Velma K. Washburn
Lance Williams
Ralph Wright
Mrs. Ruth Johnson & Ivan Goodner
George Schale
Antone & Iven Thygerson
Dennis Layton
Charles M. Hill
C. V. McCarty
Lazy B. Cattle Co., % Harry Day
Edward Barnes
Jim Brown, Exec. Secretary
N.M. Cattlegrowers Ass'n
Mahlon T. Everhart, Hatchet Ranch
Charlie T. Lee
Edward Nunn
Bryan Porcher
Lee Garner, Director
N.M. State Livestock Board
Bruce Hayward, Dept of Biology, NMSU
Jack Webb
Alan A. Koff
Milford Pettit
Jim Danren
J. F. Parker

News Media

Las Cruces Sun News	Las Cruces Bulletin
El Paso Times	Deming Graphic & Headlight
Silver City Daily Press	Lordsburg Liberal
Deming Newspapers	Silver City Enterprises
Douglas Dispatch	El Paso Herald-Post
Radio Station KOBE	Radio Station KGRT
News Director, KTSM TV	News Director, KELP TV
KNMS Am Radio Station	KRWG TV Channel 22
Las Cruces TV Cable	KASK Radio Station
KHEY Radio Station	KROD TV & Radio
KSIL Radio Station	KOTS Radio Station
KNFT Radio Station	KAPR Radio Station
KAWT Radio Station	KRWG FM Radio Station

Recreation - Off-road Vehicle Interests

Dona Ana County Sportsman Association
Picacho Gun Club
Dona Ana County Rockhound Club, Inc
Southwest Mountaineers, % Dick Ingraham
E. H. Howe
A. R. Patten, Sierra County Rock Club
LeRoy Biernes, Sierra County Sportsman's Association
Tularosa Basin Rock Club
Don R. Martin, Mesilla Valley Grotto, National Speleological Society
Gemcrafters & Explorers Club
Grant County Rolling Stones
Deming Gem and Mineral Society
UNM Mountaineering Club, University of New Mexico
Robert D. Keith, El Paso 4x4 Club
Bob Morgan, El Paso 4x4 Club
Fred Huff
Denny Keith
Paso del Norte Off-Road Association
Ken Graves, Roadrunner Racing Association
George Kerwin
Laurel Paynich
Al Paynich

Other Interests

W. I. Buhler, Sierra County Historical Society
John Davis, El Paso Archaeological Society
Cliff McDonald, President, Tularosa Basin Historical Society
Steward Peckham, Chief of Archaeology, Museum of New Mexico
Dr. Kay Sutherland, El Paso Rock Art
Dr. Stanley Bussey, Ass't Professor of Anthropology, NMSU

Society for Range Management, Animal Science Department, NMSU
Southwest NM Resource Conservation and Deveopment Project
Marjorie Burr, League of Women Voters
Darrell Baker, El Paso Natural Gas Co. (Utilities)
William G. Hoppes, El Paso Natural Gas Co. (Utilities)
Jim Knopf, U.S. Geological Survey
Walter E. Heinrichs, Jr., Heinrichs Geoexploragion Co.
James Forehand
Dr. R. T. Scholes
Roger A. Parsons
James W. Harrison, Southwest New Mexico Council of Governments

V. INTENSITY OF PUBLIC INTEREST

A letter was sent, in September 1975, to all grazing allottees and companies or individuals applying for Federal geothermal resources. This letter notified the recipient that the BLM was preparing a Technical Examination (TE) and Environmental Analysis Record (EAR) on Proposed Geothermal Leasing in the Lightning Dock Area and asked for written comments.

Public meetings were held December 4 and 5, 1975, in Silver City and Lordsburg, New Mexico in order to discuss the Unit Resource Analysis of the Gila Planning Unit. At that time, a presentation was given on the proposed recommendations for leasing in the Lightning Dock Area, and written comments were invited.

A letter was sent December 7, 1975, to all persons on the BLM mailing list for the Gila Planning Unit. This letter invited the recipients to read the draft TE and EAR in specific locations and send in written comments, this invitation was also extended through local news media.

The proposal to issue leases for the purpose of geothermal development was well received by most of the public attending the meetings. Opposition was confined primarily to location of the lands to be leased, not to developing geothermal resources in the area. When it was explained that it was being recommended that certain lands be withheld from leasing and others withheld from surface occupancy, most resistance subsided (Appendix D).

VI. PARTICIPATING STAFF

Las Cruces District BLM

Team Members

John J. Grensten, Team Leader, Surface Protection Specialist
Dan Hausel, Co-Leader, Geothermal Specialist
Robert F. Anderson, Member, Realty Specialist
William B. McMahan, Member, Wildlife Biologist
Kirby Kline, Member, Outdoor Recreation Planner
Robert R. Calkins, Member

Other Staff Members

Evelyn Horst, Typist
Yolanda Vega, Typist
William D. Tipton, Geologist
Julie Nickel, Range Technician
Lesa Cooper, Cooperative Student - Geology
Elizabeth Hummer, Cooperative Student - Environmental and
Planning Coordination

New Mexico State Office

J. L. Querry, Geothermal Specialist
Dennis Erhart, Environmental Coordinator

U. S. Geological Survey

Ken Bull, Geothermal District Supervisor, Salt Lake City, Utah
Les Dauterive, Environmentalist, Menlo Park, California
Elmer Patterson, Geologist, Roswell, New Mexico
Ray Cheeseman, Geologist, Roswell, New Mexico

U. S. Fish and Wildlife Service

Art Kinsky, Wildlife Biologist, Albuquerque, New Mexico
Robert Bridges, Wildlife Biologist, Albuquerque, New Mexico

VII. SIGNATURES

Prepared by: John J. Grensten Date 1/27/76
John J. Grensten, Surface Protection
Specialist, Team Leader

Dan Hausel Date 1/27/76
Dan Hausel, Geothermal Specialist
Team Co-Leader

Robert F. Anderson Date 1/27/76
Robert F. Anderson, Realty Specialist

William B. McMahan Date 1/27/76
William B. McMahan, Wildlife Biologist

Kirby Kline Date 1/27/76
Kirby Kline, Outdoor Recreation Planner

Robert R. Calkins Date 1/29/76
Robert R. Calkins

Approved by: Daniel C. B. Rathbun Date 1/30/76
Daniel C. B. Rathbun
Acting District Manager

LITERATURE CITED

- Beckett, Patrick H., D. P. Brethauer, and Floyd (Twister) Geery, 1976, A Reconnaissance of the Gila Planning Unit, with Emphasis on the Lightning Dock Geothermal Resource Area and the Playas Valley Land Exchange Area. Project N. YA-512-CT6-60, Dept. of Sociology and Anthropology, New Mexico State University, Las Cruces, N.M., Reprt No. 28. 144 pgs.
- Bridges, C. D., 1972. San Simon Cienega Intensive Inventory; NM-3 WHA-TZ. U.S. BLM, Las Cruces, New Mexico. unpublished.
- Bureau of Land Management, 1970, Pronghorn Antelope, BLM Manual Technical Supplement 6601-1. 30 pgs.
- Bureau of Land Management, 1973, Wildlife Inventory, BLM Manual Technical Supplement 6610. 8 pgs.
- Campbell, Howard, 1960. An Evaluation of Gallinaceous Guzzlers for Quail in New Mexico. Journal of Wildlife Management, Vol. 24:1, pp 21-26
- Conway, Marshall, 1975, New Mexico's Endangered Fishes. New Mexico Wildlife, 20, 3: pp 18-23.
- Davis, C. A., and V. W. Brevill, 1970. Effects of Restoration and Management of the San Simon Marsh on its Utilization by Mexican Ducks. New Mexico State University Agricultural Experiment Station, BLM Contract No. 14-11-0008-2839. 83 pgs.
- Davis, C. A., and M. W. Anderson, 1973. Seasonal Food Use by Mourning Doves in the Mesilla Valley, South-central New Mexico. NMSU Agricultural Experiment Station, Bull. 612.
- Dick-Peddie, William A., Thomas O. Boswell, Keith Austin, and Kathy Sison, 1974. An Environmental Impact Study of Proposed 345 KV Power Transmission Line Corridors from Dona Ana County, New Mexico, to Greenlee County, Arizona. New Mexico Environmental Institute, Las Cruces, New Mexico. 151 pgs.
- Donaldson, B. R., 1965. Abundance and Distribution of Javelina in Southwestern New Mexico. NMSU Master Thesis. 50 pgs.
- Economic Development Division, Department of Development, 1974, Community Profile. (113 Washington Ave., Santa Fe, New Mexico) 32 pgs.

Federal Register, 1973, Title 30, Part 270: Geothermal Resource Operations on Public, Acquired, and Withdrawn Lands; Part 271: Geothermal Resource Unit Plan Regulation. Office of Federal Register, National Archives and Record Service, GSA, Washington, D. C., Vol. 38, No. 245, Friday, Dec. 21.

Federal Register, 1973. Endangered Species Act. Office of Federal Register, National Archives and Record Service, GSA, Washington, D.C. Vol. 40, No. 78, Tues. April 22, 1975.

Federal Register, 1973, Title 43, Part 3000: Minerals Management General; Part 3200: Geothermal Resources Leasing; General. Office of Federal Register, National Archives and Record Service, GSA, Washington, D. C., Vol. 38, No. 245, Friday, Dec. 21.

Findley, James S., et al., 1975. Mammals of New Mexico. Albuquerque, N.M., University of New Mexico Press.

Flege, F. R., 1995. Geology of Lordsburg Quadrangle, Hidalgo County, New Mexico. NMBM Bull. 62, 36 pgs.

Gillerman, E., 1958, Geology of the Central Peloncillo Mountains, Hidalgo County, New Mexico, and Cochise County, Arizona. NMBM Bull. 57, 152 pgs.

Horvill, Steven, 1973. Javelina Hunt Information and Population Trend. NM Dept. of Game and Fish. Job Progress Report, W-93-15. 2 pgs.

Harrison, James W., Executive Director, 1974. Comprehensive Plan for Development, Hidalgo County, New Mexico. Board of County Commissioners, Hidalgo County, County Court House, Lordsburg, New Mexico. 112 pgs.

Hubbard, John P., 1970. Check-list of the Birds of New Mexico. Albuquerque, N.M., New Mexico Ornithological Society.

Kintzinger, P. F., 1956. Geothermal Survey of Hot Ground near Lordsburg, N.M. Science, V. 124, Oct. 5. p 629.

Klein, Louis W., and C. Quentin Ford, 1973. Electric Utility Industry of New Mexico. NMSU Engineering Exp. Sta. Bull. No. 47. 68 pgs.

Kline, K. K, and B. Flinn, 1975. Gila Unit Resource Analysis, BLM Las Cruces District Office, Las Cruces, New Mexico.

Koster, William J., 1975. Guide to the Fishes of New Mexico, Albuquerque, N.M., University of New Mexico Press.

Kruger, Paul, and Carel Otte, 1973. Geothermal Energy Resources, Production Stimulation. Stanford University Press, Stanford, California. 360 pgs.

Ligon, Stokley J., 1961. New Mexico Birds and Where to Find Them, Albuquerque, N.M., University of New Mexico.

Lopez, Louis A., Gordon E. Waldrip, Fredrick G. McCracke, George Flores, Anthony A. Martinez, and Martin S. Kozlouski, 1971. Hidalgo County New Mexico Manpower Resource Report. Employment Security Commission of New Mexico, Santa Fe, N.M. 37 pgs.

Maker, J. H., D. N. Cox, and J. U. Anderson, 1970. Soil Associations and Land Classification for Irrigation, Hidalgo County. NMSU Agri. Exp. Sta. Research Report 177. 29 pgs.

Monson, Gale, 1973. Unique Birds and Mannals of the Coronado National Forest. United States Forest Service. Government Printing Office.

Moore, Leonard, (no date). Rare, Endangered, Peripheral and Unusual Animals in or near Guadalupe Canyon. Las Cruces District, Bureau of Land Management, Las Cruces, New Mexico.

Moore, Leonard (no date). Bird and Mammal Species that Have Been Seen in the Cienega. Las Cruces District, Bureau of Land Management, Las Cruces, New Mexico.

Moore, Leonard (no date). Season of Use and Animals Found in the Peloncillo Mountains, Las Cruces District, Bureau of Land Management, Las Cruces, New Mexico.

Moore, Leonard, 1975. Peloncillo Mountains Intensive Inventory and Analysis. U.S. BLM, Las Cruces, N.M. unpublished.

Martin, A. C., H. S. Miz, and A. L. Nelson, 1951. American Wildlife and Plants. A Guide to Wildlife Food Habits. Dover Publications, Inc., New York, N.Y.

Nash, W. P., and W. D. Huse1, 1975. Mid and Late Cenozoic Volcanism in Southwestern Utah: Abstract, G.S.A., Abs. w/prghs. Vol. 7 #7, p. 1210.

New Mexico State Highway Department, Planning and Program Division, 1971 New Mexico Traffic Survey. U.S. Department of Transportation, Federal Highway Administration. 109 pgs.

N.M. Dept. of Game and Fish, 1975. Endangered Species and Subspecies of New Mexico. Santa Fe, N.M.

New Mexico Department of Game and Fish, 1975 through 1973. Deer, Javelina, Antelope, Cougar, Quail, Doves, Ducks and Geese Hunt Information and Population Trend. New Mexico Game and Fish Department Annual Job Progress Reports.

Odum, Eguene P., 1959. Fundamentals of Ecology. W. B. Saunders Co. Philadelphia, Pa. 456 pgs.

Reeder, H. O., 1957. Ground Water in Animas Valley, Hidalgo County, New Mexico. State of New Mexico, State Engineer Office, Tech. Rept. 11, p. 26-100.

Summers, W. K., 1965. Chemical Characteristics of New Mexico's Thermal Waters - A Critique. New Mexico Bureau of Mines, Circular 83, p. 18.

Summers, W. K., 1965. A Preliminary Report on New Mexico's Geothermal Energy Resources. N.M. Bureau of Mines, Circ. 80, 41 pgs.

Summers, W. K., 1968. Geothermics - New Mexico's Untapped Resource. Bureau of Business Research, UNM, Circular 98, 9 pgs.

Swanberg, C. A., 1975. Geochemical Studies of Two Geothermal Areas in New Mexico. (Under preparation)

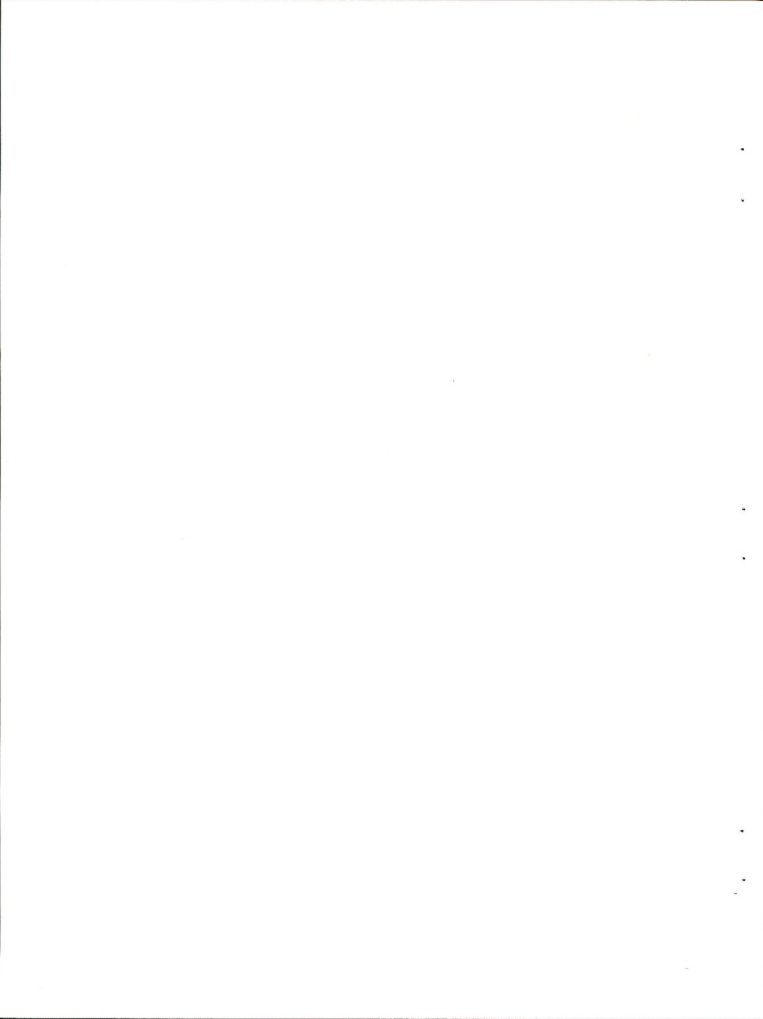
U. S. Dept. of the Interior. Fish and Wildlife Service, 1975. Endangered and Threatened Wildlife and Plants.

Wilson, Lanny O., 1973. Birds, Mammals, Reptiles and Amphibians of New Mexico, U. S. Dept. of the Interior, Bureau of Land Management, Santa Fe, New Mexico. (unpublished)

Zimmerman, Dale A. (no date). Bird Species Recorded from Guadalupe Canyon, Arizona and New Mexico. 1950-1960.

Zimmerman, Dale A., 1965. The Chiricahuas and Guadalupe Canyon. Pg 312-324, in Pettingill (ed). Bird Watchers of American. McGraw Hill, N.Y.

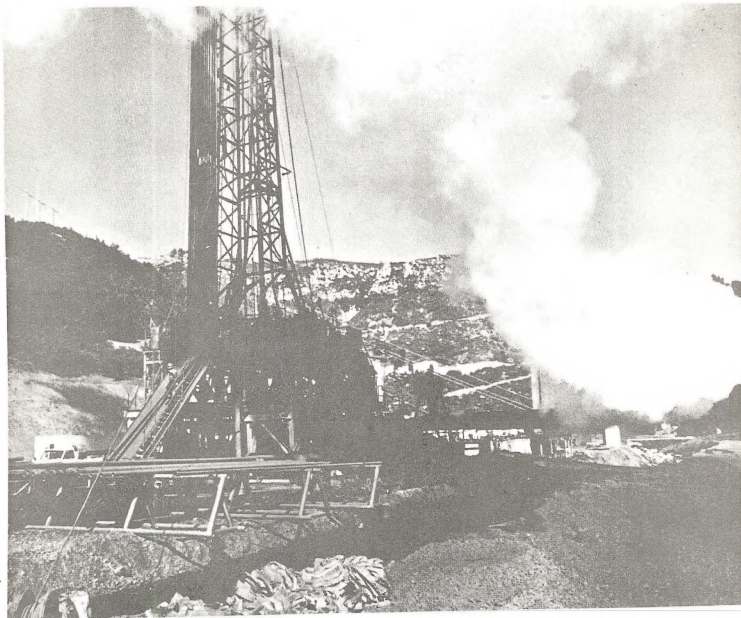
APPENDIX A



GEOHERMAL STEAM ACT OF 1970

and

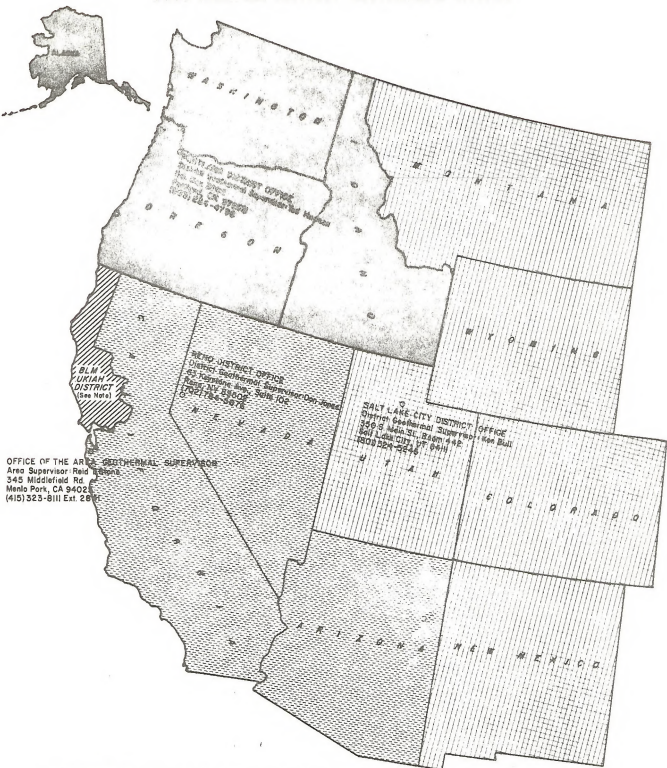
Regulations on the Leasing of Geothermal Resources



United States Geological Survey
United States Department of the Interior

May 1975

USGS AREA and DISTRICT GEOTHERMAL OFFICES



NOTE: Geothermal lease operations in the Bureau of Land Management's Utah District, CA and in all of the U.S. Geological Survey Eastern Region are administered by the Area Geothermal Supervisor in Mendocino Park, CA.

TABLE OF CONTENTS

	Page
USGS Area and District Geothermal Offices	Inside front cover
Geothermal Steam Act of 1970 (84 Stat. 1566).	1
Regulations on the Leasing of Geothermal Resources	
1. Title 30, Chapter II of the Code of Federal Regulations	
Part 270-Geothermal Resources Operations on Public, Acquired and Withdrawn Lands	13
Part 271-Geothermal Resources Unit Plan Regulations (Including suggested forms).	18
2. Title 43, Chapter II of the Code of Federal Regulations	
Part 3000-Minerals Management; General.	27
Part 3210-Noncompetitive Leases	38
Part 3220-Competitive Leases.	39
Part 3230-Rights to Conversion to Geothermal Leases or Application for Geothermal Leases	40
Part 3240-Rules Governing Leases.	42

GEOHERMAL STEAM ACT OF 1970

Public Law 91-581
91st Congress, S.368
December 24, 1970
(84 Stat. 1566)
(30 U.S.C. 1001-1025)



Public Law 91-581
91st Congress, S. 368
December 24, 1970

An Act

84 STAT. 1566

To authorize the Secretary of the Interior to make disposition of geothermal steam and associated geothermal resources, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Geothermal Steam Act of 1970".

Geothermal Steam
Act of 1970.
Definitions.

SEC. 2. As used in this Act, the term—

- (a) "Secretary" means the Secretary of the Interior;
- (b) "geothermal lease" means a lease issued under authority of this Act;
- (c) "geothermal steam and associated geothermal resources" means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any byproduct derived from them;
- (d) "byproduct" means any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves;
- (e) "known geothermal resources area" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

SEC. 3. Subject to the provisions of section 15 of this Act, the Secretary of the Interior may issue leases for the development and utilization of geothermal steam and associated geothermal resources (1) in lands administered by him, including public, withdrawn, and acquired lands, (2) in any national forest or other lands administered by the Department of Agriculture through the Forest Service, including public, withdrawn, and acquired lands, and (3) in lands which have been conveyed by the United States subject to a reservation to the United States of the geothermal steam and associated geothermal resources therein.

Leases.

SEC. 4. If lands to be leased under this Act are within any known geothermal resources area, they shall be leased to the highest responsible qualified bidder by competitive bidding under regulations formulated by the Secretary. If the lands to be leased are not within any known geothermal resources area, the qualified person first making application for the lease shall be entitled to a lease of such lands without competitive bidding. Notwithstanding the foregoing, at any time within one hundred and eighty days following the effective date of this Act:

Bids.

Conversion.

- (a) with respect to all lands which were on September 7, 1965, subject to valid leases or permits issued under the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181 et seq.), or under the Mineral Leasing Act of Acquired Lands, as amended (30 U.S.C. 351, 358), or to existing mining claims located on or prior to September 7, 1965, the lessees or permittees or claimants or their successors in interest who are qualified to hold geothermal

41 Stat. 437.

61 Stat. 913.

leases shall have the right to convert such leases or permits or claims to geothermal leases covering the same lands;

(b) where there are conflicting claims, leases, or permits therefor embracing the same land, the person who first was issued a lease or permit, or who first recorded the mining claim shall be entitled to first consideration;

(c) with respect to all lands which were on September 7, 1965, the subject of applications for leases or permits under the above Acts, the applicants may convert their applications to applications for geothermal leases having priorities dating from the time of filing of such applications under such Acts;

(d) no person shall be permitted to convert mineral leases, permits, applications therefor, or mining claims for more than 10,240 acres; and

(e) the conversion of leases, permits, and mining claims and applications for leases and permits shall be accomplished in accordance with regulations prescribed by the Secretary. No right to conversion to a geothermal lease shall accrue to any person under this section unless such person shows to the reasonable satisfaction of the Secretary that substantial expenditures for the exploration, development, or production of geothermal steam have been made by the applicant who is seeking conversion, on the lands for which a lease is sought or on adjoining, adjacent, or nearby Federal or non-Federal lands.

(f) with respect to lands within any known geothermal resources area and which are subject to a right to conversion to a geothermal lease, such lands shall be leased by competitive bidding: *Provided*, That, the competitive geothermal lease shall be issued to the person owning the right to conversion to a geothermal lease if he makes payment of an amount equal to the highest bona fide bid for the competitive geothermal lease, plus the rental for the first year, within thirty days after he receives written notice from the Secretary of the amount of the highest bid.

SEC. 5. Geothermal leases shall provide for—

(a) a royalty of not less than 10 per centum or more than 15 per centum of the amount or value of steam, or any other form of heat or energy derived from production under the lease and sold or utilized by the lessee or reasonably susceptible to sale or utilization by the lessee;

(b) a royalty of not more than 5 per centum of the value of any byproduct derived from production under the lease and sold or utilized or reasonably susceptible of sale or utilization by the lessee, except that as to any byproduct which is a mineral named in section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that Act and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that Act;

(c) payment in advance of an annual rental of not less than \$1 per acre or fraction thereof for each year of the lease. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall terminate the lease by operation of law: *Provided, however*, That whenever the Secretary discovers that the rental payment due under a lease is paid timely but the amount of the payment is deficient because of an error or other reason and the deficiency is nominal, as determined by the Secretary pursuant to regulations prescribed by him, he shall notify the lessee of the deficiency and such lease shall not automatically terminate unless

Acresage
Limitation.

Lease
provisions.
Royalties.

41 Stat. 437.

Rent.

the lessee fails to pay the deficiency within the period prescribed in the notice: *Provided further*, That, where any lease has been terminated automatically by operation of law under this section for failure to pay rental timely and it is shown to the satisfaction of the Secretary of the Interior that the failure to pay timely the lease rental was justifiable or not due to a lack of reasonable diligence, he in his judgment may reinstate the lease if--

- (1) a petition for reinstatement, together with the required rental, is filed with the Secretary of the Interior; and
- (2) no valid lease has been issued affecting any of the lands in the terminated lease prior to the filing of the petition for reinstatement; and
- (d) a minimum royalty of \$2 per acre or fraction thereof in lieu of rental payable at the expiration of each lease year for each producing lease, commencing with the lease year beginning on or after the commencement of production in commercial quantities. For the purpose of determining royalties hereunder the value of any geothermal steam and byproduct used by the lessee and not sold and reasonably susceptible of sale shall be determined by the Secretary, who shall take into consideration the cost of exploration and production and the economic value of the resource in terms of its ultimate utilization.

Sec. 6. (a) Geothermal leases shall be for a primary term of ten years. If geothermal steam is produced or utilized in commercial quantities within this term, such lease shall continue for so long thereafter as geothermal steam is produced or utilized in commercial quantities, but such continuation shall not exceed an additional forty years.

(b) If, at the end of such forty years, steam is produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of such lease for a second forty-year term in accordance with such terms and conditions as the Secretary deems appropriate.

(c) Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, actual drilling operations were commenced prior to the end of its primary term and are being diligently prosecuted at that time shall be extended for five years and so long thereafter, but not more than thirty-five years, as geothermal steam is produced or utilized in commercial quantities. If, at the end of such extended term, steam is being produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of such lease for a second term in accordance with such terms and conditions as the Secretary deems appropriate.

(d) For purposes of subsection (a) of this section, production or utilization of geothermal steam in commercial quantities shall be deemed to include the completion of one or more wells producing or capable of producing geothermal steam in commercial quantities and a bona fide sale of such geothermal steam for delivery to or utilization by a facility or facilities not yet installed but scheduled for installation not later than fifteen years from the date of commencement of the primary term of the lease.

(e) Leases which have extended by reasons of production, or which have produced geothermal steam, and have been determined by the Secretary to be incapable of further commercial production and utilization of geothermal steam may be further extended for a period of not more than five years from the date of such determination but only for so long as one or more valuable byproducts are produced in commercial quantities. If such byproducts are leasable under the Mineral Leasing Act of February 26, 1920, as amended (30 U.S.C. 181, et seq.), or under the Mineral Leasing Act for Acquired Lands (30 U.S.C.

Term.

Limitation,
Renewal.

Extension.

41 Stat., 437.

351-358), and the leasehold is primarily valuable for the production thereof, the lessee shall be entitled to convert his geothermal lease to a mineral lease under, and subject to all the terms and conditions of, such appropriate Act upon application at any time before expiration of the lease extension by reason of byproduct production. The lessee shall be entitled to locate under the mining laws all minerals which are not leasable and which would constitute a byproduct if commercial production or utilization of geothermal steam continued. The lessee in order to acquire the rights herein granted him shall complete the location of mineral claims within ninety days after the termination of the lease for geothermal steam. Any such converted lease or the surface of any mining claim located for geothermal byproducts mineral affecting lands withdrawn or acquired in aid of a function of a Federal department or agency, including the Department of the Interior, shall be subject to such additional terms and conditions as may be prescribed by such department or agency with respect to the additional operations or effects resulting from such conversion upon adequate utilization of the lands for the purpose for which they are administered.

(f) Minerals locatable under the mining laws of the United States in lands subject to a geothermal lease issued under the provisions of this Act which are not associated with the geothermal steam and associated geothermal resources of such lands as defined in section 2(c) herein shall be locatable under said mining laws in accordance with the principles of the Multiple Mineral Development Act (68 Stat. 708; found in 30 U.S.C. 521 et seq.).

Leases,
acreage.

Limitation.

Sec. 7. A geothermal lease shall embrace a reasonably compact area of not more than two thousand five hundred and sixty acres, except where a departure therefrom is occasioned by an irregular subdivision or subdivisions. No person, association, or corporation, except as otherwise provided in this Act, shall take, hold, own, or control at one time, whether acquired directly from the Secretary under this Act or otherwise, any direct or indirect interest in Federal geothermal leases in any one State exceeding twenty thousand four hundred and eighty acres, including leases acquired under the provisions of section 4 of this Act.

Increase.

At any time after fifteen years from the effective date of this Act the Secretary, after public hearings, may increase this maximum holding in any one State by regulation, not to exceed fifty-one thousand two hundred acres.

Readjustment.

Sec. 8. (a) The Secretary may readjust the terms and conditions, except as otherwise provided herein, of any geothermal lease issued under this Act at not less than ten-year intervals beginning ten years after the date the geothermal steam is produced, as determined by the Secretary. Each geothermal lease issued under this Act shall provide for such readjustment. The Secretary shall give notice of any proposed readjustment of terms and conditions, and, unless the lessee files with the Secretary objection to the proposed terms or relinquishes the lease within thirty days after receipt of such notice, the lessee shall conclusively be deemed to have agreed with such terms and conditions. If the lessee files objections, and no agreement can be reached between the Secretary and the lessee within a period of not less than sixty days, the lease may be terminated by either party.

Notice.

(b) The Secretary may readjust the rentals and royalties of any geothermal lease issued under this Act at not less than twenty-year intervals beginning thirty-five years after the date geothermal steam is produced, as determined by the Secretary. In the event of any such readjustment neither the rental nor royalty may be increased by more than 50 per centum over the rental or royalty paid during the preceding period, and in no event shall the royalty payable exceed 22½ per centum. Each geothermal lease issue under this Act shall provide

for such readjustment. The Secretary shall give notice of any proposed readjustment of rentals and royalties, and, unless the lessee files with the Secretary objection to the proposed rentals and royalties or relinquishes the lease within thirty days after receipt of such notice, the lessee shall conclusively be deemed to have agreed with such terms and conditions. If the lessee files objections, and no agreement can be reached between the Secretary and the lessee within a period of not less than sixty days, the lease may be terminated by either party.

(c) Any readjustment of the terms and conditions as to use, protection, or restoration of the surface of any lease of lands withdrawn or acquired in aid of a function of a Federal department or agency other than the Department of the Interior may be made only upon notice to, and with the approval of, such department or agency.

Sec. 9. If the production, use, or conversion of geothermal steam is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, the Secretary shall require substantial beneficial production or use thereof unless, in individual circumstances he modifies or waives this requirement in the interest of conservation of natural resources or for other reasons satisfactory to him. However, the production or use of such byproducts shall be subject to the rights of the holders of preexisting leases, claims, or permits covering the same land or the same minerals, if any.

Sec. 10. The holder of any geothermal lease at any time may make and file in the appropriate land office a written relinquishment of all rights under such lease or of any legal subdivision of the area covered by such lease. Such relinquishment shall be effective as of the date of its filing. Thereupon the lessee shall be released of all obligations thereafter accruing under said lease with respect to the lands relinquished, but no such relinquishment shall release such lessee, or his surety or bond, from any liability for breach of any obligation of the lease, other than an obligation to drill, accrued at the date of the relinquishment, or from the continued obligation, in accordance with the applicable lease terms and regulations, (1) to make payment of all accrued rentals and royalties, (2) to place all wells on the relinquished lands in condition for suspension or abandonment, and (3) to protect or restore substantially the surface and surface resources.

Sec. 11. The Secretary, upon application by the lessee, may authorize the lessee to suspend operations and production on a producing lease and he may, on his own motion, in the interest of conservation suspend operations on any lease but in either case he may extend the lease term for the period of any suspension, and he may waive, suspend, or reduce the rental or royalty required in such lease.

Sec. 12. Leases may be terminated by the Secretary for any violation of the regulations or lease terms after thirty days notice provided that such violation is not corrected within the notice period, or in the event the violation is such that it cannot be corrected within the notice period then provided that lessee has not commenced in good faith within said notice period to correct such violation and thereafter to proceed diligently to correct such violation. Lessee shall be entitled to a hearing on the matter of such claimed violation or proposed termination of lease if request for a hearing is made to the Secretary within the thirty-day period after notice. The period for correction of violation or commencement to correct such violation of regulations or of lease terms, as aforesaid, shall be extended to thirty days after the Secretary's decision after such hearing if the Secretary shall find that a violation exists.

Sec. 13. The Secretary may waive, suspend, or reduce the rental or royalty for any lease or portion thereof in the interests of conservation and to encourage the greatest ultimate recovery of geothermal

Notice.

Byproducts.

Relinquishment.

Suspension.

Leases,
termination.
Notice.

resources, if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms.

Surface
land, use.

Sec. 14. Subject to the other provisions of this Act, a lessee shall be entitled to use so much of the surface of the land covered by his geothermal lease as may be found by the Secretary to be necessary for the production, utilization, and conservation of geothermal resources.

Sec. 15. (a) Geothermal leases for lands withdrawn or acquired in aid of functions of the Department of the Interior may be issued only under such terms and conditions as the Secretary may prescribe to insure adequate utilization of the lands for the purposes for which they were withdrawn or acquired.

41 Stat. 1075;
62 Stat. 275.

(b) Geothermal leases for lands withdrawn or acquired in aid of functions of the Department of Agriculture may be issued only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purposes for which they were withdrawn or acquired. Geothermal leases for lands to which section 24 of the Federal Power Act, as amended (16 U.S.C. 818), is applicable, may be issued only with the consent of, and subject to, such terms and conditions as the Federal Power Commission may prescribe to insure adequate utilization of such lands for power and related purposes.

16 USC 1.

(c) Geothermal leases under this Act shall not be issued for lands administered in accordance with (1) the Act of August 25, 1916 (39 Stat. 535), as amended or supplemented, (2) for lands within a national recreation area, (3) for lands in a fish hatchery administered by the Secretary, wildlife refuge, wildlife range, game range, wildlife management area, waterfowl production area, or for lands acquired or reserved for the protection and conservation of fish and wildlife that are threatened with extinction, (4) for tribally or individually owned Indian trust or restricted lands, within or without the boundaries of Indian reservations.

Lessees,
citizenship
requirements.

Sec. 16. Leases under this Act may be issued only to citizens of the United States, associations of such citizens, corporations organized under the laws of the United States or of any State or the District of Columbia, or governmental units, including, without limitation, municipalities.

Sec. 17. Administration of this Act shall be under the principles of multiple use of lands and resources, and geothermal leases shall, insofar as feasible, allow for coexistence of other leases of the same lands for deposits of minerals under the laws applicable to them, for the location and production of claims under the mining laws, and for other uses of the areas covered by them. Operations under such other leases or for such other uses, however, shall not unreasonably interfere with or endanger operations under any lease issued pursuant to this Act, nor shall operations under leases so issued unreasonably interfere with or endanger operations under any lease, license, claim, or permit issued pursuant to the provisions of any other Act.

Cooperative
or unit
plan.

Sec. 18. For the purpose of properly conserving the natural resources of any geothermal pool, field, or like area, or any part thereof, lessees thereof and their representatives may unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation of such pool, field, or like area, or any part thereof, whenever this is determined and certified by the Secretary to be necessary or advisable in the public interest. The Secretary may in his discretion and with the consent of the holders of leases involved, establish, alter, change, revoke, and make such regulations with reference to such leases in connection with the institution and operation of any such cooperative or unit plan as he may deem necessary or proper to secure reasonable protection of the

public interest. He may include in geothermal leases a provision requiring the lessee to operate under such a reasonable cooperative or unit plan, and he may prescribe such a plan under which such lessee shall operate, which shall adequately protect the rights of all parties in interest, including the United States. Any such plan may, in the discretion of the Secretary, provide for vesting in the Secretary or any other person, committee, or Federal or State agency designated therein, authority to alter or modify from time to time the rate of prospecting and development and the quantity and rate of production under such plan. All leases operated under any such plan approved or prescribed by the Secretary shall be excepted in determining holdings or control for the purposes of section 7 of this Act.

When separate tracts cannot be independently developed and operated in conformity with an established well-spacing or development program, any lease, or a portion thereof, may be pooled with other lands, whether or not owned by the United States, under a communitization or drilling agreement providing for an apportionment of production or royalties among the separate tracts of land comprising the drilling or spacing unit when determined by the Secretary to be in the public interest, and operations or production pursuant to such an agreement shall be deemed to be operations or production as to each lease committed thereto.

The Secretary is hereby authorized, on such conditions as he may prescribe, to approve operating, drilling, or development contracts made by one or more lessees of geothermal leases, with one or more persons, associations, or corporations whenever, in his discretion, the conservation of natural products or the public convenience or necessity may require or the interests of the United States may be best served thereby. All leases operated under such approved operating, drilling, or development contracts, and interests thereunder, shall be excepted in determining holdings or control under section 7 of this Act.

Sec. 19. Upon request of the Secretary, other Federal departments and agencies shall furnish him with any relevant data then in their possession or knowledge concerning or having bearing upon fair and adequate charges to be made for geothermal steam produced or to be produced for conversion to electric power or other purposes. Data given to any department or agency as confidential under law shall not be furnished in any fashion which identifies or tends to identify the business entity whose activities are the subject of such data or the person or persons who furnished such information.

Sec. 20. All moneys received under this Act from public lands under the jurisdiction of the Secretary shall be disposed of in the same manner as moneys received from the sale of public lands. Moneys received under this Act from other lands shall be disposed of in the same manner as other receipts from such lands.

Moneys.

Sec. 21. (a) Within one hundred and twenty days after the effective date of this Act, the Secretary shall cause to be published in the Federal Register a determination of all lands which were included within any known geothermal resources area on the effective date of the Act. He shall likewise publish in the Federal Register from time to time his determination of other known geothermal resources areas specifying in each case the date the lands were included in such area; and

Publication in
Federal Register.

(b) Geothermal resources in lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States shall not be developed or produced except under geothermal leases made pursuant to this Act. If the Secretary of the Interior finds that such development is imminent, or that production from a well heretofore drilled on such lands is imminent, he shall so report to the Attorney General, and the Attorney General is authorized

and directed to institute an appropriate proceeding in the United States district court of the district in which such lands are located, to quiet the title of the United States in such resources, and if the court determines that the reservation of minerals to the United States in the lands involved included the geothermal resources, to enjoin their production otherwise than under the terms of this Act: *Provided*, That upon an authoritative judicial determination that Federal mineral reservation does not include geothermal steam and associated geothermal resources the duties of the Secretary of the Interior to report and of the Attorney General to institute proceedings, as hereinbefore set forth, shall cease.

SEC. 22. Nothing in this Act shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.

Waste,
prevention.

SEC. 23. (a) All leases under this Act shall be subject to the condition that the lessee will, in conducting his exploration, development, and producing operations, use all reasonable precautions to prevent waste of geothermal steam and associated geothermal resources developed in the lands leased.

Rules and
regulations.

(b) Rights to develop and utilize geothermal steam and associated geothermal resources underlying lands owned by the United States may be acquired solely in accordance with the provisions of this Act.

SEC. 24. The Secretary shall prescribe such rules and regulations as he may deem appropriate to carry out the provisions of this Act. Such regulations may include, without limitation, provisions for (a) the prevention of waste, (b) development and conservation of geothermal and other natural resources, (c) the protection of the public interest, (d) assignment, segregation, extension of terms, relinquishment of leases, development contracts, unitization, pooling, and drilling agreements, (e) compensatory royalty agreements, suspension of operations or production, and suspension or reduction of rentals or royalties, (f) the filing of surety bonds to assure compliance with the terms of the lease and to protect surface use and resources, (g) use of the surface by a lessee of the lands embraced in his lease, (h) the maintenance by the lessee of an active development program, and (i) protection of water quality and other environmental qualities.

SEC. 25. As to any land subject to geothermal leasing under section 3 of this Act, all laws which either (a) provide for the disposal of land by patent or other form of conveyance or by grant or by operation of law subject to a reservation of any mineral or (b) prevent or restrict the disposal of such land because of the mineral character of the land, shall hereafter be deemed to embrace geothermal steam and associated geothermal resources as a substance which either must be reserved or must prevent or restrict the disposal of such land, as the case may be. This section shall not be construed to affect grants, patents, or other forms of conveyances made prior to the date of enactment of this Act.

30 USC 530.

SEC. 26. The first two clauses in section 11 of the Act of August 13, 1954 (68 Stat. 708, 716), are amended to read as follows:

30 USC 181.

30 USC 261.

"As used in this Act, 'mineral leasing laws' shall mean the Act of February 25, 1920 (41 Stat. 437); the Act of April 17, 1928 (44 Stat. 301); the Act of February 7, 1927 (44 Stat. 1057); Geothermal Steam Act of 1970, and all Acts heretofore or hereafter enacted which are amendatory of or supplementary to any of the foregoing Acts; 'Leasing Act minerals' shall mean all minerals which, upon the effective date of this Act, are provided in the mineral leasing laws to be disposed of thereunder and all geothermal steam and associated geothermal resources which, upon the effective date of the Geothermal Steam Act of 1970, are provided in that Act to be disposed of thereunder;".

December 24, 1970

Pub. Law 91-681

84 STAT. 1574

SEC. 27. The United States reserves the ownership of and the right to extract under such rules and regulations as the Secretary may prescribe oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from lands leased under this Act in accordance with presently applicable laws: *Provided*, That whenever the right to extract oil, hydrocarbon gas, and helium from geothermal steam and associated geothermal resources produced from such lands is exercised pursuant to this section, it shall be exercised so as to cause no substantial interference with the production of geothermal steam and associated geothermal resources from such lands.

Certain mineral
rights, retention
by U. S.

Approved December 24, 1970.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 91-1544 (Comm. on Interior and Insular Affairs).
SENATE REPORT No. 91-1160 (Comm. on Interior and Insular Affairs).
CONGRESSIONAL RECORD, Vol. 116 (1970):

Sept. 16, Oct. 14, Dec. 4, 10, considered and passed Senate.
Oct. 5, Dec. 9, considered and passed House.

REGULATIONS ON THE LEASING
OF GEOTHERMAL RESOURCES

Title 30, Chapter II of the Code of Federal Regulations

and

Title 43, Chapter II of the Code of Federal Regulations

RULES AND REGULATIONS

Title 30—Mineral Resources

CHAPTER II—GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

PART 270—GEOHERMAL RESOURCES OPERATIONS ON PUBLIC, ACQUIRED, AND WITHDRAWN LANDS

PART 271—GEOHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUD- ING SUGGESTED FORMS)

The purpose of these regulations is to implement the Geothermal Steam Act of 1970 (30 U.S.C. 1001-1025) and provide for the leasing of the public and acquired lands of the United States for the purpose of geothermal resources exploration, development, and production.

The public was afforded an opportunity to comment on proposed rulemaking published on July 23, 1971, November 29, 1972, and July 23, 1973 and supplemented on August 8, 1973. These regulations reflect consideration of all comments received on the published proposed rulemaking.

A Final Environmental Statement, prepared in accordance with the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), was issued on October 23, 1973. It discussed the environmental impact of leasing federally owned geothermal resources under the proposed rulemaking, and proposed provisions for inclusion in regulations and leases to mitigate any possible impacts on the environment.

These regulations will be effective January 1, 1974.

GENERAL PROVISIONS

Sec.	
270.1	Purpose and authority.
270.2	Definitions.
JURISDICTION AND FUNCTIONS OF SUPERVISOR	
270.10	Jurisdiction.
270.11	General functions.
270.12	Regulation of operations.
270.13	Required samples, tests, and surveys.
270.14	Drilling and abandonment of wells.
270.15	Well spacing and well casing.
270.16	Values and payment for losses.
270.17	Suspension of operations and production.
REQUIREMENTS FOR LESSEES	
270.20	Lease terms, regulations, waste, damage, and safety.
270.21	Designation of operator or agent.
270.22	Local agent.
270.23	Drilling and producing obligations.
270.24	Plan of operation.
270.25	Subsequent well operations.
270.26	Well designations.
270.27	Well records.
270.28	Samples, tests, and surveys.
270.29	Directional survey.
270.40	Well control.
270.41	Pollution.
270.42	Noise abatement.
270.43	Land subsidence and seismic activity.
270.44	Pits or sumps.
270.45	Well abandonment.
270.46	Accidents.
270.47	Workmanlike operations.
270.48	Departure from orders.
270.49	Sales contracts.
270.50	Royalty payments

MEASUREMENT OF PRODUCTION AND COMPUTATION OF ROYALTIES

Sec.	
270.60	Measurement of geothermal resources.
270.61	Determination of content of by-products.
270.62	Value of geothermal production for computing royalties.
270.63	Computation of royalties.
270.64	Commingling production.

REPORTS TO BE MADE BY ALL LESSEES (INCLUDING OPERATORS)

270.70	General requirements.
270.71	Applications for permits to drill, re-drill, deepen, or plug-back.
270.72	Sundry notices and reports on wells.
270.73	Log and history of well.
270.74	Monthly report of operations.
270.75	Monthly report of sales and royalty.
270.76	Annual report of compliance with environmental protection requirements.
270.77	Annual report of expenditures for diligent exploration operations.
270.78	Notice of intent and permit to conduct exploration operations (other than drilling, see 43 CFR 3209.0-5 (a)).
270.79	Public inspection of records.

PROCEDURE IN CASE OF VIOLATION OF THE REGULATIONS OR LEASE TERMS

270.80	Noncompliance with regulations or lease terms.
--------	--

APPEALS

270.90	Appeals.
--------	----------

GENERAL PROVISIONS

§ 270.1 Purpose and authority.

The Geothermal Steam Act enacted on December 24, 1970 (84 Stat. 1568) referred to in this part as "the Act", authorizes the Secretary of the Interior to prescribe rules and regulations applicable to operations conducted under a lease granted pursuant to that Act, and for the development and conservation of geothermal steam and associated geothermal resources, the prevention of waste, the protection of the public interest, and the protection of water quality, and other environmental qualities. The regulations in this part shall be administered by the Director through the Chief, Conservation Division, or his duly appointed representative.

§ 270.2 Definitions.

As used in the regulations in this part, the term:

(a) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(b) "Director" means the Director of the Geological Survey.

(c) "Supervisor" means a representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such a representative acting under his direction.

(d) "Geothermal lease" means a lease issued under 43 CFR Group 3200.

(e) "Lessee" means the individual, corporation, association, or municipality to which geothermal lease has been issued and its successor in interest or assignee. It also means any agent of the lessee or an operator holding authority by or through the lessee.

(f) "Operator" means the individual, corporation, or association having control or management of operations on the leased lands or a portion thereof. The operator may be the lessee, designated operator, or agent of the lessee, or holder of rights under an approved operating agreement.

(g) "Geothermal resources" means (1) all products of geothermal processes, embracing indigenous steam, hot water, and hot brines; (2) steam and other gases, hot water, and hot brines, resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproduct derived therefrom.

(h) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium), which are found in solution or developed in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(i) "Participating area" means that part of the unit area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) "Waste" means (1) physical waste, as that term is generally understood; (2) waste of reservoir energy through inefficiency, improper use of or unnecessary dissipation of reservoir energy; (3) the location, spacing, drilling, equipping, operating, or producing of any geothermal well or wells in a manner which causes or tends to cause reduction in the quantity of geothermal energy ultimately recoverable from a reservoir under prudent and workmanlike operations or which tends to cause unnecessary or excessive surface or subsurface loss or destruction of geothermal energy; and (4) the inefficient transmission of geothermal energy from the source (wellhead) to point of utilization.

(k) "Directionally drilled well" means the deviation of a well bore from the vertical or from its normal course in an intended predetermined direction or course with respect to the points of the compass. Directionally drilled well shall not include a well deviated for the purpose of straightening a hole that has become crooked in the normal course of drilling or holes deviated at random

RULES AND REGULATIONS

without regard to compass direction in an attempt to sidetrack a portion of the hole on account of mechanical difficulty in drilling.

(l) "Geothermal resources operational order" or "GRO order" means a formal numbered order, issued by the Supervisor, with the prior approval of the Chief, Conservation Division, Geological Survey, which implements the regulations in this part and applies to operations in an area, region, or any significant portion thereof.

(m) "Producible well" means a well which is capable of producing geothermal resources in commercial quantities.

(n) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(o) "Area of operations" means that area of the leased lands which is required for exploration, development, and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, workshops, and other such facilities used for on-project geothermal resources field exploration, development, and production operations.

JURISDICTION AND FUNCTIONS OF SUPERVISOR

§ 270.10 Jurisdiction.

Drilling and production operations, handling and measurement of production, determination and collection of royalty and, in general, all operations conducted on a geothermal lease are subject to the regulations in this part and the applicable regulations contained in 43 CFR Group 3200, and are under the jurisdiction of the Supervisor for the area in which the leased land is situated, subject to the supervisory authority of the Secretary and the Director.

§ 270.11 General functions.

The Supervisor is authorized and directed to carry out the provisions of this part. He will require compliance with the terms of geothermal leases, with the regulations in this part and the applicable regulations in 43 CFR Group 3200, and with the applicable statutes. He shall act on all applications, requests, and notices required in this part. In executing his functions under this part the Supervisor shall ensure that all operations, within the area of operations, will conform to the best practice and are conducted in such manner as to protect the deposits of the leased lands and to result in the maximum ultimate recovery of geothermal resources, with minimum waste, and are consistent with the principles of the use of the land for other purposes and of the protection of the environment. Inasmuch as conditions in one area may vary widely from conditions in another area, the regulations in this part are intended to be general in nature. Detailed procedures hereunder in any particular area

will be covered by GRO orders. The requirements to be set forth in GRO orders relating to surface resources or uses will be coordinated with the appropriate land management agency. The Supervisor may issue oral orders to govern lease operations, but such orders shall be confirmed in writing by the Supervisor as promptly as possible. The Supervisor may issue other orders and rules to govern the development and method for production of a deposit, field, or area. Prior to the issuance of GRO orders and other orders and rules and the approval of any plan of operations, the Supervisor shall consult with, and receive comments from appropriate Federal and State agencies, lessees, operators, or interested parties. Before permitting other operations on the leased land, the Supervisor shall determine if the lease is in good standing, whether the lessee is authorized to conduct operations, has filed an acceptable bond, and has an approved plan of operations.

§ 270.12 Regulation of operations.

The Supervisor shall inspect and supervise operations performed under the regulations in this part to: (a) Prevent waste and damage to formations or deposits containing geothermal resources; (b) prevent unnecessary damage to other natural resources; (c) prevent degradation of the water quality; (d) protect air quality, water quality, and other environmental qualities; and (e) prevent injury to life or property. The Supervisor shall issue such GRO orders as are necessary to accomplish these purposes.

§ 270.13 Required samples, tests, and surveys.

When necessary or advisable, the Supervisor shall require that adequate samples be taken and tests or surveys be made using acceptable techniques, without cost to the lessor, to determine the identity and character of formations; the presence of geothermal resources, water, or reservoir energy; the quantity and quality of geothermal resources; water or reservoir energy; the amount and direction of deviation of any well from the vertical; formation, casing, and tubing pressures, temperatures, rate of heat and fluid flow, and whether operations are conducted in a manner looking to the protection of the interests of the lessor.

§ 270.14 Drilling and abandonment of wells.

The Supervisor shall require that drilling be conducted in accordance with the terms of the lease, GRO orders, and the regulations in this part and 43 CFR Group 3200; and shall require plugging and abandonment of any well or wells no longer necessary for operations in accordance with plans approved or prescribed by him. Upon the failure of a lessee to comply with any requirement under this section, the Supervisor is authorized to perform the work at the expense of the lessee and the surety.

§ 270.15 Well spacing and well casing.

The Supervisor shall approve proposed well-spacing and well-casing programs or prescribe such modifications to the programs as he determines necessary for proper development, giving consideration to such factors as: (a) Topographic characteristics of the area; (b) hydrologic, geologic and reservoir characteristics of the field; (c) the number of wells that can be economically drilled to provide the necessary volume of geothermal resources for the intended use; (d) protection of correlative rights; (e) minimizing well interference; (f) unreasonable interference with multiple use of land; and (g) protection of the environment, including ground water quality.

§ 270.16 Values and payment for losses.

The Supervisor shall determine the value of production accruing to the lessor where there is loss through waste or failure to drill and produce protection wells on the lease, and the compensation due to the lessor as reimbursement for such loss. Payment for such losses will be paid when billed.

§ 270.17 Suspension of operations and production.

(a) On receipt of an application filed in accordance with 43 CFR 3205.3-8 for suspension of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease), the Supervisor may, if he deems the suspension or relief warranted, approve the application.

(b) In the interest of conservation, the Supervisor may, on his own motion, suspend operations or production, or both, on any geothermal lease.

(c) Where operations or production, or both, under a lease, have been suspended, the Supervisor may approve resumption of operations or production either on his own motion or upon written request by the lessee or his agent.

(d) Whenever it appears from facts adduced by or furnished to the Supervisor that the interest of the lessor requires additional drilling or producing operations, he may, by written notice, order the beginning or resumption of such operations.

(e) See 43 CFR 3205.3-7 and 3205.3-8 for regulations concerning requests to waive, suspend, or reduce payments of rental or royalty, and extensions of leases on which operations or production have been suspended.

REQUIREMENTS FOR LESSEES (INCLUDING OPERATORS)

§ 270.30 Lease terms, regulations, waste, damage, and safety.

(a) The lessee shall comply with the lease terms, lease stipulations, applicable laws and regulations and any amendments thereof, GRO orders, and other written or oral orders of the Supervisor. All oral orders (to be confirmed in writing as provided in § 270.11) are effective when issued unless otherwise specified.

RULES AND REGULATIONS

(b) The lessee shall take all reasonable precautions to prevent: (1) Waste; (2) damage to any natural resource including trees and other vegetation, fish and wildlife and their habitat; (3) injury or damage to persons, real or personal property; and (4) any environmental pollution or damage.

(c) Any significant effect on the environment created by the lessee's operations or failure to comply with environmental standards shall be reported to the Supervisor within 24 hours and confirmed in writing within 30 days.

§ 270.31 Designation of operator or agent.

In all cases where operations are not conducted by the lessee but are to be conducted under authority of an unapproved operating agreement, assignment or other arrangement, a "designation of operator" shall be submitted to the Supervisor, in a manner and form approved by him, prior to commencement of operations. Such a designation will be accepted as authority of the operator or his local representative to act for the lessee and to sign any papers or reports required under the regulations in this part. All changes of address and any termination of the authority of the operator shall be immediately reported, in writing, to the Supervisor.

§ 270.32 Local agent.

When required by the Supervisor, the lessee shall designate a local representative empowered to receive notices and comply with orders of the Supervisor issued pursuant to the regulations in this part.

§ 270.33 Drilling and producing obligations.

(a) The lessee shall diligently drill and produce such wells as are necessary to protect the lessor from loss by reason of production on other properties, or in lieu thereof, with the consent of the Supervisor, shall pay a sum determined by the Supervisor as adequate to compensate the lessor for failure to drill and produce any such well.

(b) The lessee shall promptly drill and produce such other wells as the Supervisor may require in order that the lease be developed and produced in accordance with good operating practices. (See 43 CFR 3204.5.)

§ 270.34 Plan of operation.

Prior to commencing any operations on the leased lands or on any lands covered by a unit or cooperative agreement, the lessee shall submit in triplicate and obtain the approval of the Supervisor and the appropriate land management agency of a plan of operation for the area. Such plan shall include:

(a) The proposed location of each well including a layout showing the position of the mud tanks, reserve pits, cooling towers, pipe racks, etc.;

(b) Existing and planned access and lateral roads;

(c) Location and source of water supply and road building material;

(d) Location of camp sites, air-strips, and other supporting facilities;

(e) Other areas of potential surface disturbance;

(f) The topographic features of the land and the drainage patterns;

(g) Methods for disposing of waste material;

(h) A narrative statement describing the proposed measures to be taken for protection of the environment, including, but not limited to, the prevention or control of (1) fires, (2) soil erosion, (3) pollution of the surface and ground water, (4) damage to fish and wildlife or other natural resources, (5) air and noise pollution, and (6) hazards to public health and safety during lease activities;

(i) All pertinent information or data which the Supervisor may require to support the plan of operations for the utilization of geothermal resources and the protection of the environment;

(j) Provisions for monitoring deemed necessary by the Supervisor to ensure compliance with these regulations for the operations under the plan; and

(k) A requirement for the collection of data concerning the existing air and water quality, noise, seismic and land subsidence activities, and ecological system of the leased lands covering a period of at least one year prior to the submission of a plan for production. The information required for paragraphs (a) through (f) of this section may be shown on a map or maps available from State or Federal sources.

§ 270.35 Subsequent well operations.

After completion of all operations authorized under any previously approved notice or plan, the lessee shall not begin to redrill, repair, deepen, plug back, shoot, or plug and abandon any well, make casing tests, alter the casing or liner, stimulate production, change the method of recovering production, or use any formation or well for brine or fluid injection until he has submitted to the Supervisor in writing a new plan of operations and has received written approval from him. However, in an emergency a lessee may take action to prevent damage without receiving prior approval from the Supervisor, but in such cases the lessee shall report his action to the Supervisor as soon as possible.

§ 270.36 Well designations.

The lessee shall mark each derrick upon commencement of drilling operations and each producing or suspended well in a conspicuous place with his name or the name of the operator, the serial number of the lease, the number and location of the well. Whenever possible, the well location shall be described by section or tract, township, range, and by quarter-quarter section or lot. The lessee shall take all necessary means and precautions to preserve these markings.

§ 270.37 Well records.

(a) The lessee shall keep for each well at his field headquarters or at other locations conveniently available to the Supervisor, accurate and complete rec-

ords of all well operations including production, drilling, logging, directional well surveys, casing, perforation, safety devices, redrilling, deepening, repairing, cementing, alterations to casing, plugging, and abandoning. The records shall contain a description of any unusual malfunction, condition or problem; all the formations penetrated; the content and character of mineral deposits and water in each formation; thermal gradients, temperatures, pressures, analyses of geothermal waters, the kind, weight, size, grade, and setting depth of casing; and any other pertinent information.

(b) The lessee shall, within 30 days after completion of any well, transmit to the Supervisor copies of the records of all operations in a form prescribed by the Supervisor.

(c) Upon request of the Supervisor, the lessee will furnish (1) legible, exact copies of service company reports on cementing, perforating, acidizing, analyses of cores, electrical, and temperature logs, chemical analyses of steam and waters, or other similar services; (2) other reports and records of operations in the manner and form prescribed by the Supervisor.

§ 270.38 Samples, tests, and surveys.

(a) The lessee, when required by the Supervisor, will make adequate sampling, tests and/or surveys using acceptable techniques, to determine the presence, quantity, quality, and potential of geothermal resources, mineral deposits, or water; the amount and direction of deviation of any well from the vertical; and/or formation temperatures and pressures, casing, tubing, or other pressures and such other facts as the Supervisor may require. Such tests or surveys shall be made without cost to the lessor.

(b) The lessee shall, without cost to the lessor, take such formation samples or cores to determine the identity and character of any formation as are required and prescribed by the Supervisor.

§ 270.39 Directional survey.

The Supervisor may require an angular deviation and directional survey to be made of the finished hole of each directionally drilled well. The survey shall be made at the risk and expense of the lessee unless requested by an offset lessee, and then, at the risk and expense of the offset lessee. A copy of the survey shall be furnished the Supervisor.

§ 270.40 Well control.

The lessee or operator shall: (a) Take all necessary precautions to keep all wells under control at all times; (b) utilize trained and competent personnel; (c) utilize properly maintained equipment and materials; and (d) use operating practices which insure the safety of life and property. The selection of the types and weights of drilling fluids and provisions for controlling fluid temperatures, blowout preventers, and other surface control equipment and materials, casing and cementing programs, etc., to be used shall be based on sound engineering principles and shall take into account apparent geothermal gradients, depths and

RULES AND REGULATIONS

pressures of the various formations to be penetrated and other pertinent geologic and engineering data and information about the area.

§ 270.41 Pollution.

The lessee shall comply with all Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. Plans for disposal of well effluents must take into account effects on surface and subsurface waters, plants, fish and wildlife and their habitats, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Supervisor before action is taken under them.

§ 270.42 Noise abatement.

The lessee shall minimize noise during exploration, development and production activities. Welfare of the operating personnel and the public must not be affected as a consequence of the noise created by the expanding gases. The method and degree of noise abatement shall be as approved by the Supervisor.

§ 270.43 Land subsidence and seismic activity.

In the event subsidence or seismic activity results from the production of geothermal resources, as determined by monitoring activities by the lessee or a government body, the lessee shall take such action as required by the lease or by the Supervisor.

§ 270.44 Pits and sumps.

The lessee shall provide and use pits and sumps of adequate capacity and design to retain all materials and fluids necessary to drilling, production, or other operations unless otherwise specified by the Supervisor. In no event shall the contents of a pit or sump be allowed to: (a) Contaminate streams, artificial canals or waterways, ground waters, lakes or rivers; (b) adversely affect environment, persons, plants, fish and wildlife and their habitats; or (c) damage the aesthetic values of the property or adjacent properties. When no longer needed, pits and sumps are to be filled and covered and the premises restored to a near natural state, as prescribed by the Supervisor.

§ 270.45 Well abandonment.

The lessee shall promptly plug and abandon any well on the leased land that is not used or useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. Before abandoning a producible well, the lessee shall submit to the Supervisor a

statement of reasons for abandonment and his detailed plans for carrying on the necessary work. The detailed plans shall provide for the preservation of fresh water aquifers and for the prevention of intrusion into such aquifers of saline or polluted waters. A producible well may be abandoned only after receipt of written approval by the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor. Equipment shall be removed, and premises at the well site shall be restored as near as reasonably possible to its original condition immediately after plugging operations are completed on any well except as otherwise authorized by the Supervisor. Drilling equipment shall not be removed from any suspended drilling well without taking adequate measures to close the well and protect the subsurface resources.

§ 270.46 Accidents.

The lessee shall take all reasonable precautions to prevent accidents and shall notify the Supervisor within 24 hours of all accidents on the leased land, and shall submit a full report thereon within 15 days.

§ 270.47 Workmanlike operations.

The lessee shall carry on all operations and maintain the property at all times in a workmanlike manner, having due regard for the conservation of the property and the environment and for the health and safety of employees. The lessee shall remove from the property or store, in an orderly manner, all scrap or other materials not in use.

§ 270.48 Departure from orders.

The Supervisor may prescribe or approve either in writing or orally, with prompt written confirmation, variances from the requirements of GRO orders and other orders issued pursuant to these regulations, when such variances are necessary for the proper control of a well, conservation of natural resources, protection of human health and safety, property, or the environment. The Supervisor shall inform appropriate Federal and State agencies, of any action taken under this section.

§ 270.49 Sales contracts.

The lessee shall file with the Supervisor within 30 days after the effective date of the sales contract a copy of any contract for the disposal of geothermal resources from the lease.

§ 270.50 Royalty payments.

The lessee shall pay all royalties as due under the terms of the lease. Payments of royalties are due not later than the last day of the month following the month in which the resource is sold or utilized, and shall be by check, bank draft, or money order, drawn to the order of the United States Geological Survey.

MEASUREMENT OF PRODUCTION AND COMPUTATION OF ROYALTIES

§ 270.60 Measurement of geothermal resources.

The lessee shall measure or gauge all production in accordance with methods approved by the Supervisor. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used in industry. All measuring equipment shall be tested periodically and, if found defective, the Supervisor will determine the quantity and quality of production from the best evidence available.

§ 270.61 Determination of content of byproducts.

The lessee shall periodically furnish the Supervisor the results of periodic tests showing the content of byproducts in the produced geothermal fluid and gases. Such tests shall be taken as specified by the Supervisor and by the method of testing approved by him.

§ 270.62 Value of geothermal production for computing royalties.

(a) The value of geothermal production from the leased premises for the purpose of computing royalties shall be the reasonable value of the energy and the byproducts attributable to the lease as determined by the Supervisor. In determining the reasonable value of the energy and the byproducts the Supervisor shall consider:

- (1) The highest price paid for a majority of the production of like quality in the same field or area;
- (2) The total consideration accruing to the lessee from any disposition of the geothermal production;
- (3) The value of the geothermal production used by the lessee;
- (4) The value and cost of alternate available energy sources and byproducts;
- (5) The cost of exploration and production, exclusive of taxes;
- (6) The economic value of the resource in terms of its ultimate utilization;
- (7) Production agreements between producer and purchaser; and
- (8) Any other matters which may be considered relevant.

(b) Under no circumstances shall the value of any geothermal production for the purposes of computing royalties be less than:

- (1) The total consideration accruing to the lessee from the sale thereof in cases where geothermal resources are sold by the lessee to another party;
- (2) That amount which is the value of the end product attributable to the geothermal resource produced from a particular lease where geothermal resources are not sold by the lessee before being utilized, but are instead directly used in manufacturing, power production, or other industrial activity; or

RULES AND REGULATIONS

(3) When a part of the resource only is utilized by the lessee and the remainder sold, the sum of the value of the end product attributable to the geothermal resource and the sales price received for the geothermal resources

§ 270.63 Computation of royalties.

(a) The value of geothermal production from a particular lease as determined pursuant to § 270.62 hereof, shall be apportioned between geothermal steam, heat, and other forms of energy and the byproducts.

(b) The royalties payable shall be the sum of (1) the amount resulting from the multiplication of the value attributable to the geothermal steam, heat, and other forms of energy by the royalty rate set for such forms of geothermal energy in the lease and (2) the amount resulting from the multiplication of the value attributable to byproducts by the royalty rate for byproducts set in the lease.

§ 270.64 Commingling production.

The supervisor may authorize a lessee to commingle production from wells on his lease with production from other leases held by him or by other lessees subjects to such conditions as he may prescribe.

REPORTS TO BE MADE BY ALL LESSEES (INCLUDING OPERATORS)

§ 270.70 General requirements.

Information required to be submitted in accordance with the regulations in this part shall be furnished as directed by the Supervisor. Copies of forms can be obtained from the Supervisor and must be filed with that official within the time limit prescribed.

When forms or reports other than those referred to in the regulations in this part may be necessary, instructions for the filing of such forms or reports will be given by the Supervisor.

§ 270.71 Application for permit to drill, redrill, deepen, or plug-back.

(a) A permit to drill, redrill, deepen, or plug-back a well on Federal lands must be obtained from the Supervisor before the work is begun. The application for the permit, which shall be filed in triplicate with the Supervisor, shall state the location of the well in feet, and direction from the nearest section or tract lines as shown on the official plat of survey or protracted surveys; the altitude of the ground and derrick floor above sea level and how it was determined, and should be accompanied by a proposed plan of operations as required by these regulations.

(b) The proposed drilling and casing plan shall be outlined in detail under the heading "Details of Work" in the applications referred to herein, and shall describe the type of tools and equipment to be used, the proposed depth to which the well will be drilled, the estimated depths to the top of important markers, the estimated depths at which water, geothermal resources, or other mineral

resources are expected, the proposed casing program (including the size and weight of casing), the depth at which each string is to be set, and the amount of cement and mud to be used, the drilling method and type of circulating media (water, mud, foam, air or combinations thereof), the type of blowout prevention equipment to be used, the proposed coring, logging, or other program (such as drilling time log and sample description) to be used to determine the formations penetrated and the proposed program for determining geothermal gradients and the sampling and analysis of geothermal resources.

(c) Each application shall be accompanied by a plat showing the surface and expected bottomhole locations and the distances from the nearest section or tract line as shown on the official plat of survey or protracted surveys. The scale shall not be less than 2,000 feet to 1 inch.

(d) Each application should be accompanied by supporting structural and hydrologic information based on available geologic and geophysical data.

§ 270.72 Sundry notices and reports on wells.

(a) Any written notice of intention to do work or to change plans previously approved must be filed with the Supervisor in triplicate, unless otherwise directed, and must be approved by him before the work is begun. If, in case of emergency, any notice is given orally or by wire, and approval is obtained, the transaction shall be confirmed in writing. A subsequent report of the work performed must also be filed with the Supervisor.

(b) Casing test: Notice shall be given in advance to the Supervisor or his representative of the date and time when the operator expects to make a casing test. Later, by agreement, the exact time shall be fixed. In the event of casing failure during the test, the casing must be repaired or replaced or recemented as required by the Supervisor or his representative. The results of the test must be reported within 30 days after making a casing test. The report must describe the test completely and state the amount of mud and cement used, the lapse of time between running and cementing the casing and making the test, and the method of testing.

(c) Repairs or conditioning of well: Before the repairing or conditioning of a well, a notice setting forth in detail the plan of work must be filed with, and approved by, the Supervisor. A detailed report of the work accomplished and the methods employed, including all dates, and the results of such work must be filed within 30 days after completion of the repair work.

(d) Well stimulation: Before the lessee commences stimulation of a well by any means, a notice, setting forth in detail the plan of work, must be filed with and approved by the Supervisor. The notice shall name the type of stimulant and the amount to be used. A report showing the

amount of stimulant used and the production rate before and after stimulation must be filed within 30 days from completion of the casing.

(e) Altering casing in a well: Notice of intention to run a liner or to alter the casing by pulling or perforating by any means must be filed with and approved by the Supervisor before the work is started. This notice shall set forth in detail the plan of work. A report must be filed within 30 days after completion of the work stating exactly what was done and the results obtained.

(f) Notice of intention to abandon well: Before abandonment work is begun on any well, whether a drilling well, geothermal resources well, water well, or so-called dry hole, notice of intention to abandon shall be filed with, and approved by, the Supervisor. The notice must be accompanied by a complete log, in duplicate, of the well to date, provided the complete log has not been filed previously, and must give a detailed statement of the proposed work, including such information as kind, location, and length of plugs (by depths), plans for mudjacking, cementing, shooting, testing, and removing casing, and any other pertinent information.

(g) Subsequent report of abandonment: After a well is abandoned or plugged, a subsequent record of work done must be filed with the Supervisor. This report shall be filed separately within 30 days after the work is done. The report shall give a detailed account of the manner in which the abandonment or plugging work was carried out, including the nature and quantities of materials used in plugging and the location and extent (by depths) of the plugs of different materials; records of any tests or measurements made, and of the amount, size, and location (by depths) of casing left in the well; and a detailed statement of the volume of mud fluid used, and the pressure attained in mudjacking. If an attempt was made to part any casing, a complete report of the methods used and results obtained must be included.

§ 270.73 Log and history of well.

The lessee shall furnish in duplicate to the Supervisor, not later than 30 days after the completion of each well, a complete and accurate log and history, in chronological order, of all operations conducted on the well. A log shall be compiled for geologic information from cores or formations samples and duplicate copies of such log shall be filed. Duplicate copies of all electric logs, temperature surveys, water and steam analyses, hydrologic or heat flow tests, or direction surveys, if run, shall be furnished.

§ 270.74 Monthly report of operations.

A report of operations for each lease must be made for each calendar month, beginning with the month in which drilling operations are initiated. The report must be filed in duplicate with the Supervisor on or before the last day of the month following the month for which the report is filed unless an extension of

RULES AND REGULATIONS

time for the filing of the report is granted by the Supervisor. The report shall disclose accurately all operations conducted on each well during the month, the status of operations on the last day of the month, and a general summary of the status of operations on the leased lands. The report must be submitted each month until the lease is terminated or until omission of the report is authorized by the Supervisor. The report shall show for each calendar month:

(a) The lease serial number or the unit or communitization agreement number which shall be inserted in the upper right corner;

(b) Each well listed separately by number, and its location by 40-acre subdivision (quarter-quarter section or lot), section number, township, range, and meridian;

(c) The number of days each well was produced, whether steam or hot water or both were produced, and the number of days each input well was in operation, if any;

(d) The quantity of production and any byproducts obtained from each well, if any are recovered;

(e) The depth of each active or suspended well, and the name, character, and depth of each formation drilled during the month, the date and reason for every shutdown, the names and depths of important formation changes, the amount and size of any casing run since the last report, the dates and results of any tests or environmental monitoring conducted, and any other noteworthy information on operations not specifically provided for in the form.

(f) The footnote must be completely filled out as required by the Supervisor. If no sales were made during the calendar month, the report must so state.

§ 270.75 Monthly report of sales and royalty.

A report of sales and royalty for each productive lease must be filed each month once sales of production are made even though sales may be intermittent, unless otherwise authorized by the Supervisor. Total volumes of geothermal resources produced and sold, the value of production, and the royalty due the lessor must be shown. If byproducts are being recovered, the same requirement shall be applicable. This report is due on or before the last day of the month following the month in which production was obtained and sold or utilized, together with the royalties due the United States. Payment or royalty is to be made pursuant to § 270.50 unless otherwise authorized by the Supervisor.

§ 270.76 Annual report of compliance with environmental protection requirements.

The lessee shall submit annually a report giving a full account of the actions taken to comply with the appropriate Federal and State regulations or requirements of the Supervisor pertaining to the protection of the surface and subsurface environment. This report shall include but is not limited to such matters as:

- (a) Noise abatement;
- (b) Water quality;
- (c) Air quality;
- (d) Erosion control;
- (e) Subsidence and seismic activity;
- (f) Rehabilitation activities;
- (g) Waste disposal; and
- (h) Environmental effects on flora and fauna.

§ 270.77 Annual report of expenditures for diligent exploration operations.

A report of expenditures for exploration operations conducted during a lease year must be submitted annually to the Supervisor in order that such expenditures may be considered for qualification as diligent exploration pursuant to 43 CFR 3203.5.

§ 270.78 Notice of intent and permit to conduct exploration operations other than drilling, see 43 CFR 3209.0-5 (a).

(a) A permit to conduct exploration operations on the leased lands or on any lands covered by a unit or cooperative agreement must be obtained from the Supervisor before the work is begun. The form used for exploration operations conducted pursuant to 43 CFR 3209 will be acceptable.

(b) The notice of intent shall be filed in triplicate with the Supervisor and shall include:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) A statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) A brief description of the type of operations which will be undertaken;

(4) The approximate dates of the commencement and termination of exploration operations; and

(5) A plan of operation as required by § 270.34 covering paragraphs (a) through (h), of this section.

(c) The lessee shall, within 30 days after completion of such operations, furnish the Supervisor two copies of the records of the operation.

§ 270.79 Public inspection of records.

Geologic and geophysical interpretations, maps, and data required to be submitted under this part shall not be available for public inspection without the consent of the lessee so long as the lease remains in effect.

PROCEDURE IN CASE OF VIOLATION OF THE REGULATIONS OR LEASE TERMS

§ 270.80 Noncompliance with regulations or lease terms.

(a) Whenever a lessee or anyone acting under his authority fails to comply with the provisions of the regulations or lease terms, the Supervisor shall give the lessee notice to remedy any defaults or violations. Failure by the lessee to perform or commence the necessary remedial action pursuant to the notice may

result in a shut down of operations and may result in referral of the matter to the authorized offices of the Bureau of Land Management for action pursuant to 43 CFR 3244.3.

(b) The Supervisor is authorized to shut down any operations which he determines are unsafe or are causing or can cause pollution.

APPEALS

§ 270.90 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

PART 271—GEOTHERMAL RESOURCES UNIT PLAN REGULATIONS (INCLUDING SUGGESTED FORMS)

GENERAL PROVISIONS

- | | |
|--------|--|
| Sec. | Introduction. |
| 271.1 | Definitions. |
| 271.2 | Designation of area. |
| 271.3 | Preliminary consideration of agreements. |
| 271.4 | State land. |
| 271.5 | Qualifications of unit operator. |
| 271.6 | Parties to unit or cooperative agreement. |
| 271.7 | Approval of an executed unit or cooperative agreement. |
| 271.8 | Filing of papers and number of counterparts. |
| 271.9 | Bonds. |
| 271.10 | Appeals. |
| 271.11 | Form of unit agreement for unproved areas. |
| 271.12 | Sample form of Exhibit A of unit agreement. |
| 271.13 | Sample form of Exhibit B of unit agreement. |
| 271.14 | Form of collective bond. |
| 271.15 | Form of designation of successor unit operator by working interest owners. |
| 271.16 | Form of change in unit operator by assignment. |
| 271.17 | |

AUTHORITY: Section 18 of the Geothermal Steam Act of 1970 (84 Stat. 1556) (see 43 CFR Subpart 3244).

§ 271.1 Introduction.

The regulations in this part prescribe the procedure to be followed and the requirements to be met by holders of Federal geothermal leases (see § 271.2d) and their representatives who wish to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan for the development of any geothermal resources pool, field, or like area, or any part thereof. Such agreements may be initiated by lessees, or where in the interest of conserving natural resources they are deemed necessary they may be required by the Director.

§ 271.2 Definitions.

The following terms, as used in this part or in any agreement approved under the regulations in this part, shall have the meanings here indicated unless otherwise defined in such agreement:

(a) *Unit agreement.* An agreement or plan of development and operation for the production and utilization of separately owned interests in the geothermal resources made subject thereto

RULES AND REGULATIONS

as a single consolidated unit without regard to separate ownerships and which provides for the allocation of costs and benefits on a basis defined in the agreement or plan.

(b) *Cooperative agreement.* An agreement or plan of development and operations for the production and utilization of geothermal resources made subject thereto in which separate ownership units are independently operated without allocation of production.

(c) *Agreement.* For convenience, the term "agreement" as used in the regulations in this part refers to either a unit or a cooperative agreement as defined in paragraphs (a) and (b) of this section unless otherwise indicated.

(d) *Geothermal lease.* A lease issued under the act of December 24, 1970 (84 Stat. 1666), pursuant to the leasing regulations contained in 43 CFR Part 3200, and, unless the context indicates otherwise, "lease" means a geothermal lease.

(e) *Unit area.* The area described in a unit agreement as constituting the land logically subject to development under such agreement.

(f) *Unitized land.* The part of a unit area committed to a unit agreement.

(g) *Unitized substances.* Deposits of geothermal resources recovered from unitized land by operation under and pursuant to a unit agreement.

(h) *Unit operator.* The person, association, partnership, corporation, or other business entity designated under a unit agreement to conduct operations on unitized land as specified in such agreement.

(i) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(j) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in a unit or cooperative agreement, the owner of such interest is vested with the right to explore for, develop, produce, and utilize such resources. The right delegated to the unit operator as such by the unit agreement is not to be regarded as a working interest.

(k) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(l) *Director.* The Director of the U.S. Geological Survey.

(m) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

§ 271.3 Designation of area.

An application for designation of an area as logically subject to development and/or operation under a unit or cooperative agreement may be filed, in triplicate, by any proponent of such an agreement through the Supervisor. Each copy of the application shall be accompanied by a map or diagram on a scale of not less than 1 inch to 1 mile, outlining the area sought to be designated under this section. The Federal, State, and privately owned land should be indicated on said map by distinctive symbols or colors and Federal geothermal leases and lease applications should be identified by serial number. Geological information, including the results of geophysical surveys, and such other information as may tend to show that unitization is necessary and advisable in the public interest should be furnished in triplicate. Geological and geophysical information and data so furnished will not be available for public inspection, as provided by 5 U.S.C. section 552(b), without the consent of the proponent. The application and supporting data will be considered by the Director and the applicant will be informed of the decision reached. The designation of an area, pursuant to an application filed under this section, shall not create an exclusive right to submit an executed agreement for such area, nor preclude the inclusion of such area or any part thereof in another unit area.

§ 271.4 Preliminary consideration of agreements.

The form of unit agreement set forth in § 271.12 is acceptable for use in unproved areas. The use of this form is not mandatory, but any proposed departure therefrom should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. In areas proposed for unitization in which a discovery of geothermal resources has been made, or where a cooperative agreement is contemplated, the proposed agreement should be submitted with the application submitted under § 271.3 for preliminary consideration and for such revision as may be deemed necessary. The proposed form of agreement should be submitted in triplicate and should be plainly marked to identify the proposed variances from the form of agreement set forth in § 271.12.

§ 271.5 State land.

Where State-owned land is to be included in the unit, approval of the agreement by appropriate State officials should be obtained prior to its submission to the Department for approval of the executed agreement. When authorized by the laws of the State in which the unitized land is situated, provisions may be made in the agreement accepting State law, to the extent that they are applicable to non-Federal unitized land.

§ 271.6 Qualifications of unit operator.

A unit operator must qualify as to citizenship in the same manner as those holding interests in geothermal leases issued under the Geothermal Steam Act of 1970. The unit operator may be an owner of a working interest in the unit area or such other party as may be selected by the owners of working interests and approved by the Supervisor. The unit operator shall execute an acceptance of the duties and obligations imposed by the agreement. No designation of, or change in, a unit operator will become effective unless and until approved by the Supervisor, and no such approval will be granted unless the unit operator is deemed qualified to fulfill the duties and obligations prescribed in the agreement.

§ 271.7 Parties to unit or cooperative agreement.

The owners of any rights, title, or interest in the geothermal resources deposits to be developed and operated under an agreement can be regarded as proper parties to a proposed agreement. All such owners must be invited to join as parties to the agreement. If any owner fails or refuses to join the agreement, the proponent of the agreement should declare this to the Supervisor and should submit evidence of efforts made to obtain joinder of such owner and the reasons for nonjoinder.

§ 271.8 Approval of an executed unit or cooperative agreement.

(a) A duly executed unit or cooperative agreement will be approved by the Secretary, or his duly authorized representative, upon a determination that such agreement is necessary or advisable in the public interest and is for the purpose of properly conserving the natural resources. Taking into account the environmental consequences of the action, such approval will be incorporated in a certificate appended to the agreement. No such agreement will be approved unless at least one of the parties is a holder of a Federal lease embracing lands being committed to the agreement and unless the parties signatory to the agreement hold sufficient interests in the area to give effective control of operations therein.

(b) Where a duly executed agreement is submitted for Departmental approval, a minimum of six signed counterparts should be filed. The same number of counterparts should be filed for documents supplementing, modifying, or amending an agreement, including change of operator, designation of new operator, and notice of surrender, relinquishment, or termination.

(c) The address of each signatory party to the agreement should be inserted below the party's signature. Each signature should be attested by at least one witness, if not notarized. Corporate or other signatures made in a representative capacity must be accompanied by evidence of the authority of the signatories to act unless such evidence is already a matter of record in the United

RULES AND REGULATIONS

States Geological Survey. (The parties may execute any number of counterparts of the agreement with the same force and effect as if all parties signed the same document, or may execute a ratification or consent in a separate instrument with like force and effect.)

(d) Any modification of an approved agreement will require approval of the Secretary or his duly authorized representative under procedures similar to those cited in paragraph (a) of this section.

§ 271.9 Filing of papers and number of counterparts.

(a) All proposals and supporting papers, instruments, and documents submitted under this part should be filed with the Supervisor, unless otherwise provided in this part or otherwise instructed by the Director.

(b) Plans of development and operation, plans of further development and operation, and proposed participating areas and revisions thereof should be submitted in quadruplicate.

(c) Each application for approval of a participating area, or revision thereof, should be accompanied by three copies of a substantiating geologic and engineering report, structure contour map or maps, cross-section or other pertinent data.

(d) Other instruments or documents submitted for approval should be submitted for approval in sufficient number to permit the reviewing official to return at least one approved counterpart.

§ 271.10 Bonds.

In lieu of separate bonds required for each Federal lease committed to a unit agreement, the unit operator may furnish and maintain a collective corporate surety bond or a personal bond conditioned upon faithful performance of the duties and obligations of the agreement and the terms of the leases subject thereto. Personal bonds shall be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the obligations assumed. The liability under the bond shall be for such amount as the Supervisor shall determine to be adequate to protect the interests of the United States. Additional bond coverage may be required whenever deemed necessary by the Supervisor. The bond must be filed with and accepted by the Bureau of Land Management before operations will be approved. A form of corporate surety bond is set forth in § 271.15. In case of changes of unit operator, a new bond must be filed or a consent of surety to the change in principal under the existing bond must be furnished.

§ 271.11 Appeals.

Appeals from final orders or decisions issued under the regulations in this part shall be made in the manner provided in 30 CFR Part 290.

§ 271.12 Form of unit agreement for unproved areas.

UNIT AGREEMENT FOR THE DEVELOPMENT AND OPERATION OF THE _____ UNIT AREA
COUNTY _____
STATE OF _____

TABLE OF CONTENTS

Article	
I	Enabling act and regulations.
II	Definitions.
III	Unit area and exhibits.
IV	Contraction and expansion of unit area.
V	Unitized land and unitized substances.
VI	Unit operator.
VII	Resignation or removal of unit operator.
VIII	Successor unit operator.
IX	Accounting provisions and unit operating agreement.
X	Rights and obligations of unit operator.
XI	Plan of operation.
XII	Participating areas.
XIII	Allocation of unitized substances.
XIV	Reimbursement of leases.
XV	Rentals and minimum royalties.
XVI	Operations on nonparticipating land.
XVII	Leases and contracts conformed and amended.
XVIII	Effective date and term.
XIX	Appearance.
XX	No waiver of certain rights.
XXI	Unavoidable delay.
XXII	Postponement of obligations.
XXIII	Nondiscrimination.
XXIV	Counterparts.
XXV	Subsequent joinder.
XXVI	Covenants run with the land.
XXVII	Notices.
XXVIII	Loss of title.
XXIX	Taxes.
XXX	Relation of parties.
XXXI	Special federal lease stipulation and/or conditions.

UNIT AGREEMENT
COUNTY _____

This Agreement entered into as of the _____ day of _____, 19____, by and between the parties subscribing, ratifying, or consenting hereto, and herein referred to as the "parties hereto".

WITNESSETH: Whereas the parties hereto are the owners of working, royalty, or other geothermal resources interests in land subject to this Agreement; and

Whereas the Geothermal Steam Act of 1970 (84 Stat. 1566), hereinafter referred to as the "Act", authorizes Federal lessees and their representatives to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation of any geothermal resources pool, field, or like area, or any part thereof, for the purpose of more properly conserving the natural resources thereof, whenever determined and certified by the Secretary of the Interior to be necessary or advisable in the public interest; and

Whereas the parties hereto hold sufficient interest in the _____ Unit Area covering the land herein described to effectively conduct operations therein; and

Whereas it is the purpose of the parties hereto to conserve natural resources, prevent waste, and secure other benefits obtainable through development and operations of the area subject to this Agreement under the terms, conditions, and limitations herein set forth;

Now, therefore, in consideration of the premises and the promises herein contained,

the parties hereto commit to this agreement their respective interests in the below-defined Unit Area, and agree severally among themselves as follows:

ARTICLE I—ENABLING ACT AND REGULATIONS

1.1 The Act and all valid pertinent regulations, including operating and unit plan regulations, heretofore or hereafter issued thereunder are accepted and made a part of this agreement as to Federal lands.

1.2 As to non-Federal lands, the geothermal resources operating regulations in effect as of the effective date hereof governing drilling and producing operations, not inconsistent with the laws of the State in which the non-Federal land is located, are hereby accepted and made a part of this agreement.

ARTICLE II—DEFINITIONS

2.1 The following terms shall have the meanings here indicated:

(a) *Geothermal lease.* A lease issued under the act of December 29, 1970 (84 Stat. 1566), pursuant to the leasing regulations contained in 43 CFR Group 3200 and, unless the context indicates otherwise, "lease" shall mean a geothermal lease.

(b) *Unit area.* The area described in Article III of this agreement.

(c) *Unit Operator.* The person, association, partnership, corporation, or other business entity designated under this Agreement to conduct operations on Unitized Land as specified herein.

(d) *Participating area.* That part of the Unit Area which is deemed to be productive from a horizon or deposit and to which production would be allocated in the manner described in the unit agreement assuming that all lands are committed to the unit agreement.

(e) *Working interest.* The interest held in geothermal resources or in lands containing the same by virtue of a lease, operating agreement, fee title, or otherwise, under which, except as otherwise provided in this Agreement, the owner of such interest is vested with the right to explore for, develop, produce and utilize such resources. The right delegated to the Unit Operator as such by this Agreement is not to be regarded as a Working Interest.

(f) *Secretary.* The Secretary of the Interior or any person duly authorized to exercise powers vested in that officer.

(g) *Director.* The Director of the U.S. Geological Survey.

(h) *Supervisor.* A representative of the Secretary, subject to the direction and supervisory authority of the Director, the Chief, Conservation Division, Geological Survey, and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

ARTICLE III—UNIT AREA AND EXHIBITS

3.1 The area specified on the map attached hereto marked "Exhibit A" is hereby designated and recognized as constituting the Unit Area, containing _____ acres, more or less.

The above-described Unit Area shall when practicable be expanded to include therein any additional lands or shall be contracted to exclude lands whenever such expansion or contraction is deemed to be necessary or advisable to conform with the purposes of this Agreement.

3.2 Exhibit A attached hereto and made a part hereof is a map showing the boundary

RULES AND REGULATIONS

of the Unit Area, the boundaries and identity of tracts and leases in said area to the extent known to the Unit Operator.

3.8 Exhibit B attached hereto and made a part hereof is a schedule showing to the extent known to the Unit Operator the acreage, percentage, and kind of ownership of geothermal resources interests in all lands in the Unit Area.

3.4 Exhibits A and B shall be revised by the Unit Operator whenever changes in the Unit Area render such revision necessary, or when requested by the Supervisor, and not less than five copies of the revised Exhibits shall be filed with the Supervisor.

ARTICLE IV—CONTRACTION AND EXPANSION OF UNIT AREA

4.1 Unless otherwise specified herein, the expansion and/or contraction of the Unit Area contemplated in Article 3.1 hereof shall be effected in the following manner:

(a) Unit Operator either on demand of the Director or on its own motion after prior concurrence by the Director, shall prepare a notice of proposed expansion or contraction describing the contemplated changes in the boundaries of the Unit Area, the reasons therefor, and the proposed effective date thereof, preferably by the first day of a month subsequent to the date of notice.

(b) Said notice shall be delivered to the Supervisor, and copies thereof mailed to the last known address of each Working Interest Owner, Lessee, and Lessor whose interests are affected, advising that 30 days will be allowed for submission to the Unit Operator of any objections.

(c) Upon expiration of the 30-day period provided in the preceding item (b) hereof, Unit Operator shall file with the Supervisor evidence of mailing of the notice of expansion or contraction and a copy of any objections thereto which have been filed with the Unit Operator, together with an application in sufficient number, for approval of such expansion or contraction and with appropriate joinders.

(d) After due consideration of all pertinent information, the expansion or contraction shall, upon approval by the Supervisor, become effective as of the date prescribed in the notice thereof.

4.2 Unutilized Leases, insofar as they cover lands which are excluded from the Unit Area under any of the provisions of this Article IV may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions contained in the lease, and the lease, and amendments thereto, except that operations and/or production under this Unit Agreement shall not serve to maintain or continue the excluded portion of any lease.

4.3 All legal subdivisions of unutilized lands (i.e., 40 acres by Governmental survey or its nearest lot or tract equivalent in instances of irregular surveys), no part of which is entitled to be within a Participating Area on the fifth anniversary of the effective date of the initial Participating Area established under this Agreement, shall be eliminated automatically from this Agreement effective as of said fifth anniversary and such lands shall no longer be a part of the Unit Area and shall no longer be subject to this Agreement unless diligent drilling operations are in progress on an exploratory well on said fifth anniversary, in which event such lands shall not be eliminated from the Unit Area for as long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.4 An exploratory well, for the purposes of this Article IV is defined as any well, regardless of surface location, projected for com-

pletion in a zone or deposit below any zone or deposit for which a Participating Area has been established and is in effect, or any well, regardless of surface location, projected for completion of a surface location under Unutilized Lands not entitled to be within a Participating Area.

4.5 In the event an exploratory well is completed during the four (4) months immediately preceding the fifth anniversary of the initial Participating Area established under this Agreement, lands not entitled to be within a Participating Area shall not be eliminated from this Agreement on said fifth anniversary, provided the drilling of another exploratory well is commenced under an approved Plan of Operation within four (4) months after the completion of said well. In such event, the land not entitled to be in participation shall not be eliminated from the Unit Area so long as exploratory drilling operations are continued diligently with not more than four (4) months time elapsing between the completion of one exploratory well and the commencement of the next exploratory well.

4.6 With prior approval of the Supervisor, a period of time in excess of four (4) months may be allowed to elapse between the completion of one well and the commencement of the next well without the automatic elimination of nonparticipating acreage.

4.7 Unutilized lands proved productive by drilling operations which serve to delay automatic elimination of lands under this Article IV shall be incorporated into a Participating Area (or Areas) in the same manner as such lands would have been incorporated in such areas had such lands been proven productive during the year preceding said fifth anniversary.

4.8 In the event nonparticipating lands are included under this Agreement after the fifth anniversary of the initial Participating Area as a result of exploratory drilling operations, all legal subdivisions of unutilized land (i.e., 40 acres by Government survey or its nearest lot or tract equivalent in instances of irregular surveys), no part of which is entitled to be within a Participating Area shall be eliminated automatically as of the 121 day, or such later date as may be established by the Supervisor, following the completion of the last well recognized as delaying such automatic elimination beyond the fifth anniversary of the initial Participating Area established under this Agreement.

ARTICLE V—UNUTILIZED LAND AND UNUTILIZED SUBSTANCES

5.1 All land committed to this Agreement shall include land referred to herein as "Unutilized Land." All geothermal resources in and produced from any and all formations of the Unutilized Land are unutilized under the terms of this agreement and herein are called "Unutilized Substances."

ARTICLE VI—UNIT OPERATOR

6.1 ----- is hereby designated as Unit Operator and by signature hereto as Unit Operator agrees and consents to accept the duties and obligations of Unit Operator for the discovery, development, production, distribution and utilization of Unutilized Substances as herein provided. Whenever reference is made herein to the Unit Operator, such reference means the Unit Operator acting in that capacity and not as an owner of interest in Unutilized Substances, and the term "Working Interest Owner" when used herein shall include or refer to Unit Operator or the owner of a Working Interest when such an interest is owned by it.

ARTICLE VII—RESIGNATION OR REMOVAL OF UNIT OPERATOR

7.1 Prior to the establishment of a Participating Area, hereunder, Unit Operator

shall have the right to resign. Such resignation shall not become effective so as to release Unit Operator from the duties and obligations of Unit Operator or terminate Unit Operator's rights, as such, for a period of six (6) months after notice of intention to resign has been served by Unit Operator on all Working Interest Owners and the Supervisor, nor until all wells then drilled hereunder are placed in a satisfactory condition for suspension or abandonment whichever is required by the Supervisor, unless a new Unit Operator shall have been telephonically approved and shall have taken over and assumed the duties and obligations of Unit Operator prior to the expiration of said period.

7.2 After the establishment of a Participating Area hereunder Unit Operator shall have the right to resign in the manner and subject to the limitations provided in 7.1 above.

7.3 The Unit Operator may, upon default or failure in the performance of its duties or obligations hereunder, be subject to removal by the same or another one of the owners of Working Interests as herein provided for the selection of a new Unit Operator. Such removal shall be effective upon notice thereof to the Supervisor.

7.4 Upon resignation or removal of Unit Operator under this Agreement shall not terminate its right, title, or interest as the owner of a Working Interest or other interest in Unutilized Substances, but upon the resignation or removal of Unit Operator becoming effective, such Unit Operator shall deliver possession of all wells, equipment, material, and appurtenances used in conducting the unit operations to the newly qualified successor Unit Operator or, if no such new unit operator is elected, to the common agent appointed to represent the Working Interest Owners, any action taken hereunder to be used for the purpose of conducting operations hereunder.

7.5 In all instances of resignation or removal, until a successor Unit Operator is selected and approved as hereinafter provided, the Working Interest Owners shall be jointly responsible for performance of the duties and obligations of Unit Operator, and shall not later than 30 days before such resignation or removal becomes effective appoint a common agent to represent them in any action to be taken hereunder.

7.6 The resignation of Unit Operator shall not release Unit Operator from any liability for any default by it hereunder occurring prior to the effective date of its resignation.

ARTICLE VIII—SUCCESSOR UNIT OPERATOR

8.1 If, prior to the establishment of a Participating Area hereunder, the Unit Operator shall resign as Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unutilized Substances, based on their respective shares, on an acreage basis, in the Unutilized Land.

8.2 If, after the establishment of a Participating Area hereunder, the Unit Operator shall resign as Unit Operator, or shall be removed as provided in Article VII, a successor Unit Operator may be selected by vote of the owners of a majority of the Working Interests in Unutilized Substances, based on their respective shares, on a participating acreage basis. Provided, that, if a majority but less than 60 percent of the Working Interest in the Participating Lands is owned by the party to this Agreement, then one or more additional Working Interest Owners owning 10 percent or more of the Working Interest in the participating land shall be required to select a new Unit Operator.

8.3 The selection of a successor Unit Operator shall not become effective until

RULES AND REGULATIONS

(a) The Unit Operator so selected shall accept in writing the duties, obligations and responsibilities of the Unit Operator, and

(b) The selection shall have been approved by the Supervisor.

8.4 If no successor Unit Operator is selected and qualified as herein provided, the Director at his discretion may declare this Agreement terminated.

ARTICLE IX—ACCOUNTING PROVISIONS AND UNIT OPERATING AGREEMENT

9.1 Costs and expenses incurred by Unit Operator in conducting unit operations hereunder shall be paid and apportioned among and borne by the owners of Working Interests; in accordance with the agreement or agreements entered into by and between the Unit Operator and the owners of Working Interests, whether one or more, separately or collectively.

9.2 Any agreement or agreements entered into between the Working Interest Owners and the Unit Operator as provided in this Article, whether one or more, are hereby referred to as the "Unit Operating Agreement".

9.3 The Unit Operating Agreement shall provide the manner in which the Working Interest Owners shall be entitled to receive their respective share of the benefits accruing hereto in conformity with their underlying operating agreements, leases, or other contracts, and such other rights and obligations, as between Unit Operator and the Working Interest Owners.

9.4 Neither the Unit Operating Agreement nor any amendment thereto shall be deemed either to modify any of the terms and conditions of this Agreement or to relieve the Unit Operator of any right or obligation established under this Agreement.

9.5 In case of any inconsistency or conflict between this Agreement and the Unit Operating Agreement, this Agreement shall govern.

9.6 Three true copies of any Unit Operating Agreement executed pursuant to this Article IX shall be filed with the Supervisor prior to approval of this Agreement.

ARTICLE X—RIGHTS AND OBLIGATIONS OF UNIT OPERATOR

10.1 The right, privilege, and duty of exercising any and all rights of the parties hereto which are necessary or convenient for prospecting, producing, distributing or utilizing Unitized Substances are hereby delegated to and shall be exercised by the Unit Operator as provided in this Agreement in accordance with a Plan of Operations approved by the Supervisor.

10.2 Upon request by Unit Operator, acceptable evidence of title to geothermal resources interests in the Unitized Land shall be deposited with the Unit Operator, and the same with this Agreement shall constitute and define the rights, privileges, and obligations of Unit Operator.

10.3 Nothing in this Agreement shall be construed to transfer title to any land or to any lease or operating agreement, it being understood that the Unit Operator, in its capacity as Unit Operator shall exercise the rights of possession and use vested in the parties hereto only for the purposes specified in this Agreement.

10.4 The Unit Operator shall take such measures as the Supervisor deems appropriate and adequate to prevent drainage of Unitized Substances from Unitized Land by wells on land not subject to this Agreement.

10.5 The Director is hereby vested with authority to alter or modify from time to time, in his discretion, the rate of prospecting and development and the quantity and rate of production under this Agreement.

ARTICLE XI—PLAN OF OPERATION

11.1 Concurrently with the submission of this Agreement for approval, Unit Operator

shall submit an acceptable initial Plan of Operation. Said plan shall be as complete and adequate as the Supervisor may determine for timely exploration and/or development and to insure proper protection of the environment and conservation of the natural resources of the Unit Area.

11.2 Prior to the expiration of the initial Plan of Operation, or any subsequent Plan of Operation, Unit Operator shall submit for approval of the Supervisor an acceptable subsequent Plan of Operation for the Unit Area which, when approved by the Supervisor, shall constitute the exploratory or development drilling and operating obligations of Unit Operators under this Agreement for the period specified therein.

11.3 Any plan of Operation submitted hereunder shall

(a) Specify the number and locations of any wells to be drilled and the proposed order and time for such drilling, and

(b) To the extent practicable, specify the operating practices regarded as necessary and advisable for proper conservation of natural resources and protection of the environment in compliance with section 1.1.

11.4 Each Plan of Operation submitted concurrently with this Agreement for approval shall prescribe that within six (6) months after the effective date hereof, the Unit Operator shall begin to drill an adequate test well at a location approved by the Supervisor, unless on such effective date a well is being drilled conformably with the terms, hereof, and thereafter continue such drilling diligently until the ----- information has been tested or until at a lesser depth unitized substances shall be discovered. Unitized substances shall be produced in paying quantities (i.e., quantities sufficient to repay the costs of drilling, completing, and producing operations, with a reasonable profit) or the Unit Operator shall at any time establish to the satisfaction of the Supervisor that further drilling of said well would be unwarranted or impracticable, provided, however, that Unit Operator shall not in any event be required to drill said well to a depth in excess of ----- feet.

11.5 The initial Plan of Operation and/or subsequent Plans of Operation submitted pursuant to this article shall provide that the Unit Operator shall initiate a continuous drilling program providing for drilling of no less than one well at a time, and allowing no more than six (6) months time to elapse between completion of one well and the beginning of the next well, until a well capable of producing Unitized Substances in paying quantities is completed to the satisfaction of the Supervisor or until it is reasonably proved that the Unitized Land is incapable of producing Unitized Substances in paying quantities.

11.6 When warranted by unforeseen circumstances, the Supervisor may grant a single extension of any or all of the critical dates for exploratory drilling operations cited in the initial or subsequent Plans of Operation. No such extension shall exceed a period of four (4) months for each well, required by the initial Plan of Operation.

11.7 Until there is actual production of Unitized Substances, the failure of Unit Operator to timely drill any of the wells provided for in Plans of Operation required pursuant to this Article XI or to timely submit a subsequent Plan of Operations, shall, after notice of default or notice of prospective default to Unit Operator by the Supervisor and after failure of Unit Operator to remedy any actual default within a reasonable time (as determined by the Supervisor), result in automatic termination of this Agreement effective as of the date of the default, as determined by the Supervisor.

11.8 Separate Plans of Operations may be submitted for separate productive zones,

subject to the approval of the Supervisor. Also subject to the approval of the Supervisor, Plans of Operation shall be modified or supplemented when necessary to meet changes in conditions or to protect the interest of all parties to this Agreement.

ARTICLE XII—PARTICIPATING AREAS

12.1 Prior to the commencement of production of Unitized Substances, the Unit Operator shall submit for approval by the Supervisor a schedule (or schedules) of all land then regarded as reasonably proved to be productive from a pool or deposit discovered or developed; all lands in said schedule (or schedules), on approval of the Supervisor, will constitute a Participating Area (or Areas) effective as of the date production commences or the effective date of said schedule (or schedules), whichever is later. Said schedule shall also set forth the percentage of Unitized Substances to be allocated, as herein provided, to each tract in the Participating Area (or Areas) so established and shall govern the allocation of production commencing with the effective date of the Participating Area.

12.2 A separate Participating Area shall be established for each separate pool or deposit of Unitized Substances or for any group thereof which is produced as a single pool or deposit and any two or more Participating Areas so established may be combined into one, on approval of the Supervisor. The effective date of any Participating Area established after the commencement of actual production of Unitized Substances shall be the first of the month in which is obtained the knowledge or information by which the establishment of said Participating Area is based, unless a more appropriate effective date is proposed by the Unit Operator and approved by the Supervisor.

12.3 Any Participating Area (or Areas) established under 12.1 or 12.2 above shall, subject to the approval of the Supervisor, be revised from time to time to include additional land then regarded as reasonably proved to be productive from the pool or deposit for which the Participating Area was established or to exclude land then regarded as reasonably proved not to be productive from the pool or deposit for which the Participating Area was established or to exclude land not necessary to unit operations and the schedule (or schedules) of allocation percentages shall be revised accordingly.

12.4 Subject to the limitation cited in 12.1 hereof, the effective date of any revision of a Participating Area established under Articles 12.1 or 12.2 shall be the first of the month in which is obtained the knowledge or information on which such revision is predicated, provided, however, that a more appropriate effective date may be used if justified by the Unit Operator and approved by the Supervisor.

12.5 No land shall be excluded from a Participating Area on account of depletion of the Unitized Substances, except that any Participating Area established under the provisions of this Article XII shall terminate automatically whenever all operations are abandoned in the pool or deposit for which the Participating Area was established.

12.6 Nothing herein contained shall be construed as requiring any retroactive adjustment for production obtained prior to the effective date of the revision of a Participating Area.

ARTICLE XIII—ALLOCATION OF UNITIZED SUBSTANCES

13.1 All Unitized Substances produced from a Participating Area, established under this Agreement, shall be determined and produced equally on an acreage basis from the several tracts of Unitized Land within the

RULES AND REGULATIONS

Participating Area established for, such production.

13.2 For the purpose of determining any benefits accruing under this Agreement, each Tract of Unitized Land shall have allocated to it such percentage of said production as the number of acres in the Tract included in the Participating Area bears to the total number of acres of Unitized Land in said Participating Area.

13.3 Allocation of production hereunder for purposes other than for settlement of the royalty obligations of the respective Working Interest Owners, shall be on the basis prescribed in the Unit Operating Agreement whenever in conformity with the basis of allocation set forth above or otherwise.

13.4 The Unitized Substances produced from a Participating Area shall be allocated as provided herein regardless of whether any wells are drilled on any particular part or tract of said Participating Area.

ARTICLE XIV—RELINQUISHMENT OF LEASES

14.1 Pursuant to the provisions of the Federal leases and 43 CFR 3244.1, a lessee of record shall, subject to the provisions of the Unit Operating Agreement, have the right to relinquish any of its interests in leases committed hereto, in whole or in part; provided, that no relinquishment shall be made of interests in land within a Participating Area without the prior approval of the Director.

14.2 A Working Interest Owner may exercise the right to surrender, when such right is vested in it by any non-Federal lease, sublease, or operating agreement, provided that each party who will or might acquire the Working Interest in such lease by such surrender or by forfeiture is bound by the terms of this Agreement, and further provided that no relinquishment shall be made of such land within a Participating Area without the prior written consent of the non-Federal Lessor.

14.3 If as the result of relinquishment, surrender, or forfeiture the Working Interests become vested in the fee owner or lessor of the Unitized Substances, such owner may:

(1) Accept those Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement; or

(2) Lease the portion of such land as is included in a Participating Area established hereunder, subject to this Agreement and the Unit Operating Agreement; and provide for the independent operation of any part of such land that is not then included within a Participating Area established hereunder.

If the fee owner or lessor of the Unitized Substances does not, (1) accept the Working Interest rights and obligations subject to this Agreement and the Unit Operating Agreement, or (2) lease such lands as provided in 14.3 above within a (3) months after the relinquishment, surrender, or forfeiture Working Interest becomes vested in said fee owner or lessor, the Working Interest benefits and obligations accruing to such land under this Agreement and the Unit Operating Agreement shall be shared by the owners of the remaining unitized Working Interests in accordance with their respective Working Interest ownerships, and such owners of Working Interests shall compensate the fee owner or lessor of Unitized Substances in such lands by paying sums equal to the rentals, minimum royalties, and royalties applicable to such lands under the lease or leases in effect when the Working Interests were relinquished, surrendered, or forfeited.

14.5 Subject to the provisions of 14.4 above, an appropriate accounting and settlement shall be made for benefits and royalties or payments and expenditures made or incurred on behalf of any surrendered or forfeited

Working Interest subsequent to the date of surrender or forfeiture, and the portion of any moneys found to be owing by such an accounting shall be made as between the parties within thirty (30) days.

14.6 In the event no Unit Operating Agreement is in existence and a mutually acceptable agreement cannot be consummated between the proper parties, the Supervisor may prescribe such reasonable and equitable conditions of agreement as he deems warranted under the circumstances.

14.7 The exercise of any right vested in a Working Interest Owner to reassign such Working Interest to the party from whom obtained shall be subject to the same conditions as set forth in this Article XIV in regard to the exercise of a right to surrender.

ARTICLE XV—RENTALS AND MINIMUM ROYALTIES

15.1 Any unitized lease on non-Federal land and/or provisions which would terminate such lease unless drilling operations are commenced upon the land covered thereby within the time therein specified or rentals are paid for the privilege of deferring such drilling operations, the rentals required thereby shall, notwithstanding any other provisions of this Agreement, be deemed to accrue as to the portion of the lease not included within a Participating Area and become payable during the term thereof as extended by this Agreement, and until the required drillings are commenced upon the land covered thereby.

15.2 Rentals are payable at Federal leases on or before the anniversary date of each lease year; minimum royalties accrue from the anniversary date of each lease year and are payable at the end of the lease year.

15.3 Beginning with the lease year commencing on or after _____ and for each lease year thereafter, the rental or minimum royalty for lands of the United States subject to this Agreement shall be made on the following basis:

(a) An advance annual rental in the amount prescribed in unitized Federal leases, in any event, creditable against production royalties, shall be paid for each acre of tract thereof which is not within a Participating Area.

(b) A minimum royalty shall be charged at the beginning of each lease year (such minimum royalty to be due as of the last day of the lease year and payable within thirty (30) days thereafter) of \$2 an acre or fraction thereof, for all Unitized Acreage within a Participating Area as of the beginning of the lease year. If as is production of oil or gas in such year, the deficit, if any, between the actual royalty and the minimum royalty prescribed herein shall be paid.

15.4 Rental or minimum royalties due on leases committed hereto shall be paid by Working Interest Owners responsible therefor under existing contracts and regulations, or by the Unit Operator.

15.5 Settlement for royalty interest shall be made by Working Interest Owners responsible therefor under existing contracts, laws, and regulations, or by the Unit Operator, on or before the last day of such month for Unitized Substances produced during the preceding calendar month.

15.6 Royalty due the United States shall be computed as provided in the operating regulations and paid in value as to all Unitized Substances on the basis of the amounts thereof allocated to unitized Federal land as provided herein at the royalty rate or rates specified in the respective Federal leases.

15.7 Nothing herein contained shall operate to relieve the lessees of any land from their obligation to pay to the Government, for the payment of any rental, minimum royalty, or royalty due under their leases.

ARTICLE XVI—OPERATIONS ON NONPARTICIPATING LAND

16.1 Any party hereto owning or controlling the Working Interest in any Unitized Land having thereon a regular well location may, with the approval of the Supervisor and at such party's sole risk, costs, and expense, drill a well to test any formation of deposit for which a Participating Area has not been established or to test any formation or deposit for which a Participating Area has been established if such location is not within said Participating Area, unless within 90 days of receipt of notice from said party of his intention to drill the well, the Unit Operator elects and commences to drill such a well in like manner as other wells are drilled by the Unit Operator under this Agreement.

16.2 If any well drilled by a Working Interest Owner other than the Unit Operator proves that the land upon which said well is situated may properly be included in a Participating Area, such Participating Area shall be established or enlarged as provided in this Agreement and the well shall thereafter be operated by the Unit Operator in accordance with the terms of this Agreement and the Unit Operating Agreement.

ARTICLE XVII—LEASES AND CONTRACTS CONFORMED AND EXTENDED

17.1 The terms, conditions, and provisions of all leases, subleases, and other contracts relating to exploration, drilling, development, or utilization of geothermal resources on lands committed to this Agreement, are hereby expressed, modified, amended, or to the extent necessary to make the same conform to the provisions hereof, otherwise said leases, subleases, and contracts shall remain in full force and effect.

17.2 The parties hereto consent that the Secretary shall, by his approval hereof, modify and amend or modify and amend only to the extent necessary to make the same conform to the provisions hereof, otherwise said leases and regulations in respect thereto to the extent necessary to conform said leases and regulations to the provisions of this Agreement.

17.3 The development and/or operation of lands subject to this Agreement under the terms hereof shall be deemed full performance of any obligations for development and operation with respect to each and every separately owned tract subject to this Agreement, regardless of whether there is any development of any particular tract of the Unit Area.

17.4 Drilling and/or producing operations performed hereunder upon any tract of Unitized Lands will be accepted and deemed to be performed upon and for the benefit of each and every tract of Unitized Land.

17.5 Suspension of operations and/or production on all Unitized Lands pursuant to the direction or consent of the Secretary duly authorized representative shall be deemed to constitute such suspension pursuant to such direction or consent as to each and every tract of Unitized Land. A suspension of operations and/or production limited to specified lands shall be applicable only to such lands.

17.6 Subject to the provisions of Article XV hereof and 17.10 of this Article, each lease, sublease, or contract relating to the exploration, drilling, development, or utilization of geothermal resources of lands other than those of the United States committed to this Agreement, is hereby extended beyond any such term so provided therein so that it shall be continued for and during the term of this Agreement.

17.7 Subject to the lease renewal and the readjustment provision of the Act, any Federal lands of the United States committed to this Agreement, shall be continued for the term

RULES AND REGULATIONS

so provided therein, or as extended by law. This subsection shall not operate to extend any lease or portion thereof as to lands excluded from the Unit Area by the contract therefor.

17.6 Each sublease or contract relating to the operations and development of Unitized Substances from lands of the United States committed to this Agreement shall be continued in force and effect for and during the term of the underlying lease.

17.9 Any Federal lease heretofore or hereafter committed to any such unit plan embracing lands that are in part within and in part outside of the area covered by any such plan shall be segregated into separate leases as to the lands committed and the lands not committed as of the effective date of unitization.

17.10 In the absence of any specific lease provision to the contrary, any lease, other than a Federal lease, having only a portion of its land committed hereto shall be segregated as to the portion committed and the portion not committed, and the provisions of such lease shall apply separately to such segregated portions commencing as of the effective date hereof. In the event any such lease provides for a lump-sum rental payment, such payment shall be prorated between the portions so segregated in proportion to the acreage of the respective tracts.

17.11 Upon termination of this Agreement, the leases covered hereby may be maintained and continued in force and effect in accordance with the terms, provisions, and conditions of the Act, the lease or leases, and amendments thereto.

ARTICLE XVIII—EFFECTIVE DATE AND TERM

18.1 This Agreement shall become effective upon approval by the Secretary or his duly authorized representative and shall terminate five (5) years from said effective date unless,

- (a) Such date of expiration is extended by the Director, or
- (b) Unitized Substances are produced or utilized in commercial quantities in which event this Agreement shall continue for so long as Unitized Substances are produced or utilized in commercial quantities, or
- (c) This Agreement is terminated prior to the end of said five (5) year period as herebefore provided.

18.2 This Agreement may be terminated at any time by the owners of a majority of the Working Interests, on an acreage basis, with the approval of the Supervisor. Notice of any approval shall be given by the Unit Operator to all parties hereto.

ARTICLE XIX—APPEARANCES

19.1 Unit Operator shall, after notice to other parties affected, have the right to appear for and on behalf of any and all interests affected hereby before the Department of the Interior, and to appeal from decisions, orders or rulings issued under the regulations of said Department, or to apply for relief from any of said regulations or in any proceedings relative to operations before the Department of the Interior or any other legally constituted authority: *Provided, however,* That any interested parties shall also have the right, at its own expense, to be heard in any such proceeding.

ARTICLE XX—NO WAIVER OF CERTAIN RIGHTS

20.1 Nothing contained in this Agreement shall be construed as a waiver by any party hereto of the right to assert any legal or constitutional right or defense pertaining to the validity or invalidity of any law of the State wherein lands subject to this Agreement are located, or of the United States, or regulations issued thereunder, in any way affecting

such party or as a waiver by any such party of any right beyond his or its authority to waive.

ARTICLE XXI—UNAVOIDABLE DELAY

21.1 The obligations imposed by this Agreement requiring Unit Operator to commence or continue drilling or to produce or utilize Unitized Substances from any of the land covered by this Agreement, shall be suspended, but only so long as, Unit Operator, despite the exercise of due care and diligence, is prevented from complying with such obligations, in whole or in part, by strikes, Acts of God, Federal or other applicable law, Federal or other authorized governmental agencies, unavoidable circumstances, unavoidable delays in transportation, inability to obtain necessary materials in open market, or other matters beyond the reasonable control of Unit Operator, whether similar to matters herein enumerated or not.

21.2 No unit obligation which is suspended under this section shall become due less than thirty (30) days after it has been determined that the suspension is no longer applicable.

21.3 Determination of creditable "Unavoidable Delay" time shall be made by the Unit Operator subject to approval of the Supervisor.

ARTICLE XXII—POSTPONEMENT OF OBLIGATIONS

22.1 Notwithstanding any other provisions of this Agreement, the Director, on his own initiative or upon appropriate justification by Unit Operator, may postpone any obligation established by and under this Agreement to commence or continue drilling or to operate on or produce Unitized Substances from lands covered by this Agreement when in his judgement, circumstances warrant such action.

ARTICLE XXIII—NONDISCRIMINATION

23.1 In connection with the performance of work under this Agreement, the Operator agrees to comply with all of the provisions of sections 1021 (1) to (7) inclusive, of Executive Order 11246 (30 F.R. 12319), as amended by Executive Order 11875 (32 F.R. 14303), which are hereby incorporated by reference in this Agreement.

ARTICLE XXIV—COUNTERPARTS

24.1 This Agreement may be executed in any number of counterparts no one of which needs to be executed by all parties, or may be ratified or consented to by separate instruments in writing specifically referring hereto, and shall be binding upon all parties. Each executed such a counterpart, ratification or consent hereto, with the same force and effect as if all such parties had signed the same document.

ARTICLE XXV—SUBSEQUENT JOINDER

25.1 If the owner of any substantial interest in geothermal resources under a tract within the Unit Area fails or refuses to subscribe or consent to this Agreement, the owner of the Working Interest in that tract may withdraw said tract from the Agreement and the Unit Operator prior to the approval of this Agreement by the Supervisor.

25.2 Any geothermal resources interests in lands within the Unit Area not committed hereto prior to approval of this Agreement may thereafter be committed by the owner or owners thereof subscribing or consenting to this Agreement, and, if the interest is a Working Interest, by the owner of such interest also subscribing to the Unit Operating Agreement.

25.3 After operations are commenced hereunder, the right of subsequent joinder, as

provided in this Article XXIV, by a working Interest Owner is subject to such requirements or approvals, if any, pertaining to such Joinder as may be provided for in the Unit Operating Agreement. Joinder to the Unit Agreement by a Working Interest Owner, at any time, must be accompanied by appropriate joinder to the Unit Operating Agreement, if more than one committed Working Interest Owner is provided in order for the interest to be regarded as committed to this Unit Agreement.

25.4 After final approval hereof, joinder by a nonworking interest owner must be consented to in writing by the Working Interest Owner committed hereto and responsible for the payments of benefits that may accrue hereunder in behalf of such nonworking interest. A nonworking interest may not be committed to this Agreement unless the corresponding Working Interest is committed hereto.

25.5 Except as may otherwise herein be provided, subsequent joinders to this Agreement shall not affect the first day of the month following the filing with the Supervisor of duly executed counterparts of all or any papers necessary to establish effective commitment of any tract to this Agreement unless objection to such joinder is duly made within sixty (60) days by the Supervisor.

ARTICLE XXVI—COVENANTS RUN WITH THE LAND

26.1 The covenants herein shall be construed to be covenants running with the land with respect to the interest of the parties hereto and their successors in interest until this Agreement terminates, and any grant, transfer, or conveyance, of interest in land or leases subject hereto shall be and hereby is conditioned upon the assumption of all privileges and obligations hereunder by the grantee, transferee, or other successor in interest.

26.2 No assignment or transfer of any Working Interest or other interest subject hereto shall be binding upon Unit Operator until the first day of the calendar month after Unit Operator is furnished with the original, photostatic, or certified copy of the instrument of transfer.

ARTICLE XXVII—NOTICES

27.1 All notices, demands or statements required hereunder to be given or rendered to the parties hereto shall be deemed fully given if given in writing and personally delivered to the party or sent by postpaid registered or certified mail, addressed to such party or parties at their respective addresses set forth in connection with the signatures hereto or to the ratification or consent hereto or to such other address as any such party may have furnished in writing to party sending the notice, demand or statement.

ARTICLE XXVIII—LOSS OF TITLE

28.1 In the event title to any tract of Unitized Land shall fall and the true owner cannot be induced to join in this Agreement, such tract shall be automatically regarded as not committed hereto and there shall be such readjustment of future costs and benefits as may be required on account of the loss of such title.

28.2 In the event of a dispute as to title as to any royalty, Working Interest, or other interests subject hereto, payment or delivery on account thereof may be withheld without liability for interest until the dispute is finally settled. *Provided,* that as to Federal land or leases, no payments of funds due the United States shall be withheld, but such funds shall be deposited as directed by the Supervisor to be held as unearned money

RULES AND REGULATIONS

pending final settlement of the title dispute, and then applied as earned or returned in accordance with such final settlement.

ARTICLE XXIX—TAXES

29.1 The Working Interest Owners shall render and pay for their accounts and the accounts of the owners of nonworking interests all valid taxes on or measured by the Unitized Substances in and under or that may be produced, gathered, and sold or utilized from the land subject to this Agreement after the effective date hereof.

29.2 The Working Interest Owners on each tract may charge a proper proportion of the taxes paid under 29.1 hereof to the owners of nonworking interests in said tract, and may reduce the allocated share of each royalty owner for taxes so paid. No taxes shall be charged to the United States or the State of _____ or to any lessor who has a contract with his lessee which requires the lessee to pay such taxes.

ARTICLE XXX—RELATION OF PARTIES

30.1 It is expressly agreed that the relation of the parties hereto is that of independent contractors and nothing in this Agreement contained, expressed, or implied, nor any operations conducted hereunder, shall create or be deemed to have created

a partnership or association between the parties hereto or any of them.

ARTICLE XXXI—SPECIAL FEDERAL LEASE STIPULATIONS AND/OR CONDITIONS

31.1 Nothing in this Agreement shall modify special lease stipulations and/or conditions applicable to lands of the United States. No modification of the conditions necessary to protect the lands or functions of lands under the jurisdiction of any Federal agency is authorized except with prior consent in writing whereby the authorizing official specifies the modification permitted.

In witness whereof, the parties hereto have caused this Agreement to be executed and have set opposite their respective names the date of execution.

Witnesses: _____	Unit operator (as unit operator and as working interest owner)
Witnesses: _____	_____
Witnesses: _____	By _____
Witnesses: _____	Working Interest Owners:
_____	_____
_____	By _____
_____	Other Interest Owners:
_____	_____
_____	By _____

§ 271.13 Sample form of Exhibit A of unit agreement.

EXHIBIT A—BIG VAPOR UNIT AREA, T. 13 N., R. 10 W., M.D.M., California
R. 1 W.

Hot Rock		Volcanics	Fumarole
⑦	①	①	⑧
16	15	14	13
State		C-38470	Hadde
Volcanics	Fumarole	Hot Rock	
⑩	⑨	①	⑤
21	22	23	24
	Smith		C-83970
	Hot Volcan-Rock 1/2	Hot Rock	
	27	26	⑥
28			25
C-41345	C-41679	C-72760	⑤
	Hot Rock	Hot Rock	Hot Rock
33	34	35	⑦
C-41679	Quick, et al	C-39123	⑦
			State

① Means tract number as listed on Exhibit B

-  PUBLIC LAND
-  STATE LAND
-  PATENTED LAND

RULES AND REGULATIONS

§ 271.14 Sample form of Exhibit B of unit agreement.

EXHIBIT B—BIG VAPOR UNIT AREA, NAPA COUNTY, CALIF., T. 18 N., R. 10 W.

Tract No.	Description of land	No. of acres	Serial No. and expiration date of lease	Basic royalty and ownership percentage	Lessee of record	Writing instrument and percentage
Federal land						
1.....	Sec. 14: All Sec. 15: All Sec. 22: Lots 1, 2, 3, 4, NE 1/4, NW 1/4	1,890.00	38470 July 31, 1982.....	United States: All.....	Volcanos, Inc.....	Volcanos, Inc: All.
2.....	Sec. 35: All.....	640.00	30123 July 31, 1982.....	do.....	D. H. Botler.....	Hot Rock Co.: All.
3.....	Sec. 21: All..... Sec. 23: All..... Sec. 27: All.....	1,280.00 1,280.00 1,280.00	41870 July 31, 1982..... 41677.....	do.....	C. S. Waters—80% F. D. Mann—60% H. C. Pipes.....	Volcanos, Co.: 60% Hot Rock Co.: 50% Fumarole Ltd.: All.
4.....	Sec. 35: All.....	661.50	71278.....	do.....	Hot Rock Co.....	Hot Rock Co.: All.
5.....	Sec. 23: 3/4..... Sec. 24: All..... Sec. 25: N 1/2.....	905.50	83970 Application.....	do.....	H. C. Pipes.....	Do.
6 Federal tracts 7,017.30 acres or 68.47% of unit area.						
California State land						
7.....	Sec. 13: All..... Sec. 36: All.....	1,280.00	65-67430.....	State of California: All.	Hot Rock Co.....	Hot Rock Co.: All.
1 State tract 1,260.00 acres or 12.49% of unit area.						
Patented land						
8.....	Sec. 13: All.....	641.20	June 30, 1979.....	I. B. Haddo: All.....	Fumarole, Ltd.....	Fumarole, Ltd.: All.
9.....	Sec. 32: Lots 1, 2, 3, 4, NE 1/4, NW 1/4	500.00	Feb. 28, 1981.....	J. F. Smith: All.....	do.....	Do.
10.....	Sec. 34: All.....	640.00	Mar. 31, 1981.....	A. G. Quick: 75% P. T. Land: 25%.....	Hot Rock Co.....	Hot Rock Co.: All.
11.....	Tract 20.....	80.00	Apr. 30, 1981.....	M. V. Jones: All.....	Unleased.....	M. V. Jones: All.
3 Patented tracts 1,681.20 acres or 16.04% of unit area.						
Total... 11 tracts 10,249.10 acres in entire unit area.						

§ 271.15 Form of collective bond.

COLLECTIVE CORPORATE SURETY

Known all men by these presents, That we, _____ signing as Principal, for and on behalf of the record owners of unitized substances now or hereafter covered by the unit agreement for this _____ approved _____ (Date)

(Name of Unit) _____ as Surety are (Name and address of Surety) jointly and severally held and firmly bound unto the United States of America in the sum of _____ Dollars,

(Amount of bond) lawful money of the United States, for the use and benefit of and to be paid to the United States and any entryman or patentee of any portion of the unitized land, heretofore entered or patented with the reservation of the geothermal resources deposits to the United States, for which payment well and truly to be made, we bind ourselves, and each of us, and each of our heirs, executors, administrators, successors, and assigns by these presents.

The condition of the foregoing obligation is such that, whereas the Secretary on _____ approved under the provisions of the Geothermal Steam Act of 1970, a unit agreement for the development and operation of the _____ (Name of Unit and State) and

Whereas said Principal and record owners of unitized substances, pursuant to said unit agreement, have entered into certain covenants and agreements as set forth therein, under which operations are to be conducted; and

Whereas said Principal as Unit Operator has assumed the duties and obligations of

the respective owners of unitized substances as defined in said unit agreement; and

Whereas said Principal and surety agree to remain bound in the full amount of the bond for failure to comply with the terms of the unit agreement, and the payment of rentals, minimum royalties, and royalties due under the Federal leases committed to said unit agreement; and

Whereas the Surety hereby waives any right of notice of and agrees that this bond may remain in force and effect notwithstanding:

(a) Any additions to or change in the ownership of the unitized substances herein described.

(b) Any suspension of the drilling or producing requirements or waiver, suspension or reduction of rental or minimum royalty payments or reduction of royalties pursuant to applicable laws or regulations thereunder; and

Whereas said Principal and Surety agree to the payment of compensatory royalty under the regulations of the Interior Department in lieu of drilling necessary offset wells in the event of drainage; and

Whereas nothing herein contained shall preclude the United States from requiring an additional bond at any time when deemed necessary:

Now, therefore, if the said Principal shall faithfully comply with all of the provisions of the above-identified unit agreement and with the terms of the leases committed thereto, then the above obligation is to be of no effect; otherwise to remain in full force and virtue.

Signed, sealed, and delivered this _____ day of _____ 19____, in the presence of: _____ Witnesses:

(Principal)

(Surety)

§ 271.16 Form of designation of successor operator by working interest owner.

Designation of successor Unit Operator _____ Unit Area, County of _____ State of _____ No. _____ This indenture, dated as of the _____ day of _____, 19____, by and between _____ hereinafter designated as "First Party," and the owners of unitized working interest, hereinafter designated as "Second Parties,"

Witnesseth: Whereas under the provisions of the Geothermal Steam Act of December 24, 1970, 84 Stat. 1568, the Secretary on the _____ day of _____, 19____, approved a unit agreement for the _____ Unit Area, wherein _____ is designated as Unit Operator; and

Whereas said _____ has resigned as such Operator; and the designation of a successor Unit Operator is now required pursuant to the terms thereof; and Whereas First Party has been and hereby is designated by Second Parties as a Unit Operator, and said First Party desires to assume all the rights, duties, and obligations of Unit Operator under the said unit agreement.

Now, therefore, in consideration of the premises hereinbefore set forth and the promises hereinbefore stated, the First Party hereby covenants and agrees to fulfill its duties and assume the obligations of Unit Operator under and pursuant to all the terms of the _____ unit agreement, and the Second Parties covenant and agree that, effective upon approval of this indenture by the Supervisor, of the Geological Survey, First Party shall be granted the exclusive right and privilege of exercising any and all rights and privileges and Unit Operator, pursuant to the terms and conditions of said unit agreement; said unit agreement being hereby incorporated herein by reference and made a part hereof as fully and effectively as though said unit agreement were expressly set forth in this instrument.

In witness whereof, the parties hereto have executed this instrument as of the date hereinabove set forth.

(First Party)

(Witnesses)

(Second Party)

(Witnesses)

I hereby approve the foregoing indenture designating _____ as Unit Operator under the unit agreement for the _____ Unit Area, this _____ day of _____, 19____.

U.S. Geological Survey.

§ 271.17 Form of change in unit operator by assignment.

Change in Unit Operator _____ unit Area, County of _____ State of _____ No. _____

This indenture, dated as of the _____ day of _____, 19____, by and between _____ hereinafter designated as "First Party," and _____ hereinafter designated as "Second Party,"

* Where the designation of a successor Unit Operator is made for any reason other than resignation, such reason shall be substituted for the one stated.

RULES AND REGULATIONS

Witnesseth: Whereas under the provisions of the Geothermal Steam Act of December 24, 1970, 84 Stat. 1566, the Secretary on the _____ day of _____, 19____ approved a unit agreement for the _____ Unit Area, wherein the First Party is designated as Unit Operator; and

Whereas the First Party desires to transfer, assign, release, and quitclaim, and the Second Party desires to assume all the rights, duties, and obligations of Unit Operator under the unit agreement; and

Whereas for sufficient and valuable consideration, the receipt whereof is hereby acknowledged, the First Party has transferred, conveyed and assigned all his rights under certain operating agreements involving lands within the area set forth in said unit agreement unto the Second Party:

Now, therefore, in consideration of the premises hereinbefore set forth, the First Party does hereby transfer, assign, release, and quitclaim unto Second Party all of First Party's rights, duties and obligations as Unit Operator under said unit agreement; and Second Party hereby accepts this assignment and hereby covenants and agrees to fulfill the duties and assume the obligations of Unit Operator under and pursuant to all the terms of said unit agreement to the full extent set forth in this assignment, effective upon approval of this indenture by the Supervisor of the Geological Survey; said unit agreement being hereby incorporated herein by reference and made a part hereof as fully and effectively as though said unit agreement were expressly set forth in this instrument.

In witness whereof, the parties hereto have executed this instrument as of the date hereinabove set forth.

(First Party)

(Witnesses)

(Second Party)

(Witnesses)

I hereby approve the foregoing indenture designated _____ as Unit Operator under the unit agreement for the _____ Unit Area, this _____ day of _____, 19____.

Supervisor, U.S. Geological Survey

Dated: December 17, 1973.

W. W. LYONS,
Deputy Under Secretary
of the Interior.

[FR Doc.73-26891 Filed 12-20-73; 8:45 am]

CHAPTER II—BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR
GEOHERMAL RESOURCES

Leasing on Public, Acquired and Withdrawn Lands

The purpose of these regulations is to implement the Geothermal Steam Act of 1970 (30 U.S.C. 1201-1225) and provide for the leasing of the public and acquired lands of the United States for the purpose of geothermal resources exploration, development, and production.

The public was afforded an opportunity to comment on proposed rulemaking published on July 23, 1971, November 29, 1972, and July 23, 1973 and supplemented on August 8, 1973. These regulations reflect consideration of all comments received on the published proposed rulemaking.

A Final Environmental Statement, prepared in accordance with the provisions of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)), was issued on October 23, 1973. It discussed the environmental impact of leasing federally owned geothermal resources under the proposed rulemaking, and proposed provisions for inclusion in regulations and leases to mitigate any possible impacts on the environment.

These regulations will be effective January 1, 1974.

PART 3000—MINERALS MANAGEMENT; GENERAL

1. Section 3000.0-5 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.0-5 Definitions.

As used in this subchapter:

(a) "Leasable minerals" means oil and gas. (1) Gas means any fluid, either combustible or noncombustible, which is produced in a natural state from the earth and which maintains a gaseous or rarefied state at ordinary temperature and pressure conditions. (2) Oil or crude oil means any liquid hydrocarbon substance which occurs naturally in the earth, including drip gasoline or other natural condensates recovered from gas, without resort to manufacturing process.

(b) "Other leasable minerals" means (1) Coal, chlorides, sulphates, carbonates, borates, silicates, or nitrates of potassium and sodium; sulphur in the States of Louisiana and New Mexico; phosphate; and native asphalt, solid and semisolid bitumen and bituminous rock (including oil impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried); (2) solid (hardrock) minerals; minerals in acquired lands which would be subject to location under the U.S. mining laws if located in the public domain lands.

(c) "Secretary" means the Secretary of the Interior or any person duly authorized to exercise the powers vested in that officer.

(d) "Director" means the Director of the Bureau of Land Management or any person duly authorized to exercise the powers vested in that officer.

(e) "State Director" means the Director of a Bureau of Land Management State office or any person duly authorized to exercise the powers vested in that officer.

(f) "Authorized officer" means any person authorized by law or by lawful delegation of authority in the Bureau of Land Management to perform the duties described.

(g) "Proper BLM office" means the Bureau of Land Management office having jurisdiction over the lands subject to the regulation where the term is used.

(h) "Public domain lands" means original public domain lands which have never left Federal ownership; also, lands in Federal ownership which were obtained by the Government in exchange for public lands or for timber on such

lands; also original public domain lands which have reverted to Federal ownership through operation of the public land laws.

(i) "Acquired lands" means lands which the United States obtains by deed through purchase or gift, or through condemnation proceedings. They are distinguished from public domain lands in that acquired lands may or may not have been originally owned by the Government. If originally owned by the Government such lands have been disposed of (patented) under the public land laws and thereafter reacquired by the United States.

(j) "Other lands" means (1) "Withdrawn lands." Lands which have been withdrawn and dedicated to public purposes. (2) "Reserved lands." Lands which have been withdrawn from disposal and dedicated to a specific public purpose. (3) "Segregated lands." Lands included in a withdrawal, or in an application or entry or in a proper classification which segregates them from operation of the public land laws.

2. Section 3000.4 of Subpart 3000, Chapter II, Title 43 of the Code of Federal Regulations is revised to read as follows:

§ 3000.4 Appeals.

Any party to a case who is adversely affected by any official action or decision of an officer of the Bureau of Land Management or of an Administrative Law Judge of the Office of Hearings and Appeals, Office of the Secretary, except a decision which has been approved by the Secretary, shall have a right of appeal to the Board of Land Appeals in the Office of Hearings and Appeals, Office of the Secretary. All appeals shall be governed by the rules of practice in Subpart E of Part 4 of this title. Nothing in this group shall be construed to prevent any interested party from seeking judicial review as authorized by law.

3. A new Group 3200 is added to Chapter II, Title 43 of the Code of Federal Regulations to read as follows:

Group 3200—Geothermal Resources Leasing

PART 3200—GEOHERMAL RESOURCES LEASING; GENERAL

Subpart 3200—Geothermal Resources Leasing; General

- Sec. 3200.0-3 Authority.
- 3200.0-5 Definitions.
- 3200.0-6 Prefiling procedures.
- 3200.0-7 Cross reference.
- 3200.0-8 Use of surface.

Subpart 3201—Available Lands; Limitations; Unit Agreements

- Sec. 3201.1 Lands subject to geothermal leasing.
- 3201.1-1 General.
- 3201.1-2 Department of the Interior.
- 3201.1-3 Department of Agriculture.
- 3201.1-4 Federal Power Commission.
- 3201.1-5 Patented lands.
- 3201.1-6 Excepted areas.
- 3201.2 Acreage limitations.
- 3201.3 Leases within unit areas.

RULES AND REGULATIONS

Support 3202—Qualifications of Lessees

Sec. 3202.1 Who may hold leases.
3202.2 Statements required to be submitted.

3202.2-1 General.
3202.2-2 Guardian or trustee.
3202.2-3 Attorney-in-fact.
3202.2-4 Statements previously filed.
3202.2-5 Showing as to sole party in interest.

3202.2-6 Heirs and devisees (estates).
3202.2-7 Fractional present interests.

Support 3203—Leasing Terms

3203.1 Primary and additional term.
3203.1-1 Dating of leases.

3203.1-2 Primary term.
3203.1-3 Additional term.
3203.1-4 Extensions.

3203.1-5 Segregation of leases on commitment to, or contraction of cooperative or unit plan or communitization agreement.

3203.1-6 Conversion to mineral leases or mining claims.

3203.2 Lease acreage limitation.
3203.3 Consolidation of leases.

3203.4 Description of lands.
3203.5 Diligent exploration.
3203.6 Plan of operation.

Support 3204—Surface Management Requirements; Special Requirements

3204.1 General.
3204.2 Waste prevention.

3204.3 Readjustment of terms and conditions.

3204.4 Reservation to the United States of oil, hydrocarbon gas, and helium.

3204.5 Compensation for drainage; compensatory royalty.
3204.6 Patented lands.

Support 3205—Service Charges, Rentals and Royalties

3205.1 Payments.
3205.1-1 Form of remittance.

3205.1-2 Where submitted.
3205.2 Service charges.

3205.3 Rentals and royalties.
3205.3-1 Payment with application.

3205.3-2 Payment of annual rental.
3205.3-3 Escalating rental rates.

3205.3-4 Fractional interest.
3205.3-5 Royalty on production.

3205.3-6 Royalty on commercially demineralized water.
3205.3-7 Waiver, suspension or reduction of rental or royalty.

3205.3-8 Application for and effect of suspension of operations and production.

3205.3-9 Readjustments.
3205.4 Rental and minimum royalty liability of lands committed to cooperative or unit plans.

3205.4-1 Prior to production.
3205.4-2 After production.

Support 3206—Lease Bonds

3206.1 Types of bonds and filing.
3206.1-1 Types of bonds.

3206.1-2 Filing of bonds.
3206.2 Termination of period of liability.

3206.3 Operators bond.
3206.3-1 Compliance.

3206.3-2 Approval.
3206.3-3 Default.

3206.4 Personal bond or corporate bond.
3206.4-1 Amount.

3206.4-2 Deposit of securities.
3206.4-3 Qualified corporate sureties.

3206.5 Nationwide bond.
3206.6 Statewide bond.

Sec. 3206.7 Default.
3206.7-1 Payment by surety.
3206.7-2 Penalty.
3206.8 Applicability of provisions to existing bonds.

Support 3207—[Reserved]

Support 3208—[Reserved]

Support 3209—Geothermal Resources Exploration Operations

Sec. 3209.0-1 Purposes.
3209.0-2 Objectives.
3209.0-5 Definitions.

3209.1 Notice of intent and permit to conduct exploration operations (Geothermal resources).

3209.1-1 Application.
3209.1-2 Review of notice of intent.

3209.2 Exploration operations.
3209.3 Completion of operations.

3209.4 Bond requirements.
3209.4-1 General.

3209.4-2 Riders to existing bond forms.
3209.4-3 Termination of period of liability.

Support 3200—Geothermal Resources Leasing; General

§ 3200.0-3 Authority.

These regulations are issued pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001-1025) and rights to develop and utilize geothermal resources in land subject to these regulations may be acquired only in accordance with these regulations.

§ 3200.0-5 Definitions.

As used in Group 3200, the term:

(a) "The Act" means the Geothermal Steam Act of 1970.

(b) "Geothermal lease" means a lease issued under authority of the Act; and unless the context indicates otherwise, "lease" means a "geothermal lease".

(c) "Geothermal resources" means geothermal steam and associated geothermal resources which include: (1) All products of geothermal processes, embracing indigenous steam, hot water and hot brines; (2) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (3) heat or other associated energy found in geothermal formations; and (4) any byproducts derived from them.

(d) "Byproduct" means (1) any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves, and (2) commercially demineralized water.

(e) "Sole party in interest" means a party who is and will be vested with all legal and equitable rights under the lease. No one is, or shall be deemed to be, a sole party in interest with respect to a lease in which any other party has any interest in the lease.

(f) "Interest in the lease" means any interest whatever in a geothermal lease,

including, but not limited to: A record title interest; a working interest; an operating right; an overriding royalty interest; a claim to any prospective or future advantage or benefit from a lease; a participation in any increment, issue, or profit which may be derived, or accrue in any manner, from the lease based upon, or pursuant to, any agreement or understanding in existence at the time when the offer is filed; and an agreement pertaining to any of the foregoing.

(g) "Supervisor" means a representative of the Secretary, subject to the direction and supervision of the Director, the Chief, Conservation Division, Geological Survey and the appropriate Regional Conservation Manager, Conservation Division, Geological Survey, authorized and empowered to regulate operations and to perform other duties prescribed in the regulations in this part or any subordinate of such representative acting under his direction.

(h) "Primary term" means the first 10 years in the life of the lease, exclusive of any period of suspension of operations or production, or both.

(i) "Area of operation" means that area of the leased lands which is required for exploration, development and producing operations, and which is delineated on a map or plat which is made a part of the approved plan of operations. It encompasses the area generally needed for wells, flow lines, separators, surge tanks, drill pads, mud pits, work-shops, and other such facilities used for on-project geothermal resources field exploration, development and production operations.

(j) "Commercial quantities" means quantities sufficient to provide a return after all variable costs of production have been met.

(k) "Known geothermal resource area" or "KGRA" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

(l) In determining whether the geology of an area is of such a nature that the area should be designated a KGRA the Director, Geological Survey, acting for the Secretary, shall use such geologic and technical evidence as he shall deem appropriate, including the following:

(i) The existence of siliceous sinter and natural geysers;

(ii) The temperatures of fumaroles, thermal springs, and mud volcanoes;

(iii) The SiO₂ content of spring water;

(iv) The Na/K ratio in spring waters of hot-water systems;

(v) The existence of volcanoes and calderas of late Tertiary or Quaternary age;

(vi) Conductive heat flows and geothermal gradient;

(vii) The porosity and the permeability of a potential reservoir;

RULES AND REGULATIONS

(viii) The results of electrical resistivity surveys;

(ix) The results of magnetic, gravity, and airborne infrared geophysical surveys; and

(x) The information obtained through other geophysical methods such as microseismic, seismic ground noise, electromagnetic, and telluric surveys if such methods prove to have significant use in evaluation.

(2) For purposes of KGRA classification, a "discovery" or "discoveries" will be considered to be any well deemed by the Director, Geological Survey, to be capable of producing geothermal resources in commercial quantities and, where the geological structure is not known, "nearby" will be considered to be five miles or less from any such discovery. Lands nearby a discovery will be classified as KGRA unless the Geological Survey determines that the lands are on a different geologic structure from the discovery. Where the Geological Survey has determined the extent of a structure on which a discovery has been made, all land in that structural area contributing geothermal resources to that discovery will be deemed a KGRA regardless of the distance from the discovery.

(3) "Competitive interest" shall exist in the entire area covered by an application for a geothermal lease if at least one-half of the lands covered by that application are also covered by another application which was filed during the same application filing period, whether or not that other application is subsequently withdrawn or rejected. Competitive interest shall not be deemed to exist in the entire area covered by an application because of an overlapping application, if less than one-half of the lands subject to the first application are covered by any other single application filed during the same application filing period; however, some of the lands subject to the first application may be determined to be within a KGRA pursuant to the first sentence of this subparagraph (3).

(4) "Primarily valuable" means the principal mineral value for which the leasehold is being produced.

§ 3200.0-6 Preleasing procedures.

(a) When an area is initially considered for geothermal leasing or when the need arises, the Director shall request other interested Bureaus and Federal agencies to prepare reports describing, to the extent known; resources contained within the general area and the potential effect of geothermal resources operations upon the resources of the area and its total environment. If the Director determines that the issuance of leases in an area would be a major Federal action significantly affecting the quality of the human environment, he shall issue no leases in that area unless an environmental impact statement under section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)) has been issued.

(b) Prior to the final selection of tracts for leasing, the Director, or the head of

the agency charged with the administration of the surface, if that officer so elects, shall, when appropriate, evaluate the potential effect of the geothermal resources operations pursuant to a leasing program on the total environmental, fish and other aquatic resources, wildlife habitat and populations, aesthetics, recreation, and other resources in the entire area during exploratory, developmental, and operational phases. This evaluation will consider the potential impact of the possible development and utilization of the geothermal resources including the construction of power generating plants and transmission facilities on lands which may or may not be included in a geothermal lease. To aid him in his evaluation and selection of tracts the Director shall request and consider the views and recommendations of appropriate Federal agencies, may hold public hearings after appropriate notice, and shall, as appropriate, consult with State agencies, organizations, industries, and lease applicants, and shall consider all other potential factors, such as use of the land and its natural resources, the need for the energy mineral deposits, and socio-economic conditions consistent with multiple-use management principles. If a decision is made to lease, the Director shall develop special terms and conditions to be included in leases as required to protect the environment, to permit use of the land for other purposes, and to protect other natural resources. If tracts are offered for competitive leasing, the notice announcing the availability of the land for leasing will specify the proper BLM office where all terms and conditions to be included in leases for such tracts are available.

§ 3200.0-7 Cross reference.

(a) The regulations governing operations under geothermal leases are found in 30 CFR Part 270.

(b) The regulations setting forth the basic policies for management of the public lands are found in Part 1725 of this chapter.

§ 3200.0-8 Use of surface.

(a) A lessee shall be entitled to use for the production, utilization, and conservation of geothermal resources only so much of the surface of the leased Federal lands as is deemed necessary for such purposes. The lessee shall have the right to use so much of the leased lands as may be deemed necessary for a power generation plant or a commercial or industrial facility, and may apply for the right to use so much of other Federal lands as may be deemed necessary for such purposes; however, any use of the leased lands or other Federal lands for a power generation plant or a commercial or industrial facility will be authorized only under a separate permit issued by the appropriate agency for that specific use and subject to all terms and conditions which it may include in that permit. The uses of the lands within the area of operation are subject to the supervision of the super-

visor, and the uses of the remaining leased lands or other Federal lands are subject to the supervision of the appropriate surface management agency. The lessee shall not be entitled to use any mineral materials subject to the Materials Act except as provided by Part 3600 of this chapter.

(b) Operations under other leases or uses on the same lands shall not unreasonably interfere with or endanger operations under leases issued under these regulations nor shall operations under these regulations unreasonably interfere with or endanger operations under any lease, license, claim, permit, or other authorized use pursuant to the provisions of any other Act.

Subpart 3201—Available Lands; Limitations, Unit Agreements

§ 3201.1 Lands subject to geothermal leasing.

§ 321.1-1 General.

Subject to the exceptions listed below, geothermal leases may be issued in combination or separately for (a) lands administered by the Secretary of the Interior; (b) national forest lands or other lands administered by the Department of Agriculture through the Forest Service; and (c) geothermal resources in lands which have been conveyed by the United States subject to a reservation to the United States of geothermal resources.

§ 3201.1-2 Department of the Interior.

(a) Except as provided in this section, leases may be issued in accordance with the regulations in this part for withdrawn lands, for acquired lands, and for geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of the geothermal resources therein where such lands or resources are administered by the Secretary of the Interior.

(b) Notwithstanding any other provision in these regulations, geothermal leases shall not be issued for: (1) Lands which the Secretary has identified or may identify as being necessary to the performance of his or any other Federal officer's authorized functions, and on which geothermal resource development would in his judgment interfere with such functions; or (2) lands respecting which the Secretary has made or may make a finding that the issuance of geothermal leases would be contrary to the public interest. Upon receipt of an application for a geothermal lease affecting lands withdrawn under section 3 of the Reclamation Act of 1902 (43 U.S.C. 416) or any other appropriate authority, notice thereof and an opportunity to comment thereon shall be given to the head of the agency for whose benefit the withdrawal was made. No geothermal lease affecting lands withdrawn for any agency outside the Department of the Interior shall be leased without the consent of the head of the agency for which the lands are withdrawn. Where leases are issued under Part 3210 of this chapter or 3220 for lands neighboring such reserved lands, the lessees shall be required

RULES AND REGULATIONS

to perform such lease operations and take such measures as are prescribed by the Secretary for the protection of the Federal interests therein.

§ 3201.1-3 Department of Agriculture.

Leases for public, withdrawn or acquired lands administered by the Forest Service, may be issued by the Secretary of the Interior only with the consent of, and subject to such terms and conditions as may be prescribed by, the head of that Department to insure adequate utilization of the lands for the purpose for which they were withdrawn or acquired.

§ 3201.1-4 Federal Power Commission.

Leases for lands to which section 24 of the Federal Power Act, as amended (16 U.S.C. 818), is applicable, may be issued by the Secretary of the Interior only with the consent of, and subject to, such terms and conditions as the Federal Power Commission may prescribe to insure adequate utilization of such lands for power and related purposes.

§ 3201.1-5 Patented lands.

(a) Geothermal resources in lands which have passed from Federal ownership subject to a reservation to the United States of geothermal resources therein may be leased under the regulations in this group subject to the provisions in this part and to such terms and conditions as may be prescribed by the authorized officer to insure adequate protection of the patented lands and any improvements thereon.

(b) Geothermal resources in lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States shall not be developed or produced except under terms and conditions prescribed by the Secretary and pursuant to any agreements made therefore while the question of the title to such resources is being resolved pursuant to the provisions of section 21(b) of the Act.

§ 3201.1-6 Excepted areas.

Leases shall not be issued for lands which are: (a) Administered under the National Park System; (b) within a national recreation area; (c) in a fish hatchery administered by the Secretary, wildlife refuge, wildlife range, game range, wildlife management area, or waterfowl production area, or for lands acquired or reserved for the protection and conservation of fish and wildlife which are designated as rare and endangered species by the Secretary; or under active consideration for inclusion in categories (a), (b), or (c) as evidenced by the filing of an application for a withdrawal or a proposed withdrawal; or (d) tribally or individually owned Indian trust or restricted lands, within or without the boundaries of Indian reservations.

§ 3201.2 Acreage limitations.

(a) *Maximum holdings.* No citizen, association, corporation, or governmental unit shall take, hold, own, or control at one time, whether acquired directly

from the Secretary or otherwise, any direct or indirect interest in Federal geothermal leases in any one State exceeding 20,480 acres, including leases acquired under the provisions of section 4 (a)-(f) of the Act. Nor may any citizen, association, or corporation be permitted to convert mineral leases, permits, applications therefor, or mining claims, pursuant to the provisions of section 4 (a)-(f) of the Act into geothermal leases for more than 10,240 acres.

(b) *Computation.* In computing acreage holdings or control, the accountable acreage of a party owning an undivided interest in a lease shall be that party's proportionate part of the total lease acreage. Likewise, the accountable acreage of a party owning an interest in a corporation or association shall be his proportionate part of the corporation's or association's accountable acreage except that no person shall be charged with his pro rata share of any acreage holdings of any association or corporation unless he is the beneficial owner of more than 10 per centum of the stock or other instruments of ownership or control of that association or corporation. Parties owning a royalty or other interest determined by or payable out of a percentage of production from a lease will be charged with a similar percentage of the total lease acreage.

(1) An association shall not be deemed to exist between the parties to a contract for development of leased lands, whether or not coupled with an interest in the lease, nor between co-lessees, but each party to any such contract or each co-lessee will be charged with his proportionate interest in the lease.

(2) Lessees holding acreage in common shall be considered a single entity and cannot hold acreage in excess of the maximum specified in the law for any one lessee.

(c) *Excepted acreage.* Leases committed to any unit or cooperative plan approved or prescribed by the Secretary of the Interior shall not be included in computing accountable acreage. Leases subject to an operating, drilling or development contract approved by the Secretary pursuant to section 18 of the Act, other than communication or drilling agreements, shall be excepted in determining the accountable acreage of the lessees or operators.

(d) *Excess acreage.* (1) Where, as the result of the termination or contraction of a unit or cooperative plan, or the elimination of a lease from operating, drilling, or development plan, a party holds or controls excess accountable acreage, such party shall have 90 days from such termination or contraction or elimination in which to reduce his holdings to the prescribed limitation.

(2) If any person holding or controlling leases or interests in leases is found to hold accountable acreage in violation of the provisions of this section and of the Act, the last lease or leases or interest or interests acquired by him which created the excess acreage holdings shall be canceled or forfeited in their

entirety, even though only part of the acreage in the lease or interest constitutes excess holdings, unless it can be shown to the satisfaction of the Director that the holding or control of the excess acreage is not the result of negligence or willful intent in which event the lease or leases shall be canceled only to the extent of the excess acreage.

(3) Any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, shall be subject to these rules:

(i) If he files an application which causes him to exceed the acreage limitation, that application will be rejected. (ii) If he files a group of applications at the same time, any one of which causes him to exceed the acreage limitation, the entire group of applications will be rejected.

(4) If any person holding or controlling leases or interests in leases below the acreage limitation provided in this section, acquires a lease or leases, or an interest or interests therein, which cause him to exceed the acreage limitation, his most recently filed application for lease or applications for leases then containing acreage in excess of the limitation provided in this section will be rejected in its or their entirety. For the purpose of this subparagraph, time of filing shall be determined by the date of filing marked on the application, or, if the same date is marked on two or more applications, by the serial number of the applications.

(e) *Showing required.* No lease will be issued and no transfer or operating agreement will be approved until it has been shown that the applicant, operator, or transferee is entitled to hold the acreage or obtain the operating rights. At any time upon request by the authorized officer, the record title holder of any lease or a lease operator or a lease applicant may be required to file in the proper BLM office a statement, showing as of a specified date the serial number and the date of each lease of which he is the record holder, or under which he holds operating rights, and each application for lease held or filed by him in the particular State setting forth the acreage covered thereby, and the nature, extent and acreage interest, including royalty interests held by him in any geothermal lease of which the reporting party is not the lessee of record, whether by corporate stock ownership, interest in unincorporated associations and partnerships, or in any other manner.

§ 3201.3 Leases within unit areas.

Before issuance of a geothermal lease for lands within an approved unit agreement, the lease applicant or successful bidder will be required to file evidence that he has entered into an agreement with the unit operator for the development and operation of the lands in a lease if issued to him under and pursuant to the terms and provisions of the approved unit agreement, or a statement giving satisfactory reasons for the failure to enter into such agreement. If such

RULES AND REGULATIONS

statement is acceptable, he will be permitted to operate independently but will be required to perform his operations in a manner which the Supervisor deems to be consistent with the unit operations.

Subpart 3202—Qualifications of Lessees

§ 3202.1 Who may hold leases.

Leases may be issued only to: (a) Citizens of the United States who have reached the age of majority; (b) associations of such citizens; (c) corporations organized under the laws of the United States, any state or the District of Columbia; or (d) governmental units, including, without limitation, municipalities. The term "association" includes a partnership.

§ 3202.2 Statements required to be submitted.

(a) § 3202.2-1 General.

Each applicant for a lease is required to submit with his application a statement that his interests, direct and indirect, in Federal geothermal leases do not exceed the acreage limitations prescribed in § 3201.2, together with a statement of his citizenship.

(b) If the applicant is an association or corporation the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the association or corporation; (3) a statement setting forth the State in which it was incorporated or formed and the names and addresses of all members or stockholders holding more than 10 percent of the association or corporation; and (4) a statement from each person owning or controlling more than 10 percent of the association or corporation setting forth his citizenship and his holdings.

(c) If the applicant is a municipality, or governmental unit, the application must be accompanied by: (1) A statement showing that it is authorized to hold geothermal leases; (2) a statement that the officer executing the application is authorized to act on behalf of the municipality or governmental unit, and (3) a copy of its governing body's resolution authorizing such action.

§ 3202.2-2 Guardian or trustee.

(a) *Guardian.* If the application is made by a guardian, he must submit: (1) A certified copy of the court order authorizing him to act as guardian and, in behalf of his ward, to enter into contractual agreements and to fulfill all obligations arising under the lease; and (2) statements as to the citizenship and holdings under the Act of himself and of each person under his guardianship for whom the application is made.

(b) *Trustee.* If the application is made by a trustee, he must submit a copy of the instrument establishing the trust or a certified copy of the court order authorizing him to act as trustee, in behalf of the beneficiary, as to all obligations arising under the lease; and statements as to the citizenship and holdings under

the Act of himself and of each beneficiary.

§ 3202.2-3 Attorney-in-fact.

If an application is filed by an attorney-in-fact, it must be accompanied by a statement as to his authority to act.

§ 3202.2-4 Statements previously filed.

Where the statements required by § 3202.2 have been previously filed a reference by serial number to the record in which they have been filed, together with a statement as to any amendments will be accepted.

§ 3202.2-5 Showing as to sole party in interest.

Each application must indicate whether the applicant is the sole party in interest. Where the applicant is not the sole party in interest, separate statements must be signed by each of the parties and by the applicant setting forth the nature of the agreement between them. All interested parties must furnish evidence of their qualifications to hold such lease interest. These separate statements must be filed in the proper BLM office with the application, except as provided in § 3211.2 of this chapter.

§ 3202.2-6 Heirs and devisees (estates).

If an applicant or a successful bidder dies before the lease is issued, the lease will be issued to the executor or administrator of the estate if probate of the estate has not been completed, and if probate has been completed, or is not required, to the heirs or devisees, provided there is filed in all cases an application to lease in compliance with the requirements of this section which will be effective as of the effective date of the original application filed by the deceased. If there are any minor heirs or devisees, the application can only be made by their legal guardian or trustee in his name. Each such application must be accompanied by the following information:

(a) Where probate of the estate has not been completed:

(1) Evidence that the person who as executor or administrator submits the application, and bond form if a bond is required, has authority to act in that capacity and to sign the application and bond forms.

(2) A statement over the signature of each heir or devisee or, if the heir or devisee is a minor, over the signature of his legal guardian or trustee, concerning citizenship and holdings.

(3) Evidence that the heirs or devisees are the heirs or devisees of the deceased applicant or successful bidder and are the only heirs or devisees of the deceased.

(b) Where the executor or administrator has been discharged or no probate proceedings are required:

(1) A certified copy of the will or decree of distribution, if any, and if not, a statement signed by the heirs that they are the only heirs of the applicant or successful bidder and the provisions of the law of the deceased's last domicile showing that no probate is required.

(2) A statement over the signature of each of the heirs or devisees with reference to holdings and citizenship. If the heir or devisee is a minor, the statement must be over the signature of the guardian or trustee.

§ 3202.2-7 Fractional present interests.

(a) An application for a fractional present interest noncompetitive lease must be executed on a form approved by the Director and it must be accompanied by a statement showing the extent of the applicant's ownership of the operating rights to the fractional geothermal resources interest not owned by the United States in each tract covered by the application to lease. Ordinarily, the issuance of a lease to one who, upon such issuance, would own less than 50 percent of the operating rights in any such tract, will not be regarded as in the public interest, and an application leading to such results will be rejected.

(b) Geothermal resources in lands which have passed from Federal ownership but which lands have been purchased by the Federal Government with a fractional interest in the geothermal resources shall not be developed or produced, except under prescribed terms and conditions and pursuant to any agreement made between the parties of interest prior to the resolution of the question of ownership of the geothermal resources.

Subpart 3203—Leasing Terms

§ 3203.1 Primary and additional term.

§ 3203.1-1 Dating of leases.

All geothermal leases will be dated as of the first day of the month following the date on which the leases are signed on behalf of the lessor except that, where prior written request has been made, a lease may be dated as of the first day of the month within which it is so signed. A renewal lease will be dated from the termination of the original lease.

§ 3203.1-2 Primary term.

All leases shall be for a primary term of 10 years.

§ 3203.1-3 Additional term.

(a) If geothermal steam is produced or utilized in commercial quantities within the primary term of a lease, that lease shall continue for so long thereafter as geothermal steam is produced or utilized in commercial quantities, but the lease shall in no event continue for more than 40 years after the end of the primary term except that the lessee shall have a preferential right to a renewal of his lease for a second 40-year term upon such terms and conditions as the authorized officer deems appropriate. If at the end of the first 40-year term the lands are not needed for another purpose and geothermal steam is produced or utilized in commercial quantities. Production or utilization of geothermal steam in commercial quantities shall be deemed to include the completion of one or more wells producing or capable of

RULES AND REGULATIONS

producing geothermal steam in commercial quantities and a bona fide sale of such geothermal steam for delivery to or utilization by a facility or facilities not yet installed but scheduled for installation not later than 15 years from the date of commencement of the primary term of the lease.

§ 3203.1-4 Extensions.

(a) A lease which has been extended by reason of production, or on which geothermal steam has been produced, and which has been determined by the Secretary to be incapable of further commercial production and utilization of geothermal steam may be further extended so long as one or more valuable byproducts are produced in commercial quantities but for not more than 5 years.

(b) Where the lessee commenced actual drilling operations prior to the end of the primary term and those operations are being diligently prosecuted at that time, a lease shall be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than 35 years).

(c) A lease committed to a cooperative plan, communication agreement or a unit plan under or for which actual drilling operations were commenced prior to the end of the primary term of the lease, shall, if such operations are being diligently prosecuted at that time be extended for a period of five years and so long thereafter as geothermal steam is produced or utilized in commercial quantities (but for not more than thirty five years).

(d) Any lease on which there has been a suspension of operations or production, or both, under 30 CFR 270.17 shall continue in effect for the life of the suspension and, at the end of the suspension, shall be extended for a period equal to that portion of the primary term during which the suspension was in effect.

(e) If, at the end of 40 years after the conclusion of the primary term, steam is being produced or utilized in commercial quantities and the lands are not needed for other purposes, the lessee shall have a preferential right to a renewal of the lease for a second 40-year term on such terms and conditions as the Secretary deems appropriate.

§ 3203.1-5 Segregation of leases on commitment to, or contraction of, cooperative or unit plan or communication or drilling agreement.

(a) Any lease committed to any cooperative plan, communication agreement, drilling agreement, or unit plan, which covers lands within and lands outside the area covered by the plan or agreement, shall be segregated, as of the effective date of that plan or agreement, into separate leases, one covering the lands committed to that plan or agreement and the other as to the lands not so committed. The segregated lease covering the portion of the lands not subject to that plan or agreement shall not be entitled to an extension by reason of

the segregation, but the term of the lease of such segregated lands shall be as provided in the original lease.

(b) When only part of the land subject to a lease included in a cooperative plan, a communication agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the part of the lease which is excluded and the part which remains subject to the plan or agreement shall be segregated into separate leases. The term of the segregated lease composed of the excluded land shall not be extended because of production in commercial quantities or the existence of a producible well on the segregated lease remaining subject to the cooperative or unit plan or the communication or drilling agreement or because actual drilling operations were at the time of contraction being conducted on that other lease, but the term of the lease composed of the excluded land shall be as provided in the original lease.

(c) Where all the land subject to a lease included in a cooperative plan, a communication agreement, a drilling agreement, or a unit plan is excluded from that plan or agreement because of the contraction of the area subject to that plan or agreement, the term of the lease shall not be extended because of production in commercial quantities or the existence of a producible well on the lands remaining subject to the cooperative or unit plan or the communication or drilling agreement or because actual drilling operations were being conducted on the other lands, but the term of the lease shall be as provided in the original lease.

(d) Contraction of a unit or cooperative plan or a communication or drilling agreement causing all or part of the land in the lease to be excluded from such plan or agreement shall not serve to extend the term of such lease excluded by reason of the contraction where the 10-year primary term has already expired.

§ 3203.1-6 Conversion to mineral leases or mining claims.

(a) If the byproducts capable of being produced in commercial quantities are leaseable under the Mineral Leasing Act of February 25, 1920 as amended and supplemented (30 U.S.C. sections 121-287), or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. sections 351-359), and the leasehold is primarily valuable for the production thereof, the lessee shall be entitled to convert his geothermal lease to a mineral lease under and subject to all the terms and conditions of the appropriate act, provided the lands and its resources are available for this purpose, upon application at any time before expiration of the lease extension by reason of byproduct production.

(b) The lessee shall be entitled to locate under the mining laws all minerals which are not leaseable and which would constitute a byproduct if commercial

production or utilization of geothermal steam continued. The lessee, to acquire the rights herein granted him, shall complete the location of mining claims within 90 days after the termination of the geothermal lease, provided the lands and its resources are available for location.

(c) Any lease converted under paragraphs (a) or (b) of this section affecting lands withdrawn or acquired in aid of a function of a Federal department or agency, including the Department of the Interior, shall be subject to such additional terms and conditions as may be prescribed by that department or agency with respect to the additional operations or effects resulting from such conversion upon the utilization of the lands for the purpose for which they are administered.

§ 3203.2 Lease acreage limitation.

(a) A geothermal lease may not embrace more than 2,560 acres in a reasonably compact area, except where a departure is occasioned by an irregular subdivision or subdivisions, entirely within an area of six miles square or within an area not exceeding six surveyed or protracted sections in length or width measured in cardinal directions. Where a departure is occasioned by an irregular subdivision, the leased acreage may exceed 2,560 acres by an amount which is smaller than the amount by which the area would be less than 2,560 acres if the irregular subdivision were excluded. No lease will be issued for less than 640 acres, except at the discretion of the Secretary, or where a departure is occasioned by an irregular subdivision, or as provided for in Subpart 3230 of this chapter. In event of a departure, the leased acreage may be less than 640 acres by amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added.

(b) The authorized officer may add isolated tracts in nearby sections, notwithstanding the 640-acre minimum, where it is determined that such addition is necessary for the proper management of the resource, provided the additional lands will not cause the lessee to exceed the maximum acreage limitation as provided in § 3201.2(a) of this chapter. However, prior to the issuance of such a lease based on the application as amended by the authorized officer, the applicant will be given the option to refuse such a lease. Failure of the applicant to execute and return the lease within 30 days after receipt thereof will constitute a withdrawal of his application, as amended, without further notice.

§ 3203.3 Consolidation of leases.

Two or more contiguous leases issued to the same lessee may be consolidated if the total combined acreage does not exceed 2,560 acres. Except where a decrease is caused by an irregular subdivision or subdivisions as stated in § 3203.2.

RULES AND REGULATIONS

§ 3203.4 Description of lands.

Applications and nominations shall include a description of the lands sought to be included in a geothermal lease.

(a) *Surveyed lands.* If the lands have been surveyed under the public land rectangular system, each application or nomination shall describe the lands by legal subdivision, section, township, and range.

(b) *Unsurveyed lands.* If the lands have not been so surveyed, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, in cardinal directions except where the boundaries of the lands are in irregular form, and connected by courses and distances to an official corner of the public land surveys or to a prominent topographic feature. In Alaska the description of unsurveyed lands must be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by any agency of the United States (such as the U.S. Geological Survey, the Coast and Geodetic Survey, or the International Boundary Commission), if the record position thereof is available to the general public.

(c) When protracted surveys have been approved and the effective date thereof published in the FEDERAL REGISTER, each application or nomination for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the legal subdivision, section, township, and range shown on the approved protracted surveys.

(d) *Unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska.* In lease applications embracing unsurveyed public lands adjacent to tidal waters in southern Louisiana and in Alaska, if the applicant finds it impracticable to furnish a metes and bounds description, as required in paragraph (b) of this section with respect to the water boundary, he may, at his option, extend the boundary of his application into the water a distance sufficient to permit complete enclosure of the water boundary of his application by a series of courses and distances in cardinal directions (the object being to eliminate the necessity of describing the meanders of the water boundary of the public lands included in the application). The description in the lease application shall in all other respects conform to the requirements of paragraph (b) of this section. Such description would not be deemed for any purpose to describe the true water boundaries of the lease, such boundaries in all cases being the ordinary high water mark of the navigable waters. The land boundaries of such overall area shall include only the public lands embraced in the application. The applicant shall agree to pay rental on the full acreage included within the description with the understanding that rights

under any lease to be issued on that application will apply only to the areas within that description properly subject to lease under the act, but that the total area described will be considered as the lease acreage for purposes of rental payments, acreage limitations under § 3201.2 of this chapter and the maximum or minimum area to be included in a lease pursuant to § 3203.2. The tract should be shown in outline on a current quadrangle sheet published by the U.S. Geological Survey or such other map as will adequately identify the lands described.

§ 3203.5 Diligent exploration.

Each geothermal lease will include provisions for the diligent exploration of the leased resources until there is production in commercial quantities applicable to the lands subject to the lease, and failure to perform such exploration may subject the lease to termination. Diligent exploration means exploration operations (subsequent to the issuance of the lease) on, or related to the leased lands, including, but not limited to, operations such as geochemical surveys, heat flow measurements, core drilling, or drilling of a test well. Exploration operations in order to qualify as diligent exploration, must be approved by the Supervisor, and evidence of all expenditures therefor and the results thereof must be submitted annually to the Supervisor in compliance with applicable regulations and Geothermal Resources Operational (GRO) Orders or upon his request. Moreover, after the fifth year of the primary lease term, exploration operations, to qualify as diligent exploration for a year, must entail expenditures during that year equal to at least two times the sum of (a) the minimum annual rental required by statute, and (b) the amount of rental for that year in excess of the fifth year's rental, but in no event shall the required expenditures exceed twice the rental for the 10th year. However, any expenditures for diligent operations during the first 5 years of the lease and any expenditures for diligent operations during any subsequent year in excess of the minimum required expenditures for that year may be credited, in such proportions as the lessee may designate, against (1) expenditures needed to qualify exploration operations as diligent operations for future years, or (2) any rental requirement for that or any future years in excess of the fifth year's rental pursuant to § 3205.3-3 of this chapter. In all cases, the lessee must pay the basic annual rental specified in the lease for the initial five years of the primary term until there is production of geothermal steam in commercial quantities on the leased lands.

§ 3203.6 Plan of operation.

A lessee will be required to submit a plan of operation pursuant to 30 CFR 270.34, prior to entry upon the leased lands for any purpose other than casual use as that term is defined in § 3209.0-5 (d) of this chapter. Operations will not

be permitted on the lands until the plan of operation has been approved.

Subpart 3204—Surface Management Requirements, Special Requirements

§ 3204.1 General.

A lessee shall comply with and be bound by the following general terms and conditions, the specific requirements contained in the lease stipulations and any GRO orders that may be issued pursuant to 30 CFR 270.11. Assuring compliance with the requirements of this section is the responsibility of the Supervisor as to the lands within the area of operations and is the responsibility of the appropriate land management agency as to the remaining lands in the lease.

(a) *Equal employment opportunity.* The lessee shall comply with Executive Order 11246, as amended, 30 F.R. 12319 (1965), and regulations issued pursuant thereto, 41 CFR Chapter 60 and 43 CFR Part 17.

(b) *Public access.* (1) The lessee shall permit free and unrestricted public access to and upon the leased lands for all lawful and proper purposes except in areas where such access would unduly interfere with operations under the lease or would constitute a hazard to health and safety. Restrictions on access will not be allowed without prior approval.

(2) During construction, the lessee shall regulate public access and vehicular traffic to protect the public, wildlife, and livestock from hazards associated with the project. For this purpose, the lessee shall provide warnings, fencing, flag men, barricades, and other safety measures as appropriate.

(c) *Pollution abatement.* The lessee shall comply with all Federal and State standards and all applicable local standards with respect to the control of all forms of air, land, water, and noise pollution, including, but not limited to, the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, in his discretion, establish additional and more stringent standards, and, if he does so, the lessee shall comply with those standards. The lessee, in addition to any other action required by those standards, shall take the following specific actions:

(1) *Pesticides and herbicides.* The lessee shall comply with all rules issued by the Department of the Interior and the Environmental Protection Agency pertaining to the use of poisonous substances on public lands.

(2) *Water pollution.* The lessee shall conduct lease operations and maintenance in accordance with Federal and State water quality standards and public health and safety standards, and applicable local water quality standards and public health and safety standards. Toxic materials shall not be released into any surface waters or underground waters. Reinjection of waste geothermal fluids into geothermal or other suitable aquifers will be permitted upon approval of the lessee's plan of operation submitted pursuant to 30 CFR 270.34.

RULES AND REGULATIONS

(3) *Air pollution.* The lessee shall control emissions from operations in accordance with Federal and State air quality standards, and applicable local air quality standards.

(4) *Erosion control.* The lessee shall minimize disturbance to vegetation, drainage channels, and streambanks. The lessee shall employ such soil and resource conservation and protection measures on the leased lands as the Supervisor deems necessary.

(5) *Noise control.* The lessee shall control noise emissions from operations in accordance with Federal and State noise emission standards, and applicable local noise emission standards.

(d) *Sanitation and waste disposal.* The lessee shall remove or dispose of all waste material generated in connection with the exploration, development, production and transportation operations in a manner set forth in the approved plan of operation submitted pursuant to 30 CFR 270.34.

(e) *Land subsidence, seismic activity.* The lessee shall take precautions necessary to minimize land subsidence or seismic activity which could result from production of geothermal resources and the disposal of waste fluid where such activity could damage or curtail the use of the geothermal resources or other resources, or other uses of the land and take such measures as stipulated to: (1) monitor operations for land subsidence and for seismic activity; and (2) maintain, and when requested, make available to the lessor, records of all monitoring activities.

(f) *Aesthetics.* The lessee shall take aesthetics into account in the planning, design, and construction of facilities on the leased premises.

(g) *Fish and wildlife.* The lessee shall employ such measures as are deemed necessary to protect fish and wildlife and their habitat.

(h) *Antiquities and historical sites.* The lessee shall conduct activities on discovered, known or suspected archeological, paleontological, or historical sites in accordance with lease terms or specific instructions.

(i) *Restoration.* The lessee shall provide for the restoration of all disturbed lands in an approved manner.

(j) The lessee shall submit annual reports to the authorized officer on compliance with the requirements of paragraphs (b)-(i) of this section and report within 24 hours, and if the report is oral, shall confirm the report in writing within 30 days, any significant environmental damage suffered by the lands subject to his lease. However, if, after drilling operations have begun, the lessee is required to submit a similar report under 30 CFR 270.30 and 270.76, he may fulfill the requirement of this subsection by submitting to the authorized officer a copy of that report.

§ 3204.2 Waste prevention.

All leases shall be subject to the condition that the lessee will, in conducting his exploration, development, and pro-

ducing operations, use all reasonable precautions to prevent waste of geothermal resources and other natural resources found or developed in the leased lands.

§ 3204.3 Readjustment of terms and conditions.

(a) (1) Except as otherwise provided by law, the terms and conditions of any geothermal lease may be readjusted as determined by the authorized officer at not less than 10-year intervals beginning 10 years after the date geothermal steam is produced. Each lease shall provide for such readjustments.

(2) The authorized officer shall give notice to the lessee of any proposed readjustment of the terms and conditions of the lease and the nature thereof, and unless the lessee files with the authorized officer an objection to the proposed terms and conditions or relinquishes the lease within 30 days after receipt of such notice, the lessee shall be deemed conclusively to have agreed to such terms and conditions. If the lessee files objections, and agreement cannot be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party, subject to the provisions of § 3000.4 of this chapter. If the lessee files objections to the proposed readjusted terms and conditions, the existing terms and conditions, except for those concerning rental and royalty rates, will remain in effect until there has been an agreement between the authorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated. The readjustment of any terms concerning rental and royalty rates will be subject to § 3205.3 of this chapter.

(b) Any readjustment of the terms and conditions of any lease of lands withdrawn or acquired in aid of a function of a Federal department or agency may be made only with the approval of that other agency.

§ 3204.4 Reservation to the United States of oil, hydrocarbon gas, and helium.

The United States reserves the ownership and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from lands leased under the Act. Whenever the right to extract oil, hydrocarbon gas, and helium, from geothermal steam and associated geothermal resources produced from such lands is exercised, it shall be exercised so as to cause no substantial interference with the production of geothermal resources from such lands.

§ 3204.5 Compensation for drainage; compensatory royalty.

(a) Upon a determination by the Supervisor that lands owned by the United States are being drained of geothermal resources by wells drilled on adjacent or cornering lands, the authorized officer may execute agreements with the owners of adjacent or cornering lands whereby

the United States, or the United States and its lessees, shall be compensated for such drainage, such agreements to be made with the consent of any lessee affected thereby. The precise nature of any agreement will depend on the conditions and circumstances involved in the particular case.

(b) Where land in any lease is being drained of its geothermal resources by a well either on a Federal lease issued at a lower rate of royalty or on land not the property of the United States, the lessee must drill and produce all wells necessary to protect the leased lands from drainage. In lieu of drilling such wells, the lessee may, with the consent of the Supervisor, pay compensatory royalty in the amount determined in accordance with 30 CFR Part 270.

§ 3204.6 Patented lands.

The terms and conditions of any geothermal resource lease for lands conveyed by the United States subject to a reservation to the United States of geothermal resources may be readjusted upon notification to the surface owner.

Subpart 3205—Service Charges, Rentals and Royalties

§ 3205.1 Payments.

§ 3205.1-1 Form of remittance.

Remittances required under these regulations may be made by cash payment, check certified check, bank draft, bank cashier's check, or money order. All remittances will be deposited as received.

§ 3205.1-2 Where submitted.

(a) *Rentals on nonproducing leases.* Rentals under all nonproducing leases issued shall be paid at the proper BLM office. All remittances to the Bureau of Land Management shall be made payable to the Bureau of Land Management.

(b) *Other payments.* All royalties on producing leases, communitized leases in producing well units, unitized leases in producing unit areas, leases on which compensatory royalty is payable and all royalty payments under easements for directional drilling are to be paid to the Supervisor. All remittances to the Supervisor shall be made payable to the U.S. Geological Survey.

§ 3205.2 Service charges.

(a) *Competitive lease applications.* No service charge is required.

(b) *Noncompetitive lease applications.* Applications for noncompetitive leases must be accompanied by a nonrefundable service charge of \$50 for each application.

(c) *Assignments.* Applications for approval of an assignment of a lease or interest therein must be accompanied by a nonrefundable service charge of \$50 for each application.

(d) *Nominations.* No service charge is required.

§ 3205.3 Rentals and royalties.

§ 3205.3-1 Payment with application.

Each application, except an application filed pursuant to Subpart 3211 of

NOTICES

this chapter, of this part, must be accompanied by payment of the first year's rental of \$1 per acre or fraction thereof based on the total acreage included in the application. An application accompanied by a payment of the first year's rental which is deficient by not more than 10 percent will be approved by the authorized officer provided all other requirements are met, but, if the additional rental is not paid within 30 days from notice, the application or the lease, if issued, will be canceled. If the annual rental rate established for the lease to be issued is more than \$1 per acre or fraction thereof, the applicant will be required to submit the additional rental prior to issuance of the lease upon notice from the authorized officer.

§ 3205.3-2 Payment of annual rental.

(a) Annual rental in the amount specified in the lease which shall be not less than \$1 per acre or fraction thereof must be paid in advance and must be received by the proper BLM office on or before the anniversary date of the lease. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall terminate the lease by operation of law, except as provided by § 3244.2 of this chapter.

(b) If, on the anniversary date of the lease, less than a full year remains in the lease term, the rentals shall be payable in the same proportion as the period remaining in the lease term is to a full year. The rentals shall be prorated on a monthly basis for the full months, and on a daily basis for the fractional month remaining in the lease term. For the purpose of prorating rentals for a fractional month, each month will be deemed to consist of 30 days.

(c) If the term of a lease for which prorated rentals have been paid is further extended to or beyond the next anniversary date of the lease, rentals for the balance of the lease year shall be due and payable on the 1st day of the first month following the date through which the prorated rentals were paid. If the rentals are not paid for the balance of the lease year, the lease will be subject to cancellation. However, if the anniversary date occurs before the end of the notice period, the rental for the following lease year shall nevertheless be due on the anniversary date and failure to pay the full rental for that year on or before that date shall cause the lease to terminate automatically by operation of law except as provided by § 3244.2 of this chapter. The lessee shall not be relieved of liability for rental due for the balance of the previous lease year.

(d) If the payment is due on a day in which the proper BLM office to receive payment is not open, payment received on the next official working day will be deemed to be timely.

§ 3205.3-3 Escalating rental rates.

To encourage the orderly and timely development of geothermal leases, all

leases issued pursuant to the regulations in this Group will provide that, beginning with the sixth year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the rental will be set by the authorized officer as the amount of rental for the preceding year plus an additional rental of \$1 per acre, or fraction thereof, but the authorized officer may, upon a showing of sufficient justification by the lessee, waive the payment of all or any portion of the additional rental.

§ 3205.3-4 Fractional interests.

Rentals, minimum royalties, and royalties payable for lands in which the United States owns an undivided fractional interest shall be in the same proportion to the rentals, minimum royalties, and royalties provided for in § 3205.3, as the undivided fractional interest of the United States in the geothermal resources is to the full geothermal resources interest.

§ 3205.3-5 Royalty on production.

Royalty shall be paid at the following rates on geothermal resources:

(a) A rate, as set forth in the lease, of not less than 10 per centum and not more than 15 per centum of the amount or value of steam, or any other form of heat or energy derived from production under the lease and sold or utilized by the lessee or reasonably susceptible to sale or utilization by the lessee; (b) a rate as set forth in the lease, of not more than 5 per centum of any byproduct derived from production under the lease and sold or utilized or reasonably susceptible of sale or utilization by the lessee, except that as to any byproduct which is a mineral named in section 1 of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that Act and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that Act; (c) in no event shall the royalty on any producing lease for any lease year, commencing with the lease year beginning on or after the commencement of production in commercial quantities, be less than \$2 per acre or fraction thereof, and this minimum royalty, in lieu of rental, shall be payable at the expiration of each lease year.

§ 3205.3-6 Royalty on commercially demineralized water.

All geothermal leases issued pursuant to the provisions of this group shall provide for the payment to the lessor of a royalty on commercially demineralized water at a rate to be specified in the lease of not more than 5 per centum of the value of such commercially demineralized water that has been sold or utilized by the lessee or is reasonably susceptible of sale or utilization by the lessee, except that no payment of a royalty will be required on such water if it

is used in plant operation for cooling or in the generation of electric energy or otherwise.

§ 3205.3-7 Waiver, suspension or reduction of rental or royalty.

(a) The authorized officer may waive, suspend, or reduce the rental or royalty for any lease or portion thereof in the interests of conservation and to encourage the greatest ultimate recovery of geothermal resources if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms. No waiver, suspension or reduction of rental or royalty will be granted where the only reason for the request for such relief is the unavailability of power generating facilities to utilize the geothermal steam.

(b) An application hereunder shall be filed in triplicate with the Supervisor, and must: (1) Contain the serial number of the leases and the names of the lessee and operator; (2) show the number, location, and status of each well that has been drilled, a tabulated statement for each month covering a period of not less than 6 months prior to the date of filing the application of the aggregate amount of production subject to royalty computed in accordance with the operating regulations, the number of wells counted as producing each month, and the average production per well per day; (3) contain a detailed statement of expenses and costs of operating the lease, the income from the sale of any leased products and all facts tending to show whether the wells can be successfully operated using the royalty or rental fixed in the lease; and (4) where the application is for a reduction in royalty, furnish full information as to whether royalties or payments out of production are paid to others than to the United States, the amounts so paid, and the efforts made to reduce them. The applicant must also file agreements of the holders to a comparable reduction of all other royalties from the leasehold to an aggregate not in excess of one-half the Government royalties.

§ 3205.3-8 Application for and effect of suspension of operations and production.

(a) Applications by lessees for suspensions of operations or production, or both, under a producing geothermal lease (or for relief from any drilling or producing requirements of such a lease) shall be filed in triplicate with the Supervisor, who is authorized to act on applications filed pursuant to this section and to terminate suspensions which have been or may be granted. Complete information must be furnished showing the necessity of the relief sought.

(b) A suspension shall take effect as of the time specified in the order of the Supervisor. Rental or minimum royalty payments will be suspended during any period of suspension of all operations and production directed, or assented to, by the Supervisor, beginning with the first day of the lease month in which the

RULES AND REGULATIONS

suspension of operations and production becomes effective or, if the suspension of operations and production becomes effective on any date other than the first day of a lease month, beginning with the first day of the lease month following such effective date. The suspension of rental or minimum royalty payments shall end on the first day of the lease month in which operations or production is resumed. Where rentals are creditable against royalties and have been paid in advance, proper credit will be allowed on the next rental or royalty due under the lease.

(c) No lease shall be deemed to expire by reason of a suspension of either operations or production, pursuant to any order or assent of the Supervisor.

(d) If there is a well on the leased premises capable of producing geothermal resources and all operations and production are suspended pursuant to any order of the Supervisor, approval of recommencement of drilling operations will terminate the suspension as to operations but not as to production, and will terminate both the period of suspension of rental and minimum royalty payments provided in paragraph (b) of this section and the period of suspension for which an equivalent extension will be granted. However, as provided in paragraph (c) of this section, the lease will not be deemed to expire so long as the suspension of operations or production remains in effect.

(e) The relief authorized under this section may also be obtained for any leases included within an approved unit or cooperative plan of development and operation.

(f) See 30 CFR 270.17 for regulations concerning action of the Supervisor on applications filed pursuant to this section.

§ 3205.3-9 Readjustments.

The rentals and royalties of any geothermal lease may be readjusted at not less than 20-year intervals beginning 35 years after the date geothermal steam is produced as determined by the Supervisor. In the event of any such readjustment neither the rental nor royalty paid during the preceding period shall be increased by more than 50 per centum, and in no event shall the royalty payable exceed 22½ per centum. Each geothermal lease shall provide for such readjustment. The Supervisor will give notice of any proposed readjustment of rental or royalties. Unless the lessee relinquishes the lease within 30 days after receipt of such notice, he shall conclusively be deemed to have agreed to such terms and conditions. If the lessee files a protest, and no agreement can be reached between the authorized officer and the lessee within a period of 60 days, the lease may be terminated by either party, subject to the provisions of § 3000.4 of this chapter. If the lessee files a protest to the proposed readjusted terms and conditions, the existing terms and conditions will remain in effect until there has been an agreement between the au-

thorized officer and the lessee on the new terms and conditions to be applied to the lease or until the lease is terminated, except payments of any proposed readjusted rentals and royalties must be paid in the timely manner prescribed in these regulations and may be paid under protest. The readjusted terms and conditions will be effective as of the end of the term being adjusted.

§ 3205.4 Rental and minimum royalty liability of lands committed to cooperative or unit plans.

§ 3205.4-1 Prior to production.

All lands within any lease committed to an approved cooperative or unit plan shall at all times prior to production on any of the lands so committed remain subject to rental in accordance with § 3205.3.

§ 3205.4-2 After production.

As soon as production is obtained on or for any lands included in an approved cooperative or unit plan those lands which are included within the participating area of the producing well shall become liable for royalties in accordance with Subpart 3205. All other unitized lands, shall remain subject to rental in accordance with § 3205.3.

Subpart 3206—Lease Bonds

§ 3206.1 Types of bonds and filing.

§ 3206.1-1 Types of bonds.

(a) Bonds shall be either corporate surety bonds or personal bonds except that bonds with individual sureties may be furnished for the protection of the entryman or owner of the surface rights.

(b) Lease compliance bond. The applicant for a noncompetitive lease or the successful bidder for a competitive lease must furnish, prior to the issuance of the lease, and thereafter maintain a bond of not less than \$10,000 conditioned on compliance with all the terms of the lease.

(c) Protection bond. A lessee will be required, prior to entry on the leased lands, to furnish and maintain a bond of not less than \$5,000 for indemnification for all damages occasioned to persons or property as the result of lease operations.

§ 3206.1-2 Filing of bonds.

A single original copy of the bond on forms approved by the Director must be filed in the proper BLM office. Bonds may be filed with a noncompetitive lease application to expedite action thereon, or within 30 days after receipt of notice by the applicant of the bond requirement, or as required and directed by the authorized officer. For unit bond forms see 30 CFR Part 271.

§ 3206.2 Termination of period of liability.

The period of liability of any bond will not be terminated until all lease terms and conditions have been fulfilled.

§ 3206.3 Operator's bond.

§ 3206.3-1 Compliance.

An operator, or, if there are more than one for different portions of the lease, each operator may furnish a general cash bond of not less than \$10,000 in his own name as principal on the bond in lieu of the lessee. Where there is more than operator's bond affecting a single lease, each such bond must be conditioned upon compliance with all lease terms for the entire leasehold.

§ 3206.3-2 Approval.

An operator's bond will not be accepted unless the operator holds an operating agreement which has been approved by the Department or has pending an operating agreement in proper condition for approval. The mere designation as operator will not suffice.

§ 3206.3-3 Default.

Where a bond is furnished by an operator, suit may be brought thereon without joining the lessee if he is not a party to the bond.

§ 3206.4 Personal bond or corporate bond.

§ 3206.4-1 Amount.

In lieu of a surety bond, a personal bond in a like amount may be given by the obligor with the deposit as security therefor of negotiable bonds of the United States of a par value equal to the amount specified in the bond.

§ 3206.4-2 Deposit of securities.

Personal bonds must be accompanied by a deposit of negotiable Federal securities in a sum equal at their par value to the amount of the bond and by a proper conveyance to the Secretary of full authority to sell such securities in case of default in the performance of the conditions of the lease bond.

§ 3206.4-3 Qualified corporate sureties.

Treasury lists. A list of companies holding certificates of authority from the Secretary of the Treasury under the Act of July 30, 1947 (6 U.S.C. 6-13), as acceptable sureties on Federal bonds is published in the FEDERAL REGISTER annually.

§ 3206.5 Nationwide bond.

In lieu of bonds required under any of the preceding paragraphs, the holder of leases or of operating agreements approved by the Department, or holder of operating rights by virtue of being designated operator or agent by the lessee pending departmental approval of operating agreements may furnish a bond the amount of which must be not less than \$150,000 for full nationwide coverage for all geothermal leases.

§ 3206.6 Statewide bond.

In lieu of any of the bonds required by the preceding paragraphs, the holder of leases or of operating agreements approved by the Department or holder of operating rights by virtue of being designated operator or agent by the lessee

RULES AND REGULATIONS

pending Departmental approval of operating agreements, may furnish a statewide bond, applicable to the State in which the leases are situated, the amount of which must be not less than \$50,000.

§ 3206.7 Default.

§ 3206.7-1 Payment by surety.

Where upon a default the surety makes payment to the Government of any indebtedness due under a lease, the face amount of the surety bond and the surety's liability thereunder shall be reduced by the amount of such payment.

§ 3206.7-2 Penalty.

Thereafter, upon penalty of cancellation of all of the leases covered by that bond, the principal shall post a new nationwide bond in the amount of \$150,000 or a new statewide bond in the amount of \$50,000 as the case may be, within 6 months after notice, or within such shorter period as the authorized officer may fix. However, in lieu thereof, the principal may within that time file separate bonds for each lease.

§ 3206.8 Applicability of provisions to existing bonds.

The provisions of these regulations may be made applicable to any oil and gas nationwide or statewide bond in force at the effective date of these regulations by filing in the proper BLM office a written consent to that effect and an agreement to be bound by the provisions hereof executed by the principal and the surety. Upon receipt thereof the bond will be deemed to be subject to the provisions of these regulations.

Subpart 3207—[Reserved]

Subpart 3208—[Reserved]

Subpart 3209—Geothermal Resources Exploration Operations

§ 3209.0-1 Purposes.

(a) The regulations in this Subpart establish procedures to be followed in conducting exploration operations on the public land for geothermal resources. The regulations in this subpart are not applicable to exploration operations conducted pursuant to a geothermal resources lease.

(b) The rights obtained under this subpart do not include an exclusive right to prospect for geothermal resources on the land described in a Notice of Intent or any preference right to a geothermal resources lease.

§ 3209.0-2 Objectives.

The regulations in this Subpart encourage exploration of the public lands for geothermal resources in a manner that is consistent with the management policy set forth in § 1725.3 of this chapter. No exploration operations will be allowed if the authorized officer determines that such operations would be inconsistent with that policy. The authorized officer may suspend or terminate exploration operations upon due notice to the operator at any time if he determines that there is non-compliance with the

terms and conditions of the Notice of Intent.

§ 3209.0-5 Definitions.

As used in this subpart:

(a) "Exploration operations" means any activity relating to the search for evidence of geothermal resources which requires physical presence upon public lands and which may result in damage to public lands or resources thereon. It includes, but is not limited to, geophysical operations, drilling of shallow temperature gradient wells, construction of roads and trails, and cross-country transit by vehicle over public lands. It does not include the casual use of public lands for geothermal resources exploration. It does not include core drilling for subsurface geologic information, except drilling of shallow temperature gradient wells, or drilling for geothermal resources; these activities will be authorized only by the issuance of a geothermal resources lease. The regulations in this Subpart, however, are not intended to prevent drilling operations necessary for placing explosive charges for seismic exploration, nor do they affect the exclusive right of a lessee to drill for geothermal resources upon the land subject to his lease.

(b) "Notice of Intent" means a "Notice of Intent and Permit to Conduct Exploration Operations (Geothermal Resources)."

(c) "Public lands" means lands owned by the United States and administered by the Bureau of Land Management. It does not include a retained mineral interest in lands, title to which has passed from the United States.

(d) "Casual use" means activities that involve practices which do not ordinarily lead to any appreciable disturbance or damage to lands, resources, and improvements. For example, activities which do not involve use of heavy equipment or explosives and which do not involve vehicle movement except over established roads and trails are "casual use."

§ 3209.1 Notice of intent and permit to conduct exploration operations (Geothermal Resources).

§ 3209.1-1 Application.

(a) Forms and where filed. Any persons desiring to conduct exploration operations under the regulations of this subpart shall, prior to entry upon the lands, file for approval with the authorized officer for the district in which the public lands are located a Notice of Intent on a form approved by the Director.

(b) Requirements. The Notice of Intent will contain the following:

(1) The name and address, including zip code, both of the person, association, or corporation for whom the operations will be conducted and of the person who will be in charge of the actual exploration activities;

(2) a statement that the signers agree that exploration operations will be conducted pursuant to the terms and conditions listed on the approved form;

(3) a brief description of the type of operations which will be undertaken;

(4) a description of the lands to be explored by township;

(5) a map or maps, available from state or Federal sources, showing the lands to be entered or disturbed by the proposed exploration operations; and

(6) the approximate dates of the commencement and termination of exploration operations.

§ 3209.1-2 Review of Notice of Intent.

The authorized officer will either approve or disapprove a Notice of Intent as promptly as practicable, but in any event within 30 calendar days after the date of the filing of the Notice of Intent. If the authorized officer shall disapprove a Notice of Intent, he shall explain in writing to the applicant the reasons for disapproval.

§ 3209.2 Exploration operations.

No exploration operations will be conducted on public lands except pursuant to the terms of a Notice of Intent which has been approved by the authorized officer.

§ 3209.3 Completion of operations.

Upon completion of the exploratory operations, there shall be filed with the authorized officer a "Notice of Completion of Exploration Operations." Within 90 days after the filing of such "Notice of Completion," the authorized officer shall notify the party who had conducted compliance with all of the terms and conditions set out by the regulations in this Subpart and in the Notice of Intent, or whether any additional measures must be taken to rectify any damage to the land, specifying the nature and extent thereof.

§ 3209.4 Bond requirement.

§ 3209.4-1 General.

(a) Simultaneously with the filing of the Notice of Intent, and before the entry is made on the land, the party or parties filing the Notice of Intent must file with the authorized officer a surety company bond for each exploration operation in the amount of not less than \$5,000, conditioned upon the full and faithful compliance with all of the terms and conditions of the regulations in this Subpart and of that Notice of Intent.

(b) A party will be excused from compliance with the requirements of paragraph (a) of this section if he possesses either a nationwide bond in the amount of not less than \$50,000 covering all exploration operations or a statewide bond in the amount of not less than \$25,000 covering all exploration operations in the State in which the lands on which he has filed the Notice of Intent are situated.

§ 3209.4-2 Riders to existing bond forms.

Holders of nationwide and statewide oil and gas exploration bonds shall be permitted, in lieu of furnishing additional bonds, to amend their bonds to include geothermal resources exploration operations.

RULES AND REGULATIONS

§ 3209.4-3 Termination of period of liability.

The authorized officer will not give his consent to the cancellation of the bond if an individual bond was submitted or to the termination of the period of liability if a State or nationwide bond was submitted, unless and until there has been compliance with all of the terms and conditions of the Notice of Intent. Should the authorized officer fail to notify the party within 90 days from the filing of "Notice of Completion" that all terms and conditions have been complied with or that additional corrective measures must be taken to rehabilitate the land, the period of liability under an individual bond or the period of liability for a particular exploration operation under a State or nationwide bond shall automatically terminate on the 91st day.

PART 3210—NONCOMPETITIVE LEASES

Subpart 3210—Noncompetitive Leases; General Sec.

- 3210.1 Availability of land.
- 3210.2-1 Application.
- 3210.2-2 Submission of applications.
- 3210.2-3 Withdrawal of application.
- 3210.2-4 Amendment to lease.
- 3210.3 Determination of priorities.
- 3210.4 Rejections.

Subpart 3211—Bureau Motion, Lands Previously Leased for Geothermal Resources

- 3211.1 Releasing of formerly leased lands.
- 3211.2 Applications during simultaneous filing periods.
- 3211.3 Insurance of leases for unit on posted lands.

Subpart 3210—Noncompetitive Leases; General

§ 3210.1 Availability of land.

(a) Applications to lease, except for those filed pursuant to Part 3230, of this chapter, filed prior to the effective date of these regulations are unacceptable and will be returned summarily without earning any priority.

(b) Lands and deposits subject to disposition under this part which are not within any KGRA will be available for leasing after the effective date of these regulations. Lands which are available for noncompetitive leasing and which were included in cancelled, relinquished, expired, or terminated leases shall be available for leasing only subject to the provisions of Subpart 3211 of this chapter. All other lands available for noncompetitive leasing will be available for leasing only subject to the provisions of this Subpart. All applications to lease the same lands which are filed between the effective date of these regulations and 30 days following that time will be considered to have been filed simultaneously, and the respective priority of the various applications will be determined by a public drawing. In other respects the first 90 days after the effective date of these regulations shall be treated as an application filing period as provided in § 3210.2-2.

§ 3210.2-1 Application.

An application for a lease must be filed on a form approved by the Director in the proper BLM office in duplicate for public lands and in triplicate where acquired lands are involved. The application must be submitted in a sealed envelope marked "Application for lease pursuant to 43 CFR 3210". An application will be considered filed when it is received in the proper office during business hours. The application must include the following:

- (a) The applicant's name and address;
- (b) a statement of applicant's citizenship and qualifications;
- (c) a complete and accurate description of the lands applied for, which must include all available lands, including reserved geothermal resources, within a surveyed or protracted section, or, if the lands are neither surveyed or protracted and are described by metes and bounds, all the lands which will be included in a section when the lands are surveyed or protracted;

(d) a proposed plan which shall include: (1) A map, or maps, available from State or Federal sources, showing the topography of the land applied for, on which the applicant shall show drainage patterns, present road and trail locations, present utility systems, proposed road and trail location, proposed well locations and potential surface disturbance, and (2) a narrative statement setting forth his proposed plan and methods for diligent exploration. Such plan shall provide for a program of diligent exploration as defined in § 3203.5 of this chapter.

The narrative statement shall also describe the measures proposed to be taken to prevent or control fire, soil erosion, pollution of surface and ground water, damage to fish and wildlife or other natural resources, air and noise pollution and hazards to public health and safety during lease activities. However, the proposed plan required by this paragraph need not be submitted with the application during the initial 30-day simultaneous filing period provided by § 3210.1(b) or during any application filing period pursuant to § 3210.2-2, but must be filed prior to the issuance of the lease, upon notice from the authorized officer; and

(e) a statement that the applicant does not hold, own, or control any interest, direct or indirect, in other Federal geothermal leases in the same State in excess of 20,480 acres.

§ 3210.2-2 Submission of applications.

Except for applications filed during the first 30 days after the effective date of these regulations, applications for leases pursuant to this subpart shall be submitted only during application filing periods. An application filing period shall begin on the first working day of each calendar month and shall end at the close of business on the last working day of that month. The first application filing period shall begin on the first working

day of the month following the conclusion of the initial 30 day filing period provided in § 3210.1(b). No applicant shall file during the same application filing period a second application which overlaps any of the land covered by his first application. When an application is filed with the authorized officer, the date of filing shall be stamped on the envelope. The envelope containing the application shall remain sealed until the end of the application filing period during which the application is filed. On the first working day following the end of the application filing period all applications shall be opened, and it will be determined which applications are for lands included in a KGRA. In determining whether land included in an application is a KGRA because of competitive interest, no application submitted during any subsequent application filing period will be considered. Applications for land determined to be KGRA will be rejected. All other applications will be assigned priority according to the date of filing. If any application covers both land within a KGRA and land outside a KGRA, the applicant will be granted the opportunity to amend his application to exclude the portion included in a KGRA, and his amended application will be assigned priority according to the date of filing of his original application, but must comply with all other requirements of these regulations.

§ 3210.2-3 Withdrawal of application

An application may not be withdrawn, either in whole or in part, unless the request is received by the proper BLM office before the lease or an amendment of the lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States even though the effective date of the lease is subsequent to the date of filing of the withdrawal, except where separate conflicting lease has been signed on behalf of the United States covering the land described in the withdrawal.

§ 3210.2-4 Amendment to lease.

If any of the land applied for was open to filing when the application was filed but is omitted from the lease for any reason and thereafter becomes available for noncompetitive leasing, the original lease will be amended to include the omitted land unless, before the issuance of the amendment, the proper BLM office receives a withdrawal of the lessee's application with respect to such land or such omitted lands have been determined to be within a KGRA. The lease term for the land added by such an amendment shall be the same as if the land had been included in the original lease when it was issued.

§ 3210.3 Determination of priorities.

(a) No lease shall be issued before final action has been taken on (1) any prior application to lease the land, (2) any subsequent application to lease the land that is based upon a claimed preferential

RULES AND REGULATIONS

right, and (3) any petition for the renewal or reinstatement of an existing or former lease on the land.

(b) Where a lease is issued before final action has been taken on such applications and petitions, it shall be canceled, and the advance rental returned, after due notice to the lessee, where the applicant or petitioner is found to be qualified and entitled to receive a lease of the land.

(c) Applications for lease received in the mail or delivered on the same day will be deemed to have been simultaneously filed, and the right of priority and the order of processing will be determined by a public drawing.

(d) Prior to the issuance of any lease, a determination shall be made as to whether or not the lands are within a KGRA. Applications for lands determined to be within any KGRA will be rejected.

§ 3210.4 Rejections.

If, after the filing of an application for a noncompetitive lease and before the issuance of a lease, or amendment thereto, pursuant to that application, the land embraced in the application becomes included within a KGRA, the application will be rejected as to such KGRA lands. The authorized officer retains discretion to reject an application for a noncompetitive lease even though the tract for which application is made is not determined to be within a KGRA.

Subpart 3211—Bureau Motion—Land Previously Leased for Geothermal Resources

§ 3211.1 Releasing of formerly leased lands.

Lands available for noncompetitive leasing in canceled or relinquished leases or in leases which expire by operation of law at the end of their primary or extended terms or in leases which terminate by operation of law for nonpayment of rental pursuant to 30 U.S.C. sec. 1004, shall be subject to further leasing only in accordance with the provisions of this section. From time to time the authorized officer will publish in the FEDERAL REGISTER, post in each proper BLM office, and provide appropriate news coverage of:

(a) A list of leasing units composed of lands which are available for noncompetitive leasing and which were in canceled, expired, relinquished, or terminated leases.

(b) An announcement that applications for leases on such lands will be received after a specific hour and date and that any applications filed during a specified simultaneous filing period beginning at that time will be regarded as simultaneously filed.

(c) The address of the proper BLM office where applications must be filed and where the terms and conditions under which the lease will be issued are available; and

(d) Requirements for a complete application, indicating that the proposed plan of operation, as required by § 3210-

2-1(d) of this chapter, will not be required until there has been a drawing and a consequent determination of priority, but must be filed prior to the issuance of the lease, upon notice from the authorized officer.

§ 3211.2 Applications during simultaneous filing periods.

(a) An application shall conform to the requirements of § 3210.2-1 of this chapter, except as provided below.

(b) Only one complete leasing unit, identified by unit number, may be included in an application. Lands not on the published list may not be included in the application.

(c) An applicant is permitted to file only one application for each numbered unit on the posted list. Submission of more than one application by or on behalf of the applicant for any unit on the posted list will result in the disqualification of all applications submitted by that applicant for the drawing to be held for that particular unit.

(d) The application must be accompanied by a signed statement that the applicant will furnish the information required by these regulations within 15 days after notification that his application is the only one for the tract, or that he is the successful drawee.

(e) Each application filed during a simultaneous filing period must be submitted in a sealed envelope marked "Application for a lease pursuant to 43 CFR subpart 3211". The envelope will remain sealed until the end of the 30-day simultaneous filing period, at which time the application will be time-stamped simultaneously and serialized. A public drawing of all applications received during the simultaneous 30-day period will be held to determine respective priorities and order of processing.

(f) Applications filed during a simultaneous filing period are subject to the classification criteria established in § 3200.0-5(k) of this chapter, and will be considered as all filed the same day.

(g) The requirements of § 3210.2-1(d) of this chapter requiring a proposed plan of operation need not be satisfied for a complete application during the 30-day simultaneous filing period or during any future designated simultaneous filing period. Such plan must be filed by the successful drawee prior to the issuance of the lease, upon notice from the authorized officer.

(h) Each application must be accompanied by the service charge of \$50. The first year's advance rental need not be submitted with the application. A lease may be issued to the first drawee qualified to receive a lease upon payment of the first year's rental. Rental must be received in the proper BLM office within fifteen days from the date of receipt of notice that such rental is due. The drawee failing to submit the rental payment within the time allowed will be automatically disqualified to receive the lease, and consideration will be given to the application of the drawee having the next highest priority in the drawing.

§ 3211.3 Issuance of leases for units on posted list.

(a) If more than one application is received during the simultaneous filing period for the same unit on the list posted pursuant to § 3211.1(a), all applications on that unit filed during that period will be considered simultaneously filed. Priority of filing for such units will be determined by a public drawing. Three applications will be drawn for each unit, and the order in which they are drawn will fix the order in which the successful drawee will be determined. Where less than three applications have been filed, all applications will be drawn to determine priority.

If the lands are determined not to be within any KGRA, a lease may be issued to the successful drawee upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(b) If only one application is filed during the simultaneous filing period on a unit on the list posted pursuant to § 3211.1(a), a lease on that unit, if the land is not included within any KGRA, may be issued to the applicant, upon his compliance with all applicable regulations, including those in Subpart 3210 of this chapter.

(c) If no application is filed on a unit on the list posted pursuant to § 3211.1 (a) within the prescribed simultaneous filing period, the land in that unit, if not within a KGRA, will become available for leasing in accordance with Subpart 3210 of this chapter.

PART 3220—COMPETITIVE LEASES

Subpart 3220—Competitive Leases; General

- Sec.
- 3220.1 General.
 - 3220.2 Nominations.
 - 3220.3 Publication of notice of lease sale.
 - 3220.4 Contents of notice of lease sale.
 - 3220.5 Bidding requirements.
 - 3220.6 Award of lease.

Subpart 3220—Competitive Leases; General

§ 3220.1 General.

(a) Lands within a KGRA, except as provided under § 3201.1 of this chapter, will be available for leasing on the effective date of these regulations.

(b) The authorized officer will accept nominations to lease, or may on his own motion from time to time call for nominations to lease. Nominations may be withdrawn at any time.

§ 3220.2 Nominations.

(a) Nominations will be submitted on a card approved by the Director.

(b) A nomination must be filed in the proper BLM office in duplicate for public lands and triplicate where acquired lands are involved and must include the following:

- (1) The nominator's name and address;
- (2) A statement of citizenship and qualifications for lease;
- (3) A description of the lands; and

RULES AND REGULATIONS

(4) A statement of the interests, direct or indirect, held in other Federal geothermal leases in the same State.

§ 3220.3 Publication of notice of lease sale.

Where the Secretary determines to offer lands for competitive leasing he will publish a notice of lease sale in a newspaper of general circulation in the area in which the lands to be leased are located once a week for 4 consecutive weeks, or for such other period as he may direct.

§ 3220.4 Contents of notice of lease sale.

The notice will specify the time and place of sale, the manner in which bids may be submitted, the description of the lands, and the terms and conditions of the sale, including royalty and rental rates.

The notice will indicate the proper BLM office where the terms and conditions under which the lease will be issued are available. The notice will also indicate that the proposed plan of operation, as required by § 3210.2-1(d) of this chapter, must be filed before a lease can be issued.

§ 3220.5 Bidding requirements.

(a) A separate identified sealed bid must be submitted for each lease unit. Each bidder must submit with his bid a certified or cashier's check, bank draft, money order or cash in the amount of one-half of the amount bid together with proof of qualifications as required by these regulations.

(b) All bidders are warned against violation of the provisions of Title 18 U.S.C. section 1860 prohibiting unlawful combination or intimidation of bidders.

§ 3220.6 Award of lease.

(a) All sealed bids shall be opened at the place, date, and hour specified in the notice. No bids will be accepted or rejected at that time.

(b) Leases will be awarded to the highest responsible qualified bidder, except as required under Part 3230 of this chapter.

(c) The right to reject any and all bids is reserved. If the authorized officer fails to accept the highest bid for a lease within 30 days after the date on which the bids are opened (or such longer period as may be needed to comply with § 3230.1-6 of this chapter), all bids for that lease will be considered rejected. Deposits on rejected bids will be returned.

(d) If the lease is awarded, three copies of the lease will be sent to the successful bidder who shall be required to execute them within 30 days from receipt thereof, to pay the first year's rental, the balance of the bonus bid, file the required bond or bonds, and submit the proposed plan of operation as required by § 3210.2-1(d) of this chapter. When the three copies of the lease are executed by the successful bidder and returned to the authorized officer, the lease will be executed by the authorized officer and a copy will be mailed to the lessee.

(e) If the successful bidder fails to execute the lease or otherwise comply with the applicable regulations, his deposit will be forfeited and disposed of as provided in section 20 of the Act. In this event the lands will be reoffered when it is determined, in the opinion of the Secretary, that sufficient interest exists to justify a competitive lease sale.

PART 3230—RIGHTS TO CONVERSION TO GEOTHERMAL LEASES OR APPLICATION FOR GEOTHERMAL LEASES

Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases; General

- Sec. 3230.1 General.
- 3230.1-1 Rights to conversion to geothermal leases.
- 3230.1-2 Rights to conversion to applications for geothermal leases.
- 3230.1-3 Land in which minerals are reserved to the United States.
- 3230.1-4 Conflicting claims of rights to conversion to geothermal leases, or to applications for geothermal leases.
- 3230.1-5 Evidence required to qualify for grant of rights to conversion to geothermal leases, or to applications for geothermal leases.
- 3230.1-6 Method of leasing to owners of conversion rights to geothermal leases, or to applications for geothermal leases.
- 3230.1-7 Acreage limitation.
- 3230.2 Qualifications.
- 3230.3 Applications.
- 3230.3-1 Filing of application.
- 3230.3-2 Statements required.
- 3230.4 Conversion to geothermal leases or to applications for geothermal leases.
- 3230.4-1 Processing and adjudicating applications.

Subpart 3230—Rights to Conversion to Geothermal Leases or Application for Geothermal Leases

- § 3230.1 General.
- § 3230.1-1 Rights to conversion to geothermal leases.

Where lands were on September 7, 1965, subject to valid leases or permits issued under the Mineral Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181-287), or the Mineral Leasing Act for Acquired Lands, as amended (30 U.S.C. 351-358), or subject to existing mining claims located on or prior to September 7, 1965, the lessees, permittees, or claimants, or their successors in interest, if qualified to hold geothermal leases, shall have the right, subject to certain limitations as hereinafter provided, to convert such leases, permits or claims to geothermal leases covering the same lands. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such outstanding leases, permits, or mining claims shall be deemed to be terminated or relinquished, respectively.

- § 3230.1-2 Rights to conversion to applications for geothermal leases.

Where lands were subject to application for leases or permits under the mineral leasing laws referred to in

§ 3230.1-1 on September 7, 1965, the applicants may, subject to certain limitations as hereinafter provided, convert their applications to applications for geothermal leases having priorities dating from the time of filing such applications under said mineral leasing laws. Upon issuance of a geothermal lease based upon the exercise of conversion rights hereunder, such pending applications for leases or permits shall be deemed to be withdrawn.

- § 3230.1-3 Land in which minerals are reserved to the United States.

Where a right to one of the forms of conversion referred to in § 3230.1-1 or § 3230.1-2 is claimed as to lands the surface of which has passed from Federal ownership but in which the minerals have been reserved to the United States, final action on any claim to conversion rights under section 4 of the Act shall be held in abeyance until such time as the question of title to the geothermal resources in such lands has been resolved pursuant to the provisions of section 21(b) of the Act, unless the Secretary determines that it is in the public interest to make a determination of such claims at an earlier time, subject to the rights, if any, of surface owners.

- § 3230.1-4 Conflicting claims of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Where there are conflicting claims of rights to conversion to geothermal leases based upon mineral leases, mineral permits, or mining claims embracing the same land, the date of issuance of the permit or lease or of recordation of the claim shall determine priority.

(b) Where there are rights to conversion to applications for geothermal leases based on applications for mineral leases or permits in conflict with rights to conversion to geothermal leases based upon mining claims embracing the same lands, the mining claim right to convert to a geothermal lease shall have priority. If the applicant for a geothermal lease based upon a mining claim fails to qualify for any reason, the application for an application for a geothermal lease is entitled to priority based on the date of filing the application for a mineral lease or permit.

- § 3230.1-5 Evidence required to qualify for grant of rights to conversion to geothermal leases, or to applications for geothermal leases.

(a) Any person claiming rights to conversion to a geothermal lease must show to the reasonable satisfaction of the authorized officer that substantial expenditures for the exploration, development or production of geothermal steam, but not associated geothermal resources, were made by the applicant who is seeking the conversion on the lands for which a lease is sought or on adjoining, adjacent or nearby lands, including both Federal and non-Federal lands. The substantial expenditures must have been

RULES AND REGULATIONS

made prior to December 24, 1970, and either by the applicant seeking conversion or by his predecessors in interest.

(b) For purposes of these regulations, an application for a lease or a permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which subsequently ripened into a lease or permit, and which remains outstanding or has either terminated, expired or been canceled or relinquished, retains the right to conversion to an application for a geothermal lease. Applications for a lease or permit, filed pursuant to applicable mineral leasing acts, pending on September 7, 1965, which were subsequently withdrawn, retain the right to conversion to an application for a geothermal lease. Leases or permits issued pursuant to the applicable mineral leasing acts and outstanding on September 7, 1965, which were subsequently terminated, expired, or were canceled or relinquished, retain the right to conversion to a geothermal lease.

§ 3230.1-6 Method of leasing to owners of conversion rights to geothermal leases, or to applications for geothermal leases.

(a) Lands included within any KGRA—(1) *Competitive lease.* Where lands have been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands shall be entitled to the issuance of a competitive lease only in accordance with the provisions of subparagraph (2) of this paragraph. If the lands subject to a conversion right to a geothermal lease are in part within a KGRA and in part outside a KGRA, the holder of that conversion right shall have the right to divide his conversion right into two separate conversion rights so that he may receive a geothermal lease to the lands within the KGRA only subject to subparagraph (2) of this paragraph and a geothermal lease to the lands not within a KGRA subject to paragraph (b) of this section.

(2) *Preference right.* (i) Lands which have been included within any KGRA shall be leased only by competitive bidding in the manner prescribed in Subpart 3220 of this chapter, except that, in addition, the name and address of the applicant for any conversion right to a geothermal lease will be set forth in the lease sale notice.

(ii) The person owning the right to conversion to a geothermal lease shall be informed by written notice of the highest bona fide bid submitted for the lease at the sale. If within thirty (30) days after he has received that written notice, the person owning the right to conversion to a geothermal lease shall inform the authorized officer that he wishes such a lease, pay an amount equal to the highest bona fide bid submitted, pay the rental for the first year, file the required bond or bonds, and submit the data required by § 3210.2-1(d) and (e) of this chapter, a lease will be issued to him.

(iii) Failure of the owner of the right to conversion to a geothermal lease to

inform the authorized officer timely will constitute a forfeiture of his conversion rights without further notice to him. In this event, the lease will be offered to the highest bona fide bidder, if otherwise qualified.

(iv) Where no bids are received, the person owning the right to conversion to a geothermal lease will not be awarded the lease. Failure of the owner of the right to conversion to submit a bona fide bid or to meet the high bid for the tract offered at the sale will constitute a forfeiture of his conversion right without further notice.

(b) *Lands not included within any KGRA—Noncompetitive lease.* Where lands have not been included within any KGRA prior to the issuance of a lease, the owner of a conversion right to a geothermal lease for such lands, if otherwise qualified, shall be entitled to the issuance of a noncompetitive lease for such lands.

(c) *Lands included within a KGRA—(1) Application for a lease.* Where lands have been included within a KGRA prior to the issuance of a lease, the owner of a conversion right to an application for a geothermal lease to those lands shall be entitled to receive a competitive geothermal lease only in accordance with the provisions of Subpart 3220 of this chapter. If the lands subject to a conversion right to a geothermal application are in part within a KGRA and in part outside a KGRA, the holder of that conversion right may amend his application to cover only the land outside the KGRA.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have been included within a KGRA shall receive no preference right to meet the highest bona fide bid.

(d) *Lands not included within any KGRA—(1) Application for a lease.* Where lands have not been included within a KGRA, the owner of a conversion right to an application for a geothermal lease, if otherwise qualified, shall be entitled to convert his right into an application for a non-competitive lease.

(2) *Preference right.* The owner of a conversion right to an application for a geothermal lease where the lands have not been included within a KGRA, if otherwise qualified, shall be entitled to the issuance of a non-competitive geothermal lease for such lands in accordance with Subpart 3210 of this chapter.

§ 3230.1-7 Acreage limitation.

No person shall be permitted to obtain, through conversion of mineral leases or prospecting permits, or applications therefor, or mining claims, leases for more than 10,240 acres, or a lease to any land not included in the lease, permit, application or claim converted, except that any such geothermal lease issued may include some lands not embraced in the lease, permit, application or claim on which the conversion right is based, where a metes and bounds description was used to describe lands in issued leases or permits or in filed ap-

plications or mining claim locations. In such event, the metes and bounds description will be conformed by the authorized office to a legal subdivision, to the extent possible.

§ 3230.2 Qualifications.

Persons who believe they are qualified under the Act to convert mineral leases or permits or existing mining claims to geothermal leases and persons who believe they are entitled to convert applications for mineral leases and permits to applications for geothermal leases shall comply with the procedures set forth below.

§ 3230.3 Applications.

§ 3230.3-1 Filing of application.

(a) A person seeking to convert a lease, permit, or application therefor, or a mining claim to a geothermal lease or application must have filed a written application on or before June 22, 1971. If such an application has been filed and does not contain the information specified in § 3230.3-2, such information must be supplied by the applicant within 60 days of the effective date of these regulations.

(b) Failure to have filed a conversion right application on or before June 22, 1971, will result in the loss of any such rights so claimed.

§ 3230.3-2 Statements required.

(a) An application based on a valid lease or permit referred to in section 3230.1-1 hereof shall include the date of issuance, the State in which the lands are located, and the serial number of the lease or permit. An application based on a mining claim referred to in § 3230.1-1 shall include the name, location, legal description or reference sufficient to identify the lands on the ground, date of location and date and place of recordation of the mining claim (including volume and page), which the applicant seeks to convert to a geothermal lease. An application based on an application for a mineral lease or permit referred to in § 3230.1-1 shall include the date the application for the lease or permit was filed with the Bureau of Land Management and the location of the proper BLM office where the application was filed, and should indicate the serial number assigned to the application.

(b) An application shall include a description of the lands sought to be included in a geothermal lease. If the lands have been surveyed under the public land rectangular survey system, each application shall describe the lands by legal subdivision, section, township, and range. If otherwise officially surveyed, the lands shall be described by the legal description, mining claim survey, or irregular tracts. If the lands have not been so surveyed, but protracted surveys for those lands have been approved and the effective date thereof published in the FEDERAL REGISTER, each application for lands shown on such protracted surveys, filed on or after such effective date, shall describe the lands according to the

RULES AND REGULATIONS

legal subdivision, section, township, and range shown on the approved protracted surveys. If the lands have not been so surveyed, or included within approved protracted surveys, or it is otherwise appropriate, each application shall describe the lands by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, and connected by courses and distances to a monument or to a prominent topographic feature.

(c) An application shall be accompanied by a detailed statement showing: (1) The expenditures made for the exploration, development, or production of geothermal steam, but not associated geothermal resources, on lands for which a geothermal lease is sought or on adjoining, adjacent or nearby Federal or non-Federal lands and the date or dates such expenditures were made, (2) the names and current addresses of the persons who actually performed the aforesaid exploration, development, or production work, (3) the geological, geophysical, and engineering data acquired in such exploration, development, or production which demonstrates, or tends to demonstrate the expenditures claimed, (4) a map showing the location where the expenditures and improvements were made, (5) a proposed plan as required by § 3210.2-1(e) of this chapter, and (6) a statement that he will be bound by the terms and conditions of a lease, if issued. The applicant shall file such additional information with respect to the application as requested by the authorized officer.

§ 3230.4 Conversion to geothermal leases or to applications for geothermal leases.

§ 3230.4-1 Processing and adjudicating applications.

Application for conversion to geothermal leases or to applications for geothermal leases together with all information and data submitted or requested by the authorized officer pursuant to § 3230.3-2 and any other pertinent available information or data shall be reviewed by the authorized officer to determine whether the required showing has been made, and thereafter the authorized officer shall prepare a proposed determination which shall be submitted to the Secretary, who will make a determination that the applicant has or has not satisfactorily shown that he is entitled to receive the grant of a geothermal lease, or application for a geothermal lease.

PART 3240—RULES GOVERNING LEASES

Subpart 3240—Rules Governing Leases

Subpart 3241—Assignments and Transfers

Sec.

3241.1 Assignments, transfers, interests, qualifications.

3241.1-1 Record title assignments or transfers of leases or undivided lease interests.

Sec.

3241.1-2 Qualifications.
3241.2 Requirements for filing of assignments or transfers.

3241.2-1 Place of filing and service charge.
3241.2-2 Number of copies required.

3241.2-3 Time of filing assignments, transfers of leases, or undivided lease interests.

3241.2-4 Forms and statements.

3241.2-5 Description of lands.

3241.3 Bonds.

3241.4 Approval.

3241.5 Continuing responsibility.

3241.6 Production payments.

3241.7 Overriding royalty interests.

3241.7-1 General.

3241.7-2 Limitation of overriding royalties.

3241.8 Lease account status; requirement.

3241.9 Effect of assignment.

Subpart 3242—Production and Use of Byproducts

3242.1 General.

3242.2 Production and use of commercially demineralized water as a byproduct, production and use of other sources of water.

3242.2-1 General.

3242.2-2 Prohibition on production of commercially demineralized water.

Sec.

3242.3 Water wells on geothermal areas.

3242.3-4 State water laws.

Subpart 3243—Cooperative Conservation Provisions

3243.1 Cooperative or unit plans.
3243.2 Acreage chargeability.
3243.3 Communization or drilling agreements.

3243.3-1 Approval.

3243.3-2 Requirements.

3243.4 Operating drilling, or development contracts or a combination for joint operations.

3243.4-1 Approval.

3243.4-2 Requirements.

3243.4-3 Acreage chargeability.

Subpart 3244—Terminations and Expirations

3244.1 Relinquishments.

3244.2 Automatic terminations and reinstatements.

3244.2-1 General.

3244.2-2 Exceptions.

3244.3 Cancellation of lease for noncompliance with regulations or lease terms; notice; hearing.

3244.4 Expiration by operation of law.

3244.5 Removal of material and supplies upon termination of lease.

Subpart 3241—Assignments and Transfers

§ 3241.1 Assignments, transfers, interests, qualifications.

§ 3241.1-1 Record title assignments or transfers of leases or undivided lease interests.

(a) The record title of leases may be assigned as to all or part of the leased acreage, except that no assignment will be approved where (1) either the assigned or retained portions created by the assignment would be less than 640 acres, unless the total acreage in the lease being partially assigned includes an irregular subdivision, as provided in § 3203.2 of this chapter in which case the assigned and retained portions may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the

irregular subdivision were added, or (2) an undivided interest is created by assignment of a lease containing less than 640 acres, or (3) where the lease being assigned contains 640 acres or more, an undivided interest of less than 10 percent would be created in the leased acreage. An exception to the minimum acreage provision of this section may be made by the Secretary where he finds such exception is necessary in the interest of conservation of the resources.

(b) A working interest or operating right may be assigned, in accordance with this section, *Provided That* the assigned interest or right, divided or undivided, vests in the holder only the right to explore, develop and produce geothermal resources from the leased lands to the extent of not less than the interest assigned.

All requests for approval of any assignment will be reviewed, prior to approval, to adjust environmental terms and conditions where necessary.

§ 3241.1-2 Qualifications.

(a) No assignment will be approved (1) if the assignee or any other party in interest is not qualified to take and hold a lease; (2) if a required bond is not filed; or (3) if the amount of interest required under § 3202.2-1(a) of this chapter is not filed.

(b) An assignment to a minor other than an heir or devisee of a lessee will not be approved.

(c) The assignment must be accompanied by a signed statement by the assignee either (1) that he is the sole party in interest in the assignment, or (2) setting forth the names and qualifications of the other parties holding interests in the lease. Where the assignee is not the sole party in interest, separate statements must be signed by each of the parties setting forth the nature and extent of the interest of each party and the nature of the agreement between them.

(d) Where an attorney-in-fact or agent signs, on behalf of the assignor or assignee, the instrument of transfer or the application for approval, evidence of the authority of the attorney-in-fact or agent to sign such assignment or application must be furnished to the authorized officer.

(e) For the heir or devisee of the deceased holder of a lease, an operating agreement, or an overriding royalty interest in a producing lease, to be recognized by the authorized officer as the holder of that lease, agreement or interest, the appropriate showing required under the regulations in § 3202.2-6 of this chapter must be furnished to the authorized officer.

§ 3241.2 Requirements for filing of assignments or transfers.

§ 3241.2-1 Place of filing and service charge.

A request for approval of any assignment or other instrument of transfer of a lease or interest therein must be filed

RULES AND REGULATIONS

in the proper BLM office and accompanied by a nonrefundable service charge of \$50. An application request not accompanied by payment of such a service charge will not be accepted for filing.

§ 3241.2-2 Number of copies required.

Three copies of all instruments of assignment or transfer, and a single copy of any additional information required by § 3202.2 of this Chapter relating to citizenship or qualification of corporations and associations, including partnerships, must be filed in the proper BLM office.

§ 3241.2-3 Time of filing assignments, transfers of leases, or undivided lease interests.

(a) Any assignment or instrument of transfer of a lease or of an interest therein, including an assignment of working interests, operating agreements, and operating rights, must be filed in the proper BLM office for approval within 90 days from the date of execution of that instrument and must contain all of the terms and conditions agreed upon by the parties thereto, together with evidence and statements similar to that required of an applicant under these regulations in this group.

(b) A separate instrument of assignment must be filed in the proper BLM office for each geothermal lease involving transfers of record title. When transfers to the same person, association, including partnerships, or corporation involve more than one geothermal lease, one request for approval and one showing as to the qualifications of the assignee will be sufficient.

§ 3241.2-4 Forms and statements.

A form approved by the Director, or unofficial copies of that form in current use, must be used for transfers and requests for approval referred to in this section and must be filed in duplicate for public lands and in triplicate where acquired lands are involved. The approved form may be used for an assignment which affects a transfer of the record title to all or part of a geothermal lease, but it is not to be used for any other type of transfer. The application for assignment shall be deemed to be approved upon execution by the authorized officer.

§ 3241.2-5 Description of lands.

Each instrument of transfer must describe the lands involved in the same manner as described in the lease.

§ 3241.3 Bonds.

Where an assignment does not create separate leases, the assignee, if the assignment so provides, may become a joint principal on the bond with the assignor. Any assignment which does not convey the assignor's record title in all of the lands in the lease must also be accompanied by consent of his surety to remain bound under the bond of record as to the lease retained by said assignor, if the bond, by its terms, does

not contain such consent. If a party to the assignment has previously furnished a nationwide or statewide bond, no additional showing by such party is necessary as to the bond requirement.

§ 3241.4 Approval.

Upon approval, an assignment shall be effective as of the first day of the lease month following the date of filing of the assignment.

§ 3241.5 Continuing responsibility.

(a) The assignor and his surety will continue to be responsible for the performance of any obligation under the lease until the assignment is approved.

(b) Upon approval, the assignee and his surety shall be responsible for the performance of all lease obligations notwithstanding any terms in the assignment to the contrary.

§ 3241.6 Production payments.

If payments out of production are reserved, a statement must be submitted stating the details as to the amount, method of payment, and other pertinent items.

§ 3241.7 Overriding royalty interests.

§ 3241.7-1 General.

(a) Overriding royalty interests in geothermal leases constitute accountable acreage holdings under these regulations.

(b) If an overriding royalty interest is created which is not shown in the instrument of assignment or transfer, a statement must be filed in the proper BLM office describing the interest.

(c) Any such assignment will be deemed valid if accompanied by a statement over the assignee's signature that the assignee is a citizen of the United States, an association of such citizens, or a corporation organized under the laws of the United States or of one of the States or the District of Columbia, and that his interests in geothermal leases do not exceed the acreage limitations provided in these regulations.

(d) All assignments of overriding royalty interests must be filed for record in the proper BLM office within 90 days from the date of execution. Such interests will not receive formal approval.

§ 3241.7-2 Limitation of overriding royalties.

(a) Except as herein provided, an overriding royalty on the value of the output of all geothermal resources, or any of them, at the point of shipment to market may be created by assignment or otherwise: *Provided*, That, (1) the overriding royalty is not for less than one-fourth ($\frac{1}{4}$) of 1 percent of the value of such output, and does not exceed 50 percent of the rate of royalty due to the United States as specified in the geothermal lease, or as reduced pursuant to such lease, and (2) the overriding royalty, when added to overriding royalties previously created, does not exceed the maximum rate established herein.

(b) The creation of an overriding royalty interest that does not conform to

the requirements of paragraph (a) of this section shall be deemed a violation of the lease terms, unless the agreement creating overriding royalties provides (1) for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate established in paragraph (a) of this section and (2) for the suspension of an overriding royalty during any period when the royalties due to the United States have been suspended pursuant to the terms of the geothermal lease.

§ 3241.8 Lease account status; requirements.

Unless the lease account is in good financial standing as to the area covered by an assignment at the time the assignment and bond are filed, or is placed in good standing before the assignment is reached for action, the request for approval of the assignment will be denied, and the lease shall be subject to termination in accordance with these regulations.

§ 3241.9 Effect of assignment.

An assignment of the record title of the complete interest in a portion of the lands in a lease shall segregate the assigned and retained portions into separate and distinct leases. An assignment of an undivided interest in the entire leasehold shall not segregate the lease into separate or distinct leases.

Subpart 3242—Production and Use of Byproducts

§ 3242.1 General.

Where the Supervisor determines that production, use, or conversion of geothermal steam under a geothermal lease is susceptible of producing a valuable by-product or byproducts, including commercially demineralized water contained in or derived from such geothermal steam for beneficial use in accordance with applicable State water laws, the authorized officer shall require substantial beneficial production or use thereof, except where he determines that:

(a) Beneficial production or use is not in the interest of conservation of natural resources;

(b) beneficial production or use would not be economically feasible; or

(c) beneficial production and use should not be required for other reasons satisfactory to him.

§ 3242.2 Production and use of commercially demineralized water as a by-product, production, and use of other sources of water.

§ 3242.2-1 General.

Except as provided in these regulations, or the lease, the lessee shall have the right to process fluids, including brine, condensate, and other fluids, which are associated with geothermal steam within lands subject to the geothermal lease for the purpose of developing, producing, and utilizing the commercially demineralized water recovered as a result of such processing.

RULES AND REGULATIONS

§ 3242.2-2 Prohibition on production of commercially demineralized water.

The lessee shall not be authorized to engage in the primary production of commercially demineralized water from the produced fluids contained in or derived from geothermal steam referred to in § 3242.2-1, where such use would result in the undue waste of geothermal energy.

§ 3242.2-3 Water wells on geothermal areas.

All leases issued under these regulations shall be subject to the condition that, where the lessee finds only potable water in any well drilled for production of geothermal resources, the Secretary may, when the water is of such quality and quantity as to be valuable and useable for agricultural, domestic, or other purpose, acquire the well with casing installed in the well at the fair market value of the casing.

§ 3242.2-4 State water laws.

Nothing in these regulations shall constitute an express or implied claim or denial on the part of the Federal Government as to its exemption from State water laws.

Subpart 3243—Cooperative Conservation Provisions

§ 3243.1 Cooperative or unit plans.

To conserve the natural resources of any geothermal pool, field or like area more properly, lessees and their representatives may unite with each other or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan of development or operation or any geothermal resource area, or any part thereof (whether or not any part of that geothermal resource area is then subject to any cooperative or unit plan of development or operation). Applications to unitize shall be filed with the Supervisor who shall certify whether such plan is necessary or advisable in the public interest. The procedure in obtaining approval of a cooperative or unit plan of development, the provisions for the supervision of the cooperative or unit plan, and a suggested text of an agreement, are contained in 30 CFR Part 271.

§ 3243.2 Acreage chargeability.

All leases committed to any unit or cooperative plan approved or prescribed by the Supervisor shall be excepted in determining holdings or control for purposes of acreage chargeability. For the extension of leases committed to a unit plan, see Subpart 3203 of this part.

§ 3243.3 Communization or drilling agreements.

§ 3243.3-1 Approval.

(a) The Supervisor is authorized, when separate tracts under lease cannot be independently developed and operated in conformity with an established well-spacing or well-development program, to approve, or to require lessees to enter into, communization or drilling

agreements providing for the apportionment of production or royalties among the separate tracts of land comprising the drilling or spacing unit for the lease, or any portion thereof, with other lands, whether or not owned by the United States, when in the public interest. Operations or production pursuant to such an agreement shall be deemed to be operations or production as to each lease committed thereto.

(b) Preliminary requests to communicate separate tracts shall be filed in triplicate with the Supervisor.

(c) Executed agreements shall be submitted to the Supervisor in sufficient number to permit retention of five copies after approval.

§ 3243.3-2 Requirements.

The agreement shall describe the separate tracts comprising the drilling or spacing unit, disclose the apportionment of the production or royalties to the several parties and the name of the operator, and shall contain adequate provisions for the protection of the interests of all parties, including the United States. The agreement must be signed by or in behalf of all interested necessary parties and will be effective only after approval by the Supervisor.

§ 3243.4 Operating, drilling, development contracts or a combination for joint operations.

§ 3243.4-1 Approval.

(a) The Secretary may on such conditions as he may prescribe, approve operating, drilling, or development contracts made by one or more geothermal lessees, with one or more persons, associations, including partnerships, or corporations whenever he shall determine that such contracts are required for the conservation of natural resources or in the best interest of the United States.

(b) Contracts submitted for approval under this section should be filed with the Supervisor together with enough copies to permit retention of five copies after approval.

(c) The authority of the Secretary to approve operating, drilling, or development contracts without regard to acreage limitations ordinarily will be exercised only to permit operators to enter into contracts with a number of lessees sufficient to justify operations on a large scale for the discovery, development, production, or transmission, transportation, or utilization of geothermal resources, and to finance the same.

§ 3243.4-2 Requirements.

(a) The contract must be accompanied by a statement showing all the interests held by the contractor in the area or field and the proposed or agreed plan of operation or development of the field. All the contracts held by the same contractor in the area or field should be submitted for approval at the same time, and full disclosure of the project made. Complete details must be furnished so the Secretary may have facts upon which to make a definite determination in accordance herewith and to prescribe

the conditions on which approval of the contracts shall be made.

(b) The application must show a reasonable need for the contract and that it will not result in any concentration of control over the production or sale of geothermal resources which would be inconsistent with the antimonopoly provisions of law.

§ 3243.4-3 Acreage chargeability.

All leases operated under approved operating, drilling or development contracts shall be excepted in determining holdings or control for purposes of acreage chargeability.

Subpart 3244—Terminations and Expirations

§ 3244.1 Relinquishments.

(a) A lease, or any legal subdivision of the area covered by such lease, may be relinquished by the record title holder by filing a written relinquishment in triplicate in the proper BLM office, provided the partial relinquishment does not reduce the remaining acreage in the lease to less than 640 acres, except where a departure is occasioned by an irregular subdivision in which case the remaining leased acreage may be less than 640 acres by an amount which is smaller than the amount by which the area would be more than 640 acres if the irregular subdivision were added, and except that the minimum acreage provision of this section may be waived by the Secretary where he finds such exception is justified on the basis of exploratory and development data derived from activity on the leasehold. The relinquishment must: (1) Describe the lands to be relinquished as described in the lease; (2) include a statement as to whether the relinquished lands had been disturbed and if so whether they were restored as prescribed by the terms of the lease; (3) state whether wells had been drilled on the lands and if so whether they had been placed in condition for abandonment; and (4) furnish a statement that all moneys due and payable to workmen employed on the leased premises have been paid.

(b) A relinquishment shall take effect on the date it is filed, subject to the continued obligation of the lessee and his surety: (1) To make payments of all accrued rentals and royalties; (2) to place all wells on the land to be relinquished in condition for suspension of operations or abandonment; (3) to restore the surface resources in accordance with all regulations and the terms of the lease; and (4) to comply with all other environmental stipulations provided for by such regulations or lease. A statement must be furnished that all moneys due and payable to workmen employed on the leased premises have been paid.

§ 3244.2 Automatic terminations and reinstatements.

§ 3244.2-1 General.

Except as provided in § 3244.2-2 any lease will automatically terminate by operation of law if the lessee fails to pay

RULES AND REGULATIONS

the rental on or before the anniversary date of such lease. However, if the time for payment falls upon any day in which the proper office to receive payment is not open, payment received on the next official working day shall be deemed to be timely. The termination of the lease for failure to pay the rental must be noted on the official records of the proper BLM office. Upon such notation the lands included in such lease will become subject to leasing as provided for in Subpart 3211 of this chapter.

§ 3244.2-2 Exceptions.

(a) *Nominal deficiency.* If the rental payment due under a lease is paid on or before its anniversary date but the amount of the payment is deficient and the deficiency is nominal, the lease shall not have automatically terminated unless the lessee fails to pay the deficiency within the period prescribed in a Notice of Deficiency, or by the due date, whichever is later. A deficiency is nominal if it is not more than \$10 or one percentum (1%) of the total payment due, whichever is more. The authorized officer shall send a Notice of Deficiency to the lessee on an approved form. The Notice shall be sent by certified mail, return receipt requested, and shall allow the lessee 15 days from the date of receipt to submit the full balance due to the proper BLM office. If the payment called for in the notice is not made within the time allowed, the lease will have terminated by operation of law as of its anniversary date.

(b) *Reinstatements.* (1) Except as hereinafter provided, the authorized officer may restate a lease which has terminated automatically for failure to pay the full amount of rental due on or before the anniversary date, if it is shown to his satisfaction that such failure was either justifiable or not due to a lack of reasonable diligence on the part of the lessee; and a petition for reinstatement, together with the required rental, including any back rental which has accrued from the date of termination of the lease, is filed with the proper BLM office.

(2) The burden of showing that the failure to pay on or before the anniversary date was justifiable or not due to a lack of reasonable diligence will be on the lessee. Reasonable diligence normally requires sending or delivering payments sufficiently in advance of the

anniversary date to account for normal delays in the collection, transmittal, and delivery of the payment. The authorized officer may require evidence, such as post office receipts, of the time of sending or delivery of payments.

(3) Under no conditions will a lease be reinstated if (1) a valid lease has been issued prior to the filing of a petition for reinstatement affecting any of the lands covered by the terminated lease, or (2) the interest in the lands has been withdrawn, disposed of, or has otherwise become unavailable for leasing. However, the authorized officer will not issue a new lease for lands covered by a lease which terminated automatically until 90 days after the date of termination.

(4) Reinstatement of terminated leases is discretionary with the Secretary. The basic criterion in accordance with which this discretion will be exercised is whether the Secretary would be willing to issue a lease if a new lease offer for the same land were under consideration.

§ 3244.3 Cancellation of lease for non-compliance with regulations or lease terms; notice; hearing.

A lease may be canceled by the authorized officer for any violation of these regulations, the regulations in 30 CFR Part 270, or the lease terms, 30 days after receipt by the lessee of notice from the authorized officer of the violation, unless (a) the violation has been corrected, or (b) the violation is one that cannot be corrected within the notice period and the lessee has in good faith commenced within the notice period to correct the violation and thereafter proceeds diligently to complete the correction. A lessee shall be entitled to a hearing on the matter of any such claimed violation or proposed cancellation of lease if a request for a hearing is made to the authorized officer within the 30-day period after notice. The procedures with respect to notice of such hearing and the conduct thereof, and with respect to appeals from decisions of Administrative Law Judges upon such hearings, shall follow insofar as practicable the procedural rules applicable to hearings and appeals in public lands cases within the jurisdiction of the Board of Land Appeals, Office of Hearings and Appeals, contained in Department Hearings and Appeals Procedures,

Part 4 of this title. The period for correction of violation or commencement to correct a violation of regulations or of lease terms, as aforesaid, shall be extended to 30 days after the lessee's receipt of the Administrative Law Judge's decision upon such a hearing if the Administrative Law Judge shall find that a violation exists.

§ 3244.4 Expiration by operation of law.

Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, there is no production in commercial quantities, or a producing well, or actual drilling operations being diligently prosecuted, will expire at the end of its primary term without notice to the lessee. Notation of such expiration need not be made on the official records, but the lands previously covered by that expired lease will be subject to the filing of new applications for leases only as provided in these regulations.

§ 3244.5 Removal of materials and supplies upon termination of lease.

Upon the expiration of the lease, or the earlier termination thereof pursuant to this subpart, the lessee shall have the privilege at any time within a period of ninety (90) days thereafter of removing from the premises any materials, tools, appliances, machinery, structures, and equipment other than improvements needed for producing wells. Any materials, tools, appliances, machinery, structures, and equipment subject to removal, but not removed within the 90-day period, or any extension thereof that may be granted because of adverse climatic conditions during that period, shall, at the option of the Supervisor, become property of the lessor, but the lessee shall remove any or all such property where so directed by the lessor.

NOTE: Forms 3200-4 and 3200-1 filed as part of the original document. Copies of these forms may be obtained by writing Geothermal Coordinator, Department of the Interior, Washington, D.C. 20240.

Dated: December 17, 1973.

W. W. LYONS,
Deputy Under Secretary
of the Interior.

[FR Doc. 73-26890 Filed 12-20-73; 8:45 am]

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 1

Effective February 1, 1975

EXPLORATORY OPERATIONS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.78. All exploratory operations other than drilling of exploratory and development wells will be conducted in accordance with the provisions of this Order. All plans for exploratory operations to be conducted shall include provisions for appropriate environmental protection and reclamation of disturbed lands. A cultural resources investigation approved by the Area Geothermal Supervisor (Supervisor) shall be performed prior to any surface disturbance other than Casual Use.

All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Notice of Intent to Conduct Geothermal Resources Exploration Operations shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations, or requirements are to those given or made by the Supervisor or his delegated representative.

The following exploratory operations and reasonable expenditures therefor will qualify as diligent exploration if approved by the Supervisor prior to the initiation of such operations.

1. Casual Use. Casual Use shall include any entrance on the leased lands for geological reconnaissance or surveying purposes. Sampling of springs and water wells on the lease for geochemical analysis shall be construed as casual use. Such non-disturbing surveys and reconnaissance operations will not require a Notice of Intent to Conduct Geothermal Resources Exploration Operations. The lessee shall notify the Supervisor prior to commencing such casual use operations. Casual Use operations proposed or completed shall be included in any subsequent Plan of Operations.

2. Geophysical Exploration. Geophysical exploration shall include, but is not limited to, surface electrical resistivity surveys, seismic ground noise surveys, passive micro-earthquake monitoring surveys, magneto-telluric surveys and all other geophysical surveys, including airborne techniques.

Geophysical surveys other than airborne techniques will require a Notice of Intent to Conduct Geothermal Resources Exploration Operations, (Form 3200-9). All such anticipated surveys should be included in the Plan of Operations and must be approved by the Supervisor before the work is begun.

The lessee shall furnish the Supervisor two copies of the records of such surveys within 30 days after the completion of such operations.

3. Drilling of Shallow Holes. Drilling of shallow holes for the measurement of temperature gradients or heat flow will be considered as an exploration operation and will require approval of a Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9) by the Supervisor. The following stipulations shall apply to the drilling of such shallow holes:

A. Holes for measuring temperature gradients shall be limited to a depth of 152 metres (500 feet), unless otherwise authorized by the Supervisor.

B. Return-line temperatures shall be taken at no less than 9-metre (30 foot) intervals during drilling operations on shallow holes drilled with mud. If return-line mud temperature should reach 52°C. (125°F.), drilling ahead shall cease immediately and the hole will be either

(1) Completed as an observation hole by running steel tubing as deep as possible, filling the annulus with drilling mud from total depth to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface;

(2) Abandoned by filling the hole with drilling mud from total depth to 3 metres (10 feet) below the surface and cement to the surface thereafter, or

(3) Equipped with mud cooling and wellhead control devices to maintain well control and mud returns temperature at or below 52°C. (125°F.).

C. If flowing steam or hot water at 65°C (150°F.) or greater is encountered, further drilling shall stop immediately and the hole will be either

(1) Completed as an observation hole using steel tubing cemented from total depth to surface; or

(2) Abandoned by plugging with cement from total depth to surface.

D. If cold flowing artesian water is encountered, the hole will be completed as in (C) hereinabove, except that plastic tubing may be used.

If the conditions outlined in (B), (C) or (D) are encountered, the Supervisor shall be notified immediately.

No exceptions to the stipulations of (B), (C) or (D) will be allowed without specific prior permission of the Supervisor.

E. The lessee shall submit the following information with the Notice of Intent to Conduct Geothermal Resources Exploration Operations (Form 3200-9):

(1) The approximate location (to the nearest 30 metres (100 feet) from some identifiable marker or object within the smallest legal subdivision) and hole number or designation of each proposed hole and probable order of drilling;

(2) The type and size of drilling rig;

(3) The proposed drilling program including the drilling system (type of bit and circulating medium), approximate depths and casing (conductor) program for each such hole;

(4) The type of drilling sump and proposed method of sump abandonment at each location;

(5) The approximate time that each hole will be used for observation; and

(6) The proposed method of abandonment for each hole. Additionally, the lessee shall notify and receive the approval of the Supervisor prior to any change in the location of an approved hole or for any additional holes which the lessee desires to drill.

F. Locations proposed in natural thermal areas within a 300-metre (1,000-foot) radius of hot springs, fumaroles, or other surface geothermal indicia, or in areas of known artesian water flow, will require a detailed drilling program for each hole, approved by the Supervisor. The Supervisor may require special drilling and completion techniques for such holes (such as cemented surface casing and simple expansion-type blowout preventers) to safely control formations containing geothermal or other resources which may be penetrated.

G. A supply of mud and lost circulation material shall be kept on hand while drilling to control abnormal pressure if rotary equipment is used.

H. Holes shall be completed for observation purposes in a manner which will allow satisfactory subsequent abandonment. As a minimum, the annular space shall be filled with mud (cuttings and dirt if drilled with air or auger) to 3 metres (10 feet) below the surface and with cement from 3 metres (10 feet) to the surface, and the tubing shall be capped when not in use.

I. Holes shall be abandoned in a manner that will prevent subsurface interzonal migration of fluids and surface leakage. As a minimum, the top 3 metres (10 feet) of tubing below the surface shall be filled with cement. Tubing shall be cut off at ground level or as directed by the Supervisor.

4. Reporting Completion of Exploration Operations. The Notice of Completion of Geothermal Resources Exploration Operations (Form 3200-10) shall be submitted in triplicate, and shall include the following information for each hole drilled:

- A. Final hole designation and location;
- B. A driller's log noting water table and water aquifers encountered (if determined), and salt, coal beds or other mineral deposits, if present;
- C. Method of completion, cementing, and casting and/or tubing used;
- D. Complete details of the abandonment procedures;
- E. Any information on drilling difficulties or unusual circumstances encountered which would be helpful in assuring future safety of operations or protection of the environment in the area concerned; and
- F. Temperature data and logs for each hole surveyed.

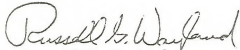
5. General. Drilling fluids or cuttings shall not be discharged onto the surface where such discharge might contaminate lakes and perennial or intermittent streams. Excavated pits or sumps used in drilling shall be backfilled as soon as drilling is completed and restored to conform with the original topography. Unattended sumps shall be completely fenced for the protection of the public, domestic animals and wildlife.

6. Notice of Entry. Applicant shall contact the appropriate U. S. Geological Survey Geothermal District Office prior to entry on the land to conduct exploration operations.



Reid T. Stone
Area Geothermal Supervisor

Approved:



Russell G. Wayland,
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 2

Effective February 1, 1975

DRILLING, COMPLETION AND SPACING OF GEOHERMAL WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14, 270.15, and 270.40. All wells shall be drilled in such a manner as to minimize damage to the environment and to protect life, health, property, usable ground waters and geothermal resources.

All exploratory wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order. Initial development wells drilled for geothermal resources shall be drilled in accordance with the provisions of this Order, and these provisions shall continue in effect until field rules are issued. After field rules have been established by the Area Geothermal Supervisor (Supervisor), development wells in the individual fields shall be drilled in accordance with such rules.

Where sufficient geologic and engineering information is obtained through exploratory drilling, lessees may make application or the Supervisor may request the lessee to submit an application for the establishment of field rules. The Supervisor may issue field rules at any time he deems appropriate upon failure of the lessee to timely file for such field rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development Plan of Operations as required under 30 CFR 270.34. Each Application for Permit to Drill (Form 9-331C) shall include all information required under 30 CFR 270.71, and shall include a notation of any proposed variances from the requirements of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, and requirements for submitting of information or applications for approval are to those granted, made or required by the Supervisor or his delegated representative. The lessee shall comply with the following requirements:

1. Well Casing. All wells shall be cased and cemented in accordance with the requirements of 30 CFR 270.15, and the application for permit to drill shall include the casing design safety factors for collapse, tension and burst. The permanent wellhead completion equipment shall be attached to the production casing or to the intermediate casing if the production casing does not reach to the surface except as otherwise authorized by the Supervisor to meet special well conditions. All casing strings reaching the surface shall be cemented at a sufficient

depth to provide adequate anchorage and support for the casing and any blowout prevention equipment required thereon. For the purpose of this Order, the several casing strings in order of normal installation are (1) conductor, (2) surface, (3) intermediate and (4) production strings. The following casing setting depth requirements are general in nature and subject to variations to permit the casing to be set and cemented in a competent formation. The Supervisor's determination of adequate casing setting depths shall be based upon all geologic and engineering factors including apparent geothermal gradients, depths and pressures of the various formations to be penetrated and all other pertinent information about the area. All depths in this Order refer to true vertical depth (TVD) below ground level, unless otherwise specified.

A. Conductor Casing. This casing shall be set at a minimum depth of 15 metres (50 feet) and a maximum depth of 60 metres (200 feet) before drilling into shallow formations suspected or known to contain geothermal resources, non-condensable gases, or other mineral resources or upon encountering such formations.

B. Surface Casing. This casing shall be set at a depth equivalent to or in excess of ten percent of the proposed total depth of the well provided, however, that such setting depth shall be not less than 60 metres (200 feet) nor more than 400 metres (1,300 feet).

C. Intermediate Casing. This casing shall be set at any time when required by well conditions encountered in drilling below the surface casing such as anomalous pressure zones, uncased fresh water aquifers, cave-ins, washouts, lost circulation zones, rapidly increasing thermal gradients or other drilling hazards. If a liner is used as an intermediate string, the lap shall be tested by a fluid entry or pressure test to determine whether a seal between the liner top and the next larger casing string has been achieved. The liner overlap shall be a minimum of 30 metres (100 feet). The test shall be recorded on the driller's log and may be witnessed by the Supervisor. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required by the Supervisor.

D. Production Casing. This casing may be set at the top of or through the potential producing zone and shall be set before completing the well for production. Production casing shall be run to the surface or lapped into the next larger casing string. The liner overlap, if utilized, shall be at least 30 metres (100 feet) and shall be tested, witnessed and recorded as in the case of intermediate casing hereinabove. In the event of lap or casing failure during the test, the lap or casing must be repaired or recemented and successfully retested as required

by the Supervisor. Production casing shall normally be of consistent nominal outside diameter from the surface or from the top of the lap to the casing shoe. The surface casing shall not be used as production casing, unless otherwise authorized by the Supervisor to meet special well conditions.

E. Cementing of Casing. The conductor and surface casing strings shall be cemented with a quantity of cement sufficient to fill the annular space back to the surface. The intermediate casing string shall likewise be cemented back to the surface or to the top of the lap if a liner is used as an intermediate string. Production casing shall be cemented with a high temperature resistant admix, unless waived by the Supervisor and shall be cemented in a manner necessary to exclude, isolate or segregate overlying formation fluids from the geothermal resources zone and to prevent the movement of fluids into possible fresh water zones. Production casing shall be cemented back to the surface or, if lapped, to the top of the lap. A temperature or cement bond log may be required by the Supervisor after setting and cementing the production casing and after all primary cementing operations if an unsatisfactory cementing job is indicated. Proposed well cementing techniques differing from the requirements of this paragraph will be considered by the Supervisor on an individual well basis.

F. Pressure Testing. Prior to drilling out the casing shoe after cementing, all casing strings set to a depth of 152 metres (500 feet) or greater, except for conductor casing, shall be pressure tested to a minimum pressure of 69 bars (1,000 psi) or 0.045 bars/metre (0.2 psi/ft) whichever is greater. All casing strings set at a depth less than 152 metres (500 feet), except for conductor casing, shall be pressure tested to a minimum pressure of 35 bars (500 psi). Such test shall not exceed the rated working pressure of the casing or the blow-out preventer stack assembly, whichever is lesser.

In the event of casing failure during the test, the casing must be repaired or recemented until a satisfactory test is obtained. A pressure decline of 10 percent or less in 30 minutes shall be considered satisfactory.

Casing test results shall be recorded on the driller's log and reported to the Supervisor within 30 days after the completion of such test. Advance notice of all casing and lap tests shall be given in sufficient time to enable the Supervisor to be present to witness such tests. The casing and lap test reports shall give a detailed description of the test, including mud and cement volumes, lapse of time between running and cementing casing and testing, method of testing and test results.

G. Directional Surveys.

(1) General. Deviation surveys (inclination from vertical or single shot) shall be taken on all wells during the normal course of drilling at intervals not to exceed 152 metres (500 feet). The Supervisor may require a directional survey giving both inclination and azimuth or a dipmeter to be obtained on all wells. In calculating all surveys, a correction from true north to Lambert-Grid north shall be made after making the magnetic to true north correction. All surveys shall be filed with the Supervisor. Where directional surveys are required, composite surveys shall be filed with the Supervisor showing the interval from the bottom of the conductor casing to total depth.

(2) Vertical Wells. Wells are considered vertical if inclination does not exceed an average of five degrees from the vertical. The Supervisor may require a directional survey giving both inclination and azimuth at intervals not exceeding 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor casing) and at total depth on any vertical well drilled in close proximity to lease boundaries or areas with an unstable land surface, highly faulted or steeply dipping beds, or in areas of suspected abnormal formation pressures.

(3) Directional Wells. Wells are considered directional if inclination exceeds an average of five degrees from the vertical. Directional surveys giving both inclination and azimuth shall be obtained at intervals not to exceed 30 metres (100 feet) between stations prior to, or upon, setting any casing string or liner (except conductor casing) and at total depth.

2. Blowout Prevention Equipment and Procedures. All necessary precautions shall be taken to keep all wells under control at all times, utilize trained and competent personnel, and utilize properly maintained equipment and materials. Blowout preventers and related well control equipment shall be installed, tested immediately thereafter and maintained ready for use until drilling operations are completed. Certain components, such as packing elements and ram rubbers, shall be of high temperature resistant material as necessary. All kill lines, blowdown lines, manifolds and fittings shall be steel and shall have a temperature derated minimum working pressure rating equivalent to the maximum anticipated wellhead surface pressure. Subject to subparagraphs (A) and (B) hereinbelow blowout prevention equipment shall have manually operated gates and hydraulic actuating systems and accumulators of sufficient capacity to close all of the hydraulically-operated equipment and have a minimum pressure of 69 bars (1,000 psi) remaining on the accumulator. Dual control stations shall be installed with a high

pressure backup system. One control panel shall be located at the driller's station and one control panel shall be located on the ground at least 15 metres (50 feet) away from the wellhead or rotary table. Air or other gaseous fluid drilling systems shall have blowout prevention assemblies. Such assemblies may include, but are not limited to, a rotating head, a double ram blowout preventer or equivalent, a banjo-box or an approved substitute therefor and a blind ram blowout preventer or gate valve, respectively. Exceptions to the requirements of this paragraph will be considered by the Supervisor only for certain geologic and well conditions such as stable surface areas with known low subsurface formation pressures and temperatures.

A proposed blowout prevention program and a blowout contingency plan including proposed containment, public health and safety and clean-up measures shall be submitted with the Application for Permit to Drill (Form 9-331C).

A. Conductor Casing. Before drilling below this string, at least one remotely controlled hydraulically-operated expansion type preventer or an acceptable alternative, approved by the Supervisor, including a drilling spool with side outlets or equivalent, shall be installed. A kill line and blowdown line with appropriate fittings shall be connected to the drilling spool.

B. Surface, Intermediate and Production Casing. Before drilling below any of these strings, the blowout prevention equipment shall include a minimum of:

- (1) One expansion-type preventer and accumulator or a rotating head;
- (2) A manual and remotely controlled hydraulically-operated double ram blowout preventer or equivalent having a temperature derated minimum working pressure rating which exceeds the maximum anticipated surface pressure at the anticipated reservoir fluid temperature;
- (3) A drilling spool with side outlets or equivalent;
- (4) A fillup line;
- (5) A kill line equipped with at least one valve; and
- (6) A blowdown line equipped with at least two valves and securely anchored at all bends and at the end.

C. Testing and Maintenance. Ram-type blowout preventers and auxiliary equipment shall be tested to a minimum of 69 bars (1,000 psi) or to the working pressure of the casing or assembly, whichever is the lesser. Expansion-type blowout preventers shall be tested to 70

percent of the above pressure testing requirements.

The blowout prevention equipment shall be pressure tested:

- (1) When installed;
- (2) Prior to drilling out plugs and/or casing shoes;
- (3) Not less than once each week, alternating the control stations;
and
- (4) Following repairs that require disconnecting a pressure seal
in the assembly.

During drilling operations blowout prevention equipment shall be actuated to test proper functioning as follows:

- (1) Once each trip for blind and pipe rams but not less than once
each day for pipe rams; and
- (2) At least once each week on the drill pipe for expansion-type
preventers.

All flange bolts shall be inspected at least weekly and re-tightened as necessary during drilling operations. The auxiliary control systems shall be inspected daily to check the mechanical condition and effectiveness and to ensure personnel acquaintance with the method of operation. Blowout prevention and auxiliary control equipment shall be cleaned, inspected and repaired, if necessary, prior to installation to assure proper functioning. Blowout prevention controls shall be plainly labeled, and all crew members shall be instructed on the function and operation of such equipment. A blowout prevention drill shall be conducted weekly for each drilling crew. All blowout prevention tests and crew drills shall be recorded on the driller's log.

D. Related Well Control Equipment. A full opening drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. A kelly cock shall be installed between the kelly and the swivel.

3. Drilling Fluid. The properties, use and testing of drilling fluids and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Sufficient drilling fluid materials to ensure well control shall be maintained in the field area readily accessible for use at all times.

A. Drilling Fluid Control. Before pulling drill pipe, the drilling fluid shall be properly conditioned or displaced. The hole shall be kept reasonably full at all times, however, in no event shall the annular mud level be deeper than 30 metres (100 feet) from the rotary table when coming out of the hole with drill pipe. Mud cooling techniques shall be utilized when necessary to maintain mud characteristics for proper well control and hole conditioning.

B. Drilling Fluid Testing. Mud testing and treatment consistent with good operating practice shall be performed daily or more frequently as conditions warrant. Mud testing equipment shall be maintained on the drilling rig at all times.

The following drilling fluid system monitoring or recording devices shall be installed and operated continuously during drilling operations, with mud, occurring below the shoe of the conductor casing. No exceptions to these requirements will be allowed without the specific prior permission of the Supervisor:

(1) High-low level mud pit indicator including a visual and audio-warning device;

(2) Degassers, desilters and desanders;

(3) A mechanical, electrical or manual surface drilling fluid temperature monitoring device. The temperature of the drilling fluid going into and coming out of the hole shall be monitored, read and recorded on the driller's or mud log for a minimum of every 9 metres (30 feet) of hole drilled below the conductor casing; and

(4) A hydrogen sulfide indicator and alarm shall be installed in areas suspected or known to contain hydrogen sulfide gas which may reach levels considered to be dangerous to the health and safety of personnel in the area.

C. Monitoring. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall monitor the rig floor at all times for surveillance purposes, unless the well is secured with blowout preventers or cement plugs.

4. Well Logging. All wells shall be logged with an induction electric log or equivalent from total depth to the shoe of the conductor casing. The Supervisor may grant an exception to this requirement when well conditions make it impractical or impossible to meet the above requirements.

A. Electric Logs. The lessee shall furnish to the Supervisor two legible exact copies of all logs run, within 30 days after completion of drilling operations on each well. Two copies of field prints of such logs shall be made immediately available to the Supervisor upon his request. Two copies of chemical analyses of geothermal fluids or other similar services performed shall be submitted to the Supervisor within 30 days after such services are completed.

B. Lithologic Logs. Two legible exact copies of core analysis reports and lithologic (mud) logs shall be submitted to the Supervisor within 30 days after the completion of such reports or logs, when such services are used. However, daily logs shall be made available to the Supervisor immediately upon the completion of such daily logs upon his request.

5. Wellhead Equipment and Testing.

A. Completions. All wellhead connections shall be fluid pressure tested to the API or ASA working pressure rating. Cold water is recommended as the testing fluid. Welding of wellhead connections shall be performed by a certified welder using materials in conformance with ASTM specifications.

B. Wellhead Equipment. All completed wells shall be equipped with a minimum of one casinghead with side outlets, one master valve and one production valve, unless otherwise authorized by the Supervisor. All casingheads, Christmas trees, fittings and connections shall have a temperature derated working pressure equal to or greater than the surface shut-in pressure of the well at reservoir temperature. Packing, sealing mediums and lubricants shall consist of materials or substances that function effectively at, and are resistant to, high temperatures. Wellhead equipment, valves, flanges and fittings shall meet minimum ASA standards or minimum API Standard 6A specifications. Casinghead connections shall be made such that fluid can be pumped between casing strings.

C. Testing. Any well showing sustained casinghead pressure or leaking of geothermal fluids between casing strings shall be tested to determine the origin of the failure, when such failure point is not otherwise determinable, and corrective measures shall be taken.

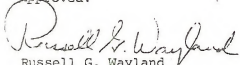
6. Well Spacing. No producing interval of any well shall be located within 30 metres (100 feet) of the outer boundaries of the leased lands, except where approved by the Supervisor. No surface location of a well shall be located within 15 metres (50 feet) of the boundary of any legal subdivision unless otherwise authorized by the Supervisor. The Supervisor may approve or prescribe such well

spacing as he determines to be necessary for the proper development of the geothermal resources in accordance with the provisions of 30 CFR 270.15.



Reid T. Stone
Area Geothermal Supervisor

Approved:



Russell G. Wayland
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 3

Effective February 1, 1975

PLUGGING AND ABANDONMENT OF WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14 and 270.45. The lessee shall comply with the following minimum plugging and abandonment procedures for all geothermal resources wells. Oral approvals shall be in accordance with 30 CFR 270.11. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Each Sundry Notice (Form 9-331) shall include a notation of any proposed variances from the requirements of this Order. References in this Order to approvals, determinations or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

The lessee shall promptly plug and abandon any well on the leased land that is not in use or demonstrated to be potentially useful. No well shall be abandoned until its lack of capacity for further profitable production of geothermal resources has been demonstrated to the satisfaction of the Supervisor. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the Supervisor.

Cement used to plug any geothermal resources well, except that cement or concrete used for surface plugging, shall be placed in the hole by pumping through drill pipe or tubing. Such cement shall consist of a high temperature resistant admix, unless this requirement is waived by the Supervisor in accordance with the particular circumstances existing in that well or area.

Prior to commencing abandonment operations, the Supervisor shall be notified of all such proposed operations.

Each Sundry Notice (Form 9-331) shall include all information required under 30 CFR 270.45 and 270.72. Any bond or rider thereto covering a lease or an individual well thereon, shall remain in full force and effect until the lease or individual well is properly abandoned and the surface properly restored. Written approval of the abandonment must be obtained from the Supervisor before release of any bonds will be recommended.

1. Permanent Abandonment.

A. Uncased Hole. In uncased portions of wells, cement plugs shall be placed to protect all subsurface mineral resources including fresh water aquifers. Such plugs shall extend a minimum of 30 metres

(100 feet) below, if possible, and 30 metres (100 feet) above such aforementioned zones. Cement plugs shall be placed in a manner necessary to isolate formations and to protect the fluids in such formations from interzonal migration or contamination.

B. Open Hole. Where there is open hole (uncased and open into the casing string above), a cement plug shall be placed in the deepest casing string by either (1) or (2) below. In the event lost circulation conditions exist or are anticipated, or if the well has been drilled with air or other gaseous substance, the plug shall be placed in accordance with (3) below.

(1) A cement plug shall be placed across the shoe extending a minimum of 30 metres (100 feet) above and 30 metres (100 feet) below; or

(2) A cement retainer with effective back pressure control set approximately 30 metres (100 feet) above the casing shoe with at least 61 metres (200 feet) of cement below the retainer and 30 metres (100 feet) of cement above.

(3) A permanent bridge plug set at the casing shoe and capped with a minimum of 61 metres (200 feet) of cement.

C. Perforations, Junk, Fish and Collapsed Pipe. A cement plug shall be placed across production perforations, extending 30 metres (100 feet) below (where possible) and 30 metres (100 feet) above the perforated interval. When a cement retainer is used to squeeze cement the perforated interval, the retainer shall be set a minimum of 30 metres (100 feet) above the perforations. Where the casing contains perforations at or below fish, junk or collapsed casing, thereby preventing cleanout operations, a cement retainer shall be set at least 30 metres (100 feet) above such point, and the interval below the retainer shall be squeeze cemented.

D. Casing Shoes, Stubs, Laps, and Liners. No casing shall be cut and recovered without first obtaining the written approval of the Supervisor. A cement plug shall be placed across all casing stubs, laps, liner tops and all casing shoes not protected by an inner casing string. Such plug shall extend a minimum of 15 metres (50 feet) below and 15 metres (50 feet) above any such shoe, stub, lap or liner top.

E. Plugging of Annular Space. All open annuli extending to the surface shall be plugged with cement.

F. Surface Plug. The innermost casing string which reaches ground level shall be cemented or concreted to a minimum depth of 15 metres (50 feet) measured from 2 metres (6 feet) below ground level.

G. Testing of Plugs. The hardness and location of cement plugs placed across perforated intervals and at the top of uncased or open hole shall be verified by setting down with tubing or drill pipe a minimum of 6,803 kilograms (15,000 pounds) weight on the plug or the maximum weight of the available tubing or drill pipe string, if less than 6,803 kilograms (15,000 pounds).

H. Mud. The intervals of the hole not filled with cement shall be filled with good quality heavy mud.

1. Surface Restoration. All casing strings shall be cut off at least 2 metres (6 feet) below ground level and capped by welding a steel plate on the casing stub. Cellars, pads, structures and other facilities shall be removed. The surface area shall be restored as specified by the Supervisor in consultation with the appropriate surface management agency.

2. Temporary Abandonment. An uncompleted drilling well that is to be temporarily abandoned shall be mudded and cemented as required hereinabove for permanent abandonment except for the provisions of subparagraphs E, F, and I.

3. Suspended Wells. The drilling equipment shall not be removed on any geothermal resources well where drilling operations have been suspended, either temporarily or indefinitely, without prior approval of the Supervisor and after approved measures have been taken to close the well and to protect all subsurface resources, including fresh water aquifers.



Reid T. Stone
Area Geothermal Supervisor

Approved:



Russell G. Wayland,
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOHERMAL RESOURCES OPERATIONAL ORDER NO. 4

Effective _____

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS

This Order is established pursuant to the authority prescribed in 30 CFR 207.11 and in accordance with 30 CFR 270.2, 270.34(k), 270.37, 270.41, 270.42, 270.43, 270.44, and 270.76. Lessees shall comply with the provisions of the Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. Reference in this Order to approvals, determinations or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

All data submitted under this Order shall be available for inspection in accordance with the Freedom and Information Act of 1966 (PL 89-487), or as amended in 1974 (PL 93-502), except information such as geological, geophysical, reservoir, and production data and interpretations of such data, maps and related files for which proprietary status is requested by the lessee and subsequently approved by the Supervisor.

Protection of the environment includes the lessee's responsibility to: conduct exploration and development operations in a manner that provides maximum protection of the environment; rehabilitate disturbed lands; take all necessary precautions to protect the public health and safety; and conduct operations in accordance with the spirit and objectives of all applicable Federal environmental legislation and supporting Executive Orders.

Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of applicable Federal, State and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards due to operations of the lessee, after notification, may be construed as grounds for the Supervisor to order a suspension of operations.

The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee. Monitoring of environmental impacts may be conducted by the use of aerial surveys, inspections, periodic samplings, continuous recordings or by such other means or methods as required by the Supervisor. Due to the differing natural environmental conditions among geothermal areas, the extent and frequency of such monitoring activities will be determined by the Supervisor on an individual basis. In the event the Supervisor determines that the degree and adequacy of existing environmental protection regulations in certain areas are insufficient, the Supervisor may establish additional and more stringent requirements by the establishment of field orders or by modifying existing orders.

Lessees shall provide for acquisition of environmental baseline data as required in accordance with 30 CFR 270.34(k) for a period of one year prior to submission of a plan for production. Techniques and standards to be used by the lessee for meeting these requirements shall receive prior approval by the Supervisor. The lessee, in accordance with the requirements of 30 CFR 270.76, shall file in duplicate with the Supervisor, on or before March 1 of each year, an annual report of compliance with environmental protection requirements for the previous calendar year.

1. Aesthetics. The lessee shall reduce visual impact where feasible by the careful selection of sites for operations and facilities on leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes and minimim profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation.

2. Land Use and Reclamation. Operating plans shall be designed so that operations will result in the least disturbance of land, water and vegetation. Existing roads shall be used where suitable. Entry upon certain environmentally fragile land areas (designated by the surface management agency) may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources, as specified by the Supervisor and surface management agency.

Operating plans shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate surface management agency. Land reclamation may include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for such reclaimed areas may be required to facilitate restoration thereof.

The lessee shall at all times maintain the leased lands in a safe and orderly condition and shall perform the operations in a workmanlike manner. The lessee shall remove or store all supplies, equipment and scrap in a timely and orderly fashion.

Operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any other lease, license, claim, permit or other authorized use on the same lands.

3. Public Access. The public shall have free and unrestricted access to geothermal leased lands, excepting however, where restrictions are necessary to protect public health and safety or where such public access would unduly interfere with the lessee's operations or the security thereof. The lessee shall provide warning signs, fencing, flag men, barricades or other safety measures deemed necessary by the Supervisor to protect the public, wildlife and livestock from hazardous geothermal or related activities.

4. Recreation. Recreational values shall be adequately protected through planning and designing of site development to minimize the aesthetic degradation of the particular recreation area. The lessee shall generally be restricted from surface locations for drilling and other lease operations within 61 metres (200 feet) of established recreation sites and access routes thereto. However, the lessee may relocate the recreational site and access routes when approved by the Supervisor with the concurrence of the land management agency.

5. Slope Stability and Erosion Control. Operations shall be conducted in such a manner so as to minimize erosion and disturbance to natural drainage. The lessee shall provide adequate erosion and drainage control to prevent sediments from disturbed sites from entering water courses for soil and natural resource conservation protection.

Mitigating measures to lessen environmental damage may include reseeding of disturbed soils, chemical stabilization, and dust and erosion control on well sites, roads and construction areas.

All operating plans shall give proper consideration to the potential hazards of slope instability. Where potentially unstable ground conditions exist, design of proposed roads, drill sites and surface facilities shall be approved by and constructed under the supervision of a qualified engineer or engineering geologist satisfactory to the Supervisor.

6. Biota. The lessee shall conduct all operations in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat. The lessee shall take such measures as are necessary for the conservation of endangered and threatened species of flora and fauna as set forth in

applicable Federal or state legislation, executive orders, and regulations such as the Endangered Species Act of 1973 and the Migratory Bird Act of 1966.

Federal or state agencies may advise the Supervisor when there are endangered species inhabiting or utilizing the immediate area of operations or proposed operations. When such species would be adversely affected by the lessee's operations on the leased lands, the lessee shall implement whatever measures the Supervisor finds necessary to minimize or eliminate such adverse effects and to protect the endangered species. Such measures may be in addition to provisions already set forth in the lease or accompanying stipulations.

The Supervisor may receive information from recognized experts that a delicate balance of flora and/or fauna exists in the area of operations or proposed operations. Upon receiving such notice, the supervisor will request a timely response from appropriate Federal and state agencies regarding: (1) An assessment of the status of flora and fauna in the area which may be adversely affected by operations and, (2) advice as to reasonable mitigating measures appropriate to minimizing or preventing adverse trends in populations, growth, vegetative recovery or repopulations in potentially affected flora and/or fauna. Based on timely receipt of advice from appropriate agencies, the Supervisor will direct the lessee to take appropriate mitigating measures to minimize significant adverse trends in flora and fauna. Such measures may include, but not be limited to, revegetation with grasses, shrubs or other vegetation of high forage values desirable for habitat, replacement of fauna where lost, or replacement of water supply or sources where destroyed.

Where the lessee's operations have destroyed significant flora and/or fauna or their natural habitat and replacement by natural processes will not take place in a normal growth cycle, the lessee shall take reasonable measures to replace those species or their habitat with the same or other acceptable species as directed by the Supervisor. The Supervisor's requirements shall be based on advice received from appropriate Federal and state agencies.

7. Cultural Resources Preservation. The lessee shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological and unique geologic sites. The lessee shall not disturb any known cemetery or burial ground of any group or culture.

Previously unknown sites uncovered by the lessee shall be immediately reported to the Supervisor, and operations on the particular site shall cease until said site can be assessed for its archaeological

value and preservation. Necessary controls and remedial actions for the protection and preservation of cultural resources shall be issued on an individual site basis by the Supervisor as warranted.

The preservation, restoration, maintenance and nomination of all resources for purposes of the National Register of Historic Places shall be in accordance with the provisions of Executive Order 11593 (36 FR 8921) entitled, "Protection and Enhancement of the Cultural Environment," or any amendments thereto.

8. Subsidence and Seismicity. Surveying of the land surface prior to and during geothermal resources production will be required for determining any changes in elevation of the leased lands. Lessee shall make such resurveys as required by the Supervisor to ascertain if subsidence is occurring. Production data, pressures, reinjection rates and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.37. In the event subsidence activity results from the production of geothermal resources, as determined by surveys by the lessee or a governmental body, the lessee shall take such mitigating actions as required by the lease terms or by the Supervisor.

If subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action including, but not limited to, reduced production rates, increased injection of waste or other fluids or a suspension of production.

A. Surveys. All required surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable by the National Ocean Survey for second order surveys. All such work shall be coordinated with the county surveyor of the county in which the surveys and bench marks are to be established. Level lines and networks shall be tied to available regional networks.

Adjusted survey data shall be filed with the Supervisor within 60 days after leveling is completed. Any lessee having a commercially productive geothermal well or wells shall participate in cooperative county-state subsidence detection programs. All survey data filed with the Supervisor shall be available to the public.

B. Bench Marks. One or more wellsite bench marks shall be required at each completed well prior to prolonged production, and said bench marks shall be located in a manner such that there is a minimal probability of destruction or damage to said bench marks. Wellsite bench marks shall be tied to existing regional networks. Additional bench marks between the wellsites and the regional network shall be

at 0.8 km (half-mile) intervals or as otherwise specified by the Supervisor. These bench marks shall be resurveyed during well production operations on a periodic basis as determined by the supervisor.

Acceptable bench marks include, but are not limited to, a brass rod driven to refusal or 9 metres (about 30 feet) and fitted with an acceptable brass plate and permanent structure with an installed acceptable brass plate.

C. Reservoir Data. Initial reservoir pressure and temperature shall be reported to the Supervisor in duplicate on Well Completion or Recompletion Report (Form 9-330C) for all completed wells within 30 days after the completion of measurements or tests conducted for the purpose of obtaining such data. Initial production test data including steam-water ratio, surface pressure and temperature, and quality and quantity of well effluent shall also be filed with the Supervisor on Form 9-330C within 30 days after a well is completed.

D. Seismicity. The installation of seismographs or other like instruments in producing geothermal areas for the purpose of detecting potential seismic activity may be initiated from time to time by appropriate public agencies. Lessees shall cooperate with the appropriate public agencies in this regard. The lessee and the appropriate public agency should take care not to unreasonably interfere with or endanger each other's respective operations. The Supervisor shall coordinate such detection programs between the appropriate public agency conducting the program and the lessee.

Where induced seismicity caused by the production of geothermal fluids is determined to exist by the Supervisor, then the Supervisor may require the lessee to install such monitoring devices as necessary to adequately quantify the effects thereof. If induced seismicity is determined to represent a significant hazard, the Supervisor may require remedial actions including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production.

9. Pollution and Waste Disposal. The lessee shall comply with all applicable Federal and state standards with respect to the control of all forms of air, land, water and noise pollution, including the control of erosion and the disposal of liquid, solid and gaseous wastes. The Supervisor may, at his discretion, establish additional and more stringent standards and, if he does so, the lessee shall comply with those standards. Plans for disposal of well effluents must be approved by the Supervisor before action is taken under them. Immediate corrective action shall be taken in all cases where pollution has occurred.

The lessee shall timely remove or dispose of all waste including human waste, trash, refuse and extraction and processing generated

in connection with the lessee's operations in a manner acceptable to the Supervisor.

The lessee shall provide safeguards to minimize potential accidental fires and shall instruct field personnel in fire prevention methods. The lessee shall maintain fire-fighting equipment in working order at strategic locations on the leased lands.

A. Pollution Prevention. In the conduct of all geothermal operations, the lessee shall not contaminate any natural waters and shall minimize adverse effect on the environment.

(1) Liquid Disposal. Liquid well effluent or the liquid residue thereof containing substances, including heat, which may be harmful or injurious and cannot otherwise be disposed of in conformance with Federal, state and regional standards, shall be injected into the geothermal resources zone or such other formation as is approved by the Supervisor.

Toxic drilling fluids shall be disposed of in a manner approved by the Supervisor and in conformance with applicable Federal, state and regional standards.

(2) Solid Waste Disposal. Drill cuttings, sand, precipitates and other solids shall be disposed of as directed by the Supervisor either on location or at other approved disposal sites. Containers for mud additives or chemicals and other solid waste materials shall be disposed of in a manner and place approved by the Supervisor.

(3) Air Quality. Noncondensable gases such as carbon dioxide, ammonia and hydrogen sulfide may be vented or ejected into the atmosphere, provide however, that the volume and the measured concentration of such vented gas or gases shall not exceed applicable Federal, state or regional air pollution standards.

(4) Pits and Sumps. Pits and sumps shall be lined with impervious material and purged of environmentally harmful chemicals and precipitates before back-filling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes and ground waters. Pits and sumps shall be constructed in a manner and in such locations so as to minimize damage to the natural environment and aesthetic values of the lease or adjacent property. When no longer used or useful, pits and sumps shall be back-filled and the premises restored to as near a natural state as reasonably possible. Temporary fencing of unattended pits and sumps to protect wildlife or personnel may be required by the Supervisor and the surface management agency.

(5) Production Facilities Maintenance. Production facilities shall be operated and maintained at all times in a manner necessary to

to prevent pollution. The lessee's field personnel shall be instructed in the proper maintenance and operation of production facilities for the prevention of pollution.

B. Inspections and Reports. Lessees shall comply with the following pollution inspection and reporting requirements.

(1) Pollution Inspections. Drilling and production facilities shall be inspected daily by the lessee. Appropriate preventative maintenance shall be performed as necessary to prevent failures and malfunctions which could lead to pollution. Wells and areas not under production shall be inspected by the lessee at intervals prescribed by the Supervisor. Necessary repairs or maintenance shall be made as required.

(2) Pollution Reports. All pollution incidents shall be reported orally within 18 hours to the appropriate Geothermal District Supervisor and shall be followed within 30 days thereof by a written report stating the cause and corrective action taken.

C. Injection. The use of any subsurface formation, including the geothermal resources zone, for well effluent disposal, the residue thereof or for the injection of fluids for other purposes such as subsidence prevention, shall not be permitted until the lessee has submitted a plan of injection covering the proposed injection project and has subsequently received the Supervisor's written approval thereof.

(1) Plan of Injection. The plan of injection shall include the quantity, quality and source of the proposed injection fluid; the means and method by which the fluid is to be injected; a structure map contoured on the intended injection zone; and cross-sections showing producing well locations and the proposed injection well location(s).

(2) Injection Report. The lessee shall file in duplicate with the Supervisor a Monthly Water Injection Report in a form approved by the Supervisor. The subject report shall be filed on or before the last day of the month following the month in which the injection took place.

(3) Inspection. Injection wells and facilities shall be inspected by the lessee at intervals as prescribed by the Supervisor to ascertain that all injected fluids are confined to the approved injection zone. A spinner survey, a radioactive tracer survey and a cement bond log may be required on each injection well within 30 days after injection begins. The lessee shall furnish to the Supervisor two legible exact copies of any and all such surveys and logs. In the event of a casing failure, inadequate annular cement or other mechanical failure, the lessee shall without unreasonable delay repair, suspend

or abandon the well. Where failure occurs in a zone which may damage surface or fresh water aquifers, injection shall immediately cease.

(4) New Wells. The drilling of new injection wells in accordance with an approved plan of injection shall be in conformance with the provisions of GRO Order No. 2. An Application for Permit to Drill, Form 9-331C, shall be filed in triplicate for each injection well.

(5) Conversions. The conversion of an existing well to an injection well in accordance with or modification of an approved plan of injection shall be in conformance with the requirements of GRO Order No. 2. The lessee shall demonstrate to the satisfaction of the Supervisor by appropriate testing and logging that the well is mechanically sound and suitable for injection purposes. A Sundry Notice, Form 9-331, shall be filed in triplicate for each conversion.

10. Water Quality. The primary responsibility for water quality and pollution control has been delegated to the states where such states have standards approved by the Environmental Protection Agency. Such states must meet basic Federal requirements prohibiting the deterioration of waters whose existing quality is higher than established water quality standards. The lessee shall comply with the state water quality control organization's standards in such states as have Federally approved standards. The Supervisor, at his discretion, may establish additional and more stringent standards.

The lessee shall file, in duplicate, a detailed water analysis report for all completed geothermal wells, upon completion and annually thereafter or as otherwise specified by the Supervisor. Unless otherwise prescribed by the Supervisor, such analyses shall include a determination of arsenic, boron, radioactive content and radioactivity of the produced fluids. In the event that a health hazard exists, the Supervisor shall require appropriate health and safety precautions, periodic monitoring, or the suspension of production.

11. Noise Abatement. The lessee shall minimize noise during exploration, development and production activities. The method and degree of noise abatement shall be as approved by the Supervisor.

The lessee shall conduct noise level measurements during exploration, development and production operations to determine the potential objectionability to nearby residents as well as the potential health and safety danger due to noise emissions.

Noise level measurements and accompanying data shall be filed with the Supervisor. Such data shall provide the basis for operational and noise control decisions by the Supervisor and shall be based on an assessment of the noise with respect to Federal or state criteria

including adjustments for the area involved and the time of day of the noise occurrence.

The lessee shall comply with Federal occupational noise exposure levels applicable to geothermal activity under the Occupational Safety and Health Act of 1970 as set forth in 29 CFR 1910.95 incorporated herein by reference or with state standards for protection of personnel where such state standards are more restrictive than Federal standards.

A. Noise Measurement Conditions. Outdoor noise measurements shall be made at least 3 metres (10 feet) from structures, facilities or other sound reflecting sources and approximately 1 metre (3 feet) above ground level. Extreme weather conditions, electrical interference and unusual background noise levels shall be avoided or given due consideration when measuring sound levels.

B. Noise Measurements. The lessee shall monitor and measure noise levels using an octave band noise analyzer with an A-weighted frequency response or a standard sound level meter than conforms to the requirements set forth in USA Standard Specifications for General Purpose Sound Level Meters USASI S1.4-1961 or the latest approved revision thereof. Bandpass filters shall conform to the requirements of USASI S1.11-1966. The lessee shall measure noise level frequency distribution as required by the Supervisor. Sound levels shall be measured in conformance with the USA Standard Method for the Physical Measurement of Sound USASI S1.2-1962.

C. Noise Criteria. In the absence of more restrictive criteria as may be established in this paragraph, the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with the Supervisor's approval, if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile) who will be affected by the noise which is in excess of 65 dB(A).

D. Noise Assessment. The lessee shall be responsible for taking such noise level measurements as are deemed necessary by the Supervisor. The background noise level shall serve as the criterion for the rating and assessment, by the Supervisor, of the objectionableness of noise emission from a particular source. The background or ambient noise is defined hereby as the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, the season, atmospheric conditions and the time of day.

E. Attenuation. To attenuate objectionable noise, the lessee shall utilize properly designated muffling devices as required by the Supervisor.

F. Relationships. Reference levels and relationships for noise measurements shall be as follows:

20 MN/m² (1) Reference sound pressure for airborne sounds shall be 20 micronewtons per square metre).

(2) Reference power shall be 10⁻¹² watts.

(3) Sound levels shall be measured using a standard Sound Level Meter with an "A" frequency response characteristic (weighting network).

(4) Sound level meter controls shall be set for as uniform a frequency response as possible when measuring sound pressure levels.

(5) Octave band noise levels shall be reported in equivalent A-weighted levels.

B. Record of Sound Measurements. A record of sound level measurements shall be filed in duplicate with the Supervisor and shall include the following data:

(1) Date, time and location.

(2) Name of observer.

(3) Description of primary noise source emitter under test.

(4) Kind of operation and operating conditions.

(5) Description of secondary noise sources including location, type and kind of operation.

(6) Type and serial numbers on all microphones, sound level meters and octave band analyzers used. Length and type of microphone cables.

(7) Position of observer.

(8) Direction of arrival of sound with respect to microphone orientation.

(9) Approximate temperature of microphone.

(10) Results of maintenance and calibration tests.

(11) Weighting network and meter speed used.

(12) Measured overall response and band levels at each microphone position and extent of meter fluctuation.

(13) Background overall response and band levels at each microphone position with primary noise source not operating.

(14) Cable and microphone corrections.

(15) Any other pertinent data such as personnel exposed directly and indirectly, time pattern of the exposure, atmospheric conditions, attempts at noise control and personnel protection.

Reid T. Stone
Area Geothermal Supervisor

Approved:

Russell G. Wayland
Chief, Conservation Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GEOTHERMAL RESOURCES LEASE

Serial Number _____

Proper BLM Office _____

Competitive _____

Noncompetitive _____

In consideration of the mutual promises, terms, and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and _____ (hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001-1025) (hereinafter called "the Act") to be effective on _____ (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements (a) of all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, and all geothermal resources operational orders (hereinafter called "CRO orders") issued pursuant thereto, all of which are incorporated herein and, by reference, made a part hereof, and (b) of any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT. The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, hereinafter called "geothermal resources", in or under the following described lands situated within the County of _____, State of _____:

Public Lands

T. :R. : Meridian

Acquired Lands

T. :R. : Meridian

Total Area _____

Total Area _____

Containing approximately _____ acres, hereinafter referred to as the "leased area" or "leased lands", together with:

(a) The non-exclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generation plants, transmission lines, industrial facilities, electric, telegraph or telephone lines and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that*, although the use of the leased area for an electric power generation plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development be conducted in accordance with procedures approved by the Supervisor of the Geological Survey, hereinafter called "Supervisor"; and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended and supplemented (30 U.S.C. 181-287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351-359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leaseable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam; *Provided that* an application is made therefore prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21-54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with its policies hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced under an approved cooperative or unit plan on the leased lands or on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is inescapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for as long as such by-products are produced in commercial quantities but for not more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES.

(a) **Annual Rental**—For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased land, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of \$_____ for each acre or fraction thereof.

(b) **Escalating Rental**—Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessor shall pay on or before the anniversary date of the lease an escalated rental of amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one dollar. If the lease is extended beyond 10 years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year as if no extension had been made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of \$_____ per acre due the Lessor for that or any future year.

(c) **Royalty** (1) On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(A) A royalty of _____% on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(B) A royalty of _____% on the value of any by-product derived from production under this lease, produced, processed, removed, sold or utilized from this lease, reasonably susceptible to sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Section I of the Mineral Leasing Act of February 25, 1920, as amended (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(C) A royalty of _____% on the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible to sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands in any lease year, a royalty in excess of more than \$2 per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(e) **Waiver and Suspension of Rental and Royalties**—Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof on the interest of conservation or for the purpose of ensuring the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so in order to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(f) **Undivided Fractional Interest**—Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Section 2 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(g) **Repayments**—Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein and not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS. It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources for the purpose of computing royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS. The Lessee shall file with the Authorized Officer and shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease

or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS.

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into different funds from those into which royalties and rentals under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At his own election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require in order that the leased lands may be properly and timely developed and for the production of by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefore is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any location of the Lessor's geothermal gathering or disposal system without cost to the Lessee. If the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except where the option is being exercised, or limit the Lessor's right to take any action under Section 25 to enforce that requirement.

Sec. 7. INSPECTION. The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands, and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS. The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor so as to prevent any and all production or operations from causing or resulting in injury to life, health or property and to avoid the waste of resources of every type, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of these requirements and stipulations will be a breach of the terms of this lease and subject to the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION.

(a) The Lessee shall be liable to the United States for any damage suffered by the United States in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the United States acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the United States from any and all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS.

The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN.

Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer of the Bureau (hereinafter called "the Authorized Officer") any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION. At such times and in such form as the Lessee may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect of the environment of operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessee may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION. In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the primary term the Lessee shall make at least the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS. The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or bulk waste, and so far as possible, repair the off-site risks and damage caused by its activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE. The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine normally or any oil, gas, fresh water, or other gas or waste of the resource, and to prevent the threat of destruction or damage to such deposits. The Lessee shall monitor noise and air and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS. The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. The records shall be kept and preserved by the Lessee for a period of five (5) years.

Sec. 17. RESERVATIONS TO LESSOR. All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) **Disposal**—The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the Lessee under this lease;

(b) **Right-of-way**—The right to authorize geological and geophysical exploration on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) **Mineral Rights**—The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) **Casing**—The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations or any well drilled for the production of geothermal resources; and

(e) **Measurements**—The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE.

The Lessee shall immediately bring to the attention of the Authorized Officer any and all antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with

any of the terms and conditions imposed by the Authorized Officer will regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the United States or the surface owner.

Sec. 19. DIRECTIONAL DRILLING. A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the leased area when drilling is commenced on the nearby land for the purpose of directional drilling under the leased area, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any rights in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES. The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output net in excess of 50 percent of the rate of royalty due to the United States specified in Section 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a pro-rated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the United States have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS. The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE DR UNIT PLAN. The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, participate and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE. The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper Bureau office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or of any portion of the leased area shall relieve the Lessee or his surety from any liability for breach of his obligation of this lease, including the obligations to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE.

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed on the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee as provided above, which are allowed to remain on the leased lands shall become the property

of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at his own expense, or if he fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT.

(1) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations and that default shall continue for a period of thirty (3) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Section 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Section 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Section 12 of the Act.

(2) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or of the regulations, or of any GRO, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as he may deem necessary to correct the failure, including a suspension of operations or production all at the expense of the Lessee. The Lessor may also exercise any legal or equitable remedy or remedies which it may have.

(3) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occurring at any other time.

(4) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Section 12 of the Act and in the regulations promulgated thereunder.

(5) Upon cancellation, the Lessee shall remove all property in accordance with Section 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST. Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST. No member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Section 3741 of the Revised Statutes, 43 U.S.C. Sec. 23, as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. EQUAL OPPORTUNITY CLAUSE. The Lessee agrees that, during the performance of this lease:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

Sec. 30. SPECIAL STIPULATIONS.

In witness whereof the parties have executed this lease.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedial invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (28) in every contract, subcontract or purchase order unless exempt by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; provided, however, that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 29. CERTIFICATION OF NONSEGREGATED FACILITIES.

By entering into this lease, the Lessee certifies that Lessee does not and will not maintain or provide for Lessee's employees any segregated facilities at any of Lessee's establishments, and that Lessee does not and will not permit Lessee's employees to perform their services at any location, under Lessee's control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. Lessee further agrees that (except where Lessee has obtained identical certifications from proposed contractors and subcontractors for specific time periods) Lessee will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that Lessee will retain such certifications in Lessee's files; and that Lessee will forward the following notice to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods): Lessee will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. Certification of Nonsegregated facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for such contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semi-annually, or annually).

THE UNITED STATES OF AMERICA

By

(Authorized Officer)

(Signature of Lessee)

(Title)

(Signature of Lessee)

(Date)

(Date)

APPENDIX B

GEOLOGICAL TIME SCALE
(in millions of years)

<u>Era</u>	<u>Period</u>	<u>Time (in millions of years)</u>
		Present
Cenozoic	Quaternary	1 m.y.
	Tertiary	70. m.y..
Mesozoic	Cretaceous	135 m.y.
	Jurassic	180 m.y.
	Triassic	225 m.y.
	Permian	270 m.y.
Paleozoic	Carboniferous	350 m.y.
	Pennsylvanian	270 m.y.
	Mississippian	350 m.y.
	Devonian	400 m.y.
	Silurian	440 m.y.
	Ordovician	500 m.y.
	Cambrian	600 m.y.
Precambrian		4700 m.y. ?

GLOSSARY OF GEOLOGIC TERMS

Amygdaloidal	Vesicles filled with secondary crystal growth (e.g., calcite, aragonite)
Andesite	A fine grained igneous rock, lighter in appearance than basalt. An andesite contains greater amounts of sodium, potassium, and water in its mineralogy than a basalt.
Ash flow tuff	Fine grained consolidated pyroclastic igneous rock.
Basalt	A dark to medium dark extrusive volcanic rock.
Breccia	A coarse-grained clastic rock composed of large (greater than sand-sized, or 2mm in diameter), angular, and broken rock fragments that are cemented together in a finer-grained matrix.
Electrical Resistivity	A geophysical survey used to measure the natural resistivity of given rock masses by inducing an electrical current. This is an excellent tool for locating buried thermal waters because decreasing resistivity can indicate an increase in temperatures.
Extensional stress regime	Said of a set of stresses (forces which result in a pulling apart, or splitting).
Geothermometer	A mineral or mineral assemblage whose composition, structure, and inclusions are fixed within known thermal limits under particular conditions of pressure and composition and whose presence thus denotes a limit or range for the temperature of formation of the enclosing rock or fluid.
Graben	An elongate, down-faulted crustal unit or block that is bound by faults on its long dimensions. In the Basin and Range, grabens are commonly valleys.

Heat Conductivity	The time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. A measure of the ability of a material to conduct heat. Rocks with abundant quartz have high thermal conductivities. Poorly consolidated sediments have lower thermal conductivities.
Horst	An elongate, uplifted crustal unit or block that is bound by faults on its long dimensions. In the Basin and Range, horsts are commonly mountain ranges.
Iddingsite	A reddish-brown mixture of silicates formed by the alteration of olivine. It forms rust-colored patches in basic igneous rocks.
Igneous	Fire rock. Molton rock.
Ignimbrite	Fire cloud. Nuees Ardentes. A rock formed by the consolidation of ash flows.
Inselberg	A prominent, isolated, usually smooth and rounded, residual knob or hill rising from an extensive flat erosional surface.
Latite	An igneous rock that is a fine-grained equivalent to a monzonite. A latite is considered to be an extrusive flow, whereas a monzonite, being coarse-grained, is considered to be intrusive.
Metamorphic	A rock which results from recrystallization in a solid state due to increasing pressure and/or temperature.
Monzonite	A "granitic" igneous rock containing less than 10% quartz and a greater percentage of calcium-sodium feldspar than granite.
Normal slip fault	A fault in which the hanging wall appears to have moved downward relative to the footwall. A gravity fault. Result of extensional stress.

Olivine	A mineral commonly found in basalts. Generally an iron, magnesium silicate - $(\text{Fe, Mg})_2 \text{SiO}_4$
Phenocryst	Large crystals contained in the texture of an igneous or metamorphic rock.
Porphyry	Said of a texture of an igneous rock made up of numerous coarse crystals and fine-grained crystals. Made up of two obviously different sizes of crystals.
Pyroclastic	Pertaining to clastic rock material formed by volcanic explosion or aerial expulsion from a volcanic vent.
Pyroxene	A mineral commonly found in dark to grey igneous rocks. A chain-silicate. Commonly has the appearance of elongated black crystals contained in the texture of an igneous rock.
Rhyolite	An igneous rock that is a fine-grained equivalent to a granite.
Schistose	A metamorphic texture in which platy crystals (e.g., biotite) are aligned in a dominate direction.
Silicic magma	A general term for a group of molten magmas containing approximately 60-75 weight percent silica (SiO_2).
Tectonic	Said of, or pertaining to the forces involved in, or resulting structures or features of.
Vesicles	A cavity of variable shape in lava formed by the entrapment of gas.
Xenolith	Xeno (foreign) lith (rock); a rock fragment that is found contained in another rock of a completely different type and origin.

GLOSSARY OF WILDLIFE TERMS

Life Zones	A classification of flora and fauna based on elevation and latitude.
Lower Sonoran	The life zone which extends from about 2817 to 5000 feet elevation. The major floral type is desert shrub.
Upper Sonoran	The life zone which extends from about 4500 to 8000 feet elevation. The major floral type is pinon-juniper.
Transition Zone	The life zone which extends from about 1000 to 9500 feet elevation. The major floral type is ponderosa pine.
Endangered Species	Those in danger of extinction throughout all or in a significant portion of their ranges.
Threatened Species	Those which are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges.
Endangered Species Group One	Those which are believed to be or to have been regular in occurrence in New Mexico and to have suffered declines in numbers and/or range in the State to the point that their survival there is severely jeopardized or possibly has ceased.
Endangered Species Group Two	Those that are believed to be or have been regular in occurrence in New Mexico and are suffering or facing declines in numbers and/or range in the State to the point that their survival there could soon become severely jeopardized.

APPENDIX C

SEASON OF USE AND HABITAT FOR MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
1. Merriam Shrew	<i>Sorex merriami</i>	Ye		Sagebrush, bunch grass.					✓
2. Vagrant Shrew	<i>Sorex vagrans</i>	Ye		Wet meadows, forest streams.	✓				✓
3. Gray Shrew	<i>Notisorex crawfordi</i>	Ye		Chaparral slope.	✓		✓		
4. Leafnose Bat	<i>Macrotus californicus</i>	M,S		Caves, old mine tunnels.	✓	✓			
5. Hognose Bat	<i>Choeronycteris mexicana</i>	M,S		Caves, mine tunnels, buildings.	✓	✓			
6. Longnose Bat	<i>Leptonycteris sandborni</i>	M,S		Caves, mine tunnels, buildings.	✓	✓	✓		
7. Little Brown Myotis	<i>Myotis lucifugus</i>	M,S		Caves, mine tunnels, buildings.	✓	✓			
8. Yuma Myotis	<i>Myotis yumanensis</i>	M,S		Caves, mine tunnels, buildings.	✓	✓			
9. Cave Myotis	<i>Myotis velifer</i>	M,S		Caves, mine tunnels, buildings.	✓	✓			
10. Arizona Myotis	<i>Myotis occultus</i>	M,S		Buildings, mine tunnels.	✓	✓			
11. Keen Myotis	<i>Myotis keeni</i>	M,S		Tunnels, caves, buildings, trees.	✓	✓			
12. Fringed Myotis	<i>Myotis thysanodes</i>	M,S		Caves, attics of old buildings.	✓	✓			✓
13. Long-legged Myotis	<i>Myotis volans</i>	M,S		Buildings.	✓		✓		
14. California Myotis	<i>Myotis californicus</i>	M,S		Tunnels, trees, buildings, loose rocks.	✓				✓
15. Small-Footed Myotis	<i>Myotis subulatus</i>	M,S		Caves, tunnels, rock crevices.	✓	✓	✓		
16. Silver-Haired Bat	<i>Lasionycteris noctivagans</i>	M,S		Forests, buildings, caves.	✓				
17. Western Pipistrel	<i>Pipistrellus hesperus</i>	M,S		Caves, looserocks, cliff crevices.	✓		✓		✓
18. Big Brown Bat	<i>Eptesicus fuscus</i>	M,S		Caves, tunnels, trees, crevices.	✓	✓	✓		

A-Palomar Mts., B-Pyramid Mts., C-North Anchos Mts., D-Anchos Valley, E-San Simon Clones

SEASON OF USE AND HABITAT FOR MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
19. Red Bat	<i>Lasiurus borealis</i>	M,S		Wooded areas.	✓		✓		✓
20. Hoary Bat	<i>Lasiurus cinereus</i>	M,S		Wooded areas, along streams.	✓				✓
21. Western Yellow Bat	<i>Lasiurus ega</i>	S		Wooded areas, along streams.					✓
22. Spotted bat	<i>Euderma maculata</i>	M,S		Buildings, caves in arid country.	✓				
23. Western Big-Eared Bat	<i>Plecotus townsendi</i>	M,S		Caves, tunnels, buildings.	✓	✓			
24. Mexican Big-Eared Bat	<i>Plecotus phyllotis</i>	M,S		Caves in pine-oak forests.	✓				
25. Pallid Bat	<i>Antrozous pallidus</i>	M,S		Caves tunnels, rock crevices, trees.	✓	✓	✓	✓	
26. Mexican Freetail Bat	<i>Tadarida brasiliensis</i>	M,S		Caves & buildings, feeds on moths.	✓	✓	✓	✓	
27. Big Freetail Bat	<i>Tadarida molossa</i>	M,S		Caves, cliff crevices, buildings.	✓	✓			
28. Pocketed Freetail Bat	<i>Tadarida femorosacca</i>	M,S		Caves, crevices.		✓			
29. Western Mastiff Bat	<i>Eumops perotis</i>	M,S		Buildings, crevices, trees, tunnels.	✓				✓
30. Black Bear	<i>Ursus americanus</i>	Ye	Game	Mountainous areas.	✓				
31. Raccoon	<i>Procyon lotor</i>	Ye	Furbearer	Streams and lake borders.	✓			✓	✓
32. Coati	<i>Nasua narica</i>	Ye	Furbearer	Open forest.	✓	✓	✓		✓
33. Ringtail	<i>Bassariscus astutus</i>	Ye	Furbearer	Chaparral, rocky areas near water.	✓	✓	✓		✓
34. Longtail Weasel	<i>Mustela frenata</i>	Ye	Furbearer	Near water.	✓			✓	✓
35. Badger	<i>Taxidea taxus</i>	Ye		Open grasslands & deserts; foot-hill areas.	✓	✓	✓	✓	✓

A - Palouse Mts., B - Pyramid Mts., C - North Anoles Mts., D - Anoles Valley, E - San Simon Clenega

SEASON OF USE AND HABITAT FOR MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
36. Spotted Skunk	<i>Spilogale putorius</i>	Ye	Furbearer	Brushy, sparsely wooded areas, near streams among boulders.	✓				✓
37. Striped Skunk	<i>Mephitis mephitis</i>	Ye	Furbearer	Semi-open country, mixed woods, brushlands and open prairie.	✓		✓	✓	✓
38. Hooded Skunk	<i>Mephitis macroura</i>	Ye	Furbearer	Along streams & rocky ledges.	✓			✓	✓
39. Hognose Skunk	<i>Conepatus leuconotus</i>	Ye	Furbearer	Partly wooded, brushy, rocky areas.	✓	✓	✓	✓	✓
40. Coyote	<i>Canis latrans</i>	Ye		All habitats.	✓	✓	✓	✓	✓
41. Kit Fox	<i>Vulpes macrotis</i>	Ye	Furbearer	Open, level, sandy ground.				✓	
42. Gray Wolf	<i>Canis lupus</i>	Ye		Wilderness areas.				✓	
43. Gray Fox	<i>Urocyon cinereoargenteus</i>	Ye	Furbearer	Chaparral, open forest, rimrock.	✓		✓	✓	✓
44. Jaguar	<i>Felis onca</i>	Ye		Low mts., chaparral, open forest.				✓	
45. Mountain Lion	<i>Felis concolor</i>	Ye	Game	Chaparral, open country, rimrock.	✓	✓	✓		
46. Ocelot	<i>Felis pardalis</i>	Ye		Thick thorn scrub, rocky areas.				✓	
47. Jaguarundi Cat	<i>Felis yagouarundi</i>	Ye		Brushy areas, thorn thickets.				✓	
48. Bobcat	<i>Lynx rufus</i>	Ye		Rimrock & chaparral areas.	✓	✓	✓	✓	✓
49. Blacktail Prairie Dog.	<i>Cynomys ludovicianus</i>	Ye		Dry, upland prairies.				✓	
50. Rock Squirrel	<i>Citellus variegatus</i>	Ye		Rocky canyons, boulder-strewn slopes.	✓	✓	✓	✓	

* A-Palomello Mts., B-Pyramid Mts., C-North Anicut Mts., D-Anima Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
51. Spotted Ground Squirrel	<i>Citellus spilosoma</i>	Ye		Open forests, sandy soil.	✓		✓		
52. Golden-Mantled Squirrel	<i>Citellus lateralis</i>	Ye		Mountainous areas, forests.	✓		✓		
53. Harris Antelope Squirrel	<i>Citellus harrisi</i>	Ye		Low arid deserts with sparse vegetation.		✓		✓	
54. Cliff Chipmunk	<i>Eutamias dorsalis</i>	Ye		Pinon pine, juniper slopes.	✓	✓	✓		
55. Arizona Gray Squirrel	<i>Sciurus arizonensis</i>	Ye		Oak and pine forest.	✓				
56. Valley Pocket Gopher	<i>Thomomys bottae</i>	Ye		Valley & mountain meadows.				✓	✓
57. Bailey Pocket Gopher	<i>Thomomys baileyi</i>	Ye		Hard, clayey soils.					
58. Pygmy Pocket Gopher	<i>Thomomys umbrinus</i>	Ye		Oaks & pines; sometimes rocky soils.	✓		✓		
59. Silky Pocket Mouse	<i>Perognathus flavus</i>	Ye		Short grass prairies.				✓	✓
60. Desert Pocket Mouse	<i>Perognathus penicillatus</i>	Ye		Open, sandy deserts; sparse vegetation.				✓	
61. Rock Pocket Mouse	<i>Perognathus intermedius</i>	Ye		Arid or semi-arid grasslands.	✓	✓	✓	✓	
62. Bailey Pocket Mouse	<i>Perognathus baileyi</i>	Ye		Rocky slopes, sparse vegetation.	✓	✓	✓		
63. Hispid Pocket Mouse	<i>Perognathus hispidus</i>	Ye		Short grass prairies.				✓	
54. Bannertail Kangaroo Rat	<i>Dipodomys spectabilis</i>	Ye		Arid or semi-arid grasslands; scattered mesquite.		✓		✓	✓
55. Ord Kangaroo Rat	<i>Dipodomys ordi</i>	Ye		Sandy soils.		✓		✓	✓

* A-Palmdale Mts., B-Pyramid Mts., C-North Animes Mts., D-Animes Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
66. Merriam Kangaroo Rat	<i>Dipodomys merriami</i>	Ye		Sandy, rocky soils with scattered vegetation.		✓		✓	✓
67. Beaver	<i>Castor canadensis</i>	Ye	Furbearer	Streams, lakes, with trees on banks.				✓	✓
68. Plains Harvest Mouse	<i>Reithrodontomys montanus</i>	Ye		Chiefly uplands.	✓		✓	✓	✓
69. Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	Ye		Grassland, open desert, weed patches. Usually dense vegetation near water.	✓	✓	✓	✓	✓
70. Fulvous Harvest	<i>Reithrodontomys fulvescens</i>	Ye		Grasslands with scattered brush; weedy fields & fence rows.	✓	✓	✓	✓	✓
71. Cactus Mouse	<i>Peromyscus eremicus</i>	Ye		Low deserts with sandy soil; rocky outcrops.		✓	✓	✓	✓
72. Deer Mouse	<i>Peromyscus maniculatus</i>	Ye		Most habitats.	✓	✓	✓	✓	✓
73. Brush Mouse	<i>Peromyscus boylei</i>	Ye		Chaparral areas; areas and semi-arid rocky situations.	✓	✓	✓		
74. Pinon Mouse	<i>Peromyscus truei</i>	Ye		Rocky terrain with scattered pinons and junipers.	✓	✓	✓		
75. Rock Mouse	<i>Peromyscus difficilis</i>	Ye		Rocky outcrops, cliffs and canyon walls.	✓	✓	✓		
76. Pygmy Mouse	<i>Baiomys taylori</i>	Ye		Grassy or weedy areas.				✓	✓
77. Northern Grasshopper Mouse	<i>Onychomys leucogaster</i>	Ye		Prairies and desert areas; sandy or gravelly soils.		✓	✓	✓	
78. Southern Grasshopper Mouse	<i>Onychomys torridus</i>	Ye		Rarely found in valley floors.	✓	✓	✓		

A-Palomillo Mts., B-Pyramid Mts., C-North Animos Mts., D-Animos Valley, E-San Simon Clonera

SEASON OF USE AND HABITAT FOR MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *			
					A	B	C	D E
79. Whitethroat Woodrat	<i>Neotoma albigula</i>	Ye		Brushland & rocky cliffs with shallow caves.	✓	✓	✓	
80. Southern Plains Woodrat	<i>Neotoma micropus</i>	Ye		Semi-arid brushland; cacti, mesquite thornbrush; low valleys & plains.		✓	✓	✓
81. Mexican Woodrat	<i>Neotoma mexicana</i>	Ye		Rocks, cliffs, and mountains.	✓	✓	✓	
82. Hispid Cotton Rat	<i>Sigmodon hispidus</i>	Ye		Tall grass, sedges and weeds, moist areas.				✓
83. Least Cotton Rat	<i>Sigmodon minimus</i>	Ye		Tall grass, sedges, and weeds, moist areas.				✓
84. Yellownose Cotton Rat	<i>Sigmodon ochrognathus</i>	Ye		Dense vegetation; foothills and mountains.	✓		✓	✓
85. Buff-Bellied Cotton Rat	<i>Sigmodon fulviventor</i>	Ye		Grassland areas.				✓
86. Mexican Vole	<i>Microtus mexicanus</i>	Ye		Mountain meadows and park-like yellow pine forests; usually dry situations.	✓			
87. Norway Rat	<i>Rattus norvegicus</i>	Ye		Cities, farms, towns, and dumps. Not in open country.				✓
88. House Mouse	<i>Mus musculus</i>	Ye		Settled areas, grain fields, ditches, farms.				✓
89. Porcupine	<i>Erethizon dorsatum</i>	Ye		Usually forested areas.	✓	✓	✓	✓
90. Whitetail Jackrabbit	<i>Lepus townsendi</i>	Ye		Open, grassy or sagebrush plains.				

A - Pelona-Elle Mts., B-Pyramid Mts., C-North Animes Mts., D-Animes Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

MAMMALS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
91. Antelope Jackrabbit	<i>Lepus alleni</i>	Ye		Grasses, mesquite, catclaws, slopes at moderate elevations.		✓	✓	✓	✓
92. Blacktail Jackrabbit	<i>Lepus californicus</i>	Ye		Open prairies, sparsely vegetated deserts.		✓		✓	✓
93. White-sided Jackrabbit	<i>Lepus gaillardi</i>	Ye		Grasslands, mesquite, catclaws, slopes at moderate elevations.				✓	
94. Eastern Cottontail	<i>Sylvilagus floridanus</i>	Ye		Heavy brush, strips of forests with open areas, nearby swamps.	✓		✓		
95. Desert Cottontail	<i>Sylvilagus auduboni</i>	Ye		Open plains; foothills and low valleys, grass, sagebrush; pinon-juniper.		✓	✓	✓	✓
96. Javelina	<i>Pecari angulatus</i>	Ye	Game	Brushy, semi-desert; cacti, oak chaparral, mesquite; near water holes.	✓	✓	✓	✓	✓
97. Mule Deer	<i>Odocoileus hemionus</i>	Ye	Game	Most habitats.	✓	✓	✓	✓	✓
98. Coues' Whitetail Deer	<i>Odocoileus virginianus couesi</i>	Ye	Game	Oak, mesquite, rocky ridges, chaparral near water.	✓		✓		
99. Pronghorn	<i>Antilocapra americana</i>	Ye	Game	Open prairies and open brushy areas.				✓	

A-Palomello Mts., B-Pyramid Mts., C-North Ancestral Mts., D-Ancestral Valley, E-San Simon Geogys

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
1. Western Grebe	<i>Aechmophorus occidentalis</i>	M-W		Rushy lakes, sloughs, bays, and large bodies of open water.					
2. Pied-Billed Grebe	<i>Podilymbus podiceps</i>	Ye		Fresh water ponds, lakes, streams, and marshes.	✓			✓	✓
3. Horned Grebe	<i>Podiceps auritus</i>	M		Lakes, reservoirs, and ponds.	✓				
4. Double-crested Cormorant	<i>Phalacrocorax auritus</i>	M		Lakes, rivers, reservoirs, and large marshes.	✓				
5. Magnificent Frigatebird	<i>Fregata magnificens</i>	W		Open areas adjacent to large rivers and reservoirs.					
6. White-faced Ibis	<i>Plegadis chihi</i>	W		Fresh-water marshes, irrigated lands and tules.				✓	✓
7. Snowy Egret	<i>Leucophoyx thula</i>	M		Marshes, ponds, irrigated land, slow-moving streams, shores.	✓			✓	✓
8. Great Blue Heron	<i>Ardea herodias</i>	Ye		Marshes, swamps, streams, shores, reservoirs, lakes, and irrigation ditches.				✓	✓
9. Little Blue Heron	<i>Florida caerulea</i>	M-S		Marshy areas and slow-moving rivers.				✓	
10. Green Heron	<i>Butorides virescens</i>	Ye		Lakes, fresh marshes, slow-moving streams.				✓	✓
11. Black-Crowned Night Heron	<i>Nycticorax nycticorax</i>	M		Marshes, lake margins, shores, slow-moving rivers.	✓				
12. American Bittern	<i>Botaurus tentiginosus</i>	M-S		Marshes, tules, reedy lakes.	✓			✓	✓

* A- Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
13. Mallard	<i>Anas platyrhynchos</i>	M-W	Game	Ponds, stock tanks.	✓			✓	✓
14. Mexican Duck	<i>Anas diazi</i>	Ye		Ponds, stock tanks.	✓			✓	✓
15. Pintail	<i>Anas acuta</i>	M-W	Game	Ponds, stock tanks.	✓			✓	✓
16. Gadwall	<i>Anas strepera</i>	M-W	Game	Stock tanks.	✓			✓	✓
17. American Widgeon	<i>Mareca americana</i>	M-W	Game	Tanks.	✓			✓	✓
18. Blue-winged Teal	<i>Anas discors</i>	M-W	Game	Dirt tanks.	✓			✓	✓
19. Cinnamon Teal	<i>Anas cyanoptera</i>	M	Game	Same.	✓			✓	✓
20. Green-winged Teal	<i>Anas carolinensis</i>	M-W	Game	Same.	✓			✓	✓
21. Masked Duck	<i>Oxyura dominica</i>	S		Marshes, small ponds.	✓			✓	✓
22. Redhead	<i>Aythya americana</i>	M-W	Game	Dirt tanks.	✓			✓	✓
23. Canvasback	<i>Aythya valisineria</i>	M-W	Game	Dirt tanks.	✓			✓	✓
24. Ring-necked Duck	<i>Aythya collaris</i>	M-W	Game	Same.	✓			✓	✓
25. Greater Scaup	<i>Aythya marila</i>	M-W	Game	Same.	✓			✓	✓
26. Common Goldeneye	<i>Bucephala clangula</i>	M-W	Game	Same.	✓			✓	✓
27. Buffelhead	<i>Bucephala albeola</i>	M-W	Game	Same.	✓			✓	✓
28. White-winged Scoter	<i>Melanitta deglandi</i>	Sp-W	Game	Same.	✓			✓	✓
29. Ruddy Duck	<i>Oxyura jamaicensis</i>	M-W	Game	Same.	✓			✓	✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
30. Red-Breasted Merganser	<i>Mergus serrator</i>	M-W	Game	Dirt tanks.	✓			✓	✓
31. Shoveler	<i>Spatula clypeata</i>	M-W	Game	Dirt tanks.	✓			✓	✓
32. Turkey Vulture	<i>Cathartes aura</i>	S, Ye		All habitats, rare in winter.					✓
33. Black Vulture	<i>Coragyps atratus</i>	S		Only at lower elevations.					✓
34. Mississippi Kite	<i>Ictinia mississippiensis</i>	S		Open foothills, river valleys and marshes.	✓			✓	✓
35. Goshawk	<i>Accipiter gentilis</i>	M-W		Forests, mountain woodlands.	✓		✓		
36. Cooper's Hawk	<i>Accipiter cooperii</i>	M, Ye		Broken woodlands, canyons, river groves.				✓	✓
37. Marsh Hawk	<i>Circus cyaneus</i>	M-W, S		Marshes, fields; prairies.				✓	✓
38. Sharp-Shinned Hawk	<i>Accipiter striatus</i>	M, S		Forests and thickets.	✓		✓		✓
39. Ferruginous Hawk	<i>Buteo regalis</i>	M-W		Arid plains, open rangelands, lower and middle elevation shrublands.	✓		✓	✓	✓
40. Red-tailed Hawk	<i>Buteo jamaicensis</i>	Ye		Open country, desert mountains.	✓		✓	✓	✓
41. Swainson's Hawk	<i>Buteo swainsoni</i>	M-S		Plains, open foothills with sparse trees.				✓	✓
42. Harris Hawk	<i>Parabuteo unicinctus</i>	M-S		River woodlands and mesquite.					✓
43. Black Hawk	<i>Buteogallus anthracinus</i>	S		Wooded stream bottoms.				✓	✓

* A- Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
44. Zone-tailed Hawk	<i>Buteo albonotatus</i>	S		Arid country, rivers, desert mountains.	✓				
45. Gray Hawk	<i>Buteo nitidus</i>	S		Wooded lowland streams.					
46. Golden Eagle	<i>Aquila chrysaetos</i>	M-Ye		Open mountains, foothills, canyon and plains.		✓	✓		
47. Bald Eagle	<i>Haliaeetus leucocephalus</i>	M-S		Rivers.					
48. Osprey	<i>Pandion haliaetus</i>	S		Rivers.					
49. Prairie Falcon	<i>Falco mexicanus</i>	Ye		Canyons, open mountains, plains, prairies, deserts.	✓	✓	✓	✓	✓
50. Pigeon Hawk	<i>Falco columbarius</i>	M-W		Open woodland, foothills, and marshes.				✓	✓
51. Kestrel	<i>Falco sparverius</i>	Ye		Open country, prairies, deserts, wooded streams, farmlands.	✓	✓	✓	✓	✓
52. Aplomado Falcon	<i>Falco femoralis</i>	S		Arid, brushy prairies; yucca flats.				✓	✓
53. Peregrine Falcon	<i>Falco peregrinus</i>	Ye, M-W		Open woodland. In migration also marshes, foothills, open country.				✓	✓
54. Greater Sandhill Crane	<i>Grus canadensis</i>	M-W		Prairies, grain fields, marshes.					
55. Virginia Rail	<i>Rallus limicola</i>	M-W		Fresh marshes and tules.					
56. Sora	<i>Porzana carolina</i>	S		Wet meadows, fresh marshes.	✓			✓	✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	DE	
57. American Coot	<i>Fulica americana</i>	M-W		Ponds.	✓			✓	✓
58. Black-Necked Stilt	<i>Himantopus mexicanus</i>	M		Ponds.				✓	✓
59. Mountain Plover	<i>Eupoda montana</i>	M		Semi-arid grasslands, plains, and plateaus near water.				✓	✓
60. Snowy Plover	<i>Charadrius alexandrinus</i>	M-S		Alkali flats, sand flats.				✓	✓
61. Killdeer	<i>Charadrius vociferus</i>	Ye		Fields, irrigated lands, shores.	✓			✓	✓
62. Common Snipe	<i>Capella gallinago</i>	M-W		Irrigation ditches, bogs.	✓			✓	✓
63. Long-Billed Curlew	<i>Numenius americanus</i>	M-S		High plains and rangelands.				✓	✓
64. Upland Plover	<i>Bartramia longicauda</i>	M		Grassy prairies and fields.				✓	✓
65. Spotted Sandpiper	<i>Actitis macularia</i>	M		Ponds, streams sides in mountainous regions, canyons.	✓			✓	✓
66. Solitary Sandpiper	<i>Tringa solitaria</i>	M		Same.	✓			✓	✓
67. Willet	<i>Catoptrophorus semipalatus</i>	M		Fresh marshes, wet meadows.	✓			✓	✓
68. American Avocet	<i>Recurvirostra americana</i>	M-W		Ponds.				✓	✓
69. Baird's Sandpiper	<i>Erolia bairdii</i>	M		Rain pools, pond margins.				✓	✓
70. Least Sandpiper	<i>Erolia minutilla</i>	W		Rain pools.	✓			✓	✓
71. Long-Billed Dowitcher	<i>Limnodromus scolopaceus</i>	M		Mud flats, shallow pools.				✓	✓
72. Western Sandpiper	<i>Ereunetes mauri</i>	M		Mud flats.	✓			✓	✓

A - Potomillo Hts., B - Pyramid Hts., C - North Animas Mts., D - Animas Valley, E - San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
73. Marbled Godwit	<i>Limosa fedoa</i>	M		Prairies adjacent to pools.					✓
74. Sanderling	<i>Crocethis alba</i>	M		Shore areas.					✓
75. Pectoral Sandpiper	<i>Erolia melanotos</i>	M		Prairie pools, marshy shores.					✓
76. Wilson's Phalarope	<i>Steganopus tricolor</i>	M		Pools, mud flats.					✓
77. Northern Phalarope	<i>Lobipes lobatus</i>	M		Pools, mud flats.					✓
78. Ringed-billed Gull	<i>Larus delawarensis</i>	W		Fields, refuse dumps.					✓
79. Forster's Tern	<i>Hirundo forsteri</i>	M		Marshes.					✓
80. Black Tern	<i>Chlidonias niger</i>	M		Fresh marshes.					✓
81. Mexican Turkey	<i>Meleagris gallopavo mexicana</i>	Ye		Mountains, forests, broken woodlands.	✓		✓		✓
82. Scaled Quail	<i>Callipepla squamata</i>	Ye	Game	Grassland, arid country.	✓	✓	✓	✓	✓
83. Gambel's Quail	<i>Lophortyx gambelii</i>	Ye	Game	Thickets near water.	✓	✓	✓	✓	✓
84. Harlequin Quail	<i>Cyrtonyx montezumae</i>	Ye	Game	Grassy oak canyons, wooded mountain slopes with bunch grass.	✓		✓		✓
85. Band-tailed Pigeon	<i>Columba fasciata</i>	S,Ye	Game	Oak canyons, foothills.	✓				✓
86. Rock Dove	<i>Columba livia</i>	Ye		Cities, farms, cliffs.					✓
87. White-winged Dove	<i>Zenaida asiatica</i>	M-S	Game	Mesquite groves, desert oasis.	✓		✓		✓
88. Mourning Dove	<i>Zenaidura macroura</i>	Ye	Game	Farmlands, open woods, mesquite, grassland, desert.	✓	✓	✓	✓	✓
89. Inca Dove	<i>Scardafella inca</i>	Ye,M		Farms, parks.					✓

A - Peloncillo Mts., B - Pyramid Mts., C - North Animas Mts., D - Animas Valley, E - San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
90. Ground Dove	<i>Columbigallina passerina</i>	M-W		River bottoms, dirt roads, wood edges.					
91. Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	M-S		River thickets, mesquite.	✓				
92. Roadrunner	<i>Geococcyx californianus</i>	Ye		Open country with scattered cover, open pinyon-juniper.	✓	✓	✓	✓	✓
93. Barn Owl	<i>Tyto alba</i>	Ye		Woodlands canyons, cliffs.	✓	✓	✓	✓	✓
94. Screech Owl	<i>Otus asio</i>	Ye		Woodlands, wooded canyons.			✓	✓	✓
95. Whiskered Owl	<i>Otus trichopsis</i>	Ye		Mountain canyons, pine-oak woods.			✓	✓	✓
96. Flammulated Owl	<i>Otus flammeolus</i>	S		Pine-oak woodlands.	✓		✓	✓	✓
97. Great Horned Owl	<i>Bubo virginianus</i>	Ye		Cliffs, woodlands.	✓		✓	✓	✓
98. Pygmy Owl	<i>Glaucidium gnoma</i>	Ye		Wooded canyons, open coniferous or mixed woods.	✓		✓		
99. Ferruginous Owl	<i>Glaucidium brasilianum</i>	Ye		Mesquite thickets, desert river woods.					
100. Elf Owl	<i>Micrathene whitneyi</i>	S		Deserts, wooded canyons.	✓				
101. Burrowing Owl	<i>Speotyto cunicularia</i>	Ye		Open grasslands, prairies, deserts.				✓	✓
102. Long-eared Owl	<i>Asio otus</i>	M-S		Mountain forests, junipers, riparian shrubs lands.	✓		✓	✓	✓
103. Short-eared Owl	<i>Asio flammeus</i>	M-W		Prairies.				✓	✓
104. Saw-Whet Owl	<i>Aegolius acadicus</i>	M,S		Forests, conifers, groves.	✓		✓		

* A- Belton-Hilo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Geogema

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
105. Spotted Owl	<i>Strix occidentalis</i>	Ye		Heavy forest, conifers, wooded canyons.					
106. Ridgway's Whip-poor-will	<i>Caprimulgus ridgwayi</i>	M-S		Rocky juniper-mesquite slopes.					
107. Whip-poor-will	<i>Caprimulgus vociferus</i>	M-S		Mountain slopes, oak-pine canyons.	✓		✓		
108. Poor-will	<i>Phalaenoptilus nuttallii</i>	S		Stony and hills, open pinon-juniper.	✓	✓	✓		
109. Common Nighthawk	<i>Chordeiles minor</i>	S		Treeless plains to mountains open pine woods.	✓	✓	✓	✓	✓
110. Lesser Nighthawk	<i>Chordeiles acutipennis</i>	S		Arid open scrub, washes.				✓	✓
111. Chimney Swift	<i>Chactura pelagica</i>	M-S		Usually close to town.	✓			✓	✓
112. Black Swift	<i>Cypseloides niger</i>	S		Mountains.					
113. White-throated Swift	<i>Aeronautes saxatalis</i>	S-M,M-W		Cliff areas, dry mountains, and canyons.	✓		✓		
114. Black Chinned Hummingbird	<i>Archilochus alexandri</i>	M-S		Semi-arid areas near water, foothill shrubs.	✓		✓	✓	✓
115. Costa's Hummingbird	<i>Calypté costae</i>	M-S		Desert washes, arid hillsides.					
116. Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>	M-S		Thickets, open undergrowth.	✓		✓		
117. Rufous Hummingbird	<i>Selasphorus rufus</i>	M-S		Forest edges.				✓	
118. Calliope Hummingbird	<i>Stellula calliope</i>	M		Canyons, forest, glades.	✓		✓		

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
119. Rivoli's Hummingbird	<i>Eugenes fulgens</i>	M-S		Canyons, forest, glades.	✓		✓		
120. Blue-throated Hummingbird	<i>Lampornis clemenciae</i>	M-S		Wooded streams in lower mountain canyons.			✓		
121. Violet-crowned Hummingbird	<i>Amazilia verticalis</i>	S		Riparian groves, agaves.					
122. Broad-billed Hummingbird	<i>Cynanthus latirostris</i>	S		Desert canyons, mesquite, agaves.					
123. Thick-billed Parrot	<i>Rhynchopsitta pachyrhyncha</i>	S		Mountains, canyons, deserts.	✓		✓		
124. Coppery-tailed Trogon	<i>Trogon elegans</i>	S		Mountain forests, pine-oak canyons.					
125. Belted Kingfisher	<i>Megaceryle alcyon</i>	S-M		Ponds.					✓
126. Red-shafted Flicker	<i>Colaptes cafer</i>	S		Groves, canyons, semi-open country.	✓		✓		✓
127. Gilded Flicker	<i>Colaptes chrysoides</i>	Ye		Deserts and river groves.					✓
128. Gila Woodpecker	<i>Centurus uropygialis</i>	Ye		Desert washes.		✓			✓
129. Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Ye		Groves, farm country.					✓
130. Lewis Woodpecker	<i>Asyndesmus Lewis</i>	S,W		River groves, burns.					✓
131. Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	Ye		High conifer forest.		✓			✓
132. Hairy Sapsucker	<i>Dendrocopos villosus</i>	Ye		Mountain forests, river groves	✓		✓		
133. Downy Sapsucker	<i>Dendrocopos pubescens</i>	Ye		Mixed forest, river groves.					✓

A - Bolsonillo Mtn., B - Pyramid Mtn., C - North Animan Mtn., D - Animan Valley, E - San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *			
					A	B	C	D
134. Ladder-backed Woodpecker	<i>Dendrocopos scalaris</i>	Ye		Deserts, canyons, arid brush.		✓	✓	
135. Arizona Woodpecker	<i>Dendrocopos arizonae</i>	Ye		Oaks in mountains, pine-oak canyons.			✓	
136. Acorn Woodpecker	<i>Melanerpes formicivorus</i>	Ye		Pine forests, riparian habitat.	✓			
137. Rose-throated Becard	<i>Platysaris aglaiae</i>	S		Wooded canyons.			✓	
138. Thick-billed Kingbird	<i>Tyrannus crassirostris</i>	M-S		Semi-arid canyons, sycamores.				✓
139. Western Kingbird	<i>Tyrannus verticalis</i>	M-S		Open country with scattered trees.				✓
140. Cassin's Kingbird	<i>Tyrannus vociferans</i>	M-S		Pine-oak mountains, ranch groves.				✓
141. Wied's Crested Flycatcher	<i>Myiarchus tyrannulus</i>	M-S		Sycamore canyons, woodlands.				✓
142. Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	M-S		Semi-arid country, mesquite, pinon-juniper.	✓	✓	✓	✓
143. Olivaceous Flycatcher	<i>Myiarchus tuberculifer</i>	M-S		Oak slopes, pine-oak canyons.	✓		✓	
144. Black Phoebe	<i>Sayornis nigricans</i>	M-W		Shady streams, walled canyons, farmlands.	✓			✓
145. Say's Phoebe	<i>Sayornis saya</i>	Ye		Open arid country, canyons mouths.			✓	✓
146. Traill's Flycatcher	<i>Empidonax traillii</i>	S		Thickets in low valley, canyons.	✓	✓	✓	✓

* A-Pedernales Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Geogeg

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *			
					A	B	C	D
147. Hammond's Flycatcher	<i>Empidonax hammondi</i>	S		High coniferous forests; in migration other trees and thickets.				
148. Dusky Flycatcher	<i>Empidonax oberholseri</i>	M,W		Mountain chaparral.	✓		✓	
149 Gray Flycatcher	<i>Empidonax wrightii</i>	M		Pinon-juniper brush.	✓	✓		✓
150. Western Flycatcher	<i>Empidonax difficilis</i>	S		Must have water and shade; canyon groves.	✓		✓	
151. Coues' Flycatcher	<i>Contopus pertinax</i>	S		Pine-oak forests, wooded canyons.	✓		✓	
152. Western Wood Peewee	<i>Contopus mordidulus</i>	M-S		Woodlands, river groves.	✓		✓	
153. Olive-sided Flycatcher	<i>Nuttallornis borealis</i>	M		Conifer forests.	✓		✓	
154. Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	M,Ye,S		Near water in desert country.	✓		✓	✓
155. Beardless Flycatcher	<i>Camptostoma imberbe</i>	S		Low woods, mesquite, stream thickets.				
156. Sulphur-Bellied Flycatcher	<i>Myiodynastes luteiventris</i>	S		Sycamores in canyons.				
157. Horned Lark	<i>Eremophila alpestris</i>	Ye		Plains, desert prairies.		✓		✓
158. Violet-Green Swallow	<i>Tachycineta thalassina</i>	M-S		Open forests, canyons.	✓		✓	
159. Tree Swallow	<i>Iridoprocne bicolor</i>	S,M		Open country near water.				
160. Bank Swallow	<i>Riparia riparia</i>	M		Usually near water.	✓			✓
161. Rough-Winged Swallow	<i>Stelgidopteryx ruficollis</i>	S		Near washes.				✓

* A - Below Elko Mts., B-Pyramid Mts., C-North Ancho Mts., D-Ancho Valley, E-San Simon Chusga

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION			
					A	B	C	D/E
162. Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	M-S		Open to semi-wooded country, farms, cliffs, canyons.	✓	✓	✓	✓
163. Purple Martin	<i>Progne subis</i>	M-S		Open forests, farms.	✓		✓	✓
164. Barn Swallow	<i>Hirundo rustica</i>	M-S		Open or semi-wooded country, farms, cliffs, canyons.	✓		✓	✓
165. Steller's Jay	<i>Cyanocitta cristata</i>	Ye		Conifers and pine-oak forests.	✓		✓	✓
166. Scrub Jay	<i>Aphelocoma coerulescens</i>	Ye		Oak-chaparral, pinon-juniper.	✓	✓	✓	✓
167. Mexican Jay	<i>Aphelocoma ultramarina</i>	Ye		Open oak forests.	✓		✓	✓
168. Pinon Jay	<i>Gymnorhinus cyanocephalus</i>	W		Pinon, juniper.	✓	✓	✓	✓
169. Clark's Nutcracker	<i>Nucifraga columbiana</i>	M		Conifers, high mountains.	✓		✓	✓
170. Black Billed Magpie	<i>Pica pica</i>	M		Foothills, ranches, prairie brush.				
171. Common Crow	<i>Corvus brachyrhynchos</i>	Ye		Woodlands, shores.				
172. Common Raven	<i>Corvus corax</i>	Ye		Mountains, deserts, canyons.	✓	✓	✓	✓
173. White-Necked Raven	<i>Crovus cryptoleucus</i>	Ye		Mainly arid country, rangelands.	✓		✓	✓
174. Mexican Chickadee	<i>Parus atricapillus</i>	Ye		Conifers, pine-oak forests.	✓		✓	✓
175. Plain Titmouse	<i>Parus inornatus</i>	Ye		Oak woods, pinon-juniper.	✓		✓	✓
176. Bridled Titmouse	<i>Parus wollweberi</i>	Ye		Oak & sycamore canyons; pine-oak woods.	✓		✓	✓
177. Verdin	<i>Auriparus flaviceps</i>	Ye		Brushy desert valleys.				✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Glenega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
178. Common Bushtit	<i>Psaltriparus minimus</i>	Ye		Oak scrub, chaparral, pinon, and juniper.	✓	✓	✓		
179. Dipper	<i>Cinclus mexicanus</i>	Ye		Fast-flowing streams.				✓	
180. White-Breasted Nuthatch	<i>Sitta carolinesis</i>	Ye		Mixed forests.					
181. Red-Breasted Nuthatch	<i>Sitta canadensis</i>	M,S		Conifer forests.					
182. Pygmy Nuthatch	<i>Sitta pygmaea</i>	Ye,W		Pines.		✓		✓	
183. Brown Creeper	<i>Certhia familiaris</i>	Ye,S		Mature forests and groves.	✓			✓	✓
184. House Wren	<i>Troglodytes aedon</i>	S		Mature forests.		✓			✓
185. Winter Wren	<i>Troglodytes troglodytes</i>	S		Coniferous forests, underbrush.					
186. Bewick's Wren	<i>Thryomanes bewickii</i>	Ye		Thickets, pinon-juniper.		✓		✓	
187. Cactus Wren	<i>Campylorhynchus brunneicapillum</i>	Ye		Cactus, yucca, mesquite.	✓		✓	✓	✓
188. Long-Billed Marsh Wren	<i>Telmatodytes palustris</i>	W		Marshes (cattails, brackish water).					✓
189. Canyon Wren	<i>Catherpes mexicanus</i>	S,Ye		Cliffs, canyons, stone buildings.	✓			✓	
190. Rock Wren	<i>Salpinctes obsoletus</i>	Ye		Plains to high mountains; rocky slopes.		✓	✓	✓	
191. Mockingbird	<i>Mimus polyglottos</i>	Ye		Farms, mesquite, desert stream sides	✓	✓	✓	✓	✓

* A-Palomillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
192. Bendire's Thrasher	<i>Toxostoma bendirei</i>	S		Desert farmland, mesquite, salt-brush.	✓	✓	✓	✓	✓
193. Curve-Billed Thrasher	<i>Toxostoma curvirostre</i>	Ye		Desert and arid brush.				✓	✓
194. Le Conte's Thrasher	<i>Toxostoma lecontei</i>	Ye		Desert flats with sparse brush.					✓
195. Crissal Thrasher	<i>Toxostoma dorsale</i>	Ye		Dense brush along desert streams, mesquite thickets.	✓			✓	✓
196. Sage Thrasher	<i>Oreoscoptes montanus</i>	M,W		Brushy slopes, stream sides.	✓		✓	✓	✓
197. Robin	<i>Turdus migratorius</i>	Ye		Open forest, stream sides.	✓	✓	✓	✓	✓
198. Hermit Thrush	<i>Hylocichla ustulata</i>	Ye		Conifer or mixed woods; in winter thickets.	✓		✓	✓	✓
199. Swainson's Thrush	<i>Hylocichla fuscescens</i>	S		River woods, forest undergrowth.	✓		✓	✓	✓
200. Eastern Bluebird	<i>Sialia sialis</i>	M-W		Open country with scattered trees			✓	✓	✓
201. Western Bluebird	<i>Sialia mexicana</i>	Ye		Scattered trees, open conifer forests, farms.	✓		✓	✓	✓
202. Mountain Bluebird	<i>Sialia currucoides</i>	Ye		Open terrain with scattered trees			✓	✓	✓
203. Townsend's Solitaire	<i>Myadestes townsendi</i>	Ye,M,W		Mountain forests, canyons, juniper			✓	✓	✓
204. Blue-Gray Gnatcatcher	<i>Polioptila caerulea</i>	S		Open mixed woods.	✓		✓	✓	✓
205. Black-Tailed Gnatcatcher	<i>Polioptila melanura</i>	S		Desert brush, dry washes	✓	✓	✓	✓	✓

* A-Palomcillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
206. Golden-Crowned Kinglet	<i>Regulus satrapa</i>	Ye, M-W		Conifers, particularly spruce-fir.					
207. Ruby-Crowned Kinglet	<i>Regulus calendula</i>	Ye, W		Conifer forests, thickets.	✓		✓		
208. Water Pipit	<i>Anthus spinoletta</i>	W		Plains, bare fields.				✓	✓
209. Bohemian Waxwing	<i>Bombycilla garrula</i>	M		Widespread in search of berries.				✓	✓
210. Cedar Waxwing	<i>Bombycilla cedrorum</i>	W, M		Open woodlands.	✓			✓	✓
211. Phainopepla	<i>Phainopepla nitens</i>	W		Desert shrub, mesquite.				✓	✓
212. Northern Shrike	<i>Lanius excubitor</i>	M		Semi-open or open country with lookout posts.				✓	✓
213. Loggerhead Shrike	<i>Lanius ludovicianus</i>	Ye		Open country with lookout post, low shrubs.	✓	✓	✓	✓	✓
214. Starling	<i>Sturnus vulgaris</i>	Ye		Ranches, open country, groves.	✓			✓	✓
215. Hutton's Vireo	<i>Vireo huttoni</i>	S		Woods and adjacent brush; prefers oak.			✓		
216. Bell's Vireo	<i>Vireo bellii</i>	S		Thickets along streams, mesquite.					
217. Gray Vireo	<i>Vireo vicinior</i>	M-S		Bushy mountains, open chaparral, shrub oaks; juniper.	✓	✓	✓	✓	✓
218. Solitary Vireo	<i>Vireo solitarius</i>	S		Mixed forests, pine, oak woods.	✓		✓		
219. Warbling Vireo	<i>Vireo gilvus</i>	S		Deciduous and mixed woods, shade trees.	✓		✓		

* A-Palomar Mts., B-Pinnacled Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
220. Orange-Crowned Warbler	<i>Vermivora celata</i>	S,M		Brushy woodlands, clearings, pine.	✓	✓	✓	✓	✓
221. Virginia's Warbler	<i>Vermivora virginiae</i>	S		Oak canyons, brushy slopes, pinon			✓		
222. Lucy's Warbler	<i>Vermivora luciae</i>	S		Mesquite along desert streams.	✓				✓
223. Tennessee Warbler	<i>Vermivora peregrina</i>	M		Deciduous and mixed forests, groves and bushes.					✓
224. Nashville Warbler	<i>Vermivora ruficapilla</i>	M		Open mixed woods with undergrowth forests edges.	✓		✓	✓	✓
225. Parula Warbler	<i>Parula americana</i>	Sp		Open country during migrations.					
226. Black-Throated Blue Warbler	<i>Dendroica caerulescens</i>	F		Plains areas when migrating.					
227. Blackpoll Warbler	<i>Dendroica striata</i>	Sp		Various trees in migration.					
228. Yellow Warbler	<i>Dendroica petechia</i>	S		Willows, poplars, streamside shrubs.				✓	✓
229. Myrtle Warbler	<i>Dendroica coronata</i>	Sp		Coniferous and mixed forests, river thickets, brush.					
230. Audubon's Warbler	<i>Dendroica auduboni</i>	M, Ye		Conifer forests in winter open woods, brush thickets.	✓		✓	✓	✓
231. Black-Throated Gray Warbler	<i>Dendroica nigrescens</i>	S		Conifer forests.	✓		✓		✓
232. Townsend's Warbler	<i>Dendroica townsendi</i>	M, Sp		Tall conifers, cool fir forests.	✓		✓		

* A- Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Glenaga

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
233. Hermit Warbler	<i>Dendroica occidentalis</i>	F		Conifer forests; in migration other trees.	✓			✓	✓
234. Grace's Warbler	<i>Dendroica graciae</i>	S		Pine-oak forests of mountains.	✓			✓	
235. Black & White Warbler	<i>Mniotilta varia</i>	W		Woodlands, trunks, and limbs of trees.					
236. Olive Warbler	<i>Peucedramus taeniatus</i>	Ye,S		Pine and fir forests of high mountains.	✓		/		
237. MacGillivray's Warbler	<i>Oporornis tolmiei</i>	M		Low dense undergrowth; shady damp thickets.	✓			/	/
238. Wilson's Warbler	<i>Wilsonia pusilla</i>	M		Thickets along woodland streams, moist tangles, low shrubs.	✓			✓	
239. Red-Faced Warbler	<i>Cardellina rubrifrons</i>	S		Open forest in high mountains.	✓			✓	
240. Yellowthroat	<i>Geothlypis trichas</i>	M		Swamp, marshes, wet thickets.	✓			/	/
241. Yellow-breasted Chat	<i>Icteria virens</i>	S		Streams tangles, briars, moist canyons.				✓	✓
242. American Redstart	<i>Setophaga ruticilla</i>	M		Second growth deciduous woods.	✓			✓	
243. Painted Redstart	<i>Setophaga picta</i>	S		Oak canyons pine-oak forests in mountains.	✓			✓	
244. House Sparrow	<i>Passer domesticus</i>	Ye		Cities, towns, and farms.	✓			/	/
245. Eastern Meadowlark	<i>Sturnella magna</i>	Ye		Open fields, meadows, plains, and deserts.				/	✓
246. Western Meadowlark	<i>Sturnella neglecta</i>	W		Open fields, meadows, plains, and deserts.				✓	✓

* A-Peloneillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
247. Yellow-Headed Blackbird	Xanthocephalus xanthocephalus	M		Fresh-water marshes; forages in fields in open country.	✓			✓	✓
248. Red-Winged Blackbird	Agelaius phoeniceus	Ye		Marshes, hayfields; forages in cultivated land and edge of water	✓			✓	✓
249. Orchard Oriole	Icterus spurius	M		Orchards, farms, towns.				✓	✓
250. Hooded Oriole	Icterus cucullatus	S		Open woodlands, thickets, shade trees.				✓	✓
251. Scott's oriole	Icterus parisorum	S		Dry woods and shrub in desert mountains; yucca forest, oak slopes, pinons, shrubby grasslands.	✓	✓	✓	✓	✓
252. Bullock's Oriole	Icterus bullockii	S		River groves, open oak woods, towns, farms.	✓			✓	✓
253. Brewer's Blackbird	Euphagus cyanocephalus	W		Varied open country, fields, farms, parks, cities.	✓			✓	✓
254. Boat-Tailed Grackle	Cassidix mexicanus	Ye		Riversides, groves, thickets, towns.				✓	✓
255. Brown-Headed Cowbird	Molothrus ater	S		River groves, open oak woods, towns, and farms.	✓			✓	✓
256. Bronzed Cowbird	Tangavius aeneus	S		Crop lands, brush, semi-open country.				✓	✓
257. Western Tanager	Piranga ludoviciana	S		Open conifer or mixed forests; riparian woodlands adjacent to mountains.	✓		✓	✓	✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
258. Hepatic Tanager	<i>Piranga flava</i>	S		Open mountain forest; oaks, pines	✓		✓		
259. Summer Tanager	<i>Piranga rubra</i>	M-S		River woods, cottonwoods, willow groves.	✓			✓	✓
260. Cardinal	<i>Richmondena cardinalis</i>	Ye		Woodland edges, river thickets, towns.	✓		✓		✓
261. Pyrrhuloxia	<i>Pyrrhuloxia sinuata</i>	M		Mesquite, thorn shrubs, deserts.	✓			✓	✓
262. Rose-Breasted Grosbeak	<i>Pheucticus ludovicianus</i>	M		Light deciduous woods.	✓		✓	✓	✓
263. Black-Headed Grosbeak	<i>Pheucticus melanocephalus</i>	S		Pine-oak woods.	✓		✓		✓
264. Indigo Bunting	<i>Passerina cyanea</i>	S		Riparian and adjacent shrubland areas.	✓			✓	✓
265. Lazuli Bunting	<i>Passerina amoena</i>	M		Broken, brushy slopes.	✓	✓	✓	✓	✓
266. Varied Bunting	<i>Passerina versicolor</i>	S		Brush, evergreen shrublands.				✓	✓
267. Painted Bunting	<i>Passerina ciris</i>	S,M		Woodland edges, roadsides, brushy stream side growth.	✓			✓	✓
268. Evening Grosbeak	<i>Hesperiphona vespertina</i>	S,W		Conifer forests, in winter, fruiting shrubs.	✓		✓	✓	✓
269. Blue Grosbeak	<i>Guiraca caerulea</i>	S		Brushy weedy areas, river thickets.	✓			✓	✓
270. Pine Grosbeak	<i>Pinicola enucleator</i>	M		Conifer forests.					
271. Purple Finch	<i>Carpodacus purpureus</i>	W		Mixed and conifer woodlands.					

* A-Peloneillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
272. Cassin's Finch	<i>Carpodacus cassinii</i>	W		Open coniferous forests of high mountains.	✓		✓		
273. House Finch	<i>Carpodacus mexicanus</i>	Ye		Towns, ranches, open woods, canyons, deserts.	✓			✓	✓
274. Pine Siskin	<i>Spinus pinus</i>	Ye		Conifer forests, mixed woods.	✓		✓		
275. American Goldfinch	<i>Spinus tristis</i>	W,M		River groves, poplars, orchards.	✓			✓	✓
276. Lesser Goldfinch	<i>Spinus psaltria</i>	W		Open brushy country, wooded streams.	✓			✓	✓
277. Lawrence's Goldfinch	<i>Spinus lawrencei</i>	W		Open oak or oak-pine woods, dry chaparral edges.	✓		✓		
278. Red Crossbill	<i>Loxia curvirostra</i>	S,Ye		Conifer forests, and groves, pine-oak woodlands.	✓		✓		
279. Green-Tailed Towhee	<i>Chlorura chlorura</i>	W		Dry brushy mountain slopes, low chaparral, open pines.					
280. Rufous-Sided Towhee	<i>Pipilo erythrophthalmus</i>	Ye		Brush, chaparral, undergrowth.	✓	✓	✓	✓	✓
281. Brown Towhee	<i>Pipilo fuscus</i>	Ye		Brushy, stony areas, open woods, pinon-juniper.	✓	✓	✓	✓	✓
282. Abert's Towhee	<i>Pipilo aberti</i>	Ye		Desert streams, brush, mesquite.				✓	✓
283. Lark Bunting	<i>Calamospiza melanocorys</i>	E		Plains, prairies; in winter also arid brush, desert shrubs.				✓	✓
284. Savannah Sparrow	<i>Passerculus sandwichensis</i>	W		Prairies, fields, meadows, salt marshes.	✓			✓	✓

* A-Peloncillo Mts.. B-Pyramid Mts.. C-North Animas Mts.. D-Animas Valley. E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
285. Grasshopper Sparrow	<i>Ammodramus savannarum</i>	M,W		Grassland, hay meadows.				✓	
286. Baird's Sparrow	<i>Ammodramus bairdii</i>	F		Long grass prairies.				✓	
287. Lark Sparrow	<i>Chondestes grammacus</i>	S		Open country with bushes, trees, open brush, farms.	✓			✓	✓
288. Vesper Sparrow	<i>Poocetes gramineus</i>	W		Fields (sparse brush), open country, roadsides.				✓	✓
289. Rufous-Crowned Sparrow	<i>Aimophila carpalis</i>	Ye		Grassy or rocky slopes with sparse low bushes; open pine-oak woods.	✓	✓	✓	✓	✓
290. Black-Throated Sparrow	<i>Amphispiza bilineata</i>	Ye		Arid brush, creosote-bush deserts, "cholla gardens".	✓	✓	✓	✓	✓
291. Sage Sparrow	<i>Amphispiza belli</i>	W		Dry, brushy foothills; in winter, deserts.					
292. Slate-Colored Junco	<i>Junco hyemalis</i>	W		Coniferous and mixed woods.	✓		✓		
293. Oregon Junco	<i>Junco oreganus</i>	W		Conifer and mixed forests; in winter, also roadsides, brush parks.	✓		✓	✓	✓
294. Gray-Headed Junco	<i>Junco caniceps</i>	W		Mountain forests.	✓		✓		
295. Mexican Junco	<i>Junco phaeonotus</i>	Ye		Conifer forests, tall pine-oak woods.	✓		✓		
296. Chipping Sparrow	<i>Spizella passerina</i>	Ye		Open woodlands, conifers, farms.	✓		✓		
297. Clay-Colored Sparrow	<i>Spizella pallida</i>	M		Open brush, "park lands", brushy prairies.	✓			✓	✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animos Mts., D-Animos Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

BIRDS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *					
					A	B	C	D	E	
298. Brewer's Sparrow	<i>Spizella breweri</i>	W		Sagebrush, bushy plains; weedy areas in winter.					✓	✓
299. Black-Chinned Sparrow	<i>Spizella atrogularis</i>	S		Brushy mountains slopes, open chaparral.	✓	✓	✓			
300. Botteri's Sparrow	<i>Aimophila botterii</i>	S		Coarse desert grass. No record in New Mexico. Could rarely occur.						
301. Cassin's Sparrow	<i>Aimophila cassinii</i>	W		Arid grassy country with bushes.					✓	✓
302. Rufous-Winged Sparrow	<i>Aimophila carpalis</i>	Ye		Tall desert grass (tobosa).						
303. Harris' Sparrow	<i>Zonotrichis querula</i>	M,W		Pinon-juniper areas, brushy edges open woodlands.	✓	✓	✓	✓	✓	✓
304. White-Crowned Sparrow	<i>Zonotrichia leucophrys</i>	W		Scattered cover; low brush; in winter, town gardens, roadsides.	✓			✓	✓	✓
305. Golden-Crowned Sparrow	<i>Zonotrichia atricapilla</i>	M		Desert shrubs in winter.				✓	✓	
306. White-Throated Sparrow	<i>Zonotrichia albicollis</i>	M,W		Woodland undergrowth, thickets, brush.	✓			✓	✓	
307. Fox Sparrow	<i>Passerella iliaca</i>	M		Stunted boreal woodlands, mountain chaparral.	✓	✓	✓	✓	✓	✓
308. Lincoln's Sparrow	<i>Melospiza lincolni</i>	W		Willow and alder thickets; in winter, tall weeds, bushes.	✓			✓	✓	
309. Swamp Sparrow	<i>Melospiza georgiana</i>	W		Brushy marshes.				✓	✓	

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR BIRDS LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
310. Song Sparrow	Melospiza melodia	W		Thickets, roadsides, marshes, gardens.	✓			✓	✓
311. Mc Cown's Longspur	Rhynchophanes mccownii	W		Plains and prairies.				✓	✓
312. Chestnut-Collared Longspur	Calcarius ornatus	W		Plains and prairies.				✓	✓
313. Canada Goose	Branta canadensis	M-W		Lakes, reservoirs, marshes, prairies, grain fields.				✓	✓
314. Snow Goose	Chen hyperborea	M-W		Large bodies of waters and grain fields.				✓	✓

* A-Peloneillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFI- CATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
1. Couch's Spadefoot Toad	<i>Scaphiopus couchi</i>	Ye		Shortgrass plains, mesquite, and creosote bush desert, other areas of low rainfall		✓			✓
2. Western Spadefoot Toad	<i>Scaphiopus hammondi</i>	Ye		Desert streams, grassland.	✓		✓		✓
3. Plains Spadefoot Toad	<i>Scaphiopus bombifrons</i>	Ye		Plains, hills, and river bottoms in shortgrass prairie regions of low rainfall				✓	✓
4. Woodhouse's Toad	<i>Bufo woodhousei</i>	Ye		Grasslands, woods in semi-arid areas. Breeds in brooks and streams.	✓		✓		✓
5. Great Plains Toad	<i>Bufo cognatus</i>	Ye		Prairies or deserts. Breeds after heavy rains in temporary pools.				✓	✓
6. Colorado River Toad	<i>Bufo alvarius</i>	Ye		Arid mesquite, creosote bush lowlands to oak-sycamore canyons. Usually near permanent water.	✓			✓	✓
7. Green Toad	<i>Bufo debilis</i>	Ye		Arid and semi-arid plains.				✓	✓
8. Red-spotted Toad	<i>Bufo punctatus</i>	Ye		Desert oasis, open grassland, rocky canyons and arroyos.	✓	✓		✓	✓
9. Canyon Treefrog	<i>Hyla arenicolor</i>	Ye		Intermittent or permanent streams with rocky pools, sometimes arroyos.	✓			✓	✓
10. Leopard Frog	<i>Rana pipiens</i>	Ye		From desert lowlands to high mountains. Permanent water and aquatic vegetation.	✓			✓	✓

* A-Palomilla Mts., B-Pyramid Mts., C-North Animan Mts., D-Animan Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR REPTILES
AMPHIBIANS LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
11. Bullfrog	<i>Rana catesbeiana</i>	Ye		Near permanent water. Usually aquatic vegetation present				✓	✓
12. Yellow Mud Turtle	<i>Kinosternon flavescens</i>	Ye		Aquatic. Semi-arid grasslands and open woodland. Permanent and intermittent streams.	✓				✓
13. Sonora Mud Turtle	<i>Kinosternon sonoriense</i>	Ye		Woodlands of oak, pinon or ponderosa pine and Douglas fir.	✓	✓	✓		
14. Western Box Turtle	<i>Terrapene ornata</i>	Ye		Prairies, treeless plains of rolling country of predominately grass in sandy soil.				✓	✓
15. Spiny Softshell	<i>Trionyx spiniferus</i>	Ye		Rivers with quiet water with mud, sand, or gravel bottoms.				✓	✓
16. Banded Gecko	<i>Coleonyx variegatus</i>	Ye		Creosote bush flats to pinon-juniper belt, also cat claw, cedar, grama grass association.	✓	✓	✓	✓	✓
17. Lesser Earless Lizard	<i>Holbrookia maculata</i>	Ye		Plains areas mostly where there are exposed areas of sand or gravel.				✓	
18. Greater Earless Lizard	<i>Holbrookia texana</i>	Ye		Cactus, mesquite, ocotillo, creosote sandy, gravelly soils of flats, washes.	✓	✓	✓	✓	✓
19. Zebra-Tailed Lizard	<i>Callisaurus draconoides</i>	Ye		Washes, desert pavements, where vegetation is sparse.				✓	✓
20. Collared Lizard	<i>Grotaphytus collaris</i>	Ye		Rocky areas in gullies, alluvial fans. Sparse vegetation.	✓	✓	✓		

* A-Palomar Mts., B-Pyramid Mts., C-North Animan Mts., D-Animan Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR
REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
21. Leopard Lizard	<i>Grotaphytus wislizenii</i>	Ye		Arid and semi-arid plains grown to bunch grass, sagebrush, creosote bush. Soils of gravel, sand.		✓		✓	✓
22. Bunch Grass Lizard	<i>Sceloporus scalaris</i>	Ye		Isolated mountains above 6,000 ft level. Bunch grass areas in open coniferous forests.	✓		✓		
23. Yarrow's Spiny Lizard	<i>Sceloporus jarrovi</i>	Ye		Mountains, rocky canyons and hillsides in oak and pine belts, mostly above 5,000 ft.	✓		✓		
24. Crevice Spiny Lizard	<i>Sceloporus poinsetti</i>	Ye		Rocky canyons, gullies in arid and semi-arid areas.	✓	✓	✓		
25. Desert Spiny Lizard	<i>Sceloporus magister</i>	Ye		Plains and lower slopes of mountains in arid and semi-arid areas. Creosote, shad-scale, juniper and mesquite.	✓	✓	✓	✓	✓
26. Clark's Spiny Lizard	<i>Sceloporus clarki</i>	Ye		Lower mountain slopes in pine-oak belt, chiefly a tree dweller.	✓		✓	✓	
27. Eastern Fence Lizard	<i>Sceloporus undulatus</i>	Ye		Forests, prairies, bushy flatlands, sand dunes, and rocky hillsides.	✓	✓	✓	✓	
28. Striped Plateau Lizard	<i>Sceloporus virgatus</i>	Ye		Mountainous areas in pine-oak woods, 5,300-7,000 ft. Along streams to 4,900 ft.	✓		✓		
29. Side-Blotched Lizard	<i>Uta stansburiana</i>	Ye		Arid and semi-arid areas of sand, rock, hardpan with low-growing vegetation.		✓		✓	

* A-Palomcillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR

REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *			
					A	B	C	D E
30. Tree Lizard	<i>Urosaurus ornatus</i>	Ye		Mesquite, oak, pinon, juniper, cottonwood, salt cedar.	✓	✓	✓	✓
31. Texas Horned Lizard	<i>Phrynosoma cronutum</i>	Ye		Arid, semi-arid country with sparse vegetation, bunch grass, cactus, mesquite.				✓
32. Short-horned Lizard	<i>Phrynosoma douglassi</i>	Ye		Semi-arid plains to mountains. Shortgrass prairies, pinon-juniper, spruce-fir.	✓	✓	✓	✓
33. Round-tailed Horned Lizard	<i>Phrynosoma modestum</i>	Ye		Sandy or gravelly soils of plains washes in arid or semi-arid habitats.				✓
34. Great Plains Skink	<i>Eumeces obsoletus</i>	Ye		Grasslands and woodlands from plains to mountains.	✓	✓	✓	✓
35. Many-lined Skink	<i>Eumeces multivirgatus</i>	Ye		Shortgrass prairie to mountains. Creosote desert to dense stream-side growth.	✓	✓	✓	✓
36. Little striped Whiptail	<i>Cnemidophorus inornatus</i>	Ye		Prairie grasslands, but ranges into pinon-juniper.	✓	✓	✓	✓
37. Desert-Grassland Whiptail	<i>Cnemidophorus uniparens</i>	Ye		Deserts of mesquite grassland. Plains and gentle foothills.	✓	✓		✓
38. Chihuahua Whiptail	<i>Cnemidophorus exsanguis</i>	Ye		Desert and desert grassland to oak-pine forests. Rocky hillsides, sandy alluvium washes.	✓	✓	✓	✓
39. Giant Spotted Whiptail	<i>Cnemidophorus burti</i>	Ye		Mountain canyons arroyos and mesas in arid and semi-arid regions. Dense vegetation among rocks.	✓	✓	✓	

* A- Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR
REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
40. Western Whiptail	<i>Cnemidophorus tigris</i>	Ye		Semi-arid habitat of sparse plants		✓			✓
41. Checkered Whiptail	<i>Cnemidophorus tesselatus</i>	Ye		Cresote bush plains to pinon zone. Rocky areas with scant vegetation.			✓		✓
42. Arizona Alligator Lizard	<i>Gerrhonotus kingi</i>	Ye		Mountains with chaparral, oak woodland, pine-fir forests in rocky areas.	✓			✓	
43. Gila Monster	<i>Heloderma suspectum</i>	Ye		Lower mountain slopes, outwash plains in arid and semi-arid regions. Arroyos with intermittent streams.	✓	✓	✓	✓	
44. Western Blind Snake	<i>Leptotyphlops humilis</i>	Ye		Desert to brush-covered mountains slopes where soils are suitable for burrowing.	✓	✓	✓	✓	
45. Texas Blind Snake	<i>Leptotyphlops dulcis</i>	Ye		Prairies, canyon bottoms, rocky or sand deserts.				✓	✓
46. Western Hognose Snake	<i>Heterodon nasicus</i>	Ye		Sandy or gravelly prairies and river flood plains. Semi-desert.				✓	✓
47. Ringneck Snake	<i>Diadaphis punctatus</i>	Ye		Moist habitats in woodland, forest grassland, and chaparral. Arid areas in mountains and by water courses.	✓			✓	
48. Coachwhip	<i>Masticophis flagellum</i>	Ye		Desert, prairie, brushland, and woodland, avoids dense vegetation.			✓		✓
49. Striped Whipnake	<i>Masticophis taeniatus</i>	Ye		Brushlands, grasslands, pinon-juniper, open pine forests.	✓	✓	✓	✓	

* A-Palomilla Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR
REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION *			
					A	B	C	DE
50. Sonora Whipsnake	<i>Masticophis bilineatus</i>	Ye		Semi-arid lower mountain slopes with grass, ocotillo, brushlands, pine-oak.	✓	✓	✓	
51. Western Patch-Nosed Snake	<i>Salvadora hexalepis</i>	Ye		Grasslands, chaparral, desert shrub. Sandy and rocky areas on lower mountains.	✓	✓	✓	✓
52. Mountain Patch-nosed Snake	<i>Salvadora grahamiae</i>	Ye		Roughlands, rocky canyons, mountain slopes.	✓	✓	✓	
53. Glossy Snake	<i>Arizona elegans</i>	Ye		Chaparral covered slopes, grassland, light brushy and barren desert.	✓		✓	✓
54. Bull Snake	<i>Pituophis melanoleucus</i>	Ye		Lowlands high into mountains. Most vegetative types.	✓	✓	✓	✓
55. Common Kingsnake	<i>Lampropeltis getulus</i>	Ye		Coniferous forests, river bottoms prairie and desert. Rock outcrops with clumped vegetation.	✓	✓	✓	✓
56. Sonora Mountain Kingsnake	<i>Lampropeltis pyromelana</i>	Ye		Mountains; pinon-juniper, pinon and chaparral belts.	✓	✓	✓	
57. Long-nosed Snake	<i>Rhinocheilus lecontei</i>	Ye		Desert prairies and brushland.				✓
58. Black-Necked Garter Snake	<i>Thamnophis cyrtopsis</i>	Ye		Desert grasslands, mesquite flats, chaparral-covered hillsides.	✓	✓	✓	✓
59. Checkered Garter Snake	<i>Thamnophis marci</i>	Ye		Lowlands around ponds, springs in arid and semi-arid areas.	✓			✓
60. Western Ground Snake	<i>Sonora semiannulata</i>	Ye		Arid and semi-arid areas, river bottoms, desert flats, sand dunes, rocky hillsides. <u>Crocoate.</u>	✓			✓

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

SEASON OF USE AND HABITAT FOR REPTILES
AMPHIBIANS

LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFICATION	HABITAT	SPECIES DISTRIBUTION #			
					A	B	C	D E
61. Western Hook-nosed Snake	<i>Gyalopion canum</i>	Ye		Semi-arid areas of grass, pinon-juniper and scrubby plant growth.	✓	✓	✓	✓
62. Plains Black-headed Snake	<i>Tantilla nigriceps</i>	Ye		Shortgrass prairie, brushland, woodland.				✓
63. Western Black-headed Snake	<i>Tantilla planiceps</i>	Ye		Arid areas of grassland, woodland brush and desert. Mesquite, sotol, agrave, yucca, creosote, ocotillo.		✓		✓
64. Night Snake	<i>Hypsiglena torquata</i>	Ye		Plains, chaparral, deserts, woodland to lower mountain slopes.	✓	✓	✓	✓
65. Sonora Lyre Snake	<i>Trimorphodon lambda</i>	Ye		Desert, desert-grassland, pinon-juniper. Chiefly rocky canyons and hillsides.	✓	✓	✓	✓
66. Arizona Coral Snake	<i>Micruroides euryxanthus</i>	Ye		Arid and semi-arid areas of thorn shrub, brushland, woodland, grassland.			✓	✓
67. Massasauga or Pygmy Rattlesnake	<i>Sistrurus catenatus</i>	Ye		Desert grassland in low areas of rank growth.				✓
68. Western Diamondback Rattlesnake	<i>Crotalus atrox</i>	Ye		Desert, grassland, brushland. Rank growth of river bottoms, rocky canyons.	✓	✓	✓	✓
69. Rock Rattlesnake	<i>Crotalus lepidus</i>	Ye		Mountain areas along rocky ridges, gorges in arid and semi-arid areas.	✓		✓	
70. Black-tailed Rattlesnake	<i>Crotalus molossus</i>	Ye		Mountain ranges in rockslides, cliffs, rocky stream courses. Avoids barren deserts.	✓		✓	

* A-Peloncillo Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Cienega

REPTILES
SEASON OF USE AND HABITAT FOR _____ AMPHIBIANS _____ LIKELY TO OCCUR IN THE PROPOSED GEOTHERMAL AREA

COMMON NAME	SCIENTIFIC NAME	SEASONS OF USE	CLASSIFI- CATION	HABITAT	SPECIES DISTRIBUTION *				
					A	B	C	D	E
71. Western Rattlesnake	<i>Crotalus viridis</i>	Ye		Grassland, woodlands. Avoids deserts. Generally in rocky areas.	✓			✓	✓
72. Ridge-nosed Rattlesnake	<i>Crotalus willardi</i>	Ye		High mountain snake of pine-oak, pine-fir belts. Canyon bottoms.	✓			✓	
73. Twin-Spotted Rattlesnake	<i>Crotalus pricei</i>	Ye		High mountains of pine-oak and coniferous forests.	✓			✓	
74. Mojave Rattlesnake	<i>Crotalus scutulatus</i>	Ye		High deserts, low mountains, barren desert, grass and brushlands. Not common in rocky areas or dense vegetation.	✓	✓			✓

* A-Palomello Mts., B-Pyramid Mts., C-North Animas Mts., D-Animas Valley, E-San Simon Glenega

STATE GAME COMMISSION'S
REGULATION NO. 563

As adopted January 24, 1975

Pursuant to the authority vested in the State Game Commission by the provisions of Section 53-2-54, New Mexico Statutes Annotated, 1953 Compilation, the following regulation is hereby made and adopted concerning:

PROTECTION OF ENDANGERED SPECIES AND SUBSPECIES OF NEW MEXICO

The following forms of wildlife indigenous to New Mexico are found to be endangered within New Mexico, as the term "endangered" is defined by Section 53-2-51 D, and are therefore declared to be subject to the provisions of Section 53-2-50 through 53-2-59, New Mexico Statutes Annotated, 1953 Compilations:

ENDANGERED SPECIES AND SUBSPECIES OF NEW MEXICO

Group No. 1. Species and subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

Mammals

white-sided jackrabbit, *Lepus callotis gaillardii*
black-footed ferret, *Mustela nigripes*
river otter, *Lutra canadensis sonora*
jaguar, *Felis onca arizonensis*

Birds

Mexican duck, *Anas diazi novimexicana*
(southern) bald eagle, *Haliaeetus leucocephalus leucocephalus*
caracara, *Caracara cheriway audubonii*
peregrine falcon, *Falco peregrinus anatum*
aplomado falcon, *Falco femoralis septentrionalis*
white-tailed ptarmigan, *Lagopus leucurus altipetens*
sharp-tailed grouse, *Pediceetes phasianellus columbianus*
sage grouse, *Centrocercus urophasianus*
coppery-tailed trogon, *Trogon elegans canescens*
buff-breasted flycatcher, *Empidonax fulvifrons pygmaeus*
sulphur-bellied flycatcher, *Myiodynastes luteiventris swarthi*
whooping crane, *Grus americana*
(added by commission action on Dec. 5, 1975)

Reptiles

Gila monster, *Heloderma suspectum suspectum*
(Chihuahuan) ridge-nosed rattlesnake, *Crotalus willardi silus*

Fish

shovelnose sturgeon, *Scaphirhynchus platyrhynchus*
American eel, *Anguilla nostratu*
Gila trout, *Salmo gila*
Colorado River squawfish, *Ptychocheilus lucius*
bluntnose shiner, *Notropis simus*
beautiful shiner, *Notropis formosus*
proserpine shiner, *Notropis proserpinus*
Pecos gambusia, *Gambusia nobilis*
Gila topminnow, *Poeciliopsis occidentalis occidentalis*

- Group No. 2. Species and subspecies whose prospects of survival or recruitment within the state are likely to be in jeopardy within the foreseeable future.

Mammals

Mexican long-tongued bat, *Choeronycteris mexicana*
Sanborn's long-nosed bat, *Leptonycteris sanborni nivalis*
southern yellow bat, *Lasiurus ega xanthinus*
(Arizona) black-tailed prairie dog, *Cynomys ludovicianus arizonensis*
southern pocket gopher, *Thomomys umbrinus emotus*
prairie vole, *Microtus ochrogaster* ssp.
coati mundi, *Nasua narica molaris*
marten, *Martes americana origenes*
mink, *Mustela vison energumenos*

Birds

olivaceous cormorant, *Phalacrocorax olivaceus* ssp.
Mississippi kite, *Ictinia mississippiensis*
black hawk, *Buteogallus anthracinus anthracinus*
osprey, *Pandion haliaetus carolinensis*
(Mexican) turkey, *Meleagris gallopavo mexicana*
buff-collared nightjar, or Ridgway's whip-poor-will,
Caprimulgus ridgwayi
violet-crowned hummingbird, *Amazilia violiceps ellioti*
broad-billed hummingbird, *Cyananthus latirostris*
blue-throated hummingbird, *Lampornis clemenciae* ssp.
red-headed woodpecker, *Melanerpes erythrocephalus caurinus*
Gila woodpecker, *Centurus uropygialis uropygialis*
thick-billed kingbird, *Tyrannus crassirostris pompalis*
beardless flycatcher, *Camptostoma imberbe ridgwayi*
Mexican chickadee, *Parus sclateri eidos*
Bell's vireo, *Vireo bellii* ssp.
varied bunting, *Passerina versicolor* ssp.

spikedace, *Meda fulgida*
rainwater killifish, *Lucania parva*
Pecos pupfish, *Cyprinodon sp.*
"Chihuahua" pupfish, *Cyprinodon sp.*
White Sands pupfish, *Cyprinodon tularosa*
bigscale logperch, *Percina macrolepida*
Pecos darter, *Etheostoma lepidum*
mottled sculpin, *Cottus bairdi*
brook stickelback, *Culaea inconstans*

Several now-rare mammals that occur or have occurred in New Mexico have rather wide home ranges, and their occasional occurrence in New Mexico in the past may not indicate that the species now occurs here regularly. Until regularity of occurrence in New Mexico can be established for such species, including gray wolf (*Canis lupus youngi*, *C. l. baileyi*) and grizzly bear (*Ursus arctos nelsoni*), their inclusion in the New Mexico endangered list is not indicated, except, as in the case of jaguar, to conform to any listing by the Secretary of the Interior pursuant to the federal Endangered Species Act of 1973.

Baird's sparrow, *Ammodramus bairdii*
Mexican junco, *Junco phaeonotus palliatus*
McCown's longspur, *Calcarius mccowni*

Reptiles

smooth softshell turtle, *Trionyx muticus muticus*
(western) spiny softshell turtle, *Trionyx spiniferus hartwegi*
(Texas) slider turtle, *Pseudemys concinna texana*
Bunchgrass lizard, *Sceloporus scalaris*
(sanddune) sagebrush lizard, *Sceloporus graciosus arenicolous*
mountain skink, *Eumeces callicephalus*
giant spotted whiptail lizard, *Cnemidophorus burti stictogrammus*
rough green snake, *Ophiodrys aestivus*
(Sonora) coachwhip, *Masticophis flagellum cingulum*
(blotched) plain-bellied water snake, *Natrix erythrogaster transversa*
narrow-headed garter snake, *Thamnophis refipunctatus*
(Pecos) western ribbon snake, *Thamnophis proximus diabolicus*
Arizona coral snake, *Micruroides euryxanthus euryxanthus*
(mottled) rock rattlesnake, *Crotalus lepidus lepidus*
(Arizona black) western rattlesnake, *Crotalus viridis cerberus*
Mojave rattlesnake, *Crotalus scutulatus scutulatus*
Arizona mountain kingsnake, *Lampropeltis p. pyromelana*
(added by ammendment on March 7, 1975)

Amphibians

Jemez Mountains salamander, *Plethodon meomexicanus*
Sacramento Mountain salamander, *Aneides hardyi*
(easter) barking frog, *Eleutherodactylus augusti latrans*
Colorado River toad, *Bufo alvarius*
(Blanchard's) cricket frog, *Acris crepitans blanchardi*

Fish

Zuni mountain sucker, *Pantosteus discobolus yarrowi*
roundtail chub, *Gila robusta*
redbelly dace, *Chrosomus erythrogaster*
loach minnow, *Tiaroga cobitis*
suckermounth minnow, *Phenacabius mirabilis*
roundnose minnow, *Dionda episcopa*

53-2-50 SHORT TITLE

Sections 53-2-50 through 53-2-59 NMSA 1953 may be cited as the "Wildlife Conservation Act".

53-2-51 DEFINITIONS

As used in the Wildlife Conservation Act:

- A. "commission" means the state game commission;
- B. "director" means the director of the department of game and fish;
- C. "ecosystem" means a system of living organisms and their environment;
- D. "endangered species" means any species of fish or wildlife whose prospects of survival or recruitment within the state are in jeopardy or are likely within the foreseeable future to become so, due to any of the following factors:
 - (1) the present or threatened destruction, modification or curtailment of its habitat;
 - (2) overutilization for scientific, commercial or sporting purposes.
 - (3) the effect of disease or predation;
 - (4) other natural or man-made factors affecting its prospects of survival or recruitment within the state; or
 - (5) any combination of the foregoing factors.

The term may also include any species or subspecies of fish or wildlife appearing on the United States list of endangered native and foreign fish and wildlife as set forth in Section 4 of the Endangered Species Act of 1973 as endangered or threatened species provided that the commission adopts such lists in whole or in part. The term shall not include any species covered by the provisions of 16 U.S.C. 1331 through 1340 (1971);

E. "management" means the collection and application of biological information for the purposes of establishing and maintaining a congruous relationship between individuals within species and populations of wildlife and the carrying capacity of their habitat. The term includes the entire range of activities that constitute a full scientific resource program of including but not limited to, research, census, law enforcement, propagation, habitat acquisition, improvement and maintenance, education and related activities of protection and regulated taking;

F. "take" means to harass, hunt, capture or kill any wildlife or attempt to do so; and

G. "wildlife" means any non-domestic mammal, bird, reptile, amphibian, fish, mollusk or crustacean or any part, egg or offspring, or the dead body or parts thereof.

53-2-52 FINDINGS AND DECLARATIONS

The legislature finds and declares that:

A. species and subspecies of wildlife indigenous to the state which may be found to be endangered should be managed to maintain and, to the extent possible, enhance their numbers within the carrying capacity of the habitat;

B. the state should assist in the management of species or subspecies of wildlife which are deemed to be endangered elsewhere by prohibiting the taking, possession, transportation, exportation, processing, sale or offering for sale or shipment within this state of species or subspecies of wildlife listed on the United States list of endangered fish and wildlife unless such actions will assist in preserving or propagating the species or subspecies; and

C. adequate funding be made available to the department of game and fish by annual appropriations from the general fund or from other sources separate and apart from the game and fish protection fund for management of endangered species.

53-2-53 INVESTIGATION

The director shall conduct investigations concerning all species of wildlife indigenous to this state and named on the list required by Section 53-2-54 NMSA 1953 and those other species of wildlife indigenous to the state which are suspected of being endangered in order to develop information relating to population, distribution, habitat needs, limiting factor and other biological and ecological data to determine management measures and requirements necessary for their survival.

53-2-54 ENDANGERED SPECIES

A. On the basis of investigations concerning wildlife, other available scientific and commercial data and after consultation with wildlife agencies in other states, appropriate federal agencies and other interested persons and organizations, not later than one year after the effective date of the Wildlife Conservation Act, the commission shall by regulation develop a list of those species and subspecies of wildlife indigenous to the state which are determined to be endangered within the state, giving their common and scientific names by species and subspecies.

B. The director shall conduct a review of the state list of endangered species biennially, commencing within two years of the effective date of the Wildlife Conservation Act, and may present to the commission recommendations for appropriate additions to or deletions from the list.

C. Except as otherwise provided in the Wildlife Conservation Act, it is unlawful for any person to take, possess, transport, export, process, sell or offer for sale or ship any species or subspecies of wildlife appearing on any of the following lists:

(1) the list of wildlife indigenous to the state determined to be endangered within the state as set forth by regulations of the commission.

(2) the United States lists of endangered native and foreign fish and wildlife, as set forth in Section 4 of the Endangered Species Act of 1973 as endangered or threatened species but only to the extent that such lists are adopted for this purpose by regulations of the commission; and

(3) provided, that any species or subspecies of wildlife appearing on any of the foregoing lists, transported into the state from another state or from a point outside the territorial limits of the United States and which is destined for a point beyond the state, may be transported across the state without restriction in accordance with the terms of any federal permit or permit issued under the laws or regulations of another state, or otherwise in accordance with the laws of another state.

53-2-55 MANAGEMENT PROGRAMS

A. The director shall establish such programs, including programs for research and the acquisition of land or aquatic habitat, as authorized and deemed necessary by the commission for the management of endangered species.

B. In carrying out programs authorized by the Wildlife Conservation Act, the director may enter into agreements with federal agencies, political subdivisions of the state or with private persons for administration and management of any program established under this section or utilized for management of endangered species.

C. The director may authorize by permit the taking, possession, transportation, exportation or shipment of species or subspecies which have been deemed by the commission to be in need of management as provided in the Wildlife Conservation Act, so long as such use is for scientific, zoological or educational purposes, for propagation in captivity of such wildlife or to protect private property.

D. Endangered species may be removed, captured or destroyed where necessary to alleviate or prevent damage to property or to protect human health. Such removal, capture or destruction may be carried out only by prior authorization by permit from the director, unless otherwise provided by law; provided, that endangered species may be removed, captured, or destroyed without permit by any person in emergency situations involving an immediate threat to human life or private property. Regulations governing the removal, capture or destruction of endangered species shall be adopted by the commission within one year after the effective date of the Wildlife Conservation Act.

53-2-56 COMMISSION-
POWER TO REGULATE

The commission is authorized and directed to establish such regulations as it may deem necessary to carry out all the provisions and purposes of the Wildlife Conservation Act.

53-2-57 COMMISSION -
LAND ACQUISITION -
STATE PLAN STUDIES

In addition to other powers and duties, the director:

A. may acquire lands, waters or interest therein for the conservation, management, restoration, propagation and protection of endangered species;

B. shall hold public hearings and include the participation of the public in the preparation and adoption of a state plan for all endangered species in order to efficiently carry out the provisions of the Wildlife Conservation Act; and

C. shall conduct studies to determine the status and requirements for survival of endangered species.

53-2-58 PENALTY

A. Any person who fails to procure any permit required by Subsection C or D of Section 53-2-55 NMSA 1953 or who fails to abide by the terms of such permit, is guilty of a misdemeanor and upon conviction shall be fined not less than fifty dollars (\$50.00) nor more than three hundred dollars (\$300) or be imprisoned for not more than ninety days, or both.

B. Any person who violates the provisions of Subsection C of Section 53-2-54 NMSA 1953, or any regulations issued pursuant to

that section is guilty of a misdemeanor and upon conviction shall be fined one thousand dollars (\$1,000) or imprisoned for a term of not less than thirty days nor more than one year, or both.

53-2-59 ENFORCEMENT - POWERS OF
CONSERVATION OFFICERS

A. The director, each conservation officer, each sheriff in his respective county and each member of the New Mexico state police shall enforce the Wildlife Conservation Act and with probable cause shall:

(1) seize any wildlife, including any wild mammal, bird, amphibian, reptile, fish, mollusk or crustacean held in violation of the Wildlife Conservation Act;

(2) arrest any person whom he knows to be guilty of a violation of the Wildlife Conservation Act;

(3) open, enter and examine all camps, cars, vehicles, tents, packs, boxes, barrels and packages where he has reason to believe any game or fish taken or held in violation of the Wildlife Conservation Act is to be found, and seize it.

B. Any warrant for the arrest of a person shall be issued upon sworn complaint, the same as in other criminal cases, and any search warrant shall issue upon a written showing of probable cause, supported by oath or affirmation, describing the places to be searched or the persons or things to be seized.

C. Conservation officers under the direction of the director may establish checking stations at points along established roads as needed.

APPENDIX D



PHILLIPS PETROLEUM COMPANY

DEL MAR, CALIFORNIA 92014
BOX 782 714 755-0131

NATURAL RESOURCES GROUP
Energy Minerals Division
Geothermal Operations

SEP 22 1977

September 18, 1975

Cr-190-75G0

RM		
OPR		
MS		
C-L		

DH

Mr. W. K. Barker
United States Department of the Interior
Bureau of Land Management
District Office
P. O. Box 1420
Las Cruces, NM 88001

Dear Mr. Barker:

Enclosed are gravity and magnetic maps covering portions of Animas Valley, New Mexico. We consider the areas covered by the maps to be prospective; however, this is more or less the extent of our investigation. A more extensive area, very likely, is prospective. We have some preliminary water chemical data which are suggestive that the area enclosed by the yellow line on the gravity map has geothermal potential.

It is our opinion, based on experience in geothermal exploration and exploitation, that the search and extraction of this resource is highly compatible with other land uses. For this reason, we petition that you withdraw lands from geothermal leasing only under the most extenuating circumstances. We can and will conduct our activities in such a manner that it would have minimal impact on other land uses, and with respect for the rights of others using federal lands.

Please keep our gravity and magnetic data proprietary.

Sincerely,

Gary W. Crosby

Gary W. Crosby
Exploration Director

GWC:jm

Enclosures

AMAX**EXPLORATION, INC.**

A SUBSIDIARY OF AMAX INC.

4704 HARLAN STREET • DENVER, COLORADO 80212 • (303) 433-6151

September 19, 1975

SEP 20 1975

M	
RM	✓
OPR	
VS	
CL	Y

DH

Mr. W. K. Barker, District Manager
 Bureau of Land Management
 District Office
 P. O. Box 1420
 Las Cruces, New Mexico 88001

Re: Geothermal Resource Potential of the Gila Planning Unit

Dear Mr. Barker:

In response to your letter of September 2, 1975, requesting public participation in the resource inventory phase of the Gila Planning Unit consideration should be given to the geothermal resource potential of the Animas Valley in the vicinity of Cotton City.

The potential resource area encompasses the Animas Valley from approximately Lordsburg on the north to 10 miles south of Animas on the southern extreme. Over 200,000 acres are involved of which an estimated 30% is under Federal jurisdiction.

Leasing and exploration programs in the area are at present being conducted by 9 industry affiliated companies. Non-competitive geothermal lease applications have been filed on a large percentage of the available Federal lands. Competition in application for Federal leases has resulted in the establishment of a KGRA consisting of at least 13,000 acres.

Two competitive lease sales involving state lands in the area have been conducted by the Commissioner of Public Lands and received respectable bidding activity. Fee acreages have been acquired in significant amounts by interested companies.

TO: W. K. Barker, Las Cruces, N.M.
Re: Geothermal Resource Potential
of the Gila Planning Unit

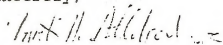
September 19, 1975
Page two

The Gila Planning Unit in its entirety merits further geothermal exploration. This is evidenced by the Unit's regional proximity to the Rio Grande rift zone and locally by extensive Cenozoic igneous activity and an abundance of warm to hot water wells.

We strongly recommend that no Federal lands within the Gila Planning Unit be withdrawn from geothermal leasing and that current pending non-competitive geothermal leases within the Planning Unit be issued to enable expedient determination of the nature of this resource. We hope that in your development of the final Management Framework Plan of the Gila Planning Unit the interests exhibited by industry and the potential advent of geothermal energy production will be taken into consideration.

Thank you.

Sincerely,



Mark H. Alldredge
Geothermal Property Manager

MHA:d



UNITED STATES
 DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 Conservation Division
 345 Middlefield Road
 Menlo Park, California 94025

BLM
 LAS CRUCES
 SEP 11 75

DM	
ADM	
RM	<input checked="" type="checkbox"/>
OPR	<input checked="" type="checkbox"/>
WS	<input checked="" type="checkbox"/>
L.C.-L	<input checked="" type="checkbox"/>

- ACTION -

BAU

September 5, 1975

Memorandum

To: District Manager, Bureau of Land Management
Las Cruces, New Mexico

From: ^{Acting} Area Geothermal Supervisor

Subject: Request for Geophysical Information

Dan R. [Signature]
Dan H. [Signature]
[Signature]

Your letter of August 20, 1975, to Lin Cordell has been forwarded to us. The U. S. Geological Survey has made no geophysical surveys in the Lightning Dock area and none are planned for the future. The University of New Mexico working under a grant from the U. S. Geological Survey has completed resistivity, gravity, and magnetic surveys of the Animas Valley. We will be using their data in our evaluation of the KGRA.

A more timely response could be provided if you would use this office as your contact point for communications with the Geological Survey concerning geothermal matters.

Dwayne E. Hill
 Acting Area Geothermal Supervisor

933 Cherry Hill Lane, L M
El Paso, Texas 79912
Sept. 18, 1975. LAS CRUCES

SEP 22 1975

Mr. W. K. Barker, District Manager
Bureau of Land Management,
P. O. Box 1420,
Las Cruces, New Mexico 88001

DM		
ADM		
RM		
OPR		
WS		
C-L	✓	
ACTION ✓		

Dear Sir:

I refer to your letter of Sept. 17 regarding study of the Lightning Dock Geothermal Area.

For your information, during much of July and August of this year, a team of geophysicists from TERRAPHYSICS, 11-A Richmond Industrial Village, 815 South 10th Street, Richmond, Calif. 94804, conducted an intensive magnetometer survey on my ranch, under contract to AMAX, Inc.

I asked them if they had authorization to work on the Federal lands, and they advised me that none was required. They implied that they were looking for geothermal resources, and indicated that results were encouraging. I am sure that they could supply you with much information.

Trusting the above will be useful, I am

Yours very truly,

J. G. Urquhart
JAMES G. URQUHART

OK
O.H.



UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Area Geothermal Supervisor
Conservation Division
345 Middlefield Road
Menlo Park, California 94025

OCT 1

September 29, 1975

DM	<input checked="" type="checkbox"/>	OPR
DM	<input checked="" type="checkbox"/>	OPR
RM	<input checked="" type="checkbox"/>	OPR
OPR	<input checked="" type="checkbox"/>	OPR
L	<input checked="" type="checkbox"/>	OPR

DH
BC

Memorandum

To: District Manager, Bureau of Land Management, Las Cruces, NM

From: Area Geothermal Supervisor

Subject: Lightning Dock EAR

An aerial and ground investigation of the Lightning Dock EAR area was made on September 3-4, 1975 by members of the USGS and BLM. The area of investigation lies within the Animas Valley, New Mexico, and is typical of a warm desert environment of the Lower Sonoran Life Zone. Vegetation is dominated by a creosote-mesquite association with plants sparsely distributed over flat terrain. No endangered species or unique biological features are known to exist within the subject area at this time.

There are several existing roads within the area of study, some of which may require minimal upgrading prior to entry by the prospective lessees. Water for the drilling operations would have to be trucked to the sites and properly disposed of, according to the approved Plan(s) of Operation submitted by the lessee(s).

In summary, there should be no significant impacts on the existing environment. The area is similar in physical characteristics to the East Mesa KGRA, California and to the Roosevelt Hot Springs KGRA in Utah where development has so far proceeded with little detriment to the environment. Proper implementation of the regulations governing geothermal resources development on Federal lands as set forth in 43 CFR 3200, 30 CFR 270 and the attendant Geothermal Resources Operational (GRO) Orders shall adequately insure proper and safe development of the resources.

If you should require any additional information which we might provide, please do not hesitate to call us.

Reid T. Stone

B.L.M.
BUREAU OF LAND MANAGEMENT

DEC 12 1975

SEARCHED	INDEXED	SERIALIZED	FILED
FBI - DENVER			

Dear Sir:

At your meeting of Dec 5 in Locksburg you asked for input into your plans set.

As for go. them - I feel that the B.L.M. and the USFS should establish a minimum price they would accept on their property in the May 1976 go. them lease in order that a fair price is received -

In the leasing that has been done so far private lands & state lands a definite pattern has been established - Bureau leases every thing north of township 24 including 24 - AMAR every thing south of 25 including 25 - other both in range 19 + 20 - ~~Chesapeake~~ Chesapeake Chevron in the township 26 + 27 range 20 + 21 - The only place competition appears is in township 27 range 18 + a little bit in 19 nearly out of the N.B.R.A. area and very low prices per acre. Anti-trust could be involved - Local Komon was that it is -

To protect the government interest they should be ready to reject bids should this pattern appear in the May 1976 sale -

The above I don't know for a fact - but have deducted from my plate - talking to prospectives leasees & what has been told me by neighbors as to what prospectives leasees have told them. your office needs to review state land leases -

of course - this pattern could be where the individual
companies think the best potential is, however it
does look odd.

This letter is to be kept in the strictest confidence
& destroyed

UNITED STATES DEPARTMENT OF AGRICULTURE
 FARMERS HOME ADMINISTRATION
 Box 1130
 Silver City, NM 88061

December 15, 1975

United States Dept. of the Interior
 Bureau of Land Management
 District Office
 Box 1420
 Las Cruces, NM 88001

Dear Sir:

Please send us a copy of the draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock area located north and south of Lordsburg, NM. Thank you.

Sincerely,

Kathryn M. Bishop
 for STEVE VILLARREAL
 County Supervisor

BLM
 LAS CRUCES

DEC 18 '75

DM		
ADM		
RM	X	
OPR		
WS		
TCL		
ACTION		

DH *AH*
 call him.
 Refer him
 to Library.

309 N 57th
 Lordsburg, N. Mex.
 88045

December 16, 1975

Gentlemen:

Please send a copy of the draft technical report and environmental analysis record on proposed geothermal leasing in the Lightning Hook area located north and south of Lordsburg, N. M. to

Wayne A. Smith Attorney at law
 2500 First Federal Savings Building
 3003 N. Central

Phoenix, Ariz. 85012

Firm of Lehmann, Olsen and Lane

Yours truly
 Andrew M. Smith

BLM
 LAS CRUCES

DEC 17 '75

DM	
ADM	
RM	X
OPR	
WS	
LC-L	

DH

- ACTION - INFO



United States Department of the Interior

GEOLOGICAL SURVEY
Geothermal District Supervisor
Conservation Division
Post Office Building - Room 443
350 South Main Street
Salt Lake City, Utah 84101

BLM	
LAS CRUCES	
DEC 15 '75	
DM	<i>[initials]</i>
ADM	<i>[initials]</i>
RM	<input checked="" type="checkbox"/> <i>[initials]</i>
OPR	<input type="checkbox"/>
IS	<input type="checkbox"/>
SECTION	<i>[initials]</i>

December 10, 1975

Mr. W. K. Barker
District Manager
Bureau of Land Management
P. O. Box 1420
Las Cruces, New Mexico 88001

Subject: Draft, Lightning Docks EAR

Dear Mr. Barker:

I will send a report to Menlo Park for inclusion of my comments with theirs on the Draft of Lightning Docks Area EAR, except for the personal comment on page 29.

I suggest that this comment be deleted, as the operation has been scrubbed. The buildings were underdesigned and the operations proved too expensive according to the information obtained from the Tulsa World newspaper office.

The project was started as a means of allowing persons on welfare to raise their own produce, but as past history indicates, these projects rarely succeed.

I am looking forward to development of Geothermal Resources in the state of New Mexico and particularly in the Las Cruces District.

Sincerely yours,

Kenneth W. Bull
District Geothermal Supervisor



PRODUCING DEPARTMENT
CENTRAL UNITED STATES
MIDLAND DIVISION

BLM
LAS CRUCES

PETROLEUM PRODUCTS

TEXACO INC.
P. O. BOX 3109
MIDLAND, TEXAS 79701

DEC 18 '75

December 16, 1975

DM	
ADM	<i>WAB</i>
RM	<i>X 1002</i>
OPR	
WS	
CL	

SECTION 4-21

Misc. 500 - Environmental Matters
Draft Technical Report and
Environmental Analysis Record
of Proposed Geothermal Leasing,
Lightning Dock Area, Lordsburg,
New Mexico

Bureau of Land Management
P. O. Box 1420
Las Cruces, New Mexico 88001

Attention: Mr. Daniel C. B. Rathbun

Gentlemen:

We understand that copies of the captioned report may be available upon request. Please send one copy to this office.

Yours very truly,

E. H. Watkins
Division Landman

By *J. E. Reinli*
J. E. Reinli

JER-BH



STATE OF NEW MEXICO

Environmental
Improvement
Agency16-120 E. POPLAR
BOX 1001
DENING, N. M. 88030

December 15, 1975

Mr. Daniel C. B. Rathbun, Dist. Manager
BLM
P.O. Box 1420
Las Cruces, N. M. 88001

Dear Mr. Rathbun:

I would like very much to have a draft copy
of the proposed geothermal leasing report in the
Lightning Dock area near Lordsburg.

Sincerely,

Mary Alice Black

Mary Alice Black,
Environmentalist, III

MAB/eg

BLM
LAS CRUCES

DEC 16 1975

DM		
ADM		
RM	X	OK
OPR		
WS		
GL	✓	
ACCIÓN		

DHX *DA.*

ALAN J. ANTWEIL
 POST OFFICE BOX 2010
 HOBBS, NEW MEXICO
 88240
 (505) 393-4111

BLM
 LAS CRUCES

DEC 17 '75

DM			
ADM			
RM	X		
OPR			
WS			
LCL			
ACTION # _____			

PH J.H.

December 16, 1975

Mr. Daniel C. B. Rathbun
 Acting District Manager
 Bureau of Land Management
 P.O. Box 1420
 Las Cruces, New Mexico 88001

RE: Your File No. 3200

Dear Mr. Rathbun:

In response to your letter of December 11, we would appreciate receiving copies of the draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock Area, located north and south of Lordsburg, New Mexico.

Since we are not near enough to the locations where the report is available for review, we would appreciate receiving a copy of same. Send it to my attention at the above address.

Thank you.

Very truly yours,

ALAN J. ANTWEIL

Jim L. Sharp
 Jim L. Sharp

JLS/jj

Bureau of Land Management
 Box 1420
 Las Cruces, New Mexico

Dear Sir:

I would like to have the
 Draft Technical Report and
 Environmental Analysis Report
 on proposed geothermal heating
 in the Lightning Rock area.

I can not come to the places
 mentioned in your letter.
 Could you possibly send me
 a copy.

BLM

Las Cruces

DEC 22 75

DM		
ADM	WKS	
RNI	X	
OPR		
WS		
C-L		

ACTION # -

Sincerely

James Farmland

Box 493

Lightning Rock, Ariz

85533

Dec. 22, 1975

Mr. Daniel C. B. Rathbun
Acting District Manager
BLM District Office

Dear Mr. Rathbun:

Please send me a copy of the Technical Report and Environmental Analysis Record on the proposed geothermal leasing in the Lightning Rock area north and south of Lordsburg.

I expect to submit written comments prior to January 5, 1976.

Very truly yours,

Roger A. Parsons

Route #1, Box 210 LM
Deming, N. M. 88030

BLM
LAS CRUCES

DEC 23 '75

DM		
ADM		
RM	X	
OPR		
WS		
C-L		

DH *JA*
RA

ACTION 4-11-75



HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA 85703, P.O. BOX 5964, PHONE: (602) 623-0578

December 19, 1975

United States Department of the Interior
Bureau of Land Management
DISTRICT OFFICE
P.O. Box 1420
Las Cruces, New Mexico 88001

Attention: Mr. Daniel C. B. Rathbun
Acting District Manager

Re: 3200

Dear Mr. Rathbun:

We are interested in reviewing the draft Technical Report and Environment Analysis Record on proposed geothermal leasing in the Lightning Dock area located north and south of Lordsburg, New Mexico.

If your supply of additional copies has not been depleted, we would appreciate it if you would send one to us.

Sincerely,

Heinrichs GEOExploration Co.

Walter E. Heinrichs, Jr.
President & General Manager

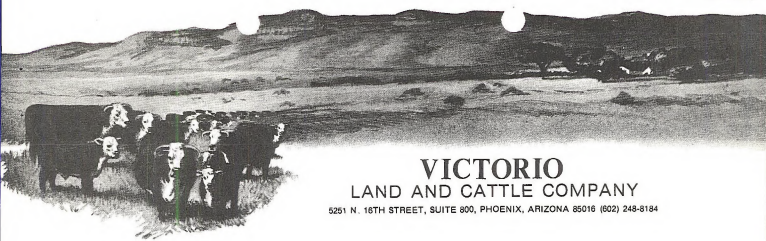
BLM
LAS CRUCES

DEC 22 '75

DM	
ADM	
RM	X
OPR	
WS	
LC-L	
Accion	

DH C.H.

WEH:mt



VICTORIO LAND AND CATTLE COMPANY

5251 N. 16TH STREET, SUITE 800, PHOENIX, ARIZONA 85016 (602) 248-8184

December 15, 1975

Mr. Daniel C. B. Rathbun
Acting District Mgr.
Bureau of Land Mgt.
P. O. Box 1420
Las Cruces, New Mexico 88001

Dear Sir:

Per your letter of December 11, 1975, we would appreciate your sending us a copy of the draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock area near Lordsburg, New Mexico.

Thank you for your assistance.

Sincerely,

VICTORIO LAND AND CATTLE COMPANY

Peter G. Wray
Peter G. Wray, Chairman

PGW:sh

BLM
LAS CRUCES

DEC 1975

DM	<i>[Signature]</i>
ADM	
RM	<i>[Signature]</i>
OPR	
WS	
GL	

DH. D.H.

- ACTION - INFO

BEN DONEGAN
CONSULTING GEOLOGIST

3202 CANDELARIA N.E. • TELEPHONE (505) 848-8882
ALBUQUERQUE, NEW MEXICO 87107

December 17, 1975

BLM	
LAS CRUCES	
DEC 19 1975	
DM	<i>[initials]</i>
DM	<i>[initials]</i>
RM	X <i>[initials]</i>
OPR	
VS	
T.C.L.	
- ACTION # - 1122	

DH *[initials]*

Bureau of Land Management
District Office
P. O. Box 1420
Las Cruces, New Mexico 88001

Gentlemen:

Please send us one copy of the draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock area located north and south of Lordsburg, New Mexico. We were advised of this publication in your letter of December 11, 1975.

Very truly yours,

Ben Donegan

Ben Donegan

Rodas NM
22 Dec 75

DEC 29 1975

Samuel C. S. Rathbun
Acting Dist. Mgr.
BLM Dist. Off.
Las Lunas, N.M.

DR		
RD		
RM		
OP	X	RDH
TR		
TL		
SL		

ACTION 4-100

D.H.

DH

Dear Mr. Rathbun -

Your letter of 11 Dec. has been received.
Because we will not be able to review
the draft Technical Report & Environmental
Analysis Record on proposed geothermal
leasing in the Lightning Rock area at any
of the locations mentioned, we would ap-
preciate it very much if you would send
a copy for our review and comment to:

DR. R. T. SCHOLLES
BOX 117
RODAS, N.M. 88056

As BLM leasees and permanent residents
of this area, we are naturally most interested
and concerned.

Thank you for your consideration.

Sincerely yours,
R. T. Scholles, MD.

JAN 5'76

DATE	12/4/75	
BY	JDK	
FOR	WDT	WDT
BY	DA	DA
FOR		
BY		
FOR		
ACTION		

The Gila Planning Unit Meeting held at Western New Mexico University on December 4, 1975, involves an excellent presentation of the proposed planning unit.

Today, some 500 million acres, the size of every state east of the Mississippi except Maine -- 67 percent of all Federal lands -- are off limits to the Nation's mineral industry.

The BIM has approached the Gila planning unit proposal with very practical ideas.

Joseph Kolessar

Phelps Dodge Corporation



STATE OF NEW MEXICO

STATE ENGINEER OFFICE

SANTA FE

December 30, 1975

S. E. REYNOLDS
STATE ENGINEER

BATAAN MEMORIAL BUILDING
STATE CAPITOL
SANTA FE, NEW MEXICO 87503

BLM	
LAS CRUCES	
JAN 1'76	
DM	<input checked="" type="checkbox"/>
ADM	<input checked="" type="checkbox"/>
RM	<input checked="" type="checkbox"/>
OPR	<input type="checkbox"/>
WS	<input type="checkbox"/>
LC-L	<input checked="" type="checkbox"/>
X - ACTION ✓ - INFO	

OH CH
JS

Mr. Daniel C. B. Rathbun
Acting District Manager
U.S. Department of the Interior
Bureau of Land Management
District Office
P. O. Box 1420
Las Cruces, New Mexico 88001

Dear Mr. Rathbun:

Your letter of December 11, 1975 requests comments on the draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock area located north and south of Lordsburg, New Mexico.

In 1973 the state legislature gave to the Oil Conservation Commission the authority and duty of regulating the drilling, development and production of geothermal resources and the authority and duty of conserving and preventing waste of geothermal resources within the state (Section 65-3-11.2, N.M.S.A. 1953 Annotated). The statute also states that nothing in the act shall be construed to supersede the authority which any state department or agency has with respect to the management, protection, and utilization of the state lands and resources under its jurisdiction.

Under the New Mexico Constitution and case law the underground water of the state belongs to the public and is subject to appropriation in accordance with state law. The State Engineer has jurisdiction of the appropriation of ground water within the boundaries of declared ground water basins. Outside such declared basins a person may drill a well and appropriate the ground water without a permit from the State Engineer.

In addition to any permits that may be required by the Oil Conservation Commission, it will be necessary for the person desiring to drill a geothermal well from which water, either in

December 30, 1975

gaseous or liquid state, will be withdrawn from geologic formations within a declared underground water basin for the purpose of utilizing the thermal energy to first obtain a permit from the State Engineer to drill a well and appropriate public waters. The State Engineer may grant such a permit only upon his finding that its exercise will not impair existing water rights. Any person desiring to drill a well for water within a declared ground water basin must be licensed by the State Engineer. Most of the Lightning Dock area is located within the Animas, Gila-San Francisco, Lordsburg, Playas and San Simon Underground Water Basins. I am enclosing a copy of the State Engineer's Rules and Regulations and refer you to Article 7 which describes the presently declared ground water basins.

Section 75-11-37 excludes from State Engineer jurisdiction water in an aquifer, the top of which aquifer is at a depth of 2500 feet or more below the ground surface at any location at which a well is drilled and which aquifer contains nonpotable water (water containing not less than 1000 ppm. total dissolved solids).

Please let me know if some further discussion of this matter would be helpful.

DEG/ma
encl.

Very truly yours,

S. E. Reynolds
State Engineer

By: 
D. E. Gray
Chief
Water Rights Division

BLM	
LAS CRUCES	
JAN 1976	
DM	<input checked="" type="checkbox"/>
RM	<input checked="" type="checkbox"/>
OPR	
COL	<input checked="" type="checkbox"/>

DA *DA*
JK
 JG *JK*

Drawer 1857
 Roswell, New Mexico 88201

December 31, 1975

ACTION - INFO
 Memorandum

To: Area Geothermal Supervisor, Menlo Park, California
 From: Area Geologist, Southern Rocky Mountain Area
 Subject: Technical Report and Environmental Analysis Record
 on proposed geothermal leasing in the Lightning Dock
 Area located north and south of Lordsburg, New Mexico

We have reviewed the enclosed report. The report is very comprehensive, and very detailed. Perhaps more use could have been made of tables rather than narrative description but this narrative form seems to be the standard method of writing EARs. Some of the geologic terms are not self explanatory and a person without geologic training would find them to be a mystery. A few short explanations following their first use would help. Terms such as : horst, graben, basalt, Tertiary, Cenozoic, rhyolite, pyroclastics, ignimbrites, latites, Iddingsite, phrphyry, zenolith, monzonite porphyry, schistose, inselberg, andesite, and breccis need explanations. In the other studies such as botany and biology, the reader can surmise that the names used refer to plants or organisms and should have no difficulty understanding them. Some terms which might be explained are phyto-planton (P. 55), forbs (P. 64), mesic (P. 65), Pediments (P. 65), zerophytic (P. 65), melanistic (P. 94 - I thought melanism referred to a skin ailment), WHA IVd (p. 98), WHA-V (P. 102) and LU-NRL (P. 102). Of course, if this report is always going to be used only by experts who will only read their portion of the report, there is no need for explanations.

E. D. PATTERSON
acting Area Geologist

cc:
 District Manager, BLM, Las Cruces

The Wilderness Society

P.O. Box 38, Glenwood, New Mexico 88039
(505) 539-2845
Southwest Regional Representative
New Mexico * Arizona * West Texas

BLM
LAS CRUCES

December 17, 1975

DEC 17 1975

Mr. Daniel C.B. Rathbun
Acting District Manager
Bureau of Land Management
PO Box 1420
Las Cruces, NM 88001

DM	<i>WSD</i>
ADM	
RM	<i>[initials]</i>
OPR	
WS	
TCL	<i>[initials]</i>
- ACCIÓN -	

copy URA file
DH *[initials]*
K₃ *[initials]*
BF *[initials]*
R.A. *[initials]*

Dear Mr. Rathbun

I have reviewed the Technical Report and Environmental Analysis on Proposed Geothermal Leasing in the Lightning Dock Area. The report seems to be well done and complete; you have done a good job.

The major concern of The Wilderness Society with the assessment area is with the outstanding wildlife and primitive values present in the Botheel part of southwestern New Mexico. The report covers these important wildlife values quite well, although a bit more consideration could be given to the primitive values. It is our position that the quality of primitive values is not dependent upon scenery, presence of water, recreational potential, or even unique or outstanding natural values. The criteria should be 'is it wild?'

We would like to see the Peloncillo, ^{North}South Animas, and Pyramid Mountains; and San Simon Cienega, South Alkali Flat, and other important wildlife areas withheld from leasing at this time. We have no objection to Alternative 1.

Please keep me informed on the progress of this geothermal leasing program.

Sincerely

[Signature]
Darius Foreman
Southwest Representative

cc: Ms. Nan Nalder, Sierra Club Geothermal Coordinator

State of New Mexico



GOVERNOR
 * JERRY APODACA
 DIRECTOR AND SECRETARY
 TO THE COMMISSION
 * WILLIAM S. HUEY

STATE GAME COMMISSION
 F. URREA, JR., CHAIRMAN
 ALBUQUERQUE
 EDWARD MUNOZ
 GALLUP
 ROBERT H. FORREST
 CARLSBAD
 J. W. JONES
 ALBUQUERQUE
 ROBERT P. GRIFFIN
 SILVER CITY

DEPARTMENT OF GAME AND FISH

STATE CAPITOL
 SANTA FE
 87503

December 18, 1975

DEC 22 1975

Mr. W. Barker
 District Manager
 United States of the Interior
 Bureau of Land Management
 P. O. Box 1420
 Las Cruces, New Mexico 88001

Dear Mr. Barker:

We have reviewed the Technical Report and Environmental Analysis on Proposed Geothermal Leasing in the Lightning Dock Area and wish to make the following comments:

This area supports a diversity of wildlife which includes a considerable number of rare or endangered species, particularly birds. This wildlife resource should be protected in the issuance of exploration permits and any subsequent issuance of development permits.

From a wildlife viewpoint, we would recommend Alternative 1. As indicated in the report, the primary lands of interest for leasing have been disturbed by human activities. A cautious approach would permit time to evaluate effects of geothermal exploration upon the environment.

Thank you for the opportunity to review and comment upon the report and analysis.

Very truly yours,

William S. Huey, Director

By: Phil E. Freeman
 Wildlife Environmentalist

SEARCHED	INDEXED	SERIALIZED	FILED

DEC 22 1975



Chevron Oil Company
 575 Market Street, San Francisco, CA 94105
 Mail Address: P.O. Box 7643, San Francisco, CA 94120

Minerals Staff

January 8, 1976

3200

BLM
 LAS CRUCES

JAN 12 '76

DM	✓	<i>DDL</i>
ADM		
RM	✓	<i>DDL</i>
OPR		
NS		
COL	✓	<i>Jan</i>
ACTION		

DN *DDL*

gs

Mr. Daniel C. B. Rathbun
 Acting District Manager
 Bureau of Land Management
 Las Cruces District
 P. O. Box 1420
 Las Cruces, NM 88001

Dear Mr. Rathbun:

We appreciate the opportunity to comment on the draft Technical Report and Environmental Analysis Record of the Lightning Dock Geothermal Assessment Area. We have reviewed the draft carefully and consider it generally quite informative.

Our comments and suggested changes are itemized below:

P. 1 The Alternatives

In addition to the three alternatives proposed, we suggest that a more general alternative be included, probably as #1, with those listed as 1, 2 and 3 renumbered as 2, 3 and 4.

1. Lease any lands which are environmentally acceptable.

As proposed in your Alternative 1, page 1, leases would be limited to only those areas which are least environmentally sensitive apparently on the assumption that exploratory results in only a few areas will determine the geothermal potential of the entire Lightning Dock Assessment Area. Results from only a few areas probably will not evaluate the potential within the entire area under consideration. It is impossible to evaluate the geothermal potential of any area from surface indicia or geophysical data alone. If the proposed Alternative 1 were followed and uneconomic results were to be obtained from drilling in only a few areas which are presently considered to have potential, it would not necessarily follow that other areas in the Lightning Dock Assessment Area lacked geothermal potential.

P. 18 Non-Competitive Leasing

The second sentence "Geothermal resources have a lower potential in these areas", refers to areas outside any KGRA. This is not

necessarily true. One cannot determine potential from surface indicia alone, which is the only evidence in many KGRAs. Furthermore, many other KGRAs are identified solely on the basis of overlapping filings for leases by two or more applicants. Many lease filings are not based upon specific scientific indications.

P. 140 Water - Production

The last two sentences warrant modification on the basis of present knowledge. Suggested changes are underlined below:

"With the withdrawal of fluids, seismic activity may increase. Reinjection of the fluids could possibly act as a lubricant, which may tend to increase the rate of seismicity."

P. 141 Vegetation - Post-Lease Exploration

We suggest modifying the last paragraph as below, to reflect the precautions which responsible operators routinely take.

"Fluids that inhibit vegetative growth may be used in any of the drilling operations, but such fluids will be confined within the mud pit, mud sump and the drill hole. Oils and greases are also used at the drill sites. Normally neither drilling fluids nor oils and greases will reach vegetation. If accidentally spilled onto vegetation and not cleaned up promptly, these substances can eliminate the plant life affected, however, many precautions can be taken to prevent this."

The last clause, "many precautions can be taken to prevent this" is a direct quote from a subsequent paragraph on page 142.

P. 148 Animals - Post-Lease Exploration

The statements point out that "all activities are greatly intensified". In order to clearly convey the magnitude of the effect we suggest adding this sentence at the end: "The amount of acreage involved in post-lease exploration usually is considerably smaller than in pre-lease exploration, therefore, the total impact may be no greater than or possibly less than that from prelease exploration."

P. 149 Animals - Development

Following the reasoning above under Post-Lease Exploration, we suggest in the first sentence that a clause be added as follows: "...localized, i.e., involving less acreage, with an even greater concentration of intensity."

Our final comments relate to what we regard as extremely improbable situations and to a poor choice of words in certain other cases, both of which, unless modified, will convey to the uninformed segment of the public a resulting "doomsday".

It is our understanding that an Environmental Analysis Record is to be an objective analysis of the environmental impacts resulting from the anticipated activities. It should convey to the public a reliable appraisal of the probable effects of these activities. In some instances, there is a lack of objectivity and the conclusions drawn do not appear to be realistic, thus the public easily could be misled to believe the worst situations would occur.

Take, for example, under Terrestrial Plants - Development -- the paragraph at the bottom of page 142 which reads, "The small communities within the area will increase in population. People moving into these areas may consider collecting some of the vegetation in the adjoining area. Problems also may develop with the introduction of exotic plant species. These exotic species may become established, invade and take over the range lands of the area making them totally useless." We ask these questions:

1. What is the probability of a newcomer introducing an undesirable exotic species?
2. If introduced, what is the probability that the plant will be able to establish itself in a "foreign" environment?
3. If established, what is the probability that the species will proliferate to the point that it will crowd out or otherwise destroy existing native species in order to take over the range?
4. What is the probability that such an invading exotic species will make the range lands totally useless?

Lacking expertise in this field, we cannot answer these questions, however, since there has been a tremendous influx of people during the past 125 years and the deserts do not appear to be "totally useless" we would conclude that the postulated situation is extremely unlikely to occur.

We believe you will concur that if the last sentence of the cited paragraph were quoted out of context, it would convey to the public an erroneous but disastrous effect of the leasing of lands for geothermal resources. We recommend that this paragraph be revised to reflect realistic probabilities.

P. 149

Animals - Development
Animals - Production

Under "Development", with reference to the clearance of vegetation at drillsites, etc., it is stated "The disturbance and destruction of animal species and habitat will occur." Under "Production",

again with reference to vegetative clearance, it is stated, "Additional animal species and their habitat may be lost." The two statements are incompatible. Is not the latter statement more appropriate?

P. 150 Animals - Production

The first sentence states "Immediate and cumulative impacts associated with a sudden increase in population can be devastating." We question the appropriateness of "devastating". According to Webster "devastate" means either "to bring to ruin or desolation by violent action" or "to reduce to chaos or disorder". We question that the Bureau of Land Management really believes that the addition of 50 to 100 people as stated in the following sentence, plus their families, can reduce the area to desolation, chaos or disorder.

Again, if that particular statement is taken out of context, it will mislead the public.

P. 159 Primitive Values - Pre-Lease Exploration

The last sentence states, "The larger a roadless area is, the greater the impact will be, because the opportunity for isolation will be reduced." In cases where exploration and development occur within the outer portions of a large primitive area, the bulk of the primitive area should not be adversely affected. If such a primitive area lies within mountainous terrain, there may be no geothermal activity within it. Activity may take place along a fault system at the edge of the mountains where they adjoin a desert area, in which case the activities would not penetrate deeply into the mountains.

We suggest the statement be modified to reflect that in certain situations, which may predominate as far as geothermal activities in primitive areas are concerned, the impact in large roadless areas could be minimal.

P. 183 Relationship Between Short-Term Use and Long-Term Productivity

The second paragraph states "significant geothermal development throughout the potential leasing area would probably immediately affect the livestock and wildlife forage resources, etc." It is very unlikely that geothermal development will occur throughout the area. A reasonable prediction probably would foresee only a limited number of small (2 to 4 sections in area) to medium (5 to 7 sections) size areas ultimately developed for geothermal resources.

P. 184 Irreversible and Irretrievable Commitment of Resources

The last sentence states "The natural environment of the entire development area in general would suffer some permanent

January 8, 1976

degradation of surface disturbance and alteration", whereas the preceding sentence refers to values and qualities of "certain areas -- if the geothermal resource is completely developed in these areas. In the sentence under question does "the entire development area" refer to one of the "certain areas" of developed geothermal resources or to the entire Lightning Dock Geothermal Assessment Area? The meaning is ambiguous and should be clarified. If the statement refers to the entire assessment area, as may be inferred by the casual reader, then we believe it is misleading. We question that the entire Lightning Dock Area in general would suffer some permanent degradation because large portions of this area will not be of interest for geothermal resources or will experience only casual use.

We have attempted to be objective in our analysis and hope that we have achieved it. If you have any questions or wish to discuss our comments, we will welcome the opportunity. We also would like to be advised of any subsequent public hearings.

Respectfully submitted,



E. G. Dobrick

BLM
CRUCES

Rodeo NM

4 Jan 74

JAN 6 '76

DM		
ADM		
RM	✓	
OPR		
WS		
CL		
ACTION		

DH JH.

Mr. W. K. Barber
Dist. Mgr., BLM
Las Cruces, N.M.

Dear Mr. Barber:

Thank you for sending the "Technical Report & Environmental Analysis on Proposed Seasonal Leasing in the Lightning Dock Area". I have reviewed the document and am sending along the following brief comments.

I think you and your staff are to be complimented on a well researched and written study. In general, the reasoning, conclusions and recommendations seem sound and well-taken.

A few relatively minor errors were noted, some of which may have been editorially corrected already. One such was the conversion of acres to hectares in a number of the handwritten figures that were legible.

I believe that some of the information we have accumulated here in the Pelonillo area hasn't gotten to you in usable form. The S&A number (see p. 21) has been seen several times about 5 miles S. of Rodeo on the road to our ranch as the Pelonillo foothills start. A number of species of birds and reptiles we have found on the Pelonillo property are not included, again probably through lack of specifics made available to you. While I believe our ranch is largely just south of the Lightning Dock KJRA, the observations would probably be helpful.

In general, your analysis of the impact of the development seems comprehensive. While not within the scope of the report.

the necessity of a rigid conservation in our energy field certainly merits emphasis, as does the use, esp. in this area, of such sources of energy as the sun - cheap, non-polluting and renewable. We strongly feel also that economic impact must be most carefully weighed against the environmental impact and this is well covered.

I could find no mention of Research Natural Areas, even under "Other Scientific Values" on page 129. As this may be a BLM category or on near this geographic area, would some brief analysis of effects of geothermal development be relevant? It would seem that anticipated impacts on Research Natural Areas would be different from all the others discussed - and much more devastating. Both short term uses and long term productivity would be much more drastically affected.

As you know, we feel that the Research Natural Area concept is a highly productive and valuable alternative to other aspects usually given primary emphasis. It could be BLM's single most significant contribution to the well-being of all of our resources.

Thank you for your consideration.

Sincerely
R. T. Scholtes

R. T. SCHOLTES, M.D.
BOX 117
RODEO, NM 88056

GOODRICH - BARTLETT & ASSOCIATES
ADVANCE PLANNING - FEASIBILITY - COORDINATION
1105 GARDNER
LAS CRUCES, NEW MEXICO 88001
(505) 524-3027

BLM	
LAS CRUCES	
JAN 6 '76	
DM	<i>DL</i>
ADM	
RM	<i>DL</i>
OHR	
WS	
LC-L	
ACTION 4-1870	

JAMES L. GOODRICH, P. E.
MRS. HELEN E. BARTLETT
ING. LUIS R. CAMACHO A.
GEORGE PENDELL, P. E.
DONALD H. RUDD, P. E.

January 5, 1976

Bureau of Land Management
P.O. Box 1420
Las Cruces, New Mexico 88001

Gentlemen:

Attention: Wm. Den Hausel, Geothermal Geologist

Confirming our telephone conversation today, we have reviewed the draft EAL No. NM-030-76 Technical Report and Environmental Analysis on Proposed Geothermal Leasing in the Lightning Lock Area.

Under the heading "Economic Analysis" there is a reference to nuclear plants "near El Paso, Texas, Belen, New Mexico and Greenlee, Arizona on which construction is expected to be substantially completed within the next 20 years".

The nuclear power plant to be constructed at Palo Verde, Arizona is the only one in the area on which there has been any definite planning.

Our projection of demand for New Mexico produced energy by 1985 is that it will be not less than 300 percent of the 1975 total production capacity (oil, gas, coal, electricity), much of which will be urgent requirements from outside New Mexico.

Sincerely,

James L. Goodrich PE

James L. Goodrich PE
Feasibility Consultant

DH 2/4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
SHORT NOTE TRANSMITTAL

January 2, 1976
(Date)

TO : DM, Las Cruces

FROM : Chief, Environmental & Planning Coordination
Staff

SUBJECT: Review comments on the Technical Report and
Environmental Analysis Record - Lightning
Dock proposed geothermal leasing

The attached comments are forwarded for your consideration. They are a compilation of review comments made by the various activity specialists in the Division of Resources. Because of workload problems, the E&PCS role was limited to coordination. If you have any questions on these comments, please direct them to Wayne Kuhn (Ext. 212). Thank you.

BLM
LAS CRUCES

JAN 7 '76

Dennis R. E. Hart
Acting Chief

js

DM	
DM	
RM	<input checked="" type="checkbox"/>
O	

Note: Return this form when action is completed or attach it to data requested

ACTION # - 1000

Comments on Lightning Dock Geothermal EAR

Page 1

Line 1 - "is to offer for leasing approx. 477,000 ac."

Line 3 - "in Hidalgo County"

Line 5 - "There are approx. 23,552.01 ac. in the proposed KGRA which will be offered for lease by competitive bids, following ----.
(The sale date will be a news release.)

Line 14 - industry instead of commercial companies.

Page 3

Lines 9-12 - too many "ands".

Line 12 - could develop instead of could become.

Page 3 & 5 don't tie

Page 5

Line 8 or 9 - put in source info (Kruger & Otte 1953).
Take out under (5).

Page 6 - Do you really want this figure? *yes*

Page 7 -

Line 23 - for ERDA not AEC.

Last line - feasibility of this system.

Page 10

Line 3 - made available not become available.

Line 8 - geothermal leases not geo resources.

Line 7 - received not accepted.

Line 10 - has also issued geothermal leases.

Line 13 - not KGRA's but thermal anomalies?

Last line - had better explain what a GRO order is.

Page 11

Line 18 - What about those in the lease contract?

Line 19 - Take sentence out - "Geothermal development of an areas is divided into pre-lease ----"

Page 16 - Omit first sentence.

Page 17 - "Competitive leases usually issued to the highest qualified bidder."

Page 18

Line 2 - "to pay the balance of the bonus bid", (one-half of the bonus is submitted with the bid).

Line 8 - "Geothermal resources supposedly have."

Line 25 - "The Geothermal Resources Lease Contract" --- (statement not complete-- add info or take out.

Page 22

Line 3 - bases?

Page 23

Line 2 " ----- resource usually requires ----"

Page 28

Line 14 - true?? temperatures have increased?

Page 133

Line 1 - first sentence - explain
second " - explain

Page 157

Line 5 - change pressures to production is

Page 167

Line 10 - "The geophysical surveys are -----"
Explain - not clear.

Wildlife Section

OK.

Page 124 - Scenic Quality

It seems unusual that the entire area would rate out the same: B. With only one rating, there is little opportunity for mitigation or special considerations other than to treat the entire area the same way. With a more detailed

scenic analysis, it might be possible to be very lenient in one area and quite restrictive in others. This would give the developers more latitude in deciding where to develop first and where to locate essential facilities which disturb the scenery. Possibly the more scenic areas could be avoided entirely if only they knew where these areas were located.

Page 125 - Primitive Values

Was the entire area rated "C" or just the Peloncillo Mountains? It is not necessary to rate areas that have little or no primitive potential. I presume here that only the Peloncillos were rated. If so, this is the kind of specific guidance which can be useful in mitigating impacts.

Page 125 - General Recreation

OK.

Page 129 - Archeology

The most important facts concerning archeology are given in sufficient detail. The main report is referred to for more detail and only summarized in the EAR. This is a good approach to take since it cuts down on the EAR's size without eliminating any necessary data.

Page 154, 158, 162 - OK

Page 164 - Exploration

Line 3 - probable not probably

Page 171 -

13. The Profile of all permanent structures will be kept as low as possible to minimize aesthetic and open space intrusion. A low profile structure disappears from view at a shorter distance than taller items. This is particularly true if structures are silhouetted against the sky or the horizon as viewed from roads or other places where people congregate.

Page 173

24. OK.

Grazing

Page 126 - How many operators and how much use licensed within the area discussed? Will the proposed action affect grazing use? If so, how and how much?

Page 143 -

Line 2 - any examples?

Page 145

Line 17 - "severity" - now about describing the general spectrum.
The worst it could be to the least.

Page 160

Line 9 - "Grazing would be moderately impacted". (How much - how many operators).

Line 13 - "This would be a beneficial impact." (For livestock!)

Line 14 - Development - (This section needs to explain more about the grazing situation? Who - how many, etc.

Page 169

Line 5 - If areas are removed from grazing (either permanently or temporarily) appropriate adjustments in use should be made.



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

January 8, 1976

IN REPLY REFER TO:

FILED
JAN 12 1976

JAN 12 1976

DM	<input checked="" type="checkbox"/>	OK	
RM	<input checked="" type="checkbox"/>	OK	OH
OPR			
S			
EL	<input checked="" type="checkbox"/>		
ALB			

MEMORANDUM

To: District Manager, Bureau of Land Management, Las Cruces, New Mexico 88001

From: ^{Acting} Regional Director

Subject: Geothermal Leasing - Comments on draft Lightning Dock Environmental Analysis Record

This responds to your December 4, 1975 request for review and comment on your draft Technical Report and Environmental Analysis Record on proposed geothermal leasing in the Lightning Dock Area in the vicinity of Lordsburg, New Mexico.

We have reviewed the report and note that it provides adequate consideration for the fish and wildlife and environmental values that would be affected within the proposed geothermal lease area. Specific comments follow:

✓ Page 24, 2nd paragraph, 1st sentence - The reference 30 CFR 270.34(k) should be to "Plan of Operation" which requires in part "...the collection of data...at least one year prior to the submission of a plan for production."

✓ Page 31, 1st full paragraph, last sentence - Suggest this sentence be reworded to read "...all disturbed areas will be revegetated."

✓ Page 76, bottom of page and top page 77 - Suggest combining all skunk species after first reference.

Page 80, 1st paragraph under Mammals - The genus and species of the gray fox is given, however, the common name has been omitted. Also in this connection it is suggested that all other references to and the spelling of scientific names be checked closely. If the gray fox is to be included, the genus and species should be corrected; (*Urocyon cinereoargenteus*).



Page 97, 1st sentence under Birds - With passage of the Endangered Species Act of 1973 and subsequent formal designation and publication of endangered and threatened species in the Federal Register, all other references to status such as rare, peripheral, and status undetermined have been discontinued. The 1973 act established two categories of endangerment; "endangered" and "threatened." At present, these are the only categories recognized by the Fish and Wildlife Service. Individual states have compiled and adopted their own lists which contain at least the same species as appear in the Federal lists and also any additional species which they may consider as warranting some form of protection or concern in their respective states. New Mexico has compiled and adopted such a list which was issued as "State Game Commission's Regulation No. 563" dated January 24, 1975. Copies of both the Federal and New Mexico lists are enclosed for your information. These lists will change as new species are added or the status of listed species is changed. In this connection three Federally designated endangered trout species, the Arizona Apache, Gila, and Lahontan cutthroat were taken off the endangered list and are now officially designated as "threatened."

At present there are no officially designated endangered or threatened plant species.

Page 101 - bottom of page under Invertebrates - Suggest that a consistent form of reference to scientific names be adopted here and in all other such references throughout the report. This paragraph refers to family and order, (e.g., Aphididae, Diptera) when perhaps a representative genus would be appropriate and consistent with other similar references.

Page 130 - top of page - Suggest deleting the word "black" from "Mexican black duck." Although common names often vary in different locations, the generally accepted common name for this species is either Mexican Duck or New Mexican Duck.

Page 146 - second full paragraph - Suggest that, if practicable, a buffer zone of at least one-quarter mile on all sides of the San Simon Cienega Mexican duck Habitat Development Area also be withdrawn from proposed leasing on the basis that the species has been officially designated as endangered and as such would justify the withdrawal of the additional lands.

Page 147 - second paragraph - The Sonoran coachwhip snake, bunchgrass lizard, Gila monster and Arizona coral snake appear only on the New Mexico endangered species list. This paragraph and all similar references to endangered species should be reworded to indicate whether they are Federal or state endangered (or both).

Page 151 - top of page under Close Out - In general, desert ecosystems are extremely fragile and surface alterations such as would exist at the close-out phase may only partially or barely rehabilitate much less result in beneficial impacts. We therefore seriously doubt, that without implementation of an intensive restoration program, such areas could be restored. Present "State-of-the-Art" on similar areas in New Mexico indicates that for best results such areas should be reseeded, preferably with native plant species, and irrigated for a minimum of two years before the new plantings are capable of surviving on their own.

We appreciate the opportunity to review and comment on the draft EAR. Please advise if we can be of further assistance.

A handwritten signature in cursive script, reading "Jerry L. Stigman". The signature is written in dark ink and is centered on the page.

Enclosures (2)



UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Area Geothermal Supervisor
Conservation Division
345 Middlefield Road
Menlo Park, California 94025

BLM

JAN 1976

JAN 1976

DM		
DM		
RM	✓	
OPR		
WS		
SL	✓	

DH

JAN 15 1976

Memorandum

To: District Manager, Bureau of Land Management
Las Cruces, New Mexico

From: Area Geothermal Supervisor

Subject: Review of Draft EAR and Proposed Lease Stipulations
Lightning Dock KGRA, Animas Valley, New Mexico

Thank you for the opportunity to review the subject EAR and proposed stipulations. Our review comments and suggestions for the EAR and proposed stipulations are included in Attachment A. Attachment B is a suggested discussion of passive seismic techniques for your information and use. Attachment C is a suggested explanation of geologic terms. Attachment D contains geothermal information for your review and use. We hope our remarks will be helpful and of use in the preparation of the final EAR.

We would appreciate a copy of the final EAR and any remaining or revised stipulations.

Rick Stone

ATTACHMENT A

General Comments

The treatment of non-living components as compared to living components is somewhat cursory. Environmental impacts should be assessed in equal detail with respect to both components.

There are several areas of discussion of Federal and State Threatened and Endangered species occurring throughout the EAR area (p.109, 150 etc.). In order to provide adequate protection for these species, such as that afforded the Mexican Duck, it is necessary, prior to leasing that endangered species critical habitat be delineated, preferable in map form.

Suggest inclusion, as part of the appendix, copies of the lease terms, Steam Act and Regulation on the Leasing of Geothermal Resources and GRO Orders.

The discussion of anticipated environmental impacts of the proposed action may be misleading. It gives the reader the impression that all the adverse impacts would occur and that an operator may do anything he wants on his lease without regard to existing rules and regulations which he must follow. In order to present a clear picture of anticipated impacts that cannot be avoided, we suggest the following steps.

1. For each of the environmental parameters, (i.e. air, water biota) identify the impact.
2. Following such identification discuss mitigating measures.
3. Differentiate mitigating measures that are adequately covered in the Rules and Regulations, GRO Orders, Standard Lease Terms from those that require special stipulations. For the former, cite the proper section or items of the existing authority.

Some of the geologic terms, (i.e. horst, graben, basalt, Tertiary, Cenozoic, rhyolite, pyroclastics, ignimbrites, latites, Iddingsite, porphyry, xenolith, monzonite porphyry, schistose, inselberg, andesite, and breccia) are not self explanatory and a person without geologic training would find such terms difficult to understand. Therefore, our Area Geologist at Roswell, New Mexico, suggests a form of explanation as presented in Attachment C. This could also be accomplished in the form of a glossary of geologic terms.

Specific Comments

Page 5, item (1) - Reservoir temperatures of 160°C (320°F) may be utilized in binary power plants. Therefore, change 180°C to 160°C.

, item (2) - 3 km may, at present be an economic depth limit; it is not a physical or engineering requirement and tomorrow may not even be an economic limit.

, item (3) - Commercial utilization of hot dry rock systems may be feasible in the near future, (as discussed on page 7 of the EAR).

Page 7, Hot Water System

The hot water remaining after steam separation may be applied to alternative uses such as industrial heat, greenhouse heating, animal husbandry, and space heating, before it is reinjected or disposed of.

Page 8, second paragraph:

The energy potentially available from geopressured reservoirs is in the form of heat, mechanical (hydraulic) energy and dissolved natural gas (primarily methane).

Page 11, Geothermal Resources Operational Orders (GRO's) 5, 6 and 7 have been drawn up and are in review at the present time. These orders will be made available upon completion.

Page 13, This is in reference to the section on "Casual Use" and "Exploration Operation". Attachment D contains a report on Exploration and Development of Geothermal Resources which may be helpful in the final assessment of this section.

Page 15, Seismic methods

The methods discussed are active seismic techniques only:

a) vibration method b) thumping method c) explosive method

Vibroseis and Dinoseis are trade names. Vibration method and thumping method are more appropriate terms. See Attachment C for a suggested discussion of passive seismic techniques.

Page 18, paragraph 2:

That geothermal potential on non-competitive leases is always lower is an assumption, not a fact. We recommend deleting this sentence.

Page 20, paragraph 4:

A typical drilling location for an exploratory well will require from 1 to 2 acres, and only rarely over 2 acres.

Page 21, paragraph 3:

Mud temperatures cannot cause blowouts as stated.

Page 22, 1st sentence (cont'd from pg 21)

Somewhat awkward sentence. Leaves reader with erroneous impression that power plant will not be built for 30 years following initial production.

Page 22, 3rd paragraph:

A number of wells may be drilled to delineate the reservoir before a "Plan of Development" is required.

Page 24, paragraph 2, last sentence.

Federal Reg. 43 CFR 3200.0-9(a) is an error. It should be 43 CFR 3200.0-8(a).

Page 28, last paragraph - See comments Page 5, Item (1).

Note: 1 acre - 0.405 hectare. Corrections have been noted where appropriate on pages 1-33 only. The rest of the EAR should be checked for incorrect conversions (i.e. pgs. 42, 78, etc.)

Page 30, fourth paragraph, last sentence:

No provisions made in the regulation or lease for marking of abandoned geothermal wells.

Page 64 - Repeat of paragraphs two and three.

Page 72 - Is it correct to address mammals and waterfowl on pp 72-73 in context with fish, aquatic amphibians, reptiles, invertebrates and zooplankton. Suggest placing mammals discussed on page 72 under

the Major Mammal section on page 75, and the waterfowl and other discussions of birds under the major section of avifauna.

Page 73 - The statement in parenthesis at the end of paragraph two might better read (listed as endangered under the U. S. list of endangered fauna May 1974).

Page 102 - suggest inclusion of a map delineating the San Simon Cienega Wildlife Habitat Area supporting the population of endangered Mexican duck. This would be helpful in post leasing operations.

Page 105 - 110, etc. - Several endangered species have been noted to occur or likely or occur (table 8) within the EAR assessment area. If these species warrant protection by law, then special stipulation to accomplish this should be addressed at this time prior to leasing.

Page 119 - The use of the kangaroo rat here as an example is not totally correct. Although the rat may be a plant eater it would not be classified a herbivore. Herbivore or herbivorous type animals are plant eating hoofed animals. Suggest another example be used.

Page 138 - Second paragraph. The approximate area occupied by a drill site is approximately 1 to 2 acres (0.405 - 0.810 hectares).

Page 138 - Second paragraph, last sentence. Oil spills from a drilling rig or vehicle are directed by way of drainage ditches into the sump (GRO #4).

Page 140 - First paragraph. Casing cementing will be in accordance with provisions of GRO Order No. 2.

Page 140 - Development - Ground water pollution would not normally occur at this stage. Measures to prevent ground water pollution at this stage would be the same as those taken during exploration.

Page 140 - withdrawal of geothermal fluids may increase seismic activity but this is not necessarily so.

Page 141 - Last paragraph. Fluid which would inhibit vegetation growth is not normally used during drilling operations. If such fluid is used it is contained in a sump and not released to surrounding areas (GRO #4).

Page 142 - Increased impact of an area due to vegetation may not necessarily be the case with increased exploration. This depends on the value of the removed vegetation to wildlife as food, cover, etc. Reclamation and revegetation (GRO #4, item 2) of a devegetated area with a more desirable vegetation species may actually be a benefit to the wildlife or domestic animals.

Page 142 - Necessary enclosures are taken to prevent the escape of any fluids from a drilling operation. Such measures are covered in GRO #4 and other regulations.

Page 143 - 5 to 10 acres (2.025 to 4.050 hectares) for power plant construction may be an over-estimate. A 5-acre area is the general space occupied by a power plant facility.

Page 150 - This page seems somewhat biased. Are there different categories of impact for Phelps-Dodge Smelter from Geothermal operations and are ~~the~~ only animal poachers, violators of environment and animal kingdoms, persons associated with Geothermal operations?

Page 157 - Development. The size of a drilling pad is generally 1 to 2 acres (0.045 to 0.810 hectares).

Pages 158 to 159 - It is unlikely that geothermal activities would further reduce the primitive values in the area which is claimed to have already been heavily intruded. This section seems to be somewhat biased and nonfactual. Suggest inclusion of a discussion of the primitive values in the assessment area. This would be helpful in assessing post leasing activity impacts to these values.

Page 168 - A plan of production requires an Environmental Analysis (EA) prepared by USGS, not BLM.

Geologic hazards as such are not addressed. However, the input for the Las Cruces District may be applied as well to the Animas Valley area. The only major difference is that water well information is available for the valley. No mention is made, however, of the presence or absence of subsidence as a hazard, even though there have been large withdrawals from the local ground water with consequent lowering of the water table.

COMMENTS ON LIGHTNING DOCK AREA DRAFT EAR
MITIGATING MEASURES AND STIPULATIONS

The subject draft has been reviewed relative to mitigating measures and possible stipulations. The following comments are offered:

1. Mitigating Measures

The mitigating measures cited in the EAR are well taken. These measures are adequately covered in existing regulations and GRO Orders and, therefore, should not be included as "Special Lease Stipulations". Each point could be considered and handled in the Plan of Operation necessary for every operation proposed by the lessee. The one exception is No. 24, Archaeological Sites, which has been included as a Special Stipulation in all geothermal leases issued to date. Our comments, and the regulation or GRO Order which applies are as follows:

1. Covered by GRO Order No. 4, Section 2, Public Access.
2. 43 CFR 3200.0-8
3. Same as #2
4. Same as #2
5. 30 CFR 270.34 (b); GRO Order #4 Section 2, Land Use and Reclamation; Section 3, Public Access and Section 5, Slope Stability and Erosion Control and Lease Section 14.
6. Lease section 9(a) and 14 (f)
7. 30 CFR 270.34, GRO Order #4, Section 3 Public Access
8. 30 CFR 270.34 (b)
9. 30 CFR 270.34; GRO Order #4 Section 5, Slope Stability and Erosion Control, and Section 9 Pollution, Waste Disposal, and Fire Prevention; and Geothermal Lease Section 9 and 14.
10. 30 CFR 270.30; 30 CFR 270.34; GRO Order #4, Section 2. Land Use and Reclamation and geothermal Resources Lease Section 14.
11. Same as above

12. 30 CFR 270.34 (h); 30 CFR 270.41; 43 CFR 3204.1(c) and (d); GRO Order #4 Section 9. Pollution, Waste Disposal, and Fire Prevention and Lease Section 14. Since wastes will originate within the Area of Operations, and be the responsibility of the Supervisor, change "Authorized Officer" to "Supervisor".
 13. 43 CFR 3204.1(f) and GRO Order #4 section 1. Aesthetics
 14. Same as #12
 15. Same applies
 16. 43 CFR 1725.3-1 and 43 CFR 1725.3-2
 17. Same as #12
 18. Same as #12
 19. 43 CFR 3204.1 (h) and Lease section 18. Suggest substitution of: "The statement required under Lease Section 18 will be completed by a qualified archeologist acceptable to the Authorized Officer."
 20. Same as #12
 21. Surveys of endangered or threatened species are the responsibility of the lessor, not the lessee.
 22. Same as #21
 23. (There is no #23)
 24. OK as Special Stipulation
 25. 43 CFR 3204.1(c)(1)
 26. 30 CFR 270.34 (h), 30 CFR 270.41, 43 CFR 3204.1 (c)(2) and (g).
2. Other Stipulations (pp. 181-2)

The following comments relate to the proposed stipulations on pp. 181-2.

1. This right is already reserved by 30 CFR 270.34 requiring joint approval by the Supervisor and surface management agency, therefore, stipulation should be removed.

2. Specific site stipulations to protect known sites are in order. It becomes rather difficult to protect an unknown site. Subsection (a) should be included as a Special Stipulation for all geothermal leases. Subsection (b) is specifically required by 3204.1(h) and Lease Section 18 and should not be included as a Special Stipulation. (Refer to comments on Mitigating Measure 24 above.)

3. Protection of the environment including endangered or threatened plant or animal species is addressed by 30 CFR 270.34 (h); 43 CFR 3204.1(g); GRO Order #4, Section 6. Biota and Lease Section 14(e); and, therefore, no Special Stipulation is necessary.

ATTACHMENT B

Passive seismicity studies. Small geophones (seismometers) are planted just beneath the ground surface. These are designed to detect the numerous micro-earthquakes which are quite frequently associated with geothermal occurrences. Several geophones may be planted, each with a small (15 foot) cable leading to a recorder about the size of a suitcase. Recorded signals from distant earthquakes or quarry blasts may also be analysed to deduce subsurface rock properties in the survey area. This study may span a time period of two to four weeks and usually involves only one or two men on foot. Vehicle use may be restricted because of vehicle vibrations which would be recorded.

A second type of passive seismicity study involves monitoring seismic noise or ground noise. The procedure is similar to the micro-earthquake study. However, the ambient level of ground noise which has been observed in many geothermal systems is monitored. This "noise" is distinguished from discrete, recognizable seismic events.

The above surveys can all be conducted from existing roads. Snow-mobiles or trail bikes can also be employed. In rare instances inaccessibility may warrant the expense of a helicopter for transporting the crew. In all of these studies the impacts on the environment are negligible.

ATTACHMENT C

SUGGESTED EXPLANATION OF GEOLOGIC TERMS

Basin and range topographic features were being formed under extensional stress (or pulling apart of the earth's crust) during mid-Tertiary time (20-26 million years ago). Prior to and at the beginning of this regime, molten silicic magmas (molten rock rich in silica) ascended along deep faults and fractures. Intruding to the near surface and extruding with violent eruptions, ash flow tuffs (compacted volcanic ash), ignimbrites (ash flows and swift flowing, turbulent, glowing gas clouds) and rhyolite (fine-grained granite) flows blanketed the earth's surface. Horst and graben (ridges and elongate basins) structures (see fig. 5A) resulted from the extensional forces applied on the western U. S. and thus formed the ranges and basins, separated by normal fault slips (the falling of one block down relative to another). Continuous erosion of the ranges throughout the Cenozoic era (from 68 million years to present), allowed for the deposition of thick accumulations of alluvium in the adjacent basins. Near the end of the Tertiary period, silicic "rhyolitic" eruptions began to give away to basaltic magmas (the common form of black lava). (This change in magma type reflects the depth of origin of the molten rock) (Nash and Hausel, 1974). Basaltic lava flows, ejected from cinder cones continued to erupt sporadically and cover the older alluvium valley-fill throughout the basin and range until present time.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ROUTING AND TRANSMITTAL SLIP

CODE	TO		ACTION	ROOM NO.
	NAME	ORGANIZATION		
	<i>Dir, Las Cruces</i>	<i>3300</i>	<i>8</i>	
		<i>NOV 10</i>		
			<i>YMC</i>	

Indicate Action by Number

- | | |
|----------------------------|---------------------|
| 1. Necessary action | 6. Note and summary |
| 2. Approval | 7. Note and return |
| 3. Signature | 8. Your information |
| 4. Prepare reply | 9. See me |
| 5. Your comment and return | 10. |

From <i>Resources</i>	Date <i>11/2/75</i>	Room No.
Office <i>NDA 80</i>		Phone

Remarks

A copy of this ~~report~~ should probably be in the 3012



United States Department of the Interior

BLM 3200 (721)

BUREAU OF LAND MANAGEMENT

WASHINGTON, D.C. 20240

5

NOV 10

W/MS

DOOR

DH
RA
KK
BM
JG

OCT 30 1975

Memorandum

To: State Director, New Mexico

From: Associate Director

Subject: Proposed Lightning Dock Geothermal Lease Sale Area

This responds to your September 3, 1975, memorandum requesting permission to proceed with the proposed subject sale prior to completion of an MFP for the entire area. Permission is granted.

For future guidance with regard to any similar cases, please refer to our Instruction Memorandum No. 75-272, Change 8, of September 9, 1975 (copy enclosed).

George L. Tinscott

Enclosure

Date Routed NOV 5 1975

Info *2*

Action *2*

advise

has answer

CS

Other

KEY *GL*

WJE *GL*

JR *GL*





721

United States Department of the Interior

3200 (721)

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20340

September 9, 1975

Instruction Memorandum No. 75-272, Change 8
Expires: 12/31/75

To: All SD's

From: Associate Director

Subject: Fiscal Year 1976 Annual Work Plan Directives - Geothermal
Leasing

This memorandum amends that part of Instruction Memorandum No. 75-2/2 concerning MFP's and the Bureau's geothermal leasing program (page G-71).

On page G-69, our Directives state that:

"Priorities relative to the existing national goal of achieving energy self-sufficiency by the early 1980's continue in FY 1976. Public land energy resources must figure substantially to the objective of increasing domestic energy production within the constraints of stringent environmental safeguards. This mandate translates into facilitating the production of leaseable minerals by processing energy-related applications in a timely manner, and accelerating energy leasing programs. Energy programs as a whole (including NBET) continue as the Bureau's highest priority effort in FY 1976."

Individuals and corporations have shown an intense interest in the exploration and development of geothermal resources. Normally, we would complete land use studies before making areas available to the public. When our geothermal goals can be met after first completing appropriate management framework plans, those plans should be completed. However, because of both this intense interest in the resource and our OPS objective of issuing 925 noncompetitive leases in FY 1976, we do not feel that the Bureau should hold up exploration and development on Federal lands pending future planning efforts.

Therefore, do not make management framework planning a prerequisite to geothermal leasing. However, carry out the required environmental studies and other necessary processing prior to lease issuance.



George A. Truesdell

January 21, 1976

Daniel C.B. Rathbun, Acting District Manager
U. S. Department of the Interior
Bureau of Land Management, District Office
P.O. Box 1420
Las Cruces, New Mexico 88001

Dear Mr. Rathbun:

I appreciate the opportunity to submit the accompanying comments on the Technical Report and Environmental Analysis Regarding the Proposed Geothermal Leasing in the Lightning Dock Area.

The pages of the copy of the draft which you sent me were not numbered, except for a blank page numbered 9 with Figure 5 indicated, and the page containing Figure 3. The latter page number is the same as the Table of Contents lists for Background Information.

The pages listed in the Table of Contents were used as an aid in numbering each page, but there still may be a few discrepancies.

Respectfully submitted,

Roger A. Parsons

Roger A. Parsons
Heating Engineer, Member ASHRAE

RAP/dp

Route #1, Box 210 IM
Deming, New Mexico 88030

BLM
DISTRICT OFFICES

JAN 21 1976

DI		
DM		
RM	✓	100
OPR		
WS		
L	✓	100
ACTION	✓	100

DH L

98

Comments on EAR & TE on Proposed Leasing in Lightning Dock Area

- Pages 159 and 160. This could be one of the most important statements in the entire report. If the California Court decides that the geothermal resources belong to the owner of the land surface, possibly much of the leasing procedure will need to be changed. Also, the proposed leasing date of May 20, 1976 may need to be changed if there are any crop lands in the proposed leasing area. This follows from the statement "Leasing of these lands will not be considered until a determination (by the Court) is final."
- Page 24. The probability of a power company applying for a Certificate of Public Convenience and Necessity seems unlikely when the following requirements are compared with the information available to date.
- Page 5. Technological Requirements for Geothermal Energy for the Production of Electricity.

RequirementsInformation Available to Date

- | | |
|---|---|
| (1) Minimum reservoir temp. 350°F | P.41. Max. 220°F; P.51 Max. 240°F |
| (2) Depth less than 1.9 miles | P.47. No water at 1.4 and 1.43 miles |
| (3) Fluid flow to the surface | P.41. Initially, at least, in one area |
| (4) Min. reservoir vol. 3 cu. miles | P.27,28. Dimensions not known |
| (5) Reservoir permeability suff. for sustained delivery of fluids at adequate rates of flow | P.27,28. OK to date in California, New Zealand and Italy
P.22. Min. 30 years required by utilities |

- The uses of geothermal energy other than for electric generation seem to offer considerable potential, as discussed on pages 28 and 29. This statement on page 29 is particularly interesting: "Two buildings, covering an area of 37 acres in Oklahoma, have the potential of producing the vegetables for half the State of Oklahoma."
- Page 41. Presumably the maximum water temperatures indicated by test holes are a good indication of the potential of the area. If so, the 7500 kw flow of energy per 160 acres (1 square mile) indicated by the heat conductivity measurements are misleading because the temperature level is not high enough for generation of electricity, even though the indicated energy equivalent is correct.
Production of 7500 x 4 = 30,000 kw of electricity per square mile would be sufficient for the needs of about 30,000 people, according to the ratio quoted on pages 5 and 7. So, even if the temperature were high enough for generation of electricity, the investment required per unit of output would be highly impractical.

6. Page 25. Construction of hot water or steam pipelines above ground is not necessary for the reason given, namely, extreme temperature changes. Expansion loops or joints take care of pipe expansion and contraction, and are necessary above or below ground. Granulated insulation (Gilsotherm) poured around piping in an underground trench should be practical and economical if properly installed in the areas under consideration.

Temperature variations much in excess of 300 to 400 F are encountered frequently in electric generating station piping.



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 36
345 Middlefield Road
Menlo Park, CA 94025

Date Routed **FEB 20 1976**

SD Info

ASD _____

IC _____ Action

IRS _____

Res _____

SS _____

PAO _____

AS _____

Sc _____

Other _____ *write in the*

FEB 18 1976

Facs. Message No. NMSO-76-184

Memorandum

To: State Director, BLM, New Mexico

From: Area Geothermal Supervisor

Subject: Special Stipulation for the Lighting Dock KGRA.

BLM
GRUCES

FEB 23 1976

DM	
ADM	
RM	
OPR	
WS	
C-L	

Our office has reviewed the final recommended measures intended to form the basis for special stipulations for the Lighting Dock EAR area. Other than item c. p. 140 our office finds the measures acceptable. Item c. which in part states that "...a field inspection examination of the site by the Authorized Officer or his representative will be conducted", and that "relocation of some operations may be required". The Area Geothermal Supervisor's office initiates a joint site inspection of all proposed geothermal drilling activities, and the authority to relocate a geothermal operation is the responsibility of the Area Geothermal Supervisor with the concurrence of the Authorized BLM Officer and not the sole responsibility of the BLM.

We therefore suggest that prior to entry upon public lands within the described areas, the lessee (operator) will discuss proposed activities jointly with the Area Geothermal Supervisor, and the Authorized Officer who may require additional measures to protect rare and endangered plant and animal species present in the Peloncillo Mountains.

Thank you for the opportunity to review the final recommended stipulations. We appreciate your continuous cooperation.

Rid Shaw

Geothermal Records Available

An Environmental Analysis Record (EAR) and Technical Evaluation (TE) concerning leasing of geothermal resources on federal land within the Lightning Dock Known Geothermal Resource Area and surrounding lands has been compiled by the Las Cruces District Office, U. S. Bureau of Land Management.

Rough drafts of the EAR and TE are available for public review and have been placed at the following locations: (1) City of Lordsburg Public Library, (2) Silver City Public Library, (3) Town of Animas U.S. Post Office, (4) Las Cruces District Office.

Public comment and evaluation is invited by January 5, 1976 and should be directed to the Las Cruces District Office, U. S. Bureau of Land Management, Box 1420, Las Cruces, New Mexico 88001.

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

Form 1236-3
June 1969

BORROWER

TD 199 .64 L57 1976

Technical report and
environmental analy

DATE LOANED	BORROWER

USDI - ELM

