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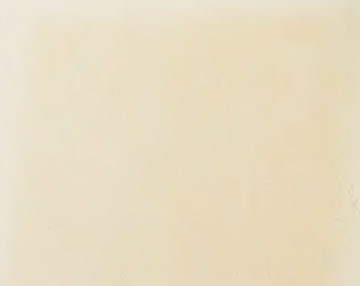
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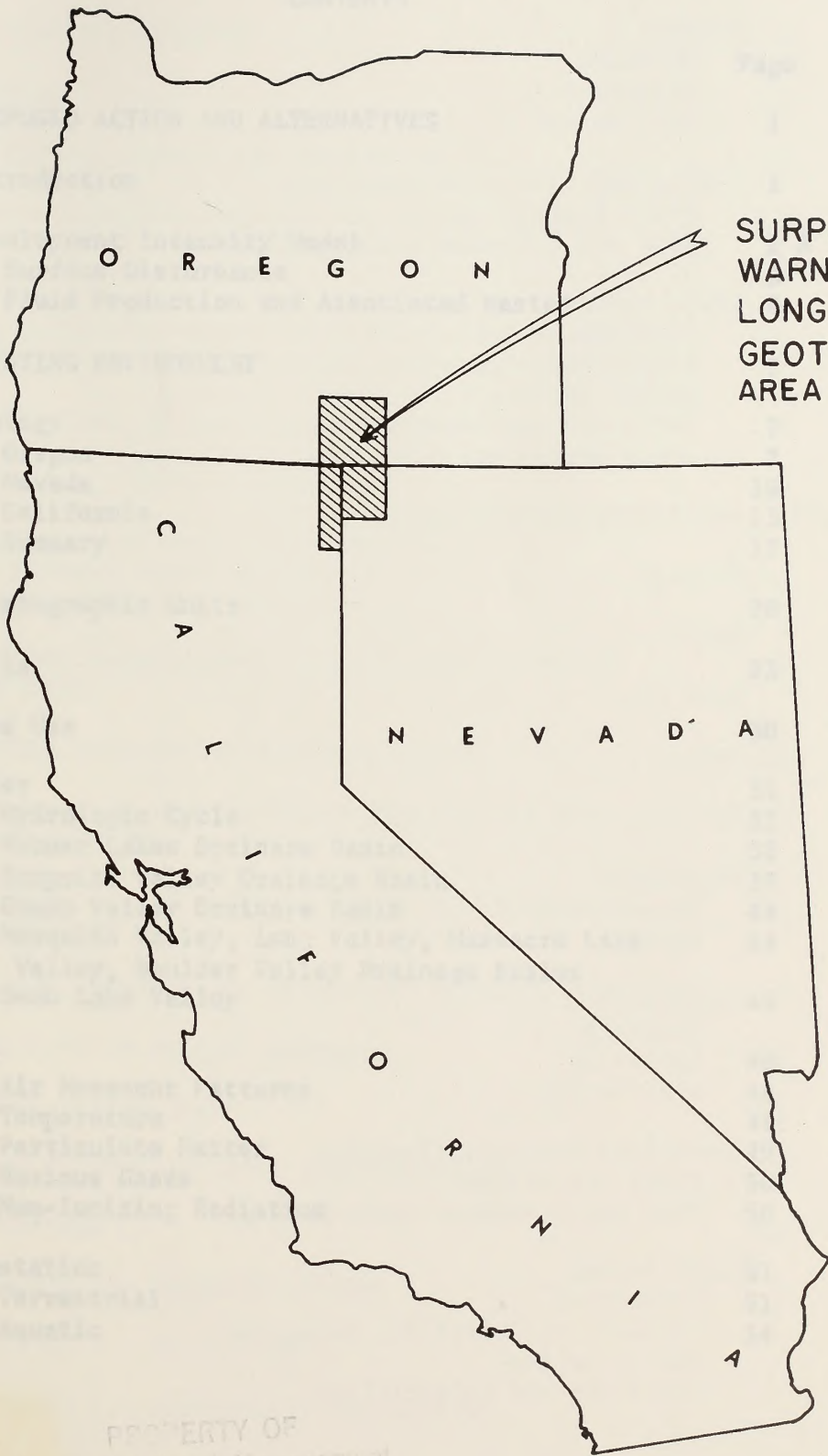
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LOCATION MAP

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I. PROPOSED ACTION AND ALTERNATIVES

INTRODUCTION

This Environmental Analysis Record (EAR) analyzes the impact of proposed geothermal resource leasing on National Resource Lands in portions of two BLM Districts - Susanville, California and Lakeview, Oregon. It includes a total area of approximately 1,231,000 acres located in south central Oregon, northeastern California, and northwestern Nevada (see Location Map). The analysis was prepared through the use of an interdisciplinary team composed of BLM resource specialists from both Districts. This EAR is a supplement to, and a specific extension of, the Interior Department's "Final Environmental Statement for the Geothermal Leasing Program" (available in Interior Department offices, public libraries, and from the Superintendent of Documents, U.S. Government Printing Office).

Information contained in this EAR pertaining to resource condition and potential was primarily obtained from BLM District documents known as Unit Resource Analyses (URAs). URAs contain comprehensive inventories and analyses of resource problems, conditions, uses, production, quality, capabilities, and management potential in geographic areas known as BLM Planning Units. URAs for each Planning Unit are maintained at District Offices and are available for public examination. The following URAs are applicable to portions of this Environmental Analysis area:

Susanville, California District

Cowhead Planning Unit
Massacre Planning Unit
Tuledad Planning Unit
Home Camp Planning Unit

Lakeview, Oregon District

North Warner Planning Unit
South Warner Planning Unit
Beatys Butte Planning Unit

Two "known geothermal resource areas" (KGRAs) exist within the area (see map titled Physiographic Regions). "Known geothermal resource area" means an area in which the geology, nearby discoveries, competitive interests, existence of hot springs, or other indicia would, in the opinion of the Secretary of the Interior, engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal resources are good enough to warrant expenditures of money for that purpose. The KGRAs are listed below:

<u>Name</u>	<u>Location</u>	<u>Approximate Size (Ac)</u>
Lake City	Surprise Valley, CA	37,800
Crump Geyser	Warner Valley, OR	23,700

The ownership of the submerged lands and resources of Lower, Middle, and Upper Alkali Lakes (Surprise Valley, California) is presently unresolved. The State of California and the United States Government claim ownership of these lands. A determination as to riparian rights is needed to identify whether the United States may have a right to these resources.

Leasing of geothermal resources will be in accordance with the Geothermal Steam Act of 1970 (84 Stat. 1566); (30 USC 1001-1025). The Act authorizes the Secretary of the Interior to 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 the reservation to the United States of the geothermal steam and associated geothermal resources therein.

If lands to be leased under this Act are within any known geothermal resource area (see definition above), 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 resource area, the qualified person first making application for the lease shall be entitled to a lease of such lands without competitive bidding. The Secretary's regulations, along with a copy of the Act, are reproduced as Appendix III of this report.

Proposed action:

Implementation of the Geothermal Steam Act involves the following actions:

1. The approval of "Notices of Intent to Conduct Geothermal Resource Exploration Operations" on areas not connected with a lease (Form 3200-9).
2. Issuance of Non-Competitive Geothermal Resource Leases (Form 3200-21).
3. Issuance of Geothermal Resource Leases (Form 3200-21) by competitive bidding in KGRAs and competitive interest areas.

Each of these actions contain built-in environmental safeguards in the form of regulations issued by the Secretary and reproduced as Appendix III of this report. The Environmental Analysis Record analyzes the proposed action and alternatives in light of these regulations, and documents the analysis of the anticipated impacts upon the environment due to the proposed geothermal leasing and alternatives (below). It determines if an Environmental Impact Statement is needed. Recommendations for mitigation and enhancement are made.

Subsequent to this analysis, before any lease is issued, environmental impacts will be assessed in more detail in a pre-sale evaluation of lands proposed for leasing. At this stage site-specific mitigating measures in the form of lease stipulations are added to the lease and Notice of Intent forms. The stipulations are binding on the lessee.

After lands are leased, the lessee must submit a Plan of Operations before activity can begin. The Plan is reviewed for compliance with applicable Federal, State, and local laws and regulations. In addition, the Plan must be compatible with lease and land use permit stipulations of the geothermal regulations, recommendations developed in this EAR, and stipulations developed in forthcoming pre-sale evaluations.

Alternatives identified are:

1. No Leasing or Exploration - Geothermal exploration and development will not be permitted on National Resource Lands within the analysis area.
2. Leasing Only Lands of Low Environmental Sensitivity - Leasing would not be permitted in those areas where significant adverse environmental impacts are probable. Geothermal exploration, exclusive of exploration drilling, will be permitted on such lands provided that adverse environmental impacts can be avoided.

DEVELOPMENT INTENSITY MODEL

Geothermal energy is similar to other energy resources in that until actual exploration and development begins, it is difficult to quantify the resource potential and possible future intensified production measures necessary to develop it. A special problem exists with geothermal energy because it is a relatively undeveloped resource when compared to other resources. In order to assess environmental impacts resulting from an action as general and variable as geothermal energy exploration, development, and operation, it is necessary to assume given levels or intensities of such development.

Several models were assumed which describe the major processes and actions involved in the various stages of lease implementation. Each model assumes one 2560 acre lease, the maximum size authorized, and serves as the baseline against which to analyze impacts upon the existing environment.

There are basically four different major types of geothermal systems: vapor-dominated systems, hot water systems, geopressured reservoir systems, and hot dry rock systems. Based on the geologic character

of this region the hot water system appears as the most likely type to occur. Therefore, a hot water system is assumed throughout the analysis.

Hot water systems are thought to be thermally driven convective systems in which meteoric water picks up heat from a local heat source and moves upward in the system. This upwelling of hot water often penetrates to the surface and is manifested as hot springs, geysers, and other thermal surface phenomena. Geothermal manifestations in this EAR area are listed in the description of areal geology. Thermal energy is stored in both the hot rock and in the water and steam which fill the pore spaces in the rock. Tapping of the upwelling hot waters by wells results in a portion of the fluid, generally 15-25 percent, flashing to steam due to pressure decrease. Temperatures of about 300 degrees C and wellhead pressures from about 50-150 psi are commonly found in this type of system. The steam fraction is separated from the hot water at the surface. Steam is directed through the turbines and the hot water is discharged to the surface or re-injected into the ground. Electric power production from this type of system is presently underway in Wairakei, New Zealand; Otake, Japan; Cerro Prieto, Mexico; and Pathe, Mexico.

SURFACE DISTURBANCE

Models were not developed for each stage of lease implementation. During the exploration stage surface disturbance is minimal with few adverse impacts until the decision is reached to drill one or more exploration wells. A technical report (attached as Appendix No. III) describes in detail the separate stages involved in geothermal resource development.

An exploration drilling model is shown in the following table which lists the maximum degree of surface disturbance expected during this phase. This table and the others which follow tend to maximize the degree of surface disturbance which might occur. For example, fewer than five exploration wells may be needed, one acre per drill site could be used rather than two acres, disposal ponds may not be needed or could be smaller, and fewer access roads may be needed when roads into the area already exist.

Table 1. Surface Disturbance Expected to Result From Exploration Drilling on One 2560 Acre Lease

Feature	Number of Acres Disturbed	Number of Features	Acres Disturbed
Well	2	5	10
Disposal Pond	4	5	20
Access Roads	1.5	5	8
TOTAL			38
			or 1.5% of total lease area

Construction activities required to develop two 100 megawatt power plants, associated wells, pipelines, roads, and transmission lines are listed in the following table. The number of wells includes those used for production, standby, and reinjection. Since development is likely to occur in about 50 megawatt increments over a period of several years, the degree of surface disturbance at any given time is less than assumed in the model. Mitigation and enhancement will have occurred in some portions of the lease before additional portions of the lease are developed.

Table 2. Surface Disturbance Expected to Result From Development of Two 100 Megawatt Power Plants on One 2560 Acre Lease

Feature	Number of Acres Disturbed	Number of Features	Acres Disturbed
Power Plant	5	2	10
Well	2	65	130
Disposal Pond	4	20	80
Pipeline	1.2	50	60
Access Rd(spurs)	0.9	65	59
Mainline Road	12	1	12
Transmission Line	4.5	2	9
TOTAL			360

or 14% of total lease area[†]

FLUID PRODUCTION AND ASSOCIATED WASTES

Production of geothermal fluids is likely for short periods as wells are tested to determine reservoir characteristics. If geothermal fluids are discovered in commercial quantities, development of the geothermal field is likely.

The rate of fluid production from a geothermal reservoir is unknown until the production testing phase is completed. Using data from other areas of geothermal development it appears that production of geothermal fluids could be expected to vary from 440,000 gallons per day per well, to 900,000 gallons per day per well. Assuming 670,000 gallons per day per well as an average production figure, a lease with 40 producing wells would yield 26.8 million gallons of fluid per day.

About 15-25 percent of the geothermal fluid produced from wells will flash to steam and be used to drive the turbines in the power plants. Using 20 percent as an average, the following table lists the amounts of geothermal fluids expected to be produced during testing of a 2560 acre lease.

Table 3. Quantities of Fluids Produced During Testing of Geothermal Exploration Wells - 15 Day Test Assumed

Fluid Production per Test Well	-	10,050,000 gallons	31 ac.ft.
Amount Converted to Steam	-	2,010,000 gallons	6 ac.ft.
Amount Left for Disposal	-	8,040,000 gallons	25 ac.ft.

Fluid Production for 5 Test Wells	-	50,250,000 gallons	154 ac.ft.
Amount Converted to Steam	-	10,050,000 gallons	31 ac.ft.
Amount Left for Disposal	-	40,200,000 gallons	123 ac.ft.

During the initial testing stage one well is likely to be tested at a time. Therefore, the quantities shown in Table 4 are likely to be spread over a period of time rather than one two-week period.

If testing is successful and production goes forth, larger quantities of fluids will be produced. The following table summarizes the amounts of fluids which could be produced and disposed of each day for 40 producing wells.

Table 4. Quantities of Fluids Produced During Production and Operation of One 2560 Acre Lease with 40 Producing Wells

Fluid Production per Well per Day	-	670,000 gallons	2 ac.ft.
Amount Converted to Steam	-	134,000 gallons	.4 ac.ft.
Amount Left for Disposal	-	536,000 gallons	1.6 ac.ft.

Fluid Production per Day for 40 Wells	-	26,800,000 gallons	82 ac.ft.
Amount Converted to Steam	-	5,360,000 gallons	16 ac.ft.
Amount Left for Disposal	-	221,440,000 gallons	66 ac.ft.

Geothermal fluids will probably consist mostly of sodium, potassium, lithium, chloride, bicarbonate, sulfate, borate, and silica with total dissolved solids ranging between 1,000 and 30,000 m/l. Toxic substances such as boron, arsenic, fluoride, and zinc may be present in minute, but significant, quantities.

The exact nature of potential geothermal fluids is unknown, but it appears likely that such fluids will be detrimental to life if allowed to mix into the surface environment in large quantities. Because of these factors it appears unlikely that geothermal fluids will be allowed to escape to the surface or shallow subsurface environment. If, during the development of a specific lease, conditions warrant surface disposal of geothermal fluids, the alkali lakes of Surprise Valley and the numerous playas scattered throughout the EAR area may be considered for disposal sites.

An alternative method of disposal is evaporation from holding basins. Solid wastes remaining after evaporation would require removal to approved disposal sites. The method is impractical for large amounts of fluid because large amounts of land are required for construction of holding basins. In the Niland, California area a 65 acre pond was required to evaporate 126 million gallons of geothermal brines at a rate of 6 feet per year. Even though evaporation rates may be greater in the area of this report because of less saline brines, the land requirement to evaporate 21 million gallons (66 acre feet) of fluid a day is, in effect, astronomical.

The major portion of geothermal fluids produced on a lease in this EAR area are likely to be disposed of by reinjection into the geothermal reservoir. Smaller portions may be disposed of in holding ponds, particularly during the exploration testing phase.

A Technical Report describing the details of geothermal development is attached as an appendix to this report. In addition, the Department of the Interior has issued a "Final Environmental Statement for the Geothermal Leasing Program" which is available in Interior Department offices, public libraries, and from the Superintendent of Documents, U.S. Government Printing Office. These reports should be consulted by individuals needing additional information regarding geothermal technology.

II. EXISTING ENVIRONMENT

GEOLOGY

The following description of geology for the EAR area was provided by William H. Lee, Conservation Division, USGS, Pacific Area Geologist's Office, Menlo Park, California. References are listed on pages 18 and 19. A detailed geologic map is available for review at the Bureau of Land Management District Offices in Susanville, California and Lakeview, Oregon.

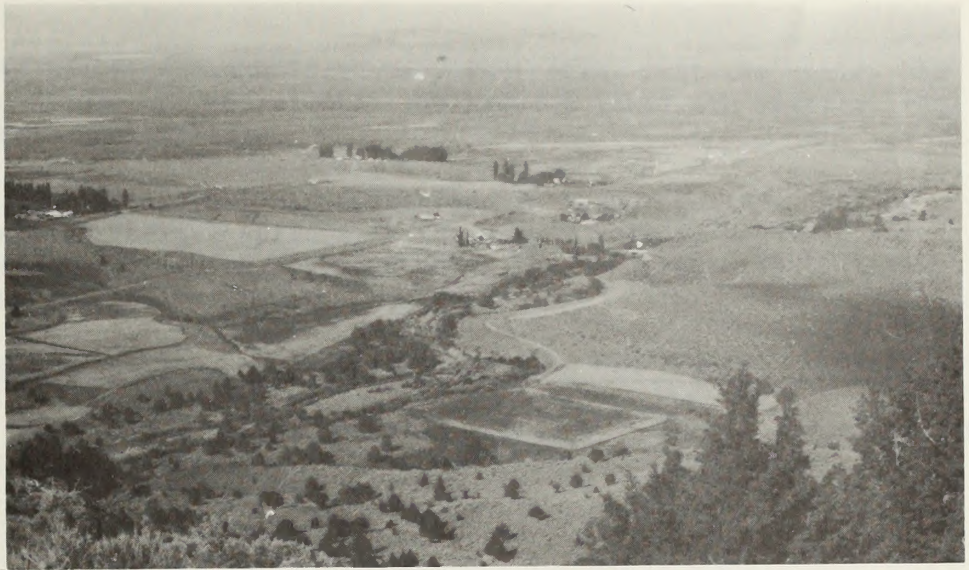
OREGON

The portion of the Environmental Analysis Record (EAR) area in Oregon is included in the Basin and Range Province. It is an area of major faulting to form horst and graben structures. Warner Valley is one of seven major basin range-type structural basins in south-central Oregon. Warner Valley is an elongate, undrained basin-type valley that was formed by late Tertiary to Holocene block faulting and is bounded on both sides by large tilted fault blocks (Peterson, 1959).

According to Donath (1962), the late Tertiary basalt flows that cover most of the Oregon portion of the EAR area were subjected to two major sets of faults, one set trending N. 35 degrees to 40 degrees W., and the other trending N. 20 degrees E. These sets of faults result in a strong regional rhombic pattern. Warner Valley, the main basin range structure, trends to the northeast and conforms with basin range development elsewhere. The faults of both sets were contemporaneous in origin and movement occurred concurrently along both sets (Donath, 1962.)

The rocks in this EAR area are tuffaceous sediments, tuffs, extensive basalt flows, andesite flows, and minor intrusive rhyolites of Miocene to Plio-Pleistocene age. The valleys and stream bottoms are filled with Quaternary alluvium, slope wash, and landslide debris. Landsliding is common along the steeper portions of the graben-bounding fault scarps. In the northern portion of this EAR area, there are large accumulations of large complex exogenous domes and related flows and flow breccias of rhyodacitic composition (Walker and Repenning, 1965; Walker, 1963). Coyote Hills, Hart Mountain, and Drakes Peak near the Warner Valley are large silica volcanic centers, characterized by steep-sided domes and related viscous flows (Walker and Peterson, 1969). Ancient lakebed sediments occur in isolated playas in this area but not to the extent as in Surprise Valley, California.

Russell (1884) reported ancient beach lines that may be traced continuously in Warner Valley about the borders of the basin at an elevation of 225 feet above the present lakes. These beach lines were



ADEL, OREGON

Foreground - Deep Creek. Mid-Photo - Adel Store, Oregon; State Highway Dept. Maintenance Station; and ranches. Background - Hay fields and desert plateau.



HART MOUNTAIN

Foreground - Friday Reservoir. Mid-Photo - Desert plateau and narrows between Hart Lake and Crump Lake. Background - Hart Mt.

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unbroken by overflow channels thereby indicating that the valley had interior drainage and no outlet. The present lakes are vestigial remnants of this ancient lake.

There are many geothermal manifestations in Warner Valley. Waring (1965) lists 10 thermal springs in the Warner Valley; however, not all of the springs listed are located in the EAR area. That listing is reproduced below:

No.	Name or Location	Temp(degrees F)	Flow (gpm)	Remarks
48	Sec. 16, T.35S., R.26E. upper Rock Creek 4 mi. east of North Warner Lake	105-115	50	Several springs
48A	Antelope Spring	104	30	Deposit of tufa
49	Hart Mtn. Hot Spring in sec. 7., T.36S., R.26E., on the N. side of Hart Mtn. a- bout 200 feet below crest	Hot	Small	
49A	Fisher's Spring	144	20	Water smells of H ₂ S
49B	W.D. Moss Ranch on W. side of S. Warner Lake	72;83	500;30	2 main and sev- eral smaller springs
49C	Charles Crump's Spring	104	5	Deposit of tufa
49D	Warner Valley Ranch	98;107; 164	20;2;10	Deposit of sili- ceous sinter
50	Adel Hot Spring in sec. 23, T.39S., R. 24E., 1 mile E. of Adel P.O.	160	20	Water smells of H ₂ S.
51	Houston Hot Spring in sec. 27, T.40S., R.24E., 3 miles E. of Warner Lake P.O.	160	5	Deposit of sili- ceous sinter

Fisher Hot Spring, in the NW1/4NW1/4NW1/4, section 10, T.38S., R.25E., has a surface temperature of 68 degrees C and an estimated subsurface reservoir temperature of about 123 degrees C (Mariner and others, 1974). Fisher Hot Spring issues from Quaternary alluvium and Miocene to Pliocene olivine basalt.

Crump Spring in the NE1/4NE1/4, section 4, T.39S., R.24E., has a surface temperature of 78 degrees C and an estimated subsurface reservoir temperature of 144 degrees C (Mariner and others, 1974). Crump Spring also issues from Quaternary alluvium and Miocene to Pliocene olivine basalt.

In 1959, Nevada Thermal Power Company drilled a hole 1,684 feet deep near the west bounding normal graben fault in SW1/4, section 34, T.38S., R.24E. The well was tested and abandoned due to the low bottom hole temperature of 170 degrees F. However, temperatures of 230 to 250 degrees F were recorded at 660 feet depth (Peterson, 1959). The well later began erupting steam and hot water. Tufa, sinter mounds and other small hot springs scattered for 2 miles along a narrow elongate northeast trending zone indicate thermal activity along a fault zone (Godwin and Peterson, 1969).

Extinct hot springs are indicated by low mounds of calcareous and siliceous tufa, especially at the north edge of Pelican Lake. Former sites of hot springs are indicated by local mounds of white to light gray siliceous sinter and calcareous-coated pebbles and boulders within the valley-filling alluvium (Peterson, 1959).

During 1968 there was some seismic activity in Warner Valley. The earthquakes epicenters, which were just south of Crump Lake, averaged 4.9 on the Richter Magnitude Scale.

NEVADA

The portion of the Environmental Analysis Record (EAR) area in Nevada is included in the Basin and Range Province. Little has been published about this portion of Nevada. The main geologic feature is Long Valley, a typical basin-range graben valley. The adjacent Hays Canyon Range is another major feature and is a horst. Probably the most unique geologic feature of this portion of Nevada is an Oligocene strato-volcano that has been dissected by Hays Canyon in T.39N., and T.40N., R.18E., and R.19E. The volcano served as a source for the rocks now mapped as the South Willow Formation (Bonham, 1969).

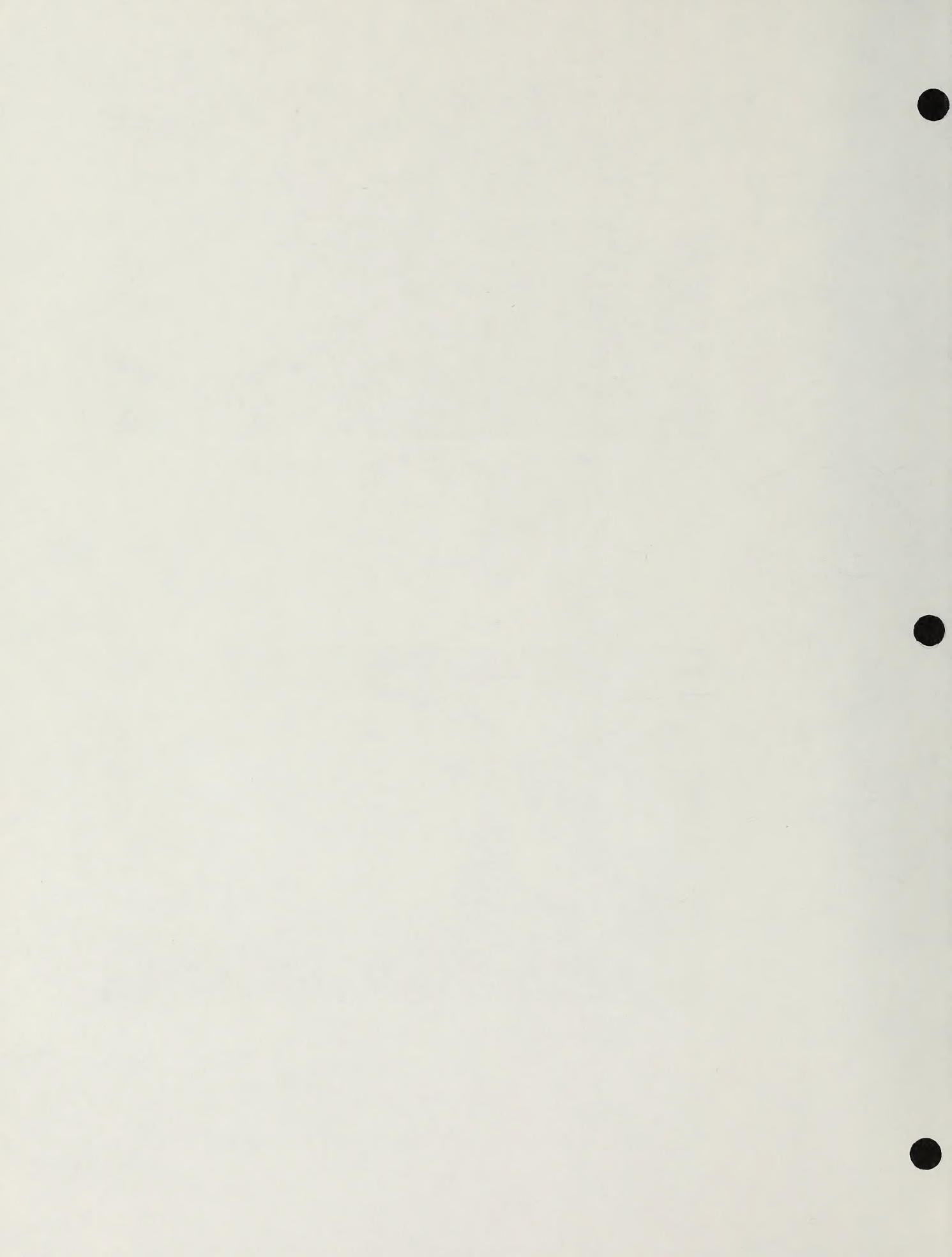
Long Valley is a large north-south trending elongate depression formed in part by faulting on the northwest and northeast sides, and in part by downwarping on the southeast side. An inferred covered basin-range



View west across Warner Valley. Snow-covered
Fish Creek rim.



Crump Geyser, Warner Valley, Oregon



high angle normal fault is projected as bounding the valley on the west (Bonham, 1969). The range northeast of Long Valley is a tilted fault block bounded by northeast trending high angle normal faults. The basin in which Massacre Lake is located is formed by a synclinal bend related to tilting (Bonham, 1969). The Hays Canyon Range is a complexly faulted horst between the Surprise Valley graben on the west and the Long Valley graben on the east. Most of the faults mapped in the range are north-south trending high angle normal faults but in the northern portion of the range a set of faults trending northwest-southeast is predominant.

The rocks in the Nevada portion of the EAR area are mostly volcanic in origin. There are olivine basalt flows of upper Miocene and Pliocene age; Miocene sediments of the High Rock sequence and rhyolites of the Canyon Rhyolite. Miocene basalt and andesite flows and breccias are common. The High Rock sequence as mapped by Bonham (1969) includes diatomite, shale, mudstone, sandstone, basalt lapilli tuff, and agglomerate, sodic rhyolite ash-fall tuff and welded ash-flow tuffs and restricted flows of sodic rhyolite and basalt. The Canyon Rhyolite includes flows, domes and subordinate welded ash-flow tuffs of soda rhyolite. The Oligocene South Willow Formation has rocks derived from the old volcano that are basalt, andesite, and dacite flows, agglomerates, mudflow breccia and associated intrusive phases.

There are Pleistocene to Holocene landslides in this area including a very large one in T.41N., and T.42N., R.18E., in the Hays Canyon Range. Landsliding has occurred wherever resistant basalt flows overlie softer tuffs and sediments. Rapid fault uplifting exposes the softer rock to erosion, resulting in oversteepening and extensive landsliding. The valleys are filled with lacustrine sediments, alluvial fan material, talus, and playa sediments.

Russell (1884) stated that Long Valley was occupied by an ancient lake concurrent but not contiguous with Pleistocene Lake Lahontan. That lake was about 250 feet deep as evidenced by elevated shorelines. The ancient lake is represented by modern alkaline pools and playas such as Alkali Lake, Massacre Lake, and others.

Geothermal activity in this portion of the EAR area is relatively meager. Waring (1965) lists only four hot springs in the area:

No.	Name or Location	Temp(degrees F)	Flow (gpm)
35A	Hill's Warm Spring in sec. 18, T.49N., R.20E. 10 miles N. of Vya	83	10

No.	Name or Location	Temp (degrees F)	Flow (gpm)
35B	Hill's Spring in sec. 11, T.43N., R.19E., 5 miles N. of Vya	66	8
35C	Twin Springs in sec. 4, T.42N., R.19E., at Vya	70	200
36	T.38N., R.18E., at south end of Surprise Valley	Hot	?

Spring numbers 35A and 35B issue from alluvium, number 35C issues from Pliocene lakebeds, and number 36 issues from Tertiary lava.

There have been no reported earthquakes in this portion of Nevada, probably due to scarcity of population. However, two epicenters of earthquakes with magnitudes of 5.0 to 5.9 have been located south of the EAR area (Slemmons and others, 1965).

The Lone Pine mercury minig district is located within the EAR area. This district is located on the south slope of Bald Mountain, an island like mass of Miocene andesitic and rhyolitic rocks that are locally silicified (Bonham, 1969). It might be noted that in other places throughout the west, geothermal potentials are linked to cinabar mineralization in silicified rhyolites. However, there is no indication that this is true in the Lone Pine district. The only other mineral occurrence in this area is a diatomite deposit near Fortynine Camp in T.43N., R.18E.

CALIFORNIA

The California portion of the Environmental Analysis Record area is included in the Basin and Range Province. The main geologic features in this area are the uplifted Warner Range horst and the Surprise Valley fault and attendant graben. Two volcanic centers have been mapped in the Cedar Pass area of the Warner Mountains (Duffield and Fournier, 1974).

The Warner Range has been uplifted at least 5,500 feet in relation to Surprise Valley and possibly as much as 11,000 feet total (Macdonald and Gay, 1966; Duffield and Fournier, 1974). The Surprise Valley graben has been filled with up to 7,000 feet of sediments shed from the adjacent mountains. Within the area of the EAR, the faulting is in two directions; north-south and N. 40 degrees W. (Gay and Aune, 1958). Duffield and Fournier (1974) have mapped two main NW-SE

structures through this area. One, the Fandango Fault Zone, forms Fandango Valley and continues across Goose Lake into Oregon. The other structure, actually a fault zone - volcano lineament, extends from the Hays Canyon volcano through the volcanic centers at Cedar Pass and on westward to Round Mountain and Blue Mountain. The mapped geology (Gay and Aune, 1958) does not suggest this lineation, however. Some faults within Surprise Valley have been mapped by geologists of the California Division of Mines and Geology on the Alturas sheet (Gay and Aune, 1958), and by Ford and others (1963). Many faults have been inferred from detailed gravity surveys by Ford and others (1963).

Uplift of the Warner Range began in the mid-Tertiary (Gay, 1959). More specifically, radiometric dating indicates that faulting began no longer than 15 million years ago (Duffield and Fournier, 1974). There is some evidence for recent faulting by fresh fault scarps of 20 to 50 feet in height truncating alluvial fans, and cutting across elevated lake terraces (Russell, 1884).

The Warner Range consists mainly of layered andesite pyroclastic rocks-tuffs breccias, agglomerates with intermingled flows. At the northern end of the range, a series of rhyolitic rocks are present as flows and shallow intrusions into the andesites (Gay, 1959). From Fandango Pass southward, the range is underlain by 10,000 feet of sedimentary and volcanic rock. The basic lithologic sequence in the southern portion of the range is a thick andesite series composed of pyroclastic material followed by a relatively thin but extensive basalt flow and later by local accumulations of rhyolite and obsidian. Basically the stratigraphy of the Warner Range and the Hays Canyon Range are quite similar, a thick andesite series, mostly pyroclastic, overlain by basalt (Russell, 1927).

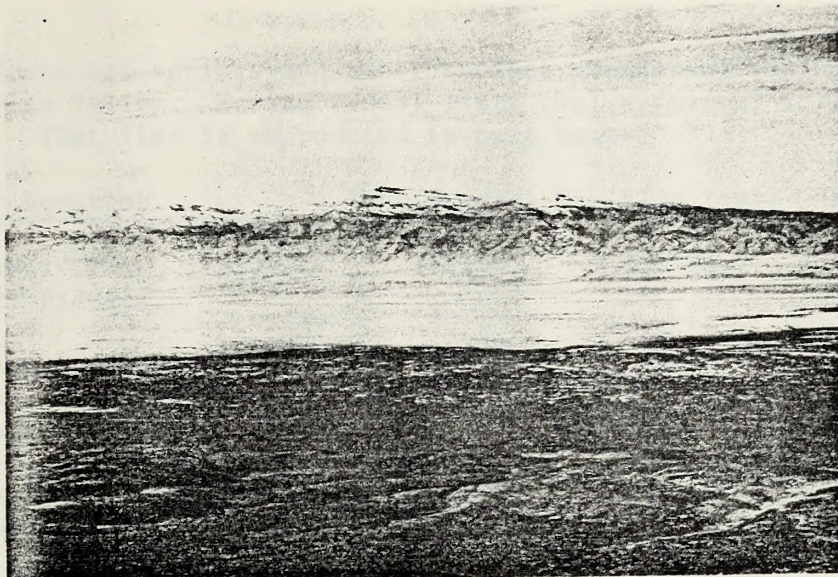
Surprise Valley, east of the main graben-forming fault, consists of lacustrine and fluvial sediments, alluvium, talus, and landslide debris. There are three small intrusive bodies in the middle of the valley southeast of the Upper Alkali Lake. These intrusives appear to be related to the faulting in this portion of the valley. Also located in the valley are areas of dune sand and saline lake deposits.

Russell (1884) applied the name Lake Surprise to that body of water that filled Surprise Valley during the Pleistocene. Lake Surprise was contemporary but not contiguous with Pleistocene Lake Lahontan, located some 35 miles to the south. Old levels of Lake Surprise are marked by truncated spurs, wave-cut terraces, and sea cliffs. The most conspicuous depositional features are old high-gradient deltas at mouths of the larger canyons (Russell, 1927). The highest beach line throughout the valley is at an elevation 550 feet above surface of lakebeds. Lake Surprise had an overflow channel southward into Duck Flat. There is evidence that the ancient lake had at least two high-water stages separated by a time of aridity and dessication (Russell, 1884).

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Surprise Valley dry basin and Warner Mountains, California. View southwest from Fortynine Mountain, Section 23, T. 42 N., R. 18 E., MDM.



Southwest portion of Lake City KGRA, California. View from National Resource Lands showing cultivated private lands along west side of Surprise Valley. View south-southeast from Section 35, T. 44 N., R. 15 E., MDM.



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There are numerous hot springs and other surface geothermal manifestations in Surprise Valley. Waring (1965) lists twelve thermal springs in the valley. That list is reproduced in part below:

No.	Name or Location	Temp(degrees F)	Flow (gpm)	Remarks
12	Near Bidwell Creek, 1 mile NW of Fort Bidwell	97-108	75	5 springs
13	Boyd Spring, on E side of Upper Lake, 12 miles SE of Fort Bidwell	70	1000	
14	Near SW side of Upper Lake, 4 miles N. of Lake City	120-127	100	Several springs at site of mud eruption of 1951
15	Near S. end of Upper Lake 12 miles NE of Cedarville	170-182	80	4 springs
16	Sec. 12, T.43N., R.18E., near N. end of Middle Lake, 12 miles NE of Cedarville	140-149	225	3 springs
17	Leonard Springs, in sec. 7, T.43N., R.17E., 11 miles NE of Cedarville	150	50	3 springs
18	Sec. 1, T.42N., R.16E., and sec. 6, T.42N., R.17E., 5 miles E. of Cedarville	130	500	5 main springs
18A	Cedar Plunge, 5 miles NE of Cedarville	180;208	115	2 wells
19	Benmac Hot Springs, in sec. 18, T.42N., R.17E., 5 miles E of Cedarville	120	200	
20	Menlo Warm Baths, in sec. 7, T.39N., R.17E., 5 miles SSE of Eagleville	117-125	425	5 springs
21	Near SW side of Lower Lake, 8 miles SSE of Eagleville	120	100	
22	Bare Ranch, 12 miles SSE of Eagleville	70	5	

South of Eagleville, many large hot springs issue from immediate escarpment of a branch of the Surprise Valley Fault. Farther north, hot springs are located out in the valley in distinct relationship to lines of recent displacement (Russell, 1928). Russell (1884) felt that the high temperature of many of the springs that come to the surface along lines of recent displacement were due to heat produced by the arrested motion of the fault blocks. The current thinking, at least in Surprise Valley and the majority of geothermal areas in the west, is that the elevated temperatures are due to volcanism or the presence of a shallow magma body (White, 1955). Duffield and Fournier (1974) summed up geothermal conditions as 1) hot springs structurally controlled and localized along the Surprise Valley Fault; 2) with one exception, hot springs no farther than 3 miles from rhyolite flows or plugs; and 3) greatest number of hot springs, representing the hottest surface water temperatures, associated with youngest looking rhyolite-obsidian bodies.

In March, 1951, several hot springs erupted as mud volcanoes in sections 23 and 24, T.44N., R.15E. The eruption consisted of clouds of steam, gases, and mud debris rising several thousand feet in the air and scattering particles over several miles. According to White (1955), 20 acres or more were involved and at least 6 million cubic feet or 300,000 tons of mud were affected by the eruption. Temperature of the hot springs in the area of the eruption ranged from 120 degrees to 207 degrees (Waring, 1965). Magma Power Company has completed four drill holes in or very near the area of the eruptions and have found hot water that will flash to steam (320 degrees F). Nothing has been done in terms of power generation as of this date.

Russell (1928) reports that some of the early residents of Surprise Valley felt the 1906 earthquake of San Francisco, the 1915 earthquake of Pleasant Valley, and the 1918 earthquake near Susanville. No recent epicenters have been reported in Surprise Valley although reported recent faulting and thermal activity would indicate the potential for seismic activity.

Other mineral commodities in this area include an old salt works near Cedarville that operated on a zone of thin, relatively pure salt layers a few feet below the present surface of the valley center (Russell, 1927; Gay 1959).

SUMMARY

The entire area is prospectively valuable for oil and gas. No oil and gas exploratory holes have been drilled.

Evaporites with sodium and potassium are present in the sediments of all the alkali lakes and most of the playa lakes. Diatomite is present in the Tertiary and Quaternary continental sediments throughout the area. These deposits are presently not economic. Gravel, rock, and cinders are the only materials which are presently being mined.

Surprise Valley is an elongated graben bounded on the west by the Warner Range and by the Hays Canyon Range on the east. Several cross faults connect the two major basin-range fault systems. Hot springs are located along a discontinuous north-south trending fault on the western margin of Surprise Valley.

Warner Valley is near the northern limit of the basin-range province. This long, undrained graben valley has resulted from late Tertiary to Holocene block faulting and is bounded on both east and west by large tilted fault blocks.

Long Valley, trending north-south, is formed in part by faulting on the northwest and northeast sides, and by down-warping on the south-east side. An inferred basin range fault is projected on the west side of the valley.

The geologic hazards involved in the area of the EAR are primarily landsliding. Several landslides appear on the geologic map and the potential for others exist wherever oversteepening of slopes exist.

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PHYSIOGRAPHIC UNITS

The area included in this Environmental Analysis has been divided into physiographic units for the purpose of describing the existing environment (see map titled Physiographic Regions). The physiographic units were delineated by similar physical characteristics, and consist of dry basins, irrigated basins, plateaus, foothills, and mountains. These units are generalized with their boundaries in the transition zone between them.

DRY BASINS

The dry basins are on downthrown fault blocks (grabens) with upthrown blocks (horsts) on both sides of them. They have either dry or alkali lakes in them.

IRRIGATED BASINS

The irrigated basins are in grabens, and have either fresh or alkali lakes in them.

PLATEAUS

The plateaus are between the basins on the lower part of the horsts.

FOOTHILLS

The foothills are on the lower part of the horsts adjacent to the National Forests.

MOUNTAINS

The mountains are between the plateaus or basins on the highest part of the horsts.

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RESULTS

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DISCUSSION

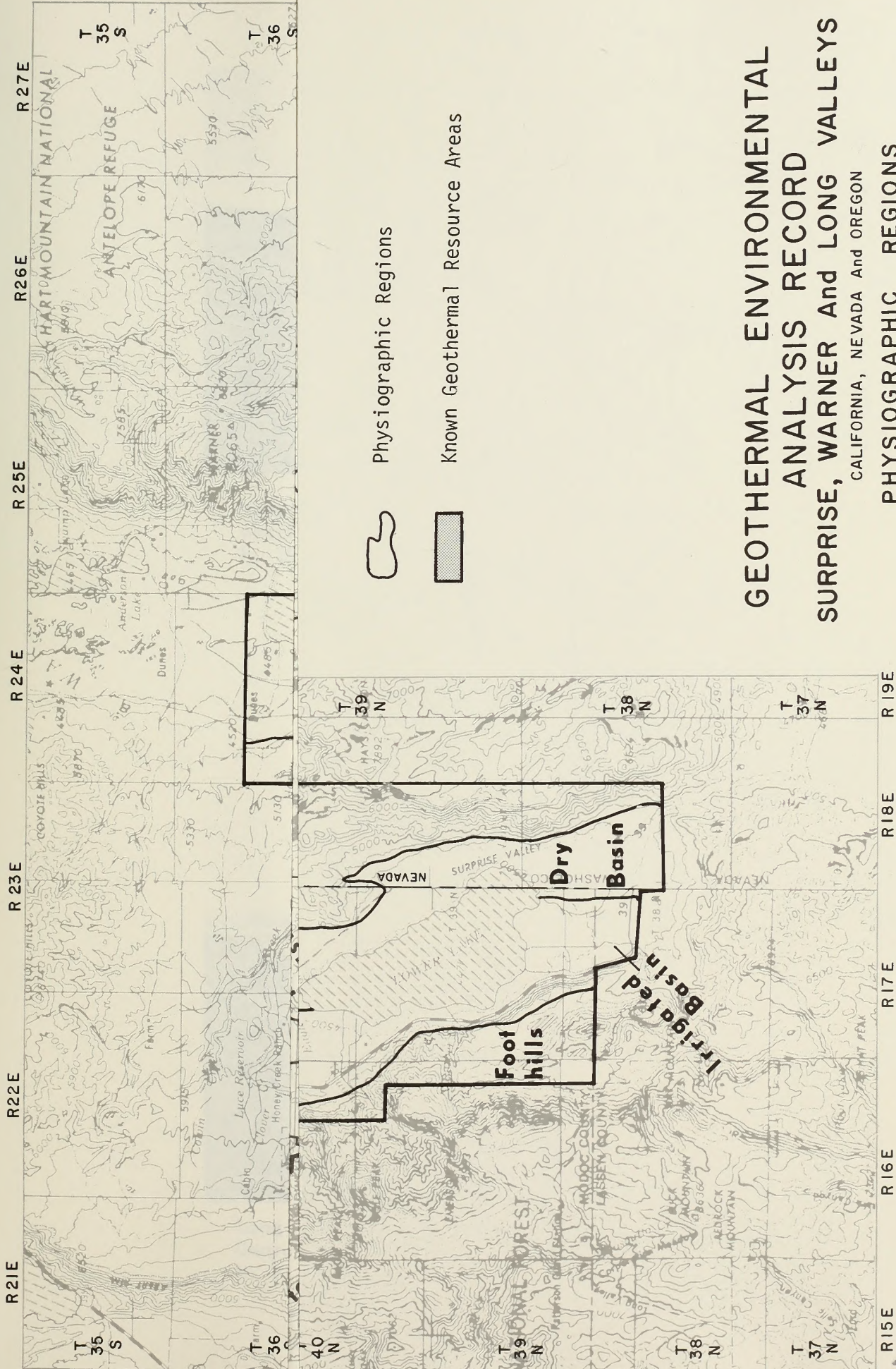
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CONCLUSIONS

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Physiographic Regions

Known Geothermal Resource Areas



GEOHERMAL ENVIRONMENTAL ANALYSIS RECORD

SURPRISE, WARNER AND LONG VALLEYS

CALIFORNIA, NEVADA AND OREGON

PHYSIOGRAPHIC REGIONS

MAP 1



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PHYSIOGRAPHIC BELT
The area included in this physiographic belt for the purpose of mapping is the ...

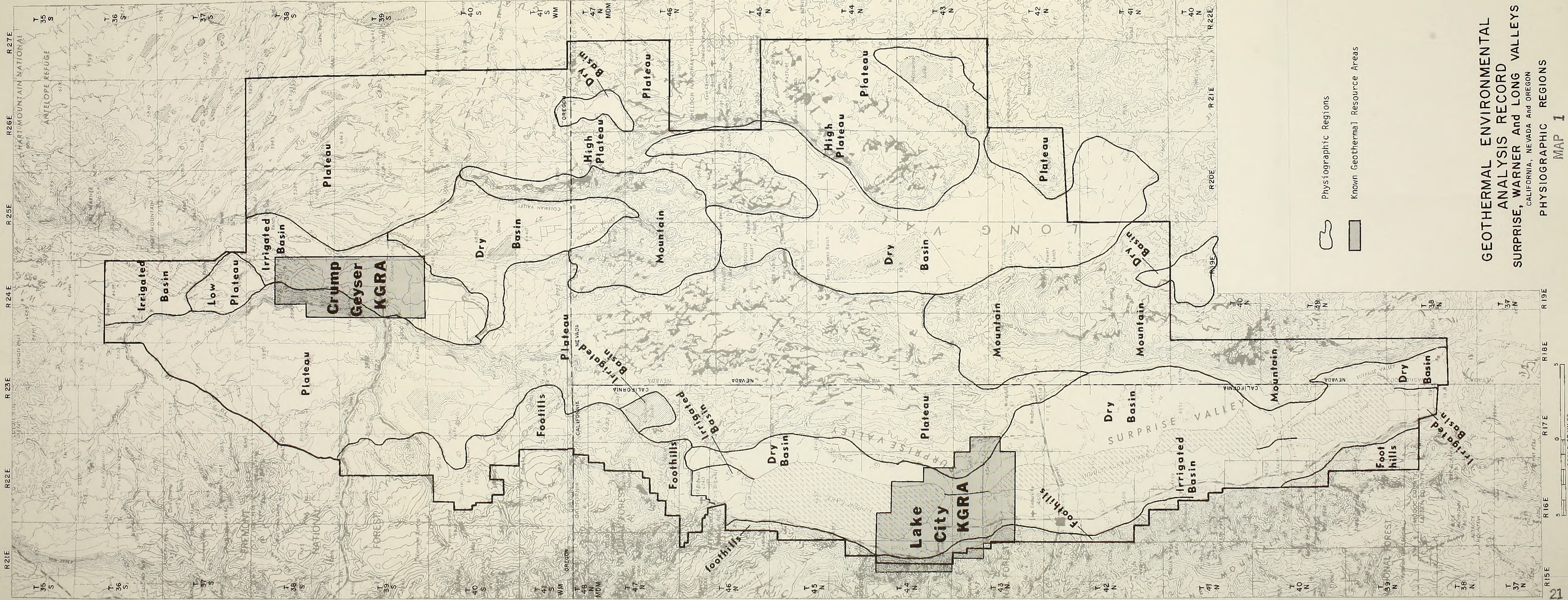
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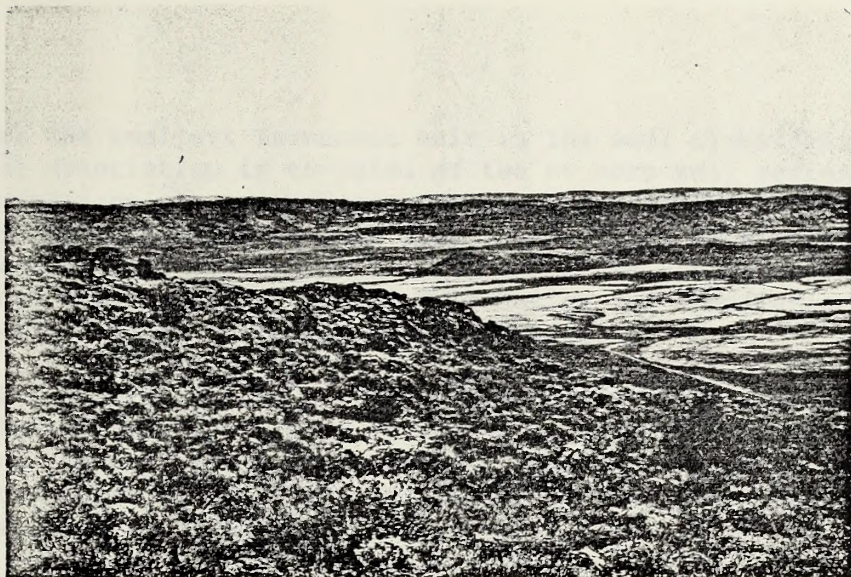
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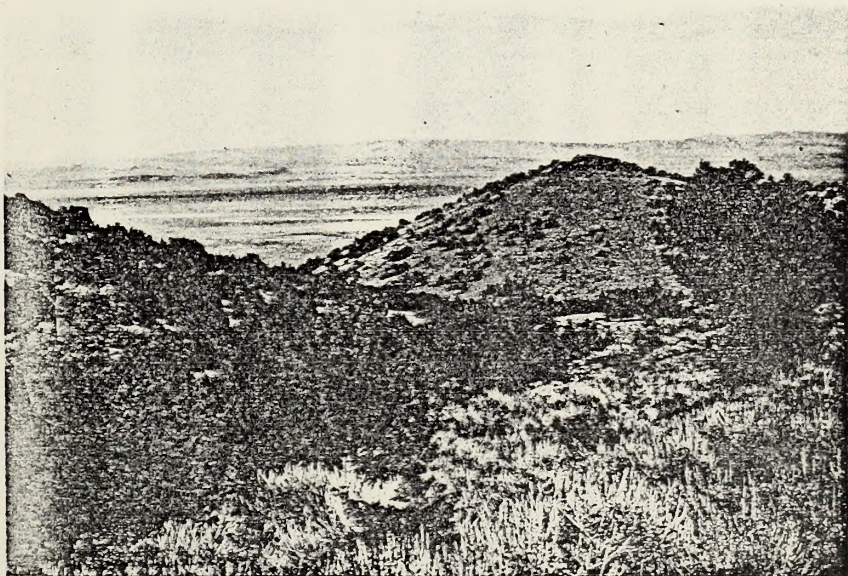


**GEOHERMAL ENVIRONMENTAL
 ANALYSIS RECORD**
SURPRISE, WARNER AND LONG VALLEYS
CALIFORNIA, NEVADA AND OREGON
PHYSIOGRAPHIC REGIONS
MAP 1





Mosquite Valley dry basin, Nevada. View southeast from Section 33, T. 46 N., R. 19 E., MDM.



Long Valley dry basin, Nevada, from Hays Canyon Range. View east from Section 4, T. 41 N., R. 19 E., MDM.



1900
The first of the series, showing the
mountain range in the distance,
with the valley in the foreground.



1900
The second of the series, showing the
mountain range in the distance,
with the valley in the foreground.

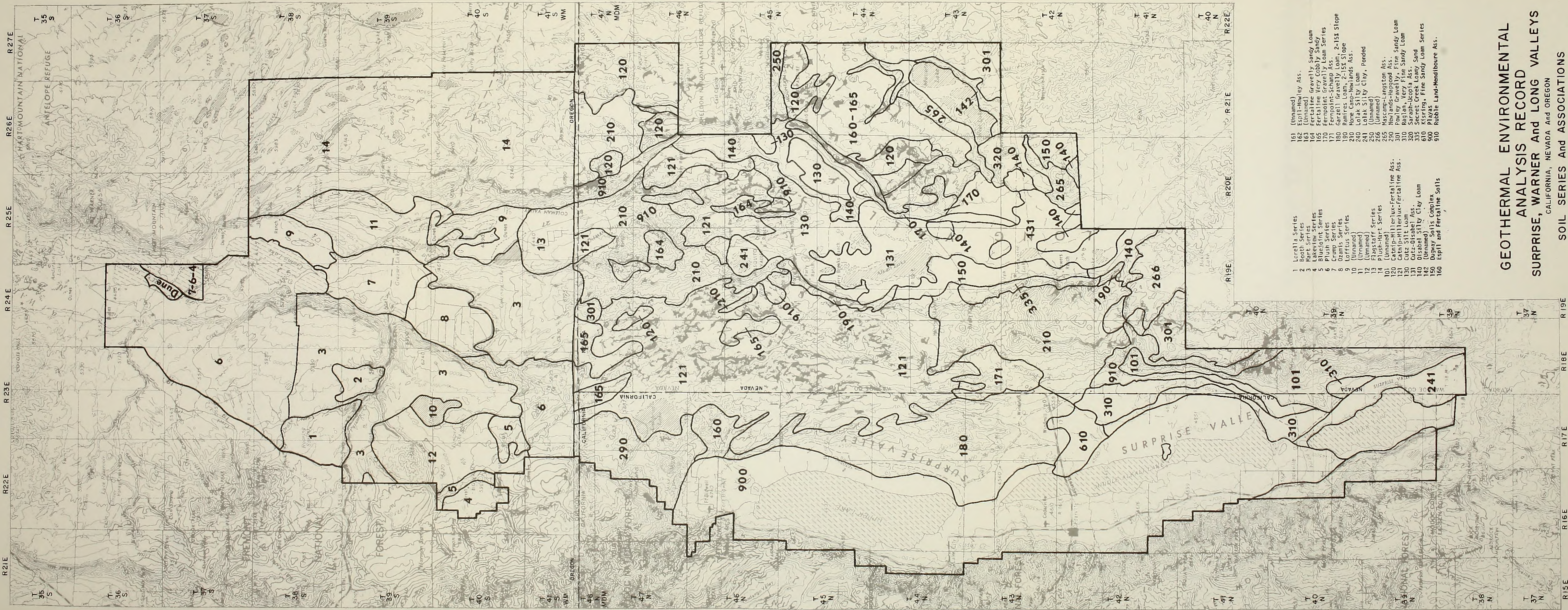
SOILS

Soil series are the smallest taxonomic unit in the soil classification system. A soil association is composed of two or more soil series generally occurring on the same physiographic unit. Series were shown for areas where sufficiently detailed field mapping was done to define this unit, whereas, soil associations are shown where field mapping was less intense. Refer to map titled Soil Series and Associations (Map 2) and Table 5 which lists soil characteristics.

The soil erosion hazard classes are shown on the map titled Soil Erosion Hazard Classes (Map 3). These classes are based upon the soil surface factor - an expression of conditions caused by wind and water as reflected by soil movement, surface litter, erosion pavement, pedastalling, rills, flow patterns, and gullies.

The first series are the results of economic work in the field classification system. A soil association is composed of two or more soil series generally occurring on the same parent material. Series have been defined for each of the soil orders. Detailed field notes and maps of the field classification system are shown in the following pages. Table 1, however, gives a summary of the soil orders and their characteristics. Refer to the field classification and Association maps in Table 2 which give soil characteristics.

The soil orders given above are shown on the map which will be also shown later (see 2). These orders are based upon the soil texture factor - an expression of conditions found in soil and water in relation to soil moisture, water table, water content, water table, etc., the pattern, and other.



- | | | | |
|-----|-----------------------------------|-----|-------------------------------------|
| 1 | Lorella Series | 161 | (Unnamed) |
| 2 | Booth Series | 162 | Esplí-Howley Ass. |
| 3 | Hart Series | 163 | (Unnamed) |
| 4 | Lakeview Series | 164 | Fertal line Gravelly Sandy Loam |
| 5 | Blueloint Series | 165 | Fertal line Very Cobbly Sandy |
| 6 | Plush Series | 170 | Fertal line Gravelly Loam Series |
| 7 | Crump Series | 171 | Fertal line Gravelly Loam Series |
| 8 | Ozamis Series | 180 | garzelli Gravelly Loam, 2-15% Slope |
| 9 | Lofftus Series | 190 | Rainres Loam, 2-15% Slope |
| 10 | (Unnamed) | 210 | Pine Camp-Highlands Ass. |
| 11 | (Unnamed) | 241 | Lolok Silty Clay, Ponded |
| 12 | (Unnamed) | 250 | (Unnamed) |
| 13 | Flagstaff Series | 266 | (Unnamed) Langston Ass. |
| 14 | Push-Hart Series | 290 | Mastams-Hugood Ass. |
| 101 | (Unnamed) | 300 | Howley Gravelly, Fine Sandy Loam |
| 121 | Catnip-Millerlux-Fertal line Ass. | 310 | Howley Very Fine Sandy Loam |
| 131 | Catnip-Millerlux-Fertal line Ass. | 320 | Sagehen-Lochia Ass. |
| 140 | Cutz-Disabel Ass. | 335 | Secret Creek Loamy Sand |
| 142 | (Unnamed) | 610 | Kirring, Fine Sandy Loam Series |
| 150 | Dugway Series Complex | 900 | Playas |
| 160 | Esplí and Fertal line Soils | 910 | Rubble Land-Hendiboure Ass. |

**GEOHERMAL ENVIRONMENTAL
 ANALYSIS RECORD**
SURPRISE, WARNER AND LONG VALLEYS
 CALIFORNIA, NEVADA AND OREGON
SOIL SERIES AND ASSOCIATIONS
MAP 2



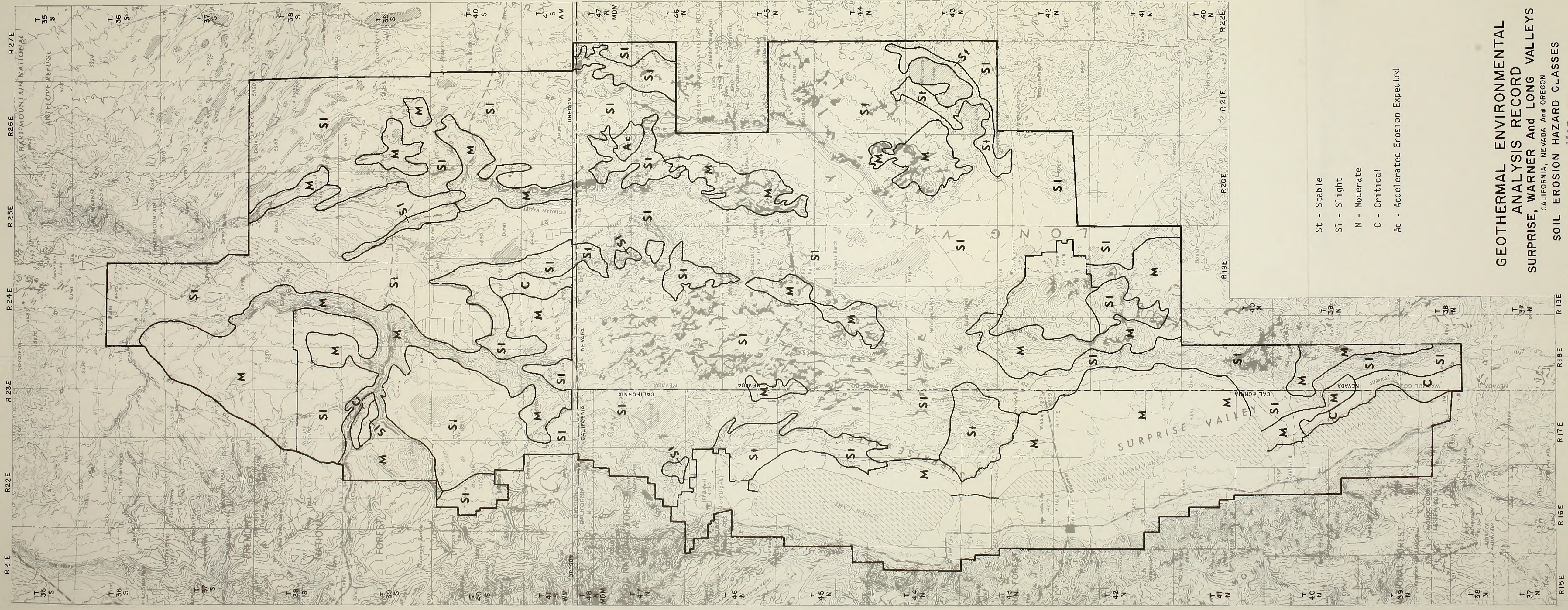
TABLE 5
SOIL SERIES BY PHYSIOGRAPHIC POSITION

Physiographic Position	Map Legend Number	Soil Series or Association	Brief Description of Series or Association	Erosion Hazard Class
Dry Basins	9	Lofftus	Moderately deep; alkali; silt loam with hardpan; level.	Slight
	10	Unnamed	Deep; fine textured, clay alluvium; level to nearly level.	Slight
	13	Flagstaff	Moderately deep; alkali, silt loams with hardpans; nearly level.	Slight
	121	Catnip-Millerlux-Ninemile	Extremely cobbly loam; 0 to 9 percent slopes.	
	130	Cutz Silt Loam	Fine, clay loam; slowly permeable; alkali; level.	Slight
	131	Cutz-Disabel	Shallow to moderately deep; clay loam; alkali; slowly permeable; 0 to 2 percent slopes.	Slight
	140	Disabel Silty Clay Loam	Very deep; silty clay loam; alkali, nearly level.	Slight
	150	Dugway Soils Complex	Sandy loam to loamy sand; gently sloping.	
	190	Ramires Loam	Fine gravelly, clay loam; 2 to 5 percent slopes.	Moderate
	240	Lolak Silty Clay	Very deep; silty clay; alkali, nearly level.	Slight
	241	Lolak Silty Clay Loam		
	301	Powley Gravelly, Fine Sandy Loam	Shallow; gravelly, loamy sand with hardpan; gently sloping to strongly sloping.	Moderate

Physiographic Position	Map Legend Number	Soil Series or Association	Brief Description of Series or Association	Erosion Hazard Class
Dry Basins	310	Raglan Very Fine Sandy Loam	Moderately deep to deep; slowly permeable; well drained; nearly level to moderately sloping; saline.	Slight
	320	Saraph-Ucopia Association	Shallow to moderately deep; moderately permeable; 0 to 5 percent slopes.	Moderate
	610	Kisring Fine Sandy Loam	Very deep; fine sandy loam; permeability slow; saline and alkaline; nearly level.	Moderate
	900	Playa	Shallow to water table; clayey; barren; flat	None
Plateaus and Rolling Hills	1	Lorella	Shallow; very stony clay loam; gently sloping.	Moderate to Severe
	2	Booth	Moderately deep; stony, fine textured loam; gently sloping to steep.	Moderate to Severe
	3	Hart	Shallow; very stony, fine silt loam; level to gently sloping.	Moderate
	5	Bluejoint	Deep to very deep; stony loam; gentle to steeply sloping ridges.	Moderate
	6	Plush	Very deep to deep; very stony loam; gentle steeply sloping ridges.	Moderate
	11	Unnamed	Shallow; very stony loam; gently rolling hills to very steep slopes.	Moderate
	12	Unnamed	Shallow; very stony, silt loam; slowly permeable; gently rolling to steeply sloping.	Moderate

Physiographic Position	Map Legend Number	Soil Series or Association	Brief Description of Series or Association	Erosion Hazard Class
Plateaus and Rolling Hills	14	Plush-Hart	(See Numbers 3 and 6)	
	120	Catnip-Millerlux-Fertaline	Shallow to moderately deep; extremely cobbly loam; very slowly permeable; gently sloping.	Slight
	160	Espil and Fertaline	Shallow; gravelly sandy loam over hardpan; slowly permeable; gently sloping.	Slight
	162	Espil-Howley	Shallow; gravelly sandy loam; slowly permeable; hardpan; gently sloping.	Slight
	164	Fertaline Gravelly Sandy Loam	Shallow; gravelly, fine sandy loam; gently sloping.	Slight
	165	Fertaline Very Cobbly Sandy Loam	Shallow; very cobbly phase of Fertaline series (See Number 164)	None
	170	Fernpoint Gravelly Loam	Shallow; gravelly, fine sandy loam; slowly permeable; level to moderately sloping.	Slight
	180	Garzell Gravelly Loam	Moderately deep to deep; gravelly loam; gently to steeply sloping.	
	210	Home Camp-Newlands	Moderately deep; gravelly to stony loams; slightly acid; moderate to steep slopes.	Slight to Moderate
	166	Unnamed		
	265	Mascamp-Langston	Shallow to very deep; sandy loam to gravelly, sandy clay loam; nearly level to strongly sloping.	Moderate

Physiographic Position	Map Legend Number	Soil Series or Association	Brief Description of Series or Association	Erosion Hazard Class
Foothills	4	Lakeview	Very deep; well drained loam; nearly level.	None
	6	Plush	Deep to very deep; very stony loam; gently sloping to very steep.	Moderate
	290	Newlands-Hapgood	Moderately deep to deep; fine sandy to stony loams; gently sloping to steep.	Slight
Mountains	101	Unnamed		
	171	Fernpoint-Schamp	Deep; fine sandy loam to loam; mildly alkaline; gently sloping to steep.	Moderate
	210	Home Camp-Newlands	Moderately deep; gravelly to stony loams; slightly acid; moderate to steep slopes.	Slight to Moderate
	265	Mascamp-Langston	Shallow to very deep; sandy loam to sandy, gravelly, clay loam; nearly to strongly sloping.	Moderate
	266	Unnamed		
	301	Powley	Shallow; gravelly, fine sandy loam; gently to strongly sloping.	Slight to Moderate
	910	Rubble land-Mendiboure	Moderately deep to deep; very stony; steep to very steep slopes.	Slight
Irrigated Basins	7	Crump	Very deep; lacustrine, muck soils, nearly level.	None
	8	Ozamis	Very deep; loamy, stratified alluvium, poorly drained; nearly level.	None



- S - Stable
- SI - Slight
- M - Moderate
- C - Critical
- Ac - Accelerated Erosion Expected

**GEOHERMAL ENVIRONMENTAL
ANALYSIS RECORD
SURPRISE, WARNER AND LONG VALLEYS**
CALIFORNIA, NEVADA AND OREGON

SOIL EROSION HAZARD CLASSES

MAP





LAND USE

BLM is currently developing Management Framework Plans (MFP) for land use in this area. Both Districts are preparing multiple-use recommendations and receiving public input. MFPs will be completed before this EAR is finalized, since it must consider impacts on planned future resource and land uses.

The Modoc (California) and Fremont (Oregon) National Forests have completed Timber Management Plans and Ranger District Multiple-Use Plans. Modoc County (California) has issued regulations for geothermal development for all lands. Both Modoc and Lake (Oregon) Counties have zoned lands to control use and development. Washoe County (Nevada) is presently revising its plan and associated ordinances. Considerable coordination is being conducted between this and the BLM planning effort.

The land base supports a variety of compatible land uses. These uses include livestock grazing, an extensive use that involves most of the area, many types of recreation, agriculture in localized areas, and a multitude of man-made improvements. Recreation uses include rock - hounding, big game and upland game hunting, fishing, and sightseeing. Agriculture is associated with the livestock industry and is most pronounced in Surprise and Warner Valleys. There are other pockets of crop production at Cowhead Lake, Mosquito Lake, Coleman Valley, and Long Valley. Small acreages of irrigated pasture are found at old ranch headquarters where soils and water permit this use.

Man-made structures are dispersed throughout the Study Area. By far the most numerous and obvious of man's influence are roads that criss - cross the area. A major high voltage powerline traverses the area from north to south. It has metal towers and an access road along its length making it highly visible to the casual traveler. There is another proposal by Pacific Power and Light to construct another high voltage line east to west through the Warner Valley area. Evidence of gravel pits exists along the major roads. These pits constitute the bulk of the mining activity and were used during road construction.

Dwellings are centralized in Surprise Valley and Warner Valley with minimal service facilities in the communities of Eagleville, Cedarville, Lake City, Fort Bidwell, Adel, and Plush. There is other habitation scattered throughout the area, but is generally seasonal in nature, depending on the needs of livestock management. The State of Nevada maintains a highway maintenance station at Vya.

Other land uses include microwave and radio facilities on 49 Mountain and Lynchs Rim. There are various range improvements throughout the project area. These include water developments such as springs,

reservoirs and wells, grass seedings, and a multitude of fences for livestock control. To a lesser degree, there are air strips and range study enclosures.

WATER

HYDROLOGIC CYCLE

The area under consideration includes portions of eight drainage basins in largely remote areas with sparse population (see map 4 Water Resources). Quantitative hydrologic information describing many aspects of the existing environment are lacking. Some information which is available is presented in the following discussion.

Water in the area originates as precipitation, mostly in the mountain ranges of the area. The plateau areas and desert alluvial basins receive lesser amounts of precipitation. Precipitation data for five stations in and near the area are shown in Table 6. Most of the precipitation occurs during winter months with moderate amounts in the spring and fall. Scanty amounts occur during the months of July, August, and September.

Water from precipitation is lost to the atmosphere by evapotranspiration, infiltrates into soil and rock, and flows into the desert alluvial basins. Typically, the larger stream courses originate in mountains and/or high plateaus and drain towards desert alluvial basins (dry basins). One or more central lakes occur in the larger basins which dry up sporadically. Smaller basins contain playa lakes which dry up seasonally. Most of the water reaching dry basins evaporates, although some infiltrates into the alluvium adjacent to and beneath the basin floor. Runoff records are available for several perennial streams originating in the Warner Mountains. Data summarizing a few hydrologic parameters derived from gaging station records are shown in Table 7. Additional data is available from Government agencies operating the gaging stations. Most other streams in the region are intermittent and streamflow data is lacking.

Groundwater occurs mostly in unconsolidated fill of the desert alluvial basins. Potable groundwater is found in sand and gravel members of alluvial fans near the mouths of canyons and along terraces surrounding the basins. The quality of groundwater generally decreases towards the center of basins due to infiltration of highly mineralized water from intermittent lakes. The depth to groundwater is greater near the basin margins than towards basin centers.

Replenishment of groundwater is by infiltration of streamflow derived from surrounding mountains and plateaus. The rate of replenishment is generally small although large amounts of groundwater occur in storage.

Small amounts of groundwater occur in bedrock mountain and plateau areas. Occurrence is sporadic and yields are generally small to moderate.

WARNER LAKES DRAINAGE BASIN

The Warner Lakes Basin extends from northeast California to northwest Nevada into Oregon. It contains three smaller basins: Big Lake, Big Valley, and Coleman Valley. Coleman Lake, at elevation 4460, is the lowest point in the Warner Lakes Basin.

Perennial streams originate on forested lands in the Warner Mountains along the western rim of the basin. From the mountains the streams trend east over foothill and plateau areas to the central lakes in the basin. From north to south these include Honey Creek, Deep Creek, and Twentymile Creek.

Honey Creek with intermittent tributaries Snyder, Twelvemile and McDowell, drains into Hart Lake. The majority of Honey Creek's drainage basin is outside the EAR area. A portion of Honey Creek is diverted for irrigation. Five small reservoirs with a combined capacity of 870 acre feet occur upstream of the gaging station.

Deep Creek runs into Warner Valley at Adel and ultimately into Crump Lake. Perennial tributaries to Deep Creek include Drakes Creek, Camas Creek, and Parsnip Creek. Water for irrigation is diverted from Camas, Drake, and Deep Creeks. Drakes Creek contains two reservoirs with a combined capacity of 436 acre feet.

Twentymile Creek flows into the Warner Valley from the vicinity of the tri States' boundaries. Twelvemile Creek, Fifteenmile Creek, Horse Creek, Long Canyon and Barley Camp Creek are major tributaries. Considerable water is diverted for irrigation in the Cowhead Lake area of California. Additional diversions for irrigation occur further downstream in Oregon.

Streamflow characteristics for several streams draining into Warner Valley are shown in Table 7. Diversions for irrigation occur above the gages.

Drainage lines along the eastern and southern portions of Warner Valley consist of dry washes in plateau and mountain areas. Streamflow is slow and non-existent for most parts of the year. Floods occur after sudden storms and/or rapid snowmelt. Numerous small intermittent lakes occur in the uplands surrounding Warner Valley. Hydrologic data is lacking on these lakes.

Crump and Hart Lakes are two major lakes within Warner Valley. The lakes are interconnected with lakes further north in Warner Valley. These lakes usually contain water, but have been known to go dry.

Surface water in streams is generally a calcium-magnesium bicarbonate

type with low dissolved solids and hardness. Most of the surface water from the perennial streams is appropriated and is used extensively for irrigation.

The mineral content of lake waters varies as lake levels fluctuate. Several lakes contain dissolved solids content in excess of 30,000 mg/l. Most lakes are too saline for normal domestic use.

Groundwater in the dry and irrigated basins occurs in alluvial deposits of unconsolidated gravel, sand, silt, and clay of fluvial and lacustrine origin. Well depths range from 135 feet to 600 feet; water depths range from 9 feet to 405 feet. Yields from coarse gravel deposits commonly range from a few hundred to more than 1000 gpm with specific capacities from 5 to 100 gpm per foot. Smaller yields occur in finer-grained sediments. Groundwater use is largely for domestic and livestock purposes.

Groundwater quality is variable. Dissolved solids are mostly less than 500 mg/l. Excessive sodium, boron, and fluoride have been reported in some places. Groundwater temperatures range from 47 degrees F, to 55 degrees F, with some occurrence of warm to hot water.

Groundwater occurs in volcanic rocks on the surrounding plateaus and mountain areas. Yields are generally small to moderate although occasional large yields occur. Quality ranges widely and dissolved solids are generally below 100 mg/l. Excessive sodium and boron occurs locally.

Chemical analyses of two hot springs are shown in Table 8.

One geothermal well has been drilled in this area (see Table 13).

Table 6

NORMAL PRECIPITATION

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Elevation
Hart Mtn. Refuge, Oregon	10.39	0.85	0.76	0.96	0.73	1.82	1.56	0.37	0.29	0.48	0.96	0.78	0.83	5616
Sheldon	11.08	1.33	1.26	1.07	0.88	1.17	1.26	0.30	0.36	0.40	0.98	0.97	1.10	6500
Fort Bidwell, Calif.	14.71	2.23	1.97	1.64	1.01	1.14	0.96	0.35	0.17	0.45	1.11	1.61	2.07	4498
Vya, Nevada	14.12	1.70	1.09	1.27	1.18	1.62	1.49	0.35	0.73	0.55	1.38	2.02	1.92	5660
Cedarville, Calif.	12.88	1.84	1.50	1.45	0.99	1.04	0.94	0.33	0.15	0.37	1.17	1.41	1.69	4670

Normal precipitation is the climatological normal based on the period 1931-1960.

Vya records are for the period 1961-1973.

Sheldon records are for the period 1934-1960.

Table 7

SELECTED MEAN DISCHARGES AT STREAM GAGING STATIONS

Station	Drain- age Area (SqMi)	Mean Discharge (cfs) For the Period 1961-73												Maximum Dischg. (cfs)	Minimum Dischg. (cfs)	
		M O N T H L Y														
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			Annual
ney Creek ar Plush, regon	170	5.69	7.26	30.9	28.8	33.7	41.8	99.1	130	56.4	8.82	1.52	1.24	37.1	11,000 12/23/ 64	0 At times
mas Creek ar Lake- ew, OR	63	9.91	14.7	37.8	36.3	45.3	61.3	144	138	41.6	9.46	5.00	4.81	45.7	3,190 12/23/ 64	0.90 8/16/60
ake Creek ar Adel, regon	67	6.61	6.55	6.87*	20.7*	25.5*	37.7*	35.9*	16.0*	9.92*	6.73*	6.41*	6.19*	15.4*	6,210 12/23/ 64	0.40 1/11/63
ep Creek ove Adel, regon	249	35.1	46.8	104	134	150	200	388	457	221	33.4	13.7	17.3	150	9,420 12/23/ 64	1.70 7/34
enty-mile . near el, OR	194	14.0	10.4	45.0	89.7	82.4	119	137	104	65.4	8.82	3.71	3.98	56.9	3,670 12/23/ 64	0 At times
dwell Creek low Mill Cr ar Ft. Bid- ll, Calif.	25.6	5.61	7.10	11.9	13.8	13.4	19.2	40.8	83.5	51.7	13.7	6.09	4.48	22.6	682 12/24/ 64	1.4 11/5/60

*Except 1965

Table 8 Chemical Analyses of Selected Hot Springs

WARNER LAKES DRAINAGE BASIN

	Temperature (degrees C.)	pH	Specific Conductance	Silica (SiO ₂)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Lithium (Li)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Boron (B)
Fisher Hot Springs * NW ¹ / ₄ sec. 10, T.38S., R.25E.	68	7.93	513	77	8.4	1.0	92	7.9	0.04	105	1	59	56	3.5	2.2
Crump (Charles Crump's Spring) * Sec. 27, T.38S., R.24E.	78	7.26	1490	180	16	0.2	280	11	0.4	153	<1	200	240	4.9	13.6

* Reference: USFS Open File Report, March, 1974.

The Chemical Composition and Estimated Minimum Thermal Reservoir Temperatures of Selected Hot Springs in Oregon, by Mariner, Rapp, Willey and Presser.

SURPRISE VALLEY DRAINAGE BASIN

Surprise Valley Drainage Basin lies in California and Nevada. Its dominant hydrologic features are three large intermittent lakes - Upper, Middle, and Lower Alkali Lakes - which lie near the center of striking Surprise Valley. The lakes are shallow, saline, and usually dry up during summer months.

Precipitation varies throughout the drainage basin because of rain shadow effects produced by the Warner Mountains and to a lesser extent the Hays Canyon Range. Moist air masses from storms generally move towards the northeast, which cause the majority of precipitation to fall in the Warner Mountains (in excess of 32 inches locally). The lowest precipitation occurs along the eastern margins of the Alkali Lakes where it averages about 6 inches annually. Mean annual precipitation increases with altitude from the lakebeds to about 8 inches at the base of Hays Canyon Range and 10 inches at the base of the Warner Mountains. It also increases from south to north along the valley floor from 10 inches in the south to 16 inches in the north.

Precipitation data from Cedarville and Fort Bidwell are summarized in Table 6.

The uneven distribution of precipitation causes an uneven distribution of runoff similar to the Warner Lakes Drainage Basin to the north. The few perennial streams originate in the Warner Mountains and flow eastward into Surprise Valley. Intermittent streams rise in plateaus along the northeast portion of the drainage area and Hays Canyon Range along the southeast portion of the drainage basin. Streams in the western and southern portions of the drainage basin originate outside the EAR area.

Much of the flow from streams is lost to the alluvium surrounding and within Surprise Valley before reaching the three central lakes. Flows resulting from snowmelt and large storms, however, reach the lakes. Mineral analyses of surface water within the three central lakes are shown in Tables 9 and 10.

Stream gaging stations are maintained on Bidwell Creek, tributary to Upper Alkali Lake; Cedar Creek, tributary to Middle Alkali Lake; and Eagle Creek, tributary to Lower Alkali Lake. These streams are the major perennial streams in the drainage basin.

A portion of the recorded streamflow data is summarized in Table 7. Records of flow for Cedar and Eagle Creeks are sparse and have not been summarized.

Records of flow for the remaining streams do not exist. However, streamflow is slow and non-existent for most parts of the year. Floods occur after sudden storms and/or rapid snowmelt.

Fee Reservoir, Crooks Lake, and Carter Reservoir are man-made impoundments in the plateaus of the eastern portion of the valley. Water from these lakes is used for irrigation and recreation.

Smaller lakes occur throughout the drainage basin. Most are intermittent and saline. Hydrologic data in reference to these lakes does not exist.

Springs occur throughout the drainage basin. Data on water quantity and quality are lacking.

Significant amounts of groundwater are used for domestic and stock use; minor amounts are used for irrigation. The principal water-bearing formations occur in unconsolidated sediments which form terraces and alluvial fans along the margins of the valley. Permeability varies from moderate to high and wells yield large quantities of confined and unconfined water of variable quality. Unconsolidated deposits closer to the saline lakes are less permeable and yield small amounts of water to wells. Depth to water varies from about 30 to 75 feet; dissolved solids content ranges from 113 to 2000 mg/l. Mineral analyses of selected wells are shown in Tables 11 and 12.

Important recharge areas occur in the foothill areas along the western portion of Surprise Valley where surface water infiltrates into the apexes of alluvial fans located below the mountain canyons. In the northern portion of the valley, surface water recharges the groundwater basin by percolation through coarse stream deposits. Additional recharge occurs along the eastern portion of the valley in bedrock units underlying the plateaus above the valley floor.

Heated, mineralized water occurs along faults in Surprise Valley. Hot springs and hot water wells yield water which contain high concentrations of sulphate, boron, fluoride, sodium, and occasional excessive arsenic. Tables 11 and 12 contain chemical analyses of several hot springs in the area. The minimum area affected, as defined by wells containing constituents in hazardous quantities, is shown on Map 4 titled Water Resources (California State Department of Water Resources, "Northeastern Counties Groundwater Investigation, Bulletin No. 98, Volume II, Plate 23). Additional information regarding this water quality hazard area is available from the California Department of Water Resources.

Eight geothermal wells have been drilled along Upper and Middle Alkali Lakes (see Map 4, Water Resources and Table 13). Specific data pertaining to reservoir characteristics and chemical quality of fluids is confidential data unavailable to the authors of this report.

TABLE 9

MINERAL ANALYSES OF SURFACE WATER WITHIN SURPRISE VALLEY

Source of Data: Northeastern Counties Investigation, Bulletin 58, State of California,
Department of Water Resources 1960.

Source	Location number, MDB&M	Date sampled	Discharge in second-foot	Temp. in °F.	Specific conductance (micro-mhos at 25°C.)	pH	Mineral constituents in parts per million											Total dissolved solids in ppm	Per cent sodium	Hardness as CaCO ₃			
							Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO ₃)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)			Silica (SiO ₂)	Other constituents	Total ppm	N.C. ppm
Lower Alkali Lake near Eagleville...	40N/17E-20H2S	5/ 5/54	-----	83	5,800	9.1	6.9	0.9	1,370	11	192	805	307	1,160	0.4	10	19	63	Fe=1.3 ppm; As=0.09 ppm	3,500	99	20	0
							0.34	0.07	59.57	0.28	6.40	13.19	6.39	32.72	0.01								
Middle Alkali Lake near Cedarville...	42N/16E-3K1S	5/ 5/54	-----	75	12,900	9.1	17	8.9	3,180	7.5	363	1,300	576	2,230	3.5	6.0	38	28	Fe=0.06 ppm; As=0.39 ppm	8,100	99	79	0
							0.85	0.73	138.28	0.19	12.10	21.31	11.99	93.92	0.06								
Upper Alkali Lake near Lake City ..	44N/16E-35G2S	5/ 5/54	-----	79	9,050	9.1	15	0.9	2,120	13	275	970	333	2,150	0.0	7.9	24	67	Fe=0.13 ppm; As=0.18 ppm	5,400	99	41	0
							0.76	0.07	92.19	0.33	9.17	15.90	6.93	80.64	0.00								

MINERAL ANALYSES OF SURFACE WATER WITHIN SURPRISE VALLEY

TABLE 10

Source of Data: Arsenic in Wells in Northeastern California, State of California, The Resources Agency Memorandum, December 11, 1970.

Owner and use	State well number and other number	Date sampled	Temp in °C	Specific conductance (micro-mhos at 25° C)	pH	Mineral constituents in parts per million										Total dissolved solids in ppm	Hardness on CaCO ₃	Assigned by	Remarks				
						Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO ₃)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)					Boron (B)	Silica (SiO ₂)	Other constituents	
Lower Alkali Lake	39N/17E-8J	12-2-58	-	19200	9.5	10 0.50	0.2 0.02	5220 227.07	18 0.46	1110 37.00	1550 25.57	1230 25.61	4840 136.49	2.7 0.04	27 1.42	57	68	Fe 0.03, Al 0.8 As 1.1(c)	0	13400	99.4	26	DWR
	39N/17E-9B	12-2-58	-	18100	9.5	8.4 0.42	0.2 0.02	4770 207.50	17 0.43	1090 36.33	1320 21.63	1070 22.28	4540 128.03	6.3 0.10	25 1.32	52	38	Fe 0.02, Al 0.8 As 0.7(c)	0	12300	99.4	22	DWR
	39N/17E-19H	5-5-54	83	5800	9.1	6.9 0.34	0.5 0.07	1370 59.57	11 0.28	192 6.10	805 13.19	307 6.39	1160 32.72	0.4 0.01	10 0.53	19	63	Fe 1.3, As 0.09 Al 0.01(c)	0	3540	99	20	USGS
	39N/17E-20H	9-17-53	70	473	8.4	37 1.85	18 1.48	37 1.61	4.4 0.11	10 0.33	234 3.93	21 0.44	14 0.39	0.6 0.01	0.5 0.03	0.19	47	47	Fe 0.25, Al 0.02 As 0.08	0	305	32	166	USGS
Alkali Lake	42N/16E-2L	12-2-58	36	24500	9.4	22 1.10	0.0 0.00	6850 297.98	12 0.31	1240 41.33	1790 29.34	1560 36.15	6810 192.04	2.5 0.04	14 0.74	94	18	Al 1.0, As 1.8	0	17500	99.4	55	DWR
	42N/16E-2N	7-17-56	-	5510	8.9	3.2 0.02	6.3 0.52	1250 54.50	7.4 0.19	91 3.02	733 12.02	302 6.29	1180 33.40	4.5 0.73	2.9 0.31	20	41	Cu 0.5, Mg 0.04 As 0.4	0	3310	99	30	DWR
	42N/16E-3R	9-17-53	55	10100	9.2	17 0.85	6.2 0.51	2330 101.32	9.0 0.23	325 10.83	1010 16.55	510 10.62	2380 67.12	0.9 0.01	9.0 0.47	31	37	Fe 1.8, As 0.21	0	6150	98	68	USGS
	42N/16E-3R	5-5-54	75	12900	9.1	17 0.85	8.9 0.73	3180 138.28	7.5 0.19	363 12.10	1300 21.31	576 11.99	3330 93.92	3.5 0.06	6.0 0.32	38	28	Fe 0.08, Zn 0.02 As 0.39	0	8160	99	79	USGS
Alkali Lake	44N/16E-33G	9-17-53	76	13400	9.3	5.1 0.25	0.3 0.02	3230 140.45	27 0.69	538 17.93	1210 19.89	467 9.72	3380 95.33	1.8 0.03	9.0 0.47	49	118	Fe 2.1, Zn 0.03 Al 0.08, As 0.2	0	8430	99	14	USGS
	44N/16E-22H	12-2-58	-	15200	9.3	10 0.50	0.2 0.02	3940 171.39	22 0.56	629 20.92	1360 22.29	561 11.68	4020 113.36	2.1 0.03	7.7 0.40	48	162	Fe 0.02, Al 0.4 As 0.7	0	10100	99.4	26	DWR
	44N/16E-23E	12-2-58	-	14900	9.3	10 0.50	0.2 0.02	3810 165.74	21 0.54	610 20.33	1350 22.13	555 11.56	3950 111.39	1.3 0.02	8.0 0.42	46	224	Fe 0.02, Al 0.4 As 0.7	0	9900	99.4	26	DWR
	44N/16E-23G	-	-	14700	9.3	9.2 0.46	0.0 0.00	3750 163.12	20 0.51	608 20.26	1300 21.31	535 11.11	3880 109.42	1.0 0.02	7.8 0.41	50	76	Fe 0.02, Al 0.4 As 0.7	0	9980	99.4	23	DWR
44N/16E-31P	5-5-54	79	9050	9.1	15 0.75	0.9 0.07	2480 92.19	13 0.33	275 9.17	970 15.90	311 6.93	2150 60.64	0.0 0.00	7.9 0.37	24	67	Fe 0.13, As 0.18	0	5480	99	41	USGS	

a Determined by addition of constituents unless otherwise noted
 b Analysis by Inducted laboratory
 U.S. Geological Survey, Quality of Water Branch (U.S.G.S.)
 State Department of Water Resources (S.D.W.R.)

TABLE 11

MINERAL ANALYSES OF GROUND WATER WITHIN SURPRISE VALLEY

Source of Data: Northeastern Counties Investigation, Bulletin 58, State of California,
Department of Water Resources, 1960.

Source	Well number MDR&M	Date sampled	Temp. in °F.	Specific conductance (micro-mhos at 25°C.)	pH	Mineral constituents in parts per million											Total dissolved solids in ppm	Per cent sodium	Hardness as CaCO ₃		Remarks				
						Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO ₃)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)			Silica (SiO ₂)	Other constituents		Total ppm	N.C. ppm		
Flowing stock well.....	38N/17E-10D1	6/ 2/56	56	216	7.5	2.9	0.7	48	1.7	0	108	4.8	12	0.2	0.9	0.18	59	Fe=0.03 ppm	143	90	10	0	0	120' Depth	
Flowing irrigation well.....	40N/16E-13J1	6/ 2/56	55	212	7.3	0.15	0.06	2.09	0.04	0.00	1.77	0.10	0.34	0.00	0.0	0.00	41	Fe=0.00 ppm	158	20	89	0	0	160' Depth	
Flowing stock well.....	41N/16E-10E2	7/15/54	---	190	7.9	1.25	0.53	0.48	0.10	0.00	2.23	0.05	0.02	0.01	0.0	0.06	36		142	40	59	0	0		
Flowing stock well.....	42N/16E-3P1	7/13/54	54	338	8.9	0.70	0.48	0.83	0.06	0.00	1.89	0.12	0.03	0.01	0.0	0.26	59		260	94	8	0	0		
Irrigation well.....	42N/17E-4D1	6/ 2/56	56	468	7.5	0.05	0.12	3.61	0.05	0.73	2.95	0.03	0.01	0.02	0.0	0.47	57	Fe=0.00 ppm	327	77	46	0	0	110' Depth	
Flowing domestic well.....	42N/17E-3P1	8/13/54	198	1,410	8.2	17	0.5	284	6.8	0	61	308	191	0.6	0.1	5.8	97	As=0.19 ppm	941	92	45	0	0		
Irrigation well.....	43N/16E-5M1	6/ 1/56	55	234	7.4	0.85	0.04	12.35	0.17	0.00	1.00	6.41	5.39	0.01	0.0	0.00	38	Fe=0.00 ppm	165	22	100	0	0	238' Depth	
Abandoned flowing hot springs.....	43N/16E-13B1	7/13/54	100+	1,780	7.8	26	8.5	13	0.9	0	148	0.4	1.0	4.3	0.0	0.00	71		1,170	93	52	0	0		
Domestic well.....	43N/17E-32M1	6/24/46	---	483	---	14	8.5	76	--	12	177	34	25	--	--	0.45	--		---	72	70	0	0	24' Depth	
Well.....	43N/17E-32N1	6/24/46	---	1,390	---	4.0	--	336	--	81	647	4.8	11	--	--	1.20	--		---	98	---	---	---	---	25' Depth
Light irrigation well.....	46N/16E-21B1	6/ 2/56	56	220	7.4	8.7	4.0	33	4.5	0	118	11	4.3	1.5	0.8	0.10	56	Fe=0.00 ppm	182	62	38	0	0	95' Depth	
Domestic well.....	47N/17E-19C1	7/14/54	60	144	6.4	0.43	0.33	1.44	0.16	0.00	1.93	0.23	0.12	0.02	0.0	0.00	31		113	37	56	0	0	25' Depth	

TABLE 12

MINERAL ANALYSES OF GROUND WATER WITHIN SURPRISE VALLEY

Source of Data: Arsenic in Wells in Northeastern California, State of California, The Resources Agency Memorandum, December 11, 1970.

Owner and use	State well number and other number	Date sampled	Temp in °F	Specific conductance (micro-mhos at 25° C)	pH	Mineral constituents in μ g/liters (ppb)										Total dissolved solids in ppm	Hardness as CaCO ₃ Total ppm	M.C. ppm	Analyzed by & Remarks				
						Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO ₃)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Iron (Fe)	Manganese (Mn)					Other constituents			
Menlo Resort Domestic (Abandon)	39N/17E-7A1	6-13-58	122	445	8.6	5.5 0.27	0.4 0.03	88 3.83	2.2 0.06	7 0.23	64 1.05	96 2.04	26 0.75	0.2 0.00	2.5 0.13	0.7	44	Fe 0.02, Al 0.13, As 0.04	306	91	15	0	DWR
Menlo Resort Irrigation	39N/17E-6E1	-	126	484	8.6	5.7 0.28	0.2 0.02	95 4.13	2.4 0.06	5 0.17	58 0.95	116 2.42	28 0.79	0.3 0.00	3.5 0.18	0.9	52	Fe 0.05, Al 0.02, As 0.04, Zn 0.01	337	92	15	0	DWR
	39N/17E-7A2	-	136	482	8.2	5.4 0.27	0.1 0.01	97 4.22	2.0 0.05	0 0.00	62 1.02	114 2.37	30 0.85	0.3 0.00	4.0 0.21	1.0	57	Fe 0.11, Al 0.21, As 0.06	342	93	14	0	DWR
Willier A. Cottrell Irrigation	39N/17E-29G1	6-13-58	106	286	8.5	2.6 0.13	0.2 0.02	59 2.57	1.7 0.04	6 0.20	73 1.20	39 0.81	16 0.45	0.8 0.01	2.0 0.11	0.4	42	Fe 0.02, Al 0.12, As 0.02	206	93	7	0	DWR
E. E. Rose Domestic	42N/17E-6L1	5-7-59	184	1410	8.5	1.7 0.85	0.1 0.01	267 11.61	5.8 0.15	8 0.27	39 0.64	300 6.25	188 5.30	0.9 0.01	5.9 0.31	5.3	82	Fe 0.02, Al 0.35, As 0.22	900	92	43	0	Hot Sprin DWR
Union Irrigation	43N/16E-12D1	5-5-59	184	1670	8.0	3.0 1.50	1.2 0.10	305 13.27	10 0.26	0 0.00	67 1.10	373 7.76	220 6.20	1.6 0.02	4.0 0.21	8.0	116	Fe 0.02, Al 0.20, Mn 0.05, As 0.35	1100	88	88	25	Hot Sprin DWR
Old Leonard Baths (Abandon)	43N/16E-13B1	5-5-59	104	1840	8.1	1.7 0.85	2.6 0.21	370 16.10	5.7 0.14	0 0.00	172 2.82	286 6.04	225 6.34	1.4 0.02	4.0 0.21	7.3	59	Fe 0.04, Al 0.20, Mn 0.10, Zn 0.12, As 0.36	1160	93	53	0	Hot Sprin DWR
S. W. Warren Stock	43N/16E-16L1	9-10-58	68	134	8.1	2.4 0.12	1.7 0.14	27 1.17	1.1 0.03	0 0.00	68 1.11	12 0.25	3.0 0.06	0.0 0.00	0.1 0.00	0.3	39	Fe 0.02, Al 0.14, As 0.02	120	80	13	0	Depth 60' Artesian DWR
Robertson Ranch Irrigation	44N/15E-20B1	5-7-59	190	1520	8.4	3.0 1.50	2.4 0.20	290 12.62	14 0.36	7 0.23	235 3.85	253 5.27	176 4.96	0.8 0.01	5.9 0.31	4.8	103	Al 0.15, Mn 0.55, Pb 0.01, Cu 0.02, As 0.25	1000	86	85	0	Hot Sprin DWR
Mike Quirk & Fort Bidwell Irrigation	44N/16E-6E2	9-10-58	77	640	8.0	3.2 0.16	0.5 0.04	138 6.00	4.0 0.10	0 0.00	270 4.56	1.9 0.04	70 1.97	0.1 0.00	0.7 0.04	5.2	68	Fe 0.03, Al 0.20, As 0.02	431	94	10	0	Depth 45' Flowing DWR
Max Pflücker	46N/16E-3L1	6-14-58	82	240	8.3	4.0 0.20	0.3 0.02	66 2.70	7.5 0.19	3.3 0.11	144 1.97	38 0.82	18 0.51	1.0 0.02	0.9 0.05	0.56	72	Al 0.07, As 0.02	296	87	11	0	Depth 11' Artesian DWR

a. Determined by addition of constituents unless otherwise noted.

b. Analysis by indicated laboratory.

U.S. Geological Survey, Quality of Water Branch (U.S.G.S.)

State Department of Water Resources (D.W.R.)

Table 13

GEOHERMAL WELLS

Operator	Well	Location	Date Completed	Max. Recorded Temp. (C.)	Status	Total Depth (Ft.)
GEOHERMAL WELLS DRILLED IN SURPRISE VALLEY, MODOC COUNTY, CALIFORNIA						
Gulf Oil Company	"Surprise Valley"1-ST	Sec. 30, T.44N., R.16E., MDM	9/12/73	--	Observation	--
	"Surprise Valley"2-ST	Sec. 13, T.43N., R.16E., MDM	10/22/73	--	Abandoned	6503
Magma Power Company	"Cedarville" 1	Sec. 6, T.42N., R.17E., MDM	7/25/62	54	Abandoned	735
	"Parman" 1	Sec. 24, T.44N., R.15E., MDM	9/29/62	140	Suspended	2149
	"Parman" 2	Sec. 24, T.44N., R.15E., MDM	7/26/59	125	Abandoned	1968
	"Parman" 3	Sec. 24, T.44N., R.15E., MDM	8/09/62	--	Blew Out	92
	"Phipps" 1	Sec. 24, T.44N., R.15E., MDM	9/17/62	137	Suspended	1268
	"Phipps" 2	Sec. 24, T.44N., R.15E., MDM	12/26/72	--	Proposal to deepen has been approved	--
GEOHERMAL WELLS DRILLED IN WARNER VALLEY, LAKE COUNTY, OREGON						
Nevada Thermal Power Company	-----	Sec. 34, T.38S., R.24E., WM		121		1684

GUANO VALLEY DRAINAGE BASIN

A small portion of the upper reaches of Guano Drainage Basin occurs in the northeastern portion of the area.

Precipitation varies with elevation as in surrounding areas. Data from the weather stations at Hart Mountain Refuge and Sheldon (Table 6) are representative of the area.

Runoff records are non-existent. Guano Creek, one of the larger intermittent streams, crosses the northeast portion of the area in passage to Guano Valley. A small dam on this creek has created Jacobs Reservoir at the site of a former intermittent lake.

Further south the upper reaches of Piute Creek, also intermittent, embark towards Guano Valley from the uplands along the Oregon and Nevada State line.

The remaining area contains several intermittent lakes situated in both upland areas and in flat portions of northwest trending valleys. Intermittent stream channels connect the valley lakes.

Groundwater use and data are sparse. Yields from wells are small to moderate.

MOSQUITO VALLEY, LONG VALLEY, MASSACRE LAKE VALLEY, AND BOULDER VALLEY DRAINAGE BASINS

The drainage areas considered in this section consist of contiguous basins with similar hydrologic characteristics. Hydrologic correspondence within these areas resulted from past geologic conditions when one drainage basin existed in the locale of the Mosquito Valley, Long Valley, Massacre Lake Valley, and Boulder Valley. During Pleistocene times one large lake, Lake Meinger, existed in what is now separate desert alluvial basins.

Precipitation varies with elevation from around 16 inches in the Hays Canyon Range to less than 8 inches in the dry basins. Normal monthly precipitation at Vya and Sheldon are shown in Table 6.

Streamflow is ungaged and drains towards playa lakes along the axis of the dry basins. Permanent streams do not exist in the region. Runoff from snowmelt and storms occurs mostly during spring and early summer. Only peak flows reach the playas. Much streamflow seeps into streambeds, alluvial fans, and terraces to recharge groundwater reservoirs.

Moderate to large amounts of groundwater are available to wells constructed in unconsolidated alluvium along the valley margins. The best aquifers are sand and gravel deposits buried within less permeable deposits of alluvium. Total dissolved solids are generally less than 1000 ml/l. Wells close to playas may yield poor quality water whereas wells in mountains and some higher valleys contain less than 500 ml/l total dissolved solids.

Wells in the volcanic rocks which underlie the mountains and plateaus yield low to moderate amounts of water. Better yields come from zones of secondary permeability.

Chemical analyses of groundwater from several wells is shown in Table 14.

SWAN LAKE VALLEY DRAINAGE BASIN

About six square miles of this drainage basin occurs along the boundary of the EAR area directly south of Sheldon National Antelope Refuge. The area is characterized by Bald Mountain Canyon which contains the upper reaches of Bald Mountain Creek, an intermittent stream draining to Swan Lake Reservoir east of the EAR area. The creek originates in several springs which occur throughout the canyon area.

The area contains Lone Pine Mining District, which is presently inactive. Data is lacking on water resources, and the impact of former mining on water resources is unknown.

Table 14

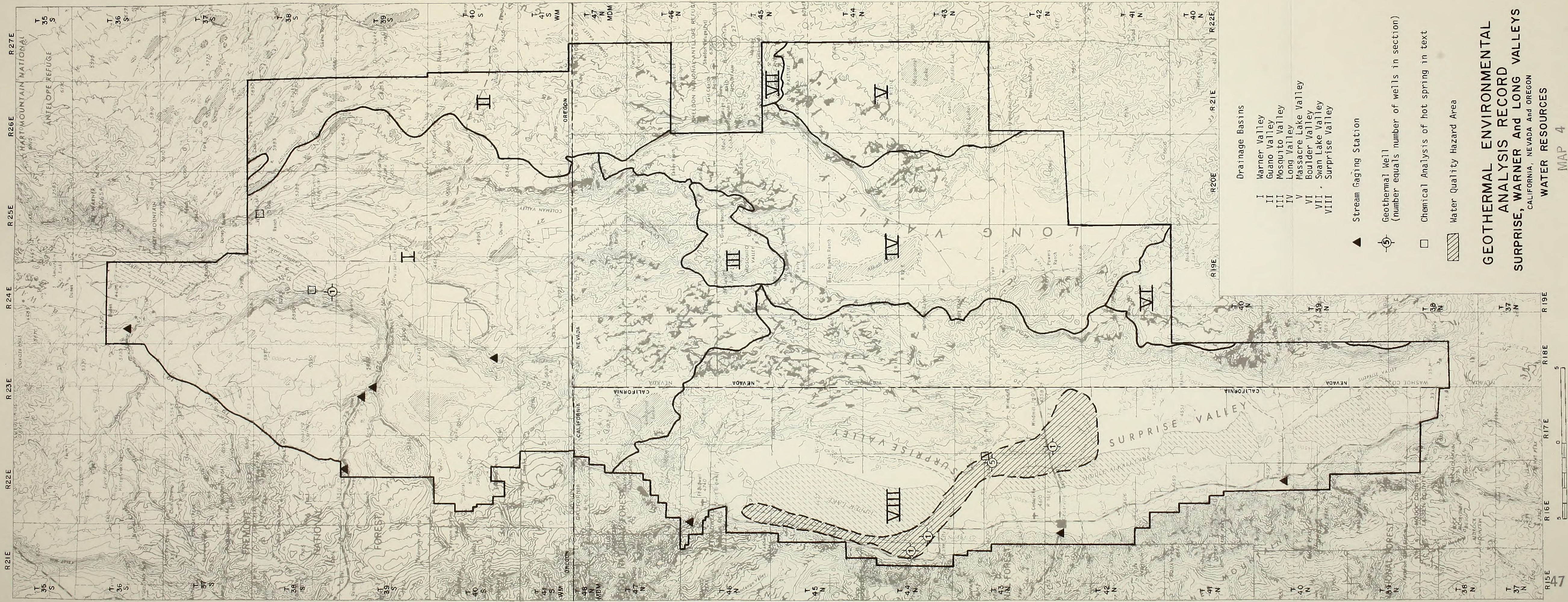
CHEMICAL ANALYSES OF GROUNDWATER IN THE LONG VALLEY-MASSACRE LAKE REGION, WASHOE COUNTY, NEVADA
(Analyses by U.S. Geological Survey. Constituents in parts per million)

Data from: Groundwater Resources - Reconnaissance Series, Report 15, State of Nevada, Department of Natural Resources

Well or Spring number	Date collected	Temperature °F	Silica (Si)	Calcium(Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO ₃)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Boron (B)	Hardness as CaCO ₃		Specific conductance (micromhos at 25°C)	Dissolved solids residue at 180°C	Sodium adsorption ration (SAR) (epm)	Residual sodium carbonate (RSC) (epm)	pH
															non-Carbonate	Calcium Magnesium					
Well 45/19-2a1	5-2-61	48	60	75	26	97	8.5	0	243	49	70	0.8	215	0.35	97	296	1030	721	2.47	0	7.6
Spring 45/21-18b	5-2-61	55	55	12	3.2	14	7.3	0	62	11	13	.2	1.6	.10	0	42	173	160	.09	.14	7.4
Well 43/19-33b1	5-2-61	53	59	22	7.5	69	9.8	0	198	45	32	.4	.3	.26	0	87	499	356	3.15	1.4	7.5
Well 42/20-8d1	5-2-61	48	61	57	25	151	41	5	289	134	94	.5	70	.76	0	244	1130	749	4.25	0	8.3
Well 43/21-34d1	5-2-61	55	69	13	3.4	17	4.0	0	89	5.6	7.0	.2	.8	.17	0	46	174	157	.78	.6	7.4
Well 40/20-3d1	5-3-61	58	61	25	9.0	32	4.7	0	148	16	23	.2	.5	.13	0	100	339	243	1.4	.46	7.8

Date	Description	Debit		Credit		Balance
		Dr	Cr	Dr	Cr	
1-1-73	Opening Balance			1000		1000
1-15-73	Bank of Montreal	500				500
1-30-73	Bank of Montreal	500				1000
2-15-73	Bank of Montreal	1000				2000
2-30-73	Bank of Montreal	1000				3000
3-15-73	Bank of Montreal	1000				4000
3-30-73	Bank of Montreal	1000				5000
4-15-73	Bank of Montreal	1000				6000
4-30-73	Bank of Montreal	1000				7000
5-15-73	Bank of Montreal	1000				8000
5-30-73	Bank of Montreal	1000				9000
6-15-73	Bank of Montreal	1000				10000
6-30-73	Bank of Montreal	1000				11000
7-15-73	Bank of Montreal	1000				12000
7-30-73	Bank of Montreal	1000				13000
8-15-73	Bank of Montreal	1000				14000
8-30-73	Bank of Montreal	1000				15000
9-15-73	Bank of Montreal	1000				16000
9-30-73	Bank of Montreal	1000				17000
10-15-73	Bank of Montreal	1000				18000
10-30-73	Bank of Montreal	1000				19000
11-15-73	Bank of Montreal	1000				20000
11-30-73	Bank of Montreal	1000				21000
12-15-73	Bank of Montreal	1000				22000
12-30-73	Bank of Montreal	1000				23000

1. The above is a true and correct copy of the original as shown to the undersigned on the date hereof.
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- Drainage Basins
- I Warner Valley
 - II Guano Valley
 - III Mosquito Valley
 - IV Long Valley
 - V Massacre Lake Valley
 - VI Boulder Valley
 - VII Swan Lake Valley
 - VIII Surprise Valley

- ▲ Stream Gaging Station
- ⊕ Geothermal Well
(number equals number of wells in section)
- Chemical Analysis of hot spring in text
- ▨ Water Quality Hazard Area

**GEOHERMAL ENVIRONMENTAL
ANALYSIS RECORD**
SURPRISE, WARNER AND LONG VALLEYS
CALIFORNIA, NEVADA AND OREGON
WATER RESOURCES

SCALE OF MILES
0 5



1000
900
800
700
600
500
400
300
200
100
0

1000
900
800
700
600
500
400
300
200
100
0

1000
900
800
700
600
500
400
300
200
100
0

AIR

The air appears to be of high quality throughout the area, although there are no air monitoring stations in the area. Weather stations at Adel, Vya, Cedarville, and Fort Bidwell record only temperature and precipitation data.

AIR MOVEMENT PATTERNS

The prevailing wind is from the west and southwest with occasional cold north wind during the winter. The west and southwest winds average 15 mph with some spring wind storms up to 30 mph. The north wind averages 15 mph.

The wind commonly begins in the late morning and ends by sunset. On hot summer days dust devils are common in the dry basins.

The dry and irrigated basins are susceptible to air temperature inversions, especially during the winter. The major effect of an inversion is, in the absence of significant pollutants, to maintain lower temperatures near the ground. Inversions also occur during the summer, but are usually broken in the morning.

TEMPERATURE

The basins usually have about 90 frost-free days, and average 67 degrees F in the summer and 32 degrees F in the winter. The temperature extremes in the basins are from 100 degrees F in the summer to -15 degrees F in the winter. The daily temperatures vary about 40 degrees F.

The highlands usually have about 25 frost-free days, and average 60 degrees F in the summer and 27 degrees F in the winter. The temperature extremes are from 90 degrees F in the summer to -25 degrees F in the winter. The daily temperatures vary about 40 degrees F.

Mean Annual Temperature *

	B a s i n s				Plateaus, Foothills, Mtns.	
	Adel	Vya	Cedar-ville	Fort Bidwell	Hart Mtn. Refuge	Sheldon Refuge
Jan	29.0	24.7	29.1	29.1	26.0	25.1
Feb	34.1	30.3	33.6	33.2	33.0	26.9
Mar	38.8	32.2	39.8	39.6	31.3	30.8
Apr	45.3	41.4	48.4	47.2	37.9	39.0
May	53.3	53.4	55.3	53.9	51.8	45.9
Jun	58.7	57.7	62.5	60.2	56.6	51.8
Jul	68.8	67.5	70.4	68.4	63.6	61.4
Aug	65.8	63.5	70.4	67.0	61.8	60.3
Sep	59.7	55.2	62.2	60.1	54.8	54.0
Oct	51.2	43.8	50.8	50.1	43.8	44.4
Nov	40.4	36.3	39.0	38.5	34.7	34.3
Dec	33.4	32.7	32.2	32.4	23.1	29.3
Avg.	47.9	44.9	49.7	48.3	43.2	41.9

*For more detailed information on air temperatures, refer to the respective District's climatological file.

PARTICULATE MATTER

No comprehensive data is available on the concentration, areal extent, or persistence of particulate matter in the EAR area.

Wind blown dust from the dry basins is the primary contributor to suspended particulate matter in the dry basins and on the plateaus. The dust is of greater concentration in the dry basins where it originates, and diminishes in concentration away from the source. The dry basins which contribute the most dust are Coleman Valley, Surprise Valley, Long Valley, and Massacre Valley.

Minor amounts of dust are dispersed by vehicles travelling on un-surfaced roads in the dry basins.

Smoke from burning garbage dumps and a wigwam burner are the primary contributors of particulate matter in the irrigated basins. The garbage dumps are located near Lake City, Cedarville, Eagleville, Fort Bidwell, Vya, Adel, and Plush. The wigwam burner is located at the sawmill in Cedarville. The amount of smoke from these sources is minor and the effects are local.

The minor particulate matter in the air of the plateaus, foothills, and mountains is blown in from the basins or from outside the EAR area.

NOXIOUS GASES

No comprehensive data is available on the concentration, areal extent, or persistence of carbon monoxide, hydrocarbons, nitrogen oxides, or sulfur oxides.

The burning of garbage dumps near Lake City, Cedarville, Eagleville, Fort Bidwell, Vya, Adel, and Plush contributes the most noxious gases in the basins. Some additional gases are produced by the burning of sawmill waste at the mill in Cedarville. The gases dispersed by burning are carbon monoxide and hydrocarbons.

The noxious gases contributed by vehicles in the area is insignificant (carbon monoxide, hydrocarbons, and nitrogen oxides.).

There is a minor amount of hydrogen sulfide gas dispersed by the hot springs within the area. Concentrations are approximately 0.03 ppm in the immediate vicinity of the springs.

NON-IONIZING RADIATION

Some non-ionizing radiation is emitted from microwave, television, and radio transmitters on the plateaus, foothills, and mountains. This radiation is emitted from directional transceivers at a frequency of 54 to 88 megahertz. These stations are located on the plateau west of Warner Valley, on the mountain east of Cedarville, and in the foothills west of Surprise Valley.

There is a 750 KV direct current transmission line which crosses the plateau west of Warner Valley, east of Fort Bidwell, and the length of Long Valley. Because the transmission line is direct current, it emits very little non-ionizing radiation.

VEGETATION

TERRESTRIAL

The principal vegetative types are shown on the map titled Vegetative Types. Table 15 below lists the major plant species by types and relates vegetative types to physiographic position.

Table 15. Principal Plant Species by Vegetative Type and Physiographic Position

<u>Vegetative Type</u>	<u>Principal Plant Species</u>	<u>Physiographic Position</u>
Grass Seedings*	Agropyron desertorum Agropyron intermedium Bromus tectorum Sitanion hystrix Salsola Kali tenuifolia Annual forbs Artemisia tridentata	Dry basins, and deeper upland soils on plateaus and terraces.
Grass-Native Perennials	Stipa thurberiana Sitanion hystrix Poa secunda Agropyron spicatum Festuca Idahoensis Annual forbs Chrysothamnus spp.	Primarily on deeper soils on plateaus and terraces.
Forbs-Perennial	Eleocharis palustris Muhlenbergia squarrosa Rumex spp. Iva axillaris Oenothera tenacetifolia	Seasonally flooded basins.
Greasewood	Sarcobatus vermiculatus Artemisia tridentata Chrysothamnus nauseosus Grayia spinosa Atriplex confertifolia Artemisia spinescens Distichlis stricta Poa secunda Elymus cinereus Sitanion hystrix Lepidium perfoliatum Annual forbs	Alkali soils of the dry basins.

*Approximately 57,400 acres of range vegetation improvement projects have been completed within the proposed geothermal lease area. Specific data regarding these projects may be reviewed in the Unit Resource Analyses (URAs) for those Planning Units involved. (California and Nevada - Massacre & Cowhead; Oregon - South Warner)

Table 15 Continued

<u>Vegetative Type</u>	<u>Principal Plant Species</u>	<u>Physiographic Position</u>
Salt desert shrubs	Atriplex confertifolia Grayia spinosa Artemisia tridentata Artemisia spinescens Stipa thurberiana Sitanion hystrix Elymum cinereus Oryzopsis hymenoides Annual forbs	Low terraces and dry basins on soils with high concentrations of neutral salts.
Mountain Shrub (mtn. mahogany)	Cercocarpus ledifolius Amelanchier alnifolia Chrysothamnus viscidiflorous Chrysothamnus nauseosus Ceanothus velutinus Prunus emarginata Symphoricarpus spp. Populus tremuloides Sitanion hystrix poa secunda Stipa spp. Festuca idahoensis Phlox spp. Lupine spp.	High plateaus and lower mountain slopes
Big Sagebrush	Artemisia tridentata Artemisia arbuscula Sitanion hystrix Poa secunda Stipa thurberiana Agropyron spicatum Festuca idahoensis Bromus tectorum Elymus cinereus Annual forbs Chrysothamnus nauseosus Chrysothamnus viscidiflorous Purshia tridentata Lupinus spp.	On the moderately deep to deep, well drained, non-saline, non-alkaline soils of all physiographic units.
Low Sagebrush	Artemisia arbuscula Artemisia tridentata Chrysothamnus spp. Purshia tridentata Poa secunda	Primarily on the shallow stony soils of the terraces and plateaus

Table 15 Continued

<u>Vegetative Type</u>	<u>Principal Plant Species</u>	<u>Physiographic Position</u>
Low Sagebrush (continued)	Sitanion hystrix Stipa thurberiana Festuca idahoensis Phlox spp. Erigeron spp. Eriogonum spp. Perideridia oregana Annual forbs	
Western Juniper	Juniperous occidentalis Artemisia arbuscula Artemisia tridentata Purshia tridentata Chrysothamnus nauseosus Chrysothamnus viscidiflorous Poa secunda Sitanion hystrix Agropyron spicatum Stipa thurberiana Festuca idahoensis Annual forbs	Plateaus and lower mountain slopes.
Mountain Shrub (Bitterbrush)	Purshia tridentata Artemisia tridentata Chrysothamnus nauseosus Chrysothamnus viscidiflorous Poa secunda Bromus tectorum Sitanion hystrix Stipa thurberiana Lupine spp. Erigeron spp.	Primarily on higher plateaus.
Broadleaf Trees (scattered small groves, not shown on map)	Populus tremuloides Amelanchier alnifolia Prunus emarginata Chrysothamnus spp. Elymus triticoides Agropyron spicatum Sitanion hystrix Stipa spp. Wyethia mollis Annual forbs	High plateaus and mountains on north and east slopes near ridge tops. Along perennial stream courses at lower elevations.

Table 15 Continued

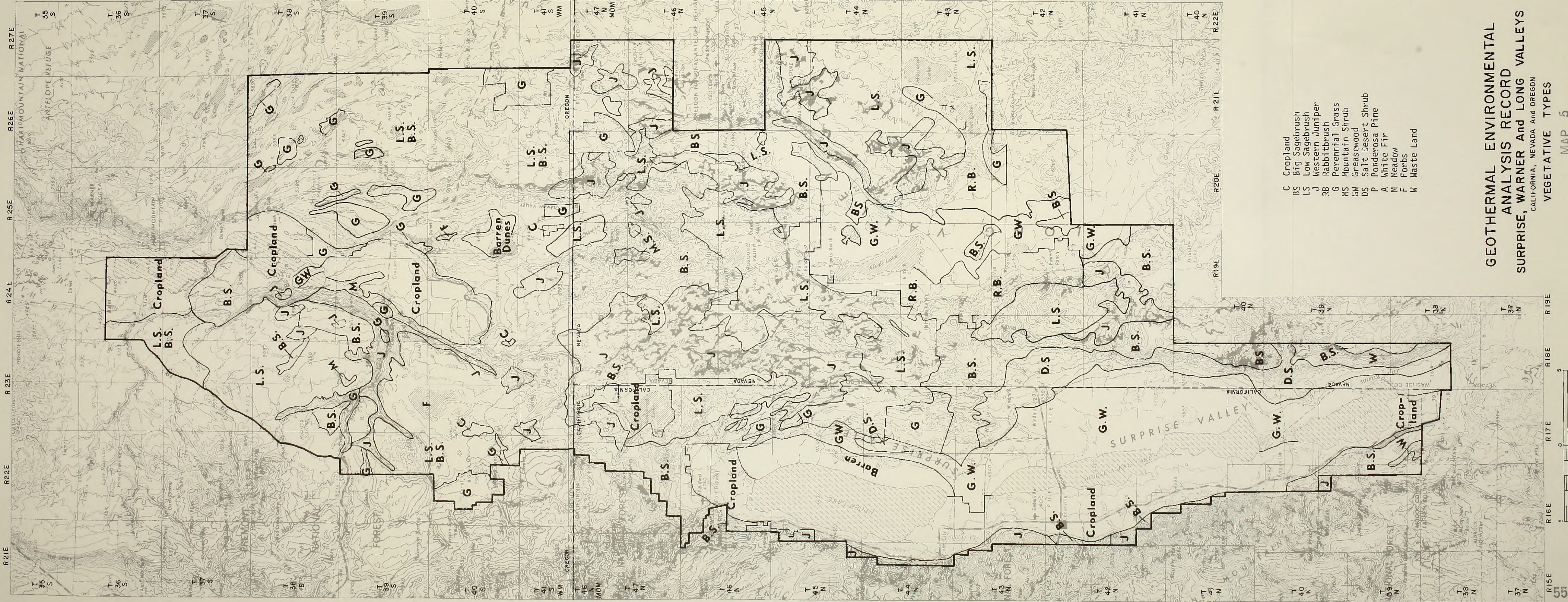
<u>Vegetative Type</u>	<u>Principal Plant Species</u>	<u>Physiographic Position</u>
Conifer	Pinus ponderosa Abies concolor Populus tremuloides Cercocarpus ledifolius Juniperous occidentalis Artemisia tridentata Purshia tridentata Peraphyllum ramossissimum Chrysothamnus spp. Elymus triticoides Agropyron spicatum Bromus tectorum Lupinus spp. Wyethia mollis Erigeron spp.	Mountain

AQUATIC

Dry basin aquatic plants are limited to spring areas and playa lakebeds. The most common genera represented are sedges (Carex spp.), and rush (Juncus spp.). The perennial springs and more permanent type lakebeds also contain cattail (Typhalatifolia), pondweeds (Potamogeaton spp.), phytoplankton, and many others not listed here.

Hart Lake, Crump Lake, portions on the west side of the Surprise Valley Lakes, and the Crump Lake flood plain are the major aquatic communities within the irrigated basin physiographic unit. A great variety of aquatic species occur in these perennial lakes, streams, and adjacent marsh areas. These range from minute species of phytoplankton to the common cattail (Typhalatifolia). Some of the more common larger plant genera represented are: sedges (Carex spp.), spikerush (Eleocharis spp.), horsetail (Equisetum spp.), rush (Juncus spp.), pondweed (Potamogeaton spp.), bladderwort (Utricularia spp.), and watermilfoil (Myriophyllum spp.). The majority of these species favor the slow moving water areas of lakes and marshes. Portions of the larger lakes in Surprise Valley produce similar vegetation during good moisture years, when the lakes fill.

On the plateaus, foothills, and mountains; springs, lakebeds, reservoirs, and streams provide the sites suitable for growth of aquatic vegetation. Many of the same species found in the irrigated basins are represented here. Willows are common along most perennial streams



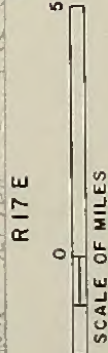
- C Cropland
- BS Big Sagebrush
- LS Low Sagebrush
- J Western Juniper
- RB Rabbitbrush
- G Perennial Grass
- MS Mountain Shrub
- GW Greasewood
- DS Salt Desert Shrub
- P Ponderosa Pine
- A White Fir
- M Meadow
- F Forbs
- W Waste Land

**GEOHERMAL ENVIRONMENTAL
ANALYSIS RECORD
SURPRISE, WARNER AND LONG VALLEYS**

CALIFORNIA, NEVADA AND OREGON

VEGETATIVE TYPES

MAP 5





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together with many other riparian species. Deep Creek and Twentymile drainages are the most prominent stream areas within the unit.

ANIMALS

WILDLIFE

Wildlife within the designated area is quite diversified. Literature review and data provided by State and Federal wildlife agencies indicate there are 68 species of mammals, over 200 species of birds, 20 species of reptiles, 6 species of amphibians, and 9 species of fish expected to be present in the area at some time. A listing of these animals is presented in Appendix 2.

The following statements concerning current wildlife use within the designated area are based upon data contained within appropriate Unit Resource Analyses (U.R.A.). These analyses contain inventory and analysis data on wildlife resources within specific planning units and include an identification of capabilities and opportunities to enhance wildlife populations within the units. These analyses reflect data currently available from State and Federal wildlife agencies.

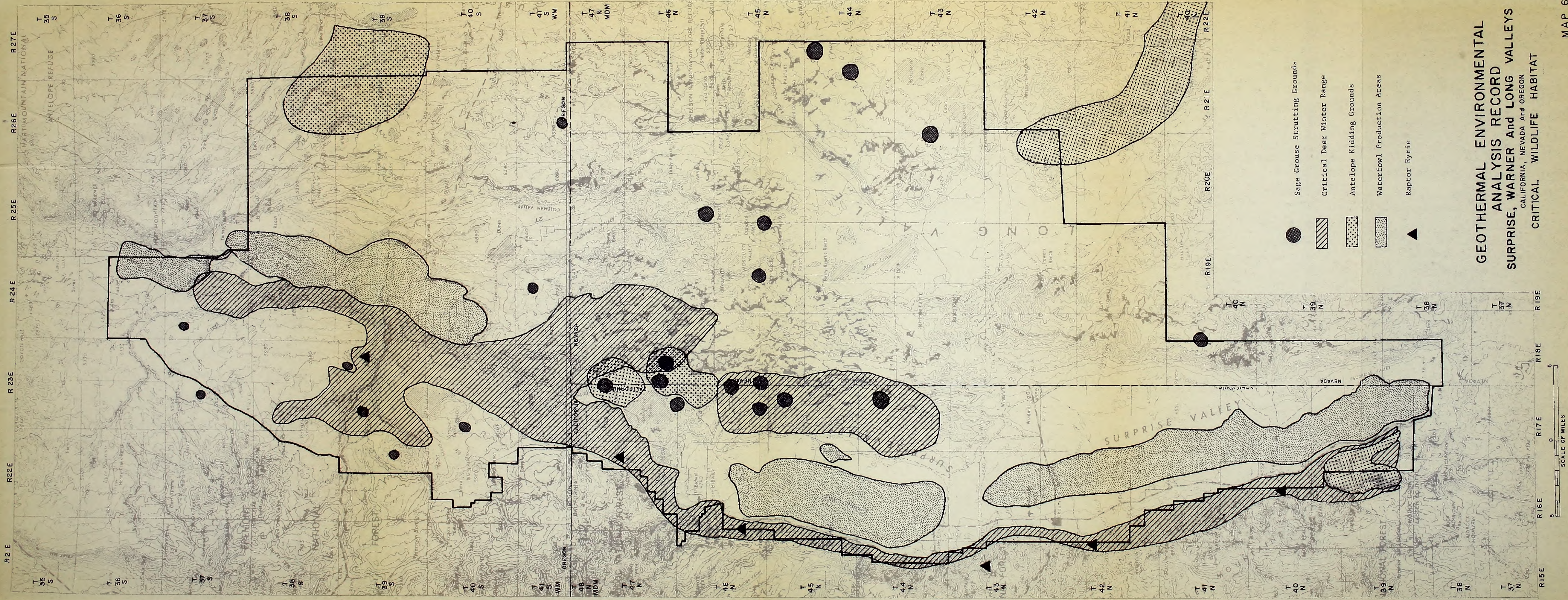
Aquatic species include ducks, geese, swans, grebes, pelicans, cormorants, shorebirds, furbearers (beaver and muskrat), fish, frogs, and various forms of invertebrates.

Ducks and geese use the playa lakes of the dry basins in the spring for resting and feeding during migration. The deeper lakes that retain water on good years are used by waterfowl, shorebirds, and other water-oriented species during the summer and fall. This use is sporadic and dependent upon water conditions of the year.

Springs present in the unit provide habitat for invertebrates and other small species. Fosket Spring in Coleman Valley has been identified as containing the "Fosket spring dace" (Rhinichthys spp.) which is considered rare by the State of Oregon. This spring is on private land.

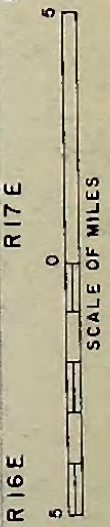
The irrigated basin unit is the most productive aquatic habitat. Major waterfowl (ducks, geese, and swans) use is concentrated on the larger perennial lakes and marshes in Warner and Surprise Valleys. Crump Lake and the Crump Flood Plain are especially valuable for waterfowl production (see map 6). This area along with other permanent marsh types provide the bulk of waterfowl production sites. Most of these lands are in private or State ownership. In addition to production, lakes of Surprise Valley and Warner Valley receive heavy spring-fall use by migrant waterfowl.

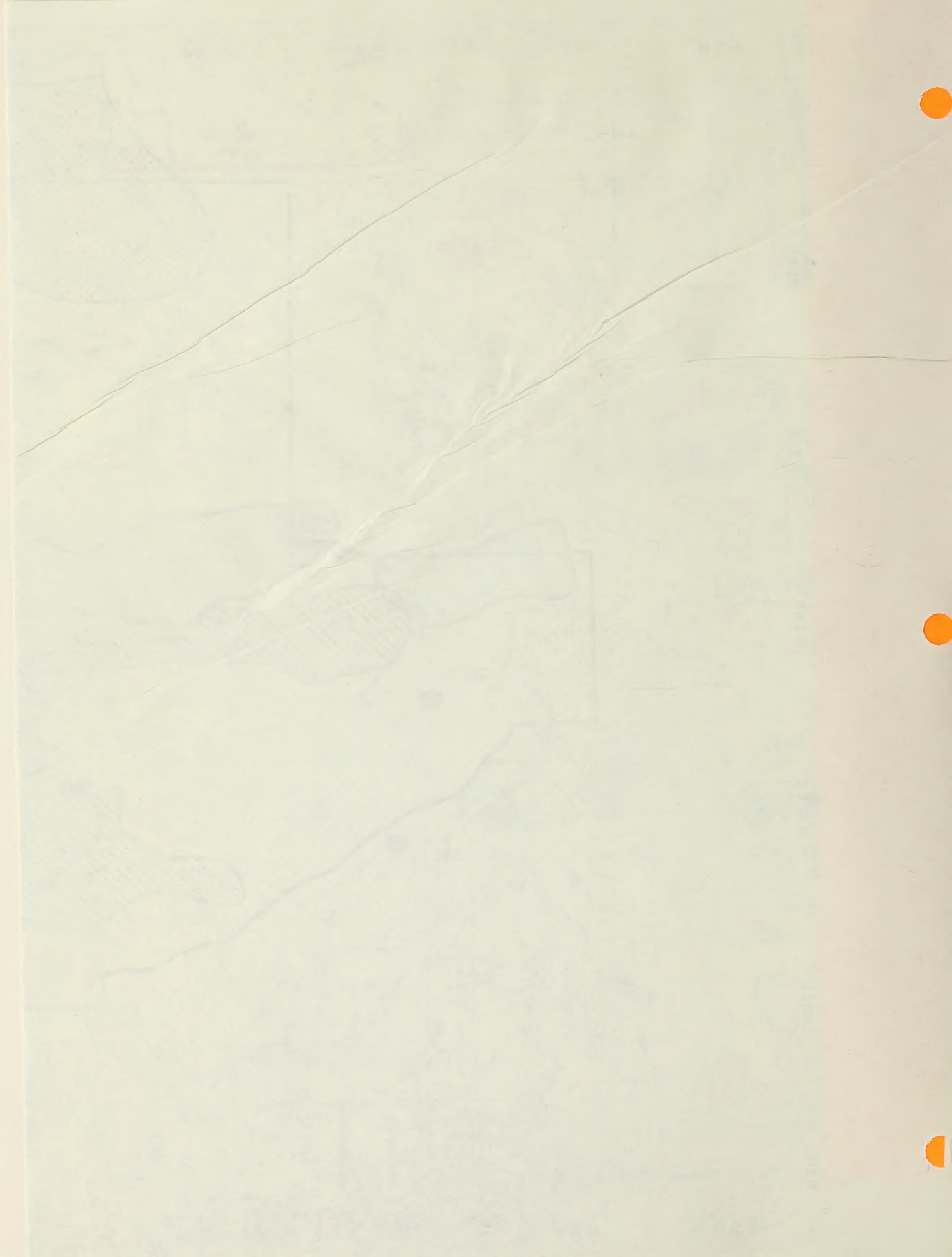
Shorebirds, grebes, herons, bitterns, ibis, egrets, cranes, rails, plovers, phalaropes, gulls, and terns are found in close association with waterfowl, many utilizing the same or similar type habitat. Pelican Lake, located in Warner Valley, contains a small island which serves as a rookery for white pelican, egret, heron, and cormorant.



- Sage Grouse Strutting Grounds
- ▨ Critical Deer Winter Range
- ▤ Antelope Kidding Grounds
- ▧ Waterfowl Production Areas
- ▲ Raptor Eyrie

**GEOHERMAL ENVIRONMENTAL
 ANALYSIS RECORD**
SURPRISE, WARNER AND LONG VALLEYS
CALIFORNIA, NEVADA AND OREGON
CRITICAL WILDLIFE HABITAT





Hart and Crump Lakes possess a variety of warm water fish (see Appendix 2 - Warner Lakes). One species, the Warner sucker (Catostomus warnerensis) is considered rare by the State of Oregon. This species is confined in distribution to the Warner Lakes Basin.

The many playa lakes in the plateau physiographic unit provide spring - fall habitat for waterfowl and shorebirds. The intensity of use is dependent upon water conditions of the year.

Rainbow trout are present in the Deep Creek and Twentymile drainage systems. Other species known to be present are listed in Appendix 2. Several small reservoirs within this unit have been planted with rainbow trout. Fee, Mud Lake, Lucky Reservoir, and Priday Reservoir are some of the better known sites.

Fishing use on these reservoirs and streams is relatively heavy due to the scarcity of fishable waters within the general area.

Many of the small perennial streams originating in the Warner Mountains contain rainbow trout within the foothill areas. The headwaters of Deep Creek support small populations of brook trout. However, this species is restricted to higher areas on the National Forest.

Aquatic species in the mountain type are limited mainly to the smaller forms of animal life (invertebrates and amphibians) found in springs, small streams, stock ponds, and reservoirs. Coleman Creek supports a small population of rainbow trout. Limited aquatic bird use occurs on these sites, but amount of use is low due to scarcity of available habitat.

Big game (mule deer and antelope) use in the dry basins consists primarily of deer winter use on the salt desert shrub and big sagebrush types during years of heavy snowfall. The sites used generally lie adjacent to the plateau and mountain types (lower foothills and rim slopes). Random summer antelope use occurs in the perennial forb type near the playa lakes and the east side of Surprise Valley. These are not generally concentration areas for a large number of animals.

Mule deer utilize the juniper, big sagebrush, and mountain shrub types as winter and intermediate ranges. Resident populations of deer are found in the willows and cultivated fields of Surprise Valley.

Deep Creek winter range in southern Oregon and extreme northern California provides winter habitat for several hundred mule deer that summer in the Warner Mountains. Several smaller winter concentration areas have been identified further east (see URA). The higher plateau areas (mountain shrub type) provide summer range for deer east of Warner and Surprise Valleys.

The foothills, the transition area between the forested zone of the Warner Mountains and the lower plateau or irrigated basin units to the east, comprise critical deer intermediate and winter range for the deer summering in the Warner Mountains. Summer browse consists of aspen, snowbrush, mahogany, and other deciduous shrub types. The mountain shrub and big sage are the preferred winter vegetative types.

The southern extremity of this unit (Snake Lake area) provides year long habitat for sagegrouse and antelope.

Antelope and sagegrouse are widely distributed in plateau areas. Both species are closely associated with low sagebrush and mixed big and low sagebrush types which provide year-long habitat. Distribution is keyed around available water sources during the dry periods of the year. Known kidding and strutting grounds are shown on Map 6.

Sagegrouse are present in the basins in cultivated fields and closely adjacent areas during the summer period. In severe winters lower foothill and rim areas may be used. Morning doves are abundant in the summer, being associated with agricultural and reseeded rangeland.

Small rodents, desert songbirds, jackrabbits, and reptiles are often abundant throughout the dry basins depending upon the stage of population cycles. Coyotes and raptors are common, in association with prey species.

As discussed previously, aquatic species are abundant in the irrigated basins. The crop and pasture land developed for agriculture has also created considerable upland game habitat. Species such as pheasant, valley quail, hungarian partridge, and doves are well adapted to these areas. An abundance of small bird species are present due to the diversity of habitat created by the aquatic environment and associated agricultural development. Predatory species often frequent these areas, due to the abundance of small rodents and other prey animals. Raptors are common.

Two species on the Federal Endangered Species List have been observed. (Southern Bald Eagle and Peregrine Falcon). The bald eagle is associated with the lake and fringe timber units. Nesting sites are probable in the plateaus and foothills adjacent to the larger lakes. The peregrine falcon is, although rarely observed, found in the open plateau and rim areas. Neither species are abundant here. Most bald eagle sightings (during winter and spring) occur in the irrigated basins due to presence of water and availability of preferred food species.

Many species of small birds inhabit the juniper and mountain brush types. Chukars and cottontail are present in the rims and canyons adjacent to water. Raptors are common and some species nest in the rim areas. Species commonly seen seasonally include the red-tailed hawk, swainson's hawk, rough-legged hawk, marsh hawk, american kestrel and golden eagle. The less common species are listed in Appendix 2.

Coyotes, bobcats, rabbits, and small rodents are widely distributed.

Sagegrouse, valley quail, and chukar partridge are present. A variety of small animals and birds utilize the area. Water is generally more abundant in this unit, making the unit more suitable for animal use.

There is a limited amount of the mountainous type of country, where water is generally more abundant in the high desert area. This increases its importance in fulfilling the year round requirements of several animal species, mule deer being one of the more significant.

Five types of critical wildlife habitat are indicated on Map 6. Each habitat type is considered high in environmental sensitivity due to its importance to the welfare of dependent species.

Sagegrouse strutting grounds and nesting areas constitute the breeding complex where courtship and the production and care of young occur. Destruction or disturbance to such areas results in general population reduction and the possible elimination of localized populations.

Critical deer winter range is considered of vital importance to herd maintenance. This relatively small amount of habitat must support a major portion of the herd during inclement weather. Degradation of this habitat will result in a population decline thus reducing deer use on the entire range.

Antelope kidding grounds are areas consistently used for kidding and rearing young antelope. Destruction of these areas could cause their abandonment and result in a population decline.

Waterfowl production areas are used for breeding, nesting, brooding and molting. Disturbance to such areas would result in reduced production of young.

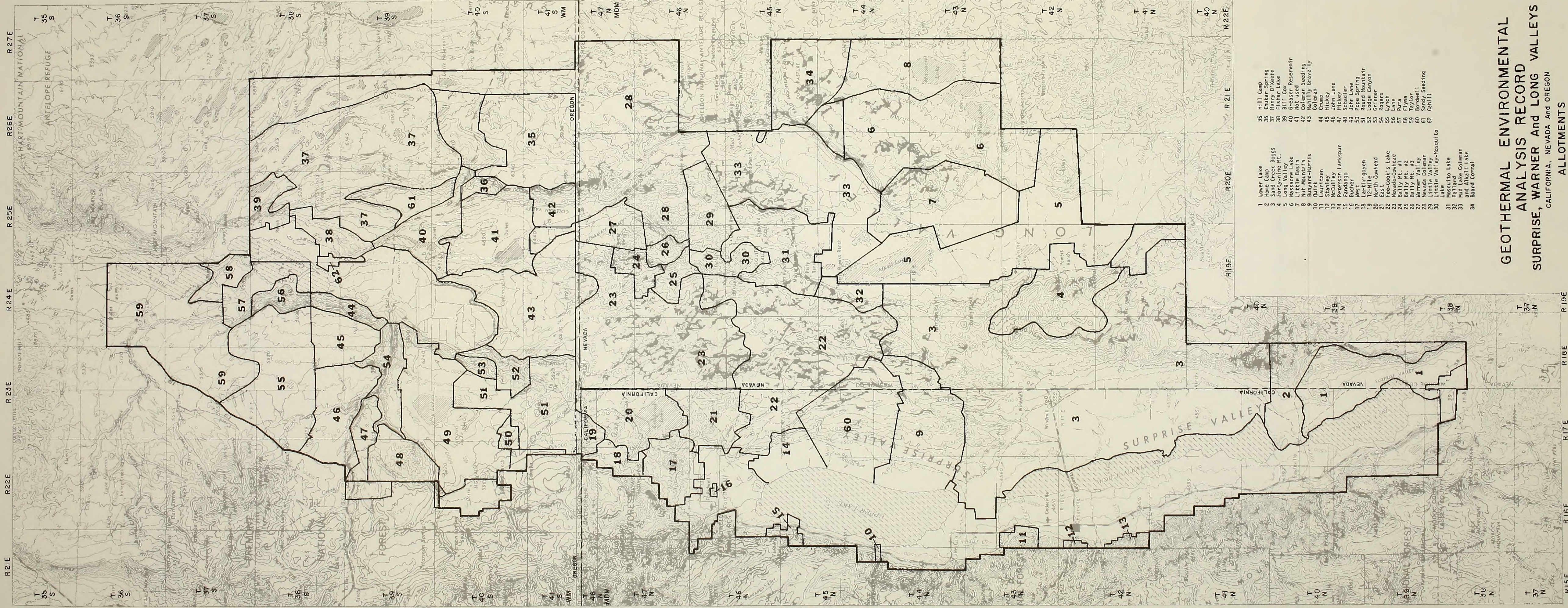
Raptor eyries are the nests of birds of prey. Severe declines in raptor populations dictates stringent requirements are necessary to protect existing populations. Protection of nesting sites is essential to allow maximum recruitment.

DOMESTIC LIVESTOCK

There is licensed cattle and horse use within the proposed geothermal lease area to the extent of about 65,481 animal unit months (AUMs) on 65 allotments. The livestock grazing is authorized during spring, summer, and fall on most of the area. There is occasional winter use on one small allotment in Oregon. Tables 16 through 20 show allotments by Planning Units, acres by ownership, seasons of use, and AUMs by classes of livestock. (Also see Map 7)

WILD AND FREE ROAMING HORSES

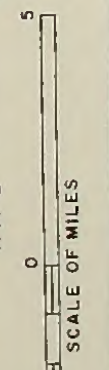
Two Herd Management Areas exist within the area: (see Map 8) the Catnip Mountain Habitat Management Area shown as Area A, and the New Years Lake Habitat Management Area shown as Area B. Both of these areas provide year-round habitat with seasonal fluctuations within the areas. The number of animals to be maintained on a long-term basis has not been established, and it is believed that no great impact would be encountered on a long term basis in providing satisfactory habitat for this population when established. No burros exist in the area at this time and only 150 to 200 horses are present, with the major area of use being Herd Management Area A.



- | | |
|-------------------------------------|----------------------|
| 1 Lower Lake | 35 Hill Camp |
| 2 Home Camp | 36 Chukar Spring |
| 3 Sand Creek Boggs | 37 Henry O'Keefe |
| 4 Long Valley | 38 Fishers Lake |
| 5 Surprise Valley | 39 Greaser Reservoir |
| 6 Nut Mountain | 40 Not used |
| 7 Nut Mountain | 41 Not used |
| 8 Nut Mountain | 42 Coleman Seeding |
| 9 Nut Mountain | 43 Rahlly Gravelly |
| 10 Quirk | 44 Coleman |
| 11 Luritzen | 45 Crump |
| 12 Stanley | 46 Hickey |
| 13 McCutley | 47 John Lane |
| 14 Peterson Larkspur | 48 Hickey |
| 15 Fandango | 49 Schradler |
| 16 Bucher | 50 John Lane |
| 17 West | 51 Pope Spring |
| 18 Lantirigoyen | 52 Round Mountain |
| 19 12-Mile | 53 Frigid Canyon |
| 20 North Cowhead | 54 Rogers |
| 21 Egan | 55 Lynch |
| 22 Egan-Cook's Lake | 56 Lane |
| 23 Nevada-Cowhead | 57 Pura |
| 24 Bally Mt. #1 | 58 Flynn |
| 25 Bally Mt. #2 | 59 Taylor |
| 26 Bally Mt. #3 | 60 Bordwell |
| 27 Warner Valley | 61 Sandy Seeding |
| 28 Nevada Coleman | |
| 29 Little Valley | |
| 30 Little Valley-Mosquito Lake | |
| 31 Mosquito Lake | |
| 32 Ballard | |
| 33 Mud Lake Coleman and Atrial Lake | |
| 34 Board Corral | |

**GEOHERMAL ENVIRONMENTAL
ANALYSIS RECORD
SURPRISE, WARNER AND LONG VALLEYS**
CALIFORNIA, NEVADA AND OREGON

ALLOTMENTS
MAP 7





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Table 16

NORTH WARNER UNIT
ALLOTMENTS

Allotment	Number of Operators	Number of Acres		AUM's Use or Qualifications	Season of Use	Class of Livestock	AUM's Production
		Federal approx.	State Private approx.				
Flynn	1	1,280	3,000	--	Spr-F	C&H	25
Lane	1	1,930	1,320	--	Spr-S-F	C&H	65
Lynch	1	14,710	5,500	--	5/1-7/15	C	1,255
Pura	1	940	2,410	--	W or S	C	30
Taylor	1	9,890	8,750	--	4/15 - 9/15	C	332
TOTALS		28,750	20,980				1,707

SOUTH WARNER UNIT
ALLOTMENTS

Table 17
Page 1 of 2

Allotment	Number of Operators	Number of Acres			AUM's Use or Qualifications	Season of Use	Class of Livestock	AUM's Production
		Federal	State	Private				
Hill Camp & Greaser Basin	2	25,385	120	2,395	4300	Spr-S-F	C	4300
Coleman Seeding	1or2	2,280	---	480	500	Spr	C	500
Sandy Seeding	1or2	4,210	---	---	430	Spr	C	430
O'Keefe Indv.	1	50,330	---	2,660	6140	Spr-S-W	C	6140
Cox Indv. *	1	4,518	---	74	215	Spr-S	C	372
Fisher Lake *	2	3,380	243	301	500	W	C	500
Federal Range Fenced	7	3,453	---	---	531	All	C&H	531
Hickey *	1	10,561	705	40	1094	Spr-S	C	565
Rogers Indv. *	1	6,210	540	--	525	Spr-S	C&H	425

Table 17 - South Warner Unit Allotments
Page 2 of 2

Allotment	Number of Operators	Number of Acres			AUM's Use or Qualifications	Season of Use	Class of Livestock	AUM's Production
		Federal	State	Private				
John Lane * Plan II	1	9,909	235	3,136	1039	Spr	C	637
John Lane * Plan I	1	24,101	625	1,370	2069	Spr-S	C	2046
Schadler Indv.	1	3,823	220	2,242	670	S	C	507
Round Mtn.*	3	15,770	560	1,720	1170	Spr	C	1170
Blue Creek	1	320	---	-----	----	Spr-F	C	100
Griener *	1	2,679	---	660	136	Spr-S	C&H	91
Chukar Spr.*	1	1,765	---	---	---	Spr	---	120
Crump Indv.	1	2,889	41	475	217	~Spr	C&H	111
Rahilly Gravelly	2	23,982	47	1,993	2046	Spr	C	1722
Fee Indv.	1	955	--	284	282	S	C	214
TOTALS		196,520	3,336	17,830				20481(1)

(1) Of this total, 18,900 AUMs on Public Land.

Table 18

HOME CAMP PLANNING UNIT
ALLOTMENTS

Allotment	Number of Operators	Number of Acres			AUM's Use or Quali-fica-tions	Season of Use	Class of Live-stock	AUM's Produc-tion
		Federal	State	Private				
Bicondoa	1	10,845	640	30	379	12/1-1/31	S	368
Home Camp	4	9,160	---	--	---	4/16-9/15	C	445
Lower Lake	1	19,841	---	642	937	4/1-10/30	C	690
TOTALS		39,846	640	672				1503

Table 19 - Cowhead Planning Unit Allotments
Page 2 of 3

Allotment	No. of Oprs.	Number of Acres		AUMs Use or Qualifications	Season of Use	Class of Livestock	AUMs Production	Water Used 300 Gal/AUM
		Federal	State Private					
Lartirigoyen	1	988	2,376	364	S-F	Sheep	83	24,900
Little Valley	1	5,865	80	670	Spr-S	Cattle	436	130,800
Massacre Lake Indv. (Watson)	1	6,105		715	Spr-S-F	Cattle	572	171,600
Mosquito Lake	1	10,983	90	2,011	Spr-S-F	Cattle	2,011	603,300
Little Valley - Mosquito Lake	1	2,918	220	708	Spr-S-F	Cattle	270	81,000
Mud Lake-Coleman Alkali Lake (2)	1	41,677	340	(1,730) () (1,534)	Spr-S-F	Cattle Horses Cattle	(1,315) (70) (788)	393,900 21,000 233,400
Nevada-Coleman Nevada-Coleman	3	55,701	2,275	5,278 (1) 375	Spr-S-F	Cattle	4,504	1,351,200
Nevada-Cowhead	2	38,460	3,071	5,200	Spr-S-F	Cattle	2,880	864,000
North Cowhead	2	4,576	8,134	743	Spr	Cattle	453	135,900
Twelve-Mile	1	485	1,406	200	S-F	Cattle	132	39,600
(1) Class 2 privileges			(2) Not fenced. Separate & intended fenceline location not known. Treated as one allotment.					

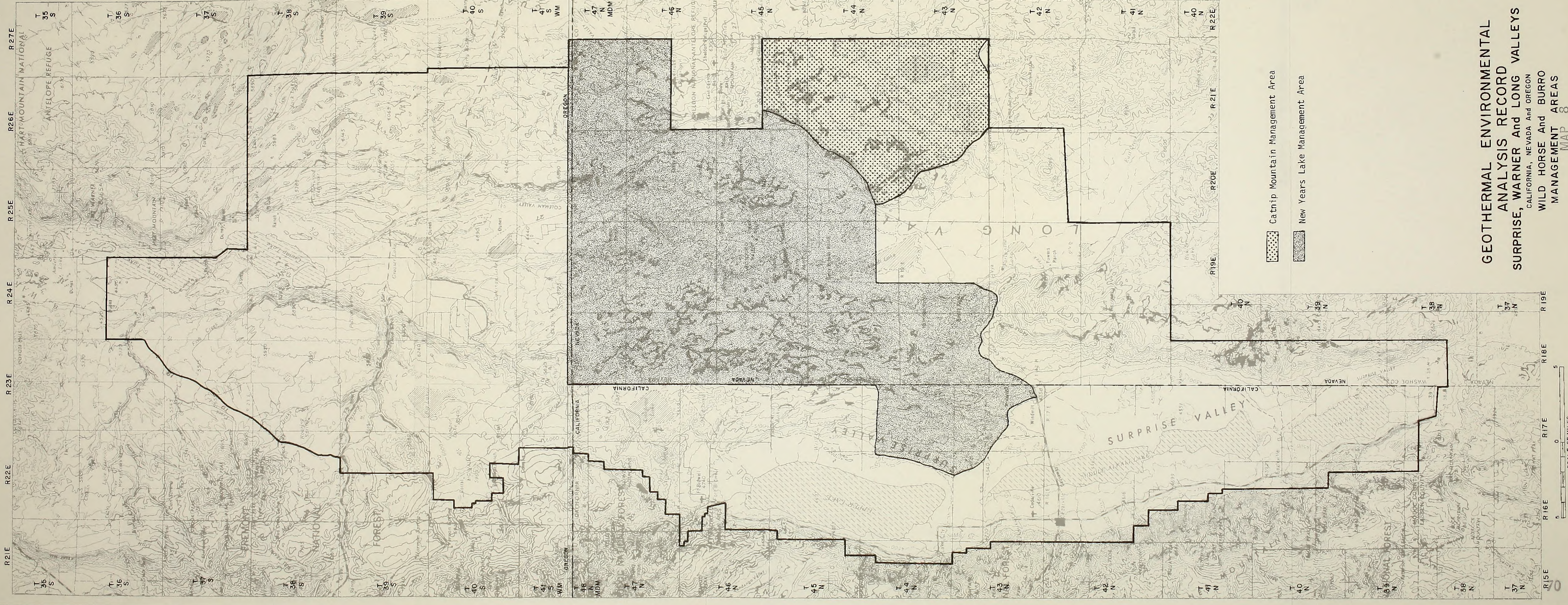
Table 19 - Cowhead Planning Unit Allotments
Page 3 of 3



Allotment	No. of Oprs.	Number of Acres		AUMs Use or Qualifications	Season of Use	Class of Livestock	AUMs Production	Water Used 300 Gal/AUM
		Federal	State . Private					
West Warner Valley Isolated Tracts	1	1,930	5,597	594	Spr	Cattle	161	48,300
	1	3,098	600	320	Spr-S	Cattle	320	96,000
		320			No licenses issued			
TOTALS		256,650	55,301	30,304			20,343	6,102,900
(1) Class 2 privileges								
(2) Not fenced. Separate & intended fenceline location not known. Treated as one allotment.								

Table 20

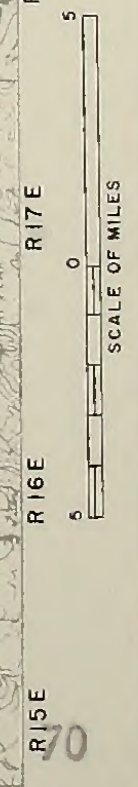
MASSACRE PLANNING UNIT
ALLOTMENTS

Allotment	No. of Oprs.	Number of Acres		AUMs Use or Qualifications	Season of Use	Class of Livestock	AUMs Production	Water Used 300 Gal/AUM
		Federal	State Private					
Ballard Indv.	1	2903	930	371	Spr-S-F	Cattle	371	111,300
Bunyard-Harris	2	18734	1140	1525	Spr-S-F	Cattle	1483	431,400
Bunyard Indv.	1				Spr-S-F	Cattle	42	12,600
Forty-Nine Mtn.	1	13950	5045	512	S-F	Cattle	512	153,600
Hill Indv.	1	40		10	Spr-S-F	Cattle	10	3,000
Lauritzen Indv.	1	1040		60	Spr-S	Cattle	60	1,800
Little Basin	1	28776	10	2322	Spr-S-F	Cattle	1857	557,100
Long Valley	9	27498	7090		Spr-S-F	Cattle	1380	414,000
Massacre Lake	2	36900	80		Spr-S-F	Cattle	2460	738,000
(AMP)			382					
Massacre Mtn.	2	3880	800		Spr-S-F	Cattle	47	14,100
McCulley	1	1320		28	Spr	Cattle	28	8,400
Nut Mtn.	3	9940	2615		Spr-S-F	Cattle	7970	239,100
Sand Cr.-Boggs	10	129892	17385	6816	Spr-S-F	Cattle	5310	1,593,000
Stanley Indv.	1	440		30	Spr	Cattle	30	9,000
Quirk Indv.	1	120	640	18	Spr-S-F	Horses	18	5,400
Isolated Tracts				No licenses issued				
TOTALS		275400	1520 38273				21578	4,279,200



-  Catnip Mountain Management Area
-  New Years Lake Management Area

**GEOHERMAL ENVIRONMENTAL
 ANALYSIS RECORD
 SURPRISE, WARNER AND LONG VALLEYS**
 CALIFORNIA, NEVADA AND OREGON
 WILD HORSE AND BURRO
 MANAGEMENT AREAS
 MAP 8





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ECOLOGICAL INTERRELATIONSHIPS

PLANT SUCCESSION

The vegetative sites within the geothermal study area can be broadly classified by topographic position as:

- (1) dry basins, (2) irrigated basins, (3) plateaus,
- (4) foothills, and (5) mountains

(see Table 15).

The principal vegetative types, their composition and the area occupied by each area are shown on Table 21 - Vegetation, Present Situation and Projected Climax.

The sagebrush type is the largest type and is well adapted to a broad range of sites. The low sagebrush (Artemisia arbuscula) occurs generally on the shallow, stony sites of the well-drained upland plateaus. Sandberg bluegrass (Poa secunda) and a great variety of annual forbs are principal understory plant associates at the lower seral stages of succession. Such perennial grasses as squirreltail (Sitanion hystrix), needlegrass (Stipa thurberiana), Idaho fescue (Festuca idahoensis), and bluebunch wheatgrass (Agropyron spicatum) are present in significant quantities at a higher stage in the plant succession. Such perennial forbs as hog fennel (Lomatium spp.), bighead clover (Trifolium macrocephalum), beard-tongue (Penstemon spp.), pussytoes (Antennaria spp.), and fleabane (Erigeron spp.) are more abundant at the higher successional stages than the annual forbs.

The big sagebrush subtype is best adapted to the deeper, well-drained upland soils. Rabbitbrush (Chrysothamnus spp.), bitterbrush (Purshia spp.), horsebrush (Tetradymia spp.), and snowberry (Symphoricarpus spp.) are the principal shrub associates. The annual cheatgrass (Bromus tectorum) is one of the principal understory plants in deteriorated stands at a low seral stage. Thurber needlegrass (Stipa thurberiana) and squirrel-tail often are the most persistent perennial grasses on areas that have been subjected to heavy grazing over a long period of time. Annual forbs of low forage value are a characteristic of a low seral stage. Perennial grasses such as bluebunch wheatgrass, Idaho fescue, and Thurber needlegrass are characteristic of the higher seral stages. Perennial forbs such as lupine (Lupinus spp.), mules ears (Wyethia mollis) arrowleaf balsamroot (Balsamorhiza sagitata), and butterweed are characteristic of the higher seral stages.

The western juniper (Juniperous occidentalis) type now extends over a very substantial part of the well-drained, shallow, rocky upland soils. It is generally limited to areas with 12 inches or more average annual

precipitation. The older juniper trees are generally found on rocky ridges with relatively deep soil between the rocks. Heavy grazing over a prolonged period of time, periods of drought, and suppression of natural fires have greatly extended the area covered by juniper. The principal understory plants are those associated with the low sagebrush type on the better sites.

The perennial grass type is comprised principally of (1) bluebunch wheatgrass on the well-drained uplands that are steep or rocky and quite inaccessible to livestock, (2) range seedings of desert wheatgrass (Agropyron desertorum) and other wheatgrass species, and (3) sagebrush spray areas with mixed stands of perennial grasses - Idaho fescue, needlegrass, and squirreltail. Annual cheatgrass and annual forbs are generally associated with this type. Sagebrush and rabbitbrush generally germinate from seeds or many plants survive the brush spraying with herbicides.

The annual grass type is comprised primarily of cheatgrass and annual forbs. This type occurs on areas where fires have burned over the same ground frequently and where livestock were allowed access to the area after each fire. Sagebrush plants and other shrubs were destroyed by the fire; some perennial grass species do not withstand fire and all perennial grasses were heavily grazed following the fires. This type generally occurs on the well-drained upland plateaus. There is about the same potential with respect to plant species and ground cover as there is for the sagebrush type, or perennial grass type.

The mountain shrub type is found on well-drained, deeper upland soils and on the mountain peaks and ridges. Bitterbrush (Purshia tridentata and P. glandulosa) are the principal dominant shrubs on the well-drained plateaus but big sagebrush, rabbitbrush, snowberry, squawapple, and currant (Ribes spp.) are shrub associates within this type. Thurber needlegrass, Idaho fescue, bluebunch wheatgrass, squirreltail, Sandberg bluegrass, and cheatgrass are the most common grasses associated with this type. The annual cheatgrass is the predominant grass in the lower seral stages and conversely Idaho fescue and bluebunch grass are most common as conditions approach climax. The forbs are those common in the big sagebrush type.

The greasewood (Sarcobatus vermiculatus) type is quite extensive. It occurs primarily in the dry basins on moderately deep, alkali soils. Rubber rabbitbrush (Chrysothamnus nauseosus), spiny hopsage (Grayia spinosa), big sagebrush, horsebrush (Tetradymia spp.), and shadscale (Atriplex confertifolia) are the principal associated shrubs. Squirreltail is the principal grass at a low seral stage. Great Basin wildrye (Elymus cinereus), needlegrass, and salt grass (Distichlis stricta) are the principal grasses in areas that approach climax condition. Pepperweed (Lepidium perfoliatum) and tansy mustard (Descurainia pinnata) are the most abundant annual forbs on degraded sites at a low seral stage.

The saltbush type is best characterized by an abundance of shadscale, but spiny hopsage and budsage (Artemisia spinescens) are also relatively abundant in this type. The type is generally found on the saline soils of the lower outwash plains and adjacent to the greasewood type. Thurber needlegrass, squirreltail, and Indian ricegrass (Oryzopsis hymenoides) are the grasses most characteristic of this type. A sparse understory of annual forbs and grasses are indicative of prolonged heavy grazing, especially during the early spring months and are characteristic of a low seral stage. Perennial grasses and good ground cover (35% to 40%) are characteristic of a good range condition.

Good meadow grasses and forbs are found on semi-wet areas and irrigated basins or along drainage courses and on moderately deep to deep, non-saline, non-alkaline soils. Nevada bluegrass (Poa nevadensis), hairgrass (Deschampsia caespitosa), creeping wildrye (Elymus triticoides), sedges (Carex spp.), and clovers (Trifolium spp.) are the principal species in areas in excellent condition. Many of these meadow and drainage course areas have been heavily grazed and in many instances have undergone severe gully erosion. Rushes (Juncus spp.), low quality sedges and such grasses as foxtail (Hordeum spp.), and rabbits foot (Polypogon monspeliensis) and annual weedy forbs dominate these degraded sites.

FOOD AND COMMUNITY RELATIONSHIPS

Within the broad area involved there are numerous food relationships between plants and animals and among animals themselves. All are dependent upon the production of food materials by green plants. The existing vegetation and associated climate dictates what animal species will inhabit an area.

Following are examples of some of the relationships that exist within the area:

Predatory mammals and birds such as coyotes, bobcats, badgers, skunks, golden eagles, hawks, and owls prey upon rodents. Rodent populations are somewhat cyclic and governed to a large extent by production of plant materials (green forage and seeds) for food. Food production is related to the climatic range conditions for a given area in a given year. During periods of low rodent populations predators will shift more to other prey species that are available (birds, deer, antelope, sheep, calves, etc.).

Mule deer and antelope are dependent upon a variety of plant species to provide year-long forage. Forage preference and availability change with the season. A forage deficiency on a particular seasonal

range (spring, fall, summer, or winter) will limit the population even though surplus forage is available on a different seasonal use area.

Meadow areas are an important segment in the life cycle of the sage-grouse. The young chicks are unable to utilize sagebrush to any extent until they are 10-12 weeks old. The wet meadows provide insects and forbs for young broods during the summer and early fall, at which time they are able to adjust to a sagebrush diet.

In the eastern portion of the area, animal distribution during the summer and fall is closely related to the availability of water. It is an essential habitat component for most species. Most of the available water is derived from springs, reservoirs, and stock wells. The addition or loss of water in these areas would have a significant impact upon the existing animal life.

Waterfowl production is dependent upon the maintenance of quality habitat. This includes production of aquatic plants for food and cover and maintenance of water levels in lakes and marshes of Warner and Surprise Valley. A change in these components will be reflected in waterfowl production.

Table 21 - VEGETATION
PRESENT SITUATION & PROJECTED CLIMAX

Major Vegetative Type	Present Situation			Climax (Projected)		
	Z Ground Cover	Percent Composition by Vegetation Classes		Z Ground Cover	Percent Composition by Vegetation Classes	
		Z	Vegetation Classes		Z	Vegetation Classes
Juniper (Western)	28	3	Western Juniper	35-45	1	Western Juniper
		33	Grass		45	Grass
		18	Forbs		25	Perennial Forbs
Perennial Grass	38	46	Sagebrush & Other Shrubs	45-50	29	Sagebrush & Other Shrubs
		70	Perennial Grass		75	Perennial Grass
		10	Annual Grass		5	Annual Grass
Annual Grass	30	5	Forbs	40-50	2	Forbs
		15	Sagebrush & Rabbitbrush		18	Sagebrush & Other Shrubs
		75	Annual Grass		75	Perennial Grass
Sagebrush	28	25	Annual Forbs	35-50	5	Annual Grass
		50-55	Sagebrush & Other Shrubs		15	Sagebrush & Other Shrubs
		20-25	Perennial Grasses		20-30	Sagebrush & Other Shrubs
Mountain Shrub	33	25	Forbs	45-55	60-70	Perennial Grasses
		60	Mc. Mahogany, Bitterbrush & Others		10	Perennial Forbs
		10	Forbs		60	Mc. Mahogany, Bitterbrush & Others
Greasewood	19	30	Grass	40-50	5	Perennial Forbs
		50	Greasewood & Other Shrubs		35	Perennial Grass
		45	Forbs		50	Greasewood & Other Shrubs
Saltbush	30	5	Grass	35-40	5	Forbs
		60	Shadscale & Other Shrubs		45	Perennial Grass
		28	Grass		60	Shadscale & Other Shrubs
Meadows	50-60	12	Forbs	80-90	5	Perennial Forbs
		30-35	Perennial Grass		45-50	Perennial Grass
		60-70	Sedges & Rushes		45	Sedges & Rushes
		1-5	Forbs		5-10	Perennial Forbs

HUMAN VALUES

AESTHETICS

The irrigated basins are characterized by fields of alfalfa and native hay intermingled with pastures containing cattle and horses. Cultural features such as homesteads with tall poplar windbreaks, barns, fences, and irrigation equipment accent these fields. This land type also contains the population centers of picturesque Lake City and historic Fort Bidwell. Overall the basins convey a pleasant rural atmosphere.

Expansive sage flats offer little variation in the view across the dry basins. Several alkali lakes are hardly noticeable from the roads on the basin floors. From vantage points at the edges of these basins, the lakes appear as white barren flats. Roads are very prominent from these vantage points.

From all points within and around the dry basins, the eye is attracted to prominent landmarks such as Painted Point, Lynchs Pim, Coleman Rim, or 49 Mountain. A powerline crossing Long Valley also attracts the eye. The steel towers and cables are especially noticeable in full sunlight when they reflect the light. Several small ranches are found on the edges of these basins, their green windbreaks contrasting with the flat neutral color of the sagebrush.

The foothills form the transition from the pine forested Warner Mountains into the cold desert biome to the east. This land type is characterized by diminishing pine trees graduating into western juniper and sagebrush. The steep slopes are marked by deeply eroded rock canyons and irregular talus slopes which tend to tie the landscape together. The Warner Mountains provide a scenic background to this landscape. Man-made improvements are not highly visible and are not distracting to the casual viewer.

Rolling sage hills in the plateaus above the basin areas create an undulating landscape character with little color variation. Texture is provided by sagebrush and some smaller basaltic escarpments. The rolling character is sometimes broken by numerous drainage channels and small juniper forests. The low profile created by the sagebrush accentuates occasional high-rise windmills and transmission line towers. The towers, as well as roads and fencelines, that cut across the expanses are generally visible from great distances.

The mountains form the background for all the other units and serve as landmarks for orientation. The high points also serve as vista points for the area. 49 Mountain has large sagebrush flats which provide long views. Rimrocks which often separate elevational levels

are highlighted by aspen groves at the cliff bases. This provides scenic contrast to sage-juniper types and accents the scenic quality of these physiographic units.

EDUCATIONAL/SCIENTIFIC RESOURCES

The area covered by this analysis contains several phenomena which merit more than casual interest. These include hot springs and petrified wood (geologic), hot springs biota and waterfowl habitat (ecologic), Indian artifacts and occupation sites (archeologic), Oregon Central Military Road and the Lassen-Applegate Trail (historic).

The occurrence of hot springs is common in the west and indicates groundwater coming into contact with an underground heat source. To geologists a hot spring provides certain clues to the subterranean features of the area. These clues plus terrain features give a geologist information about potential for geothermal power sources. Hot springs are usually associated with fault zones, also providing clues to the possibility of natural catastrophic events, such as earthquakes.

Even though earthquakes are common, the biotic community influenced by the hot springs may be uncommon, if not unique. This is particularly true of the micro-flora and micro-fauna. Hot springs, such as Cox Hot Springs, Hill's Warm Springs, Ben Mal Hot Springs, and the spring seven miles northeast of Cedarville, all on Federal lands, should be analyzed for micro-flora and fauna. Unusual micro-organisms specially adapted to the environmental conditions of a particular hot spring have been used in scientific research. Because each hot spring may have different amounts of minerals in the water, the micro-organisms, at least regionally, may prove to be significantly different scientifically. It is doubtful that the macro-flora and macro-fauna of the area's hot springs are significantly unique or rare.

In addition, cold springs, such as the Blue Spring are in Long Valley, may contain unusual micro-flora and fauna, especially adapted to sensitive environmental conditions.

One significant petrified wood deposit is known to exist in the pass area through the 49 Mountain Range, where three petrified redwood stumps, estimated to be 18 million years old, have been signed and protected by cages. The potential exists for the discovery of additional stumps in the area.

The section of the Warner Valley, particularly the Pelican Lake area, within the area of analysis had uncommon waterfowl. Pelican Lake has one of the few white pelican rookeries in Oregon and is therefore of critical ecological value. In the past, this rookery has been the subject of study for a graduate degree and has the potential for further research.

The area under consideration has many locations of archaeological interest (see Map 7). For discussion purposes the area will be divided into four sections. Each section represents an area of sensitivity and in most cases an area of a particular type of archaeological resource. Area IV in particular may be one of the richest resources of its kind in the Western United States.

The Northwestern Great Basin was inhabited aboriginally by as many as three linguistically separate peoples over a span of some 5,000 years or more. Reconstruction of their lifeways reveals a basic hunting and gathering economy centered around springs, shallow lake marshes, and large game migration trails.

Archaeological site types include dunes, caves, rock shelter, petroglyphs, spring areas, and lakesides. Site areas generally exhibit a ground surface concentration of lithic debitage and in many cases grinding implement remains. Most lakeside dune sites in the Oregon area also contain small shell fragments. Pottery is not found in the Northwestern Great Basin.

Areas of known or suspected aboriginal occupation on public lands were inspected and recorded according to the required features of BLM site survey forms. Diagnostic artifacts were collected at sites when available to aid in significance determinations.

Area I

All Area I sites are in Surprise Valley, California. As noted earlier, the western side of the valley is in sharp contrast to the eastern side which is largely a sparsely vegetated alkali flat. The majority of the aboriginal activity in the area probably took place on the relatively well-watered western side which is now almost completely privately owned.

The sites found in Area I are primarily spring-associated dune occupation sites which, judging from the projectile point types recovered on the surface, have been used over a considerable span of time.

Winter campsites in the area could have been used over a longer seasonal period of time than other sites which are further to the north and more isolated. Occupation areas may contain concentrated stratified debris. The possibility of fossilized animal remains associated with human occupation exists.

Excavation and additional study is needed to determine whether values are great enough to warrant nomination to the National Register of Historic Places. Two sites have been excavated on private land in Surprise Valley by teams from the University of California, yielding archaeological evidence dating to approximately 800 B.C. and 3500 B.P.

Area II

The Massacre Lake area was first investigated by Dr. Robert Heizer of the University of California beginning in the late 1930s. The area was found to be rich in archaeological resources which included caves, petroglyphs, and obsidian quarries. Amateur collectors have long known about the Massacre Lake area, but the major sites are remote and relatively undisturbed. The importance of the Massacre Lake site appears to be that although the artifact assemblages found in the caves resemble closely those found in other Great Basin sites, they also have affinities to types found in the more northerly intermountain plateau area.

The Massacre Lakes area as a whole must be considered as an Archaeological District. Chipping debris cover almost the entire area. Obsidian occurs naturally in the area and may be found in large chunks several miles to the south.

Area II meets the requirements for nomination to the National Register of Historic Places as the Massacre Archaeological District.

Area III

Investigations for this area are incomplete but, based on the factors listed below, it appears to be rich in archaeological values:

- (1) Disclosure of reports by informants of numerous sites in the area.
- (2) The area surrounding Massacre Valley is rich in archaeological values which appear to continue into this area. Petroglyph style elements found north extend into northern Nevada. Petroglyph style elements found north of Massacre Lake resemble those found in Oregon. Petroglyphs in this region are found associated with antelope migration trails and Area III is bordered on the east by the Sheldon National Antelope Refuge (antelope trails from which continue into Area III).

Area IV

Twenty-four separate petroglyph sites have been counted in Area IV and more are being discovered all the time. The area as a whole is being considered for nomination to the National Register of Historic Places by the Lakeview District Office.

Looting and vandalism have occurred in several locations throughout all these areas. Rejects of diggers (broken grinding implements and chips) cover the ground, and petroglyphs have been defaced, some as recently as August, 1974.

The purpose of this study was to determine the effect of the treatment on the concentration of the active ingredient in the plasma. The study was conducted in a double-blind, randomized, controlled trial. The subjects were healthy volunteers who were screened for safety and efficacy. The study was conducted in a clinical setting. The results of the study are presented in the following table.

The results of the study show that the treatment significantly increased the concentration of the active ingredient in the plasma. The increase was observed in both the treated and control groups. The increase was statistically significant (p < 0.05). The results of the study are presented in the following table.

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- (i) Disposition of active ingredient in plasma
- (ii) Disposition of active ingredient in plasma
- (iii) Disposition of active ingredient in plasma
- (iv) Disposition of active ingredient in plasma
- (v) Disposition of active ingredient in plasma

The results of the study show that the treatment significantly increased the concentration of the active ingredient in the plasma. The increase was observed in both the treated and control groups. The increase was statistically significant (p < 0.05). The results of the study are presented in the following table.

The Llanos-Apaches Trail and the Oregon Country Highway lead the
way to the site of the petroglyphs. The Llanos-Apaches Trail was used by
early pioneers coming to the gold fields in California and to
new settlements in western Oregon during the 1840s. The site itself
has been returned and protected at various places by the State.

The area
part of
trail,
The road
partially
covered



and
1843
1845

In
next
last
at yet

The
one

PETROGLYPHS
Rock art near Adel, Oregon

Adel	1843
Adelville	1843
Adelville	1843
Adelville	1843
Adelville	1843
Adelville	1843
Adelville	1843

The population for the year is reported to have been about 100,000 in
1840, or approximately 1/3 of the population of the United States
which California and Oregon.

The history of this area is naturally very old and somewhat uncertain
depending on the various sources and reports which have been
made of it. It is believed that the first people who came to
the region were the Indians, and that they were the same as those
found in the other parts of the State. It is also believed that the
first white settlers came to the area in the early part of the
19th century, and that they were the same as those who came to
the other parts of the State.



UNRECORDED
NOV 22 1964

The Lassen-Applegate Trail and the Oregon Central Military Road traverse the area of analysis. The Lassen-Applegate Trail was used by early pioneers travelling to the gold fields in California and to new settlements in western Oregon during the 1840s. The old trail has been retraced and marked at various places by Trails West, Inc.

The Oregon Central Military Road was surveyed in 1867 for the purpose of establishing a road between Eugene, Oregon and Ruby City, Idaho. It was used mostly by troops from Fort Warner until 1873. The road is being located and considered for inclusion in the National Register of Historic Places by the Lake County Bicentennial Committee.

John C. Fremont passed through a portion of the area in the winter of 1843 during his expedition to cross the Sierra Nevada Range into California.

In numerous instances throughout the West, remnants of similar trails have been discovered and authenticated. Suspected trail ruts have been found along the routes of the above trails, although none have as yet been authenticated.

SOCIAL WELFARE

The area under analysis has several small towns with Cedarville being the only one that is incorporated. All of the towns represent a rural population, each of which is listed below:

Cedarville	640
Eagleville	250
Fort Bidwell	330
Lake City	105
Adel	43*
Plush	54*

*Registered voters

The population for the area is expected to grow only slightly by 1980, at approximately 1/3 of the rate expected for other areas within California and Oregon.

The economy of this area is narrowly based and somewhat depressed depending entirely on agriculture and lumber milling with products such as livestock, hay, rough lumber, and some grain being shipped to markets outside. The income per capita for the area is below both State and National averages. It is important to note that any change in this narrowly based economy will have significant effects on it.

The Lumber-Products Trade and the Oregon Lumber Industry have been
very low since the analysis. The Lumber-Products Trade was made by
early business traveling to the gold fields in California and the
two settlements in western Oregon during the 1850s. The old trade
has been renewed and raised at various times by the fact that

The Oregon Lumber Industry has been successful in that for the past
years of maintaining a good business volume. Oregon and Idaho have
lumber. It has good energy in Oregon and Idaho and is still
the most reliable and consistent for business in the
National Lumber Association of the Lumber Industry.

From 1850 to 1860 the industry was in the state of
1850 during the early years of the Oregon Lumber Industry. It was
lumber.

In Oregon the industry was in the state of
have been successful and consistent. Oregon and Idaho have
been there since the fact of the Oregon Lumber Industry. It was
as yet been successful.

GENERAL STATE

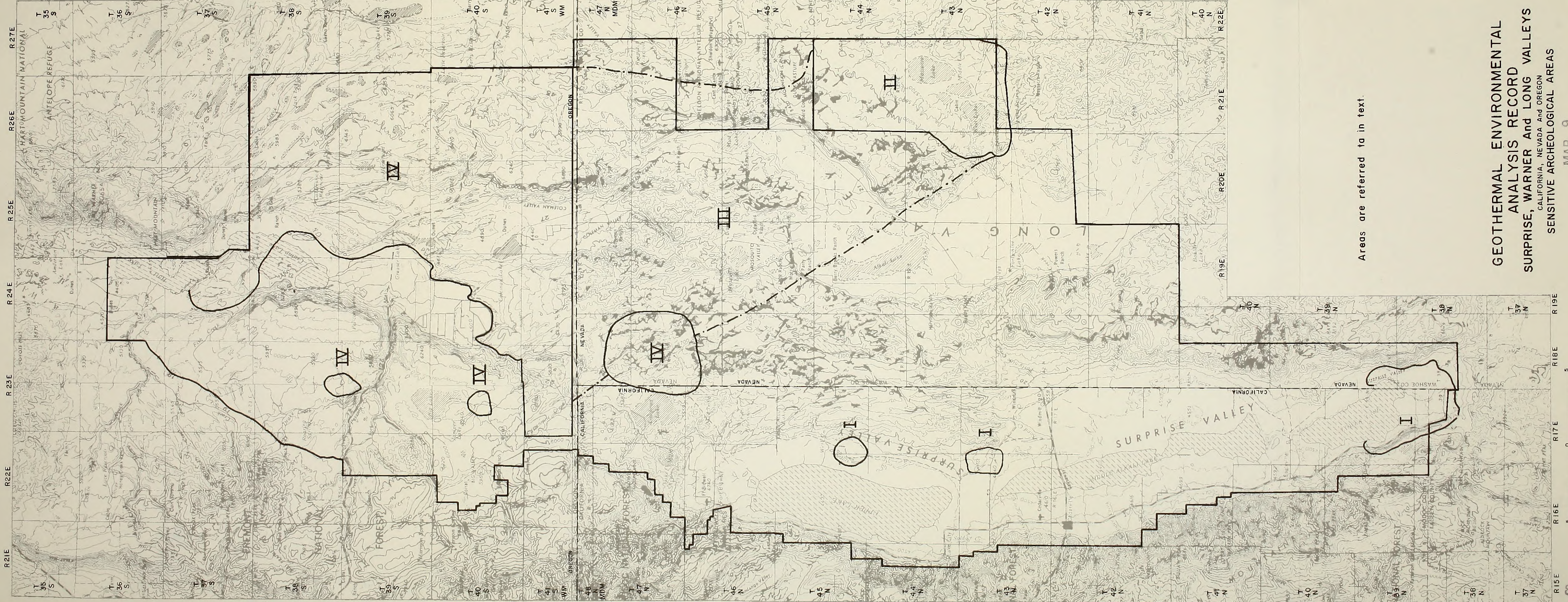
The state of Oregon has a large population and a large
the only one that is important. All of the trees reported
total population each of them is about 100,000.

1850	1860
1870	1880
1890	1900
1910	1920
1930	1940
1950	1960

Population

The population for the state is expected to grow with slightly
1960, at approximately 1/2 of the rate reported for other states
which California and Oregon.

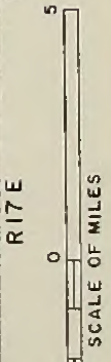
The economy of this state is currently based on business interests
dependent entirely on agriculture and timber raising with products
such as livestock, wool, grain, lumber, and some other forest products
to various markets. The timber products for the state are
both state and national markets. It is expected to grow with
change in this market. Based on the fact that the state
on 10.



Areas are referred to in text.

**GEOHERMAL ENVIRONMENTAL
ANALYSIS RECORD
SURPRISE, WARNER AND LONG VALLEYS**
CALIFORNIA, NEVADA AND OREGON
SENSITIVE ARCHEOLOGICAL AREAS

MAP 9

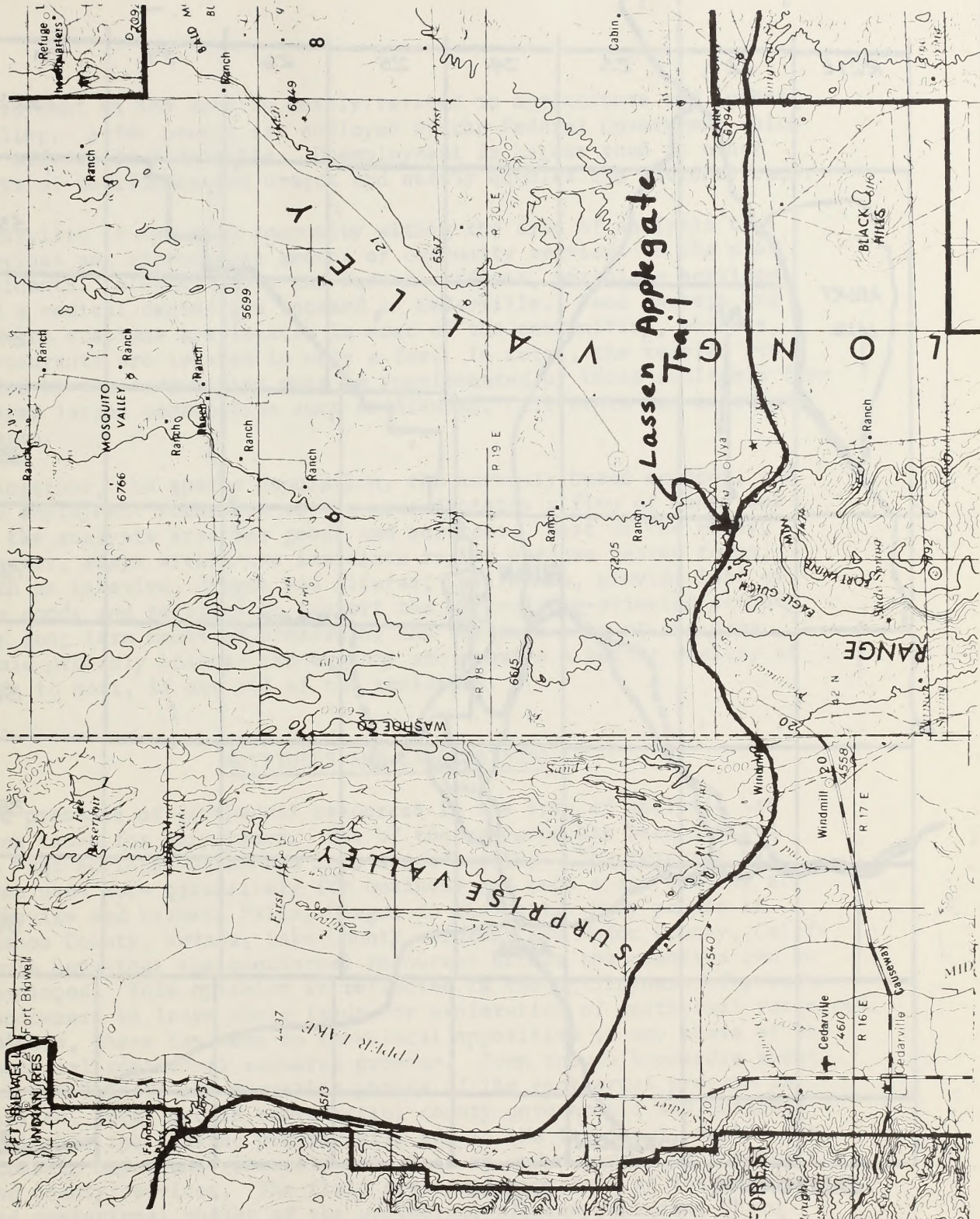




8510 8520 8530 8540 8550 8560 8570 8580 8590 8600

Vertical distance



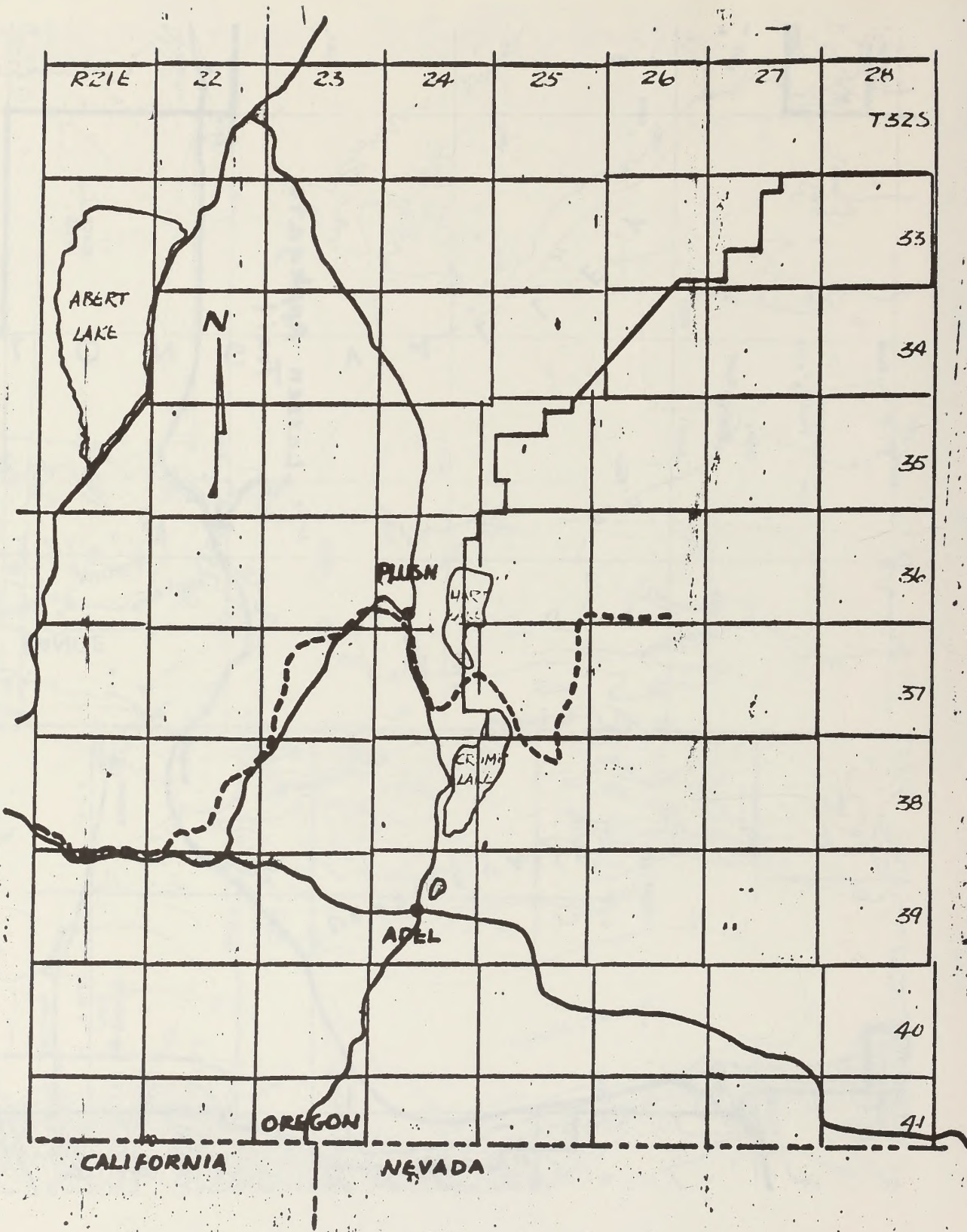


GEOLOGICAL ENVIRONMENTAL ANALYSIS RECORD

LASSEN - APPLEGATE TRAIL

(California & Nevada)

MAP 10



T32S

33

34

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37

38

39

40

41

CALIFORNIA

NEVADA

MAP 11

CENTRAL OREGON MILITARY ROAD
1867-1873

Employment in the area is mostly related to agriculture and lumber milling. A few people are employed by the Federal Government which has offices in Cedarville. Unemployment is higher than in other parts of California and Oregon and nearly doubles the National rate.

Cedarville is the only community within the area of analysis that provides any appreciable amount of community services to the area residents. A bank, State and Federal offices, petroleum services, and a medical center are located in Cedarville. Food markets and service stations are located in most of the communities, whereas, restaurants are located in only a few. In total, the service provided by the communities must be supplemented by those available from nearby larger communities such as Alturas, California and Lakeview, Oregon.

Altogether, the sparse population, the narrowly based economy, and the employment situation of the area dictates a flow of money out of the analysis area for goods and services. Most of the money, however, stays within the immediate region because nearby towns, such as Lakeview, Oregon and Alturas, California, provide most of the goods and services to support the agriculture-oriented economy. Any long term means of broadening the economic base of the area would probably bolster the economy and provide a better quality of life to most, if not all of the residents.

ATTITUDES AND EXPECTATIONS

The presence of geothermal resources in the area of analysis has been known for many years. Use of the resource has been limited to "hot springs" baths and some space heating. The resource has been used more extensively for business and home space heating at Lakeview and Klamath Falls, Oregon to the west. Many people in Washoe County, Nevada; Lake County, Oregon; and Modoc County, California hope that the geothermal resources within the counties can be developed. This optimism is reflected in the willingness of private landowners to lease their lands for exploration of geothermal resources. To date, there has been no known local opposition to any phase of the potential geothermal resource program. Even though knowledge about the development and operation phases of the geothermal program is limited, local people representing county governments and business feel that the leasing program will add to the tax input, expand the economic base, and generally not place an undue burden on community and county services. The field crews and operators of the development and operational phases of the geothermal program represent "hard working men", an image very compatible to a rural life style.

LOCAL REGULATORY STRUCTURE

Lake County, Oregon is governed by a three-member Board of County Commissioners, while Modoc County, California has a five-member Board of Supervisors, and Washoe County, Nevada has a five-member Board of Commissioners.

All Counties have a Planning Commission. Modoc County also has an Environmental Review Committee responsible for assessment of environmental impacts on all lands within the County. Modoc County has issued regulations for geothermal development for all lands. Lake and Modoc Counties within the analysis area have zoned lands for the purpose of controlling land use and development. Any land use not consistent with the published ordinances is subject to variance clearance in these Counties.

III. UNMITIGATED ENVIRONMENTAL IMPACTS

GEOLOGY

Exploration and development will have a very minor impact upon geology in the basins, amounting simply to the drill holes left in the ground after drilling. An additional impact possible in the plateaus, foothills, and mountains is that of a landslide caused by road and drill pad construction on steep slopes.

Several components of the geology will be impacted during the operation stage by both waste disposal and production. The components are subsidence and seismicity.

Subsidence may occur in the basins as the geothermal fluids are removed from the ground during production. The probability of subsidence occurring in this area is unknown.

Seismicity may be affected by both waste disposal (re injection of geothermal fluids) and production (removal of geothermal fluids). Removal of the geothermal fluids would have the probable effect of decreasing the number and increasing the severity of local earthquakes. Re injection of the geothermal fluids would have the probable effect of increasing the number and decreasing the severity of local earthquakes.

SOILS

During the exploration stage, off-road vehicle use, road and trail construction, and drilling will crush and destroy vegetation on approximately 38 acres of each lease area (see Table 1 Surface Disturbance Expected from Exploration Drilling on 2560 Acre Lease), and on any new access trails required to travel to the drilling site. The area involved is approximately 1.5 percent of the total lease area. Impacts estimated to occur during the exploration process are considered relatively minor overall.

The fine-textured, alkali soils of the dry basins are very susceptible to wind erosion during the dry summer months and to water erosion losses during the spring (see Table 5 Soil Series by Physiographic Position, and Map 2, Soil Series and Associations, under Description of Existing Environment). Soil losses may amount to 0.5 inch or more of the soil depth on the disturbed area during the course of a year, if the soil is continuously disturbed by equipment.

Within the irrigated basins, forage, grain, or row crops would be destroyed. Soil compaction on wet areas, especially muck soils in Oregon, would break down soil structure for some time after such areas

ceased to be subjected to vehicular travel. Disruption of surface irrigation systems by vehicular travel could result in considerable loss of crop production at elevations below a trail or a road through a field. The impacts of vehicle use and trails would not be as great on the sandy to gravelly clay loam soils along the east base of the Warner Mountains in California where overhead sprinkler irrigation is generally used. Severe gully development may occur where surface irrigation water follows a vehicle track downslope.

Ground cover loss in the plateaus and rolling hills will result in some soil erosion, particularly on soils without coarse gravelly or stony surfaces and on moderately steep slopes. Vegetation loss could have a more significant adverse impact on the soils in the foothill and mountain areas. Gully erosion could be a problem where vegetative cover is crushed and destroyed and vehicle trails are made up steep slopes. Severe sheet and rill erosion may occur on areas where vegetative cover is removed on steep slopes.

All activities connected with geothermal steamplant development - roads, drill sites, pipelines, plant construction, and transmission lines - would result in removing vegetation and exposing the soil to both wind and water erosion over approximately 360 acres, or 14% of a lease area (see Table 2 Surface Disturbance Expected to Result from Development of Two 100 Megawatt Power Plants on One 2560 Acre Lease). In addition to wind and water erosion losses over the whole disturbed area, soil depth would be altered on approximately 220 acres by the construction of a power plant, drilling of wells, and excavation of disposal ponds. Soil structure would be altered on approximately 71 acres affected by road construction.

Impacts will be least pronounced in dry basin areas. Disturbance of existing irrigation ditches or canals could result in gully erosion on fields within irrigated basins. Changes in soil depth from construction may contribute to increased rill and sheet erosion on the steeper slopes.

The operation of the steam plant would not have impacts on soils beyond that caused by exploration and development, except the possible increase of toxic salt level in the disposal ponds, and the possibility of seepage from disposal ponds reaching the surface or raising the water table and increasing toxic salt or other mineral levels on soils at a lower elevation.

The overall soil effects of the close-out of a steam plant would be beneficial. However, wind and water erosion may occur as a result of the soil disturbance while dismantling the equipment. In the irrigated basins, the most probable adverse effect would be the breaching of some irrigation ditch or canal by heavy equipment and the consequent gully erosion from uncontrolled streamflow.

Close-out operations may result in destruction of vegetation and soil disturbance that would result in rill, sheet, and gully erosion on steep slopes without proper rehabilitation measures.

LAND USE

The impacts of geothermal development will be most significant in the irrigated basins because of the population concentrations and the extensive land improvements. These basins contain the communities and headquarters for grazing and other land uses in the other physiographic units. The generally level terrain will allow easy visibility and noises to carry. Also, any impacts that affect improvements are more significant generally than those that may affect only raw land. An exception to this will be the dry valley portions of Surprise and Warner Valleys in which the impacts are still close to population and subsidence, noise, and offensive gases could cause problems. There are, of course, small agricultural areas in isolated areas of the dry valleys which could be impacted. Impacts on grazing, recreation, and other extensive land uses found in these provinces will be minimized because of the vastness of space and population void.

There are two plateau areas that have tentatively been identified as having primitive values where road construction and other of man's activity would not be compatible. These are 1) the ridge extending west from Bitner Butte separating the Massacre Lake Complex and Long Valley, and 2) the area between the north boundary of the Sheldon Refuge and the Oregon-Nevada State line. Any geothermal development within these areas would be totally incompatible with these values and potential designations, as the total land use would be changed.

Generally, the discrete actions of the exploration stage exist only for a short duration and will not have significant long term impacts on other land uses. Road and trail construction during this stage will have some temporary impacts on cropland by destroying vegetation and compacting the soil. Noise from seismic blasting and shallow hole drilling will probably be of some nuisance if done around population centers or farmsteads. The temporary existence of a drill rig may have scenic impacts on the rural tranquility or be a minor curiosity to passersby depending upon the individual's viewpoint. Rehabilitation of disturbed land areas will basically be insignificant as only small areas will have man's activity for short periods of time.

The development of a geothermal field has the most significant impacts on land use than all other stages. The activity and construction at the development site would basically preempt all other land uses during this stage. The significance would be more on

irrigated cropland than on unimproved sagebrush holding pastures. However, the noise from drilling and construction will last for longer periods and be more continual which could have significant nuisance value. Transmission line construction will affect other than the development site, and if crossing cropland, could make cultivation and irrigation more difficult. Here again, the visual impacts on the rural land use aspects could be important depending on individual viewpoints. Escaping gases, if occurring, could have nuisance affects around population centers and farmsteads although minor amounts of gases are now associated with the Cedarville Resort Hot Springs.

By the time the operation stage is reached, most of the major land use impacts have occurred. The problem of subsidence, if it occurred, could affect cropland irrigation systems. If it occurred in a residential or other structural area, buildings would very likely receive some damage. Here again, escaping gases could create local nuisances. During this stage, there would be less of man's construction activity and ground disturbance. As vegetation grew back and the developed area reached its equilibrium, it is expected that some compatible land uses would be permitted and some animal life would adapt to the habitat changes.

Removal of improvements when the resource is depleted will have insignificant impacts on other land uses. At this time an equilibrium will have been reached among these uses. As the improvements are removed, other uses will fill this void. Rehabilitation of the site will facilitate this transition, probably to former use. The construction noises of dismantling the facilities will be short term and minor.

WATER

Surface disturbance in dry basins associated with exploratory drilling and development (Tables 1 and 2) will have no appreciable effect on erosion and sedimentation by running water, although local effects are possible in areas of low to moderate relief. Seismic surveys carried out near springs and wells may cause changes in discharge if the energy from the blast is of sufficient magnitude. Particularly in the irrigated basins, irrigation, domestic and livestock wells are numerous and could be damaged by blasting from seismic surveys.

The surface disturbance expected from exploration drilling and development in mountain, plateau, and foothill areas could result in damage and/or destruction of water resources in perennial and intermittent streams, reservoirs, lakes and meadows. Destructive processes consist of increased runoff, erosion, and sedimentation, and decreased recharge to shallow water tables. The processes are inter-related and affect each other so that an increase in one may cause an increase or decrease in another.

Increased runoff into meadow areas will result from surface disturbance in the meadow or in the drainage area above the meadow. One effect of increased runoff would be to start or accelerate gully erosion, which, over a long period of time, would result in loss of the meadow soils and accompanying marshes.

Sedimentation resulting from increased runoff and erosion may occur within the mountain province and/or downstream into adjacent areas. Surface disturbance in portions of the drainage basin above a meadow may cause sedimentation within the meadow. Sedimentation would damage wetland areas by filling them in.

Decreased recharge to shallow water tables would eventually result in decreased discharge of springs which supply water to mountain meadows and intermittent streams. Lower recharge rates result from increased runoff on lands which have been cleared and compacted by construction of geothermal features.

The impacts due to surface disturbance of exploration drilling and development vary from negligible for one or two exploration wells near large meadows, to severe for full development in small to medium sized meadows.

Increased rates of siltation in reservoirs and lakes resulting from increased erosion due to surface disturbance during exploration drilling and development may occur. The combination of decreased storage capacity from siltation and increased runoff from upstream surface disturbance may increase the probability of local reservoir (dam) failure after periods of heavy runoff.

Local gully enlargement and/or channel enlargement in areas of significant surface disturbance will bring about increased sedimentation in areas where local flattening of stream gradients occur. Prominent areas with marked decreases in stream gradients in Surprise Valley occur at the mouths of canyons and along the edges of the three Alkali Lakes. Wetlands along the edges of these lakes may be filled with sediment. Sedimentation will be increased in downstream reservoirs and possibly in Hart and Crump Lakes. Channel deepening and/or filling will disrupt local water control devices used for irrigation. Increased sediment in irrigation water may be deleterious to aquatic wildlife and crops.

Surface disturbance expected from exploration drilling and development in the irrigated basins would have minimal impact on water resources because of low relief. Local changes in runoff, erosion, and sedimentation would occur on elevated terraces and alluvial fans with effects similar to those discussed for foothill areas.

Production and disposal of geothermal fluids during the exploratory drilling and operation stages (Tables 3 and 4) may adversely affect shallow water tables and surface waters in mountain meadows, reservoirs, and perennial streams. Blowouts and accidental spills of geothermal fluids will likely introduce deleterious substances such as salts and toxic chemicals to meadows and/or intermittent stream courses. The effect on surface water would be short-lived. Toxic chemicals and salts which reach shallow groundwaters, however, would cause a lingering pollution problem which may deny downstream users the beneficial use of the water for local stock, irrigation, and wildlife. Leaching of salts from disposal ponds or dumps after rehabilitation could also cause pollution of shallow groundwaters.

Pollution of surface water would be distributed downstream throughout the remaining portion of the drainage basins. Irrigated basins in Warner, Cowhead, and Surprise Valleys would be affected.

Irrigation, livestock, and domestic water supplies are derived in part from groundwater stored in sediments beneath irrigated basins. Introduction of salts and toxic chemicals into aquifers could occur during production and disposal of geothermal fluids. Pollution of groundwater would occur from infiltration of spilled geothermal fluids from stream channels and alluvial fans into freshwater aquifers.

Within the irrigated basins accidental leakage of geothermal fluids through faulty drill casings or poor cement jobs could intermingle with potable water in aquifers causing a lingering pollution problem. Leaching of salts from disposal ponds or dumps through granular soils could cause pollution of shallow water tables and springs.

Impacts within the dry basins would be negligible. Groundwater quality generally diminishes towards basin centers. Introduction of salts and toxic chemicals into poor quality groundwaters will have no effect on the quantity of water available for beneficial use. Small to moderate quantities of potable groundwater occur in largely untapped aquifers around the margins of dry basins (particularly the eastern margin of Surprise Valley). Pollution of these aquifers would have the effect of depleting a potential resource.

AIR

Particulate matter (dust) will be dispersed during all of the implementation stages. Concentrations in the basins are expected to be higher than the States' (Oregon, California, Nevada) air quality standards (10 grams/M² per month). Highest concentrations would occur mostly during the winter months, due to air inversions. Dust concentrations in the foothills, plateaus, and mountains should be lower than State standards.

The only significant contribution of noxious gases would be from drilling operations. The noxious gas most likely encountered would be hydrogen sulfide of concentrations similar to that found in a hot spring (0.03 ppm). This concentration would be very near the States' (Oregon, California, and Nevada) air quality standards (0.03 pp. for a 1 hour average) and may exceed the standard during production testing in the development stage and during maintenance, waste disposal, and production in the operational stage. Concentrations may be increased during winter months by inversion layers within the basins, but probably not to toxic levels. The toxic effect of hydrogen sulfide is not cumulative. The impact to an individual in the area would be a rotten egg odor to which one may grow accustomed over a period of time.

Temperature will be impacted by production and possibly by waste disposal. The impact would be to increase the air temperature by 1 to 5 degrees F in the immediate vicinity.

Air movement patterns will be impacted by production and possibly by waste disposal. How the air movement patterns will be impacted by the venting of large quantities of steam is unknown.

Non-ionizing radiation will be impacted by the production of electricity. The impact will be interference with radio transmission and reception by the 60 cycle frequency of the generators and transmission lines. This impact will be localized around the geothermal power plant and along the transmission lines.

VEGETATION

TERRESTRIAL

Off-road vehicle travel, road and trail construction, drilling, and disposal ponds associated with the exploration stage would crush and remove vegetation on approximately 38 acres of a typical 2560 acre lease area. There are substantial acreages of dry land grass seedings for forage production in the dry basins. These seedings are generally stocked at the rate of about 5 acres per animal unit month (AUM). Without rehabilitation there would be a loss of about 8 AUMs for a 38 acre disturbed area for each exploration drilling site for a typical 2560 acre lease area.

Practically all of the irrigated basins are under private ownership. Forage production is generally from 5 to 6 tons of alfalfa per acre on much of this unit. A small percentage of the irrigated basins are used for higher value row crops such as potatoes and small orchards and gardens. The destruction of these high value irrigated crops for exploratory drilling could amount to \$16,000 to \$23,000 of damage in one year.

Destruction of such valuable browse as bitterbrush, mountain mahogany, snowberry, and native perennial broad-leaved herbs and grasses in the plateau and rolling hill areas will result in degrading the habitat for several species of wildlife. These native plant species probably will not regenerate on the site to the extent that they once occupied the area because the plant community has been opened to highly competitive invaders. There are several brush spray areas with an average stocking rate of 7 to 8 acres per animal unit month within this physiographic unit. The destruction or removal of perennial grasses on such areas would lower the carrying capacity of the range by approximately 5 AUMs per year on an exploratory drilling area.

There are some commercial timber stands and valuable wildlife habitat provided by the native vegetation of the foothill and mountain physiographic units. Regeneration of the vegetation on such areas may require from 75 to 100 years, especially where commercial timber stands are involved.

The impacts of development upon the vegetation would be very similar to those of exploration, but the area would be much more extensive. Approximately 360 acres of each typical 2560 acre lease would be denuded of vegetation. Within the irrigated basins, this could result in loss of \$151,000 to \$216,000 in gross value of crops in one year.

The impacts of operation of a steam plant would be similar to the impacts of development. However, if there were seepage from the disposal sumps that affected lands below the sumps, a larger area of adverse impact may be involved, especially if the seepage water contained harmful salts or toxic minerals.

Dismantling a geothermal steam plant would result in crushing and destruction of some vegetation. However, with appropriate rehabilitation measures the overall effect should be beneficial in terms of restoring vegetation on the site.

AQUATIC

Impacts upon aquatic vegetation are limited to minor on-site disturbances during the exploration and development stages, with the exception of deep-well exploration drilling which could result in a greater area being disturbed (up to 20 acres per drill site). Spring sites and lakebeds are the most sensitive areas in basins. However, the amount of Federal land within this aquatic type is limited. Deep-well exploration drilling on or adjacent to perennial streams (Deep Creek and Twentymile Creek) in the plateau, foothill, and mountain areas could physically damage aquatic plants in the immediate site and very probably cause off-site damage through channel disturbance and increased erosion and sedimentation from access road construction.

The greatest potential impact of the operational phase will be the disposal of surplus water associated with production. Harmful effluents (chemical or thermal) entering natural lakes or stream systems could have a significant impact on aquatic vegetation. An increase in water temperature, dissolved solids, pH, or toxic substances above the tolerance level of existing vegetation would result in the loss or reduction of susceptible plant species. These changes in floristic composition would alter the entire aquatic ecosystem.

Conversely disposal of good quality surplus waste water could prove beneficial by creating new aquatic sites.

The removal of developments and reclamation of the disturbed sites would allow for some recovery of aquatic vegetation.

ANIMALS

WILDLIFE

Potential adverse impacts to aquatic species during exploration and development activities are expected to be of a minor, temporary nature. There may be temporary disturbance to waterfowl and shore birds on the playa lakes (Calcutta, Alkali, Massacre Lakes and others) during the spring and fall migration, but this should be minor since the dry basins are not high waterfowl production areas.

If deep exploration drilling takes place in the aquatic types in Crump Lake and its flood plain (See Map 6), there could be a temporary low impact on waterfowl near the site. This would be primarily disturbance during the breeding season and loss of 6-8 acres of habitat in the immediate drill site.

The increased disturbance and activity associated with development could be detrimental to these species, especially during the breeding season (February to July). The rookery in Pelican Lake would be included in this category. The significance of this is not known at present. Many species adapt to changing conditions and increased human activity, while others tolerate little change.

If the development encroaches on the aquatic type and the lakes proper, there will be a loss of 6-8 acres of habitat. The significance of this is dependent upon the cumulative effect of development over the entire lake or marsh area.

Significant potential impacts in the plateaus, foothills, and mountains will be limited to deep exploration drilling and associated

road construction in aquatic habitat. If these occur on or adjacent to perennial streams (Deep Creek and Twentymile drainage system) it would result in physical damage to the streambed in the immediate sites, and very probably off-site damage to lower stream areas. Increased turbidity and resultant sedimentation of lower streambeds could cause a reduction in aquatic insects, loss of spawning areas and eventually a decline in fish populations.

Similar activities on or adjacent to the large lakebeds could cause temporary disturbance and minor loss of waterfowl habitat. The impact of this would be low during this stage.

Impacts to aquatic species during the operational stage would be related to the disposal of waste effluents and disturbance of animal life by increased noise levels. The increased noise levels from producing wells differs from that in the development stage only in that operational noise is of a more constant and permanent nature. Animals may become accustomed to the latter with time. The impact will be minor in all but the irrigated basin areas.

Discharging toxic materials or poor quality water into the lakes of Warner and Surprise Valleys or into perennial stream systems (Deep Creek and Twentymile Creek), reservoirs, and large semi-permanent lakebeds (Big Lake, Long Lake, etc.) would prove detrimental to aquatic animals.

Changing the chemical or thermal properties of existing waters would result in a different aquatic environment. The fish population in Warner Lakes would be very susceptible to changes in water quality. Those species unable to adapt would not survive. Subtle changes in aquatic vegetation would be reflected in reduced waterfowl use and production.

If surplus water is of acceptable quality, waterfowl use may be enhanced.

The removal of developments and human activity should result in aquatic conditions similar to those existing prior to development.

Impacts upon terrestrial animals will be minimal in the exploration stage. Probably of greatest concern is increased access in plateau, foothill, and mountain areas from road and trail construction. Future use by the public could lead to increased harassment of animals during critical periods of their life cycle (breeding, kidding, etc.).

During development there will be limited habitat loss in the immediate site, and some disturbance from construction activities. Impacts from this should be low in the basin areas, due to the relatively uniform

character of the land and the amount of land anticipated to be developed. In the higher elevations (plateaus, foothills, mountains) forage and cover would be removed resulting in localized loss of habitat for many species (including sagegrouse, antelope, and mule deer). This may result in a lasting adverse impact if the site is in a sagegrouse strutting ground, antelope kidding area, wintering area, raptor nesting sites, or other critical animal use area. The severity of the impact is dependent upon the number of sites, amount, and location of land involved. For example, one development within a deer or antelope winter range may be acceptable, but five or six in the same area would have a high impact.

In many of the homogeneous sagebrush types, some development may be of little significance.

Increased activity may cause some species to leave the area. This may be temporary or permanent depending upon the tolerance levels of the individual animal species.

Construction of transmission lines will attract raptors. If improperly designed, electrocution may result.

Should waste water associated with production prove to be toxic, it would present a hazard to animal life. However, if water is of acceptable quality it would be beneficial.

Increased noise levels and activity during production may drive the more sensitive species from the immediate area. Other more tolerant species may adjust to the new conditions. The wildlife species within the irrigated basins are anticipated to be fairly adaptable to changing conditions.

The close-out operations should prove beneficial to most animals. Human activity and disturbance will be removed. Many of the roads and other disturbed sites can be reseeded, thereby replacing lost forage and cover.

Both of the endangered bird species are uncommon in the EAR area. The actual impacts of geothermal development on their welfare is unknown. However, it is not anticipated that any highly adverse impact will occur.

LIVESTOCK

Off-road vehicle use, road construction, drill site development, and steam plant construction may disturb livestock in certain areas where animals normally concentrate such as water sources, meadows, and grass seedings.

Pipelines from geothermal wells to the steam plant may interfere with livestock movements.

New trails and roads may breach existing allotment boundary or pasture fences. Control of areas of use by livestock would be adversely affected by uncontrolled breaches in fencelines. Some loss of forage will occur.

Sumps for mud and for waste water could be hazardous to livestock. Water from geothermal wells may contain toxic substances.

Vehicular travel in areas where livestock are grazing may be somewhat hazardous to the animals and to vehicle operators.

It is not known how livestock would respond to the loud noises produced by emission of waste steam.

Old geothermal wells with unsealed casing may be hazardous for livestock.

Animals may rub on and cause collapse of partially disassembled equipment and cause injury to themselves.

WILD HORSES

Exploration activities may disturb these animals in certain areas where they feed, rest, and water. New trails and roads may open areas to all types of vehicle use that is not now present. Prolonged use of this nature will cause horses and burros to move or seek new areas.

Development and operation will force horses out of the area. If the development is not in critical areas of use the horses will move to another area of the range and no problem will be created. The horses will return to the area after a period of time if complete clean-up is done and no further activity is being carried on.

Critical use requirements of horses in the EAR area have not been established, but population maintenance on a long-term basis is not expected to be a major problem.

ECOLOGICAL INTERRELATIONSHIPS

PLANT SUCCESSION

Plant succession will be altered on all disturbed sites. Little effect is anticipated for most plant communities because impacts will be very localized.

Destruction or removal of the native vegetation on the salt desert shrub type could result in an invasion of such a site by the undesirable, poisonous halogeton (Halogeton glomeratus). It is very difficult to reestablish any desirable vegetation on the saline soils occupied by the salt desert shrubs.

Rabbitbrush will become established alongside roadways and exposed earth in the sagebrush type.

Regeneration of the vegetation on fragile timber sites may require from 75 to 100 years, especially where commercial timber stands are involved. Native plant species of the plateaus such as bitterbrush, mountain mahogany, snowberry, and native perennial broad-leaved herbs and grasses probably will not regenerate on the site to the extent that they once occupied the area because the plant community has been opened to highly competitive invaders.

The addition of water to a previously dry area, or possible changes in existing aquatic environments from discharged surplus waste water could alter plant succession on these sites. It is quite remote that any significant changes of this type would occur.

Plant succession would be left to natural processes. Many of the disturbed sites will revegetate, although species may differ from the original flora. Introduced species resulting from rehabilitation will be present on those sites where they are adapted. Other sites may be dominated by annual and perennial species able to adapt to the changed environment.

FOOD AND COMMUNITY RELATIONSHIPS

Food relationships will be changed on localized sites by loss of vegetation and animal production. The loss of a use area, critical for a species to complete its life cycle, would obviously be detrimental to that species. For example, destruction of the meadow types in a sagegrouse brooding area. The significance of these impacts depend on the location and amount of area involved.

Most impacts relating to the operational stage have been discussed previously - increased activity, noise, pollution of existing waters,

etc. All of these factors may affect animals either directly or indirectly. For example, increased noise and activity could cause a species of animal to leave a preferred area during a critical period. They may then be forced to subsist on an area that does not fulfill their requirements. This would result in a loss of animals. This example is included only to illustrate one of many possibilities that could occur. The significance of impacts is dependent upon the variables previously discussed, number of sites, location, and amount of acreage involved.

Destruction of such valuable browse as bitterbrush, mountain mahogany, and snowberry, and native perennial broad-leaved herbs and grasses will result in degrading the habitat for several species of wildlife. These native plant species probably will not regenerate on the site to the extent that they once occupied the area because the plant community has been opened to highly competitive invaders.

There are several brush spray areas with an average stocking rate of 7 to 8 acres per animal unit within the plateau physiographic unit. The destruction or removal of perennial grasses on such areas would lower the carrying capacity of the range by approximately 5 AUMs per year on an exploratory drilling area.

The completion of the close-out stage will be beneficial. Disturbance from human activity will be removed. As disturbed sites are seeded, some additional forage will become available.

HUMAN VALUES

AESTHETICS

Impacts to existing landscape character will, in most all cases, be in the form of visual intrusions to existing vistas. Aesthetic impact severity will depend primarily on a population to view the intrusion and the ability of land forms to break up outlines or hide the geothermal improvement from view.

Exploration, development, operation, and close-out will have impacts on the harmonious aspects of the landscape. Drill rigs, trucks, testing equipment, roads, and general activity will cause visual distraction during the exploration stage. Establishment of new roads will create additional semi-permanent gashes in the landscape. Plant construction, geothermal steamlines, and electric transmission lines will become long-term distractions to the vastness of the desert from the onset of development through the operation stage. Although the actual site may be relatively small, the size of the plant is expected to make it readily visible. Transmission lines will interrupt large

expanses of natural setting. Odors of various gases, hydrogen sulfide in particular, may permeate the air and be carried by wind currents over large areas detracting from other uses and personal enjoyments found in the desert. Noise from air drilling and production testing may be intense (100-124 decibels @ 25 feet) and approximate the levels of an unmuffled diesel truck. This may detract from the enjoyment of the area by visitors. Close-out and the removal of the plant facilities will return the landscape to its natural accentuating features.

Impacts will be greatest in the irrigated and dry basin portions of Surprise and Warner Valleys. These areas contain the population and transportation routes allowing for disturbed vistas. The gentle relief in these types of valleys allows great visibility.

Land use for geothermal development represents an industrial aspect which will conflict with the rural agricultural land uses. In dry basins, where there is even less diversity of land use, geothermal operations will readily attract the eye. Transmission lines will cross these basins with their outlines uninterrupted.

Impacts to the plateau landscape will be the same as in the basins, but generally with less intensity. The rolling character of the landforms will break up outlines of plants and transmission lines and allow some improvements to be hidden from the casual traveler altogether. These physiographic units form a tie between the valleys and mountains. If a development were on a prominent ridge or other high spot, the intensity of impacts would become similar to those found in the basins.

The impacts in these type areas will vary upon individual circumstances of location. The potential to lessen impacts is good because the varied terrain and juniper-pine vegetation can break up outlines and hide improvements such as roads and pipelines. However, plant sites on ridges or mountain tops will greatly distract from the aesthetics of historic landmarks or the scenic quality of the landform.

EDUCATIONAL/SCIENTIFIC RESOURCES

During geothermal exploration, surface disturbance will be minor, but beneficial impacts may be high, owing to the additional knowledge of the geology gained through geologic mapping, geophysical exploration, and geochemical surveys.

During development, road construction and drill site locations would largely alter the stratigraphy of archaeological sites, and affect the Lassen-Applegate and Oregon Central Military Road by isolating,

fragmenting, and destroying portions. Such activities will also alter the surrounding environment and introduce visual, audible, and atmospheric elements out of character with the area and sufficiently to severely alter the setting. Increased access would promote vandalism of archaeological sites.

The significance of the proposal's impact on the cultural environment varies with the significance of individual cultural resources. Of the four archaeological resource areas identified, two (Areas II and IV) are significant enough for nomination to the National Register. Area IV may be one of the richest resources of its kind in the Western United States.

Area IV contains closely situated petroglyph sites which are, by nature of location (cliffs, rims) resistant to natural destruction. Significant losses to vandalism and construction activities could occur with increased access. Both areas could suffer from direct and indirect effects of geothermal development. It is doubtful whether the discovery of new archaeological sites by road and drill site construction would offset the effects of destruction and increased access. A temporary population in an area (such as would be required with geothermal development) might have less concern for antiquities than would a local population which is proud of its area's historic or scenic qualities. (This behavior is witnessed every hunting season for instance.)

Additional investigations and studies are needed in Areas I and III to determine their value. Presently it appears that both contain sites eligible for nomination to the National Register. Area III is similar to Area IV in resistance to natural deterioration and vulnerability to indirect damage. Area I sites probably are in the most danger of direct destruction or alteration due to their locations within Surprise Valley, a promising geothermal development area. All sites are presently located near well used roads, so chances for increased indirect effects are negligible.

The meandering Lassen-Applegate Historical Trail and the Oregon Central Military Road cross the area. Surface disturbance associated with geothermal development would accelerate destruction of these historical trails. While isolated segments of the road and trail might be preserved, the net result of the proposal could be not only the physical destruction of major parts of the trails and associated features, but the destruction of their physical and visual continuity -- and therefore of their very essence as historical routes. The total effects of the proposal will likely impair the integrity of these cultural resources sufficiently that they would no longer retain those qualities that would justify its listing in the National Register.

Since these routes were important in the history of a sizable region, the adverse impact of destruction would be quite significant on the quality of the cultural environment of the region, but perhaps not as significant on a National scale.

A significant adverse effect on scientific and educational values would be the possible "drying up" of hot springs. Hot spring drying has occurred near Klamath Falls and has been attributed to drilling for sources of hot water. If drying should occur in the analysis area, it would eliminate the opportunity to study micro-flora and micro-fauna associated with the hot springs.

It is also possible that geothermal operations may increase the flow at hot springs. After the 1968 earthquake, Cox Hot Springs in Warner Valley increased its flow, however, other hot springs and geysers in this area did not change. If flow rates do increase because of geothermal development, it is unlikely that the change would be adverse.

The environmental impact of effects on cultural resources may be magnified through cumulative effects. Progressive destruction of a characteristic category of cultural resources may seriously impair future opportunities for scientific research or preservation of representative facets of the cultural heritage of the region or locality. Each successive disappearance of one of such a category of cultural resources occasions a correspondingly greater impact on the cultural environment.

SOCIAL WELFARE

The exploration phase of the geothermal program would have a light positive impact on the social welfare of the area. Although the exploration crews would only be within the area for one or two years, the indirect expenditures to the small communities would be significant. An estimated 40 to 50 employees working in the exploration phase would increase business for the local communities without creating an undue burden on services.

If an excellent geothermal resource is found and developed, it is expected that as many as 100 new workers may be introduced to the local rural communities. This impact could be considered good in relation to increased local business, employment and services. If the geothermal program expands rapidly, within two years demands on local services and the County Planning Commissions may prove adversely overwhelming.

ATTITUDES AND EXPECTATIONS

Because there is no apparent local opposition to geothermal development and because the local people are optimistic about the program, the local attitudes will predominantly be courteous and curious.

IV. MITIGATING MEASURES

GEOLOGY

Control measures may be required by the supervisor (30 CFR 270.43) in areas where subsidence could be detrimental to farming, engineering works, public utilities, and other essential features.

The impact of geothermal operations upon seismicity cannot be predicted at this time because the subsurface geology is inadequately known. If induced seismicity occurs or appears imminent, controlling measures will be developed by the supervisor (30 CFR 270.43).

SOILS AND TERRESTRIAL VEGETATION

Temporary trail construction will be held to a minimum and be for short term use in environmentally sensitive areas. A Plan of Operations (30 CFR 270.34) or Notice of Intent to Conduct Geothermal Resource Explorations (Form 3200-9) is required prior to entering on the land. Special stipulations, nonoccupancy, and short term occupancy provisions may be imposed on Plan of Operations and Notices of Intent to minimize the destruction of soils and vegetation. Trail locations will be field checked and rerouted when necessary to avoid easily eroded soils and areas of choice or fragile vegetation. Restrictions may be imposed as to period of occupation or use to control erosion during periods of intense runoff or ground thaw.

Road locations must be included in the exploratory or development Plan of Operation (30 CFR 270.34). Construction will be only where necessary and with adherence to the following BLM road construction standards: (1) roads must be graded and drained, (2) maximum gradient is 8 percent, (3) drainage must be maintained through correct placement of culverts or other drainage structures of adequate size, and (4) roads must be properly surfaced and maintained.

Topsoil will be stockpiled from all disturbed areas for reuse. All disturbed areas not occupied by roads, wells, buildings, storage, etc. will be reseeded to adapted soil-stabilizing grasses, forbs, shrubs, and trees. Native vegetation should be restored when seeds of these species are obtainable. Where a suitable quality and quantity of water is available, sprinkler irrigation may be required to aid in reestablishing vegetation.

WATER RESOURCE, AQUATIC PLANTS, AND ANIMALS

Potential adverse impacts on water resources, aquatic plants, and animals will be minimized through enforcement of applicable Federal and State laws and regulations. Under the Federal Water Pollution Control Act, as amended, the primary responsibility for water quality standards which then must be approved by the Environmental Protection Agency. California, Oregon, and Nevada have Federally approved standards.

CALIFORNIA

In California, water quality responsibility is vested in the State Water Resources Control Board, Enforcement of State-Federal regulations is carried out by nine regional water quality control boards. The Surprise Valley Area is in the area of jurisdiction of the Lahontan Regional Water Quality Board located at South Lake Tahoe, California. An Interim Water Quality Control Plan was published in June, 1971 which served as a guide in water quality management activities. It established priorities and time schedules for action required to meet water quality and environmental objectives. A more comprehensive fully developed basin plan is currently near completion and is expected to be in effect by the time geothermal leasing of National Resource Lands occurs in Surprise Valley.

A summary of the current rules titled "Regulations for Geothermal Drillers" has been prepared by the California Division of Oil and Gas. It is reproduced below. Following the regulations is a sample waste discharge order issued by the Lahontan Region Water Quality Board for drilling and monitoring of geothermal exploratory wells on privately owned land in Surprise Valley.

REGULATIONS FOR GEOTHERMAL DRILLERS

Introduction

The State Water Resources Control Board and nine regional water quality control boards establish and enforce rules, regulations, and policy for protection of the quality and appropriate use of water of the State. Any discharge or action that could adversely affect directly or indirectly the surface water or groundwater of the State is regulated by these boards.

In general, the State Water Resources Control Board formulates State-wide policy, administers appropriate water rights, and hears appeals on regional board actions. Each of the regional water quality control boards administers and regulates all water quality matters within specific geographic areas set forth in Chapter 4, Article 1, Section 13200 of the Porter-Cologne Water Quality Control Act.

A. Surface Discharges

A surface discharge of wastes includes sewage and any other waste substances, liquid, solid, gaseous, or radioactive associated with human activity or from any producing, manufacturing or processing operation. This includes on-site or off-site disposal of any material solid or fluid.

At least 120 days prior to start of drilling, a complete report of waste discharge along with fees (maximum of \$1000) must be in the files of the appropriate regional water quality control board. Since this must be a complete report of waste discharge containing all materials required for issuance or waiver of waste discharge requirements, it is suggested that it be filed six months prior to start of drilling to allow time for development of the completed report. These reports of waste discharge should contain information related to at least the following factors:

1. Quality and quantity of any surface or near surface discharge of fluid.
 - a. The provisions for disposal of drilling muds, oils, and associated waste water used at the drilling site.
 - b. Disposal methods and quality of waste brines, condensate, and other wastes related to the geothermal reservoir.
 - c. Disposal of waste from sanitary facilities provided at the site.
2. A storm drainage and erosion control plan must be submitted with the proposed geothermal development which includes:
 - a. Expected volumes, peak rates, characteristics, and other pertinent information concerning storm water runoff and dry weather drainage from both drilling site and road construction and under ultimate development phases.
 - b. Adequate collection and treatment systems that are, or will be, available as necessary to protect the water environment from any adverse effects.
 - c. Stabilization and/or erosion control of all cuts, fills, and other excavations or gradings by planting, riprapping, or other effective means that will prevent erosion.

- d. Installation of adequate storm drainage facilities which will minimize the amount of silt, sand, and debris discharged to area receiving waters.
 - e. Stabilization of all storm water runoff channels by the installation of culverts, ripraps, or other effective means that will prevent erosion.
 - f. Scheduling of work so as to minimize erosion from weather conditions and the stabilization of work in progress against inclement weather conditions.
3. Subsequent to issuance of discharge requirements a self - monitoring program is established for the operator by the regional water quality control board. The complexity and frequency of sampling and analysis is dependent on the resources to be protected and the amount and type of waste that could be discharged.

B. Deep Well Injection

It is the staff position to encourage injection of waste brines and condensate back into the geothermal reservoir.

This should be done in such a manner that it will prevent damage to underground and surface waters suitable for beneficial use. Injection of brines and condensate is considered disposal by waste wells and is regulated by the Division of Oil and Gas and also by the regional water quality control boards.

1. The operator will report the proposed waste discharge to the Division of Oil and Gas on forms required by the Division and file the report in the District Office. The Division will forward a copy of the report to the regional board.
2. The Division of Oil and Gas, the regional board, and local agencies will consult with one another and conduct any necessary investigations of the proposed waste discharge.
3. The Division of Oil and Gas will prescribe requirements for discharge of the waste water in accordance with statutory regulations, furnishing a copy of the documents to the regional board.
4. The regional board will either concur in the requirements of the Division of Oil and Gas or prescribe separate discharge requirements, but in either case will furnish a copy of its actions to the Division of Oil and Gas.

C. Transportation and Disposal of Waste

Division 7.5 of the California Water Code and Subchapter 13 of Chapter 3, Title 23, California Administrative Code, provide regulations for the transportation and disposal of liquid wastes. By definition "liquid waste" includes any solid or gaseous substances contained in such waste but does not include sewage, fertilizer, or any radioactive material that is subject to the Health and Safety Code.

Subchapter 15 of Chapter 3, Title 23, California Administrative Code, further provides regulations for waste disposal to land. By definition "disposal site" means any place used for the disposal of solid or liquid wastes but does not include any part of a sewage treatment plant or point of discharge of sewage effluent or land drainage from pipes or ditches into waters of the State.

Disposal sites are divided into four classifications. Class I sites are those at which complete protection is provided for all time for the quality of ground and surface waters from all wastes deposited therein and against hazard to public health and wild-life resource.

Class II-1 sites are those overlying usable groundwater and geologic conditions are either naturally capable of preventing lateral and vertical hydraulic continuity between liquids and gases emanating from the waste in the site and usable surface of groundwaters, or the disposal area has been modified to achieve such capability.

Class II-2 sites are those having vertical and lateral hydraulic continuity with usable groundwater, but for which geologic and hydraulic features such as soil type, artificial barriers, depth to groundwater, and other factors will assure protection of the quality of usable groundwater underneath or adjacent to the site.

Class III sites are those at which protection is provided to water quality from only nonwater soluble, nondecomposable inert solids by location, construction, and operation which prevent erosion of deposited material.

Waste discharged to "disposal sites" are divided into three groups. Group 1 wastes consist of or contain toxic substances and substances which could significantly impair the quality of usable waters. Group 2 wastes consist of or contain chemically or biologically decomposable material which does not include toxic substances nor those capable of significantly impairing the quality of usable waters. Group 3 wastes consist entirely of nonwater soluble, nondecomposable inert solids.

Group 1 wastes must be discharged only at Class I sites or Class II-1 sites which have been approved by the executive officer of the regional board for disposal of specific Group 1 wastes. Group 2 wastes may be deposited only at Class I, Class II-1, or Class II-2 sites. Group 3 wastes may be discharged at any classified site.

Most liquid wastes which are hauled to a disposal site are easily identified as Group 1, 2, or 3 wastes. A notable exception is waste drilling fluids which have been used in the drilling of oil, gas, geothermal, and water wells. Such wastes may either be Group 1 or Group 3 depending on the nature of materials added during or before use in the drilling process. There are literally hundreds of additives used in drilling fluids. Some of these contain toxic substances or those capable of significantly impairing the quality of usable waters. Most, however, do not contain such substances in sufficient concentrations to justify classification of the waste drilling fluid as a Group 1 waste.

To assure that all liquid wastes from drilling production of oil, gas, or geothermal wells, transported to off-site locations for disposal, are hauled to approved sites, the following guideline will apply:

The Division of Oil and Gas will ascertain the character of all wastes to be hauled to off-site locations for disposal and advise the driller, producer, or hauler regarding the nearest approved disposal sites for such waste and will notify the regional board of any Group 1 and 2 wastes to be hauled to a surface disposal site.

D. Water Rights

Prior to appropriation of water from any stream for use at the site, an application must be filed with the Division of Water Rights of the California Water Resources Control Board. This application should be filed about 1 year prior to the start of the project to allow time for determination of availability of unappropriated water and the effect of the project on the environment. An environmental impact report is required with the water right application.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION
BOARD ORDER 6-74-108
WASTE DISCHARGE REQUIREMENTS
FOR
AMERICAN THERMAL RESOURCES, INC.
Modoc County

Dept. of Interior
RECEIVED

SEP 30 1974

BUREAU OF LAND
MANAGEMENT
SUSANVILLE, CALIFORNIA

The California Regional Water Quality Control Board, Lahontan Region finds:

1. American Thermal Resources, Inc., submitted a completed report of waste discharge dated June 20, 1974.
2. American Thermal Resources, Inc. proposed to recirculate up to 0.10 mgd of water-based slurry waste in drilling operations and discharge up to 125 cubic yards of drilling mud to lands owned by the Lazy 'SJ' Ranch, Inc., Eagleville, California 96110.
3. A geothermal exploration well is to be located in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 12, T40N, R16E, MDB&M as shown on Attachment 'A', which is made a part of this order.
4. For the purpose of this order, American Thermal Resources and the property owner are designated as the discharger.
5. The proposed drilling fluid which will be used in the operation is a water-based mud with possible addition of several chemical additives, which are reportedly non-toxic to fish, waterfowl, or wildlife in the drilling fluid.
6. The geothermal well location will not involve more than one (1) acre in area, and all liquid and solid waste produced by the operation will be confined in a non-infiltrating retention pit located adjacent to the drilling rig.
7. Upon completion of the drilling operation, the drilling mud slurry will be allowed to dry and then covered with native soil, restoring the area to approximately the original condition.
8. The nearest waterwell is located a minimum of 2,000 feet southeast from the proposed well drilling area. The depth to good quality groundwater is approximately 125 feet below the well drilling area.
9. Land within 1,000 feet of the proposed drilling site is used for ranching.
10. The Interim Water Quality Control Plan for the North Lahontan Basin was adopted on June 11, 1971, and this order implements the water quality objectives stated in the plan.
11. The beneficial uses of ground and surface waters of Surprise Valley as set forth and defined in the Interim Plan are:
 - a. municipal and domestic supply
 - b. agricultural supply

- c. water contact recreation
- d. non-water contact recreation
- e. fresh water habitat for fish, waterfowl, and wildlife

12. The Board has notified the discharger and the interested agencies of its intent to prescribe waste discharge requirements for the discharge.
13. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that the discharger shall comply with the following:

A. DISCHARGE SPECIFICATIONS

1. Any solid or liquid waste discharged from the drilling operation shall at all times be confined in a sealed retention pit which prevents all infiltration.
2. The retention pit disposal area shall be protected from washout or erosion of wastes or covering material, and from inundation which could occur as a result of floods having a predicted frequency of once in 100 years.
3. There shall be no discharge either to the sealed retention pit or otherwise of any substances in concentrations individually, collectively, or cumulatively toxic, harmful, or deleterious to humans, animals, birds or aquatic biota.
4. There shall be no discharge of any oil, oily substances, or other petroleum outside the sealed retention pit.
5. There shall be no discharge of any substances which cause measurable tastes, odor, color, foam or any other objectionable characteristic in the surface waters or groundwaters of the Surprise Valley watershed.
6. Group I wastes encountered during the drilling operation shall be periodically removed to an approved Class I disposal site.
7. There shall be no adverse effect on the beneficial uses of surface or groundwaters as a result of the drilling or waste disposal operation.
8. All domestic sewage disposed of by the discharger shall be contained in properly operating sewage disposal facilities and shall not have any adverse effect on either ground or surface waters.
9. The discharge of any liquids or solids shall not cause a pollution.
10. The discharge of any liquids or solids shall not cause a nuisance.

B. PROVISIONS

1. The discharger shall comply with Monitoring and Reporting Program 74-108 as specified by the Executive Officer.

2. This Board considers the property owner to have a continuing responsibility for correcting any problems which may arise in the future as a result of this waste discharge.
3. In the event of any change in control of ownership of land prior to termination of drilling activities, the discharger shall notify the Board of such change and notify the succeeding property owner of the existence of this order.
4. Any proposed material change in the character of the waste or method of discharge or location of discharge shall be reported to this Regional Board.
5. The Board shall be notified immediately by telephone of the presence of adverse conditions resulting from this discharge; written confirmation shall follow.
6. The California Regional Water Quality Control Board, Lahontan Region hereby reserves the privilege of changing all or any portion of this order upon legal notice to and after opportunity to be heard is given to all concerned parties.

I, Roy C. Hampson, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Lahontan Region on September 26, 1974.

ROY C. HAMPSON
EXECUTIVE OFFICER

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MONITORING AND REPORTING PROGRAM NO. 74-
FOR
AMERICAN THERMAL RESOURCES, INC.
Modoc County

DRILLING AND MONITORING

Complete records of well logs shall be prepared containing information as to depth(s) at which groundwater is encountered and mud additive quantity and composition used throughout various depths of drilling.

In the event it is necessary to remove Class I materials to a Class I disposal site the discharger shall provide information regarding:

1. The type of Class I waste encountered.
2. The quantity of Class I waste removed from the waste-water detention pit.
3. The date which the Class I waste is to be removed.
4. The final disposal location of the Class I waste.

The above information shall be reported to this office by telephone as soon as Class I wastes are encountered. Written confirmation shall follow.

GEOHERMAL WATER MONITORING

Representative grab samples of geothermal waters produced from the exploration well shall be taken on each day such waters are produced. The monitoring program shall be as follows:

<u>PARAMETER</u>	<u>UNITS</u>	<u>SAMPLING LOCATION</u>	<u>SAMPLING FREQUENCY</u>
Arsenic	mg/l	Discharge to waste-water detention pit.	Immediately upon first encountering water and immediately whenever new water is encountered in the underlying strata.
Barium	mg/l	"	"
Boron	mg/l	"	"
Cadmium	mg/l	"	"
Chromium	mg/l	"	"
Cyanide	mg/l	"	"
Lead	mg/l	"	"
Mercury	mg/l	"	"
Nitrate & Nitrite Nitrogen	mgN/l	"	"
Selenium	mg/l	"	"

<u>PARAMETER</u>	<u>UNITS</u>	<u>SAMPLING LOCATION</u>	<u>SAMPLING FREQUENCY</u>
Fluoride	mg/l	Discharge to waste-water detention pit.	Immediately upon first encountering water and immediately whenever new water is encountered in the underlying strata.
Copper	mg/l	"	"
Iron	mg/l	"	"
Manganese	mg/l	"	"
Zinc	mg/l	"	"
Total Filtrable Residue	mg/l	"	"
Sulfate	mg/l	"	"
Sodium	mg/l	"	"

REPORTING

Weekly monitoring reports shall be submitted to the Regional Board commencing with the start of the exploration program. In reporting the monitoring data, the discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible.

Unless otherwise noted, all sampling, sampling preservation, and analyses shall be conducted in accordance with the current edition of "Standard Methods for the Examination of Water and Waste Water" or approved by the Executive Officer.

All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Public Health or a laboratory approved by the Executive Officer.

Date: _____

Ordered By: _____

ROY C. HAMPSON
EXECUTIVE OFFICER

OREGON

The Department of Environmental Quality was created by the 1969 Oregon Legislature and was assigned State-wide responsibility for air quality control, water quality control, and solid waste disposal. The Department consists of the Environmental Quality Commission, a director and professional staff. Five lay commission members are appointed by the Governor subject to confirmation by the State Senate.

The Commission establishes policy for guidance of the director and staff, reviews and confirms or modifies staff actions, adopts rules and regulations, issues orders and authorizes and directs legal enforcement actions. Solid waste regulations adopted by the Commission are enforceable by the State Board of Health and local health departments, as well as by the Department.

Oregon's first comprehensive water quality control laws were approved by the voters in 1938 and were substantially modified by the State Legislature in 1961. Some changes have been made at each succeeding legislative session, but in 1967 Oregon's water quality control laws were completely rewritten and greatly strengthened.

The most significant changes in 1967 were:

1. The State's water pollution control policy was changed from one of primarily pollution abatement to pollution prevention and water quality enhancement.
2. It was made unlawful, after January 1, 1968, for any wastes to be discharged to public waters without a permit from the State Sanitary Authority. (Now known as the Department of Environmental Quality.)
3. A program of State Sewage Works Construction Grants was instituted to supplement the Federal grant program to assist cities in financing construction of needed sewage treatment works.
4. State tax credits were made available to industries to assist them in partially recovering costs of installing pollution control facilities.

The 1969 legislature, in order to give even further emphasis to environmental quality programs, separated the Sanitary Authority's air and water quality control programs from the State Board of Health, added responsibility for solid waste disposal, and established these functions in a new and separate Department of Environmental Quality.

The mainstays of the Department of Environmental Quality's present water quality control program are the State-wide water quality standards established in 1967, 1968, and 1969, and the waste discharge permit program.

All waters in the State are covered by standards. Almost all major waters are covered by special stream standards which specify numerical limits for pH, temperature, dissolved oxygen (D.O.), turbidity, coliform bacteria (MPN), and certain chemical ions.

Secondary treatment is established as the minimum acceptable treatment prior to discharging sewage into any of Oregon's public waters. Where higher treatment than conventional secondary treatment is required, the standards also include specific treatment requirements and effluent limits.

All major point-source waste discharges, and many minor ones as well, are covered by specific waste discharge permits. All other known sources are covered by temporary permits which are being processed for specific permits as rapidly as possible.

Waste discharge permits generally contain definite limits on quantities and strengths of wastes that can be discharged and characteristically include numerical limits on pounds of Biochemical Oxygen Demand (BOD) and suspended solids, pH and bacteria, and where pertinent, temperature, color, turbidity and toxic elements.

Where present treatment or control is inadequate a specific, detailed program and timetable for providing fully adequate treatment is written into the waste discharge permit.

Oregon's water quality control statutes and standards may be found in Oregon Revised Statutes Chapter 449 and Oregon Administrative Rules, Chapter 340, Division 4.

The following General Water Quality Standards shall apply to all waters of the State except where they are clearly superseded by Special Water Quality Standards applicable to specifically designated waters of the State. No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause in any waters of the State:

1. The dissolved oxygen content of surface waters to be less than six (6) milligrams per liter unless specified otherwise by special standard.

2. The hydrogen-ion concentration (pH) of the waters to be outside the range of 6.5 to 8.5 unless specified otherwise by special standard.
3. The liberation of dissolved gases, such as carbon-dioxide, hydrogen sulfide or any other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such waters.
4. The development of fungi or other growth having a deleterious effect on stream bottoms, fish or other aquatic life, or which are injurious to health, recreation, or industry.
5. The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish.
6. The formation of appreciable bottom or sludge deposits of the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry.
7. Objectionable discoloration, turbidity, scum, oily sleek, or floating solids, or coat the aquatic life with oil films.
8. Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or be otherwise injurious to public health.
9. Any measurable increase in temperature when the receiving water temperatures are 64 degrees F or greater; or more than 0.5 degrees F increase due to a single-source discharge when receiving water temperatures are 63.5 degrees F or less; or more than 2 degrees F increase due to all sources combined when receiving water temperatures are 62 degrees F or less.
10. Aesthetic conditions offensive to the human senses of sight, taste, smell, or touch.
11. Radiosotope concentrations to exceed Maximum Permissible Concentrations (MPC's) in drinking water, edible fishes or shellfishes, wildlife, irrigated crops, livestock, and dairy products or pose an external radiation hazard.

12. The concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection to exceed one hundred and five percent (105%) of saturation, except when streamflow exceeds the 10-year, 7-day average flood.

NEVADA

Administration of the State water pollution control activities of Nevada is the concern of several State agencies. The Bureau of Environmental Health is designated as the water pollution control agency for the purpose of the Federal Water Pollution Control Act, and is charged with the protection of water resources, including regulation and standards for discharge and with taking actions to correct pollution. The Attorney General, with the consent of the Governor, may commence actions on suits necessary to prevent or restrain pollution of any public stream. The Fish and Game Commission is charged with the protection of streams, as may be necessary to carry on the program of fisheries and wildlife. The Department of Water Resources is charged with the regulations of surface and underground water as to volume and use. Water quality standards for the inter-State waters of the State of Nevada were approved by the Secretary of Interior on June 27, 1968.

Water pollution control regulations were adopted by the State Environmental Commission on October 23, 1973. Portions of Article 3 of the Regulations, referring to the administration of waste discharge permits, follows:

- 3.1.1 Any person, firm, industrial corporation or governmental entity who discharges or deposits wastes from a point source into waters of the State is, in the absence of an appropriate Department Waste Discharge Permit, in violation of these rules and regulations. The filing of an application requesting a waste discharge permit does not preclude any legal action provided by law to prevent or abate violation.
- 3.1.2 No person, firm, industrial corporation, municipal corporation, or governmental entity without first obtaining a permit from the Department shall:

- a. Construct, install, expand, or significantly modify any factory, mill, plant, or other industrial or commercial facility which will result in a waste discharge not authorized by an existing permit to waters of the State.
- b. Add extensions to existing municipal or privately owned sewer systems or provide new sewer service to existing or newly constructed buildings which could cause the raw sewage influent to the treatment plant to exceed the limits prescribed by the permit.
- c. Construct, install, or significantly modify any facilities designed or used for treatment or discharge of waste.
- d. Operate any facilities which function to treat or dispose of wastes.
- e. Discharge any wastes into any waters of the State.
- f. Conduct any industrial, commercial, or agricultural operation which will or may cause or tend to cause pollution of any waters of the State.
- g. Construct or use any new outlet for discharge of wastes into waters of the State.

3.1.3 In establishing a discharge standard, consideration shall be given, but shall not be limited by the following, to the end that the policy of the State as declared in Section 3(2) in A.B. 472 shall be effectively carried out:

- a. The effect of the discharge on the receiving waters and its beneficial use.
- b. The need for standards that specify by chemical, physical, biological, or other characteristics the extent to which pollution by various substances will not be tolerated.
- c. Requirements for establishing water quality standards promulgated from time to time by the Federal Environmental Protection Agency.

- 3.1.4 The cost of all testing and sampling as may be required and specified in writing by the Department shall be provided and paid for by the discharger.

Water quality standards for water receiving waste discharges are stated in Article 4 of the Water Pollution Control Regulations. Portions of the Article follow:

- 4.1 The quality of any waters receiving waste discharges shall be such that no impairment of the beneficial usage of water shall occur as the result of such discharge. Natural water conditions may on occasion be outside of the limits established by standards. The standards adopted herein relate to the condition of waters as affected by discharges relating to the activities of man.

4.1.1 Water Quality Criteria Related to Beneficial Uses

- a. Agricultural use. Water shall be suitable for stock watering and irrigation without treatment.
- b. Aquatic life. The water shall be suitable as a habitat for fish or other aquatic life indigenous to a body of water.
- c. Bathing and water contact sports. There shall be no evidence of man-made pollution, floating debris, sludge accumulation or similar pollutants.
- d. Boating and aesthetics. The water shall be free from visible floating, suspended, or settled solids arising from man's activities; sludge banks; slime infestation; heavy growth of attached plants, blooms or high concentrations of plankton, discoloration or excessive acidity or alkalinity that leads to corrosion of boats and docks; surfacants that foam when the water is agitated or aerated; excessive water temperatures.
- e. Drinking water supply. The water must be capable of being treated by conventional water treatment methods in order to comply with Nevada's drinking water standards.
- f. Industrial supply. The water must be treatable to provide a quality of water which is suitable for the intended use.

- g. Wildlife propagation. Shall be suitable for the propagation of wildlife and waterfowl without treatment.

4.1.2 Narrative Standards Applicable to All Waters of the State

- a. Free from substances attributable to domestic or industrial waste or other controllable sources that will settle to form sludge or bottom deposits in amounts sufficient to be unsightly, putrescent or odorous, or in amounts sufficient to interfere with any beneficial use of the water.
- b. Free from floating debris, oil, grease, scum, and other floating materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to be unsightly or in amounts sufficient to interfere with any beneficial use of the water.
- c. Free from materials attributable to domestic or industrial waste or other controllable sources in amounts sufficient to produce taste or odor in the water or detectable off-flavor in the flesh of fish, or in amounts sufficient to change the existing color, turbidity, or other conditions in the receiving stream to such degree as to create a public nuisance, or in amounts sufficient to interfere with any beneficial use of the water.
- d. Free from high temperature, biocides, organisms pathogenic to human beings, toxic, corrosive, or other deleterious substances attributable to domestic or industrial waste or other controllable sources at levels or combinations sufficient to be toxic to human, animal, plant, or aquatic life or in amounts sufficient to interfere with any beneficial use of the water.
- e. Radioactive materials attributable to municipal, industrial, or other controllable sources shall be the minimum concentrations which are physically and economically feasible to achieve. In no case shall materials exceed the limits established in the 1962 Public Health Service Drinking Water Standards (or later amendments) or 1/30th of the MPC values given for continuous occupational exposure in the National Bureau of Standards Handbook No. 69. The concentrations in water shall not result in accumulations of radioactivity in plants or animals that result in a hazard to humans or harm to aquatic life.

- f. No wastes from municipal or industrial or other controllable sources containing arsenic, barium, boron, cadmium, chromium, cyanide, fluoride, lead, selenium, silver, copper, and zinc that are reasonably amenable to treatment or control will be discharged untreated or uncontrolled into the waters of Nevada. In addition, the limits for concentrations of the chemical constituents will provide water quality consistent with the mandatory requirements of the 1962 Public Health Service Drinking Water Standards.

Article 4 continues with standards and classifications for additional public waters. Three classes are defined - Classes A, B, and C - relating to specific bodies of water. However, all of the specific water bodies occur outside the EAR area.

ALL STATES

Under provisions of the geothermal regulations, operational and environmental controls for the protection of water resources, aquatic plants and animals may be imposed by the supervisor or the authorized officer. Buffer strips will be required around all lakes, meadows, streams, and springs. The width of buffer strips will be determined in the field to insure adequate protection.

AIR

The lessee is required to meet State air quality standards and a permit issued by the State is required if gaseous discharges exceed minimum levels. State and Federal air quality standards for dust are 10 grams/M² per month. For hydrogen sulfide the standards are 0.03 ppm for a one hour average. Monitoring of air quality may be required by either the State or Supervisor.

TERRESTRIAL WILDLIFE, WILD HORSES, AND DOMESTIC ANIMALS

Temporary trail construction will be minimized. Restrictions and stipulations will be coordinated and combined with those previously discussed under Soils and Terrestrial Vegetation. Control of trail construction may be necessary to restrict or relocate away from special animal use areas.

Surface disturbance should not be allowed in or near sagegrouse strutting grounds and nesting areas. This breeding complex should be protected by buffer zones.

Antelope kidding grounds should be protected from disturbance and destruction by protective zones. Fences or other barriers which prevent free movement of antelope should not be constructed.

Critical deer winter range should be exempt from disturbance or destruction.

Waterfowl production areas should be free of disturbance during the nesting, brooding and molting period. A disturbance free zone around the production areas should be provided.

Raptor nesting sites should be protected from disturbance and the eyrie of any endangered raptor species should be held inviolate through the establishment of a protective zone.

Should other wildlife habitat of critical value be encountered, immediate action should be taken to prevent or minimize its destruction.

Surface disturbance adjacent to streams, lakes, ponds or other bodies of water should be **prohibited**. Wet meadows should be exempt from disturbance.

Specifications relating to the protection of critical wildlife habitat should be developed based upon site analysis. Subsequent to such analysis protective measures will be implemented with reference to published guidelines.

Development of semi-permanent features such as roads, wells, plants, etc., should occur on non-critical habitat areas.

Revegetation and restoration of disturbed areas should be accomplished where feasible. Unavoidable habitat loss should be mitigated by enhancement of an equal quantity of wildlife habitat elsewhere.

Potential hazards to wildlife (mud sumps, toxic waters, etc.) will be eliminated by implementation of appropriate safety measures.

Some areas will be designated as not suitable for surface occupancy with buffer strips for protection. Large areas in this category **may not be leased, or be leased subject to a no surface occupancy stipulation.**

Disposal sites containing toxic waters may be enclosed to exclude use by domestic and wild animals. Where waste water is suitable for consumption, provisions for safe entry and exit may be required by the Authorized Officer.

Self-closing gates or cattleguards may be required at fence openings to control livestock movement. Pipeline crossings may be required in selected areas by the authorized officer. Transmission lines should be designed to prevent raptor electrocution.

AESTHETICS AND LAND USE

Aesthetics will be required as design parameters during all phases of activity from exploration to close-out. Facilities will be kept to a low profile. Buildings will not be skylined on the landscape. Horizontal steamline expansion joints and mufflers may be required. Color of structures will be required to blend with natural landscape colors. Reflective metal surfaces will be prohibited. Electric transmission lines shall utilize wood towers or non-reflective steel, painted where necessary to harmonize with the landscape. Existing transportation corridors will be used if possible. Additional utility corridors identified in the Management Framework Plans (MFPs) will be utilized for new transmission line routes. Noise levels will not exceed 125 decibels at 25 feet.

ECOLOGICAL INTERRELATIONSHIPS

Minimal surface disturbance and revegetation as described in the section of this report on Soils and Terrestrial Vegetation will be required to mitigate adverse impacts on plant succession and food and community relationships. Grazing control, herbicides, mulches, and sprinkler irrigation (if water is available) may be required by the authorized officer to accomplish revegetation.

Changes in food relationships due to the loss of vegetation will be temporary for those areas successfully reseeded with native vegetation. Where native vegetation cannot be reestablished, other species of suitable vegetation will be established. Areas occupied by roads, wells, buildings, and storage will be deprived of habitation by plants and animals for the duration of geothermal development.

Minimal surface disturbance appears to be the only practical mitigation in dry basin areas occupied by salt desert shrubs. Areas cleared of vegetation may be invaded by the undersirable Halogeton glomeratus. Revegetation with native or unnative desirable species appears unlikely.

Destruction of meadows will be minimized by use of buffer strips around water features and enforcement of State-Federal pollution control regulations. Special animal use areas will be avoided where possible or protected with buffer strips.

EDUCATIONAL/SCIENTIFIC RESOURCES

Mitigation of potential adverse impacts on cultural resources can be accomplished through enforcement of applicable Federal laws, avoidance of sensitive areas, and salvage and/or preservation of important sites.

FEDERAL LAWS AND ORDERS GOVERNING CULTURAL RESOURCES

Declaring that it is the policy of the Federal Government "to preserve important historic, cultural, and natural aspects of our national heritage," the National Environmental Policy Act (NEPA) directs that "to the fullest extent possible . . . the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act." Compliance with NEPA therefore includes a demonstration of compliance during project planning and execution with other measures for the protection of environmental values. The following Acts and Executive Orders are directly related to the protection of cultural resources:

The Antiquities Act of 1906 (34 Stat. 225)

Provides for the protection of historic or prehistoric remains, "or any object of antiquity," on Federal lands; establishes criminal sanctions for unauthorized destruction or appropriation of antiquities; authorizes the President to declare by proclamation national monuments; and authorizes the scientific investigation of antiquities on Federal lands, subject to permit and regulations.

The Historic Sites Act of 1935 (49 Stat. 660)

Authorizes the programs that are known as the Historic American Buildings Survey, the Historic American Engineering Record, and the National Survey of Historic Sites and Buildings; authorizes the establishment of national historic sites and otherwise authorizes the preservation of properties "of national historical or archaeological significance;" authorizes the designation of national historic landmarks; establishes criminal

sanctions for violation of regulations pursuant to the Act; authorizes interagency, intergovernmental, and interdisciplinary efforts for the preservation of cultural resources; and other provisions.

The Reservoir Salvage Act of 1960 (74 Stat. 220)

Provides for the recovery and preservation of "historical and archaeological data (including relics and specimens)" that might be lost or destroyed as a result of the construction of dams, reservoirs, and attendant facilities and activities.

The National Historic Preservation Act of 1966 (80 Stat. 915)

Declares a national policy of historic preservation (defined in the Act as "the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or culture"), including the encouragement of preservation on the State and private levels; directs the expansion of the National Register of Historic Places to include cultural resources of State and local as well as national significance; authorizes matching Federal grants to States and the National Trust for Historic Preservation for acquisition and rehabilitation of National Register properties; establishes an Advisory Council on Historic Preservation; provides procedures in Section 106 for Federal agencies to follow in the event a proposal may affect a National Register property.

Specifically, Section 106 states: "The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation established under title II of this Act as a reasonable opportunity to comment with regard to such undertaking."

Executive Order 11593, "Protection and Enhancement of the Cultural Environment", May 13, 1971 (36 F.R. 8921)

In furtherance of the purpose and policies of NEPA, the National Historic Preservation Act, the Historic Sites Act, and the Antiquities Act, asserts that "the Federal Government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation;" directs Federal agencies to assure the preservation of cultural resources

in Federal ownership, and "institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural, or archaeological significance;" orders Federal agencies to nominate to the National Register all properties under their control or jurisdiction that meet the criteria for nomination; directs them to exercise caution to assure that cultural resources under their control are not inadvertently damaged, destroyed, or transferred before the completion of surveys to locate and identify properties worthy of nomination to the National Register; directs agencies to provide for recording of National Register properties that will be unavoidably altered or destroyed as a result of Federal action; directs agencies to undertake other measures to ensure the preservation of cultural resources under their control; and orders the Secretary of the Interior to undertake certain advisory responsibilities in compliance with the Order.

Section 2 of Executive Order 11593 states: "in cooperation with the liaison officer for historic preservation for the State or territory involved, locate, inventory, and nominate to the Secretary of the Interior all sites, buildings, districts, and objects under their jurisdiction or control that appear to qualify for listing on the National Register of Historic Places."

"(b) exercise caution during the interim period until inventories and evaluation required by subsection (a) are completed to assure that any federally owned property that might qualify for nomination is not inadvertently transferred, sold, demolished or substantially altered. The agency head shall refer any questionable actions to the Secretary of the Interior for an opinion respecting the property's eligibility for inclusion on the National Register of Historic Places. The Secretary shall consult with the liaison officer for historic preservation for the State or territory involved in arriving at his opinion. Where, after a reasonable period in which to review and evaluate the property, the Secretary determines that the property is likely to meet the criteria prescribed for listing on the National Register of Historic Places, the Federal agency head shall reconsider the proposal in light of national environmental and preservation policy. Where, after such reconsideration, the Federal agency head proposes to transfer, sell, demolish or substantially alter the property he shall not act with respect to the property until the Advisory Council on Historic Preservation shall have been provided an opportunity to comment on the proposal."

HISTORIC ROADS AND TRAILS

Surface occupancy will be prohibited on portions of roads and trails containing visible remnants of past use, landmarks, or sign posts along the way, and prominent locales mentioned in historical records which are essentially unchanged or capable of restoration to former appearance. Buffer strips will be established in the field for each feature or section designated for non-occupancy.

ARCHAEOLOGICAL RESOURCES

Mitigation measures consist of non-occupancy or salvage under the direction of a qualified archaeologist acceptable to the authorized officer. The first measure will protect the occupation sites discovered thus far from disturbance by geothermal development. After termination of the lease, however, the area will again be subject to vandalism, grazing, and casual uses. In contrast to no surface occupancy, salvage operations would increase knowledge of historic or prehistoric periods, rescue from further destruction non-renewable portions of past human environments, and release a portion of the land for development of a nationally significant resource.

The antiquities stipulation listed below will replace Section 18 of all Geothermal Resource Leases (Form 3200-21). This same stipulation (with words lease, lessee, and lessor changed to Notice, Undersigned, and Authorized Officer) will be added to the Notice of Intent to Conduct Geothermal Resource Explorations (Form 3200-9) when surface disturbance of any sort is intended. Drilling of shallow holes as defined in Geothermal Resource Operational Order No. 1 (Federal Register Volume 39, No. 190, pp. 35192-35193, September 30, 1974) will be excluded from this stipulation provided that such holes are immediately adjacent to existing roads and trails and that the drill sites has been previously inspected and approved by the authorized officer.

SECTION 18 ANTIQUITIES AND OBJECTS OF HISTORIC VALUE

Prior to any operations under this lease, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to make an archaeological survey of the land to be disturbed or occupied. A certified statement, signed by the qualified archaeologist, setting out the steps taken in the survey and the findings thereof as to the existence of antiquities or other objects of historic or scientific interest, shall be submitted to the Authorized Officer. If the statement indicates the existence of such objects which might be disturbed by operations under this lease, the Lessee shall take such steps as may be required by the Authorized Officer,

including archaeological salvage. 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 Lessor or the surface owner.

The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific value or 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 with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433).

V. ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED

Subsidence cannot be reversed and engineering or agricultural features may not be completely rectified if subsidence occurs. When other conditions warrant, land subsidence areas, because of the unique topography created, could be rezoned for recreation such as camping, picnicking, golfing, hiking, biking, or off-road vehicle use.

If increased seismicity occurred, it would raise the probability of a damaging earthquake. While most of the areas included in this EAR are remote, the principal geothermal areas - Crump Geyscr and Lake City KGRAs - are close to habitation centers which could suffer damage from a major earthquake.

Topsoil and vegetation will be lost for the duration of use beneath roads, wells, disposal ponds, power plants and other structures. Revegetation to native species will be only partially effective causing a loss of terrestrial vegetation with associated forage value reduction and wildlife habitat degradation. Areas cleared of vegetation in dry basin areas may be invaded by the undesirable Haloxylon glomeratus. Revegetation with native or introduced species appears unlikely. Soil depth and structural changes will be permanent.

Slight soil losses will be experienced due to minor increases in wind and water erosion during surface disturbance activities.

Primitive values would be altered by geothermal resource development in remote unspoiled areas.

Discharge characteristics of hot springs may change in areas of development.

An increase in noxious gas content will occur in local areas adjacent to wells and power plants. State air quality standards may occasionally be exceeded, particularly during periods of temperature inversion. A nuisance effect from hydrogen sulfide odor may persist.

Air temperatures will be increased in the immediate vicinity of the plant during operation.

Increased noise levels and improved vehicular access in previously undisturbed wildlife habitat may drive the more sensitive species from the immediate area. This is expected to be least prevalent within the irrigated basins because of adaptability of wildlife in these areas.

Wild horses will vacate an area of geothermal development. Critical areas have not been established.

Visual impacts will result from increased distraction from the natural scene, especially within the basins. Although actual plant sites may be relatively small, the size of the facility renders it quite visible. Impacts will be observed most in irrigated basins because they contain the population and transportation routes allowing such observation; however, in dry basins, where there is even less density of land use, geothermal operations will readily attract the eye.

Significant indirect damage in the form of increased vandalism of archaeological resources is likely to result from increased access. Areas II and IV (see Map 7) are the most susceptible to vandalism although all areas appear to contain values which make them eligible for nomination to the National Register of Historic Places.

VI. ALTERNATIVES TO THE PROPOSED ACTION

NO LEASING

There would be no exploration or development of Federally owned geothermal resources under this alternative. That portion of the potential geothermal generating capacity applicable to public lands would have to be provided from alternative sources. Potential production of fresh water or mineral by-products also would not materialize. Development of private lands could be even more intensive. Where private lands are adjacent to public lands, geothermal resources of the adjacent public lands could be depleted even though no development took place on the public lands. Surface environmental impacts associated with geothermal exploration and development would not occur if public lands were not leased but problems associated with potential subsurface effects, such as subsidence, could occur as a result of operations on adjacent private lands. The more intensive development of private land resources could result in less efficient overall use of geothermal resources of the area.

LEASING ONLY LANDS OF LOW ENVIRONMENTAL SENSITIVITY

Acceptance of this alternative would confine geothermal development to those areas with no significant residual adverse impacts. However, geothermal exploration of portions of these lands may be allowed with environmental safeguards as set forth below. Archaeological Sensitive Areas II, III, IV (Map 9) and Critical Wildlife Habitat Areas (Map 6) would temporarily be excluded from leasing. Map 12, Environmentally Sensitive Areas, delineates those areas effected by this alternative.

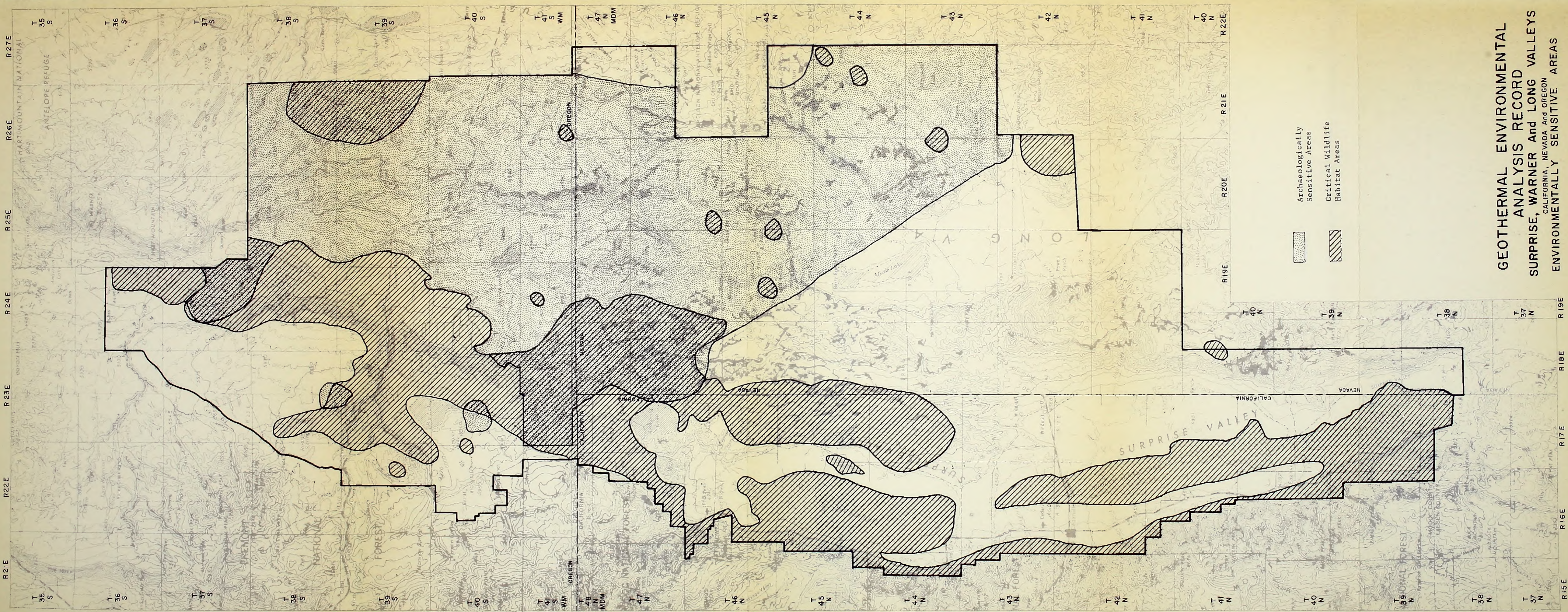
Withdrawal of Archaeological Sensitive Areas (Map 12) from geothermal leasing is necessary until potentially valuable archaeological resources within these areas are studied and delineated. Then determinations regarding nomination to the National Register and land-use decisions will be feasible. These actions are in accordance with Executive Order 11593, and Federal policies and orders requiring preservation of the cultural and historic environment of the Nation. Upon reviewing the results of future archaeological studies of Sensitive Archaeological Areas, a new EAR or updated supplement to this document could be developed in order to provide a complete analysis of the effects of geothermal leasing in all or portions of the areas.

Current preclusion of critical wildlife habitat areas from geothermal leasing is needed to protect significant habitat from deterioration. Further documentation may be necessary to analyze the effects of each specific leasing proposal contemplated in a critical wildlife habitat area. The degree of habitat deterioration and availability of opportunities for habitat enhancement vary widely and are dependent on the unique relationship between a specific leasing proposal and a specific critical habitat area.

Geothermal exploration of portions of the lands shown on Map 12 would be allowed under this alternative. Exploratory operations are defined in Proposed Geothermal Resources Operational Order No. 1 (See Appendix III).

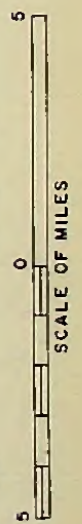
Three types of exploration operations are defined in this order: (1) casual use, (2) geophysical exploration, and (3) drilling of shallow holes. Sufficient environmental safeguards exist in the terms and conditions of Form 3200-9 (Notice of Intent to Conduct Geothermal Resource Exploration Operations), and in the provisions developed in this EAR to allow casual use and passive geophysical exploration. Surface disturbance does not occur with these operations and the land in these areas is not restricted from other forms of casual use.

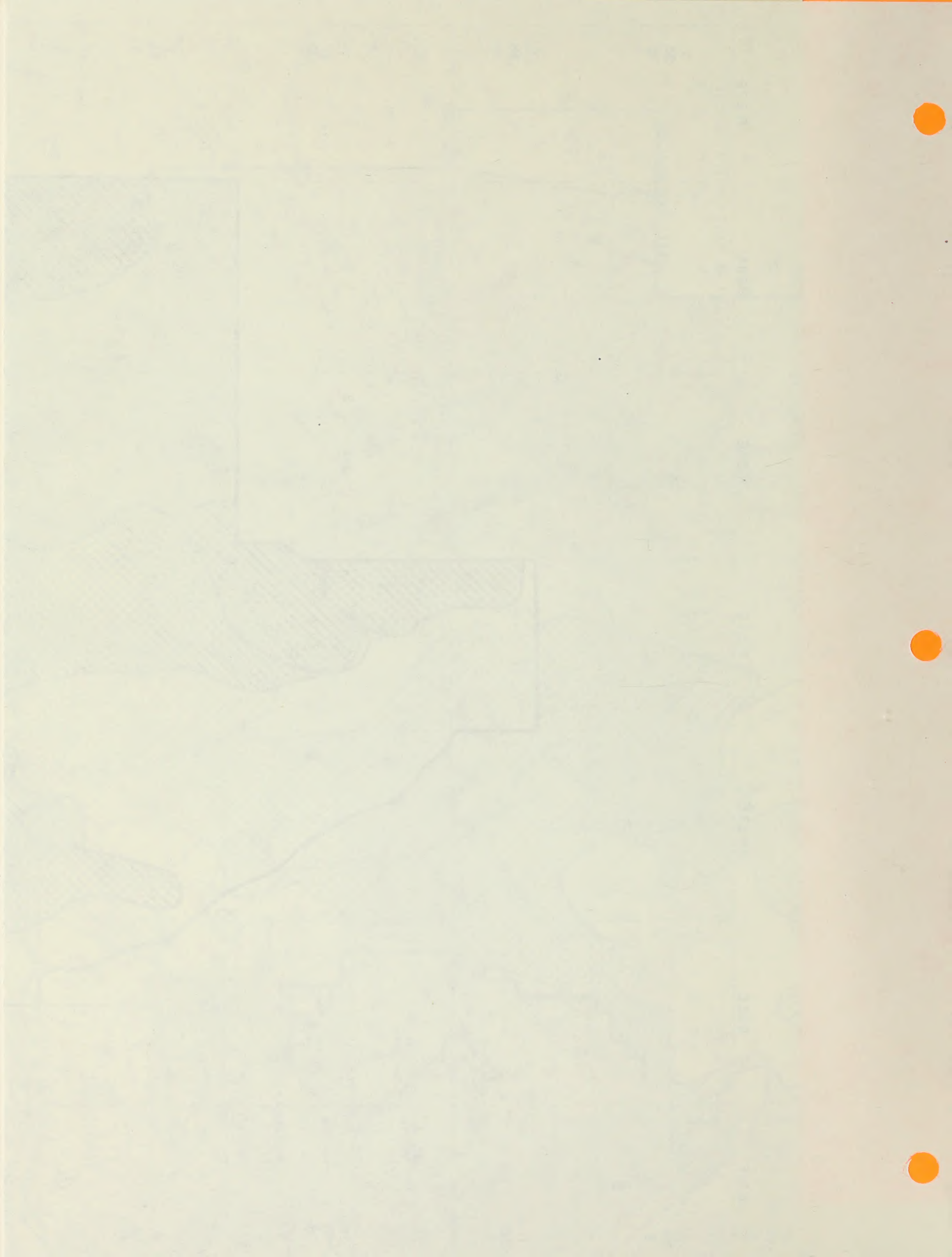
Restrictions to insure adequate environmental safeguards could be placed on surface disturbing operations such as drilling of shallow holes and trail building. Trail building can be restricted to maintenance of existing trails and grading in areas previously disturbed and determined to be free of archaeological resources and sensitive wildlife habitat. Drilling of shallow holes can be restricted to existing roads, trails, and disturbed areas with access. On-site inspection should be performed to insure environmental safeguards before drill-site approval by the Authorized Officer. The effect of this disposition is to restrict surface disturbance activities to areas of existing disturbance along established corridors and during periods of non critical wildlife occupancy.



Archaeologically Sensitive Areas
 Critical Wildlife Habitat Areas

**GEOHERMAL ENVIRONMENTAL
 ANALYSIS RECORD**
SURPRISE, WARNER AND LONG VALLEYS
CALIFORNIA, NEVADA AND OREGON
ENVIRONMENTALLY SENSITIVE AREAS





VII. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Geothermal resource development implies a change in land use from the present situation toward an industrial complex. The leasing of lands for geothermal resource development will involve the commitment of a portion of the geothermal heat, water, land, and resources of the sites involved. Over a period of 20 to 50 years (depending on the extent of the resource) production capacity would be depleted until further operation would not be economically feasible. The leases would then terminate, facilities would be dismantled, and the land restored. The combination of restoration and natural vegetative recovery, over time, should result in a near natural setting. The lands would then return to their former productivity or be available for other appropriate uses.

It is particularly significant to recognize that the geothermal heat is a wasting resource that otherwise would be dissipated over time from the surface of the earth to the atmosphere with little or no identifiable benefit. By contrast, development of this resource in an environmentally acceptable manner can have substantial benefit by affording a relatively clean power generation energy source. While depletion of some of the heat within the geothermal reservoir would occur over the period of operations, no permanent adverse effect is anticipated. Over time, perhaps a hundred or more years, natural heat transfer within the earth might even return the heat content to nearly the same intensity as existed before utilization. At some time in the relatively distant future it might be possible for such areas to again be used for similar productivity. Any use of by-product minerals probably would represent mineral recovery that otherwise would never have occurred. Such use would preclude the need to obtain a like amount of such materials from other sources. Where waste waters are reinjected, the associated mineral values would be returned to the earth.

The generation of power would be the principal use of geothermal resources. However, there also is a good possibility that by-products of water or minerals might be possible, at least at some locations. In terms of total energy requirements, the contribution of geothermal resources may be relatively small but it can be important, particularly on a local basis.

Geothermal resources may contribute to the production of chemicals from the brines and fresh water through desalinization. In many cases the geothermal resources may not be of sufficient temperature to be useful for electric power production but will be useful for space heating or industrial processing.

Geothermal fluids also may be of sufficient purity to be used directly for irrigation or other purposes after the fluid has been cooled. This could provide a source of fresh water during the period of power operation and it is possible that the wells could continue to be used even after power production has ended.

Under the proposed controls for waste disposal, degradation of surface and fresh groundwaters is not expected to be significant, especially in a long-term sense. Mishaps or accidents may have short-term impacts that, depending upon the volume and nature of discharge involved, could be serious, particularly on aquatic resources. However, corrective measures such as dilution, diversion of waste waters from streams, capturing water in impoundments, etc., should provide adequate measures against serious or long-term impacts. Natural pollution of groundwater exists in some areas. Other areas will probably be discovered. The pollution results from the upward movement of geothermal fluids into groundwater aquifers which could be reversed by the geothermal resource.

Land uses during the period of production operations would be changed to industrial operations from fish and wildlife habitat, recreation, grazing, forests, agriculture, etc. However many such uses could continue on a reduced compatible basis. Wells, pipelines, power plants, by-product facilities, and power transmission facilities would dominate the local area. Public access in the vicinity of such facilities would have to be restricted to protect the public and the facilities. Development and production of geothermal resources generally are not expected to have any lasting or inhibiting effects on the use of the land after geothermal operations have been concluded and the facilities have been removed.

Geothermal resource development could result in certain localized adverse impacts on fish and wildlife and their habitat. There could be a loss of wildlife habitat in the immediate vicinity of installations, minor loss of birds from collision with and/or electrocution on electric distribution lines, and potential danger to fish and other aquatic life from toxic fluids in the water. In addition, restrictions of public access would reduce hunting and related recreation opportunities in the vicinity of installations. A change in the natural setting of lands could result in long-range effects on wildlife by rendering some lands less desirable for wildlife habitat purposes. Wildlife values probably would reestablish themselves as soon as the operations are terminated. In some instances they may even benefit from this use.

Geothermal development requires substantial investment in drilling wells and construction of roads, pipelines, power and by-product plants, and transmission lines. Such investments result in an increased tax base for the area of development. However, the labor-intensive phase

is short-term, occurring primarily during field development, and would not result in significant changes in population distribution. The economic benefits probably would be more in the nature of transfer benefits as a corresponding power generation capacity would have to be developed elsewhere if the geothermal resources were not developed.

There could be some aesthetic or social impacts in terms of increased noise levels, odors, additional traffic, etc., even though all of the environmental stipulations of the permits are met. These would be minor but objectionable in terms of preoperational conditions. Since such operations could continue for a period of 25 to 50 years, they would exist during most of the lifetime of local residents or users of these areas.

Archaeological values will be destroyed by intensive geothermal development if mitigating and enhancement measures are not followed. Continuation of the present situation is also unfavorable to preservation of archaeological values because of steady vandalism by the general public. In some respects the long-term outlook for protection of archaeological values is better if geothermal development occurs because mitigating and enhancing measures would be required.

VIII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This topic is generally covered in the preceding section. The principal commitment of resources would be the depletion of thermal energy and water from the geothermal reservoir. Both of these resources are renewable, but, however, not within the life span of a specific project. Once they were depleted to the point where economic production could not continue, production would stop, facilities would be removed, and the area would be restored to as near a natural state as is practicable.

Compaction and resulting land subsidence that may result from the removal of geothermal fluids could have irreparable consequences. An equivalent amount of water storage would be lost. In local communities - Eagleville, Cedarville, Lake City, Fort Bidwell, Adel, and Plush - grade adjustments of roads, drainage and public utilities might be required to compensate for such subsidence. Drainage adjustments in areas with irrigated agriculture, primarily Warner and Surprise Valleys, might be required. If seismic action should result from fluid withdrawal or reinjection, there could be considerable damage, depending upon the severity of such action.

If archaeological values within the analysis area are disturbed or destroyed by the proposed action, they cannot be duplicated or restored to a condition that would provide the scientific information they possessed nor can the site be used for recreation in the form of outdoor education.

Authentic evidence of the Lassen-Applegate Trail or the Oregon Central Military Road cannot be duplicated once it has been destroyed or disturbed.

Dedication of the land surface to industrial uses generally will result in land areas being used for wells, associated surface facilities, power plants, roads, and transmission lines. While not of a permanent nature, such uses will represent a commitment for a period of 25 to 50 years. This is a relatively long period in terms of human life-times and related alternative uses of these lands and their other resources. Human energy, money, and construction materials are other resources irretrievably committed in the development of geothermal steam. However, to the extent that these resources represent a commitment to increased power generating capacity to meet regional or National needs, their consumption would be necessary regardless of the technology utilized in the generating process.

IX. PERSONS, GROUPS, AND GOVERNMENT AGENCIES CONSULTED

State of California

Resources Agency
Sacramento

Department of Water Resources
Redding

Division of Oil and Gas
Sacramento

University of California
Dr. James O'Connell
Archaeologist
Riverside

California Regional Water Quality Control Board
South Lake Tahoe

Department of Fish and Game, Redding
State Clearinghouse, Sacramento

State of Nevada

Desert Research Institute
Dr. Don D. Fowler, Archaeologist
Reno

Nevada State Museum
Carson City

University of Nevada
Dr. Donald Hardesty, Anthropologist
Reno

Bureau of Environmental Health
Carson City

State of Oregon

Executive Director
Oregon Environmental Council
Portland

Assistant to the Governor
Natural Resources
Salem

Department of Geology and Mineral Industries
Portland

State Water Resources Board
Salem

State Game Commission
Portland

Division of State Lands
Salem

State Soil & Water Conservation Commission
Salem

Clearing House
Executive Department
Capital Building
Salem

Curator of Archaeology
Museum of Natural History
University of Oregon
Eugene

State Engineer's Office
Salem

Department of Fisheries and Wildlife
Oregon State University
Corvallis

United States Department of Agriculture

Fremont National Forest
Lakeview, Oregon

Modoc National Forest
Alturas, California

Soil Conservation Service
Lakeview, Oregon

United States Department of the Interior

Geological Survey
Conservation Division
Menlo Park, California

Geological Survey
Water Resources Division
Sacramento, California and
Portland, Oregon

Bureau of Sport Fisheries and Wildlife
Lakeview, Oregon

County Governments

Lake County Planning Commission
Lakeview, Oregon

Lake County Commissioners
Lakeview, Oregon

Lake County Extension Agent
Lakeview, Oregon

Modoc County Planning Commission
Alturas, California

Individuals and Groups

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1436 Sargent Avenue
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Mr. Henry O'Keeffe
Adel, Oregon 97640

Mr. George Reed
Oregon Wildlife Federation
811 S.W. 6th Avenue
Room 216
Portland, Oregon 97205

Oregon High Desert Study Group
c/o Coleen Gooding
St. Paul, Oregon 97137

OSPIRG
408 S.W. 2nd
Portland, Oregon 97204

Sierra Club
P.O. Box 1774
Klamath Falls, Oregon 97601

United States Department of the Interior
Geological Survey
Conservation Division
Bldg 100, California

Geological Survey
Water Resources Division
Sacramento, California 95833
Portland, Oregon

Division of Geology and Mineral
Resources, Oregon

County Commissioners

Clatsop County Planning Commission
Astoria, Oregon

Clatsop County Commissioners
Astoria, Oregon

Clatsop County Planning Dept
Astoria, Oregon

Clatsop County Planning Commission
Astoria, California

Individuals and Firms

Mr. Leo Hovland
1400 West 14th
14th Street
Klamath Falls, Oregon 97601

Mr. Larry O'Leary
Astoria, Oregon 97103

Mr. George Reed
Oregon Wildlife Federation
411 S.W. 4th Avenue
Room 210
Portland, Oregon 97204

X. INTENSITY OF PUBLIC INTEREST

The proposed geothermal leasing program for Federal lands within the analysis area has raised a moderate amount of interest by the public. Individual public contacts concerning the geothermal program have indicated an optimism by the general public and local Governments about the program. The Lake County Examiner has had editorials and articles favoring geothermal development in Lake County, Oregon. A slide program about geothermal development was presented to the Lake County Planning Commission recently and the feeling of the Commission was optimistic also. Some members of the Commission were dismayed at the absence of local revenue returns by the program.

Public information meetings concerning the geothermal program were held in conjunction with Management Framework Planning (MFP) meetings by the Lakeview and Susanville Districts during the latter part of 1974. Three meetings were held to specifically bring the geothermal leasing of the area covered by this EAR before the public and obtain comments. These meetings were held in Adel, Lakeview, and Cedarville. Attendance was limited and few comments were received. Those who did attend expressed a favorable attitude toward geothermal development.

To date there has been no opposition to the geothermal leasing program, however, most people when asked for their opinion about the program admit they have little knowledge of what it is going to be and feel that they are not prepared to answer adequately.

XI. PARTICIPATING STAFF

Bureau of Land Management

Lakeview District Office

Christopher J. Broili, Geologist

Larry A. Doughty, Wildlife Specialist

Dennis H. Hill, Recreation and Public Affairs Specialist

Susanville District Office

Robert A. Barney, Realty Specialist

Robert W. Bright, Natural Resource Specialist

Arnold E. Bullock, Range Conservationist

John V. Roberts, Geologist

George H. Weiskircher, Outdoor Recreation Planner

James C. Wood, Archaeologist

U.S. Geological Survey (Menlo Park, California)

William H. Lee, Geologist

XII. INTERDISCIPLINARY TEAM RECOMMENDATIONS

It is the recommendation of the Interdisciplinary Team that Alternative 2 - Leasing Only Lands of Low Environmental Sensitivity - be adopted. This alternative provides sufficient protection and mitigation to allow the implementation of the proposal in a portion of the analysis area.

It is further recommended that, in accordance with Executive Order 11593, BLM accelerate procedures to inventory and evaluate the archaeological resources located within the deleted portion of the analysis area (Archaeological Sensitive Areas - Map 12). The Historic Preservation Officers for the respective three States should be contacted with reference to completing the evaluation and nomination to the National Register.

A new Environmental Analysis Record, or an appendix to this EAR, may then be prepared to determine the effects of geothermal leasing on Archaeological Sensitive Areas (Map 12). Furthermore, additional documentation of the effects of specific leasing proposals on Critical Wildlife Habitat Areas (Map 12) should be undertaken if leasing is contemplated in critical wildlife habitat areas.

Based on the foregoing analysis, an Environmental Impact Statement need not be prepared.

XIII. SIGNATURES

John V. Roberts
EAR Interdisciplinary Team Leader

JAN 24 1975
Date

Robert W. Bright
Environmental Coordinator, Susanville

JAN 24 1975
Date

W. Dean Bills
Susanville District Manager

JAN 24 1975
Date

Maurice Le Noue
Lakeview District Manager

JAN 24 1975
Date

CONCUR WITH INTERDISCIPLINARY TEAM RECOMMENDATIONS

YES / NO

yes /
yes /

W. Dean Bills
Susanville District Manager
Maurice Le Noue
Lakeview District Manager

TABLE 22
ENVIRONMENTAL ANALYSIS WORKSHEET

REMARKS: Environmental Impacts of the Proposed Action:
 0 - No Impact M - Medium Impact X - Unknown + - Beneficial Impact
 L - Low Impact H - High Impact - - Adverse Impact

STAGES OF IMPLEMENTATION	EXPLORATION				DEVELOPMENT						OPERATION				CLOSE-OUT		REMARKS
	Airborne	Off-Road Vehicle Travel	Road & Trail Construction	Drilling	Rehabilitation	Road Construction	Drill Site Development	Geothermal Pipelines	Plant Construction	Electric Transmission Lines	Rehabilitation	New Drill Sites	Misce. of Existing Facilities	Waste Disposal	Production	Removal of Surface Equip		Surface Reclamation & Restoration
I. NON-LIVING COMPONENTS																	
A. AIR																	
Air Movement Patterns	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	0	0
Temperature	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0
Particulate Matter	0	-L	-L	-L	0	-L	-L	-M	0	-L	+L	0	0	0	0	-L	+M
Noxious Gases	0	-L	-L	-L	0	0	0	0	0	0	0	X	X	X	X	0	0
Non-ionizing Radiation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0
B. LAND																	
Soil Depth	0	0	-L	-L	+L	-M	-L	0	0	0	0	0	0	0	0	-L	0
Soil Structure	0	-L	-L	-L	+L	-M	-L	0	0	0	0	0	0	0	0	-L	0
Soil Erosion	0	-L	-L	-L	+M	-M	-L	0	0	0	0	0	0	0	0	-L	0
Geologic Structure	0	0	0	0	0	-M	-L	0	0	0	+L	0	0	0	0	-L	+M
Land Use Compatibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soil Pollutant Properties	0	0	-L	-L	+L	+L	0	0	0	0	0	0	0	0	0	0	+H
C. WATER																	
Sediment Load	0	-L	-L	-L	0	-L	-L	0	0	0	0	0	0	0	0	0	0
Hydrologic Cycle	0	0	0	X	0	-L	0	-L	0	0	0	0	0	0	0	0	0
Dissolved Solids	0	0	0	X	0	0	0	0	0	0	X	0	0	0	X	0	0
Toxic Chemicals	0	0	0	X	0	0	0	0	0	0	0	0	0	-L	-L	X	0

X refers to unknown chemical quality of geothermal fluids.

ENVIRONMENTAL ANALYSIS WORKSHEET

REMARKS: Environmental Impacts of the Proposed Action:

0 - No Impact M - Medium Impact X - Unknown + - Beneficial Impact
 L - Low Impact H - High Impact - - Adverse Impact

STAGES OF IMPLEMENTATION	EXPLORATION				DEVELOPMENT						OPERATION			CLOSE-OUT		REMARKS		
	Airborne	Off-Road Vehicle Travel	Road & Trail Construction	Drilling	Rehabilitation	Road Construction	Drill Site Development	(Geothermal) Pipelines	Plant Construction	Electric Transmission Lines	Rehabilitation	New Drill Sites	Mice, of Existing Facilities	Waste Disposal	Production		Removal of Surface Equip	Surface Reclamation & Restoration
C. WATER (continued)																		
Temperature												0	0	X	X	0	0	0
Dissolved Oxygen	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	+L	
Radiochemical Contam.	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	
PH	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	
II. LIVING COMPONENTS																		
A. PLANTS (AQUATIC)																		
ALL	0	0	0	0	0	-L	-L	0	0	0	0	0	0	X	0	0	+L	
B. PLANTS (TERRESTRIAL)																		
ALL	0	-L	-L	-L	+L	-L	-L	-L	-L	0	+L	-L	0	X	0	-L	+L	
C. ANIMALS (AQUATIC)																		
ALL	0	-L	-L	-L	0	-L	-L	0	0	0	+L	-L	0	X	0	0	0	
D. ANIMALS (TERRESTRIAL)																		
All Domestic & Wildlife	0	-L	-L	-L	+L	-L	-L	0	-L	0	+L	-L	0	X	0	0	+L	

ENVIRONMENTAL ANALYSIS WORKSHEET

REMARKS: Environmental Impacts of the Proposed Action:
 0 - No Impact M - Medium Impact X - Unknown + - Beneficial Impact
 L - Low Impact H - High Impact - - Adverse Impact

STAGES OF IMPLEMENTATION	EXPLORATION					DEVELOPMENT							OPERATION				CLOSE-OUT		REMARKS
	Airborne	Off-Road Vehicle Travel	Road & Trail Construction	Drilling	Rehabilitation	Road Construction	Drill Site Development	(Geothermal) Pipelines	Plant Construction	Electric Transmission Lines	Rehabilitation	New Drill Sites	Mice. of Existing Facilities	Waste Disposal	Production	Removal of Surface Equip	Surface Reclamation		
III. ECOLOGICAL INTERRELATIONSHIPS																			
A. ECOLOGICAL PROCESSES																			
Succession	0	-L	-L	-L	X	-L	-L	0	-L	0	X	-L	0	X	0	0	X	0	
Food Relationships	0	0	0	0	0	-L	0	0	-L	0	X	-L	0	X	0	0	+L	0	
Community Relationships	0	0	0	0	0	-L	0	0	-L	0	X	-L	0	X	0	0	0	0	
IV. HUMAN VALUES																			
A. LANDSCAPE CHARACTER																			
Harmonious	0	0	-L	-L	+L	-L	-L	0	-L	-M	0	X	0	X	X	+H	+L	0	
Accentuating	0	X	X	X	X	0	0	0	0	-M	0	0	0	0	0	0	0	0	
B. SOCIOCULTURAL INTERESTS																			
Educational/Scientific	0	0	-M	+M.	0	X	0	X	0	0	0	0	0	0	0	0	0	0	
Social Welfare	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	0	0	
Attitudes & Expectations	0	0	0	+L	0	X	X	X	X	X	0	0	0	0	0	0	0	0	
Local Regulatory Struct.	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	0	0	
Cultural Values	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Year	Month	Day	Time	Location	Activity	Remarks
1970	Jan	1	08:00	...	...	...
1970	Jan	2	08:00	...	...	...
1970	Jan	3	08:00	...	...	...
1970	Jan	4	08:00	...	...	...
1970	Jan	5	08:00	...	...	...
1970	Jan	6	08:00	...	...	...
1970	Jan	7	08:00	...	...	...
1970	Jan	8	08:00	...	...	...
1970	Jan	9	08:00	...	...	...
1970	Jan	10	08:00	...	...	...
1970	Jan	11	08:00	...	...	...
1970	Jan	12	08:00	...	...	...
1970	Jan	13	08:00	...	...	...
1970	Jan	14	08:00	...	...	...
1970	Jan	15	08:00	...	...	...
1970	Jan	16	08:00	...	...	...
1970	Jan	17	08:00	...	...	...
1970	Jan	18	08:00	...	...	...
1970	Jan	19	08:00	...	...	...
1970	Jan	20	08:00	...	...	...
1970	Jan	21	08:00	...	...	...
1970	Jan	22	08:00	...	...	...
1970	Jan	23	08:00	...	...	...
1970	Jan	24	08:00	...	...	...
1970	Jan	25	08:00	...	...	...
1970	Jan	26	08:00	...	...	...
1970	Jan	27	08:00	...	...	...
1970	Jan	28	08:00	...	...	...
1970	Jan	29	08:00	...	...	...
1970	Jan	30	08:00	...	...	...
1970	Jan	31	08:00	...	...	...

P - 1st phase, 0 - 1000 ft
 S - 2nd phase, 0 - 1000 ft
 T - 3rd phase, 0 - 1000 ft
 U - 4th phase, 0 - 1000 ft
 V - 5th phase, 0 - 1000 ft
 W - 6th phase, 0 - 1000 ft
 X - 7th phase, 0 - 1000 ft
 Y - 8th phase, 0 - 1000 ft
 Z - 9th phase, 0 - 1000 ft
 AA - 10th phase, 0 - 1000 ft
 AB - 11th phase, 0 - 1000 ft
 AC - 12th phase, 0 - 1000 ft
 AD - 13th phase, 0 - 1000 ft
 AE - 14th phase, 0 - 1000 ft
 AF - 15th phase, 0 - 1000 ft
 AG - 16th phase, 0 - 1000 ft
 AH - 17th phase, 0 - 1000 ft
 AI - 18th phase, 0 - 1000 ft
 AJ - 19th phase, 0 - 1000 ft
 AK - 20th phase, 0 - 1000 ft
 AL - 21st phase, 0 - 1000 ft
 AM - 22nd phase, 0 - 1000 ft
 AN - 23rd phase, 0 - 1000 ft
 AO - 24th phase, 0 - 1000 ft
 AP - 25th phase, 0 - 1000 ft
 AQ - 26th phase, 0 - 1000 ft
 AR - 27th phase, 0 - 1000 ft
 AS - 28th phase, 0 - 1000 ft
 AT - 29th phase, 0 - 1000 ft
 AU - 30th phase, 0 - 1000 ft
 AV - 31st phase, 0 - 1000 ft
 AW - 32nd phase, 0 - 1000 ft
 AX - 33rd phase, 0 - 1000 ft
 AY - 34th phase, 0 - 1000 ft
 AZ - 35th phase, 0 - 1000 ft
 BA - 36th phase, 0 - 1000 ft
 BB - 37th phase, 0 - 1000 ft
 BC - 38th phase, 0 - 1000 ft
 BD - 39th phase, 0 - 1000 ft
 BE - 40th phase, 0 - 1000 ft
 BF - 41st phase, 0 - 1000 ft
 BG - 42nd phase, 0 - 1000 ft
 BH - 43rd phase, 0 - 1000 ft
 BI - 44th phase, 0 - 1000 ft
 BJ - 45th phase, 0 - 1000 ft
 BK - 46th phase, 0 - 1000 ft
 BL - 47th phase, 0 - 1000 ft
 BM - 48th phase, 0 - 1000 ft
 BN - 49th phase, 0 - 1000 ft
 BO - 50th phase, 0 - 1000 ft
 BP - 51st phase, 0 - 1000 ft
 BQ - 52nd phase, 0 - 1000 ft
 BR - 53rd phase, 0 - 1000 ft
 BS - 54th phase, 0 - 1000 ft
 BT - 55th phase, 0 - 1000 ft
 BU - 56th phase, 0 - 1000 ft
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 BV - 95th phase, 0 - 1000 ft
 BV - 96th phase, 0 - 1000 ft
 BV - 97th phase, 0 - 1000 ft
 BV - 98th phase, 0 - 1000 ft
 BV - 99th phase, 0 - 1000 ft
 BV - 100th phase, 0 - 1000 ft

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

State Oregon, California, Nevada

MINERAL REPORT

TECHNICAL REPORT
on
Geothermal Energy Development
in
South Central Oregon
Northeastern California
Northwestern Nevada

(Title)

Dept. of Interior
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SEP 18 1974

LANDS INVOLVED

Lake County, Oregon
Klamath County, Oregon
Modoc County, California
Washoe County, Nevada

BUREAU OF LAND
MANAGEMENT
SUSANVILLE, CALIFORNIA

September 3, 1974

(Date)

By

Christopher J. Broili
Geologist

Technical Review

Management Review

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South Central Region, Northwestern California
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United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Lakeview District

TECHNICAL REPORT

on

Geothermal Energy Development

in

South Central Oregon

Northeastern California

Northwestern Nevada

by

Christopher J. Broili

Introduction

The data in this technical report is supplementary to data included in the Environmental Analysis Record. Both the technical and the environmental data must be considered together to reach a judgement as to the conduct of a leasing program. The technical information presented here is equally applicable throughout all of south central Oregon, northeastern California, and northwestern Nevada. The final Environmental Statement for the Geothermal Leasing Program, covering all Federal lands, was published in October 1973, additional data is contained therein.

Proposed Action

The proposal is to lease federally owned potential geothermal resources in south central Oregon, northeastern California, and northwestern Nevada.

The geothermal energy leasing program would be conducted under the Geothermal Steam Act of 1970 and the regulations in 43 CFR 3200 and 30 CFR 270 which became effective January 1, 1974.

The proposal involves:

- (A) The approval of "Notices of Intent to Conduct Geothermal Resource Explorations" on areas not connected with a lease (Form 3200-9).
- (B) The issuance of Noncompetitive Geothermal Resource Leases (Form 3200-21).
- (C) The issuance of Geothermal Resource Leases (Form 3200-21) on Known Geothermal Resource Areas by Competitive bidding.
- (D) The issuance of Geothermal Resource Leases (Form 3200-21) on Competitive Geothermal Interest Areas by competitive bidding.

Geothermal Resource Leases, both noncompetitive and competitive, are between 640 and 2560 acres each. Such leases are issued for an initial term of 10 years and the term is extended if commercial production is reached.

The areas under consideration are several hot spring areas in south central Oregon, northeastern California, and northwestern Nevada. Most of the land is national resource land with the remainder privately owned with no federally owned minerals.

Geothermal Resources

The earth is a tremendous reservoir of thermal (heat) energy. Heat flows beneath the surface and dissipates. This is usually not noticeable because it is dissipated in small quantities.

The increase of heat with depth is called geothermal gradient. Normally it would average about 1° F. for every 100 feet of depth. Some areas are discharging heat at rates of 10 to 1,000 times normal. These are the areas of interest for development of geothermal energy.

The heat source that creates these near-surface "hot spots" is either:

- (1) A deep-seated magma (molten rock) from which the heat escapes via faults, or
- (2) A shallow magma or magma cooling chamber in areas of fairly recent volcanic activity (within the last few million years).

Groundwater is heated by these energy sources and rises toward the surface. In some places the hot water is trapped by overlying impermeable rocks. In others it reaches the surface through faults. Hot springs, fumaroles, mud pots and geysers are the surface expressions of such escape.

Geothermal Systems

Two types of geothermal systems are considered to have present commercial application:

- (1) Vapor-dominated systems (dry steam) are believed to contain both saturated steam and water in the reservoir. When a well is drilled, the decrease in pressure superheats and dries the steam. The steam may be used to drive a turbine directly. Vapor-dominated systems are believed to be relatively rare. Power production from such fields occurs at the Geysers in California, Lardarello, Italy; and Matsukawa, Japan. The Valles Caldera field in New Mexico appears to be of this type and is currently under development.
- (2) Hot water systems are believed to result from a thermally driven convection system which moves the heated water upward. The upwelling hot water often penetrates the surface as hot springs, geysers, etc. When a well is drilled, a portion of the water flashes into steam and both water and steam come to the surface.

The steam is separated from the water and used to drive a turbine. Power production from hot water fields is currently underway at Wairakei, New Zealand; Otaka, Japan; Cerro Prieto, Mexico and Pathe, Mexico.

U. S. Geothermal Development

The Geysers, in northern California, is the only commercially developed geothermal energy field in the United States, with the exception of local use for space heating in a number of places.

At the Geysers, five power generating plants operate on a vapor dominated geothermal system to produce 400 megawatts of electrical power. This is roughly equivalent of 2/3 the electrical power demand of the City of San Francisco. The ultimate capacity of the field, when fully developed, is estimated to be between 1,000 and 3,000 megawatts--sufficient power to satisfy the demands of the entire San Francisco Bay urban area.

The initial development at the Geysers was pioneered by Magma Power Company. Union Oil Company is the current operator.

Exploration has been going on for the last 15 years or so in many localities in the western States. Technical development problems and the economics of alternate fuel sources have thus far delayed commercial power development.

Oregon, California, and Nevada Geothermal Development.

Between 600 and 800 hot springs are scattered over the three states -- evidence of higher than normal heat flow in many areas. During the 1800's and early 1900's resorts grew up around many of the hot springs.

Shallow wells, drilled into hot water systems, are currently used for space heating in all three states. At the Geysers, in California, geothermal steam is used to drive turbines and generate electricity.

Only in the last several years have serious attempts been made to develop geothermal energy within the three states for the generation of electricity. Most of the exploration effort has been made by Magma Power Company which has drilled more wells throughout the three states than all the other geothermal companies combined. Magma Power Company has drilled exploratory holes on almost all the best geothermal areas in the three states.

Numerous companies, the U. S. Geological Survey, and the various state geologic surveys are presently conducting exploration activities throughout the three states.

South Central Oregon, Northeastern California, and Northwestern Nevada Geology and Mineral Development

- (A) Geology -- South central Oregon, northeastern California, and northwestern Nevada are within the northern extension of the "Basin and Range Province". The topography consists of broad flat basins separated by plateaus or fault block mountains. The basins are

separated from the uplands by long north-south and northwest-southeast trending scarps. The scarps are caused by high angle normal faults with large vertical displacements.

Most of the rocks in the area are Tertiary age volcanic, intrusive, and sedimentary rocks which are best exposed on the fault scarps between the basins and uplands. Pre-Tertiary rocks are not exposed in this area, but they are believed to be Mesozoic sedimentary rocks. The other rocks in the area are Quaternary age sediments and volcanic rocks.

The volcanic rocks are flows, breccias, agglomerates, eruptives, tuffs, and ash-flow tuffs. The flows, breccias, eruptives, and tuffs range in composition from basalt, andesite, and trachyte to dacite, rhyodacite, and rhyolite. The ash-flow tuffs are either rhyolitic or dacitic, and the agglomerates are basaltic.

The intrusive rocks form dikes, domes, breccias, necks, plugs, and sills. The plugs and domes consist of rhyolite and dacite, and sills and necks consist of andesite, basalt, and gabbro. The dikes and breccias range from rhyolite and dacite to andesite and basalt.

The sedimentary rocks are conglomerates, sandstones, mudstones, siltstones, shales, and diatomite. Some of these rocks have varying amounts of tuff mixed in with them.

The sediments are gravel, sand, silt, clay, evaporite, and talus.

There has been seismic activity in the area as recently as 1968. The earthquake epicenters, just south of Crump Lake in the Warner Valley, averaged 4.9 on the Richter Magnitude Scale.

- (B) Mineral Occurrences -- The U. S. Geological Survey states that the entire area is prospectively valuable for oil and gas. The oil and gas is supposedly in the Mesozoic basement rocks, although no exploratory wells have been drilled deep enough to confirm this.

Diatomite and some sodium and potassium in evaporites are present in a few basins and playa lakes. Because there has been no attempt to mine the diatomite or evaporites in the area, the deposits must be either too low grade or too poor a quality to be economic.

The Lone Pine Mining District, south of the Sheldon Antelope Refuge in Nevada, has had some small scale mining for mercury, but it is presently inactive. There are no figures on the production from the district.

There are other mercury occurrences in the area, but they are only prospects.

The only active mining in the area is common variety materials for road maintenance and construction. The materials being mined are cinders, gravel, sand, and rock (basalt and andesite).

- (C) Geothermal Energy Development -- Hot springs are abundant throughout this area of Oregon, California, and Nevada. Since the early 1900's, hot water from wells in the Klamath Falls vicinity has been used for space heating, hot baths, and swimming pools. Several other places throughout the area are now utilizing hot water in the same way.

Exploratory drilling for geothermal steam was begun in 1959 by Magma Power Company. Since then, the U.S.G.S., the Oregon Department of Geology and Mineral Industries, and other companies have done some exploration and test drilling in the area.

The recent investigations consist of geologic mapping, water sampling, gravity and resistivity surveys, shallow drilling with thermal gradient and heat flow measurements, and deep exploratory drilling.

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Stages of Implementation

Four separate stages of implementation have been identified:

- I) Exploration
- II) Development
- III) Operation
- IV) Close-out

The progression from one stage to the next is dependent upon the success of each earlier stage. In practice, one stage often blends into another and it would be common for exploration and development to be undertaken in one part of a geothermal field, while a production operation was going on in another part of the field. Close-out of some wells, including rehabilitation, might also be taking place at the same time.

EXPLORATION

Exploration includes all activities from the decision to explore for a geothermal field through the drilling of one or more "wildcat" (exploratory) wells.

Operations conducted under an approved "Notice of Intent to Conduct Geothermal Resource Exploration Operations," (43 CFR 3209) cover any surface disturbing techniques up to and including the drilling of shallow temperature gradient holes. Such operations do not include, however, the drilling of core holes for geologic information nor the drilling of "wildcat" geothermal wells.

Operations conducted under a geothermal lease (both competitive and non-competitive) include all exploration actions.

For convenience, exploration activities (as they relate to surface damage) may be classified into five discrete operations, four of which require physical presence on the land. They are:

- (A) Airborne exploration
- (B) Off-road vehicular travel
- (C) Road and trail construction
- (D) Drilling
- (E) Rehabilitation

In practice, several of these operations may be going on concurrently. The technique is to start by evaluating large areas (i.e. several townships) and gradually reduce the area of interest to select a target for drilling. As the area of interest shrinks, more intensive exploration techniques are employed.

(A) Airborne Exploration - This involves a series of techniques including:

- (1) Aerial photography - for geologic interpretation.
- (2) Imagery - infrared to detect heat differentials; microwave to detect soil moisture differentials.
- (3) Magnetic - airborne magnetometer measures variations in the magnetic intensity of the earth.
- (4) Gravity - airborne gravimeter measures differences in the specific gravity of the earth.

All of these techniques are attempts to gain data on the subsurface geology of an area. The data gathered must be interpreted by specialists and may supply clues as to areas deserving of more detailed studies.

Airborne exploration produces no surface disturbance. It creates only a temporary negligible impact on air quality and noise levels.

(B) Off-Road Vehicular Travel - Many exploration techniques require off-road vehicular travel in various degrees. Generally, existing roads are used where possible. Techniques which sometimes require cross-country travel include:

- (1) Geological mapping - One or more small vehicles transport geologists to the work area.
- (2) Geophysical exploration - Includes a number of techniques seeking clues as to underground geology:

Gravity - Ground gravity surveys involve obtaining gravity readings along a surveyed grid with a portable gravimeter. A three-man crew does the work (two survey and the third records gravity readings). One or two small trucks transport the crew and equipment to the work area.

Magnetic - Magnetic variations are measured with a magnetometer. The field technique is similar to the gravity determination.

Seismic - Elastic shock waves are generated and measured along a grid system (generally 1-2 mile grid). Receivers (geophones) pick up elastic waves generated at a specific point on the grid. The elastic waves are generated by one of three methods:

Vibration method - Vibrations are produced by truck mounted vibrators, usually four, which operate in unison.

Thumping method - A truck-drawn or self-propelled unit containing a heavy weight or "hammer" drops the hammer on the ground to produce shock waves.

Explosive method - A truck-mounted rotary drill is used to drill holes 100-200 feet deep. These holes are loaded with 5-50 lbs. of explosives and detonated (shot) to produce the elastic waves.

In all three seismic methods, 5-7 trucks and 10-15 men are required. Surface mineral matter and vegetation must be removed from the energy generation sites (shot points) and receiving sites (geophones) to provide for the maximum amount of energy to be sent and received. In addition, the explosive method often requires road construction, blading of lines and clearing of small areas for drill operation.

All three seismic methods involve varying degrees of surface disturbance. The explosive method produces the most intense surface disturbance. Only the explosive method possesses the potential for subsurface impact (damage to nearby water wells, damage to near-surface aquifers, etc.), and then, only within a limited radius of the shot point.

Microseismic - Small geophones called seismometers are buried at a shallow depth and transmit normal extremely minor seismic activity (micro-earthquakes) to an amplifier on the surface. The amplifier is about the size of a suitcase. Locations are set up away from roads to avoid traffic "noise." These units are often backpacked into areas inaccessible to vehicles.

Resistivity - Induced Polarization (IP) techniques are used to measure the resistance of subsurface rocks to the passage of an electrical current. A vehicle mounted transmitter sends pulses of electrical current into the ground through two widely spaced electrodes (usually about two miles apart). The behavior of these electrical pulses as they travel through underlying rocks is recorded by "pots" (potential electrodes), small ceramic devices that receive the current at different locations. The electrodes are either short (2-3 feet) rods driven into the ground or aluminum foil shallowly buried over an area of several square feet. Two or three small trucks transport the crew of 3 to 5 men to transmitting and receiving sites.

Telluric - A string of "pots" (potential electrodes) record the variations in the natural electrical currents in the earth. No transmitter is required. Small trucks are used to transport the crew to the work area.

Radiometric - Radioactive emissions (generally radon gas) are measured as an indication of subsurface steam. Such measurements are usually made in the vicinity of hot springs, hence existing roads are generally used. Measurements are taken with a hand held scintillometer.

- (3) Geochemical surveys - Includes the sampling of spring water to determine dissolved solid content (acidity, Na/K ratio and silica content) and the taking of small (hand trowel) surface soil and rock samples on a grid system to determine introduced mineralization and source areas for recharge. Occasionally small trucks are used to transport the crew (usually 2-3 men) and equipment to the work area.

- (C) Road and Trail Construction - For exploration activities utilizing large equipment in rough terrain with poorly developed access, roads and trails are often constructed. Since they are intended to provide only temporary access for such equipment as small drilling rigs and water trucks, they are usually constructed to a very low standard--generally a 10-foot wide dozer trail is used in dry, stable country. Where larger drilling equipment is to be used for an exploratory (wildcat) well, a considerably higher road standard may be employed.
- (D) Drilling - Several types of drilling are utilized in the exploration phase including seismic test holes, temperature gradient holes, geologic or stratigraphic information holes, and exploration wells. The size of the equipment and the surface area needed differs with each. The type of drilling used is rotary drilling which employs the principle of a rotating vertical pipe (drill stem) upon which has been mounted a rock bit designed to chip rock as it rotates under pressure.

Drill cuttings or chips produced as the hole progresses are removed from shallow shot-holes by introducing a jet of air during drilling. For deeper drilling, a circulating medium of water or mud (a suspension in oil or water of various finely-divided substances, each possessing specific properties) is pumped down the inside of the drill pipe and allowed to return up the annular space between the hole wall and outside of the drill pipe. This circulating medium is used to cool and lubricate the bit as well as to return the drill cuttings to the surface. Drilling mud helps prevent caving by plastering and consolidating the walls of the hole with a clay lining, thereby making casing unnecessary during shallow drilling.

- (1) Seismic test holes - Shallow holes 100-200 feet deep are drilled with small truck-mounted rigs. Cuttings are removed by compressed air. The surface area used is just sufficient for the truck and equipment. An area of about 30 x 30 feet is disturbed by the operation. No specific drill pad is built.
- (2) Temperature gradient holes - Shallow holes 300-500 feet deep are drilled with a small truck-mounted rig. The holes are usually between 4 and 6 inches in diameter. Mud is employed to remove the cuttings, and generally a portable metal mud pit is used to contain the mud. An area of about 30 x 30 feet is disturbed by use of the drill rig and servicing water truck.

Upon completion of the temperature gradient hole a capped pipe (usually 3/4 inch diameter) is placed in the hole, and let stand for about a week. Water in the pipe is heated by the temperature of the surrounding rock. Because of the small diameter of the pipe, convection currents do not form, hence the water temperature in the pipe varies with depth. The temperature at different depths is measured by a thermister probe on a cable.

- (3) Geologic information holes - These holes are similar to those drilled for temperature gradient purposes. Larger equipment is employed and a surface area of about 40 x 60 feet may be used. The cuttings are examined and the hole is probed with geophysical instruments to acquire data on the rock types and structure. Because these holes may extend to 1000 feet or more, a larger mud pit is needed. Typically, a mud pit is scooped out with a bulldozer. These pits may be 10-20 feet wide by 30-50 feet long by 3-6 feet deep depending on the terrain and the depth of the hole.
- (4) Exploration wells - These wells are the same as development and production wells. If successful, they are generally converted to production. Drilling equipment, technology and methods are similar to those used in oil and gas operations. Well bores of up to 24 inches in diameter may be drilled to depths of 5,000-10,000 feet.

Mud is generally used for the drilling. Where water flows are not encountered, compressed air may be substituted as the circulation medium. At the Geysers dry steam field, for example, mud is used to the depth that temperature interferes with proper operations, then compressed air is used. Noise created during the air drilling operation is intense and approximates that of an unmuffled diesel truck.

A drill pad is leveled and cleared of vegetation. This generally involves a surface area of from less than one acre up to two acres. The ancillary equipment is generally also located on the drill pad. A reserve pit of approximately 1,000 to 10,000 square feet and 6-8 feet deep is sometimes dug to contain waste fluids and drill cuttings during drilling operations.

The well is cemented and cased and a blow-out preventer is installed to control sudden surges of pressure.

Blow-outs are uncommon, but do occur. The basic problem is a lack of knowledge of the specific characteristics of a geothermal field. During the pioneering development in many fields around the world, blow-outs seem to have occurred in 1-3% of the test and production wells drilled. At the Geysers there have been three blow-outs with over 100 wells drilled. Landslides in that steep terrain caused much of the problem. Geothermal blow-outs cause no fire hazard and are generally controlled by slant drilling and sealing with concrete.

While the blow-out is taking place, water, steam and contained elements are wasted and spread on the surrounding land.

The release of pressure and water through drill holes may affect the surface expression of the geothermal field. Springs and geysers may dry up, may be renewed in a different place, or may be increased. Accurate prediction of the results of drilling on such surface features cannot be made.

Since geothermal reservoirs are typically in active fault areas, normal earthquakes also occasionally change the surface features by drying up, moving or increasing thermal activity. It is thus not always possible to determine whether the observed effect was caused by drilling or by natural action.

(E) Rehabilitation - Rehabilitation activities vary with terrain, climate, and significance of the damage.

- (1) Off-road vehicular travel. Generally no rehabilitation is undertaken because the disturbance is temporary and, in most areas, heals itself in a short time.
- (2) Road and trail construction. Generally no rehabilitation is undertaken unless there is a definite requirement for it (i.e. erosion hazard, access where none is wanted, etc.). Where needed, such roads and trails can be scarified and reseeded if the site is susceptible to revegetation.
- (3) Drilling. Small drill hole sites (seismic test holes, temperature gradient holes, informational holes) are usually rehabilitated by cleaning up any debris and smoothing the area with a bulldozer where needed. Mud pits are filled and leveled. Where climate and terrain permit, revegetation could be accomplished.

Large exploratory wells are capped with a pressure head ("Christmas tree") to prevent blow-outs, and typically left in operating condition. Other structures are removed and the drilling pad may be revegetated if climate permits.

DEVELOPMENT

Development includes all activities from the decision to develop a producing field until commercial power generation and transmission is reached. These operations are conducted only under a geothermal lease (either competitive or noncompetitive).

Five discrete operations, as they relate to surface disturbance, are recognized:

- (A) Road development
- (B) Drill site development
- (C) Geothermal pipelines
- (D) Plant construction
- (E) Transmission lines
- (F) Rehabilitation

Many of these operations would normally be taking place concurrently.

(A) Road Development

During development, roads to drill sites, power plant sites, and along transmission line routes may be constructed. Roads to producing wells and power plants will be permanent and may be surfaced and stabilized. Culverts will be utilized to avoid erosion of the road bed where necessary. Temporary roads to drill sites and for construction of power lines will generally be built to a low standard.

(B) Drill Site Development

Wells drilled during the development stage will be similar to exploration wells. Often, somewhat larger equipment is used. The drill pad is leveled and cleared of vegetation. Generally from less than one up to two acres are disturbed. A reserve pit (sump) 1,000 to 10,000 square feet and 6-8 feet deep is sometimes dug to contain waste fluids during the drilling operations. The sump may be fenced to keep out animals.

- (1) Water - About 500-1,000 barrels (1 barrel = 42 gallons) of water per day will be used in drilling a well. This water may come from water wells drilled in the immediate vicinity (about 60 gpm flow would be adequate), from nearby surface water, or it may be hauled in by truck.
- (2) Spacing - Current geothermal plants require a steam pressure of about 100 PSI at the generator. This places a limit on the distance steam can be piped to the generator because of heat loss. Wells are therefore generally located within one-half mile of the generation plant. The number of wells used to service a plant is dependent on the temperature of the wells (a temperature of 325-350^oF at the generator is needed) and the characteristics of the geothermal reservoir. Generally, from 16 to 20 producing wells are used per power plant.

At Cerro Prieto, 18 wells (3 are standby) will service a 75 MW generating plant. They are drilled on a 10 acre spacing (one well per 10 acres). A 40 acre well spacing is being used at the Geysers initially, but future infill drilling to 20 acre spacing is planned in order to maintain steam production to plant capacity.

- (3) Production Testing - To determine the sustained flow characteristics of a well, and to clean out the hole, each new well is vented to the atmosphere for a period of time. At the Geysers, enough experience has been gained as to the characteristics of the reservoir that this is no longer necessary there. Elsewhere it is an established practice.

Steam, water and noise accompany production testing. The water is generally directed into the reserve pit and is contained. The steam is released into the atmosphere.

Noncondensable gases (carbon dioxide, methane, hydrogen, nitrogen, argon, carbon monoxide, hydrogen sulfide, radon, ammonia) and vapors (boric acid and mercury) are often contained in the steam. These vapors and gases make up generally less than 3% of the total steam fraction.

When present in excessive amounts, some of these gases and vapors are toxic.

<u>Gas</u>	<u>Toxicity Levels</u>
Ammonia	50 ppm
Boric acid	None established
Carbon dioxide	5,000 ppm
Carbon monoxide	100 ppm
Hydrogen sulfide	20 ppm
Mercury	12.2 ppb
Methane	10,000 ppm

Where present in unacceptable amounts, monitoring devices and special precautions may be necessary as a safety measure.

Additionally, very small amounts of hydrogen sulfide (as small as .025 ppm) can be detected by smell. This "rotten egg" odor, common in hot spring areas, can be an aesthetic problem.

High noise levels accompany production testing. Because of this, muffling devices are generally installed. At the Geysers measurements of noise from a muffled testing well indicates a noise level slightly less than that of an unmuffled diesel truck.

Noise levels from other geothermal fields, both vapor dominated and water dominated, may not be of a similar magnitude.

- (4) Blowouts - In the four geothermal areas in the world (Geysers, USA; Lardarello, Italy; Wairakei, New Zealand; Cerro Prieto, Mexico) which have undergone commercial development, blowouts have occurred in approximately 1-3% of the wells drilled. These blowouts were mostly in the exploratory or early stages of development drilling, with few mishaps in later stages as experience was gained and local drilling techniques perfected. Although some of these blowouts were temporarily spectacular, none have resulted in any significant or lasting environmental damage.

At Lardarello, Italy, the oldest commercial geothermal field in the world, they are routinely handled as a noisy, difficult part of regular operations. They are not considered as serious mishaps that could cause pollution or have other adverse effects.

(C) Geothermal Pipelines

Pipelines 10 to 30 inches in diameter will be used to transmit steam or hot water from the production wells to the power plants. The pipes are typically insulated with fiberglass or asbestos to minimize heat loss. Expansion loops or joints are placed at frequent intervals either vertically or horizontally to provide for the extreme expansion and contraction of the pipes upon production startup (heating up) and shutdown (cooling down).

Under present technology, pipelines are constructed above ground to provide for expansion and contraction and to enhance maintenance and detection of leaks. Underground installation is thus far uneconomical and may also present some safety hazards.

The lines form a radiating pattern on the surface, connecting wells with the power plant. They may be painted to blend with the surroundings.

(D) Plant Construction

Generating plants are centrally located to minimize the length of the steam or water pipes from the servicing wells. The largest plants in current use consist of two 55 MW generators housed together so that production is 110 MW per power plant. Power plant spacing is about one plant per 640 acres throughout the productive area.

At the Geysers, the average 110 MW plant building is about 100 x 200 feet and three stories high. The adjacent cooling towers are about a third larger than the generating plant building. The entire generating plant-cooling tower complex occupies an area of about five acres.

(E) Transmission Lines

Power generated from the plant is transmitted via conventional power lines to the area of use. The size and location of the lines is dependent upon the power output and destination.

The lines will tend to be large, considering that 1 MW of plant capacity will service the power needs of about 1,000 people. To express this another way, one 110 MW power plant could supply the power needs of the City of Reno.

(F) Rehabilitation

Rehabilitation will be possible on disturbed areas not needed for continued production, commensurate with terrain, climate and significance of the damage.

- (1) Road Development - Roads needed for maintenance and further development will not be rehabilitated. Temporary roads and trails can be scarified and revegetated, if desirable.
- (2) Drill Site Development - After well completion, an area approximately 30 ft. x 30 ft. directly surrounding the well head will be needed for operation. An additional graded area about 50 x 100 feet may be needed for moving in a drilling rig to correct any problems which may develop during production. The reserve pit (sump) is generally dried out, covered with dirt, and graded. It and the remaining area of the drill site can be rehabilitated and revegetated.
- (3) Plant Construction - The area disturbed in constructing the generating plant and cooling towers can be rehabilitated and revegetated. The buildings may be painted to blend with the surroundings. Some cooling towers are architecturally attractive and, if desired, may be intentionally painted to contrast with the surroundings to heighten the visual experience.
- (4) Geothermal Pipelines - Geothermal pipelines may be painted to blend with the surroundings and any areas not needed for access may be revegetated. At Lardarello, Italy, steam lines cross grainfields and vineyards with essentially no loss of land productivity.
- (5) Transmission Lines - Surface disturbance accompanying electrical transmission line construction may be rehabilitated with the exception of needed maintenance roads.

OPERATION

The operation phase starts upon reaching commercial power production. Exploration and development are typically carried on in other parts of the geothermal field simultaneously with the operational activities.

The operation stage may be divided into the following discrete operations:

- (A) New drill sites
- (B) Maintenance
- (C) Waste disposal
- (D) Production

(A) New Drill Sites

Geothermal fields are long lived resources. The Lardarello field has been in production since 1904 and the Geysers since 1958. The Geysers is estimated to have a minimum productive life of 30 more years. Nonetheless, production slowly diminishes the heat flow and additional wells must be drilled and completed to keep the generating plant operating at full capacity.

Additional wells may also be required to replace wells that have become inoperative and, if the waste waters are disposed of by injection, injection wells may be drilled.

The technique and effect of these wells would be the same as for development wells. On a major producing field, it can be expected that one or two drilling rigs would be operating continuously throughout the life of the field drilling additional or replacement wells.

(B) Maintenance

Repair, maintenance and monitoring of an operating field will require the periodic use of access roads to service the equipment. Existing wells will require occasional repair work or cleanout. The amount of this remedial work will depend upon the production characteristics of the field; severe scaling and corrosion would require frequent remedial work. Normally, one medium-sized drill rig would be required full-time for each 20-30 wells (one 110 MW power plant).

(C) Waste Disposal

The work force (both construction and maintenance) for geothermal power plants will usually be housed in the nearest town rather than creating a new town at the site. Thus, waste materials connected with human habitation will typically be handled in the local community.

At the plant site itself, sanitary facilities for workers will be provided. Solid wastes will either be disposed of in a dump developed at the site or trucked to the nearest established dump site.

The most significant waste disposal problem relates to handling the excess geothermal fluids. In vapor dominated systems, as at the Geysers,

about 75-80% of the water from the spent steam is consumed in the cooling towers, leaving 20-25% to be disposed of. In water dominated systems, such as Cerro Prieto, the reverse is true with 80% or more of the total well production requiring disposal.

Disposal techniques vary, depending on the quality and quantities involved. Any or a combination of the following techniques may be employed:

- (1) Evaporation ponds - Waste water at Cerro Prieto is piped to evaporation ponds. Where water quality is satisfactory, such ponds may provide new aquatic habitat. Where water quality is toxic, special measures may be required to protect the groundwater supply, livestock and wildlife.
- (2) Natural drainage systems - At Wairakei, New Zealand, waste water is discharged into a large river. High quality water disposed of in this manner provides additional resources for agriculture, wildlife and other uses. Low quality water may require extensive treatment before it is suitable for release into natural drainages.
- (3) By-product development - In some instances it may be economical to extract useful minerals or gases from the geothermal fluids. This could result in increasing the waste water quality so as to make it available for other purposes. Desalinization may also be feasible in some areas, providing by-product fresh water for other uses.
- (4) Re-injection - At the Geysers, excess water is re-injected into nonproductive zones of the geothermal field. Successful re-injection is dependent on the quality of the waste water and the geologic characteristics of the geothermal field. Typical considerations would include: whether plugging and scaling problems will prevent the reservoir from accepting the fluid; whether fresh water aquifers can be adequately protected from contamination by hot saline waste water; and whether the sub-surface rock structure will adequately hold the re-injected fluids.

(D) Production

Production from a geothermal field will generally require 2-5 people per plant to inspect, adjust and service the wells, making the rounds about once each day on the existing road network.

Sustained production will have several effects:

- (1) Temperature drop - The field will gradually realize diminishing temperatures as the energy is utilized.

- (2) Water utilization - Cooling towers will consume about 40-45 acre feet of water per year for each megawatt of plant capacity. Each 110 MW plant would thus consume about 5,000 acre feet of water per year. The water may come either from steam condensate, waste geothermal water, or from any other water source. This water consumption might be reduced by use of some technique other than conventional cooling towers. One such scheme, called the "night stream cooling system" would theoretically use only 42% as much water.
- (3) Subsidence - As large volumes of water are pumped from a geothermal reservoir, some subsidence of the ground surface may occur. In many cases subsidence may have no serious land use or environmental consequences. In some situations, such as developed agricultural land under gravity irrigation, minor surface subsidence could have a significant impact. Continuous monitoring might be necessary to detect whether subsidence was occurring. In some instances, re-injection of the waste water might correct subsidence problems.
- (4) Seismic activity - Geothermal areas are typically associated with seismic activity. Such activity is generally of small magnitude (usually less than 4.5 on the Richter scale). Fluid pressure changes from both production and re-injection may tend to increase earthquake frequency, though the relationship is not well known. To date, such earthquakes have been small and there is some evidence to suggest that this minor seismic activity tends to relieve regional stresses and diminishes the likelihood of large earthquakes. Earthquakes sometimes modify geyser activity and may effect other geothermal features such as hot springs.

CLOSE-OUT

Close-out or final abandonment takes place when energy production ceases to be economic. To date, no developed geothermal field has reached this stage. In a sense, geothermal reservoirs may be somewhat renewable resources in that after a long period of rest, the fluids may become reheated to temperatures that are again useable.

Two discrete operations are expected to take place during close-out:

- (A) Removal of improvements
- (B) Restoration of surface

(A) Removal of Improvements

The removal of improvements from a geothermal field involves:

- (1) Surface improvements - Removal of all structures constructed during field development and operations will be accomplished. Solid waste remaining may either be disposed of in a dump developed at the site or trucked to the nearest established dump.
- (2) Wells - The bottom of the hole is plugged with cement and the surface casing will also be plugged with about 20 feet of cement. The casing will be cut off below the surface and a steel plate welded over the hole. A vertical steel pipe and marker will be welded to the plate. The concrete lined excavation surrounding the hole (called the "cellar") will be pushed in and the location may be graded and revegetated. The marker will remain above ground to provide identification.
- (3) Transmission lines - Any of the electrical transmission lines no longer in use will be removed.

(B) Restoration of the Surface

Surface restoration will typically be a gradual process, taking place throughout the life of the field and culminating with the final abandonment. Access roads can be ripped up, landscaped and revegetated. Power lines can be landscaped and revegetated. Well and plant locations can similarly be treated but, because of their larger size, complete landscaping to approximate the original surface in steep terrain will not be feasible except in unusual circumstances.

Environmental Controls

Geothermal energy development is subject to a wide variety of environmental controls under the authorities of two agencies--Geological Survey and BLM. Such environmental controls are covered in the regulations of both agencies (GS - 30 CFR 270; BLM - 43 CFR 3200) and are part of the exploration form (3200-9) and lease form (3200-21). Additional controls in the form of special stipulations, geothermal resources operational orders (GRO orders), and approved operational plans may also be used. Bonding is required to assure compliance.

Basically, the two agencies consult throughout the leasing program and agree on any needed special stipulations. For all actions up to and including issuance of a lease, the BLM is the responsible agency. For all operational activities undertaken after a lease has been issued, the Geological Survey is the responsible agency.

Opportunities to attach special environmental controls occur at several points:

- (A) Notice of Intent to Conduct Geothermal Resource Explorations - (Form 3200-9) - This form is filed for exploration activities not connected with a lease. The BLM District Manager has 30 days to either approve or disapprove the permit. Special stipulations may be added if needed. The Geological Survey will advise of any recommended stipulations to protect subsurface resource values. A \$5,000 compliance bond is required.
- (B) Proposed Plan - Prior to the issuance of a lease, the applicant must file a proposed plan detailing his proposed methods for diligent exploration. Environmental protection measures proposed are included. The proposed plan may alert the District Manager to special problems that should be covered by special stipulations in the lease. The Geological Survey will also review these plans and may furnish additional comments or information which may be useful for environmental considerations.

However, these proposed plans are filed so early in the process that they will generally be based on little knowledge of the available geothermal resource and, hence, will usually undergo major changes as new exploration data is gathered. They will tend to be written in broad general terms commensurate with the limited data available. Therefore, they cannot be entirely relied upon in anticipating environmental effects.

The chief value of the proposed plan is to commit the applicant to a program of diligent exploration. Reliable environmental judgments can be made later when an actual plan of operation is filed.

- (C) Leases - Lessees are committed to a variety of environmental controls by regulation and the standard lease (Form 3200-21) contains stipulations on protection of the environment and antiquities.

Additionally, special stipulations may be added if necessary. The Geological Survey will provide advice as to recommended special stipulations to protect the subsurface environment and as to the effect of any proposed BLM special stipulations on geothermal development.

Two bonds are required: a \$10,000 bond to insure lease compliance, and a \$5,000 bond to indemnify any damages to persons or property. A \$150,000 nationwide bond or \$50,000 Statewide bond may be substituted.

- (D) Geothermal Resources Operational Order (GRO Order) - The Geological Survey issues GRO orders which set forth the requirements and procedures to be followed within a particular region or area. This allows flexibility to address conditions which vary widely from area to area. The BLM District will be consulted by Geological Survey to develop any needed surface resource protection requirements.
- (E) Plan of Operation - Before any operations may commence on a lease, the lessee must submit a detailed plan of operation and gain approval of it. Both the Geological Survey and the BLM must approve it.

In practice, these plans will tend to be incremental with new phases of the plan based on information gained in the preceding phase. They will be detailed enough to allow a sound environmental assessment prior to approval.

Energy Considerations

U. S. energy demand is expected to continue increasing at a rate of 3-5% per year. To keep pace, we shall either have to import more fuel (imports are currently about 4%) or develop more domestic sources. Former President Nixon stated that our policy goal is to become independent in energy resources by 1980.

All forms of energy supplement one another in the total energy picture. Should geothermal energy be used to produce electricity, other forms of energy (coal, oil, gas) would be freed for use elsewhere.

Estimates of our geothermal potential vary widely but suggest that by the year 2000 such energy may supply 5-14% of our use. This is a significant amount considering that hydroelectric power currently supplies only about 5% of the total.

Geothermal energy offers less environmental impact than conventional energy sources. Essentially all of the impact, with the exception of power lines, is confined to a small site. Other power forms have multiple impacts: power dams flood large acreages; coal, oil, gas and nuclear sources are mined in one place, transported to another place where power is generated and then transmitted via power lines to the area of use.

In the short range, geothermal sources stand a far better likelihood of substantial contributions to the energy pool than do such exotic sources as solar energy, breeder and fusion reactors, fuel cells, etc.

Economic Considerations

There are several ways to view the economic implications of geothermal development:

- (A) Direct revenues
- (B) Indirect revenues
- (C) Direct expenditures
- (D) Indirect expenditures

(A) Direct Revenues

Lease rentals and royalties are distributed as follows:

- 95% - U. S. Government
- 5% - State Governments

- (1) Rentals - Each lease brings in \$1/acre per year annual rental (minimum) which increases on a graduated basis after the fifth year. Advance rentals filed during the first three months of filing in Nevada total 1.7 million dollars.
- (2) Royalties - When production is reached, royalties of 10-15% of the value of the steam are assessed. Royalties up to 5% are also paid on by-product minerals, including commercial demineralized water.

At the Geysers, a royalty of 10% of the steam value is paid to private landowners. The royalty averages about \$250,000 per year per 100 MW plant. With 400 MW capacity, the royalty is about 1 million dollars per year from a production area about two miles wide by seven miles long.

- (3) Bonus Bids - On competitive lease sales, bonus bids are an additional source of revenue. In the first federal lease sale held in California on January 22, 1974, twenty leasing units were bid on with 57 bids totalling \$12-1/2 million. The highest bid for a single leasing unit was \$3,200,000, which amounts to \$1,367.50 per acre for the 2,340 acre unit.

(B) Indirect Revenues

Taxation by State and local subdivisions accounts for an additional increment of revenue. Taxes paid to Sonoma Co. from the Geysers approximate \$1 million per year for the current 400 MW capacity.

Dr. Robert W. Rex, President of Republic Geothermal Inc., in remarks to the Sub-Committee on Energy, Committee on Science and Astronautics, U. S. House of Representatives, on September 18, 1973, said in part "...Every 1000 megawatts of geothermal development on Federal lands yield about \$1 billion of public revenue; 73% to the Federal government, 11% to State governments which have income taxes...and 18% to County governments.

(C) Direct Expenditures

Development of a 110 MW plant costs \$15-17.5 million at the Geysers. Individual wells cost about \$150,000-\$200,000 each.

(D) Indirect Expenditures

The local business community will be affected by geothermal development, both by increased business and by having to provide additional services.

During exploration drilling, two drilling rigs might be used for 1-2 years. Employees would consist of about 40 people directly involved in drilling, with 10-20 additional service people intermittently involved.

Development would advance in 55-110 MW increments in an orderly fashion over a period of 2-10 years. Drill crews for 2-3 rigs would number 40-60, and 20-30 additional people would be involved in plant construction. All of the above personnel would be temporary.

Once the field is operating on stream, about five (5) permanent employees are needed for field production plus five (5) more for each 110 MW plant. One drilling rig would be needed full time, adding 20 more permanent employees to the area.

Thus, for several years, a local community would be burdened with providing necessary school and service facilities for between 40 and 90 additional temporary families. Thereafter, 30 or more families would become permanent residents, also requiring services.

In the short run, communities near a geothermal development would be financially strained. However, such development is capital intensive and in a few years the increased tax base should be much greater than community expenditure on a per capita basis of additional residents.

Other Considerations

This technical report is addressed principally to electrical power generation from vapor dominated and hot water geothermal systems. There are other uses and other geothermal systems that might be involved.

- (A) Uses - The heat from geothermal fields may be used for space heating, greenhouse heating, vegetable dehydration and a myraid of other uses for which a heat source is required. Water also might be used for a variety of purposes. The impacts of these uses would be less than the impacts of power generation.
- (B) Systems - The hot water and steam systems offer the best chance of commercial use in the near future. For long range consideration two other systems may, with developing technology, become useful.
 - (1) Hot Dry Rock Systems - Basically similar in origin to the water or steam systems, but lack water to form a convection cell. Such areas may be susceptible to fracturing and introduction of water to develop steam for power generation. Exploration of what is believed to be a hot dry rock geothermal area is currently being carried out on national resource lands near Marysville, Montana by Battelle Northwest Institute under a National Science Foundation grant.
 - (2) Geopressurized Reservoir Systems - Consist of hot brines under great pressure in marine sediments along the Gulf Coast. They are thought to represent an accumulation of heat due to the normal heat flow being trapped by an insulating layer of under-compacted clay. The resource is large, but years will be required to develop the technology for commercial use.

Stipulations

To be effective, stipulations must be feasible, understandable, germane (related to a specific problem), not redundant, and enforceable.

- (A) General Stipulations - The regulations and the standard lease form contain stipulations that cover most general environmental problems. They require among other things, that the lessee shall comply with all Federal and State pollution standards (air, land, water and noise) and that the lessee shall take all mitigating actions required by the lessor to protect the environment and to restore any lands affected by the operation.

- (B) Special Lease Stipulations - Care must be taken to avoid using special stipulations that reiterate general stipulations already covered. Special stipulations should relate to specific lease conditions that will have a significant operational or economic impact on the lessee. Generally, these will involve:
 - (1) Restrictions on surface occupancy.
 - (2) Restrictions on time of year when operations will be permitted.

More detailed stipulations can best be developed during the operational stage.

- (C) Plan of Operation Stipulations - Detailed stipulations such as erosion control, road and drill site locations and standards, surface facilities, restoration requirements, etc. are developed when the plan of operation is being reviewed. The plan provides the detailed information on operations, location and methods that allows the development of specific, enforceable stipulations tailored to that plan.

- (D) Technical Problems With Stipulations - Some stipulations that would appear to provide improved surface protection may face economic or technical restrictions that are not initially apparent.

For example, directional drilling would lessen surface damage. However, it can add from \$20,000 to \$100,000 extra cost per hole (depending on the angle). Also, directional work in hot holes presents special problems in getting surveys to accurately locate the bottom of the hole as most survey systems involve photographic film which is severely affected by the heat.

In addition, directional drilling may pose a significantly greater safety hazard. The extreme temperature differences from drilling to producing conditions (often 400°F or more) may create unsafe stresses on casing. Stuck drill pipe is much more common in directional drilling. In hot holes, the greatest danger of blowouts occurs when mud temperatures exceed the boiling point-depth curve. Any excess down time without circulation, such as a stuck drill pipe, greatly increases the chances of a serious blowout due to the mud boiling off and blowing out of the hole.

Developing stipulations with technologic or economic implications must be closely coordinated with the Geological Survey to assure that such stipulations are sound.

Animals of Probable Occurrence
within
The Warner - Surprise - Long Valley Area

Mammals

Order - Artiodactyla

Pronghorn antelope - Antilocapra americana

Rocky Mountain Mule Deer - Odocoileus hemionus hemionus

Order - Carnivora

Bobcat - Lynx rufus

Mountain lion - Felis concolor

Coyote - Canus latrans

Kit fox - Vulpes macrotis

Red fox - Vulpes fulva

Gray fox - Urocyon cinereoargenteus

Raccoon - Procyon lotor

Striped skunk - Mephitis mephitis

Spotted skunk - Spilogale putorius

Badger - Taxidae taxus

Mink - Mustela vison

Long tailed weasel - Mustela frenata

Order - Rodentia

California ground squirrel - Spermophilus beccheyi

Townsend's ground squirrel - Spermophilus townsendii

Belding (Oregon) ground squirrel - Spermophilus beldingi

Antelope ground squirrel - Ammospermophilus lecurus

Golden mantel ground squirrel - Spermophilus lateralis

Least chipmonk - Eutamias minimus

Yellow pine chipmonk - Eutamias amoenus

Porcupine - Erethizon dorsatum

Beaver - Castor canadensis

Yellow-bellied marmot - Marmota flaviventris

Townsend's pocket gopher - Thomomys townsendi

Northern pocket gopher - Thomomys talpoides

Great Basin pocket mouse - Perognathus parvus

Little pocket mouse - Perognathus longimembris

Ord's Kangaroo rat - Dipodomys ordii

Chisel toothed kangaroo rat - Dipodomys microps

Dark kangaroo rat - Microdipodops megacephalus

Western harvest mouse - Reithrodontomys megalotis

Northern grasshopper mouse - Onychomys leucogaster

Bushy tailed wood rat - Neotoma cinerea

Desert wood rat - Neotoma lepida

Canyon mouse - Peromyscus crinitus

Pinyon mouse - Peromyscus truei

Deer mouse - Peromyscus maniculatus

Brush mouse - Peromyscus maniculatus

Sagebrush vole - Lagurus curtatus

Long tailed meadow mouse - Microtus longicaudus

Montane meadow mouse - Microtus montanus

Muskrat - Ondatra zibethica

Housemouse - Mus musculus

Norway rat - Rattus norvegicus

Western Jumping mouse - Zapus princeps

Order - Lagomorpha

Pigmy rabbit - Sylvilagus idahoensis

Mountain cottontail - Sylvilagus nuttalli

Snowshoe hare - Lepus americana

White-tailed jackrabbit - Lepus townsendii

Black-tailed jackrabbit - Lepus californicus

Order - Chiroptera

Lump nose bat - Plecotus townsendii

Pallid bat - Antrozous pallidus

Silver-haired bat - Lasionycteris noctivagans

Hoary bat - Lasiurus cinereus

Big brown bat - Eptesicus fuscus

Western pipistrelle - Pipistrellus hesperus

Fringed myotis - Myotis thysanodes

Long-eared myotis - Myotis evotis

Hairy-winged myotis - Myotis volans

California myotis - Myotis californicus

Small footed myotis - Myotis subulatus

Yuma myotis - Myotis yumanensis

Little brown bat - Myotis lucifugus

Order - insectivora

Water shrew - Sorex palustris

Merriams shrew - Sorex merriami

Vagrant shrew - Sorex vagrans

Trowbridge shrew - Sorex trowbridgii

Fish - streams (area wide)

Rainbow trout - Salmo gairdneri

Speckled dace - Rhinichthys osculus

Tui chubs - Gila bicolor

Brook trout - Salvelinus fontinalis - restricted to higher
areas on national forest

- Warner Lakes

Tuichub - Gila bicolor

Brown bullhead - Ictalurus nebulosus

White crappie - Pomoxis annularies

Black crappie - Pomoxis nigromaculatus

Largemouth bass - Micropterus dolomieu

Rainbow trout - Salmo gairdneri

Warner Valley sucker - Catostomus warnerensis

- Fosket Spring

Fosket Spring Dace - Rhinichthys spp

Reptiles

Lizards

Short horned lizard - Phrynosoma douglassi

Desert horned lizard - Phrynosoma platyrhinos

Great Basin skink - Eumeces skiltonianus utahensis

Great Basin whiptail - Cnemidophorus tigris tigris

Collard lizard - Crotaphytus collaris

Leopard lizard - Crotaphytus wislizenii

Sagebrush lizard - Sceloporus graciosus

Western fence lizard - Sceloporus occidentalis biseriatus

Side-blotched lizard - Uta stansburiana

Snakes

Rubber boa - Charina bottae utahensis

Racer - Coluber constrictor

Desert striped whipsnake - Masticophis taeniatus

Common whipsnake - Masticophis flagellum

Western ground snake - Sonora semiannulata

Long nosed snake - Rhinocheilus lecontei

Great Basin gopher snake - Pituophis melanoleucus deserticola

Common garter snake - Thamnophis sirtailis fitchi

Western terrestrial garter snake - Thamnophis elegans

Night snake - Hypsiglena torquata deserticola

Great Basin rattlesnake - Crotalus viridis lutosus

Amphibians

Great Basin spadefoot toad - Scaphiopus intermontanus

Western toad - Bufo boreas

Pacific treefrog - Hyla regilla

Leopard frog - Rana pipens

Spotted frog - Rana pretiosa

Bullfrog - Rana catesbeiana

Appendix 2

Bird List

This bird list was prepared by the BSF&W for Hart Mt. Refuge. It is felt that the list is applicable to the Warner-Surprise, Long Valley Area.

Those marked with an * are most likely to be recorded in Warner Valley. Relative abundance of each species is indicated by letters: a - abundant; c - common, u - uncommon; o - occasional. Rare and accidental species, observed only once or twice, are not included.

<u>Status</u>	<u>Abundance</u>
S - March-May	a - Abundant
S - June-August	c - Common
F - September-November	u - Uncommon
W - December-February	O - Occasional
* - Nesting	

<u>Seasonal Abundance</u>			
<u>S</u>	<u>S</u>	<u>F</u>	<u>W</u>

LOONS

*Common Loon o

GREBES

*Horned Grebe	o	u	o
*Eared Grebe	u	c	c
*Western Grebe	u	c	c
*Pied-billed Grebe	u	c	c

Seasonal Abundance

S S F W

PELICANS, CORMORANTS

*White Pelican u c c
 *Double-crested Cormorant u c c

HERONS, BITTERNs, IBIS

Great Blue Heron u c c o
 *Common Egret u c c
 *Snowy Egret u c c
 *Black-crowned Night Heron u c c
 *Least Bittern u u u
 *American Bittern u c u
 *White-faced Ibis u u u

WATERFOWL

*Whistling Swan c a u
 Canada Goose c c c c
 *White-fronted Goose u u
 *Snow Goose u u
 *Ross' Goose o o
 Mallard c c c c
 Gadwall c c c u
 Pintail c c c c
 Green-winged Teal c c c u
 *Blue-winged Teal o o o o
 *Cinnamon Teal c c c o
 *American Widgeon c c c u
 *Shoveler c c c u
 *Wood Duck c o o
 *Redhead c c c c
 *Ring-necked Duck o o o o
 *Canvasback u c c u
 *Lesser Scaup u u u u
 *Common Goldeneye u u u u
 *Barrow's Goldeneye o o o
 *Bufflehead c c c c
 *Ruddy Duck c u c u
 *Hooded Merganser o o o o
 *Common Merganser c c u u

Seasonal Abundance

S S F W

VULTURES, HAWKS, FALCONS

Turkey Vulture	c	c	c	u
Goshawk	o	o	o	-
Sharp-shinned Hawk	u	u	u	u
Cooper's Hawk	u	u	u	u
Red-tailed Hawk	c	c	c	c
Swainson's Hawk	c	u	u	c
Rough-legged Hawk	c	u	u	c
Ferruginous Hawk	u	u	u	u
Golden Eagle	c	c	c	c
Bald Eagle (Endangered species)	u	o	-	u
Marsh Hawk	c	c	c	c
*Osprey	o	o	o	o
Prairie Falcon	u	u	u	u
Peregrine Falcon (Endangered Species)	o	o	o	o
Sparrow Hawk	a	a	a	a

CROWS, JAYS

Gray Jay		u	u	
Steller's Jay	o	u	u	o
Scrub Jay		u	u	
Black-billed Magpie	c	c	c	c
Common Raven	u	c	c	c
Pinon Jay	o	o	o	
Clark's Nutcracker		u	u	

CHICKADEES

Black-capped Chickadee		c	c	
Mountain Chickadee		c	c	
Bushtit		u	u	

NUTHATCH

White-breasted Nuthatch		c	c	
Red-breasted Nuthatch		u	u	
Pygmy Nuthatch		u	u	

CREEPERS

Brown Creeper		u	u	
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DIPPER

Dipper		o	o	
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WRENS

House Wren		u	u	
Winter Wren		u	u	
*Long-billed Marsh Wren	u	c	c	
Canon Wren		c	c	
Rock Wren	c	c	c	c

	Seasonal Abundance			
	S	S	F	W
THRASHER				
Sage Thrasher	o	u	u	
THRUSHES				
Robin	u	c	c	
Varied thrush		u	u	
Hermit Thrush		u	u	
Veery		u	u	
Western Bluebird		o	o	
Mountain Bluebird		c	c	o
Townsend's Solitaire		c	c	
KINGLETS				
Golden-crowned Kinglet		c	c	
Ruby-crowned Kinglet		c	c	
PIPIT				
Water Pipit		u	u	
WAXWINGS				
Bohemian Waxwing				o
Cedar Waxwing		u	u	
SHRIKES				
Northern Shrike				o
Loggerhead Shrike	c	c	c	c
STARLING				
Starling	c	c	c	c
VIREOS				
Solitary Vireo		u	u	
Warbling Vireo		u	u	
WARBLERS				
Orange-crowned Warbler		u	u	
Nashville Warbler		u	u	
Yellow Warbler		u	u	
Audubon's Warbler	u	u	u	
Black-throated Gray Warbler		u	u	
Townsend's Warbler		u	u	
Hermit Warbler		o	o	
Macgillivray's Warbler		u	u	

Seasonal Abundance

	<u>S</u>	<u>S</u>	<u>F</u>	<u>W</u>
WARBLERS, Cont.				
Yellowthroat		u	u	
Yellow-breasted Chat		c	c	
Wilson's Warbler		u	u	
American Redstart	u	u	u	
WEAVER FINCH				
House Sparrow	c	c	c	c
MEADOWLARK, BLACKBIRDS, ORIOLES				
Western Meadowlark	u	c	c	
*Yellow-headed Blackbird	u	c	c	
*Redwinged Blackbird	u	c	c	
Bullock's Oriole			c	c
Brewer's Blackbird	u	c	c	
Brown-headed Cowbird	u	c	c	
TANAGER				
Western Tanager	u	c	c	
GROSBEAKS, SPARROWS, FINCHES				
Black-headed Grosbeak		u	u	
Lazuli Bunting		u	u	
Evening Grosbeak		c	c	
Cassin's Finch		u	u	
House Finch	u	u	u	
Pine Grosbeak		u	u	
Common Redpoll				u
Pine Siskin	u	u	u	
American Goldfinch	o	c	c	
Lesser Goldfinch		u	u	
Red Crossbill		o	o	
GALLINACEOUS BIRDS				
Sage Grouse	c	c	c	c
California Quail	c	c	c	c
Mountain Quail	o	o	o	o
*Ring-necked Pheasant	o	o	o	o
Chukar	u	u	u	u
Gray Partridge	o	o	o	o

	Seasonal Abundance			
	<u>S</u>	<u>S</u>	<u>F</u>	<u>W</u>
CRANES				
*Sandhill Crane	c	c	c	o
RAILS				
*Virginia Rail	o	o	o	o
*Sora	o	o	o	o
American Coot	c	a	a	o
PLOVERS				
Killdeer	c	a	a	o
Black-bellied Plover	o	u	u	o
SHOREBIRDS				
Common Snipe	c	c	c	o
*Long-billed Curlew	c	c	c	o
Spottend Sandpiper	u	c	c	
Willet	c	c	c	o
*Greater Yellowlegs	o	o	o	
*Least Sandpiper	o	o	o	
*Dunlin	o	o	o	
Long-billed Dowitcher	o	o	o	
*Western Sandpiper	u	c	c	
Avocet	u	c	c	
*Black-necked Stilt	o	u	u	
PHALAROPES				
*Wilson's Phalarope	u	c	c	
*Northern Phalarope				
GULLS, TERNS				
*California Gull	u	a	a	o
*Ring-billed Gull	u	a	a	o
*Bonaparte's Gull	u	c	c	o
*Forster's Tern	u	u	u	
*Caspian Tern	u	c	c	
*Black Tern	u	c	c	
PIGEONS, DOVES				
Band-tailed Pigeon		o	o	
Mourning Dove	u	a	a	u

Seasonal Abundance

	S	S	F	W
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OWLS

Barn Owl	o	o	o	o
Great Horned Owl	c	c	c	c
Pygmy Owl	o	o	o	o
Burrowing Owl	u	u	u	
Long-eared Owl	u	u	u	u
Short-eared Owl		c	c	
Saw-whet Owl	o	o	o	o

GOATSUCKERS

Poor-will	o	c	c	
Common Nighthawk	o	c	c	

SWIFTS

Black Swift	o	o	o	
White-throated Swift	o	o	o	

HUMMINGBIRDS

Black-chinned Hummingbird	o	u	u	
Broad-tailed Hummingbird	o	o	o	
Rufous Hummingbird	o	u	u	
Calliope Hummingbird	o	u	u	

KINGFISHERS

Belted Kingfisher	u	u	u	u
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WOODPECKERS

Red-shafted Flicker	u	c	c	u
Pileated Woodpecker		o	o	
Lewis' Woodpecker	o	u	u	
Yellow-bellied Sapsucker		u	u	
Williamson's Sapsucker		u	u	
Hairy Woodpecker		u	u	
Downy Woodpecker		o	o	
White-headed Woodpecker		o	o	

FLYCATCHERS

Eastern Kingbird		o	o	
Western Kingbird	u	c	c	
Ash-throated Flycatcher	u	c	o	
Say's Phoebe	u	c	c	
Traill's Flycatcher		u	u	
Hammond's Flycatcher		c	c	
Dusky Flycatcher		c	c	
Gray Flycatcher		u	u	

Seasonal Abundance

S S F W

FLYCATCHERS, Cont.

Western Flycatcher		u		u
Western Wood Pewee		c		c
Olive-sided Flycatcher		c		c

LARKS

Horned Lark	a	a	a	a
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SWALLOWS

Violet-green Swallow	u	u		u
Tree Swallow		u		u
Rough-winged Swallow		o		o
Barn Swallow	u	c		c
Cliff Swallow	u	c		c
Green-tailed Towhee		u		u
Rufous-sided Towhee	u	c		c
Savannah Sparrow		u		u
Vesper Sparrow		u		u
Lark Sparrow		c		c
Sage Sparrow	o	c		c
Slate-colored Junco	o			o
Oregon Junco	c			c
Chipping Sparrow		u		u
Brewer's Sparrow		c		c
White-crowned Sparrow		c		c
Golden-crowned Sparrow		o		o
Fox Sparrow		u		u
Lincoln Sparrow		u		u
Song Sparrow		u		u
Snow Bunting	u			o

General Appearance

Number of

100

100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4

100

100	1	2	3	4
100	1	2	3	4
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100

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100

100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4
100	1	2	3	4

PLATEAU, Conf.
Western Flycatcher
Western Wood Pewee
Olive-sided Flycatcher

LARK

House Lark

SWALLOW

White-throated Swallow
Tree Swallow
Rough-winged Swallow
Bank Swallow
Cliff Swallow
Green-winged Teal
Rufous-sided Tanager
Greenish Tanager
Yellow Tanager
Less Tanager
Dark Tanager
Black-crowned Tanager
Orange-billed Tanager
Cinnamon Tanager
Rufous Tanager
White-crowned Tanager
White-crowned Tanager
Red Tanager
Black Tanager
Blue Tanager

APPENDIX III

Secretary's Regulations

1. Geothermal Steam Act
2. Title 30 - Mineral Resources
Chapter II - Geological Survey, Department of the Interior
 - a. Part 270 - Geothermal Resources Operations
On Public, Acquired & Withdrawn Lands
 - b. Part 271 - Geothermal Resources Unit Plan
Regulations (Including Suggested Forms)
3. Title 43 - Public Lands
Chapter II - Bureau of Land Management,
Department of the Interior
Subchapter C - Minerals Management
 - a. Part 3000 - Minerals Management; General
 - b. Part 3200 - Geothermal Resources Leasing; General
4. Notice of Proposed Geothermal Resources Operational
Orders No. 1, 2 and 3.
5. Bureau of Land Management Form 3200-9; Notice of Intent
to Conduct Geothermal Resource Exploration Operations.
6. Bureau of Land Management Form 3200-21;
Geothermal Resources Lease.



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.

- (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

Conversion.

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;

Acreage limitation.

(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.

Lease provisions. Royalties.

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;

41 Stat. 437.

(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;

Rent.

(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

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 25, 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.

61 Stat. 913.

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.

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.

Limitation.

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.

Notice.

(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.

Byproducts.

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.

Relinquishment.

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.

Suspension.

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.

Leases,
termination.
Notice.

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

Surface
land, use.

41 Stat. 1075;
62 Stat. 275.

16 USC 1.

Lessees,
citizenship
requirement.

Cooperative
or unit
plan.

resources, if he determines that this is necessary to promote development or that the lease cannot be successfully operated under the lease terms.

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.

(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.

(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.

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.

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.

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

(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

Moneys.

Publication in
Federal Register.

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.

(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.

Rules and
regulations.

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 281.

"As used in this Act, 'mineral leasing laws' shall mean the Act of February 25, 1920 (41 Stat. 437); the Act of April 17, 1926 (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.

Title 30—Mineral Resources

CHAPTER II—GEOLOGICAL SURVEY,
DEPARTMENT OF THE INTERIORPART 270—GEOHERMAL RESOURCES
OPERATIONS ON PUBLIC, ACQUIRED,
AND WITHDRAWN LANDSPART 271—GEOHERMAL RESOURCES
UNIT PLAN REGULATIONS (INCLUDING
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.

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GENERAL PROVISIONS

§ 270.1 Purpose and authority.

The Geothermal Steam Act enacted on December 24, 1970 (84 Stat. 1566) 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 a 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

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.

(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

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 he may consider 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

(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 lines 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 work.

(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 mudding, 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 mudding. 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

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

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271.16	Form of designation of successor unit operator by working interest owners.
271.17	Form of change in unit operator by assignment.

AUTHORITY: Section 18 of the Geothermal Steam Act of 1970 (84 Stat. 1566) (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

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. 1566), 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 as 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 deposited 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

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 approving 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 OF _____
STATE OF _____

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----- **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 control 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 24, 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

of the Unit Area, the boundaries and identity of tracts and leases in said area to the extent known to the Unit Operator.

3.3 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 and 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 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 Unitized Leases, insofar as they cover any 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 Act, and the lease or leases 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 unitized 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 at a subsurface location under Unitized 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 Unitized 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 retained under this Agreement after the fifth anniversary of the initial Participating Area as a result of exploratory drilling operations, all legal subdivisions of unitized 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—UNITIZED LAND AND UNITIZED SUBSTANCES

5.1 All land committed to this Agreement shall constitute land referred to herein as "Unitized Land". All geothermal resources in and produced from any and all formations of the Unitized Land are unitized under the terms of this agreement and herein are called "Unitized 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 Unitized 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 Unitized Substances, and the term "Working Interest Owner" when used herein shall include or refer to Unit Operator as 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 Operators rights, as such, for a period of six (6) months after notice of its 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 selected and 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 percentage vote 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 The 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 Unitized 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 new duly qualified successor Unit Operator or, if no such new unit operator is elected, to the common agent appointed to represent the Working Interest Owners in 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 Unitized Substances, based on their respective shares, on an acreage basis, in the Unitized 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 Unitized 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, a concurring vote of 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

(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 election 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; all 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 herein 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 Untitized 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 Untitized Land shall be deposited with the Unit Operator, and together 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 Untitized Substances from Untitized 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 to be necessary 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 and/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 The 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 ----- formation has been tested or until at a lesser depth untitized substances shall be discovered which can 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 under 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 Untitized Substances in paying quantities is completed to the satisfaction of the Supervisor or until it is reasonably proved that the Untitized Land is incapable of producing Untitized Substances in paying quantities in the formations drilled under this Agreement.

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 Untitized Substances, the failure of Unit Operator to timely drill any of the wells provided for in Plans of Operation required under this Article XI or to timely submit an acceptable 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 interests of all parties to this Agreement.

ARTICLE XII—PARTICIPATING AREAS

12.1 Prior to the commencement of production of Untitized 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 this Unit Agreement, whichever is later. Said schedule (or schedules) shall also set forth the percentage of Untitized 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 Untitized 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 Untitized Substances shall be the first of the month in which is obtained the knowledge or information on 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 include lands necessary to unit operations, 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 Untitized 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 UNTITIZED SUBSTANCES

13.1 All Untitized Substances produced from a Participating Area, established under this Agreement, shall be deemed to be produced equally on an acreage basis from the several tracts of Untitized Land within the

Participating Area established for such production.

13.2 For the purpose of determining any benefits accruing under this Agreement, each Tract of Utilized 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 Utilized 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 whether in conformity with the basis of allocation set forth above or otherwise.

13.4 The Utilized 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 Utilized 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.

14.4 If the fee owner or lessor of the Utilized 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 six (6) months after the relinquished, surrendered, or forfeited 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 unutilized Working Interests in accordance with their respective Working Interest ownerships, and such owners of Working Interests shall compensate the fee owner or lessor of Utilized 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 all benefits accruing to or payments and expenditures made or incurred on behalf of any surrendered or for-

feited Working Interest subsequent to the date of surrender or forfeiture, and payment 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 unutilized lease on non-Federal land containing 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 on 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, 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 unutilized Federal leases, in no event creditable against production royalties, shall be paid for each acre or fraction 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 Utilized Acreage within a Participating Area as of the beginning of the lease year. If there is production during the lease year the deficit, if any, between the actual royalty paid 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, laws, 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 each month for Utilized 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 Utilized Substances on the basis of the amounts thereof allocated to unutilized 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 respective lease obligations for the payment of any rental, minimum royalty, or royalty due under their leases.

16.1 Any party hereto owning or controlling the Working Interest in any Utilized 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 30 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 expressly modified and amended only 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 the Federal leases committed hereto and the 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 Utilized Lands will be accepted and deemed to be performed upon and for the benefit of each and every tract of Utilized Land.

17.5 Suspension of operations and/or production on all Utilized Lands pursuant to direction or consent of the Secretary or his duly authorized representative shall be deemed to constitute such suspension pursuant to such direction or consent as to each and every tract of Utilized 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 lease committed hereto may, as to the Utilized Lands, be continued for the term

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 contraction thereof.

17.8 Each sublease or contract relating to the operations and development of Untitized 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) Untitized Substances are produced or utilized in commercial quantities in which event this Agreement shall continue for so long as Untitized 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 heretofore 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 such 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 expenses, 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 Untitized Substances from any of the land covered by this Agreement, shall be suspended while, 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 accidents, uncontrollable 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 Untitized 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 section 202 (1) to (7) inclusive, of Executive Order 11246 (30 F.R. 12319), as amended by Executive Order 11375 (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 who have 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 this Agreement by written notice delivered to the Supervisor 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 XXV, 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 involved, 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 payment of any 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 be effective as of 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 Untitized Land shall fail 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.

a partnership or association between the parties hereto or any of them.

ARTICLE XXIX—TAXES

ARTICLE XXXI—SPECIAL FEDERAL LEASE STIPULATIONS AND/OR CONDITIONS

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 Utilized 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.

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.

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.

In witness whereof, the parties hereto have caused this Agreement to be executed and have set opposite their respective names the date of execution.

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




Witnesses: _____ Unit operator (as unit operator and as working interest owner)
 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 ⑦ 16 State	① 15	Volcanics ① 14 C-38470	Fumarole ⑥ 13 (4120) Hadde 40.00 40.20 40.40 40.60
Volcanics ③ 21	Fumarole ② 22 (590.00) Smith	① 23 (410.00)	Hot Rock ⑥ 24 (413.80) C-83970 40.80 41.00 41.00 41.00
Hot Rock ③ 28 C-41345	Hot Volcan-Rock ④ 27 C-41679	Hot Rock ③ 26 C-72780	⑥ 25 (413.50) ⑤ 40.80 40.70
③ 33 C-41679	Hot Rock ⑥ 34 Quick, et al.	Hot Rock ② 35 C-39123	Hot Rock ⑦ 36 (412.60) State 40.60 40.40 40.00 39.60

T.
13
N.

- ① Means tract number as listed on Exhibit B
-  PUBLIC LAND
-  STATE LAND
-  PATENTED LAND

§ 271.14 Sample form of Exhibit B of unit agreement.

EXHIBIT B—BIG VAPOR UNIT AREA, NAPA COUNTY, CALIF., T. 13 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	Working interest and percentage
<p><i>Federal land</i> <i>California acrias</i></p>						
1.....	Sec. 14: All. Sec. 15: All. Sec. 23: Lots 1, 2, 8 1/2, NE 1/4, E 1/2 NW 1/4.	1,890.00	38470 July 31, 1982...	United States: All.	Volcanics, Inc.....	Volcanics, Inc: All.
2.....	Sec. 35: All.	640.00	39123 July 31, 1982.	do.....	D. H. Boller.....	Hot Rock Co.: All.
3.....	Sec. 21: All. Sec. 28: All.	1,280.00	41345 July 31, 1982.	do.....	C. S. Waters—50% D. F. Mann—50%	Volcanics, Co.: 50% Hot Rock Co.: 50%
4.....	Sec. 27: All. Sec. 33: All.	1,280.00	41679	do.....	H. C. Pipes.....	Fumarole Ltd.: All.
5.....	Sec. 26: All. Sec. 25: E 1/2.	961.50	71278 Sept. 31, 1982.	do.....	Hot Rock Co.....	Hot Rock Co.: All.
6.....	Sec. 24: All. Sec. 25: N 1/2.	965.80	83970 Application.	do.....	H. C. Pipes.....	Do.
<p>6 Federal tracts 7,017.30 acres or 68.47% of unit area.</p>						
<p><i>California State land</i></p>						
7.....	Sec. 16: All. Sec. 36: All.	1,280.60	65-67430	State of California: All.	Hot Rock Co.....	Hot Rock Co.: All.
<p>1 State tract 1,280.60 acres or 12.49% of unit area.</p>						
<p><i>Patented land</i></p>						
8.....	Sec. 13: All.	641.20	June 30, 1979.	I. B. Hadde: All.	Fumarole, Ltd.....	Fumarole, Ltd.: All.
9.....	Sec. 22: Lots 1, 2, 3, 4, E 1/2, NW 1/4.	590.00	Feb. 28, 1981.	J. P. 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 30.....	80.00	Apr. 30, 1981.	M. V. Jones: All.	Unleased.....	M. V. Jones: All.
<p>3 Patented tracts 1,951.20 acres or 19.04% of unit area.</p>						
<p>Total.. 11 tracts 10,249.10 acres in entire unit area.</p>						

§ 271.15 Form of collective bond.

COLLECTIVE CORPORATE SURETY

Known all men by these presents, That we, _____ signing as Principal, (Name of Unit Operator) _____, for and on behalf of the record owners of unitized substances now or hereafter covered by the unit agreement for this _____, approved _____, (Name of Unit) _____, (Date) _____, 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 (Date) _____ 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 unit operator by working interest owners.

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. 1566, 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,¹ 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 hereinafter stated, the First Party hereby covenants and agrees to fulfill the 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 references 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____.

Supervisor,
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."

¹ Where the designation of a successor Unit Operator is required for any reason other than resignation, such reason shall be substituted for the one stated.

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/its 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 accept 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]

Geothermal Resources Operational Order
No. 2

Effective -----

*Drilling, Completion and Spacing of
Geothermal Wells*

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.14, 30 CFR 270.15, and 30 CFR 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 drilling rules are issued. After field drilling rules have been established by the 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 to the Supervisor for the establishment of field drilling rules. When required by the Supervisor, lessees shall make application for the establishment of field drilling rules for existing fields containing development wells on the effective date of this Order. The Supervisor may issue field drilling rules at any time he deems appropriate upon failure of the lessee to timely file for such field drilling rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development Plan of Operation for the lease 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. All casing strings reaching the surface shall be of sufficient length and cemented in a manner such that adequate anchorage and support will be provided 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. 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.

Geological Survey
**DRILLING, COMPLETION AND SPACING OF
GEOTHERMAL WELLS**

Notice of Proposed Geothermal Resource
Operational Order No. 2

SEPTEMBER 25, 1974.

Notice is hereby given that pursuant to 30 CFR 270.14, 270.15, 270.40 and 270.48, the Chief, Conservation Division, Geological Survey proposes to approve GRO Order No. 2 for geothermal operations conducted in the Central and Western Regions as set forth below.

The purpose of proposed GRO Order No. 2 is to provide requirements to geothermal operators for drilling, completion and spacing of geothermal wells.

Interested persons may submit written comments, suggestions, and objections concerning the proposed order to the Chief, Conservation Division, U.S. Geological Survey, Mail Stop 650, 12201 Sunrise Valley Drive, Reston, Virginia 22092, with a copy to the Geothermal Supervisor, 345 Middlefield Road, Menlo Park, California 94025, on or before November 15, 1974.

W. A. RADLINSKY,
Acting Director.

UNITED STATES DEPARTMENT OF THE INTERIOR,
GEOLOGICAL SURVEY, CONSERVATION DIVISION
NOTICE TO LESSEES AND OPERATORS OF FEDERAL
GEOTHERMAL LEASES

A. Conductor casing. This casing shall be set at a minimum depth of 27 metres (90 feet) and a maximum depth of 60 metres (200 feet) below drilling into shallow formations known to contain geothermal resources or non-condensable gases or, if unknown, 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), unless otherwise authorized by the Supervisor.

C. Intermediate casing. This casing shall be set at any time when drilling below the surface casing when required by well conditions such as anomalous pressure zones, uncased fresh water aquifers, cave-ins, wash-outs, uncontrollable 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 failure during the test, the lap 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 an intermediate casing string. The casing 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 casing failure during the test, the casing must be repaired or recemented as required by the Supervisor. Production casing shall 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.

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, if possible, 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 shall be run after setting and cementing the production casing and after all primary cementing operations.

F. Pressure testing. Prior to drilling out the casing shoe after cementing, all casing strings except for conductor casings, shall be pressure tested to a minimum pressure of 69 bars (1000 psi). Such test shall not exceed the rated working pressure of the casing. 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 20 percent or less in 15 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. The Supervisor shall be given advance notice of all casing

tests in sufficient time to enable the Supervisor to be present to witness such tests. The casing test report shall give a detailed description of the test including but not limited to mud and cement volumes, lapse of time between running and cementing casing and testing, the method of testing and the test results.

G. Directional surveys. Surveys shall be taken on all wells during the normal course of drilling. Surveys shall be obtained at intervals not to exceed 152 metres (500 feet). Directional surveys giving both inclination and azimuth shall be obtained at intervals not to exceed 30 metres (100 feet) between stations and prior to setting any casing string as well as at total depth. Composite directional surveys shall be filed from the bottom of the conductor casing to total depth. The Supervisor may require a directional survey to be made of the finished hole of 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, where possible.

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 daily, 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. All fill-up lines, kill lines, blowdown lines, manifolds and fittings shall be steel and shall have a minimum temperature derated working pressure rating equivalent to that of the highest pressure rated blowout prevention equipment proposed for the particular well in question. Blowout prevention equipment shall have hydraulic actuating systems and accumulators of sufficient capacity unless waived by the Supervisor. Dual control stations shall be installed with a hydraulic high pressure backup system. One control panel shall be located at the driller's station and one control panel shall be located at least 15 metres (50 feet) away from the wellhead or rotary table. Air or other gaseous fluid drilling methods shall have blowout prevention assemblies which shall include but are not limited to a rotating head, a double ram blowout preventer or equivalent, a so-called banjo-box and a blind ram blowout preventer, respectively. A proposed blowout prevention program and a blowout contingency plan 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 equivalent, approved by the Supervisor, including a drilling spool with side outlets, shall be installed. When deemed necessary by the Supervisor, 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, a remotely controlled hydraulically operated double ram blowout preventer or equivalent having a temperature derated working pressure which exceeds the maximum anticipated surface pressure at the anticipated reservoir fluid temperature;
- (2) A drilling spool with side outlets;
- (3) A fillup line;
- (4) A kill line equipped with at least one valve; and

(5) A blowdown line equipped with at least two valves and securely anchored at all bends and at the end.

C. Testing and maintenance. Blowout preventers and auxiliary equipment shall be tested to a minimum of 69 bars (1000 psi) or to the working pressure of the casing or assembly, whichever is the lesser, after installation, prior to drilling out plugs and/or casing shoes and on a daily basis during drilling operations. Riser flange bolts shall be inspected at least daily and retightened as necessary during drilling operations. The auxiliary control systems shall be inspected and operated 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 dismantled, 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 installed between the Kelly and the swivel shall be required if deemed necessary by the Supervisor as well as a drill string check valve when drilling with air or other gaseous fluids.

3. Drilling fluid. The properties, use and testing of drilling fluid 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, 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 annular mud level shall not be deeper than 30 metres (100 feet) from the rotary table when coming out of the hole with drill pipe, and the hole shall be kept reasonably full at all other times. 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 occurring below the shoe of the conductor casing.

- (1) High-low level mud pit indicator including a visual or audio-warning device.
- (2) Degassers, desilters and desanders shall be installed when deemed necessary by the Supervisor.
- (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 meters (30 feet) of hole drilled below the conductor casing.
- (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 induction, radiation, temperature, bond, and any other logs run, within 30 days after completion of drilling operations on each well. 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.* The lessee shall furnish to the Supervisor two legible exact copies of core analysis reports and lithologic (mud) logs within 30 days after the completion of such reports or logs.

5. *Wellhead equipment and testing.*

A. *Completions.* All wellhead connections shall be fluid pressure tested to 1.5 times the API 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 specification. Wellhead and other surface production equipment shall be maintained in good condition with particular attention exercised for the prevention or mitigation of corrosion and erosion.

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. 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 of substances that function effectively at, and are resistant to, high temperatures. Wellhead equipment, valves, flanges and fittings shall meet 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 to correct such failure.

6. *Well spacing.* No portion of any well shall be located within 61 metres (200 feet) of the outer boundaries of the leased lands, except where necessary to protect those lands against wells on lands the title to which is not held by the lessor and then only on consent in writing from 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.

RED T. STONE,
Area Geothermal Supervisor,

Approved:

RUSSELL G. WAYLAND,
Chief, Conservation Division.

[FR Doc.74-22566 Filed 9-27-74; 8:45 am]

EXPLORATORY OPERATIONS

Notice of Proposed Geothermal Resource Operational Order No. 1

SEPTEMBER 25, 1974.

Notice is hereby given that pursuant to 30 CFR 270.11, and in accordance with 30 CFR 270.78, the Chief, Conservation Division, Geological Survey proposes to approve GRO Order No. 1 for geothermal operations conducted in the Central and Western Regions as set forth below.

The purpose of proposed GRO Order No. 1 is to provide requirements to geothermal operators for all exploratory operations other than drilling of exploratory and development wells.

Interested persons may submit written comments, suggestions, and objections concerning the proposed Order to the Chief, Conservation Division, U.S. Geological Survey, Mail Stop 650, 12201 Sunrise Valley Drive, Reston, Virginia 22092, with a copy to the Geothermal Supervisor, 345 Middlefield Road, Menlo Park, California 94025, on or before November 15, 1974.

W. A. RADLINSKI,
Acting Director.

UNITED STATES DEPARTMENT OF THE INTERIOR,
GEOLOGICAL SURVEY, CONSERVATION DIVISION

NOTICE TO LESSEES AND OPERATORS OF FEDERAL
GEOHERMAL LEASES

Geothermal Resources Operational
Order No. 1

Effective -----

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 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 Resource 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 lessee shall comply with the requirements of this Order.

The following exploratory operations and reasonable expenditures therefore will qualify as diligent exploration if approval prior to the initiation of such operations is received by the lessee from the Supervisor.

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 require a Notice of Intent to Conduct Geothermal Resource Exploration Operations (Form 3200-9). 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 electric resistivity surveys, seismic ground noise surveys and all other passive micro-earthquake monitoring surveys, mag-

neto-telluric surveys, all other geophysical surveys, including airborne techniques.

Geophysical surveys will require a Notice of Intent to Conduct Geothermal Resource Exploration Operations (Form 3200-9). All such anticipated surveys should be included in the Plan of Operation 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.* The 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 Resource 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. Flow line temperatures shall be taken at frequent time intervals during drilling operations on shallow holes drilled with mud. If flow line mud temperature should reach 52° C (125° F) without special cooling, 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, or

(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.

During drilling operations, exceptions will be allowed only with specific permission from the Supervisor.

C. If flowing steam or hot water at 65° C (150° F) 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.

Exceptions will be allowed only with specific permission from the Supervisor.

D. If cold flowing artesian water is encountered, hole will be completed as in (C) hereinabove, except that plastic tubing may be used.

If the conditions outlined in either (B) or (C) hereinabove or herein are encountered, the Supervisor shall be notified immediately.

E. The lessee shall submit the following information with the Notice of Intent to Conduct Geothermal Resource Exploration Operations (Form 3200-9):

(1) The approximate location [to the nearest 30 metres (100 feet) from some identifiable marker or object within a section] and hole number or designation of each proposed hole and order of drilling;

(2) The type and size of drilling rig;

(3) The proposed drilling program including drilling method (auger, air or mud), approximate depths and casing (conductor) program;

(4) The type of drilling sump and proposed method of sump abandonment;

(5) The approximate time holes will be used for observation; and

(6) The proposed method of abandonment. Additionally, the lessee shall notify the Supervisor of any changes in locations and

locations of any additional holes to be drilled.

F. Locations proposed in natural thermal areas [within a 457 metre (1500 foot) radius of hot springs, fumaroles, or other surface geothermal indicia] or in areas of known artesian water flow, will require a drilling program for each hole, approved by the Supervisor. Such holes may require special drilling and completion techniques (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-weighting material shall be kept on hand while drilling to control excess pressure (if using rotary equipment).

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/or dirt if drilled with air or auger) to 3 metres (10 feet) and with cement 3 metres (10 feet) to surface, and the tubing shall be capped when not in use.

I. Holes shall be abandoned in a manner that will prevent subsurface inter-zonal migration of fluids and surface leakage. As a minimum, the top 3 metres (10 feet) of tubing should 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 Resource Exploration Operations (Form 3200-10) shall be submitted in triplicate, and shall contain, among other items, the following information for each hole drilled:

- A. Final hole designation and location.
- B. A drillers log noting water table (if determined), and salt, coal bends or other mineral deposits, if present.
- C. Methods of completion, cementing, and casing and/or tubing used.
- D. Details of abandonment.
- 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.
- F. Temperature survey data from each hole.
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 back-filled as soon as drilling is completed and restored to conform with the original topography. If necessary to allow evaporation before backfilling, the sumps shall be completely fenced for the protection of domestic animals or 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.

[FR Doc.74-22567 Filed 9-27-74; 8:45 am]

PLUGGING AND ABANDONMENT OF WELLS

Notice of Proposed Geothermal Resource Operational Order No. 3

SEPTEMBER 25, 1974.

Notice is hereby given that pursuant to 30 CFR 270.11 and in accordance with 30 CFR 270.14 and 270.45, the Chief, Con-

servation Division, Geological Survey, proposes to approve GRO Order No. 3 for geothermal operations conducted in the Central and Western Regions as set forth below.

The purpose of proposed GRO Order No. 3 is to provide requirements to geothermal operators for all well abandonment operations.

Interested persons may submit written comments, suggestions, and objections concerning the proposed Order to the Chief, Conservation Division, U.S. Geological Survey, Mail Stop 650, 12201 Sunrise Valley Drive, Reston, Virginia 22092, with a copy to the Geothermal Supervisor, 345 Middlefield Road, Menlo Park, California 94025, on or before November 15, 1974.

W. A. RODLINSKI,
Acting Director.

UNITED STATES DEPARTMENT OF THE INTERIOR,
GEOLOGICAL SURVEY, CONSERVATION DIVISION

NOTICE TO LESSEES AND OPERATORS OF FEDERAL GEOTHERMAL LEASES

Geothermal Resources Operational Order No. 3

Effective -----

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 270.45 and 30 CFR 270.14. 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 Supervisor or his delegated representative.

The lessee shall promptly plug and abandon any well on the leased land that is not in use or 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 and such cement shall consist of a high temperature resistant admix, unless 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. Any bond or rider thereto, covering the lease or an individual well thereon, shall remain in full force and effect until the lease or individual well, as the case may be, is properly abandoned (including surface restoration) and written approval by the Supervisor has been obtained.

1. **Permanent abandonment—A. Uncased hole.** In uncased portions of wells, cement plugs shall be placed to cover the fresh water and geothermal resources zones. Such plugs

shall extend a minimum of 30 metres (100 feet) below, if possible, and 30 metres (100 feet) above all 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 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 all production perforations, extending 30 metres (100 feet) below (where possible) and 30 metres (100 feet) above the perforated interval. When using a cement retainer to squeeze cement the perforated interval, it shall be set a minimum of 30 metres (100 feet) above the perforations. Where the hole contains 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 squeezed cemented.

D. **Casing 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 and liner tops. Such plug shall extend a minimum of 15 metres (50 feet) below and 15 metres (50 feet) above any such stub, lap or liner top.

E. **Casing shoes.** All casing shoes not protected by an inner casing string shall be straddled with a 30-metre (100-foot) cement plug.

F. **Plugging of annular space.** All open annular extending to the surface shall be filled with cement to the surface.

G. **Surface plug.** A minimum of 15 metres (50 feet), measures from ground level, of neat cement or concrete shall be placed in the innermost casing string which reaches ground level.

H. **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 15,000 pounds weight on the plug.

I. **Mud.** Each of the respective intervals of the hole not filled with cement shall be filled with good quality heavy mud.

J. **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 sub-

paragraphs F, G, and J of paragraph 1, or as otherwise approved by the Supervisor.

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, before adequate measures have been taken to close the well and protect the subsurface resources including fresh water aquifers.

RED T. STONE,
Area Geothermal Supervisor.

Approved:

RUSSELL G. WAYLAND,
Chief, Conservation Division.

[FR Doc.74-22565 Filed 9-27-74; 8:45 am]

Title 43—Public Lands: Interior
CHAPTER II—BUREAU OF LAND MANAGE-
MENT, DEPARTMENT OF THE INTERIOR
SUBCHAPTER C—MINERALS MANAGEMENT
(3000)

Circular 2356

GEOTHERMAL RESOURCES

Leasing on Public, Acquired and Withdrawn
Lands

**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—GEOTHERMAL
RESOURCES LEASING; GENERAL**

**Subpart 3200—Geothermal Resources Leasing
General**

Sec.	
3200.0-3	Authority.
3200.0-5	Definitions.
3200.0-6	Preleasing 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.

Subpart 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.

Subpart 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.

Subpart 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.

Subpart 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.

Subpart 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.
- 3206.7 Default.
- 3206.7-1 Payment by surety.
- 3206.7-2 Penalty.
- 3206.8 Applicability of provisions to existing bonds.

Subpart 3207—[Reserved]

Subpart 3208—[Reserved]

Subpart 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.

Subpart 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, workshops, 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;

(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).

(1) "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 fully the potential effect of the geothermal resources operations pursuant to a leasing program on the total environment, 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 supervisor, 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.

§ 3201.1-1 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 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 therefor 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 communization 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 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.

§ 3202.2-1 General.

(a) 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 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, communitization 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 communitization or drilling agreement.

(a) Any lease committed to any cooperative plan, communitization 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 communitization 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 communitization 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 communitization 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 communitization 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 communitization 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 181-287), 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.

§ 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. Rejection 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.

(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 producing 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 of 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 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 required to submit the additional rental fraction thereof, the applicant will be 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 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 authorized 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 unutilized 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 lease 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

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.

§ 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 list.

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 30 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 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 a 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 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 thereof, 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
- (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 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 applications 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 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 expenditure made for the exploration, development, or production of 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

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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.

(c) 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 statement 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 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 byproduct 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 byproduct, 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.

§ 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 Communitization 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, communitization 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 communitize 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 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 reinstate 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 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 (i) 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 (ii) 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
BUREAU OF LAND MANAGEMENT

Notice Number

**NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE
EXPLORATION OPERATIONS**

Applicant(s)	Address (include zip code)
Operator	Address (include zip code)
Contractor(s)	Address (include zip code)

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands (give description of lands by township, attach map or maps showing lands to be entered or affected)

Type of operations to be conducted (give brief description)

Exploration operations will be conducted during the period (date) from _____ to _____

Attached \$ _____ Surety bond Rider to Nationwide bond Rider to Statewide bond Bond to be furnished

Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.

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|---|---|
| <p>The undersigned agrees that the filing of this Notice under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.</p> <p>The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:</p> <ol style="list-style-type: none"> 1. Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner. 2. Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities. 3. All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against | <p>hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.</p> <ol style="list-style-type: none"> 4. All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer. 5. Upon expiration, conclusion, or abandonment of operations conducted pursuant to this Notice, all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. All geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a Notice of Completion of Geothermal Resource Exploration Operations (Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible. 6. Location and depth of water sands encountered shall be disclosed to the Authorized Officer. |
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7. Operator shall contact the Authorized Officer prior to actual entry upon the land in order to be appraised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this *Notice* and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.
8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.
9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.
10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.
11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.
12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.
13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.
14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and

to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.

15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.
16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.
17. If operations conducted under the provisions of this *Notice* causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.
18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.
19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.
20. Contractor shall be liable for assuring compliance with all terms and conditions of this *Notice* and all actions of his designated operator, agents, and employees.
21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this *Notice* will be immediately cancelled by the Authorized Officer.

22. Special Stipulations:

(Signature of Applicant)

(Date)

(Signature of Operator)

(Date)

We hereby agree to the special stipulations added and made a part of this *Notice* to conduct exploration operations.

(Signature of Holder of Notice)

(Date)

(Signature of Operator)

(Date)

I hereby approve this *Notice* to conduct exploration operations.

(Signature of Authorized Officer)

(Title)

(Date)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number
USGS - KGRA Determination:

GEOTHERMAL RESOURCES LEASE

Competitive Noncompetitive

In consideration of the 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 of (a) 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, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) 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 _____:

National Resource Lands			Acquired Lands		
T.	; R.	Meridian	T.	; R.	Meridian
Total Area			Total Area		

Containing _____ acres (hereinafter called the "leased area" or "leased lands"), together with:

- (a) The nonexclusive 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 generating 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 generating 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 are 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 therefor 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 the purposes for which these lands are administered; and
- (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 the 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 on the leased lands or under an approved plan or agreement 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 incapable 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 so long as such by-products are produced in commercial quantities but not for 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 lands, 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 Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional amount of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (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. If any expenditures are 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 or fraction thereof due the Lessor for that or any future year.

(c) **Royalty** - 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:

(1) A royalty of _____ percent 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.

(2) A royalty of _____ percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 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 statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of _____ percent of 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 or any subsequent lease year, a royalty of less than two (2) dollars 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.

(d) **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 in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) **Undivided Fractional Interests** - Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 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.

(f) **Readjustments** - 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 at 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 to compute 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 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 cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of 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 of the Bureau (hereinafter called the "Authorized Officer") 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 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 the Lessee's 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 so that the leased lands may be properly and timely developed and for the production of geothermal steam and its 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 therefor 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 point in the Lessee'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 when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 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 to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, 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 this lease, including the stipulations attached hereto, will be subject to all 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 Lessor for any damage suffered by the Lessor 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 Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from 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 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 Lessor 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 on the environment by 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 Lessor 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 solid waste, and, so far as possible, repair the offsite and onsite damage caused by his 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 zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, 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. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

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 rights of the Lessee under this lease;

(b) **Rights-of-way** - The right to authorize geological and geophysical explorations 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; 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 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 with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). 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 Lessor 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 nearby land for the purposes of this lease, 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 right 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 nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 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 prorated 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 Lessor 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 OR 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, subscribe to 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 BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation 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 in 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 its own expense, or if it 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

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations 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 (30) 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 Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 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 Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, 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 it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) 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.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(c) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 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 Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), 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. MONOPOLY AND FAIR PRICES - The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE - The Lessee agrees that, during the performance of this contract:

(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.

(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 its 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 as may be imposed and remedies 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 (29) in every contract, subcontract or purchase order unless exempted 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 subcontract, 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. 30. CERTIFICATION OF NONSEGREGATED FACILITIES - By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its 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, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, 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 it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it 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 it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A 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 each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS - (stipulations, if any, are attached hereto and made a part hereof)

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DENVER, CO 80225

In witness whereof the parties have executed this lease.
Lessee:

THE UNITED STATES OF AMERICA, Lessor:

(Signature of Lessee)

By _____ (Authorized Officer)

(Signature of Lessee)

(Title)

[SEAL]

(Date)

(Date)

R'S CARD	1974 Land onmental	DATE				
		RETURNED				
		OFFICE				

(Continued on reverse)

TD 195 .E4 L362 1974
U. S. Bureau of Land
Management.
Geothermal environmental
analysis record

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