

GL03134-243

Plan of Operation - Exploration  
Lease Unit 10 CA958  
PG&E Geysers Power Plant Unit 16  
23 March, 1979

Section 35, T11N, R8W, MDB&M  
Geysers Area KGRA  
Lake County, California

Aminoil USA, Inc.  
Geothermal Resources Division  
P. O. Box 11279  
Santa Rosa, California 95406  
(707) 527-5332

Plan proposes the construction of one access road and one multiple drill pad site and the drilling of one or more geothermal resource wells to evaluate the potential for geothermal steam for operation of the proposed Geysers Power Plant Unit 16.

Plan of Operation  
Exploration  
Lease Unit 10 CA958  
PG&E Geysers Power Plant Unit 16

Pursuant to 30 CFR 270.34, Aminoil USA, Inc., formerly Burmah Oil and Gas Company hereby supplements and amends its Plan of Operation, Lease Unit 10 CA958. The Plan of Operation is supplemented and amended to include the construction of one access road and multiple drill pad site and the drilling of one or more geothermal resource wells to evaluate the geothermal steam beneath the portion of Federal lease Unit 10 CA958 which will provide a part of the steam supply for operation of the Geysers Power Plant Unit 16.

Aminoil USA, Inc. has been duly designated as operator of Lease Unit 10 CA958 by the lessee, Occidental Petroleum Corporation by Designation of Operator executed September 25, 1974.

Project Description

Aminoil USA, Inc., Geothermal Division, proposes to construct an access road, multiple drill pad site and drill one or more geothermal resource wells to a depth of +2500 meters (8000') from the portion of Lease Unit 10 CA958 which will provide a part of the steam supply for operation of the Geysers Power Plant Unit 16 in the Geysers KGRA, Lake County, California.

The multiple well pad site is to be constructed on lease Unit 10 CA958 at a location being approximately 781 meters (2560') east and 534 meters (1750') south from the northwest corner of Section 35, Township 11 North, Range 8 West, MDB&M, Lake County, California. Access to the project site is from Highway 175 via Socrates Mine Road, the improved ridgetop forestry service road and the Aminoil "Davies Estate" road which extends across Federal lease Units 8 and 10 in an east northeasterly direction. The Aminoil Davies Estate road was the subject of the USGS Environmental Analysis "Burmah Oil and Gas Company Access Road, CA956 and CA958", October 30, 1974. The proposed project site has been selected and designed to take advantage of existing topographic features and to minimize grading and environmental impacts. All proposed earth movement associated with the project is to be designed to provide for balanced cuts and fills.

Access to the multiple well drill pad site is to be provided by improvements to an existing jeep trail which intersects with the "Davies Estate" road on fee property at a point approximately 1029 meters (3375') east and 781 meters (2560') south of the NW corner of Section 35, T11N, R8W. The access road then extends in a northwesterly direction approximately 303 meters (1000') to a point of intersect with the boundary of Federal Lease Unit 10 CA958 being approximately 839 meters (2750') east and 686 meters (2250') south from the northwest corner of Section 35 and continues in a northwesterly direction on Federal lands for approximately 303 meters (1000') where it terminates at the drill pad site. A relatively short segment of the proposed access road immediately south of the proposed drill pad site is underlain by landslide debris which has been classified as dormant and is not anticipated to present any hazards. The road width is to be limited to the width required to provide for safe operation and to accommodate heavy drilling equipment (4.3m-6.1m). Safety turnouts are to be provided at strategic locations as needed.

The project area appears to be underlain by metamorphosed greenstone. A careful field reconnaissance of the area and studies of aerial photography have failed to reveal any geologic hazards on or immediately adjacent to the proposed site which would preclude construction (Cooper Clark & Asso., February 1979). Several landslides have been identified south and west of the proposed project site, but none are believed close enough to cause a serious hazard. In terms of identification reliability, these landslides vary from definite to questionable and are all considered to be dormant in activity.

The drill pad site is located at an elevation of approximately 763 meters (2500') on a rather broad pear shaped topographic knob with its long axis oriented in an east west direction and its greater width at the west end. Moderate slopes surround the location to the north, east, west and southwest with moderately steep slopes to the northeast and southeast.

Drainage from the project area is by ephemeral tributaries which flow into Hot Springs Creek above its confluence with Anderson Creek. Anderson Creek flows into Putah Creek which forms a part of the watershed area for Lake Berryessa. Water monitoring stations have been in operation for several years downstream from the surface drainage area to which the project area contributes.

Construction areas are to be stripped of vegetation and fills are to be benched and keyed into undisturbed ground and compacted as required by technical specifications as prepared by Hawke Engineers and based on The ASTM method D-1557-70 "Moisture Density Relations Test for Soils". Cut slopes shall not be steeper than 1 horizontal to 1 vertical except where, in the opinion of the Engineering Geologist, sound and durable rock is encountered. Compacted outer fill slopes shall not be steeper than 1-1/2 horizontal to 1 vertical. The area to be stripped of vegetation includes approximately 1 acre for road improvements and 2 acres for well pad site construction. Approximately 1 acre of woodland habitat will be lost to the widening and the lengthening of the existing jeep trail to reduce overly steep areas to more desirable grades. Woodland habitat in the area to be disturbed by road construction consists of black oak, canyon oak, bay and madrone. The approximate two acres to be lost to construction of the multiple well pad site are along the ridgeline and consist mainly of the shrubby live oak community of manzanitas, ceanothus, coffeeberry, mountain mahogany and buckbrush.

No rare Species or Species of special concern are known to exist within the project limits. A study completed for Shell Oil Company "Observation on Populations of the Rare *Streptanthus Morrisonii* Complex in the Central and Southern Mayacmas Mts., Lake, Sonoma and Napa Counties, California" Dr. James A. Neilson PhD, May 15, 1977, failed to locate any populations in the immediate vicinity of the project location. Since appropriate habitats do exist within the area for some species of special concern, a survey for rare and endangered species is to be done at a selected period between April and June, 1979, when the various species could be expected to be in flower. Areas disturbed by construction, except for areas essential to normal geothermal operations, are to be revegetated pursuant to USGS, Menlo Park and BLM, Ukiah requirements and during the period of July through October, prior to the beginning of the winter wet season.

Construction disturbance to the portions of the project area essential to geothermal operations will result in a permanent loss of approximately 2.5 acres of mixed evergreen forest and mixed chaparral wildlife habitat. Wildlife species most likely to be directly impacted would be expected to be the smaller more sedentary species such as fence lizards, salamanders, small birds and small rodents. Habitat for a

relative few individuals of these or other common and widespread species could be lost to the population. Species adaptable to open or edge situations would likely benefit from the revegetation of fill slopes and road sides.

The limits of the area proposed to be disturbed by construction activities will be staked and flagged for appropriate field inspection by USGS and BLM personnel prior to commencement of any operations.

As specified by each geothermal lease, an archeological firm was consulted and a cultural resource reconnaissance of Aminoil's Federal leasehold was performed. The report, "Archeological Assessment of Cultural Resources of Geothermal Leaseholds in Lake and Sonoma Counties, California", was completed by Ann S. Peak, Consulting Archeologist, October 27, 1974 under Antiquity Permit No. 74 EM 016 (Copy on file with USGS, Menlo Park). The report found that no archeological sites were located within the leasehold area and no impact on cultural resources would occur as a result of the proposed construction required for the development of geothermal resources. Subsequent to completion of the above report, the requirement for cultural resources studies was extended to include Native American and Historic Studies. The Ethnographic Laboratory, Department of Anthropology, Sonoma State University completed the report "An Ethnographic and Historical Cultural Resources Study of the Aminoil, Little Geysers, Ford Flat, Cobb Mountain (Units 16, 18, 19, 20, 21) Geothermal Leaseholds Sonoma and Lake Counties, California" in October, 1978. The report inadvertently omitted the Federal leases which form a part of the steam supply field for Units 13 and 16 and therefore, the specific project area described in this Plan. Negotiations are now under way for an extension of that study to include the area of Federal lease Units 8 and 10, and thus cover the project area proposed for construction. Either that study or, if a time constraint becomes evident, a site specific study of the project area will be forwarded under separate cover when completed.

#### Water Supply and Road Building Material

Water supply for the construction and drilling operations associated with the proposed project would be imported to the site location by pipeline or by tank vehicle from a source or sources off Aminoil's Federal leased lands and stored in close proximity to the project operations in a container of sufficient capacity to allow for continuous uninterrupted operations.

Offsite Road building materials required for the proposed project would be provided from an existing borrow pit on Aminoil's fee lease at a location being immediately west of the point of intersect of the proposed access road with the "Davies Estate" road. All earth movement on Federal leases including, but not limited to, roads, drill pads and sumps and all revegetation activities associated with such earth movement will be done pursuant to any U. S. Geological Survey, Menlo Park, or Bureau of Land Management, Ukiah District Office recommendations.

#### Camp Sites, Air Strips and Other Supporting Facilities

Completion of the project proposed by this Plan does not alter Aminoil's plans to utilize its existing support facilities located on adjacent private lands.

No campsites, airstrips or other supporting facilities other than those identified in the project description are contemplated by Aminoil to be constructed on Federal lands.

### Topographic Features and Drainage Pattern

In general, the area to be disturbed by construction for the project lies at elevations from 763 meters (2500') to 793 meters (2600'). The proposed access road at its point of intersect with the Davies Estate road lies at an elevation of approximately 793 meters (2600') and travels downslope in a northwesterly direction to the proposed multiple well drill pad site which lies at an elevation of approximately 763 meters (2500').

Drainage from the entire construction area flows to the northeast and northwest by two ephemeral streams which empty into Hot Springs Creek prior to its confluence with Anderson Creek above the Community of Anderson Springs. The area is a part of the Upper Putah Creek drainage which in turn forms a part of the watershed basin for Lake Berryessa.

### Methods of Disposal of Waste Material

Disposal of waste materials for the proposed project will be in accordance with general methods as described in the Supplement I to the original Plan of Operation for Lease Unit 10 CA958 which was submitted October 9, 1974 and approved November 1, 1974.

Waste disposal methods specific to the proposed site location will be pursuant to specifications provided in the "Aminoil USA, Inc. Geothermal Resources Division, Contract Book for Construction of Access Road and Geothermal Well Location CA958 No. 5 in Lake County, Contract No. CA958-5" which is now being prepared by Hawke Engineers and will be forwarded in the near future under separate cover.

Further waste disposal methods specific to the site are pursuant to Order No. 78-184, Waste Discharge Requirements for Aminoil USA, Inc. Castle Rock Springs Leasehold as adopted by the California Regional Water Quality Control Board, Central Valley Region October 27, 1978.

### Measures for Protection of the Environment

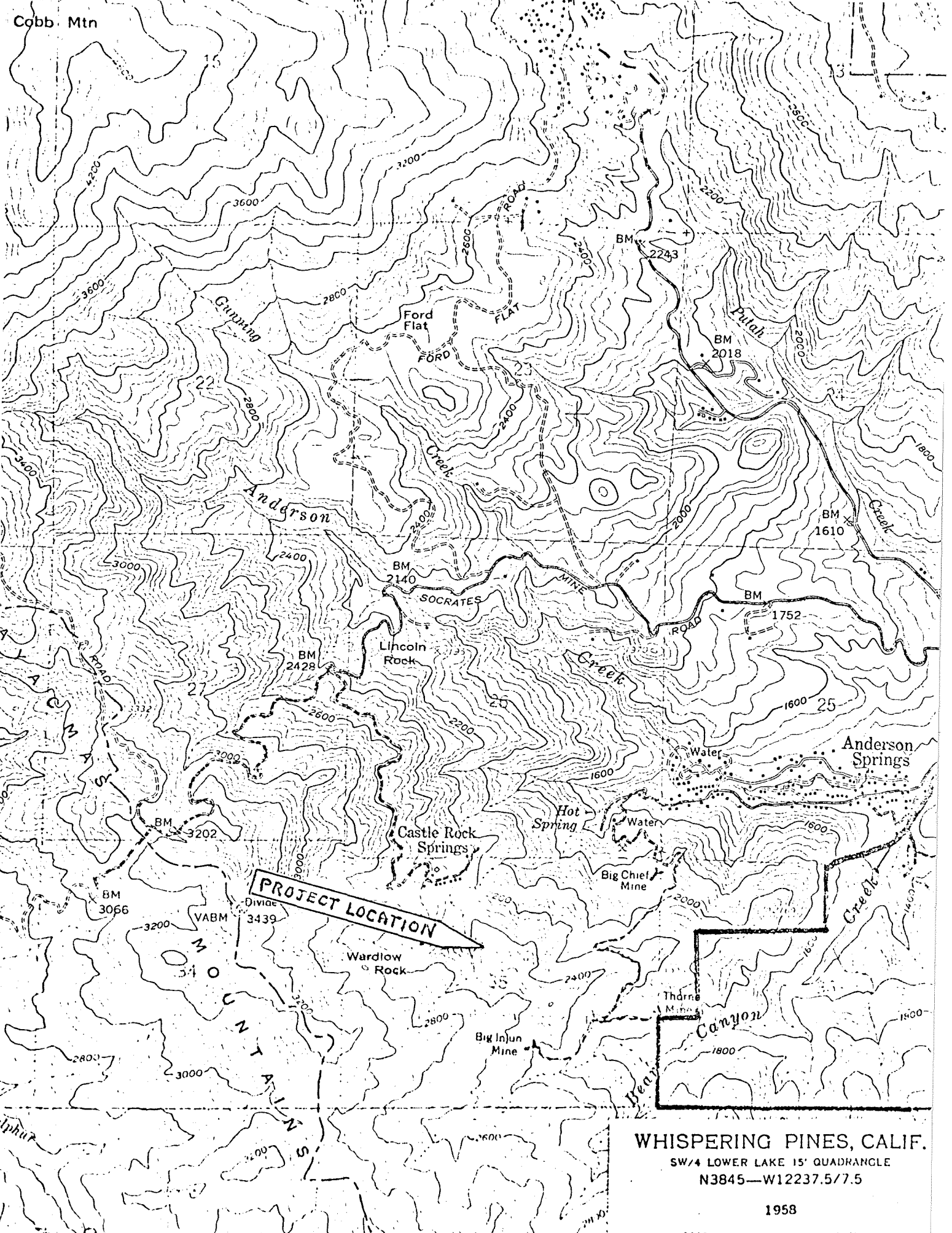
General measures for protection of the environment will be as provided in Supplement I to the Lease Unit 10 CA958 Plan of Operation as approved November 1, 1974. Contingent plans for (1) Emergency Accidental Spills and Discharge Control Procedures, (2) Emergency Fire Control Procedures, (3) Hydrogen Sulfide Contingency Plan and (4) Blowout Contingency Plan were forwarded with cover letter dated July 26, 1977 and are on file at the USGS Office of the Geothermal Supervisor, Menlo Park, California. Measures for protection of the environment specific to the proposed project will be included with technical specifications proposed by Hawke Engineers for the Contract Book for Construction of Access Road and Geothermal Well Location CA958 No. 5 in Lake County - Contract No. 958-5 now under preparation. The specifications along with the Contract Book will be forwarded to the USGS Office of the Geothermal Supervisor under separate cover when completed.

A survey for rare and endangered plant species is to be conducted by Aminoil's revegetation consultant, Ralph Osterling, during the period from April to June 1979 to determine the presence of any rare and endangered species or species of special concern. Upon completion, results of the survey will be forwarded to the USGS Office of the Geothermal Supervisor, Menlo Park, California.

An ethnographic and historical cultural resources study is also to be conducted for the leasehold within which the project area is located. The study will supplement the existing archeological reconnaissance completed by Ann S. Peak, Consulting Archeologist, October 27, 1974 and is to be completed by the Ethnographic Laboratory, Department of Anthropology, Sonoma State University, David A. Fredrickson, Professor of Anthropology. The study will be forwarded to the USGS under separate cover when completed.

All other comments not addressed in this Plan and as contained in the Aminoil USA, Inc. (formerly Burmah Oil and Gas Company) initial Plan of Operation Lease Unit 10 CA958 as submitted September 26, 1974 and approved October 10, 1974 and the Supplement I to the Plan of Operation Lease Unit 10 CA958 submitted October 9, 1974 and approved November 1, 1974, continue to be applicable.

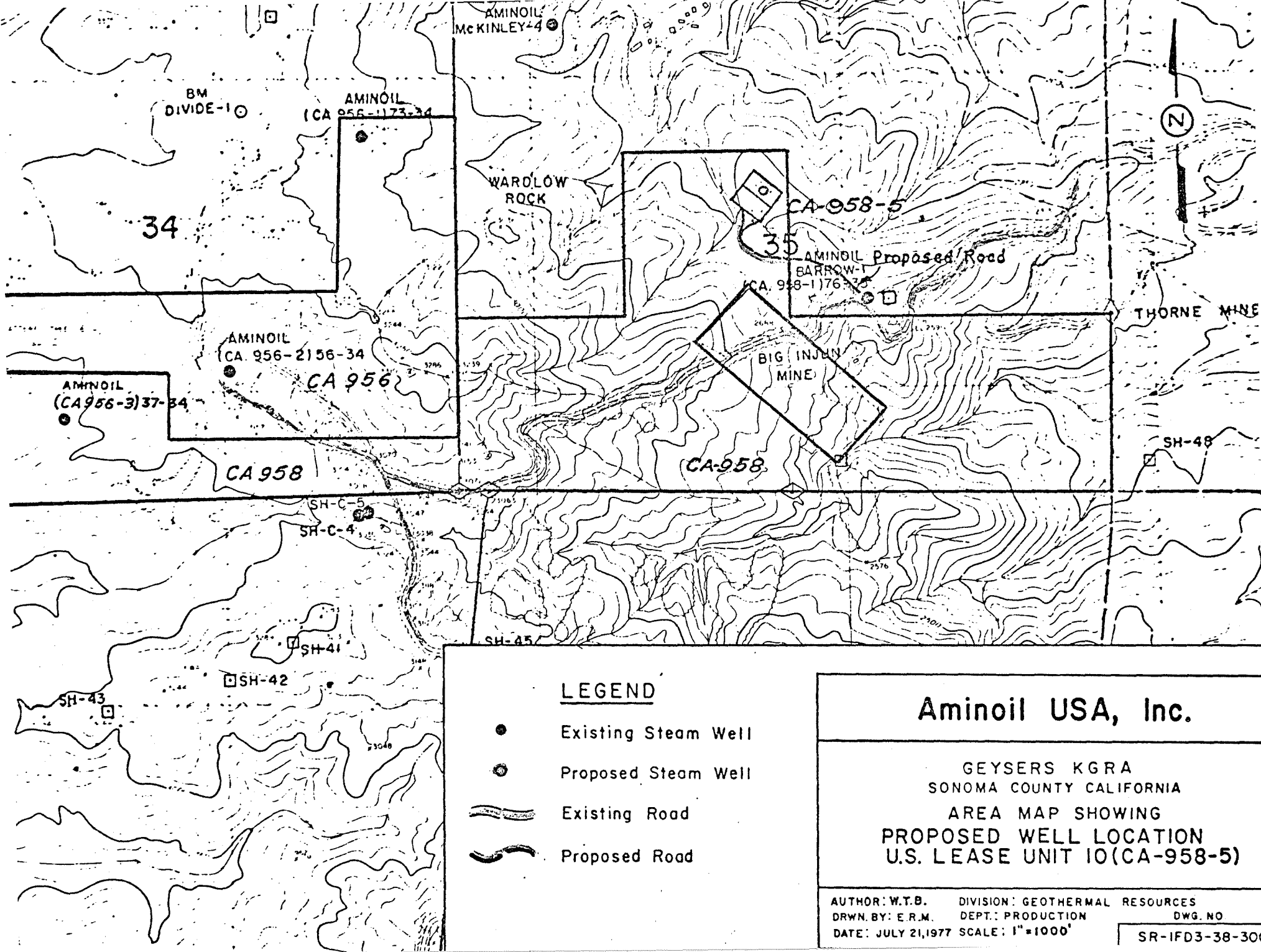




**WHISPERING PINES, CALIF.**  
 SW/4 LOWER LAKE 15' QUADRANGLE  
 N3845—W12237.5/7.5

1958

AMC 1:25,000 SERIES MAP



**LEGEND**

- Existing Steam Well
- Proposed Steam Well
- Existing Road
- - - Proposed Road

**Aminoil USA, Inc.**

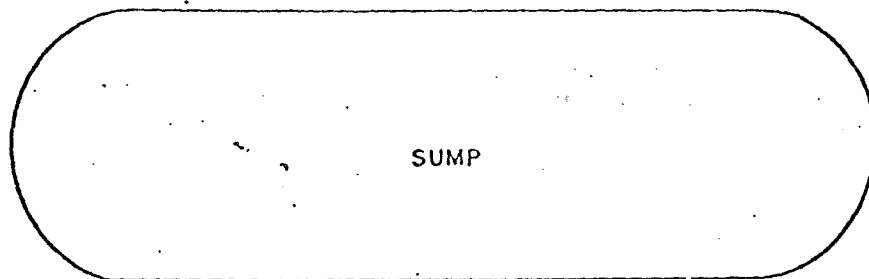
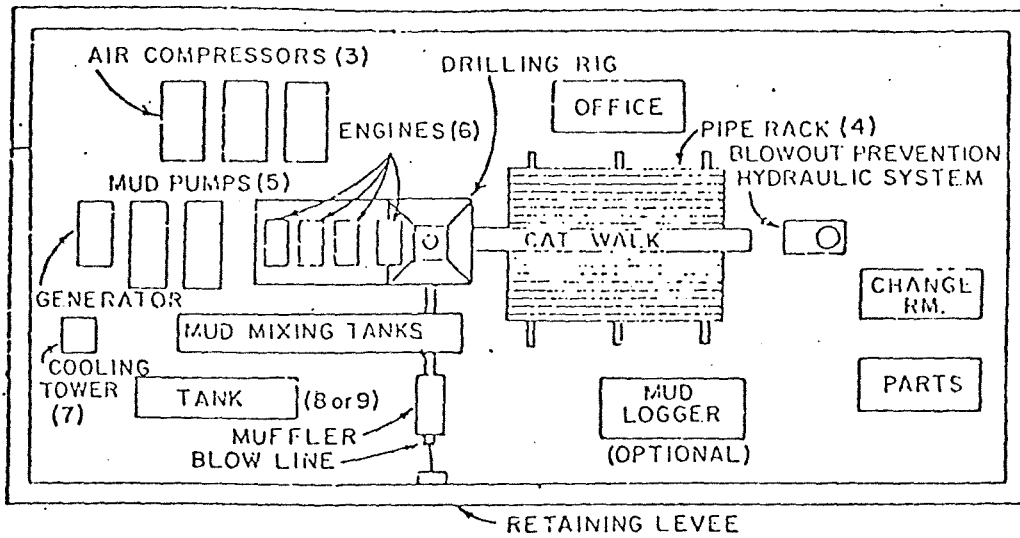
GEYSERS KGRA  
 SONOMA COUNTY CALIFORNIA  
 AREA MAP SHOWING  
 PROPOSED WELL LOCATION  
 U.S. LEASE UNIT 10(CA-958-5)

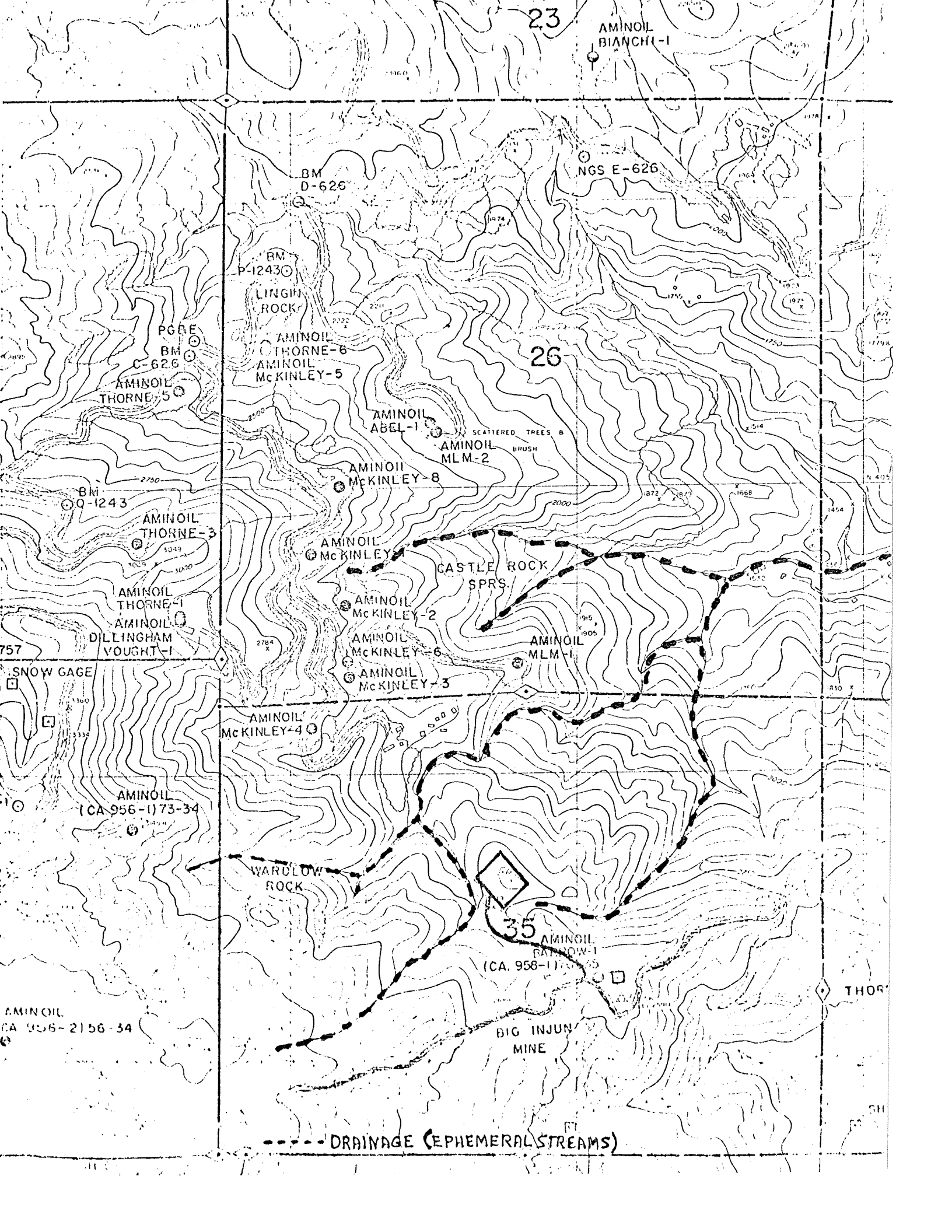
AUTHOR: W.T.B. DIVISION: GEOTHERMAL RESOURCES  
 DRWN. BY: E.R.M. DEPT.: PRODUCTION DWG. NO.  
 DATE: JULY 21, 1977 SCALE: 1" = 1000'

SR-IFD3-38-300



# TOP VIEW OF A TYPICAL DRILLING SITE





AMINOIL BIANCHI-1

NGS E-626

BM D-626

BM P-1243

LINGIN ROCK

AMINOIL THORNE-6  
AMINOIL MCKINLEY-5

PGRE

BM C-626

AMINOIL THORNE-5

26

AMINOIL ABEL-1

AMINOIL MLM-2

AMINOIL MCKINLEY-8

SCATTERED TREES & BRUSH

BM Q-1243

AMINOIL THORNE-3

AMINOIL THORNE-1

AMINOIL DILLINGHAM VOUGHT-1

CASTLE ROCK SPRS.

AMINOIL MCKINLEY

AMINOIL MCKINLEY-2

AMINOIL MCKINLEY-6

AMINOIL MCKINLEY-3

AMINOIL MLM-1

SNOW GAGE

AMINOIL MCKINLEY-4

AMINOIL (CA. 956-1) 73-34

35 AMINOIL RAINBOW-1 (CA. 958-1)

WARDLOW ROCK

AMINOIL (CA. 956-2) 156-34

BIG INJUN MINE

THOR

--- DRAINAGE (EPHEMERAL STREAMS)

## Vegetation Communities

Symbols in Parenthese are used on Figure

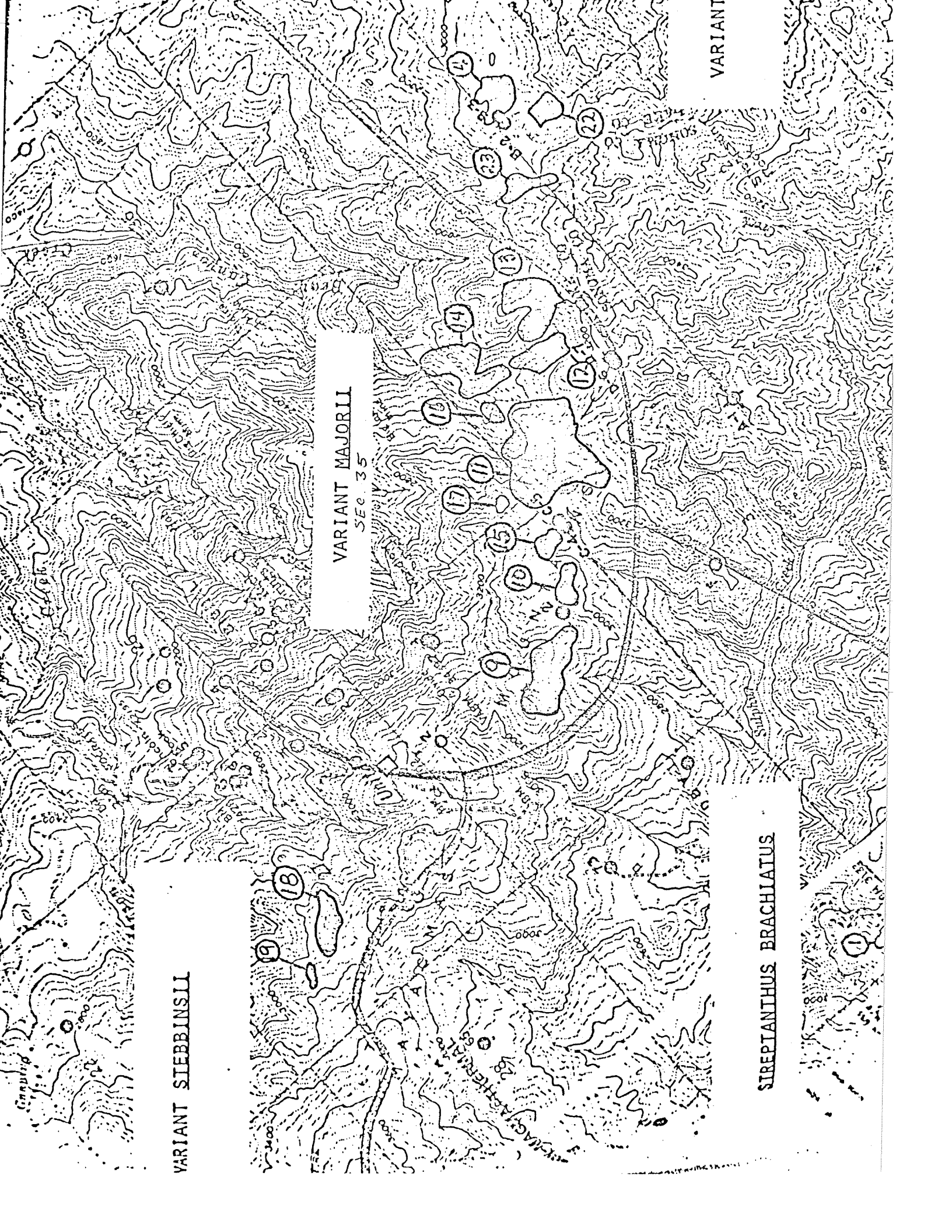
<p><b>Barrens</b> (Bor)</p>	<p>Barrens, rock, and scree</p>
<p><b>Grasslands</b> (Grl)</p>	<p>California annual grass-herb</p>
<p><b>Savannahs</b> (Dp-Grl)</p>	<p>Digger pine, California annual grass</p>
<p><b>Chaparrals</b> (Ch) (Ch-Ce) (SLO) (SLO-Mn-Ce-Toy)  (SLO-Ce-St) (SLO-B-Ce) (Cer)</p>	<p>Chamise Chamise - buck brush Shrubby live oak Shrubby live oak-Eastwood's manzanita-wavy leaved ceanothus-buck brush-toyon Shrubby live oak-buck bursh-silk tassel brush Shrubby live oak-bay-deer brush Mountain mahogany</p>
<p><b>Woodlands</b> (R) (Kn)  (Kn-Md)  (Kn-BO) (Kn-SLO-B)  (Dp-CO-Mn)  (Dp-BO-Md-B)  (Kn-Mn)  (Cy)</p>	<p>Riparian Knob cone pine with or without Eastwood's manzanita Knob cone pine-madrone with some manzanita, deer brush, coffee berry, and occasional California nutmeg. Knob cone pine-Black oak Knob cone pine-shrubby live oak-bay with some buck brush and Eastwood's manzanita Digger pine-canyon oak-big manzanita with some buck brush and toyon Digger pine-black oak -madrone-bay with some shrubby live oak and deer brush Knob cone pine-black oak with poison oak and snow berry Cypress</p>

( Cooper Clark & Associates February, 1979 )



TABLE 1. Location of *Streptanthus morrisonii* complex population in the central and southern Mayan Mountains. Population location numbers are correlated to the distribution map (Figure 1). The letter E after population size indicates that the total number is estimated.

Size #	Streptanthus Variant	Number In Population*	Elev.	Township & Range	Section Number
1. Socrates Mine	brachiatus	35	3200	T11-R8	SW $\frac{1}{4}$ of 2W $\frac{1}{4}$ of 33
2. Socrate Mine	brachiatus	84	3280	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -32
3. Lunar Point	?	16	3452	T11-R8	NE $\frac{1}{4}$ of NE $\frac{1}{4}$ -10
4. Well Site "B"	kruckebergii	1000E	3200	R10-R8	SW $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
5. Shell Control Pt	kruckebergii	47+		T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
6. Shell Ridge	kruckebergii	71+	2920	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
7. Shell Ridge	kruckebergii	350E	2880	T10-R8	NE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
8. Shell Ridge	kruckebergii	500E	3000	T10-R8	SE $\frac{1}{4}$ of NE $\frac{1}{4}$ -1
9. Aminol Ridge (North) ?		15 incompl.	3400	T11-R8	NW $\frac{1}{4}$ of SE $\frac{1}{4}$ -34
10. Aminol Ridge (South) majorii		57	3080	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -24
11. Bear Creek Canyon (North)	majorii	550+E	2880	T10-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
12. Bear Creek Canyon (West)	mixed	450+E	2880	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
13. Bear Creek Canyon (West)	mixed	300+E	3000	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
14. Bear Creek Canyon (East)	majorii	250+E	2600	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
15. Aminol Ridge (South) majorii		27	2860	T11-R8	SW $\frac{1}{4}$ of SE $\frac{1}{4}$ -34
16. Bear Creek Canyon majorii		50+E	2600	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
17. Aminol Gate	?	No 1977 Plants	3120	T11-R8	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -35
18. Anderson Creek	stebbinsii	176+	3120	T11-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -27
19. Anderson Creek	stebbinsii	6	3120	T11-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -27
20. Pine Mountain	kruckebergii	12	3200	T10-R8	SE $\frac{1}{4}$ of NE $\frac{1}{4}$ -11
21. Pine Mountain	kruckebergii	6	3400	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -11
22. Shell Ridge	kruckebergii	?	2920	T10-R8	SW $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
23. Shell Ridge	kruckebergii	?	3120	T10-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -2
24. Shell Ridge	kruckebergii	?	2880	T10-R8	SE $\frac{1}{4}$ of NW $\frac{1}{4}$ -1
25. Apple Tree Creek	kruckebergii	60+E	2400	T10-R8	NW $\frac{1}{4}$ of NW $\frac{1}{4}$ -7
26. Apple Tree Creek	?	180+E	2200	T10-R8	NE $\frac{1}{4}$ of NW $\frac{1}{4}$ -7
27. Apple Tree Creek	?	200+E	2180	T10-R8	SW $\frac{1}{4}$ of NE $\frac{1}{4}$ -7
28. White Point	elatus	258	2280	T10-R6	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -30
29. Three Peaks	elatus	2500+E	2200	T10-R6	SW $\frac{1}{4}$ - 19
30. Wall Street Mine	kruckebergii	300+E	2600	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
31. Wall Street Mine	kruckebergii	70	2400	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
32. Dry Creek Tributary	kruckebergii	9	2600	T10-R8	SE $\frac{1}{4}$ of SE $\frac{1}{4}$ -1
33. Helen Mine	kruckebergii	?	2600	T10-R8	SW $\frac{1}{4}$ of SW $\frac{1}{4}$ -1



VARIANT STEBBINSII

VARIANT MAJORII  
SEC 35

VARIANT

VARIANT BRACHIATUS



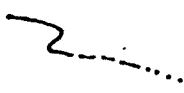
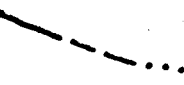

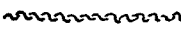



# EXPLANATION

## ROCK UNITS

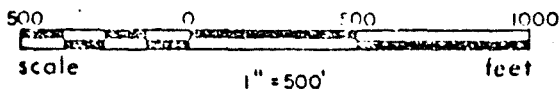
sc	SILICA CARBONATE ROCK
sp	SERPENTINITE
fsr	MELANGE
fs <sub>2</sub>	GREYWACKE
fg	GREENSTONE
fm	BLUESCHIST
fms	METAGREYWACKE
fmc	METACHERT
fmg	METAGREENSTONE
mum	METAMORPHOSED, ULTRAMAFIC ROCK

## GEOLOGIC SYMBOLS

	GEOLOGIC CONTACT; DASHED WHERE INFERRED DOTTED WHERE CONCEALED, AND QUERIED WHERE PROJECTION UNCERTAIN
	FAULT; DASHED WHERE INFERRED DOTTED WHERE CONCEALED, AND QUERIED WHERE PROJECTION UNCERTAIN
	FOLIATION ORIENTATION
	SHEAR ZONE
	HYDROTHERMAL ALTERATION

FRANCISCAN FORMATION

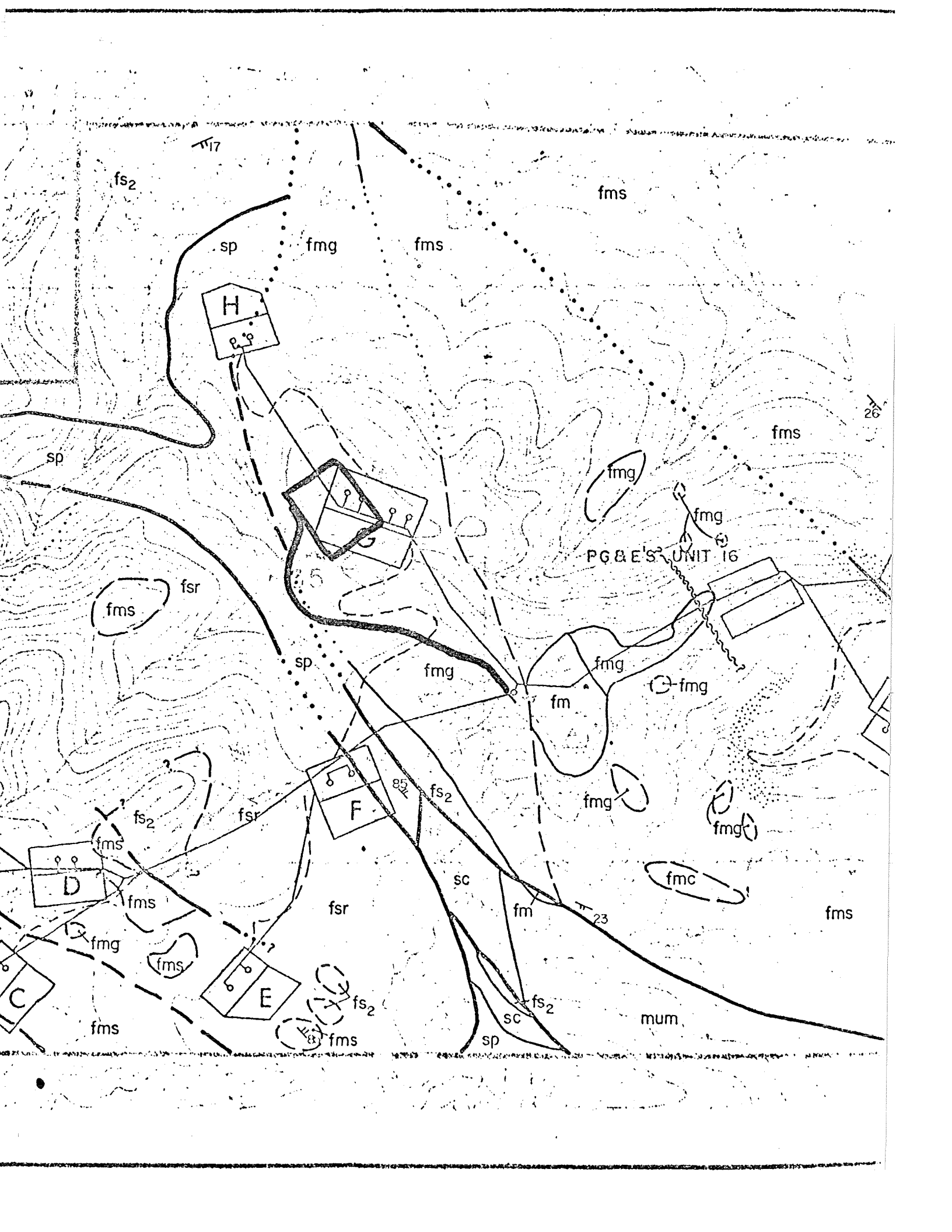
# GEOLOGIC MAP



UNDEVELOPED AREAS  
ARE DELINEATED BY  
A DOTTED LINE  
WHICH IS NOT  
REPRESENTED IN  
THIS MAP. FOR  
MORE INFORMATION  
CONTACT THE  
BUREAU OF LAND  
MANAGEMENT,  
WASHINGTON, D.C.

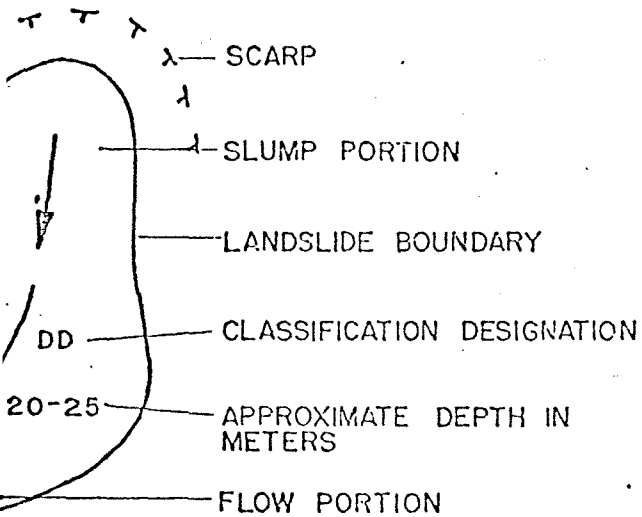
PRELIMINARY  
GEOLOGIC MAP OF THE CENTRAL  
AND THE GLYSERS STEAM FIELDS  
IN LAKE COUNTIES, CALIFORNIA  
1979

( Cooper Clark & Associates, February, 1979 )



# EXPLANATION

## LANDSLIDE FEATURES



## CLASSIFICATION DESIGNATIONS

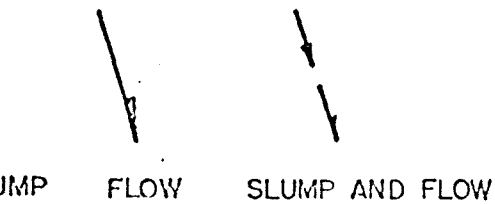
← INCREASING IN AGE → DECREASING IN ACTIVITY →

ESTIMATED LEVEL OF ACTIVITY RELIABILITY IDENTIFICATION	ACTIVE TO RECENTLY UP TO A FEW DECADES (D, D) A-RA	FORMER SEVERAL DECADERS TO CENTURIES D	STATIC (CENTURIES TO MILLENNIA) S
DEFINITE LANDSLIDE D	DA OR DRA	DD	DS
PROBABLE LANDSLIDE P		PD	PS
QUESTIONABLE LANDSLIDE Q		QD	QS

GRADATIONAL  
D-S

INCREASING AGE  
DECREASING RELIABILITY

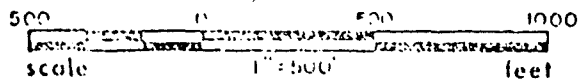
## MOVEMENT



## MAP SYMBOLS

LANDSLIDE AREAS CONSISTING OF NUMEROUS COALESCED  
 SUPERIMPOSED LANDSLIDES OF VARIOUS SIZES, TYPES OF  
 MOVEMENT, AND DEGREES OF ACTIVITY. BECAUSE OF THE  
 COMPLEXITY, IT IS NOT FEASIBLE TO DELINEATE INDIVIDUAL  
 LANDSLIDES COMPRISING THESE ZONES.

# LANDSLIDE MAP



GEOLOGY IS DESCRIBED IN  
 APPENDIX FOR ENVIRONMENTAL  
 STUDY.

