GEOThermal SERVICES, INC.

S-146

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FINAL REPORT
INTERMEDIATE-DEPTH
HOLE NO. 1-78-U1
SUNOCO ENERGY DEVELOPMENT CO.
SOCORRO PROSPECT, NEW MEXICO
GTS JOB NO. 1-78

GEO THERMAL SERVICE

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 921

*1 copy of report,
clipped together*

FINAL REPORT
INTERMEDIATE-DEPTH
HOLE NO. 1-78-U1
SUNOCO ENERGY DEVELOPMENT CO.
SOCORRO PROSPECT, NEW MEXICO
GTS JOB NO. 1-78

SUMMARY

During the period May 28, 1978 to June 30, 1978, an intermediate depth heat flow borehole (1-78-U1) was completed on the Socorro Prospect, New Mexico. Rock types encountered in the hole ranged from unconsolidated Quaternary alluvium to clays and dense volcanic rocks. Depth of the hole was 1360 feet with the major drilling problems being sticky clays and hard rock. The geothermal gradient measured in this borehole was 2.46 °F/100 ft with an average thermal conductivity of 5.9 mcal/cm-sec-°C. The calculated heat flow value is 2.7 HFU (1 HFU = 1 μ cal/cm²-sec). The linearity of the gradient for this hole suggests that heat transport in the shallow subsurface penetrated by the borehole is predominately by conduction.

Based on published data as well as the results of the present survey, a value of about 2.5 HFU is probably representative of the background heat flow in the area of the Socorro Prospect. A surface heat flow of 2.5 HFU implies partial melting in the lower crust and upper mantle beneath the Prospect but does not necessitate the presence of an economic geothermal deposit.

INTRODUCTION

During the period May 28, 1978 to June 30, 1978, an intermediate depth heat flow borehole was completed for Sunoco Energy Development Company in the Socorro Prospect, New Mexico (Fig. 1). Drilling operations were conducted in Townships 3 South, Range 2 West, New Mexico Principal Meridian.

The borehole was drilled on a federal lease controlled by the Bureau of Land Management (BLM) and the United States Geological Survey (USGS). Drilling operations on this federal geothermal lease (NM-32271) were performed under USGS Notice of Intent No. AGS-78-NM-32270. The hole was drilled and completed in accordance with the Revised Special Stipulations for Shallow Temperature Gradient Holes of the USGS and the Environmental Stipulations of the BLM.

Those sites located on federal land (whether surface, mineral or both surface and mineral) require an Archaeological Reconnaissance Survey in accordance with item #2 of N2-3200-1(A), October, 1974. This site was surveyed for objects of historical significance by a team from the Division of Conservation Archaeology, San Juan County Museum Association, Farmington, New Mexico, authorized by Federal Antiquities Permit No. 78-NM-015.

Three separate temperature runs were made in this hole. Thermal conductivity determinations were made on seven drill cutting samples from the hole. Selected borehole data are presented in Table 1. These include elevation, total depth, average geothermal gradient, gradient interval, average thermal conductivity, number of samples, and calculated value of heat flow for the hole. Equilibrium temperature/depth and geothermal gradient profiles and preliminary temperature/depth profiles for the hole are presented in Appendix A. Individual thermal conductivity measurements are tabulated in Appendix B. Individual temperature surveys, lithologic and geophysical logs, including self-potential, electrical

Figure 1. Location Map of the Socorro Prospect, New Mexico with Published Heat Flow Data (Sass, *et al.*, 1976).*

*Sass, J.H., Diment, W.H., Lachenbruch, A.H., Marshall, B.V., Munroe, R.J., Moses, T.J., Jr., and Urban, T.C., 1976, A new heat-flow contour map of the conterminous United States: U. S. Geol. Surv. Open-File Rpt. 76-756, 24 pp.

TABLE 1. BOREHOLE DATA FOR HOLE NO. 1-78-U1
SOCORRO PROSPECT, NEW MEXICO
GTS JOB NO. 1-78

Elevation (feet)	6090
Total Depth (feet)	1360
Geothermal Gradient (°F/100 ft)	2.46
Gradient Interval (feet)	800-1340
Thermal Conductivity (mcal/cm-sec-°C)	5.9
No. of Samples	7
Heat Flow (HFU)	2.7

resistance, continuous temperature and natural gamma are provided in Appendix C.

The hole will be abandoned in accordance with the Revised Special Stipulations for Shallow Temperature Gradient Holes of the USGS and the Environmental Stipulations of the BLM. Abandonment will be completed in September, 1978. Copies of the Notice of Completion and the release of liability will be forwarded in a supplemental letter.

RESULTS AND DISCUSSION

The Socorro Prospect is situated in the Rio Grande Rift in central New Mexico. The Rio Grande Rift, which has developed since the late Miocene, is an area of extensive volcanism and young extensional tectonics (Chapin and Seager, 1975). The Socorro Mountain block and the Socorro cauldron are covered by silicic volcanics and exhibit several young silicic volcanic centers. Modern uplift has been observed in the Socorro area (Reilinger and Oliver, 1976) over a postulated magma chamber lying at a depth of about 11 mi (Sanford, et al., 1973). Several thermal springs having temperatures of about 90°F are present on the eastern slope of the Socorro Mountain block (Sanford, 1977).

Within the Socorro area anomalously high heat flow values have been observed. There have been seven heat flow values in the immediate vicinity of the Socorro Prospect published by Reiter, et al., 1975, Reiter and Smith, 1977, and Sanford, 1977. The geothermal gradients at these seven locations range from 2.09 to 13.3 °F/100 ft while the thermal conductivities vary from 4.0 to 7.3 mcal/cm-sec-°C resulting in heat flows of 2.2 to 12. HFU. In addition to these published heat flow values, Clark and Summers (1971) have published a considerable amount of data on the hydrology, geochemistry, and subsurface temperature of wells and springs in the area of this Prospect.

Rock types encountered in hole No. 1-78-U1 varied from unconsolidated Quaternary alluvium to clays and dense volcanic rocks. The completed hole depth was 1360 feet. Drilling conditions were variable; portions of the hole drilled in sediments tended to be unstable while the hard volcanics slowed penetration rates. The daily drilling log and history is presented in Appendix D.

The borehole was temperature logged three separate times and the results are presented in Appendix A and C. The measured geothermal gradient is

2.46 °F/100 ft (Appendix A). The linearity of the gradient for the hole suggests that heat transport in the shallow subsurface penetrated by this borehole is predominately by conduction.

Using a divided-bar cell apparatus, thermal conductivity measurements (Appendix B) were made on a total of seven samples of drill cuttings collected at various depths in the lower section of the hole. The thermal conductivities ranged from 5.6 to 6.2 mcal/cm-sec-°C with an average value of 5.9 mcal/cm-sec-°C. These values are for samples identified as rock types ranging from quartzose clays to acidic volcanics and are correlative with published thermal conductivities.

A heat flow value (Table 1) was calculated by multiplying the average thermal conductivity for the hole by the geothermal gradient over the sampled interval. The heat flow value obtained is 2.7 HFU (1 HFU = 1 μ cal/cm²-sec).

Based on the published data as well as the results of the present survey (Table 1), a value of about 2.5 HFU is probably representative of the background heat flow in the area of the Socorro Prospect. A surface heat flow of 2.5 HFU implies partial melting in the lower crust and upper mantle beneath the Prospect but does not necessitate the presence of an economic geothermal deposit.

Heat flow values greater than 3 HFU require either melting within the shallow crust or convective transport of heat by water or magma. Because the Rio Grande Rift is an area of late Tertiary to Quaternary volcanism and extensional tectonics, the high heat flow is probably caused by the transient effects of fairly recent multiple intrusions in the shallow crust. Furthermore, geological models that employ the transient effects of recent crustal or upper mantle intrusions are preferred to explain the relatively sharp boundary of the heat flow anomaly. Therefore, one of the important questions in evaluating the commercial geothermal potential of this Prospect is whether any of the crustal

intrusions penetrated near enough to the surface in the area of the Socorro Prospect to be presently functioning as a heat source for an economic geothermal system.

RECOMMENDATIONS

We recommend that a second phase project of heat flow boreholes be drilled on the Socorro Prospect to more accurately determine the lateral extent of the anomalous heat flow zone characterized by hole No. 1-78-U1. In order to avoid potential problems caused by groundwater circulation, these additional holes should be sufficiently budgeted to insure reaching a target depth of at least 1000 feet and to include grouting of the pipe from total depth to the surface.

Upon request, we at GTS would be pleased to be involved in any of the follow-on planning, decision making, and drilling and logging of any additional shallow and/or intermediate depth heat flow boreholes.

REFERENCES

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Prepared by:

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President
GeoThermal Services, Inc.

September, 1978

APPENDIX A

EQUILIBRIUM TEMPERATURE/DEPTH AND GEOTHERMAL GRADIENT
PROFILES WITH PRELIMINARY TEMPERATURE/DEPTH PROFILES

GTS HOLE NO. 1-78-U1

TEMPERATURE (°F)

DEPTH (FEET)

TEMPERATURE (°F)

DEPTH (FEET)

TEMPERATURE (°F)

DEPTH (FEET)

APPENDIX B

THERMAL CONDUCTIVITY DATA

GTS HOLE NO. 1-78-U1

THERMAL CONDUCTIVITY DATA
SOCORRO PROSPECT, NEW MEXICO
GEOTHERMAL SERVICES, INC. JOB NO. 1-78

HOLE NO. 1-78-U1

DEPTH (feet)	ASSUMED POROSITY (%)	THERMAL CONDUCTIVITY (mcal/cm-sec-deg C)
965	15	6.2
1005	15	5.9
1075	15	5.7
1155	15	5.6
1205	15	5.7
1275	15	6.0
1335	15	6.2

|-----|
Kave = 5.9 mcal/cm-sec-deg C

APPENDIX C

INDIVIDUAL TEMPERATURE SURVEYS, LITHOLOGIC AND
GEOPHYSICAL LOGS, INCLUDING SELF-POTENTIAL, ELECTRICAL
RESISTANCE, CONTINUOUS TEMPERATURE AND NATURAL GAMMA

GTS HOLE NO. 1-78-U1

FIELD DATA SHEET

TEMPERATURE SURVEY

HOLE NUMBER 1-78 U-1 TD 1360'

REFERENCE MAP 5-77

REMARKS @ 470', DAVE LLOYD AND I SPENT
ABOUT 60 MINS. TROUBLE SHOOTING SLIP WIND ASSEMBLY

HOLE NO. 1-78 U-1

RUN NO. 1

DATE 29 JUNE

TIME:

START 1:00P

END 6:17P

SENSOR SERIAL NO.
5382

OPERATOR
WALKER

FT.	K Ω	°F	FT.	K Ω	°F	FT.	K Ω	°F
10	53.188	70.99	280	54.35	70.15	550	48.52	74.57
20	55.237	69.52	290	54.29	70.19	560	47.78	75.18
30	56.135	68.90	300	54.13	70.31	570	48.02	74.98
40	56.201	68.85	310	54.00	70.40	580	47.45	75.45
50	56.245	68.83	320	53.46	70.40	590	47.35	75.53
60	56.132	68.90	330	53.49	70.79	600	47.36	75.53
70	56.116	68.91	340	53.15	70.76	610	46.63	76.14
80	55.943	69.03	350	53.08	71.01	620	46.24	76.46
90	55.68	69.22	360	52.94	71.06	630	46.92	75.89
100	55.545	69.31	370	52.46	71.52	640	47.00	75.82
110	54.928	69.74	380	52.27	71.66	650	46.65	76.12
120	54.847	69.80	390	52.10	71.79	660	46.37	76.36
130	54.430	70.09	400	51.94	71.91	670	46.38	76.36
140	54.265	70.21	410	51.79	72.02	680	46.21	76.49
150	54.287	70.19	420	51.70	72.09	690	46.13	76.56
160	54.940	69.73	430	51.25	72.43	700	45.96	76.71
170	55.049	69.65	440	51.76	72.04	710	45.84	76.81
180	55.344	69.45	450	51.60	72.17	720	45.85	76.81
190	55.33	69.46	460	51.35	72.35	730	45.81	76.84
200	55.49	69.35	470	50.16	73.27	740	45.51	77.10
210	55.45	69.37	480	49.24	73.99	750	45.44	77.16
220	55.39	69.42	490	49.03	74.16	760	45.31	77.27
230	55.22	69.53	500	49.56	73.74	770	44.95	77.59
240	54.92	69.74	510	49.06	74.14	780	44.87	77.66
250	54.66	69.93	520	48.97	74.21	790	44.29	78.17
260	54.61	69.96	530	48.81	74.34	800	44.28	78.17
270	54.51	70.03	540	48.51	74.38	810	43.95	78.48

FIELD DATA SHEET TEMPERATURE SURVEY

HOLE NO. 1-78 U-1
 RUN NO. 1
 DATE 29 JUNE
 TIME:
 START 1:00P
 END 6:17P

HOLE NUMBER 1-78 U-1 TD 1360

REFERENCE MAP 5-77

REMARKS _____

FT.	K Ω	°F	FT.	K Ω	°F	FT.	K Ω	°F
820	43.82	78.60	1050	39.32	82.93	1280	34.86	87.83
830	43.59	78.81	1060	39.06	83.20	1290	34.80	87.90
840	43.68	78.73	1070	38.84	83.43	1300	34.59	88.15
850	43.39	78.99	1080	38.66	83.62	1310	34.42	88.35
860	43.29	79.08	1090	38.37	83.93	1320	34.11	88.72
870	43.10	79.26	1100	38.16	84.15	1330	33.95	88.92
880	42.88	79.46	1110	37.98	84.34	1340	33.76	89.15
890	42.67	79.66	1120	37.89	84.44	1350	33.46	89.52
900	42.51	79.81	1130	37.73	84.61	1360	33.77	89.13
910	42.17	80.13	1140	37.41	84.95	1370	TOTAL DEPTH	1360'
920	41.76	80.52	1150	37.43	84.93	1380		
930	41.52	80.75	1160	37.26	85.12	1390		
940	41.32	80.94	1170	37.04	85.36	1400		
950	41.07	81.19	1180	36.77	85.65	1410		
960	40.81	81.44	1190	36.60	85.84	1420		
970	40.66	81.59	1200	36.39	86.08	1430		
980	40.47	81.78	1210	36.24	86.25	1440		
990	40.34	81.91	1220	36.08	86.42	1450		
1000	40.22	82.03	1230	35.90	86.63	1460		
1010	40.06	82.19	1240	35.61	86.96	1470		
1020	39.95	82.30	1250	35.55	87.03	1480		
1030	39.76	82.49	1260	35.32	87.29	1490		
1040	39.52	82.73	1270	35.13	87.61	1500

FIELD DATA SHEET

TEMPERATURE SURVEY

HOLE NUMBER 1-78 U-1 TD 1360'

REFERENCE MAP 5-77

REMARKS _____

HOLE NO. 1-78 U-1

RUN NO. TWO

DATE 30 JUNE

TIME:

START 1:35P

END 4:38P

SENSOR SERIAL NO.

5382

OPERATOR

WALKER

FT.	K Ω	° F	FT.	K Ω	° F	FT.	K Ω	° F
10	42.17	80.13	280	53.80	70.54	550	51.61	72.16
20	44.61	77.89	290	53.83	70.52	560	51.21	72.46
30	45.23	77.34	300	53.82	70.53	570	48.99	74.19
40	46.87	75.93	310	53.82	70.53	580	50.62	72.91
50	47.13	75.71	320	53.80	70.54	590	48.52	74.57
60	47.37	75.51	330	53.72	70.60	600	50.23	73.22
70	47.70	75.24	340	53.53	70.74	610	48.01	74.99
80	47.94	75.04	350	53.30	70.90	620	47.91	75.15
90	48.33	74.73	360	53.22	70.96	630	47.52	75.39
100	48.68	74.44	370	53.08	71.06	640	47.37	75.52
110	48.89	74.27	380	52.95	71.16	650	47.21	75.65
120	49.03	74.16	390	52.75	71.31	660	47.04	75.79
130	49.30	73.95	400	52.63	71.39	670	46.73	76.05
140	49.58	73.72	410	52.58	71.43	680	46.50	76.25
150	50.03	73.37	420	52.44	71.54	690	46.25	76.46
160	50.51	73.00	430	51.99	71.87	700	46.14	76.55
170	51.02	72.60	440	51.99	71.87	710	45.97	76.70
180	51.47	72.26	450	51.90	71.94	720	45.84	76.81
190	51.83	71.99	460	51.66	72.12	730	45.73	76.91
200	51.97	71.89	470	51.27	72.41	740	45.51	77.10
210	52.45	71.53	480	50.85	72.74	750	45.26	77.31
220	52.61	71.41	490	52.44	71.54	760	44.96	77.58
230	53.07	71.07	500	52.22	71.70	770	44.67	77.83
240	53.37	70.85	510	50.27	73.18	780	44.58	77.92
250	53.57	70.71	520	52.21	71.71	790	44.44	78.04
260	53.65	70.65	530	52.22	71.70	800	44.21	78.25
270	53.77	70.56	540	51.79	72.02	810	43.97	78.46

FIELD DATA SHEET TEMPERATURE SURVEY

HOLE NO. 178-U1
 RUN NO. 2
 DATE 30 JUNE
 TIME:
 START 1:35P
 END 4:30P

HOLE NUMBER 1-78 U-1 TO 1360

REFERENCE MAP 5-77

REMARKS _____

FT.	K Ω	°F	FT.	K Ω	°F	FT.	K Ω	°F
820	43.75	78.66	1050	38.29	84.01	1280	33.51	89.45
830	43.53	78.86	1060	38.00	84.32	1290	33.30	89.71
840	43.33	79.05	1070	37.76	84.57	1300	33.11	89.95
850	43.08	79.28	1080	37.52	84.83	1310	32.91	90.20
860	42.89	79.45	1090	37.27	85.10	1320	32.71	90.45
870	42.57	79.75	1100	37.04	85.35	1330	32.57	90.63
880	42.42	79.89	1110	36.85	85.56	1340	32.35	90.91
890	42.22	80.08	1120	36.69	85.74	1350	32.08	91.25
900	41.93	80.36	1130	36.54	85.91	1360	31.96	91.41
910	41.65	80.62	1140	36.41	86.05	1370	TOTAL DEPTH	
920	41.32	80.94	1150	36.20	86.29	1380		
930	41.03	81.23	1160	36.00	86.52	1390		
940	40.71	81.54	1170	35.78	86.76	1400		
950	40.38	81.87	1180	35.57	87.01	1410		
960	40.14	82.11	1190	35.40	87.20	1420		
970	39.94	82.31	1200	35.18	87.46	1430		
980	39.74	82.51	1210	34.98	87.69	1440		
990	39.57	82.68	1220	34.80	87.90	1450		
1000	39.39	82.87	1230	34.57	88.17	1460		
1010	39.10	83.16	1240	34.29	88.51	1470		
1020	38.96	83.31	1250	34.15	88.67	1480		
1030	38.77	83.51	1260	33.99	88.87	1490		
1040	38.51	83.78	1270	33.77	89.13	1500

FIELD DATA SHEET TEMPERATURE SURVEY

HOLE NUMBER 1-78 U-1 TD 1360'

REFERENCE MAP 5-77

REMARKS 10' intervals 0' - 520' 20' intervals 520' - T.D.

HOLE NO. 1-78 U-1

RUN NO. 3

DATE 16 July 78

TIME:

START 4:45 p

END 6:40

SENSOR SERIAL NO. 476

OPERATOR WALKER

FT.	KΩ	°F	FT.	KΩ	°F	FT.	KΩ	°F
10	39.53	82.92	280	55.40	69.41	580		
20	40.41	81.84	290	55.50	69.34	560	50.54	72.97
30	40.83	81.42	300	55.58	69.30	570		
40	43.33	79.05	310	55.60	69.27	580	49.92	73.46
50	44.12	78.33	320	55.62	69.26	590		
60	45.07	77.48	330	55.63	69.25	600	49.44	73.83
70	46.53	76.22	340	55.52	69.32	610		
80	47.11	75.73	350	55.43	69.39	620	48.88	74.28
90	47.31	75.56	360	55.40	69.41	630		
100	47.74	75.21	370	55.26	69.51	640	48.32	74.73
110	48.14	74.88	380	55.10	69.62	650		
120	48.52	74.59	390	54.98	69.70	660	47.87	75.10
130	48.80	74.35	400	54.85	69.79	670		
140	49.19	74.03	410	54.69	69.91	680	47.24	75.62
150	49.59	73.72	420	54.61	69.96	690		
160	50.00	73.39	430	54.56	70.00	700	46.80	75.99
170	50.49	73.01	440	53.47	70.78	710		
180	50.89	72.71	450	53.36	70.86	720	46.22	76.48
190	51.25	72.43	460	53.18	70.99	730		
200	53.45	70.79	470	52.95	71.16	740	46.04	76.64
210	53.72	70.60	480	52.67	71.37	750		
220	53.87	70.49	490	51.50	72.24	760	45.53	77.08
230	54.26	70.21	500	52.28	71.66	770		
240	54.46	70.07	510	52.02	71.85	780	45.15	77.41
250	54.62	69.95	520	50.34	73.13	790		
260	54.81	69.82	530			800	44.80	77.72
270	55.20	69.55	540	50.92	72.68	810		

FIELD DATA SHEET TEMPERATURE SURVEY

HOLE NO. 1-78 U-1
 RUN NO. .3.
 DATE 16 July 78
 TIME:
 START 4:45 P
 END 6:40 P

HOLE NUMBER 1-78 U-1 TD 1360'

REFERENCE MAP _____

REMARKS _____

FT.	K Ω	°F	FT.	K Ω	°F	FT.	K Ω	°F
820	44.37	78.10	1050			1280	33.53	89.43
830			1060	38.06	84.25	1290		
840	43.76	78.65	1070			1300	33.10	89.96
850			1080	37.50	84.85	1310		
860	43.32	79.05	1090			1320	32.65	90.52
870			1100	37.09	85.29	1330		
880	42.85	79.49	1110			1340	32.26	91.02
890			1120	36.70	85.73	1350		
900	42.36	79.95	1130			1360	31.93	91.45
910			1140	36.28	86.20	1370		
920	41.70	80.58	1150			1380		
930			1160	35.95	86.57	1390		
940	41.04	81.22	1170			1400		
950			1180	35.61	86.96	1410		
960	40.27	81.98	1190			1420		
970			1200	35.16	87.48	1430		
980	40.07	82.18	1210			1440		
990			1220	34.77	87.94	1450		
1000	39.56	82.69	1230			1460		
1010			1240	34.21	88.60	1470		
1020	39.13	83.13	1250			1480		
1030			1260	33.88	89.00	1490		
1040	38.62	83.66	1270			1500

FIELD DATA SHEET LITHOLOGY LOG

HOLE NO. 1-78 U-1
DATE 18 June 78
PROJECT GEOLGIST
W. K. K. K.

HOLE NUMBER 1-78 U-1

SOURCE MAP 1-78

REMARKS _____

DEPTH		LITHOLOGY
TO	FROM	
0'	90'	Gravels from 3/4" to 1" in length appear > 50%, and in beds of 20' thickness. Smaller gravels (50%) are the remainder. Lots of Silica - mainly phenocryst of orthoclase, clastic & clear - some fine chalcedony occasionally in the rhyolitic gravels varying in color from pink to red or dark red or even brown. Sometimes orthoclase in a rock is > 70%. Indisited gravel chips with other bits of feldspars throughout appear ≈ 20%. Sometimes a dark red chert chip appears.
90'	150'	Smaller chips of gravels are consistent usually < 1/2". 50% of chips < 1/8". ≈ 50% of chips are 1/8" - 1/2". Rhyolitic chips appear in some cases slightly darker.
150'	170'	A definite greenish tint causes by a very brittle, fine grained green rock. Reddish spots appear sometimes on the green rock. These chips make up ≈ 40% (30-40% is better). The rest are small (< 1/8") chips of andesite and rhyolite.

REMARKS _____

[illegible]

FIELD DATA SHEET LITHOLOGY LOG

HOLE NO. 1-78 U-1
DATE 25 June 78
PROJECT GEOLOGIST
WALKERT.

HOLE NUMBER 1-78 U-1

SOURCE MAP 5-77

REMARKS _____

DEPTH		LITHOLOGY
TO	FROM	
330'	900'	volcanic chips including rhyolite, andesite, basalt. clays appear $\approx$ 370' ($\approx$ 20%) @ 390' clays increase to 30-40% clays are red & brown. andesite 20-30% rhyolite 25-30% basalt $\leq$ 25%. free quartz appears clear and milky white $\leq$ 10%. & greenish white chips with $>$ 50% qtz in $\leq$ 5% of the chips. chips are very uniform in size and 90% are $<$ 1/4". dry chips are grayish in colour and the wetted chips are reddish to dark brown. clays stop at $\approx$ 660' and reappear again @ 870' but only in a 10' sample ($>$ 50%). volcanic chips vary in percentages throughout ^{the} section with rhyolite and andesite making up the majority. the free quartz sometimes increases to 10-15%.
900'	1420'	clays are present in varying amounts from 20-40%. usually buff brown with small amounts of yellow and green. chips are rhyolites (20-35%). free qtz is still clear to milky white. rhyolite is either <u>very</u> crystalline (30-40% clear qtz) or <u>very</u> fine grained w/ little or no qtz - color is red or brown. clays are in greatest amounts from 1160' to 1190'

LOG HEADLINE

HOLE NO. 198-01

HOLE NO.	198-01	TIME	START: 12:30A	REFERENCE MAP	NOTES:
DATE	29 JUNE 88	END:	3:55A	E-98	01-1234
OPERATOR(S)	WILLIAM T.	NOMINAL HOLE DIAMETER	5 1/2 (100) IN.		RATE 100
		DRILLING MEDIUM	H ₂ O		TC 1
		TYPE OF MUD	CONCRETE		VS 0.830
DEPTH (FEET)	100	GROUNDWATER (FEET)	555-560		RES 10.930
ELEVATION	6030				
NUCLEAR RADIATION			INSTRUMENTATION		ELECTRIC LOG
RUN NUMBER	1	2	3	PROBE NUMBER	5004
DEPTH (INTERVAL) FEET	15-933			TYPE	100
RANGE	0-250			PROBE NUMBER	5340
	0-800			TYPE	100
TIME CONSTANT	5			REMARKS	
LOGGING SPEED FPM	20				
VERTICAL SCALE FPM	50				
DIGITAL RECORD?					
					DEPTH (INTERVAL) 15-933 FEET
					RESISTANCE 50 OHMS
					SP. 100 FPM
					VERTICAL SCALE 50 FPM
					FLUID LEVEL 100
					TEMPERATURE
					DEPTH (INTERVAL) 15-933 FEET
					RANGE 50-200 F
					VERTICAL SCALE 50 FPM
					LOGGING SPEED 20 FPM

APPENDIX D

DRILLING LOG AND HISTORY

GTS HOLE NO. 1-78-U1

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

POSTED

Project No. 178 Hole No. 41 Date 5/28/78
 Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
				20		270	
7:00				30		280	
				40		290	
8:00		1.	LOOKING OVER ALL DRILL	50		300	
			SITES and trying to	60		310	
9:00			locate. u2 & u3, also	70		320	
				80		330	
10:00			trying locate possible	90		340	
				100		350	
11:00			water hole for loading	110		360	
				120		370	
12:00		10.	water. Trying to find	130		380	
				140		390	
1:00			STORAGE SHED BUT	150		400	
				160		410	
2:00			HOLIDAY WEEKEND HAS	170		420	
				180		430	
3:00		1. & 2.	everyone OUT OF TOWN	190		440	
				200		450	
4:00				210		460	
				220		470	
5:00				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED
 Quantities

_____ Joint, 3/4" Pipe @ 21 ft. ea.
 _____ Quik-Trol (pkgs.)
 _____ Drift Foam/Quik-Foam (gals.)
 _____ Hy-Seal-N _____ Barite
 _____ Quik-Gel _____ Other
 _____ Jel-Flake _____ (describe)
 _____ Micatex C _____
 _____ Fluid-Trol _____
 _____ Cedar Fibre _____
 _____ Cottonseed Hulls _____
 _____ Wall-Nut _____
 _____ Cellophane Flakes _____
 _____ Cement _____
 _____ Lime _____

FOOTAGE:

from _____ ft. Bit Size _____
 to _____ ft. Air _____ Mud _____

Bit No.	Changed at	Log Approved:
	ft.	_____
	ft.	_____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: moved rig to u1 site & set up.

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 41 Date 5/29/78
 Geologist Tim W Driller Woods RIG I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10	68	260	
7:00		1.		20	"	270	
				30	"	280	
8:00				40	"	290	
			unloading 120' of 6 5/8"	50	"	300	
9:00				60		310	
		10.	casing, unloaded Quik-	70		320	
10:00			sel & L.C. material	80		330	
				90		340	
11:00			Rented Warehouse, unloaded	100		350	
				110		360	
12:00		10.	all bits & spare Rig parts	120		370	
				130		380	
1:00			IN STORAGE SITED	140		390	
				150		400	
2:00			set 20'-10" of surface	160		410	
				170		420	
3:00		3.	casing, started pilot	180		430	
			hole to 150'	190		440	
4:00				200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea. _____

Quik-Trol (pkgs.) _____

Drift Foam/Quik-Foam (gals.) _____

Hy-Seal-N _____ Barite _____

Quik-Gel _____ Other _____

Jel-Flake _____ (describe) _____

Micatex C _____

Fluid-Trol _____

Cedar Fibre _____

Cottonseed Hulls _____

Wall-Nut _____

Cellophane Flakes _____

Cement _____

Lime _____

FOOTAGE:

from 0 ft.
to 50 ft.

Bit Size 5 5/8"
Air ☒ Mud ☐

Bit No.	Changed at
WM #3 used	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled hard rock & some gravel, HIT loose sand at 40', got hung up, finally got loose, couldn't drill with air so will dig with mud soon as we can get a back-hoe out to dig a pit

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 5/30/78
 Geologist Tim W. Driller woods Rig I.D. #3
Konkel

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00			Lining up back-hoe, water & diesel, called for	20		270	
8:00		10.	Casing out of ALBQ.	30		280	
9:00				40		290	
10:00				50		300	
11:00		10.	Back-Hoe is Digging pits	60	72	310	
12:00				70	"	320	
1:00				80	"	330	
2:00			DRILLING pilot hole	90	"	340	
3:00		3.		100	"	350	
4:00			3 LOADS WATER	110	"	360	
5:00			<u>10 hrs</u>	120	"	370	
				130	73	380	
				140	"	390	
				150	"	400	
				160	"	410	
				170		420	
				180		430	
				190		440	
				200		450	
				210		460	
				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

_____ Joint, 3/4" Pipe @ 21 ft. ea.
 _____ Quik-Trol (pkgs.)
 _____ Drift Foam/Quik-Foam (gals.)
 _____ Hy-Seal-N _____ Barite
18 _____ Quik-Gel _____ Other
 _____ Jel-Flake (describe)
 _____ Micatex C _____
 _____ Fluid-Trol _____
 _____ Cedar Fibre _____
 _____ Cottonseed Hulls _____
 _____ Wall-Nut _____
 _____ Cellophane Flakes _____
 _____ Cement _____
 _____ Lime _____

FOOTAGE:

from 50' ft.
to 160' ft.

Bit Size 5 5/8
Air _____ Mud ☒

Bit No.	Changed at
<u>Y-2 04946</u>	<u>160'</u> ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled very Hard Purple & Red Rock
BIT WAS SHOT AFTER DRILLING 100'

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 5/31/78
Geologist Tim W. Driller WOODS Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF. CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		10.	WENT TO AIR PORT AT ABBQ. To GET BIT SUB	10		260	
7:00		1.		20		270	
8:00				30		280	
9:00				40		290	
10:00			UNLOADED 47 JOINTS OF	50		300	
11:00			STEM INCLUDING 3 DRILL	60		310	
12:00				70		320	
1:00				80		330	
2:00				90		340	
3:00				100		350	
4:00		10.	collars, 4 bits, (2-13 3/4")	110		360	
5:00			(2-9 7/8"), 4 part blocks,	120		370	
6:00			CASING TOOL, 4 1/2" STABILIZER	130		380	
7:00				140		390	
8:00				150		400	
9:00				160		410	
10:00				170		420	
11:00				180		430	
12:00				190		440	
1:00				200		450	
2:00		4.	TAPPING OFF PITS	210		460	
3:00			2 loads WATER	220		470	
4:00				230		480	
5:00				240		490	
6:00				250		500	
7:00							
8:00							
9:00							
10:00							
11:00							
12:00							

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from _____ ft.

to _____ ft.

Bit Size _____

Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
2 set up 7 run 3/4" pipe
3 drilling 8 rig down &
 clean site
4 water trip 9 maintenance
5 pull drill pipe 10 Other (explain)

Remarks: _____

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/1/78

Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10	68	260	
7:00		1.		20	"	270	
				30	"	280	
8:00				40		290	
				50		300	
9:00				60		310	
				70		320	
10:00		3.		80		330	
				90		340	
11:00				100		350	
				110		360	
12:00				120		370	
				130		380	
1:00				140		390	
			Going to ALBQ To	150		400	
2:00		10.	PICK UP Kelly SUB.	160		410	
			TRYING TO GET BROKEN	170		420	
3:00				180		430	
				190		440	
4:00			OFF PIN OUT OF Kelly	200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
2 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
5 Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 0' ft.
to 35' ft.

Bit Size 13 3/4"

Air _____ Mud ☒

Bit No.	Changed at
<u>Hughes w7R</u>	_____ ft.
	_____ ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: While DRILLING 13 3/4 hole - Kelly
SUB BROKE OFF ON THE PIN END, having one
air freighted out OF DENVER To ALBQ.

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/2/78
 Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
				20		270	
7:00			waiting at Air Freight	30		280	
				40	68	290	
8:00			office IN ALBQ. FOR	50	"	300	
				60		310	
9:00		10.	SUB To come IN, BAD	70		320	
				80		330	
10:00			weather IN DENVER HELD	90		340	
				100		350	
11:00			up FREIGHT SHIPMENTS	110		360	
				120		370	
12:00			SUB came IN AT 12:30	130		380	
				140		390	
1:00		1.	TRAVEL BACK TO SOCORRO	150		400	
			AND TO SDB SITE	160		410	
2:00		10.	FISHED OUT BIT, STAB, & one	170		420	
			DRILL COLLAR	180		430	
3:00				190		440	
		3.	DRILLING again.	200		450	
4:00				210		460	
				220		470	
5:00			(10 hrs)	230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

_____ Joint, 3/4" Pipe @ 21 ft. ea.
 _____ Quik-Trol (pkgs.)
 _____ Drift Foam/Quik-Foam (gals.)
 _____ Hy-Seal-N _____ Barite
 _____ Quik-Gel _____ Other
 _____ Jel-Flake _____ (describe)
 _____ Micatex C _____
 _____ Fluid-Trol _____
 _____ Cedar Fibre _____
 _____ Cottonseed Hulls _____
 _____ Wall-Nut _____
 _____ Cellophane Flakes _____
 _____ Cement _____
 _____ Lime _____

FOOTAGE:

from 35 ft.
to 50 ft.

Bit Size 13 3/4

Air _____ Mud ☒

Bit No.	Changed at
<u>Hughes WTR</u>	_____ ft.
	_____ ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
 2 set up 7 run 3/4" pipe
 3 drilling 8 rig down &
 clean site
 4 water trip 9 maintenance
 5 pull drill pipe 10 Other (explain)

Remarks: DRILLED VERY HARD ROCK, HAVE TO DRILL
VERY SLOW SO I WON'T TWIST OFF AGAIN, MY HELPER,
KONKEL STAYED AT THE RIG ALL MORNING & GREASED
AND SERVICED IT.

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 22-1 Date 6/3/78
Geologist Tim W. Driller Woods Rig I.D. #3
Konkel

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1-		20		270	
				30		280	
8:00				40		290	
				50		300	
9:00				60	70	310	
				70	"	320	
10:00				80	"	330	
				90	"	340	
11:00		3.		100		350	
				110		360	
12:00				120		370	
				130		380	
1:00				140		390	
				150		400	
2:00				160		410	
				170		420	
3:00				180		430	
				190		440	
4:00			1 Load water	200		450	
			10 hrs	210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
4 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
8 Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 50' ft.
to 90' ft.

Bit Size 13 3/4"

Air _____ Mud ☒

Bit No.	Changed at
<u>Hughes WTR</u>	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
2 set up 7 run 3/4" pipe
3 drilling 8 rig down &
clean site
4 water trip 9 maintenance
5 pull drill pipe 10 Other (explain)

Remarks: Drilled very very hard rock

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 21-1 Date 6/12/78
Geologist Tim W. Driller WOODS RIG I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
				30		280	
8:00			BACK FROM BREAK	40		290	
				50		300	
9:00			STARTED DRILLING FROM	60		310	
				70		320	
10:00			90' on down	80		330	
				90	70	340	
11:00		3.		100	"	350	
				110	"	360	
12:00				120	"	370	
				130		380	
1:00				140		390	
				150		400	
2:00				160		410	
				170		420	
3:00				180		430	
				190		440	
4:00			1 load water	200		450	
				210		460	
5:00			(10 hrs)	220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
2 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
5 Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 90' ft.
to 120' ft.

Bit Size 1 3/4
Air _____ Mud ☒

Bit No.	Changed at
<u>Hughes W7R</u>	_____ ft.
	_____ ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: DRILLED VERY HARD REDISH-PURPLE ROCK

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/13/78
Geologist Tim W. Driller Woods Rig I.D. #3
KONKEK

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		9.	running surface casing	10		260	
7:00		1.		20		270	
8:00				30		280	
9:00			← FINISH RUNNING SURFACE PIPE	40		290	
10:00				50		300	
11:00				60		310	
12:00				70		320	
1:00				80		330	
2:00				90		340	
3:00				100		350	
4:00				110		360	
5:00				120		370	
				130	72	380	
				140	"	390	
				150	"	400	
				160	73	410	
				170		420	
				180		430	
				190		440	
				200		450	
				210		460	
				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
4 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
5 Quik-Gel 150' Other
Jel-Flake _____ (describe)
Micatex C 10 3/4" casing
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 120' ft.
to 154' ft.

Bit Size 13 3/4"
Air _____ Mud ☒

Bit No.	Changed at
<u>Hughes W7R</u>	_____ ft.
	_____ ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks:

Drilling is very hard & rough

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/14/78
Geologist Tim W. Driller WOODS RIG I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
				30		280	
8:00				40		290	
		9. 10.	Welding cap & 2" coupler	50		300	
9:00			ON 10 ³ / ₄ " casing	60		310	
				70		320	
10:00		9. 10.	Fleet Cementors cementing	80		330	
				90		340	
11:00			surface casing	100		350	
				110		360	
12:00		9. 10.	Cementors forgot valve	120		370	
			AND HAD TO LEAVE THE	130		380	
1:00			PUMPER TRUCK TIED ON.	140		390	
				150		400	
2:00			MAINTAINCE ON RIG &	160		410	
				170		420	
3:00		9.	OVERHAULED DRAWWORKS	180		430	
				190		440	
4:00			CLUTCH. (NEW CLUTCHES)	200		450	
				210		460	
5:00			(11 hrs)	220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from _____ ft.
to _____ ft.

Bit Size _____

Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: _____

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/15/78
Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
		10.	CUT PLUG OFF 10 3/4" casing	30		280	
8:00				40		290	
				50		300	
9:00		3.	DRILLED cement	60		310	
				70		320	
10:00				80		330	
				90		340	
11:00		10.	RUN 6 5/8" casing	100		350	
				110		360	
12:00				120		370	
				130		380	
1:00		10.	WELDED REDUCER RING ON 6 5/8" & 10 3/4" casing	140		390	
				150		400	
2:00				160		410	
				170		420	
3:00		10.	assembled and installed Blow OUT PREVENTER &	180		430	
				190		440	
4:00			welded EVERYTHING together.	200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 Load water

Joint, 3/4" Pipe @ 21 ft. ea.

Quik-Trol (pkgs.)

Drift Foam/Quik-Foam (gals.)

Hy-Seal-N

Barite

Quik-Gel

147'

Other

Jel-Flake

(describe)

Micatex C

16 5/8" casing

Fluid-Trol

Cedar Fibre

Cottonseed Hulls

Wall-Nut

Cellophane Flakes

Cement

Lime

FOOTAGE:

from _____ ft.

Bit Size _____

to _____ ft.

Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Had pits cleaned out by Ross Electric.

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/16/78
 Geologist TIM W. Driller WOODS Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
				20		270	
7:00		1.		30		280	
				40		290	
8:00			Preparing for B.O.P Test	50		300	
				60		310	
9:00		10.		70		320	
				80		330	
10:00				90		340	
				100		350	
11:00				110		360	
				120		370	
12:00		3.	Drilled 5' of cement	130		380	
				140		390	
1:00				150		400	
				160		410	
2:00		10.	B.O.P. Test	170		420	
			(Passed)	180		430	
3:00				190		440	
				200		450	
4:00				210		460	
				220		470	
5:00			<u>10 hrs</u>	230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

3 Loads water

Joint, 3/4" Pipe @ 21 ft. ea.

21 Quik-Trol (pkgs.)

Drift Foam/Quik-Foam (gals.)

Hy-Seal-N _____ Barite

12 Quik-Gel _____ Other (describe)

Jel-Flake _____

Micatex C _____

Fluid-Trol _____

Cedar Fibre _____

Cottonseed Hulls _____

Wall-Nut _____

Cellophane Flakes _____

Cement _____

Lime _____

FOOTAGE:

from 140 ft.
to 145' ft.

Bit Size 5 5/8"

Air _____ Mud ☒

Bit No.	Changed at
<u>Varrel D1479</u>	_____ ft.
	_____ ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Had some difficulty holding pressure on B.O.P. test but finally passed. Installed relief valve below b.o.p.

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/17/78
 Geologist Tim W. Driller WOODS RIG I.D. #3
KONKEH

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	"
				20		270	72
7:00		1.		30		280	"
				40		290	"
8:00			DRILLING CEMENT to	50		300	73
				60		310	"
9:00			155'	70		320	74
				80		330	"
10:00				90		340	"
				100		350	
11:00		3.		110		360	
				120		370	
12:00				130		380	
				140	69	390	
1:00				150	"	400	
				160	"	410	
2:00				170	"	420	
				180	"	430	
3:00				190	"	440	
				200	"	450	
4:00				210	70	460	
				220	"	470	
5:00			10 hrs	230	"	480	
				240	"	490	
				250	"	500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 load water
 Joint, 3/4" Pipe @ 21 ft. ea.
 Quik-Trol (pkgs.)
 Drift Foam/Quik-Foam (gals.)
 Hy-Seal-N _____ Barite
 Quik-Gel _____ Other
 Jel-Flake _____ (describe)
 Micatex C _____
 Fluid-Trol _____
 Cedar Fibre _____
 Cottonseed Hulls _____
 Wall-Nut _____
 Cellophane Flakes _____
 Cement _____
 Lime _____

FOOTAGE:

from 140' ft.
 to 340' ft.

Bit Size 5 5/8"
 Air _____ Mud ☒

Bit No.	Changed at
<u>YHI 01479</u>	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled Hard purpleish rock & rock of all colors, VERY HARD DRILLING

GEOTHERMAL SERVICES, INC.

10072 WILLOW, CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

POSTED

6/23/78

DRILLING LOG AND HISTORY

Project No. 178 Hole No. W-1 Date 6/18/78

Geologist Tim W. Driller Woods Rig I.D. #3

Konkel *

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
8:00		3.		30		280	
9:00				40		290	
10:00		10.	TRIP OUT	50		300	
11:00		10.	New BIT - TRIP IN	60		310	
12:00				70		320	
1:00				80		330	
2:00		3.		90		340	
3:00				100		350	71
4:00				110		360	"
5:00				120		370	"
				130		380	73
				140		390	74
				150		400	"
				160		410	75
				170		420	"
				180		430	"
				190		440	76
				200		450	77
				210		460	78
				220		470	"
				230		480	"
				240		490	"
				250		500	"

10 hrs

EXPENDABLE DRILLING MATERIALS USED

- Quantities
- 4 Joint, 3/4" Pipe @ 21 ft. ea.
 - 4 Quik-Trol (pkgs.)
 - Drift Foam/Quik-Foam (gals.)
 - Hy-Seal-N _____ Barite
 - 7 Quik-Gel _____ Other
 - Jel-Flake _____ (describe)
 - Micatex C _____
 - Fluid-Trol _____
 - Cedar Fibre _____
 - Cottonseed Hulls _____
 - Wall-Nut _____
 - Cellophane Flakes _____
 - Cement _____
 - Lime _____

FOOTAGE:

from 340' ft.
to 500' ft.

Bit Size 5 5/8

Air _____ Mud ☒

Bit No.	Changed at
VH10479	360' ft.
VH106319	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: DRILLED VERY HARD ROCK, HIT WHAT
LOOKED LIKE FLINT ROCK AT 380-381 (VERY HARD)
ALSO SOME CLAY

GEOTHERMAL SERVICES, INC. POSTED 6/28/78

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/19/78
 Geologist Tim W. Driller Woods Rig I.D. #3
KONKE

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				510	73	260	
				520	"	270	
7:00		1.		530	74	280	
				540	"	290	
8:00				550	"	300	
				560	75	310	
9:00				570	"	320	
				580	"	330	
10:00				590	"	340	
				600	"	350	
11:00		3.		610	76	360	
				620	"	370	
12:00				630	"	380	
				640	77	390	
1:00				650	"	400	
				160		410	
2:00				170		420	
				180		430	
3:00				190		440	
				200		450	
4:00		10.	Trip out (New Bit)	210		460	
				220		470	
5:00				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED
 Quantities 2 loads water
6 Joint, 3/4" Pipe @ 21 ft. ea.
6 Quik-Trol (pkgs.)
 Drift Foam/Quik-Foam (gals.)
 Hy-Seal-N _____ Barite
5 Quik-Gel _____ Other
 Jel-Flake _____ (describe)
 Micatex C _____
 Fluid-Trol _____
 Cedar Fibre _____
 Cottonseed Hulls _____
 Wall-Nut _____
 Cellophane Flakes _____
 Cement _____
 Lime _____

FOOTAGE:

from 500' ft.
to 650' ft.

Bit Size 55/8
Air _____ Mud ☒

Bit No.	Changed at
<u>VH106319</u>	<u>650</u> ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled Hard rock & some clay (very Hard Rock STKS) Hole is taking small amount of water

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. W-1 Date 6/20/78
Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
				30		280	
8:00				40		290	
			4 parted cable ON	650		300	
9:00		10.		660	74	310	
			Kelly & welded LUGS	670	"	320	
10:00				680	"	330	
			ON DRILL STEM	690	"	340	
11:00				700	75	350	
				710	"	360	
12:00				720		370	
				730		380	
1:00		3.		740		390	
				750		400	
2:00				760		410	
				770		420	
3:00				780		430	
				790		440	
4:00				800		450	
				810		460	
5:00				820		470	
				830		480	
				840		490	
				850		500	

EXPENDABLE DRILLING MATERIALS USED Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 650' ft.
to 710' ft.

Bit Size 5 5/8"

Air _____ Mud ☒

Bit No.	Changed at
VH1 06256	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: DRILLED VERY HARD ROCK OF ALL COLORS,
NOT SO MUCH CLAY AS BEFORE.

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/21/78
Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				710		260	
7:00		1.		720	73	270	
				730	"	280	
8:00				740	74	290	
				750	75	300	
9:00				760	"	310	
				770	"	320	
10:00				780	76	330	
				790	"	340	
11:00		3.		800	77	350	
				810	"	360	
12:00				820	"	370	
				830	"	380	
1:00				840	"	390	
				850	"	400	
2:00				160		410	
				170		420	
3:00				180		430	
				190		440	
4:00		5.	Trip out (New Bit)	200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
5 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
10 Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 710 ft.
to 850 ft.

Bit Size 5 5/8"
Air _____ Mud ☒

Bit No.	Changed at
<u>VH106256</u>	<u>850</u> ft.
<u>VH106257</u>	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled very hard rock, some clay strks
Pulled out and put on new bit

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/22/78
 Geologist Tim W. Driller Woods Rig I.D. #3
KANKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
				20		270	
7:00		1.		30		280	
				40		290	
8:00				50		300	
				60	75	310	
9:00				70	"	320	
				80	"	330	
10:00				90	"	340	
				100	76	350	
11:00				110	"	360	
				120	"	370	
12:00		3.		130	"	380	
				140		390	
1:00				150		400	
				160		410	
2:00				170		420	
				180		430	
3:00				190		440	
				200		450	
4:00				210		460	
				220		470	
5:00				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
 Quik-Trol (pkgs.)
 Drift Foam/Quik-Foam (gals.)
 Hy-Seal-N Barite
 Quik-Gel 5 gal. Other (describe)
 Jel-Flake
 Micatex C Con Det
 Fluid-Trol
 Cedar Fibre
 Cottonseed Hulls
 Wall-Nut
 Cellophane Flakes
 Cement
 Lime

FOOTAGE:

from 850 ft.
 to 930 ft.

Bit Size 5 5/8
 Air _____ Mud ✓

Bit No.	Changed at
VH1 06257	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Hit gummy clay at 880, drilling very slow as bit keeps balling up.

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/23/78
 Geologist Tim W. Driller Woods Rig I.D. #3
Konkel

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
				20		270	
7:00		1.		30		280	
				40	77	290	
8:00				50	"	300	
				60	78	310	
9:00				70	79	320	
				80	80	330	
10:00		3.		90	"	340	
				100	"	350	
11:00				110	81	360	
				120	"	370	
12:00				130	82	380	
				140	"	390	
1:00		5.	Trip out (new bit)	150	"	400	
				160	"	410	
2:00			Trip in	170		420	
				180		430	
3:00				190		440	
				200		450	
4:00		3.		210		460	
				220		470	
5:00				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 load water

Joint, 3/4" Pipe @ 21 ft. ea.
5 Quik-Trol (pkgs.)
 Drift Foam/Quik-Foam (gals.)
 Hy-Seal-N _____ Barite
 Quik-Gel _____ Other
 Jel-Flake _____ (describe)
 Micatex C _____
 Fluid-Trol _____
 Cedar Fibre _____
 Cottonseed Hulls _____
 Wall-Nut _____
 Cellophane Flakes _____
 Cement _____
 Lime _____

FOOTAGE:

from 930' ft.
 to 1060 ft.

Bit Size 55/8"

Air _____ Mud ☒

Bit No.	Changed at
VH1 06257	1020 ft.
V2 04602	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Drilled STICKY PINK CLAY, green clay & red shale - very gummy & slow drilling to 960', then hit rock again, drilled fair but hard, with streaks of clay

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/24/78
Geologist Tim W. Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				1070	82	260	
				1080	"	270	
7:00		1.		1090	"	280	
				1100	"	290	
8:00				1110	83	300	
				1120	"	310	
9:00				1130	"	320	
				1140	"	330	
10:00				1150	"	340	
				1160	"	350	
11:00		3.		1170	"	360	
				1180	"	370	
12:00				1190	"	380	
				1200	"	390	
1:00				1210	"	400	
						410	
2:00						420	
						430	
3:00						440	
						450	
4:00						460	
						470	
5:00						480	
						490	
						500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 load water

4 Joint, 3/4" Pipe @ 21 ft. ea.
4 Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
5 Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 1060 ft.
to 1210 ft.

Bit Size 55/8"

Air _____ Mud ☒

Bit No.	Changed at
<u>V2 04602</u>	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
2 set up 7 run 3/4" pipe
3 drilling 8 rig down &
clean site
4 water trip 9 maintenance
5 pull drill pipe 10 Other (explain)

Remarks: Drilled lots of clays & shales and
Hard rock

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/25/78
Geologist Tim W. Driller Woods Rig I.D. #3
Konkleh

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		5.	Trip out at 1280'	10		1260	"
7:00		5.	(new bit) changed to 5 1/8" bit	20		1270	"
8:00		5.	Trip in	30		1280	"
9:00		3.	drilling sticky shale	40		1290	"
10:00		3.	4 clay from 1280'-1360'	50		1300	"
11:00		3.	Few Hard rock STRS.	60		1310	"
12:00		3.		70		1320	"
1:00		3.		80		1330	"
2:00		3.		90		1340	"
3:00		3.		100		1350	"
4:00		3.		110		1360	"
5:00		3.		120		370	
				130		380	
				140		390	
				150		400	
				160		410	
				170		420	
				180		430	
				190		440	
				200		450	
				210		460	
				220	82	470	
				230	"	480	
				240	"	490	
				250	"	500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from 1210 ft.
to 1360 ft.

Bit Size 5 5/8 to 1280
Air _____ Mud ✓ 5 5/8 ON
down.

Bit No.	Changed at
V2 04602	1280 ft.
V10 50621	ft.

Log Approved: _____
Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
2 set up 7 run 3/4" pipe
3 drilling 8 rig down &
clean site
4 water trip 9 maintenance
5 pull drill pipe 10 Other (explain)

Remarks: (Working hours were from 12:00 PM. - 2:00 AM)

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/26/78
Geologist Tim W. Driller woods RIG I.D. #3
Konkel

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		3.		10		260	
7:00		3.	Lost circ. @ 1400 in broken formation right below clay formation	20		270	
8:00		3.	mixed up mud & lost circ. material & regained 50% circulation to 1410 and lost circ. completely again, tried to mix more L.C. material & mud to no avail. drilled on to 1420' blind and ran out of water.	30		280	
9:00		3.		40		290	
10:00		3.		50		300	
11:00		5.		60		310	
12:00		6.	Tripped out	70		320	
1:00		6.	Logging, probe went to 1367'	80		330	
2:00		⑥ 10.	Pickup up 60' drill stem at freight office and hauled to drill site	90		340	
3:00		1.		100		350	
4:00		3.	drilling sticky clay & shales.	110		360	82
5:00		3.		120		370	"
				130		380	"
				140		390	"
				150		400	L.C.
				160		410	L.C.
				170		420	L.C.
				180		430	
				190		440	
				200		450	
				210		460	
				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 load water

Joint, 3/4" Pipe @ 21 ft. ea.

5 Quik-Trol (pkgs.)

Drift Foam/Quik-Foam (gals.)

Hy-Seal-N

Barite

20 Quik-Gel

150 lbs. Other

Jel-Flake

(describe)

Micatex C

Barafos

Fluid-Trol

3 Cedar Fibre

Cottonseed Hulls

Wall-Nut

3 Cellophane Flakes

Cement

Lime

FOOTAGE:

from 1360 ft.

to 1420 ft.

Bit Size 5/8

Air Mud ✓

Bit No.

Changed at

Log Approved:

Y10 50621

1420 ft.

ft.

Date

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: Working hours were from 2:30 PM - 2:30 AM.

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/27/78
 Geologist Tim W Driller Woods Rig I.D. #3
KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		10.	Finally got 1360' of black pipe in hole & filled with water	10		260	
7:00		⑩		20		270	
8:00		⑩ 1.		30		280	
		⑩		40		290	
9:00		⑩ 3.	Trying to clean bridge out at 930'. Kept getting hung up & plugged bit. Finally tripped out	50		300	
10:00		⑩		60		310	
		⑩ 10.		70		320	
11:00		⑩		80		330	
		⑩	Removed B.O.P. & prepared to run 2" black pipe	90		340	
12:00		⑩		100		350	
				110		360	
1:00				120		370	
2:00			Running 2" pipe, had quite a few problems	130		380	
				140		390	
3:00				150		400	
				160		410	
4:00		10.	getting black pipe down, hit several bridges	170		420	
				180		430	
5:00				190		440	
				200		450	
				210		460	
				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

1 load water

Joint, 3/4" Pipe @ 21 ft. ea.

Quik-Trol (pkgs.)

Drift Foam/Quik-Foam (gals.)

Hy-Seal-N _____ Barite

Quik-Gel 65 jts Other

Jel-Flake _____ (describe)

Micatex C

21' x 2" black pipe

Fluid-Trol _____

Cedar Fibre _____

Cottonseed Hulls _____

Wall-Nut _____

Cellophane Flakes _____

Cement _____

Lime _____

FOOTAGE:

from _____ ft.

to _____ ft.

Bit Size _____

Air _____ Mud _____

Bit No.

Changed at

ft.

ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down & clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: (Working hours were from 8:00 AM - 1:00 AM)

GEOHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. 2-1 Date 6/28/78

Geologist Tim W. Driller Woods Rig I.D. #3

Konkel

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00		8.		10		260	
				20		270	
7:00		8.		30		280	
				40		290	
8:00		8.		50		300	
				60		310	
9:00		8.		70		320	
				80		330	
10:00		8.		90		340	
				100		350	
11:00				110		360	
				120		370	
12:00		1.		130		380	
				140		390	
1:00		10.	CUT 2" pipe & finished filling with water	150		400	
				160		410	
2:00		8.		170		420	
				180		430	
3:00		8.		190		440	
				200		450	
4:00		8.		210		460	
				220		470	
5:00		8.		230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED Quantities

Joint, 3/4" Pipe @ 21 ft. ea.
Quik-Trol (pkgs.)
Drift Foam/Quik-Foam (gals.)
Hy-Seal-N _____ Barite
Quik-Gel _____ Other
Jel-Flake _____ (describe)
Micatex C _____
Fluid-Trol _____
Cedar Fibre _____
Cottonseed Hulls _____
Wall-Nut _____
Cellophane Flakes _____
Cement _____
Lime _____

FOOTAGE:

from _____ ft.
to _____ ft.

Bit Size _____

Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
2 set up 7 run 3/4" pipe
3 drilling 8 rig down &
clean site
4 water trip 9 maintenance
5 pull drill pipe 10 Other (explain)

Remarks: Transferred drilling mud, quik trol & L.C.
material, axes on stem trailer broke, blocked it
up & prepared to fix it, fabricated locking
mechanism for top of 2" pipe.

GEO THERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/29/78

Geologist Tim W. Driller Woods Rig I.D. #3

KONKEL

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00				20		270	
				30		280	
8:00				40		290	
				50		300	
9:00				60		310	
				70		320	
10:00				80		330	
				90		340	
11:00				100		350	
				110		360	
12:00				120		370	
				130		380	
1:00				140		390	
				150		400	
2:00				160		410	
				170		420	
3:00				180		430	
				190		440	
4:00				200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

_____ Joint, 3/4" Pipe @ 21 ft. ea.
 _____ Quik-Trol (pkgs.)
 _____ Drift Foam/Quik-Foam (gals.)
 _____ Hy-Seal-N _____ Barite
 _____ Quik-Gel _____ Other
 _____ Jel-Flake _____ (describe)
 _____ Micatex C _____
 _____ Fluid-Trol _____
 _____ Cedar Fibre _____
 _____ Cottonseed Hulls _____
 _____ Wall-Nut _____
 _____ Cellophane Flakes _____
 _____ Cement _____
 _____ Lime _____

FOOTAGE:

from _____ ft.

to _____ ft.

Bit Size _____

Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site 6 logging
 2 set up 7 run 3/4" pipe
 3 drilling 8 rig down &
 clean site
 4 water trip 9 maintenance
 5 pull drill pipe 10 Other (explain)

Remarks: _____

GEOTHERMAL SERVICES, INC.

10072 WILLOW CREEK ROAD, SAN DIEGO, CALIFORNIA 92131 • (714) 566-4520

DRILLING LOG AND HISTORY

Project No. 178 Hole No. u-1 Date 6/30/78
Geologist Tim W. Driller Woods Rig I.D. #3
Konken

TIME AM/PM (Circle)	LOG	REF CODE NO.	REMARKS	DRILLING MUD/AIR RETURN TEMPERATURES			
				FT.	°F	FT.	°F
6:00				10		260	
7:00		1.		20		270	
				30		280	
8:00			Trying to find out about	40		290	
			cementing u-1 and	50		300	
9:00		10.	Lining up someone to	60		310	
			cover the mud pit	70		320	
10:00			up & smooth up the	80		330	
			location paying storage	90		340	
11:00			shed bill.	100		350	
				110		360	
12:00				120		370	
				130		380	
1:00			pulling maintenance on	140		390	
			stem trailer that the	150		400	
2:00		9.	axles broken up and	160		410	
				170		420	
3:00			trying to get it going	180		430	
				190		440	
4:00			again	200		450	
				210		460	
5:00				220		470	
				230		480	
				240		490	
				250		500	

EXPENDABLE DRILLING MATERIALS USED

Quantities

Joint, 3/4" Pipe @ 21 ft. ea. _____

Quik-Trol (pkgs.) _____

Drift Foam/Quik-Foam (gals.) _____

Hy-Seal-N _____ Barite _____

Quik-Gel _____ Other _____

Jel-Flake _____ (describe) _____

Micatex C _____

Fluid-Trol _____

Cedar Fibre _____

Cottonseed Hulls _____

Wall-Nut _____

Cellophane Flakes _____

Cement _____

Lime _____

FOOTAGE:

from _____ ft.
to _____ ft.

Bit Size _____
Air _____ Mud _____

Bit No.	Changed at
	ft.
	ft.

Log Approved: _____

Date _____

LOG REFERENCE CODE NUMBERS

1 travel to site	6 logging
2 set up	7 run 3/4" pipe
3 drilling	8 rig down &
	clean site
4 water trip	9 maintenance
5 pull drill pipe	10 Other (explain)

Remarks: _____