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GL04240

*Geothermal Potential of
Hill Air Force Base
Little Mountain Facility*

by

*J. A. Whelan
20 December 1977*

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Introduction and Summary

The Little Mountain Facility of Hill Air Force Base (Figures 1 and 2) is considered to have good potential of having a geothermal resource suitable for space heating; based on the following data:

- (a) Great Salt Lake Minerals and Chemical Corporation has wells about 5 miles north of the facility varying in depth from 412 to 920 feet, with temperatures ranging from 78° to 104° F. ≈ 110°C / km
- (b) These wells have a uniform gradient of 6° F/100 ft. Wells on the eastern edge of the facility have uniform gradients of 5° F/100 ft., indicating a similar geologic situation.
- (c) Gravity data indicates deep faulting both to the east and west of the facility. It is thought that the hot waters in the area are heated by deep circulation up these faults.

The best location for a geothermal well would be three miles to the east. A depth of 4000 to 5000 feet would be required. A site one and one half miles to the west would also be favorable, but the well would have to be on the order of 9000 feet deep. Well sites are selected on drilling into the faults surrounding the Little Mountain horst, with several hundred feet of bedrock over the intersection of the well and fault.

Surficial Geology

Little Mountain is a horst of Precambrian Mutual Formation consisting of purple quartzite. On both the east and west flanks, small areas of alluvium occur. To the east of this are marshlands, to the west salt flats.

Subsurface Geology

Gravity data (Lum, 1957) indicates that on the south end of Little Mountain, the top of the horst to the east is approximately two and one half miles east of the bedrock outcrops and lies at a depth of 1375 feet (See Figure 3).

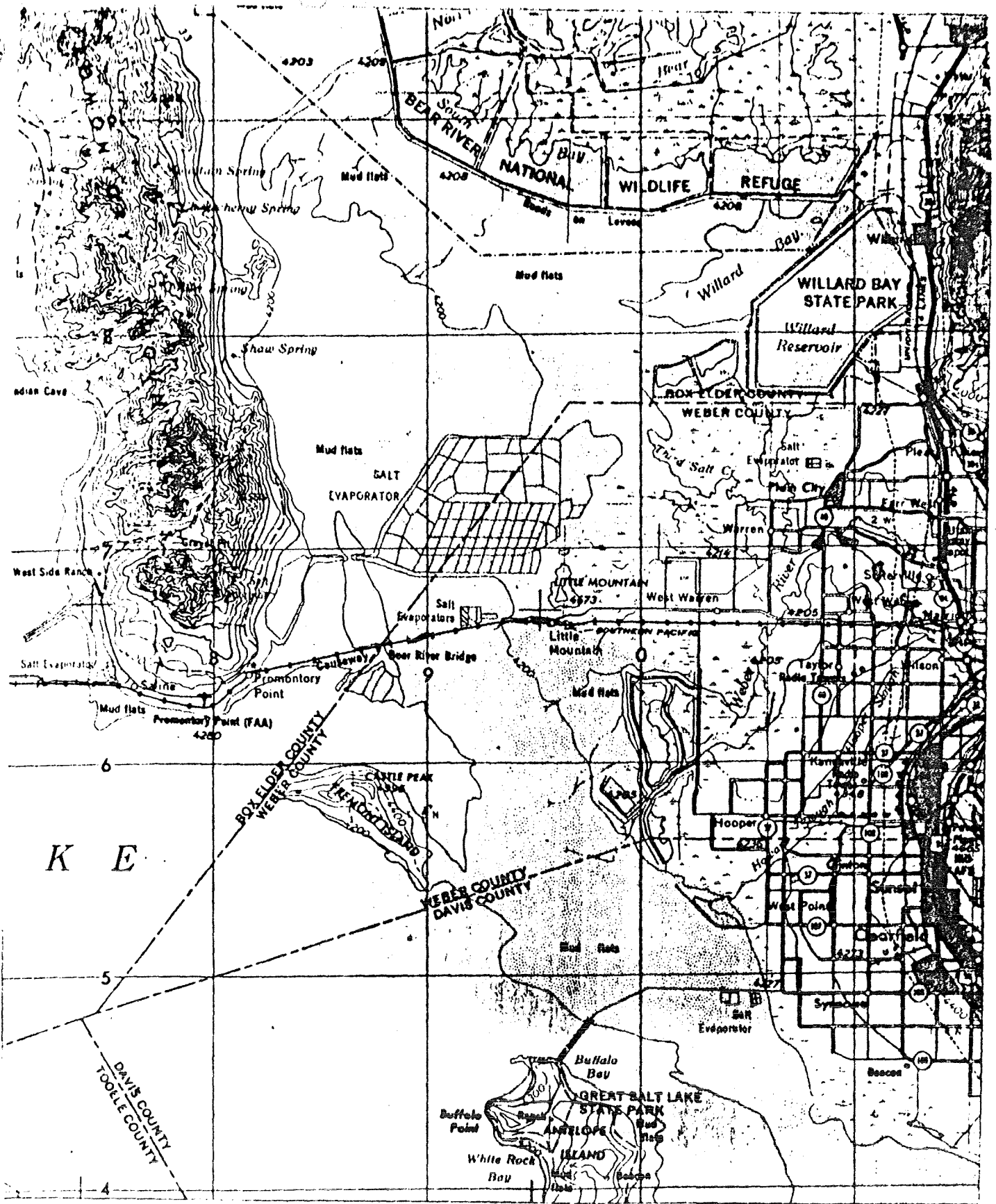


Fig. (1)- Location of Little Mountain Air Force Training Annex

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At the north end of Little Mountain the top of the horst to the east is at about 2-3 miles, and lies at a depth of 1200 feet. The top of the graben is found at a distance of 2.6 miles and a depth of 4700 feet (Figure 4). The top of the horst, to the west, is at about 0.55 miles distance, at a depth of 300 feet. The top of the graben occurs at a distance of one mile, at a depth of 800 feet. Lum's sections are given as figures 3 and 4.

Hydrology

The groundwater utilized just east of Little Mountain is pumped from alluvial aquifers. Recharge is from subsurface flow from the Wasatch Range; direct infiltration from precipitation; and seepage from the Weber and Ogden Rivers, mountain front streams, and irrigated areas (Bolke and Waddell, 1972, p. 3). Some of the water from the Wasatch Range circulates deep enough to become heated. This heated water rises along faults and mixes with cooler waters in the alluvium. Waters are of the sodium chloride and sodium bicarbonate type. Total dissolved solids vary from 337 to 1400 ppm. Data on Great Salt Lake Mineral and Chemical Corporation wells are given in Appendix A. Appendix A also contains summary data (SiO₂, Na, K, Ca, F, and B) for the wells on which data is available (Bolke and Waddell, 1972, pp. 49-51). For complete analyses the reader is referred to their publication.

Water Geochemistry

Water analyses were used to determine wall rock equilibration temperatures using the Na-K-Ca thermometer (Fourier and Truesdell, 1973) and the silica thermometer (Fourier and Rowe, 1966). The Na-K-Ca thermometer gave reservoir temperatures ranging from 70°C to 291°C. The highest temperature was from an analysis with an unusually high potassium content (160 mg/l), which seems unreasonable. Excluding the results obtained from that analysis, the range is from 70°C to 177°C. The mean is 137°C. Silica temperatures are lower, ranging from 20°C to 110°C, with a mean of 78°C.

Hooper Hot Spring, 8½ miles to the southeast has an observed temperature of 48°C, a Na-K-Ca temperature of 204°C, and a silica temperature of 30°C. Southwest Hooper Warm Springs, in the same vicinity, has an observed temperature of 32°C, a Na-K-Ca temperature of 222°C, and a silica temperature of 100°C (Trurry, Benson and Miller, 1976, p. 7). The mean air temperature of the region is 11°C (Bolke and Waddell, 1972, p. 2).

Although contamination by evaporites in alluvium can disturb the Na-K-Ca

4
thermometer and the silica contents may not represent equilibrium with quartz, it would seem reasonable to expect temperatures in the fault zones between 80°C and 140°C.

Geothermal Gradients

Geothermal gradients were calculated utilizing well depths and temperatures. Mean air temperature was assumed to be 11°C (Bolin and Waddell, 1972, p. 2). Gradients ranged from 7°C/100M to 12°C/100M. These are well above the expected gradients of 3°C/100M (Combs and Suffer, 1973, p. 102).

Conclusions and Recommendations

Warm wells, water geochemistry, high geothermal gradients, and major faults all indicate that waters ranging from 80°C to 140°C (176°F to 284°F) could be expected within the fault zones in bedrock. Water at such temperatures is extremely adequate for space heating.

The ideal location for wells would be in the hanging walls of the faults bounding the Little Mountain horst as shown in Figure 3. It would be desirable to go far enough into the hanging wall to have several hundred feet of bedrock above the fault where it is tapped. Therefore to the east the wells should be located about three miles east of the eastern edge of Little Mountain. If near the southern end of Little Mountain the well should be planned at about 4000 feet; if near the northern end at about 5000 feet.

If it is desired to drill to the west, the well should be sited about one and one half miles west of Little Mountain and a 9000 foot well should be planned.

References Cited

- Bolke, E. L. and Waddell, K. M., 1972, Ground Water Conditions in the East Shore Area, Box Elder, Davis, and Weber Counties, Utah: Technical Publication No. 35, State of Utah, Department of Natural Resources, 59 p.
- Combs, J. and Muffler, L. J. P., 1973, Exploration for Geothermal Resources: In *Geothermal Energy*, ed. by V. Kruger and C. Otte, Stanford Univ. Press, pp. 95-128
- Fournier, R. O. and Rowe, J. J., 1966, Estimation of Underground Temperature from Silica Content of Water from Hot Springs and Wet Steam Wells: *Am. Jour. Sci.*, 24, p. 685-697
- Fournier, R. O. and Truesdell, A. H., 1973, An Empirical Na-K-Ca Geothermometer for Natural Waters: *Geochim. et. Cosmochim. Acta*, 37, pp. 1255-1276
- Lum, D., 1957, Regional Gravity Survey of the North-Central Wasatch Mountains and Vicinity, Utah: M.S. Thesis, Univ. of Utah, 27 p.
- Perry, W. J.; Benson, N. L.; and Miller, C. D.; 1976, Geochemistry and Hydrothermal Alteration at Selected Utah Hot Springs: Dept. of Geology and Geophysics, Univ. of Utah, Final Report, Vol. 3, NSF Contract No. GI 43741, 131 p.

Appendix A

Well Data
Vicinity of
Little Mountain, Utah

Summary of Well Data From Bolke & Wadell (1972) pp 42-51 together with Na-K-Ca and S_1O_2 Temperatures.

Well	Depth		Temp	Gradient	S_1O_2	S_1O_2	Na	K	Ca	Na-K-Ca	B	F	Tds	S**
	Ft	M	C°	°C/100M		Temp				Temp			R*	
(B-b-3)														
4 DAB-1	540	165	21	6	25	76	147	4.8	4.0	128	700	2.0	531	
5CCC-1	510	155	25	9										
19AAB-1	229	70	17	9								0.4	1230	
			22	16								-	1230	
			19	11			336	8.2	103	70		0.6	1230	
			<u>X</u>	12										
19ABC-1	220	67	-	-	-		114	7.0	7.4	170	-		337	
			-		17	66						1.0	348	
			19	12	23	74								353
			18	10	20	70								332
			18	10	21	71						0.6		337
			16	8	24	75	111	8.8	6.6	170				
			19	12	-									
			18	10	-									
			<u>X</u>	10										
19ABC-2	295	90	19	9	32	83								696
			18	8	29	80								737
			18	8	33	84	207	5.5	41	71	0.7			700
			<u>X</u>	8										
(B-7-3)														
31AAC1	806	246	39	11	24	75					200	0.3	462	-
				-	30	82	148	9.4	15	157	260	0.6	473	
				11										
31AAC-2	920	280	38	10	67		110						980	

*R = residue at 180°C

**S = Sum of Constituents

Summary of Well Data from Bolke & Waddell (1972) pp 42-51 together with Na-K-Ca and S_1O_2 Temperatures. (Cont.)

Well	Depth		Temp C°	Gradient °C/100M	SiO ₂	SiO ₂ Temp	Na	K	Ca	Na-K-Ca Temp	B	F	Tds R*	S**
	FT	M												
31DAC-1	621	189	30	10										
			29	10										
			30	10										
			\bar{x}	10										
31DDA-1	597	182	30	10										
			-											
			30	10										
			29	10	33	84								
32CBB-1	717	219	34 ⁹⁾	11										
			34	11	36	87	145	6.5	8.0	145	60	0.8	458	R
			34	11										
			34	11	38	89							0.2	539
33CDD-1	399	122	-		27	78	139	9.0	6.8	164		0.2	413	
			19	7	26	77								260
			20	7	23	74								258
			20	7	24	75	76	8.0	10	166		0.4		259
			20	7	25	76				165		0.4	263	
			\bar{x}	7										
(B-6-3)											210			
12BCC-1	550		18	4	20	71	79	3.4	14	67	210	.3	275	-
(B-6-3)														
14DCC-2	604		17	3	19	70	-	-	20		-	-	220	-
(B-6-3)														
AAB-1	229		19	11	34	87	336	8.2	103	70	-	.6	-	1230
(B-6-3)														
10ACB	752		22	5	19	70	159	2.7	8	81				

GSLM&CC

WATER WELL PERFORMANCE DATA

Well No. 12

Date Completed 8-20-68

Size of Casing 8"

Total Depth 717'

27' *Water level*

DATE	TEMP F	AP? PRESSURE PSI?	FLOW GPM	REMARKS
9-1-72	94	7.0	56.7	
11-20-72	94	10.0	62	
12-7-72	94	6.8	50.5	
12-13-72	94	6.5	50	Avg. Flow from 2-5-71 53.3
1-8-73	94		52	
2-14-73	94	6.1	54	
3-6-73	94	6	51	<i>[Handwritten notes and scribbles]</i>
3-27-73	94	6	51	
4-24-73	94	6.2	50	
6-19-73	94	6.7	49	
8-13-73	94	6.0	47	
9-10-73			0.7	
1-25-74	94	5.8	43	
3-1-74		6.1	48	
3-21-74	94	5.7	44	
5-31-74	94	6.5	45	
	34°C			

120
117
100

WELL LOG AND DATA SHEET

WELL NO. 12

WELL DATA

Date drilled 8-20-68

Size of casing 3"

Length of casing 55' 6"

Length of screens 10'

ELEVATION

4200

4100

4000

3900

3800

3700

3600

3500

0

100

200

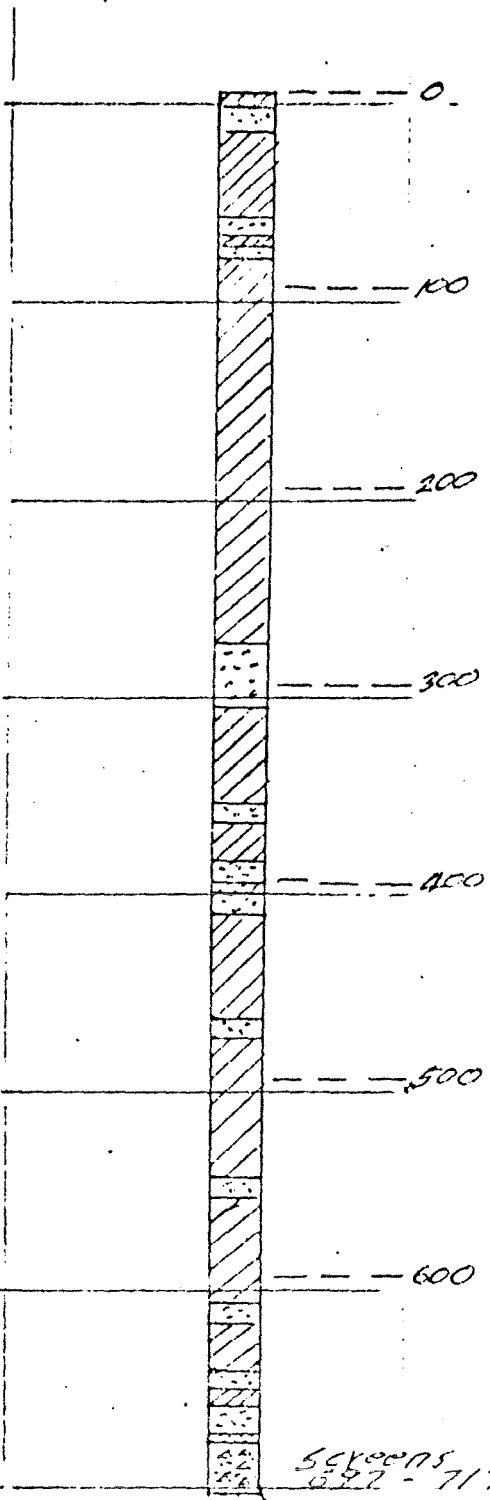
300

400

500

600

DEPTH FEET



Screens
697 - 717

maybe "partial penetration"

LEGEND



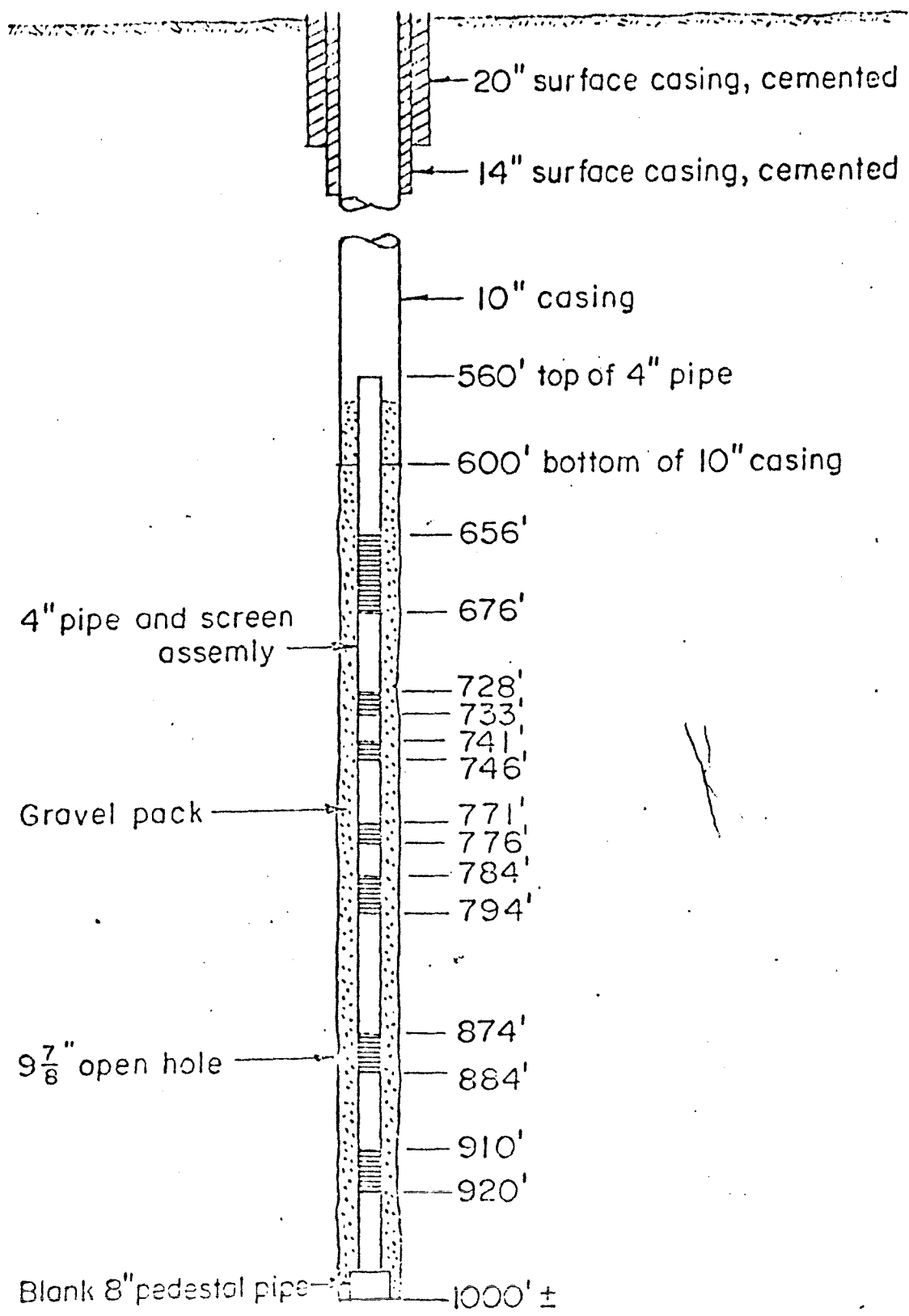
Clay



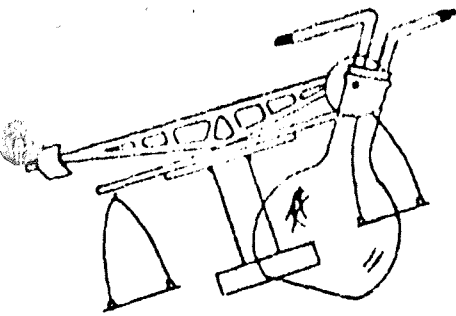
Sand



Sand & Gravel



		TOLERANCES UNLESS OTHERWISE SPECIFIED		USP JOHNSON DIVISION	ST. PAUL, MINN.
		FRACTIONS		Great Salt Lake Min & Chem Corp. Well Well No. 15	
		DECIMALS			
		ANGLES			
DESCRIPTION	DATE	APPROVED	DATE	SHEET ____ OF ____ 000371-1	
REVISIONS					
MATERIAL:					



Ford Chemical

LABORATORY

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE

SALT LAKE CITY, UTAH 84115

August 9, 1968

CERTIFICATE OF ANALYSIS 68-1255

Great Salt Lake Mineral & Chemical Corp.
P. O. Box 1190
Ogden, Utah

Gentlemen:

The following analysis is on water samples submitted on August 2, 1968 under Purchase Order No. 01908:

SAMPLE: Well No. ³²⁴ _{Co. No. 15} 4 collected August 2, 1968.

	RESULTS
Conductivity	2,150 mhos/cm
pH	7.75
Total Dissolved Solids at 103° C.	1,400 mg/l
Alkalinity as CaCO ₃	760 mg/l
Aluminum as Al	0.00 mg/l
Arsenic as As	0.00 mg/l
Bicarbonate as HCO ₃	927 mg/l
Boron as B	0.00 mg/l
Calcium as Ca	20 mg/l
Carbonate as CO ₃	14 mg/l
Chloride as Cl	50 mg/l
Chromium (Hex.) as Cr	0.00 mg/l

U.S.G.
0-30-
650

Great Salt Lake Mineral & Chemical Corp.

Page 2

August 9, 1968

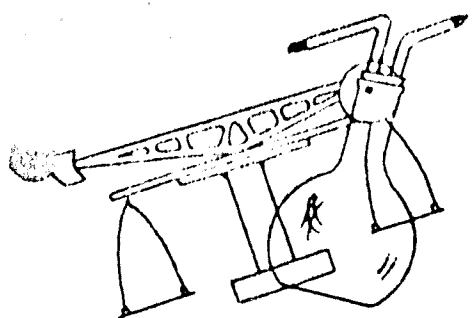
Copper as Cu	0.00 mg/l
Fluoride as F	0.00 mg/l
Total Hardness as CaCO ₃	110 mg/l
Iron (total) as Fe	0.13 mg/l
Iron (filtered) as Fe	0.10 mg/l
Lead as Pb	0.00 mg/l
Magnesium as Mg	14 mg/l
Manganese as Mn	0.02 mg/l
Nitrate as NO ₃	0.76 mg/l
Phosphate as PO ₄	2.05 mg/l
Potassium as K	160 mg/l
Sodium as Na	238 mg/l
Sulfate as SO ₄	21 mg/l
Zinc as Zn	0.00 mg/l

Sincerely,

FORD CHEMICAL LABORATORY


Lyle S. Ford

LSF/rd



Ford Chemical

LABORATORY
Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115

August 16, 1968

CERTIFICATE OF ANALYSIS 68-1287

Great Salt Lake Mineral & Chemical Corp.
P. O. Box 1190
Ogden, Utah

Gentlemen:

The following analysis is on water samples submitted on
8/2/68 under Purchase Order No. 01908:

SAMPLE: Well No. 8 Collected August 2, 1968.

	RESULTS
Conductivity	1,490 mhos/cm
pH	7.80
Total Dissolved Solids at 103° C.	950 mg/l
Alkalinity as CaCO ₃	470 mg/l
Aluminum as Al	0.00 mg/l
Arsenic as As	0.00 mg/l
Bicarbonate as HCO ₃	560 mg/l
Boron as B	0.01 mg/l
Calcium as Ca	8 mg/l
Carbonate as CO ₃	6.8 mg/l
Chloride as Cl	100 mg/l
Chromium (Hex.) as Cr	0.00 mg/l

*USES
E-30
250*

Temp. = 19.1°C

Great Salt Lake Mineral & Chemical Corp.

Page 2

August 16, 1968

Copper as Cu	0.00 mg/l
Fluoride as F	0.00 mg/l
Total Hardness as CaCO ₃	80 mg/l
Iron (total) as Fe	0.35 mg/l
Iron (filtered) as Fe	0.31 mg/l
Lead as Pb	0.00 mg/l
Magnesium as Mg	2 mg/l
Manganese as Mn	0.06 mg/l
Nitrate as NO ₃	0.85 mg/l
Phosphate as PO ₄	2.50 mg/l
Potassium as K	23 mg/l
Sodium as Na	255 mg/l
Sulfate as SO ₄	10.0 mg/l
Zinc as Zn	0.00 mg/l

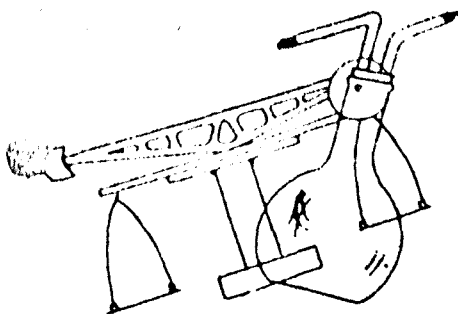
Sincerely,

FORD CHEMICAL LABORATORY



Lyle S. Ford

LSF/rd



Ford Chemical

LABORATORY, INC.

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 485-5761

Date: July 30, 1974

Name Great Salt Lake Mineral & Chemical Corp.

CERTIFICATE OF ANALYSIS
74-2602

Address Box 1190

Ogden, Utah

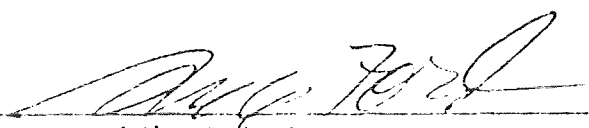
Sample water from Well #10 received on July 10, 1974, under

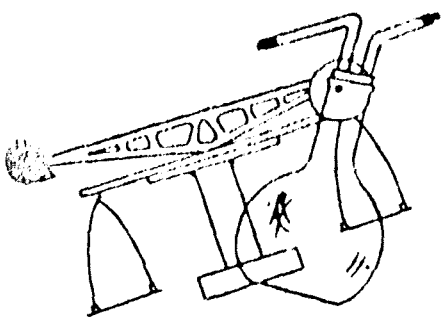
P.O. No. 1101

Ca - Na - K 155°C

SiO₂ = 26°C

Turbidity	<u>0.28</u> JTU	Fluoride as F	<u>0.34</u> mg/l
Conductivity	<u>943.40</u> umhos/cm	Total Hardness as CaCO ₃	<u>49.00</u> mg/l
pH	<u>7.85</u>	Iron (Total) as Fe	<u>0.13</u> mg/l
Total Dissolved Solids at 180° C.	<u>651.0</u> mg/l	Iron (Filtered) as Fe	<u>0.12</u> mg/l
Alkalinity as CaCO ₃	<u>290.0</u> mg/l	Lead as Pb	<u>< 0.01</u> mg/l
Aluminum as Al	<u>< 0.01</u> mg/l	Magnesium as Mg	<u>1.95</u> mg/l
Arsenic as As	<u>< 0.01</u> mg/l	Manganese as Mn	<u>0.02</u> mg/l
Bicarbonate as HCO ₃	<u>336.90</u> mg/l	Mercury as Hg	<u>< 0.001</u> mg/l
Barium as Ba	<u>0.02</u> mg/l	Nitrate as NO ₃ -N	<u>0.73</u> mg/l
Boron as B	<u>< 0.01</u> mg/l	Phosphate as PO ₄	<u>0.69</u> mg/l
Cadmium as Cd	<u>< 0.001</u> mg/l	Potassium as K	<u>10.07</u> mg/l
Calcium as Ca	<u>16.40</u> mg/l	Selenium as Se	<u>< 0.01</u> mg/l
Carbonate as CO ₃	<u>12.00</u> mg/l	Silica as SiO ₂	<u>1.41</u> mg/l
Chloride as Cl	<u>96.00</u> mg/l	Silver as Ag	<u>< 0.001</u> mg/l
Chromium as Cr (Hex)	<u>< 0.01</u> mg/l	Sulfate as SO ₄	<u>6.50</u> mg/l
Cyanide as Cn	<u>< 0.01</u> mg/l	Sodium as Na	<u>173.10</u> mg/l
Copper as Cu	<u>< 0.01</u> mg/l	Zinc as Zn	<u>0.12</u> mg/l


Ford Chemical Laboratory, Inc.



Ford Chemical

LABORATORY, INC.

Bacteriological and Chemical Analysis
40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 485-5761

Date: July 31, 1974

Name Great Salt Lake Mineral & Chemical Corporation CERTIFICATE OF ANALYSIS

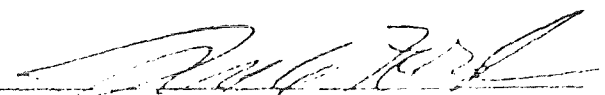
Address P.O. Box 1190

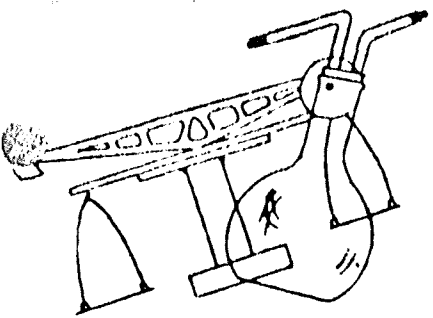
74-2610

Ogden, Utah

Sample Water from Well #15 received on July 10, 1974 under P.O. No. 1101.

<i>Calc. Alk. 110°C</i>		<i>SiO₂ 27</i>	
Turbidity	<u>0.50</u> JTU	Fluoride as F	<u>0.60</u> mg/l
Conductivity	<u>1,446.0</u> umhos/cm	Total Hardness as CaCO ₃	<u>143.0</u> mg/l
pH	<u>7.75</u>	Iron (Total) as Fe	<u>0.25</u> mg/l
Total Dissolved Solids at 180° C.	<u>998.0</u> mg/l	Iron (Filtered) as Fe	<u>0.20</u> mg/l
Alkalinity as CaCO ₃	<u>266.0</u> mg/l	Lead as Pb	<u>< 0.01</u> mg/l
Aluminum as Al	<u>< 0.01</u> mg/l	Magnesium as Mg	<u>7.44</u> mg/l
Arsenic as As	<u>< 0.01</u> mg/l	Manganese as Mn	<u>0.08</u> mg/l
Bicarbonate as HCO ₃	<u>332.0</u> mg/l	Mercury as Hg	<u>< 0.001</u> mg/l
Barium as Ba	<u>0.15</u> mg/l	Nitrate as NO ₃ -N	<u>2.46</u> mg/l
Boron as B	<u>< 0.01</u> mg/l	Phosphate as PO ₄	<u>1.20</u> mg/l
Cadmium as Cd	<u>< 0.001</u> mg/l	Potassium as K	<u>18.80</u> mg/l
Calcium as Ca	<u>44.80</u> mg/l	Selenium as Se	<u>< 0.01</u> mg/l
Carbonate as CO ₃	<u>8.0</u> mg/l	Silica as SiO ₂	<u>1.51</u> mg/l
Chloride as Cl	<u>332.0</u> mg/l	Silver as Ag	<u>< 0.001</u> mg/l
Chromium as Cr (Hex)	<u>< 0.01</u> mg/l	Sulfate as SO ₄	<u>2.0</u> mg/l
Cyanide as Cn	<u>< 0.01</u> mg/l	Sodium as Na	<u>264.5</u> mg/l
Copper as Cu	<u>0.05</u> mg/l	Zinc as Zn	<u>0.49</u> mg/l


Ford Chemical Laboratory, Inc.



Ford Chemical

LABORATORY, INC.

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
PHONE 485-5761

Date: July 31, 1974

Name Great Salt Lake Mineral & Chemical Corp.

CERTIFICATE OF ANALYSIS

Address P.O. Box 1190

74-2614

Ogden, Utah

Sample Water from Well #16 received on July 10, 1974 under P.O. No. 1101.

1.1. No. 201 5.02 62°C

	<i>#13</i>	<i>#13</i>
Turbidity	<u>0.50</u> JTU	<u>0.69</u> mg/l
Conductivity	<u>1,210.0</u> umhos/cm <i>900</i>	<u>62.0</u> mg/l
pH	<u>7.75</u> <i>7.8</i>	<u>0.23</u> mg/l
Total Dissolved Solids at 180° C.	<u>835.0</u> mg/l <i>624</i>	<u>0.21</u> mg/l
Alkalinity as CaCO ₃	<u>392.0</u> mg/l <i>250</i>	<u>0.01</u> mg/l
Aluminum as Al	<u>0.01</u> mg/l <i>.01</i>	<u>3.36</u> mg/l
Arsenic as As	<u>0.01</u> mg/l <i>.01</i>	<u>0.04</u> mg/l
Bicarbonate as HCO ₃	<u>460.0</u> mg/l <i>307</i>	<u>0.001</u> mg/l
Barium as Ba	<u>0.25</u> mg/l <i>.02</i>	<u>0.70</u> mg/l
Boron as B	<u>0.01</u> mg/l <i>.01</i>	<u>0.82</u> mg/l
Cadmium as Cd	<u>0.001</u> mg/l <i>-</i>	<u>27.6</u> mg/l
Calcium as Ca	<u>19.20</u> mg/l <i>10.5</i>	<u>0.01</u> mg/l
Carbonate as CO ₃	<u>10.0</u> mg/l <i>-</i>	<u>13.9</u> mg/l
Chloride as Cl	<u>118.0</u> mg/l <i>115</i>	<u>0.001</u> mg/l
Chromium as Cr (Hex)	<u>0.01</u> mg/l <i>-</i>	<u>1.5</u> mg/l
Cyanide as Cn	<u>0.01</u> mg/l <i>-</i>	<u>204.0</u> mg/l
Copper as Cu	<u>0.01</u> mg/l <i>-</i>	<u>0.03</u> mg/l
Fluoride as F		<u>0.69</u> mg/l
Total Hardness as CaCO ₃		<u>62.0</u> mg/l
Iron (Total) as Fe	<i>.18</i>	<u>0.23</u> mg/l
Iron (Filtered) as Fe	<i>.15</i>	<u>0.21</u> mg/l
Lead as Pb		<u>0.01</u> mg/l
Magnesium as Mg	<i>1.92</i>	<u>3.36</u> mg/l
Manganese as Mn	<i>.01</i>	<u>0.04</u> mg/l
Mercury as Hg		<u>0.001</u> mg/l
Nitrate as NO ₃ -N		<u>0.70</u> mg/l
Phosphate as PO ₄		<u>0.82</u> mg/l
Potassium as K	<i>7.95</i>	<u>27.6</u> mg/l
Selenium as Se		<u>0.01</u> mg/l
Silica as SiO ₂	<i>6.6</i>	<u>13.9</u> mg/l
Silver as Ag		<u>0.001</u> mg/l
Sulfate as SO ₄		<u>1.5</u> mg/l
Sodium as Na	<i>163.3</i>	<u>204.0</u> mg/l
Zinc as Zn		<u>0.03</u> mg/l

[Signature]
Ford Chemical Laboratory, Inc.

6° F / 100 FT
10.9° C / 100 M

5

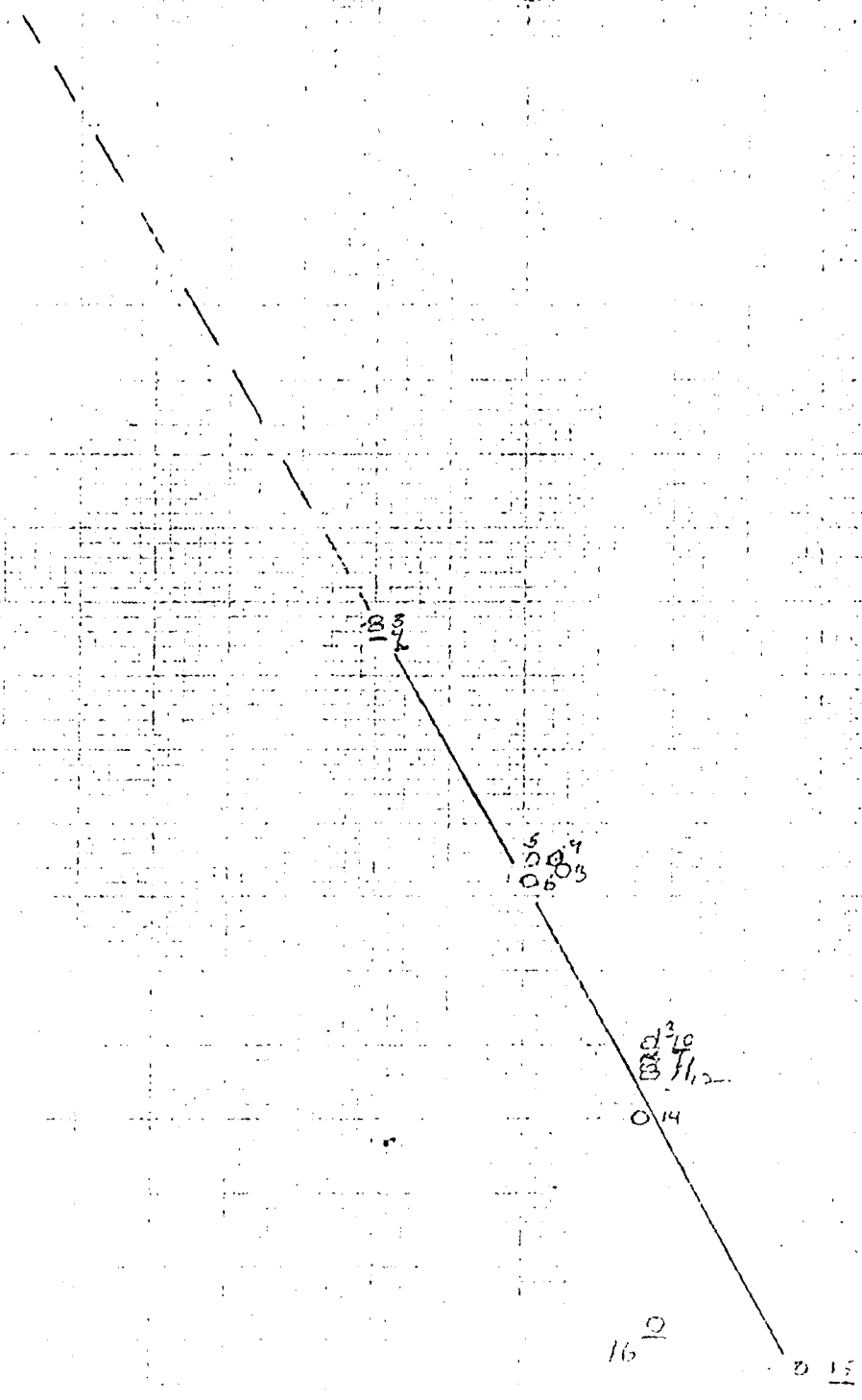


FIGURE 5.
TEMPERATURES OF
ARTESIAN WELLS VS
DEPTH, GSI, M ETC.

NO. 15 WELL 15

Well Test Results

Well	Temp.	Dissolved Oxygen	pH	Alkalinity	CO ₂ Dissolved
Well 2	65°F	16 3.7 2.4 ppm	7.6	260 ppm as CaCO ₃	14 ppm (calculated)
Well 3	60°F	16 2.3 5.2 ppm	7.7	231 ppm as CaCO ₃	9 ppm (calculated)
Well 4	67°F	3.6 0.2 ppm	7.7	290 ppm as CaCO ₃	12 ppm (calculated)
Well 5	71°F	72 4.5 0.2 ppm	7.7	226 ppm as CaCO ₃	9 ppm (calculated)
Well 6	59°F	1.5 4.1 ppm	7.5	244 ppm as CaCO ₃	16 ppm (calculated)
Well 8	60°F	5.5 ppm	7.7	213 ppm as CaCO ₃	9 ppm (calculated)
Well 10	59°F	5.5 ppm	7.7	196 ppm as CaCO ₃	8 ppm (calculated)
Well 1	61°F	1.5 ppm	7.5	286 ppm as CaCO ₃	19 ppm (calculated)
Well 2	61°F	2.0 ppm	7.4	290 ppm as CaCO ₃	7 ppm (calculated)

Water level at well - 200

Well No.	Water Level	Time	Notes
1	544	10	
2	544	7	
3	545	25	
4	545	28	
5	575	42	
6	575	28	
7	575	34	
8	583	27	
9	573	32	
(1) 10	705	47	
11	712	47	
12	717	55	
(1) 13	701	51	
14	800	44	
(1) 15	920	150	
(2) 16	889	70	
			<u>104</u>
			94

(1) Production well to plant

(2) Well at Pond Control Center

8-5-74

P.B.

U.S. GEOLOGICAL SURVEY
CENTRAL LABORATORY
SALT LAKE CITY, UTAH 84101

WATER ANALYSIS
ID # 1306

DEOSW, CIVIL ENGINEERING DIVISION HILL AIR FORCE BASE, UTAH 84401
DAF, AIR FORCE LOGISTICS COMND, WRIGHT PATTERSON AFB, OHIO 45433
COLL SITE---LITTLE MOUNTAIN WELL 2 DATE---75-10-22 TIME---0900
APPEARANCE---WATER CLEAR MAIL RESULTS TO AFLC

RESULTS OF ANALYSIS

MAJOR IONS

CATIONS	MG/L	ME/L	ANIONS	MG/L	ME/L
CALCIUM	45	2.245	BICARBONATE	166	2.721
MAGNESIUM	9.4	0.773	CARBONATE	0	0.000
SODIUM	240	10.440	SULFATE	7.6	0.158
POTASSIUM	7.8	0.199	CHLORIDE	360	10.156
			FLUORIDE	0.5	0.026
			NO2 + NO3 AS N	1.40	0.100

ADDITIONAL CONSTITUENTS

SILICA	MG/L	27	DISSOLVED SOLIDS	MG/L	777
IRON	MG/L	0.87	RESIDUE AT 180 C	MG/L	785
MANGANESE	MG/L	0.12	CALCULATED (SUM)	MG/L	785
COLOR		4	HARDNESS AS CaCO3		
PH		8.1	TOTAL	MG/L	150
SPECIFIC CONDUCTANCE			NON-CARBONATE	MG/L	15
IN UMHOS AT 25 C		1530	ALKALINITY AS CaCO3	MG/L	136
			CARBON DIOXIDE (CALC)	MG/L	2.1
			SODIUM ADSORP. RATIO		8.5
			LANGELIER INDEX --	25 C	+0.2

HILL AIR FORCE BASE
ANALYSES BY GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR

(Results in parts per million except as indicated)

Salt Lake City Laboratory No.	40622	40623
Date of collection	8-4-69 <i>Range</i> <i>2 1/2</i>	8-4-69 <i>Range</i> <i>1 1/2</i>
Silica (SiO ₂)	44	42
Iron (Fe)	0.28	0.21
Manganese (Mn)	0.01	0.05
Calcium (Ca)	71	105
Magnesium (Mg)	144	228
Sodium (Na)	2440	3210
Potassium (K)		
Bicarbonate (HCO ₃)	374	373
Carbonate (CO ₃)	0	0
Sulfate (SO ₄)	793	1070
Chloride (Cl)	3500	4790
Fluoride (F)	1.9	1.5
Nitrate (NO ₃)	2.4	1.4
Boron (B)		
Dissolved solids		
Calculated	7180	9630
Residue on evaporation at 180° C.	7310	9790
Hardness as CaCO ₃	770	1200
Non carbonate hardness as CaCO ₃	463	895
Alkalinity as CaCO ₃	307	306
Percent Sodium	87	85
Sodium-Adsorption Ratio	38	40
Specific Conductance μ mhos @ 25°C.	11200	14700
pH	7.8	7.9
Color (units)		
Carbon Dioxide (CO ₂), Calculated	9.4	7.5

40622 Loc: Hill Air Force Base
 POC: Pump Discharge
 Owner: U.S. Air Force
 Source: Range Well No. 2
 Temp: 16°C

40623 Loc: Hill Air Force Base
 POC: Pump Discharge
 Owner: U.S. Air Force
 Source: Range Well No. 1
 Temp: 16°C