CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the Walter E. Heinrichs, Jr. Mining Collection

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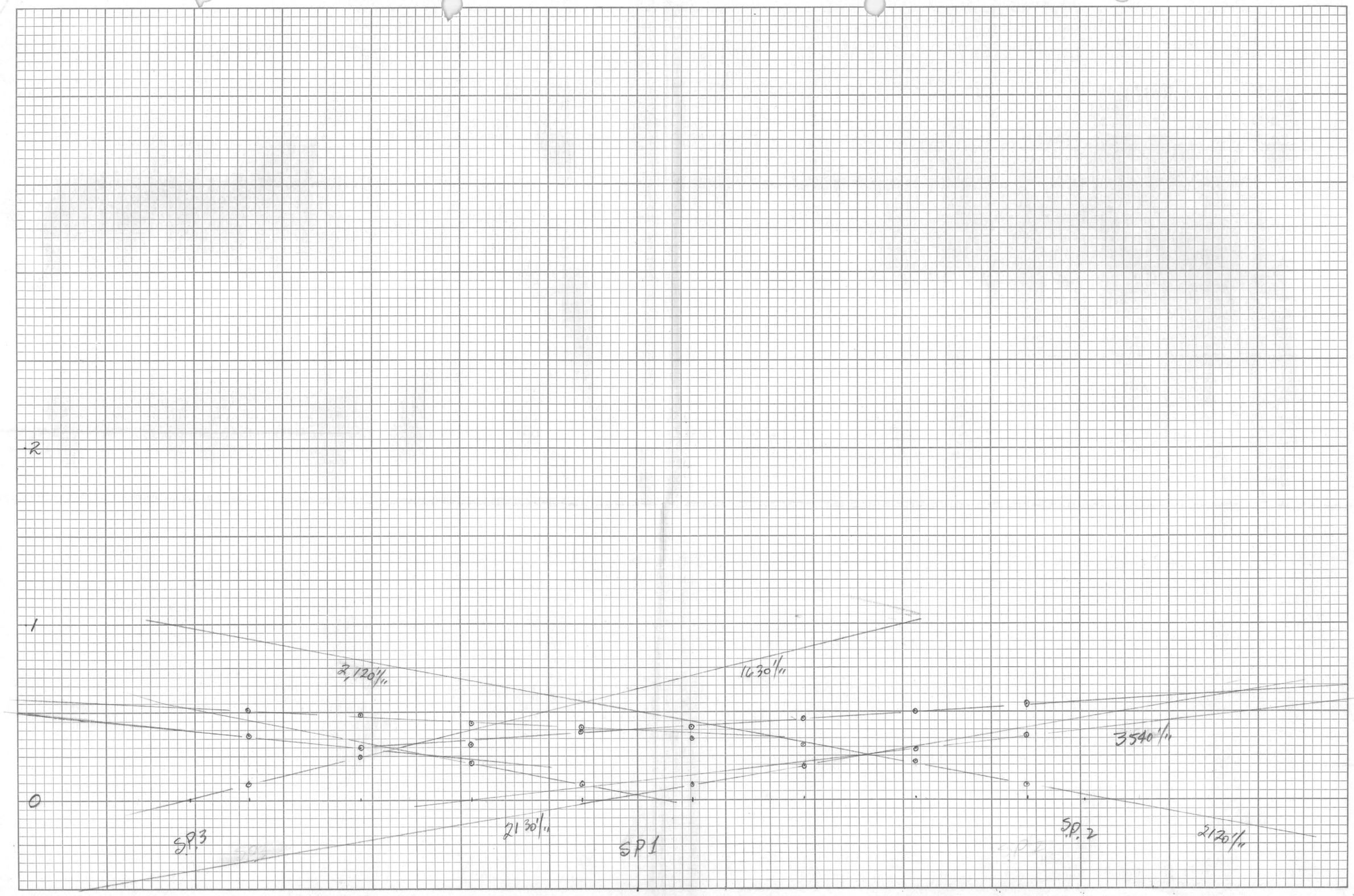

K+E 10 X 10 TO THE INCH 359-5DLG
KEUFFEL & ESSER CO. MADE IN U.S.A.

March 20, 1959

S T A T E M E N T

To: Mr. Wes. Miller
Miller Homes
6942 East Baker
Tucson, Arizona

Water well location work, Sabino Ranch Area, Sabino Canyon Vicinity, Pima County, Arizona
Re: Professional Services

Mobile Magnetometer 1/2 day	$225.00
Resistivity Surveys 1 day	250.00
Surveying 1 day	125.00
Seismic 1 day	500.00
	$1100.00
Dr. Leonard C. Halpenny Consultation charge	409.95
Total	$1509.95

Mrs. Sanders
AX 89984

Ed Rucker (Lawyer for Mrs. Sanders)
MA 37528

Miller Construction Co.
(~~AX 81265~~) AX 80741
Mrs Sanders

HEINRICHS GEOEXPLORATION COMPANY
MINERAL ENGINEERING CONSULTANTS AND CONTRACTORS
GEOPHYSICAL, GEOLOGICAL AND ECONOMIC APPRAISALS
TUCSON, ARIZONA

WALTER E. HEINRICHS, JR.
E. GROVER HEINRICHS

PHONE: MAIN 2-4202
806-808 WEST GRANT ROAD
MAIL: P. O. BOX 5671

March 6, 1959

Mr. Wes. Miller
Miller Homes
6942 East Baker
Tucson, Arizona

Dear Mr. Miller:

This will confirm our phone conversations and visits to your office during the past few days regarding professional services for the purpose of locating water well sites on property in the Sabino Canyon area near Tucson, described approximately as being in portions of Sections 16, 21, 22, T 13 S, R 15 E, G & S. R. B & M, Pima County Arizona.

It is agreed that commencing on March 9, 1959, in full collaberation with Dr. Leonard Halpenny of Tucson, together, we will furnish a technical crew and equipment necessary, and will conduct geological and geophysical surveys in the area described. From the results we will endeavor to pick at least three drill site locations within said area, with a relative evaluation concerning each location, or in lieu thereof, our next best alternate recommendation for getting water to the area. It is our understanding that the whole is not to exceed $2,000.00, and is expected to be completed within seven to ten days from the start of the project, with payment due within 30 days after receipt of our billing at the end of the job.

For your information, our employees are fully covered by liability and workmen's compensation insurance.

Your acceptance of this letter and its contents, by signing and dating in the spaces provided on the enclosed carbon copy, and returning same to us, will be appreciated.

Very truly yours,

HEINRICHS GEOEXPLORATION COMPANY

by: _____
Walter E. Heinrichs, Jr.
President & General Manager

Encl: 1
cc: L. Halpenny

Accepted by: W H Miller
Miller Homes
Date: 3/9/59

March 6, 1959

Mr. Wes. Miller
Miller Homes
6942 East Baker
Tucson, Arizona

P.O. Box 6056

Dear Mr. Miller:

This will confirm our phone conversations and visits to your office during the past few days regarding professional services for the purpose of locating water well sites on property in the Sabino Canyon area near Tucson, described approximately as being in portions of Sections 16, 21, 22, T 13 S, R 15 E, G & S. R. B & M, Pima County Arizona.

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Walter E. Heinrichs, Jr.
President & General Manager

Encl: 1
cc: L. Halpenny

Accepted by: _____
Miller Homes

Date: _____

1. Bedrock profile – Lowest portions or basins. Bedrock ridges.

2. Major & minor faults

3. Por. & Per. factors (reservoir) (dam)
   a. Faults, breci, & gouge zones
   b. Formational lithologic characteristics

Fences ?

Leonard C. Halpenny
3938 Santa Barbara Ave
EA 61133

To Grover

Date 2-16-59 Time 3:10

WHILE YOU WERE OUT

Mr. Bill Wheeler

of

Phone Ma 27623

TELEPHONED	✓	PLEASE CALL HIM	✓
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		RUSH	

Message about using the NoMag to find drill targets for ground water for one of his clients.

Operator

No. 2725 S REORDER from Howard & Stofft Tucson, Arizona

Johannessen, Girard & Taylor Co.

William H. Wheeler

Water Search

300 - 400 acres

For

Land development concern.
Miller Construction Co
Wes Miller AX 80741 - Green Hills Estates
near El Dorado Lodge
E. on Speedway beyond
Wilmot is office.

When

No deffinite date

Where

Vicinity of Sabino Canyon
See Map (attached)

Wants

3 200 gal/min. wells in vicinity of E1/2, NW1/4
Sec 21, T13S, R15E.

HEINRICHS GEOEXPLORATION COMPANY
MINERAL ENGINEERING CONSULTANTS AND CONTRACTORS
GEOPHYSICAL, GEOLOGICAL AND ECONOMIC APPRAISALS
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President & General Manager

Accepted: Miller Homes
Date:_____
By:_____

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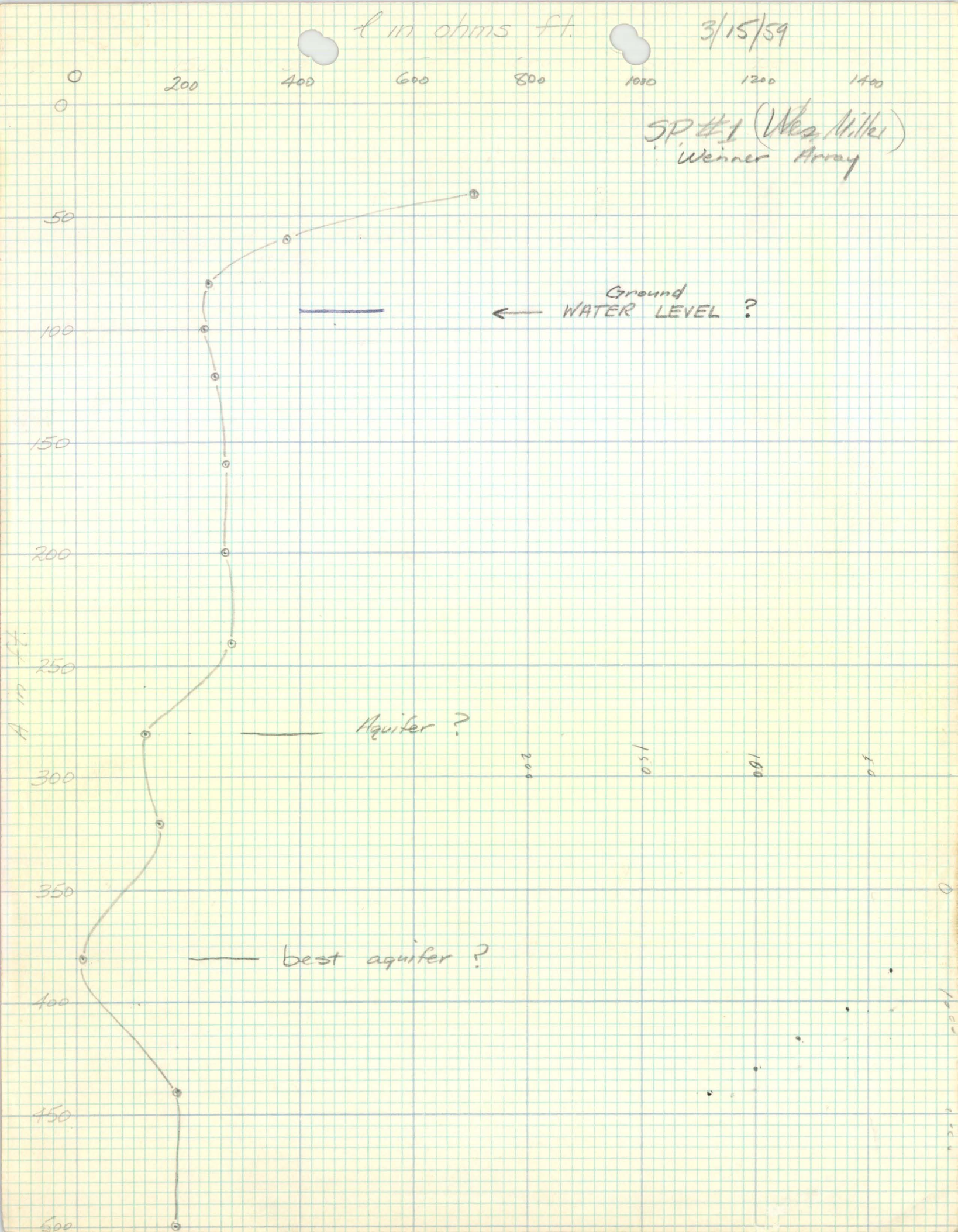
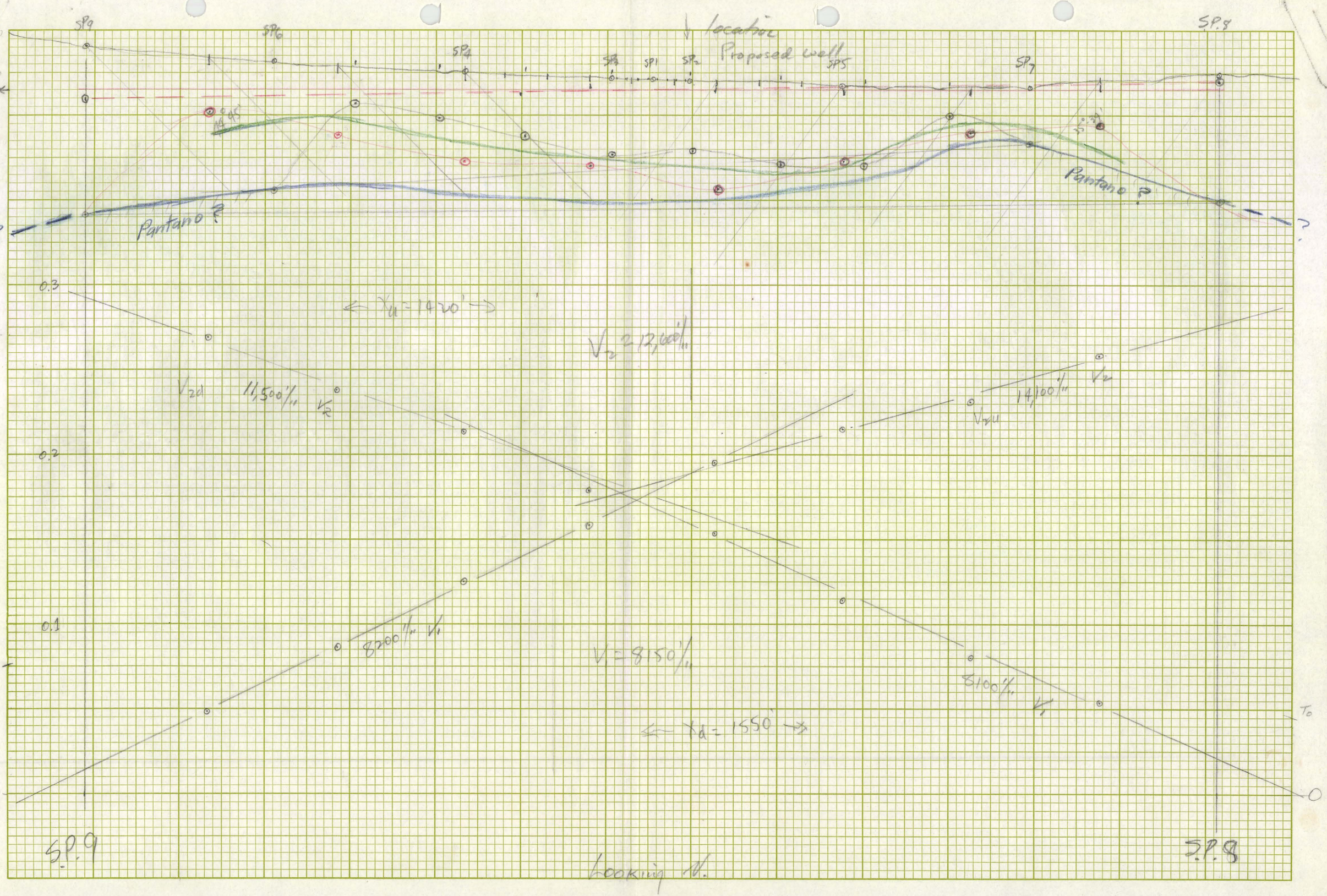

ρ in ohms ft.
3/15/59
0
200
400
600
800
1000
1200
1400
SP #1 (Wes Miller)
Wenner Array
50
100
150
200
250
300
350
400
450
500
Ground
WATER LEVEL ?
Aquifer ?
best aquifer ?



K+E 10 X 10 TO THE INCH 359-5DLG
KEUFFEL & ESSER CO. MADE IN U.S.A.

Water Development Corporation
CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAST 6-1133
CABLE: WADEVCO, TUCSON

RECEIVED JUN 10 1959

WATER LEVELS AND AQUIFER TEST DATA

PROJECT 359
LOCATION
OWNER Wes Miller

WELL NO. (D-13-15)21 acd
MEASURING POINT Entrance pipe
ALTITUDE of measuring point 2661.09

Date	Hour	Depth to water (ft, m)	Discharge Q (gpm, lps)	Meas. by	Altitude of water surface (ft, m)	Time since pumping began t (min, hrs)	Time since pumping stopped t' (min, hrs)	t/t'	Residual drawdown s (ft, m)	Specific capacity Q/s (gpm/ft, lps/m)	Remarks
6-4-59	9:55a	121.68		DKG							
	10:32	121.68		"							
	11:14	121.68		"							
	11:20			LCH							Started surging
	11:33			"	Started pumping steady to clear						11 surges
	11:41			"	Shut down						
	11:44	126.63		"							
	11:45			"	Started surging						15
	12:07p			"	Stopped surging						
	12:10			"	Started steady through 3" orifice						
	12:16	159 +		"							
	12:25		Traj 90.5	"	(82 gpm corrected)						
	12:38	155.86		"							
	12:40	162.4		"							
	1:05P	162.45		"							
	1:10			"							pump 1100 rpm
	1:18	162.85		"							
	1:20										Increased rpm to 1145
	1:25	Traj 125		"	(116 gpm corrected)						
	1:45	148.9		EGH							
	1:55	139.0		"							
	2:05	127.1 ?		"							
	2:15	138.5		"							
	2:17	138.5		LCH							
	2:20	189.3		"	electrode meas.; more accurate than above measurements						
	2:57			"							Increased rpm to 1350
	3:05		Traj 140	"	(125 gpm Cox Flowmeter)						
	3:30			"	mark - 1.5 = 201.7						Mark on electrode = 203.2
	3:45	200 +		"							

Water Development Corporation

CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAST 6-1133
CABLE: WADEVCO, TUCSON

WATER LEVELS AND AQUIFER TEST DATA

PROJECT 359

WELL NO.

LOCATION

MEASURING POINT Entrance pipe

OWNER Wes Miller

ALTITUDE of measuring point 2661.09

Date	Hour	Depth to water (ft, m)	Discharge Q (gpm, lps)	Meas. by	Altitude of water surface (ft, m)	Time since pumping began t (min, hrs)	Time since pumping stopped t' (min, hrs)	t/t'	Residual drawdown s (ft, m)	Specific capacity Q/s (gpm/ft, lps/m)	Remarks
6-5-59	7:30	122.19		EGH							
	8:13			LCH							RPM 1250
	8:22		192 Vol	"							Started pumping Q about 200-225 Traj 214
	8:50	240.7		DG							Meas with sounder
	8:55		148 Vol	"							
	9:07	tape 192		"							
	9:14	tape 176		"							
	9:19		148 Vol	EGH							
	9:30	tape 193		DG							
	9:48		128 Vol	"							125 gpm using head on 3" orifice
	9:55	tape 193		"							
	10:24		137 Vol	"							Temp. 77° F
	10:28	tape 190		"							
	10:54		137 Vol	EGH							
	10:55	tape 193.40		DG							
	11:00			"							shut off pump
	11:05	179.0		"							
?	11:09	176.0 ?		"							
	11:15	156.0		"							
	11:20	150.0		"							
	11:25	145.98		"							
	11:35	139.52		"							
	11:45	135.58		"							
	12:00	131.84		"							

Water Development Corporation
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WATER LEVELS AND AQUIFER TEST DATA

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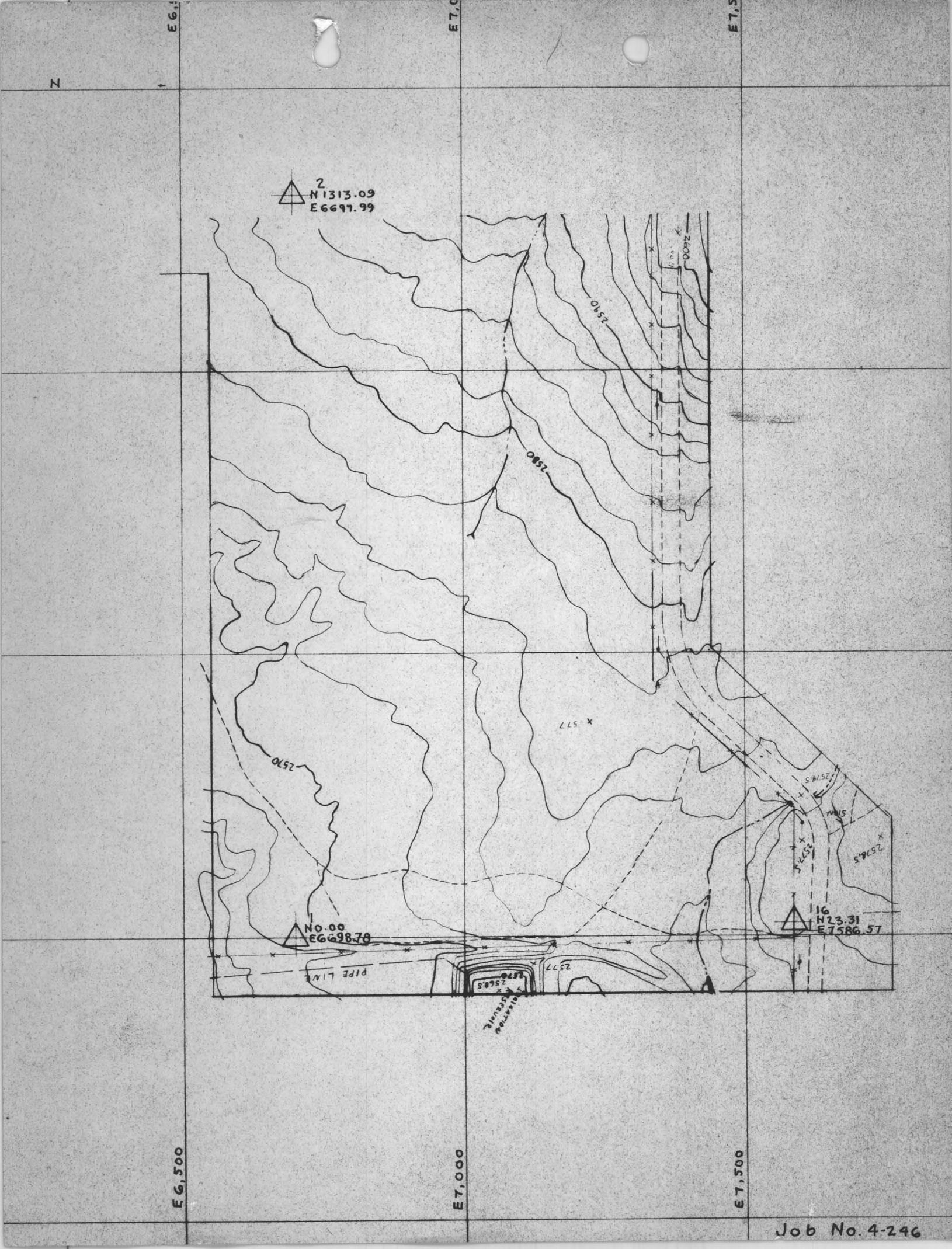
6-4-59	3:45p	200+		LCH							
	4:05		ave 132	"							
	4:06			"							speeded up to 1400 rpm
	4:10			"							sucked air
	4:14			"							shut off
	4:17	182.7		DKG							electrode
	4:22	163.61	tape	DKG							
	4:26	154.48		"							
	4:30	149.74		"							
	4:34	145.08		"							
	4:40	140.31		"							
	4:50	135.90		"							
	4:59	133.12		"							
	5:14	129.87		"							
	5:29	128.0		NED							
	5:45	126.53		"							
	5:59	125.69		"							
	6:15	124.94		"							
	6:30	124.44		"							
	6:45	124.04		"							
	6:59	123.76		"							
	7:15	124.22	?	"							
	7:28	123.35		"							
	7:45	123.19		"							
	7:59	123.08		"							
	8:14	122.98		"							
6-5-59	7:00a	122.20		GH							
	7:15	122.19		"							
	7:30	122.19		"							


N
E6,500
E7,000
E7,500
2
N1313.09
E6697.99
1
N0.00
E6698.78
16
N23.31
E7586.57
2600
2590
2580
2570
577
2577
2578.5
2576.5
2574.5
2573.5
2572.5
2571.5
2570
2568.5
PIPE LINE
DIVERSION
STRUCTURE

Job No. 4-246

$$i = \tfrac{1}{2}\left(\sin^{-1}\frac{V_1}{V_{2u}} + \sin^{-1}\frac{V_1}{V_{2d}}\right) = \tfrac{1}{2}\left(\sin^{-1}\frac{8150}{14,100} + \sin^{-1}\frac{8150}{11,500}\right) = \tfrac{1}{2}\left(\sin^{-1}0.578 + \sin^{-1}0.709\right)$$

$$\tfrac{1}{2}(35.3^\circ + 45.2)$$

$$\tfrac{1}{2}(80.5 = \underline{\underline{40.25}}$$

$$\phi = \tfrac{1}{2}\left(\sin^{-1}\frac{V_1}{V_{2d}} - \frac{V_1}{V_{2u}}\right) = \tfrac{1}{2}\left(\sin^{-1}\frac{8150}{11,500} - \frac{8150}{14,100}\right) = \tfrac{1}{2}\left(\sin 0.709 - \sin^{-1}0.578\right)$$

$$= \tfrac{1}{2}(45.2 - 35.3) = \tfrac{1}{2}(9.9^\circ) = \underline{\underline{4.95^\circ}}$$

$$V_2 = \frac{8150}{0.647} = 12,600'/''$$

$$V_2 = \frac{V_1}{\sin i} = \nearrow$$

SP9 $\nearrow$

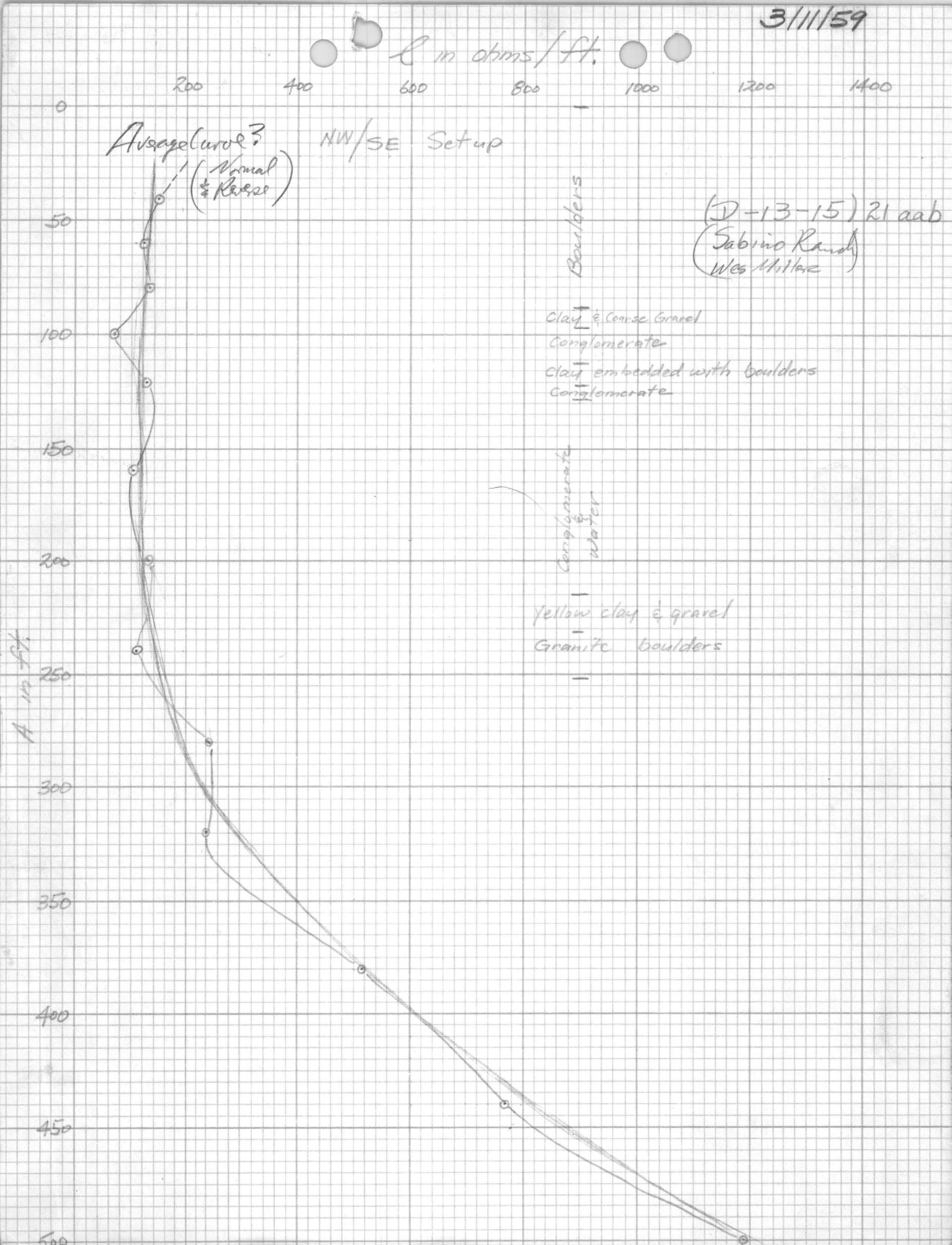
$$H_u = \frac{1420'}{2(0.762 \cdot 0.996)}\left(1 - 0.578\right) = \frac{1420}{1.519}\left(0.422\right)$$

$$= 936 \cdot 0.422 = \underline{\underline{395'}}$$

SP.8 $\nearrow$

$$h_d = \frac{1550'}{1.519}\left(1 - 0.709\right) = 1021 \cdot 0.291 = \underline{\underline{297'}}$$

3/11/59


ρ in ohms/ft.
200
400
600
800
1000
1200
1400
0
50
100
150
200
250
300
350
400
450
500
A in ft.
Average curve?
(Normal & Reverse)
NW/SE Setup
(D-13-15) 21 aab
(Sabino Ranch
Wes Miller)
Boulders
Clay & Coarse Gravel
Conglomerate
Clay embedded with boulders
Conglomerate
Conglomerate & water
Yellow clay & gravel
Granite boulders

Retter Well

191-ft-well.

1 1/2 mi So on Cloud Rd.

correct log

240' deep

cong all the way

Top To bottom

PAMEL for PRINTING MAin 3-6582
1024 18th St. Denver 2, Colorado

Water Development Corporation

CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAST 6-1133
CABLE: WADEVCO, TUCSON

WATER LEVELS AND AQUIFER TEST DATA

PROJECT Miller
LOCATION Sabino Canyon
OWNER

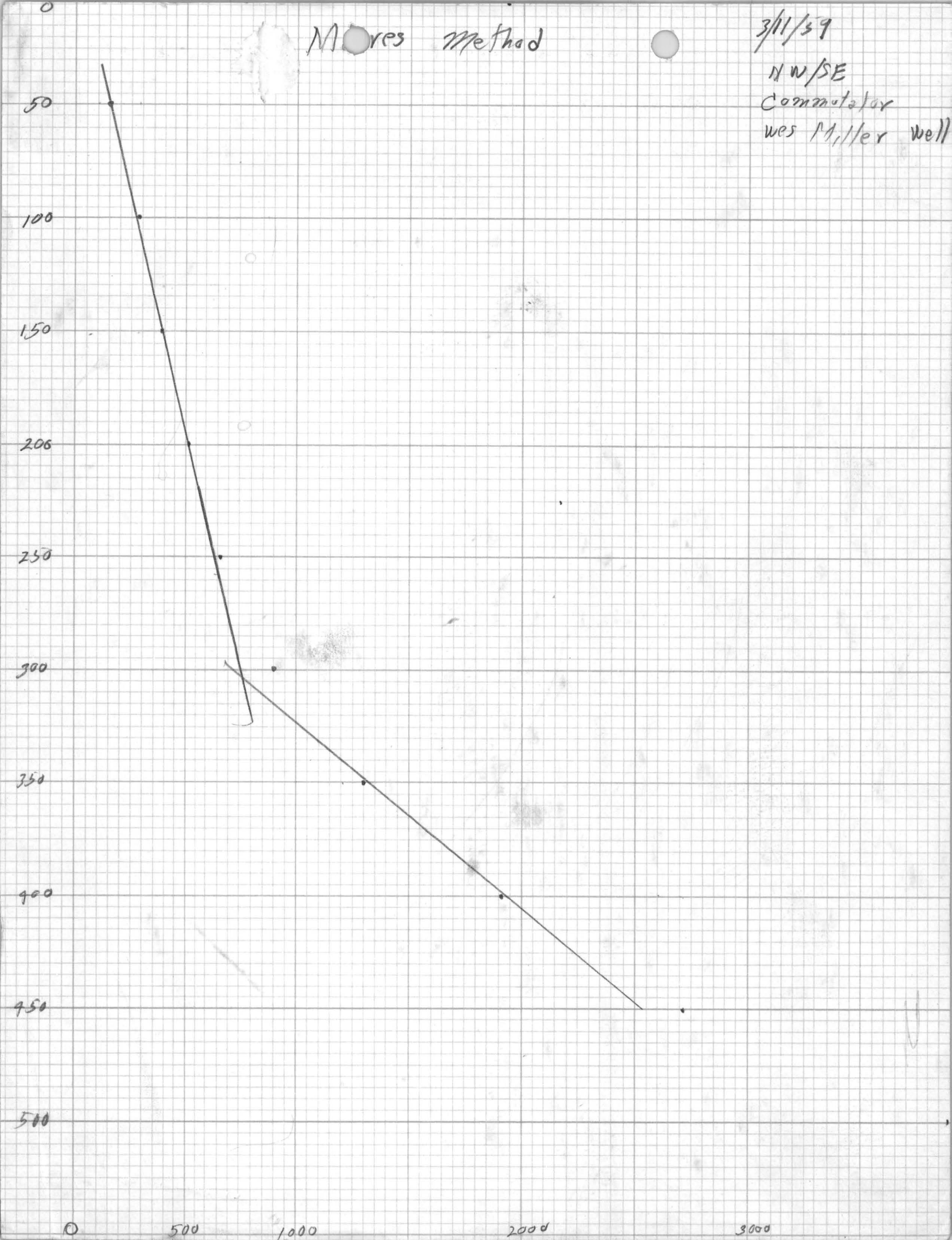
WELL NO.
MEASURING POINT Top of casing, Eq. side
ALTITUDE of measuring point

Date	Hour	Depth to water (ft, m)	Discharge Q (gpm, lps)	Meas. by	Altitude of water surface (ft, m)	Time since pumping began t (min, hrs)	Time since pumping stopped t' (min, hrs)	t/t'	Residual drawdown s (ft, m)	Specific capacity Q/s (gpm/ft, lps/m)	Remarks
4/29/59	0800	121.57		A.O.C. J.W.M.							Static Level
			Commenced bailing @ 0826 with small								
bailer - 8 gals capacity (?) Then at 0850											
used large bailer for all remaining runs. Large bailer											
in poor condition & total capacity maximum average of											
only ten gals. due to leaks (size of bailer 9' x 0.65')											
	0826										
	0830	Small mud bailer									
	0833										
	0835										
	0837				Water recovery level						
	0850				Time		Depth				
	0854										
	0856				0951		129.5 ft.				
	0857										
	0859				1000		125.5 "				
	0901										
	0904				1005		124.48				
	0905										
	0906				1010		124.09				
	0907										
	0908				1015		123.75				
	0911										
	0914				1020		123.48				
	0917										
	0919				1025		123.28				
	0921										
	0924				1030		123.15				
	0925										
	0929	Large bailer			1040		122.92				
	0930										
	0932				1050		122.77				
	0933										
	0934				1100		122.65				
	0935										
	0936				1130		122.55				
	0937										
	0938				1200		122.40				
	0938										
	0939		An estimated 400 gals./hr. withdrawn from								
	0940										
	0941		well however the water level was not								
	0942										
	0943		lowered after the first 15 minutes of bailing.								
	0944										
	0945										
	0946										
	0947										
	0948										
	0949										
	0950										

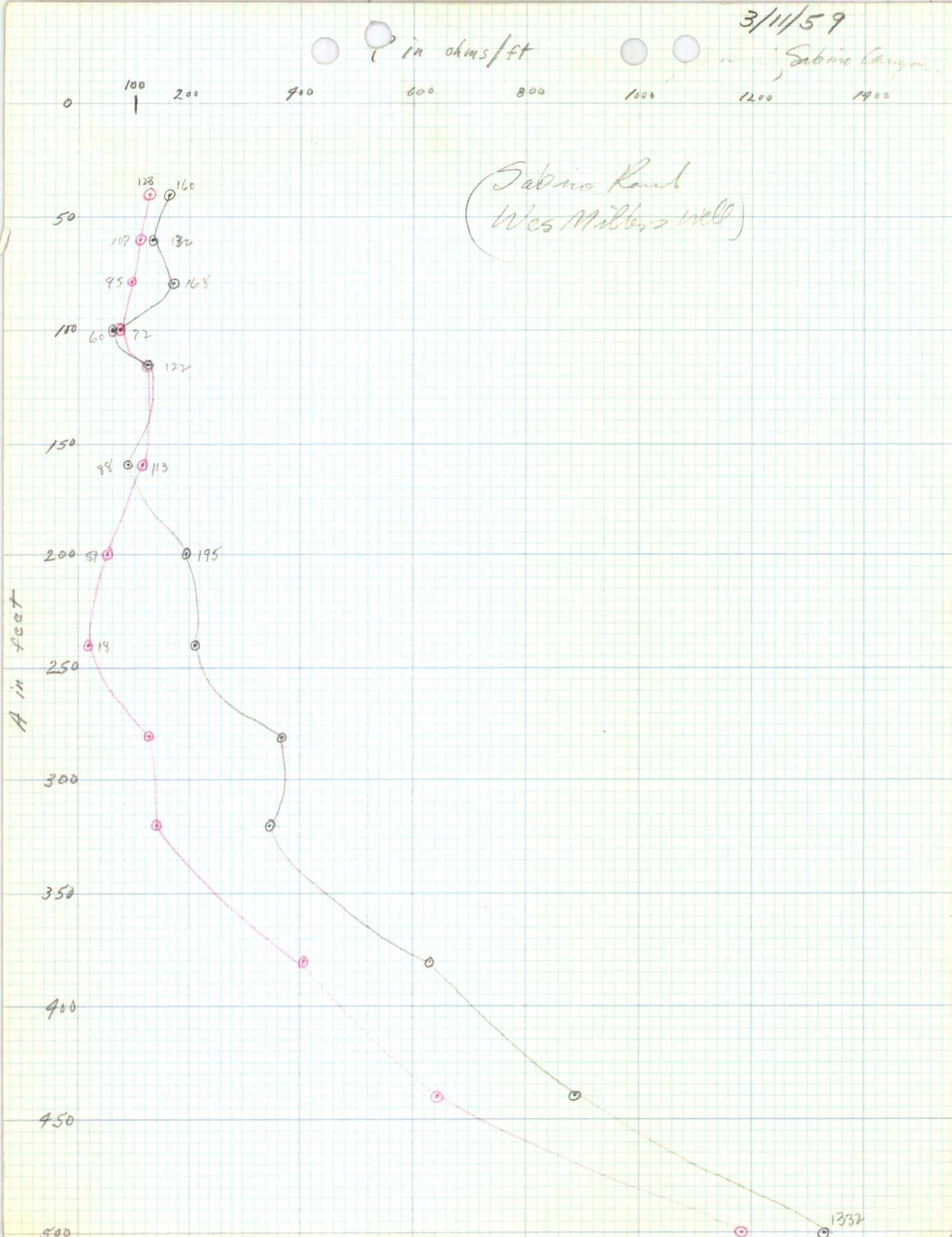
Mores Method

3/11/59

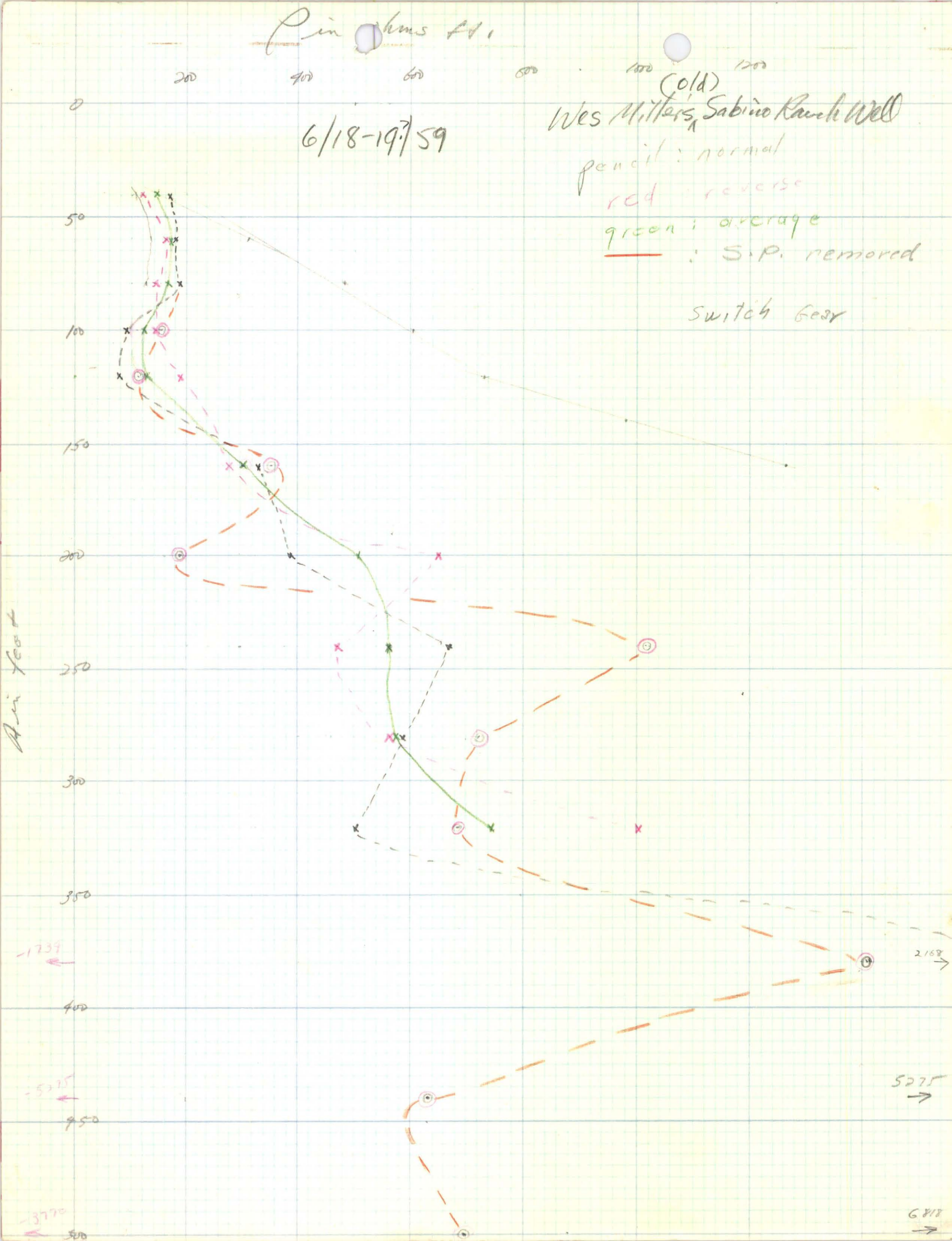
NW/SE
Commutator
wes Miller well

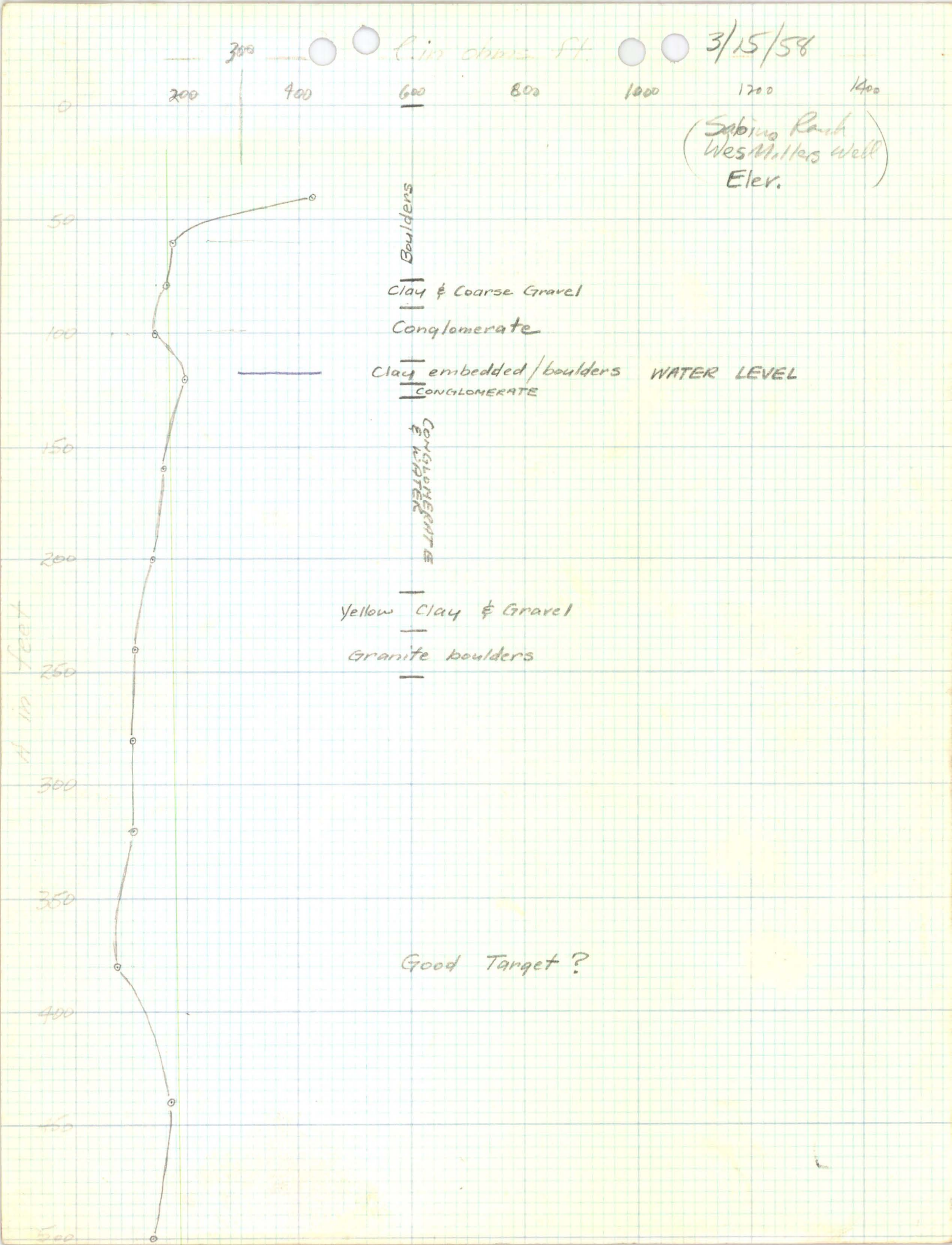


3/11/59


ρ in ohms/ft
Sabino Canyon
0
100
200
400
600
800
1000
1200
1400
Sabino Road
(Wes Miller's Well)
128
160
107
132
95
168
60
72
122
88
113
51
195
18
1332
A in feet
50
100
150
200
250
300
350
400
450
500

Pin ohms ft.


200
400
600
800
1000
1200
0
50
100
150
200
250
300
350
400
450
500
Air feet
-1739
-5275
-3770
2168
5275
6818
6/18-19/59
(old)
Wes Milters Sabino Ranch Well
pencil : normal
red : reverse
green : average
: S.P. removed
Switch Gear


3/15/58
Cin chan ft.
300
200
400
600
800
1000
1200
1400
(Sabino Ranch
Wes Millers well
Elev.)
0
50
100
150
200
250
300
350
400
450
500
Feet
Boulders
Clay & Coarse Gravel
Conglomerate
Clay embedded / boulders
WATER LEVEL
CONGLOMERATE
CONGLOMERATE & GRAVEL
Yellow Clay & Gravel
Granite boulders
Good Target ?

Resistivity Survey
3/13/59
Pittsburgh Const. Co.
Depth Probe
Set up SP #1

(A) Sta	(V) Pot.	(I) Curr	Volts	2πA	V/I	2πA V/I
500	+2	99	135	3142	.0202	63.4
	-2	98			.0204	64.0
					Av.	64
440	6	94	"	2763	.0156	43.1
	-6	93			.0155	42.8
					Av.	43
380	6	116	"	2388	.0517	123.4
	-6	115			.0522	124.6
					Av.	124
320	8	96	"	2011	.0833	167.5
	-6	95			.0631	126.8
					Av	147
280	-3	95	"	1759	.0316	55.5
	3	95			.0316	55.5
					Av.	56
240	7	95	"	1508	.0737	111.1
	-9	94			.0957	144.3
						128
	12	94		1256	.1276	160.2
200	-10	95			.1052	132.1
						146
	14	94		1005	.1489	149.6
160	15	94			.1595	160.2
						155
120	18	103		754	.1747	131.7
	-16	102			.1569	118.3
						125

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TR. MK. REG. U.S. PAT. OFF

100	12	98	135	628	·1224	76·8
	-14	97	"		·1443	90·6
						84
80	15	96	"	503	·1562	78·5
	-16	96	"		·1667	83·8
						81
60	6	95		377	·0631	23·7
	-8	94			·0851	32
						28
40	5	94		251	·0532	13·3
	-13	92			·1413	35·4
						24

SP #1
3/13/59

LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

153
204
181
177

4 | 715
179

60 13
61 9
60.5 4

173
157
208
538
3 | 538
177

0.1
61 | 90
6

60 3

683
464
219

108
123
2 | 231
16

157
52
209
2 | 209
105

683
464
1147
574

165
8.2
8.1
8.2
4 | 41.0
10

60 +3
61 −1

121
145
159
147
9 | 572
143

S.P. # 1 3/15/59

135 Volts

Sta	SD (mV)	I (mA)	V (mV)	2Ta	R. MA. REG. U.S. PAT. OFF. V/I	2TaV/I
500	-10	54.5	3	3142	·0550	173
		60.0	13		·2166	683
		61.0	9		·1475	464
S.P.	Corr.	60	3		·05	157
	"	61	-1		·0164	52
	Av.	60.5	+2		·0331	104
	Diff	60.5	4		·0661	208
					Av.	177
440	C -2	108	8	2763	·0074	204
	CR	107	-7		·0065	181
	D	123	6		·0049	135
	DR	125	-8		·0064	177
	DRept.	120	5		·0042	117
	DRept	108	-6		·0056	153
					Av.	179
380	C 6	29	-1	2388	·0034	825
	CR	29	-2		·0069	165
	D	33.5	-7		·0209	50
	DR	34.0	-11		·0324	77
	C	29.5	-1	2388	·0035	8.1
	CR	29	+1		·0034	8.24
					Av.	10
320	C 7	83	+5	2011	·0602	121
	CR	83	-6		·0723	145
	CA	82	-6.5		·0793	159
	CRA	82	+6		·0732	147
					Av.	143
280	C +13	104	+7	1759	·0673	118
	CR	101	-7		·0692	122

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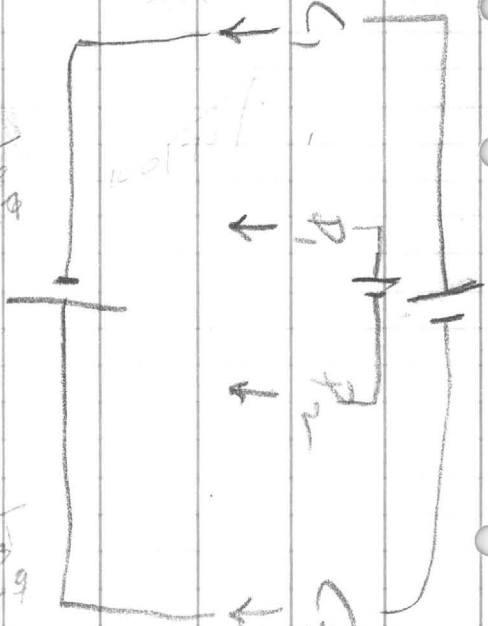
284
299
273
258
4 | 1114
279

277
258
260
3 | 795
265

268
271
249
278
4 | 1066
267

237
280
248
224
4 | 993
249

237
240
221
3 | 698
233



SP #1 3/15/59

Sta	SP	M/A	M/V	2πA	TR. MK. REG. U.S. PAT. OFF. $\frac{\checkmark}{I}$	ℓ
280		100	-7	1759	.07	123
		100	+7		.07	123
					Av.	121
240	Rd +12	106	+20	1508	.189	284
	Dd	106	-21		.198	299
	Rr	105	-19		.181	273
	Dr	105	+18		.171	258
					Av.	279
200	Rd +12	136	+30	1256	.220	277
	Dd	136	-30		.220	277
	Rr	136	-28		.206	258
	Dr	135	+28		.208	260
					Av.	265
160	Rd +3	116	+31	1005	.267	268
	Dd	115	-31		.270	271
	Rr	113	-28		.248	249
	Dr	112	+31		.276	278
					Av.	267
120	Rd +2	70	+22	754	.314	237
	Dd	70	-26		.372	280
	Rr	70	-23		.328	248
	Dr	70	+21		.300	226
					Av.	249
100	Rd +2	91	+22	628	.242	152
	Dd	90	-34		.378	237
	Rr	89	-34		.382	240
	Dr	91	+32		.352	221
					Av.	233

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373
393
365

2)1231
377

708
~~870~~
697
717

3)2121
707

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SP #1 3/15/59

Sta	SP	M/A	M/V	2πA	V/I	ℓ
80	Rd ±0	113	+54	503	·478	240
	Dd	113	-55			
	Rr	113	-53			
	Dr	112	+53			
					Av.	240
60	Rd +23	96	+95	377	·989	373
	Dd	96	-95			373
	Rr	96	-100		1·041	393
	Dr	96	+93		·968	365
					Av.	377
40	Rd +16	146	+412	251	2·82	708
	Dd	145	-480		3·31	~~830~~
	Rr	144	-400		2·78	697
	Dr	140	+400		2·86	717
					Av.	707

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716
118

117
157
274
137

41
66
168
126
401
100

558
544
149
220
28
5506.2
101

Resistivity Survey
West Miller

Saturday
March 21/1959

A'	(MV)	I (MA)	Volts Applied 135	2πA	V/I	ρ
40'	84	132	"			
	44	90				
	64	111	"	251	0.576	145
60	46	115				
	29	90				
	37.5	102.5	"	337	0.366	123
80	48	142				
	30	155				
	39	148.5	"	503	0.263	132
100	17	77				
	7.5	63				
	12.25	70	"	628	0.175	110
120	26	58				
	-3	61				
	11.5	59.5	"	754	0.193	145
160	8.0	91				
	9.0	80				
	8.5	85.5		1005	0.0994	100
200	16	101				
	4.5	101				
	10.25	101		1256	0.1014	127
240	12.5	90				
	-1	83				
	5.75	86.5		1508	0.0665	100
280	12.5	60				
	-3.5	50				
	4.5	55		1759	0.082	144

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3) 416
6.4 832 500
3 4 1.6 0 0 0
500

17.0
6.5
10.5

20.0
11.5
8.5

41.0
32.0
2 73.0

Wes Miller
Sabinal
Ranch

3/11/59

A	V	I	135V	2πA	V/I	R
320	17	100	✓			
	-6.5	96				
	5.25	98		2011	0.0536	108
380	20	76				
	-11.5	68		2388		
	4.25	72		2385	0.059	141
440	24	75				
	-18	77		2765		
	3	76		2763	0.0395	109
500	41.0	97				
	-32.0	96				
	4.5	96.5		3142	0.0466	147

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.022

97 | 200
194
6

.204

98 | 200
196
400

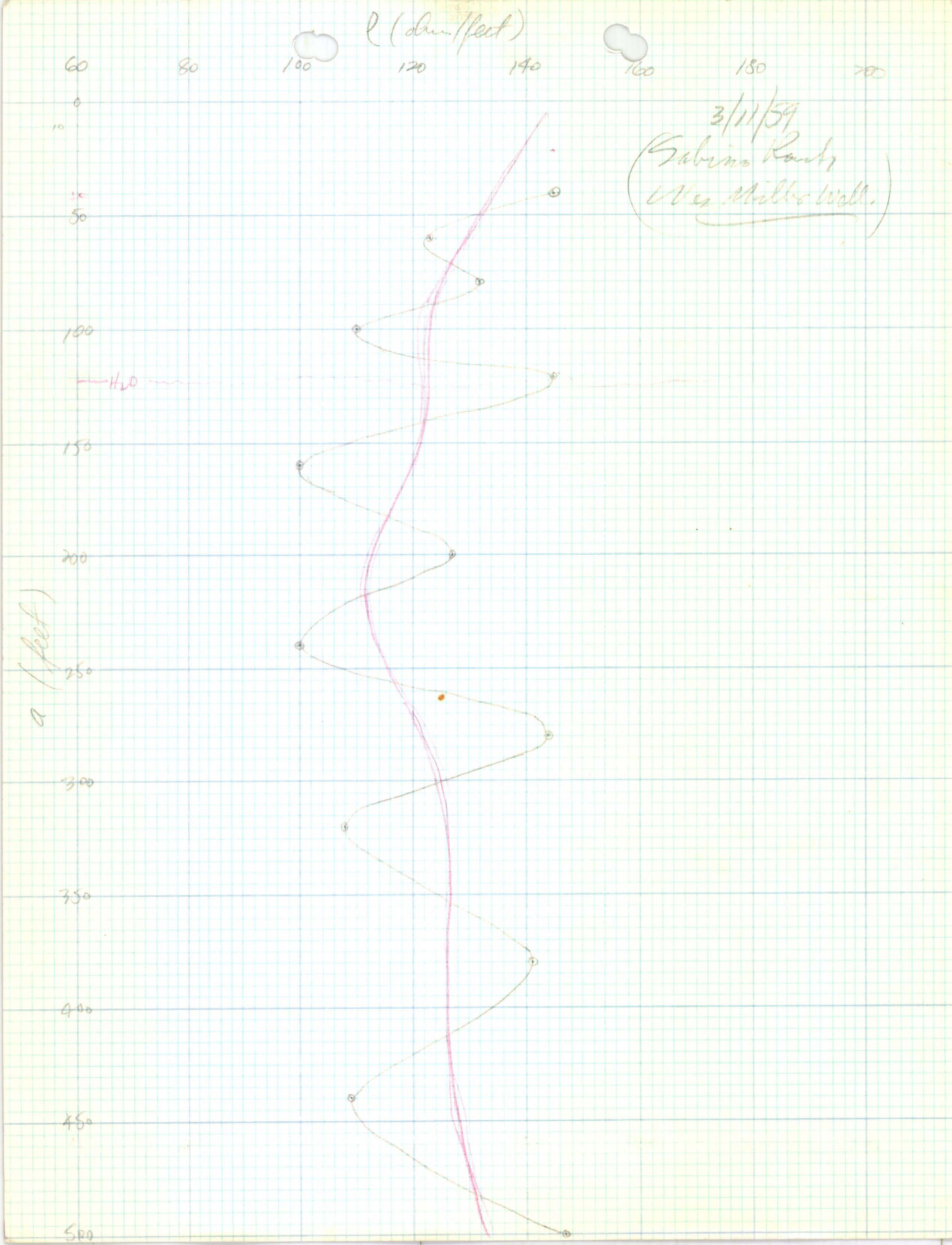
.16

100 | 16.00
100
600

3.42
204
1256
6284
34056

3.42
204
6 84
6 84
6 84
6 84

74.1
6
4524
154
120.64


l (dim./feet)
60
80
100
120
140
160
180
200
0
10
50
100
140
150
200
250
300
350
400
450
500
a (feet)
3/11/59
Sabino Rocky
Wes Miller Well.

MILLER WATER WELL
SABINO CANYON AREA, TUCSON

April 29, 1959
Clark & Marlatt

Static water level at 8:00 a.m.----------121.57 feet

Mud bailer runs to bottom:***----------0826 (time of day

Small mud bailer for these 5 runs

0830
0833
0835
0837

(Large,
Bailer runs (size: 9ft. by 0.65ft)

All runs from 0850 to 0950 made with the bigger bailer.

Big bailer

0850
0854
0856
0857
0859
0901
0904
0905
0906
0907
0908
0911
0914
0917
0919
0921
0924
0925
0929
0930
0932
0933
0934
0935
0936
0937
0938
0938.5
0939.5
0940.5
0941.5
0942.5
0943
0944
0945
0946
0947
0948
0949
0950

Bailer pulling out not over half full due to leaks.
Estimated maximum average= 10gals per bail.
40 bails for 1 hour = 400 gals/hr. But, the water level was not lowered any more after the first 15 minutes, or less

Water Level Recovery —:

Level at 0951	129.5 ft
1000	125.5 "
1005	124.48
1010	124.09
1015	123.75
1020	123.48
1025	123.28
1030	123.15
1040	122.92
1050	~~122.97~~ 122.77
1100	122.65
1130	122.55
1200	122.40

Resistivity Survey
3/11/59
Miller Const. Co.
Armand Retter Well
Depth Probe (last repeat checks in)

3/11/59

TR. MK. REG. U.S. PAT. OFF.

(a) Sta	(V) Pot	(I) Curr	Volts	2πa	V/I	2πa V/I
	46 43	64 63			Av=0.793	
40	45	75	135	251.0	0.6	199
"	63	66	"		0.954	
"	175	50	"		(3.5)	
60	58	90	"	377.0	0.645	
"	38	100	"		0.380	
"				Av=	0.513	194
80	30	83	"	503.0	0.362	
"	31	80	"		0.388	
				Av=	0.375	189
100	25	76		628.0		
✓	23	76				
Av	24	76			0.316	198
120	22	84		754.0		
120	23	80				
Av.	22.5	82			0.274	206
160	24.5	86		1005.0		
"	12	93				
AV	18.25	89.5			0.204	205
200	16.5	58		1256.0		
"	2.0	58				
Av.	9.25	58			0.159	200

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3.456

$$\begin{array}{r} 47 \\ \times\ 6 \\ \hline 103 \\ 515 \end{array}$$

$$\begin{array}{r} .08 \\ \overline{)4.25} \\ 1\,24 \end{array}$$

$$\begin{array}{r} .53 \\ \times\ 8 \\ \hline 4.24 \end{array}$$

6,28 32

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240	4	47		1508.0		
	10	56				
	7	51.5			0.136	205
280	5.0	86		1759.0		
	13.	93				
	9.0	89.5			0.1005	177
320	5.0	55.		2011.0		
	3.5	51				
	4.25	53			0.082	165
380						
440						
500						

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42
.0994
1005
4970

30
48
78

84
44
128

994
998.970

39

142
155
297

222

148.5

46
29
75

205

63
77
140

37

24.5
12.25

21.5
23

11.5

.1
55 55

3 500
0.066
9000
9000
69.000

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(a)	V	I				
40	60	67		251	896	226
60	46	76		337		
80	54	58		503		
100	150	70		628		
120				754		
160				1005		
200				1256		
240						
280						
320						
380						
440						
500						

ORIGINAL COPR. 1910

LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

50 66
46 53

96 119

48 59.5 = 0.807

0.600
0.954
1554

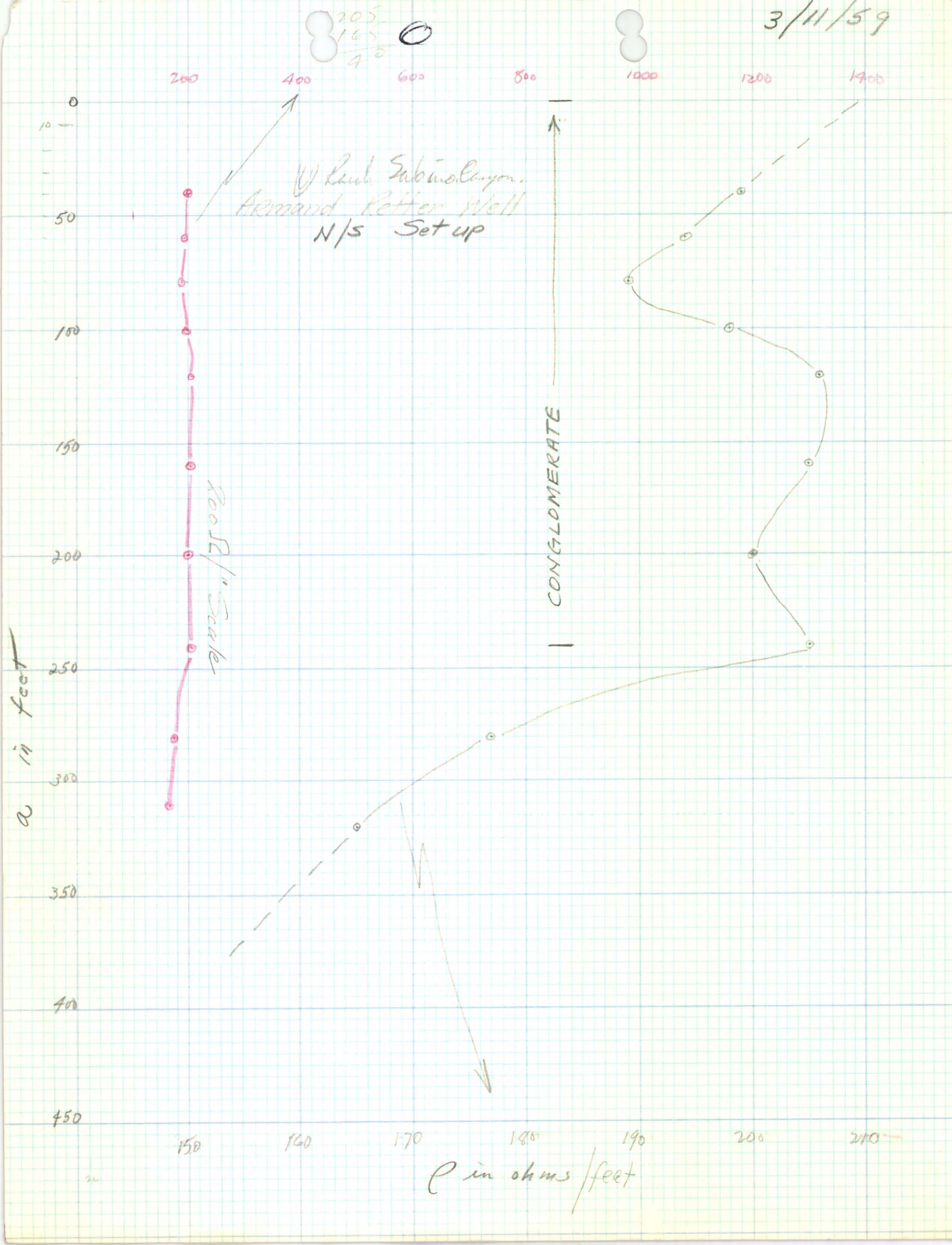
.807

645
380
1025
513
465

.797
.809
1586
575
793

62
88
150
75

3/11/59


(1) Lab. Submolayer.
Armand Retter Well
N/S Set up
100 Ft/in Scale
CONGLOMERATE
a in feet
ρ in ohms/feet
0
10
50
100
150
200
250
300
350
400
450
200
400
600
800
1000
1200
1400
150
160
170
180
190
200
210

Wk. ℄	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D –	5'	5'	10'	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15	15	15
C –	15'	15'	30'	30	30	30	30	30	30	30	45	45	45	45	45	45	45	45	45	45
	15	30	60	90	120	150	180	210	240	270										

4500'

270'
270

3) 540

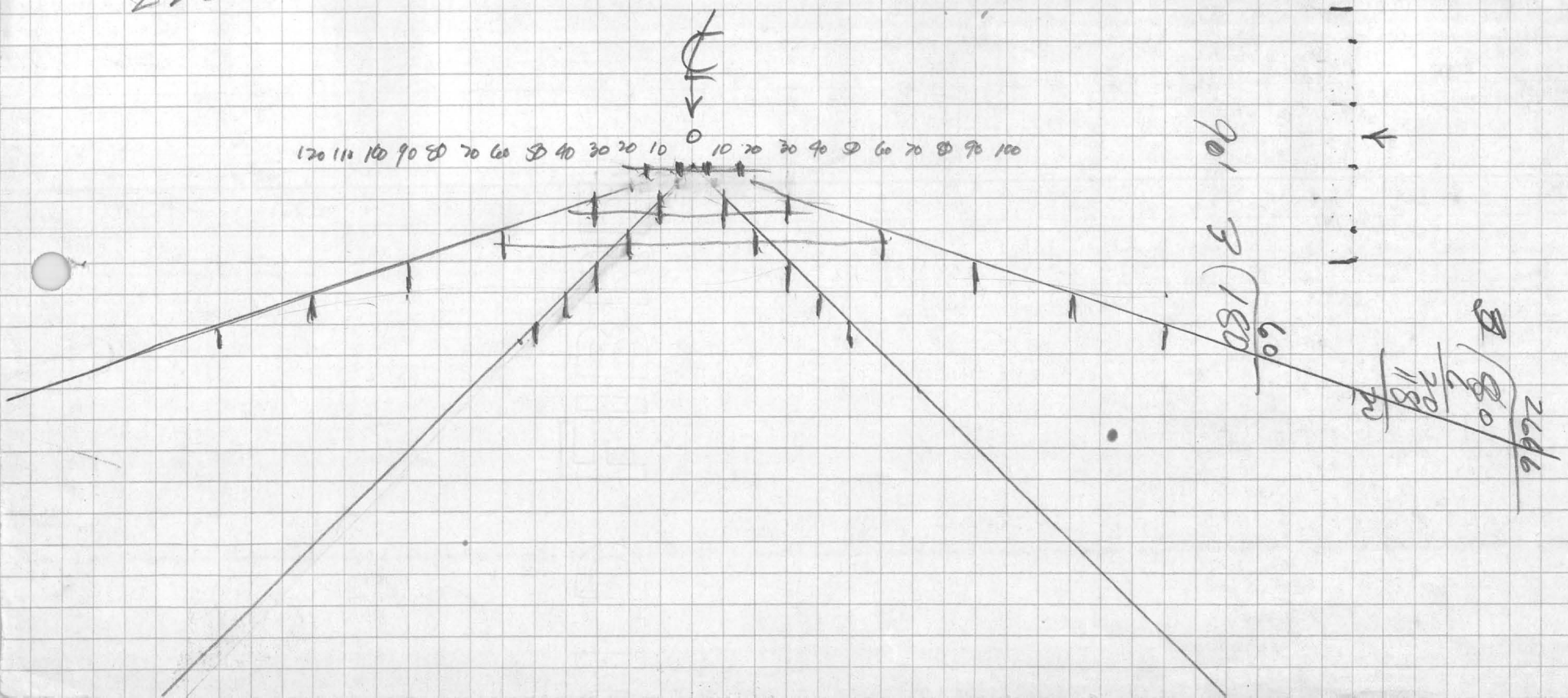
180 = A

40
3) 120

45

20 60

2
45
5
225



Johnson Prospect
5/27/59

Sta. To	Read South
1	±0
2	±0
3	+10
4	+15
5	+12
6	+20
7	+21
8	+32
9	+15
10	

Sta. To	Read West
1	+10
2	+20
3	+35
4	+10
5	+15
6	—

Sta. To	Read North
1	+5
2	+20
3	+25
4	+2
5	+25
6	+35
7	+5
8	+30
9	+30
10	+34

Put on separate sheet. 6/26/59 WBD.

Wes Miller Sabino Ranch
Well Resistivity
Check 6/18-19?/59

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		I	R
[illegible]	.660	59/96	125.00
114.36	.473	35/74	78.72
	.438	60/137	140.96
	.431	62/144	162.49
	.371	26/70	186.61
	.28	21/75	140.84
	.139	19/15	87.3
	.226	28/124	141.93
	.104	5/48	72.41
	.25	12/48	188.50
	.326	28/86	327.63
	.279	24/86	280.39
	.308	4/13	386.85
	.519	7/13.5	651.86
	.447	17/38	674.10
	.316	17/38	476.50

Wes Miller Sabine Road 6/18-19?/59 well

A	I mA	E mV	2πA	E Volt.	
40	N 76	50	251	225	0
	R 74	35			
60	N 132	60	377	225	0
	R 144	62			
80	N 70	26	503	225	0
	R 75	21			
100	N 115	16	628	225	-10
	R 124	28			
120	N 48	5	754	225	-2
	R 48	12			
160	N 86	24	1005	225	-2
	R 86	24			
200	N 13	4	1256	225	+2
	R 13.5	7			
240	N 38	17	1508	225	-11
	R 38	12			

Stevenson Wash.

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.333	35/50	585.75
.323	29/62	568.15

502.77	.250
100.55	.500
14.07	.070
28.15	.140

.909	60/66	2167.96
-.727	-48/66	-1733.89

1.909	42/22	5274.57
-1.909	-42/22	-5274.57

2.17	10/46	6818.14
-1.20	-54/45	-3770.40

Wes Miller Sabino Ranch Well.
6/18-19/59

A	I MA	E MV	2πA		SP
280	66 62	22 20	1759	225	-5
320 160 480	44 43	11 (22) 3 (6)	2811	225	-4
380 570	66 66	60 -48	2385	225	+21
440 220 660	22 22	42 -42	2763	225	+57
500 250	46 45	100 -54	3142	225	+44

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Wes Miller
Cabino Ranch 3/15/59

N/S Sta	set SP	M/A	M/V	2πA	V/1	ℓ
500	+20	81	+3	3142	.037	116
		80	-3		.0375	118
		80	-3		.037	116
		80	+4		.050	157
					Av.	137
				2763		
440	+20	73	+4	2763	.0547	151
		73	-4.5		.0616	170
		73	-4.0		.0547	151
		74	+6.0		.0811	224
					Av.	174
380	+4	74	+1	2388	.0135	32.3
		76	-2		.0263	62.8
		75	-4		.0534	127
		75	+4		.0534	127
					Av.	74
		72	+2			
320	+7	~~72~~	~~+1~~	2011	.0278	55.8
		74	+2		.0271	54.4
		74	-5½		.0744	149
		73	+8		.1096	220
		72	+1		.0139	28
					Av.	101
280	+8	85	+2	1759	.0235	41.4
		80	-3		.0375	66
		84	-8		.0953	168
		84	+6		.0715	126
					Av.	100

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86
17
91
127
149

6 | 620
103

190
165
92
110

4 | 557
139

155
123
137

3 | 415
138

169
136
158
145

4 | 608
152

183
194
177
223

4 | 777
193

ORIGINAL COPR. 1917 BY J. C. PARKER

TR. MK. REG. U.S. PAT. OFF.

Sta	SP	M/A	M/V	2πA	V/I	ℓ
240	+6	90	+3	1508	·0333	50
		88	−5		·0568	86
		88	−1		·0113	17
		71	+9		·1268	191
		71	+6		·0845	127
		71	−7		·0986	149
					Av	103
200	±0	92	+10	1256	·1088	137
		92	−10		"	137
		92	−9		·0978	123
		89	+11		·1236	155
					Av	138
160	+3	89	+15	1005	·1686	169
		89	−12		·1356	136
		89	−14		·1572	158
		90	+13		·1444	145
					Av	152
120	+8	74	+18	754	·243	183
		70	−18		·257	194
		70	−16		·2281	172
		71	+21		·2960	223
					Av.	193
100	+2	76	+23	628	·303	190
		76	−20		·264	165
		88	−13		·148	92
		86	+15		·1743	110
					Av	139

LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

$\begin{array}{r} 3\overline{)145} \\ 137 \\ \hline 15 \\ 12 \\ \hline 3 \end{array}$

$\begin{array}{r} 4\overline{)140} \\ 160 \end{array}$

$\begin{array}{r} 131 \\ 132 \\ 133 \\ 134 \\ \hline 4\overline{)522} \\ 131 \end{array}$

TR. MK. REG. U.S. PAT. OFF.

Sta	SP	M/A	M/V	2πA	V/I	l
80	+3	~~135~~	~~+28~~	503		
		~~135~~	~~-55~~			
		132	+38		·288	145
		132	-49		·371	187
		133	+41		·308	155
		132	-40		·303	153
					Av	160
60	+16	137	+60	377	·449	168
		136	-62			
		136	-61			
		136	+61			
					Av.	168
40	+18	79	+131	251	1·68	422
		78	-132	78	131	
		78	-130			
		77	+129			
					Av.	

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LEFAX, PHILADELPHIA 7, PA., MADE IN U.S.A.

3 Tables sorted

27,500

14,000 Pad 1 Stats

2 Pad 2 Stats

ORIGINAL COPR. 19[illegible] BY J. C. PARKER

TR. MK. RE[illegible] U.S. PAT. OFF

	MV	I	Volts	2πA	V/I	ρ
240						
Sp+2	-10	8				
	+11	8.3				
280						
320						
380						
440						
500						

LEFAX, PHILADELPHIA 7, PA. MADE IN U.S.A.

ORIGINAL COPR. 191[illegible] BY J. C. PARKER

SABUNG RANCH 6[illegible]/59

TR. MK. RE[illegible].S. PAT. OFF.

Equip. Test

	MY	Amps I	Volts	2πA	V/I	C
40	50	90	90	251	5.6	
	50	95			5.3	54
	49	94			5.2	
	48	90			5.4	1355
60	51	90 N	135	337	5.7	1921
	48	95 R			5.1	1719
80	5	48 N	135	503	.104	52.3
	23	36 R			.64	321.8
100	3	21 N	135	628	.14	87.9
	9	21 R			.43	270.0
120	10	12.5		754		
-7.5 SP	2.5	12.5				
	4.5	12.5 N				
	5.5	12.5 R				
	9.5					
160	+2.5	68 N		1005		
	+11	68 R				
200	5	38 N		1256	.13	163
	3	40 R			.08	100.

LEFAX, PHILADELPHIA 7, PA. MADE IN U.S.A.

Water Development Corporation

CONSULTANTS IN GROUND WATER HYDROLOGY

3938 SANTA BARBARA AVE
TUCSON, ARIZONA

PHONE: EAst 6-1133
CABLE: WADEVCO Tucson

Summary of work done on Project 359, Wes Miller

Date	Hrs worked	Hrs charged	Work by	Work done
3-6	2	2	LCH	Copying well records USGS
3-7	2	2	DG	Copying well records U of A
3-9	9	8	LH	Studying theses; field coll. of data
3-10	6	1	LH	Conf. w/Heinrich; review of Koeiger thesis, plotting well data
3-11	8	8	LH	Conf. w/Heinrich; field trip, review of Blissenbach thesis
3-12	4	3	LH	Studying geology, plotting well logs
3-15	2	2	LH	Plotting GW contours & Pantano contours
3-16	4	5	LH	Conf. w/Heinrichs, meas. well
3-17	3	2	LH	Spotting well, conf. w/Miller
	40	32		

Other Expenses

3-9	61 miles @ 12¢	7.32
3-11	24 do.	2.88
3-16	25 do.	3.00
3-17	25 do.	3.00

Time charged

Halpenny	3 3/4 days @ $100	$375.00
Greene	1/4 day @ $75	18.75
Expenses		16.20
		$409.95

Wes Miller Well

4/23/59

Unwashed cuttings

290 - 300	Clay & granitic pebbles (Conglomerate ?) Buff colored	
280 - 290	Same	slighty darker color than above
270 - 280	"	
260 - 270	"	coarser material
250 - 260	"	finer material than above
240 - 250	—	
230 - 240	"	
220 - 230	"	
210 - 220	"	
200 - 210	"	Slightly Less clay material
190 - 200	"	" " "
180 - 190	"	
170 - 180	"	Less clay material
160 - 170	"	Same
150 - 160		
140 - 150	—	Darker less clay yet
130 - 140		
120 - 130	—	" " " "
110 - 120		
100 - 110		
90 - 100	—	" " " "
80 - 90		
50 - 60	—	

Water Development Corporation

CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAST 6-1133
CABLE: WADEVCO, TUCSON

WATER LEVELS AND AQUIFER TEST DATA

PROJECT Miller
LOCATION Sabino Canyon
OWNER

WELL NO.
MEASURING POINT Top of casing, Eu. side
ALTITUDE of measuring point

Date	Hour	Depth to water (ft, m)	Discharge Q (gpm, lps)	Meas. by	Altitude of water surface (ft, m)	Time since pumping began t (min, hrs)	Time since pumping stopped t' (min, hrs)	t/t'	Residual drawdown s (ft, m)	Specific capacity Q/s (gpm/ft, lps/m)	Remarks
4/29/59	0800	121.57		A.O.C. J.W.M.							Static Level
			Commenced bailing @ 0826 with small bailer - 8 gals capacity (?) Then at 0850 used large bailer for all remaining runs. Large bailer in poor condition & total capacity maximum average of only ten gals. due to leaks (size of bailer 9' x @.65')								
	0826										
	0830		Small mud bailer								
	0833										
	0835										
	0837										
					Water recovery level						
					Time		Depth				
	0850										
	0854										
	0856				0951		129.5 ft.				
	0857										
	0859				1000		125.5 "				
	0901										
	0904				1005		124.48				
	0905										
	0906				1010		124.09				
	0907										
	0908				1015		123.75				
	0911										
	0914				1020		123.48				
	0917										
	0919				1025		123.28				
	0921										
	0924				1030		123.15				
	0925										
	0929				1040		122.92				
	0930										
	0932				1050		122.77				
	0933										
	0934				1100		122.65				
	0935										
	0936				1130		122.55				
	0937										
	0938				1200		122.40				
	0938										
	0939										
	0940										
	0941										
	0942										
	0943										
	0944										
	0945										
	0946										
	0947										
	0948										
	0949										
	0950										

Large bailer

An estimated 400 gals./hr. withdrawn from well however the water level was not lowered after the first 15 minutes of bailing.

Water Development Corporation
CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAst 6-1133
CABLE: WADEVCO, TUCSON

WATER LEVELS AND AQUIFER TEST DATA

PROJECT Miller
LOCATION Sabino Canyon
OWNER
WELL NO.
MEASURING POINT Top of casing, E4 side
ALTITUDE of measuring point

Date	Hour	Depth to water (ft, m)	Discharge Q (gpm, lps)	Meas. by	Altitude of water surface (ft, m)	Time since pumping began t (min, hrs)	Time since pumping stopped t' (min, hrs)	t/t'	Residual drawdown s (ft, m)	Specific capacity Q/s (gpm/ft, lps/m)	Remarks
4/29/59	0800	121.57		A.O.C. J.W.M.							Static level

Commenced bailing @ 0826 with small bailer - 8 gals capacity (?) Then at 0850 used large bailer for all remaining runs. Large bailer in poor condition & total capacity maximum average of only ten gals. due to leaks (size of bailer 9' x Ø.65')

0826, 0830, 0833, 0835, 0837 } Small mud bailer

0850
0854
0856
0857
0859
0901
0904
0905
0906
0907
0908
0911
0914
0917
0919
0921
0924
0925
0929
0930
0932
0933
0934
0935
0936
0937
0938
0938
0939
0940
0941
0942
0943
0944
0945
0946
0947
0948
0949
0950

Large bailer

Water recovery level

Time	Depth
0951	129.5 ft.
1000	125.5 "
1005	124.48
1010	124.09
1015	123.75
1020	123.48
1025	123.28
1030	123.15
1040	122.92
1050	122.77
1100	122.65
1130	122.55
1200	122.40

An estimated 400 gals./hr. withdrawn from well however the water level was not lowered after the first 15 minutes of bailing.

CRANE MACHINE, ELECTRIC, DIESEL
AND PUMP REPAIR
1786 ADELAIDE DRIVE
TUCSON, ARIZONA
EA 6-1693

SPRING VALLEY WATER CO. Nov-4th-1964

Calle Aurora Well 22nd Street & Spanish Trail
800' X 12" 10" Well. water level 262'

TEST REPORT

TIME	CONDITION	G.P.M.
11;00-11;30 A.M.	cloudy	150-175
11;30-------	pumped-out	
11;45-12;00	cloudy	20
12:00-12:30	cloudy	20
12:30- 1;00 P.M.	rested returned slowly .due to ~~xxx~~ (large cavity.)	
1;00- 2;00 P.M.	back flush.	
2;00- 4;30 P.M.	varied R.P.M. ~~xx~~	20-60.
4;30- 6;00 P.M.	clear	20.

I think this well has a good chance of improving due to large cavity which are very hard to back-flush.

G.F. Crane

GFC/tc G.F.CRANE

Well at OLD SPANISH TRAIL #29 — A. L. "Cotton" Boring

SPRING VALLEY W[illegible]ER C[illegible]MPANY I.O. #57 — [illegible]ll Drilling Contractor

1915 S. Wilson

November 11, 1964

Drill and case 12" hole to 790'

LOG:

0 - 275	Clay and sand
275 - 305	Broken granite - Water
305 - 340	Clay and sand
340 - 405	Broken granite - Water
406 - 420	Clay and sand
420 - 450	Broken granite
450 - 490	Clay and rock
490 - 520	Broken granite
520 - 645	Clay and rock
645 - 680	Broken granite
680 - 695	Red clay and rock
695 - 720	Broken granite
720 - 725	Clay and granite
725 - 790	Hard granite

Water level - 266'

507 ft. 12" casing
289 ft. 10" casing
589 ft. of casing perforated

WILSON JONES COMPANY G7206 GREEN 7206 BUFF MADE IN U.S.A.

$$i = \tfrac{1}{2}\left(\sin^{-1}\frac{V_1}{V_{2u}} + \sin^{-1}\frac{V_1}{V_{2d}}\right) = \tfrac{1}{2}\left(\sin^{-1}\frac{7950}{19{,}500} + \sin^{-1}\frac{7950}{10{,}700}\right) = \tfrac{1}{2}\left(\sin^{-1}0.4075 + \sin^{-1}0.7425\right) = \tfrac{1}{2}\left(24^\circ + 48^\circ\right) = \tfrac{1}{2}\,72 = \underline{\underline{36^\circ = i}}$$

$$\phi = \tfrac{1}{2}\left(\sin^{-1}\frac{V_1}{V_{2d}} - \sin^{-1}\frac{V_1}{V_{2u}}\right) = \tfrac{1}{2}\left(\sin^{-1}\frac{7950}{10{,}700} - \sin^{-1}\frac{7950}{19{,}500}\right) = \tfrac{1}{2}\left(\sin 0.7425 - \sin^{-1}0.4075\right) = \tfrac{1}{2}\left(48^\circ - 24^\circ\right) = \tfrac{1}{2}\,24 = \underline{\underline{12^\circ = \phi}}$$

$$\sin(i-\phi) = \frac{7950}{19500} = 0.4075 = 24^\circ \qquad V_2 = \frac{7950}{0.588} = 13{,}500'/''$$

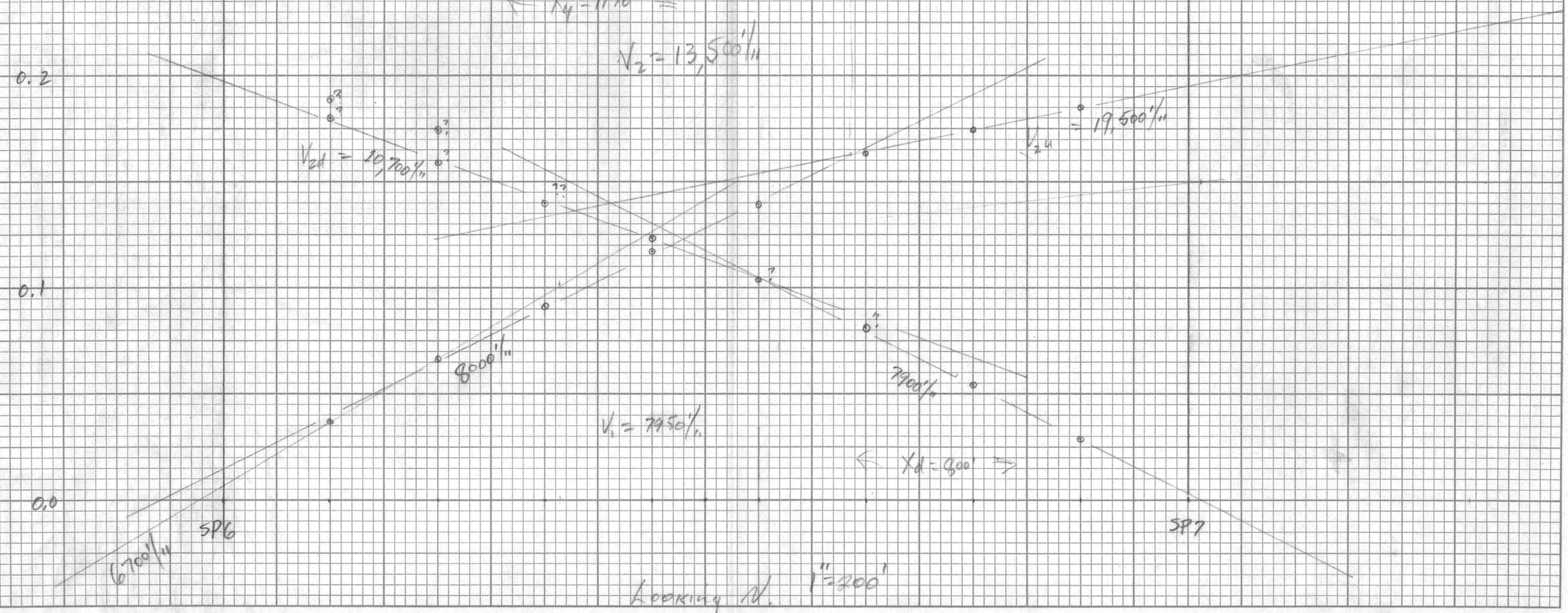
$$\sin(i+\phi) = \frac{7950}{10{,}700} = 0.7425 = 48^\circ \qquad = \frac{V_1}{\sin i} =$$

$$L_u = \frac{1170'}{2(0.978)(0.809)}\left(1 - \frac{7950}{19{,}500}\right) = \frac{1170'}{1.584}\left(1 - 0.4075\right) = \underline{301'}\ (\text{S.P. 6})$$

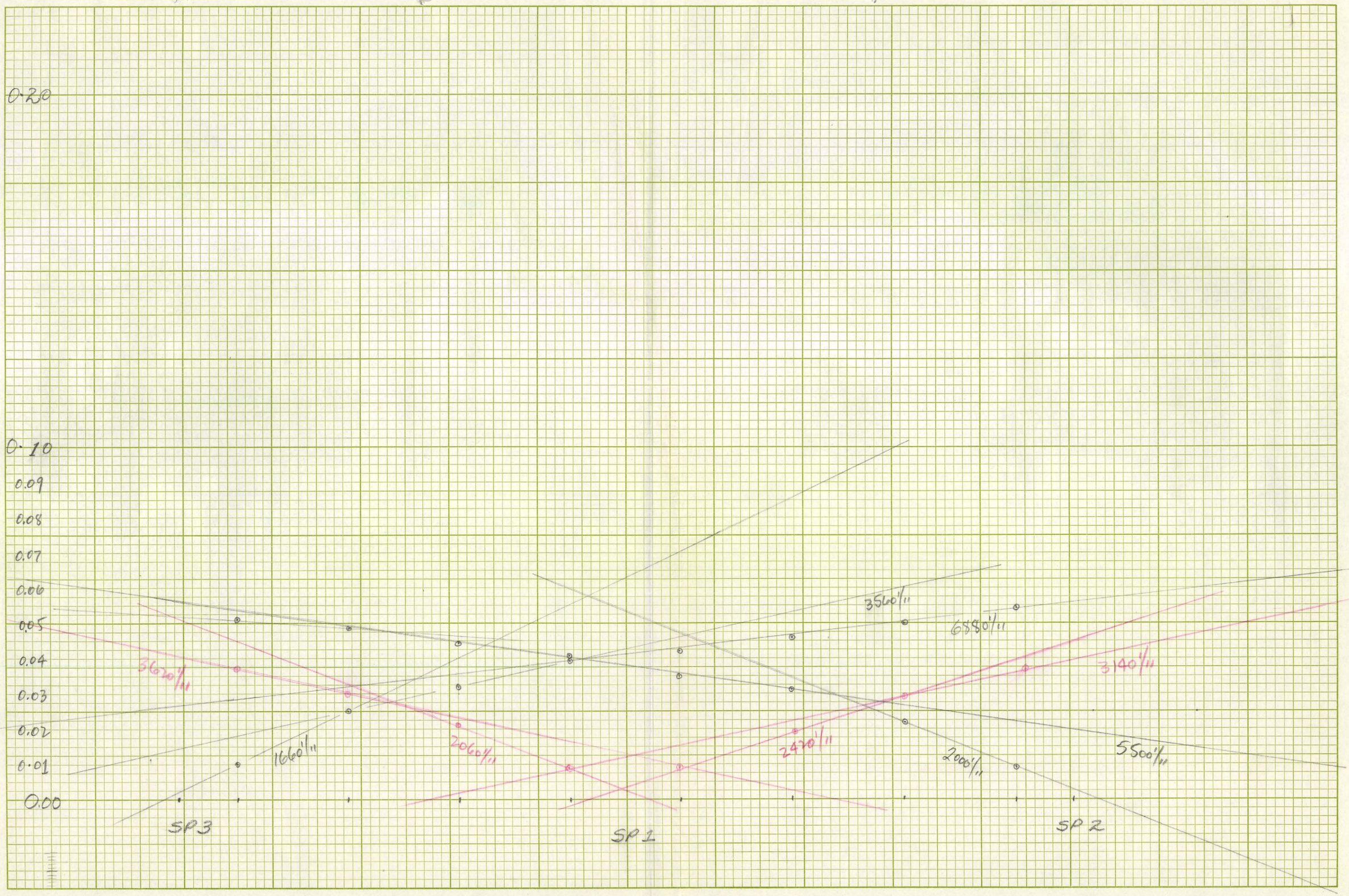
$$L_d = \frac{800'}{1.584}\left(1 - 0.7425\right) = 505 \cdot 0.2575 = \underline{130'}\ (\text{S.P. 7})$$

W

E



Looking N. 1" = 800'



10 X 10 TO THE INCH 359-5DLG
KEUFFEL & ESSER CO. MADE IN U.S.A.

Resistivity Survey 3/9/59 Miller Const. Co

3/9/59

TR. MK. REG. U.S. PAT. OFF

(Plotted black)

Set up Akmand Retter Well N/S depth probe

SP MV	(a) Sta.	(V) Pot. mV	(I) Curr mA	Applied Volts	2πa	V/I	2πa V/I ρ ohm ft
	10'	+54	9	22.5	62.8	6	(377)
	✓	+120	18.5	45	62.8	6.67	(419)
25	20'	+40	27.5	✓	125.5	1.455	(183)
	✓	+80	57	90	125.5	1.402	(176)
20	40'	+20	27.5	✓	251.0	0.727	(182)
		+25	43.5	135	251.0	0.575	(144)
		+72 P Pot	42	✓	377	1.714	(647)
7	60'	+23	73	✓	377	0.315	188
-47	"	+75 actual	40	✓	377	1.875	707
7	80'	30	58	✓	503	0.517	255
	100'	-45	79	✓	628	0.55	345
	120'	-55	92	✓	754	0.598	451
27	160'	-30	68	✓	1005	0.441	444
20	200'	-12	61	✓	1256	0.197	247
	✓	-12	62	✓	1256	0.194	244

-195 mv/o P Pots (Metal P1 & P2)

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LEBAN, PHILADELPHIA 7, PA., MADE IN U.S.A.

3/10/59

TR. MK. REG. U.S. PAT. OFF

Resistivity Survey 3/10/59 (Plotted green)

Miller Const. Co.

Set up Armand Potter Well N/S depth probe

	(a) Sta	(v) Pot mv	(i) Curr ma	Volts	2πa	V/I	2πa V/I
N/Pot.							Ohm/ft.
	40	+100	35	135	251.0	2.8	705
	"	+90	32	"		2.8	
.195	60	-19	34	"	377.0	.53	199.8
	"	-40	31	"		1.3	49.0
-.235	80	-15	20	"	503.0	5.7	2867.1
-.38	100	-40	41	"	628.0	.98	615.4
-.40	120	-32	62	"	754	.51	384.54
.150	160	+60	42	"	1005	1.46	1467.3
.40	"	+30	42	Porous Pots		.72	
.86	200	+12	18		1256	.67	841.5
	"	±0	18	Rev. Switch			
.99	"	-10	16			.63	791.3
		"	"	Rev. Switch			

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LEPAK, PHILADELPHIA, PA., MADE IN U.S.A.

ORIGINAL COPR. 1910 BY J. C. PARKER

3/4/59
TR. MK. REG. U.S. PAT. OFF

Reference Well
West down all ½ P. pots.

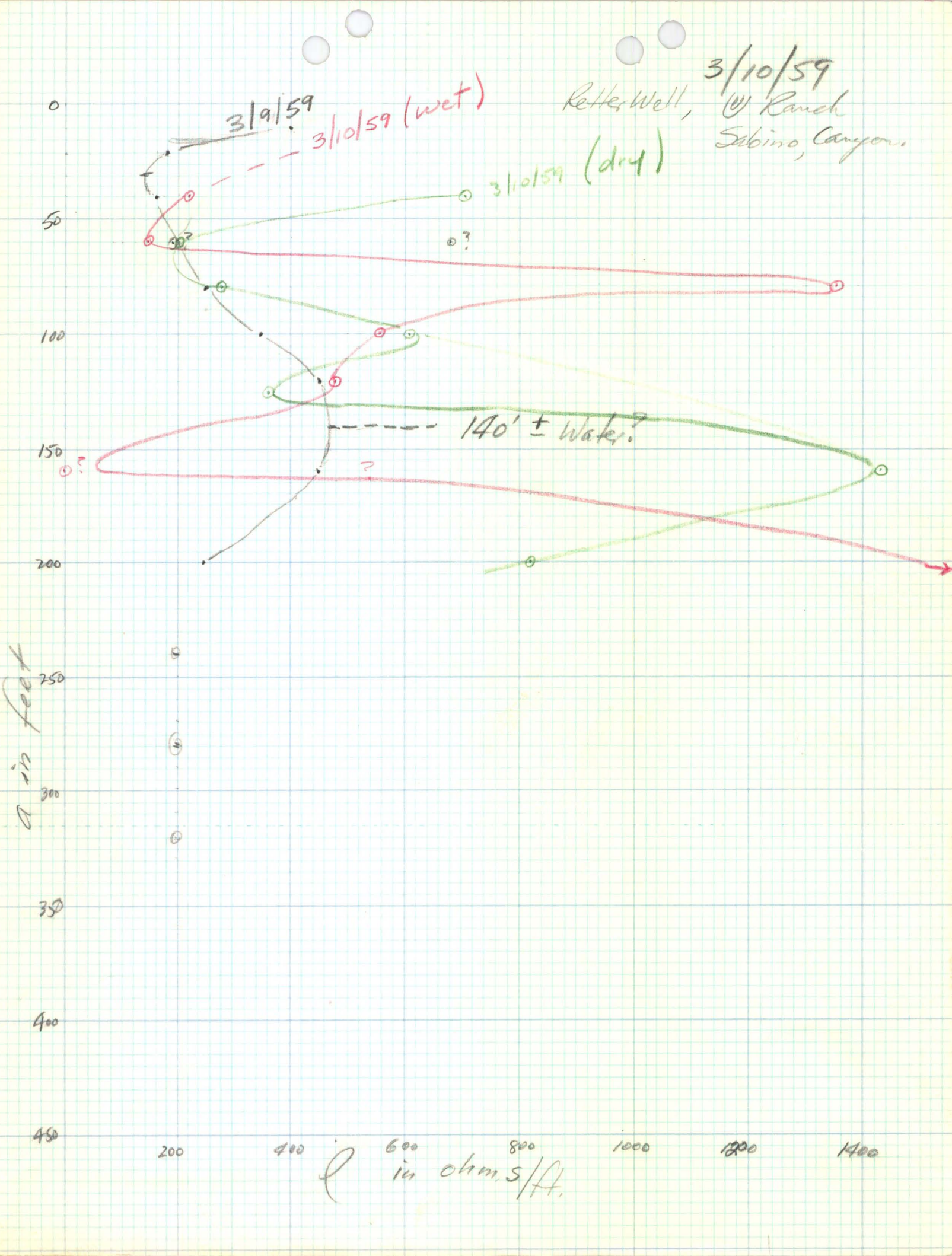
Sta	Pot V	Curr I	Volts	2πa	V/I	2πa V/I / ρ
200	+50	38	135	1256	1.31	1650
160	0	100	135	1005	0 ?	0
120	32	50	135	754	.64	483
100	45	51	135	628	.89	558
80	83	31	135	503	2.69	1353
60	18	48		377	.376	143
40	65	74		251	.88	222

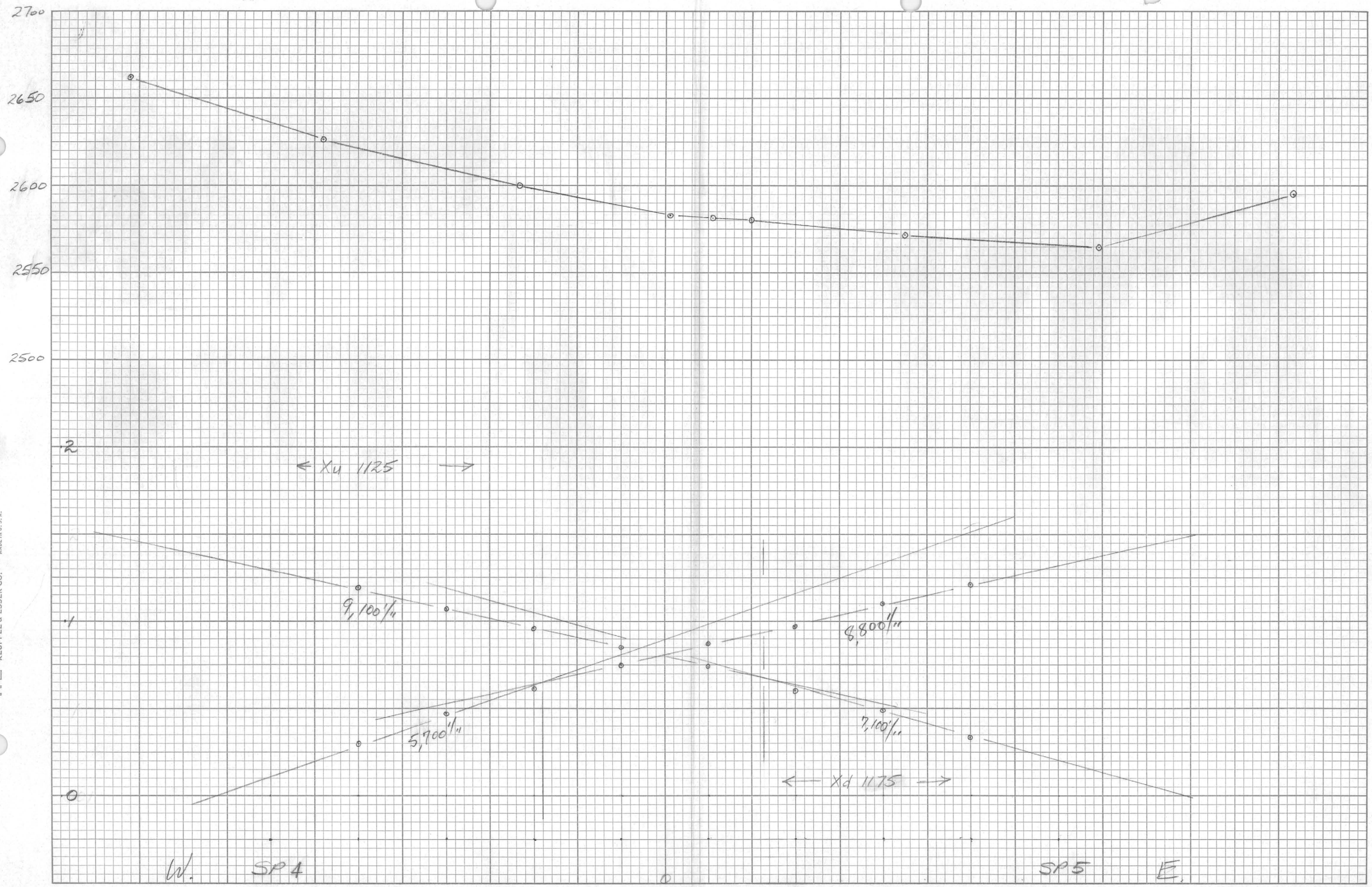
(Plotted)

Reference Well (W) Rank.

3/10/59.

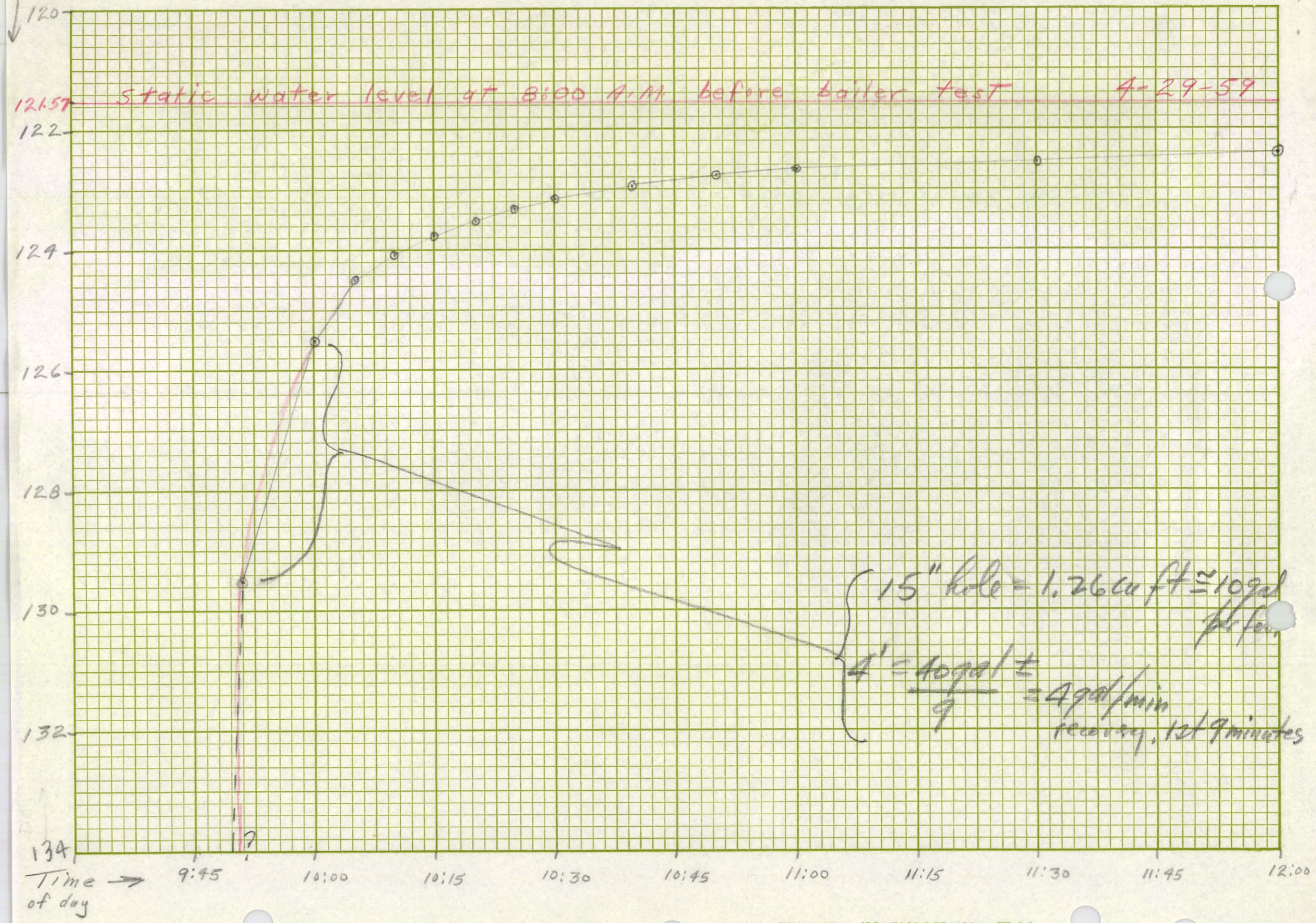
LEPAK, PHILADELPHIA 7, PA., MADE IN U.S.A.


3/10/59
Retter Well, @ Ranch
Sabino Canyon.
3/9/59
3/10/59 (wet)
3/10/59 (dry)
140' ± Water?
0
50
100
150
200
250
300
350
400
450
a in feet
200
400
600
800
1000
1200
1400
ρ in ohms/ft.



K+E 10 X 10 TO THE INCH 359-5DLG
KEUFFEL & ESSER CO. MADE IN U.S.A.

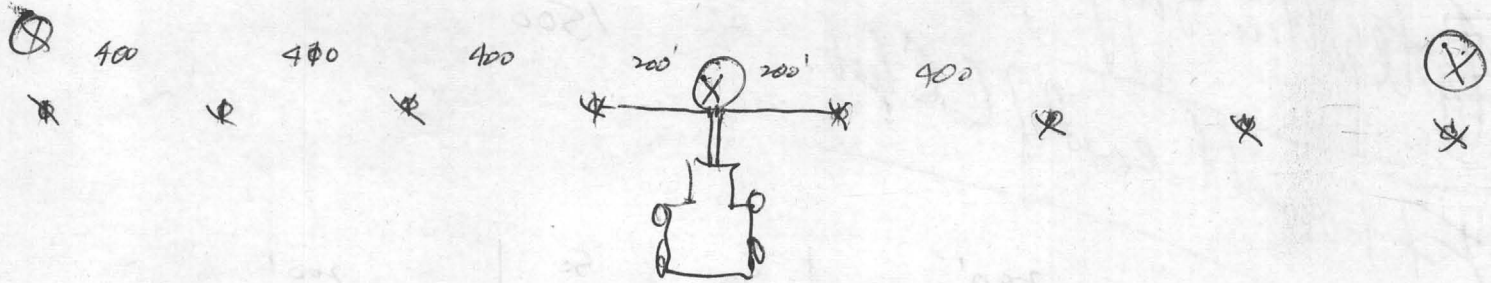
Miller Water Well — Recovery from bailer draw-down test

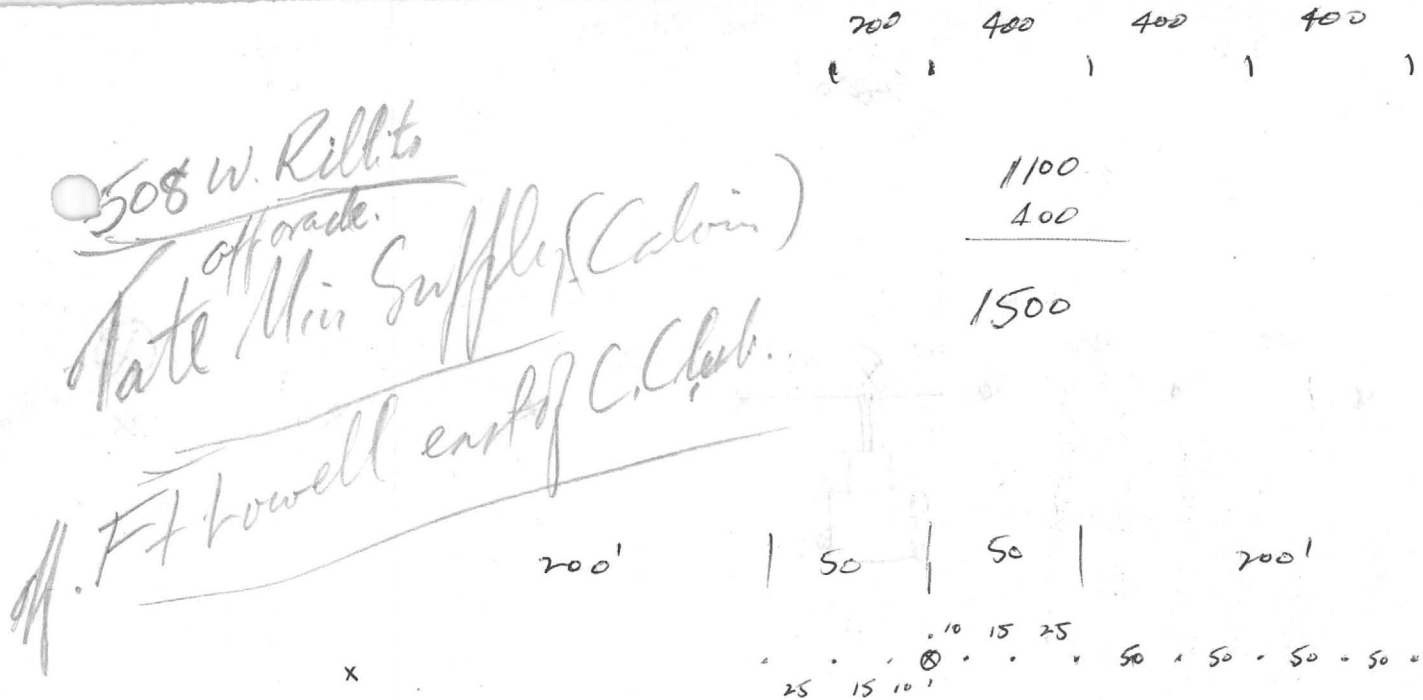


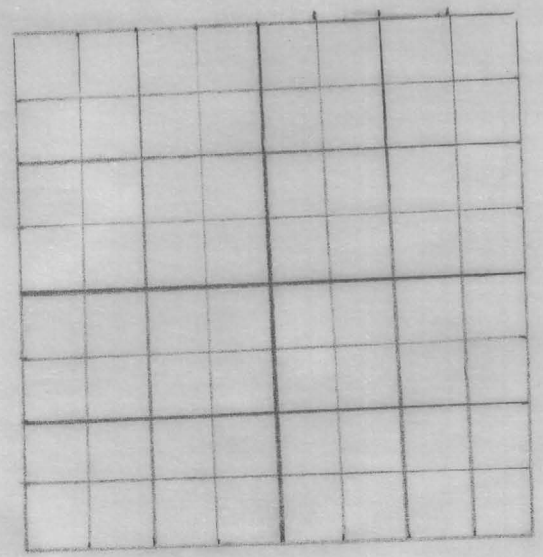
K+E 10 X 10 TO THE INCH 359-5DG KEUFFEL & ESSER CO. MADE IN U.S.A.

2500'

4




200
400
400
400
508 W. Rillito
off grade.
Tate Min Supply (Calvin)
1100
400
1500
N. Ft Lowell east of C. Club.
200'
50
50
200'
10 15 25
25 15 10
50 50 50 50
x



2700
30
240

SP 9

$\cancel{Z = (T_0 V_1/2) / (1 - V_1^2/V_2^2)^{1/2}}$

19881

Bangbardt

$V_1 = 8200$

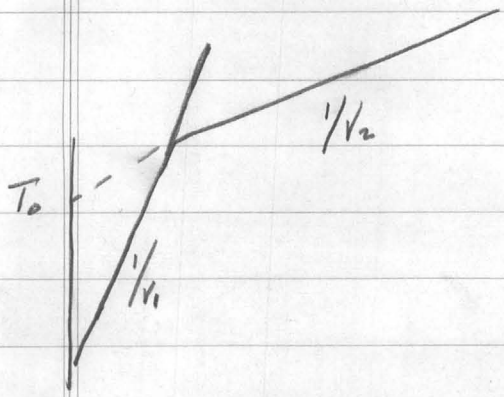
$V_2 = 14{,}100$

$\cancel{(.258 \times 8200/2)}$

$\cancel{258 \times 4100}$

$\cancel{1057800}$

$Z = (.075 \times 4100) / (1 - \frac{6724}{19881})^{1/2}$



$Z = (307.5) / (1 - \frac{.1691}{2})$

$Z = (\frac{307.5}{(1 - .1691} = \frac{307.5}{.8309}$ 370

.4154.5

.258

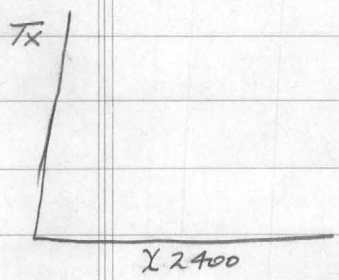
$Z = 370'$

$T_x = .258$

$X = 2400$

$\frac{1.0000}{.1691}$ $\frac{8309}{2} = .4154.5$

.8309



.42 | 307.0 . 70
294
30

307.5
.41545

1.00000
.01685
2 | 9.832
.4916

.015
4000
060.000

4000
.015
20000
4000
60.000

.8 | 3000 3
240

.25 | 18200 72
175
70
50
200

1.000
4961
2 | .5039
.2520

$\frac{\sin 1}{1} = \frac{\sin 90^\circ}{\sqrt{2}} = \frac{1}{\sqrt{2}}$

130

260

275 10

2 2060

$\frac{1500}{3500}$ 181

2

362

83

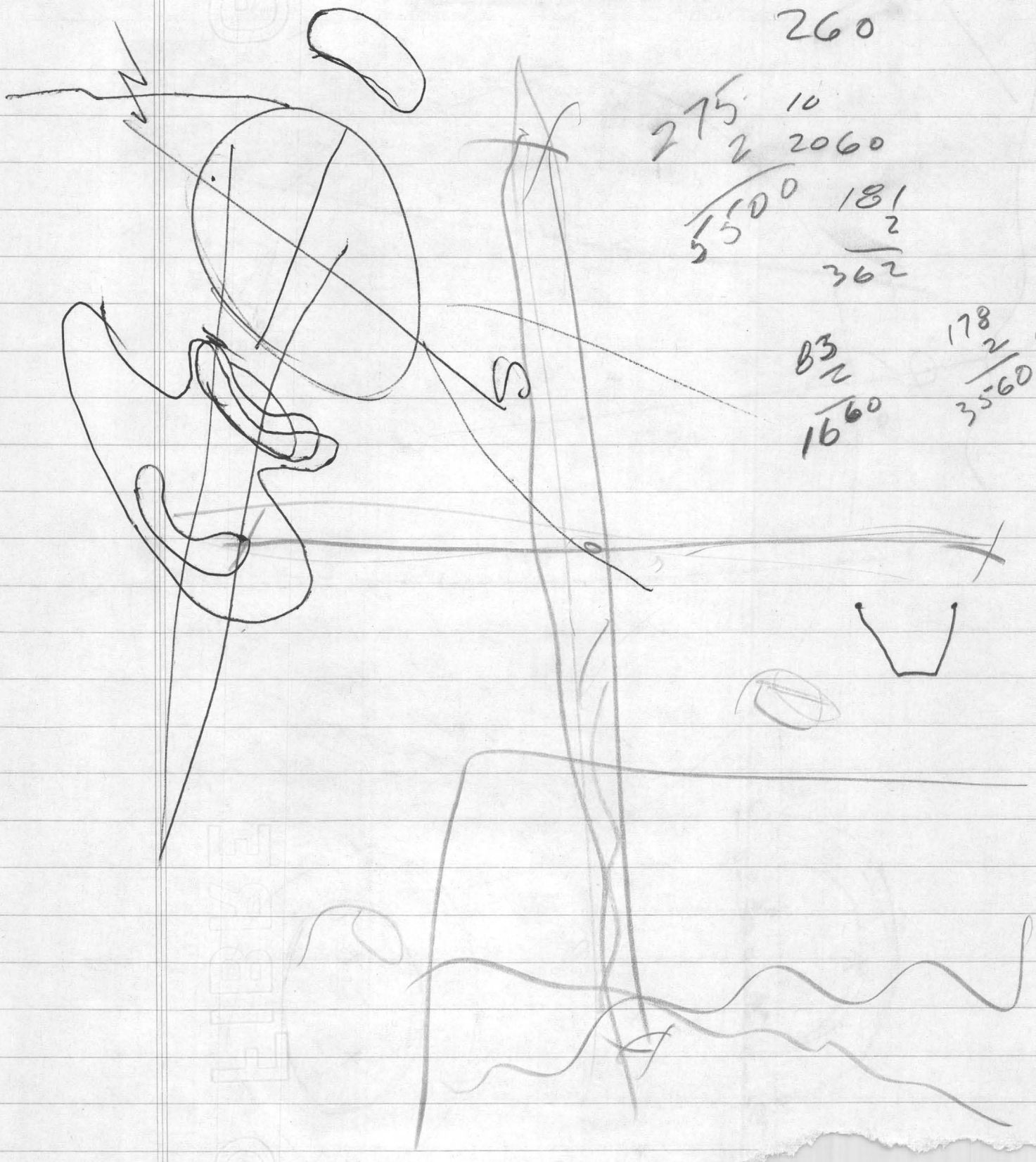
2

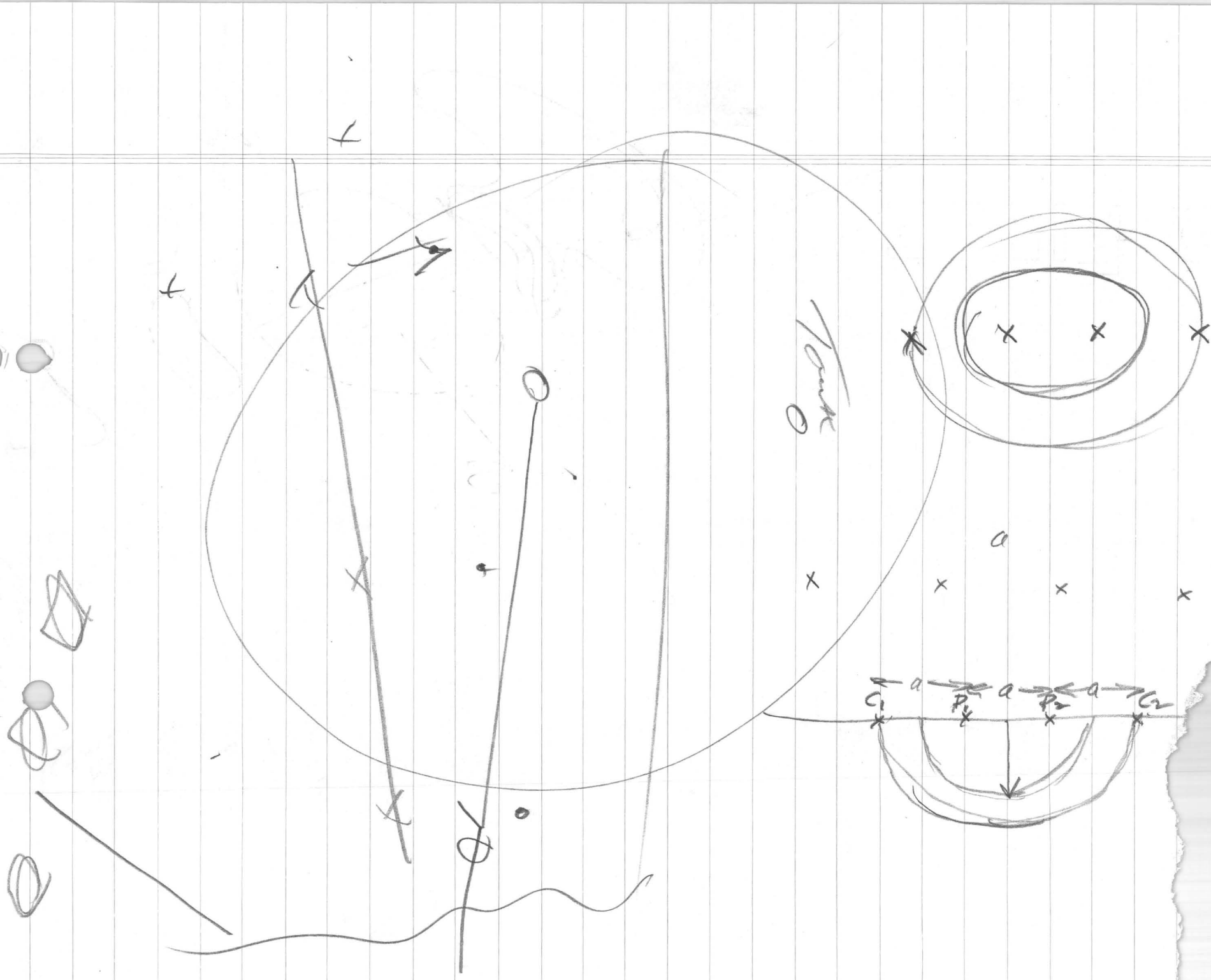
$\frac{1660}{}$

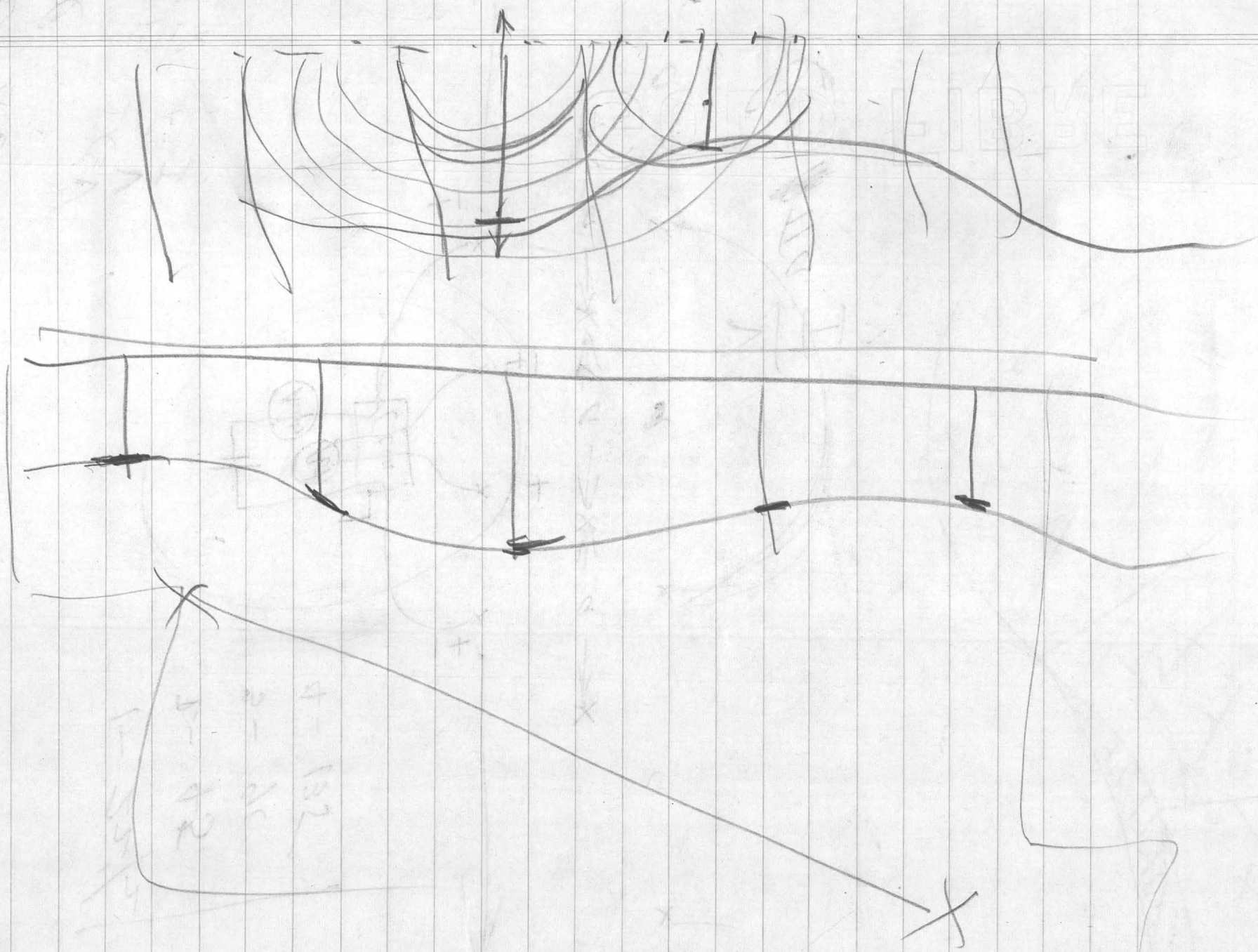
178

2

$\frac{1}{3560}$




a
a
a
C_1
P_1
P_2
C_2



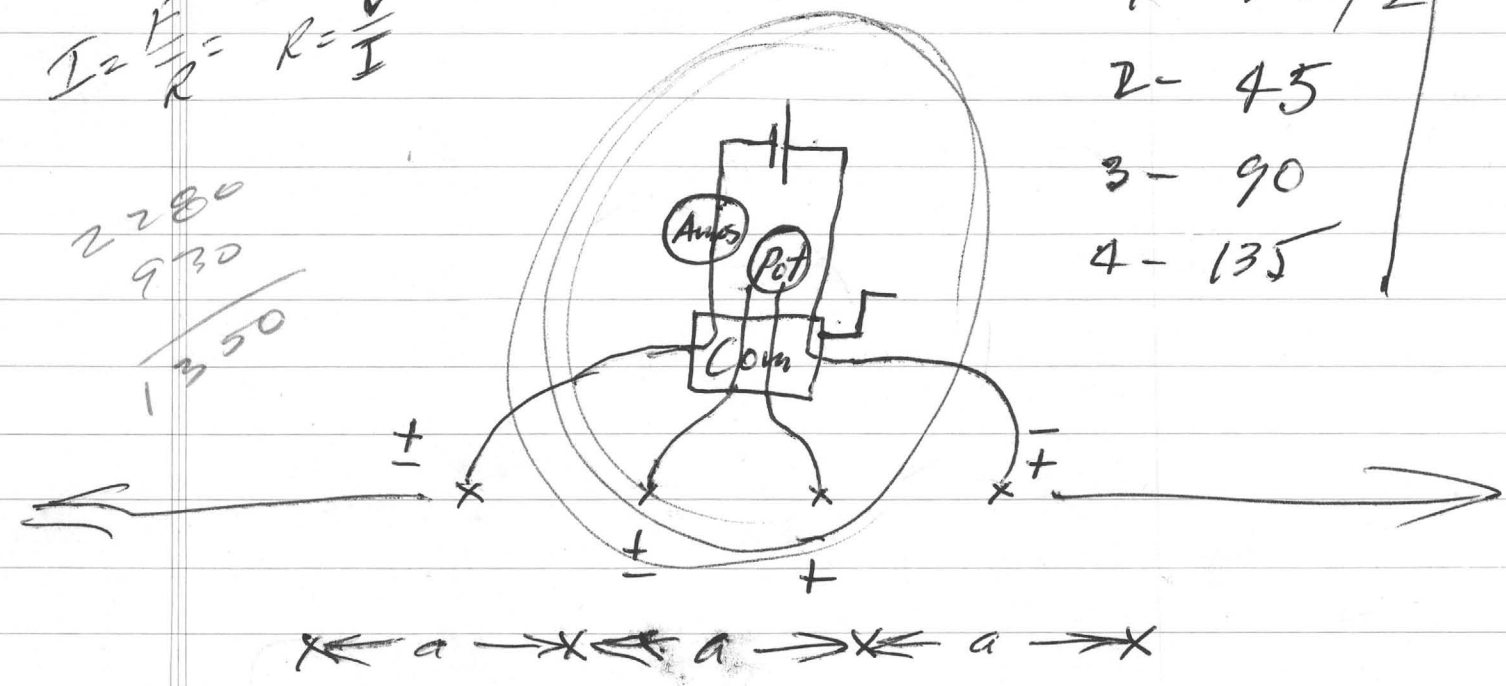
πD πD $a = D$

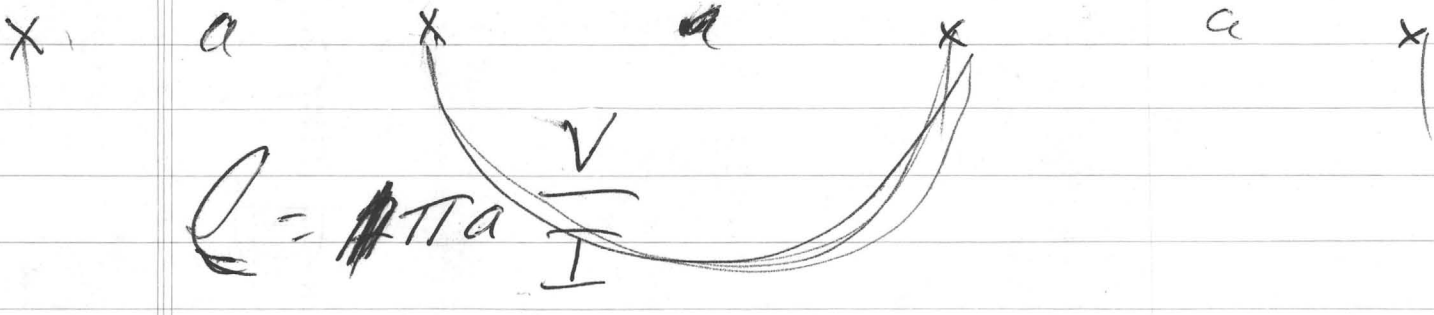
$2\pi R$

$I = \frac{E}{R}$ $IR = V$ $R = \frac{V}{I}$

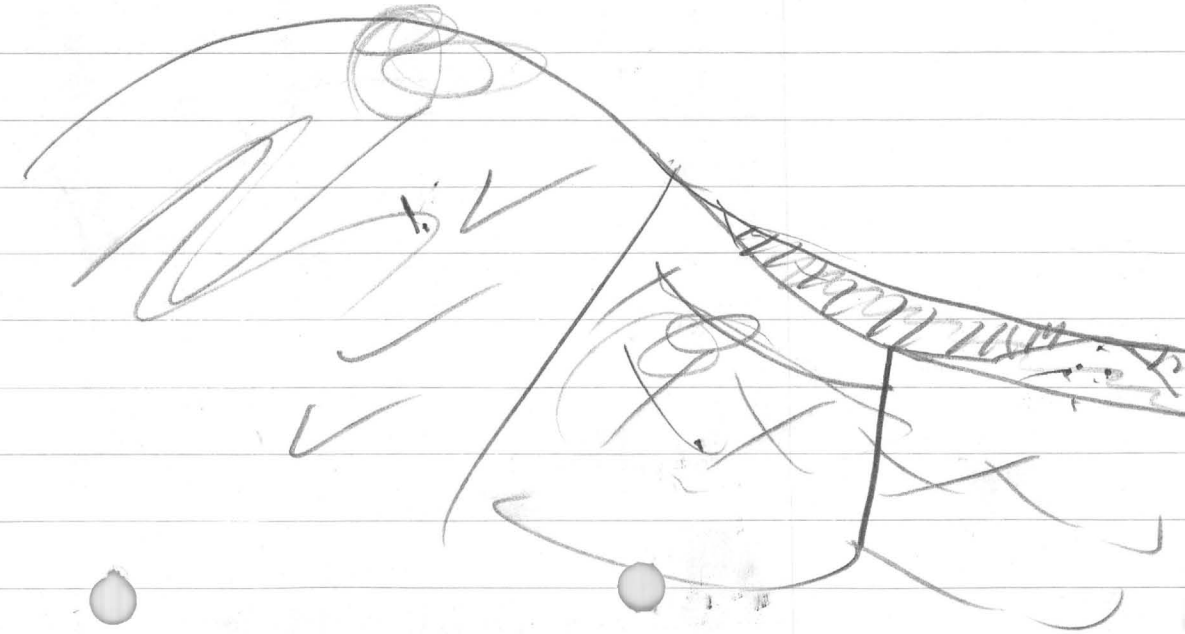
1 – 22½
2 – 45
3 – 90
4 – 135

2280
930
1350





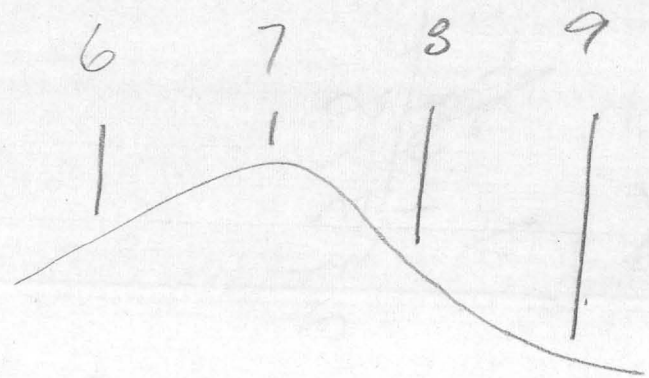
$Q = \pi a \frac{V}{I}$



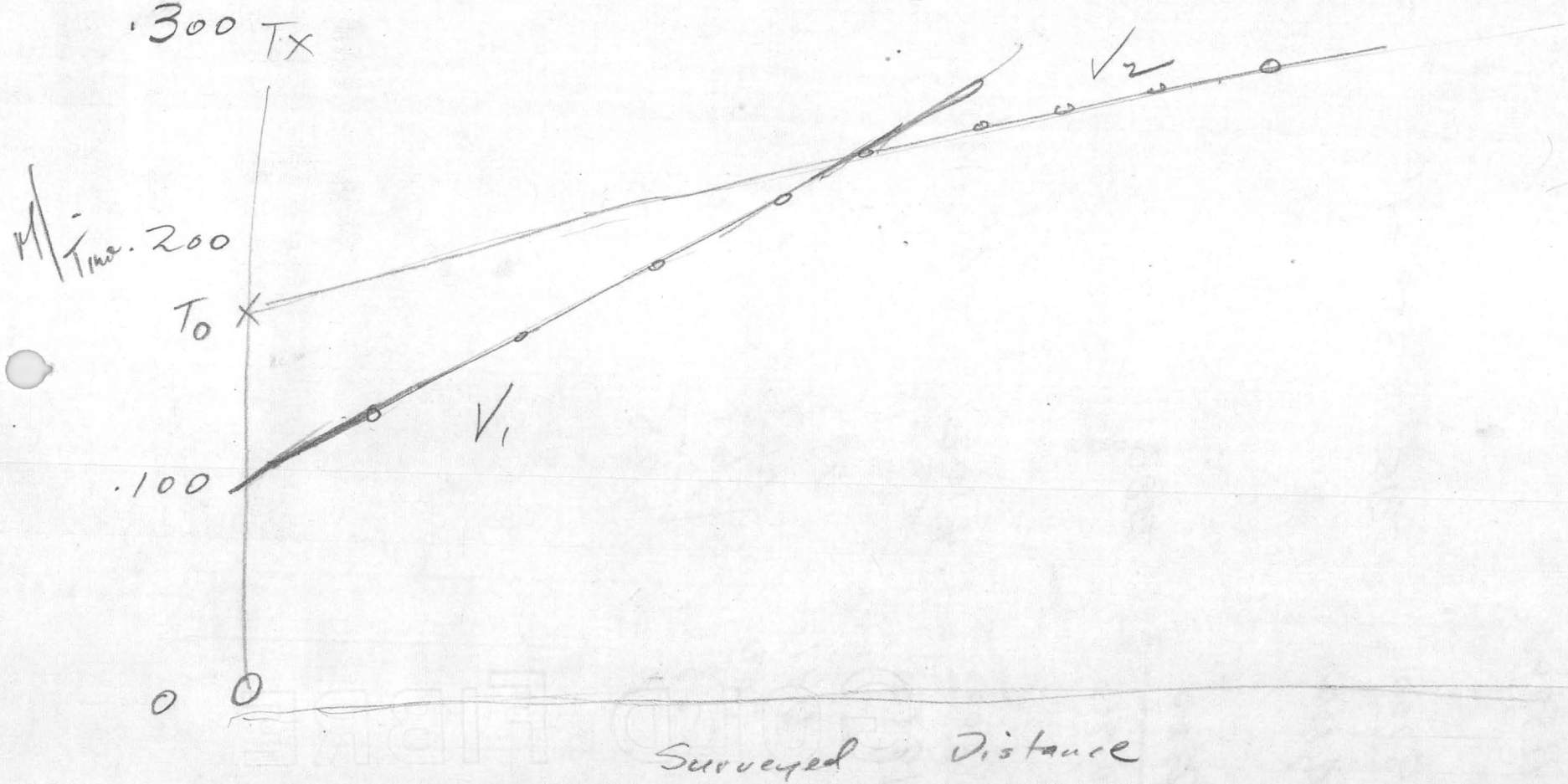
$$Z = (T_0 V_1/2) / (1 - V_1^2/V_2^2)^{1/2}$$

$$1 - \frac{V_1^2}{V_2^2}$$

$$\frac{1 - V_1^2}{V_2^2}$$



100



$\frac{8100}{11500} = .7043 = 44^\circ 47'$

185
174
11

$\frac{8200}{14,100} = .5815 \quad 35^\circ 34'$

180
159
21
11
2 | 32
16

195
197
196

$\frac{7900}{10,700} = .7383$

8050

$\frac{8000}{19,500} = .4102 \quad 24^\circ 13'$

$D = \frac{D}{T}$

091
140
231

292
277
569
285

$V = D/T$

169
2 | 378

1620
285
1905

SP-9

$V_1 = 8200$

$V_2 = 14{,}100$

$$Z = (T_0 V_1/2) \Big/ (1 - V_1^2/V_2^2)^{1/2}$$

$$Z = (.075 \times 4100) \Big/ \left(1 - \frac{6724000}{19881}\right)^{1/2}$$

$$Z = (307.5) \Big/ (1 - .1691)$$

$$Z = \frac{(307.5)}{.8309} = 740'$$

.4154

SP-8

$V_1 = 8100$

$V_2 = 11{,}500$

$$Z = (.045 \times 4050) \Big/ \left(1 - \frac{6561}{13225}\right)^{1/2}$$

$$Z = (182.25) \Big/ (1 - .4961)^{1/2}$$

$$Z = \frac{182.25}{.2520} = 723'$$

SP-6

$V_1 = 8000$

$V_2 = 19{,}500$

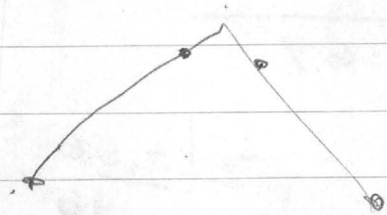
$$Z = (.015 \times 4000) \Big/ \left(1 - \frac{6400}{38025}\right)^{1/2}$$

$$Z = (60) \Big/ (1 - .01683)$$

$$Z = \frac{60}{.4916} = 122'$$

140

.0175



2) 282
141

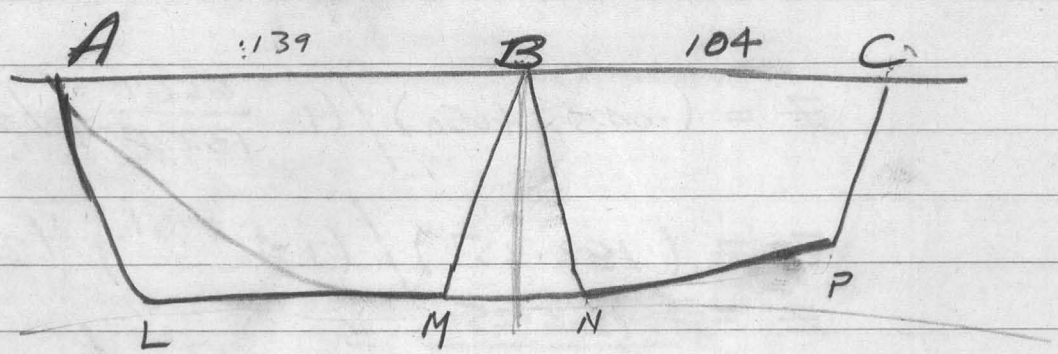
.091
.140
231
196
035

037
180
217
196
021

.195
.153

2) 3.54
177

S 6 4 S 1



2) 169
85

.117
.123
240
196
44

.066
159
225
196
29

2) 234
107

139
104
243

243
− 196
.047

AL MB = .139
BN PC = .104
AL PC .196

8050
V_1 × .047 =

.082
.163
245
196
49

.028
.185
213
196
.017

2) 13.7
69

.054
.174
228
196
32

2) 344
197

2) 258
129

Moneq
Data is in Pima County Moneq File

Miller Construction Co.
Water Exploration

✓ INDEX

Job Commenced: 3/7/59 Terminated 3/17/59

Methods used: Resistivity, Magnetic, Siesmic

Problems encountered:

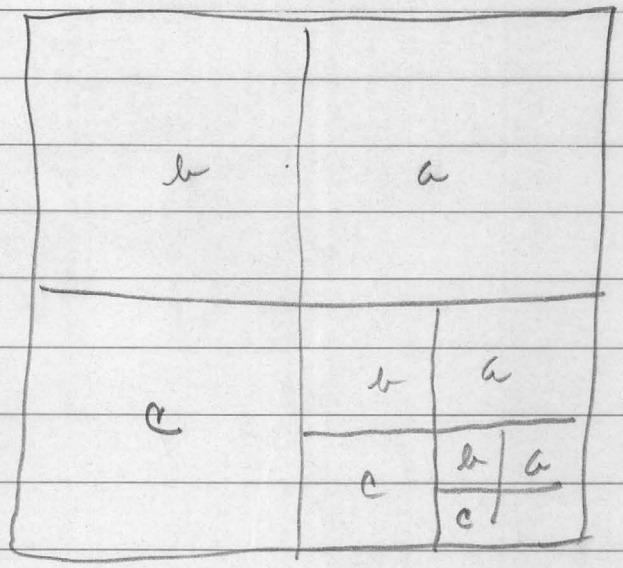
Mrs. Sanders (a land owner to South of Millers Property) refused us permission to conduct surveys on her property. This restricted our resistivity measurements at the Armand Retten Well.

Instrumental problems in the resistivity gear caused considerable delay. This has now been temporarily corrected.

Instrumental problems in the seismic gear also caused considerable delay. It is now operative

Future water work should involve a more comprehensive program of resistivity in areas where control is lacking (No well info.) Provided a correllation exists between wells in area & method applied.

Procedure should be to collect all Geol. theses in area, all well data & other related info. Make a GW (Ground Water) contour map & a contour map of a known shallow marker bed (Pantano Formation in Tucson Area)


b
a
c
b
a
c
b
a
c

Owner J.W. Sherwin
Drilled 1938-1939, south of Double V Ranch, Bear Canyon
Casing 188 ft of 6 in, 100 ft perforated
Water level at time of drilling 83 ft

0-2	Soil
2-85	Rocky clay conglomerate
85-95	Loose conglomerate, water
95-120	Rocky clay conglomerate
120-127	Loose clay conglomerate
127-170	Rocky, gray, clay conglomerate
170-176	Soft, gray, silty conglomerate, water
176-185	Rocky granitic conglomerate, hard

Bailed at rate of 1280 gallons per hour

Owner: Frank Daulberry
Driller: A.A. McDaniel, 1948
Depth: 200 ft.
Casing: Diam. 6 in., Depth 201 ft.
Perforated 120-200
Water level 73 ft., 5-26, 1948

0-25	Sandy fill
25-123	Brown shale
123-127	Broken hard shale and water
127-200	Brown shale, probably has small streaks of broken hard shale or sandstone which carries some water.

Owner: Russell Hasting
Driller: Anderson, October 5, 1956

0-70	Conglomerate
70-75	Soft conglomerate, water very weak
75-90	Conglomerate
90-105	Soft conglomerate, water
105-140	Hard conglomerate
140-162	Soft conglomerate, sand and water
162-170	Hard conglomerate

Owner: Russ Allen
Driller: A.A. McDaniel, 1955
Depth: 183 ft.
Casing: Diam. 6 in., Depth 184 ft.
Perforated 94-180
Water level 86 ft., 8-25, 1955

0-50	Boulders
50-95	Red muddy conglomerate
95-130	Red muddy conglomerate with water
130-165	Tight rocky conglomerate
165-183	Very hard conglomerate

Owner: Hastings
Driller: Pistor, 1941
Depth: 134 ft.
Casing: Diam. 6 in., Depth ?
Perforated 45 ft.
Water level: 50 ft. April 1941

0-8	Boulders and gravel
8-20	Gravel and clay
20-55	Boulders and clay
55-58	Sand
58-100	Boulders and clay
100-110	Yellow clay and sand
110-134	Boulders, little clay

Owner: H.W. Mather
Driller: A.A. McDaniel, 1947
Depth: 88 ft.
Casing: Diam. 12 in., Depth 88 ft.
Perforated 20-86
Water level 17 ft., 5-15, 1947

0-16	Topsoil
16-23	Dry sand
23-45	Coarse gravel and water
45-71	Sand and water
71-76	Coarse gravel and water
76-88	Clay

100 gpm, 25 ft. drawdown
Bailer test for 2½ hours

Owner: Russell Fairgrieve
Driller: A.A. McDaniel, March 1, 1949

0-225	#1	Gray conglomerate. Some water 160 ft.
225-525		Red conglomerate
		Bailer test, 20 gal. per hr.
0-155	#2	Gray conglomerate
155-230		Red conglomerate. Some water 155 ft.
		Bailer test, 10 gal. per hr.
0-20	#3	Gray conglomerate
20-70		Red shale
0-15	#4	Gray gravel fill
15-160		Red shale
		No water
0-220	#5	Gray conglomerate. Some water at 115.
220-320		Red conglomerate
		Bailer test, 12½ gal. per hour
0-40	#6	Gray gravel fill
40-120		Red shale
		No water

U. S. G. S. Well Record

T. 13 S., R. 15 E., 25 c a c (2)

Owner not given
Record made in 1951
T D 470'

Topsoil	0-20	
Red clay, sand	20-470	Water at 240' and 275'
No other data given		

U. S. G. S. Well Record

T. 13 S., R. 15 E., 28 a b d

J. Sanders
Driller - McCray
Drilled 1956 T D 400' Diam 16"
WL 64.0 ft on 6/16/56

No log. Driller reported formations as follows: Alluvium; sand, boulders, and clay; finished in red clay; first water at 75'.

Q not given
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 28 a a a

J. Sanders
Driller - McCray (?)
Drilled ? T D 300' Diam 14"
Q 270 gpm
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 25 c a c (1)

Owner not given
Record made in 1951
T D 925'

Red clay and sand	0-220	
Water sand	220-260	Bailed 150 gal per hr
Red clay, sand	260-525	
Water sand	525-560	Bailed 500 gal per hr
Red clay, sand	560-925	

No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 14 a d a

Gibbons Ranch
Depth 80 ft
Record made in 1947
No other data available

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16
(no detailed location)

F. R. Doulberry
Rt. 2, Box 375
Driller A. A. McDaniel
Drilled 1948 T D 180' Diam 6"
WL 73' Q 500 g p d

Sandy fill	0-25
Brown shale	25-123
Broken hard shale, water	123-127
Brown shale with streaks of broken shale or sand, water	127-200

U of Ariz analysis (ppm)

Ca	293
Mg	11
Na	115
CO_3	0
HCO_3	49
Cl	68
SO_4	850
F	1.8
TDS	1387

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 a b (1)

So. Ariz. School for Boys
Driller A. A. McDaniel
Drilled 1947 T D 144' Diam 8"
Flows, 2 gpm T 78° F

Topsoil	0-1	
Rocky Gila conglomerate	1-6	
Brown "	6-61	
Rocky "	61-62	Static WL 45', Q bailing 2 gpm
Decomposed granite fill	62-112	
Hard blue lime	112-117	
Red shale	117-120	
Broken granite	120-125	Static WL 32'
Broken granite	125-134	Static WL 12'
Hard granite	134-135	
Broken granite	135-137	Static WL 0, flow 2 gpm
Hard granite	137-144	

U of Ariz analysis (ppm)

Ca 30
Na 212
HCO_3 124
Cl 84
SO_4 240
TDS 690

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 a b (2)

So. Ariz. School for Boys
Driller A. A. McDaniel
Drilled 1938 T D 170' Diam ?

No log

Ux of Ariz analysis (ppm)

Ca 12
Mg 16
Na 134
HCO_3 188
Cl 88
SO_4 111
TDS 549

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (1)

R. Fairgreve
Driller A. A. McDaniel
Drilled 2-49 T D 525' Diam ?

Gray conglomerate	0-225	Some water at 160'
Red "	225-525	

Bailer test, 20 gal per hr
No water level given

Feth made well record in 1949; states there is a "lava and gneiss zone 30 feet wide trending NNE - SSW" through the well site

There are six wells on the 40-acre tract (NW 1/4 SW 1/4 16)

Feth noted depth to red shale in the wells as follows:

1	235 ft
2	155 ft
3	20 ft
4	15 ft
5	220 ft
6	40 ft

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (2)

R. Fairgreve
Driller ?
Drilled ? T D 230 Diam ?

Gray conglomerate	0-155	Some water at 155'
Red conglomerate	155-230	

Bailer test, 10 gal per hr
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 21 d d a (2)

John W. Sanders Double U Ranch
Driller - McGr ?
Drilled ? T D 300' Diam 14"
Q 340 g p m
Southernmost of two wells irrigating 58 acres
No other data given

Owner: P.W. Foster
Driller: Pistor-Crane, January 1936
Depth: 336 ft.
Casing: Diam. 7 5/8 in. to 5 5/8 in., Depth, 336 ft.
Finish - 7 5/8 csg. to 69.5 ft. Rest 5 5/8
Water level, 10 ft. January 1936

0-3	Sandy soil
3-40	Sand and boulders
40-59	Decomposed granite
59-62	Sand and clay
62-68	Decomposed granite
68-77	Gray granite
77-92	Decomposed granite
92-160	White sand and clay
160-172	White clay
172-325	White sand and clay
325-336	Sand and clay

Owner: Pell Foster
Driller: A.A. McDaniel, 1951
Depth: 253 ft.
Casing: Diam. 8 in. Depth 253 ft.
Perforated 133-250
Water level 122 ft. 8-23, 1951

0-78	Boulders
78-90	Clay, embedded with coarse gravel
90-112	Conglomerate
112-122	Clay, embedded with boulders
122-127	Conglomerate
127-215	Conglomerate and water
215-232	Yellow clay and gravel
232-253	Granite boulders

U. S. G. S. Well Record

T. 13 S., R. 15 E., 21 d d a (1)

John W. Sanders
Double U Ranch
Driller R. H. Wininger
Drilled 1951 T D 300' Diam 12"
Perforated 65-300'
WL 74.42 ft on 4/24/51 Q pumping 230 gpm
Northernmost of two wells irrigating 58 acres

Decomposed granite	0-10
Boulders and soil	10-30
Conglomerate	30-45
Clay and conglomerate	45-65
Sand and gravel, water	65-80
Hard conglomerate	80-105
Clay and conglomerate	105-120
Sand, water	120-135
Clay and conglomerate	135-150
Broken schist	150-160
Water sand	160-175
Gray shale	175-200
Conglomerate	200-240
Sandy clay	240-250
Sandy shale	250-275
Conglomerate	275-290
Water sand	290-300

Owner: J. Sanders
Driller: Winninger, 19??
Depth: 300 ft.
Casing: Diam. 14 in., Depth, ?

0-10	Decomposed granite
10-20	Boulders and soil
20-30	No record
30-45	Conglomerate
45-65	Clay and conglomerate
65-80	Sand and gravel water
80-105	Hard conglomerate
105-120	Clay and conglomerate
120-135	Sand, water
135-150	Clay and conglomerate
150-160	Broken schist
160-175	Sand water
175-200	Gray shale
200-240	Conglomerate
240-250	Sandy clay
250-275	Sandy shale
275-290	Conglomerate
290-300	Sand water

Owner: P.J. Martin
Drilled: April 1927
6 in. csg. to ? Water level 50 ft., April, 1927

0-54	Sandy soil
54-60	Sandy clay
60-110	Red hard sand-clay
110-140	White hard sand-clay
140-162	Hard clay, coarse sand
162-179	Hard clay, coarse, boulders
179-190	Red clay - sand
190-195	White clay
195-201	Sand, gravel
201-210	Gravel, some clay
210-216	Sand, some clay

Owner: Armand Retter
Driller: A.A. McDaniel, 1948
Depth: 191 ft.
Casing: Diam. 8 in., Depth 192
Perforated 80-191
Water level 75 ft. 4-5, 1948

0-6	Rocky soil
6-88	Hard conglomerate
88-191	Broken conglomerate and water

Owner: Southern Arizona School for Boys
Driller: AA McDaniel, May 30, 1947
Second dry hole

0-3	Topsoil
3-40	Rocky gila conglomerate
40-52	Red shale

Owner: Southern Arizona School for Boys
Driller: A.A. McDaniel, June 1947
Depth: 144 ft.
Casing: Diam. 8 in., Depth 145 ft.
Perforated 60-144
Water level 0 - flows, 6-2, 1947

0-1	Topsoil
1-6	Rocky gila conglomerate
6-61	Brown gila conglomerate
61-62	Rocky gila conglomerate, water. Water makes about 2 gal. per minute and raises overnight to 45 ft.
62-112	Decomposed granite fill
112-117	Hard blue lime
117-120	Red shale
120-125	Broken granite, water. Water raised to 32 ft.
125-134	Broken granite, water. Water raised to 12 ft.
134-135	Hard granite
135-137	Broken granite, water. Water flows over at about 2 gpm.
137-144	Hard granite

40 gpm, 75 ft. drawdown
Bailed for 1 hour.

Owner: E.P. Denisi
Driller: A.A. McDaniel, June 18, 1957
Location: Sabino Canyon Road

0-20	Boulders in brown shale
20-50	Brown shale
50-115	Red shale
115-120	Red shale with gypsum crystals
120-592	Red shale
592-600	Granite

Owner: Southern School for Boys
Driller: AA McDaniel, May 30, 1947
First dry hole

0-5	Topsoil
5-25	Gila conglomerate
25-62	Red shale
62-65	Broken red shale, water. Water makes about 40 gal. per hour and rises overnight to 46 ft.
65-72	Gray shale
72-98	Red shale
98-124	Gray shale
124-178	Red shale
178-185	Gray shale
185-277	Red shale

(d-13-15) 15 ca?

Owner: Treehaven School
Driller: AA McDaniel, October 5, 1956
Location: End of Bear Canyon Road
Casing 203 ft. of $8\frac{1}{4}$ in.
Perforated 65-90 only
Water level 61 ft.

0-15	Granite boulders
15-45	Conglomerate
45-80	Hard shale (purple)
80-87	Broken hard shale and water
87-199	Hard red shale
199-215	Fractured granite and water
215-219	Very hard granite

Bailer test: 10 gpm for 2 hours.

Owner: Southern Arizona School for Boys, Capt. Russel Fairgreave
Driller: AA McDaniel, June 17, 1957
Casing 8 in. to 109
Perforated 20-105 ft.
Water Level 20 ft.

0-20	Caliche conglomerate
20-30	Purple shale, some rocks
30-35	Muddy red shale
35-40	Hard broken shale with water
40-77	Light red shale
77-81	Hard red sandstone
81-103	Medium hard red shale with gravel
103-200	Hard to very hard granite-schist

Bailed dry at 1,125 gal.
Waited 30 minutes and bailed 204 gal. in 15 minutes.
Estimated recovery rate at $4\frac{1}{2}$ gpm.

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (3)

R. Fairgreve
Driller ?
Drilled ? T D 70' Diam ?

Gray conglomerate	0-20
Red shale	20-70

Apparently dry and abandoned; there were no other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (4)

R. Fairgreve
Driller ?
Drilled ? T D 160' Diam ?
Dry hole

Gray gravel fill	0-15
Red shale	15-160

No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (5)

R. Fairgreve
Driller ?
Drilled ? T D 320' Diam ?

Gray conglomerate	0-220	Some water at 115'
Red conglomerate	220-320	

Bailer test, 12 1/2 gal per hr
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 16 c b (6)

R. Fairgreve
Driller ?
Drilled ? T D 120' Diam ?
Dry hole

Gray gravel fill	0-40
Red shale	40-120

No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 30 c d d

Country Club Estates
Dug well, constructed before 1919
T D 15' Q 500 gpm, centrifugal pump
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 29 d d d

W. Boyd
Windmill well, 75 yards N of Rillito Creek (Tanque Verde)
Used as observation well from 9/22/39 to 1/17/42
T D 130'

Silt and gravel	0-130

WL	22.19' on 9/22/39
WL	18.65' on 1/17/42
Lowest WL	23.40' on 11/7/40

U. S. G. S. Well Record

T. 13 S., R. 15 E. 27 d c b

Rainbow Ranch
Record made in 1951
Dug well, T D 80'
No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 25 d b b (2)

Owner not given
Record made in 1951
T D 65' Dry hole

Topsoil and caliche	0-20
Red clay, sand, with lime	20-65

No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 25 d b b (1)

Owner not given
Record made in 1951
T D 200' No data on water

Topsoil	0-10	
Red formation	10-136	
Red formation	136-200	Got stickier as went down; shale and clay; oily appearance

No other data given

U. S. G. S. Well Record

T. 13 S., R. 15 E., 25 d b

Owner not given
Record made in 1951
T D 135' Dry hole

Red shale	0-135
No other data given	

U. S. G. S. Well Record

T. 13 S., R. 15 E., 17 d d

Rock House Station
Driller ?
Record collected 1941
Driller ? T D 80' Diam ?
Windmill
W L 60' in Nov. 1941