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

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

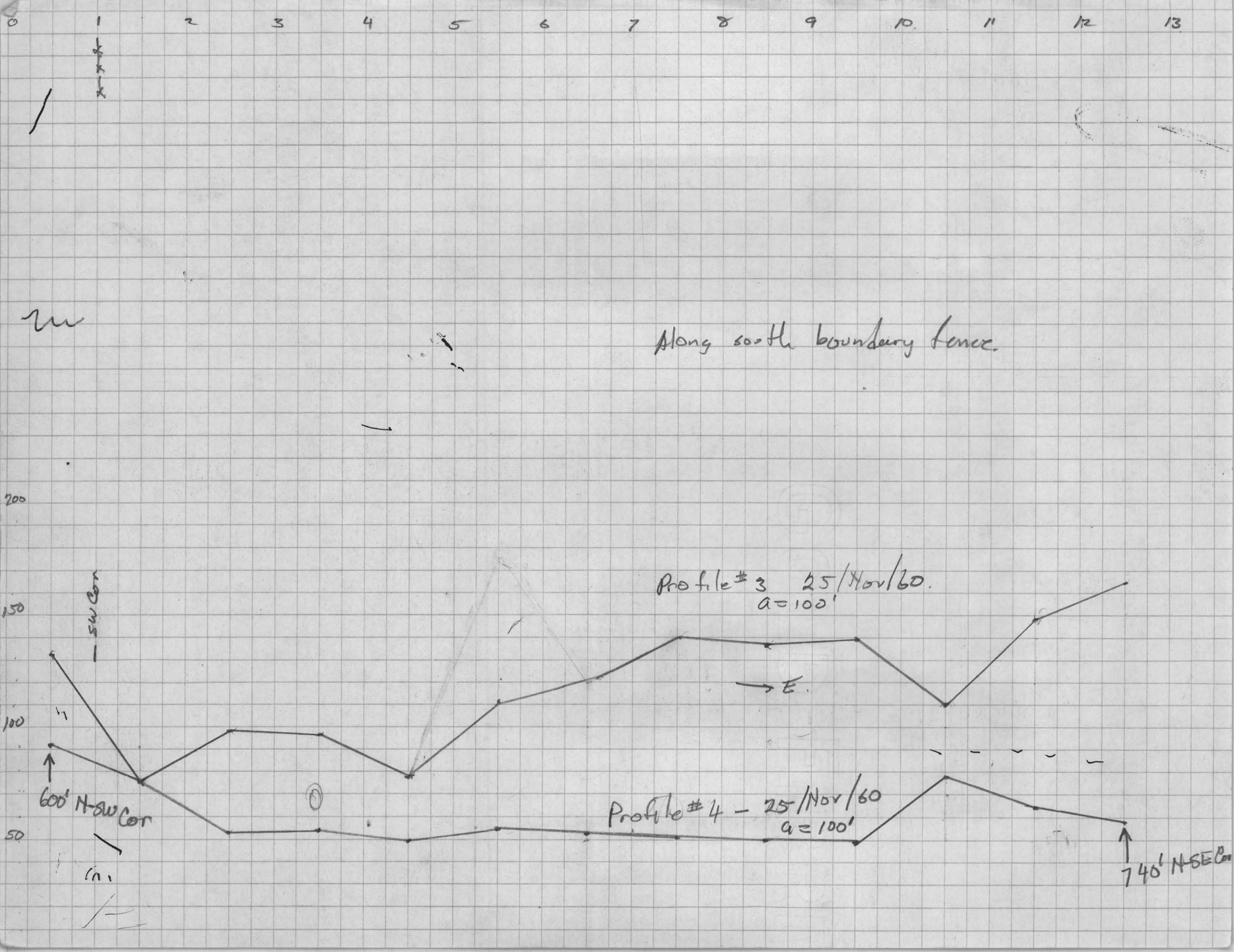
CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.


0
1
2
3
4
5
6
7
8
9
10
11
12
13
Along south boundary fence.
200
150
100
50
SW Cor
600' N-SW Cor
Profile #3 25/Nov/60.
a=100'
→ E.
Profile #4 - 25/Nov/60
a=100'
740' N-SE Cor

Pt. #1 600' N of SW Cor. a = 100' Sta 13 50' W of fence.

E Pot at Sta #1 Profile #4

	Meter	Sw	I	V		ρ	SP
1 N	61	5	305	43.6	.143 .145		0
R	62	5	310	45.2	.144	90.5	
2 N	33	5	165	17.2	.104 .139 .243		+2.5
R	34	5	170	23.6	.121	76.0	
3 N	50	1	50	5.0	.100 .067 2.167		-1
R	51	1	51	3.4	.83	52.0	
4 N	58	5	290	18.2	.063 .109 2 .172		+5
R	58	5	290	31.6	.086	54.0	
Polarizing current electrodes 5 N	25×5 = 125 92	1	92	8.6 -6.1	.068 .091 2 .159		0
R	33	5	165	15	.079	49.6	
6 N	28	5	140	+1.0	.007 .166 2 .173		+17
R	28	5	140	23.3	.86	54.0	
7 N	27	5	135	22.8	2 .169		-13
R	27	5	135	0	.084	52.8	
8 N	34	5	170	0	0 .165 2 .165		+13
R	32	5	160	26.5	.082	51.8	
9 N	37	5	185	-16.0	.0865 .0726 2 .1591		-2.1
R	38	5	190	-13.8	.0795	50.0	
10 N	73	1	73	+0.6	.0082 .1500 2 .1582		+5.8
R	74	1	74	-11.1	.0791	49.6	
11 N	19	5	95	-20.0	.211 .036 2 .247		-11.5
R	19	5	95	+2.9	.123	77.4	
12 N	22	5	110	-14.7	.1355 .0774 .2129		-3.5
R	26	5	130	-10.3	.1014	63.8	
13 N	48	5	240	-20.3	.0845 .1025 2 .1870		+1
R	48	5	240	24.6	.0935	58.7	

a = 100'
Sta = 100' int.

Profile # 2. Same loc. as Profile #1
23/Nov/60.

		Meter	SW	I	V			SP
14	N	56	5	280	42.7	.152 .182 2 .334	105	+5
	R	54	5	270	49.3	.167	105	
13	N	36	5	180	-17.5	.097 .200 2 .297	94	+9
	R	36	5	180	-36.0	.149	94	
12	N	58	5	290	-52.3	.180 .102 2 .282		-11
	R	57	5	285	-29	.141	86	
11	N	81	5	405	71	.175 .169 2 .344		+0.8
	R	85	5	425	72	.172	108	
10	N	68	5	340	40	.118 .116 2		-0.5
	R	68	5	340	39.3	.117	73.5	
9	N	70	5	350	39.0	.111 .137 2 .248		+4
	R	70	5	350	47.8	.124	78.0	
8	N	83	5	415	39.2	.095 .104 2 .199		+1.1
	R	81	5	405	42.2	.100	62.8	
by tm com 7	N	80	5	400	38.5	.096 .089 2 .185		-2
	R	79	5	395	35.0	.093	58.5	
6	N	82	5	410	34.0	.083 .087 2		+1.5
	R	81	5	405	35.2	.085	53.5	
5	N	90	5	450	21.2	.047 .071 2 .118		+5.5
	R	88	5	440	31	.059	37.1	
4	N	93	5	465	40	.086 .064 2 .150		-5
	R	91	5	455	29.2	.075	47.2	
3	N	88	5	440	37.7	.063 .089 .152		+5.7
	R	87	5	435	38.5	.076	47.7	
2	N	83	5	415	45.5	.110 .085 2 .195		-5.5
	R	81	5	405	34.5	.098	61.6	
1	N	71	5	355	40	.113 .110		-0.5
	R	71	5	355	39	.112	70.4	

Pump & well 1/2 way between pt 3 & pt 4

a = 100'
x = 100'

25/Nov/60

Profile #3. W → E along south fence line

Point #1 at East Pot.

	Meter	Sw	I	V	$2\pi a$	ρ	S.P.
1 N	45	5	225	-40.5	.180 .241 2|.421	132	+7.
R	45	5	225	-54.2	.211		
2 N	71	5	355	-52.6	.148 .090 .238	74.7.	-10
R	69	5	345	-31.2	.119		
3 N	27	5	135	-10.0	.074 .239 2|.313	98	+17.6
R	28	5	140	-33.5	.156		
4 N	24	5	120	-33.7	.280 .030 2|.310	97.	-18.3
R	25	5	125	+3.8	.155		
5 N	53	5	265	-24.1	.091 .157 2|.248	78.	+8.
R	55	5	275	+43.1	.124		
6 N	55	5	275	-37.6	.132 .220 2|.352 .176 .137 .220 2|.357 .178	~~176.~~ 112.	+11.5
R	53	5	265	-58.5			
7 N	51	5	255	-47.5	.186 .195 2|.381	120.	+1.7
R	52	5	260	50.9	.191		
8 N	67	5	335	-75.0	.224 .221 2|.445	140.	-1
R	66	5	330	-73	.223		
9 N	80	5	400	-83	.207 .230 2|.437	137.	+4.1
R	80	5	400	-92.4	.218		
10 N	37	5	185	-43.1	.232 .210 2|.442	139,	-1.8
R	38	5.	190	40.0	.221		
11 N	54	5	270	40.8	.151 .199 2|.350	110	+6.6
R	53	5	265	52.7	.175		
12 N	57	5	285	55.5	.195 .278 2|.473	148.	+11.1
R	56	5	280	78.0	.236		
13 N	42	5	210	51.0	.242 .283 2|.525	165.	+3.2
R	41	5	205	58	.262		
14 N							
R							

Probe #1

DeVries

23/Nov/60.

by WCM to Tank E→W.

		Meter	Switch	I	V.	V/I	$V/I\,2\pi a = \rho$	S.R.	S.P.
50	N	16	5	80	-4.5	.0562			+20.
						.489			
						.545			
	R	18	5	90	+44	2 .273	859		
100	N	36	5	180	+24	.133			+44.5
	R	29	5	145	-61	.421 / .554 .277	174		
150	N	46	5	230	-6	.026 / .150 / .176 .088			+13.
	R	40	5	200	-30.		82.8		
200	N	58	5	290	-5	.017 / .130 / 2 .147			+14.
	R	46	5	230	-30.	.073	92.3		
250	N	50	5	250	-1	.004 / .115 / 2 .119			+13
	R	46	5	230	-26.5	.0595	93.6		
300	N	50	5	250	+2.5	.010 / .114 / 2 .124			+13.5
	R	42	5	210	-23.9	.0062	117		
350	N	46	5	230	-8	.035 / .035 / 2 .070			0.
	R	45	5	225	-8	.035	77		
400	N	53	5	265	-14.5	.055 / .006 / 2 .061			-5.8
	R	49	5	245	-1.4	.0305	77		
450	N	41	5	205	+9	.044 / .104 / 2 .148			+15.5
	R	40	5	200	-20.8	.074	209		
500	N	45	5	225	+0.5	.002 / .063 / 2 .065			+7
	R	42	5	210	13.2	.0325	102		

a = 350'
sta int = 100'
Sta 14 is 110' N.SE Cor.

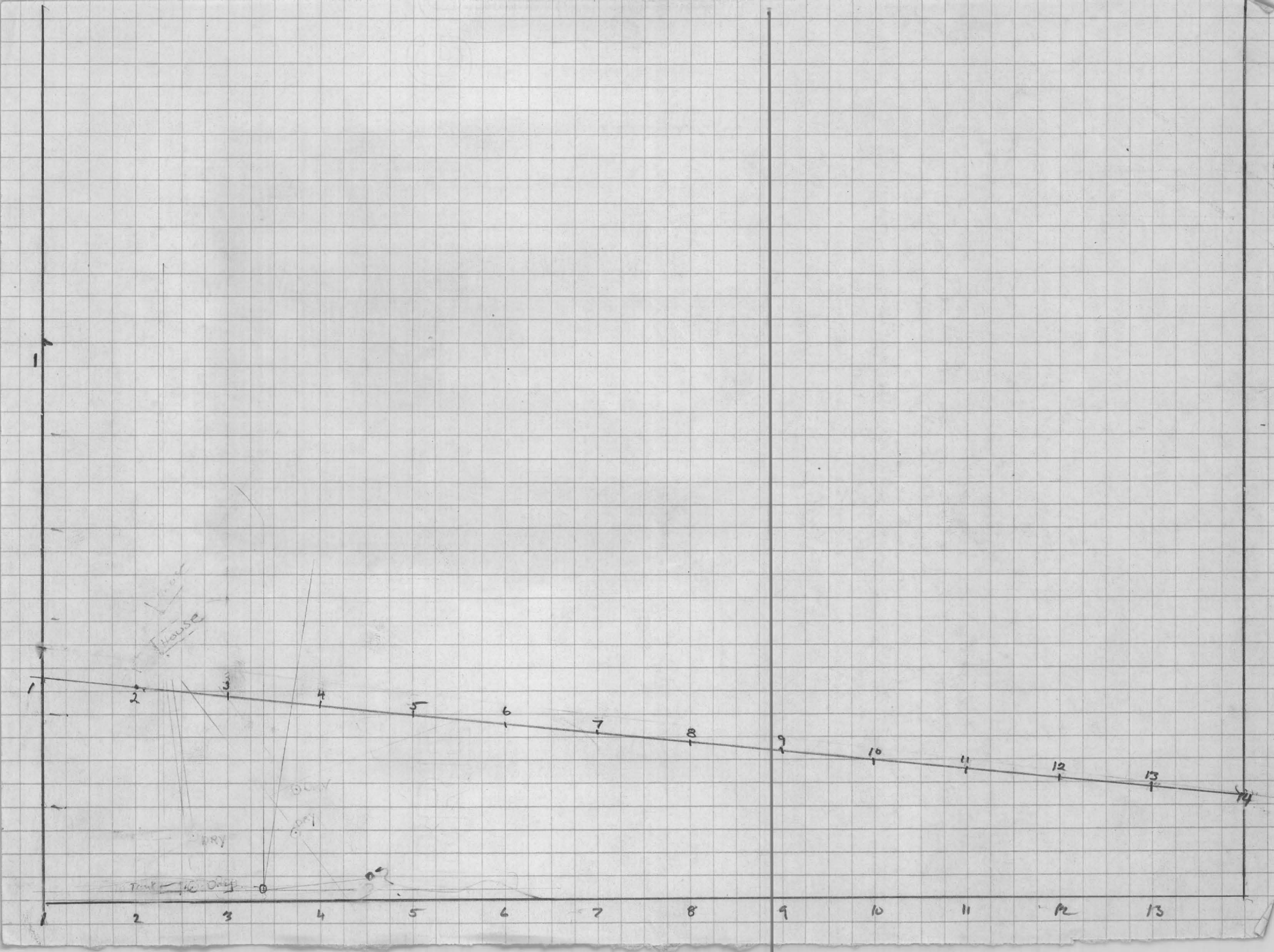
Devries Profile #1 East from fence

270' N of SW Cor.

23/Nov/60

Sta	Meter	Switch	I	V			S.P
1 N	36	5	180	10.9	.067 .065 2/.126	138	0
R	35	5	175	11.4	.063		0
2 N	60	5	300	−17.2	.057 .067 2/	136	0
R	59	5	295	19.9	.062		
3 N	25	5	125	10.5	.084 .038 .122	134	−3.8
R	26	5	130	5	.061		
4 N	44	5	220	14.4	.065 .056 .121	134	−2
R	43	5	215	12.0	.61		
5 N	48	5	240	12.4	.052 .051 .103	112	0
R	47	5	235	12	.051		
6 N	56	5	280	−7.8	.028 .061 2/.089	99	+4.5
R	56	5	280	17.0	.045		
7 N	28	5	140	5.0	.036 .053 .089	99	+1
R	29	5	145	7.7	.045		
8 N	25	5	125	11.8	.094 .010 .104	114	−8
R	25	5	125	1.2	.052		
9 N	39	5	195	−14.2	.073 .039 .112	123	−6.5
R	40	5	200	7.8	.056		
10 N	30	5	150	−6.2	.041 .061 2/.102	112	+1.0
R	29	5	145	8.8	.051		
11 N	44	5	220	14.8	.067 .029 2/.096	105	−4.5
R	44	5	220	6.3	.048		
12 N	58	5	290	−12.0	.059 .042 2/.101	112	−3.5
R	57	5	285	12	.051		
13 N	34	5	170	−4.8	.028 .092 .128	141	+4.3
R	35	5	175	−16	.064		
14 N	20	5	100	−19.7	.197 .067 2/.264	290	−14.0
R	21	5	105	+7	.132		

House
N32°E
60'
#2
N79°W
240'
well
N37°W 237'
well


1
2
3
4
5
6
7
8
9
10
11
12
13
14
House
DRY
Track

East End Int 44.5

Sand	2-3	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
Rec	Cal	1-2E	→	2-3E	→		3-4E	→		
Time			1607	1615	1616		1621	1622		1625
		9.8	2.99	13.0	3.65	1.51	10.7	4.02	1.66	.93
DC_1	28.5	9.8	2.98	13.0	3.70	1.54	10.2	3.82	1.77	.99
		10.0	3.25	12.0	3.32	1.55	11.4	4.20	1.74	.89
DC_2	28.5	10.0	3.26	12.0	3.27	1.51	11.9	3.35	1.64	.82
		19.8	6.24	25.0	6.97	3.06	22.1	7.82	3.40	1.82
Σ		19.8	6.24	25.0	6.97	3.05	22.1	7.55	3.41	1.81
								97		
								69		
		9.8	3.00							
DC_3	28.5	9.8	2.95							
		10.0	3.25							
DC_4		10.0	3.27							
		19.8	6.25							
Σ		19.8	6.22	~~25~~						
		19.8.	6.24	25.0.	6.97	3.05	22.1.	7.68.	3.40	1.82.
DC AV	57.0.									
AC_1		8.8								
AC_2		8.8								
Σ										
ACN			110							
SP			-7.8							
.15cps										

East End

Sand	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	2-3
Rec	4-5E	→			5-6E	→			Cal
Time		1630	1631	1632	1639	1640	1641		
DC_1	3.80	2.05	1.04	.66	1.52	.82	57	45	
	3.82	2.07	1.06	67	1.62	77	60	50	
DC_2	3.41	1.92	1.10	62	1.13	89	48	21	
	340	1.90	1.09	62	1.03	94	42	17	
Σ	7.21	3.97	2.14	1.28	2.65	1.71	1.05	.66	
	7.22	3.97	2.15	1.29	2.65	1.71	1.02	.67	
DC_3									
DC_4									
Σ									
DCAv	7.22	3.97	2.14	1.28	2.65	1.71	1.04	.66	
Ac_1									
Ac_2									
Σ									
ACN									
SP									
.15									

W E

	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
Rec	1-2W	→	2-3W	→		3-4W	→		
Time			1656	1657	1658	1702	1702	1703	1704
Dc_1	12.0	3.10	12.0	2.43	1.00	11.7	2.90	.93	.50
	11.4	3.40	12.0	2.43	1.00	11.7	2.88	.91	.50
Dc_2	14.0	2.85	11.8	2.72	1.13	11.7	3.05	1.15	.50
	14.3	2.50	11.8	2.72	1.13	11.7	3.07	1.16	.50
Σ	26.0	5.95	23.8	5.15	2.13	23.4	5.95	2.08	1.00
	25.9	5.90	23.8	5.15	2.13	23.4	5.95	2.07	1.00
DcAv	25.8	5.92	23.8	5.15	2.13	23.4	5.95	2.08	1.00
~~Dc4~~									

	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	2-3
Rec	4-5W	→			5-6W	→			Cal
Time	1707	1708	1709	1710	1712	1713	1714		
Dc_1	3.0	1.21	.52	.29	1.80	.86	.48	.21	28.5
	3.0	1.20	.51	.32	1.85	.90	.51	.20	28.5
Dc_2	3.05	1.24	.52	.25	1.65	.90	.38	.30	28.5
	3.03	1.24	.53	.20	1.60	.86	.33	.31	28.5
Σ	6.05	2.43	1.04	.54	3.45	1.76	.86	.51	57.0
	6.03	2.44	1.04	.52	3.45	1.76	.84	.51	57.0
DcAv	6.04	2.44	1.04	.53	3.45	1.76	.85	.51	
~~Dc4~~									

East end. 0^E at. Resist effect.

Send	2-3	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3
Rec.	Cal.											
		1^E-2^E	1^E-2^E	2^E-3^E →			3^E-4^E →				4^E-5^E →	
Time	1603	1605	1607	1615	1616	1618	1621	1622	1624	1625	1630	1631
I	650	1300	1200	1200	1300	1200	1100	1200	1300	1200	1100	1200

Rec	4E-5E →		5E-6E →			
Send	3-4	4-5	1-2	2-3	3-4	4-5
Time	1632	1633	1639	1640	1641	1642
I	1300	1200	1100	1200	1300	1200

West end

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4
Rec	1^W-2^W	2^W-3^W	2^W-3^W →			3^W-4^W →				4^W-5^W →	
Time	1651	1652	1656	1657	1658	1702	1702	1703	1704	1707	1708
I	1200	1100	1300	1200	1100	1200	1300	1200	1100	1200	1300

Send	2-3	1-2	4-5	3-4	2-3	1-2	2-3
Rec	4^W-5^W →		5^W-6^W				Cal
Time	1709	1710	1712	1713	1714	1715	1722
I	1200	1100	1200	1300	1200	1100	650

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Devries Line Profile #5E Field date 25/Nov/60 Data page — Comp. date — . Comp by _____

(A) Send	2-3	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3
(B) Receive	Cal	1E-2E →		2E-3E →			3E-4E →				4E-5E →	
(C) n separation		1	2	1	2	3	1	2	3	4	2	3
(D) I	650	1300	1200	1200	1300	1200	1100	1200	1300	1200	1100	1200
(E) Vdc (avg)	57.0	19.8	6.24	25.0	6.97	3.05	22.1	7.68	3.40	1.82	7.22	3.97
(F) DCcal	1.140											
(G) Kn x 10^{-3}		.3	1.2	.3	1.2	3.0	.3	1.2	3.0	6.0	1.2	3.0
(H) ρ dc=ExFxGx10^3/D		5.21	7.12	7.14	7.35	8.70	6.88	8.26	8.95	10.4	9.00	11.3
(I) Vac Σ												
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)												
(O) MCF=(M-1)(10^5)/H												
(H) x 2π		35.4	48.2	48.4	49.8	59.0	46.6	56.0	60.6	70.5	61.0	76.6

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

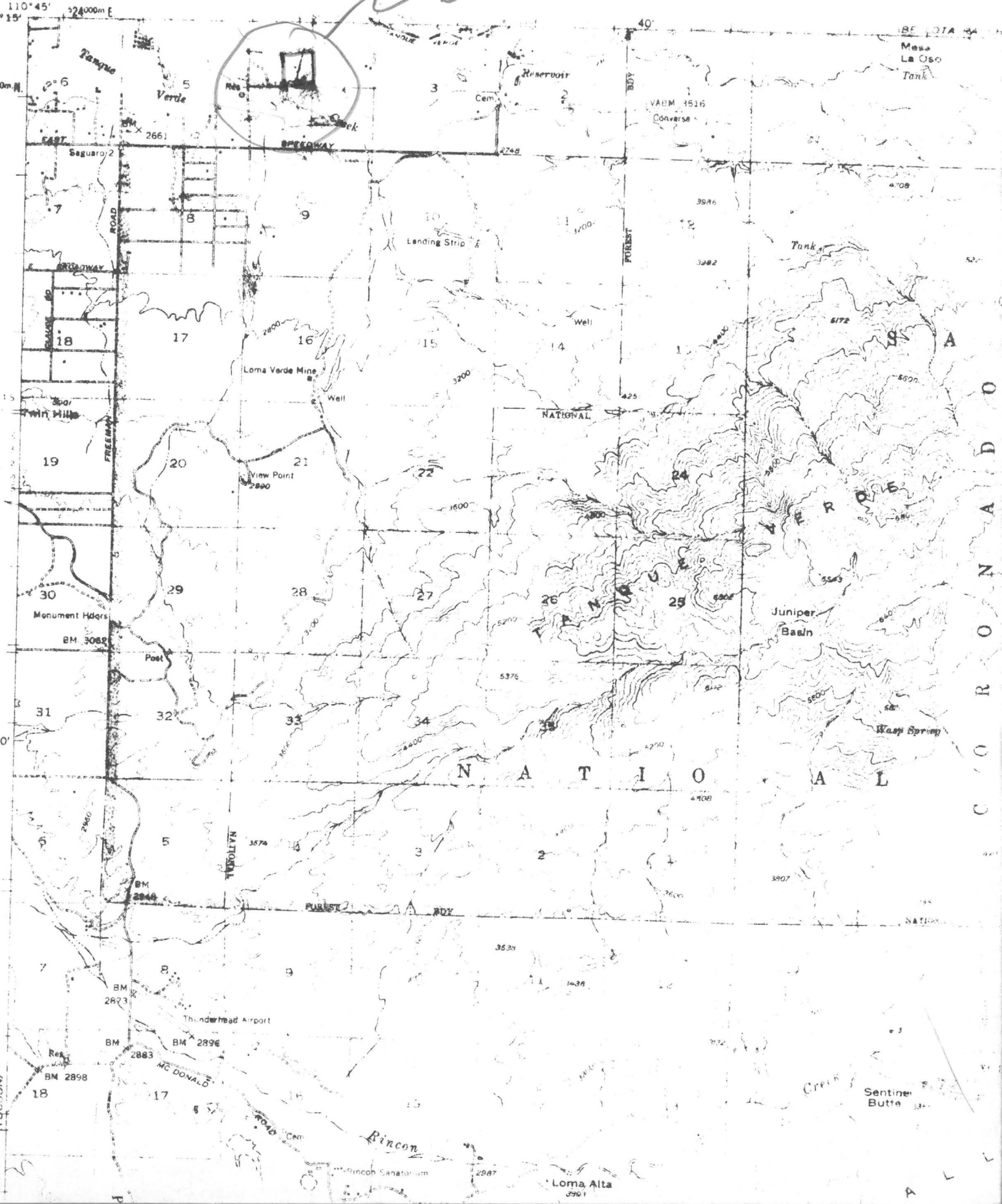
Page _____

Project _____ Line _____ Field date _____ Data page _____ Comp. date _____ Comp by _____

(A) Send	3-4	4-5	1-2	2-3	3-4	4-5						
(B) Receive	4E-5E →		5E-6E →									
(C) n separation	4	5	3	4	5	6						
(D) I	1300	1200	1100	1200	1300	1200						
(E) Vdc (avg)	2.14	1.28	2.65	1.71	1.04	.66						
(F) DCcal							1.140					
(G) Kn x 10^{-3}	6.0	10.5	3.0	6.0	10.5	16.8						
(H) ρ dc=ExFxGx10^3/D	11.25	12.75	8.25	9.75	9.57	10.51						
(I) Vac Σ												
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)												
(O) MCF=(M-1)(10^5)/H												
H x 2π	76.3	86.5	55.8	66.0	65.0	71.4						

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DeVries



EDWARD L. BREAZEALE

ARIZONA SEROLOGICAL LABORATORIES
P. O. BOX 4133
TUCSON, ARIZONA

PHONE EA 5-3459

Statement

RECEIVED JAN 9 1961

RECEIVED JAN 9 1961

LABORATORY No. 610105

Date 4 January 1961

Sample WATER Marked Dr. deVries

Received 4 January 1961

Submitted by Frank Seward

ANALYSIS

ANALYSIS OF DISSOLVED SOLIDS		PARTS PER MILLION	HYPOTHETICAL COMBINATIONS		PARTS PER MILLION
Silica	(SiO_2)		Silica	SiO_2	
Aluminum Oxide	(Al_2O_3)		Aluminum Oxide	Al_2O_3	
Iron Oxide	(Fe_2O_3)		Iron Oxide	Fe_2O_3	
Calcium	(Ca)	250	Calcium Bicarbonate	$Ca(HCO_3)_2$	
Magnesium	(Mg)	150	Calcium Sulphate	$CaSO_4$	
Sodium	(Na)	240	Calcium Chloride	$CaCl_2$	
Potassium	(K)	10	Magnesium Bicarbonate	$Mg(HCO_3)_2$	
Sulphate	(SO_4)	1200	Magnesium Sulphate	$MgSO_4$	
Chlorine	(Cl)	338	Magnesium Chloride	$MgCl_2$	
Carbonate	(CO_3)	0	Sodium Bicarbonate	$NaHCO_3$	
Bicarbonate	(HCO_3)	74	Sodium Carbonate	Na_2CO_3	
Fluorine	(F)	0.7	Sodium Sulphate	Na_2SO_4	
Nitrates	(NO_3)	Trace	Sodium Chloride	$NaCl$	
Boron	(B)	0.35	Total Solids		
Total Solids		2262			
Total Non-Volatile Solids			Total Hardness as $CaCO_3$		

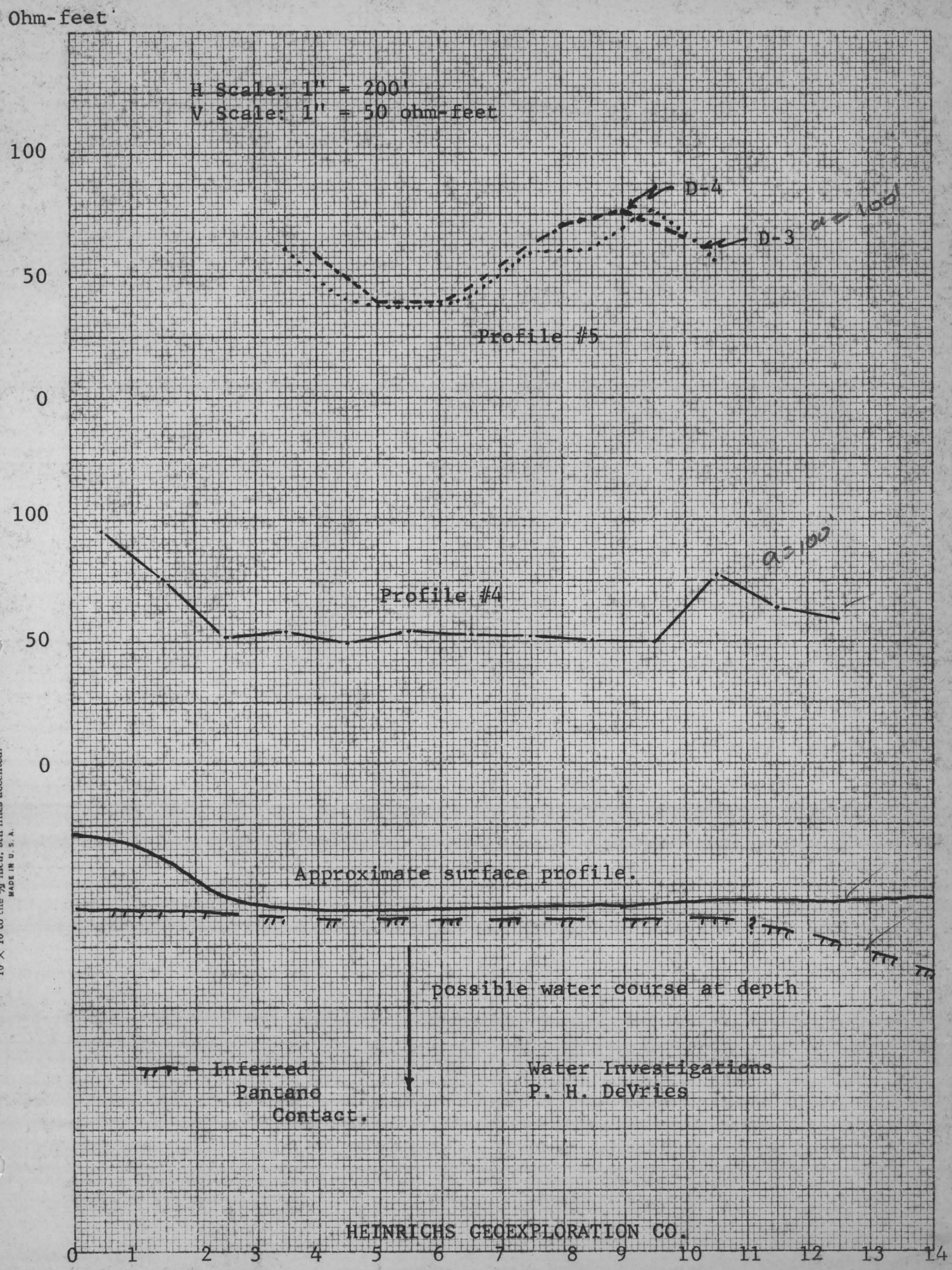
DETERMINATIONS

Carbon Dioxide (CO_2) uncombined in p.p.m.		Color	clear
Hydrogen Sulphide (H_2S) in p.p.m.	none	Odor	none
Specific Electrical Conductance ($K \times 10^{-5}$)		Taste	salty
Hydrogen Ion Concentration (pH)	7.7	Turbidity	none
Total Hardness grains/gal.	72	Suspended Matter	

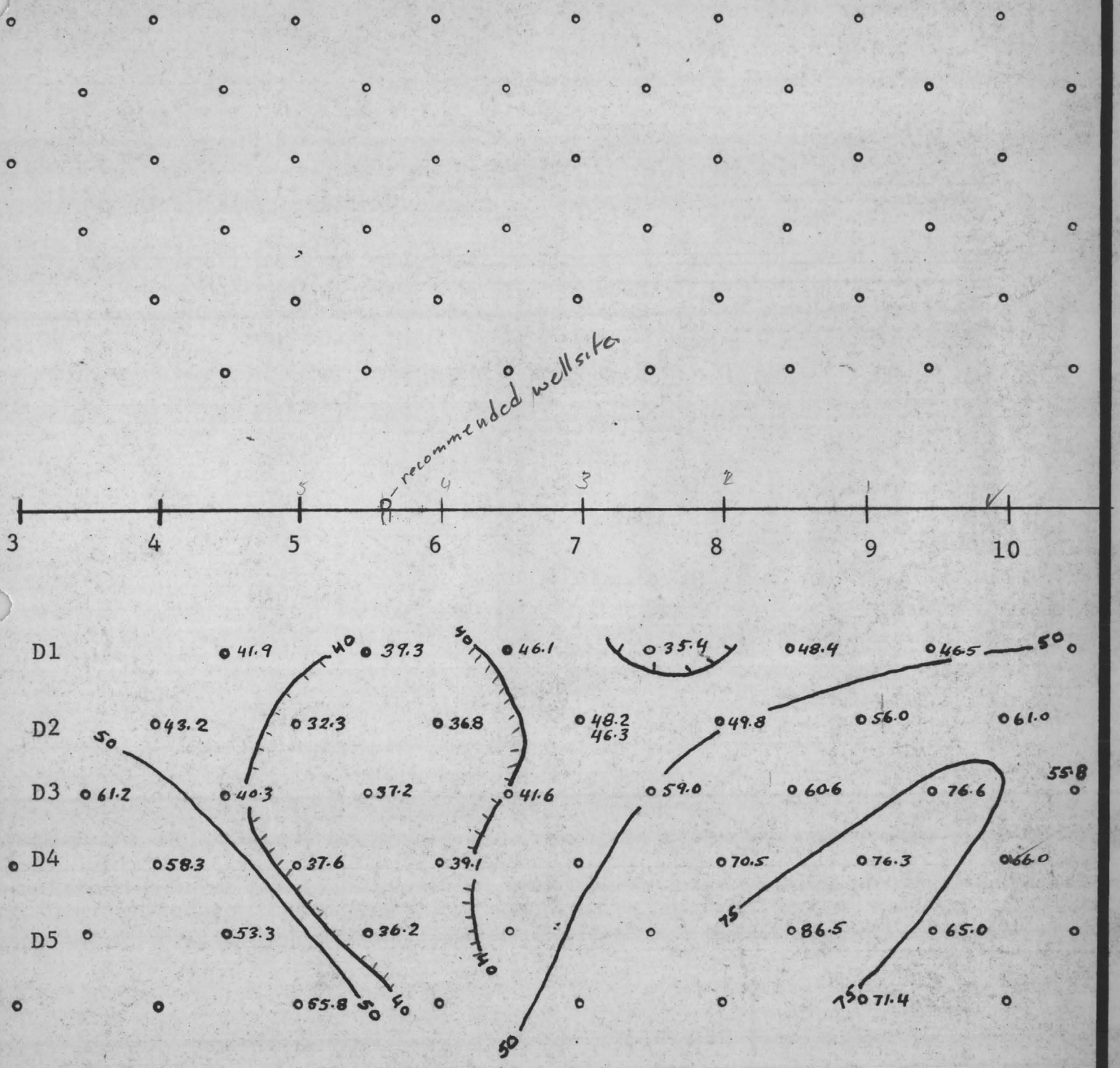
Respectfully submitted,

Edward L. Breazeale
Chemist

Chemist



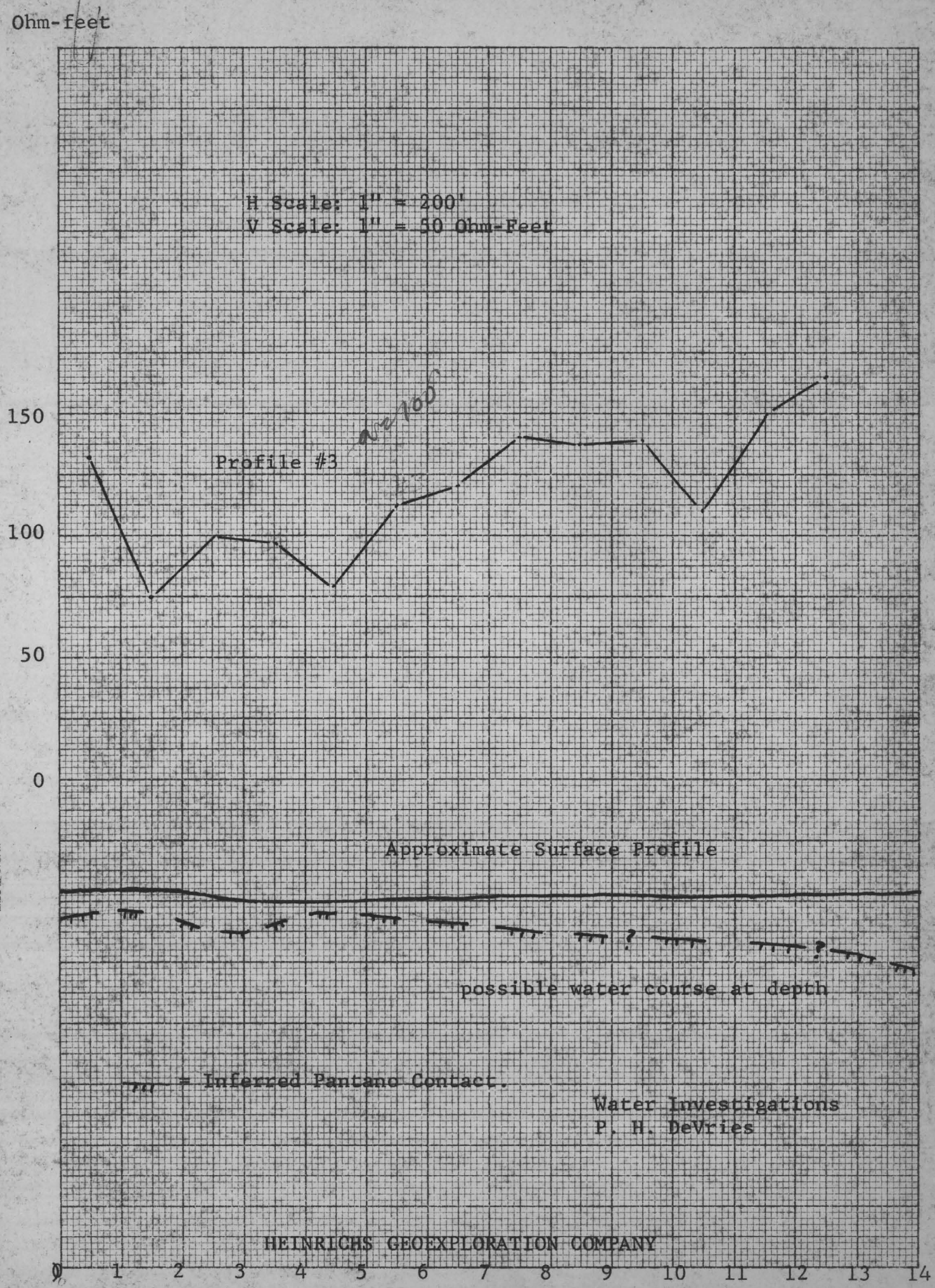
359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.



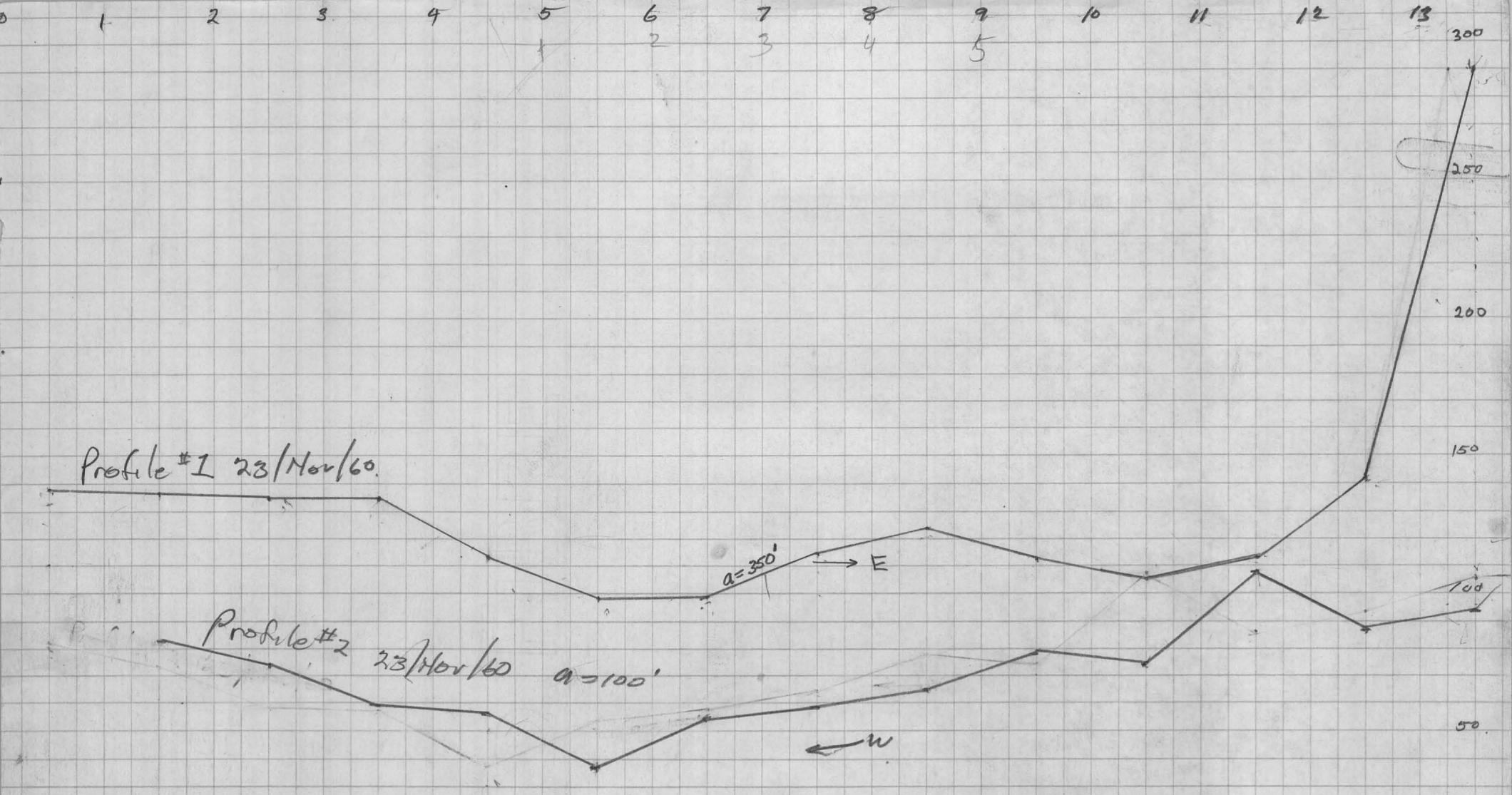
Induced Polarization
Resistivity Section
Profile #5

Water Investigations
P. H. DeVries

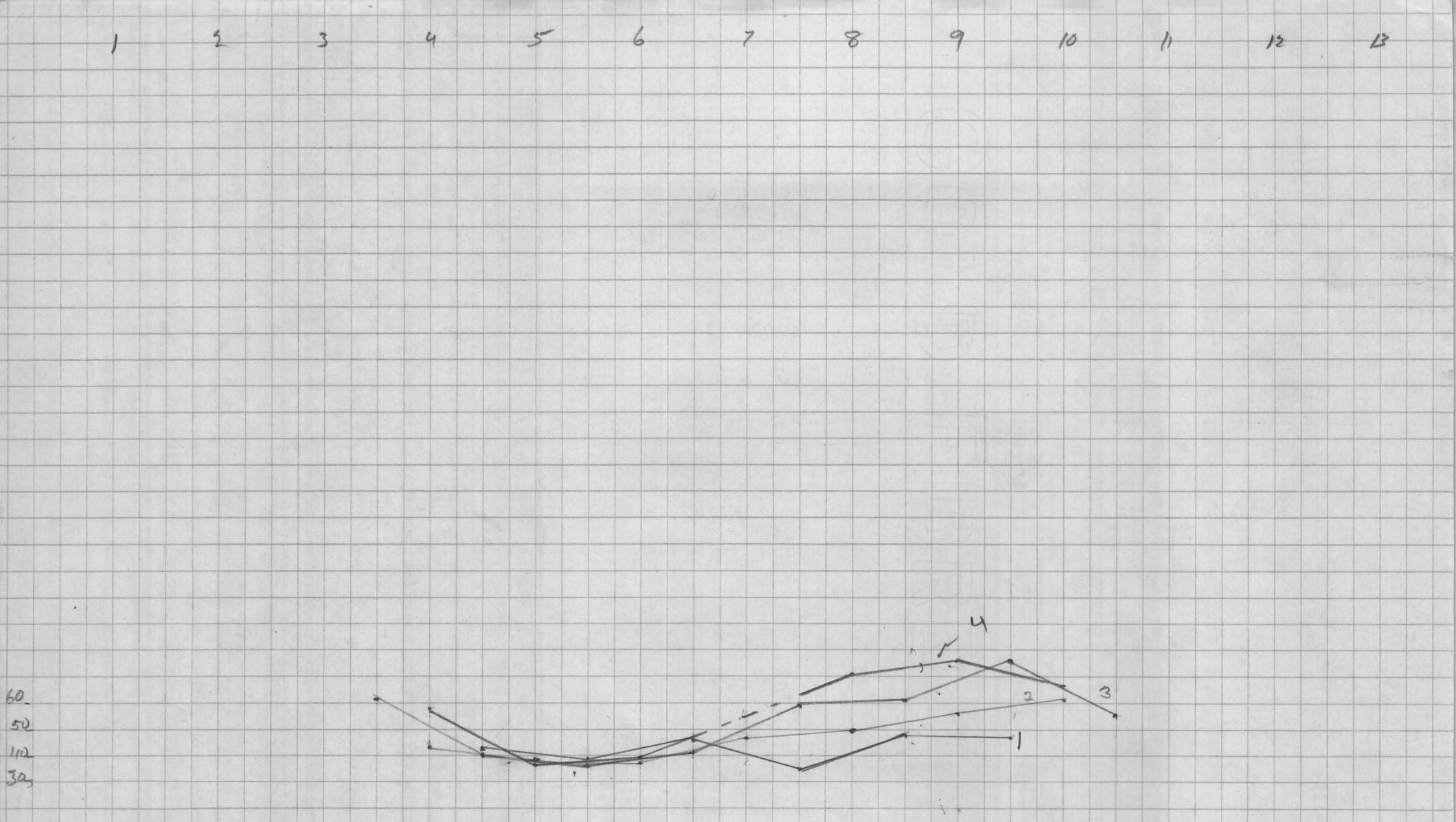
HEINRICHS GEOEXPLORATION COMPANY



359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.

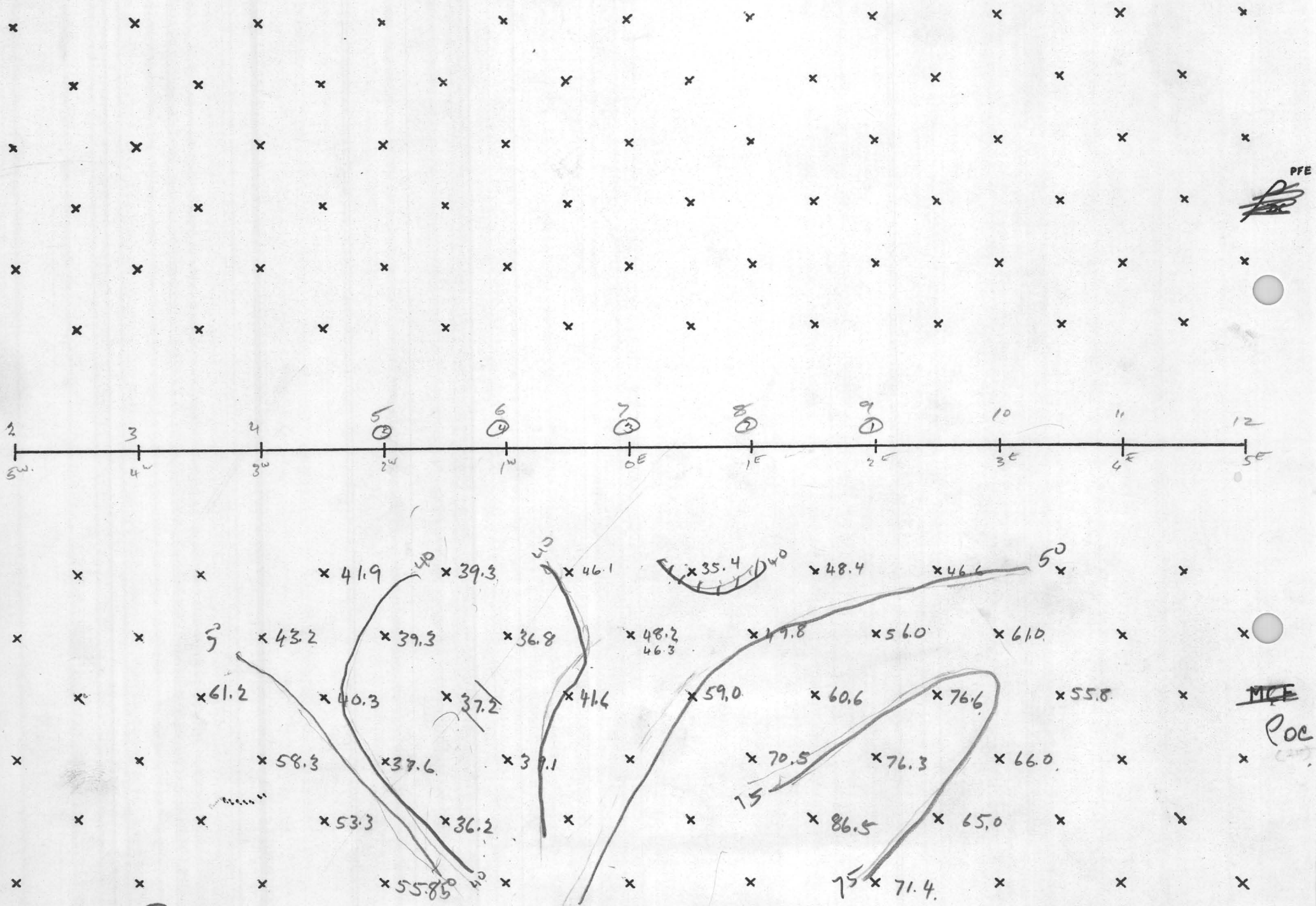

1 2 3 4 5 6 7 8 9 10 11 12 13
1 2 3 4 5
300
250
200
150
100
50
0
Profile #1 23/Nov/60.
a=350'
E
Profile #2 23/Nov/60 a=100'
W

DeVries



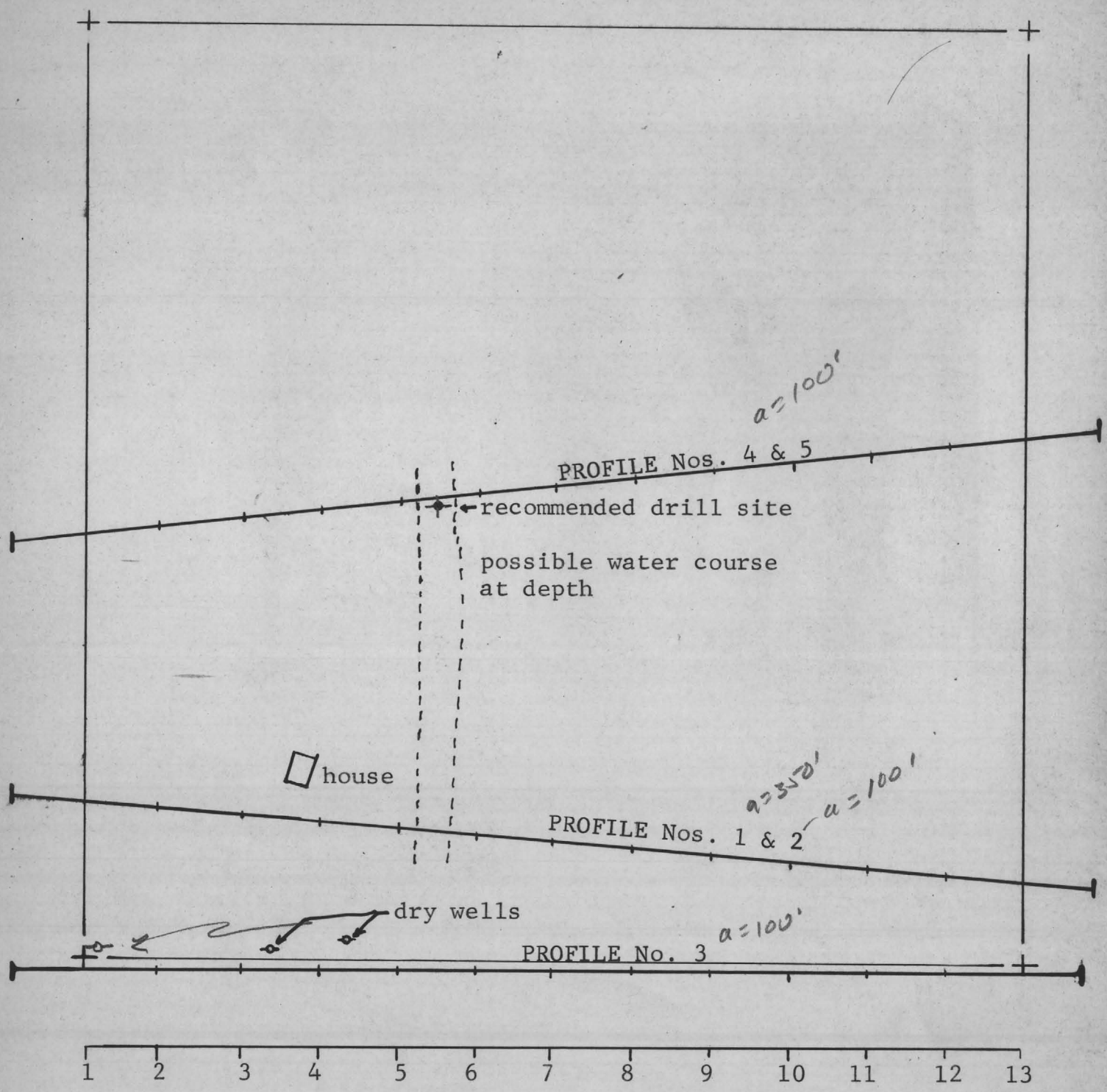
Devries I.P-Resistivity
Profile # 5

INDUCED POLARIZATION WORK SHEET



Area Dennes Scale 1" = 100' Date

WATER INVESTIGATIONS - Dr. P. H. DeVries

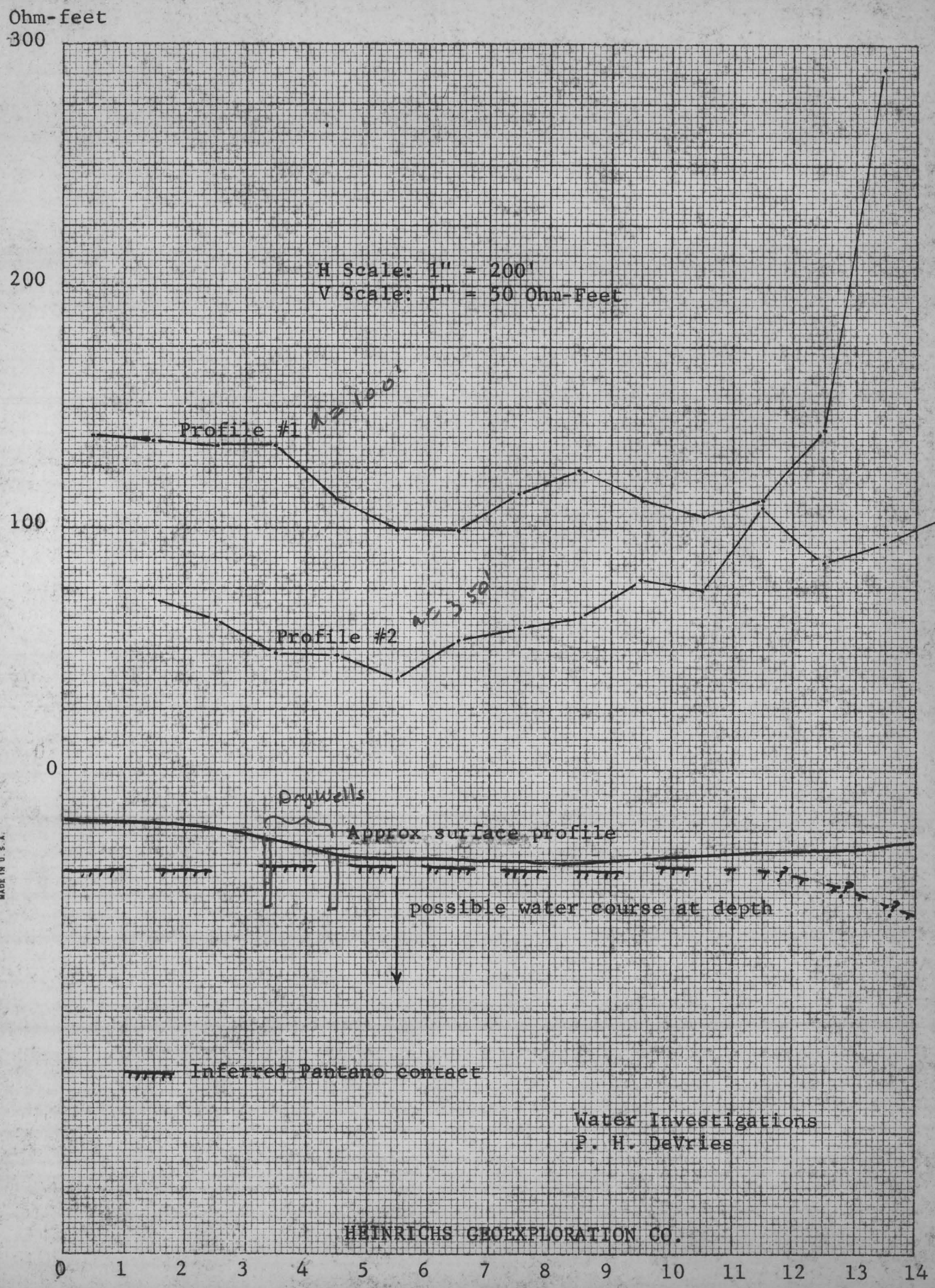


SKETCH MAP

SE¼, NW¼, Sec.4, T14S, R16E, G&SRB&M

Approx. Scale: 1" = 200'

HEINRICHS GEOEXPLORATION COMPANY

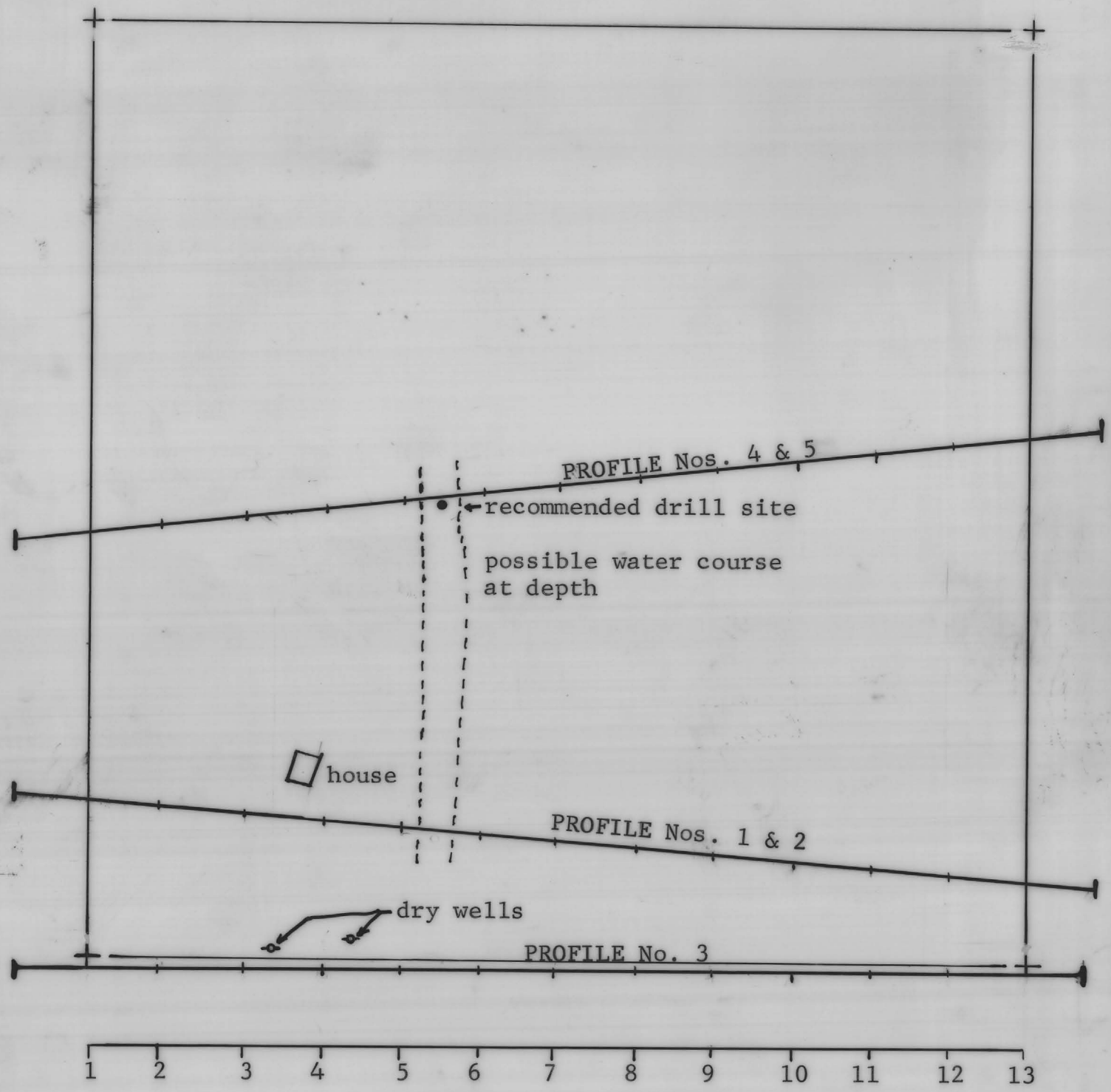


359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.

Devries

H_2O

WATER INVESTIGATIONS - Dr. P. H. DeVries

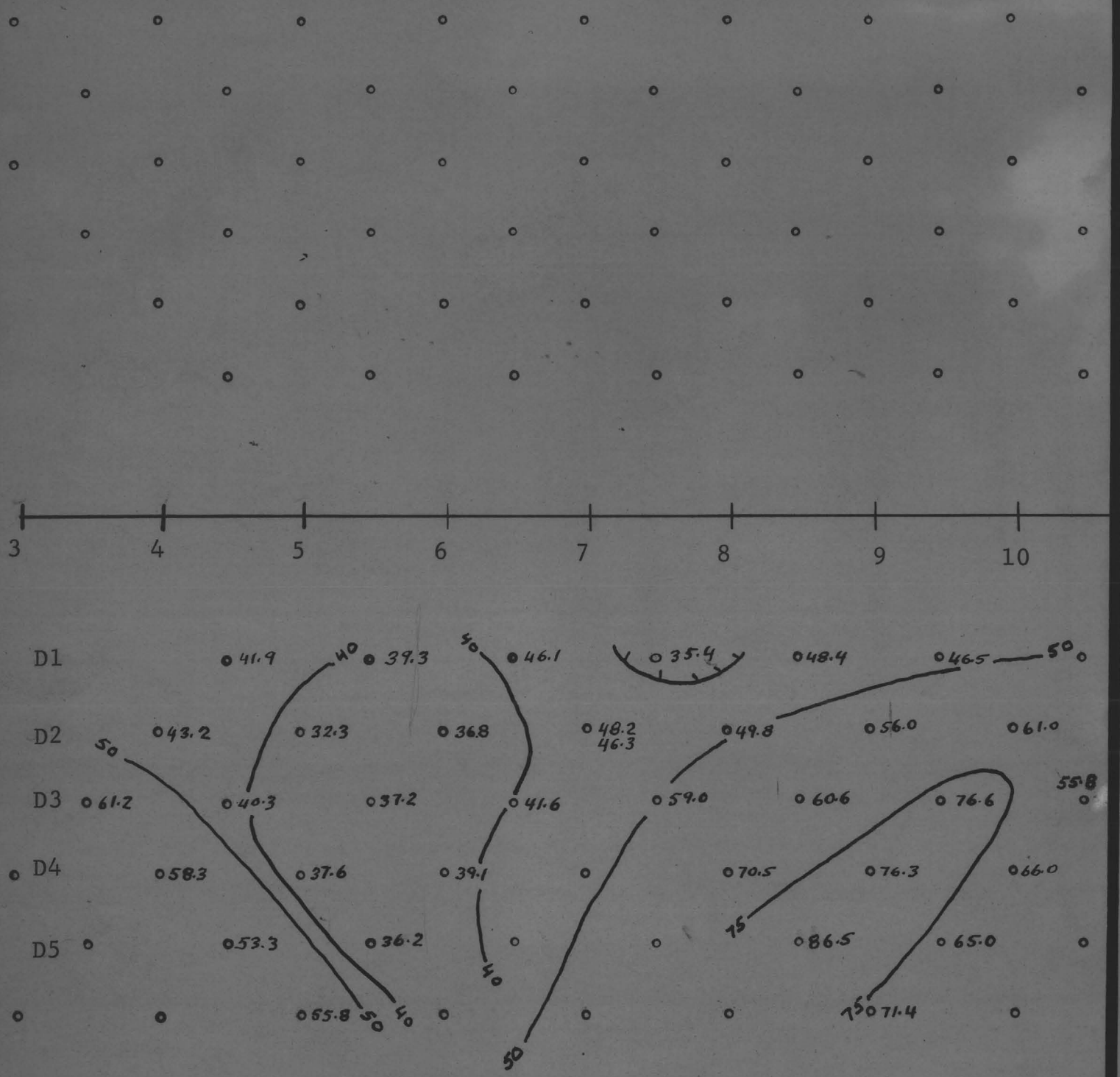


SKETCH MAP

SE¼, NW¼, Sec.4, T14S, R16E, G&SRB&M

Approx. Scale: 1" = 200'

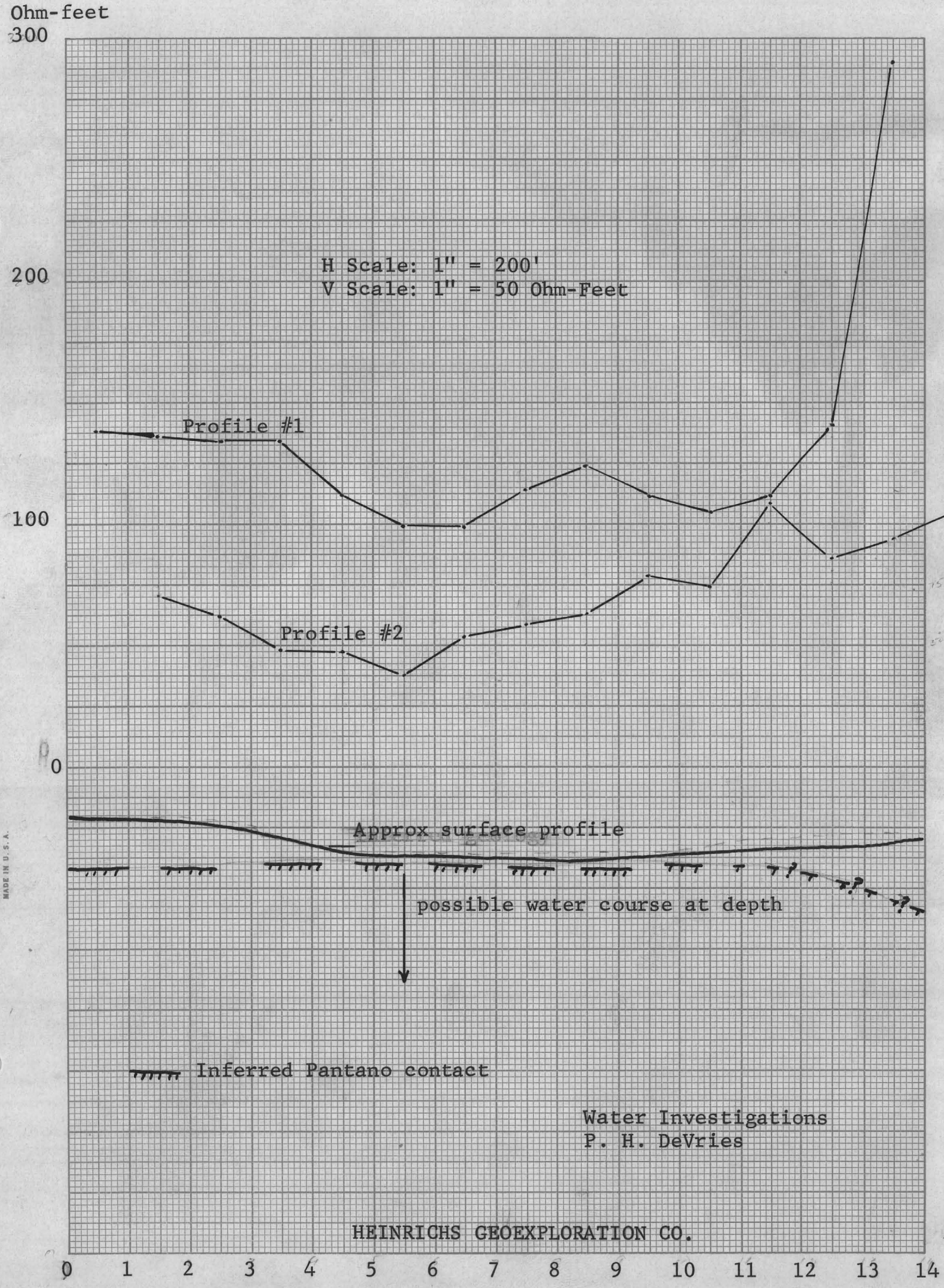
HEINRICHS GEOEXPLORATION COMPANY



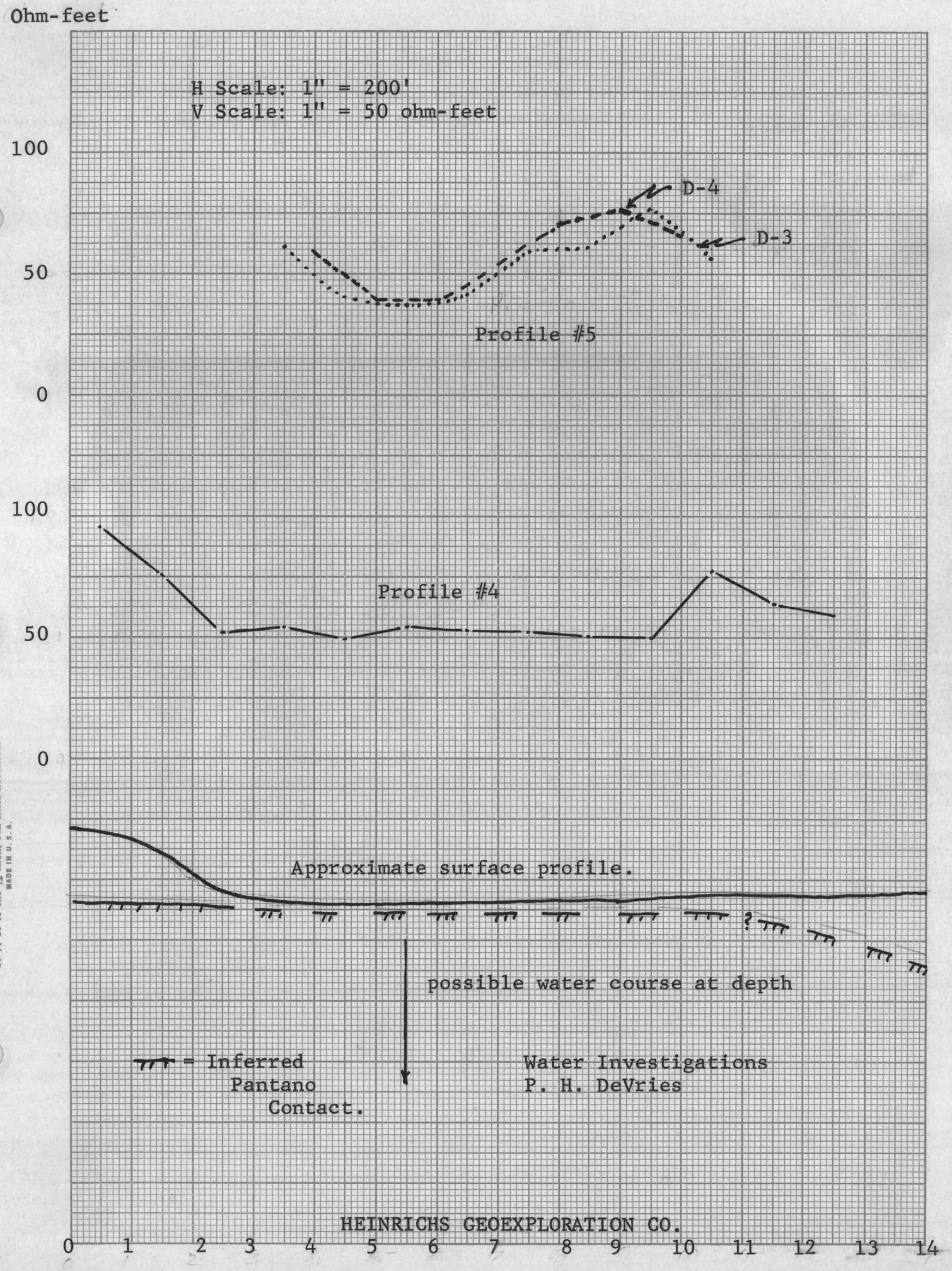
Induced Polarization
Resistivity Section
Profile #5

Water Investigations
P. H. DeVries

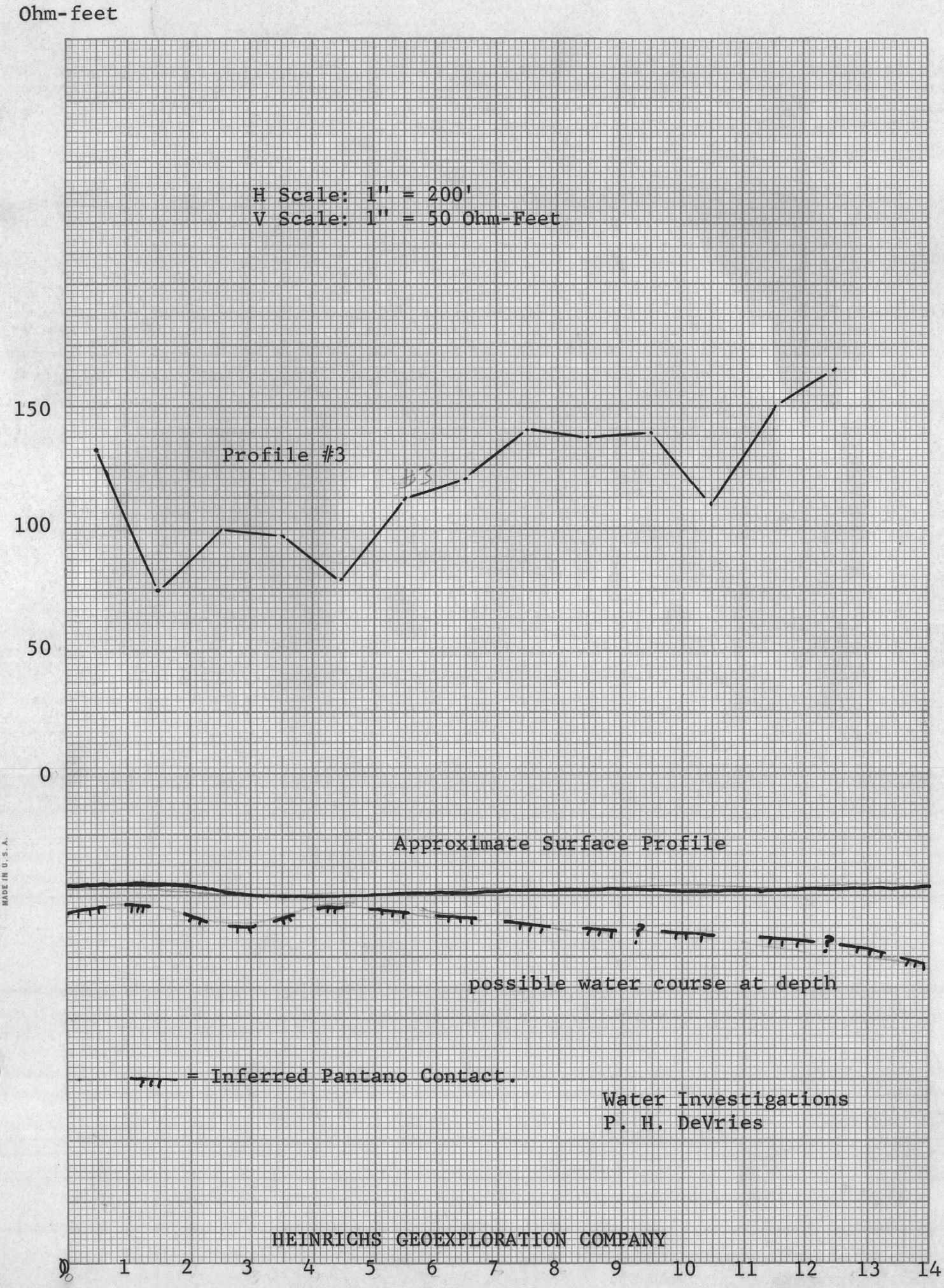
HEINRICHS GEOEXPLORATION COMPANY



359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U.S.A.



359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U.S.A.


Ohm-feet
H Scale: 1" = 200'
V Scale: 1" = 50 Ohm-Feet
150
100
50
0
Profile #3
#3
Approximate Surface Profile
?
?
possible water course at depth
= Inferred Pantano Contact.
Water Investigations
P. H. DeVries
HEINRICHS GEOEXPLORATION COMPANY
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U.S.A.

FRANK

Drill Logs from

Shaw

Copy of Log in Pima Co. File

Log of Well: - Catalina Development Co., ~~Box 382, Tucson, Ariz.~~
~~Quarter of~~ Sec. 33. Twp. 13 S. R 16E.
Used for (domestic, stock, ~~irrigation~~, (Test well for oil) ~~supply~~
Type - Drilled, 14" hole

Frank Crayroft - Driller.

#23

LOG

From Feet	To Feet	Material
0	11	Washed clay and gravel
11	54	Shale & sand streaks
54	57	Brown sandstone
57	63	Brown shale
63	78	Brown sandstone
	64	Water. 2 holes @ 64' & 68' (3" streams) Yield 400g/m by bailer.
78	81	Brown shale with coarse gravel.
81	190	Hard brown sandstone, dry.
	190	Warm water raised to 50' level.
190	193	Brown shale
193	203	Hard brown sandstone
203	205	Very hard sandstone, siliceous.
205	250	Hard brown sandstone
250	252	Brown shale with globules, light green oil
252	268	Brown shale and sand streaks.
268	298	Ditto with a little oil scattered through it.
298	302	Brown sand
302	315	Hard coarse sandstone, dry.
315	330	Brown shale with a little gas and light oil.
330	332	Hard dry brown sandstone.
332	340	Brown shale
340	377	Brown shale with sand streaks, with a little showing of oil.
377	380	Hard dry sand.
380	399½	Sand with little streaks of shale, gassy & oil.

Plugged at 350' with 50' concrete

Totals for 400', 163' shale and 226' sandstone.

Water Level: Depth from surface 64 feet. Date Aug. 1911.
Depth to first water when well was 50 feet. Date Nov. 1911.
W.L. Rose 14' when 190' level was reached.
Dip is 40° to S 80° W.

LOG

FROM Feet	TO Feet	Material
399½	424	Hard brown sandstone
424	500	Hard black sandstone, some gas and light oil.
500	505	Brown shale, gassy.
505	513	Shale and sand streaks. Heavy asphalt
513	515	Brown shale, gas
515	517	Half dry oil sand
cased to 518ft with 12" casing		Oil 12.° Baume , make about 10 gal. per day.
517	530	Hard Brown shale
530	551	Hard Brown sandstone
551	555	Coarse sandstone
555	582	Brown sandstone
582	592	Brown shale, gassy.
592	617	Brown sandstone
617	621	Very hard sandstone
621	630	Hard brown shale, gassy
630	654	Sandstone, layers shale - gassy, light oil.

Water Level: Depth from surface 60 feet. Date Oct. 10, 1911.

LOG

FROM Feet	TO Feet	Material
654	671	Sandy Blue Shale
671	680	Blue clay wash lime boulders
680	682	Very hard brown shale
682	730	Blue clay, lime and flint boulders
730	733	Blue shale, gas and light oil.
733	736	Hard brown sandstone
736	744	Blue shale
744	759	Blue clay, wash gravel
759	762	Hard Blue shale
762	764	Hard brown shale
764	769	Blue clay, wash gravel
769	799	Blue clay, lime, flint and quartz boulders.
799	807	Brown shale, gassy
807	821	Blue clay, boulders
821	827	Boulders and quicksand. Water rose to 40 feet of surface.

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project Devries Line Profile #5-W Field date 25/Nov Data page_____ Comp. date_____. Comp by_____

(A) Send	Cal	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4
(B) Receive		1w-2w →		2w-3w →			3w-4w →				4w-5w →	
(C) n separation		1	2	1	2	3	1	2	3	4	1	3
(D) I		1200	1100	1300	1200	1100	1200	1300	1200	1100	1200	1300
(E) Vdc (avg)		25.8	5.92	238	5.15	2.13	23.4	5.95	2.08	1.00	6.04	2.44
(F) DCcal	1.140											
(G) Kn x 10^{-3}		.3	1.2	.3	1.2	3.0	.3	1.2	3.0	6.0	1.2	3.0
(H) ρdc=ExFxGx10^3/D		7.35	7.37	6.26	5.87	6.63	6.67	6.26	5.93	6.23	6.89	6.42
(I) Vac Σ												
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρdc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)												
(O) MCF=(M-1)(10^5)/H												
		46.1	46.3	39.3	36.8	41.6	41.9	39.3	37.2	39.1	43.2	40.3

$\rho_{dc}/2\pi \times 2\pi = \rho_{ac}$

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send	2-3	1-2	4-5	3-4	2-3	1-2	2-3					
(B) Receive	4w-5w →		5w-6w →				Cal					
(C) n separation	4	5	3	4	5	6						
(D) I	1200	1100	1200	1300	1200	1100						
(E) Vdc (avg)	1.04	.53	3.45	1.76	.85	.51						
(F) DCcal							1.140					
(G) Kn x 10^{-3}	6.0	10.5	3.0	6.0	10.5	16.8						
(H) ρdc=ExFxGx10^3/D	5.99	5.76	9.84	9.27	8.49	8.89						
(I) Vac Σ												
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)												
(O) MCF=(M-1)(10^5)/H												
	37.6	36.2	61.2	58.3	53.3	55.8						

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

November 29, 1960

Dr. P. H. DeVries
116 N. Tucson Blvd.
Tucson, Arizona

Dear Dr. DeVries:

On November 23 and November 25, 1960 Heinrichs Geoexploration Co., at your request, conducted earth resistivity surveys at your property in the SE¼, NW¼, Sec. 4, T14S, R16E G&SRB&M in an attempt to determine the most likely sight for a water well for domestic purposes. The work consisted of one depth probe at the site of the southern most dry hole, using an expanding Wenner electrode configuration, three east-west resistivity profiles using 100 ft. Wenner configuration electrode spacing and 100 ft. station spacing, one east-west profile using 350 ft. Wenner configuration electrode spacing and 100 ft. station spacing and one induced polarization profile using an expanding dipole-dipole configuration and 100 ft. electrode spacing. The attached sketch plan shows the location of this work.

As suspected previously, and further indicated by the 100 ft. configuration profiles, there is no indication of an alluvium filled channel on your property on top of the Pantano that might be a source for water. Apparently the gravel outwash thickens to the west and to the east from the center of your property (see cross sections), but in my opinion, all indications are that the Pantano is above water table throughout your area.

The 350 ft. configuration resistivity profile and the induced polarization profile give an indication of the possibility of water at some depth in the Pantano. There is not sufficient resistivity relief to get any strong feeling or make any definite statements as to the water potential, but in my opinion a deep well (possibly 400-500 ft.) located some 450 ft. N 26°E of the house offers the best possibility of providing sufficient water for a domestic supply and this would be my first choice of a site.

As mentioned above, the gravel apparently thickens to the east and west with the greater thickness to the east and it is necessary to offer an alternative interpretation. That is, the possibility exists that a relatively shallow well might produce from the greater thicknesses of gravel along your east boundary. However, I believe that any channel that may exist in the area lies to the east of your property and that your chances for shallow water there are rather poor.

There is a distinct possibility that further resistivity investigation might give better definition to the water potential, possibly using a greater electrode spacing, providing for greater depth penetration and also running some north-south profiles, but I did not feel justified in proceeding with further work without further afirmation from you pending your evaluation of this report.

I shall make another trip to the property to more accurately tie down the location of the house, well and profiles and to mark a well location.

Our survey points are marked with orange flagging and I shall use blue and white flagging to mark the recommended drill site.

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1960
ARIZONA, U.S.A.

Respectfully submitted,

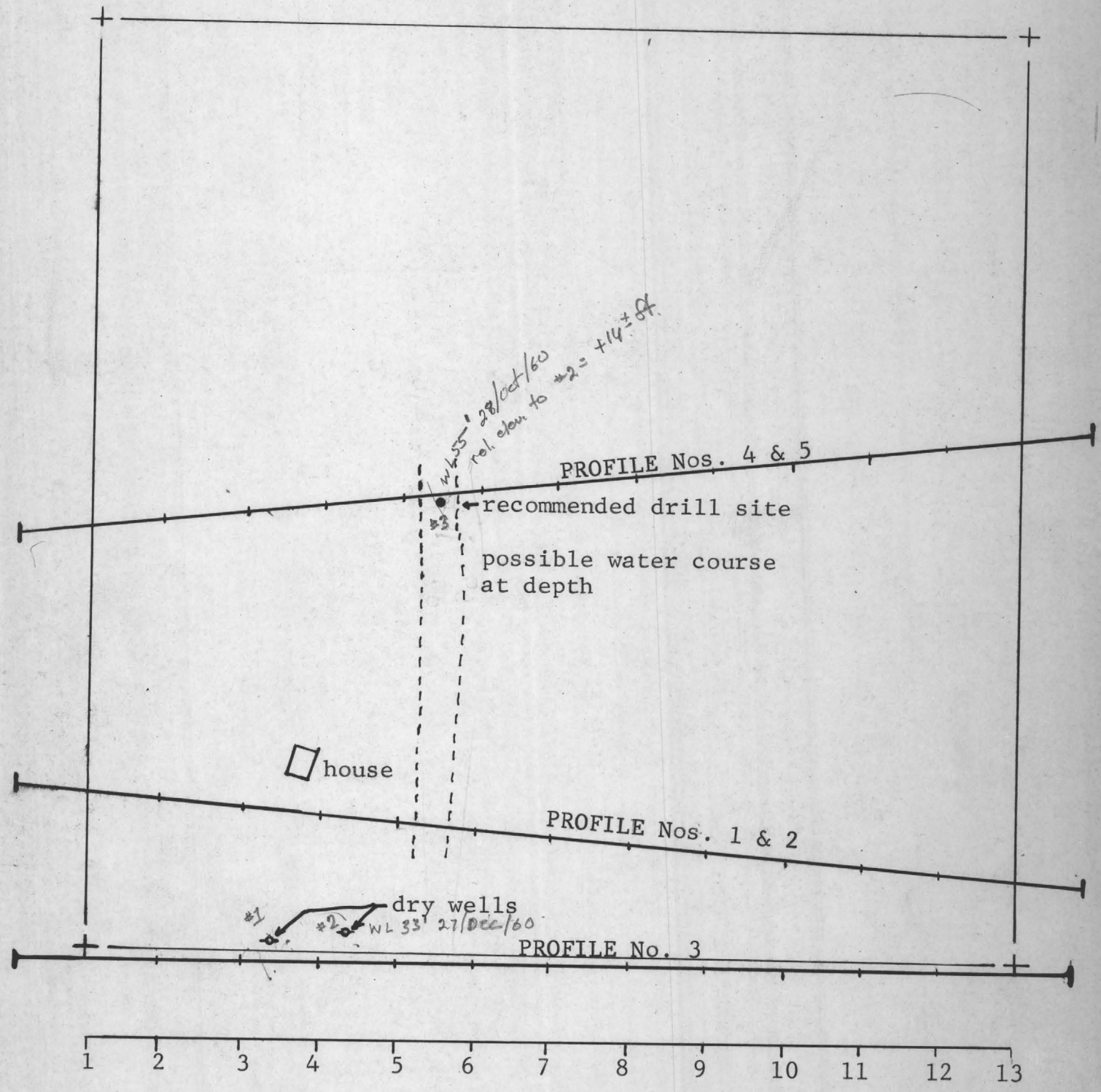
HEINRICHS GEOEXPLORATION COMPANY

Franklin A. Seward Jr.

Franklin A. Seward, Jr.
Geophysicist

FAS:jh

WATER INVESTIGATIONS - Dr. P. H. DeVries

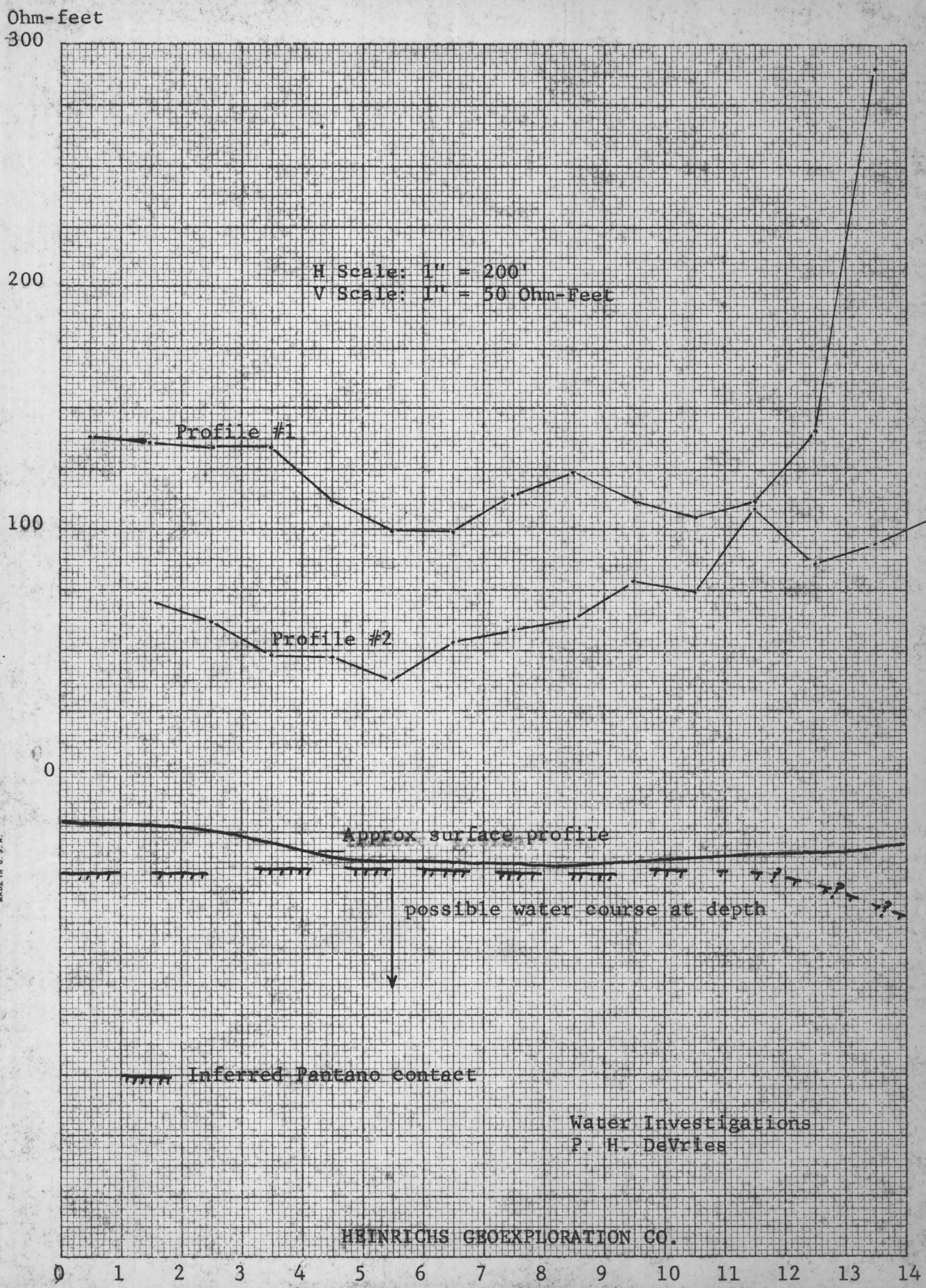


SKETCH MAP

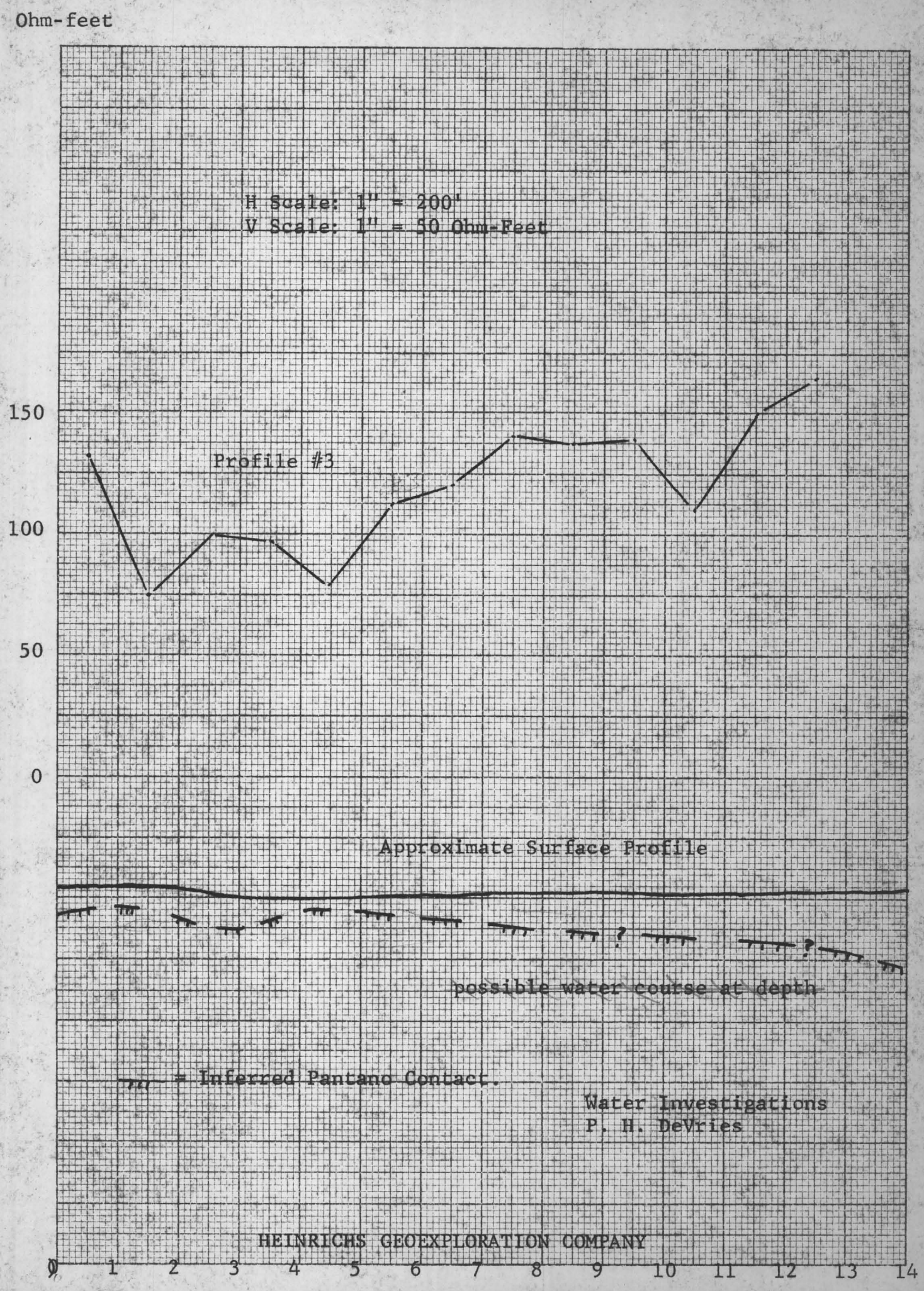
SE¼, NW¼, Sec.4, T14S, R16E, G&SRB&M

Approx. Scale: 1" = 200'

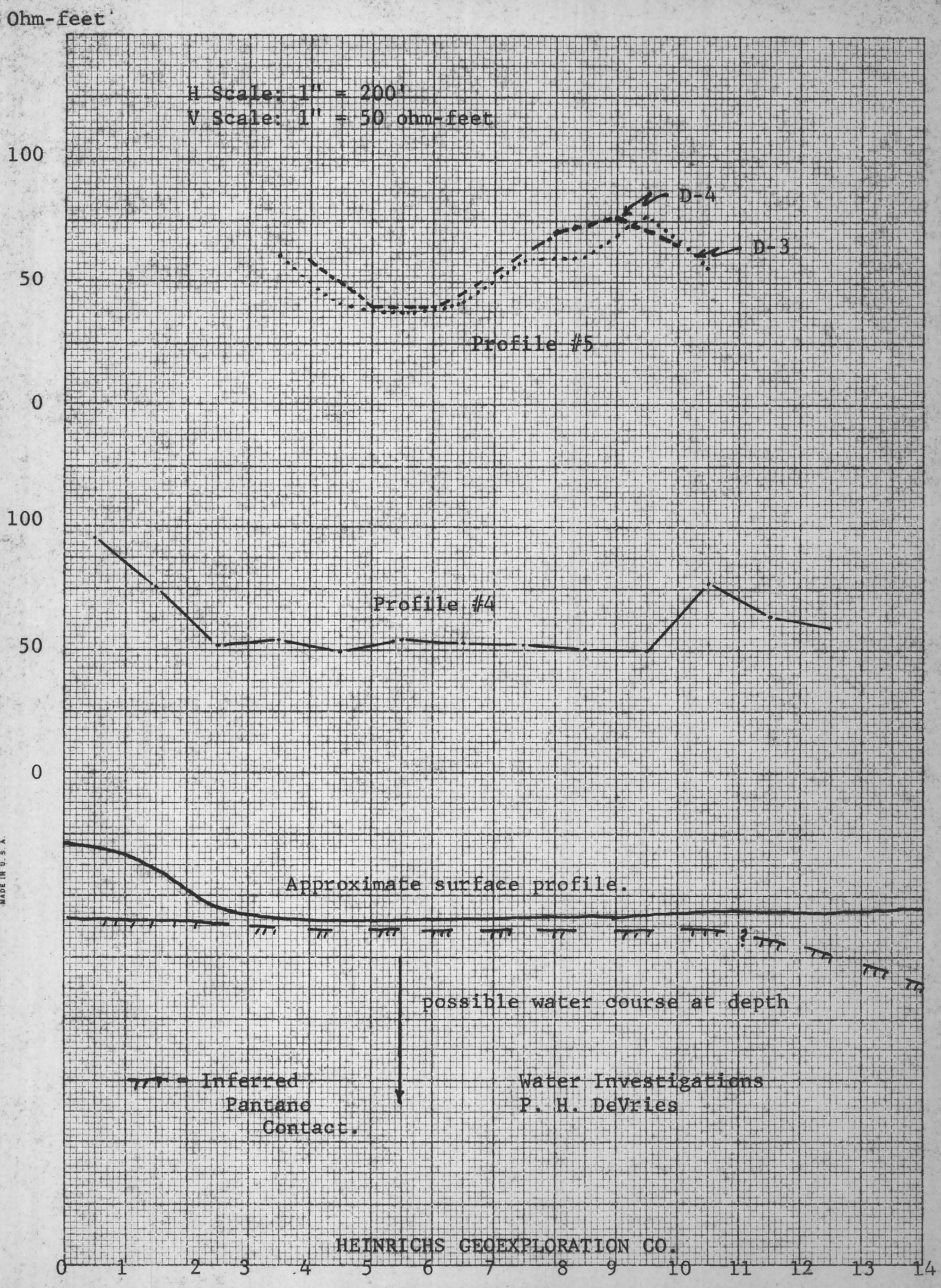
HEINRICHS GEOEXPLORATION COMPANY



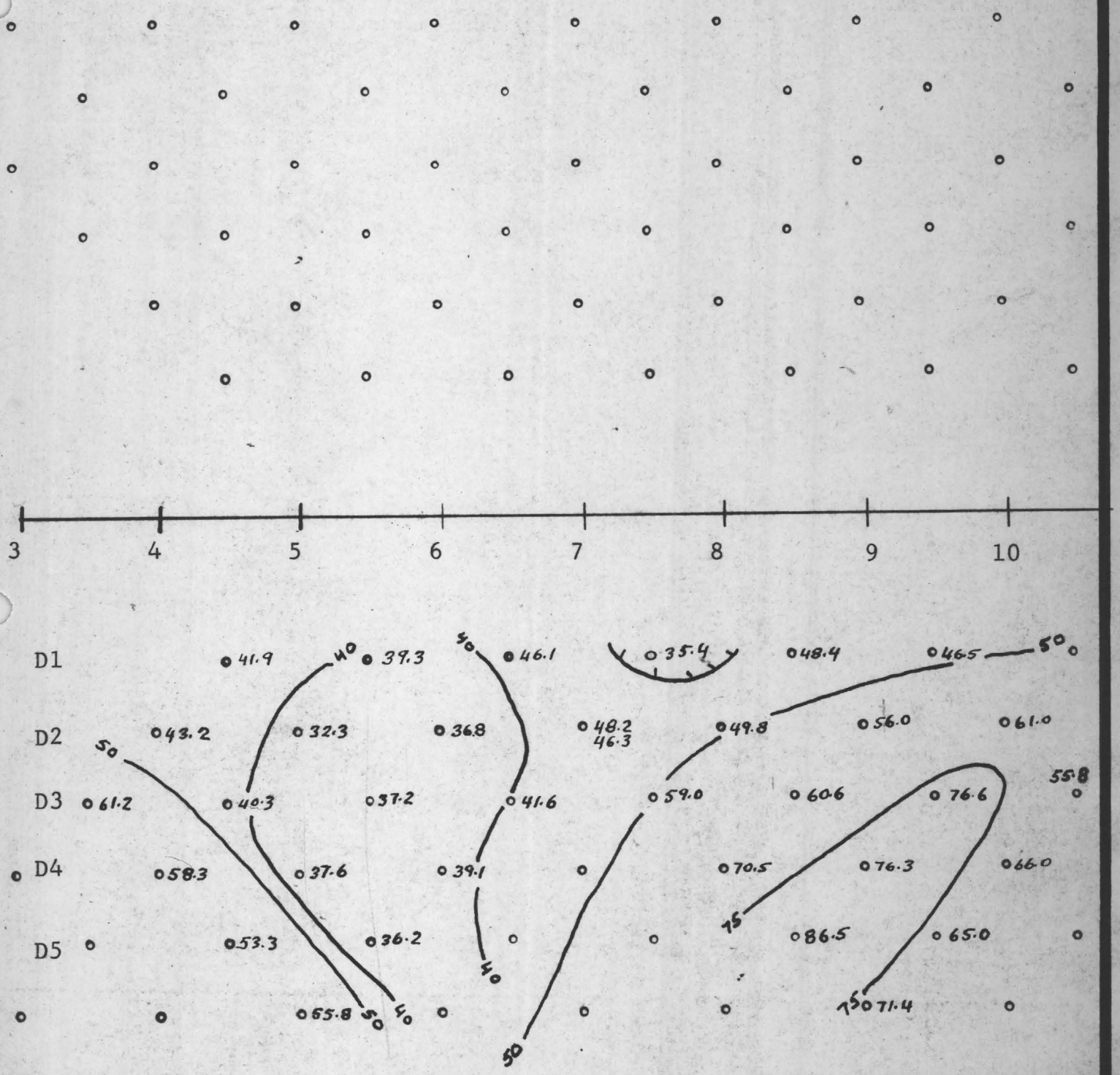
359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.



359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.



359-11 KEUFFEL & ESSER CO.
10 X 10 to the ½ inch, 5th lines accented.
MADE IN U. S. A.



Induced Polarization
Resistivity Section
Profile #5

Water Investigations
P. H. DeVries

HEINRICHS GEOEXPLORATION COMPANY

January 10, 1961

Dr. Paul H. DeVries
116 N. Tucson Blvd
Tucson, Arizona

Dear Dr. DeVries:

Following completion of drilling at the new well site to 612 ft., Heinrichs Geoexploration Co., at your request, made a study of the water potential of this well and also of #2 well at which the pump and tank are located.

On December 23, 1960, McDaniels Drilling Co. bailed the new well from 80 ft. to 612 ft. starting at 12:15 p.m. removing 108 bails in 2 hrs. 19 min., completing bailing at 2:34 p.m. The bailer holds roughly 17 gallons giving a total of 1840 gallons removed. Allowing for spillage, recharge, etc. this would be rounded off to a conservative 1700 gallons or approximately 3.2 gallons per foot. The calculated per foot volume for an 8 inch hole is 2.26 gallons but of course the hole will be slightly over size.

On December 24, 1960 at 12:15 p.m. I measured the depth to water and found it to be at 283 ft. The well had recovered 329 ft. in 21 hours and 41 minutes. Using a conservative figure of 8.5 in. for hominal hole size and 3 gallons per foot the yield would equal about 46 gallons per hour. Recovery was watched at this time to 1:52 p.m. by which time it had recovered an additional 27 ft. for an average of 16.25 ft. per hour or 48.8 gallons per hour.

On December 27, 1960 the well was again bailed from 59.0' to bottom. Due to the clearness of the water, the bailer leaked quite badly and no attempt was made to estimate the quantity of water removed. Recovery was again measured from 11:40 a.m. to 4:45 p.m. a total of 5 hrs. and 5 minutes during which time the well recovered from 601.5' to 514.5' a total of 87 ft. or some 261 gallons for a yield of about 51 gallons per hour.

On January 7, 1961 following the installation of the pump by McDaniels in the old well we conducted a pump test measuring drawdown, yield and recovery. The static level in this well was

42 ft. before pumping, was 28 ft. in the east well and 49 ft. in the new well. The pump was started at 10:35 and was pumped to pump depth (75 ft.) by 10:52. A total of 217.5 gallons was removed. Recovery was measured from 10:52 to 11:52 and was equal to exactly 0.0 ft. recovered. The static level was again measured in the other two wells and found not to have changed or to have come up a foot or two if anything.

Results of a quality test of the water from the new well by Arizona Serological Laboratories indicates the water to be quite hard but not unusable. However, some type of water softening should be definitely considered.

The following are my conclusions and recommendations:

1. To the best of our knowledge the new well is the only type of water existing on your property at reasonable depth. A possibility exists that at some greater depth (1000 - 1500 ft?) as bedrock is approached, these formations might yield more water, but this factor is unknown. Although the new well is the best location indicated by our work, it is entirely possible that similar wells might be developed particularly along this same north-south structure, or elsewhere especially in the northern portion of your property.

2. The other two wells apparently must be considered very poor--at least to 75' in the well with the pump. This well might have marginal or better use with pump set about 10' above the bottom but this factor is unknown.

It is our opinion that the new well will yield from 48 to 52 gallons per hour for an extended if not indefinite period of time. This conclusion is arrived at from the fact that the static level of approximately 50 ft. has recovered constantly with every drawdown since completion of drilling, that the recovered water after first bailing was exceptionally clean, and that the rate of recovery from bottom to at least 150 ft. was exceedingly constant, approximately 17 ft. or 50 gallons per hour.

4. It is further our opinion that this hole will stand uncased for a long period of time, if not indefinitely. This opinion is based again on the exceptional clarity of the water recovered following first bailing.

5. We therefore recommend the following procedure to develop your well:

a) That at least the surface casing be retained or a deeper one installed to 50', but that preferably the hole be cased to 175 ft. and perforated (approx. cost $3.00/ft.)

b) That a pump jack be installed with intake at 555 ft. operated by tank capacity or pressure switch and with contact shut off electrodes set at 530 ft., and a manual switch for emergency.use. This allows for approximately 1000 gallons of storage in the well plus the storage available in your 1000 gallon tank which should be sufficient for domestic purposes.

Of possible interest to you are some statistical figures obtained from the City of Tucson concerning the use of water in Tucson. The average Tucson domicile contains 4.25 persons, the average Tucson domicile uses 9500 gallons water per month on a 12 month basis which is equal to 316 gallons per day. The average domicile used 1.54 gal/min. peak rate at the peak hour (June 21, 1960) 6:30 a.m. - 7:30 a.m.) which is equal to 2217.6 gallons per day. If the peak hour is projected to 24 hours, the average person's use of water on a 12 month basis is therefore 74.5 gallons per person per day. These figures are based on domestic use only (3/4 inch meters). The normally quoted figures are based on the total urban use including industries. This figured for Tucson is 155 gallons per capita per day; Phoenix 200 gallons per capita per day; Salt Lake 230 gallons per capita per day, etc.

Based on the above it is our opinion that considering your storage facilities you have at least a 100 per cent safety factor and that your well is worthy of development.

Respectfully submitted,

HEINRICHS GEOEXPLORATION CO.

Walter F. Heinrichs, Jr.

Registered Professional Engineer (Mining) CERTIFICATE EXPIRES WALTER F. HEINRICHS, JR. DEC. 31, 1961 ARIZONA, U.S.A.

Franklin A. Seward, Jr.
Geophysicist

Approved:
January 10, 1961

November 29, 1960

Dr. P. H. DeVries
116 N. Tucson Blvd.
Tucson, Arizona

Dear Dr. DeVries:

On November 23 and November 25, 1960 Heinrichs Geoexploration Co., at your request, conducted earth resistivity surveys at your property in the SE¼, NW¼, Sec. 4, T14S, R16E G&SRB&M in an attempt to determine the most likely sight for a water well for domestic purposes. The work consisted of one depth probe at the site of the southern most dry hole, using an expanding Wenner electrode configuration, three east-west resistivity profiles using 100 ft. Wenner configuration electrode spacing and 100 ft. station spacing, one east-west profile using 350 ft. Wenner configuration electrode spacing and 100 ft. station spacing and one induced polarization profile using an expanding dipole-dipole configuration and 100 ft. electrode spacing. The attached sketch plan shows the location of this work.

As suspected previously, and further indicated by the 100 ft. configuration profiles, there is no indication of an alluvium filled channel on your property on top of the Pantano that might be a source for water. Apparently the gravel outwash thickens to the west and to the east from the center of your property (see cross sections), but in my opinion, all indications are that the Pantano is above water table throughout your area.

The 350 ft. configuration resistivity profile and the induced polarization profile give an indication of the possibility of water at some depth in the Pantano. There is not sufficient resistivity relief to get any strong feeling or make any definite statements as to the water potential, but in my opinion a deep well (possibly 400-500 ft.) located some 450 ft. N 26°E of the house offers the best possibility of providing sufficient water for a domestic supply and this would be my first choice of a site.

As mentioned above, the gravel apparently thickens to the east and west with the greater thickness to the east and it is necessary to offer an alternative interpretation. That is, the possibility exists that a relatively shallow well might produce from the greater thicknesses of gravel along your east boundary. However, I believe that any channel that may exist in the area lies to the east of your property and that your chances for shallow water there are rather poor.

There is a distinct possibility that further resistivity investigation might give better definition to the water potential, possibly using a greater electrode spacing, providing for greater depth penetration and also running some north-south profiles, but I did not feel justified in proceeding with further work without further afirmation from you pending your evaluation of this report.

I shall make another trip to the property to more accurately tie down the location of the house, well and profiles and to mark a well location.

Our survey points are marked with orange flagging and I shall use blue and white flagging to mark the recommended drill site.

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1960
ARIZONA, U. S. A.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Franklin A. Seward, Jr.

Franklin A. Seward, Jr.
Geophysicist

FAS:jh

November 4, 1960

Dr. Paul Devries
116 N. Tucson Blvd.
Tucson, Arizona

Dear Dr. Devries:

On 31 October 1960 I determined from courthouse records the location of your property to be the SW¼, NW¼, Sec. 4, T14S, R16E, G&SRB&M. I then examined records of the various wells in the area (including yours) on file at the U. S. Geological Survey Groundwater Branch and at the College of Agriculture, University of Arizona.

On 3 November 1960 I visited your property and made a reconnaissance surface examination including an examination of the well cuttings near the well at which the pump is currently set and the other cased hole and at a third location near the southwest corner of your property. Pursuant to our telephone discussion of this date, I called A. A. McDaniel and discussed with him the three holes drilled on your property and the wells on the 40 acres adjoining your property on the west. His opinion concurred with mine in that the success of the well to the west of your property was due to the fact that it is located over the Tanque Verde erosional channel and that the source of the water is Tanque Verde underflow. This is the source of water for nearly all the successful shallow wells in the area as determined from existing logs and records. All evidence indicates that the Pantano formation on your property is at a higher elevation than the water table in Tanque Verde Wash. If this is the case we could not expect to locate a well on your property with the source directly related to Tanque Verde underflow.

From surface examination it would appear that the two wells drilled in the southerly trending wash near the house stood the best chance of being located in a possible erosional channel cut in the Pantano formation to a depth below the Tanque Verde water table and such was not found to be the case. This does not definitely mean that no such channel exists as we often find that stream channels will migrate to some degree. It does, however, seriously limit the probability of the existence of such a channel.

COPY

Our geophysical investigation will be aimed at two possibilities. First determining the possible existence of an erosional channel as described above and second at the discovery of a possible water course, lense, or solution channel at some depth within the Pantano formation itself. I feel it necessary to mention that the Pantano formation is generally not a good aquifer and that the quality of water that does exist in water courses in the Pantano may vary from very good to very poor.

We might derive some optimism from the fact that a deep well located approximately one mile due north of your property in Section 33 produced water from several different depths in the Pantano. This well, originally drilled to a depth of 827 ft. in 1911, was bridged more recently at 350 ft. to provide water of better quality than some of the deeper water. I do feel that a resistivity survey is the best and possibly the only method of determining whether or not a domestic water supply exists on your property.

Resistivity surveying involves the work of five men. Our rate for this service is $200.00 per day. I believe that three days of work should provide sufficient information to determine your water possibilities. This service will include a final report and summary of the field data, together with whatever recommendations are possible.

We shall commence work as soon as scheduling permits following our receipt of the enclosed carbon copy of this letter signed by you.

Very truly yours,

HEINRICHS GEOEXPLORATION CO.

Franklin A. Seward

Franklin A. Seward, Jr.
Geophysicist

FAS: JH

encl: 1 copy

Paul Devries. M.D.

COPY

November 4, 1960

Dr. Paul Devries
116 N. Tucson Blvd.
Tucson, Arizona

Dear Dr. Devries:

On 31 October 1960 I determined from courthouse records the location of your property to be the SW¼, NW¼, Sec. 4, T14S, R16E, G&SRB&M. I then examined records of the various wells in the area (including yours) on file at the U. S. Geological Survey Groundwater Branch and at the College of Agriculture, University of Arizona.

On 3 November 1960 I visited your property and made a reconnaissance surface examination including an examination of the well cuttings near the well at which the pump is currently set and the other cased hole and at a third location near the southwest corner of your property. Pursuant to our telephone discussion of this date, I called A. A. McDaniel and discussed with him the three holes drilled on your property and the wells on the 40 acres adjoining your property on the west. His opinion concurred with mine in that the success of the well to the west of your property was due to the fact that it is located over the Tanque Verde erosional channel and that the source of the water is Tanque Verde underflow. This is the source of water for nearly all the successful shallow wells in the area as determined from existing logs and records. All evidence indicates that the Pantano formation on your property is at a higher elevation than the water table in Tanque Verde Wash. If this is the case we could not expect to locate a well on your property with the source directly related to Tanque Verde underflow.

From surface examination it would appear that the two wells drilled in the southerly trending wash near the house stood the best chance of being located in a possible erosional channel cut in the Pantano formation to a depth below the Tanque Verde water table and such was not found to be the case. This does not definitely mean that no such channel exists as we often find that stream channels will migrate to some degree. It does, however, seriously limit the probability of the existence of such a channel.

Our geophysical investigation will be aimed at two possibilities. First determining the possible existence of an erosional channel as described above and second at the discovery of a possible water course, lense, or solution channel at some depth within the Pantano formation itself. I feel it necessary to mention that the Pantano formation is generally not a good aquifer and that the quality of water that does exist in water courses in the Pantano may very from very good to very poor.

We might derive some optimism from the fact that a deep well located approximately one mile due north of your property in Section 33 produced water from several different depths in the Pantano. This well, originally drilled to a depth of 827 ft. in 1911, was bridged more recently at 350 ft. to provide water of better quality than some of the deeper water. I do feel that a resistivity survey is the best and possibly the only method of determining whether or not a domestic water supply exists on your property.

Resistivity surveying involves the work of five men. Our rate for this service is $200.00 per day. I believe that three days of work should provide sufficient information to determine your water possibilities. This service will include a final report and summary of the field data, together with whatever recommendations are possible.

We shall commence work as soon as scheduling permits following our receipt of the enclosed carbon copy of this letter signed by you.

Very truly yours,

HEINRICHS GEOEXPLORATION CO.

Franklin A. Seward, Jr.

Franklin A. Seward, Jr.
Geophysicist

FAS: JH

encl: 1 copy

Paul Devries. M.D.

Dear Dr –

Just talked to McDaniel on the phone as I was signing this letter and agree that if there is a chance of making a producer out of one of your present wells that that is the best bet – so I am holding off until I get further word from you As I told you on the phone – one way or the next you'll have water at your door step.

Am enclosing a simple explanation of the resistivity method strictly schematic of course

Sincerely

F. A. Lenard Jr.