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HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT IRON KING - HANNA
LINE #1 HALF S SP. A DATE 2/13

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-7.5	7.5-15	→	15 —	—	→ 22.5	22.5	—	—	→ 30
RANGE	.3	.3	.1	.3	.1	.03	.3	.1	.03	.03
DC 1	115-113	153-156	45-45.8	110-110	42.1-43	17.4-18.0	97-97	27-28.2	14.8-15.2	7.5
DC 2	116-112	154-155	46.0-45	110-110	42.1-43	17.5-18.1	97-97	28.2-27.5	15.0-15.8	7.8
DC 3	116-112	153-155	45-45.8		41-42.8	17.4-18.0		27.29.2	15.2-15.8	7.5
DC 4			45.8-44.9							7.8
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	114	154	45.4	110	42.3	17.7	97	27.7	15.3	7.7
AC 1	111	151	44.3	107	41.5	17.53	96	27.2	15	7.4
AC 2	111	151	44.3	107	41.5	17.3	96	27.2	15	7.4
AC AVG.	111	151	44.3	107	41.5	17.4	96	27.2	15	7.4
S.P. +	1.61	+5.0	+12.2				+1.3			
AC NOISE	0.2									
POT RES.										

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PAGE 2

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT IORN KING - HANNA

LINE 1 HALF S SP. A DATE 2/13

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CAL
RECEIVE	30 →			37.5	37.5 →			45		3-4
RANGE	.1	.03	.03	.01	.03	.01	.01	.01		
DC 1	23.0	9.3	7.6	4.35	10.0	5.45	505-415	2.85		98-98
DC 2	23.5	10.6	5.6	4.40	10.9	5.09	51-415	3.50		98-98
DC 3	23.0	10.6	7.6	4.25	10.1	5.85	435-51	2.9		
DC 4	23.5	9.3	5.6	4.05	10.9	5.55	415-49	3.5		
DC 5				4.05		5.55-6.0	445 475	3.05-3.4		
DC 6				4.30		5.05-5.5		3.5-2.75		
DC 7				4.30		5.30-6.10				
DC 8				4.00						
DC AVG.	23.3	10.0	6.6	4.2	10.5	5.66	4.63	3.2		
AC 1	22.5	9.6	6.4	3.95	10.1	5.45	4.35	3.00		98
AC 2	22.5	9.6	6.4	3.95	10.1	5.45	4.35	3.00		98
AC AVG.	22.5	9.6	6.4	3.95	10.1	5.45	4.35	3.00		
S.P.	+10.9				+10.0					
AC NOISE										
POT RES.	ash	Chris								

EW fence at. 37.0 ft.

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Iron King (Hanna)

LINE 1 HALF S SP. 750 DATE 2/13/6

PAGE 1

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-750	750-1500	750-1500	1500-2250	→	→	2250-3000	→	→	→
RANGE	X 10	→	→	→	→	→	→	→	→	→
VOLTAGE	195	210	200	220	210	200	250	220	210	200
CURRENT	4.0	→	→	→	→		4.0			
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CAL
RECEIVE	3000-3750	→	→	→	3750	4500	→	→		1 AMP
RANGE	→	→	→	→	→	→	→	→		3-4
VOLTAGE	250	220	210	200	250	220	210	200		80
CURRENT	4									

FREQUENCIES 0.5 3.0

SENDER NO. Mark 7 10663 S

OPERATOR H. Lindsay

RECEIVER NO. 3641

OPERATOR J. McLean

COMMENTS: BLEW 20 AMP. FUZE ON 4-5 second STATION First ½ OF LINE JUST AFTER changing TO 4-5 on AC

6.40
5 | 32
30
20

16

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page 2

Project IRON KING (HANNA) Line 1 south ST A Field date _____ Data page 2 Comp. date _____. Comp by H.L.

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal
(B) Receive	0-7.5	7.5-15 →		15.0 →		22.5	22.5 →			30		3-4
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	4.0 →											1 amp
(E) Vdc (avg)	114	154	45.4	110	42.3	17.7	97	27.7	15.3	7.7		98
(F) DCcal	~~98~~ →											1.021
(G) Kn x 10^{-3}	2.25	2.25	9.0	2.25	9.0	22.5	2.25	9.0	22.5	45.0		
(H) ρ dc=ExFxGx10^3/D	~~63~~ 66	~~85~~ 89	~~100~~ 104	~~64~~	~~93~~ 97	~~98~~ 102	~~54~~ 56	~~64~~	~~84~~ 89	~~84~~ 86		
(I) Vac Σ	111	151	44.3	107	41.5	17.4	96	27.2	15	7.4		98
(J) AC noise x 2	—	—										9
(K) Vac(corr) = $\sqrt{I^2 - J^2}$	—	—										
(L) AC-DC cal.	1.00 →											1.000
(M) ρ dc/ρac=ExL/K	1.028	1.020	1.023	1.027	1.020	1.017	1.010	1.018	1.020	1.041		
(N) PFE=(M-1)(10^2)	2.8	2.0	2.3	2.7	2.0	1.7	1.0	1.8	2.0	4.1		
(O) MCF=(M-1)(10^5)/H	~~43~~ 42	~~23~~ 22	~~23~~ 22	~~44~~ 42	~~22~~ 21	17	~~19~~ 18	~~29~~ 28	~~24~~ 22	48		
	+19.1	+5.0	+12.2	+12.2			+1.3					

Project " Line 1 south Field date " Data page " Comp. date " Comp by "

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5				
(B) Receive	30 →			37.5	37.5 →			45.0				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	4.0 →											
(E) Vdc (avg)	23.3	10.0	6.6	4.2	10.5	5.66	4.63	3.2				
(F) DCcal	~~98~~ →											
(G) Kn x 10^{-3}	9.0	22.5	45.0	78.75	22.5	45.0	78.75	126.0				
(H) ρ dc=ExFxGx10^3/D	~~52~~ 54	~~85~~ 87	~~73~~ 76	~~84~~	~~58~~ 60	~~67~~ 65	~~89~~ 93	~~98~~ 103				
(I) Vac Σ	22.5	9.6	6.4	3.95	10.1	5.45	4.35	3.00				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$	3.3	~~3.6~~ 5.9	3.1	6.8	3.8	3.3	5.5	6.3				
(L) AC-DC cal.	1.00 →											
(M) ρdc/ρac =ExL/K	1.035	1.042	1.032	1.063	1.040	1.033	1.063	1.067				
(N) PFE=(M-1)(10^2)	3.5	4.2	3.2	6.3	4.0	3.3	6.3	6.7				
(O) MCF=(M-1)(10^5)/H	~~67~~ 65	~~26~~ 24	~~44~~ 42	~~78~~ 76	~~69~~ 67	~~83~~ 81	~~71~~ 68	~~68~~ 65				
	+10.9				+10							

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c

PAGE

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Iron King - Hanna

LINE 1 HALF N SP. A DATE 2/13

SEND	1-2	2-3	1-2	3-4	2-3	-1-2	4-5	3-4	2-3	1-2
RECEIVE	0-750	750-1500	→	1500-2250	→	→	2250-3000	→	→	→
RANGE										
DC 1	155	115	44.5 45.2	158 157	49	28	226	65	28.1	19.4
DC 2	153	114	46.0	156	50	29	228	65	28.8	20.1
DC 3	155	115	46.0 45.5	157 157.2	49	28	226	65	28.7	20.1
DC 4	153.5	114.5	45.0	156.5	50	29	226	65	28.1	19.6
DC 5			45.0 45.5	158 157.2						
DC 6			46.0	156.5						
DC 7										
DC 8										19.4 19.4
DC AVG.	154	114.5	45.5	157.2	49.5	28.5	227	65	28.4	19.8
AC 1	149	111	44.2	152	47.5	27.2	220	62.5	27.3	19.0
AC 2	149	110	44.2	152	47.5	27.3	220	62.5	27.4	19.0
AC AVG.										
S.P.	-.4	+4.7	→	-5.9			+21.5			
AC NOISE	.3			.3						
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT IRON KING - HAUNA

LINE 1 HALF N SP. A DATE 2/13

PAGE

SEND	4-5	4-3	3-2	2-1	11-5	3-4	2-3	1-2	CAL	
RECEIVE	30-37.5	→		→	37.5-45	→		→	2-3	
RANGE			.03	.03	.10	.03	.03	.03		
DC 1	51.5 51	25.0 23	11.5 11.9	18.5 18.9	23.8 24.0	15.2	9.0	7.6	98	
DC 2	50.5	21.2	12.3	19.3	24.1	15.0	9.2	7.5	98	
DC 3	49.0 50.5	25.0 23	11.5 11.9	18.5 18.9	23.9 24.0	15.1	9.2	7.6	98	
DC 4	52.0	21.2	12.3	19.4	24.1	15.1	8.9	7.5	98	
DC 5	52.0									
DC 6	50.0 51			? ↑						
DC 7										
DC 8				8.9						
DC AVG.	51.2	23.1	11.9	18.9	24.0	15.1	9.1	7.55		
AC 1	49.0	22.3	11.5	18.5	23.0	14.4	8.6	7.1	97.0	
AC 2	49.0	22.2	11.6	18.6	23.1	14.4	8.7	7.1	97.5	
AC AVG.				? ↑						
S.P.	+19.9				-29.4					
AC NOISE				8.6						
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT IRON KING - HANNA

LINE 1 HALF N SP. ____ DATE 2-13

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0→7.5	7.5 →	15	15 →		22.5	22.5 →			30
RANGE	X 10	X 10		X 10			X 10			
VOLTAGE	250	210	250	210	215	230	200	215	215	245
CURRENT	4.0	4.0		4.0			4.0			
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		CAL
RECEIVE	30 →			47.5 →						
RANGE	X 10			X 10						X 1
VOLTAGE	200	200	210	230	200	200	225	215	250	85
CURRENT	4.0			4.0						1.0

FREQUENCIES 3 .05

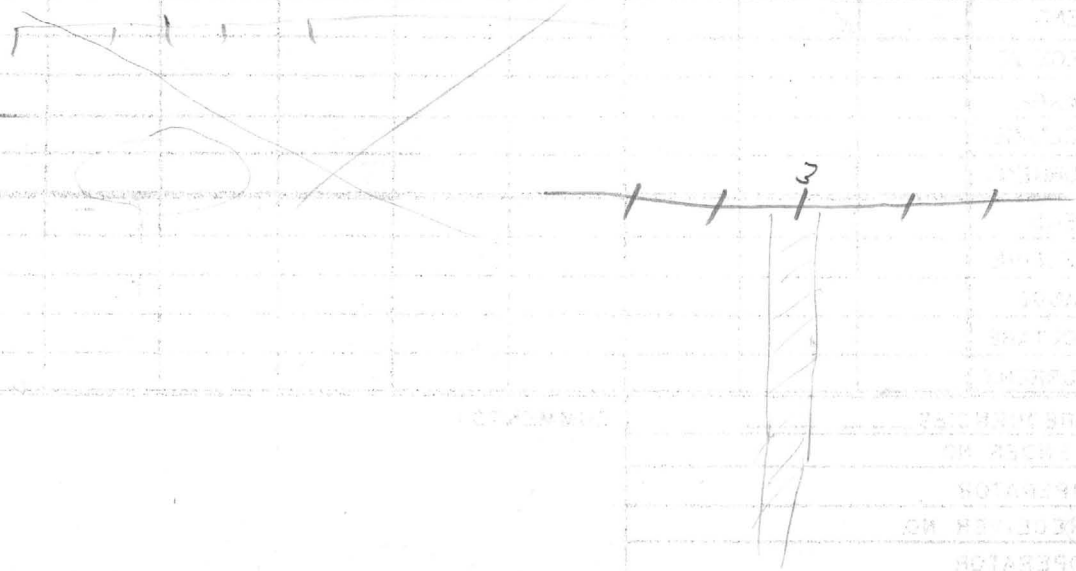
SENDER NO. 106635

OPERATOR RPF

RECEIVER NO. 3641

OPERATOR J McLAUL.

COMMENTS:



HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

2.0 x 2.8 → x 2.3 2.1 ← 2.8 x 2.1 →

Page_____

Project IRON KING Line 1-N 1/2 Field date FEB 14 Data page_____ Comp. date_____. Comp by JMC

(A) Send	4-2	2-3	4-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		2-3
(B) Receive	0-7.5	7.5-15	→	15-22.5	→	→	22.5-30	→	→	→		Cal
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	4	→	→	→	→	→	→	→	→	→		1.0
(E) Vdc (avg)	154	114.5	45.5	157.2	49.5	28.5	227	65	28.4	19.8		98
(F) DCcal	.980	→	→	→	→	→	→	→	→	→		1.021
(G) Kn x 10^{-3}	2.25	2.25	9.0	2.25	9.0	22.5	2.25	9.0	22.5	45.0		
(H) ρ dc=ExFxGx10^3/D	~~85~~ 89	~~63~~ 65	100 104	~~87~~ 91	109 118	~~157~~ 164	~~126~~ 130	~~143~~ 149	~~157~~ 163	~~218~~ 227		
(I) Vac Σ	149	110.5	44.2	152	47.5	27.2	220	62.5	27.35	19.0		97.25
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.995	→	→	→	→	→	→	→	→	→		.993
(M) ρ dc/ρac=ExL/K	1.028	1.031	1.024	1.014	1.037	1.042	1.026	1.035	1.035	1.036		
(N) PFE=(M-1)(10^2)	2.8	3.1	2.4	1.4	3.7	4.2	2.6	3.5	3.5	3.6		
(O) MCF=(M-1)(10^5)/H	~~33~~ 31	~~49~~ 46	~~24~~ 23	~~16~~ 15	~~34~~ 32	~~27~~ 26	~~21~~ 20	~~24~~ 23	~~22~~ 21	~~17~~ 16		
	-.4	+4.7		-5.9			+21.5					

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2				
(B) Receive	30-37.5	→	→	→	37.5-45	→	→	→				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	4	→	→	→	→	→	→	→				
(E) Vdc (avg)	51.2	23.1	11.9	8.9	24.0	15.1	9.1	7.55				
(F) DCcal	.980	→	→	→	→	→	→	→				
(G) Kn x 10^{-3}	9.0	22.5	45	78.75	22.5	45	78.75	126.0				
(H) ρ dc=ExFxGx10^3/D	~~113~~ 118	~~127~~ 132	~~131~~ 137	~~171~~ 178	~~132~~ 138	~~166~~ 173	~~175~~ 182	~~233~~ 243				
(I) Vac Σ	49.0	22.3	11.5	8.6	23.1	14.4	8.7	7.1				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.995	→	→	→	→	→	→	→				
(M) ρdc/ρac =ExL/K	1.039	1.030	1.028	1.030	1.034	1.044	1.040	1.057				
(N) PFE=(M-1)(10^2)	3.9	3.0	2.8	3.0	3.4	4.4	4.0	5.7				
(O) MCF=(M-1)(10^5)/H	~~35~~ 33	~~24~~ 23	~~21~~ 20	~~18~~ 17	~~26~~ 25	~~27~~ 25	~~23~~ 22	~~24~~ 23				
	+19.9			↑ ?	-29.4							

$\frac{I_{cal}}{10 V_{cal}}$

$$
\begin{array}{r}
6.59 \\
5\,\overline{)\,32.96} \\
\underline{30} \\
29 \\
\underline{25} \\
46
\end{array}
$$

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HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT IRON-KING "HA[illegible]

LINE #1 HALF S SP. [illegible] DATE 2-15

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	[illegible]	4-5
RECEIVE	1 → 2	2 →	3	3 →		4	4 →			5
RANGE	.3	.3	.1	.1	.03	.03				
DC 1	130	80.0	28.5	55.5	20.0	10.5				
DC 2	128	80.0	29.0	56.5	20.0	10.7				
DC 3	127	80.0	28.5	55.0	20.0	10.4				
DC 4	129	80.0	29.0	56.5	20.0	10.7	not	completed to		
DC 5										
DC 6						10.6	changed			
DC 7						10.1				
DC 8							another	line		
DC AVG.	129	80	28.8	55.9	20	10.6				
AC 1	125	78.0	28.0	54.5	19.4	10.1				
AC 2	125	78.0	28.0	54.5	19.4	10.1				
AC AVG.	125	78.0	28.0	54.5	19.4	10.1				
S.P.	-7.1	+93.8	+4.6				+91.3			
AC NOISE							CROSSED FENCE			
POT. RES.										

FENCE AT 1,000 ft S of #3

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT IRON KING (HANNA)
LINE #1 HALF S SP. "B" DATE 2-14

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CAL.
RECEIVE	5 →			→ 6	6 →			→		3-4
RANGE										
DC 1										99.5
DC 2										99.5
DC 3										99.5
DC 4										99.5
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1										99.5
AC 2										99.5
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

Line A Electrode #3 = Line #B #4

go 1000' N38E then 500 N66W
to center Line (2)

run 1000' centers N66W + S66E

INDUCED POLARIZATION SENDER NOTES

Project: Iron King - Hanna Line: 1(b) south Date: 2/14

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
Receive	0-1.0	1.0	2.0	2.0		3.0	3.0			4.0		
~~Time~~ Voltage	195	220	—	250			130					
Range	x10							uncompleted moved to different line				
Current	4.0						2.0					
Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5			Cal. 3-4	
Receive	4.0			5.0	5.0			6.0			lamp	
Time												
Range												
Current												

1000' spacing

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project IRON KING (HANNA) Line 1 (b) South Field date_____ Data page_____ Comp. date_____. Comp by H.L.

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2					
(B) Receive	1-2	2.0	3.0	3.0		4.0	4.0					
(C) n separation	1	1	2	1	2	3						
(D) I	4.0											
(E) Vdc (avg)	129	80	28.8	55.9	20.0	10.6						
(F) DCcal	.995											
(G) Kn x 10^{-3}	3.0	3.0	12.0	3.0	12.0	30.0						
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ	125	78.0	28.0	54.5	19.4	10.1						
(J) AC noise x 2	.04											
(K) Vac(corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	3.2	2.6	2.8	2.6	3.1	5.0						
(O) MCF=(M-1)(10^5)/H												

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send												
(B) Receive												
(C) n separation												
(D) I												
(E) Vdc (avg)												
(F) DCcal												
(G) Kn x 10^{-3}												
(H) ρ dc=ExFxGx10^3/D												
(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												

int. .87
ext.

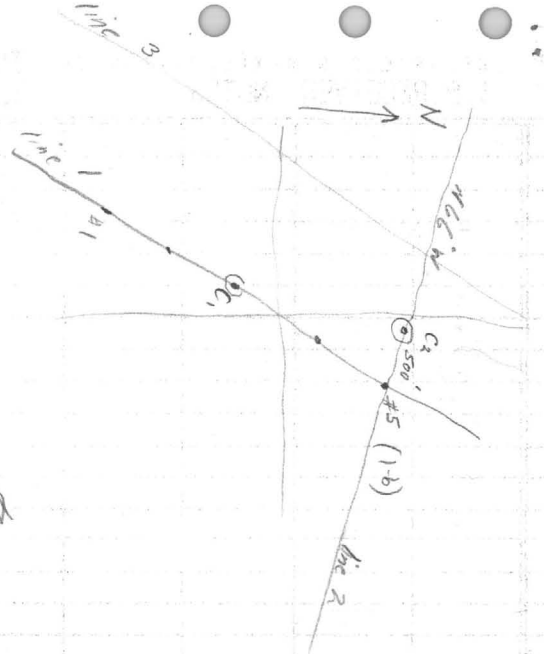
PAGE

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Iron King - Hanna
LINE 2 HALF W SP. 1000 DATE 2/16

	4-5	3-4	2-3	3-4	2-3	1-2	4-5	3-4	2-3	1-2
SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-1.0	1.0	2.0	2.0		3.0	3.0			4.0
RANGE	.3	.3	.1	.1	.1	.03	.1	.03	.03	.01
DC 1	135	108	49.0	58.8	19.8	12.2	50	17.5	8.5	5.8
DC 2	135	111	43.5	55.0	22.0	12.8	46.3	15.6	8.6	6.0
DC 3	135	108	49.3	54.8	19.7	12.2	46.3	15.9	8.0	5.82
DC 4	135	111	43.4	60.0	23.8	13.4	50.0	16.7	9.0	5.72
DC 5			43.2	54.2		13.3		16.5	7.7	5.8
DC 6			49.8	60.0		11.8		16.2	9.0	6.0
DC 7								16.0	7.8	
DC 8								16.8	9.0	
DC AVG.	135	110	46.4	57.1	21.8	12.6	48.1	16.4	8.5	5.9
AC 1	132	107.5	45.2	56	21.0	12.3	47.0	16.1	8.2	5.7
AC 2	132	107.5	45.2	56	21.0	12.3	47.0	16.1	8.2	5.7
AC AVG.	132	107.5	45.2	56	21.0	12.3	47.0	16.1	8.2	5.7
S.P.	-3.1	+5.9		-2.2			+8.5			+11.6
AC NOISE	0.1						>			
POT RES.										



0.1 Ω

10 ma

100/97.7

Ical / 10 Vcal

Bearing N 66° W

PAGE

HEINRICHS GEOEXPLORATION CO. PROJECT I.K. (Hanna)

I.P. RECEIVER NOTES LINE 2 HALF W SP. DATE

	1-2	2-3	3-4	4-5	1-2	4-5	3-4	2-3	1-2		
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2			(a).
RECEIVE	4.0			5.0	5.0			6.0			2-3
RANGE	.03	.03	.03	.03	.03	.03	.03	.01			.3
DC 1	20.5	12.0	11.3	7.1	9.8	7.7	7.5	5.3			97
DC 2	19.5	13.8	9.3	7.6	11.0	9.8	8.0	5.7			98
DC 3	19.5	12.6	9.0	7.0	11.5	8.5	8.0	5.4			97.5
DC 4	21.0	14.3	11.8	8.0	9.5	8.5	6.6	5.6			98
DC 5	19.7	12.8	12.0	8.7	11.5	8.5	7.0	~~6.0~~			
DC 6	20.2	13.8	8.5	6.4	9.7	7.4	7.8	~~6.4~~			
DC 7	18.6	12.8	8.9	8.7		7.9					
DC 8	21.5	14.1	11.6	6.1		8.5					
DC AVG.	20.1	13.3	10.3	7.5	10.5	8.3	7.5	5.8			
AC 1	19.7	12.7	9.9	7.1	10.0	7.4	6.6	5.35			98
AC 2	19.6	12.7	9.8	7.1	10.0	7.7	6.6	5.35			98
AC AVG.	19.6	12.7	9.9	7.1	10.0	7.6	6.6	5.35			
S.P.	-6.6	-2.6	-4.1		-6.4	-4.6		-8.3			
AC NOISE	0				0						
POT RES.											

INDUCED POLARIZATION SENDER NOTES

Project: IRON King (HANNA) Line: #2 W ½ Date: 2-15-67

Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4
Receive	0-1000	1000-2000		2000-3000	→		3000-4000		→		4000-5000	
VOLTAGE Time	190	190	190	200	190	190	290	200	190	190		
Range	10	→										→
Current	4.0	→						→	3.5	→		→
Send	2-3	1-2	4-5	3-4	2-3	1-2		CHL LAMP				
Receive	→		5000-6000		→							
Time												
Range	→											
Current	→											

BLEW 2 (20) AMP FUSES ON
2-3 D-C
GEN. WAS AT 380 CYCLES AND 120 V.

A B

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project Iron King (Hanna) Line 2-west Field date 3/16 Data page_____ Comp. date_____. Comp by H.L.

	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
(A) Send	~~1-2~~	~~2-3~~	~~1-2~~	~~3-4~~	~~2-3~~	~~1-2~~	~~4-5~~	~~3-4~~	~~2-3~~	~~1-2~~		CaL
(B) Receive	0-1.0	1.0	2.0	2.0		3.0	3.0			4.0		2-3
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.5			
(E) Vdc (avg)	135	110.	46.4	57.1	21.8	12.6	48.1	16.4	8.5	5.9		97.7
(F) DCcal	~~98~~ 1.02											
(G) Kn x 10^{-3}	3.0	3.0	12.0	3.0	12.0	30.0	3.0	12.0	30.0	60.0		
(H) ρdc=ExFxGx10^3/D	~~99~~ 104	~~84~~	~~136~~ 142	~~42~~ 44	~~64~~ 67	~~93~~ 97	~~35~~ 37	~~48~~ 50	~~71~~ 74	~~99~~ 103		
(I) Vac Σ	132	107.5	45.2	56	21.0	12.3	47.0	16.1	8.2	5.7		98
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.004											
(M) ρdc/ρac=ExL/K	1.022	1.022	1.025	1.020	1.038	1.012	1.023	1.018	1.037	1.036		
(N) PFE=(M-1)(10^2)	2.2	2.2	2.5	2.0	3.8	1.2	2.3	1.8	3.7	3.6		
(O) MCF=(M-1)(10^5)/H	~~22~~ 21	~~27~~ 26	18	~~48~~ 45	~~59~~ 57	~~13~~ 12	~~66~~ 62	~~38~~ 36	~~52~~ 50	~~36~~ 35		

Project_____ Line 1-2 2-3 3-4 4-5 1-2 2-3 3-4 4-5 Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send	~~4-5~~	~~3-4~~	~~2-3~~	~~1-2~~	~~4-5~~	~~3-4~~	~~2-3~~	~~1-2~~				
(B) Receive	4.0			5.0	5.0			6.0				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	3.5											
(E) Vdc (avg)	20.1	13.3	10.3	7.5	10.5	8.3	7.5	5.8				
(F) DCcal	~~98~~ 1.02											
(G) Kn x 10^{-3}	12.0	30.0	60.0	105.0	30.0	60.0	105.0	168.0				
(H) ρdc=ExFxGx10^3/D	~~67~~ 70	~~112~~ 117	~~173~~ 181	~~210~~ 230	~~88~~ 92	~~137~~ 146	~~210~~ 230	~~277~~ 295				
(I) Vac Σ	19.6	12.7	9.9	7.1	10.0	7.6	6.6	5.35				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.004											
(M) ρdc/ρac =ExL/K	1.024	1.047	1.040	1.057	1.050	1.093	1.137	1.085				
(N) PFE=(M-1)(10^2)	2.4	4.7	4.0	5.7	5.0	9.3	13.7	8.5				
(O) MCF=(M-1)(10^5)/H	~~36~~ 34	~~42~~ 40	~~25~~ 22	~~27~~ 25	~~57~~ 54	~~67~~ 64	~~65~~ 60	~~31~~ 30				

? ? INT 88

PAGE 1

HEINRICHS GEOEXPLORATION CO. PROJECT IRON KING-HANNA

I.P. RECEIVER NOTES LINE 2 HALF SE SP. DATE

	1-2	1-3	1-4	3-4	2-3	1-2	2-3	3-4	4-5	1-2
SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-10	10-20	→	20-30	→	→	30-40	→	→	→
RANGE	.3	.3	.1	.3	.1	.03	.3	.1	.03	.03
DC 1	96	117	39.4	110	41.0	18.1	103	41.0	20.8	10.5
DC 2	95	119	42.3	110	40.5	17.7	104	42.5	20.6	10.3
DC 3	95	117	39.2	110	41.0	17.9	103	41.0	21.1	10.3
DC 4	97	119	42.2	110	40.0	18.3	104	42.5	20.7	9.8
DC 5	96									10.4
DC 6	95	138 (4)	47.5 (4)							9.7
DC 7										
DC 8										
DC AVG.	95.6	138	47.5	110	40.7	18.0	104	41.8	20.8	10.2
AC 1	94	134	46.0	107	39.5	17.6	100	40.0	20.2	10.0
AC 2	94	134	46.0	107	39.5	17.6	100	40.0	20.2	10.0
AC AVG.	94	134	46.0	107	39.5	17.6	100	40.0	20.2	10.0
S.P.	+9.1	-14.2		+13.3			+6.4			
AC NOISE		-4.8								
POT RES.										

2 IND CAL.

2-3

1. AC	98
DC	98
	98
	98
	98
2 AC	98

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PAGE 2

HEINRICHS GEOEXPLORATION CO. PROJECT IRON KING

I.P. RECEIVER NOTES LINE 2 HALF ~~E~~ SP. ____ DATE ____

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	~~40-50~~				~~50-60~~				3-4	
RANGE	.1	.03	.03	.01	.1	.01	.03	.03		
DC 1	31.0	19.9	10.0	5.75	24.5	4.85	7.5	15.6	97	
DC 2	30.5	19.5	10.0	5.60	24.0	49.0	8.3	15.8	97	
DC 3	31.0	19.0	10.0	5.50	24.5	47.5	7.5	15.7	97	
DC 4	30.5	18.4	9.8	5.60	24.0	50.5	8.3	15.7	97	
DC 5		19.0		5.50		47.0				
DC 6		18.5		5.60		50.5				
DC 7										
DC 8										
DC AVG.	30.8	18.6	10.0	5.59	24.3	4.88	7.9	15.7	97	
AC 1	30.0	17.6	9.5	5.25	22.5	4.60	7.46	14.9	97	
AC 2	30.0	17.5	9.5	5.25	22.5	4.60	7.45	14.8	97	
AC AVG.	30.0	17.6	9.5	5.25	22.5	4.60	7.45	14.9	97	
S.P.	+1.7				+12.5					
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: IRON King (HAMM) Line: #2 E ½ Date: 2-16-67

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3
Receive	0-1000	1000 —	2000	2000 —	3000	→	3000 —	4000	→		4000 —	5000
VOLTAGE Time		215	285	190	215	285	190	190	215	285	190	190
Range	10	→										
Current	4.0	→										
Send	3-4	4-5	1-2	2-3	3-4	4-5			CAL IAMD			
Receive	→		5000 —	6000	→				2-3			
Time	215	285	190	190	215	285						
Range	10	→										
Current	→											

INDUCED POLARIZATION SENDER NOTES

Project: Iron King-(Hanna) Line: #2 ~~1~~ ½ ? Date: 2-15-67

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
Receive	0-1.0	1.0 —	2.0	2.0 —		3.0	3.0 —			4.0		
Time	250					incomplete!						
Range						Kept blowing fuses						
Current	3.5 —									→		
Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CHL LAMP		
Receive	4.0 —			5.0	5.0 —			6.0				
Time												
Range												
Current	—							→				

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project HANNA IRON KING Line #2 Field date 2-17-67 Data page 1 Comp. date 2-18-67 Comp by RPF

	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
(A) Send	~~4-5~~	~~3-4~~	~~4-5~~	~~2-3~~	~~3-4~~	~~4-5~~	~~1-2~~	~~2-3~~	~~3-4~~	~~4-5~~		
(B) Receive	0→10	10 →	→20	20 →	→	→30	30 →	→	→	→40		3-4
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	3.5	4.0	→	→	→	→	→	→	→	→		1.00
(E) Vdc (avg)	95.6	138	47.5	110	40.7	18.0	104	41.8	20.8	10.2		97.0
(F) DCcal	.970	→	→	→	→	→	→	→	→	→		1.032
(G) Kn x 10^{-3}	3.0	3.0	12.0	3.0	12.0	30.0	3.0	12.0	30.0	60.0		
(H) ρ dc=ExFxGx10^3/D	~~77~~ 84	~~100~~ 107	~~138~~ 147	~~80~~ 85	~~118~~ 126	~~131~~ 139	~~76~~ 80	~~122~~ 129	~~151~~ 161	~~148~~ 158		
(I) Vac Σ	94	134	46.0	107	39.5	17.6	100	40.0	20.2	10.0		97
(J) AC noise x 2												
(K) Vac(corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.00	→	→	→	→	→	→	→	→	→		1.00
(M) ρ dc/ρac=ExL/K	1.017	1.029	1.032	1.028	1.030	1.022	1.040	1.045	1.029	1.020		
(N) PFE=(M-1)(10^2)	1.7	2.9	3.2	2.8	3.0	2.2	4.0	4.5	2.9	2.0		
(O) MCF=(M-1)(10^5)/H	~~2220~~	~~2927~~	~~2322~~	~~3533~~	~~2524~~	~~1716~~	~~5350~~	~~3735~~	~~1918~~	~~1913~~		
	+9.1	-4.8		+13.3			+6.4					

Project_____ Line 4-5 3-4 2-3 1-2 4-5 3-4 2-3 1-2 Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send	~~1-2~~	~~2-3~~	~~3-4~~	~~4-5~~	~~1-2~~	~~2-3~~	~~3-4~~	~~4-5~~				
(B) Receive	40 →	→	→	→50	50 →	→	→	→60				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	4.0	→	→	→	→	→	→	→				
(E) Vdc (avg)	30.8	18.6	10.0	5.59	24.3	4.88	7.90	15.7				
(F) DCcal	.970	→	→	→	→	→	→	→				
(G) Kn x 10^{-3}	12.0	30.0	60.0	105.0	30.0	60.0	105.0	168.0				
(H) ρ dc=ExFxGx10^3/D	~~90~~ 95	~~135~~ 144	~~146~~ 155	~~142~~ 151	~~177~~ 188	~~71~~ 75	~~201~~ 214	~~640~~ 680				
(I) Vac Σ	30.0	17.6	9.5	5.25	22.5	4.60	7.45	14.9				
(J) AC noise x 2	—											
(K) Vac (corr) $=\sqrt{I^2 - J^2}$	—											
(L) AC-DC cal.	1.00	→	→	→	→	→	→	→				
(M) ρdc/ρac =ExL/K	1.026	1.056	1.052	1.064	1.080	1.060	1.060	1.053				
(N) PFE=(M-1)(10^2)	2.6	5.6	5.2	6.4	8.0	6.0	6.0	5.3				
(O) MCF=(M-1)(10^5)/H	~~2927~~	~~4139~~	~~2633~~	~~4542~~	~~4543~~	~~2580~~	~~2028~~	8				
	+1.7				+12.5							

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PAGE 1

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT IRON-KING - HANNA

LINE #3 HALF S SP. ____ DATE 2-17

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0 → 10	10 →	20	20 →		→ 30	30 →			→ 40
RANGE	.1	.1	.03	.1	.03	.01	.1	.03	.01	.01
DC 1	51	37.5	16.3	33.0	13.0	8.6	34.1	8.0	6.0	4.8
DC 2	49.5	37.0	15.3	33.0	13.9	8.4	33.0	9.5	6.9	4.1
DC 3	51	37.0	16.0	33.0	13.8	8.6	34.1	8.5	6.75	4.6
DC 4	49.5	36.5	15.7	33.0	13.9	8.1	33.1	9.0	5.9	4.8
DC 5			15.8		13.8	8.6		8.9	6.0	4.1
DC 6			15.9		14.0	8.4		8.5	6.5	4.7
DC 7										4.5
DC 8										4.7
DC AVG.	50.3	37.0	15.8	33.0	13.8	8.4	33.6	8.8	6.4	4.5
AC 1	49.0	36.0	15.3	32.5	13.3	8.0	32.5	8.5	6.1	4.3
AC 2	49.0	36.0	15.3	32.5	13.3	8.0	32.5	8.5	6.10	4.30
AC AVG.	49.0	36.0	15.3	32.5	13.3	8.0	32.5	8.5	6.1	4.3
S.P.	+17.0	-14.2		+6.2			-1.0			
AC NOISE										
POT RES.										

fence at 970 ft
" " 1500 ft

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT IROW-KING - HANNA
LINE #3 HALF S SP. ____ DATE 2-17

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CAL
RECEIVE	40			> 50	50			> 60		3-4
RANGE	.03	.01	.01	.01	.01	.003	.003	.003		
DC 1	7.2	3.50	2.9	2.5	2.9	2.18	2.14	1.58		100
DC 2	7.1	3.65	3.4	2.25	2.9	2.22	2.14	1.68		100
DC 3	6.8	3.6	3.25	2.25	3.00	1.95	2.10	1.71		100
DC 4	7.0	3.7	3.05	2.55	2.80	2.05	2.50	1.50		100
DC 5	7.5	3.6	3.4	2.25	3.15	1.94	2.02	1.76		
DC 6	6.9	3.55	2.9	2.60	2.65	2.34	2.12	1.38		
DC 7		3.5				2.06	1.98	1.54		
DC 8		3.75				2.15	2.05	1.65		
DC AVG.	7.1	3.6	3.17	2.37	2.92	2.10	2.16	1.59		
AC 1	6.7	3.45	2.95	2.25	2.75	1.94	1.85	1.46		100
AC 2	6.9	3.45	2.95	2.26	2.75	1.93	1.85	1.46		100
AC AVG.	6.7	3.45	2.95	2.25	2.75	1.94	1.85	1.46		
S.P.	+7.2				+3.9					
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

project: Iron King (HAMP) Line: #3 5½ Date: 2-17-67

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3
Receive	0-1000	1000-2000		2000-3000		→	3000-4000			→	4000-5000	
VOLTAGE Time	320	300	320	250	300	320	250	250	300	320	250	250
Range	10	—	—	—	—	—	—	—	—	—	—	→
Current	3.0	—	—	—	—	—	—	—	—	—	—	→
Send	3-4	4-5	1-2	2-3	3-4	4-5			CAL 1 AMP			
Receive	—	→	5000-6000		—	→			3-4			
VOLTAGE Time	300	320	250	250	300	320						
Range	—	—	—	—	—	→						
Current	—	—	—	—	—	→						

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project_____ Line #3 5½ Field date_____ Data page_____ Comp. date_____. Comp by Z.L.

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal
(B) Receive	0-1.0	1.0	2.0	2.0		3.0	3.0			4.0		3-4
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	3.0											
(E) Vdc (avg)	50.3	37.0	15.8	33.0	13.8	8.4	33.6	8.8	6.4	4.5		10 C
(F) DCcal	1.0											1.00
(G) Kn x 10^{-3}	3.0	3.0	12.0	3.0	12.0	30.0	3.0	12.0	30.0	60.0		
(H) ρ dc=ExFxGx10^3/D	50	37	63	33	55	84	34	33	64	110		
(I) Vac Σ	49.0	36.0	15.3	32.5	13.3	8.0	32.5	8.5	6.1	4.3		100
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.0 2.6	2.8	3.1	1.5	3.6	5.5	3.3	3.9	4.3	4.8		1.00
(M) ρ dc/ρac=ExL/K	1.027	1.028	1.032	1.015	1.037	1.050	1.033	1.035	1.050	1.046		
(N) PFE=(M-1)(10^2)	2.7	2.8	3.2	1.5	3.7	5.0	3.3	3.5	5.0	4.6		
(O) MCF=(M-1)(10^5)/H	54	76	51	45	67	60	97	106	78	42		

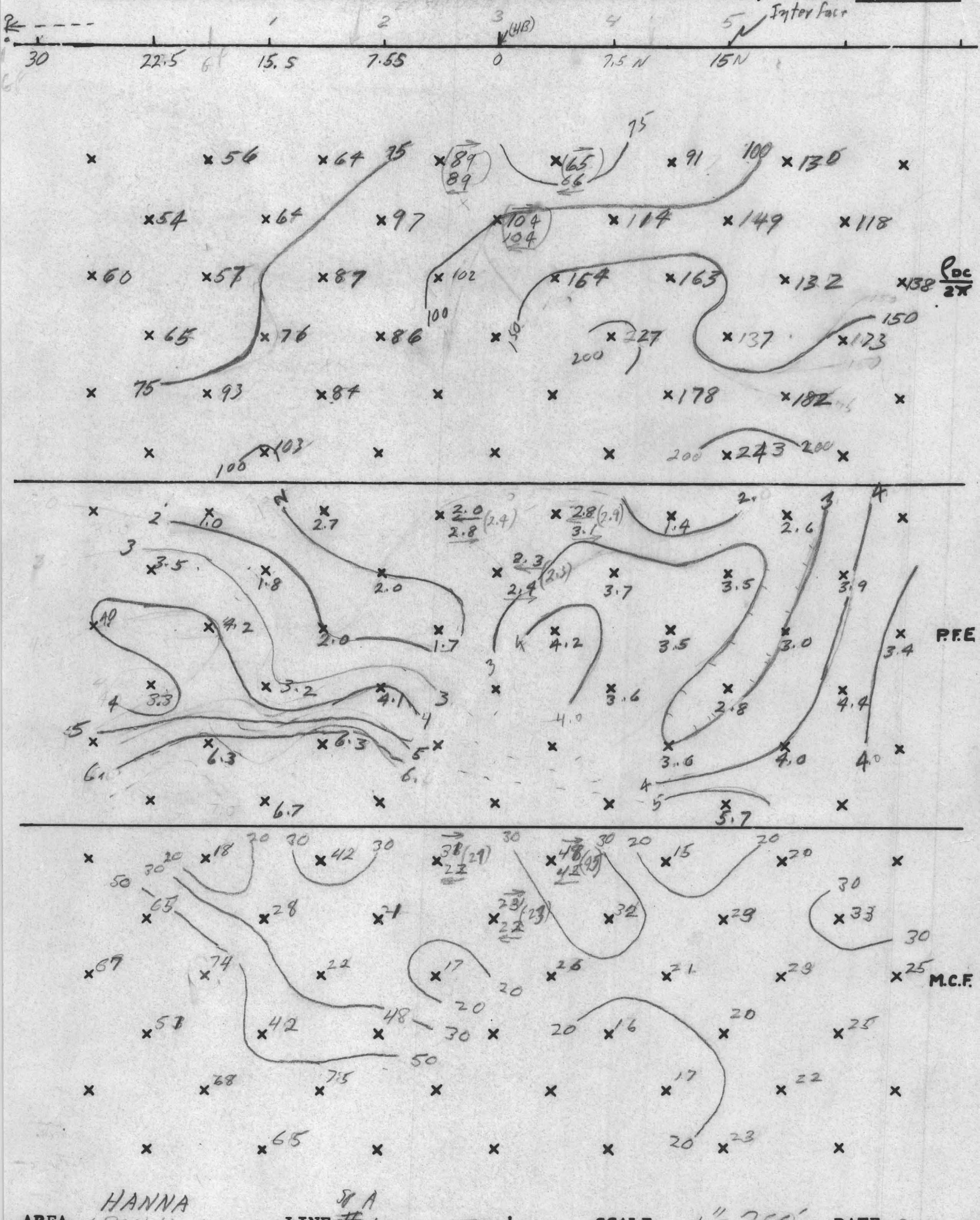
Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5				
(B) Receive	4.0			5.0	5.0			6.0				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	3.0											
(E) Vdc (avg)	7.1	3.6	3.17	2.37	2.92	2.10	2.16	1.59				
(F) DCcal	1.0											
(G) Kn x 10^{-3}	12.0	30.0	60.0	105.0	30.0	60.0	105.0	168.0				
(H) ρ dc=ExFxGx10^3/D	28	36	63	83	29	42	76	89				
(I) Vac Σ	6.7	3.45	2.95	2.25	2.75	1.94	1.85	1.46				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.05.5	4.5	8.5	5.3	6.4	8.6	12.4	9.4				
(M) ρdc/ρac =ExL/K	1.059	1.043	1.073	1.052	1.062	1.082	1.168	1.089				
(N) PFE=(M-1)(10^2)	5.9	4.3	7.3	5.2	6.2	8.2	16.9	8.9				
(O) MCF=(M-1)(10^5)/H	210	119	116	63	214	195	222	100				

$\frac{10 \times 2.1}{3}$

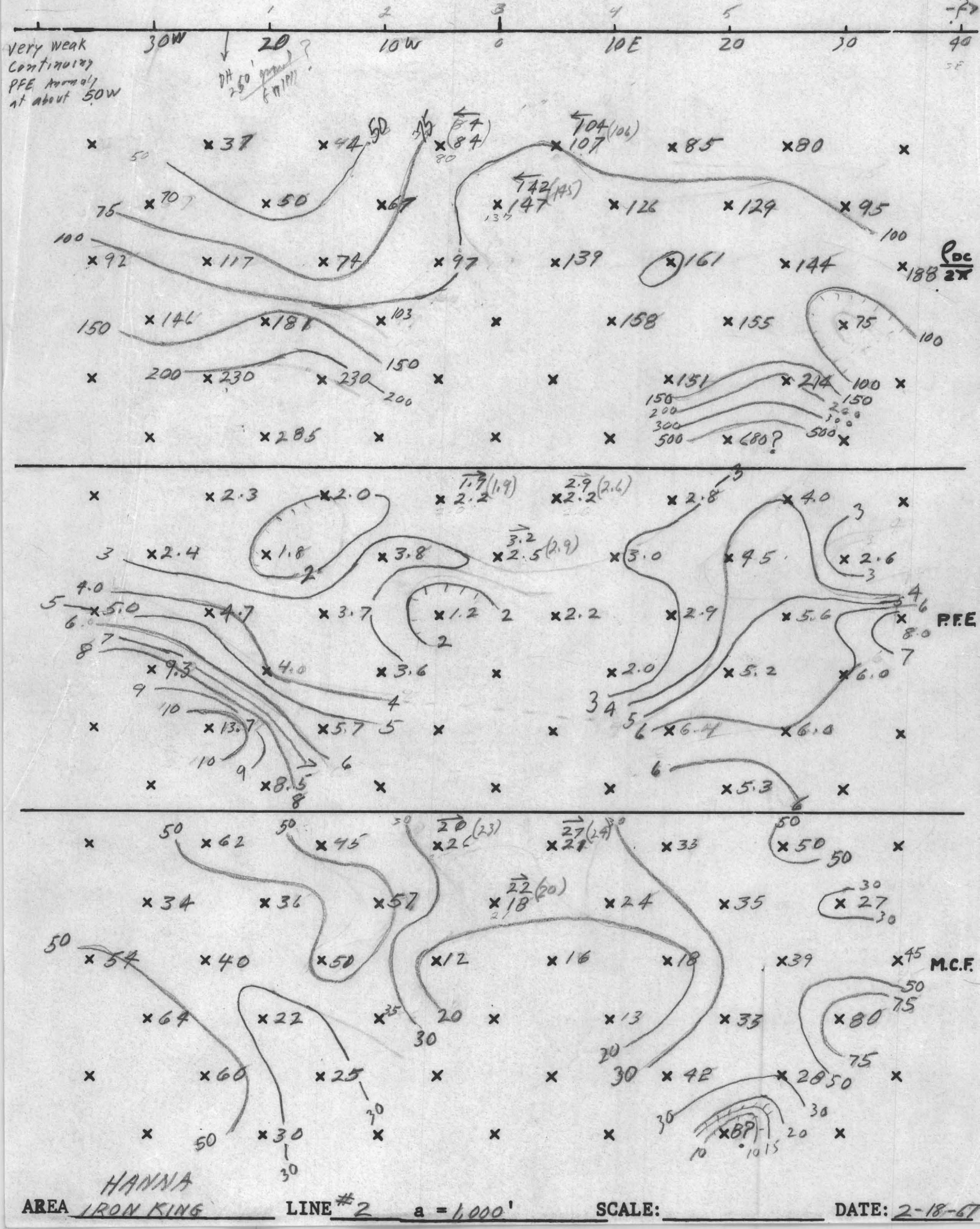
17000

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING WEST



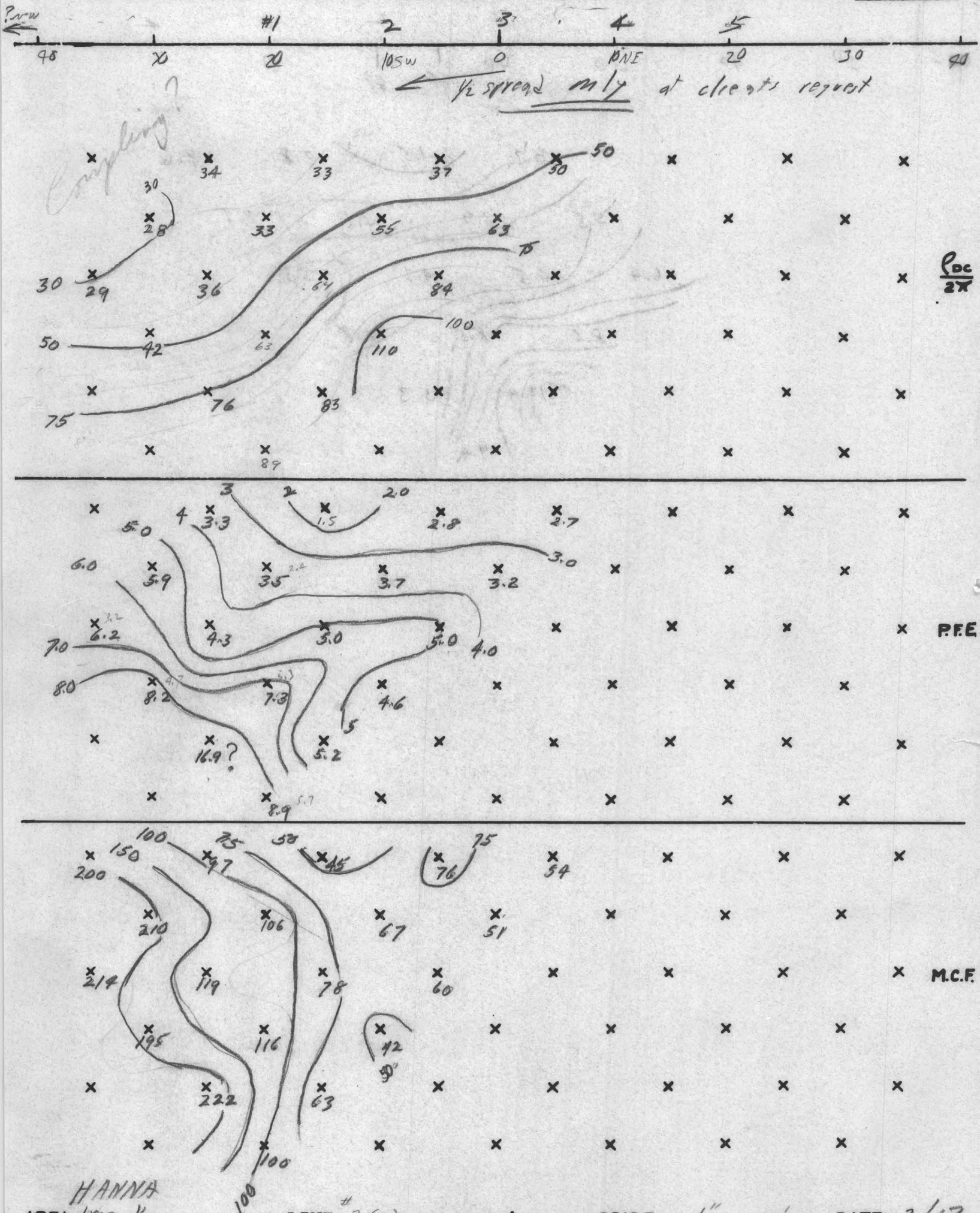
AREA HANNA IRON KING LINE #1 & A a = 750' SCALE: 1" = 750' DATE: 2-14-67

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N 24°E



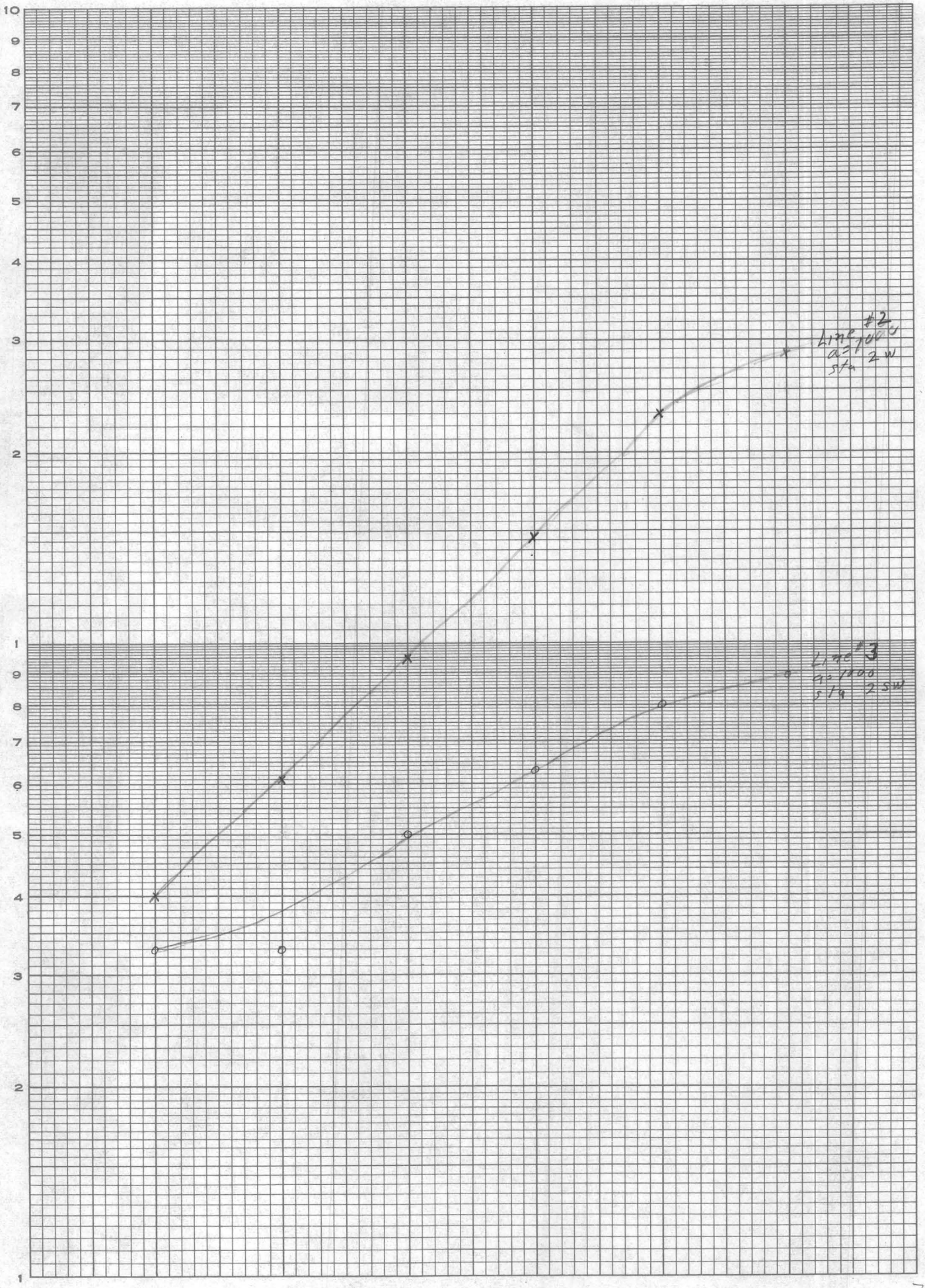
AREA IRON KING HANNA LINE #2 a = 1000' SCALE: DATE: 2-18-67

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N54°W



AREA Iron King HANNA LINE # 3 (S) a = 1000 ' SCALE: 1" = 1000' DATE: 2/17

HANNA
Feb 1967



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February 23, 1967

Mr. John Ruckmick
Hanna Mining Company
P. O. Box 12697
Tucson, Arizona

Dear John:

As you requested, this letter and the enclosed rough sectional data sheet reproductions will be a progress report for the induced polarization survey done near the North Star Mine, Pinal County, Arizona in February 1967.

Line 1 was run with 750' dipoles using our standard 3.0 and 0.05 cps frequencies. Intermediate values of resistivity were obtained over the entire length of the line. An interface at approximately 1.5N is indicated which may mark a steeper slope of the basement rocks and consequently shallow bedrock. Very weak polarization effects are noted at depth and are indicated as possibly continuing beyond 30S. We believe that this response must be from 750' or greater depth.

Due to the depth seen here, it was recommended that the next line (Line 3) be run with 1000' dipoles centered 1000 feet west and 1000 feet south of the first spread center. By your request, only half a spread was run. A very weak anomaly is noted at about 40SW and is indicated as continuing SW. We believe that the origin of the polarization effects is at least as deep as on Line 1. Coupling effect corrections have been spot checked and found to be not large enough to be of great concern at this time, and considering the slower field production and reduced frequency effects from lowering the AC frequency, we continued using 3.0 cps.

Line 2 was centered and oriented as directed by Hanna personnel. A 1000' dipole set up was used with 3 cps and 0.05 cps. Very weak anomalism is noted at about 50W, associated with moderately high resistivity at depth. Depth determination based on resistivity are difficult because of lateral effects or gradational changes in the alluvium. We would estimate that the depth to bedrock is greater than 250 feet and less than 750 feet in the vicinity of 20W.

To properly interpret these anomalies, we recommend that two expanding dipole-dipole arrays set at right angles, centered near the south end of Line 3. Lateral effects and depth to bedrock would be defined and positive confirmation of an anomalous zone will result. A defined limiting area would then have to be determined before drilling could be recommended.

We must stress that the data to date is not exciting and only hints at the presence of something better.

Very truly yours,

HEINRICHS GEOEXPLORATION COMPANY

Paul A. Head
Geophysicist

PAH:jc
Enclosures

9:00

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