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REPORT ON
INDUCED POLARIZATION SURVEY
QUIJOTOA AREA, ARIZONA

HUNTING SURVEY CORPORATION LIMITED

REPORT ON

INDUCED POLARIZATION SURVEY

QUIJOTOA AREA, ARIZONA

for

HUNTING GEOPHYSICAL SERVICES, INC.

by

HUNTING SURVEY CORPORATION LIMITED

Toronto, Ontario

January, 1963.

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INTRODUCTION

From September 7 to November 20, 1962 an Induced Polarization (I.P.) survey was carried out by Hunting Survey Corporation Limited over part of the Papago Indian Reservation, Arizona for Hunting Geophysical Services, Inc. The area surveyed is located approximately 130 miles southwest of Tucson, Arizona.

The survey was performed by a five-man crew. The geophysicist in charge of the survey was J. Lloyd of Hunting Survey Corporation Limited. Hunting Geophysical Services, Inc. supplied the I.P. assistants required.

The geophysical survey was carried out along chained picket lines. The lines surveyed lie in a northwest direction and are designated by numbers 1, 2, 3, 4, 5 and 6. In addition a cross line designated by the letter A was surveyed. This grid system provided a total of 44,250 feet or approximately 8.4 miles of profiles. The basic coverage of the survey consisted of readings at 500-foot intervals with additional readings being taken at 250-foot intervals wherever necessary.

The data was obtained with the "three-electrode array" configuration. This array consists of one current electrode (C_1), two potential electrodes (P_1 and P_2), the second current electrode (C_2) remaining fixed at "infinity". With this configuration C_1, P_1 and P_2 are moved in unison in 500-foot jumps. The values were plotted against the mid-point of C_1-P_1. Two electrode spacings, 250 feet and 500 feet, were used to

survey the lines.

The Hunting pulse-type instrument is similar in design and operation to those described by R. W. Baldwin in "A Decade of Development in Overvoltage Survey", A.I.M.E. Transactions, Vol. 214, 1959. Power is obtained from a Briggs and Stratton motor coupled to a 900 cycle generator which provides a maximum of 2,000 watts d.c. to the ground. The cycling rate is 1.5 seconds current on and 0.5 seconds current off, the pulses reversing continuously in polarity. The data collected in the field consists of careful measurement of the current (I) in amperes flowing through electrodes C_1 and C_2, the primary voltage (V_p) in volts appearing between P_1 and P_2 during the "current on" part of the cycle, and the secondary voltage or overvoltage appearing between electrodes P_1 and P_2 during the "current off" part of the cycle. The latter voltage is integrated electronically with respect to time, to provide a measurement of polarization (V_s) in millivolt-seconds. The "apparent chargeability" in milliseconds is calculated by dividing the polarization (V_s) by the primary voltage (V_p). The "apparent resistivity" in ohm-meters is proportional to the primary voltage (V_p) divided by the measured current (I), the proportionality factor depending on the geometry of the array used. The resistivity and chargeability obtained are called "apparent" as they are the values which that portion of the earth sampled by the array must have if it were homogeneous. As the earth sampled is usually inhomogeneous, the calculated "apparent resistivity" and "apparent

chargeability" are functions of the "true" resistivities and chargeabilities of the various sections of the earth sampled and of the geometry of those sections.

The results of the survey are shown on the individual profiles in the Appendix of this report. These profiles have a horizontal scale of 1 inch to 250 feet. The "apparent chargeability" is plotted at a vertical scale of 2.0 milliseconds per inch. The "apparent resistivity" is plotted on a vertical logarithmic scale of 2 miles per logarithmic cycle. A map at a scale of 1 inch to 500 feet showing contours of chargeability at the 500-foot electrode spacing is located in the pocket at the rear of this report. The map is an enlargement of the 1 inch to 1,000 feet geological map provided by Hunting Geophysical Services, Inc. Some discrepancies in station location appear to exist between the map and the I.P. profiles. It has been necessary, therefore, to locate the profiles on the map by means of the highway. Each profile has the highway marked on it so that cross reference between the map and the profiles can be made.

INTERPRETATION

The technique used in the interpretation is based on the assumption of a layered earth. The complex problem of the combined effects of depth of burial, width, dip and true chargeability of a vertically mineralized zone plus the physical characteristics of the overburden and country rock have not been solved practically. However, certain rule-of-thumb plus the experience gained from test surveys over known ore bodies permit certain estimates to be made. Thus the maximum possible width of the causative bodies are indicated on the accompanying profiles, with the understanding that the body most probably is narrower than indicated. Rough depth estimates are possible in some cases, but it is necessary to know the electrode spacings at which maximum response is obtained; thus a minimum of three electrode spacings across the anomaly are usually required.

The interpretation of the survey data consists of a careful analysis of each individual profile. The results of this analysis are shown by appropriate symbols on the I.P. profiles in the Appendix of this report. These results are also transferred to the interpretation map in the pocket at the end of this report using the same symbols. Due to the high degree of complexity of the interpreted I.P. results and to the absence of geological data in certain parts of the area, caused by the presence of overburden, no attempt was made to outline in plan

form the various zones by use of contact or similar symbols. Instead, possible relationships between zones of different lines are shown by long arrows.

The symbols used warrant some further discussion. The "zones of special interest" (cross-hatched) represent the causative bodies of specifically recognizable anomalies measured from profiles observed with the shortest electrode spacings. Thus, the width indicated is the probable width nearest to the bedrock surface and need not represent the true width of the body at depth. The "zones of possible interest" (single-hatched) are anomalous zones which cannot be broken down into individual bodies, or zones which show lower chargeability (less mineralization) or greater depth. Special features of the I.P. data are indicated by arrows between limiting marks along the profile and are explained by notes, both on the profiles and on the map.

Estimated depth (h), or the limits thereof, are shown in feet. Where a maximum value of depth is shown, it is believed that more often than not the actual depth will be found to be one-half, or less, of the maximum shown. It is to be noted that these depths would be more properly called distances to the body, the distances being measured in a plane perpendicular to the line and to the ground surface. This is due to the fact that the I.P. method samples a certain volume of the earth and therefore the causative bodies do not necessarily lie beneath the lines surveyed but could be located to one or the other side of the line.

Such an occurrence is called a "side effect".

As previously explained, the mathematical problem of the relationship between the width, the depth and the true chargeability is not solved in the case of bodies of limited vertical cross sections. Thus, only a minimum chargeability in milliseconds is shown. Past experience shows that one percent sulphide by volume will cause a chargeability of 3 to 8 milliseconds. In other words, a minimum chargeability of 12 milliseconds indicates an absolute minimum sulphide content of 1.5%, but the sulphide content could also be greater than 4%. The sulphides may or may not be economical as the I.P. method does not differentiate between chalcopyrite and pyrite, for example.

The resistivity measurement remained fairly constant, throughout the area, at 180 to 300 ohm-meters. The weak variations observed are mainly due to changes in overburden properties and in its thickness and are not considered significant in the present problem.

The interpretation of the I.P. data based on all available data is presented in the following paragraphs.

The chargeability measurements indicate a fairly large anomalous zone lying approximately in an east-west direction. A normal background value of chargeability of 2 milliseconds is observed on all sides of the anomalous zone. Over the zone the chargeability reaches a maximum of 11.8 milliseconds on Line 5. The results obtained with the two electrode spacings show similar chargeabilities at each station indicating that the

causative body extends to depth.

Lines 1 and 2 indicated a fairly well defined anomaly extending from 0+00 to 3+75S giving a width of 2,375 feet. However there is a possibility that this anomaly consists of two zones. Calculations carried out indicate the true chargeability of the anomaly may be as high as 9.0 milliseconds and that the causative body is at a depth of approximately 100 feet.

The results obtained over Line 3 indicate only one anomalous zone extending from 5+00S to 17+50S. Calculations indicate the true chargeability for this portion of the anomaly to be a minimum of 7.5 milliseconds. The depth to the causative body is approximately 125 feet.

Line 4 indicates a widening of the anomalous zone. As Line 4 lies 500 feet to the east of Lines 1 and 2, this widening indicates that the two zones indicated on Lines 1 and 2 have apparently merged into one zone. The calculated true chargeability of this zone is 7.4 milliseconds and the depth of the body is less than 100 feet.

A fairly strong anomaly was located on Line 5 centered at 10+00S. To the north of this zone the chargeability remained fairly high indicating a probable change in the country rock. It is, however, possible that the mineralized zone swings to the north and is the cause of the high chargeability reading found on the north end of this line.

The results obtained along Line 6 indicated a fairly extensive zone extending from 27+50S to 5+00N. However this anomaly may be

found to consist of two zones. The true chargeability is found to be 8.0 milliseconds and the depth of the causative body is approximately 100 feet.

Line 'A', the cross line, indicates two main anomalous zones showing that the anomaly located by the north-south line is approximately 3,000 feet long. The high readings located between 12+50E and 20+00E are in all probability due to side effects from the anomalous zone as it extends eastward beyond the survey area of Line 'A'.

A magnetometer survey carried out over the same lines as was the I.P. survey indicated no magnetic anomaly. It is, therefore, thought that any magnetite present must be in small amounts and not sufficient to cause the I.P. anomaly.

Geologically the anomaly appears to be suitably located within the quartz porphyry. Zones of alteration and discolouration are to be found surrounding the anomalous zone. The breccia pipes do not appear to be the cause of the anomaly as many are located outside of it.

In general then, this large anomalous area, which is still open at both ends, appears to be suitably located and the chargeabilities indicate that the anomaly could be caused by a body containing 1% to 3% sulphides by volume. An expanding Wenner electrode configuration indicated the depth to the body to be approximately 50 feet. Other depths calculated from the I.P. profiles range from 50 to 150 feet. The accompanying profiles and interpretation map shows possible trend patterns based on information available. Although the trends may be considered to be

fairly well established, their lateral extent and position is still open to question due to the possibility of side effects. Thus, it must be remembered that the bodies indicated may or may not reach a specific line, and may become more or less significant in between lines.

SUMMARY AND RECOMMENDATIONS

An Induced Polarization survey was carried out over a small area in the Quijotoa Area of the Papago Indian Reservation, Arizona. A large anomalous zone was indicated, probably due to the presence of sulphides. This anomaly is approximately 2,000 feet wide and although it has been traced for a length of 3,000 feet, it is still open to the east and west. A number of calculations were carried out on each profile and the true chargeability of the zone varies from 6.6 milliseconds to 14 milliseconds. The depth to the causative body varies from 45 feet to 150 feet. The amount of sulphide mineralization present to cause an anomaly of this type varies from 1% to 3% by volume.

A magnetometer survey carried out over the same lines as the I.P. survey indicate no magnetic anomaly, and therefore there is no reason to suspect that magnetite is the cause of the I.P. response.

The anomaly is located within the quartz porphyry and is surrounded by areas of discolouration or alteration. It is, therefore, believed that the zone is suitably located and should be further investigated.

Insufficient I.P. work was carried out to completely outline the anomalous zone. It is recommended that further I.P. work be carried out to completely outline the causative body and to further investigate the high chargeability readings located on the north end of Line 5.

It is further recommended that the anomaly located to date be investigated by diamond drilling, as the economic significance of the zone must be determined by visual examination, the I.P. method cannot differentiate between economic and non-economic sulphide minerals. The following locations are recommended for diamond drill holes:

Lines 1 and 2 - vertical hole at 17+50N

Line 4 - vertical hole at 10+00S

In drilling, it must be remembered that due to the wide intervals (500 feet) between lines, it is possible that the causative body does not reach the particular line on which the anomaly is observed.

Should the results of the drilling prove encouraging then, of course, further work should be undertaken to completely outline the anomalous zone.

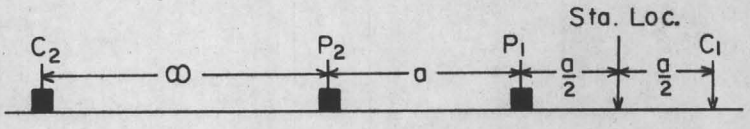
HUNTING SURVEY CORPORATION LIMITED

E. B. Nicholls,
Geophysicist.

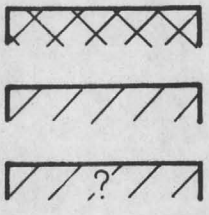
APPENDIX

I. P. PROFILES : Lines - 1 & 2
3
4
5
6
"A"

3 - ELECTRODE ARRAY

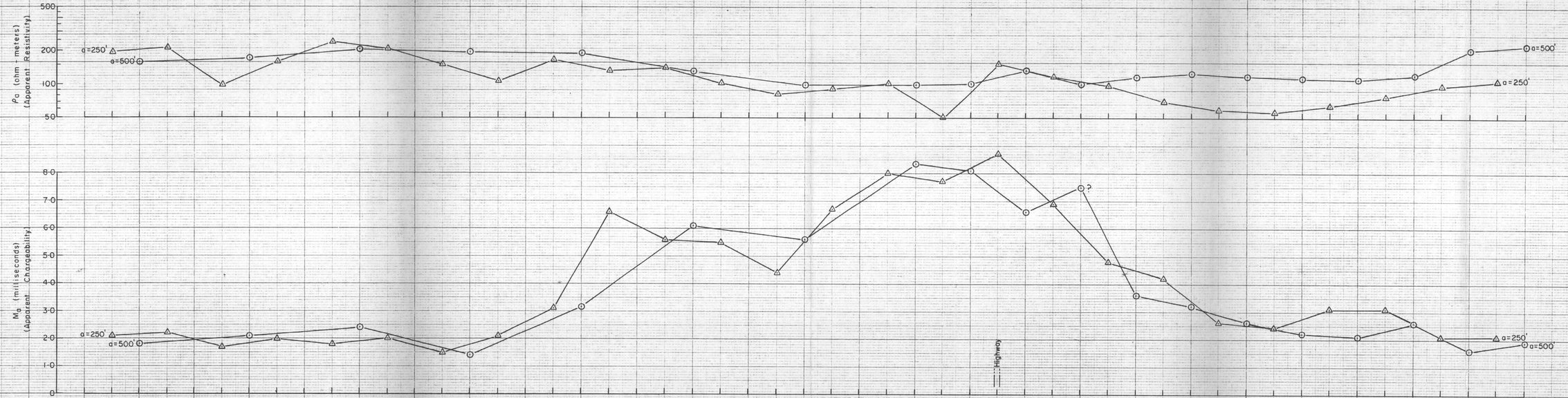


INTERPRETATION LEGEND



J-2315

I.P. PROFILE - LINES 1 & 2



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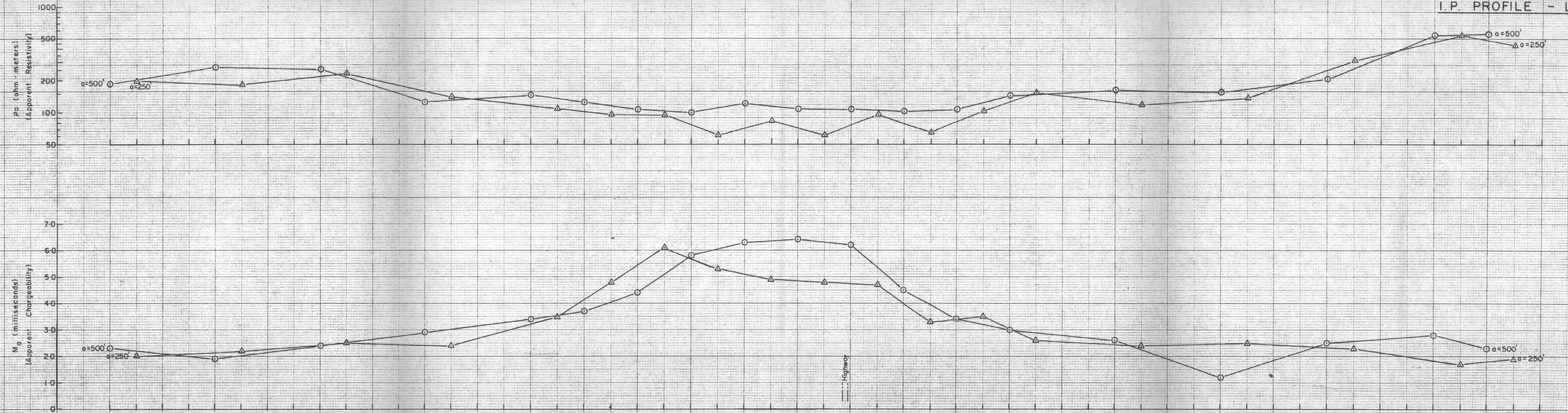

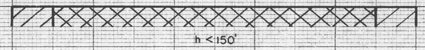

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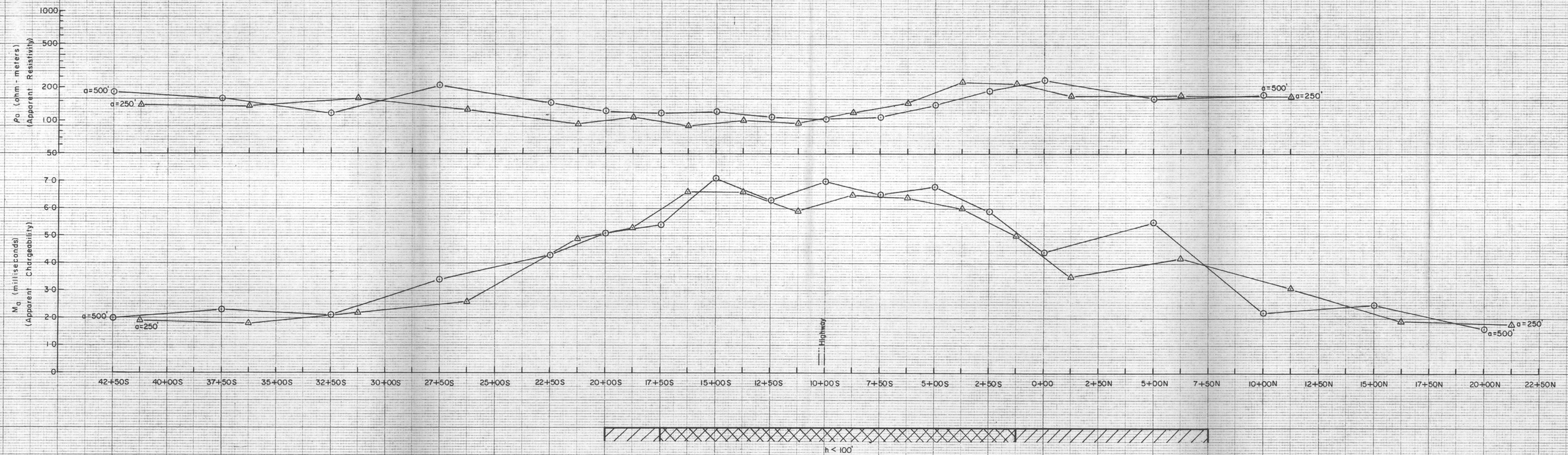
I.P. PROFILE - LINE 4



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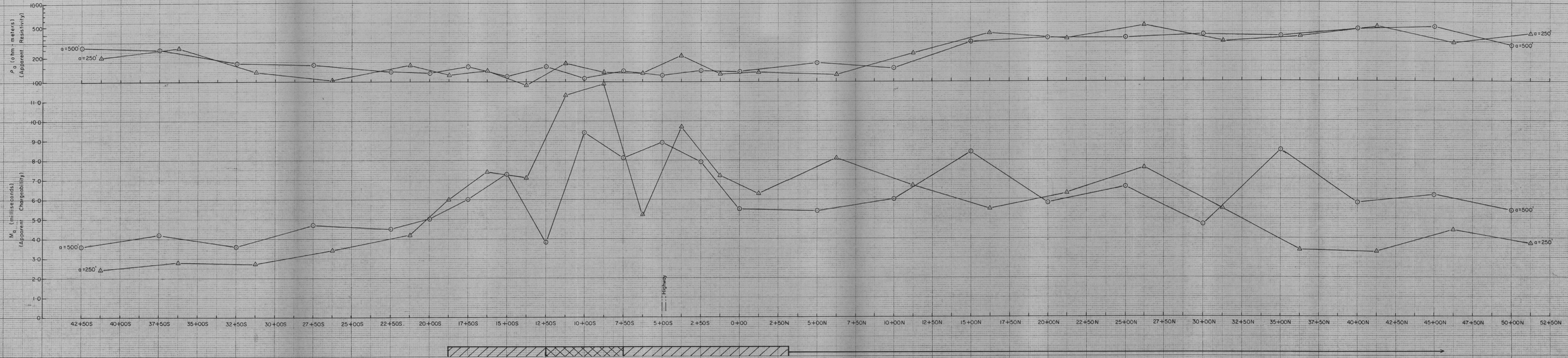
I.P. PROFILE - LINE 5



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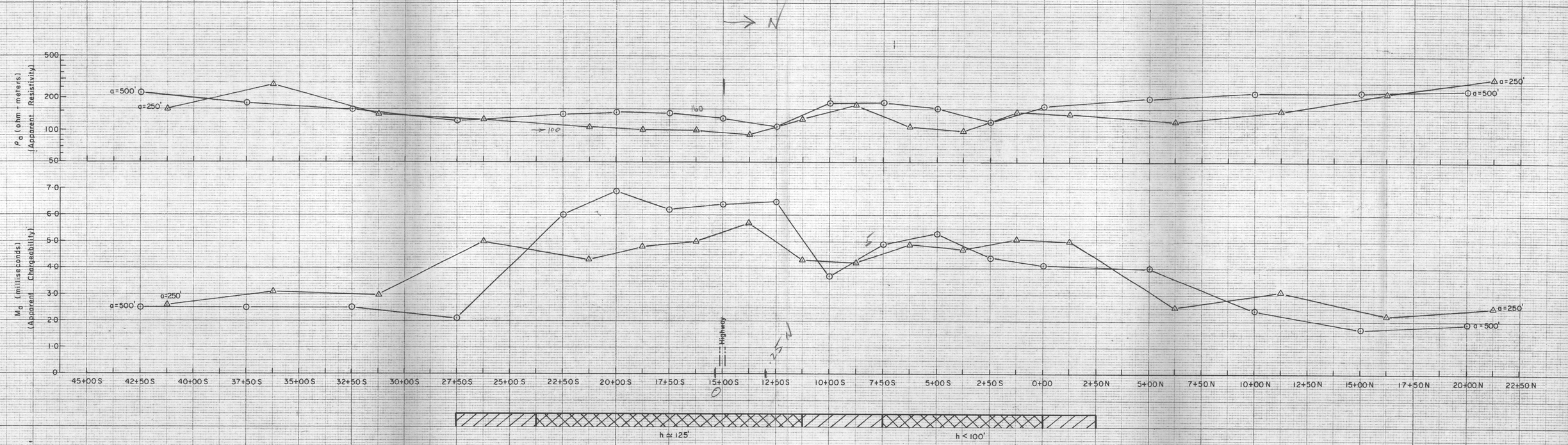
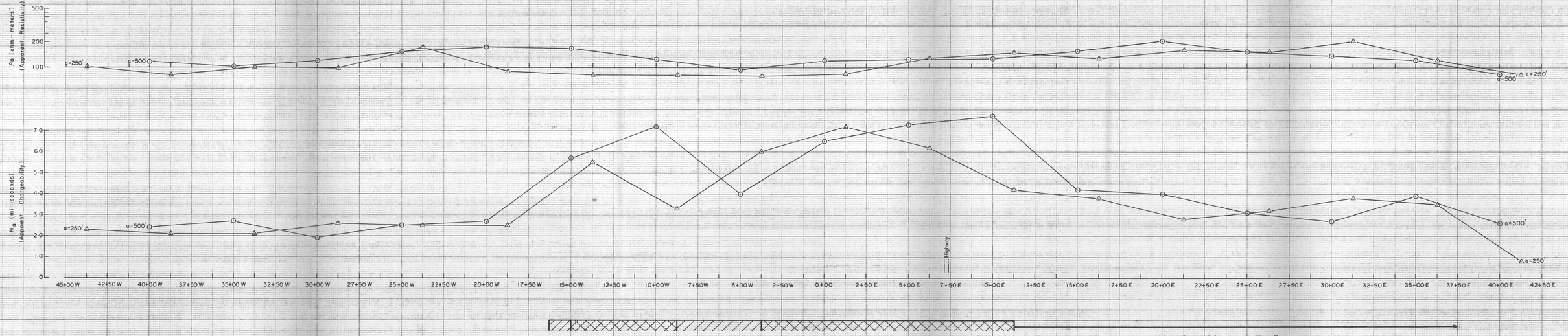
I.P. PROFILE - LINE 6



J-2315

I.P. PROFILE - LINE "A"



NOTE: This map is a two times enlargement from map supplied by Hunting Geophysical Services Inc.

Some discrepancies in station locations appear to exist between the map and Induced Polarization Profiles.

HUNTING GEOPHYSICAL SERVICES, INC.

QUIJOTOA MOUNTAINS BRECCIA ZONES

INDUCED POLARIZATION SURVEY

CONTOURS OF RESULTS

OBTAINED FROM 500 FOOT ELECTRODE SPACING

Approximate Scale: 1 inch = 500 feet

Hunting Survey Corporation Limited, Toronto, Canada – January 1962

INDUCED POLARIZATION SURVEY

QUIJOTOA MINING DISTRICT

Papago Indian Reservation
Pima County, Arizona

January 1963

for
HUNTING GEOPHYSICAL SERVICES, INC.

by
HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5671 Tucson, Arizona

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Sectional Data Sheets, Lines 1 thru 4

Depth Curve---Line 3

In Pocket:

Plan Location Map

Self Potential Profiles

INTRODUCTION

From January 18 through January 25, 1963 Heinrichs Geoexploration Co. conducted induced polarization surveys over part of the Quijotoa Mining District, Papago Indian Reservation near Covered Wells, Arizona. This work was performed at the request of Mr. Quentin G. Whishaw of Hunting Geophysical Services, Inc., under the supervision of Mr. Franklin A. Seward, Jr., geophysicist, with E. Grover Heinrichs, Chris Ludwig and Floyd Hanly assisting.

The twofold purpose of this work was to first test an I. P. anomaly mapped by Hunting Geophysical Services and second to provide a direct comparison of the Hunting data which was obtained by the time domain or pulse method and the data of this report which utilized the multiple frequency technique.

Included with this report are sectional data sheets for each of the four lines surveyed and a plan location map, a depth curve profile on Line 3 and self potential profiles.

CONCLUSIONS AND RECOMMENDATIONS

1. The anomalism observed is definite, but considered to be of only moderate absolute magnitude. It is interpreted to be due to sulfide mineralization and compares with rather surprising similarity to the previous pulse results.

2. Data on Lines 1, 3 and 4 indicate definite attenuation of sulfide involvement at depth.

3. Data on Line 2 is suspect at least in part due to proximity of Line and electrodes to parallel fence.

4. Line 4 repeated with two end on spreads of 500 ft. dipoles would probably give much more definite east-west boundary interpretation.

5. Lateral resolution is best on Line 3 and least on Line 4

6. Lateral resistivity inhomogeneities preclude discrete depth analyses. One depth curve analysis on Line 3 indicates a thickness of the upper layer of 500 ft.

PROCEDURES

Lines 1, 2 and 3 were run along Hunting Geophysical Lines 2, 5 and 6 respectively, centered as indicated on the plan map, using a 500 ft. dipole spacing. Line 4 was run along Hunting Line 7 centered as indicated at 1.0 south on Line 1 and using a 1,000 ft. dipole spacing.

Observations were made from the expanding dipole-dipole or Eltran electrode configuration which has become standard in the industry for those using the frequency domain technique.

A D.C. frequency of .05 cps was used throughout the survey except when receiving the 5th and 6th separation data on Lines 2 and 3 and 3rd through 6th separation data on Line 4 where high telluric noise-to-signal ratio was minimized by using .15 cps. The A.C. frequency used was 3.0 cps.

INTERPRETATION

The interpretation is presented on the sectional data sheets and the plan maps as blank, dashed, single bar, single bar and dashed and double bar lines indicating the relative degree of anomalism observed and respectively, the terms very weak, weak, moderate and strong are used to indicate the strength. It should be emphasized that these terms are used in a relative sense only and may be only indirectly related to absolute degree of anomalism or intensity of mineralization.

The anomaly on each of the four lines correlates well with that mapped by Hunting. The highest absolute anomalism (with respect to the percent frequency effects) appears to exist on Line 2. On the other hand much if not all of these data are subject to question regarding degree of sulfide involvement because of the close proximity of this line and the current electrodes to a

parallel grounded wire fence. In fact it is almost certain that the data on the 2.5n to 3n dipole was strongly affected by the fence and it was not reasonable from the observations made to compute frequency effects or metal factors on the last three data points.

Line 1 shows a distinct anomaly from 1.0n to 2.0s with the strongest effects from 0.5s to 1.5s. The best pattern is observed on Line 3 which offers the highest degree of resolution although not necessarily the highest magnitude effects.

The 1,000 ft. dipole, Line 4 offers the least lateral resolution and the lowest magnitude anomalous data.

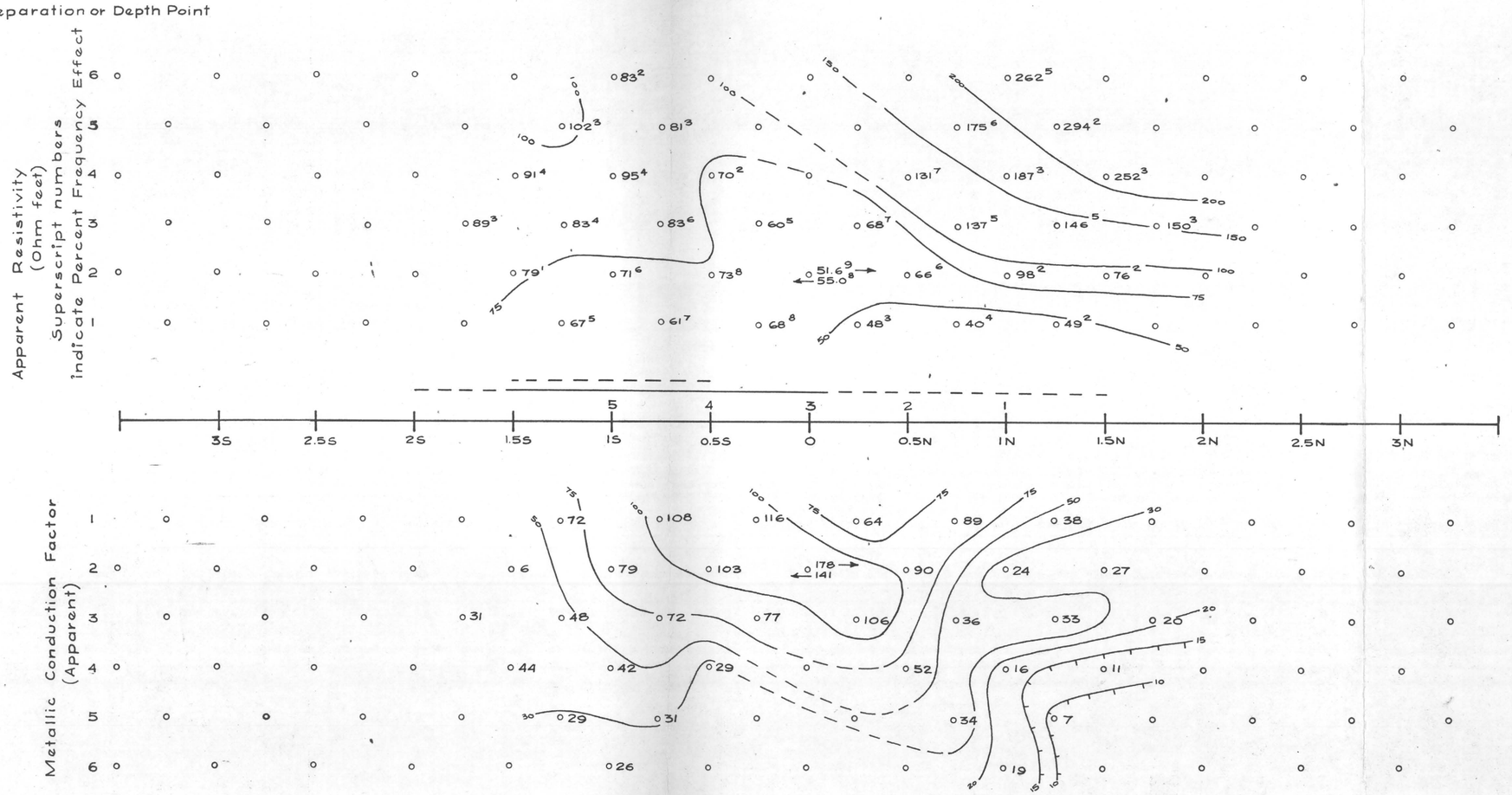
On all of the lines, with the possible exception of Line 2 (of the questionable data), the anomaly appears to attenuate with depth, indicating that perhaps the mineralized zone is a relatively horizontal layer.

A number of depth analyses were attempted on each of the lines, but in general lateral resistivity changes prevented any successful interpretation. One depth curve on Line 3, taken along the diagonal projecting to the north from between stations 0.5s to 1.0s, gives a depth to the top of the second layer of 500 ft, a resistivity of 70 ohm ft./2pi for the top layer and a resistivity of 210 ohm ft./2pi for the bottom layer.

Respectfully submitted,
HEINRICHS GEOEXPLORATION CO.

Franklin A. Seward, Jr., Geophysicist

January 30, 1963
P. O. Box 5671
Tucson, Arizona



LEGEND

Electrode &/or Pot. Location & End of Line

Station

No Anomaly

Very Weak

Weak

Moderate

Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

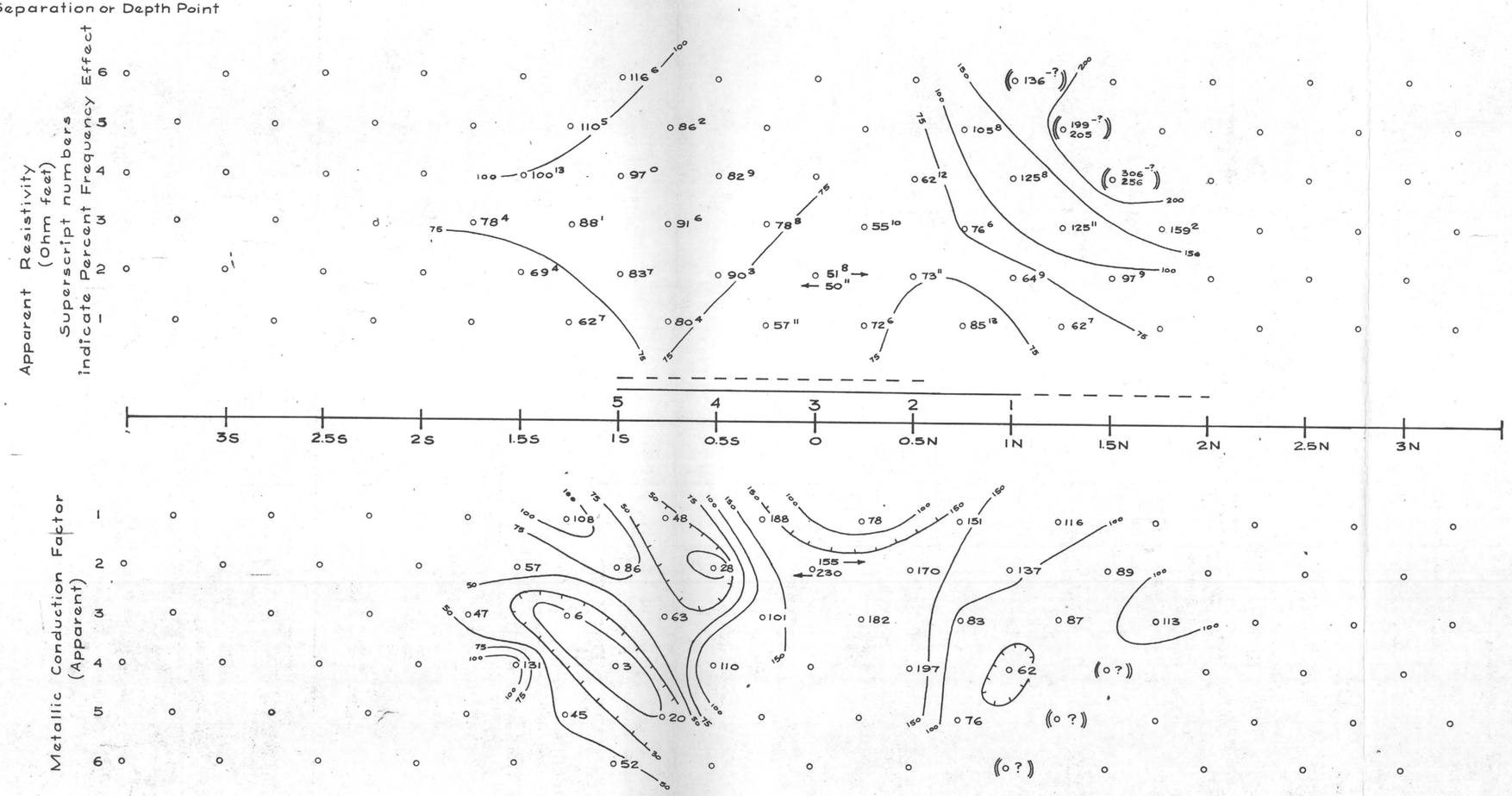
SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 1

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963



LEGEND

Electrode ℄/or Pot. Location
℄ End of Line

Station

No Anomaly

Very Weak

Weak

$\rho_{DC}/2\pi$

Moderate

Strong

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

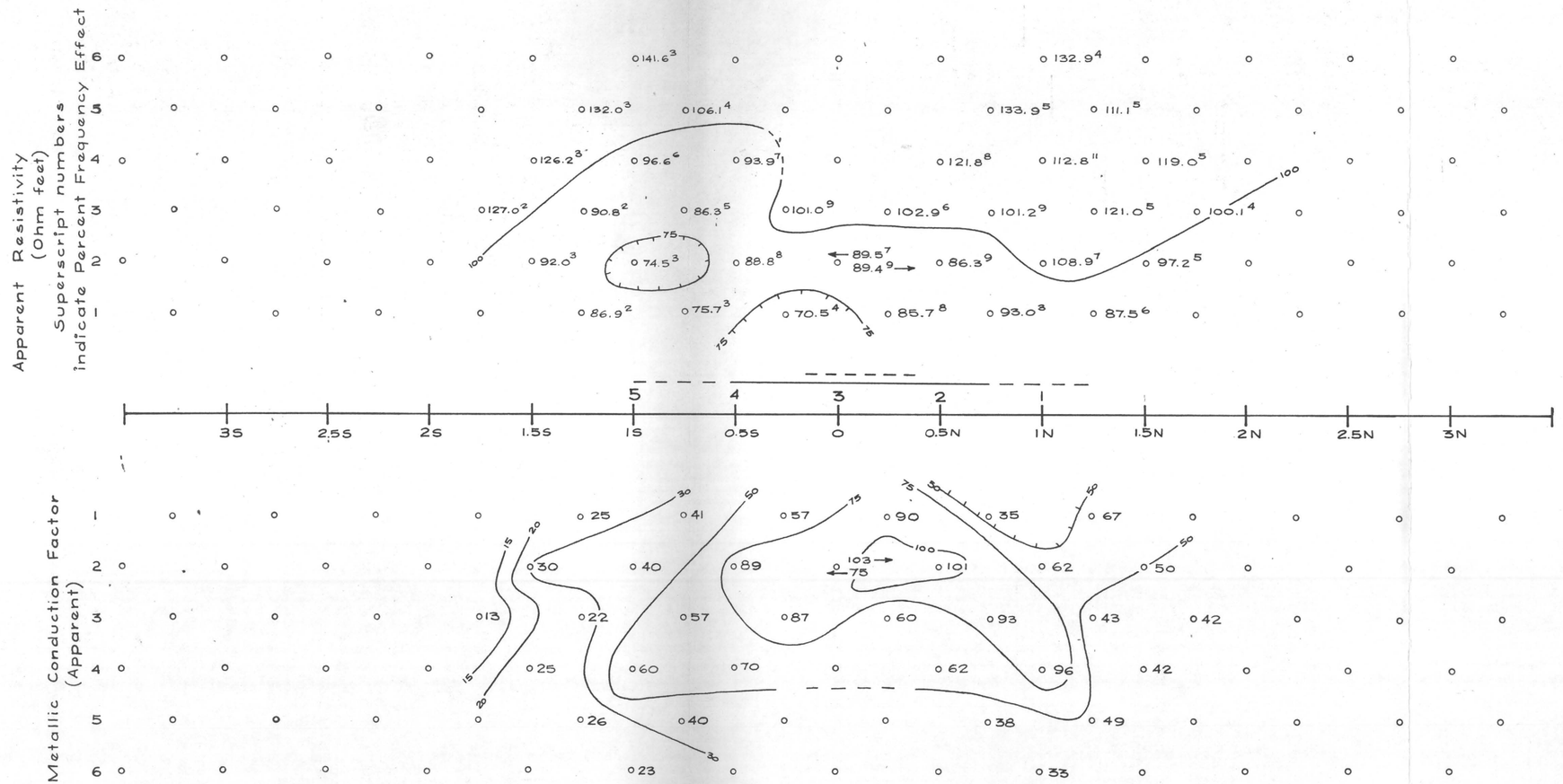
LINE No. 2

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963

Registered Professional Engineer
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 19 63
ARIZONA, U. S. A.



LEGEND

- Electrode &/or Pot. Location & End of Line
- Station
- No Anomaly
- Very Weak
- Weak ($\rho_{DC}/2\pi$)
- Moderate
- Strong

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

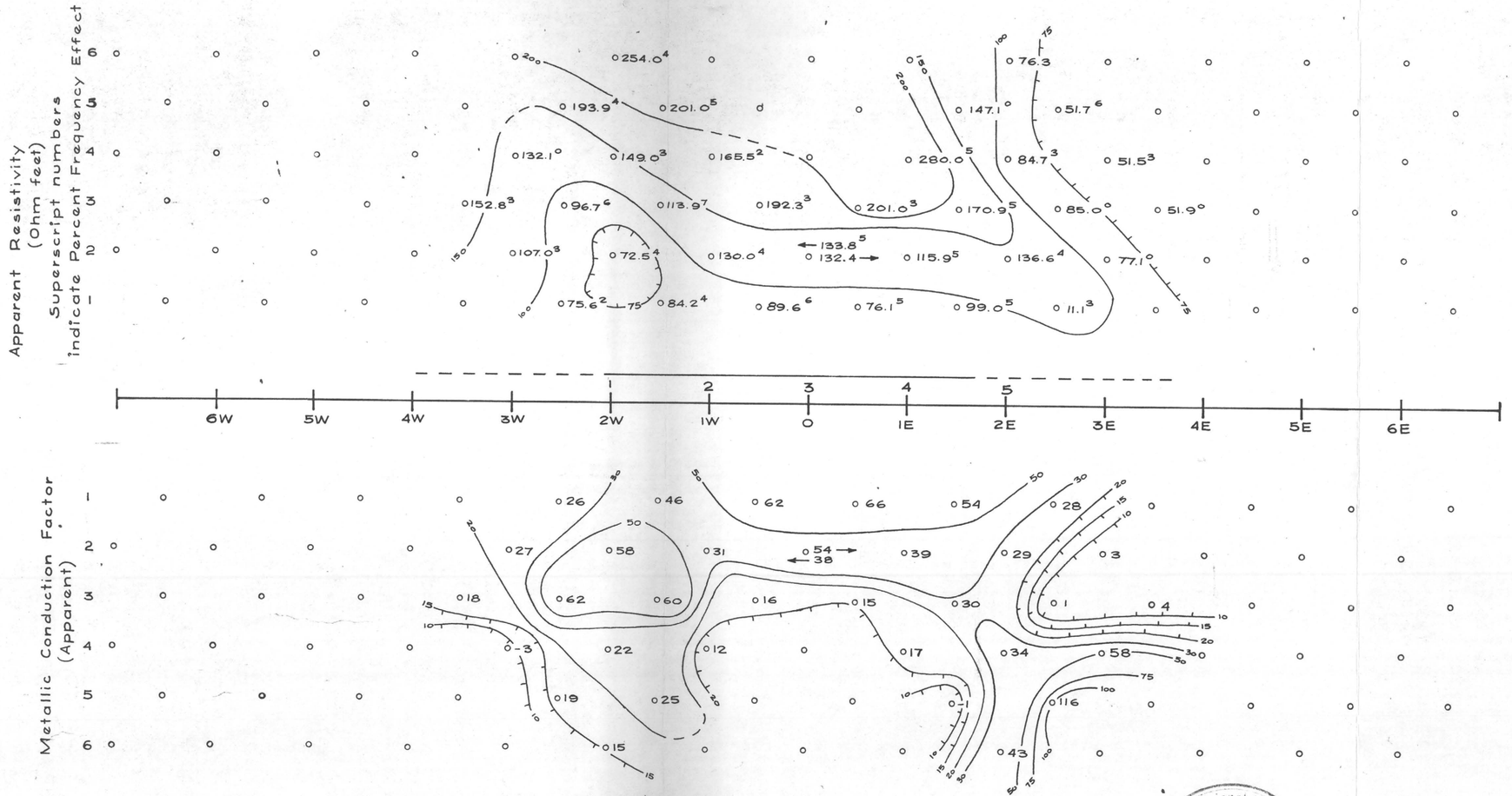
SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 3

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963



LEGEND

Electrode ¢/or Pot. Location & End of Line

Station

No Anomaly

Very Weak

Weak

Moderate

Strong

$\rho \frac{dc}{2\pi}$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

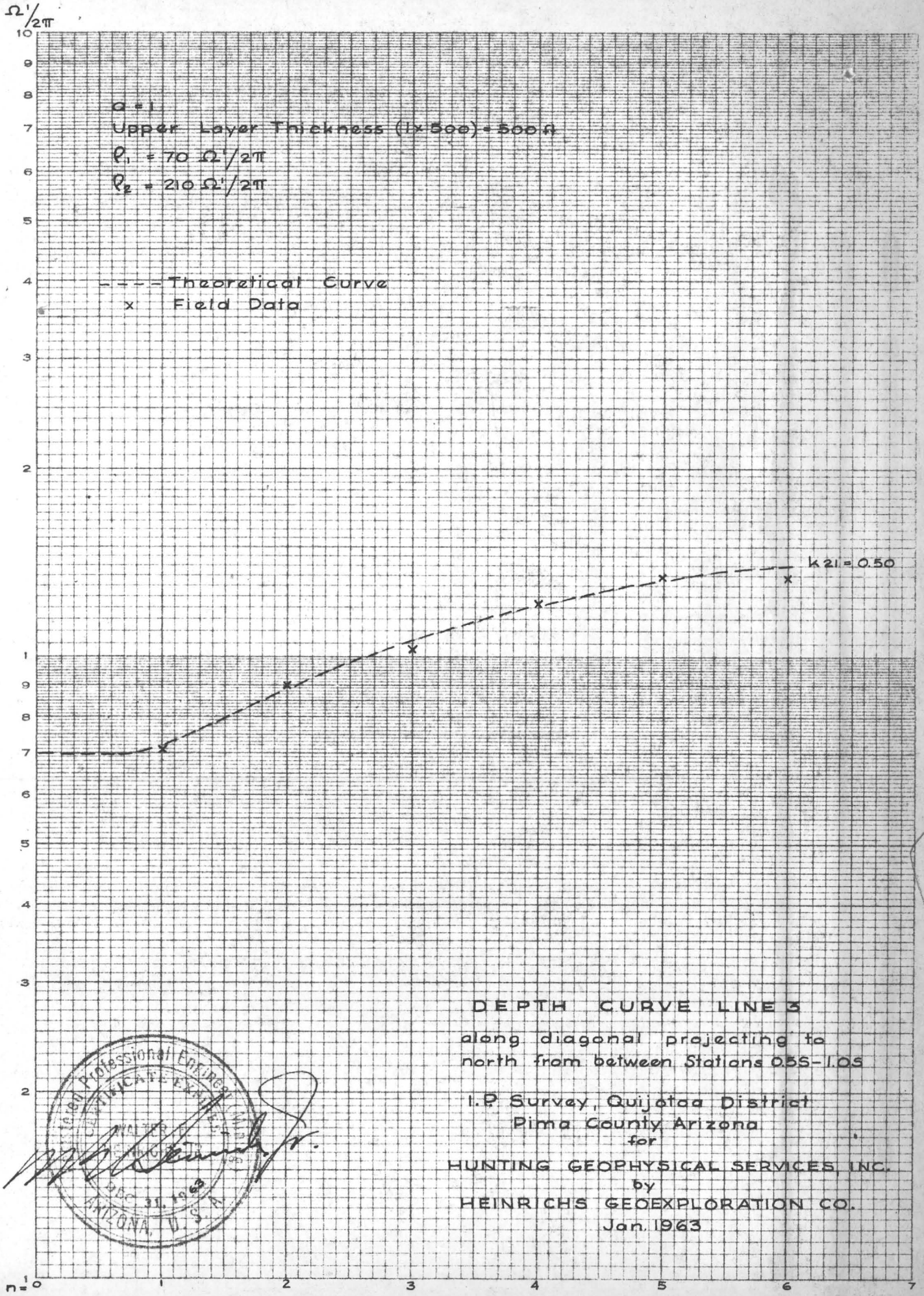
LINE No. 4

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 1000'
Date: Jan. 1963

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER C. HEINRICHS, JR.
DEC. 31, 19 63
ARIZONA, U.S.A.



6W 5W 4W 3W 2W 1W 0 1E 2E 3E 4E 5E 6E feet

mv

+25
0
-25
-50

LINE 4

+25
0
-25
-50

LINE 3

+25
0
-25
-50

LINE 2

+25
0
-25
-50

LINE 1

I.P INTERPRETATION LEGEND

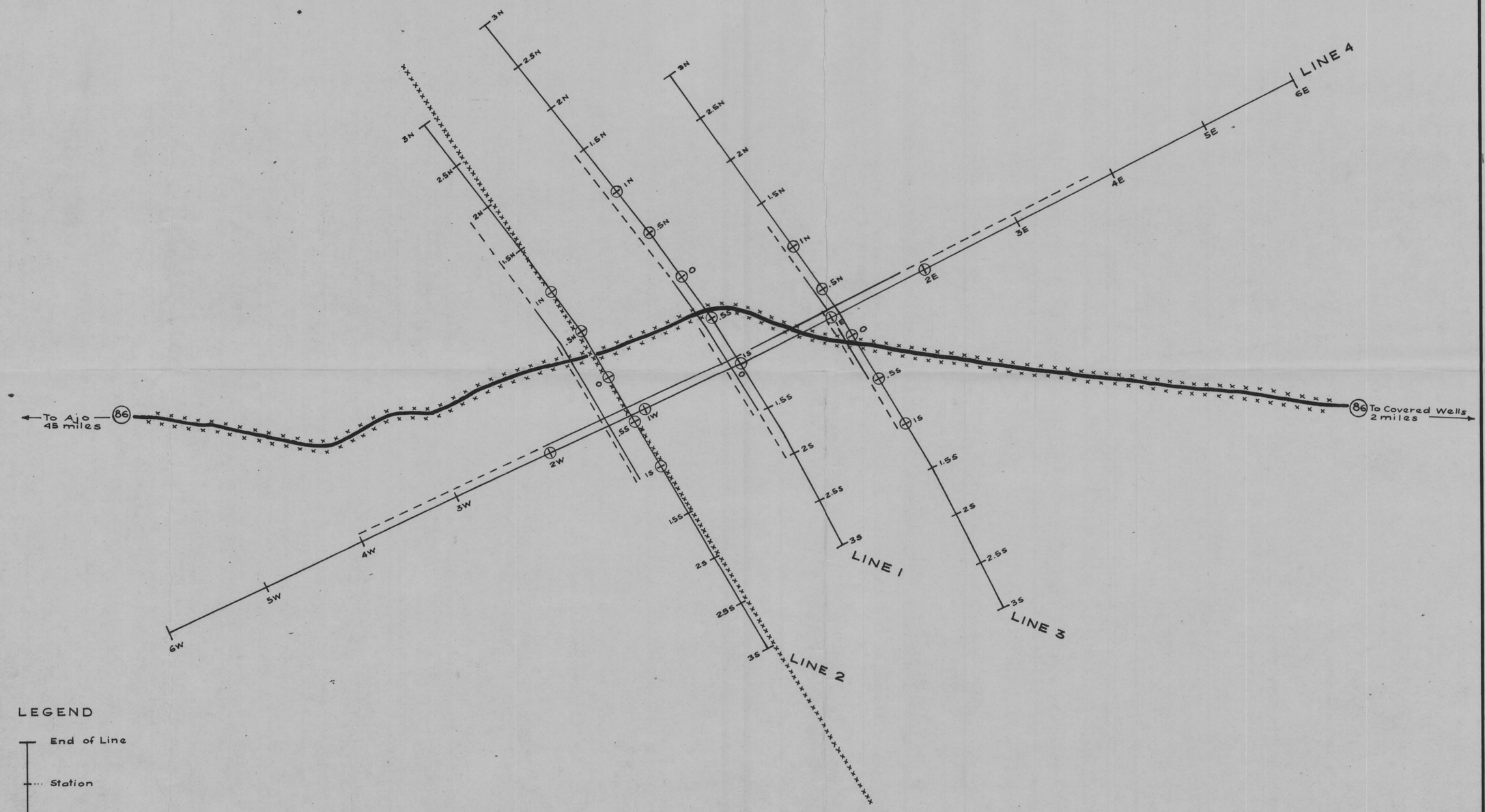
Very Weak

Weak

Moderate

Strong

SELF POTENTIAL PROFILES
I.P. SURVEY, QUIJOTOA DISTRICT
PIMA COUNTY, ARIZONA
for
HUNTING GEOPHYSICAL SERVICES, INC.
by
HEINRICHS GEOEXPLORATION CO.
Hor. Scale: 1" = 1000'
Vert. Scale: 1" = 50 MV
Jan. 1963



LEGEND

- End of Line
- Station
- Electrode
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

xxxxx Grounded wire fence

From Base Map furnished by Hunting Geophysical Services, Inc.

N

INDUCED POLARIZATION SURVEY

QUIJOTOA MINING DISTRICT

Papago Indian Reservation – Pima County, Arizona

for

HUNTING GEOPHYSICAL SERVICES INC.

by

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 800' Jan. 1963

INDUCED POLARIZATION SURVEY

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Papago Indian Reservation
Pima County, Arizona

January 1963

for
HUNTING GEOPHYSICAL SERVICES, INC.

by
HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5671 Tucson, Arizona

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INTRODUCTION

From January 18 through January 25, 1963 Heinrichs Geoexploration Co. conducted induced polarization surveys over part of the Quijotoa Mining District, Papago Indian Reservation near Covered Wells, Arizona. This work was performed at the request of Mr. Quentin G. Whishaw of Hunting Geophysical Services, Inc., under the supervision of Mr. Franklin A. Seward, Jr., geophysicist, with E. Grover Heinrichs, Chris Ludwig and Floyd Hanly assisting.

The twofold purpose of this work was to first test an I. P. anomaly mapped by Hunting Geophysical Services and second to provide a direct comparison of the Hunting data which was obtained by the time domain or pulse method and the data of this report which utilized the multiple frequency technique.

Included with this report are sectional data sheets for each of the four lines surveyed and a plan location map, a depth curve profile on Line 3 and self potential profiles.

CONCLUSIONS AND RECOMMENDATIONS

1. The anomalism observed is definite, but considered to be of only moderate absolute magnitude. It is interpreted to be due to sulfide mineralization and compares with rather surprising similarity to the previous pulse results.

2. Data on Lines 1, 3 and 4 indicate definite attenuation of sulfide involvement at depth.

3. Data on Line 2 is suspect at least in part due to proximity of Line and electrodes to parallel fence.

4. Line 4 repeated with two end on spreads of 500 ft. dipoles would probably give much more definite east-west boundary interpretation.

5. Lateral resolution is best on Line 3 and least on Line 4

6. Lateral resistivity inhomogeneities preclude discrete depth analyses. One depth curve analysis on Line 3 indicates a thickness of the upper layer of 500 ft.

PROCEDURES

Lines 1, 2 and 3 were run along Hunting Geophysical Lines 2, 5 and 6 respectively, centered as indicated on the plan map, using a 500 ft. dipole spacing. Line 4 was run along Hunting Line 7 centered as indicated at 1.0 south on Line 1 and using a 1,000 ft. dipole spacing.

Observations were made from the expanding dipole-dipole or Eltran electrode configuration which has become standard in the industry for those using the frequency domain technique.

A D.C. frequency of .05 cps was used throughout the survey except when receiving the 5th and 6th separation data on Lines 2 and 3 and 3rd through 6th separation data on Line 4 where high telluric noise-to-signal ratio was minimized by using .15 cps. The A.C. frequency used was 3.0 cps.

INTERPRETATION

The interpretation is presented on the sectional data sheets and the plan maps as blank, dashed, single bar, single bar and dashed and double bar lines indicating the relative degree of anomalism observed and respectively, the terms very weak, weak, moderate and strong are used to indicate the strength. It should be emphasized that these terms are used in a relative sense only and may be only indirectly related to absolute degree of anomalism or intensity of mineralization.

The anomaly on each of the four lines correlates well with that mapped by Hunting. The highest absolute anomalism (with respect to the percent frequency effects) appears to exist on Line 2. On the other hand much if not all of these data are subject to question regarding degree of sulfide involvement because of the close proximity of this line and the current electrodes to a

parallel grounded wire fence. In fact it is almost certain that the data on the 2.5n to 3n dipole was strongly affected by the fence and it was not reasonable from the observations made to compute frequency effects or metal factors on the last three data points.

Line 1 shows a distinct anomaly from 1.0n to 2.0s with the strongest effects from 0.5s to 1.5s. The best pattern is observed on Line 3 which offers the highest degree of resolution although not necessarily the highest magnitude effects.

The 1,000 ft. dipole, Line 4 offers the least lateral resolution and the lowest magnitude anomalous data.

On all of the lines, with the possible exception of Line 2 (of the questionable data), the anomaly appears to attenuate with depth, indicating that perhaps the mineralized zone is a relatively horizontal layer.

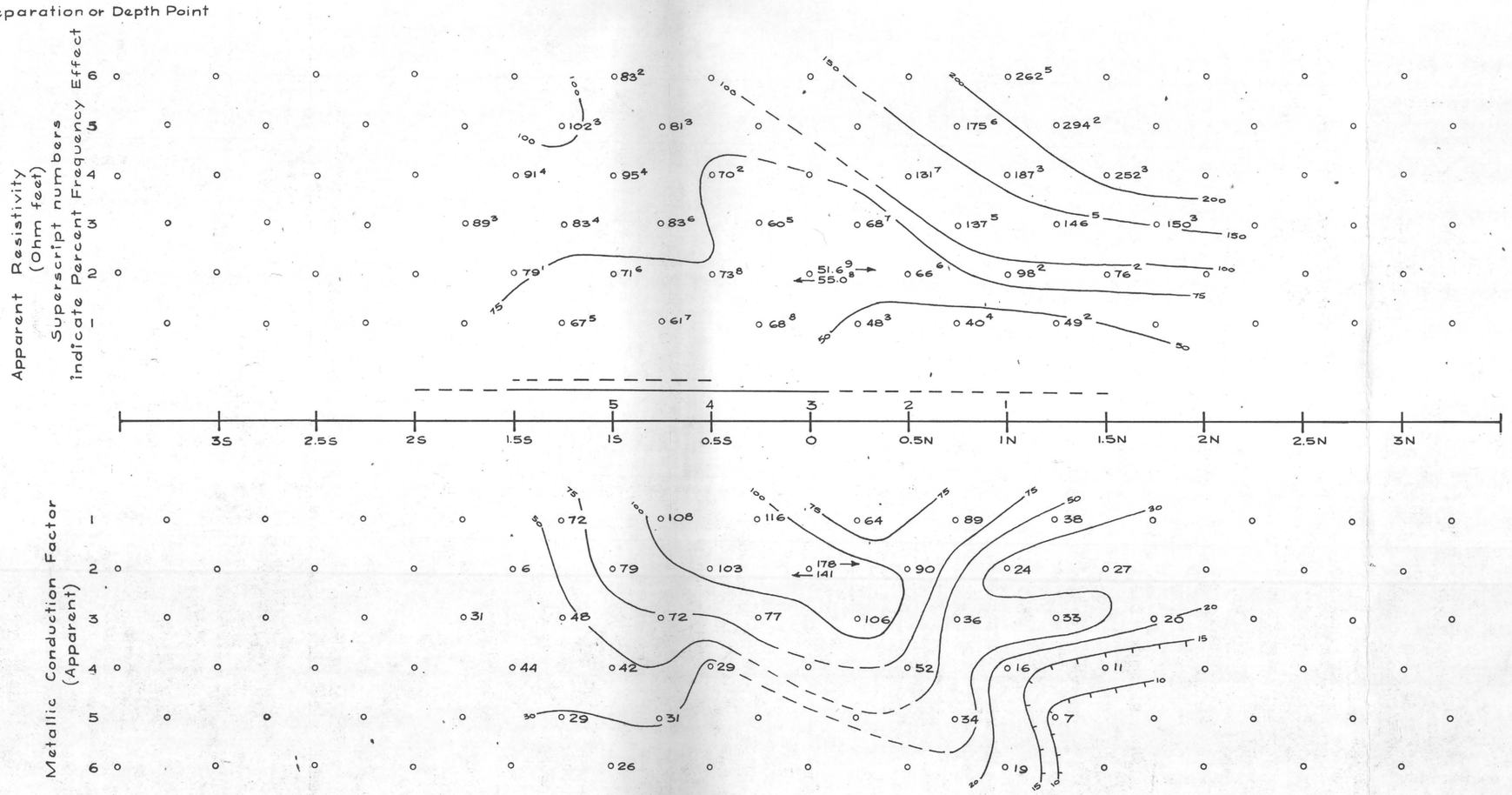
A number of depth analyses were attempted on each of the lines, but in general lateral resistivity changes prevented any successful interpretation. One depth curve on Line 3, taken along the diagonal projecting to the north from between stations 0.5s to 1.0s, gives a depth to the top of the second layer of 500 ft, a resistivity of 70 ohm ft./2pi for the top layer and a resistivity of 210 ohm ft./2pi for the bottom layer.

Respectfully submitted,
HEINRICHS GEOEXPLORATION CO.

Franklin A. Seward Jr.

Franklin A. Seward, Jr., Geophysicist

January 30, 1963
P. O. Box 5671
Tucson, Arizona



LEGEND

Electrode &/or Pot Location & End of Line

Station

No Anomaly

Very Weak

Weak

Moderate

Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

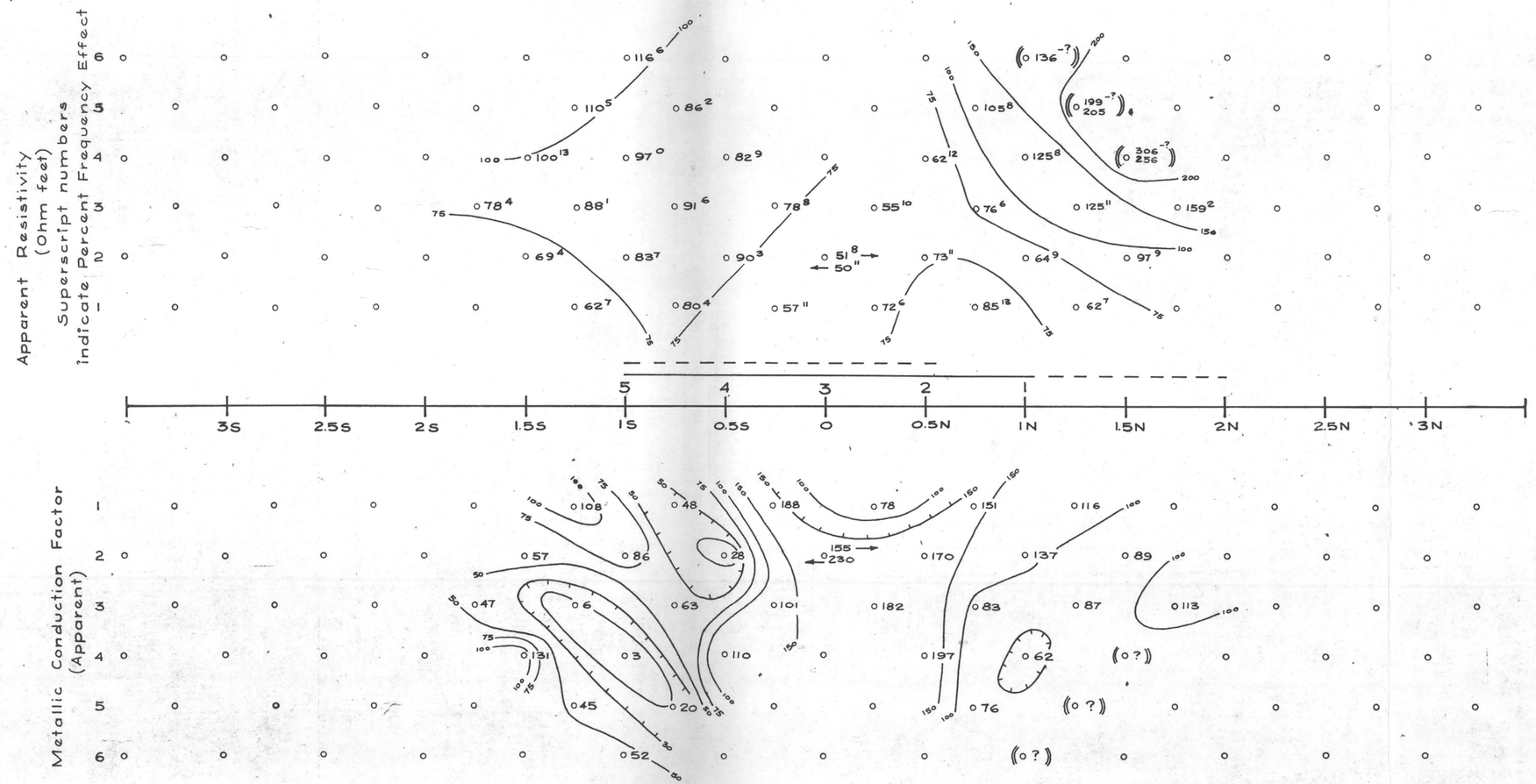
LINE No. 1

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
DEC. 31, 1963
ARIZONA, U.S.A.



LEGEND

Electrode &/or Pot. Location & End of Line

Station

No Anomaly

Very Weak

Weak

Moderate

Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 2

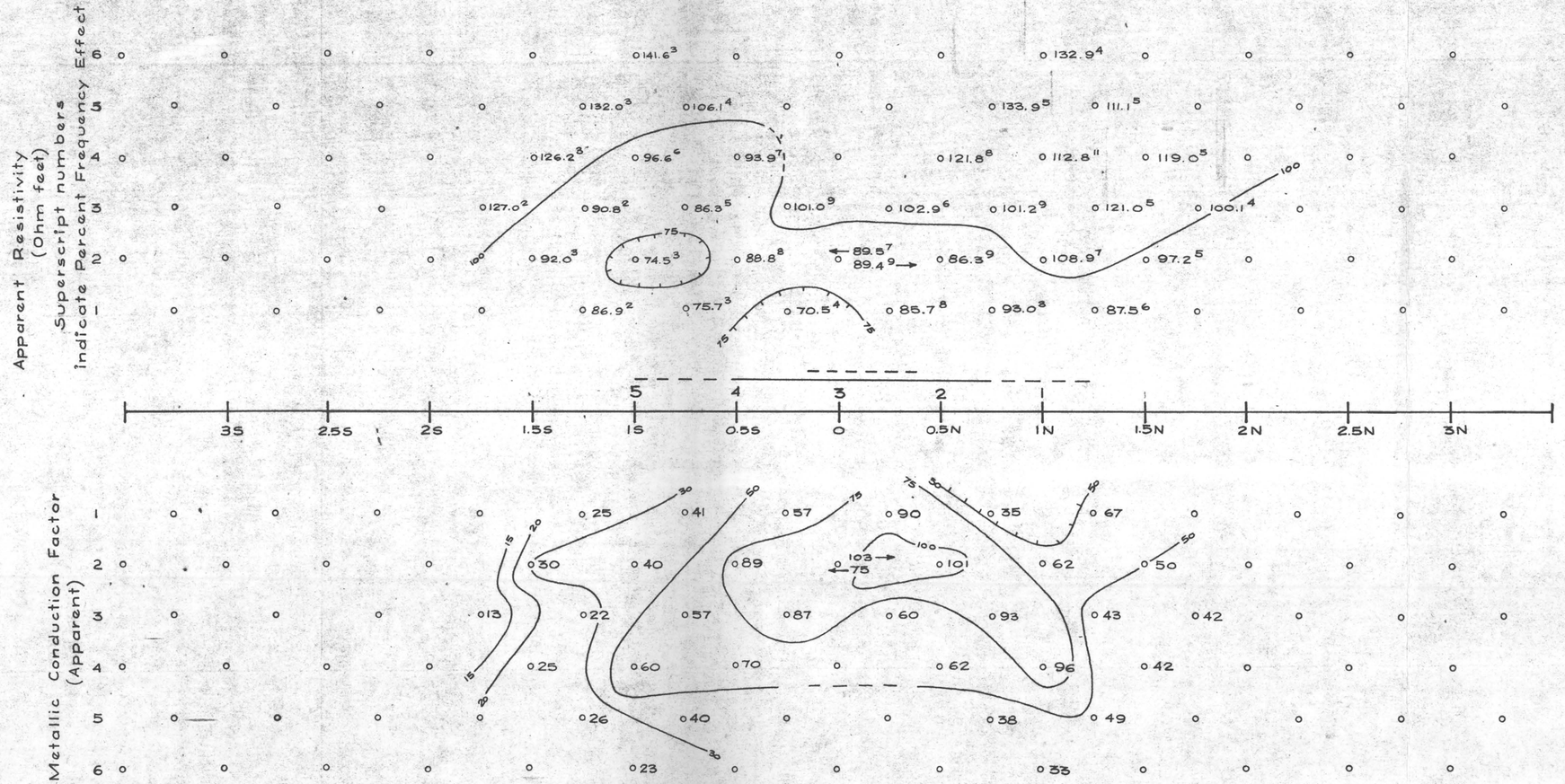
INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'

Date: Jan. 1963

Registered Professional Engineer
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1963
ARIZONA, U.S.A.



LEGEND

- Electrode &/or Pot Location & End of Line
- Station
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 3

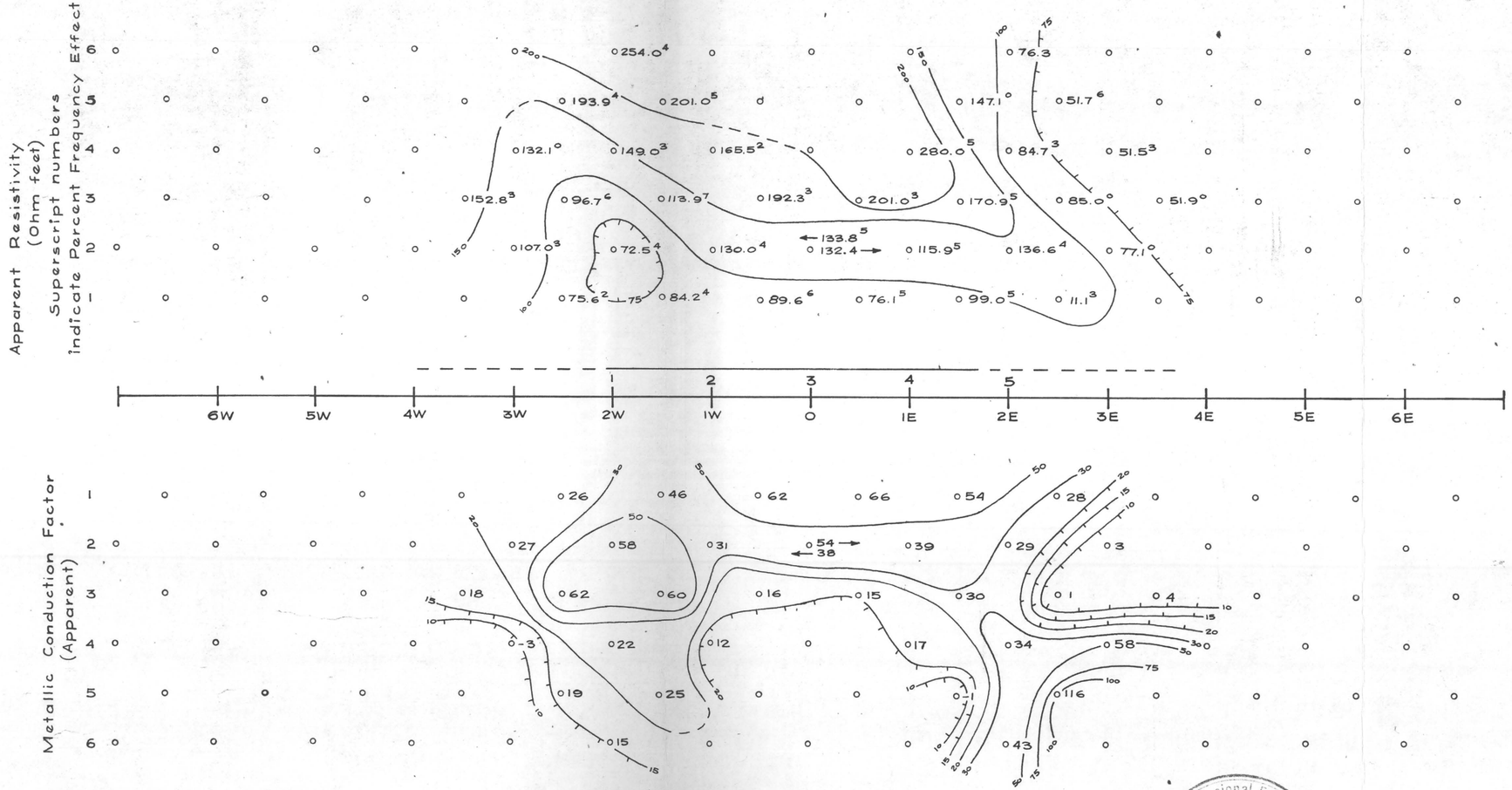
INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

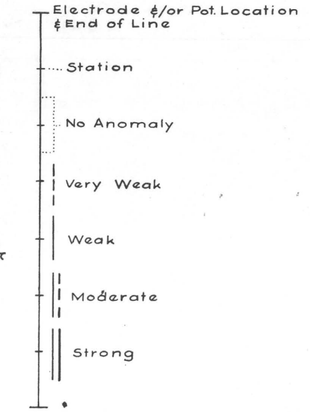
Scale: 1" = 500'
Date: Jan. 1963

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
DEC. 31, 1963
ARIZONA, U.S.A.

GEOEX



LEGEND



Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

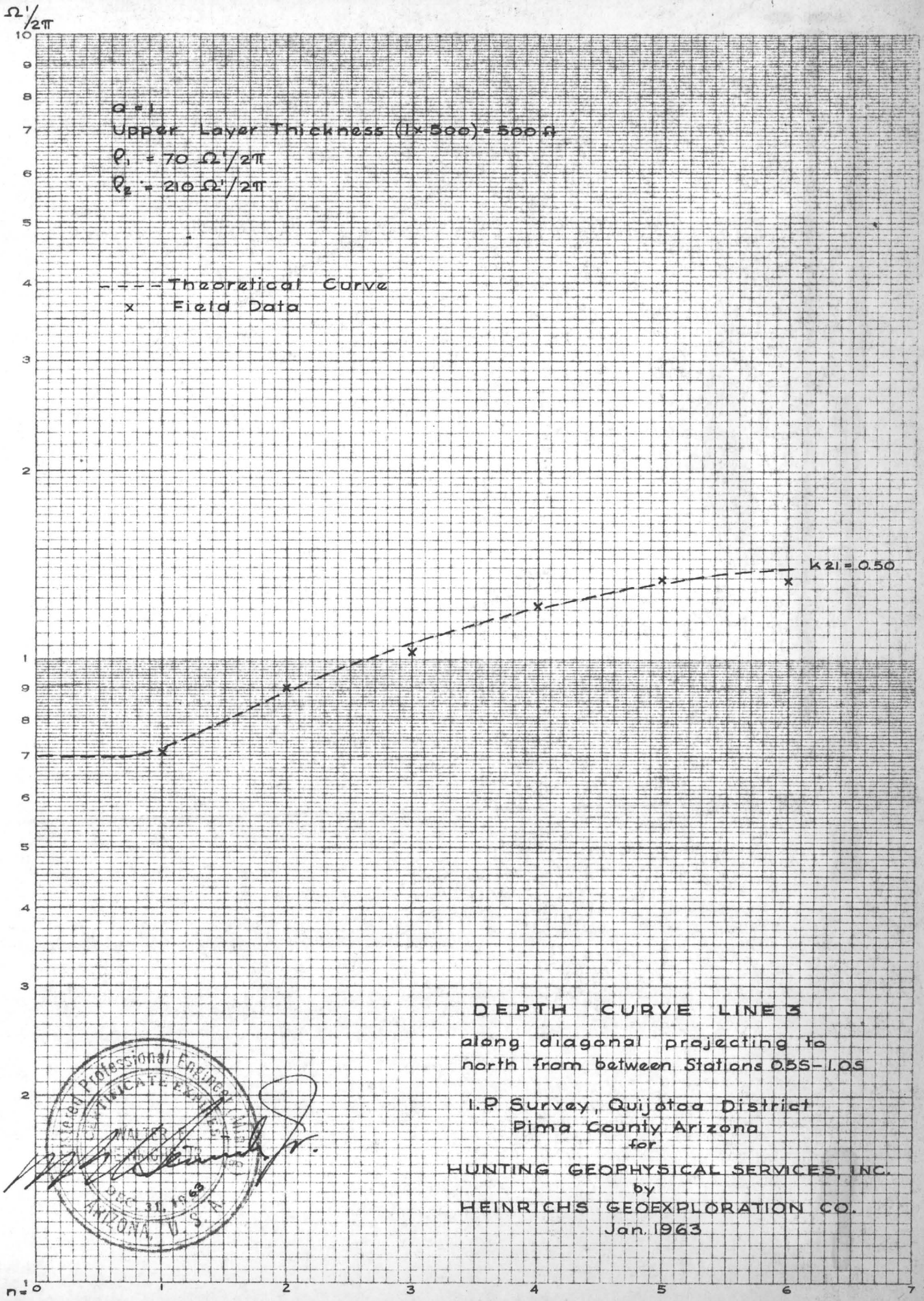
SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 4

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 1000'
Date: Jan. 1963



6W 5W 4W 3W 2W 1W 0 1E 2E 3E 4E 5E 6E feet

mv

+25
0
-25
-50

LINE 4

+25
0
-25
-50

LINE 3

+25
0
-25
-50

LINE 2

+25
0
-25
-50

LINE 1

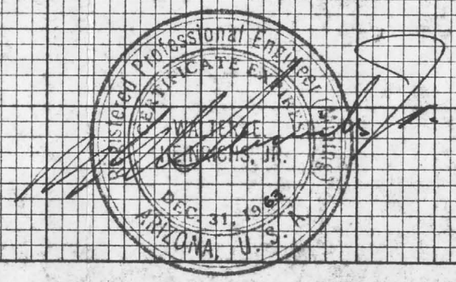
Very Weak

Weak

Moderate

Strong

I.P INTERPRETATION LEGEND



SELF POTENTIAL PROFILES
I.P. SURVEY, QUIJOTOA DISTRICT
PIMA COUNTY, ARIZONA

for

HUNTING GEOPHYSICAL SERVICES, INC.

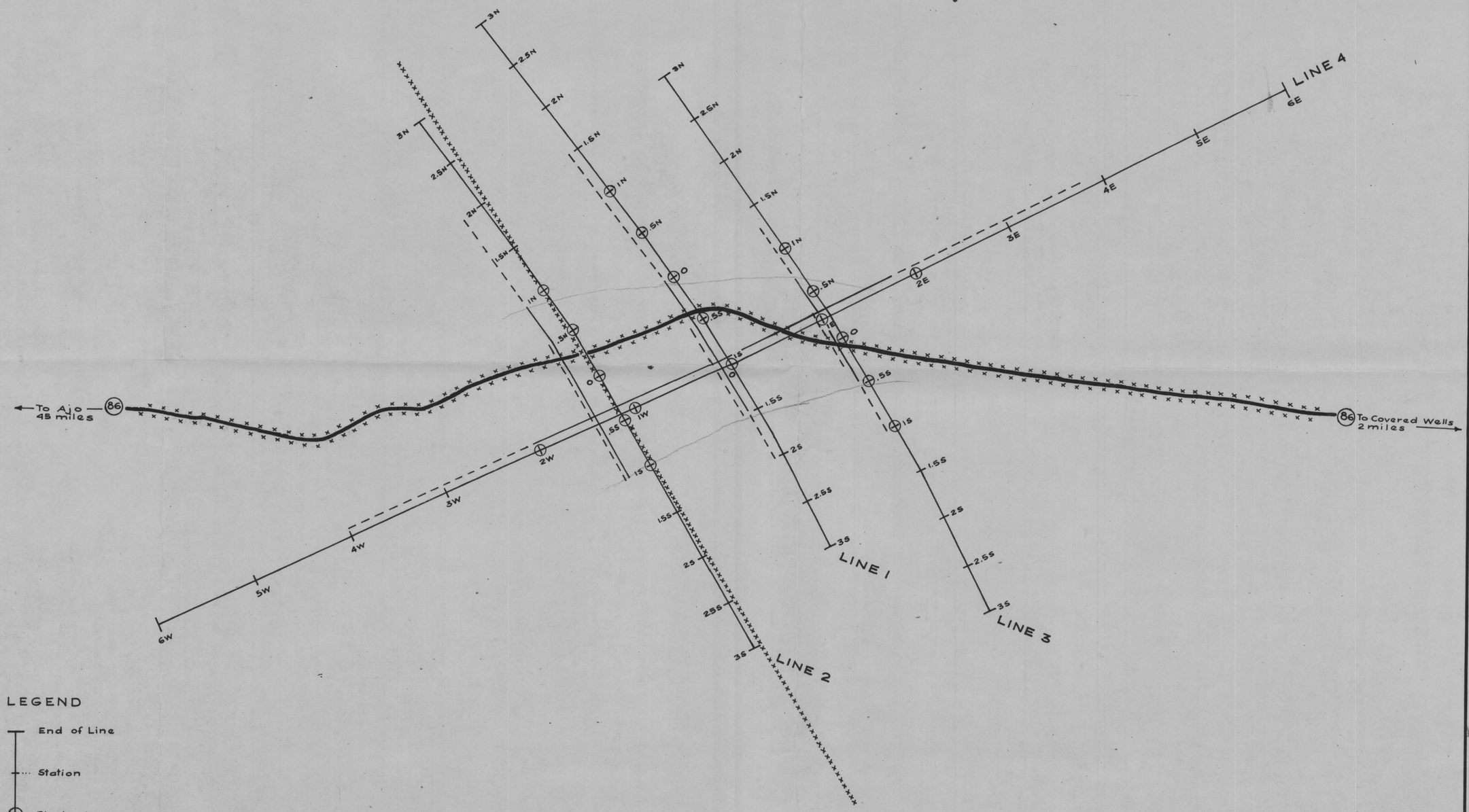
by

HEINRICHS GEOEXPLORATION CO.

Hor. Scale: 1" = 1000'

Vert. Scale: 1" = 50 MV

Jan. 1963



LEGEND

- End of Line
- Station
- Electrode
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

xxxxx Grounded wire fence

From Base Map furnished by
Hunting Geophysical Services, Inc.

N

INDUCED POLARIZATION SURVEY

QUIJOTOA MINING DISTRICT

Papago Indian Reservation – Pima County, Arizona

for

HUNTING GEOPHYSICAL SERVICES. INC.

by

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 800' Jan. 1963

Floyd Hanly

Project - Hunting

Advance	$40.00
Food	$34.28
Balance	$5.72
Lunch	$1.00
Balance owed-company	$4.72

15.75
10.71
1.32
4.52
1.00
.98

34.28 S

34.28 I

Covered Wells
Trading Post

1/23/63

		*
.2	3	
.2	3	
.4	9	
.9	5	S
	3	
.9	8	*

Covered Wells Trading Post

1/23/63

	*
.25	
.25	
.25	
.25	
1.00	*

OWENS MEAT HOUSE
918 W. PRINCE

20 JAN 63

$10.40 —
$00.31 —

$10.71 TOTL.

MINUTE MARKET
920 West Prince
—5—

20 JAN 63

$00.31 —
$00.33 —
$00.30 —
$00.33 —
$00.05 TAX

$01.32 TOTL.

MINUTE MARKET
928 West Prince
— 6 —

20 JAN 63

$00.46	—
$00.46	—
$00.23	—
$00.25	—
$00.72	—
$00.31	—
$00.55	—
$00.39	—
$00.39	—
$00.25	—
$00.34	—
$00.17	TAX
$04.52	TOTL.

A. J. BAYLESS
MARKETS
— 462 —

JAN 10 5249

$ 000.29Gr
$ 000.29Gr
$ 000.29Gr
$ 000.29Gr
$ 000.56Gr
$ 000.56Gr
$ 000.63Nr
$ 000.35Gr
$ 000.49Gr
$ 000.49Nr
$ 000.31Pr
$ 000.32Pr
$ 000.76Pr
$ 000.45Pr
$ 000.11Gr
$ 000.31Pr
$ 000.49Gr
$ 000.23Gr
$ 000.33Gr
$ 000.53Nr
$ 000.17Gr
$ 000.19Gr
$ 000.23Gr
$ 000.33Gr
$ 000.15Gr
$ 000.37Gr
$ 000.29Gr
$ 000.19Gr
$ 000.54Gr
$ 000.50Gr
$ 000.49Gr
$ 000.59Gr
$ 000.39Gr
$ 000.35Gr
$ 000.45Gr
$ 000.39Nr
$ 000.79Nr
$ 000.39Nr
$ 000.39Nr
$ 000.35Gr
$ 000.10Gr

S$ 015.75 TLA
$ 000.63Tx

S$ 016.38 TLA
$ 040.00 AT

$ 023.62 CHA

Thank You

11/27/62

5792

Moe Kauffman

FRI.

Salesman Shoe

35.00 ~~15.00~~ 10/day

~~100.00~~ ~~50.00~~ /day

300.00 ~~150.00~~ /week

/month

To Walt

Date 1-28-63 Time 10 a.m

WHILE YOU WERE OUT

Mr. Wishaw

of Hunting

Phone 624-1991
Area Code Number Extension

TELEPHONED	X	PLEASE CALL	X
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	
	RETURNED YOUR CALL		

Message

Call as soon as you can.

Operator

Gibson's Arizona Stationers
760 So. Stone Ave., Tucson, Arizona

To Walsh

Date 11-26-62 Time 9:15

WHILE YOU WERE OUT

Mr Ken Wissent

of Hunting

Phone 624 1991

TELEPHONED		PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	

Message

Saw Gnat PM.

NW

Operator

Efficiency Line No. 2725

Summary:

Generally increases w/ depth, substantially to NW, somewhat to SE and slightly to west.

Highest PFE's (13) ~~on line~~ & Mcfs 230 on line 2, but some doubt owing to force. Otherwise, 7 to 9 pfE's & 100 Mcfs after anomalies & about twice background.

Question -: Lower grading one notch Anomaly seem? cut off SW & NE?

if time & money no object line might have been interesting?

3500 N sw of #2

W.

1/30/63

[illegible] -:

Line 1 - B.G. 1-5 = 3 Av. PFE
= ℓ low. 40-70 = 55
ℓ meiores N most but some S.
" 2 - " 0-6 = 31 "
ℓ low 50-80 = 65
ℓ meiores N. most but some S.

Line 3. -
B.G. 2-6 = Av ℓ.

Line 4. -
B.G. - 0 to? use Av. ℓ.
Make analysis over B.G. 1 mainly due to 1000'
dipoles? N/S or direction of travel?

H Scale 1" = 1000'

V Scale 1" = 50 mV

mV

+100

+50

0

-50

-100

Line 1

3S 2S 1S 0 1N 2N 3N

Line 2

3S 2S 1S 0 1N 2N 3N

Line 3

3S 2S 1S 0 1N 2N 3N

To -70 at 6W

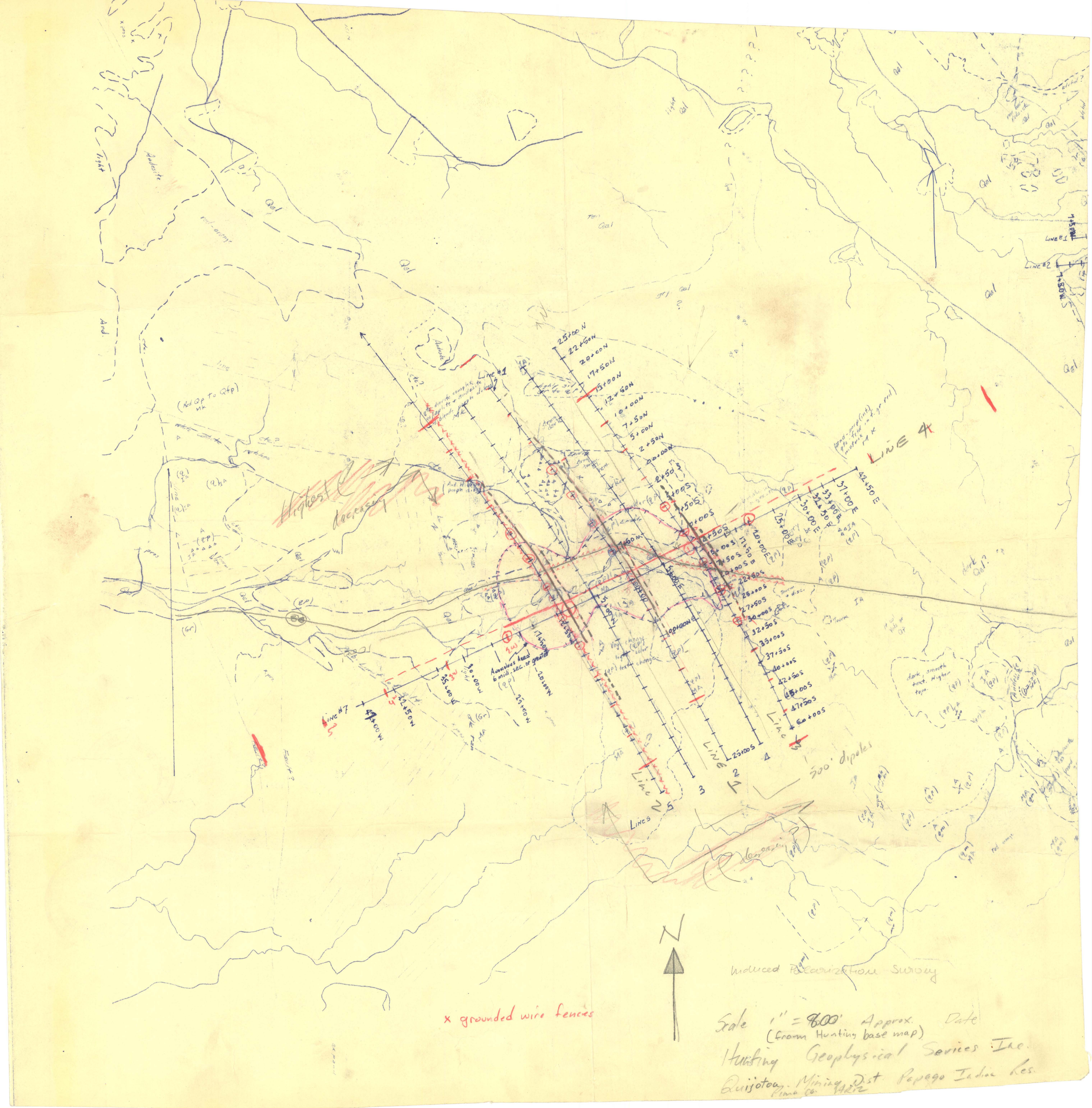
Line #4

To -2 at 6E

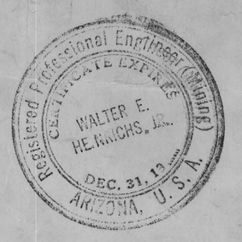
5W 4W 3W 2W 1W 0 1E 2E 3E 4E 5E

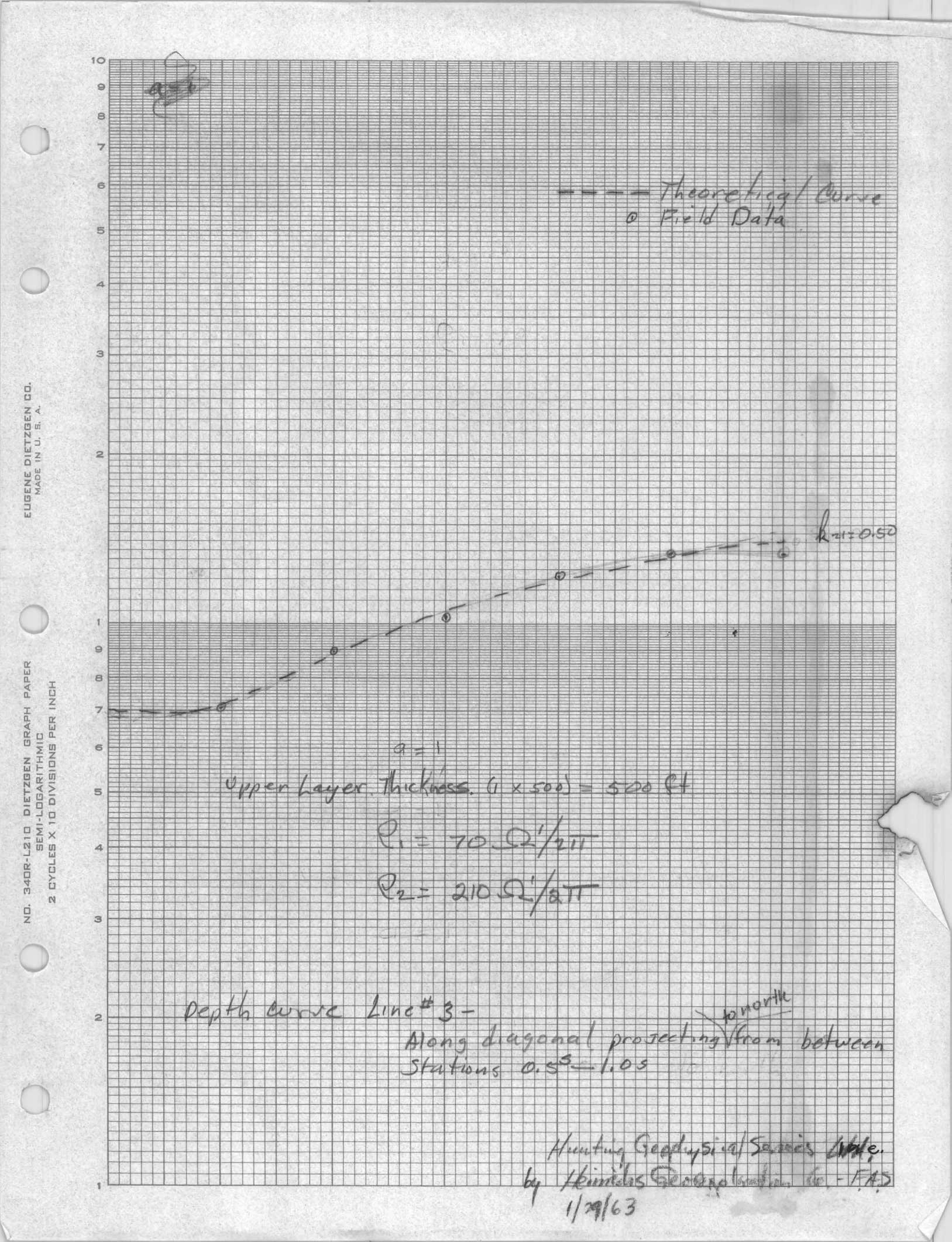
Self Potential Profiles


FROM
HUNTING
N
SCALE : 1" = 800'
Line #1
Line #7
Lines
5
3
2
4
6
25+00 N
22+50N
20+00N
17+50N
15+00N
12+50N
10+00N
7+50N
5+00N
2+50N
2+50S
5+00S
7+50S
10+00S
12+50S
15+00S
17+50S
20+00S
22+50S
25+00S
27+50S
30+00S
32+50S
35+00S
37+50S
40+00S
42+50S
45+00S
47+50S
50+00S
42+50E
37+00E
30+00E
25+00E
20+00E
10+00W
15+00W
20+00W
22+50W
25+00W
47+00W
Anomalous lead
Red Qp to Qtp
Andesite
dark, smooth
text. Higher
topo.


Line #1
LINE 4
Line 2
Line #7
Lines 2 5
500' dipoles
Highest
x grounded wire fences
N
Induced Polarization Survey
Scale 1" = 800' Approx. Date
(from Hunting base map)
Hunting Geophysical Services Inc.
Quijotoa Mining Dist. Papago Indian Res.
Pima Co. Ariz


Registered Professional Engineer (Mining)
WALTER E.
HEMMONS, JR.
DEC. 31, 19
U.S.A.


Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E.
HEMMONS, JR.
DEC. 31, 19
ARIZONA, U.S.A.



---- Theoretical Curve

o Field Data

a = 1

Upper Layer Thickness. (1 x 500) = 500 Ft

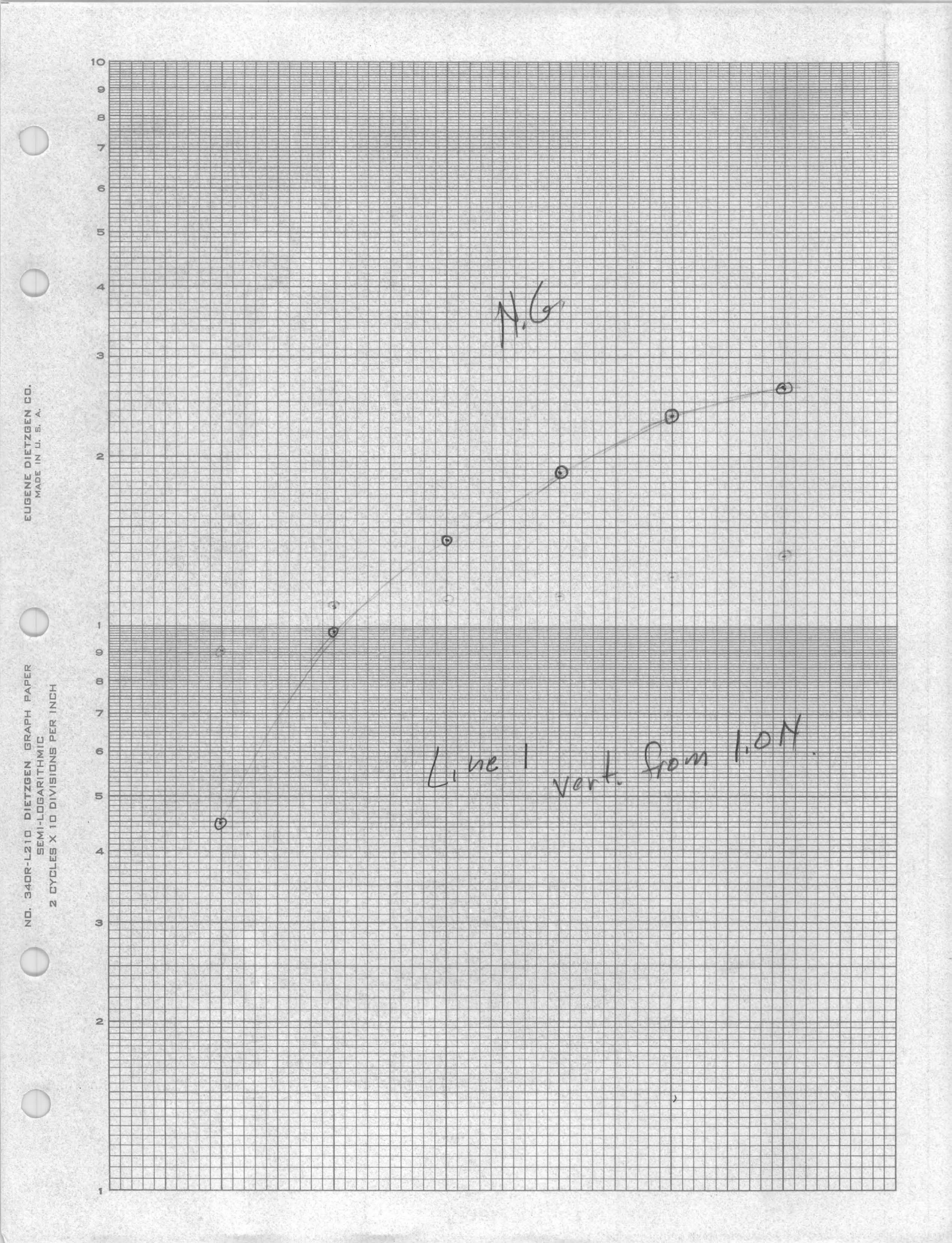
$\rho_1 = 70\ \Omega'/2\pi$

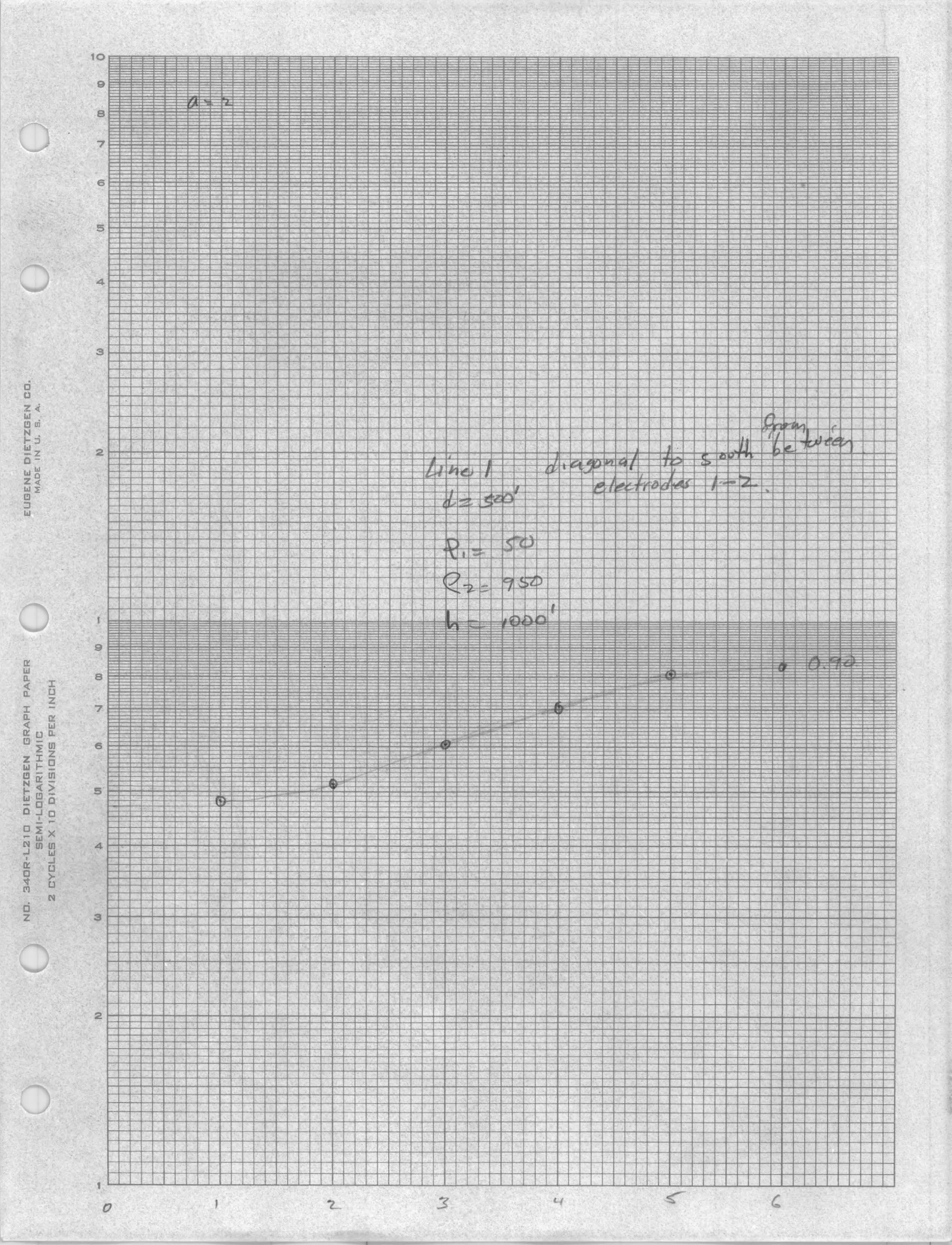
$\rho_2 = 210\ \Omega'/2\pi$

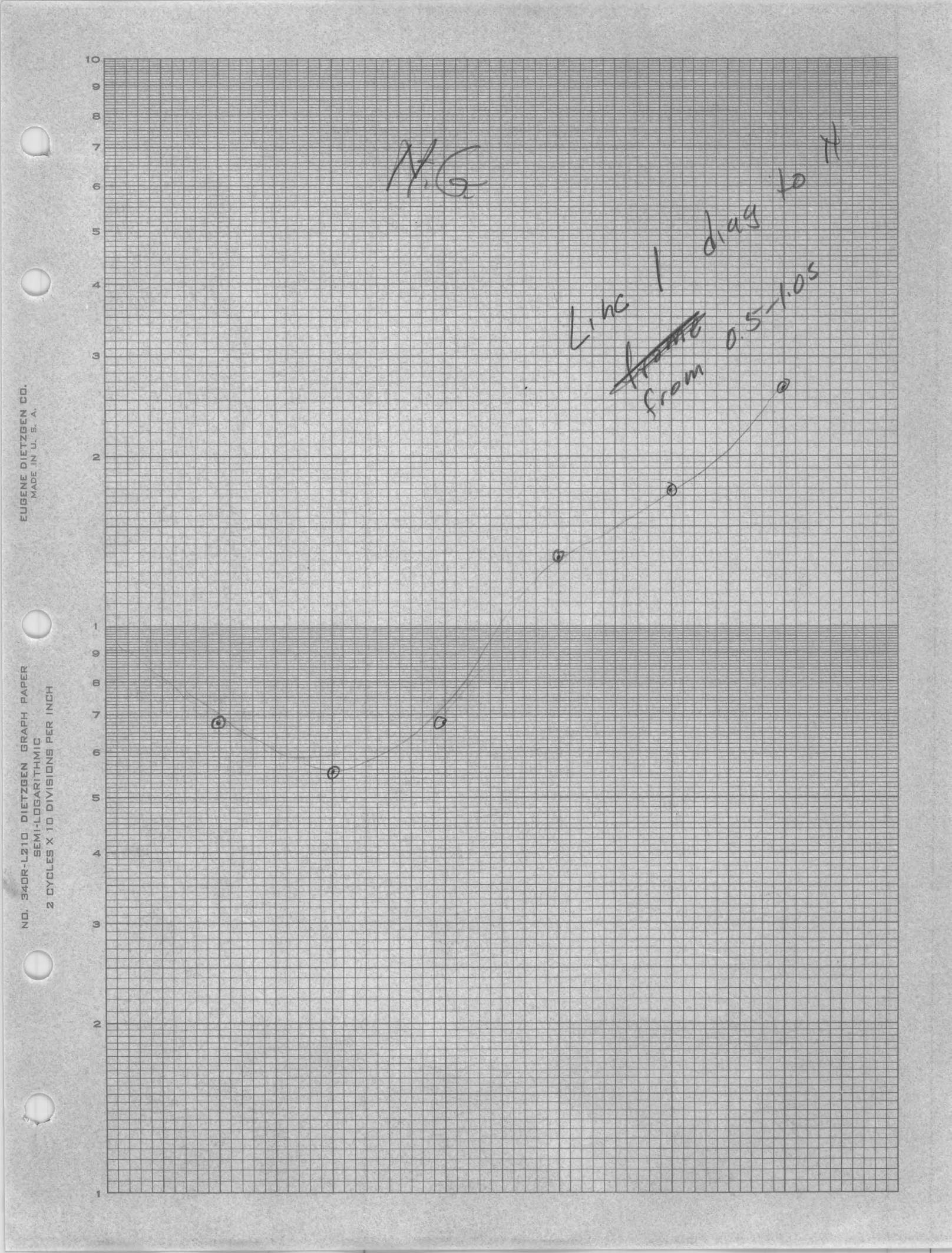
Depth Curve Line #3 -

Along diagonal projecting ~~from~~ to north from between Stations 0.5S — 1.0S

Hunting Geophysical Services Div.
by Himalaya Exploration Co. - F.A.S.
1/29/63


10
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
N.G
Line 1 vert. from 1.0 N.
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH


A = 2
Line 1 diagonal to south from between electrodes 1-2.
d = 500'
R_1 = 50
R_2 = 950
h = 1000'
0.90
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH


NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
10
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
Line 1 drag to N
from 0.5-1.0s

Run with Madd + Acc & B.C. U.T.U.M.

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Covered Wells Line 1 - N½ Field date 1/14/61 Data page _____ Comp. date 1/19/61 Comp by C.S.L.

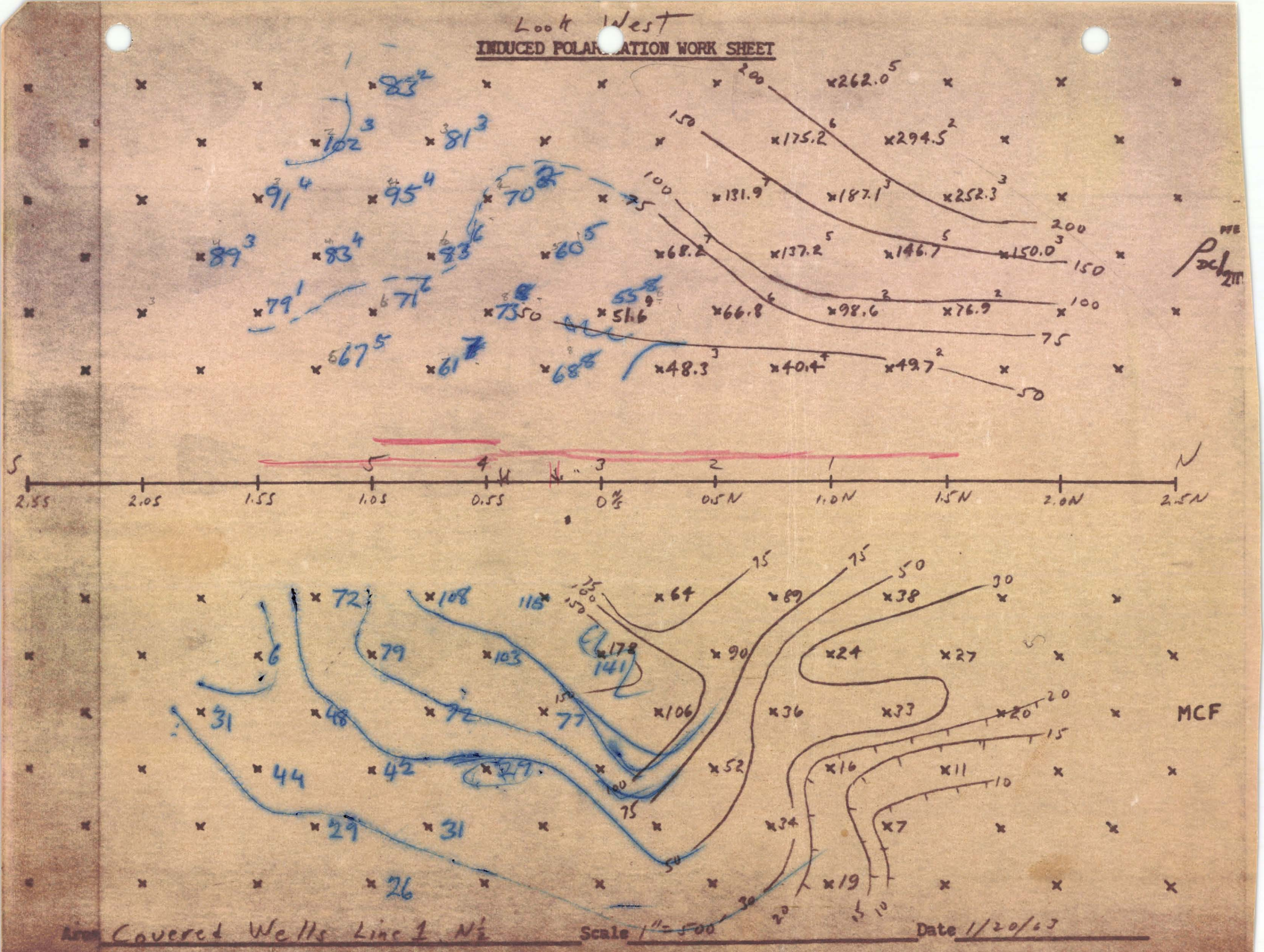
	9. S.P.	86	28	23	68	74	23	31	86	37	29	47	73	36	37	78	58
A) Send		3-4		4-5		2-3		3-4		4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
B) Receive		0.5-1.0N		→		1.0-1.5N		—		→	1.5-2.0N	—		→	2.0-2.5N		
C) n separation		1		2		1		2		3	1	2	3	4	2	3	4
D) I		1400		—		—		—		—	—	—	—	—	—	—	—
E) Vdc (avg)		57.5	56.1	15.0	15.35	49.7	46.5	19.6	19.6	8.02	58.5	29.0	16.14	7.76	22.6	17.23	11.0
F) DCeal	USED	1.020		—		—		—		—	—	—	—	—	—	—	—
G) Kn x 10-3		1.5		6		1.5		6		15	1.5	6	15	30	6	15	30
H) ρ dc=ExFxGx10³/D		48.3		51.6		40.4		66.8		68.2	49.7	98.6	137.2	131.9	76.9	146.7	187.1
I) Vac Σ		51.6	55.6	13.8	13.6	44.3	46.0	18.7	17.2	7.47	58.0	27.9	14.60	7.27	22.1	15.54	10.47
J) AC noise x 2		0		—		—		—		—	—	—	—	—	—	—	—
K) Vac(corr) = √I² - J²		—		—		—		—		—	—	—	—	—	—	—	—
L) AC-DC cal.		.933	1.012	1.018	.957	.949	1.018	1.007	.933	.999	1.010	.986	.950	1.001	.999	.944	.979
M) ρ dc/ρac=ExL/K		1.039	1.023	1.104	1.050	1.042	1.030	1.056	1.064	1.072	1.019	1.024	1.050	1.069	1.021	1.048	1.030
N) PFE=(M-1)(10²)		4	(3) 2	10	(9) 8	4	(4) 3	6	(6) 6	7	2	2	5	7	2	5	3
O) MCF=(M-1)(10⁵)/H		31	64	92	178	36	89	40	90	106	38	24	36	52	27	33	16

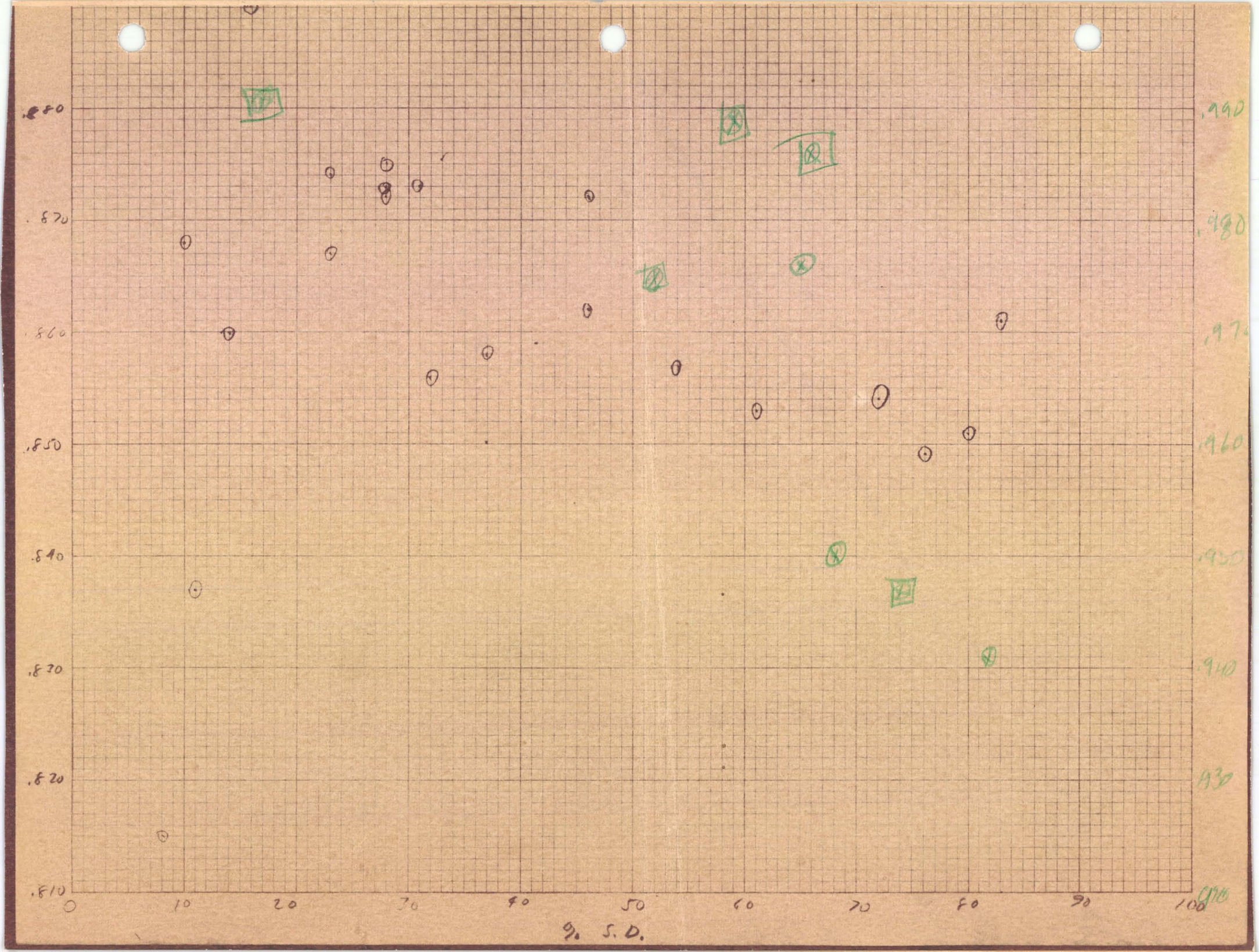
Project _____ Line 2E 81 Field date _____ Data page 69 48 26 83 Comp. date _____ Comp by _____

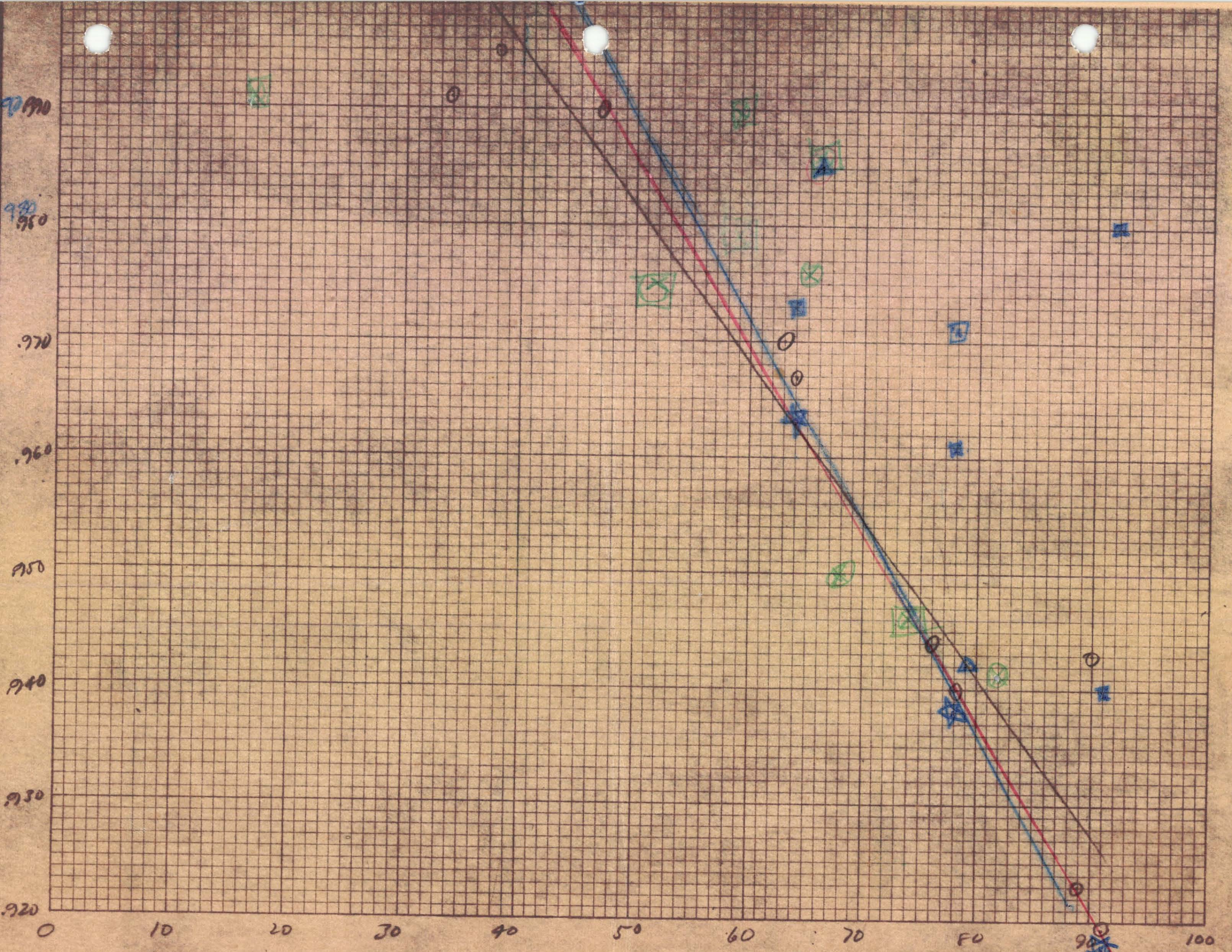
							CAL						
A) Send	4-5	1-2	2-3	3-4	4-5		1-2						
B) Receive	→	2.5-3.0N	—	—	→								
C) n separation	5	3	4	5	6	→							
D) I	—	—	—	—	—		400	400	500	500	600	600	600
E) Vdc (avg)	5.89	17.65	14.85	9.90	5.43	5.58	39.8	38.4	50.1	48.3	59.4	58.7	56
F) DCeal	—	—	—	—	→		1.005	1.041	.998	1.035	1.010	1.021	1.021
G) Kn x 10-3	52.5	15	30	52.5	84				~1.020				
H) ρ dc=ExFxGx10³/D	175.2	150.0	252.3	294.5	262.0								
I) Vac Σ	5.64	16.10	13.80	9.54	5.24	5.00	38.5	39.7	47.1	49.3	54.5	52.7	56
J) AC noise x 2	—	—	—	—	→								
K) Vac (corr) = √I² - J²	—	—	—	—	→								
L) AC-DC cal.	1.012	.940	.956	.984	1.014	.937	.967	1.033	.940	1.020	.919	1.017	1.000
M) ρdc/ρac =ExL/K	1.059	1.030	1.029	1.021	1.051	1.049							
N) PFE=(M-1)(10²)	6	3	3	2	5	(5) 5							
O) MCF=(M-1)(10⁵)/H	34	20	11	7	49	19							

Look West

INDUCED POLARIZATION WORK SHEET



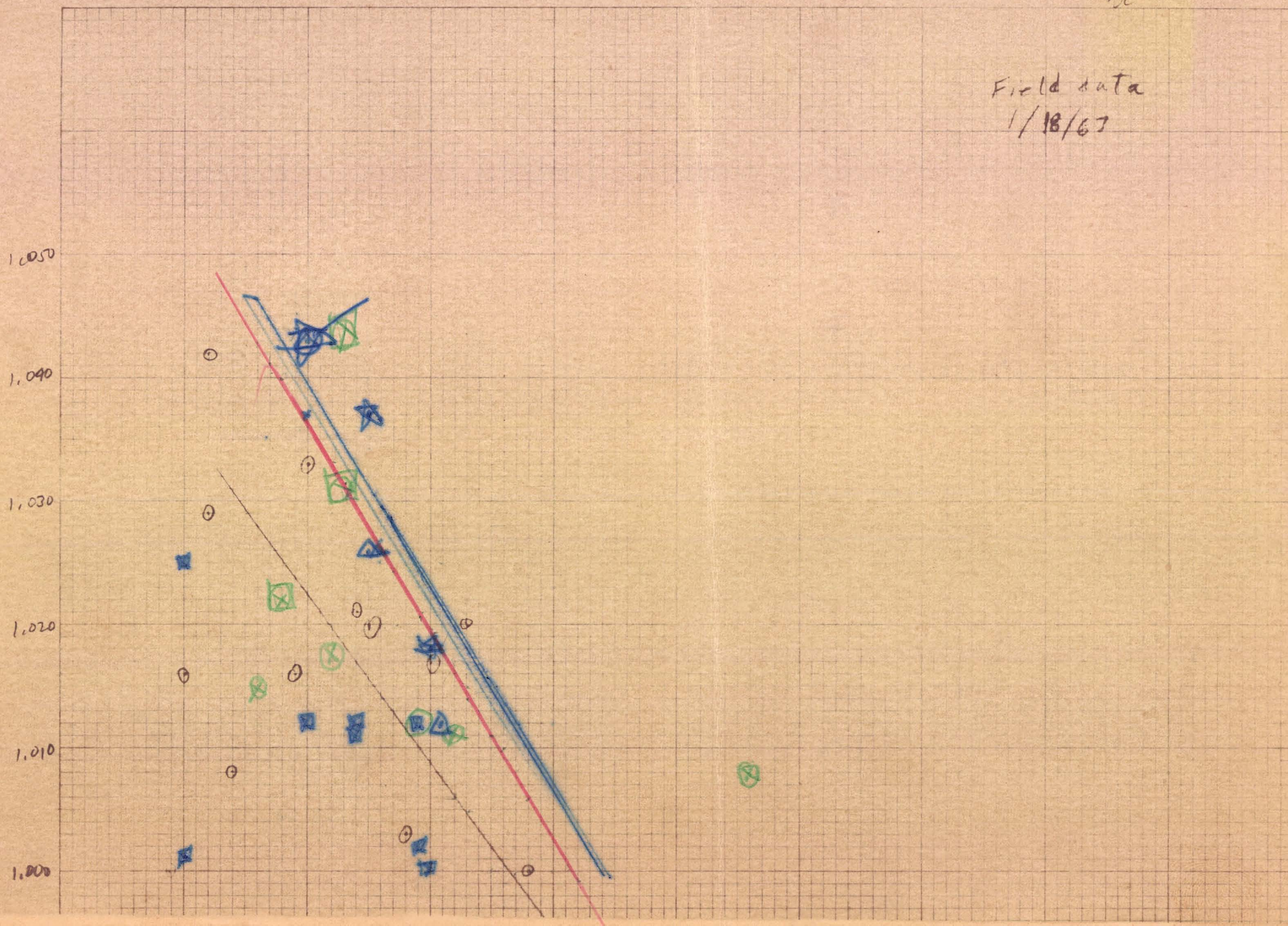

.890
.870
.860
.850
.840
.830
.820
.810
.990
.980
.970
.960
.950
.940
.930
.920
0
10
20
30
40
50
60
70
80
90
100
% S.D.



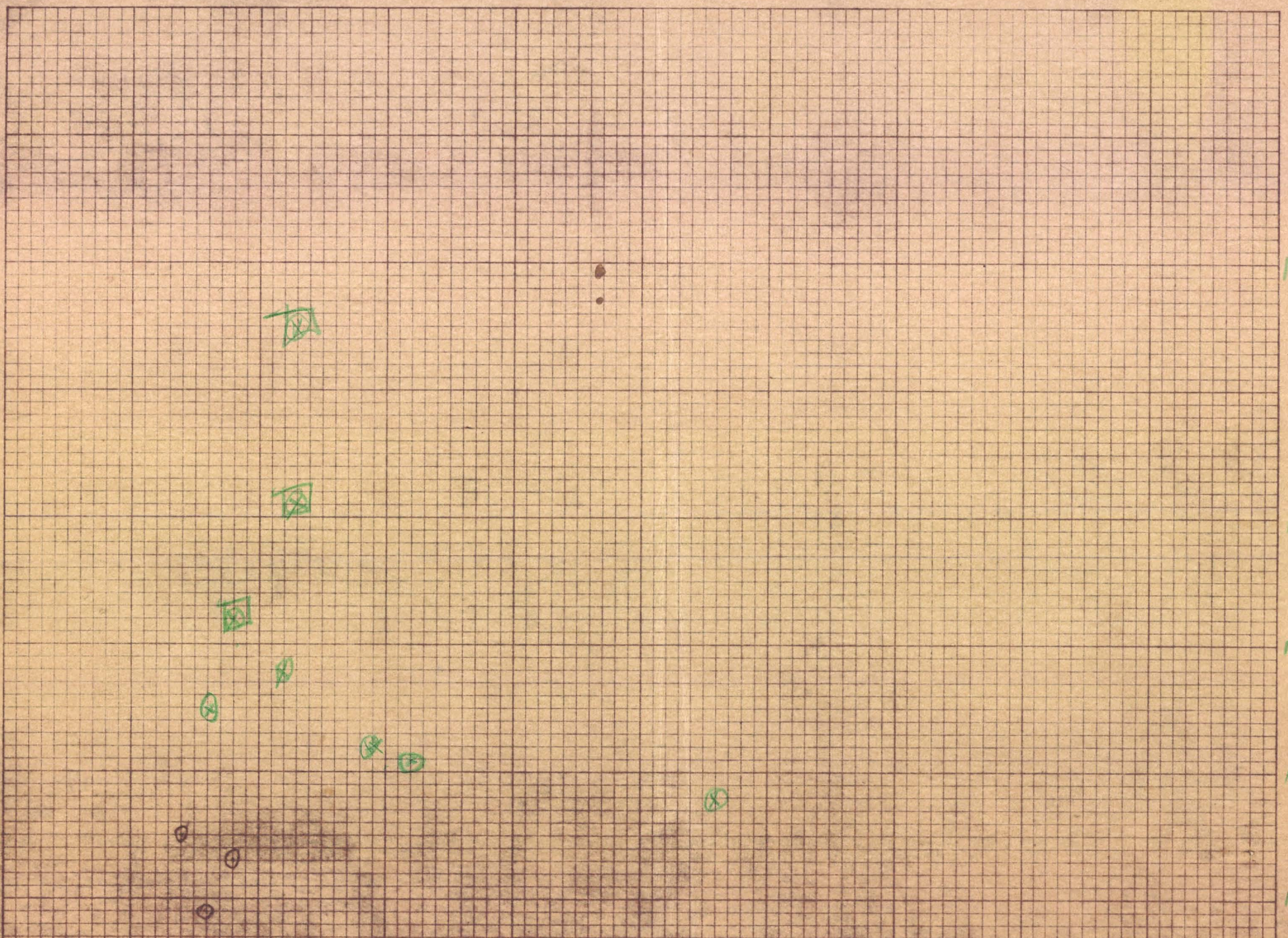
.990
.980
.970
.960
.950
.940
.930
.920
0
10
20
30
40
50
60
70
80
90
100

1/2/63

Madden Mee B.C. VTUM



Daves Receiver B.C. UTUM



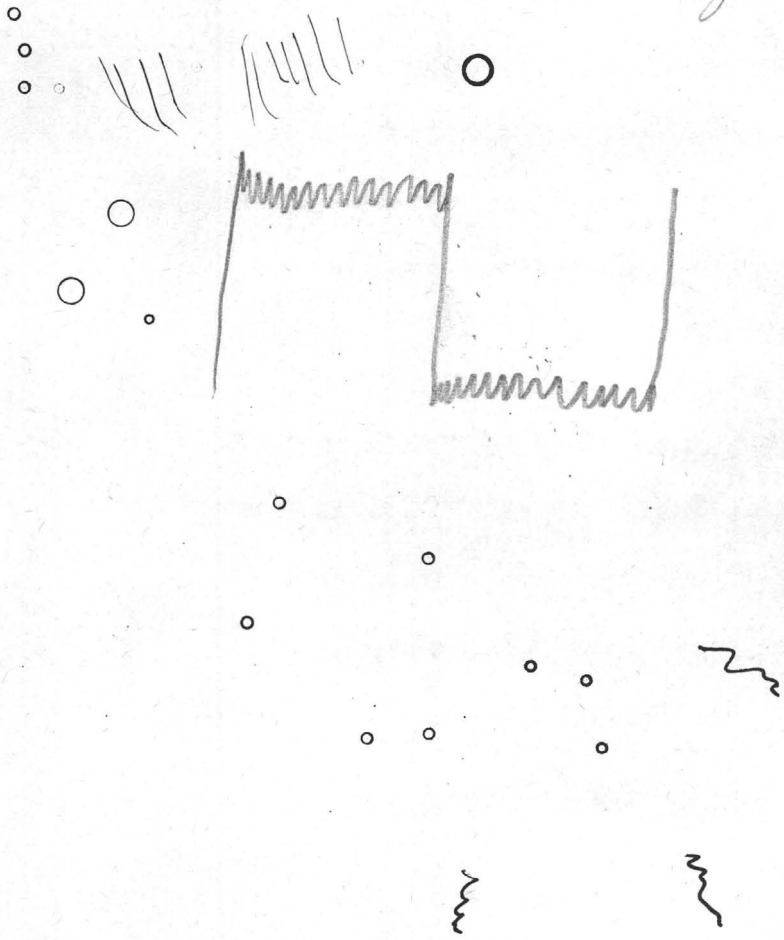
Geology
Huntting G.P.
Brownell Area
Quijotoa Papago
Indian Res.
1962
BROWNELL Mtns. Area - Photo Interp. with local field check
Scale: Approx. 1" - 1000'
Legend
Qal
Cretaceous? Basalt w/some interbedded tuffs
Cretaceous Comobabi group (Bryner); red beds, arkose w/occas. thin Lms. rhyolite to intermed vols (occas. inter bedded w/ seds.)
Cretaceous Comobabi group; thick conglomerate (this unit may not be correlative throughout map area)
Cretaceous Acid volcanics + related fine grained intrusives. (This complex previously referred to as "qtz. porph.")
Intrusive Rocks
probably young Andesite and andesite porph.
post Comobabi Rhyolite and "felsite" (JAL) intrusives Brownell Mine area
post Comobabi Small granite body - Brownell Mine area
post Comobabi Qtz. latite porph. (JAL)
post Cret. acid vols. Poor Boy granite (Miami Cu Co. qtz. monz.) and rocks of similar comp.
post Cret. acid vols. Diorite complex
post Cret. acid vols.? Brownell Mtn. granite
Symbols
Ponds
Faults
Bedding attitudes in seds.; Flow banding in extrusives
Breccia; confined by postulated pipe-like forms and linear zones.
Outline of altered or discolored area; from field evidence and photo interp.
Line 20
Line 21
Line 22
Line 23
Line 24
Line 25
BROWNELL MINE
POOR BOY PROSPECT
BY CHANCE PROSPECT
ST. PATRICK CLAIMS
Line #1
Line #2
Andesite
Village
Trading Post
prospects
mostly Qal
100' depth
400 to center
of Anomalies

Pulse : Frequency

2 Contoured plan maps showing main zone of anomalies for each technique

1 profile of Line 6 (Pulse)

1 profile of Line 3 (Freq)



Empire 4f414

K

12/5/63

4:30 p.m.

Long distance for E.G.H.
from George Rogers.
Told operator Grover would
be back tomorrow afternoon.
call was cancelled.

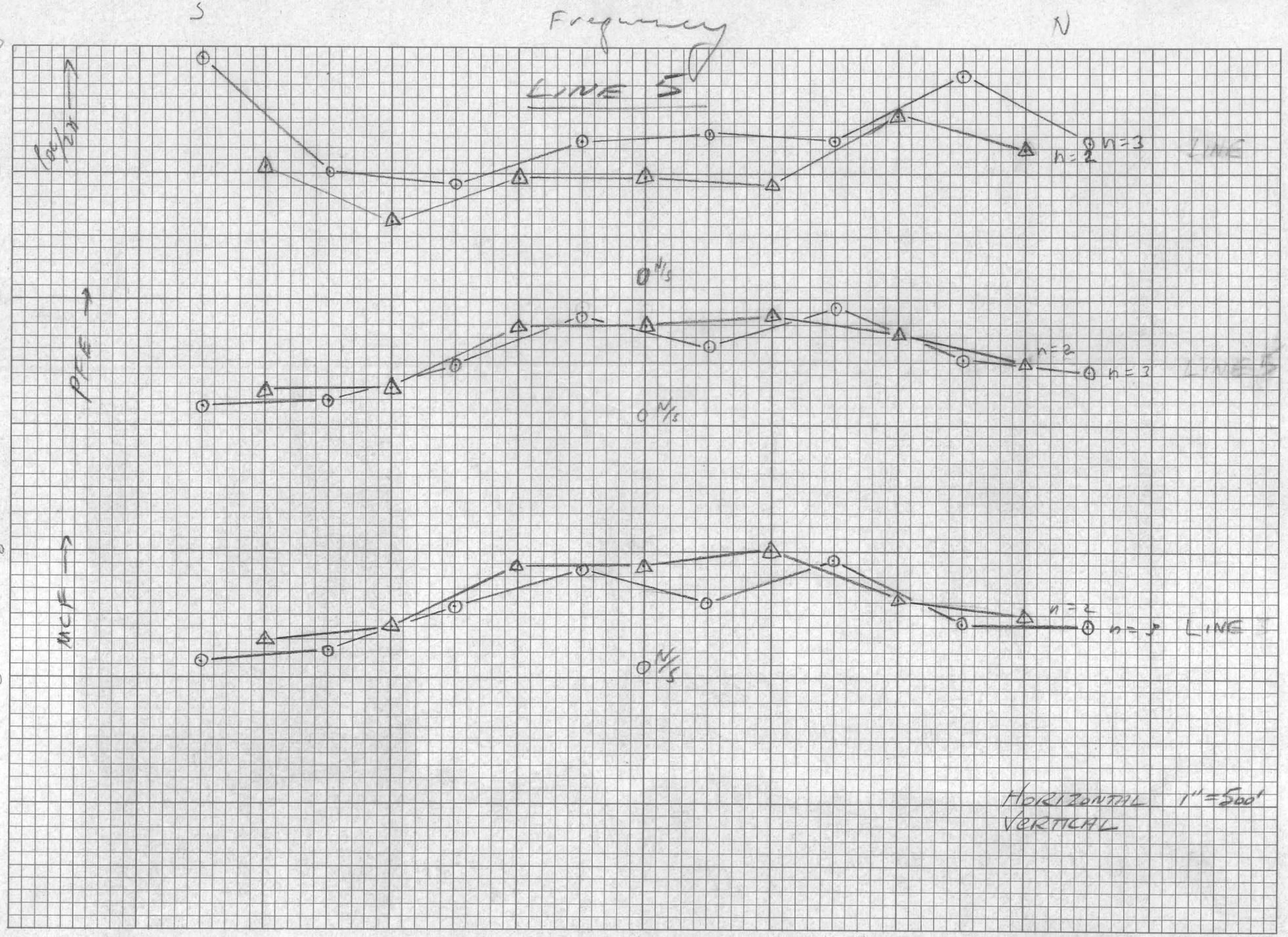
5-6
Separations-6
0.15

6 → 6
8 → 10.5
10 → 13

$\frac{PFE_{.05}}{PFE_{.15}} = \left(\frac{.05}{.115}\right)^{-\frac{1}{4}}$

To the 1/4 Power.

Re: Data I.P. depth?
Pulse-Freq. confusion.



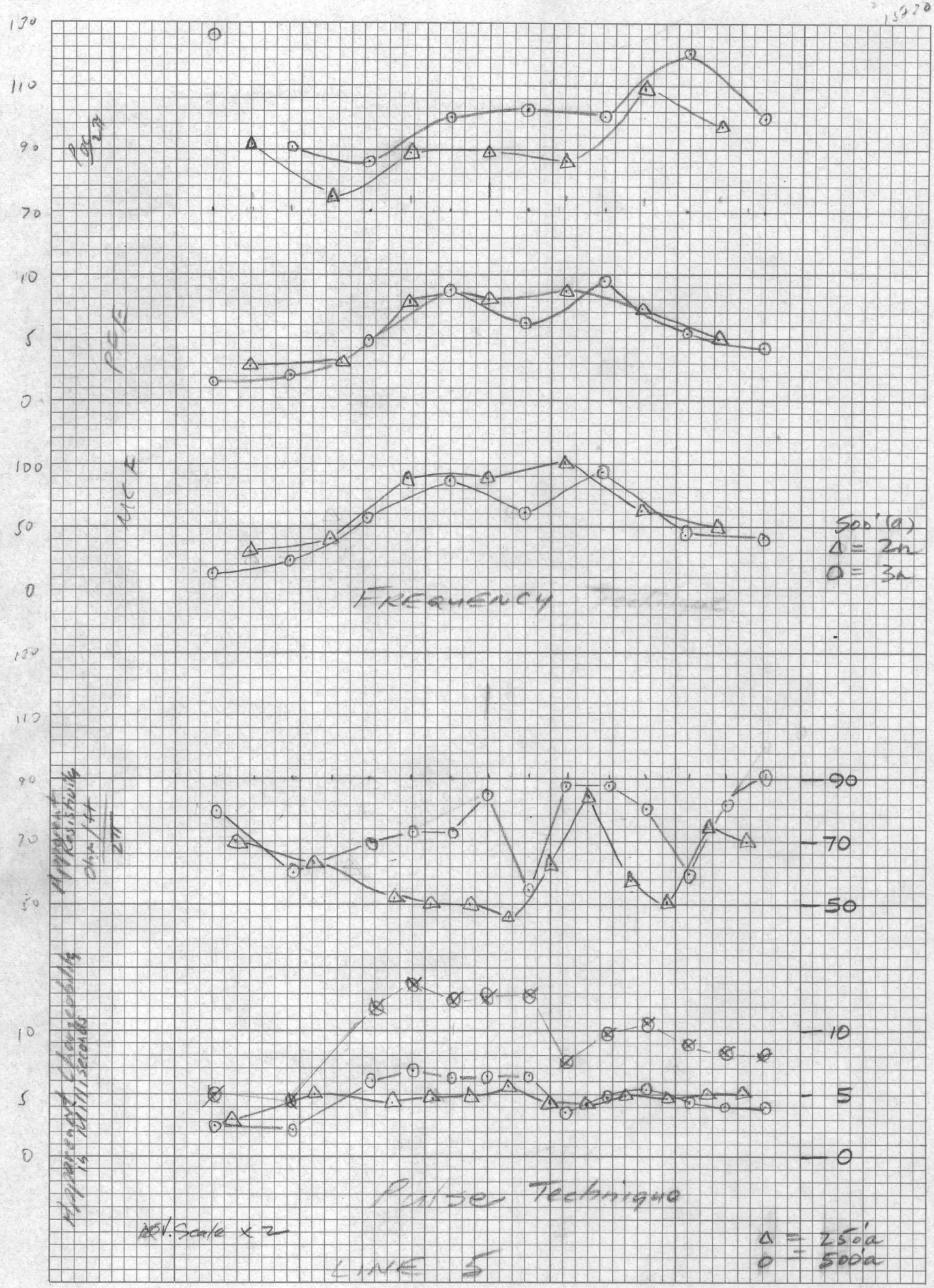
APPARENT CHARGEABILITY
IN MILLISECONDS

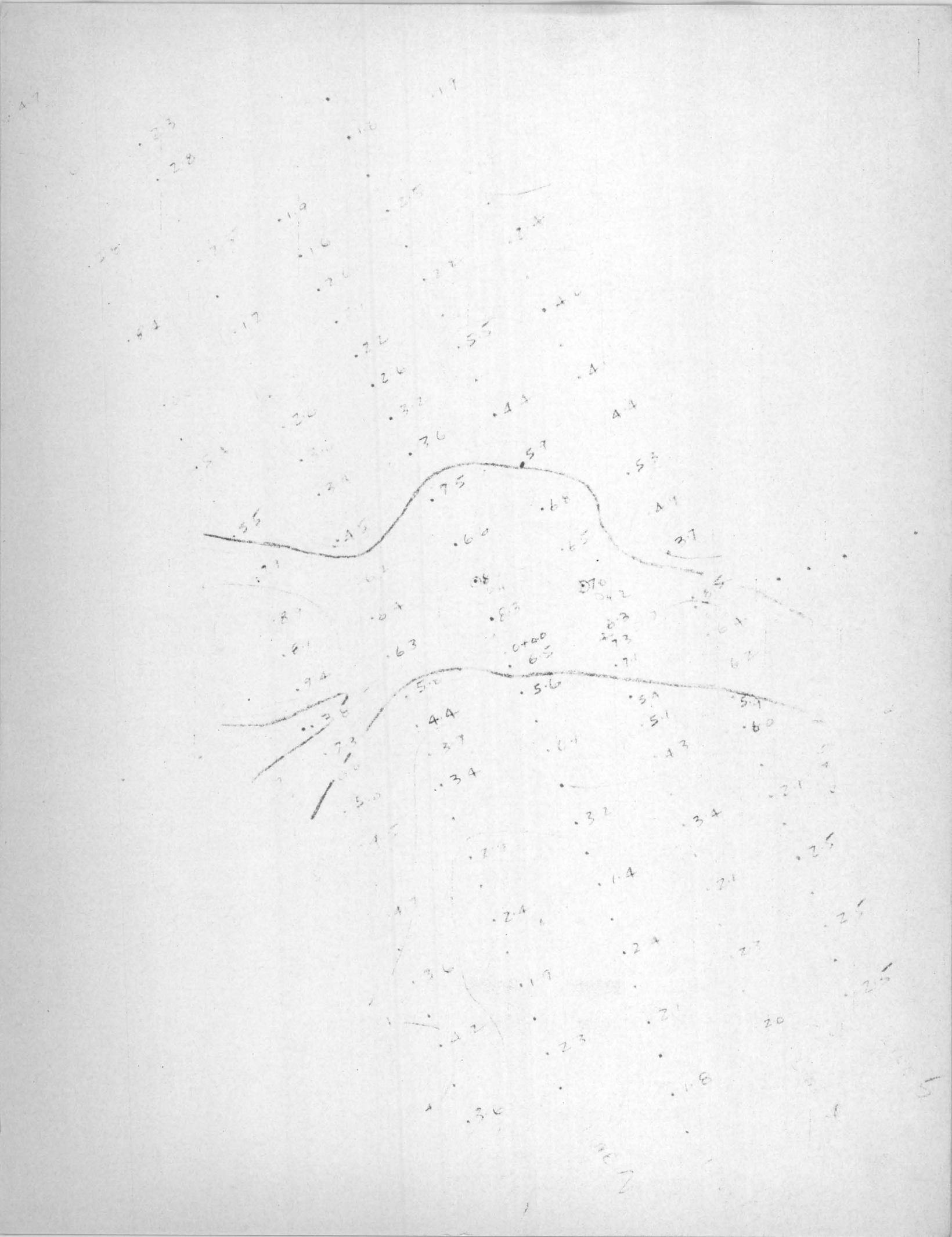
0 10 20

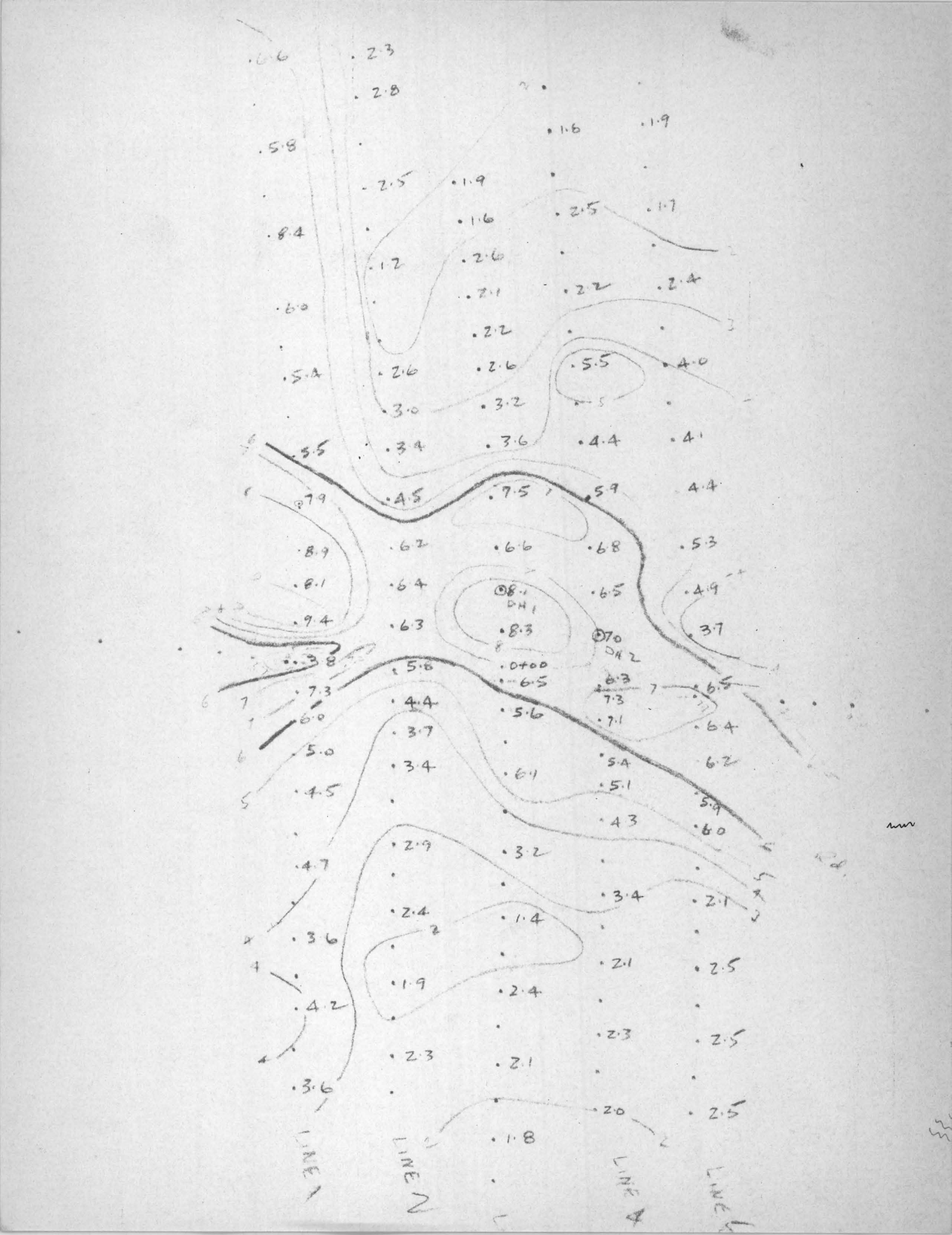
APPARENT
RESISTIVITY
Ohm FEET
2 π

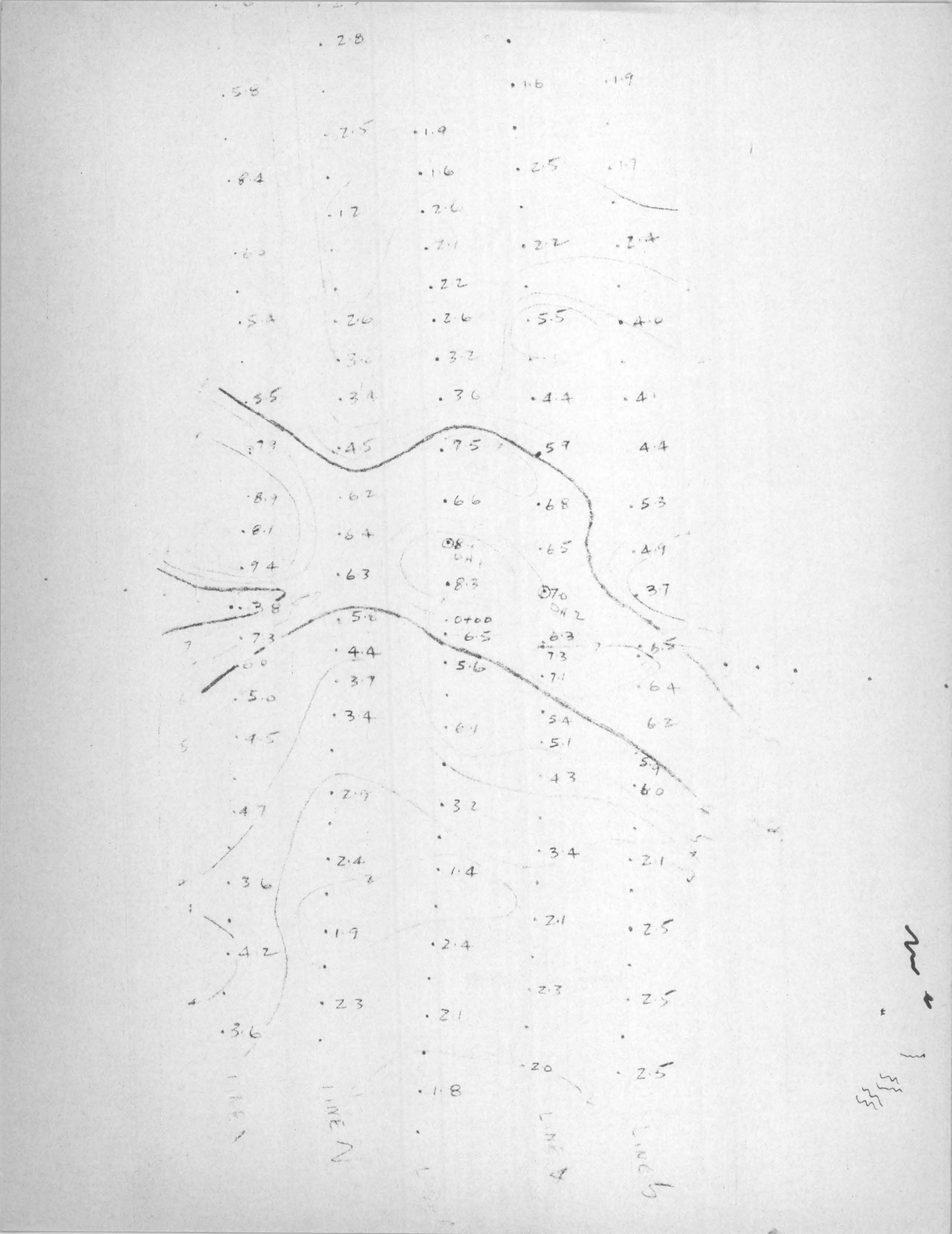
50 70 90

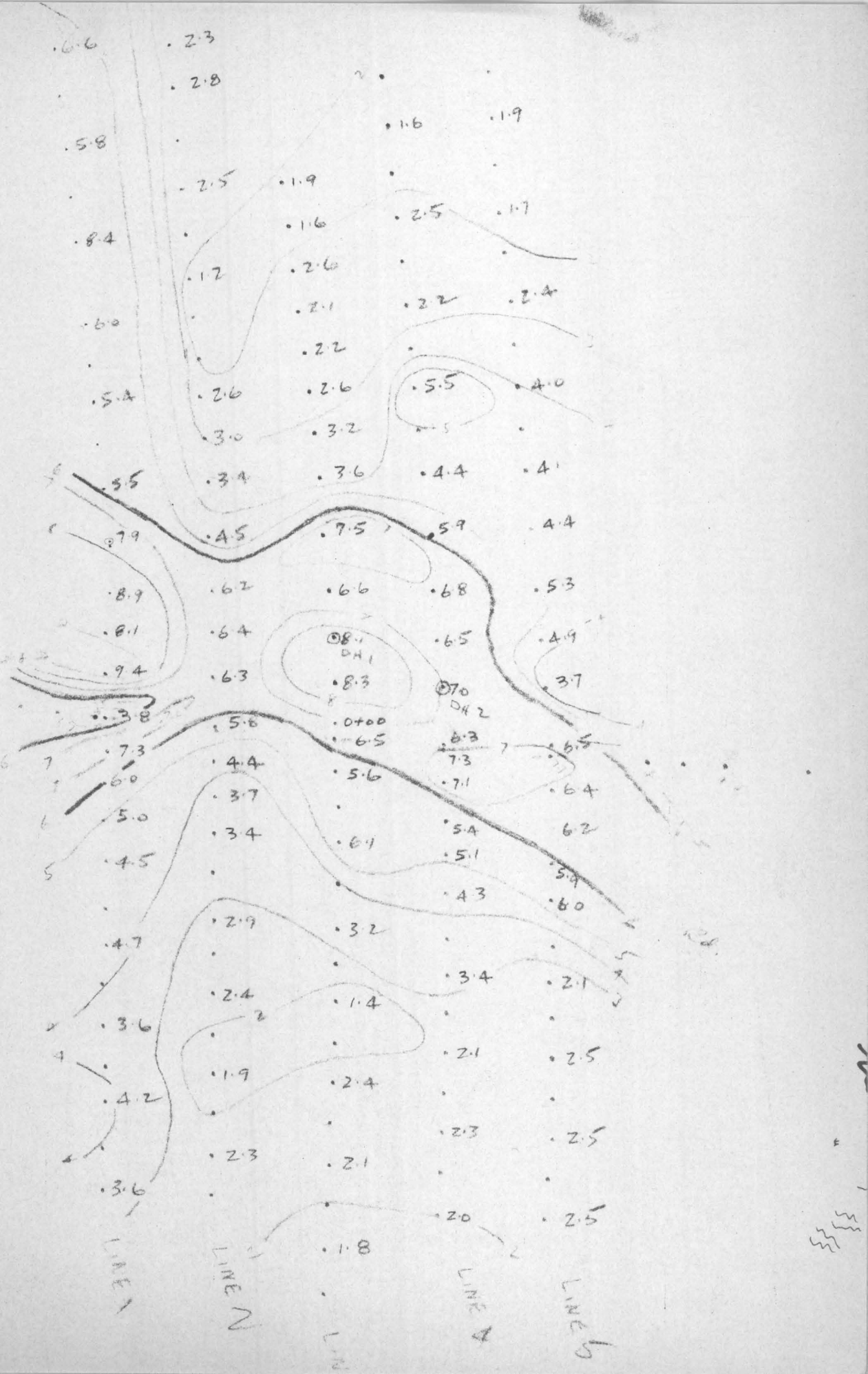
METALLIC
CONDUCTION
FACTOR



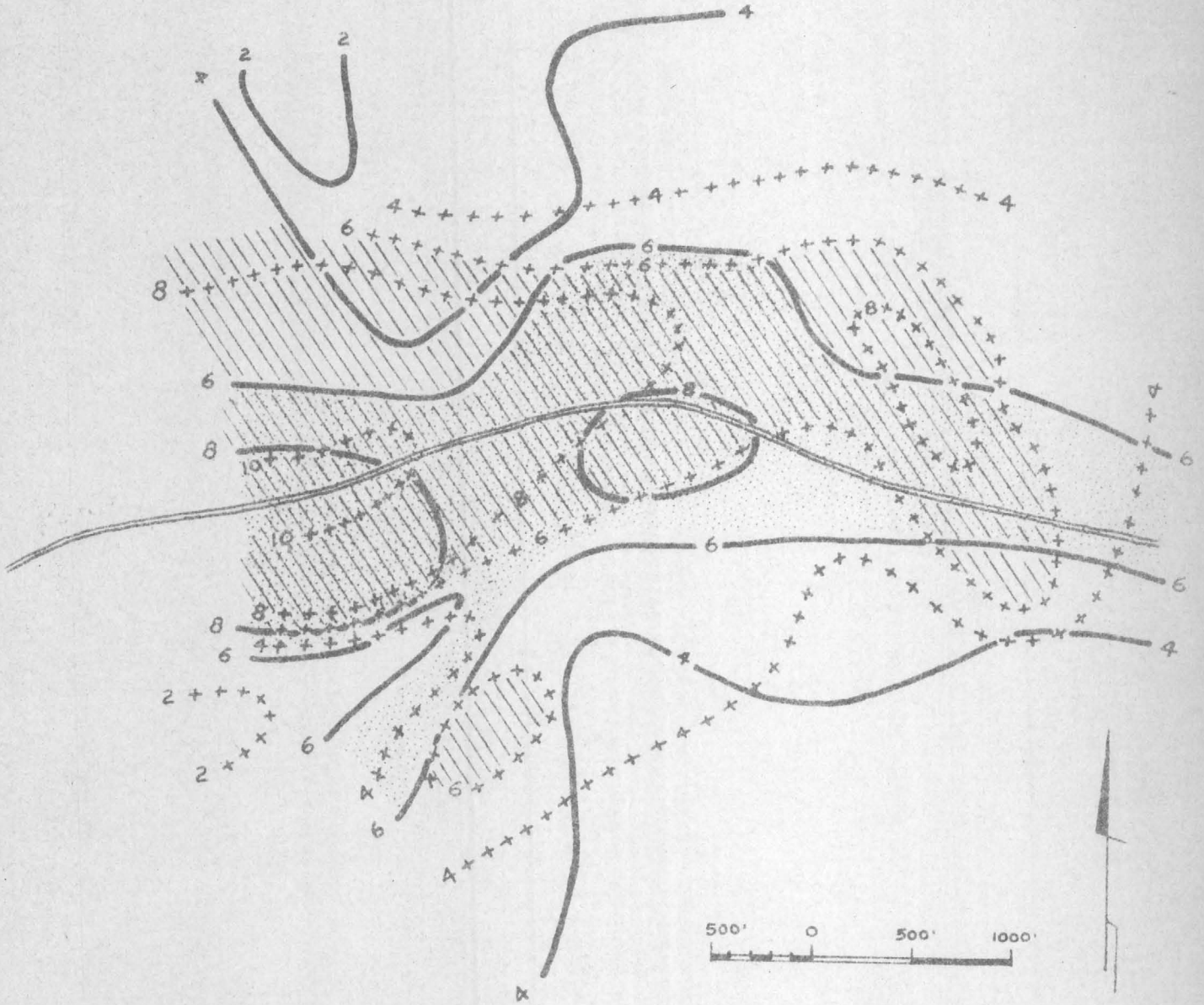



DH1
DH2
LINE 1
LINE 2
LINE 4
LINE 5

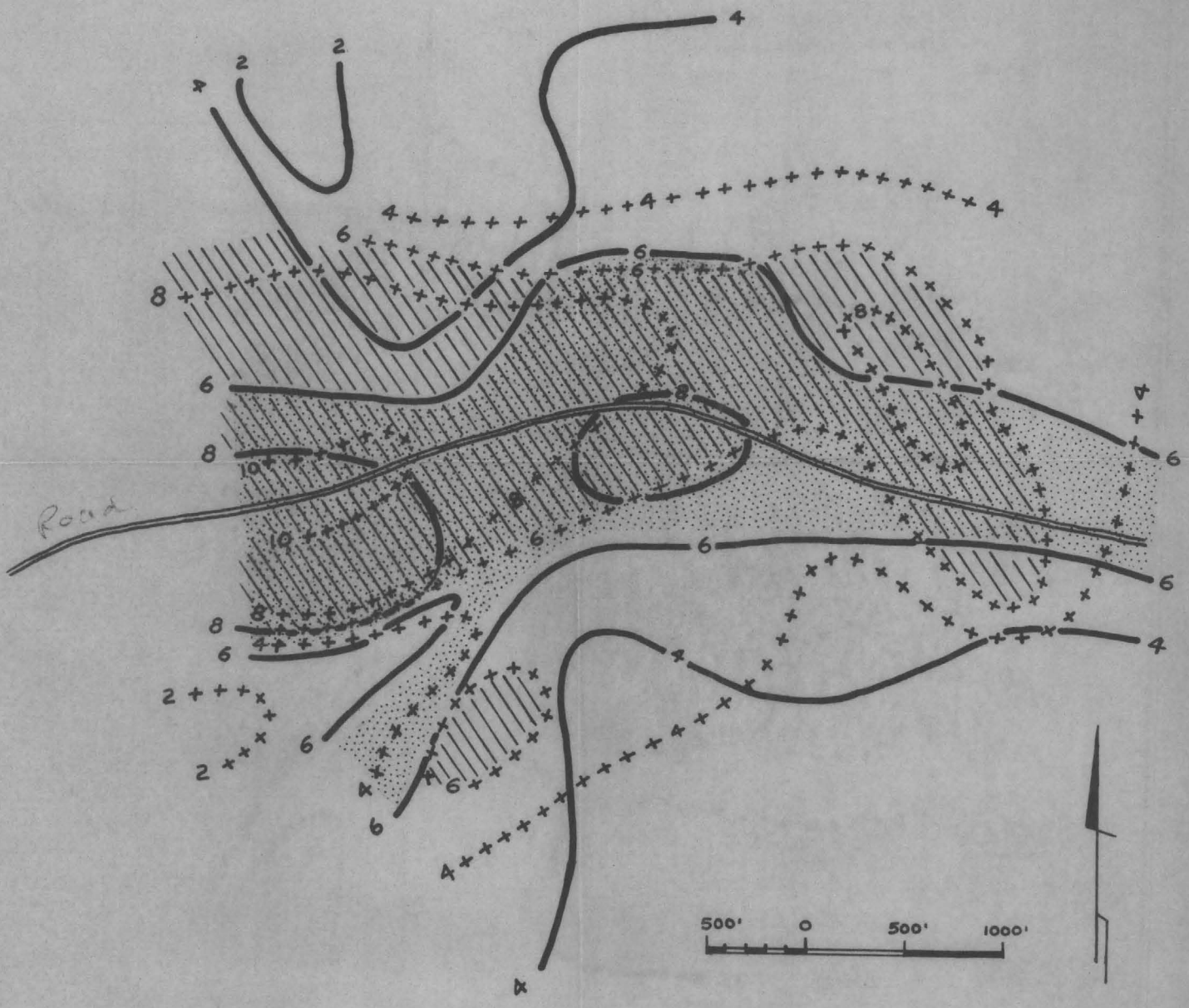



DH1
DH2
LINE 1
LINE 2
LINE 4
LINE 5

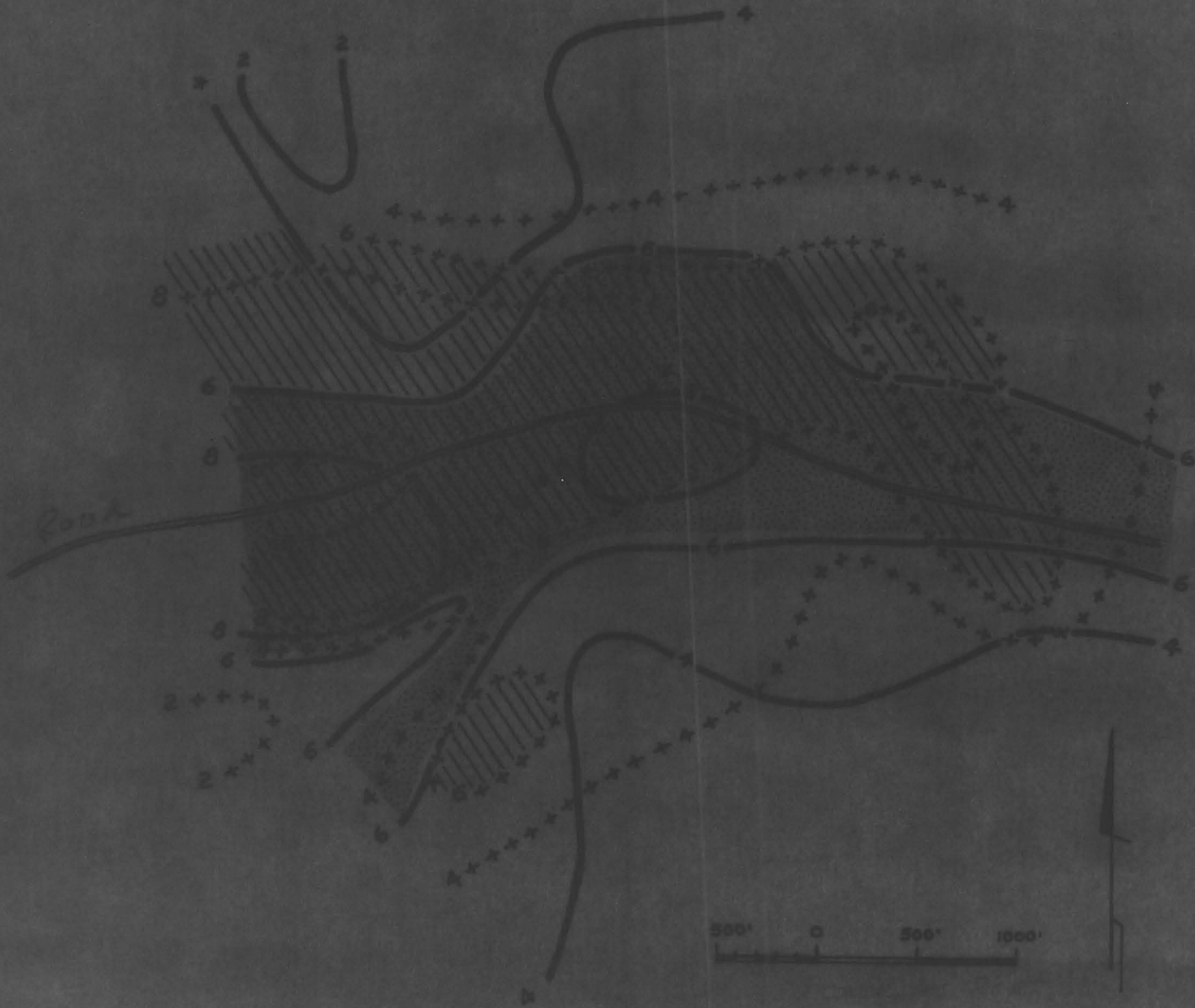
N Contour Plan



IN CONTOUR Plan

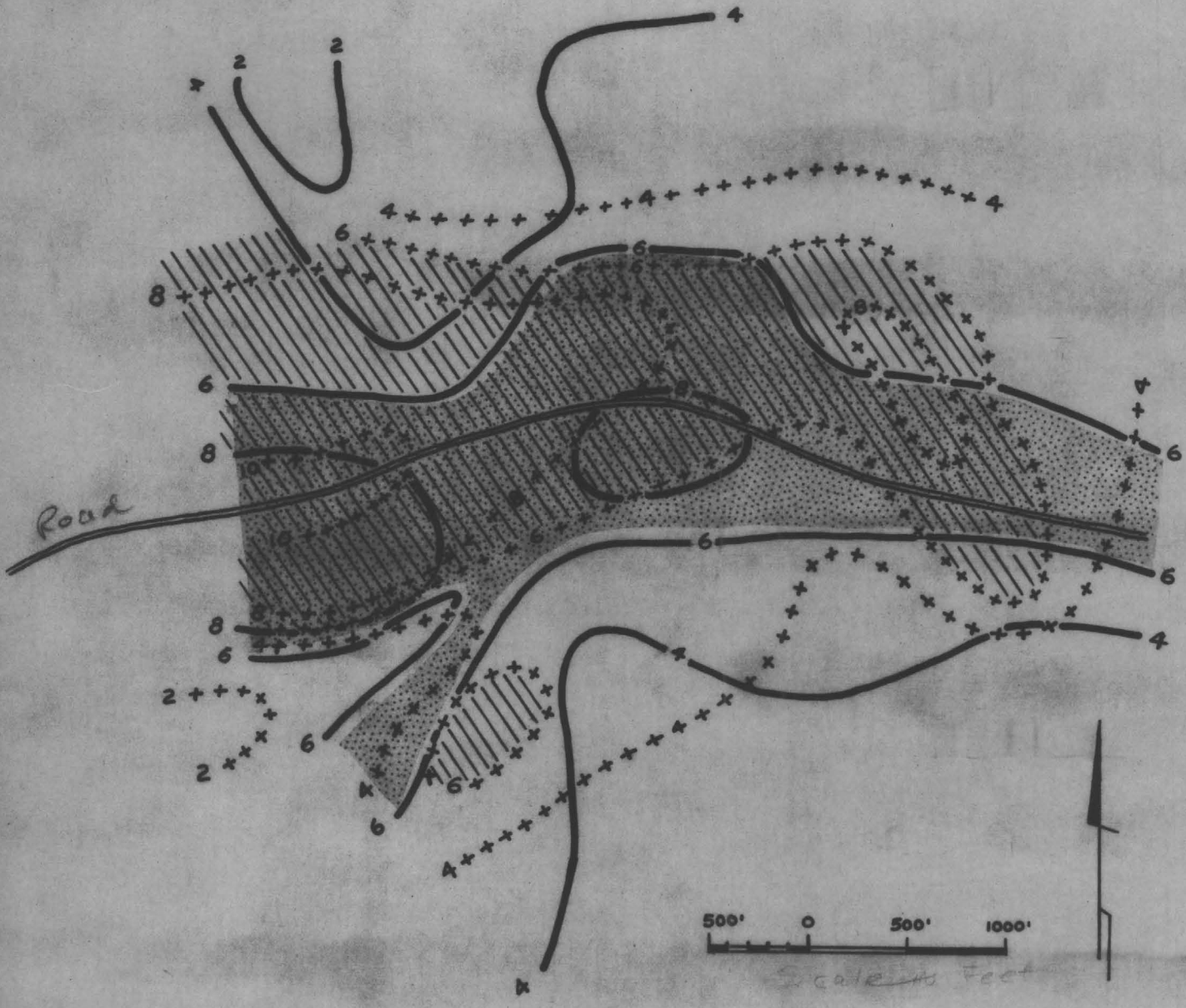


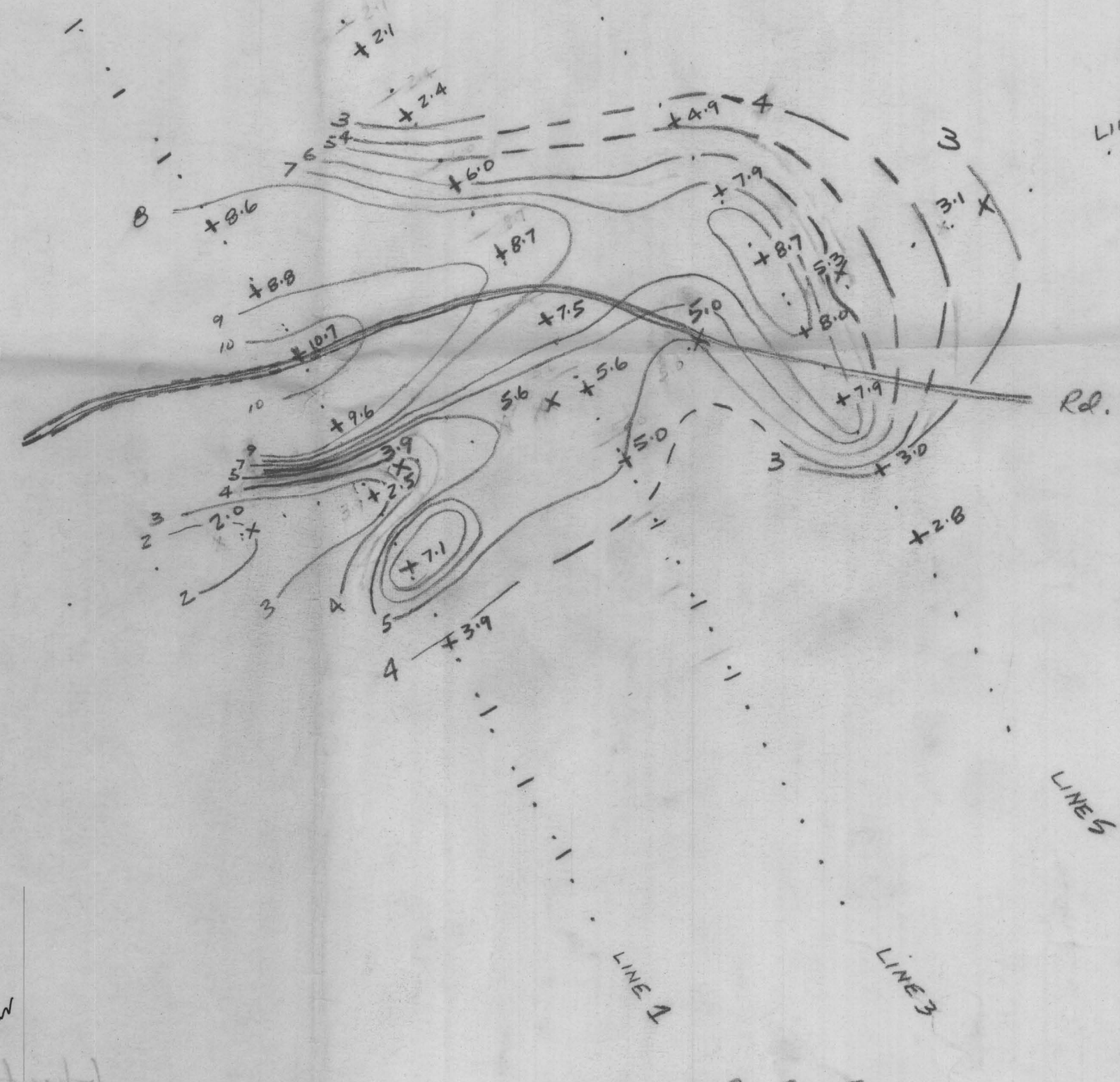
IN CONTOUR PLAN

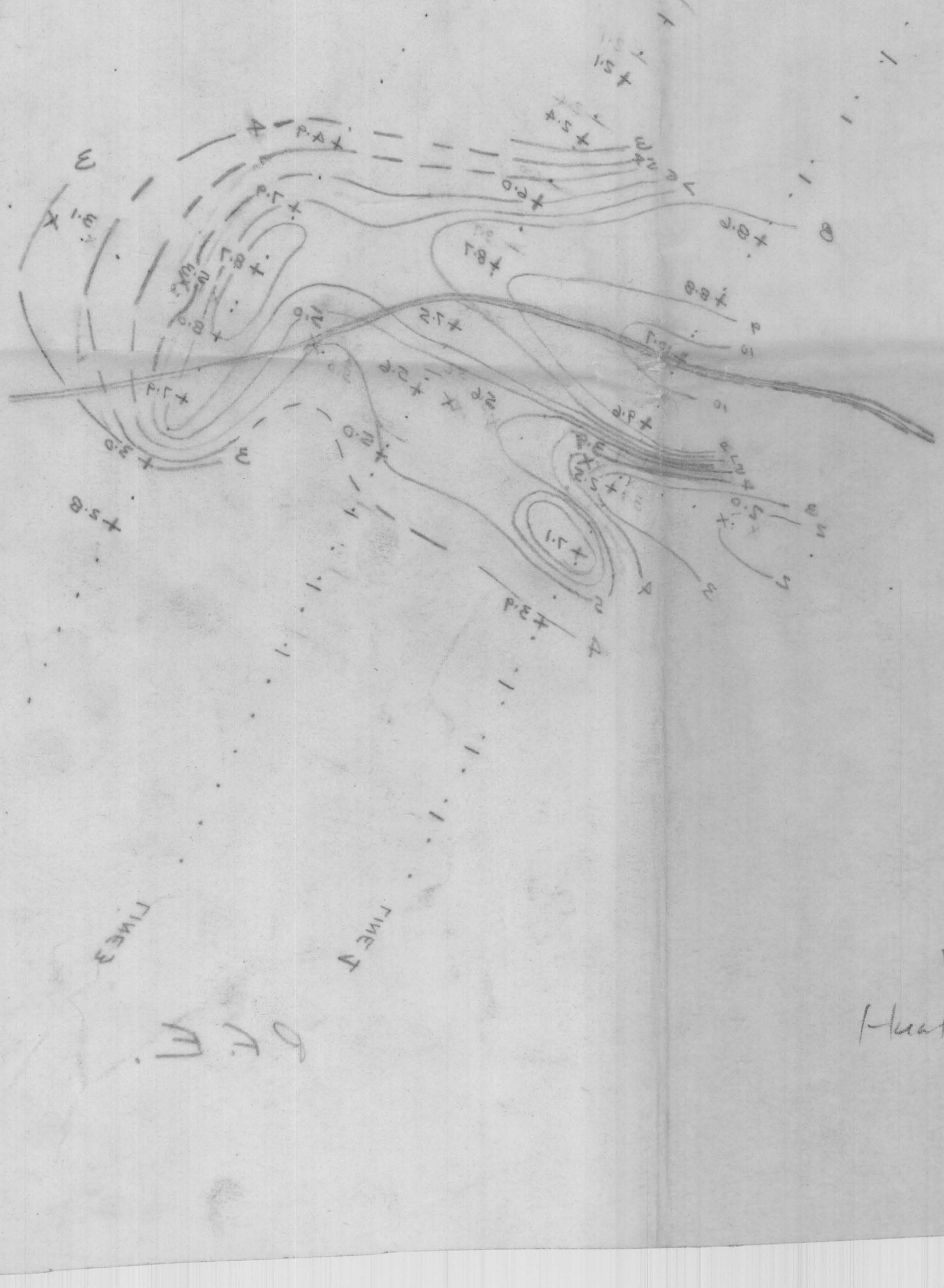


Induced Polarization
Time - Frequency Mode Comparison

IN CONTOUR PLAN




LINE 6
Rd.
LINE 5
LINE 3
LINE 1
P.F.E.



File

Hunting Covered Wells Proj.

DH 1

DH 2

Rd.

LINE 1

LINE N

LINE A

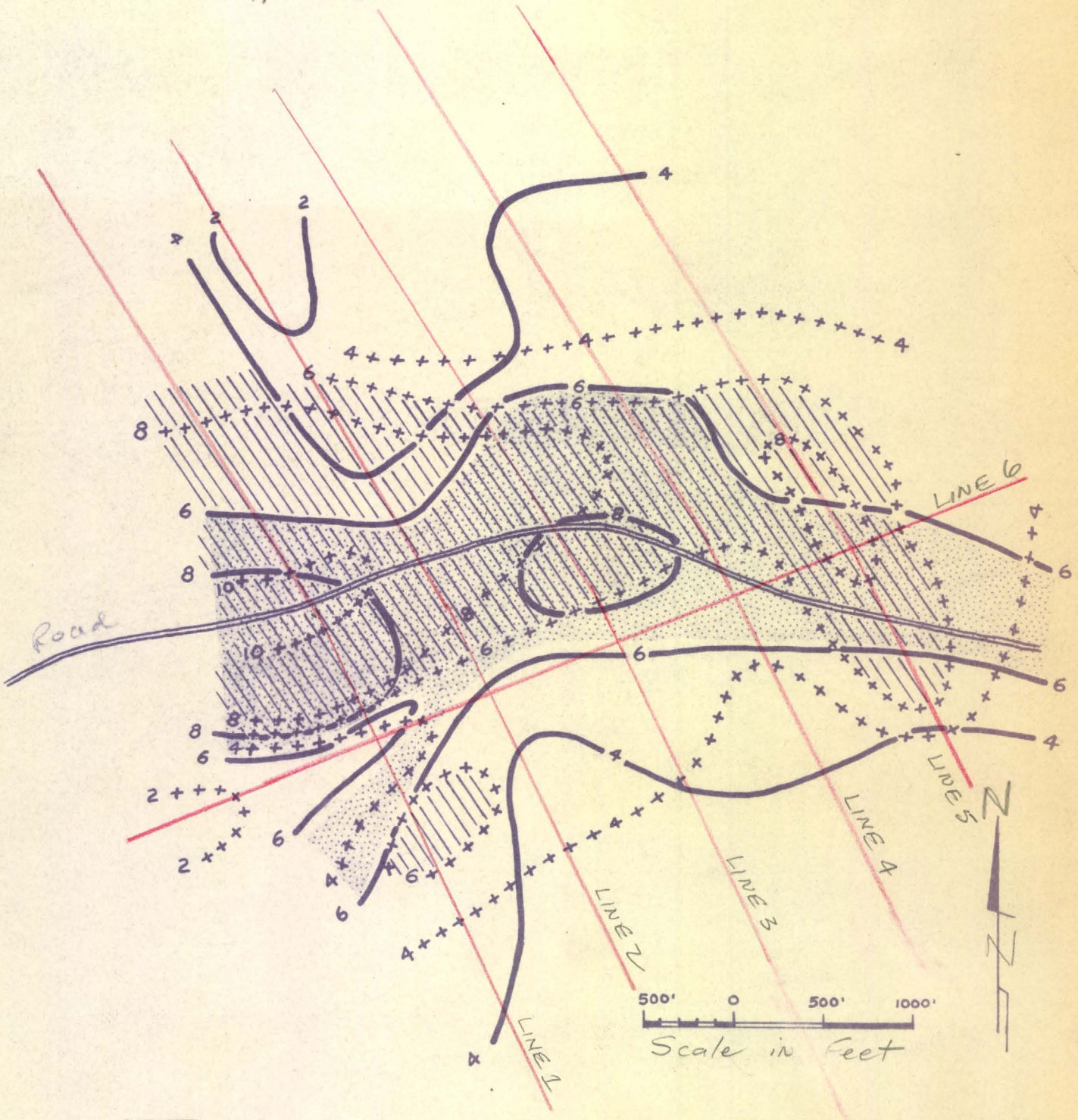
LINE 4

LINE 5

Scale 1" = 800' Approx.

103
73
178
89

Induced Polarization
Time – Frequency Mode Comparison
IN CONTOUR PLAN



FREQUENCY CONTOURS (Percent Frequency Effect)

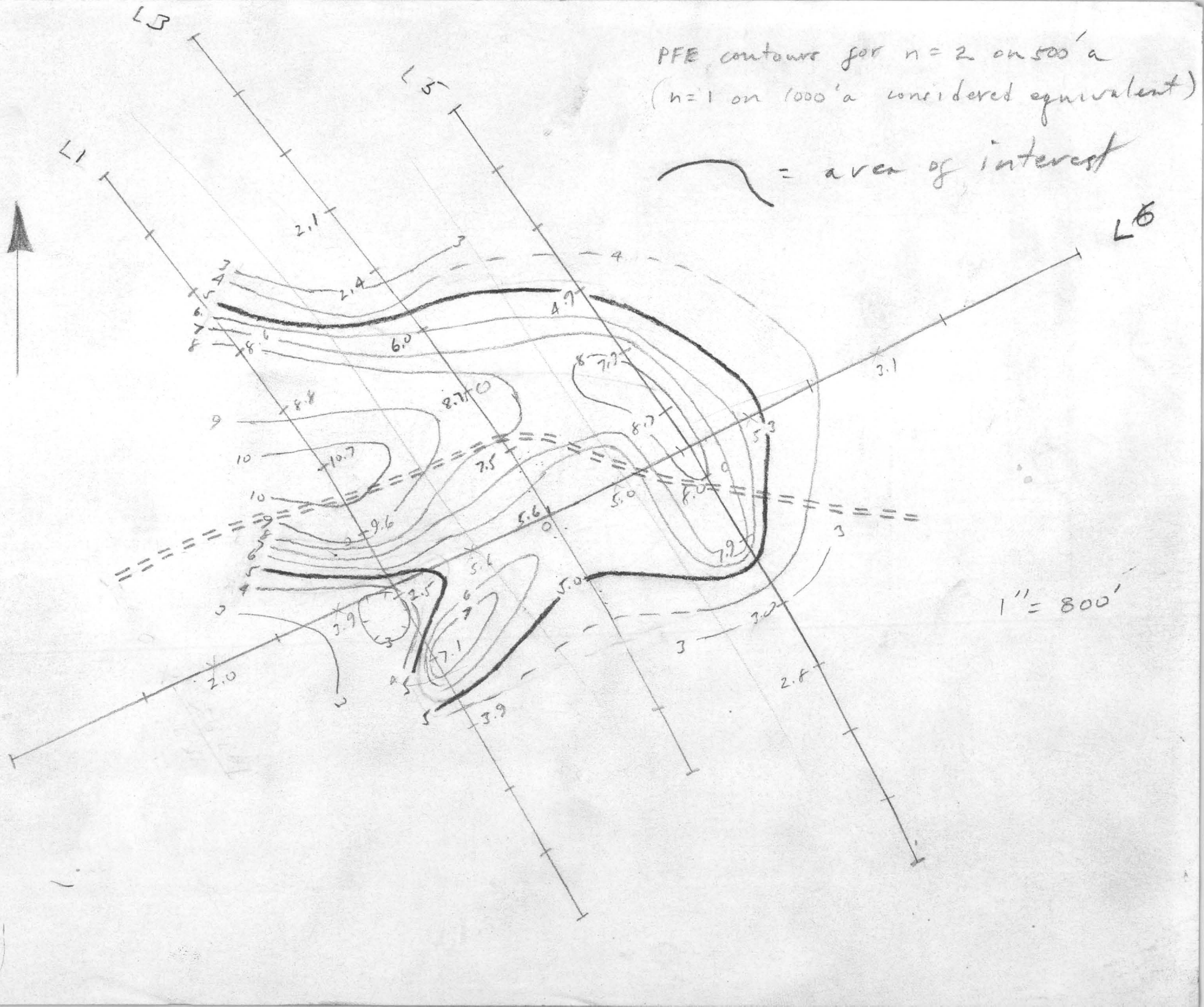
FREQUENCY ANOMALOUS ZONE

PULSE CONTOURS (Apparent Chargeability in milliseconds)

PULSE ANOMALOUS ZONE

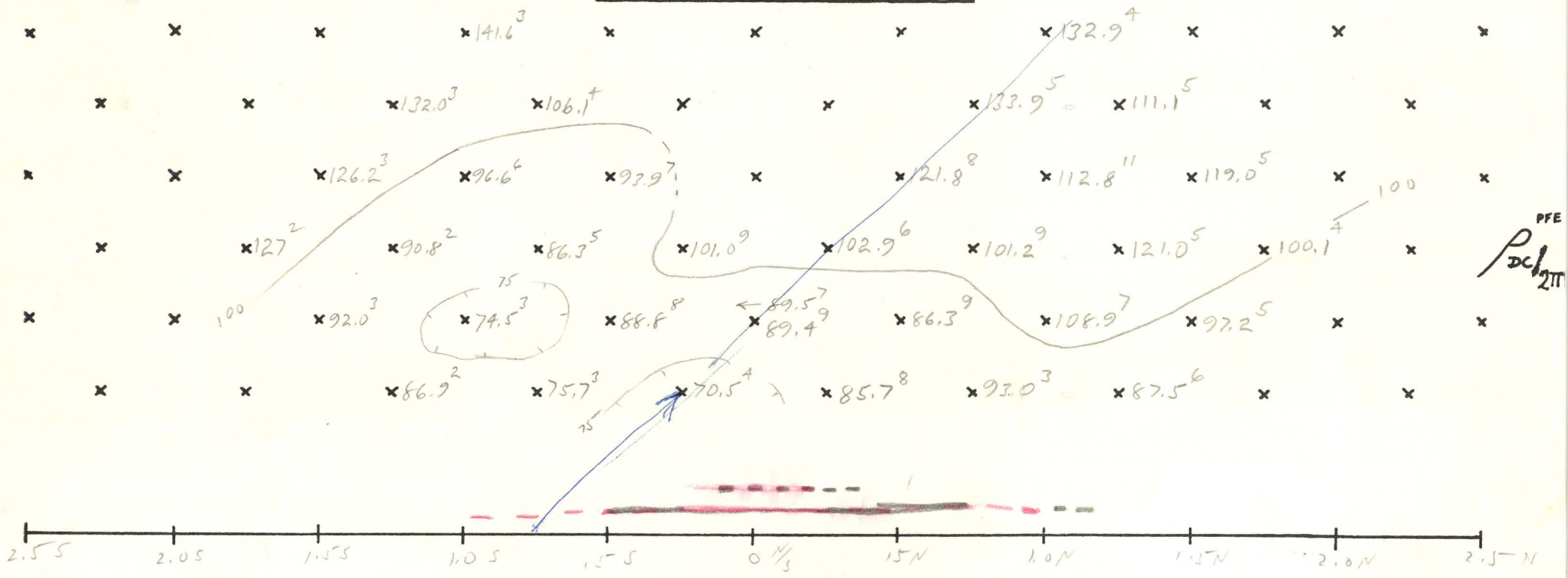
FREQUENCY & PULSE MODE LINE LOCATION

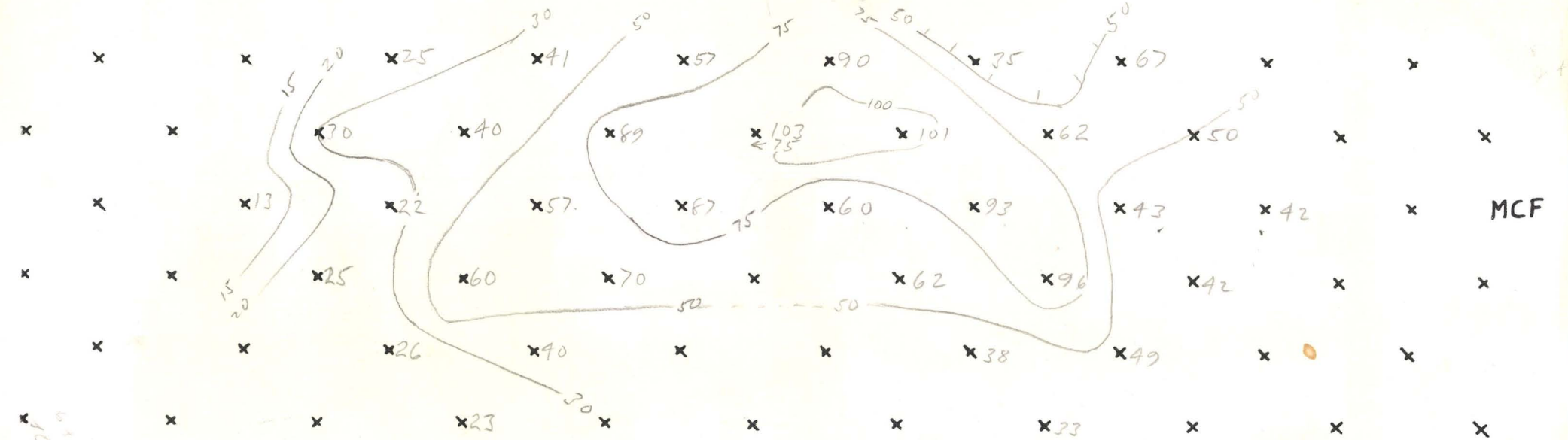
PULSE MODE ONLY LINE LOCATION


PFE contours for n = 2 on 500'a
(n=1 on 1000'a considered equivalent)
= area of interest
L3
L5
L1
L6
1" = 800'

looking W.

INDUCED POLARIZATION WORK SHEET





MCF

Area Covered Wells Line 3 N½ & S½ Scale 1" = 500' Date 1/28/63

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 3 S 1/2 Int.Cal Date: 1/23/63

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Rec.	.5-1.0 S		1.0 S	1.5 S	→	1.5 S	-2.0 S		→		2.0 S	-2.5 S
Time RANGE	100	30	100	30	30 10	100 L	30 R	10 R	10R 3R	30 R	10 R	10R 3R
DC-1	41.8 41.8	13.1 13.1	45.0	13.3	5.7 6.05	46.0	10.9	4.9	2.75 2.85	12.5 11.9	5.4	2.7 2.85
DC-2	42.0 42.0	13.5 13.5	45.0	13.1	5.9 5.98	45.8	11.2	5.1 5.25	2.70 2.78	(11.8) 12.5	5.38	2.76 2.95
Σ	83.8 83.8	26.6 26.6	90.0	26.4	11.6 12.03	91.8	22.1	10.25	5.45 5.72	24.3 24.4	10.78	5.68
DC-3			45.0	13.3	5.7 6.05	46.0	10.9	5.1 4.9	2.75 2.90	11.8	5.4	2.7 3.0
Dc-4			45.0	13.1	5.9 5.98	45.8	11.2	5.25	2.75 2.74	12.5	5.4	2.76 2.8
Σ			90.0	26.4	11.6 12.03	91.8	22.1	10.25	5.50 5.64	24.3	10.8	5.68 5.80
DC-AV	83.8	26.6	90.0	26.4	11.6 12.03	91.8	22.1	10.25	5.47 5.68	24.3	10.79	5.68 5.80
AC-1	40.1	12.4	43.2	12.2	5.3 5.5	44.5	10.8	4.82	2.60 2.50	11.8	5.18	2.70 2.58
AC-2	40.0	12.4	43.2	12.1	5.3 5.5	44.3	10.7	4.80	2.60 2.5	11.8	5.18	2.70 2.58
Σ	80.1	24.8	86.4	24.3	10.6 11.0	88.8	21.5	9.62	5.20 5.00	23.6	10.36	5.40 5.16
S. P.	-76.1		+27.8			+17.2			+17.8	+21.2		
AC-N						noisy but no correction						
Pot Res.	900Ω		900Ω			900Ω						

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 3 S 1/2 Int.Cal Date: 11/23/63

Send	1-2	4-5	3-4	2-3	1-2	CAL	4-5					0-0.5 South + 24.8 S.P.
Rec.	3	2.5	5 - 3.0 S →									
Time RANGE	3R	10R.	10R	3R		100	30	30	100	100	30	
DC-1	1.8	6.6	3.75	2.25	1.50 1.50	19.7	19.9	25.1	24.2	29.7	30.0	
DC-2	1.8	6.8	3.75	2.23	1.48 1.50	19.3	20.0	24.9	24.1	29.5	29.9	
Σ	3.60	13.4	7.50	4.48	2.98 3.00	39.0	39.9	50.0	48.3	59.2	59.9	
DC-3	1.79	6.6	3.75	2.25	1.50	19.7	19.9	25.1	24.2	29.7	30.0	
Dc-4	1.81	6.8	3.75	2.23	1.50	19.3	20.0	24.9	24.1	29.5	29.9	
Σ	3.60	13.4	7.50	4.48	3.00	39.0	39.9	50.0	48.3	59.2	59.9	
DC-AV	3.60	13.4	7.50	4.48	3.00	39.0	39.9	50.0	48.3	59.2	59.9	
AC-1	1.68	6.35	3.65	2.07	1.43	19.7	19.1	23.5	24.5	29.8	27.3	
AC-2	1.68	6.35	3.62	2.07	1.43	19.8	19.2	23.6	24.5	29.8	27.3	
Σ	3.36	12.70	7.27	4.14	2.86	39.5	38.3	47.1	49.0	59.6	54.6	
S. P.	+23.5	+11.3										
AC-N	0											
		1500Ω										

INDUCED POLARIZATION SENDER NOTES

Project: COVERED-WELLS Line: 3 S ½ Date: 1-28-62

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Receive	→		→		→	→			→	→		
Time	x2		x2			x2				x2		
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1800	1800	1800	1800	1800	1600	1900	1800	1800	1600	1800	1800
Send	1-2	4-5	3-4	2-3	1-2							
Receive	→	→	→	→	→		CAL	4-5				
Time	x2	x2					x1	x1	x1			
Range	2.0	2.0	2.0	2.0	2.0		.30	.30	.30			
Current	1800	1600	1800	1800	1800		400	500	600			

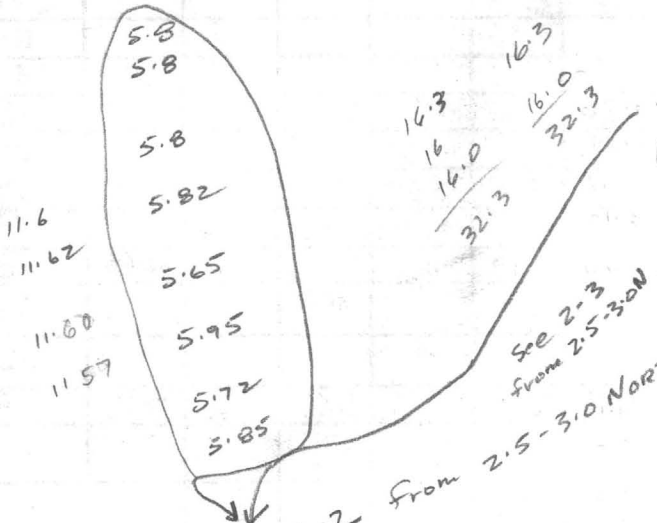
F Loyd

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 3 N 1/2 Int.Cal 48.0 Date: 1/23/63

11:15 a.m.

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Rec.	.5-1.0	NORTH	1.0 -	1.5 N	→	1.5 -	2.0	NORTH	→	2.0 -	2.5	NORTH
Time	100	30	100	100 | 30	10	100	100 | 30	30 | 10	10	30	30 | 10	10
DC-1	49.8 49.8	11.5 11.5	54.5 54.5	12.2 | 13.5 12.2 | 13.5	5.32 5.32	51.0 51.0	15.0 | 16.3 15.0 | 16.3	5.6 | 5.82 5.6 | 5.80	3.1 3.10	14.2 14.2	7.0 | 7.1 6.9 | 7.1	3.37 3.40
DC-2	50.0 50.0	11.6 11.6	54.0 54.0	12.1 | 12.5 12.1 | 12.5	5.32 5.32	50.8 50.8	16.0 | 15.8 16.0 | 15.9	6.0 | 6.19 6.0 | 6.21	3.19 3.20	14.1 14.1	6.7 | 7.1 6.6 | 6.95	3.20 3.17
Σ	99.8 99.8	23.1 23.1	108.5 108.5	24.3 | 26.0 24.3 | 26.0	10.64 10.64	101.8 101.8	31.0 32.1 31.0 32.2	11.6 | 12.01 11.6 | 12.01	6.29 6.30	28.3 28.3	13.7 | 14.2 13.5 | 14.05	6.57 6.57
DC-3						51.0	16.5 16.6	5.80			6.9 7.0 | 6.95 7.1	
Dc-4						50.8	15.9 15.8	6.20			6.6 6.7 | 6.85 7.0	
Σ	99.8					101.8	32.4 32.4	12.0			13.5 | 13.8 13.7 | 14.1	
DC-AV	99.8	23.1	108.5	24.3 | 26.0	10.64	101.8	31.0 | 32.3	11.6 12.01	6.29	28.3	13.6 | 14.06	6.57
AC-1	46.5	10.8	52.2	11.8 | 12.2	5.0	48.2	15.0 | 15.3	5.4 5.52	3.0	13.6	6.6 | 6.58	3.05
AC-2	46.5	10.8	52.2	11.8 | 12.1	5.0	48.2	15.0 | 15.2	5.4 5.52	3.0	13.6	6.6 | 6.58	3.05
Σ	93.0	21.6	104.4	23.6 | 24.3	10.0	96.4	30.0 30.5	10.8 | 11.04	6.0	27.2	13.2 | 13.16	6.10
S. P.	-15.9		+13.1			-31.6			-32.8	+35.4		
AC-N		0				0			0			
Scale % Rec. Res.			600Ω			1200Ω				1100Ω		


5.8
5.8
5.8
5.82
5.65
5.95
5.72
5.85
11.6
11.62
11.60
11.57
16.3
16.0
32.3
16.3
16
16.0
32.3
5.5
6.1
11.6
5.52
6.10
11 62
5.50
6.05
11 55
5.60
6.10
11.70
5.40
6.22
11.62
3.70
3.60
6.90
3.35
3.45
6.80
3.45
3.52
6.97
3.30
3.62
6.92
See 2-3 from 2.5-3.0 NORTH
See 1-2 from 2.5-3.0 NORTH

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 3 N 1/2 Int.Cal Date: 1/23/63

Send	4-5		1-2	2-3	3-4	4-5	CAL	1-2					0-5N + 24.0
Rec.	—		2.5—	3.0	NORTH	→							
Time RANGE	10	3	10	10	3	3	100	30	30	100	100	30	
DC-1	1.90 2.00	2.02 2.02	5.82 5.78	3.4 3.52	1.85 1.89	1.29 1.35	19.0	19.8	24.8	24.0	29.0	29.7	
DC-2	1.90 1.97	2.01 2.00	5.92 6.08	3.42 3.8	1.84 1.81	1.13 1.10	19.0	19.8	24.9	24.0	29.0	29.6	
Σ	3.80 3.97	4.03 4.02	11.74 11.86	6.82 7.32	3.69 3.70	2.42 2.45	38.0	39.6	49.7	48.0	58.0	59.3	
DC-3	1.98 1.98		5.72 5.62	3.43 3.42	1.89 1.85	1.37 1.25	19.0	19.8	24.8	24.0	29.0	29.7	
Dc-4	1.97 1.90		6.10 6.00	3.50 3.42	1.82 1.85	1.09 1.27	19.0	19.8	24.9	24.0	29.0	29.6	S.P.
Σ	3.95 3.88		11.82 11.62	6.93 6.84	3.71 3.70	2.46 2.52	38.0	39.6	49.7	48.0	58.0	59.3	
DC-AV	3.90	4.03	11.65	6.94	3.70	2.46	38.0	39.6	49.7	48.0	58.0	59.3	
AC-1	1.90	1.90	5.55	3.39	1.73	1.19	19.8	19.2	23.7	25.0	29.8	27.3	
AC-2	1.90	1.90	5.52	3.38	1.73	1.20	19.8	19.2	23.6	25.0	29.8	27.3	
Σ	3.80	3.80	11.07	6.77	3.46	2.39	39.6	38.4	47.3	50.0	59.6	55.6	
S. P.	+36.3		+11.6			+8.6							
AC-N	0					0							
Scale % Rel. Res.			900Ω										

INDUCED POLARIZATION SENDER NOTES

Project: COVERED-WELLS Line: 3 N ½ Date: 1-23-63

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	→	→	→	→	→	→	→	→	→	→	→	→
Time	x2		x2			x2				x2		
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1800	1600	1900	1800	1600	1800	1800	1800	1600	1800	1800	1800
Send	4-5	1-2	2-3	3-4	4-5							
Receive	→	→	→	→	→		Cal	1-2				
Time		x2					x1	x1	x1			
Range	2.0	2.0	2.0	2.0	2.0		30	30	30			
Current	1600	1800	1800	1800	1600		400	500	600			

Floyd

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Covered Walk Line 3 - 5½ Field date 1/27/63 Data page _____ Comp. date 1/28/63 Comp by C.S.L.

	40	41	43	41	18 55	44	36	48	26 83	39	52	27 86
(A) Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
(B) Receive	.5-1.0	→	1.0-1.5	→	→	1.5-2.0	→	→	→	2.0-2.5	→	→
(C) n separation	1	2	1	2	3	1	2	3	4	2	3	4
(D) I	1600	1800	1600	1800	1400	1600	1800	1800	1600	1600	1800	1800
(E) Vdc (avg)	83.8	26.6	90.0	26.4	11.6 | 12.03	91.8	22.1	10.25	5.47 | 5.68	24.3	10.79	5.68 | 5.80
(F) DCcal used	1.010											
(G) Kn x 10^{-3}	1.5	6	1.5	6	15	1.5	6	15	30	6	15	30
(H) ρ dc=ExFxGx10^3/D	70.5	89.5	75.7	88.8	101.0	86.9	74.5	86.3	93.9	92.0	90.8	96.6
(I) Vac Σ	60.1	24.8	66.4	24.3	10.6 | 11.0	88.8	21.5	9.62	5.20 | 5.00	23.6	10.36	5.40 | 5.16
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.995	.994	.991	.994	1.025 | .975	.990	1.001	.984	1.014 | .937	.997	.979	1.013 | .933
(M) ρ dc/ρac=ExL/K	1.040	1.067	1.031	1.079	1.121 1.068	1.022	1.030	1.049	1.068 1.064	1.028	1.020	1.067 1.049
(N) PFE=(M-1)(10^2)	4	7	3	8	9	2	3	5	7	3	2	6
(O) MCF=(M-1)(10^5)/H	57	75	41	89	87	25	40	57	70	30	22	60

Project _____ Line 56 64 Field date 36 69 48 Data page 20 Comp. date 64 78 25 Comp by 30 91

(A) Send	1-2	4-5	3-4	2-3	1-2							
(B) Receive	→	2.5-3.0	→	→	→							
(C) n separation	5	3	4	5	6							
(D) I	1600	1600	1800	1800	1800		400	400	500	500	600	600
(E) Vdc (avg)	3.60	13.4	7.50	4.48	3.00		39.0	39.9	50.0	48.3	59.2	59.9
(F) DCcal							1.026	1.002	1.000	1.036	1.012	1.001
(G) Kn x 10^{-3}	52.5	15	30	52.5	84						1.010	
(H) ρ dc=ExFxGx10^3/D	106.1	127.0	126.2	132.0	141.6							
(I) Vac Σ	3.36	12.7	7.27	4.14	2.86		39.5	38.3	47.1	49.0	59.6	54.6
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.974	.963	1.001	.956	.984		1.012	0.961	0.942	1.017	1.008	0.912
(M) ρdc/ρac =ExL/K	1.043	1.016	1.032	1.034	1.032							
(N) PFE=(M-1)(10^2)	4	2	3	3	3							
(O) MCF=(M-1)(10^5)/H	40	13	25	26	23							

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

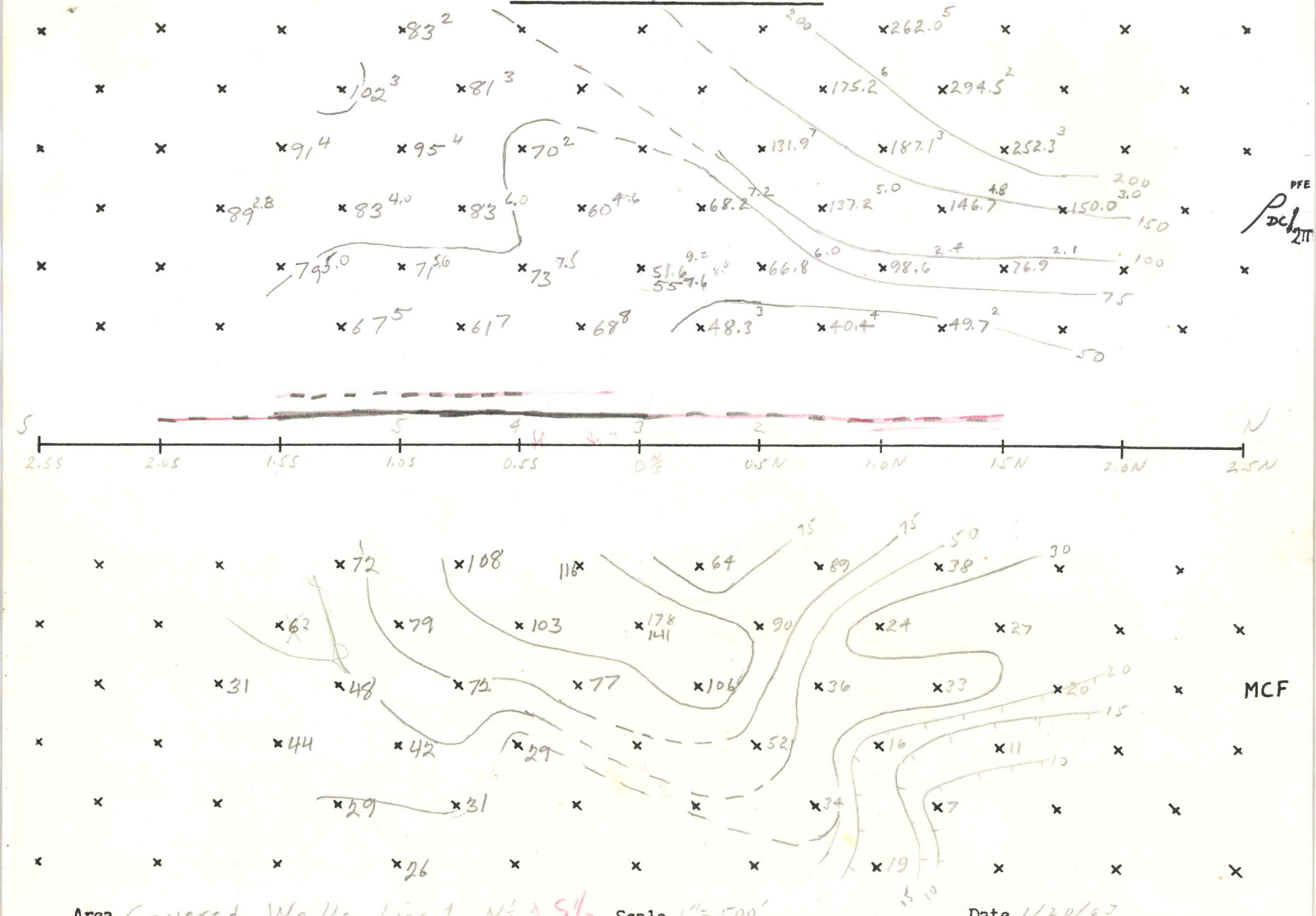
Project Covered Welk Line J N½ Field date 1/23/63 Data page _____ Comp. date 1/28/63 Comp by C.S.L.

% S.D.	47	36	52	12 40	50	48.2	15 51	18 55	30	44	22 66	31
(A) Send	J-4	4-5	2-J	J-4	4-5	1-2	2-J	J-4	4-5	1-2	2-J	J-4
(B) Receive	.5-1.0N	→	1.0-1.5N	→	→	1.5-2.0N	→	→	→	2.0-2.5N	→	→
(C) n separation	1	2	1	2	J	1	2	J	4	2	J	4
(D) I	1800	1600	1800	1800	1600	1800	1800	1800	1600	1800	1800	1800
(E) Vdc (avg)	99.8	23.1	108.5	24.3 | 26.0	10.64	101.8	31.0 | 32.3	11.6 | 12.01	6.29	28.7	13.6 | 14.06	6.57
(F) DCcal USED	1.030											
(G) Kn x 10^{-3}	1.5	6	1.5	6	15	1.5	6	15	30	6	15	30
(H) ρ dc=ExFxGx10^3/D →	85.7	89.4	93.0	86.3	102.9	87.5	108.9	101.2	121.8	97.2	121.0	112.8
(I) Vac Σ	93.0	21.6	104.4	23.6 | 24.3	10.00	96.4	30.0 | 30.5	10.8 | 11.04	6.02	27.2	13.2 | 13.16	6.10
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.003	1.021	0.995	1.059 | 1.014	.998	1.002	1.054 .997	1.049 .990	1.030	1.008	1.043 .973	1.029
(M) ρ dc/ρac=ExL/K	1.077	1.092	1.033	1.089 | 1.086	1.062	1.059	1.091 | 1.056	1.126 | 1.078	1.076	1.049	1.076 | 1.040	1.109
(N) PFE=(M-1)(10^2)	8	9	3	9 87	6	6	7 68	9 94	8	5	5 52	11
(O) MCF=(M-1)(10^5)/H	90	103	35	101	60	67	62	93	62	50	43	96

	19 63	55	34	58	40		20	64	79	25	30	91
Project _____	Line _____		Field date _____		Data page _____		Comp. date _____			Comp by _____		
(A) Send	4-5	1-2	2-J	J-4	4-5		CAL					
(B) Receive	→	2.5-3.0N	→	→	→		1-2					
(C) n separation	5	3	4	5	6							
(D) I	1600	1800	1800	1800	1600		400	400	500	500	600	600
(E) Vdc (avg)	3.90 | 4.03	11.65	6.94	3.70	2.46		38.0	39.6	49.7	48.0	58.0	59.3
(F) DCcal					→		1.052	1.010	1.006	1.041	1.034	1.011
(G) Kn x 10^{-3}	52.5	15	30	52.5	84				~1.030			
(H) ρ dc=ExFxGx10^3/D	133.9	100.1	119.0	111.1	132.9							
(I) Vac Σ	3.80 | 3.80	11.07	6.77	3.46	2.39		39.6	38.4	47.3	50.0	59.6	55.6
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.048 .978	.990	1.024	.986	1.014		1.043	0.970	0.952	1.041	1.029	0.938
(M) ρdc/ρac =ExL/K	1.076 | 1.038	1.042	1.050	1.054	1.044							
(N) PFE=(M-1)(10^2)	5 51	4	5	5	4							
(O) MCF=(M-1)(10^5)/H	38	42	42	49	33							

Look West

INDUCED POLARIZATION WORK SHEET



Area Covered Wells Line 1 N½ & S½ Scale 1"=500' Date 1/20/67

FLoyd

INDUCED POLARIZATION SENDER NOTES

Project: COVERED-WELLS Line: I N 1/2 Date: 1-18-63

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	→	→	→	→	→	→	→	→	→	→	→	→
Time												
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1900	1800	1800	1800	1800	1900	1900	1800	1900	1800	1900	1800
Send	4-5	1-2	2-3	3-4	4-5	cal	1-2					
Receive	→	→	→	→	→							
Time												
Range	2.0	2.0	2.0	2.0	2.0		.30	.30	.50			
Current	1800	1800	1800	1800	1800		400	500	600			

INDUCED POLARIZATION SENDER NOTES

Project: COVERED-WELLS Line: 1 S ½ Date: 1-21-72

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Receive	→	→	→	→	→	→	→	→	→	→	→	→
Time												
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Send	1-3	4-5	3-4	2-3	1-2	Cal	45					
Receive	→	→	→	→	→	→	→					
Time												
Range	2.0	2.0	2.0	2.0	2.0		.30	.30	.30	.30	.300	
Current	1800	1800	1800	1800	1800		400	500	600	400	500	

Floyd

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Nov. Wells Line: 1 - N 1/2 Int.Cal 48.5 Date: 18 Tau

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Rec.	0.5-1M →		1M-1.5" →			1.5-2M				2M-2.5"		
Time	30 100	30 10	30 100	30 10	10R.	100R.	30R.	10R.	10R	30R	10R	10R
DC-1	29.0 27.9	7.5 7.7	24.2 23.5	9.8 9.8	4.05	29.5	14.5	8.3 8.15	3.92 3.80	11.3	8.58 8.58	5.7 5.75
DC-2	28.5 27.2	7.5 7.65	24.5 23.0	9.8 9.85	3.95	29.0	14.5	7.9 7.95	3.95 3.95	11.3	8.65 8.65	5.3 5.4
Σ	57.5 54.1	15.0 15.35	48.7 46.5	19.6 19.65	8.00	58.5	29.0	16.20 16.10	7.87 7.75	22.6	17.23 17.23	10.7 11.0
DC-3	29.0 27.9	7.5 7.7	24.2 23.5	9.8 9.8	4.05	29.5	14.6	8.20 8.18	3.86 3.95	11.3	8.55 8.65	5.5 5.7
Dc-4	28.4 28.2	7.5 7.65	24.5 23.0	9.8 9.85	3.98	29.0	14.4	7.90 7.99	3.80 3.80	11.3	8.70 8.55	5.5 5.3
Σ	57.4 56.1	15.0 15.35	48.7 46.5	19.6 19.65	8.03	58.5	29.0	16.10 16.16	7.66 7.75	22.6	17.25 17.20	11.0 11.0
DC-AV	57.5 56.1	15.0 15.35	48.7 46.5	19.6 19.65	8.02	58.5	29.0	16.14	7.76	22.60	17.23	11.0
AC-1	25.8 27.8	6.9 6.8	22.2 23.0	9.4 8.6	3.75	29.0	14.0	7.30	3.65	11.10	7.77	5.25
AC-2	25.8 27.8	6.9 6.8	22.1 23.0	9.3 8.6	3.72	29.0	13.9	7.30	3.62	11.00	7.77	5.22
Σ	51.6 55.6	13.8 13.6	44.3 46.0	18.7 17.2	7.47	58.0	27.9	14.60	7.27	22.1	15.54	10.47
S. P.	+38.0		-10.7			+36.3				-59.8	drift	-62.1
AC-N	0	0	0	0	0	0			0	0		
	5000 86 28	23 68	74 23	31 86	37	29	47	73	36	37	78	52

27
15
8
15
63
16
4/63

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Cow Wells Line: 1' N 1/2 Int.Cal Date: 18 Jan 85

	4-5	1-2	2-3	3-4	4-5	1-2						
Send		.05	.15	.15								
Rec.	2M 2.5M	2.5 3M				CAL						
Time	10R	10R	10R	10R	10R 3X	30R	100R	30R	100K	30	100	300
DC-1	3.0 3.0	8.80	7.40 7.35	5.0 5.0	2.80 2.75 2.65 2.7	20.0	19.2	25.1	24.2	29.9	292	28
DC-2	2.8 2.9	8.85	7.45 7.50	4.9 4.8	2.65 2.80 2.80 2.92	19.8	19.2	25.0	24.1	29.5	29.5	28
Σ	5.80 5.90	17.65	14.85 14.85	9.9 9.9	5.45 5.55 5.45 5.62	39.8	38.4	50.1	48.3	59.4	58.7	56
DC-3	2.9 3.2	8.90	7.3 7.6	5.2 4.65	2.85 2.72 2.90 2.92	20.0	19.2	25.1	24.2	29.9	29.2	28
Dc-4	3.03 2.7	8.85	7.6 7.2	4.7 5.25	2.55 2.82 2.50 2.65	19.8	19.2	25.0	24.1	29.5	29.5	28
Σ	5.95 5.90	17.65	14.9 14.8	9.9 9.9	5.40 5.54 5.40 5.60	39.8	38.4	50.1	48.3	59.4	58.7	56
DC-AV	5.89	17.65	14.85	9.90	5.43 5.58	39.8	38.4	50.1	48.3	59.4	58.7	56
AC-1	2.82	8.05	6.90	4.77	2.62 2.50	19.3	19.9	23.6	24.8	27.2	29.9	28
AC-2	1.92	8.05	6.90	4.77	2.62 2.50	19.2	19.8	23.5	24.5	27.3	29.8	28
Σ	5.64	16.10	13.80	9.54	5.24 5.00	38.5	39.7	47.1	49.3	54.5	59.7	56
S. P.		+ 7.7										
AC-N	0											
	28	81	69	48	26 83	64	20	78	25	91	30	9

#2 Cal Recs

INDUCED POLARIZATION - RECEIVER NOTES

PAGE

Project: Covered Wells Line: 2 5 1/2 Int.Cal 48.5 Date: 1/21/67

11:30 Rec & Out Unit

13:30 — 49.0

Send	2-3	1-2		3-4	2-3	1-2		4-5	3-4	2-3	1-2		4-5	3-4	2-3	
Rec.	.5-1.0	→		1.0-1.5	→	1.5-2.0		→			→		2.0-2.5			
Time RANGE	100	30	10	100	30 10	10	100	30	30	10	10	3	30	10	10	3
DC-1	40.1	8.2	8.25	34.6	10.6	3.50	39.5	10.0	4.9	4.87	2.15	2.04	11.3	4.82	2.8	2.75
	40.2	8.2	8.25	34.6	10.6	3.52	39.4	10.0	4.9	4.90	2.14	2.04	11.3	4.82	2.8	2.74
DC-2	38.8	7.7	7.67	36.4	10.7	3.45	38.2	10.7	4.75	4.67	1.91	2.02	11.7	4.86	2.75	2.79
	38.8	7.1	7.67	36.4	10.7	3.43	38.2	10.7	4.75	4.66	1.93	2.02	11.7	4.87	2.75	2.80
Σ	78.9	15.9	15.92	71.0	21.3	6.95	77.7	20.7	9.65	9.54	4.06	4.06	23.0	9.68	5.55	5.54
	79.0	15.9	15.92	71.0	21.3	6.95	77.6	20.7	9.65	9.56	4.07	4.06	23.0	9.69	5.55	5.53
DC-3	40.3	8.2	8.25	34.6	10.7	3.55	39.3	10.0	4.9	4.90	2.14	2.04	11.3	4.80	2.8	2.74
	40.4	8.2	8.25	34.6	10.7	3.62	39.4	10.0	4.9	4.89	2.14	2.04	11.2	4.79	2.8	2.73
Dc-4	38.7	7.7	7.67	36.4	10.6	3.41	38.2	10.7	4.75	4.65	1.91	2.02	11.8	4.90	2.75	2.80
	38.6	7.7	7.67	36.4	10.7	3.31	38.2	10.7	4.75	4.67	1.91	2.02	11.8	4.92	2.75	2.81
Σ	79.0	15.9	15.92	71.0	21.3	6.96	77.5	20.7	9.65	9.55	4.05	4.06	23.1	9.70	5.55	5.54
	79.0	15.9	15.92	71.0	21.3	6.93	77.6	20.7	9.65	9.56	4.05	4.06	23.0	9.71	5.55	5.54
DC-AV	79.0	15.9	15.92	71.0	21.3	6.95	77.6	20.7	9.65	9.55	4.06	4.06	23.0	9.70	5.55	5.54
AC-1	36.8	7.5	7.27	33.4	9.95	9.34 3.34	37.0	9.85	4.6	4.54	1.99	1.94	10.95	4.60	2.65	2.52
AC-2	36.6	7.5	7.27	33.5	9.95	3.34	37.0	9.85	4.6	4.54	2.0	1.95	10.95	4.60	2.63	2.53
Σ	73.4	16.0	14.54	66.9	19.90	6.68	74.0	19.70	9.2	9.08	3.99	3.89	21.90	9.20	5.28	5.07
S. P.		+4.8				-17.7					+10.5					
AC-N		0.02				0.03					0.04					
Pot Res.		1000Ω		1400				1800Ω						1300Ω		

INDUCED POLARIZATION - RECEIVER NOTES

PAGE ____

Project: Covered Well Line: 1-S ½ Int.Cal 49.1 Date: 1/21/63

15:00

Send	1-2	4-5	3-4	2-3	1-2	CAL							
Rec.	→	2.5 3.05			→	4-5							
Time RANGE	3	10	10 | 3	3	3	100	30	100	30	100	30	300	
DC-1	1.38 1.38	5.20 5.20	2.81 | 2.62 2.82 | 2.60	1.71 1.70	.89 .90	19.0 19.0	19.3 19.2	23.9 23.9	24.3 24.3	28.6 28.6	29.1 29.1	29.5 29.5	
DC-2	1.30 1.31	5.19 5.19	2.45 | 2.67 2.44 | 2.70	1.68 1.69	.83 .81	19.2 19.2	19.3 19.2	24.0 24.0	24.2 24.2	28.7 28.7	29.0 29.0	29.0 29.0	
Σ	2.68 2.69	10.39 10.39	5.26 | 5.29 5.26 | 5.30	3.39 3.39	1.72 1.71	38.2 38.2							
DC-3	1.38 1.38	5.20 5.20	2.84 | 2.59 2.86 | 2.59	1.69 1.68	.92 .96	38.2 38.2	38.6 38.4	47.9 47.9	48.5 48.5	57.3 57.3	58.1 58.1	58.5 58.5	
Dc-4	1.31 1.31	5.19 5.19	2.41 | 2.7 2.39 | 2.71	1.70 1.71	.79 .77								
Σ	2.69 2.69	10.39 10.39	5.25 | 5.29 5.25 | 5.30	3.39 3.39	1.71 1.73								
DC-AV	2.69	10.39	5.25 5.30	3.39	1.72	38.2	38.5	47.9	48.5	11.6	11.6	11.6	
AC-1	1.30	4.97	2.54 | 2.44	1.61	0.85	19.8	19.2	24.2	23.5	29.0	27.6	30.0	
AC-2	1.30	4.97	2.55 | 2.44	1.61	0.85	19.8	19.3	24.2	23.6	29.0	27.5	30.0	
Σ	2.60	9.94	5.09 4.88	3.22	1.70	39.6	38.5	48.4	47.1	58.0	55.1	60.0	
S. P.	+7.0				-3.6								
AC-N	0.04				0.03								
Pot Res.			600Ω										

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 1 - 5+ Int.Cal Date: 1/21/63

Send	CAL	→	→	→	→				0-.5 SOUTH	0.5 NORTH		
Rec.	4-5	→	→	→	→							
~~Time~~ Range	100	30	100	30	300	100	30					
DC-1	19.5	19.65 19.65	24.0	24.3	29.9	28.9	29.1					
DC-2	19.5	19.60 19.60	24.0	24.3	29.9	28.9	29.0		S	S		
Σ	39.0	39.25 39.25	48.0	48.6	59.8	57.8	58.1		.5	.5		
DC-3			24.0	24.3	29.9	28.9	29.1		.0	.0		
Dc-4			24.0	24.3	29.9	28.9	29.0		↓			
Σ	39.0	39.25	48.0	48.6	59.8	57.8	58.1					
DC-AV									↓			
AC-1	19.7	19.0	24.2	23.3	29.9	29.0	27.3					
AC-2	19.8	19.2	24.4	23.4	30.0	29.0	27.3					
Σ	39.5	38.2	48.6	46.7	59.9	58.0	54.6					
S. P.									+23.0	-42.5		
AC-N												

Run with Madden Rec & B.C. U.T.U.M.

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project Covered Wells Line 1 - N½ Field date 1/16/62 Data page_____ Comp. date 1/19/62 Comp by C.S.L.

	S.D. 86 28	23 68	74 23	31 86	37	29	47	73	36	37	78	52
(A) Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
(B) Receive	0.5-1.0N	→	1.0-1.5N	→	→	1.5-2.0N	→	→	→	2.0-2.5N	→	→
(C) n separation	1	2	1	2	3	1	2	3	4	2	3	4
(D) I	1800	→	→	→	→	→	→	→	→	→	→	→
(E) Vdc (avg)	57.5 | 56.1	15.0 | 15.35	48.7 | 46.5	19.6 | 19.65	8.02	58.5	29.0	16.14	7.76	22.6	17.23	11.0
(F) DCcal USED	1.020	→	→	→	→	→	→	→	→	→	→	→
(G) Kn x 10^{-3}	1.5	6	1.5	6	15	1.5	6	15	30	6	15	30
(H) ρ dc=ExFxGx10^3/D	48.3	51.6	40.4	66.8	68.2	49.7	98.6	137.2	131.9	76.9	146.7	187.1
(I) Vac Σ	51.6 | 55.6	13.8 | 13.6	44.3 | 46.0	18.7 | 17.2	7.47	58.0	27.9	14.60	7.27	22.1	15.54	10.47
(J) AC noise x 2	0	→	→	→	→	→	→	→	→	→	→	→
(K) Vac(corr) = $\sqrt{I^2 - J^2}$	→	→	→	→	→	→	→	→	→	→	→	→
(L) AC-DC cal.	.933 | 1.012	1.018 | .957	.949 | 1.018	1.007 | .933	.999	1.010	.986	.950	1.001	.999	.944	.979
(M) ρ dc/ρac=ExL/K	1.039 | 1.023	1.104 | 1.080	1.042 | 1.030	1.056 | 1.064	1.072	1.019	1.024	1.050	1.069	1.021	1.048	1.030
(N) PFE=(M-1)(10^2)	4 (3) 2	10 (9) 8	4 (4) 3	6 (6) 6	7	2	2	5	7	2	5	3
(O) MCF=(M-1)(10^5)/H	31 64	92 178	36 89	60 90	106	38	24	36	52	27	33	16

Project_____ Line 28 81 Field date 69 48 26 83 Data page_____ Comp. date 64 20 78 25 91 30 9 Comp by_____

	4-5	1-2	2-3	3-4	4-5		C+L 1-2						
(A) Send													
(B) Receive	→	2.5-3.0N	→	→	→		→	→	→	→	→	→	→
(C) n separation	5	3	4	5	6		→	→	→	→	→	→	→
(D) I	→	→	→	→	→		400	400	500	500	600	600	600
(E) Vdc (avg)	5.89	17.65	14.85	9.90	5.43 | 5.58		39.8	38.4	50.1	48.3	59.4	56.7	56
(F) DCcal	→	→	→	→	→		1.005	1.041	.998	1.035	1.010	1.021	1.01
(G) Kn x 10^{-3}	52.5	15	30	52.5	84		→	→	~1.020	→	→	→	→
(H) ρ dc=ExFxGx10^3/D	175.2	150.0	252.3	294.5	262.0		→	→	→	→	→	→	→
(I) Vac Σ	5.64	16.10	13.60	9.54	5.24 | 5.00		38.5	39.7	47.1	49.3	54.5	59.7	56
(J) AC noise x 2	→	→	→	→	→		→	→	→	→	→	→	→
(K) Vac (corr) = $\sqrt{I^2 - J^2}$	→	→	→	→	→		→	→	→	→	→	→	→
(L) AC-DC cal.	1.012	.940	.956	.984	1.014 | .937		.967	1.033	.940	1.020	.919	1.017	1.00
(M) ρdc/ρac =ExL/K	1.059	1.030	1.029	1.021	1.051 | 1.047		→	→	→	→	→	→	→
(N) PFE=(M-1)(10^2)	6	3	3	2	5 (5) 5		→	→	→	→	→	→	→
(O) MCF=(M-1)(10^5)/H	34	20	11	7	49 19		→	→	→	→	→	→	→

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Wells Covered Line ~~37~~ 1-5 1/2 Field date 21/Jan/63 Data page _____ Comp. date 21/Jan/63. Comp by JCH

(A) Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
(B) Receive	.5-1.5	→	1-1.5	→	→	1.5-2.5	→	→	→	3-2.5	→	→
(C) ~~n separation~~ Ranges	100	30 10	100	30 10	10	100	30	30 10	10 3	30	10	10 3
(D) I	1800	→	→	→	→	→	→	→	→	→	→	→
(E) Vdc (avg)	79.0	15.9 15.92	71.0	21.3	6.95	77.6	20.7	9.65 9.55	4.06 4.06	23.0	9.70	5.55 5.54
(F) DCcal	1.032	→	→	→	→	→	→	→	→	→	→	→
(G) Kn x 10^{-3}	1.5	6	1.5	5	15	1.5	6	15	30	6	15	30
(H) ρ dc=ExFxGx10^3/D	68	54.6	61	73	60	67	71	83	70	79	83	95
(I) Vac Σ	73.4	15.0 14.54	66.9	19.90	6.68	74.0	19.70	9.2 9.08	3.99 3.89	21.90	9.20	5.28 5.07
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.000	1.015 .951	1.005	1.005	1.005	1.000	1.005	1.029 .988	1.022 .961	.956	.987	1.019 .936
(M) ρ dc/ρac=ExL/K	1.028	1.074	1.066	1.075	1.046	1.048	1.056	1.079 1.040	1.040 1.007	1.005	1.040	1.063 1.022
(N) PFE=(M-1)(10^2)	8	8	7	8	5	5	6	8 4	4 2 0	1	4	6 4 2
(O) MCF=(M-1)(10^5)/H	115	141	108	103	77	72	79	72	29	6	46	42
	37%	25% 73%	33%	33%	33%	37%	33%	15% 45%	20% 65%	69%	46%	26% 84%

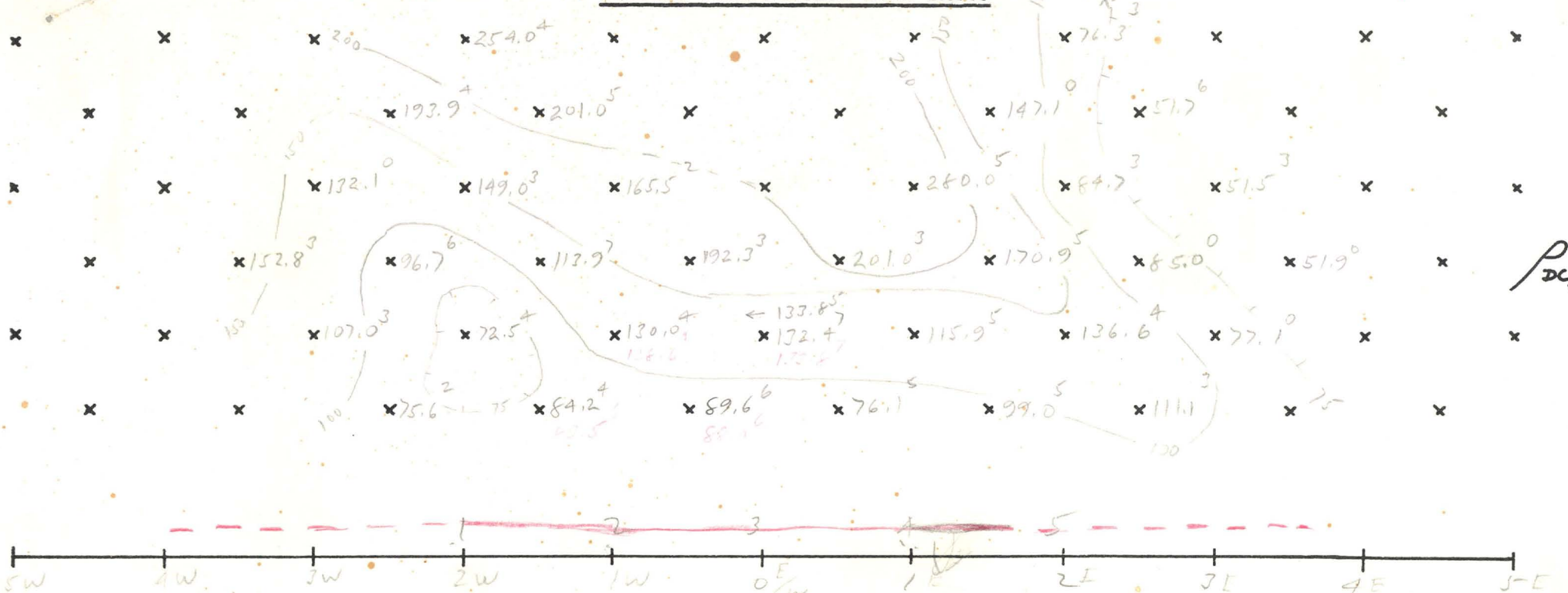
Project _____ Line _____ Field date _____ Data page 24% 78% Comp. date 24% 78% Comp by 29% 90%

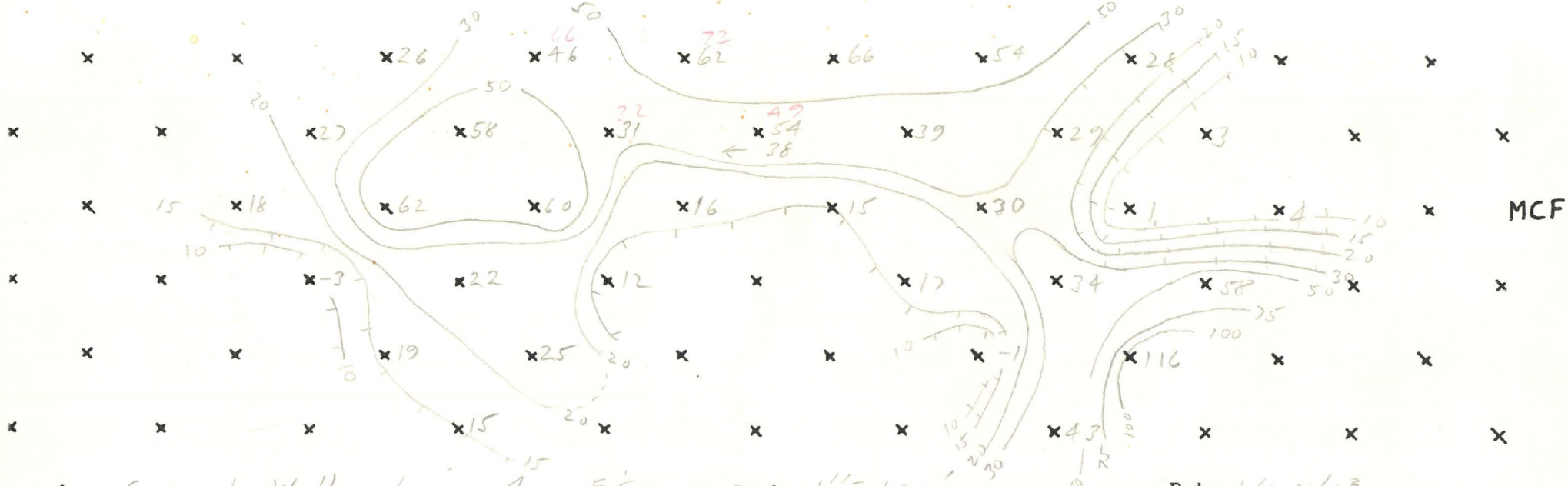
(A) Send	1-2	4-5	3-4	2-3	1-2	4-5	→	→	→	→	→	→
(B) Receive	2-2.5	2.5-3	→	→	→	CAL	→	→	→	→	→	→
(C) n separation	3	10	10 3	3	3	100 30	100 30	100 30 300	100 30	100 30	300	100 30
(D) I	1800	→	→	→	→	400	500	600	400	500	600	600
(E) Vdc (avg)	2.69	10.39	5.25 5.30	3.39	1.72	38.2 38.5	47.9 48.5	57.3 58.1 58.5	39.0 39.25	48.0 48.6	59.8	57.8 58.1
(F) DCcal	1.032	→	→	→	→	1.048 1.039	1.042 1.030	1.047 1.031 1.025	1.026 1.020	1.040 1.029	1.002	1.038 1.032
(G) Kn x 10^{-3}	52.5	15	30	525	84							
(H) ρ dc=ExFxGx10^3/D	81	89	91	102	83							
(I) Vac Σ	2.60	9.94	5.09 4.88	3.22	1.78	39.1 38.5	48.4 47.1	58.0 55.1 60.0	39.5 38.2	48.6 46.7	59.9	58.0 54.6
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.991	.982	1.014 .940	.978	1.012	1.037 1.000	1.011 .977	1.012 1.025	1.012 .973	1.012 .961	1.001	1.002 .940
(M) ρdc/ρac =ExL/K	1.025	1.028	1.018 1.020	1.030	1.022							
(N) PFE=(M-1)(10^2)	1.5	3	5 4 2	3	2							
(O) MCF=(M-1)(10^5)/H	31	31	44	29	26							
	43%	50%	26% 81%	53%	28%							

New Rec
to Red.

Look North

INDUCED POLARIZATION WORK SHEET





Area Covered Wells Line 4 E½ Scale 1"=1000' Date 1/28/63

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Par Wells Line: #4 - W'ly Int.Cal 47.5 Date: 25/Jan 63

Worst S.P. Noise I've seen (DC)

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Rec.	1^W-2^W	→	2^W-3^W		→	3^W-4^W			→	4^W-5^W	→	
Time	100 30	30 10	30	10	10	30	10	10	3	10	10	31
DC-1	19.0 19.9 20.5	7.1 8.1 7.66 2	20.9 21.8	7.55 7.70 7.4 7.8	4.6 4.1 4.05 4.6	19.9 20.5	4.70 4.8 5.00 4.95	2.45 2.4	1.42 1.6 1.9 2.2	6.90 6.88	2.60 2.45	1.55 1.75
DC-2	22.0 19.9 21.0	7.9 7.0 7.2 8.9	22.8 21.8	7.30 7.40 7.15 7.10	4.0 4.8 4.75 4.85	19.4 18.7	4.90 4.85 4.90 4.85	2.7 2.7	2.35 2.8 2.05 1.65	6.90 6.92	2.40 2.55	1.82 1.65
Σ	41.0 39.8 41.5	15.0 15.1 14.8 15.1	43.7 43.6	14.85 14.80 14.55 14.70	8.60 8.80 8.80 8.85	39.3 39.2	9.40 9.75 9.50 9.80	5.1 5.15	3.77 3.78 3.95 3.70	13.80	5.00 5.00	3.45 3.37
DC-3	21.1 20.0 21.1	7.9 7.1 7.5 6.3	21.6 23.0	8.2 7.8 7.3 8.0	4.7 5.0 4.7 4.5	19.0 19.7	4.6 4.8 4.3	2.55 2.50	1.75 1.73 1.72 1.75	6.65 6.30	2.90	1.55 1.61
Dc-4	20.1 19.8 20.1	7.1 8.3 7.4 9.1	21.9 20.6	6.6 6.85 7.4 6.7	4.0 3.7 3.9 4.2	20.0 19.3	4.8 4.7 5.05	2.65 2.65	1.85 2.03 2.02 1.35	7.10 7.50	2.10	1.85 1.72
Σ	41.2 39.8 41.2	15.0 13.4 14.9 15.4	43.5 43.6	14.80 14.60 14.70 14.7	8.7 8.7 8.6 8.7	39.3 39.0	9.4 9.5 9.4 9.4	5.15 5.20	3.80 3.76 3.74 3.70	13.80	5.00	3.33 3.40
DC-AV	39.8 41.2	14.9 15.25	43.6	14.72	8.71	39.1	9.39	5.15	3.75	13.80	5.00	3.38
AC-1	19.2 18.9	7.1 6.98	20.2	6.77	4.20	18.5	4.45	2.45	1.78	6.45	2.40	1.60
AC-2	19.2 18.9	7.1 6.98	20.1	6.78	4.20	18.5	4.45	2.45	1.78	6.45	2.40	1.60
Σ	38.4 37.8	14.2 13.96	40.3	13.55	8.40	37.0	8.90	4.90	3.56	12.90	4.80	3.20
S. P.	-5.5 very noisy -4.6		-23.1	←	-26.3	+138				-17.9	→	-19.2
AC-N						1.54						
	900Ω						900Ω			900Ω		

7.05
6.75
13.80

7.10
6.65
13.75

7.25
6.40
3.65

7.50

1.55
.89
2.44

6.30
3.50
13.80

1.75
.75
2.50

2.11
1.39
3.50

1.1
1.5
2.60

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Cor Wells Line: #4 W/2 Int.Cal 47.5 Date: 25/JAN/67

Send	4-5	1-2	2-3	3-4	4-5	1-2						
Rec.	4W-5W	5W-6W			→	CAL						
Time	3R	10R	3	.		30	100	30	100	30	100	
DC-1	1.22 1.31	4.25 4.05	1.83 2.00	1.75 0.89 1.10	1.08 1.02	19.8	19.2	24.8	24.0	29.6	29.0	0+1W
DC-2	1.40 1.28	3.75 3.80	1.67 1.41	0.78 1.55 1.50	0.98 0.58	19.8	19.2	24.8	24.0	29.6	29.0	
Σ	2.59 2.62	8.00 7.85	3.50 3.41	2.53 2.60	2.06 2.00	39.6	38.4	49.6	48.0	59.2	58.0	
DC-3	1.20	3.90 3.85	1.34 1.80	1.11 1.30	0.88 0.86	19.8	19.2	24.8	24.0	29.6	29.0	1
Dc-4	1.39	3.95 4.10	1.55 2.11	1.41 1.12	1.20 1.20	19.8	19.2	24.8	24.0	29.6	29.0	3.4 mV
Σ	2.59	7.85 7.95	3.35 3.45	2.52 2.44 2.42	2.08 2.06	39.6	38.4	49.6	48.0	59.2	58.0	
DC-AV	2.60	7.90	3.43	2.51	2.05	39.6	38.4	49.6	48.0	59.2	58.0	
AC-1	1.24	3.85	1.68	1.20	0.99	19.0	19.9	23.2	24.5	27.0	29.9	
AC-2	1.25	3.82	1.68	1.21	1.00	19.0	19.8	23.2	24.5	27.0	29.9	
Σ	2.49	7.67	3.36	2.41	1.99	38.0	39.7	46.4	49.0	54.0	59.8	
S. P.		-30.1										
AC-N	0-0.2											
		1100-2										

INDUCED POLARIZATION SENDER NOTES

Project: COVERED WELLS Line: 4 W½ Date: 1-25-68

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	→		→		→		→		→			
Time												
Range	2×7	2×7	2×8	2×7	2×7	2×8	2×8	2×7	2×7	2×8	2×8	2×7
Current	1400	1400	1600	1400	1400	1600	1600	1400	1400	1600	1600	1400
Send	4-5	1-2	2-3	3-4	4-5							
Receive	→		→		→		CAL	1-2				
Time												
Range	2×7	2×8	2×8	2×7	2×7		1×4	1×5	1×6			
Current	1400	1600	1600	1400	1400		400	500	600			

Floyd

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Line: #4 - E 1/2 Int.Cal Date: 24/Jan/83

Send	1-2	4-5 Good	3-4 Good	2-3 Good	1-2	4-5'	→				→	
Rec.	4'-5'	5'-6'	→	→	→	CAL						
Time	3	3R	3R	3R.		100	30	30	100	100	30	
DC-1	1.11 1.22 1.11 1.05	1.20 1.15	.55 .62 .53	40 39	40 2.2 40	19.5	19.9	25.1	24.5	29.8	30.1	
DC-2	1.13 1.03 1.07 1.20	1.19 1.26	.63 .58 .65	38 39	32 5.0 32	19.5	19.9	25.1	24.5	29.8	30.0	
Σ	2.24 2.25 2.18 2.25	2.41 2.39	1.18 1.18 1.20	78 78	72 72 72	39.0	39.8	50.2	49.0	59.6	60.1	
DC-3	1.11 1.18 1.11 1.11	1.18 1.22	1.60 .65 .61	39 39	49 30 30 43	19.5	19.9	25.1	24.5	29.8	30.1	+ 40%
Dc-4	1.11 1.08 1.11 1.12	1.22 1.18	1.60 .53 .58	39 39	25 42	19.5	19.9	25.1	24.5	29.8	30.0	
Σ	2.22 2.26 2.22 2.23	2.40 2.40	1.20 1.18 1.19	78	72 73 74	39.0	39.8	50.2	49.0	59.6	60.1	
DC-AV	2.22	2.40	1.19	.78	.72	39.0	39.8	50.2	49.0	596	60.1	11
AC-1	1.11	1.19	0.59	0.38	0.36	19.7	19.3	23.7	25.0	29.8	27.5	
AC-2	1.11	1.19	.59	0.38	36	19.8	19.3	23.7	25.0	29.8	27.5	- 10
Σ	2.22	2.38	1.18	.76	.72	39.5	38.6	47.4	50.0	59.6	55.0	
S. P.	+6.3	-17.3	no noise									0
AC-N		←	no noise	→								
						20%	64%	99%	25%	38%	91%	SP

INDUC[illegible]D POLAR[illegible]ZATION - RECEIVER NOTES PAGE ______

Project: Anc # 4 E 1/2 ~~Line~~: Corr Wells Int.Cal 48.6 Date: 24/Jan 63

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Rec.	1-2E	→	2E-3E	→	→	3E-4E	←	→	→	4E-5E	→	→ *
Time	30 100	30	100 30	30 10	10 R	30R 100	10	10	10	10 R	3	3
DC-1	20.6 21.0	8.3	21.5 23.4	7.8 7.75	5.2 5.0	26.5 25.8	8.2 8.2	4.8 4.65 4.2 4.4	3.9 3.8 4.0 3.8	4.5 4.45 4.4 4.2	1.95 1.95	1.38 1.08 1.20
DC-2	20.4 18.2	9.2	23.5 23.0	7.4 7.75	5.4 5.6	25.5 25.0	7.6 7.5	4.1 4.25 4.8 4.5	3.5 3.6 3.5 3.5	4.38 4.48 4.55 4.65	1.97 1.98	1.12 1.42 1.30
Σ	41.0 39.2	17.5	45.0 46.4	15.2 15.50	10.6 10.6	52.0 50.8	15.6 15.7	8.9 8.9 9.0 8.9	7.4 7.4 7.5 7.2	8.88 8.90 8.95 8.85	3.92 3.93	2.50 2.50
DC-3	20.2 21.0	8.3	21.5 23.6	7.6 8.1	4.6 6.4	26.5 26.2	7.2 8.7	4.95 4.4 4.4 4.6	3.2 3.8 3.9	4.4 4.5 4.15 4.35	2.15 1.99	1.12 1.40
Dc-4	20.8 18.2	9.1	23.5 22.8	7.6 7.4	5.9 4.2	25.5 24.5	8.6 7.55	4.2 4.7 4.7 4.45	4.3 3.6 3.5	4.55 4.35 4.75 4.50	1.78 1.92	1.38 1.07
Σ	41.0 39.2	17.4	45.0 46.6	15.2 15.5	10.5 10.6	52.0 50.7	15.8 15.75	9.15 9.10 9.14 9.05	7.4 7.5 7.4	8.95 8.85 8.90 8.85	3.91 3.93	2.50 2.50 2.47
DC-AV	41.0 39.2	17.45	45.0 46.5	15.2 15.5	10.6	52.0 50.8	15.75	9.05 8.99	7.4 7.4	8.92 8.86	3.92	2.50
AC-1	18.8 19.2	8.3	21.8 21.2	7.3 7.15	5.05	23.7 25.0	7.22	4.25	3.59	4.39	1.88	1.21
AC-2	18.8 19.2	8.2	21.6 21.1	7.3 7.15	5.05	23.7 25.0	7.20	4.25	3.60	4.40	1.89	1.21
Σ	37.6 38.4	16.5	43.4 42.3	14.6 14.3	10.10	47.4 50.0	14.42	8.50	7.09	8.79	3.77	2.42
S. P.	+47.6.	→ 50.9	-37.1	→	39.0	+16.3			+16.3	+1.6		
AC-N	0 burst	to 0.2										
	63% 19%	28%										

INDUCED POLARIZATION SENDER NOTES

Project: COVENED WELLS Line: 4 E½ Date: 1-24-63

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Receive	→	→	→	→	→	→	→	→	→	→	→	→
Time	x2		x2			x2				x2		
Range	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Current	1600	1600	1400	1600	1600	1400	1400	1600	1600	1400	1400	1600
Send	1-2	4-5	3-4	2-3	1-2	CAL	4-5					
Receive	→	→	→	→	→							
Time		x2				x1	+1	x1				
Range	1.50	1.50	1.50	1.50	1.50	.30	.30	.30				
Current	1600	1400	1400	1600	1600	400	5.00	600				

FLOYD-HANLY

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Con. Wells Line: #4 w/k Int.Cal 47.0 Date: 25/Jan

Geotx Rec.

Send	1-2		New Rec				3-4	3-4	4-5	4-5	2-3	3-4
Rec.	CAL		Same	Sender notes			1W-2W	→	2W-3W	→	3W-4W	→
Time	100R	30R	30	100	100	30	30	100	30	10	30	10
DC-1	19.3	19.9	25.2	24.5	29.8	30.1	21.0 20.1	20.0 19.8	7.9 7.9	8.05 7.7	22.0 21.6	6.5 7.8 6.9
DC-2	19.3	19.9	25.1	24.5	29.8	30.1	19.8 21.6	20.0 20.2	7.5 7.5	7.22 7.9	22.0 22.7	8.3 7.1 7.9
Σ	38.6	39.8	50.3	49.0	59.6	60.2	40.8 41.7	40.0 40.0	15.4 15.4	15.6 15.27	44.0 44.3	14.8 14.9 14.9
DC-3	19.3	19.9	25.2	24.5	29.8	30.1	20.2 19.5 19.9	19.9	7.8 7.8	7.4 7.75	21.9 22.6	7.8 7.8 8.2
Dc-4	19.3	19.9	25.1	24.5	29.8	30.1	21.3 22.2 21.7	20.0	7.3 7.7	8.2 7.70	22.1 21.5	7.15 7.1 6.7
Σ	38.6	39.8	50.3	49.0	59.6	60.2	41.0 41.7	39.9	15.1 15.5	15.6 15.45	44.0 44.5	14.95 14.9 14.9
DC-AV	38.6	39.8	50.3	49.0	59.6	60.2	41.4	40.0	15.4	15.48	44.1	14.87
AC-1	19.0	19.1	23.9	24.0	28.2	28.1	18.6	18.7	7.0	7.05	19.9	6.8
AC-2	19.0	19.3	23.9	24.0	28.2	28.3	18.7	18.5	7.0	7.02	20.1	6.82
Σ	38.0	38.4	47.8	49.0	56.4	56.4	37.3	37.2	14.0	14.07	40.0	13.62
S. P.							-1.1	→	→	-4.9	-23.5	
AC-N												
							→					

New Rec

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project Covered Wells Line 4 - W½ Field date 1/25/62 Data page_____ Comp. date 1/28/62 Comp by C.S.L.

	20 S.D. 62 19	23 70	67	68								
(A) Send	3-4	4-5	2-3	3-4								
(B) Receive	1-2 W	→	2-3 W	→								
(C) n separation	1	2	1	2								
(D) I	1400	1400	1600	1400								
(E) Vdc (avg)	41.4/40.0	15.4/15.48	44.1	14.87								
(F) DCcal USED.	1.010	→	→	→								
(G) Kn x 10^{-3}	3	12	3	12								
(H) ρ dc=ExFxGx10^3/D	88.0	133.8	83.5	128.6								
(I) Vac Σ	37.3/37.2	14.0/14.07	40.0	13.62								
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.960/.984	.982/.955	.957	.956								
(M) ρ dc/ρac=ExL/K	1.066 1.060	1.088 1.050	1.055	1.041								
(N) PFE=(M-1)(10^2)	6 C3	7 C5	6	4								
(O) MCF=(M-1)(10^5)/H	72	49	66	32								

Project_____ Line_____ Field date_____ Data page 19 64 80 24 28 94 Comp. date_____ Comp by_____

(A) Send						CAL						
(B) Receive						1-2						
(C) n separation												
(D) I						400	400	500	500	600	600	
(E) Vdc (avg)						38.6	39.8	50.3	49.0	59.6	60.2	
(F) DCcal						1.037	1.004	.994	1.020	1.005	.996	
(G) Kn x 10^{-3}								~	1.010			
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ						38.0	38.9	47.8	48.0	56.4	56.4	
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.						.985	.965	.950	.980	.946	.937	
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)												
(O) MCF=(M-1)(10^5)/H												

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Covered Wells Line 4-E ½ Field date 1/24/63 Data page _____ Comp. date 1/28/63. Comp by C.S.L.

	S.P. 63 19	28	22 71	24 72	51	79 25	72	43	36	44	63	40
(A) Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
(B) Receive	1-2 E	→	2-3 E	→	→	3-4 E	→	→	→	4-5 E	→	→
(C) n separation	1	2	1	2	3	1	2	3	4	2	3	4
(D) I	1600	1600	1400	1600	1600	1400	1400	1600	1600	1400	1400	1600
(E) Vdc (avg)	41.0 39.2	17.45	45.0 46.5	15.2 15.5	10.60	52.0 50.8	15.75	9.02	7.40	8.89	3.92	2.50
(F) DCcal USED	1.010											
(G) Kn x 10^{-3}	3	12	3	12	30	3	12	30	60	12	30	60
(H) ρ dc=ExFxGx10^3/D	76.1	132.4	99.0	115.9	201	111.1	136.6	170.9	280	77.1	85.0	84.7
(I) Vac Σ												
(J) AC noise x 2	37.6 38.4	16.5	43.4 42.3	14.6 14.3	10.10	47.4 50.0	14.42	8.50	7.09	8.79	3.77	2.42
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.964 1.024	1.012	1.020 .953	1.017 .952	.980	.942 1.016	.952	.991	1.001	.990	.964	.995
(M) ρ dc/ρac=ExL/K	1.051 1.048	1.071	1.058 1.049	1.059 1.032	1.030	1.032 1.031	1.040	1.052	1.047	1.002	1.001	1.029
(N) PFE=(M-1)(10^2)	5 50	7	5 53	5 45	3	3	4	5	5	0	0	3
(O) MCF=(M-1)(10^5)/H	66	54	54	39	15	28	29	30	17	3	1	34

Project _____	Line 37 40		Field date 20 13		12	Data page 20		Comp. date 64 79		25	Comp by 30 92	
(A) Send	1-2	4-5	3-4	2-3	1-2		CAL					
(B) Receive	→	5-6 E	→	→	→		4-5					
(C) n separation	5	3	4	5	6							
(D) I	1600	1400	1400	1600	1600		400	400	500	500	600	600
(E) Vdc (avg)	2.22	2.40	1.19	.78	.72		39.0	39.8	50.2	49.0	59.6	60.1
(F) DCcal	→	→	→	→	→		1.026	1.004	0.996	1.020	1.007	0.998
(G) Kn x 10^{-3}	105	30	60	105	168				1.010			
(H) ρ dc=ExFxGx10^3/D	147.1	51.9	51.5	51.7	76.3							
(I) Vac Σ	2.22	2.38	1.18	.76	.72		39.5	38.6	47.4	50.0	59.6	55.0
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.999	.995	1.022	1.032	1.033		1.012	.970	.944	1.020	1.000	.915
(M) ρdc/ρac =ExL/K	.999	1.002	1.031	1.060	1.033							
(N) PFE=(M-1)(10^2)	0	0	3	6	3							
(O) MCF=(M-1)(10^5)/H	-1	4	58	116	43							

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

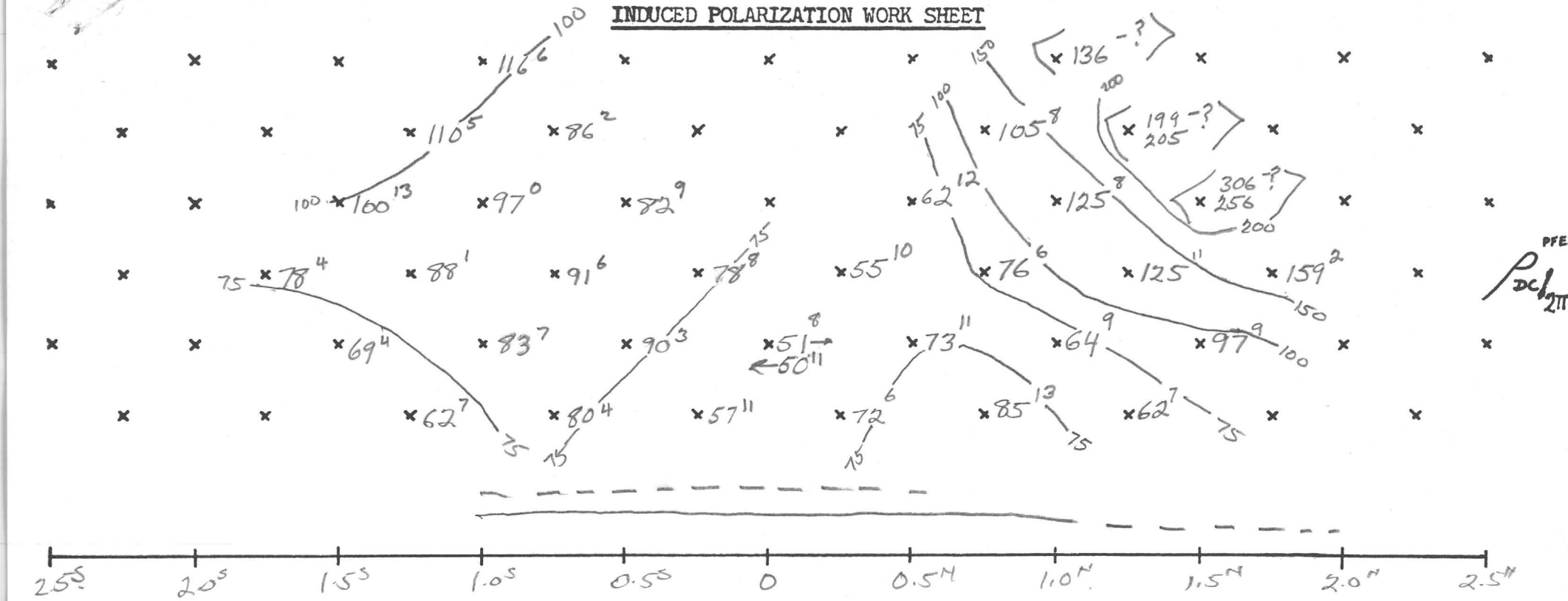
Project Covered Wells Line 4 - W½ Field date 1/25/63 Data page _____ Comp. date 1/28/63 Comp by C. S. L.

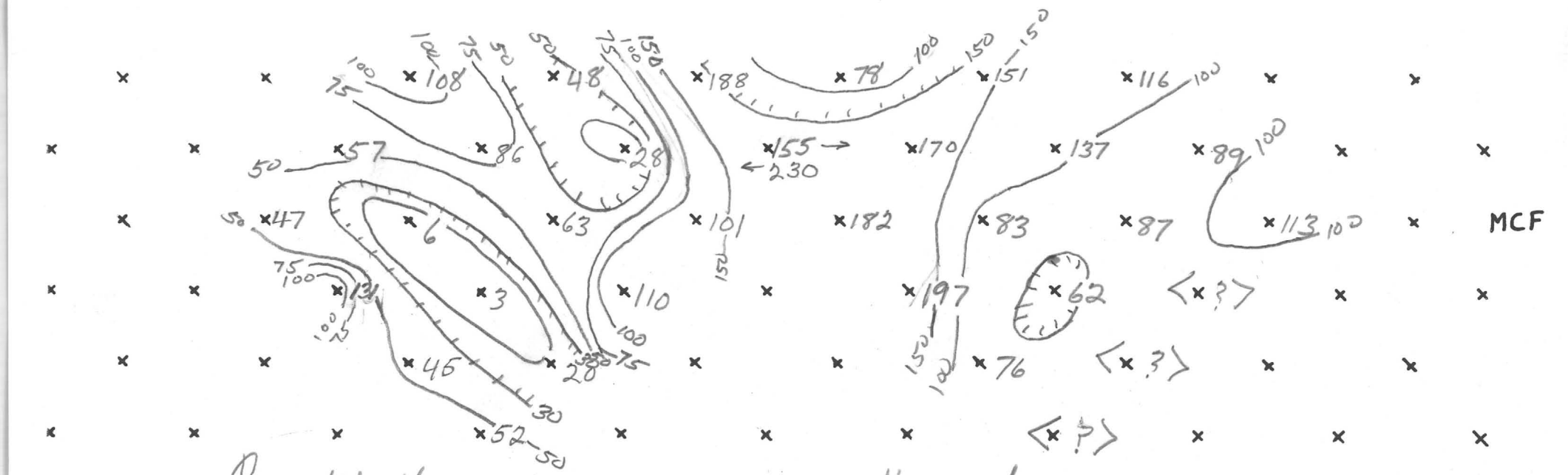
	19	63	24	70	67	68	42	62	45	25	59	65	24	53
(A) Send	3-4		4-5		2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
(B) Receive	1-2W		→		2-3W	→	→	3-4W	→	→	→	4-5W	→	→
(C) n separation	1		2		1	2	3	1	2	3	4	2	3	4
(D) I	1400		1400		1600	1400	1400	1600	1600	1400	1400	1600	1600	1400
(E) Vdc (avg)	39.8	41.2	14.9	15.25	43.6	14.72	8.71	39.1	9.39	5.15	3.75	13.80	5.00	3.38
(F) DCcal USED	1.030		→		→	→	→	→	→	→	→	→	→	→
(G) Kn x 10^{-3}	3		12		3	12	30	3	12	30	60	12	30	60
(H) ρ dc=ExFxGx10^3/D	89.6		133.8		84.2	130	192.3	75.6	72.5	113.9	165.5	107.0	96.7	149.0
(I) Vac Σ	38.9	37.8	14.2	13.96	40.3	13.55	8.40	37.0	8.90	4.90	3.56	12.90	4.80	3.20
(J) AC noise x 2														
(K) Vac(corr) = $\sqrt{I^2 - J^2}$														
(L) AC-DC cal.	1.024	.964	1.017	.955	.959	.957	.993	.965	.988	1.016	.969	.961	1.017	.978
(M) ρ dc/ρac=ExL/K	1.061	1.051	1.068	1.034	1.039	1.040	1.030	1.020	1.042	1.069	1.020	1.029	1.060	1.033
(N) PFE=(M-1)(10^2)	6	56	5	31	4	4	3	2	4	7	2	3	6	3
(O) MCF=(M-1)(10^5)/H	62		38		46	31	16	26	58	60	12	27	62	22

Project _____ Line 31 38 Field date 56 40 33 Data page 63 Comp. date 20 77 25 Comp by 90 30

(A) Send	4-5	1-2	2-3	3-4	4-5		CAL	→	→	→	→	→	→
(B) Receive	→	5-6W	→	→	→		1-2	→	→	→	→	→	→
(C) n separation	5	3	4	5	6								
(D) I	1400	1600	1600	1400	1400		400	900	500	500	600	600	
(E) Vdc (avg)	2.60	7.90	3.43	2.51	2.05		39.6	38.4	49.6	48.0	59.2	58.0	
(F) DCcal	→	→	→	→	→		1.010	1.041	1.010	1.041	1.013	1.035	
(G) Kn x 10^{-3}	105	30	60	105	168			~1.030					
(H) ρ dc=ExFxGx10^3/D	201	152.8	132.1	193.9	254								
(I) Vac Σ	2.49	7.67	3.36	2.41	1.99		38.0	39.7	46.4	49.0	54.0	59.8	
(J) AC noise x 2													
(K) Vac (corr) = $\sqrt{I^2 - J^2}$													
(L) AC-DC cal.	1.007	.998	.974	.995	1.005		.960	1.034	.935	1.021	.911	1.030	
(M) ρdc/ρac =ExL/K	1.050	1.028	.996	1.037	1.037								
(N) PFE=(M-1)(10^2)	5	3	0	4	4								
(O) MCF=(M-1)(10^5)/H	25	18	-3	19	15								

INDUCED POLARIZATION WORK SHEET





MCF

Area Cor Wells Line #2 Scale 1"=500' Date

INDUCED POLARIZATION SENDER NOTES

Project: COVERED WELLS Line: 2 N½ Date: 1-22-63

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	0.5 →		→			→						
Time	x2		x2			x2				x2		
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Send	4-5	1-2	2-3	3-4	4-5	Cal	1-2					
Receive	→				→							
Time		x2					x1	x1	x1			
Range	2.0	2.0	2.0	2.0	2.0		30	30	30			
Current	1800	1800	1800	1800	1800		400	500	600			

FLOYD

INDUCED POLARIZATION SENDER NOTES

Project: COVERED-WELLS Line: 2 S 1/2 Date: 1-22-63

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Receive	→		→		→		→		→			
Time	x2		x2			X2				X2		
Range	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Send	1-2	4-5	3-4	2-3	1-2	CAL	4-5					
Receive	→		→		→							
Time		x2					x1	x1	x1			
Range	2.0	2.0	2.0	2.0	2.0		30	30	30			
Current	1900	1800	1800	1800	1800		400	500	600			

1 1 FLoyd

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: Line 2N'/2 Int.Cal 48.0 9:30 Date: 1/22/63

Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Rec.	.5-1.0	N →	1.0-	1.5 NORTH →		1.5-	2.0 NORTH →			2.0	2.5	NORTH
Time RANGE	100	30 | 10	100	30	10	100	30 | 10	10	10 | 3	30	30 | 10	10
DC-1	42.5 42.5	7.3 | 7.6 7.3 | 7.6	49.5 49.5	11.0 10.9	3.22 3.23	37.0 37.0	9.5 | 9.5 9.5 | 9.42	4.45 4.45	1.78 | 1.83 1.78 | 1.83	14.0 14.0	7.3 | 7.4 7.3 | 7.42	3.75 3.75
DC-2	42.5 42.5	7.5 | 7.62 7.5 | 7.62	50.0 50.0	10.6 10.7	3.20 3.20	36.2 36.2	9.2 | 9.42 9.2 | 9.5	4.45 4.45	1.81 | 1.90 1.82 | 1.90	14.4 14.4	7.3 | 7.4 7.3 | 7.40	3.65 3.60
Σ	85.0 85.0	14.8 | 15.22 14.8 | 15.22	99.5 99.5	21.6 21.6	6.42 6.43	73.2 73.2	18.7 | 18.92 18.7 | 18.92	8.90 8.90	3.59 | 3.73 3.60 | 3.73	28.4 28.4	14.6 | 14.8 14.6 | 14.82	7.40 7.35
DC-3			49.5		3.25 3.30		9.4				7.42	3.70 3.75
Dc-4			50.0		3.18 3.12		9.52				7.40	3.60 3.60
Σ	85.0	14.8 | 15.22	99.5	21.6	6.43 6.42		18.92				14.82	7.30 7.35
DC-AV	85.0	14.8 | 15.22	99.5	21.6	6.425	73.2	18.7 | 18.92	8.9	3.59	28.4	14.6 | 14.82	17.35
AC-1	40.5	6.9 | 6.8	44.0	9.9	2.98	34.5	8.7 | 8.2	4.18	1.67 | 1.62	13.1	6.7 | 6.53	3.45
AC-2	40.2	7.0 | 6.8	43.8	9.9	2.98	34.5	8.7 | 8.2	4.18	1.67 | 1.63	13.0	6.7 | 6.53	3.45
Σ	80.7	13.9 | 13.6	87.8	19.8	5.96	69.0	17.4 | 16.4	8.36	3.34 | 3.25	26.1	13.4 | 13.06	6.90
S. P.	+20.6		-23.1		-22.8	-3.9	-7.2		-1.8	+21.5		
AC-N		0			0		29% 82%		0			
% Scale Ω Res.	40% 1000Ω	32% 68	44%	33%	30% 900Ω	35% 900Ω	1 82	42%	16% 56%	43.10 1100Ω	22 65	35%

3-4

2.5-3.0

10 After

DC 3.62

3.62

Σ 7.24

A.C 3.60

3.60

Σ 7.20

7.18
7.30
14.48
7.24
2

7
2
9
4
2

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 2 N 1/2 Int.Cal Date: 11/22/63

Send	4-5	1-2	2-3	3-4	4-5	CAL	1-2				
Rec.	→	2.5-	3.0	NORTH	→						
Time RANGE	3	30	B 30 A	B 10 A	B 3	30	100	100	30	30	100
DC-1	1.79 1.75	9.5 9.5	7.5 | 9.0 7.3 | 9.0	3.45 3.58 3.50 3.50	1.80 1.79	19.6	19.0	24.5	25.0	29.8	29.5
DC-2	1.75 1.79	9.2 9.2	7.6 | 9.0 7.7 | 9.0	3.25 3.6 3.20 3.8	1.07 1.03	19.8	19.2	24.2	25.2	30.2	29.7
Σ	3.54 3.54	18.7 18.7	15.1 | 18.0 15.0 | 18.0	6.70 | 7.18 6.70 | 7.30	2.87 2.82	39.4	38.2	48.7	50.2	60.0	59.2
DC-3					1.80 1.83	19.6	19.0	24.5	25.0	29.8	29.5
Dc-4					1.02 1.04	19.8	19.2	24.2	25.2	30.2	29.7
Σ					2.82 2.87	39.4	38.2	48.7	50.2	60.0	59.2
DC-AV	3.54	18.7	15.05 | 18.0	6.7 | 7.24	2.85						
AC-1	1.61	9.4	8.9	3.61	1.68	19.3	19.9	25.0	23.6	27.3	30.0
AC-2	1.60	9.3	8.9	3.60	1.68	19.5	20.0	25.0	23.7	27.4	30.0
Σ	3.21	18.7	17.8	7.21	3.36	38.8	39.9	50.0	47.3	54.7	60.0
S. P.	+23.1	+5.7									
AC-N	0				0						
% SCALE RES. Ω	54%	31 -1000Ω	30%	36%	36%	65%	20%	25%	79%	91%	30%

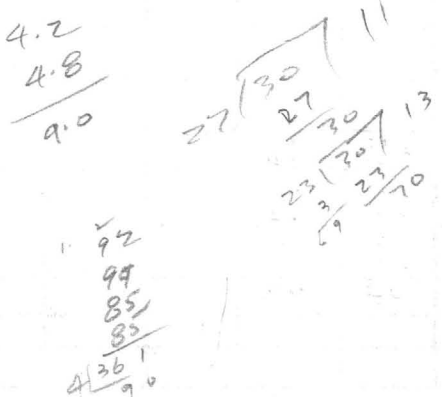
0-.5N —

98
98
95
100
391 | 196

INDUCED POLARIZATION - RECEIVER NOTES PAGE

Project: Covered Wells Line: 2 S 1/2 Int.Cal Date: 1/23/63

Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
Rec.	0.5-	1.0 S	1.0-	1.5 South →		1.5-2.0 South →				2.0-	2.5 South	
Time RANGE	100	30 | 10	100	30	10	100	30	10	10 | 3	30	30 | 10	10
DC-1	34.2 34.2	7.1 7.4 7.1 7.4	47.5 47.5	13.5 13.5	4.55 4.55	35.9 36.0	12.0 12.0	5.3 5.3	2.45 2.48 2.45 2.5	10.2 10.2	5.0 5.25 5.0 5.22	2.90 2.90
DC-2	33.2 33.2	7.4 7.55 7.4 7.6	47.2 47.2	12.9 12.9	4.50 4.50	37.0 37.0	12.3 12.3	5.4 5.4	2.3 2.44 2.32 2.43	10.2 10.2	5.2 5.22 5.1 5.25	2.80 2.80
Σ	67.4 67.4	14.5 14.95 14.5 15.0	94.7 94.7	26.4 26.4	9.05 9.05	72.9 73.0	24.3 24.3	10.7 10.7	4.75 4.92 4.77 4.93	20.4 20.4	10.2 10.47 10.1 10.47	5.70 5.70
DC-3		7.38 7.38							2.51 2.52			
Dc-4		7.6 7.6							2.42 2.42			
Σ	67.4	14.98 14.78							4.93 4.93		10.15 10.47	
DC-AV	67.4	14.5 | 14.98	94.7	26.4	9.05	72.95	24.3	10.7	4.76 | 4.93	20.4	10.15 | 10.47	5.70
AC-1	31.0	6.8 | 6.63	45.7	12.9	4.19	34.7	11.4	5.0	2.25 | 2.22	10.0	5.2 | 5.22	2.92
AC-2	31.0	6.8 | 6.63	45.0	12.8	4.20	34.5	11.4	5.0	2.25 | 2.22	10.0	5.1 | 5.22	2.88
Σ	62.0	13.6 | 13.26	90.7	25.7	8.39	69.2	22.8	10.0	4.50 | 4.44	20.0	10.3 | 10.44	5.80
S. P.	+12.5		+18.1		+18.8	-18.8			-18.0	+14.0		
AC-N		0			0				0			
% Scale Pot Res	31% -1000 Ω	23% 66%	45%	43% 700 Ω	42%	35% 1000 Ω	38%	50%	23% 74%	30% - 1000 Ω	17% 52	29%



INDUCED POLARIZATION - RECEIVER NOTES PAGE ____

Project: Covered Wells Line: 2 S1/2 Int.Cal 48 Date: 1/23/63

Send	1-2	4-5	3-4	2-3	1-2	CAL	4-5					
Rec.	→	2.5	-3.0	South	→							
Time RANGE	3	10	10	10 | 3	3	100	30	30	100	100	30	S.P. 0 - .5 North S.P. 0 - .5 South
DC-1	1.42 1.36	4.58 4.58	2.98 2.98	1.80 1.85 1.80 1.85	1.21 1.21	19.0 19.0	19.9 19.9	24.9 24.9	24.0 24.0	29.3 29.3	29.8 29.8	
DC-2	1.50 1.53	4.60 4.60	2.90 2.90	1.85 1.91 1.85 1.92	1.22 1.23	19.0 19.0	19.8 19.8	24.9 24.9	24.0 24.0	29.5 29.5	29.9 29.9	
Σ	2.92 2.89	9.18 9.18	5.88 5.88	3.65 3.76 3.65 3.77	2.43 2.44	38.0 38.0	39.7 39.7	49.8 49.8	48.0 48.0	58.8 58.8	59.7 59.7	
DC-3	1.38 1.49											
Dc-4	1.47 1.36											
Σ	2.85 2.85											
DC-AV	2.88	9.18	5.88	3.65 3.76	2.43	38.0	39.7	49.8	48.0	58.8	59.7	
AC-1	1.4	4.4	2.67	1.78 | 1.77	1.15	19.8	19.1	23.4	25.0	29.9	27.3	- 30.2 - 36.5
AC-2	1.4	4.42	2.65	1.78 | 1.77	1.15	19.9	19.1	23.3	24.8	29.9	27.3	
Σ	2.8	8.82	5.32	3.56 3.54	2.30	39.7	38.2	46.7	49.8	59.8	54.6	
S. P.	+15.4	+25.7										
AC-N	0				0							
Scale % Pot Res.	48%	44% ~1000Ω	27%	18% 59%	38%	20%	64%	78%	25%	30%	91%	

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Cor. Wells Line # 2 - N 1/2 Field date 22/June/63 Data page _____ Comp. date 22/June/63 Comp by JH

(A) Send	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	1-2	2-3	3-4
(B) Receive	1.5-1.0 M	→	1.0-1.5 M	→	→	1.5-2 M	→	→	→	2-2.5 M	→	→
(C) ~~n separation~~ % SD	40%	32 68	44	33	30	35	29 82	42	16 56	43	22 65	35
(D) I	1800	→	→	→	→	→	→	→	→	→	→	→
(E) Vdc (avg)	85.0	14.8 10.0 15.22	99.5	21.6	6.43	73.2	18.7 18.81 18.92	8.9	360 364 373	28.4	14.6 14.82	7.35
(F) DCcal	1.020	→	→	→	→	→	→	→	→	→	→	→
(G) Kn x 10^{-3}	1.5	6	1.5	6	15	1.5	6	15	30	6	15	30
(H) ρdc=ExFxGx10^3/D	72	51	85	73	55	62	64	76	62	97	125	125
(I) Vac Σ	80.7	13.9 13.6	87.8	19.8	5.96	69.0	17.4 16.4	8.36	3.34 3.25	26.1	13.4 13.06	6.90
(J) AC noise x 2	0	→	→	→	→	→	→	→	→	→	→	→
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.002	1.016 .956	.995	1.014	1.020.	1.011	1.021 .934	.999	1.043 .976	.997	1.033 .961	1.011
(M) ρdc/ρac=ExL/K	1.056	1.081 1.073	1.128	1.107	1.100	1.072	1.098 1.086 1.079	1.063	1.124 1.121	1.086	1.127 1.109 1.091	1.078
(N) PFE=(M-1)(10^2)	6	8 8 7	13	11	10	7	9	6	12	9	11	8
(O) MCF=(M-1)(10^5)/H	78	155	151	170	182	116	137	83	197	89	87	62

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

(A) Send	4-5	1-2	2-3	3-4	4-5	1-2						
(B) Receive	2-2.5 M	2.5-3 M	→	→	→	CAL	→	→	→	→	→	→
(C) ~~n separation~~ % SD	54	31	30	36	56	65	20	25	79	91	30	
(D) I	1800	→	→	→	→	400	400	~~500~~	~~500~~	600	600	
(E) Vdc (avg)	3.54	18.7	15.05 X 18.10	67 X 7.24	2.85	39.4	38.2	48.7	50.2	60.0	59.2	
(F) DCcal	1.020	→	→	→	→	1.037	1.048	1.027	.996	1.000	1.013	
(G) Kn x 10^{-3}	525	15	30	57.5	84							
(H) ρdc=ExFxGx10^3/D	105	159	256 306	199 205	136							
(I) Vac Σ	3.21	18.7	17.8	7.21	3.36	38.8	39.9	50.0	47.3	54.7	60.0	
(J) AC noise x 2	0	→	→	→	→	→						
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.979	1.018	1.020	1.010.	.976	.985	1.043	1.026	.942	.905	1.012	
(M) ρdc/ρac =ExL/K	1.080	1.018	865 1.031	940 1.012	.826							
(N) PFE=(M-1)(10^2)	8	2										
(O) MCF=(M-1)(10^5)/H	76	113										

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page _____

Project Cor. Wells Line #2-5½ Field date 22/June/83 Data page _____ Comp. date 22/June/83 Comp by JM

(A) Send	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	4-5	3-4	2-3
(B) Receive	.5s-1.0s	→	1.0-1.5s	→	→	1.5-2.0s	→	→	→	2.0-2.5s	←	→
(C) n separation ~~%~~ 50	31	23 66	45	43	42	35	38	50	23 74	30	17 52	29
(D) I	1800	→	→	→	→	→	→	→	→	→	→	→
(E) Vdc (avg)	67.4	14.5 14.98	94.7	26.4	9.05	72.95	24.3	10.7	4.76 4.84 4.93	20.4	10.15 10.34 10.47	5.70
(F) DCcal	1.020	→	→	→	→	→	→	→	→	→	→	→
(G) Kn x 10^{-3}	1.5	6	1.5	6	15	1.5	6	15	30	6	15	30
(H) ρdc=ExFxGx10^3/D	57	50	80	90	78	62	83	91	82	69	88	97
(I) Vac Σ	62.0	13.6 13.26	96.7	25.7	8.39	69.2	22.8	10.0	4.50 4.44	20.0	10.3 10.44	5.80
(J) AC noise x 2	0	→	→	→	→	→	→	→	→	→	→	→
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.018	1.031 .960	.994	1997	.999	1.011	1.006	.986	1.031 .947	1.019	1.041 .983	1.021
(M) ρdc/ρac=ExL/K	1.107	1.100 1.105 9.131	1.038	1.025	1.079	1.067	1.071	1.057	1.090 1.091	1.039	1.026 1.005 .985	1.003
(N) PFE=(M-1)(10^2)	11	10 11 13	4	3	8	7	7	6	9	4	1	0
(O) MCF=(M-1)(10^5)/H	188	230	48	28	101	108	86	43	110	57	6	3

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

(A) Send	1-2	4-5	3-4	2-3	1-2	~~4-5~~ CAL	4-5 CAL	→	→	→	→	→
(B) Receive	2.0-2.5s	2.5-3.0s	→	→	→	→	→	→	→	→	→	→
(C) n separation ~~%~~ 50	48	44	27	18 59	38		20	64	78	25	30	91
(D) I	1800	→	→	→	→		400	400	500	500	600	600
(E) Vdc (avg)	2.88	9.18	5.88	3.65 3.76	2.43		35.0	39.7	49.8	48.0	58.8	54.7
(F) DCcal	1.020	→	→	→	→		1.052	1.008	1.002	1.046	1.019	1.006
(G) Kn x 10^{-3}	52.5	15	30	52.5	84							
(H) ρdc=ExFxGx10^3/D	86	78	100	110	116							
(I) Vac Σ	2.8	882	5.32	3.56 3.54	2.30		39.7	38.2	46.7	49.8	59.8	54.6
(J) AC noise x 2	0	→	→	→	→							
(K) Vac (corr) = $\sqrt{I^2 - J^2}$			+									
(L) AC-DC cal.	.989	.996	1.024	1.041 .971	1.006		1.043	.963	.938	1.037	1.018	.915
(M) ρdc/ρac =ExL/K	1.017	1.037	1.131	1.068 1.050 1.032	1.061							
(N) PFE=(M-1)(10^2)	2	4	13	5	6							
(O) MCF=(M-1)(10^5)/H	20	47	131	45	52							

INDUCED POLARIZATION SURVEY

QUIJOTOA MINING DISTRICT

Papago Indian Reservation
Pima County, Arizona

January 1963

for
HUNTING GEOPHYSICAL SERVICES, INC.

by
HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5671 Tucson, Arizona

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Depth Curve---Line 3

In Pocket:

Plan Location Map

Self Potential Profiles

INTRODUCTION

From January 18 through January 25, 1963 Heinrichs Geoexploration Co. conducted induced polarization surveys over part of the Quijotoa Mining District, Papago Indian Reservation near Covered Wells, Arizona. This work was performed at the request of Mr. Quentin G. Whishaw of Hunting Geophysical Services, Inc., under the supervision of Mr. Franklin A. Seward, Jr., geophysicist, with E. Grover Heinrichs, Chris Ludwig and Floyd Hanly assisting.

The twofold purpose of this work was to first test an I. P. anomaly mapped by Hunting Geophysical Services and second to provide a direct comparison of the Hunting data which was obtained by the time domain or pulse method and the data of this report which utilized the multiple frequency technique.

Included with this report are sectional data sheets for each of the four lines surveyed and a plan location map, a depth curve profile on Line 3 and self potential profiles.

CONCLUSIONS AND RECOMMENDATIONS

1. The anomalism observed is definite, but considered to be of only moderate absolute magnitude. It is interpreted to be due to sulfide mineralization and compares with rather surprising similarity to the previous pulse results.

2. Data on Lines 1, 3 and 4 indicate definite attenuation of sulfide involvement at depth.

3. Data on Line 2 is suspect at least in part due to proximity of Line and electrodes to parallel fence.

4. Line 4 repeated with two end on spreads of 500 ft. dipoles would probably give much more definite east-west boundary interpretation.

5. Lateral resolution is best on Line 3 and least on Line 4

6. Lateral resistivity inhomogeneities preclude discrete depth analyses. One depth curve analysis on Line 3 indicates a thickness of the upper layer of 500 ft.

PROCEDURES

Lines 1, 2 and 3 were run along Hunting Geophysical Lines 2, 5 and 6 respectively, centered as indicated on the plan map, using a 500 ft. dipole spacing. Line 4 was run along Hunting Line 7 centered as indicated at 1.0 south on Line 1 and using a 1,000 ft. dipole spacing.

Observations were made from the expanding dipole-dipole or Eltran electrode configuration which has become standard in the industry for those using the frequency domain technique.

A D.C. frequency of .05 cps was used throughout the survey except when receiving the 5th and 6th separation data on Lines 2 and 3 and 3rd through 6th separation data on Line 4 where high telluric noise-to-signal ratio was minimized by using .15 cps. The A.C. frequency used was 3.0 cps.

INTERPRETATION

The interpretation is presented on the sectional data sheets and the plan maps as blank, dashed, single bar, single bar and dashed and double bar lines indicating the relative degree of anomalism observed and respectively, the terms very weak, weak, moderate and strong are used to indicate the strength. It should be emphasized that these terms are used in a relative sense only and may be only indirectly related to absolute degree of anomalism or intensity of mineralization.

The anomaly on each of the four lines correlates well with that mapped by Hunting. The highest absolute anomalism (with respect to the percent frequency effects) appears to exist on Line 2. On the other hand much if not all of these data are subject to question regarding degree of sulfide involvement because of the close proximity of this line and the current electrodes to a

parallel grounded wire fence. In fact it is almost certain that the data on the 2.5n to 3n dipole was strongly affected by the fence and it was not reasonable from the observations made to compute frequency effects or metal factors on the last three data points.

Line 1 shows a distinct anomaly from 1.0n to 2.0s with the strongest effects from 0.5s to 1.5s. The best pattern is observed on Line 3 which offers the highest degree of resolution although not necessarily the highest magnitude effects.

The 1,000 ft. dipole, Line 4 offers the least lateral resolution and the lowest magnitude anomalous data.

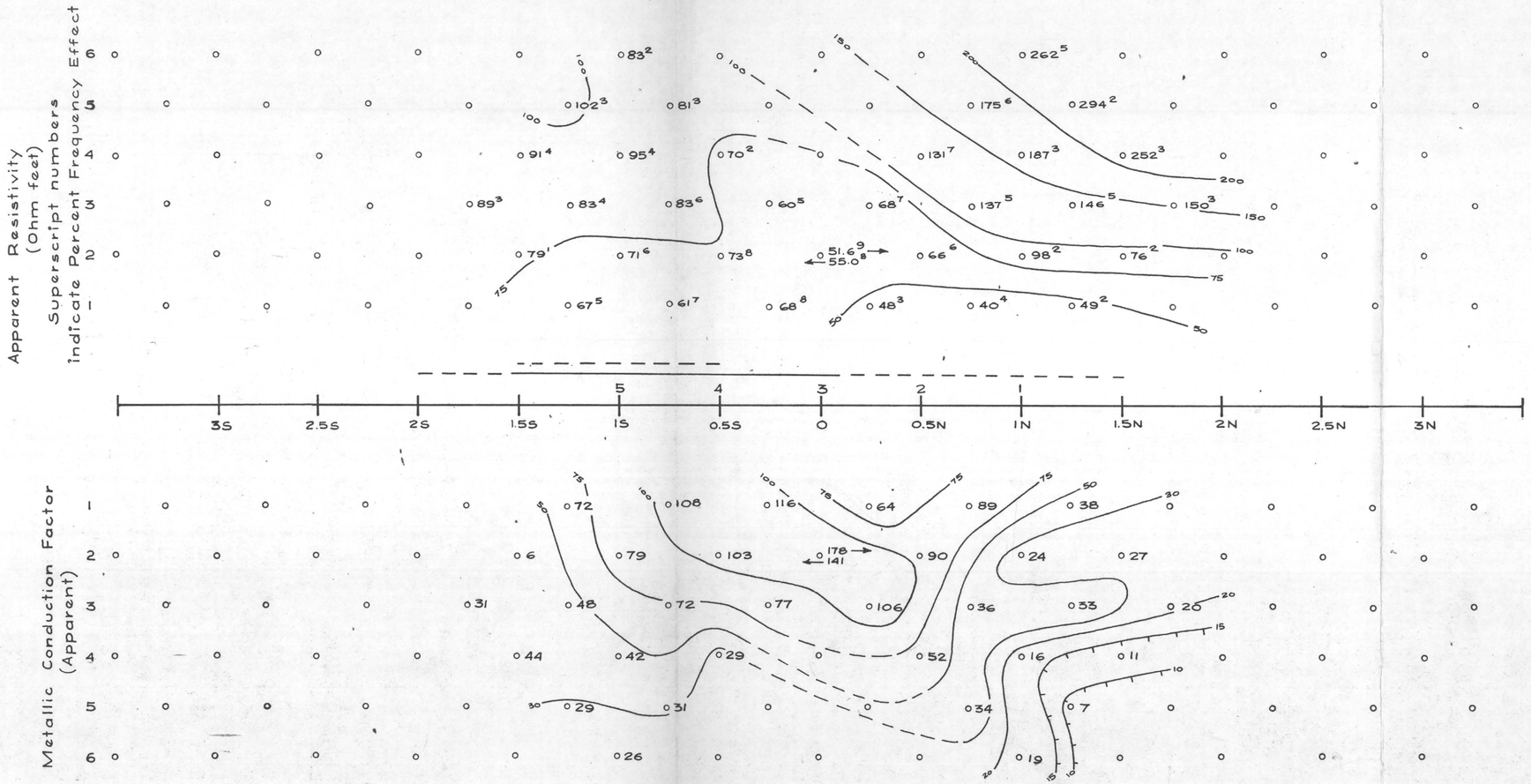
On all of the lines, with the possible exception of Line 2 (of the questionable data), the anomaly appears to attenuate with depth, indicating that perhaps the mineralized zone is a relatively horizontal layer.

A number of depth analyses were attempted on each of the lines, but in general lateral resistivity changes prevented any successful interpretation. One depth curve on Line 3, taken along the diagonal projecting to the north from between stations 0.5s to 1.0s, gives a depth to the top of the second layer of 500 ft, a resistivity of 70 ohm ft./2pi for the top layer and a resistivity of 210 ohm ft./2pi for the bottom layer.

Respectfully submitted,
HEINRICHS GEOEXPLORATION CO.

Franklin A. Seward, Jr., Geophysicist

January 30, 1963
P. O. Box 5671
Tucson, Arizona



LEGEND

- Electrode &/or Pot. Location & End of Line
- Station
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

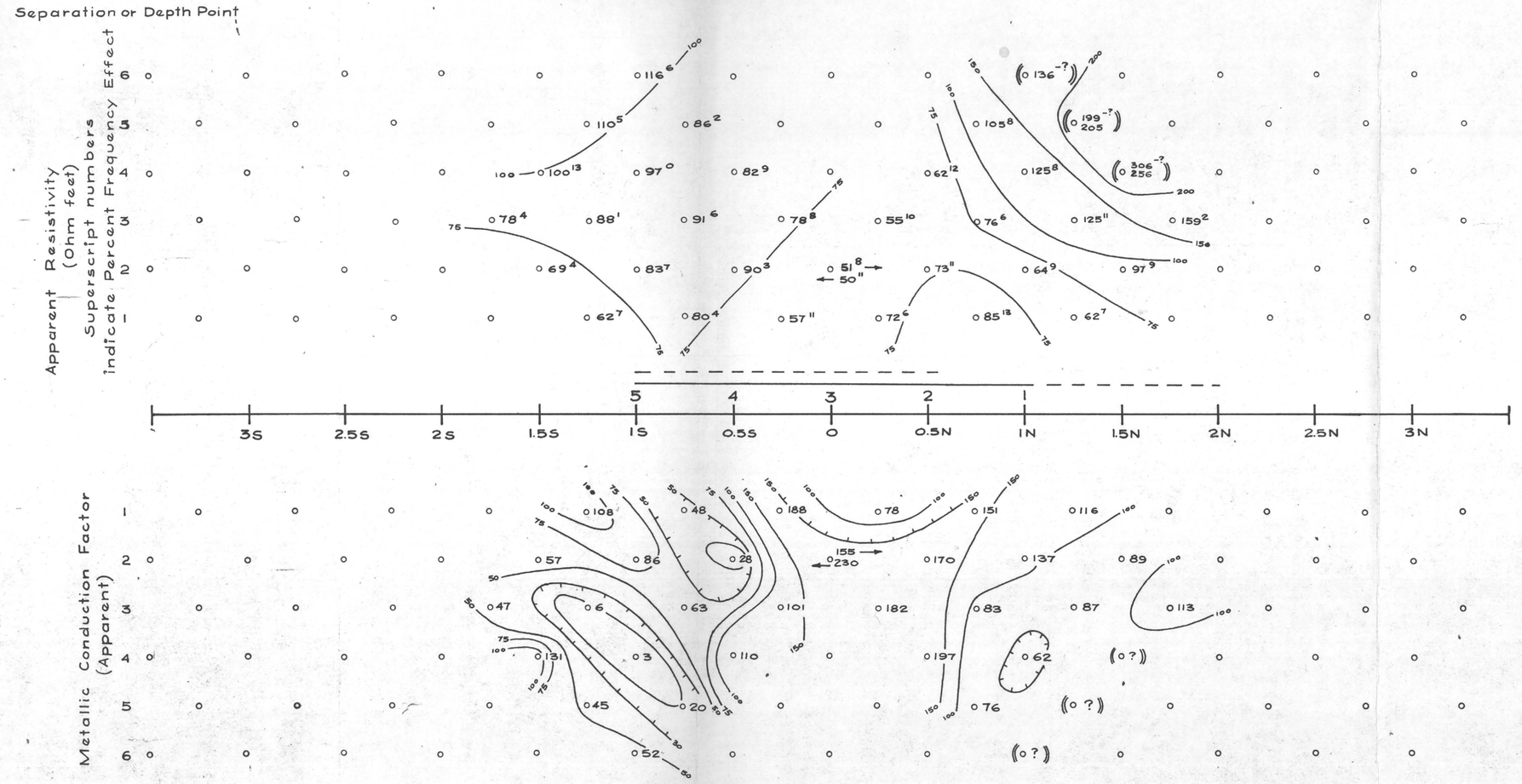
LINE No. 1

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963

Registered Professional Engineer (Arizona) — Certificate Expires — Walter E. [illegible] — Dec. 31, 1963 — Arizona, U.S.A.



LEGEND

Electrode &/or Pot. Location & End of Line

Station

No Anomaly

Very Weak

Weak

Moderate

Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

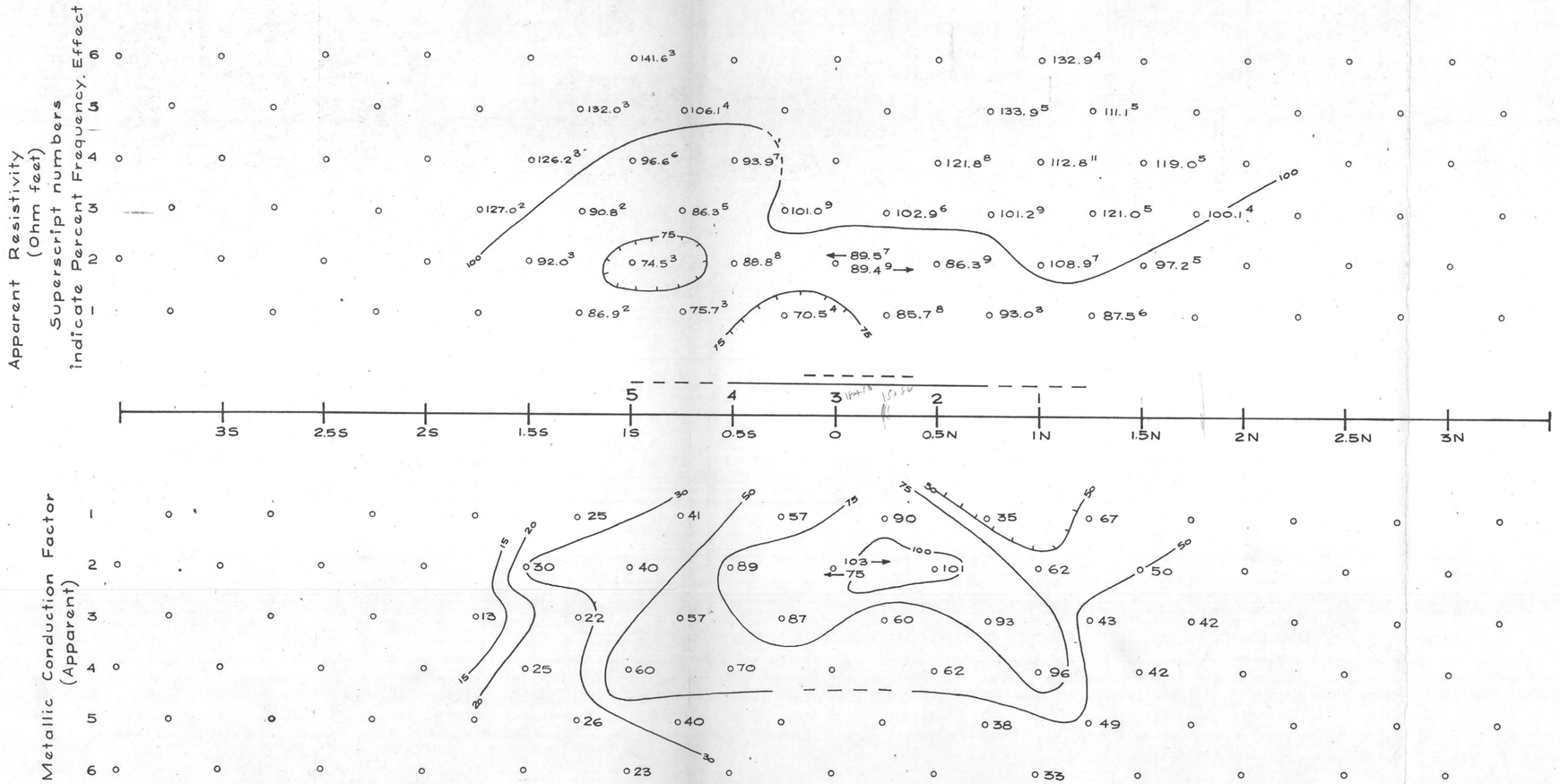
SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

LINE No. 2

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963



LEGEND

- Electrode &/or Pot. Location & End of Line
- Station
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

$\rho_{DC}/2\pi$

Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

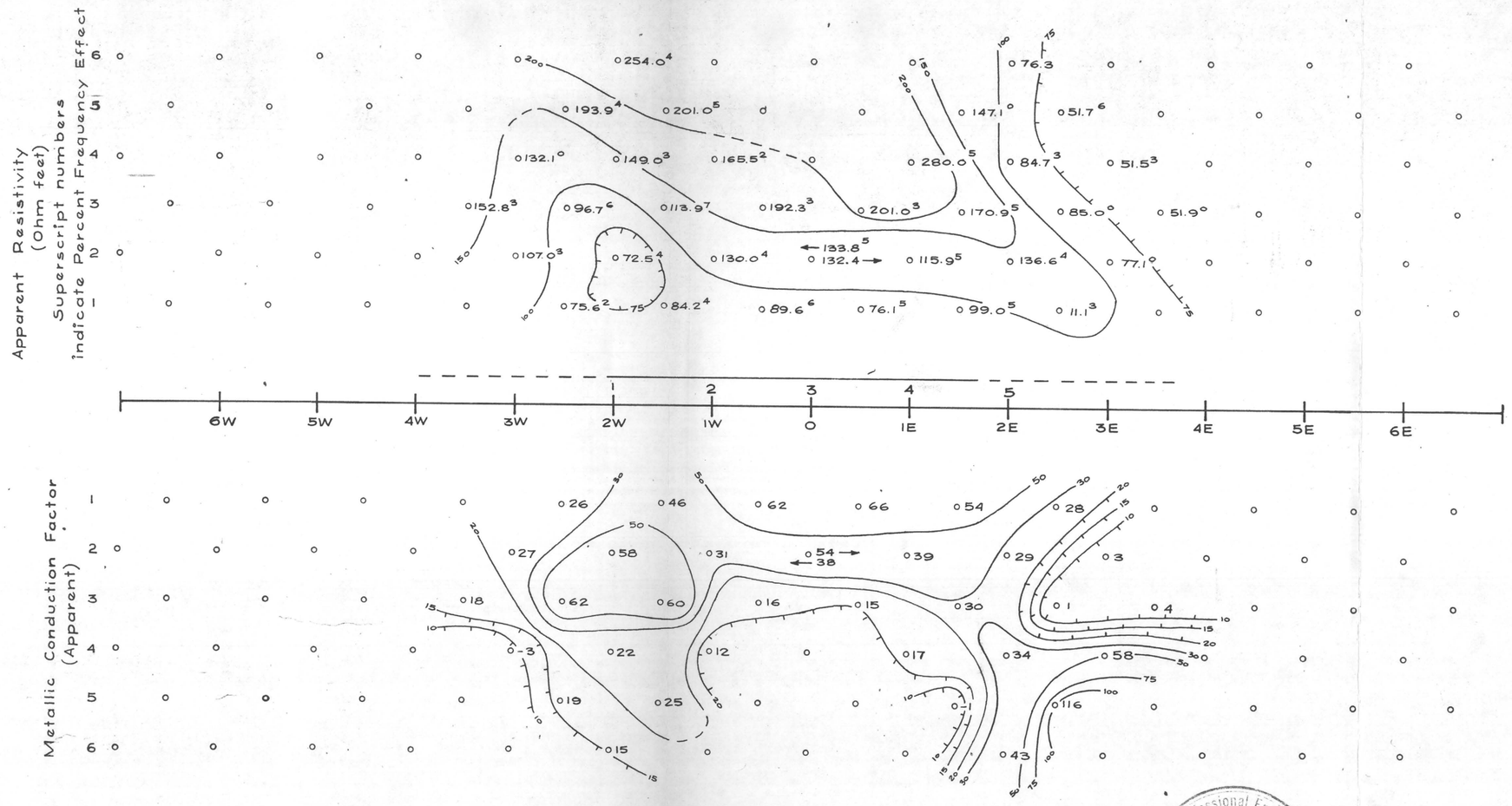
LINE No. 3

INDUCED POLARIZATION SURVEY

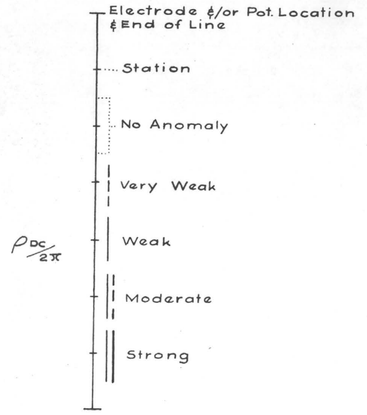
HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 500'
Date: Jan. 1963

Registered Professional Engineer (Mining) — Dec. 31, 1963 — Arizona, U.S.A.



LEGEND



Contour interval: Logarithmic

(( )) indicates questionable data

M.C.F.

QUIJTOA DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET
for
HUNTING GEOPHYSICAL SERVICES INC.

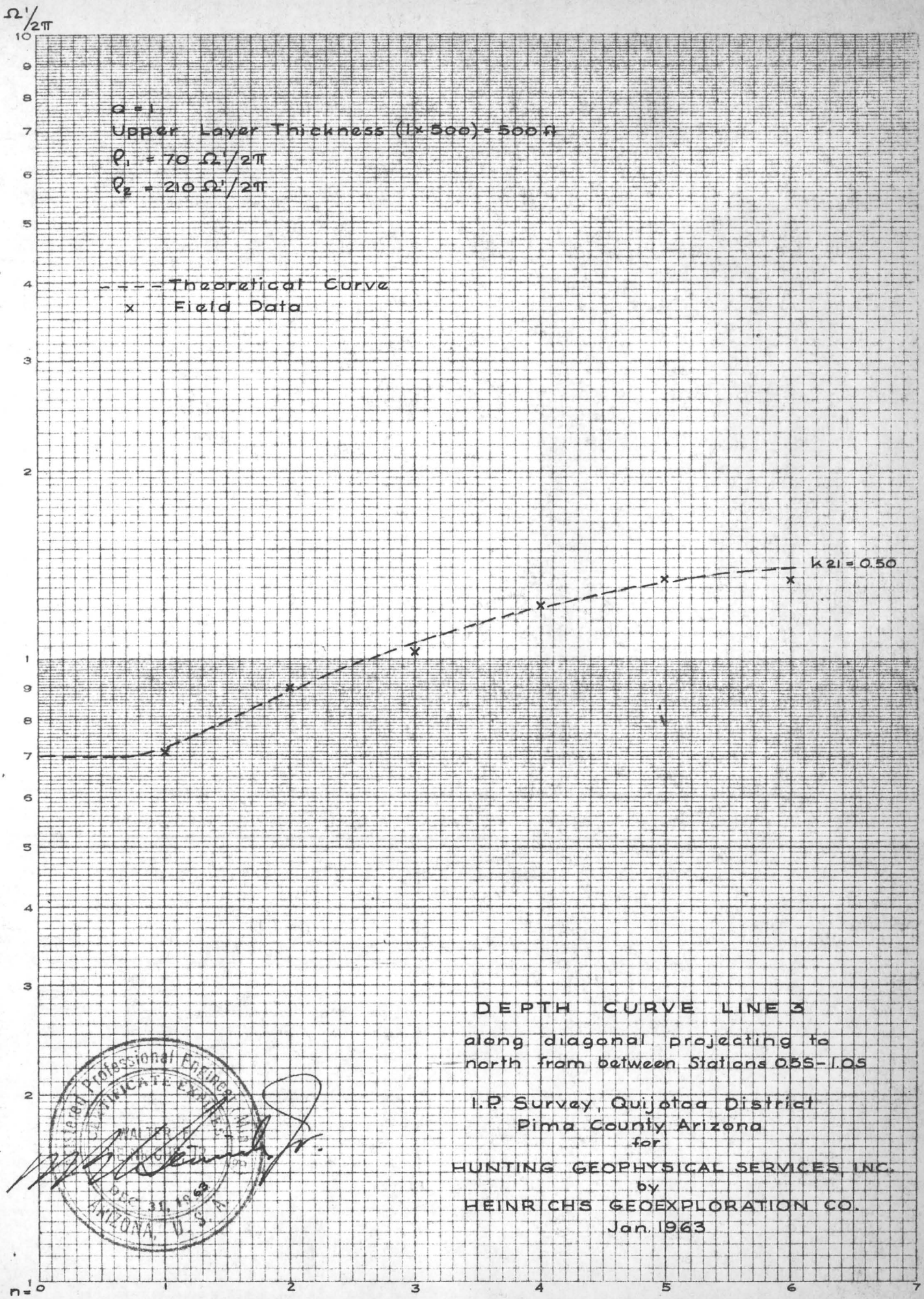
LINE No. 4

INDUCED POLARIZATION SURVEY

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 1000'

Date: Jan. 1963



DEPTH CURVE LINE 3

along diagonal projecting to north from between Stations 0.55-1.05

I.P. Survey, Quijotaa District
Pima County Arizona
for
HUNTING GEOPHYSICAL SERVICES, INC.
by
HEINRICHS GEOEXPLORATION CO.
Jan. 1963

6W 5W 4W 3W 2W 1W 0 1E 2E 3E 4E 5E 6E feet

mv

+25
0
-25
-50

LINE 4

+25
0
-25
-50

LINE 3

+25
0
-25
-50

LINE 2

+25
0
-25
-50

LINE 1

Very Weak

Weak

Moderate

Strong

I.P. INTERPRETATION LEGEND

Registered Professional Engineer (Geophysics) CERTIFICATE EXPIRES DEC. 31, 1963 WALTER E. HEINRICHS, JR. TUCSON, ARIZONA, U.S.A.

SELF POTENTIAL PROFILES
I.P. SURVEY, QUIJOTOA DISTRICT
PIMA COUNTY, ARIZONA

for

HUNTING GEOPHYSICAL SERVICES, INC.

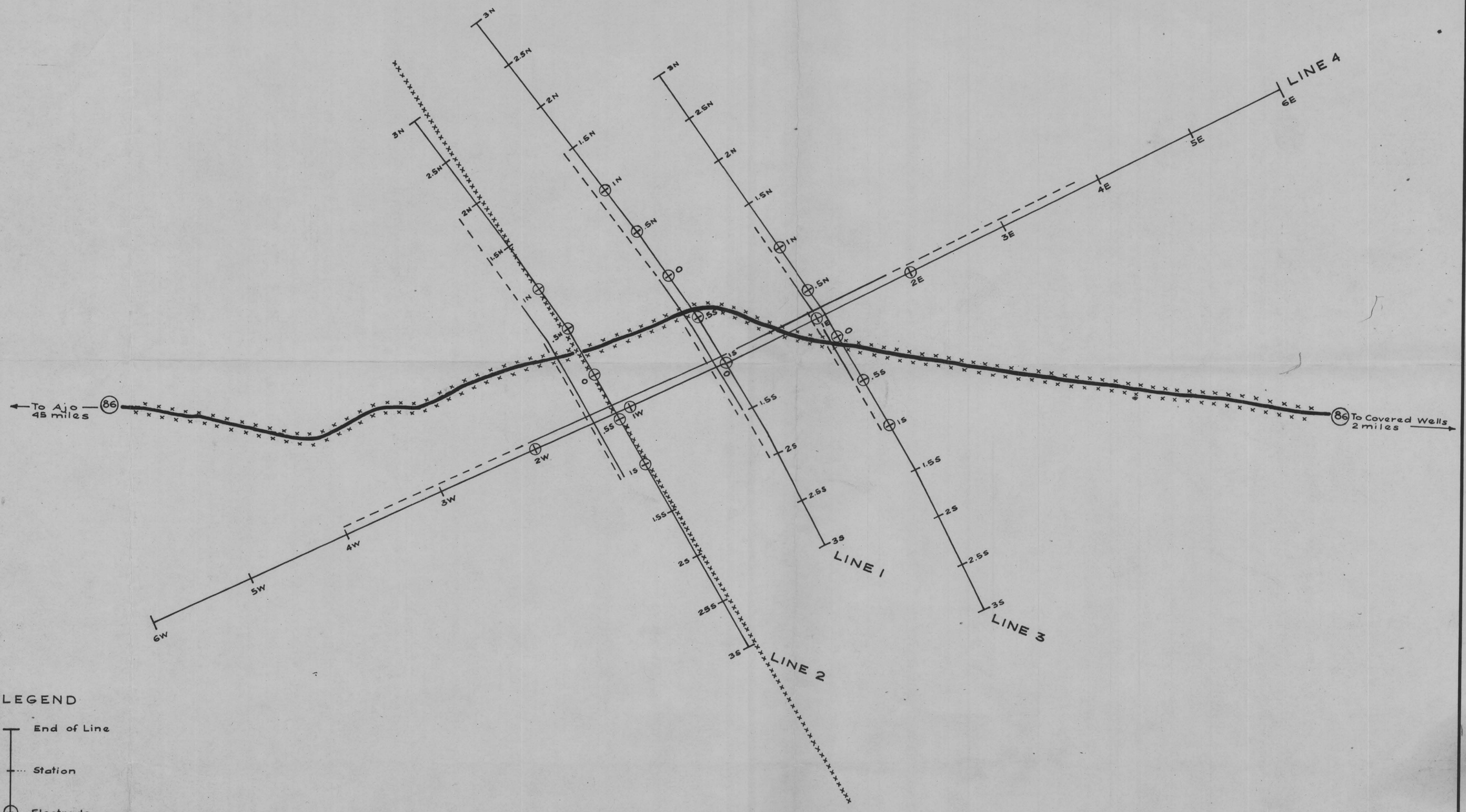
by

HEINRICHS GEOEXPLORATION CO.

Hor. Scale: 1" = 1000'

Vert. Scale: 1" = 50 MV

Jan. 1963



LEGEND

- End of Line
- Station
- Electrode
- No Anomaly
- Very Weak
- Weak
- Moderate
- Strong

xxxxx Grounded wire fence

From Base Map furnished by
Hunting Geophysical Services, Inc.

N

INDUCED POLARIZATION SURVEY

QUIJOTOA MINING DISTRICT

Papago Indian Reservation – Pima County, Arizona

for

HUNTING GEOPHYSICAL SERVICES INC.

by

HEINRICHS GEOEXPLORATION CO.

Scale: 1" = 800' Jan. 1963