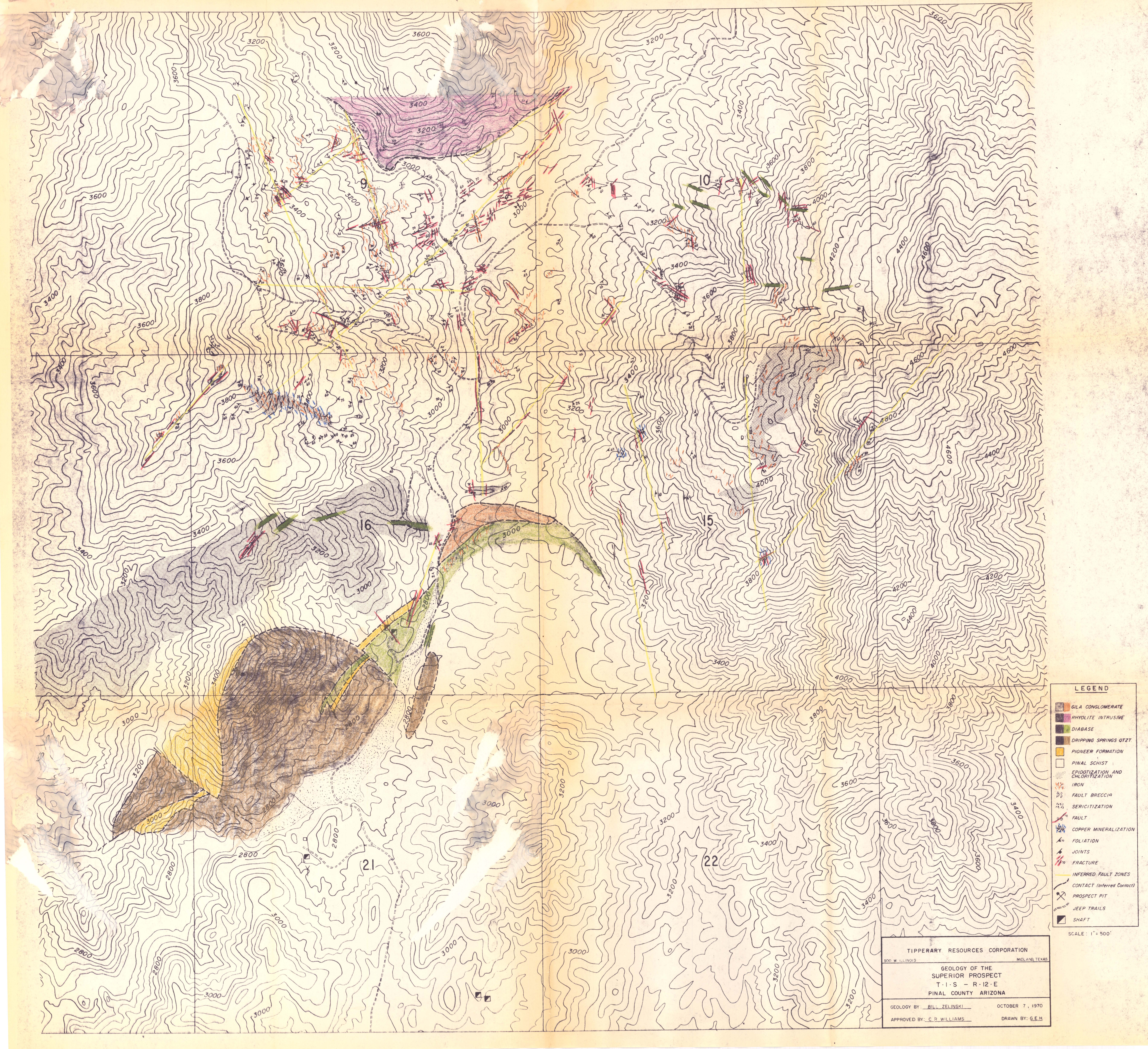
CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov



9
10
16
15
21
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LEGEND
GILA CONGLOMERATE
RHYOLITE INTRUSIVE
DIABASE
DRIPPING SPRINGS QTZT.
PIONEER FORMATION
PINAL SCHIST
EPIDOTIZATION AND CHLORITIZATION
IRON
FAULT BRECCIA
SERICITIZATION
FAULT
COPPER MINERALIZATION
FOLIATION
JOINTS
FRACTURE
INFERRED FAULT ZONES
CONTACT (Inferred Contact)
PROSPECT PIT
JEEP TRAILS
SHAFT
SCALE: 1" = 500'
TIPPERARY RESOURCES CORPORATION
500 W. ILLINOIS
MIDLAND, TEXAS
GEOLOGY OF THE
SUPERIOR PROSPECT
T·1·S – R·12·E
PINAL COUNTY ARIZONA
GEOLOGY BY: BILL ZELINSKI
OCTOBER 7, 1970
APPROVED BY: C. R. WILLIAMS
DRAWN BY: G.E.H.

SUPERIOR COPPER PROSPECT

PINAL COUNTY, ARIZONA

By

TI?PERARY RESOURCES CORPORATION

C. R. Williams
Exploration Manager, Southern Region

Bill Zelinski
Geologist

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ILLUSTRATIONS

SUPERIOR COPPER PROSPECT
PINAL COUNTY, ARIZONA

INTRODUCTION

An exploration lease and option to purchase mining claims comprising the Superior Prospect were acquired by Tipperary Resources Corporation in May of 1970.

A preliminary reconnaissance program utilizing geochemical techniques and detailed surface mapping was completed in August. Results show the presence of a number of fault zones crossing the property which have been evaluated by geophysical techniques.

LOCATION AND ACCESSIBILITY

The Superior Prospect is located in northern Pinal County, Arizona approximately 65 miles southeast of Phoenix. The claims are situated in the Superior Mining District two and one half miles northwest of Magma Copper's underground mine at Superior (Figure 1).

Tipperary has an exploration lease and option to purchase a contiguous group of 56 unpatented mining claims located in Sections 9, 10, 15 and 16 of T1S, R12E, Pinal County (Figure 2). The claims are adjacent to and adjoining mining claims owned by Magma Copper and Ranchers Exploration.

Access to the prospect is via an unimproved gravel road, designated the Happy Camp Road, which extends north from U. S. Highway 60 one mile ~~east~~ west of Superior through Whitford Canyon to the property. Road conditions require use of 4-wheel drive vehicles.

CLIMATE AND VEGETATION

The climate has considerable annual variation. Temperatures range from near zero degrees in the winter to summer highs around 110 degrees. Rainfall is scant averaging around 20 inches per year. The rainfall normally occurs in torrential showers creating hazardous conditions in the numerous gullies and washes in the prospect area.

Vegetation is sparse and variable. A few cottonwoods are scattered along the main washes. The lower slopes are sprinkled with saguaro, cholla and prickly pear cacti, ocotillo, cat claw and mesquite. Gullies higher up the slope often contain thickets of scrub oak. The tops of the ridges north of the prospect are sparsely covered with scrub cedar.

GENERAL GEOLOGY

The prospect lies within the Basin and Range Province of Arizona which is divided into the mountain region and the plains or desert region in the southwest portion of the state. The latter region is characterized by narrow mountain ranges separated by broad valleys. The mountain region is transitional from the stable elevated mass of the Colorado Plateau to the low desert region. It is made up of numerous mountain ranges which

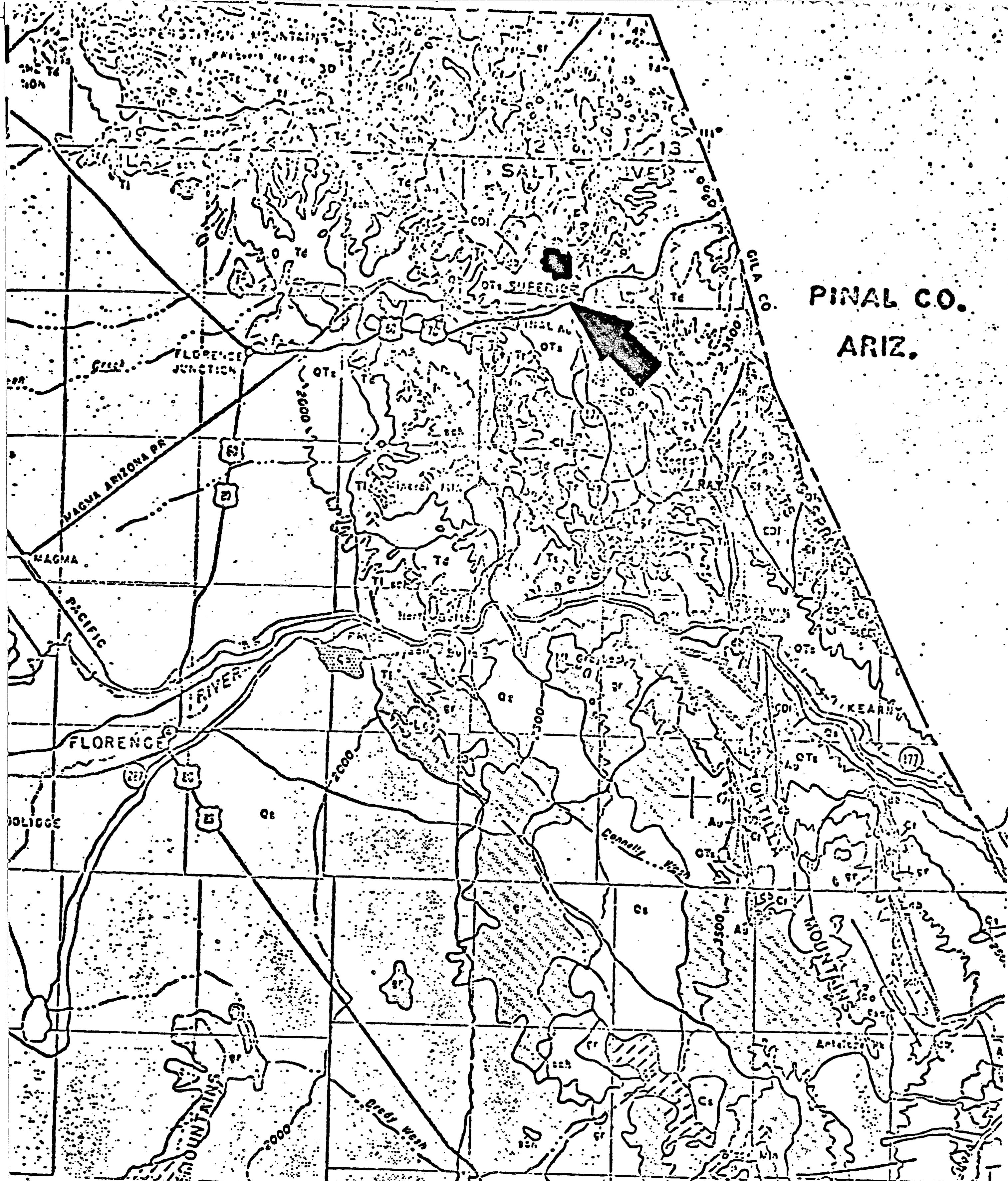

FIG. I LOCATION PLAT

SUPERIOR PROSPECT

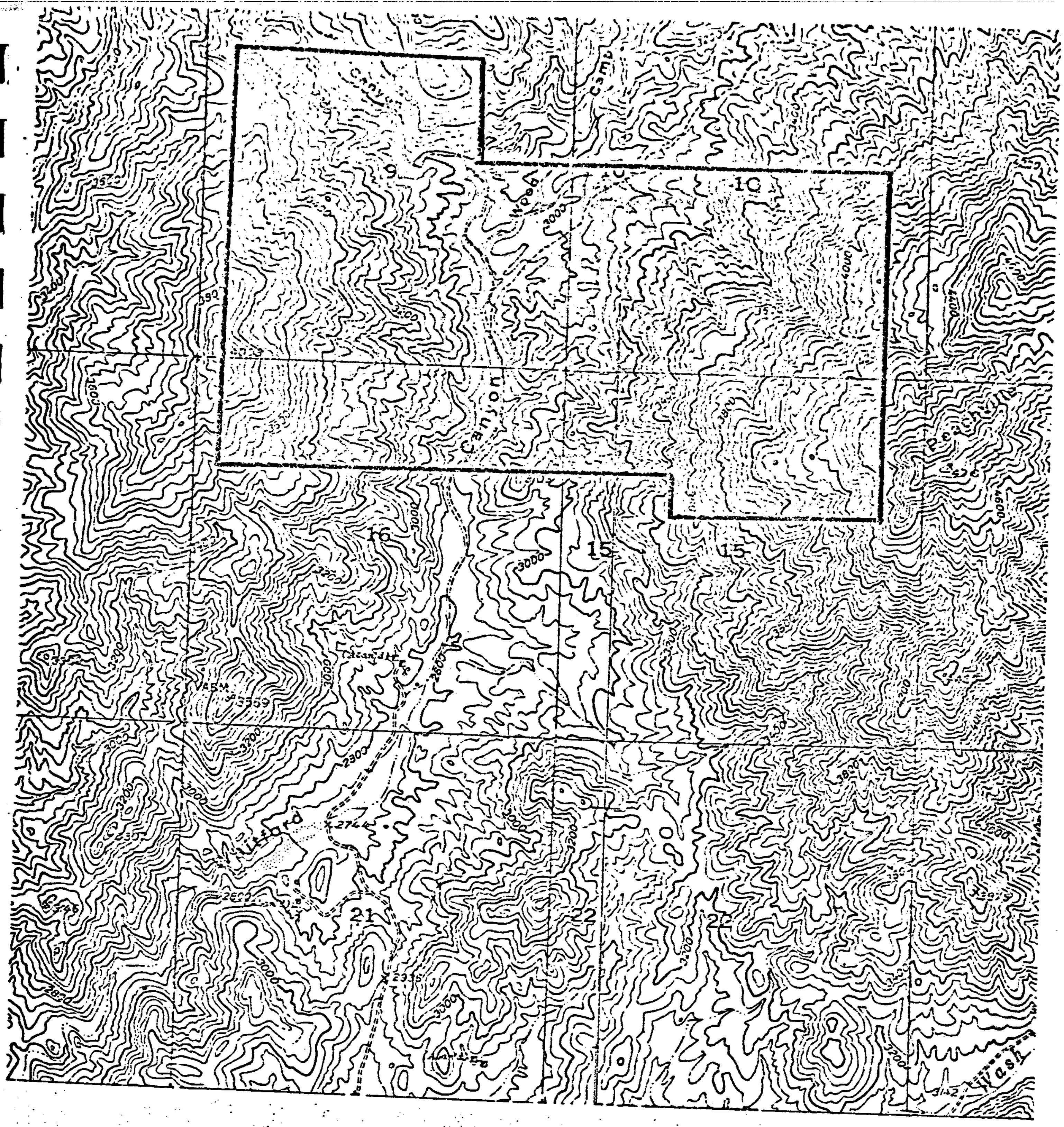

FIG 2

TOPOGRAPHY
&
CLAIM PLAT
T1S - R12E
PINAL CO., ARIZONA

are roughly parallel to each other and to the curved edge of the plateau. In this area, the ranges trend NNW. The prospect lies just within the mountain region adjacent to the lower desert.

The area south of Superior presents a complicated picture of numerous small fault blocks composed of Precambrian and Paleozoic sediments and irregular intrusions. Detailed mapping of the prospect indicates that this complex structure extends at least as far north as the property, but the sedimentary units which make the complexity so evident to the south have been eroded away.

The geologic section in the Superior Mining District consists of excellent exposures of Precambrian and Paleozoic rocks which are overlain by an extensive cover of Tertiary dacite flows east of Superior. Precambrian exposures consist of the Pinal Schist and the Apache group of conglomerates, shales, quartzites, and limestones. Two diabase sills totalling over 3000 feet in thickness intrude the Upper Precambrian section. Overlying the Upper Precambrian rocks is a quartzite probably equivalent to the Bolsa or Abrigo Formation of Cambrian age. The quartzite is overlain by the Devonian Martin Limestone (340'), Mississippian Escabrosa Limestone (420'), Pennsylvanian Naco Limestone (1200'), and the dacite flows of Tertiary age. A number of Cretaceous quartz monzonite porphyry dikes and Tertiary basalt dikes crop out in this area. The latter dikes are postmineralization.

During the Laramide, faulting and tilting of the sediments resulted in east-west faults which were invaded by quartz monzonite magmas and subsequent ascending ore fluids. The source of the monzonitic magmas and ore fluids is believed to have been a large buried pluton represented surficially by a quartz diorite stock which crops out two miles north of the mine. Post ore faulting, associated with the dacitic activity produced the north to northwest trending structures.

ORE DEPOSITS AT MAGMA

Two parallel east-west faults control the mineralization at the Magma mine. Mineralization is present along a strike length of 9000 feet and a vertical dimension of 5000 feet. Ore filled open spaces along the fault zone and reacted with the wall rocks to form replacement deposits which constitute the bulk of mineralization.

The Devonian Martin Limestone was apparently highly favorable for replacement, as a zone ranging from 30 to 50 feet in thickness is the host for an extensive manto deposit localized along a subsidiary branch of the Magma fault. The manto averages 20 feet thick by 950 feet in strike length and is over 5000 feet in dip length.

Mineral distribution is irregular and numerous zonal mineralogical assemblages are present. In general, ore minerals consist of massive sulfide ore-bornite, chalcopyrite, pyrite, sphalerite, enargite, tennantite, galena, chalcocite, digenite, and stromeyerite. Mineral zoning was apparently produced by a temperature gradient and by wall-rock chemistry.

Production of base metals from the Superior district from 1875-1965 approaches a value of $280 million of which $230 million was copper production.

GEOLOGY OF THE SUPERIOR PROSPECT

Because the Magma ores were deposited by ascending hydrothermal fluids that travelled along east-west faults created by Laramide disturbances, and because of the apparent association with the buried plutonic mass, a portion of which crops out north of the mine, a geological study was undertaken to examine the structure of the area north of the diorite porphyry stock to ascertain whether similar mineralized structures exist north of the pluton as are present south of the pluton.

The current study has disclosed the presence of a number of fault zones, two of which show some mineralization.

Exposures in the prospect area consist of Precambrian Pinal Schist, diabase, and quartz rhyolite porphyry. Immediately south of the property, exposures of Cambrian quartzite and the Pioneer

Shale occur along complex fault zones. Also to the south is a wide, complexly sheared and altered zone of Pinal Schist with abundant chlorite-epidote alteration.

The dominant rock type in the Superior Prospect is the Pinal Schist. The schist has been extensively fractured and faulted. Repeated movement along the faults has resulted in the broken nature of the rocks. Only the major structural features could be inferred due to the absence of contacts and the generally poor exposure of the schist.

Following is a review of the basic petrology in the Superior Prospect.

Pinal Schist

The Pinal Schist crops out over approximately 80 percent of the prospect area. It is generally a bluish-gray sericitic schist although a couple of loose fragments of garnet schist were found near the north edge of the property. The schist often has a knotted appearance due to andalusite inclusions. Outcrops are highly altered, folded and faulted. Iron staining is common as are cross foliation microfractures filled with quartz. Foliation and joint patterns are pronounced and are shown on the enclosed geologic map.

Irregular bands of milky white quartz parallel to the foliation are common. Although exposures are poor, these bands may comprise as much as 50 percent of the rock in a few spots.

The preponderance of quartz and muscovite mica suggests that the Pinal Schist in this area was derived from quartzose sediments.

Rhyolite Porphyry

The rhyolite porphyry which crops out in the northern portion of the property occurs as an elongate intrusion measuring about two miles along its north-south axis and three quarters of a mile across. It contains scattered cavities measuring less than twelve inches which often contain doubly terminated quartz crystals.

Diabase

Weathered, dark brown to black diabase crops out immediately south of the property. Iron staining is common as is epidote and chlorite. The only diabase noted on the prospect occurred as dike fragments in the northeast corner. The chopped character of the dike(s) demonstrates the complexity of faulting.

Structure

Structure is the important localizer of mineralization in the prospect area. There are at least three fault systems present and probably more.

The most prominent trend is northeast-southwest. This is reflected in a similar trend in the topography. Activity along these faults is probably comparatively recent.

The second most prominent system strikes NNW. These faults sometimes contain breccia zones several yards wide with an iron rich matrix. The breccia contains a trace of copper. It is possible that there is a second younger system of faults with similar orientation associated with the Concentrator fault at the Magma Mine. This important fault is active and cuts off the Magma vein at Superior.

The third system strikes ENE and is the most obscure. Its existence is inferred from the pattern of epidote and chlorite alteration and from the fracture pattern in the low area south of the rhyolite intrusion between Reevis Trail Canyon and Woods Camp Canyon. This system as well as the northwest striking faults may have been important in localizing mineralization as indicated by the alteration pattern.

In addition, there is probably a zone of weakness trending north-south as evidenced by one fracture zone in the bottom of Whitford Canyon and the orientation of the rhyolite porphyry intrusion.

Mineralization

Mineralization in the Superior Prospect consists principally of scattered shows of copper oxides along fractures in the schist in a few of the old prospect pits. This type of mineralization is subject to rapid leaching. An area on the west side of the prospect approximately half way up the ridge along the jeep trail exhibited oxide copper mineralization. The area appears to be intersected by several important faults.

One thin, irregular vein of malachite and azurite with quartz was noted in a prospect adit on the east side of the property about 1/3 of the way up Peachville Mountain. The Pinal Schist adjacent to the vein exhibited malachite along fractures and foliation planes for several yards. The vein strikes east-west and assayed approximately 20 percent copper. It was offset and then cut off by a NNW striking system of fractures which are probably associated with the active Concentrator fault. As is the case at the Magma mine, the faults exhibit an insignificant leached outcrop pattern. The main Magma ore body formed an apex 450 feet below the surface.

Alteration

The types of alteration observed were limited. Chloritization and epidotization of the Pinal Schist are evident, particularly along a line trending ENE parallel to and cutting across the southern boundary of the prospect.

There is a rusty hue over many of the flatter slopes. This is due primarily to iron staining on quartz fragments weathered out of decomposed schist. Talus fragments from a few inches below the surface generally exhibit iron staining along fractures and to a lesser degree along planes of foliation. The staining appears to be more extensive on the west side of Whitford Canyon, but differences in the soil cover make this observation uncertain. The iron staining is probably associated with the NNW striking faults which sometimes contain breccia zones with an iron rich cement.

PREVIOUS EXPLORATION

Two shallow core holes were drilled on the property in the mid 1950's. Reliable results from the tests are unavailable. The property owner provided information in locating the drill holes and stated that both drill holes encountered significant copper mineralization. Drill Hole No. 1 located approximately 3175' FEL and 100' FSL of Section 9 reportedly cored 235 feet of copper oxide mineralization. No assay data is available. Drill Hole No. 2 located approximately 2750' FEL and 3050' FSL of Section 9 reportedly encountered mineralization totalling 170 feet in a 315 foot drill hole. Both of these drill holes were cored with AX wireline equipment and were located on the fault zones discussed above.

TIPPERARY PROGRAM

Tipperary initiated a detailed reconnaissance mapping program of the claim area and surrounding property during June, 1970. (see Geologic Map) A number of samples were taken for subsequent analysis for copper-silver mineralization. In addition, a series of geophysical IP Lines were established across fault traces. Geophysical surveys were conducted by Heinrich's Geoexploration and results and data sheets are compiled in "Preliminary Induced Polarization Survey - Superior Prospect".

A second phase geophysical program was conducted following the initial report. Phase II results are reported in "Induced Polarization Survey of the Superior Prospect - Phase II".

CONCLUSIONS

The Superior Prospect shows indications of possible subsurface disseminated mineralization similar to the porphyry copper type deposits in addition to vein type mineralization along northwest trending faults. Exploratory efforts to date have been limited to detailed mapping, sampling and induced polarization surveys. Results of the preliminary program are sufficiently encouraging to warrant additional exploration.

Geologic mapping has shown the presence of mineralized fault traces and the IP coverage has reflected possible disseminated mineralization.

Additional geophysical coverage has been completed on the prospect and results dictate future exploratory procedure to incorporate a drilling program designed to evaluate the highest priority geophysical targets.

INDUCED POLARIZATION SURVEY
ON THE
SUPERIOR PROSPECT
PINAL COUNTY, ARIZONA

PHASE II

FOR

TIPPERARY RESOURCES CORPORATION

JANUARY, 1971

By

Heinrichs GEOEXploration Company
P.O. Box 5964, Tucson, Arizona 85703
Tel: 623-0578

GEOEX Job # 585

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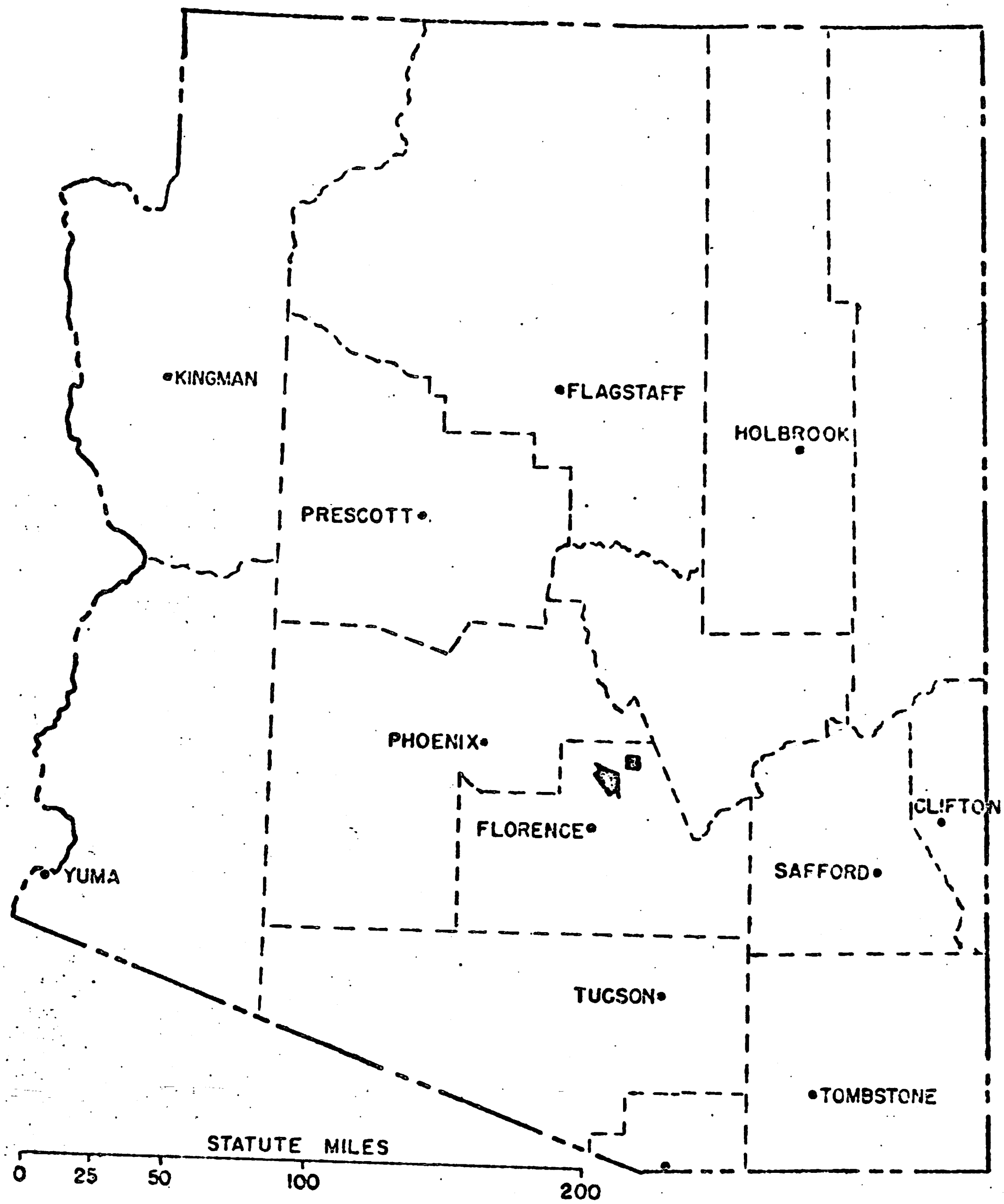
GENERAL LOCATION
of
SUPERIOR PROSPECT
for
TIPPERARY RESOURCES CORPORATION

ARIZONA



HEINRICHS
GEOEXPLORATION COMPANY

GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

INTRODUCTION

At the request of Mr. C.R. Williams of Tipperary Resources Corporation, Heinrichs GEOEXploration Company conducted a second phase of more detailed induced polarization coverage, as recommended in our initial report dated December 1970, over parts of the Superior Prospect near Superior, Pinal County, Arizona. This Phase II field work was accomplished during the interim December 28, 1970 to January 15, 1971.

Lines 1 and 2 were extended to the east and five new lines (Lines 5 through 9) were run all roughly parallel to and near Lines 1, 2 and 3. A total of 14 new spreads were completed. All the new coverage is on 250 foot dipoles except Line 9 which was run on 500 foot dipoles. The total lineal coverage of both phases, counting both dipole spacings used, is 15.1 line miles of which 10.7 line miles are "subsurface" plotted data.

The new coverage was tied to and is presented with the Phase I coverage and the same sending frequencies of 0.3 and 3.0 Hz were used on both phases. For completeness, all data from both phases is presented in this Phase II report. The "Induced Polarization Location and Interpretation Plan" has been modified to show all coverage and the surface projected relative anomaly strength has been schematically contoured to help show the interpreted sulfide distribution in plan.

GEOEX personnel involved in the Phase II field work were W. Freeman, Geophysicist-Crew Chief; T. Freeman and A. Gotmer, technical assistants. Computations, compilation and final report by C. Ludwig, Senior Geophysicist, assisted by W. Freeman and the GEOEX staff.

CONCLUSIONS

The more detailed coverage of Phase II has outlined a complexly shaped probable sulfide zone, within the Pinal schist, flanking and likely intimately related to the rhyolite intrusive mainly on the south and west but also on the southeast.

As seen in plan, there are two stronger lobes of the anomaly. The more westerly lobe is quite elongate and strikes NNW and lies in the schist along the southwest contact of the intrusive and its SSE projection. To the SSE, the west lobe truncates somewhere between Lines 9 and 6 and continues to the NNW past Line 7 but is apparently becoming gradually weaker. The source of this anomaly appears to be steeply dipping (with a suggestion of a westerly dip) and has good depth persistence. The anomalous response is perhaps reflecting mineralization in and near the iron stained fracture mapped nearby.

The easterly strong lobe is somewhat elongate in a NNE direction but is considerably broader than the west lobe. The source has a pronounced layered aspect perhaps being 200 or 300 feet in thickness below which the sulfide content is expected to decrease somewhat. As discussed in the Phase I report, this layered aspect could conceivably be reflecting an enriched sulfide blanket or may only be a weathering or structural phenomenon.

There is a pronounced deepening to the top of these anomalous sources southerly from the intrusive suggesting a gentle southerly dip on the east lobe and a slight southward slope of the top of the west lobe.

The most shallow appearing response is noted on Line 5 in both lobes although response on Lines 1, 7 and 8 is nearly as shallow and the interpreted depth to the top of the sulfide zone is probably within 100 feet of the surface on these four lines. The deepest resolvable response is noted on Line 6 where 300 to 400 feet or so is expected to the top of the polarizable zone.

Strength of sulfide indicated in the strongest portions of the two anomalies (Lines 5 and 8) is only slightly more than was estimated in the Phase I report (based on Lines 1 and 2 mainly), that is, roughly 1.5 to 4% total sulfide by volume rather than 1 to 3%. This content would be roughly 3 to 8% total sulfide by weight and is based on the interpreted source geometries and a comparison with "typical" disseminated sulfide zones in the Southwest and is subject to considerable variance based on specific mineralogic parameters, etc.

As suspected and mentioned in the Phase I report, the Phase II data verifies that Line 4 is mainly responding laterally to polarizable material east thereof. Line 9 cuts off most of the significant appearing response to the south and the eastern cutoff is fairly well defined by Lines 1, 2,5,6 and 8. The anomalous zones are still open to the northwest and northeast but are apparently becoming weaker in that direction.

A weak but possibly interesting anomaly is seen on the east end of Line 1 and on Spread 2 of Line 7 which is similar to and perhaps related to but discrete from the east lobe of the main anomaly. This zone is open to the north, south and east.

The additional coverage on the rhyolite intrusive shows it to be very non-conductive and apparently not significantly mineralized where traversed. The resistivities associated with the stronger I.P. effects in the schist are somewhat lower than the surroundings possibly reflecting the content of conductive sulfide material and associated alteration products or perhaps only increased weathering effects.

The new coverage shows no significant appearing self potential response. This furthers the Phase I conclusion that no appreciable quantities of near surface relatively oxidizing interconnected sulfides occur in the area surveyed. This, of course, does not rule out disseminated sulfides being present as indicated by the I.P. response.

RECOMMENDATIONS

Six drill holes are suggested, in order of geophysical priority, to initially test the two main sources of the anomalous I.P. effects. These holes are mainly designed to evaluate the zones of stronger I.P. response. However, drilling anywhere within the schematic boundaries of the weak response as shown on the plan map should intersect strong enough polarizable mineralization that, if consisting of mainly sulfide ore minerals, could be economically interesting. Initial attention is given to the zones of strongest response in the hope they would have the best chance of being of economic interest but the weaker fringes should not be ignored in the initial drilling, particularly is there is interesting correlating geology or geochemistry.

1. A vertical drill hole collared near 28.5NE on Line 8 is recommended to test a strong portion of the east lobe. This hole should be programmed to go at least 400 feet in depth to completely test the section of interest.

2. To help evaluate the west lobe, a vertical drill hole collared near 10NE on Line 5 is recommended and should go to about 500 feet to sample the zone of interest. Alternately (or even preferably if the dip is geologically expected to be near vertical) a 45° easterly angle hole collared near 6.75NE on Line 5 is suggested assuming a steep westerly dip and should be at least 700 feet in length to pass through the zone of interest. If the dip is expected to be vertical or steeply to the east a 45° westerly angle hole collared near 12.5NE may be preferable and would take better advantage of the topographic slope.

3. If the results of recommendation 1.) are interesting, a 400 foot vertical hole near 31NE on Line 5 would test a geophysically equivalent target on the east lobe.

4. If drilling recommendation 2.) proves encouraging the west lobe could be further tested in a strongly anomalous area with a vertical hole about 500 feet in length collared near 11E on Line 8. An east or west angle alternate may be preferable if steep dips and a narrow target is expected.

5. Depending on the results of the above recommended drilling, the east lobe could be further evaluated in a deeper but broader, moderately strong portion by a 500 foot vertical hole collared near 28.75NE on Line 2.

6. The west lobe could be further evaluated by vertical (or angle) drilling on Line 1 near the rhyolite contact. A 500 foot or deeper vertical hole collared near 2.5SW should sample the zone of geophysical interest unless there are adverse depth and width factors which would best be circumvented by angle drilling.

The above drilling should, of course, depend on the results of testing higher priority holes or any other existing drilling information, geological and geochemical or additional geophysical information available, all of which should be in constant correlation.

Additional geophysical drill targets can be chosen by reference to the schematic anomaly strength contours on the interpretation plan correlated with all information to date.

Based on these drilling results, additional I.P. coverage could be justified. Fill in lines between Lines 1 and

5, Lines 2 and 6 and Lines 1 and 7 on 250 feet dipoles would add useful detail in the main sulfide areas. Further coverage of a reconnaissance nature near Spread 5, Line 1 and Spread 2, Line 7 would help evaluate the apparently discrete weak I.P. anomaly in the area.

COMMENTS ON DRILLING I.P. TARGETS

To maximize the probability that a recommended drill hole will intersect the source of an induced polarization anomaly, the following points should be considered:

1. The anomaly has been caused by some physical property, hopefully a polarizable body containing economically interesting metallic mineralization, and this property should be determined before abandoning the anomaly.

2. Location of drill holes should be made relative to the actual sending and receiving electrode positions as they exist on the ground.

3. Due to inherent limitations in the I.P. method, depth interpretations are only approximate and the determination of dip is severely limited, particularly for angles greater than 45°. Also, targets can generally be laterally resolved no finer than the station spacing (dipole length). Because of these limitations, targets less than one dipole spacing in width, particularly when steeply dipping or deeper than the dipole length, may be difficult to intersect. In these cases, several drill holes in a fence line should be considered. For the steeply dipping cases, angle drilling may also prove advantageous, mainly where the direction of dip can be geologically inferred and the drill hole oriented such that an optimum intersection of the zone of interest is obtained.

4. An observed anomaly can be the effect of a polarizable body laterally offset to the side of a line and therefore if practical, drilling should be confined to those portions of the anomalous zones well defined by several lines. Also, it should be noted that a single line cannot define the strike direction of an elongate anomalous zone - another reason for utilizing several parallel lines.

5. Logging of the drill core <u>must</u> be done with special

care to note the quantity of all possible polarizable material such as pyrite, graphite, magnetite, manganese oxides and clay minerals as well as the polarizable ore minerals. The anomalous source could conceivably be overlooked if the core is not carefully logged.

6. Typical sections of core representing the gross physical properties of material encountered in the drilling should be tested in the laboratory for their I.P. parameters if there is some doubt about confirmation of the anomalous source.

INTERPRETATION

Line 1 (Spreads 3, 4 and 5, 250' dipoles): Spread 3 shows very high resistivities, high background PFEs and very low MCFs from Spread 2 easterly to about 24NE where the line leaves the rhyolite and goes into the schist. The schist from about 24NE to 42.5NE is very weakly anomalous and very shallow with most response coming from within 200 feet of the surface. Near 39NE within this broad very weak zone is a questionably significant weak anomaly in the MCF also with a very shallow appearance and within a pronounced resistivity low.

Another broad zone of very weak to weak I.P. response is noted northeast of 50N to at least the end of Spread 5. This response also has a near surface character but with somewhat more depth persistence than the east lobe anomaly generally shows. More coverage to the northeast would be necessary for a complete interpretation.

Line 2 (Spread 3, 250' dipoles): Spread 3 was added on to the eastern end of Spread 2 to determine the easterly edge of the broad zone of moderate strength I.P. response partially delineated by Spread 2. The cutoff is fairly definite and is near 35NE although very weak fringing response is noted out to about 41NE. Lower near surface resistivity seems to relate to the entire length of anomalous I.P. response although it may only be an indirectly associated weathering effect.

Line 5 (Spreads 1, 2 and 3, 250' dipoles): Both the west and east lobe I.P. anomalies are noted on this traverse and on both zones the relative anomaly strength varies from weak to strong with some very weak fringing response outside and between the two zones. The west anomaly is centered near 10NE and the PFE pattern, in particular, suggests a steeply dipping tabular source with good depth extent and well defined boundaries implying a width of likely no more than one dipole (250 feet). Depth to the top is estimated as less than 100 feet. The MCF pattern, however, suggests a westerly dipping source although this may only be the effect of the gradationally decreasing resistivities to the west. The east lobe I.P. anomaly is centered near 30NE and shows a very pronounced layered aspect best seen in the MCF pattern. Depth to the top is estimated at being well within 100 feet of the surface with an anomalous source thickness of about 200 or 300 feet. The west edge is rather sharp and is near 27.5NE. The east edge is gradational with weak response persisting to about 44NE. Low near surface resistivity seems to relate to most of the width of the anomaly.

<u>Line 6 (Spreads 1 and 2, 250' dipoles):</u> Only the east lobe anomaly is noted on this line and is centered near 12NE. The layered aspect of the east lobe anomaly is not evident here probably because the source is buried deep enough that its bottom is not being sensed by the 250 foot dipoles. The depth to the top of this anomaly is interpreted as 300 or 400 feet below surface. Very weak fringing response increases the width of the zone to between stations 5NE and 22.5NE.

A complexly shaped level change near 2.5SW in the resistivity is probably reflecting a rock type change with more conductive material west of 2.5SW.

<u>Line 7 (Spread 1, 250' dipoles):</u> This spread was run to investigate the west lobe anomaly about 1200 feet north of Line 1. The anomaly is seen to continue to Line 7 and is quite similar in shape but somewhat weaker in strength. A minor, broad self potential low seems to be related to the I.P. effects but its amplitude is too weak to normally be considered as significant. As on Line 1, the anomaly appears to be intimately related to the schist-rhyolite contact which is reflected in the resistivity as a level change (interface) near 1.25NE. The I.P. response is mostly west of this contact, within the schist. The rhyolite is again very high in resistivity and shows several interfaces suggesting some sort of a change in its composition or fabric near 5NE and 16.25NE. The highest resistivities on the survey are noted on the east

end of this spread.

Line 7 (Spread 2, 250' dipoles): Continuous coverage was not obtained on the rhyolite between Spreads 1 and 2 because of time and logistic limitations. Spread 2 was centered near the eastern rhyolite-schist contact (near 63.5NE) to determine if the schist is mineralized on both contacts. Weak to very weak but definite I.P. response was located between 65NE and 75NE in the schist and again has a layered near surface aspect correlating with near surface lower resistivity.

Line 8 (Spreads 1 and 2, 250' dipoles): Line 8 is between Lines 2 and 5 and is quite similar in appearance to Line 5 with both anomaly lobes being up to strong in relative anomaly strength. Again, the west lobe anomaly which is centered near 11NE appears to have a rather steeply dipping tabular source roughly 250 feet in width and showing good depth persistence. Slightly more depth to the top than on Line 5 is indicated, probably about 100 feet. The east lobe anomaly again shows a pronounced layered character with gradational weak fringes. The strongest portion is centered near 28.5NE and is likely not buried more than 100 feet to its top. Both anomalies have associated near surface lower resistivities and even the zone between the two anomalies appears to be significantly mineralized.

Line 9 (Spread 1, 500' dipoles): This line was run to determine if the I.P. anomalism continues at depth south of Line 6 (but north of Line 3). A 500 foot dipole spacing was used because on Line 6 the anomaly appeared quite deep and seemed to be progressively deepening to the south. East of 0 NE/SW, the I.P. response is mostly background in strength although a hint of a layered I.P. anomaly is noted near 15NE on the second "n" level of data - too weak to be of significance at this stage. The west end of the traverse shows a portion of a very weak anomaly apparently not correlating with response on nearby lines and is therefore not considered to be of any particular importance.

Respectfully submitted:
HEINRICHS GEOEXPLORATION COMPANY

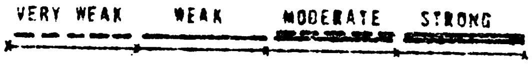
By: Chris S. Ludwig
Senior Geophysicist

Approved By: Walter E. Heinrichs, Jr.
President

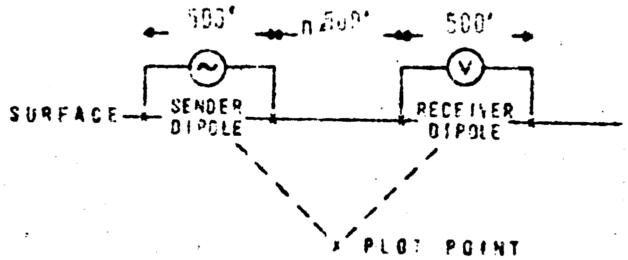
P.O. Box 5964
Tucson, Arizona 85703
January 1971
GEOEX Job # 585

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

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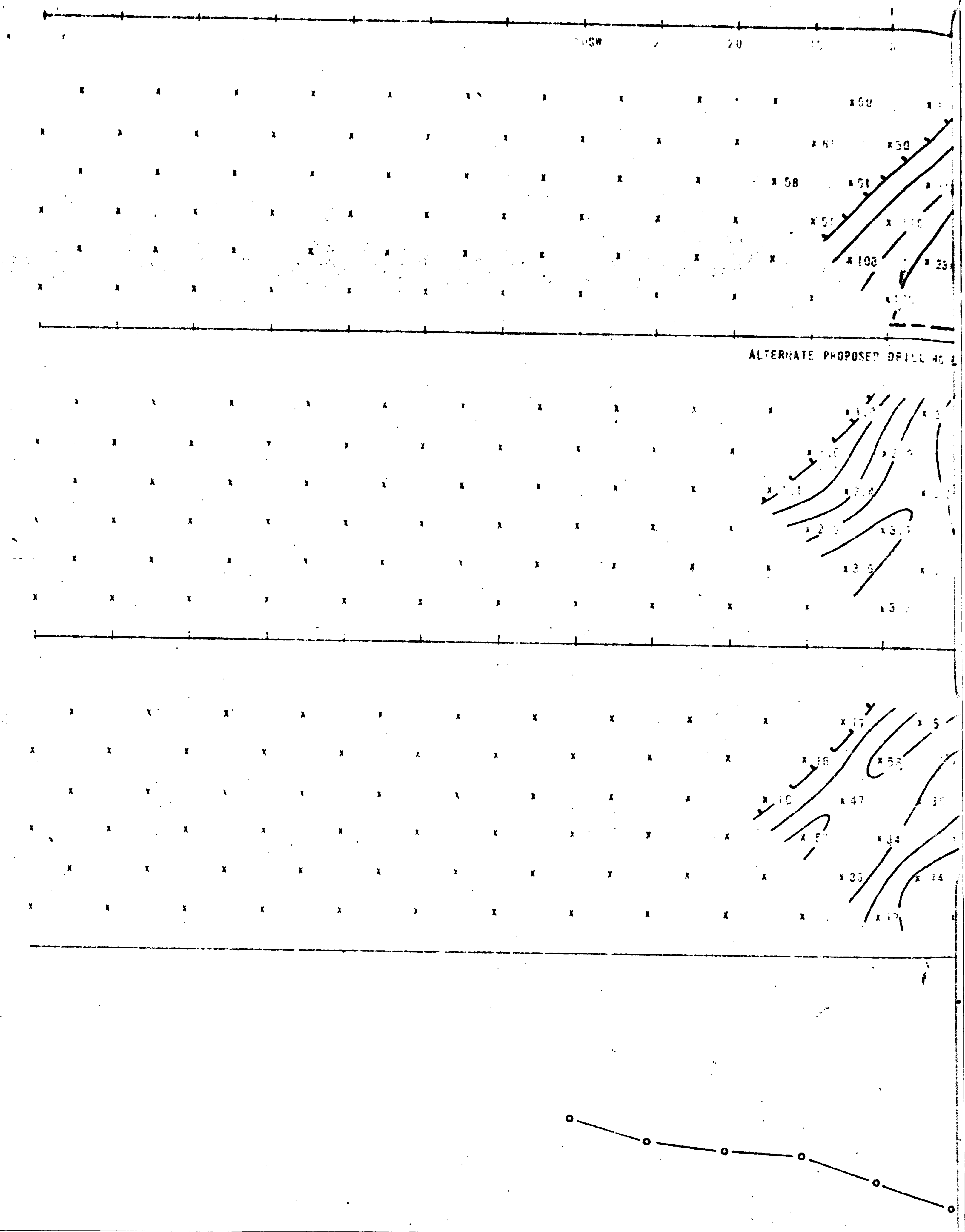
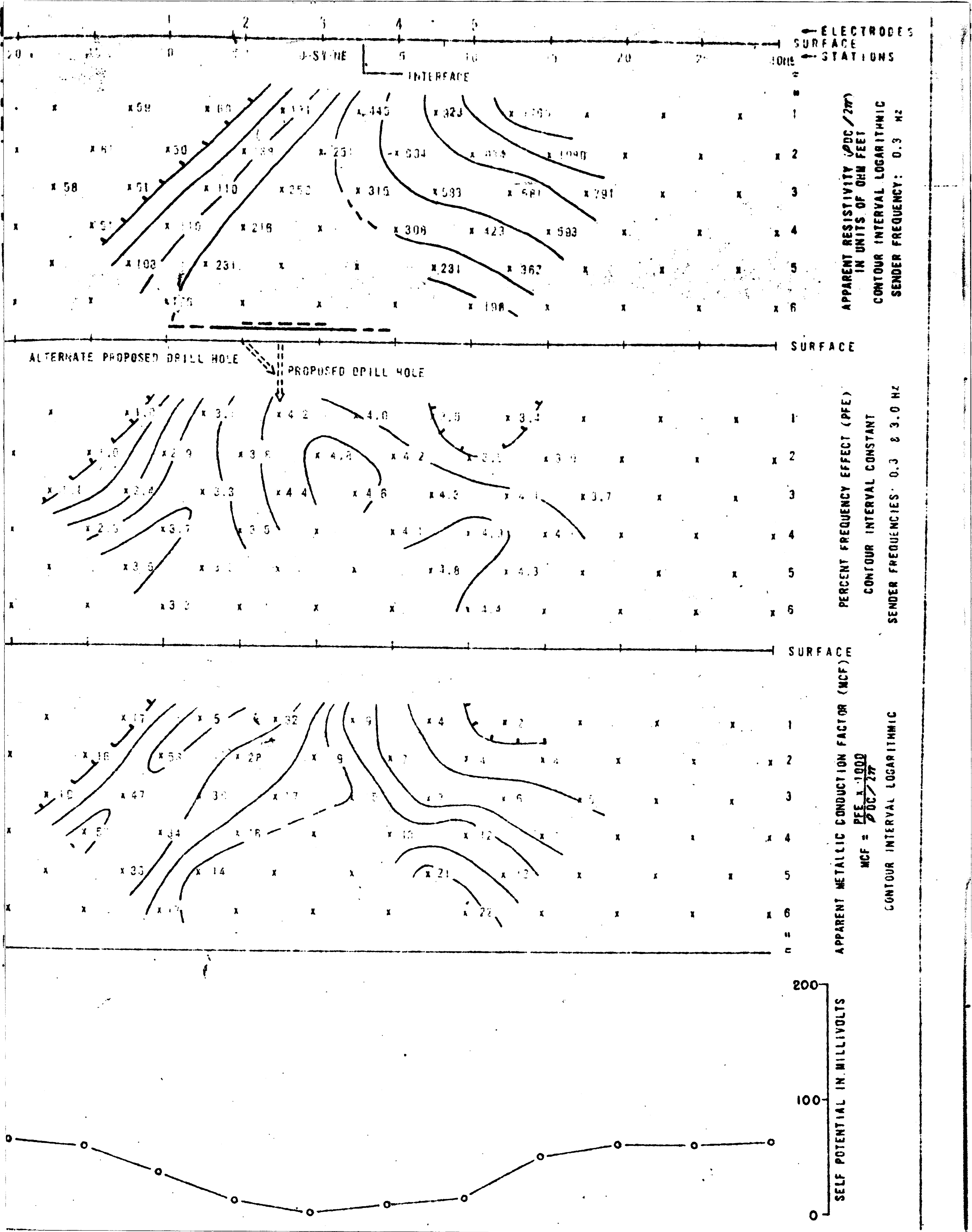
DATE

NOV 1970

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS
AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793
U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable. GEOEX, Tucson



58
30
58
102
ALTERNATE PROPOSED



ELECTRODES
SURFACE
STATIONS
INTERFACE
ALTERNATE PROPOSED DRILL HOLE
PROPOSED DRILL HOLE
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

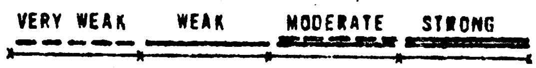
385-70

LINE NO.
1
SPREAD(S)
2, 3, 4 & 5

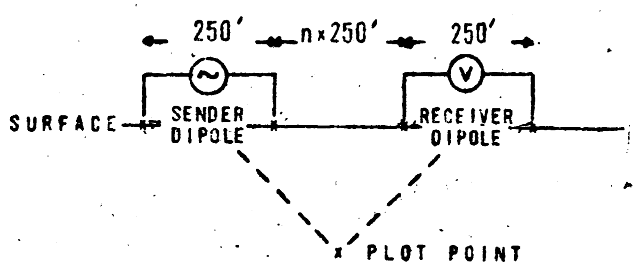
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

N 21° W

DATE

SPR 2 - NOV 1970
SPR 3, 4 & 5 - JAN 1971

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AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
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U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
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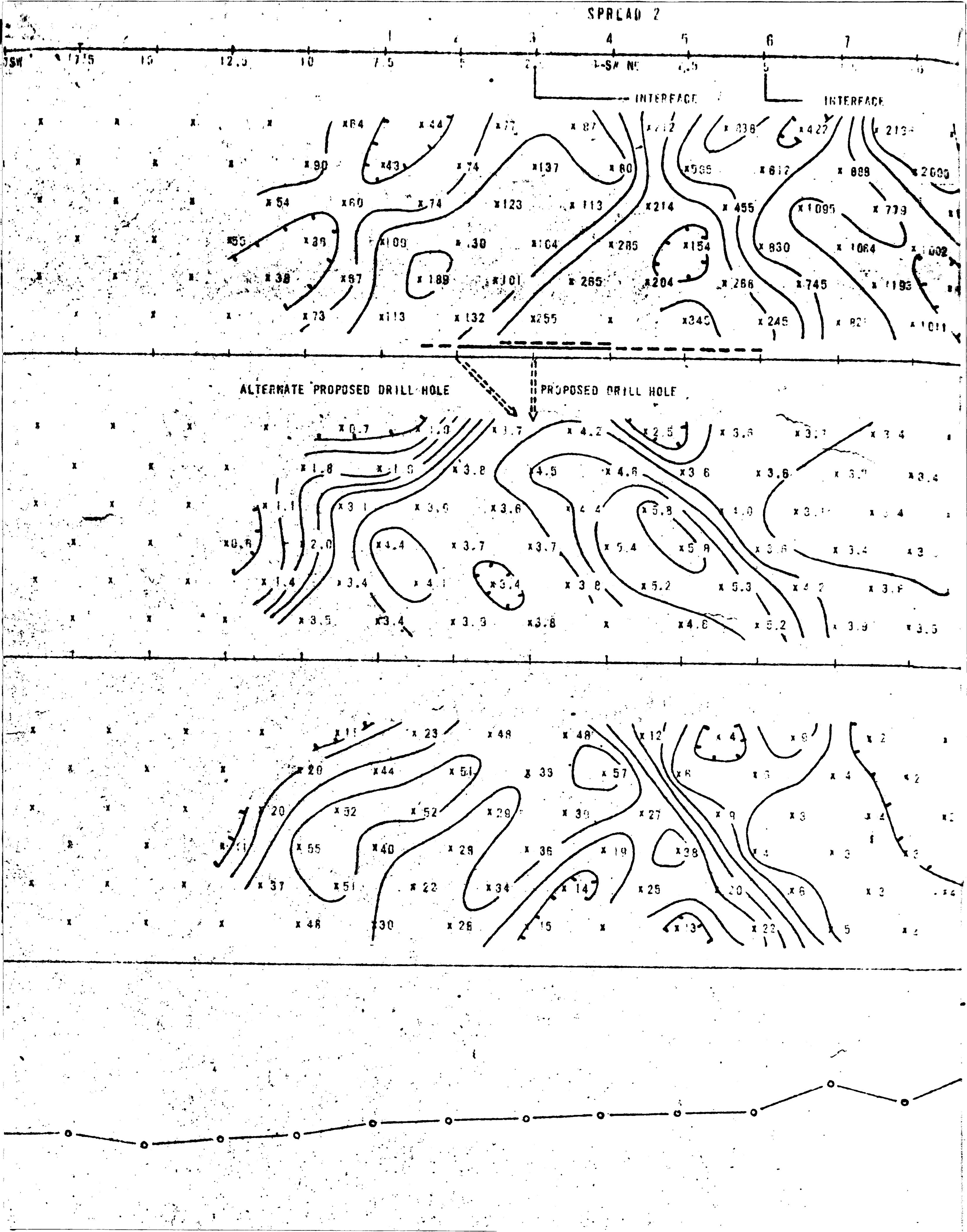
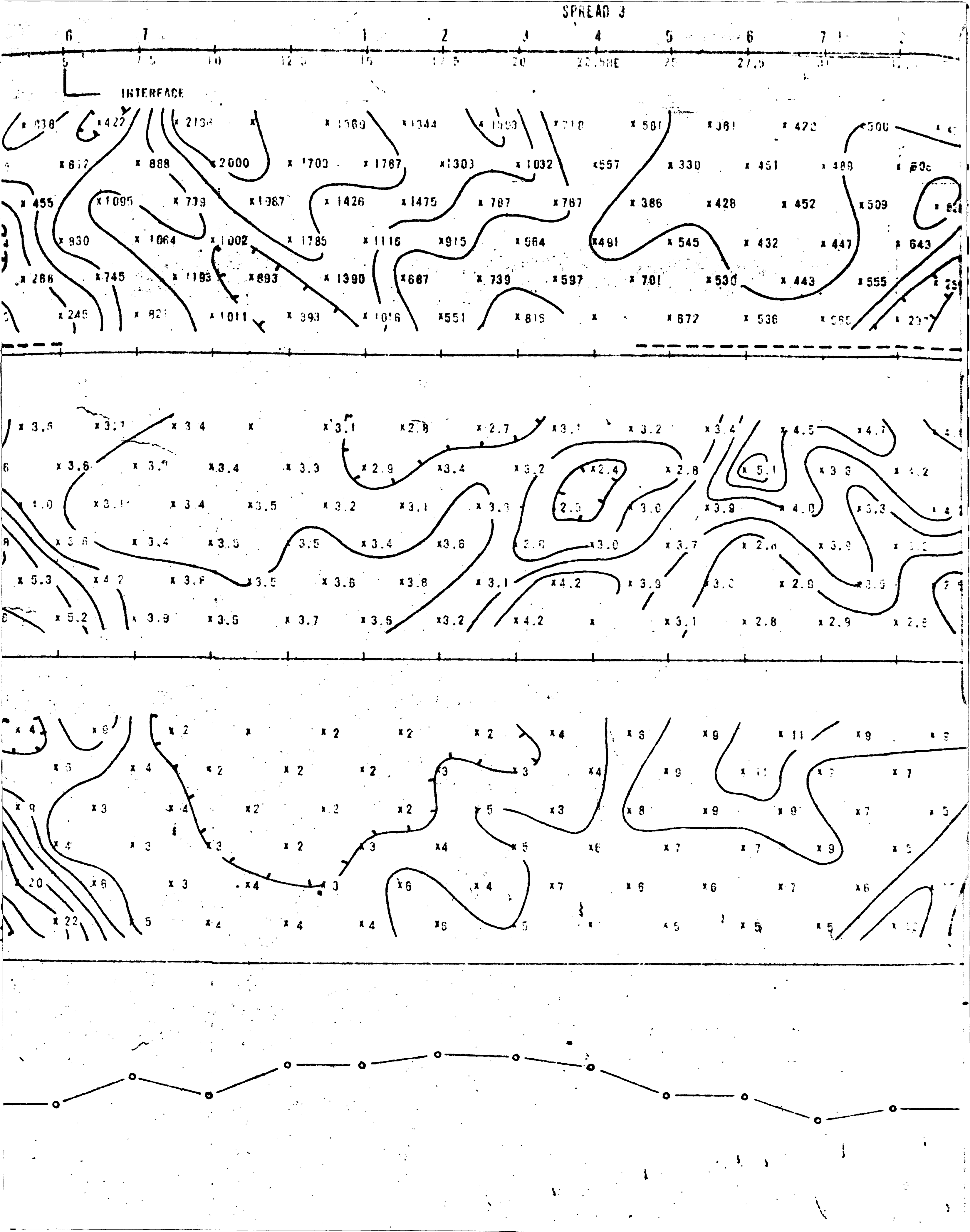
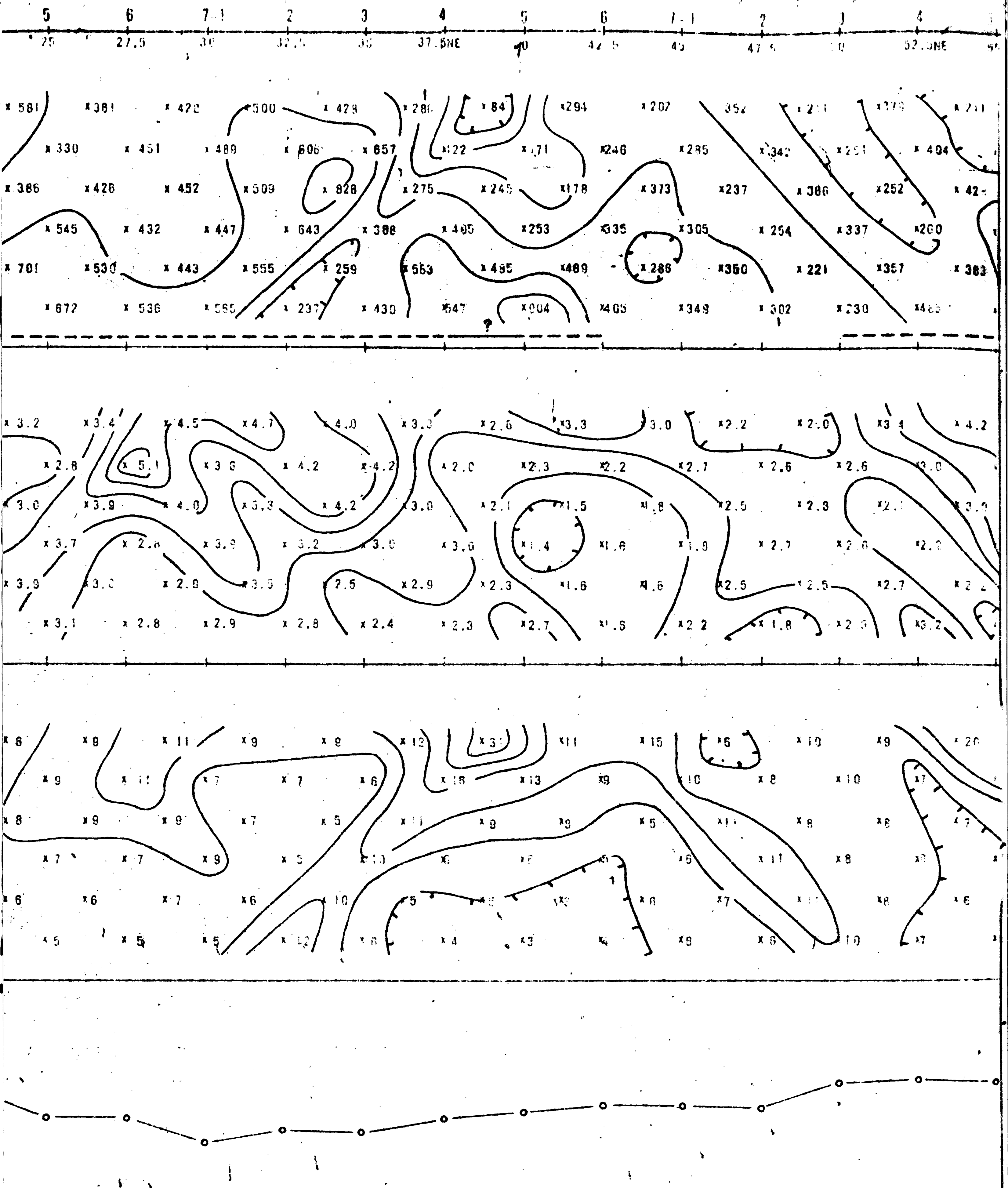
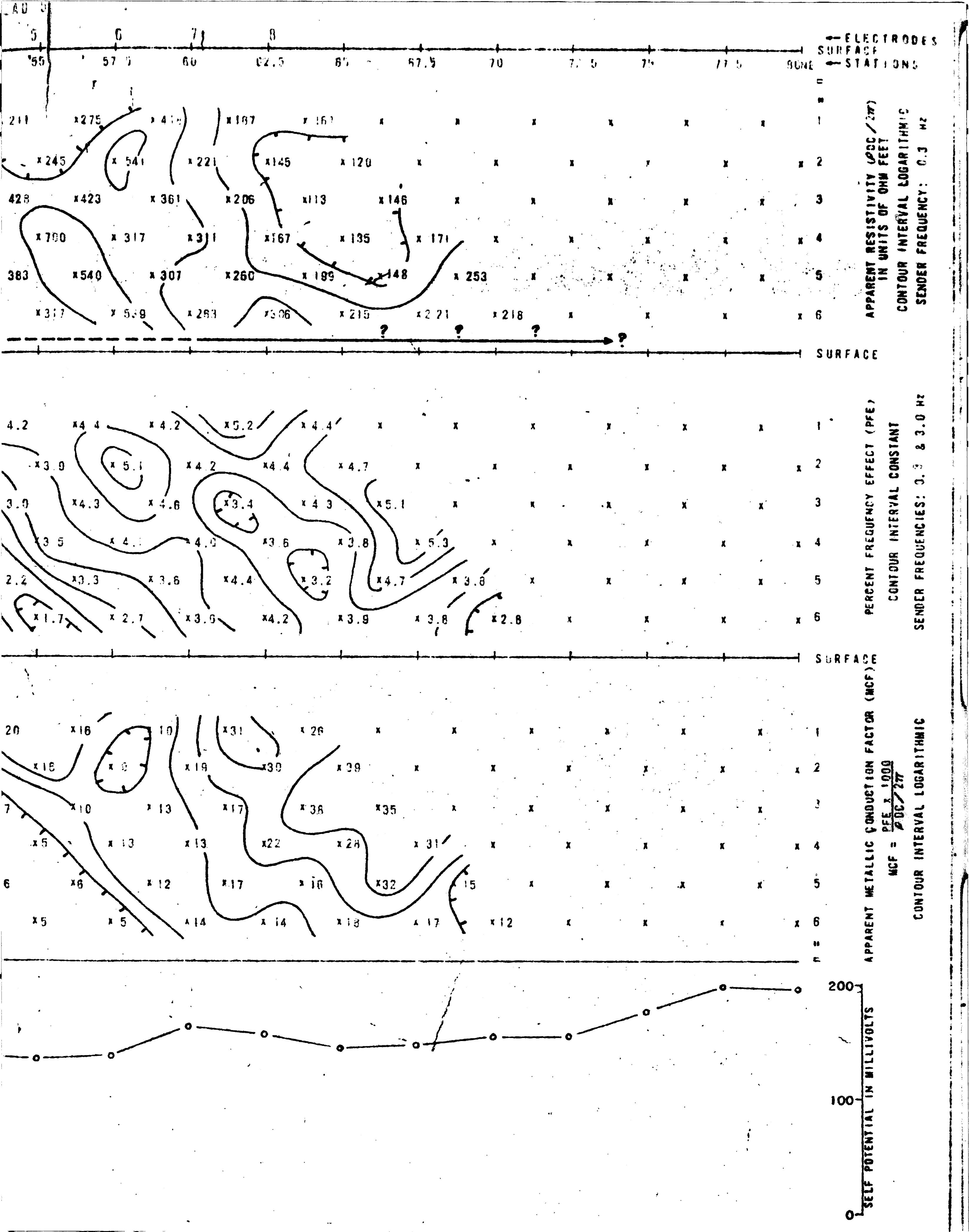


SPREAD 2
INTERFACE
INTERFACE
ALTERNATE PROPOSED DRILL HOLE
PROPOSED DRILL HOLE


SPREAD 3
INTERFACE

SPREAD 4





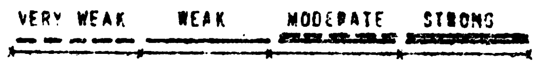
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC / 2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

LINE NO.
2
SPREAD(S)
1

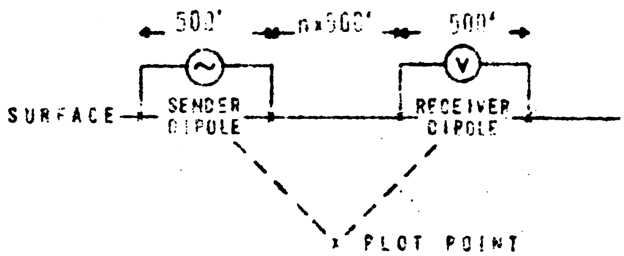
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

W½ - N 40° W

E½ - N 32° W

DATE

NOV 1970

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AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
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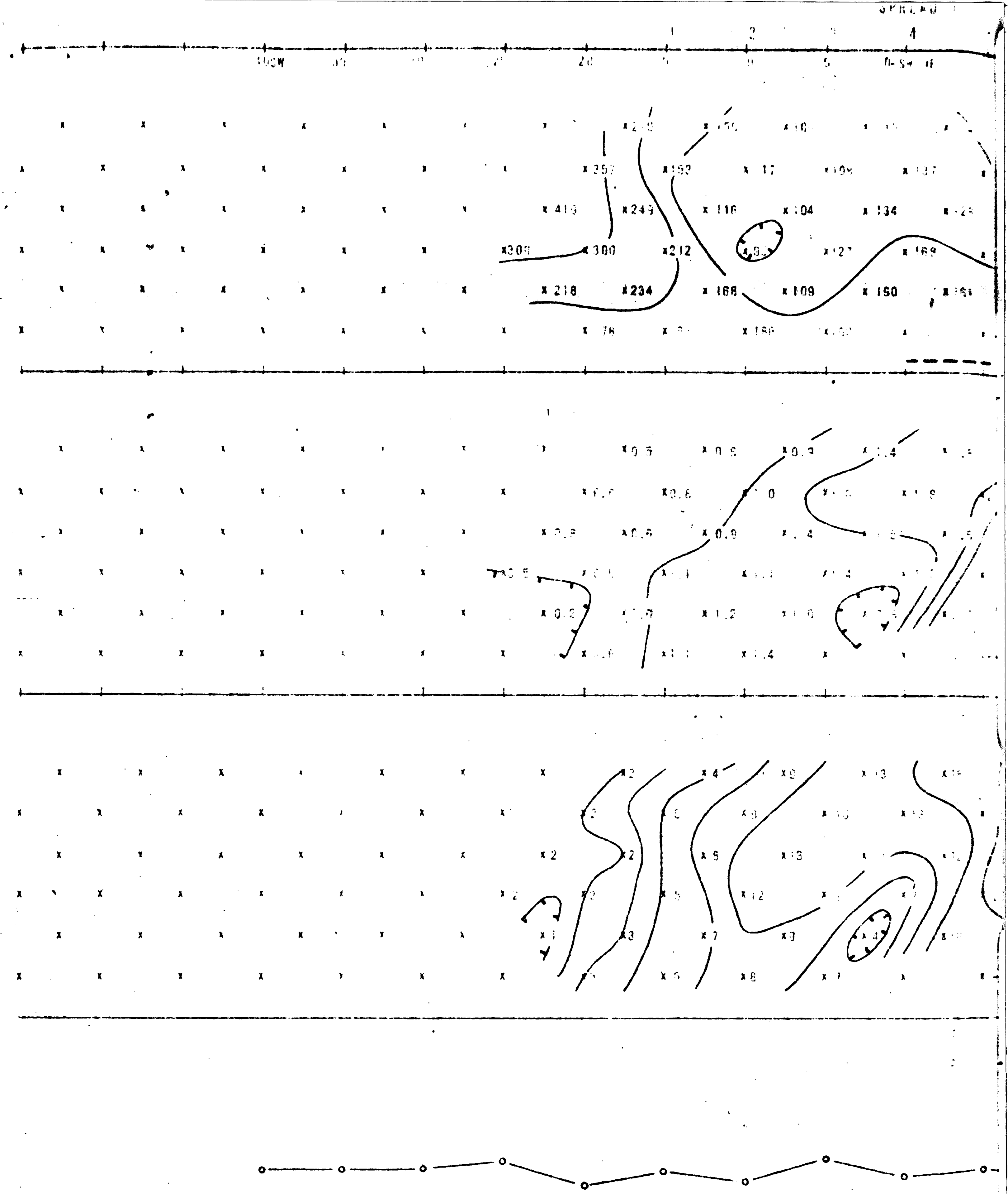
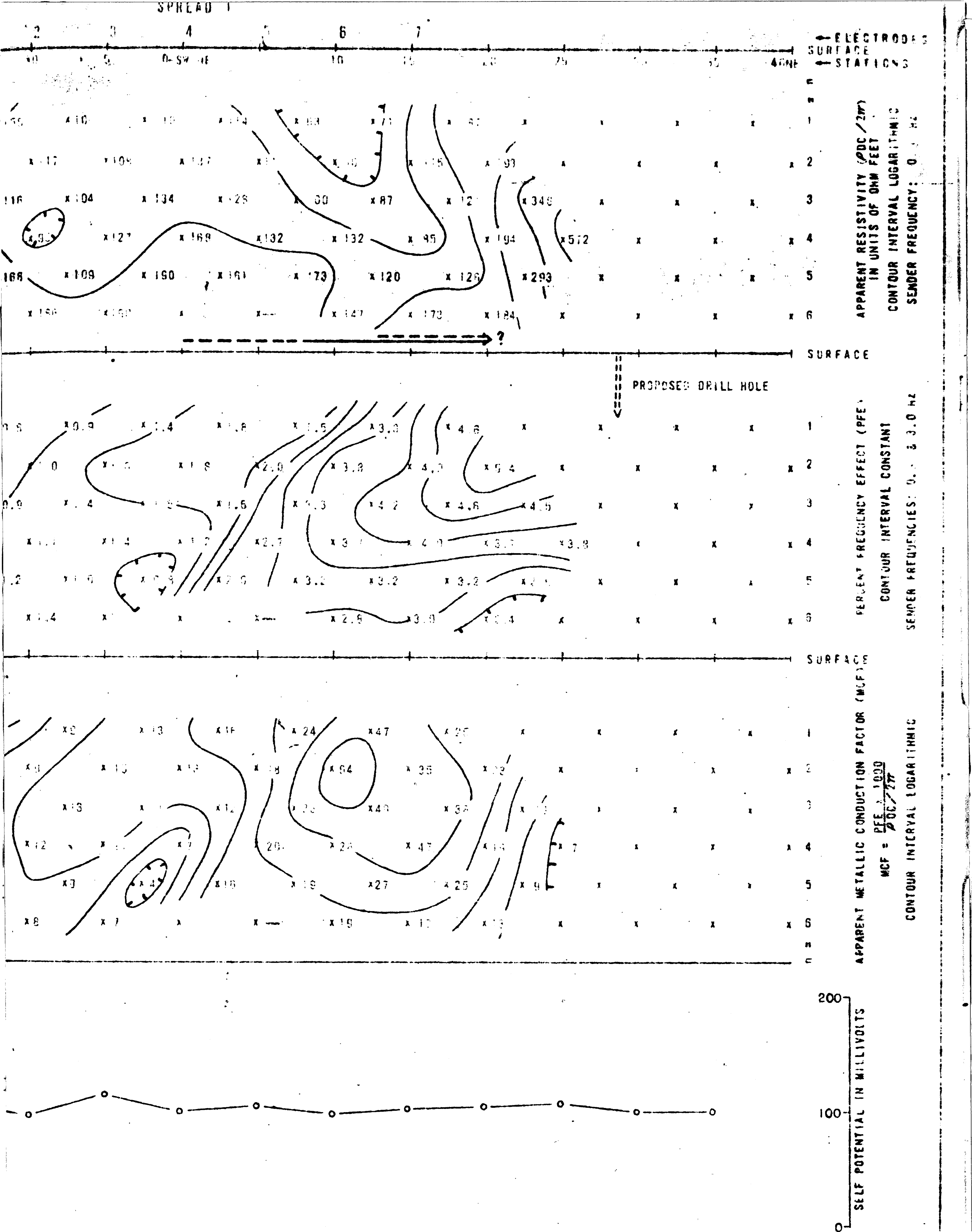


100W
20
0-SW
416
249
116
134
309
300
212
169
218
234
168
109
150



SPREAD 1
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY:
PROPOSED DRILL HOLE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES:
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

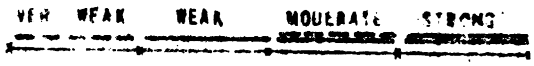
35-70

LINE NO.
2
SPREAD(S)
2 & 3

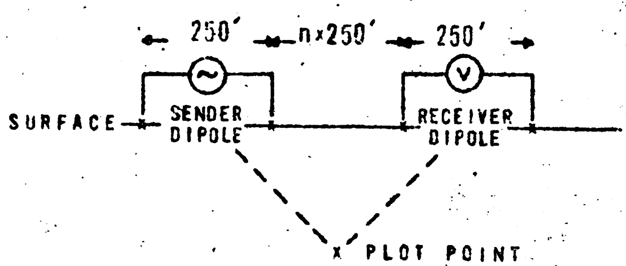
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

LOOKING
N 22° W

DATE

SPR. 2 - NOV 1970
SPR. 3 - DEC 1970

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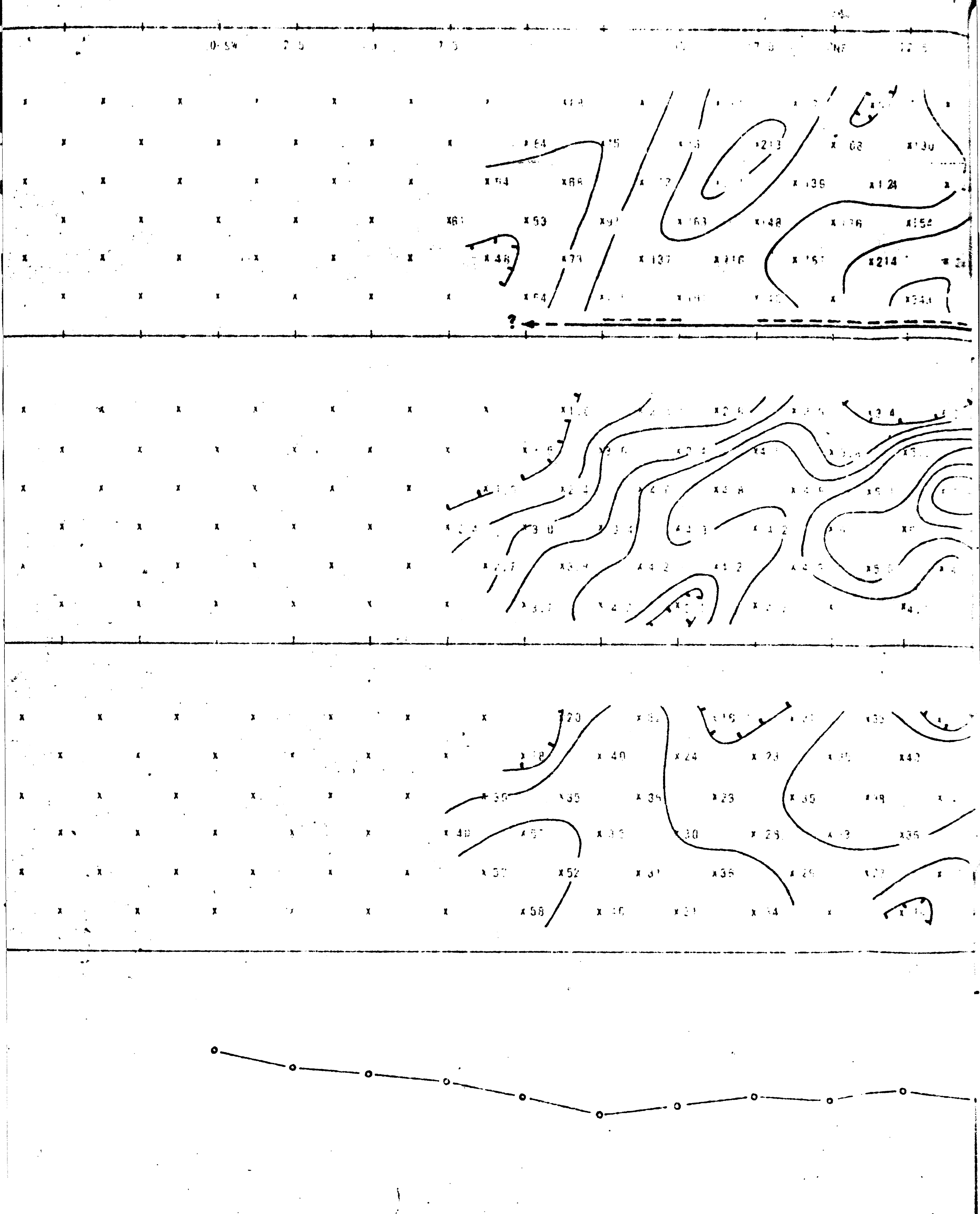
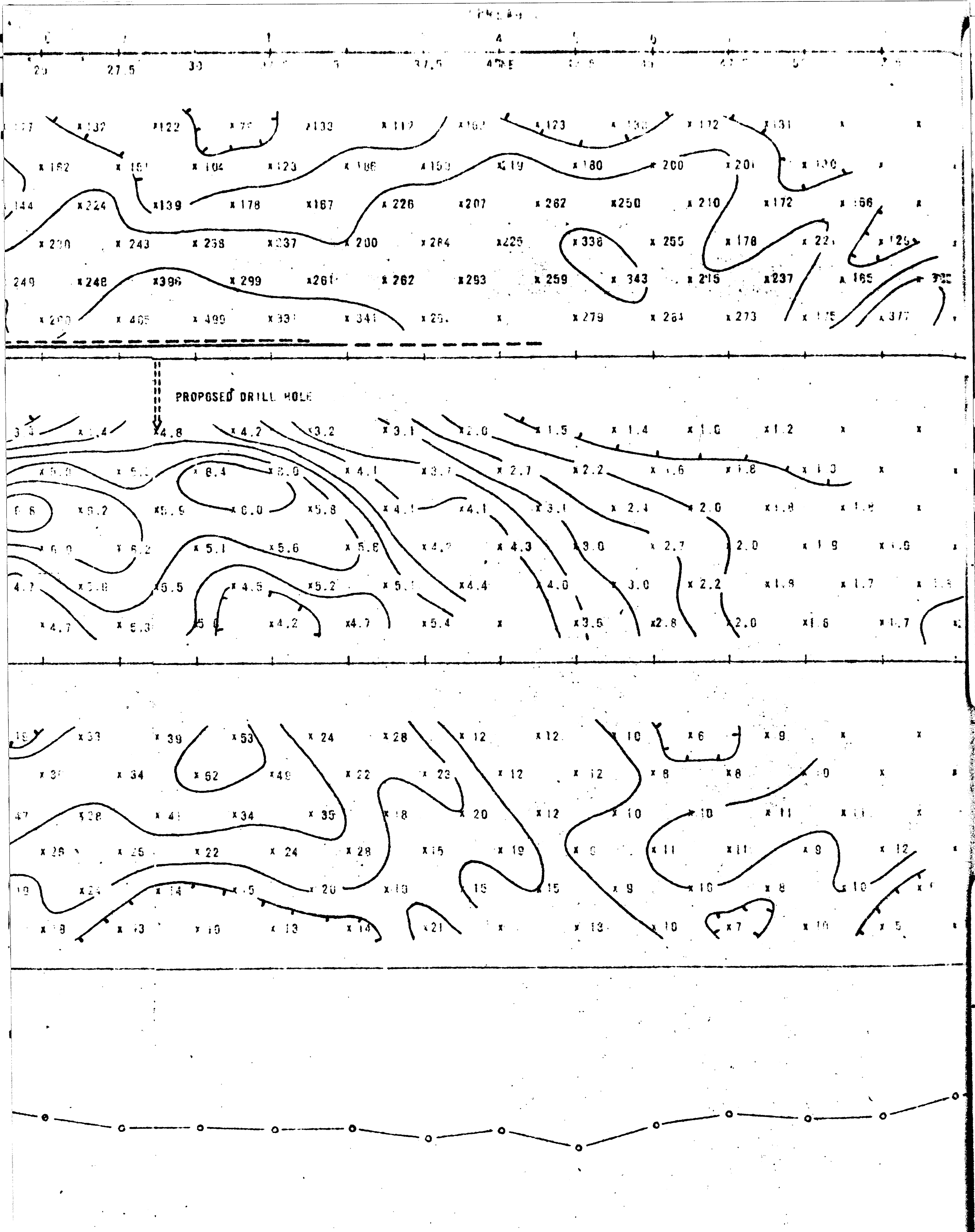
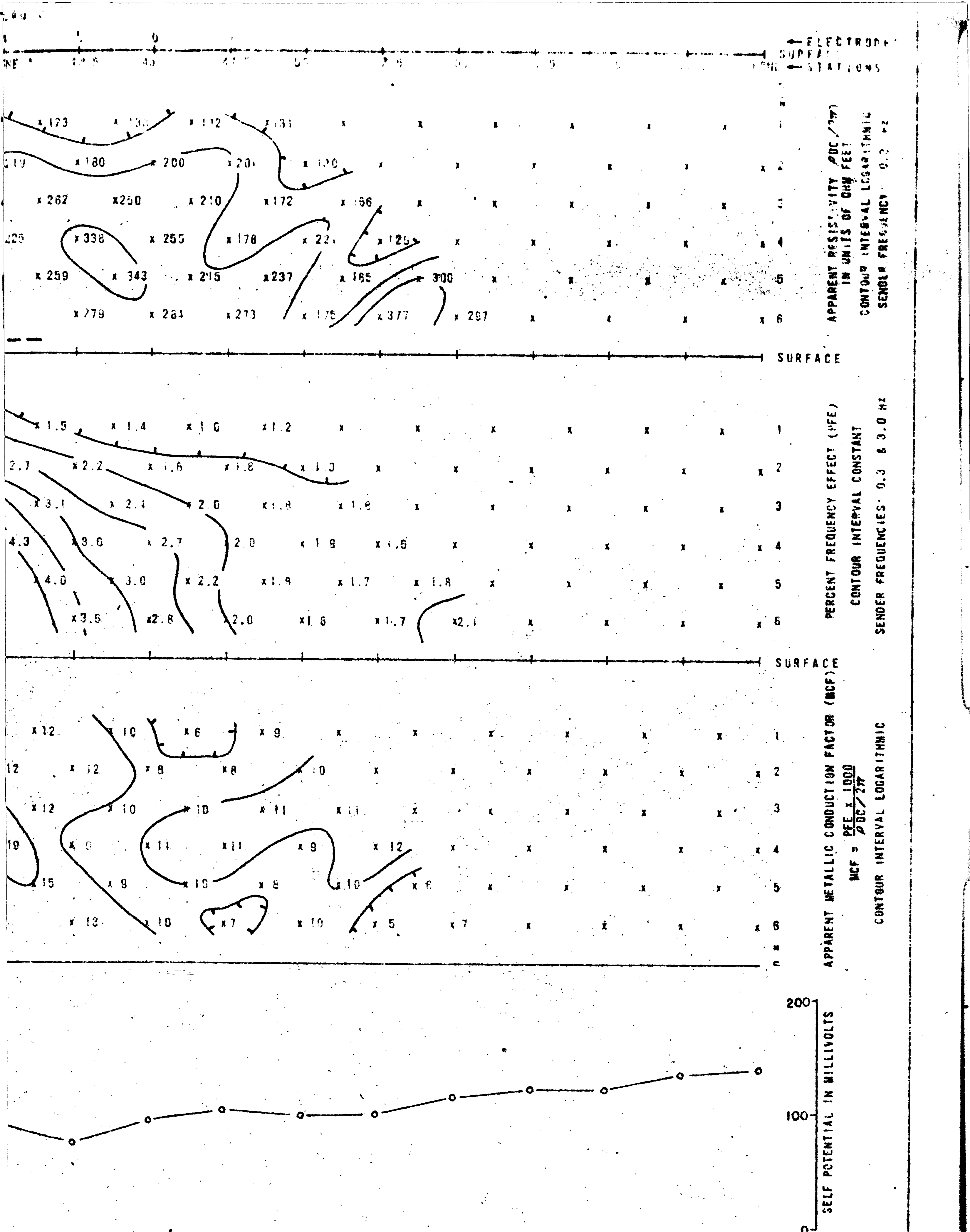
AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson




27.5
30
37.5
PROPOSED DRILL HOLE

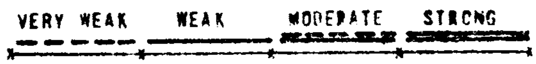


ELECTRODE
SURFACE
STATIONS
APPARENT RESISTIVITY ρDC/2π IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

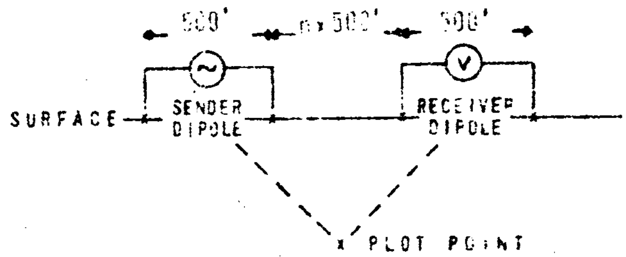
LINE NO.
3
SPREAD(S)
1 & 2

INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for
TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

N 18° W

DATE

NOV 1970

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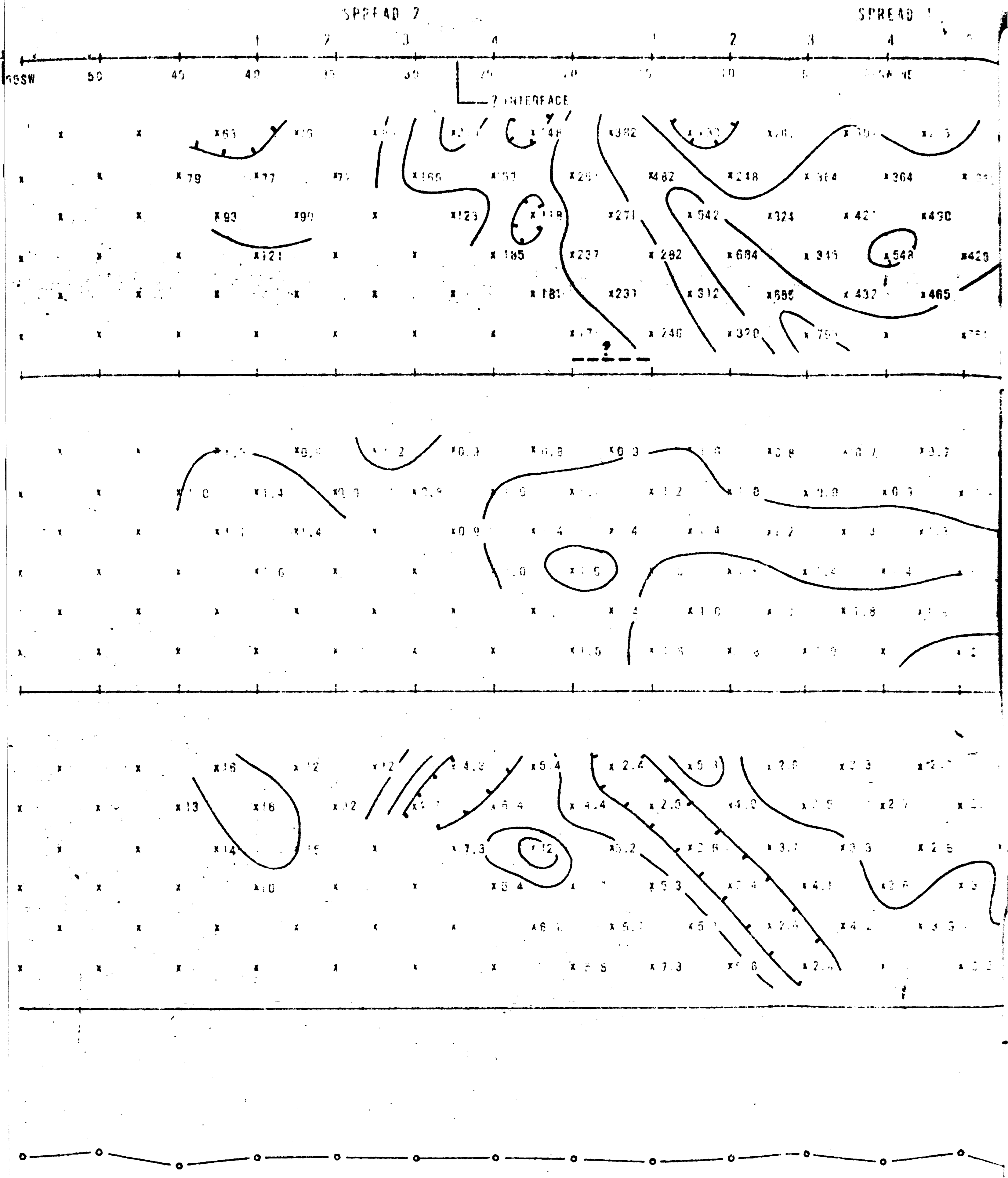
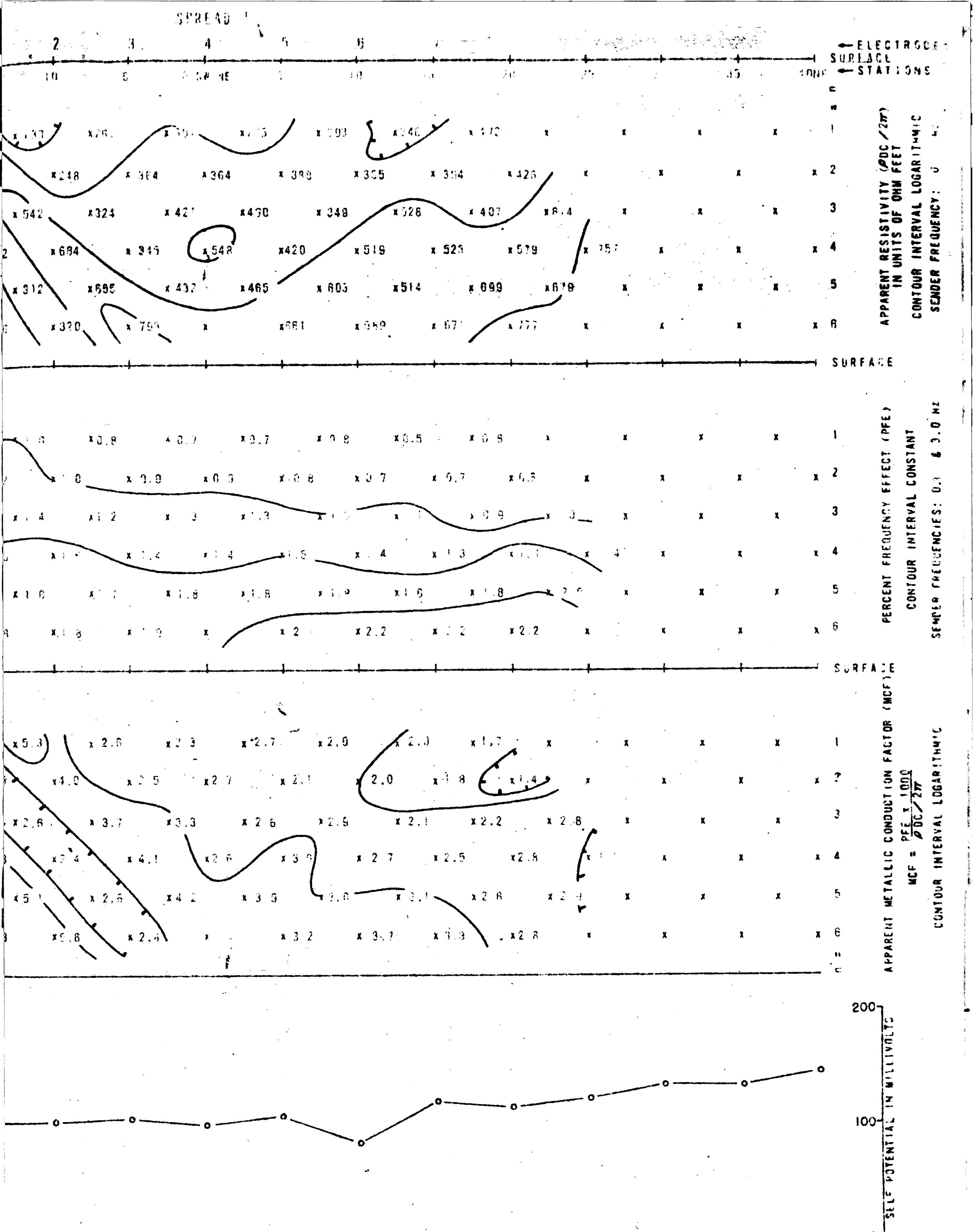
U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEx, Tucson


SPREAD 2
SPREAD 1
SSW
? INTERFACE

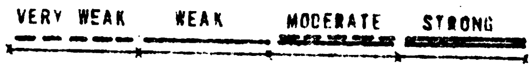

SPREAD
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC / 2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
200
100
SELF POTENTIAL IN MILLIVOLTS

585 70

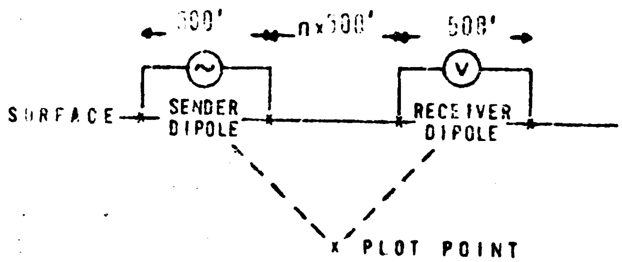
LINE NO.
4
SPREAD(S)
I

INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for
TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

LOOKING
S 70° W

DATE
NOV 1970

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39 Hume Street
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Tucson, Arizona 85703
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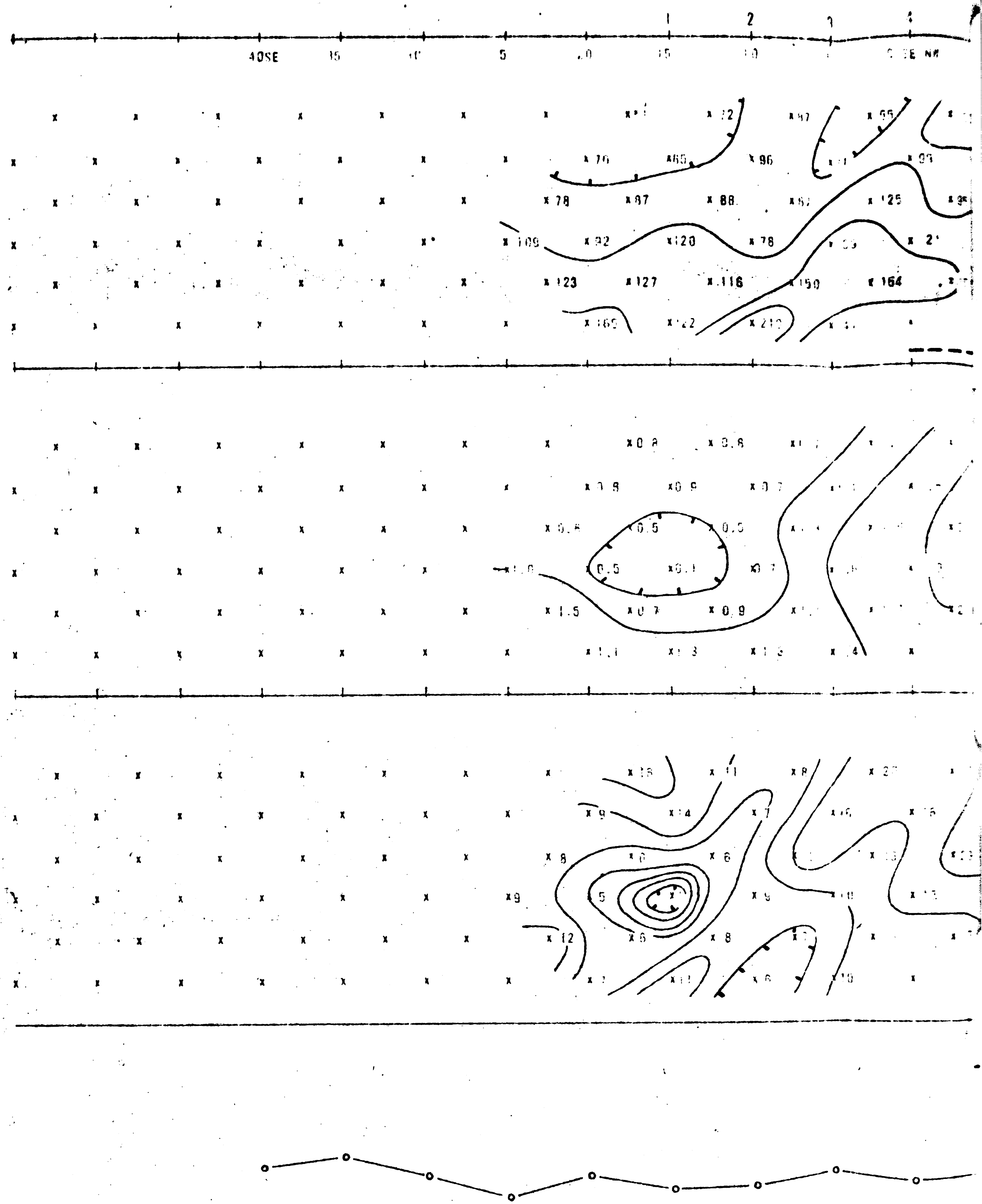
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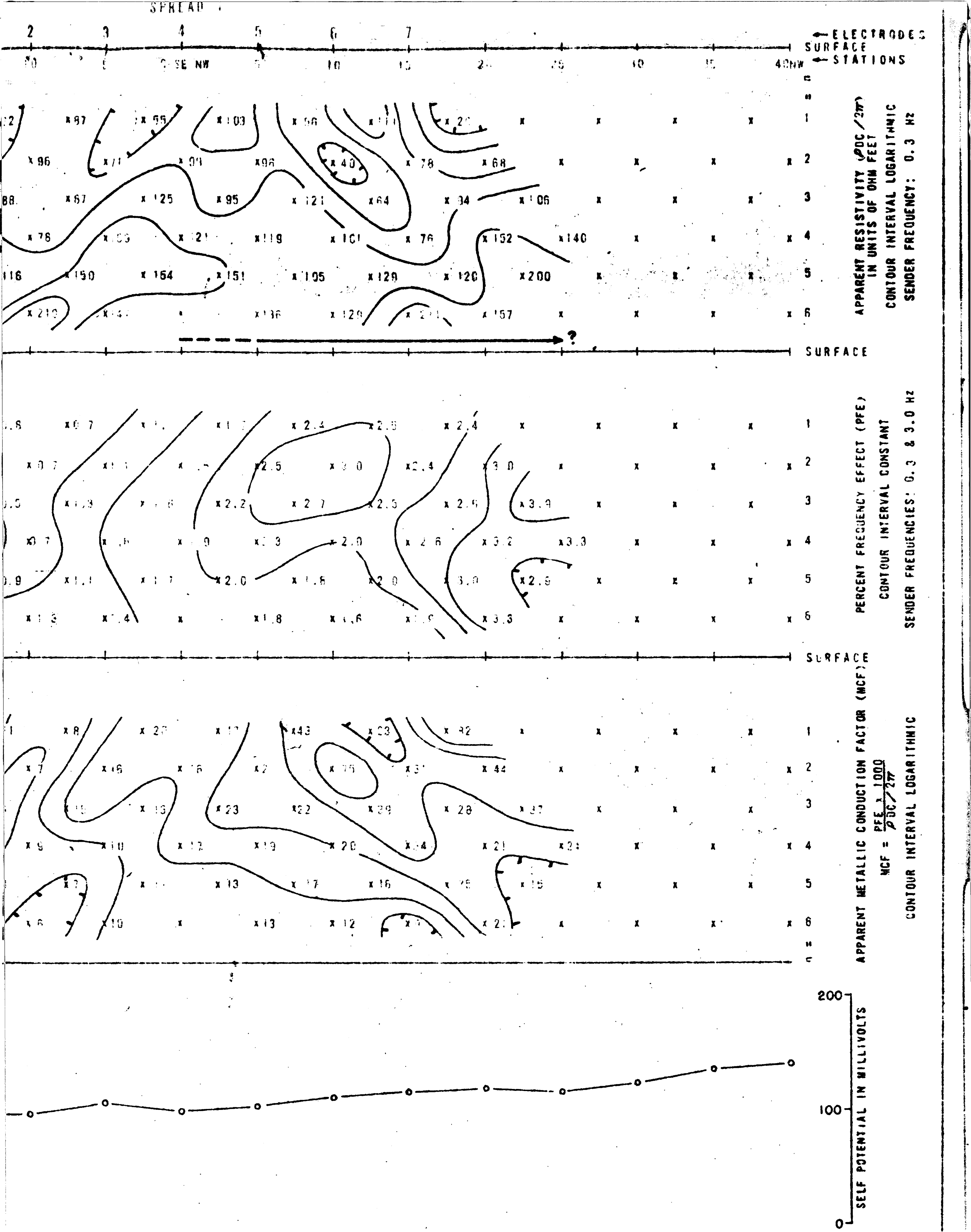


SPREAD
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

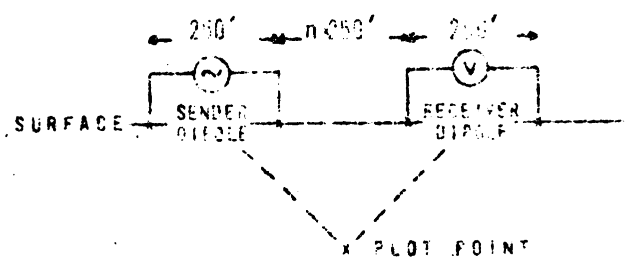
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK | WEAK | MODERATE | STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA

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LOOKING

N 22° W

DATE

DEC 1970

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AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: [illegible]-1793

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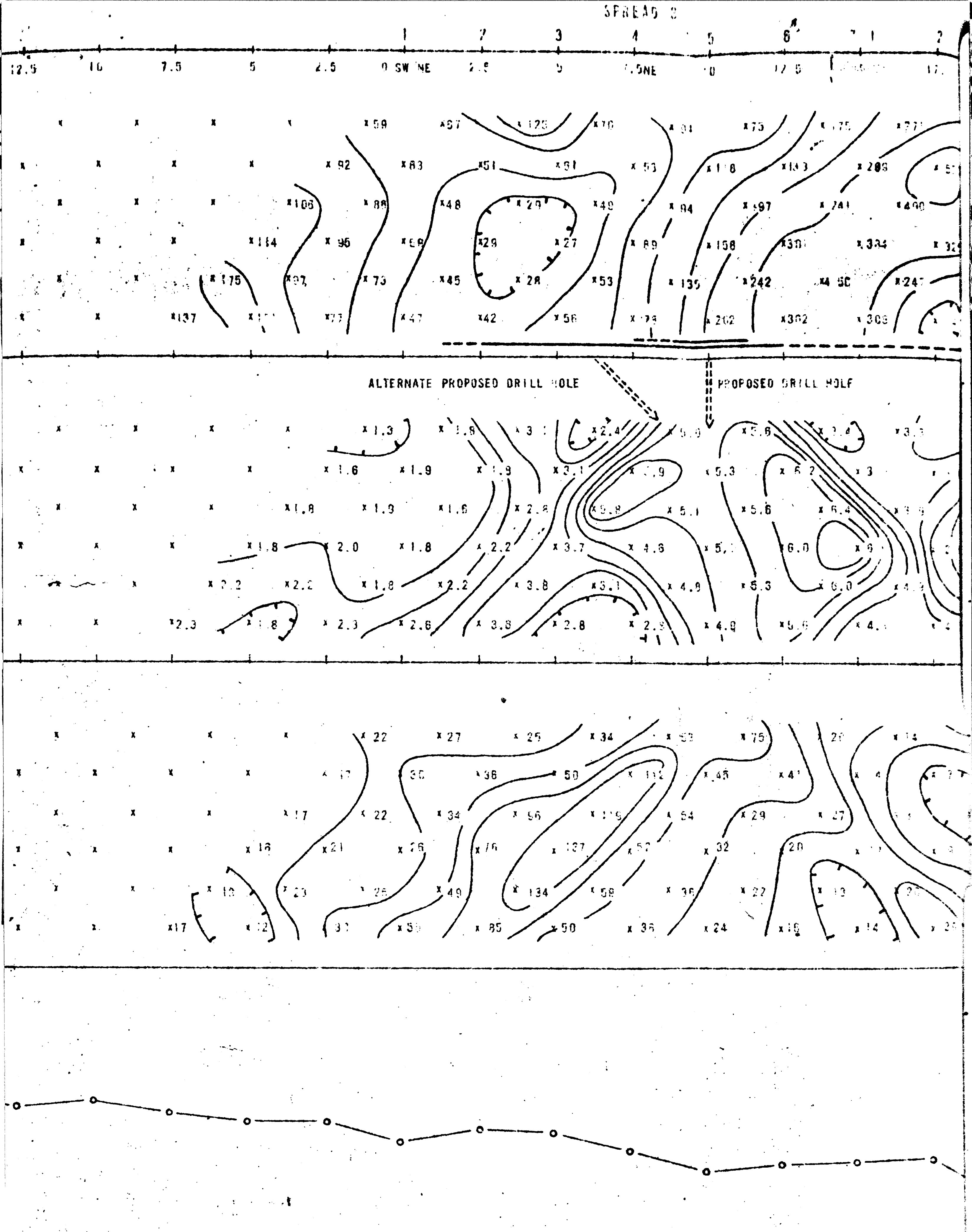
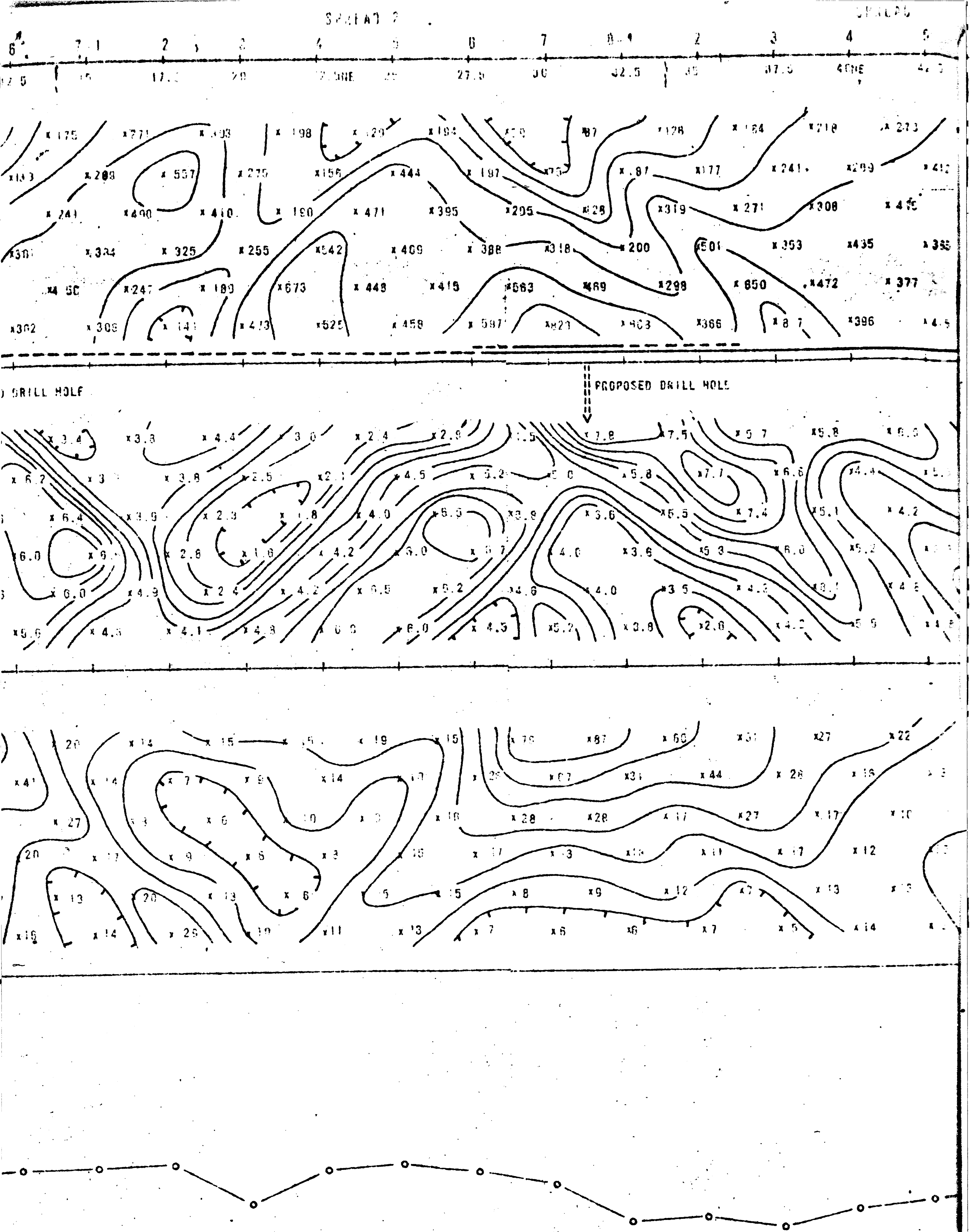
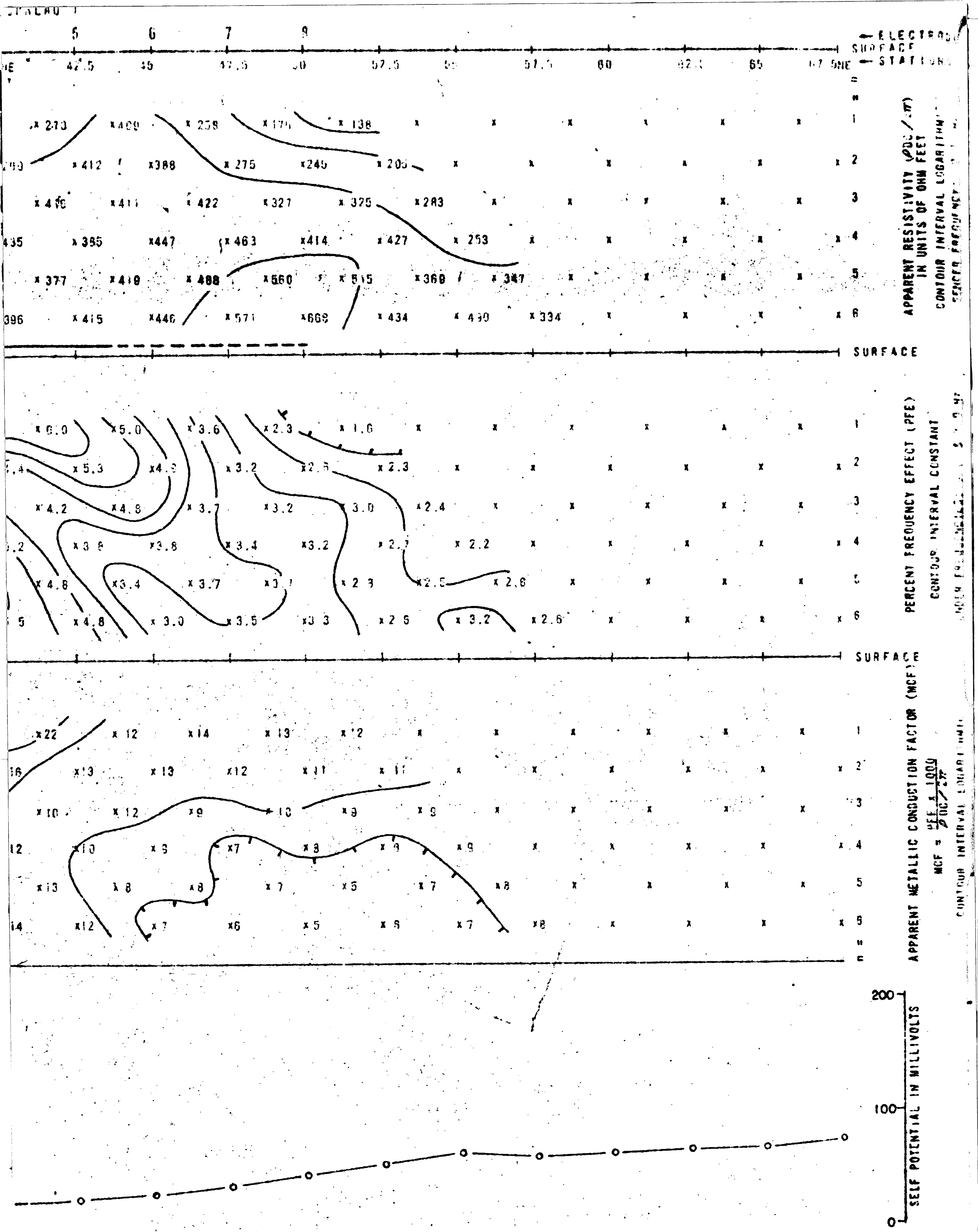
Post Office Box [illegible]
Tucson, Arizona [illegible]
Phone: [illegible]
Cable: "GEOEX, Tucson"

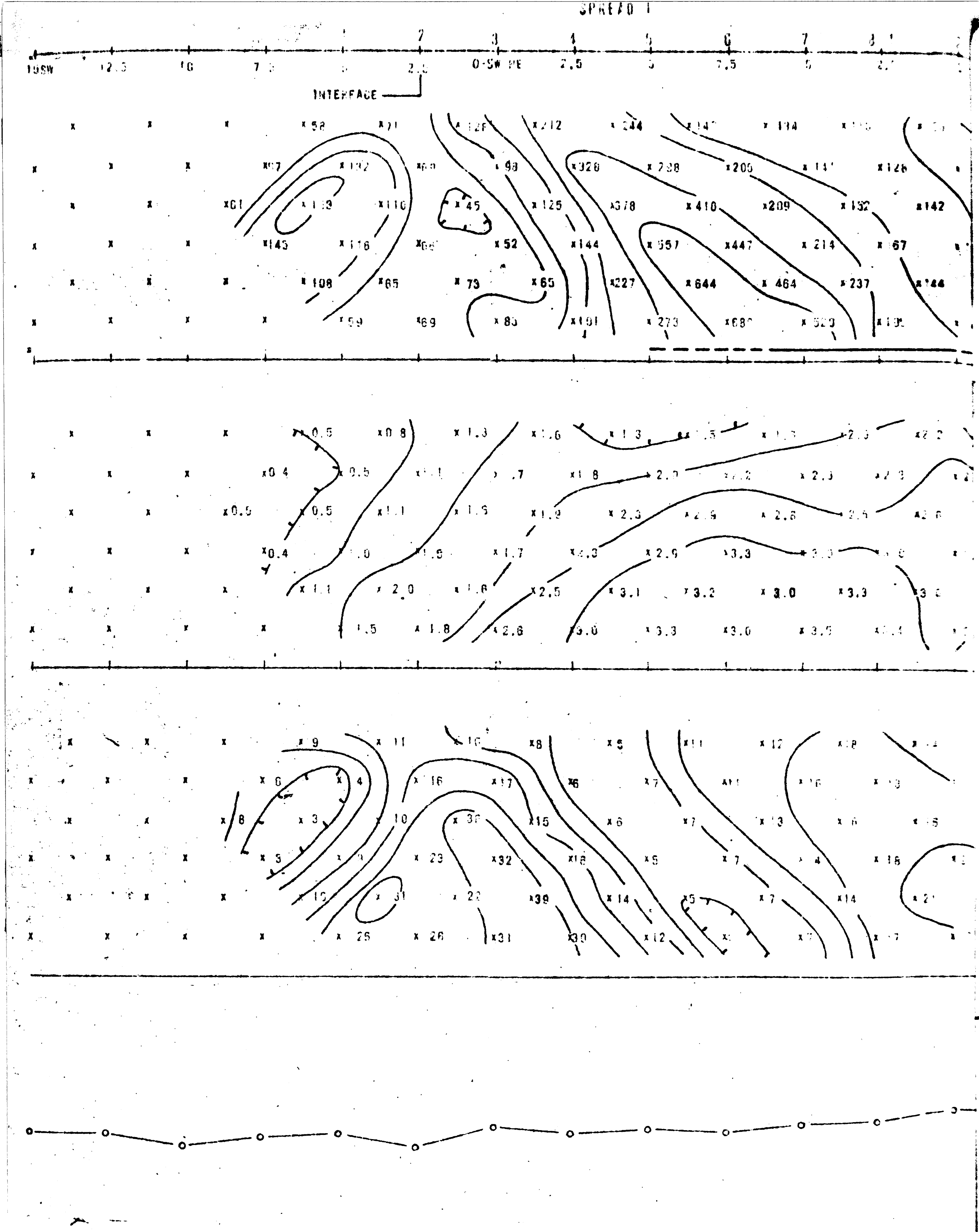


ALTERNATE PROPOSED DRILL HOLE
PROPOSED DRILL HOLE

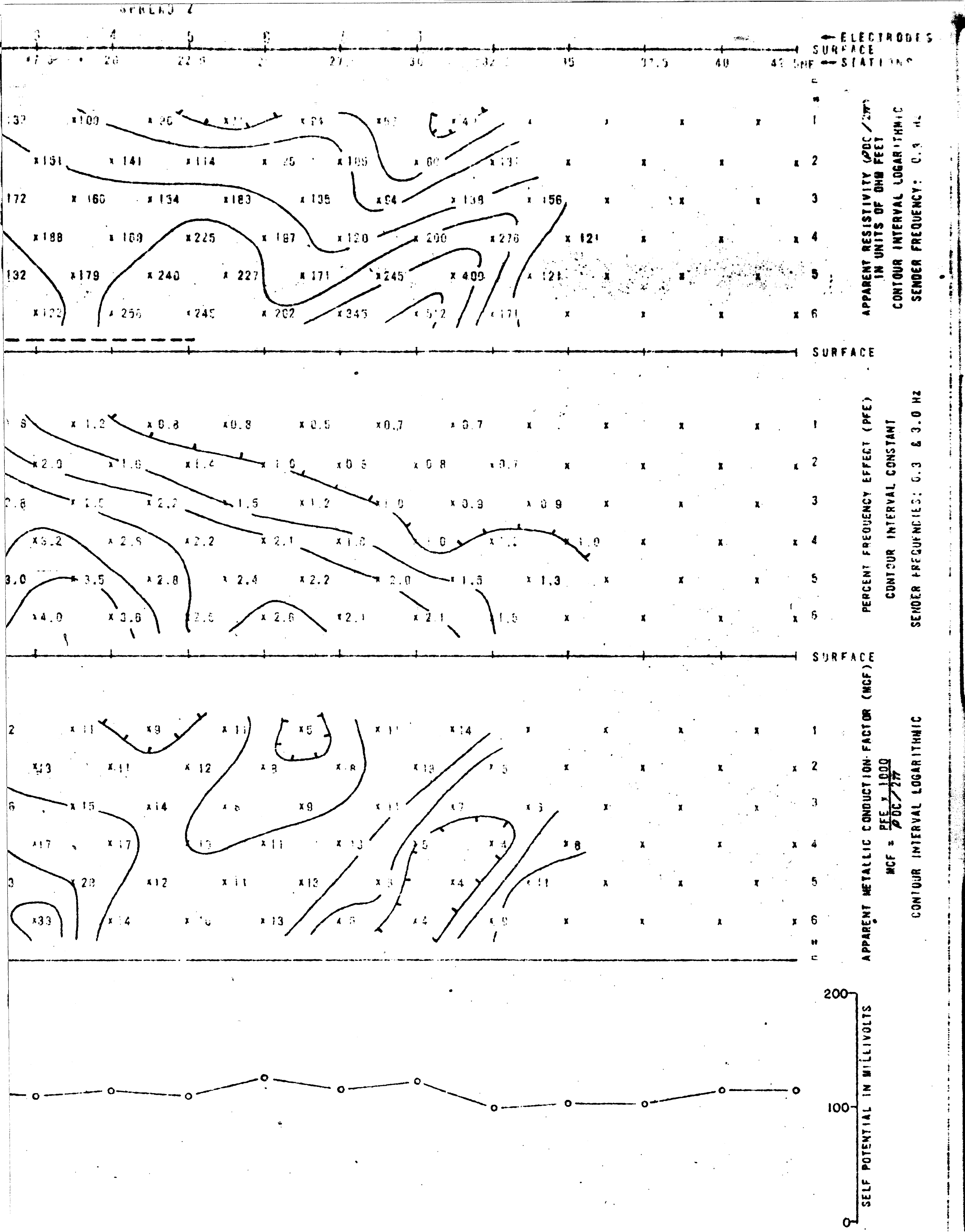

PROPOSED DRILL HOLE
DRILL HOLE



ELECTRODE
SURFACE
STATIONS
SURFACE
SURFACE
APPARENT RESISTIVITY ($\rho_{DC}/2\pi$) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = $\frac{PFE \times 1000}{\rho_{DC}/2\pi}$
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0



SPREAD 1
INTERFACE
O-SW PE



ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
200
100
0
SELF POTENTIAL IN MILLIVOLTS

585-79

LECTRODES
ACE
TATIONS

APPARENT RESISTIVITY ($\rho DC/2\pi$) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 HZ

ACE

PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 HZ

ACE

APPARENT METALLIC CONDUCTION FACTOR (MCF)
$MCF = \frac{PFE \times 1000}{\rho DC/2\pi}$
CONTOUR INTERVAL LOGARITHMIC

SELF POTENTIAL IN MILLIVOLTS

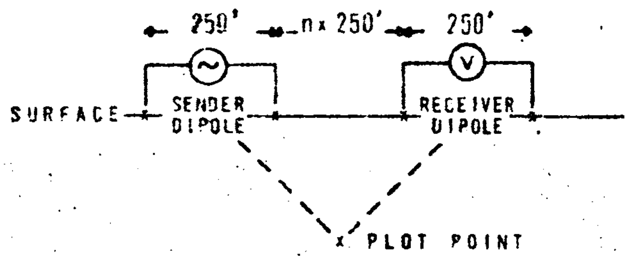
LINE NO
6
SPREADS
1 & 2

INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for
TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

LOOKING
N 22° W

DATE
JAN 1971

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1783

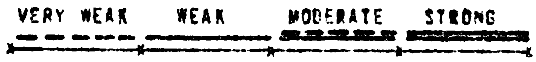
U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

LINE NO.
7
SPREAD(S)
1

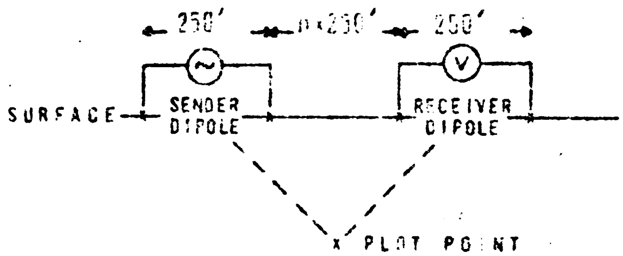
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR
LOOKING
N 20° W
DATE
JAN 1971

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(SYDNEY)
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U.S.A.
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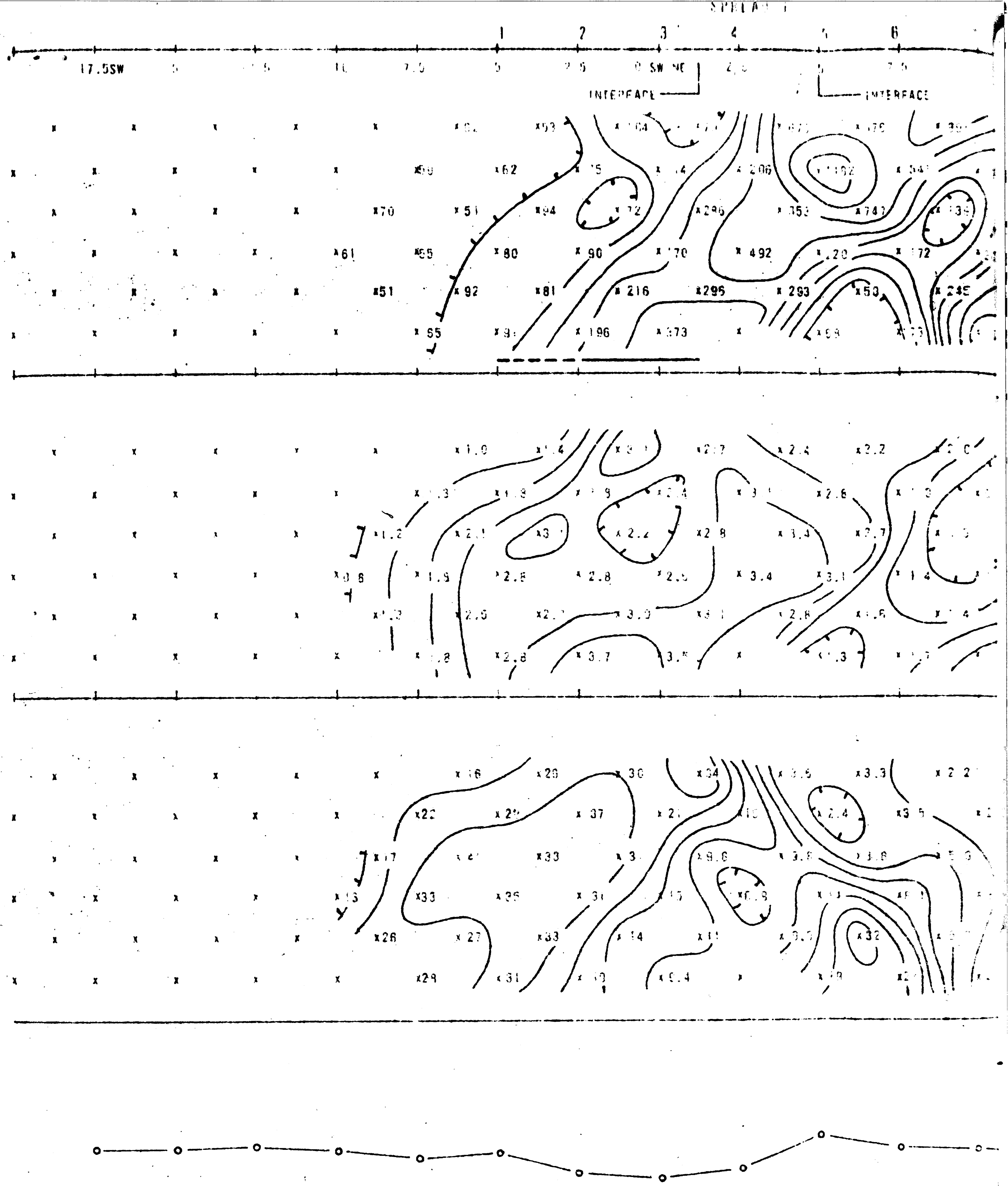
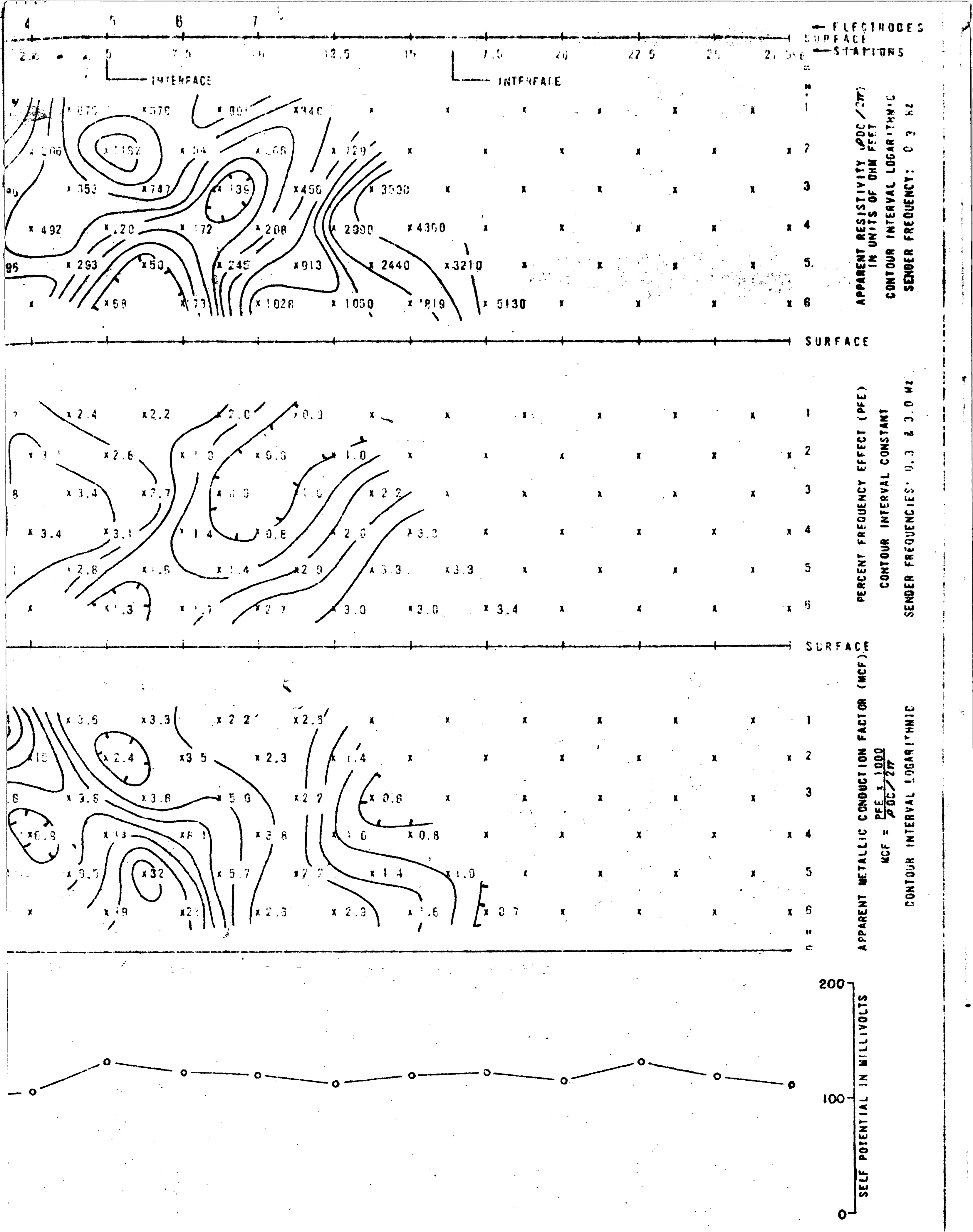

17.5SW
0 SW NE
INTERFACE
INTERFACE


ELECTRODES
SURFACE
STATIONS
INTERFACE
INTERFACE
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 HZ
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 HZ
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

LINE NO.
7
SPREAD(S)
1

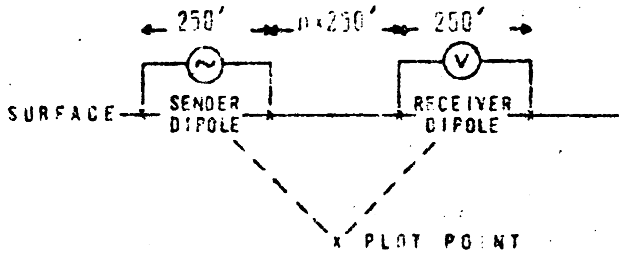
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR
LOOKING
N 20° W
DATE
JAN 1971

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GEOPHYSICAL ENGINEERS
AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793
U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
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535-70

LINE NO.
7
SPREAD(S)
2

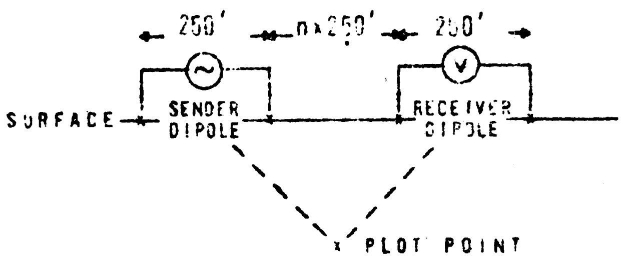
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

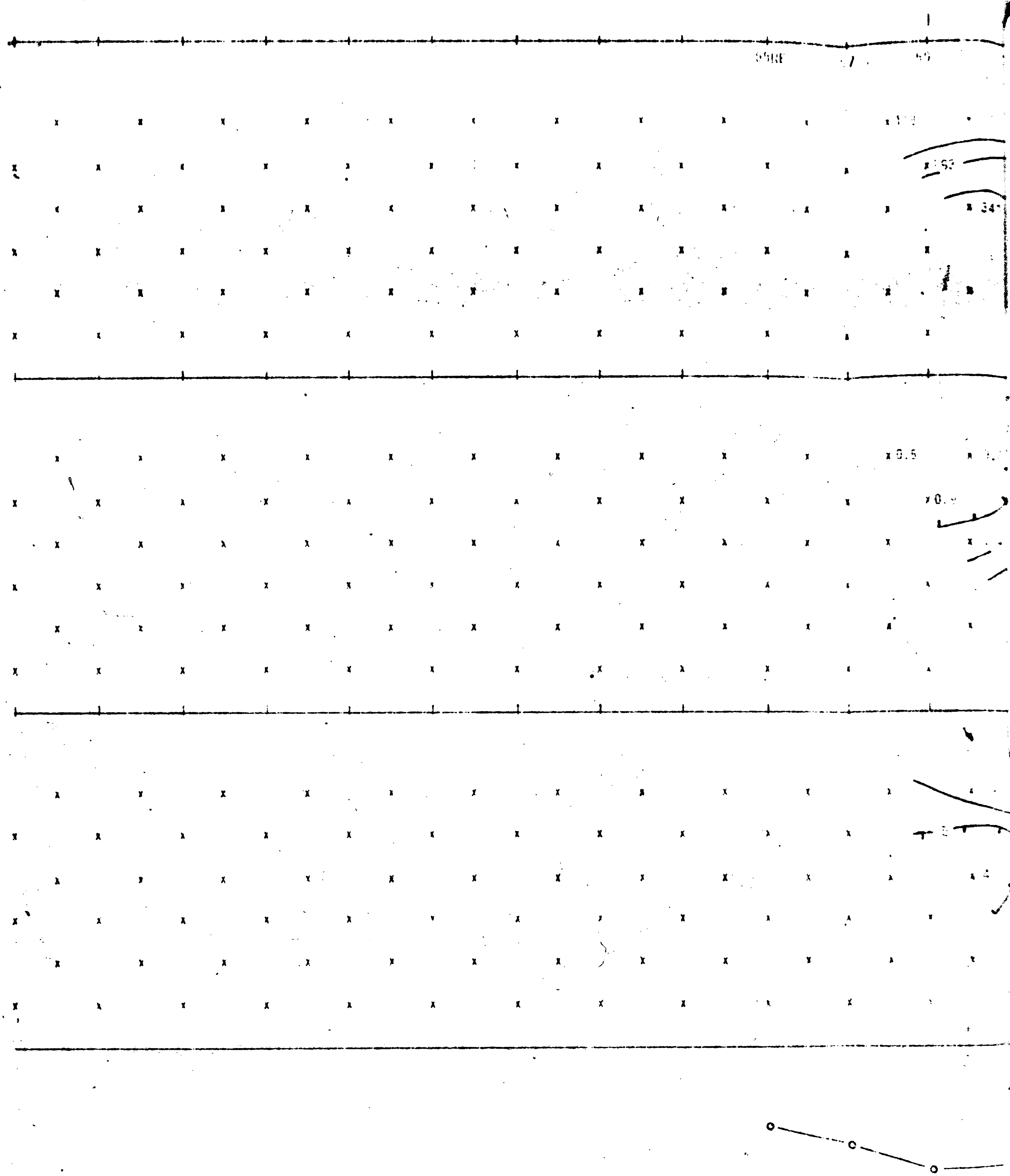
LOOKING
N 22° W

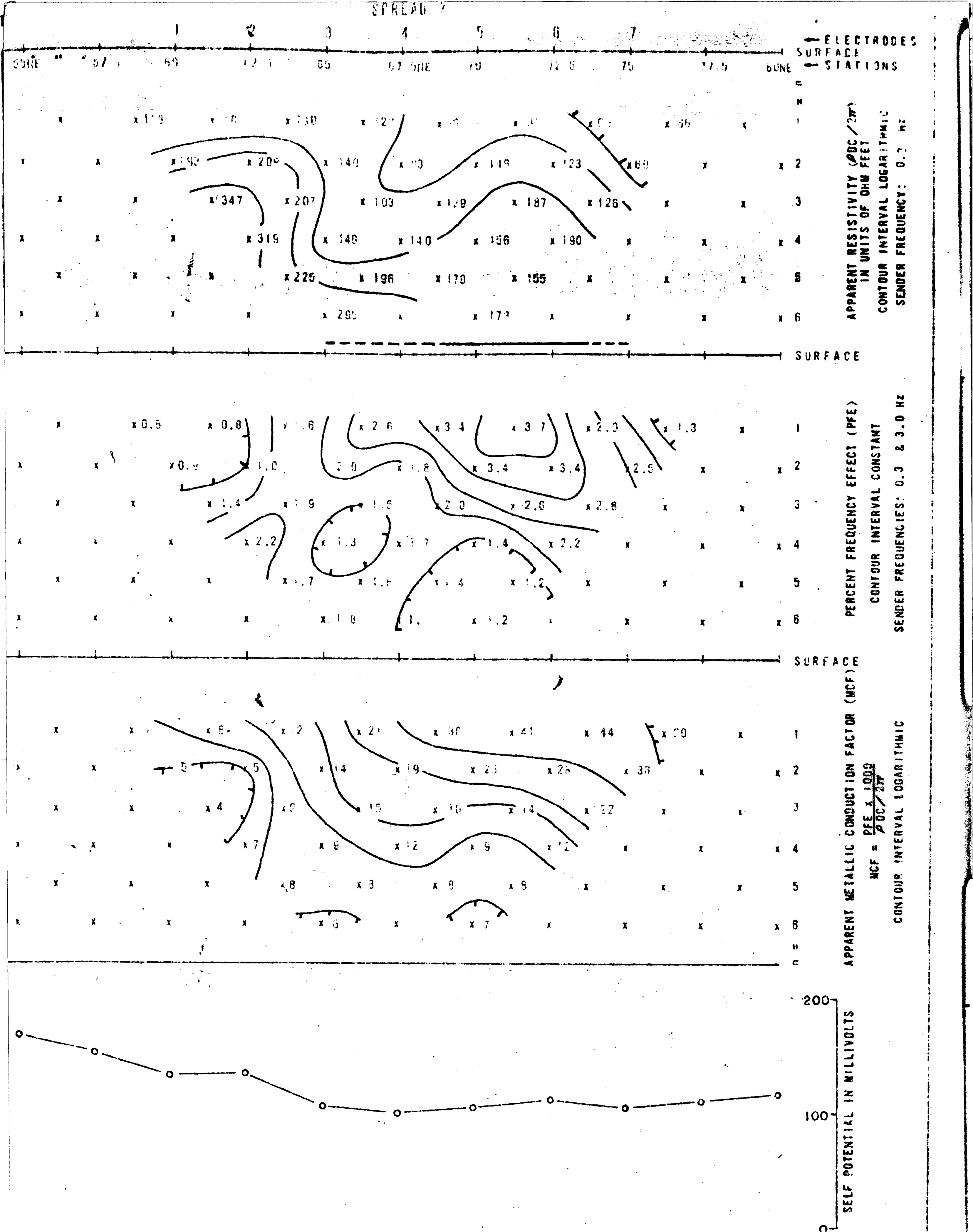
DATE
JAN 1971

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone 439-1793

U.S.A
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable — GEOEX, Tucson




ELECTRODES
SURFACE
STATIONS
SURFACE
APPARENT RESISTIVITY (ρDC/2π)
IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / (ρDC/2π)
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

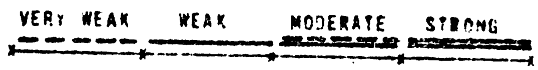
555-70

LINE NO. 3
SPREAD(S) 1 & 2

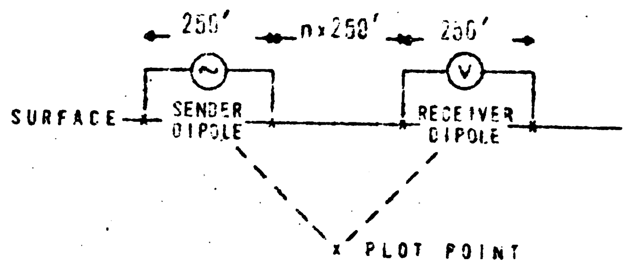
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

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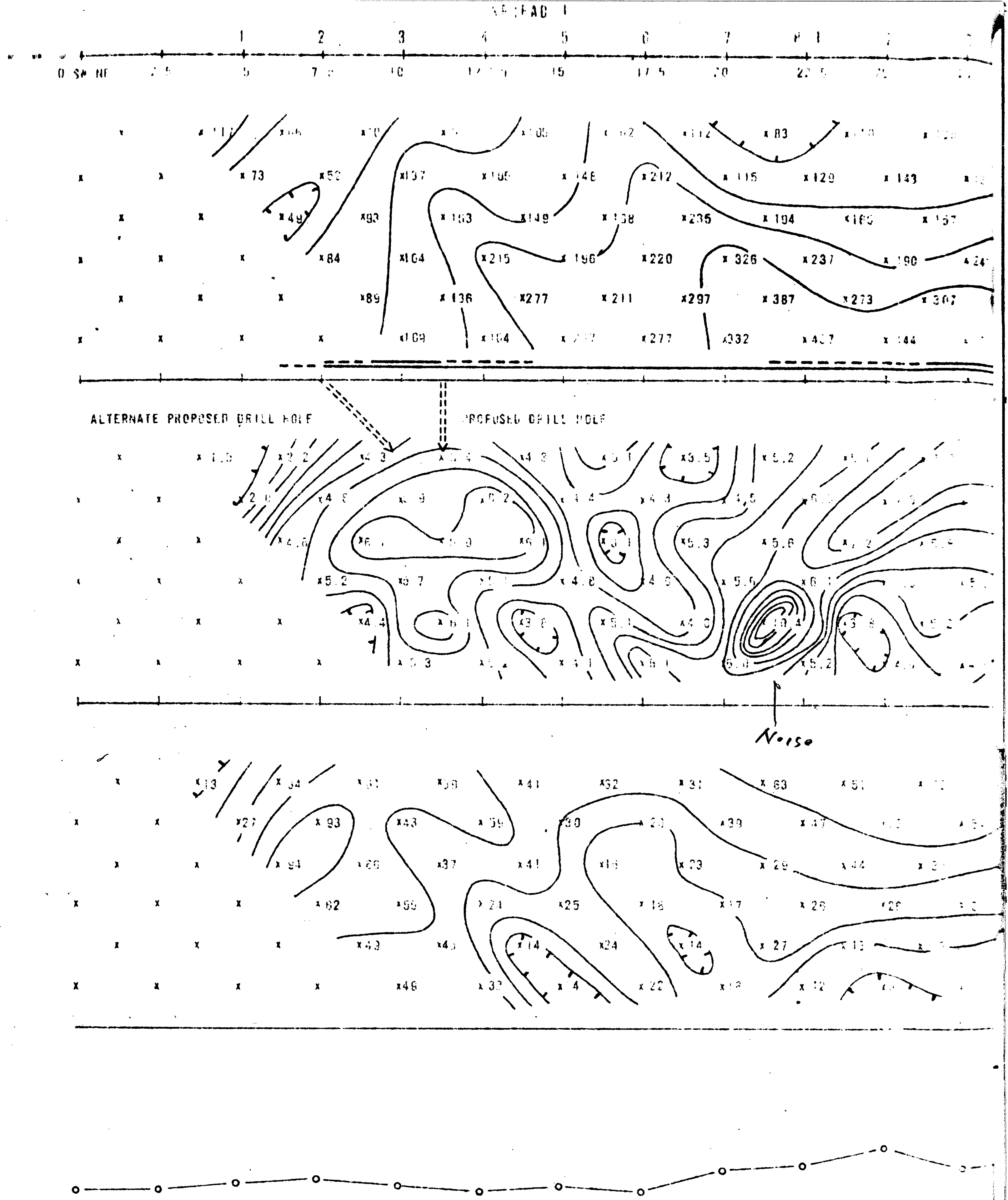
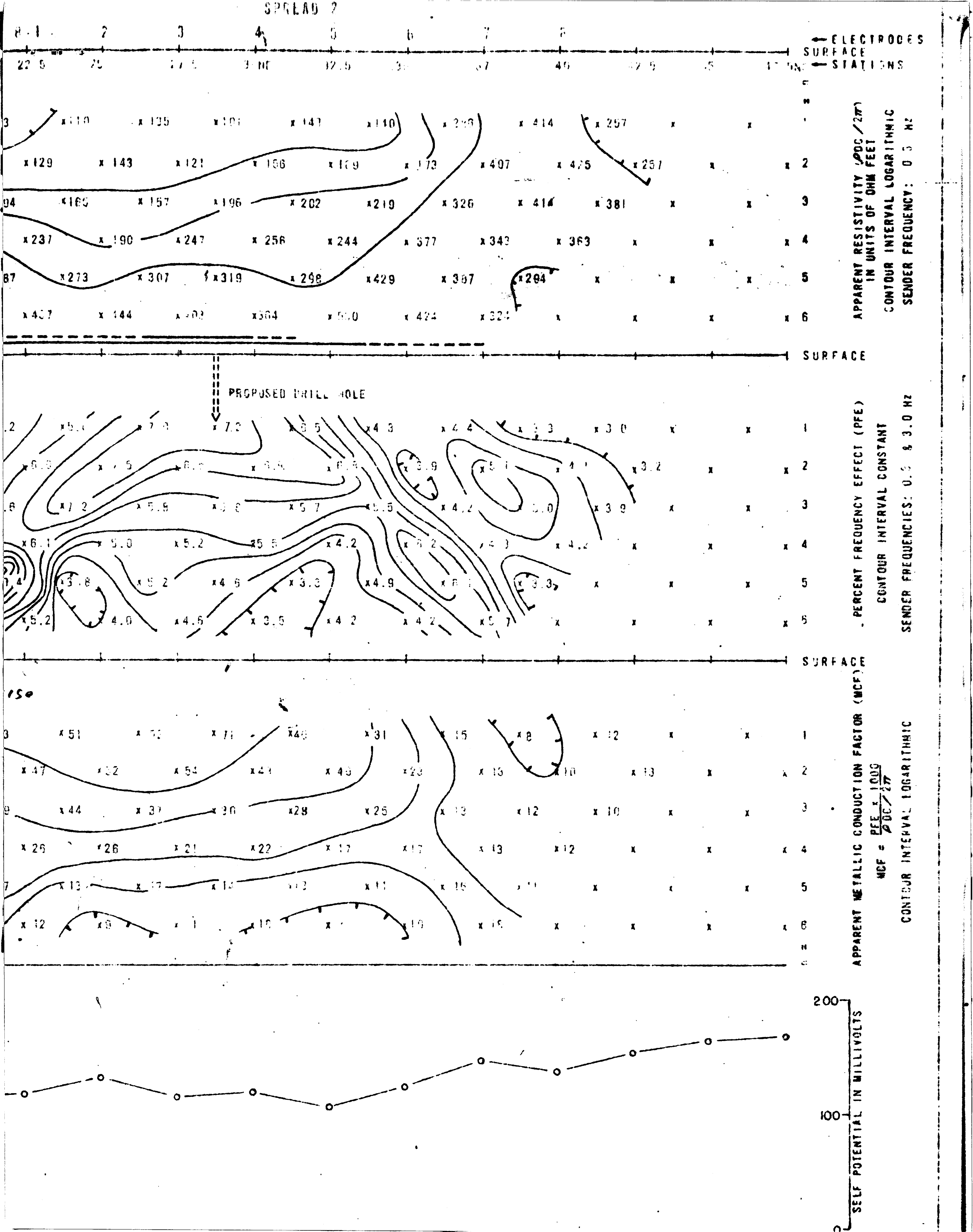
GEOEXPLORATION COMPANY

GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson


ALTERNATE PROPOSED DRILL HOLE
PROPOSED DRILL HOLE
Noise


SPREAD 2
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SURFACE
PROPOSED DRILL HOLE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.5 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

585-70

LINE NO.
9
SPREAD(S)
1

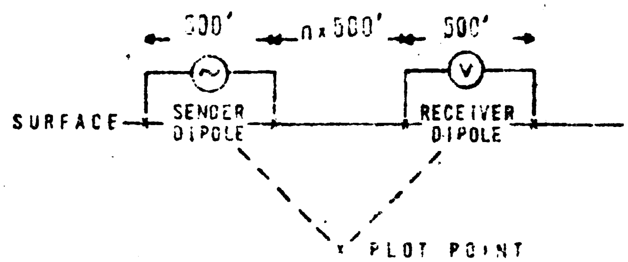
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK   WEAK   MODERATE   STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

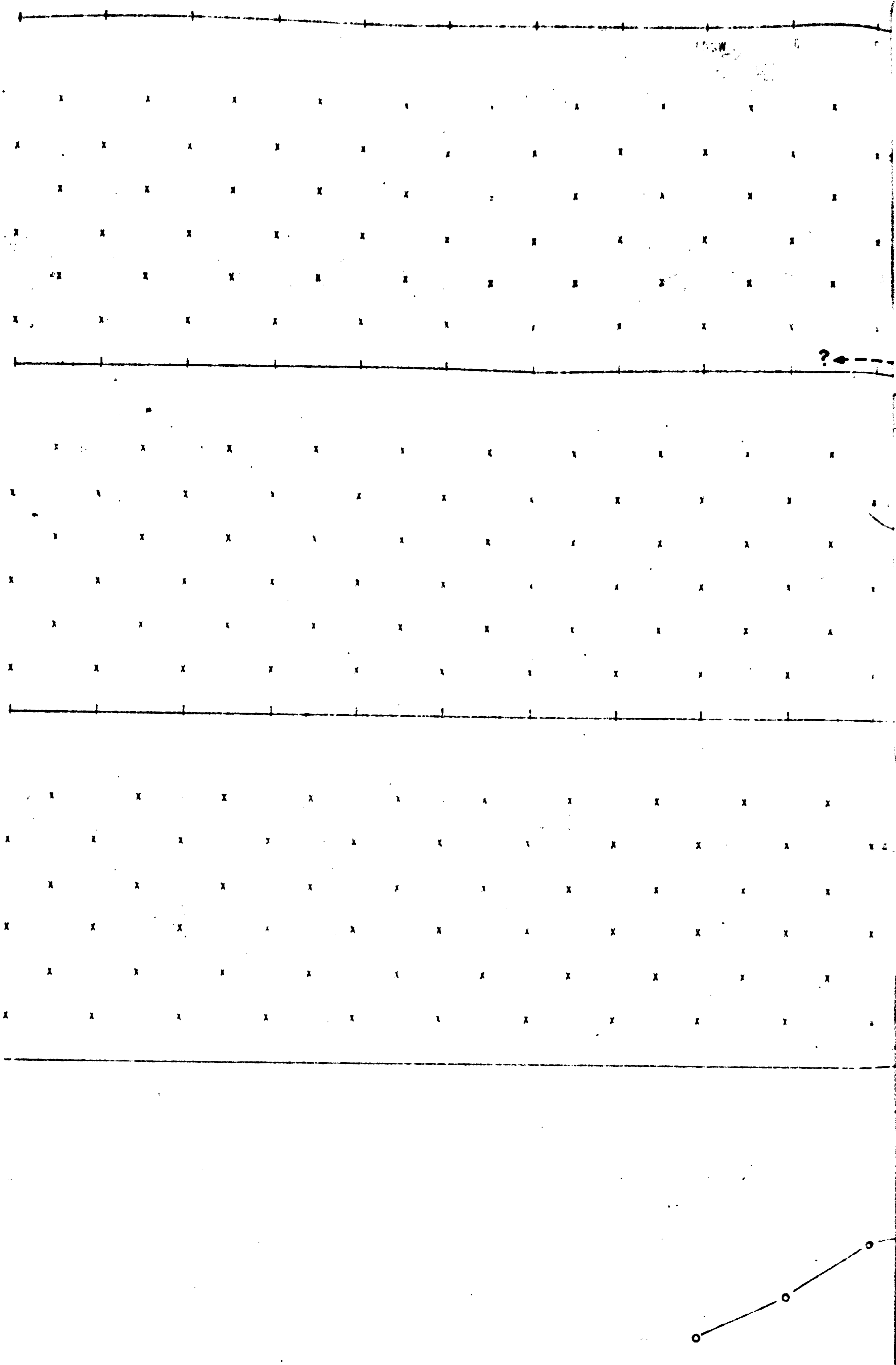
LOOKING
N 25° W

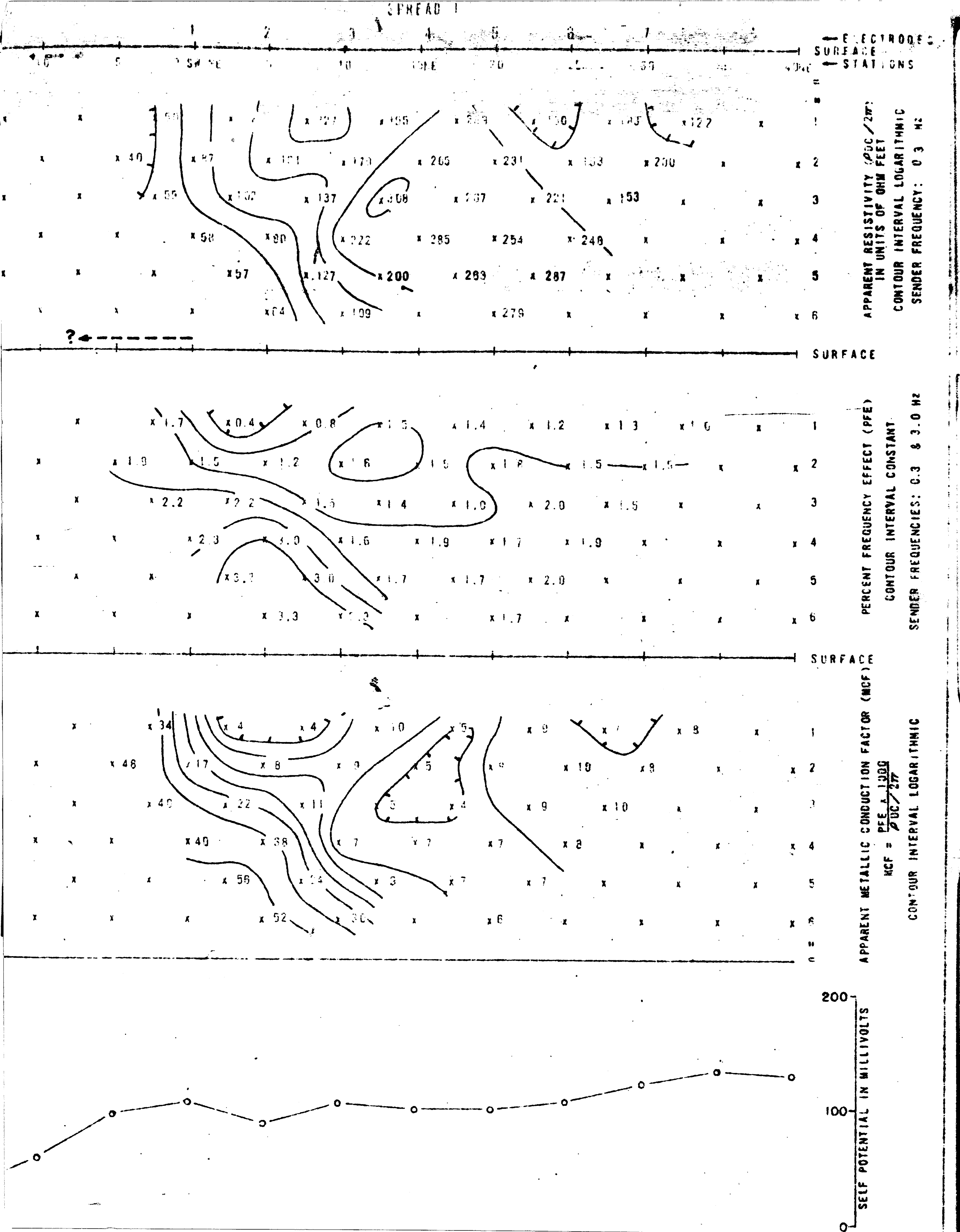
DATE
JAN 1971

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson




SPREAD 1
ELECTRODES
SURFACE
STATIONS
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

INDUCED POLARIZATION SURVEY
ON THE
SUPERIOR PROSPECT
PINAL COUNTY, ARIZONA

FOR

TIPPERARY RESOURCES CORPORATION

DECEMBER 1970

By

Heinrichs GEOEXploration Company
P.O. Box 5964, Tucson, Arizona 85703
Tel: 623-0578

GEOEX Job # 585

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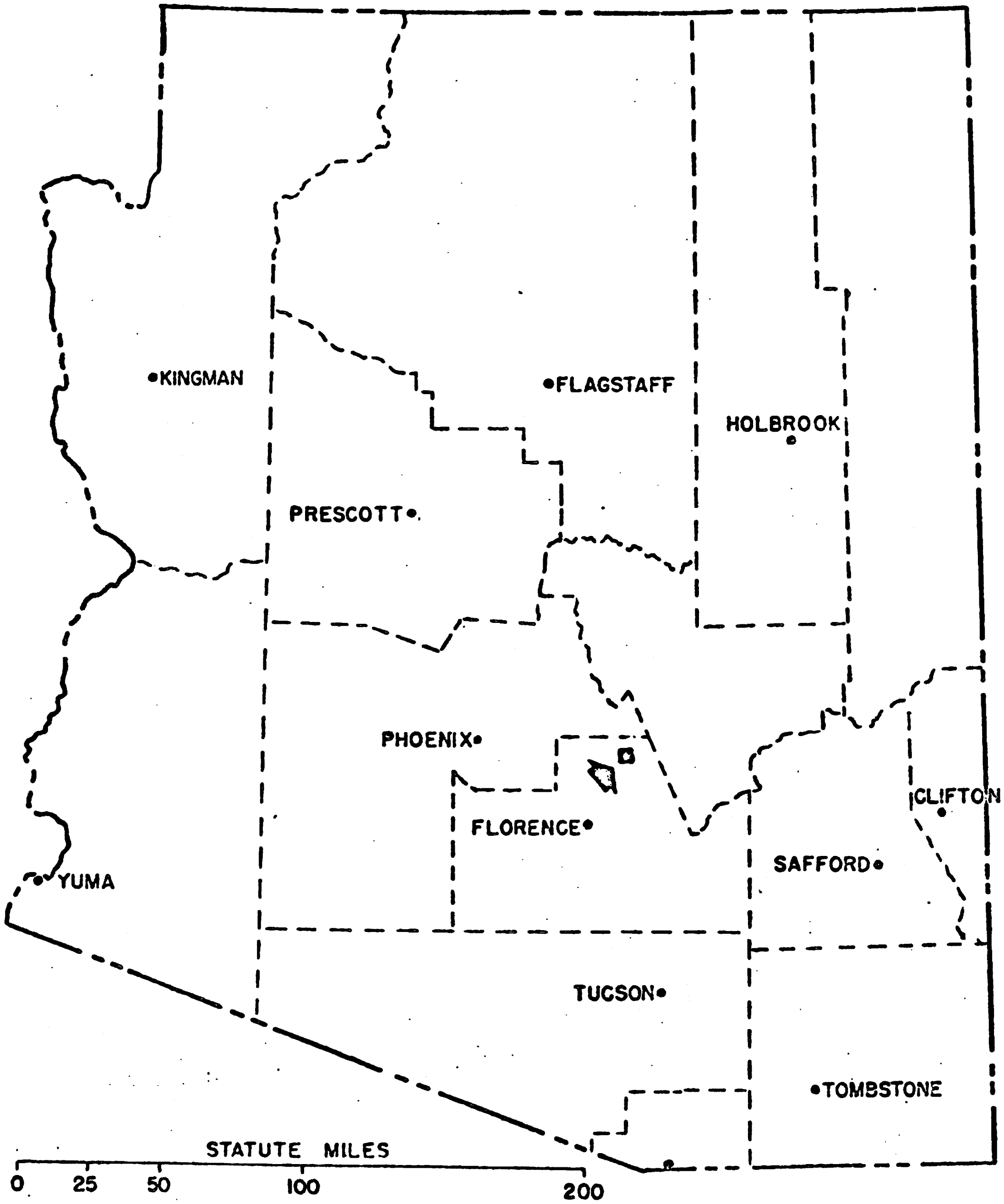
GENERAL LOCATION
of
SUPERIOR PROSPECT
for
TIPPERARY RESOURCES CORPORATION

ARIZONA



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GEOEXPLORATION COMPANY

GEOPHYSICAL ENGINEERS

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Crows Nest, NSW
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U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson

INTRODUCTION

At the request of Mr. C.R. Williams of Tipperary Resources Corporation, Heinrichs GEOEXploration Company conducted a preliminary reconnaissance induced polarization survey over a portion of the Superior Prospect near Superior, Pinal County, Arizona. The field work was done during the interim November 4 to November 17, 1970.

A total of four lines as positioned by the client were completed and consist of seven spreads. Lines 1, 2 and 3 are roughly parallel to each other and oriented approximately N70^{o}E. Line 4 crosses the other three lines and is oriented roughly normal to them. Lines 1 and 2 were run both on 500 foot and 250 foot dipole spacings while Lines 3 and 4 were run only with 500 foot spacings. A partial second spread was added to the west end of Line 3 to obtain the desired length of coverage. See the plan map for details of line location.

The dual frequency I.P. technique was used with sending frequencies of 0.3 and 3.0 Hz. The collinear dipole-dipole array was the electrode configuration employed, which on a 500 foot spacing should typically give resolvable penetration within the zone from roughly 150 feet to 600 or 750 feet below surface. The detail 250 foot data would penetrate proportionally less but with a corresponding increase in resolution.

The purpose of this survey was to locate in a reconnaissance fashion any geophysically significant subsurface sulfide zones, hopefully similar to the nearby Magma Mine mineralization, in an area of Pinal Schist with minor surface oxide copper showings, iron staining and alteration.

The data are presented on sectional data sheets, one for each line and spacing, showing resistivity, percent frequency effect (PFE) and metallic conduction factor (MCF) contoured in section and self potential (SP) in profile form. An "Induced Polarization Location and Interpretation Plan" is also included and shows the surface projected plan interpretation at a scale of 1" = 500' to overlay the "Geology of the Superior Prospect" map supplied by Tipperary. For additional details as to theory, interpretation and presentation, refer to the "Basis of the Induced Polarization Method" appended to the report.

GEOEX personnel involved in the field work were G. Hix, geophysical crew chief, W. Hitchcock and J. Masciandaro, technical assistants. Initial site and office supervision by P. Head, Geophysicist. Final report by C. Ludwig, Senior Geophysicist, assisted by Mr. Head and the GEOEX staff. We hereby wish to express our appreciation to Mr. Zelinski of Tipperary for his assistance to the crew in the field.

CONCLUSIONS

No Induced Polarization response typical of the Magma Vein type of massive sulfide mineralization was located in the area surveyed. However, interesting polarization effects more typical of disseminated mineralization have been partially delineated. The strongest response is noted east of Line 4 on Lines 1 and 2 in an ill-defined complex zone which crudely correlates with a rather heavily fractured and iron stained portion of the Pinal Schist bordering on and south of the rhyolite intrusive as based on the geology map.

Insufficient geophysical coverage is available to interpret this anomalous zone in detail and the zone is open-ended to the east on Line 2 and to the north on Line 4. Based on available data, the strongest response on Line 1 seems to be roughly between 0.0NE/SW and 5.0SW, perhaps bounded on the northeast by the southwest contact of the rhyolite intrusive, and is likely directly related to the heavily iron stained NNW fracture mapped near station 2.5SW. The strongest response on Line 2 is mainly east of 17.5NE to at least 30.0NE and is not obviously related to any particular mapped geologic feature within the schist although several iron stained fractures project into the area of anomalism.

No significant appearing polarization response is noted on Line 3 thereby defining a southern limit to the zone of anomalism noted on Lines 1 and 2. Line 4 is likely just within the western limit of anomalism or may even be a lateral response from polarizable material just to the east.

The cause of the anomalous I.P. response is probably metallic lustered sulfides. However, the lack of well defined directly correlating resistivity lows plus the lack of any correlating self potential lows, suggests that non-sulfide polarizers should not be ruled out as a cause of the anomalism. Metallic lustered non-sulfide polarizers would include magnetite and other iron or manganese oxides and graphite. In rare cases, clay can contribute to the response.

If sulfide caused, the stronger portion of the anomaly suggests roughly from 1 to 3% total sulfide by volume (approximately 2 to 6% by weight) based on the interpreted source geometry and on a comparison with "typical" disseminated sulfide zones in the Southwest. These estimated percentages are only meant to be a crude relative guide and in practice are often found to be at variance with actual average assays for sulfide. Regardless, the indicated polarizer concentration, if mainly sulfide, is high enough to be of economic interest providing the ratio between ore polarizers such as chalcopyrite, molybdenite, etc., to the non-ore polarizers such as pyrite, magnetite or graphite is reasonably high.

The depth to the top of the anomalous source is probably within 150 feet of the surface on the Line 1 anomaly and possibly as deep as 250 feet on the Line 2 anomaly. The Line 1 anomaly appears to be caused by a rather steeply dipping tabular source having good depth persistence and which is probably 250 to 500 feet in width in the strongest portion. The Line 2 anomaly has the aspect of a broad, relatively flat lying, source perhaps with limited thickness as evidenced by the decreased PFEs and MCFs on the deeper readings. A thickness of 200 or 300 feet is suggested.

Conceivably, this layered aspect on the Line 2 anomaly could be reflecting a supergene enriched sulfide blanket although other possibilities such as a weathering phenomenon or lithologic or structural control of mineral emplacement need be considered.

The apparent resistivities show several features of possible interest. Line 1, particularly on Spread 2, shows two level changes (interfaces) suggesting rock type changes near 2.5SW and 5.0NE which are probably related to the rhyolite intrusive and the iron stained fracture near the southwest margin of the intrusive. East of 5.0NE, the resistivities are very high - perhaps indicating that the intrusive is tight, relatively unaltered and unmineralized. The zone between 5.0NE and 2.5SW is intermediate in resistivity level and west of 2.5SW the resistivity becomes even lower perhaps reflecting rather altered or weathered schist. The stronger portion of the Line I.P. anomaly seems to closely correlate with or be related to the resistivity interface near 2.5SW. Much of the other coverage shows a general increase in apparent resistivity with increased depth, likely the effect of decreased weathering with depth.

The self potentials show only background variations suggestive of a lack of significant quantities of actively oxidizing relatively interconnected sulfides in the vicinity of the lines within several hundred feet of the surface. This is not necessarily in opposition to the anomalous I.P. results which, even if sulfide caused, could possibly be too disseminated and/or too deep for appreciable S.P. effects to develop or be detected. Of course, a non-sulfide cause of the I.P. anomalism would also explain the lack of S.P. response.

RECOMMENDATIONS

Ideally more I.P. coverage should be obtained to better define the zone of anomalism before selecting drilling targets. Additional coverage is particularly recommended between Lines 1, 2 and 3 plus extending Line 2 (and perhaps Line 1) further east to find the eastern limit of the anomalous zone. Some coverage should also be considered north of Line 1.

In lieu of more coverage, some preliminary drilling could be done to see if the anomalism located to date is of enough interest to warrant additional follow up I.P. coverage. In this regard, two drilling recommendations are given in order of geophysical priority:

Proposed Drill Hole #1: A vertical drill hole collared near station 26.0NE on Line 2 is recommended to test the most interesting portion of the Line 2 anomaly. This hole should be programmed to go 500 feet in total depth to evaluate the zone of interest unless the anomalism has obviously been explained at a shallower depth.

Proposed Drill Hole #2: A vertical hole collared near 2.5SW on Line 1 is recommended to evaluate the Line 1 anomaly. This hole should be drilled to at least 500 feet in depth to test the zone of interest although polarizable material should be seen within 150 feet or so of the surface. In that steep dips may be involved in the anomaly, angle drilling could be considered to increase the chances of intersection, particularly if there is any geologic data as to expected dip directions. See the drilling comments section below for further points to consider in this regard.

If either of these two holes produce interesting results, the additional I.P. coverage as recommended above should be obtained to aid in delineating other targets. Two other lower priority drill holes are also suggested depending on results of the initial drilling:

Proposed Drill Hole #3: A vertical hole collared near 21.0NE on Line 2 should sample a geophysically similar zone to proposed hole #1. Likewise, the hole should be programmed to go 500 feet in depth.

Proposed Drill Hole #4: A 500 foot plus vertical hole could be considered on the fringe of the I.P. anomaly on Line 2 near station 14.0NE on a MCF high within a zone of intermediate PFEs and resistivities.

All of the above drilling should of course depend on the results of drilling higher priority holes, or any existing drilling results plus any geological and geochemical or additional geophysical information available, all of which should be in constant correlation.

Additional geophysical drill targets can be located by reference to the surface projected plan interpretation and its correlation with all information to date. The weaker fringes of the I.P. anomalism should also be given some consideration especially if in an area having evidence of a favorable copper to iron ratio. In some mining areas, it is found that the weaker I.P. zones are of more interest than the stronger portions which may only be reflecting high pyrite concentrations. In this area, initial attention has been focused on the stronger zones in the hope that they would have the highest probability of being economically interesting.

Consideration should also be given to obtaining ground magnetic coverage to further help in delineating the geology and determine if there is any magnetite relating to the polarizable zones. A geochemical survey may also prove useful in defining the more cupriferous areas of the anomalous zone particularly if it is sulfide caused.

COMMENTS ON DRILLING I.P. TARGETS

To maximize the probability that a recommended drill hole will intersect the source of an induced polarization anomaly, the following points should be considered:

1. The anomaly has been caused by some physical property, hopefully a polarizable body containing economically interesting metallic mineralization, and this property should be determined before abandoning the anomaly.

2. Location of drill holes should be made relative to the actual sending and receiving electrode positions as they exist on the ground.

3. Due to inherent limitations in the I.P. method, depth interpretations are only approximate and the determination of dip is severely limited, particularly for angles greater than 45°. Also, targets can generally be laterally resolved no finer than the station spacing (dipole length). Because of these limitations, targets less than one dipole spacing in width, particularly when steeply dipping or deeper than the dipole length, may be difficult to intersect. In these cases, several drill holes in a fence line should be considered. For the steeply dipping cases, angle drilling may also prove advantageous, mainly where the direction of

dip can be geologically inferred and the drill hole oriented such that an optimum intersection of the zone of interest is obtained.

4. An observed anomaly can be the effect of a polarizable body laterally offset to the side of a line and therefore if practical, drilling should be confined to those portions of the anomalous zones well defined by several lines. Also, it should be noted that a single line cannot define the strike direction of an elongate anomalous zone - another reason for utilizing several parallel lines.

5. Logging of the drill core <u>must</u> be done with special care to note the quantity of <u>all</u> possible polarizable material such as pyrite, graphite, magnetite, manganese oxides and clay minerals as well as the polarizable ore minerals. The anomalous source could conceivably be overlooked if the core is not carefully logged.

6. Typical sections of core representing the gross physical properties of material encountered in the drilling should be tested in the laboratory for their I.P. parameters, if there is some doubt about confirmation of the anomalous source.

INTERPRETATION

<u>Line 1 (Spread 1, a = 500' and Spread 2, a = 250')</u>: Spread 1 shows a moderate strength I.P. anomaly mainly between 0.0NE/SW and 5.0SW with weak to very weak fringes extending the zone roughly 500 feet both to the east and west. The anomaly has a near surface source with good depth persistence and appears to be related to the west flank of a gradational resistivity interface near 2.5NE. The resistivity interface shows quite resistive material to the east on the rhyolite intrusive and lower resistivities to the west in the schist. The resistivity and I.P. pattern east of this interface indicates decreasing resistivity and increasingly anomalous I.P. effects at depth in turn suggesting that anomalous material persists in the schist south of the intrusive - being sensed as a lateral effect to the south of the line rather than effects at depth vertically below the line.

Spread 2 was run to delineate the anomalous zone in more detail and at a somewhat shallower depth. The stronger effects are still mainly between 0.0NE/SW and 5.0SW although the edges are somewhat better defined; the east edge being quite abrupt and the west boundary more gradational. The overall pattern suggests a steeply dipping tabular body between 250 and 500 feet in width coming to within 150 feet of the surface. The gradational resistivity interface noted near 2.5NE on Spread 1 is resolved into two more definite interfaces on Spread 2; near 5.0NE and 2.5SW. The I.P. anomaly appears to be intimately related to the 2.5SW interface. A very weak narrow I.P. anomaly of questionable significance is noted near 12.5SW evidenced mainly as a string of higher PFEs pointing towards that station.

No significant self potential response is seen on Spread 2. A broad low centered near 0.0NE/SW on Spread 1 was not verified by Spread 2 and is therefore not considered to be valid and was perhaps caused by drifting potential electrodes or telluric noise.

<u>Line 2 (Spread 1, a = 500' and Spread 2, a = 250')</u>: Spread 1 shows only background I.P. effects on its west half. The east half of the spread gradually increases to a moderate strength anomaly east of about 12.5NE continuing eastwards to at least 20.0NE where lack of coverage prevents complete interpretation. As on Line 1, the I.P. response is associated with a change in resistivity, namely an increase to the east but no well defined interfaces are noted as on Line 1. The I.P. anomaly appears to have a near surface source with a decrease in strength with increased depth implying a bottom to the anomaly source.

Spread 2 was run across the east half of Spread 1 to better delineate the anomaly with shorter dipoles. The anomaly has a quite pronounced layered aspect suggesting a tabular source, fairly flat lying, perhaps 250 feet in depth to its top and 200 to 300 feet in thickness. There is some indication that the source very gradually becomes shallower to the east limit of coverage near 30.0NE from the deeper west end near 12.5NE. The anomaly is open-ended on the east and may be slightly increasing in strength in that direction. The resistivities on this spread show decreased values west of about 15.0NE and an increase with depth east of about 20.0NE likely due to decreased weathering with depth. No significant appearing self potentials are noted on either spread.

Line 3 (Spreads 1 and 2, a = 500'): No definitely anomalous I.P. effects are seen on this line. A very weak, questionably significant, narrow zone of slightly increased PFEs are noted near 17.5SW showing no obvious correlation with the geology or other I.P. lines. East of about 10.0SW the PFEs show a general increase with depth but the resistivity is so high that the MCFs are very low background in strength and therefore probably not of interest. There is an ill-defined resistivity interface near 27.5SW west of which the resistivity is lower. A narrow high resistivity zone is seen near 22.5SW not correlating with any obvious geologic feature. The self potential shows only background variations along the traverse.

Line 4 (Spread 1, a = 500'): The south half of the traverse shows only very low background I.P. effects. The north half of the line is weakly but definitely anomalous and ties in with the western fringes of anomalous response on Lines 1 and 2. The anomalism here is similar to that on the Line 2 in that it exhibits a layered aspect in a similar depth range. It is possible that much of this traverse is responding laterally to a polarizable zone lying mainly to the east thereof. The resistivities are quite complex within the zone of I.P. anomalism and show a general increase with depth on Line 2. The south half of the line is somewhat lower than the north half on the average but again shows an increase with depth likely due to decreased weathering with depth. Only background self potential variations are noted.

Respectfully submitted,
HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Senior Geophysicist

P.O. Box 5964
Tucson, Arizona 85703
December 1970
GEOEX Job # 585

505-70

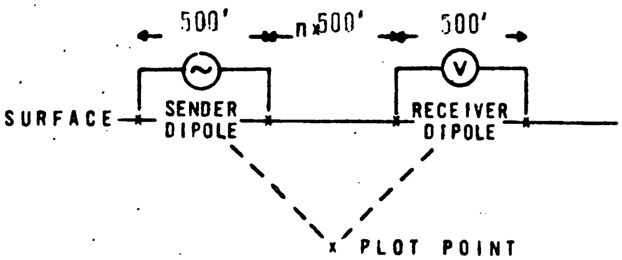
LINE NO.
1
SPREAD(S)
1

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

DIPOLE DIPOLE ELECTRODE ARRAY



AREA

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HEINRICHS
GEOEXPLORATION COMPANY

GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
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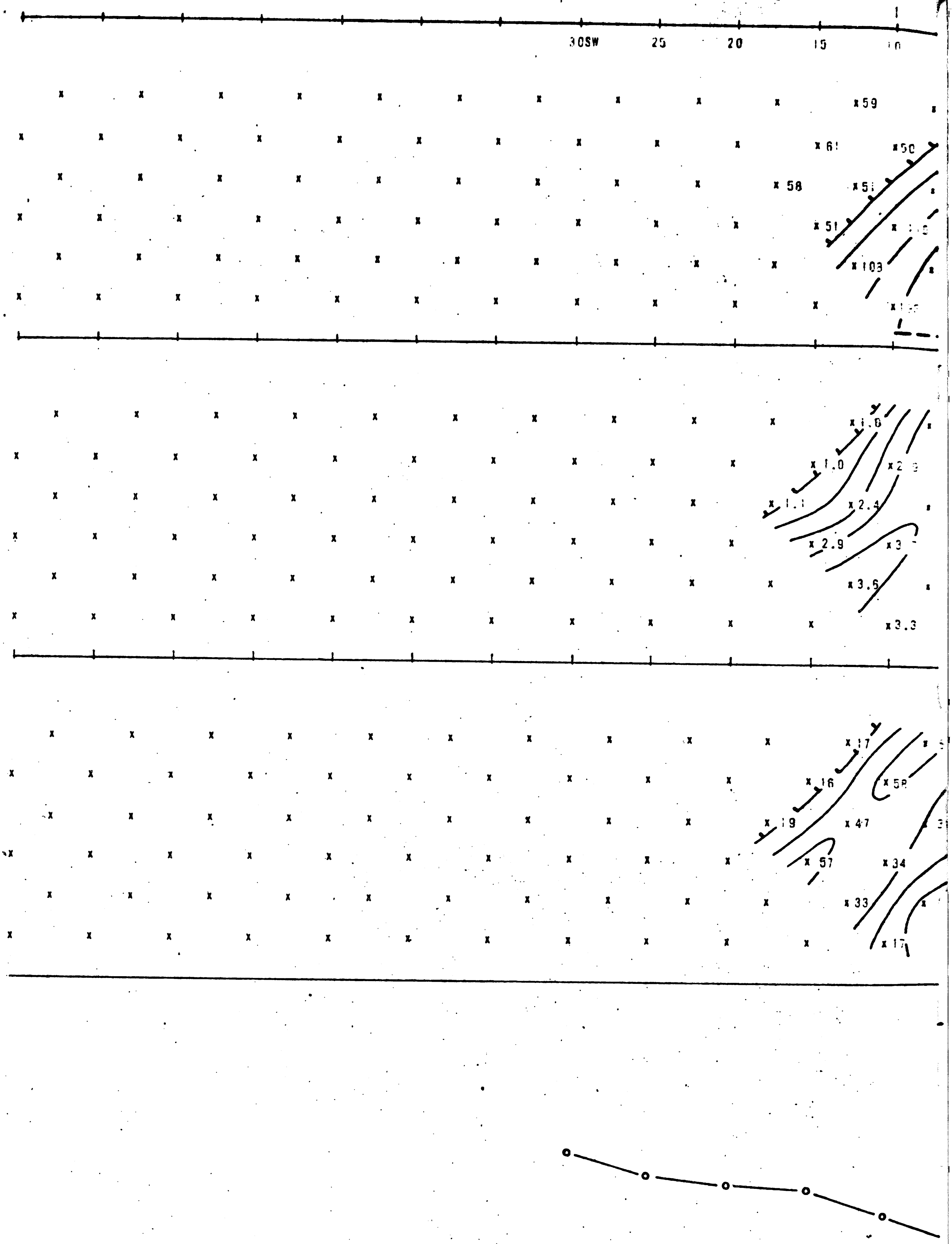

30SW
25
20
15
59
61
58
51
103
1.0
2.4
2.9
3.6
3.3
17
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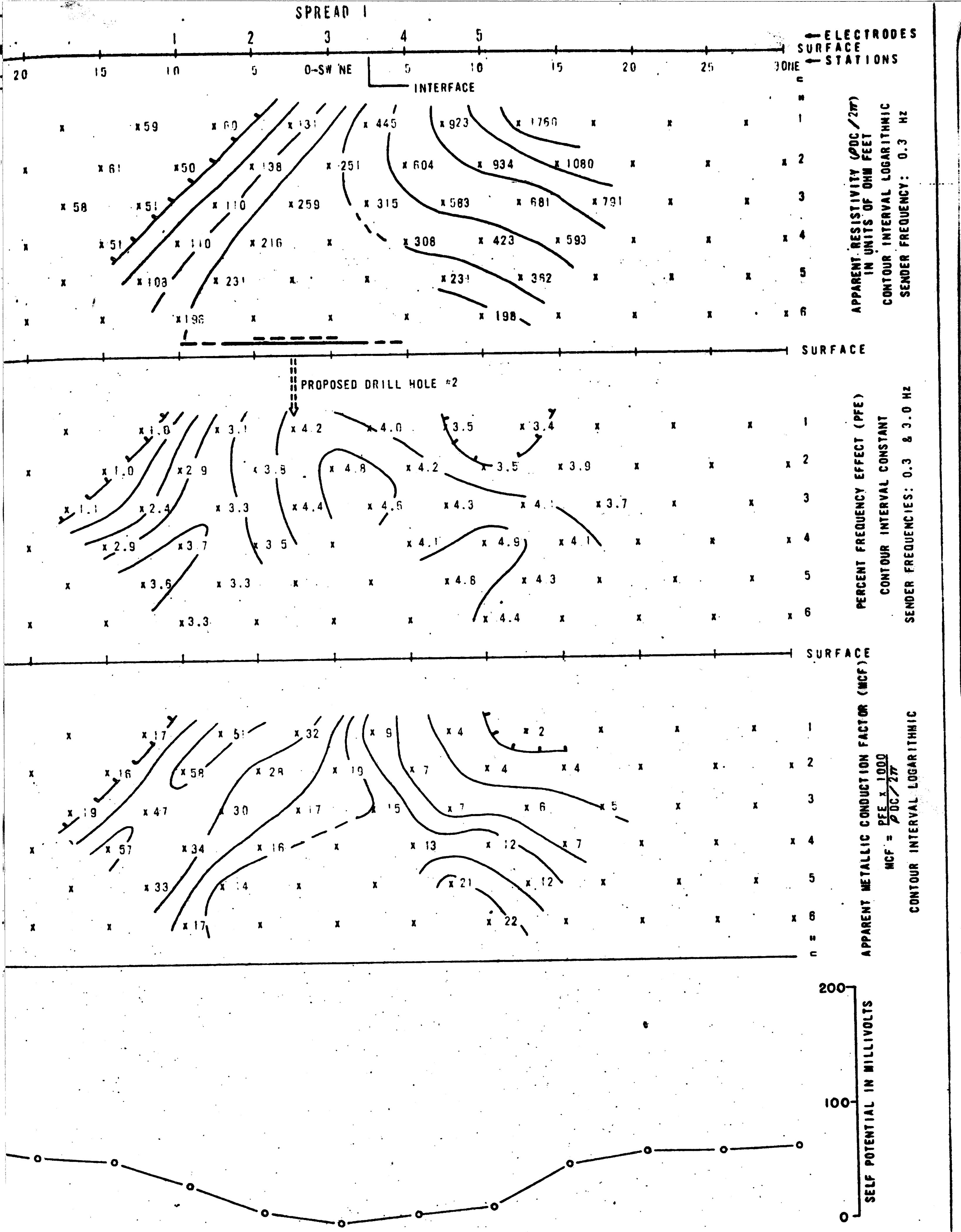
19
47
57
34
33


SPREAD 1
ELECTRODES
SURFACE
STATIONS
0-SW NE
30NE
INTERFACE
APPARENT RESISTIVITY (ρDC / 2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PROPOSED DRILL HOLE #2
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
n =
SELF POTENTIAL IN MILLIVOLTS
200
100
0

LINE NO.
1
SPREAD(S)
2

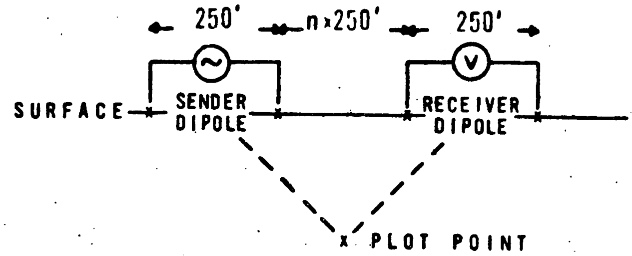
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK | WEAK | MODERATE | STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



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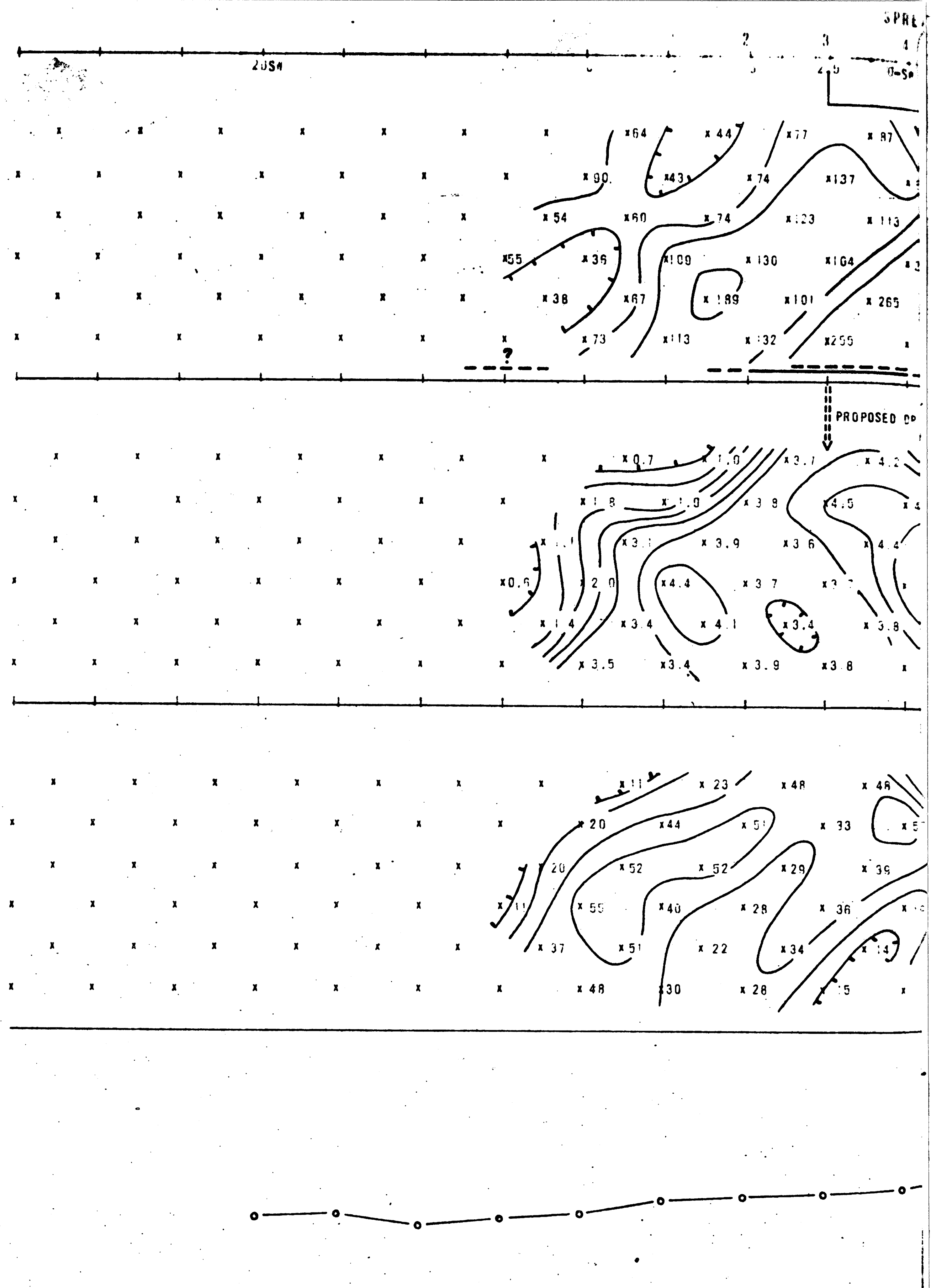
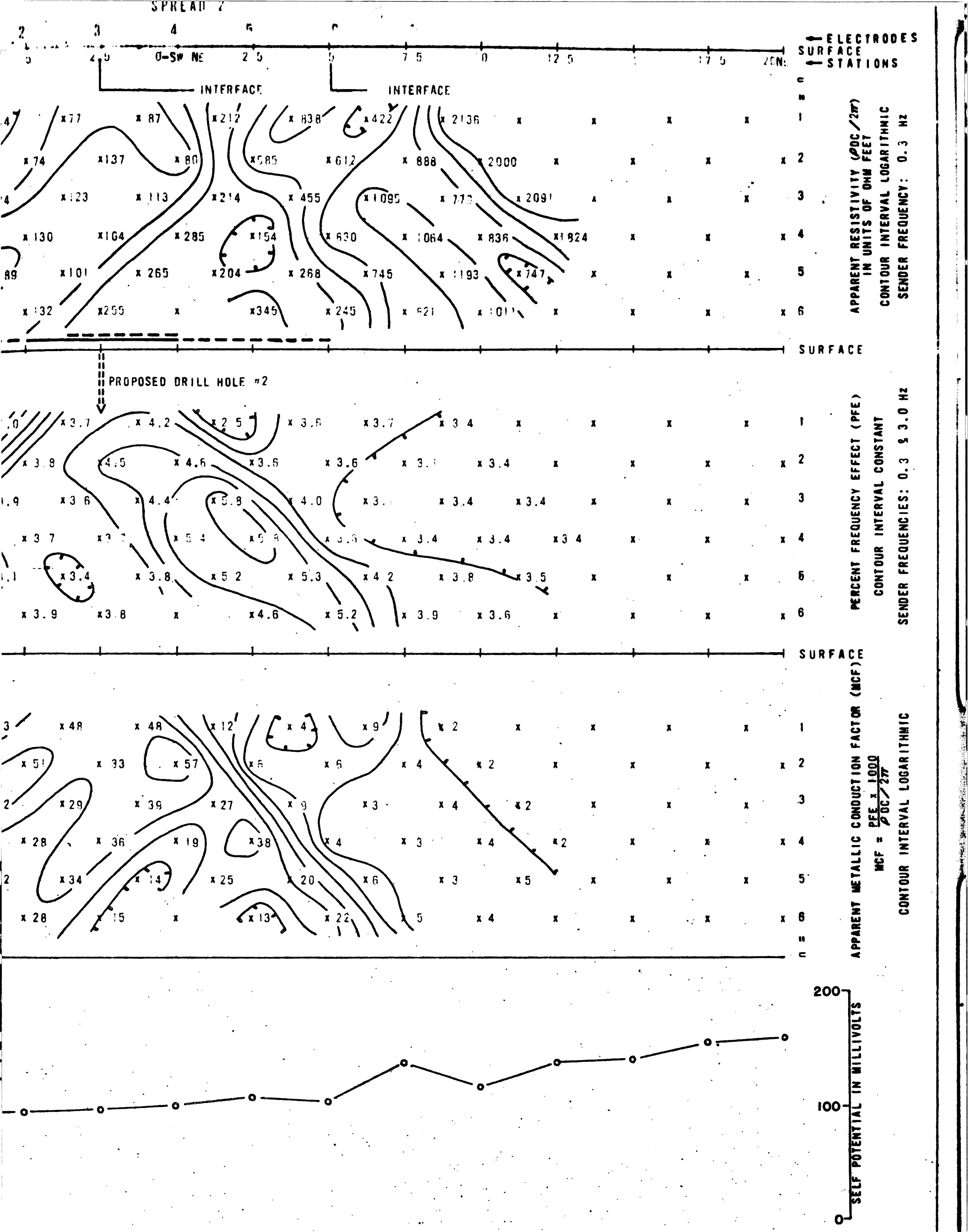

PROPOSED


SPREAD 2
ELECTRODES
SURFACE
STATIONS
0-SW NE
INTERFACE
INTERFACE
SURFACE
PROPOSED DRILL HOLE #2
SURFACE
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

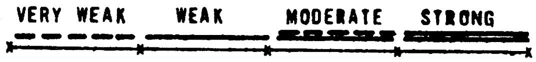
585-70.

LINE NO.
2
SPREAD(S)
I

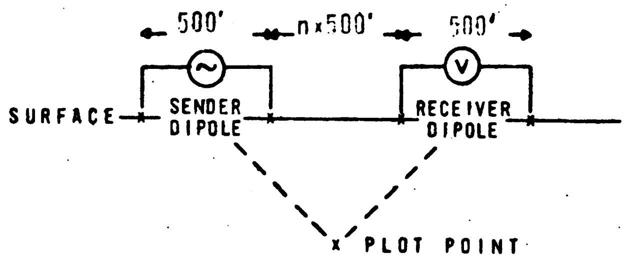
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

W½ - N 40° W

E½ - N 22° W

DATE

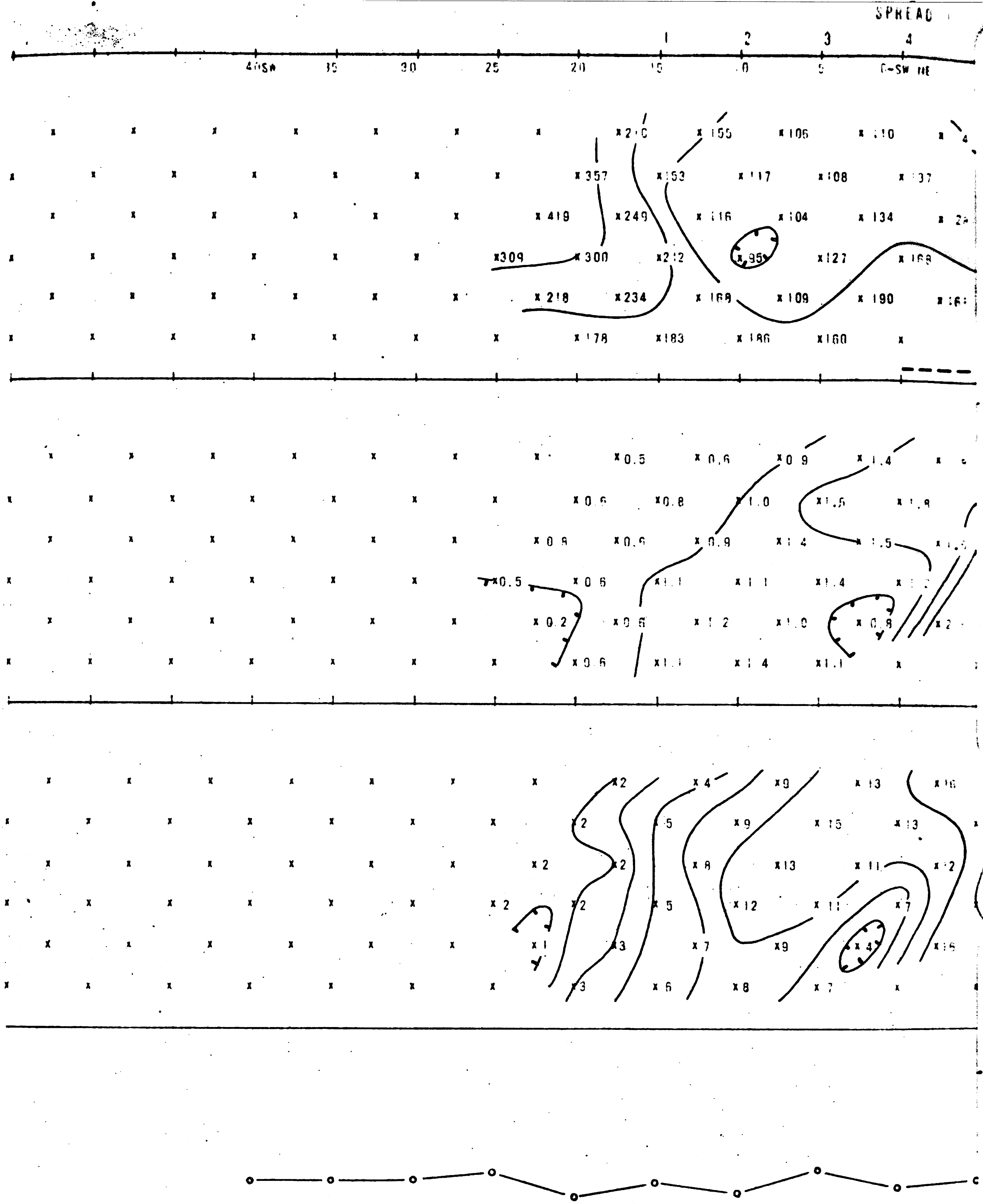
NOV 1970

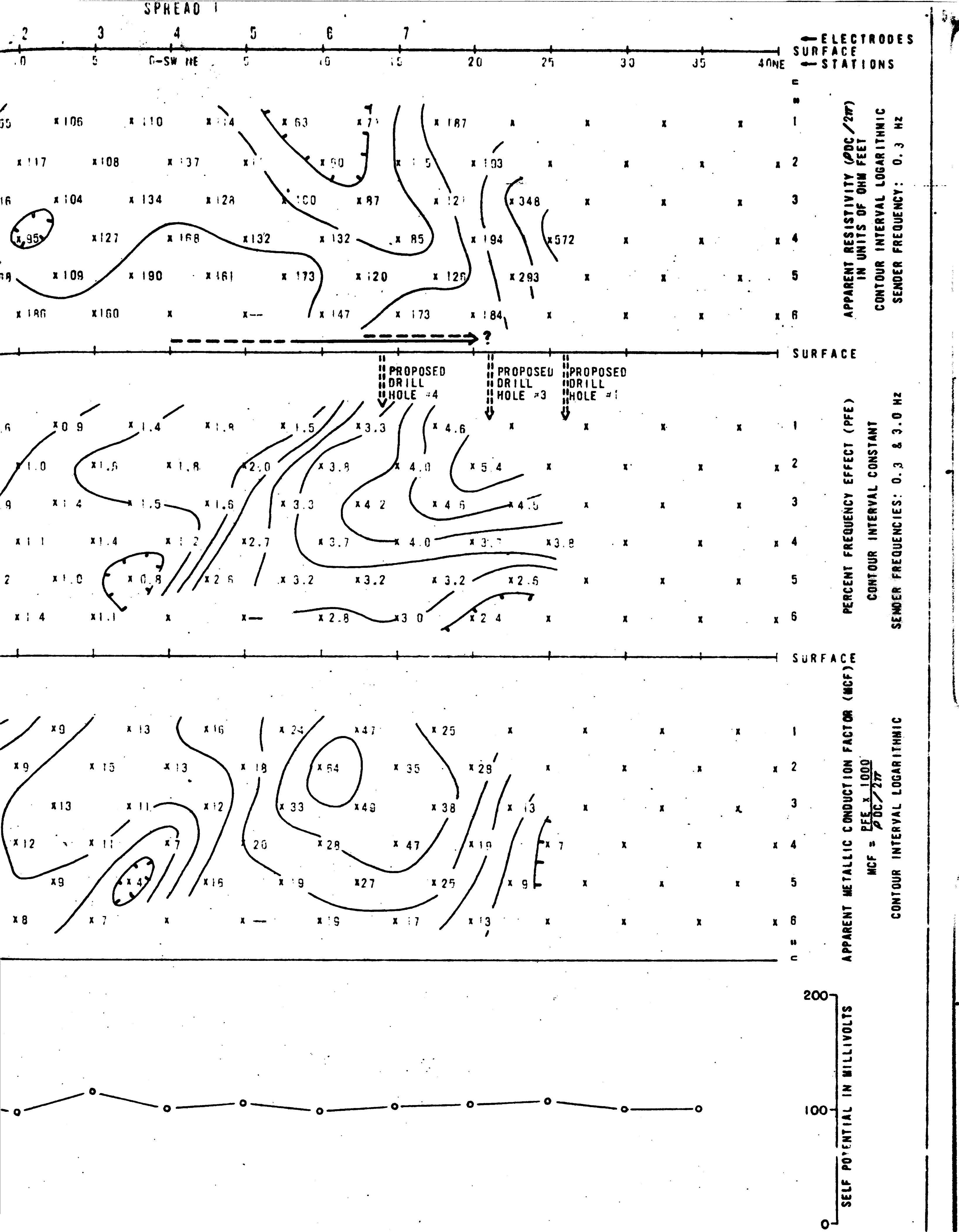
HEINRICHS
GEOEXPLORATION COMPANY

GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
Crows Nest, NSW
Phone: 439-1793

U.S.A.
Post Office Box 5964
Tucson, Arizona 85703
Phone: (602) 623-0578
Cable: GEOEX, Tucson


SPREAD
1
2
3
4
40SW
35
30
25
20
15
10
5
0-SW NE


SPREAD 1
ELECTRODES
SURFACE
STATIONS
0-SW NE
40NE
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PROPOSED DRILL HOLE #4
PROPOSED DRILL HOLE #3
PROPOSED DRILL HOLE #1
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

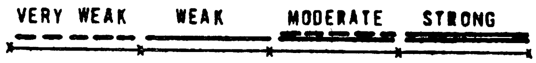
585-70

LINE NO.
2
SPREAD(S)
2

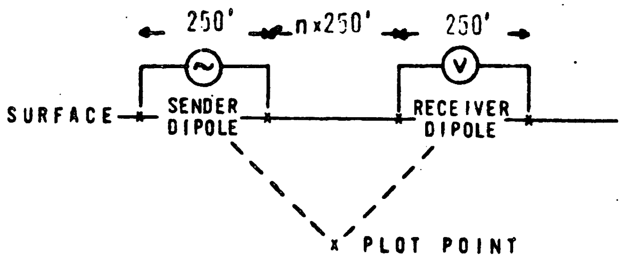
INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

LOOKING
N 22° W

DATE
NOV 1970

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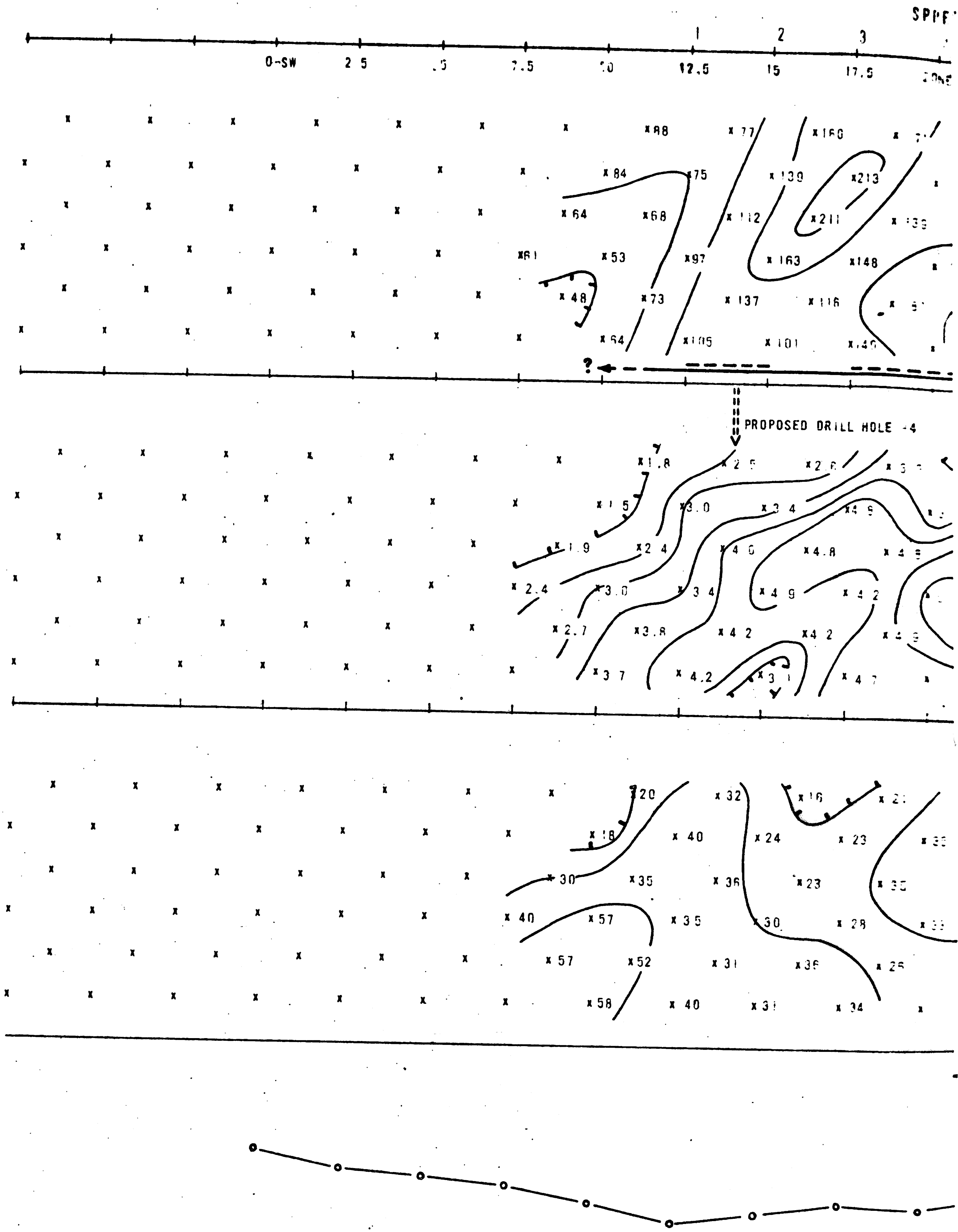
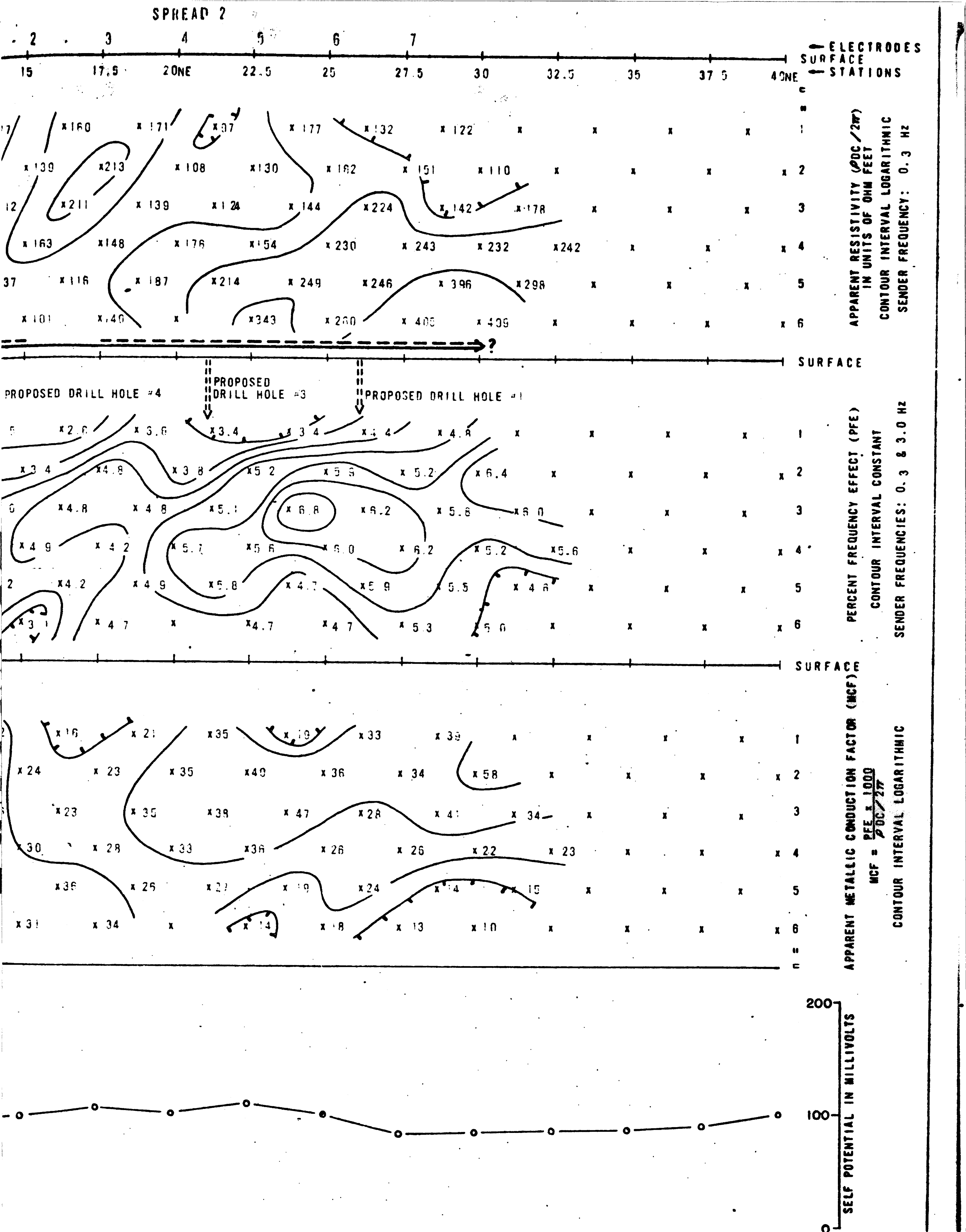


0-SW
2 5
7.5
12.5
15
17.5
1
2
3
88
77
84
75
139
213
64
68
211
61
53
97
163
148
48
73
137
64
101
PROPOSED DRILL HOLE
1.8
2.5
3.0
3.4
1.9
2.4
4.8
2.4
3.0
3.4
2.7
3.8
4.2
3.7
4.2
20
32
18
40
24
23
30
35
23
40
57
30
28
57
52
58
40
34


SPREAD 2
ELECTRODES
SURFACE
STATIONS
15
17.5
20NE
22.5
25
27.5
30
32.5
35
37.5
40NE
n =
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PROPOSED DRILL HOLE #4
PROPOSED DRILL HOLE #3
PROPOSED DRILL HOLE #1
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

585-70

LINE NO.
3
SPREAD(S)
1 & 2

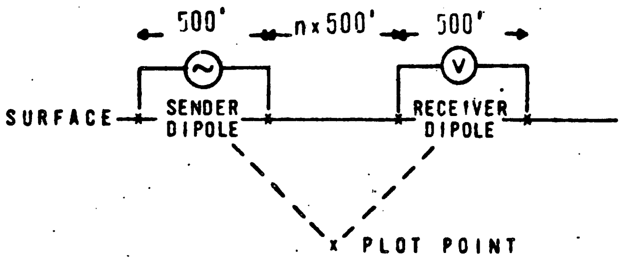
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH

VERY WEAK WEAK MODERATE STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA

SUPERIOR

LOOKING

N 18° W

DATE

NOV 1970

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GEOPHYSICAL ENGINEERS

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(SYDNEY)
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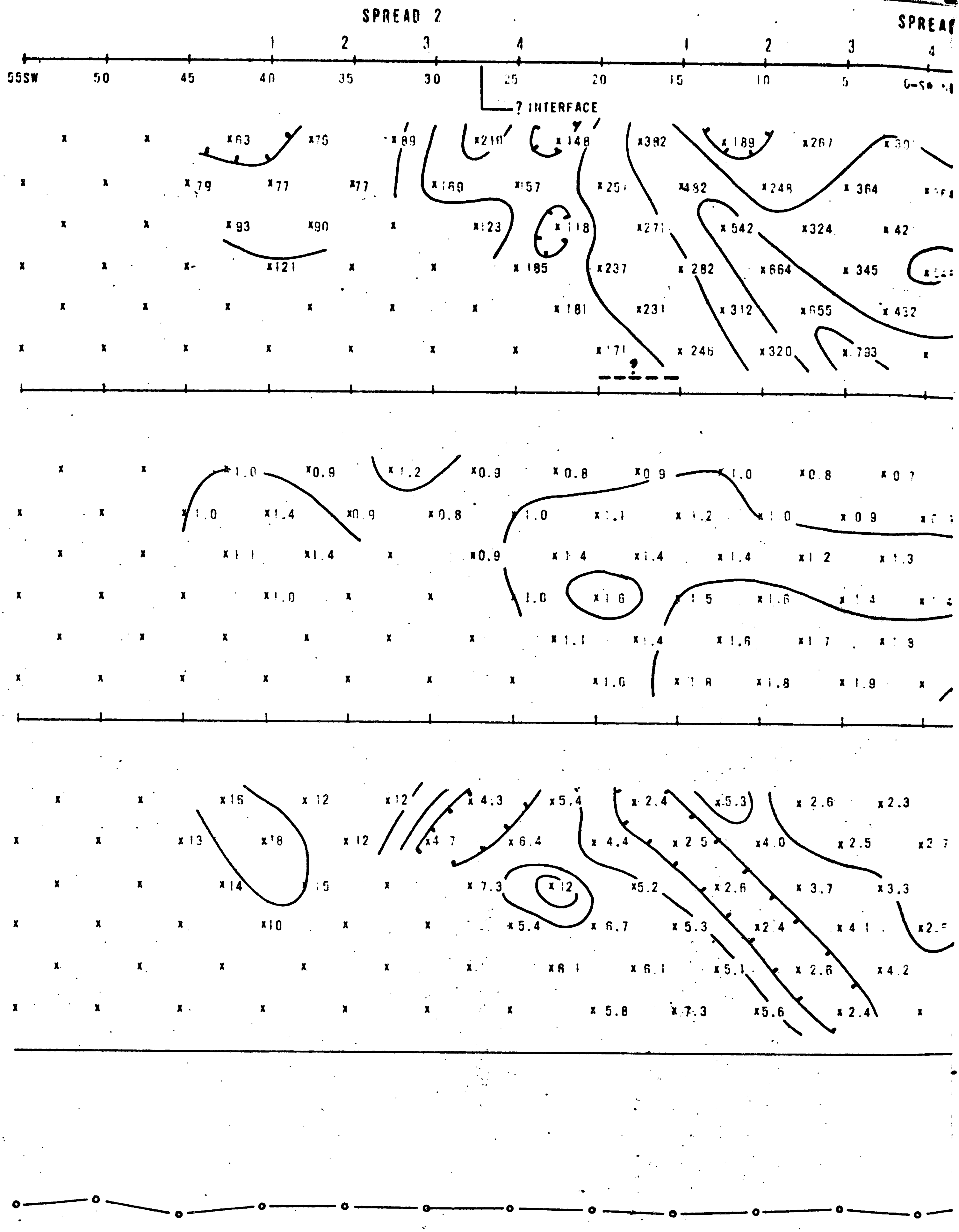
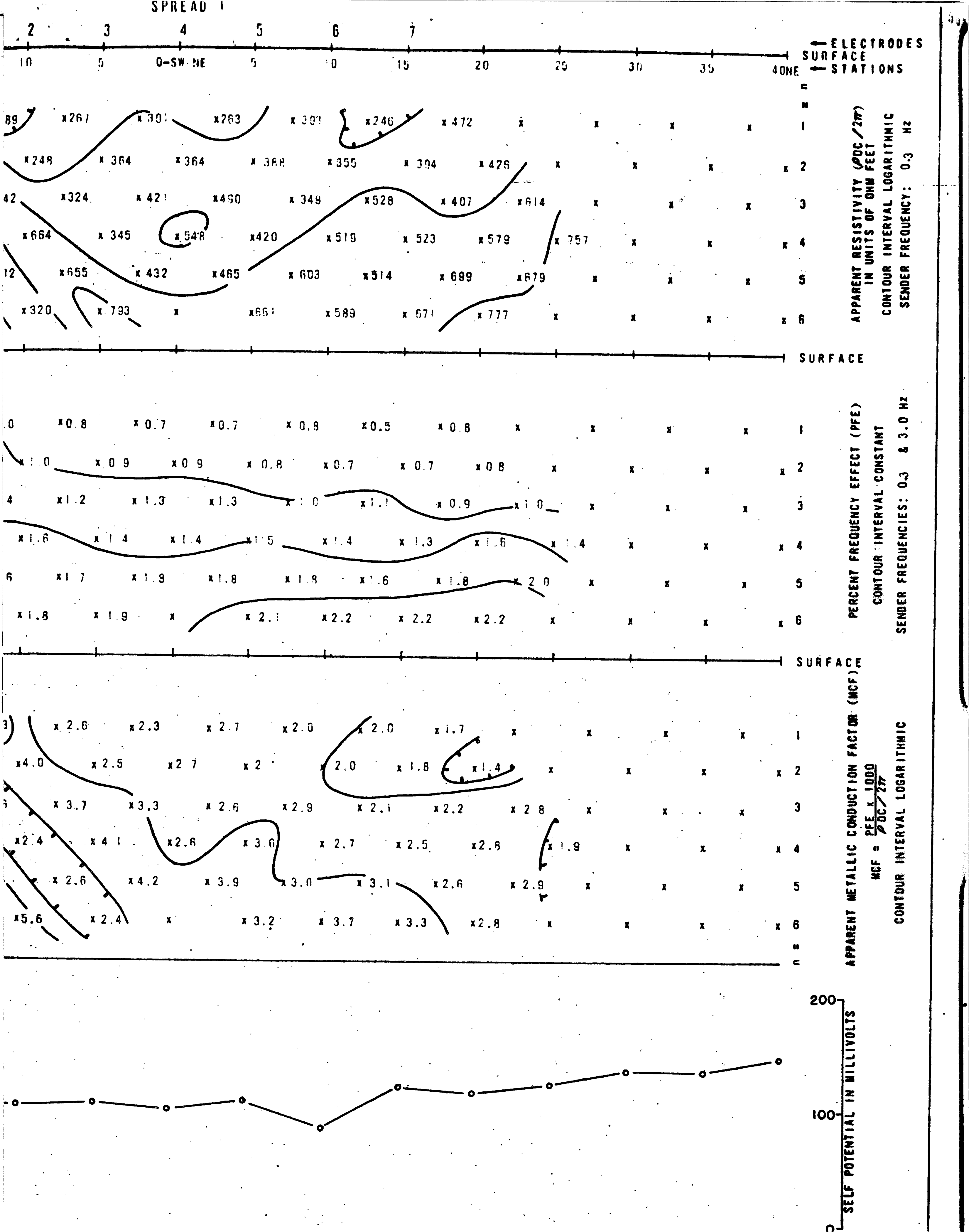

SPREAD 2
SPREAD
1 2 3 4 1 2 3 4
55SW 50 45 40 35 30 25 20 15 10 5
? INTERFACE



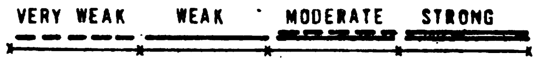
SPREAD 1
ELECTRODES
SURFACE
STATIONS
0-SW NE
40NE
n =
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0

585-70

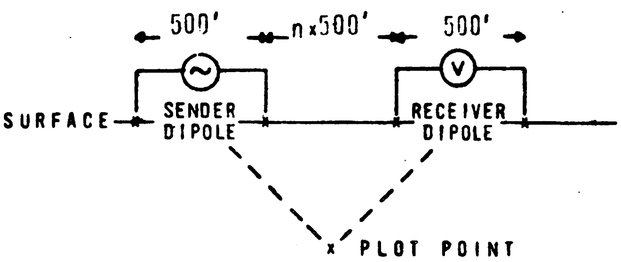
LINE NO.
4
SPREAD(S)
1

INDUCED POLARIZATION TRAVERSE
SECTIONAL DATA SHEET
for
TIPPERARY RESOURCES CORPORATION

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
SUPERIOR

LOOKING
S 70° W

DATE
NOV 1970

HEINRICHS
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GEOPHYSICAL ENGINEERS

AUSTRALIA
(SYDNEY)
39 Hume Street
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U.S.A.
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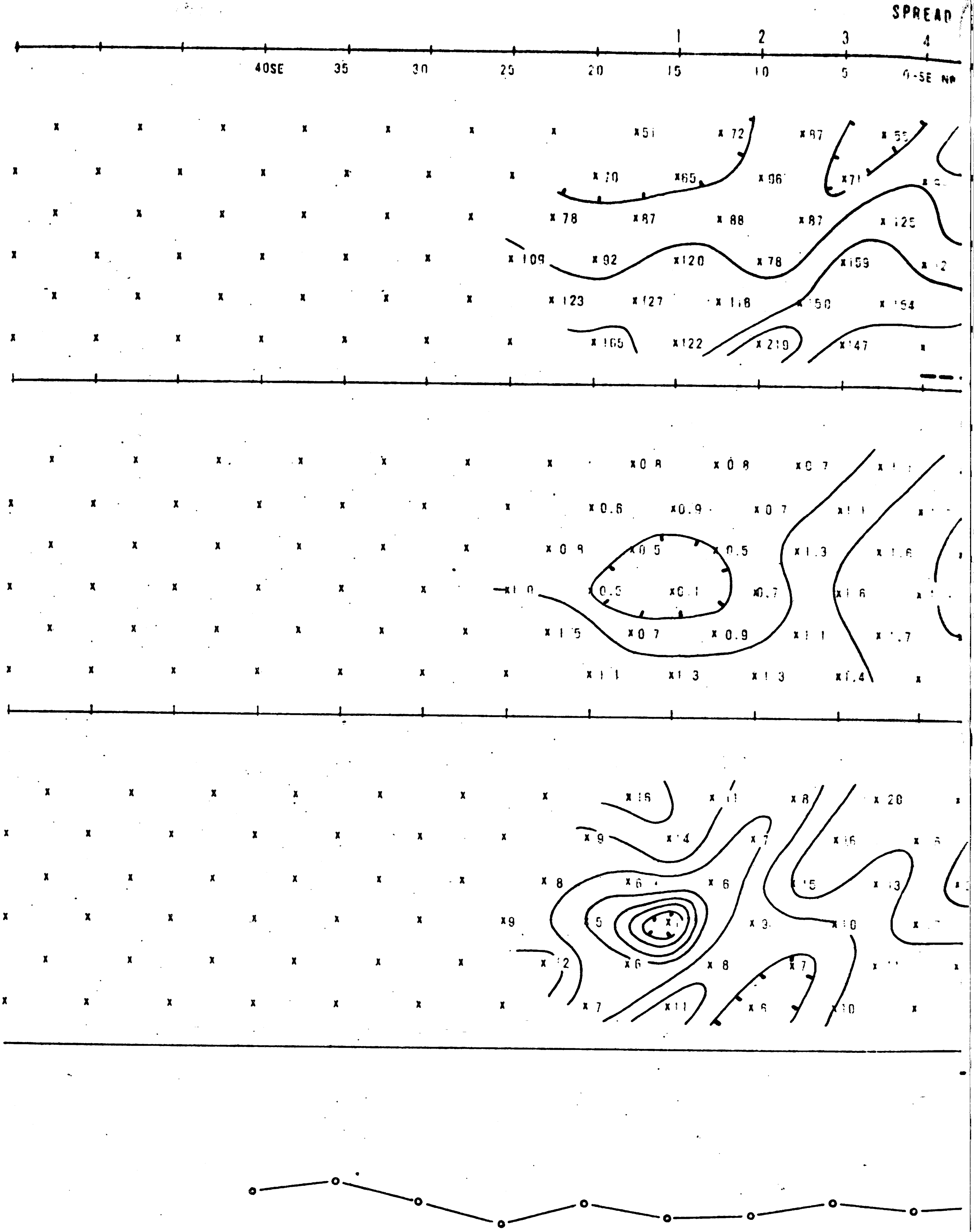
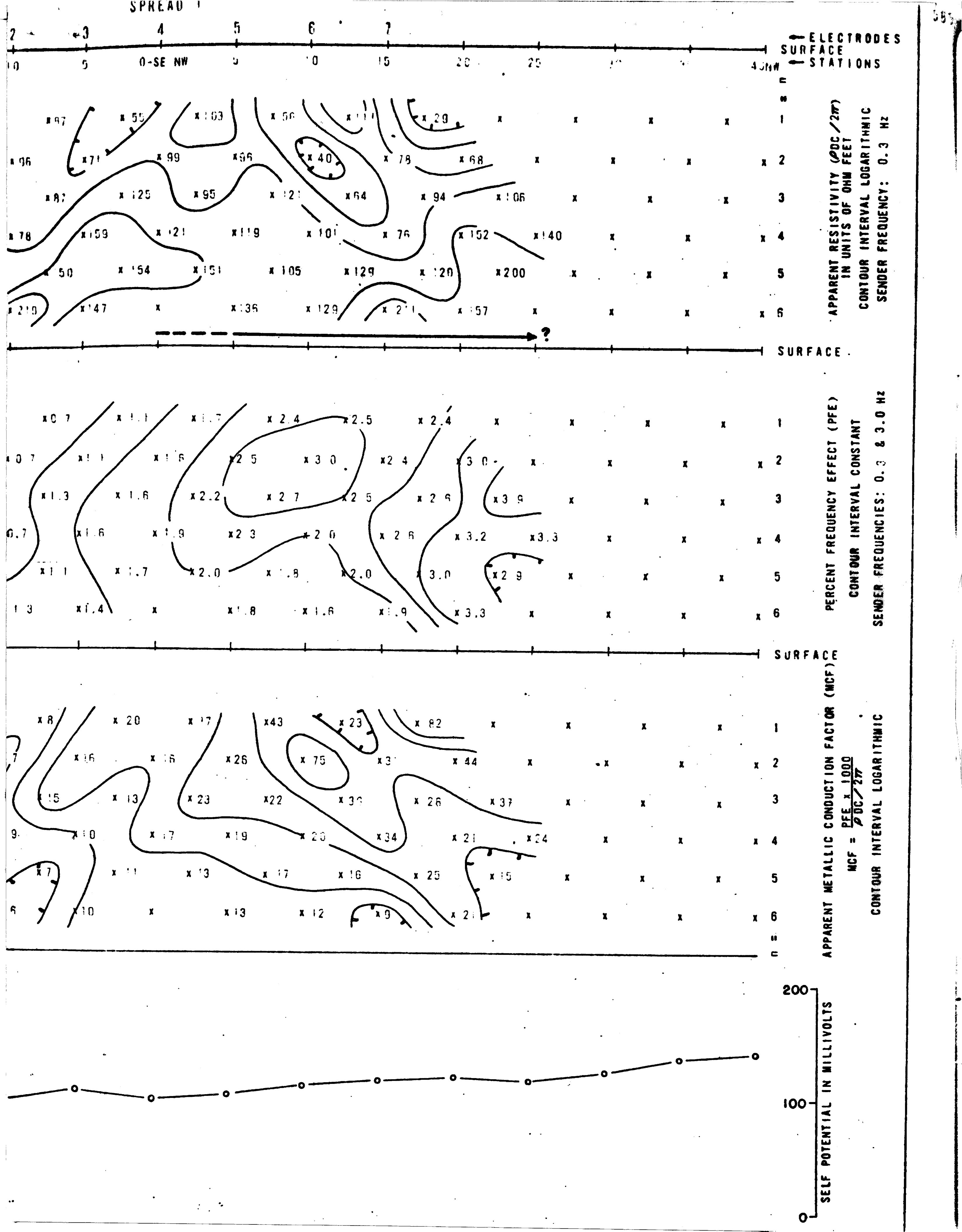

SPREAD
1
2
3
4
40SE
35
30
25
20
15
10
5
0-SE NW


SPREAD 1
ELECTRODES
SURFACE
STATIONS
0-SE NW
APPARENT RESISTIVITY (ρDC/2π) IN UNITS OF OHM FEET
CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.3 Hz
SURFACE
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.3 & 3.0 Hz
SURFACE
APPARENT METALLIC CONDUCTION FACTOR (MCF)
MCF = PFE x 1000 / ρDC/2π
CONTOUR INTERVAL LOGARITHMIC
SELF POTENTIAL IN MILLIVOLTS
200
100
0