DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 85/29

GEOPHYSICAL INTERPRETATION - BROMPTON PUGHOLE (Anne Street, Brompton) - S.A. Housing Trust -

OIL, GAS AND COAL DIVISION

by

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GEOPHYSICS

FEBRUARY, 1986

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PLANS

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 85/29
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GEOPHYSICAL INVESTIGATION - BROMPTON PUGHOLE
(Anne Street, Brompton)

ABSTRACT

Combined gravity and ground magnetic methods over an old clay pit at Brompton, have delineated the probable extent of excavation prior to infill of various materials.

Areas with apparently high concentrations of ferro-metallic debris along with a deeper section of relatively uncompacted material have been delineated.

Sirotem results have proved inconclusive due to the relatively few stations that were occupied.

A number of grid locations have been recommended for future drilling to substantiate the interpretation contained within this report.

INTRODUCTION

Following a request from the South Australian Housing Trust, a geophysical survey was conducted in December, 1983, over a concealed clay pit which has been backfilled to natural surface elevations. The objectives were to investigate the extent of excavations prior to backfilling and the nature and relative compactness of the fill material, to aid in the determination of the structural stability of future development.

The Brompton site is bounded by the Port Road, Anne and West Streets, and the Port Adelaide railway line.

During the investigation, both gravity and ground magnetic methods were undertaken on a 5 metre grid spacing over the entire area (Fig. 1). Sirotem was also sampled at 11 sites over this area.

FIELD PROCEDURES

A five metre grid was pegged and optically levelled over the area with each peg being numbered to aid relocation. The numbering consisted of lines A to K and station numbers 1 to 26.

Gravity was read on all stations with the exception of E14 to E26, and readings were frequently tied to a base station (H14), to control and adjust gravity reading errors due to instrumental drift and earth tide effects.

The base station (H14) was tied to the Bureau of Mineral Resources (BMR) reference station 8090-0108 at the Adelaide Airport, and thence to the Australia gravity network.

Latitude and elevation corrections were calculated and added to the observed gravity readings to produce Bouguer gravity values, using a standard density approximation of 2.67 g/cm^3 for near surface material. Resulting values were contoured at an interval of 0.02 milligals (mgal), (Fig. 2).

Ground magnetic readings were taken at all stations with the exceptions of Line A, and stations near the Port Road, for which background noise from power transmission lines and machinery caused poor repeatability of readings. All ground magnetic readings were similarly tied to the base station (H14) to correct for magnetic drift variations. A convenient value of 59250 gammas was subtracted from all readings and resultant values were contoured at an interval of 100 gamma, (Fig. 3).

Sirotem readings were read from stations H14 and H24 with results being represented on Figure 6.

INTERPRETATION

The gravity method can be used to differentiate between material of differing densities, providing the magnitude of the density contrast relative to the depth of burial and vertical extent of the interface in question is adequate. For instance, a 10 metre vertical interface between two materials possessing a density contrast of 0.25 g/cm^3 produces a calculated maximum gravity effect of 0.10 mgal.

This method, however, is only suitable for detecting lateral density variations.

The resulting Bouguer gravity contours (Fig. 2), indicate a negative anomaly extending northwards from stations 13 of lines A through to K. This anomaly is consistent with an area of low density material (approximately -0.3 g/cm^3 density contrast), extending to a depth of six metres. A deeper zone centred on station E18 is also indicated.

Gravity modelling along line G (Fig. 4), confirms two possible levels of fill extending to an approximate depth of 14 metres. The lower level is considered to have a lower density than the near surface material and may indicate a zone of relatively uncompacted fill.

The increased density of the near surface material, down to an approximate depth of 6 metres may also reflect on increased concentration of heavy objects such as metal, broken concrete slabs, brick fragments and other demolition site debris.

A secondary gravity low centred on stations 023 and P23, is consistent with a small collapsed pit which appears to be separated, in part, from the main excavation.

Several small magnitude high and low anomalies scattered throughout the area, are considered to be associated with small concentrations of debris within the near surface material.

The magnetic method was used as an indicator of ferromagnetic (ferric) material below the earths surface. Magnetic contours over the Brompton site (Fig. 3) highlight anomalies, possibly associated with buried iron and steel waste.

The boundary of magnetic zone 1 (Fig. 4) is coincident with the limits of low density fill, as indicated from gravity results, and reflects a larger concentration of ferric material within the near surface fill. Four large bodies are interpreted within this area (Fig. 4), which may indicate large piles of metallic waste such as car bodies or steel containers.

Until the completion of drilling the nature of material within the second magnetic zone (centred on station N14) is unknown. Debris relating to the demolition of pre-existing building situated over this area could possibly be the cause of this anomaly.

Minor magnetic anomalies along the perimeter of the area surveyed, are considered anomalous effects from water pipes, galvanised iron fences and sheds bounding the area.

The Sirotem system is a Transient Electromagnetic method useful in delineating electrical conductors within the ground. A current flowing through a transmitter loop sets up a magnetic field which induces eddy currents within any conductor.

Results of the Sirotem measurements for stations G15 to H24 are plotted on figure 6. Results for station H14 were questionable and therefore deleted. This diagram represents a pseudo-section of apparent resistivities below each station, from surface to a depth depending upon the number of channels of noise free data.

It is apparent from the results that a fairly conductive body exists below station H20 at an approximate depth of 5 metres.

Unfortunately accurate depth values are difficult to ascertain with the limited data and more readings are therefore recommended.

CONCLUSIONS AND RECOMMENDATIONS

Both gravity and ground magnetic methods have delineated an area comparable with prior knowledge of the extent of the clay pit. The exact limits of excavation are difficult to interpret accurately at present however, due to both noise effects from near surface sources and the wide range of material comprising the fill.

Preliminary modelling along line G indicates the fill material to extend from surface to an overall depth of 14 metres with an intermediate level extending to approximately 6 metres from the surface. These dimensions are difficult to finalise at present. However, with accurate density values from drilling operations further modelling could be undertaken to remedy this.

Secondary gravity and magnetic anomalies covering a portion of the total area surveyed indicate the fill to be composed of a large variety of both ferric and non-magnetic debris.

Other excavations over the block which predate the interpreted limits, as shown on aerial photographs, have not been sufficiently delineated. A minimal density contrast is therefore assumed to be associated with these earlier excavations and may reflect an advanced stage of compaction.

The Sirotem method has indicated that conductive sources can be delineated, however more data collection is needed to verify the usefulness of the system over this type of environment.

A number of drillsites have been proposed to evaluate the composition and depth extent of the fill material (Fig. 4). Drilling at sites positioned both over the magnetic anomalies and within the limits of excavation should identify the composition of the fill. If possible, drillholes should penetrate through to the clay substratum, to ascertain depths of fill and physical characteristics of the surrounding clay.

Other drillsites should also be located, as shown, outside the excavation limits to investigate previously discussed anomalous zones and to examine areas of minimal fill.

It is recommended that other geophysical methods be attempted on an experimental basis. Possible methods include reflection seismic, resistivity and electromagnetic methods (i.e. SIROTEM, EM31). The use of these methods will aid the planning of further related surveys within the Adelaide metropolitan, and country areas.

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GEOPHYSICIST

Fig. 1

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GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE

ANNE STREET BROMPTON

LOCALITY PLAN

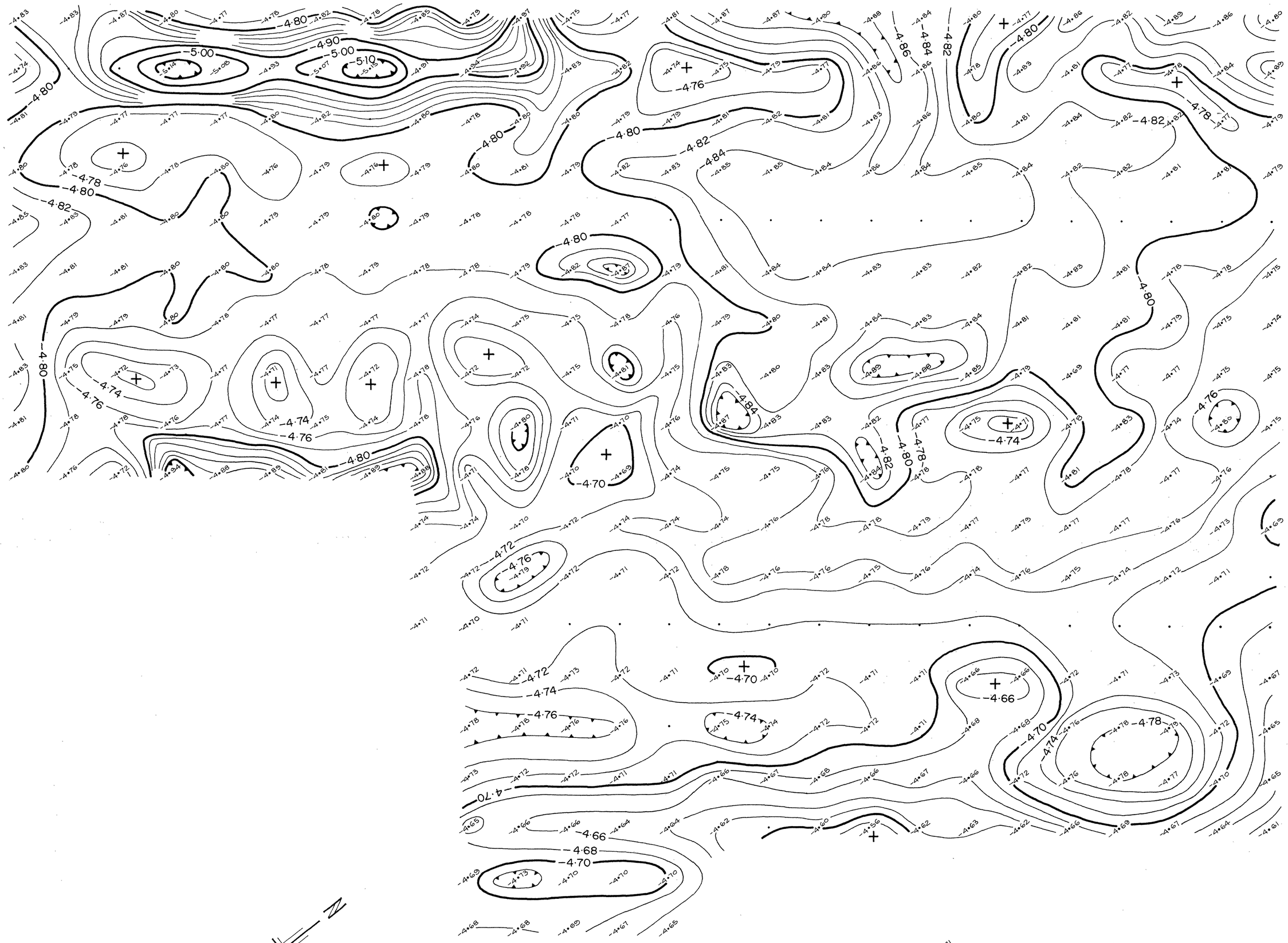
COMPILED G. R.	CDO	28·2·86 DATE
DRAWN N. S.	SCALE 1 : 2 500	
DATE 6-1-84	PLAN NUMBER S17173	
CHECKED		

STATION NUMBER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

LINE NUMBER

A B C D E F G H I J K L M N O P Q R S T U V W X



N

SCALE

METRES 10 0 10 20 METRES

-4·71 Gravity station and Bouguer Gravity value (−30 milligals).

—-4·74— Gravity contour (−30 milligals, interval 0·02 milligals).

\+ Gravity high.

Gravity low.

DENSITY 2·67 g/cm^3

Fig. 2

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED G. R.	C.D.O	28·2·86 DATE
GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE ANNE STREET BROMPTON	DRAWN N. S.	SCALE 1 : 250	
BOUGUER GRAVITY CONTOURS	DATE 6-1-84	PLAN NUMBER 84-3	
	CHECKED		

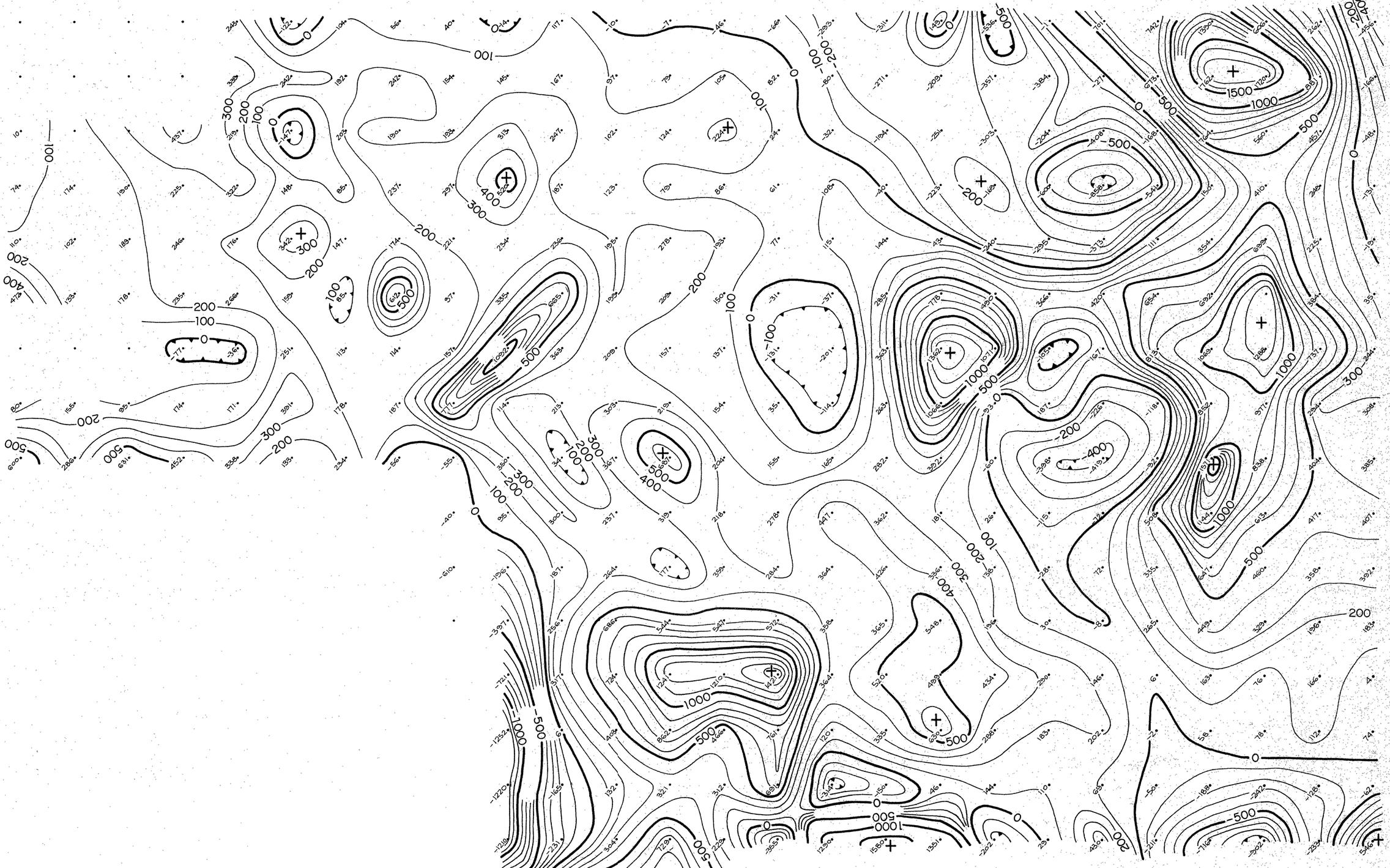
3411

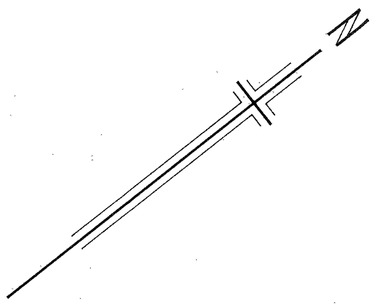
STATION NUMBER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

LINE NUMBER

A B C D E F G H I J K L M N O P Q R S T U V W X





325• Magnetic station and value (Gammas).

—300— Magnetic contour (interval 100 Gammas).

+ Magnetic high.

Magnetic low.

SCALE

METRES 10 0 10 20 METRES

Fig. 3

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SOUTH AUSTRALIA

GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE
ANNE STREET BROMPTON

MAGNETIC CONTOURS

COMPILED G. R.	UR 28.2.86 C.D.O. DATE
DRAWN N. S.	SCALE 1 : 250
DATE 6-1-84	PLAN NUMBER 84-4
CHECKED	

3411

STATION NUMBER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

LINE NUMBER

A B C D E F G H I J K L M N O P Q R S T U V W X

MAGNETIC ZONE 1

AREA OF DEEPER FILL

MAGNETICS

GRAVITY

MAGNETIC ZONE 2

N

Approx. limit of fill (MAGNETICS).

Approx. limit of fill (GRAVITY).

Magnetic zone boundary.

Magnetic body.

Proposed drill site.

SCALE

METRES 10 0 10 20 METRES

Fig. 4

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GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE

ANNE STREET BROMPTON

GRAVITY AND GROUND MAGNETICS INTERPRETATION

COMPILED G. R.	C.D.O.	28·2·86 DATE
DRAWN N. S.	SCALE	1 : 250
DATE 6-1-84	PLAN NUMBER	84-5
CHECKED		

3411

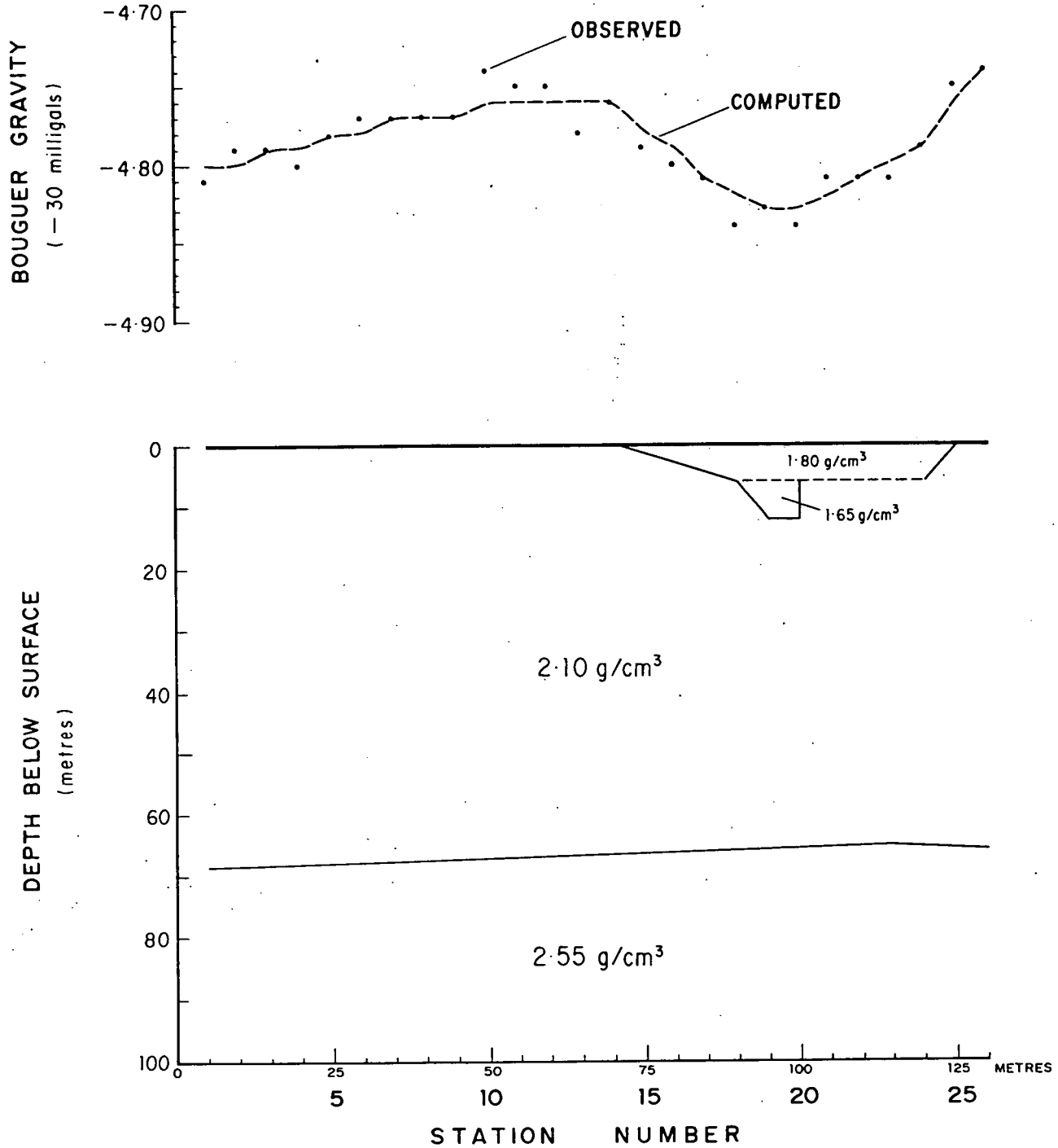

Fig. 5

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GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE
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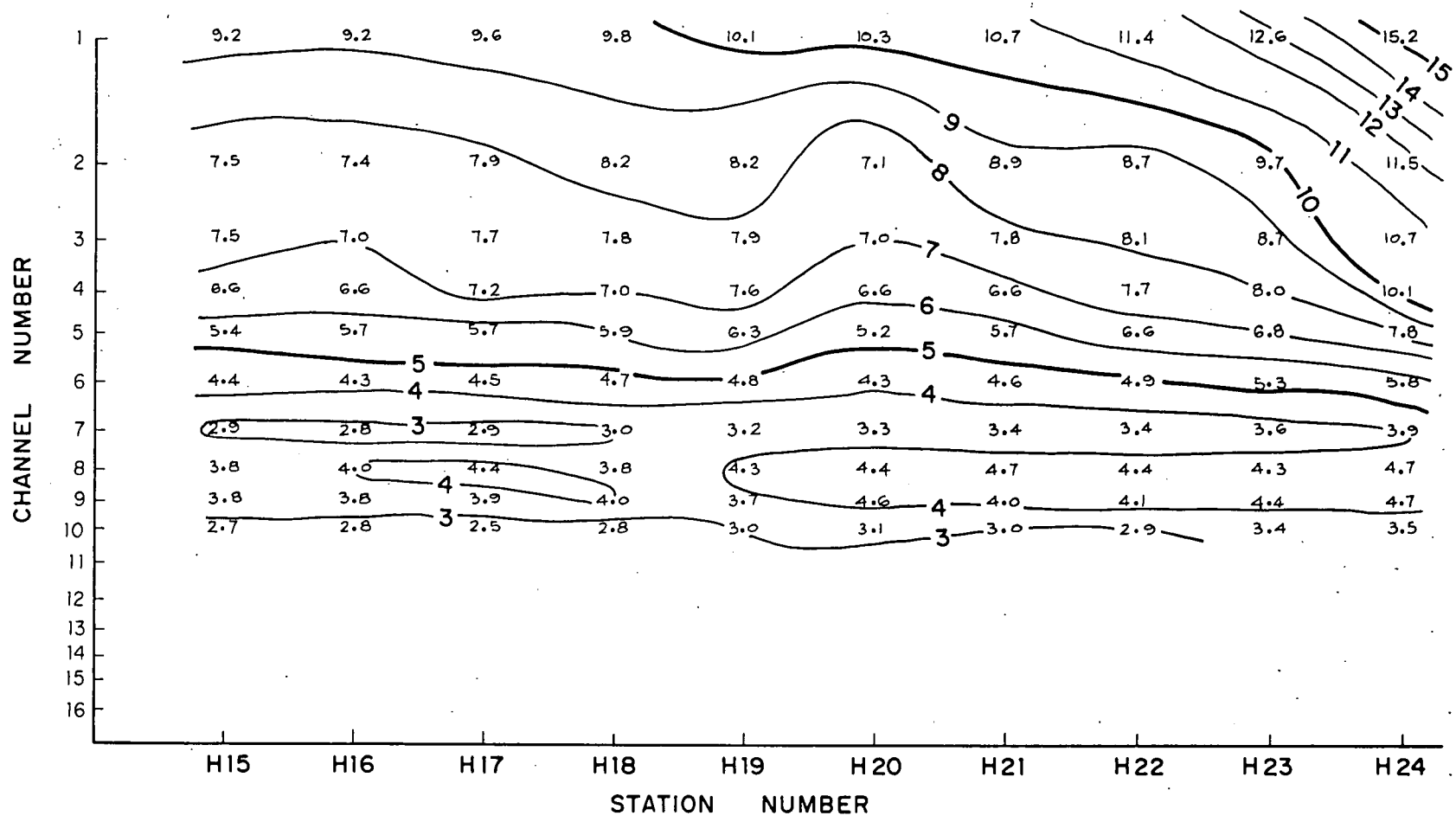
GRAVITY MODEL — LINE G

COMPILED G. R.	C.D.O. 28·2·86 DATE
DRAWN N. S.	SCALE 1 : 1 000
DATE 6-1-84	PLAN NUMBER S 17174
CHECKED	

3411



CONFIGURATION : 100m square Transmitter Loop
in Loop Receiver
Reading Interval 5m

APPARENT RESISTIVITY in Ohm-metres

Fig. 6

GEOPHYSICAL INVESTIGATION — BROMPTON PUGHOLE

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T.E.M. APPARENT RESISTIVITY
TIME-DISTANCE PLOT — LINE H

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COMPILED	DRAWN	DATE	CHECKED
G.R.	N.S.	6-1-84	

C.D.O. 28.2.86 DATE

SCALE 1 : 500

PLAN NUMBER S17175