STRATASCAN

Geophysical Survey Report

Yaxley, Peterborough

for

MOLAS

March 2005

J 1969

David Elks MSc.

REGISTERED IFA ORGANISATION

Document Title:	**Geophysical Survey Report** **Yaxley, Peterborough**
Client:	**MOLAS**
Stratascan Job No:	**J 1969**
Techniques:	**Detailed magnetic survey (gradiometry)**
National Grid Ref:	**TL 191 929**

Field Team:	Luke Brown, Richard Fleming
Project Manager:	Simon Stowe BSc.
Report written by:	David Elks MSc.
CAD illustration by:	David Elks MSc.
Checked by:	Simon Stowe BSc.

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LIST OF FIGURES

1 SUMMARY OF RESULTS

A detailed magnetic survey was carried out over a sample area of 1.5ha on a region of farm land on the north east side of Yaxley, Peterborough.

The survey identified anomalies which may relate to a former settlement with associated responses possibly caused by contemporary agricultural activity.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by MOLAS to undertake a geophysical survey of an area of farm land set aside for redevelopment.

2.2 Site location

The site is located on the north east side of Yaxley, near Peterbrough, Cambridgeshire at OS ref. TL 191 929.

2.3 Description of site

The site consists of 5ha of scrub land. The detailed magnetic survey was conducted over a sample of 1.5ha split over 2 areas, one in the north and the other in the south of the survey area.

Figure 8. Site photograph showing the southern end of the site.

2.4 Geology and soils

The underlying geology is Oxford Clay from the Upper Jurassic Period (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils are of

the Hanslope soil association. These consist of slowly permeable calcareous clayey soils, with some non permeabale clayey soils (Soil Survey of England and Wales, Sheet 4 Eastern England).

2.5 Site history and archaeological potential (Edwards, M. 2003), (Huntingdonshire District Council, 2005)

The north west side of Yaxley is the oldest part of the village. This stands on high ground relative to the fens to the east. The fens in this region were included in the drainage scheme during the reign of Charles I (1625-49), other parts were not drained until an Act of Parliament was passed in 1830.

Neoliothic and Bronze Age finds have been discovered in the old village and the fen area respectively, evidence has also been identified suggesting the presence of a fen side Roman settlement. Prior to the draining there was an inland port which was used to deliver French prisoners to the nearby prisoner of war camp built during the Napoleonic Wars.

Given this history the potential for discovering archaeological features is considered high.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological origin.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 2 days, 24th & 25 the January 2005. Weather conditions during the survey were dry.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced to suitable topographic features around the perimeter of the site.

3.3 Survey equipment

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The Grad601-2 consists of

two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements increasing the sensitivity to small changes in the Earths magnetic field.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

The Grad601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed gradiometer data used in this report:

1. *Despike* (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

   Geoplot parameters:
   X radius = 1, y radius = 1, threshold = 3 std. dev.
   Spike replacement = mean

2. *Zero mean traverse* (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

Geoplot parameters:
Least mean square fit = on

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the raw data both as greyscale (Figure 3) and trace plots (Figure 4 and 5), together with a greyscale plot of the processed data (Figure 6). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 7).

4 RESULTS

The detailed magnetic survey has revealed anomalies in both areas which can be broadly classified as: positive linear anomalies of possible archaeological origin, positive linear anomalies of possible ancient agricultural origin, positive linear anomalies with an associated negative response possibly relating to ditch and bank features, areas of magnetic disturbance associated with modern magnetic interference, and an area of positive response which may relate to a pit/depression.

4.1 Area 1

Area 1 is dominated by a large area of strong magnetic disturbance oriented west-east across the centre of the area. This is probably caused by a modern service cutting through the survey area. To the south of this are two weakly enhanced curvilinear positive anomalies. These may be associated with cut features infilled with magnetically enhanced topsoil, possibly of archaeological origin.

The north of Area 1 contains a series of equispaced (roughly 8m), parallel positive linear anomalies. One is also seen in the south of the area. It is possible that these responses are related to channels built to drain the fens, although it is more likely that they are caused by agricultural processes. In the north east corner is an area of positive magnetic enhancement. This may be a discrete pit or depression, or it may be related to the positive linear anomaly which seems to cut through it.

4.2 Area 2

The east of this area contains anomalies which seem to define enclosures, probably of an archaeological origin pertaining to a former settlement. Also in evidence are positive linear anomalies which may represent infilled ditch features. Positive linear anomalies with an associated negative response are also observed in the data, and suggest the presence of infilled ditches with related embankments.

In the centre of the area are two parallel positive anomalies which appear weaker than those to the east. It is possible that these are related to a different type of feature. They may associated with drainage features or former field boundaries and trackways.

The parallel positive anomalies seen in Area 1 do not appear to continue into Area 2 or cut through any anomalies in Area 2. This suggests that their cause may be of agricultural origin contemporary with the interpreted archaeological features seen in Area 2.

Both Areas 1 and 2 have a region of magnetic disturbance along their western edges, this is likely to be caused by modern magnetic debris along the fenceline.

5 CONCLUSION

Area 2 contains anomalies which are interpreted to pertain to a former settlement location. Area 1 has identified features which are thought to be of agricultural origin contemporary with this settlement. Some further curvilinear positive anomalies are also seen in Area 1 which may also be of archaeological origin.

REFERENCES

British Geological Survey, 1979. *Geological Survey Ten Mile Map, South Sheet, Third Edition (Solid).* British Geological Society.

Edwards, M. 2003. Yaxley. *www.genuki.org.uk/big/eng/HUN/Yaxley/* (consulted on 4/3/05)

Huntingdonshire District Council, 2005. www.huntsdc.gov.uk/Community+and+People/Neighbourhood-village/Towns+and+Villages/Yaxley.htm (consulted on 4/3/05)

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 4 Eastern England.*

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremnant* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremnance is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremnant archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

OS 100km square = TL

95

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SURVEY AREA

17 18 19 20 21

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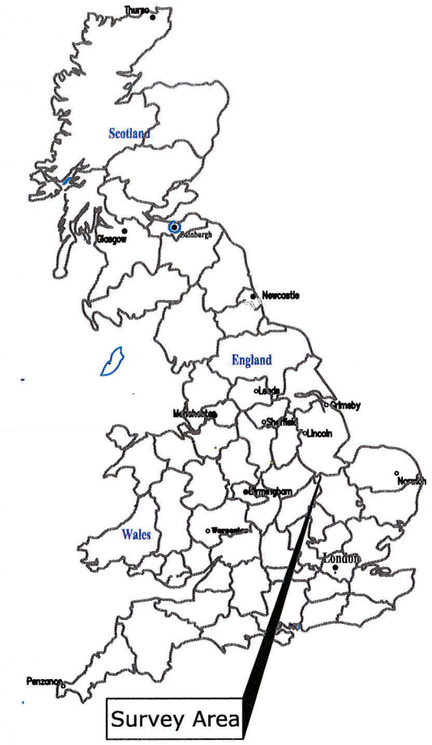

Site centred on NGR TL 191 929

Client
MOLAS

Project Title Job No. 1969
GEOPHYSICAL SURVEY - YAXLEY, PETERBOROUGH

Subject
LOCATION PLAN OF SURVEY AREA

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Survey date	Drawn by	Figure No.
JAN 05	DGE	01

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REFERENCING INFORMATION

A-B	229.45m	A-C	40.15m	A-D	230.04m
A-E	25.47m	A-F	58.81m	B-C	268.76m
B-D	3.58m	B-E	254.75m	B-F	260.62m
A-G	60m	G-H	90m		

A&B	Baseline
A,G,H I,J,K	Grid nodes
X&Y	Grid node pegs and baseline
2	Survey grid number

Client

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GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

SITE PLAN SHOWING LOCATION OF SURVEY GRIDS AND REFERENCING

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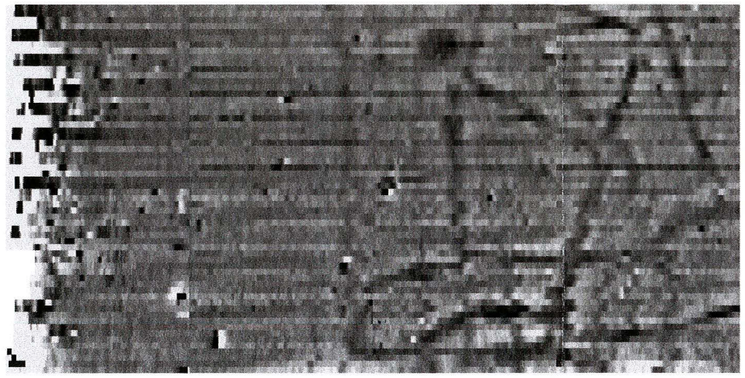

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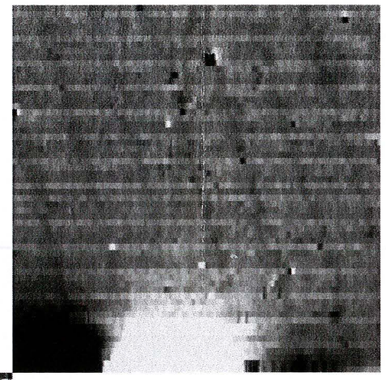

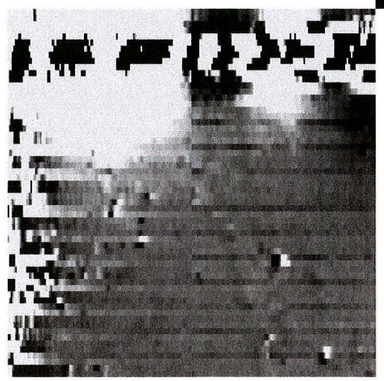

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+5nT

-5nT

AREA 2

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Client

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GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

PLOT OF RAW MAGNETOMETER DATA

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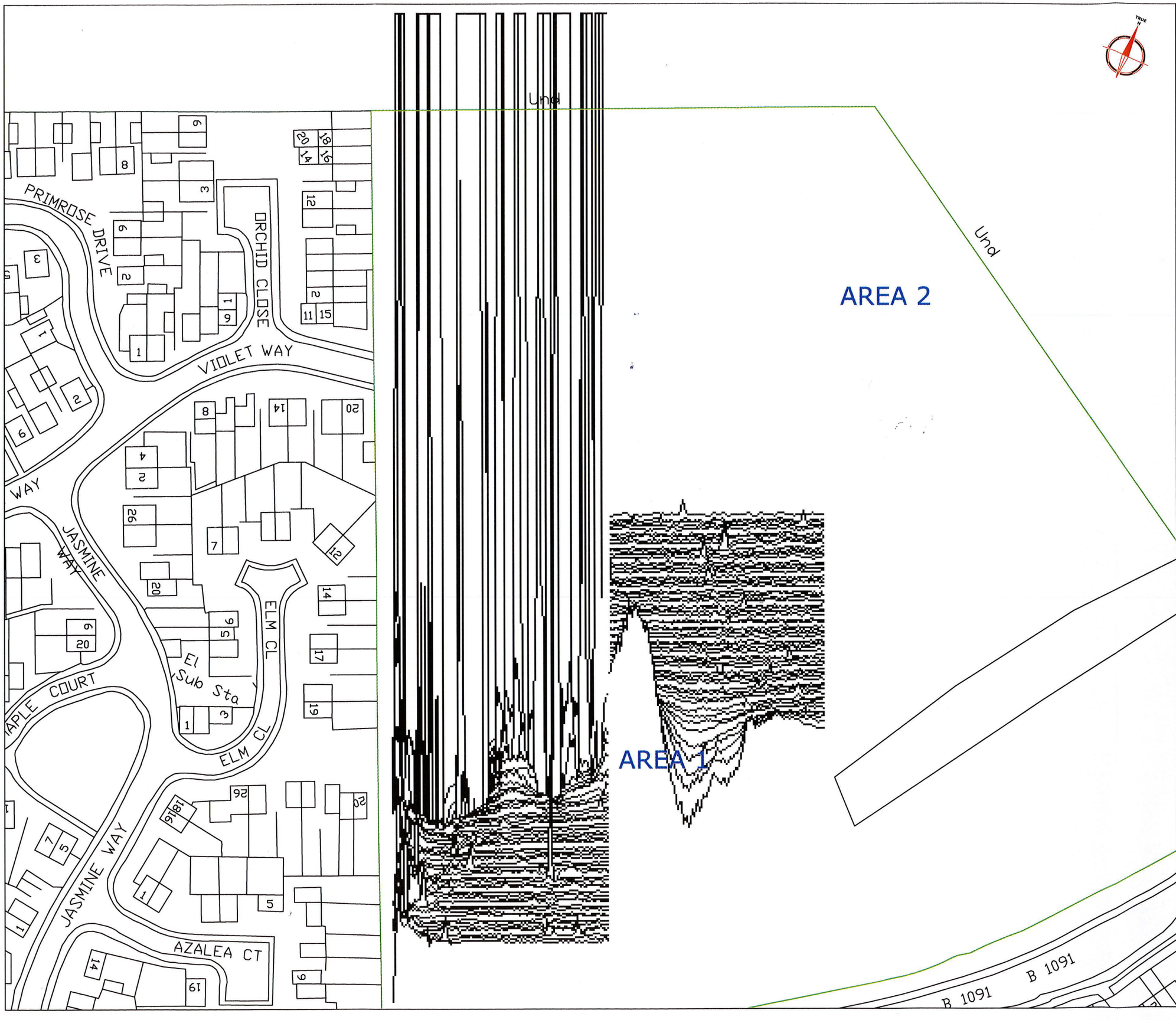

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Client

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GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

TRACE PLOT OF RAW MAGNETOMETER DATA SHOWING POSITIVE VALUES - AREA 1

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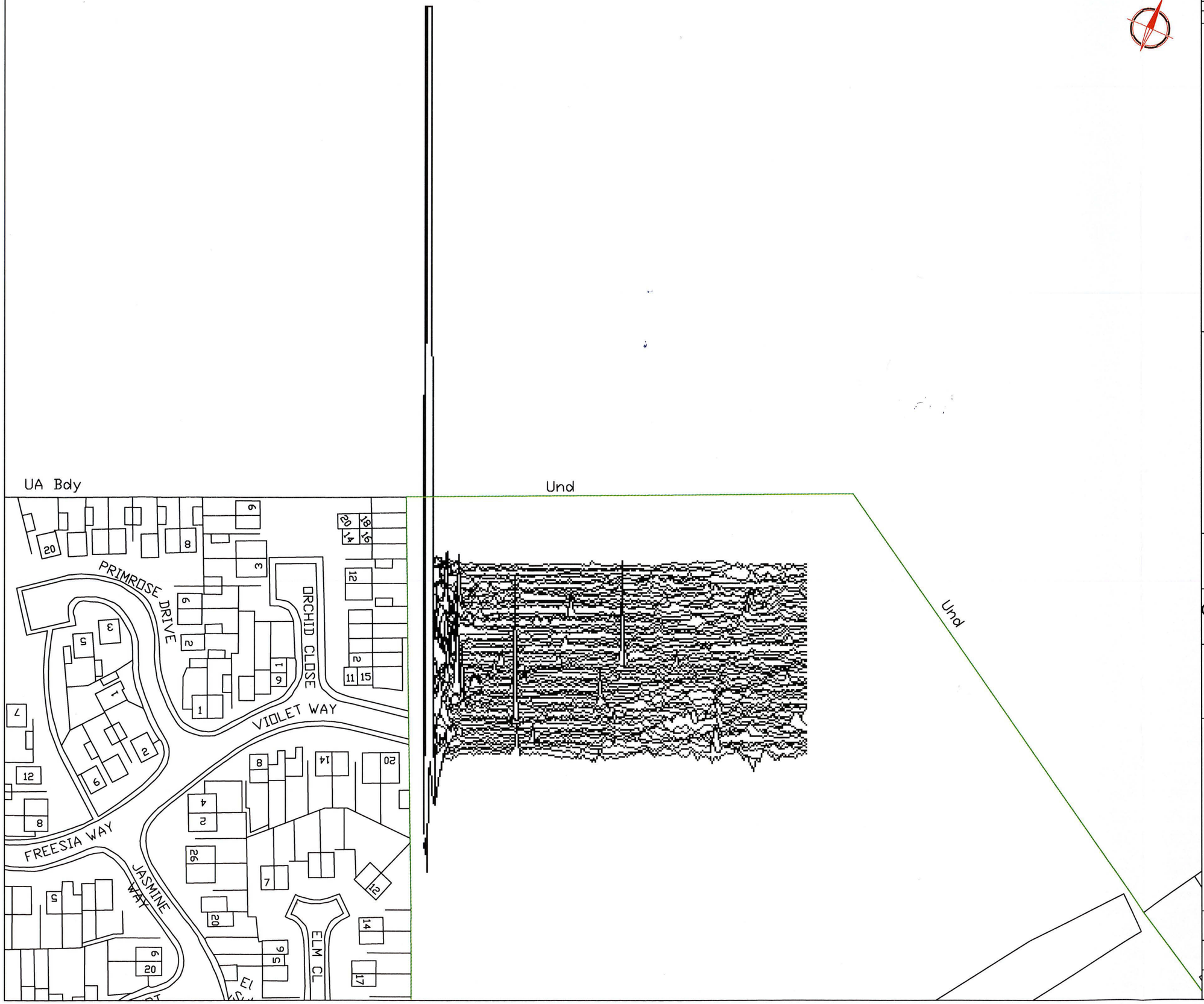

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Client

MOLAS

Project Title — Job No. 1969

GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

TRACE PLOT OF RAW MAGNETOMETER DATA SHOWING POSITIVE VALUES - AREA 2

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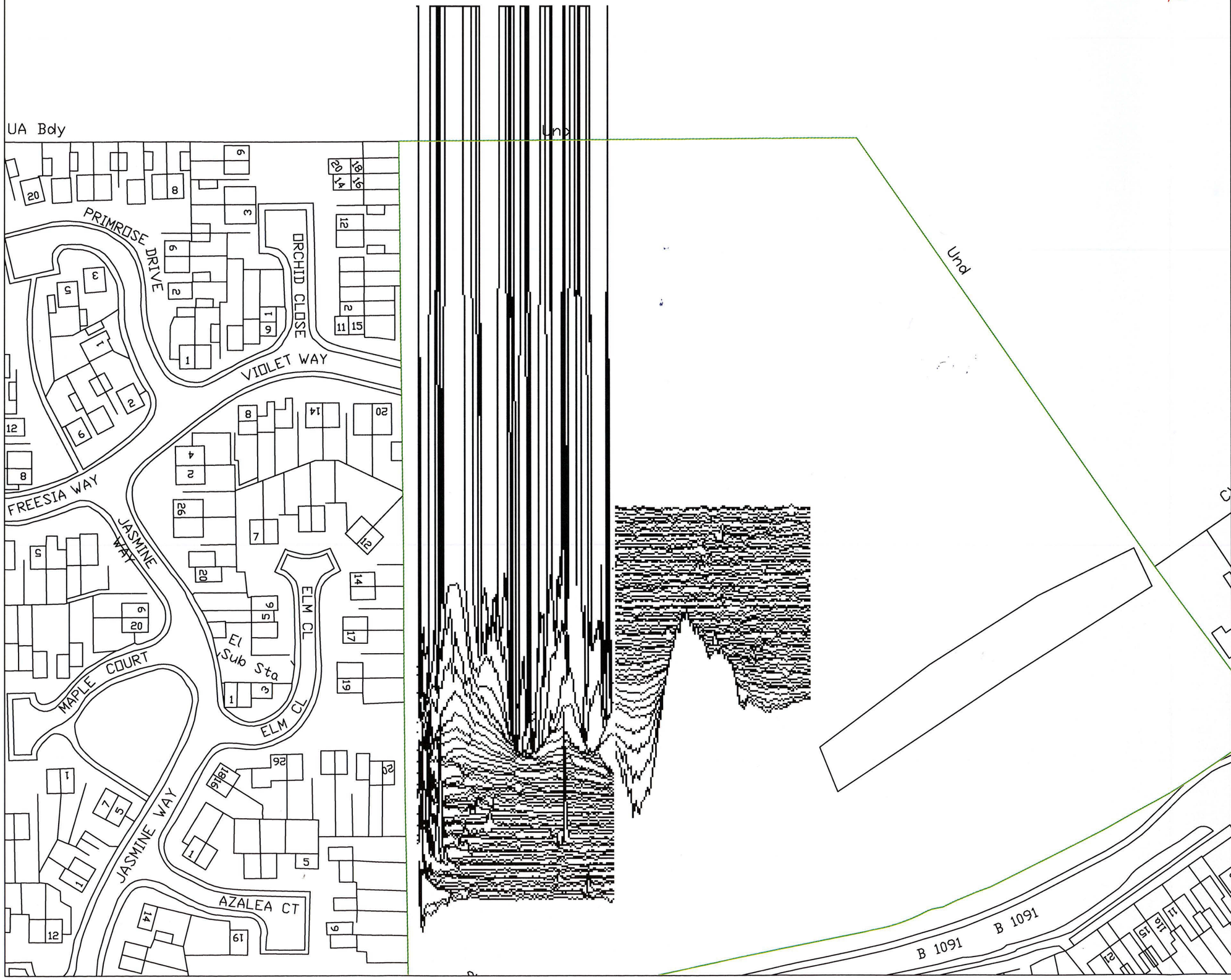

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-40nT
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Client

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Project Title — Job No. 1969

GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

TRACE PLOT OF RAW MAGNETOMETER DATA SHOWING NEGATIVE VALUES - AREA 1

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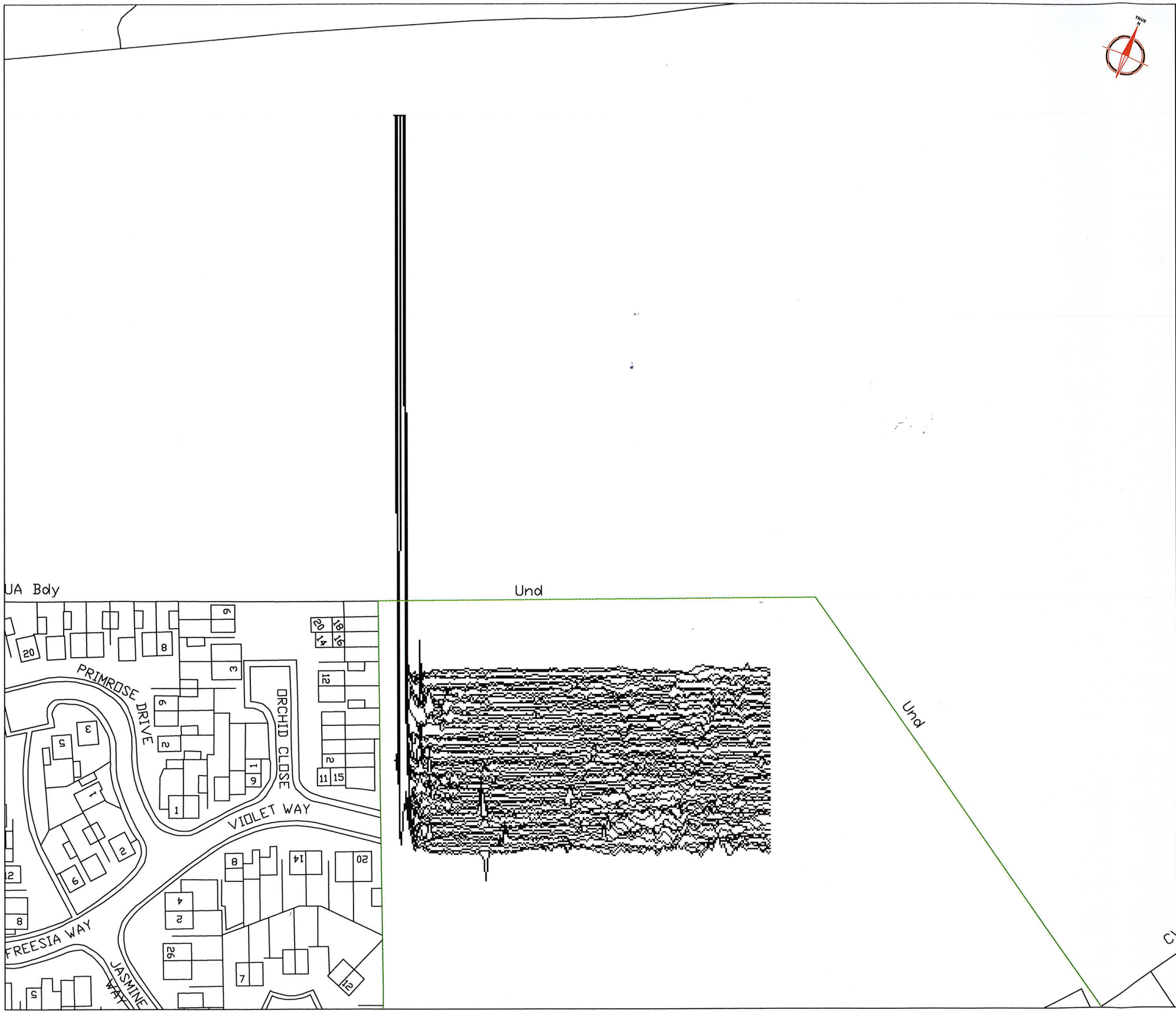

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Client

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GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

TRACE PLOT OF RAW MAGNETOMETER DATA SHOWING NEGATIVE VALUES - AREA 2

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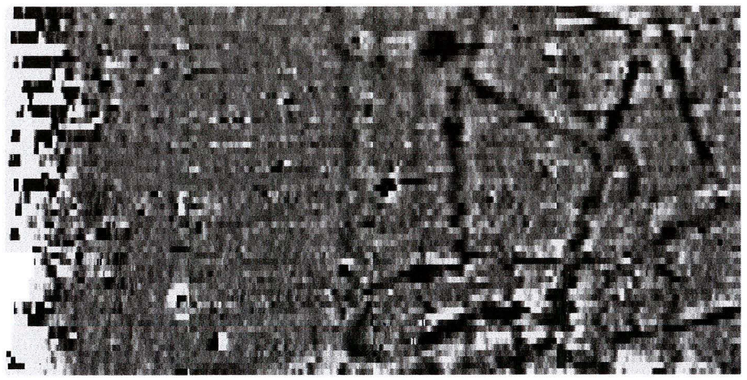

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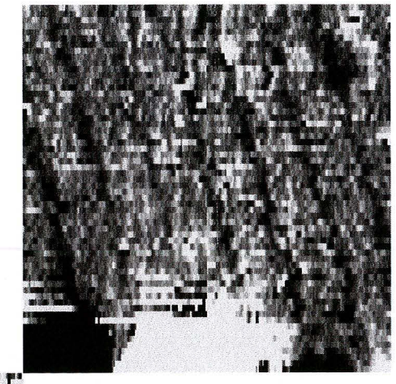

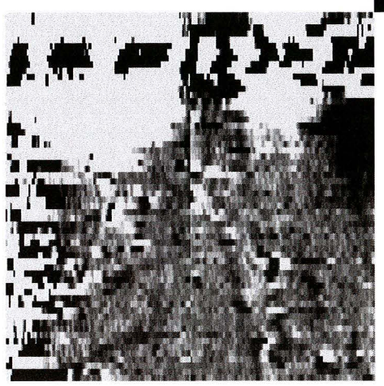

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Minimum -1nT (white)

-3SD +3SD

+1nT

-1nT

AREA 2

Plotting parameters

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Minimum -2nT (white)

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+2nT

-2nT

Client

MOLAS

Project Title — Job No. 1969

GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

PLOT OF PROCESSED MAGNETOMETER DATA

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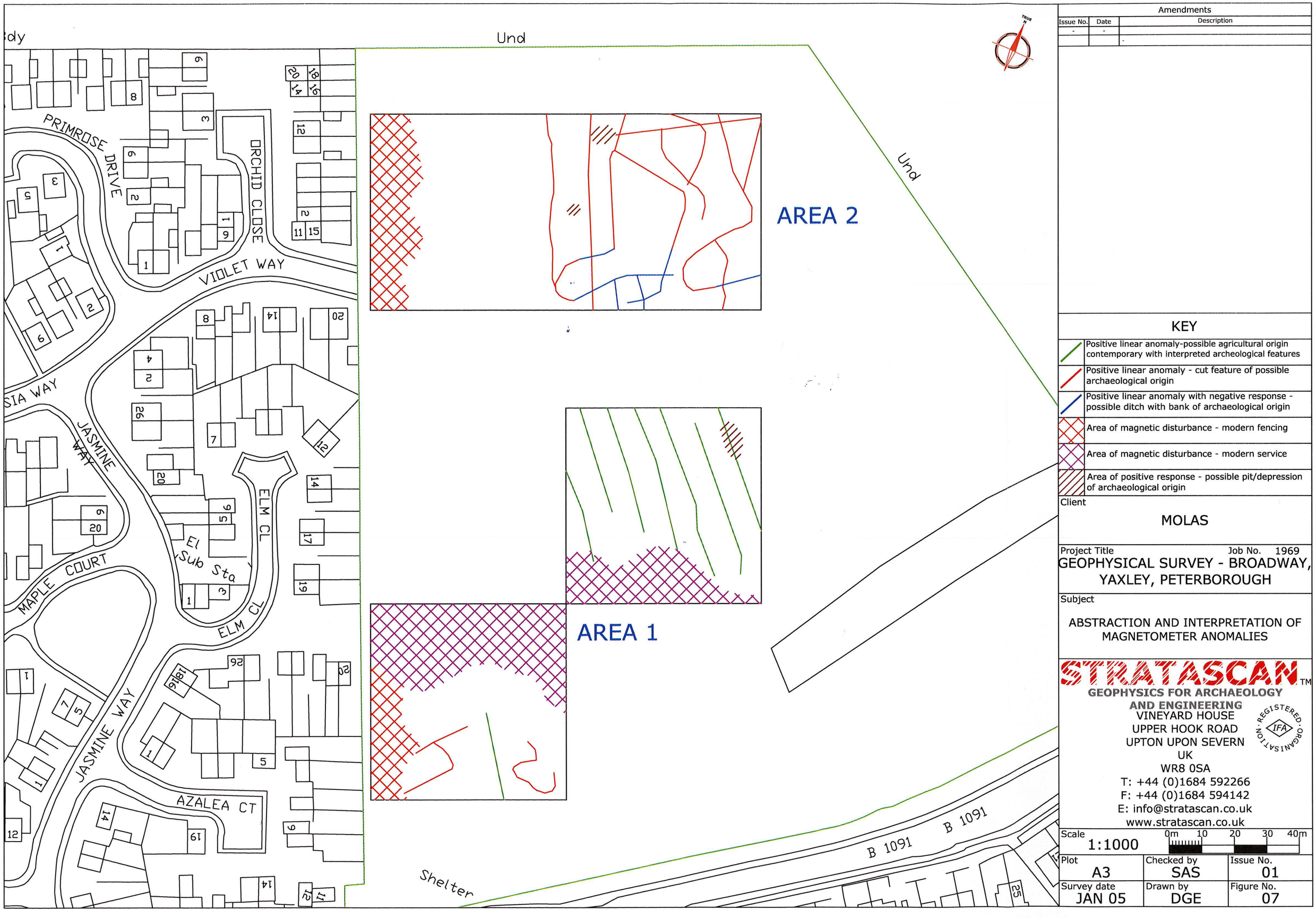

Amendments

Issue No.	Date	Description
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KEY

- Positive linear anomaly-possible agricultural origin contemporary with interpreted archeological features
- Positive linear anomaly - cut feature of possible archaeological origin
- Positive linear anomaly with negative response - possible ditch with bank of archaeological origin
- Area of magnetic disturbance - modern fencing
- Area of magnetic disturbance - modern service
- Area of positive response - possible pit/depression of archaeological origin

Client

MOLAS

Project Title — Job No. 1969

GEOPHYSICAL SURVEY - BROADWAY, YAXLEY, PETERBOROUGH

Subject

ABSTRACTION AND INTERPRETATION OF MAGNETOMETER ANOMALIES

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