GEOPHYSICAL SURVEY REPORT

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SUMO Survey Services
SUMO Group Member

Project name:
Land West of Alford Close, Sandhurst

Client:
CgMs

Job ref:
J10184

August 2016

GEOPHYSICAL SURVEY REPORT

Project name: **Land West of Alford Close, Sandhurst** Client: **CgMs**	Job ref: **J10184**
Survey date: **2nd August 2016**	Report date: **August 2016**
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Version number and issue date:	Amendments:
V1 24/08/16	

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1 SUMMARY OF RESULTS

Magnetic survey at Sandhurst has not identified any responses which would normally be interpreted as being of *probable* or *possible* archaeological interest. One area proved to be magnetically disturbed as a result of past landscaping. Possible drains associated with a large gas pipeline have been recorded. Increased magnetic responses are thought to be localised magnetic gravels.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned to undertake a geophysical survey of an area outlined for residential development. This survey forms part of an archaeological investigation being undertaken by CgMs.

2.2 Site Details

NGR / Postcode	SU 8320 6170 / GU47 8DX
Location	Sandhurst lies south of Bracknell, close to the Berkshire / Surrey / Hampshire boundary. The site is located on the southern fringe of the town, close to numerous reservoirs which form Trilakes Country Park.
HER/SMR	Berkshire
Planning Authority / Ref	Bracknell Forest Borough Council
District	Bracknell Forest
Parish	Sandhurst Civil Parish
Topography	The ground slopes from 59m AOD in the north to 56m AOD in the south.
Current Land Use	Grassland / pasture – horse grazing. Numerous oak trees.
Weather Conditions	Fine
Soils	The overlying soils are unsurveyed due to the urban nature of the site. (Soil Survey of England and Wales, Sheet 6, South East England)
Geology	The underlying geology is Windlesham Formation Sand, Silt and Clay. The drift geology is Alluvium, Clay, Silt Sand and Gravel (British Geological Survey website).
Archaeology	No known heritage assets (TVAS 2013).
Survey Methods	Magnetometer survey
Study Area	*c*. 7.5ha

2.3 Aims and objectives

To locate and characterise any anomalies of possible archaeological interest within the study area.

3 METHODS, PROCESSING & PRESENTATION

3.1 Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (2008) and the Chartered Institute for Archaeologists (2002 & 2014).

Stratascan Ltd are a Registered Organisation with the CIfA and are committed to upholding its policies and standards.

3.2 Survey methods

Detailed magnetic survey has proved to be an efficient and effective method of locating a wide range archaeological anomalies. Given the size of the survey area, and the lack of known archaeological features of interest, magnetic survey was selected at this site as being the most appropriate geophysical technique.

More information regarding this technique is included in Appendix A.

3.3 Processing

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

1. *De-stripe*
2. *De-stagger*

3.4 Presentation of results and interpretation

The presentation of the data for each site involves a plot of the minimally processed data as a greyscale plot and a colour plot showing extreme magnetic values. Magnetic anomalies have been identified and plotted onto the 'Interpretation of Anomalies' drawing.

When interpreting the results several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to very specific known features documented in other sources, this is done (for example: Abbey Wall, Roman Road). For the generic categories levels of confidence are indicated, for example: probable, or possible archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification "possible".

4 RESULTS

The detailed magnetic gradiometer survey conducted at Sandhurst has identified no anomalies which would be characterised as being either of a *probable* or *possible* archaeological origin. The following list of numbered anomalies refers to numerical labels on the interpretation plots.

4.1 Probable Archaeology

No probable archaeology has been identified within the survey area.

4.2 Possible Archaeology

No possible archaeology has been identified within the survey area

4.3 Other Anomalies

1-7 Two parallel linear anomalies **[1]** and one singular response **[2]** are visible in the north-west and south-east of the survey area. While an archaeological origin cannot be entirely ruled out, the lack of any other responses makes such an interpretation unlikely. The responses could be drains, perhaps associated with a large gas pipe **[3]** which crosses the survey area on an east-west alignment; it is worth noting that anomalies **[1]** do not extend south of the pipe, while those at **[2]** do not extend north of the pipe. The responses associated with the pipeline itself show a characteristic string of positive and negative anomalies each with their own magnetic halos. In the westernmost field the gas pipeline veers to the north and a second, much smaller pipe **[4]** is visible straight across this westernmost field.

Parallel anomalies and trends in the data at **[5]** coincide with a depression in the field and marked on the mapping; the change in topography is responsible for the magnetic trends.

Covering the whole of the north-eastern field and extending southwards into the adjacent field is an area of strong magnetic responses **[6]** which show clearly on the colour plot (Figure 03). Google Earth imagery shows that this area was at one stage stripped of vegetation and topsoil. The observed responses reflect the ground disturbance after the landscaping operations had been completed.

There is an area of 'noisier' data **[7]** in the southern half of the survey; this could be a localised pedological effect, though a definitive origin remains uncertain.

Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and huts. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.

A number of magnetic 'spikes' (strong focussed values with positive, negative or bi-polar responses) indicate ferrous metal objects. These are likely to be modern rubbish.

5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Alluvial, sand and gravel geologies can provide poor responses for magnetic survey. In this instance, the data show marked variation across the site; one area has clearly been landscaped while another shows increased magnetic responses. Given that possible drains are in the data and that minor topographic variations are visible; it is likely that any substantial archaeological remains would have been detected. Thus the survey has been effective, except in the landscaped area.

6 CONCLUSION

No features of definite archaeological interest have been detected. Three linear anomalies, possibly drains associated with a large gas pipe, are visible in the results. Topographic features have resulted in linear trends in the data. The field in the north-east has been landscaped and the southern area shows increased magnetic responses possibly due to localised variations in the soils.

7 REFERENCES

British Geological Survey, n.d., *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) Geology of Britain viewer. [Accessed 22/08/2016]

Chartered Institute for Archaeologists. *Standard and Guidance for Archaeological Geophysical Survey. (*http://www.archaeologists.net/sites/default/files/CIfAS&GGeophysics_1.pdf)

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation.*

IfA 2002. The Use of Geophysical Techniques in Archaeological Evaluations, IFA Paper No 6, C. Gaffney, J. Gater and S. Ovenden. Institute for Archaeology, Reading

TVAS 2013.*Land near Alford Close, Sandhurst, Berkshire, Archaeological Desk-based Assessment, ACS13/190*, Thames Valley Archaeological Services, unpublished.

Appendix A - Technical Information: Magnetometer Survey Method

Grid Positioning
For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad*601-2
Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m.

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 site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (Destagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology/Probable Archaeology	This term is used when the form, nature and pattern of the response are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal- working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains will often lead and empty into larger diameter pipes and which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present. They are presumed to be modern.
Service	Magnetically strong anomalies usually forming linear features indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) cause weaker magnetic responses and can be identified from their uniform linearity crossing large expanses.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* and *Possible Natural* or (in the case of linear responses) *Possible Archaeology* and *Possible Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

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. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected.

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

Thermoremanence 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. Thermoremanent 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 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.

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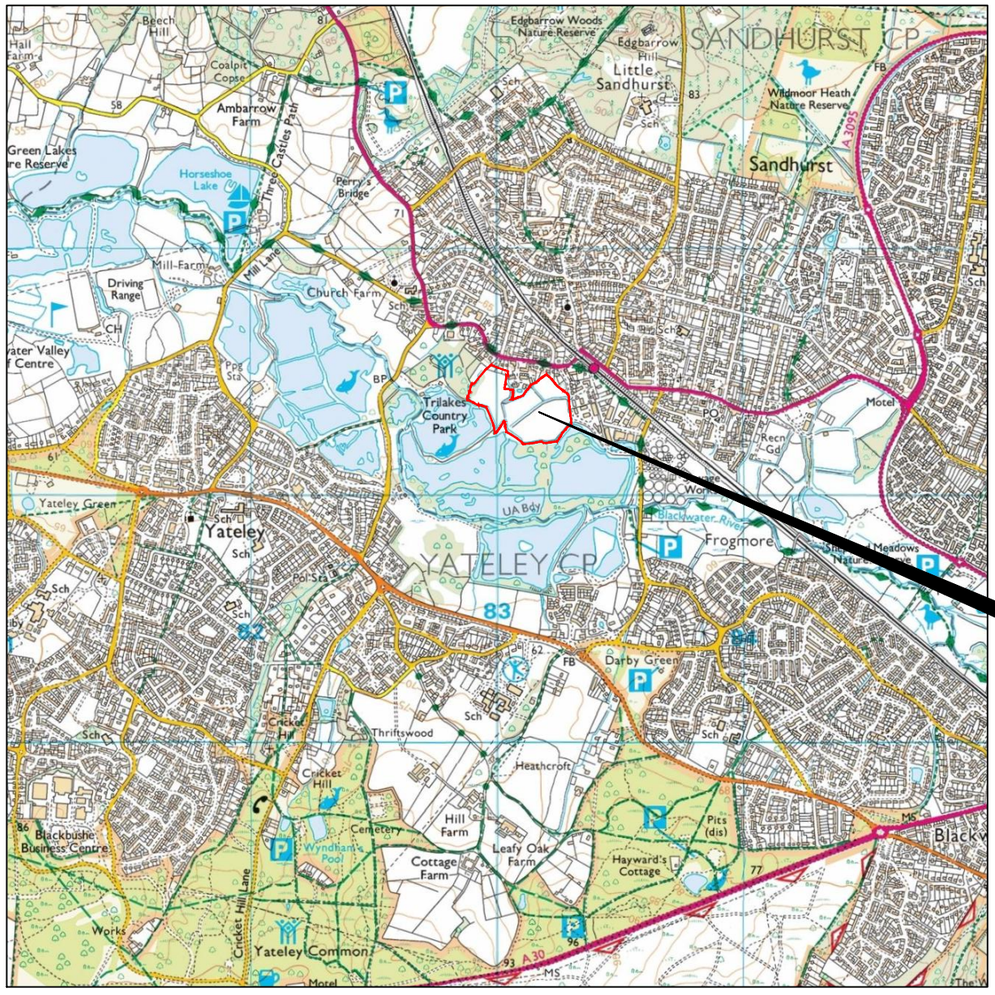

Survey Area

N

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Site centred on NGR SU 832 617

Client
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Project Title
LAND WEST OF ALFORD CLOSE, SANDHURST, BERKSHIRE

Job No. 10184

Subject
LOCATION PLAN OF SURVEY AREA

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Scale 1:25000 (0m 500 1000m)

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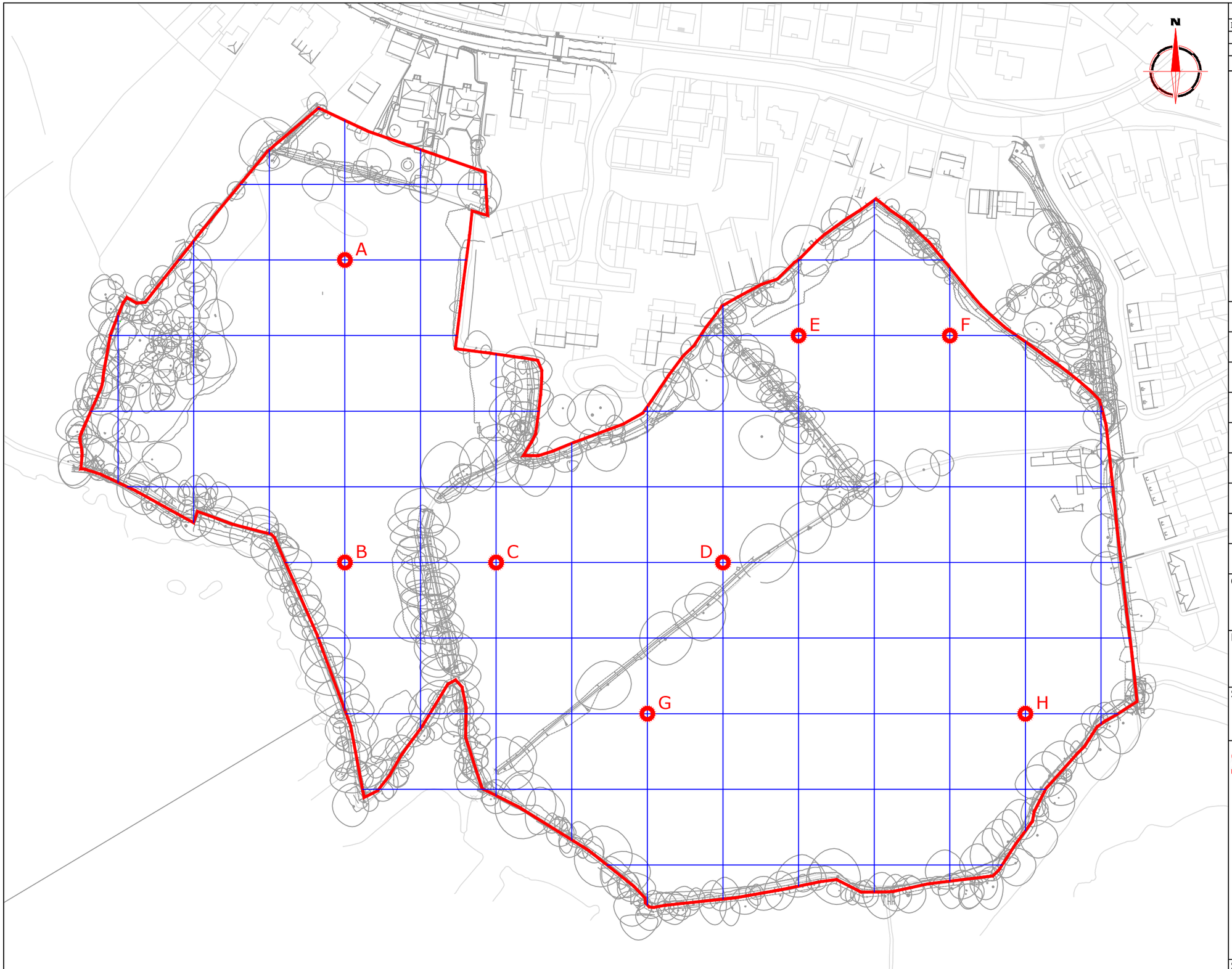
Survey date	Drawn by	Figure No.
AUG 16	RD	01



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LOCATION OF SURVEY GRIDS AND REFERENCING

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Survey date	Drawn by	Figure No.
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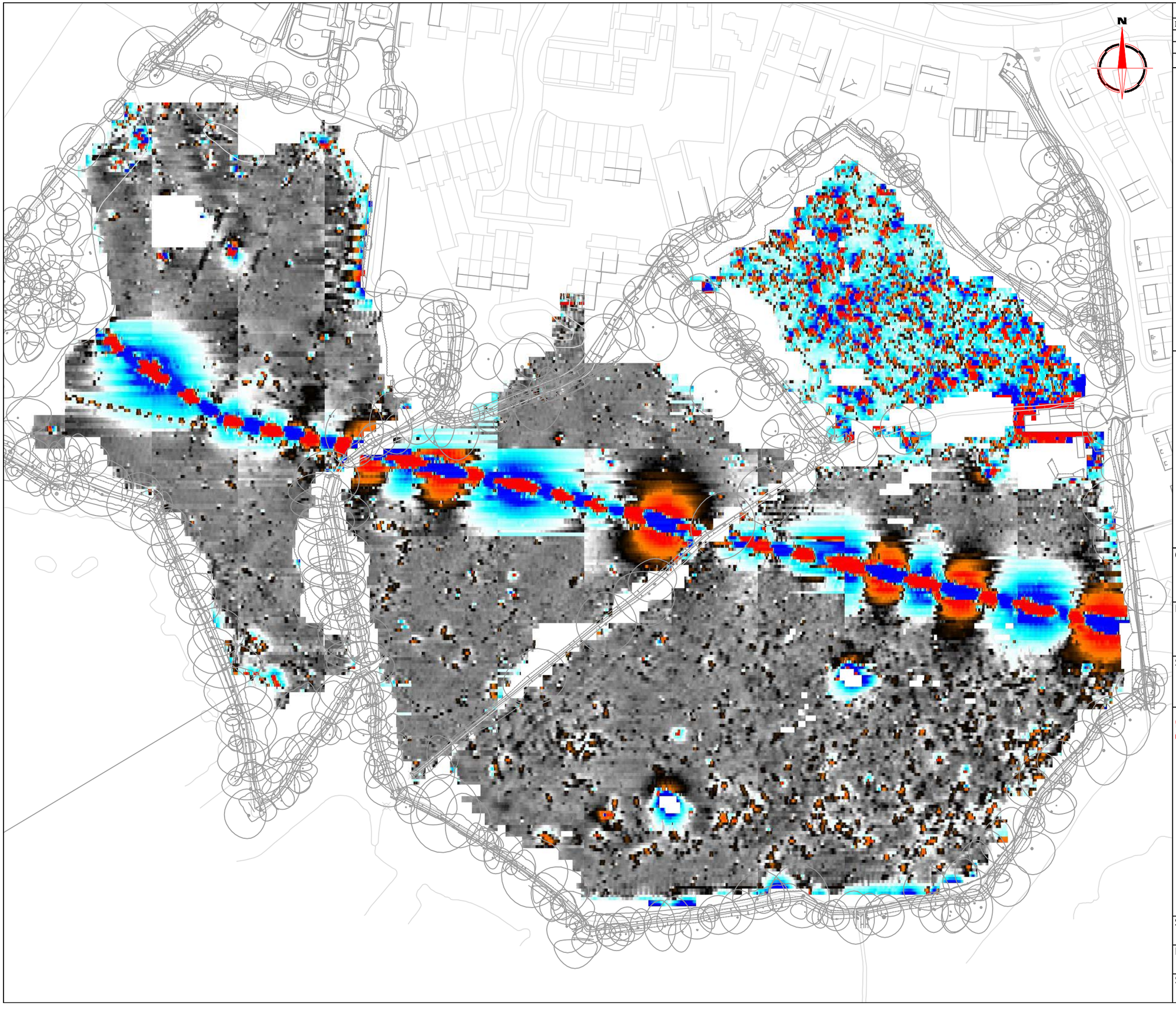

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Issue No.	Date	Description
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Plotting parameters

Maximum +100nT (red)
Minimum -100nT (blue)

+100nT
+25nT
+3nT
-3nT
-25nT
-100nT

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COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES

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Scale 1:1250

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A3	DGE	01
Survey date	Drawn by	Figure No.
AUG 16	SDH	03

Amendments

Issue No.	Date	Description
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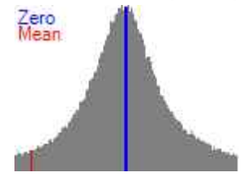

Client
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Project Title
LAND WEST OF ALFORD CLOSE, SANDHURST, BERKSHIRE

Job No. 10184

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PLOT OF MINIMALLY PROCESSED GRADIOMETER DATA

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A3	DGE	01
Survey date	Drawn by	Figure No.
AUG 16	SDH	04

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

OTHER ANOMALIES

	Linear anomaly - probably related to pipe, cable or other modern service
	Linear anomaly - uncertain origin
	Linear anomaly - coincides with depression in field and on mapping
	Magnetic disturbance associated with nearby metal object such as service or field boundary
	Strong magnetic debris - possible disturbed or made ground
	Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin
	Areas of enhanced magnetic response - uncertain origin, possibly natural
	Magnetic spike - probable ferrous object

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LAND WEST OF ALFORD CLOSE, SANDHURST, BERKSHIRE

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ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES

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