Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Littledown
Donhead St Mary parish, Wiltshire

Ordnance Survey (E/N): 387179,124676 (point)

Report: 141022

Ross Dean BSc MSc MA MIfA

22 October 2014

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Contents

Figures

Tables

Accompanying CD-ROM

Report ..... Adobe PDF format
Copies of report figures ..... Adobe PDF format
Raw and processed grid & composite files ..... DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata ..... Adobe PDF format
GIS project, shape files and classification schema
- GIS project ..... Manifold 8 '.map' file
- GIS shape files ..... ESRI standard
- GIS classification schema ..... Adobe PDF format

AutoCAD version of the survey interpretation ..... AutoCAD DXF

1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	October 2014
Area:	12ha
Lead surveyor:	Ross Dean BSc MSc MA MIfA

1.2 Client

AC Archaeology Ltd, Manor Farm Stables, Chicklade, Hindon, Nr. Salisbury, Wiltshire SP3 5SU

1.3 Location

Site:	Land at Littledown
Parish:	Donhead St Mary
County:	Wiltshire
Nearest Postcode:	SP7 9BT
NGR:	ST 871 246
Ordnance Survey E/N:	387179,124676 (point)

1.4 Archive

OASIS number:	substrat1-193155
Archive:	At the time of writing, the archive of this survey will be held by Substrata.

1.5 Introduction

This report was commissioned by AC Archaeology Ltd on behalf of Aardvark EM Ltd and has been prepared as part of a programme of work in support of a forthcoming planning application for a proposed solar array. The location of the proposed development area is shown in Figure 4.

1.6 Summary

The magnetic contrast across the area, although low, was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses. Three magnetic anomaly groups were identified as relating to possible archaeological deposits or features. Of these, one coincides with a field boundary mapped between 1841 and 1985-87. Another group may also relate to a former field boundary as it aligns with an extant field boundary to the south. The third anomaly group may indicate archaeological deposits but could equally well relate to relatively recent field drains.

2 Survey aims and objectives

2.1 Aims

1. Define and characterise and detectable archaeological remains on the site.
2. Inform any future archaeological investigation of the area.

2.2 Objectives

1. Complete a gradiometer survey across agreed parts of the application area.
2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
3. Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
4. Accurately record the location of the identified anomalies.
5. Produce a report based on the survey that is sufficiently detailed to inform any subsequent development on the site about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Institute for Archaeologists (2011). The codes of approved practice that were followed are those of the Institute for Archaeologists (2008 and 2009) and Archaeology Data Service/Digital Antiquity Guides (undated). The document text was written using the house style of the Institute for Archaeologists (Institute for Archaeologists, undated).

4 Site description

4.1 Landscape and land use

The application area is composed of three adjacent parcels of agricultural land totalling approximately 12ha and lying about 240m O.D. on gently sloping, south-facing land. The field boundaries are mature hedges with irregularly spaced trees.

At the time of the survey the hay had been recently cropped and hay bails were being removed.

4.2 Geology

The application area is located on a solid geology of the Lower Cretaceous Boyne Hollow Chert Member which is composed of glauconitic sand and sandstone with regularly developed nodular and tabular beds of chert. The chert comprises interbedded chert beds and nodules, up to 0.4m thick. The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

A comprehensive description of all designated and non-designated heritage assets within 1km of the application area can be found in the AC Archaeology Ltd Historic Environment Assessment for this programme of work (Cottam, 2014). The following is a short interpretation of information obtained from the Historic Environment Assessment relevant to the application area.

The reader is advised that this summary should not be used outside the context of this report and is referred to the Wiltshire Historical Environment Record (HER).

There are no designated assets within the application area and two within the broader study area examined in the Assessment, both of which are Grade II Listed Buildings; Thanes Farmhouse (HER reference MDO27821) and Wincombe Park (English Heritage reference LEN 1146083). All of the hedgerows within, and forming boundaries to, the application area are considered to be historic hedgerows. There are no non-designated heritage assets within the application area and seven within 1km. These include two settlements of Medieval origin (AD 1066 to AD1 539); Hatts Farm (HER MWI190) and Ramshill Farm (MWI216) lying to the northeast and southeast of the application area respectively. Post-medieval (AD 1540 to 1901) non-designated assets comprise a rifle range to the west of the application area (MDO27929), flag staffs associated with the rifle range (MDO27933 and MDO27931) and several small quarries (MDO27932). An area of Modern (AD 1901 to present) allotments are recorded to the southwest of the application area on the 1901 Ordnance Survey map but these are no longer extant (MDO27934).

6 Results, discussion and conclusions

This survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits and structures.

The reader is referred to section 7.

6.1 Results

Figure 1 shows the interpretation of the survey data. It includes the anomaly groups identified as relating to archaeological deposits along with their numbers. Table 1 is an extract from a detailed analysis of the survey data provided in the attribute tables of the GIS project on the accompanying CD-ROM.

Figure 1 along with table 1 comprises the analysis of the survey data. Plots of the processed data are provided in Figures 2 and 3.

6.2 Discussion

Refer to Figures 1 to 3. Not all anomalies or anomaly groups identified in the survey dataset are necessarily discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM. Those anomaly groups possibly representing archaeological deposits are included in the data analysis (Table 1).

<u>General points</u>

Anomalies though to relate to natural features were not mapped. Recent man-made objects such as manholes, water management equipment, drain, cables and other services were only mapped when they comprised significant magnetic responses across the dataset. If mapped, they are listed in Table 1 but are not discussed below.

Data collection along the field edges was restricted as shown in Figures 1 to 3 due to hay bales within the field and the presence of magnetic materials in and adjacent to the field boundaries. Strong magnetic responses mapped close to the field boundaries are likely to relate to these materials except where indicated otherwise in Figure 1.

There are two sets of parallel linear anomalies aligned with the approximately north-south trending extant field boundaries (Figure 2). These anomaly sets are likely to relate to sub-soil disturbance caused by ploughing of unknown date.

<u>Data relating to historical maps and other records</u>

Magnetic anomaly group **1** (Figure 1) coincides with a former section of field boundary mapped on the 1841 Donhead St Mary Tithe map and on Ordnance Survey maps between 1888 and 1985-87.

<u>Data with no previous provenance</u>

Anomaly group **2** aligns with an extant field boundary to the south of the application area and so may represent a former field boundary although no such boundary was recorded on the 1841 Tithe map or later Ordnance Survey maps.

A series of linear trends in the southern parcel of land (group **3**) may have archaeological origins but could equally well relate to relatively recent field drainage.

6.3 Conclusions

The magnetic contrast across the area, although low, was sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses. Three magnetic anomaly groups were identified as relating to possible archaeological deposits or features. Of these, one coincides with a

field boundary mapped between 1841 and 1985-87. Another group may also relate to a former field boundary as it aligns with an extant field boundary to the south. The third anomaly group may indicate archaeological deposits but could equally well relate to relatively recent field drains.

7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

8 Acknowledgements

Substrata would like to thank Peter Cox of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

Archaeology Data Service/Digital Antiquity Guides to Good Practice (undated): *Geophysical Data in Archaeology* [Online], Available: http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc [July 2014]

British Geological Survey (undated) *Geology of Britain viewer [Online], Available: http://www.bgs.ac.uk/discovering Geology/geologyOfBritain/viewer.html* [October 2014]

Clark, A. (2000) *Seeing Beneath the Soil, Prospecting methods in archaeology*, London: Routledge

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Dean, R. (2014) *A gradiometer survey method statement, Land at Littledown, Donhead St Mary parish, Wiltshire,* Substrata unpublished document

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Institute for Archaeologists (2009) *Code of conduct*. Reading: Author [Online], Available: http://www.archaeologists.net/sites/default/files/node-files/code_conduct.pdf [October 2014]

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Appendix 1 Analysis table and supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.

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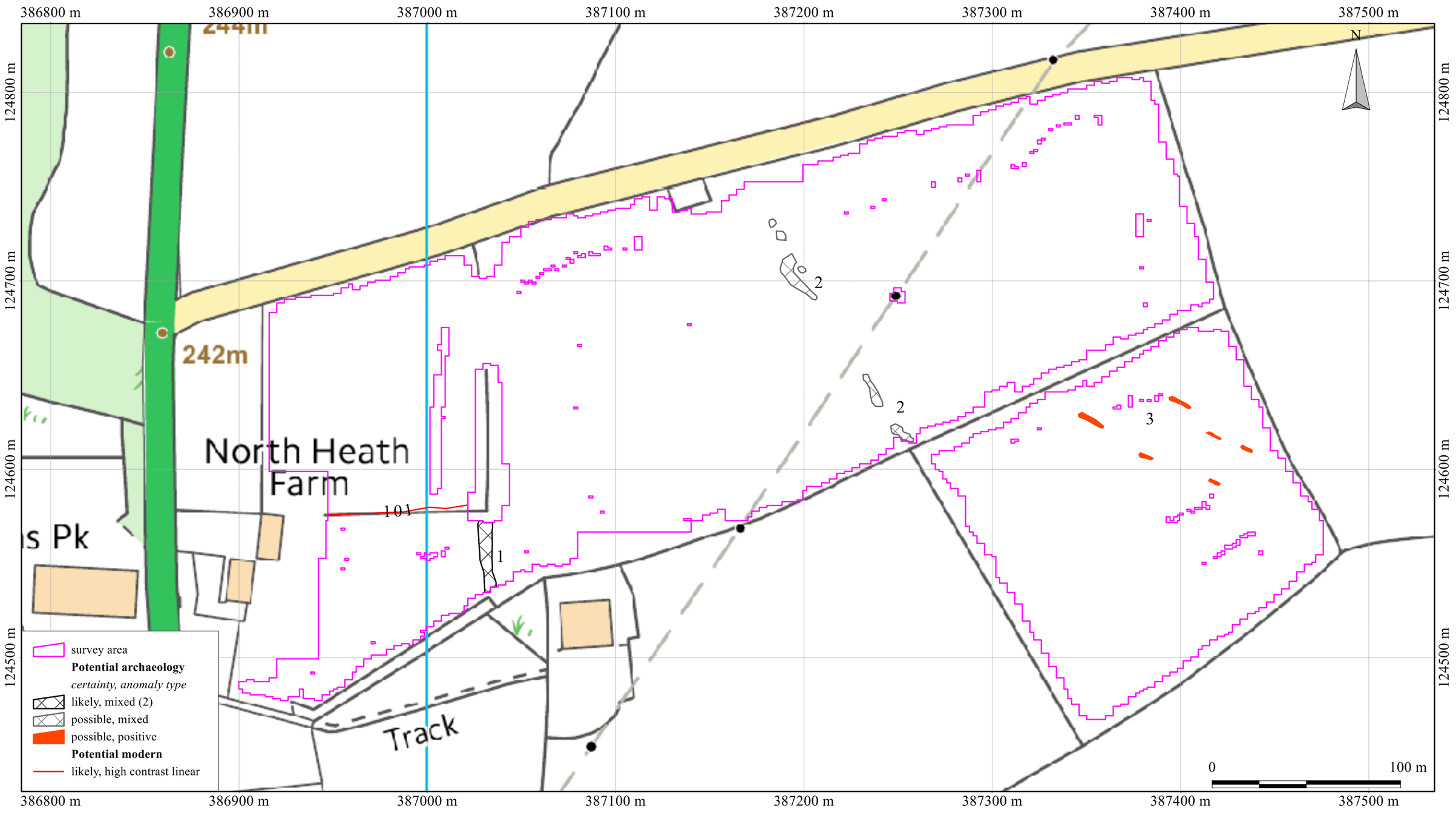
anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		likely, mixed	linear	former field boundary	anomaly group coincides with a former field boundary, partially extant today, mapped between 1841 and at least 1985 - 87	1841 Donhead St Mary Tithe Map, Ordnance Survey maps 1888 to 1985-87
2		possible, mixed	linear	former field boundary	anomaly group aligns with former field boundary not mapped on the 1841 Tithe map or historical Ordnance Survey maps	1841 Donhead St Mary Tithe Map, Ordnance Survey maps 1888 onwards
3		possible, positive	linear		a series of similar trending faint anomaly groups that may indicate archaeological deposits or, equally, relatively recent field drains	
101		likely, high contrast linear		fence wire on the ground		

Table 1: data analysis



British Grid
centre X: 387159.66 m, centre Y: 124632.75 m

Scale: 1:2000 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
3. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 1: survey interpretation

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British Grid
centre X: 387159.66 m, centre Y: 124632.75 m

Scale: 1:2000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 2: shade plot of processed data

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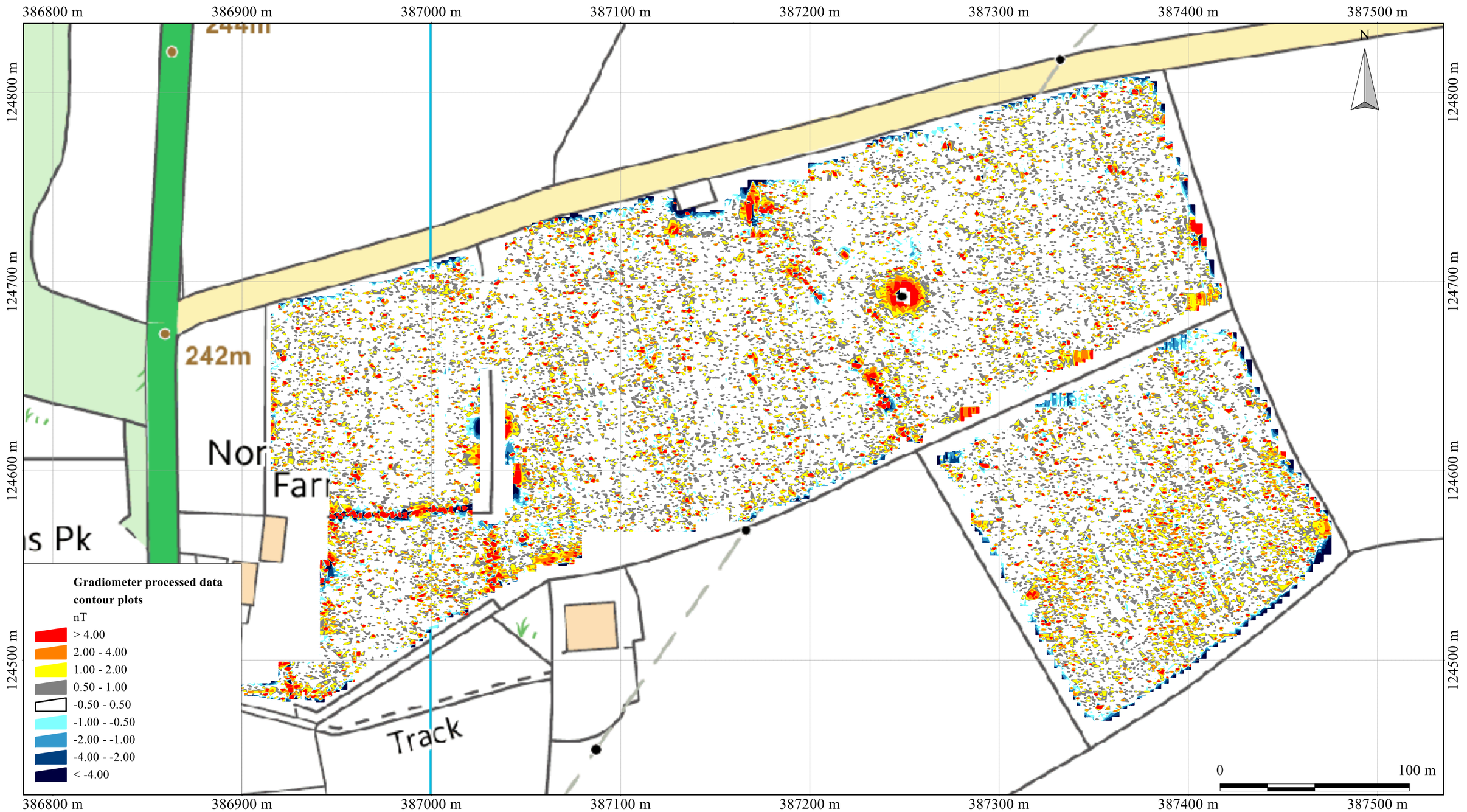

British Grid
centre X: 387159.66 m, centre Y: 124632.75 m

Scale: 1:2000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: contour plot of processed data

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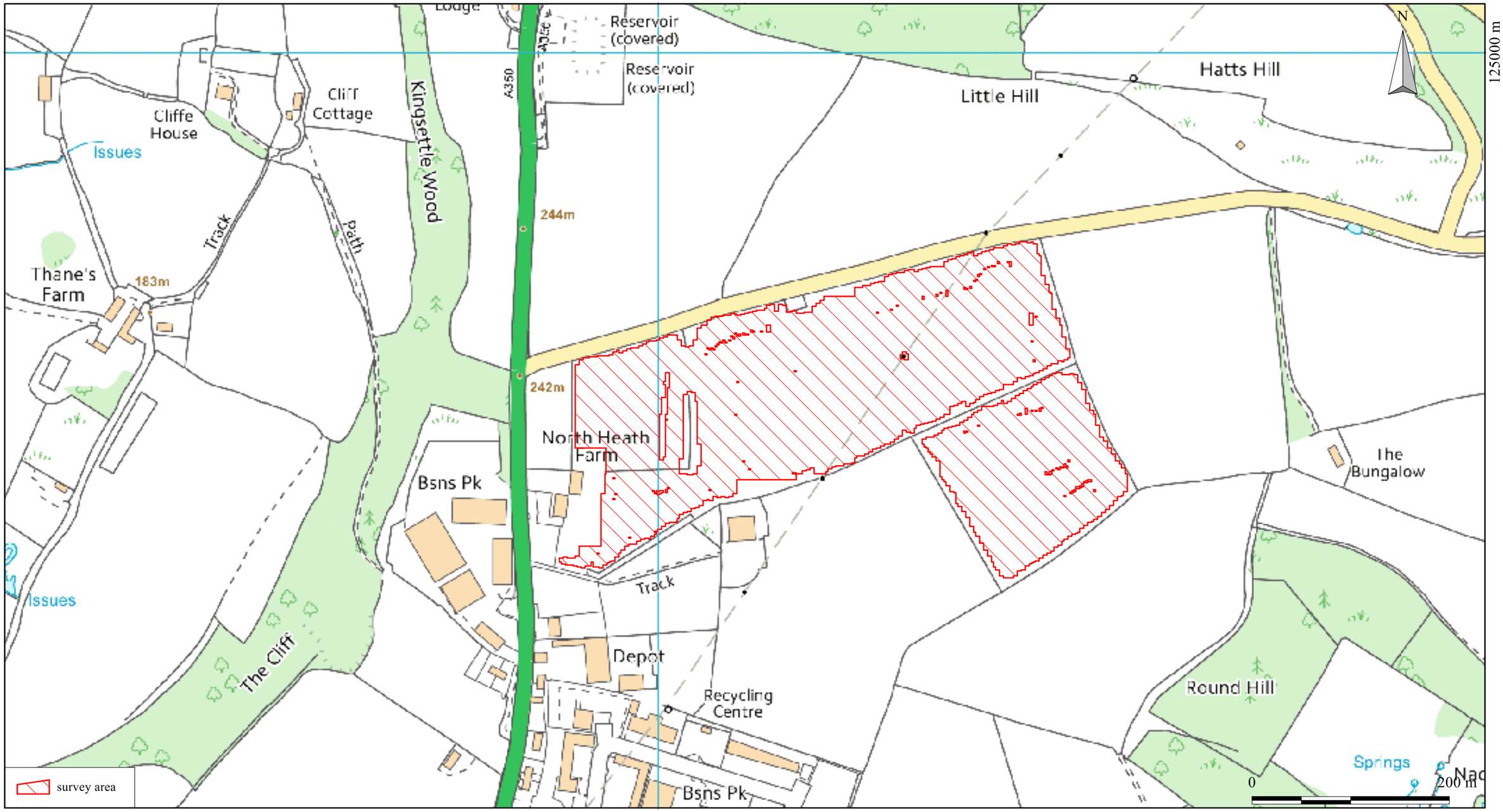
387000 m

125000 m



387000 m

125000 m

British Grid
centre X: 387087.96 m, centre Y: 124641.61 m

Scale: 1:4000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
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Figure 4: location map

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Appendix 2 Methodology Summary

<table>
<tr><th colspan="2">Table 2: methodology summary</th></tr>
<tr><td colspan="2">Documents
Survey methodology statement: Dean (2014)</td></tr>
<tr><td colspan="2">Methodology
1. The work was undertaken in accordance with the survey methodology statement. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011) and Archaeology Data Service/Digital Antiquity Guides (undated).
2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system.
3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology.</td></tr>
<tr><td colspan="2">Grid
Method of Fixing: DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates.
Composition: 30m by 30m grids
Recording: Geo-referenced and recorded using digital map tiles.
DGPS used: Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</td></tr>
<tr><td>Equipment
Instrument: Bartington Instruments grad601-2
Firmware: version 6.1</td><td>Data Capture
Sample Interval: 0.25-metres
Traverse Interval: 1 metre
Traverse Method: zigzag
Traverse Orientation: GN</td></tr>
<tr><td colspan="2">Data Processing, Analysis and Presentation Software
IntelliCAD Technology Consortium IntelliCAD 7.2
DW Consulting TerraSurveyor3
Manifold System 8 GIS
Microsoft Corp. Office Excel 2013
Microsoft Corp. Office Publisher 2013
Adobe Systems Inc Adobe Acrobat 9 Pro Extended</td></tr>
</table>

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata
SITE Instrument Type: Bartington Grad 610 Units: nT Direction of 1st Traverse: 0 deg Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing. Dummy Value: 32702 PROGRAM Name: TerraSurveyor Version: 3.0.25.1
Stats Max: 27.76 Min: -21.33 Std Dev: 1.78 Mean: 0.00 Median: 0.00 Processes: 7 1 Base Layer 2 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 180, Left 398, Bottom 239, Right 457) 3 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 16, Left 480, Bottom 46, Right 585) 4 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 20, Left 182, Bottom 41, Right 376) 5 Clip at 1.00 SD 6 Clip at 5.00 SD 7 DeStripe Median Traverse: Grids: All Note: converting the gradiometer data into ESRI GIS files imposed an x=y interpolation on the entire dataset

Appendix 4 Geophysical surveying techniques

1 Introduction

Substrata offers magnetometer and earth resistance surveying. We also provide other archaeology-specific geophysical surveys such as ground penetrating radar and resistivity. The particular method or combination of methods used depends on local soil conditions and the survey requirements. These methods are capable of delivering fast and accurate assessments of the archaeology of both large and small sites.

Further details can be found on our website at www.substrata.co.uk.

2 Magnetometer surveying

Standard magnetometer surveys are the workhorse of archaeological surveying when speed and cost-effectiveness are important. Identifiable archaeological features include areas of occupation, hearths, kilns, furnaces, ditches, pits, post-holes, ridge-and-furrow, timber structures, wall footings, roads, tracks and similar buried features.

Magnetometer surveying is used to detect and map small changes in the earth's magnetic field caused by concentrations of ferrous-based minerals within the soil and subsoil, and by materials buried beneath the surface. While most of these changes are too small to affect a compass needle, they can be detected and mapped by sensitive field equipment. During surveys the different magnetic properties of top-soils, sub-soils, rock formations and archaeological features are recorded as variations against a background value. Subsequently magnetic anomalies resulting from potential archaeology can be identified and interpreted.

Bartington grad601-2 gradiometers

A gradiometer is a type of magnetometer and is sensitive to relatively small changes in the earth's magnetic field. Our primary surveying instruments are Bartington Grad601-2 (dual sensor) fluxgate gradiometers with automatic data loggers. They are specifically designed for field use by archaeologists. The Bartington gradiometers provide proven technology in archaeological magnetic surveying and offer fast, accurate set-up and survey rates. They are sensitive to depths of between 0 and 1.5m below ground level, with optimum sensitivity at depths of 1m or less.

Multiple sensor arrays

A technique relatively new to commercial archaeological surveying but well understood in academic circles involves the use of multiple magnetometer sensors towed behind a quad bike or similar vehicle. With multiple sensors and the use of on-board GPS units, it is possible to achieve faster survey rates at competitive commercial rates when compared to the use of multiple instruments and the techniques discussed above provided the ground is suitable for the vehicle and array. Substrata is pleased to announce that we now offer this service on suitable larger sites

3 Earth resistance surveying

Earth resistance surveying is an excellent tool for detecting buried archaeology. Its relatively slow rate of survey compared to magnetometer surveys means that it usually employed in commercial surveys when a detailed understanding of buried building remains is required. This technique measures changes in the electrical resistance of the ground being surveyed. In practice, the recording of differences in the electrical resistance of near-surface deposits and structures allows the detection and interpretation of masonry and brick foundations, paving and floors, drains and other cavities, large pits, building platforms, robber trenches, ditches, graves and similar buried features.

Resistance to electrical current flow in the ground depends on the moisture content and structure of the soil and other materials buried beneath the surface. For example, the higher the moisture content of a soil, the less resistant it is to electrical current flow. A ditch completely buried beneath the present ground surface is likely to have an infill soil different to that surrounding the ditch in terms of compactness and composition. As a result, the soil filling the buried ditch will retain moisture in a different way to the surrounding soil which means it will

have an electrical resistance at variance with the surrounding environment. By passing a small current through the ground it is possible to detect, record, plot and interpret such changes in electrical resistance.

For earth resistance surveying Substrata uses the Geoscan Research RM15 series multi-probe resistance meters and purpose-built automatic data-loggers. The Geoscan MPX15 multiplexer is an integral part to the instrument configuration and facilitates multi-probe arrays which speed up survey area coverage rates and, if required, facilitate simultaneous multiple-depth data collection.