Substrata
Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Wood Close, Exbourne, Devon

Centred on NGR (E/N): 260260,101700 (point)

Report: 1612WOO-R-1

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9 February 2017

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Project archive

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	DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata	DW Consulting TerraSurveyor 3 formats
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

Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	5 January 2017
Area:	0.44ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA

1.2 Clients

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch Nr Exeter, Devon EX5 4QL

1.3 Location

Site:	Wood Close
Village & Civil Parish:	Exbourne
District:	West Devon
County:	Devon
Nearest Postcode:	EX20 3SA
NGR:	SS 603 017 (point)
NGR (E/N):	260260,101700 (point)

1.4 Archive

OASIS number:	substrat1-275839
Archive:	At the time of writing, the archive of this survey will be held by Substrata. Depending on local authority policy, an archive of the unprocessed data may be deposited with the Archaeological Data Service

1.5 Introduction

This report presents the results of an archaeological magnetometer survey at the above site, hereafter referred to as the survey area. It has been prepared for AC Archaeology Ltd on behalf of clients. The survey area location is shown in Figure 1.

1.6 Summary

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Six magnetic anomaly groups were mapped as representing potential archaeological deposits or features. One anomaly group may represent a deposit of strongly heated material. A recent origin cannot be ruled out but, if archaeological in origin, the deposit may be associated with craft or industrial production or indicative of cremation. The other anomaly groups mapped as representing potential archaeological deposits and features have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

2 Survey aims and objectives

2.1 Aims

To establish the presence or absence, extent and character of any archaeological features and deposits within the survey area.

2.2 Survey objectives

1. Complete a magnetometer survey across agreed parts of the survey 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 survey area about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

4 Site description

4.1 Landscape and land use

The site comprises a single field on the southern end of the village of Exbourne. It covers an area of approximately 0.44 hectares and slopes west to east from approximately 140m to 130m AOD with a shallow valley on its southern side as shown in Figure 1. Domestic buildings border the field to the north, west and south with a garage and workshop on the south-western corner. Agricultural fields lie to the east.

4.2 Geology

The bedrock across the site is of the Permian Bow Breccia Formation and generically comprises reddish-brown (weathering yellow), silty and sandy breccia (locally muddy or silty) with pebbles of sandstone, slate, shale, hornfels, acid lava, vein-quartz and quartz porphyry (British Geological Survey, undated).

Superficial deposits for the site are unknown (ibid).

5 Archaeological background

5.1 Historic landscape characterisation

'Medieval enclosures based on strip fields'

This area was probably first enclosed with hedge-banks during the later middle ages. The curving form of the hedge-banks suggests that earlier it may have been farmed as open strip-fields (Devon County Council, undated)

5.2 Summary of archaeological background

The following is taken from a Statement of Archaeological Potential, Impact and Mitigation produced by AC Archaeology for the same programme of work as this report (Costen, 2017).

Six heritage assets are recorded within the immediate environs of application area in the Devon and Dartmoor Historic Environment Record; the most significant is a prehistoric barrow in the adjacent field to the east of the application area which was recorded as a cropmark in 1992 (MDV55831). There is also some further evidence for prehistoric activity within the wider study area surrounding the application site. Another prehistoric barrow is recorded at Court Barton to the north east of the application area (MDV12579) identified from documentary evidence and described as "a large tumulus, unopened on the property of J.S Tattershall Esq. Court Barton" (Baring Gould 1898). A prehistoric curvilinear enclosure identified by aerial photography in 1992 is further to the west of Court Barton.

6 Results, discussion and conclusions

6.1 Scope and definitions

This survey was designed to record magnetic anomalies. A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can result from variations in the magnetism of underlying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface artefacts can also create magnetic anomalies.

The terms ‘archaeological deposit’, ‘structure’ and ‘feature’ refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity, excluding recent land maintenance and farming.

Magnetic anomalies cannot be regarded as physical archaeological deposits, structures or features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits, structures and features.

The reader is referred to section 7.

6.2 Results

Figure 2 shows the interpretation of the survey data which includes the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers. Table 1 is an extract of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive.

Figure 2 and Table 1 comprise the analysis of the survey data.

Figures 3 and 4 are plots of processed data as specified in Table 3. Figure 5 is a plot of unprocessed data with its metadata.

6.3 Discussion

6.3.1 General points

Discussion scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

Data collection

Data collection along the survey area edges was restricted as shown in the figures due to the presence of magnetic materials within and adjacent to boundaries. Strong magnetic responses mapped close to the boundaries are likely to relate to these materials except where otherwise indicated in Figure 2 and Table 1.

Anomaly characterisation and mapping

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

Anomalies thought to relate to natural features and recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent ferrous objects. They are only mapped if they could influence the analysis of anomaly groups thought to have an archaeological origin.

6.3.2 Data relating to historic maps and other records

None of the magnetic anomaly groups related to known historic records or assets.

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly group **3** has a large, positive, magnetic response which can be indicative of a deposit of strongly heated material. In this case, the anomaly pattern is not clear-cut and a modern origin cannot be ruled out. If archaeological in nature, such material can be associated with cremations, craft production or industrial production. Given the presence of a prehistoric barrow in the adjacent field (Section 5.2), this anomaly group may be significant.

The other anomaly groups mapped as representing potential archaeological deposits and features have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

6.4 Conclusions

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Six magnetic anomaly groups were mapped as representing potential archaeological deposits or features. One anomaly group (3) may represent a deposit of strongly heated material. A recent origin cannot be ruled out but, if archaeological in origin, the deposit may be associated with craft or industrial production or indicative of cremation. The other anomaly groups mapped as representing potential archaeological deposits and features (groups 1, 2, 4, 5 and 6) have patterns that typically represent former field and enclosure boundaries of unknown date and possibly of more than one phase of past land management.

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 John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

Archaeology Data Service (undated) *Archaeology Data Service/Digital Antiquity Guides to Good Practice: Geophysical Data in Archaeology.* [Online], Available: http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_Toc [October 2016]

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Devon County Council (undated) *Historic Environment.* [Online], https://new.devon.gov.uk/historicenvironment/ [February 2017]

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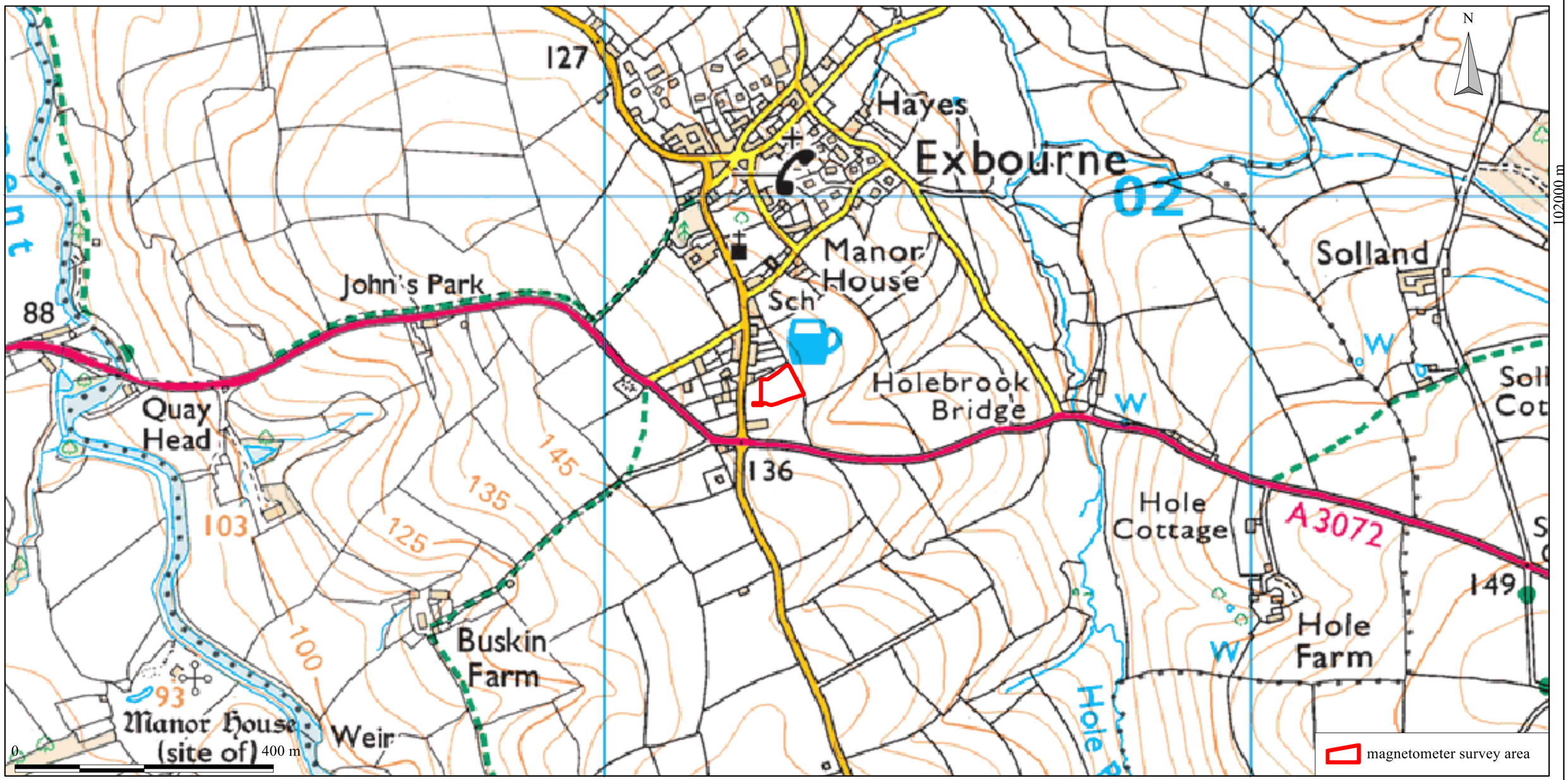
Appendix 1 Figures

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 (see Section 6.1).

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.



British Grid
centre X: 260267.54 m, centre Y: 101696.61 m

Scale: 1:6000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Wood Close, Exbourne, Devon
Centred on NGR (E/N): 260260,101700 (point)
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Figure 1: location

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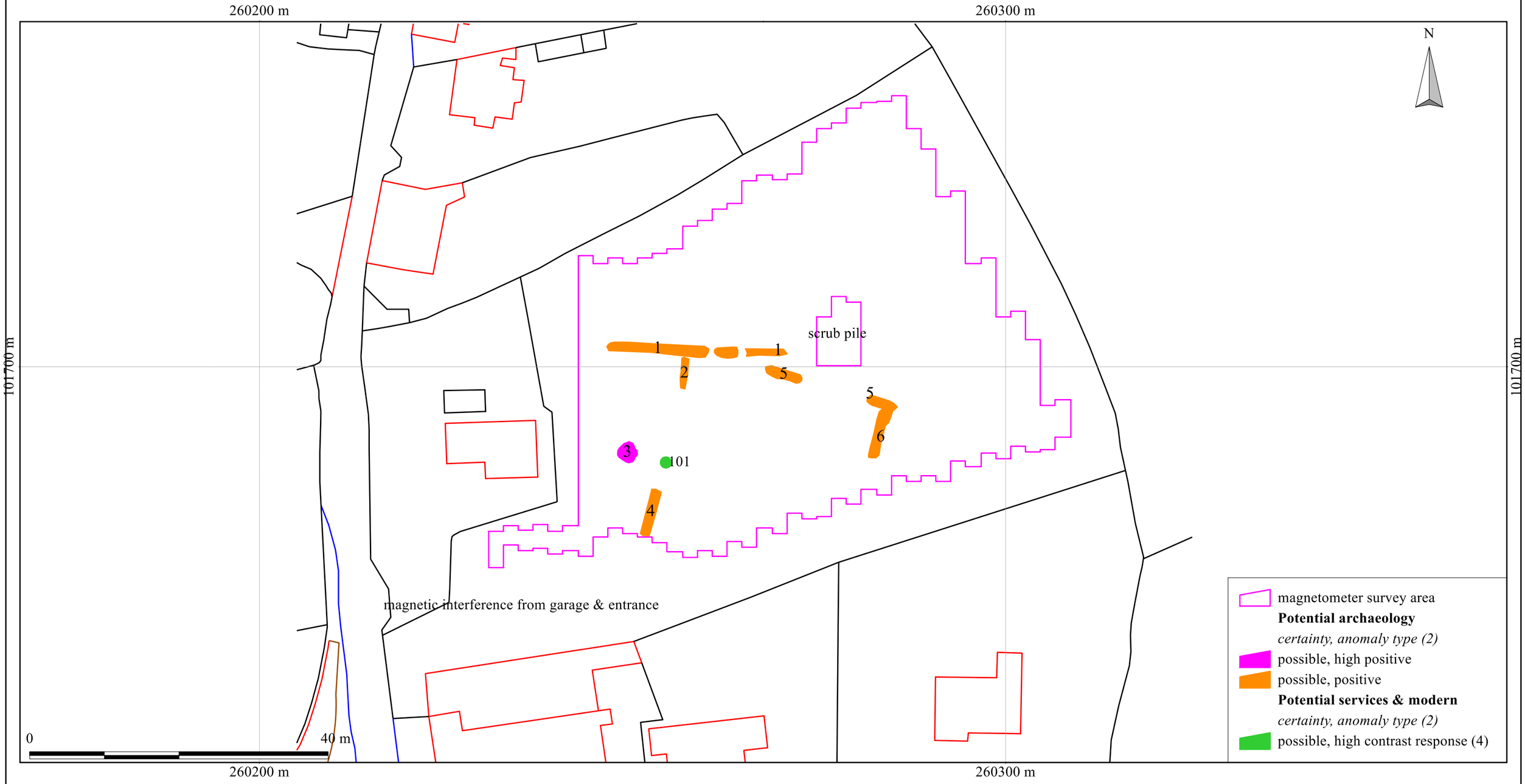

British Grid
centre X: 260267.54 m, centre Y: 101696.61 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Representative; not all instances are mapped.
5. 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 2: survey interpretation

Substrata Limited
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British Grid
centre X: 260267.54 m, centre Y: 101696.61 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
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Figure 3: shade plot of processed data

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260200 m

260300 m

101700 m

N

magnetometer survey area

Processed magnetometer data (nT)

- > 4.00
- 2.00 - 4.00
- 1.00 - 2.00
- 0.50 - 1.00
- -0.50 - 0.50
- -1.00 - -0.50
- -2.00 - -1.00
- -4.00 - -2.00
- < -4.00

0

40 m

260200 m

260300 m

101700 m

British Grid
centre X: 260267.54 m, centre Y: 101696.61 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
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Figure 4: contour plot of processed data

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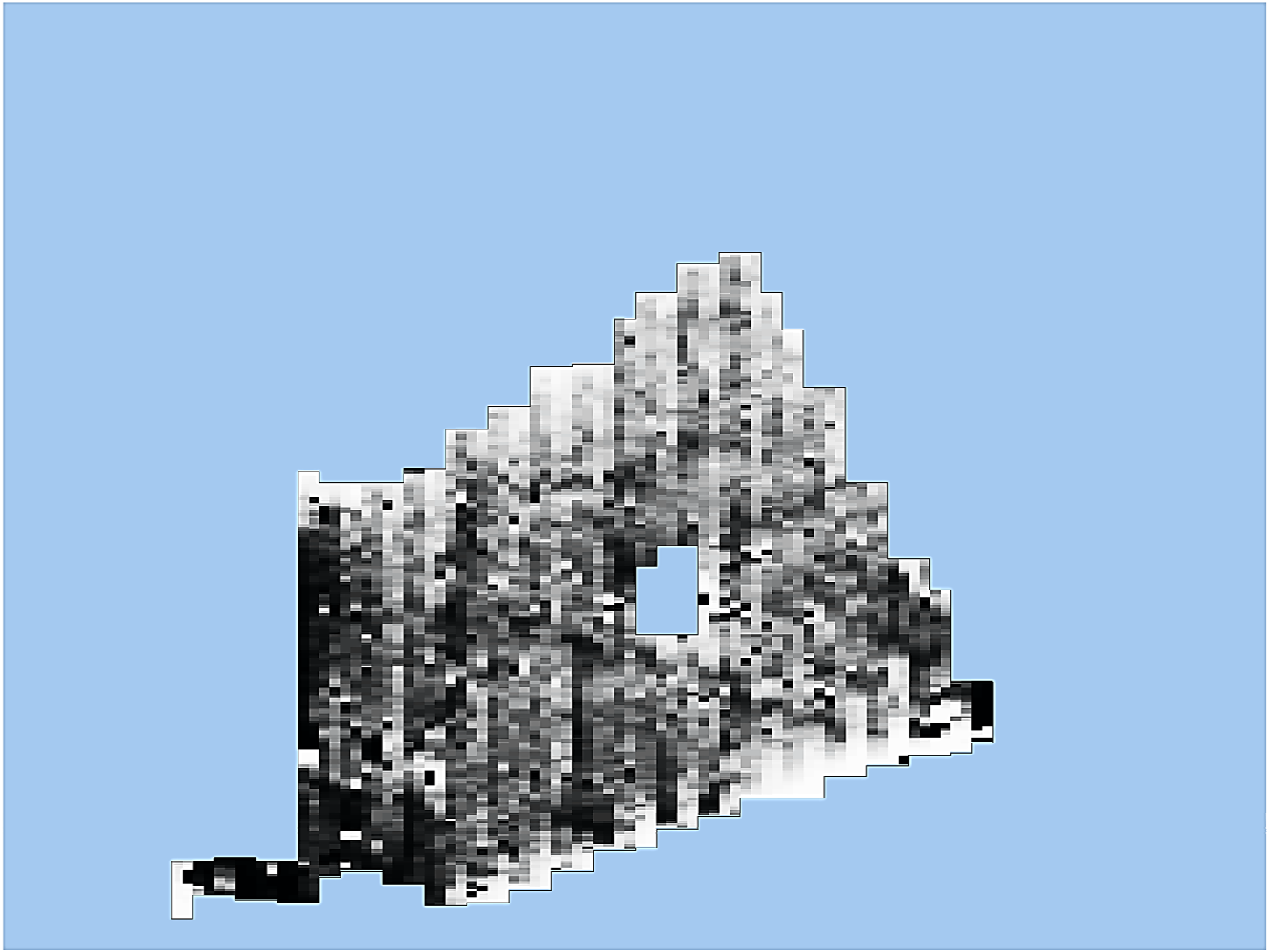
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



Instrument type: Bartington grad601-2
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 3000.00
Min: -3000.00
Std Dev: 74.28
Mean: -0.17
Median: -0.30

PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Processes: 1
1 Base Layer

Figure 5: shade plot of unprocessed data

Appendix 2 Tables

Site: An archaeological magnetometer survey
Wood Close, Exbourne, Devon
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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments
1	possible, positive	disrupted linear		
2	possible, positive	linear		
3	possible, high positive	oval	surface or pit with either highly heated material or with relatively modern ferrous material	the anomaly group may represent an archaeological deposit of heated material but a modern origin cannot be ruled out
4	possible, positive	linear		
5	possible, positive	disrupted linear		the anomaly group may represent a linear deposit such as a ditch but a coincidence in alignment of separate anomalies with unknown provenance cannot be ruled out
6	possible, positive	linear		
101	possible, high contrast response		ferrous material	anomaly group has a very high positive response with a 'halo' negative response; it is likely that the negative response does not reflect archaeology

Table 1: data analysis

Documents
Survey methodology statement: Dean (2017)

Methodology

1. The work was undertaken in accordance with the survey methodology statement. The geophysical (magnetometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service (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.

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.

Equipment	**Data Capture**
Instrument: Bartington Instruments grad601-2 *Firmware:* version 6.1	*Sample Interval:* 0.25m *Traverse Interval:* 1 metre *Traverse Method:* zigzag *Traverse Orientation:* GN

Data Processing, Analysis and Presentation Software
IntelliCAD Technology Consortium IntelliCAD 8.0
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

Table 2: methodology summary

SITE
Instrument Type: Bartington Grad-601 gradiometer
Units: nT
Direction of 1st Traverse: see below
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Stats	
Max:	6.27
Min:	-7.46
Std Dev:	1.43
Mean:	0.17
Median:	0.26

Processes: 9
1 Base Layer
2 Clip at 1.00 SD
3 Clip at 1.00 SD
4 De Stagger: Grids: All Mode: Both By: -1 intervals
5 De Stagger: Grids: All Mode: Both By: -1 intervals
6 De Stagger: Grids: All Mode: Both By: -1 intervals
7 DeStripe Mean Traverse: Grids: All
8 Edge Match (Area: Top 30, Left 0, Bottom 59, Right 119) to Right edge
9 Edge Match (Area: Top 60, Left 240, Bottom 89, Right 359) to Left edge

Table 3: processed data metadata