

Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land at Grovelands, New Exeter Street, Chudleigh, Devon

Centred on NGR (E/N): 287130,079740 (point)

Report: 1603GRO-R-1

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13 April 2016

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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: 22 and 23 March 2016
Area: Plot 1: 1.2ha
Plot 2: 1.5ha
Lead surveyor: Mark Edwards BA
Author: Ross Dean BSc MSc MA MifA

1.2 Client

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

1.3 Location

Site: Land at Grovelands, New Exeter Street
Village: Chudleigh
Civil Parish: Chudleigh
District: Teignbridge
County: Devon
Nearest Postcode: TQ13 0DD
NGR: SX 871 797
Ordnance Survey NGR (E/N): 287130,079740 (point)

1.4 Archive

OASIS number: substrat1-248252
Archive: At the time of writing, the archive of this survey will be held by Substrata.

1.5 Introduction

This report presents the results of an archaeological magnetometer survey at the above site, hereafter referred to as the application area. It has been prepared for AC archaeology on behalf of Taylor Wimpey as supporting information for a forthcoming planning application for residential development. The application area location is shown in Figure 1.

1.6 Summary

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

Eight magnetic anomaly groups were mapped as representing possible archaeological deposits or structures. Of these, one is likely to represent a former field boundary recorded on historical maps. Two anomaly groups may represent in-situ heated archaeological deposits and an adjacent set of deposits or structures. The remainder are typical of anomalies representing former field and enclosure boundaries of unknown origin and possibly of more than one phase of land enclosure.

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 application area. The results of the survey and any subsequent trial trenching will be reviewed and used to inform any ensuing mitigation.

2.2 Survey objectives

1. Complete a magnetometer 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 application 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/Digital Antiquity Guides (undated).

4 Site description

4.1 Landscape and land use

The field designations Plot 1 and Plot 2 shown in Figure 2 are those used in an historic environment assessment produced by AC Archaeology Ltd as part of the same programme of work as this report (Pink 2016).

The application area comprises two fields located on the north side of the town of Chudleigh and separated by the northeast-southwest aligned New Exeter Street. The northern field (Plot 1) comprises an area of approximately 1.2ha of land, which slopes down in a south-easterly direction from 81m aOD to 76m aOD. This plot is bounded by agricultural land to the north and northeast, and housing to the east and west. The southern field (Plot 2) comprises an area of approximately 1.5ha, with the land sloping in a south-easterly direction from 77m aOD to 66m aOD. The plot is bounded by an east-west aligned road to the north and surrounded by housing to the south, east and west (ibid: 1). At the time of the survey both plots were under grass and used for grazing.

4.2 Geology

The application area has a solid geology of rhythmically bedded, dark blue-grey mudstones and subordinate predominantly grey sandstones and siltstones of the Carboniferous Crackington Formation. The superficial geology is not recorded across most of the application area but is mapped as alluvium on the south-eastern boundary of Plot 2 (British Geological Survey, undated).

5 Archaeological background

5.1 Historic landscape characterisation

Modern enclosures adapting post-medieval fields.

These are modern enclosures that have been created by adapting earlier fields of post-medieval (AD 1539 to AD 1900) date which were probably laid out in the eighteenth and nineteenth centuries and commonly have many surveyed dead-straight field boundaries (Devon County Council, undated).

5.2 Historical and archaeological background

An historic environment assessment of an area of 500m around the application area was produced by AC Archaeology Ltd (Pink 2016) as part of the same programme of work as this report and is the main source for the discussion below.

Archaeological sites, buildings, historic parks and gardens, conservation areas, registered battlefields and other aspects of the historic environment that are significant because of their historic, archaeological, architectural or artistic interest are considered *heritage assets*. *Designated heritage assets* are afforded protection as either scheduled monuments, listed

buildings or through their inclusion within conservation areas. *Non-designated heritage assets* are potential archaeological remains and historic landscapes.

5.2.1 Heritage assets within the application area

No assets are recorded within the application area on the Devon HER, although cartographic evidence from a 'stylised' map of 1827 might suggest the presence of former buildings within the northern part of Plot 2 of the application. These are not present on the subsequent parish tithe map of 1838. No evidence for these was recorded in the survey data. The remains of two agricultural buildings within the application area were extant at the time of the survey.

5.2.2 Heritage assets within 500m of the application area

Within the land immediately to the northeast of the application area there is reference to a Romano-British (AD 43 to AD 410) urn containing charcoal and bone. There is clearly some uncertainty about the exact location of this find as there are three HER records relating to this cremation urn, two of which are located within a field to the east of the application area whilst the third suggests the urn was found within a barrow at Littlehill, the location of which has not been identified.

An archaeological gradiometer survey was undertaken on land adjacent to Bottle Bridge Hill, Chudleigh, in 2014 by Substrata (EDV6730, Dean 2014). A follow-up archaeological evaluation was undertaken on this land in 2015 by AC Archaeology (EDV6765, Caine and Passmore 2015). The evaluation targeted geophysical anomalies and identified, amongst various archaeological features, two burnt features, one of which may represent an iron smelting furnace of very Late Iron Age (600 BC to AD 43) date. The other feature of unknown date was disturbed by a later hollow containing burnt material and sherds of undiagnostic pottery of probable medieval (AD 1066 to AD 1539) date.

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, structures and features.

The terms archaeological deposits, structures and features refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity and not undertaken as recent land maintenance or farming.

The reader is referred to section 7.

6.1 Results

Figure 2 shows the interpretation of the survey data. It includes the anomaly groups identified as 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. These plots represent different views of the data that were used to assess potential archaeology.

6.2 Discussion

6.2.1 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 application area edges was restricted as shown in Figures 3 and 4 due to the presence of magnetic materials adjacent to the application area. Strong magnetic responses mapped close to survey boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

A soakaway and a manhole cover restricted data collection near the middle of Plot 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.

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. If mapped, they are listed in Table 1 but are not discussed below.

Anomalies thought to relate to natural features were not mapped.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent buried ferrous objects and such patterns are frequently found in close proximity to settlements.

6.2.2 Data relating to historic maps and other records

Magnetic anomaly group 7 coincides with, and likely represents, a field boundary recorded on the Chudleigh Tithe map and historic Ordnance Survey maps as listed in Table 1.

6.2.3 Data with no previous archaeological provenance

Magnetic anomaly groups 2 and 3 have characteristics often associated with in-situ highly heated deposits such as those relating to kilns and furnaces. In this case, group 3 may be in part the negative magnetic component of group 2 and may also represent an adjacent, possibly related, stony structure or deposit. A probable iron smelting furnace was recorded in an archaeological assessment of an adjacent field to the north (Caine and Passmore, 2015: 2-5) after the evaluation of a similar magnetic anomaly pattern (Dean, 2014: 4-6).

The remaining magnetic anomalies mapped as possible archaeological deposits or structures are typical of anomalies representing former field and enclosure boundaries of unknown origin and possibly of more than one phase of land enclosure.

6.3 Conclusions

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

Eight magnetic anomaly groups were mapped as representing possible archaeological deposits or structures. Of these, one is likely to represent a former field boundary recorded on historical maps. Two anomaly groups may represent in-situ heated archaeological deposits and an adjacent set of deposits or structures. The remainder are typical of anomalies representing former field and enclosure boundaries of unknown origin and possibly of more than one phase of land enclosure.

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.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79). This report contains material that is non-Substrata copyright or the intellectual property of third parties. Such material is labelled with the appropriate copyright and is non-transferrable by Substrata.

8 Acknowledgements

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

9 Bibliography

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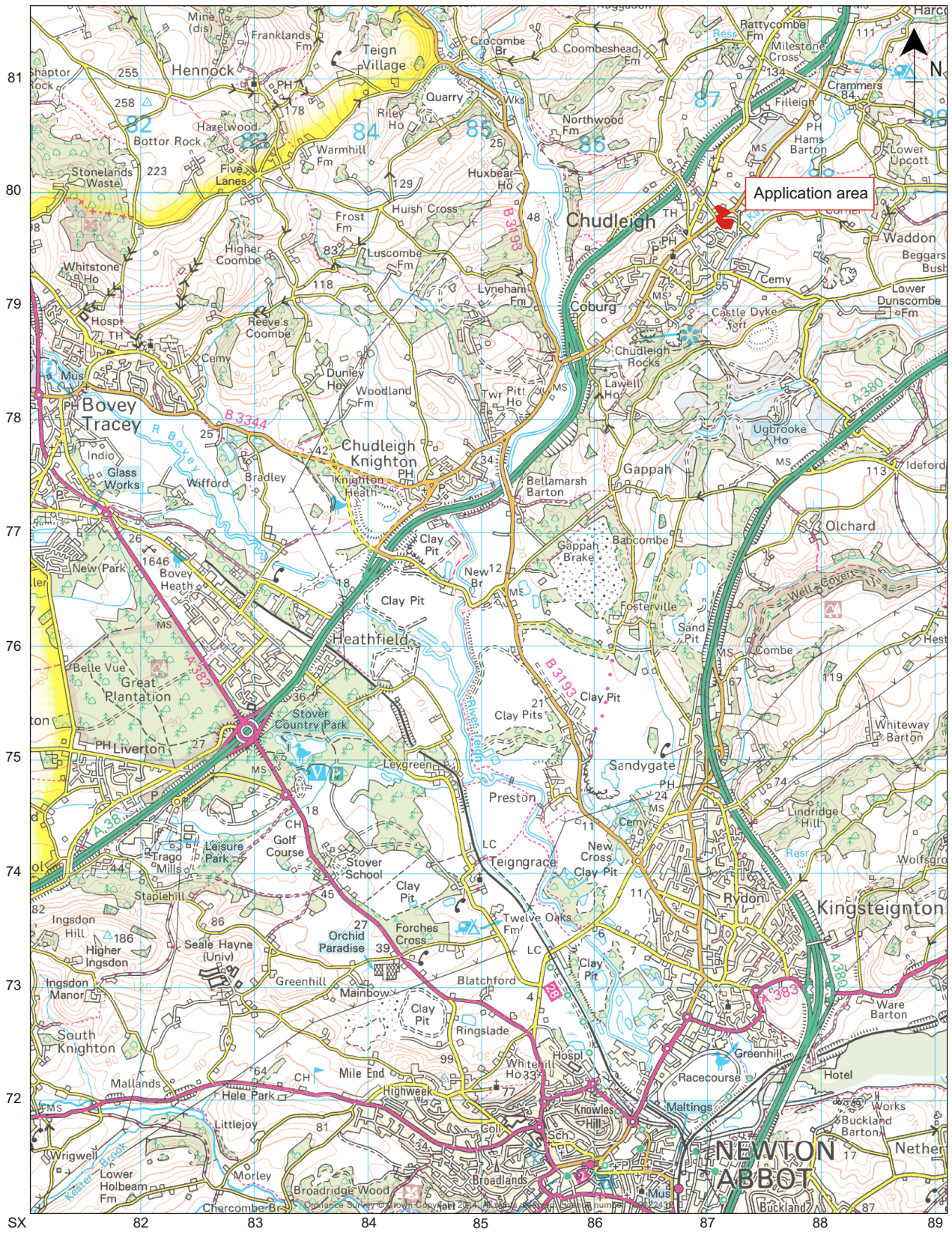
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation*, [Online], Available: <https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf> [April 2016]

Appendix 1 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.



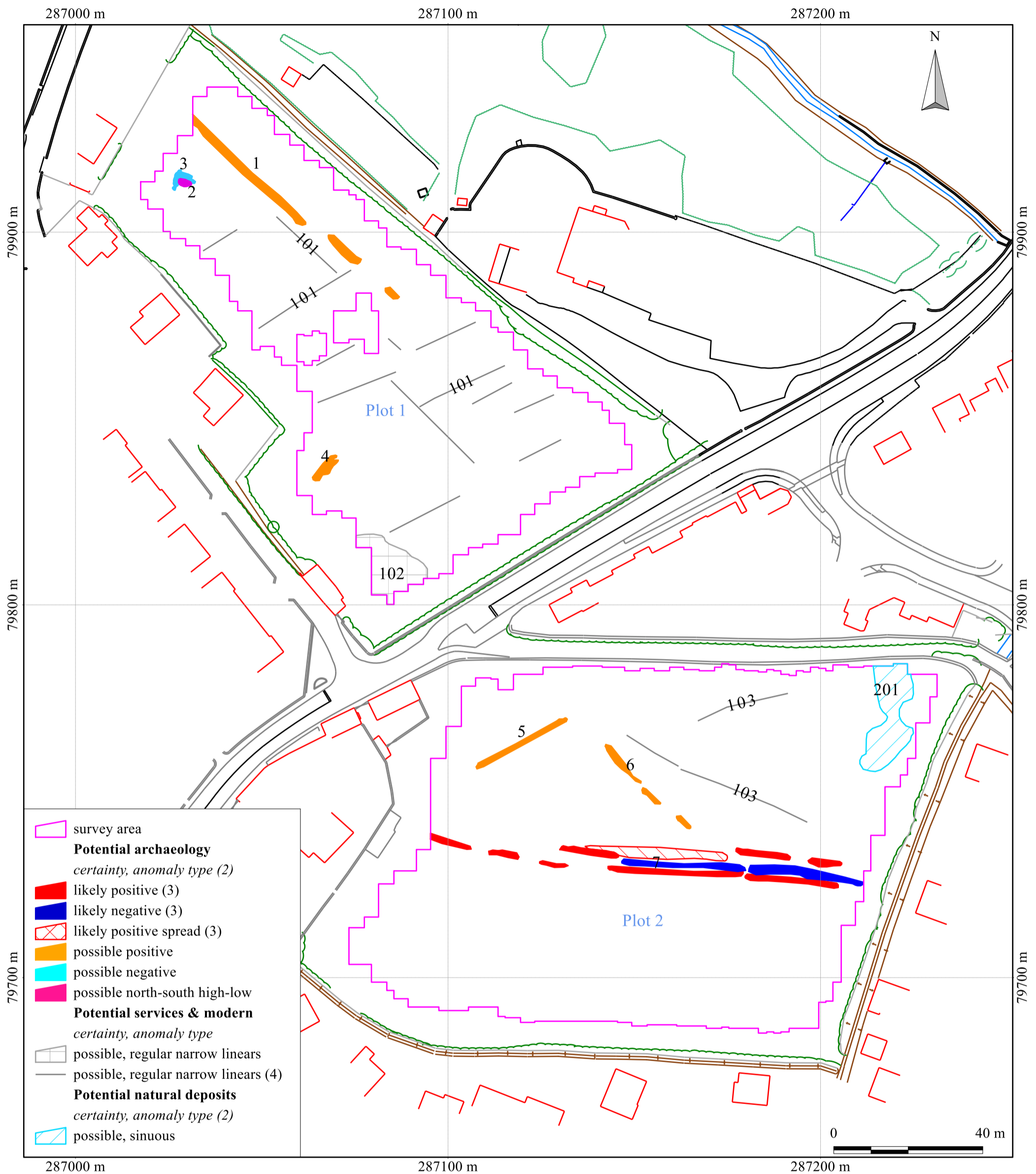
0 2.5km
Scale 1:50,000@A4

PROJECT
**Land at Grovelands, New Exeter Street,
 Chudleigh, Devon**

TITLE

Fig. 1: Location of site





British Grid
centre X: 287118.85 m, centre Y: 79803.73 m

Geophysical survey: Copyright Substrata 2016.
Base map: Ordnance Survey (c) Crown Copyright 2016,
Licence number 100022432. All rights reserved.

Notes:

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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.

An archaeological gradiometer survey
Land at Grovelands, New Exeter Street, Chudleigh, Devon
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Figure 2: survey interpretation

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Site: An archaeological gradiometer survey
 Land at Grovelands, New Exeter Street, Chudleigh, Devon
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plot number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	1		possible, positive	disrupted linear			
	2	3	possible, north-south high-low		in-situ heated deposits	anomaly groups together indicate a possible highly heated in-situ deposit such as a kiln or furnace; a possible furnace was recently reported in an archaeological evaluation of an adjacent field to the north	Caine and Passmore (2015)
	3	2	possible, negative	return	deposits or structures associated with in-situ heated deposits	anomaly group partially comprises the magnetically negative component of anomaly group 2 but may also reflect adjacent and associated deposits or structures	
	4		possible, positive	linear			
	101		possible, regular narrow linears		field drains		
2	102		possible, regular narrow linears		rubble and/or landfill		visible to surveyor team
	5		possible, positive	linear			
	6		possible, positive	disrupted linear			
	7		likely, positive/negative/positive spread	disrupted curvilinear	field boundary - possible Devon bank	anomaly groups coincide with a former field boundary mapped on historical maps between 1838 and 1936	Chudleigh Tithe map 1838, Ordnance Survey maps 1888 1:2500 to 1936 1:2500
	8		possible, positive	irregular	deposit of earthen deposits	anomaly group may represent a large deposit of earthen material	
	103		possible, regular narrow linears		field drains		
	201		possible, sinuous	irregular	palaeochannel	anomaly group most likely to represent a palaeochannel of adjacent streams before creation of adjacent leat along with magnetic responses from nearby field boundaries although an archaeological origin cannot be entirely ruled out	

Table 1: data analysis



British Grid
 centre X: 287118.85 m, centre Y: 79803.73 m

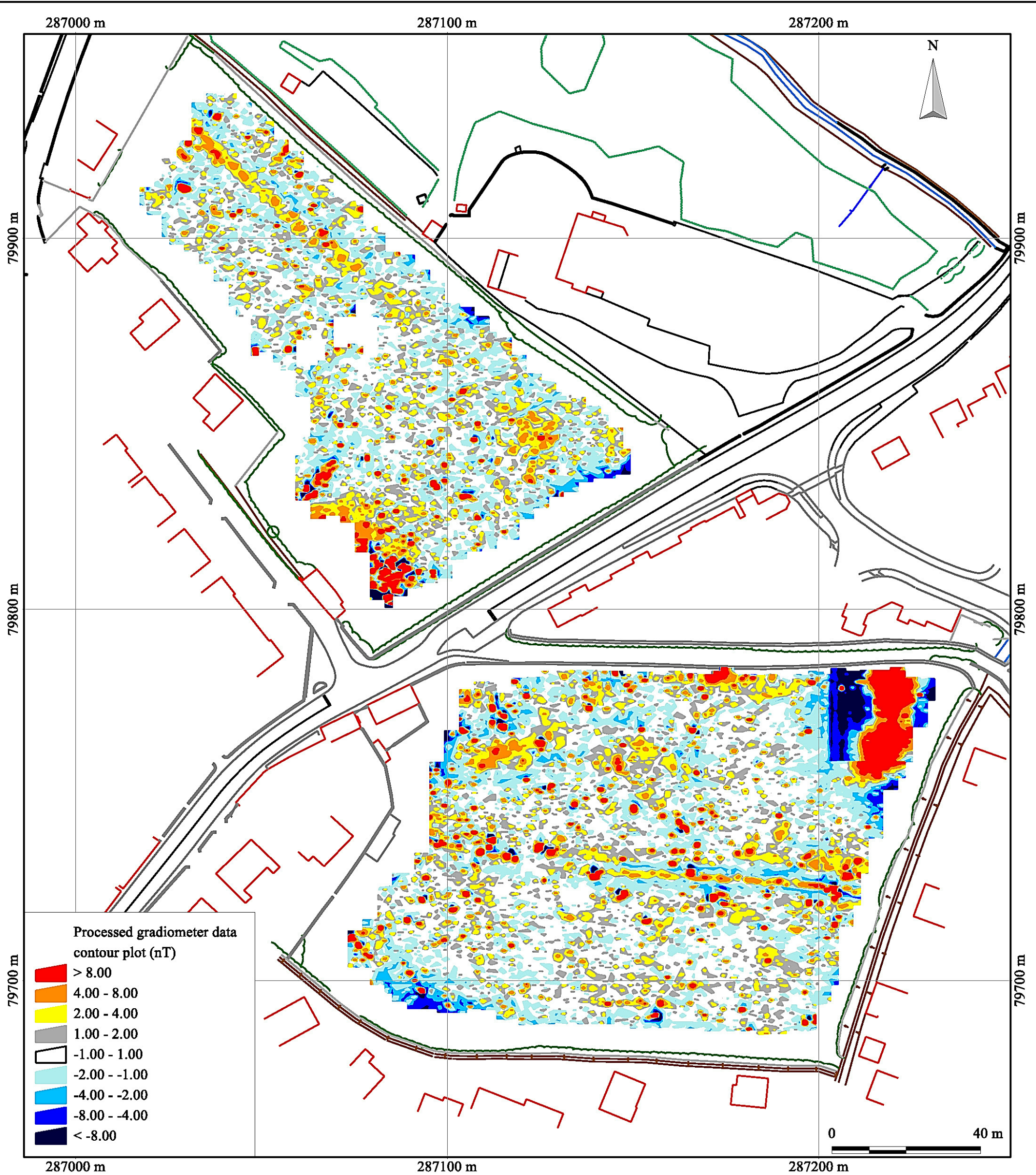
Geophysical survey: Copyright Substrata 2016.
 Base map: Ordnance Survey (c) Crown Copyright 2016,
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Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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

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British Grid
 centre X: 287118.85 m, centre Y: 79803.73 m

Geophysical survey: Copyright Substrata 2016.
 Base map: Ordnance Survey (c) Crown Copyright 2016,
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Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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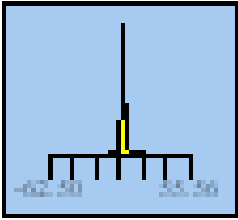
Figure 4: contour plot of processed data

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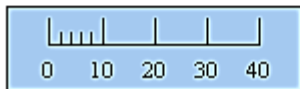
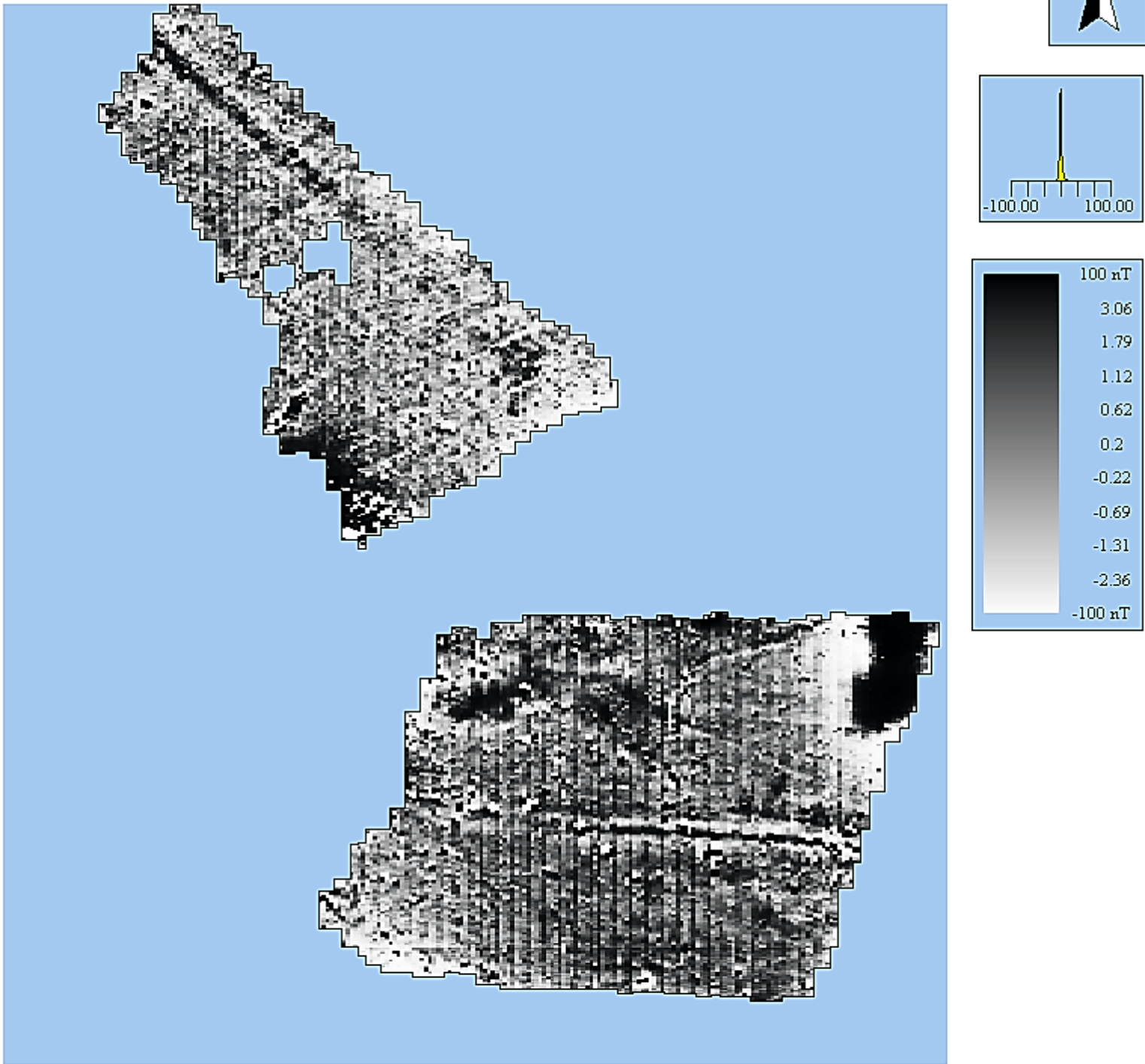
Appendix 2 Methodology Summary

Table 2: methodology summary	
<p>Documents Survey methodology statement: Dean (2016)</p>	
<p>Methodology</p> <ol style="list-style-type: none"> 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/ 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. 	
<p>Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</p>	
<p>Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p>Data Capture <i>Sample Interval:</i> 0.25m <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p>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</p>	

Appendix 3 Data processing

Table 3: magnetometer survey - processed data metadata	
<p>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</p> <p>PROGRAM Name: TerraSurveyor Version: 3.0.28.1</p>	
<p>Stats Max: 55.56 Min: -62.50 Std Dev: 3.71 Mean: 0.17 Median: -0.01</p> 	<p>Processes: 9</p> <ol style="list-style-type: none"> 1 Base Layer 2 Clip at 3.00 SD 3 DeStripe Median Sensors: All 4 Edge Match (Area: Top 90, Left 0, Bottom 119, Right 119) to Right edge 5 Edge Match (Area: Top 90, Left 0, Bottom 119, Right 119) to Bottom edge 6 De Stagger: Grids: b17.xgd b16.xgd b15.xgd b14.xgd Mode: Both By: 1 intervals 7 Interpolate: Match X & Y Doubled. 8 Edge Match (Area: Top 210, Left 360, Bottom 239, Right 479) to Top edge 9 Edge Match (Area: Top 210, Left 360, Bottom 239, Right 479) to Left edge

Appendix 4 Unprocessed data plot



Processes: 1
1 Base Layer

Instrument Type: Bartington Grad 6
10
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Dimensions
Composite Size (readings): 1080 x 240
Survey Size (meters): 270 m x 240 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 100.00
Min: -100.00
Std Dev: 6.94
Mean: 0.57
Median: 0.20

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.1

Figure 5: shade plot of unprocessed data