Substrata
Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Cross Lanes, Lanstephen
Launceston, Cornwall

Centred on NGR (E/N): 233173,085586 (point)

Report: 1612WOO-R-1

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12 February 2017

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Contents

Figures

Tables

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:	24 January 2017
Area:	1.8ha
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:	Cross Lanes, Lanstephen
Town & Civil Parish:	Launceston
County:	Cornwall
Nearest Postcode:	PL15 8JR
NGR:	SX 332 856 (point)
NGR (E/N):	233173,085586 (point)

1.4 Archive

OASIS number:	substrat1-276033
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.

Nine magnetic anomaly groups were mapped as representing potential archaeological deposits or features. Four anomaly groups are likely to represent the same features as cropmarks previously recorded in adjacent fields. Their anomaly pattern is suggestive of former Cornish Hedges. One group may represent another of these features although it may represent a separate filled ditch. Two groups correspond with cropmarks recorded on Google Earth imagery and may represent a former enclosure or field boundary. A group to the south may represent a separate enclosure or field boundary. One group possibly represents a former track, current stock route or ground disturbed by service laying.

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 land within two fields located to the east of Lanstephen which lies on the northern edge of Launceston, Cornwall. The land slopes to the southwest from 137m AOD in the northeast corner to 116m AOD in the southwest corner. At the time of the survey the land was under grass pasture.

4.2 Geology

The bedrock across the site is interbedded mudstone and sandstone of the Carboniferous Crackington Formation. On the northern boundary of the site the rocks are chert from the Carboniferous Teign Chert Formation (British Geological Survey, undated).

Superficial deposits for the site are unknown (ibid).

5 Archaeological background

5.1 Historic landscape characterisation

'Farmland: Medieval'

The agricultural heartland, with farming settlements documented before the 17th century AD and whose field patterns are morphologically distinct from the generally straight-sided fields of later enclosure. Either medieval or prehistoric origins (Cornwall County Council, undated)

5.2 Summary of archaeological background

The following is taken from a Historic Environment Assessment produced by AC Archaeology for the same programme of work as this report (AC Archaeology, in progress).

The medieval settlement of Truscott as shown by the Tithe map and later Ordnance Survey maps as being located approximately 2 miles northwest of the study area (HER entry 2577).

A series of parallel cultivation marks covering several fields to the east of Newport were recorded on aerial photographs, and plotted, during the Cornwall National Mapping Programme. The marks are visible as earthworks and are thought to be medieval or post-medieval in date, although a modern agricultural origin cannot be ruled out (HER entry 58491)

Two post-medieval quarries are recorded to the northeast of the site at SX 3347 8580 (HER entry 2631, probably of eighteenth or nineteenth century origins) and at SX 336 858 (HER entry 2634, probably nineteenth century). A further post-medieval quarry is recorded to the southeast of the site at NGR SX 3336 8553 (HER 2636).

St Stephen's Mine is shown on the First Edition 25-inch Edition Ordnance Survey map of 1884 as two square shafts to the north of the site. The shafts are not shown on the second or later editions (HER entry 2654).

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.

Data Trends

A distinct, parallel, linear trend in the data running west-south-west to east-north-east is likely to represent past ploughing disturbance, from possibly ridge-and-furrow ploughing.

6.3.2 Data relating to historic maps and other records

Magnetic anomaly groups **2**, **3**, **4** and **6** are likely to represent the same features as cultivation marks visible on aerial photographs in adjacent fields (HER entry 58491). These may be medieval, post-medieval or modern in origin. Their magnetic anomaly patterns are similar to those often associated with former Cornish Hedges which are stone-revetted earthen banks, often with flanking ditches. Group **5** may also represent one of these features although it may represent a separate filled ditch.

Groups **1** and **7** correspond with crop marks visible on Google Earth imagery (Google Earth, Imagery, 1/1/2010) and may represent a former field or enclosure boundary.

6.3.3 Data with no previous archaeological provenance

Group **8** may represent a former field or enclosure boundary.

Group **9** has a pattern typical of anomalies representing a former track, current stock route or ground disturbed by the laying of a service such as a pipe.

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.

Nine magnetic anomaly groups were mapped as representing potential archaeological deposits or features. Four anomaly groups (2, 3, 4 and 6) are likely to represent the same features as cropmarks previously recorded in adjacent fields. Their anomaly pattern is suggestive of former Cornish Hedges. One group (5) may represent another of these features although it may represent a separate filled ditch. Two groups (1 and 7) correspond with cropmarks recorded on Google Earth imagery and may represent a former enclosure or field boundary. A group (8) to the south may represent a separate enclosure or field boundary. One group (9) possibly represents a former track, current stock route or ground disturbed by service laying.

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

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Cornwall Council (undated) *Cornwall Council Interactive map.* [Online], https://map.cornwall.gov.uk/website/ccmap/?zoomlevel=3&xcoord=181424&ycoord=50321&wsName=ccmap&layerName=Historic%20Landscape%20Characterisation [February 2017]

Google Earth, Imagery (1/1/2010) 50°38'47.19" N 4°21'39.19" W, elev 133m, eye alt 625m

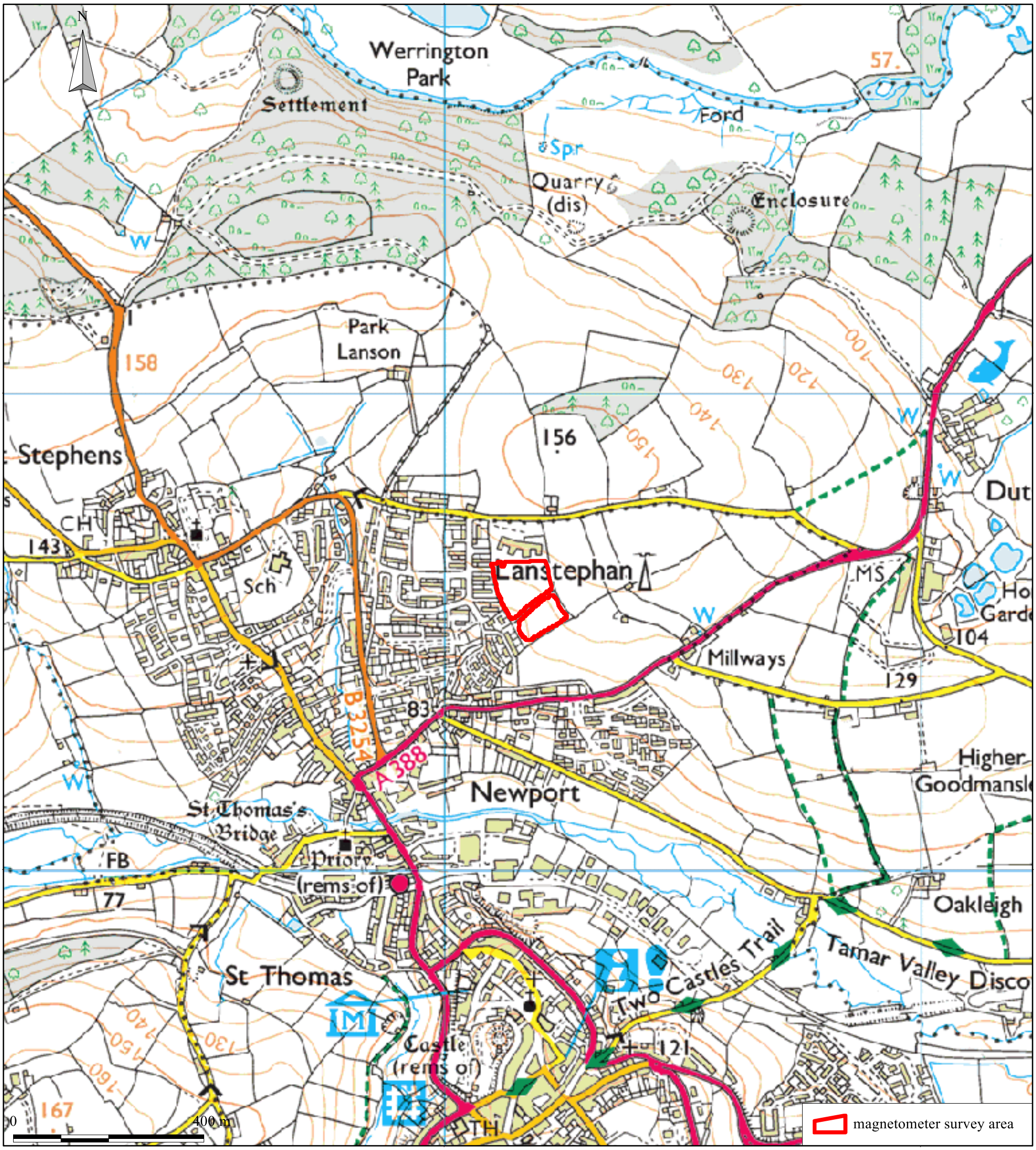
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation*. [Online], Available: https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/ [August 2016]

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: 233155.08 m, centre Y: 85618.08 m

Scale: 1:8000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Report: 1701LAN-R-1

Figure 1: location map

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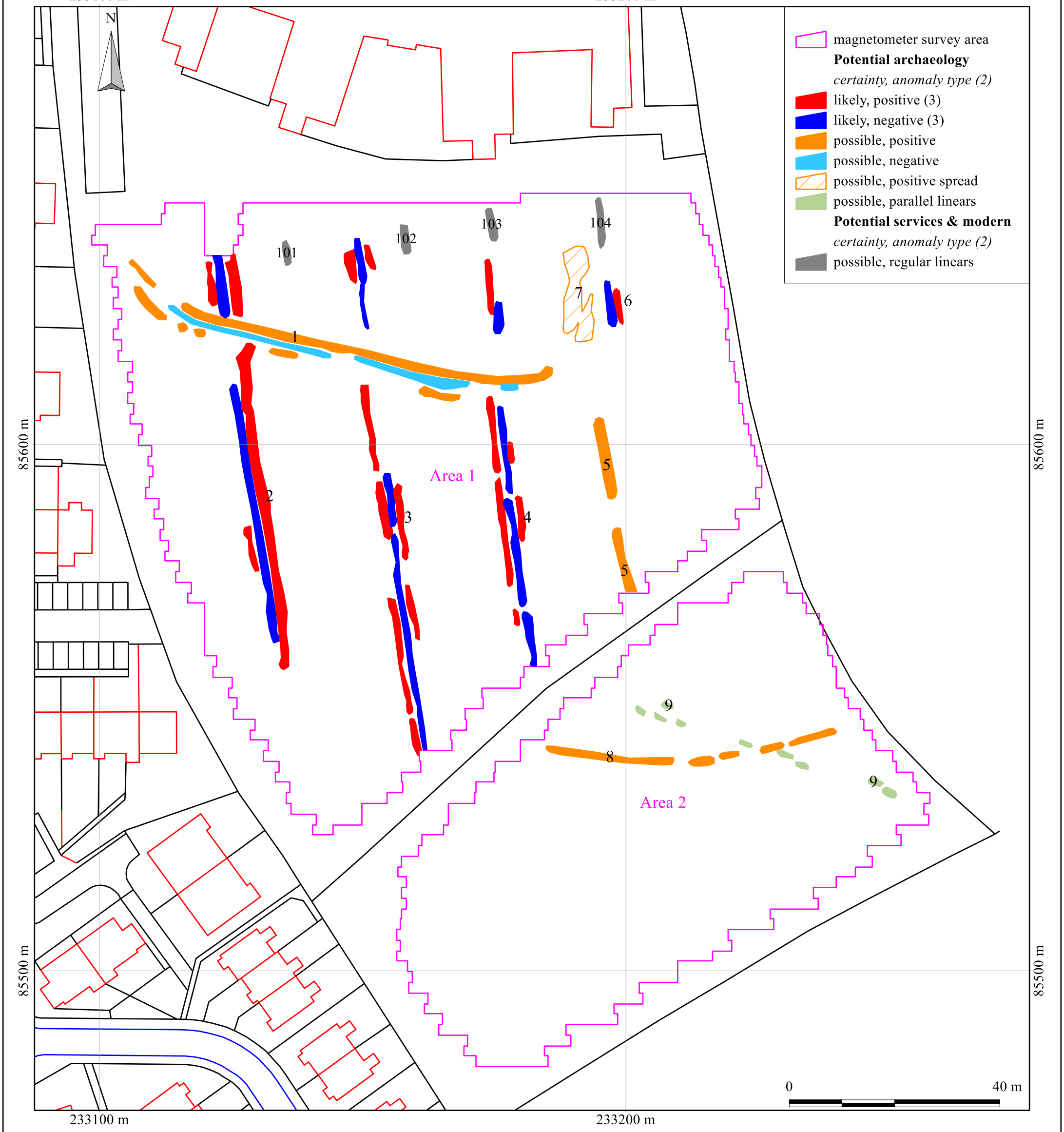

British Grid
centre X: 233182.17 m, centre Y: 85578.30 m

Scale: 1:700 @ 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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Report: 1701LAN-R-1

Figure 2: survey interpretation

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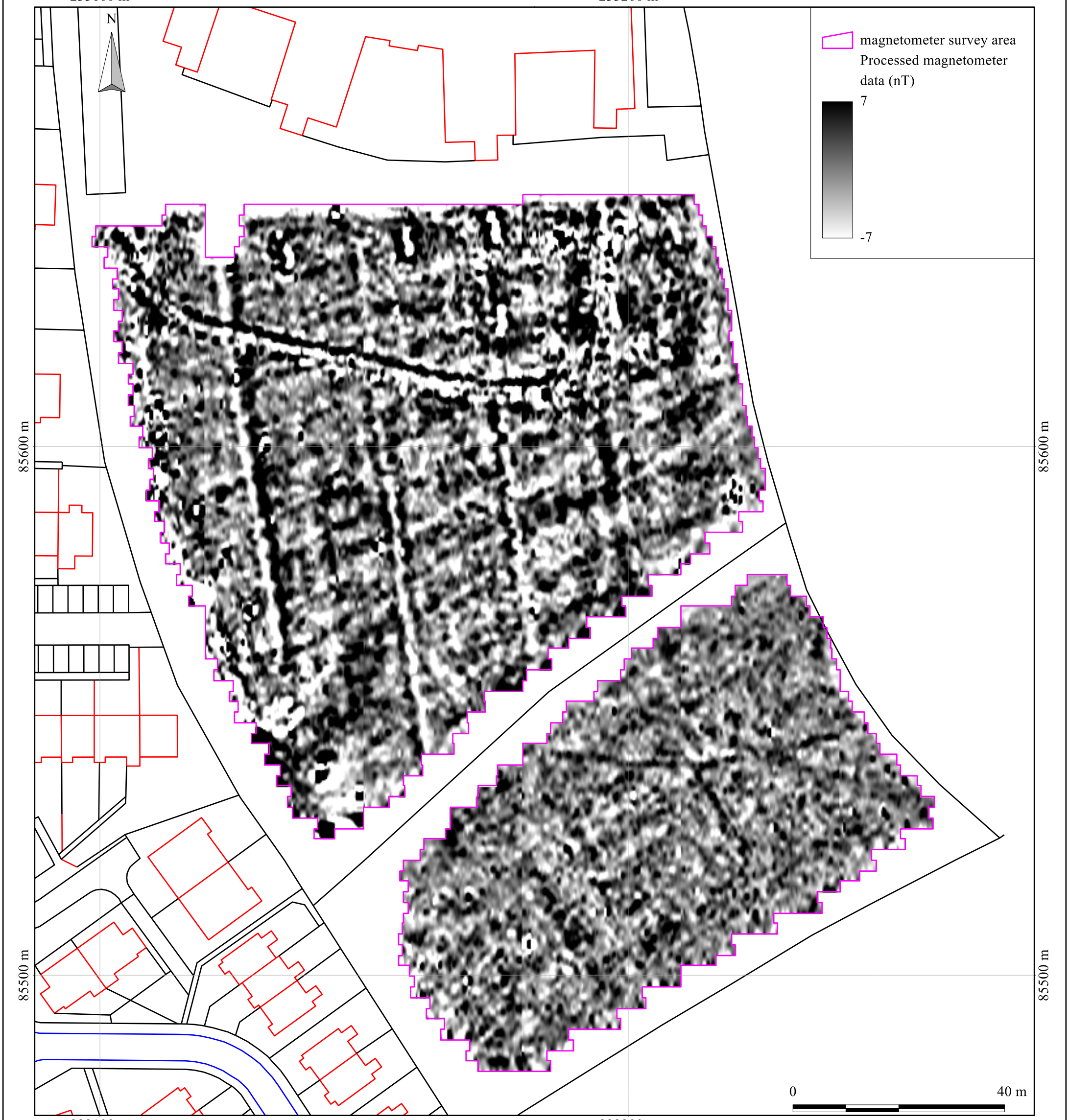

British Grid
centre X: 233182.17 m, centre Y: 85578.30 m

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: shade plot of processed data

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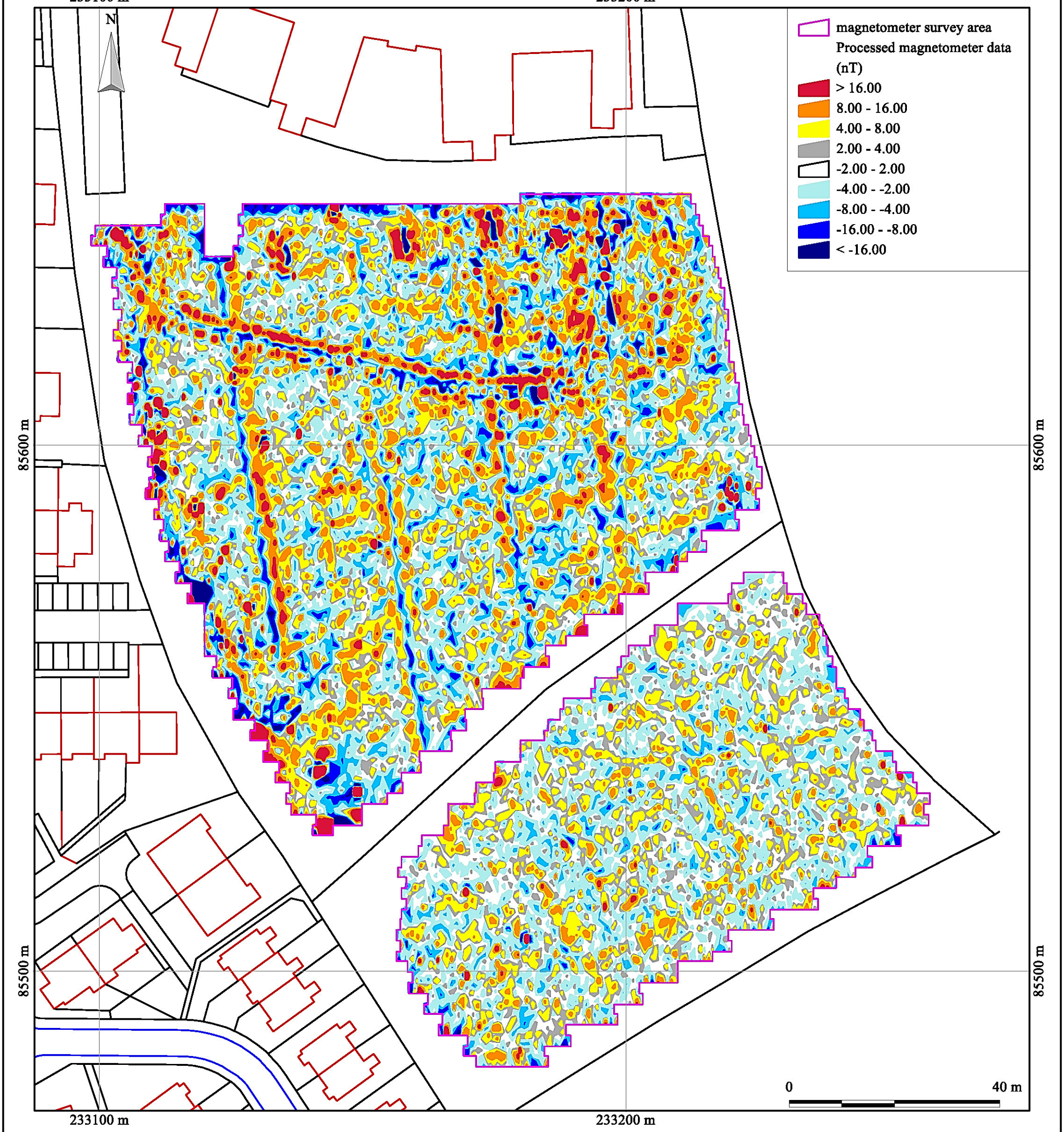

British Grid
centre X: 233182.17 m, centre Y: 85578.30 m

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
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Report: 1701LAN-R-1

Figure 4: contour plot of processed data

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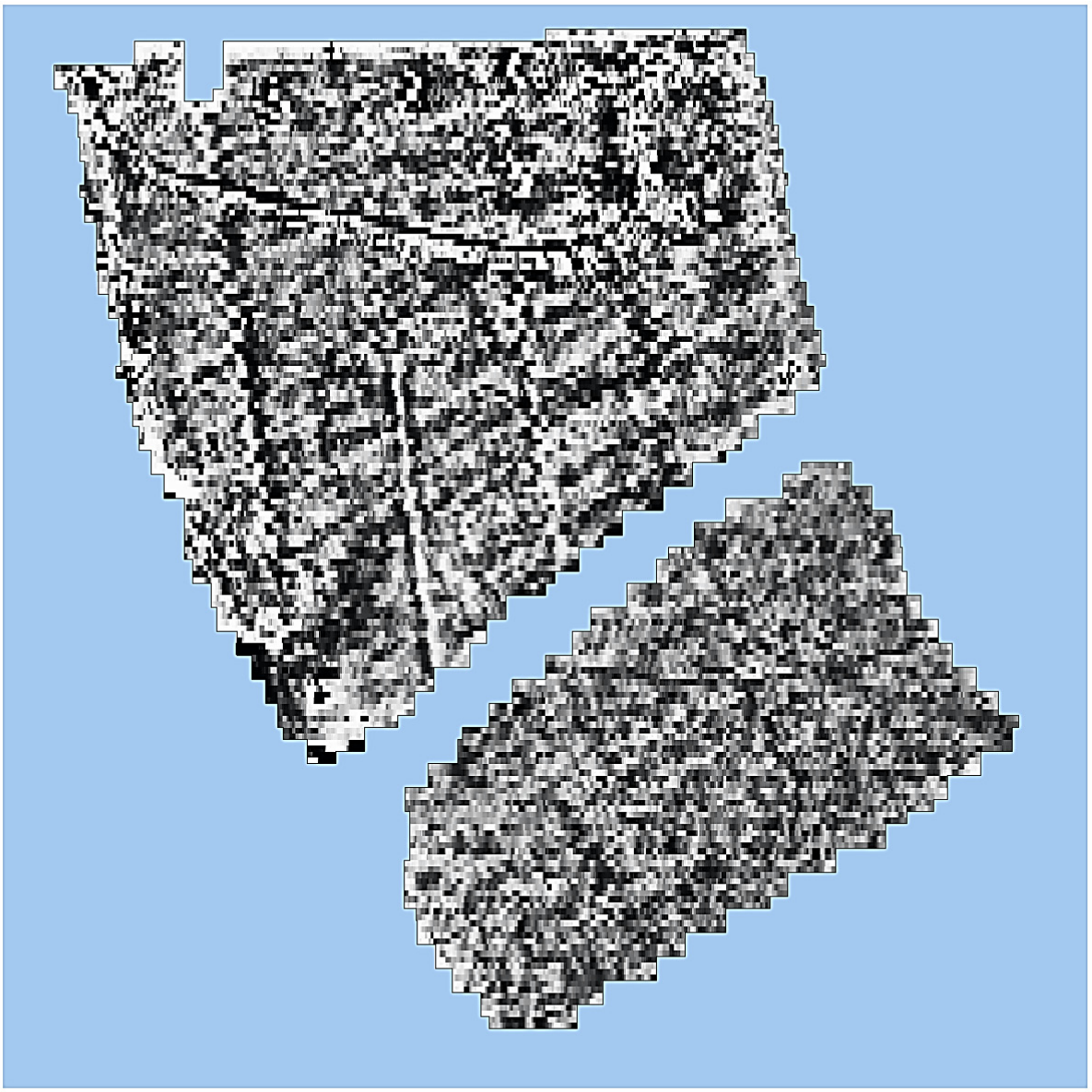

Units: nT
Direction of 1st Traverse: 90 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 3000.00
Min: -3000.00
Std Dev: 118.54
Mean: 2.90
Median: 2.20
Surveyed Area: 1.558 ha

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
Cross Lanes, Lanstephen, Launceston, Cornwall
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Report: 1701LAN-R-1

area number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	1	7	possible, positive/negative/positive	disrupted curvilinear	field or enclosure boundary, possibly a Cornish hedge	anomaly group coincides with crop marks visible on Google Earth imagery; not recorded in the Cornwall & Scilly HER	Google Earth, Imagery Date: 1/1/2010, 50°38'47.19" N 4°21'39.19" W, elev 133m, eye alt 625m
	2	3 4 5? 6	likely, positive/negative/positive	disrupted linear	parallel cultivation marks or possibly Cornish hedges	anomaly group conforms with the trend and pattern of earthworks described as cultivation marks in the Cornwall & Scilly HER; thought to be medieval, post-medieval or possibly modern	Cornwall & Scilly HER entry 58491
	3	2 4 5? 6	likely, positive/negative/positive	disrupted linear	parallel cultivation marks or possibly Cornish hedges	anomaly group conforms with the trend and pattern of earthworks described as cultivation marks in the Cornwall & Scilly HER; thought to be medieval, post-medieval or possibly modern	Cornwall & Scilly HER entry 58491
	4	2 3 5? 6	likely, positive/negative/positive	disrupted linear	parallel cultivation marks or possibly Cornish hedges	anomaly group conforms with the trend and pattern of earthworks described as cultivation marks in the Cornwall & Scilly HER; thought to be medieval, post-medieval or possibly modern	Cornwall & Scilly HER entry 58491
	5	2? 3? 4? 6?	possible, positive	disrupted linear	parallel cultivation marks or a filled ditch	anomaly group may relate to the cultivation marks recorded in this field or may represent a filled ditch	
	6	2 3 4 5 6?	likely, positive/negative	linear	parallel cultivation marks or possibly Cornish hedges	anomaly group conforms with the trend and pattern of earthworks described as cultivation marks in the Cornwall & Scilly HER; thought to be medieval, post-medieval or possibly modern	Cornwall & Scilly HER entry 58491
	7	1	possible, positive spread	broad linear	field or enclosure boundary?	anomaly group coincides with crop marks visible on Google Earth imagery; not recorded in the Cornwall & Scilly HER	Google Earth, Imagery Date: 1/1/2010, 50°38'47.19" N 4°21'39.19" W, elev 133m, eye alt 625m
	103		possible, regular linears		drains	anomaly group may represent part of a drainage system from the buildings to the north which are situated on built-up land	
2	8		possible, positive	disrupted curvilinear			
	9		possible, parallel linears		routeway, track, service or stock-track	anomaly group may indicate ground disturbance from any period, including very recent disturbance	

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:* GE

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: 262.61 Min: -150.82 Std Dev: 9.26 Mean: 0.17 Median: 0.05	Processes: 6 1 Base Layer 2 Clip at 1.00 SD 3 De Stagger: Grids: All Mode: Both By: -3 intervals 4 De Stagger: Grids: a13.xgd a25+a17.xgd Mode: Both By: 2 intervals 5 DeStripe Median Sensors: Grids: All 6 Interpolate: X & Y Doubled.

Table 3: processed data metadata