

# Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey  
**Land at West Street, Kilkhampton  
Bude, Cornwall**

Centred on NGR: 225080,111320

Report: 18067KIL-R-1

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## 1 Introduction

This report presents the results of an archaeological geophysical survey at the site listed in Section 4 and shown in Figure 1, hereafter referred to as the 'Survey Area'. It was commissioned by Trewin Design Architects Ltd on behalf of clients in support of a proposed residential development. The commissioning of this report was in keeping with the National Planning Policy Framework, Chapter 16, Paragraph 189 (Ministry of Housing, Communities & Local Government, 2018).

The survey and report were completed in compliance with a Survey Method Statement (Dean, 2018).

## 2 Clients

Mr and Mrs Elliott, Henscott Barton, Bradford, Holsworthy, Devon EX22 7AP  
Mr and Mrs Andrew Jenn, Fairholme, Woolsey, Bideford, Devon EX39 5QP

## 3 Copyright

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## 4 Survey type and location

### 4.1 Survey

Method:	shallow depth magnetometer survey
Instrument:	twin-sensor fluxgate gradiometer
Date:	26 June 2018
Area:	0.5ha

### 4.2 Location

Location:	Land at West Street
Address:	West Street, Kilkhampton, Bude, Cornwall EX23 9QW
Civil Parish:	Kilkhampton
District:	North Cornwall
County:	Cornwall
Survey centre NGR:	SS 25080 11320
Survey centre NGR (E/N):	225080,111320
Historic environment designation:	None
OASIS ID:	substrat1-323148

## 5 Summary

A magnetometer survey was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Survey Area (see Section 14). The magnetic anomaly groups pertaining to potential buried archaeology were georeferenced to the Ordnance Survey National Grid, mapped, characterised and assigned with an appropriate degree of certainty in conformance with the survey aims and objectives set out in Section 6.

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Two magnetic anomaly groups were recorded as representing potential linear archaeological deposits although one of these may be a data collection phenomena caused by an adjacent buried ferrous object. The remaining mapped anomaly groups were characterised as representing field drains and other relatively recent features.

## 6 Aims and objectives

### 6.1 Aims

1. Within the framework set out in Chartered Institute for Archaeologists (2014a), complete an archaeological geophysical survey and report which will, as far as possible, establish the presence or absence, extent and character of any buried archaeology within the Survey Area.
2. Provide sufficient information on the nature of any archaeological remains to facilitate the assessment of their interest prior to the determination of the planning application.

### 6.2 Objectives

1. Complete a magnetometer survey across the Survey Area.
2. Identify any magnetic anomalies that may be related to buried archaeology.
3. Within the limits of the technique 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.

## 7 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2008). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

## 8 Methodology

The magnetometer survey was undertaken in accordance a Survey Method Statement (Dean, 2018) to achieve the aims and objectives set out in Section 6 using the standards and guidance specified in Section 7. The survey method was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Survey Area (see Section 14).

Data processing was undertaken using appropriate software (Table 2), with all anomalies being digitised and geo-referenced. The final report (this document) includes 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. The survey and report conform to the Chartered Institute for Archaeologists standard for geophysical survey (CIfA, 2014a).

## 9 Survey Area

### 9.1 Location and description

The 'Survey Area' comprises two fields on the western side of Kilkhampton (Figure 1). The fields are bounded by hedges and wire fencing with a Cornish Hedge on the south western side of the western field. West Street lies beyond the northern field boundaries.

The Survey Area was under cut grass at the time of the survey.

### 9.2 Geology

The bedrock across the Survey Area is mudstone and sandstone of the Carboniferous Bude Formation. Generically, these rocks are grey thick-bedded, somewhat argillaceous and silty sandstones, in laterally discontinuous internally massive beds 1-5m thick and commonly amalgamated into units up to 10m thick. Very thick beds of slumped and de-stratified strata are also present. Grey mudstones occur as interbeds up to 1m thick and as packets of darker mudstone up to 20m thick. These thicker beds have thin ironstone beds and bundles of thin

sandstones, especially in the upper part of the Formation. The superficial geology is not recorded in the source used (British Geological Survey, undated).

### 9.3 Soils and near-surface deposits

The topsoil is 'Freely draining slightly acid loamy soils' (LandIS, undated).

No site-relevant geotechnical reports or borehole logs of near-surface deposits were available at the time of writing.

## 10 Archaeological background

### 10.1 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 (Cornwall Council, undated).

### 10.2 Statement of research

The Cornwall Council Historic Environment Record was examined via the Heritage Gateway (Historic England, undated) to gain an appreciation of historic assets pertinent to the geophysical survey data within approximately 500m of the survey area perimeter. Whilst providing a useful context for the data analysis, this source is not comprehensive and publication of the information in commercial reports is not permitted.

## 11 Results

### 11.1 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 magnetic properties of the 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 dimensions of magnetic anomalies mapped as representing potential buried archaeology do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to buried archaeology.

### 11.2 Analysis

Figure 2 shows the interpretation of the survey data and 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 the processed data as specified in Table 3. Figure 5 is a plot of minimally processed data as specified in Table 4. Figure 6 shows the location of the survey grid and grid data files.

## 12 Discussion

### 12.1 General points

#### 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 in 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

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 mapped as potential archaeology when they are associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 1.

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

Numerous dipole magnetic anomalies are present within the dataset. 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.

#### 12.2 Data relating to historic maps and other records

None of the magnetic anomaly groups relate to known historic assets.

#### 12.3 Data with no previous archaeological provenance

Referring to Figure 2, magnetic anomaly group 1 may be a data collection phenomena related to the mapped ferrous object 302 rather than being related to any buried feature although that it represents a potential archaeological feature cannot be ruled out. Group 2 may represent a linear archaeological deposit such as a former ditch. At first sight, groups 1 and 2 appear to form a return but close examination of the data suggests that their apparent relationship is coincidental.

Groups 301, 303, 304 and 305 are most likely to represent field drains on two different orientations. An alternative explanation for group 301 is that it represents ploughing disturbance. The orientation of this group is, however, different to that of the adjacent, extant field boundaries. As the Historic Landscape Characterisation for the area is Medieval Farmland (Section 10.1 above), the modern field boundaries probably follow the pattern of medieval fields making it unlikely that group 301 represents modern or medieval ploughing disturbance. It is not likely that pre-medieval ploughing disturbance would be distinct in the dataset given the medieval to modern history of the two fields. An alternative explanation for group 304 is that it represents a linear, stony deposit such as the footings of a field boundary but a similar argument to that presented for group 301 makes this alternative less likely. It is possible that group 304 represents a set of linear stony deposits such as field or plot boundaries but their magnetic response is more typical of field drains.

### 13 Conclusions

The differences in magnetic responses across the Survey Area were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Two magnetic anomaly groups (1 and 2) were recorded as representing potential linear archaeological deposits although one of these (group 1) may be a data collection phenomena caused by an adjacent buried ferrous object (302). The remaining mapped anomaly groups were characterised as representing field drains and other relatively recent features.

## 14 Disclaimer

The description and discussion of the results presented in this report are the authors', based on their 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.

## 15 Archive

### 15.1 Online Access to the Index of archaeological investigationS (OASIS)

OASIS ID: substrat1-323148

The OASIS entry has been completed and the boundary file and report uploaded with six months delay in publication.

### 15.2 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as specified in Appendix 3.

### 15.3 Archaeological Data Service (ADS)

Depending on local authority policy, an archive may be deposited with the ADS as specified in Appendix 3.

### 15.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF or printed copy of the report will be submitted to the appropriate HER within six months of completion.

## 16 Acknowledgements

Substrata would like to thank James Trewin, Managing Director, Chartered Architect, Trewin Design Architects Ltd for commissioning Substrata Ltd on behalf of Mr and Mrs Elliott and Mr and Mrs Andrew Jenn.

## 17 Bibliography

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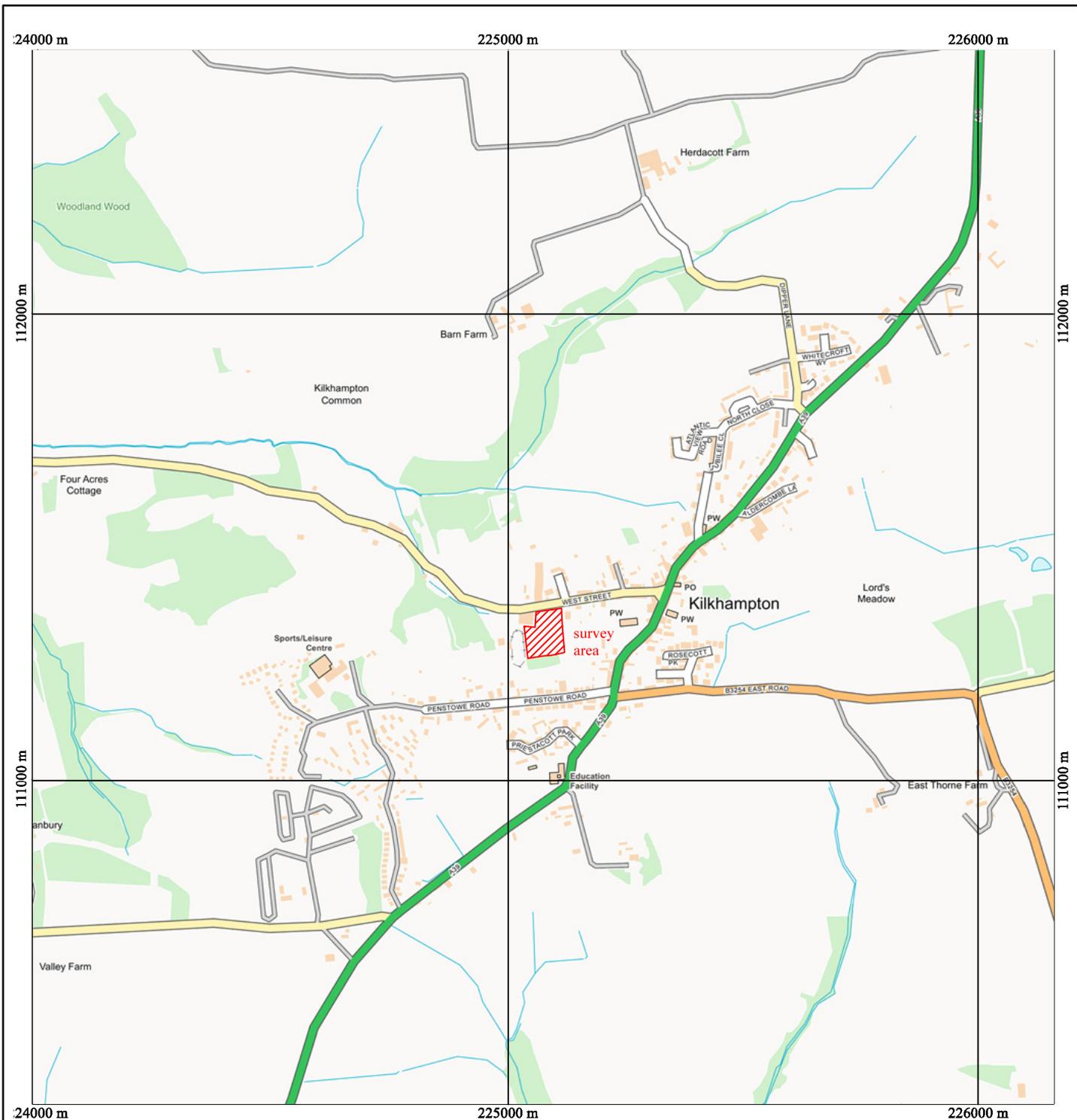
Ministry of Housing, Communities & Local Government (2018). *National Planning Policy Framework* [online]. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/728643/Revised\\_NPPF\\_2018.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf) [Accessed 3 Aug. 2018]

## 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 .

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: 225074.23 m, centre Y: 111318.85 m

Geophysical survey: Copyright Substrata Limited.  
 Base map: Ordnance Survey (c) Crown Copyright 2018.  
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Figure 1: location map



British Grid  
 centre X: 225074.23 m, centre Y: 111318.85 m

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Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

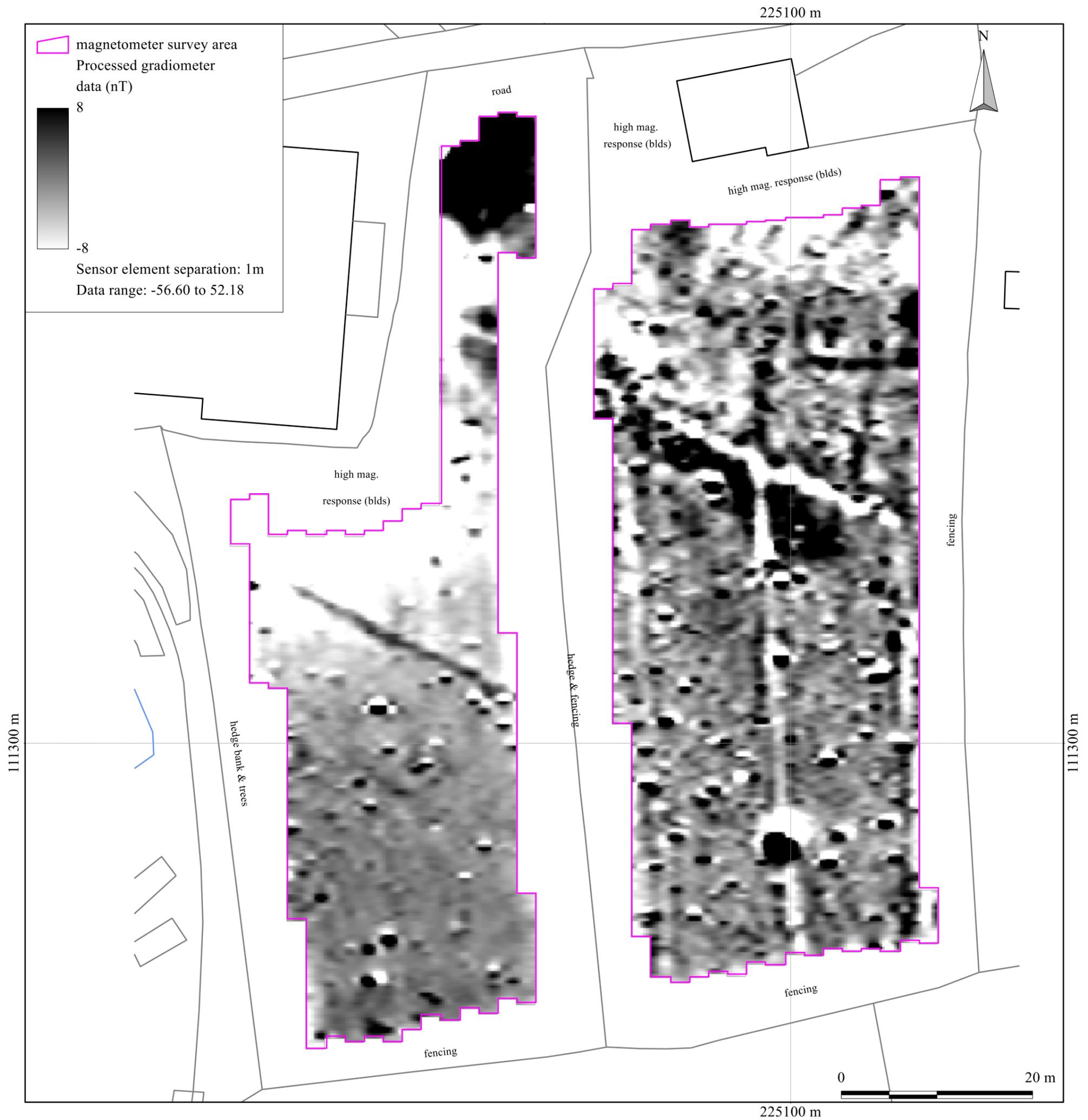
Notes:

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. Not all instances are mapped.
5. Anomalies likely to represent recent deposits or ground disturbance, or geological and other natural deposits are not mapped unless relevant to potential buried archaeology.

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Figure 2: survey interpretation



British Grid  
 centre X: 225074.23 m, centre Y: 111318.85 m

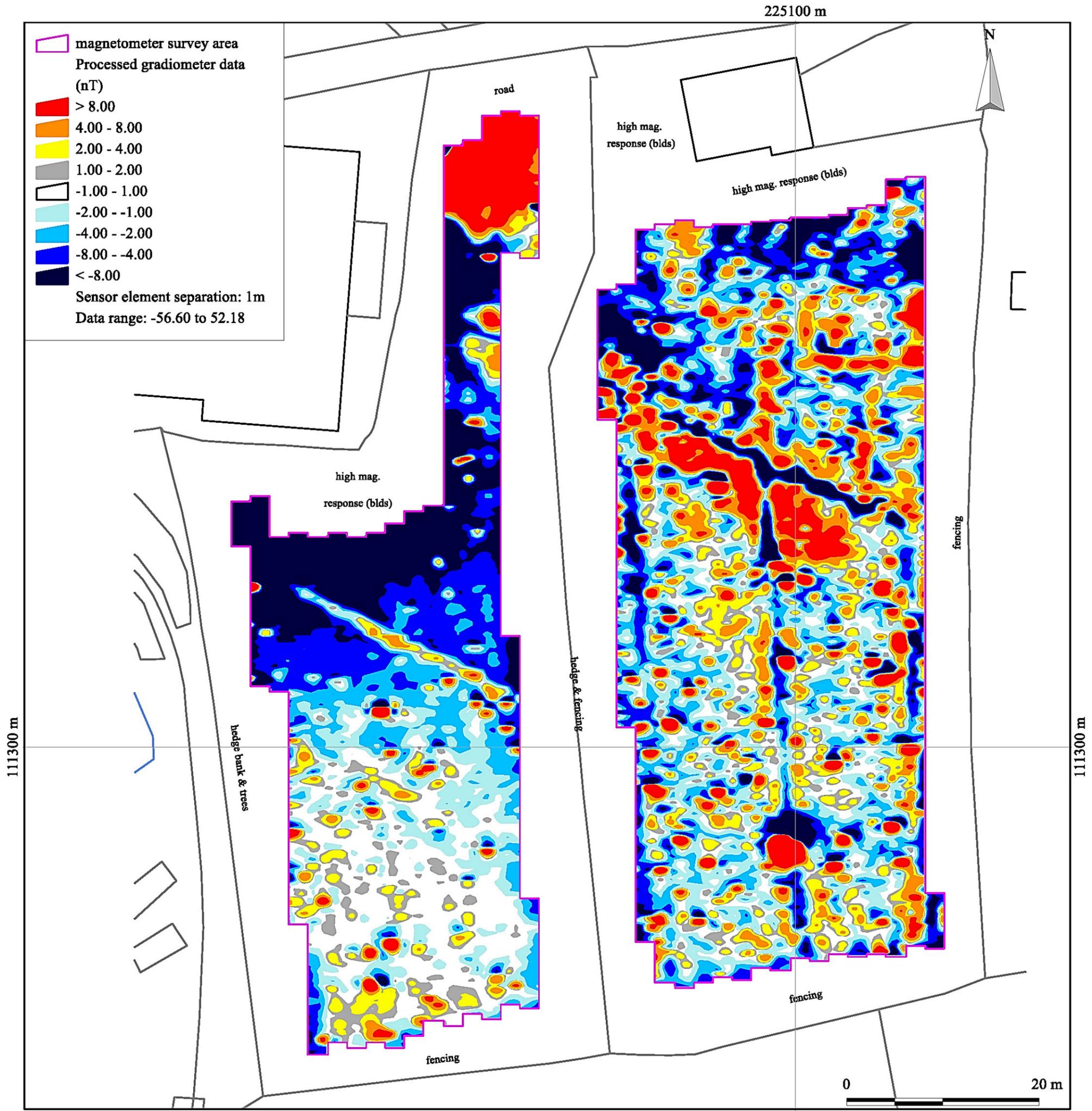
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Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: shade plot of processed data



British Grid  
 centre X: 225074.23 m, centre Y: 111318.85 m

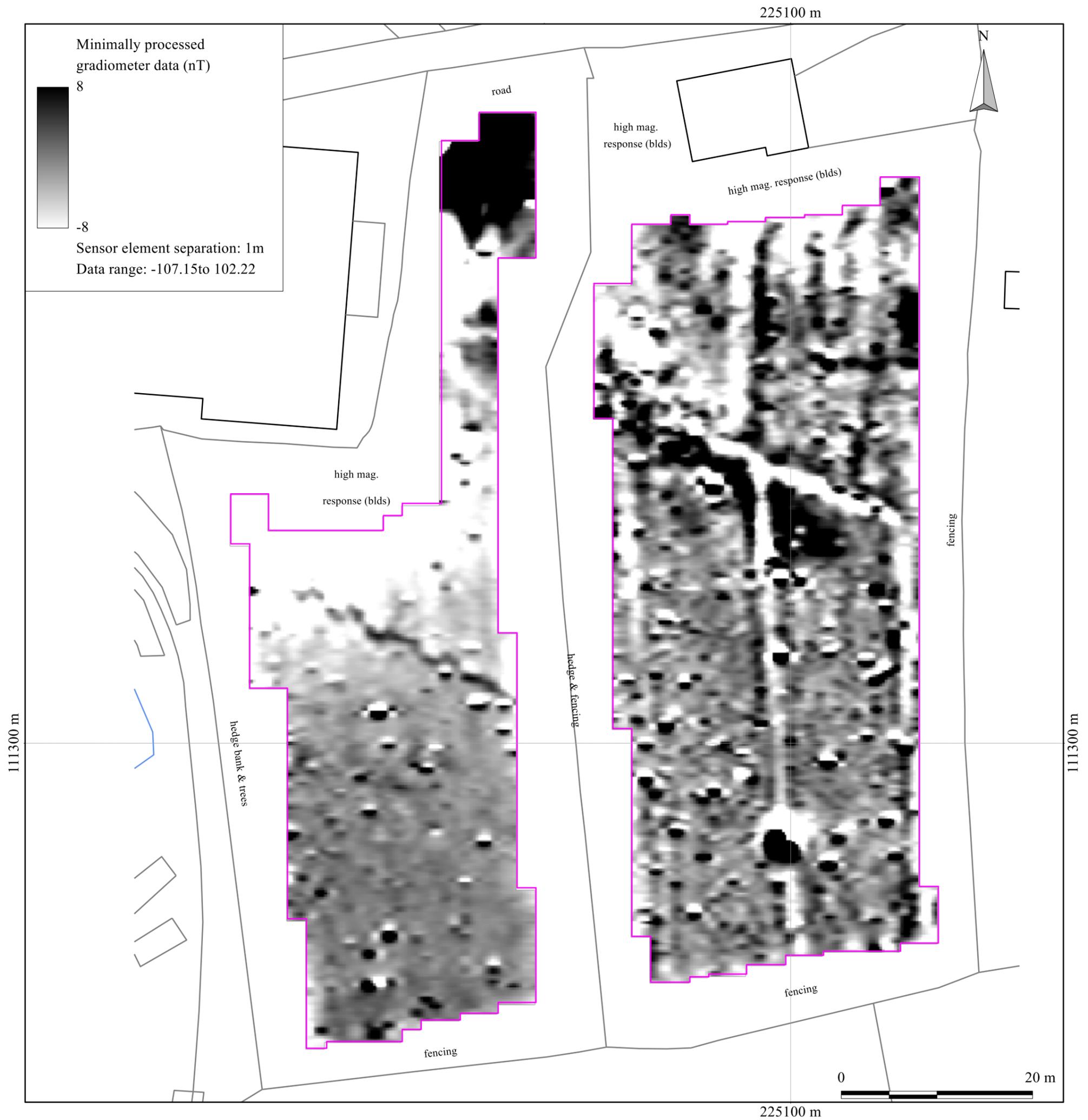
Geophysical survey: Copyright Substrata Limited.  
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Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 4: contour plot of processed data



British Grid  
 centre X: 225074.23 m, centre Y: 111318.85 m

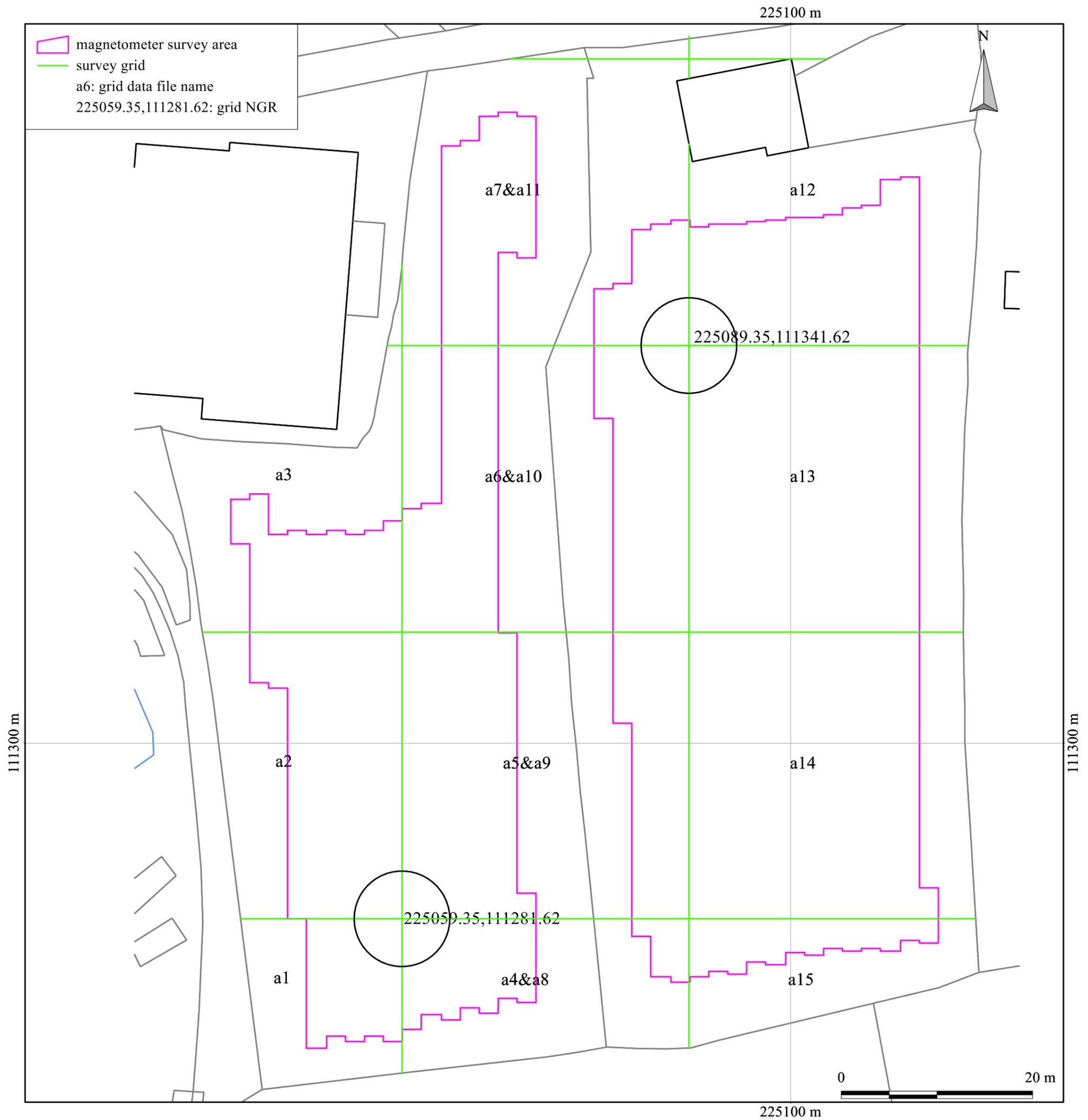
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Scale: 1:400 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 5: shade plot of minimally processed data



British Grid  
 centre X: 225074.23 m, centre Y: 111318.85 m

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Figure 6: survey grid plan and location

## Appendix 2 Tables

Site: Land at West Street, Kilkhampton, Bude, Cornwall  
 Centred on NGR 225080,111320

anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	302	possible, positive	linear		may represent a 'data streak' associated with adjacent buried ferrous material	
2		possible, positive	linear			
301		possible, regular parallel linears		field drains or ploughing disturbance	the orientation with respect to the surrounding extant boundaries in land classified as Medieval Farmland suggests that a field drain is more likely	Cornwall Council Historic Landscape Characterisation
302	1	possible, dipole		iron or steel buried object		
303		possible, regular parallel linears		field drains		
304		possible, regular parallel linears		field drain or other linear stony deposit	the orientation with respect to the surrounding extant boundaries in land classified as Medieval Farmland suggests that a field drain is more likely	Cornwall Council Historic Landscape Characterisation
305		possible, regular parallel linears		field drains or other linear stony deposit	while a field drain is most likely, the anomaly group may represent the footings of a wall	
306		possible, dipole		iron or steel buried object		
307		possible, low contrast linear		service trench		

Table 1: data analysis

<p><b>Grid</b>  <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><b>Equipment</b>  <i>Instrument:</i> Bartington Instruments grad601-2  <i>Firmware:</i> version 6.1</p>	<p><b>Data Capture</b>  <i>Sample Interval:</i> 0.25m  <i>Traverse Interval:</i> 1 metre  <i>Traverse Method:</i> zigzag  <i>Traverse Orientation:</i> GN</p>
<p><b>Data Processing, Analysis and Presentation Software</b>                  IntelliCAD 8.4                  DW Consulting TerraSurveyor3                  Manifold System 8 GIS                  Microsoft Corp. Office 365: Excel, Publisher, Word                  Adobe Systems Inc Adobe Acrobat 9 Pro Extended</p>	

Table 2: methodology information

<b>Instrument</b>	
Type:	Bartington Grad-601 gradiometer
Units:	nT
Direction of 1st Traverse:	see below
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing, each with 1m separation
Dummy Value:	32702
<b>Program</b>	
Name:	TerraSurveyor
Version:	3.0.33.6
<u>Statistics</u>	<u>Processing</u>
Max:	52.18
Min:	-56.60
Std Dev:	9.75
Mean:	-2.09
Median:	-1.33
	1 Base Layer
	2 Clip at 2.00 SD
	3 De Stagger: Grids: All By: 0 intervals, 25.00cm
	4 De Stagger: Grids: a1.xgd a4+a8.xgd a2.xgd a5+a9.xgd a3.xgd a10+a6.xgd a7+a11.xgd By: 0 intervals, 25.00cm
	5 DeStripe Median Traverse: Grids: a12.xgd
	6 DeStripe Median Traverse: Grids: a13.xgd
	7 Edge Match (Area: Top 60, Left 360, Bottom 89, Right 479) to Left edge
	Interpolate match x & y double is imposed on export to the GIS

Table 3: processed data metadata

<b>Instrument</b>	
Type:	Bartington Grad-601 gradiometer
Units:	nT
Direction of 1st Traverse:	see below
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing, each with 1m separation
Dummy Value:	32702
<b>Program</b>	
Name:	TerraSurveyor
Version:	3.0.33.6
<u>Statistics</u>	<u>Processing</u>
Max:	102.22
Min:	-107.15
Std Dev:	10.83
Mean:	-2.26
Median:	-1.40
	1 Base Layer
	2 Clip at 4.00 SD
	Interpolate match x & y double is imposed on export to the GIS

Table 4: minimally processed data metadata

## Appendix 3 Project archive contents

### A3.1 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as follows:

Report:	Adobe PDF (.pdf), Microsoft Publisher (.pub)
Raw grid data files:	DW Consulting TerraSurveyor 3 (.xgd) and XYZ (.dat)
Minimally processed data composite files:	DW Consulting TerraSurveyor 3 (.xgd) and ESRI ASCII (.asc)
Final data processing composite files:	DW Consulting TerraSurveyor 3 (.xgd) and ESRI ASCII (.asc)
GIS project:	GIS project Manifold 8 (.map)
Survey interpretation:	ESRI shape files
AutoCAD version of the survey interpretation: (if generated)	AutoCAD (.dwg)
All project working files:	IntelliCAD 8.4 Microsoft Corp. Office 365: Excel, Publisher, Word Adobe Systems Inc Adobe Acrobat 9 Pro Extended

### A3.2 Online Access to the Index of archaeological investigationS (OASIS)

Metadata:	online form
Georeferenced survey boundary file:	ESRI shape file
Report:	Adobe PDF (.pdf)

### A3.3 Archaeological Data Service

Depending on local authority policy, an archive may be deposited with the ADS as follows:

Raw data composite file:	XYZ file
Processed data plot:	rendered images in TIFF format
Survey grid plot:	image in TIFF format
Details of data processing:	image in TIFF format
Interpretation plot:	rendered images in TIFF format
Metadata:	Microsoft Excel format

### A3.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF copy of the report will be submitted to the appropriate HER within 6 months of the completion of this report via the OASIS process or by other means, depending on the relevant HER process.