

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

**Land off Hendra Road, Hendra
Stithians, Cornwall**

Centred on NGR (E/N): 172995,37220 (point)

Report: 1601HEN-R-1

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13 January 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: 8 January 2016
Area: gradiometer survey: 0.88ha
Lead surveyor: Mark Edwards BA
Author: Ross Dean BSc MSc MA MifA

1.2 Commissioning Agent and Client

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch, Nr Exeter, Devon EX5 4QL on behalf of Coastline Design and Build Limited, Coastline Housing Limited and Kier Living Limited.

1.3 Location

Site: Land off Hendra Road, Hendra
Civil Parish: Stithians
County: Cornwall
Nearest Postcode: TR3 7DZ
NGR: SW 730 372
Ordnance Survey NGR (E/N): 172995,37220 (point)
Planning Reference: PA15/11860

1.4 Archive

OASIS number: substrat1-238112
Archive: At the time of writing, the archive of this survey will be held by Substrata and will be deposited with the ADS in due course.

1.5 Introduction

This report was completed for AC Archaeology Ltd on behalf of Coastline Design and Build Limited, Coastline Housing Limited and Kier Living Limited. It is part of a programme of works required for a planning application at the above Site. The survey was commissioned in response to comments by Cornwall Council Historic Environment Planning (Historic Environment Planning, 2016):

“We have consulted the Cornwall & Isles of Scilly Historic Environment Record and the submitted Heritage Desk-Based Assessment and note that a number of known heritage assets are located nearby and that the application lies in an area characterised as Anciently Enclosed Land. This landscape character type has the potential to contain buried remains of medieval or earlier date. We therefore consider it prudent that a geophysical survey of the site should be undertaken to support this application.

This application should not be determined before this survey is received and we have had an opportunity to comment further. This survey should be carried out by a suitably qualified organisation or individual in accordance with accepted national guidelines. This is in accordance with the provisions of NPPF Section 12, paragraph 128.”

The Site location is shown in Figure 1.

1.6 Summary

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

Thirteen magnetic anomaly groups were mapped as possibly representing archaeological deposits or features. One of these may represent a former field boundary or ditched lane not mapped in the 1842 Stithians tithe map or on later Ordnance Survey maps. Between two and five of the anomaly groups may represent a double-curvilinear feature but this is by no means certain. It is clear that two of these groups represent distinct curvilinear features. The other

mapped groups are typical of anomalies representing remnants of field and enclosure boundaries.

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 site. 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 gradiometer survey across agreed parts of the site.
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 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 Site comprises an agricultural field located on a gentle south-facing slope in an undulating landscape of small hills and valleys to the north of the River Kennall. It is bounded to the east and west by residential development, to the north by agricultural fields, and to the south Hendra Road with fields beyond. The external boundaries are high Cornish hedges (stone-faced earth banks often with flanking ditches) which are topped by hedgerows interspersed with mature trees. The Site topography slopes down from approximately 138m AOD to the north to approximately 133m AOD along the southern boundary (Taylor, 2015: 5-6,).

4.2 Geology

The solid geology underlying the Site comprises granite of the Permian and Carboniferous Carnmenellis Intrusion. The superficial geology across the site is unrecorded in the source consulted (British Geological Survey, undated).

5 Archaeological background

5.1 Historic landscape characterisation

Anciently Enclosed Land.

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

5.2 Historical and archaeological background

A heritage desk-based assessment was produced by Cotswold Archaeology as part of the programme of archaeological works that includes this report. The historical and archaeological background is comprehensively addressed in that assessment (Taylor, 2015).

The following is a short summary of information obtained from the desk-based assessment relevant to the understanding of the geophysical survey.

Archaeological sites, buildings, historic parks and gardens, conservation areas, registered battlefields and other aspects of the historic environment that are considered 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 site

There are no heritage assets previously recorded within the Site.

5.2.2 Heritage assets within 1000m of the site

Prehistoric occupation in the Site's environs is evidenced by probable standing stones and rounds. Later prehistoric or Romano-British settlement activity is presented by a cairn, situated to the south-west, and a hoard of silver and bronze coins to the south-east of the Site. From the medieval period onwards, the Site is thought to have comprised part of a wider farming landscape, with known settlements located in close proximity but not within the Site itself. In the post-medieval period, some industrial activity took place within the wider environs of the Site (Taylor, 2015: 36).

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.

Archaeological structures, features and deposits 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 numbers. Table 1 is an extract of the detailed analysis of the survey data which is 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 site edges was restricted as shown in Figures 3 and 4 due to the presence of magnetic materials adjacent to the site. Strong magnetic responses mapped close to survey boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

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.

General data trends

A faint trend running approximately north-south may represent relatively recent ploughing disturbance and/or data collection stripes caused by zig-zag traversing and made visible in the plots because of the relatively low magnetic response across the site typical in areas with granitic bedrock (Figure 4).

6.2.2 Data relating to historical maps and other records

None of the recorded magnetic anomalies related to previously mapped or otherwise recorded features.

6.2.3 Data with no previous archaeological provenance

Magnetic anomaly group **1** is most likely to represent a former field boundary in the form of a Cornish hedge not mapped on the 1842 Stithians tithe map and later Ordnance Survey maps. An alternative, less likely, interpretation is that the anomalies represent a narrow ditched lane.

Anomaly groups **3, 6, 9** and possibly **10** appear to represent a double-curvilinear feature but, as can be seen in Figure 4 and noted in Table 1, there is some ambiguity in the apparent relationship between the groups. It is clear that groups **3** and **6** represent two curvilinear features, possibly ditches. Group **8** may be associated with group **3** and there is a possibility that group **12** forms a double parallel feature with group **8**.

All of the other mapped anomaly groups are most likely to represent fragments of linear deposits such as ditches or banks and are typical of anomalies representing remnants of earlier fields.

6.3 Conclusions

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

Thirteen magnetic anomaly groups were mapped as possibly representing archaeological deposits or features. One of these may represent a former field boundary or ditched lane not mapped in the 1842 Stithians tithe map or on later Ordnance Survey maps. Between two and five of the anomaly groups may represent a double-curvilinear feature but this is by no means certain. It is clear that two of these groups represent distinct curvilinear features. The other mapped groups are typical of anomalies representing remnants of field and enclosure boundaries.

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 Andrew Passmore of AC Archaeology Ltd for commissioning us to carry out this survey.

9 Bibliography

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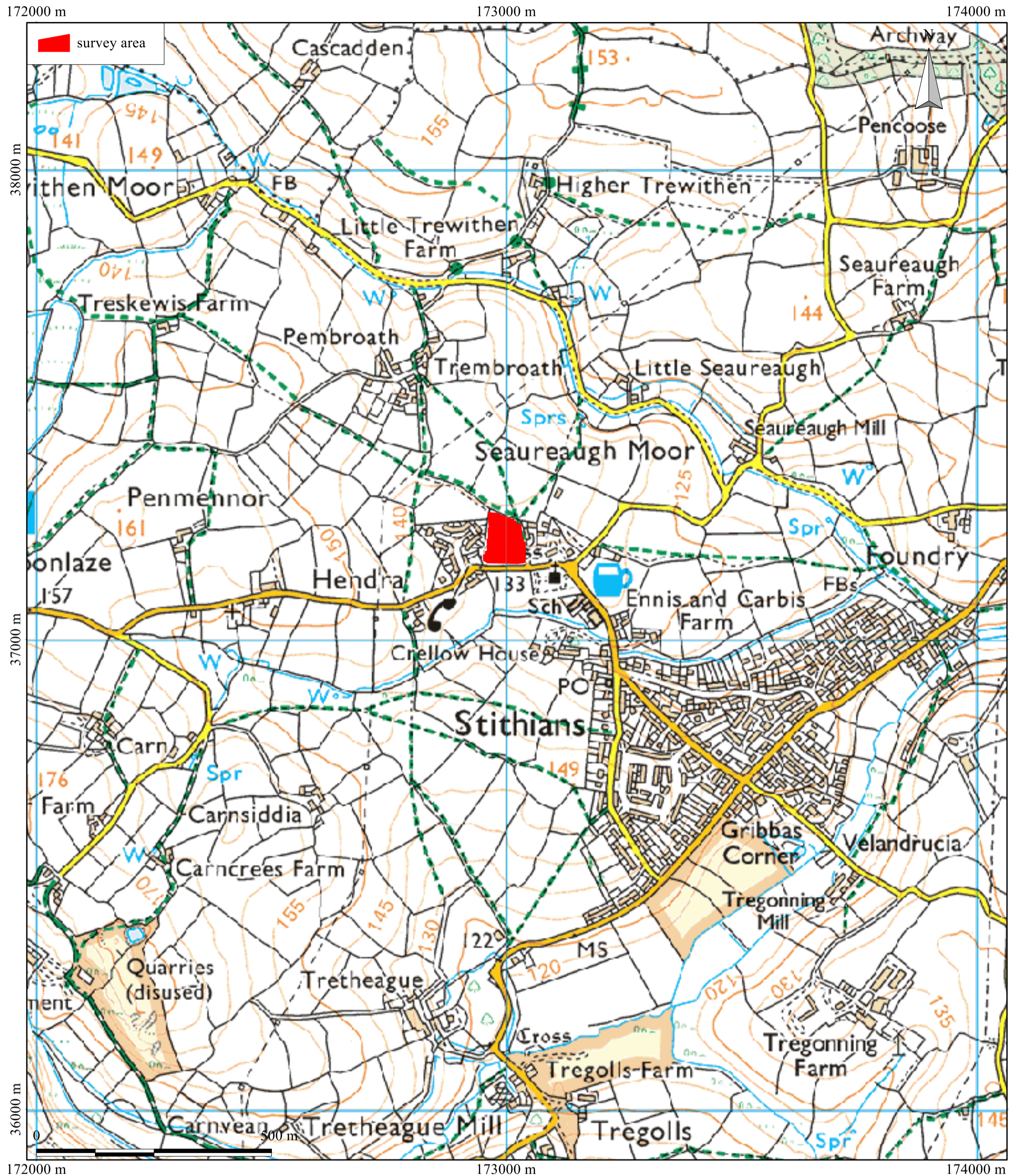
Taylor, E. (2015) *Land at Hendra Road, Stithians, Cornwall, Heritage Desk-Based Assessment*, Cotswold Archaeology unpublished report 15862

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.



British Grid
 centre X: 173023.09 m, centre Y: 37102.53 m

Geophysical survey: Copyright Substrata 2016.
 Base map: Ordnance Survey via Promap 78030658_1_1,
 All rights reserved.

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

An archaeological gradiometer survey
 Land off Hendra Road, Hendra, Stithians, Cornwall
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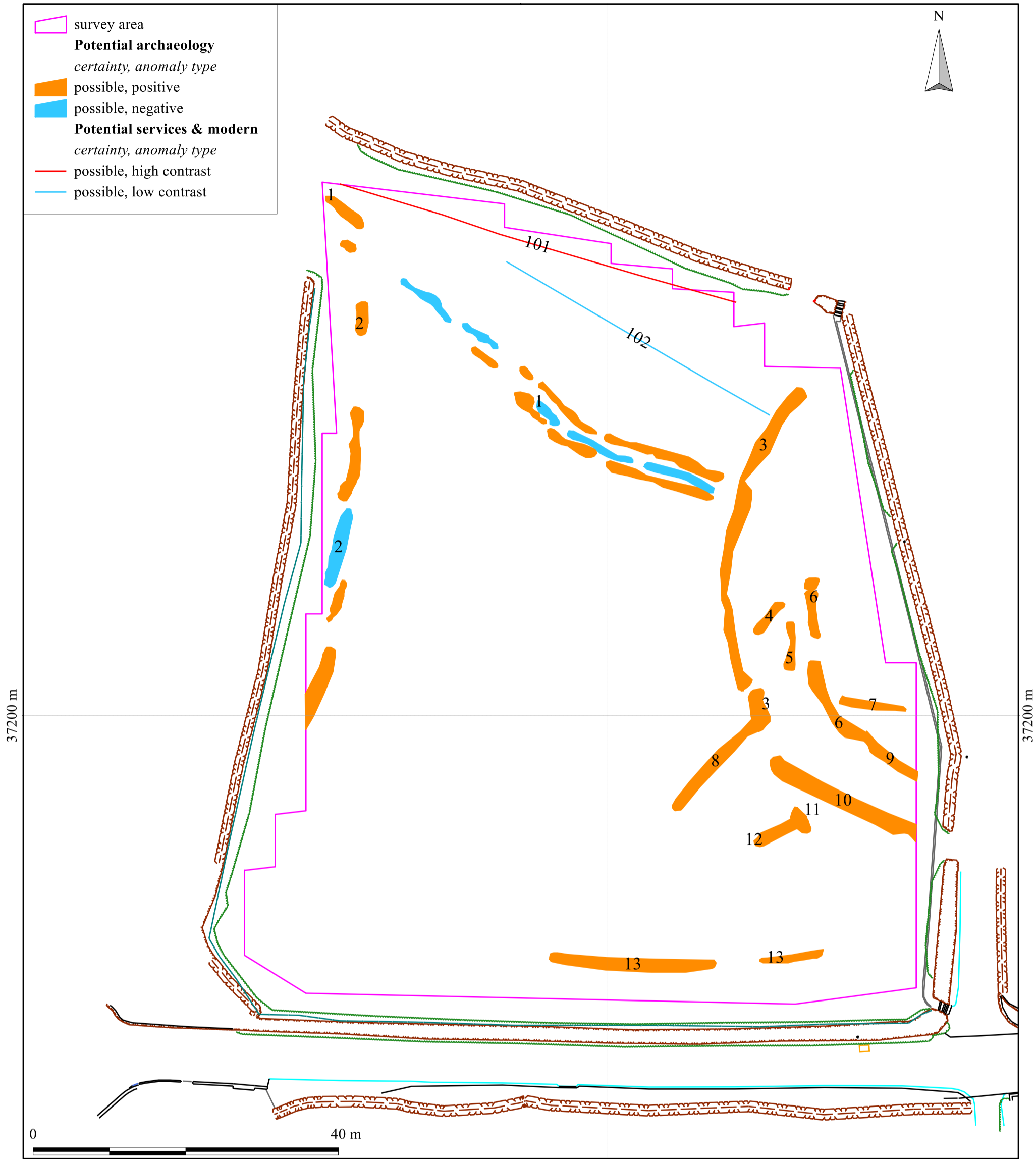
Figure 1: location map

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173000 m

N

- survey area
- Potential archaeology**
certainty, anomaly type
- possible, positive
- possible, negative
- Potential services & modern**
certainty, anomaly type
- possible, high contrast
- possible, low contrast



37200 m

37200 m

173000 m

British Grid
centre X: 172988.60 m, centre Y: 37217.58 m

Geophysical survey: Copyright Substrata 2016.
Base map: KEMP Chartered Land and Engineering Surveyors,
All rights reserved.

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. 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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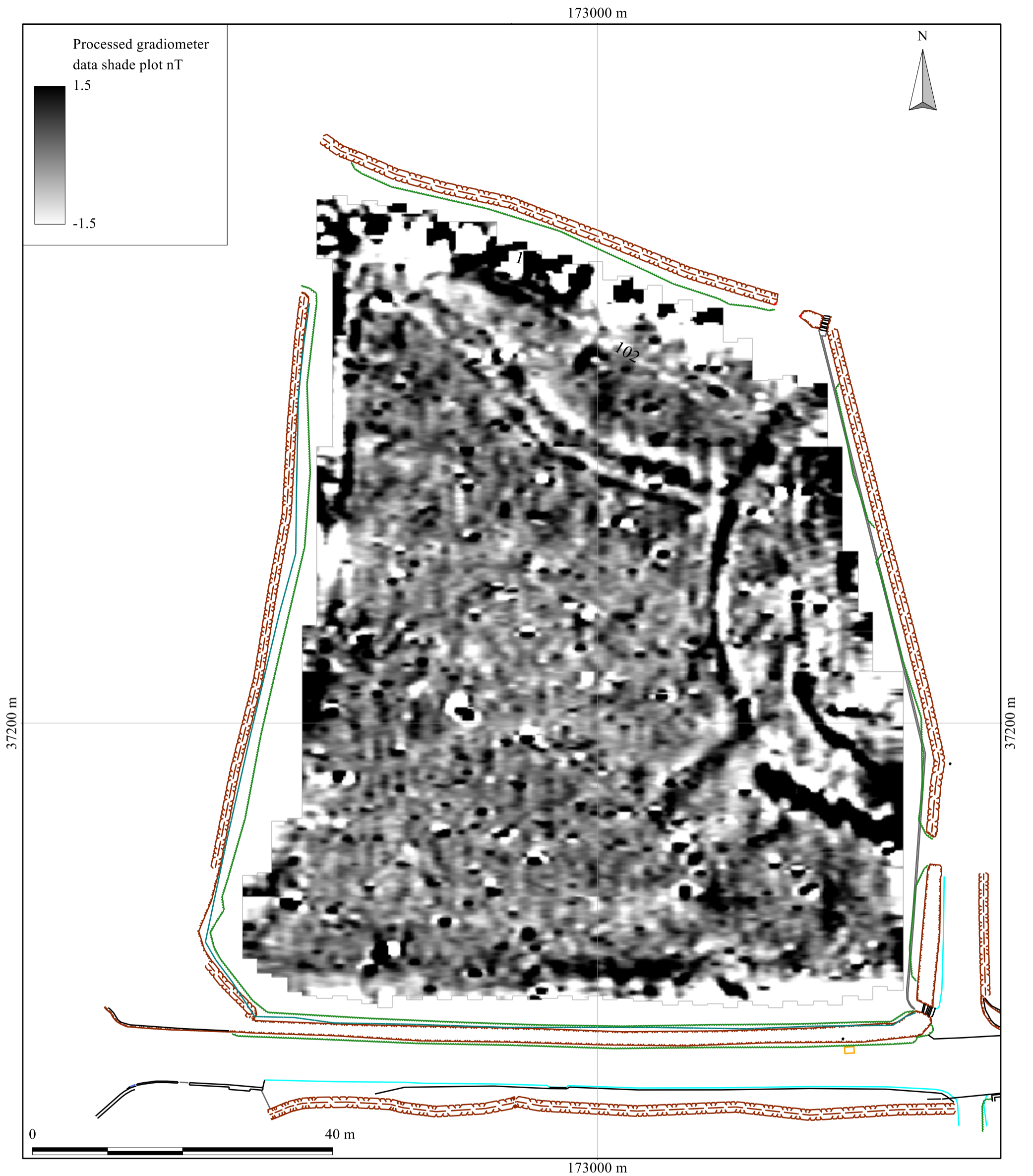
Figure 2: survey interpretation

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anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		possible, positive & negative	disrupted curvilinear	field boundary - Cornish hedge	anomaly group is most likely to represent a former field boundary removed before the publication of the Stithians tithe map although a small track is a possibility	1842 Stithians tithe map
2		possible, positive & negative	disrupted linear			
3	6 8 9 10	possible, positive	disrupted curvilinear		anomaly group 3 may be associated with group 8 and, in addition, may form a double curvilinear with anomaly group 6 and possibly with groups 9 and 10 but this is not certain	
4		possible, positive	linear			
5		possible, positive	linear			
6	3 9 10	possible, positive	disrupted curvilinear		anomaly group 6 may form a double curvilinear with anomaly group 3 and possibly with groups 9 and 10 but this is not certain	
7		possible, positive	linear			
8	3	possible, positive	linear		group 8 appears to be part of group 3 but further archaeological investigations are required to test this hypothesis	
9	6	possible, positive	linear		anomaly group 9 may be an extension of group 6 but this is not certain	
10	3	possible, positive	linear		anomaly group 10 may be associated with group 3 but has an alignment suggesting a different origin	
11		possible, positive	linear			
12		possible, positive	linear			
13		possible, positive	disrupted curvilinear			
101		possible, high contrast	linear	cable, pipeline or drain		
102		possible, low contrast	linear	service trench		

Table 1: data analysis



British Grid
 centre X: 172988.60 m, centre Y: 37217.58 m

Geophysical survey: Copyright Substrata 2016.
 Base map: KEMP Chartered Land and Engineering Surveyors,
 All rights reserved.

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

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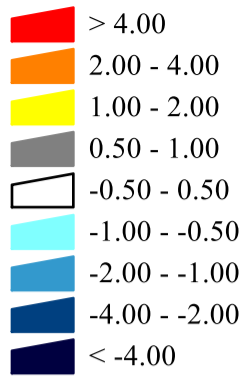
Figure 3: shade plot of processed data

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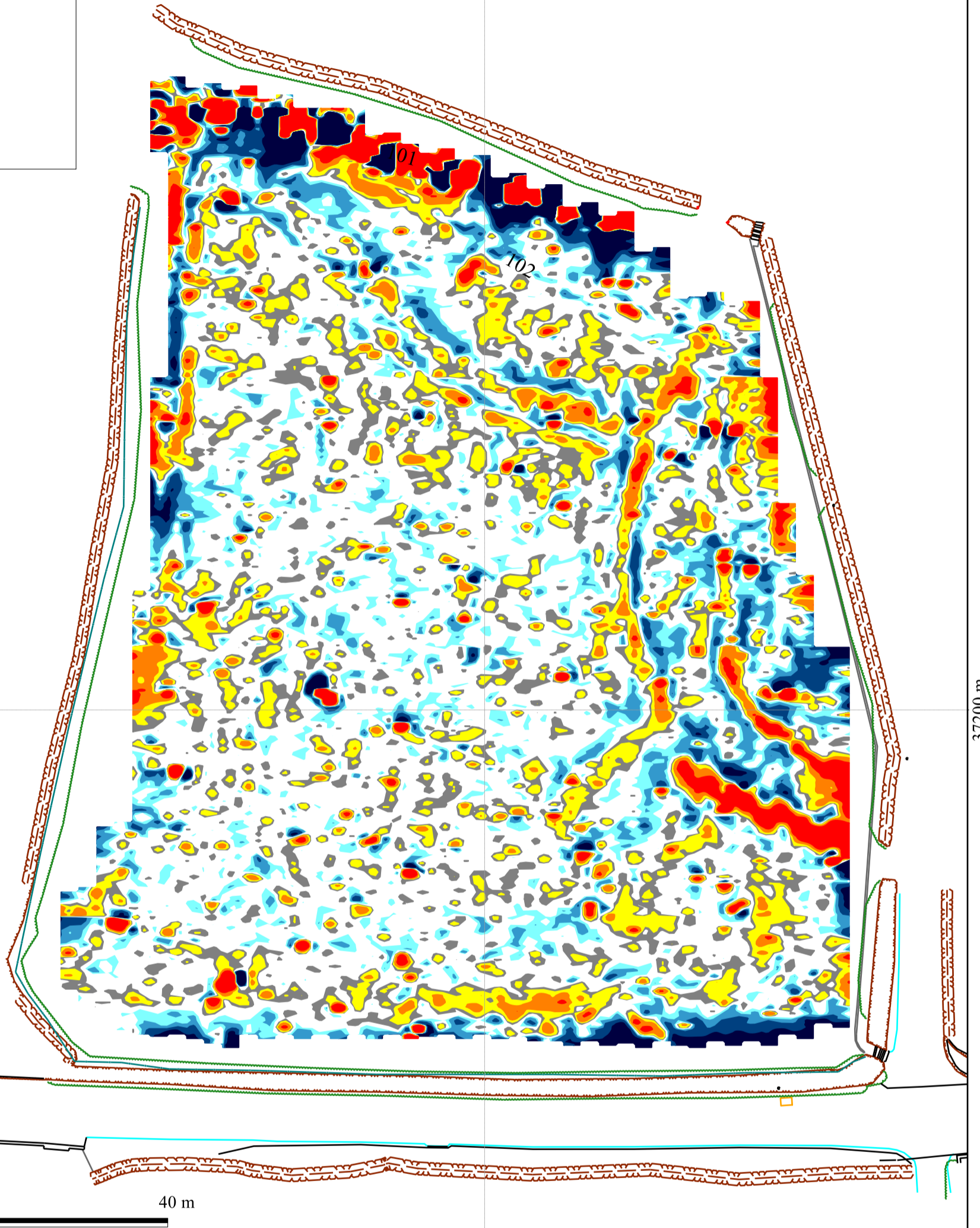
173000 m



Processed gradiometer data
contour plot (nT)



37200 m



37200 m

173000 m

British Grid
centre X: 172988.60 m, centre Y: 37217.58 m

Geophysical survey: Copyright Substrata 2016.
Base map: KEMP Chartered Land and Engineering Surveyors,
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Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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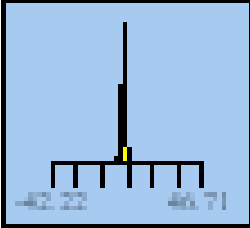
Figure 4: contour plot of processed data

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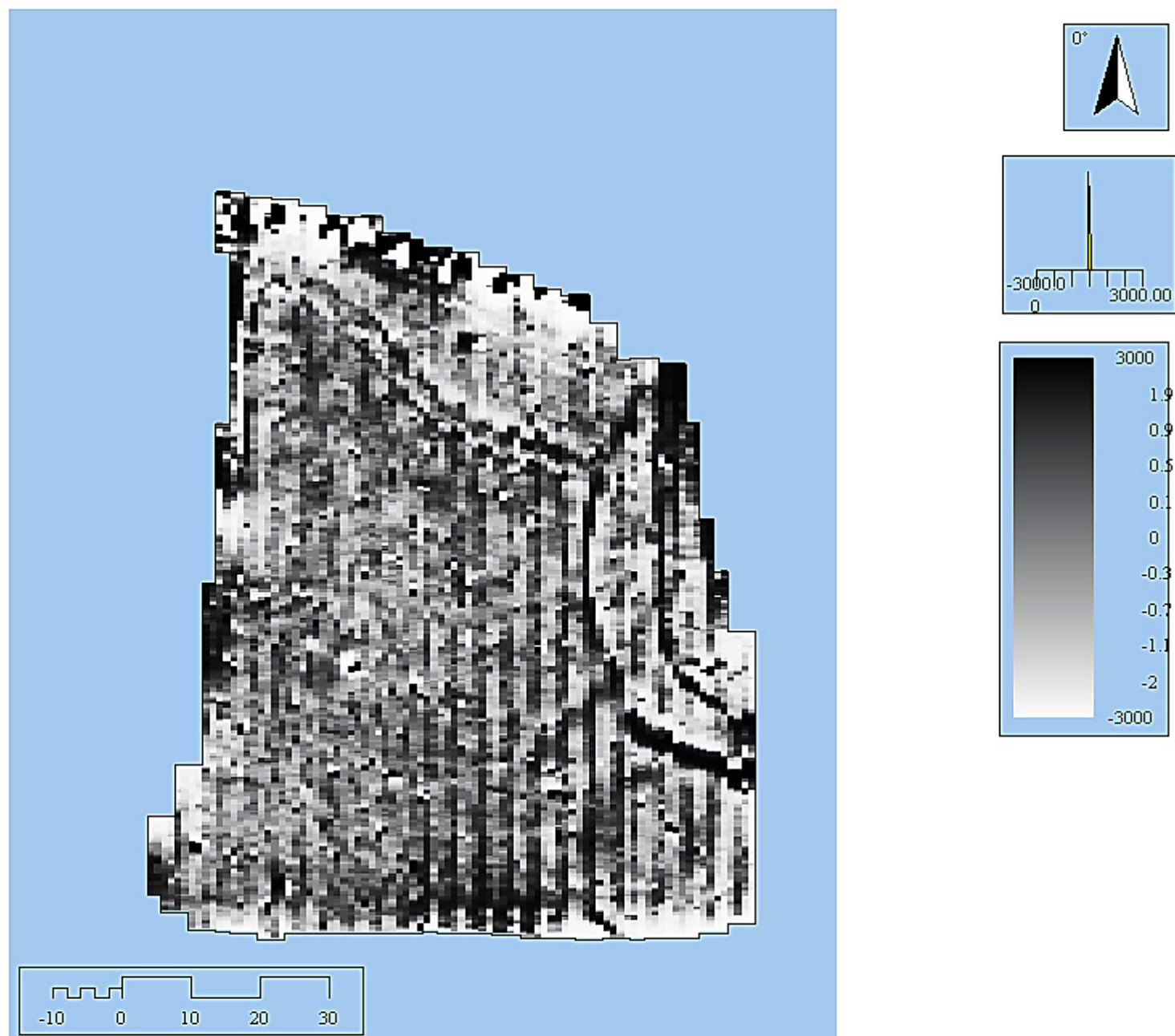
Appendix 2 Methodology Summary

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 (gradiometer) 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: gradiometer survey - processed data metadata	
<p>SITE Instrument Type: Bartington Grad 610 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: 46.71 Min: -42.22 Std Dev: 2.71 Mean: 0.02 Median: 0.00</p> 	<p>Processes: 7 1 Base Layer 2 Clip at 1.00 SD 3 Clip at 1.00 SD 4 De Stagger: Grids: All Mode: Both By: -2 intervals 5 De Stagger: Grids: h7.xgd Mode: Both By: 1 intervals 6 DeStripe Median Traverse: Grids: All 7 Interpolate: Match X & Y Doubled.</p>

Appendix 4 Unprocessed data plot



Instrument Type: Bartington Grad 610
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702

Processes: 1
1 Base Layer

Dimensions

Composite Size (readings): 600 x 120
Survey Size (meters): 150 m x 120 m
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: 194.18
Mean: 0.49
Median: -0.10
Composite Area: 1.8 ha
Surveyed Area: 0.73755 ha

PROGRAM

Name: TerraSurveyor
Version: 3.0.28.1

Figure 5: shade plot of unprocessed data