

Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land at Row, St Breward, Cornwall

Centred on NGR (E/N): 209660,076660 (point)

Report 1609ROW-R-1

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21 September 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: 19 September 2016
Area: 0.6ha
Lead surveyor: Ross Dean 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: Land at Row
Village and Civil Parish: St Breward
County: Cornwall
Nearest Postcode: PL30 4LL
NGR: SX 0966 7666 (point)
NGR (E/N): 209660,076660 (point)

1.4 Archive

OASIS number: substrat1-263320
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.

Three magnetic anomaly groups were mapped as representing possible archaeological deposits or features in the form of field boundaries or, less likely, traces of former ridge-and-furrow ploughing. Of the other seven anomaly groups mapped, three are most likely to represent relatively recent rubble and/or landfill. Three groups are most likely to represent magnetic responses from adjacent modern materials. One group may represent a recent service such as a ferrous-rich pipe, cable or drain.

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 survey area comprises an irregularly shaped field which was formally partially subdivided by a now remnant stone wall which is not mapped on the current Ordnance Survey MasterMap but which is marked by the survey area divide in Figure 2. The field lies between 186m and 194m AOD on the eastern edge of the village of St Breward as depicted in Figure 1. The village is on the western side of Bodmin Moor, approximately 9.6km north of Bodmin, overlooking the valley of the River Camel.

The hedges within and surrounding the survey area are thick with accompanying wire fencing. A modern housing estate lies along the western boundary of the site.

At the time of the survey the field was under recently cleared rough pasture.

4.2 Geology

The survey area has a solid geology of granite of the Permian and Carboniferous Bodmin Intrusion.

The superficial geology is not recorded in the source used (British Geological Survey, undated).

5 Archaeological background

The following is a short summary of information obtained from an Historical Environment Assessment completed by AC Archaeology (Costen, 2016) and thought relevant to the understanding of this geophysical survey. The Assessment was produced as part of the programme of archaeological work to which this report contributes.

5.1 Historic landscape characterisation

The Cornwall Historic Landscape Characterisation mapping project (HLC) has characterised the land within the application area as '20th-century settlement'. This is defined as, "Settled areas from larger farming settlements upwards". However, as the HLC is very much a broad brush approach, this category is unlikely to apply based on land-use, as surrounding the application area on all sides, the land is described as 'Medieval farmland' which is defined as, '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. They have either Medieval or prehistoric origins.' The survey area is therefore more likely to belong to this category (ibid: 13).

5.2 Historical and archaeological background

5.2.1 Heritage assets within the survey area

There are no previously recorded heritage assets within the survey area.

5.2.2 Heritage assets within 1000m of the survey area relevant to the geophysical survey (ibid: 6-10; Appendix 1)

There is a partially extant, Bronze Age hut circle settlement consisting of 11 hut circles with an associated field system and boundary banks situated on a hilltop and high ridge of open moorland at Lady Down, c. 600m to the east of the application area. The settlement and field system cover an area of approximately nine hectares; the largest of the two boundary banks extends to the northeast for 865m¹. To the southeast of the Lady Down settlement is the Penvorder Bronze Age hut circle. Here a small patch of uncleared ground in a pasture field contains a well preserved hut circle. Ploughed-down lynchets in the same field, to the west, might be part of an associated field system, but need not be contemporary and might be part of the Medieval/Post-medieval field pattern².

The remains of a possible Iron Age round are visible on aerial photographs at Chapel Farm and were plotted as part of the National Mapping Programme. The site is visible as a cropmark bank, and the northern edge is preserved in the shape of a field boundary³.

Four probable Medieval field systems are recorded from aerial photography and were plotted as part of the National Mapping Programme. At Chapel Farm the boundaries are sited within an area of Anciently Enclosed Land, and may form part of a Medieval field system⁴. At Churchtown remains of a possible Medieval strip field system are visible on aerial photographs⁵. At Glebe farm parallel features, possibly Medieval ridge and furrow, are visible as earthworks⁶. At Hantergantick a possible Medieval field system is situated on a southwest slope in an enclosed pasture. This system consists of a series of strip fields visible on the 10-inch and 25-inch Ordnance Survey maps and on aerial photographs⁷.

To the north of the application area is the Great Onslows Consol mine. The works commenced in 1845 as Great Michell Consols and was abandoned in 1848. It re-opened between 1851 and 1863 as Great Onslow Consols and was active again in the 1870s. Remains of the site are visible on aerial photographs and were plotted as part of the National Mapping Programme⁸. The De Lank Quarry was worked into the west face of the hill, and marked on 1880 Ordnance Survey 25-inch map as Penvarder Quarry. The quarry is visible on aerial photographs and was also plotted as part of the National Mapping Programme⁹. The Tor Down Quarry is marked on both the 1st and 2nd editions of the Ordnance Survey 25-inch map and was worked from at least 1873 until after 1950. It is again plotted as part of the National Mapping Programme. In 1970 the quarry was sold. Modern Ordnance Survey maps show the quarry much expanded with a second cutting to the north¹⁰.

There are six heritage assets for which the Historic Environment Record does not give firm dates. These include four field boundaries, all visible as cropmarks on aerial photographs and plotted during the National Mapping Programme. They are all likely to be Medieval or later in date¹¹⁻¹⁴. At Hantergantick is a sub circular ditched enclosure, visible as cropmarks and low earthworks on aerial photographs and again plotted during the National Mapping Programme.

Historic Environment Notes

Record entries listed below in order: Historical Environment Record, National Grid Reference, Scheduled monument number (if present), National Monuments Record (if present)

1. MCO21135, SX 1040 7632 (a further 21 individual HER records also relate to this site)
2. MCO19995, SX 0983 7591
3. MCO37470, SX 09120 77016
4. MCO37468, SX 0879 7696
5. MCO37475, SX 0949 7741
6. MCO49944, SX 10158 77394
7. MCO21016, SX 0965 7590
8. MCO12135 & MCO12136, SX 093 775
9. MCO23938, SX 0987 7577
10. MCO24204, SX 0939 7661
11. MCO37487, SX 0942 7761
12. MCO49953, SX 10280 76684
13. MCO49955, SX 10041 76580
14. MCO50154, SX 10338 75896

The enclosure lies on a south-facing slope above Hantergantick Farm and is of uncertain date and function¹⁵. At Lower Penquite a large hollow feature is visible as low earthworks on aerial photographs. It is possibly the site of a Medieval or later extractive pit or quarry and was again plotted during the National Mapping Programme¹⁶.

Historic Environment Notes

Record entries listed below in order: Historical Environment Record, National Grid Reference, Scheduled monument number (if present), National Monuments Record (if present)

15. MCO50153, SX 10354 75944

16. MCO49954, SX 10246 76568

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. It includes the anomaly groups identified as possibly relating to archaeological and other 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 the minimally processed data.

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 adjacent to the survey area. 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.

Anomalies thought to relate to natural features were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

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

6.3.2 Data relating to historic maps and other records

No magnetic anomaly groups pertaining to known heritage assets were recorded.

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly groups **1**, **2** and **3** are ill-defined in the data set and may relate to archaeological deposits or relatively recent sub-soil disturbance. If they are archaeological in origin, they are most likely to represent former field boundaries or possibly remnants or ridge-and-furrow cultivation. Group **3** may represent an extension of an extant field boundary as shown in Figure 2.

Anomalies **101**, **103** and **105** probably represent relatively recent deposits.

Groups **104** is most likely to represent strong magnetic responses from modern magnetic materials in the adjacent garden wall which has a iron railing on top. Group **105** is influenced by a nearby street light post and, most probably, other recent magnetic materials. Group **107** is likely to reflect both recent deposits associated with construction of housing and the adjacent street as well as nearby parked vehicles.

6.4 Conclusions

Three magnetic anomaly groups (1, 2 and 3) were mapped as representing possible archaeological deposits or features in the form of field boundaries or, less likely, traces of former ridge-and-furrow ploughing. Of the seven other magnetic anomaly groups mapped, three (101, 103 and 105) are most likely to represent relatively recent rubble and/or landfill. A further three groups (104, 106 and 107) are most likely to represent magnetic responses from adjacent modern materials. Group 102 may represent a recent service such as a ferrous-rich pipe, cable or drain.

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 complete this survey.

9 Bibliography

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Clark, A. (2000) *Seeing Beneath the Soil, Prospecting methods in archaeology*, London: Routledge

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Dean, R. (2016) *A survey method statement for a detailed magnetometer survey over Land at Row, St Brevard, Cornwall*, Substrata unpublished document 1609ROW-M-1

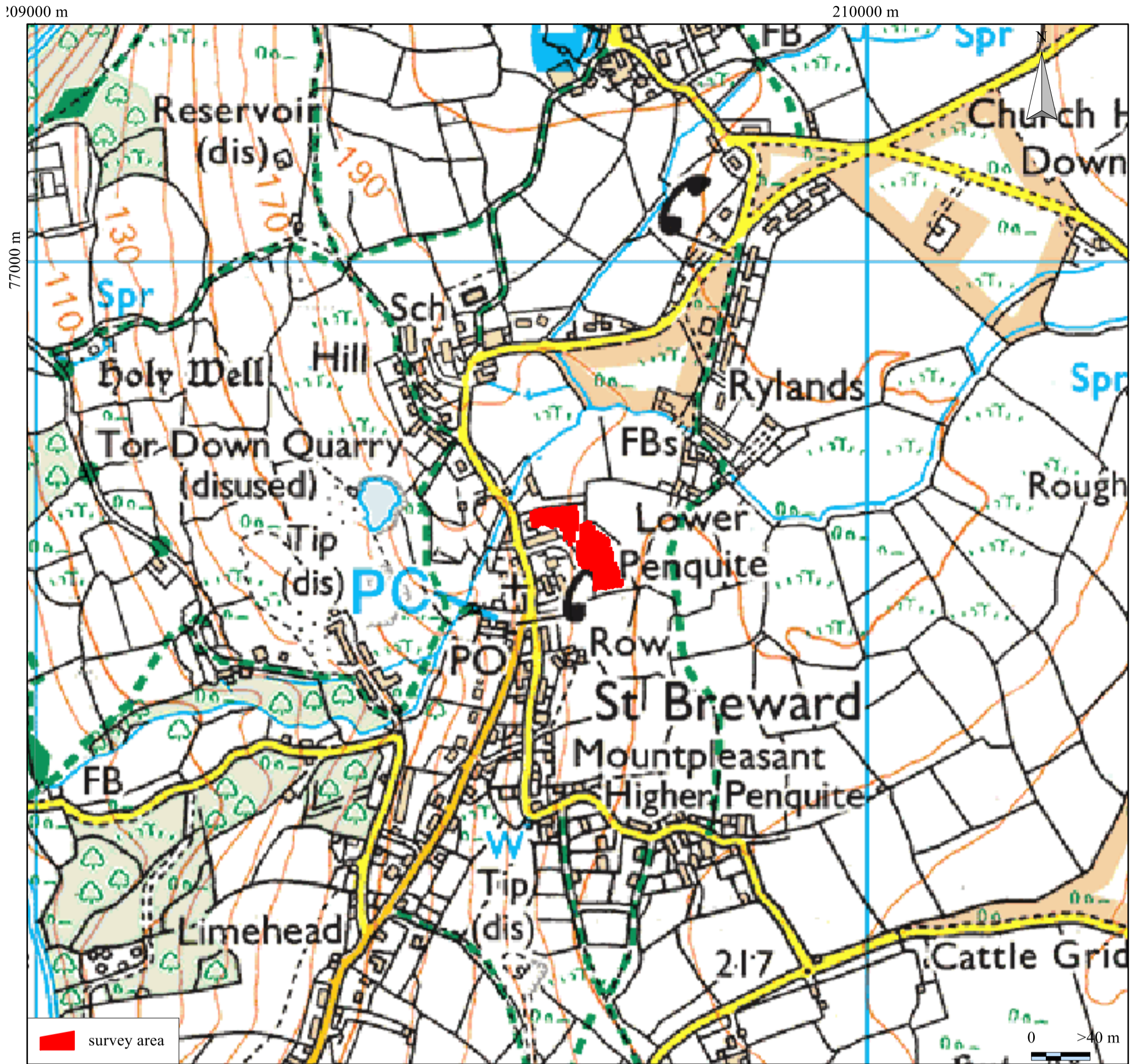
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation*, [Online], Available: <https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/> [June 2016]

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 (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: 209653.14 m, centre Y: 76658.33 m

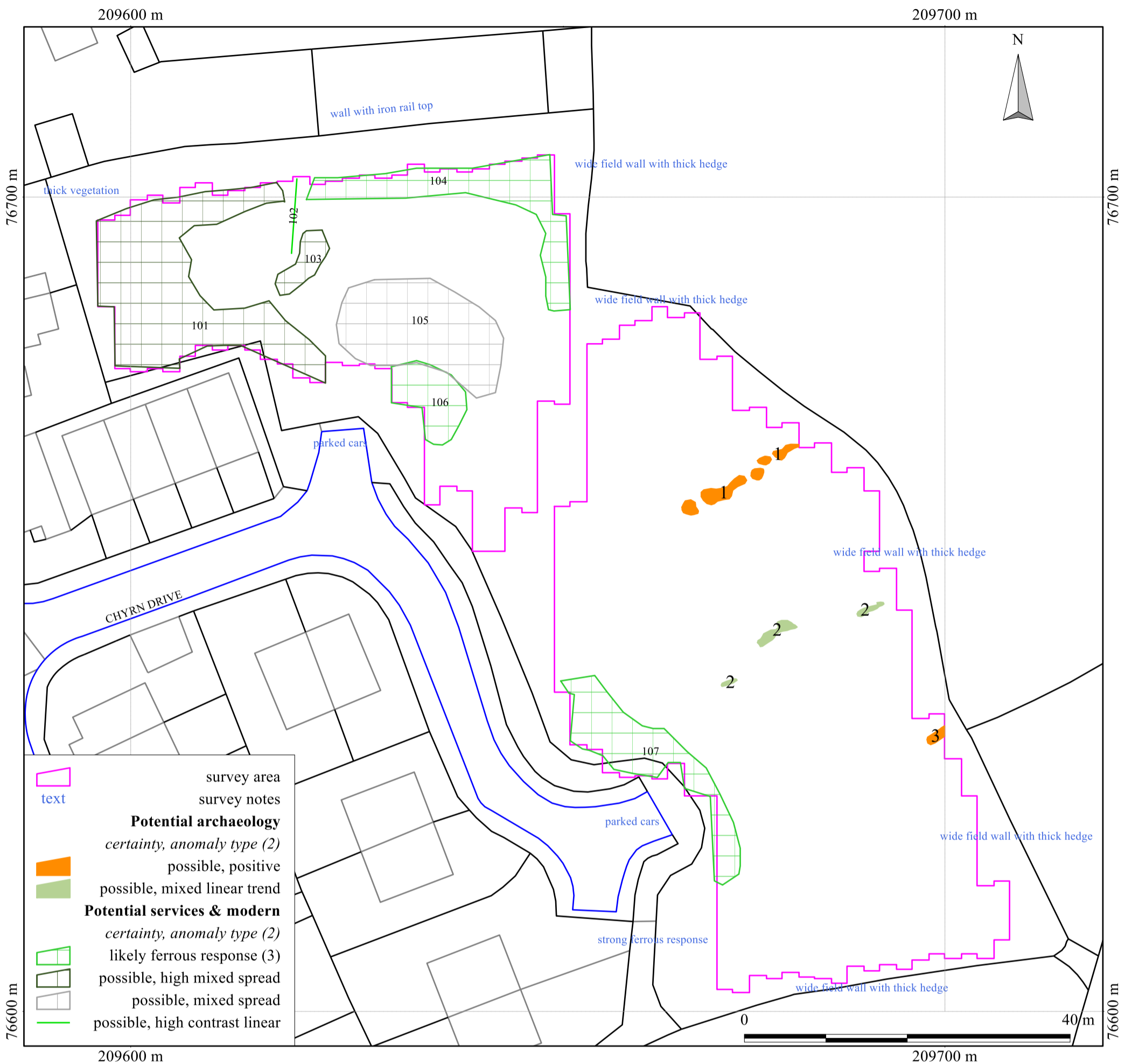
Geophysical survey: Copyright Substrata 2016.
 Base map: Ordnance Survey (c) Crown Copyright 2016
 All rights reserved. Licence Promap order 97615984_1_1

Scale: 1:5000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 1: location map

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

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely" have supporting evidence e.g. historical maps, visible earthworks or surveyor observation.
4. Representative; not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 2: survey interpretation

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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	supporting evidence
1	possible, positive	disrupted linear		
2	possible, mixed linear trend	disrupted linear		
3	possible, positive	linear		
101	possible, high mixed spread		rubble and/or landfill with ferrous material	
102	possible, high contrast linear		ferrous-rich drain, pipe or cable	
103	possible, high mixed spread		rubble and/or landfill with ferrous material	
104	likely, ferrous response		ferrous response from modern materials at boundary	surveyor observation
105	possible, mixed spread		disturbed ground	
106	likely, ferrous response		ferrous response from modern materials at boundary	surveyor observation
107	likely, ferrous response		ferrous response from modern materials at boundary	surveyor observation

Table 1: data analysis

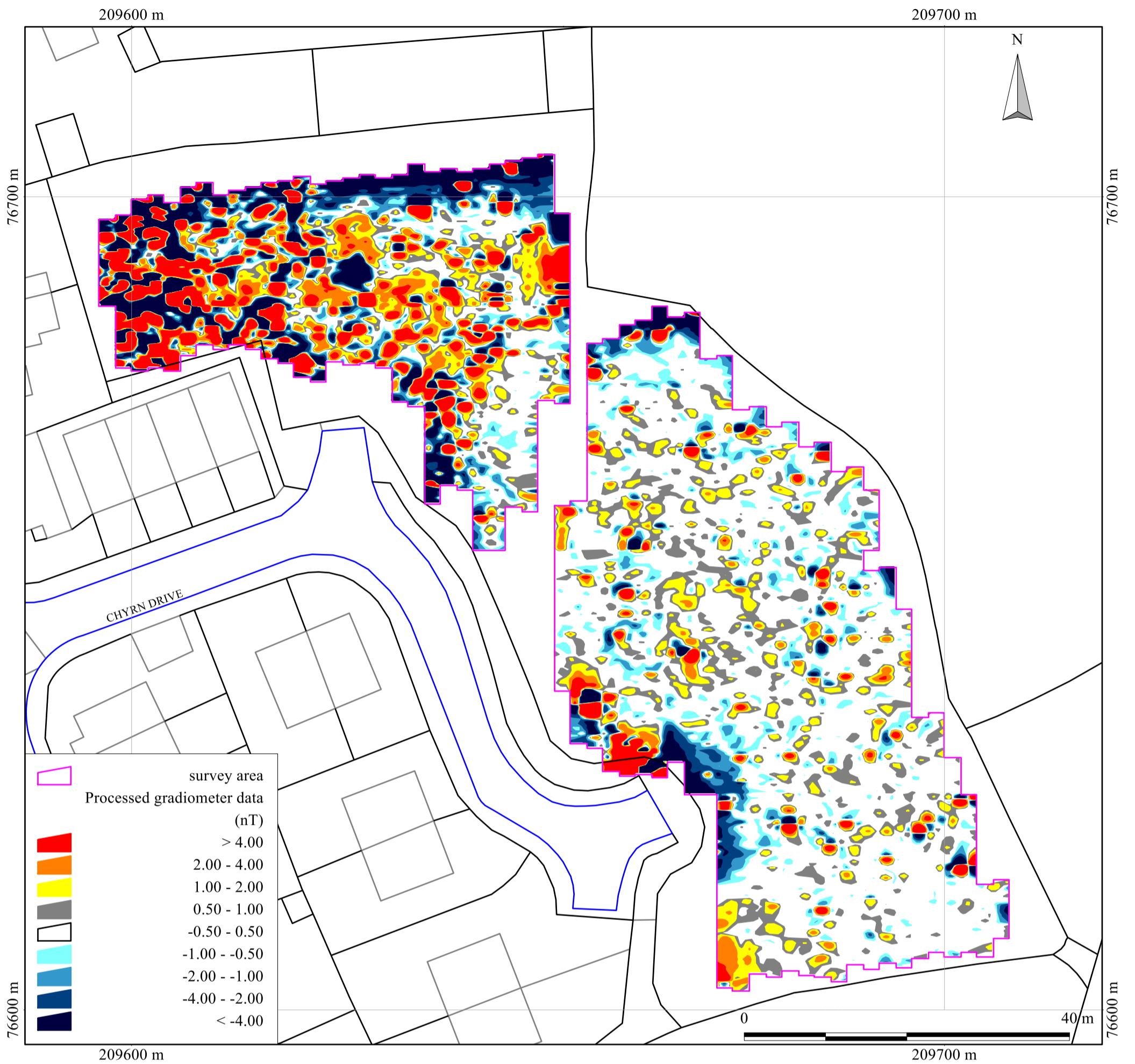


British Grid
 centre X: 209653.14 m, centre Y: 76658.33 m

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

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

Figure 3: shade plot of processed data



British Grid
centre X: 209653.14 m, centre Y: 76658.33 m

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

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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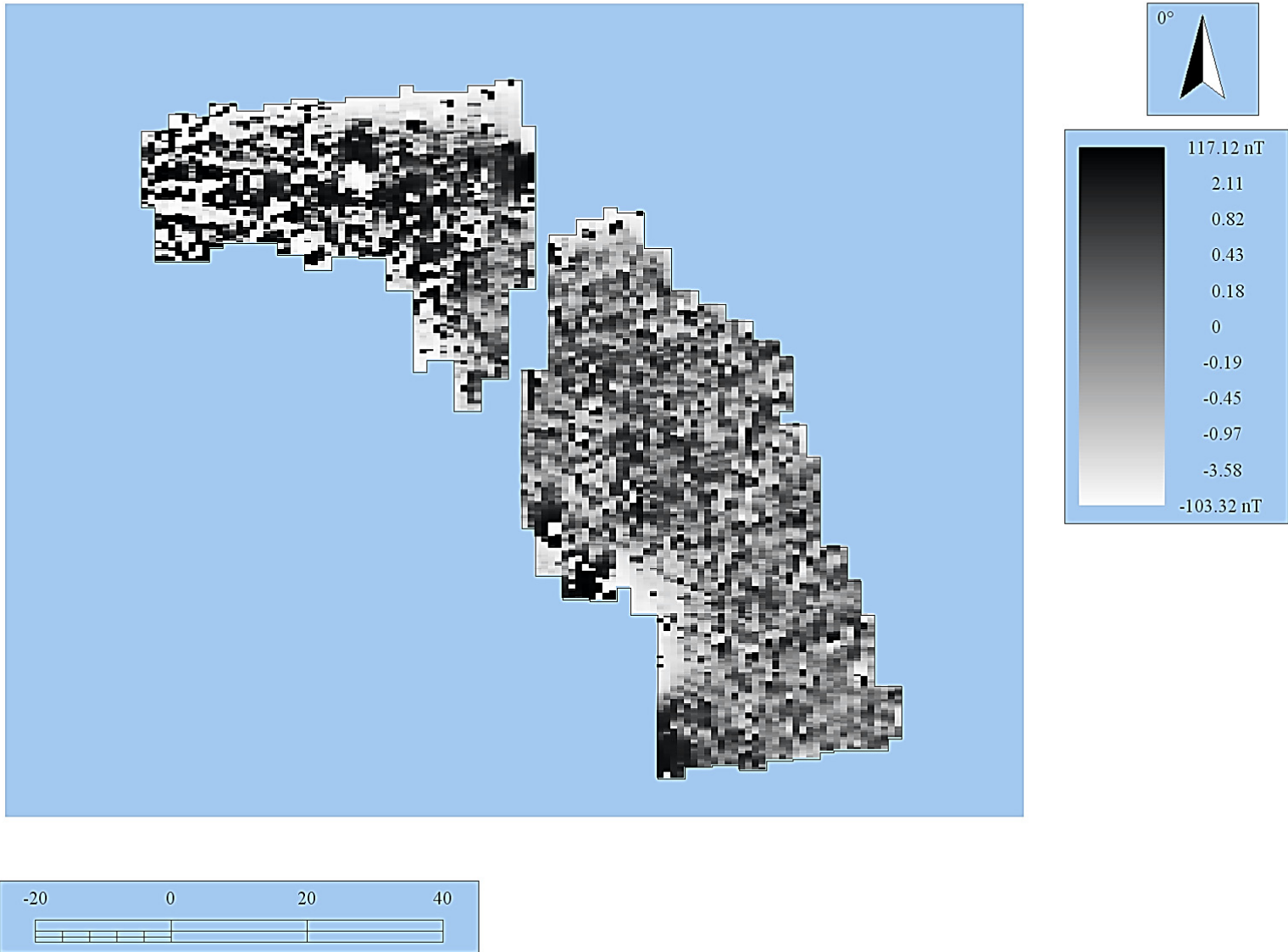
Appendix 2 Methodology Summary

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 (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. 	
<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: 3.0.29.3</p>	
<p>Stats Max: 55.92 Min: -83.82 Std Dev: 5.88 Mean: -0.35 Median: -0.01</p>	<p>Processes: 5 1 Base Layer 2 Clip at 2.00 SD 3 De Stagger: Grids: All Mode: Both By: -2 intervals 4 DeStripe Median Traverse: Grids: All 5 Interpolate: Match X & Y Doubled.</p>

Appendix 4 Minimally processed data plot



Instrument Type: Bartington Grad 601
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 117.12
Min: -103.32
Std Dev: 12.73
Mean: -0.15
Median: 0.00
Composite Area: 1.8 ha
Surveyed Area: 0.437 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Processes: 2
1 Base Layer
2 DeStripe Median Traverse: Grids: All

Figure 5: shade plot of minimally processed data