



An archaeological magnetometer survey

**Land adjacent to Abham Substation
Riverford Farm, Staverton, Devon**

Centred on NGR (E/N): 277380,064770

Report: 1706RIV-R-1

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Project archive

Report	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, 10 and 12 July 2017
Area: 5.8ha
Lead surveyor: Mark Edwards BA
Author: Ross Dean BSc MSc MA MifA

1.2 Clients

Statera Energy Limited, 3rd Floor, 239 High Street Kensington, London W8 6SA

1.3 Location

Site: Land adjacent to Abham Substation, Riverford Farm
Civil Parish: Staverton
District: South Hams
County: Devon
Nearest Postcode: TQ11 0LA
NGR: SX 77380 64770 (point)
NGR (E/N): 277380,064770 (point)

1.4 Archive

OASIS number: substrat1-292602
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 Statera Energy Limited 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.

Fourteen magnetic anomaly groups were mapped as representing potential archaeological deposits or features. Seven and possibly eight of these groups represent former field boundaries recorded on historic maps. One anomaly group may represent a large pit or archaeological surface. The remaining anomaly groups are, with varying degrees of certainty, characterised as representing linear and curvilinear deposits such as fragments of former field or 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 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 Methodology

The work was undertaken in accordance with the survey methodology statement (Dean, 2017).

The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system (Table 3).

Data processing was undertaken using appropriate software (Table 3), 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.

4 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).

5 Site description

5.1 Landscape and land use

The survey area comprises one field and part of an adjacent field to the south of Abham substation in the parish of Staverton, Devon (Figure 1). The northern field is bounded by fencing. Mature hedges coincide with the fencing to the north and east. A minor road lies along the western boundary. A stream flows southbound along the eastern boundary. The area slopes west to east from approximately 40m to 20m AOD. There are a number of nearby springs and two ponds lie within the survey area.

The area was under pasture at the time of the survey.

5.2 Geology

The bedrock across the site is slate. A geological boundary runs through the area with Upper Devonian Slates on the northwest side and Middle Devonian Slates to the south east. Alluvium is recorded along the stream on the eastern side of the survey area (British Geological Survey, undated).

6 Archaeological background

6.1 Historic landscape characterisation

‘Modern enclosures’: These modern fields have been created out of probable medieval enclosures first hedged during the later middle ages. The sinuous medieval boundaries survive in places and when present they suggest the land may have been farmed as open strip-fields (Devon County Council, undated).

6.2 Summary of archaeological background

The Devon County Council Historic Environment Record (DHER) 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.

This section is not designed to provide a comprehensive understanding of the historic environment of the surrounding area and should not be used as a source for further work.

Table 1 provides a summary of the DHER entries though relevant. There are no entries recorded within the survey area. Five enclosures have been recorded within the examined area, all but one being characterised as prehistoric.

7 Results, discussion and conclusions

7.1 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 changes in the magnetism of underlying, varying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface and 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 8.

7.2 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 2 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 along with Table 2 comprise the analysis of the survey data.

Figures 3 and 4 are plots of processed data as specified in Table 4. Figure 5 is a plot of the unprocessed survey data with its metadata.

7.3 Discussion

7.3.1 General points

Discussion scope

Not all anomalies or anomaly groups identified in Table 2 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 field 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 2.

The area around the two ponds contained high vegetation which prevented surveying (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 were mapped as potential archaeology when they were associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 2.

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 set of parallel linear anomalies trending approximately west to east in the north and east of the survey area were interpreted as relatively recent ploughing disturbance.

7.3.2 Data relating to historic maps and other records (Figure 2 and Table 2)

Magnetic anomaly groups 1, 2, 3, 4, 6, 12 and 14 coincide with former field boundaries recorded on historic maps. Group 13 may also represent the same field boundary as group 14 or possibly a different phase of the boundary.

All the above boundaries were recorded on the Staverton tithe map of 1845. By the publication of the Ordnance Survey 1:2500 map in 1887, the field boundaries represented by anomaly groups 13 and 14 had been removed. The remaining field boundaries were last recorded on the Ordnance Survey 1:10560 map of 1963.

7.3.3 Data with no previous archaeological provenance (Figure 2 and Table 2)

Anomaly group 7 is well defined in the data set and may reflect an archaeological deposit such as a large pit or a surface. Its location on a known field boundary may imply association with the boundary but it is a distinct anomaly group and must be treated as potentially representing separate archaeology.

Groups 5, 8, 9 and 11 have characteristics often associated with fragments of former field or enclosure boundaries. These are of unknown date but group 11 has a similar trend to group 6 and may have a similar origin; their curvilinear nature may indicate medieval enclosure of earlier strip fields (Section 6.1). Group 10 may also reflect the presence of an archaeological deposit, possibly the same as that represented by group 11, but its trend is the same as that of the survey traverses and it may reflect a spurious instrument response caused when passing over relatively recent ferrous material.

7.4 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.

Fourteen magnetic anomaly groups were mapped as representing potential archaeological deposits or features. Seven and possibly eight of these groups (1, 2, 3, 4, 6, 12, 13 and 14) represent former field boundaries recorded on historic maps. One anomaly group (7) may represent a large pit or archaeological surface. The remaining anomaly groups are, with varying degrees of certainty, characterised as representing linear and curvilinear deposits such as fragments of former field or enclosure boundaries.

8 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.

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9 Acknowledgements

Substrata would like to thank Kirsty Cassie of Statera Energy Limited for commissioning us to complete this survey.

10 Bibliography

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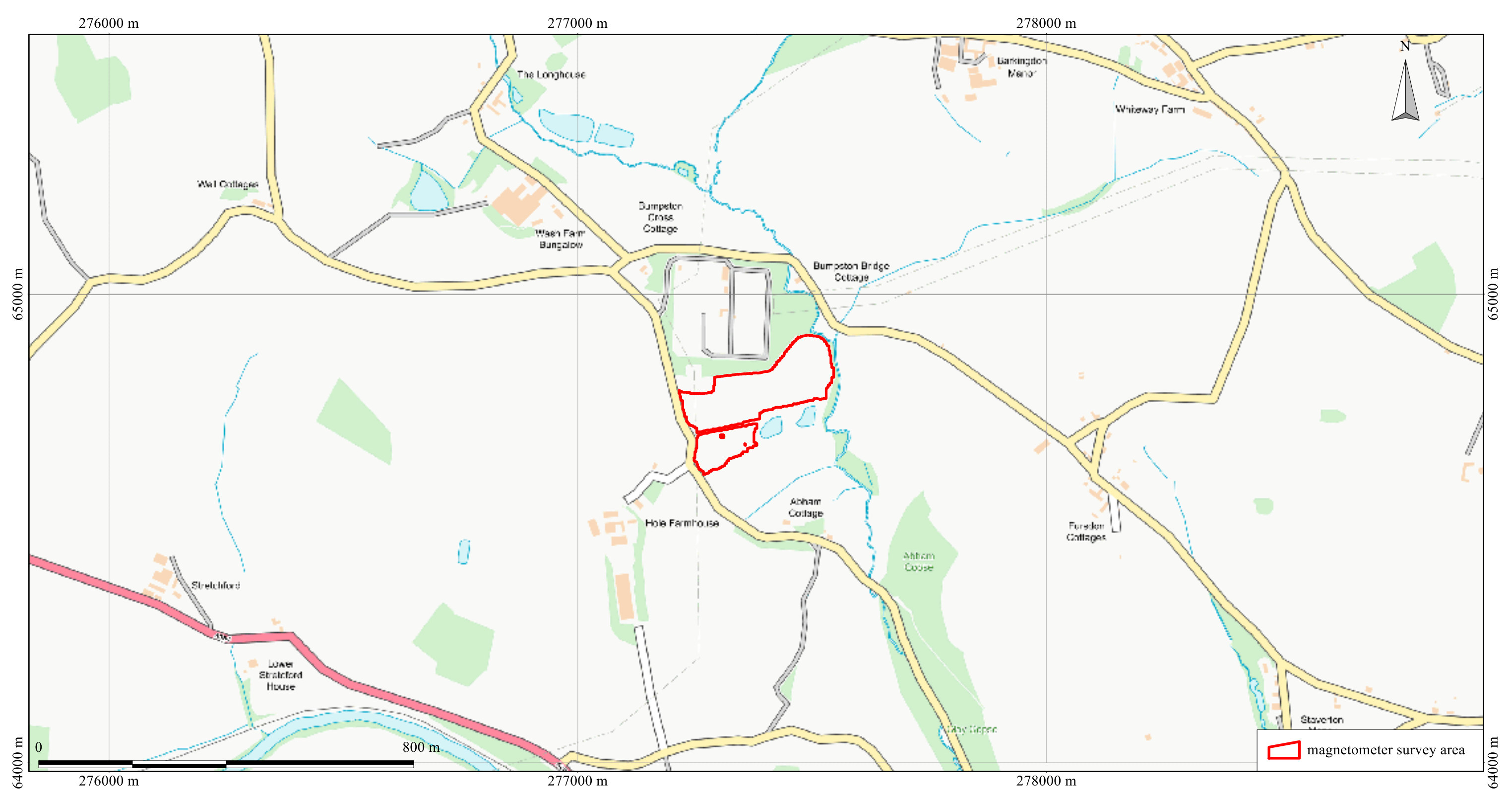
Historic England (2010) *Geophysical Survey in Archaeological Field Evaluation* [Online], Available: <https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/> [April 2017]

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.



British Grid
centre X: 277380.70 m, centre Y: 64767.70 m

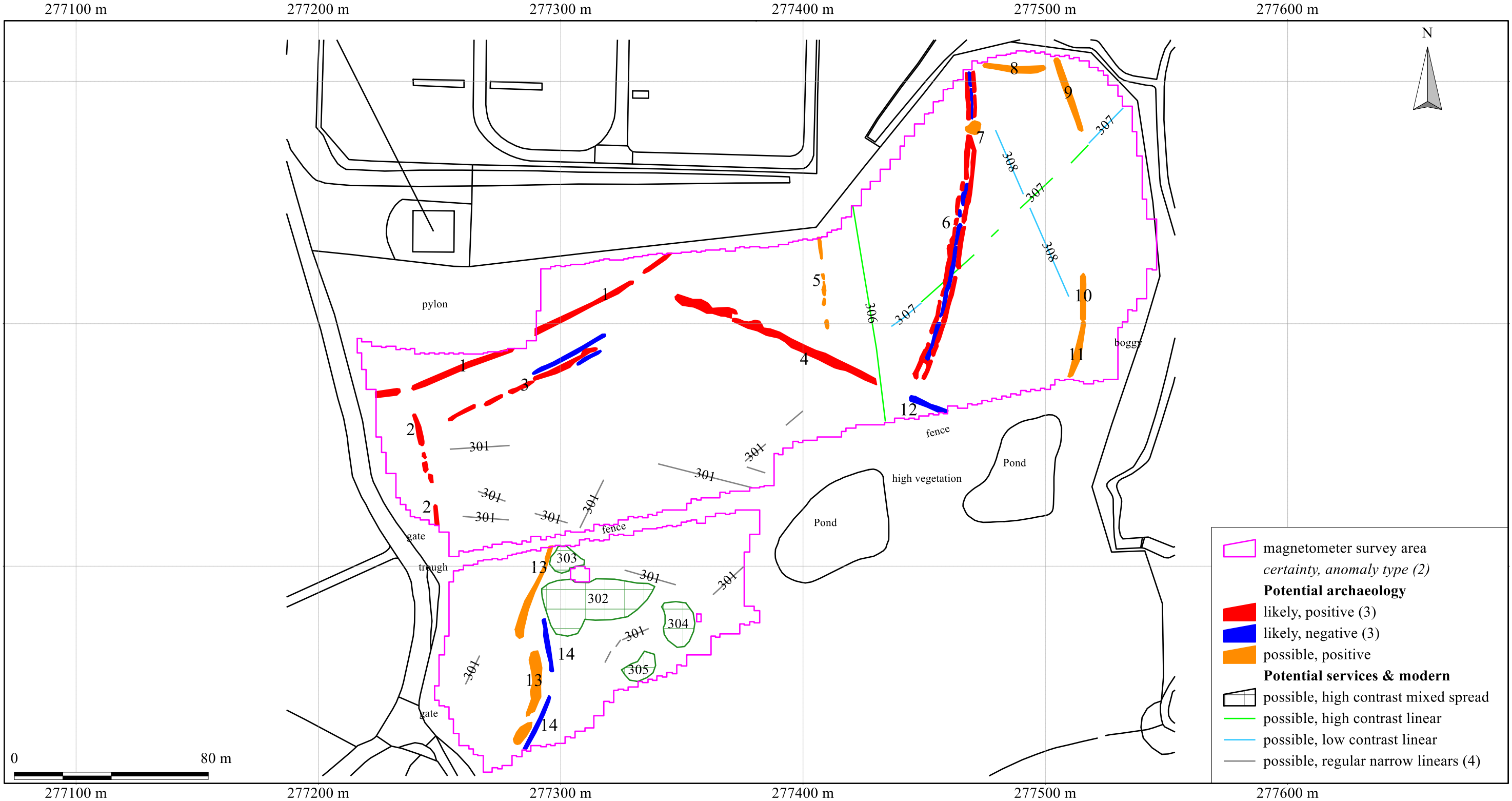
Scale: 1:8000 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata Limited.
Base map: Ordnance Survey (c) Crown Copyright 2017.
All rights reserved. Licence number 100022432

An archaeological magnetometer survey
Land adjacent to Abham Substation,
Riverford Farm, Staverton, Devon
Centred on NGR (E/N): 277380,064770 (point)
Report: 1706RIV-R-1

Figure 2: survey interpretation

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British Grid
centre X: 277380.70 m, centre Y: 64767.70 m

Scale: 1:1600 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata Limited.
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- 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 geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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centre X: 277380.70 m, centre Y: 64767.70 m

Scale: 1:1600 @ A3. Spatial Units: Meter. Do not scale off this drawing

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

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Langstrath, Goodleigh
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Email: geophysics@substrata.co.uk
Web: substrata.co.uk

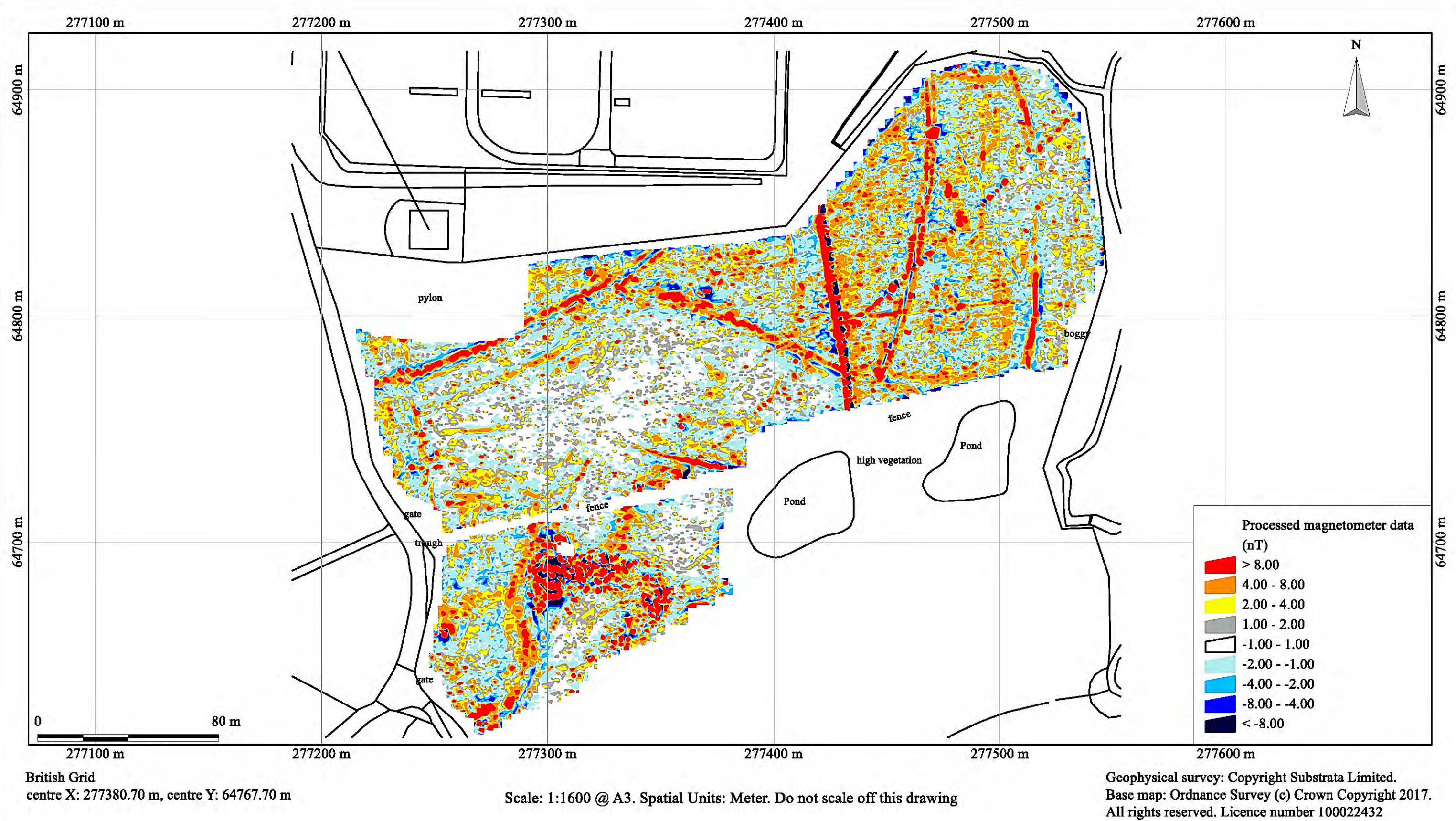


Figure 4: contour plot of processed data



Figure 5: shade plot of unprocessed magnetometer data

Appendix 2 Tables

An archaeological magnetometer survey
Land adjacent to Abham Substation, Riverford Farm
Staverton, Totnes, Devon
Centred on NGR (E/N): 277380,064770 (point)
Report: 1706RIV-R-1

County: Devon
District: South Hams
Parish: Staverton
Source: Heritage Gateway
Site centre: 277357,064780

HER number	grid reference	designations	type	period	description	distance (m) from site centre	bearing (GN) from site centre
MDV60104	SX 773 643		ENCLOSURE	Unknown date	Site of a possible curvilinear double ditched enclosure or the ditches of a former field boundary identified on aerial photograph	477	190
MDV49078	SX 773 653		QUARRY	XVIII to XXI - 1751 AD to 2009 AD (Between)	Quarry in the Parish of Staverton	536	351
MDV56044	SX 777 653		LINEAR FEATURE	Unknown date	Linear cropmarks visible on aerial photograph in 1994 to the south of Barkington Manor	619	31
MDV49947	SX 777 642		QUARRY	XIX - 1801 AD to 1900 AD (Between)	Quarry shown on 19th century map to the south of Abham Bridge	654	151
MDV77965	SX 769 643		HOLLOW	Unknown date	Circular hollow feature shown on late 19th and early 20th century Ordnance Survey maps	672	226
MDV43011	SX 767 650		ENCLOSURE	Prehistoric - 698000 BC to 42 AD	North side of curvilinear single ditched enclosure, length c 70m. Other adjacent cropmarks	718	289
MDV56045	SX 779 640		LINEAR FEATURE	Unknown date	Area of complex linear and curvilinear features recorded as cropmarks to the east of Clay Copse	929	146
MDV37206	SX 764 648		ENCLOSURE	Prehistoric - 698000 BC to 42 AD	Small circular single ditched enclosure diam 30-40m. Linear features adjacent. Enclosure bisected by new but already lynchetted fence. Moderate north west slope, possible faint terrace. Linear feature to north is old field boundary on tithe map. Linear feature to east runs obliquely down slope, nothing visible on the ground	980	272
MDV37205	SX 764 649		ENCLOSURE	Prehistoric - 698000 BC to 42 AD	Part of rectangular single ditched enclosure (south east corner). Site lies on even north west slope. Nothing visible on ground	989	278
MDV29896	SX 762 654		ENCLOSURE	Prehistoric - 698000 BC to 42 AD	Subrectangular ditched enclosure recorded as crop mark. Diameter about 80-90m. Other linear features and possible circular enclosures in same field	1338	298
MDV115308	SX 705 594		ARCHAEOLOGICAL FEATURE	Unknown date	More than 130 anomalies were recorded during a magnetometer survey along sections of the route of a gas pipeline from Fishacre to Choakford. Many, however, are likely to relate to agricultural activity and land drainage. Characteristic anomalies relating to former land boundaries were located in at least six of the surveyed areas and several areas revealed rectilinear and linear anomalies caused by cut features that may have archaeological potential.	8728	232

Table 1: Historical Environment Entries thought relevant to geophysical survey within approximately 500m of the survey area edges

Site: An archaeological magnetometer survey
Land adjacent to Abham Substation,
Riverford Farm, Staverton, Devon
Centred on NGR (E/N): 277380,064770 (point)
Report: 1706RIV-R-1

anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1		likely, positive	disrupted linear	field boundary	anomaly group coincides with, and likely represents, a field boundary recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1963 1:10560
2		likely, positive	disrupted linear	track	anomaly group coincides with, and likely represents, a track recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1963 1:10560
3		likely, negative/positive/negative	disrupted linear	track	anomaly group coincides with, and likely represents, a track recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1963 1:10560
4		likely, positive	disrupted linear	track	anomaly group coincides with, and likely represents, a track recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1963 1:10560
5		possible, positive	disrupted linear			
6		likely, positive/negative/positive	disrupted linear	field boundary - possible Devon bank	anomaly group coincides with, and likely represents, a field boundary recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1938 1:10560
7		possible, positive	oval	large pit, archaeological surface or natural deposit		
8		possible, positive	linear	archaeological deposit or land drain		
9		possible, positive	linear	archaeological deposit or land drain		
10	11?	possible, positive	linear	archaeological deposit or instrument response	anomaly group has same trend as survey traverses implying an instrument response only but may represent an archaeological deposit	
11	10?	possible, positive	curvilinear			
12		likely, negative	linear	field boundary	anomaly group coincides with, and likely represents, a field boundary recorded on historic maps	1845 Staverton tithe map, Ordnance Survey 1887 1:2500 to 1963 1:10560
13	14?	possible, positive	disrupted curvilinear	field boundary?	anomaly group approximately coincides with, and may represent, a field boundary recorded on historic maps	1845 Staverton tithe map
14	13	likely, negative	disrupted curvilinear	field boundary	anomaly group coincides with, and likely represents, a field boundary recorded on historic maps	1845 Staverton tithe map
301		possible, regular narrow linears		field drain		
302		possible, high contrast mixed spread	irregular	rubble and/or landfill with ferrous material		
303		possible, high contrast mixed spread	irregular	rubble and/or landfill with ferrous material		
304		possible, high contrast mixed spread	irregular	rubble and/or landfill with ferrous material		
305		possible, high contrast mixed spread	irregular	rubble and/or landfill with ferrous material		
306		possible, high contrast linear		ferrous cable, drain or pipe		
307		possible, high contrast linear		service trench with ferrous material in parts		
308		possible, low contrast linear		service trench		

Table 2: data analysis

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.	
Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1	Data Capture <i>Sample Interval:</i> 0.25m <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN
Data Processing, Analysis and Presentation Software QCAD Professional 3 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 3: methodology information

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		
Statistics Max: 150.24 Min: -131.61 Std Dev: 9.87 Mean: 0.24 Median: 0.00	Processing 1 Base Layer 2 Clip at 1.00 SD 3 De Stagger: Grids: All Mode: Both By: -1 intervals 4 De Stagger: Grids: b9.xgd Mode: Both By: 1 intervals 5 De Stagger: Grids: b6.xgd Mode: Both By: -1 intervals 6 De Stagger: Grids: a4.xgd Mode: Both By: 1 intervals 7 De Stagger: Grids: a13.xgd Mode: Both By: 1 intervals 8 De Stagger: Grids: b14.xgd Mode: Both By: 1 intervals 9 DeStripe Median Sensors: Grids: All 10 De Stagger: Grids: b2.xgd Mode: Both By: 1 intervals 11 De Stagger: Grids: b9.xgd Mode: Both By: 1 intervals 12 De Stagger: Grids: b10.xgd Mode: Both By: 1 intervals	

Table 4: processed data metadata