

T H A M E S V A L L E Y

ARCHAEOLOGICAL

S E R V I C E S

S O U T H W E S T

**Western Extension of Hillhead Quarry,
Uffculme, Devon**

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: HQU16/46

(ST 0583 1362)

Western Extension of Hillhead Quarry, Uffculme, Devon

Geophysical Survey (Magnetic) Report For Aggregate Industries

by Kyle Beaverstock
Thames Valley Archaeological Services Ltd

Site Code HQU 16/46

September 2016

Summary

Site name: Western Extension of Hillhead Quarry, Uffculme, Devon

Grid reference: ST 0583 1362

Site activity: Magnetometer survey

Date and duration of project: 5th - 8th of September 2016

Project manager: Steve Ford

Site supervisor: Kyle Beaverstock

Site code: HQU16/46

Area of site: 9.9ha

Summary of results: A range of magnetic anomalies were recorded during the geophysical survey. These included several which may represent buried cut archaeological features (e.g. ditches and pits) located primarily in the southern field of the site. The probable line of a late post-medieval field boundary was also recorded along with several areas of magnetic disturbance.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

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Report edited/checked by: Steve Ford✓ 28.09.16 Tim Dawson✓ 28.09.16
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Western Extension of Hillhead Quarry, Uffculme, Devon A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 16/46

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Houndaller Farm, Uffculme, Devon (ST 05825 13618) (Fig. 1). The work was commissioned by Clive Tompkins of Aggregate Industries UK Ltd, Stoneycombe Quarry, Bickley Road, Kingskerswell, Newton Abbot, Devon, TQ12 5LL

Permission for the western extension of Hillhead Quarry in the area around Houndaller Farm was granted in 1990 and is restated in Devon County Minerals Local Plan (DCC 2004). Under the provisions of the Review of Old Mineral Permissions (ROMP), the Mineral Planning Authority (Devon County Council) requires an Environmental Impact Assessment (EIA) in order to update conditions for these old consents, and formulate mitigation. This survey is to be a contribution to that assessment relating to the effects of the extraction on archaeological and heritage issues.

The fieldwork was undertaken by Kyle Beaverstock, Nick Dawson, Peter Banks and Piotr Wrobel between the 5th and 8th September 2016 and the site code is HQU 16/46. The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located to the north-west of the village of Uffculme and to the south-east of the J27 of the M5 motorway for Tiverton Parkway (Fig. 1). The site includes three fields with various elevations ranging from 103m to 127m above Ordnance Datum (OD). These undulating parcels of land are currently under pasture for cattle. The geology is recorded as Permian and Triassic Pebble Beds (BGS 1974). Weather during the survey period, created ground conditions that were dry (Pl. 1-3).

Site history and archaeological background

A detailed analysis can be found in the desk-based assessment (Tabor 2016). To summarise, there are no heritage assets in the immediate vicinity of the site, however, the site forms part of a landscape characterised as 'Medieval enclosure', an interpretation for which the hedge and bank boundaries around and within the site offer

some corroboration. There is also some evidence for features visible from aerial photography and LiDAR (Tabor 2016; Fig.11)

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution. The majority of the site was open grassland however there were several obstacles that had a moderate effect on the data. In area 5 there was a metal feeding cage as well as a small fence running north-south for approximately 120m then turning west. Within this fenced area was a small building, formally a water pumping station as well as a log pile which prohibited the scanning. There were a further two feeding cages in area 7 as well as a large metal plough in area 6 also caused some interference.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both English Heritage (2008) and the Chartered Institute for Archaeologists (2002, 2011, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two fluxgates mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	Effect
Clip from -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: y doubled	Increases the resolution of the readings in the y axis, enhancing the shape of anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw results are presented as a greyscale plot in relation to the site (Fig. 3) with a second plan showing the processed results (Fig. 4), followed by a second plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 5). Anomalies are shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.16.2 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

A range of magnetic anomalies were recorded across the survey area, most of which were linear in nature in the south of the surveyed area (Area 6) (Fig. 4). The magnetic anomalies of possible archaeological origin are recognisable as positive variations in the site's general background magnetic field. The positive anomalies usually represent buried cut features such as ditches or pits whereas negative anomalies are indicative of earthen banks, or thickened or disturbed subsoil.

A single, strongly positive anomaly [Fig. 5: 1] circular in nature is approximately 5m in diameter in the northern half of Area 7 and may represent a small circular feature such as a trace of tight structural remains. In the southern half of Area 7 are strong positive anomaly [3] and weak positive anomaly [2] these form a linear roughly aligned south-west to north-east and approximately 100m long and are likely to be related to weak positive anomaly [5], itself approximately 100m in length and of the same alignment although these anomalies do form a distinct linear shape due to the uneven edges and variations in their magnetic responses it is possible that these anomalies may represent weak background variations caused by natural features such as fissures in the underlying geology. A single, strongly positive linear anomaly [4] runs along the northern boundary of Area 6 (east-west) and is approximately 38.5m long, due to its alignment this linear may represent an earlier phase of the current field boundary at its northern edge (Area 6).

Two, strongly positive anomalies, representing pitting features p [6] were recorded in the northern half of Area 6. To the south-west of these is a strong positive linear anomaly [7] running from the north-west to the south-east for approximately 82m and is likely to be a cut feature such as a ditch. Anomaly [8] which is a negative linear response with two associated positive responses, this anomaly which runs east to west across the centre of Area 6 for approximately 150m is most likely the remains of a grubbed field boundary which was recorded on the 1841 tithe map of Burlescombe (Tabor 2016).

Strongly positive linear anomaly [9] runs along a NNE-SSW alignment for approximately 50m and due to its alignment may represent the return of anomaly [7] to form the field boundary of an earlier agricultural system. To the south and west of this anomaly are several weak positive linear responses which may indicate concentrated activity or weak background variations. These include two parallel linear anomalies [10] running north-west to south-east which are approximately 10m and 11m long respectively. Segmented linear [11] running south-west to north-east for approximately 115m with a possible return [12] running south-east to north-west for approximately 36m. Crossing anomaly [11] is a short linear anomaly [13] on a SSW to NNE alignment and running for approximately 36m.

In Area 5 is a strongly positive linear anomaly [14] and a weak positive linear anomaly [15] on a SSW to NNE alignment. These anomalies are most likely related and represent a cut feature such as a ditch. Several dipolar responses [16] were detected but were the result of interference from above ground ferrous objects such as farm equipment (Pl. 1). The dipolar response [17] in the south west corner of Area 5 however was the result of interference from a small building which housed a former water pumping station, from this a bipolar linear [18] was most likely the result of a remaining buried pipeline associated with the former pumping station.

All areas contained several magnetic spikes, often caused by buried ferrous objects, and areas of ferro magnetic disturbance. This is usually caused by close proximity to wire fencing, ferrous objects above ground (e.g. farm equipment) or buried services.

Conclusion

The geophysical survey of the three fields that comprise the proposed western extension of Hillhead Quarry was undertaken successfully. The results identified several magnetic anomalies, some of which may represent buried archaeological features, and a limited quantity of historical agricultural features. These appear to be particularly concentrated of features in Area 6, the southern field, where several strong and weak linear anomalies indicate the presence of archaeological derived ditches. A strong anomaly that runs east-west across this field probably represents a field boundary shown on the 1841 tithe map. There is a masking effect on the edges of all the fields, caused by near-by ferrous objects (e.g. fences), which may have had a masking effect on any weaker anomalies of archaeological origin.

References

- BGS, 1974, *British Geological Survey*, 1:50,000, Sheet 310, Solid and Drift Edition, Keyworth
- CIfA, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading
- CIfA, 2011, *Standard and Guidance: for archaeological geophysical survey*, Reading
- CIfA, 2014, *Standard and Guidance: for archaeological geophysical survey*, Reading
- English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage, Portsmouth (2nd edn)
- NPPF, 2012, *National Planning Policy Framework*, Dept. Communities and Local Government, London
- Tabor, R, 2016, Western Extension of Hillhead Quarry, Uffculme, Devon: A Desk-Based Assessment, unpublished report, TVAS, Reading

Appendix 1. Survey and data information

Programme:

Name: TerraSurveyor
Version: 3.0.29.3

Area 5

Raw data

Survey corner coordinates (X/Y):

Northwest corner: 305856.76, 113799.06 m

Southeast corner: 306056.76, 113599.06 m

Direction of 1st Traverse: 95.27142 deg

Collection Method: ZigZag

Sensors: 2 @ 1.00 m spacing.

Dummy Value: 2047.5

Dimensions

Composite Size (readings): 800 x 200

Survey Size (meters): 200 m x 200 m

Grid Size: 20 m x 20 m

X Interval: 0.25 m

Y Interval: 1 m

Stats

Max: 98.22

Min: -100.00

Std Dev: 11.41

Mean: -0.52

Median: -0.27

Composite Area: 4 ha

Surveyed Area: 2.3168 ha

Source Grids: 87

1 Col:0 Row:0 Area 5\29.xgd
2 Col:0 Row:1 Area 5\30.xgd
3 Col:0 Row:2 Area 5\31.xgd
4 Col:0 Row:3 Area 5\32.xgd
5 Col:0 Row:4 Area 5\33.xgd
6 Col:0 Row:5 Area 5\34.xgd
7 Col:0 Row:6 Area 5\35.xgd
8 Col:0 Row:7 Area 5\36.xgd
9 Col:1 Row:0 Area 5\37.xgd
10 Col:1 Row:1 Area 5\38.xgd
11 Col:1 Row:2 Area 5\39.xgd
12 Col:1 Row:3 Area 5\40.xgd
13 Col:1 Row:4 Area 5\41.xgd
14 Col:1 Row:5 Area 5\42.xgd
15 Col:1 Row:6 Area 5\43.xgd
16 Col:1 Row:7 Area 5\44.xgd
17 Col:2 Row:7 Area 5\55.xgd
18 Col:2 Row:8 Area 5\56.xgd
19 Col:2 Row:9 Area 5\57.xgd
20 Col:3 Row:0 Area 5\45.xgd
21 Col:3 Row:1 Area 5\46.xgd
22 Col:3 Row:2 Area 5\47.xgd
23 Col:3 Row:3 Area 5\48.xgd
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26 Col:3 Row:6 Area 5\51.xgd
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32 Col:4 Row:2 Area 5\84.xgd
33 Col:4 Row:3 Area 5\85.xgd
34 Col:4 Row:4 Area 5\86.xgd
35 Col:4 Row:5 Area 5\87.xgd
36 Col:4 Row:6 Area 5\61.xgd
37 Col:4 Row:7 Area 5\60.xgd
38 Col:4 Row:8 Area 5\59.xgd
39 Col:4 Row:9 Area 5\58.xgd
40 Col:5 Row:0 Area 5\72.xgd
41 Col:5 Row:1 Area 5\73.xgd
42 Col:5 Row:2 Area 5\74.xgd

43 Col:5 Row:3 Area 5\75.xgd
44 Col:5 Row:4 Area 5\76.xgd
45 Col:5 Row:5 Area 5\77.xgd
46 Col:5 Row:6 Area 5\78.xgd
47 Col:5 Row:7 Area 5\79.xgd
48 Col:5 Row:8 Area 5\80.xgd
49 Col:5 Row:9 Area 5\81.xgd
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52 Col:6 Row:2 Area 5\64.xgd
53 Col:6 Row:3 Area 5\65.xgd
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55 Col:6 Row:5 Area 5\67.xgd
56 Col:6 Row:6 Area 5\68.xgd
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70 Col:8 Row:0 Area 5\08.xgd
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76 Col:8 Row:6 Area 5\12.xgd
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81 Col:9 Row:2 Area 5\26.xgd
82 Col:9 Row:3 Area 5\02.xgd
83 Col:9 Row:4 Area 5\03.xgd
84 Col:9 Row:5 Area 5\04.xgd
85 Col:9 Row:6 Area 5\05.xgd
86 Col:9 Row:7 Area 5\06.xgd
87 Col:9 Row:8 Area 5\07.xgd

Processed data

Stats

Max: 2.20

Min: -1.80

Std Dev: 0.89

Mean: 0.09

Median: 0.03

Processes: 6

- 1 Base Layer
- 2 Move (Area: Top 0, Left 0, Bottom 159, Right 159) to X 160, Y 0
- 3 DeStripe Median Sensors: Grids: All
- 4 Despiking Threshold: 1 Window size: 3x3
- 5 Interpolate: Y Doubled.
- 6 Clip from -1.80 to 2.20 nT

Area 6

Raw data

Survey corner coordinates (X/Y):

Northwest corner: 305718.35, 113635.12 m

Southeast corner: 305898.35, 113375.12 m

Direction of 1st Traverse: 100.66713 deg

Collection Method: ZigZag

Sensors: 2 @ 1.00 m spacing.

Dummy Value: 2047.5

Dimensions

Composite Size (readings): 720 x 260
Survey Size (meters): 180 m x 260 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats

Max: 97.96
Min: -100.00
Std Dev: 8.80
Mean: -0.42
Median: 0.33
Composite Area: 4.68 ha
Surveyed Area: 3.8414 ha

Source Grids: 117

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3 Col:0 Row:2 grids\107.xgd
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7 Col:0 Row:6 grids\111.xgd
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113 Col:8 Row:8 grids\26.xgd
114 Col:8 Row:9 grids\27.xgd
115 Col:8 Row:10 grids\28.xgd
116 Col:8 Row:11 grids\29.xgd
117 Col:8 Row:12 grids\30.xgd

Processed data

Stats
Max: 2.20
Min: -1.80
Std Dev: 0.71
Mean: -0.01
Median: 0.01

Processes: 6

- 1 Base Layer
- 2 DeStripe Median Sensors: Grids: All
- 3 De Stagger: Grids: All Mode: Both By: -1 intervals
- 4 Despike Threshold: 1 Window size: 3x3
- 5 Interpolate: Y Doubled.
- 6 Clip from -1.80 to 2.20 nT

Area 7

Raw data

Survey corner coordinates (X/Y):

Northwest corner: 305695.08, 113825.28 m

Southeast corner: 305895.08, 113605.28 m

Direction of 1st Traverse: 88.92597 deg

Collection Method: ZigZag

Sensors: 2 @ 1.00 m spacing.

Dummy Value: 2047.5

Dimensions

Composite Size (readings): 800 x 220

Survey Size (meters): 200 m x 220 m

Grid Size: 20 m x 20 m

X Interval: 0.25 m

Y Interval: 1 m

Stats

Max: 96.57

Min: -100.00

Std Dev: 10.33

Mean: 0.41

Median: 0.71

Composite Area: 4.4 ha

Surveyed Area: 2.9668 ha

Source Grids: 93

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8 Col:1 Row:7 Area 7\87.xgd
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10 Col:1 Row:9 Area 7\89.xgd
11 Col:2 Row:3 Area 7\76.xgd
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42 Col:5 Row:1 Area 7\44.xgd
43 Col:5 Row:2 Area 7\45.xgd
44 Col:5 Row:3 Area 7\46.xgd
45 Col:5 Row:4 Area 7\47.xgd
46 Col:5 Row:5 Area 7\48.xgd
47 Col:5 Row:6 Area 7\49.xgd

48 Col:5 Row:7 Area 7\50.xgd
49 Col:5 Row:8 Area 7\51.xgd
50 Col:5 Row:9 Area 7\52.xgd
51 Col:5 Row:10 Area 7\53.xgd
52 Col:6 Row:0 Area 7\32.xgd
53 Col:6 Row:1 Area 7\33.xgd
54 Col:6 Row:2 Area 7\34.xgd
55 Col:6 Row:3 Area 7\35.xgd
56 Col:6 Row:4 Area 7\36.xgd
57 Col:6 Row:5 Area 7\37.xgd
58 Col:6 Row:6 Area 7\38.xgd
59 Col:6 Row:7 Area 7\39.xgd
60 Col:6 Row:8 Area 7\40.xgd
61 Col:6 Row:9 Area 7\41.xgd
62 Col:6 Row:10 Area 7\42.xgd
63 Col:7 Row:0 Area 7\21.xgd
64 Col:7 Row:1 Area 7\22.xgd
65 Col:7 Row:2 Area 7\23.xgd
66 Col:7 Row:3 Area 7\24.xgd
67 Col:7 Row:4 Area 7\25.xgd
68 Col:7 Row:5 Area 7\26.xgd
69 Col:7 Row:6 Area 7\27.xgd
70 Col:7 Row:7 Area 7\28.xgd
71 Col:7 Row:8 Area 7\29.xgd
72 Col:7 Row:9 Area 7\30.xgd
73 Col:7 Row:10 Area 7\31.xgd
74 Col:8 Row:1 Area 7\11.xgd
75 Col:8 Row:2 Area 7\12.xgd
76 Col:8 Row:3 Area 7\13.xgd
77 Col:8 Row:4 Area 7\14.xgd
78 Col:8 Row:5 Area 7\15.xgd
79 Col:8 Row:6 Area 7\16.xgd
80 Col:8 Row:7 Area 7\17.xgd
81 Col:8 Row:8 Area 7\18.xgd
82 Col:8 Row:9 Area 7\19.xgd
83 Col:8 Row:10 Area 7\20.xgd
84 Col:9 Row:1 Area 7\01.xgd
85 Col:9 Row:2 Area 7\02.xgd
86 Col:9 Row:3 Area 7\03.xgd
87 Col:9 Row:4 Area 7\04.xgd
88 Col:9 Row:5 Area 7\09.xgd
89 Col:9 Row:6 Area 7\10.xgd
90 Col:9 Row:7 Area 7\05.xgd
91 Col:9 Row:8 Area 7\06.xgd
92 Col:9 Row:9 Area 7\07.xgd
93 Col:9 Row:10 Area 7\08.xgd

Processed data

Stats

Max: 2.00

Min: -1.80

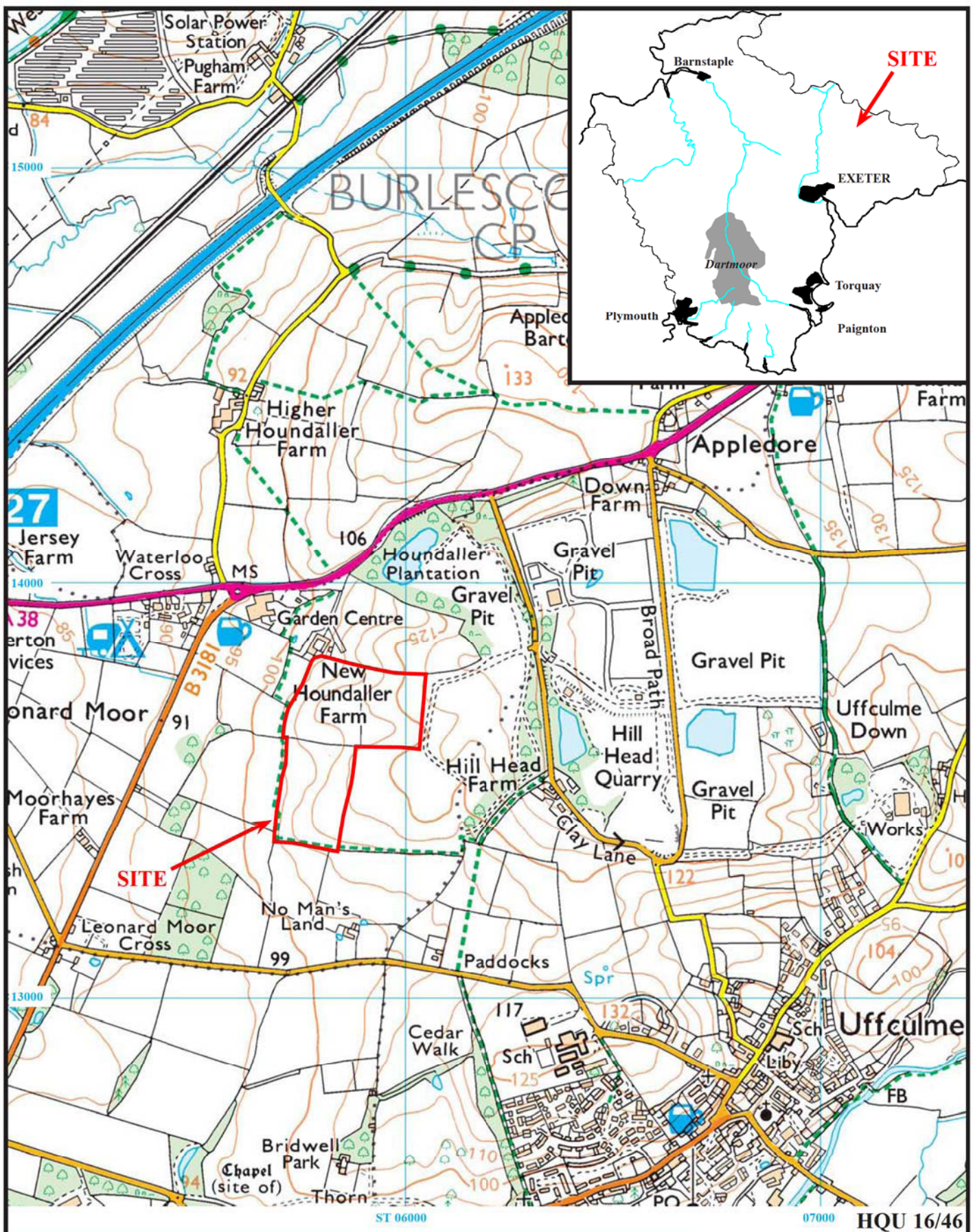
Std Dev: 0.85

Mean: 0.00

Median: 0.01

Processes: 6

- 1 Base Layer
- 2 DeStripe Median Sensors: Grids: All
- 3 De Stagger: Grids: All Mode: Both By: -1 intervals
- 4 Despike Threshold: 1 Window size: 3x3
- 5 Interpolate: Y Doubled.
- 6 Clip from -1.80 to 2.00 nT

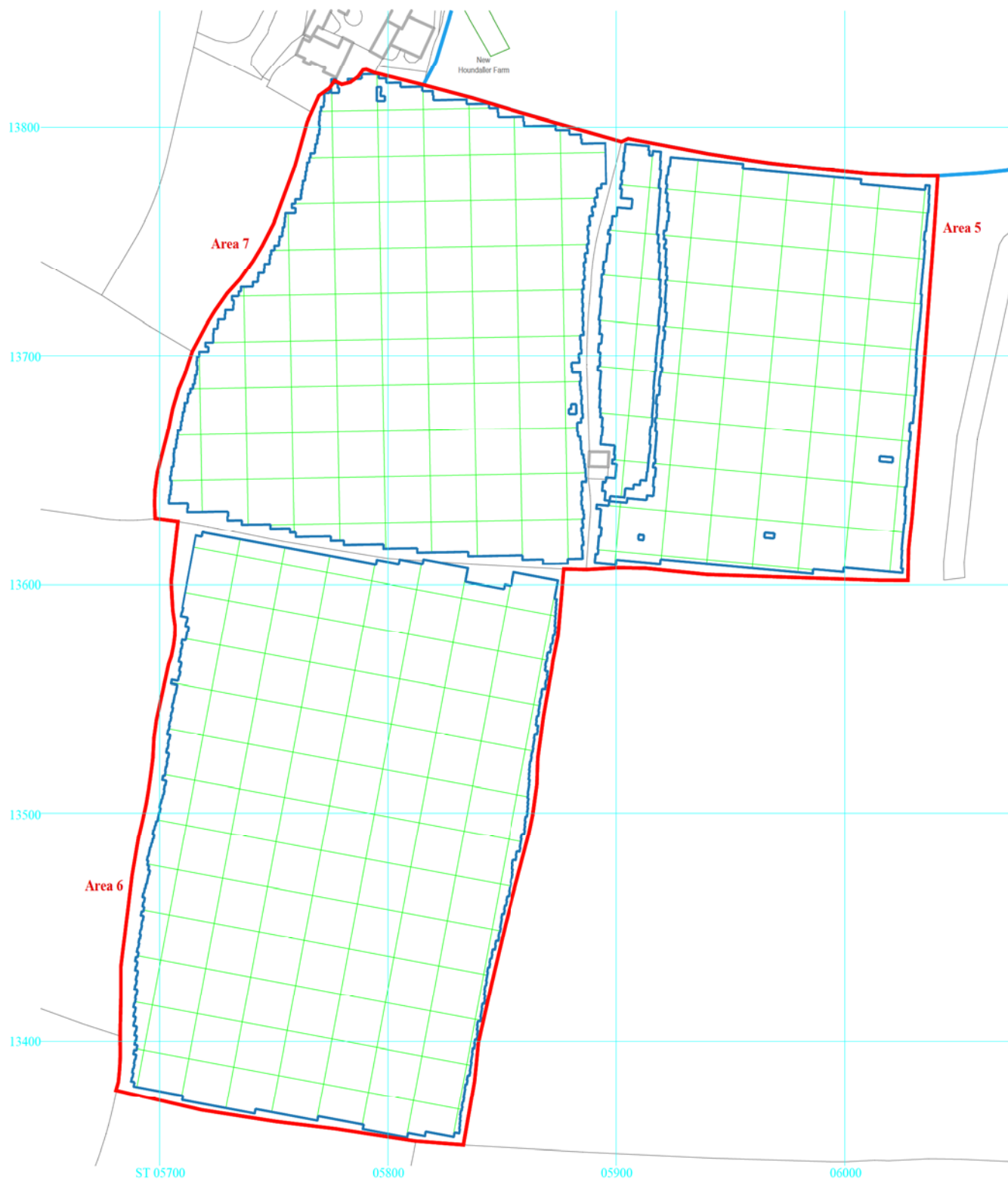


**Western Extension of Hillhead Quarry,
Uffculme, Devon, 2016
Geophysical Survey (Magnetic)**

Figure 1. Location of site within Uffculme and Devon.

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Ordnance Survey Licence 100025880

TVAS
SOUTH WEST



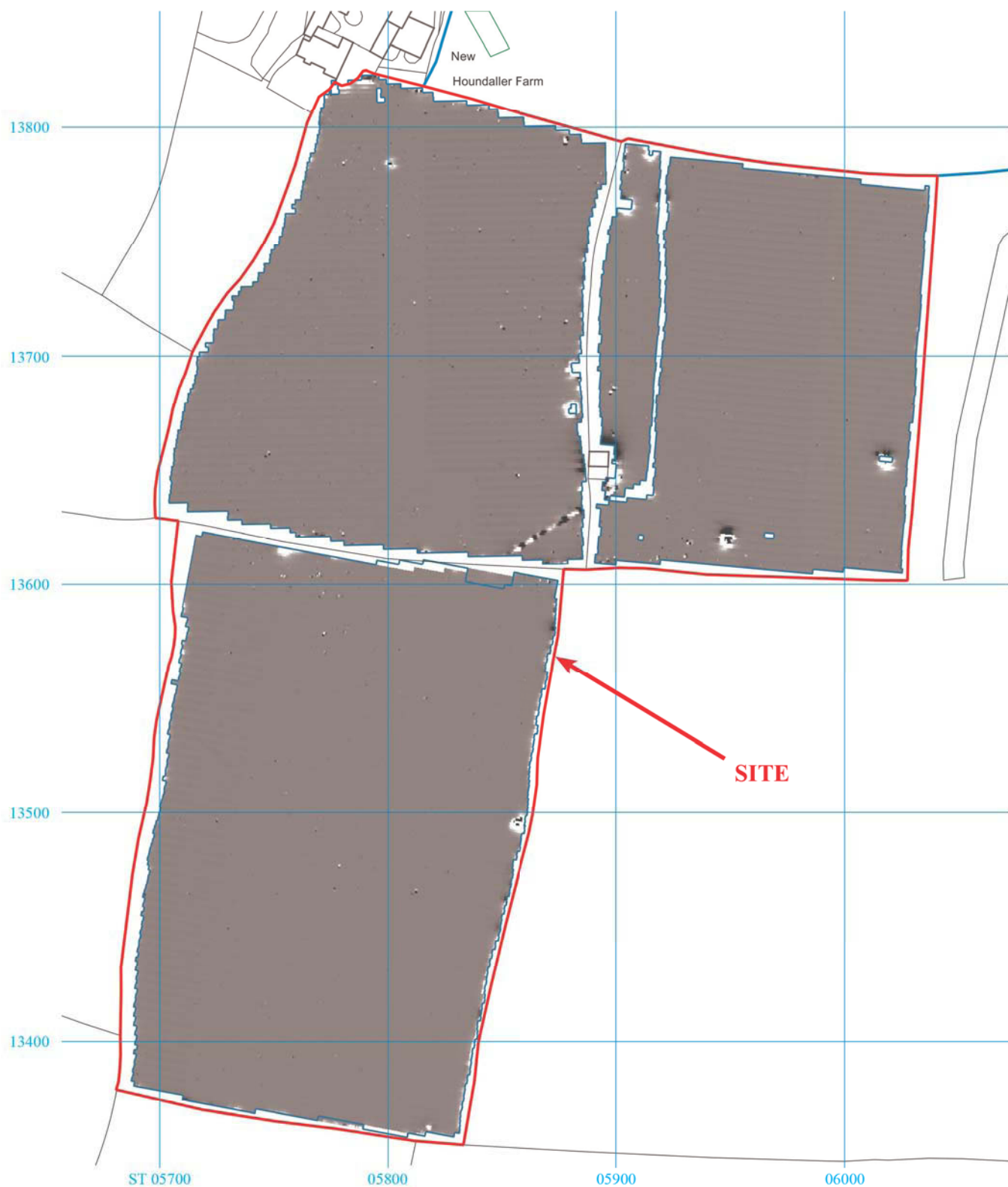
HQU 16/46

**Western Extension of Hillhead Quarry,
Uffculme, Devon, 2016
Geophysical Survey (Magnetic)**

Figure 2. Survey grid layout.

0 100m

TVAS
SOUTH WEST



HQU 16/46



**Western Extension of Hillhead Quarry,
Uffculme, Devon, 2016
Geophysical Survey (Magnetic)**

Figure 3. Plot of raw gradiometer data.

0m 100m





**Western Extension of Hillhead Quarry,
Uffculme, Devon, 2016
Geophysical Survey (Magnetic)**

Figure 4. Plot of minimally processed gradiometer data.

0m 100m



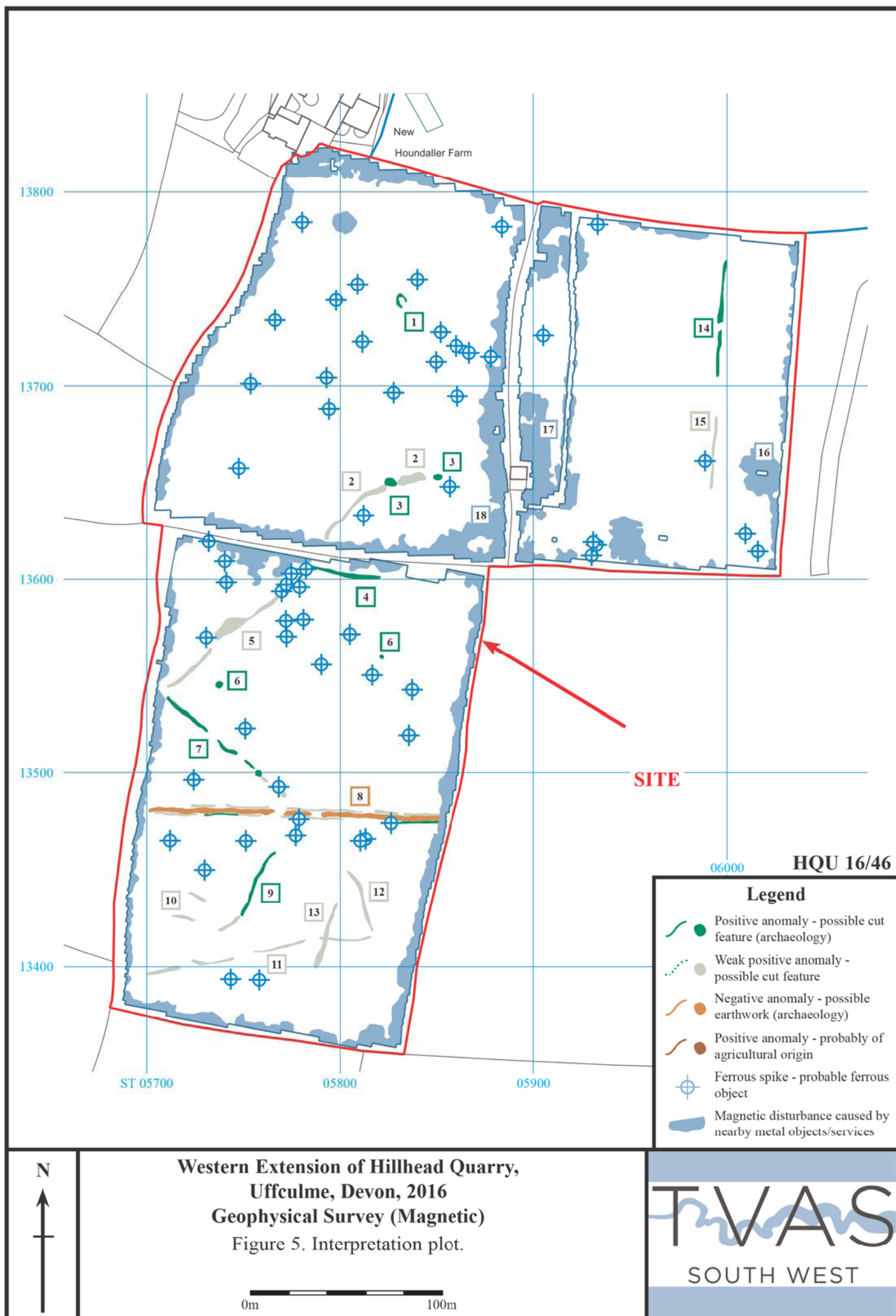




Plate 1. Area 5, looking south within the fenced area, showing feeding cage.



Plate 2. Area 6, looking north-west from the eastern edge.



Plate 3. Area 7, looking north-west from the eastern edge.

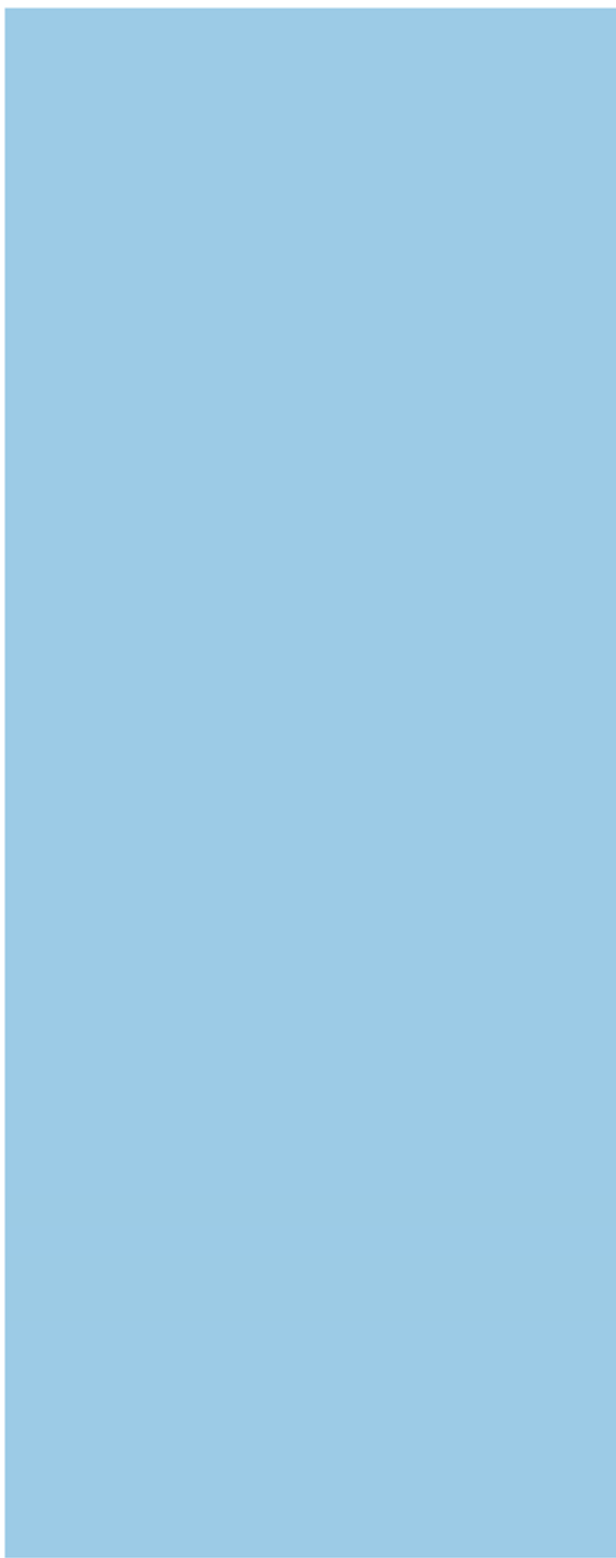
HQU 16/64

**Western Extension of Hillhead Quarry,
Uffculme, Devon, 2016
Geophysical Survey (Magnetic)
Plates 1 - 3.**

TVAS
SOUTH WEST

TIME CHART

	Calendar Years
Modern _____	AD 1901
Victorian _____	AD 1837
Post Medieval _____	AD 1500
Medieval _____	AD 1066
Saxon _____	AD 410
Roman _____	AD 43
Iron Age _____	BC/AD 750 BC
Bronze Age: Late -----	1300 BC
Bronze Age: Middle -----	1700 BC
Bronze Age: Early -----	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC
↓	↓



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