THAMES VALLEY

ARCHAEOLOGICAL

SERVICES

Land west of Lechlade Road, Highworth, Swindon

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: LRH17/95B

(SU 2000 9377)

Land west of Lechlade Road, Highworth, Swindon

Geophysical Survey (Magnetic) Report

For Aldi Stores Ltd and Highworth Business Park Ltd

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code LRH 17/95B

February 2018

Summary

Site name: Land west of Lechlade Road, Highworth, Swindon

Grid reference: SU 2000 9377

Site activity: Magnetometer survey

Date and duration of project: 15th – 19th February 2018

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: LRH 17/95B

Area of site: 0.99ha

Summary of results: The entire field in which the site lies was successfully surveyed and found to contain a range of magnetic anomalies. Within the site area itself were a large number of linear and curvilinear positive anomalies, probably indicating the presence of buried archaeological features, along with others representing furrows from former cultivation of the field. A large bipolar linear anomaly crosses the southern part of the site, indicating a modern service pipeline.

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

Report edited/checked by:	Steve Ford✓ 28.02.18
	Tim Dawson✓ 28.02.18

Land west of Lechlade Road, Highworth, Swindon
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 17/95c

Introduction

This report documents the results of a geophysical survey (magnetic) carried out on a parcel of land to the west of Lechlade Road, Highworth, Swindon (SU 2000 9377) (Fig. 1). The work was commissioned by Mr Taylor Cherrett of Turley, The Pinnacle, 20 Tudor Road, Reading, RG1 1NH on behalf of Aldi Stores Ltd, Wentloog Avenue, Cardiff, CF3 2GJ and Highworth Business Park Ltd.

Planning consent is to be sought from Swindon Borough Council for the erection of a supermarket and business park. This assessment will accompany the application in order to inform the planning process with regard to potential archaeological and heritage implications. This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012), and the Borough's policies on archaeology. The field investigation was carried out to a specification approved by Ms Melanie Pomeroy-Kellinger, archaeological advisor to Swindon Borough Council. The fieldwork was undertaken by Kyle Beaverstock and Ashley Kruger between 15th and 19th February 2018 and the site code is LRH 17/95.

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

Location, topography and geology

Highworth straddles the A361 road 5km north-east of Swindon's north-eastern outskirts (Fig. 1). The site is set north-west of a roundabout at the junction of Blackworth with the A361 Lechlade Road. The greater part of the site is covered by grass and sits at a height of *c*.81m aOD. The southern boundary (along Blackworth) consists of a belt of woodland which gets wider towards the eastern end of the site. The site is set on a slight rise above the valley bottom with low hills of varying heights rising on all sides within a distance of 2km. The underlying geology of the site is recorded as Jurassic sedimentary mudstone of Oxford Clay Formation (BGS 1974). The area of the proposed business park occupies a plot of 5.38ha within the 6.37ha field. Conditions during the survey were dry and cold (Pl. 1-4).

Site history and archaeological background

The archaeological potential of the site has been highlighted in a desk-based assessment for the project (Tabor 2017) and briefing notes prepared by the archaeological advisor to Swindon Borough Council. In summary, the site lies within an area of moderate archaeological potential with Roman occupation to the south-east and finds of prehistoric flintwork from other locations nearby. Cartographic evidence indicates that the site has not been significantly disturbed thereby ensuring the preservation of any below-ground archaeological remains.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using a single cart-mounted Bartington Grad601-2 fluxgate gradiometer. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time GPS positional trace plot. Readings were taken at 0.25m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating north-south zig-zag orientation across the survey area. The site was free from large obstructions although the grass ground cover was thick which, when combined with the topography, made keeping a constant speed with the equipment challenging.

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 two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of two vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by a Bartington Grad601-2 logger and collated using MLgrad601 software on a Linx 12x64 tablet running Windows 10 mounted at the rear of the cart. 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.

The Trimble Geo7x centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses 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 -3.80 to 4.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological 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 150cm intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

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 2.18.15 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 within the survey area (Fig. 3). These most likely represent a variety of buried features, both modern and ancient in date.

Positive magnetic anomalies which may represent buried archaeological features such as ditches, pits and ring gullies were recorded across the entire width of the site. A pair of parallel linear positive anomalies run north-west – south-east for 35m at the western end of the survey area with a discrete positive anomaly just east of the mid-point of the western linear **[Fig. 4: 1]**. A much weaker positive linear anomaly was recoded perpendicular to the first pair but *c*.50m to the east **[2]**. A further pair of parallel linear positive anomalies are located a further 25m to the east **[3]**, on a similar orientation to **[1]** but with a fork towards the southern end where a branch heads in a more easterly direction. North of these, close to the survey's northern border, is another weak disjointed linear positive anomaly **[4]**, which extends eastwards for *c*.30m where it terminates a the first of the penannular positive anomalies **[5]**. This has a diameter of *c*.18m while its neighbour to the east **[6]** measures 16m across. There are several shorter lengths of weak linear positive anomaly between **[5]** and **[6]** on similar orientations to **[1/3]** and **[2]**. Leading south from **[6]** is a stronger length of anomaly which almost links **[6]** to the main complex in the centre of the site **[7]**. This consists of parts of 4 or 5 penannular positive anomalies with diameters of between 12m and 15m and a series of linear anomalies which appear to form a complex of small enclosures, which extends a short way to the south. Directly to the east are another set of linear positive anomalies **[8]** which lie on a different orientation to **[7]** and appear to form a larger enclosure with **[9]** to

the south and another series of enclosures at **[10]** and **[11]** to the east. A final set of linear positive anomalies straddle the eastern site border **[12, 13]**, appearing to form two parallel lines.

Within the remaining magnetic anomalies there appears to be two sets of parallel linear positive anomalies which most likely represent furrows formed by previous agricultural activity of unknown date. At the eastern end of the side the furrows follow a broadly south-west to north-east alignment **[14]** while further towards the centre of the area they are almost north-south **[15, 16]**. There are also two areas of strong dipolar responses, one along the western edge of the site **[17]** and the other just east of centre **[18]**. These probably represent magnetically enhanced debris (e.g. ferrous objects or brick rubble) within the subsoil. The final anomalies of note are three strong linear bipolar trails which cross the site in three parallel east-west lines. The northernmost **[19]** corresponds to the location of a known modern pipeline while a second **[20]** runs parallel to this some 10m further south. The strongest of the three **[21]** is located *c*.35m north of the site's southern boundary, probably indicating the presence of a larger pipe.

Conclusion

The geophysical survey successfully covered the areas of the proposed development site that are not wooded and located a range of magnetic anomalies. Across the whole field were several anomalies which appear to represent an Iron Age settlement, complete with roundhouses, enclosures and drove ways, with the main cluster appearing towards the northern edge of the site's centre. Also recorded were several anomalies which reflect previous agricultural use of the site as well as modern services. A small number of ferrous objects were located and a small amount of magnetic disturbance was recorded along the eastern and southern edges of the field, probably as a result of ferrous fencing.

References

Beaverstock, K, 2018, 'Land west of Lechlade Road, Highworth, Swindon: Geophysical Survey (Magnetic)', Thames Valley Archaeological Services report 17/95c, Reading

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CI*f*A, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading

CI*f*A, 2011, *Standard and Guidance: for archaeological geophysical survey*, Reading

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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, 2017, 'Land west of Lechlade Road, Highworth, Swindon: An archaeological desk-based assessment', Thames Valley Archaeological Services report 17/95a, Reading

Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.33.11

Raw data
Filename: Highworth 180215_raw.xcp
Description: Imported as Composite from: Highworth 180215.xyz
Instrument Type: MLgrad import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 588905.943532725, 5722109.3386767 m
Southeast corner: 589122.393532725, 5721964.2586767 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 32702

Source GPS Points: 38991

Dimensions
Composite Size (readings): 1665 x 1116
Survey Size (meters): 216 m x 145 m
Grid Size: 216 m x 145 m
X Interval: 0.13 m
Y Interval: 0.13 m

Stats
Max: 107.02
Min: -109.73
Std Dev: 9.73
Mean: 0.21
Median: 0.44
Composite Area: 3.1403 ha
Surveyed Area: 2.2773 ha

Filename: Highworth 180216_raw.xcp
Description: Imported as Composite from: Highworth 180216.xyz
Instrument Type: MLgrad import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 589089.605318353, 5722123.06161223 m
Southeast corner: 589297.995318353, 5721987.99161223 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 32702

Source GPS Points: 36067

Dimensions
Composite Size (readings): 1603 x 1039
Survey Size (meters): 208 m x 135 m
Grid Size: 208 m x 135 m
X Interval: 0.13 m
Y Interval: 0.13 m

Stats
Max: 106.69
Min: -109.73
Std Dev: 6.72
Mean: -0.63
Median: -0.89
Composite Area: 2.8147 ha
Surveyed Area: 2.0573 ha

Filename: Highworth 180219_raw.xcp
Description: Imported as Composite from: Highworth 180219.xyz
Instrument Type: MLgrad import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 589269.092389294, 5722134.35090042 m
Southeast corner: 589371.532389294, 5722025.28090042 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 32702

Source GPS Points: 12959

Dimensions
Composite Size (readings): 788 x 839
Survey Size (meters): 102 m x 109 m
Grid Size: 102 m x 109 m
X Interval: 0.13 m
Y Interval: 0.13 m

Stats
Max: 106.60
Min: -109.71
Std Dev: 7.98
Mean: -1.24
Median: -0.49
Composite Area: 1.1173 ha
Surveyed Area: 0.75498 ha

Processed data
Filename: Highworth 180215.xcp
Stats
Max: 3.52
Min: -3.10
Std Dev: 1.12
Mean: 0.09
Median: 0.00
GPS based Processes 8
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 DeStagger by: 150.00cm, Shift Positions
5 Clip at 3.00 SD
6 Despike Threshold: 1 Window dia: 3
7 Clip from -3.80 to 4.20
8 Clip from -2.80 to 3.20

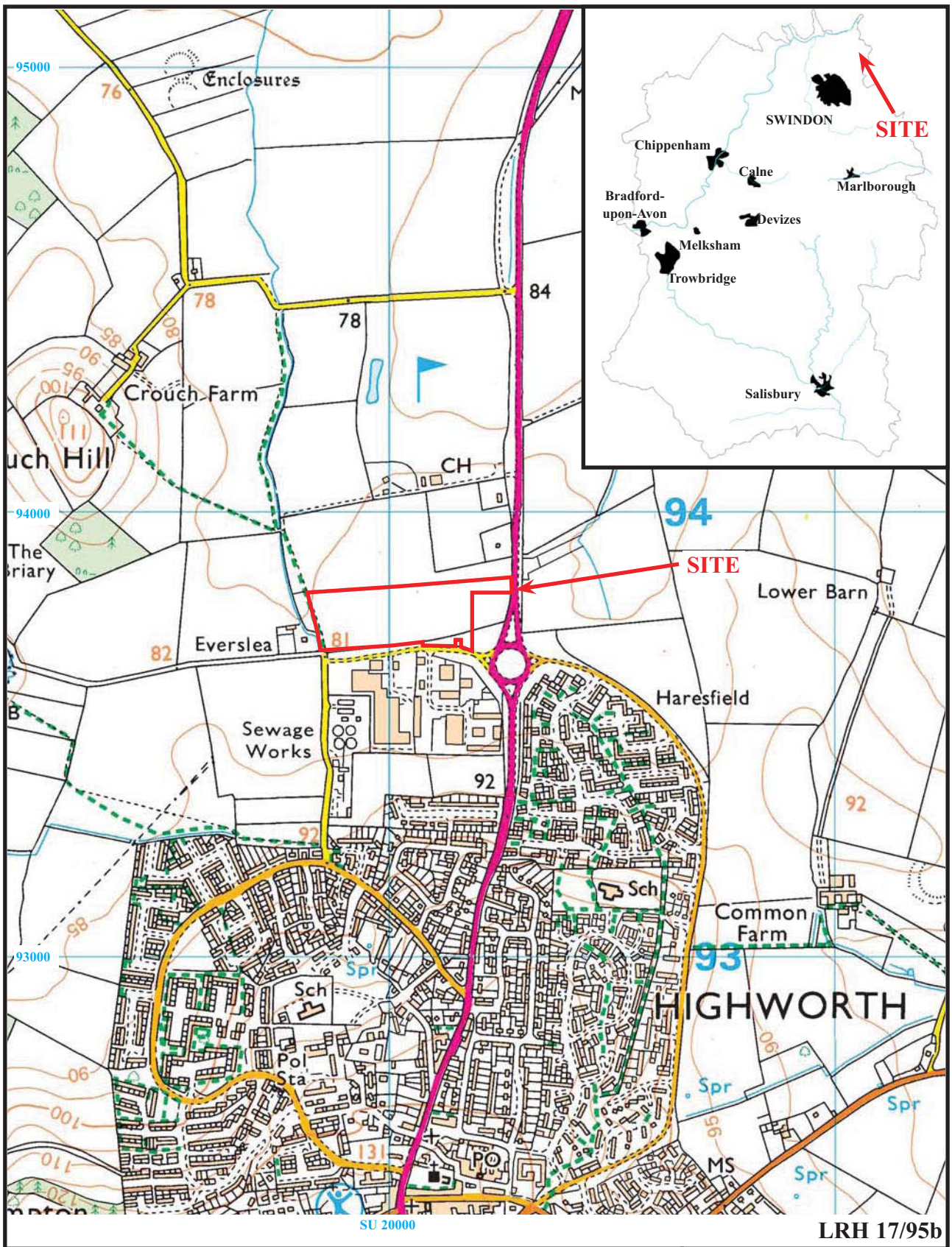
Filename: Highworth 180216.xcp
Stats
Max: 3.52
Min: -3.10
Std Dev: 1.09
Mean: 0.00
Median: 0.00

GPS based Processes 8
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 DeStagger by: 150.00cm, Shift Positions
5 Clip at 3.00 SD
6 Despike Threshold: 1 Window dia: 3
7 Clip from -3.80 to 4.20
8 Clip from -2.80 to 3.20

Filename:	Highworth 180219.xcp
Stats	
Max:	4.62
Min:	-4.20
Std Dev:	1.20
Mean:	-0.20
Median:	0.00

GPS based Processes sses: 7

1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStagger by: 150.00cm, Shift Positions
4 DeStripe Median Traverse:
5 Clip at 3.00 SD
6 Despike Threshold: 1 Window dia: 3
7 Clip from -3.80 to 4.20



Land west of Lechlade Road,
Highworth, Swindon, 2018
Geophysical Survey (Magnetic)

Figure 1. Location of site within Highworth and Wiltshire.

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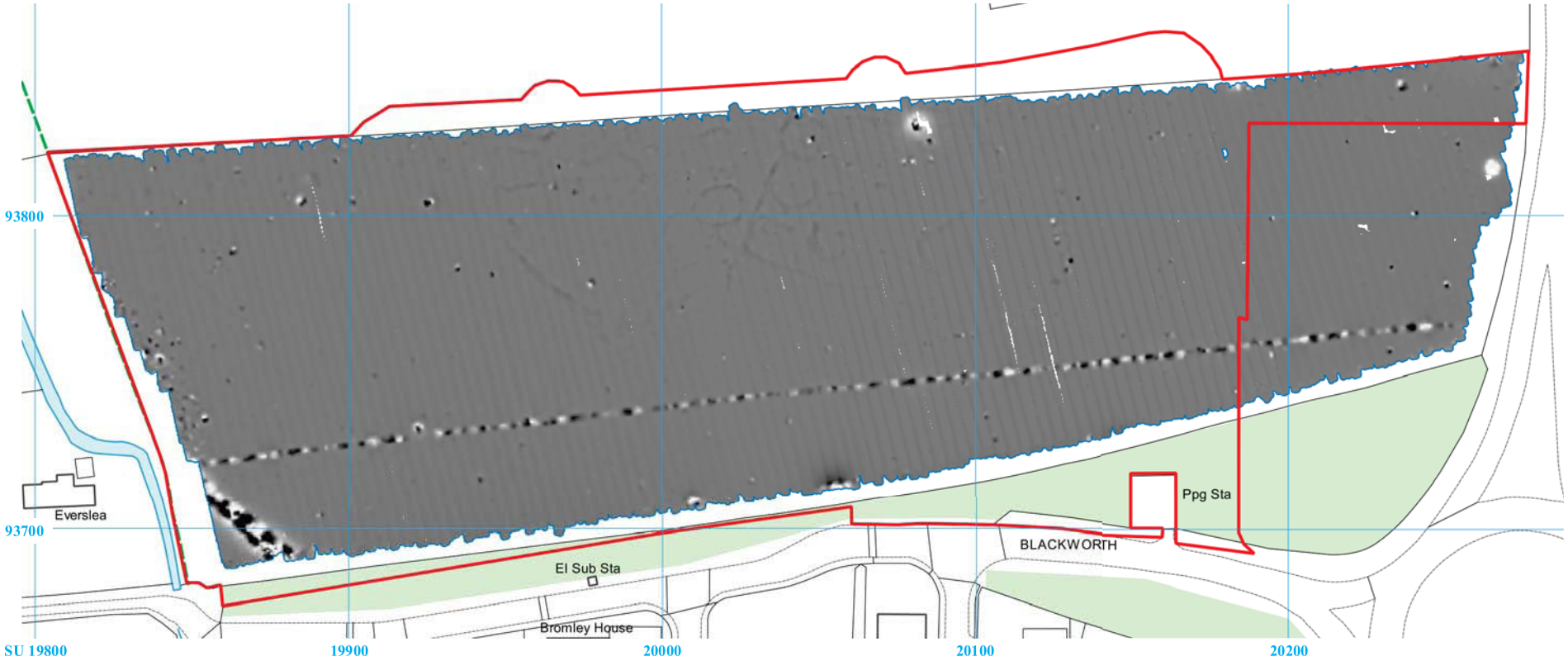

LRH 17/95b

N

Land west of Lechlade Road,
Highworth, Swindon, 2018
Geophysical Survey (Magnetic)

Figure 2. Plot of raw gradiometer data.

0m 100m

+100
nT
-100

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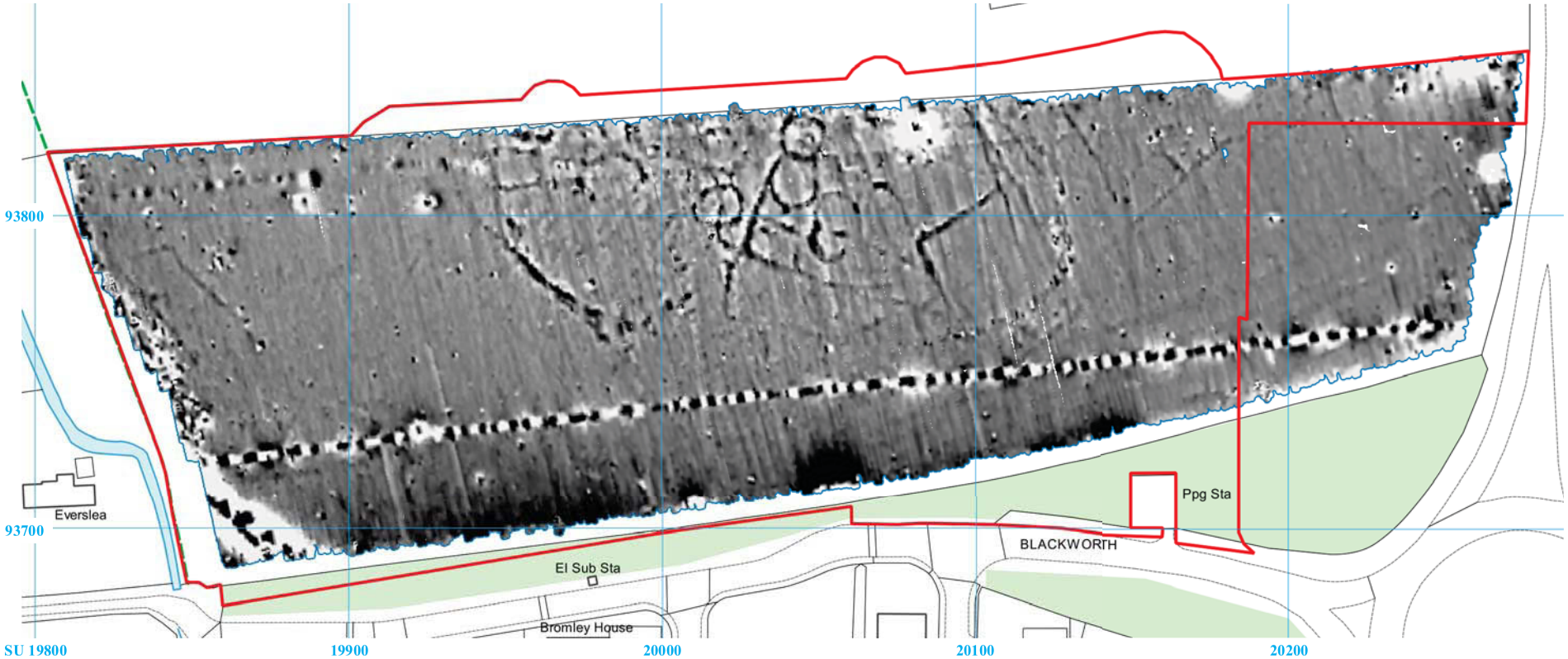

LRH 17/95b

N

Land west of Lechlade Road,
Highworth, Swindon, 2018
Geophysical Survey (Magnetic)

Figure 3. Plot of minimally processed gradiometer data.

0m 100m

+4.2
nT
-3.8

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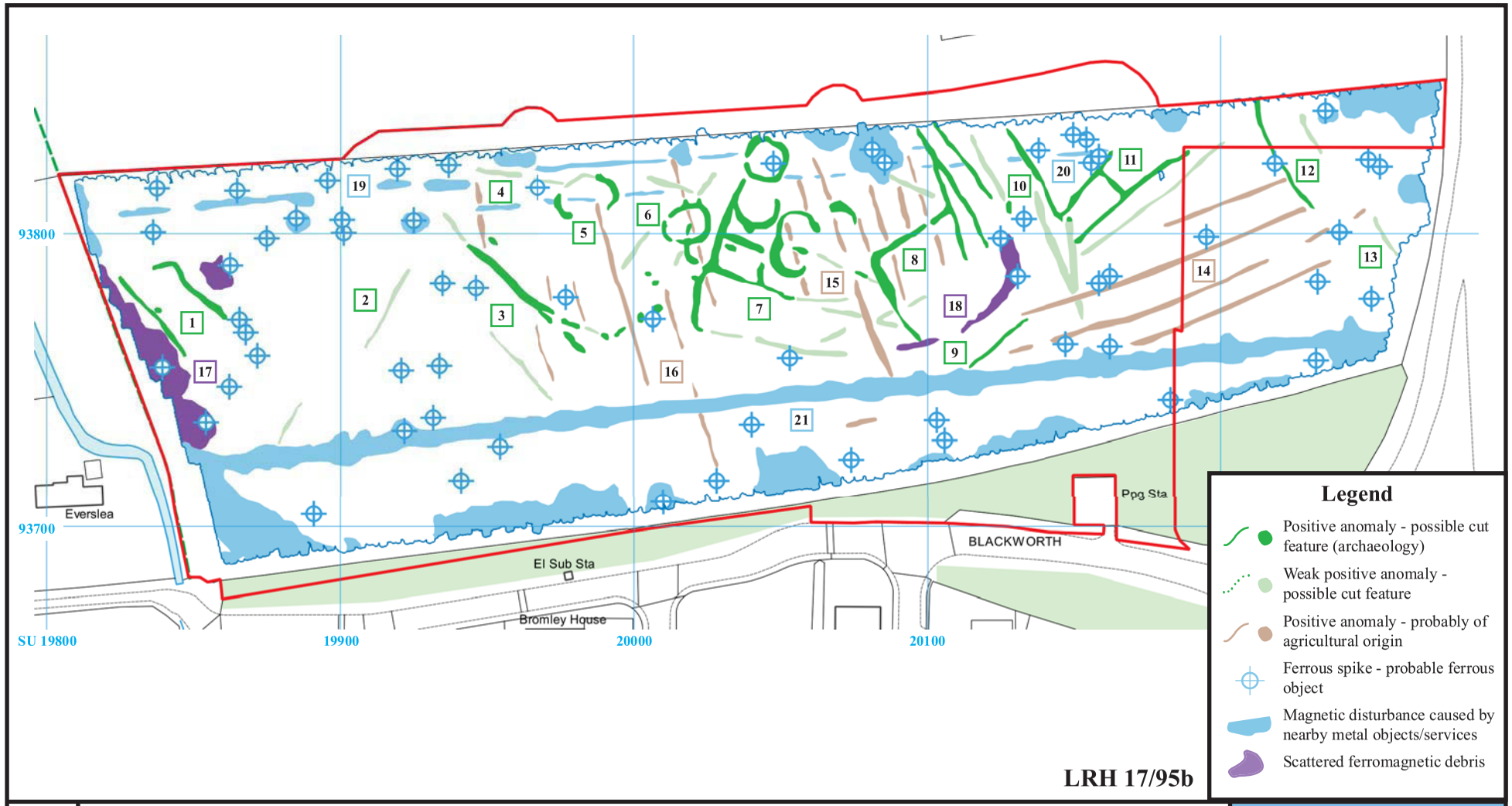

N

Land west of Lechlade Road,
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Geophysical Survey (Magnetic)

Figure 4. Interpretation plot.

0m 100m

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Plate 1. The site, looking east along southern field boundary.

Plate 2. The site, looking east.

Plate 3. The site, looking north.

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Land west of Lechlade Road,
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Geophysical Survey (Magnetic)
Plates 1 to 3.

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TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
	AD 0 BC
Iron Age	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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