THAMES VALLEY

ARCHAEOLOGICAL

SERVICES

HAD007, Land at Churchway, Haddenham, Ayelsbury, Buckinghamshire

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: CHB17/37

(SP 7404 0948)

HAD007, Land at Churchway, Haddenham, Aylesbury, Buckinghamshire

Geophysical Survey (Magnetic) Report

For Redrow Homes Ltd

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code CHB 17/37

April 2020

Summary

Site name: HAD007, Land at Churchway, Haddenham, Ayelsbury, Buckinghamshire

Grid reference: SP 7404 0948

Site activity: Magnetometer survey

Date and duration of project: 16h - 17th April 2020

Project coordinator: Tim Dawson

Site supervisor: Kyle Beaverstock

Site code: CHB 17/37

Area of site: c.12.8ha

Summary of results: The survey revealed a series of parallel linear anomalies, most likely indicating agricultural activity, and a positive linear anomaly which most likely represents a former field boundary.

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✓ 20.04.20
	Tim Dawson✓ 20.04.20

Thames Valley Archaeological Services Ltd, 47–49 De Beauvoir Road, Reading RG1 5NR
Tel. (0118) 926 0552; Email tvas@tvas.co.uk; Website: www.tvas.co.uk

HAD007, Land at Churchway, Haddenham, Aylesbury, Buckinghamshire
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 17/37

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Churchway, Haddenham, Buckinghamshire (SP 7404 0948) (Fig. 1). The work was commissioned by Andrew Morgan of Redrow Homes, Limited, Redrow House, 6 Waterside Way, The Lakes, Northampton, Northamptonshire, NN4 7XD

A combination of outline and reserved planning permission (app 17/02280/AOP) is to be sought from Buckinghamshire County Council for the construction of 285 dwellings with associated access, parking, amenity space, landscaping and play area on a *c.*12.8ha parcel of land. This is in accordance with the Department for Communities and Local Government's *National Planning Policy Framework* (NPPF 2012), and the County's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock and Thomas Stewart on the 16th and 17th of April 2020 and the site code is CHB17/37.

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 on the northern edge of Haddenham, 1.6km southeast of the River Thame between Aylesbury, 9km to the northeast, and Thame, 4.8km to the southwest (Fig. 1). This rectangular parcel of land is relatively flat at a height of c. 85.7m above Ordinance Datum and is bounded by Churchway to the east, residential properties to the south, industrial units to the west and open farmland to the north. The underlying geology is stated as Purbeck formation (BGS 1994).

Site history and archaeological background

The archaeological potential of the site has been highlighted in a briefing document prepared by Philip Markham of Buckinghamshire County Archaeological Service and an accompanying desk-based assessment (Elliott 2017). In summary, the site lies adjacent to the medieval and post-medieval historic core of Haddenham, a village with late Saxon origins which is recorded in Domesday Book (Williams and Martin 2002). It was a substantial settlement and appears originally to have had two foci, one of which was located towards the northern end of the

modern settlement (BCC 2008). Various excavations in the settlement have documented parts of its development (Bray and Weale 2014). Investigations undertaken nearby have uncovered stray prehistoric and Roman finds as well as features and finds of Saxon, medieval and post-medieval date.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time 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 northeast to southwest zig-zag orientation across the western and eastern fields and northwest to southeast across the central field. Most of the survey area was unobstructed, however the far eastern and south-eastern area of the site were too wet to survey consistently.

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 European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 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 four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble Geo 7x centimetre edition GPS. Readings were collected by two Bartington Grad601-2 loggers 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 -3.20 to 3.30 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 -1 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

The geophysical survey of the site identified a range of magnetic anomalies (Fig. 3). Around the periphery of the site there is a band of magnetic disturbance which is most likely caused by ferrous fencing (Fig. 4). There are also several magnetic disturbances most likely caused by ferrous objects such as monitoring wells. In the central and eastern fields there are several patches of enhanced positive readings which most likely indicate geological variations. This is depicted by an outline of positive responses with a weak negative response which represents disturbance to the underlying limestone. Across the whole survey area are a number of parallel positive linear anomalies, these anomalies run northwest to southeast in the western field and southwest to northeast in the central and eastern fields. These linear anomalies mostly run the length of the fields and between 8 and 15m apart. These most likely represent ridge and furrow cultivation or field drainage.

The only possible feature of archaeological interest is a single positive linear anomaly in the far eastern field, which runs from the southeast to the northwest. This feature is most likely the ditch of a former field boundary, possibly the one seen on Biddle's parish map of 1820 (Elliott 2017).

Conclusion

The geophysical survey revealed some geological disturbance along with parallel linear anomalies across the whole survey area which represents agricultural activity such as ridge and furrow or field drainage. In the far eastern field is a possible ditch running southeast to the northwest, this ditch is likely a former field boundary.

References

BCC, 2008, Haddenham, *Historic Town Assessment Report,* Buckinghamshire County Council, Aylesbury

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IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

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Williams, A and Martin, G H, 2002, *Domesday Book, a complete translation,* London

Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Filename: Haddenham RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 642932.054622707, 5738734.78317522 m
Southeast corner: 643176.324622707, 5738488.69317522 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 244 m x 246 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 96615, Recorded: 96615

Stats
Max: 97.99
Min: -109.72
Std Dev: 3.35
Mean: -3.33
Median: -2.95
Composite Area: 6.0112 ha
Surveyed Area: 3.1603 ha

Filename: Haddenham B RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 642770.512429603, 5738375.42770169 m
Southeast corner: 642933.402429603, 5738222.15770169 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 163 m x 153 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 15423, Recorded: 15423

Stats
Max: 99.20
Min: -104.07
Std Dev: 7.06
Mean: 1.81
Median: 0.82
Composite Area: 2.4966 ha
Surveyed Area: 0.41412 ha

Filename: Haddenham C RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 642813.757578909, 5738616.5512868 m
Southeast corner: 643055.947578909, 5738380.2112868 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 242 m x 236 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 75127, Recorded: 75127

Stats
Max: 106.04
Min: -109.71
Std Dev: 5.50
Mean: -0.35
Median: -0.03
Composite Area: 5.7239 ha
Surveyed Area: 2.7878 ha

Filename: Haddenham C 2 RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 642807.942677877, 5738534.57571585 m
Southeast corner: 642955.492677877, 5738365.31571585 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 148 m x 169 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 9163, Recorded: 9163

Stats
Max: 69.86
Min: -49.83
Std Dev: 3.04
Mean: 0.72
Median: 0.75
Composite Area: 2.4974 ha
Surveyed Area: 0.3402 ha

Filename: Haddenham D RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 642636.597791653, 5738521.29077321 m
Southeast corner: 642919.997791653, 5738231.26077321 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 283 m x 290 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 120383, Recorded: 120383

Stats
Max: 106.50
Min: -109.71
Std Dev: 10.32
Mean: 1.01
Median: -0.42
Composite Area: 8.2194 ha
Surveyed Area: 4.2369 ha

Processed data

Filename: Haddenham.xcp
Stats
Max: 3.31
Min: -3.20
Std Dev: 0.83
Mean: 0.06
Median: 0.03
Composite Area: 6.0112 ha
Surveyed Area: 3.155 ha

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip at 1.00 SD
5 DeStagger by: 20.00cm, Shift Positions

Filename: Haddenham B.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.67
Mean: 0.19
Median: 0.06
Composite Area: 2.4966 ha
Surveyed Area: 0.41274 ha

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00
5 DeStagger by: 100.00cm, Shift Positions

Filename: Haddenham C.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.96
Mean: 0.04
Median: 0.02
Composite Area: 5.7239 ha
Surveyed Area: 2.7788 ha

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00
5 DeStagger by: 70.00cm, Shift Positions

Filename: Haddenham C 2.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.03
Mean: 0.05
Median: -0.01
Composite Area: 2.4974 ha
Surveyed Area: 0.3394 ha

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00
5 DeStagger by: 20.00cm, Shift Positions

Filename: Haddenham D.xcp
Stats
Max: 6.63
Min: -6.60
Std Dev: 2.41
Mean: 0.49
Median: -0.02
Composite Area: 8.2194 ha
Surveyed Area: 4.2225 ha

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -6.00 to 6.00
5 DeStagger by: 50.00cm, Shift Positions

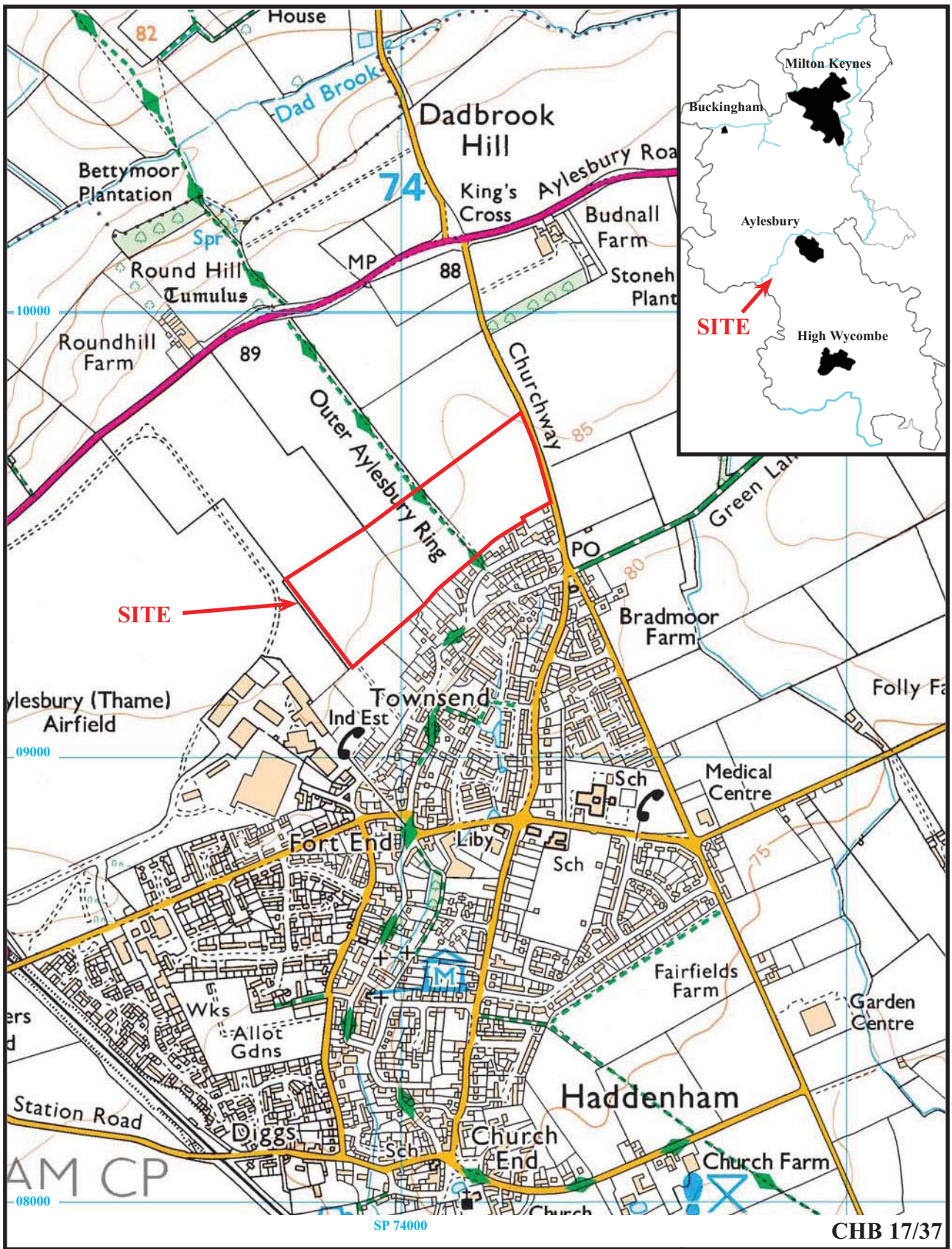

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Figure 1. Location of site within Haddenham and Buckinghamshire.

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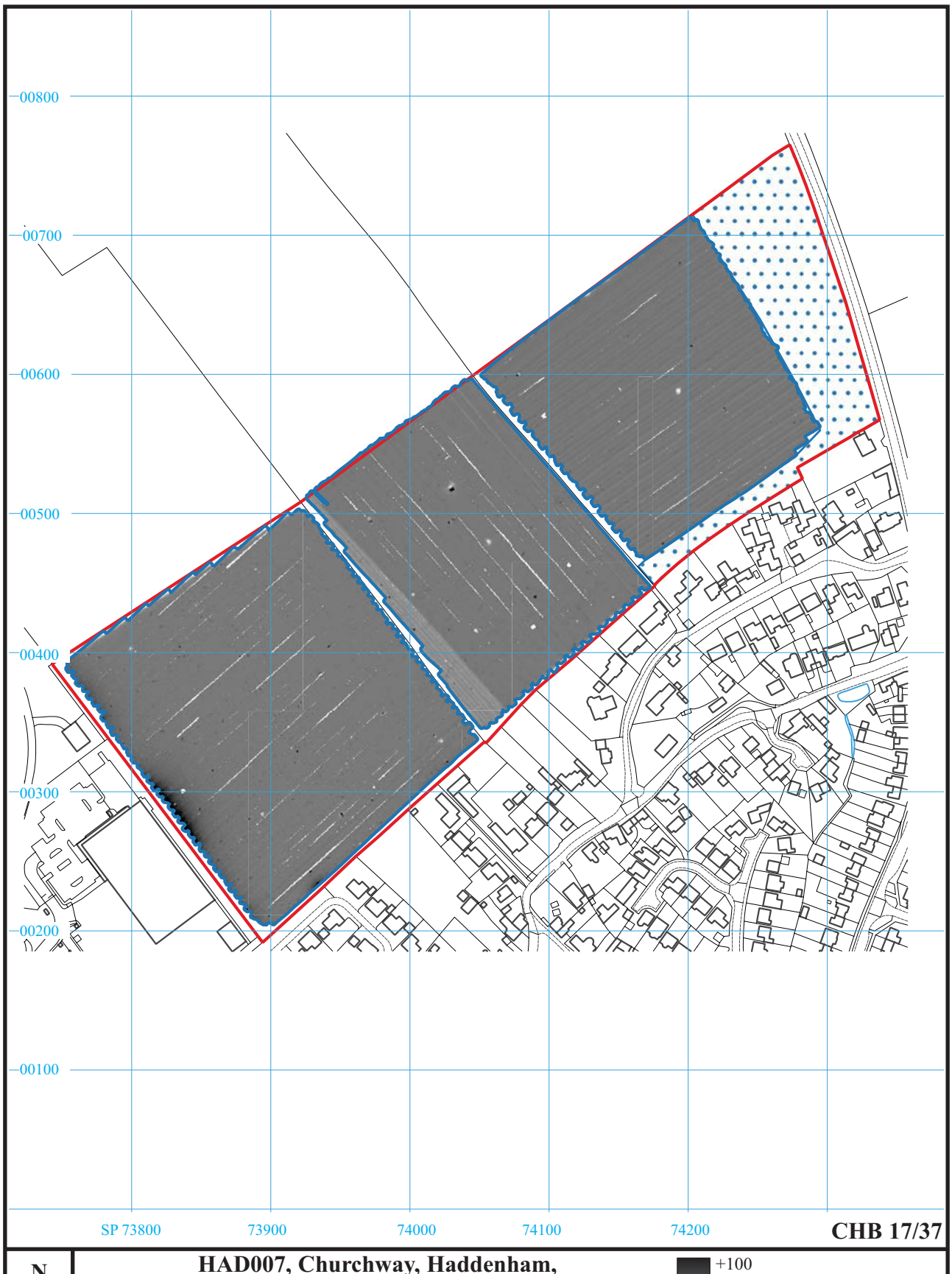

HAD007, Churchway, Haddenham, Aylesbury, Buckinghamshire, 2020
Geophysical Survey (Magnetic)
Figure 2. Plot of raw gradiometer data.

N

0m 200m

+100
nT
-100

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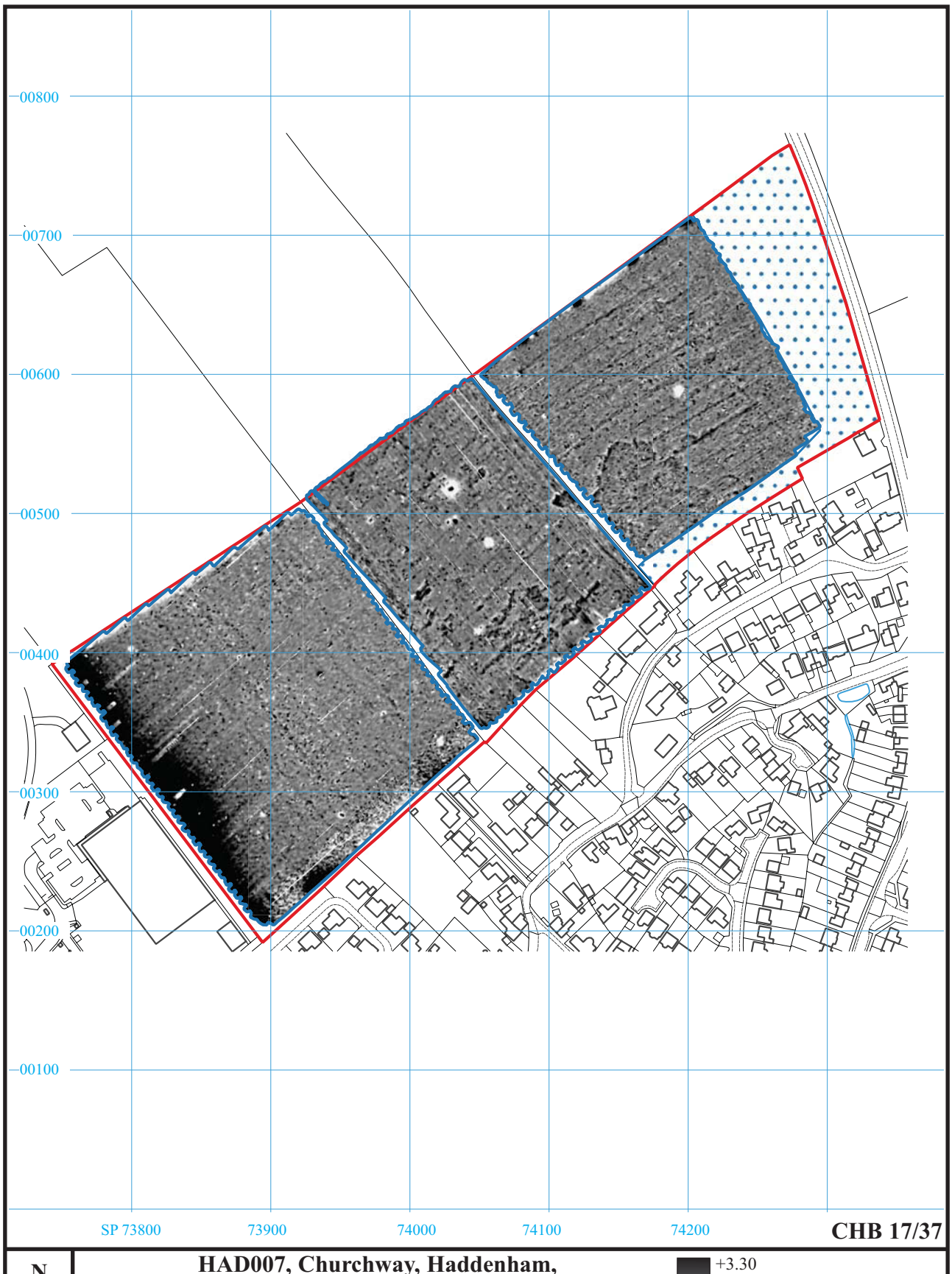

HAD007, Churchway, Haddenham, Aylesbury, Buckinghamshire, 2020
Geophysical Survey (Magnetic)
Figure 3. Plot of processed gradiometer data.

N

0m 200m

+3.30
nT
-3.20

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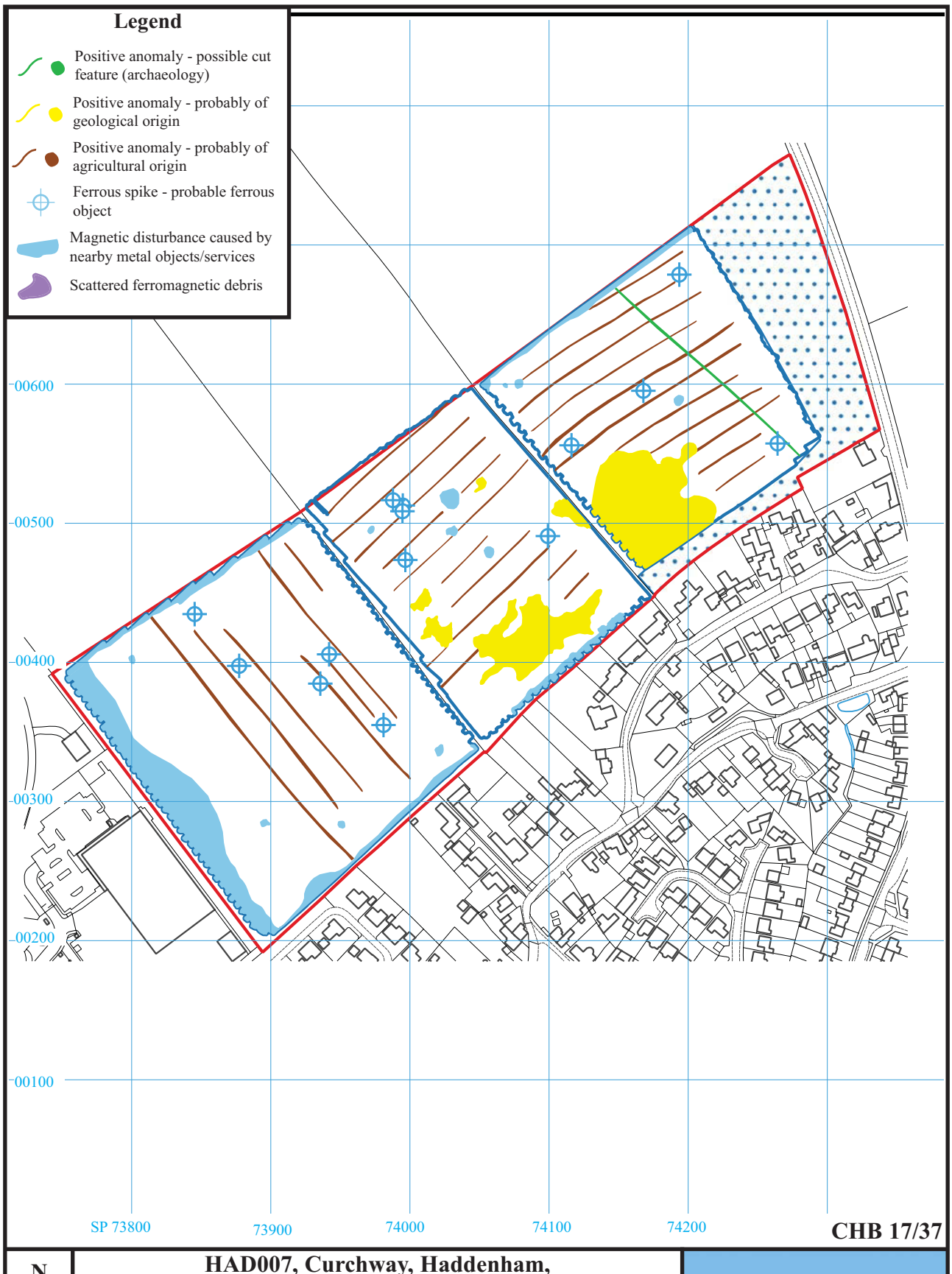

N

HAD007, Curchway, Haddenham, Aylesbury, Buckinghamshire, 2020
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Figure 4. Interpretation plot.

0m 200m

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Plate 1. Western field looking northwest towards the industrial units..

Plate 2. Central field looking east

Plate 3. Eastern field looking west.

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Geophysical Survey
Plates 1 to 3.

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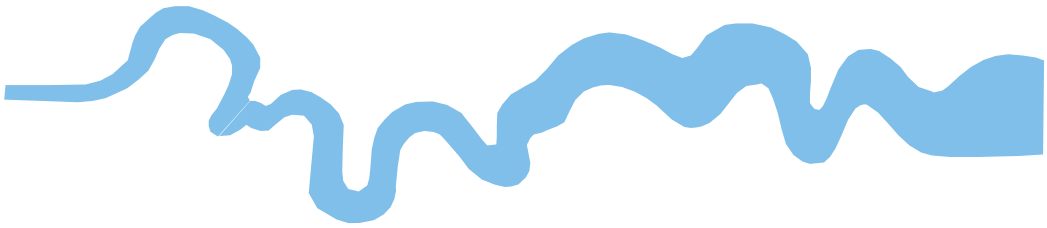
TIME CHART

	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



Thames Valley Archaeological Services Ltd,
47-49 De Beauvoir Road,
Reading RG1 5NR

Tel: 0118 9260552
Email: tvas@tvas.co.uk
Web: www.tvas.co.uk

Offices in:
Brighton, Taunton, Stoke-on-Trent, Wellingborough and Ennis (Ireland)