EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

DETAILED MAGNETOMETER SURVEY

Report Number: 1044

January 2014

EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

Detailed Magnetometer Survey

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Site Code	ENF132560	**NGR**	TG 1844 2620
Planning Ref.	n/a	**OASIS**	britanni1- 168116
Approved By	Matthew Adams	**DATE**	January 2014

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ABSTRACT

This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies that would benefit from further archaeological investigation.

Isolated dipolar responses were most numerous and two areas of magnetic disturbance caused by the proximity of ferrous material were further recorded.

A very weak positive curvilinear anomaly indicative of a potential ring-ditch or drip-gully is tentatively interpreted as being of archaeological origin. A series of weak positive discrete anomalies interpreted as archaeological rubbish pits were also recorded within the dataset, seven of which form the line of a potential discontinuous ditch, however a natural or geological origin cannot be ruled out. One weak negative linear trend which is believed to delineate a modern service run was also recorded.

It appears that the overall picture is similar to that of the surrounding archaeological area, potential dispersed rubbish pits or possible tree throws and hollows in a landscape dominated by later Iron Age, Roman, Post-medieval and modern agricultural activity. The curvilinear trends provide only weak evidence in support of a potential archaeological settlement.

It would be prudent to further evaluate the features of potential archaeological origin by means of a trial trench evaluation to assess the interpretations given in this report.

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1.0 INTRODUCTION

On Tuesday 17th and Wednesday 18th December 2013, Britannia Archaeology Ltd (BA) undertook a detailed fluxgate gradiometer survey over *c.*2 hectares of land at Woodgate Nursery, Cawston Road, Aylsham, Norfolk (TG 1833 2620), on one field currently under set-aside. This followed on from a previous detailed magnetometer survey that was undertaken in October 2013 on the field immediately adjacent to the west (see Figure 1).

This survey was undertaken on behalf of the land owner Mr Peter Purdy with the approval of Dr Ken Hamilton of Norfolk County Council Historic Environment Team (NCC HET). It forms the second survey stage of a programme of archaeological research investigations that are to be carried out within the immediate area. The weather was sunny and cold on day 1 following a period of prolonged precipitation, dry and overcast conditions prevailed on day 2.

2.0 SITE DESCRIPTION

The survey was undertaken on one field located to the south-west of Aylsham in an area dominated by arable cultivation, the site slopes north to south from 35 to 30m AOD. Cawston Road borders the site to the north, a meadow that was once part of the formal gardens of Woodgate House opens onto a landscaped lake to the south, the smaller field previously surveyed in October is located immediately to the west and beyond the hedgerow to the east lies the minor road of Stonegate. A 5m exclusion zone was kept around the periphery of the field due to the presence of a bordering metal fence.

The bedrock is described as Wroxham Crag Formation sand and gravel, a sedimentary bedrock formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by swamps, estuaries and deltas periodically inundated by the sea (BGS, 2013).

The superficial deposits are described as Mid Pleistocene Glaciofluvial Deposits of sand and gravel formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by ice age conditions with glaciers scouring the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS, 2013).

3.0 ARCHAEOLOGICAL BACKGROUND

The archaeological background summarises finds and features located on the Norfolk Heritage Explorer Website.

This survey was undertaken within the grounds of the Grade II* Listed Woodgate House (12216) that was built between 1706 and 1726. A plethora of Roman pottery has been collected by the land owner over the last few years within this field that show an apparent clustering and concentration depicted in Figure 1 (Magenta Hatching). Kiln

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fragments were discovered for the first time during the last ploughing season and is the principal reason why a magnetometer survey was employed to evaluate the area.

In the fields to the north of the site and Cawston Road a detailed magnetometer survey was carried out over 20 hectares in 2011 by ASWYAS (Webb, A. 2011) followed by a subsequent trial trench evaluation by NAU Archaeology (NPS) ahead of a housing and football pitch development. This evaluation recorded some evidence of Roman activity to the south of the area, predominantly a series of late medieval and post-medieval field boundaries and trackways that were also present on air photographs. At the time of the survey Oxford Archaeology East were undertaking a large open area excavation targeting archaeological activity present within these trial trenches. The excavations revealed dispersed prehistoric pits (one containing a complete Beaker vessel), tree hollows and tree throws providing evidence for a previously forested area with no real evidence of settlement activity. This was followed by a long period of agricultural activity that started in the Late Iron Age and Roman epochs, evidenced by widely distributed ditches, post-medieval ditches were also recorded and this agricultural pattern continued up until very recently (OAE, forthcoming report).

Bordering this field to the north of Cawston Road lies the railway embankment of the former East Norfolk Railway Line. A post-medieval brick kiln (15883) is also located 330m to the south-west of the site.

4.0 PROJECT AIMS

A detailed magnetometer survey of the area was undertaken to enable the archaeological resource, both in quality and extent, to be investigated. Specific research questions are as follows:

- Can any supporting evidence of potential archaeological activity associated with the very strong dipolar discrete anomalies, pottery cluster and kiln fragments be seen in the dataset to the east?
- What is the extent of the areas of archaeological potential?
- Are there any anomalies similar to those found to the north of Cawston Road recorded in the dataset?

5.0 METHODOLOGY

5.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that that the site had a fairly low magnetic background susceptibility probably due to the nature of the glacial till that is predominant in this area.

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5.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument; this same station was used to zero the sensors throughout the survey providing a common zero point. Sensor drift was noted particularly on day one and caused 'striping' within the dataset especially during outbreaks of sunshine.

5.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on 20 x 20m grids.

5.4 Survey Grid Location

To keep the survey costs to a minimum fibre tapes were employed to lay out the grid using a geo-referenced scale drawing created in AutoCAD. The grids were positioned on a NNW-SSE alignment (Figure 1).

5.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the amount of field boundary magnetic disturbance which slightly reduced the area available.

5.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 2 and 3). An XY trace plot of the processed data has also been included (Figure 4). The raw data is presented with no processing, and was clipped to produce a uniform greyscale plot. The processed data schedule is also displayed below, metadata sheets are presented in Appendix 1.

Raw Data:
***Data Clipping**: 4 standard deviations.*
***Display Clipping:** 1 standard deviation.*

Processed Data:
***De-spike**: X diameter = 3, Y diameter = 3, Threshold = 1, centre value=mean, replace with = mean;*
***De-stripe**: Traverse, Median, X (Horizontal).*

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Data Clipping: 4 standard deviations;
Display Clipping: 1 standard deviation.

An interpretation plan characterising the anomalies recorded can be found at Figure 5, it draws together the evidence collated both from the greyscale and XY trace plots (Figures 2, 3, and 4). All figures are tied into the National Grid and printed at an appropriate scale.

5.7 Software

Raw data were downloaded using Bartington software Grad601 and will be stored in this format as raw data. The software used to process the data and produce the composites was DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. An interpretation plot was then produced using AutoCAD.

5.8 Grid Restoration

Britannia Archaeology Ltd positioned two reference stations in the field to enable the grid to be accurately relocated using the geo-referenced stations printed in Figure 1, this will also enable the accurate relocation of geophysical anomalies.

6.0 RESULTS & DISCUSSION (Figures 1 – 5)

The surveyors noted that the sites overall magnetic background was relatively low, causing little difficulty in locating a suitable zero station to set-up the instruments sensors. Ground conditions were found to be challenging for the surveyors, the field had been recently ploughed removing scrubland to help alleviate drag on the instruments sensors. It had also consistently rained over the preceding weeks causing soft spongy conditions underfoot.

Isolated dipolar ('iron spike') responses were once again most numerous (see also western field) and probably caused by modern ferrous cultural debris being introduced into the topsoil through manuring and loss rather than resulting from the presence of buried archaeological artefacts. These responses (yellow hatched circles) seem to be fairly evenly spaced throughout the field with no apparent concentration.

Two areas of magnetic disturbance (yellow hatching) were present in the dataset, plastic wrapped hay bales and a metal fence were responsible for the readings in the north-western corner of the plot while the strong ferrous response of a metal gate was culpable for the strong reading in the south-eastern corner.

One weak negative linear trend (light blue line) was recorded running parallel (north-south) with the hedge boundary towards the eastern extremity of the dataset. This has been interpreted as a service run with a possible modern origin.

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Twenty-eight weak positive discrete anomalies (orange hatching) were recorded during this survey that may be indicative of cultural rubbish pits. However they may also delimit patches of a more magnetic susceptible material present within the natural geology, or could be related to natural features such as tree throws or hollows similar to those recorded during the excavation to the north of Cawston Road (OAE, forthcoming). An alignment of seven elongated and rounded discrete anomalies have been recorded running through the centre of the dataset and up to the northern boundary, possibly forming a discontinuous linear trend that may adjoin a similarly discontinuous post-medieval ditch witnessed by the author in the excavations to the north.

One very weak positive curvilinear anomaly (red hatching) has been recorded in the north-eastern quadrant of the dataset. It is slightly weaker in strength than those present in the western field and therefore its existence is perhaps more tenuous. These are commonly indicative of prehistoric ring-ditches or possible drip-gully type features.

7.0 CONCLUSION

This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies that would benefit from further archaeological investigation. A very weak positive curvilinear anomaly indicative of a ring-ditch or drip-gully and a series of weak positive discrete anomalies (potential rubbish pits) are most likely to be of archaeological origin.

The four very strong dipolar discrete anomalies present in the western field interpreted as two individual kilns with associated stoking-pits, remain the most intriguing of those recorded in both surveys. They may form a phase of industrial activity that is commonly found to be located on the periphery of a settlement, which would help explain the lack of settlement-type anomalies recorded during both surveys. The only anomalies indicative of settlement activity within the two data sets are the three curvilinear trends. They are widely spaced apart from each other and contrast weakly with the natural magnetic background, there existence therefore is somewhat tenuous.

It appears that the overall picture is similar to that of the surrounding area, potential dispersed rubbish pits or possible tree throws and hollows in a landscape dominated by later Iron Age, Roman, Post-medieval and modern agricultural activity. The curvilinear trends provide only weak evidence in support of a potential archaeological settlement.

It would be prudent to further evaluate the features of potential archaeological origin by means of a trial trench evaluation to assess the interpretations given in this report.

8.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections,* Archaeological

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Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

9.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to Mr Peter Purdy for funding the project and for arranging site access, and to Dr Ken Hamilton and Mr James Albone of Norfolk County Council Historic Environment Team for their advice and input.

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Norfolk Heritage Explorer. http://www.heritage.norfolk.gov.uk/home.

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APPENDIX 1 METADATA SHEETS

Raw Data

Filename:	AylE2 Raw.xcp AylE3 Raw.xcp
Instrument Type:	Grad 601-2 (Gradiometer)
Units:	nT
Surveyed by:	TPS/MB on 12/19/2013 + 20/12/2013
Assembled by:	TPS on 12/20/2013
Direction of 1st Traverse:	90 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702.00
Dimensions	
Composite Size (readings):	480 x 120
Survey Size (meters):	120.00m x 120.00 m
Grid Size:	20.00 m x 20.00 m
X Interval:	0.25 m
Y Interval:	1.00 m
Stats	
Max:	20.88
Min:	-19.76
Std Dev:	4.61
Mean:	0.56
Median:	0.40
Composite Area:	1.44 ha
Surveyed Area:	1.19 ha
Program	
Name:	ArcheoSurveyor
Version:	2.5.16.0

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54	Col:6 Row:3 grids\54.xgd
55	Col:6 Row:4 grids\55.xgd

Processed Data

Filename:	AylE2.xcp AylE3.xcp
Description	
Instrument Type:	Grad 601-2 (Gradiometer)
Units:	nT
Surveyed by:	TPS/MB on 12/19/2013
Assembled by:	TPS on 12/20/2013
Direction of 1st Traverse:	90 deg
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702.00
Dimensions	
Composite Size (readings):	480 x 120
Survey Size (meters):	120.00m x 120.00 m
Grid Size:	20.00 m x 20.00 m
X Interval:	0.25 m
Y Interval:	1.00 m
Stats	
Max:	8.91
Min:	-8.87
Std Dev:	1.60
Mean:	0.05
Median:	0.00
Composite Area:	1.44 ha
Surveyed Area:	1.19 ha
Program	
Name:	ArcheoSurveyor
Version:	2.5.16.0

Source Grids: 55	
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APPENDIX 2 TECHNICAL DETAILS

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.

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Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.

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APPENDIX 3 OASIS FORM

OASIS ID: britanni1-168116

Project details

Project name	East Field, Land to the South of Cawston Road, Aylsham, Norfolk. Detailed Magnetometer Survey.
Short description of the project	This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies that would benefit from further archaeological investigation. Isolated dipolar responses were most numerous and two areas of magnetic disturbance caused by the proximity of ferrous material were further recorded. A very weak positive curvilinear anomaly indicative of a potential ring-ditch or drip-gully is tentatively interpreted as being of archaeological origin. A series of weak positive discrete anomalies interpreted as archaeological rubbish pits were also recorded within the dataset, seven of which form the line of a potential discontinuous ditch, however a natural or geological origin cannot be ruled out. One weak negative linear trend which is believed to delineate a modern service run was also recorded. It appears that the overall picture is similar to that of the surrounding archaeological area, potential dispersed rubbish pits or possible tree throws and hollows in a landscape dominated by later Iron Age, Roman, Post-medieval and modern agricultural activity. The curvilinear trends provide only weak evidence in support of a potential archaeological settlement. It would be prudent to further evaluate the features of potential archaeological origin by means of a trial trench evaluation to assess the interpretations given in this report.
Project dates	**Start:** 17-12-2013 **End:** 18-12-2013
Previous/future work	Yes / Yes
Any associated project reference codes	P1024B - Contracting Unit No ENF132560 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 3 - Operations to a depth more than 0.25m
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	'"Geophysical Survey"'
Development type	Research Project
Prompt	Research
Position in the planning process	Not known / Not recorded
Solid geology	(other) Wroxham Crag Formation Sand and Gravel
Drift geology	GLACIAL SAND AND GRAVEL
Techniques	Magnetometry

Project location

Country	England
Site location	NORFOLK BROADLAND AYLSHAM Land South of Cawston Road
Study area	2.00 Hectares
Site coordinates	TG 1844 2620 52 1 52 47 19 N 001 14 23 E Point
Height OD / Depth	**Min:** 30.00m **Max:** 35.00m

Project creators

Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Contractor (design and execute)
Project design originator	Timothy Schofield
Project director/manager	Timothy Schofield
Project supervisor	Martin Brook
Type of sponsor/funding body	Landowner
Name of sponsor/funding body	Mr Peter Purdy

Project archives

Physical Archive Exists?	No

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Digital Archive recipient	Norfolk Museums and Archaeology Service
Digital Contents	"Survey"
Digital Media available	"Geophysics", "Images raster / digital photography", "Images vector", "Survey", "Text"
Paper Archive recipient	Norfolk Museums and Archaeology Service
Paper Contents	"Survey"
Paper Media available	"Map", "Plan", "Report", "Survey ", "Unpublished Text"
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	East Field, Land to the South of Cawston Road, Aylsham, Norfolk; Detailed Magnetometer Survey
Author(s)/Editor(s)	Schofield, T.P.
Other bibliographic details	R1044
Date	2014
Issuer or publisher	Britannia Archaeology Ltd
Place of issue or publication	Stowmarket, Suffolk
Description	A4 bound report with A3 fold-out figures
URL	www.britannia-archaeology.com
Entered by	Tim Schofield (tim@britannia-archaeology.com)
Entered on	10 January 2014

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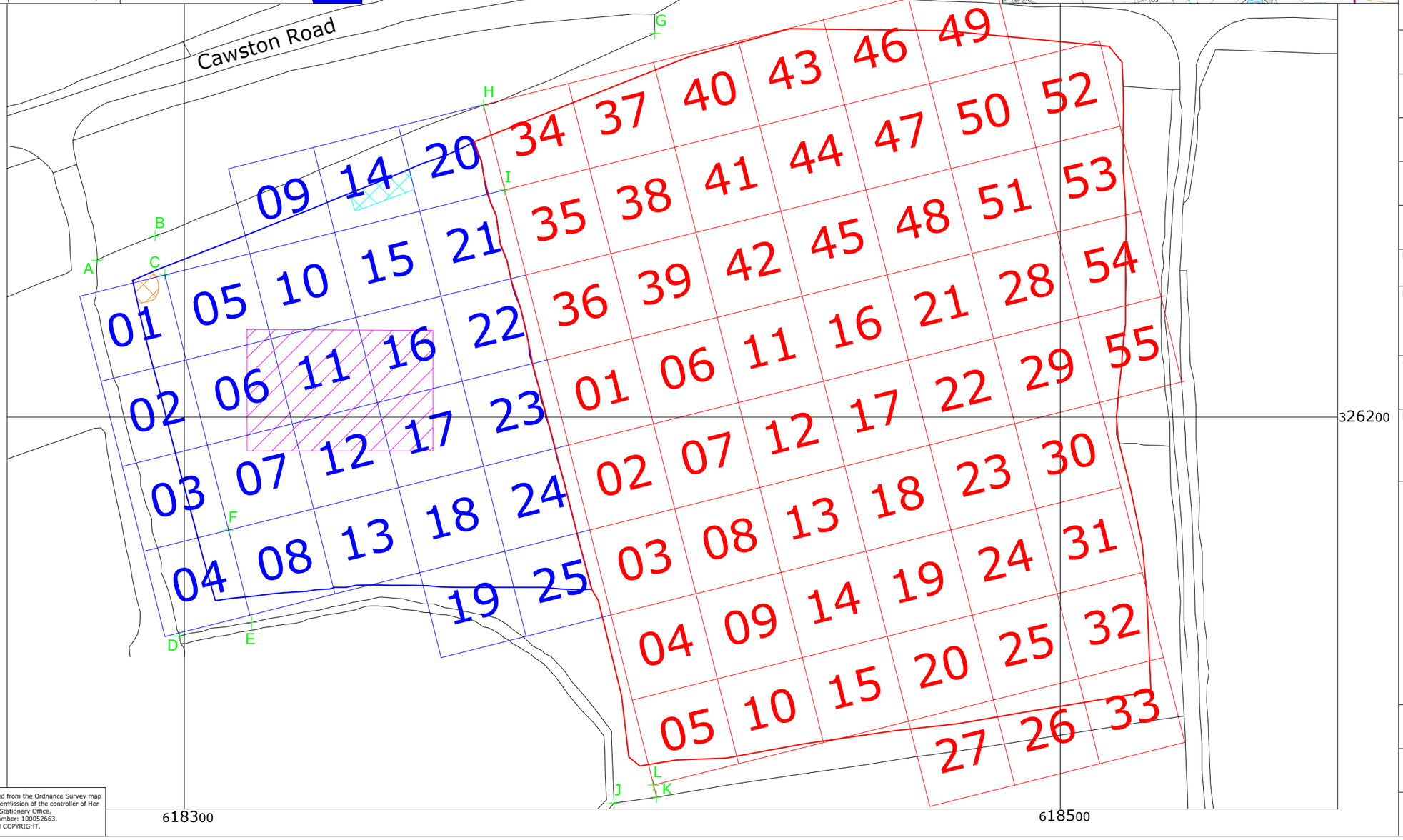

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N

G - H	42.41m
H - I	19.92m
I - G	49.51m
J - K	9.79m
J - L	9.90m
K - L	2.84m
	East Field Survey Grids
	West Field Survey Grids
	Location of Sheds
	Area of Burning
	Pottery/Kiln Fragment Concentration
	Site Boundary

NGR: 618445 326200

REPORT NUMBER: 1044

PROJECT: EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

CLIENT: PETER PURDY

DESCRIPTION: SITE/SURVEY GRID LOCATION & REFERENCING PLAN

BRITANNIA ARCHAEOLOGY LTD

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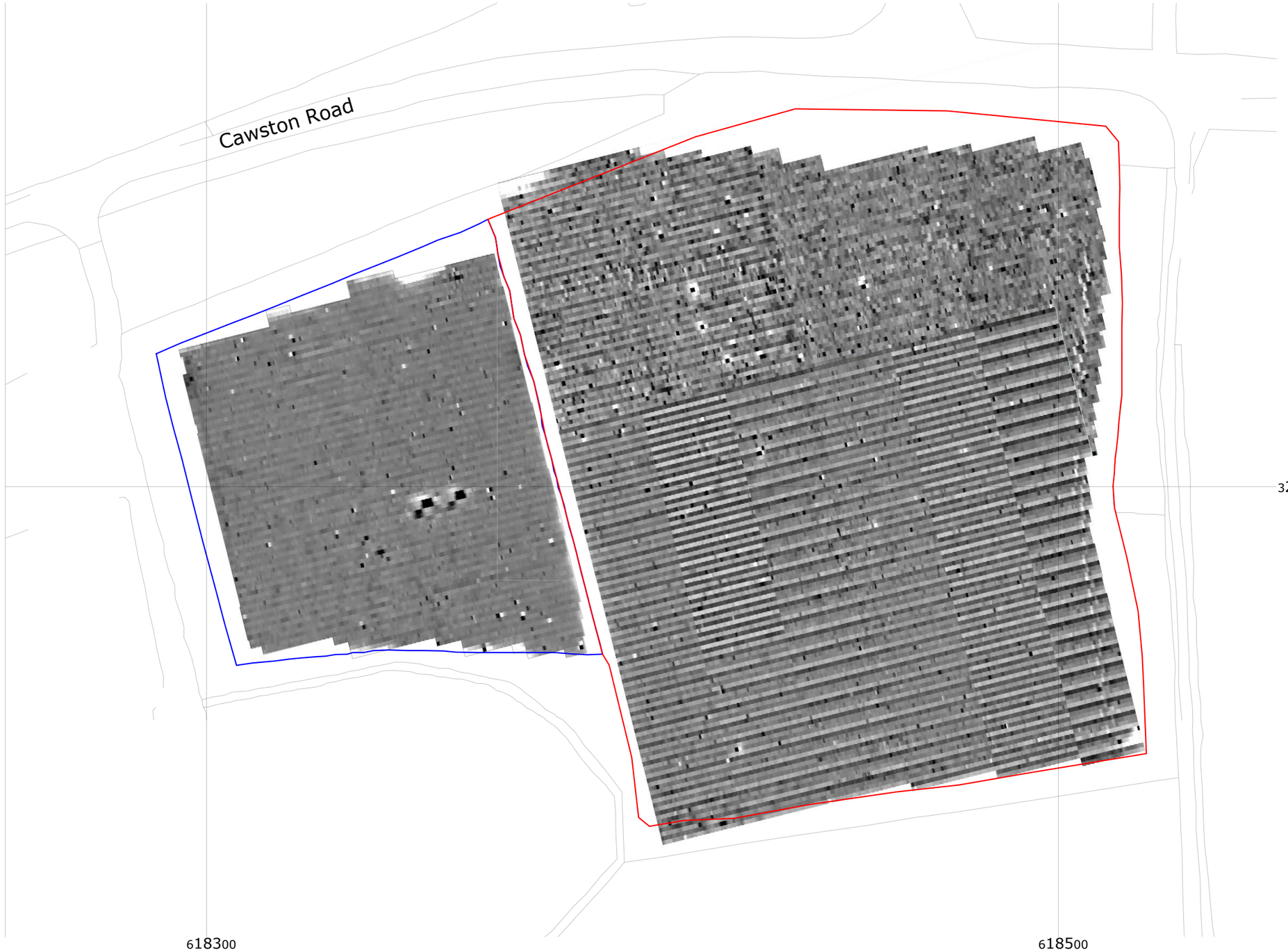
SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
JAN 2014	TPS	01



N

+20.88nT

-19.76nT

West Field Site Boundary

East Field Site Boundary

NGR: 618445 326200

REPORT NUMBER: 1044

PROJECT: EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

CLIENT: PETER PURDY

DESCRIPTION: RAW MAGNETOMETER GREYSCALE PLOT

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DATE: JAN 2014 | AUTHOR: TPS | FIGURE: 02

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Cawston Road

N

+8.91nT

-8.87nT

326200

618300

618500

West Field Site Boundary

East Field Site Boundary

NGR: 618445 326200

REPORT NUMBER: 1044

PROJECT: EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

CLIENT: PETER PURDY

DESCRIPTION: PROCESSED MAGNETOMETER GREYSCALE PLOT

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PLOT: A3

APPROVED: MCA

VERSION: 01

DATE: JAN 2014

AUTHOR: TPS

FIGURE: 03

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N

20nT/cm	Scale Interval
	West Field Site Boundary
	East Field Site Boundary

NGR: 618445 326200

REPORT NUMBER: 1044

PROJECT:
EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

CLIENT:
PETER PURDY

DESCRIPTION:
PROCESSED MAGNETOMETER XY TRACE PLOT

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SCALE: 1:1000

0 40m

PLOT:	APPROVED:	VERSION:
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DATE:	AUTHOR:	FIGURE:
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N

	Very Strong Dipolar Discrete Anomaly, Archaeology?
	Weak Positive Curvilinear Anomaly, Archaeology?
	Weak Positive Discrete Anomaly, Archaeology?
	Weak Negative Linear Trend, Service Run?
	Weak Positive Linear Trend, Agricultural
	Area of Magnetic Disturbance
	Isolated Dipolar Responses
	West Field Site Boundary
	East Field Site Boundary

NGR: 618445 326200

REPORT NUMBER: 1044

PROJECT: EAST FIELD, LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

CLIENT: PETER PURDY

DESCRIPTION: INTERPRETATION PLOT OF MAGNETOMETER ANOMALIES

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DATE: JAN 2014	AUTHOR: TPS	FIGURE: 05

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