WYAS Archaeological Services

Land at Eagle Road

Erpingham

Norfolk

Geophysical Survey

Report no. 2765
June 2015

Client: NPS Archaeology

Land at Eagle Road, Erpingham, Norfolk

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 2.3 hectares, was carried out on land immediately to the west of the village of Erpingham, Norfolk, prior to the proposed development of the site. Although no anomalies of obvious archaeological origin have been identified, two linear anomalies of uncertain origin have been identified. Whilst an archaeological origin cannot be discounted, it is considered on balance that a non-archaeological or post-medieval origin is most. Consequently the archaeological potential of the site, based on the results of the survey, is considered to be low.

WYAS
Archaeological Services

Report Information

Client:	Niall Oakey
Address:	NPS Archaeology, Scandic House, 85 Mountergate, Norwich NR1 1PY
Report Type:	Geophysical Survey
Location:	Erpingham
County:	Norfolk
Grid Reference:	TG 19500 31724
Period(s) of activity:	Modern
Report Number:	2765
Project Number:	4413
Site Code:	HRA15
OASIS ID:	Archaeol11-211448
Planning Application No.:	N/A
Museum Accession No.:	N/A
Date of fieldwork:	May 2015
Date of report:	June 2015
Project Management:	Christopher Sykes BA MSc
Fieldwork:	Alexander Schmidt BA
	Mark Evans BSc
	Rebecca Goulding BSc MSc (Dip)
	Ross Bishop BA
Report:	David Williams BA MCIfA
Illustrations:	Christopher Sykes and David Williams
Photography:	Site staff
Research:	N/A

Authorisation for distribution: ----------

PO Box 30, Nepshaw Lane South, Morley, Leeds LS27 0UG
Telephone: 0113 383 7500.
Email: admin@aswyas.com

Contents

List of Figures

List of Plates

1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Niall Oakey of NPS Archaeology (the Client), to undertake a geophysical (magnetometer) survey of land at Eagle Road, Erpingham, Norfolk to inform a proposed planning application. The work was undertaken in accordance with the Generic Brief for Archaeological Evaluation by Magnetometer Survey (Norfolk County Council 2014), and a written scheme of investigation (Oakey 2015) provided to and approved by the Historic Environment Service of Norfolk County Council. Guidance contained within the National Planning Policy Framework (DCLG 2012) was also followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out on 20th May 2015 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The Proposed Development Area (PDA) is located towards the south-western side of the village of Erpingham, approximately 10.5 km to the south of Cromer, North Norfolk, centered at TG 19500 31724 (see Fig. 1). It comprises two separate fields, Field 1 is roughly rectangular whereas Field 2 is also rectangular but tapers towards the south. Both fields are bound to the east by agricultural fields. Housing bounds the PDA to the west with a sports field and club house located to the north. Eagle Road is located along the southern side. The total size of the PDA was 2.3 hectare and was generally flat, located at 31m above Ordnance Datum (aOD). Both fields were used as rough pastures and covered with numerous trees and shrubs.

Soils and geology

The underlying bedrock comprises Wroxham Crag Formation, sand and gravel with the superficial deposits recorded as ‘Brickearth’ made up of clay, silt and sand (British Geological Survey 2015). The soils in this area are classified in the Wick 2 association, characterised as deep well drained coarse loamy soils (Soil Survey of England and Wales 1983).

2 Archaeological Background

A single flint barbed and tanged arrowhead, dating from the Neolithic was found in 1971 towards the south-western corner of the PDA (NHER 6705). Surrounding the PDA there are numerous historical sites including the remains of a medieval moat, 120m north-east of the PDA. This moated site was thought to have been the site of a hall built by Sir Thomas Erpingham *c*. 1400 (NHER 6713). Remains include a medieval flint and tile bastion with a retaining wall.

3 Aims and Methodology

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim a magnetometer survey covering all amenable parts of the PDA was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The magnetometer survey was undertaken using a Sensys Magneto MXPDA cart-based instrument. The instrument has 5 fluxgate gradiometers spaced 0.5m apart with readings recorded at 20Hz. The gradiometers have a range of recording between 0.1nT and 10,000nT. They are linked to a Trimble R6 RTK dGPS system with data recorded by Sensys Magneto MXPDA software on a rugged PDA device. The data was stored on an SD memory card within the PDA and later downloaded to a computer for processing and interpretation. MAGNETO (Sensys Gmbh) and TerraSurveyor V3.0.25.0 software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey mapping, is shown in Figure 1. A scale (1:1000) plan showing the survey area and the proposed development area is presented as Figure 2. Detailed data plots (processed) and a full interpretative figure are presented at a scale of 1:1000 in Figures 3, 4 and 5.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1 and Appendix 2. Data repeatability plots are included in Appendix 3 and Appendix 4 describes the composition and location of the archive.

The survey methodology, report and any recommendations comply with the Project Design (Richardson 2015) and with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

4 Results and Discussion (see Figures 3 to 5)

Summary

A large area of Field 1 was unsuitable for survey due to the presence of well developed trees and shrubs. Fields 1 and 2 of the survey area are dominated by numerous areas of magnetic disturbance typical of fields that have been under agricultural use for some time. The only potential archaeological features are located within Field 1 and are identified as linear trends.

Ferrous anomalies

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

A linear dipolar anomaly, **A**, running north-west/south-east across the western side of Field 2 is caused by a buried service pipe.

Areas of ferrous disturbance within Field 2 are located along the western boundary and are the product of ferrous material within the field boundary.

Agricultural Anomalies

Across Field 2 vague linear trend anomalies aligned north/south, which run parallel with the field boundaries are indicative of recent ploughing. These are caused by post-medieval cultivation of the land – specifically ploughing activity.

Geological anomalies

Throughout the survey area discrete anomalies, characterised as localised areas of enhanced magnetic response, have been identified concentrated towards the central and northern part of Field 1 and also in the centre of Field 2. These anomalies are interpreted as geological in origin being caused by localised variation in either the underlying geology or the composition of the soils.

Possible archaeological anomalies

Two linear anomalies, **B** and **C**, are identified, within Field 1. None of these anomalies corresponds with any features on the historic mapping, but as they run parallel to the existing field boundaries, there is the possibility that they relate to early modern agricultural activity within the fields. Given the agricultural nature of the land, they could be stock corrals for example. A second possibility is that these linear anomalies have a geological origin. Equally an archaeological interpretation for any of these anomalies cannot be discounted and so these anomalies have been interpreted as of possible archaeological origin.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

5 Conclusions

No anomalies of obvious or definite archaeological origin have been identified by the geophysical survey, although two linear anomalies of uncertain origin have been identified, confined to the central portion of Field 1. Whilst an archaeological origin cannot be discounted, it is considered on balance that a non-archaeological or post-medieval origin is more likely, although the precise origin is unknown. Consequently the archaeological potential of the site, based on the results of the survey, is considered to be low.

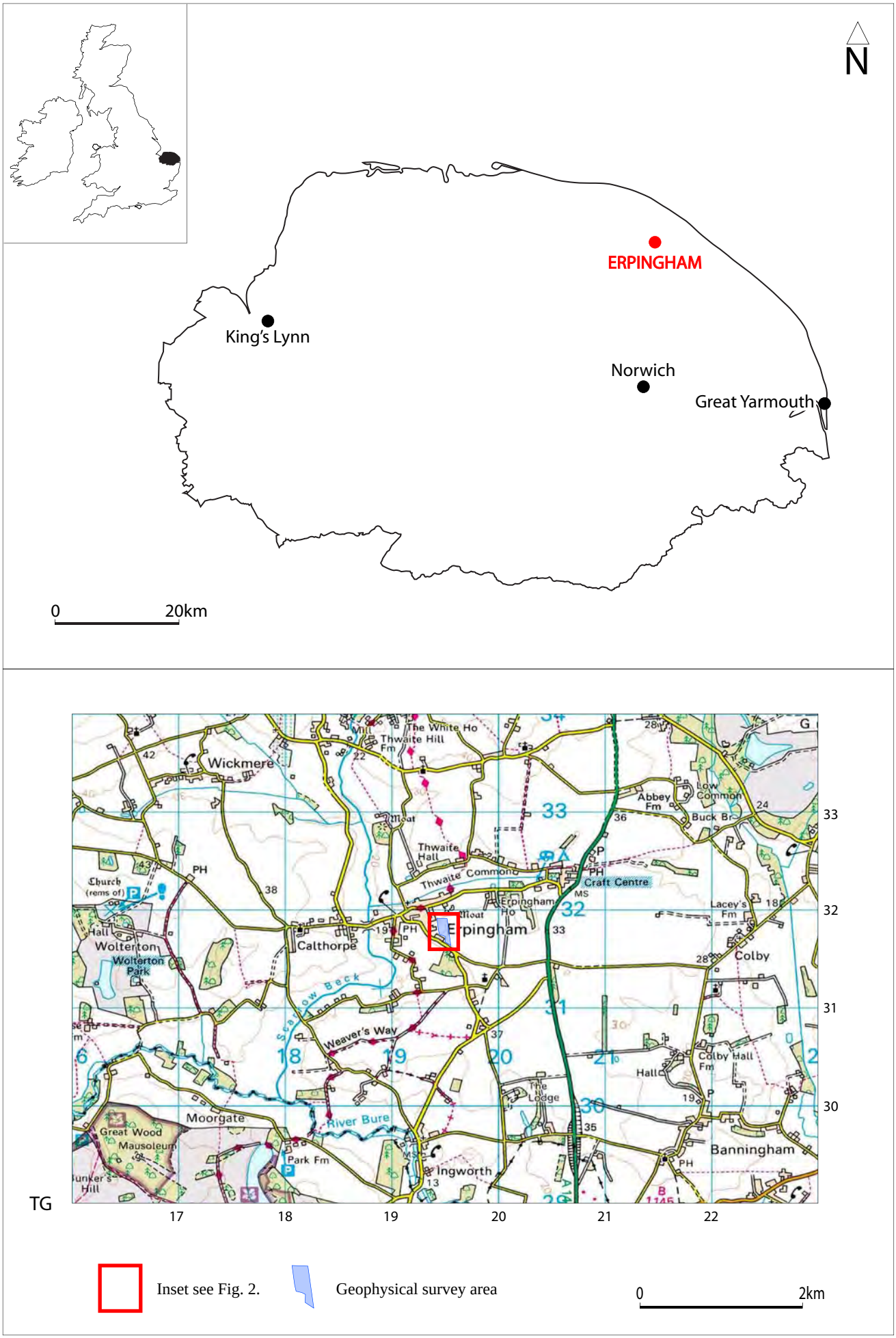

Fig. 1. Site location

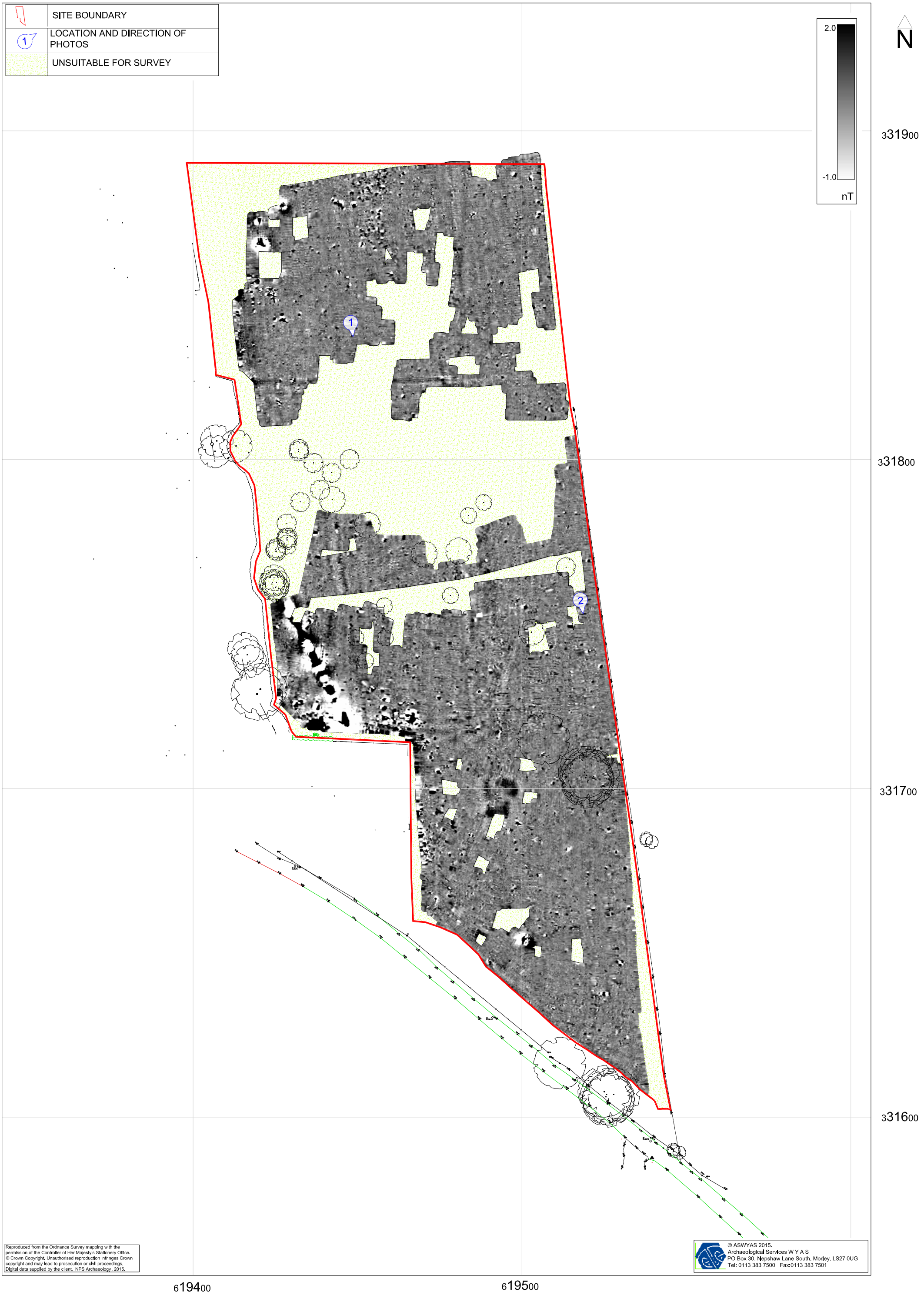

Fig. 2. Survey location showing greyscale of cart-based magnetometer data (1:1000 @ A3)

Fig. 3. Processed greyscale of cart-based magnetometer data (1:1000 @ A3)

20.0 nT/cm

N

3319 00

3318 00

3317 00

3316 00

6194 00

6195 00

0 50m

© ASWYAS 2015.
Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

Fig. 4. XY trace plot of minimally processed cart-based magnetometer data (1:1000 @ A3)

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	DIPOLAR LINEAR	SERVICE PIPE
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?

N

A

B

C

319 00

318 00

317 00

316 00

194 00

195 00

© ASWYAS 2015.
Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

0 50m

Fig. 5. Interpretation of cart-based magnetometer data (1:1000 @ A3)

Plate 1. General view of Field 1, looking south

Plate 2. General view of Field 2, looking south

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic ‘spiky’ trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an ‘iron spike’ anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Gradiometer Survey

The magnetometer survey was undertaken using a Sensys Magneto MXPDA cart-based instrument. The instrument has 5 fluxgate gradiometers spaced 0.5m apart with readings recorded at 20Hz. The gradiometers have a range of recording between 0.1nT and 10,000nT. They are linked to a Trimble R6 RTK dGPS system with data recorded by Sensys Magneto MXPDA software on a rugged PDA device. The data was stored on an SD memory card

within the PDA and later downloaded to a computer for processing and interpretation. MAGNETO (Sensys Gmbh) and TerraSurveyor V3.0.25.0 software was used to process and present the dataData Processing and Presentation

The detailed gradiometer data has been presented in this report in processed greyscale format. The data in the greyscale images has been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

TerraSurveyor V3.0.25.0 was used to compensate (destripe) interpolate and clip the data. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The cart data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better then 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Data Repeatability

TRACK 1
DATA COLLECTED AT 10:00
21 MAY 2015

TRACK 2
DATA COLLECTED AT 16:00
21 MAY 2015

N

Archaeological Services W Y A S
PO Box 30, Nepshaw Lane South, Morley, LS27 0UG
Tel: 0113 383 7500 Fax:0113 383 7501

0 10m

Appendix 3: Data repeatability (1:200 @ A4)

Appendix 4: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Norfolk Historic Environment Record).

Bibliography

British Geological Survey, 2015. www.bgs.ac.uk/discoveringGeology/geology OfBritain/viewer.html. (Viewed May 29th 2015)

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for Archaeological Geophysical Survey*

David, A., N. Linford, P. Linford and L. Martin, 2008. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines (2nd edition)* English Heritage

DCLG, 2012. *National Planning Policy Framework*. Department of Communities and Local Government

Gaffney, C. and Gater, J., 2003. *Revealing the Buried Past: Geophysics for Archaeologists* Tempus Publishing Ltd

Norfolk County Council, 2014. *Generic Brief for Archaeological Evaluation by Magnetometer Survey* NCC Historic Environment Service

Norfolk Heritage Explorer, 2015. http://www.heritage.norfolk.gov.uk/map-search (viewed May 29th 2015)

Oakey, N., 2015. *Geophysical Survey Eagle Road, Erpingham, Norfolk Written Scheme of Investigation*. Unpublished NPS Archaeology document

Richardson, J. 2015. *Eagle Road Erpingham: Geophysical Survey Project Design.* Unpublished ASWYAS document

Soil Survey of England and Wales, 1983. *Soil Survey of England and Wales: Soils of Eastern England*, Sheet 4