

LRBS18



LAND WEST OF LONDON ROAD, BECCLES, SUFFOLK

GEOPHYSICAL SURVEY

commissioned by CgMs Heritage

November 2018

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PROJECT INFO:

HA Project Code **LRBS18** / NGR **TM 4198 8891** / Parish **Beccles** / Local Authority **Suffolk** / OASIS Ref.
headland5-313807 / HER Parish Code **BCC136**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **David Harrison** / Fieldwork **Ross Bishop** / Graphics **David Harrison**

Approved by **Sam Harrison**



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PROJECT SUMMARY

Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey, covering approximately 9 hectares, to inform planning proposals for a proposed residential development at Beccles, Suffolk. No archaeological activity is known within the proposed development area or the immediate surrounding area. The survey has not identified any anomalies of definite archaeological potential although two anomalies of uncertain origin have been identified and an archaeological origin for these anomalies cannot be discounted. Elsewhere anomalies have been identified which reflect the recent agricultural use of the site (as depicted on historical cartographic sources) and are interpreted as being caused by former boundaries, farm tracks, a demolished building, backfilled pond and possible localised mineral extraction. Therefore, on the basis of the geophysical survey, the archaeological potential of the proposed development area is assessed as low corroborating the results of an earlier desk-based assessment.

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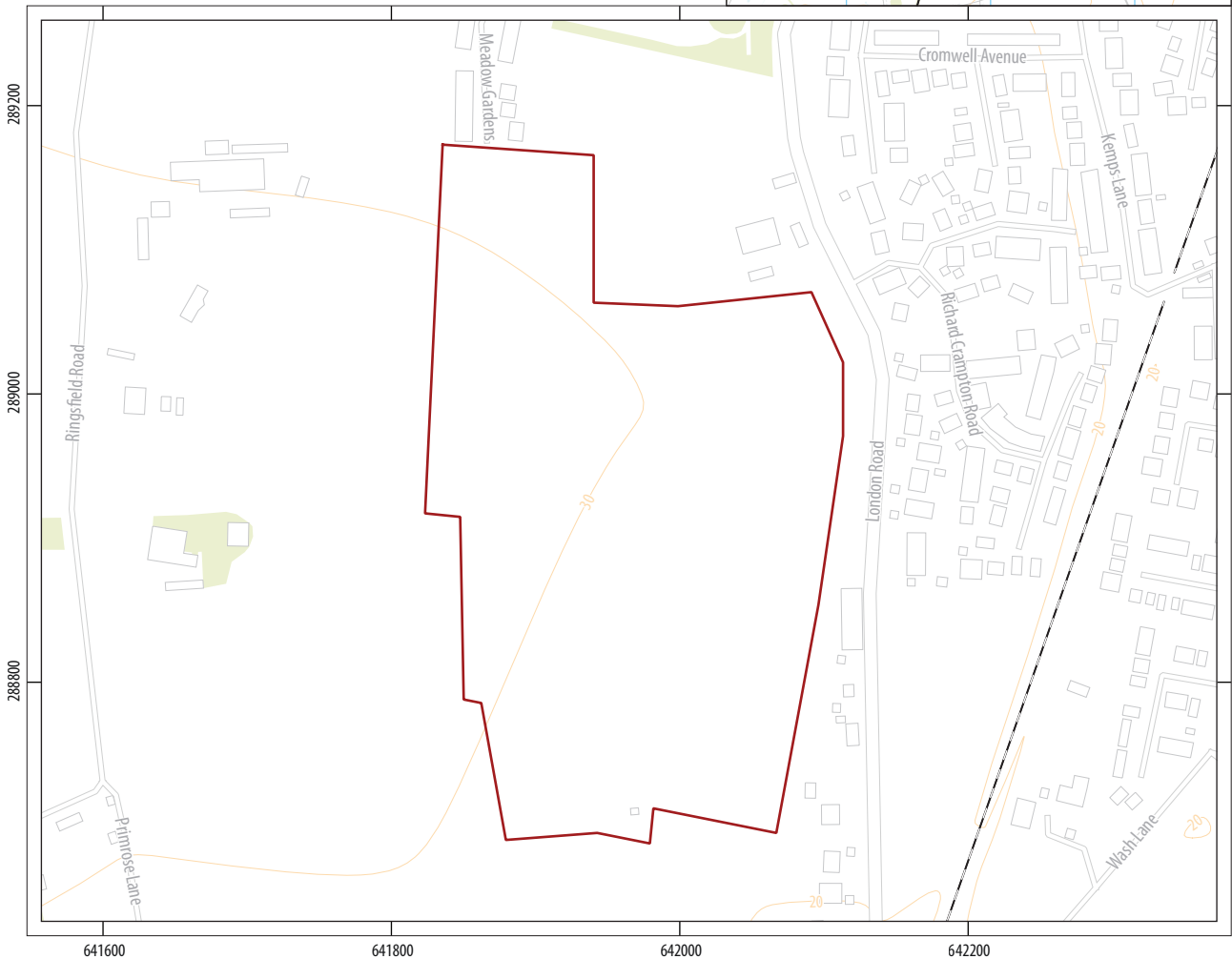
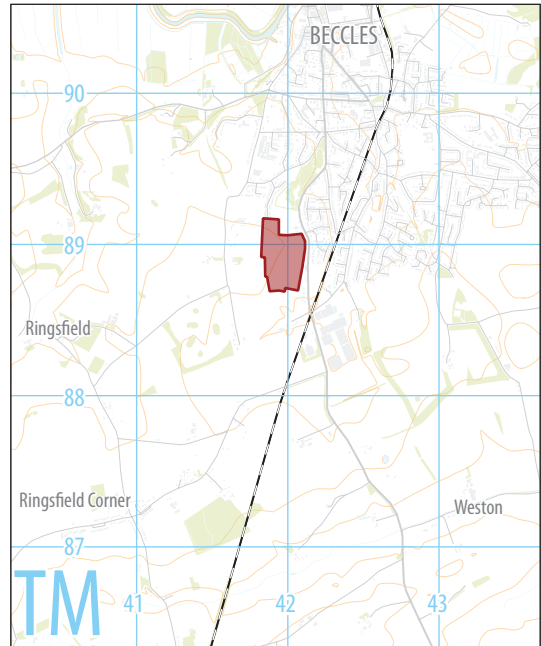
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Land west of London Road
Beccles
Suffolk

0 200km
1:10,000,000 @ A4



0 100m
1:5,000 @ A4

 proposed development area



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LAND WEST OF LONDON ROAD, BECCLES, SUFFOLK

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology was commissioned by Chris Harrison of CgMs Heritage (the Client), to undertake a geophysical (magnetometer) survey at the proposed site of a residential development on the south-western periphery of Beccles, in Suffolk (see Illus 1). The survey report will be submitted in support of a probable planning application and will be used to inform and determine future archaeological strategy.

The work was undertaken in accordance with a Written Scheme of Investigation for Geophysical Survey (Headland 2018). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out on 11th and 12th April 2018.

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The proposed development area (PDA) is located west of London Road (A145) Beccles (which forms the eastern site boundary) being centred at TM 4198 8891, on the south-western edge of Beccles. The PDA comprises a single field under permanent pasture (see Illus 2) which covers an area of approximately 9 hectares. Agricultural land borders the PDA to the south and west with a few buildings to the north.

The PDA slopes gradually down from north to south being at 32m above Ordnance Datum (AOD) at the north-western corner and 30m and 27m AOD in the south-western and south-eastern corners of the site.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Crag Group sands overlain by superficial deposits of Lowestoft Formation diamicton (NERC 2018).

The soils are classified in the Soilscape 10 association, characterised as freely draining sandy soils (Cranfield University 2018).

2 ARCHAEOLOGICAL BACKGROUND

A desk-based assessment (CgMs Heritage 2018) has established that there are no known archaeological sites within the PDA and few in the surrounding area. Consequently the assessment concluded that the PDA has a low potential for significant evidence from all periods. However, it was recognised that this assessment may be due to the lack of any systematic archaeological investigation within the PDA or surrounding area.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the survey area. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

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

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:5000. Illus 2 is a site condition photograph. Illus 3 is a 1:2,000 scale survey location plan showing the direction of survey as GPS swaths. Large-scale fully processed (greyscale) data, minimally processed data (XY traceplot) and an accompanying interpretative plot are also presented at a scale of 1:2,000 in Illus 4–6.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Headland 2018), guidelines outlined by Historic England (English Heritage 2008)

and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations 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 illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

The ground conditions were very good allowing for a balanced and stable operating system. Consequently the data quality is good throughout.

A moderate level of background magnetic variation is present throughout the dataset due to the effect of the undifferentiated superficial deposits and their incorporation into the upper soil horizons. Against this background, anomalies have been identified. All are discussed below and cross-referenced to specific anomalies on the interpretative drawings, where appropriate.

4.1 FERROUS AND MODERN ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', 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 is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

A high magnitude linear anomaly aligned south-east/north-west at the southern end of the PDA (Illus 6 – SP1) locates a sub-surface pipe.

Linear and arcing bands of high magnitude responses in the northern half of the PDA (Illus 6 – FT1 and FT2) locate farm tracks – the high magnitude response is due to the fired and highly magnetic material used to form the surface of the track.

Discrete clusters of high magnitude anomalies (Illus 6 – FP1 and B1) locate an infilled pond and the demolished remains of a building respectively. Both features are shown on the first edition mapping (see Illus 3).

In the south-eastern quarter of the PDA a discrete crescent shaped anomaly (Illus 6 – Q1) has been identified. There is no mapped feature that correlates with the anomaly. One possibility is that Q1 is a small backfilled extraction pit, probably for sand. Several such features are recorded on the historic mapping in the immediate vicinity of the PDA.



ILLUS 2 Geophysical survey area, looking south

Magnetic disturbance around the field edges is due to ferrous material within the adjacent boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historic Ordnance Survey (OS) maps indicates that the PDA formerly comprised four individual fields. Linear anomalies (Illus 6 FB1 – FB4) locate these former boundaries.

Linear trend anomalies aligned at right angles to these former (or current) boundaries are assumed to be due to recent agricultural activity, either caused by ploughing or to field drains. The magnitude of these anomalies is varied with some being extremely weak whilst some, such as those in the north-west corner of the site are much stronger. Nevertheless all are considered to be of likely agricultural origin.

4.3 GEOLOGICAL ANOMALIES

Numerous discrete anomalies comprising small areas of slight magnetic enhancement are identified throughout the PDA. These anomalies are caused by localised variations in the depth and composition of the soils.

4.4 ANOMALIES OF UNCERTAIN ORIGIN

Two anomalies of uncertain origin are identified and for this reason an archaeological origin should therefore be considered.

Linear anomaly (Illus 6 – D1), aligned broadly east/west, is slightly oblique to the alignment of the current and former field layout and may be indicative of a ditch forming part of an earlier field system. However, the anomaly could equally plausibly be interpreted as having an agricultural and/or modern origin.

The second anomaly lies immediately south of D1, respects and is at right angles to it. It is on the same alignment as other linear trend anomalies which are interpreted as agricultural. However, this anomaly is much broader and of higher magnitude, hence the uncertainty of its origin. However, on balance it is thought most likely to be of agricultural or modern origin.

5 CONCLUSION

The survey has successfully evaluated the PDA. No anomalies of definite archaeological potential have been identified although two anomalies of uncertain origin have been recorded. Anomalies that have been identified are due to recent activity and agricultural practice including former boundaries and tracks, ploughing and drains, an infilled pond and demolished building. A possible small sand pit has also been identified. On the basis of the geophysical survey, the archaeological potential of the PDA is assessed as low corroborating the results of an earlier desk-based assessment.

6 REFERENCES

CgMs Heritage 2018 *London west of London Road, Beccles Archaeological Desk Based Assessment* [unpublished client report] CgMs Heritage Ref. CH\24246/01

Chartered Institute for Archaeologists (CIfA) 2014 *Standard and guidance for archaeological geophysical survey* (Reading) http://www.archaeologists.net/sites/default/files/CIfA&Geophysics_1.pdf accessed 19 April 2018

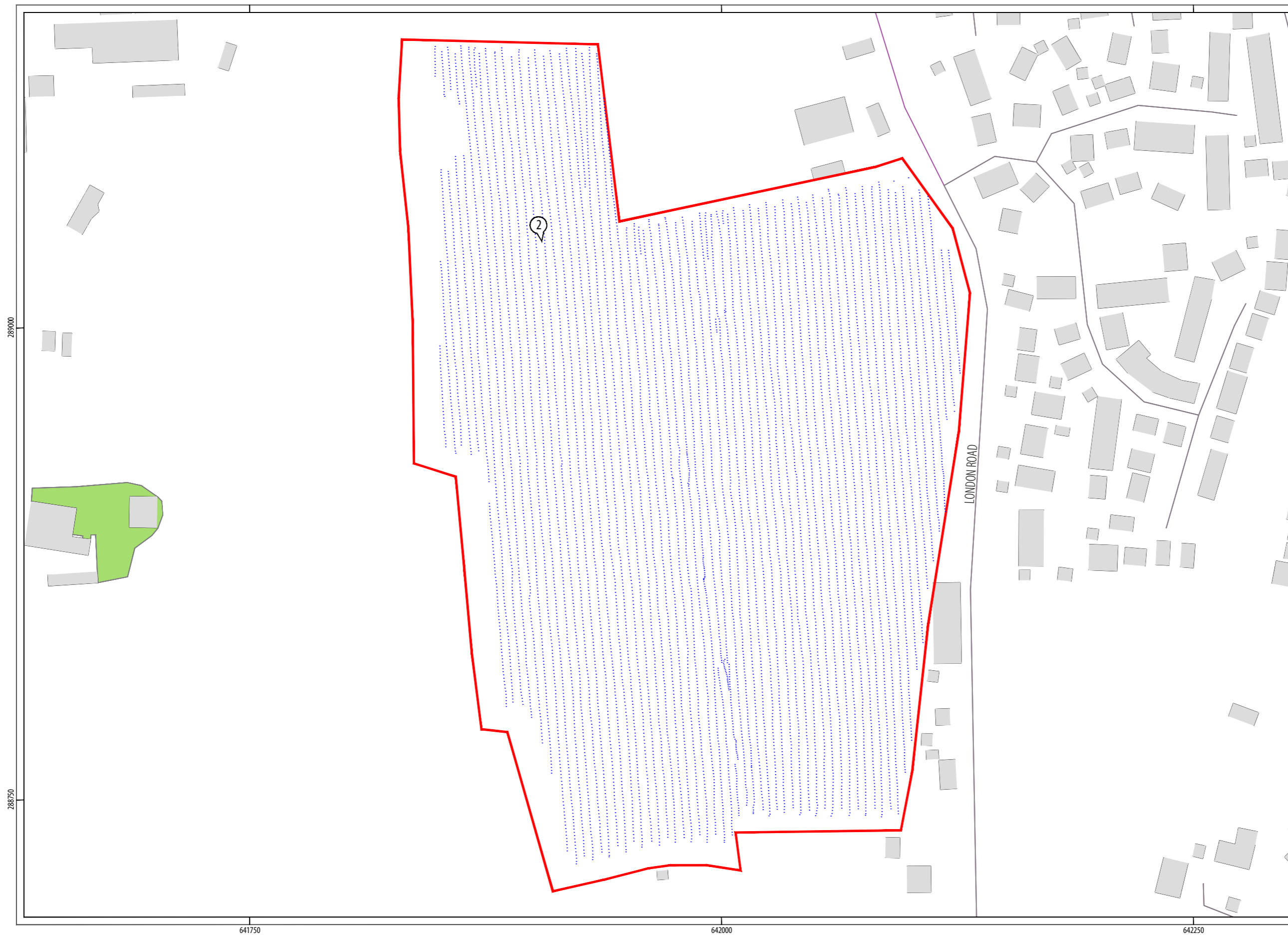
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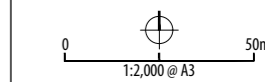
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Headland Archaeology 2018 *Land west of London Road, Beccles, Suffolk; Written Scheme of Investigation for Geophysical Survey* [unpublished client report] Headland Archaeology Ref. LRBS18

Natural Environment Research Council (NERC) 2018 British Geological Survey <http://www.bgs.ac.uk/> accessed 16 April 2018



- proposed development area
- GPS swaths
- location and direction of ILLUS 2



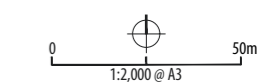
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ILLUS 3 Survey location showing GPS swaths (1:2,000)



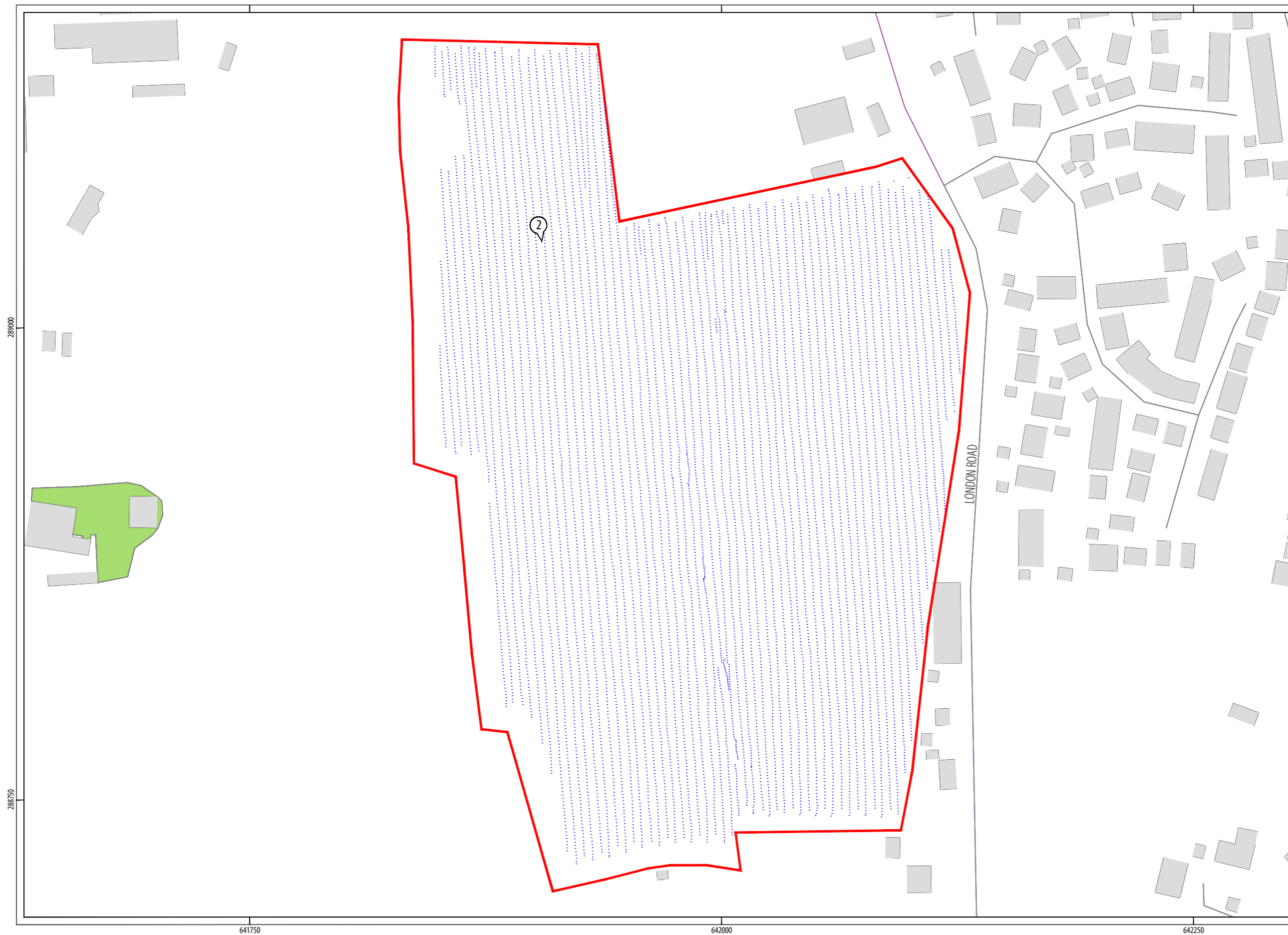
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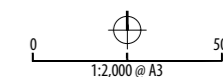


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ILLUS 4 Processed greyscale magnetometer data (1:2,000)



- proposed development area
- GPS swaths
- location and direction of ILLUS 2



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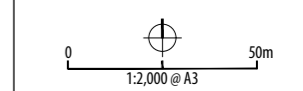
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TYPE OF ANOMALY	INTERPRETATION
• dipolar isolated	ferrous material
••• magnetic disturbance	ferrous material
— dipolar linear	service pipe
— linear trend	agricultural
— linear	former field boundary
••• magnetic enhancement	agricultural?
••• magnetic enhancement	geology
••• magnetic enhancement	quarrying?
••• magnetic enhancement	archaeology?

ABBREVIATIONS

B	building
D	ditch
FB	former boundary
FP	former pond
FT	farm track
Q	quarry
SP	service pipe



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ILLUS 6 Interpretation of magnetometer data; Sector 1 (1:2,000)

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

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 haematite. 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 so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue 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. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

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 (sometimes only visible on an XY trace plot) 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.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data 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 coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associated world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: *headland5-313807*

PROJECT DETAILS	
Project name	Land west of London Road, Beccles
Short description of the project	A geophysical survey of a site west of London Road, Beccles
Project dates	Start: 11-04-2018 End: 13-04-2018
Previous/future work	Yes / Not known
Any associated project reference codes	LRBS18 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Rural residential
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Crag Group – sand
Drift geology (other)	Lowestoft
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	SUFFOLK WAVENEY BECCLES Land west of London Road, Beccles
Study area	9 Hectares
Site coordinates	TM 4198 8891 52.443902909269 1.561079715208 52 26 38 N 001 33 39 E Polygon
Entered by	Sam Harrison (sam.harrison@headlandarchaeology.com)
Entered on	10 April 2018



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