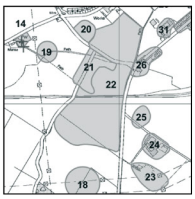
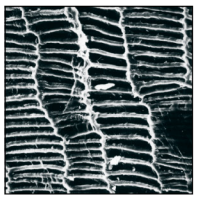
LISC/01








LAND SOUTH OF HORSEHEATH ROAD, LINTON, CAMBRIDGESHIRE

GEOPHYSICAL SURVEY

commissioned by CgMs Consulting

S/1969/15/OL

April 2016

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LAND SOUTH OF HORSEHEATH ROAD, LINTON, CAMBRIDGESHIRE

GEOPHYSICAL SURVEY

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S/1969/15/OL

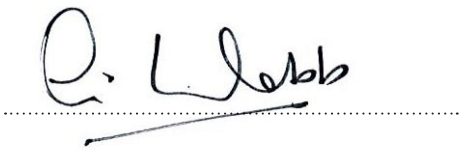
April 2016

project info

HA JOB NO.	LISC/01
NGR	557178,246780
PARISH	Linton
LOCAL AUTHORITY	Cambridgeshire
OASIS REF.	headland5-233642

project team

PROJECT MANAGER	Sam Harrison
AUTHOR	David Harrison
FIELDWORK	Alex Schmidt, Ross Bishop
GRAPHICS	Caroline Norrman, David Harrison, Rafael Maya-Torcelly
APPROVED BY	Alistair Webb – Project Manager



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north@headlandarchaeology.com

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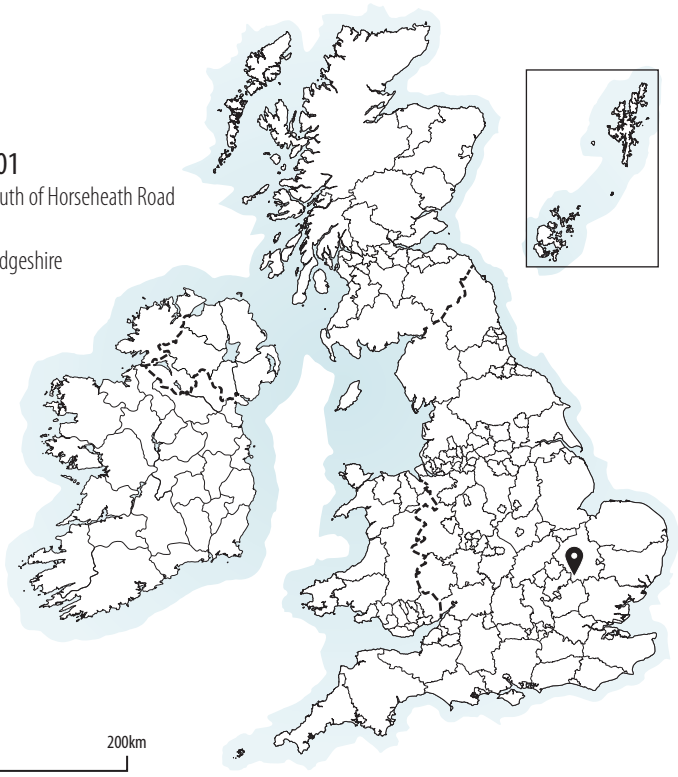
PROJECT SUMMARY

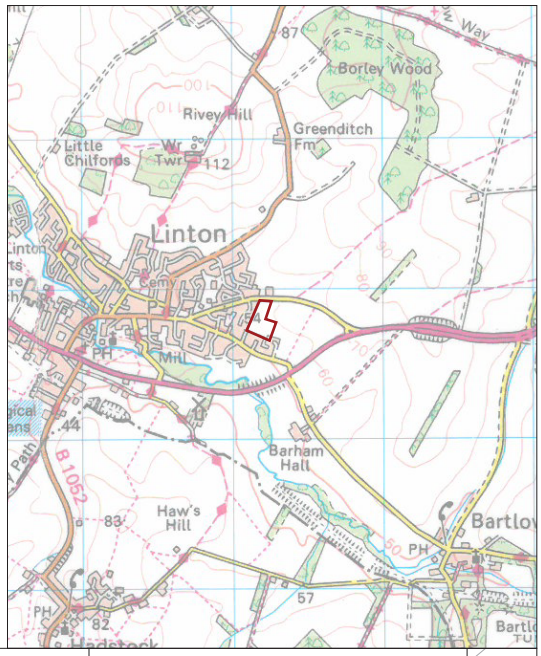
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 3 hectares to the south of Horseheath Road, Linton, to provide information about the archaeological potential of the site in advance of a proposed residential development. The site is located in a rich archaeological landscape with a possible Anglo-Saxon cemetery located 100m to the south. A clear ring ditch has been identified close to the southern site boundary, locating the remains of a probable ploughed-down barrow although no direct correlation with the possible Saxon cemetery can be inferred. No anomalies indicative of graves have been identified in the survey. Within the south-west corner of the site a short ditch and two pit-type anomalies have been ascribed some archaeological potential. Elsewhere, the survey data is dominated by patterns of broad sinuous parallel anomalies which are caused by soil-filled fissures in the chalk bedrock. There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the survey area. Therefore, based solely on the results and interpretation of the data, the archaeological potential at the southern boundary of the site is considered to be high and low in the north.

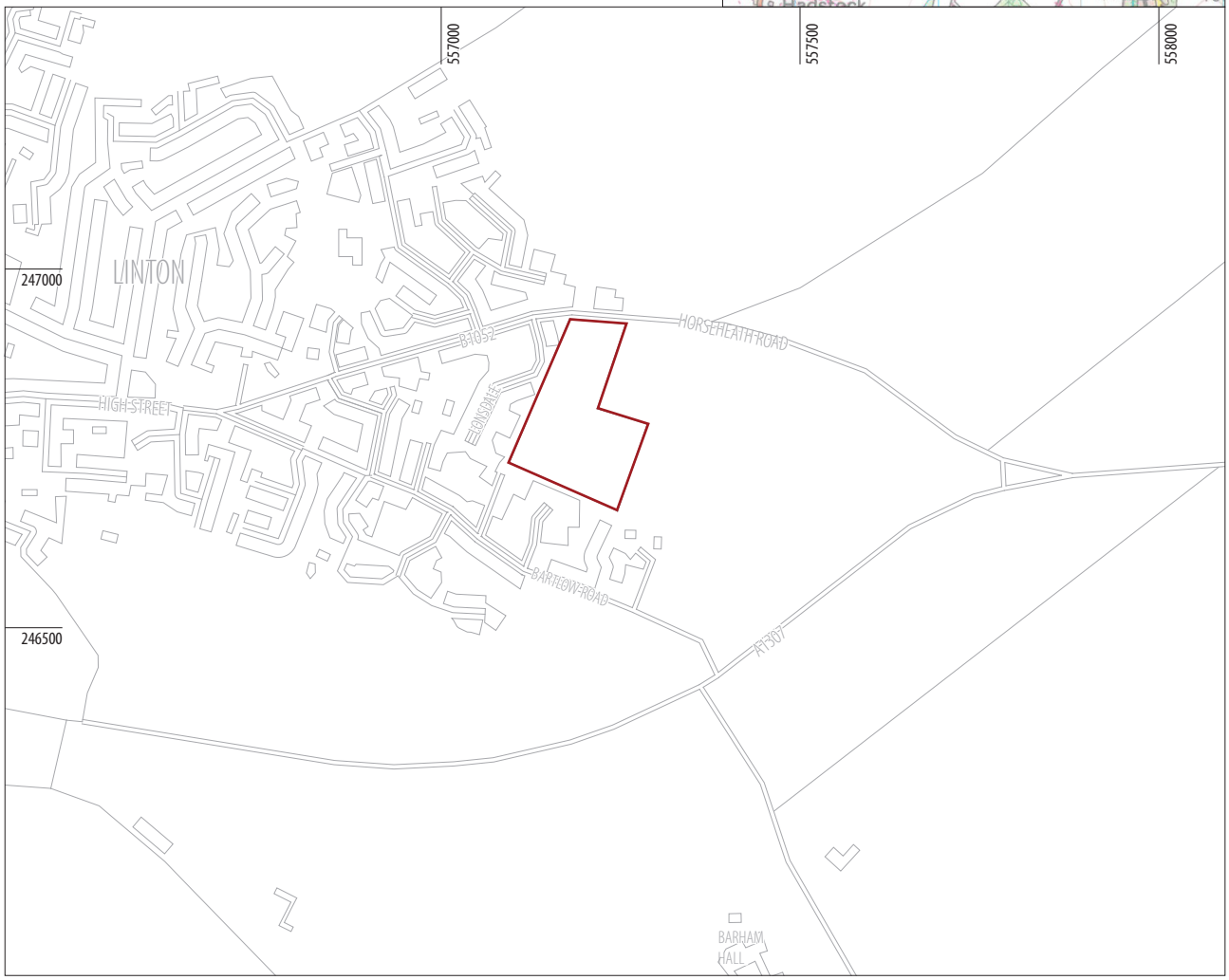
CONTENTS

LIST OF ILLUSTRATIONS

LISC/01
land south of Horseheath Road
Linton
Cambridgeshire







KEY
development boundary

N
0 500m
scale 1:10,000 @ A4

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ILLUS 1 Site location

LAND SOUTH OF HORSEHEATH ROAD, LINTON, CAMBRIDGESHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by CgMs Consulting (The Client) to undertake a geophysical (magnetometer) survey on land which is proposed for residential development (Planning Ref. S/1969/15/OL) to the south of Horseheath Road, Linton, Cambridgeshire.

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2015) which was submitted to Kasia Gdaniec (Senior Archaeologist, Historic Environment Team, Cambridgeshire County Council), with guidance within the National Planning Policy Framework (DCLG 2012) and in line with current best practice (David et al. 2008). The survey was carried out on 30th November 2015 in order to provide additional information on the archaeological potential of the site.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises of an L-shaped parcel of land within a single field on the eastern periphery of Linton, centred at NGR 557178, 246780 (see **ILLUS 1**). The field is bound to the north by the B1052 Horseheath Road, to the west by residential properties fronting onto Lonsdale, to the south by residential properties fronting onto Martins Lane, Harefield Rise and Kenwood Gardens and to the east by a hedged field boundary, beyond which lies arable farmland.

Generally, the field lies on a gentle south-facing slope being at 62m above Ordnance Datum (aOD) at Horseheath Road and 55m aOD at the southern boundary. Locally, the topography slopes towards a broad low channel running south-west from the north-eastern corner of the field.

At the time of the survey the field contained a short cereal crop (see **ILLUS 2**).

1.2 GEOLOGY AND SOILS

The underlying bedrock consists of New Pit Chalk Formation. No superficial deposits are recorded (British Geological Survey 2015).

The soils are classified in the Soilscape 5 association, characterised as freely draining lime-rich loams (LandIS 2015).

2 ARCHAEOLOGICAL BACKGROUND

The Design Brief for Archaeological Evaluation (Cambridgeshire County Council 2015) states that the PDA lies in an area of high archaeological potential. To the immediate south of the site a Saxon burial ground (Cambridgeshire Historic Environment Record (HER) Ref. MCB16249) was uncovered during house construction works (see **ILLUS 3**). Further south a Roman cemetery is recorded (MCB7542) and further human remains are recorded to the west of the PDA including cremation burials (MCB7440) and Saxon burials (MCB17059, MCB7442 and MCB7441). The medieval core of the village of Linton lies to the west of the PDA, and archaeological investigations have revealed evidence of post-medieval occupation to the west and the north-west of the PDA (MCB15263 and MCB13088).

3 AIMS, METHODOLOGY AND PRESENTATION

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of any proposed development on any potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended.

The general 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. Features such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce

ILLUS 2 General view of survey area, looking south

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 and 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 is programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses 4m apart. These readings are stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system is 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 has been used to collect and export the data. Terrasurveyor V3.0.27.1 (DWConsulting) software has been used to process and present the data.

3.2 REPORTING

A general site location plan is shown in **ILLUS 1** at a scale of 1:10,000. **ILLUS 2** is a general site condition photograph. A large scale (1:2,500) survey location plan showing the processed greyscale magnetometer data is presented in **ILLUS 3** and detailed data plots ('raw' and processed) and an interpretative illustration are presented at a scale of 1:1,000 in **ILLUS 4**, **ILLUS 5** and **ILLUS 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. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 4.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Headland Archaeology 2015) and guidelines outlined by English Heritage (David et al. 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (Ó 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

Generally, the survey has detected a variable magnetic background throughout the PDA. The data is dominated by broad curvilinear anomalies caused by soil-filled fissures in the chalk bedrock (see Section 4.3). Within this background, numerous areas of magnetic enhancement have been identified. These are discussed below and cross-referenced to specific examples on the interpretive figures, where appropriate.

ILLUS 3 Survey location showing greyscale magnetometer data (1:2,500)

4.1 FERROUS 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 or material is common on most sites, often being present as a consequence of manuring or tipping/infilling. At the southern site boundary, two particularly high magnitude 'spikes', A and B (see **ILLUS 6**), are probably caused by large buried ferrous objects.

Magnetic disturbance at the perimeter of the survey area is caused by ferrous material within the adjacent field boundaries and by the close proximity of buildings and gardens.

4.2 AGRICULTURAL ANOMALIES

Analysis of historical mapping indicates that the division of land within the PDA has remained unchanged since the publication of the first edition Ordnance Survey map in 1886. The 1838 Enclosure Map, however, shows the PDA as being subdivided into a number of north/south orientated strip-fields. A fragmented linear anomaly, C, within the west of the PDA runs parallel with the extant field boundaries and is thought to be caused by one of these former strip-field boundaries. The anomaly is caused by the magnetically-enhanced soil-fill of a ditch.

A faint linear trend, D, in the north of the PDA runs parallel with Horseheath Road and is thought to be caused by a modern ploughing headland. Further south, and aligned north-east/south-west a series of parallel faint linear trends are identified, E - H. The anomalies are oblique to the existing and historical pattern of land division and are probably caused by field drains.

4.3 GEOLOGICAL ANOMALIES

Two distinct patterns of geological anomalies have been identified across the PDA, appearing on either side of the low north-east/south-west undulation in topography. Within the north of the site a series of north/south parallel curvilinear trends, I, can be seen. Following the contours of the slope, the trends form an extension to a pattern of cropmarks which is visible on aerial photographs (Google Earth 2015) and are thought to be caused by soil-filled fissures in the chalk bedrock. Within the southern half of the PDA, the anomalies, J, are broader, and more sinuous but are thought to be due to the same natural process.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Within the north of the PDA a faint curvilinear trend, K, may be of archaeological interest, perhaps being due to a soil-filled ditch. However, the anomaly is isolated and partly corresponds to the same north-east/south-west alignment upon which a series of probable field drains, E – H, have been identified (see Section 4.2). It is likely therefore that the anomaly is due to a field drain.

In the south-west corner of the field a linear anomaly, L, can be seen on a north-west/south-east orientation. The anomaly is thought to be due to a soil-filled ditch, and may also be of archaeological interest. However, the anomaly appears at right-angles to the series of possible field drains, E – H, raising the possibility that the ditch may be agricultural in origin. Nevertheless, given the local context, an archaeological origin cannot be dismissed. Discrete anomalies M and N, immediately south of L, are more clearly defined and higher in magnitude than the surrounding geological anomalies and are interpreted as being possible archaeological anomalies, perhaps being due to soil-filled pits.

4.5 ARCHAEOLOGICAL ANOMALIES

A well-defined circular anomaly, O, measuring 29m in diameter, has been identified close to the southern site boundary, centred at NGR 557194, 246712. The anomaly is caused by a soil-filled ditch. No definite internal features have been identified by the survey although a number of low magnitude anomalies have been marked as being of possible archaeological potential, perhaps being due to pits. Nor has any clear entrance been identified, although the anomaly is masked in the south-east by high-magnitude ferrous anomalies A and B. It is likely therefore, that that anomaly locates the site of a ploughed-down barrow. The anomaly is located 100m north of the possible Anglo-Saxon cemetery (MCB16249; see **ILLUS 2**) although no anomalies have been identified by the survey which might clearly correlate the probable barrow to the cemetery site.

5 CONCLUSION

The geophysical survey has identified a circular anomaly close to the southern boundary of the site which is interpreted as a probable barrow. Discrete anomalies within its interior may indicate pits. No obvious anomalies have been identified to suggest a correlation between the probable barrow and the possible Saxon cemetery (MCB16249) which is located 100m to the south although a probable ditch and two pit-type anomalies at the south-west corner of the site may be of interest. No anomalies that are indicative of graves have been identified in the survey.

Elsewhere, the survey has identified numerous sinuous anomalies throughout the dataset which are thought to be due to soil-filled fissures in the chalk bedrock.

There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the survey area. Therefore, based solely on the results and interpretation of the geophysical data, the archaeological potential within the south of the site is assessed to be high, and low in the north.

6 REFERENCES

British Geological Survey 2015 Available: www.bgs.ac.uk/discoveringGeology/geology OfBritain/viewer.html Accessed: December 7th 2015

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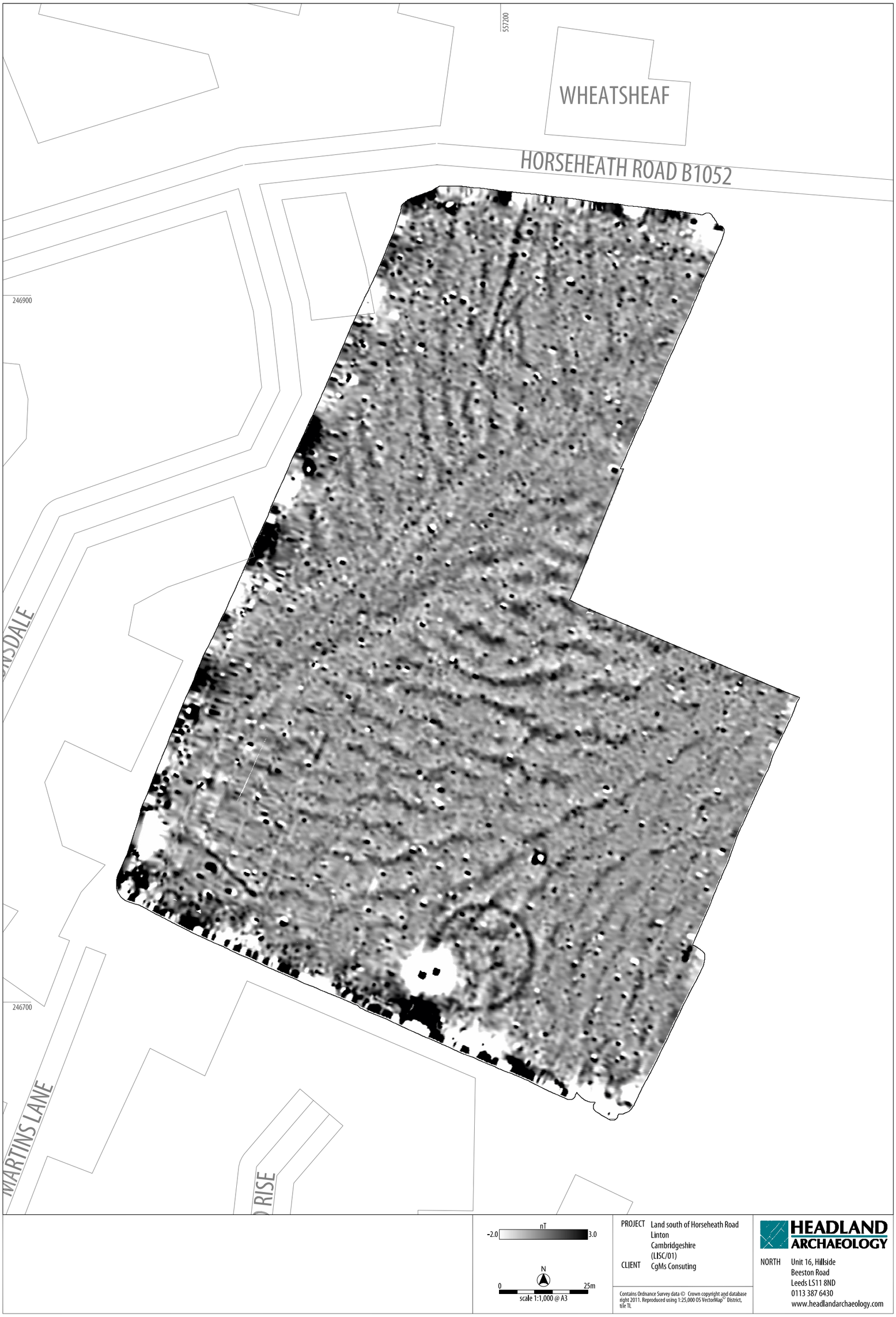
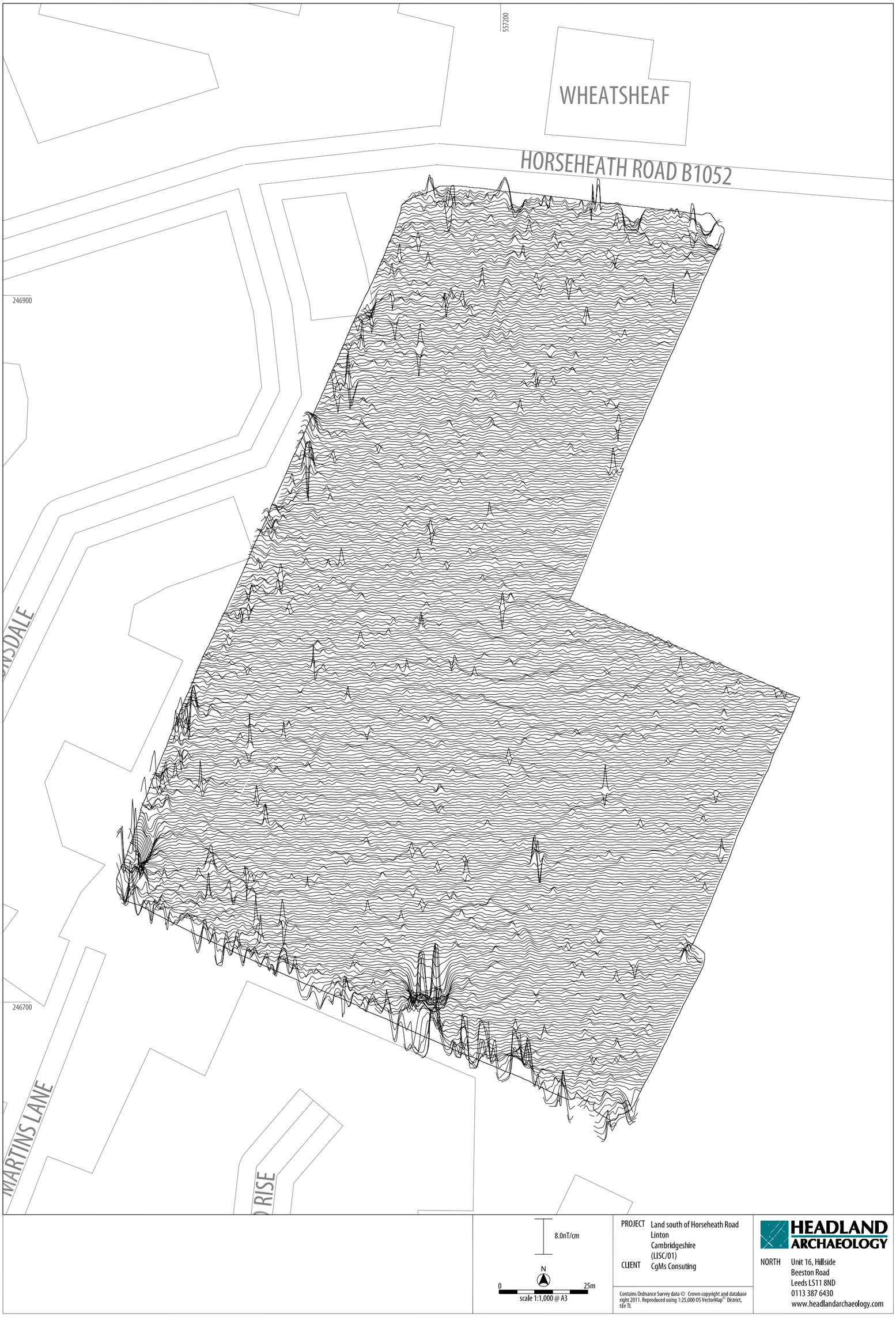
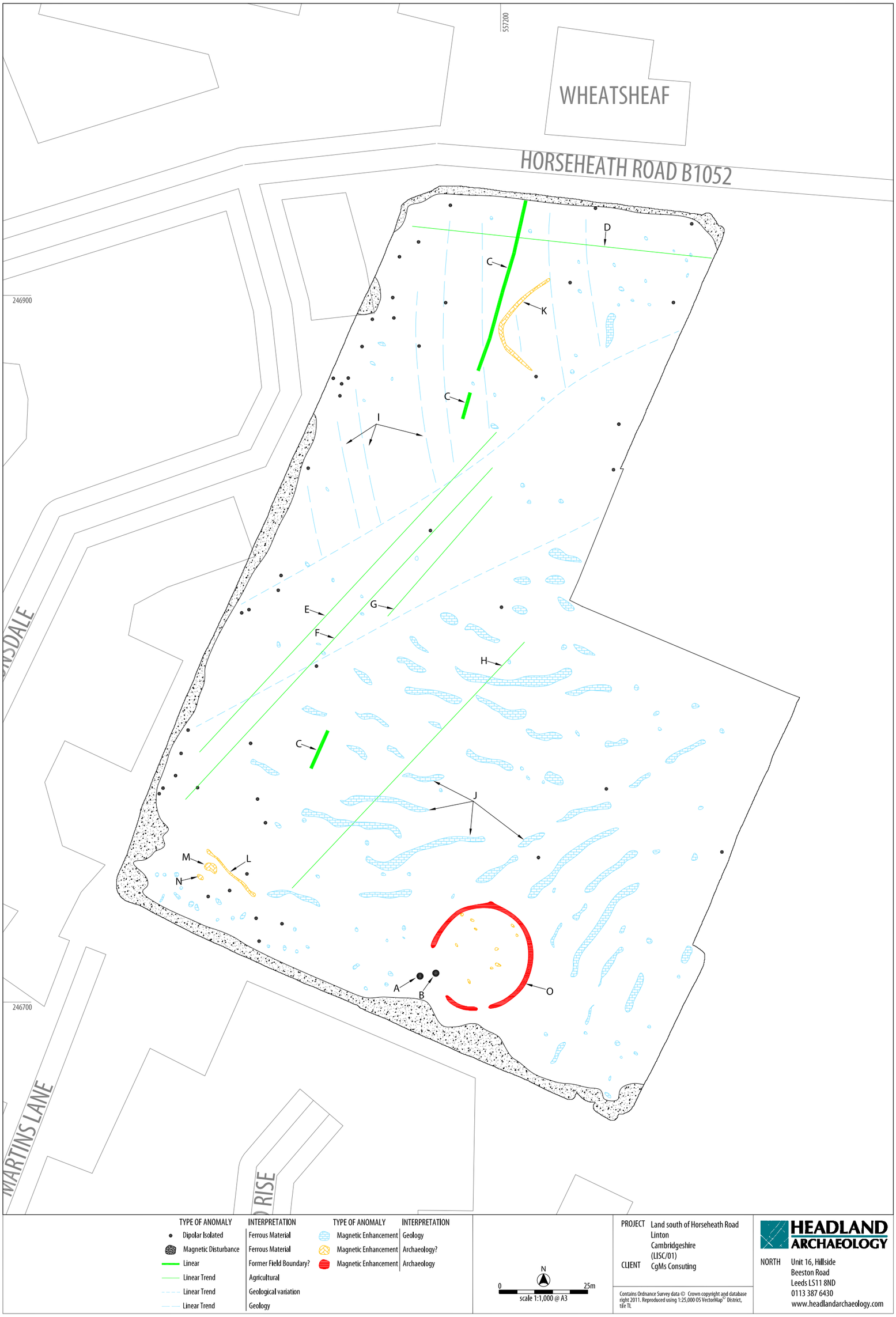


ILLUS 4 Processed greyscale magnetometer data (1:1,000)



ILLUS 5 XY trace plot of minimally processed magnetometer data (1:1,000)



TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
Dipolar Isolated	Ferrous Material	Magnetic Enhancement	Geology
Magnetic Disturbance	Ferrous Material	Magnetic Enhancement	Archaeology?
Linear	Former Field Boundary?	Magnetic Enhancement	Archaeology
Linear Trend	Agricultural		
Linear Trend	Geological variation		
Linear Trend	Geology		

N

0 25m

scale 1:1,000 @ A3

PROJECT Land south of Horseheath Road
Linton
Cambridgeshire
(LISC/01)

CLIENT CgMs Consuting

HEADLAND ARCHAEOLOGY

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

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 associate 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 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-233642

PROJECT DETAILS	
Project name	Land south of Horseheath Road, Linton, Cambridgeshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 3 hectares to the south of Horseheath Road, Linton, to provide information about the archaeological potential of the site in advance of a proposed residential development. The site is located in a rich archaeological landscape with a possible Anglo-Saxon cemetery located 100m to the south. A clear ring ditch has been identified close to the southern site boundary, locating the remains of a probable ploughed-down barrow although no direct correlation with the possible Saxon cemetery can be inferred. Within the south-west corner of the site a short ditch and two pit-type anomalies have been ascribed some archaeological potential. Elsewhere, the survey data is dominated by patterns of broad sinuous parallel anomalies which are caused by soil-filled fissures in the chalk bedrock. There is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the survey area. Therefore, based solely on the results and interpretation of the data, the archaeological potential at the southern boundary of the site is considered to be high and in the north.
Project dates	Start: 30-11-2015 End: 30-11-2015
Previous/future work	Not known / Not known
Any associated project reference codes	001 - Contracting Unit No.
Any associated project reference codes	LISC - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Between deposition of an application and determination
Solid geology	CHALK (INCLUDING RED CHALK)
Drift geology (other)	None
Techniques	Magnetometry

PROJECT LOCATION	
Country	England
Site location	CAMBRIDGESHIRE SOUTH CAMBRIDGESHIRE LINTON Land south of Horseheath Road, Linton
Postcode	CB21 4LT
Study area	3 Hectares
Site coordinates	TL 57178 46780 52.096555003574 0.294850563877 52 05 47 N 000 17 41 E Point

PROJECT CREATORS

Name of Organisation	Headland Archaeology
Project brief originator	Cambridgeshire County Council
Project design originator	Headland Archaeology
Project director/manager	Harrison, S
Project supervisor	Schmidt, A
Type of sponsor/funding body	Developer

PROJECT ARCHIVES

Physical Archive Exists?	No
Digital Archive Exists?	No
Digital Media available	"Geophysics"
Paper Archive Exists?	No
Paper Media available	"Report"

PROJECT BIBLIOGRAPHY 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land south of Horseheath Road, Linton, Cambridgeshire: Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Date	2015
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	A4 bound report
Entered by	David Harrison (david.harrison@headlandarchaeology.com)
Entered on	9 December 2015

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