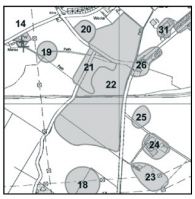
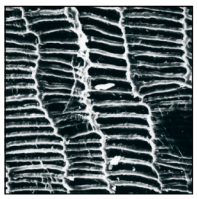
KCGL19










SITE K1B, KEMBLE CIRENCESTER, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

commissioned by Resisolutions
on behalf of Kemble Farms Ltd

February 2019

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

SITE K1B, KEMBLE
CIRENCESTER, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

commissioned by Resisolutions
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February 2019

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This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **KCGL19** / NGR **ST 9888 9761** / Parish **Kemble** / Local Authority **Gloucestershire** / OASIS Ref. **headland5-343814**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **David Harrison** / Fieldwork **Beth Shenton, Ross Bishop** / Graphics **David Harrison, Eleanor Winter**

Approved by **Sam Harrison** .....

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

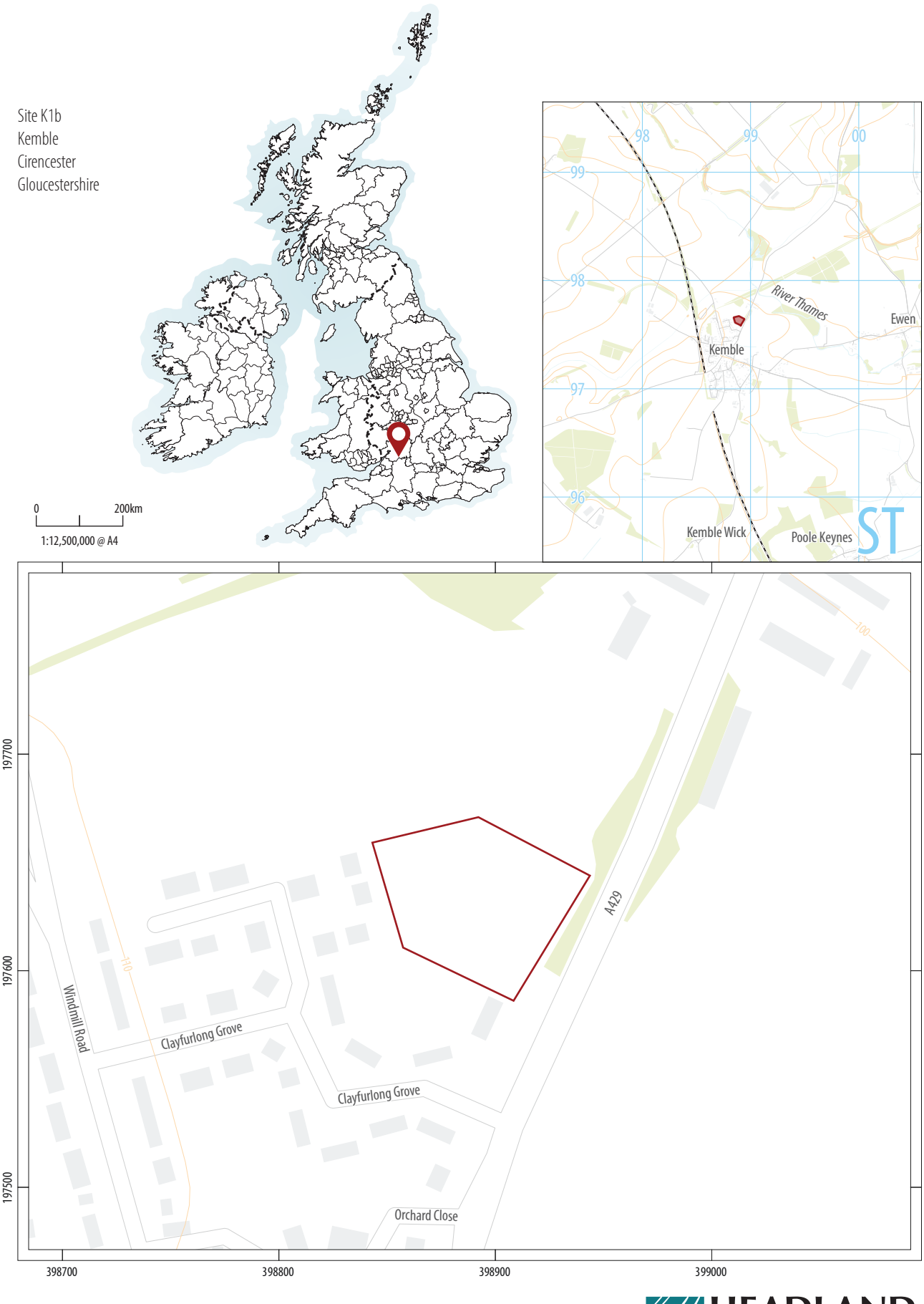
HEADLAND ARCHAEOLOGY

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 0.5 hectare site on land on the northern periphery of Kemble, Gloucestershire, where a new residential development (Site K1b) is proposed. The site is located in an area of high archaeological potential with Anglo Saxon burials recorded on the Gloucestershire Historic Environment Record (GHER) both north and immediately south of the current site. Numerous discrete anomalies have been identified throughout the survey area. These anomalies may be caused by archaeological features such as pits or possibly graves. However, a geological interpretation for any or all of these anomalies is also considered possible due to the susceptibility of the limestone bedrock to erosion by water. This can lead to the natural formation of features which, when filled with soil, are very difficult to distinguish from infilled archaeological features. No clear archaeological pattern can be discerned hence most anomalies have been interpreted as geological. A cluster of broader, higher magnitude anomalies are ascribed higher archaeological potential and are interpreted as possible pits and/or burials although this interpretation is also considered tentative.

CONTENTS

LIST OF ILLUSTRATIONS



HEADLAND ARCHAEOLOGY
Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

ILLUS 1 Site location

SITE K1B, KEMBLE CIRENCESTER, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by The Environmental Dimension Partnership (the Archaeological Consultant) acting on behalf of Kemble Farms Ltd, to undertake a geophysical (magnetometer) survey of land on the northern periphery of Kemble, Gloucestershire, where a new residential development (Site K1b) is proposed. The results of the survey will inform future archaeological strategy at the site.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2019) which was submitted to, and approved by, Charles Parry (Gloucestershire County Council Archaeologist), with guidance within the National Planning Policy Framework (MHCLG 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was carried out on 5 February 2019.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) is located on the northern periphery of the village of Kemble, 5km south-west of Cirencester (centred on ST 9888 9761). It comprises a polygonal parcel of land, 0.5 hectares in size, which is bound to the east by the A429 and to the south and west by residential properties and gardens fronting onto Clayfurlong Grove. The northern PDA limit is unbound (Illus 1).

The topography rises slightly from 106m Above Ordnance Datum (AOD) at the A429 in the east of the PDA to 108m AOD in the west. At the time of the survey the PDA was under short grass (Illus 2).

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Forest Marble Formation – Limestone. No superficial deposits are recorded (NERC 2019).

The soils are classified in the Soilscape 3 Association, characterised as freely-draining, shallow, lime-rich soils (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

No heritage assets are recorded within the PDA on the GHER. However, 26 Anglo-Saxon burials were discovered at Clayfurlong Farmhouse (GHER 3117), 150m north of the PDA, in the mid-nineteenth century and in 1986 two shallow and plough-damaged Anglo-Saxon inhumations were discovered in the rear gardens of 39 and 49 Clayfurlong Grove to the immediate south of the PDA (HER 4894; see Illus 3).

Subsequent archaeological investigations in advance of development on Clayfurlong Grove (Cotswold Archaeology 1989), immediately west of the PDA, identified no archaeological features to confirm the presence of an Anglo-Saxon burial ground. The evaluation report concluded that either the cemetery, represented by finds at Clayfurlong Grove and Clayfurlong Farm, extends beneath the field containing the current PDA or that the two groups of burials represent discrete clusters which are unconnected and are not part of a more extensive complex.

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ILLUS 2 PDA, looking west

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 PDA. 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 0.5m intervals (0.5m 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) 2m apart (Illus 3). 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 1:7,500. Illus 2 is a site condition photograph. Illus 3 shows the survey location and the direction of survey as GPS swaths at a scale of 1:2,500. Large scale minimally processed (XY trace plot) data, fully processed (greyscale) data and an accompanying interpretative plot are presented at a scale of 1:1,000 in Illus 4–6 inclusive.

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 (Harrison 2019), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2016). 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

Ground conditions were good across the entire survey area leading to a high standard of data.

The survey has detected a variable magnetic background across the PDA which is characterised by numerous discrete anomalies and faint ploughing trends. These are discussed below and cross-referenced to specific examples on the interpretive figure, where appropriate.

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 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.

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

4.2 AGRICULTURAL ANOMALIES

Closely-spaced parallel linear trend anomalies aligned both parallel with, or at right angles to, the field boundaries are due to modern ploughing.

4.3 GEOLOGICAL ANOMALIES

Discrete low-magnitude anomalies are identified throughout the PDA. Potentially, any of these anomalies could be caused by soil-filled pits and/or graves. However, the underlying bedrock comprises limestone which can be soft and susceptible to erosion from water and ice. In-filled solution hollows also manifest as discrete anomalies making it very difficult to differentiate between naturally formed and archaeological features. In the absence of any clear archaeological patterns in the data, most of these anomalies are therefore interpreted as geological in origin.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Several higher magnitude discrete anomalies have been identified by the survey including a cluster in the north-west of the PDA where the anomalies are notably broader and of a higher magnitude than the surrounding discrete anomalies. These anomalies are ascribed higher archaeological potential and are interpreted as of possible archaeological potential, perhaps locating soil-filled features such as pits and/or graves although a geological origin is also considered possible.

5 CONCLUSION

No anomalies of definite archaeological potential have been identified by the survey and, whilst discrete anomalies have been identified across the site, none can be confidently interpreted as being due to inhumation activity. However, archaeological features, such as unenclosed pits and/or graves, can be difficult to differentiate from discrete natural features, such as solution hollows, on limestone geology. For this reason, any of the discrete anomalies identified by the survey could potentially be archaeological in origin although, in the absence of any clear archaeological pattern most are tentatively ascribed a geological interpretation. Broader, higher magnitude anomalies, including a distinctive cluster in the north-west, may be considered to have a higher archaeological potential and are therefore interpreted as possible pits and/or burials even if a geological origin for these anomalies is also possible.

6 REFERENCES

Chartered Institute for Archaeologists (CIfA) 2016 ***Standard and guidance for archaeological geophysical survey*** Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf accessed 12 February 2019

Cotswold Archaeology 1989 ***Clayfurlong Grove, Kemble, Gloucestershire; Archaeological Evaluation*** [unpublished document]

Cranfield University 2018 ***Cranfield Soil and Agrifood Institute Soilscapes*** http://www.landis.org.uk/soilscapes/ accessed 12 February 2019

Europae Archaeologia Consilium 2016 ***EAC Guidelines for the use of Geophysics in Archaeology, Archaeolingua 2016: Questions to Ask and Points to Consider*** Namur, Belgium https://historicengland.org.uk/images-books/publications/eac-guidelines-for-use-of-geophysics-in-archaeology/ accessed 12 February 2019

Gaffney C & Gater J (2003) ***Revealing the Buried Past: Geophysics for Archaeologists*** Stroud

Harrison S 2019 ***Site K1b, Kemble, Cirencester; Written Scheme of Investigation for Geophysical Survey*** [unpublished client document] Headland Archaeology, Ref KCGL19

Ministry of Housing, Communities and Local Government (MHCLG) 2018 ***National Planning Policy Framework*** https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf accessed 12 February 2019

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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 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.

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APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-343814

Project details	
Project name	Site K1b, Kemble, Cirencester, Gloucestershire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 0.5 hectare site on land on the northern periphery of Kemble, Gloucestershire, where a new residential development (Site K1b) is proposed. The site is located in an area of high archaeological potential with Anglo Saxon burials recorded on the Gloucestershire Historic Environment Record (GHER) both north and immediately south of the current site. Numerous discrete anomalies have been identified throughout the survey area. These anomalies may be caused by archaeological features such as pits or possibly graves. However, a geological interpretation for any or all of these anomalies is also considered possible due to the susceptibility of the limestone bedrock to erosion by water. This can lead to the natural formation of features which, when filled with soil, are very difficult to distinguish from infilled archaeological features. No clear archaeological pattern can be discerned hence most anomalies have been interpreted as geological. A cluster of broader, higher magnitude anomalies are ascribed higher archaeological potential and are interpreted as possible pits and/or burials although this interpretation is also considered tentative.
Project dates	Start: 05-02-2019 End: 05-02-2019
Previous/future work	No / Not known
Any associated project reference codes	KCGL19 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A
Monument type	N/A
Significant Finds	N/A
Significant Finds	N/A
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Forest Marble Formation - Limestone
Drift geology (other)	None
Techniques	Magnetometry
Project location	
Country	England
Site location	GLOUCESTERSHIRE COTSWOLD KEMBLE Site K1b, Kemble, Cirencester, Gloucestershire
Study area	0.5 Hectares
Site coordinates	ST 9888 9761 51.676793284301 -2.016199671257 51 40 36 N 002 00 58 W Point
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	EDP
Project design originator	Headland Archaeology
Project director/manager	Harrison, S
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer

Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Site K1b, Kemble, Cirencester, Gloucestershire; Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Date	2019
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	PDF[A]
Entered by	David Harrison (david.harrison@headlandarchaeology.com)
Entered on	26 February 2019

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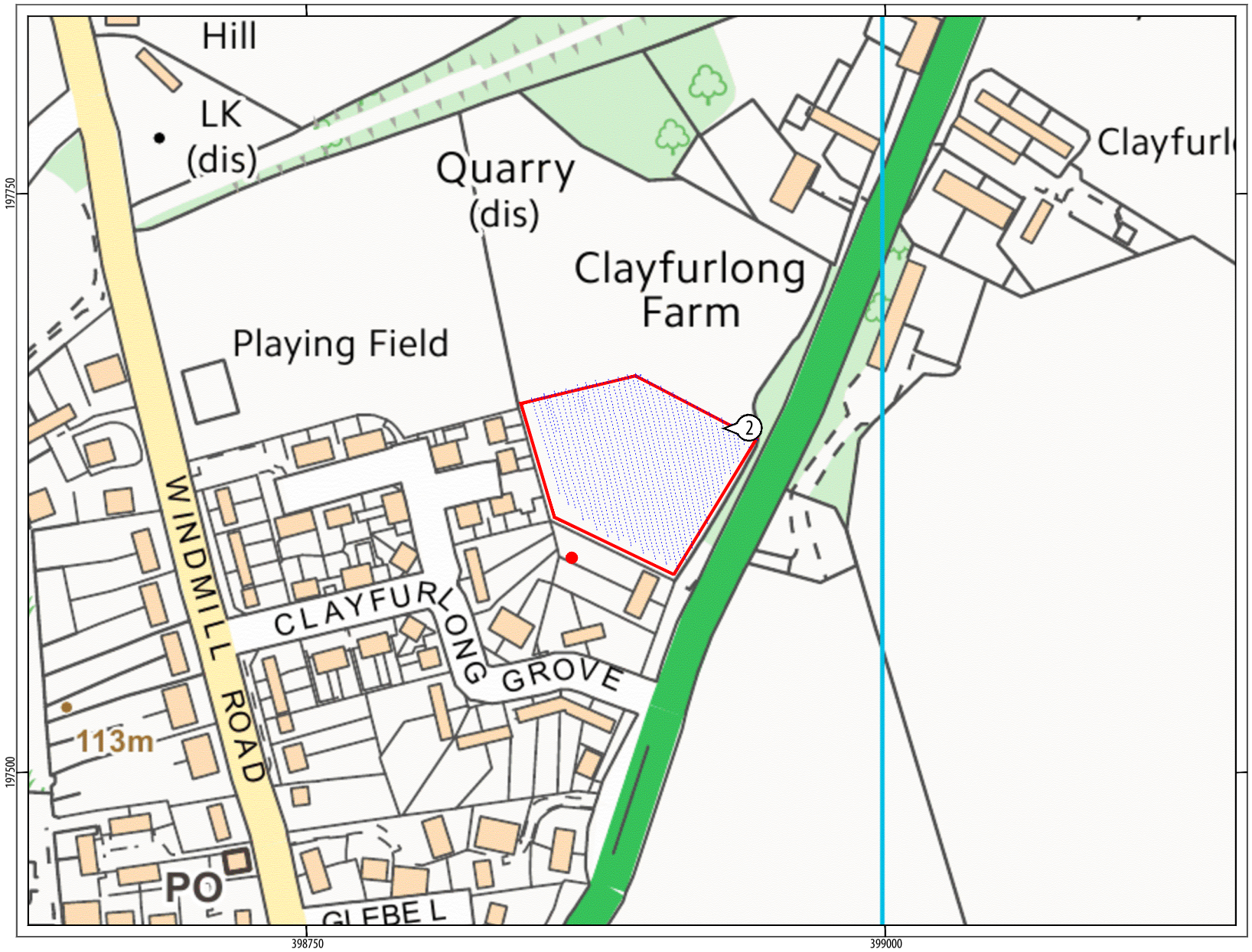

geophysical survey area
GPS Swaths
Site of Anglo Saxon burials (1986)
Location and direction of ILLUS 2

0 50m
1:2,500 @ A4

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Site K1b
Kemble
Cirencester
Gloucestershire
CLIENT Resisolutions

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NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 3 Survey location showing GPS swaths (1:2,500) (Reproduced using mapping provided by Resisolutions)

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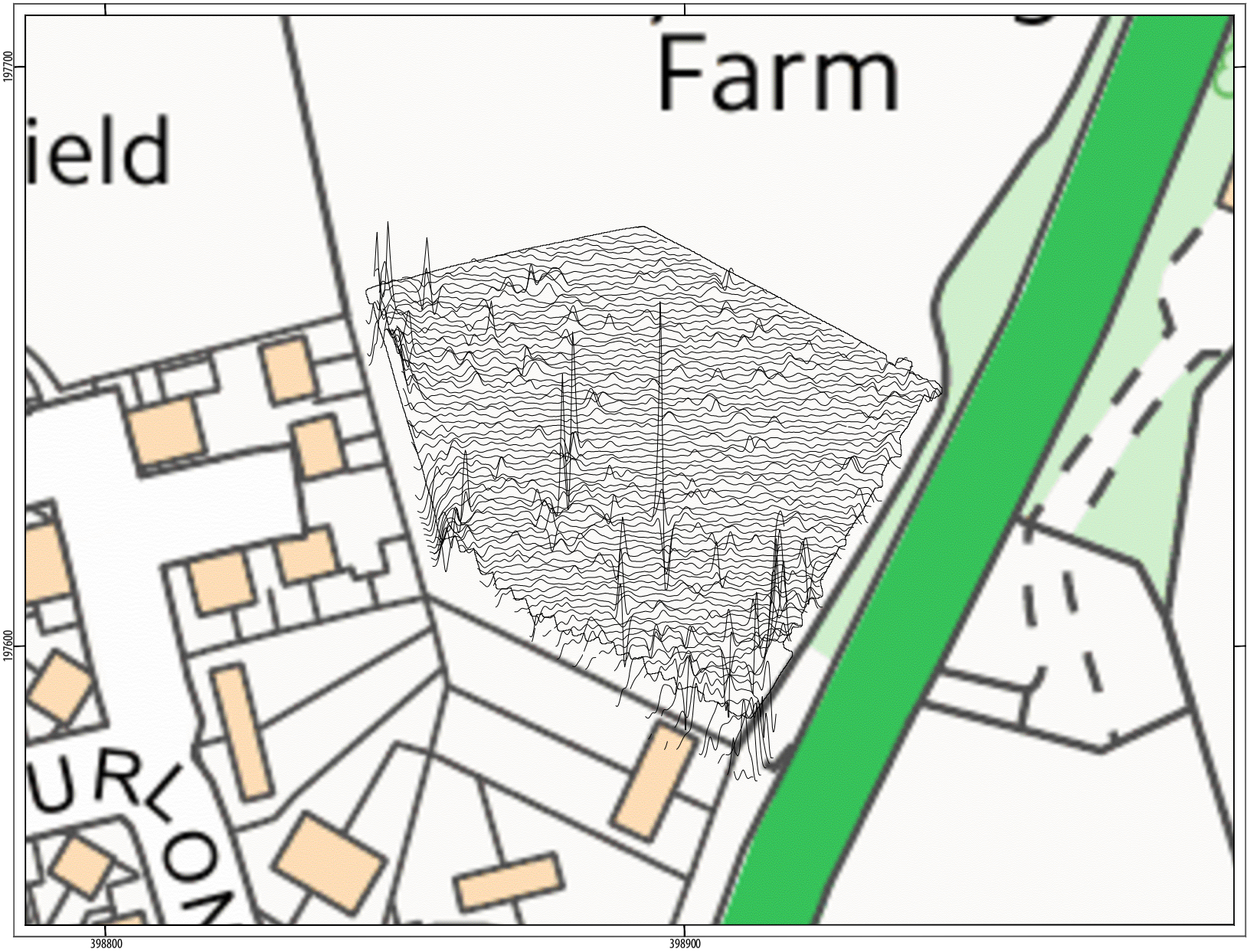
NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 4 Processed greyscale magnetometer data (1:1,000) (Reproduced using mapping provided by Resisolutions)



ILLUS 5 XY trace plot of minimally processed magnetometer data (1:1,000) (Reproduced using mapping provided by Resisolutions)

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Cirencester
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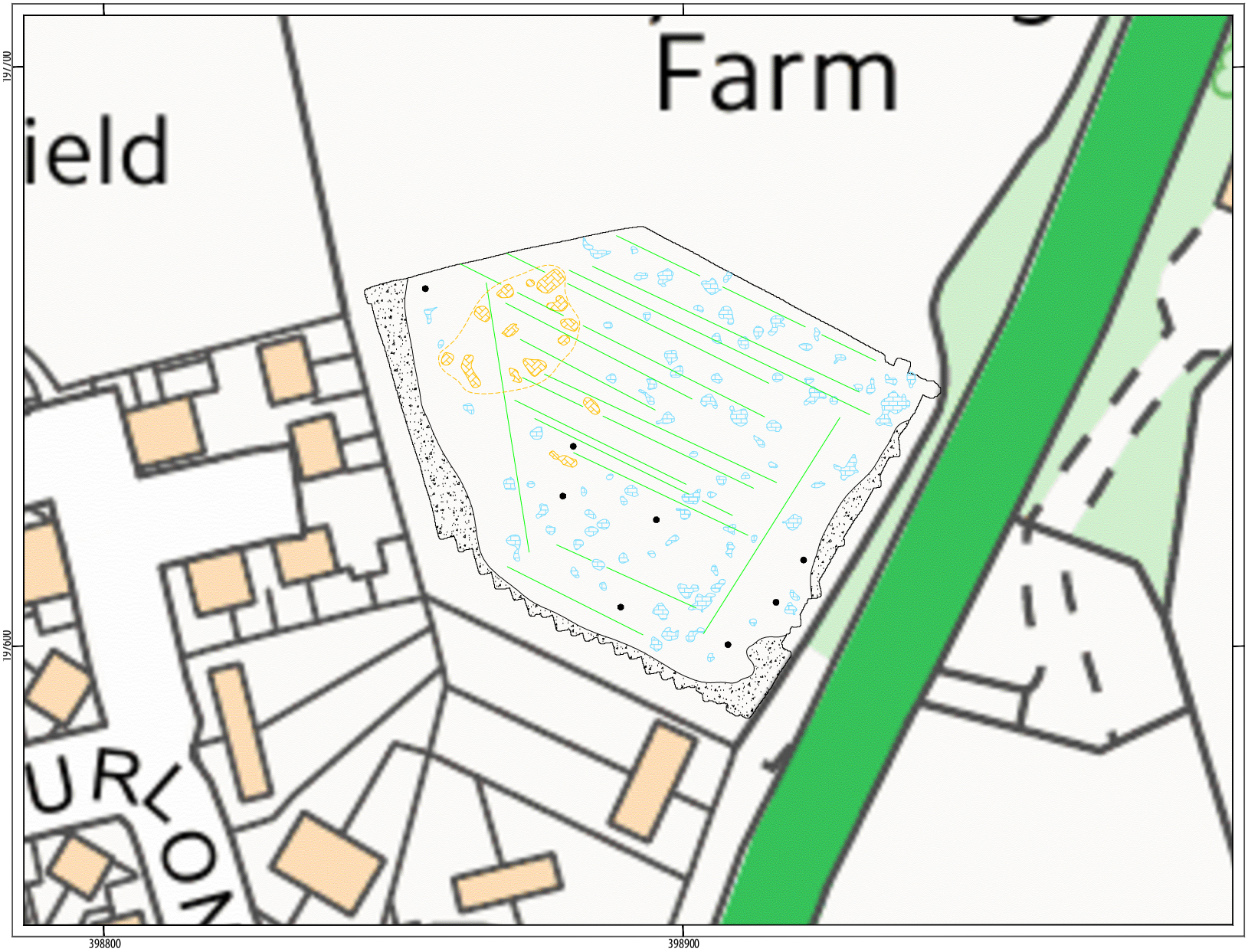

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
magnetic enhancement	geology
magnetic enhancement	archaeology?

0 25m
1:1,000 @ A4

PROJECT KCGL19
Site K1b
Kemble
Cirencester
Gloucestershire

CLIENT Resisolutions

HEADLAND ARCHAEOLOGY

NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 6 Interpretation of magnetometer data (1:1,000) (Reproduced using mapping provided by Resisolutions)

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Headland Archaeology South & East
Building 68C | Wrest Park | Silsoe | Bedfordshire MK45 4HS
t 01525 861 578
e southandeast@headlandarchaeology.com

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Twyford Rd | Hereford HR2 6JR
t 01432 364 901
e midlandsandwest@headlandarchaeology.com

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com

Headland Archaeology Scotland
13 Jane Street | Edinburgh EH6 5HE
t 0131 467 7705
e scotland@headlandarchaeology.com

www.headlandarchaeology.com