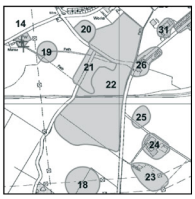
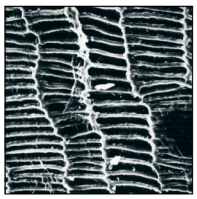
SDEL19










STONEBRIDGE DRIVE, EAST LEAKE, NOTTINGHAMSHIRE

GEOPHYSICAL SURVEY

commissioned by WYG Group Ltd

July 2019

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

STONEBRIDGE DRIVE, EAST LEAKE, NOTTINGHAMSHIRE

GEOPHYSICAL SURVEY

commissioned by WYG Group Ltd

July 2019

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

PROJECT INFO:

HA Project Code **SDEL19** / NGR **SK 5617 2681** / Parish **East Leake** / Local Authority **Nottinghamshire** / OASIS Ref. **headland5-357715**

PROJECT TEAM:

Project Manager **David Harrison** / Author **Olivier Vansassenbrouck** / Fieldwork **Krasimir Dyulgerski, Richard McGregor Edwards** / Graphics **Eleanor Winter, Olivier Vansassenbrouck, Rafa Maya-Torcelly**

Approved by **David Harrison** D 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

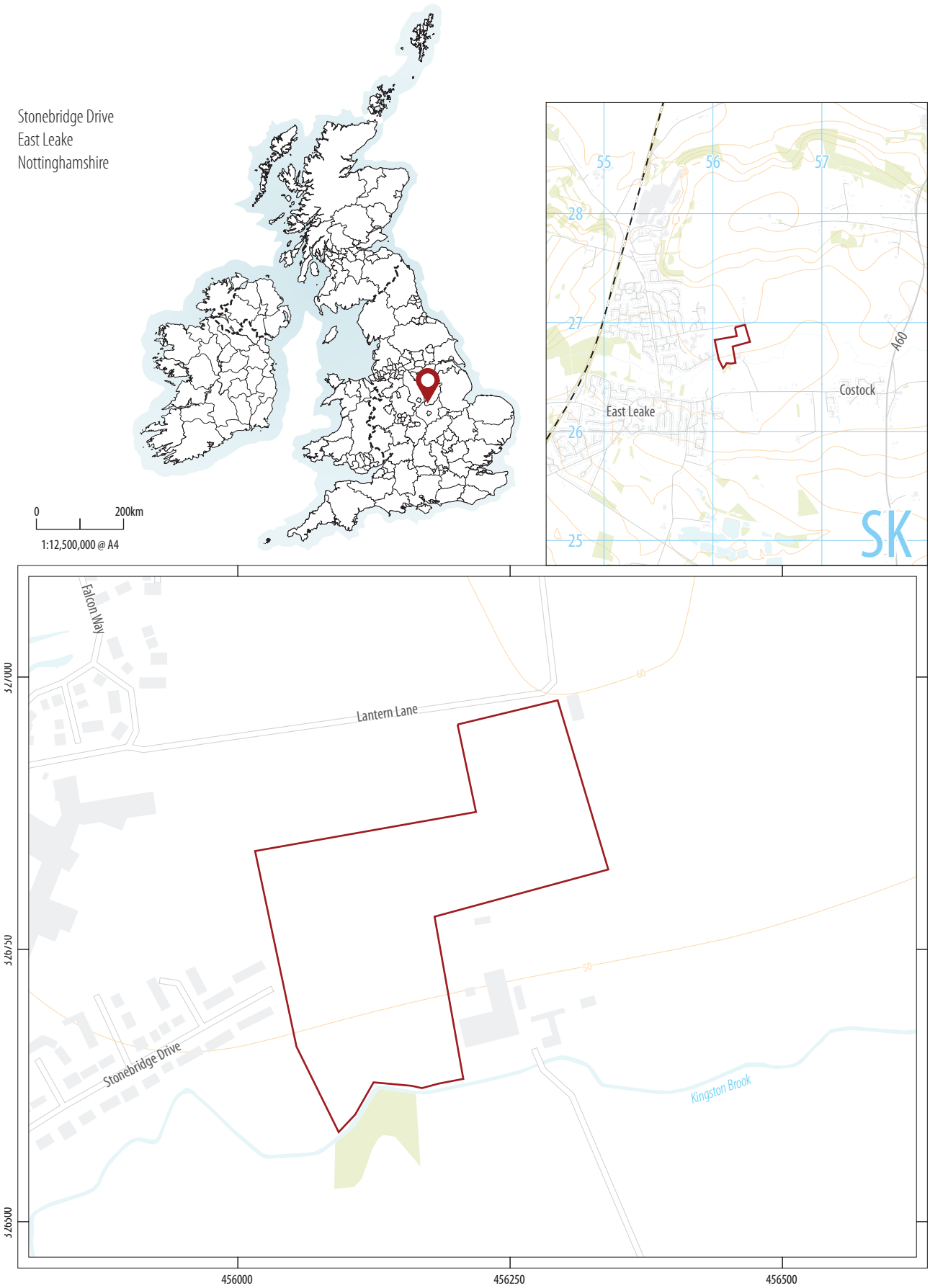
REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 5.5 hectare site at East Leake, Nottinghamshire, where a new residential development is proposed. No anomalies of definite archaeological potential have been identified. Linear anomalies caused by the medieval and post-medieval practice of ridge and furrow cultivation have been identified over the majority of the site. These may be of local historical interest but are not thought to be of any archaeological significance. A broad high magnitude anomaly in the south-west of the site cannot be confidently interpreted as either modern, geological or agricultural in origin and therefore an archaeological origin remains possible – the anomaly may be caused by a soil-filled pit. However, in the absence of any other supporting evidence, a modern origin is equally plausible and the anomaly is assessed as of low-moderate archaeological potential. Elsewhere, on the basis of the geophysical survey, the archaeological potential of the site is assessed as very low.

CONTENTS

LIST OF ILLUSTRATIONS



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

STONEBRIDGE DRIVE, EAST LEAKE, NOTTINGHAMSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by WYG Group Ltd (the Client), to undertake a geophysical (magnetometer) survey of land east of East Leake, where a new residential development 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 (WYG 2019), and 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 20 May 2019.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) is located east of East Leake, centred on SK 5617 2681 (see illus 1). It comprises of three fields (F1–F3) within an irregularly shaped block of land which is bound to the north by Lantern Lane, by Sheep Plank Lane to the west and by Kingston Brook to the south. Brookfurlong Farm lies to the immediate south-east.

The topography ranges from approximately 50m Above Ordnance Datum (AOD) on the southern boundary to approximately 60 AOD in the north.

At the time of the survey, the fields were under pasture (see illus 2–3).

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Branscome Mudstone Formation. No superficial deposits are recorded over the majority of the PDA although a pocket of glaciofluvial sand and gravel is recorded in the north-east of the site and alluvial sands and gravels are recorded along Kingston Brook in the south (NERC 2019).

The soils are classified in the Soilscape 8 and Soilscape 20 Associations, characterised as acid loams and clays with impeded drainage, and floodplain loams and clays with naturally high groundwater respectively (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

A Desk-Based Archaeological assessment (DBA) (WYG 2017) has identified ridge and furrow, a furlong boundary, a possible holloway and a pond within the PDA. Further areas of ridge and furrow, lynchets, boundary banks and a bank and ditch have been identified within a wider 500m study area (WYG 2019).

Analysis of historical Ordnance Survey (OS) maps indicates that the pattern of land division within the PDA has remained unchanged since the publication of the first edition OS map in 1884.

3 AIMS, METHODOLOGY AND PRESENTATION

The aim of the survey as set out in the Written Scheme of Investigation (WYG 2019) is to identify possible archaeological remains within the development site. Specifically, the archaeological geophysical survey will:

ILLUS 2 F1, looking north-east

- gather sufficient information to the extent, condition, character and date (as far as circumstances permit) of any archaeological features and deposits within the survey area;

- obtain information that will contribute to an evaluation of the significance of impact of the scheme upon cultural heritage assets; and

- enable further evaluation and/or mitigation measures to be scoped and designed, where appropriate. Further assessment will take the form of evaluation trenching, and the geophysical survey results will inform the scope of that work. Further mitigation may be required, which is likely to take the form of archaeological monitoring during groundworks, design measures to enable preservation in situ or targeted excavation of significant archaeological remains.

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 (see illus 4). 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 V3.0.35.1 (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 1:5,000. illus 2–3 are site condition photographs. illus 4 is a 1:1,500 survey location plan showing the direction of survey as GPS swaths. Large scale fully processed (greyscale) data, minimally processed (XY trace plot) data, and an accompanying interpretative plot are presented at a scale of 1:1,500 in illus 5–7 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 (WYG 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 (see illus 2–3) leading to a high standard of data throughout.

The survey has detected a homogeneous magnetic background throughout with the exception of the westernmost field which is extremely variable (see 4.1 below). Against this background, anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figures, 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.

Two large spike anomalies (TP1 and TP2; illus 7) in the east of F3 are caused by telegraph poles.

The broad area of magnetic disturbance throughout F2 and the north of F3 is caused by tipping and spreading of magnetically enhanced material. Any low magnitude anomalies of archaeological potential, if present, may be masked against this elevated magnetic background.

The high magnitude north/south band of magnetic disturbance within the centre of F1 corresponds to a former farm track shown in recent historical mapping (see illus 7). The disturbance is due to magnetic material (e.g. brick, tile, clinker etc) within the buried surface of the track.

Magnetic disturbance along the field boundaries are caused by ferrous material within, or adjacent to, the field boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Series of slightly curving, parallel trend anomalies are identified parallel with the existing filed boundaries in F1 and F3 (illus 7). These are characteristic of the medieval and post-medieval practice ridge and furrow cultivation. The anomalies are caused by the magnetic contrast between the soil-fill of the furrow and the surrounding soils. The cultivation strips survive as low earthworks in F3 (illus 3).

A vague east/west linear anomaly in the south of F3 is aligned parallel with Kingston Brook. The anomaly is likely to be due to a soil-filled ditch and, whilst an archaeological origin cannot be fully dismissed, an agricultural origin is thought more likely.

4.3 GEOLOGICAL ANOMALIES

Several low-magnitude discrete anomalies have been identified within the south of the PDA. These are caused by localised variation in the depth and composition of the topsoil, and the superficial deposits from which they derive.

Subtle magnetic background variation in the north of F1 corresponds to a superficial deposit of sand and gravel.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

An isolated broad high magnitude anomaly in the south-west of F3 cannot be confidently interpreted as either modern, geological or agricultural in origin and therefore an archaeological origin should be considered. The anomaly may be due to a soil-filled pit. However, in the absence of any other supporting evidence, a modern origin is equally plausible and the anomaly is assessed as of low-moderate archaeological potential.

5 CONCLUSION

The survey has successfully evaluated the proposed development area and has not identified any anomalies of definite archaeological potential. Linear anomalies caused by the medieval and post-medieval practice of ridge and furrow cultivation have been identified over the majority of the site. These may be of local historical interest but are not thought to be of any archaeological significance. A broad high magnitude anomaly in the south-west of the site cannot be confidently interpreted as either modern, geological or agricultural in origin and therefore an archaeological origin remains possible – the anomaly may be caused by a soil-filled pit. However, in the absence of any other supporting evidence, a modern origin is equally plausible and the anomaly is assessed as of low-moderate archaeological potential. Elsewhere, on the basis of the geophysical survey, the archaeological potential of the site is assessed as very low.

ILLUS 3 F3, looking west

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 21 May 2019

Cranfield University 2018 ***Cranfield Soil and Agrifood Institute Soilscapes*** http://www.landis.org.uk/soilscapes/ accessed 21 May 2019

Europae Archaeologia Consilium 2016 ***EAC Guidelines for the use of Geophysics in Archaeology*** Archaeolingua 2015

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

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 21 May 2019

Natural Environment Research Council (NERC) 2019 ***British Geological Survey*** http://www.bgs.ac.uk/ accessed 21 May 2019

WYG Group Ltd 2019 ***Stonebridge Drive, East Leake, Nottinghamshire. Geophysical Survey Written Scheme of Investigation*** [unpublished client document]

Proposed Development Area
GPS swaths
location and direction of ILLUS 2-3

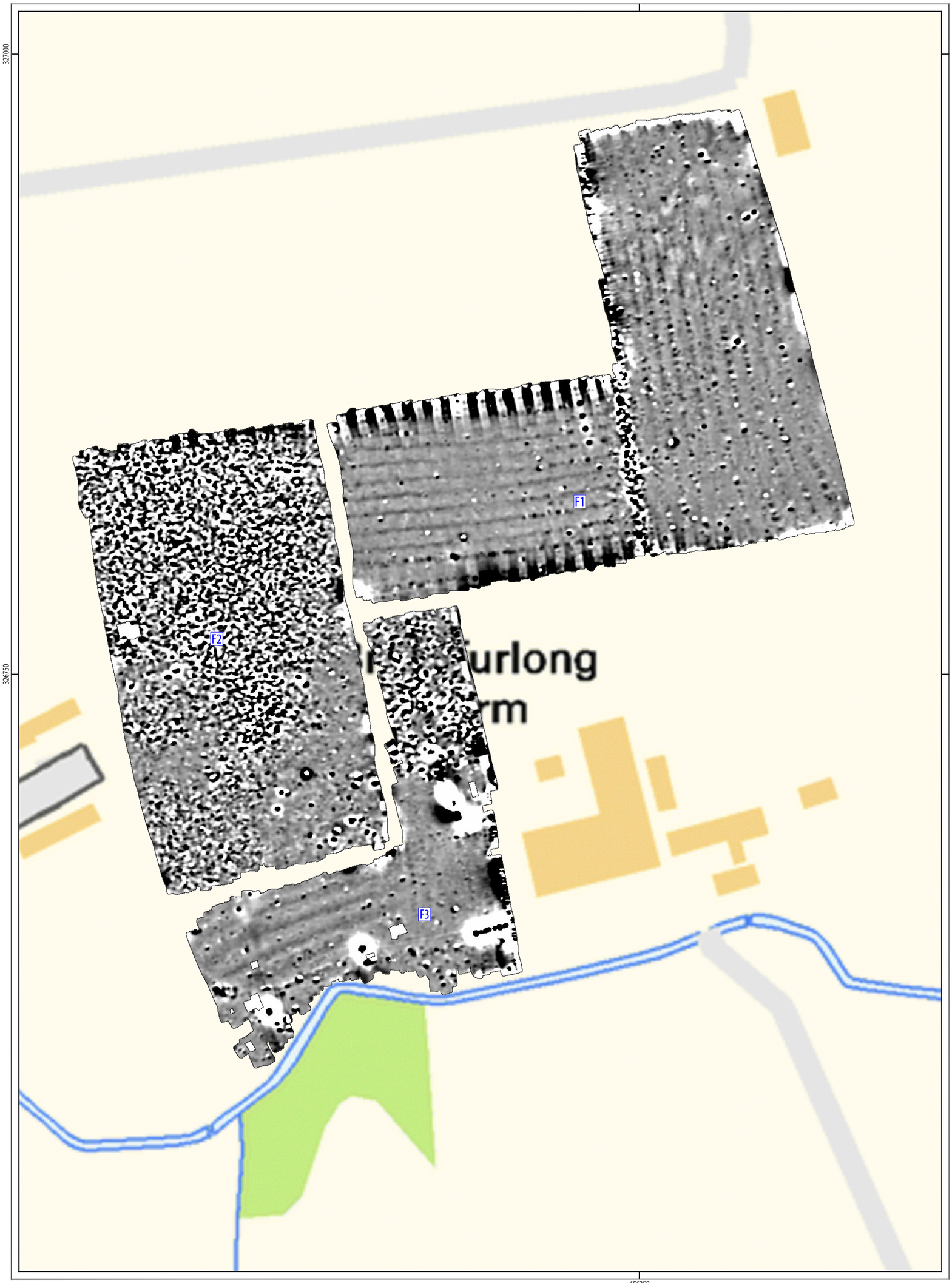
SUPERFICIAL DEPOSITS
Glaciofluvial Deposits, Mid Pleistocene - sand and gravel
Syston Member - sand and gravel
Alluvium - clay, silt, sand and gravel

0 50m
1:1,500 @ A3

PROJECT SDEL19
Stonebridge Drive
East Leake
Nottinghamshire
CLIENT WYG Group Limited

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

ILLUS 4 Survey location showing GPS swaths and superficial deposits (1:1,500)

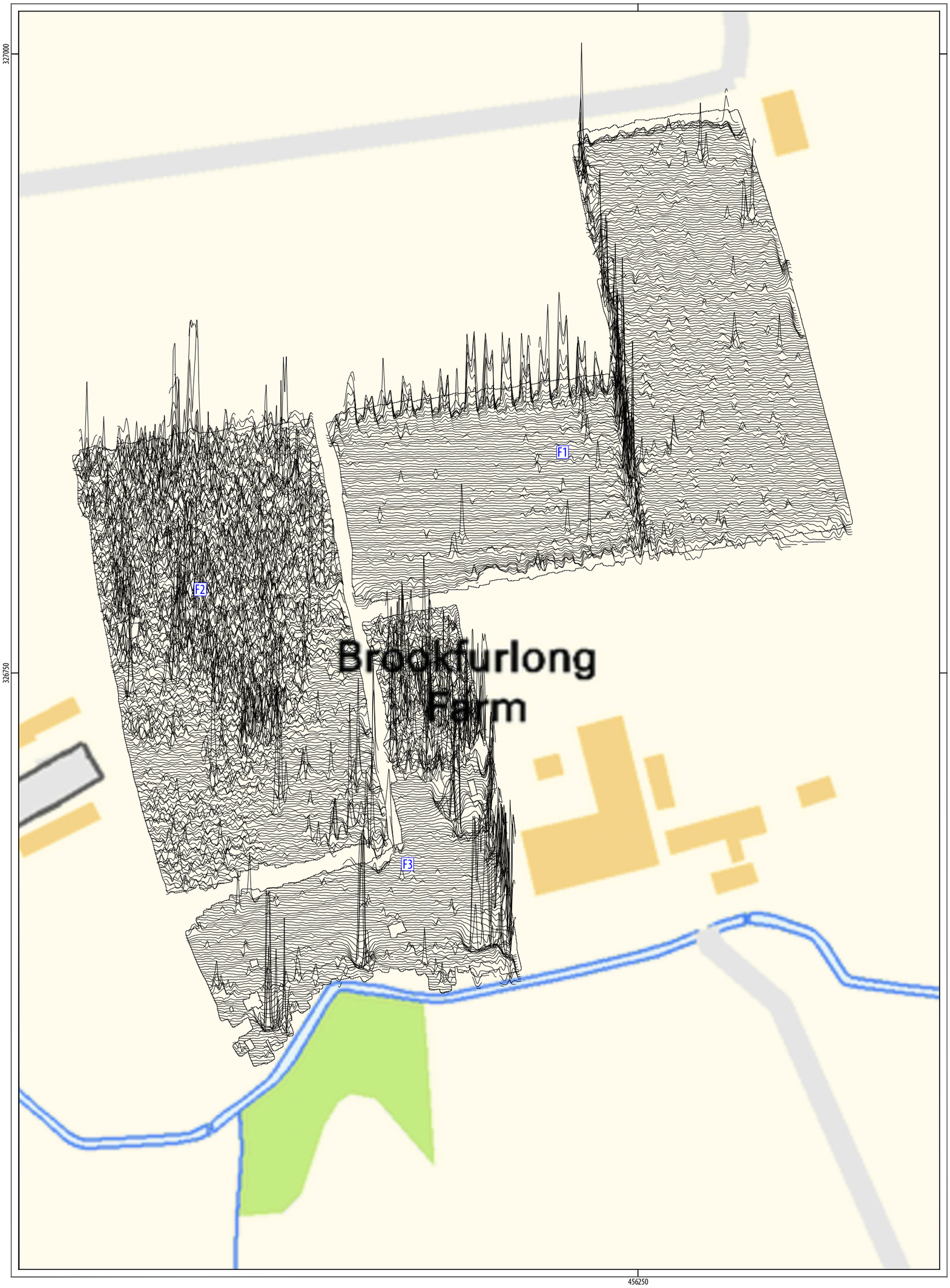


PROJECT SDEL19
Stonebridge Drive
East Leake
Nottinghamshire

CLIENT WYG Group Limited

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

ILLUS 5 Processed greyscale magnetometer data (1:1,500)



47.0nT/cm

0 50m

1:1,500 @ A3

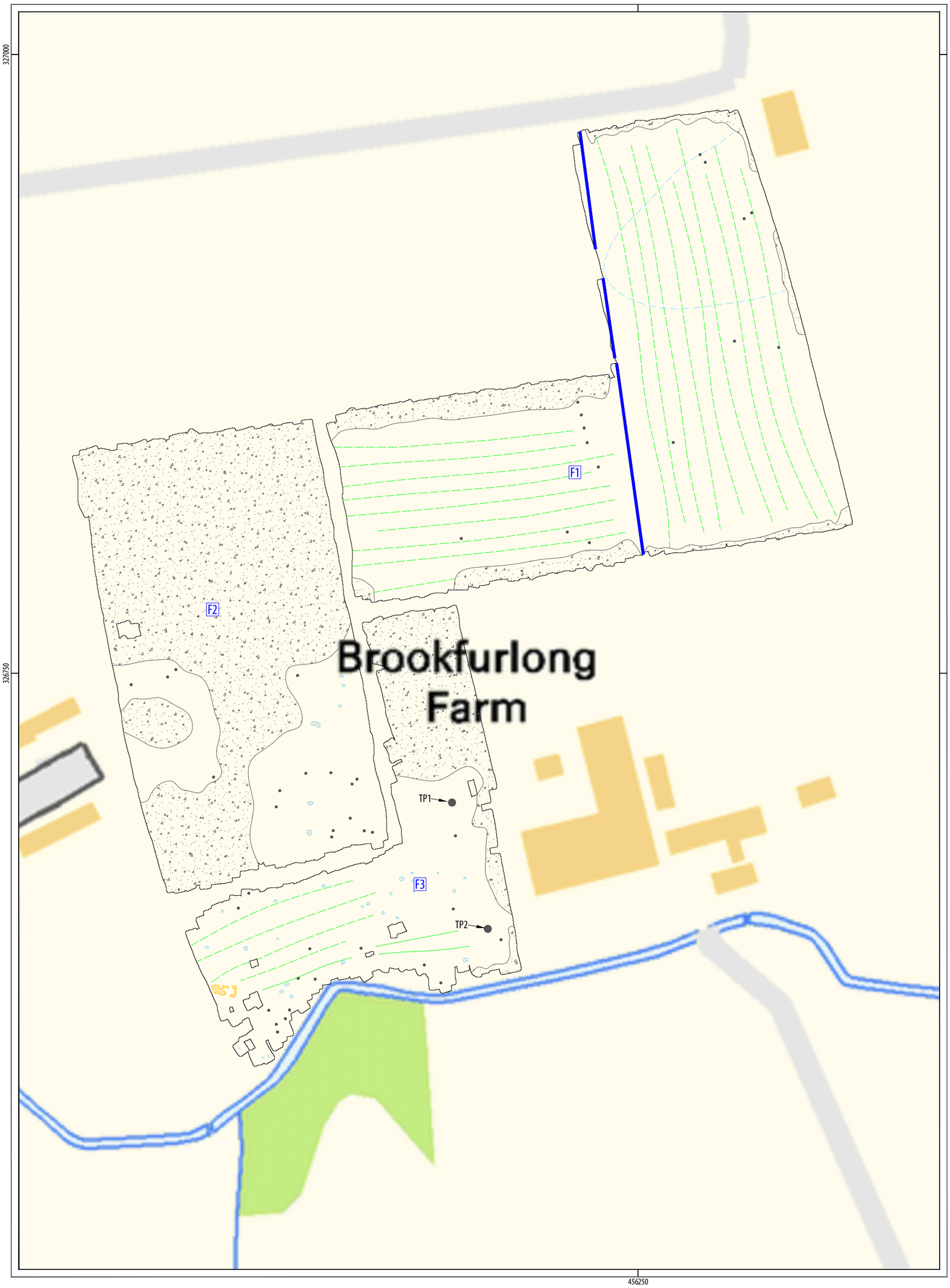
PROJECT SDEL19
Stonebridge Drive
East Leake
Nottinghamshire

CLIENT WYG Group Limited

HEADLAND ARCHAEOLOGY

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

ILLUS 6 XY trace plot of minimally processed magnetometer data (1:1,500)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear	farm track
linear trend	agricultural
linear trend	ridge and furrow
	geological variation

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	geology
magnetic enhancement	archaeology?

ABBREVIATIONS	
TP	telegraph phole

0 50m
1:1,500 @ A3

PROJECT SDEL19
Stonebridge Drive
East Leake
Nottinghamshire

CLIENT WYG Group Limited

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

ILLUS 7 Interpretation of magnetometer data (1:1,500)

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.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-357715

PROJECT DETAILS	
Project name	Stonebridge Drive, East Leake, Nottinghamshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 5.5 hectare site at East Leake, Nottinghamshire, where a new residential development is proposed. No anomalies of definite archaeological potential have been identified. Linear anomalies caused by the Medieval and post-Medieval practice of ridge and furrow cultivation have been identified over the majority of the site. These may be of local historical interest but are not thought to be of any archaeological significance. A broad high magnitude anomaly in the south-west of the site cannot be confidently interpreted as either modern, geological or agricultural in origin and therefore an archaeological origin remains possible - the anomaly may be caused by a soil-filled pit. However, in the absence of any other supporting evidence, a modern origin is equally plausible and the anomaly is assessed as of low-moderate archaeological potential. Elsewhere, on the basis of the geophysical survey, the archaeological potential of the site is assessed as very low.
Project dates	Start: 20-05-2019 End: 20-05-2019
Previous/future work	No / Not known
Any associated project reference codes	SDEL19 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 5 – 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	Not known / Not recorded
Solid geology (other)	Branscome Mudstone
Drift geology	Glacial Sand And Gravel
Drift geology	Alluvium
Techniques	Magnetometry

PROJECT LOCATION	
Country	England
Site location	Nottinghamshire Rushcliffe East Leake Stonebridge Drive, East Leake, Nottinghamshire
Study area	5.5 Hectares
Site coordinates	SK 5617 2681 52.8355472438 -1.166097064609 52 50 07 N 001 09 57 W Point

PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	WYG Group
Project design originator	Headland Archaeology
Project director/manager	Harrison, D

Project supervisor	Dyulgerski, K.
Type of sponsor/funding body	Developer

PROJECT ARCHIVES

Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"other"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

PROJECT BIBLIOGRAPHY 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Stonebridge Drive, East Leake, Nottinghamshire; Geophysical Survey
Author(s)/Editor(s)	Vansassenbrouck, O.
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	2 July 2019

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