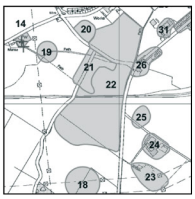
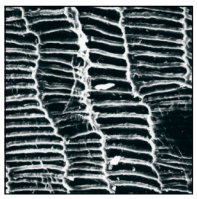
ARCS19










LAND WEST OF ASHBOURNE ROAD, CHEADLE, STAFFORDSHIRE

GEOPHYSICAL SURVEY

commissioned by CgMs Heritage

March 2019

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LAND WEST OF ASHBOURNE ROAD, CHEADLE, STAFFORDSHIRE

GEOPHYSICAL SURVEY

commissioned by CgMs Heritage

March 2019

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

PROJECT INFO:

HA Project Code **ARCS19** / NGR **SK 0195 4281** / Parish **Cheadle** / Local Authority **Staffordshire Moorlands** / OASIS Ref. **headland5-346031**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **Olivier Vansassenbrouck** / Fieldwork **Bethany Shenton, Olivier Vansassenbrouck** / Graphics **Beata Wieczorek-Oleksy, Nick Hannon, Rafael Maya-Torcelly**

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

REGISTERED ORGANISATION CIfA

ASCB Accreditation Services Worldwide

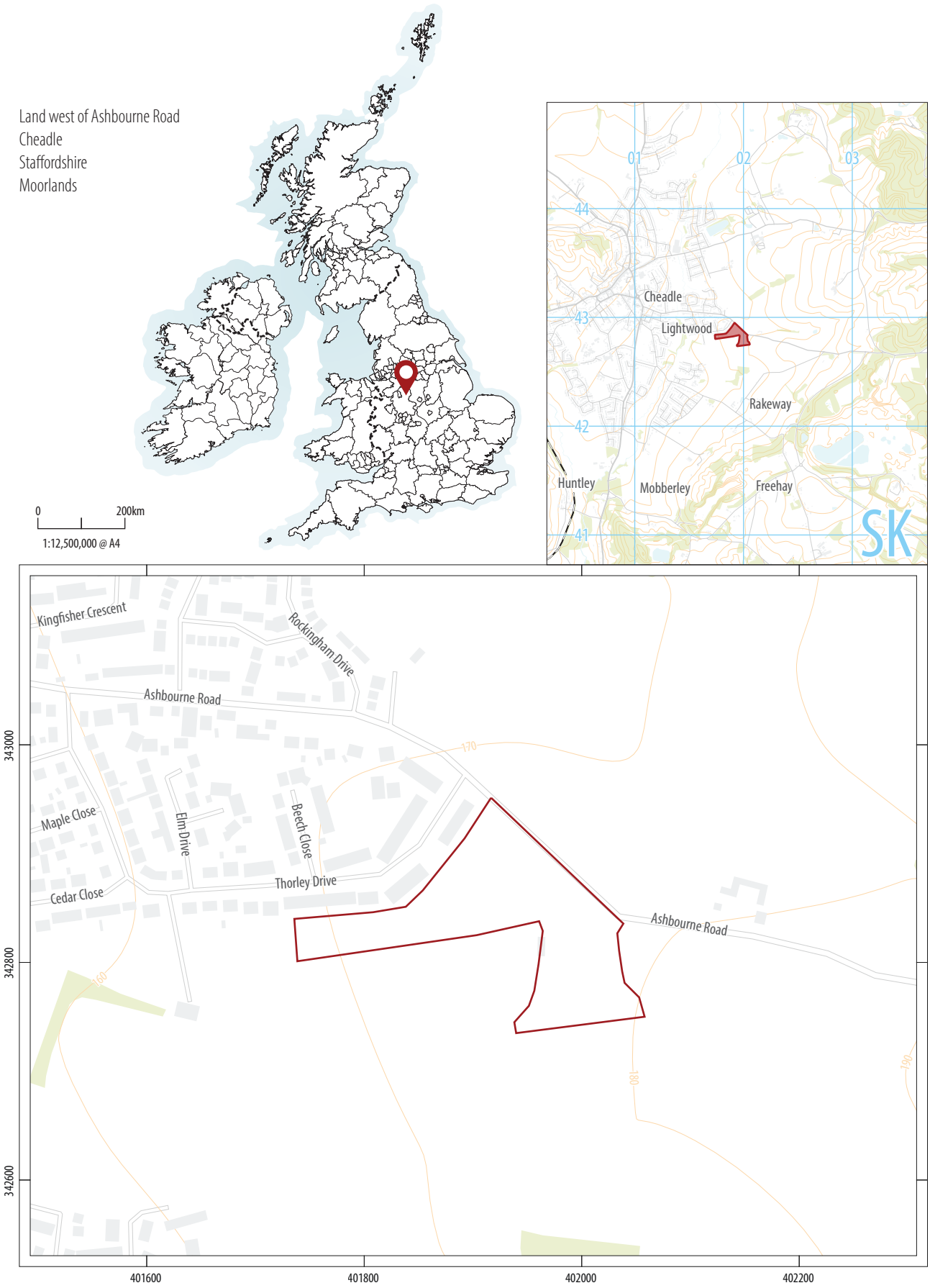
ISO 9001

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 2 hectare site west of Ashbourne Road, Cheadle, where a new residential development is proposed. No anomalies of any archaeological potential have been identified by the survey. The survey has identified linear anomalies consistent with agricultural activity, discrete anomalies consistent with variation in the composition of the soils and a broad area of magnetic disturbance typical of modern tipping/ infilling. This area of magnetic disturbance could be related to the infilling of shallow coal mining activity and would perhaps corroborate the results from the boreholes and trial pits in the same area. However, no anomalies could be confidently identified as providing direct evidence of coal mining. On the basis of the geophysical survey, the archaeological potential of the proposed development area is assessed as low.

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

LAND WEST OF ASHBOURNE ROAD, CHEADLE, STAFFORDSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by CgMs Heritage (the Client), to undertake a geophysical (magnetometer) survey of land west of Ashbourne Road, Cheadle, 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 (Vansassenbrouck 2019) which was submitted to the Client, 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 13th March 2019.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) is located immediately east of Cheadle, centred on SK 0195 4281 (Illus 1). It comprises an irregularly-shaped block of land within two parcels which are bound to the north by Thorley Drive and to the north-east by the B5032 Ashbourne Road. The south-eastern boundary is unbound.

The topography of the site is varied, with the north-western area sloping to the west from 175m Above Ordnance Datum (AOD) to 168m AOD, and the south-eastern part sloping to the east from 175m AOD to 178.5m AOD.

The PDA comprised two parcels of land both of which were under permanent pasture (Illus 2–3).

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Pennine Lower Coal Measures Formation – mudstone, siltstone and sandstone, with a band of Pennine Lower Coal Measures Formation – sandstone cutting through the PDA in the west. No superficial deposits are recorded (NERC 2019).

The soils are classified in the Soilscape 17 association, characterised as slowly permeable seasonally wet acid loams and clays (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

No archaeological background is available at the time of writing.

Analysis of historical Ordnance Survey (OS) maps indicates that a number of field boundaries have been removed since the 1957 edition OS mapping.

A site investigation report (Travis Baker 2018) indicates that shallow coal workings may be present in the east of the PDA.

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.

ILLUS 2 Survey area, looking west

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 (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 1:1,250 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 1:1,250 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 (Vansassenbrouck 2019), guidelines outlined by Europae Archaeologia Consilium (EAC 2016)

ILLUS 3 Survey area, looking south-east

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 (Illus 2–3) leading to a high standard of data throughout.

The survey has detected a relatively homogeneous magnetic background throughout characterised by numerous low magnitude discrete anomalies which are due to localised variations in the composition of the topsoil. Against this background, numerous anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figures, 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.

A single high magnitude dipolar linear anomaly SP1 has been identified (Illus 7). This anomaly is caused by buried service pipes.

The site investigation report (Travis Baker 2018) has recorded made ground, possibly coal pit backfill, in several boreholes and test pits (LP5, LP7, LP9, TP7, TP09 and TP10; see Illus 5) in the east of the PDA. This made ground loosely corresponds to a band of magnetic disturbance, PE1, aligned north/south. Whilst none of the site investigation works directly correspond with the magnetic disturbance it is considered likely that the anomaly has been caused by the backfill material relating to former coal extraction.

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

4.2 AGRICULTURAL ANOMALIES

Linear anomalies in the data are identified in the north and western part of the PDA. All these anomalies are due to agricultural activity such as boundary removal, ploughing and drainage.

Parallel linear trend anomalies aligned east/west in the north and west part of the PDA (see Illus 7) reflect the alignment of recent ploughing. Two linear anomalies in the south of the PDA have been tentatively identified as possible field drains.

4.3 GEOLOGICAL ANOMALIES

Numerous low-magnitude discrete anomalies have been identified throughout the PDA. The frequency and distribution of these anomalies precludes an archaeological interpretation and the anomalies are thought to be caused by localised variation in the depth and composition of the topsoil, and the superficial deposits from which they derive.

5 CONCLUSION

The survey has successfully evaluated the PDA and has not identified any anomalies of archaeological potential. Discrete anomalies, consistent with variation in the composition of the soils and broad areas of magnetic disturbance typical of modern tipping/infilling, and linear anomalies, consistent with modern agricultural activity and services. have been identified by the survey

The band of magnetic disturbance in the east of the PDA provides some corroborating evidence for the results from the boreholes and trial pits. It is considered likely that the magnetic disturbance is a result of infilling of shallow coal mining activity and to that extent the survey has successfully identified the extent of the infilled area. No anomalies were identified which could be confidently identified as evidence for individual extraction pits.

On the basis of the geophysical survey the archaeological potential of the PDA is assessed as low.

6 REFERENCES

Chartered Institute for Archaeologists (ClfA) 2016 ***Standard and guidance for archaeological geophysical survey*** (Reading) http://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_2.pdf accessed 14 March 2019

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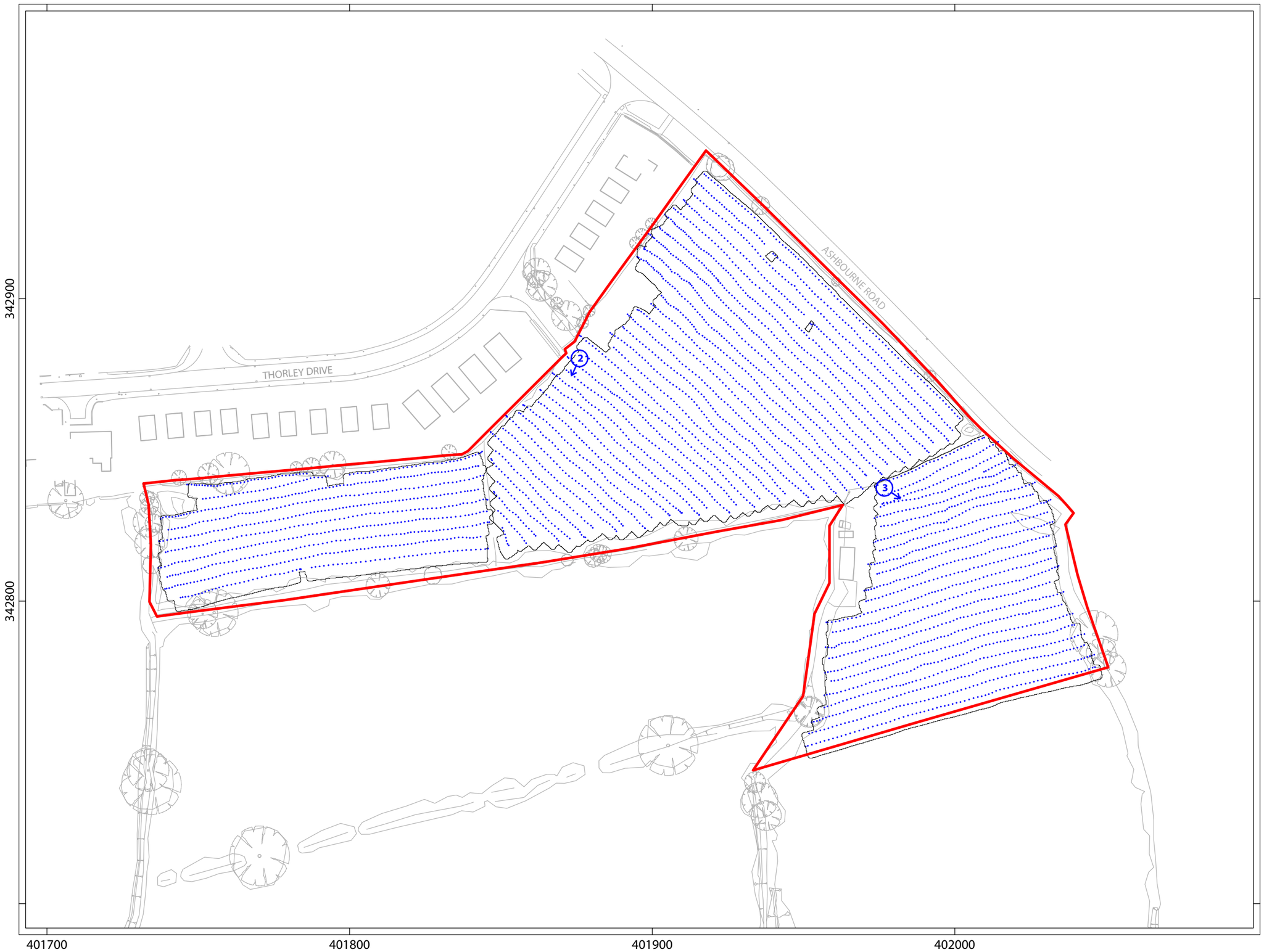
Vansassenbrouck O (2019) ***Land west of Ashbourne Road, Cheadle, Staffordshire; Written Scheme of Investigation for Geophysical Survey*** [unpublished client document] Headland Archaeology Ref ARCS19



proposed development area

location & direction of ILLUS 2-3

GPS swathes

0 50m

Scale at A3: 1:1,250

PROJECT ARCS19
Land west of Ashbourne Road
Cheadle, Staffordshire

CLIENT CgMs Heritage

DATE 19/03/19

DOCUMENT HA_ARCS-Illus4

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NORTH Unit 16, Hillside, Beeston Road
Leeds, LS11 8ND
0113 387 6430
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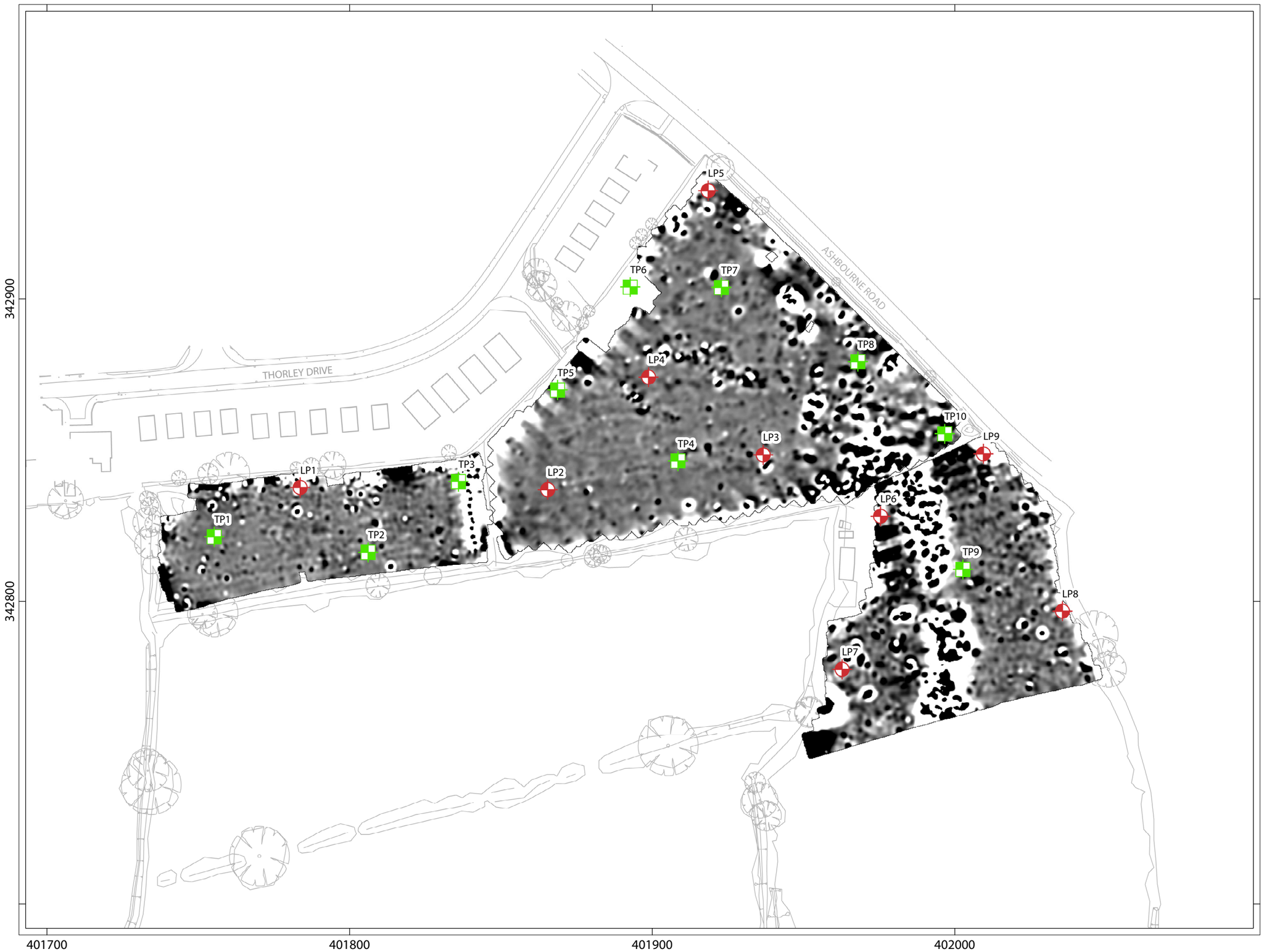
ILLUS 4 Survey area showing GPS swaths (1:1,250)



light percussion borehole

trial pit

(nT)
High : 3
Low : -3

0 50m

Scale at A3: 1:1,250

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Land west of Ashbourne Road
Cheadle, Staffordshire

CLIENT CgMs Heritage

DATE 19/03/19

DOCUMENT HA_ARCS-Illus5

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Leeds, LS11 8ND
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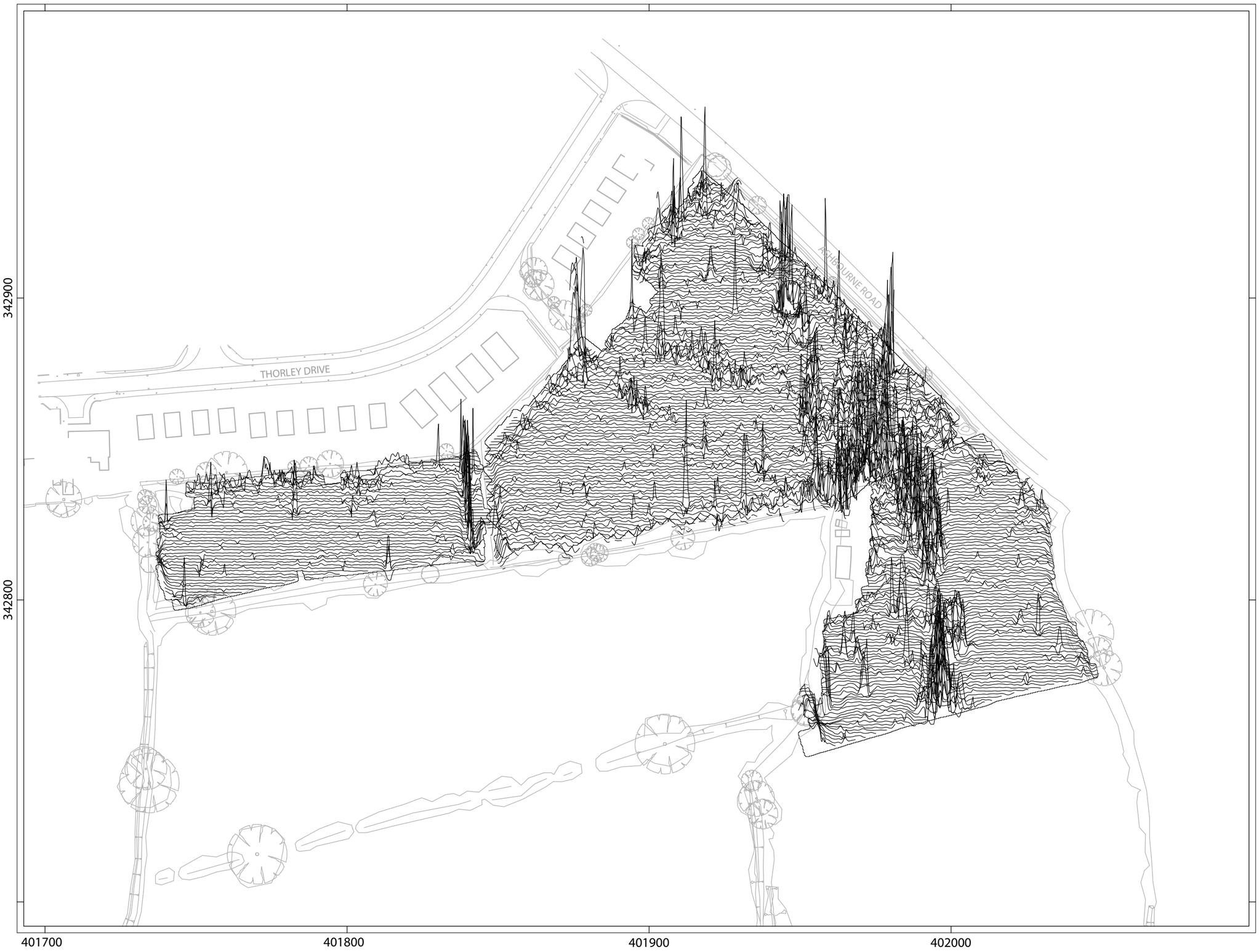
ILLUS 5 Processed greyscale magnetometer data (1:1,250)



ILLUS 6 XY trace plot of minimally processed gradiometer data (1:1,250)

40.0nT/cm

0 40m

Scale at A3: 1:1,250

PROJECT ARCS19
Land west of Ashbourne Road
Cheadle, Staffordshire

CLIENT CgMs Heritage

DATE 19/03/19

DOCUMENT HA_ARCS-Illus6

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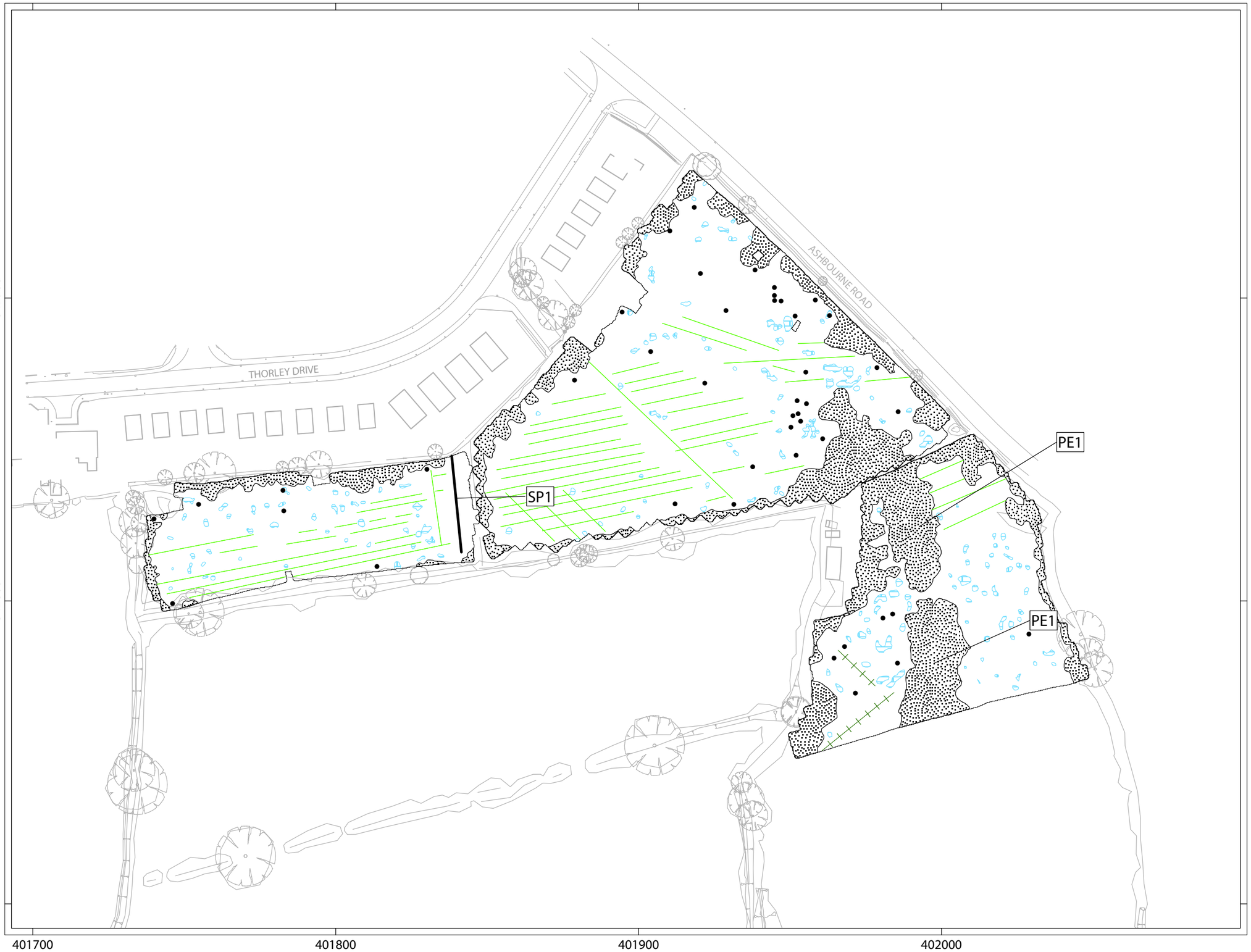

- dipolar isolated - ferrous material
- magnetic disturbance - ferrous material
- magnetic enhancement - geology
- dipolar linear - service pipe
- linear trend - agricultural
- linear trend - field drain

ABBREVIATIONS

SP service pipe
PE possible extraction

0 50m

Scale at A3: 1:1,250

PROJECT ARCS19
Land west of Ashbourne Road
Cheadle, Staffordshire

CLIENT CgMs Heritage

DATE 19/03/19

DOCUMENT HA_ARCS-Illus7

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Leeds, LS11 8ND
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ILLUS 7 Interpretation of magnetometer data (1:1,250)

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: headland5-346031

PROJECT DETAILS	
Project name	Land west of Ashbourne Road, Cheadle, Staffordshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of land west of Ashbourne Road, Cheadle, where a new residential development is proposed. No anomalies of any archaeological potential have been identified by the survey. The survey has identified linear anomalies consistent with agricultural activity, discrete anomalies consistent with variation in the composition of the soils and a broad area of magnetic disturbance typical of modern tipping/infilling. This area of magnetic disturbance could be related to the infilling of shallow coal mining activity and would perhaps corroborate the results from the boreholes and trial pits in the same area. However, no anomalies could be confidently identified as providing direct evidence of coal mining. On the basis of the geophysical survey, the archaeological potential of the proposed development area is assessed as low.
Project dates	Start: 13-03-1019 End: 13-03-2019
Previous/future work	Not known / Not known
Any associated project reference codes	ARCS19 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 5 - 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	Pre-application
Solid geology (other)	Pennine Lower Coal Measures
Drift geology (other)	None
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	STAFFORDSHIRE STAFFORDSHIRE MOORLANDS CHEADLE Land west of Ashbourne Road, Cheadle, Staffordshire
Study area	2.2 Hectares
Site coordinates	SK 0195 4281 52.982318601214 -1.970952455236 52 58 56 N 001 58 15 W Point
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	CgMs
Project design originator	Headland Archaeology
Project director/manager	Harrison, S
Project supervisor	Vansassenbrouck, O.

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	Land west of Ashbourne Road, Cheadle, Staffordshire; 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	18 March 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