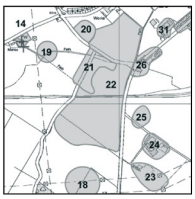
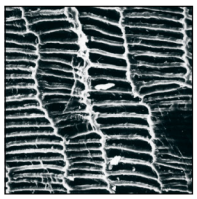
CLHC18










LAND OFF COUPE LANE, HOLMGATE, CHESTERFIELD

GEOPHYSICAL SURVEY

commissioned by Orion Heritage

June 2018

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LAND OFF COUPE LANE, HOLMGATE, CHESTERFIELD

GEOPHYSICAL SURVEY

commissioned by Orion Heritage

June 2018

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

PROJECT INFO:

HA Project Code **CLHC18** / NGR **SK 3820 6440** / Parish **Wingerworth, Clay Cross** / Local Authority **Derbyshire** / OASIS Ref. **headland5-318986**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison** / Fieldwork **<names in alphabetical order>** / Graphics **Caroline Norrman, David Harrison, Rafael Maya Torcelly**

Approved by **David Harrison** D Harrison .....

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HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

ASCB Accreditation Services Worldwide

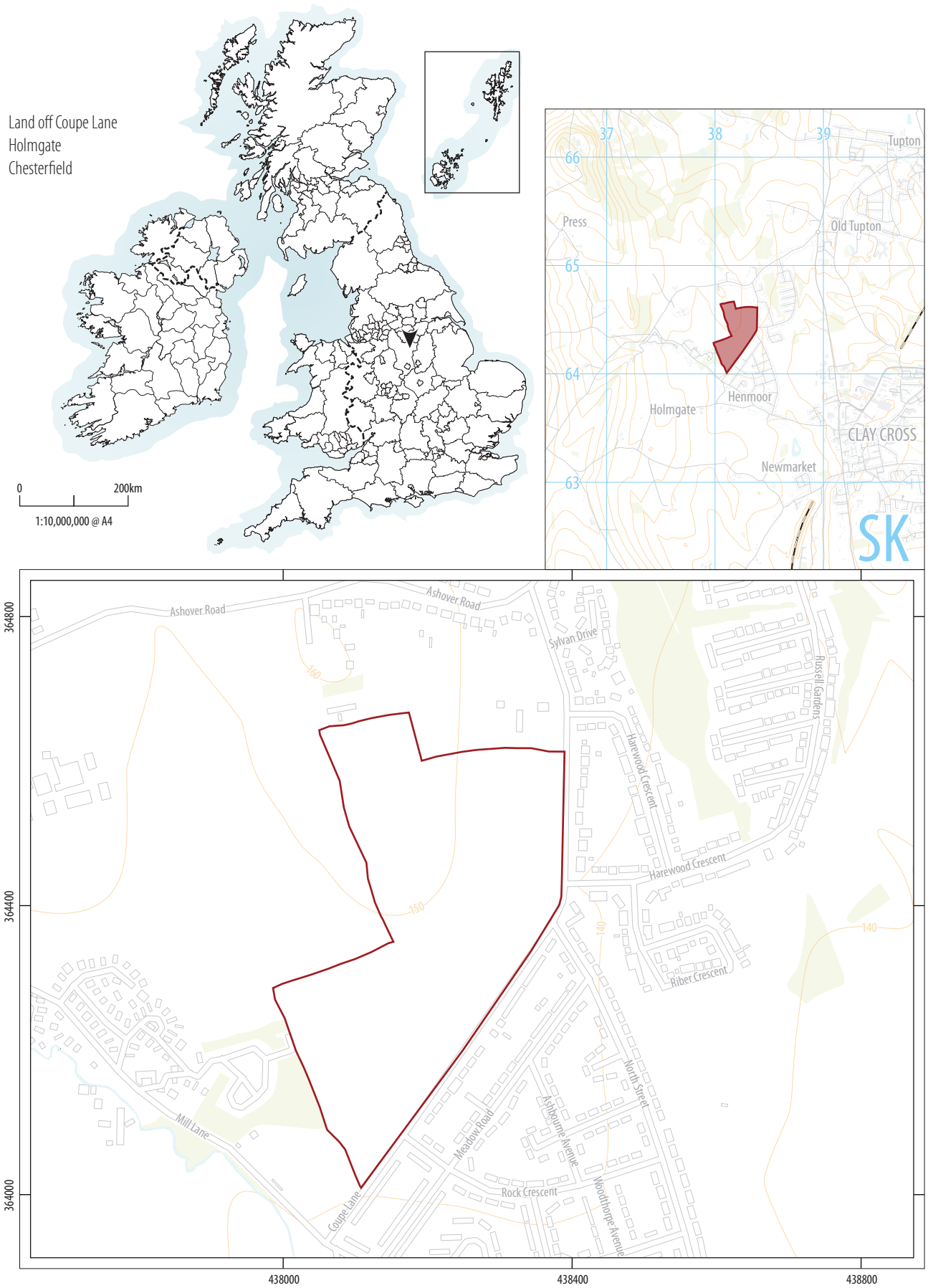
ISO 9001

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering approximately 13 hectares at Holmgate, Chesterfield, where a new residential development is proposed. The survey has identified a cluster of four ring-ditches in the north-east of the site which are thought to probably locate round barrows. Three of the ring-ditches are particularly notable for their conjoined and symmetrical appearance whereas the fourth is less regular and is notable for containing extremely high magnitude anomalies, possibly locating areas of burning. These anomalies are considered to be of likely high archaeological potential. Elsewhere, isolated high magnitude pit-type anomalies may be archaeological in origin although a geological cause is also plausible. These anomalies are ascribed a moderate archaeological potential. However, with the exception of the ring-ditches, the majority of the site is assessed as having a low to moderate archaeological potential – the anomalies identified mostly being due to geological variation, cultivation and drainage.

CONTENTS

LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

LAND OFF COUPE LANE, HOLMGATE, CHESTERFIELD

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Orion Heritage (the Consultant), to undertake a geophysical (magnetometer) survey on land off Coupe Lane, Holmgate, where a new residential development is proposed. The survey was carried out in order to inform planning proposals by assessing the heritage potential of the proposed development area (PDA) and therefore the impact of any proposed development on the historic environment.

The work was undertaken in accordance with a Written Scheme of Investigation for Geophysical Survey (Harrison 2018), with guidance within the National Planning Policy Framework and in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out on the 14th, 15th and 21st of May 2018.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises five fields (F1–F5) within an irregularly-shaped block of land at Holmgate on the western periphery of Clay Cross, centred on SK 3820 6440 (see Illus 1). It is bounded to the east and south by Coupe Lane, by farm buildings and a pasture field to the north and by arable land to the west.

The site is located on the south-eastern side of a low hill with the land sloping from 160m Above Ordnance Datum (AOD) in the north to 142m AOD in the east, and 140m AOD in the south (see Illus 5).

At the time of the survey F1–F3 contained wheat (see Illus 2), F4 was fallow (see Illus 3) and F5 had been recently drilled. A wooded area to the north-east of F4 was unsuitable for survey.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Pennine Lower Coal Measures Formation – mudstone, siltstone and sandstone with bands of Pennine Lower Coal Measures Formation – sandstone aligned north/south across the western and central part of the PDA (see Illus 5; NERC 2018). No superficial deposits are recorded.

The soils are classified in the Soilscape 17 association, characterised as slowly permeable, seasonally wet acid loams and clays (Cranfield University 2018).

2 ARCHAEOLOGICAL BACKGROUND

A Heritage Desk-Based Assessment (Orion Heritage 2017) has established that 'the study site has a low archaeological potential for settlement or other significant archaeological evidence from all periods'.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the survey area. This will therefore enable an assessment to be made

ILLUS 2 F2, looking west

of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

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

3.1 MAGNETOMETER SURVEY

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

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

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

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:7,500. Illus 2 and Illus 3 are site condition photographs. Illus 4 is a 1:2,000 survey location plan showing the direction of survey as GPS swaths. Illus 5 shows the contours and geology data overlying the 1892–1914 25 inch OS map, also at a scale of 1:2,000. Large-scale, fully processed (greyscale) data, minimally processed data (XY traceplot) and an accompanying interpretative plot are presented at a scale of 1:2,000 in Illus 6–8 inclusive with more

ILLUS 3 F4, looking south-west

detailed plots (1:1,000) of the area of probable archaeological activity (AAA) shown in Illus 9 to Illus 11 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 2018), guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

The ground conditions were generally good (Illus 2–3) and contributed to a high standard of data quality throughout.

Generally, a variable magnetic background has been detected throughout the PDA manifesting as a plethora of discrete anomalies and resulting in a speckled appearance across the greyscale dataset. This is thought to be due to localised variations in the composition of the soils and the Pennine Lower Coal Measures bedrock from which they derive. Slightly less magnetic variation has been detected across F5, resulting in a more monotone greyscale appearance to this part of the dataset. This is probably due to less manuring within F5 and/or lower magnetic contrast within the soils. Against this background, numerous anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figure, where appropriate.

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.

Three high magnitude dipolar linear anomalies (SP1–SP3; see Illus 6–8) have been identified on varying alignments within the west of F1/F3/F4 and F5. The anomalies locate buried service pipes. SP2 clearly corresponds to a water main which is depicted on the 1892–1914 25 inch OS map (see Illus 5).

A broad area of magnetic disturbance (FP1) is identified in the east of F4. The disturbance does not correspond to any features shown on historical OS maps but is probably caused by magnetic material (eg brick, tile, iron etc) used to infill a former pond.

Broad areas of disturbance around the perimeter of the field edges is due to ferrous material accumulated along, and contained within, the adjacent boundaries and is of no archaeological interest.

Agricultural anomalies

Analysis of historical OS mapping indicates that the division and layout of land within the PDA has changed since the publication of the first edition OS map in 1880 with the removal of three field boundaries to create larger fields. Only one of these former boundaries has been detected by the survey as a faint linear trend (FB1) aligned north-east/south-west across F5. The anomaly is caused by the magnetic contrast between the soil-fill of a ditch and the surrounding soil and forms the boundary between the parishes of Wingerworth to the north and Clay Cross to the south. An east/west aligned former boundary within F1 and a north/south aligned former boundary within F4 have not been detected by the survey. It is possible that the former boundaries have been completely removed by modern ploughing or that there is insufficient magnetic contrast in the soils for the former boundaries to manifest as magnetic anomalies.

Series of closely-spaced parallel linear trends within F1, F2 and F4 are characteristic of modern ploughing. More broadly-spaced parallel linear trends, often oblique to the surrounding boundaries are typical of field drains.

Geological anomalies

A plethora of discrete anomalies across the GSA are probably due to localised variations in the soils and the Pennine Coal Measures bedrock from which they derive. Sinuous bands of anomalies in the west of F3/F4 are probably caused by bands of sandstone in the bedrock geology (see Illus 5).

Archaeological and possible archaeological anomalies

A clear area of archaeological activity (AAA1) has been identified on a gentle east-facing slope in F2, centred on SK 3829 6458, comprising of four ring-ditches (RD1–RD4), probably round barrows. RD1–RD3 are circular in appearance and are conjoined. The ring-ditches are remarkably similar in appearance, each measuring 20m in diameter and containing broad C-shaped anomalies and concentric faint circular trends within their interior. The C-shaped anomalies are high in magnitude and may locate spreads of burnt or magnetically-enhanced material. The faint circular trends may be caused by smaller ditches or structures. A fourth ring-ditch (RD4) is clearly visible 5m east of RD1–RD3. This ring-ditch is notably different in appearance, being 18m in diameter and sub-circular or irregular in form. Extremely high magnitude anomalies within the interior of RD4 are probably due to areas of burning or spreads of burnt material. These anomalies are considered to be of high archaeological potential.

A very faint north-west/south-east aligned linear trend (D1) is identified extending through RD1–RD3. The origin of this anomaly is unclear, and it may be agricultural in origin. However, given the local context an archaeological origin must be considered and the anomaly may be due to a soil-filled ditch. Isolated high magnitude pit-type anomalies (P1–P5) are notable for their particularly high magnitude and these anomalies may be due to soil-filled pits, although a geological origin is plausible.

5 CONCLUSION

The survey has successfully evaluated the geophysical survey area and has identified a clear area of archaeological activity in the north-east of the site comprising of a cluster of four ring-ditches in the north-west of the site which are thought to probably locate round barrows. Three of the ring-ditches are particularly notable for their conjoined and symmetrical appearance whereas the fourth is less regular and is notable for containing extremely high magnitude anomalies, possibly locating areas of burning. These anomalies are considered to be of likely high archaeological potential. Elsewhere, isolated high magnitude pit-type anomalies may be archaeological in origin although a geological cause is also plausible. These anomalies are ascribed a moderate archaeological potential. However, with the exception of the ring-ditches, the majority of the site is assessed as having a low to moderate archaeological potential – the anomalies identified mostly being due to geological variation, cultivation and drainage.

6 REFERENCES

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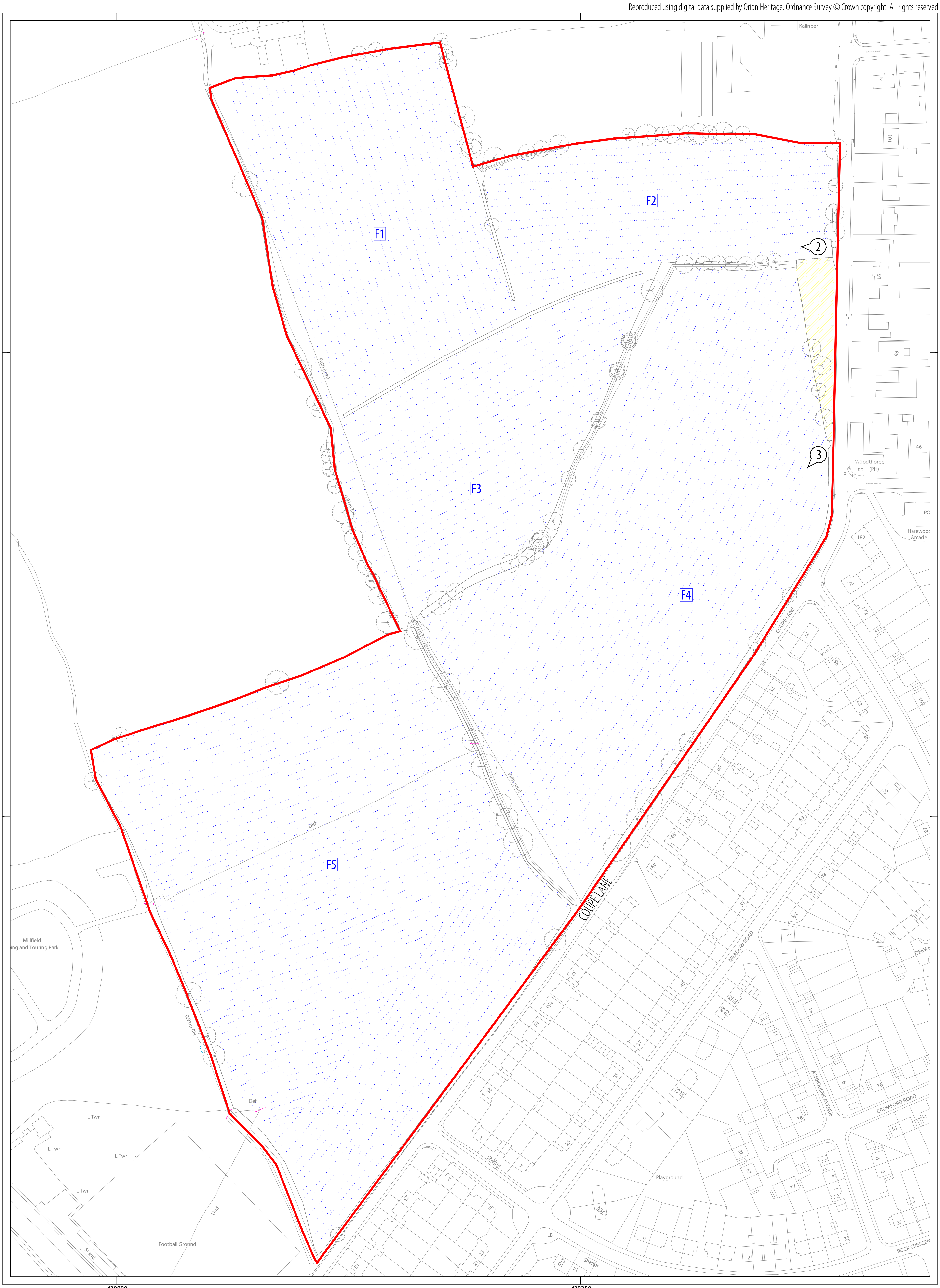

proposed development area
GPS swaths
area unsuitable for survey
location and direction of ILLUS 2-3

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Land off Coupe Lane
Holmgate
Chesterfield

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0 50m
1:2,000 @ A3

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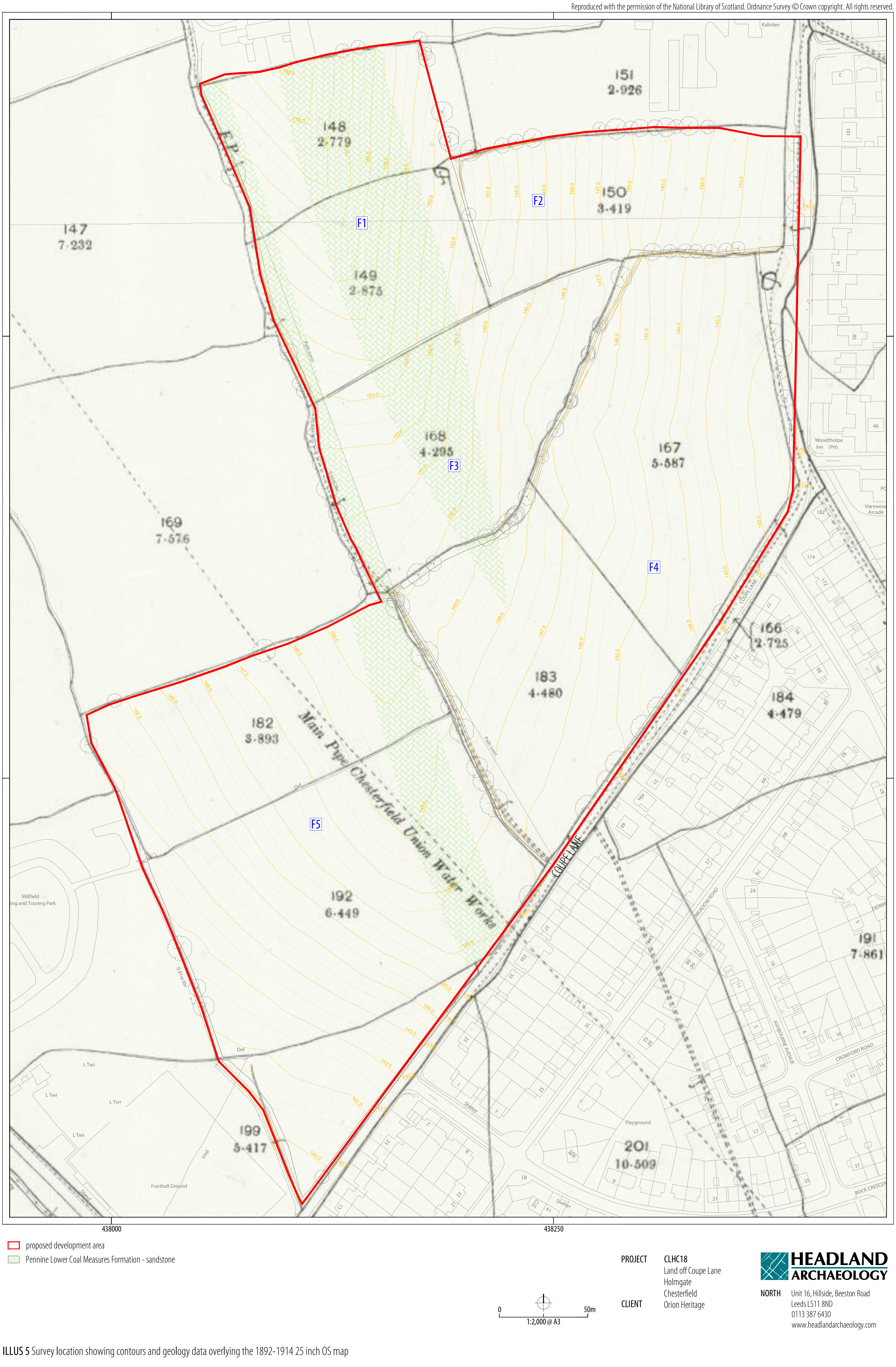
ILLUS 4 Survey location showing GPS swaths



proposed development area

Pennine Lower Coal Measures Formation - sandstone

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0 50m
1:2,000 @ A3

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ILLUS 5 Survey location showing contours and geology data overlying the 1892–1914 25 inch OS map

F1

F2

F3

F4

F5

COUPE LANE

MEADOW ROAD

ASHBOURNE AVENUE

CROMFORD ROAD

Kalinber

Woodthorpe Inn (PH)

Playground

Football Ground

Millfield ng and Touring Park

364500

364250

438000

438250

nT

2.0 3.0

0 50m

1:2,000 @ A3

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ILLUS 6 Processed greyscale magnetometer data

90.0nT/cm

0 50m

1:2,000 @ A3

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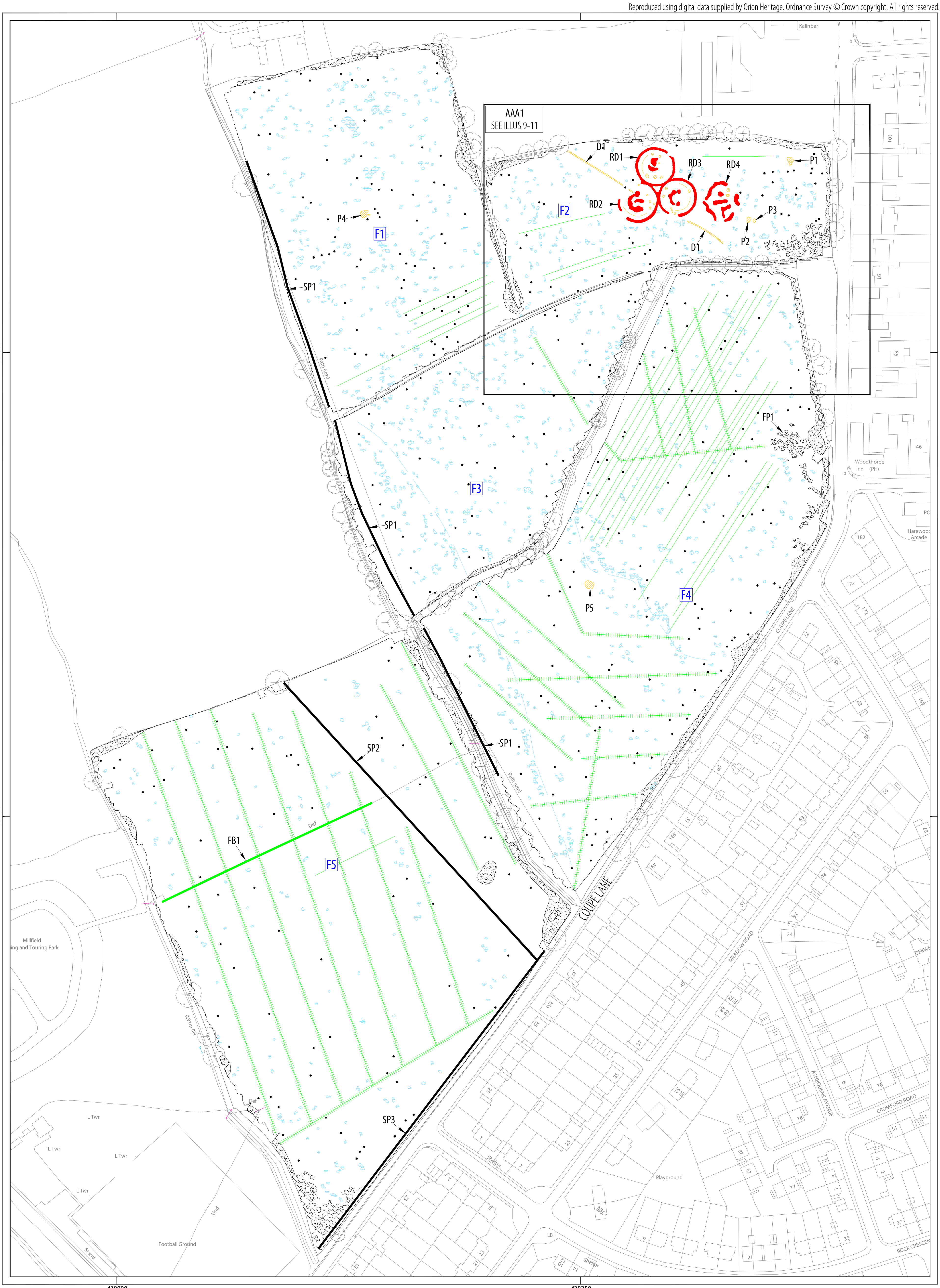
ILLUS 7 XY trace plot of minimally processed magnetometer data



TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material	linear trend	geological variation
magnetic disturbance	ferrous material	magnetic enhancement	geology
dipolar linear	service pipe	linear trend	archaeology?
linear trend	agricultural	magnetic enhancement	archaeology?
linear trend	field drain	magnetic enhancement	archaeology
linear	former field boundary		

ABBREVIATIONS

AAA area of archaeological activity

D	ditch	P	pit
FB	former boundary	RD	ring-ditch
FP	former pond	SP	service pipe

0 50m
1:2,000 @ A3

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Chesterfield

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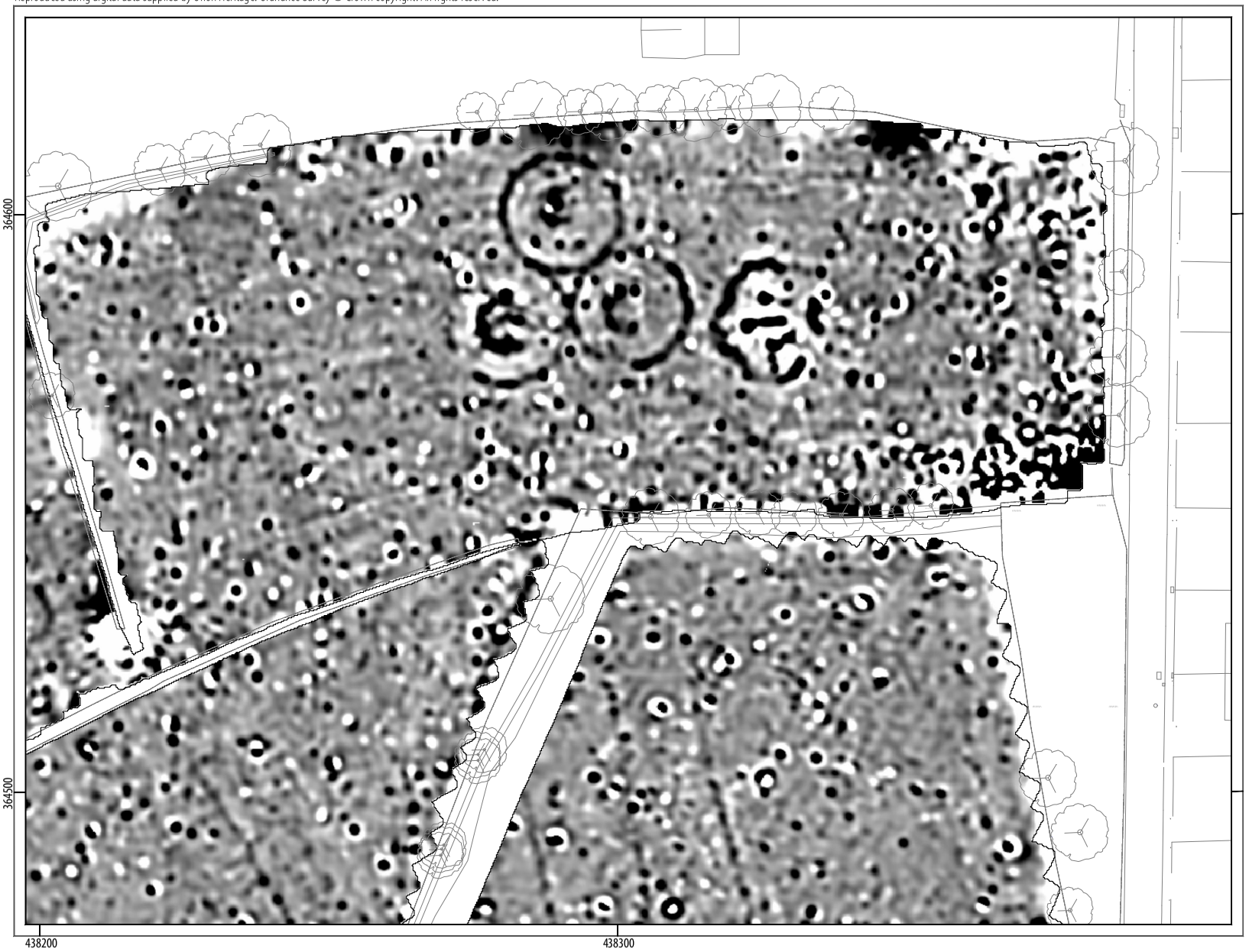
ILLUS 8 Interpretation of magnetometer data



nT
-2.0 3.0

0 25m
1:1,000 @ A4

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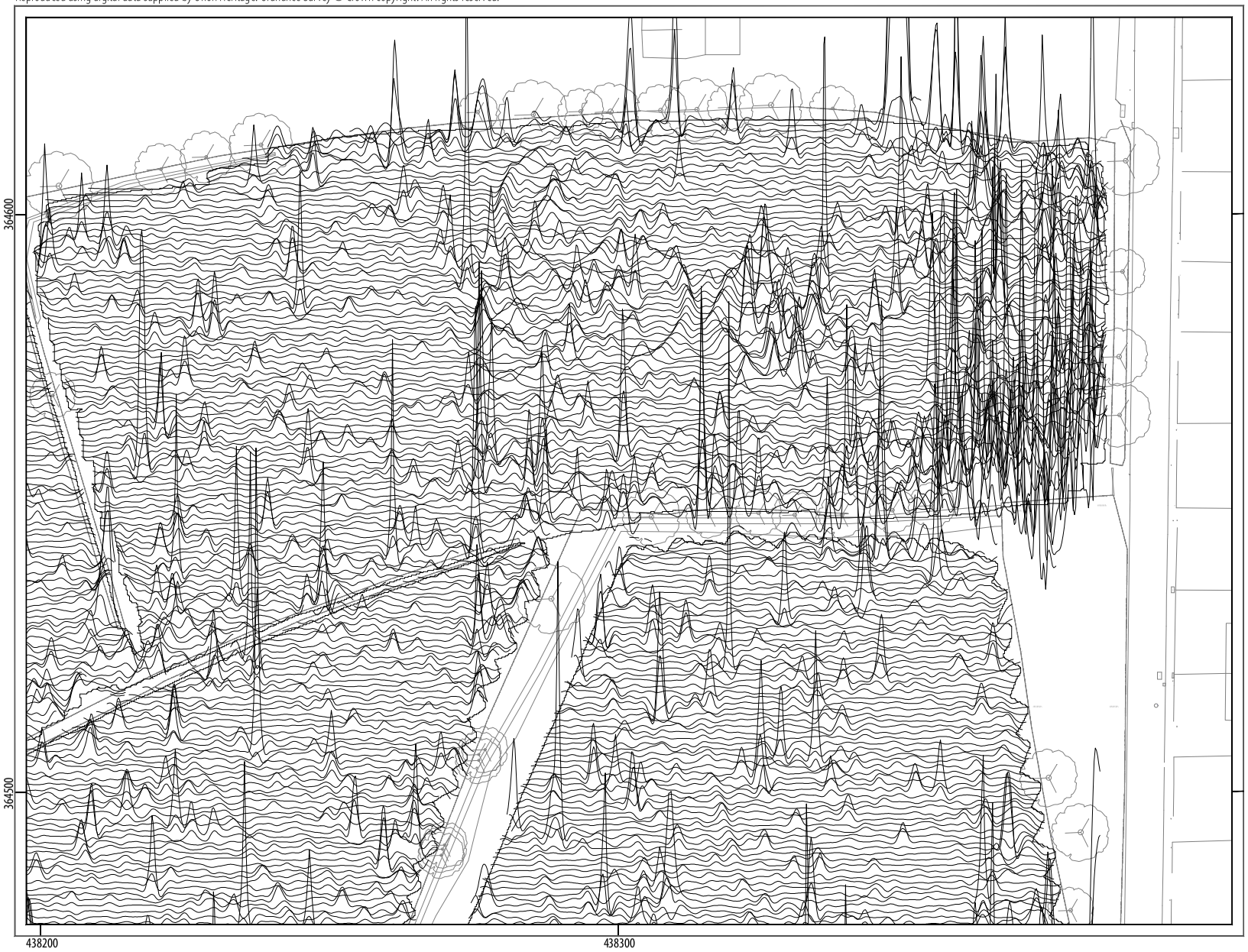
ILLUS 9 Processed greyscale magnetometer data; AAA1



45.0nT/cm

0 25m

1:1,000 @ A4

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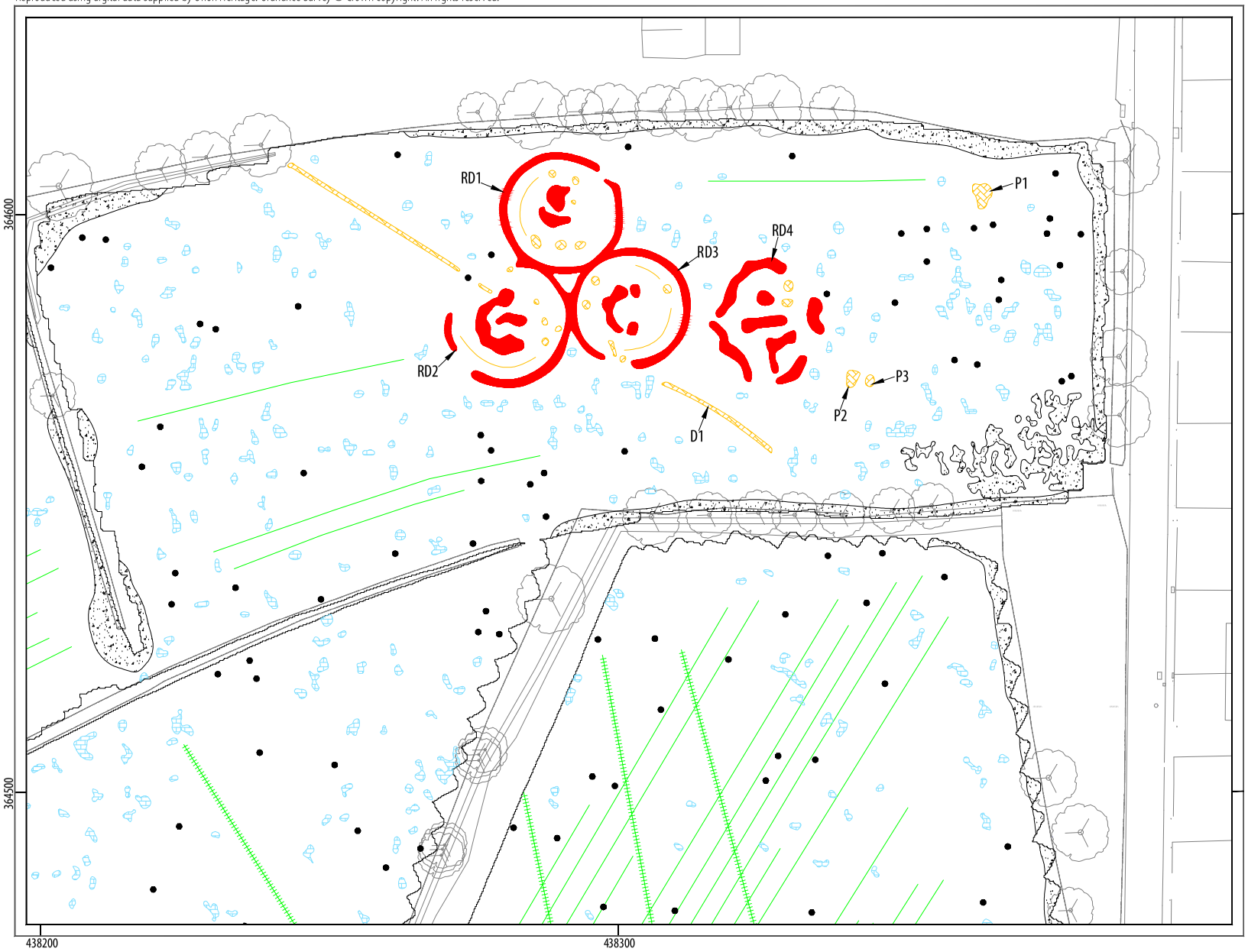
ILLUS 10 XY trace plot of minimally processed magnetometer data; AAA1



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

ABBREVIATIONS

D ditch
P pit
RD ring-ditch

0 25m
1:1,000 @ A4

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Land off Coupe Lane
Holmgate
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ILLUS 11 Interpretation of magnetometer data; AAA1

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: headland5-318986

Project details	
Project name	Land off Coupe Lane, Holmgate, Chesterfield
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering approximately 13 hectares at Holmgate, Chesterfield, where a new residential development is proposed. The survey has identified a cluster of four ring-ditches in the north-east of the site which are thought to probably locate round barrows. Three of the ring-ditches are particularly notable for their conjoined and symmetrical appearance whereas the fourth is less regular and is notable for containing extremely high magnitude anomalies, possibly locating areas of burning. These anomalies are considered to be of likely high archaeological potential. Elsewhere, isolated high magnitude pit-type anomalies may be archaeological in origin although a geological cause is also plausible. These anomalies are ascribed a moderate archaeological potential. However, with the exception of the ring-ditches, the majority of the site is assessed as having a low to moderate archaeological potential - the anomalies identified mostly being due to geological variation, cultivation and drainage.
Project dates	Start: 14-05-2018 End: 21-05-2018
Previous/future work	Not known / Not known
Any associated project reference codes	CHLC18 - 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	Rural residential
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology (other)	Pennine Lower Coal Measures Formation – mudstone, siltstone and sandstone with bands of Pennine Lower Coal Measures Formation – sandstone
Drift geology (other)	None
Techniques	Magnetometry
Project location	
Country	England
Site location	DERBYSHIRE NORTH EAST DERBYSHIRE CLAY CROSS Land off Coupe Lane, Holmgate, Chesterfield
Study area	13 Hectares
Site coordinates	SK 3820 6440 53.175047023591 -1.428416496463 53 10 30 N 001 25 42 W Polygon
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	Orion Heritage
Project design originator	Headland Archaeology
Project director/manager	Harrison, D
Project supervisor	Vansassenbrouck, O.
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	Land off Coupe Lane, Holmgate Cheserfield: Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Other bibliographic details	CHLC18
Date	2018
Issuer or publisher	Headland Archaeology
Place of issue or publication	Edinburgh
Description	A4 glue bound report and PDF/A
Entered by	Sam Harrison (sam.harrison@headlandarchaeology.com)
Entered on	6 June 2018

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