

BRBS/01



# LAND NORTH OF BEAMHILL ROAD, BURTON UPON TRENT, STAFFORDSHIRE

GEOPHYSICAL SURVEY

commissioned by WYG  
on behalf of Gladman Developments Ltd

September 2017



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#### PROJECT INFO:

HA Job No. **BRBS/01** / NGR **SK 2300 2634** / Parish **Outwoods** / Local Authority **Staffordshire** / OASIS  
Ref. **headland5-296218**

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## PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 40 hectare site, north-west of Burton upon Trent, to inform planning proposals for a proposed residential development. The survey has successfully evaluated the site identifying anomalies consistent with medieval and post-medieval agricultural activity which is also recorded on the Staffordshire HER and which had been identified in an earlier desk-based Archaeological Appraisal. This activity may be of local historical significance but is unlikely to be considered as having any more than a low archaeological value. No anomalies of definite archaeological potential have been identified by the survey with only a single isolated cluster of anomalies being ascribed any archaeological potential. These may be due to soil-filled archaeological features although a topographical and/or agricultural origin is considered more likely. Modern agricultural activity restricted the survey area locally and also resulted in large areas of magnetic disturbance across the southern part of the site. This disturbance could mask the response from archaeological features, if present, within these areas. However, on balance, considering the absence of archaeological anomalies across the rest of the site, this is thought to be unlikely and overall the archaeological potential of the site is considered to be low.

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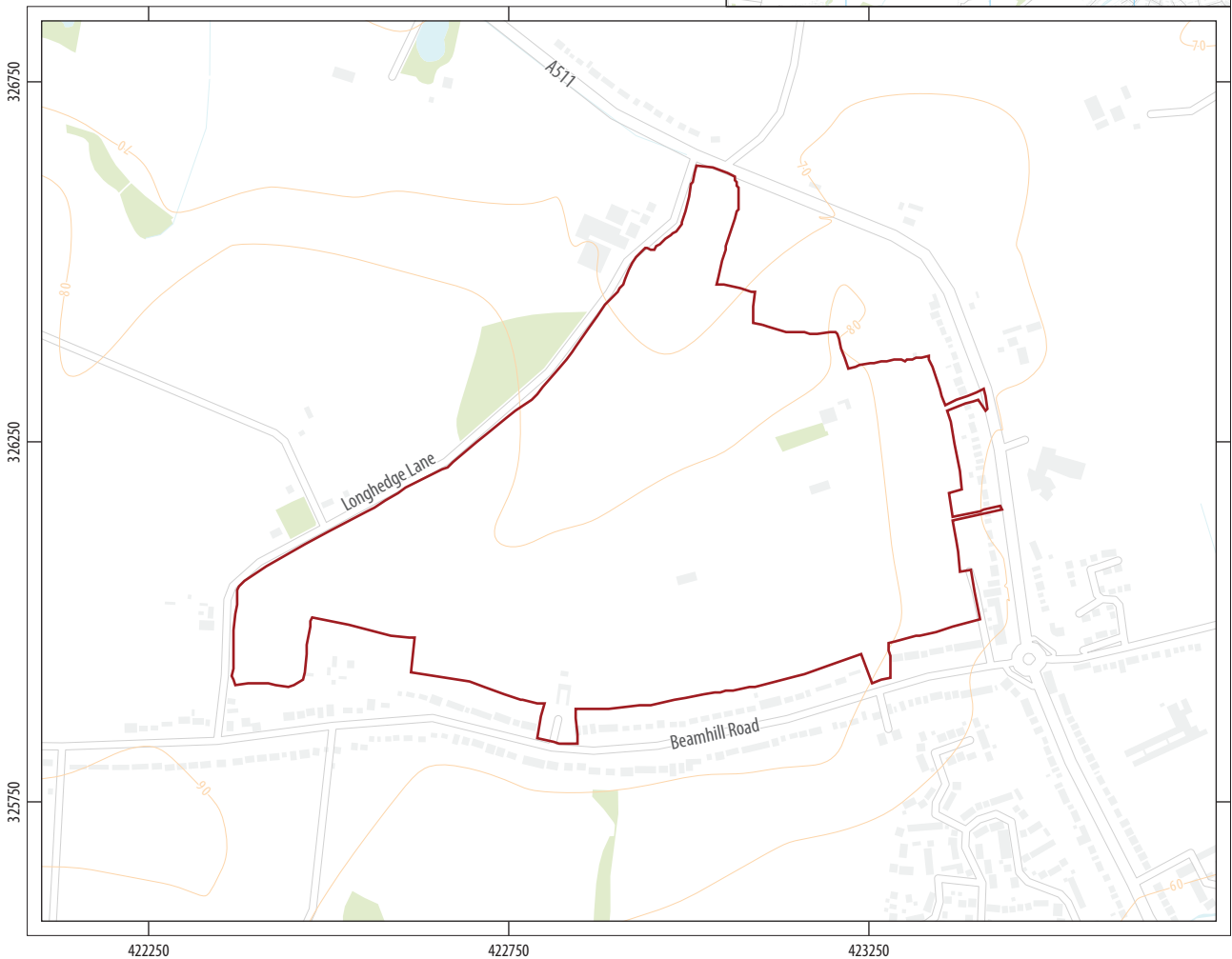
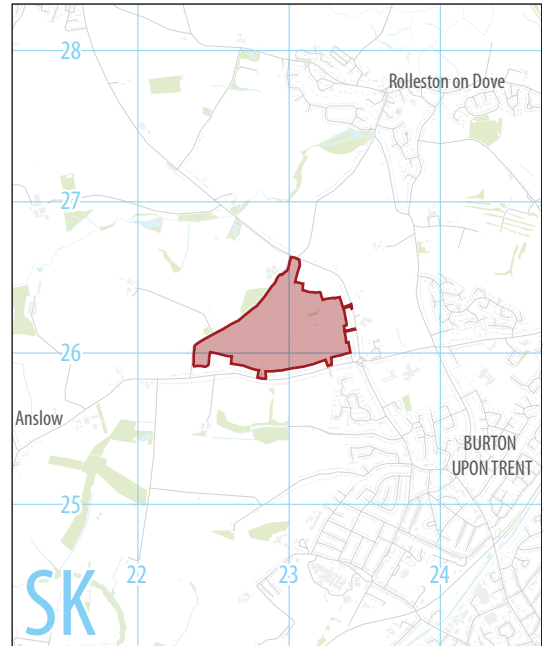
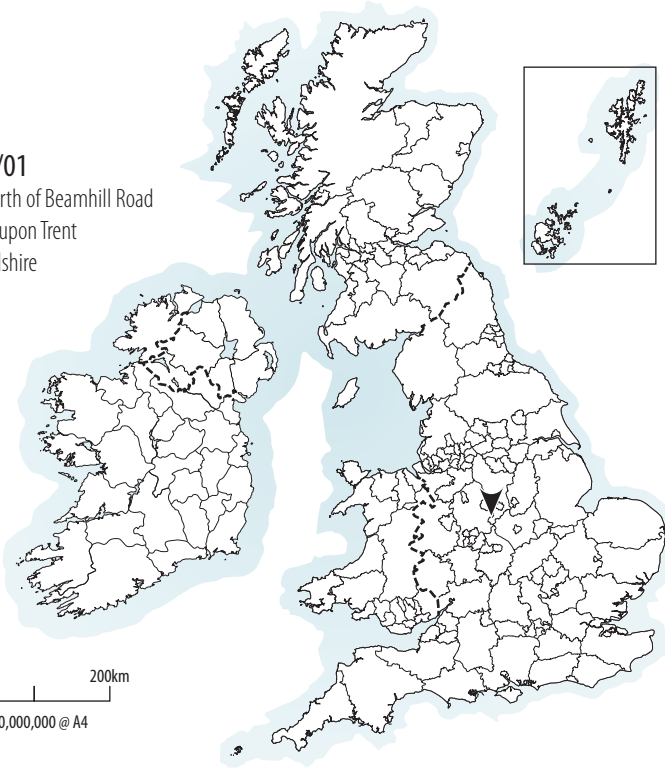
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BRBS/01  
land north of Beamhill Road  
Burton upon Trent  
Staffordshire

0 200km  
1:10,000,000 @ A4



0 200m  
1:10,000 @ A4

 proposed development area



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# LAND NORTH OF BEAMHILL ROAD, BURTON UPON TRENT, STAFFORDSHIRE

## GEOPHYSICAL SURVEY

### 1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by WYG (The Consultant), on behalf of Gladman Developments Ltd, to undertake a geophysical (magnetometer) survey of land north of Beamhill Road, Burton upon Trent, Staffordshire, where a residential development is being 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 the proposed development on the historic environment.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2017) which was submitted to and approved by the Consultant, and with guidance contained in the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out between August 21st and August 23rd 2017.

#### 1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The PDA comprised thirty one fields (F1-F31) within an irregularly-shaped block of agricultural land to the north-west of Burton upon Trent, Staffordshire, centred at SK 2300 2634 (see Illus 1). It is bound to the south by Beamhill Road and residential development, Tutbury Road (A511) and residential development to the east, and Longhedge Lane and agricultural land to the north and west.

At the time of the survey the site was under a mix of grazed pasture and un-grazed fields used for chicken farming (see Illus 2–5). Survey was restricted within the north of F25 by a chicken shed and at the perimeters of most of the fields by overgrown vegetation. F6–F9 and

F27–F31 were subdivided into horse paddocks. Of the 40ha PDA, approximately 30ha were available for survey.

A low hill (Beam Hill) rises within the south of the PDA from 84m above Ordnance Datum (AOD) at Beamhill Road to 90m AOD in F25. From here the land falls away gently to 68m AOD in the north of the PDA and 85m AOD in the west.

#### 1.2 GEOLOGY AND SOILS

The underlying bedrock geology comprises Mercia Mudstone. No superficial deposits are recorded over the majority of the site with localised Glaciofluvial sands and gravels recorded in F24 and F25 on top of Beam Hill (NERC 2017).

The soils are mainly classified in the Soilscape 18 association being characterised as slowly permeable, seasonally wet loams and clays. In the lower-lying northern part of the site, the soils are classified in the Soilscape 8 association, characterised as slightly acid loams and clays with impeded drainage (Cranfield University 2017).

### 2 ARCHAEOLOGICAL BACKGROUND

An Archaeological Appraisal (WYG 2017) has identified that there are no previously recorded designated heritage assets within the PDA and concluded that it is not anticipated to contain any previously unrecorded archaeological remains of national significance.

Two non-designated heritage assets (MST5553 and MST17266) are recorded on the Staffordshire Historic Environment Record (HER). These comprise the earthwork remains of ridge and furrow. Whilst these are considered significant at a local level, as a historic landscape feature indicative of the medieval agricultural use of the site, their overall heritage value is considered to be low.

2



3



4



ILLUS 2 Field 7, looking west    ILLUS 3 Field 12, looking north-east    ILLUS 4 Field 18, looking north-east

### 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



ILLUS 5 Field 25, looking south-west

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 1:10,000. Illus 2–5 inclusive are site condition photographs. Illus 6 is a 1:4,000 scale survey location plan showing the GPS swath data. The Staffordshire HER data is shown in Illus 7 overlying the six inch Ordnance Survey (OS) map (1888–1913), also at 1:4,000. The processed greyscale data and an overall interpretation plot are also presented at 1:4,000 on Illus 8 and Illus 9. Detailed data plots of the fully processed data (greyscale), the minimally processed data (XY traceplot) and an accompanying interpretative plot of the two sectors into which the site is divided, are presented at a scale of 1:2,500 in Illus 10 to Illus 15 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 2017) and 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

Despite the presence of overgrown vegetation at many of the field boundaries, generally, the ground conditions across the PDA were good and the overall quality of the data collected was good

throughout. The survey has detected little change in levels of background magnetic variation across the PDA except with F16, F17 and F18 (see below). Against this background, numerous anomalies have been identified. Those anomalies with modern, agricultural or geological origins are discussed first followed by those anomalies with a possible archaeological cause. All are discussed below and cross-referenced to specific anomalies on the interpretative drawings, 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.

Broad areas of high magnitude magnetic disturbance within the south of the PDA are caused by the close proximity to agricultural buildings and machinery and to areas of dumping. Within the north of F24 the disturbance corresponds to the site of a former chicken shed, whereas the disturbance within the west of F22, F24 and F27 is likely to be caused by modern dumped material within the topsoil. Magnetic disturbance around the field edges is due to ferrous material within or close to the adjacent field boundaries and is of no archaeological interest.

#### 4.2 AGRICULTURAL ANOMALIES

Analysis of historic OS mapping indicates that the division and layout of land within the PDA has changed little over the last 130 years (see Illus 7). With the exception of the addition of farm access tracks, farm buildings and paddocks, only one boundary has been removed from within F13. The former boundary has not been detected as a magnetic anomaly which may indicate a low level of magnetic contrast within the prevailing soils, or perhaps more likely, that the former boundary comprised a hedge rather than a ditch.

Numerous parallel linear and curvilinear trend anomalies have been identified across the PDA. Slightly curvilinear, broadly-spaced parallel trend anomalies have been recorded throughout F12, F13 and F15, aligned parallel with the extant field boundaries. These anomalies correspond to the undesignated heritage assets (MST5553 and MST17266) on the Staffordshire HER and are caused by the medieval and post-medieval practice of ridge and furrow cultivation. The anomalies are caused by the contrast between the former ridges and the soil-filled furrows. More closely-spaced parallel linear trends within the south-west of F12 and across the eastern part of the PDA are caused by modern cultivation.

The three, parallel, evenly-spaced, east/west aligned linear trends within F16 are characteristic of modern field drains.

Elsewhere, occasional isolated linear trends have been identified on a variety of alignments across the PDA. All of these are aligned parallel

with the surrounding field boundaries and are therefore ascribed an agricultural interpretation, probably being due to ploughing.

#### 4.3 GEOLOGICAL ANOMALIES

As discussed, a variable magnetic background has been identified across the PDA resulting in a plethora of localised low magnitude discrete anomalies. These are caused by localised variations in the depth and composition of the soils. The anomalies increase in frequency within F16, F17 and F18, probably as a result of increased agricultural activity and associated with the close proximity of Spinney Farm.

#### 4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

A cluster of anomalies has been identified within the centre of F14 which are notable for their high magnitude relative to the prevailing discrete geological anomalies. It is possible that the anomalies are caused by soil-filled pits and an archaeological origin should be considered. However, the cluster is located at the base of a north-facing slope and it is equally possible that the anomalies are caused by the natural accumulation of material at the base of the slope.

### 5 CONCLUSION

The survey has successfully evaluated the proposed development site identifying anomalies which are consistent with the medieval and post-medieval agricultural landscape as recorded on the Staffordshire HER and which has been identified in an earlier desk-based Archaeological Appraisal. These anomalies may be of local historical significance but are unlikely to be considered as any more than low archaeological value. No anomalies of definite archaeological potential have been identified by the survey with only a single isolated cluster of anomalies being ascribed limited archaeological potential. These may be due to soil-filled archaeological features although a topographical and/or agricultural origin is considered more likely. Modern agricultural activity restricted survey locally and also resulted in large areas of magnetic disturbance across the southern part of the site. This disturbance could mask the response from archaeological features, if present, within these areas, although on balance, considering the absence of archaeological anomalies across the rest of the site, this is thought to be unlikely. Overall the archaeological potential of the site is considered to be low, corroborating the results of the Archaeological Appraisal.

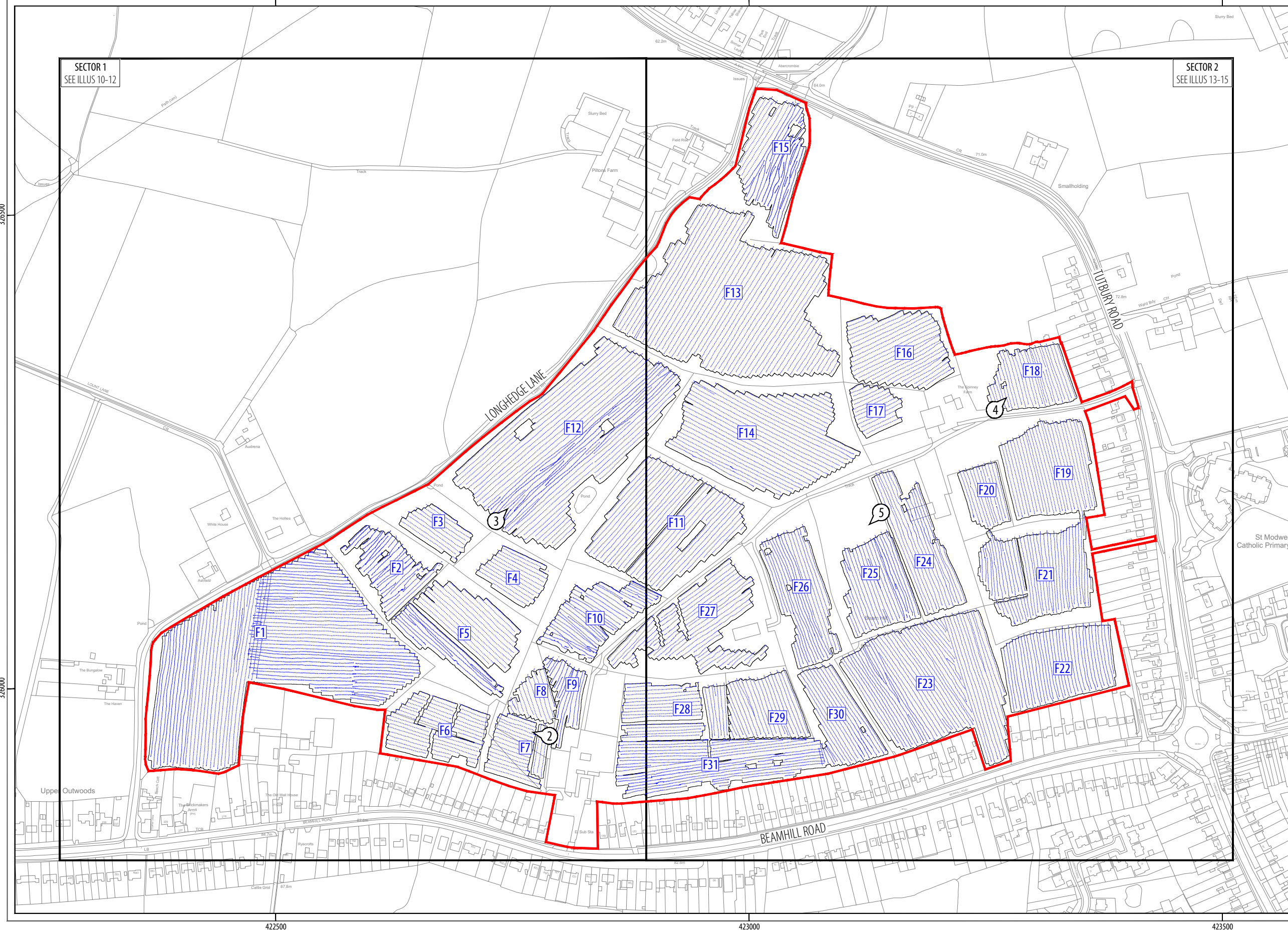
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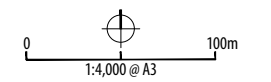
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- proposed development area
- GPS swaths
- location and direction of ILLUS 2-5



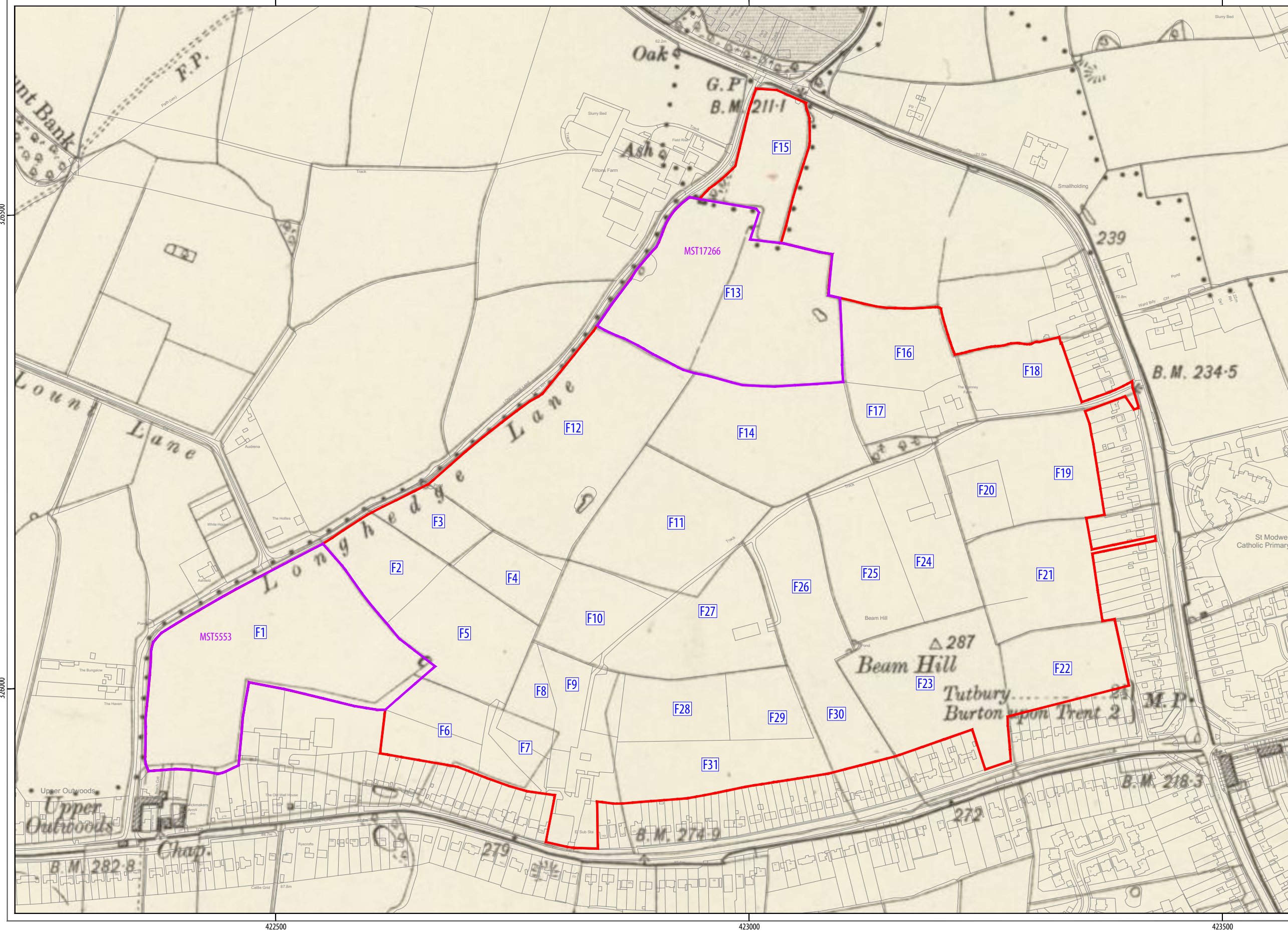
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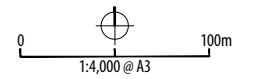


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Illus 6 Survey location showing GPS swaths



▭ proposed development area  
▭ Staffordshire HER data



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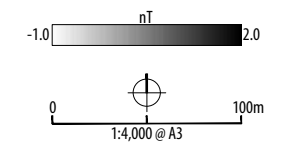
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Illus 7 Survey location showing Staffordshire HER data overlying 1888-1913 six inch OS map





proposed development area



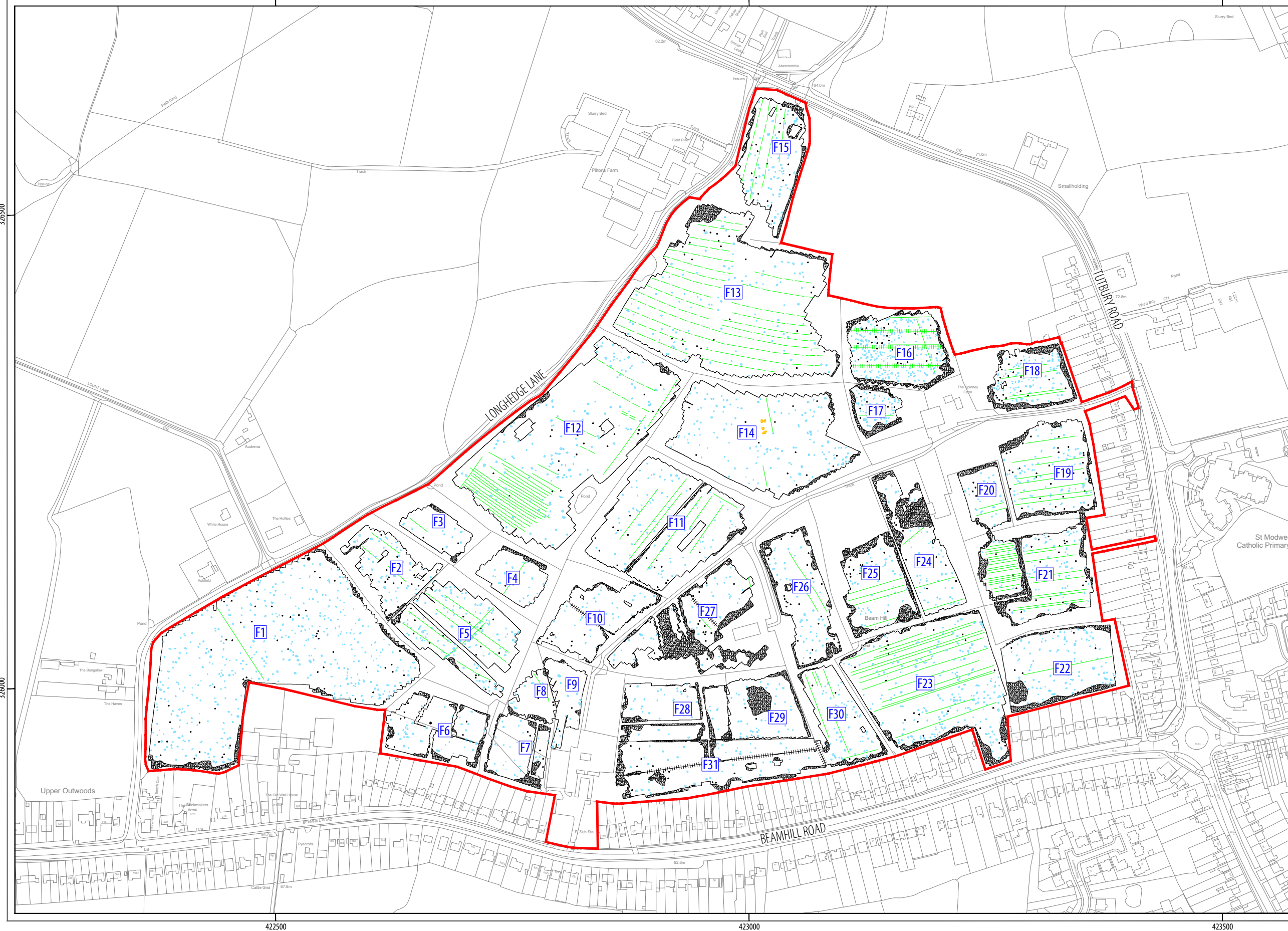
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Illus 8 Overall processed greyscale magnetometer data



TYPE OF ANOMALY	INTERPRETATION
● dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
--- dipolar linear	fence
--- linear trend	ridge and furrow
--- linear trend	field drain
--- linear trend	agricultural
● magnetic enhancement	geology
● magnetic enhancement	archaeology?



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Illus 9 Overall interpretation of magnetometer data

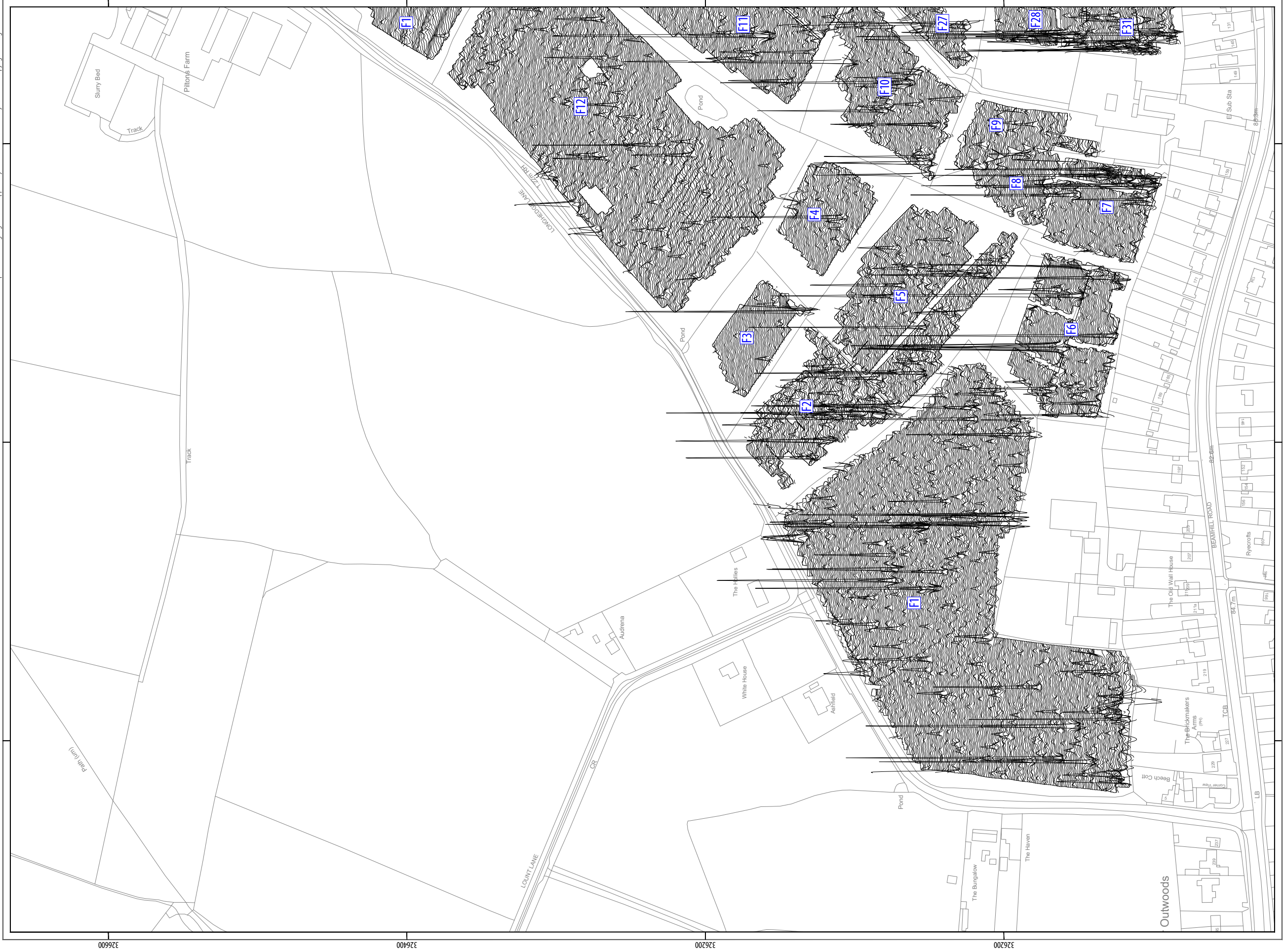


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15.0m/cm

0 50m

1:2,500 @ A3

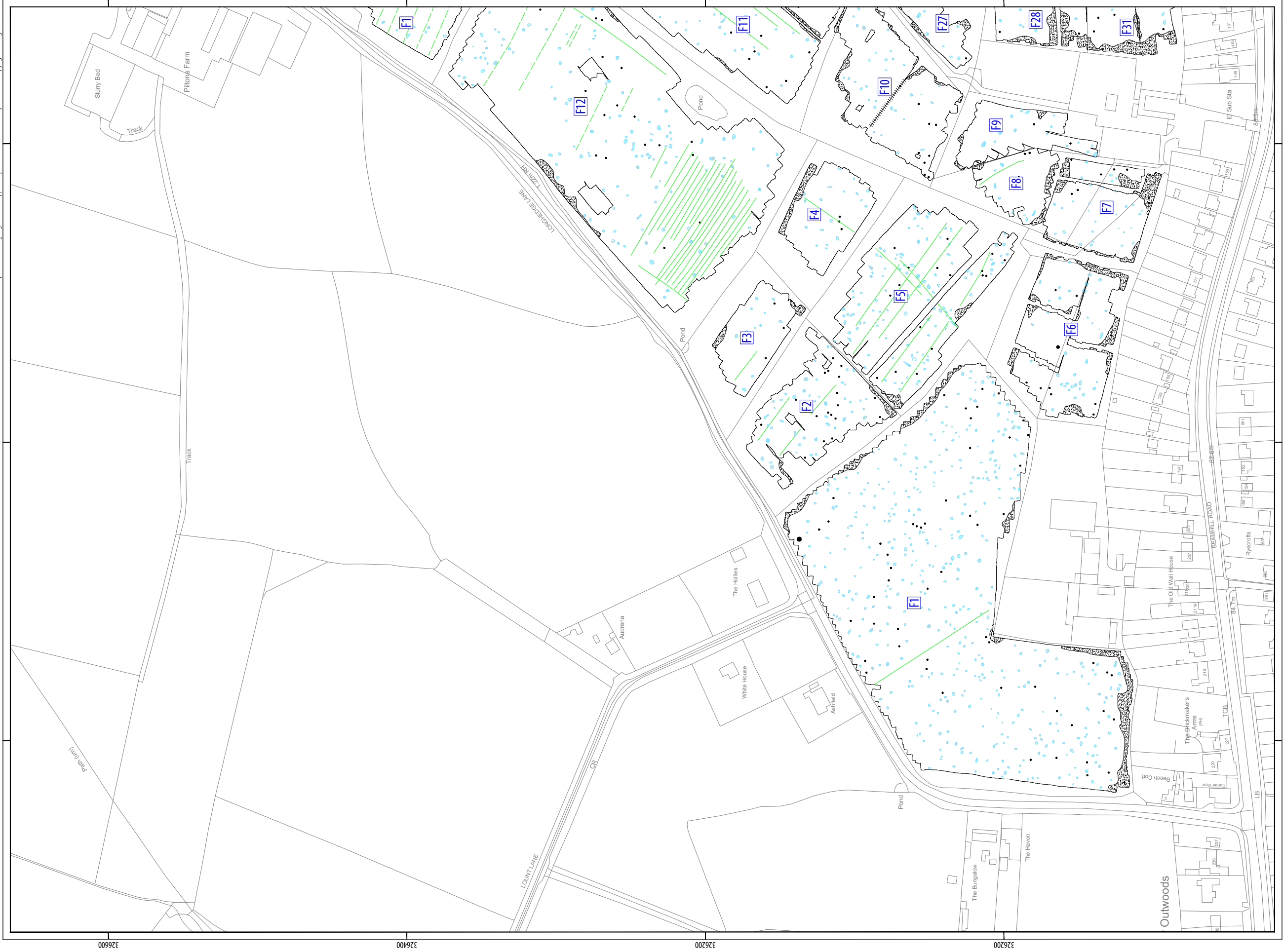
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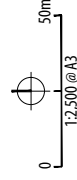
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- TYPE OF ANOMALY**
- dipolar isolated
  - magnetic disturbance
  - dipolar linear
  - linear trend
  - linear trend
  - magnetic enhancement

- INTERPRETATION**
- ferrous material
  - ferrous material
  - fence
  - ridge and furrow
  - agricultural
  - geology



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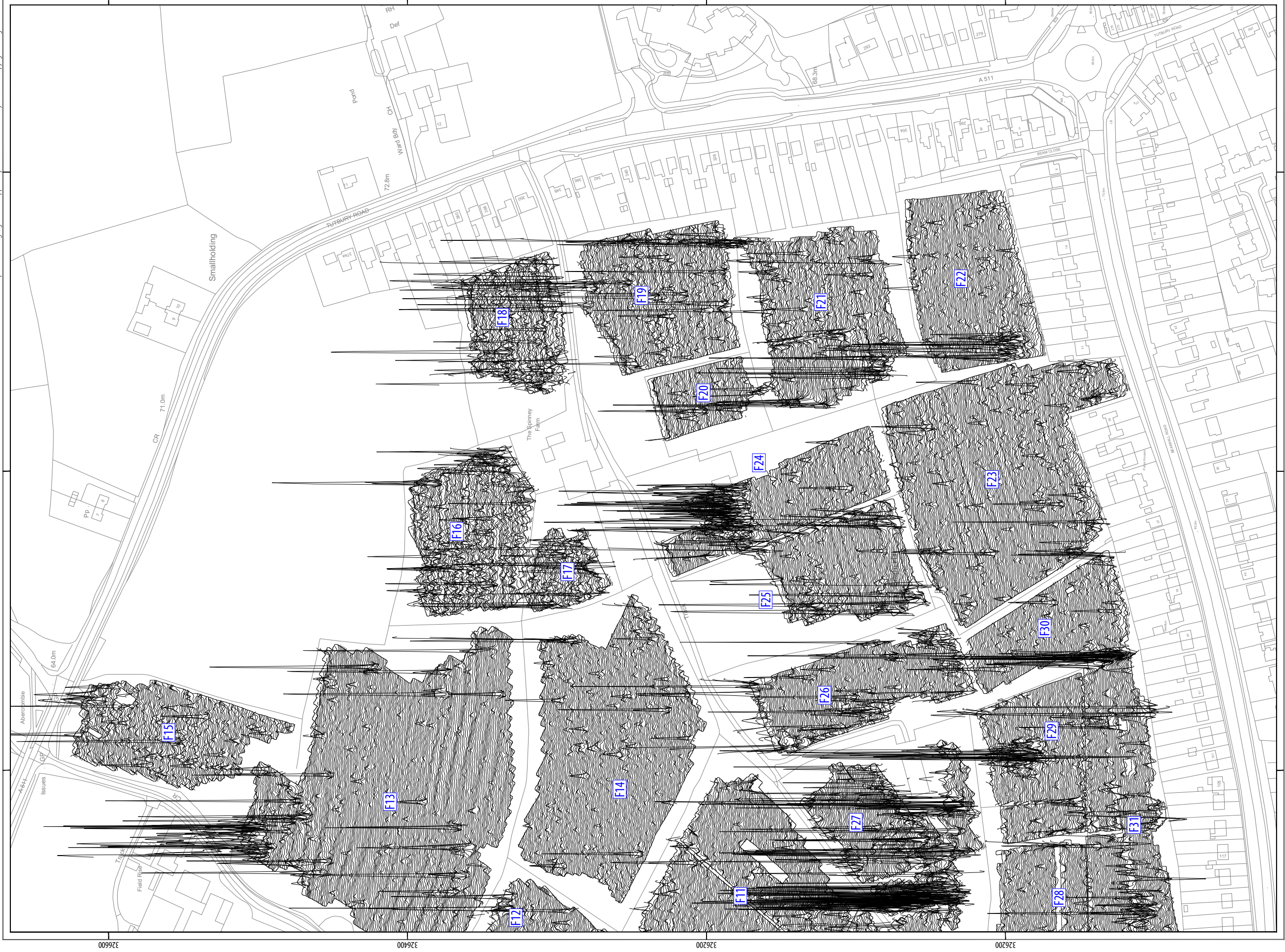


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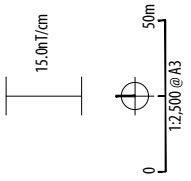
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ILLUS 14 XY trace plot of minimally processed magnetometer data; Sector 2





## 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 associated 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](http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3)). The data will be stored in an indexed archive and migrated to new formats when necessary. In addition, the raw data will be deposited with the Archaeology Data Service (ADS) in accordance with Devon County Council's Specification for Geophysical Survey.

## 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: *headland5-296218*

PROJECT DETAILS	
Project name	Land north of Beamhill Road, Burton upon Trent
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 40 hectare site, north-west of Burton upon Trent, to inform planning proposals for a proposed residential development. The survey has successfully evaluated the site identifying anomalies consistent with medieval and post-medieval agricultural activity which is also recorded on the Staffordshire HER and which had been identified in an earlier desk-based Archaeological Appraisal. This activity may be of local historical significance but is unlikely to be considered as having any more than a low archaeological value. No anomalies of definite archaeological potential have been identified by the survey with only a single isolated cluster of anomalies being ascribed any archaeological potential. These may be due to soil-filled archaeological features although a topographical and/or agricultural origin is considered more likely. Modern agricultural activity restricted the survey area locally and also resulted in large areas of magnetic disturbance across the southern part of the site. This disturbance could mask the response from archaeological features, if present, within these areas. However, on balance, considering the absence of archaeological anomalies across the rest of the site, this is thought to be unlikely and overall the archaeological potential of the site is considered to be low.
Project dates	Start: 21-08-2017 End: 23-08-2017
Previous/future work	Not known / Not known
Any associated project reference codes	BRBS-01 - 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)	Mercia Mudstone
Drift geology	ALLUVIUM
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	STAFFORDSHIRE EAST STAFFORDSHIRE OUTWOODS Land north of Beamhill Road, Burton upon Trent
Study area	30 Hectares
Site coordinates	SK 2300 2634 52.833759968873 -1.658557461909 52 50 01 N 001 39 30 W Point
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	WYG
Project design originator	Headland Archaeology
Project director/manager	Webb, A.

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","Survey"  
 Paper Archive Exists? No

PROJECT BIBLIOGRAPHY 1

Publication type Grey literature (unpublished document/manuscript)  
 Title Land north of Beamhill Road, Burton upon Trent, Staffordshire: Geophysical Survey  
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