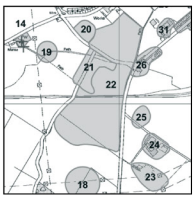
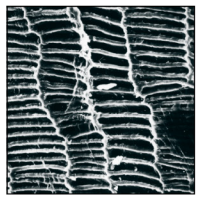
WRLC/01










WOODFEN ROAD, LITTLEPORT, CAMBRIDGESHIRE

Geophysical Survey

commissioned by Peter Brett Associates

September 2015

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

WOODFEN ROAD, LITTLEPORT, CAMBRIDGESHIRE

Geophysical Survey

commissioned by Peter Brett Associates

September 2015

project info

HA JOB NO.	WRLC/01
NGR	TL 554 560, 870 300
PARISH	Littleport
LOCAL AUTHORITY	Cambridgeshire
OASIS REF.	Headland5-222841

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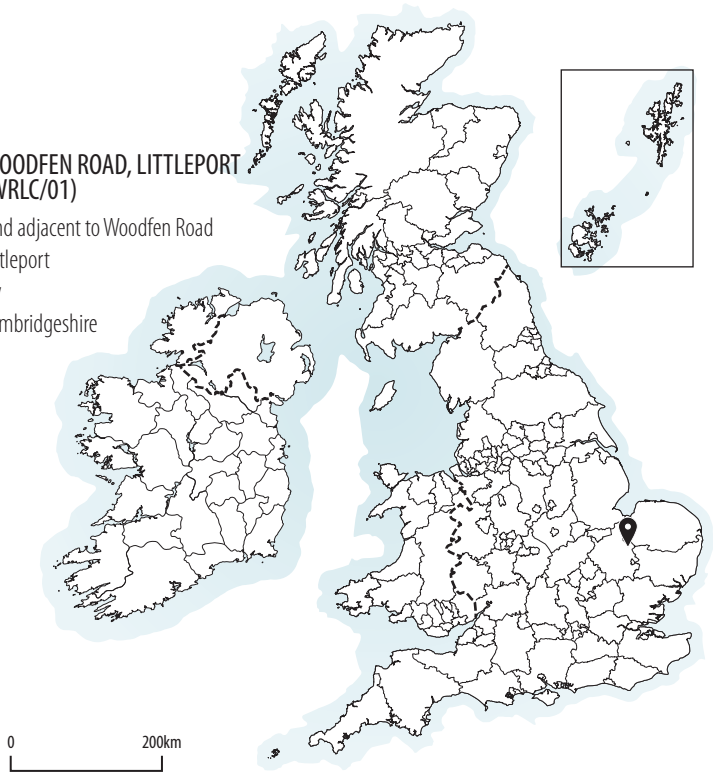
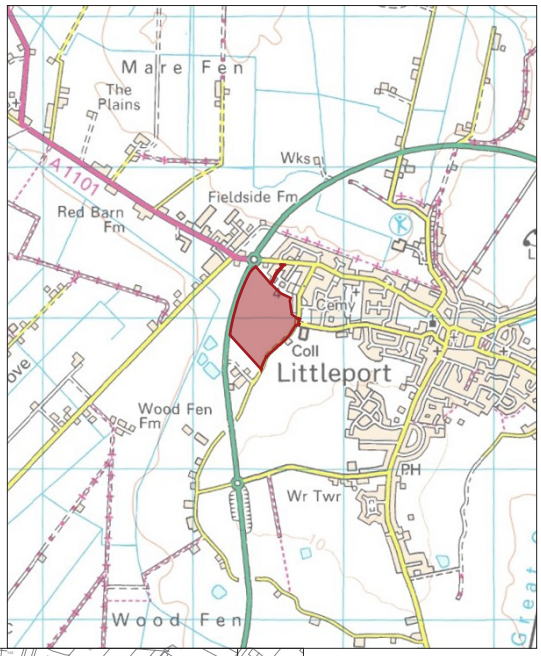
CONTENTS

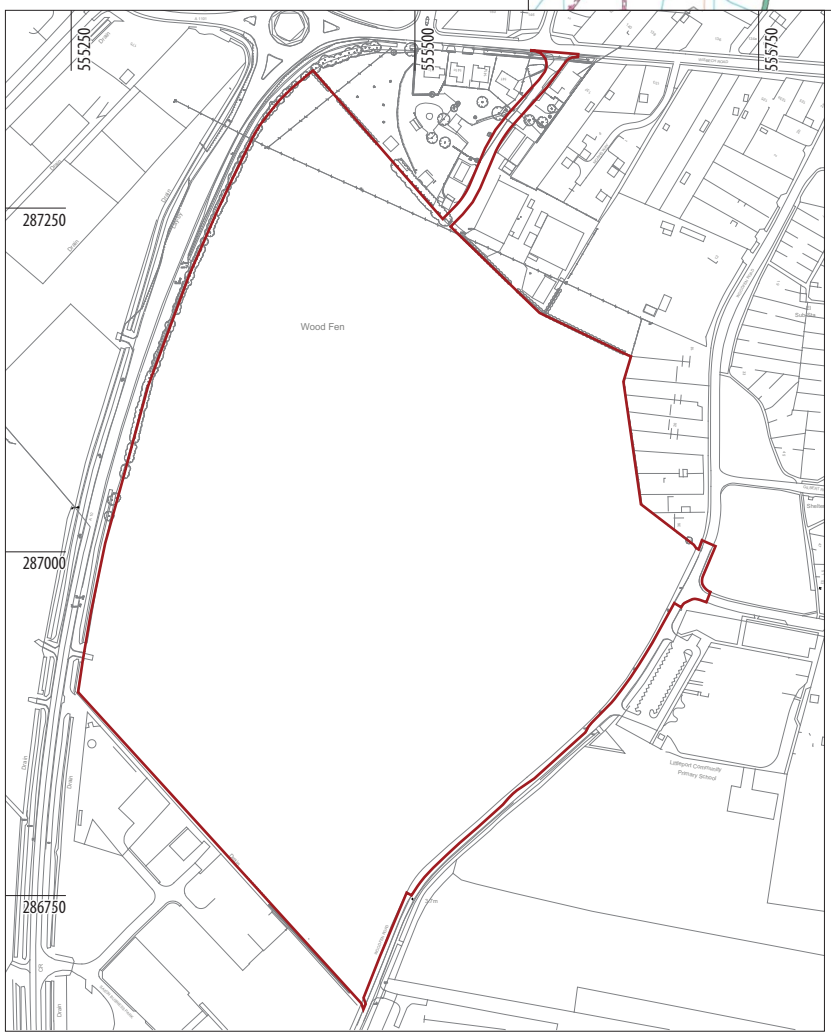
LIST OF ILLUSTRATIONS

WOODFEN ROAD, LITTLEPORT (WRLC/01)

land adjacent to Woodfen Road
Littleport
Ely
Cambridgeshire







KEY

development boundary

N

0 200m

scale 1:5,500 @ A4

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ILLUS 1

Site location

WOODFEN ROAD, LITTLEPORT, CAMBRIDGESHIRE

Geophysical Survey

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering approximately 16 hectares on agricultural land on the western periphery of Littleport, Cambridgeshire, to provide information about the archaeological potential of land proposed for housing development. Although the site (prior to survey) has been assessed as having moderate to high potential for unknown Iron Age, Roman and medieval remains the survey has only definitively identified evidence of post-medieval agricultural activity including anomalies caused by former field boundaries, drains, ploughing and the locations of former buildings and water pumps. All of these features are recorded on maps and plans from the early 19th century onwards. Anomalies indicative of geological and pedological variation within the superficial deposits are notable throughout the data set. Four anomalies that may not have a geological, modern or agricultural origin and which therefore cannot otherwise be confidently interpreted have been ascribed a possible archaeological origin. There is no indication that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the proposed development area and, therefore, based solely on the results and interpretation of the data, the archaeological potential of the site is considered to be low. However, the possibility of unenclosed prehistoric activity cannot be dismissed.

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Peter Brett Associates (PBA) to undertake a geophysical (magnetometer) survey on land proposed for development to the west of Littleport, Cambridgeshire. The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2015) submitted to and approved by Kasia Gdaniec, Senior Historic Environment Advisor with Cambridgeshire County Council, with guidance within the National Planning Policy Framework (DCLG 2012) and in line with current best practice (David et al. 2008). The survey was carried out between August 10th and August 12th 2015 in order to provide additional information on the archaeological potential of the site.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises a single parcel of land on the western edge of Littleport, Cambridgeshire (see Illus 1), (centred at TL 555 870) covering approximately 16 hectares. The PDA is bound to the west by the A10, to the north-east by the rear of premises off Wisbech Road, Noahs Way and Woodfen Road and to the south-west by Saxon Business Park. Littleport Community School borders the site to the east.

The site lies on the edge of a low 'island' capped with sand and gravel and south of a sand and gravel capped spit of land which follows the alignment of Wisbech Road. Within the extent of the PDA the land surface is generally flat sloping very gently from 5m above Ordnance Datum (aOD) in the north to 4m aOD at the southern apex of the site. An arable crop was harvested immediately prior to survey (see **Illus 2** and **Illus 3**).

1.2 GEOLOGY AND SOILS

The underlying bedrock comprises Mudstone of the Kimmeridge Clay Formation which is overlain by superficial deposits of sand and gravel (see Section 1.1) of the Oadby Member across the northern and central parts of the site (British Geological Survey 2015).

The soils are classified in the Soilscape 7 association in the northern half of the site, characterised as freely draining, slightly acid base rich soils changing to loamy and sandy soils with high groundwater and a peaty surface (Soilscape 23) to the south of the site (Landis 2015).

ILLUS 2

General view of Area 1, looking SE

2 ARCHAEOLOGICAL BACKGROUND

Information provided by the Cambridgeshire County Council Historic Environment Team indicates that the site is on the edge of Littleport 'island' , which has an 'inlet' in the southern half of the application area. It is also close to a former tidal channel (Old Croft river roddon). These fen islands, and particularly inlets are known as possible areas of prehistoric (Neolithic) activity) and a single piece of Neoloithic material is recorded on the Cambridgeshire Historic Environment Record (HER No. 0793). Medieval pottery has also been recovered within the PDA.

An archaeological desk-based assessment (CgMs 2014) reported that the site was 'considered to have a moderate to high potential for late prehistoric evidence (lithic scatters), a moderate to high potential for Iron Age and Roman settlement (particularly within the northern half of the site) and a moderate to high potential for the remains of Iron Age, Roman and Medieval field ditches and stray finds' and concluded that 'if present, these remains are likely to be of probable local and/or regional significance'.

3 AIMS, METHODOLOGY AND PRESENTATION

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of any proposed development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended.

The general 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. Features 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 and Gater, 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1. Magnetometer survey is particularly good at identifying areas of enclosure or settlement activity. It is less successful in locating areas of unenclosed or transitory activity.

Bartington Grad601 magnetic gradiometers were used during the survey, taking readings at 0.25m intervals on zig-zag traverses 1m

ILLUS 3
General view of Area 2, looking NW

apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data.

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble GeoXR model).

3.2 REPORTING

A general site location plan is shown in **Illus 1** at a scale of 1:5,500. **Illus 2** and **Illus 3** are general site location photographs. **Illus 4** is a large scale (1:2,000) survey location plan displaying the processed greyscale magnetometer data. An overall interpretation of the data is shown in **Illus 5** at the same scale. Detailed data plots ('raw' and processed) and interpretative illustrations are presented at a scale of 1:1000 in **Illus 6** – **17** 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. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 4.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Headland Archaeology 2015) and guidelines outlined by English Heritage (David et al. 2008) and by the Chartered Institute for Archaeologists (ClfA 2014). All illustrations reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (Ó 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

Generally, the magnetic background reflects the changes in geology and soils across the site. Across the majority of the site the general magnetic background is fairly low with random discrete anomalies indicative of magnetic gravels present throughout. The only noticeable variation is in a band aligned northwest/southeast and approximately 75m wide at the southern end of the site, to the south a former field boundary, where there is a much greater degree of variation. This band corresponds with the lowest part of the site and the more peaty soils – it is adjacent to Wood Fen.

Against this magnetic background numerous anomalies have been identified which are discussed below and cross-referenced to specific examples depicted on the interpretative figures, where appropriate.

4.1 FERROUS/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 or material is common on most sites, often being present as a consequence of manuring or tipping/infilling.

A cluster of anomalies, A, forming a sub-circular area of magnetic disturbance is located around the intersection of a former boundary (see below) and a drain recorded on historic mapping. This disturbance may be due to material cleaned out of the drain or from material left over following the infilling of the drain.

Two other areas of disturbance, B and C, are noted in the south-western corner of the site. This is in an area of field drains and is probably due to the installation of the drains.

Linear bands of disturbance around the periphery of the site are due to the proximity of fences or sub-surface drains and are not of archaeological significance.

Several discrete rectilinear anomalies of much higher magnitude are identified across the site. Analysis of late 19th and early to mid-20th century mapping reveals that several of these anomalies correlate with features recorded on the historic mapping. Anomalies D and E, to the north of the site in Sector 1, correlate with two sub-rectangular features recorded on the 1886 Ordnance Survey. On the 1901 edition a single rectangular feature remains and is recorded as a pump. This feature is shown on the 1925 and 1952 editions but is no longer recorded on the 1973 edition.

Four other pumps recorded on the early OS mapping are located as high magnitude anomalies. In Sector 2 is F. This feature although recorded on early maps isn't labelled as such until the 1952 edition. Two anomalies, G and H, 100m to the south of F, also correlates with the position of a pump. Both these features are recorded up until the 1952 OS edition but disappear thereafter.

The two final pumps are located in Sector 4. Anomaly I, on the south-eastern site boundary, is recorded from 1925 until 1952. Anomaly J is also mapped between 1925 and 1952 and is not labelled but assumed also to be a pump.

4.2 AGRICULTURAL ANOMALIES

Analysis of the historical OS mapping indicates that the site formerly comprised a series of at least 11 rectilinear fields aligned on a northwest/southeast axis and with two parallel open drains, located as K and L, to the north-west of the site in Sector 1; the boundaries are identified as anomalies N to W inclusive. All but the boundary division, N, and the drains had been removed by 1973. These final features from the late 19th century were subsequently removed/infilled leaving the single open field present today. All of these former boundaries can be located in the data as linear trend anomalies easily identified by intermittent high magnitude anomalies along the line of the former boundary. It is likely that drains were laid along the former boundaries.

Field drains are present right across the site on varying alignments, usually parallel with, or at right angles to, the former boundaries. These anomalies present as fairly weak anomalies across most of the site, with the exception of at the southern end of the site, south of V, where they are particularly strong. It is not clear whether linear anomaly X is a drain or another (unmapped) former boundary. However it terminates at a former boundary and is therefore not considered likely to be of any archaeological potential.

More closely spaced linear trend anomalies generally aligned NNE/SSW reflect recent ploughing.

4.3 GEOLOGICAL ANOMALIES

Throughout the site numerous discrete, low magnitude, anomalies have been identified. In theory any of these anomalies could be due to an archaeological pit. However, the sheer number of these anomalies and their relatively even distribution precludes an archaeological interpretation and it is likely that the anomalies are caused by variations in the composition of the soils and superficial deposits from which they derive.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Several discrete anomalies which cannot be confidently interpreted as of obviously modern, geological or agricultural origin have been identified by the survey. These anomalies have therefore been ascribed a possible archaeological origin although a non-archaeological cause is considered equally plausible.

Anomalies Y, Z and A1, in Sector 4, are not dissimilar to other anomalies that correlate with the mapped locations of pumps but do not correspond to any features on the historic mapping although a modern origin is considered most likely.

On the northern site boundary in Sector 1 a discrete anomaly, B1, could be indicative of a pit but geological or modern activity may also be considered possibilities.

Finally a cluster of discrete anomalies C1, in Sector3, could indicate a series of pits. Geological variation might also cause the recorded responses.

5 CONCLUSION

The geophysical survey has identified anomalies reflecting the post-medieval and modern historical agricultural landscape with the identified anomalies charting the change in the agricultural landscape over the last 150 years from the draining of the fens using pumps and drains through to the rationalisation of the land by the removal of boundaries to create a single large field for modern arable cultivation.

A handful of discrete anomalies of uncertain origin have been identified. These have been ascribed a possible archaeological origin but could equally plausibly be due to geology, modern or agricultural activity.

The variation in the superficial deposits and soils is evident in the data but there is no indication from any other source to suggest that the magnetic data provides anything other than an accurate representation of the sub-surface conditions within the proposed development area. Under the prevailing conditions there is no reason to suppose that had there been any significant archaeological remains, particularly Iron Age and Roman settlement activity, or field systems of similar and later period, that they would not have been identified by the survey. The possibility of late prehistoric activity cannot be dismissed as lithic scatters or any other ephemeral or transitory activity is not likely to be detectable by magnetometer survey. Therefore, based solely on the results and interpretation of the data, the archaeological potential of the site is considered to be low.

6 REFERENCES

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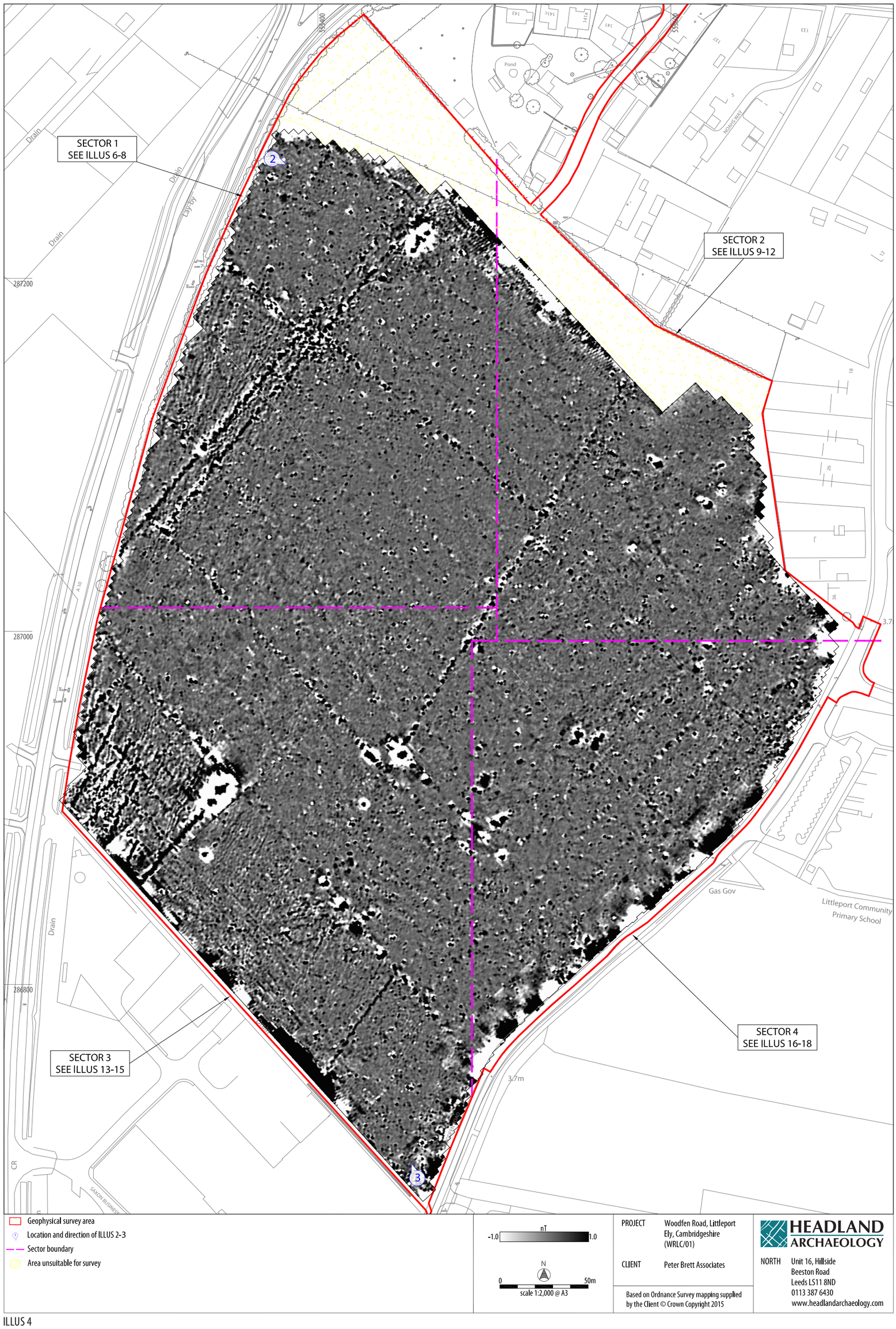
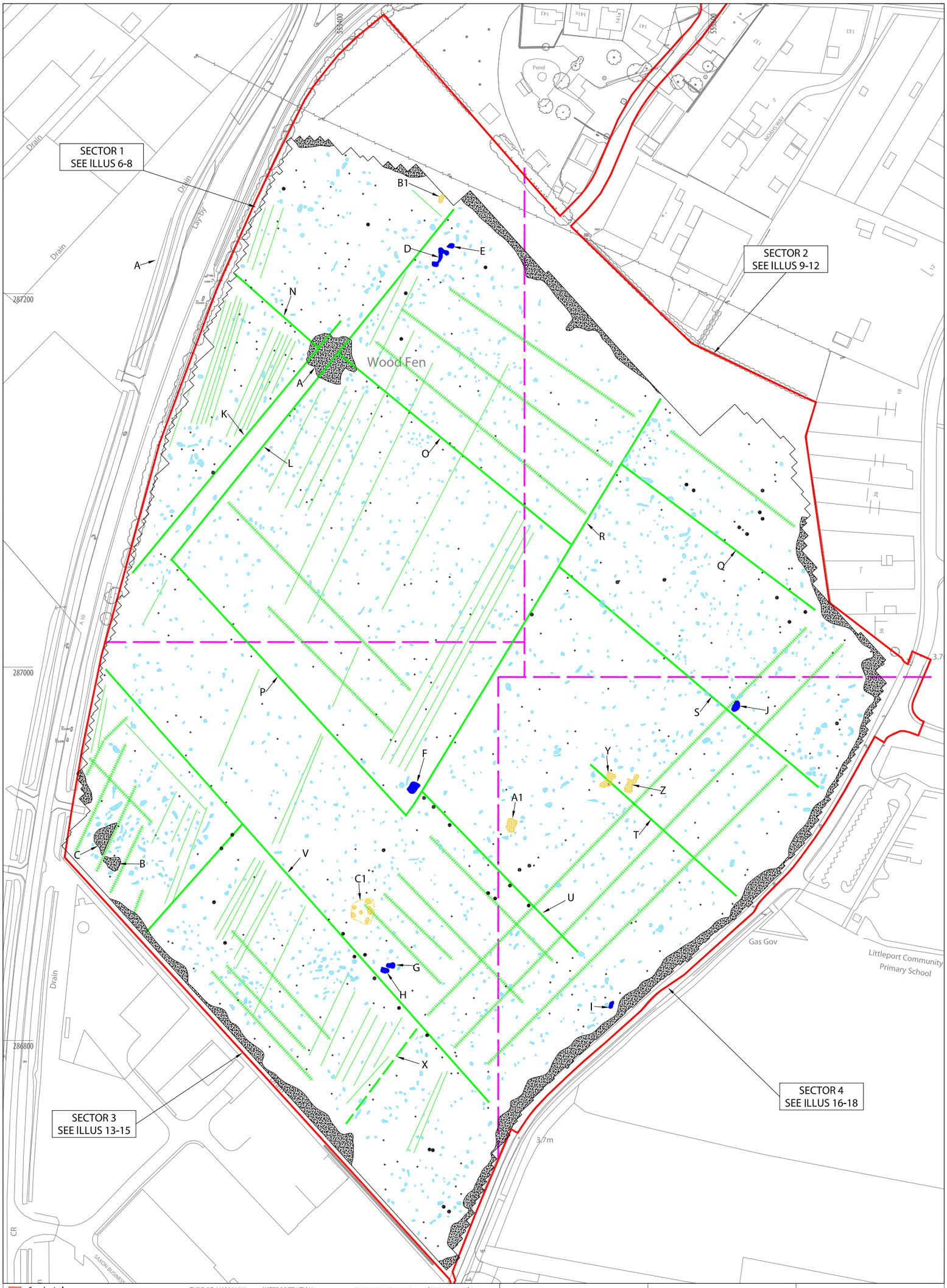


ILLUS 4

Survey location showing processed greyscale magnetometer data (1:2,000)



Geophysical survey area	TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
Sector boundary	Dipolar Isolated	Ferrous Material	Magnetic Disturbance	Modern?
	Magnetic Disturbance	Ferrous Material	Magnetic Enhancement	Archaeology?
	Linear Trend	Field Drain		
	Linear Trend	Agricultural		
	Linear	Former field boundary		
	Magnetic Enhancement	Geology		

N

0 50m

scale 1:2,000 @ A3

PROJECT Woodfen Road, Littleport Ely, Cambridgeshire (WRLC/01)

CLIENT Peter Brett Associates

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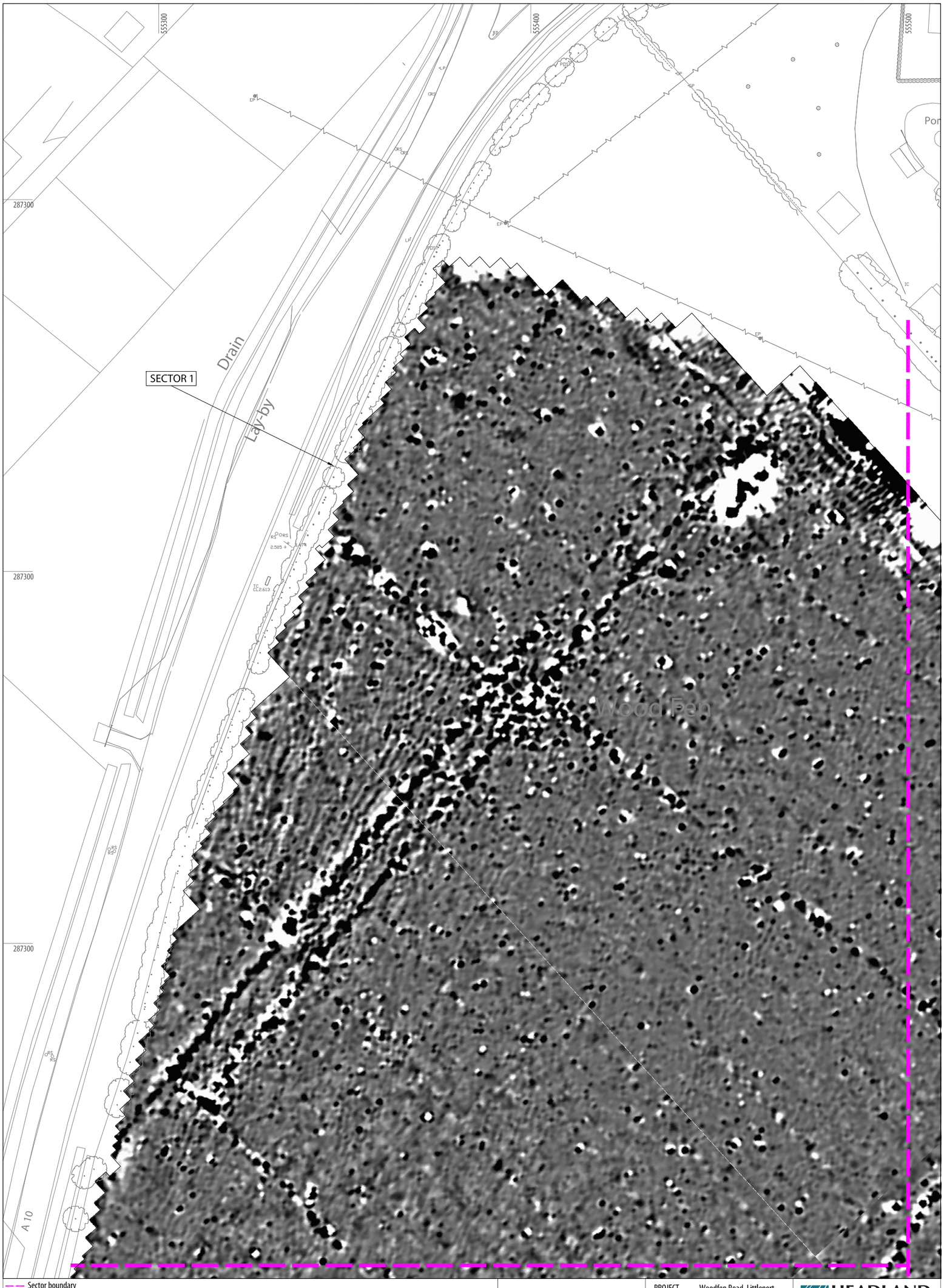
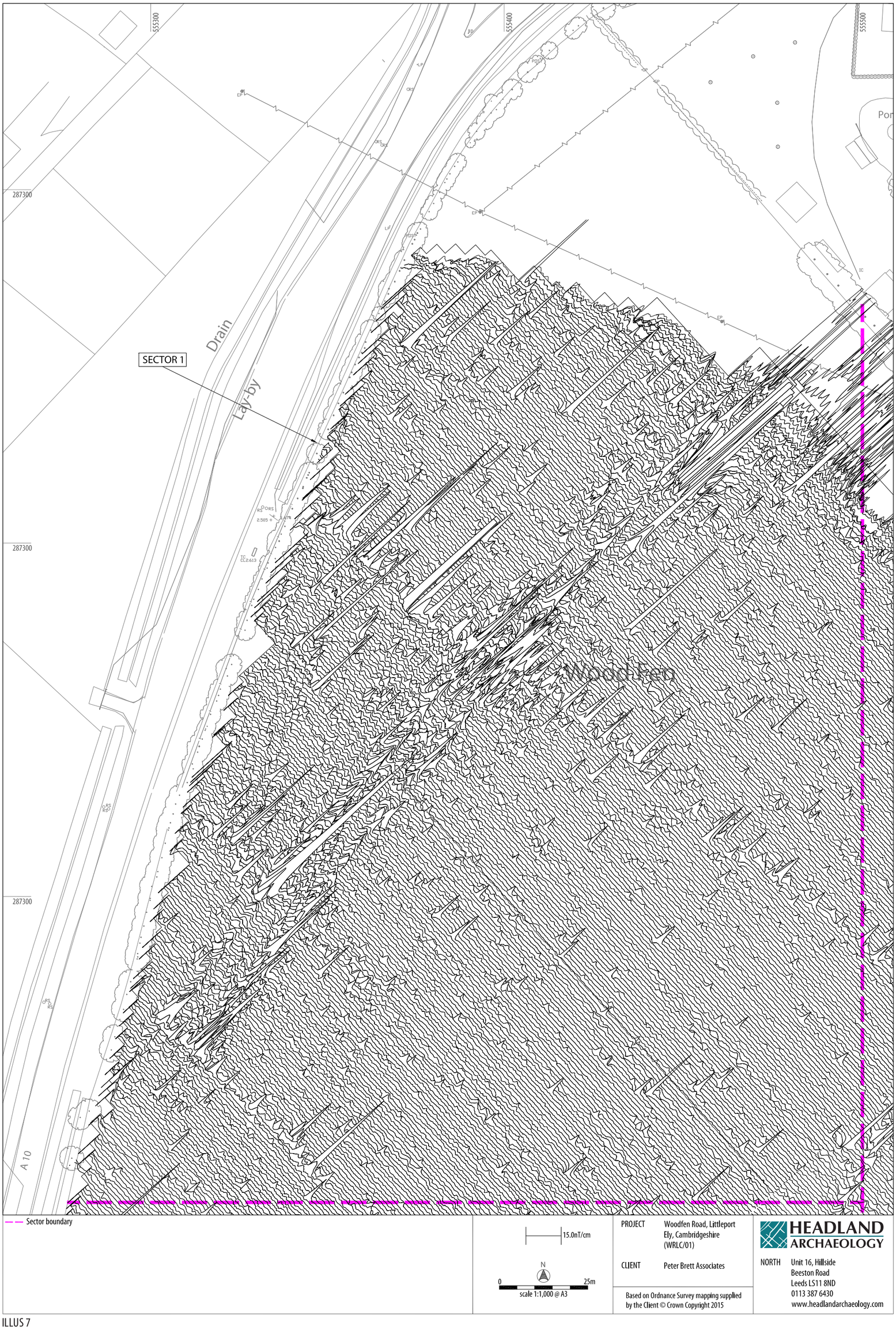
ILLUS 5

Overall interpretation of magnetometer data (1:2,000)



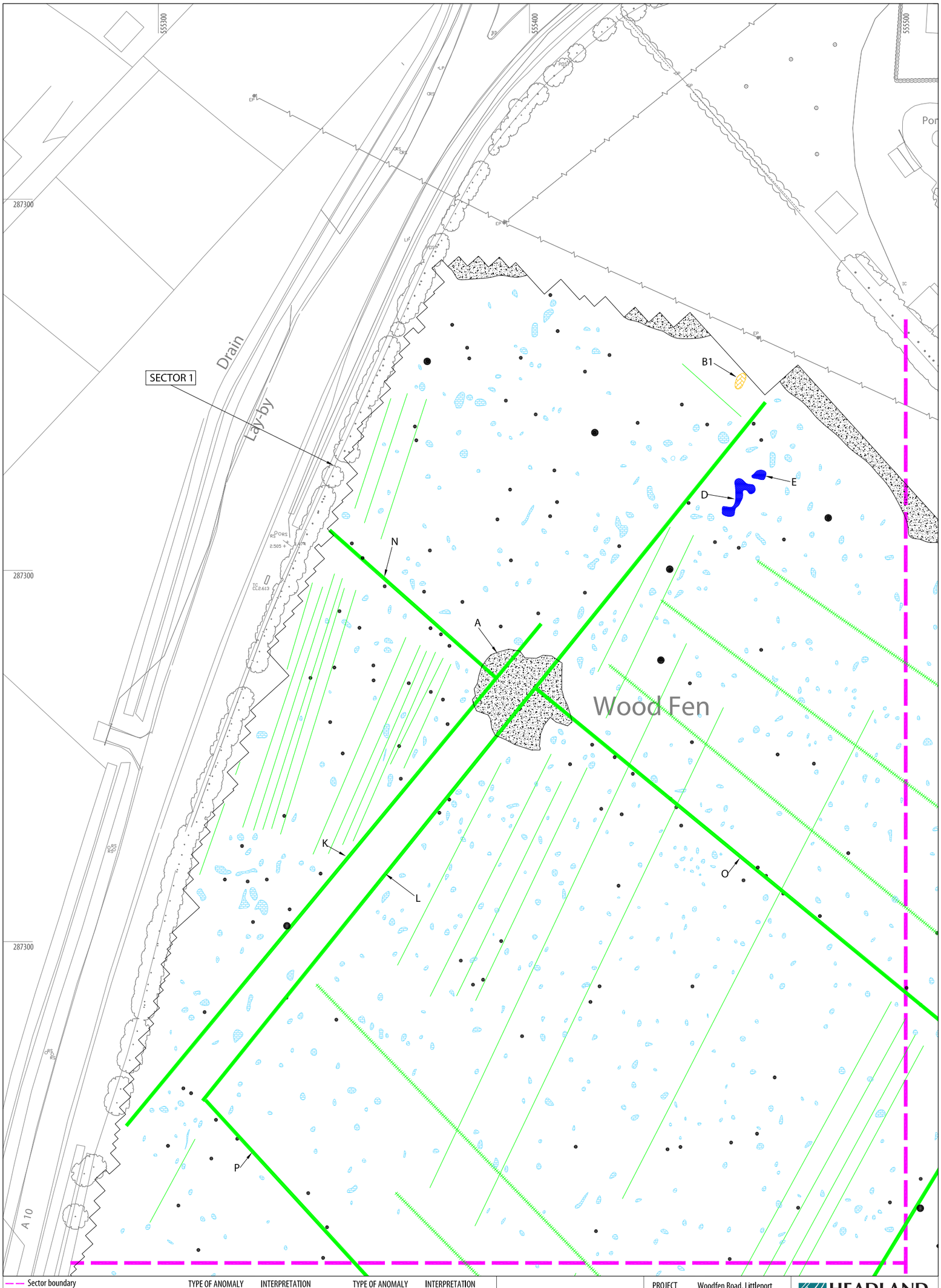
ILLUS 6

Processed greyscale magnetometer data; Sector 1 (1:1,000)



ILLUS 7

XY trace plot of minimally processed magnetometer data; Sector 1 (1:1,000)



ILLUS 8

Interpretation of magnetometer data; Sector 1 (1:1,000)

ILLUS 9

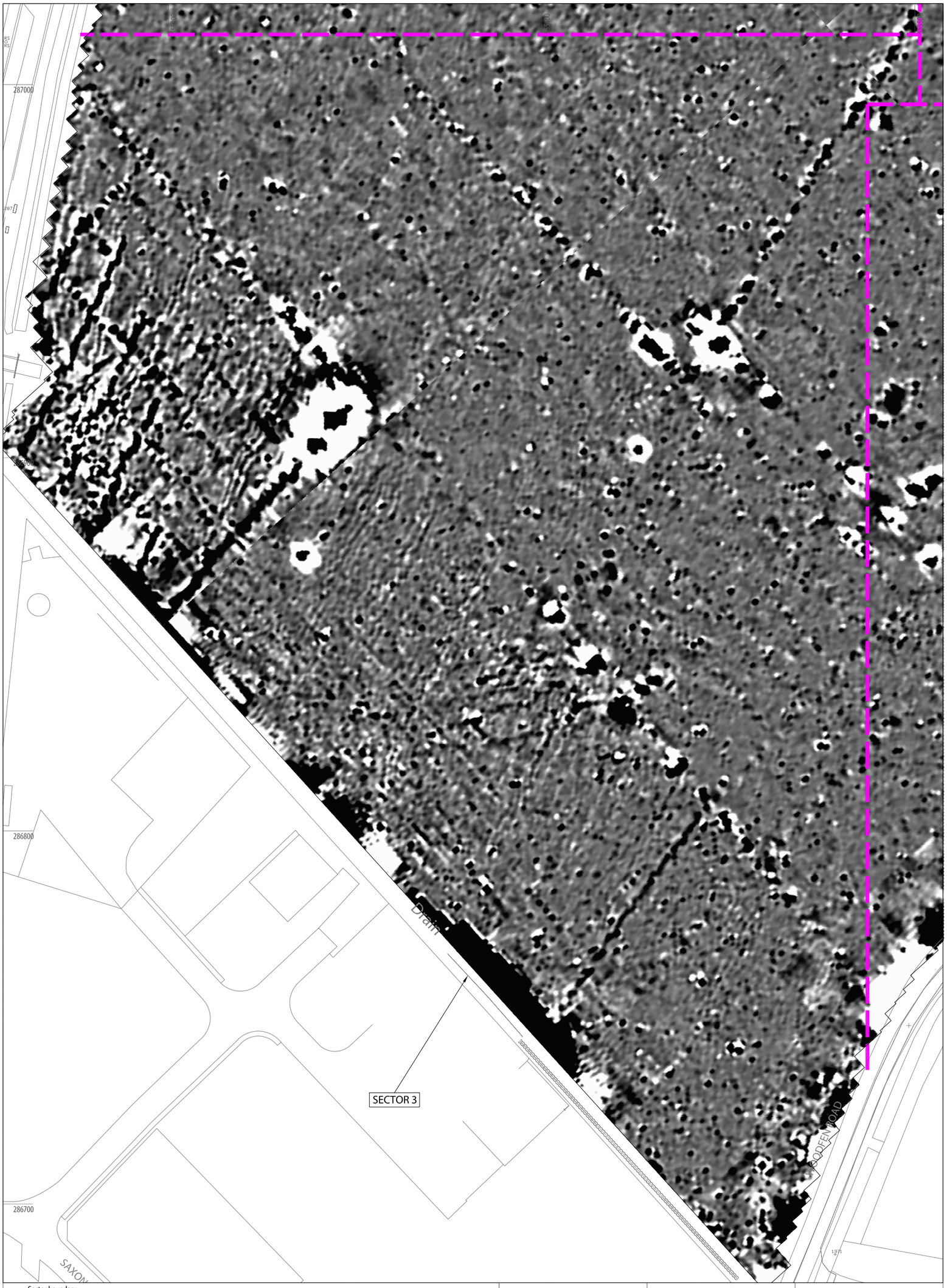
Processed greyscale magnetometer data; Sector 2 (1:1,000)

ILLUS 10

XY trace plot of minimally processed magnetometer data; Sector 2 (1:1,000)

ILLUS 11

Interpretation of magnetometer data, Sector 2 (1:1,000)



Sector boundary

nT
-1.0 1.0

N
0 25m
scale 1:1,000 @ A3

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ILLUS 12

Processed greyscale magnetometer data; Sector 3 (1:1,000)

Sector boundary

15.0nT/cm

N

0 25m

scale 1:1,000 @ A3

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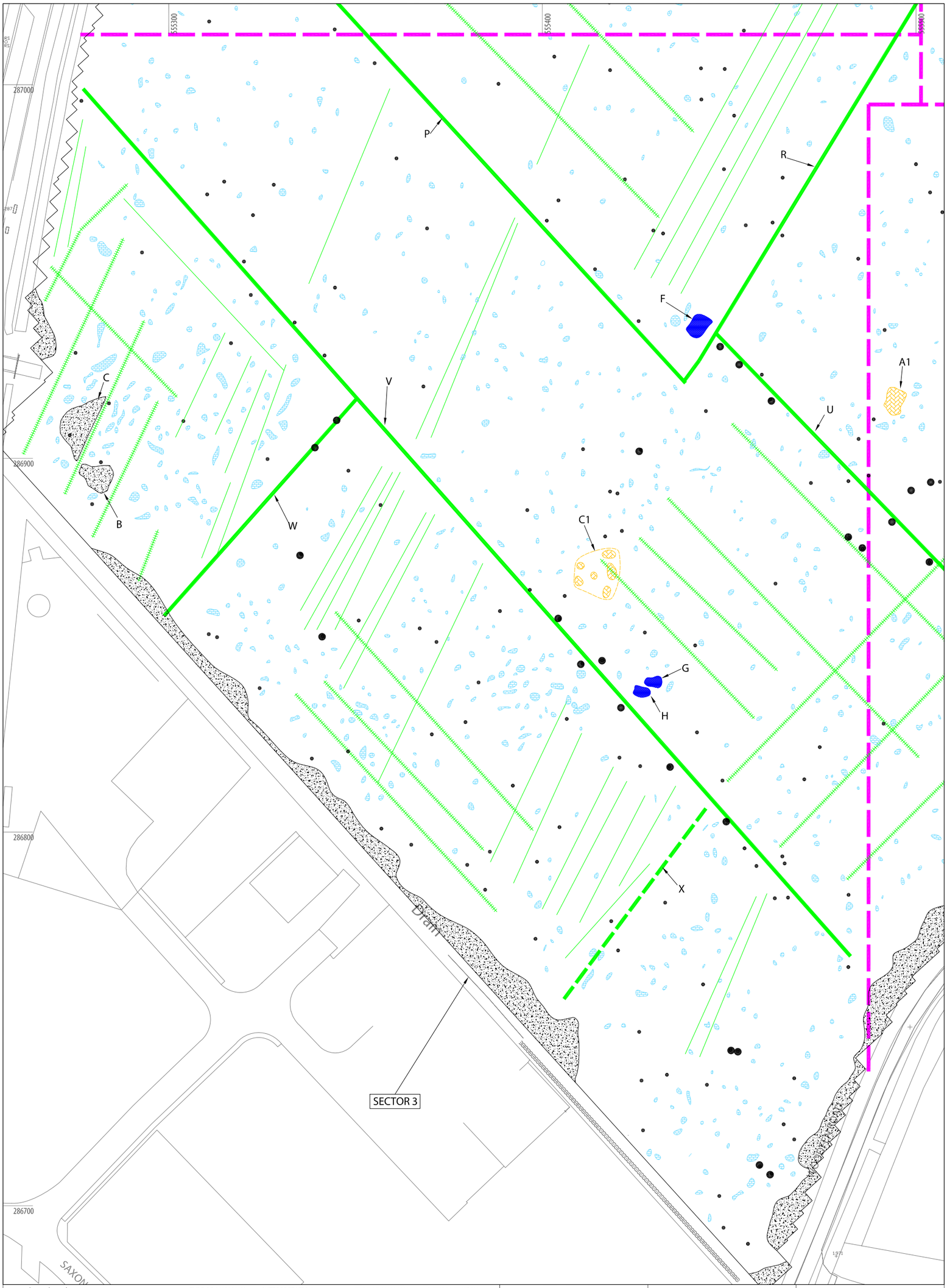
ILLUS 13

XY trace plot of minimally processed magnetometer data; Sector 3 (1:1,000)



Sector boundary

TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
Dipolar Isolated	Ferrous Material	Magnetic Disturbance	Modern?
Magnetic Disturbance	Ferrous Material	Magnetic Enhancement	Archaeology?
Linear Trend	Field Drain		
Linear Trend	Agricultural		
Linear	Former field boundary		
Magnetic Enhancement	Geology		

N

0 25m

scale 1:1,000 @ A3

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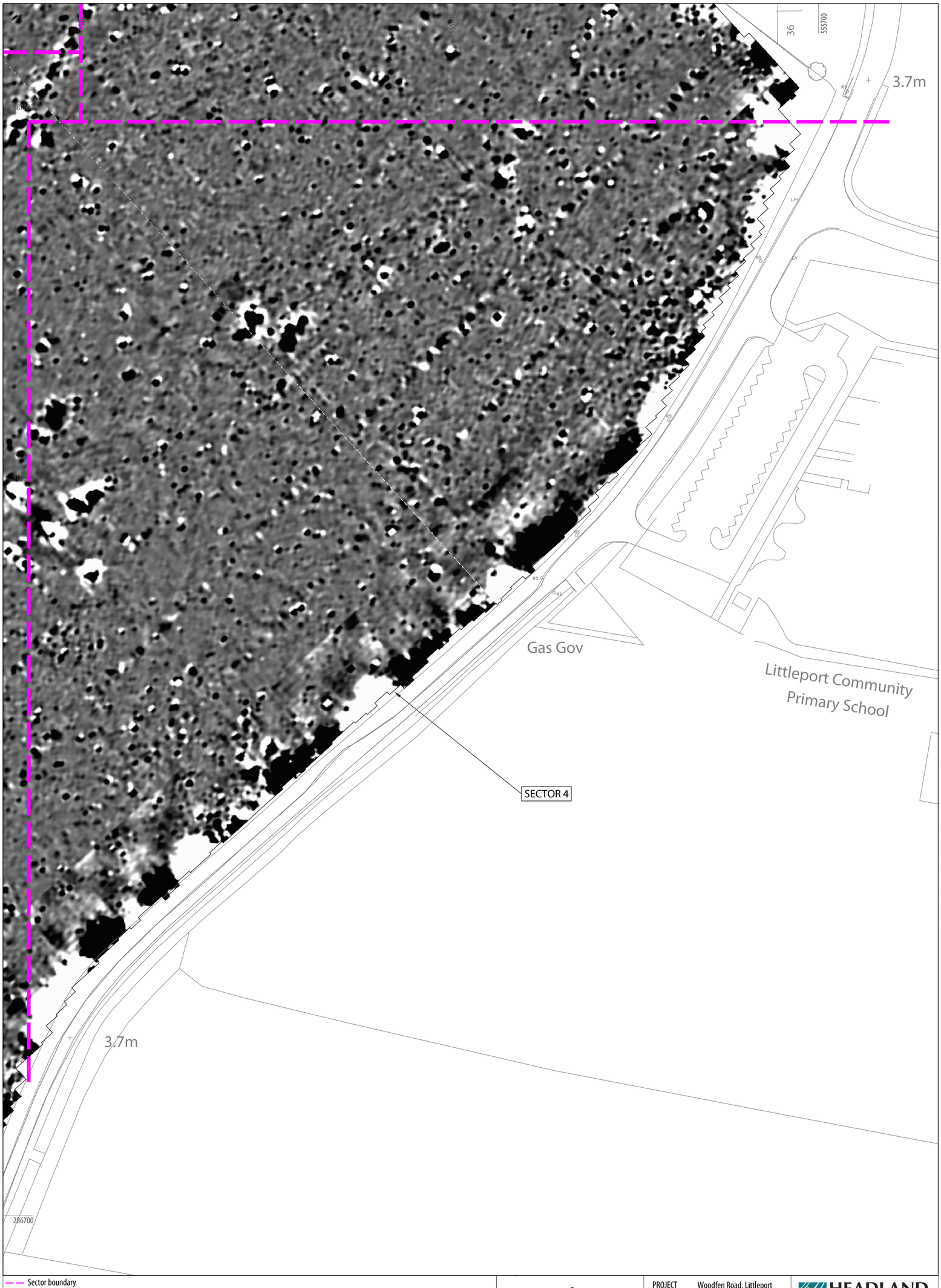
ILLUS 14

Interpretation of magnetometer data; Sector 3 (1:1,000)



ILLUS 15

Processed greyscale magnetometer data; Sector 4 (1:1,000)

Sector boundary

15.0nT/cm

N

0 25m

scale 1:1,000 @ A3

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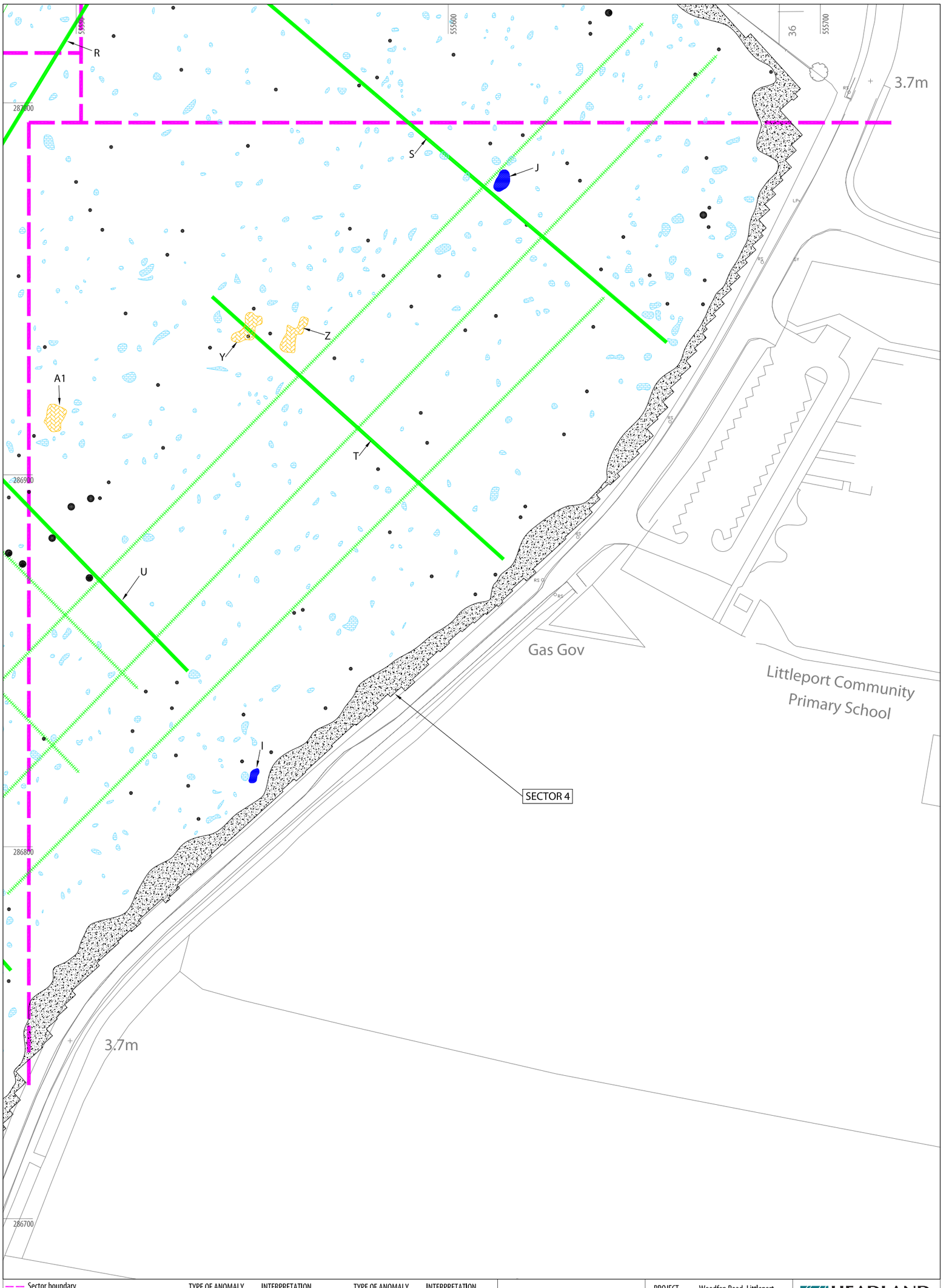
ILLUS 16

XY trace plot of minimally processed magnetometer data; Sector 4 (1:1,000)



Sector boundary

TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
Dipolar Isolated	Ferrous Material	Magnetic Disturbance	Modern?
Magnetic Disturbance	Ferrous Material	Magnetic Enhancement	Archaeology?
Linear Trend	Field Drain		
Linear Trend	Agricultural		
Linear	Former field boundary		
Magnetic Enhancement	Geology		

N

0 25m

scale 1:1,000 @ A3

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ILLUS 17

Interpretation of magnetometer data, Sector 4 (1:1,000)

7 APPENDICES

APPENDIX 1 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 haemetite. 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

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The accuracy of this equipment is better than 0.01m. The survey grids 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.

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