



WYAS  
**Archaeological  
Services**

**Land west of Kirkleatham Lane  
Kirkleatham  
Redcar and Cleveland**

**Geophysical Survey**

Report no. 2913  
November 2016

**Client:** WYG Environment Planning  
Transport Ltd



# **Land west of Kirkleatham Lane, Kirkleatham, Redcar and Cleveland**

## **Geophysical Survey**

### *Summary*

*A geophysical (magnetometer) survey, covering approximately 18 hectares was undertaken on agricultural land to the west of Kirkleatham Lane, Kirkleatham. This was part of a programme of archaeological works in advance of proposed residential development. The survey area is dominated by responses associated with geology. A number of possible archaeological anomalies have also been detected such as ditches, pit-like responses, a possible enclosure and areas of burning. In addition former field boundaries, and medieval ridge and furrow, have also been identified. Therefore the archaeological potential of the survey area is deemed to be low to medium.*





## Report Information

Client: WYG Environment Planning Transport Ltd.  
 Address: Arndale Court, Headingley, Leeds, West Yorkshire, LS6 2UJ  
 Report Type: Geophysical Survey  
 Location: Kirkleatham  
 County: Redcar and Cleveland  
 Grid Reference: NZ 5911 2284  
 Period(s) of activity: ?Prehistoric/ Medieval  
 Report Number: 2913  
 Project Number: 6537  
 Site Code: KIK16  
 OASIS ID: archaeol11-269717  
 Date of fieldwork: November 2016  
 Date of report: November 2016  
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Authorisation for  
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## 1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by WYG Environment Planning Transport Ltd., to undertake a geophysical (magnetometer) survey on land west of Kirkleatham Lane, Kirkleatham to inform on proposed development. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CifA 2014; David *et al.* 2008). The survey was carried out between 1st - 7th November 2016 to provide additional information on the archaeological resource of the Proposed Development Area (PDA).

### Site location, topography and land-use

The PDA consists of one field totaling approximately 23ha on land to the north of Kirkleatham Hall and east of Wilton Works, a chemical processing establishment. The eastern, and parts of the northern section, of the PDA (see Fig. 2) were unsuitable for survey due to trees and overgrown vegetation. The survey area was bound to the east by the A1402, woodland to the north and agricultural land to the west. The site is located approximately 7km north of Guisborough and 9km east of Middlesborough (see Fig. 1). At the time of survey, ground cover consisted of short stubble. The survey area is centred at NZ 5911 2284. The topography of the site is generally flat with a height above Ordnance Datum (aOD) of approximately 9m in the north to 12m in the south.

### Soils and geology

The underlying geology comprises of Redcar mudstone formation - mudstone. Superficial deposits are recorded as Till, Devensian – Diamicton (BGS 2016). Soils of the area belong to the Dunkeswick (711p) association consisting of slowly permeable fine loams over clayey soils (SSEW 1983).

## 2 Archaeological Background

A Desk Based Assessment was prepared for the client (WYG 2016) and the following archaeological background has been taken from this.

The Historic Environment Record (HER) holds details for seven recorded heritage sites, excluding designated sites, within the study area. Evidence for Iron Age settlement lies to the northwest of the PDA at Foxrush Farm.

Kirkleatham is recorded in the Domesday Book and the area is recorded as a village, being part of the king's land. Tenants included Earl Hugh, the Count of Mortain and William de Percy. By 1348 a chantry with 12 priests had been endowed in Kirkleatham but its exact location is unknown.

Kirkleatham was an important military location during World War II. Located to the southwest of the PDA a searchlight and a former Prisoner of War Camp were located. The latter is visible on 1948 aerial photography and comprised at least six small huts.

### **3 Aims and Methodology**

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim, a magnetometer survey covering all amenable parts of the PDA was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

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

#### **Magnetometer survey**

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m 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. Further details are given in Appendix 1.

#### **Reporting**

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays processed magnetometer data at a scale of 1:2500 and Figure 3 shows the interpretation at the same scale. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 4 to 15 inclusive at a scale of 1:1000.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (Cifa 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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

## **4 Results and Discussion (see Figures 4 to 15)**

### **Ferrous anomalies**

Ferrous anomalies, as individual 'spikes', or as large discrete areas 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 rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Along the southern limits of the PDA magnetic disturbance have been recorded which reflects the modern development of footpaths and access to the recently building police station.

### **Geological anomalies**

The survey has detected a number of low magnitude anomalies across the site and have been interpreted as geological in origin. It is thought that the responses have been detected because of the variation in the composition and depth of the soils and deposits of superficial material in which they derive.

However, due to the number of possible archaeological remains that have been identified, some of the geological anomalies may have an anthropogenic origin. It is difficult to give a definite interpretation especially as ploughing of both historic and modern date will have likely to have disturbed and/or destroyed any features below ground.

### **Agricultural anomalies**

Evidence for medieval ridge and furrow cultivation can be seen throughout on an approximate east - west orientation. Three linear trends, on the same alignment have also been detected and correlate to former field divisions depicted on old mapping dating from 1857. By 1973, the field layout as it is today, was established (OS 2016).

Modern ploughing trends on a north-south alignment can be seen throughout.

### **Possible archaeology anomalies**

A linear trend (**A**) running on a northeast to southwest alignment does not confirm with any boundaries depicted on old mapping. It is therefore possible that it represents a former field division predating available mapping. It is also possible that it represents a feature of a more modern date.

Linear anomalies (**B**) are made up of a series of ditch-like responses which run for approximately 300m through the centre of the survey area. An exact interpretation is difficult, but due to the nearby Iron Age settlement it is possible that this feature may be associated in the form of a prehistoric boundary.

Clusters of ditch and pit-like anomalies (**C-E**) can be seen through the background level of magnetic noise. The response at C has a high magnetic strength and could therefore indicate an area of burning. Responses D, again show an increased level of magnetic strength and a similar interpretation could be made.

It is possible that the anomalies at E may represent part a rectilinear enclosure measuring approximately 20m north-south. It is difficult to gain a full interpretation due to the proximity of magnetic disturbance to the immediate south.

*The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.*

## **5 Conclusions**

The PDA is dominated by responses of a likely geological origin which has made the interpretation of potential archaeological anomalies difficult as they can mimic each other. A number of potential archaeological responses have been recorded in the form of linear ditches, possibly reflecting ancient boundaries, an enclosure and areas of burning amongst numerous pit-like anomalies.

Medieval ridge and furrow cultivation is visible throughout along with modern ploughing and three former field boundaries that correspond to first edition OS mapping.

Based on the results of the geophysical survey, archaeological potential of the site is deemed to be low to medium.

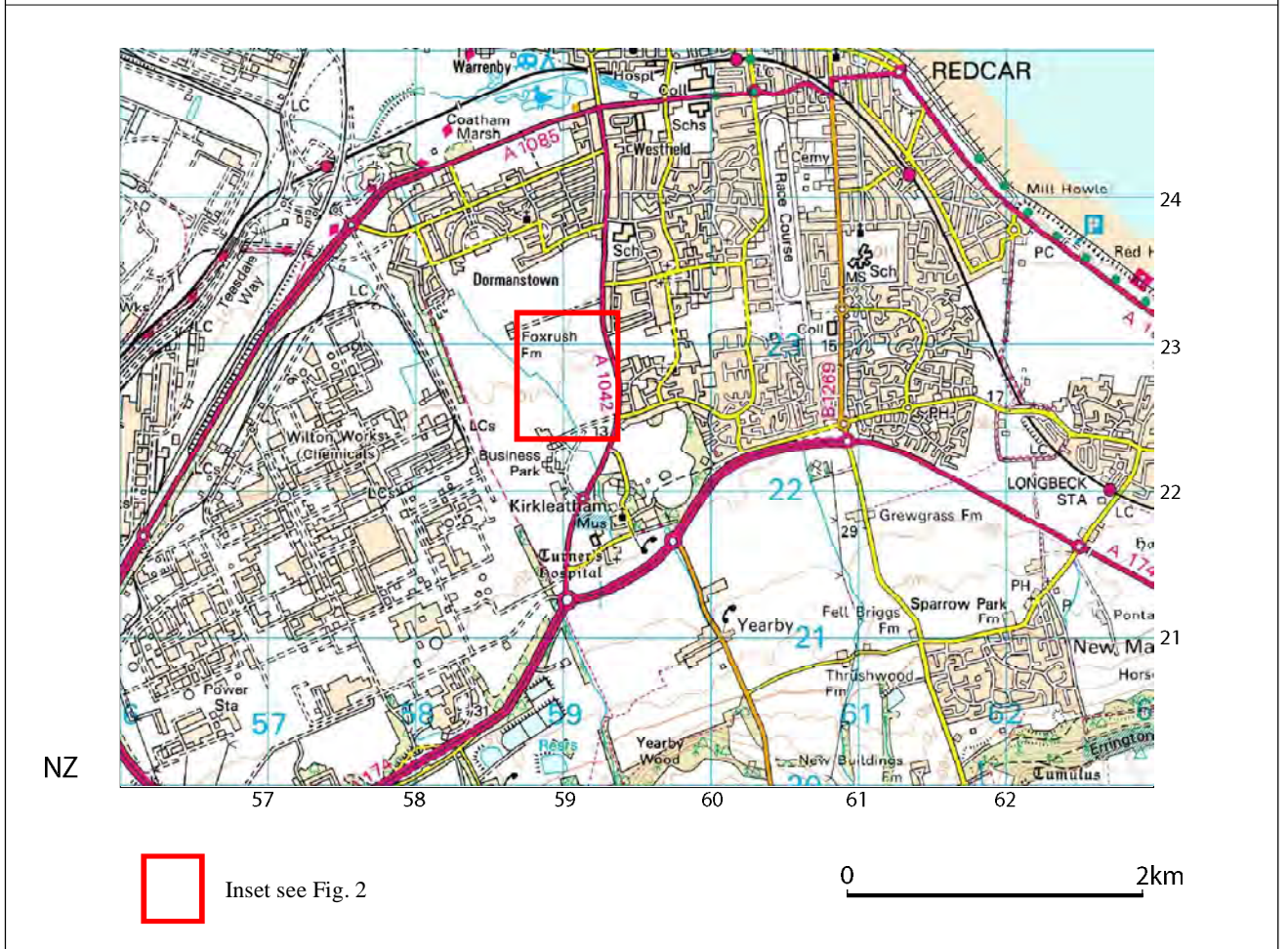
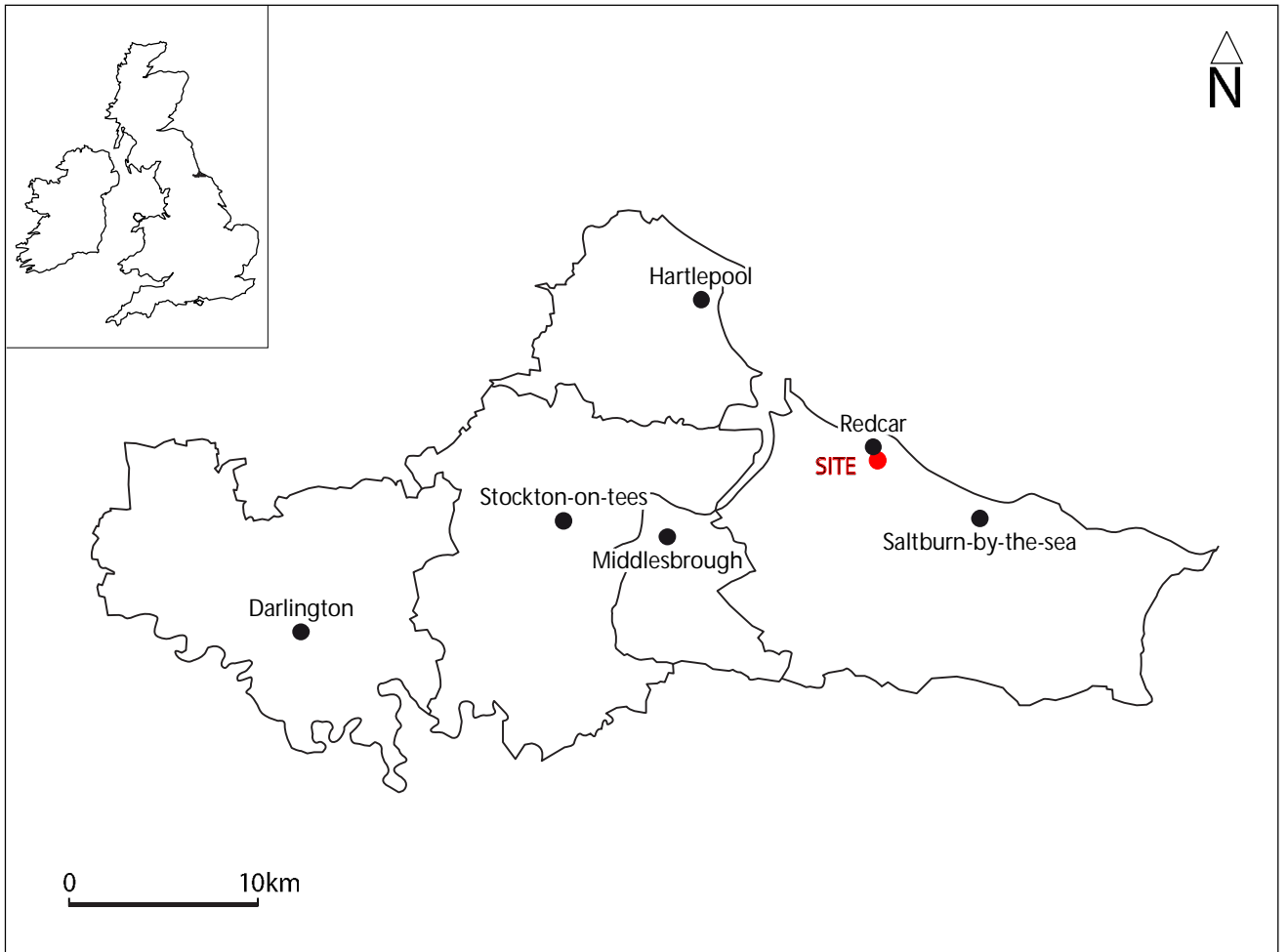
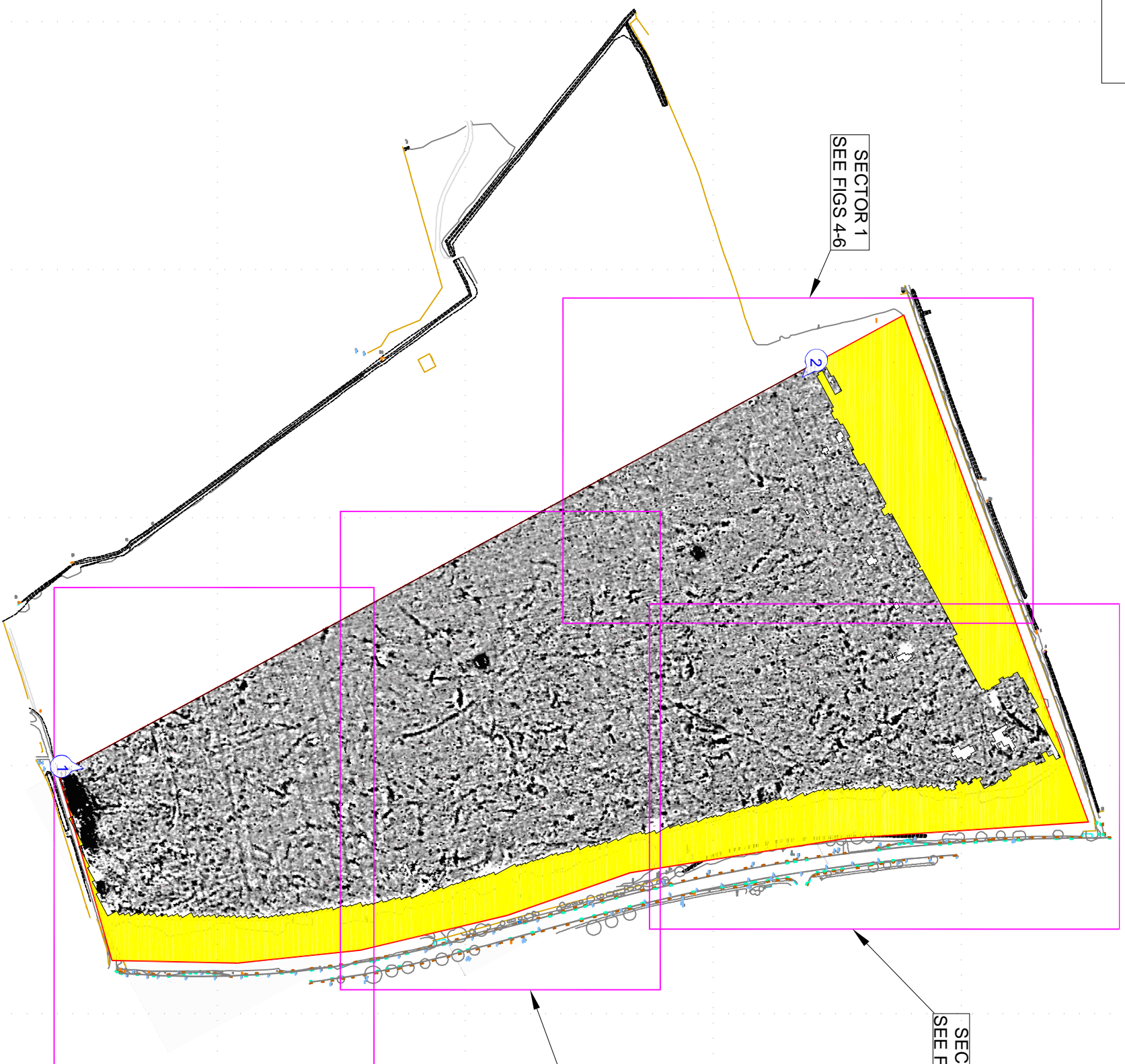


Fig. 1. Site location



PROJECT ID: 6537_KIK16
SECTOR BOUNDARY
LOCATION AND DIRECTION OF PLATES
UNSURVEYABLE

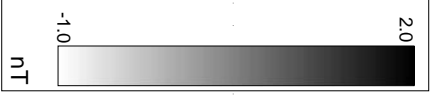


SECTOR 1  
SEE FIGS 4-6

SECTOR 2  
SEE FIGS 7-9

SECTOR 3  
SEE FIGS 10-12

SECTOR 4  
SEE FIGS 13-15













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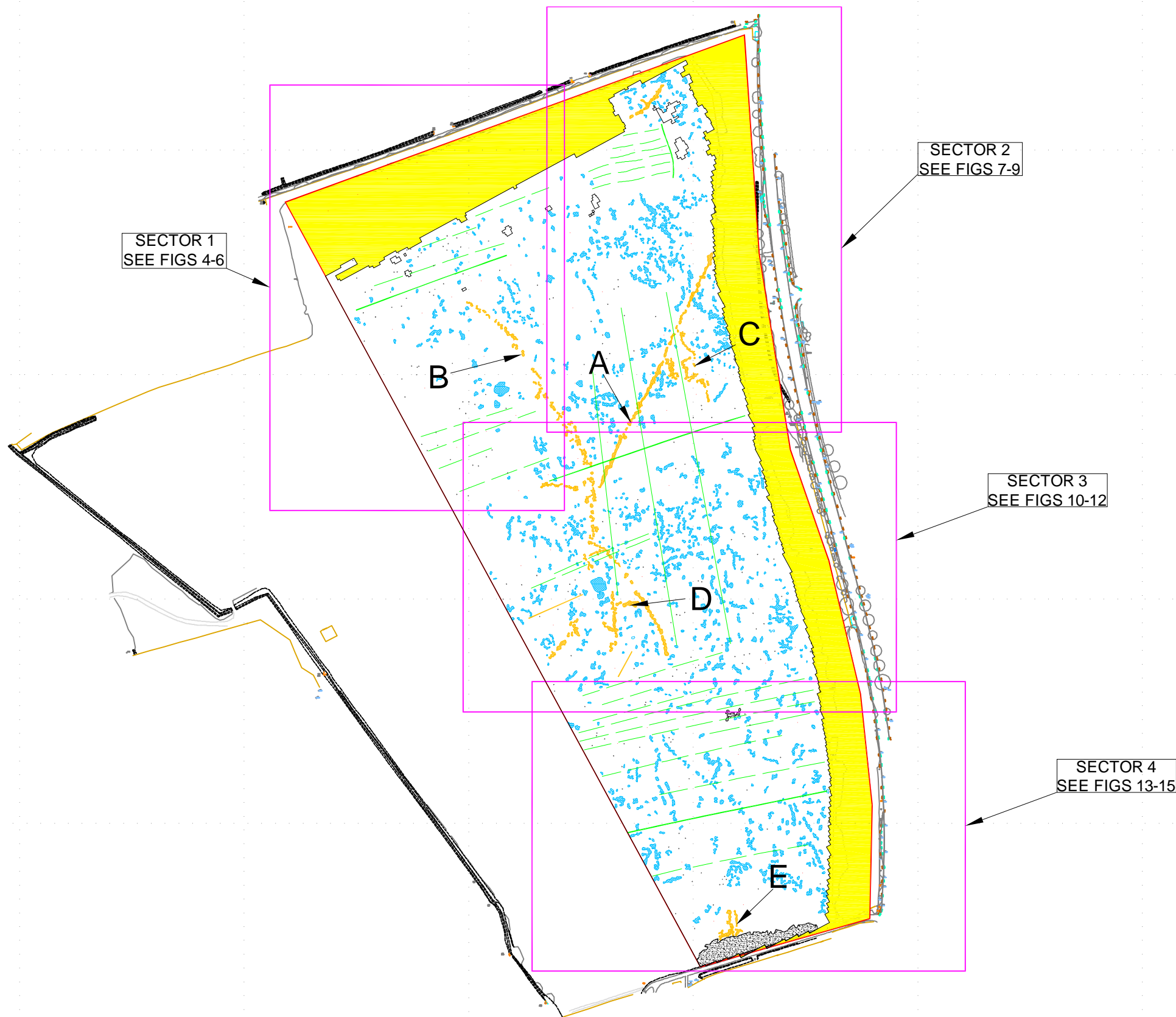
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Nepshaw Lane South, Melton, LE27 7JQ  
Tel: 0113 383 7500 Fax: 0113 383 7501

Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A3)



PROJECT ID: 6537_KIK16	
	SECTOR BOUNDARY
	UNSURVEYABLE

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	RIDGE AND FURROW
	LINEAR TREND	FORMER FIELD BOUNDARY
	LINEAR TREND	MODERN PLOUGHING
	MAGNETIC ENHANCEMENT	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
	LINEAR TREND	ARCHAEOLOGY?



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458600 459000 459400

523200  
522800

Fig. 3. Overall interpretation of magnetometer data (1:2500 @ A3)

0 100m



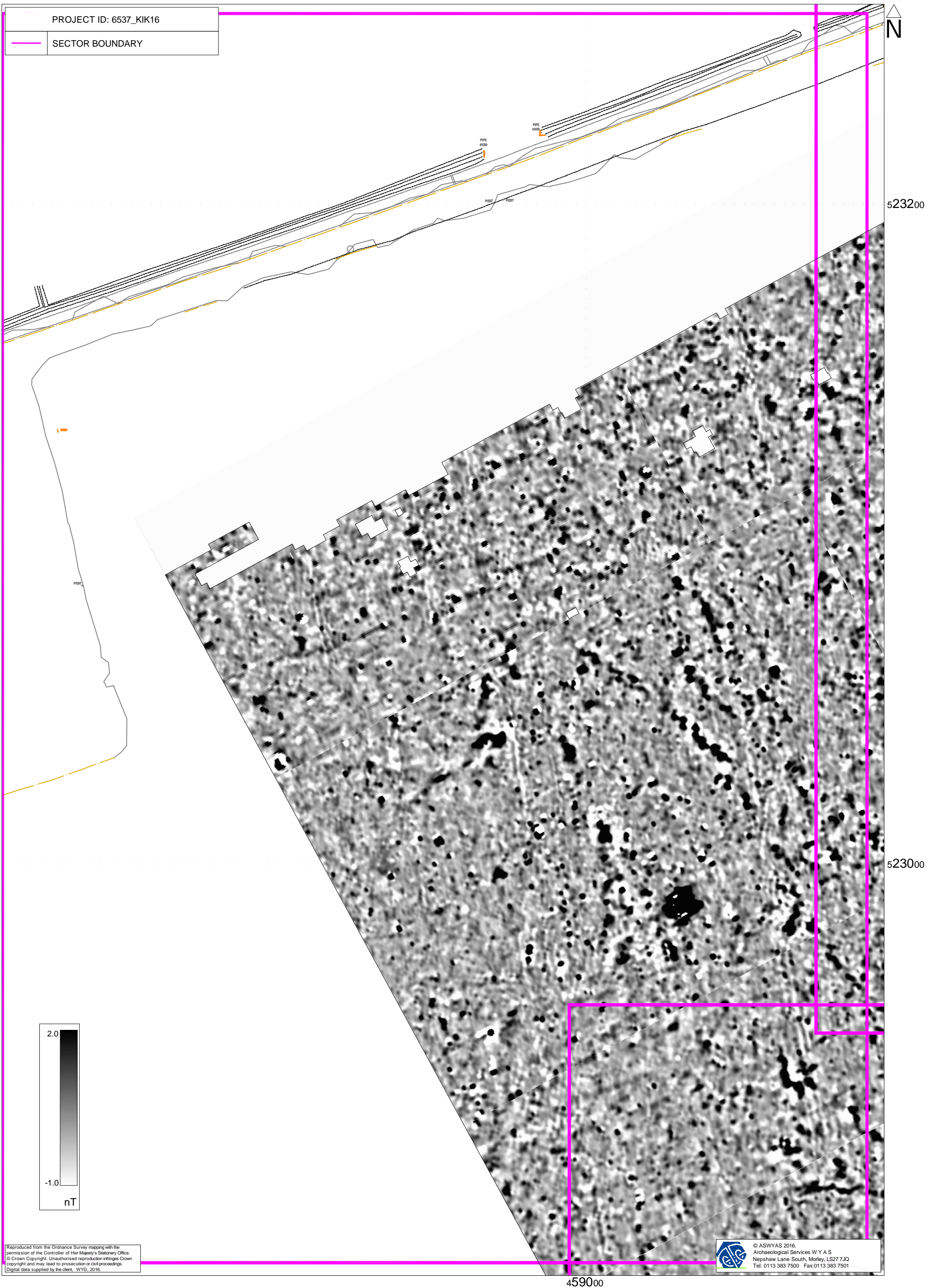
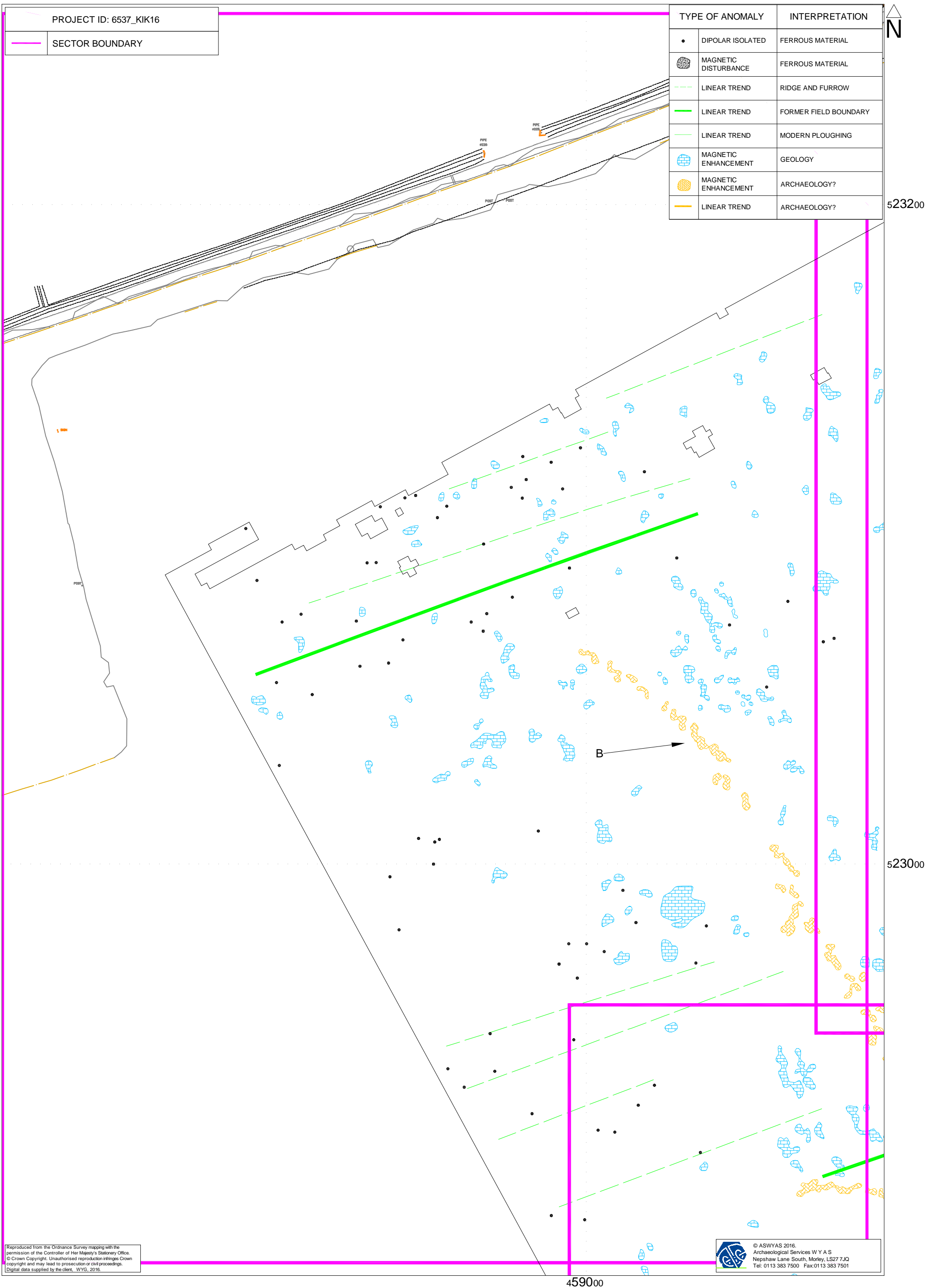


Fig. 4. Processed greyscale magnetometer data; Sector 1 (1:1000 @ A3)





Fig. 5. XY trace plot of minimally processed magnetometer data; Sector 1 (1:1000 @ A3)



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Fig. 6. Interpretation of magnetometer data; Sector 1 (1:1000 @ A3)

0 50m



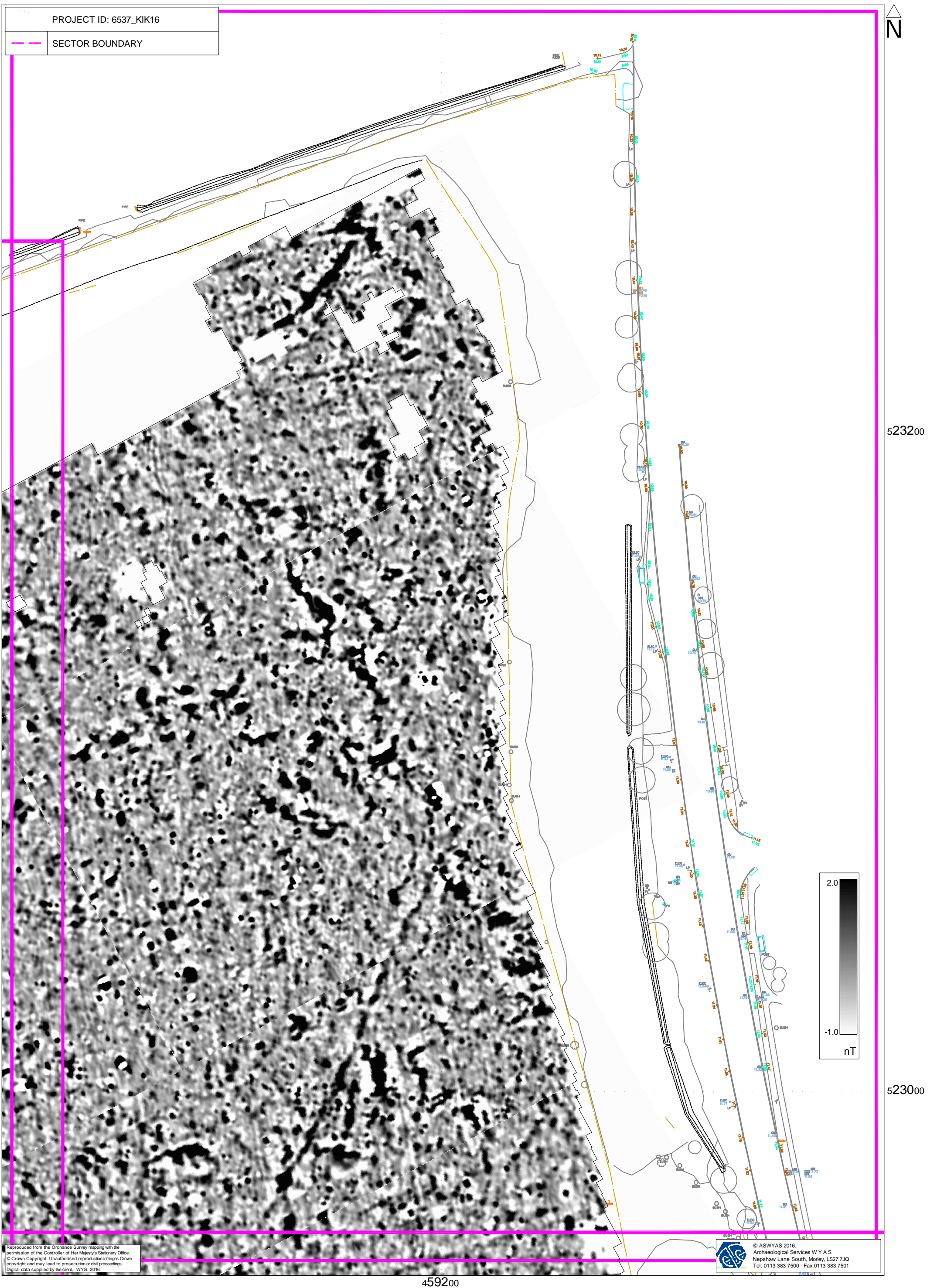


Fig. 7. Processed greyscale magnetometer data; Sector 2 (1:1000 @ A3)



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SECTOR BOUNDARY



20.0 nT/cm

523200

523000

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459200

Fig. 8. XY trace plot of minimally processed magnetometer data; Sector 2 (1:1000 @ A3)

0 50m



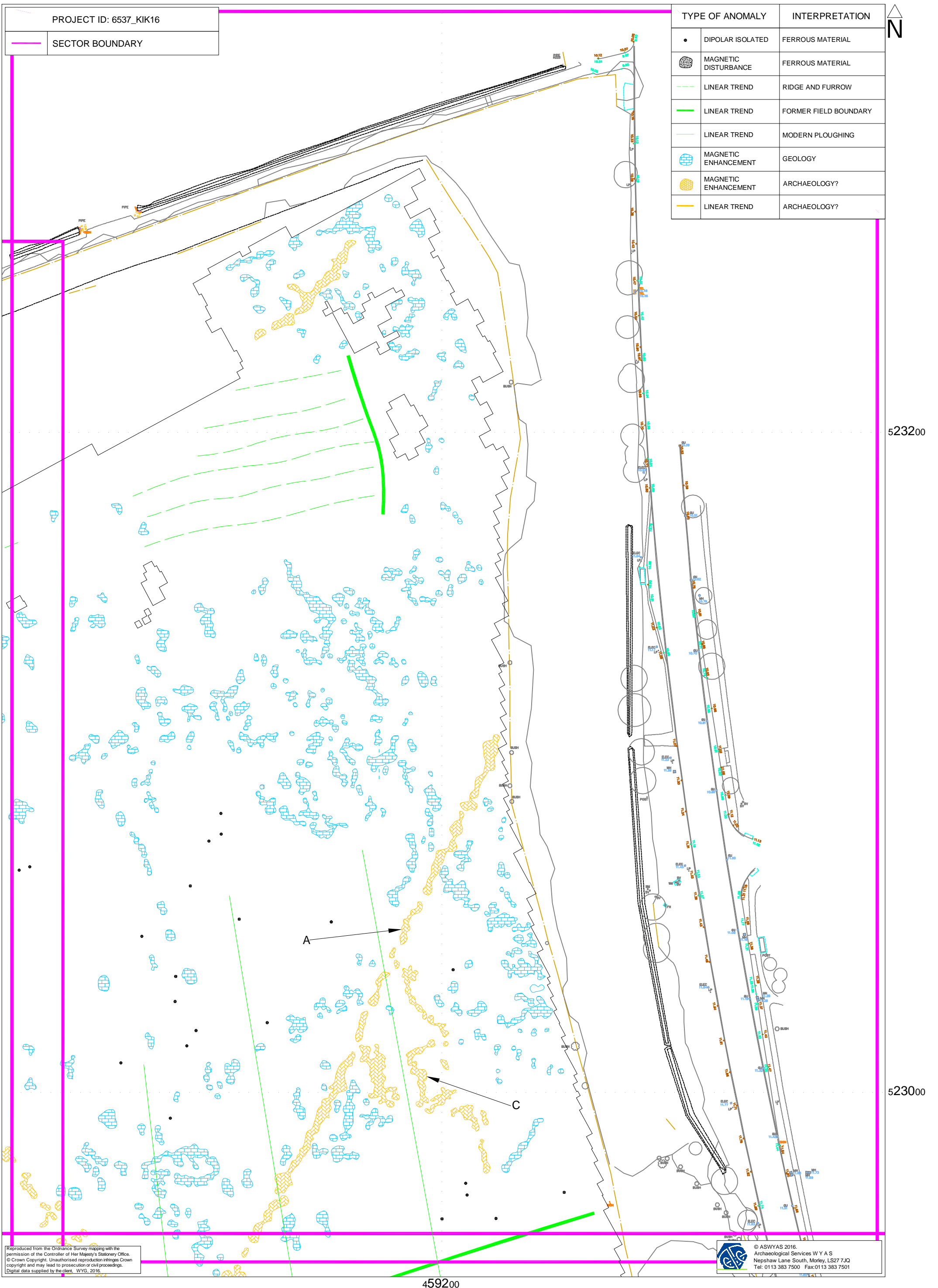
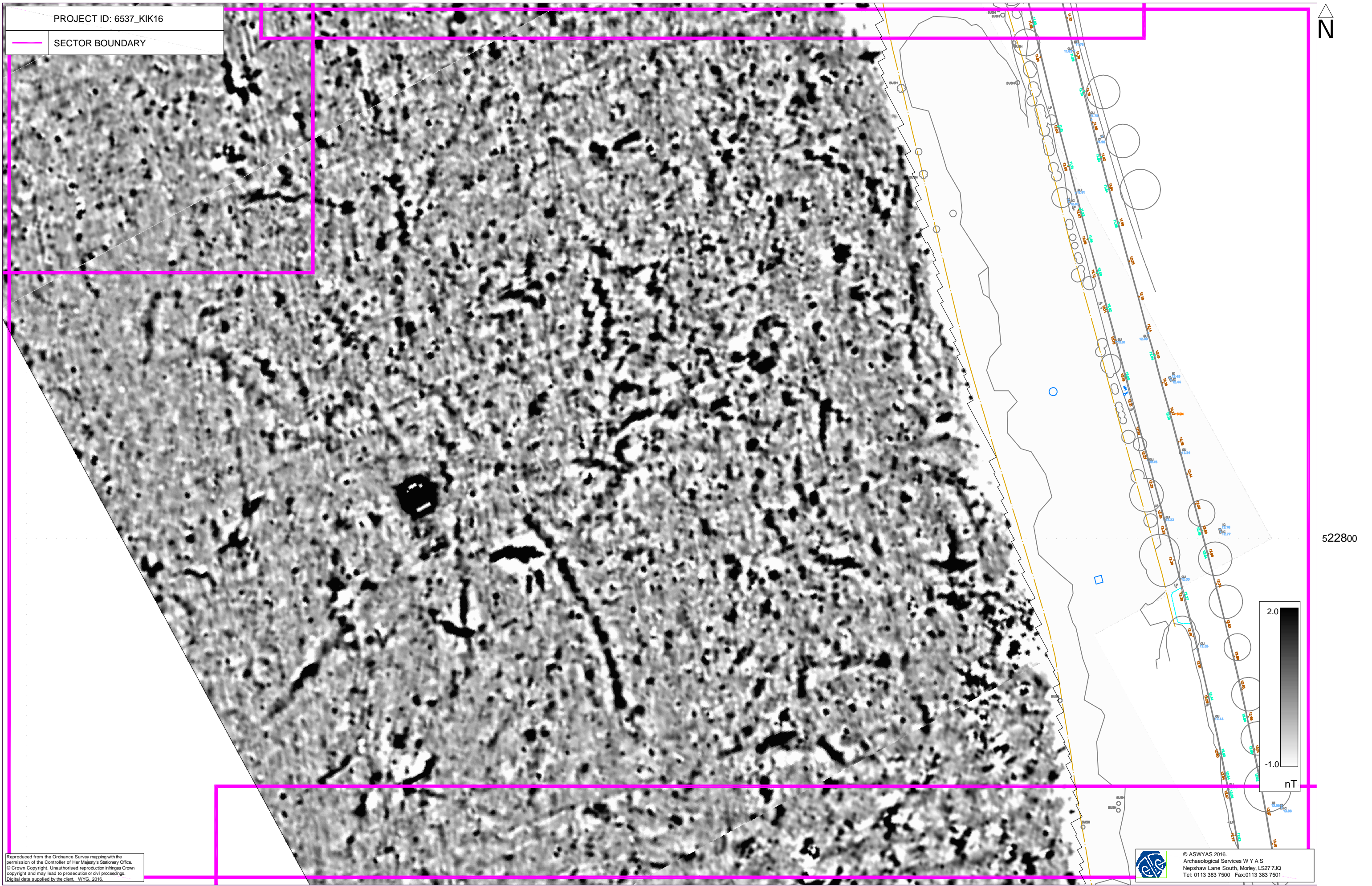


Fig. 9. Interpretation of magnetometer data; Sector 2 (1:1000 @ A3)

0 50m





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459000 459200 522800

0 50m

Fig. 10. Processed greyscale magnetometer data; Sector 3 (1:1000 @ A3)



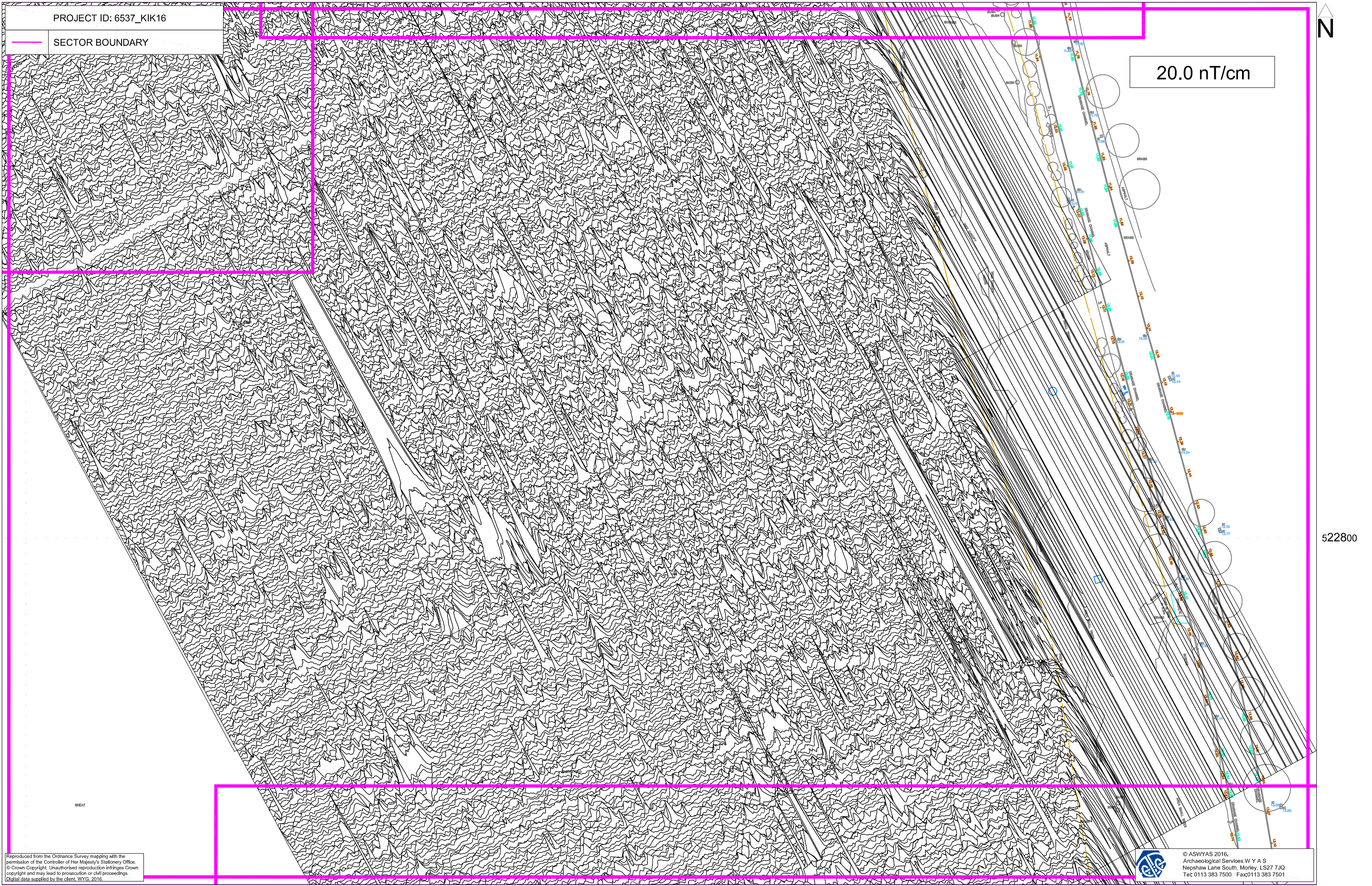
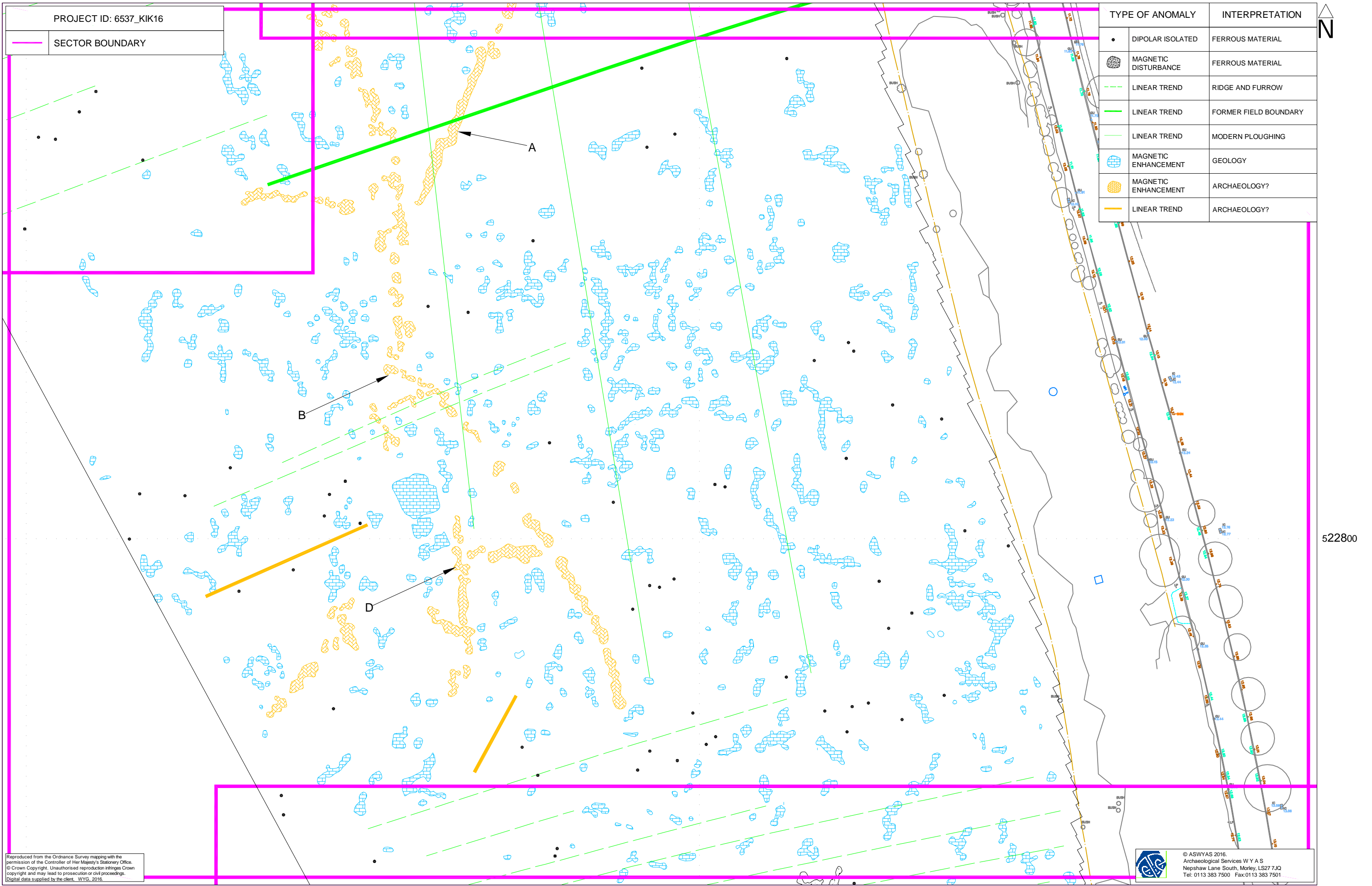


Fig. 11. XY trace plot of minimally processed magnetometer data; Sector 3 (1:1000 @ A3)





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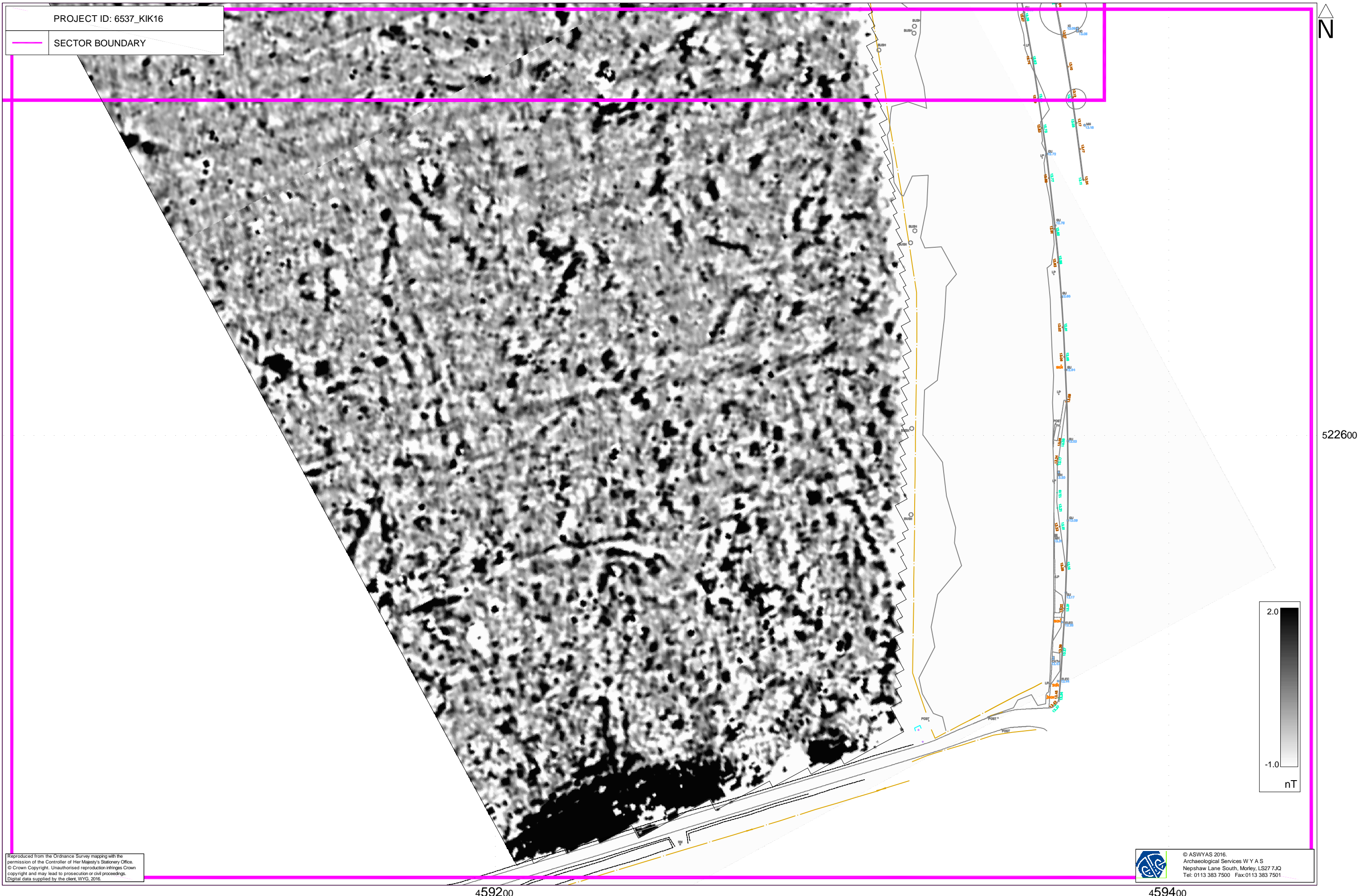
SECTOR BOUNDARY

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
- - -	LINEAR TREND	RIDGE AND FURROW
—	LINEAR TREND	FORMER FIELD BOUNDARY
—	LINEAR TREND	MODERN PLOUGHING
	MAGNETIC ENHANCEMENT	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
—	LINEAR TREND	ARCHAEOLOGY?

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Fig. 12. Interpretation of magnetometer data; Sector 3 (1:1000 @ A3)



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SECTOR BOUNDARY

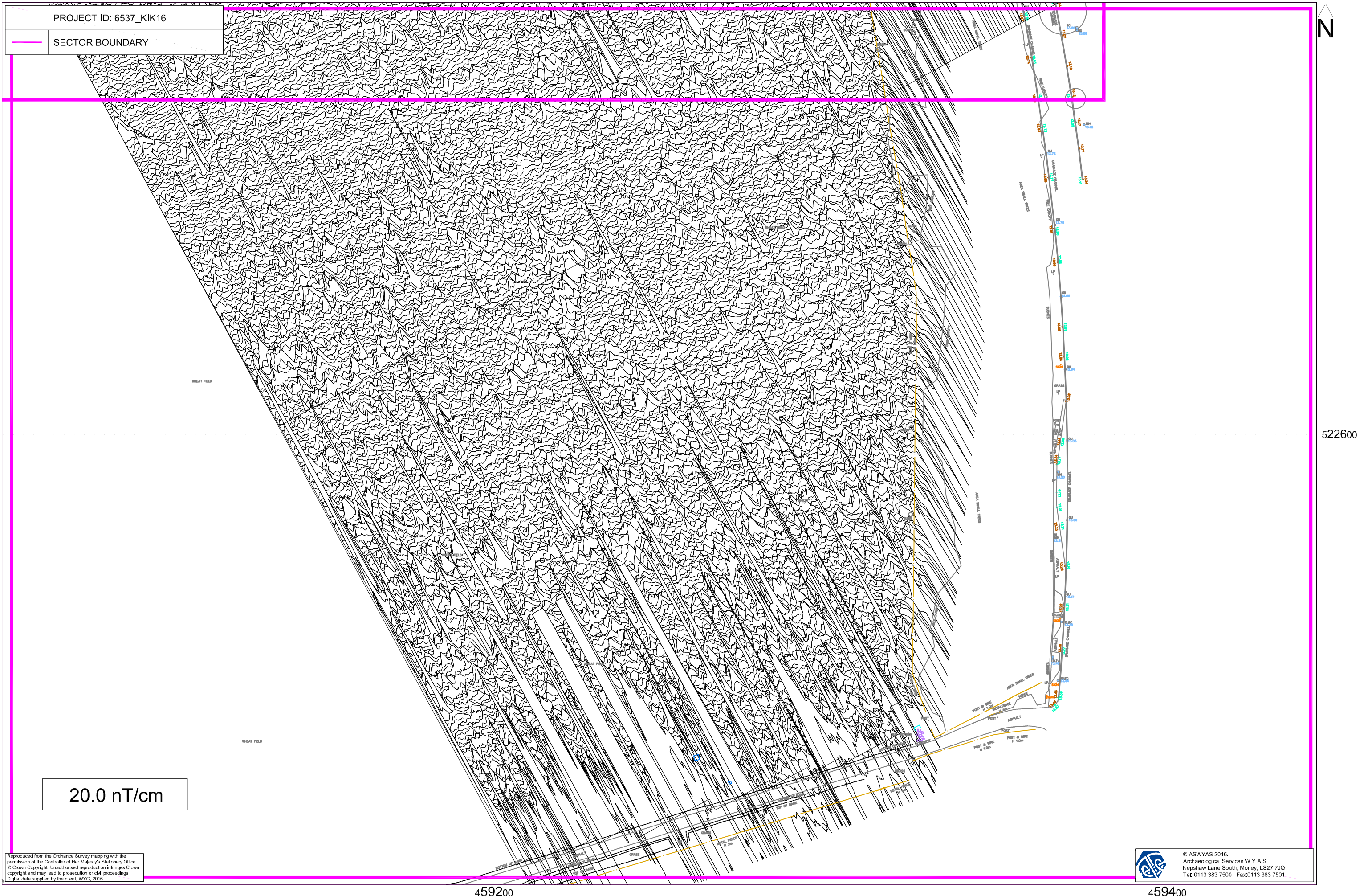
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Fig. 13. Processed greyscale magnetometer data; Sector 4 (1:1000 @ A3)

0 50m





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SECTOR BOUNDARY

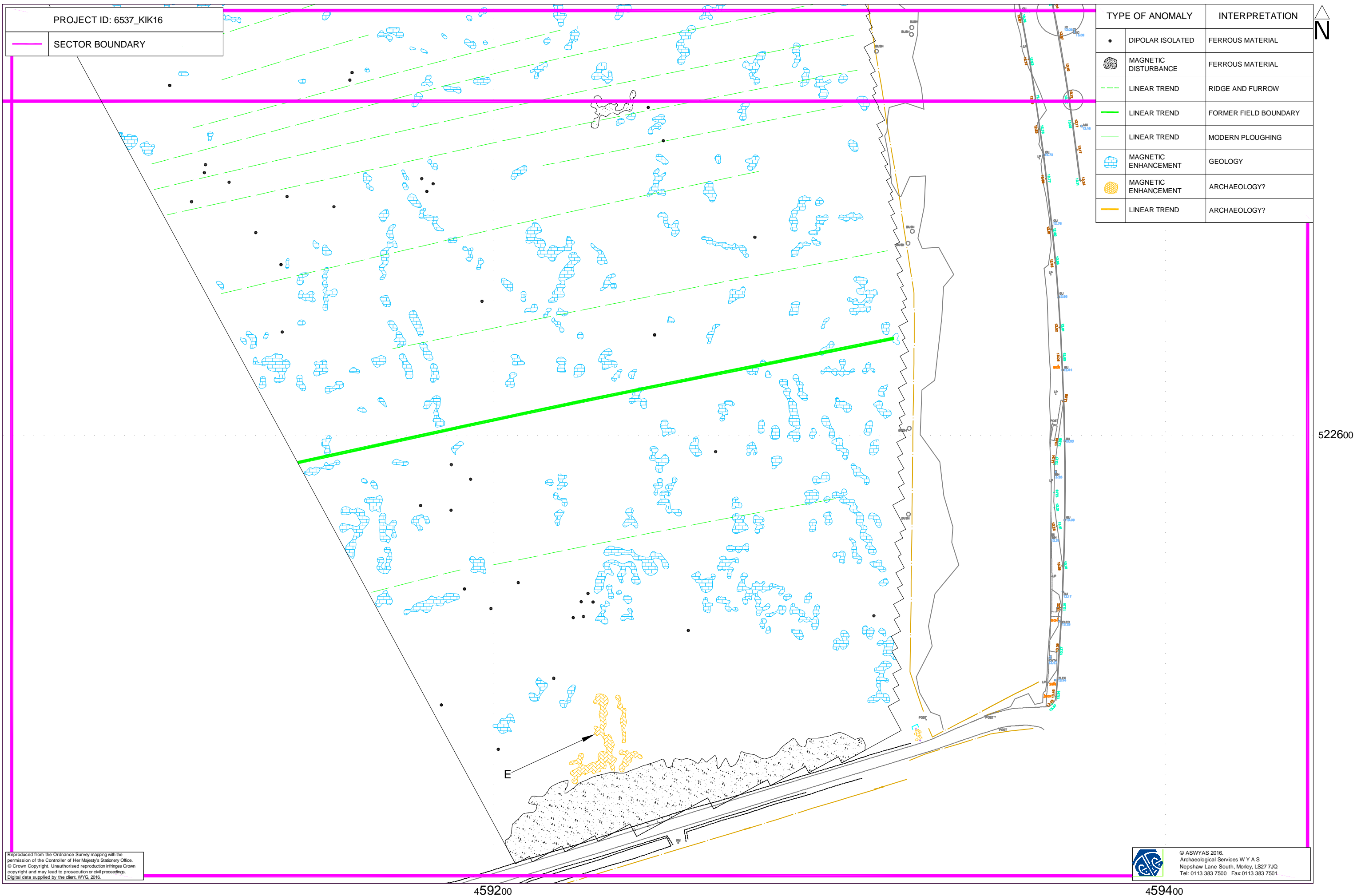
20.0 nT/cm

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Fig. 14. XY trace plot of minimally processed magnetometer data; Sector 4 (1:1000 @ A3)

0 50m



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Fig. 15. Interpretation of magnetometer data; Sector 4 (1:1000 @ A3)

0 50m





*Plate 1. General view of survey area, looking northeast*



*Plate 2. General view of survey area, looking southeast*

## **Appendix 1: Magnetic survey - technical information**

### **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. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because 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 and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

### **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 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.

**Methodology: Gradiometer Survey**

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as *detailed survey* and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

## **Appendix 2: Survey location information**

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The cart data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 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 co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

*Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.*

### **Appendix 3: Geophysical archive**

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the Teesside Historic Environment Record).

## **Appendix 4: Oasis form**

# OASIS DATA COLLECTION FORM: England

[List of Projects](#) | [Manage Projects](#) | [Search Projects](#) | [New project](#) | [Change your details](#) | [HER coverage](#) | [Change country](#) | [Log out](#)

## Printable version

**OASIS ID: archaeol11-269717**

### Project details

Project name	Land west of Kirkleatham Lane
Short description of the project	A geophysical (magnetometer) survey, covering approximately 18 hectares was undertaken on agricultural land to the west of Kirkleatham Lane, Kirkleatham. This was part of a programme of archaeological works in advance of proposed residential development. The survey area is dominated by responses associated with geology. A number of possible archaeological anomalies have also been detected such as ditches, pit-like responses, a possible enclosure and areas of burning. In addition former field boundaries, and medieval ridge and furrow, have also been identified. Therefore the archaeological potential of the survey area is deemed to be low to medium.
Project dates	Start: 01-11-2016 End: 07-11-2016
Previous/future work	Not known / Not known
Any associated project reference codes	KIK16 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 2 - Operations to a depth less than 0.25m
Monument type	ENCLOSURE Iron Age
Monument type	0 None
Significant Finds	0 None
Significant Finds	0 None
Methods & techniques	"Geophysical Survey"
Development type	Urban residential (e.g. flats, houses, etc.)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology	PERMIAN MUDSTONES
Drift geology	SAND AND GRAVEL OF UNCERTAIN AGE OR ORIGIN
Techniques	Magnetometry

**Project location**

Country	England
Site location	CLEVELAND REDCAR AND CLEVELAND GUISBOROUGH Land west of Kirkleatham Lane
Postcode	TS10 5NJ
Study area	18 Hectares
Site coordinates	NZ 59115 22915 54.597830891891 -1.084901640571 54 35 52 N 001 05 05 W Point
Lat/Long Datum	WGS 84 Datum
Height OD / Depth	Min: 9m Max: 12m

**Project creators**

Name of Organisation	Archaeological Services WYAS
Project brief originator	WYG
Project design originator	Archaeological Services WYAS
Project director/manager	C. Sykes
Project supervisor	C. Sykes
Type of sponsor/funding body	Landowner

**Project archives**

Physical Archive Exists?	No
Digital Archive recipient	ASWYAS
Digital Archive ID	kik16
Digital Contents	"Survey"
Digital Media available	"Geophysics", "Images raster / digital photography", "Survey", "Text"
Paper Archive Exists?	No

**Project bibliography 1**

Publication type	Grey literature (unpublished document/manuscript)
Title	Land west of Kirkleatham Lane
Author(s)/Editor(s)	Brunning, E.
Other bibliographic details	2913
Date	2016
Issuer or publisher	ASWYAS

Place of issue or  
publication      Morley

Entered by              Chris Sykes (mrtsykes@hotmail.co.uk)

Entered on              24 November 2016



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