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Project ID: XF70_HLO22
 XY trace plot of minimally processed magnetometer data:
 Sector 17

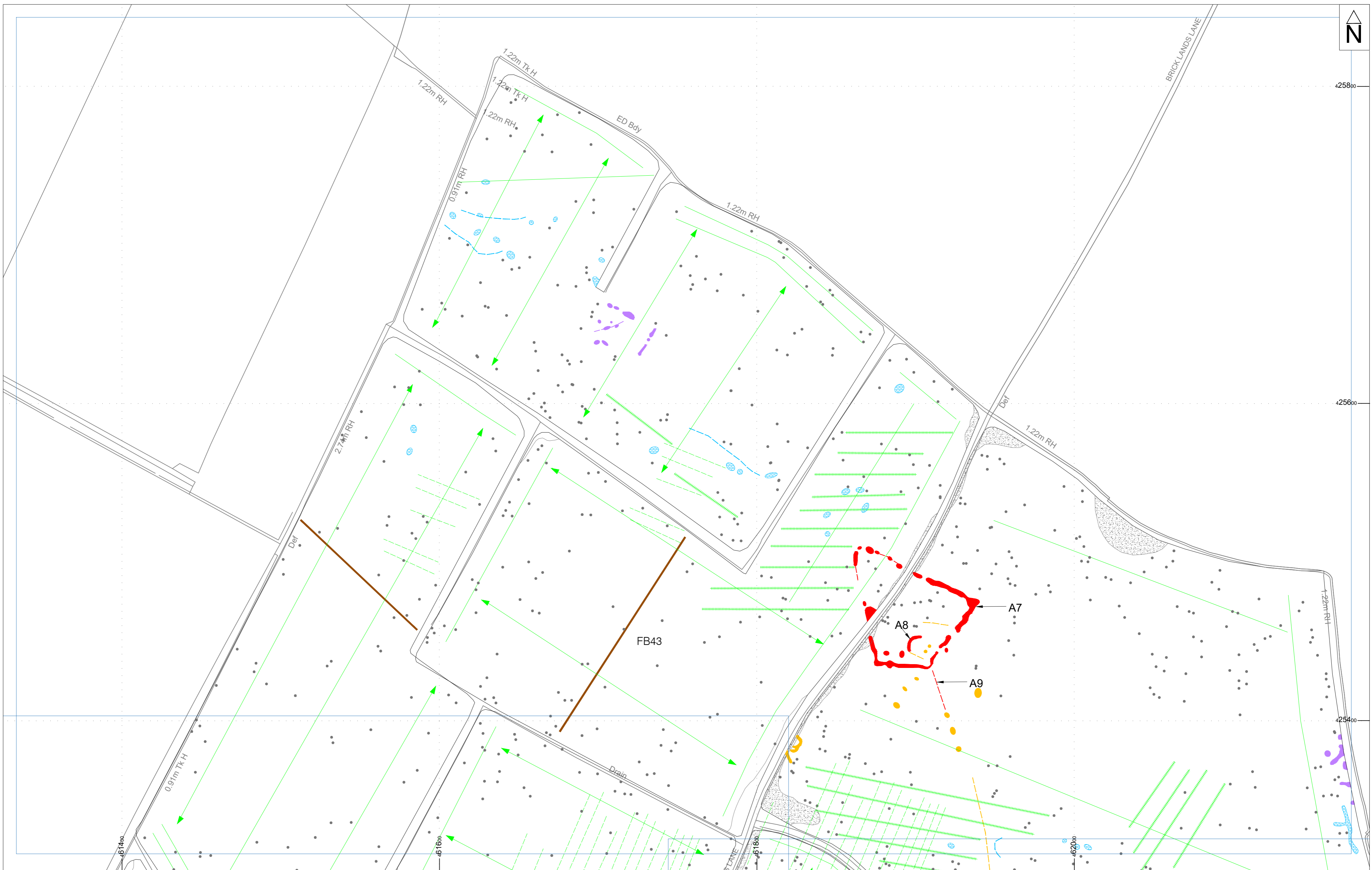
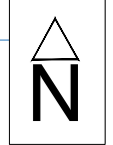
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Title
SECTOR BOUNDARY

15.0 nT/cm

0 50m
 1:1,500 @ A2

Fig. 64




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 Interpretation of magnetometer data: Sector 17

Title
 SECTOR BOUNDARY

Interpretation					
	FERROUS		RIDGE & FURROW		UNCERTAIN
	MAGNETIC DISTURBANCE		AGRICULTURAL		ARCHAEOLOGY?
	FIELD DRAIN		FORMER FIELD BOUNDARY		ARCHAEOLOGY
	GEOLOGY				

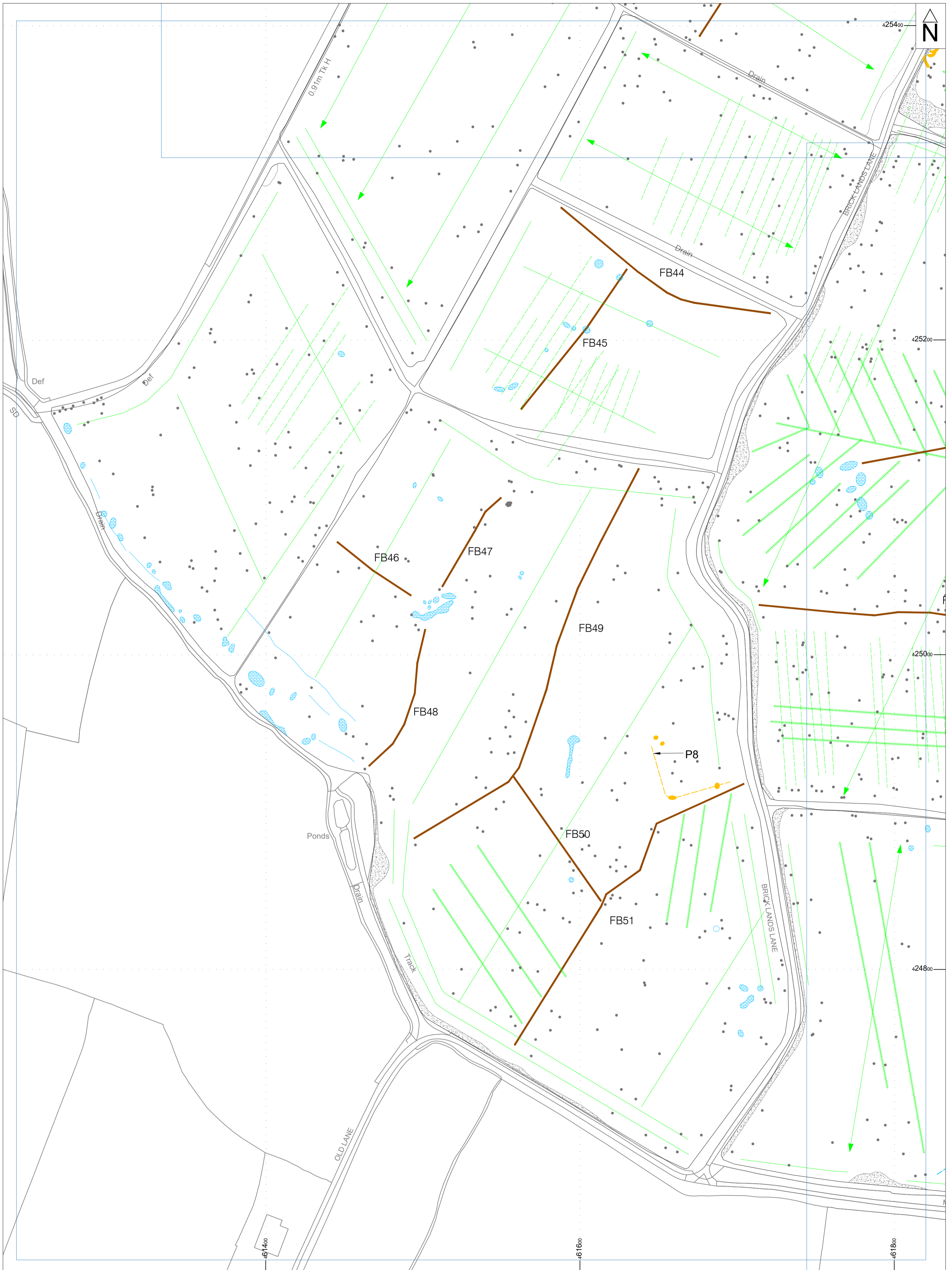
0 50m
 1:1,500 @ A2


Fig. 65

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








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Interpretation of magnetometer data: Sector 18

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Title	
	SECTOR BOUNDARY

Interpretation			
	FERROUS		RIDGE & FURROW
	MAGNETIC DISTURBANCE		AGRICULTURAL
	FIELD DRAIN		FORMER FIELD BOUNDARY
	GEOLOGY		UNCERTAIN
	ARCHAEOLOGY?		


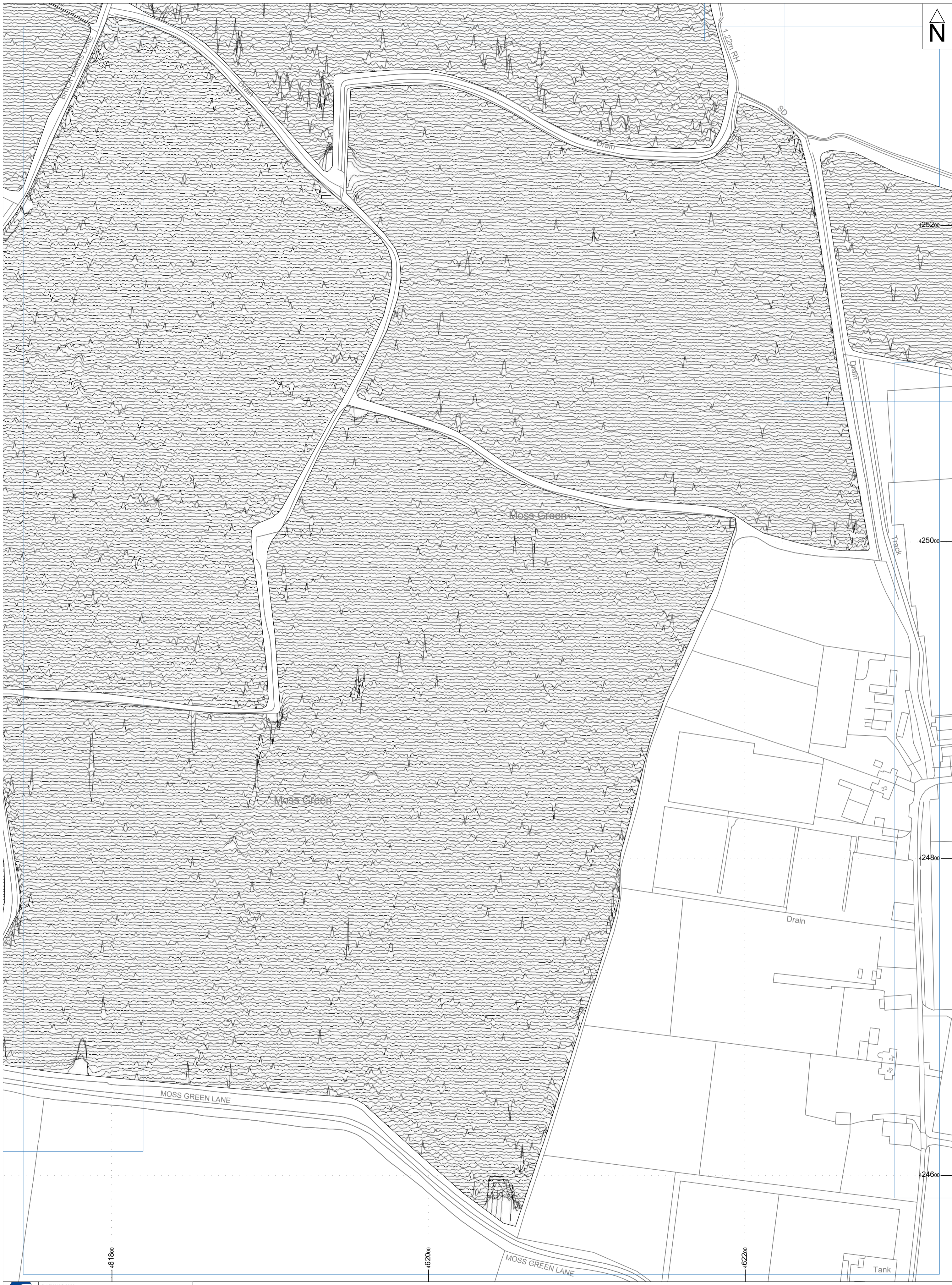
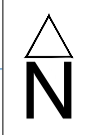

 0 50m
 1:1,500 @ A2

Fig. 68







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Project ID: XF70_HLO22
 XY trace plot of minimally processed magnetometer data:
 Sector 19

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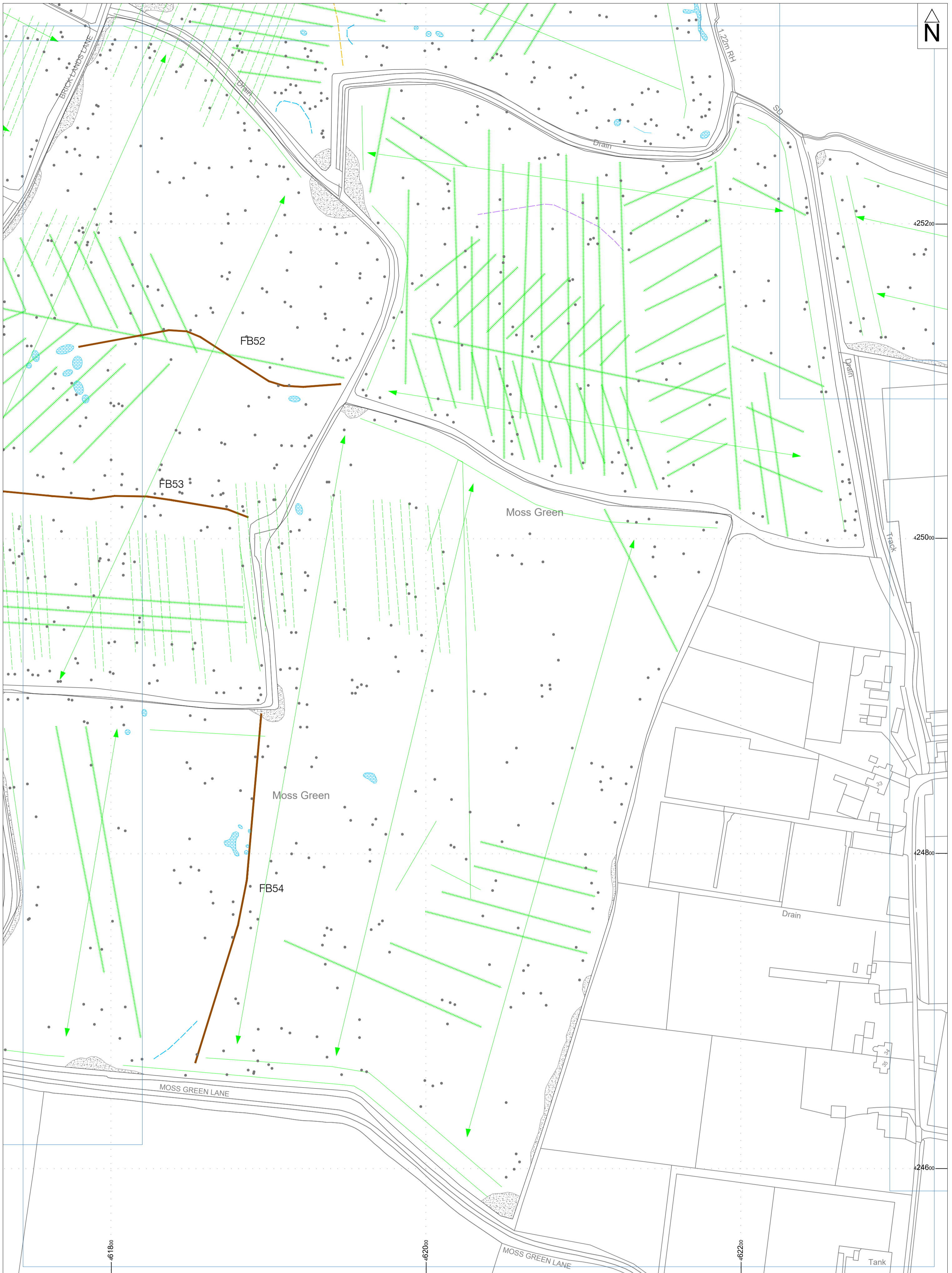
Title
 SECTOR BOUNDARY


15.0 nT/cm

0 50m

1:1,500 @ A2

Fig. 70




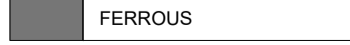
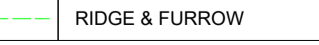

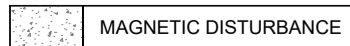
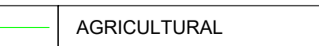

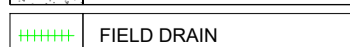
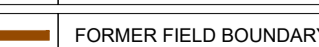
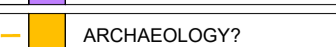

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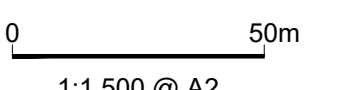
Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 19

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Title	
	SECTOR BOUNDARY


Interpretation					
	FERROUS		RIDGE & FURROW		GEOLOGY
	MAGNETIC DISTURBANCE		AGRICULTURAL		UNCERTAIN
	FIELD DRAIN		FORMER FIELD BOUNDARY		ARCHAEOLOGY?




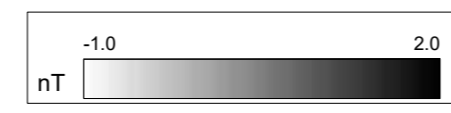
1:1,500 @ A2

Fig. 71




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 Processed greyscale magnetometer data: Sector 20

Title
 SECTOR BOUNDARY





0 50m
 1:1,500 @ A2

Fig. 72

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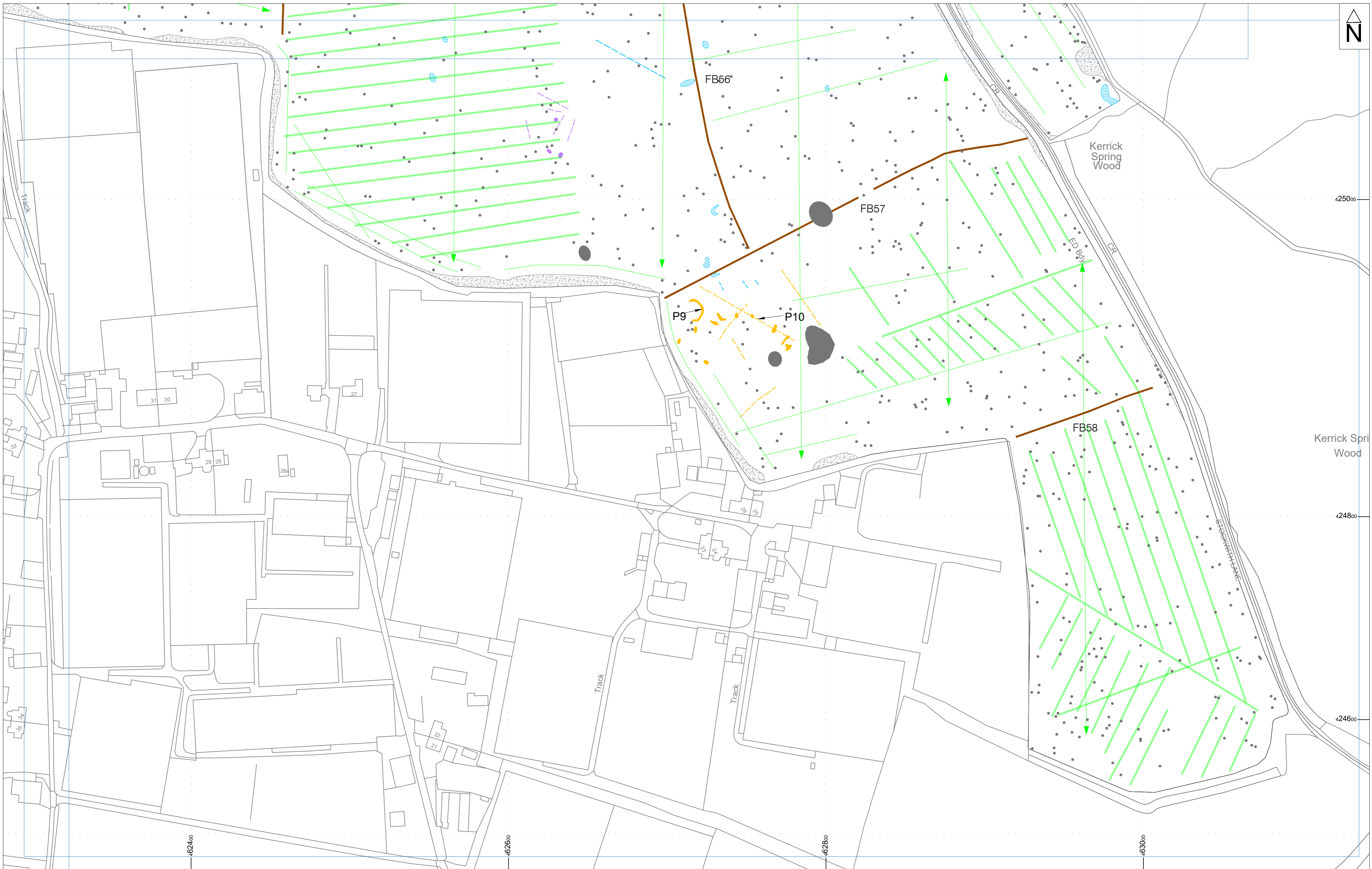

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 XY trace plot of minimally processed magnetometer data:
 Sector 20


Title
 SECTOR BOUNDARY


15.0 nT/cm

0 50m
 1:1,500 @ A2









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 Interpretation of magnetometer data: Sector 20

Title
 SECTOR BOUNDARY

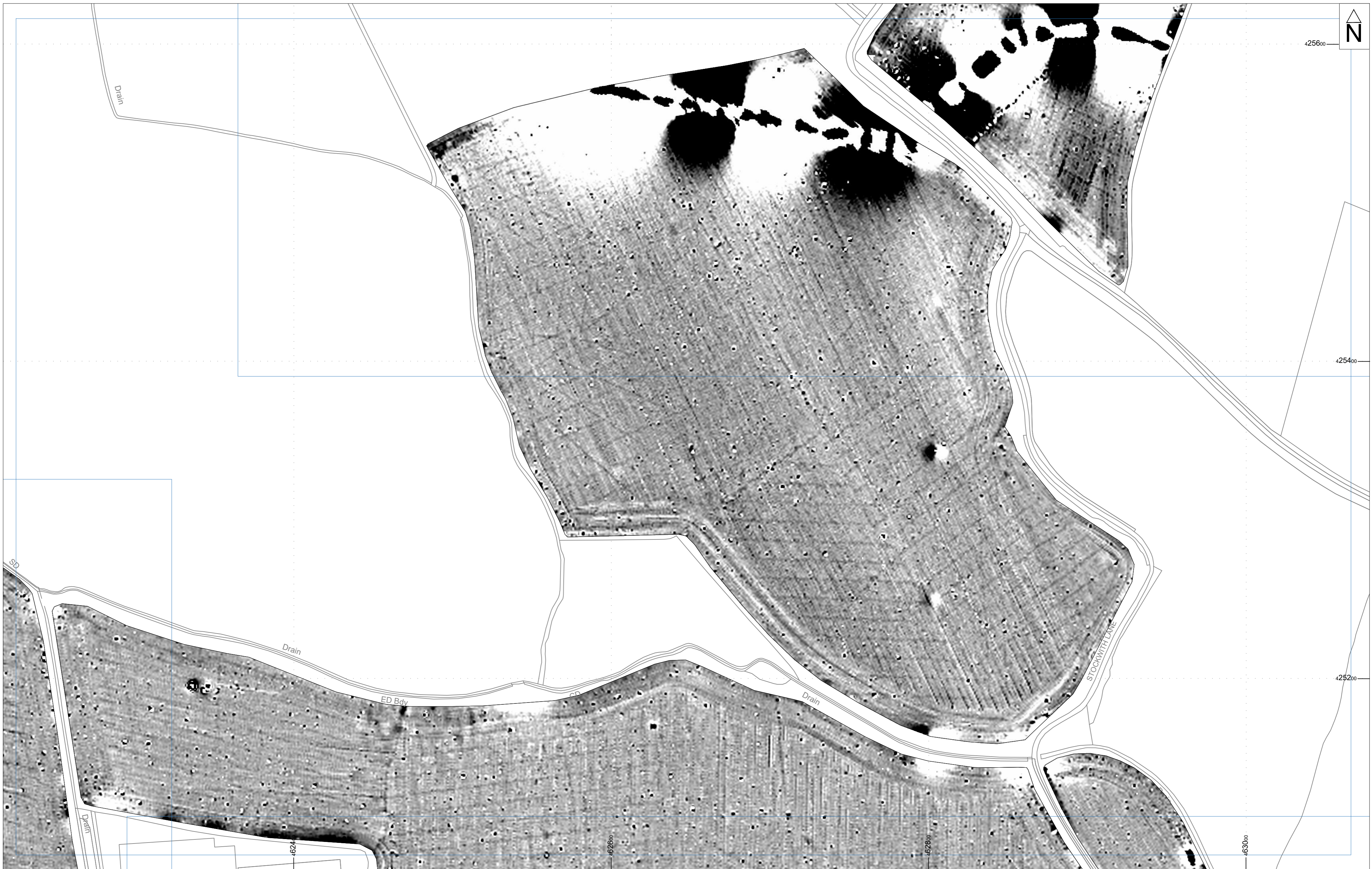
Interpretation


 FERROUS	 AGRICULTURAL	 UNCERTAIN
 MAGNETIC DISTURBANCE	 FORMER FIELD BOUNDARY	 ARCHAEOLOGY?
 FIELD DRAIN	 GEOLOGY	


0 50m
 1:1,500 @ A2

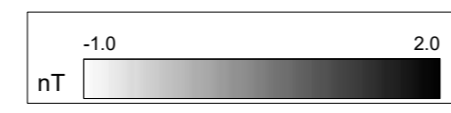
Fig. 74

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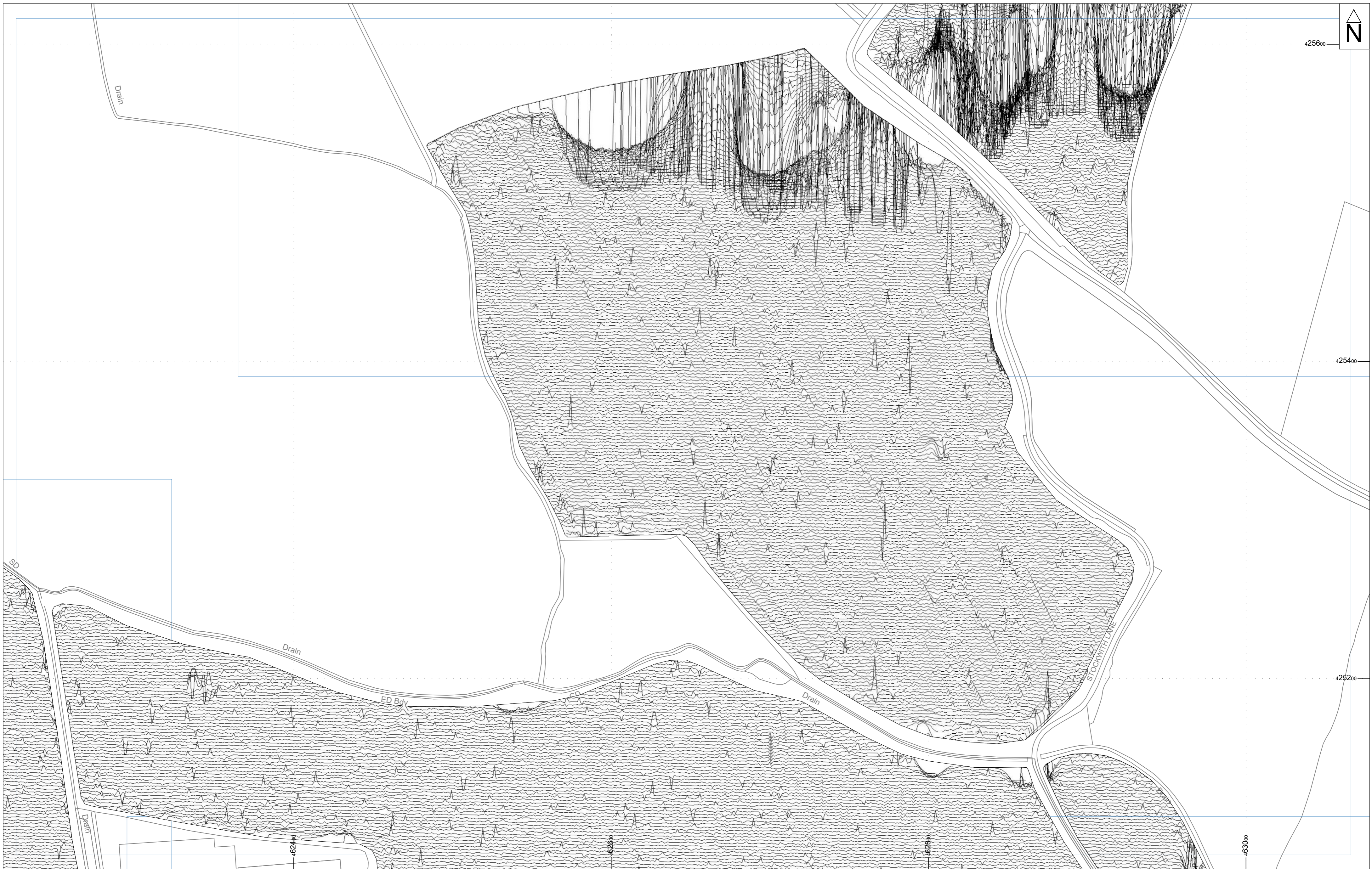

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Title
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0 50m
 1:1,500 @ A2

Fig. 75




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 Project ID: XF70_HLO22
 XY trace plot of minimally processed magnetometer data:
 Sector 21

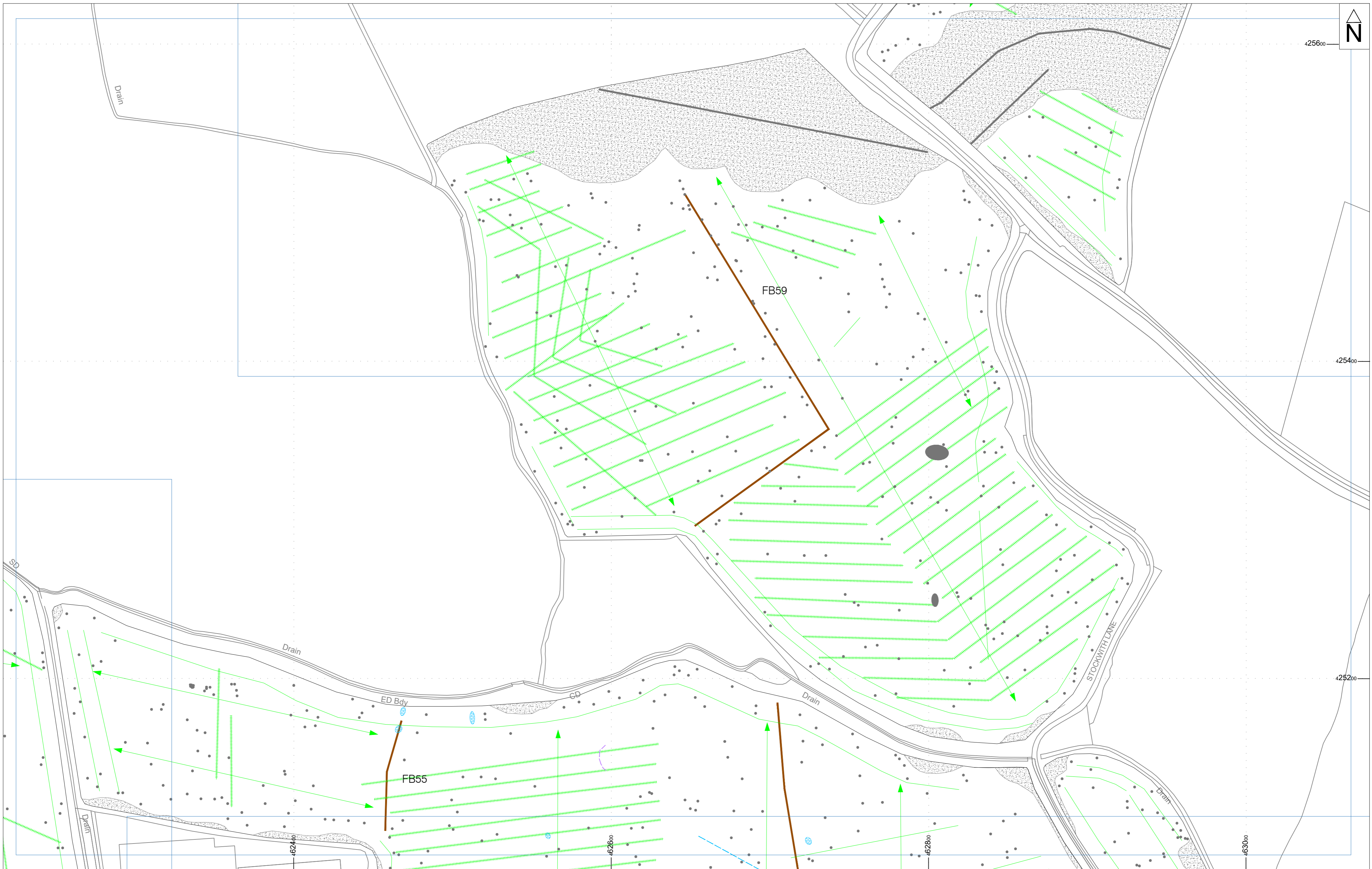
Title
 SECTOR BOUNDARY


15.0 nT/cm









0 50m
 1:1,500 @ A2

Fig. 76

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 Project ID: XF70_HLO22
 Interpretation of magnetometer data: Sector 21

Title		Interpretation			
	SECTOR BOUNDARY		FERROUS		AGRICULTURAL
	MAGNETIC DISTURBANCE		FORMER FIELD BOUNDARY		UNCERTAIN
	FIELD DRAIN		GEOLOGY		


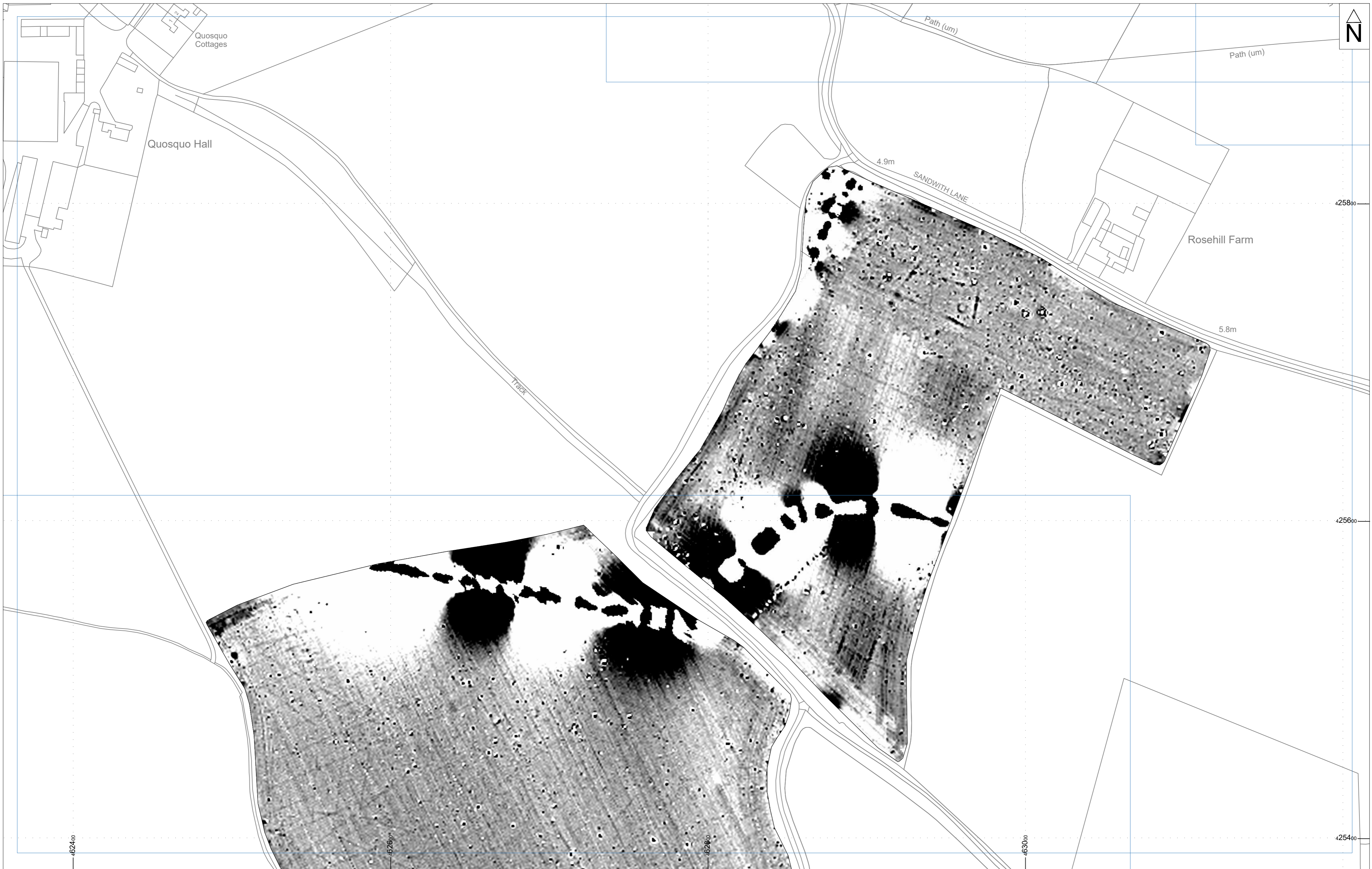


0  50m
 1:1,500 @ A2

Fig. 77




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 Project ID: XF70_HLO22
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Title
 SECTOR BOUNDARY




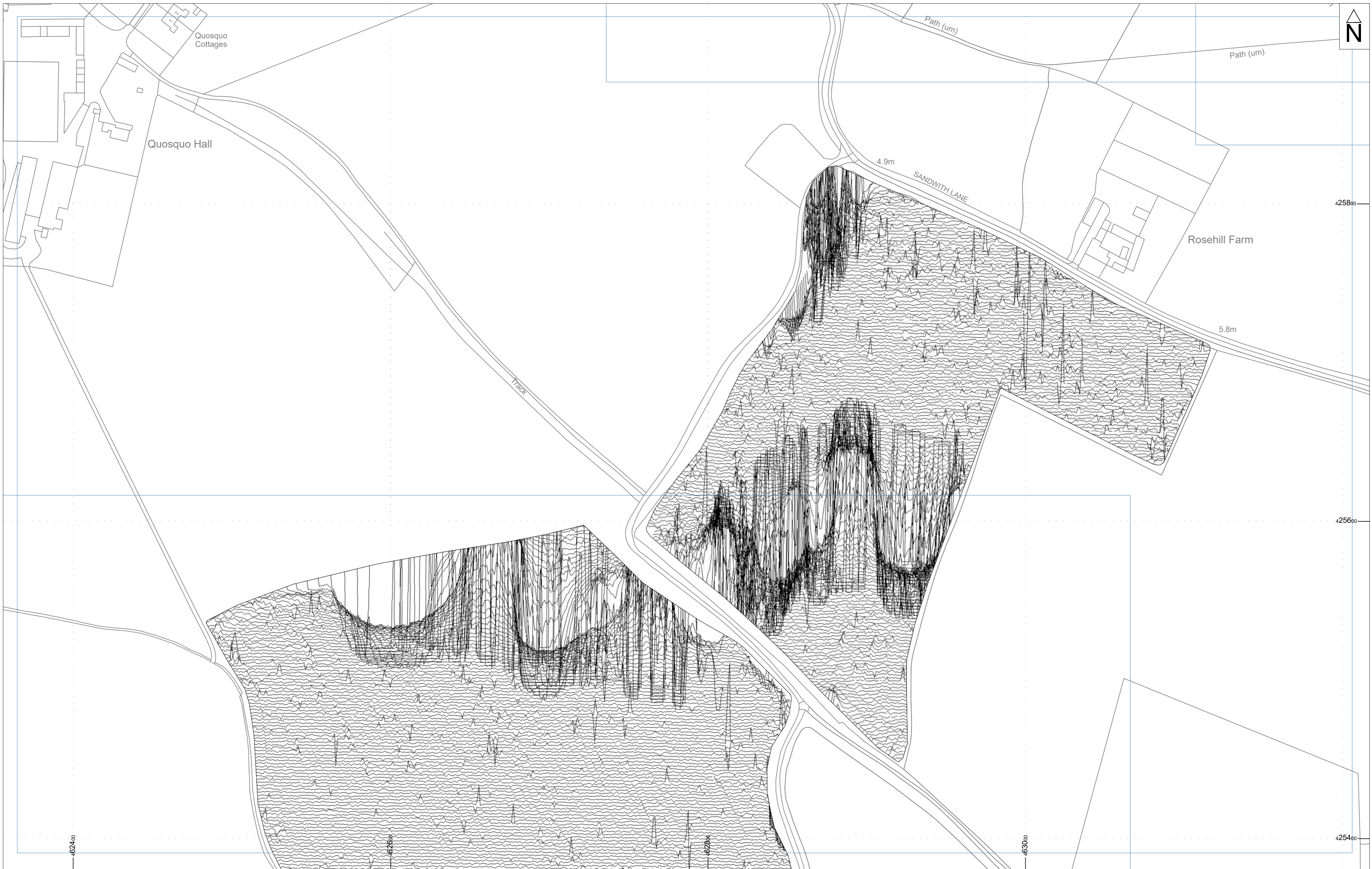


0  50m
 1:1,500 @ A2

Fig. 78




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 Tel: 0113 535 0163 Email: archaeology@wys.org.uk www.aswyas.com
 Project ID: XF70_HLO22
 XY trace plot of minimally processed magnetometer data:
 Sector 22

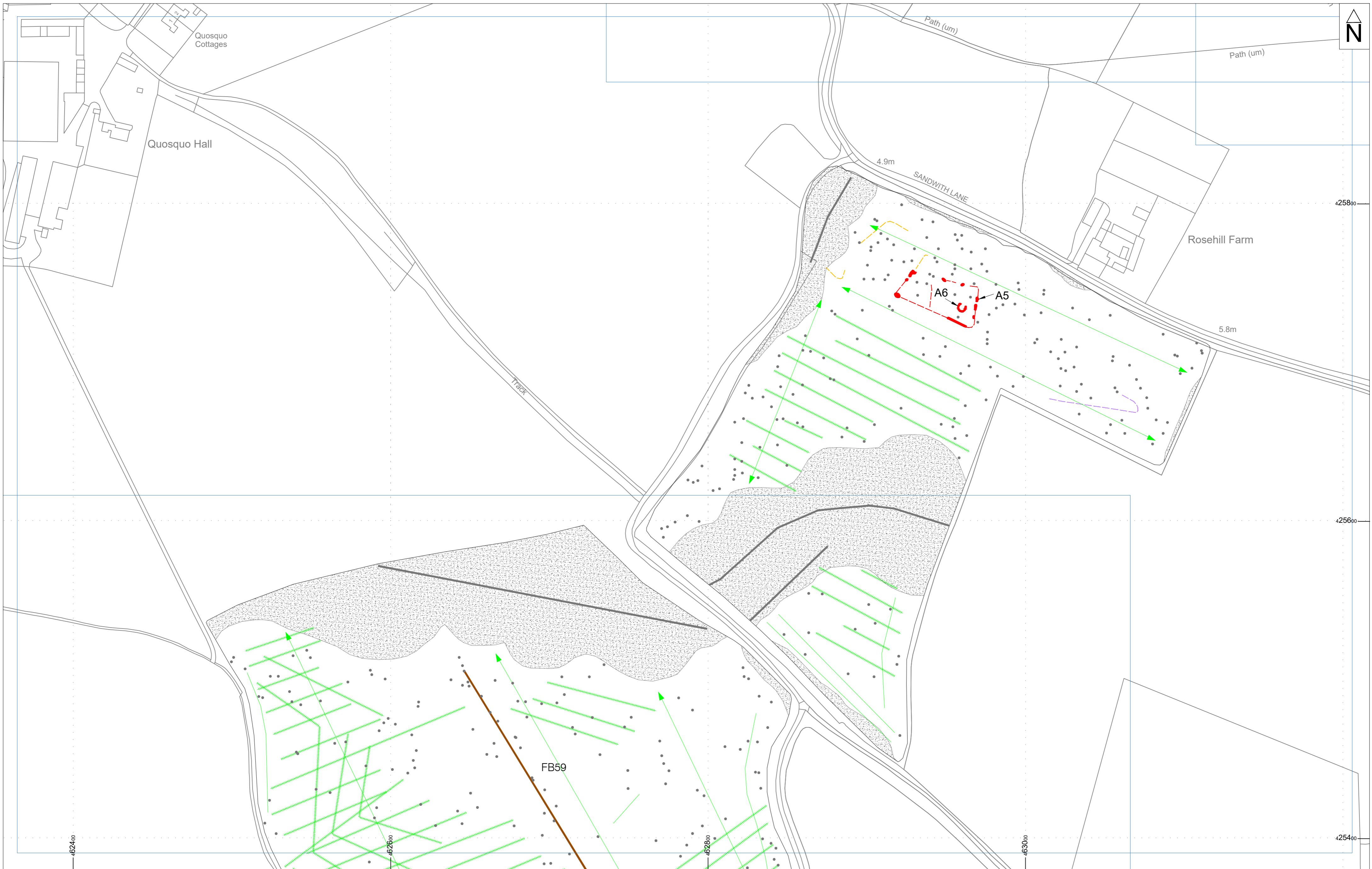
Title
 SECTOR BOUNDARY


15.0 nT/cm












0 50m
 1:1,500 @ A2

Fig. 79

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Title		Interpretation					
	SECTOR BOUNDARY		FERROUS		FIELD DRAIN		GEOLOGY
	SERVICE PIPE		AGRICULTURAL		FORMER FIELD BOUNDARY		UNCERTAIN
	MAGNETIC DISTURBANCE		ARCHAEOLOGY?		ARCHAEOLOGY		


0  50m
 1:1,500 @ A2

Fig. 80

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 an eight channel Sensys MX V3 system containing eight FGM650 sensors was also used which was towed across the area using an ATV. Readings were taken every 20MHz (between 0.05 and 0.1m). Data was be recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation.

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.

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The 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 and metadata

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2003), and graphics files (Adobe Illustrator CS6 and AutoCAD 2017) 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 North Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS Summary for archaeol11-515749

OASIS ID (UID)	archaeol11-515749
Project Name	Geophysical Survey at Helios Renewable Energy Scheme
Sitename	Helios Renewable Energy Scheme
Sitecode	HLO22
Project Identifier(s)	
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Archaeological Services WYAS
Project Dates	21-Jul-2022 - 11-Aug-2023
Location	Helios Renewable Energy Scheme NGR : SE 64168 25505 LL : 53.722015079752296, -1.029036540433109 12 Fig : 464168,425505
Administrative Areas	Country : England County : North Yorkshire District : Selby Parish : Carlton
Project Methodology	The cart-based survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data.
Project Results	A geophysical (magnetometer) survey was undertaken on approximately 530 hectares of land located to the northwest of Camblesforth known as the Helios Renewable Energy Project. The majority of the anomalies recorded are agricultural including field drains, medieval or post-medieval ridge and furrow cultivation, modern ploughing and former field boundaries. Archaeological and possible archaeological responses have been recorded within the study which comprise linear ditches and trends, rectilinear enclosures and sub-circular trends, perhaps indicative of settlement activity. Based on the geophysical survey, the archaeological potential of this Site is deemed to be high in the areas of likely settlement and low elsewhere.
Keywords	Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types
Funder	Private or public corporation Enso Energy
HER	North Yorkshire HER - unRev - STANDARD
Person Responsible for work	
HER Identifiers	
Archives	

Bibliography

- BGS, 2023. www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html. British Geological Survey (viewed May 2023)
- CIfA, 2020. *Standard and Guidance for Archaeological Geophysical Survey*. Chartered Institute for Archaeologists
- Heritage Gateway, 2020. www.pastscape.org.uk. Historic England. (viewed June 2022)
- MHCLG, 2019. *National Planning Policy Framework*. Ministry of Housing, Communities and Local Government.
- NLS, 2023. <https://maps.nls.uk/index.html>. National Library of Scotland (viewed April 2023)
- Schmidt, A. Linford, P., Linford, N., David, A., Gaffney, C., Sarris, A, and Fassbinder, J. 2016. *EAC Guidelines for the Use of Geophysics in Archaeology*. English Heritage
- SSEW, 1983. *Soils of Northern England, Sheet 1*. Soil Survey of England and Wales
- Trace, A. 2021. *Camblesforth PV Solar Farm, Selby, North Yorkshire. Report no. 3540*. ASWYAS