ARCHAEOLOGICAL SERVICES WYAS

Knaresborough Overhead Line Bramham Moor and Knaresborough West and North Yorkshire

Geophysical Survey

Report no. 2501

August 2013

Client: Parsons Brinkerhoff Ltd

REGISTERED ORGANISATION IfA

Knaresborough Overhead Line
Bramham Moor and Knaresborough
West Yorkshire and North Yorkshire

Geophysical Survey

Summary

A second phase of geophysical (magnetometer) survey, covering 3.6 hectares, was carried out at selected locations along the proposed connection route for a scheme of pylon replacements across Bramham Moor. In addition magnetometer survey covering 6 hectares was also carried out in several fields north-west of Knaresborough, where pylons are also to be replaced as part of the same scheme. On the Bramham Moor section the survey has identified anomalies which are caused by sub-surface archaeological features (soil filled ditches) which form field boundaries and enclosures of likely late Iron Age/Romano-British date. Some, but not all, of these anomalies have been previously recognised as cropmarks thus confirming the high archaeological potential along this section of the scheme. In the Knaresborough section the archaeological potential is considered to be lower with few anomalies of archaeological potential other than those caused by ridge and furrow ploughing some of which survive as low earthworks.

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Report Information

Client:	Parsons Brinckerhoff Ltd
Address:	Amber Court, William Armstrong Drive, Newcastle-upon-Tyne, NE4 7YQ
Report Type:	Geophysical Survey
Location:	Bramham Moor and Knaresborough
County:	West Yorkshire and North Yorkshire
Grid Reference:	SE 435 423 to SE 464 417 (Bramham) and SE 335 594 (Knaresborough)
Period(s) of activity:	Prehistoric/Romano-British/Post-Medieval
Report Number:	2501
Project Number:	4080
Site Code:	KOL13
OASIS ID	archaeol11-156842
Planning Application No.:	n/a
Museum Accession No.:	n/a
Date of fieldwork:	June 2013
Date of report:	July 2013
Project Management:	Sam Harrison BSc MSc AIfA
Fieldwork:	Christopher Sykes BA MSc
	Kieron Kinnenmont BSc PG Dip
Report:	Christopher Sykes with Alistair Webb
Illustrations:	Christopher Sykes
Photography:	Christopher Sykes
Research:	n/a

Authorisation for distribution: ---

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Contents

List of Figures

1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Simon McCudden of Parsons Brinckerhoff Ltd, on behalf of their clients Northern Powergrid (Yorkshire) plc, to undertake a programme of geophysical (magnetometer) survey in advance of ground and infrastructure works for a proposed connection route between XC Monk Fryston-Poppleton Circuit and the PHG Ferrybridge-Knaresborough Circuit. This will involve the replacement of some pylons and the addition of others on Bramham Moor and north-east of Knaresborough. The work was carried out after consent for the scheme had been granted but in advance of any groundworks. The scheme of work was undertaken in accordance with guidance contained with the National Planning Policy Framework (2012) and to a Project Design produced by Archaeological Services WYAS (ASWYAS 2013 – see Appendix 1). The survey was carried out between June 17th and June 20th 2013.

Site location, land-use and topography

The geophysical survey was carried out at two locations (see Fig. 1) approximately 20km apart. The first location was on Bramham Moor where three areas were surveyed. These blocks expanded around areas previously surveyed in December 2012 (ASWYAS 2013) near the village of Bramham (see Fig. 2). Area 1 is located 0.8km east of Bramham and is centred at SE 434 423. Area 2 is located 2.6km east of Bramham, centred at SE 453 419 and Area 3 is located 3.1km east of Bramham. Area 1 and Area 2 lie within West Yorkshire whilst Area 3 is in North Yorkshire, centred at SE 462 417. All of the survey areas in this section were on arable land which was under winter wheat at the tine of survey.

The second focus of survey was centred approximately 4km north-west of Knaresborough, at SE 335 594, immediately south of the village of Lingerfield (see Fig. 4). The survey covered areas of approximately 1 hectare centred on the proposed locations of five new pylons (Areas 4 to 8 inclusive - see Fig. 5), immediately north and south of Smithy Lane. All of these areas were under permanent pasture. Remnant earthworks indicative of ridge and furrow ploughing were still visible in Areas 7 and 8.

Geology and soils

The underlying bedrock in the Bramham Moor section comprises Dolostone of the Cadeby Formation (British Geological Survey 2013). There are no superficial deposits. The soils across all three areas in this section of the scheme comprise shallow, locally brashy, well-drained calcareous fine loams over limestone (Soil Survey of England and Wales 1983).

The underlying bedrock of the Knaresborough survey area comprises Huddersfield White Rock and Millstone Grit Group overlain by till superficial deposits. The soils in this area are classified in the Dunkeswick association and comprise slowly permeable seasonally waterlogged fine loams (Soil Survey of England and Wales 1983).

2 Archaeological and Historical Background

An Environmental Statement produced on behalf of National Grid in 2006 identified that the landscape around Bramham Moor Sub-station has a high archaeological potential. This potential was primarily based on analysis of air photographs which revealed extensive cropmarks in the Bramham Moor area. These cropmarks are interpreted as features of probable late Iron Age or Roman date indicative of the buried remains of field systems, enclosures and settlements. A Roman road is also thought to cross this landscape. A geophysical survey recently carried out by ASWYAS (Webb 2013), also as part of the evaluation works for this scheme, produced results both confirming and enhancing the cropmark evidence locating many of the cropmark features as well as other sub-surface features not previously identified. The line of the Roman road was also confirmed.

The area around Knaresborough based upon an Environmental Statement produced on behalf of National Grid in 2006 revealed ridge and furrow indicative of a medieval or post-medieval agricultural landscape.

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 the proposed development on any potential archaeological remains and for mitigation proposals, if appropriate, to be recommended. To achieve this aim a magnetometer survey covering areas likely to be impacted by the scheme was carried out, an area of 9.6 hectares.

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

Bartington Grad601 magnetic gradiometers were used during the survey taking readings at 0.25m intervals on zig-zag traverses 1m 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 2.

Reporting

The relative positions of the two areas of survey are displayed on an Ordnance Survey base map in Figure 1. Figure 2 shows the Bramham Moor section of the survey corridor with the magnetometer data and cropmarks overlaid at a scale of 1:7500; the 2012 data is also displayed. Figure 3, also at 1:7500, shows the overall interpretation of the data with the cropmark data also displayed. The survey areas in the Knaresborough section can be seen in overview in Figure 4 at a scale of 1:4000 with an overview of the interpretation at the same scale in Figure 5.

Greyscale plots, XY trace plots and interpretations of the data in each of the three areas in the Bramham Moor sector areas are presented at a scale of 1:1000 in Figures 6 to 14 inclusive whilst the five areas at Knaresborough are similarly presented in Figures 15 to 23 inclusive.

Further technical information on the equipment used, data processing and survey methodologies are given in Appendix 2 and Appendix 3. Appendix 4 describes the composition and location of the site archive.

The geophysical survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Institute for Archaeologists (IfA 2010). 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 ‘raw’ and 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 Figs. 3 to 23 inclusive)

Anomalies common to all survey areas are described below. The results from each of the two parts of the scheme are then described and discussed more fully.

Ferrous Anomalies - Modern

Ferrous responses, either as individual ‘spike’ anomalies or more extensive areas of magnetic disturbance, are typically caused by modern ferrous (magnetic) debris, either on the ground surface or in the plough-soil, or are due to the proximity of magnetic material in field boundaries, buildings or other above ground features. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation. Ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. Throughout the scheme iron ‘spike’ anomalies are common and there is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the plough-soil, or from previous disturbance, as is the case in Knaresborough. In this case it is probably as a result from the construction of, and proximity to, the existing pylons.

Agricultural Anomalies – Post-medieval

Linear trend anomalies have been identified in all of the survey areas. These anomalies are all likely to be due to agricultural activity, specifically ploughing (recent and post-medieval ridge and furrow ploughing), land drains or former boundaries.

Bramham Moor (see Figs 2, 3 and 6 to 14 inclusive)

The effects of the existing electricity infrastructure can be clearly seen in the data, particularly in Area 1 where the effects of the proximity of two pylons has resulted in massive magnetic disturbance which manifests as the observed ‘halo’ effect around the two structures. Other significant areas of magnetic disturbance in the Bramham area are also due to below ground structures associated with infrastructural services such as electricity or gas pipes, in Areas 2 and 3. These very strong readings mean that the much weaker responses of any sub-surface archaeological features, if present, in the immediate vicinity of these highly magnetic steel structures are likely to be ‘masked’. Several discrete anomalies have been interpreted as possibly archaeological but given the amount of magnetic disturbance this interpretation should be treated with a degree of caution.

In Area 1 (see Figs 6, 7 and 8) linear anomalies **A** and **B** have been identified to the east of the two small enclosures located by the previous survey. Anomaly **A** heads east from the two enclosures and is intersected at 90º by **B**. Both anomalies correspond with cropmarks (see Fig. 6) and are caused by soil filled ditches forming part of the late prehistoric/early Roman agricultural landscape. Anomaly **C** is the continuation of the linear ditch feature that extends south from the two previously identified enclosures.

Linear anomalies due to ridge and furrow ploughing are noted throughout on the same north-north-east/south-south-west alignment as anomalies **B** and **C**.

A cluster of discrete anomalies of slightly elevated magnetic response are noted to the southern corner of the larger of the two blocks. These anomalies are interpreted as due to geological variation.

Within Area 2 (see Figs 9, 10 and 11) magnetic disturbance caused by the service pipe identified previously masks any potential archaeological responses to the north and north-west of the survey area. However, a short linear anomaly, **D**, aligned east/west has been identified to the west. This ditch type anomaly has not previously been noted as a cropmark but is on the same alignment as cropmarks noted to the north and south of the survey area and is also at right angles to another linear anomaly identified in the 2012 survey 110m to the east. A discrete anomaly, **E**, immediately to the north of **D**, may also be of archaeological potential although a geological cause is also considered possible. Other geological and agricultural anomalies have also been identified in this survey area.

In Area 3 (see Figs 12, 13 and 14) at the eastern end of the Bramham Moor section intersecting linear ditch type anomalies, **F** and **G**, are clearly visible in the data set. Both anomalies have previously been identified as cropmarks, although a third cropmark (see Fig. 12) does not manifest as a magnetic anomaly. A buried pipe, ploughing and geological anomalies are also identified in this area.

Knaresborough (see Figs. 4, 5 and 15 to 23 inclusive)

The influence of the existing electricity infrastructure can be seen in the data, especially in Area 4 where the magnetic effects of the current pylon overshadows any potential archaeological responses over more than half of this area. Only linear ploughing anomalies are noted in the southern half of this area that is not affected by the magnetic effects of the pylon.

The magnetic effects of the pylon are still recorded along the southern edge of Area 5 but here the data is largely dominated by linear trends, aligned north-west/south-east that are indicative of the former agricultural practice of ridge and furrow ploughing. Two parallel linear anomalies, **H**, at right angles to the ploughing anomalies have been interpreted as potentially archaeological, possibly ditches flanking a trackway. However, they could equally be associated with the ploughing regime, or the square pond feature located immediately to the north. A second short linear anomaly, **I**, oblique to the ploughing, has also been interpreted as potentially archaeological but a non-archaeological origin is considered equally plausible.

In Area 6 and Area 7 no anomalies of definite archaeological potential have been identified. Anomalies indicative of ridge and furrow ploughing are again noted in both areas, particularly in the northern half of Area 7 where it is visible as low earthworks. A former field boundary, **J**, (shown on the 1854 Ordnance Survey mapping) is partially visible as a weak linear anomaly in Area 7. A vague linear anomaly, **K**, aligned north-west/south-east is highlighted as of possible archaeological potential but again modern or agricultural origins are considered equally likely.

In Area 8 (see Fig. 23) a faint south-west/north-east aligned linear, **L**, has been identified amongst the ridge and furrow. Due to the alignment, this has been identified as possible archaeology, but may be more in keeping with disturbance created by an informal pathway across the field.

5 Conclusions

The geophysical survey has identified anomalies of probable archaeological origin in all of the areas surveyed in the Bramham Moor section of the replacement scheme again confirming the high archaeological potential of this landscape.

In the Knaresborough section the archaeological potential appears to be much lower with only a few anomalies of uncertain origin being interpreted as having some potential although there is widespread and extensive evidence of the former practice of ridge and furrow ploughing, both as magnetic anomalies and surviving low earthworks.

Disclaimer

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.

Proposed geophysical survey areas — Inset see Fig. 2. — Inset see Fig. 4.

0 — 2km

Fig. 1. Site location

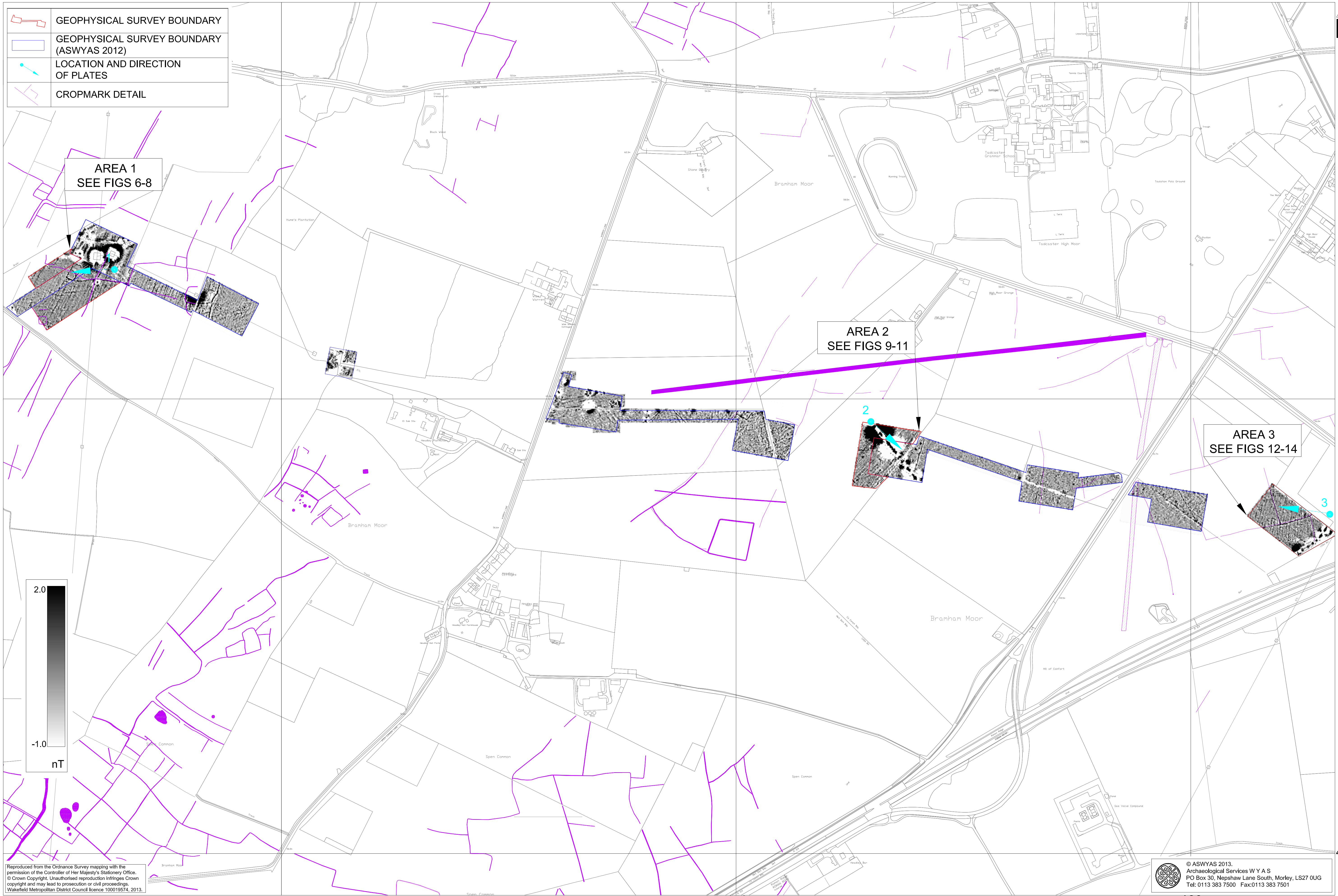

Fig. 2. Overview of magnetometer data: Bramham (1:7500 @ A3)

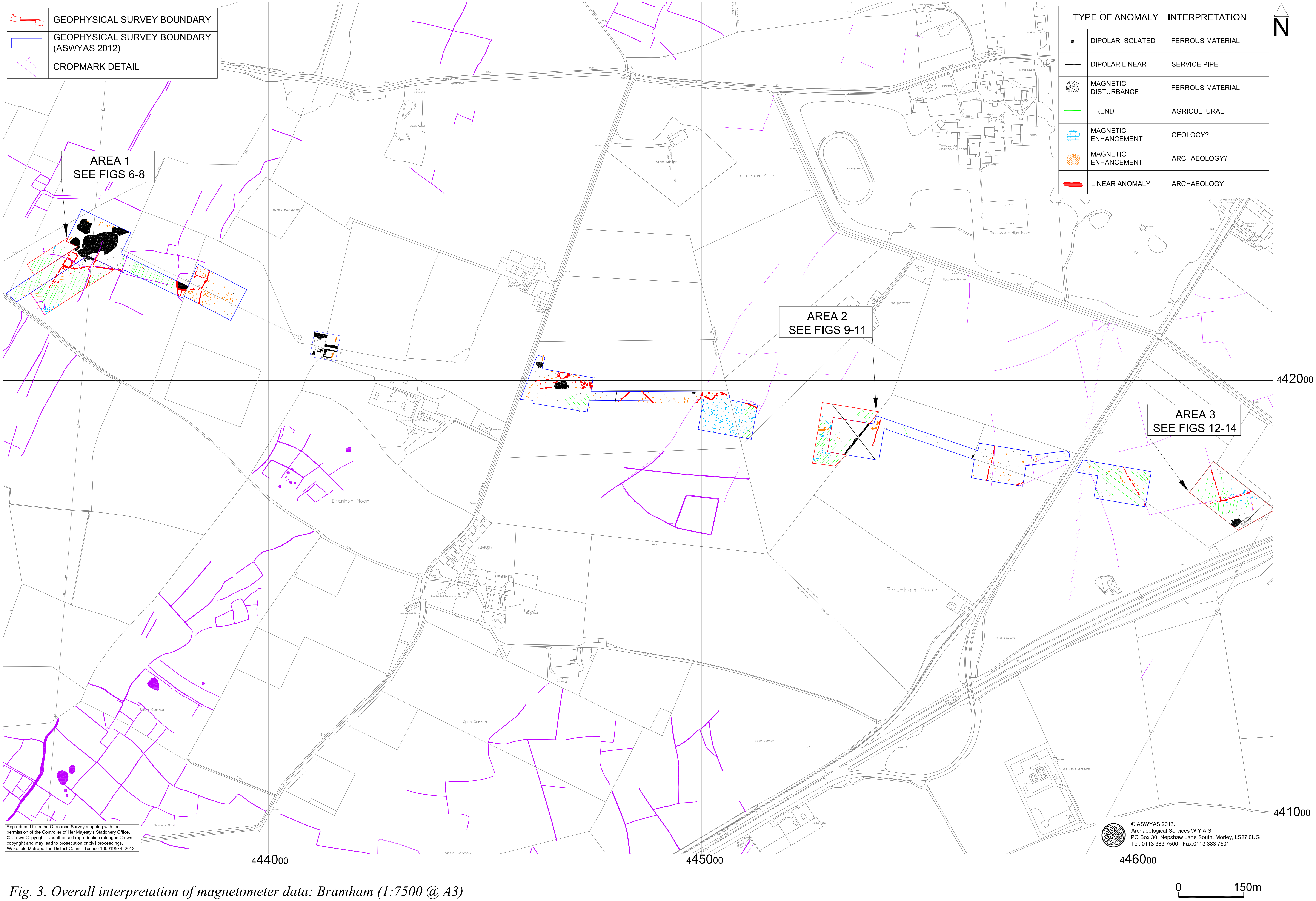

Fig. 3. Overall interpretation of magnetometer data: Bramham (1:7500 @ A3)

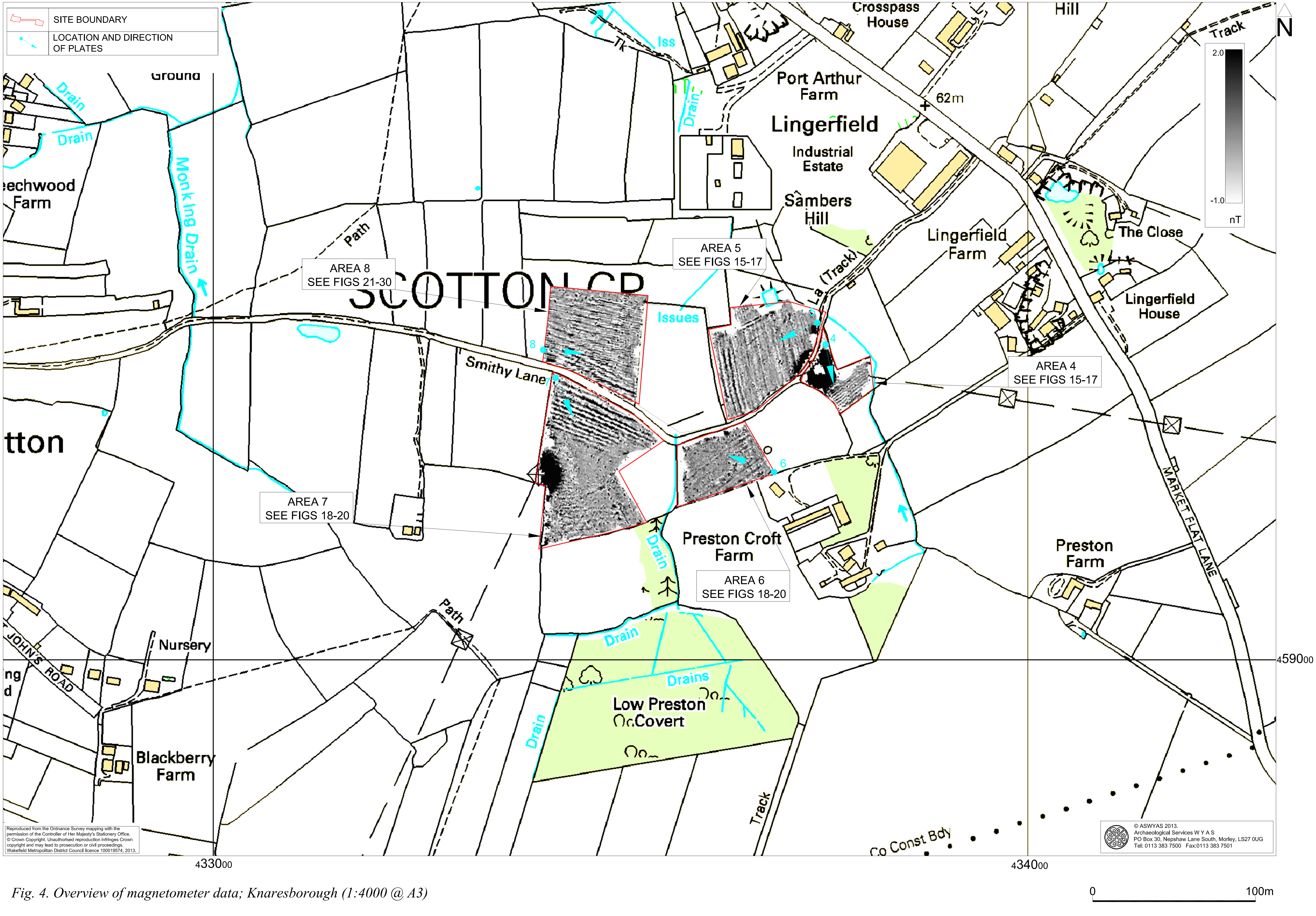

Fig. 4. Overview of magnetometer data; Knaresborough (1:4000 @ A3)

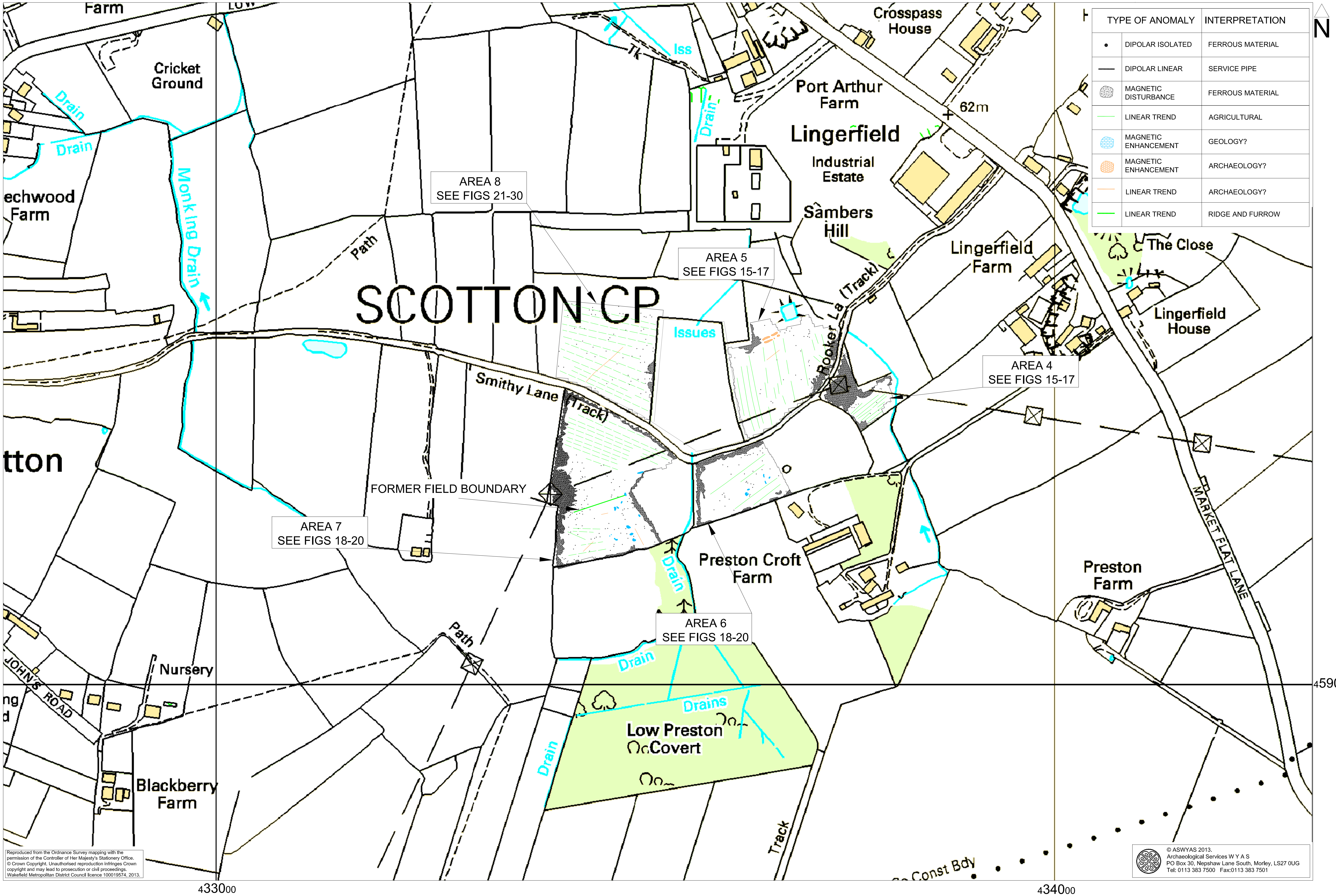

Fig. 5. Overall interpretation of magnetometer data; Knaresborough (1:4000 @ A3)

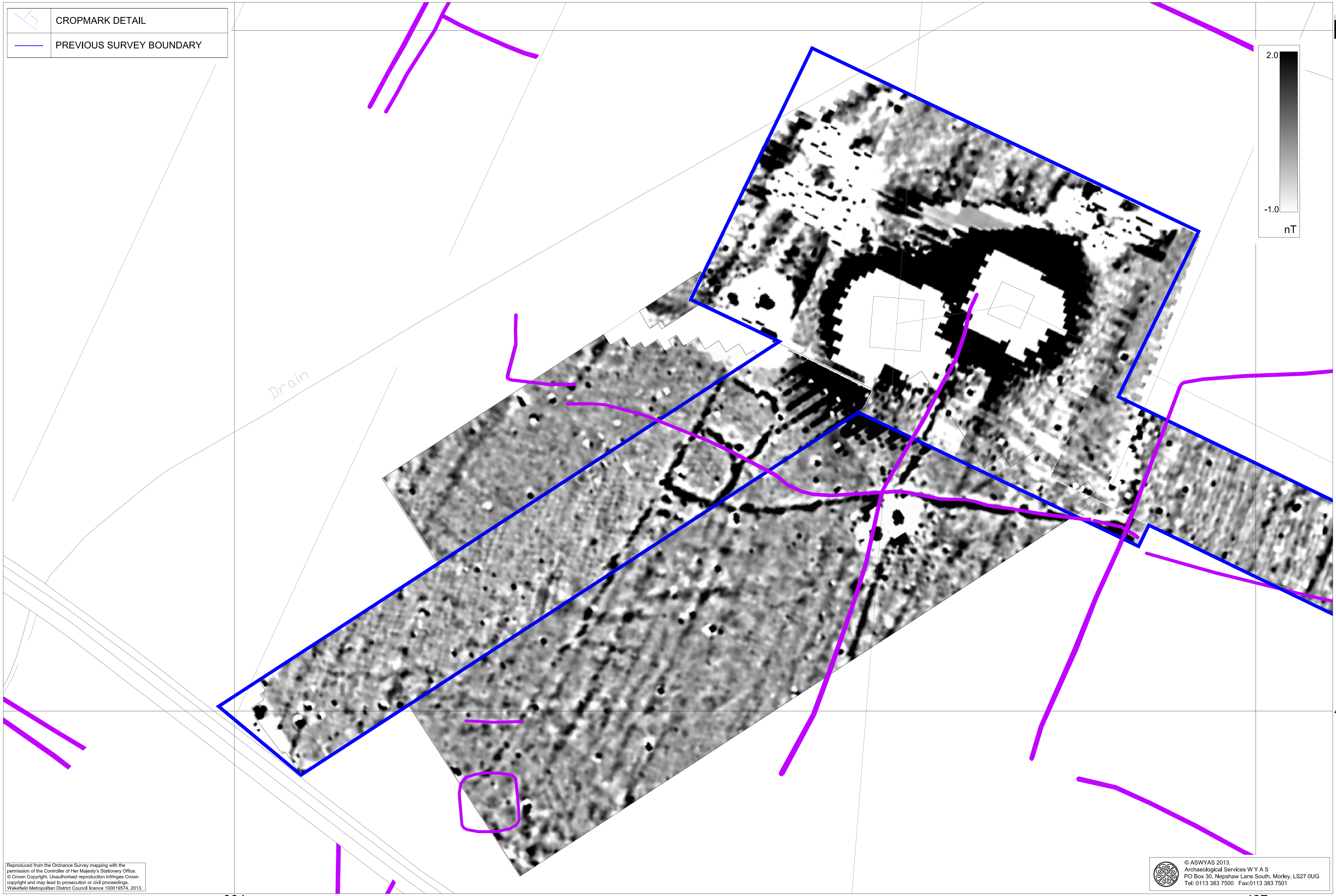

Fig. 6. Processed greyscale magnetometer data; Bramham, Area 1 (1:1000 @ A3)

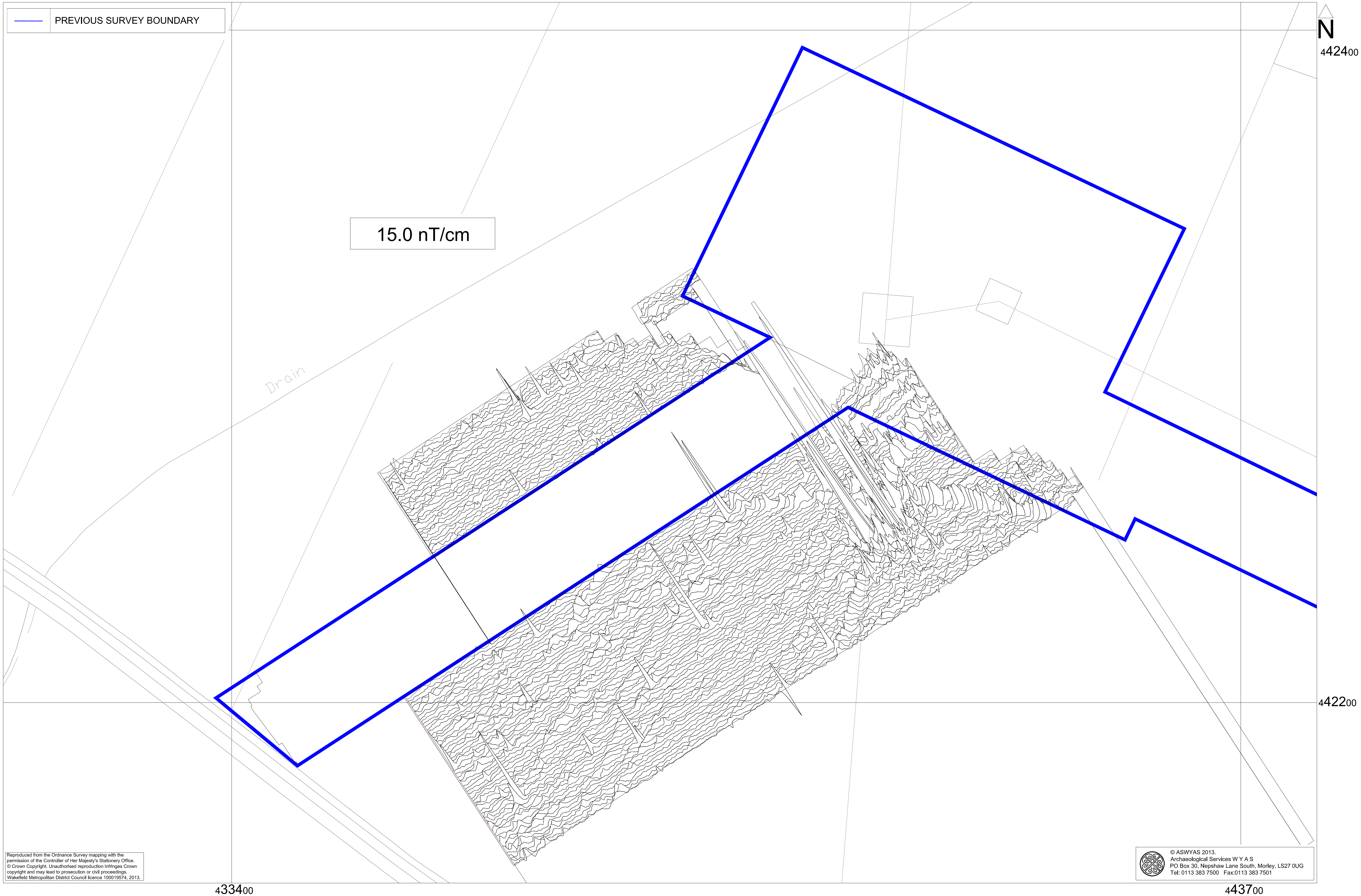

Fig. 7. XY trace plot of minimallly processed magnetometer data; Bramham, Area 1 (1:1000 @ A3)

0 25m

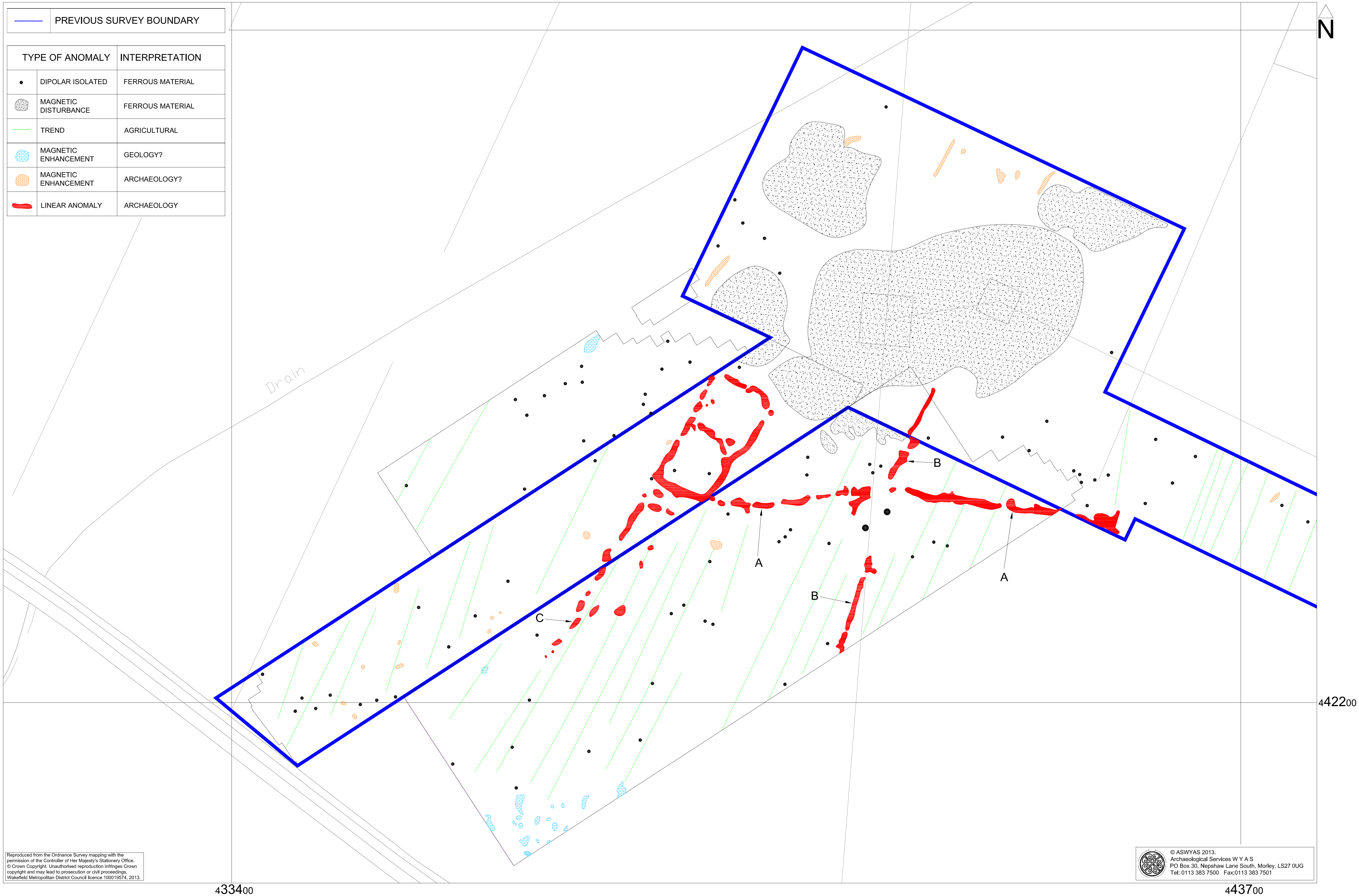

Fig. 8. Interpretation of magnetometer data; Bramham Moor - Area 1 (1:1000 @ A3)

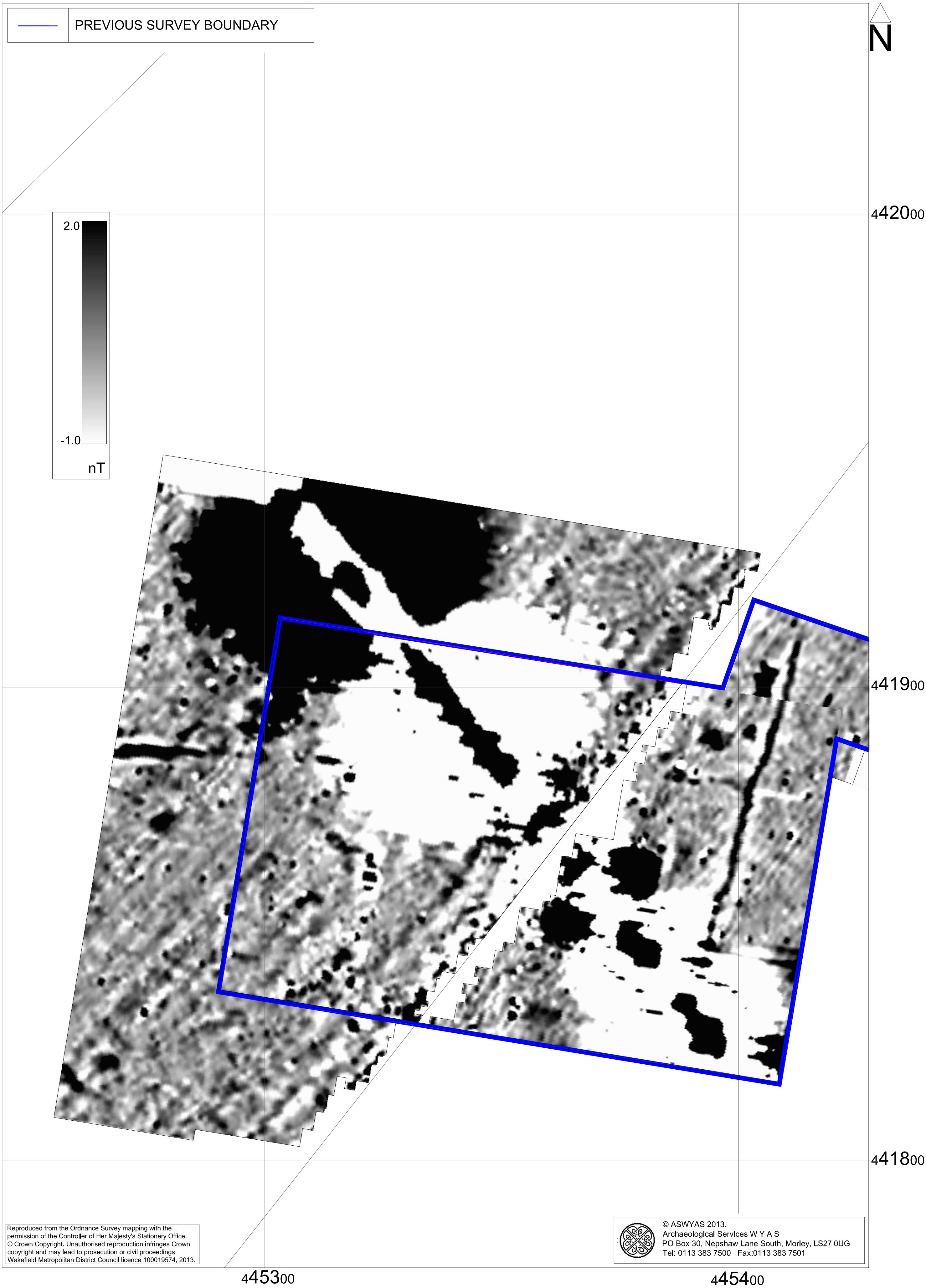

Fig. 9. Processed greyscale magnetometer data; Bramham, Area 2 (1:1000 @ A4)

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Fig. 10. XY trace plot of minimally processed magnetometer data; Bramham, Area 2 (1:1000 @ A4)

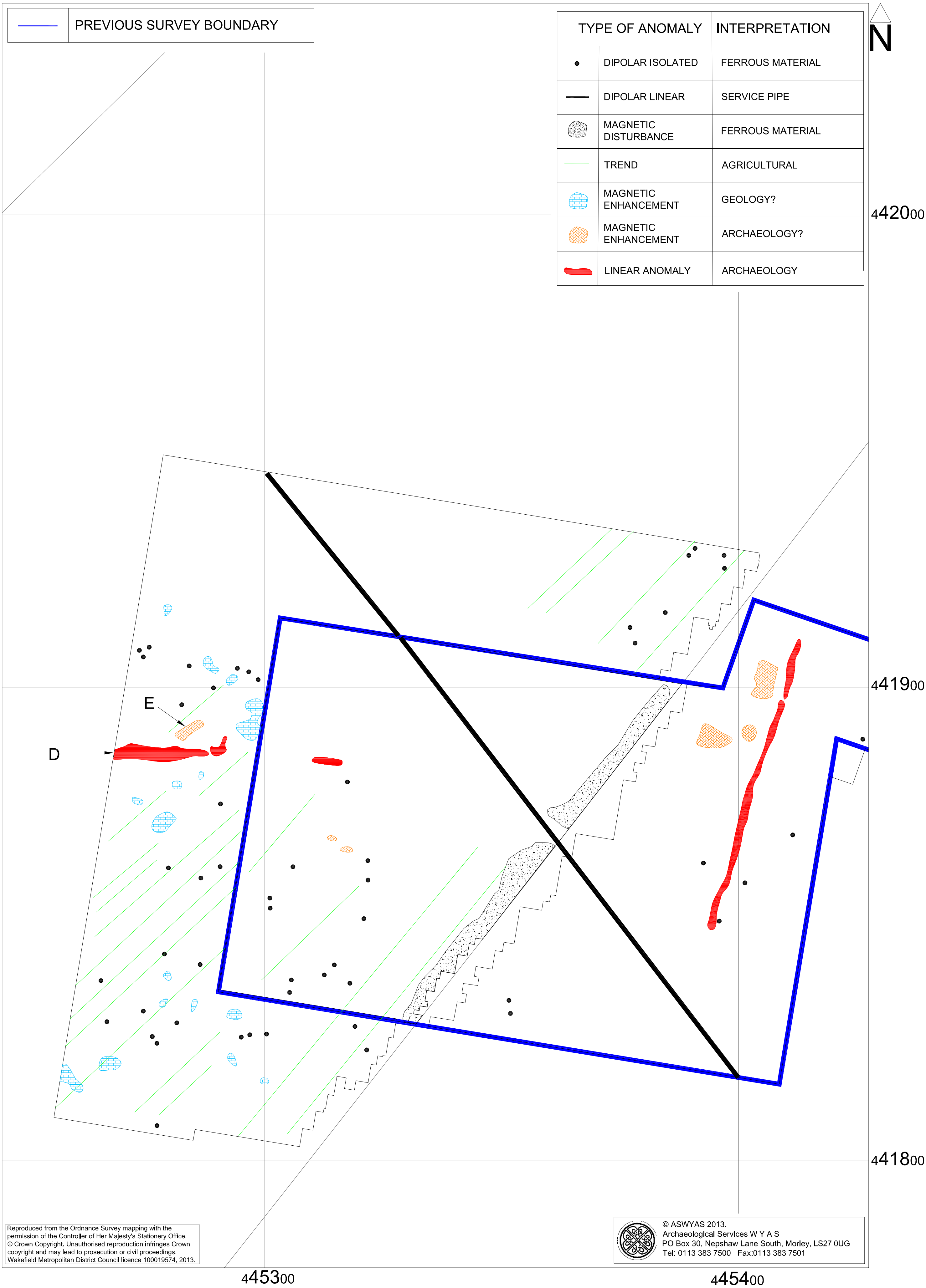

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Fig. 11. Interpretation of magnetometer data; Bramham Moor - Area 2 (1:1000 @ A4)

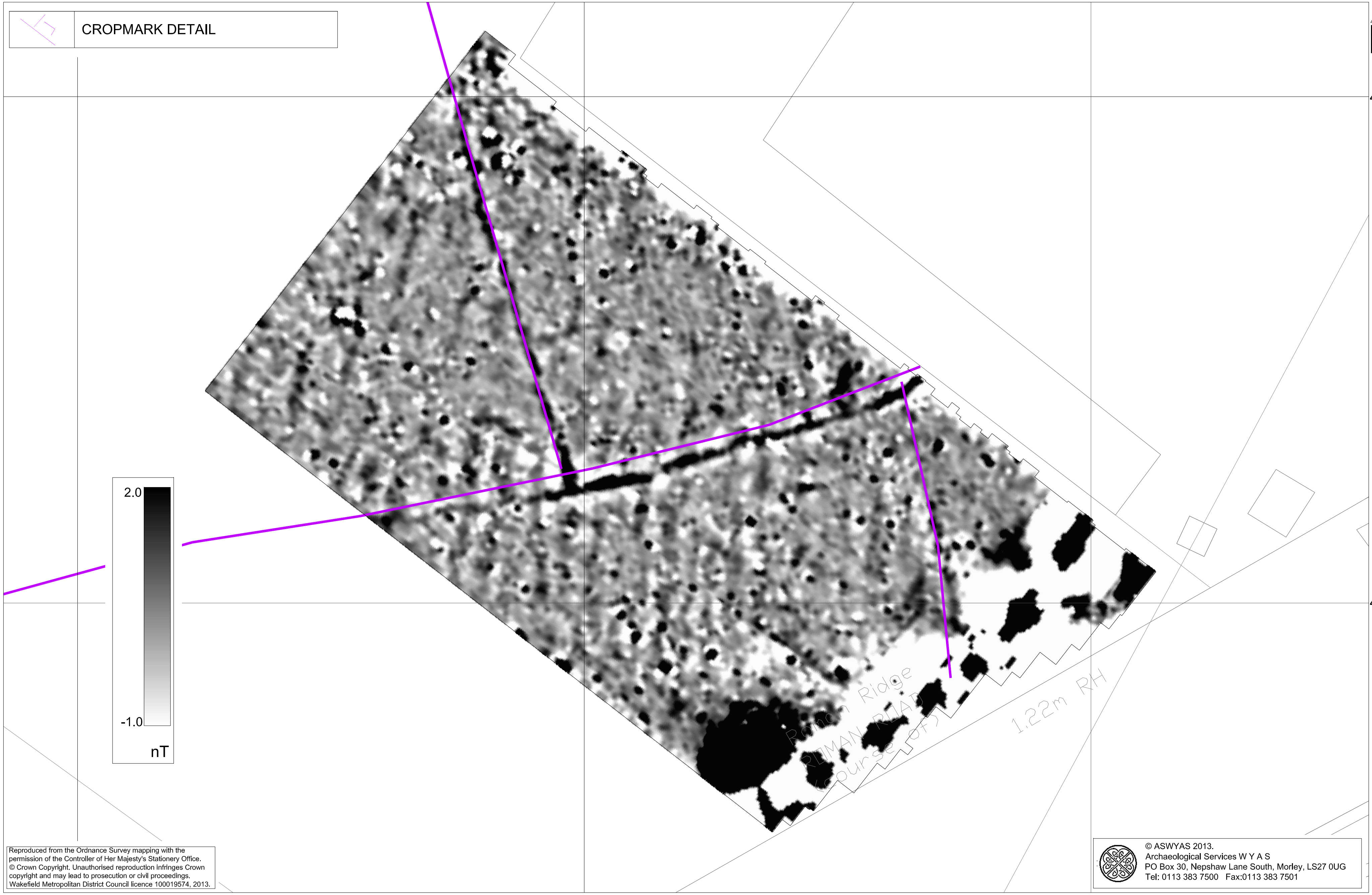

Fig. 12. Processed greyscale magnetometer data; Bramham, Area 3 (1:1000 @ A4)

0 50m

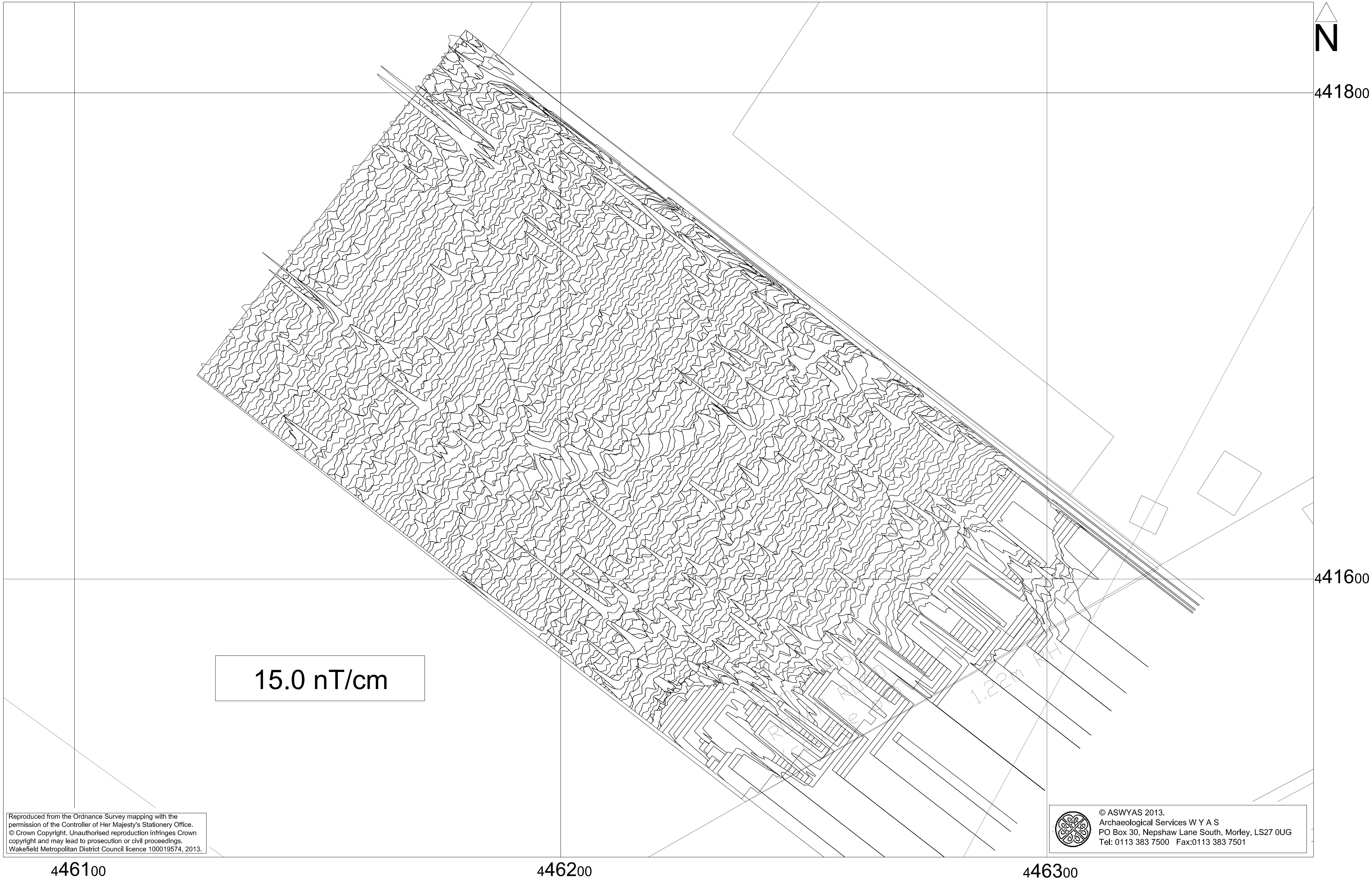

Fig. 13. XY trace plot of minimallly processed magnetometer data; Bramham, Area 3 (1:1000 @ A4)

0 50m

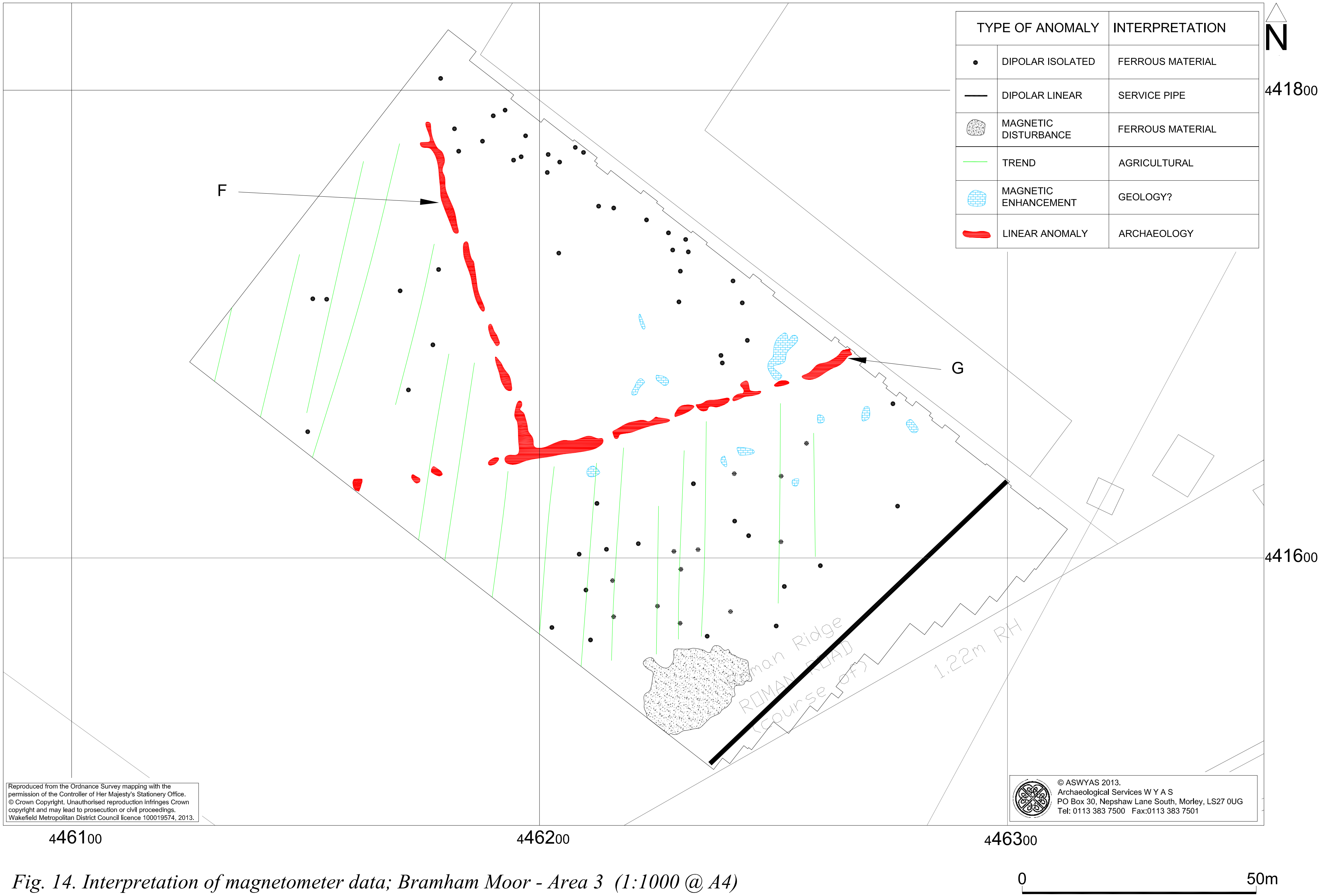

Fig. 14. Interpretation of magnetometer data; Bramham Moor - Area 3 (1:1000 @ A4)

Fig. 15. Processed greyscale of magnetometer data; Knaresborough, Area 4 and Area 5 (1:1000 @ A3)

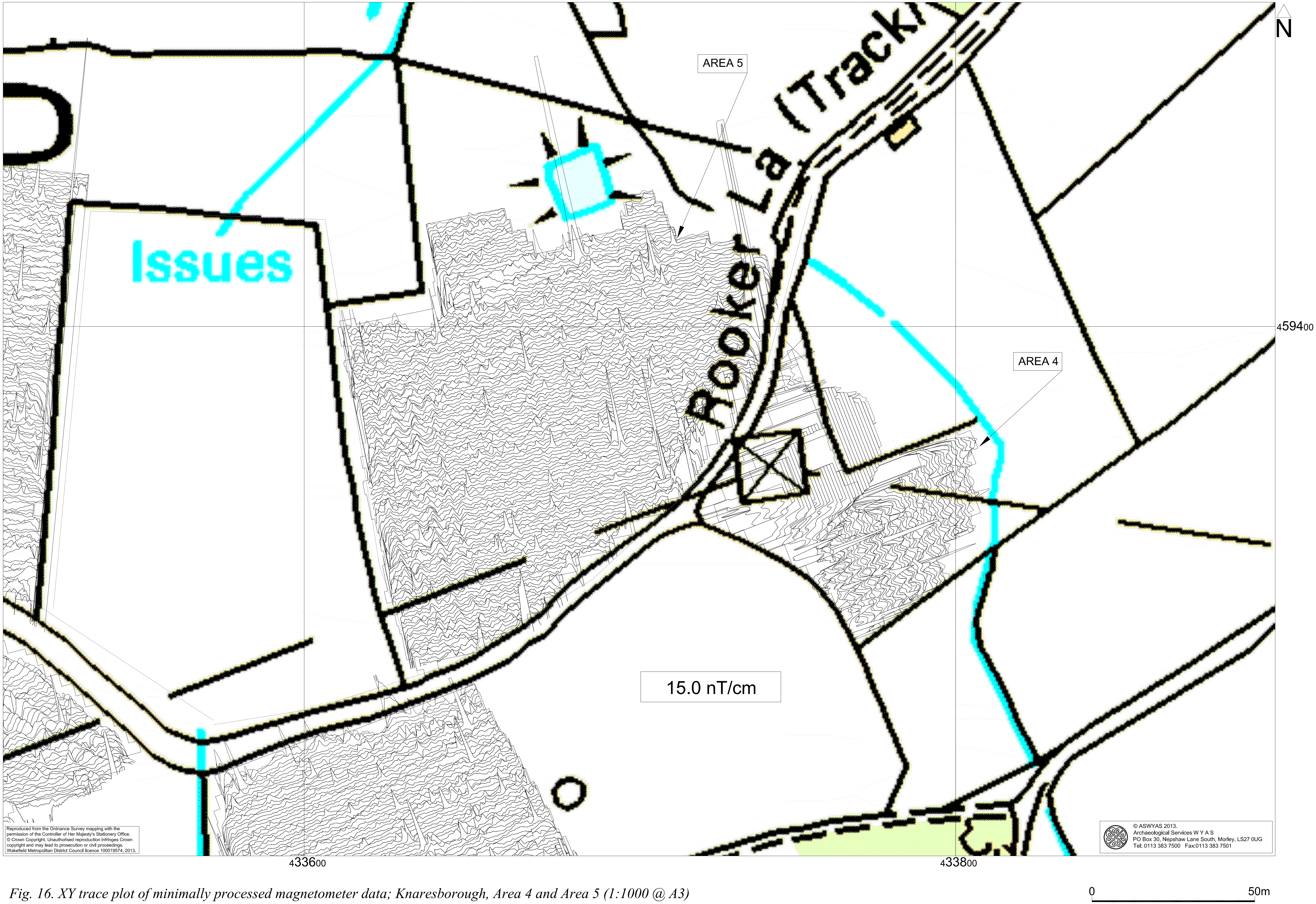

Fig. 16. XY trace plot of minimally processed magnetometer data; Knaresborough, Area 4 and Area 5 (1:1000 @ A3)

Fig. 17. Interpretation of magnetometer data; Knaresborough - Area 4 and Area 5 (1:1000 @ A3)

0 50m

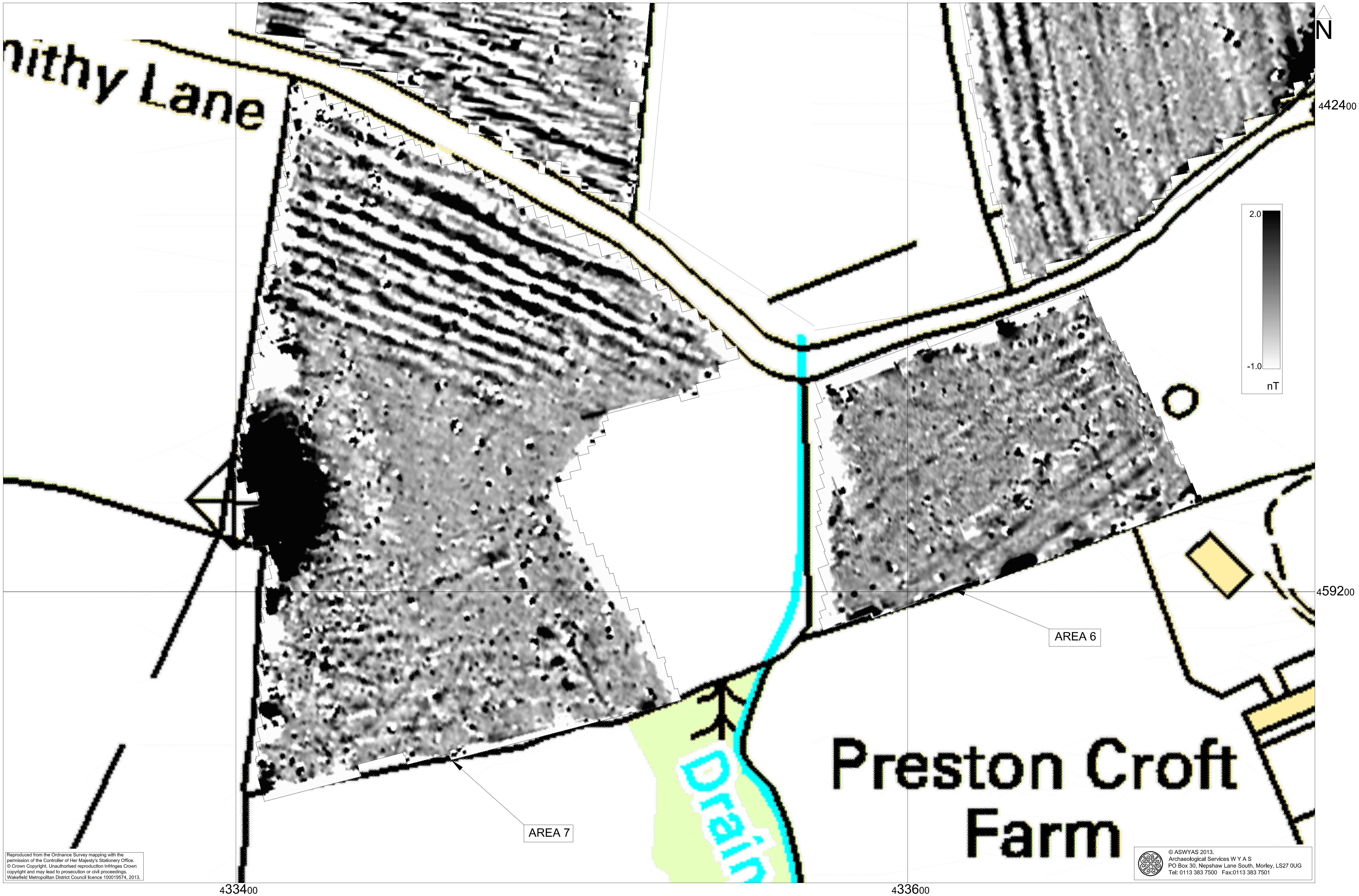

Fig. 18. Processed greyscale magnetometer data; Knaresborough: Area 6 and Area 7 (1:1000 @ A3)

0 100m

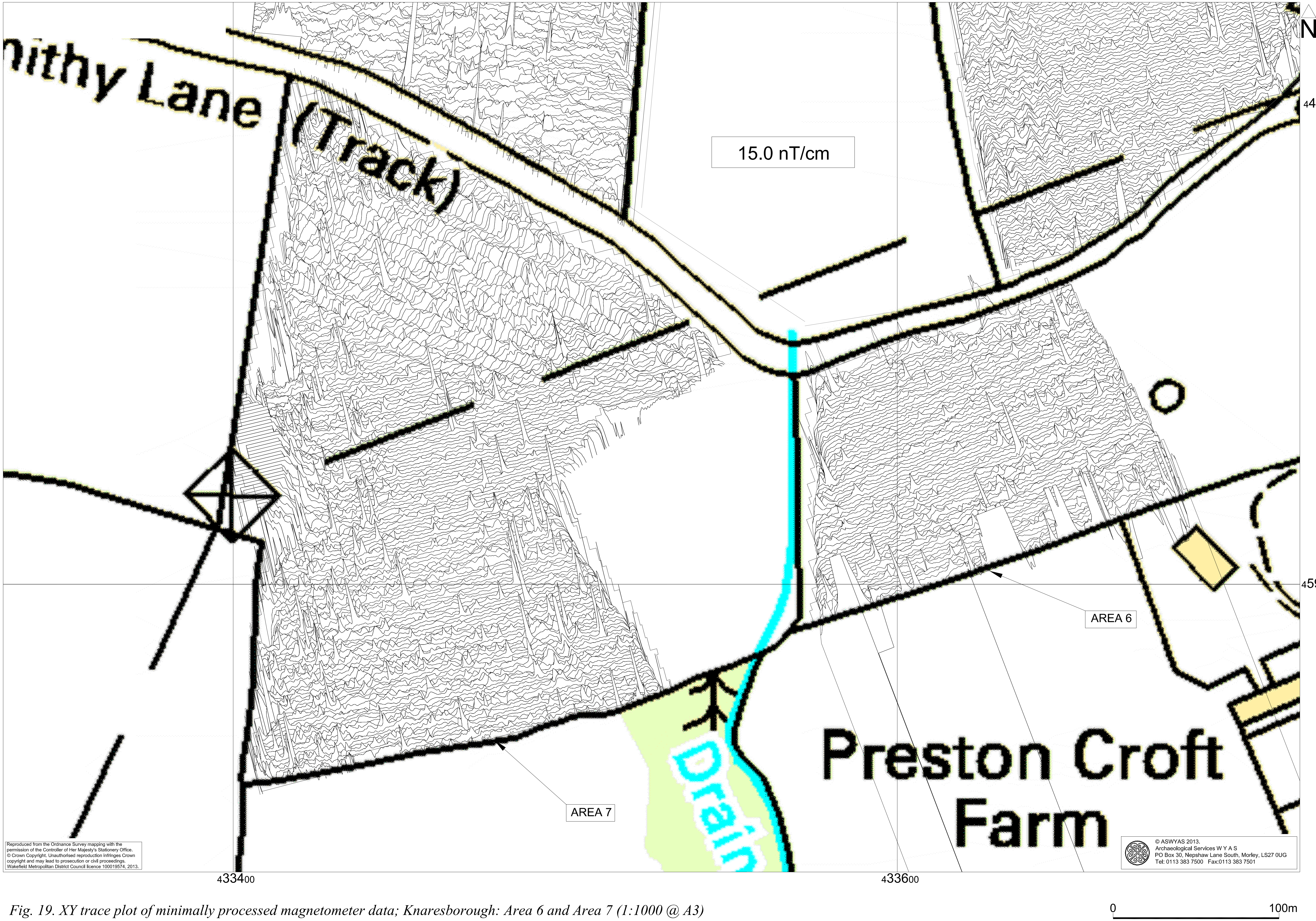

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Fig. 19. XY trace plot of minimally processed magnetometer data; Knaresborough: Area 6 and Area 7 (1:1000 @ A3)

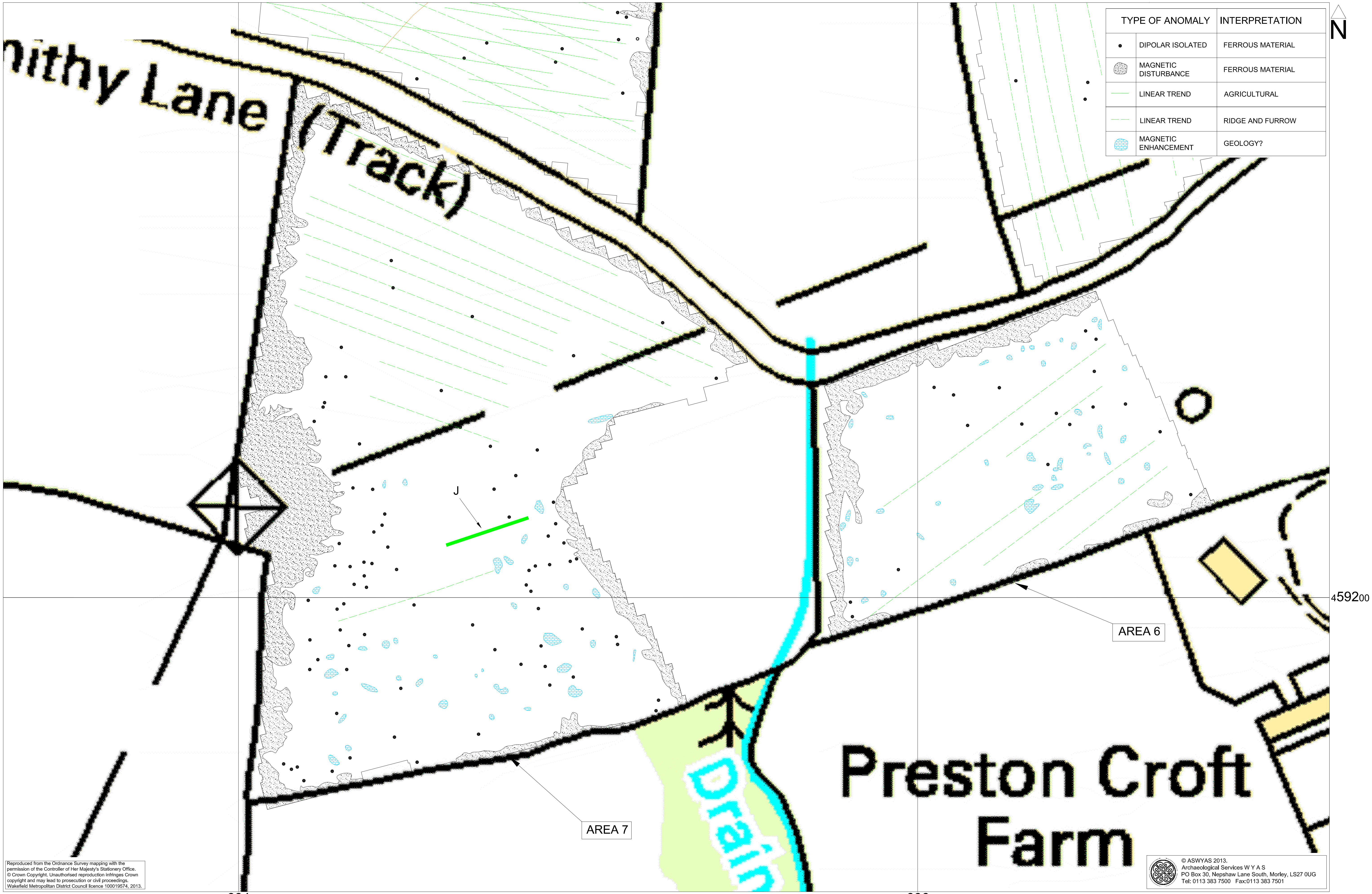

Fig. 20. Interpretation of magnetometer data; Knaresborough - Area 6 and Area 7 (1:1000 @ A3)

0 100m

Fig. 21. Processed greyscale magnetometer data; Knaresborough, Area 8 (1:1000 @ A4)

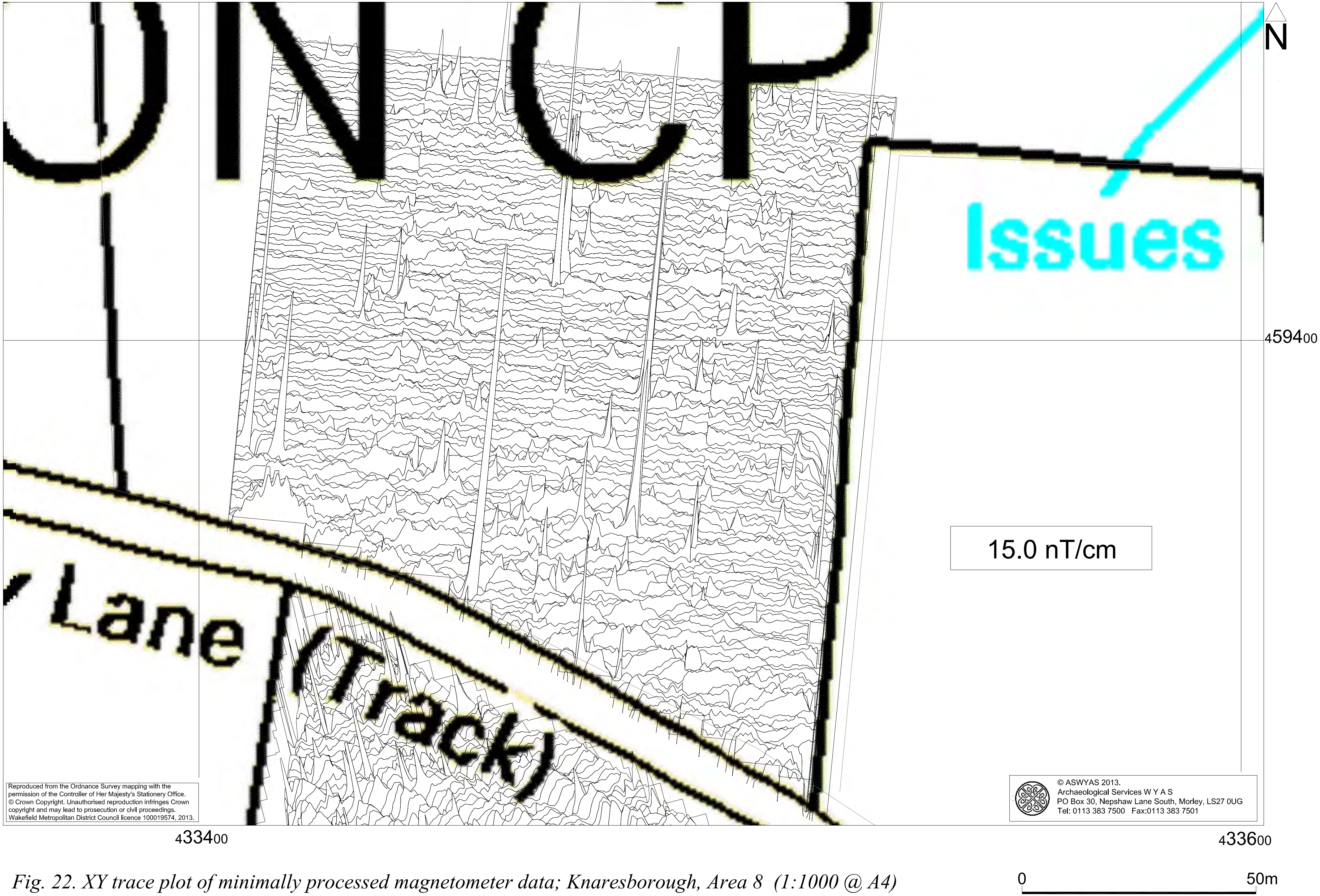

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Fig. 22. XY trace plot of minimally processed magnetometer data; Knaresborough, Area 8 (1:1000 @ A4)

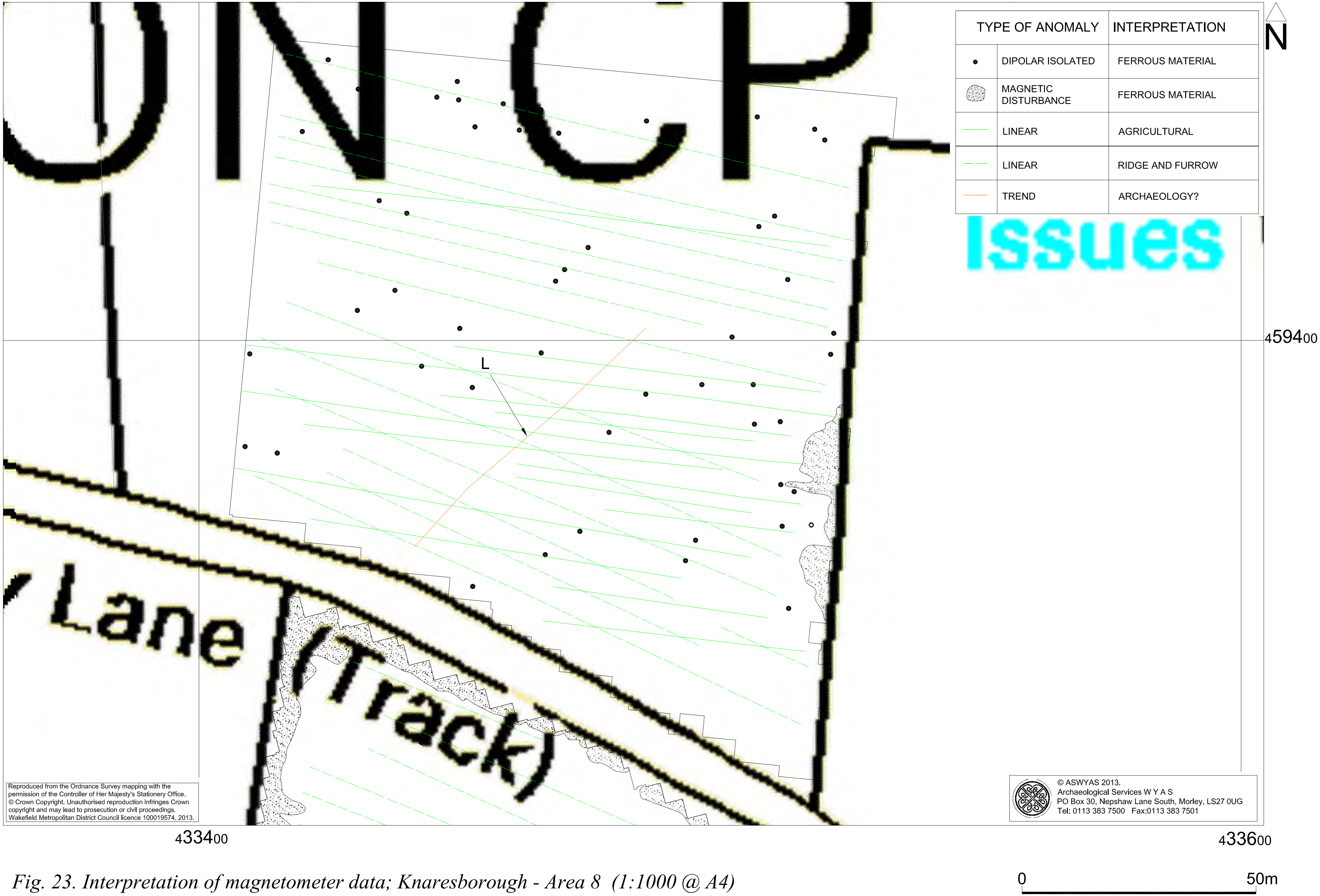

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Fig. 23. Interpretation of magnetometer data; Knaresborough - Area 8 (1:1000 @ A4)


Plate 1. General view of Area 1, looking north-west


Plate 2. General view of Area 2, looking south-west


Plate 3. General view of Area 3, looking south-west


Plate 4. General view of Area 4, looking south

Plate 5. General view of Area 5, looking west

Plate 6. General view of Area 6, facing north-west

Plate 7. General view of Area 7, looking south

Plate 8. General view of Area 8, looking east

Appendix 1: Written Scheme of Investigation

Knaresborough Overhead Line

Bramham Moor to Knaresborough

West and North Yorkshire

Geophysical Survey Project Design

Prepared by: Sam Harrison
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June 2013

Project Design for Geophysical Survey at Knaresborough Overhead Line, West and North Yorkshire

1. Introduction

1.1 This Project Design has been prepared by Archaeological Services WYAS (ASWYAS) for Simon McCudden of Parsons Brinkerhoff in advance of a geophysical (magnetometer) survey of the proposed connection route between the XC Monk Fryston-Poppleton Circuit and the PHG Ferrybridge-Knaresborough Circuit on Bramham Moor, West Yorkshire and North Yorkshire and Knaresborough, North Yorkshire.

1.2 The scheme of work will be undertaken in accordance with the requirements of the National Planning Policy Framework (2012).

1.3 This document details a proposed programme of non-intrusive geophysical (magnetometer) survey.

1.4 The Project Design was produced to the standards laid down in English Heritage's guideline publication *Geophysical Survey in Archaeological Field Evaluation* (2008) and the Institute for Archaeologists (IfA) *Standard and Guidance for Archaeological Geophysical Survey (IfA 2010).*

2. Site location and Description

2.1 The proposed geophysical survey area is divided in to two areas. The first contains three survey blocks, located to the south-east of Bramham, West Yorkshire and west of Tadcaster, North Yorkshire. The second area is located to the north-west of Knaresborough and comprises five proposed tower locations. A total of 8.5 hectares is proposed (see Fig. 1).

3. Geology and Soils

3.1 The underlying bedrock comprises of Cadeby and Brotherton formations within the Bramham survey area and Huddersfield White Rock and Millstone Grit Group overlain by till superficial deposits in the Knaresborough survey area (BGS 2013). The soils in the Bramham area are classified in the Aberford association, characterised as shallow, locally brashy, well drained calcareous fine loams. The soils in the Knaresborough area are classified in the Dunkeswick association and comprise of slowly permeable seasonally waterlogged fine loams (Soil Survey of England and Wales 1983).

4. Archaeological Background

4.1 An Environmental Statement produced on behalf of National Grid in 2006 identified that the landscape around Bramham Moor Sub-station has a high archaeological potential. This potential was primarily based on analysis of air photographs which reveal extensive cropmarks in the Bramham Moor area. These cropmarks are interpreted as features of probable late Iron Age or Roman date indicative of the buried remains of field systems, enclosures and settlements. A Roman road is also thought to cross this landscape.

4.2 A geophysical survey recently carried out by ASWYAS (Webb 2012), across the Bramham Moor landscape, confirmed and enhanced the cropmark evidence locating many of the cropmark features as well as other sub-surface features not previously identified as cropmarks. The survey identified numerous anomalies which are caused by sub-surface archaeological features and which have been previously identified as cropmarks. In addition many other anomalies of obvious archaeological potential, not previously identified as cropmarks, have also been identified confirming the high archaeological potential of this area.

4.3 The area at Knaresborough was identified in the Environmental Statement as being part of an extensive network of ridge and furrow field systems from the medieval and post-medieval periods.

5. Aims and Objectives

5.1 The aims and objectives of the programme of geophysical survey is to gather sufficient information to establish the presence/absence, character, extent, of any archaeological remains within the specific areas to be impacted by the proposed connection route, and to inform further strategies should they be necessary.

The aims of the survey are to:

- 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;
- to produce a comprehensive site archive and report.

6. Fieldwork Methodology

6.1 A geophysical (magnetometer) survey will be carried out across the proposed development area. The total area for survey will be approximately 8.5 hectares.

6.2 The Bramham area will expand on a previous survey undertaken for the same scheme in 2012. The Knaresborough area will be subject to a 1 hectare block over each of the five proposed towers.

6.3 The geophysical survey site grid will be established using a Trimble 5800 VRS dGPS system or 5600 Total Station. The site grid will be tied into the Ordnance Survey National Grid and semi-permanent survey markers will be left on site, so that the grid can be accurately re-located during any later stages of archaeological investigation.

6.4 The survey will be undertaken using Bartington Grad601 instruments to take readings at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m grid squares, allowing 3600 readings to be recorded in each grid square. These readings will be stored in the memory of the instrument and later downloaded for processing and interpretation. Geoplot 3 (Geoscan Research) software will be used to process and present the data.

6.5 The geophysical survey will comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Institute for Archaeologists (IfA 2010). All figures will be reproduced from Ordnance Survey mapping with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

6.6 On completion of the geophysical survey, a report will be produced containing all relevant information including:

i) Site code/project number; dates for fieldwork visits; grid references; location plan, and a plan showing the limits of the detailed study area.

ii) A non-technical summary of the reason, aims and main results of the assessment.

iii) An introduction to outline the circumstances leading to the commission of the report and any restrictions encountered.

iv) The aims and objectives of the study

v) The methodology used.

vi) A summary and synthesis of the archaeological results in relation to the methods used. This shall be supported by a survey location plan (minimum scale 1:2500), a plot of raw data (preferred minimum scale 1:1000, grey-scale format, and/or X-Y trace format as appropriate to the technique(s) used), a plot of enhanced data and one, or more, interpretative plots. Each plan/plot will have a bar scale and accurately oriented north sign.

vii) An assessment of the importance of sites and features within the study area against a background of national, regional or local importance.

viii) Recommendations regarding the future treatment of the remains and/or any further archaeological work necessary on site in advance of, or during, development.

ix) References to all primary and secondary sources consulted.

6.7 A project archive will be prepared in accordance with recent good practice guidelines and submitted to the client in acceptable formats. The geophysical archive will comprise:

- an archive CD containing compressed (WinZip 8) files of the raw data, report text (Word 2000), and graphics files (Adobe Illustrator and AutoCAD 2007) files;
- a full copy of the report.

6.8 Following completion and submission of the report to the client, and deposition of the archive, copies of the report will by sent to the relevant Historic Environment Record, local authority Planning Officer and/or Conservation Officer. In addition, ASWYAS will make their work accessible to the wider research community by submitting digital data and copies of the report on line to OASIS.

7 Copyright, Confidentiality and Publicity

7.1 The copyright of any written, graphic or photographic record and reports produced as part of this project shall belong to the client, unless otherwise agreed, with ASWYAS being acknowledged as the originating body.

7.2 The circumstances under which the report or records can be used by other parties will be identified at the commencement of the project, as will the proposals for the distribution of the report. ASWYAS will respect any requirements regarding confidentiality, but will endeavour to emphasise the company's professional obligation to make the results of archaeological work known to the wider archaeological community within a reasonable time.

8. Health and Safety

8.1 All work will conform to the ASWYAS Health and Safety Policy (a copy of which can be supplied if requested), which makes particular reference to the FAME (Federation of Archaeological Managers and Employers) Health and Safety Manual and will be carried out according to the relevant Health and Safety Legislation. This includes, in particular, the following regulations:

- Health and Safety at Work 1974
- Construction (Design and Management) Regulations 2007
- The Management of Health and Safety at Work Regulations 1999
- Personal Protective Equipment at Work Regulations 1992
- Provision and Use of Work Equipment Regulations 1998
- Manual Handling Operations Regulations 1992
- Workplace (Health, Safety and Welfare) Regulations 1992

8.2 In addition each project undergoes a 'Risk Assessment' which sets project specific Health and Safety requirements to which all members of staff are made aware of prior to on–site work commencing.

8.3 Health and Safety will take priority over archaeological matters. Necessary precautions will be taken with regard to protecting ASWYAS staff and the public.

9. Insurance

9.1 ASWYAS is covered by the insurance and indemnities of the City of Wakefield Metropolitan District Council. Insurance has been effected with: Zurich Municipal, PO Box 568, 1st Floor, 1 East Parade, Leeds, LS1 2UA (policy number QLA-03R896 0013). Any further enquiries should be directed to: City of Wakefield Metropolitan District Council, Corporate Services, Financial Services (Insurance, Room 403), County Hall, Bond Street, Wakefield WF1 2QW.

10. Quality

10.1 ASWYAS is an accredited ISO 9001:2008 organisation and a Registered Archaeological Organisation with the Institute for Archaeologists, operating to nationally agreed guidelines, processes and procedures. These are set within a framework that endeavours to carry out the required work and submit the final report in a manner that meets with our client's specific needs, providing quality assurance throughout the project and for the end product. These guidelines, processes and procedures are contained within a Quality Manual and all staff work in accordance with this manual.

11. Monitoring

11.1 A standard working day will involve driving to site, condition surveys of the survey area, survey area setting out and detailed earth resistance and/or magnetic survey recording. Constant updating of the survey work will be relayed back to the office by telephone.

Contacts

Senior Managing Archaeologist: Alistair Webb	0113 393 9753
Project Manager: Sam Harrison	0113 393 9745
Health and Safety Coordinator: Alistair Webb	0113 393 9753
Survey team:	07796 996444

12. Staffing

Archaeological Services WYAS currently employs seven dedicated geophysicists together with a further two staff with extensive field experience. Summary Curriculum Vitae for all the staff to be employed on the proposed project are detailed below together with their proposed role in the scheme.

Senior Project Management:	Alistair Webb BA MIfA
Senior Geophysicist / Project Manager:	Sam Harrison BSc MSc AIfA
Archaeological Geophysicist	David Harrison BA MSc MIfA

Archaeological Geophysicist	Chris Sykes BA MSc
Archaeological Geophysicist	James Lawton BSc MSc PIfA
Assistant Geophysicist	Thomas Fildes BA
Assistant Geophysicist	Kieron Kinninmont BSc PGDip

Name:- Alistair Webb BA MIfA

Current Position:- Senior Managing Archaeologist

Proposed Role:- Senior Archaeological Geophysicist

Alistair is the Senior Manager responsible for overall management of the geophysical survey teams, as well as other developer funded archaeological field projects. He has more than twenty years archaeological experience being involved in geophysical surveys almost exclusively for fifteen years. During this time he has written well in excess of three hundred geophysical survey reports for clients including English Heritage and Historic Scotland, as well as for commercial companies such as Barratts, Bryant Homes, Ben Bailey and RJB Mining and for archaeological consultants and contractors including Albion Archaeology, AC Archaeology, Headland Archaeology, Ed Dennison Archaeological Services and Northern Archaeological Associates.

Alistair gained his BA in Environmental Studies in 1984 and in 1995 successfully completed modules on Magnetic and Electromagnetic Methods of Survey, part of the MSc in Archaeological Prospection run by Bradford University. Alistair is a member of the Institute for Archaeologists at Member level (MIfA)

Name:- Sam Harrison BSc MSc AIfA

Current Position:- Senior Archaeological Geophysicist

Proposed Role:- Project Manager

Sam graduated in 2002 from Bradford University with an Honours degree in Archaeological Sciences having a particular interest in Archaeological Geophysics. He subsequently refined this interest gaining an MSc in Archaeological Prospection, also at Bradford, in 2005.

Prior to joining Archaeological Services on a full time basis in April 2004 Sam worked for Stratascan Ltd. He has substantial experience in shallow sub-surface archaeological prospection techniques including magnetometry, earth resistance, ground penetrating radar and electro-magnetic methods. Sam is also experienced in software programs including Geoplot 3, AutoCad Map, Illustrator, MapInfo and ArcGIS.

Since joining ASWYAS Sam has managed over a 100 geophysical projects from small scale Heritage Lottery funded schemes to large-scale infrastructure projects.

Sam is a member of the Institute for Archaeologists at Associate level (AIfA) Sam is also CSCS certified and Emergency First Aid at Work trained.

Name:- David Harrison BA MSc MIfA

Current Position:- Project Officer (Geophysics)

Proposed Role:- Senior Geophysical Supervisor

David has recently joined ASWYAS in August 2010 as a Geophysicist following five years experience undertaking and managing (since May 2006) the geophysical survey team at Margaret Gowen and Co Ltd, a large multidisciplinary commercial archaeological consultancy based in Dublin. Whilst at Margaret Gowen David undertook over 100 surveys across Ireland ranging from small independent developments to pipelines, regional and national infrastructure projects. In his former post he had responsibility for tendering, data collection and processing, client liaison and final report preparation. In addition David has more than three years commercial archaeological excavation experience half of which was at a Supervisory level.

David has a BA (Hons) in Archaeology awarded in by 1999 by King Alfred's College, Winchester and an MSc in Archaeology awarded by the University of Liverpool in 2002. David is also CSCS certified and Emergency First Aid at Work trained. He has recently attained MIfA status within the Institute for Archaeologists.

Name:- Chris Sykes BA MSc

Current Position:- Archaeologist (Geophysics)

Proposed Role:- Geophysical Surveyor/Supervisor

Having graduated from the University of Sheffield with his degree in Archaeology in 2008, Christopher has been engaged in a number of community involvement projects in and around South Yorkshire as an excavation supervisor. It was an interest in geophysical survey which prompted him to undertake the Masters programme in Archaeological Prospection at Bradford University in September 2009.

Since completing his Masters studies, Christopher immediately began working as a geophysicist in Ireland with Headland Archaeology on the major N20 project. Building on this experience he undertook geophysics in Crete, before becoming the geophysicist for Wessex Archaeology at their Sheffield office. Here he supervised staff in the undertaking of geophysical projects and also assisted in excavations, before joining WYAS in 2011.

Starting in 2005, Christopher has been involved in a number of community focused archaeological pursuits which has included working with children and adults with special requirements. Chris is CSCS certified.

Name:- James Lawton BSc MSc PIfA

Current Position:- Archaeologist (Geophysics)

Proposed Role:- Geophysical Surveyor/Supervisor

James graduated from the University of Bradford in 2007 where he had studied for 5 years which included a 4 year BSc Undergraduate course in Geoarchaeology followed by a 1 year MSc in Archaeological Prospection.

As part his undergraduate, James completed a 1 year diploma in archaeology where he undertook geophysical surveying with GSB Prospection Ltd. During the course of this placement James gained experience surveying throughout the British Isles and Ireland as well as the Isle of Man.

After graduating James took a job with AECOM Ltd as a graduate archaeologist working as a consultant, where he spent four and half years gaining experience and knowledge within archaeology sector, working on large scale developments. This involved consultations between the client and developer and writing detailed reports as part of the planning requirements. These involved Desk-based Assessments and Environmental Impact Assessments.

As part of his work James continued to be involved with geophysics writing tenders for geophysical subcontractors planning specifications and undertaking voluntary geophysical surveys in his spare time as part of his own archaeological research. James joined ASWYAS in late September 2012. James is CSCS certified and Emergency First Aid at Work trained.

Name:- Thomas Fildes BA

Current Position:- Assistant Archaeologist (Geophysics)

Proposed Role:- Geophysical Surveyor

Tom graduated with a BA degree in Archaeology from the University of Liverpool in 2012, having worked with the university on sites such as Iron Age hillforts & Medieval settlements, as well as HER and planning work with the Staffordshire County Council Countryside & Planning department. Since then he has been working principally in field excavation work, and with various institutes including Liverpool Museum Field Archaeology on a Mesolithic settlement, and on a variety of sites ranging from Roman to Victorian with Birmingham-based Benchmark Archaeology. In this short space of time since graduation he has experienced working in a variety of environments including HER & archival research, Watching Briefs, Evaluations, & report-writing, and is now expanding on this experience in a different direction by working with the ASWYAS Geophysics team, having joined the company in early 2013.

Name:- Kieron Kinninmont BSc PGDip

Current Position:- Assistant Archaeologist (Geophysics)

Proposed Role:- Geophysical Surveyor

Kieron graduated from Sheffield University in 2005 with an Honours degree in Archaeological Sciences. Subsequently, Kieron worked in the heritage sector developing skills in small finds identification with the Portable Antiquities Scheme and in several post-excavation roles. Kieron volunteered extensively with North Lincolnshire Museum Service where he contributed to a range of documentation and outreach projects; working with local school children, volunteer groups and individuals interacting with museum and PAS services.

During a placement with the North Lincolnshire Sites and Monuments Record, Kieron worked on the SHINE programme to promote the stewardship of archaeological sites in the countryside, and as a result of related fieldwalking and metal detector surveys developed an interest in archaeological geophysics.

Kieron recently attended Bradford University where he completed a post-graduate diploma in Archaeological Prospection. Kieron is familiar with a number of shallow geophysical techniques, instruments, data processing and presentation techniques.

12.2 Archaeological Services WYAS project personnel may be subject to change.

13. References

BGS, 2013. http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html (Viewed 13th AJune 2013)

David, A., N. Linford, P. Linford and L. Martin, 2008. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines (2nd edition)* English Heritage

IfA, 2010. *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Soil Survey of England and Wales, 1983, Soils of Northern England, Sheet 4.

Appendix 2: 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 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 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. An advantage of magnetic susceptibility over magnetometry is that a certain amount of occupational activity will cause the same proportional change in susceptibility, however weakly magnetic is the soil, and so does not depend on the magnetic contrast between the topsoil and deeper layers. Susceptibility survey is therefore able to detect areas of occupation even in the absence of cut features. On the other hand susceptibility survey is more vulnerable to the masking effects of layers of colluvium and alluvium as the technique, using the Bartington system, can generally only measure variation in the first 0.15m of ploughsoil.

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.

Methodology: Magnetic Susceptibility Survey

There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the sample. For field surveys a Bartington MS2 meter with MS2D field loop is used due to its speed and simplicity. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

Methodology: Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that a 'negative' scanning result should be validated by sample detailed magnetic survey (see below).

The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.25m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

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 1m 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.

Data Processing and Presentation

The detailed gradiometer data has been presented in this report in XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. The data in the greyscale images has 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.

An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from 'iron spikes'. Geoplot 3 software was used to create the XY trace plots.

Geoplot 3 software was used to interpolate the data so that 3600 readings were obtained for each 30m by 30m grid. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 3: 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 then 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 4: 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 relevant Historic Environment Record).

Bibliography

British Geological Survey. http://maps.bgs.ac.uk/geologyviewer/ (Viewed June 25th 2013)

David, A., N. Linford, P. Linford and L. Martin, 2008. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines (2nd edition)* English Heritage

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Webb, A. 2012 *Knaresborough Overhead Line, Bramham Moor, North and West Yorkshire.* Unpubl. Client Report ASWYAS No. 2435