Geophysical Survey Report

Old Wood Energy Park, Nottinghamshire

For

Pegasus Planning Group Ltd

On Behalf Of

Exagen Development Limited

Magnitude Surveys Ref: MSSK1600

May 2024

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Abstract

Magnitude Surveys was commissioned to assess the subsurface potential of two land parcels, covering a c. 105.8ha area of land west of Wysall, Nottinghamshire. A magnetic gradiometer survey was successfully undertaken across the survey area. The survey has identified three areas of focused archaeological activity, comprising a large probable Romano-British complex with internal features and further associated enclosures outside of the main complex. A second area of possible archaeological activity has been identified in the northern half of the survey area, comprising linear and rectilinear features and several strong dipolar features that might represent industrial activity. Further probable and possible archaeological activity was identified within the south of the survey area. Anomalies relating to the prolonged agricultural use of the landscape have also been identified across the survey area and indicate multiple ridge and furrow regimes, former mapped and unmapped field boundaries, drains and modern ploughing. Several anomalies of undetermined origin have been identified across the survey area. These anomalies lack sufficient context for a confident interpretation, and likely represent anomalies relating to the natural, agricultural or modern use of the survey area. However, an archaeological origin should not be ruled out for these anomalies. Magnetic interference from modern sources such as service lines, electric pylons and extant fencing is limited, but locally significant.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Pegasus Planning Group Ltd on behalf of Exagen Development Limited to undertake a geophysical survey over a c. 105.8ha area of land, which included two land parcels, west of Wysall, Nottinghamshire (SK 59675 27627).

1.2. The geophysical survey comprised quad-towed, cart-mounted GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al*., 2008).

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al*., 2008), the Chartered Institute for Archaeologists (CIfA, 2020) and the European Archaeological Council (Schmidt *et al.,* 2015).

1.4. It was conducted in line with a WSI produced by Magnitude Surveys (Chandrasekaran, 2023).

1.5. The survey commenced on 14th August 2023 and took 5 days to complete the first phase of works in the northern parcel of the survey area. A second deployment surveyed c. 16.8ha of available land within the southern parcel over 3 days between the 14th to the 16th of September 2023. A third deployment took place over 2 days between the 30th of November and the 1st of December 2023, which is when the majority of Area 16 and a portion of Area 17 were surveyed. The areas that could not be surveyed due to ground conditions were collected between the 8th and 10th of May 2024.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).

2.2. The directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and has served as the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London and a Member of CIfA, has been a member of the ISAP Management Committee since 2015, and is currently the Chair of the Archaeological Prospection Community of the European Archaeological Association.

2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area is located c. 1km west of Wysall and was divided into two distinct parcels (Figure 1). The c. 72ha northern parcel was located c. 1.3km to the northwest of Wysall, Nottinghamshire. It lies directly south of Old Wood and is to the west of Bradmore Road (Figure 2). The c. 33.8 southern parcel lies c. 1km west-southwest of Wysall and between Kingstone Brook to the south and Rough Plantation to the north (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The survey area consisted of a flat arable field.	The survey area was surrounded on all sides by hedgerows, except the southern boundary which was formed by a large ditch in the west and a mound of agricultural waste in the east.
2	The survey area consisted of an arable field sloping down from the east to the centre, the remaining being flat.	The survey area was bordered on all sides by hedgerows containing metal wire fencing. Overhead cables crossed the survey area west to east.
3	The survey area consisted of a flat arable field rising slightly along the centre southern edge.	The survey area was bordered on all sides by hedgerows.
4	The survey area consisted of a flat arable field.	The survey area was bordered on all sides by hedgerows. The southern part of the survey area was heavily overgrown and deeply rutted and could not be surveyed.
5	The survey area consisted of an arable field sloping gently down from the east.	The survey area was bordered on all sides by hedgerows. Overhead cables crossed the northern part of the survey area.
6	The survey area consisted of an arable field sloping gently down from the east.	The survey was bordered on all sides by hedgerows. Overhead cables crossed the northern part of the survey area.
7	The survey area consisted of an arable field sloping down from the east to the centre the rest being flat.	The survey area was bordered on all sides by hedgerows.
8	The survey area consisted of an arable field sloping gently east to west.	The survey area was bordered on all sides by hedgerows.
9	The survey area consisted of flat pasture.	The survey was bordered by hedgerows to the east and west. Wooden fencing was present along the northern boundary and the southern boundary consisted of an access road.
10	The survey area consisted of a stubble field that sloped down gently to the southeast.	The survey area was bordered by hedgerows to the east, west and south with no physical boundary to the north.
11	The survey area consisted of a stubble field.	The survey was bordered by trees to the south and hedgerows on all other sides.

12	The survey area consisted of a pasture field that sloped down gently to the southeast.	The survey was bordered by hedgerows to the east and trees on all other sides.
13	The survey area consisted of a fallow field that sloped down gently to the southeast.	The survey area was bordered by a wooden fence to the east, wire fencing to the west and wire fencing and hedgerow to the north. A stream comprised the southern boundary. An overhead pylon ran across the centre of the field in a west-east orientation.
14	The survey area consisted of a fallow field that sloped down gently to the southeast.	The survey area was bordered by a wooden fence to the east, wire fencing to the west and wire fencing and hedgerow to the south. A stream comprised the northern boundary.
15	The survey area consisted of a flat, stubble field.	The survey area was bordered by hedges and trees to the north, east, west and southwest with no physical boundary to the southeast.
16	The survey area consisted of a stubble field that down gently from north to south.	The area was bordered by hedges on all sides. A small area in the southwestern corner could not be surveyed due to heavily rutted ground.
17	The survey area consisted of a flat, stubble field.	The field was bordered by hedges on all sides. There was an area of deeply rutted ground near the western border.

4.3. The underlying geology across the majority of the survey area comprises Jurassic and Triassic interbedded mudstones and limestones of the Barnstone Member. The eastern areas of the northern parcel were underlain by Jurassic mudstones of the Barnby Member. Superficial deposits are limited to the area around Field View Farm and consist of glaciofluvial deposits, mid Pleistocene – sand and gravel, and an outer ring of head clay, silt, sand and gravel. In the southernmost section of the southern parcel, superficial deposits comprise alluvium, clay, silt sand and gravel (British Geological Survey, 2024).

4.4. The soils consist of slowly permeable seasonally wet and slightly acid but base-rich loamy and clayey soils across the majority of the site. Areas 8 and 9 and the east of Areas 1 and 7 consisted of slightly acid, loamy and clayey soils with impeded drainage (Soilscapes, 2024).

5. Archaeological Background

5.1. The following is a summary of a Pre-Application Heritage Statement produced and provided by Pegasus Group on behalf of Exagen Developments Limited (Ward, 2024).

5.2. No previous archaeological works have been recorded within the survey area. In the wider surroundings, investigations have been limited to visual assessments, metal detecting and limited excavations.

5.3. There is no recorded prehistoric activity within the survey area and evidence of any activity within the wider area is limited to the discovery of a Bronze Age spear tip c. 110m east of the southern area (L5511).

5.4. No Romano-British finds or features are recorded within the survey area. Within the wider environment, a well of Roman date (M13) was discovered and excavated c. 910m northwest of

the northern area yielding environmental evidence and pottery dating to c. 3rd century A.D. Discrete finds of Roman material, including coins, a brooch and a bronze spoon have been recorded c. 700m southeast of the southern area (L5876, L5882).

5.5. The area and its hinterland remained largely agricultural during the Early Medieval and Late Medieval periods. The Holy Trinity Church in Wysall is Medieval in date and lies c. 500m east of the southern area. Linear banks and ditches defining enclosures as well as ridge and furrow earthworks have been identified in the wider area through aerial photography.

5.6. The survey area and the wider environment remained agricultural during the Post-Medieval and Modern periods and is depicted on historical maps (OS 1884) with tree-lined field boundaries. A small woodland known as Stone Pit Plantation may indicate quarrying activities in the vicinity.

5.7. With the exception of the addition of small outbuildings at Lodge Farm in the northern area, and woodland planting in the southern area, no significant changes are depicted during the 20th and early 21st centuries.

6. Methodology

6.1.Data Collection

6.1.1. Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey.

6.1.2. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.3. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.4. The magnetic data were collected using MS' bespoke quad-towed GNSS-positioned cart system.

6.1.4.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.4.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing, and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.4.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2.Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.2 in David *et al.,* 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al*. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3.Data Visualisation and Interpretation

6.3.1.This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plots (Figures 9, 12, 15, 18, 21, 24 and 27). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.

6.3.2.Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2024) was also consulted, to compare the results with recent land use.

6.3.3.Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical survey was successfully conducted over the c. 72ha northern parcel of the survey area and over c. 33.8ha of the southern parcel. The results are presented in combination with satellite imagery and historical maps (Figures 3-10). Modern disturbance within the survey area was limited to buried services, overhead pylons, and fencing on the edges of fields.

7.2.2. Three archaeological *foci* have been identified across the survey area. The first, and most significant, is a large, probably Romano-British complex situated close to the extant Field View Farm (Figures 5-6). This complex covers an area of around c. 175m by c. 190m, and has clear internal features and identifiable subdivisions. While, on the basis of their morphology and the dates of known findspots in the vicinity, a Romano-British date is perhaps most likely for these features, late-Iron Age or Early Medieval activity is also possible. Further archaeological anomalies and enclosures are located in close proximity to this larger complex. The second of these *foci* is located in the northern half of the northern parcel, where several linear and rectilinear features have been identified (Figures 3-4). In close proximity to these areas are numerous discrete, strongly dipolar anomalies that may represent industrial activity. The third focus of activity comprises a group of probable, partial enclosures located within the southern parcel (Figures 9-10). To their immediate north, a series of linear anomalies may correspond to further possible archaeological activity; however, the strongly enhanced natural variations in the background make it difficult to identify them with more confidence.

7.2.3. Anomalies relating to the historical agricultural use of the area have been identified. Regimes of ridge and furrow cultivation have been identified, often respecting mapped and unmapped field boundaries, some of which are visible on historical OS mapping. Several drainage regimes and modern ploughing trends have also been identified within the survey area.

7.2.4. Multiple anomalies have been identified and classified as 'Undetermined'. These anomalies lack sufficient contextual evidence to confidently classify them, and although they are likely to have modern, agricultural, or natural origins, an archaeological origin cannot be ruled out.

7.3.Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Data Artefact** – Data artefacts usually occur in conjunction with anomalies with strong magnetic signals due to the way in which the sensors respond to very strong point sources. They are usually visible as minor 'streaking' following the line of data collection. While these artefacts can be reduced in post-processing through data filtering, this would risk removing 'real' anomalies. These artefacts are therefore indicated as necessary in order to preserve the data as 'minimally processed'.

7.3.1.3. **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.

7.3.1.4. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.

7.3.1.5. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.

7.3.1.6. **Undetermined** – Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally distinct from those caused by ferrous sources.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Archaeology Probable (Strong and Weak) (possible Romano-British Settlement Complex) –** In the eastern section of Area 7, near Field View Farm, a complex of linear and rectilinear anomalies has been identified **[7a]** (Figures 26-28). These anomalies exhibit a strong magnetic signal within an area of c. 175m by c. 190m, which is situated between linear features running north to south. These anomalies form rectilinear enclosures that vary in size and shape, and within these enclosures, multiple, ephemeral, linear and curvilinear anomalies have been identified which may form a series of internal subdivisions. The generally linear nature of anomalies that comprise the complex suggest a Romano-British date, but these are not morphologically distinct enough that, combined with the scarcity of archaeological finds in the nearby area, a late-Iron Age or early-Medieval date cannot be ruled out. Several anomalies align southeast to northwest **[7b]**, which

present a similar morphology to the possible archaeological anomalies in Area 8 (Figures 29-31) and could be suggestive of multiple phases of activity in this area.

7.3.2.2. **Archaeology Probable (Strong and Weak) –** To the east of the possible Romano-British settlement in Area 7, several rectilinear anomalies were identified **[8a]** in Area 8 (Figures 29-31). These align with the probable archaeology in Area 7, and are morphologically suggestive of a continuation of the settlement, or enclosures and field systems outside the primary settlement. Due to the presence of other agricultural linear anomalies within the area, the anomaly is best viewed in Total Field data (Figure 5).

7.3.2.3. **Archaeology Probable (Weak)** – In the southern parcel of the survey area, within Area 11, several weakly positive curvilinear anomalies were identified **[11a],** continuing into the south of Area 16 **[16a]** (Figures 35-37). These anomalies appear to form a group of partial enclosures with rounded corners, representing further archaeological activity across the survey area.

7.3.2.4. **Archaeology Possible (Strong and Weak)** – Within Area 2, several linear and rectilinear features have been identified (Figures 11-19). A large, positive rectilinear enclosure **[2a]** is located in the centre of the area, in close proximity to several large, strong dipolar anomalies. Several linear anomalies **[2b]** extend outwards from this rectilinear enclosure to both the north and the south. These anomalies don't correlate with any known mapped field boundaries on historical mapping and represent a possible archaeological enclosure and related linear features.

7.3.2.5. **Archaeology Possible (Strong) –** In the north of the survey area, within Area 2, several strong discrete anomalies were detected **[2c] [2d]** (Figures 11-19). These may be indicative of industrial activity, possibly related to the possible settlement in Area 7. All of these anomalies are located in close proximity to a large rectilinear enclosure **[2a]**, and no anomalies with similar characteristics appear in other parts of the survey area. These dipolar anomalies may relate to more modern industrial activity, but their proximity to other archaeological anomalies should be considered.

7.3.2.6. **Archaeology Possible (Weak)** – Linear and sinuous anomalies were identified in the southeast of the survey area in Area 8 (Figure s 29-31). These anomalies **[8c]** exhibit a largely weak magnetic enhancement in comparison to other identified archaeological anomalies however they do not follow the orientations of agricultural trends. Thus, these linear anomalies, as well as adjacent outlying anomalies **[8a]** may identify fragmentary remains of archaeological anomalies related to the settlement anomaly to the west.

7.3.2.7. **Archaeology Possible (Strong & Weak)** – Located to the immediate north of anomalies **[16a]**, a series of linear anomalies were identified that could represent further archaeological activity such as further partial enclosures and possible boundaries (Figures 32-34). The strongly enhanced geological background present

in this area however complicated the identification and interpretation of these anomalies.

7.3.2.8. **Ridge and Furrow -** Parallel, strong and weak positive linear and curvilinear anomalies have been identified and interpreted as being a result of ridge and furrow cultivation throughout much of the survey area **[1a] [2e] [3b] [9b]** (Figures 11-31). The anomalies are aligned to various orientations, possibly indicating different historical land divisions. These anomalies respect some of the archaeological anomalies, suggesting that some of these agricultural practices may have been contemporaneous with the archaeological anomalies, or that they post-date them.

7.3.2.9. **Agricultural (Weak) –** Across the survey area anomalies were detected of a linear and sinuous nature, with predominantly weak magnetic signals (Figures 32-43). The anomalies designated as Ridge and Furrow agriculture respect these linear anomalies, suggesting they likely represent former field boundaries. Several of these anomalies **[2f] [4a] [7d]** correlate with known former field boundaries present on historical OS maps. The southern area also contains three linear anomalies that fit the profile of former field boundaries. One, located in Area 16, corresponds to a mapped field boundary, visible on 2nd edition OS maps (Figure 10). The others do not however align with any visible on historical mapping.

7.3.2.10. **Natural (Spread)** – Areas of magnetic enhancement have been identified within the southwest of Area 8 and in Area 16 (Figures 29-31 & 32-34). This enhancement has been interpreted as resulting from natural variations caused by the difference between the bedrock geology and the upper soil horizons (see Section 4).

7.3.2.11. **Undetermined (Strong and Weak)** – Across the survey area, several linear curvilinear and amorphous anomalies have been identified which are lacking sufficient contextual evidence to enable a more confident interpretation of their origin (Figures 17-43). A pair of parallel linear anomalies in Area 6 **[6b]** has similar morphology to anomalies present in Area 7 **[7a]**. However, the lack of adjacent rectilinear anomalies means it cannot be defined as archaeological and may have an agricultural origin not associated with the probable archaeology present in the survey area. Several linear anomalies **[11b, 11c, 12a]** have been identified in the southern parcel of the survey area that are likely agricultural in origin, but do not correspond with any known features on historical mapping. A pair of curvilinear anomalies were identified in Area 9 **[9a]**, which may have an archaeological origin, but due to the lack of similar morphology within Areas 7 and 8, and the lack of iron age finds in the surrounding landscape (see section 5.3 & 5.4), have been identified as undetermined. These anomalies may be of agricultural, natural or modern origin, however an archaeological origin should not be excluded.

8. Conclusions

8.1. A fluxgate gradiometer survey was successfully undertaken across the survey area. The survey technique has responded well to the environment of the survey area. Magnetic disturbance is limited to buried service lines, pylons, and field boundaries which may have masked weaker more ephemeral anomalies. Nevertheless, the survey has identified anomalies of archaeological, agricultural, natural, and undetermined origin. Many anomalies of a likely archaeological origin were clearly defined, as is evidence of historical agriculture across the landscape.

8.2. Three *foci* of archaeological activity are present within the survey area. These anomalies have been interpreted as: a multiphase settlement, groups of enclosures and possible industrial activity. The morphology of several anomalies suggests a multiphase landscape usage of possible Romano-British origin, with associated discrete anomalies and smaller divisions possibly indicating further settlement.

8.3. Historical agricultural activity has been identified throughout the survey area as ridge and furrow trends, as well as former mapped and unmapped field boundaries.

8.4. Natural variations in the near surface geology have also been detected. These anomalies likely relate to changes in the bedrock and superficial geology as well as the soil properties of the survey area.

8.5. Anomalies of undetermined origin have also been detected. It has not been possible to definitively determine whether these anomalies are the result of archaeological, agricultural or modern practices.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

10.1. Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

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12. Project Metadata

MS Job Code	MSSK1600
Project Name	Old Wood Energy Park, Willoughby, Nottinghamshire
Client	Pegasus Planning Group Ltd.
Grid Reference	SK 59675 27627
Survey Techniques	Magnetometry
Survey Size (ha)	105.8Ha
Survey Dates	14-08-2023 to 10-05-2024
Project Lead	Jake Dolan BSc FGS, Isabella Carli BA MA PCIfA
Project Officer	Jake Dolan BSc FGS, Isabella Carli BA MA PCIfA
HER Event No	N/A
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.11

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	DPT	JD	25 August 2023
0.2	Corrections following Project Lead Review	HR	JD	04 September 2023
0.3	Amendments following Project Lead Review	JD	PJS	8 September 2023
0.4	Further amendments following Director Review	JD	PJS	12 September 2023
0.5	Amendments following Client review	HR	JD	15 September 2023
0.6	Additions following 2nd Deployment	JD	IC, PJS	29 September 2023
0.7	Corrections from Client	CL	IC	5 October 2023
0.8	Addition of new areas	IC	FPC	21 December 2023
0.9	Comments from the Client	IC	IC	22 January 2023
0.10	Amendments following 3rd deployment	DPT, IC	FPC	23 May 2024
0.11	Amendments following Client review	HM	IC	28 May 2024

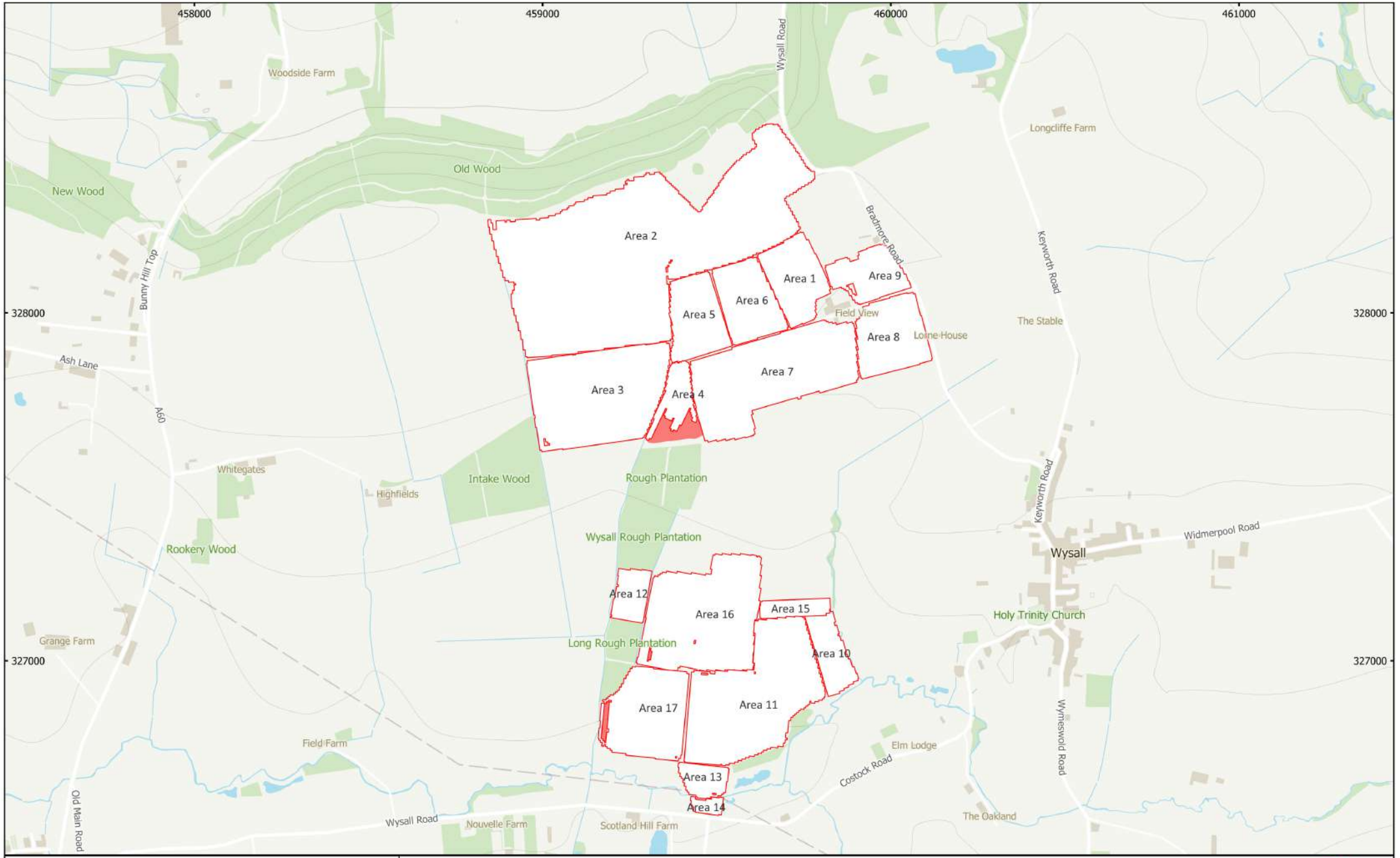
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 2 - Location of Survey Area
1:10,000 @ A3

Survey Extent
Unsurveyable

N

0 10 20 30 m

magnitude surveys

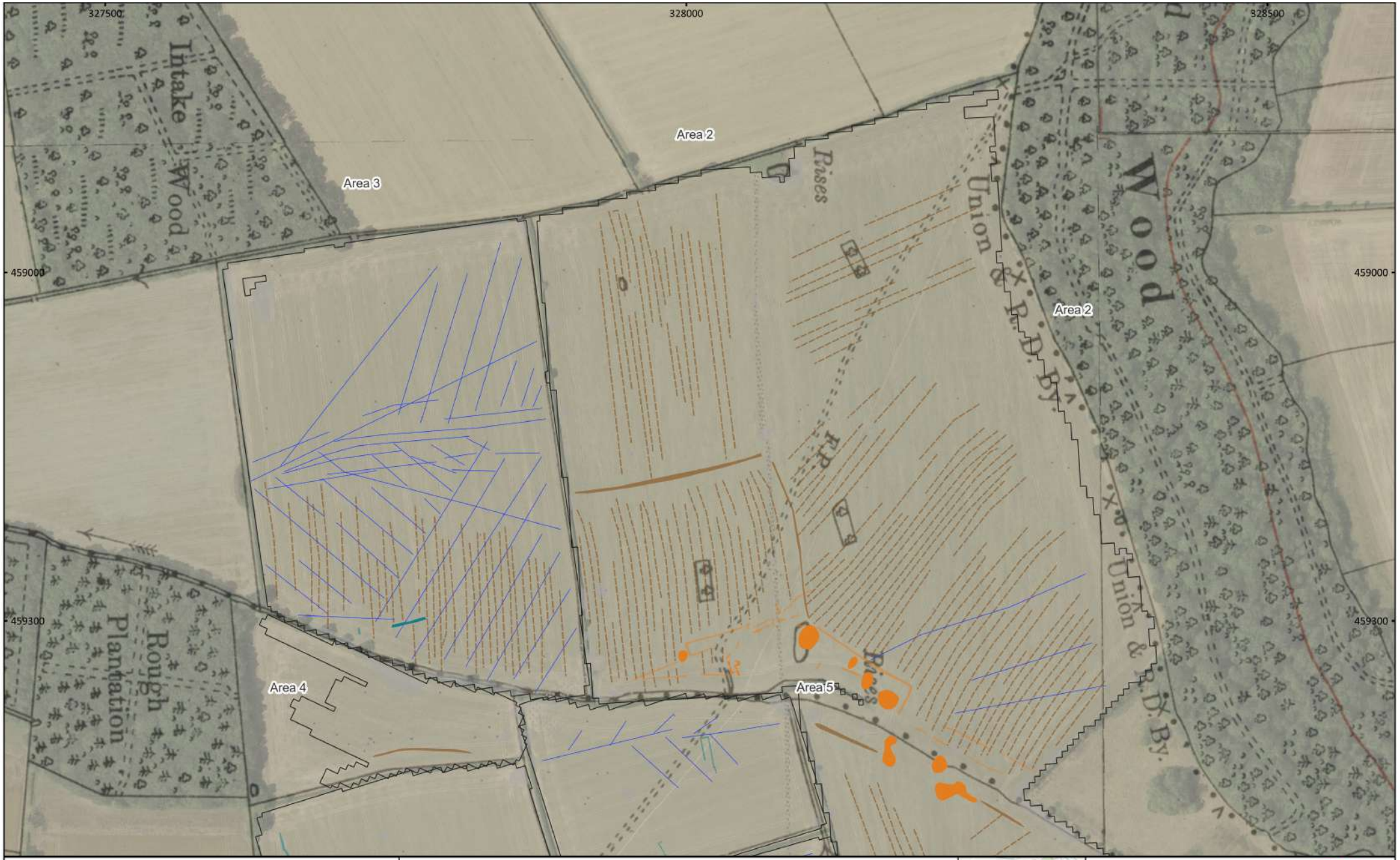
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 3 - Magnetic Total Field (Lower Sensor) (Overview) (Northern Areas - West)
1:3,000 @ A3

48,998 nT 49,003

N

0 50 100 150 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 4 - Magnetic Interpretation Over Historical Maps (Overview) (Northern Areas - West)
1:3,000 @ A3

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Overhead Cables
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

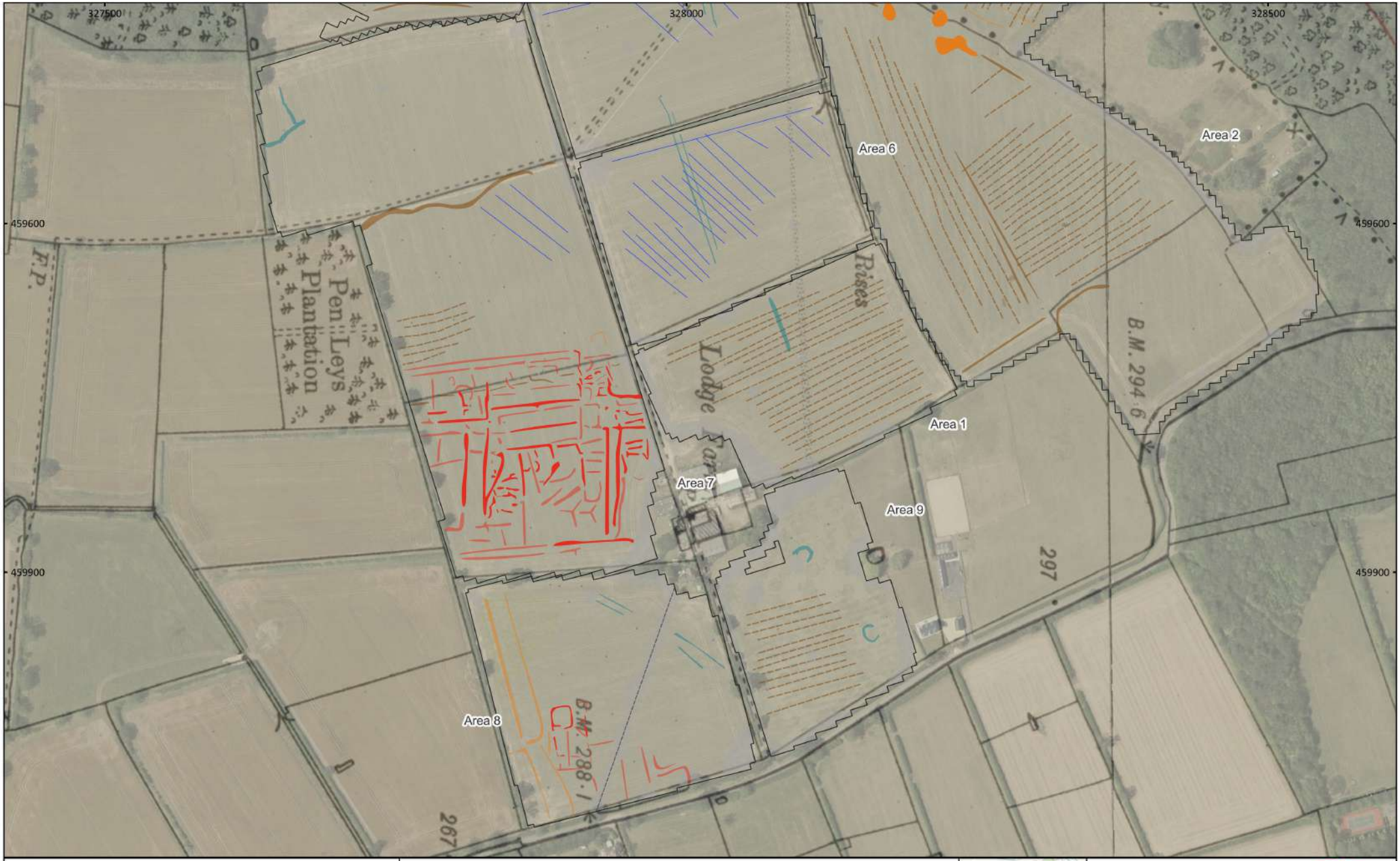
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 5 - Magnetic Total Field (Lower Sensor) (Overview) (Northern Areas - East)
1:3,000 @ A3

48,998 nT 49,003

N

0 50 100 150 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 6 - Magnetic Interpretation Over Historical Maps (Overview) (Northern Areas - East)
1:3,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Overhead Cables
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Natural (Spread)
- Service
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 7 - Magnetic Total Field (Lower Sensor) (Overview) (Southern Areas)
1:3,000 @ A3

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 8 - Magnetic Interpretation Over Historical Maps (Overview) (Southern Areas)
1:3,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Natural (Spread)
- Agricultural (Trend)
- Artefact
- Drainage Feature
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 9 - Magnetic Total Field (Lower Sensor) (Overview) (Southern Areas - East)
1:3,000 @ A3

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 10 - Magnetic Interpretation Over Historical Maps (Overview)
(Southern Areas - East)
1:3,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Natural (Spread)
- Agricultural (Trend)
- Artefact
- Drainage Feature
- Ferrous (Spike)

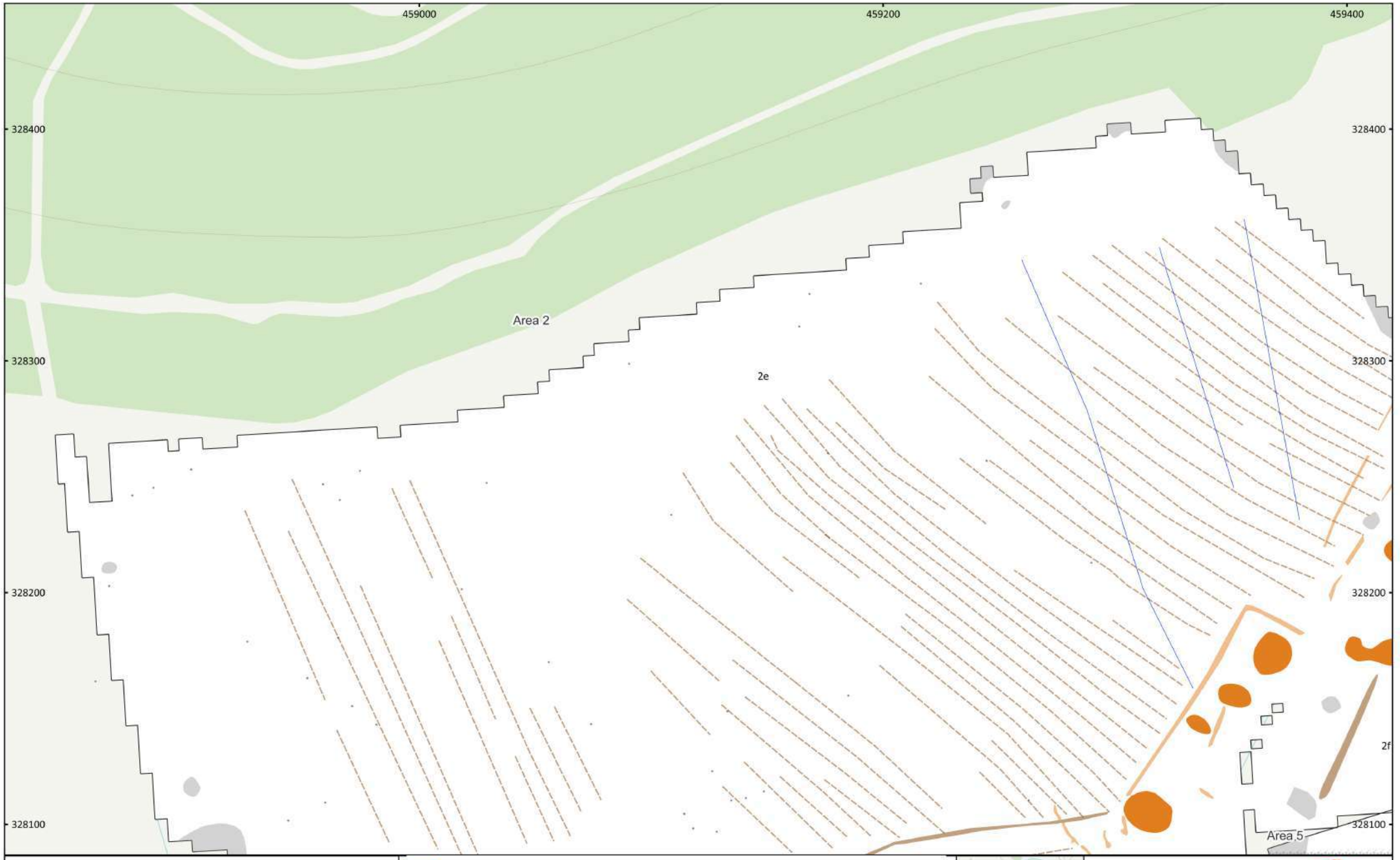
N

0 50 100 150 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 11 - Magnetic Gradient (Areas 2 & 5)
1:1,500 @ A3

magnitude surveys



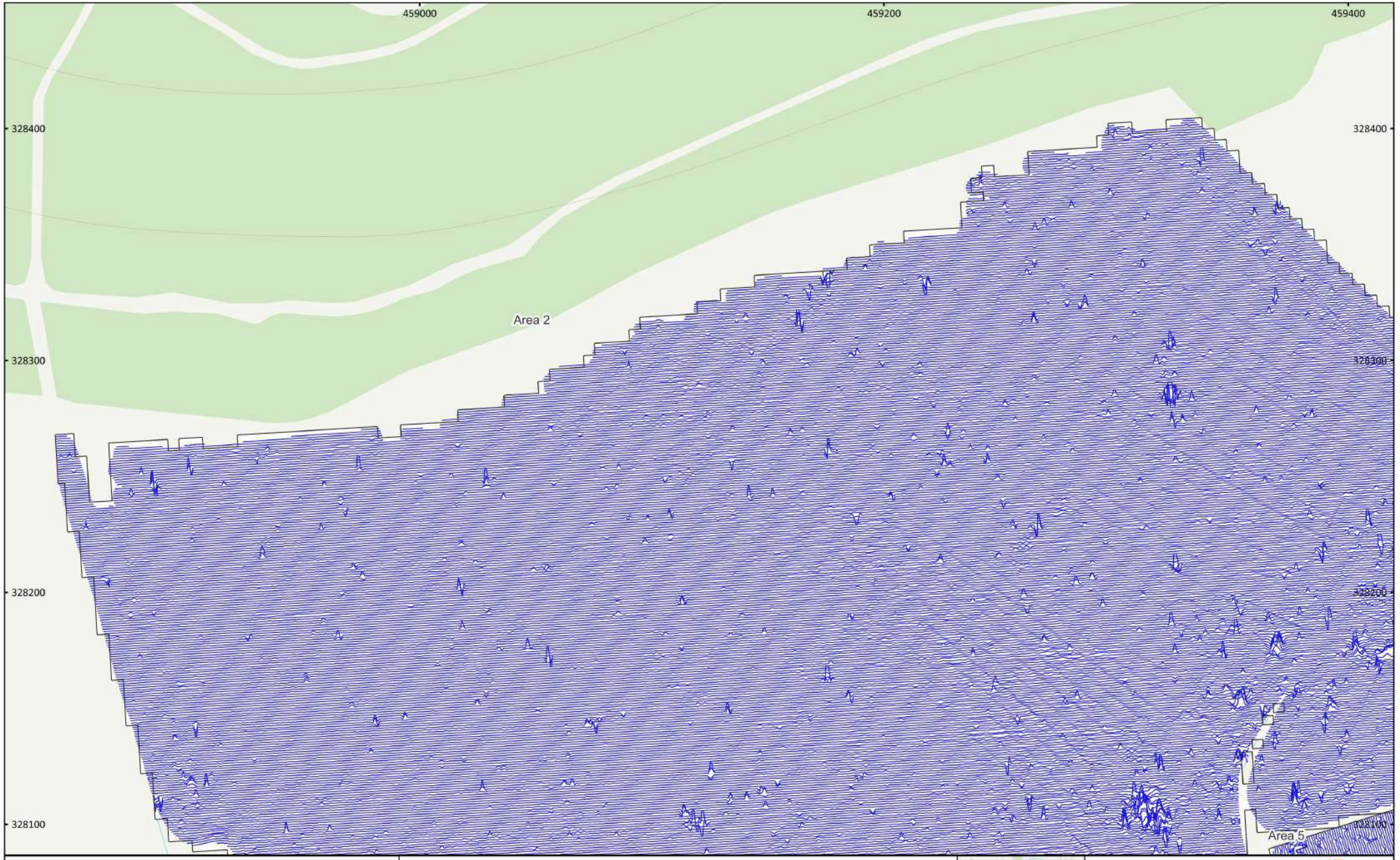
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 12 - Magnetic Interpretation (Areas 2 & 5)
1:1,500 @ A3

Archaeology Possible (Strong)
Archaeology Possible (Weak)
Agricultural (Weak)
Overhead Cables
Magnetic Disturbance
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

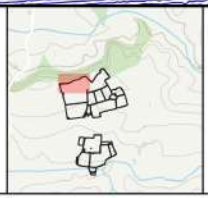
N

0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 13 - XY Trace Plot (Areas 2 & 5)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys

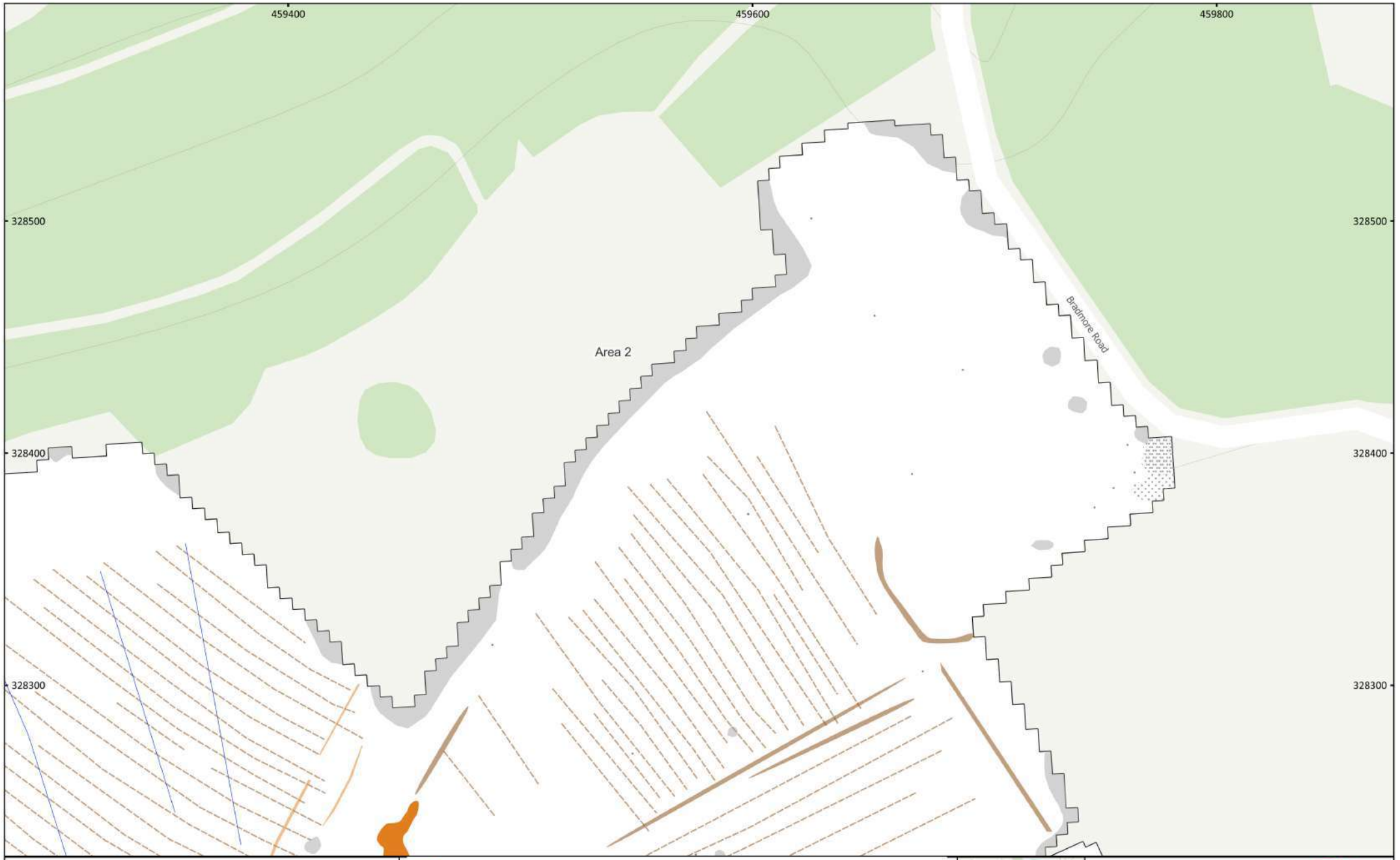
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 14 - Magnetic Gradient (Area 2)
1:1,500 @ A3

-1 nT 2

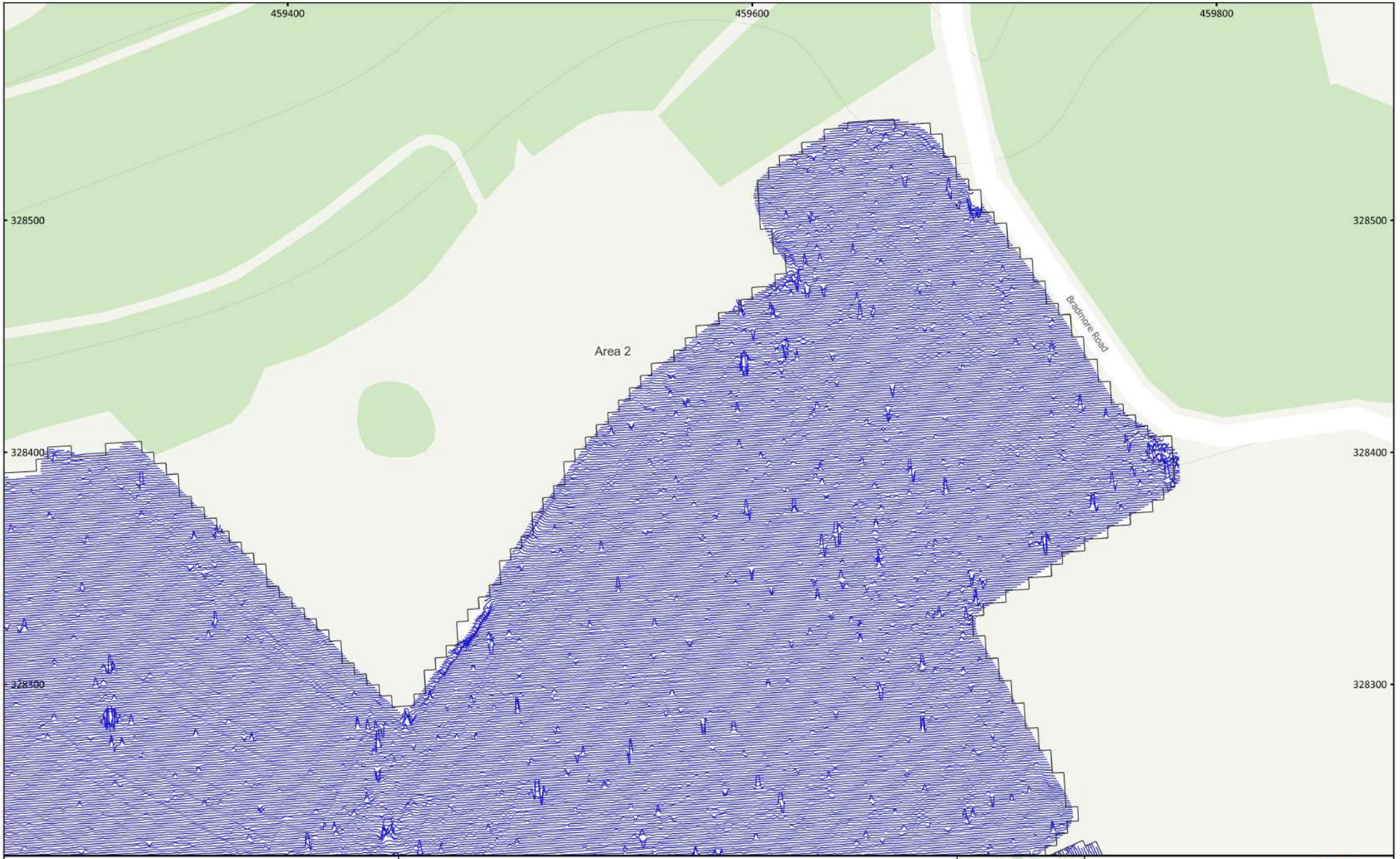
N

0 20 40 60 m

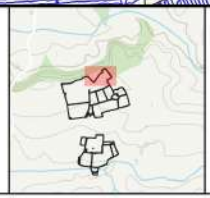
magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 15 - Magnetic Interpretation (Area 2)
1:1,500 @ A3



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 16 - XY Trace Plot (Area 2)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys

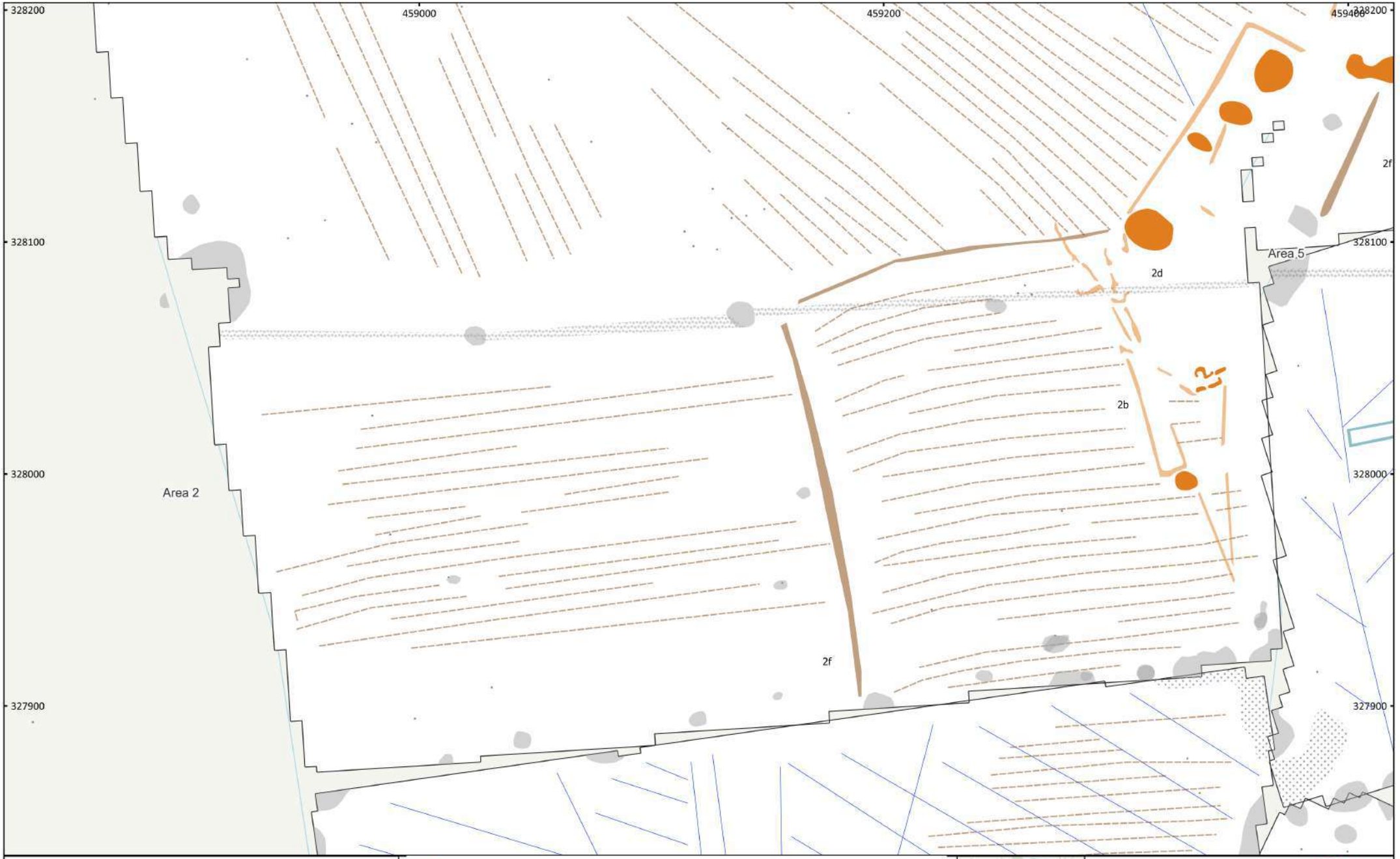
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 17 - Magnetic Gradient (Areas 2, 3 & 5)
1:1,500 @ A3

-1 nT 2

N

0 20 40 60 m

magnitude surveys



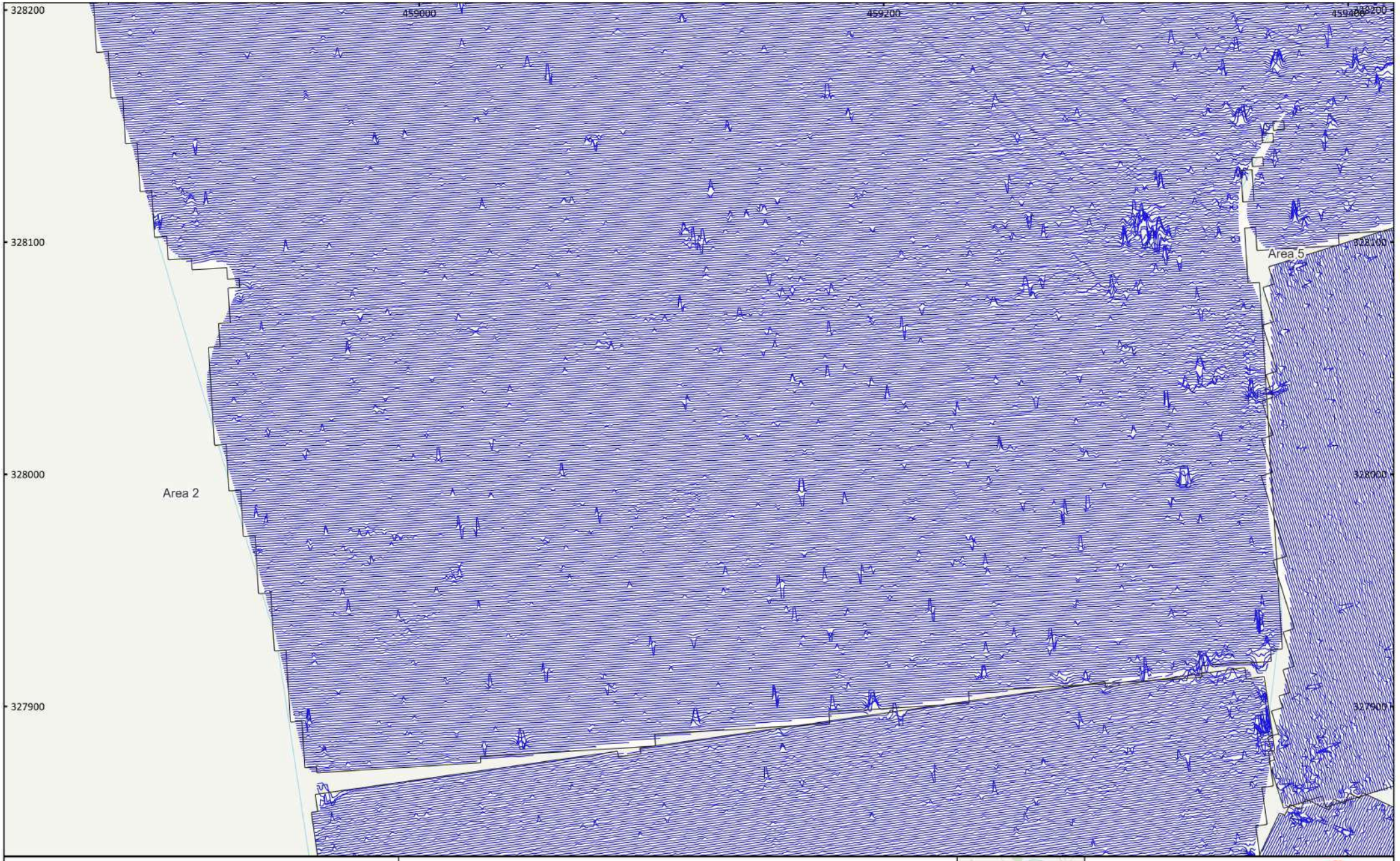
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 18 - Magnetic Interpretation (Areas 2, 3 & 5)
1:1,500 @ A3

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Overhead Cables
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)

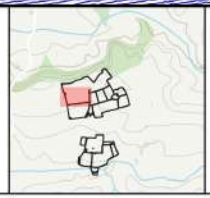
N

0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 19 - XY Trace Plot (Areas 2, 3 & 5)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys

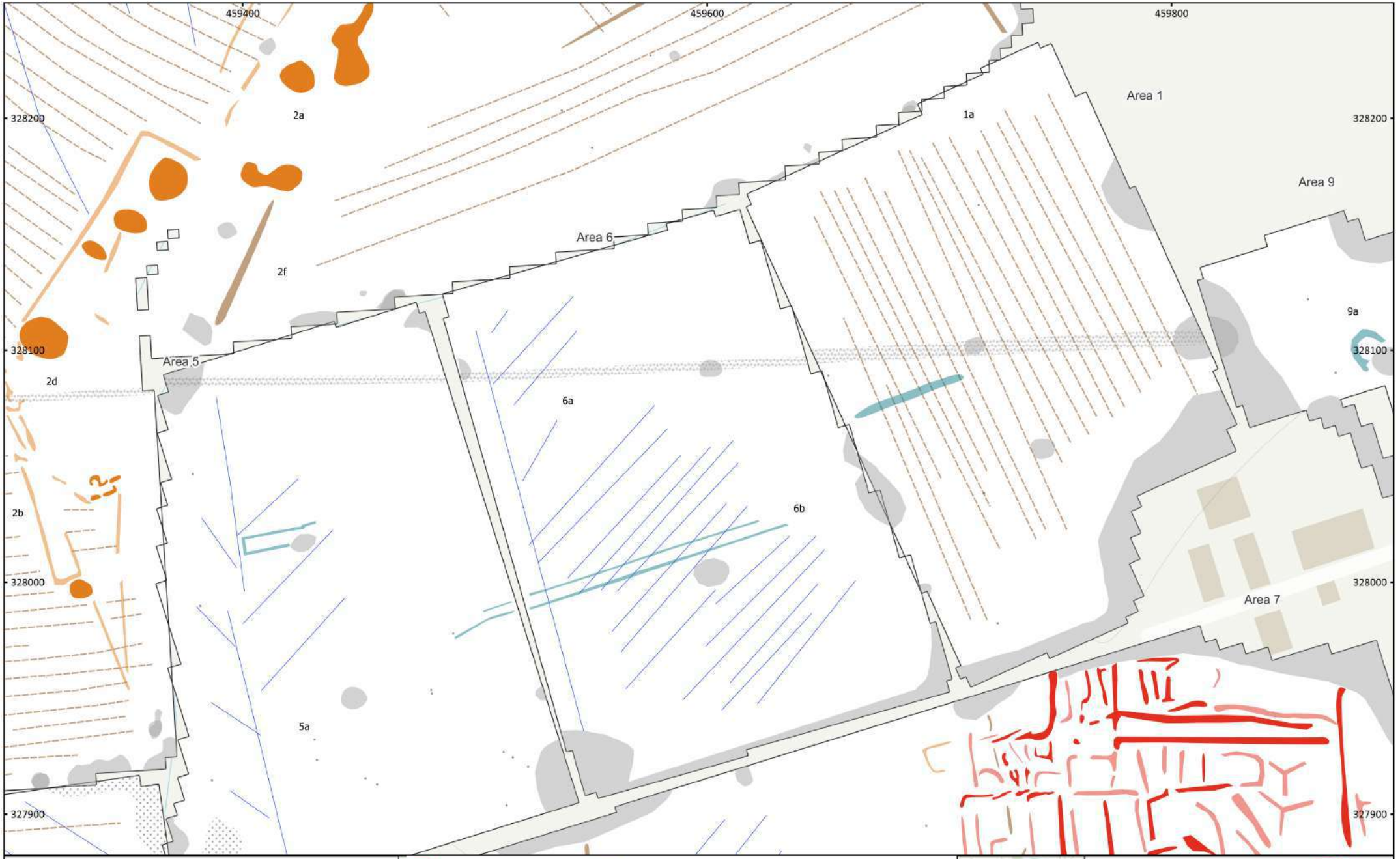
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 20 - Magnetic Gradient (Areas 1, 2, 3, 5, 6, 7 & 9)
1:1,500 @ A3

-1 nT 2

N

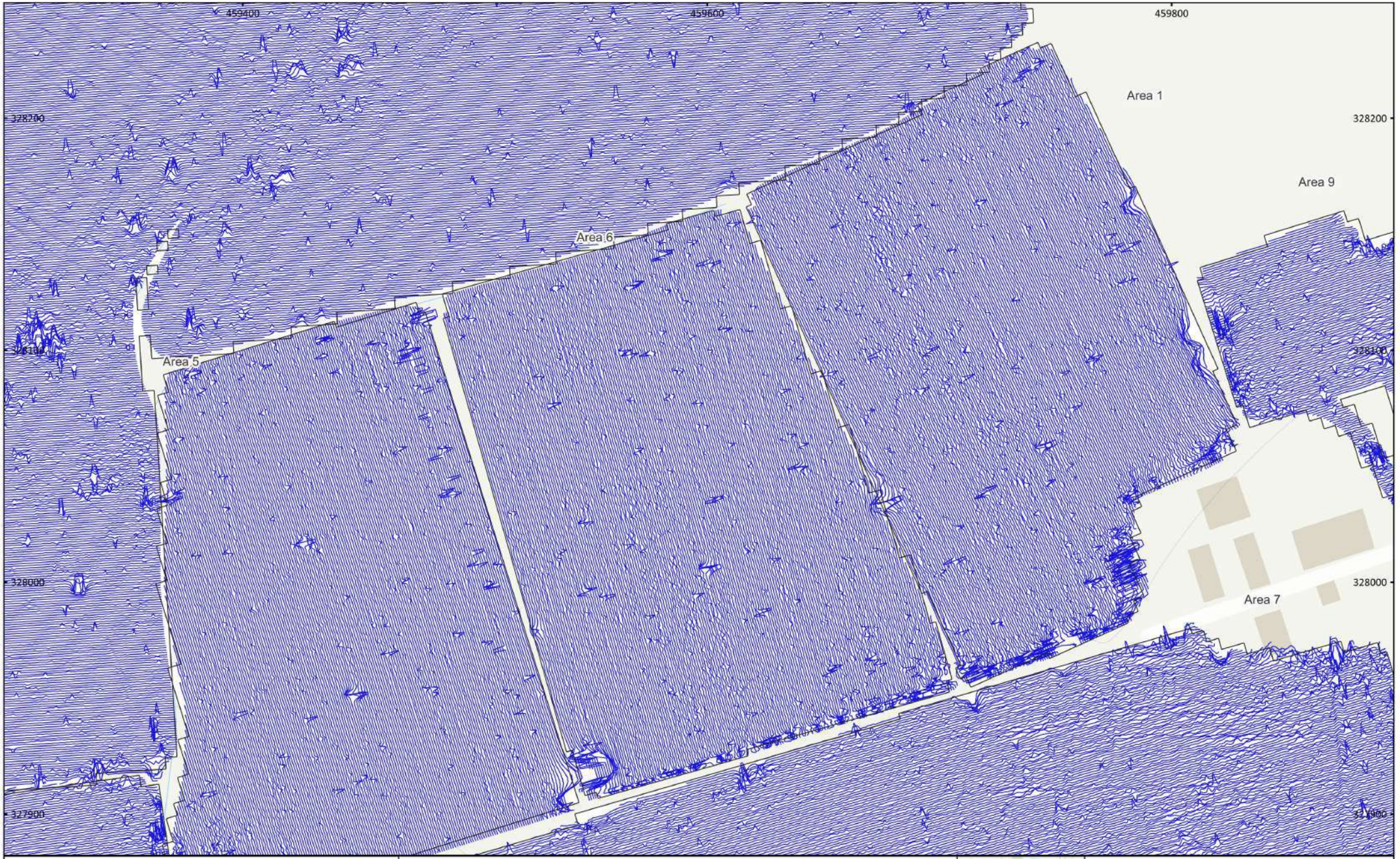
0 20 40 60 m

magnitude surveys

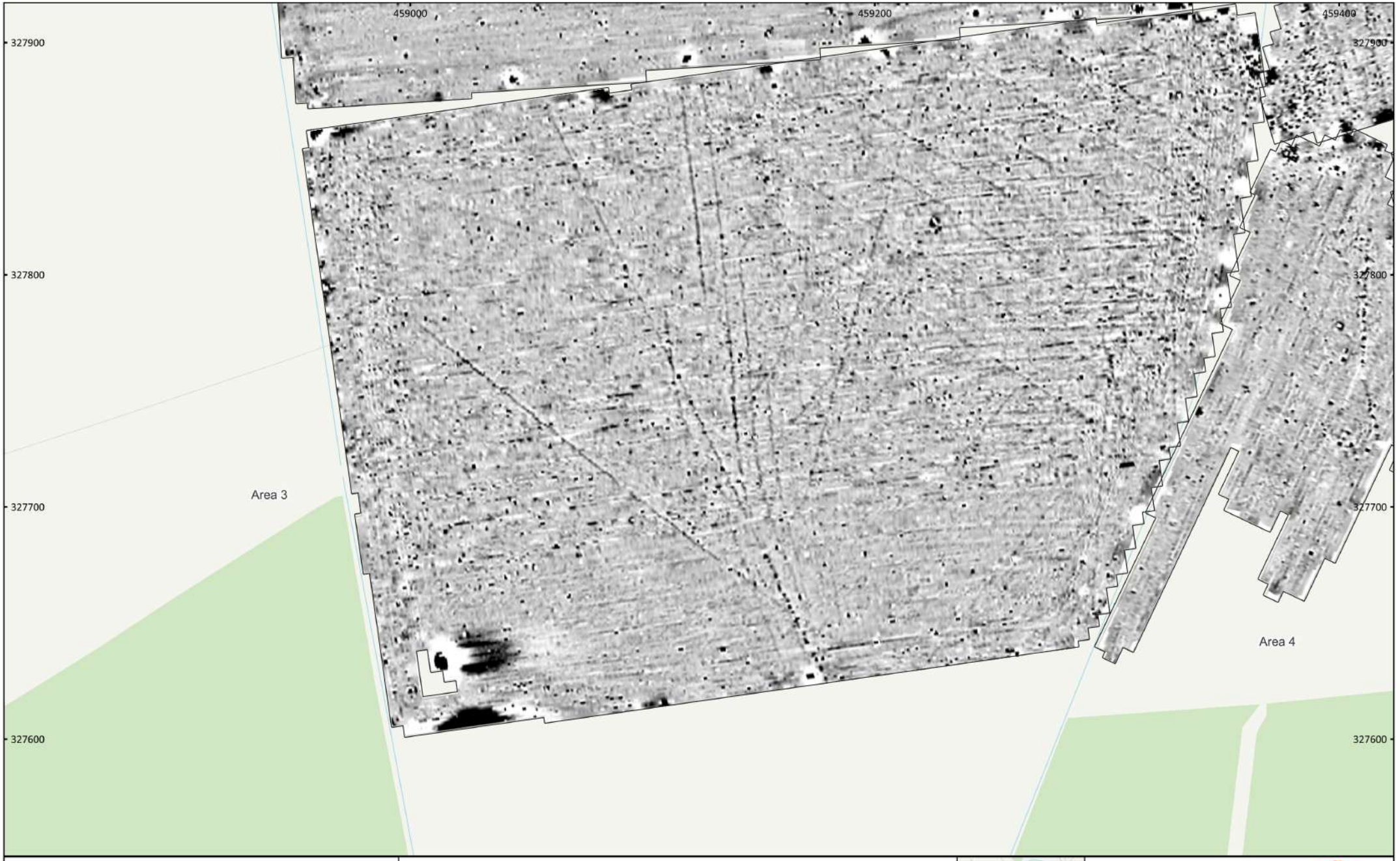


MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 21 - Magnetic Interpretation (Areas 1, 2, 3, 5, 6, 7 & 9)
1:1,500 @ A3

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 22 - XY Trace Plot (Areas 1, 2, 3, 5, 6, 7 & 9)
30nT/cm at 1:1,500 @ A3



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 23 - Magnetic Gradient (Areas 2, 3, 4 & 5)
1:1,500 @ A3

-1 nT 2

N

0 20 40 60 m

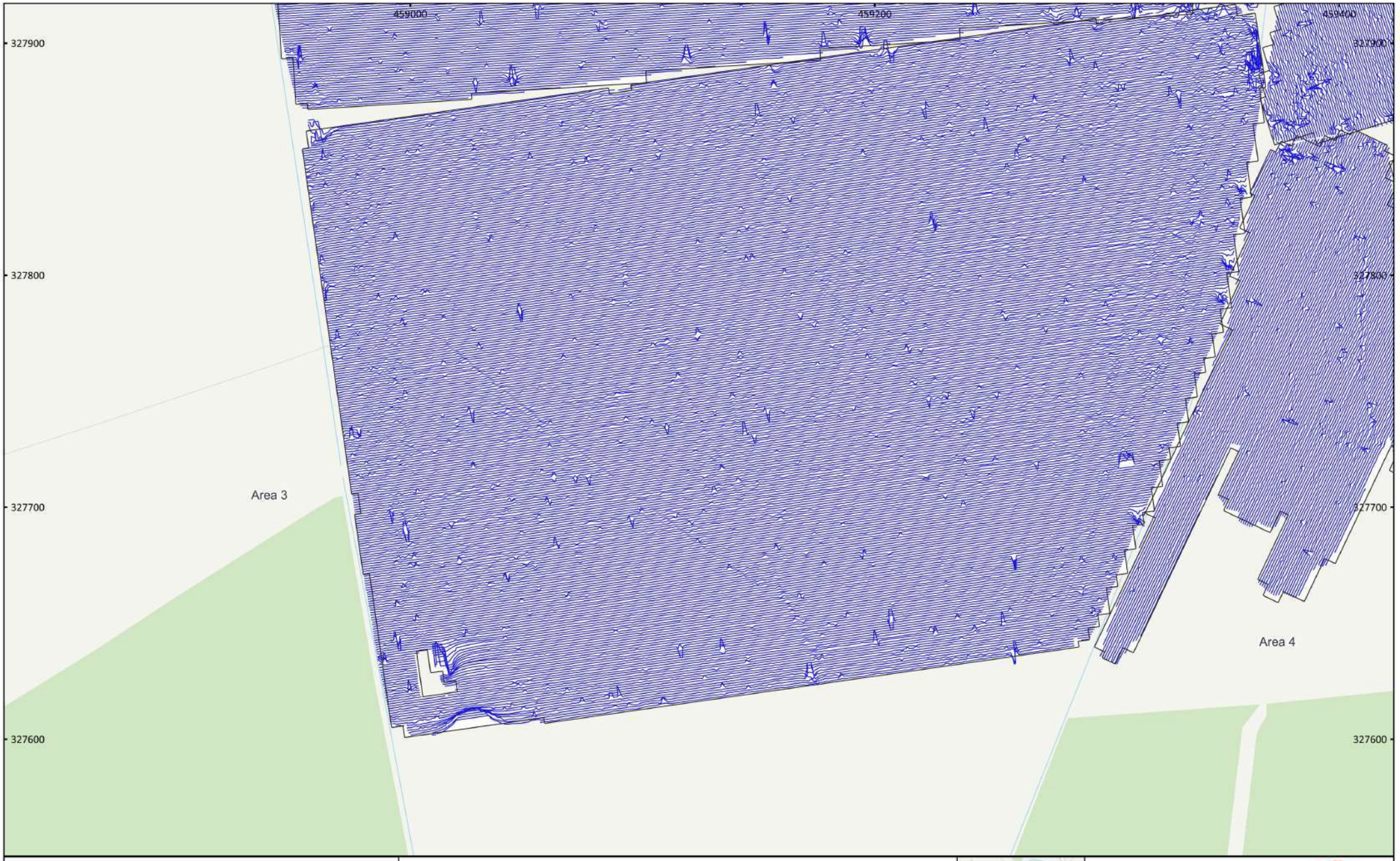
magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 24 - Magnetic Interpretation (Areas 2, 3, 4 & 5)
1:1,500 @ A3

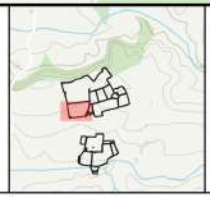
Agricultural (Weak)
Undetermined (Strong)
Undetermined (Weak)
Ferrous/Debris (Spread)
Magnetic Disturbance
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

N
0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 25 - XY Trace Plot (Areas 2, 3, 4 & 5)
30nT/cm at 1:1,500 @ A3



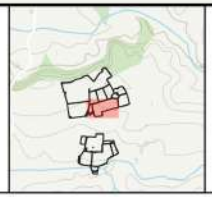
N

0 20 40 60 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 26 - Magnetic Gradient (Areas 3, 4, 5, 6 & 7)
1:1,500 @ A3

-1 nT 2



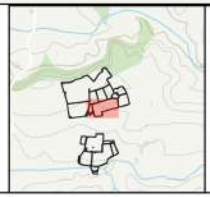
N

0 20 40 60 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 27 - Magnetic Interpretation (Areas 3, 4, 5, 6 & 7)
1:1,500 @ A3

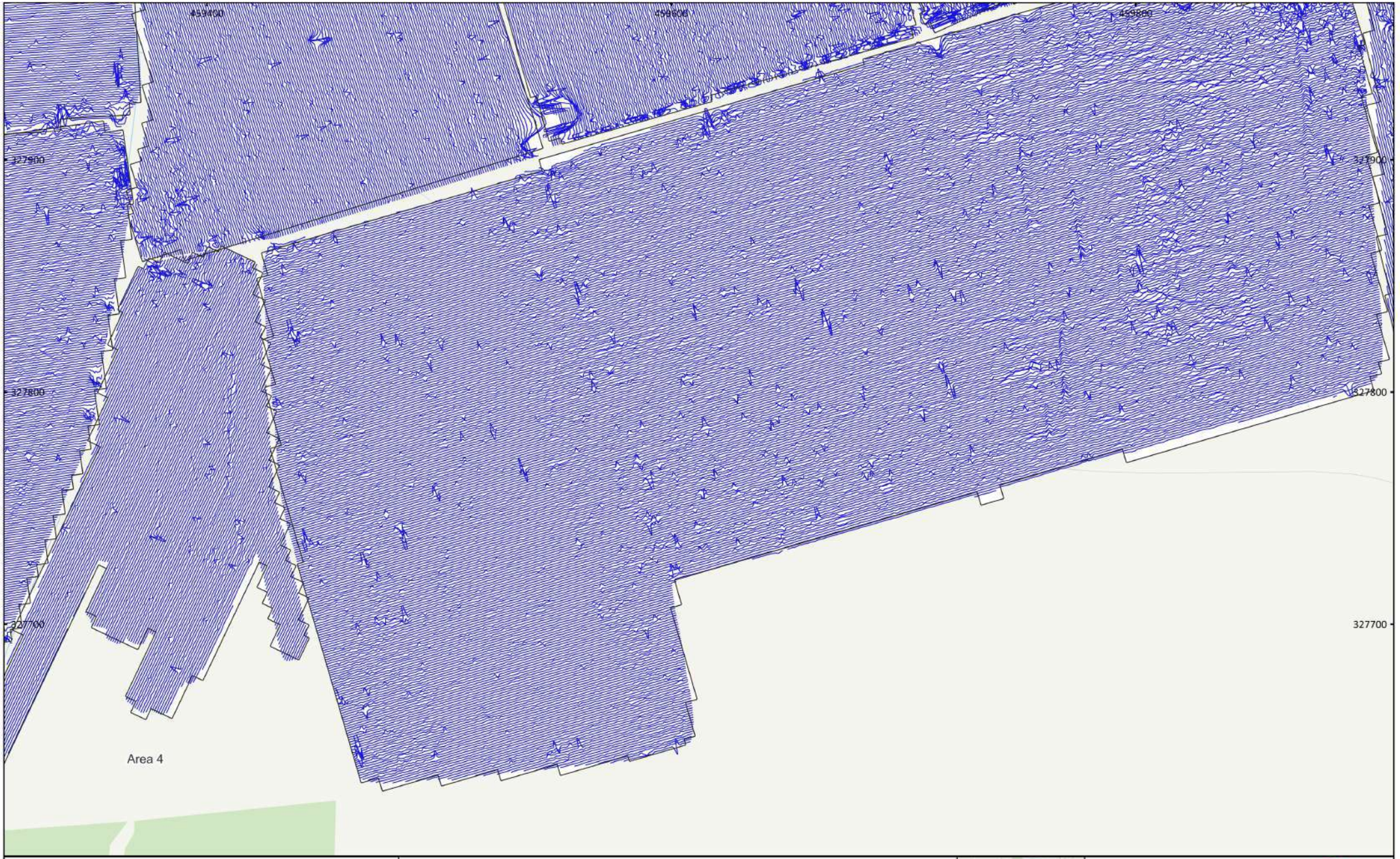
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Weak)
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Ridge and Furrow (Trend)
- Drainage Feature
- Ferrous (Spike)



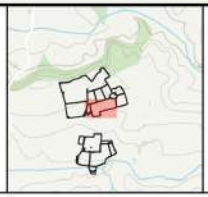
N

0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 28 - XY Trace Plot (Areas 3, 4, 5, 6 & 7)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 29 - Magnetic Gradient (Areas 1, 7, 8 & 9)
1:1,500 @ A3

-1 nT 2

N

0 20 40 60 m

magnitude surveys

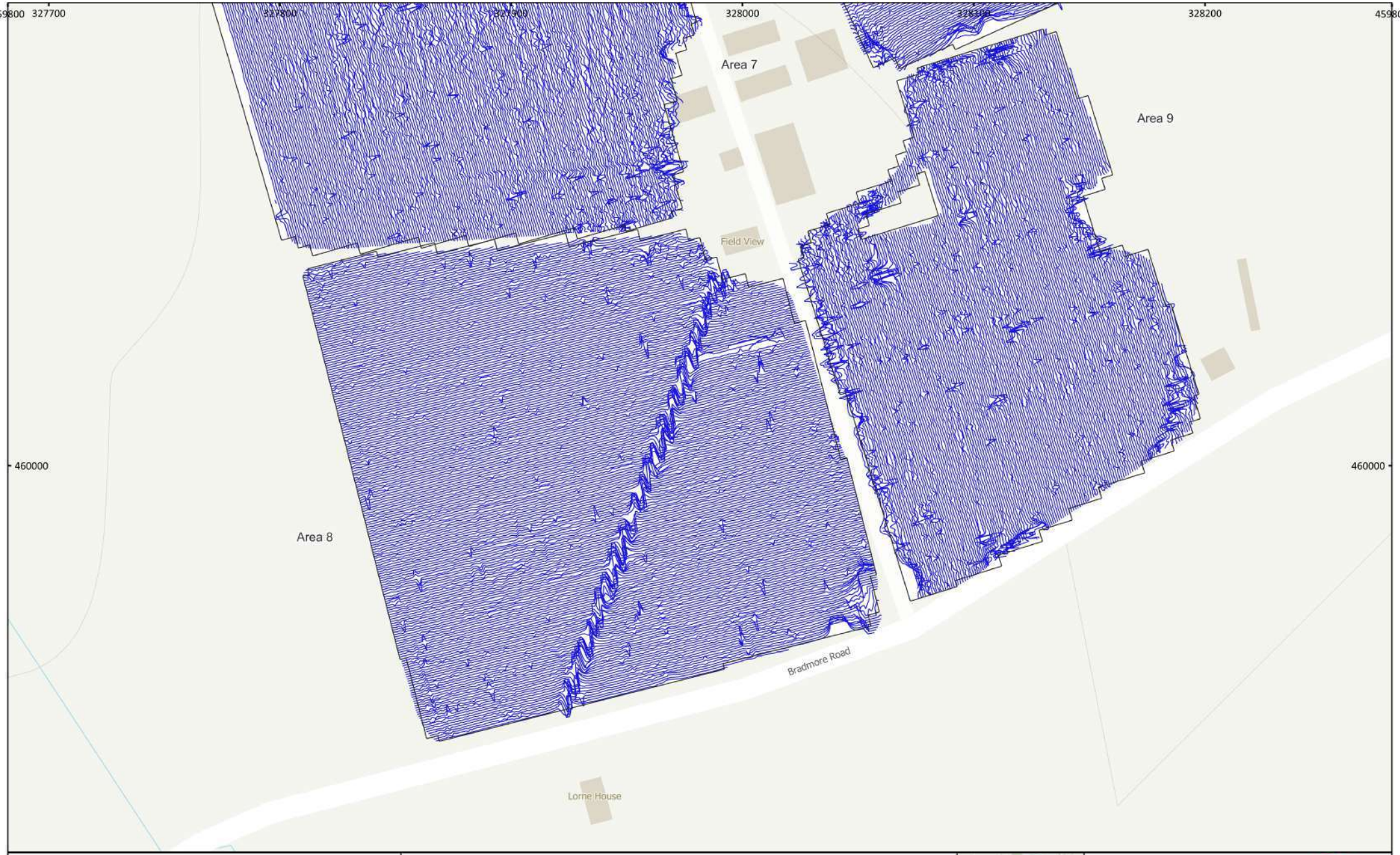
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 30 - Magnetic Interpretation (Areas 1, 7, 8 & 9)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Weak)
- Undetermined (Weak)
- Overhead Cables
- Magnetic Disturbance
- Natural (Spread)
- Service
- Ridge and Furrow (Trend)
- Ferrous (Spike)

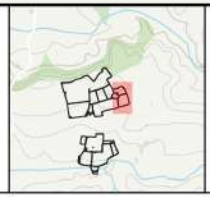
N

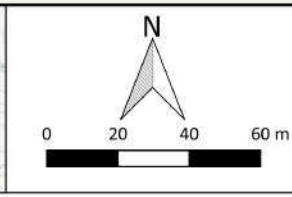
0 20 40 60 m

magnitude surveys

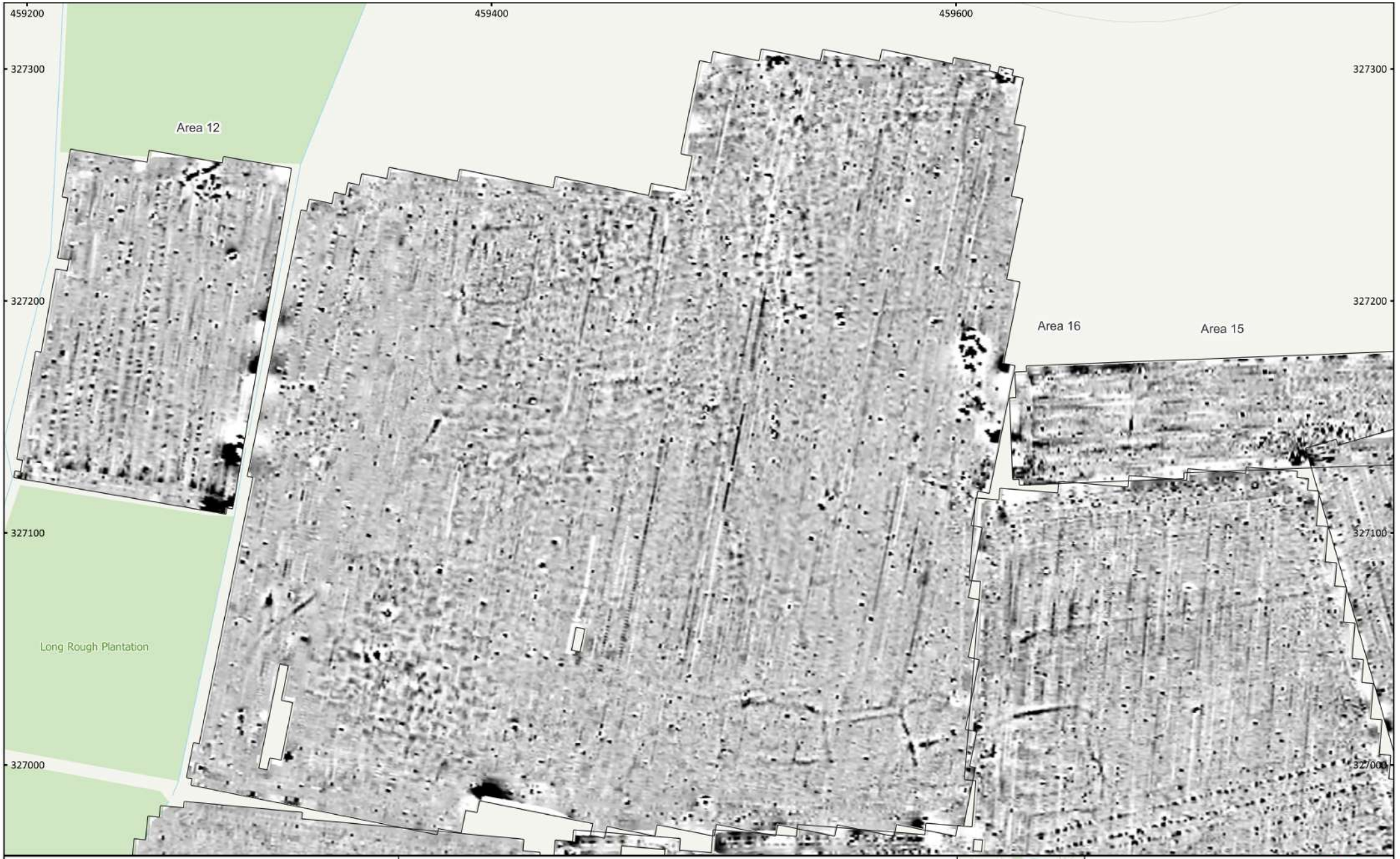


MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 31 - XY Trace Plot (Areas 1, 7, 8 & 9)
30nT/cm at 1:1,500 @ A3





magnitude surveys

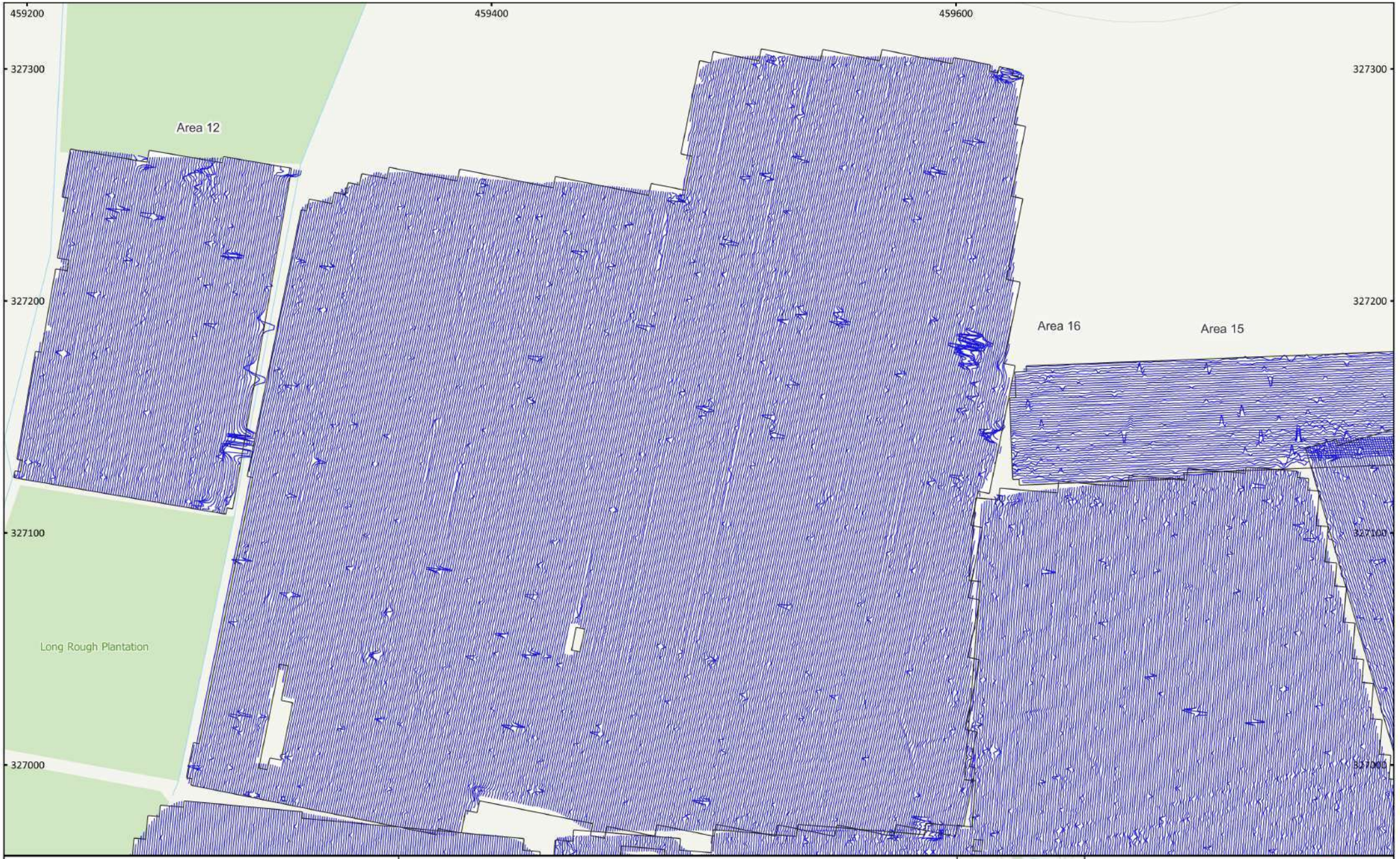


MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 32 - Magnetic Gradient (Areas 10, 11, 12 & 15)
1:1,500 @ A3

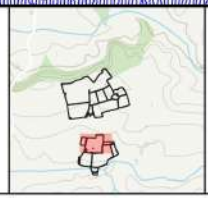
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 33 - Magnetic Interpretation (Areas 10, 11, 12 & 15)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Natural (Spread)
- Agricultural (Trend)
- Artefact
- Drainage Feature
- Ferrous (Spike)

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 34 - XY Trace Plot (Areas 10, 11, 12 & 15)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys

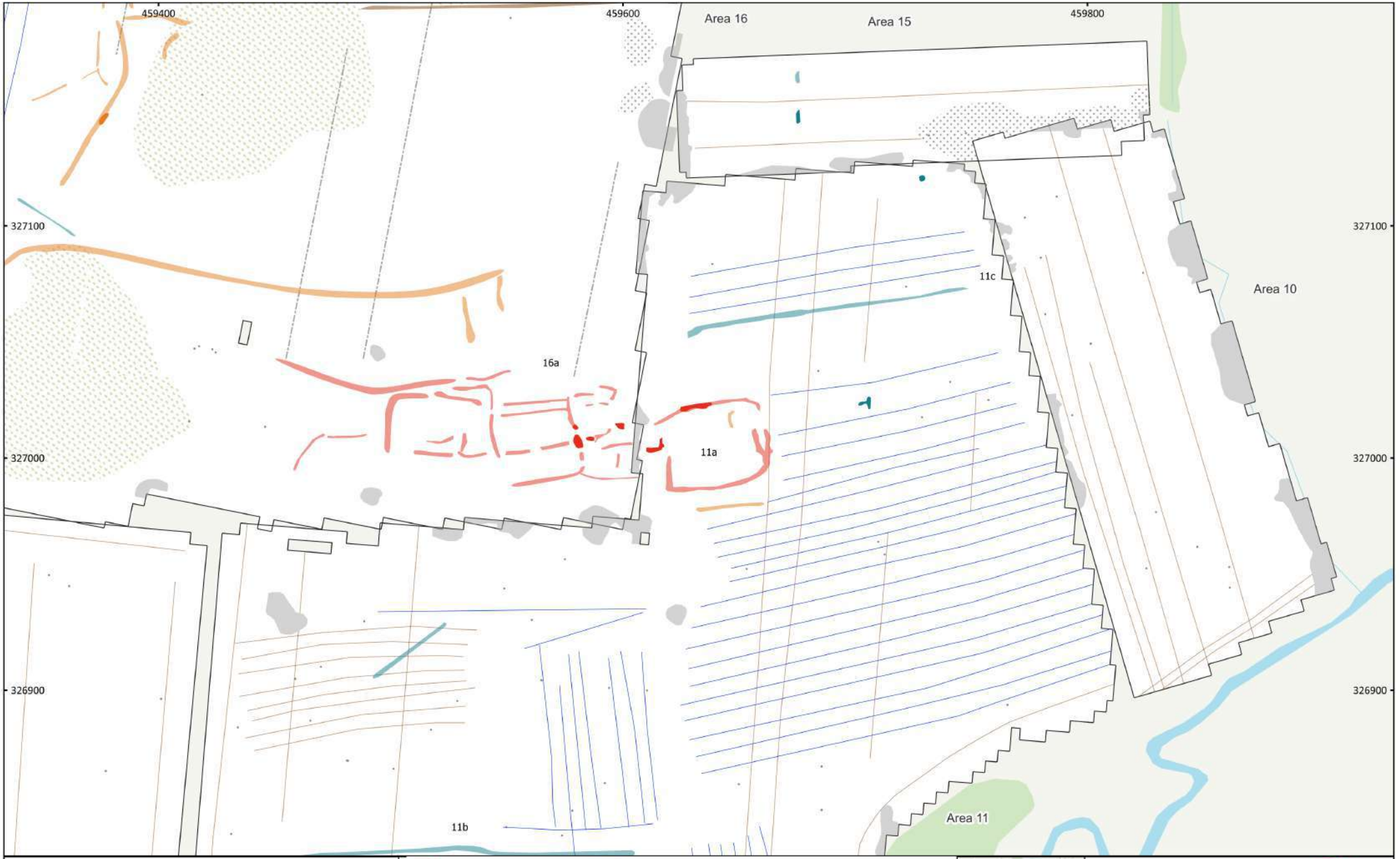
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 35 - Magnetic Gradient (Areas 10, 11 & 15)
1:1,500 @ A3

-1 nT 2

N

0 20 40 60 m

magnitude surveys



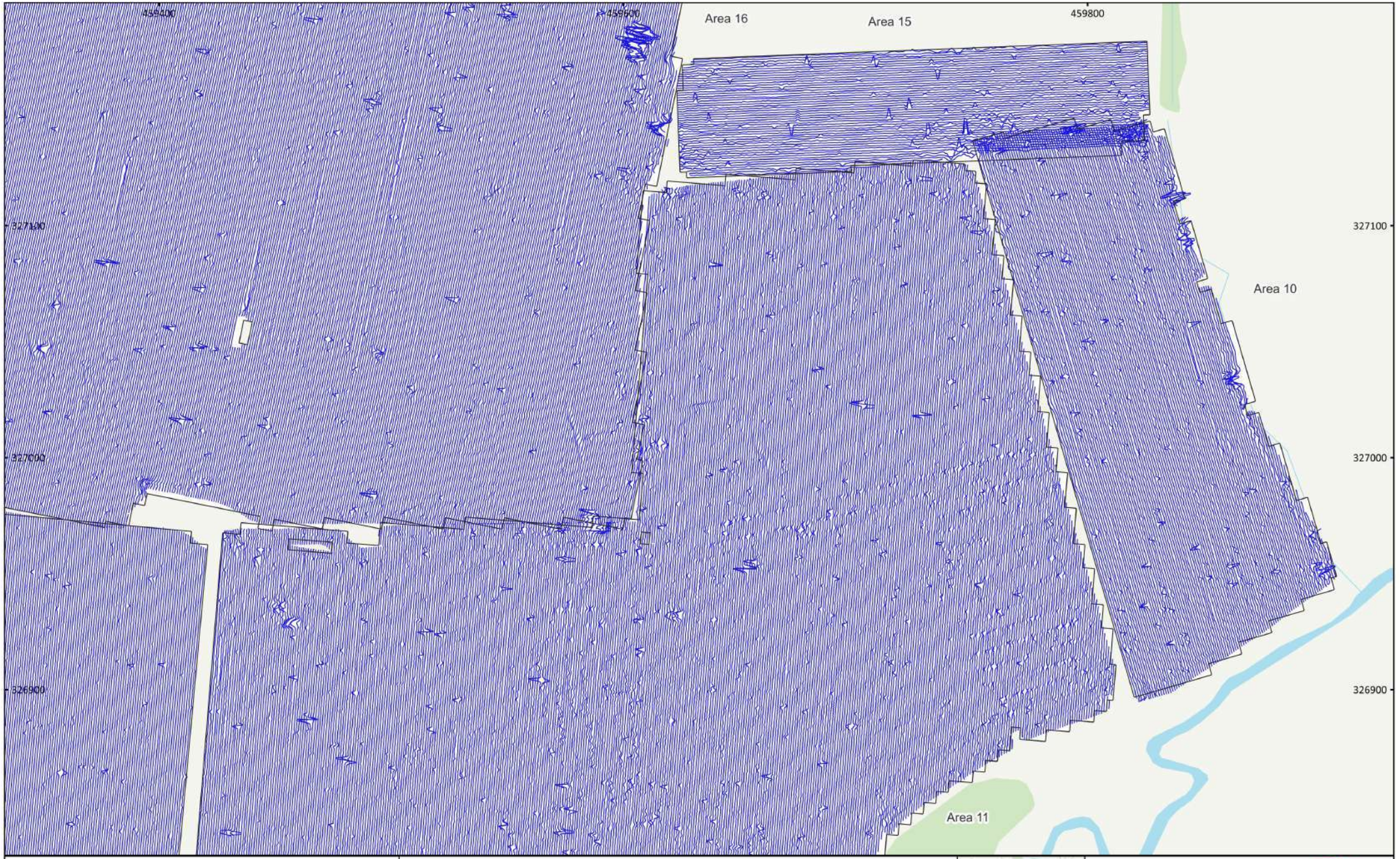
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 36 - Magnetic Interpretation (Areas 10, 11 & 15)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous/Debris (Spread)
- Magnetic Disturbance
- Natural (Spread)
- Agricultural (Trend)
- Artefact
- Drainage Feature
- Ferrous (Spike)

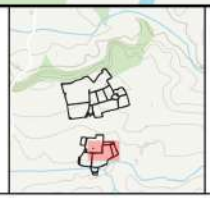
N

0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 37 - XY Trace Plot (Areas 10, 11 & 15)
30nT/cm at 1:1,500 @ A3



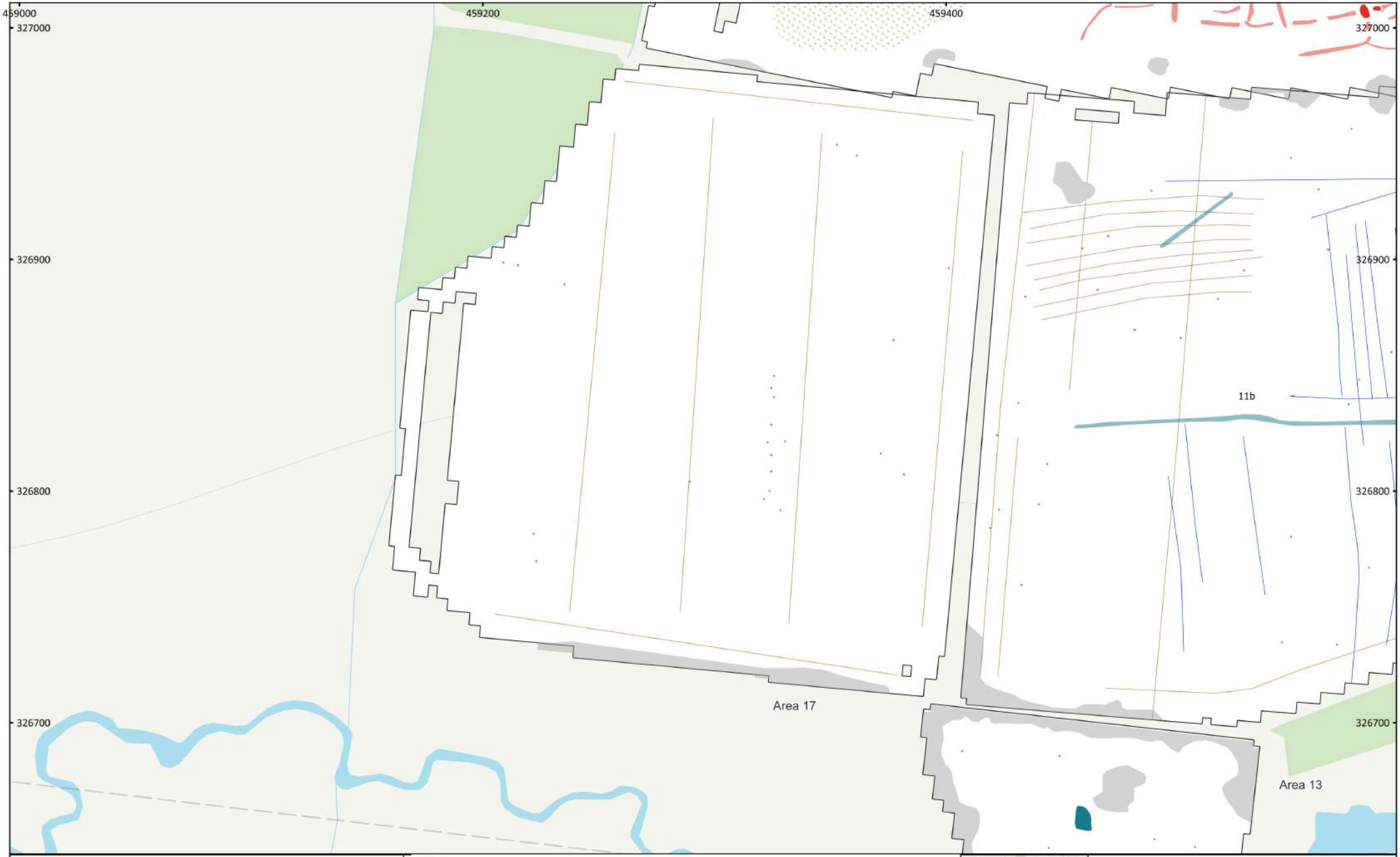
N

0 20 40 60 m

magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 38 - Magnetic Gradient (Areas 13 & 14)
1:1,500 @ A3

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 39 - Magnetic Interpretation (Areas 13 & 14)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Undetermined (Strong)
- Undetermined (Weak)
- Magnetic Disturbance
- Natural (Spread)
- Agricultural (Trend)
- Drainage Feature
- Ferrous (Spike)

N

0 20 40 60 m

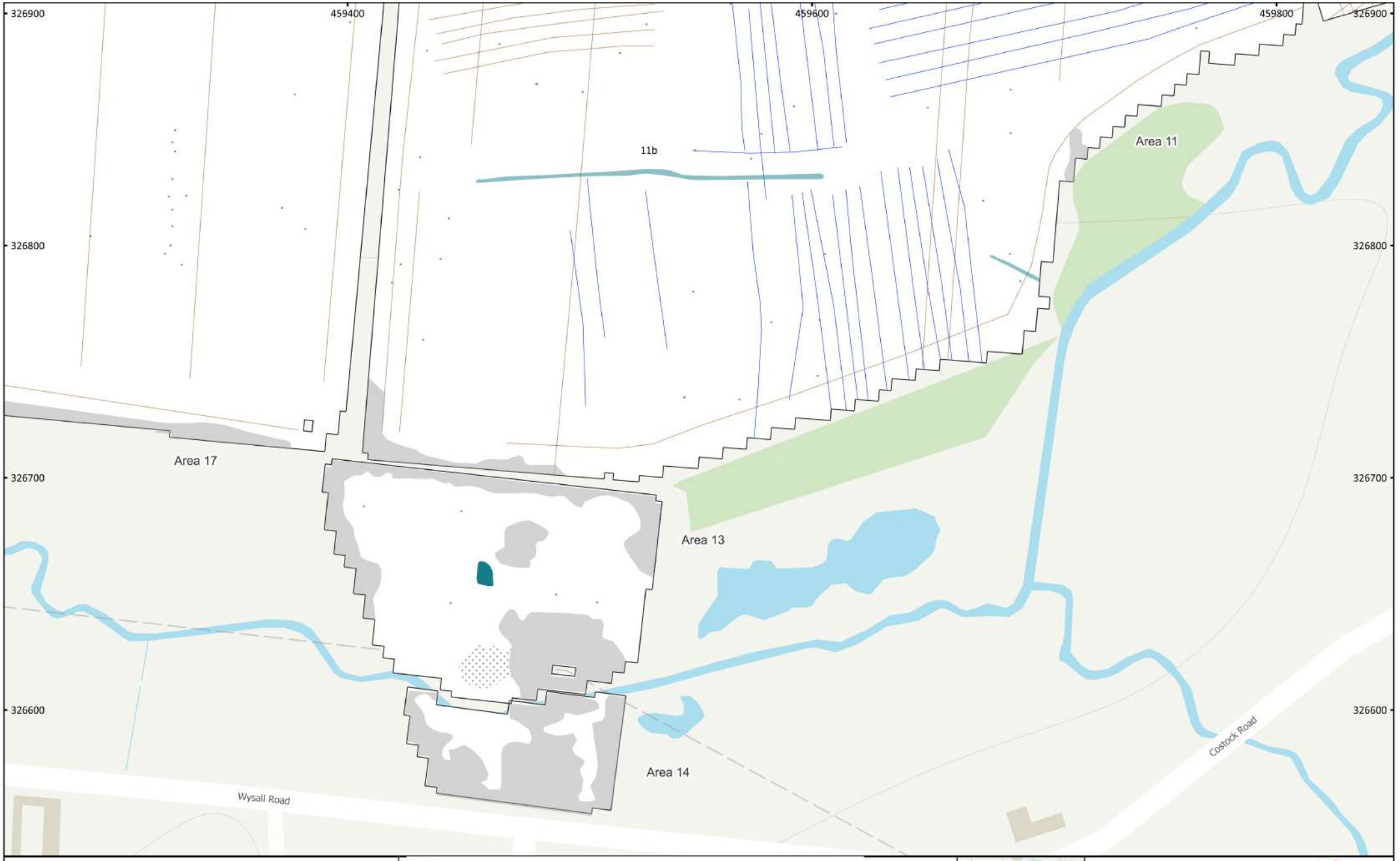
magnitude surveys

MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 40 - XY Trace Plot (Areas 13 & 14)
30nT/cm at 1:1,500 @ A3

magnitude surveys

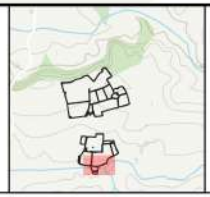
MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 41 - Magnetic Gradient (Areas 11, 13 & 14)
1:1,500 @ A3

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 42 - Magnetic Interpretation (Areas 11, 13 & 14)
1:1,500 @ A3

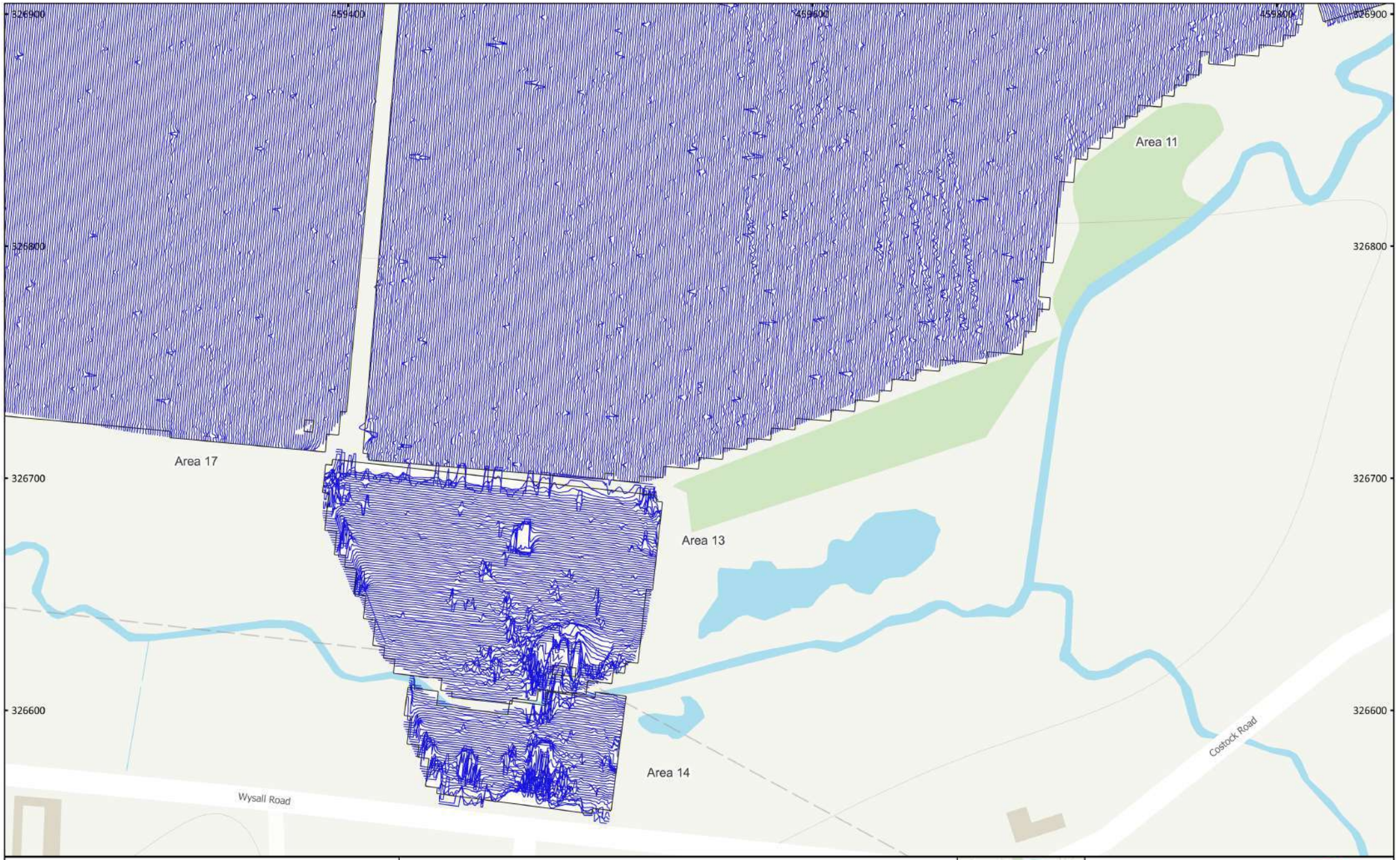
Undetermined (Strong)
Undetermined (Weak)
Ferrous/Debris (Spread)
Magnetic Disturbance
Agricultural (Trend)
Drainage Feature
Ferrous (Spike)



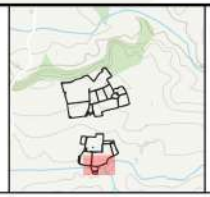
N

0 20 40 60 m

magnitude surveys



MSSK1600 - Old Wood Energy Park, Willoughby, Nottinghamshire
Figure 43 - XY Trace Plot (Areas 11, 13 & 14)
30nT/cm at 1:1,500 @ A3



N

0 20 40 60 m

magnitude surveys