

River Foss – Flood Storage Area

Heritage Statement

Appendix C – Geophysical Survey Report and Interpretative Note



**magnitude
surveys**

**Geophysical Survey Report
of
FAS Works on the River Foss, York**

**For
York Archaeological Trust**

**On Behalf of
Capita**

Magnitude Surveys Ref: MSSE463

HER Event Number: ENY8596

May 2019



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Version	Purpose/Revision	Author	Interpretation/Figures	Checked By	Date Issued
Draft 1.0	Initial Draft to line manager	Marta Fortuny BA MA Kayt Armstrong BA MSc PhD MCIFA	Marta Fortuny BA MA	Julia Cantarano Ingénieur	05 April 2019
1.1	First draft to client	Marta Fortuny BA MA	Marta Fortuny BA MA	Finnegan Pope-Carter BSc (Hons) MSc FGS	05 April 2019
Final 2.0	Final to client	NA	NA	Marta Fortuny BA MA	20 May 2019

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.73ha area of land by the River Foss, north of York. A fluxgate magnetometer survey was successfully completed, and no anomalies suggestive of significant archaeological features were identified. The geophysical data has primarily recorded the former course of the River Foss running north-south across the centre of the survey area; features associated with fluvial morphology have also been identified, such as meanders and ox-bows. The survey area is generally characterised by extensive drainage features, suggestive of longstanding and intense landscape management of the survey area. Agricultural activity has been identified in the form of known and unknown former field boundaries and modern ploughing trends. Modern interference is limited to the survey edges, underground services, pylons and overhead cables.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by York Archaeological Trust on behalf of Capita to undertake a geophysical survey on a c.73ha area of land bordering the River Foss, north of York. (NGR SE650627).
- 1.2. The geophysical survey comprised hand-pulled, cart-mounted and hand-carried GNSS-positioned fluxgate magnetometer survey.
- 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, 2014) and the European Archaeological Council (Schmidt et al., 2015).
- 1.4. The survey followed the Written Scheme of Investigation (WSI) issued by MS and approved by the client in March 2019 (MS 2019).
- 1.5. The survey commenced on 18/03/2019 and took seven days to complete.

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 of Archaeological Prospection).
- 2.2. Director Dr. Chrys Harris is a Member of CIfA, has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of ISAP. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Reporting Analyst Dr. Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is the Vice Conference Secretary and Editor of ISAP News for ISAP, and is the UK Management Committee representative for the COST Action SAGA.
- 2.3. All MS managers have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

3. Objectives

- 3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located on either side of the floodplain of a canalised section of the River Foss approximately 11km north of the city of York (Figure 1). Survey was undertaken over multiple arable fields, bounded on the west by a trackway, bisected by the River Foss (running NS through the survey area), and bounded on the north eastern side by Lilling Low Lane. South of this point the survey area boundary crosses two fields, before being constrained by drainage ditches to the southern tip of the area. At the very north eastern boundary, there are thin strips of land on the eastern side of Lilling Low Lane. The survey area is flat and low-lying, with gentle slopes towards the river on both sides. (Figure 2). An area east of Lilling Low Lane (see below and Figure 2) could not be surveyed due to an oilseed rape crop that prevented access.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Mostly flat with short vegetation, patches of more recent ploughing in north and on eastern side of area.	Bounded on the east by the river, on the west by a farm track and to the north by a hedge, separating this area from Area 2. Bisected at its narrowest part by a line of telegraph poles. Ponds bordered by trees interrupt the survey in various places. There are also boreholes and wetter patches within the area.
2	Flat with short stubble.	Bounded to the northwest and southeast by hedges, to the northeast by the river and to the southwest by a farm track.
3	Flat with a young cereal crop, 10-20cm.	Area north and east of Area 2. Bounded to the south west by the River Foss, to the northwest the survey boundary crosses the open field. Bounded to the northeast by a drainage ditch, and to the southeast the area boundary crosses the field at the same point as a change in ploughing direction. A power line on large pylons runs outside along the eastern boundary. There is a raised manhole within the survey area, and there is a short row of trees in the southeast.
4	Flat with a young cereal crop, 10-20cm	Long narrow survey area with the long axis running north-south, western boundary is the River Foss. The eastern boundary is a drainage ditch. The northern boundary of the area is flush with Area 3: the change in Area / walking orientation is due to a change in the ploughing orientation at this point. The area is crossed by a run of telegraph poles. There are also boreholes and a short trench.
5	Flat, no crop.	Bisected by footpath running north-south; multiple small obstacles to survey in the form of ponds, reed beds, wet ground and wood piles.
6	Flat, mostly covered by young cereal crop c10-20cm tall. In the middle of the southern	The survey area excludes (at the northern part) an area under and around overhead powerlines carried on metal pylons. To the east/south, a

	edge there is a patch of grassland due to various different plantings across an un-bounded area.	pylon is included within the survey boundary. The area is bounded on the east by Lilling Low Lane, to the west by a drainage ditch (that borders Areas 3-5). To the south east the survey area boundary crosses open fields. The northern boundary is a ditch with a trackway running alongside it. The very southern tip of the area is bounded by a farm track, however this area also contains farm machinery and soil dumps, and so was not surveyable. There is a pond / wet area in the northern part of the block. There are also boreholes.
7	Flat with short cereal crop, c15-25cm.	Thin strip along the western boundary of Lilling Low Lane. Open field to the west, bounded by a treeline with a wire fence to the north, a hedge and tree line along the road edge and to the south by a drainage ditch and trackway.
8	Flat grass gallop.	Thin strip along the eastern border of Lilling Low Lane, opposite the southern half of Area 7. Bounded to the west along the road by hedging and a fence, to the south by a drainage ditch, to the east by open field, and to the north by a small unsurveyable patch of cleared and burned wood.
9	Flat stubble.	Thin strip along the eastern border of Lilling Low Lane, opposite the northern half of Area 7. Bounded to the west along the road by hedging, to the south hedging and a fence, to the east by open field, and to the north by a drainage ditch. There is a metal gate in the NW corner.
10	Flat with a young cereal crop of c30-40cm.	Thin strip to the north of Lilling Low Lane, bounded by a hedge along the road and open field to the west and north, and a drainage ditch (bordering Area 9) to the south/east. There is a metal gate in the SE corner.
11	Flat with a young cereal crop of c20-30cm.	Thin strip to the south of Lilling Low Lane, no boundary on the road and open fields to the west and south. Bounded by a tree line with a wire fence on the south (bordering Area 7).

4.3. The underlying geology comprises Mercian Mudstone. Superficial deposit in Area 1 is underlain by the Sutton Sand Formation to the west, transitioning to Alluvium along the eastern edge following the river. This alluvium also underlies Areas 2-5, apart from the eastern edge of Area 3. Here, there is a transition to the Alne glaciolacustrine formation of silty clay, which also underlies Areas 6-11. (British Geological Survey, 2019).

4.4. The soils consist of naturally wet and very acid sandy and loamy soils to the west of Areas 1 and 2, the east of Area 6 and all of Areas 7-11. Loamy and clayey floodplain soils with naturally high groundwater lie across the east of Areas 1 and 2, all of Areas 3, 4 and 5 and the west of Area 6. (Soilscapes, 2019).

5. Archaeological Background

- 5.1. This information is taken from a report on previous geoarchaeological test pitting within the survey area provided to MS by the client (YAT, 2018).
- 5.2. The Vale of York was a major lake formed during the retreat of the last glaciers c. 12,000 years BP. As this lake slowly drained it created a landscape of mires, moorland and higher points that would have attracted Mesolithic human activity.
- 5.3. Very little is known about this area until the establishment of the Roman fortress at York, 12km to the south-west, but elsewhere in the Vale of York Iron Age settlements have been identified on areas of slightly raised ground bordered by marshes and, in this case, the early River Foss.
- 5.4. Geo-technical investigation has revealed potential earlier courses of the River Foss. If these are present, they could retain good environmental evidence of previous land use and human activity.
- 5.5. The site lies c.2.5km north-east of the village of Strensall. A settlement is recorded in Domesday and thought by some to be associated with a 9th century reference to a place called 'Streonaeshalch'. It is mentioned in conjunction with the AD 664 Synod of Whitby where the early Christian church of the Kingdom of Northumberland adopted a style of worship influenced by Rome rather than one developed in Ireland.
- 5.6. The deserted medieval settlement of East Lilling lies 2km to the north-east of the site.
- 5.7. The River Foss was canalised from its confluence with the River Ouse in York to Sheriff Hutton Bridge in the 1780s. The present course of the river derives from this period. The Navigation was closed up-stream of Layerthorpe in York by 1850.
- 5.8. The available historical mapping shows the development of the area from a mid 19th century enclosed landscape of small fields through gradual amalgamation to the larger agricultural fields currently present.

6. Methodology

6.1. Data Collection

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

6.1.2. 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

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system and hand-carried GNSS-positioned system.

6.1.3.1. MS' cart and hand-carried 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.

6.1.3.2. 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.

6.1.3.3. 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 Historic England's standards for "raw or minimally processed data" (see sect 4.2 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 upper and/or 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 at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (FIGURES 8, 11, 14, 17, 20, 23, 26 and 29). XY trace plots visualise the magnitude and form of the geophysical response, aiding in 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, historic maps, LiDAR data, and soil and geology maps. Google Earth (2019) was consulted as well, to compare the results with recent land usages.
- 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 will be 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 of further work in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with historic maps (Figure 5).

7.2.2. The fluxgate magnetometer survey has responded well to the environment of the survey area, with magnetic interference of modern origin being limited to the edges of the fields, underground services recorded in the east and pylons and overhead cables identified in the north-east. The magnetic data is characterised by a relatively quiet magnetic background, allowing for the identification of weaker, more ephemeral anomalies, such as the former course of the River Foss. This broad anomaly has been categorised as 'Palaeochannel / Natural (Spread)' in the interpretation drawings (Figure 4) as it exhibits the typical morphology of these fluvial features, such as braiding, meanders and evidence of former ox-bows.

7.2.3. The general survey area is characterised by extensive drainage features. These are recorded in multiple orientations and patterns. In the north and east of the survey area, this multi-orientation occurs in the same place. This is suggestive of an intensive and prolonged regime of land management of the area.

7.2.4. Further anomalies of agricultural origin have been recorded throughout the survey area. These consist of known and unknown former field boundaries, some of which have been interpreted as being filled with mixed highly magnetic debris.

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. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures along the edges of the field and by services that cross the survey area have been classified as ‘Magnetic Disturbance’. These magnetic ‘haloes’ will obscure the response of any weaker underlying features, should they be present, often over a greater footprint than the structure they are being caused by.
- 7.3.1.3. **Ferrous (Spike)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of isolated modern metallic debris on or near the ground surface.
- 7.3.1.4. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentrated deposition of discrete, dipolar ferrous anomalies and other highly magnetic material.
- 7.3.1.5. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant 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 not ferrous in nature.

7.3.2. Magnetic Results - Specific Anomalies

- 7.3.2.1. **Agricultural (Strong) / Drainage Feature** – In the north-east of Area 4, two groups of parallel linear anomalies [4a] have been recorded. These stand out as positive strong anomalies in comparison to the quiet magnetic surroundings. They have been interpreted as drainage features, possibly associated with the canalisation of the River Foss, which appears to have been straightened along parts of its course in this area. Further anomalies of similar magnetic signal have been recorded in the west of Area 3 [3a] (Figure 10) and across Area 10 [10a] (Figure 7).
- 7.3.2.2. **Drainage Feature** – In the north-west of Area 6, a contained zone [6a] has been identified as being crossed by numerous drainage features, in multiple directions. This is suggestive of prolonged and/or more aggressive draining management of this zone.
- 7.3.2.3. **Industrial/Modern (Spread)** – Adjacent to the eastern boundary of Area 1, a distinct sub-rectangular anomaly [1a] has been identified. It exhibits a spread of ferrous-type dipolar material in the XY traces (Figure 23), with two further spreads of debris recorded to the north-west and south-west of [1a]. This anomaly is well correlated with an area of marsh or bog, possibly enclosed, depicted in the 2nd ed OS map (Figure 5). Considering the numerous ‘Old Marl

Pits' recorded within the immediate proximity to [1a] on the same historic maps, an industrial origin related to the extraction of marl or clay has been considered likely.

8. Conclusions

- 8.1. A fluxgate magnetometer survey has successfully been completed across the site. The survey results present a quiet magnetic background, allowing for the identification of weaker anomalies related to the former course of the River Foss. This palaeochannel has been recorded running north-south across the centre of the survey area, characterised by anomalies typical of fluvial features such as meanders and ox-bows.
- 8.2. Extensive drainage features have been recorded throughout the survey area, suggesting intense and prolonged landscape management of the site. Further agricultural activity has been identified in the form of known and unknown former field boundaries and weak modern ploughing trends.

9. Archiving

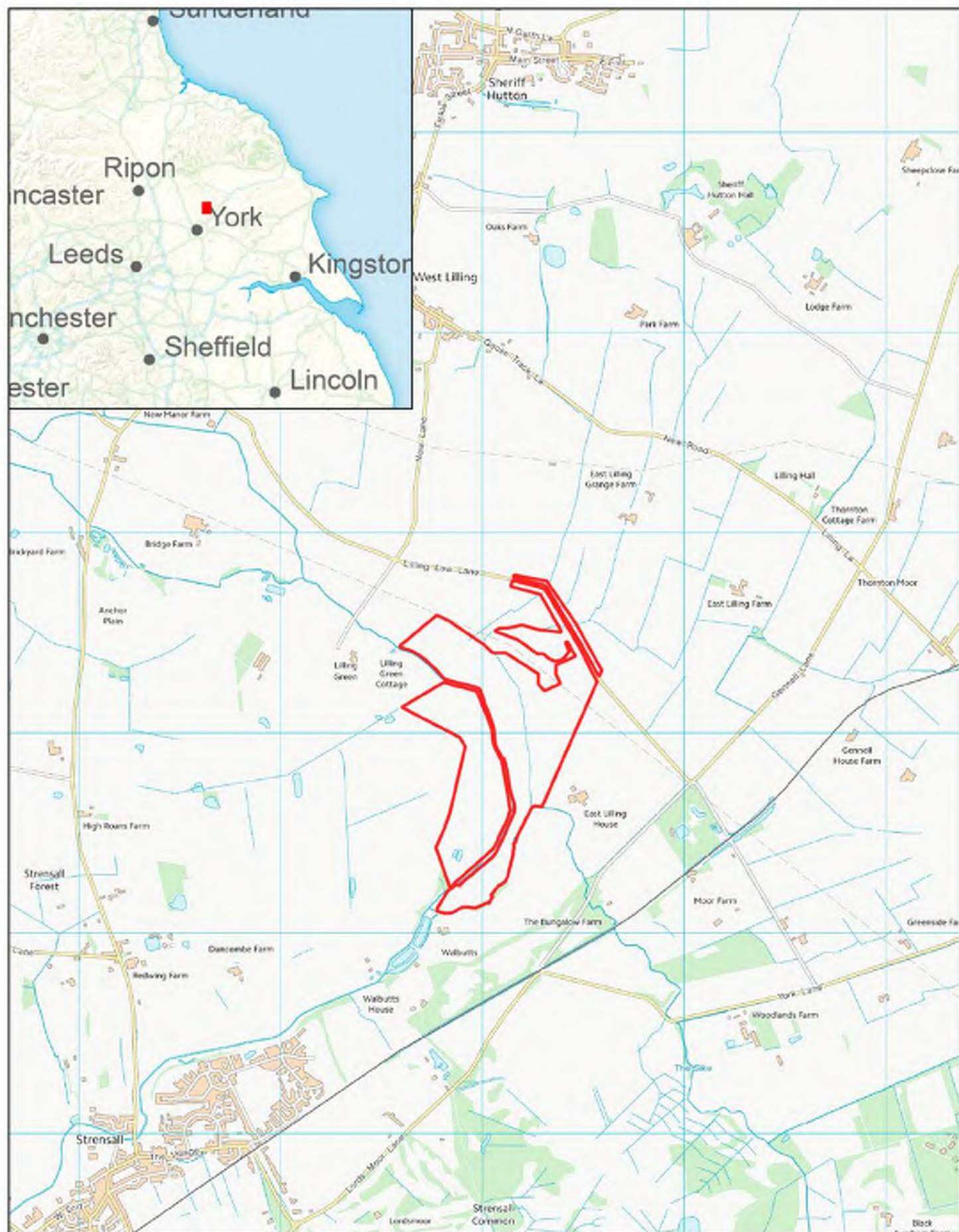
- 9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.
- 9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

10. Copyright

- 10.1. Copyright and the 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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MSSE463 - York EA Flood Cell 11

Figure 1 - Site Location

1:25,000 @ A4

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OS (100056946)

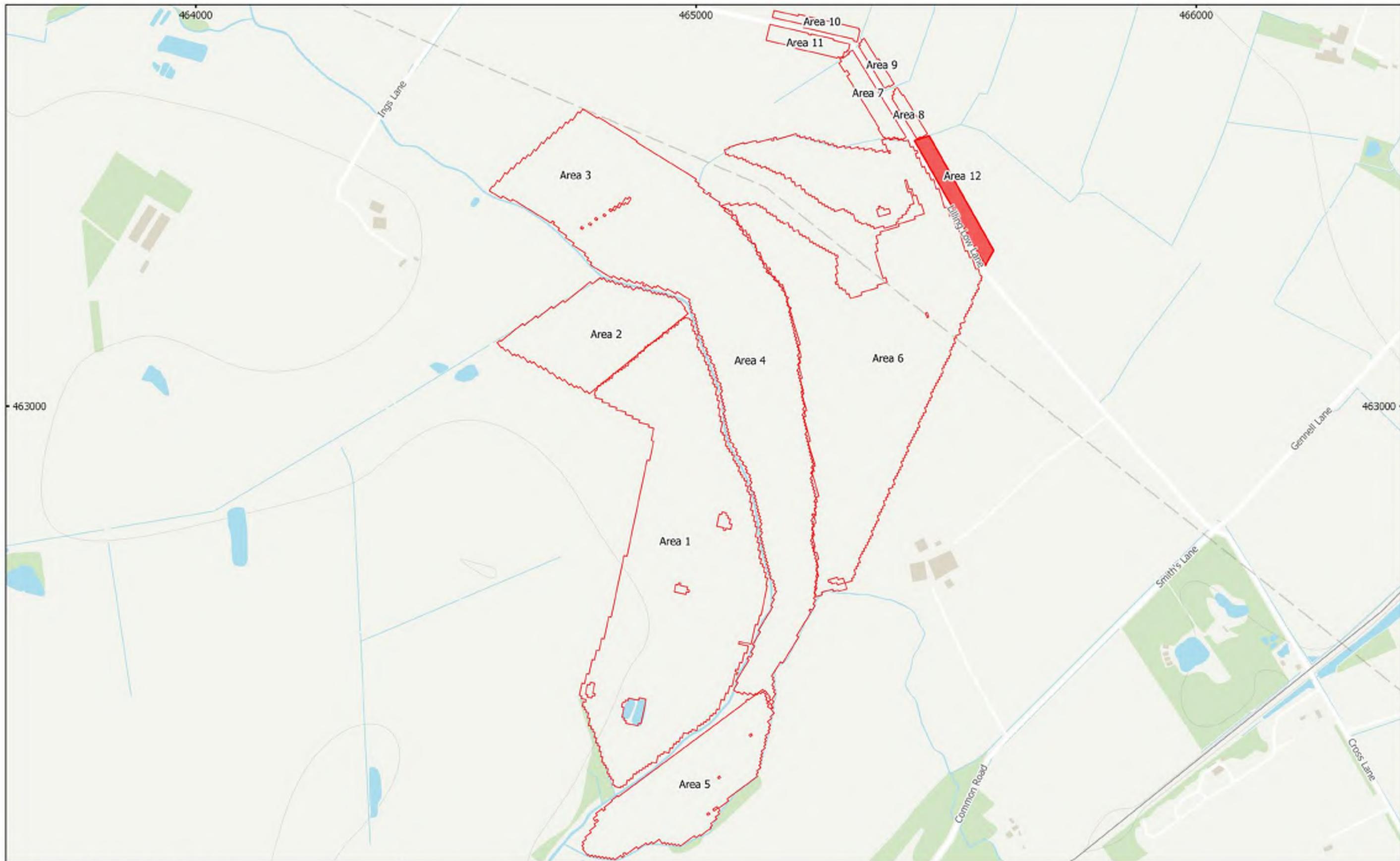
 Site Boundary



0 0.5 1 km

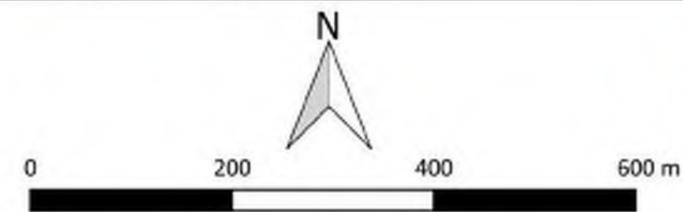


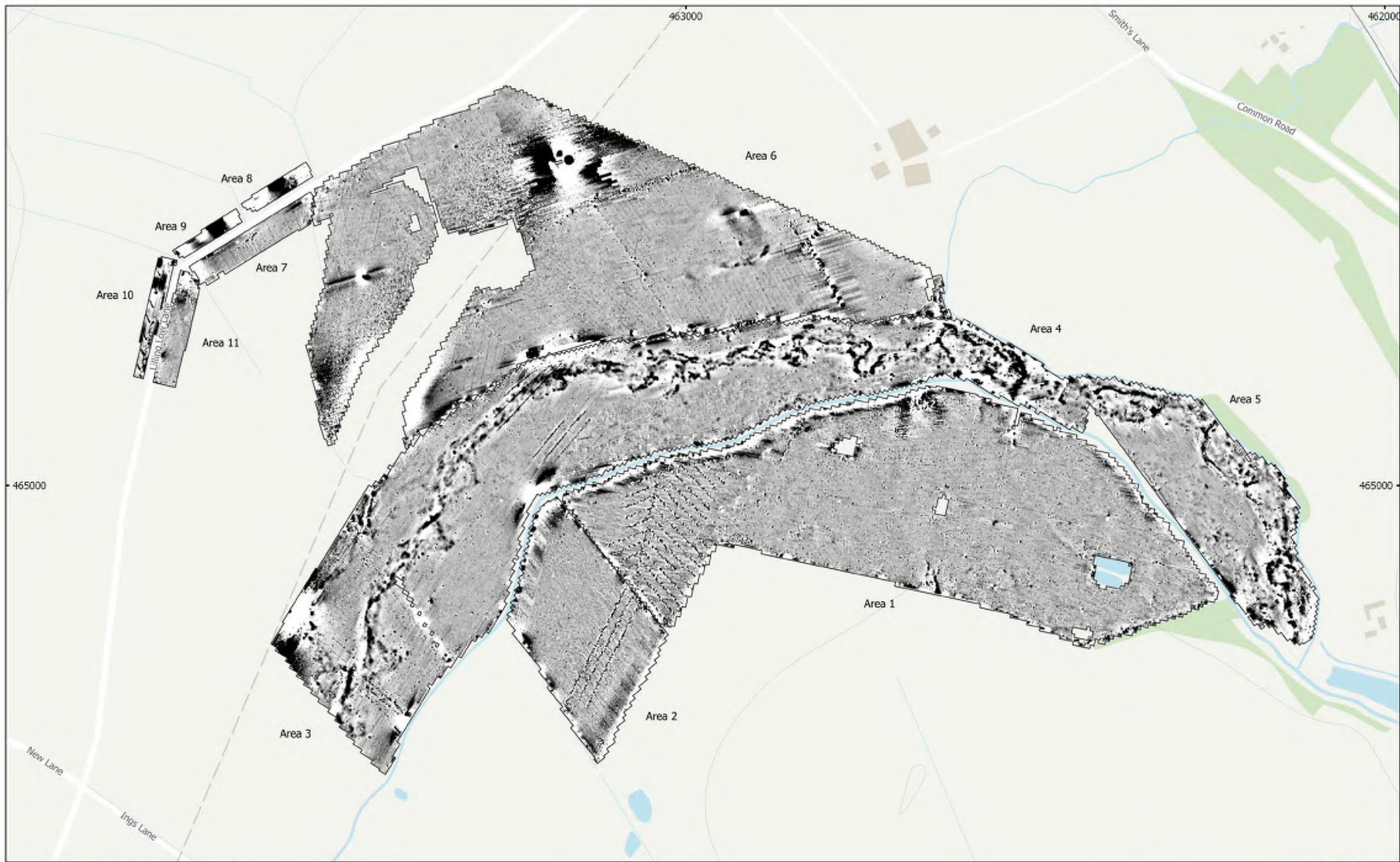
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MSSE463 - FAS works on the River Foss, York
 Figure 2 - Location of Survey Areas
 1:7,000 @ A3
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- Survey Extent
- Unsurveyable

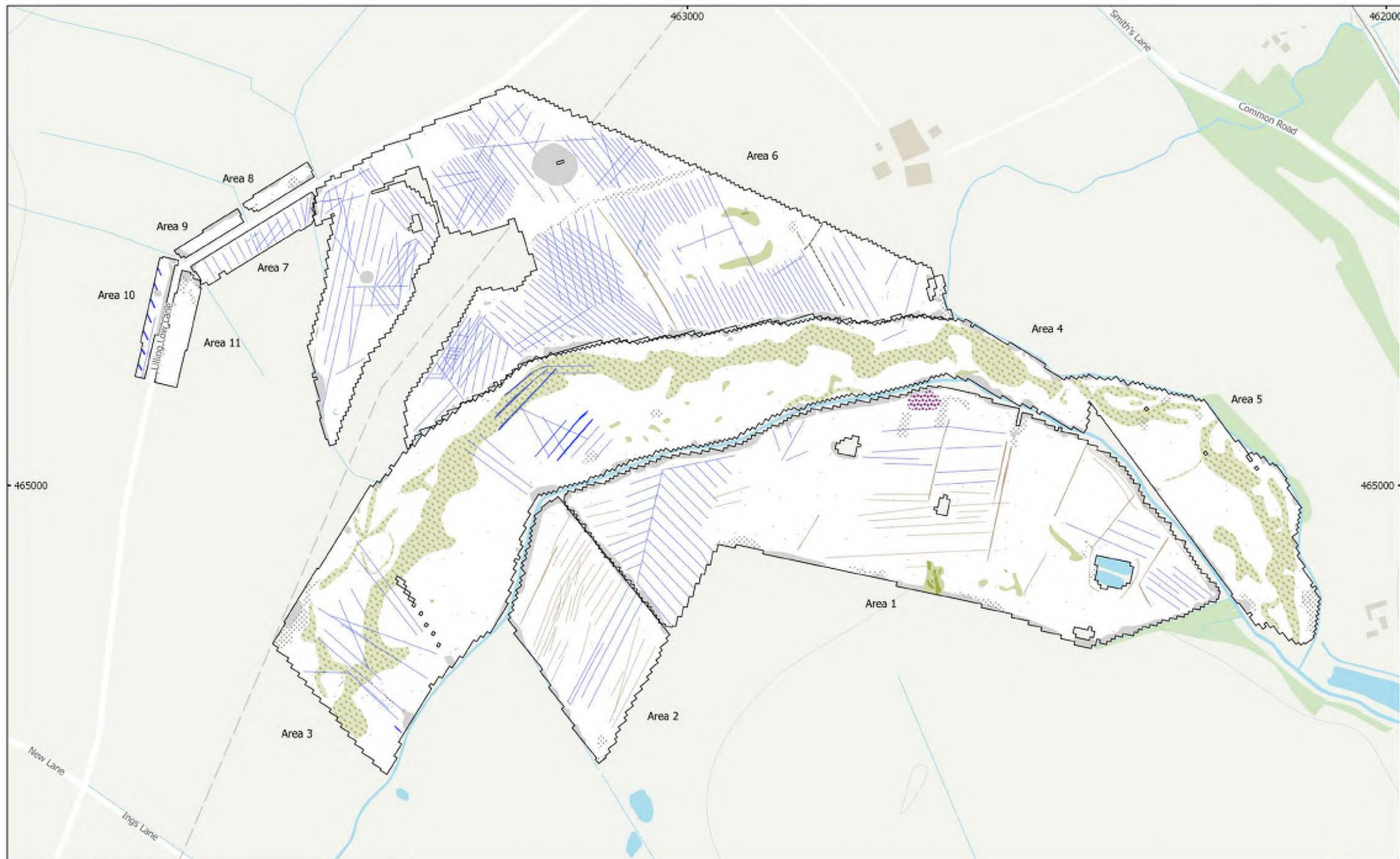




MSSE463 - FAS works on the River Foss, York
 Figure 3 - Magnetic Total Field (Lower Sensor) (Overview)
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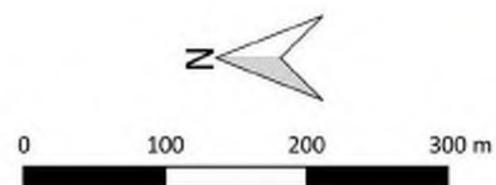


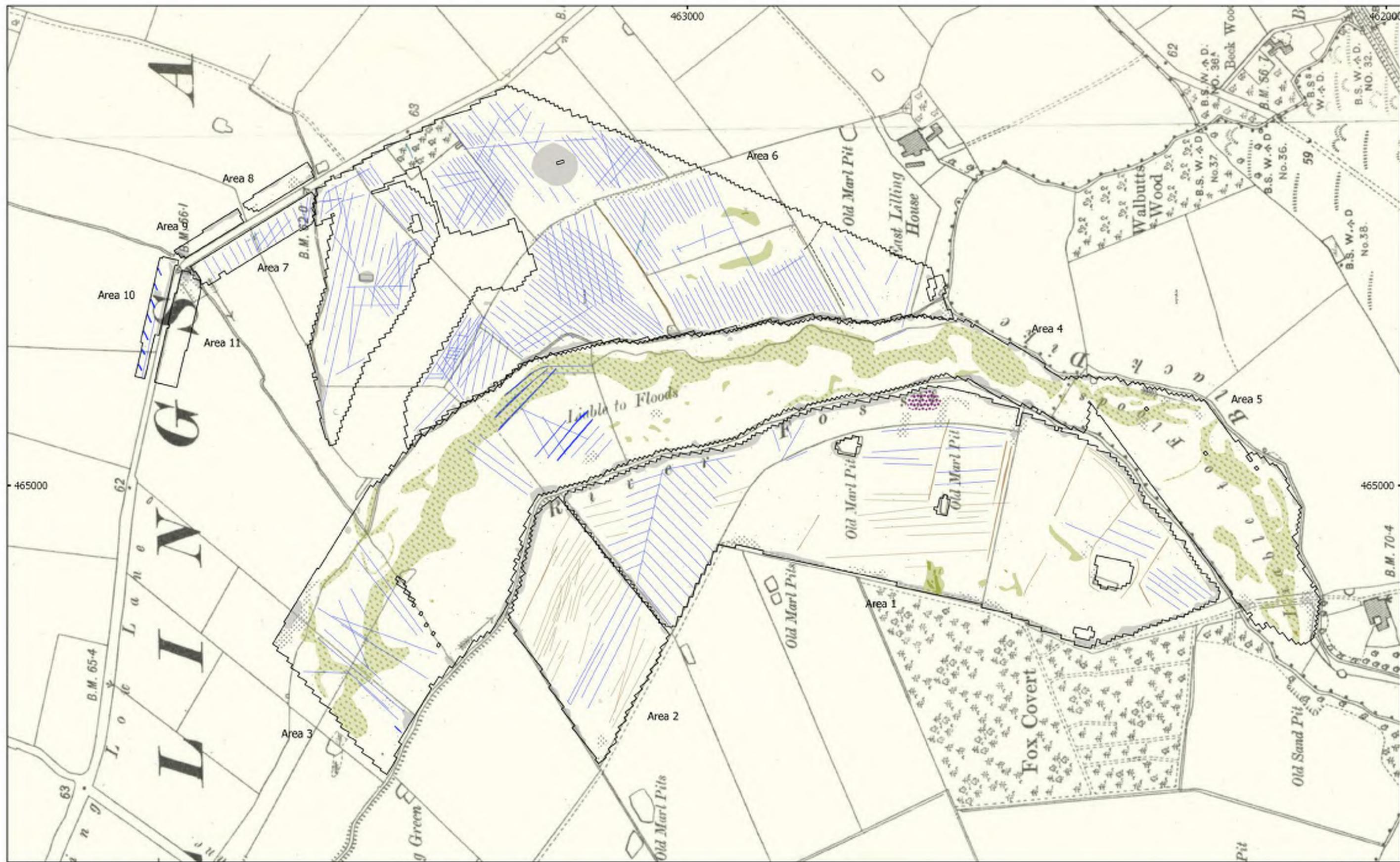
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surveys



MSSE463 - FAS works on the River Foss, York
 Figure 4 - Magnetic Interpretation (Overview)
 1:5,000 @ A3
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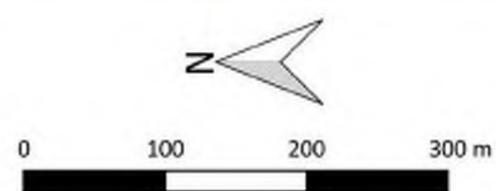
- | | | |
|--|----------------------------|------------------|
| Agricultural (Strong) / Drainage Feature | Natural (Strong) | Service |
| Agricultural (Weak) | Natural (Weak) | Drainage Feature |
| Magnetic Disturbance | Undetermined (Weak) | Ferrous (Spike) |
| Ferrous/Debris (Spread) | Industrial/Modern (Spread) | |
| Palaeochannel / Natural (Spread) | Agricultural (Trend) | |

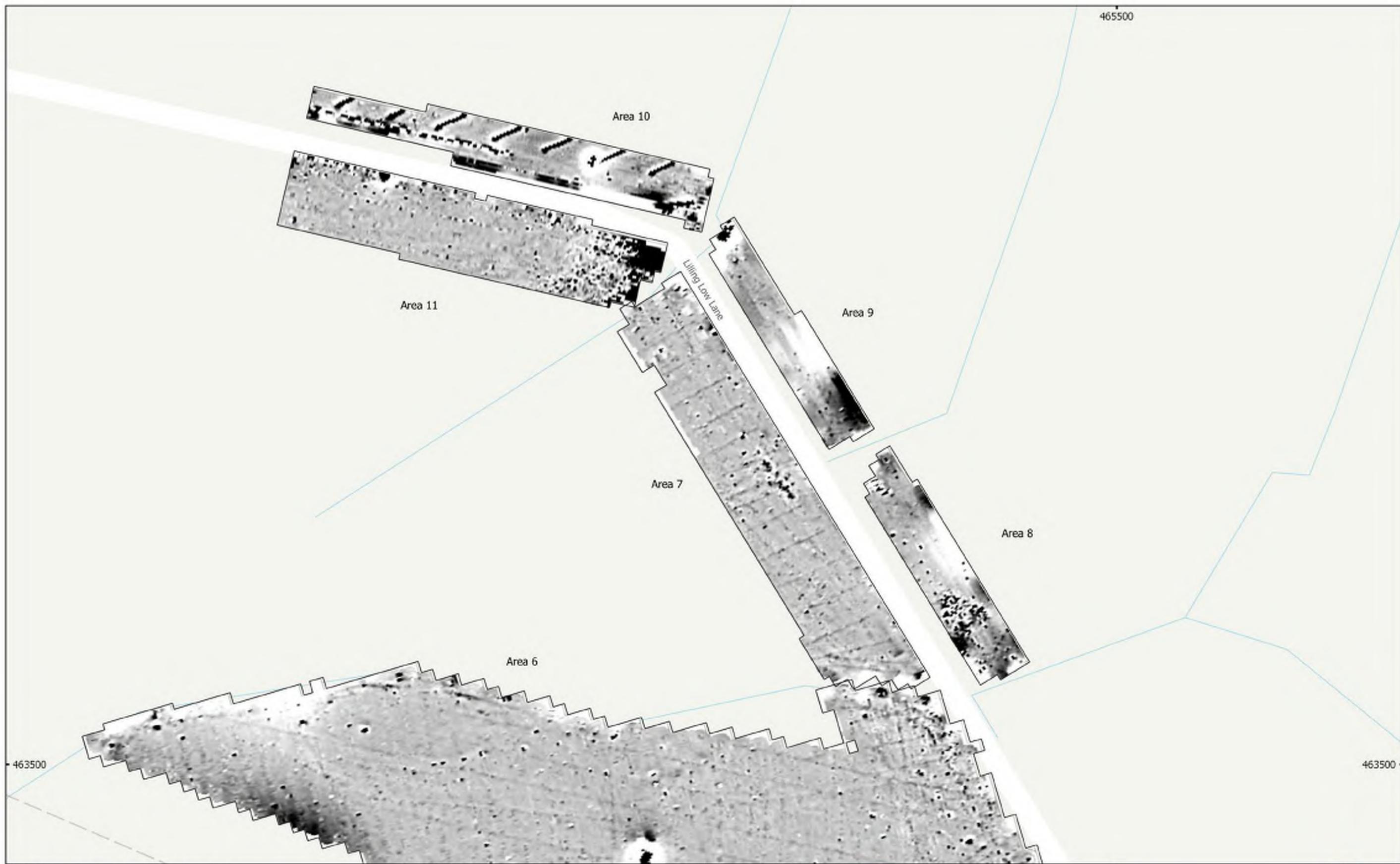




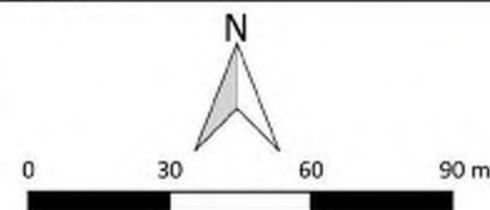
MSSE463 - FAS works on the River Foss, York
 Figure 5 - Magnetic Interpretation Over Historic Maps (Overview)
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 Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 ©
 National Library of Scotland

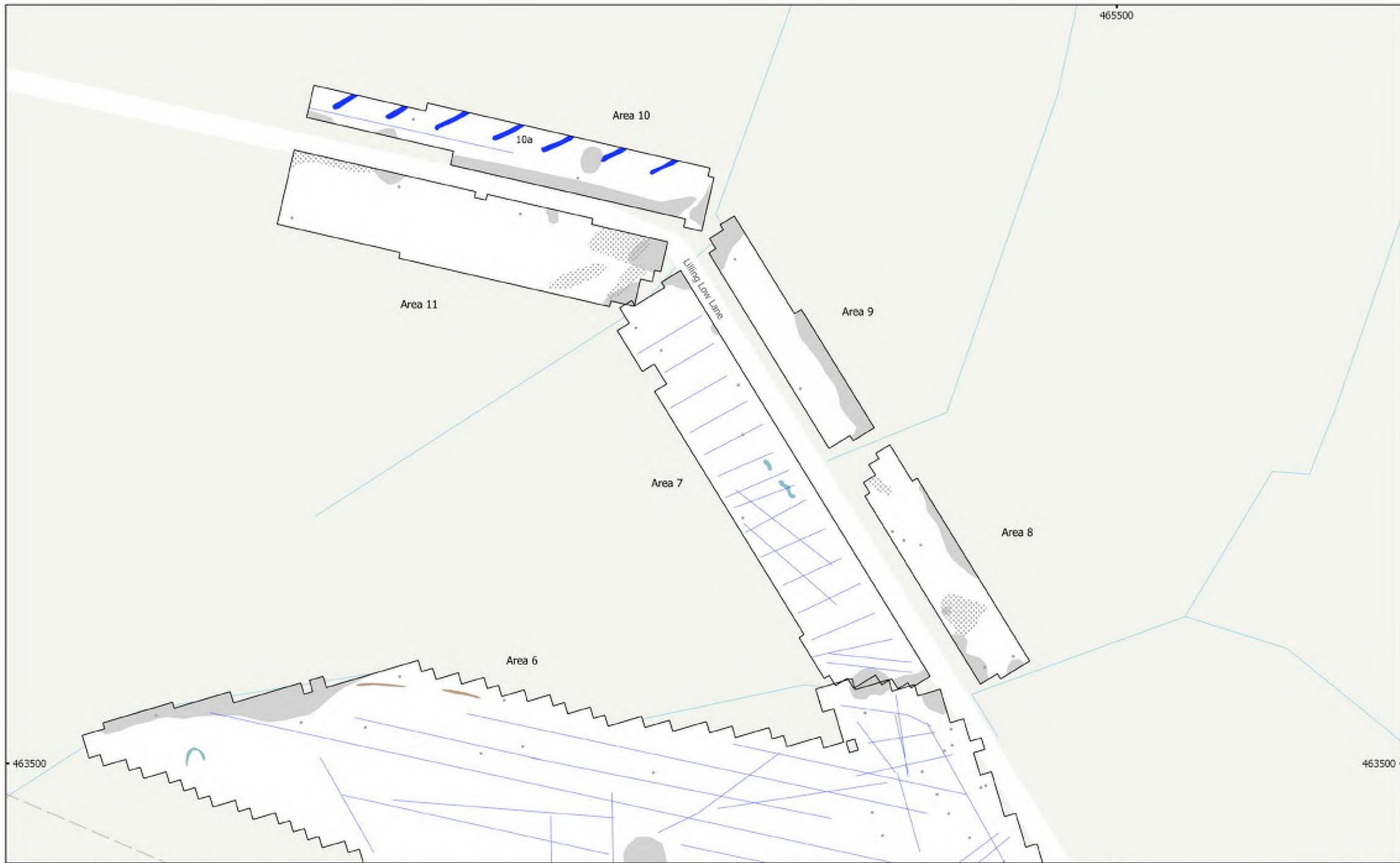
- | | | |
|--|----------------------------|------------------|
| Agricultural (Strong) / Drainage Feature | Natural (Strong) | Service |
| Agricultural (Weak) | Natural (Weak) | Drainage Feature |
| Magnetic Disturbance | Undetermined (Weak) | Ferrous (Spike) |
| Ferrous/Debris (Spread) | Industrial/Modern (Spread) | |
| Palaeochannel / Natural (Spread) | Agricultural (Trend) | |





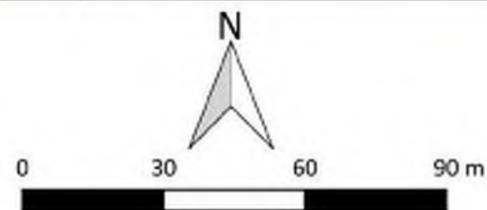
MSSE463 - FAS works on the River Foss, York
 Figure 6 - Magnetic Gradient (North)
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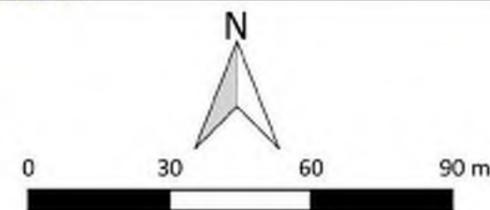
MSSE463 - FAS works on the River Foss, York
 Figure 7 - Magnetic Interpretation (North)
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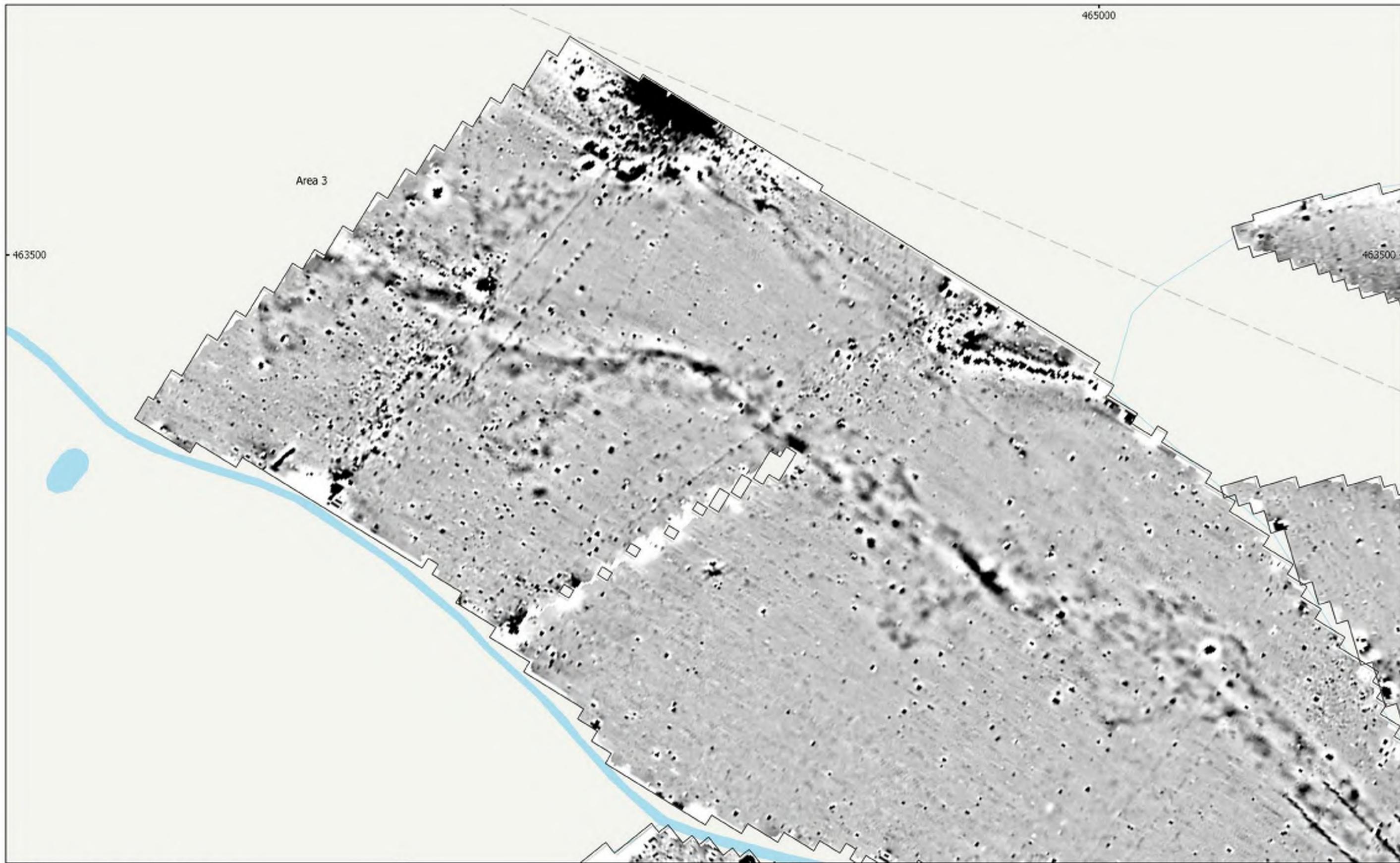
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|---|--|---|------------------|
|  | Agricultural (Strong) / Drainage Feature |  | Drainage Feature |
|  | Agricultural (Weak) |  | Ferrous (Spike) |
|  | Magnetic Disturbance | | |
|  | Ferrous/Debris (Spread) | | |
|  | Undetermined (Weak) | | |



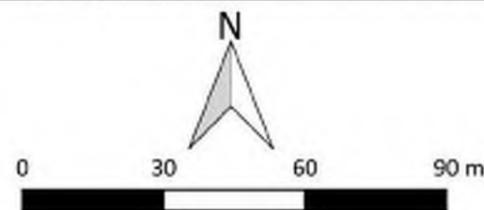


MSSE463 - FAS works on the River Foss, York
 Figure 8 - XY Trace Plot (North)
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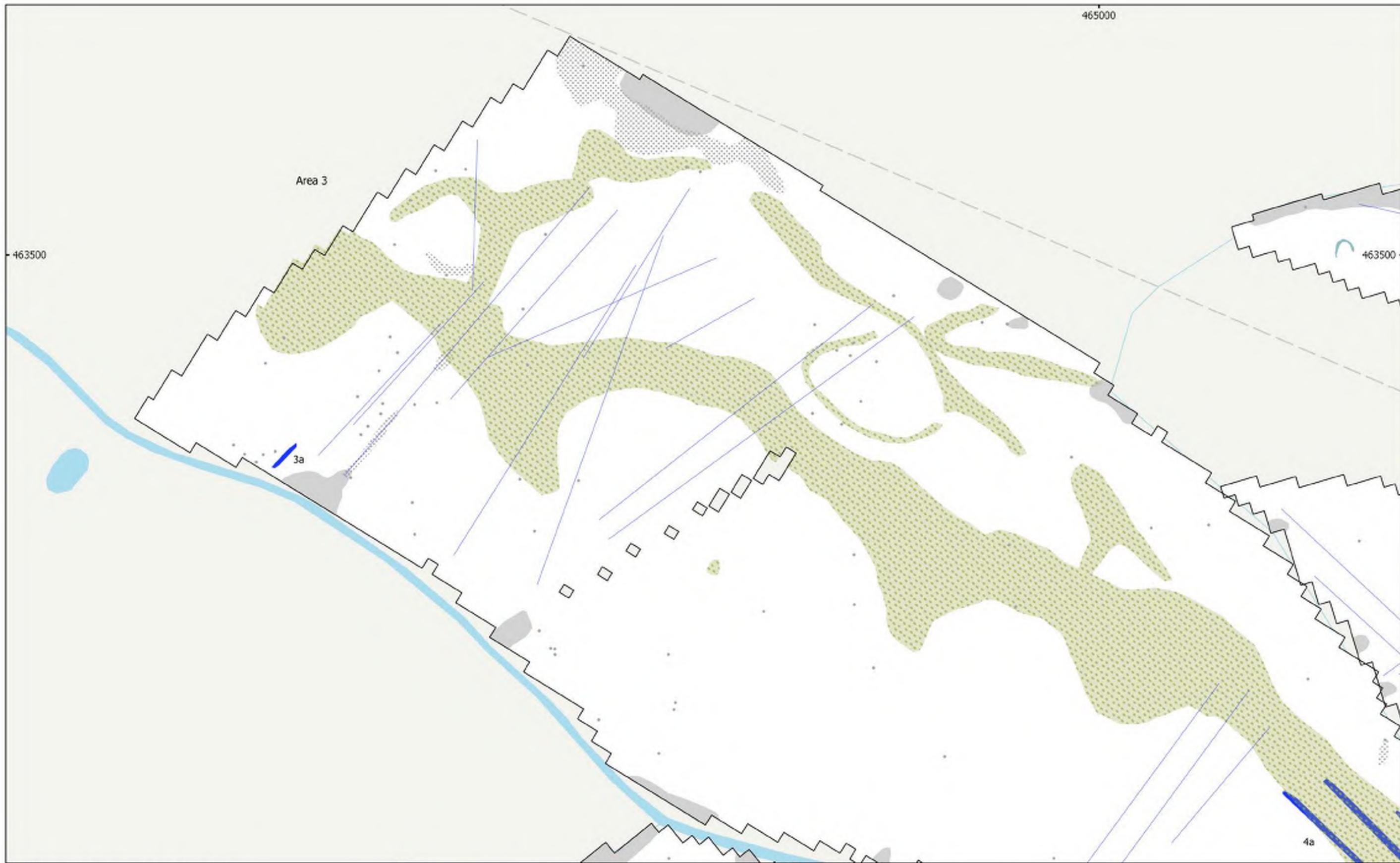




MSSE463 - FAS works on the River Foss, York
Figure 9 - Magnetic Gradient (North-West)
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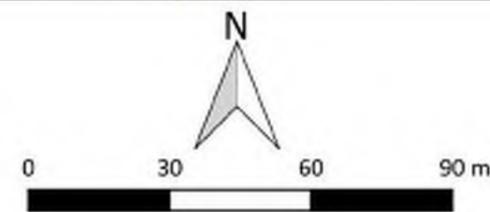


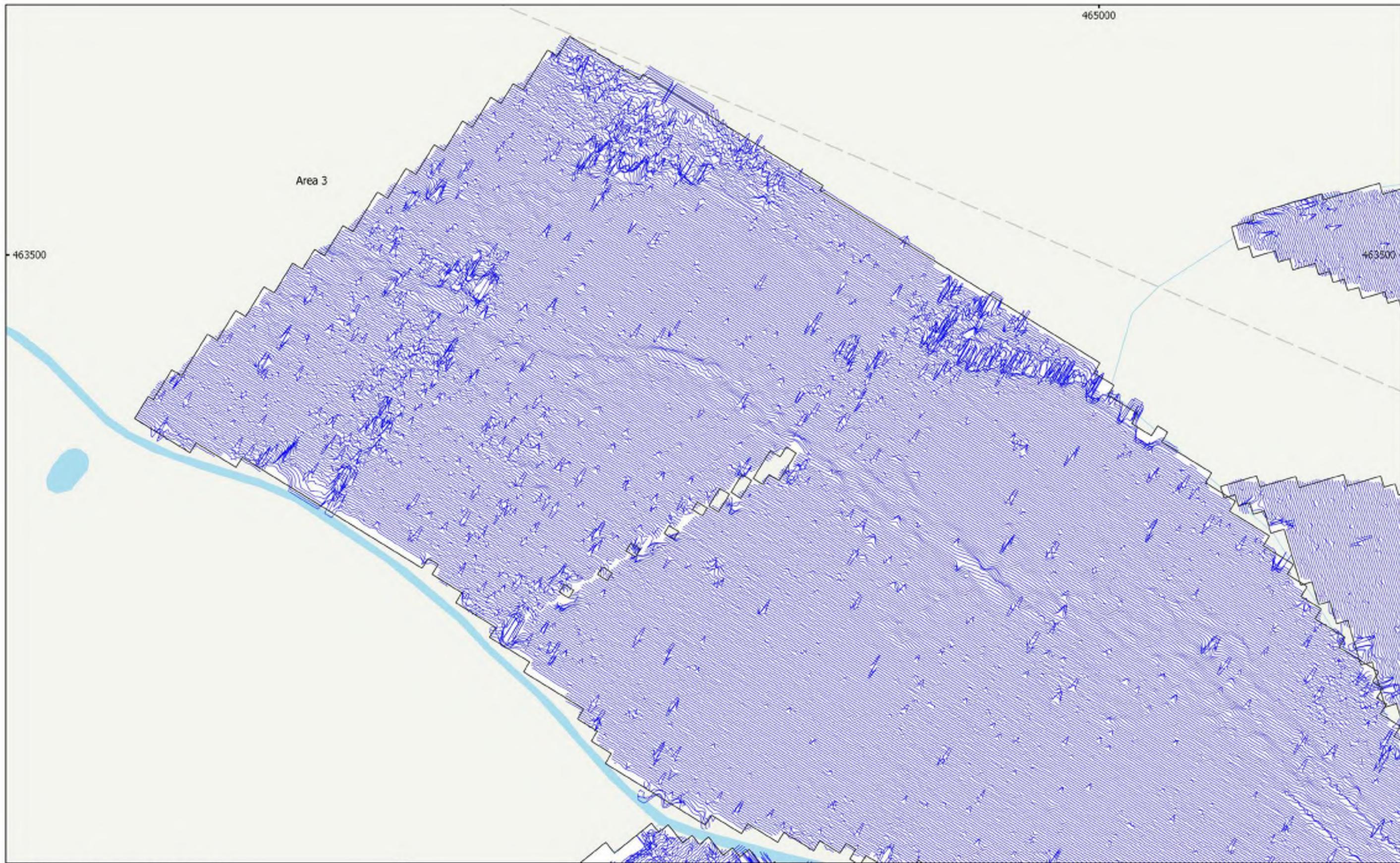
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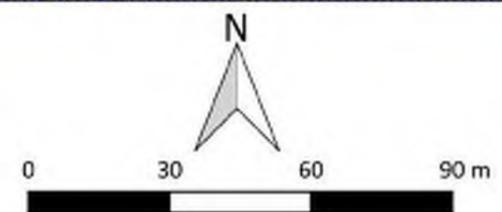
MSSE463 - FAS works on the River Foss, York
 Figure 10 - Magnetic Interpretation (North-West)
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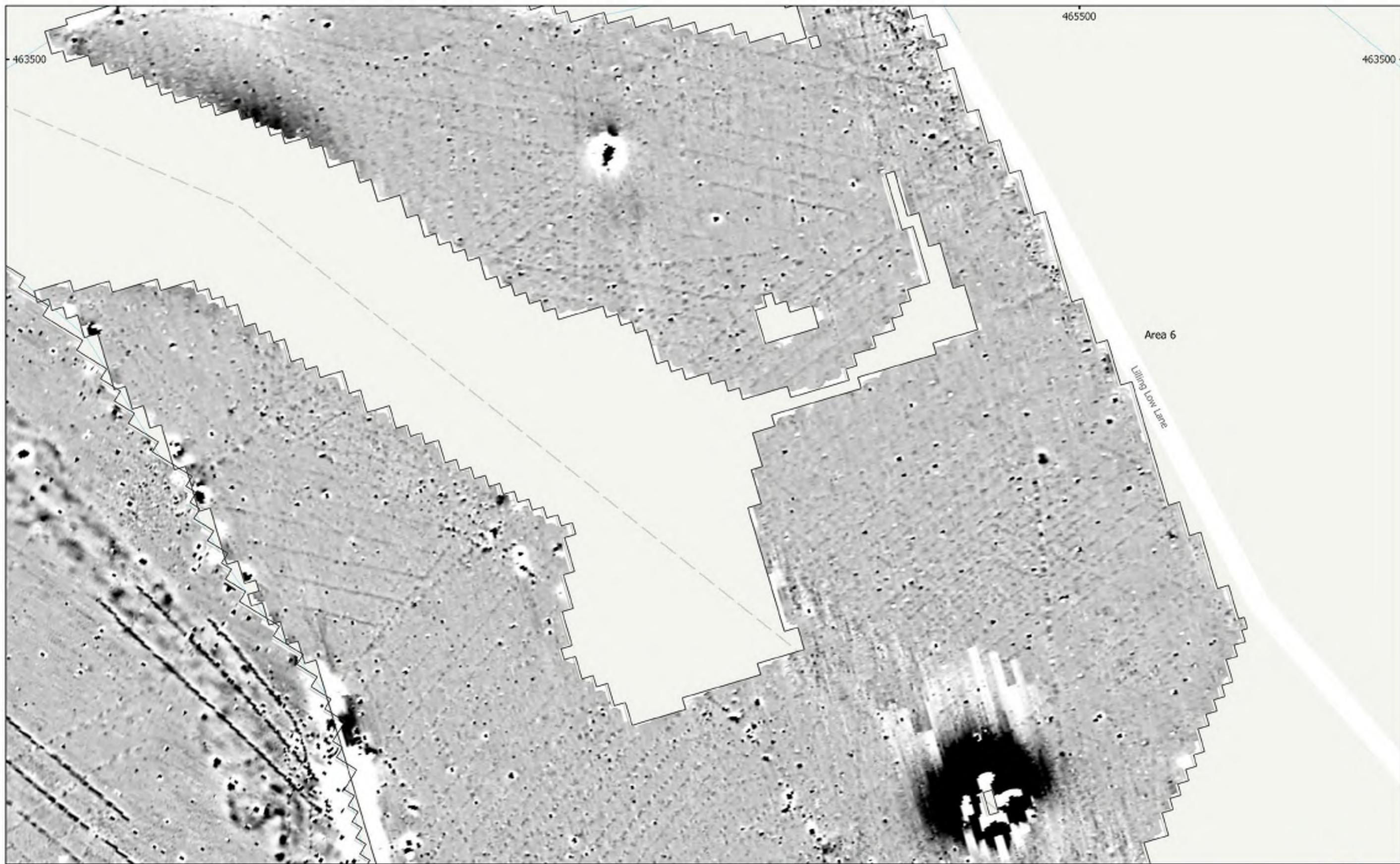
- | | | | |
|---|--|---|------------------|
|  | Agricultural (Strong) / Drainage Feature |  | Drainage Feature |
|  | Agricultural (Weak) |  | Ferrous (Spike) |
|  | Magnetic Disturbance | | |
|  | Ferrous/Debris (Spread) | | |
|  | Palaeochannel / Natural (Spread) | | |
|  | Undetermined (Weak) | | |



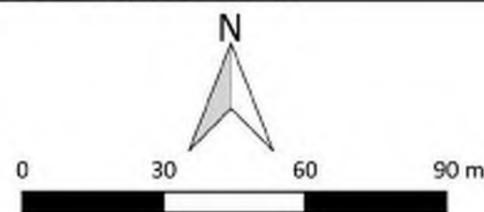


MSSE463 - FAS works on the River Foss, York
Figure 11 - XY Trace Plot (North-West)
30nT/cm @ 1:1,500 @ A3
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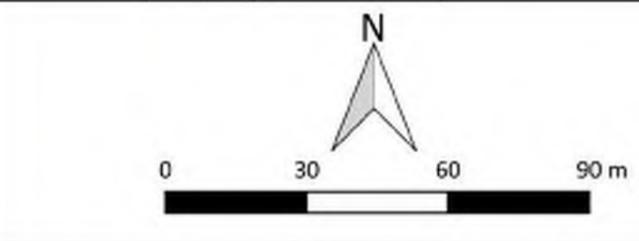
MSSE463 - FAS works on the River Foss, York
Figure 12 - Magnetic Gradient (North-East)
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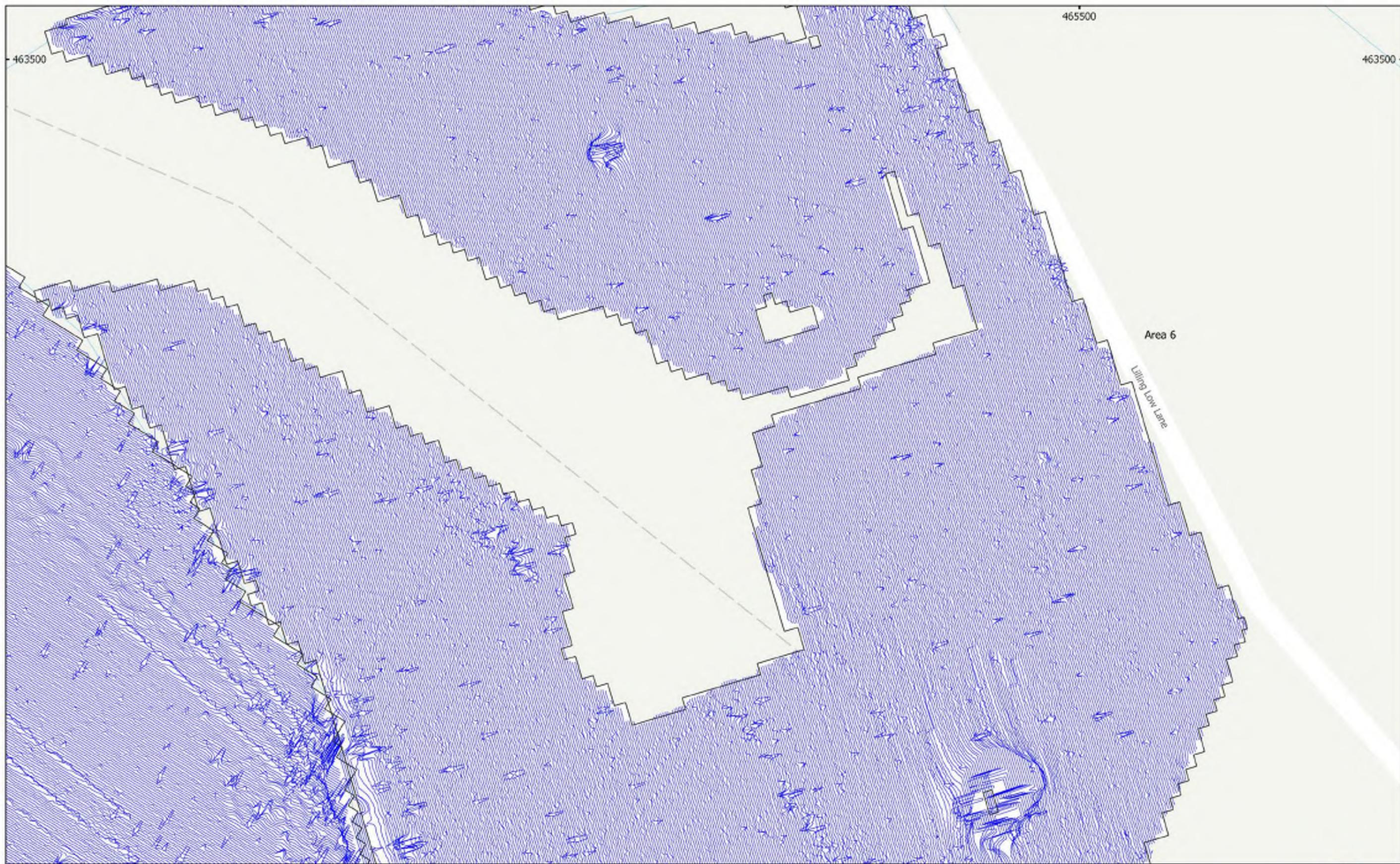




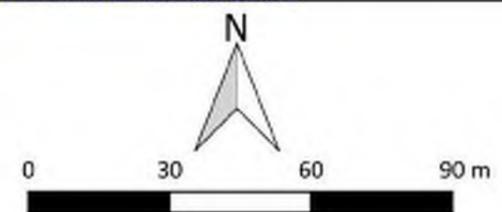
MSSE463 - FAS works on the River Foss, York
 Figure 13 - Magnetic Interpretation (North-East)
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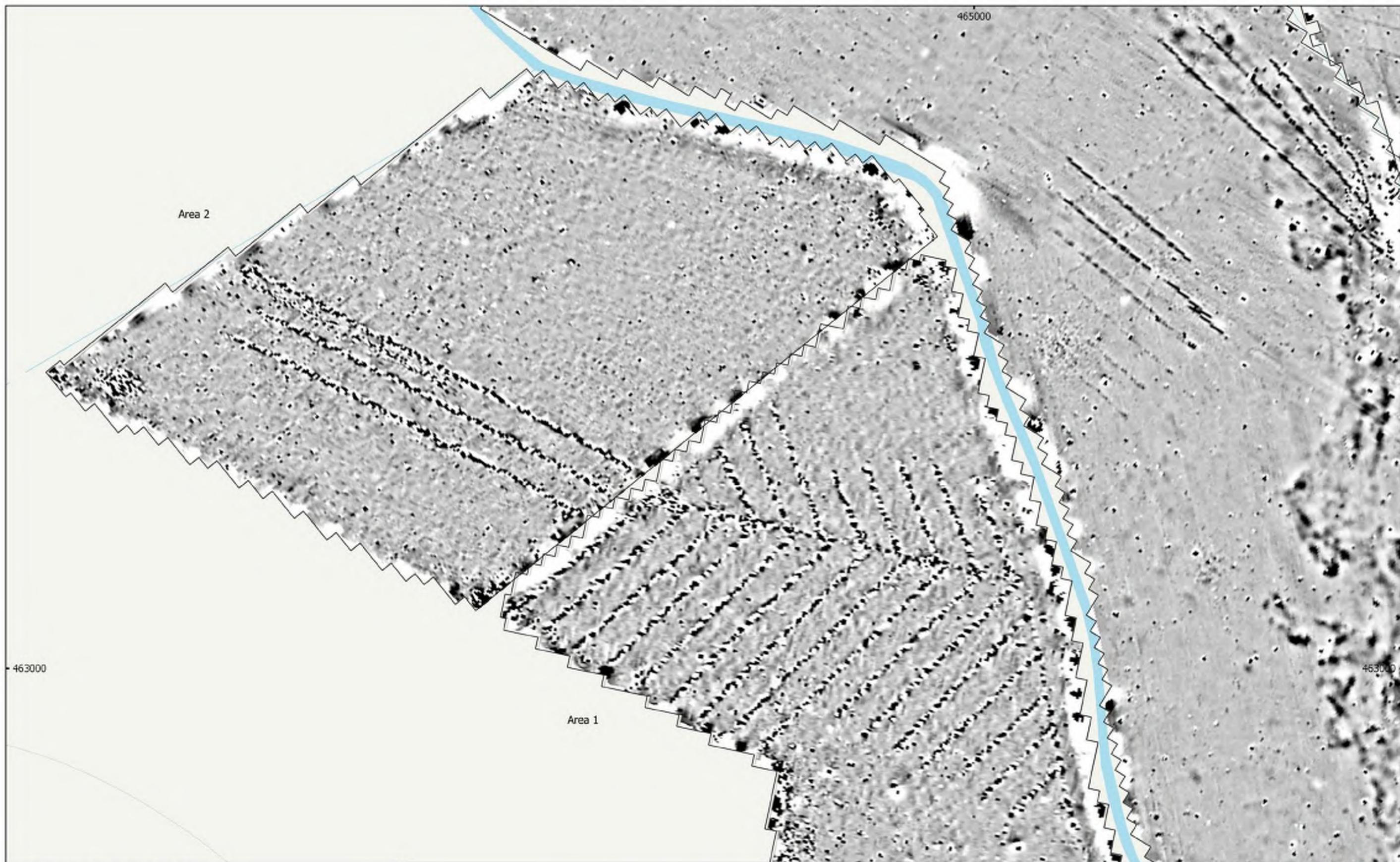
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|  Agricultural (Strong) / Drainage Feature |  Drainage Feature |
|  Magnetic Disturbance |  Ferrous (Spike) |
|  Ferrous/Debris (Spread) | |
|  Palaeochannel / Natural (Spread) | |
|  Undetermined (Weak) | |



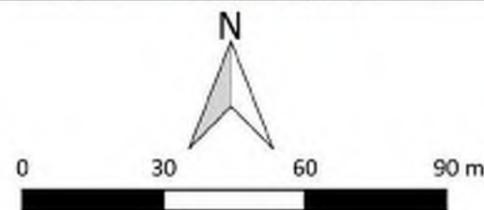


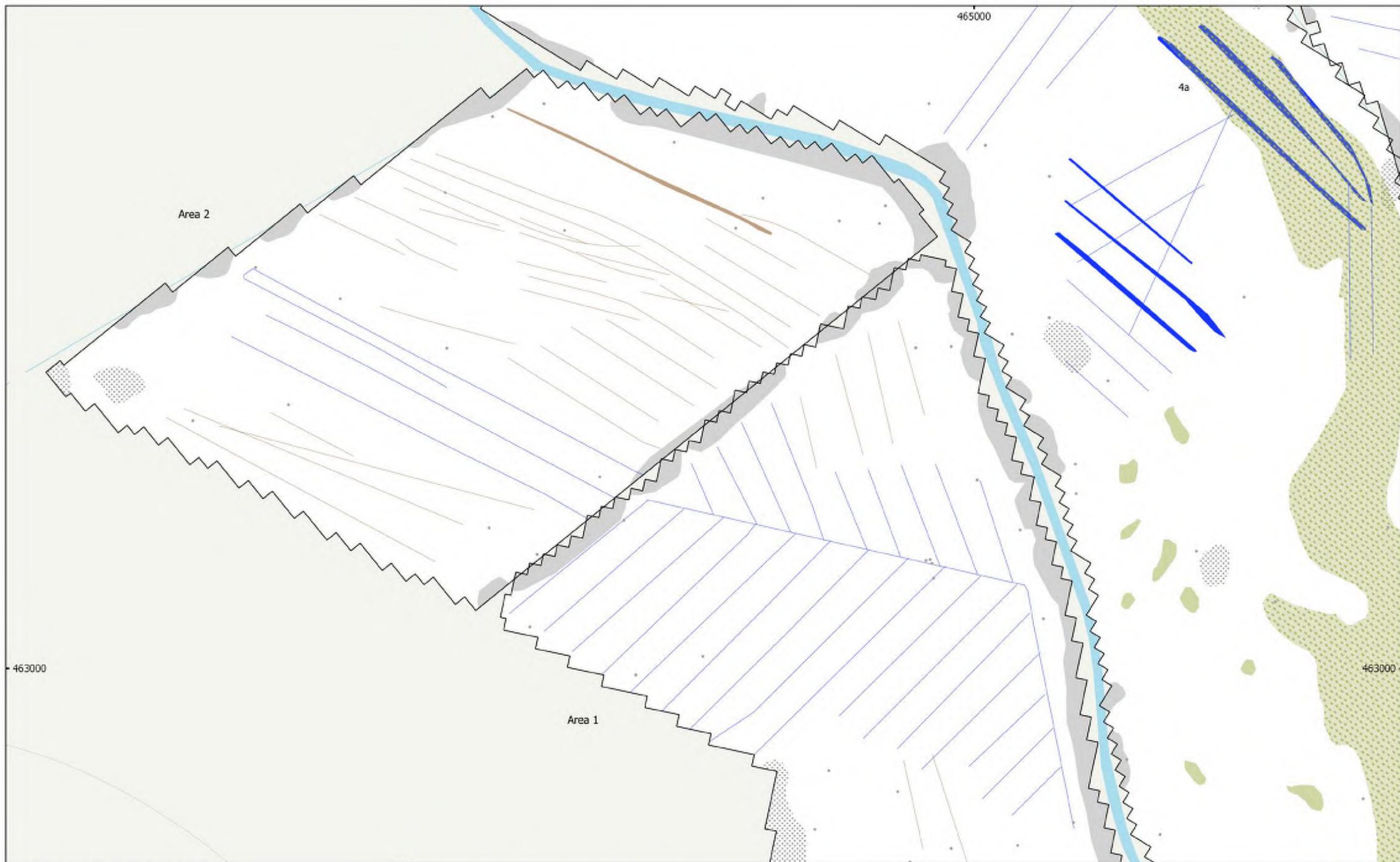
MSSE463 - FAS works on the River Foss, York
Figure 14 - XY Trace Plot (North-East)
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MSSE463 - FAS works on the River Foss, York
 Figure 15 - Magnetic Gradient (West)
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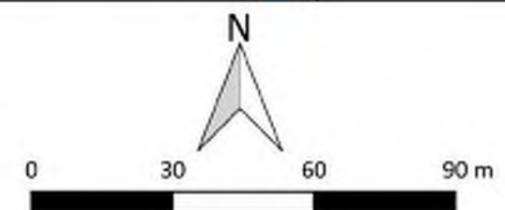
MSSE463 - FAS works on the River Foss, York
 Figure 16 - Magnetic Interpretation (West)

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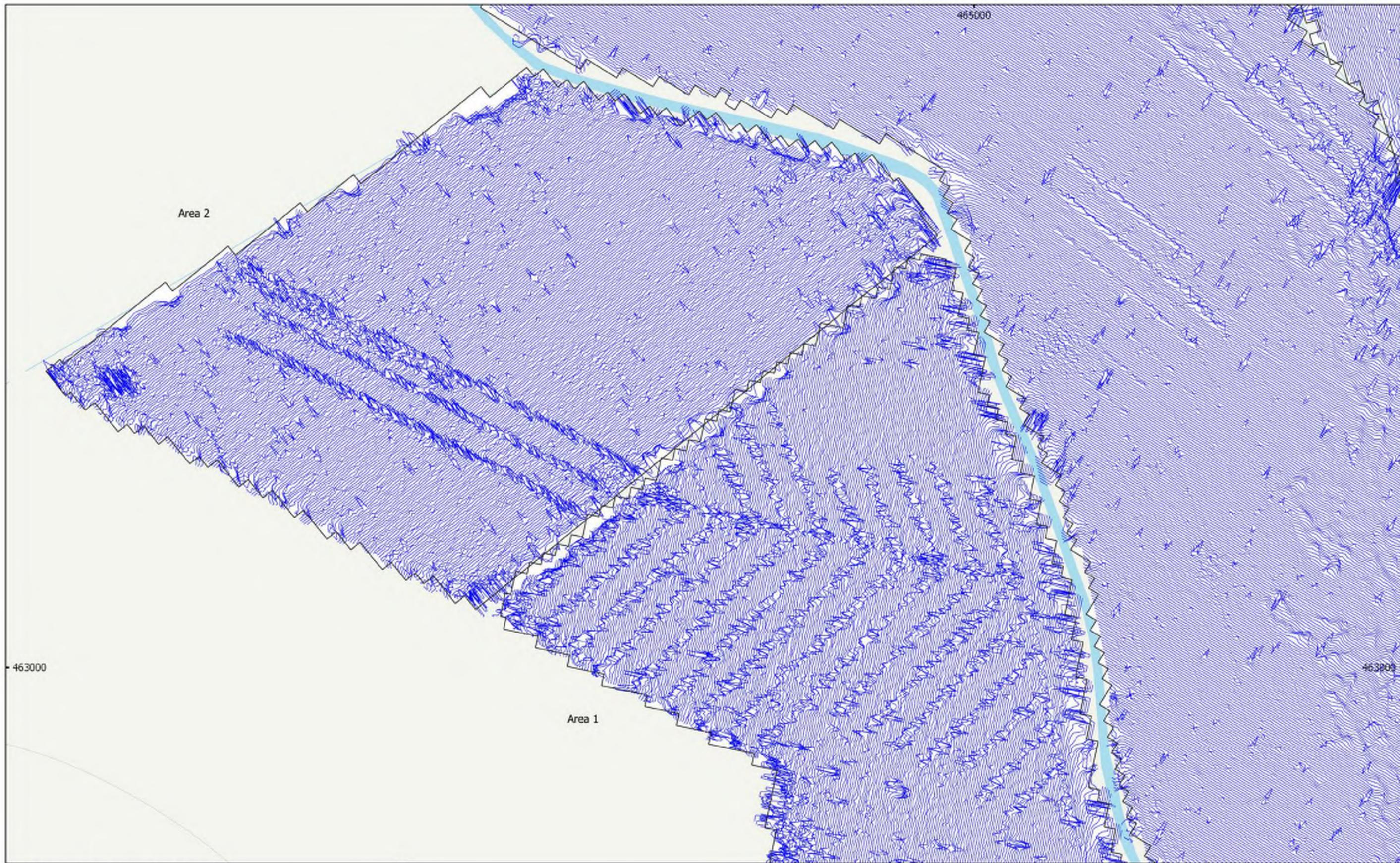
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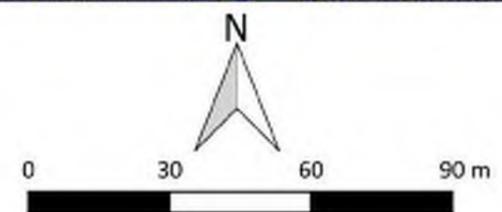
- | | |
|--|----------------------|
| Agricultural (Strong) / Drainage Feature | Agricultural (Trend) |
| Agricultural (Weak) | Drainage Feature |
| Magnetic Disturbance | Ferrous (Spike) |
| Ferrous/Debris (Spread) | |
| Palaeochannel / Natural (Spread) | |
| Natural (Weak) | |

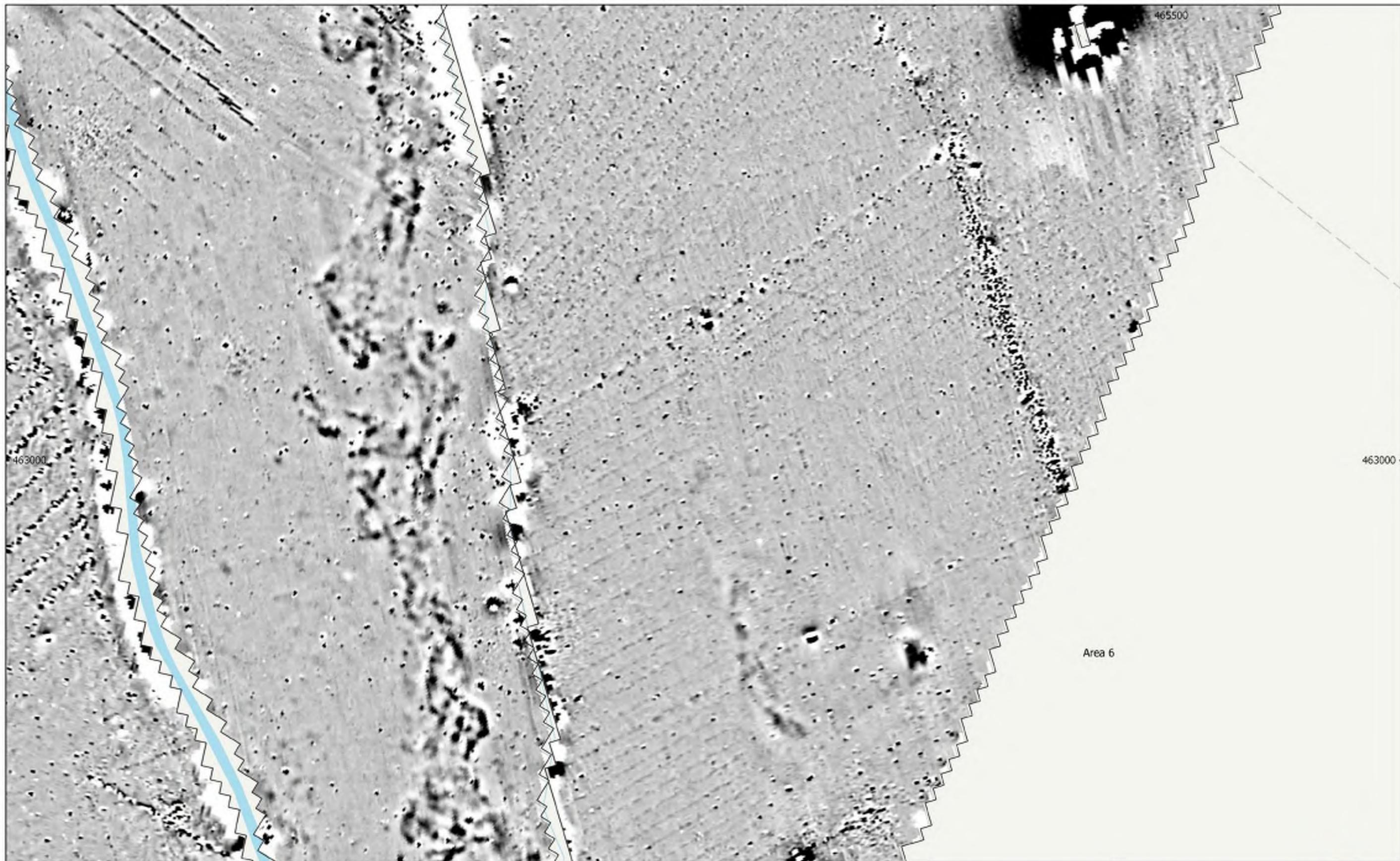


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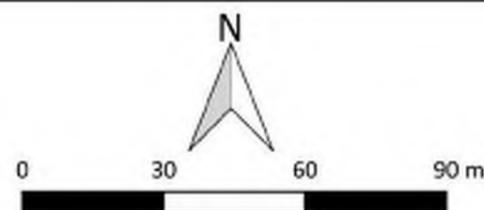


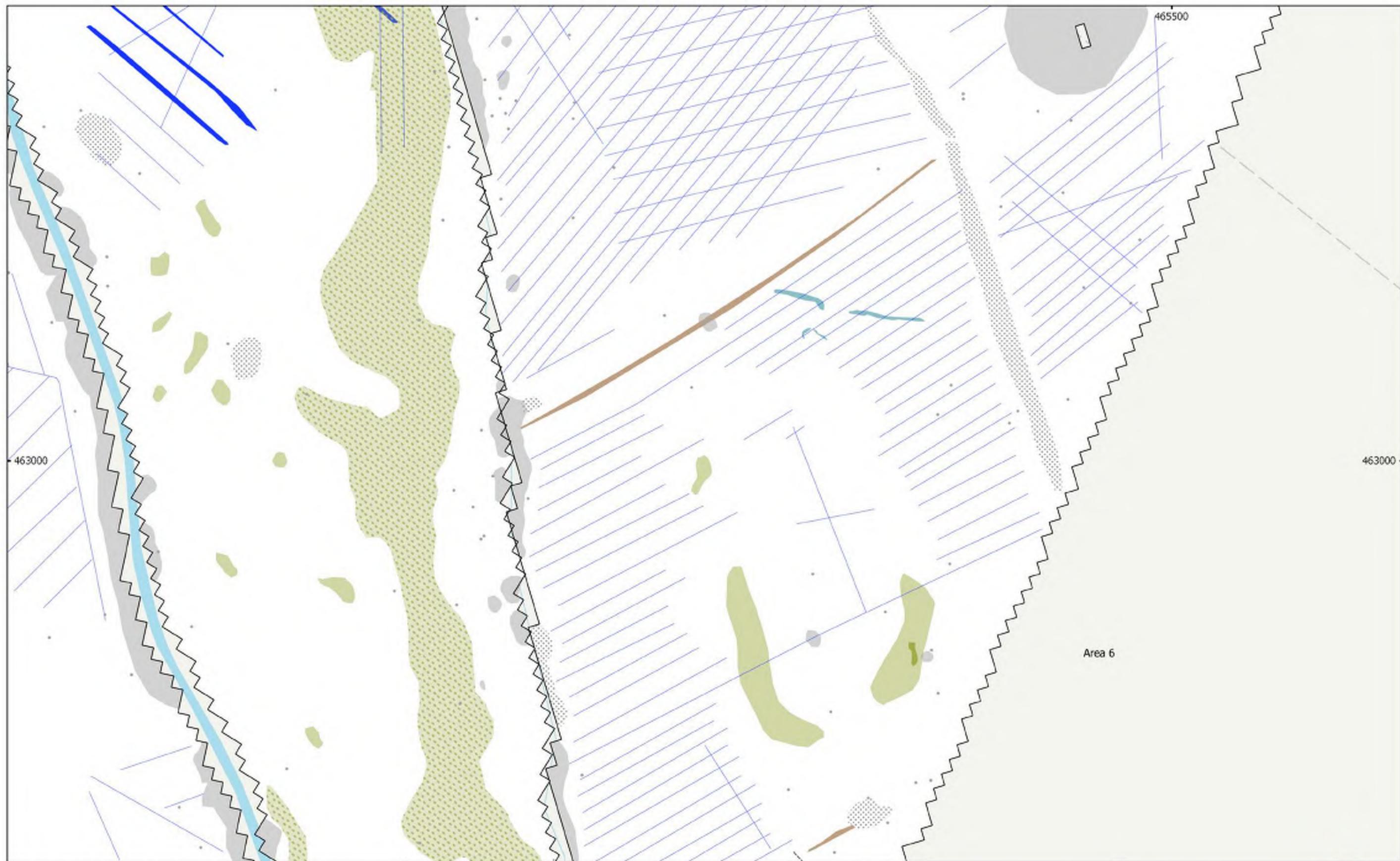
MSSE463 - FAS works on the River Foss, York
Figure 17 - XY Trace Plot (West)
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MSSE463 - FAS works on the River Foss, York
Figure 18 - Magnetic Gradient (East)
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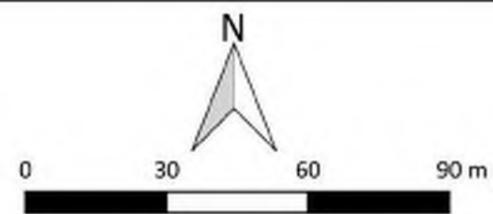


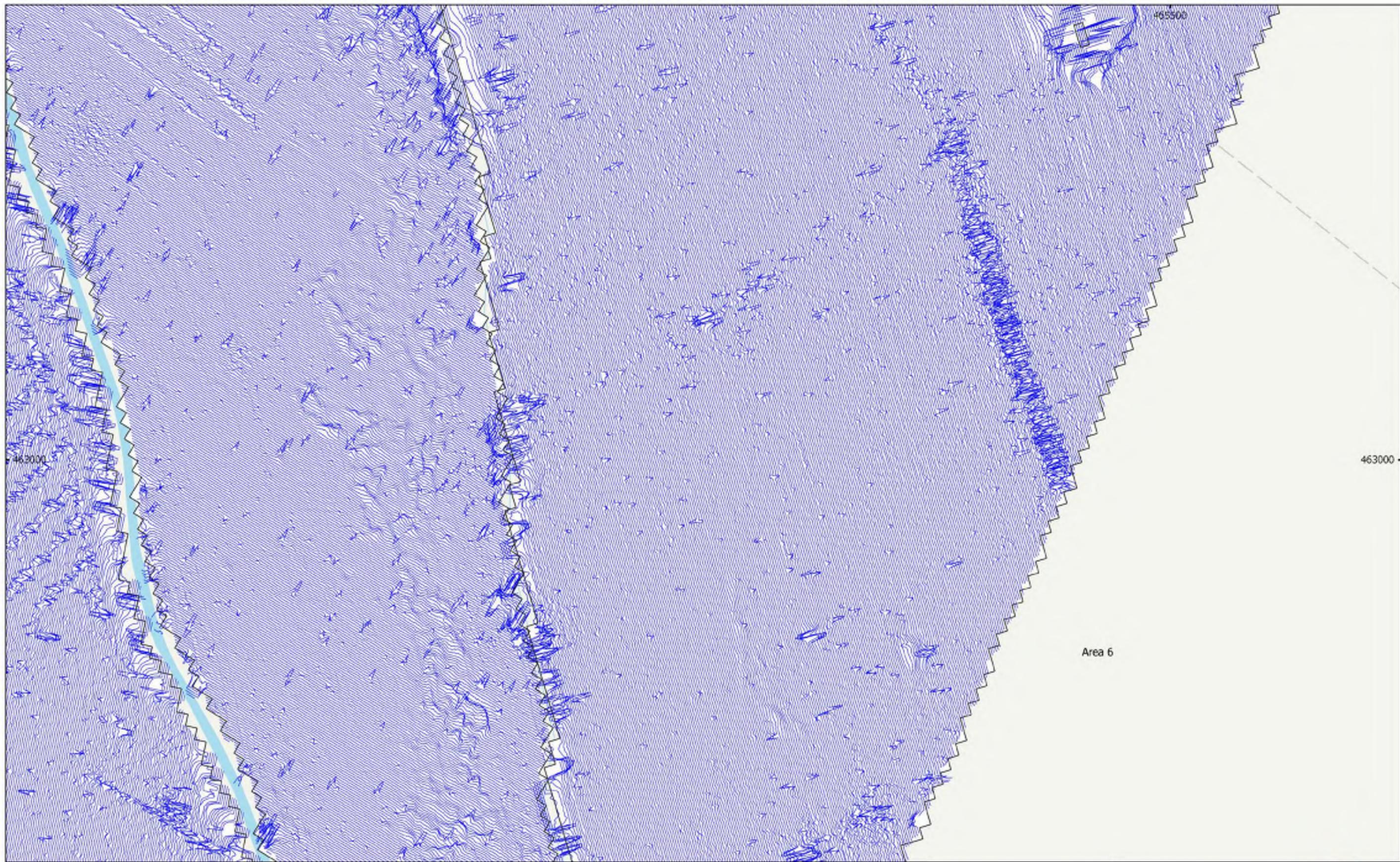


MSSE463 - FAS works on the River Foss, York
 Figure 19 - Magnetic Interpretation (East)
 1:1,500 @ A3

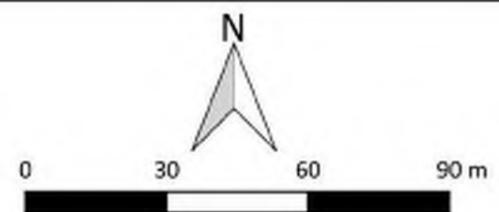
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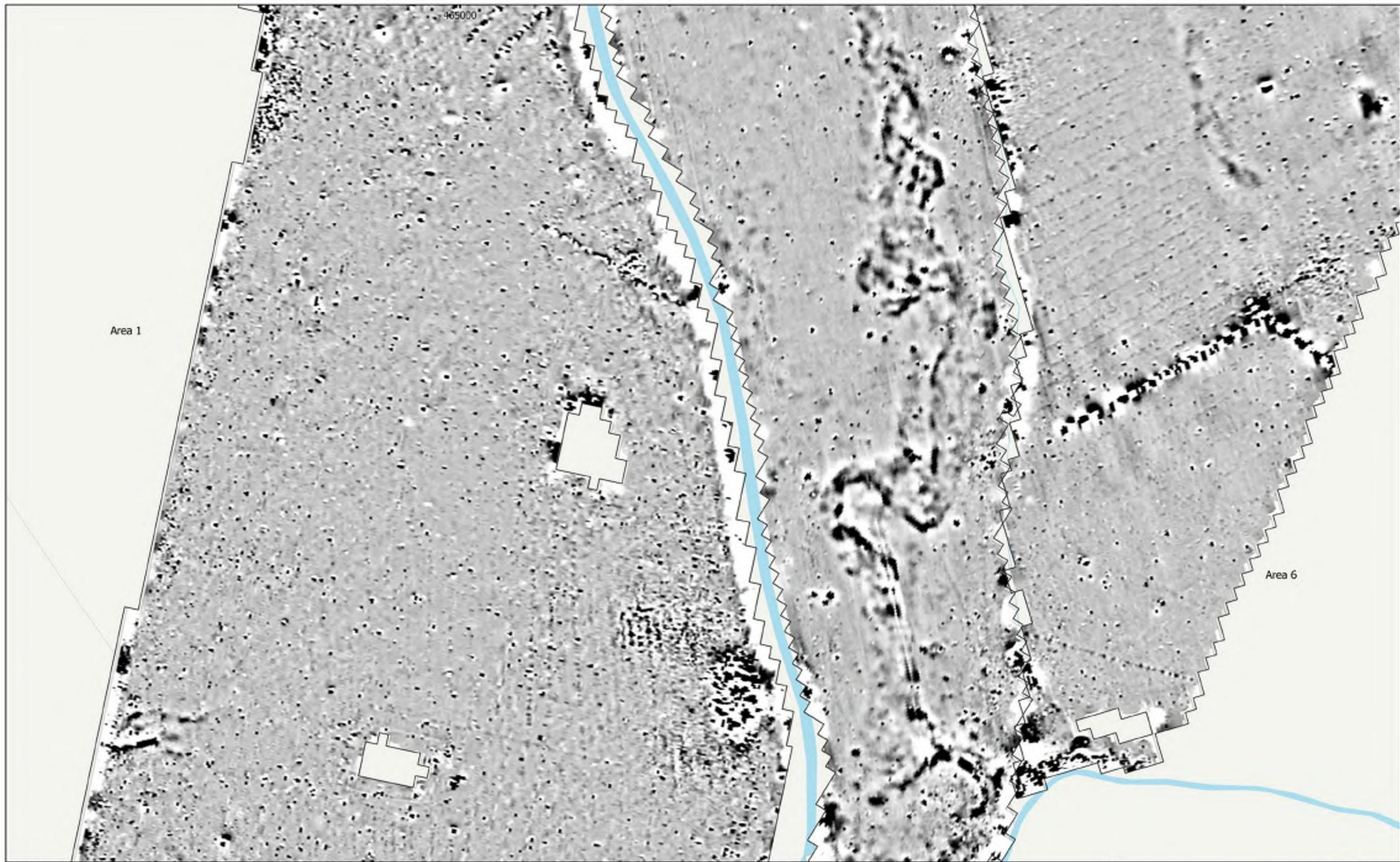
- | | | | |
|---|--|---|---------------------|
|  | Agricultural (Strong) / Drainage Feature |  | Natural (Weak) |
|  | Agricultural (Weak) |  | Undetermined (Weak) |
|  | Magnetic Disturbance |  | Service |
|  | Ferrous/Debris (Spread) |  | Drainage Feature |
|  | Palaeochannel / Natural (Spread) |  | Ferrous (Spike) |
|  | Natural (Strong) | | |



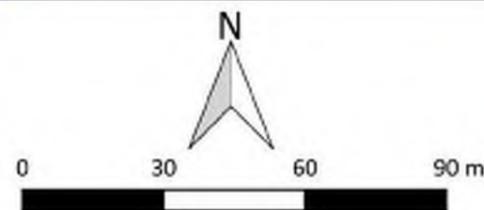


MSSE463 - FAS works on the River Foss, York
Figure 20 - XY Trace Plot (East)
30nT/cm @ 1:1,500 @ A3
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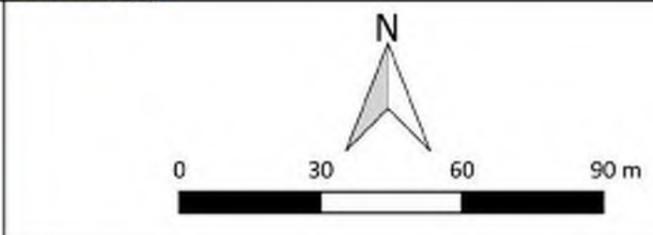
MSSE463 - FAS works on the River Foss, York
Figure 21 - Magnetic Gradient (Centre)
1:1,500 @ A3
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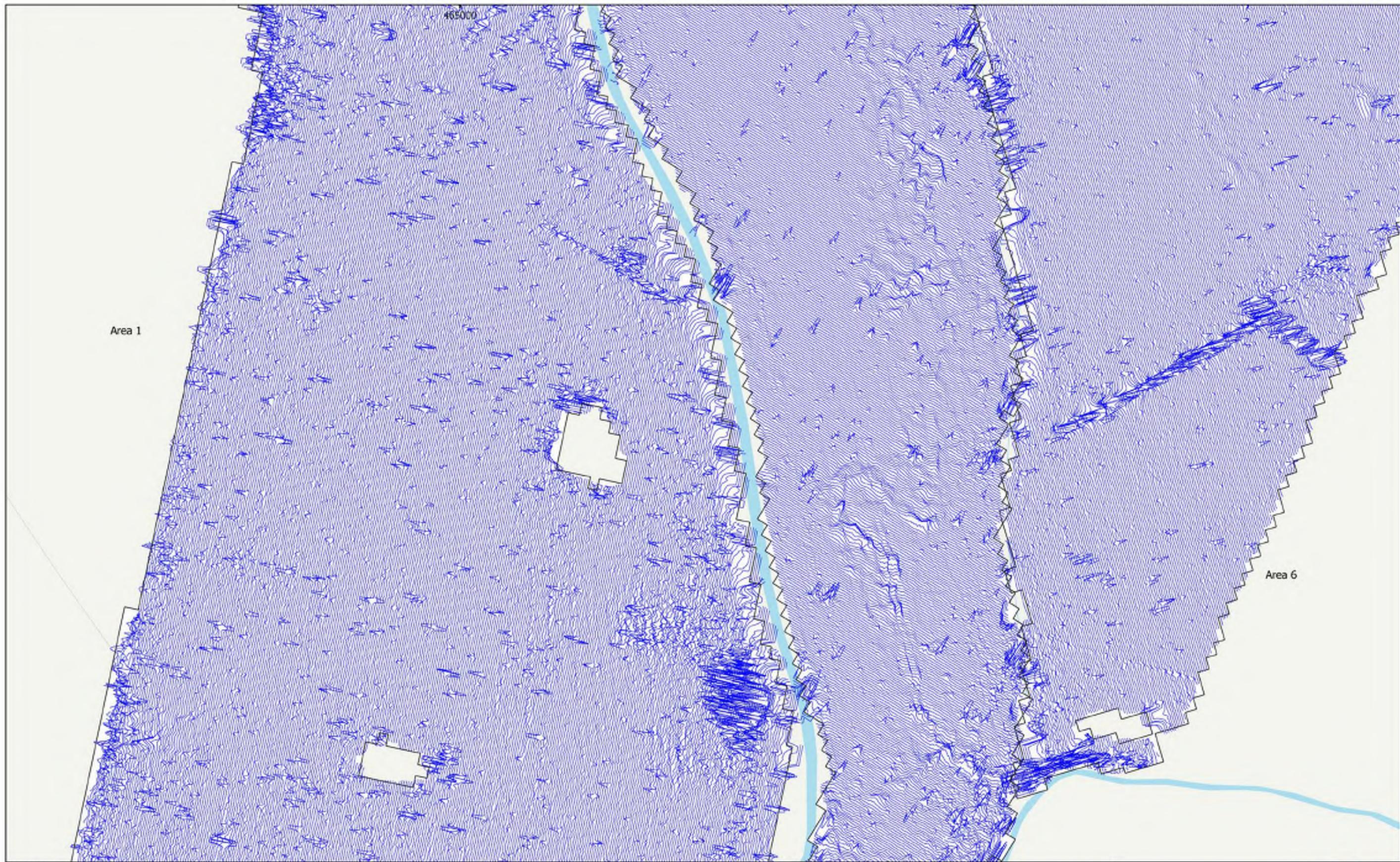




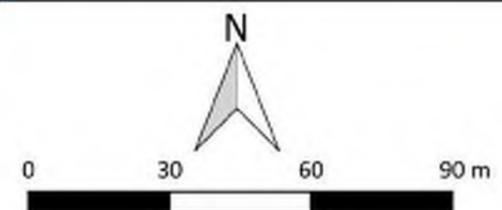
MSSE463 - FAS works on the River Foss, York
 Figure 22 - Magnetic Interpretation (Centre)
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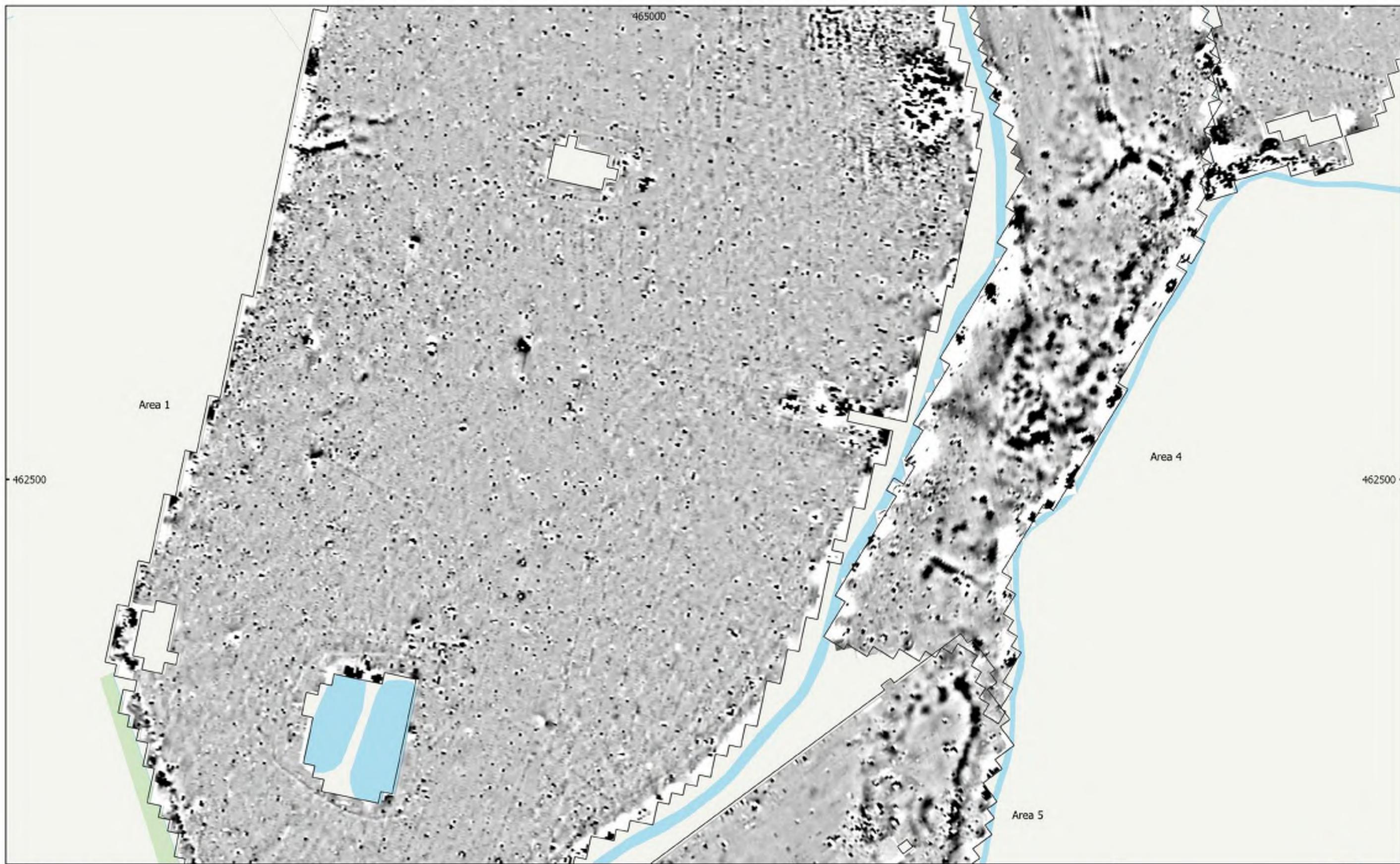
- | | |
|----------------------------------|----------------------------|
| Agricultural (Weak) | Industrial/Modern (Spread) |
| Magnetic Disturbance | Agricultural (Trend) |
| Ferrous/Debris (Spread) | Service |
| Palaeochannel / Natural (Spread) | Drainage Feature |
| Natural (Strong) | Ferrous (Spike) |
| Natural (Weak) | |



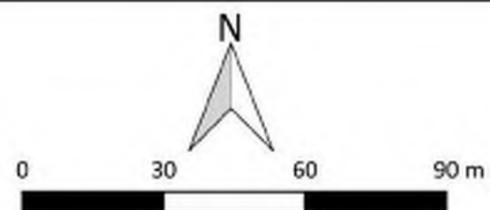


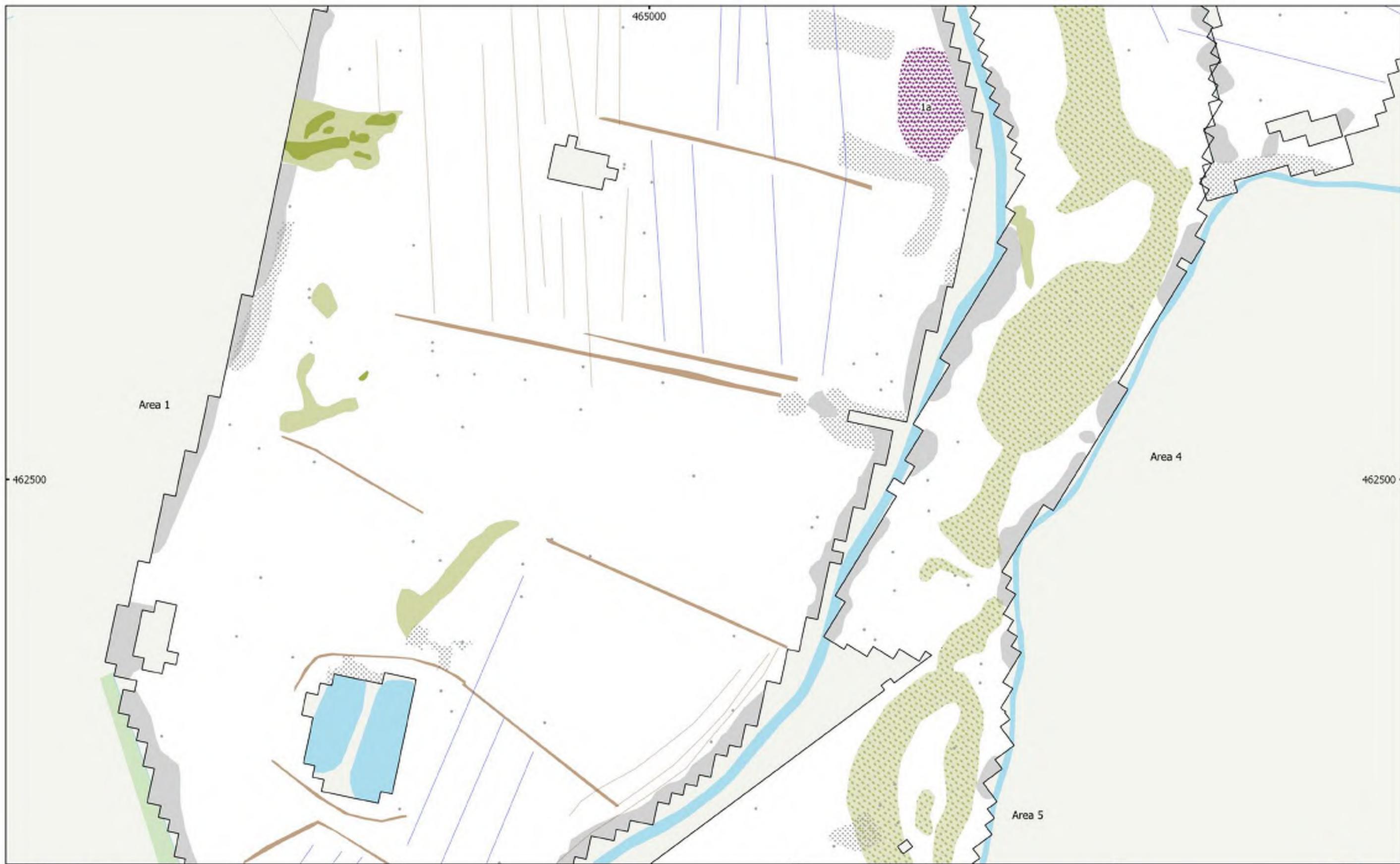
MSSE463 - FAS works on the River Foss, York
Figure 23 - XY Trace Plot (Centre)
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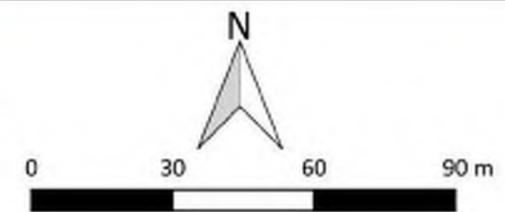
MSSE463 - FAS works on the River Foss, York
Figure 24 - Magnetic Gradient (South-Centre)
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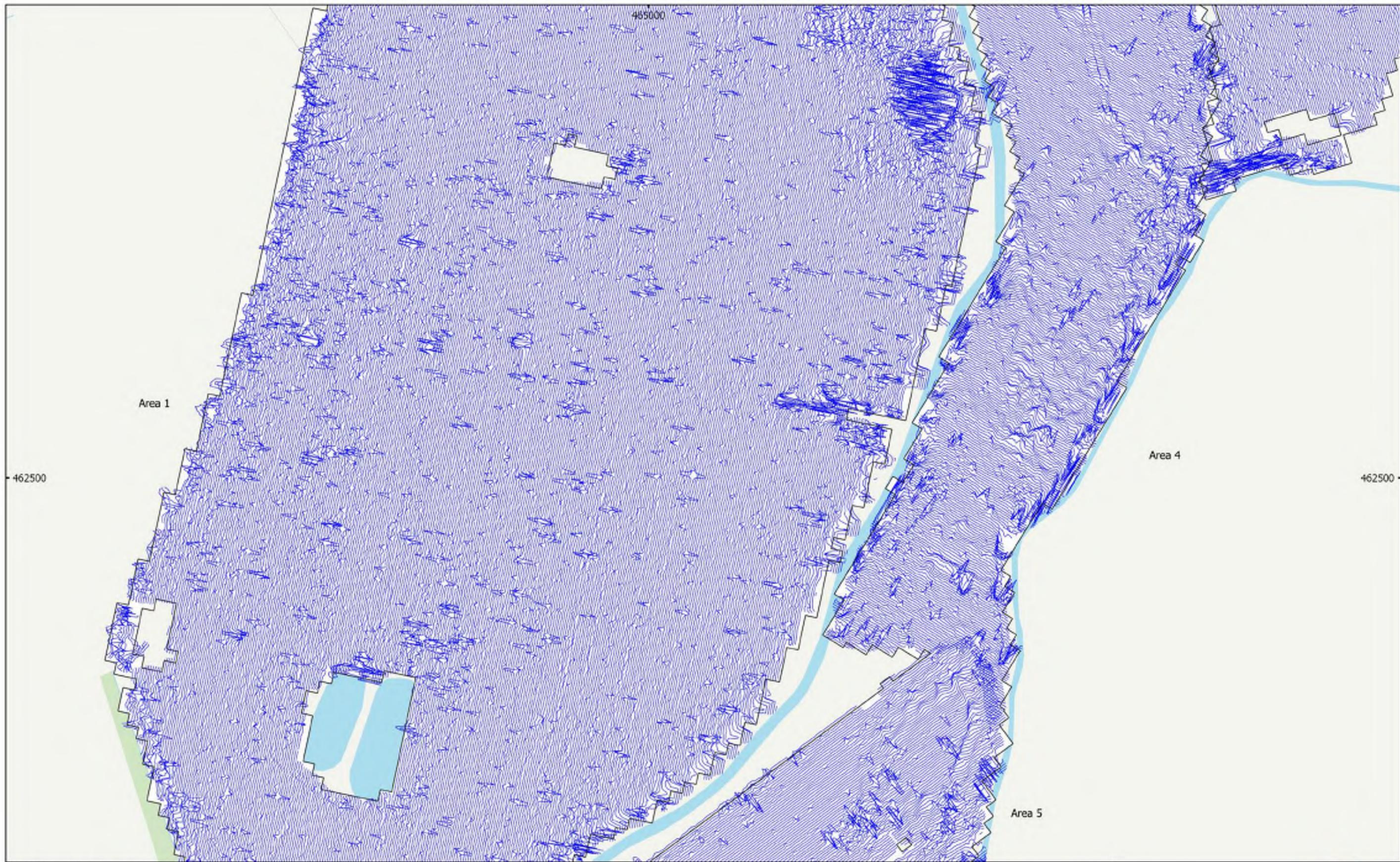




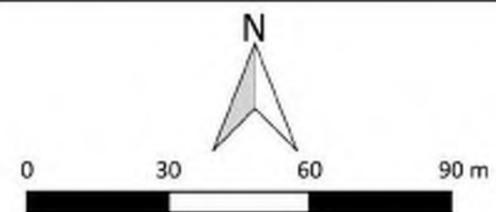
MSSE463 - FAS works on the River Foss, York
 Figure 25 - Magnetic Interpretation (South-Centre)
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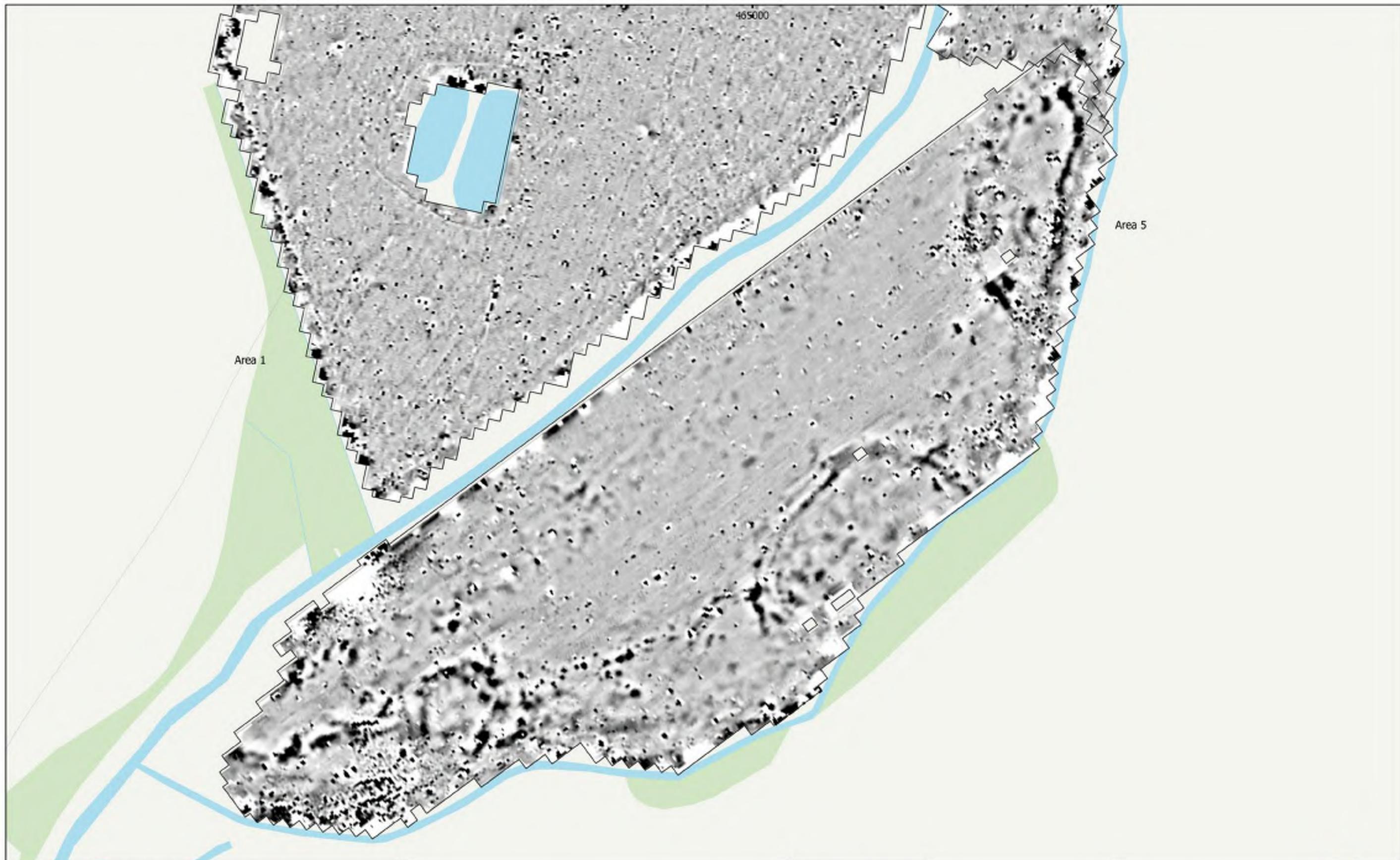
- | | |
|----------------------------------|----------------------------|
| Agricultural (Weak) | Natural (Weak) |
| Magnetic Disturbance | Industrial/Modern (Spread) |
| Ferrous/Debris (Spread) | Agricultural (Trend) |
| Palaeochannel / Natural (Spread) | Drainage Feature |
| Natural (Strong) | Ferrous (Spike) |



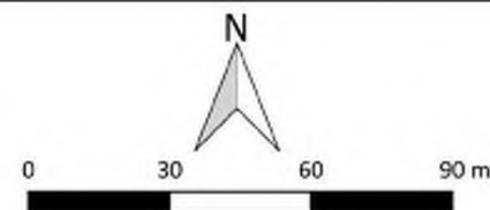


MSSE463 - FAS works on the River Foss, York
 Figure 26 - XY Trace Plot (South-Centre)
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MSSE463 - FAS works on the River Foss, York
Figure 27 - Magnetic Gradient (South)
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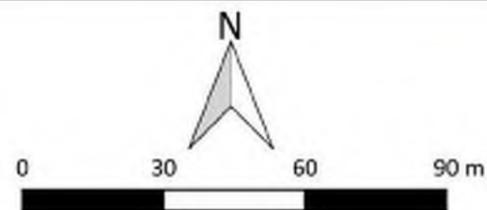
MSSE463 - FAS works on the River Foss, York
 Figure 28 - Magnetic Interpretation (South)

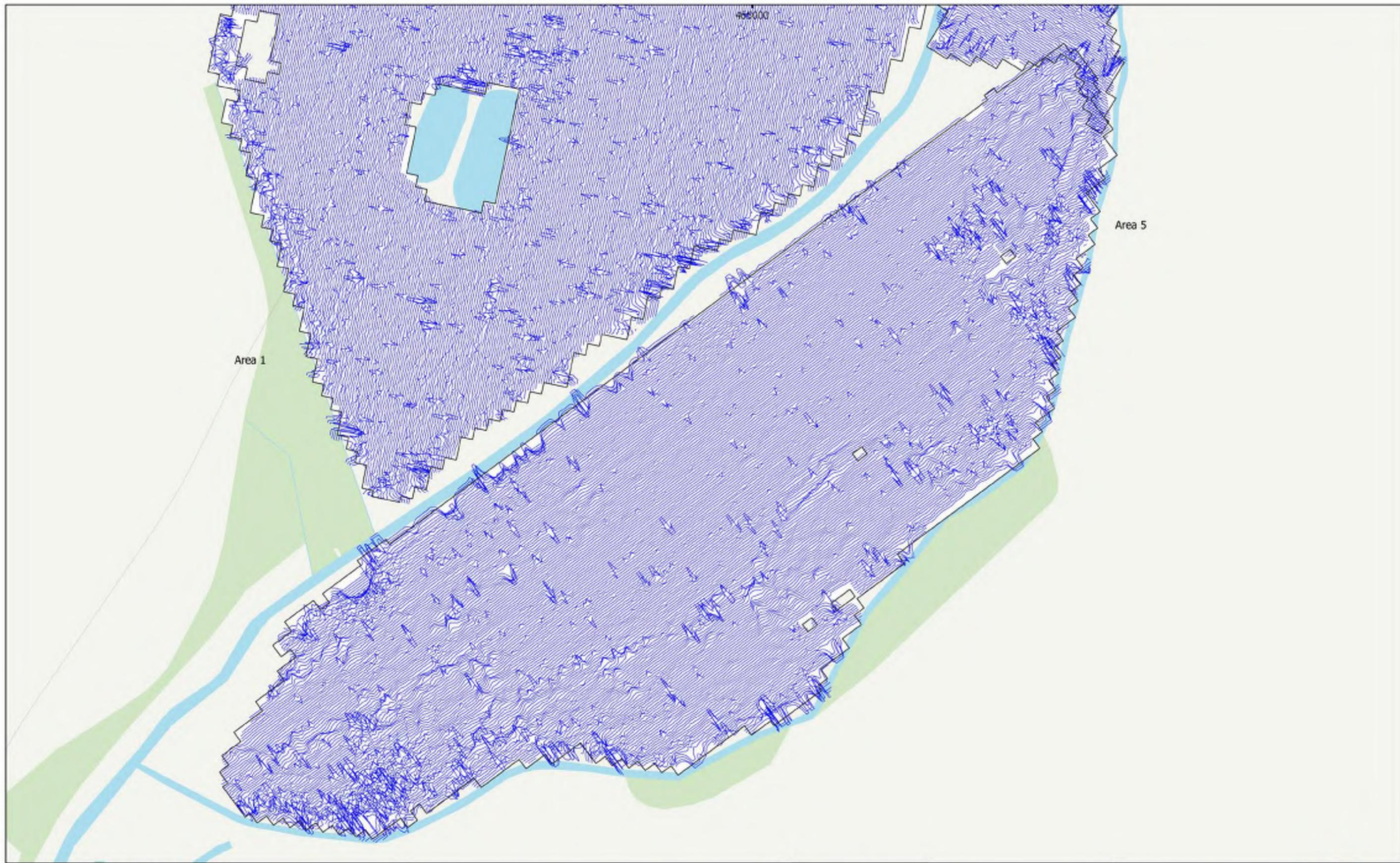
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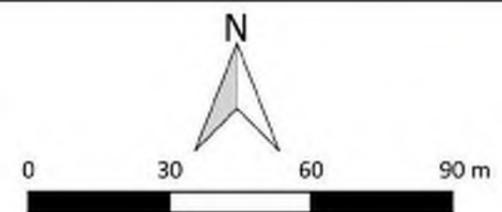
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- | | |
|--|--|
|  Agricultural (Weak) |  Agricultural (Trend) |
|  Magnetic Disturbance |  Drainage Feature |
|  Ferrous/Debris (Spread) |  Ferrous (Spike) |
|  Palaeochannel / Natural (Spread) | |
|  Natural (Weak) | |





MSSE463 - FAS works on the River Foss, York
Figure 29 - XY Trace Plot (South)
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YORK ARCHAEOLOGICAL TRUST

SITE	River Foss FMP		
CLIENT NAME	Capita		
YAT PROJECT #	6088, 6130	YAT REPORT #	2019/66
MUSEUM ACCESSION #	N/A	GRID REFERENCE	SE 65024 63189
PLANNING REFERENCE #	N/A	AAI OPS NOTICE #	N/A

TECHNICAL NOTE AND RECOMMENDATIONS FOR FURTHER INVESTIGATION

INTRODUCTION

In 2018, YAT conducted a watching brief on Site Investigation works in support of the York Flood Management Plan for up-stream flood water storage on the River Foss (YAT 2018/135). In March 2019, a 74ha geophysical survey was undertaken by Magnitude Surveys Ltd at the site (MSSE 463). Both pieces of work were undertaken on behalf of Capita at River Foss FMP, NGR SE 65024 63189 (Figure 1).

The purpose of this note is to summarise the findings of both investigations and to make recommendations for further investigation.

PREVIOUS INVESTIGATION: SUMMARY

In August and September 2018, YAT observed the excavation of 21 trial pits in the area (Figure 1). No archaeological features were identified, but in several places alluvial deposits with some degree of organic preservation were observed and interpreted as deriving from either a palaeochannel of the River Foss or from associated flood deposits. These were particularly present in TPs 2, 4, 5, 6, 9, 10, 11, 12 and 18. These appear to follow the former course of the river, with a notable wider spread of deposits at the southern end of the survey, although this could reflect a higher density of test pits in this area.

In March 2019, Magnitude undertook a 74ha geophysical survey of the site (Figure 2). The survey identified a large number of drainage features, reflecting the intensive agricultural management of the area. Additionally, the survey identified a palaeochannel of the Foss, supporting the earlier interpretation of the trial pit watching brief. Notably, the generally weak magnetic background of the site allowed for more ephemeral features such as this to be identified. In the southern area, where the trial pits identified a wider spread of alluvium, the channel appears to diverge, possibly reflecting braiding or different phases of the river's course over time.

DISCUSSION: ARCHAEOLOGICAL POTENTIAL

Whilst no clear evidence for settlement or agriculture pre-dating c.1800 has been identified, there remains the possibility that such remains are present sealed beneath alluvial deposits and therefore masked from the geophysical survey. If this is so, however, then it may lie too deeply buried to be adversely affected by the proposed scheme across most of the site.

There is a high potential for the palaeochannel to preserve waterlogged archaeological remains, including palaeoenvironmental data pertaining to the evolution of the landscape, including anthropogenically-driven change, since the formation of the Foss in the post-glacial period after c.10,000 BC. The organic deposits recorded in the trial pits suggest that the site has the potential to preserve multi-proxy environmental remains such as pollen, plant remains and insects, amongst other organic debris. Additionally, the areas closest to the former river course may preserve any associated settlement activity or waterside structures.

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YORK ARCHAEOLOGICAL TRUST

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CLIENT NAME	Capita		
YAT PROJECT #	6088, 6130	YAT REPORT #	2019/66
MUSEUM ACCESSION #	N/A	GRID REFERENCE	SE 65024 63189
PLANNING REFERENCE #	N/A	AAI OPS NOTICE #	N/A

RECOMMENDATIONS

It is likely that the planning authorities will expect a degree of further evaluation across the site and therefore it may be useful to undertake a purposive geoarchaeological borehole survey with sample recovery and selective trial trenching in the areas where the impact is greatest, particularly in the borrow pit areas and the proposed embankment, and especially where these intersect with potential river deposits.

The borrow pits and embankment areas account for c.20ha. A typical percentage-based evaluation trench survey would be very extensive and is not recommended here as the likelihood of archaeology to be present across much of the site is thought to be low.

It is recommended that windowless sleeved borehole transects be cored across the impacted areas in the southern part of the site where the palaeochannel has been identified. This would require up to 2,000m of survey, which would permit broad characterisation of the area using c.30 cores.

If further deposits of interest are identified in the boreholes, are safely accessible and are to be impacted by the proposed scheme, then a limited number of stepped trenches could be excavated in order to better understand the deposits. Environmental samples for further analysis can be recovered from both boreholes, mainly microfossil and radiocarbon age determination, and open-sections in trenches, from which both micro and macrofossil samples as well as material suitable for absolute dating can be recovered.

In addition to the mechanically-driven cores, it is recommended that a hand auger is utilised in selected areas to refine the spread of the alluvial deposits and to provide data for the production of a deposit model for the area.

The remainder of the site is not under threat and should not require further investigation.

It is likely that during construction, a watching brief may be required by the planning authorities. There is also a risk that if the proposed survey identifies significant archaeological remains that will be impacted by the scheme then further archaeological mitigation works, such as excavation, may be required.

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YORK ARCHAEOLOGICAL TRUST

SITE	River Foss FMP		
CLIENT NAME	Capita		
YAT PROJECT #	6088, 6130	YAT REPORT #	2019/66
MUSEUM ACCESSION #	N/A	GRID REFERENCE	SE 65024 63189
PLANNING REFERENCE #	N/A	AAI OPS NOTICE #	N/A



Figure 1 Location of 2018 trial pits and potential palaeochannels

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SITE	River Foss FMP		
CLIENT NAME	Capita		
YAT PROJECT #	6088, 6130	YAT REPORT #	2019/66
MUSEUM ACCESSION #	N/A	GRID REFERENCE	SE 65024 63189
PLANNING REFERENCE #	N/A	AAI OPS NOTICE #	N/A

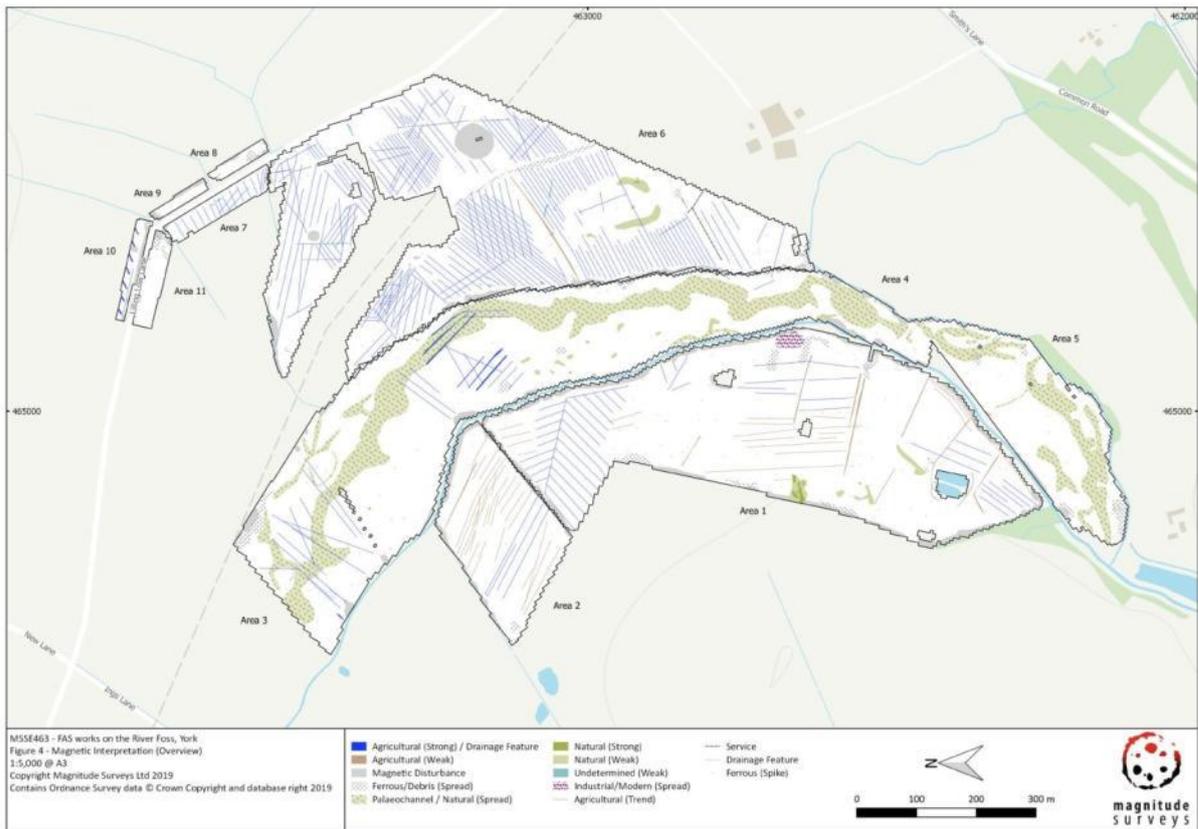


Figure 2 Geophysical interpretation (Magnitude Surveys): note North is to the left

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