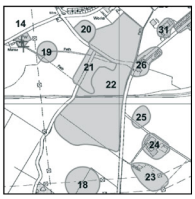
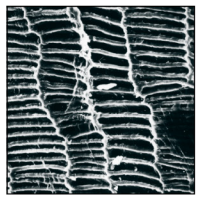
MTBB17










MARSTON THRIFT, BEDFORDSHIRE

GEOPHYSICAL SURVEY

commissioned by Catesby Estates Plc

May 2018

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

MARSTON THRIFT, BEDFORDSHIRE

GEOPHYSICAL SURVEY

commissioned by Catesby Estates Plc

May 2018

This report adheres to the quality standard of ISO 9001:2008

PROJECT INFO:

HA Project Code **MTBB17** / NGR **SP 9858 4243** / Parish **Marston Moretaine** / Local Authority **Central Bedfordshire Council** / OASIS Ref. **headland5-315192**

PROJECT TEAM:

Project Manager **David Harrison** / Author **Alistair Webb** / Fieldwork **Kevin Heaton, Krasimir Dyulgerski, Ross Bishop** / Graphics **David Harrison**

Approved by **David Harrison** D Harrison .....

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

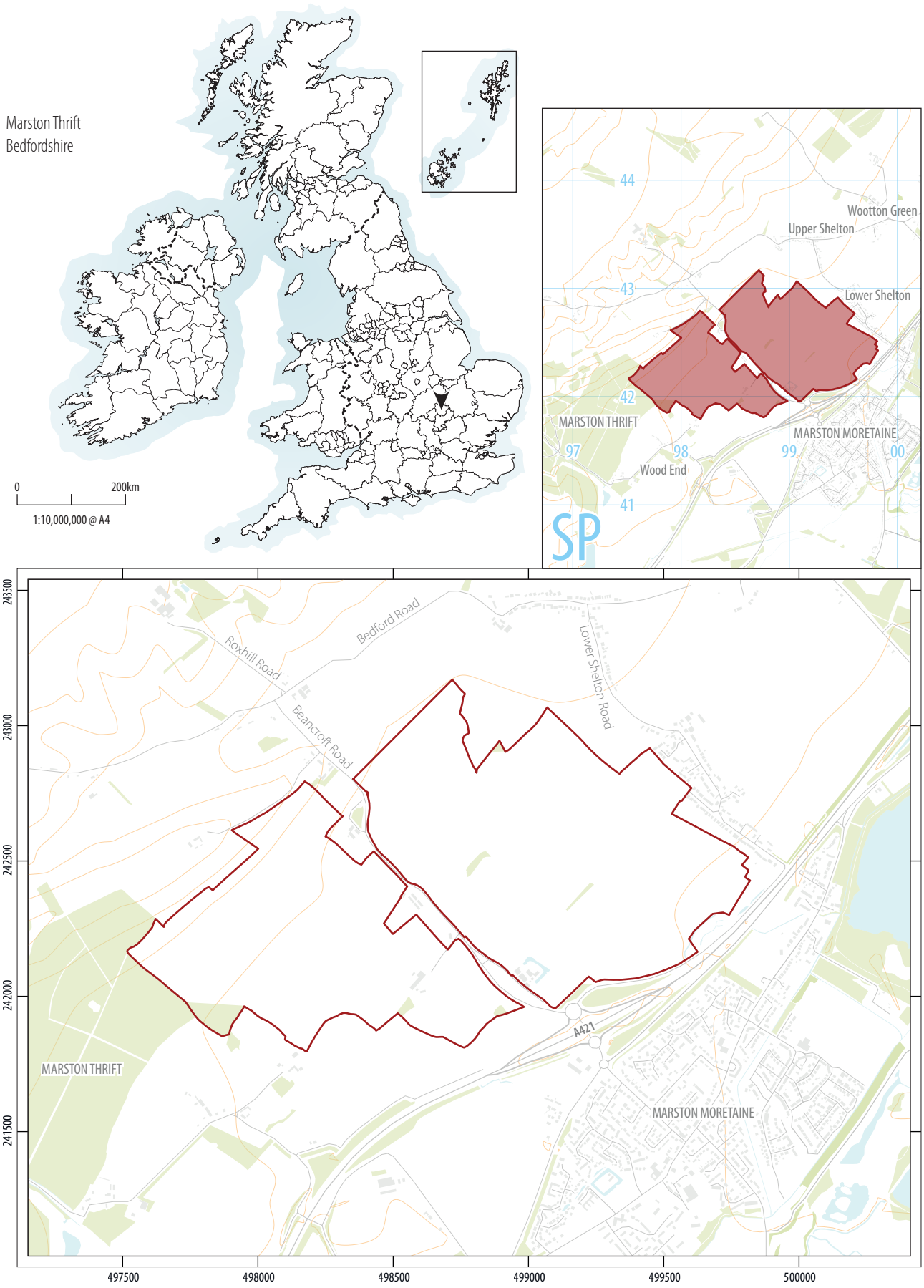
HEADLAND ARCHAEOLOGY

PROJECT SUMMARY

Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering approximately 170 hectares, on land north of Marston Moretaine (Marston Thrift), in advance of the possible submission of a planning application for a residential development, amenity and associated infrastructure. Anomalies indicative of multi-period settlement activity have been identified in three locations in the north of the site with a fourth area at the south-western site boundary. Some of this archaeological activity was previously suggested through the presence of cropmarks or has been inferred through the identification of clusters of pottery although the extent of the remains is more extensive than previously known. The majority of this activity is likely to be of Iron Age/Romano British date although there is also evidence for possible medieval activity. The results of the survey corroborate the conclusions of an earlier Archaeology Assessment. On the basis of the geophysical survey the potential for the presence of buried archaeological remains is assessed as low to moderate across the majority of the site, with the exception of the four areas of definite archaeological potential.

CONTENTS

LIST OF ILLUSTRATIONS



HEADLAND ARCHAEOLOGY
Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

ILLUS 1 Site location

MARSTON THRIFT, BEDFORDSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by BSA Heritage Ltd (the Consultant) on behalf of Catesby Estates Plc (the Client), to undertake a geophysical (magnetometer) survey of a large parcel of land to the north-west of the A421 and Marston Moretaine (Illus 1), where an application to build residential units with amenity space and infrastructure is being considered. The proposed development area (PDA) covers approximately 170 hectares.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2017) which was submitted to, and approved by, Central Bedfordshire Council, and with guidance contained in the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out between November 27th and December 19th 2017.

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The proposed development area (PDA) comprises sixteen fields, predominantly under arable cultivation (rape or winter wheat – Illus 2 and 3) with a couple of paddocks adjacent to Beancroft Farm, on the northern side of the A421 near Marston Moretaine, Bedfordshire. It is centred at SP 9860 4235 and is divided into two halves by Beancroft Road. It is bounded by the A421 to the south, farmland to the north-west, Marston Thrift nature reserve to the south-west and the village of Lower Shelton to the north-east.

The site generally slopes gently down from Hunger Hill to the north-west, ranging from circa 70m Above Ordnance Datum (AOD) in the north-west, to circa 40m AOD in the east (see Illus 4).

1.2 GEOLOGY AND SOILS

The bedrock geology mainly comprises mudstone of the Peterborough Member and Stewartby Member. Hardly any superficial deposits are recorded west of Beancroft Road, whereas deposits of Head (clay, silt, sand and gravel) and Alluvium (clay and silt) overlie the east of the PDA (NERC 2018; see Illus 5).

In the east the soils are classified in the Soilscape 9 association, characterised as lime-rich loams and clays with impeded drainage. West of Beancroft Road the soils are classified in the Soilscape 18 association, characterised as slowly permeable, seasonally wet loams and clays (Cranfield University 2018).

2 ARCHAEOLOGICAL BACKGROUND

The information below is abstracted from an Archaeology Assessment (BSA Heritage 2017) and illustrated on Illus 5.

The Central Bedfordshire HER (CBHER) records a number of likely sites and findspots within the PDA. Although few archaeological investigations have occurred near the site (at Wood End to the south west, Lower Shelton to the south east and along the line of the A421's construction to the south) evidence of Iron Age activity has been revealed.

Evidence for nearby Roman activity has also been found with a concentration of Roman coins and pottery suggesting the site of a

ILLUS 2 Field 3, looking north-west

Roman settlement or other focus lies in the west of the site close to Marston Thrift (CBHER 15905).

East of a stream which runs roughly north/south through the site, extensive cropmarks including likely enclosures have been observed (CBHER 8726) and three Roman coins were found within the same area (CBHER 15891). Cropmarks to the north and south west beyond the PDA may also reflect earlier field systems. A postulated Roman road is unlikely to actually run through the site though.

Settlements beyond the PDA and aligned along roads which may have medieval origins include Lower Shelton, Upper Shelton, Wood End and an area around Roxhill Farm to the north of the PDA. Aerial images suggest much of the PDA itself was arable, with extensive ridge and furrow.

A medieval moat survives at Beancroft Farm (CBHER 52) and others marked on historic maps or identified from cropmarks or ponds lay in the north-east of the PDA and possibly in the centre and at Draper's Farm in the west. The HER records the site of 'Dyers Moat' in the north of the PDA (CBHER 8334). There is also some map evidence for gravel extraction in the north of the site and post-medieval settlement remains to either side of Beancroft Road.

The assessment concluded that:

> *Known features and finds within and on the periphery of the site do suggest that sub-surface archaeological remains survive too. There is likely to be an area of Roman remains in the north-west of the site close to Marston Thrift and in the east of the site both Roman deposits and a medieval moat are likely. Finds beyond the site suggest prehistoric remains may also lie within the site area. Any such remains will have been truncated by more recent cultivation across the site. The existing evidence suggests that they will be relatively common types of archaeology which would rate as of local to county significance only. It is also the case that the areas of greatest interest are likely to coincide with areas proposed for woodland planting or public open space. There is greater scope to preserve sub-surface remains through detailed design in such areas. However, any harm to such remains could alternatively be mitigated through archaeological investigation ahead of construction.*

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the survey area. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

ILLUS 3 Field 10, looking north-west

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

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2, and 3 are site condition photographs. Illus 4 is a 1:7,500 scale survey location plan showing the GPS swaths and 2m contour data derived from 2m LiDAR data (Environment Agency Geomatics Survey Data 2018). Superficial deposits (NERC 2018) are shown along with the Central Bedfordshire HER data on Illus 5, overlying the 1888-1913 six inch OS map, also at 1:7,500. Detailed data plots of the fully processed data and an accompanying interpretative plot are produced, also at 1:7,500, as Illus 6 and Illus 7. The areas of archaeological activity are shown in isolation on Illus 8, together with contour data and superficial deposits. The fully processed (greyscale) data, minimally processed data (XY traceplot) and accompanying interpretative plots are presented at a scale of 1:2,500 in Illus 9 to Illus 26 inclusive with more detailed plots (1:1,000) of the areas of archaeological activity (AAA) in Illus 27 to Illus 44 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing

details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2017) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (ClfA 2014). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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

4 RESULTS AND DISCUSSION

The ground conditions across the application area were variable with generally good conditions underfoot south of Beancroft Road, where the fields were still under stubble following the last harvest, and poor to the north of the road where most of the fields were sown with a mature fodder crop of rape. Nevertheless there is no difference in the overall data quality which is good throughout.

There is, however, a noticeable difference in levels of magnetic background variation between the northern and southern halves of the PDA with a very homogenous background south of Beancroft Road where there are virtually no superficial deposits, resulting in the uniform grey tone to the data. Immediately north of Beancroft Road the magnetic background is similarly uniform but this noticeably changes becoming much more variable on the higher ground immediately north of a small stream that flows across the PDA from north-west to south-east. This change in magnetic background is due to the presence of superficial deposits from alluvium to the south to head in the north.

Against these backgrounds, numerous anomalies caused by soil-filled features have been identified. It is therefore assessed that the results provide a reliable indication of the extent of the sub-surface archaeological remains, except on the alluvium, where detection of soil-filled features may be hampered by low magnetic contrast in the surrounding soils and/or the depth of the superficial deposits. All the anomalies are discussed below and cross-referenced to specific anomalies on the interpretative drawings, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are caused by the random distribution of ferrous debris in the upper soil horizons. An isolate 'spike', W1, in the north-west of F10 locates a well which is shown on the 1888-1913 six inch OS map (Illus 5).

Haloes of disturbance in F7, F9 and F10 are due to the proximity of electricity pylons on an overhead line running north/south through the centre of the site.

The low slung wires on a second overhead line, which is aligned north-north-east/south-south-west in F16 before turning to the south-east crossing F15 and F14, have created a massive magnetic effect along the route of the wires masking the responses from the sub-surface archaeological features which are clearly present in the area adjacent to the overhead line (see below). Even stronger responses are recorded around the pylon bases.

Alignments of large 'spike' anomalies, TP, traverse the central and southern parts of the PDA. These anomalies locate wooden telegraph poles.

Clusters of ferrous 'spike' responses coalescing to form more general areas of magnetic disturbance are identified at several locations across the PDA. Some are due to infilled ponds, (FP1–FP8) which are recorded on the historic mapping. Other similar responses, such as FP9–FP10) could also be due to infilled ponds, although there is no mapping evidence to support this interpretation. However, none is considered to be of any archaeological significance. The strong response is due to the magnetic properties of the material used to backfill the ponds.

The location of two former buildings (B1 in the north-eastern corner of the site in F16 and B2 close to the southern boundary) are also identified as areas of magnetic disturbance. The response is due to the mixing of strongly magnetic or fired building material (bricks etc.) into the topsoil post-demolition.

The infilled remains of a former clay pit (CP1) recorded on historic mapping also manifests as an area of disturbance in the north-eastern corner of the PDA in F16.

Magnetic disturbance around the field edges is due to ferrous material within or close to the adjacent field boundaries, and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historic OS mapping indicates that the division and layout of land within the PDA has changed significantly since the publication of the first edition Ordnance Survey map in 1888. Many boundaries, particularly to the south of Beancroft Road, have been removed to create larger fields, with all the current fields south of the road having been created by the amalgamation of at least two smaller fields. All of these boundaries can still be identified in the data set, FB1–FB10, either as lines of discrete ferrous anomalies indicative of ferrous debris that probably accumulated along the boundary or to drains laid along the boundary. There is less change

north of Beancroft Road where anomalies locating seven former boundaries are identified, FB11–FB17.

Closely-spaced parallel elongated S-shaped linear anomalies are identified across most of the PDA. These anomalies are most clearly visible in in F15 and F16, aligned north-west/south-east, and in F4 where it is aligned form north-west to south-east. These anomalies are indicative of the medieval and post-medieval practice of ridge and furrow ploughing.

Other linear trend anomalies that are not necessarily aligned parallel with or at right angles to the current field layout are almost certainly due to field drains.

4.3 GEOLOGICAL ANOMALIES

As discussed a relatively homogenous magnetic background has been identified across the southern half of the PDA, characterised in the greyscale data as a uniform grey tone with sparsely distributed discrete areas of magnetic enhancement (anomalies). These anomalies are caused by localised variations in the depth and composition of the topsoil. The discrete anomalies increase in frequency and density to the north of Beancroft Road. The band of increased background response aligned north-west/south-east through F10 and F14 corresponds with a band of alluvium and is caused by the presence of sands and gravels within the soils. In the north-west of F16, the increased response is caused by gravels and sands in the superficial Head deposits.

4.4 ARCHAEOLOGICAL ANOMALIES

Unless specified all the linear anomalies described are likely to be due to soil filled cut features, such as ditches, forming clear patterns of enclosure and land division. With the variable magnetic background it is difficult to confidently discriminate between discrete anomalies which may be due to archaeological features, such as pits, which may be indicative of occupational activity, and those that are probably due to localised geological variation. For this reason most of the discrete anomalies within enclosures have been ascribed a possible archaeological origin with those outside, except where the responses are particularly broad or high in magnitude, interpreted as of non-archaeological origin.

Three sites of clear archaeological potential have been identified within the PDA north of Beancroft Road with a fourth in the south-west corner of the site. The sites have been termed areas of archaeological activity (AAA). It is notable that the clearest and most extensive of these sites are located on the Head superficial deposits (AAA1-AAA3) with few anomalies of archaeological potential identified in areas of no superficial deposits, with the exception of AAA4. This reflects the more variable magnetic contrast within the soils overlying the Head deposits. The same correlation is largely mirrored in the CBHER record (see Illus 5), perhaps suggesting that the superficial deposits were more favourable for habitation.

AAA1 (see Illus 27–32)

AAA1 locates a broad area of archaeological activity centred on SP 9884 4282 in the north-west of F15 and within an area of extensive cropmarks which are recorded on the CBHER (8726). It comprises of at least two enclosures, E1 and E2, and measures at least 120m in diameter. Four circular anomalies, RH1-4, within the south of E2 are caused by ring-ditches, probably reflecting round-houses. The ring-ditches measure approximately 12m in diameter. In the north of the complex a dense cluster of high magnitude anomalies is difficult to discern but is almost certainly due to settlement activity.

To the immediate west of the settlement complex, separated by a pylon base, at least two further enclosures, E3 and E4, are identified within an irregular system of curving ditch anomalies, perhaps locating an outlying field system. The extents of this system are not clearly defined, perhaps having been truncated by ploughing, although they appear to be restricted to the northern side of a watercourse in F9. Fewer anomalies are visible in the interior of this system of ditches although discrete anomalies may locate pits.

AAA2 (see Illus 33–35)

The second definite area of archaeological potential is located 200m north-east of AAA1, in the north-west of F16, centred at SP 9909 4297, and corresponds to the site of Dyers Moat which is recorded on the CBHER (8334). The area is defined by anomalies describing at least three sides of a trapezoidal enclosure, E5, measuring 67m north/south and 52m east/west. Numerous anomalies are identified within the interior of the enclosure which may be archaeological in origin. However, the enclosure is located in an area of particularly variable magnetic background and a geological origin is possible for most, perhaps with the exception of the large high magnitude anomaly in the north-east corner of the enclosure which probably locates a pit.

AAA3 (see Illus 36–41)

AAA3 locates an extensive complex of enclosures and curvilinear ditches, centred at SP 4260 4260. It is located 170m south of AAA2 and the same distance south-east from AAA1. It comprises at least eight enclosures, E6-E13, and extends northwards from the small stream at the southern boundary of F15 for 280m into the south-western part of F16. Numerous anomalies are identified within the interior of the enclosures including internal divisions, pit-type anomalies and at least three probable round-houses (RH5-RH7) indicating settlement activity. E12 is worthy of note, with a single internal round-house, RH7, and an elongated, entrance passageway to the north-east, giving the appearance of a banjo enclosure. Whilst the extents of AAA3 are generally clearly defined, the southern limit of the enclosure complex becomes unclear at the interface between the head superficial deposits to the north and the band of alluvium at the southern boundary of F15. Archaeological features may extend further into F10 than is indicated by the geophysical data. Faint parallel linear anomalies, TR1, can be seen extending southwards from F15, through F10 and into the east of F11. It is possible that these anomalies locate soil-filled ditches flanking a trackway.

The massive electro-magnetic field generated by low-slung electricity wires over the east of AAA3 has resulted in null data throughout the affected area, masking the response from any

archaeological features, if present. However, given the clear identification of archaeological anomalies on either side of the null data it is highly likely that the complex extends beneath the wires.

AAA4 (see Illus 42–44)

A cluster of fragmented high magnitude linear and curvilinear anomalies is identified in the south of F1 and the west of F2 within an otherwise homogenous magnetic background. The anomalies are located on the northern side of a small stream in an area of suspected Roman settlement as recorded on the CBHER by find spots of pottery and coins (15905). No clear pattern is discernible and the extents of AAA4 cannot be clearly defined from the magnetic dataset but at least three probable enclosures (E15-E17) can be identified. It is likely that alluvial deposits may be present adjacent to the stream, perhaps masking the response from weaker anomalies. Nevertheless, it is likely, given the density of high magnitude anomalies within this cluster, that the anomalies are caused by settlement activity.

4.5 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Unless otherwise specified the anomalies of possible archaeological potential are caused by soil-filled features such as pits or ditches or by spreads of magnetically enhanced material within the upper soil horizons. Whilst these anomalies do not manifest in any coherent archaeological pattern, they are either located near to areas of known archaeology or cannot be satisfactorily interpreted as either modern, agricultural or geological in origin. On this basis, these anomalies are interpreted as potentially archaeological in origin.

More isolated linear and curvilinear anomalies, D1-D8, probably locating soil-filled ditches, have been identified within the south of F7, the south-east of F12 and the north of F16. However, no clear archaeological pattern is discernible and these anomalies are ascribed a moderate archaeological potential.

5 CONCLUSION

The survey has successfully evaluated the survey area identifying four distinct areas of archaeology overlying the Head superficial deposits in the north-east of the proposed development area. The areas are indicative of multi period settlement activity. Two extensive areas of curving ditches containing multiple anomalies, enclosures, round-houses and pits correspond to cropmarks recorded on the Central Bedfordshire HER and are likely to locate areas of Iron Age/ Romano British settlement. A more localised trapezoidal enclosure to the north of these settlement sites corresponds to Dyers Moat which is also recorded on the HER. This is likely to locate a moated site of probable medieval origin.

The fourth area of definite archaeological activity is located in the south-west corner of the PDA close to an area of suspected Roman settlement activity. The area is characterised by multiple curvilinear anomalies and pit-type responses against an otherwise homogenous magnetic background. The anomalies are fragmentary and the extent of the area of activity is not clearly defined, but it is thought to locate settlement activity.

Several further isolated anomalies across the site have been ascribed a possible archaeological origin based upon their high magnitude and their non-conformity to modern, geological or agricultural origins. These anomalies are ascribed a moderate archaeological potential.

Elsewhere, the survey has identified anomalies reflecting the medieval and post-medieval agricultural landscape including ridge and furrow anomalies throughout, infilled ponds and former field boundaries. Therefore, on the basis of the geophysical survey the potential for the presence of buried archaeological remains is assessed as low to moderate across the majority of the site, with the exception of the four areas of definite archaeological potential.

6 REFERENCES

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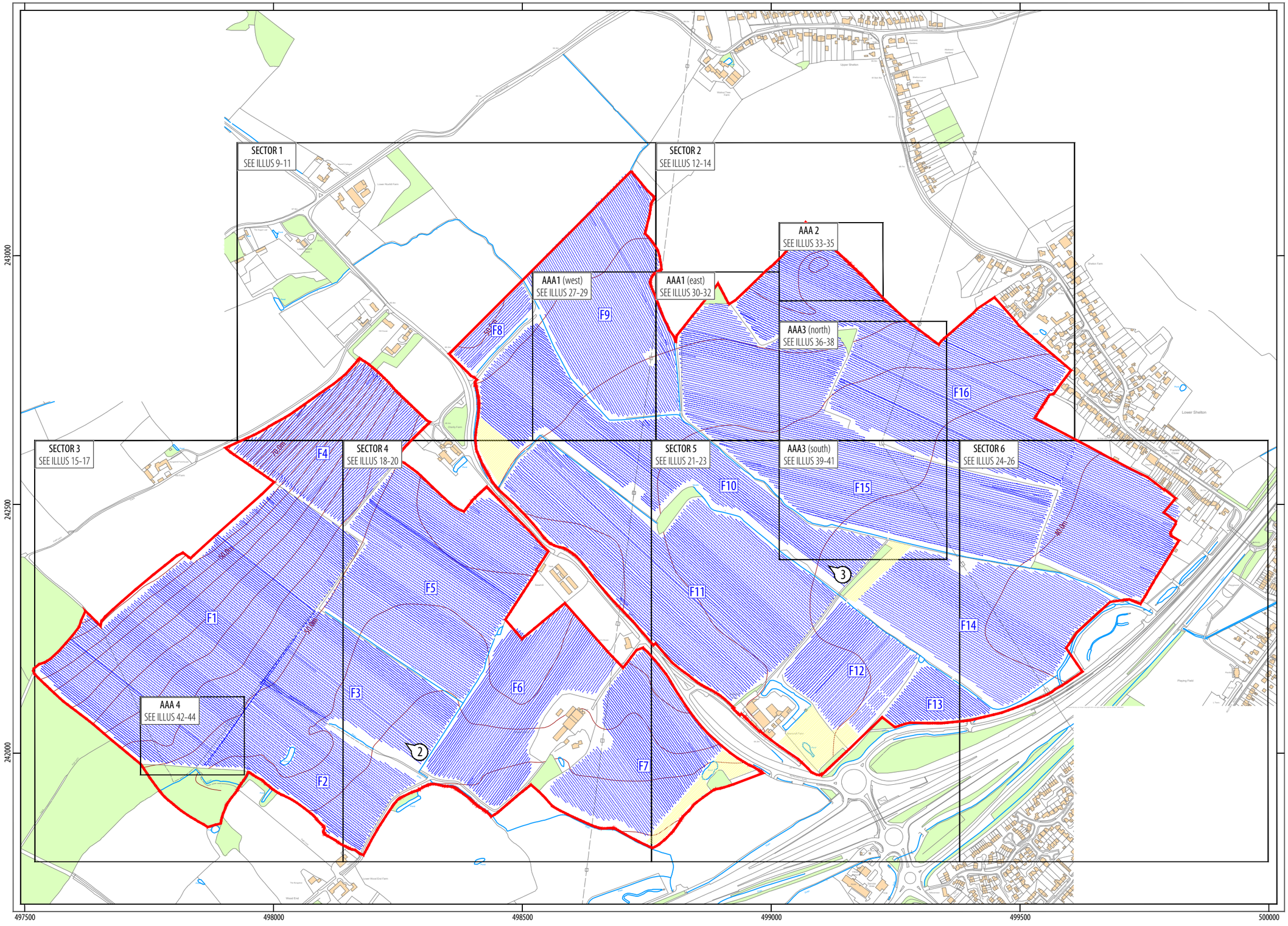


proposed development area
GPS swaths
area unsuitable for survey
location and direction of ILLUS 2-3

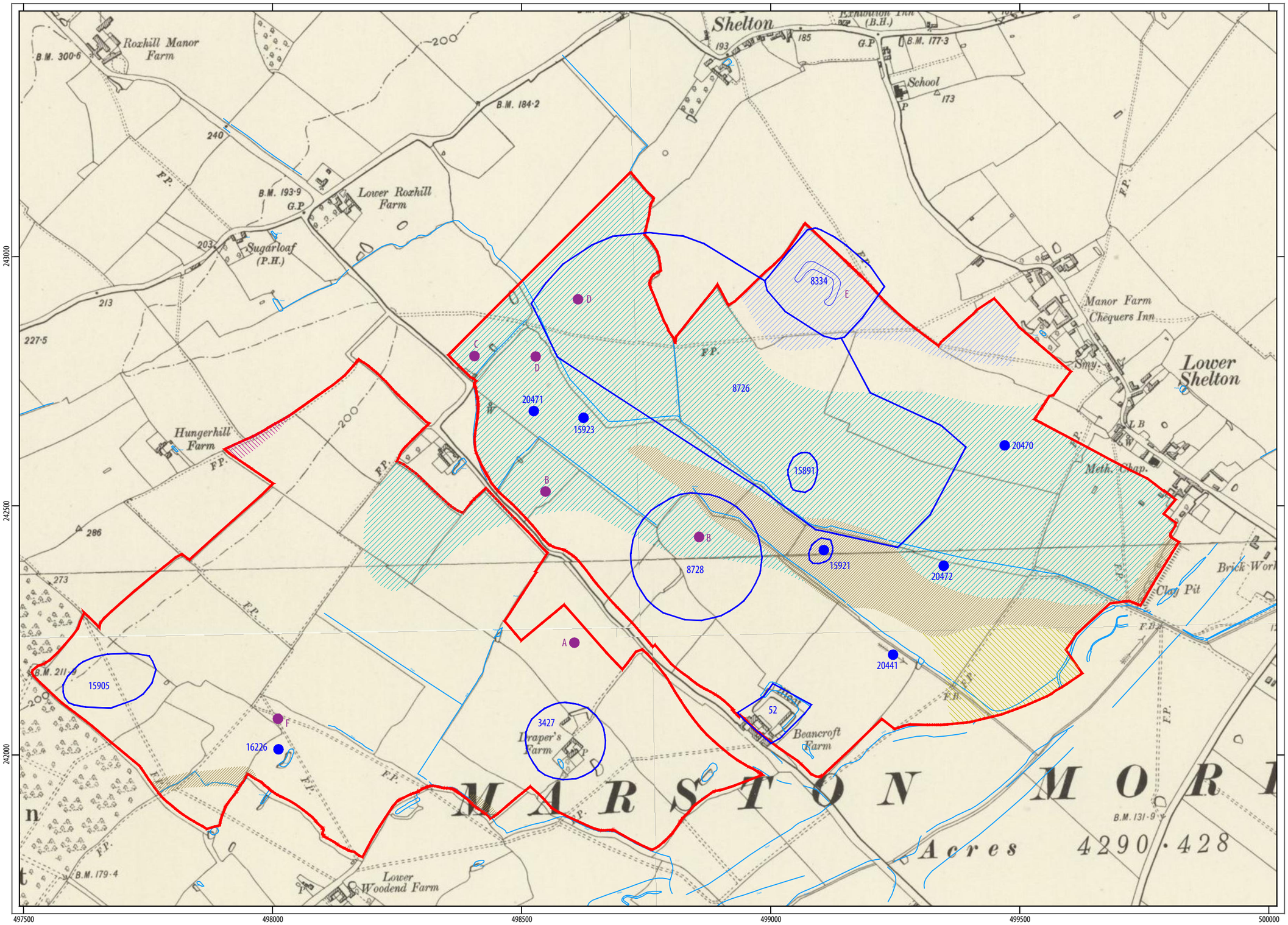
0 200m
1:7,500 @ A3

PROJECT MTBB/01
Marston Thrift
Bedfordshire

CLIENT Catesby Estates PLC

HEADLAND ARCHAEOLOGY
NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 4 Survey location showing GPS swaths and 2m contour data



proposed development area
CBHER data polygon
CBHER data point
report reference

SUPERFICIAL DEPOSITS
Alluvium - clay and silt
Oadby Member - diamicton
Head - clay, silt, sand and gravel
Head 1 - clay, silt, sand and gravel
Head 2 - gravel, sand, silt and clay

0 200m
1:7,500 @ A3

PROJECT MTBB/01
Marston Thrift
Bedfordshire

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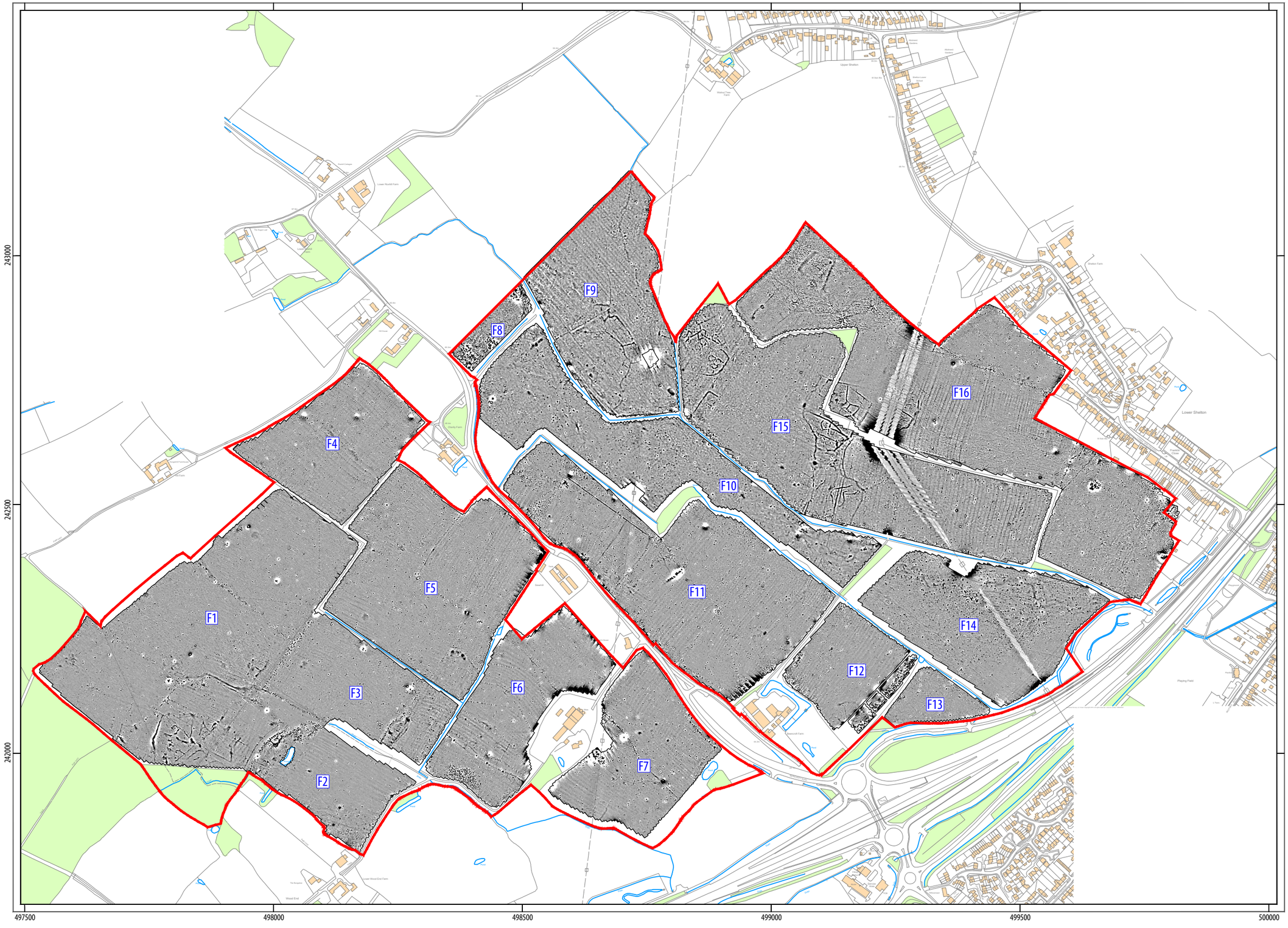
HEADLAND ARCHAEOLOGY
NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 5 Survey location showing Central Bedfordshire HER data overlying 1888-1913 six inch OS map



proposed development area

nT
-1.0
2.0

0
200m
1:7,500 @ A3

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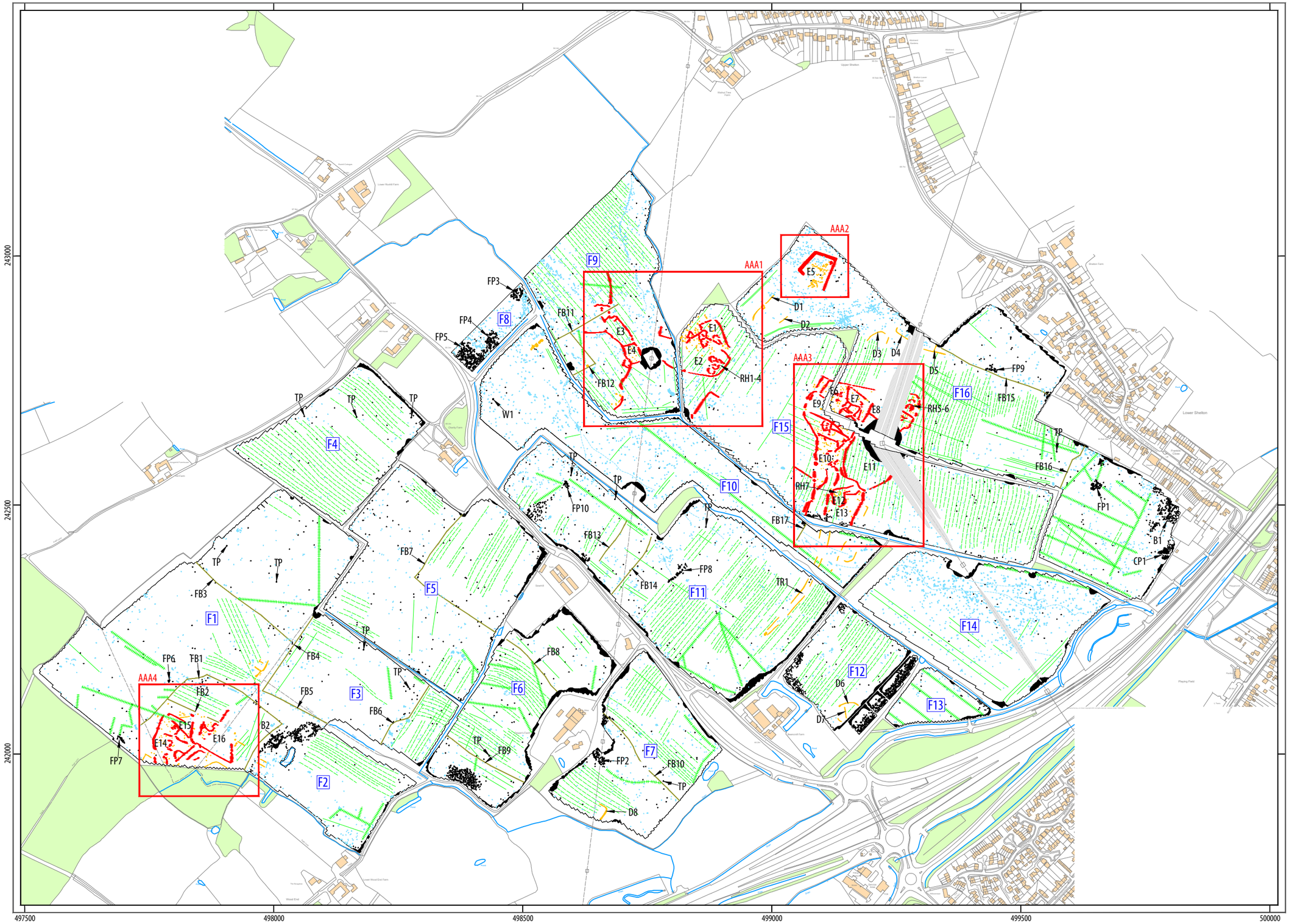
ILLUS 6 Processed greyscale magnetometer data



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
null data	overhead cables
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

AAA area of archaeological activity
B former building
CP clay pit
D ditch
E enclosure
FB former boundary
FP former pond
RH round-house
TR trackway
TP Telegraph pole
W well

0 200m
1:7,500 @ A3

PROJECT MTBB/01
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Bedfordshire

CLIENT Catesby Estates PLC

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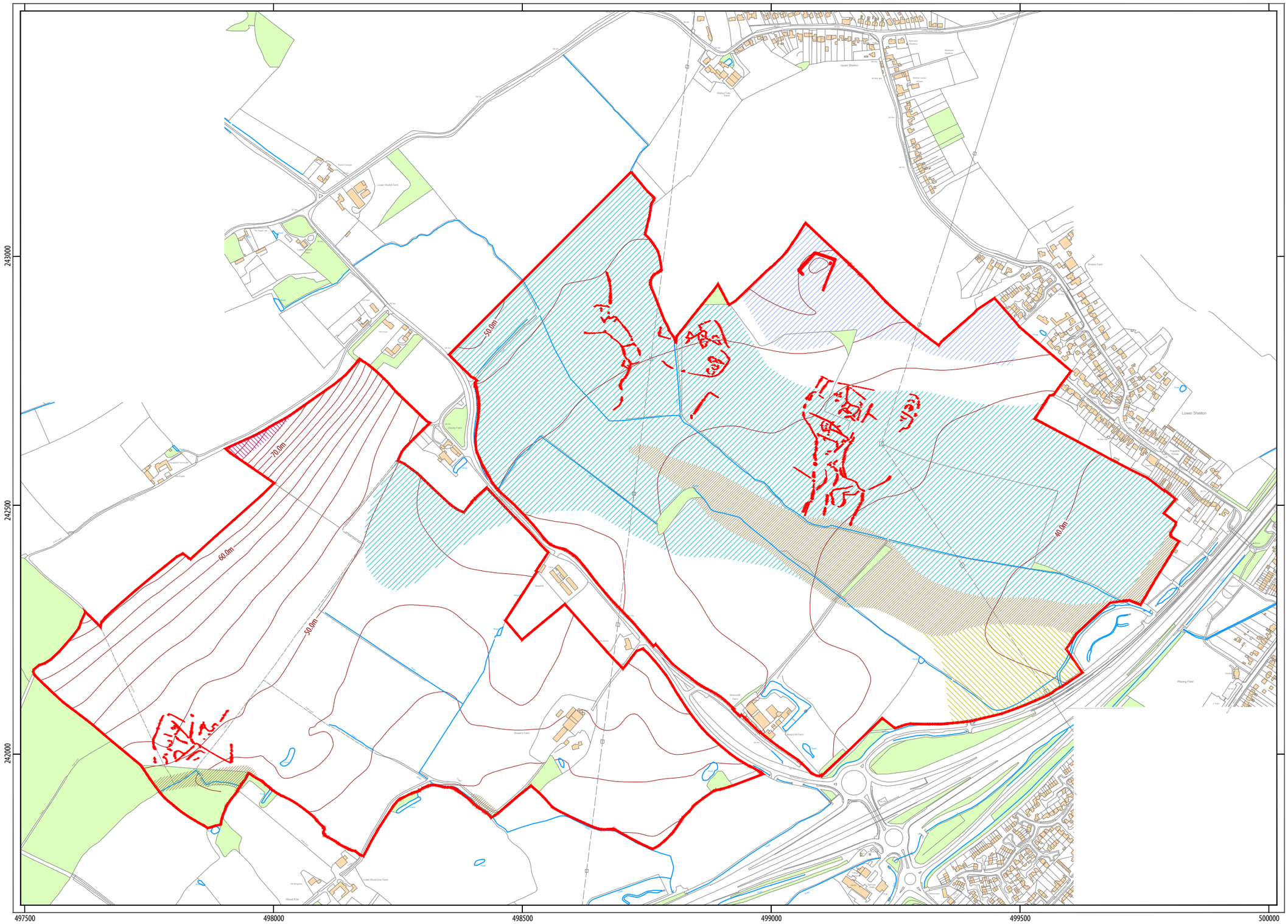
NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 7 Interpretation of magnetometer data



proposed development area

area of archaeological activity

SUPERFICIAL DEPOSITS

- Alluvium - clay and silt
- Oadby Member - diamicton
- Head - clay, silt, sand and gravel
- Head 1 - clay, silt, sand and gravel
- Head 2 - gravel, sand, silt and clay

0 200m

1:7,500 @ A3

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ILLUS 8 Survey location showing 2m contour data, superficial deposits and areas of archaeological activity

nT
-1.0 2.0

0 50m
1:2,500 @ A3

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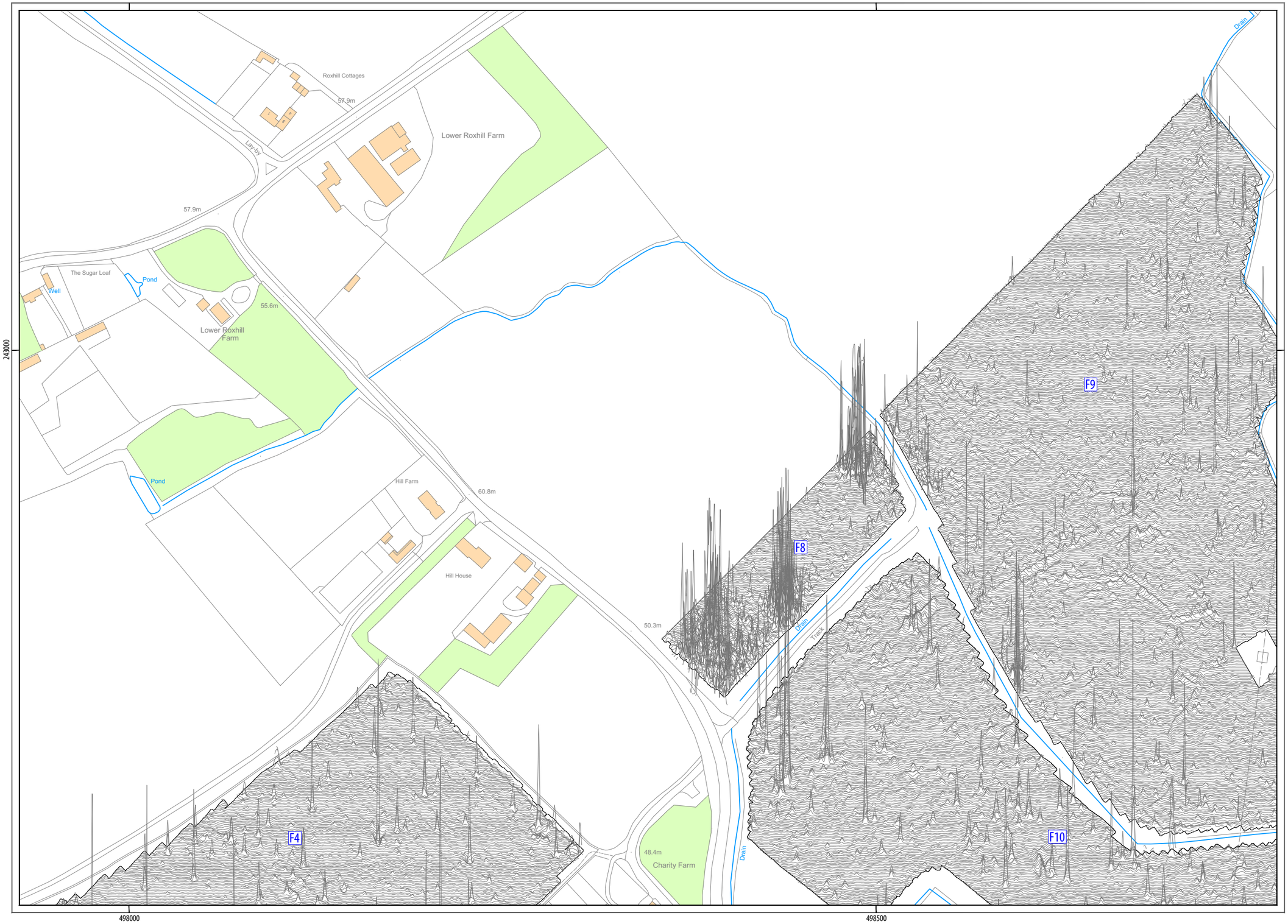
ILLUS 9 Processed greyscale magnetometer data; Sector 1



50.0nT/cm

0 50m

1:2,500 @ A3

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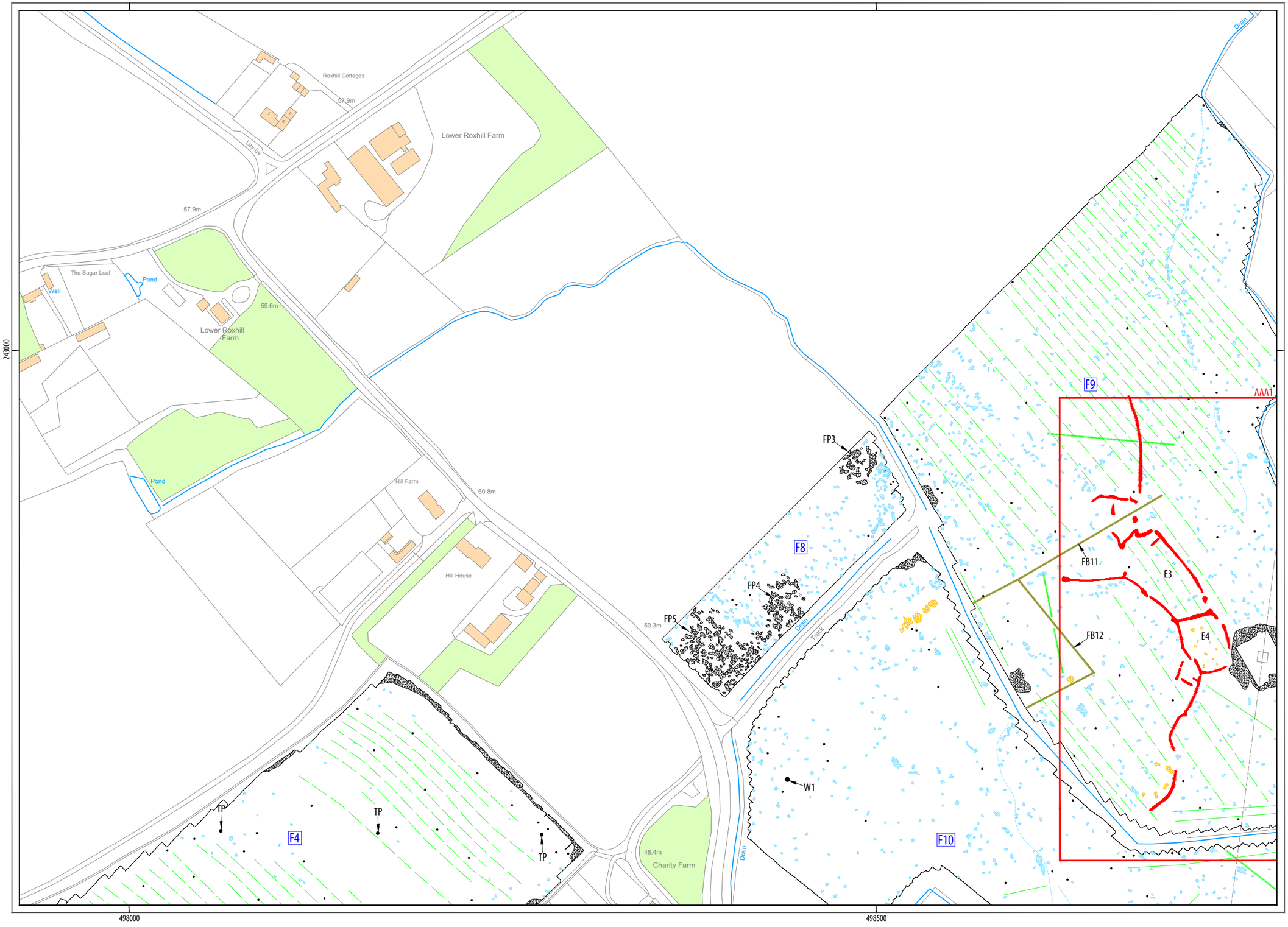
ILLUS 10 XY trace plot of minimally processed magnetometer data; Sector 1



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

- **AAA** area of archaeological activity
- **E** enclosure
- **FB** former boundary
- **FP** former pond
- **TP** telegraph pole
- **W** well

0 50m
1:2,500 @ A3

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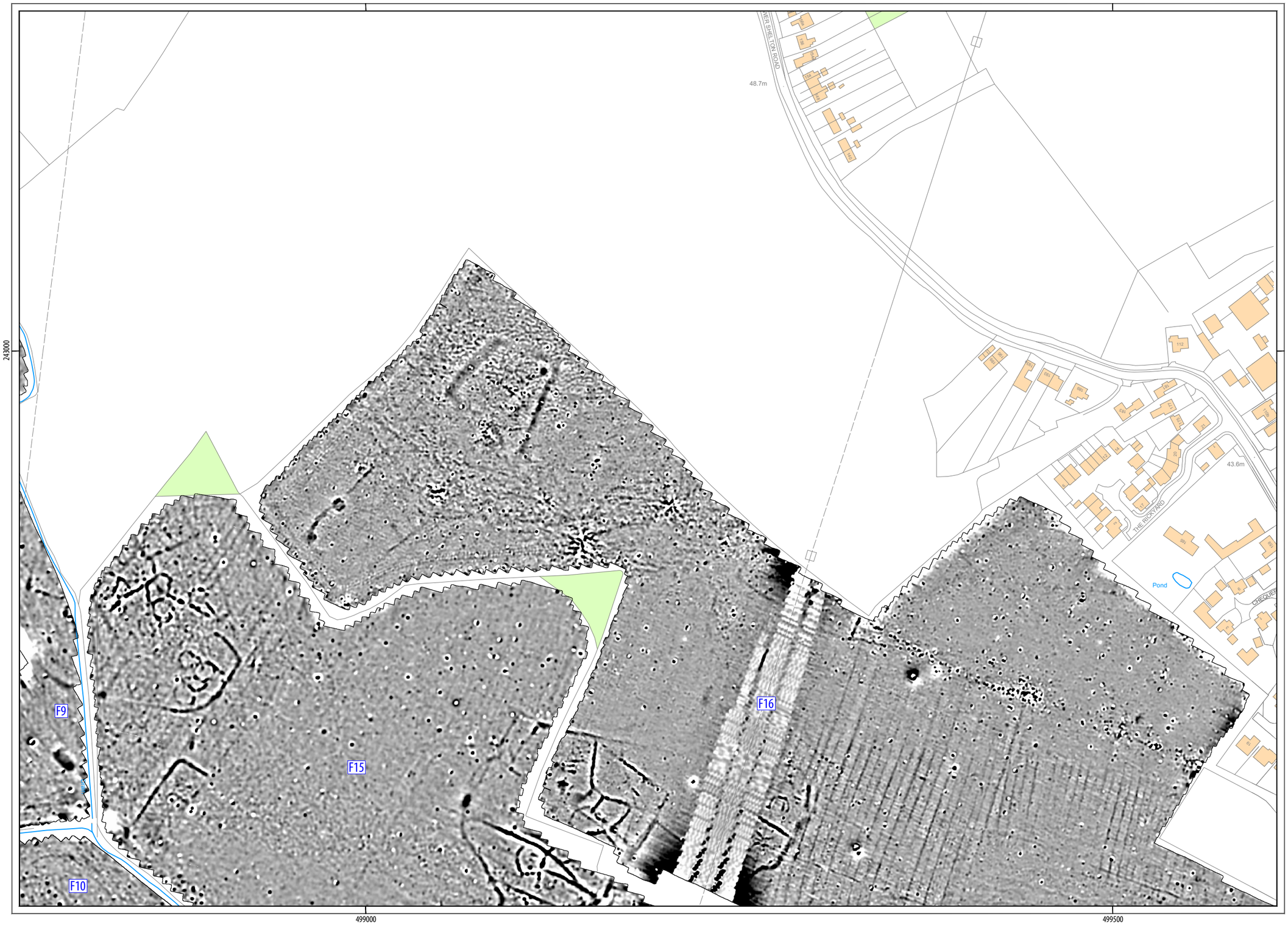
ILLUS 11 Interpretation of magnetometer data; Sector 1



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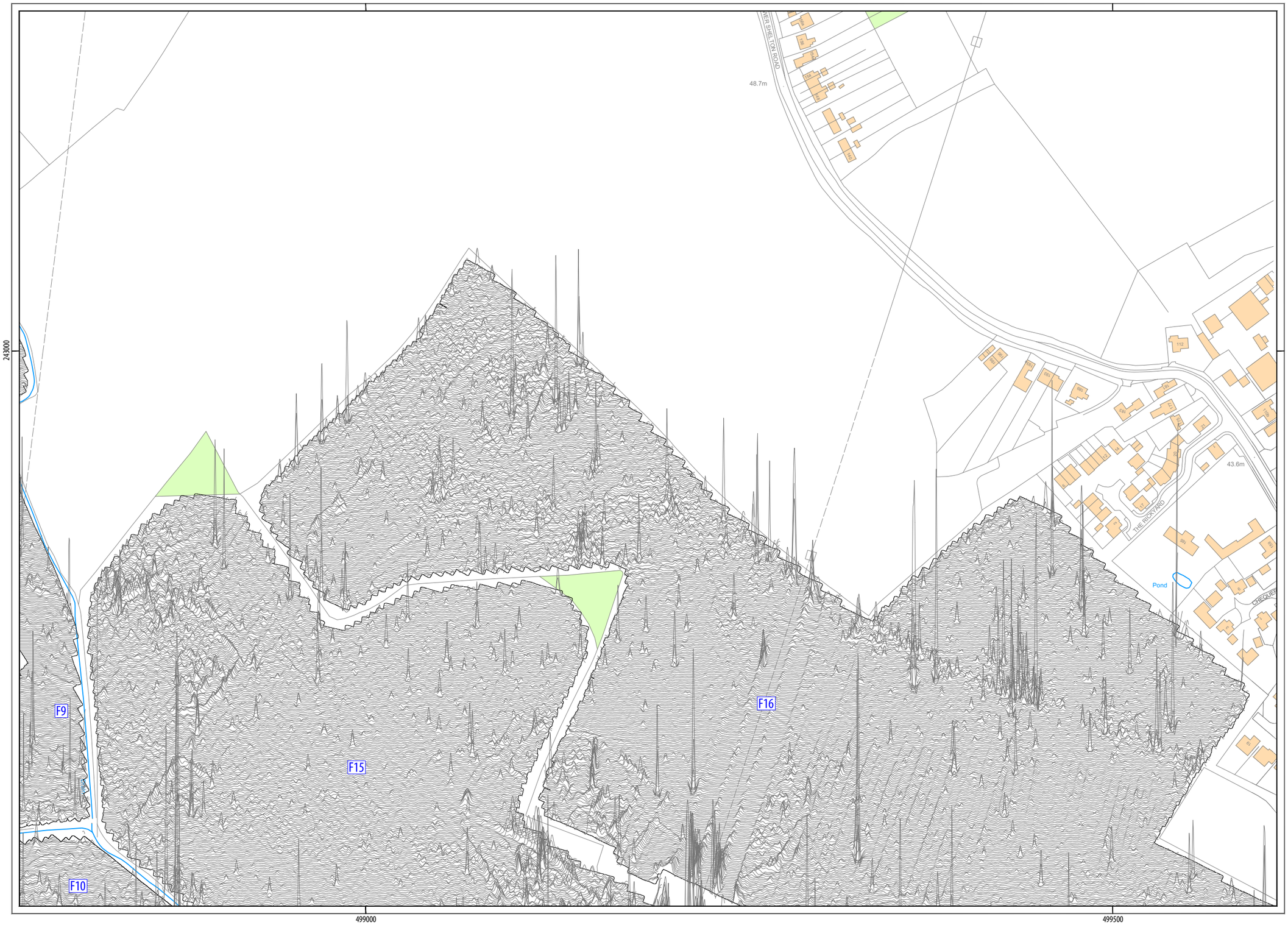
ILLUS 12 Processed greyscale magnetometer data; Sector 2



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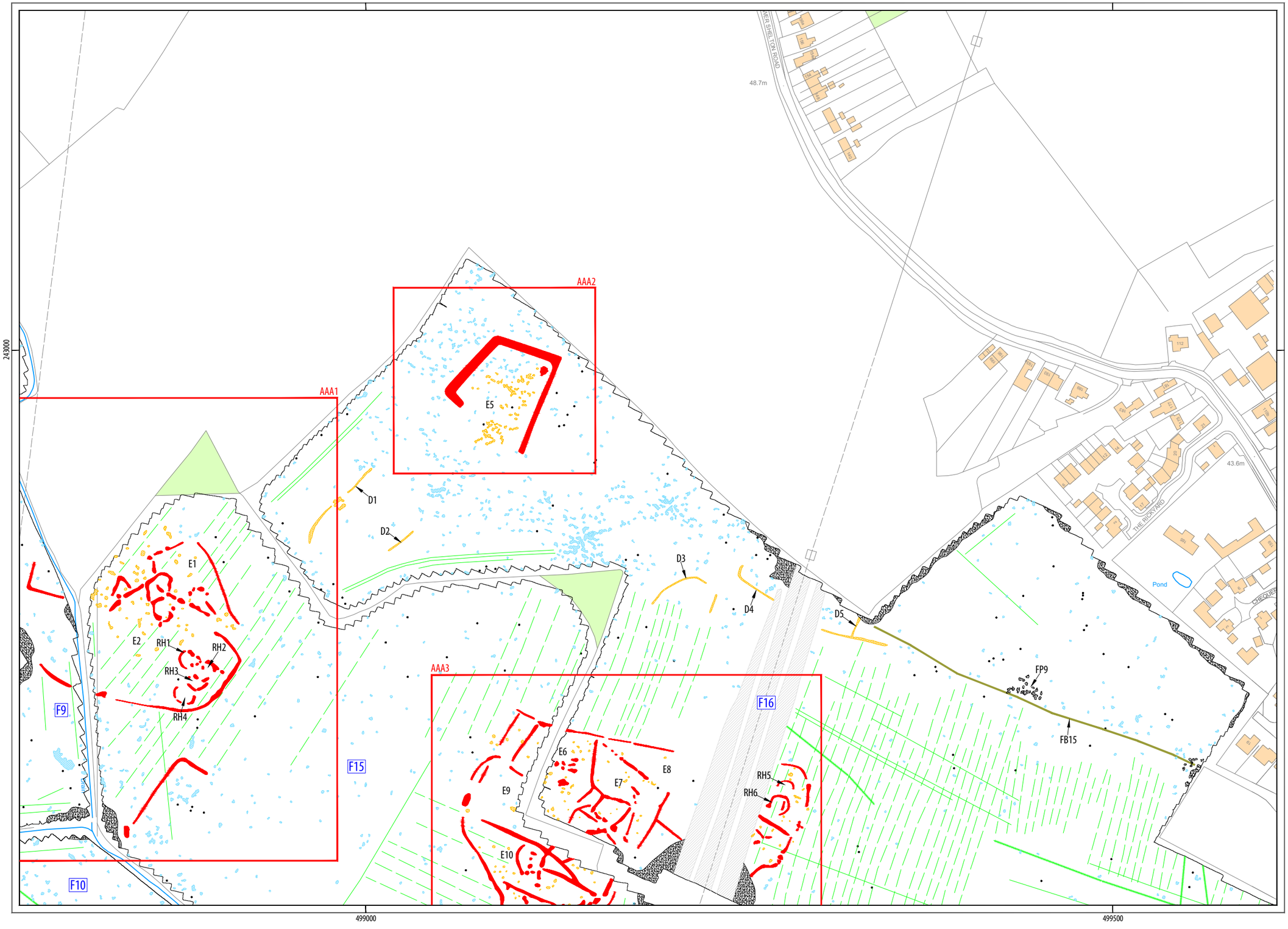
ILLUS 13 XY trace plot of minimally processed magnetometer data; Sector 2



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
null data	overhead cables
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

AAA area of archaeological activity
D ditch
E enclosure
FB former boundary
FP former pond
RH round-house

0 50m
1:2,500 @ A3

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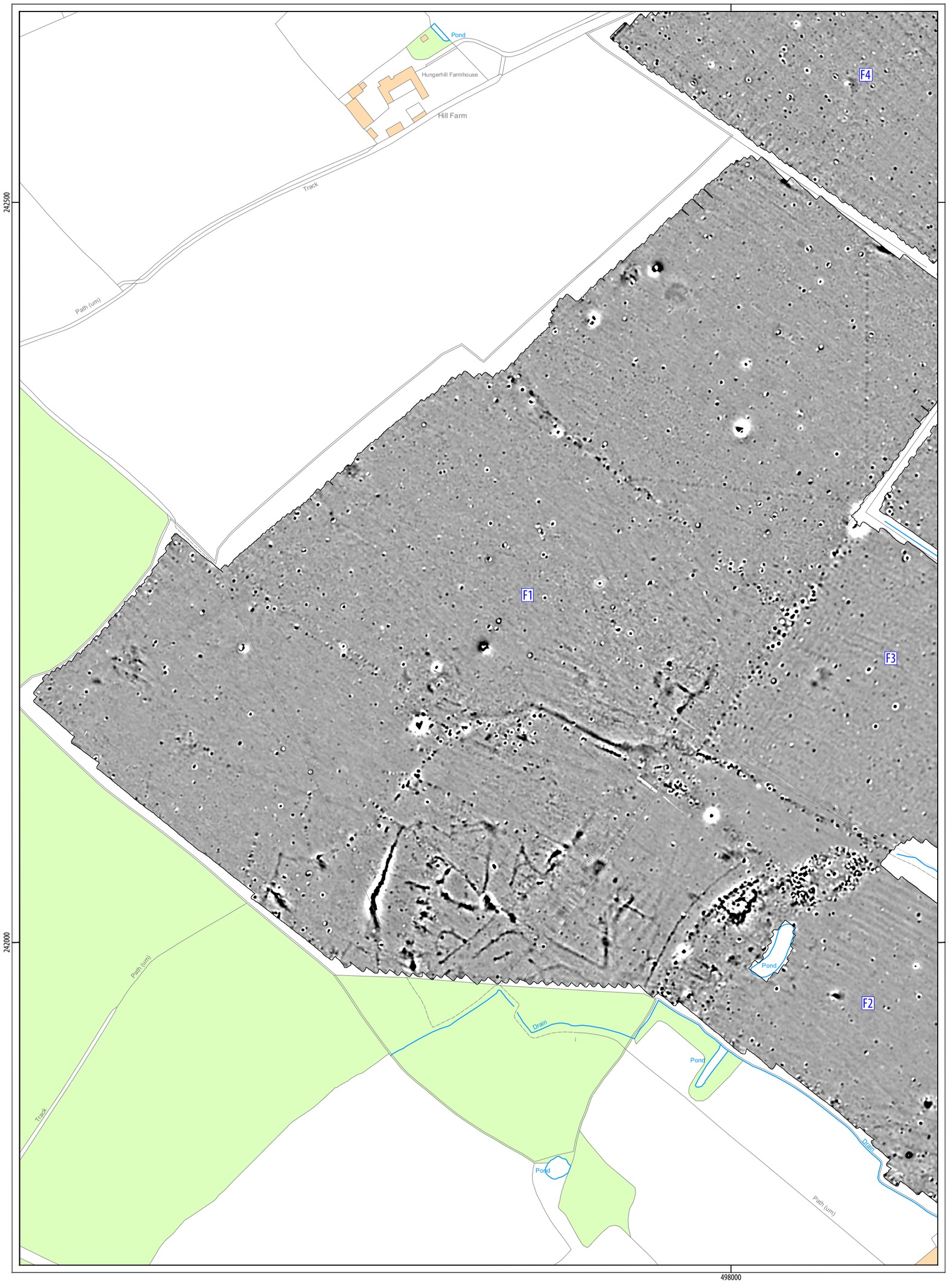
ILLUS 14 Interpretation of magnetometer data; Sector 2



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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ILLUS 15 Processed greyscale magnetometer data; Sector 3

50.0nT/cm

0 50m

1:2,500 @ A3

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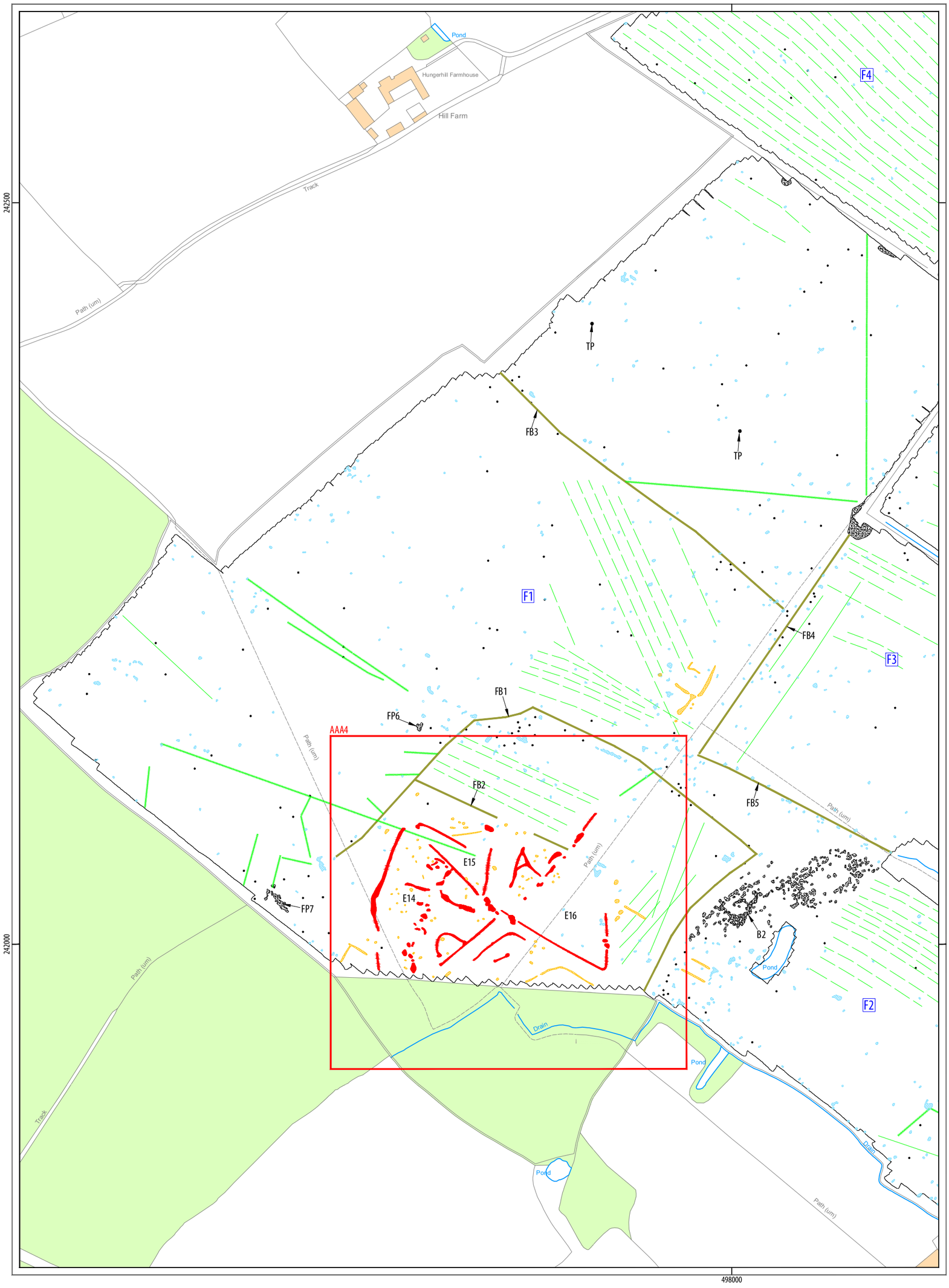
ILLUS 16 XY trace plot of minimally processed magnetometer data; Sector 3



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

- **AAA** area of archaeological activity
- **B** former building
- **E** enclosure
- **FB** former boundary
- **TP** telegraph pole

0 50m

1:2,500 @ A3

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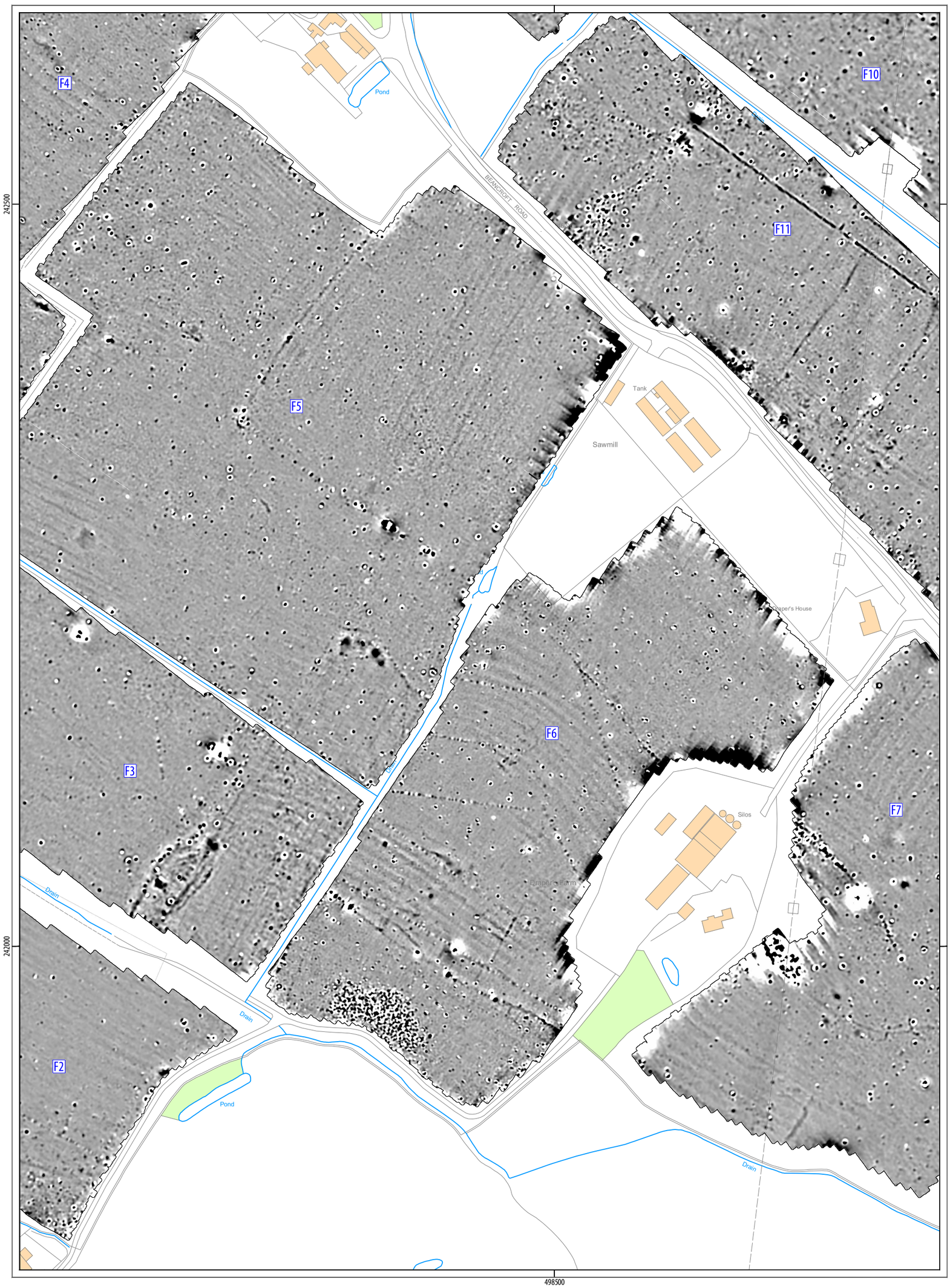
ILLUS 17 Interpretation of magnetometer data; Sector 3



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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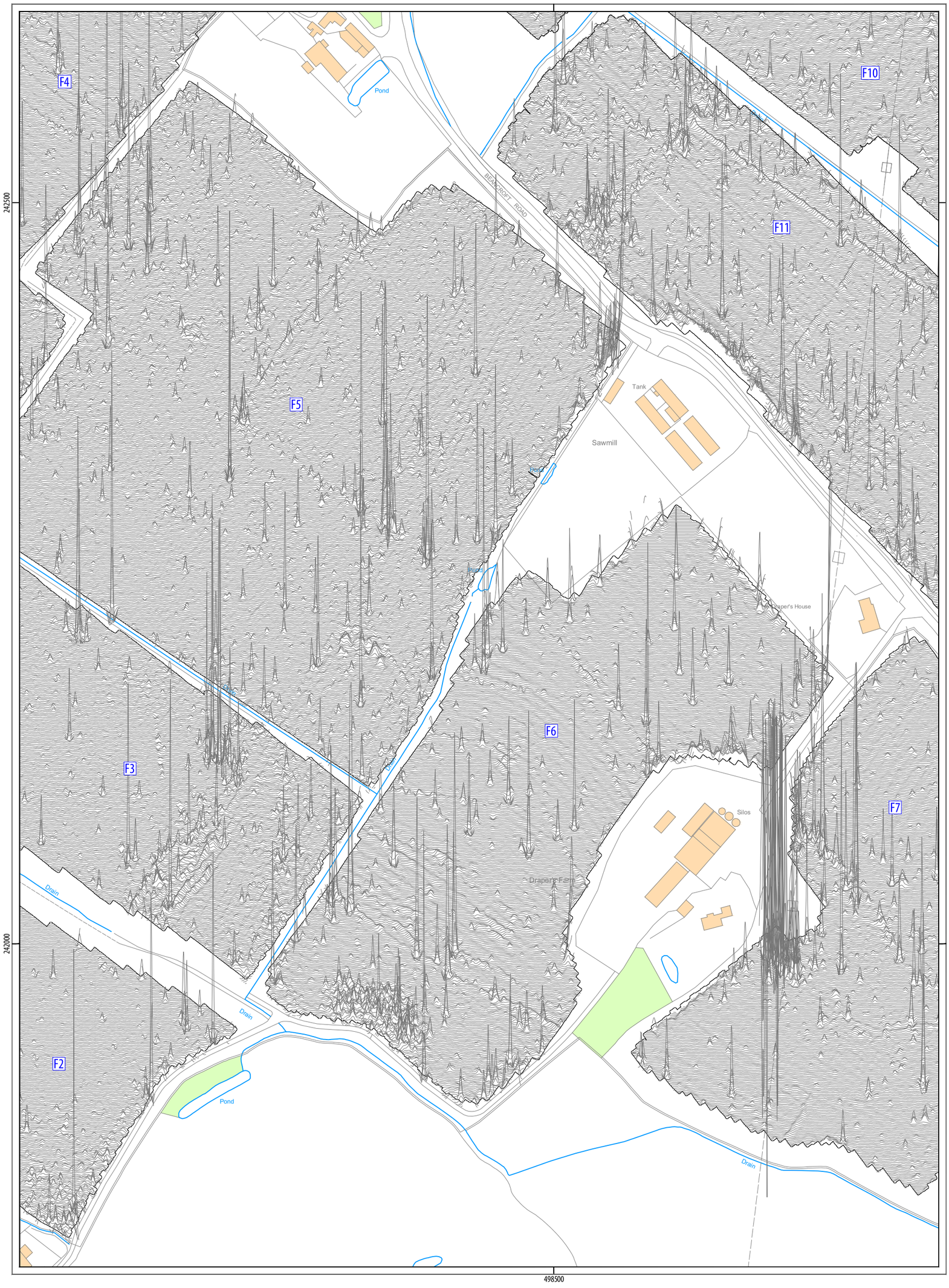
ILLUS 18 Processed greyscale magnetometer data; Sector 4



50.0nT/cm

0 50m

1:2,500 @ A3

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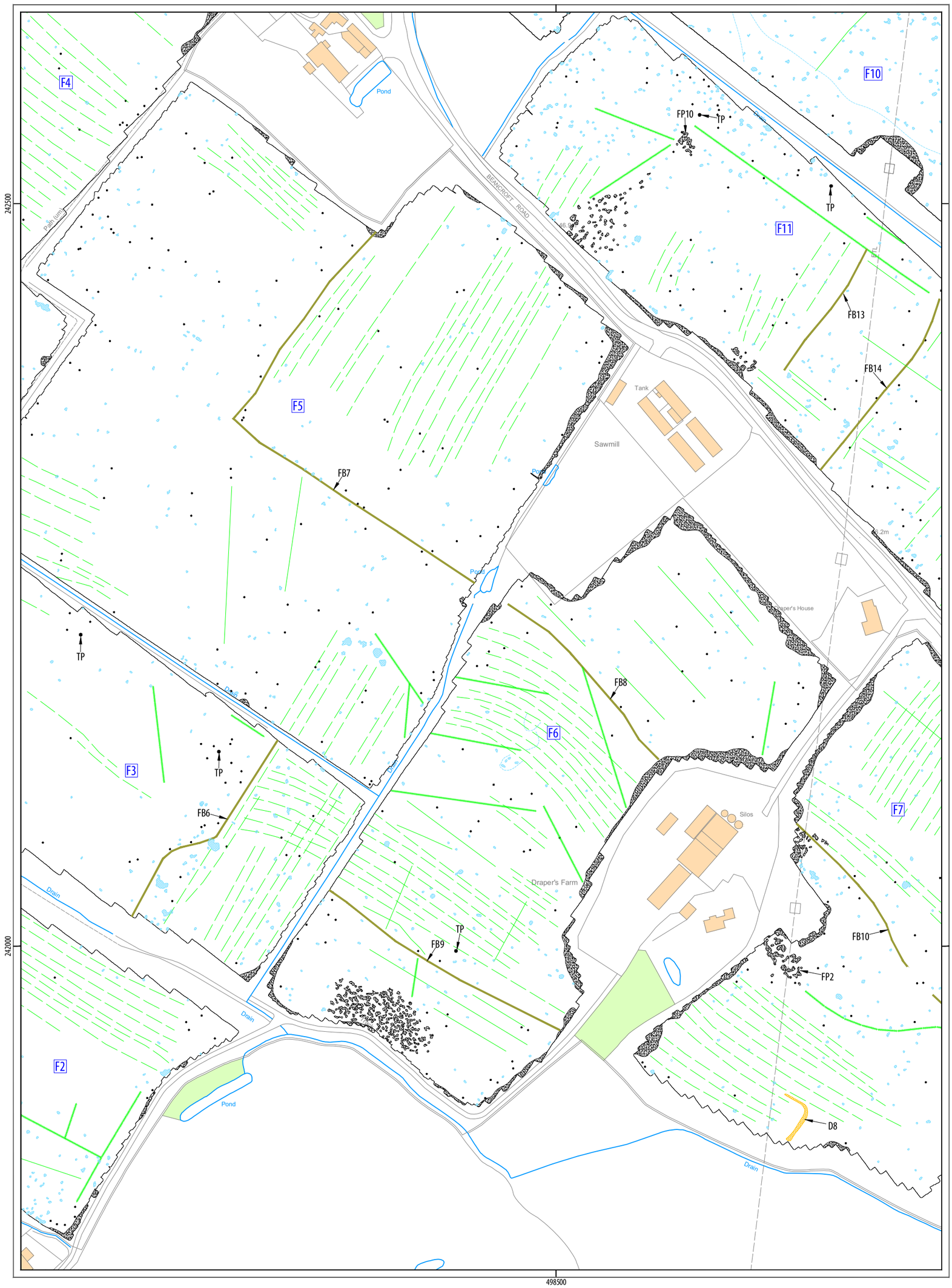
ILLUS 19 XY trace plot of minimally processed magnetometer data; Sector 4



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?

ABBREVIATIONS	
D	ditch
FB	former boundary
FP	former pond
TP	telegraph pole

0 50m
1:2,500 @ A3

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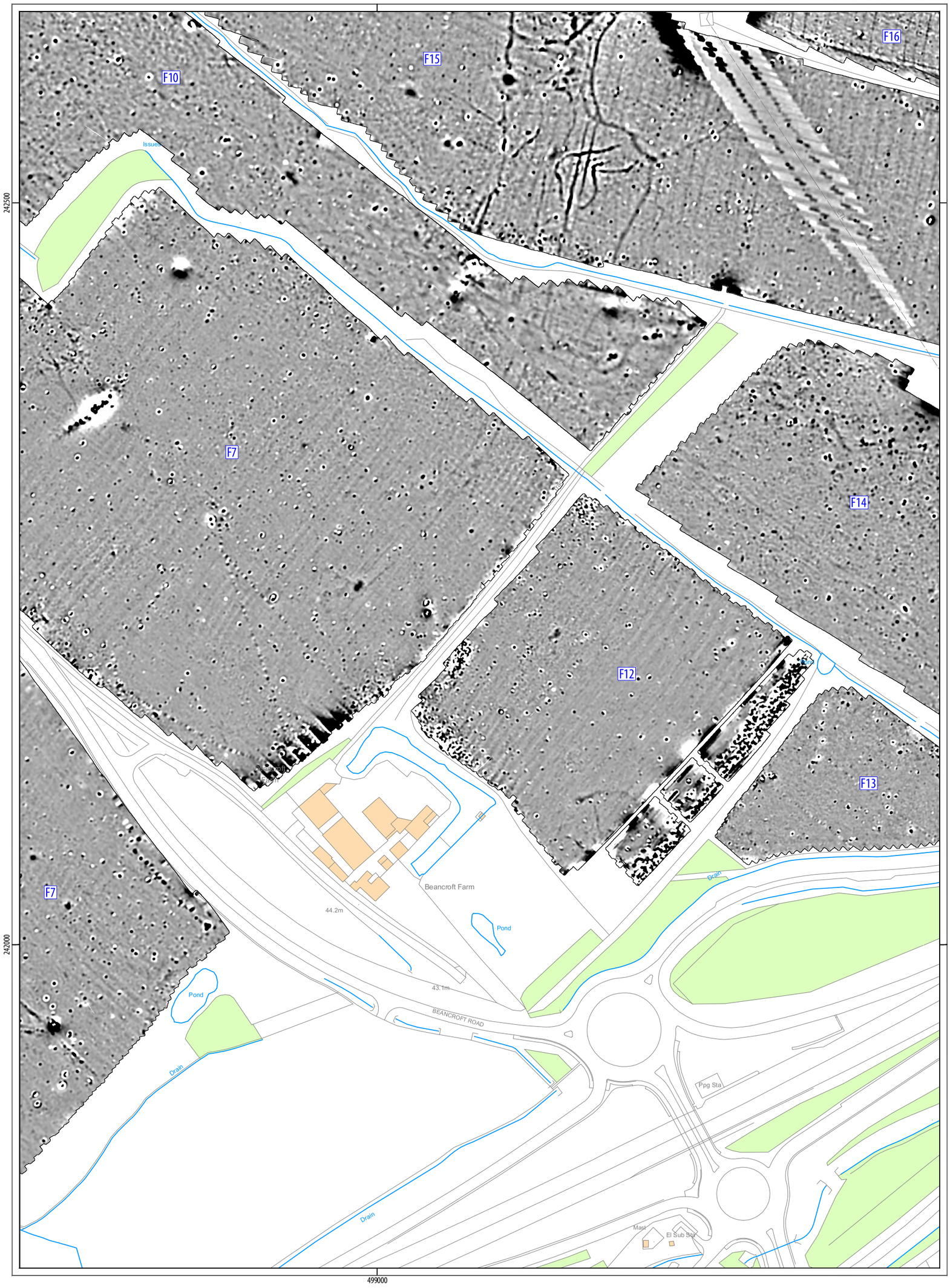
ILLUS 20 Interpretation of magnetometer data; Sector 4



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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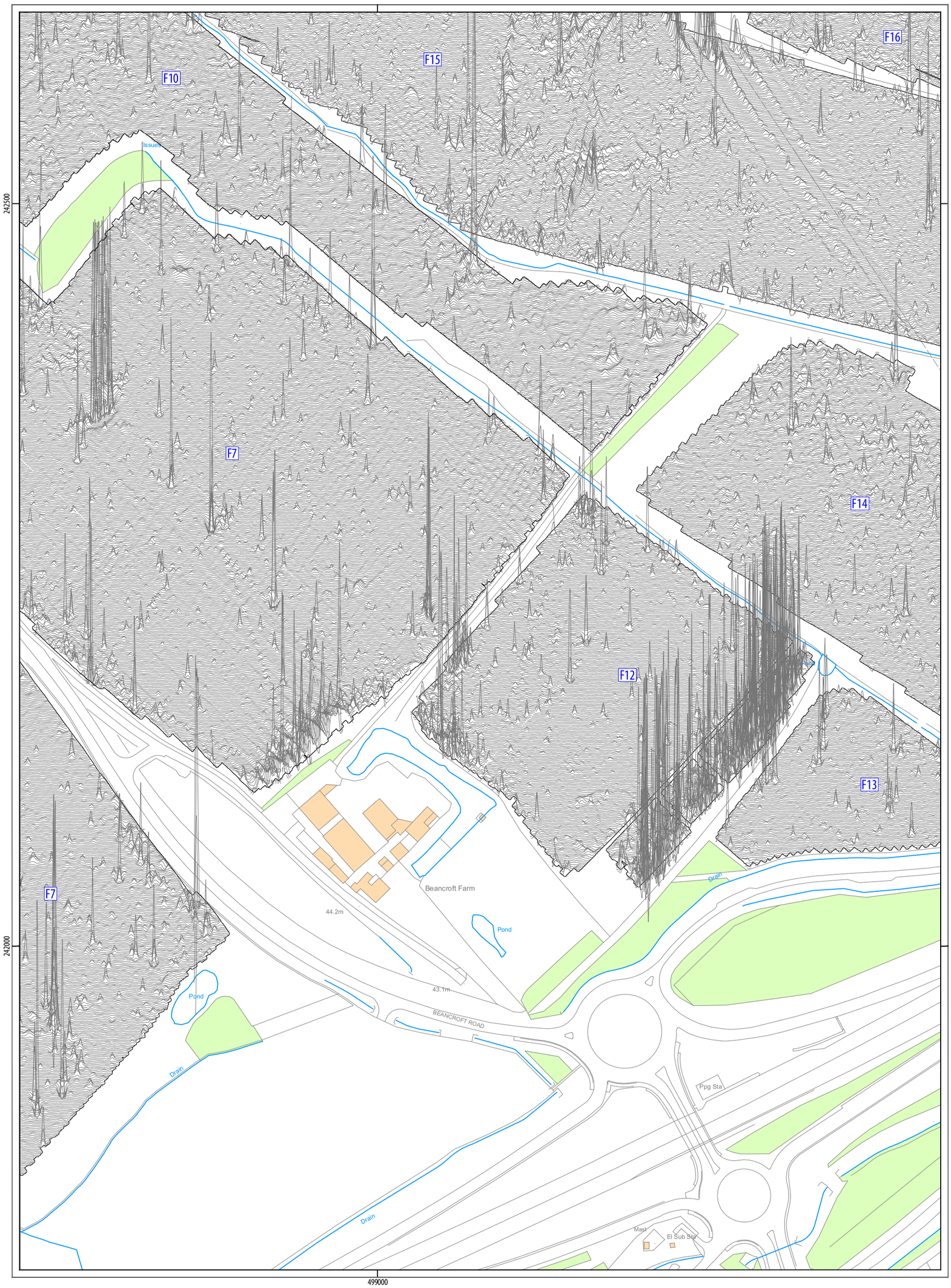
ILLUS 21 Processed greyscale magnetometer data; Sector 5



50.0nT/cm

0 50m

1:2,500 @ A3

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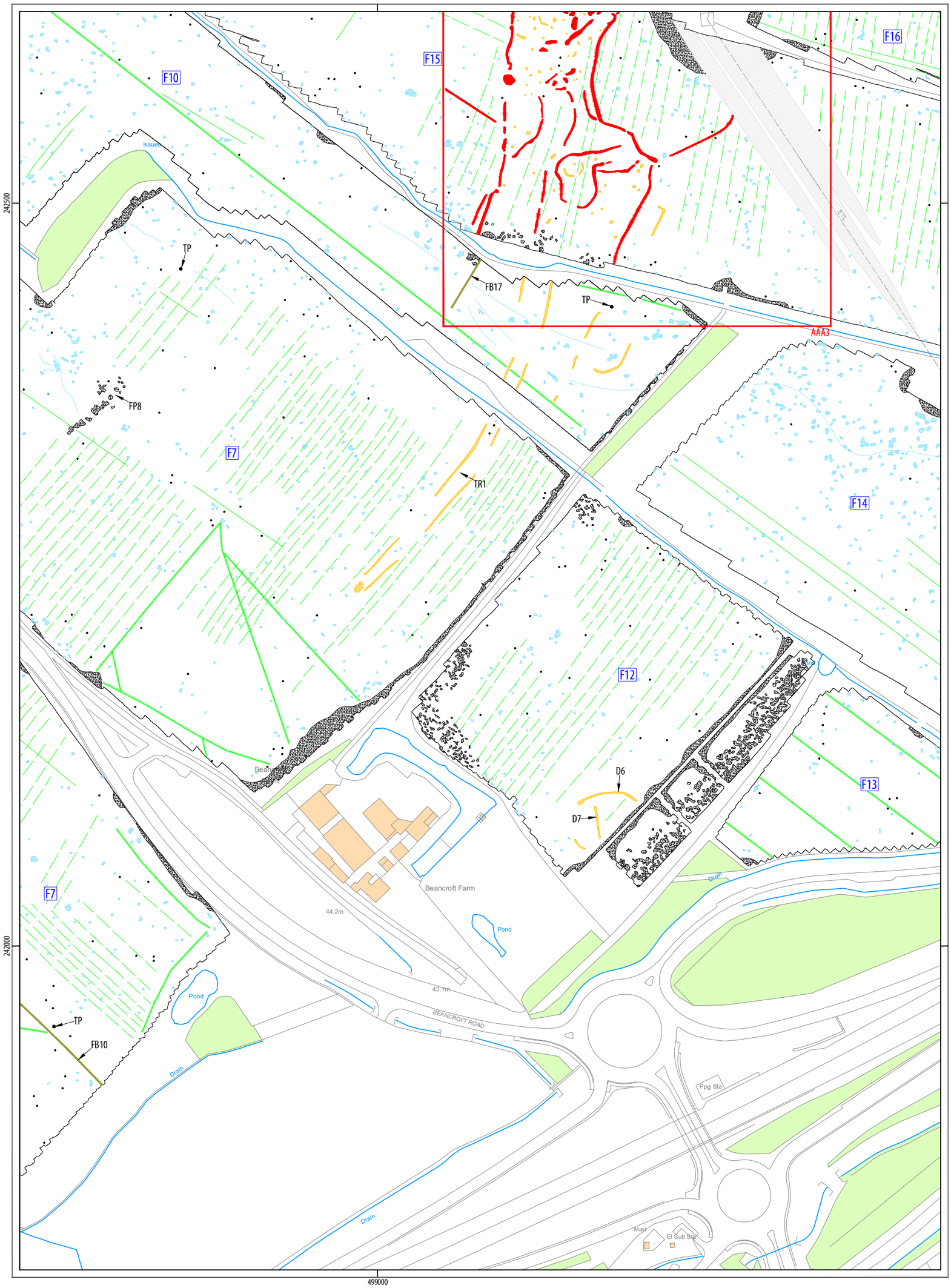
ILLUS 22 XY trace plot of minimallly processed magnetometer data; Sector 5



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

D	ditch
FB	former boundary
FP	former pond
TP	telegraph pole
TR	trackway

0 50m
1:2,500 @ A3

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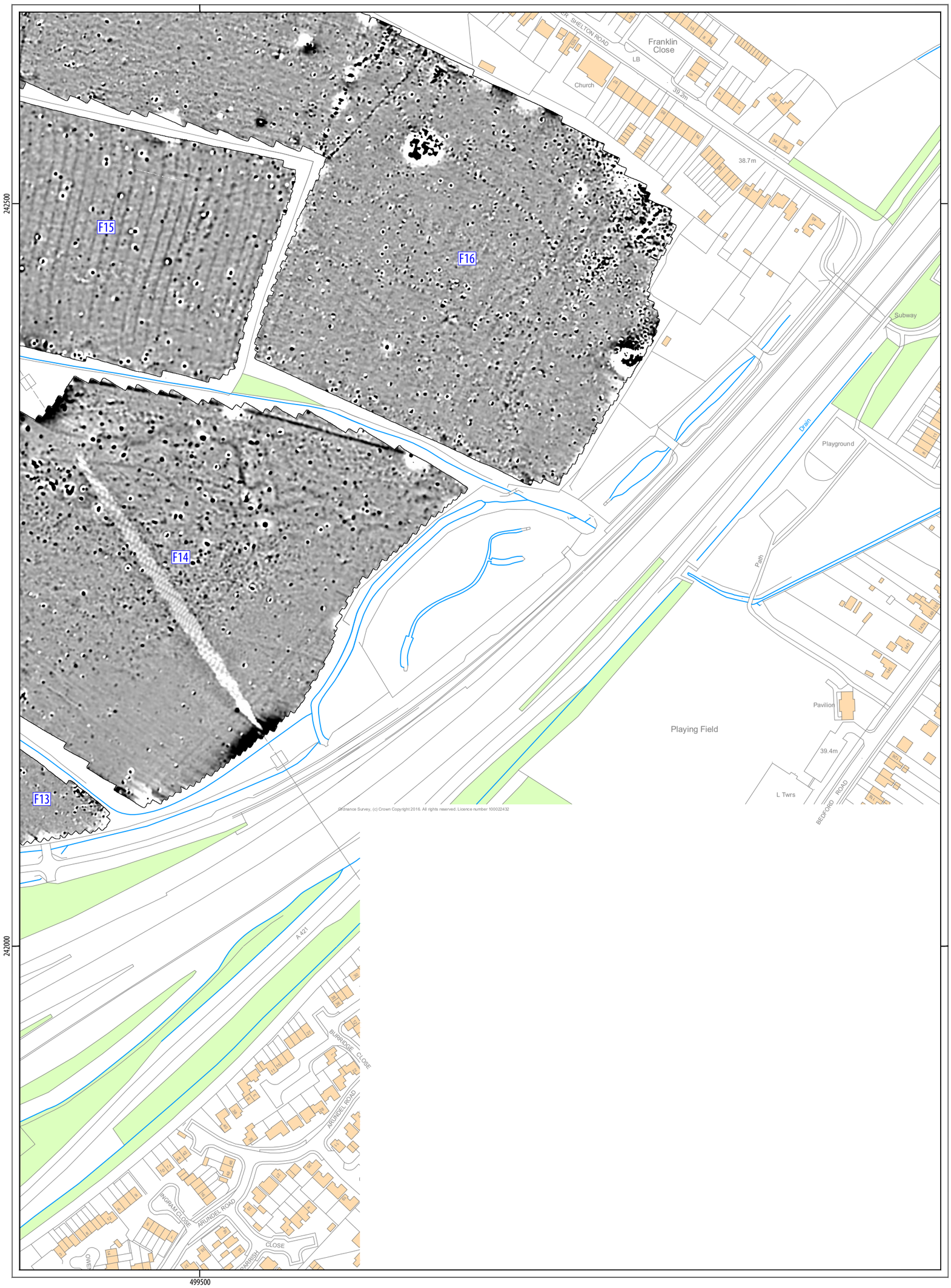
ILLUS 23 Interpretation of magnetometer data; Sector 5



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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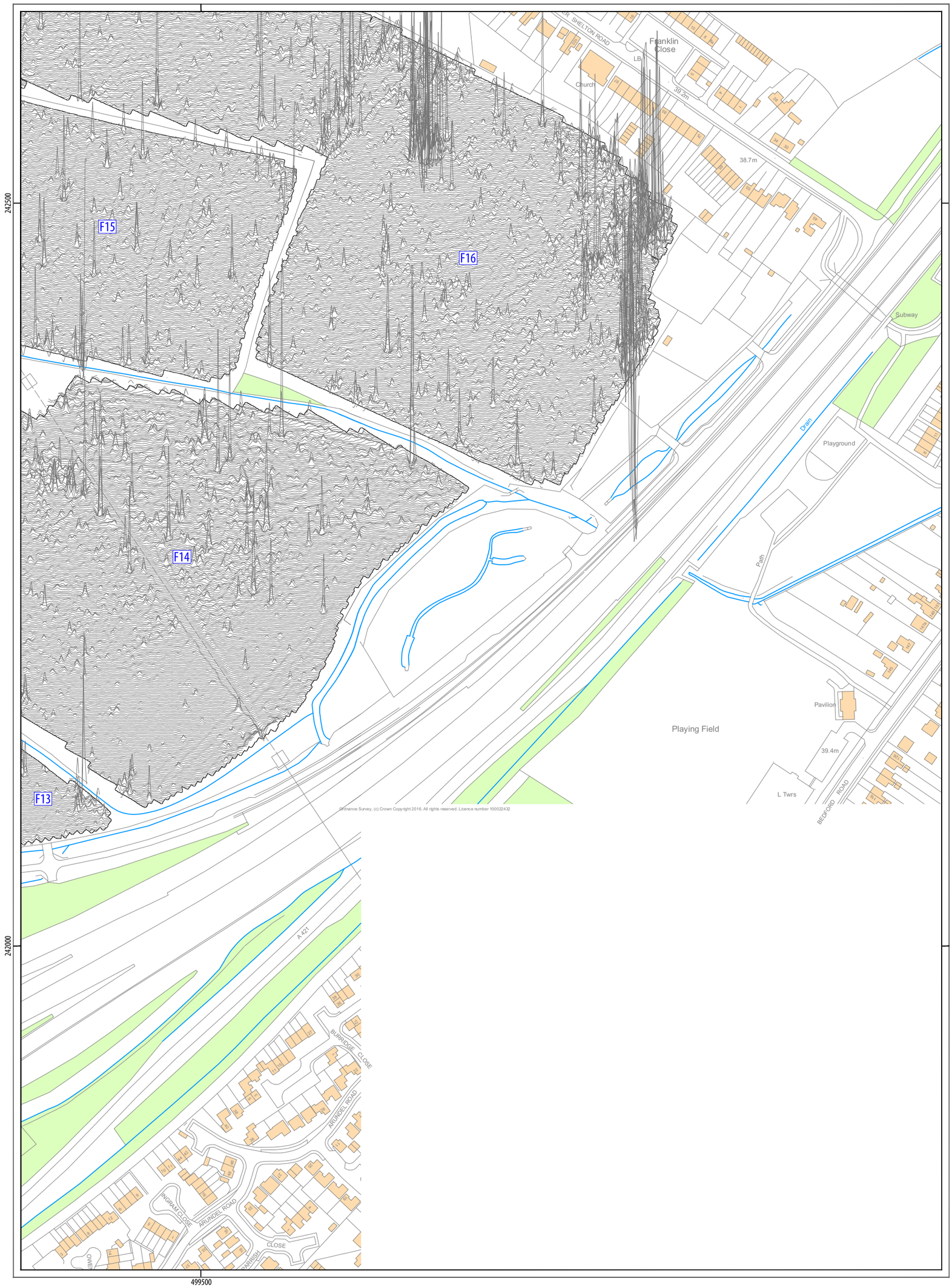
ILLUS 24 Processed greyscale magnetometer data; Sector 6



50.0nT/cm

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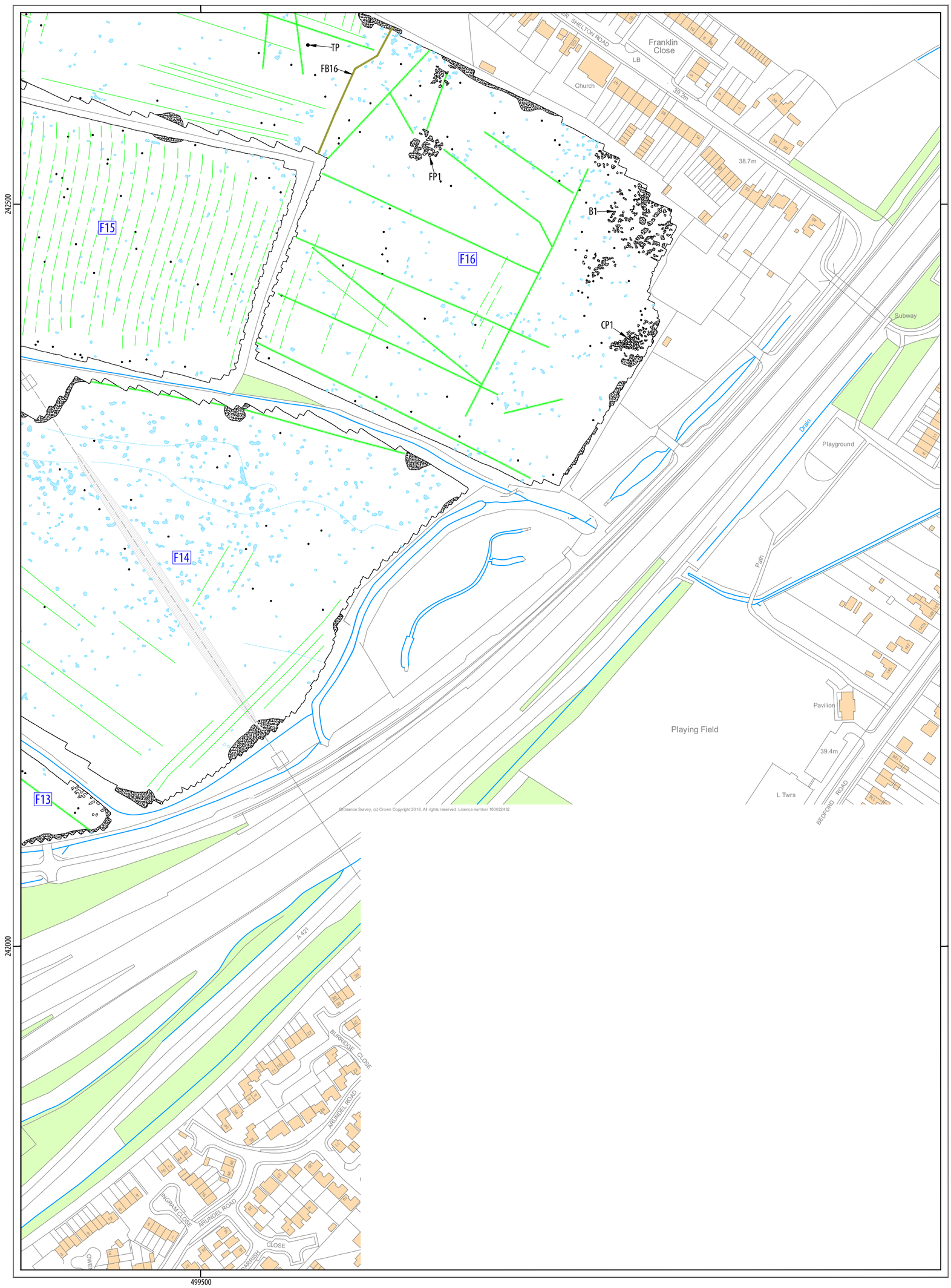
ILLUS 25 XY trace plot of minimally processed magnetometer data; Sector 6



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
null data	overhead cables
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain

TYPE OF ANOMALY	INTERPRETATION
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology?

ABBREVIATIONS	
B	former building
CP	clay pit
FB	former boundary
FP	former pond
TP	telegraph pole

0 50m
1:2,500 @ A3

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ILLUS 26 Interpretation of magnetometer data; Sector 6

-1.0 nT 2.0

0 25m

1:1,000 @ A3

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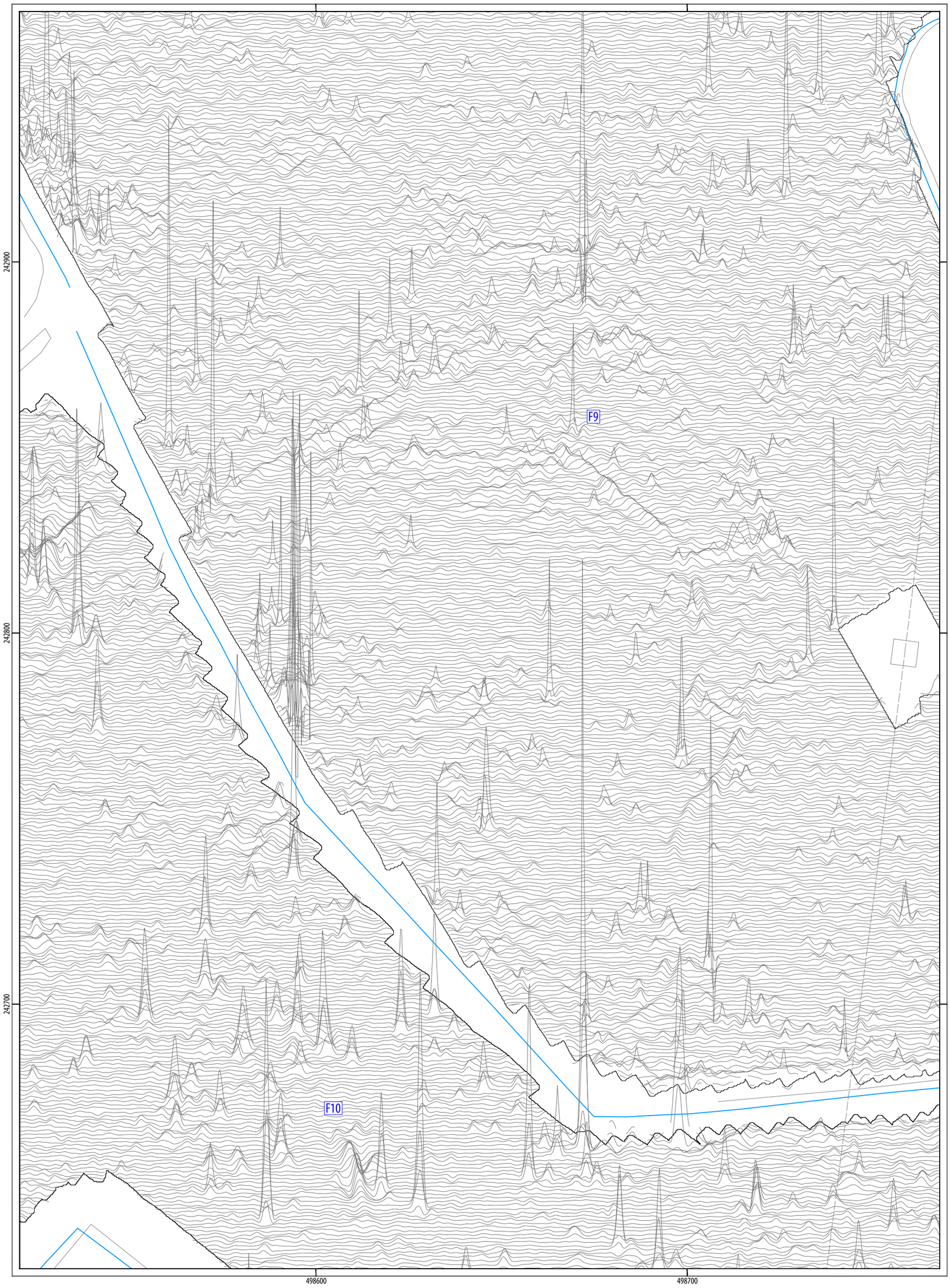
ILLUS 27 Processed greyscale magnetometer data; AAA1 (west)



20.0nT/cm

0 25m

1:1,000 @ A3

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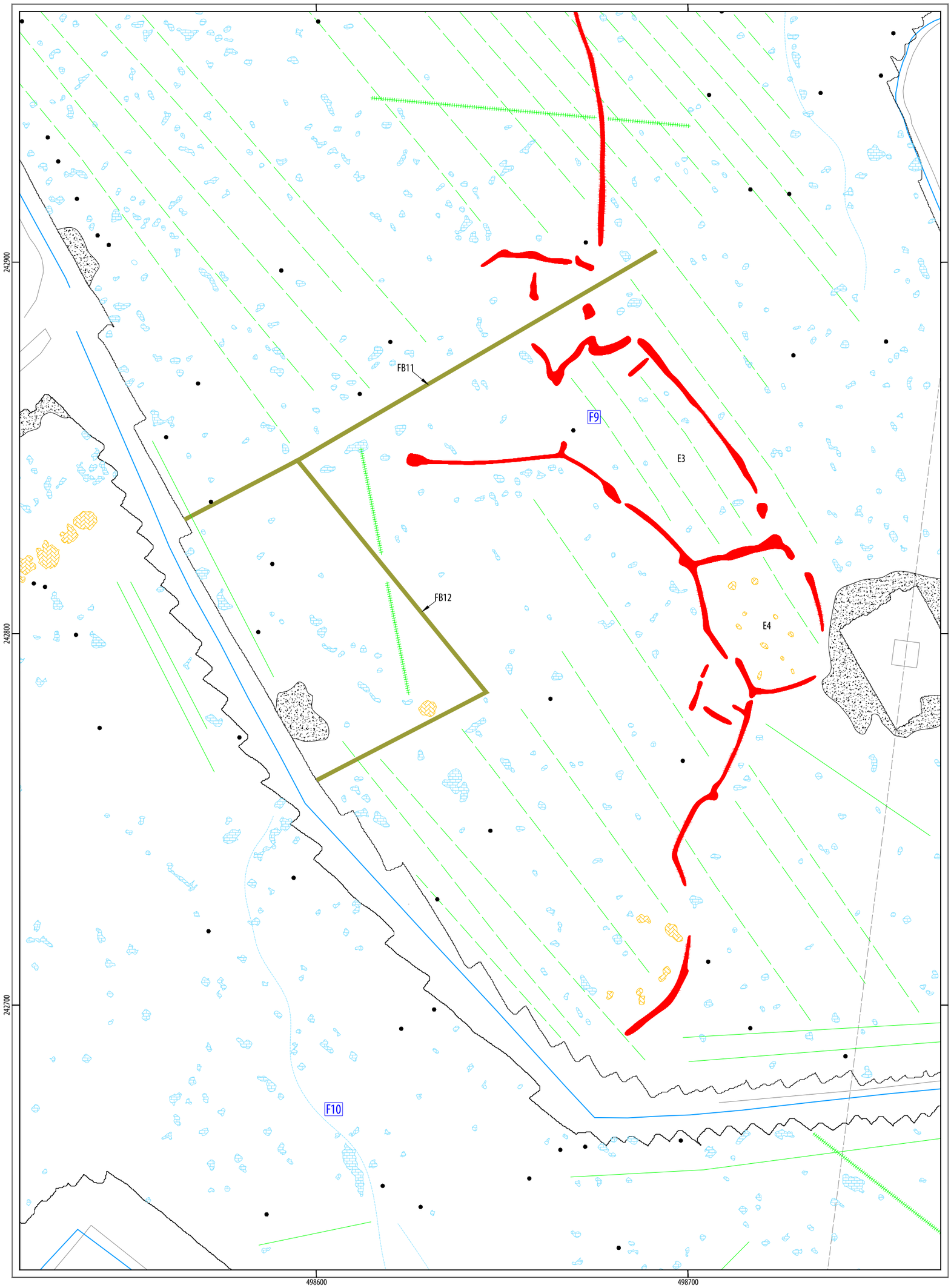
ILLUS 28 XY trace plot of minimally processed magnetometer data; AAA1 (west)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
linear trend	geological variation
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

E enclosure

FB former boundary

0 25m

1:1,000 @ A3

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ILLUS 28 Interpretation of magnetometer data; AAA1 (west)

-1.0 nT 2.0

0 25m
1:1,000 @ A3

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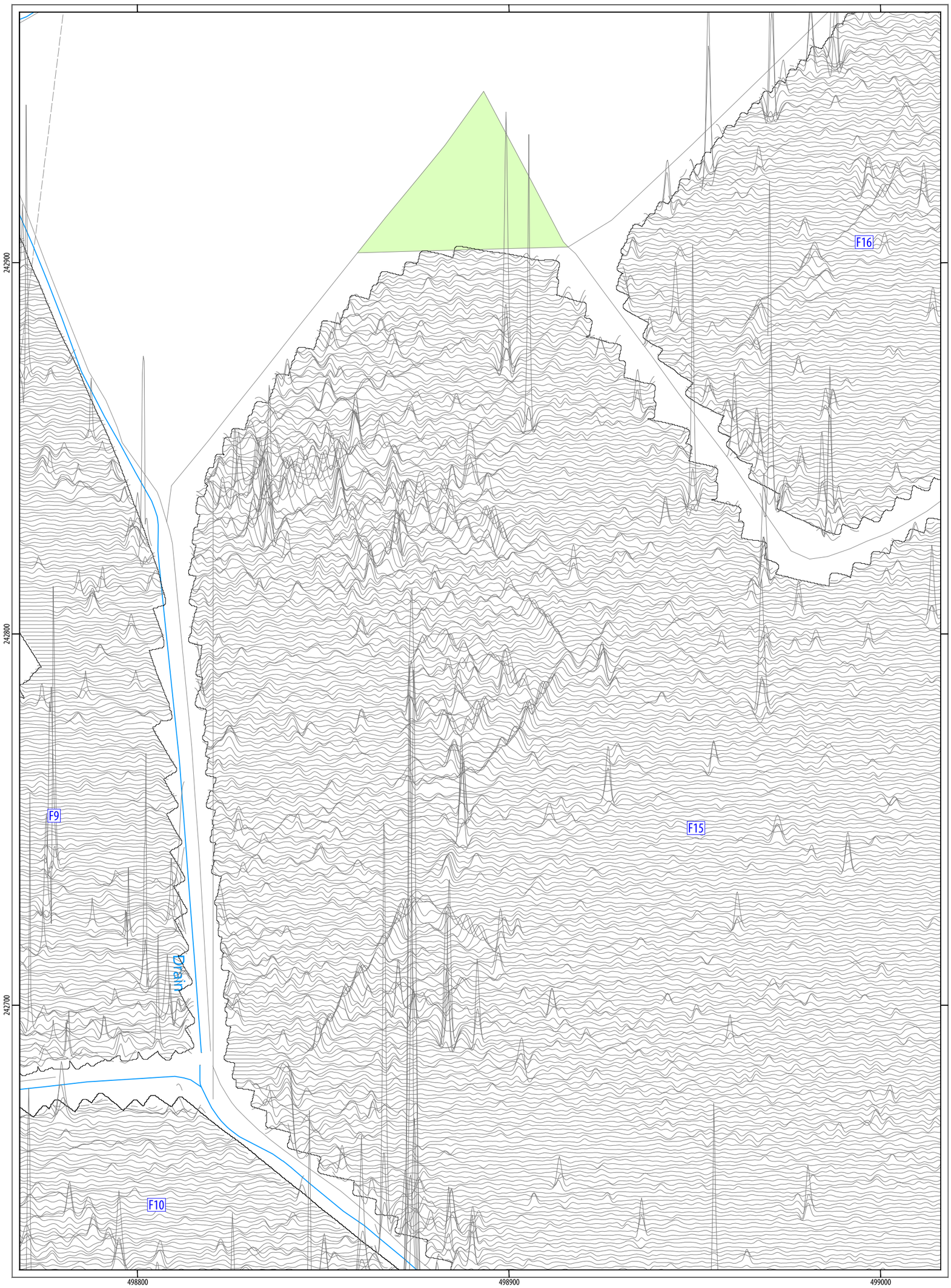
ILLUS 30 Processed greyscale magnetometer data; AAA1 (east)



20.0nT/cm

0 25m

1:1,000 @ A3

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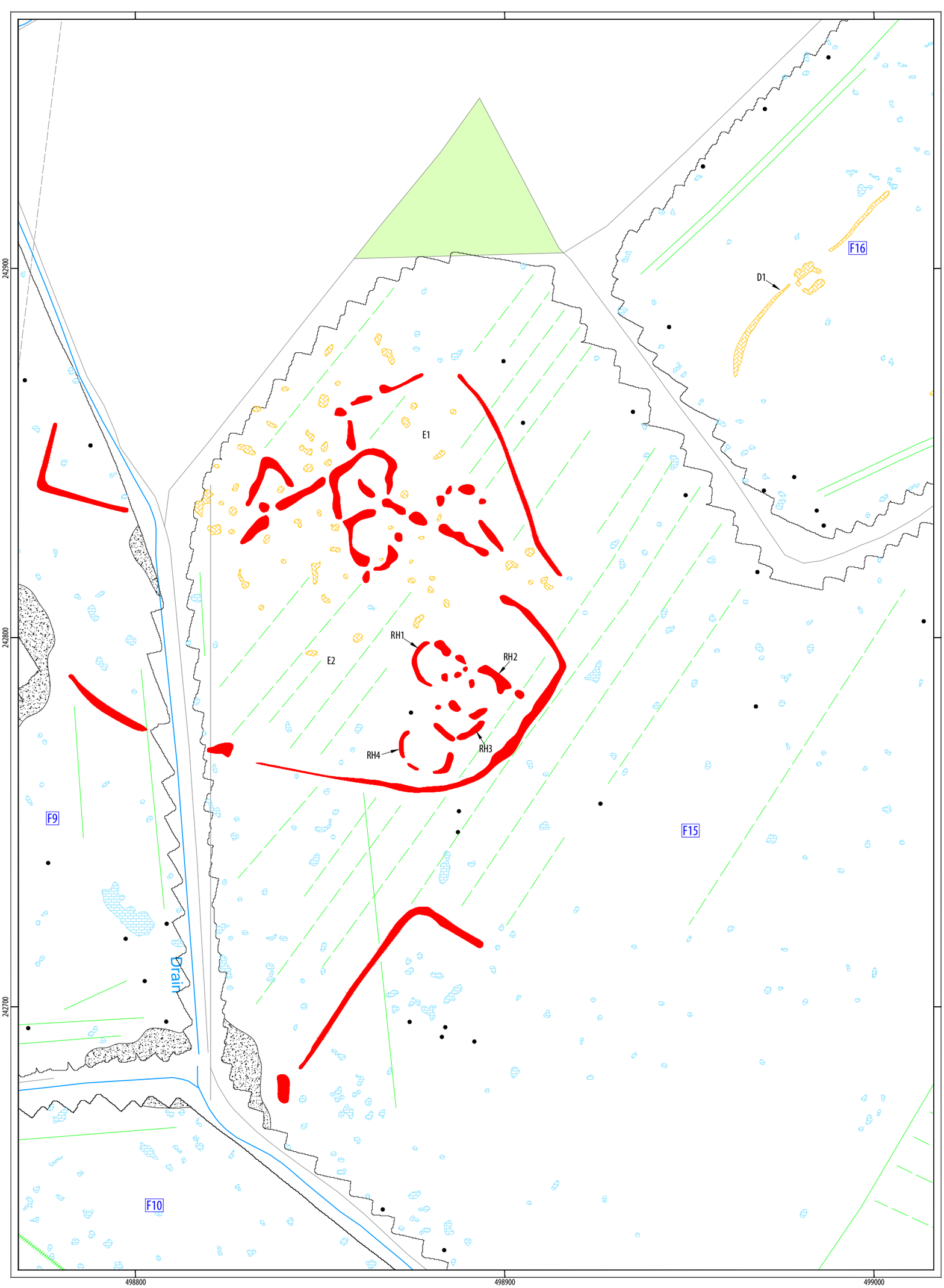
ILLUS 31 XY trace plot of minimally processed magnetometer data; AAA1 (east)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
magnetic enhancement	geology

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

D ditch
E enclosure
RH round-house

0 25m
1:1,000 @ A3

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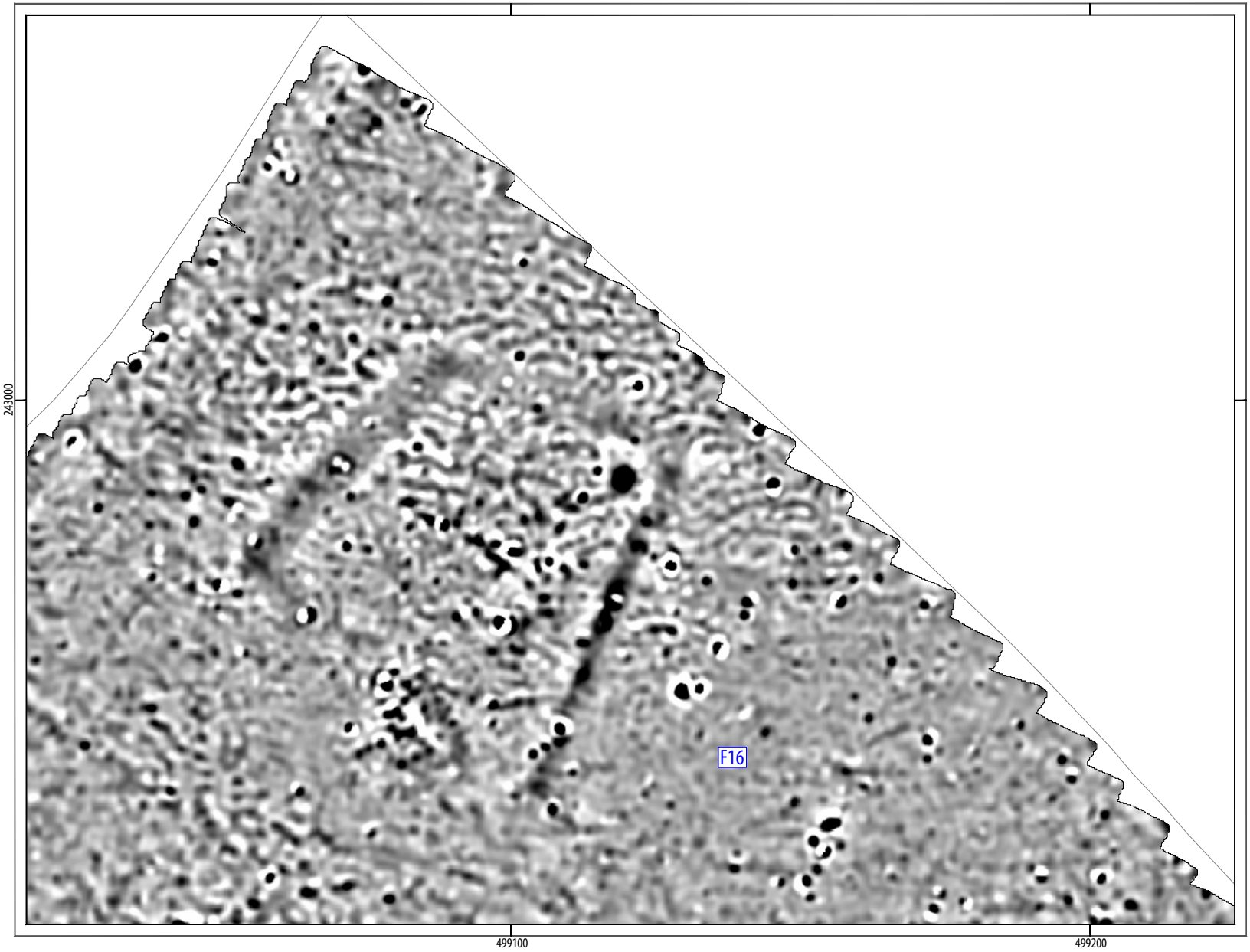
ILLUS 32 Interpretation of magnetometer data; AAA1 (east)



nT
-1.0 2.0

0 25m
1:1,000 @ A4

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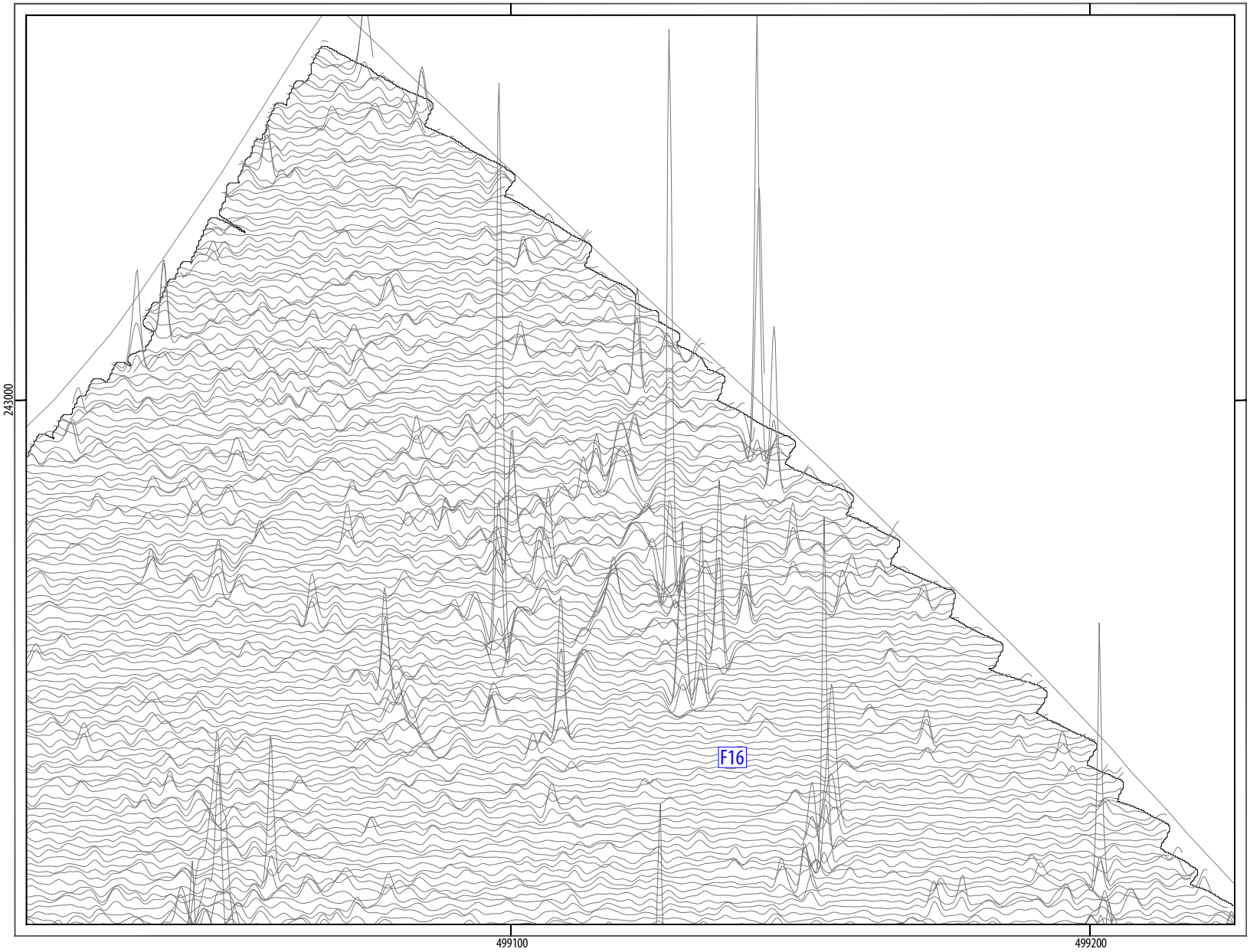
ILLUS 33 Processed greyscale magnetometer data; AAA2



20.0nT/cm

0 25m

1:1,000 @ A4

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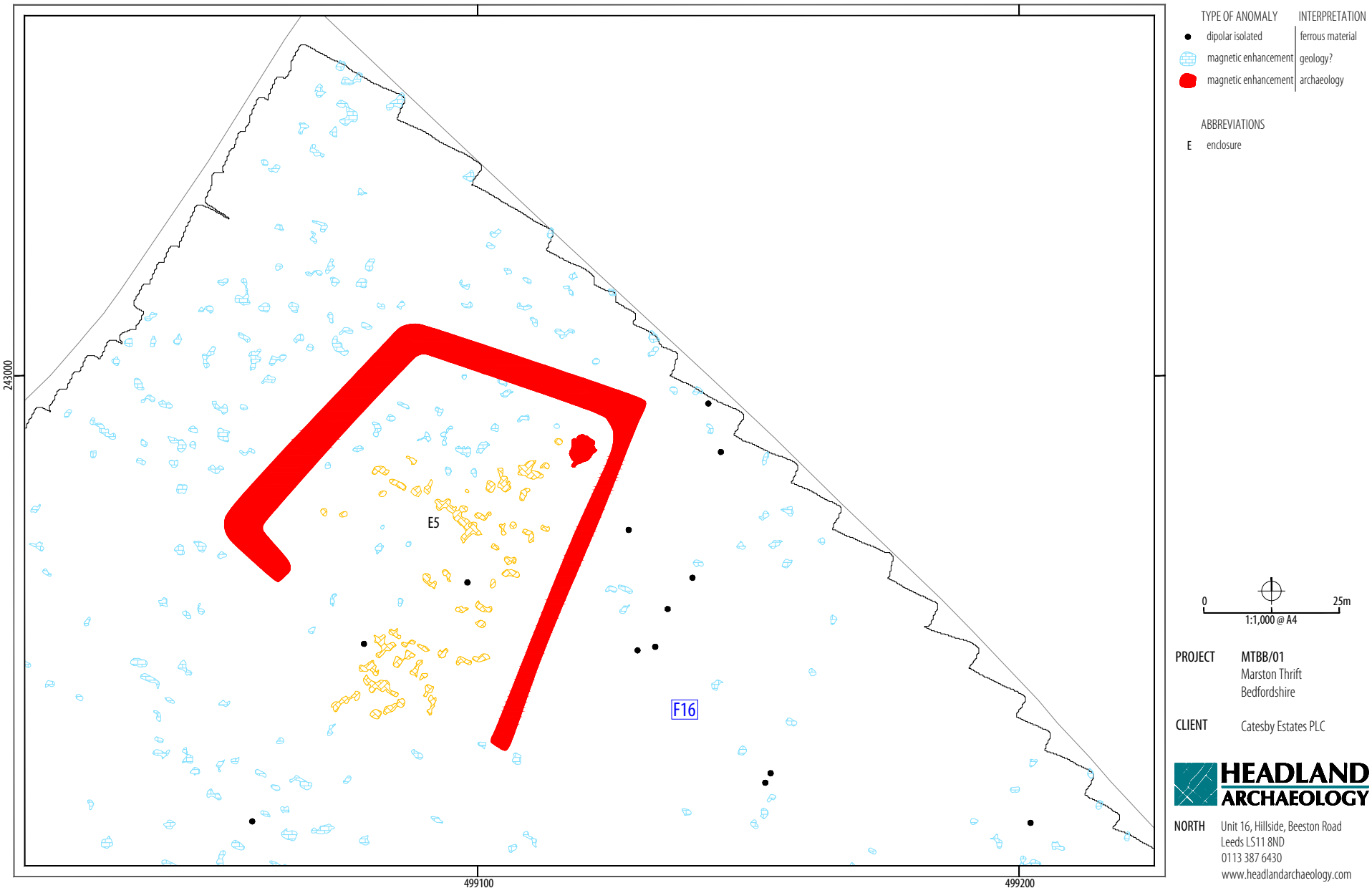
ILLUS 34 XY trace plot of minimally processed magnetometer data; AAA2



TYPE OF ANOMALY | INTERPRETATION

- dipolar isolated | ferrous material
- magnetic enhancement | geology?
- magnetic enhancement | archaeology

ABBREVIATIONS

E enclosure

0 25m

1:1,000 @ A4

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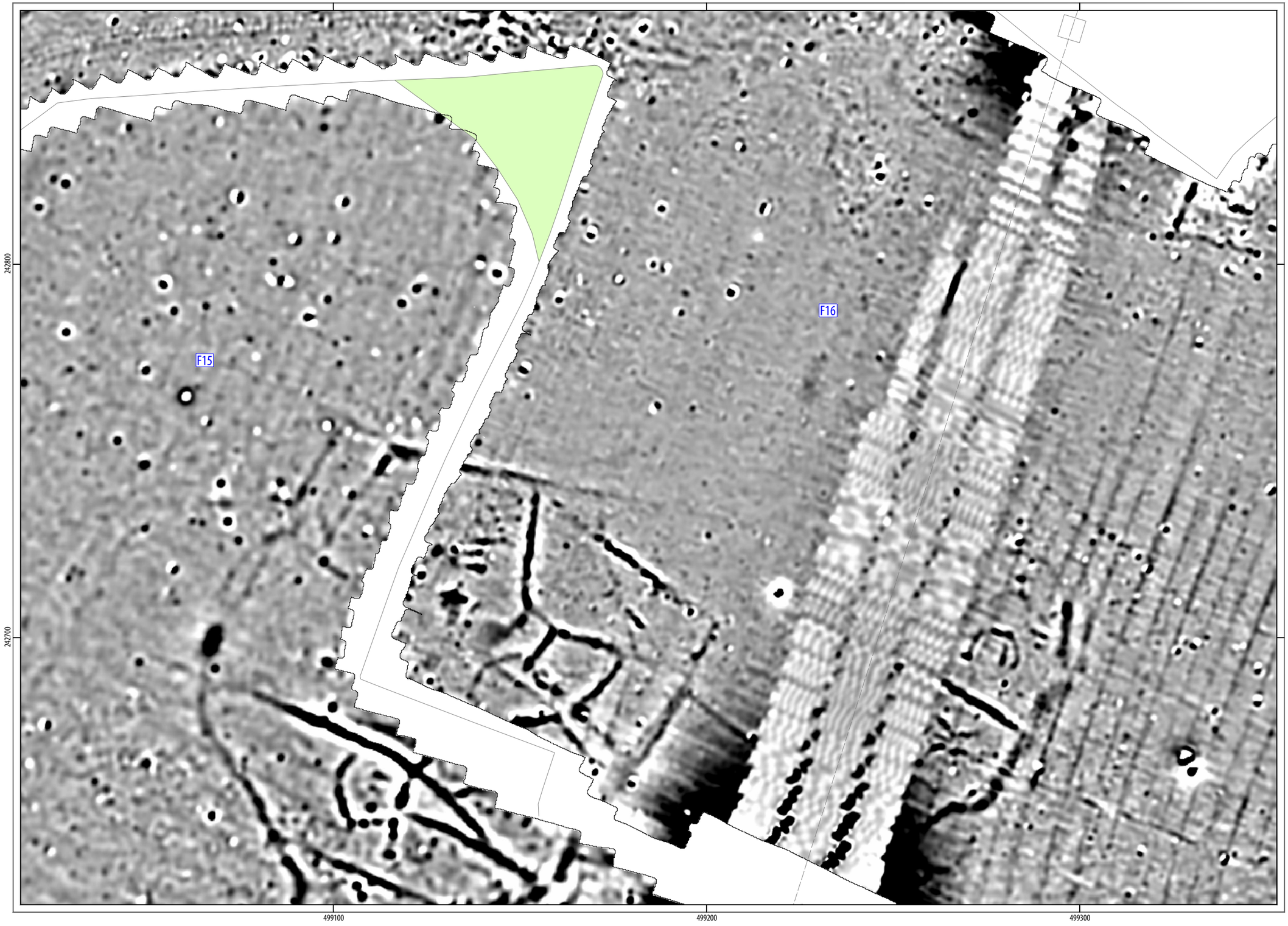
ILLUS 35 Interpretation of magnetometer data; AAA2



nT
-1.0 2.0

0 25m
1:1,000 @ A3

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ILLUS 36 Processed greyscale magnetometer data; AAA3 (north)

20.0nT/cm

0 25m

1:1,000 @ A3

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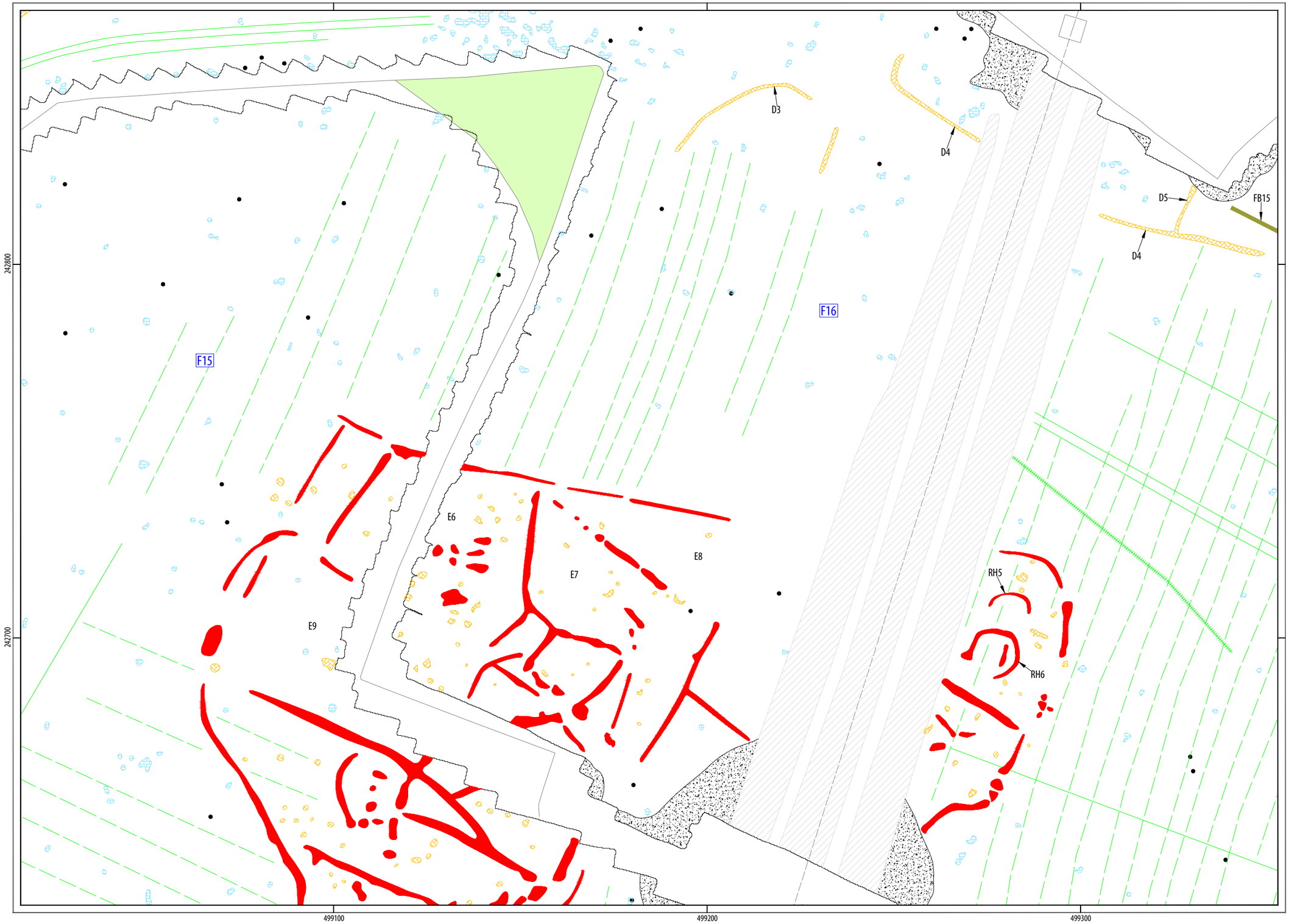
ILLUS 37 XY trace plot of minimally processed magnetometer data; AAA3 (north)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
null data	overhead cables
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear	former field boundary
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

D	ditch
E	enclosure
FB	former boundary
RH	round-house

0 25m
1:1,000 @ A3

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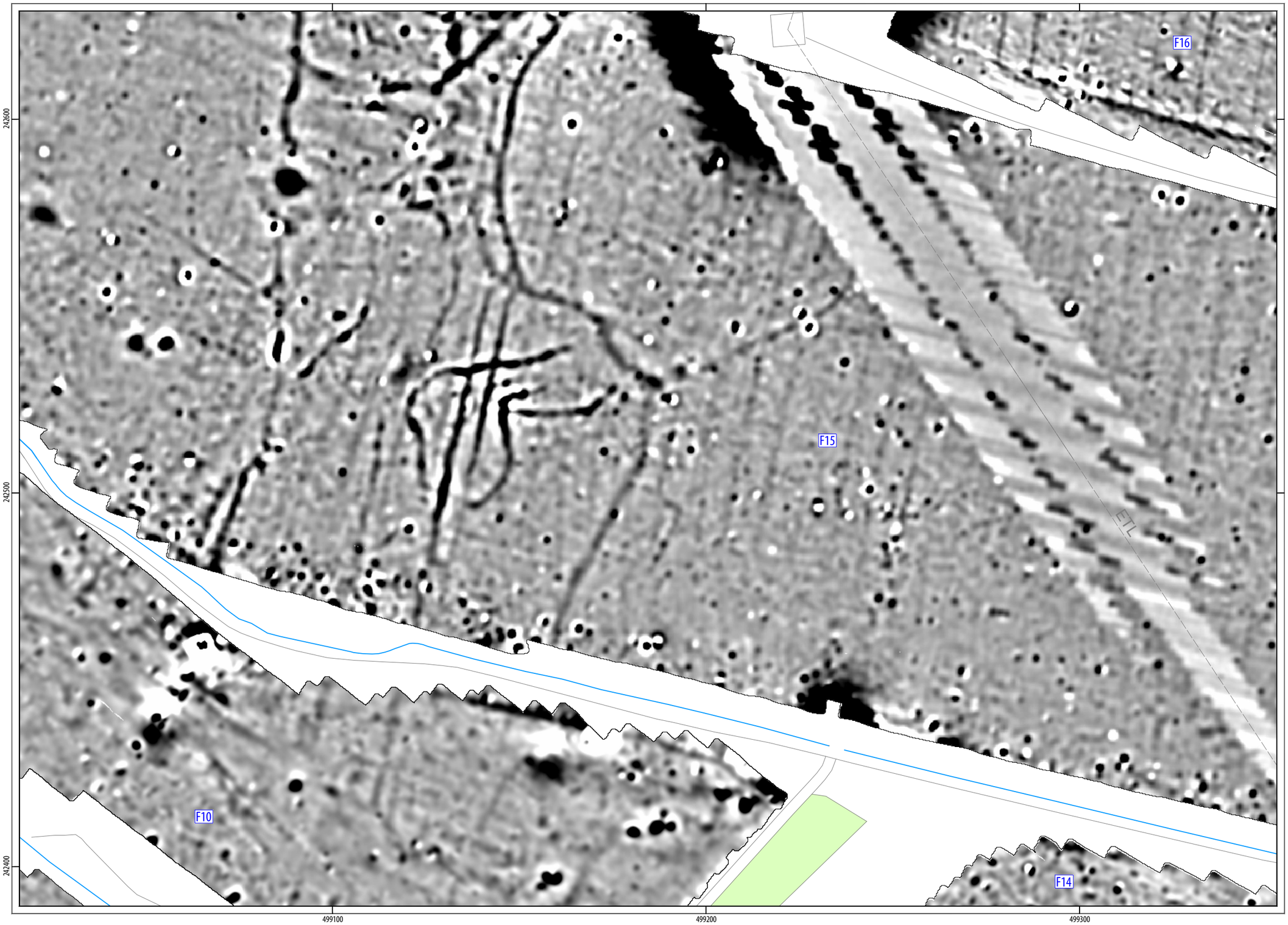
ILLUS 38 Interpretation of magnetometer data; AAA3 (north)



nT
-1.0 2.0

0 25m
1:1,000 @ A3

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Marston Thrift
Bedfordshire

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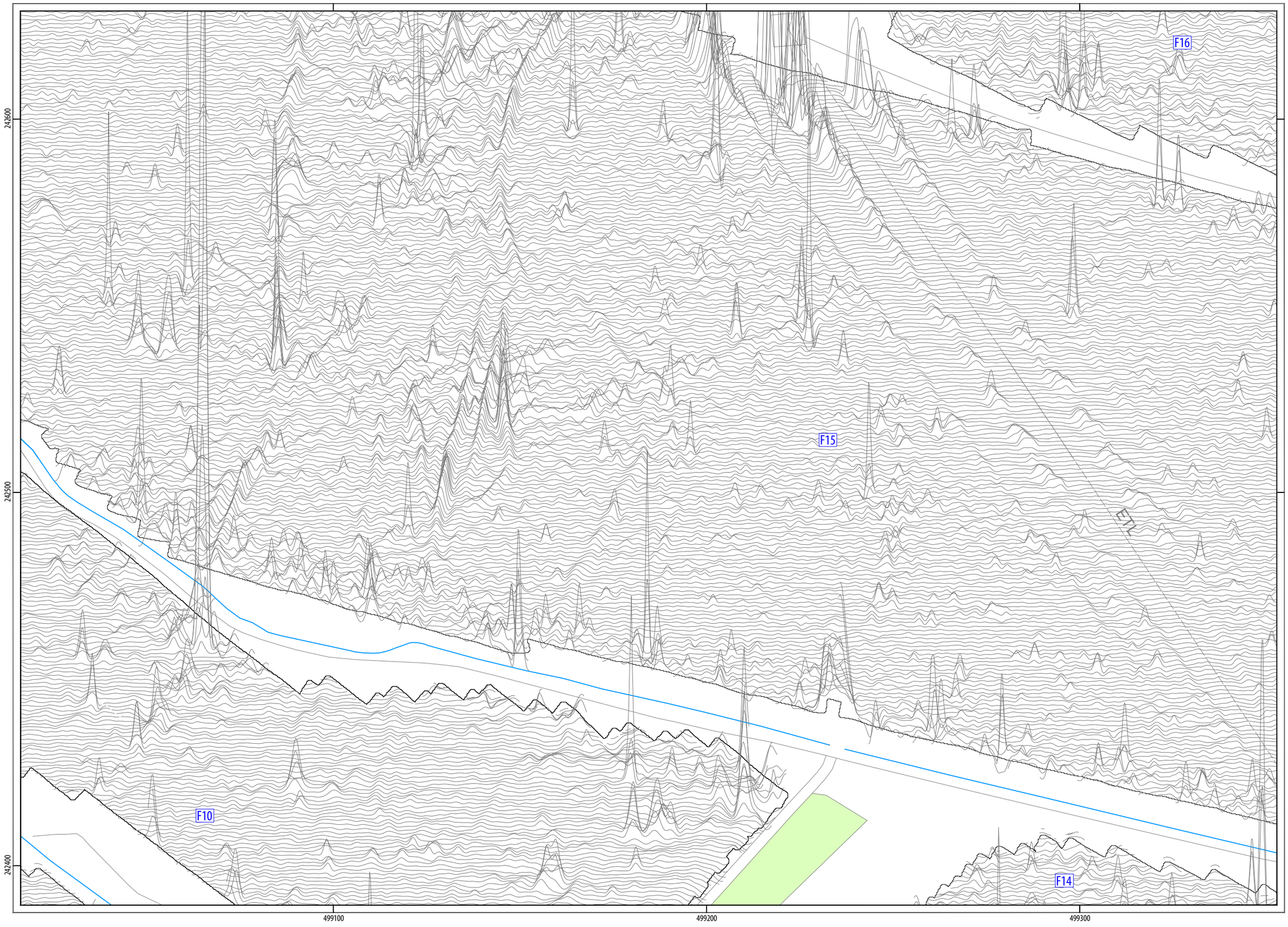
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 39 Processed greyscale magnetometer data; AAA3 (south)



20.0nT/cm

0 25m

1:1,000 @ A3

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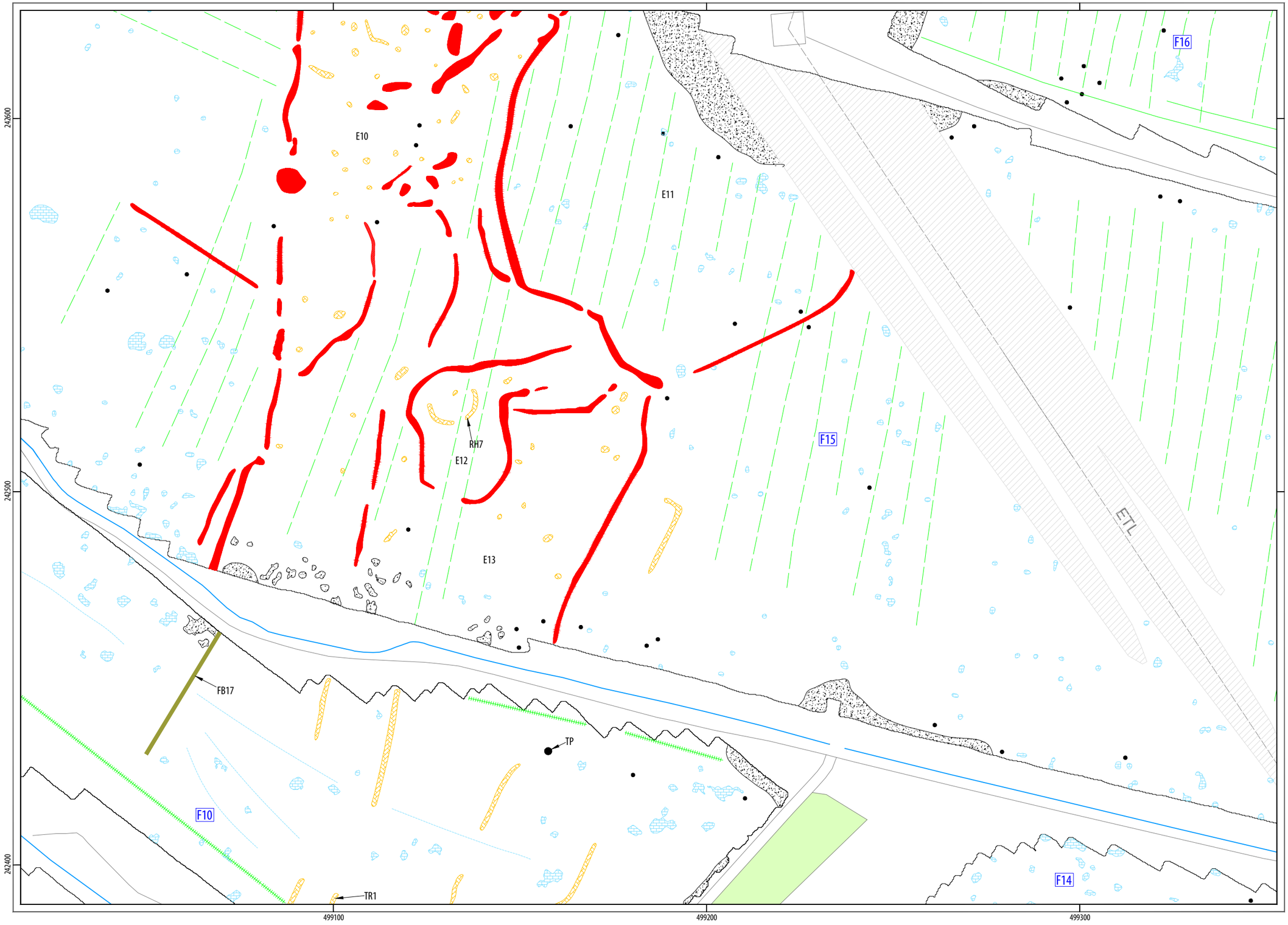
ILLUS 40 XY trace plot of minimally processed magnetometer data; AAA3 (south)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
null data	overhead cables
linear trend	ridge and furrow
linear trend	agricultural
linear trend	field drain
linear trend	geological variation
magnetic enhancement	geology?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

- **E** enclosure
- **FB** former boundary
- **RH** round-house
- **TP** telegraph pole
- **TR** trackway

0 25m
1:1,000 @ A3

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Leeds LS11 8ND
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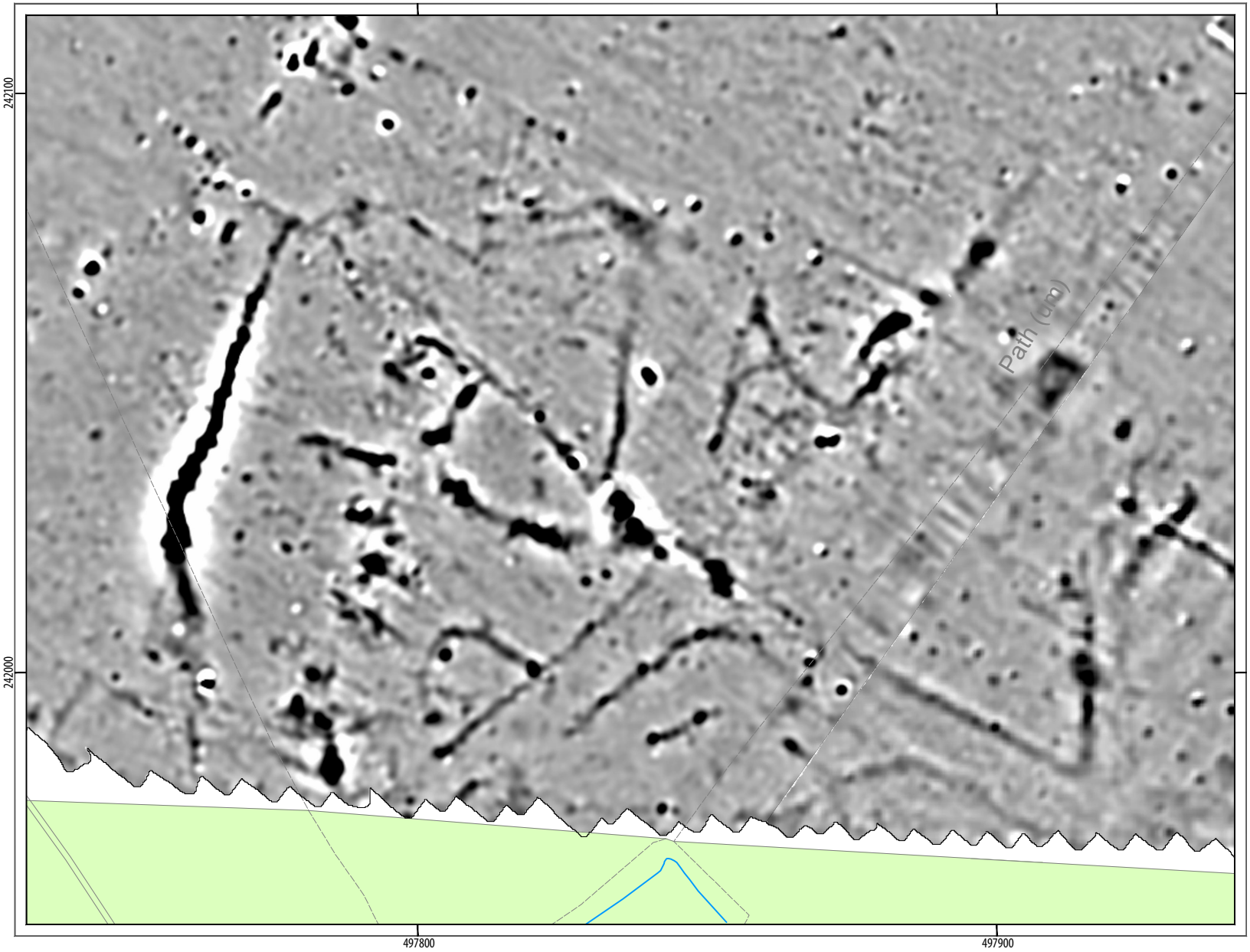
ILLUS 41 Interpretation of magnetometer data; AAA3 (south)



nT
-1.0 2.0

0 25m
1:1,000 @ A4

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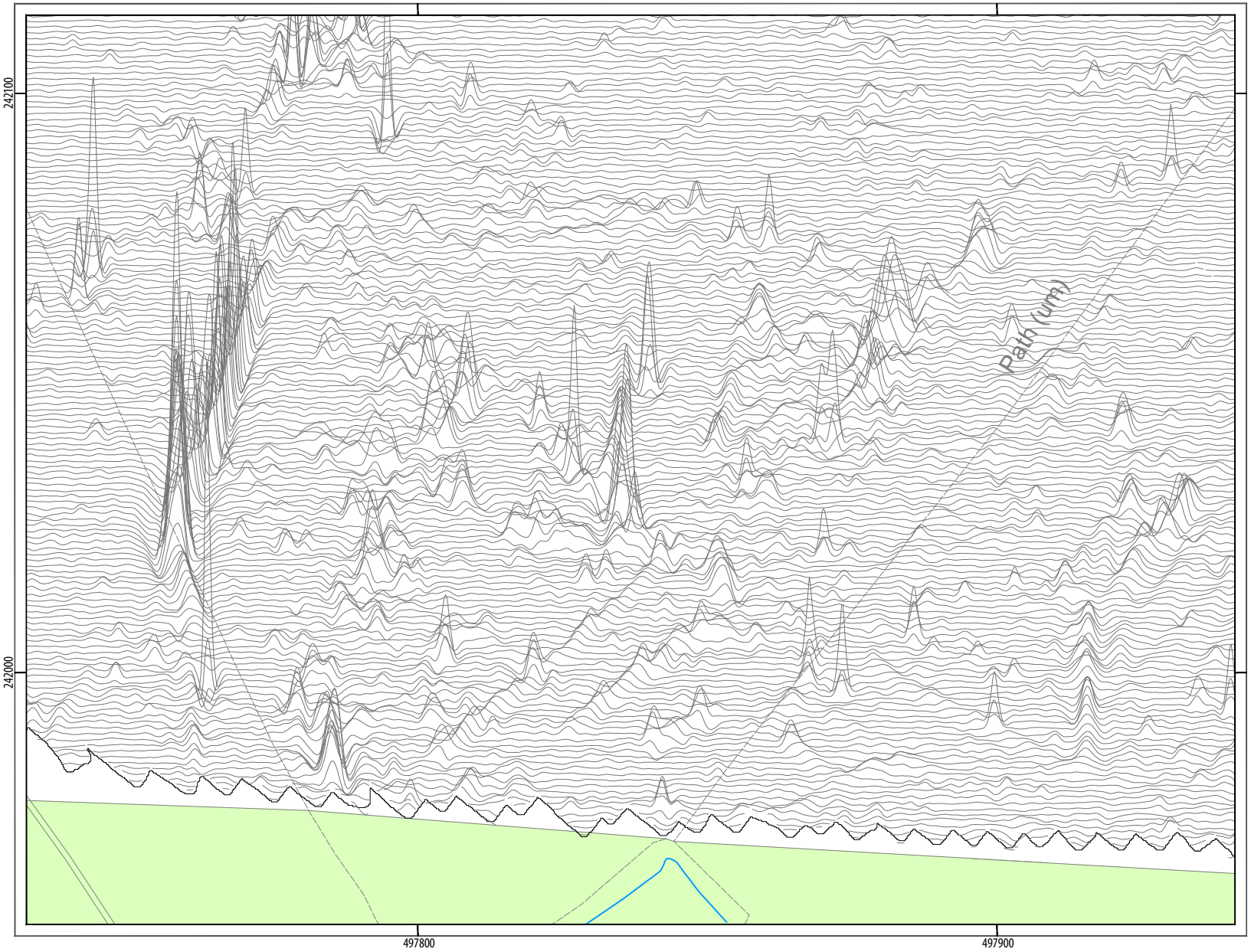
ILLUS 42 Processed greyscale magnetometer data; AAA4



20.0nT/cm

0 25m

1:1,000 @ A4

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ILLUS 43 XY trace plot of minimally processed magnetometer data; AAA4

TYPE OF ANOMALY | INTERPRETATION

- dipolar isolated — ferrous material
- linear trend — ridge and furrow
- linear trend — field drain
- linear — former field boundary
- magnetic enhancement — geology?
- magnetic enhancement — archaeology?
- magnetic enhancement — archaeology

ABBREVIATIONS

E enclosure

FB former boundary

0 25m

1:1,000 @ A4

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Leeds LS11 8ND
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ILLUS 44 Interpretation of magnetometer data; AAA4

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-315192

Project details	
Project name	Marston Thrift, Bedfordshire
Short description of the project	Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering approximately 170 hectares, on land north of Marston Moretaine (Marston Thrift), in advance of the possible submission of a planning application for a residential development, amenity and associated infrastructure. Anomalies indicative of multi-period settlement activity have been identified in three locations in the north of the site with a fourth area at the south-western site boundary. Some of this archaeological activity was previously suggested through the presence of cropmarks or has been inferred through the identification of clusters of pottery although the extent of the remains is more extensive than previously known. The majority of this activity is likely to be of Iron Age/Romano British date although there is also evidence for possible medieval activity. The results of the survey corroborate the conclusions of an earlier Archaeology Assessment. On the basis of the geophysical survey the potential for the presence of buried archaeological remains is assessed as low to moderate across the majority of the site, with the exception of the four areas of definite archaeological potential.
Project dates	Start: 27-11-2017 End: 19-12-2017
Previous/future work	Not known / Not known
Any associated project reference codes	MTBB/01 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 3 - Operations to a depth more than 0.25m
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Rural residential
Prompt	Direction from Local Planning Authority - PPG16
Position in the planning process	Not known / Not recorded
Solid geology (other)	Peterborough Member
Drift geology (other)	Clays, Silts, Gravels
Techniques	Magnetometry
Project location	
Country	England
Site location	BEDFORDSHIRE BEDFORD BEDFORD Marston Thrift, Bedfordshire
Study area	170 Hectares
Site coordinates	SP 9858 4243 52.071030268807 -0.561578910517 52 04 15 N 000 33 41 W Point
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	Consultant
Project design originator	Headland Archaeology
Project director/manager	Harrison, D
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer

Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Marston Thrift, Bedfordshire
Author(s)/Editor(s)	Webb, A
Date	2017
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	A4 Bound Report
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Entered on	23 April 2018

Headland Archaeology South & East
Building 68C | Wrest Park | Silsoe | Bedfordshire MK45 4HS
t 01525 861 578
e southandeast@headlandarchaeology.com

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Twyford Rd | Hereford HR2 6JR
t 01432 364 901
e midlandsandwest@headlandarchaeology.com

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com

Headland Archaeology Scotland
13 Jane Street | Edinburgh EH6 5HE
t 0131 467 7705
e scotland@headlandarchaeology.com

www.headlandarchaeology.com