national highways

Lower Thames Crossing

Environmental Statement Appendices
Appendix 6.7 – Geophysical survey reports (1 of 2)

APFP Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

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LTCK18

Lower Thames Crossing Phase 1
Kent

Geophysical Survey

For Arcadis Consulting (UK) Ltd
on behalf of Highways England

March 2019

HEADLAND ARCHAEOLOGY

Lower Thames Crossing Phase 1 Kent

Geophysical Survey

For Arcadis Consulting (UK) Ltd on behalf of Highways England

March 2019

HA Job no.:	LTCK18
NGR:	TQ 6777 7144
Parish:	Gravesend Shorne
Local Authority:	Gravesham
Planning ref.:	N/A
OASIS ref.:	headland5-XXXXXX

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LIST OF ILLUSTRATIONS

LOWER THAMES CROSSING PHASE 1
KENT

GEOPHYSICAL SURVEY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 287 hectare site east of Gravesend, Kent, where a new crossing underneath the River Thames is proposed. The survey has identified ten distinctive areas of archaeological activity (AAA) mostly comprising isolated ring-ditches, rectilinear and oval enclosures and sections of fragmented sinuous trackways. A more extensive area of multi-phase settlement activity has been identified towards the north of the site adjacent to Rochester Road. Most of these areas were previously known, although some were less extensive than has been identified by the geophysical survey, whereas some were not known at all. These areas are assessed as of high archaeological potential. Anomalies at numerous other locations have been interpreted as being of possible archaeological potential, including possible field systems, trackways, isolated ditches and pits. However, the weak, fragmentary nature of these anomalies, or an absence of supporting archaeological information (cropmarks or HER data), precludes a more confident interpretation. These anomalies are ascribed a moderate archaeological potential. In the west of the site the survey has identified numerous high magnitude and ferrous anomalies corresponding to buried features and infrastructure from the former RAF Gravesend airfield. These anomalies may be of local historic interest. Elsewhere, over the vast majority of the site, no anomalies of any archaeological potential have been identified by the survey and in these areas the archaeological potential is assessed as low.

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Arcadis Consulting (UK) Ltd (the Client), to undertake a geophysical (magnetometer) survey on land east of Gravesend, Kent, where a new crossing underneath the River Thames is proposed. The survey will inform a Cultural Heritage Desk-Based Assessment (DBA) and an Environmental Statement which will be submitted with a Development Consent Order (DCO) to the Planning Inspectorate to be examined on behalf of the Secretary of State for Transport.

The work was undertaken in accordance with a Technical Specification for Archaeological Geophysical Survey in Kent (Highways England 2018), a Written Scheme of Investigation (WSI; Harrison 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was carried out between 13 November 2018 and 21 January 2019.

1.1 Site location, topography and land-use

The Proposed Development Area (PDA) comprises an irregularly-shaped block of land between the A2 (TQ 6670 7010) and the area of the proposed southern portal at Lower Higham Road (TQ 6810 7310) (Illus 1). It comprises 23 fields (F1-F23) which were mainly under arable cultivation at the time of the survey (Illus 2-7) with F5 and F6 being part of Southern Valley golf course.

Generally, the land falls from 70m Above Ordnance Datum (AOD) at the A2 in the south and west of the PDA to 2m AOD at Lower Higham Road in the north-east. Locally, the topography is undulating.

1.2 Geology and soils

The bedrock geology mostly comprises Lewes Nodular Chalk, Seaford Chalk and Hewhavan Chalk with Thanet Formation – sand recorded in the centre and south-west of the PDA. The bedrock is overlain locally by Head (clay, silt, sand and gravel) along the base of slopes and, in the north, by pockets of sand, silt and clay (classified in both the Lambeth Group and the London Clay Formation) (NERC 2019).

The soils are classified in the Soilscape 5, Soilscape 6 and Soilscape 7 Associations, being characterised as freely draining loams (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

Baseline information collated for a Scoping Report (Highways England 2017) includes numerous entries on

the Kent Historic Environment Record (HER) including extensive cropmark data across the PDA (see Illus 11). The report states that, based on the concentration of known sites, '*the potential for unknown archaeological remains to be present in the study area is considered to be high.*

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information and to establish the presence/absence, character and extent of any archaeological remains within the PDA. 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 aims, as stated in the Technical Specification, were:

+ to inform further phases of archaeological investigation within a programme of research;
+ to inform, to an extent, the overall mitigation strategy in Kent; and
+ to inform the detailed assessment of the scheme in the form of a cultural heritage desk-based assessment (DBA) and an Environmental Statement (ES) for the DCO application.

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 V3.0.35.1 (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 1:40,000. Illus 2 to Illus 6 inclusive are site condition photographs. Illus 7 is a 1:12,500 survey location plan showing the direction of survey as GPS swaths and photograph locations. Illus 8 presents the survey location showing superficial geological deposits and the archaeological interpretation. The overall greyscale displayed at a 1:12,500 scale in Illus 9. The overall interpretation is displayed on Illus 10. The archaeological interpretation and cropmark data are illustrated on Illus 11. Large-scale, fully processed (greyscale) data, minimally processed data (XY traceplot) and accompanying interpretative plots are presented at a scale of 1:2,500 in Illus 12 to Illus 44 inclusive. Larger scale (1:1000) plots of the ten areas of archaeological activity (AAA) are presented in Illus 45 to Illus 80 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 Technical Specification (Highways England 2018), the Written Scheme of Investigation (Harrison 2018), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2016). 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 were good throughout (Illus 2-6) and contributed to a high standard of data throughout.

A relatively homogenous magnetic background has been detected across the majority of the PDA which is characterised by evenly dispersed low magnitude discrete areas of magnetic enhancement. The magnetic background within the north of the PDA is characterised by series of short sinuous trends, broadly orientated north/south and corresponding with the general direction of slope. These anomalies are typical of chalk geologies and are due to soil-filled fissures in the soft chalk bedrock – the result of water and/or ice erosion. More elevated magnetic backgrounds have been detected across the golf course (F5) and the east of F7. These are caused by modern landscaping and agricultural spreading respectively and are discussed further below (Section 4.1). Against these backgrounds, numerous linear and discrete anomalies of geological, agricultural and archaeological nature have been identified. These anomalies are discussed below and cross-referenced to specific examples on the interpretive figures, 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 likely caused by the random distribution of ferrous debris in the upper soil horizons.

Several buried service pipes have been identified by the survey as high magnitude dipolar linear anomalies on varying alignments. The magnetic interference from these services can be broad and can mask the response from any low magnitude anomalies of archaeological potential within the affected areas. Two high magnitude service pipes can have been identified running from the south-west of the site to the north-east, through fields F4, F6-F8, F11-F13, F17-20, F22 and F23 (see Illus 18-41).

Several overhead cables also criss-cross the PDA on varying alignments being carried by pylons which are detected as high magnitude magnetic haloes such as those in the north of F13 (Illus 24-26). Where the cables are low-slung, as they are across F7 and F13 (Illus 24-26) a null value has been identified.

The majority of the Southern Valley Golf Course (F5/F6) is dominated by high magnitude magnetic disturbance. The disturbance is characteristic of modern filling and landscaping, most likely from the remediation works associated with RAF Gravesend Airfield and the local infrastructure (see Section 4.2 below). Any low magnitude anomalies of archaeological potential within the affected area may not be detected by the survey. The low magnetic response from the sand within the bunkers is evident within the survey data.

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

4.2 Airfield anomalies

A broad band of high magnitude anomalies aligned north-south across F19 (Illus 27-41) corresponds to taxiways, turning circles and other RAF Gravesend airfield infrastructure recorded on the Kent HER. As mentioned in Section 4.1 numerous ferrous anomalies on the golf course (F5/F6) are thought to be caused by demolition material from the former airbase.

4.3 Agricultural anomalies

Linear anomalies in the data are identified throughout the survey. All these anomalies are due to agricultural activity such as modern ploughing and boundary removal.

Parallel linear trend anomalies on differing alignments, but mostly parallel or orthogonal to the current field boundaries, have been identified throughout the survey (see Illus 12 – 44 inclusive). These anomalies predominantly reflect the alignment of recent ploughing.

Analysis of the historic OS mapping indicates that the pattern of enclosure has changed slightly since 1898 with the removal of field boundaries in F1, F3, F13 and F20. These former boundaries manifest in the data as positive linear anomalies which are caused by the magnetic contrast between the former (but now infilled) boundary ditch and the surrounding soils.

4.4 Geological anomalies

As discussed, a relatively homogenous magnetic background has been identified across the southern half of the survey area, 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 larger, more defined discrete geological anomalies are thought to be soil-filled depressions in the chalk, it is unknown if these are dene holes or natural solution hollows. Based on a lack of evidence regarding dene holes in the vicinity of the site a standard geological cause has been ascribed, although this cause cannot be discounted.

Broad, weak curvilinear anomalies have been identified meandering through the survey area. These are located at the base of slopes and are caused by unmapped superficial deposits of head.

In the north of the survey area, F1-F4 (see Illus 12-26), short sinuous trends, broadly orientated north/south have been recorded which correspond with the general direction of slope. These anomalies are typical of chalk geologies and are due to soil-filled fissures in the soft chalk bedrock – the result of water and/or ice erosion.

Possible areas of chalk extraction have been identified in F13. The slightly elevated magnetic response being caused by the material used to backfill the former pits

4.1 Possible Archaeological anomalies

Throughout the PDA there are a number of ephemeral fragmented linear anomalies that have been interpreted as possible enclosures (PE). Given the weak magnetic response and fragmented nature of these a more definitive interpretation cannot be assigned, as such they have been given a possible archaeological origin.

PE1, located in the centre of F7 is difficult to discern, measuring 40m north to south with no eastern or western boundaries (see Illus 24-26). Several anomalies within the possible enclosure may locate pits, hearths and spreads of magnetically enhanced material.

On the southern border of F12 and F13 (see Illus 30 to 35) two sides of two possible enclosures, PE2 and PE3, have been recorded. The tentative enclosures are similar in form with anomalies recorded on the northern and eastern side only. It is thought that these linear anomalies may indicate soil filled ditches, although an archaeological or modern origin cannot be discerned from the data.

In the north-east of F19 a curvilinear anomaly, possible enclosure PE4, has been identified appended to the northern boundary, there are three further linear anomalies radiating from the main anomaly (see Illus 30-32). This corresponds to a cropmark identified as a possible Iron Age or Roman enclosure. Given the proximity of the airfield a possible archaeological origin has been attributed to these anomalies, although an archaeological cause cannot be discounted.

Another two-sided enclosure, PE5 has been recorded in F20 (see Illus 36-38). These anomalies lie immediately south of a service pipe and a taxiway of the former airfield, where a large pylon is situated. It is unknown if these anomalies are associated with the former airfield, installation of the pylon base, or construction of the service pipe. Based on the proximity to a probable trackway (TR4 – see below) a possible archaeological interpenetration has been attributed to these anomalies.

A further possible enclosure, PE6, has been identified in the south of F18 (see Illus 39-40). The possible enclosure is located immediately on the southern boundary, the southern extent of the possible enclosure is not visible in the data. It is not clear if these anomalies are caused by the removal of former field boundaries or soil-filled ditches.

Located within a series of paddock fields is a weak fragmented possible enclosure, PE7 (see Illus 39-41). The possible enclosure is trapezoidal in shape, measuring approximately 35m in the north, 20m in the south and 18m in the west and east. There are several discrete anomalies within the enclosure which may suggest human occupation, although some (or all) of these anomalies may just be due to minor variations in the composition of the topsoil.

A linear anomaly in the south of F22 and F23 (see Illus 42-44) measuring 500m in length, running parallel with the southern extent of the surveyed area has been identified. The origin of this anomaly is unknown but given the proximity of Watling Street to the south an archaeological cause cannot be discounted.

Anomalies at numerous other locations throughout the PDA have been interpreted as being of possible archaeological potential, including possible field systems, trackways, isolated ditches and pits. However, the weak, fragmentary nature of these anomalies, or an absence of supporting archaeological information (cropmarks or HER data), precludes a more confident interpretation.

4.2 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. Against a 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.

Ten areas of archaeological activity (AAA) have been identified which are discussed below.

Area of Archaeological Activity 1 (AAA1) - (Illus 45 to Illus 47)

In AAA1 a large enclosure, E1, measuring 30m by 35m has been identified within F1. The enclosure is subdivided by a weak east-west linear anomaly in the north of the enclosure. A subcircular enclosure, E2, with a diameter of 20m is appended to the eastern edge of E1 with a modern field boundary bisecting the subcircular enclosure north/south.

There are several discrete anomalies within the enclosure which may suggest human occupation, although some (or all) of these anomalies may just be due to minor variations in the composition of the topsoil.

Area of Archaeological Activity 2 (AAA2) – (Illus 48 to Illus 50)

A large sub-oval enclosure, E3, has been identified in the north of F3 (see Illus 48-50). A smaller more circular enclosure, E4, is appended to the southern extent of E3. A plethora of discrete anomalies have been recorded within the two enclosures, the sheer number and similarity to probable geological anomalies identified elsewhere in the survey make a confident interpretation difficult. Four larger anomalies, P1-P4 within enclosure E3 have a higher probability of being archaeological in origin given their size and increased magnetic response.

Enclosure E3 was previously identified in cropmark data, as well as P1 and P2. The identification of E4 and P3-P4 have enhanced the archaeological data here.

Area of Archaeological Activity 3 (AAA3) – (Illus 51 to Illus 53)

In AAA3 a square enclosure, E5, aligned north-east/south-west has also been recorded in F3 (see Illus 51-53). The enclosure measures 30m by 12m. A small number of discrete anomalies of possible archaeological potential have been recorded within this enclosure. This enclosure corresponds to a cropmark feature of a possible Iron Age or Roman enclosure.

Area of Archaeological Activity 4 (AAA4) – (Illus 54 to Illus 56)

An irregularly shaped enclosure, E6, has been identified in the west of F3 (see Illus 54-56). A clear break in the anomaly in the south-west may indicate an entrance. The discrete anomalies located within the enclosure have been interpreted as possible archaeology. This enclosure anomaly corroborates a known cropmark, the feature is ascribed as being of Bronze Age date.

Area of Archaeological Activity 5 (AAA5) - North (Illus 57 to Illus 59), South (Illus 60 to 62) and East (Illus 63 to 65)

An extensive complex of linear, rectilinear and circular anomalies has been Identified in F4 (see Illus 57-62).

The main complex of anomalies covers approximately 4.3ha. Two service pipes bisect the complex heading north-east/south-west making a confident interpretation difficult. A substantial number of archaeological anomalies have been identified that corroborate and expand upon the cropmark data and intrusive investigations. Several linear anomalies aligned at right-angles to one another may form a series of enclosures, only the eastern part of the complex forms any clear patter of enclosure, with a large enclosure E7 being the most easily identifiable anomaly. Several linear anomalies converge on this enclosure. There are also a number of weaker linear anomalies, possible associated, on similar alignments.

The western part of the complex is more difficult to distinguish, consisting of several linear anomalies on overlapping alignments. A possible trackway, TR1, is visible within this area. Many discrete anomalies have been identified, these are considered to be possible archaeology given the proximity to the linear anomalies as well as their increased magnetic response. This complex of anomalies represents settlement activity, probably Roman in origin

Another much larger trackway, TR2, is evident to the east. The ditches either side of the anomaly measure 15m apart and may signify roadside ditches of Roman origin. A possible agger is visible in the data between the two ditches as and area of increase magnetic response.

A third trackway, TR3, appears to delimit the complex of archaeological anomalies. The parallel linear anomalies located ditches that are indictive of a trackway. This anomaly is located with F3, F4 and F6.

Two circular anomalies shave been identified with AAA5, that are indictive of ploughed out ring-ditches. RD1 is located within AAA5 (east) and measures 19m in diameter (see Illus 63-65), RD2 is located with AAA5 (south) and measures 19m in diameter see Illus 60-62). Any discrete anomalies within these anomalies have been interpreted as possible archaeology.

Area of Archaeological Activity 6 (AAA6) - (Illus 66 to Illus 68)

In AAA6 a single ring ditch anomaly, RD3, with a diameter of 22m, has been identified adjacent to the northern boundary of F7. Discrete anomalies within the interior of the ring-ditch are interpreted as of possible archaeological origin, perhaps being due to former pits. This feature is possibly the ploughed down remains of a Bronze Age funerary monument (round barrow).

Area of Archaeological Activity 7 (AAA7)– (Illus 69 to Illus 71)

Several linear anomalies have been identified in AAA7, these have been bisected by a service pipe which makes interpretation difficult. Cropmark data has identified an enclosed settlement in this location. The anomalies recorded do not form any coherent settlement pattern, this may be due to the landscaping of the golf course and the cutting service pipe. The linear anomalies in AAA7 are thought to be archaeological in origin with the discrete anomalies ascribed a possible archaeological origin, although these anomalies could be caused by the landscaping or variations in the soils.

Area of Archaeological Activity 8 (AAA8)– (Illus 72 to Illus 74)

On the boundary between F7 and F13 a single rectilinear enclosure E8, corroborating a known cropmark, has been identified. This anomaly measures 35m by 31m. The discrete anomalies within the enclosure have been interpreted as possibly archaeological in origin, although as in all the other areas a geological cause cannot be dismissed. A weakly enhanced curvilinear anomaly has been recorded in the east on the AAA and is bisected by the field boundary between F7 and F13. The origin of this anomaly is unknown.

Area of Archaeological Activity 9 (AAA9)– (Illus 75 to Illus 77)

AAA9 consists of a weakly enhanced circular anomaly, RD4. The anomaly appears to be a set of concentric ring-ditch type anomalies, corroborating a cropmark which identifies the anomalies as being the phase development of a barrow. Due to the weak magnetic response the interpretation is tentative and only attributed as probable archaeology based on the cropmark data.

Area of Archaeological Activity 10 (AAA10)– (Illus 78 to Illus 80)

An area of settlement has been identified in F21, these have been interpreted as several small conjoined enclosures, E18-E12. A main enclosure has been subdivided into four irregularly sized enclosures, part of which has been masked by the high magnetic response from the airfield and modern features. The anomalies of the enclosure boundaries are caused by soil-filled ditches. Within these enclosures a series of enhanced pit-like responses have been identified.

A trackway, TR4 has been identified in F22. This is aligned east/west and possibly continues into F21, forming the southern boundary of the enclosures.

In close proximity to the archaeological activity several high magnitude pit-type anomalies and weak linear trends have been identified in the survey. It is unclear if these are associated with the former airfield or are archaeological in origin. They have all been assigned a possible archaeological origin, but a more modern cause cannot be dismissed.

5 CONCLUSION

The magnetometer survey has identified a moderate level of magnetic variation across the PDA and has identified numerous soil-filled features of varying origin. The survey has successfully evaluated 23 fields further advancing knowledge of the archaeological potential of the PDA and providing evidence for ten areas of definite archaeological activity, ranging from isolated ring ditches to extensive areas of settlement. Eight of these areas (AAA2, AAA3, AAA4, AAA5, AAA6, AAA7, AAA8 and AAA9), were previously known through the presence of cropmarks and intrusive investigation, although to a lesser extent than has been identified by the geophysical survey. The other two areas were not previously known (AAA1And AAA10). The majority of the areas of archaeological activity are situated on locations where no superficial geological deposits have been recorded with the exception of AAA10.

It is assessed that the survey provides a reliable indication of the extent of sub-surface deposits within the PDA although some isolated features and/or areas of unenclosed settlement, if present, may not manifest as magnetic anomalies in the datasets. The survey has clearly identified the extents of complex settlement activity in AAA5 and AAA10 and has identified internal anomalies which may be due to internal features. Further geophysical investigation such as earth resistance survey and/or ground penetrating radar may provide clarity and definition of these internal anomalies.

6 REFERENCES

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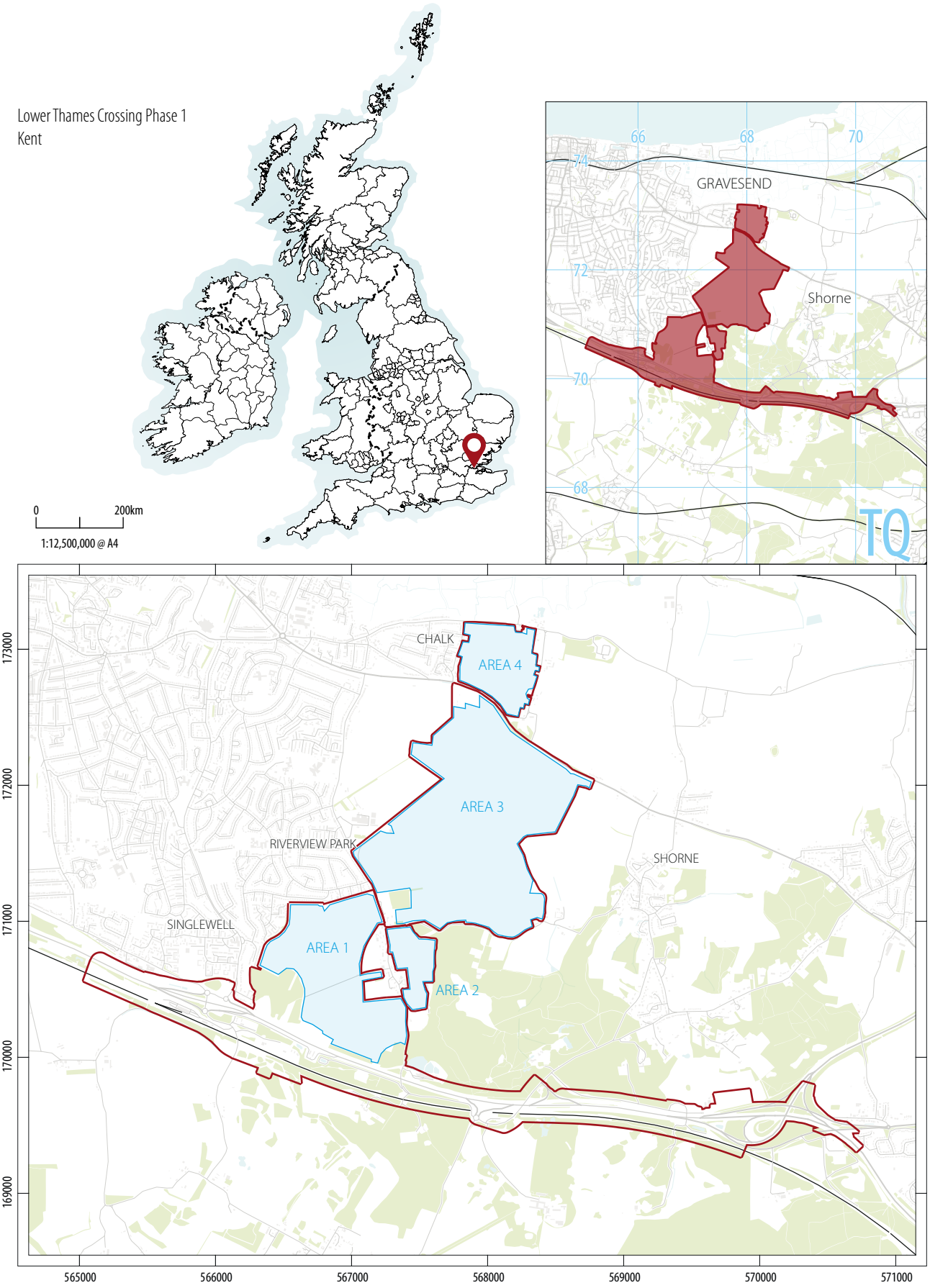

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ILLUS 1 Site location

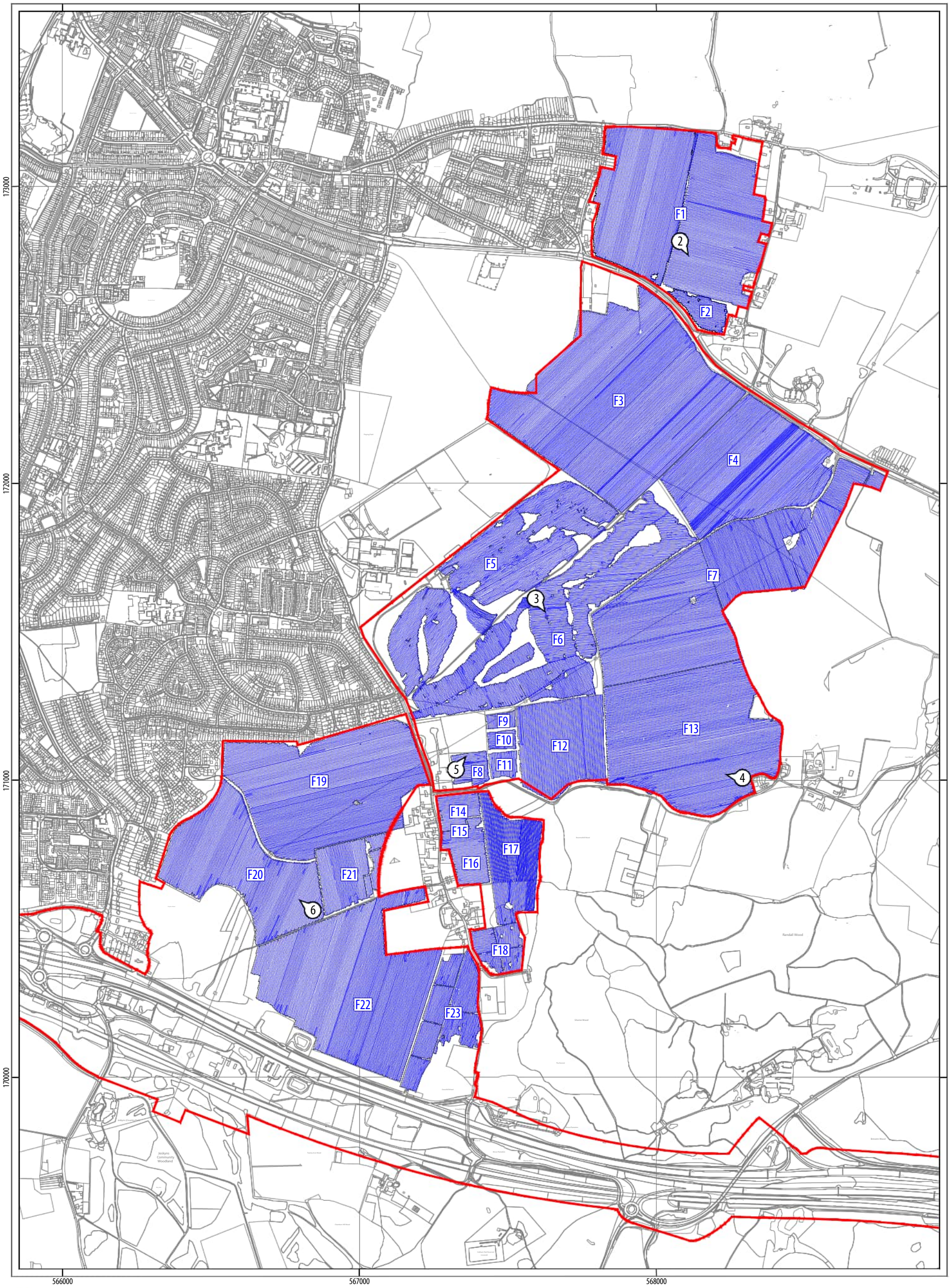
Illus 2. F2, looking south-east

Illus 3. F6, looking south-east

Illus 4. F13, looking west

Illus 5. F8, looking north-east

Illus 6. F20, looking north-west



PDA

GPS swath

photo locations and directions

0 250m

1:12,500 @ A3

PROJECT LTCK18
Lower Thames Crossing
Phase 1
Kent

CLIENT Arcadis Consulting (UK) Ltd

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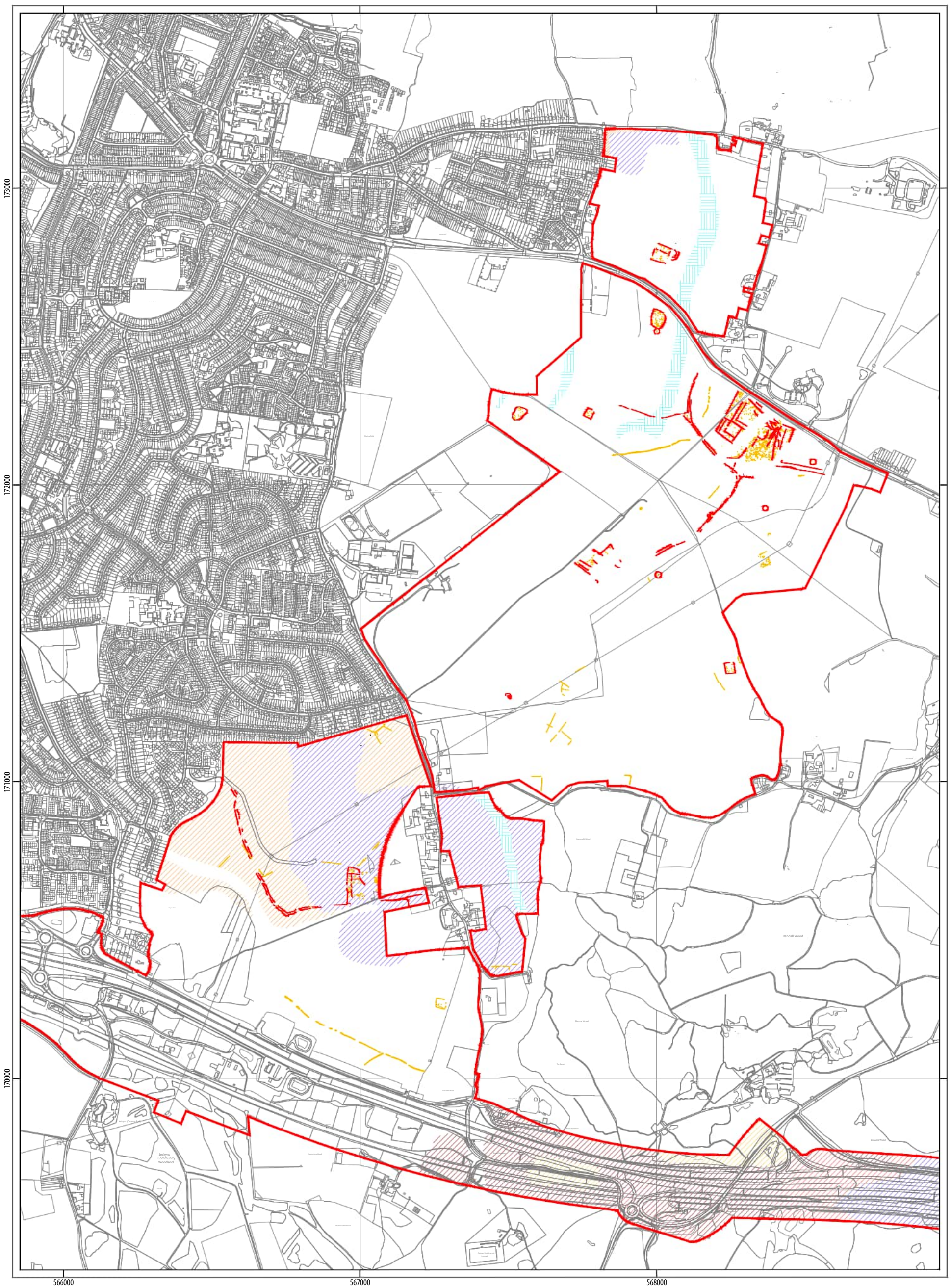
ILLUS 7 Survey location showing GPS swaths and photo locations



PDA

Superficial Geology
- Head- Clay, Silt, Sand and Gravel
- Lynch Hill Gravel Member- Sand and Gravel
- Taplow Gravely Member- Sand and Gravel

Bedrock Geology
- Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation-Chalk
- Thanet Formation- Sand
- Harwich Formation- Sand and Gravel
- Lambeth Group- Sand, Silt and Clay
- London Clay Formation- Clay and Silt

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 250m
1:12,500 @ A3

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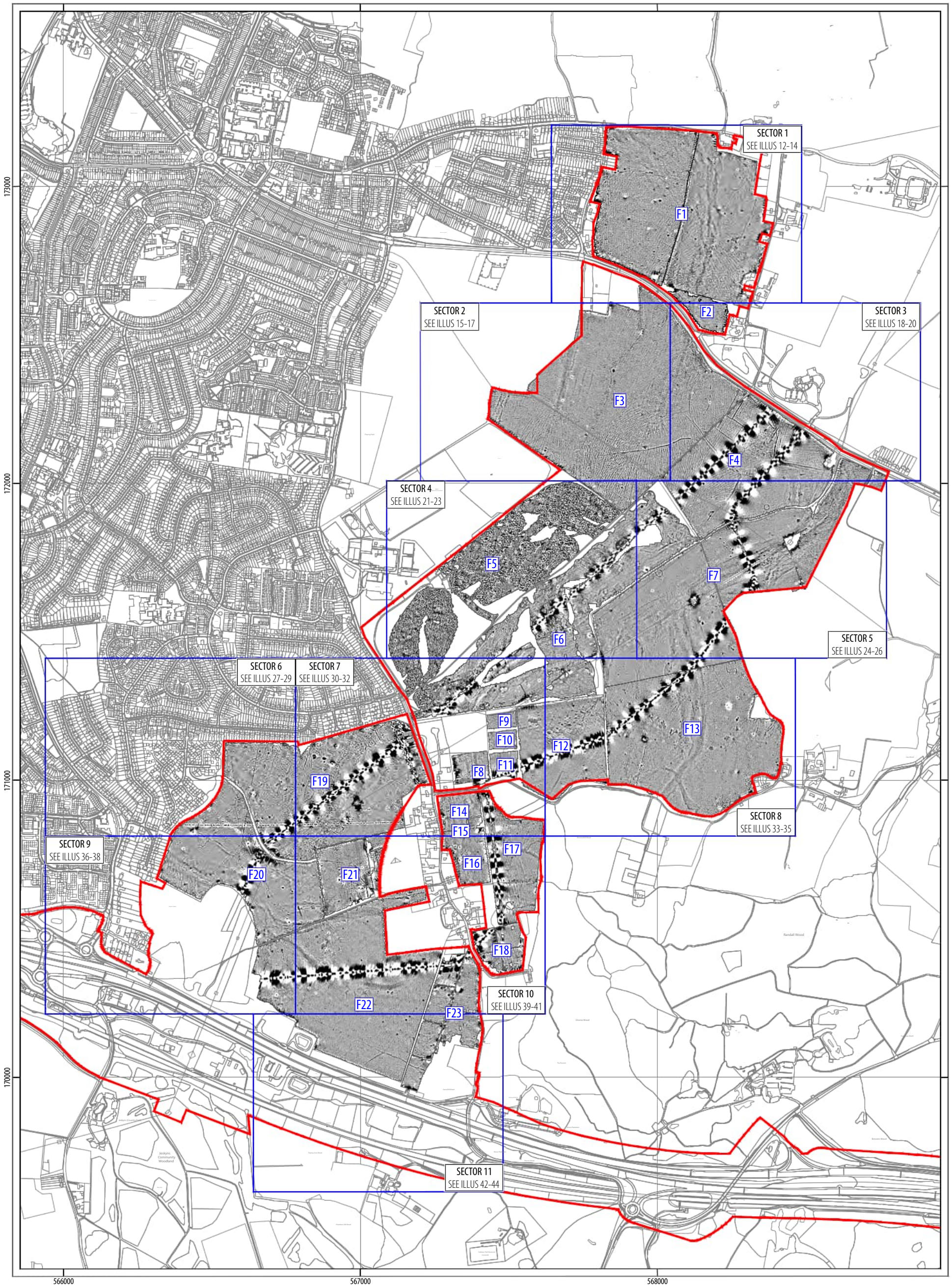
ILLUS 8 Survey location showing geology (after BGS) overlain with archaeology



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ILLUS 9 Overall greyscale magnetometer data

AAA1
SEE ILLUS 45-47

AAA2
SEE ILLUS 48-50

AAA3
SEE ILLUS 51-53

AAA4
SEE ILLUS 54-56

AAA5 (north)
SEE ILLUS 57-59

AAA5 (east)
SEE ILLUS 63-65

AAA5 (south)
SEE ILLUS 60-62

AAA6
SEE ILLUS 66-68

AAA7
SEE ILLUS 69-71

AAA8
SEE ILLUS 72-74

AAA9
SEE ILLUS 75-77

AAA10
SEE ILLUS 78-80

173000
172000
171000
170000
566000
567000
568000

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
null value	overhead powerlines
magnetic disturbance	modern
magnetic disturbance	golf bunkers

TYPE OF ANOMALY	INTERPRETATION
magnetic disturbance	airfield
linear trend	agricultural
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	archaeology

0 250m
1:12,500 @ A3

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Kent

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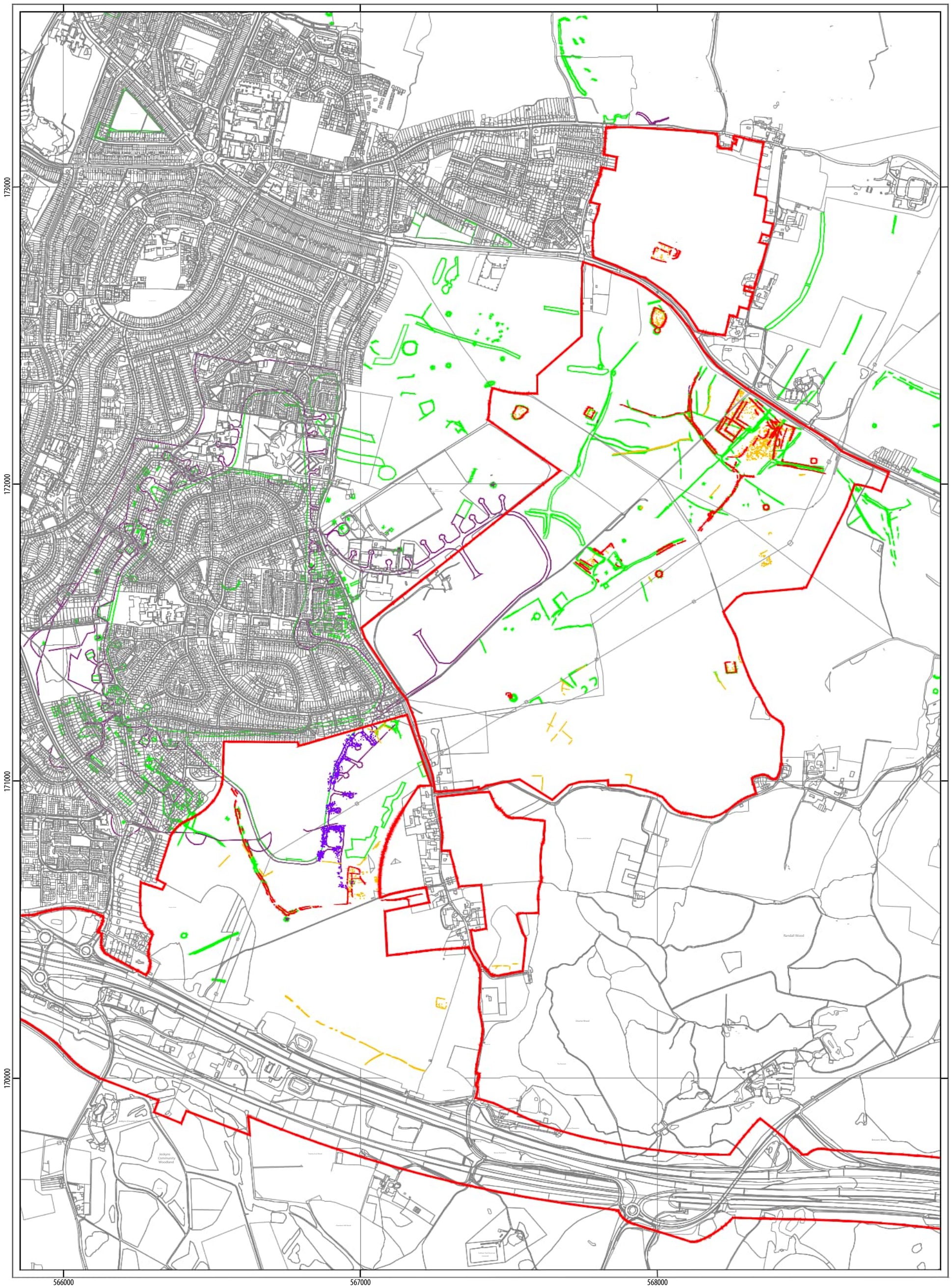
ILLUS 10 Overall interpretation of magnetometer data



geophysical survey area
NMP cropmark data
NMP airfield data

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	archaeology?
magnetic enhancement	archaeology
magnetic disturbance	ferrous material

0 250m
1:12,500 @ A3

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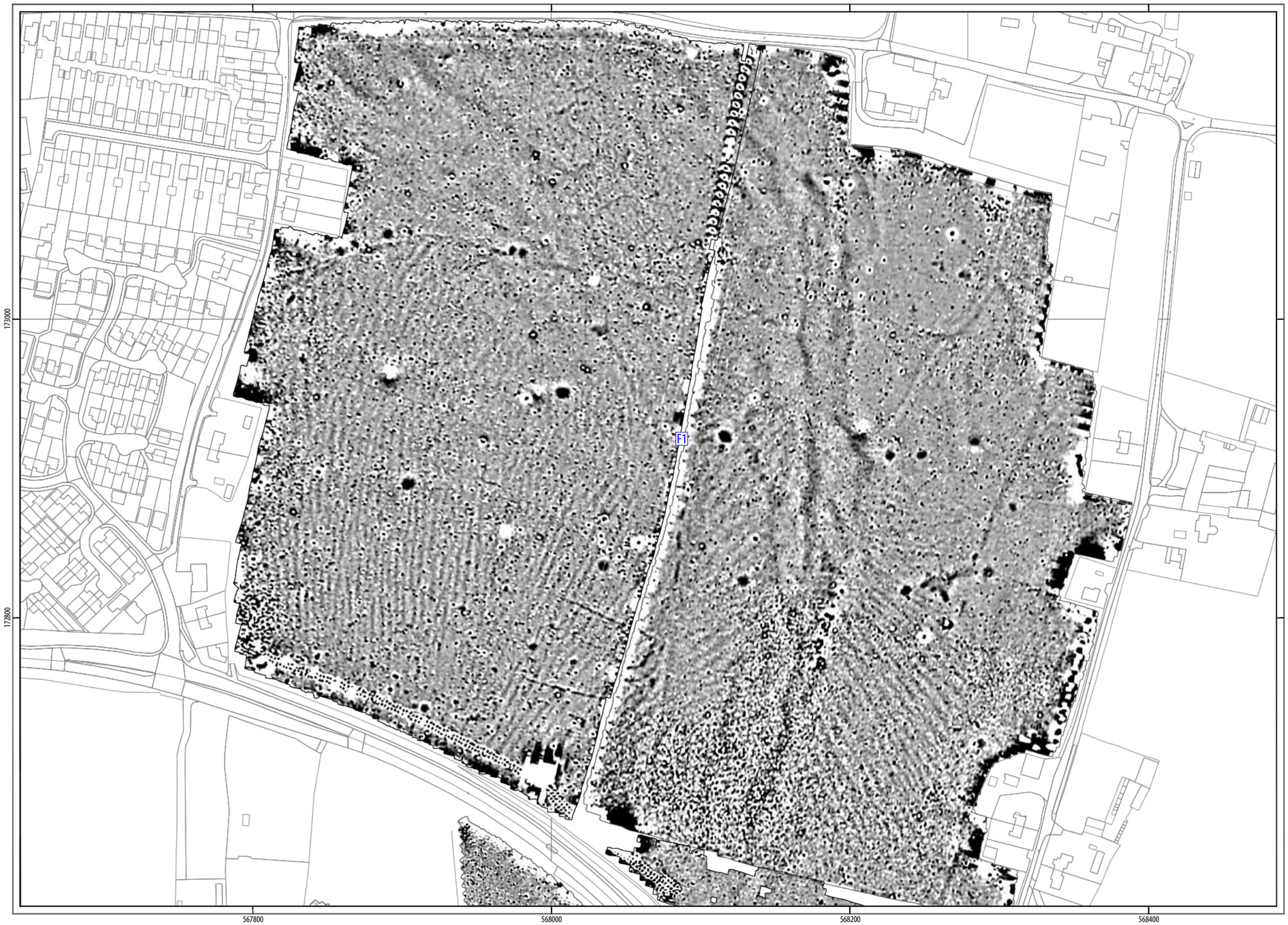
ILLUS 11 Archaeological Interpretation with cropmark data



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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ILLUS 12 Processed greyscale magnetometer data; Sector 1

77.0nT/cm

0 50m

1:2,500 @ A3

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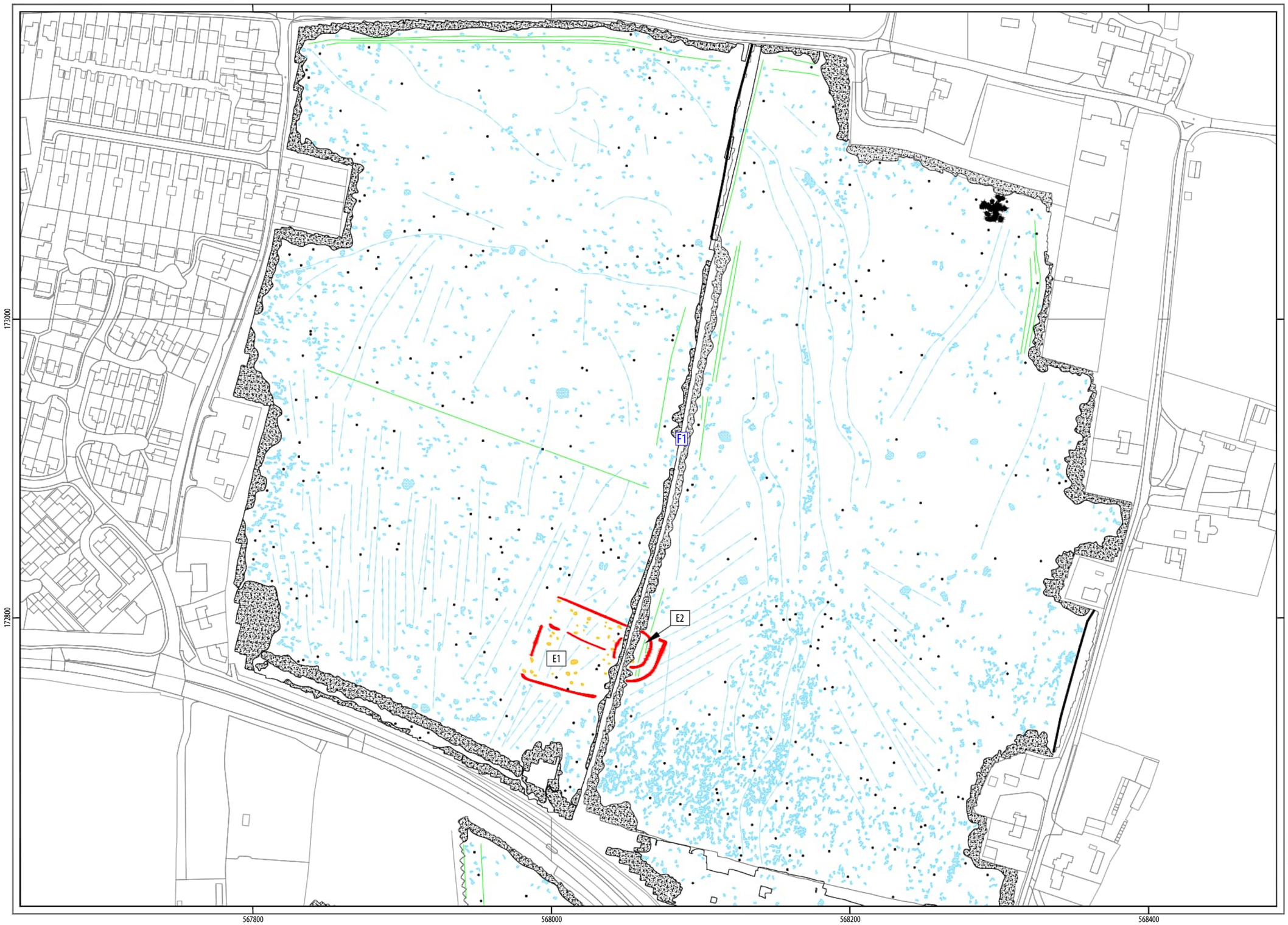
ILLUS 13 XY trace plot of minimally processed magnetometer data; Sector 1



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	geology
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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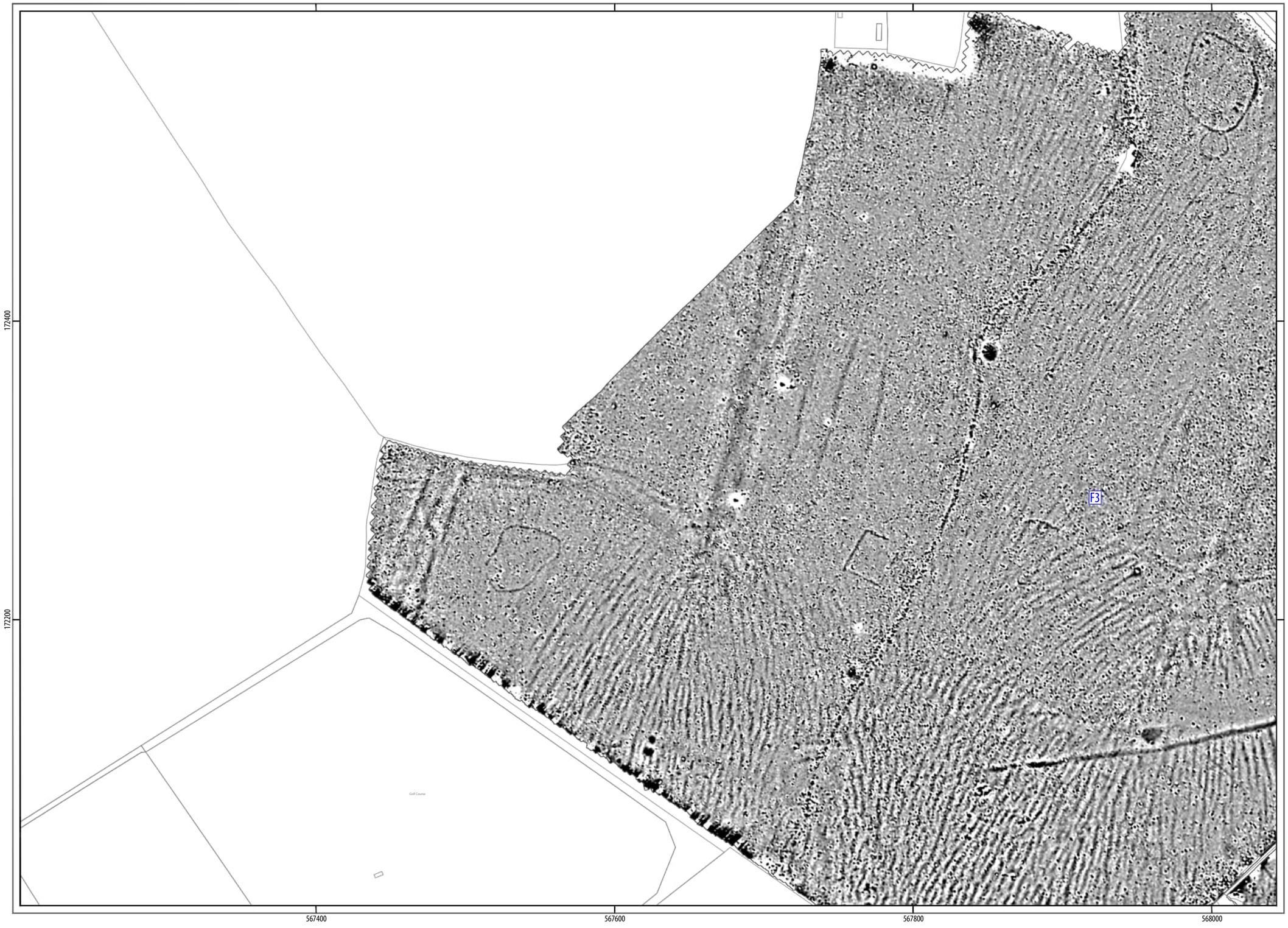
ILLUS 14 Interpretation of magnetometer data; Sector 1



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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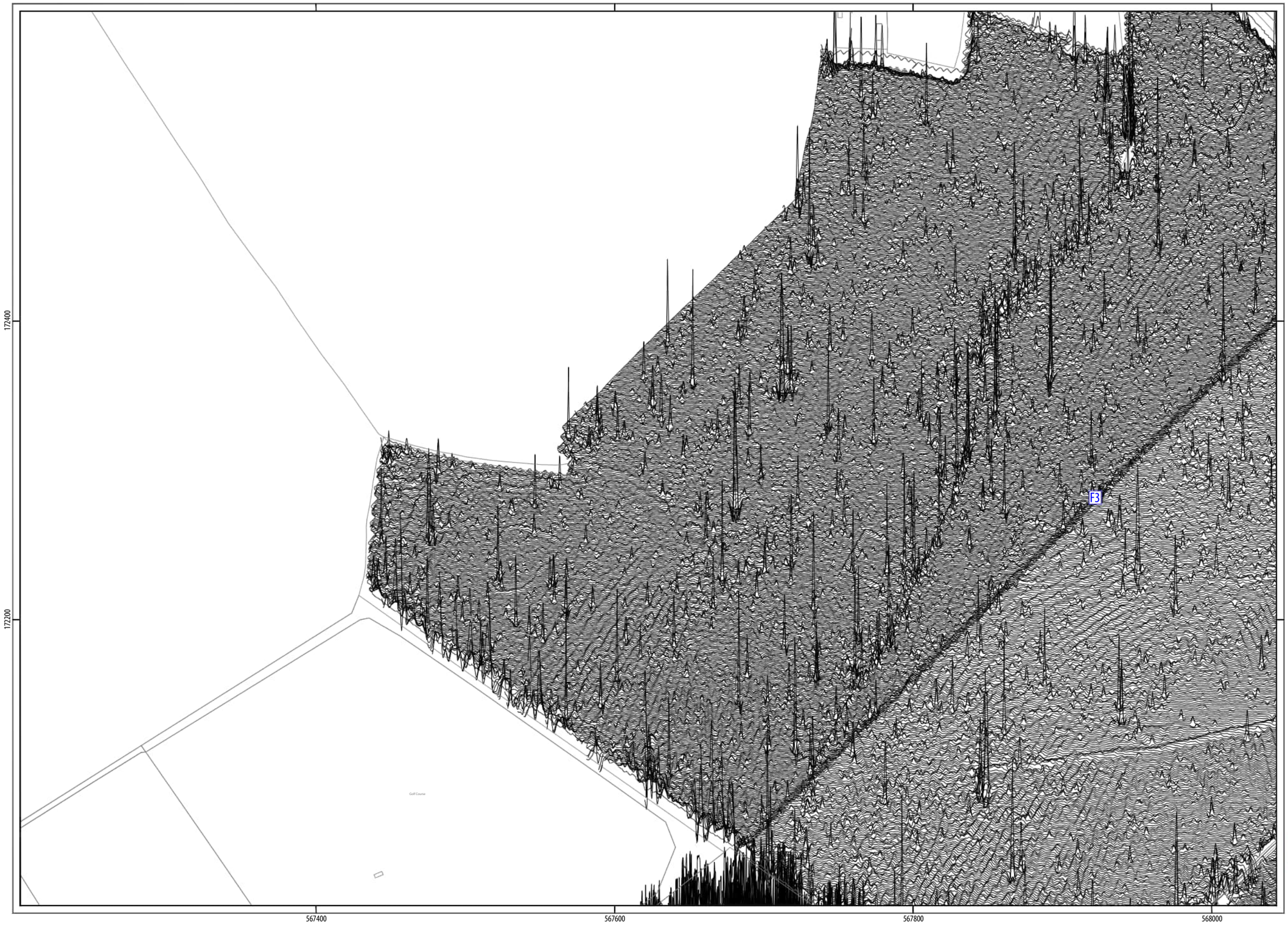
ILLUS 15 Processed greyscale magnetometer data; Sector 2



77.0nT/cm

0 50m

1:2,500 @ A3

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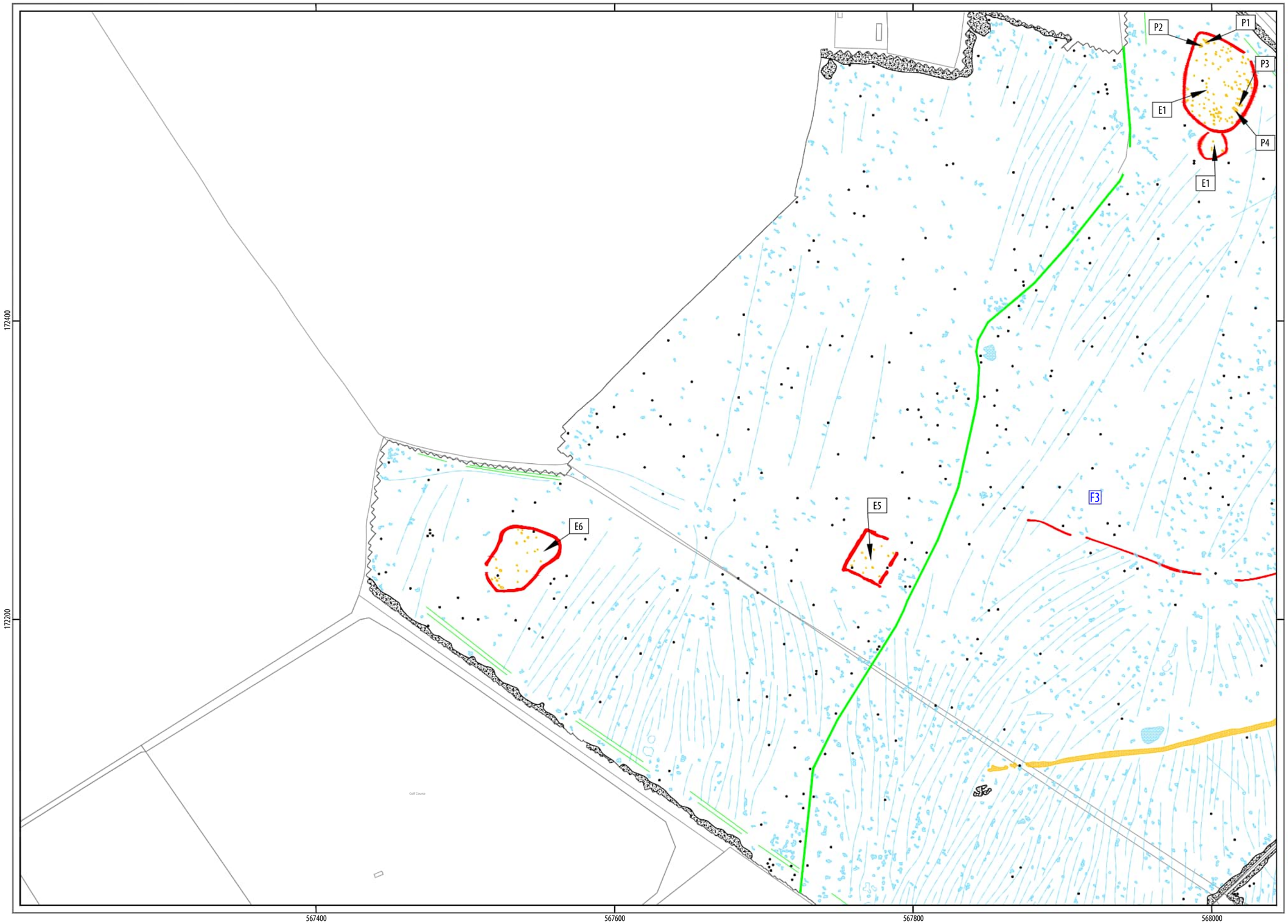
ILLUS 16 XY traceplot of minimally processed magnetometer data; Sector 2



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

0 50m
1:2,500 @ A3

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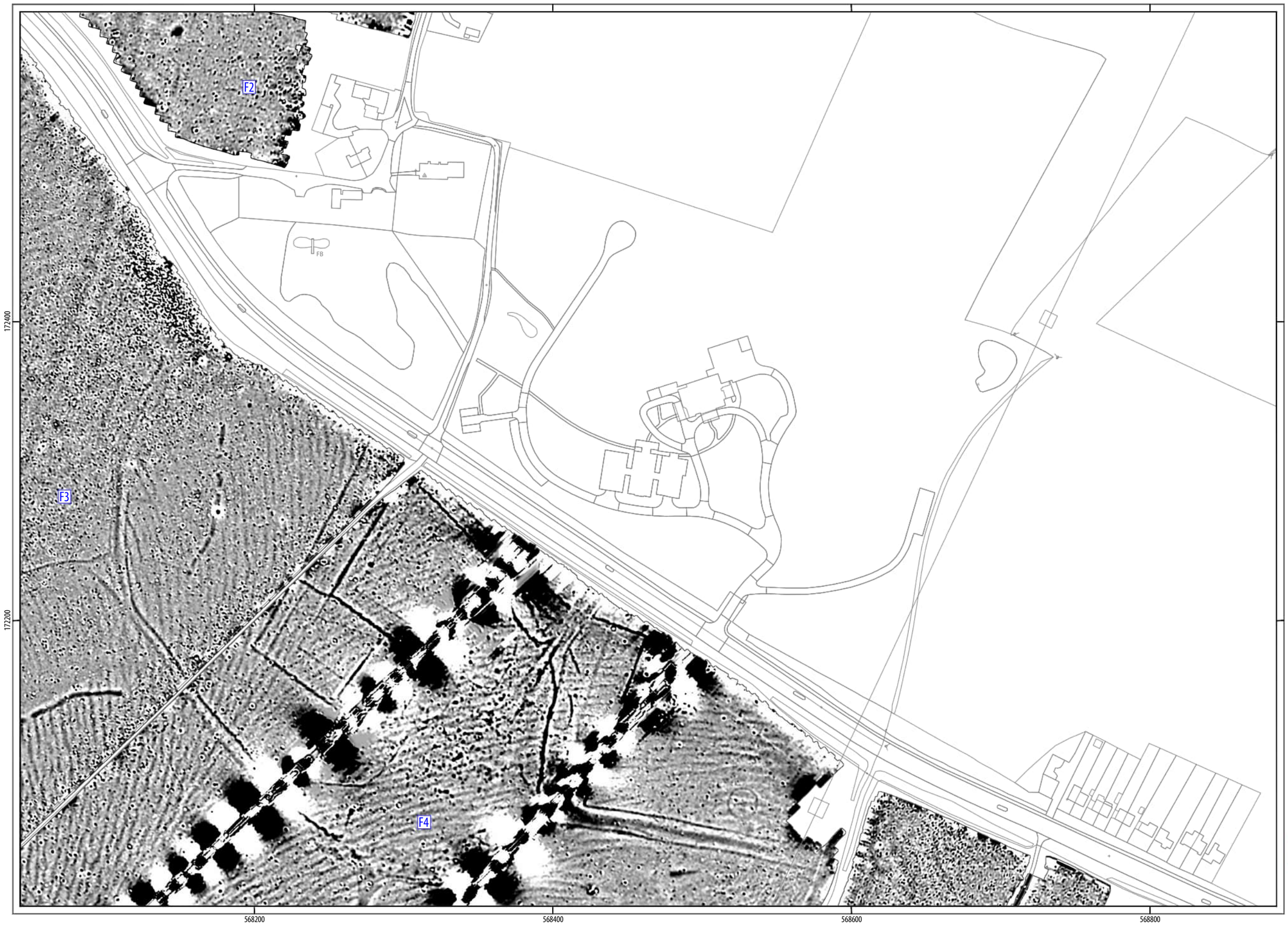
ILLUS 17 Interpretation of magnetometer data; Sector 2



nT
-1.0
2.0

0
50m
1:2,500 @ A3

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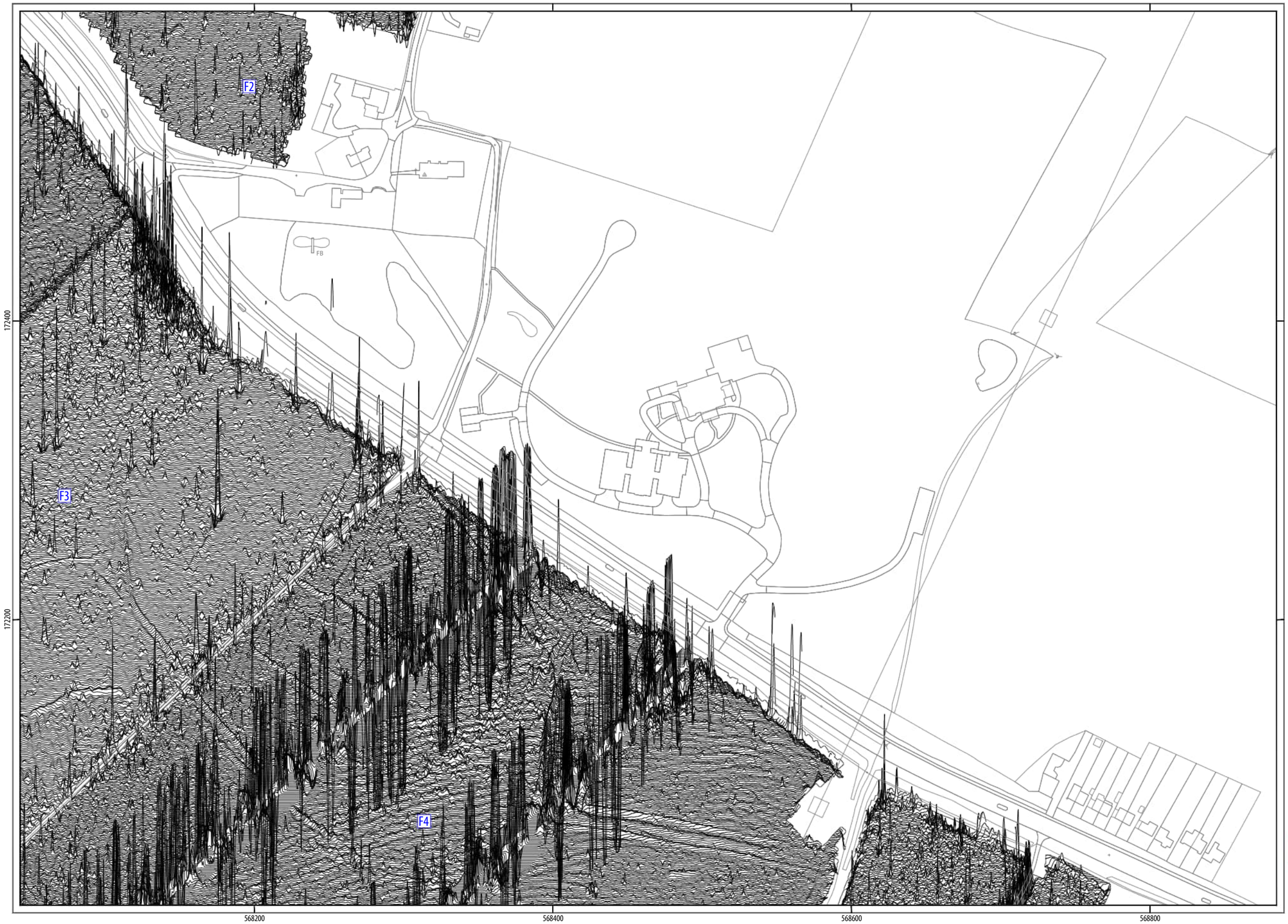
ILLUS 18 Processed greyscale magnetometer data; Sector 3



77.0nT/cm

0 50m

1:2,500 @ A3

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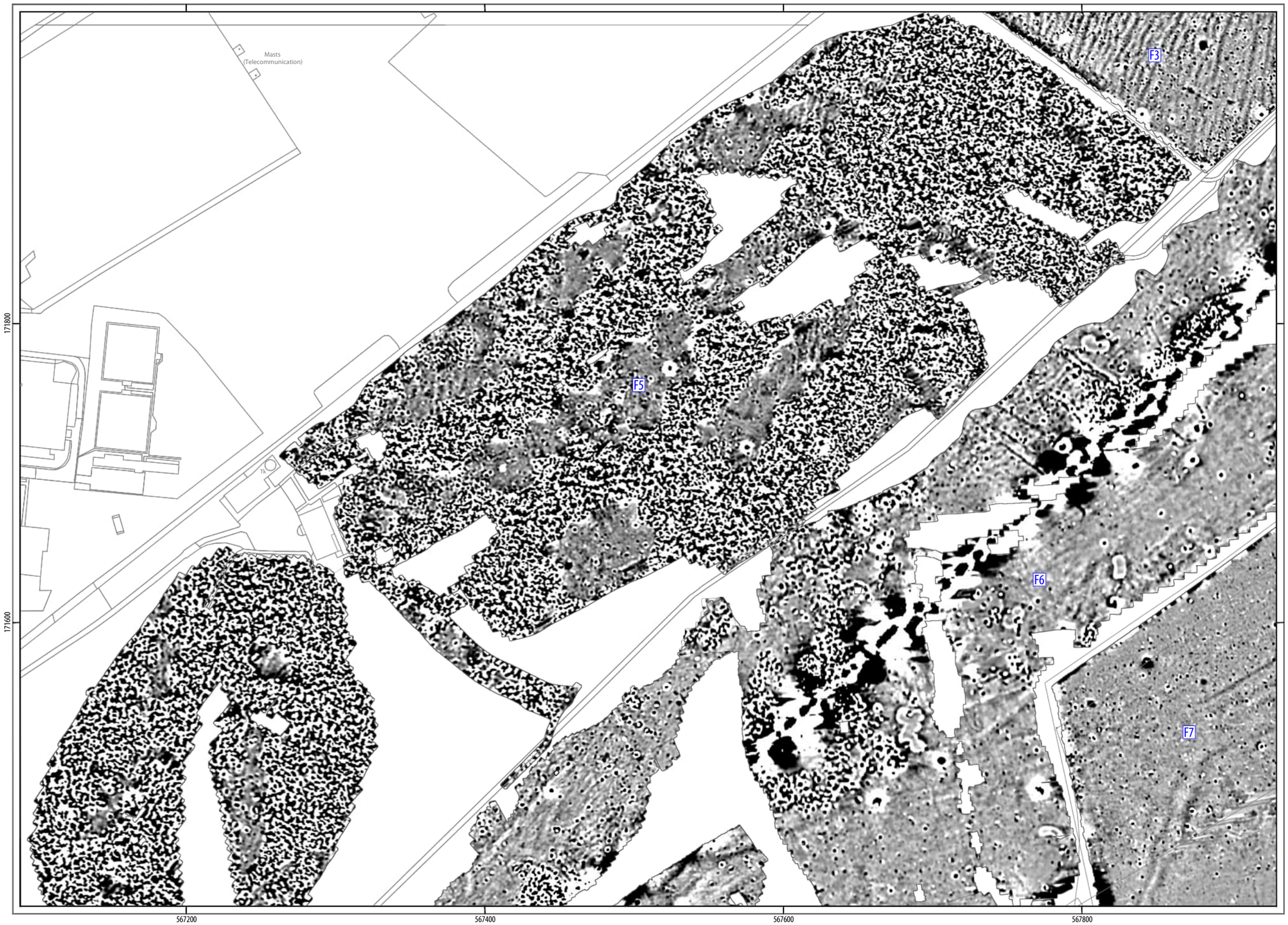
ILLUS 19 XY traceplot of minimally processed magnetometer data; Sector 3

568200

ILLUS 20 Interpretation of magnetometer data; Sector 3



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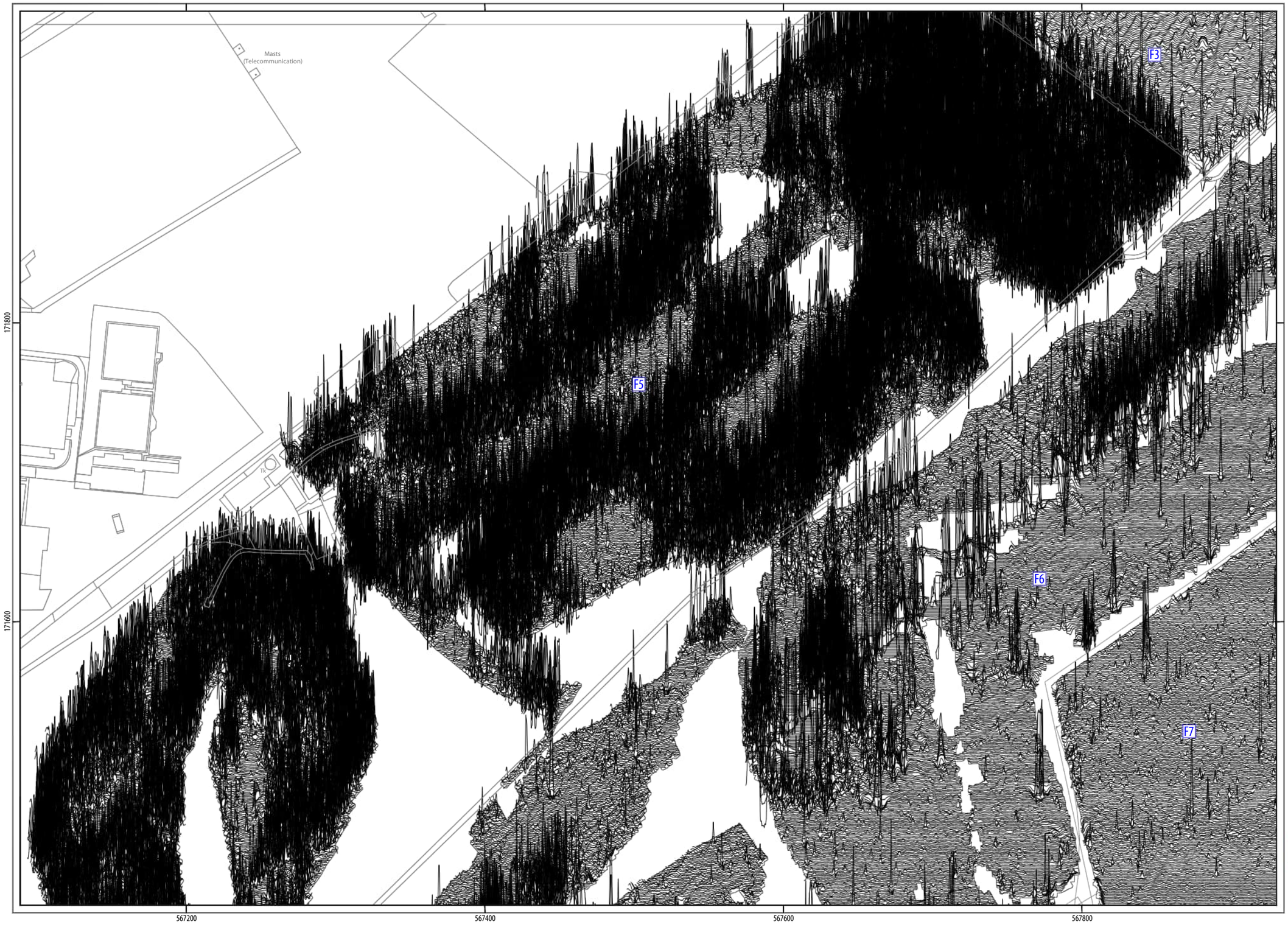
ILLUS 21 Processed greyscale magnetometer data; Sector 4



77.0nT/cm

0 50m

1:2,500 @ A3

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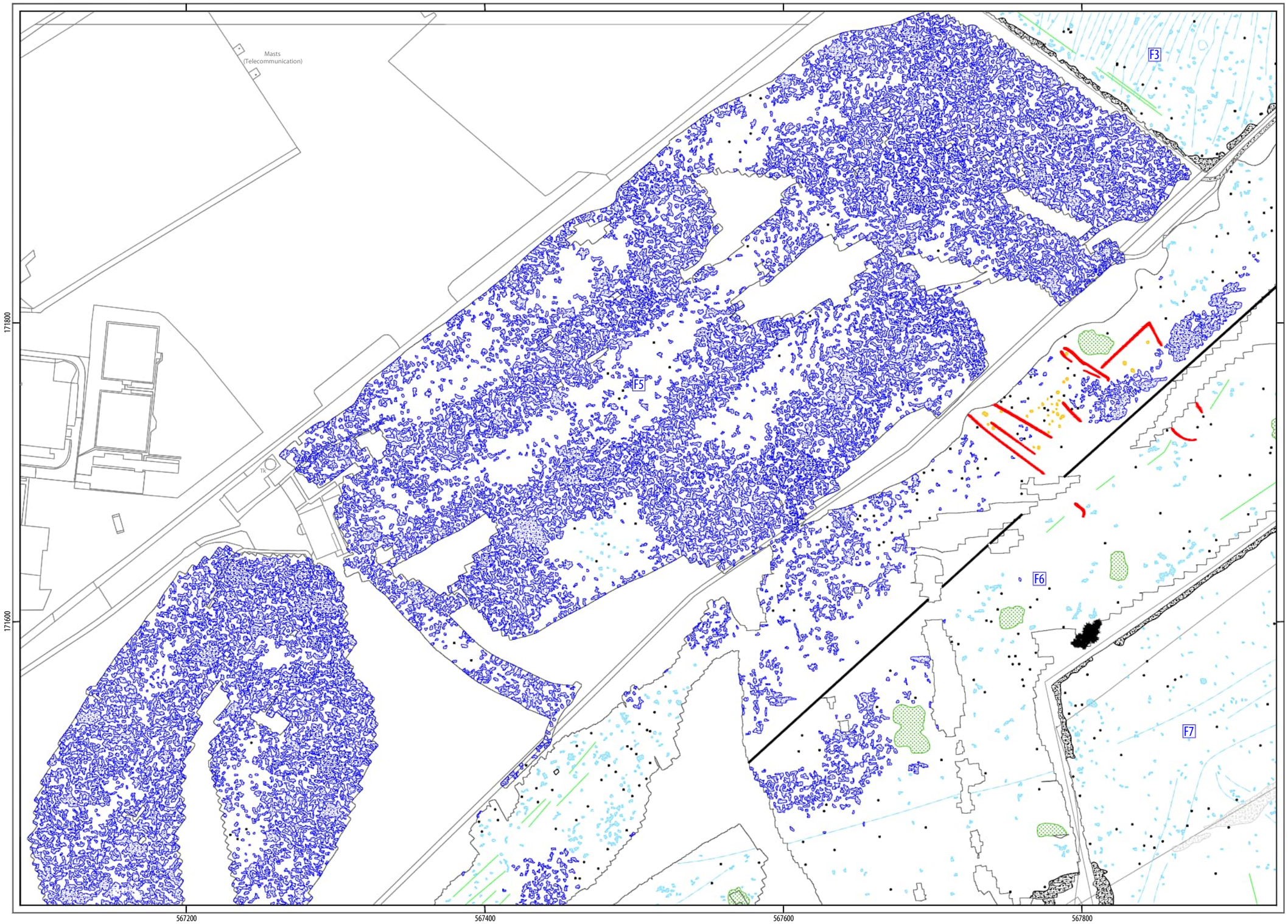
ILLUS 22 XY traceplot of minimally processed magnetometer data; Sector 4



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
null value	overhead powerlines
magnetic disturbance	modern
magnetic disturbance	golf bunkers
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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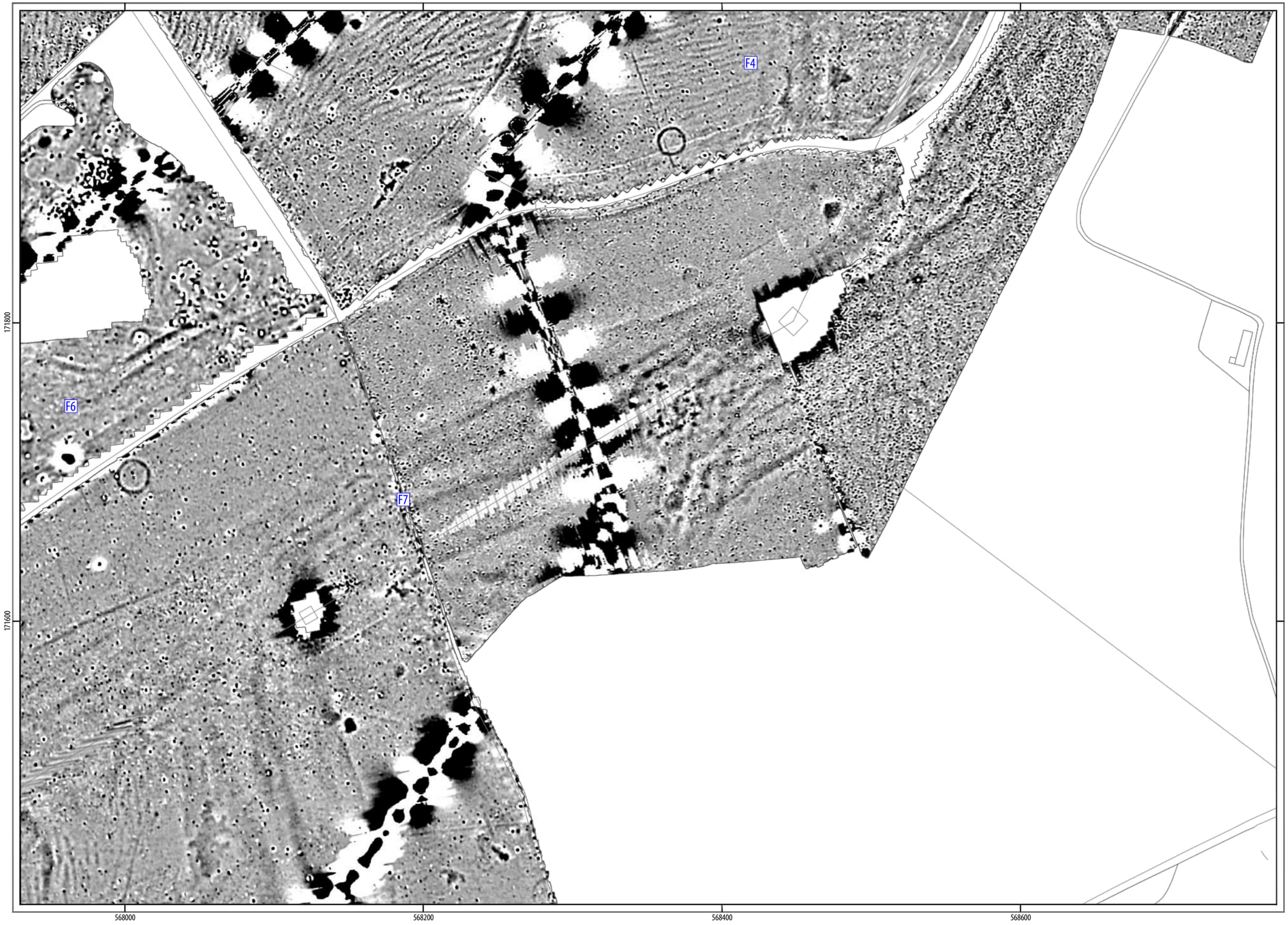
ILLUS 23 Interpretation of magnetometer data; Sector 4



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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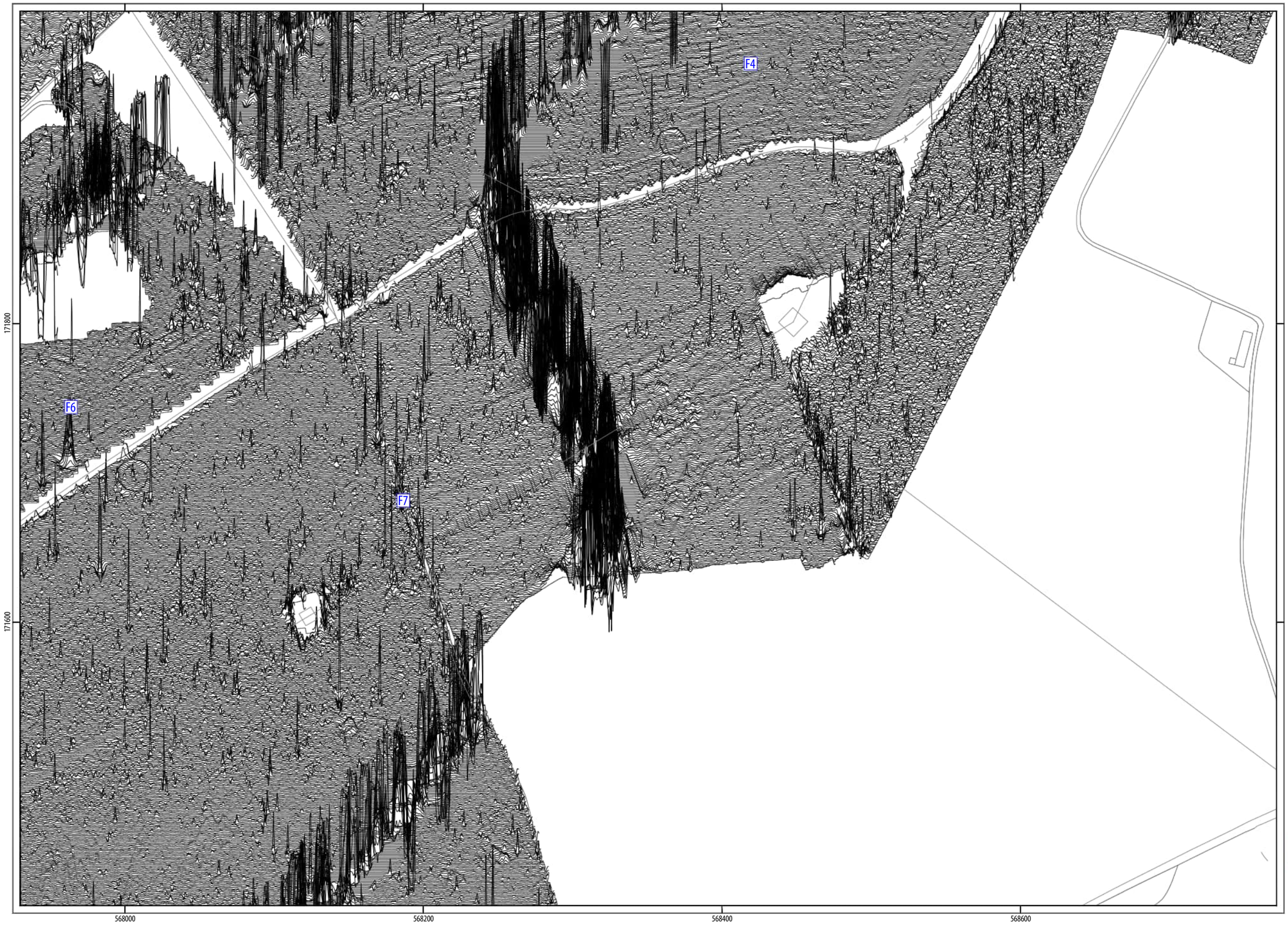
ILLUS 24 Processed greyscale magnetometer data; Sector 5



77.0nT/cm

0 50m

1:2,500 @ A3

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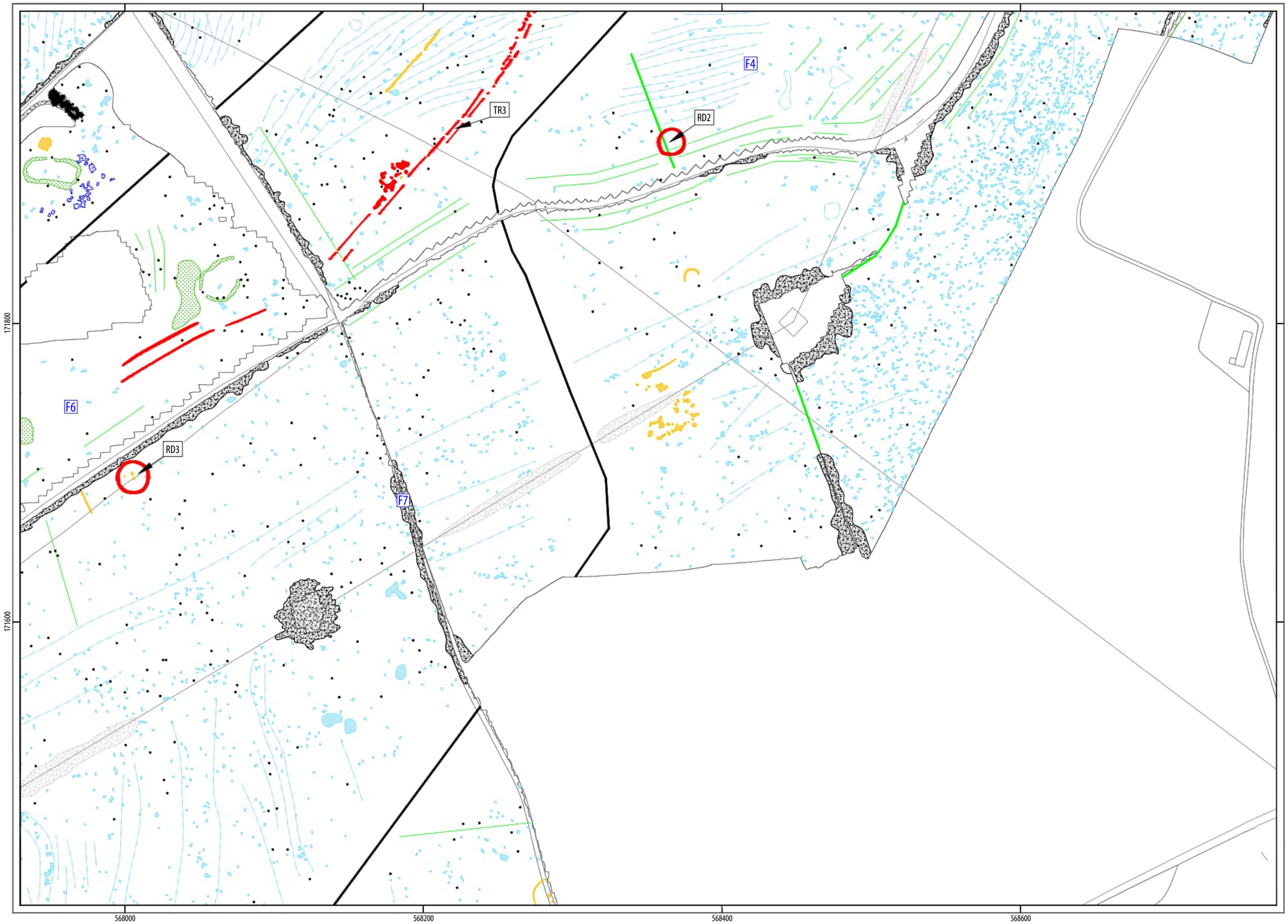
ILLUS 25 XY traceplot of minimally processed magnetometer data; Sector 5



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
null value	overhead powerlines
magnetic disturbance	modern
magnetic disturbance	golf bunkers
linear trend	agricultural
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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ILLUS 26 Interpretation of magnetometer data; Sector 5

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ILLUS 27 Processed greyscale magnetometer data; Sector 6

77.0nT/cm

0 50m

1:2,500 @ A3

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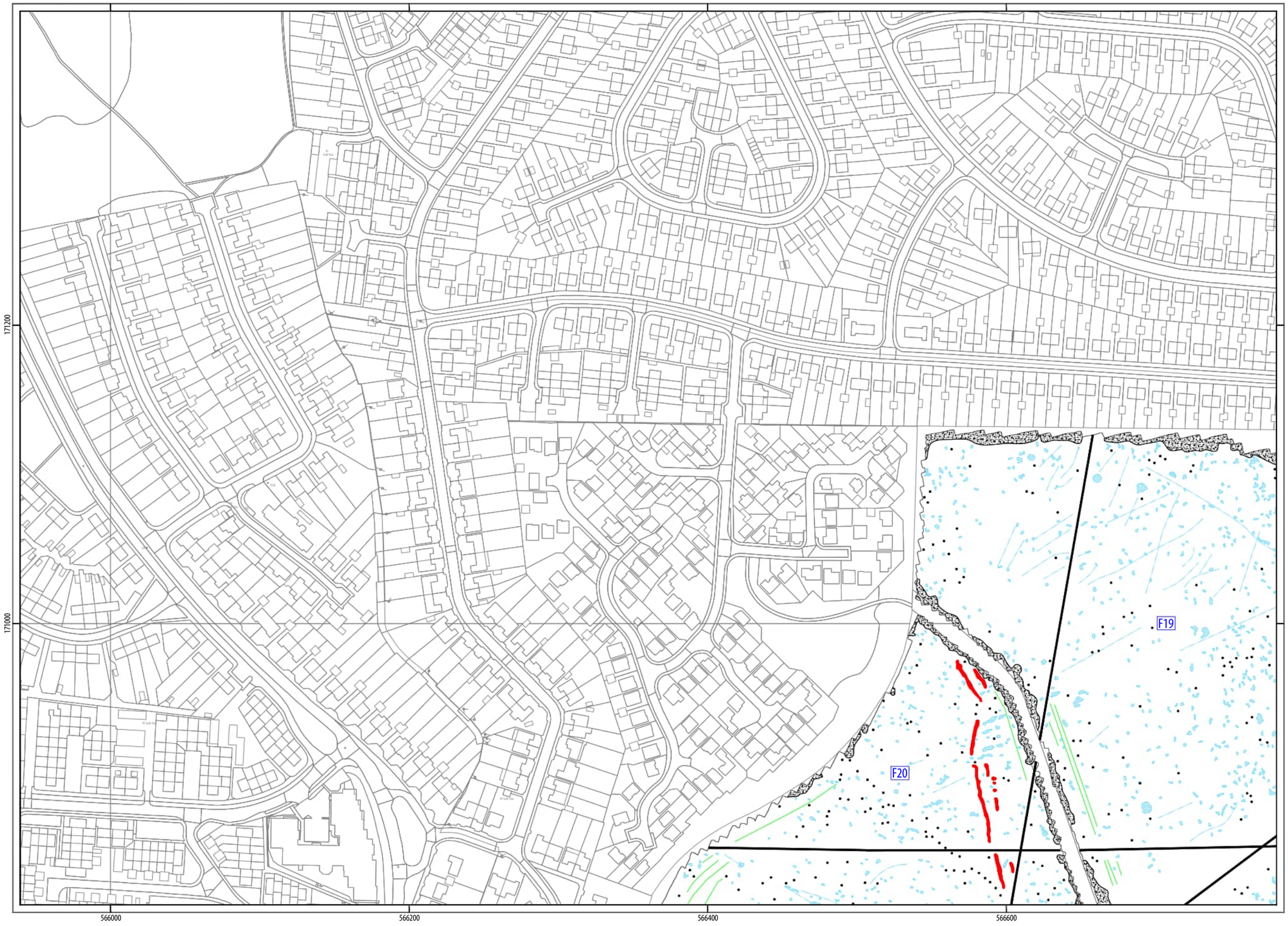
ILLUS 28 XY traceplot of minimally processed magnetometer data; Sector 6



0 50m
1:2,500 @ A3

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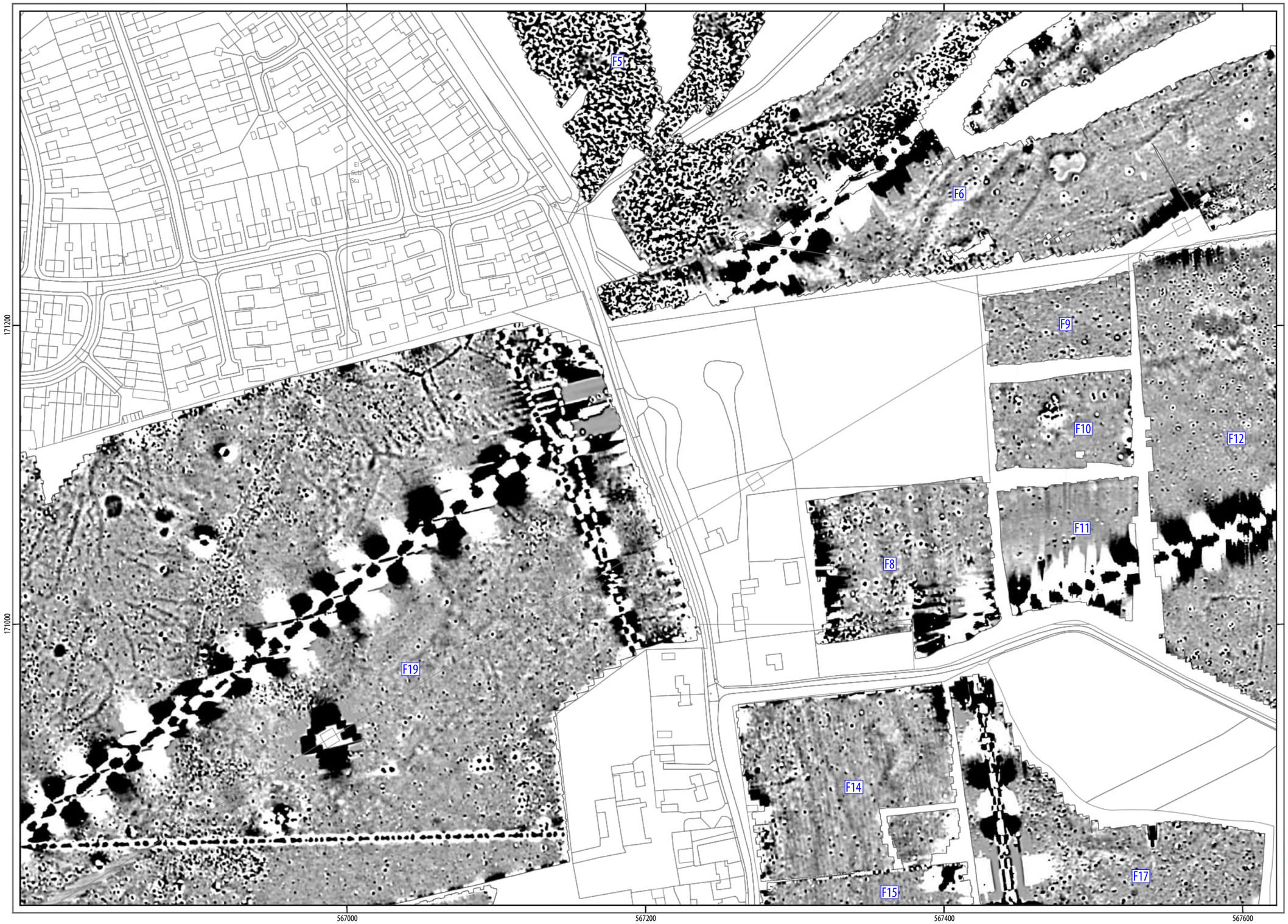
ILLUS 29 Interpretation of magnetometer data; Sector 6



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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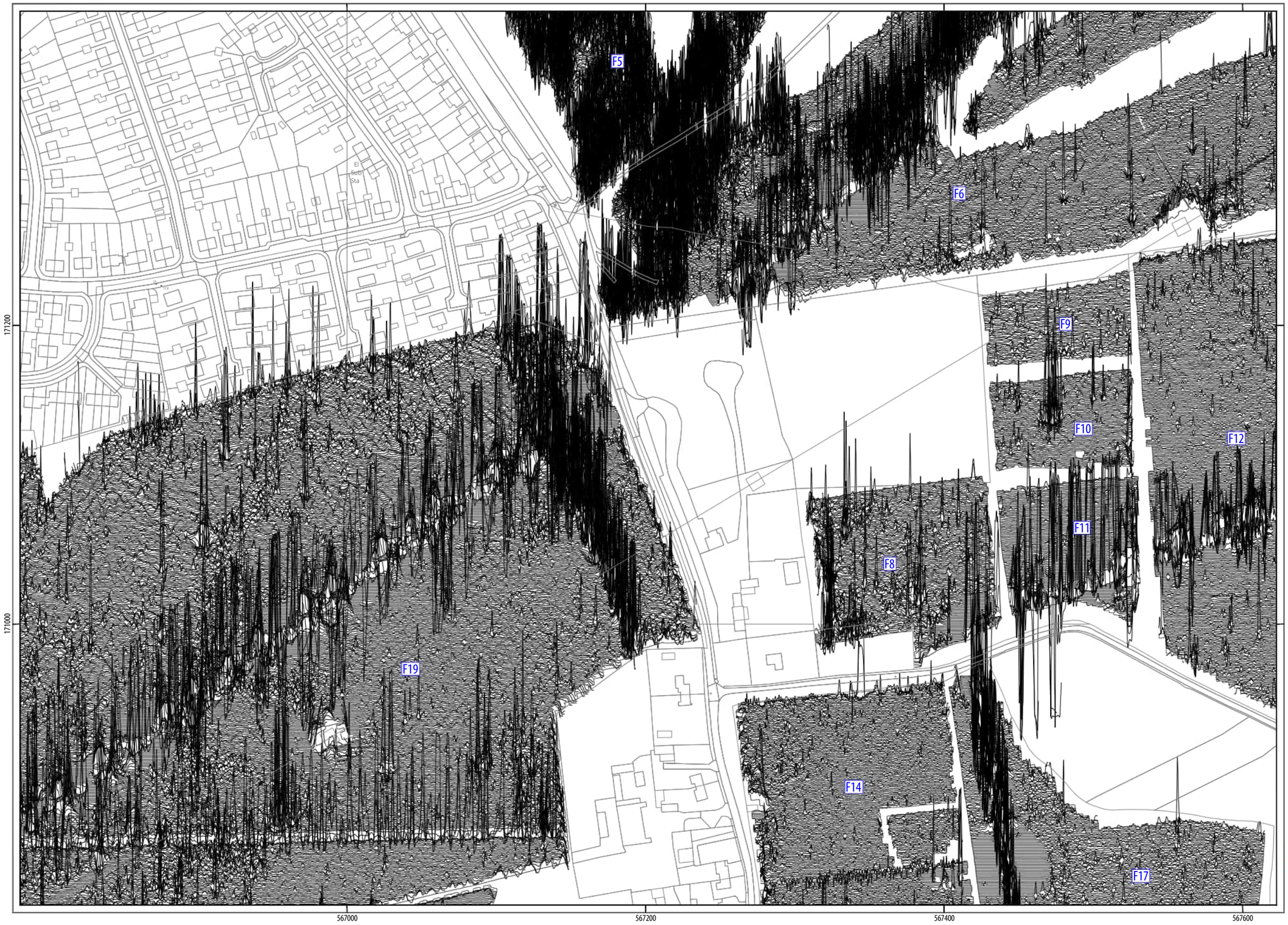
ILLUS 30 Processed greyscale magnetometer data; Sector 7



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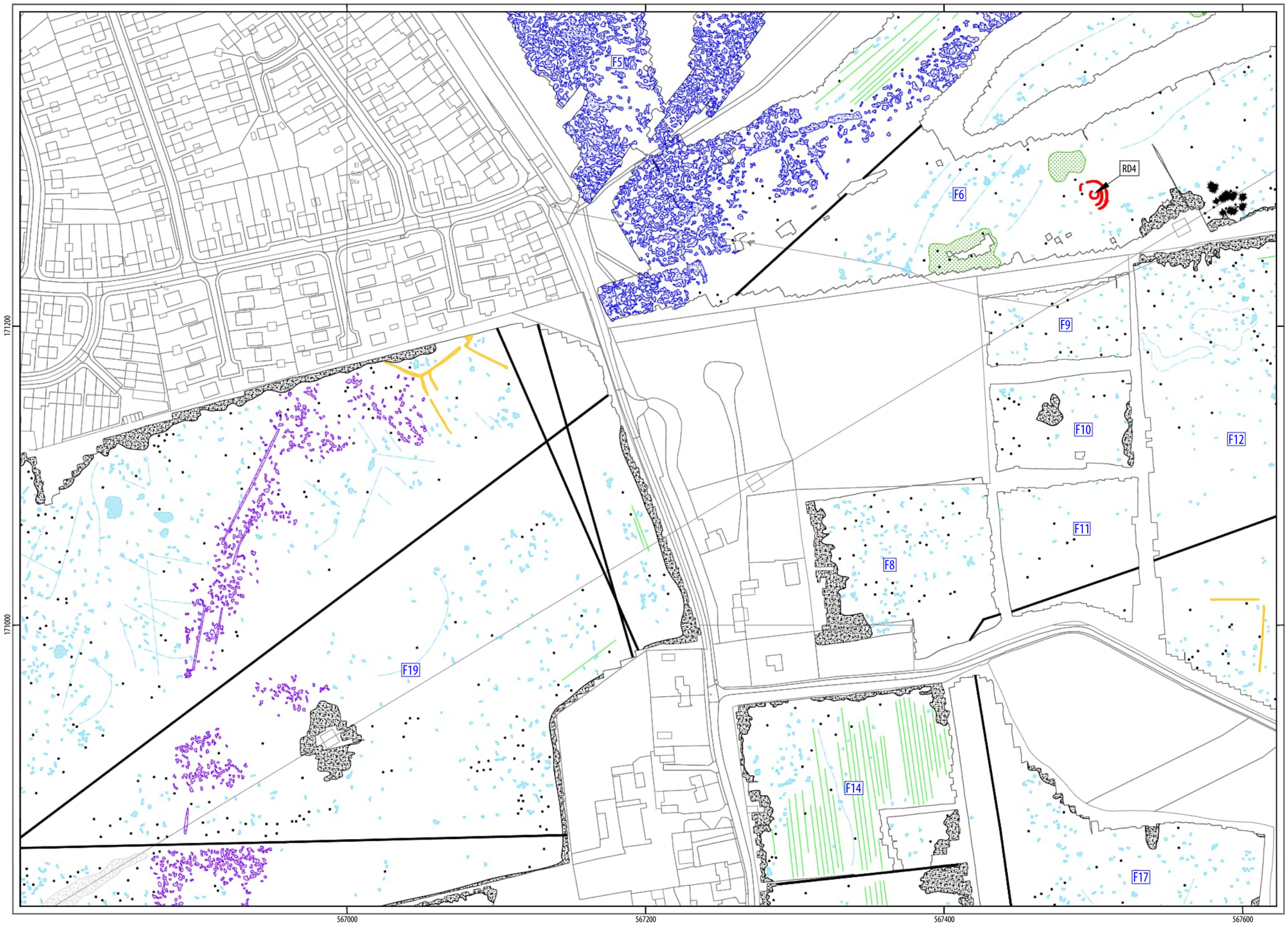
ILLUS 31 XY traceplot of minimally processed magnetometer data; Sector 7



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
null value	overhead powerlines
magnetic disturbance	modern
magnetic disturbance	airfield
magnetic disturbance	golf bunkers
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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ILLUS 32 Interpretation of magnetometer data; Sector 7

F6
F7
F12
F13
171200
171000
567800
568000
568200
568400
nT
-1.0
2.0
0
50m
1:2,500 @ A3
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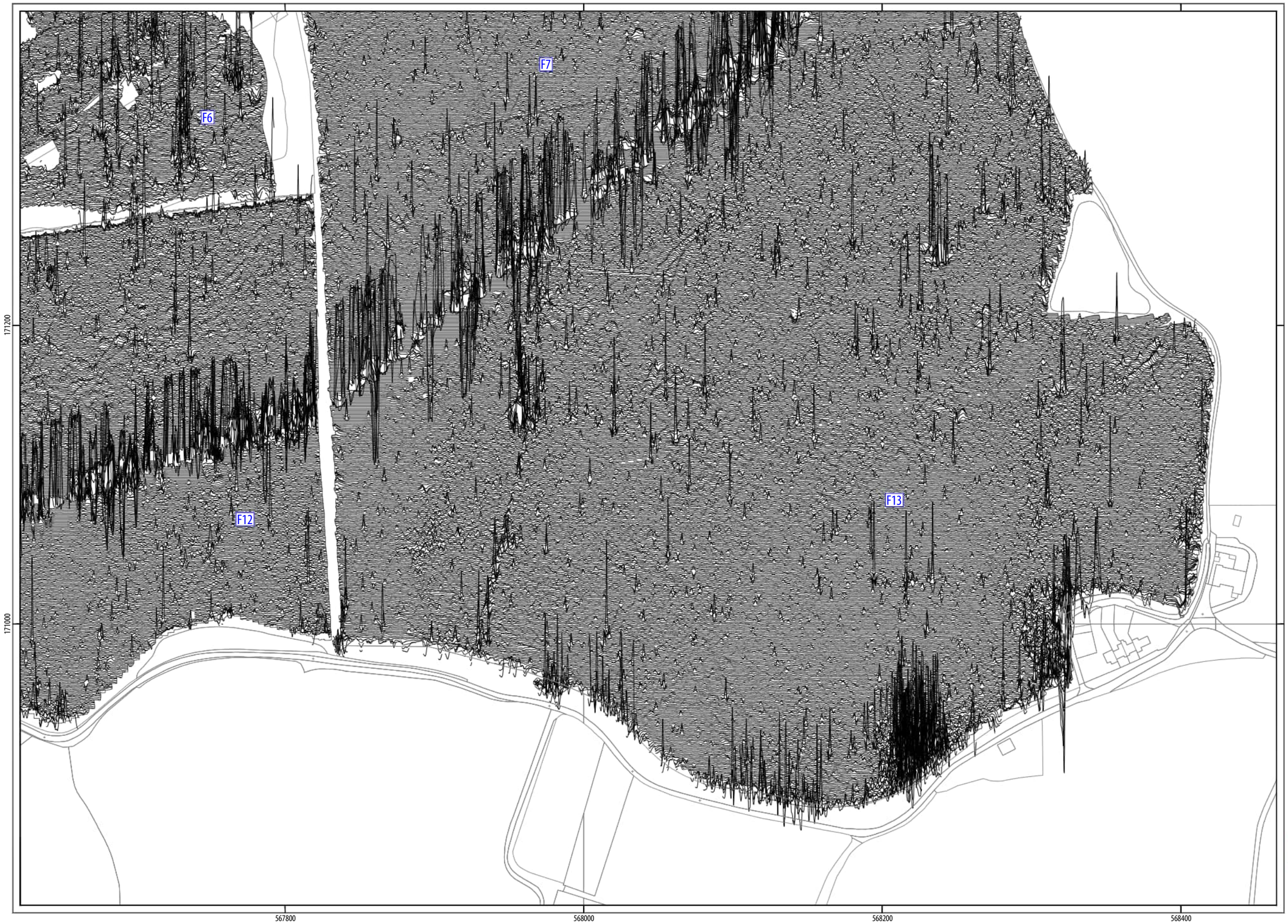
ILLUS 33 Processed greyscale magnetometer data; Sector 8



77.0nT/cm

0 50m

1:2,500 @ A3

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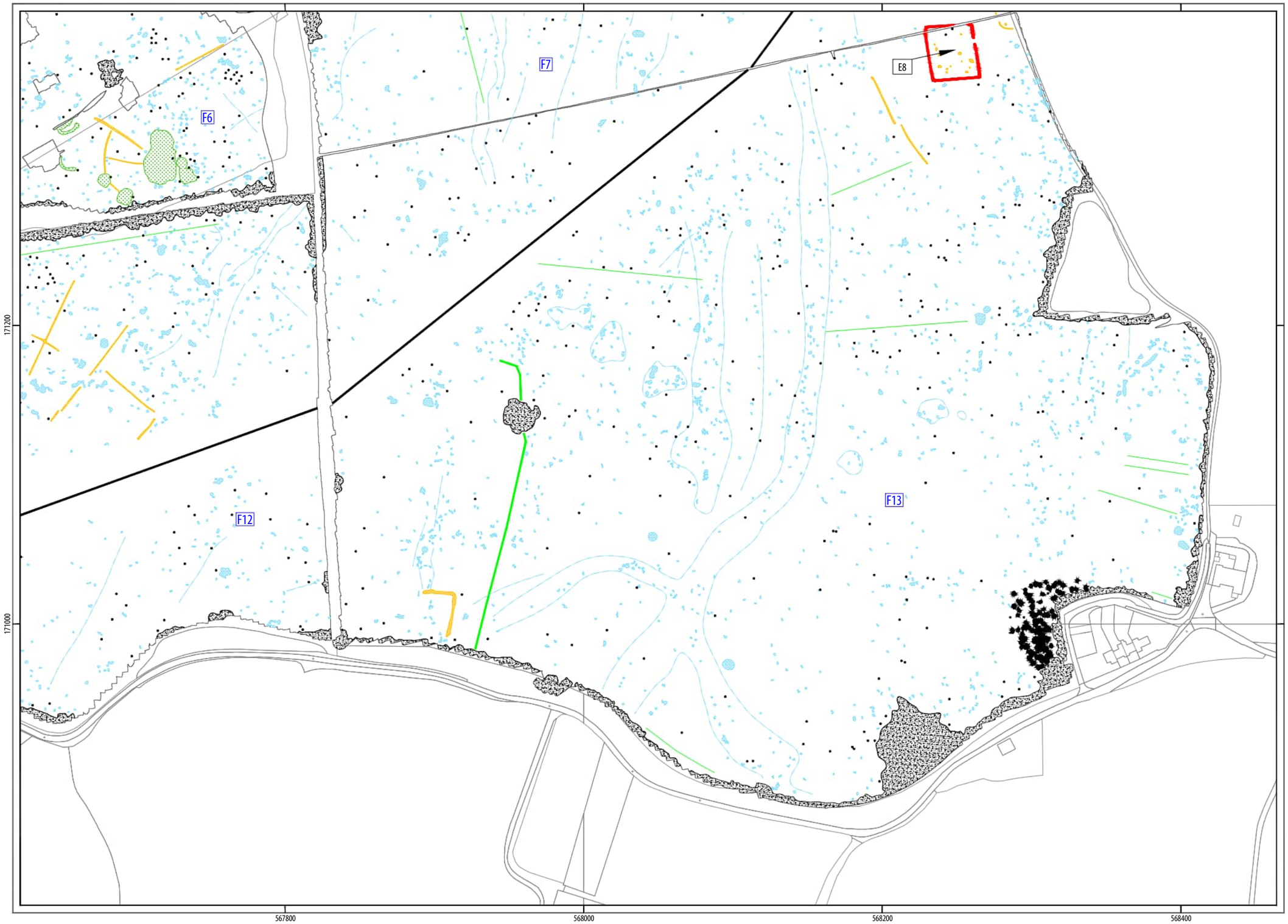
ILLUS 34 XY traceplot of minimally processed magnetometer data; Sector 8



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
magnetic disturbance	golf bunkers
linear trend	agricultural
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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ILLUS 35 Interpretation of magnetometer data; Sector 8

nT
-1.0 2.0

0 50m
1:2,500 @ A3

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ILLUS 36 Processed greyscale magnetometer data; Sector 9

77.0nT/cm

0 50m

1:2,500 @ A3

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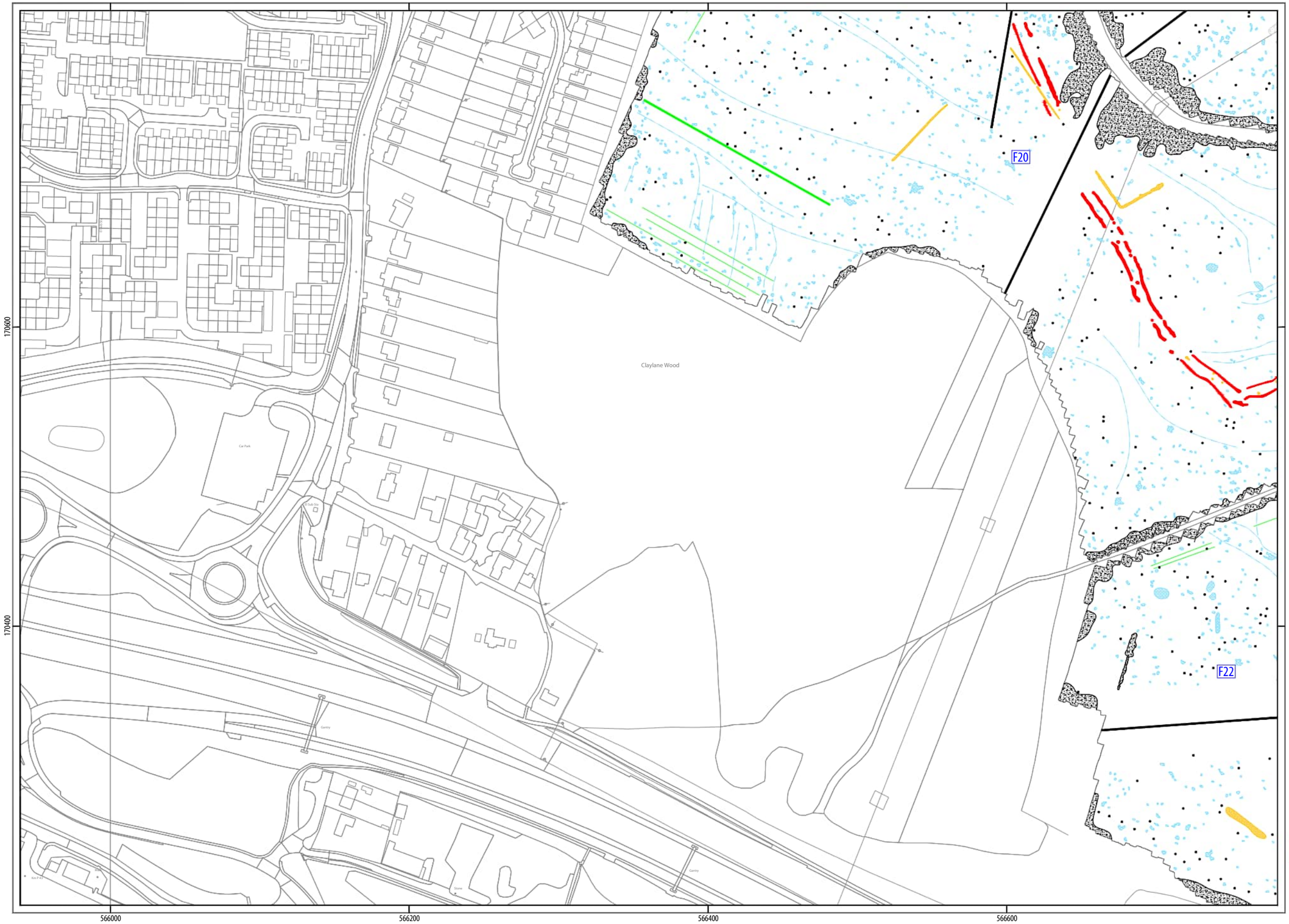
ILLUS 37 XY traceplot of minimally processed magnetometer data; Sector 9



ILLUS 38 Interpretation of magnetometer data; Sector 9

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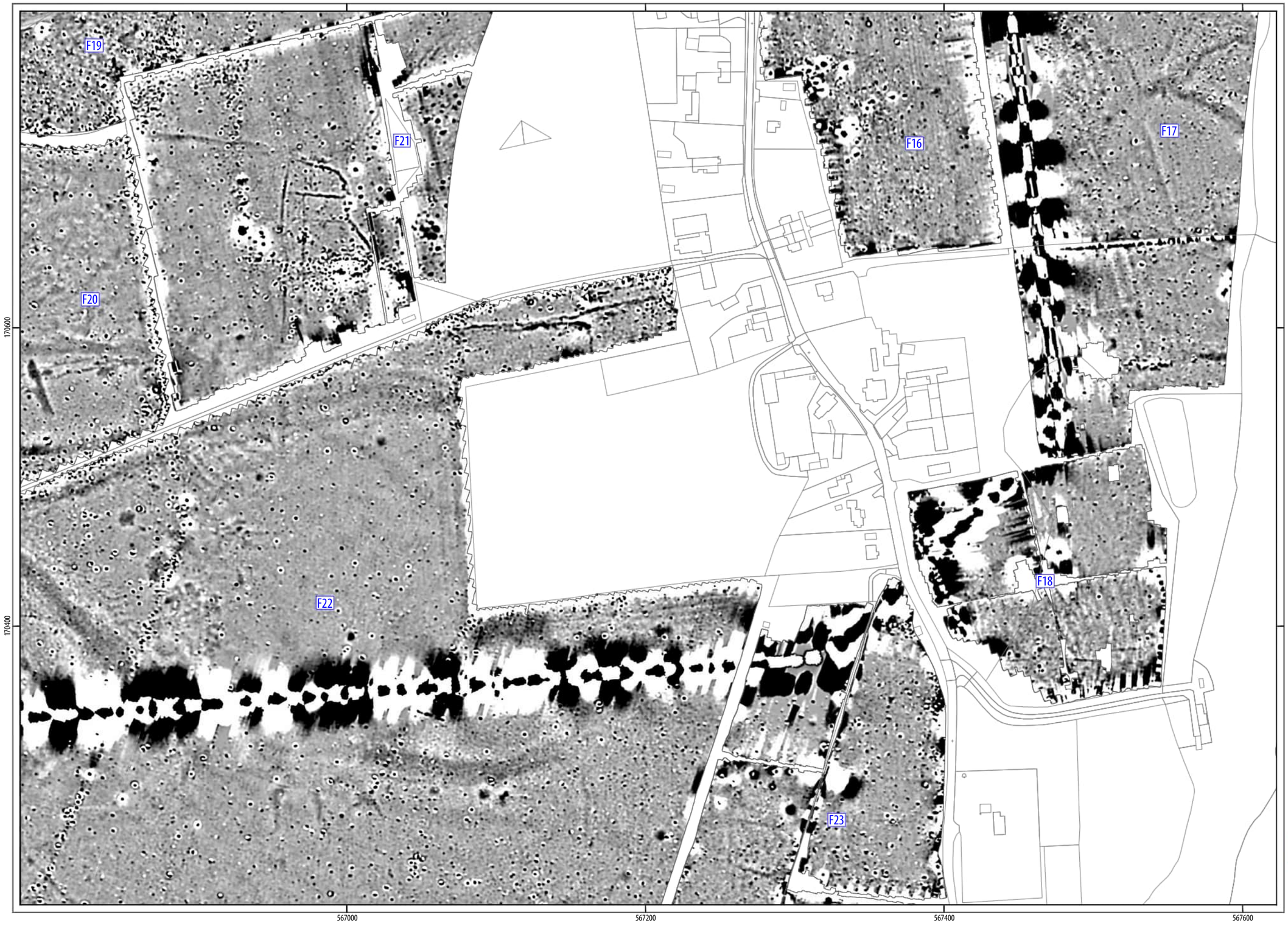

nT
-1.0 2.0

0 50m
1:2,500 @ A3

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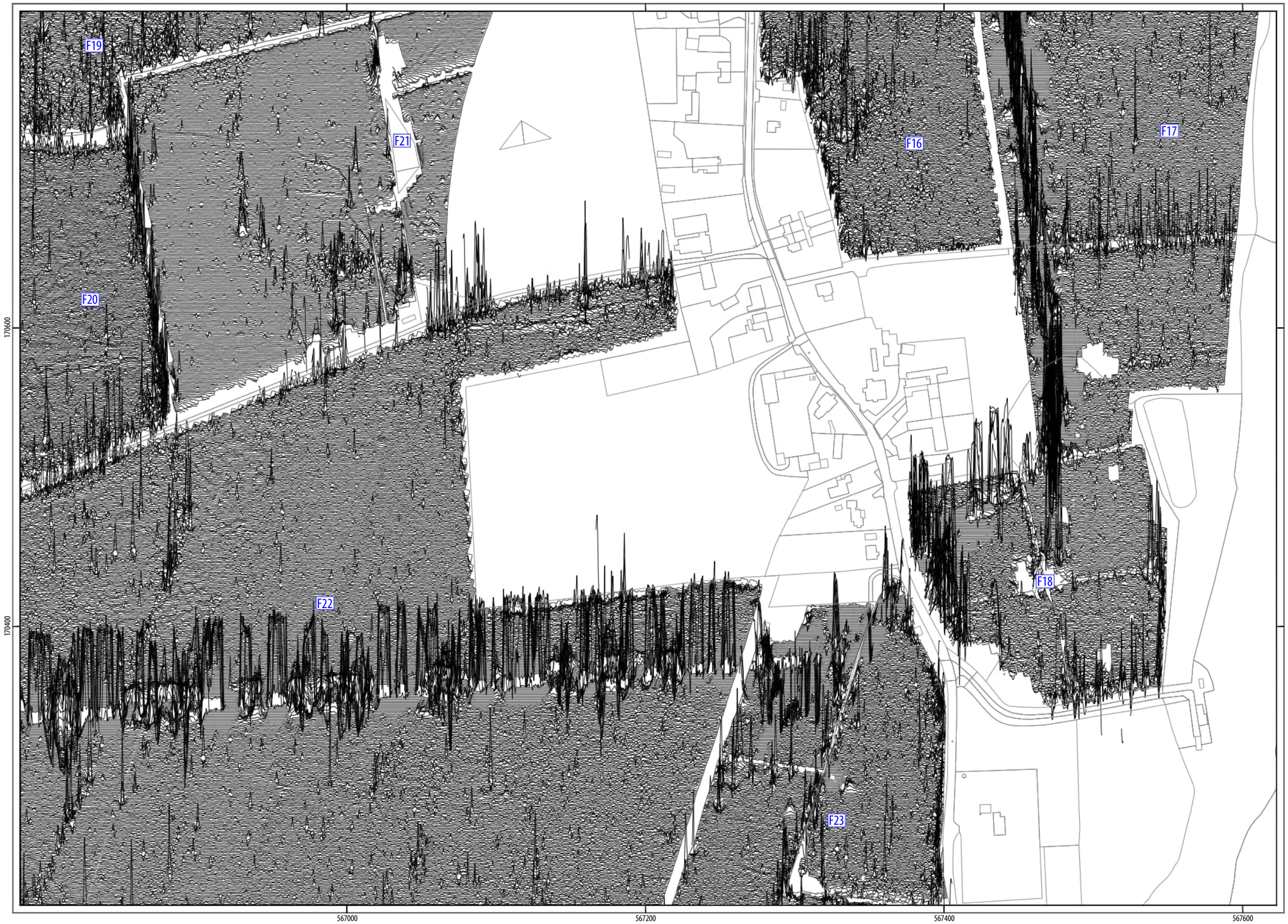
ILLUS 39 Processed greyscale magnetometer data; Sector 10



77.0nT/cm

0 50m

1:2,500 @ A3

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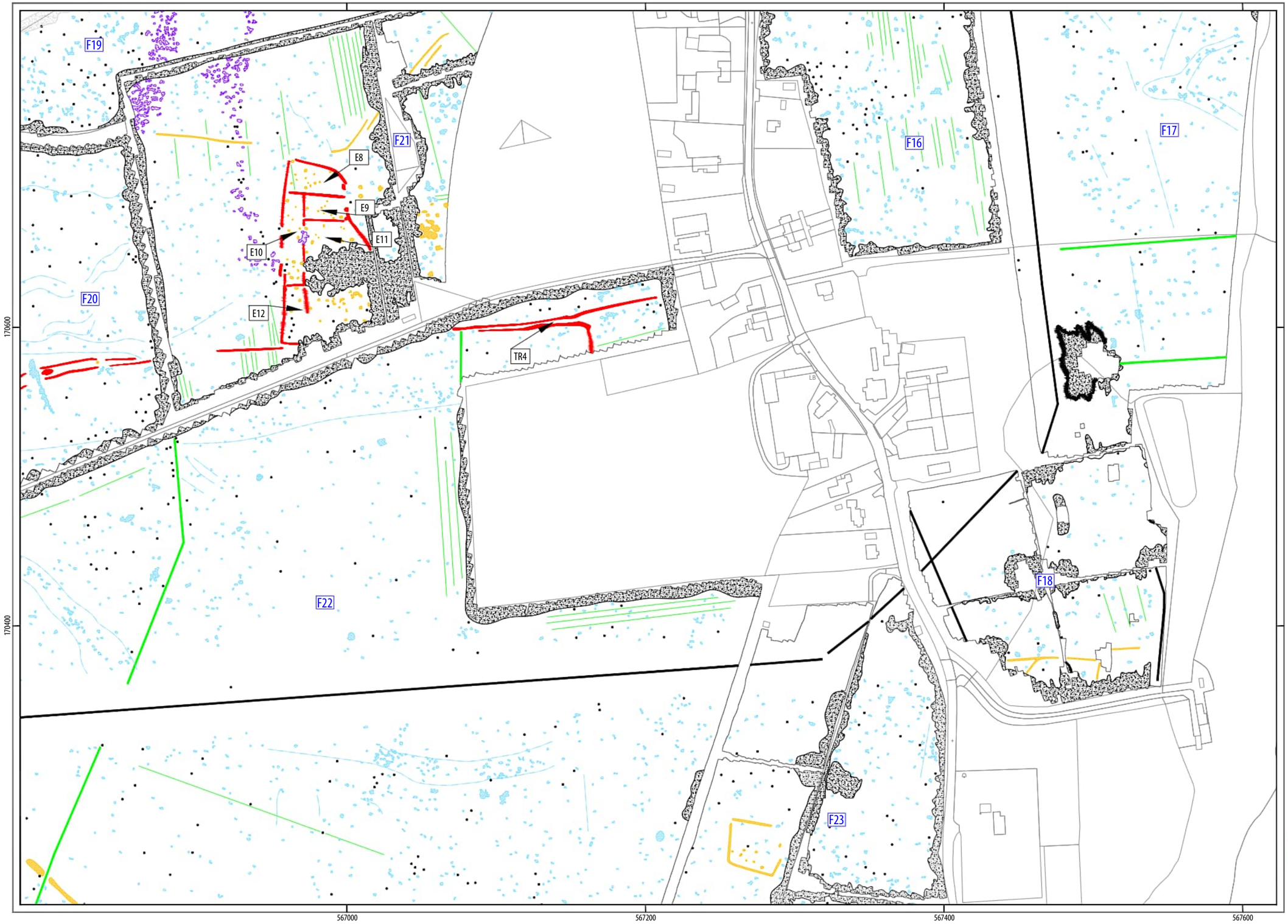
ILLUS 40 XY traceplot of minimally processed magnetometer data; Sector 10



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
magnetic disturbance	airfield
linear trend	agricultural
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology
null value	overhead powerlines

0 50m
1:2,500 @ A3

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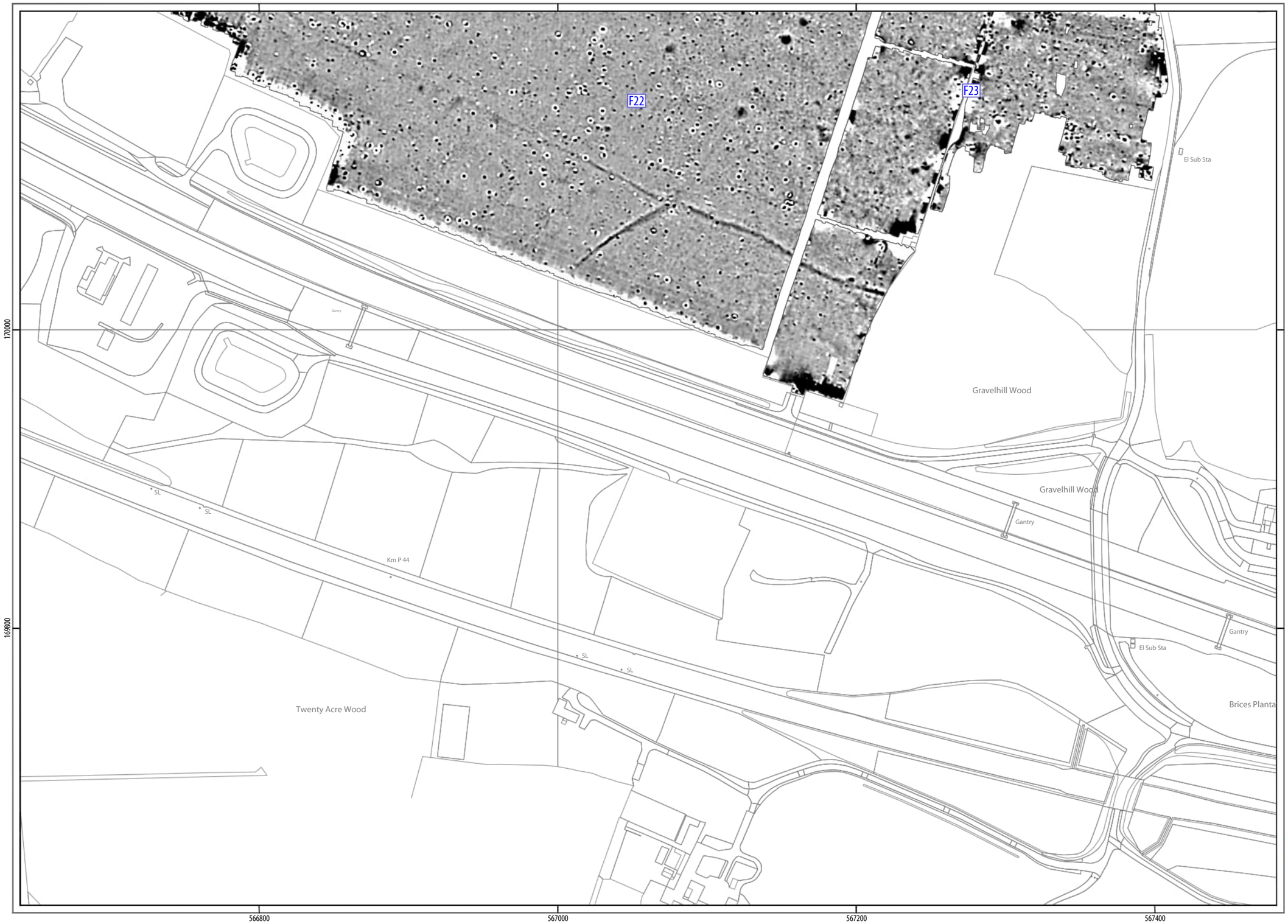
ILLUS 41 Interpretation of magnetometer data; Sector 10



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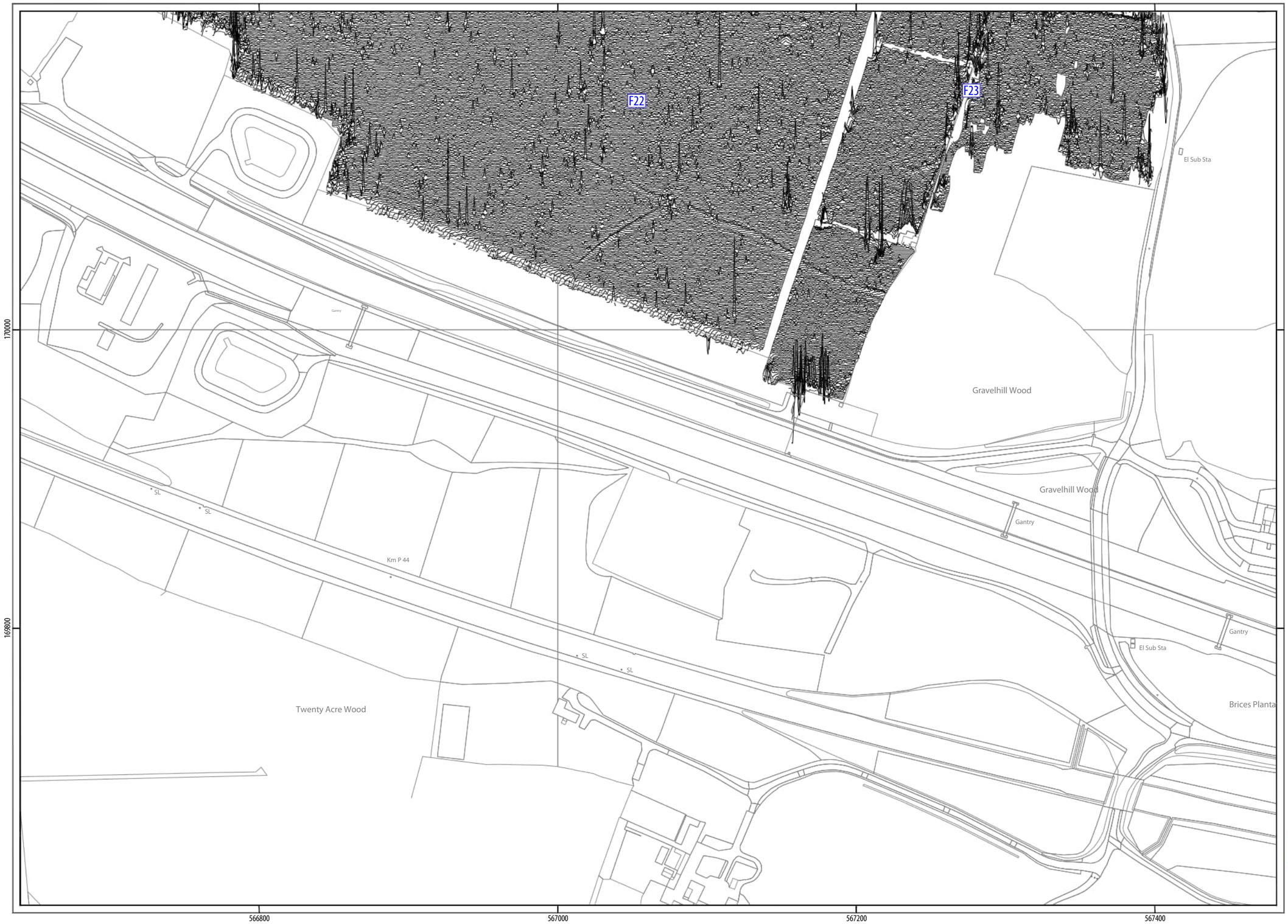
ILLUS 42 Processed greyscale magnetometer data; Sector 11



77.0nT/cm

0 50m

1:2,500 @ A3

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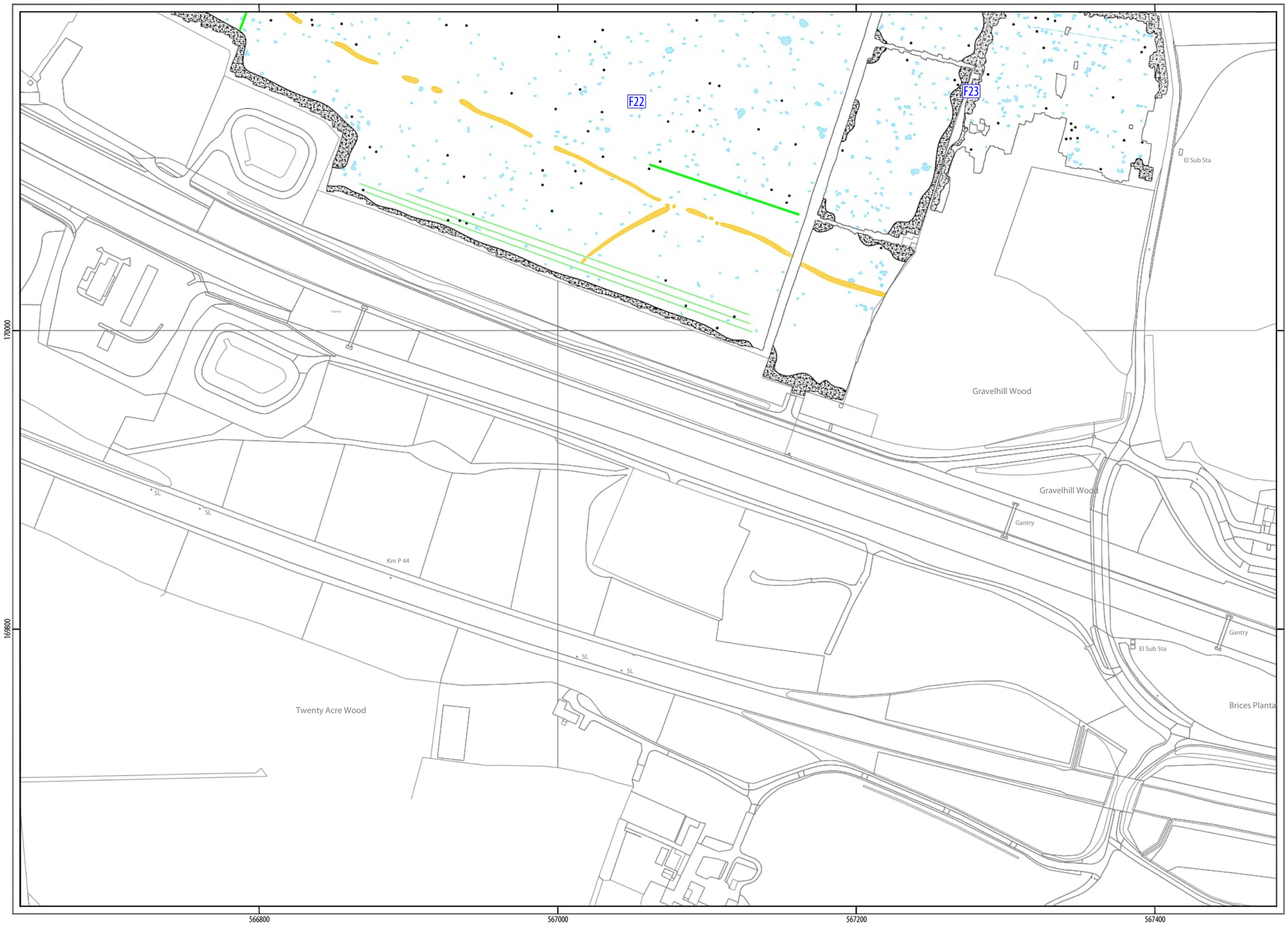
ILLUS 43 XY traceplot of minimally processed magnetometer data; Sector 11



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

0 50m
1:2,500 @ A3

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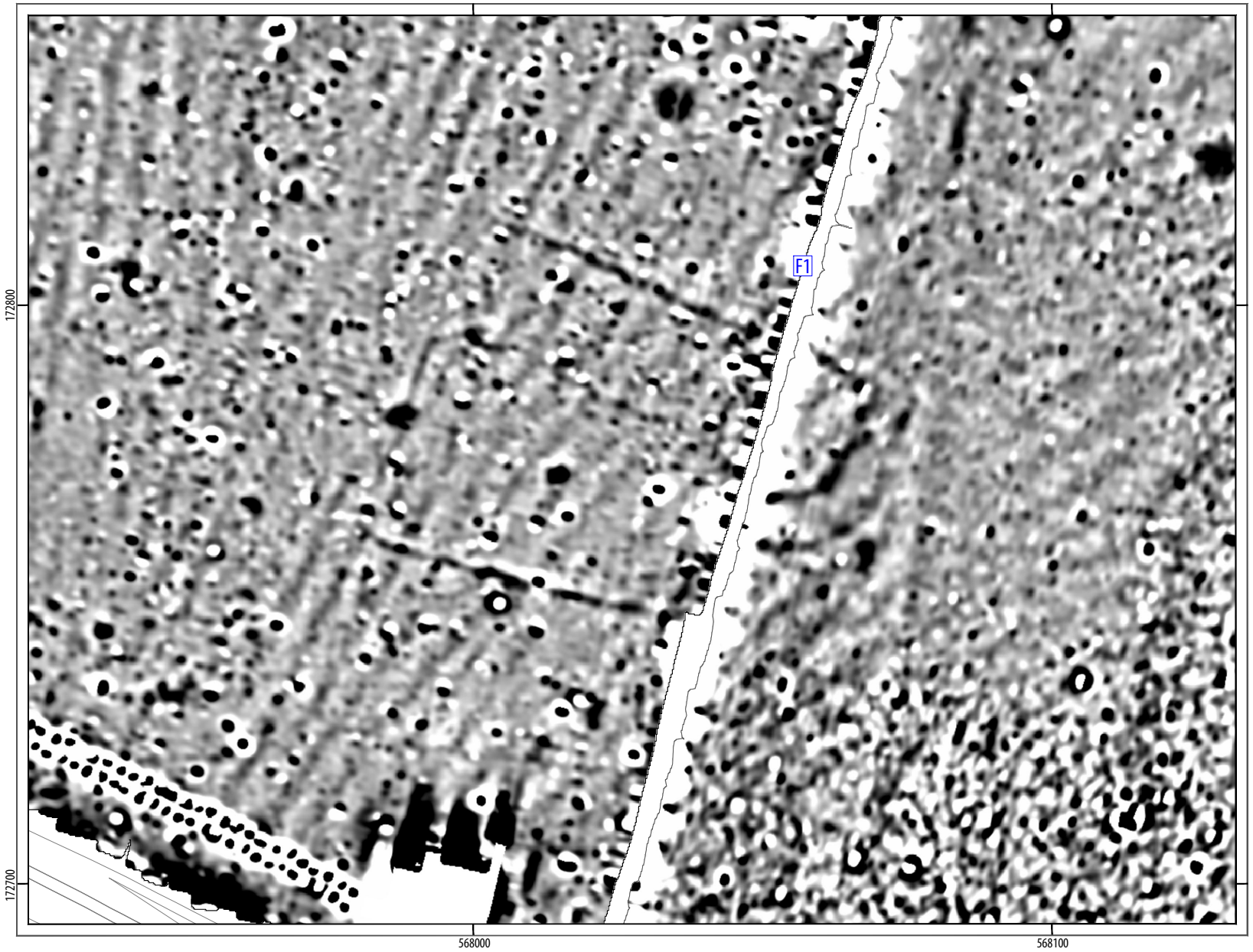
ILLUS 44 Interpretation of magnetometer data; Sector 11



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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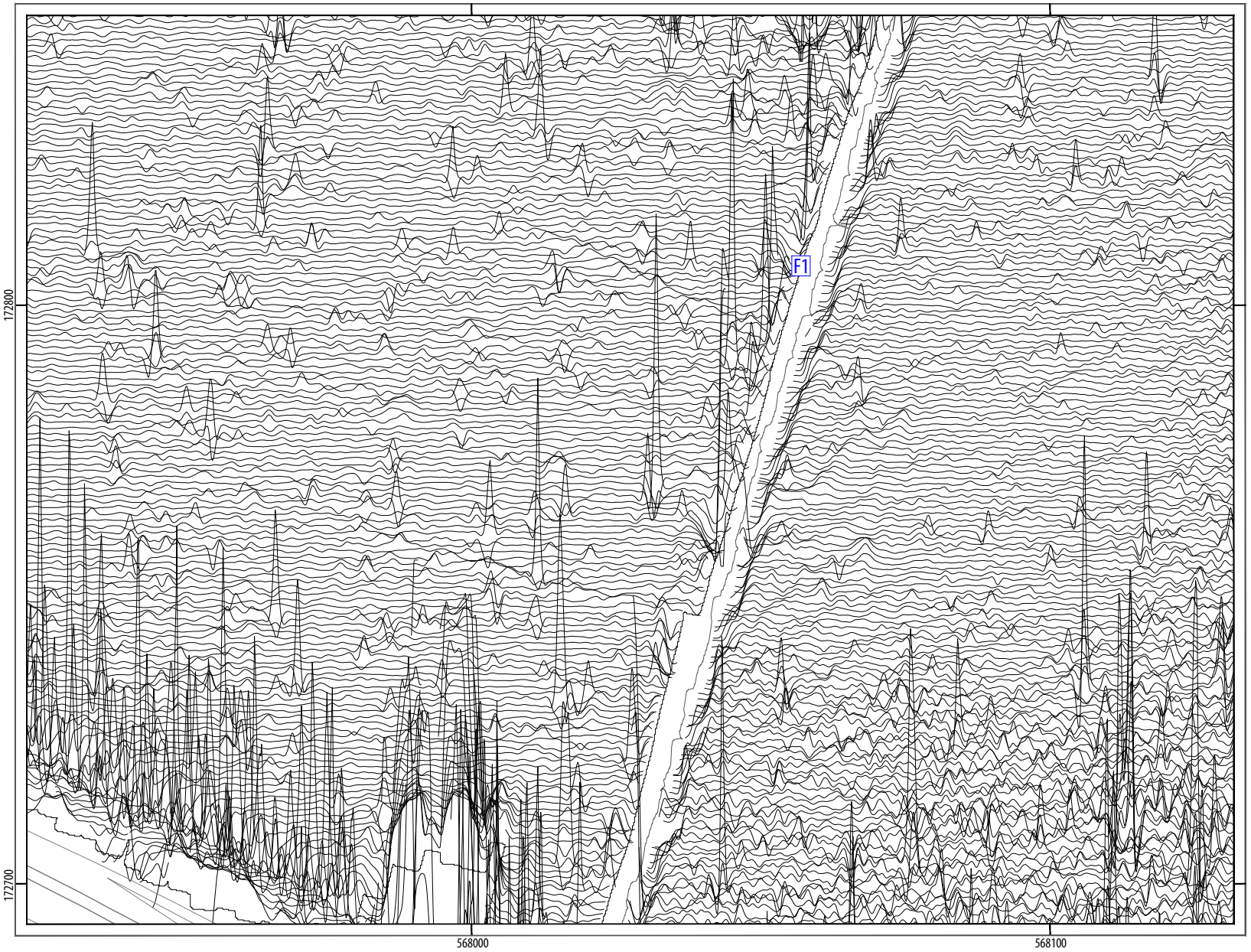
ILLUS 45 Greyscale magnetometer data; AAA1



13.0nT/cm

0 20m

1:1,000 @ A4

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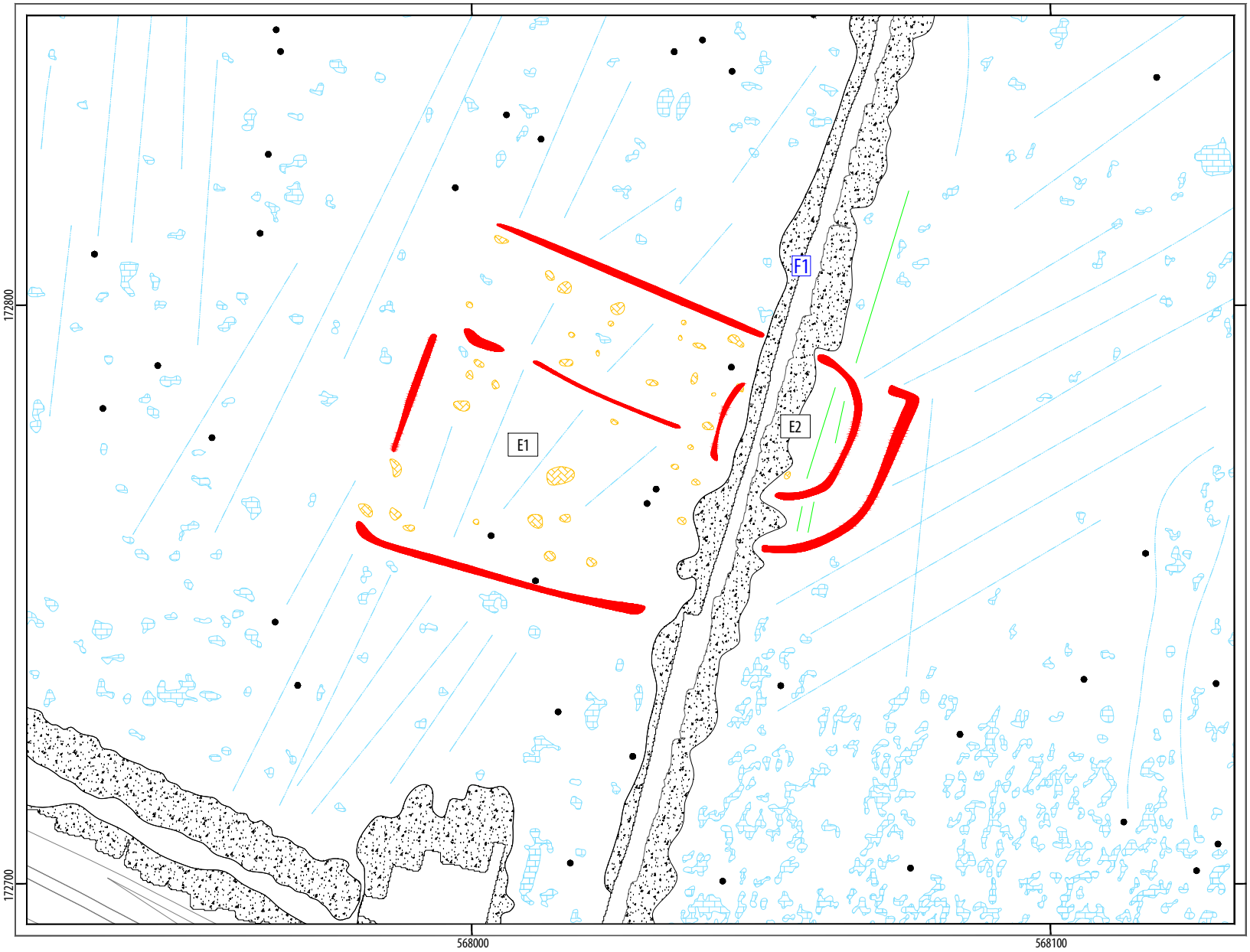
ILLUS 46 XY traceplot of minimally processed magnetometer data; AAA1



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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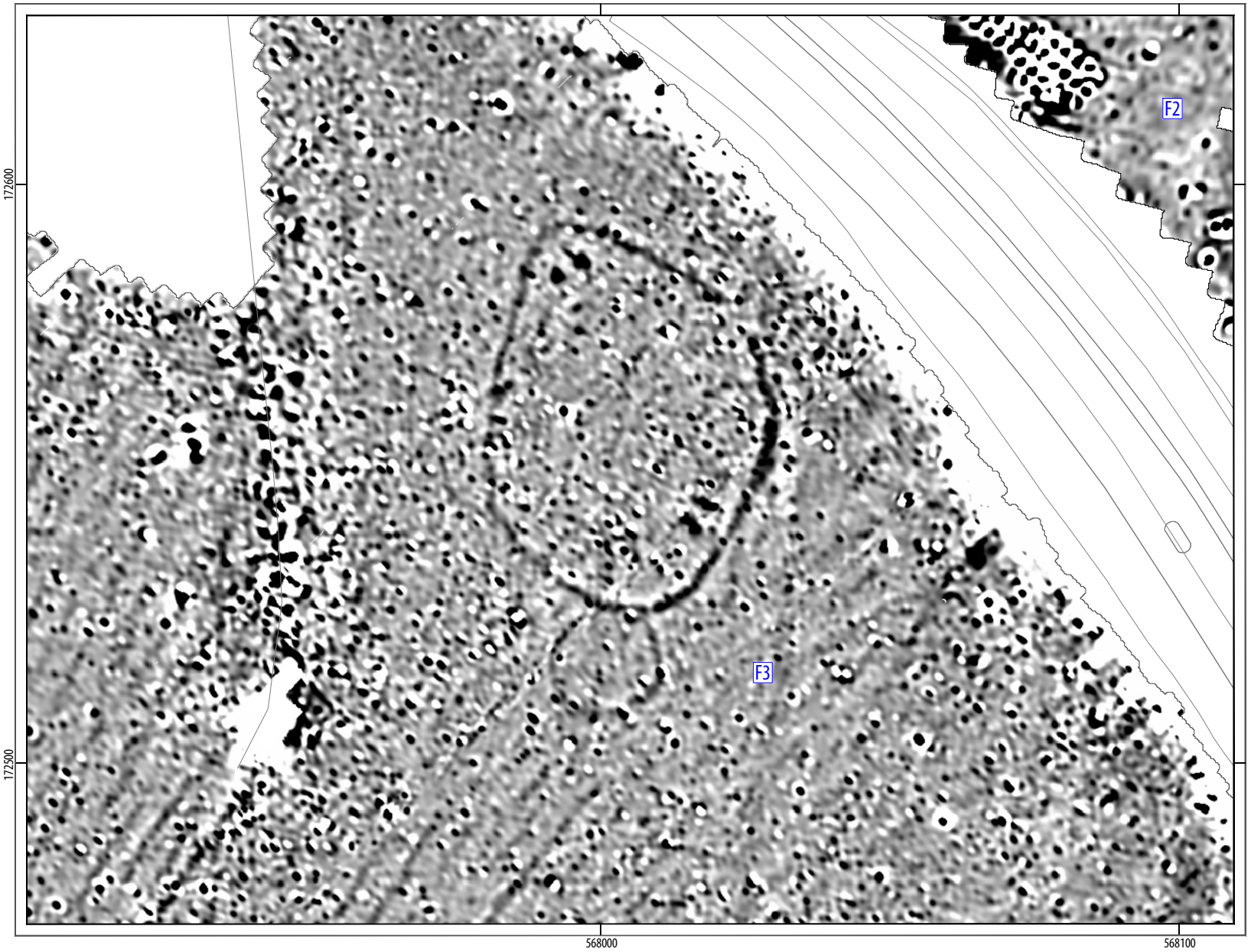
ILLUS 47 Interpretation of magnetometer data; AAA1



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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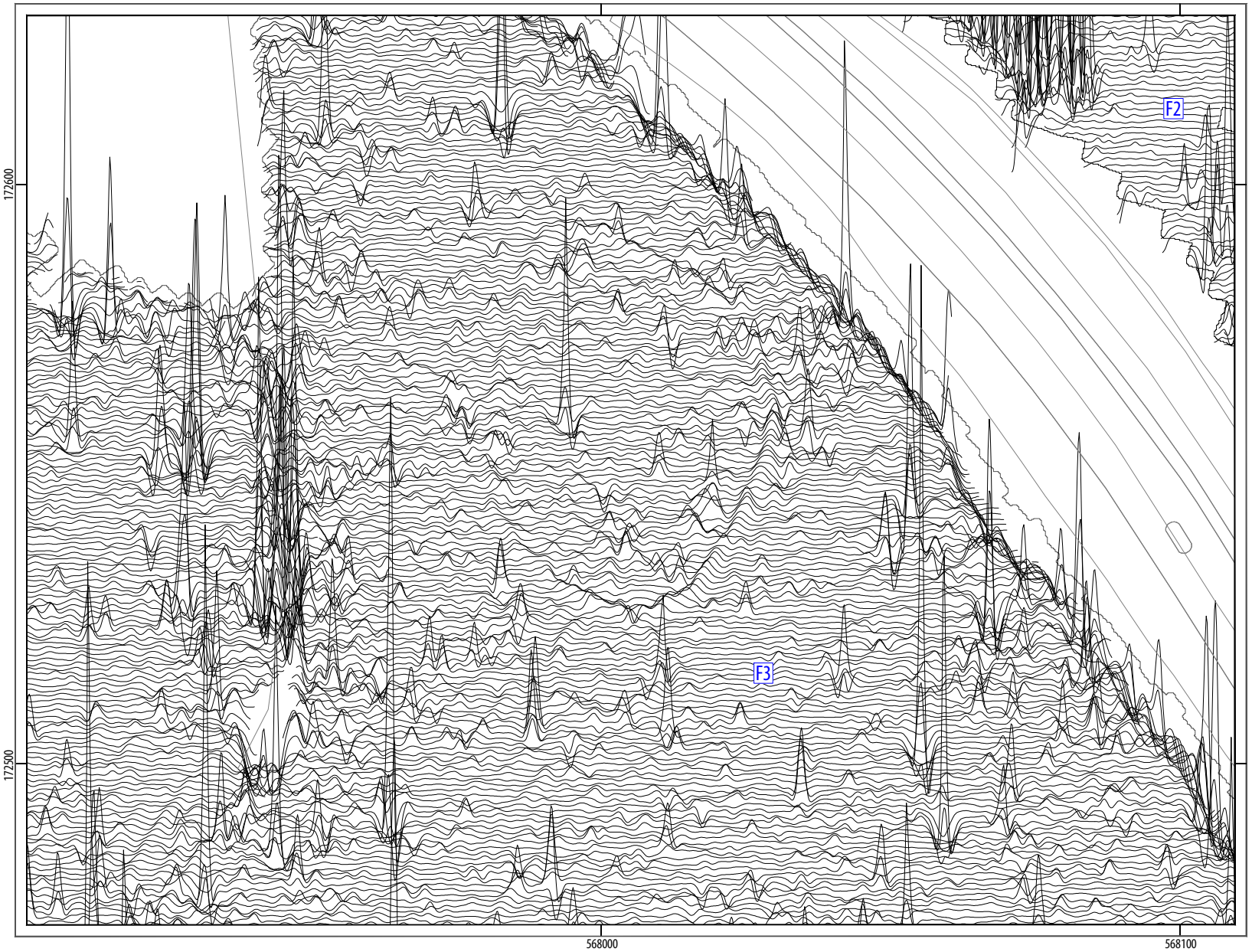
ILLUS 48 Greyscale magnetometer data; AAA2



13.0nT/cm

0 20m

1:1,000 @ A4

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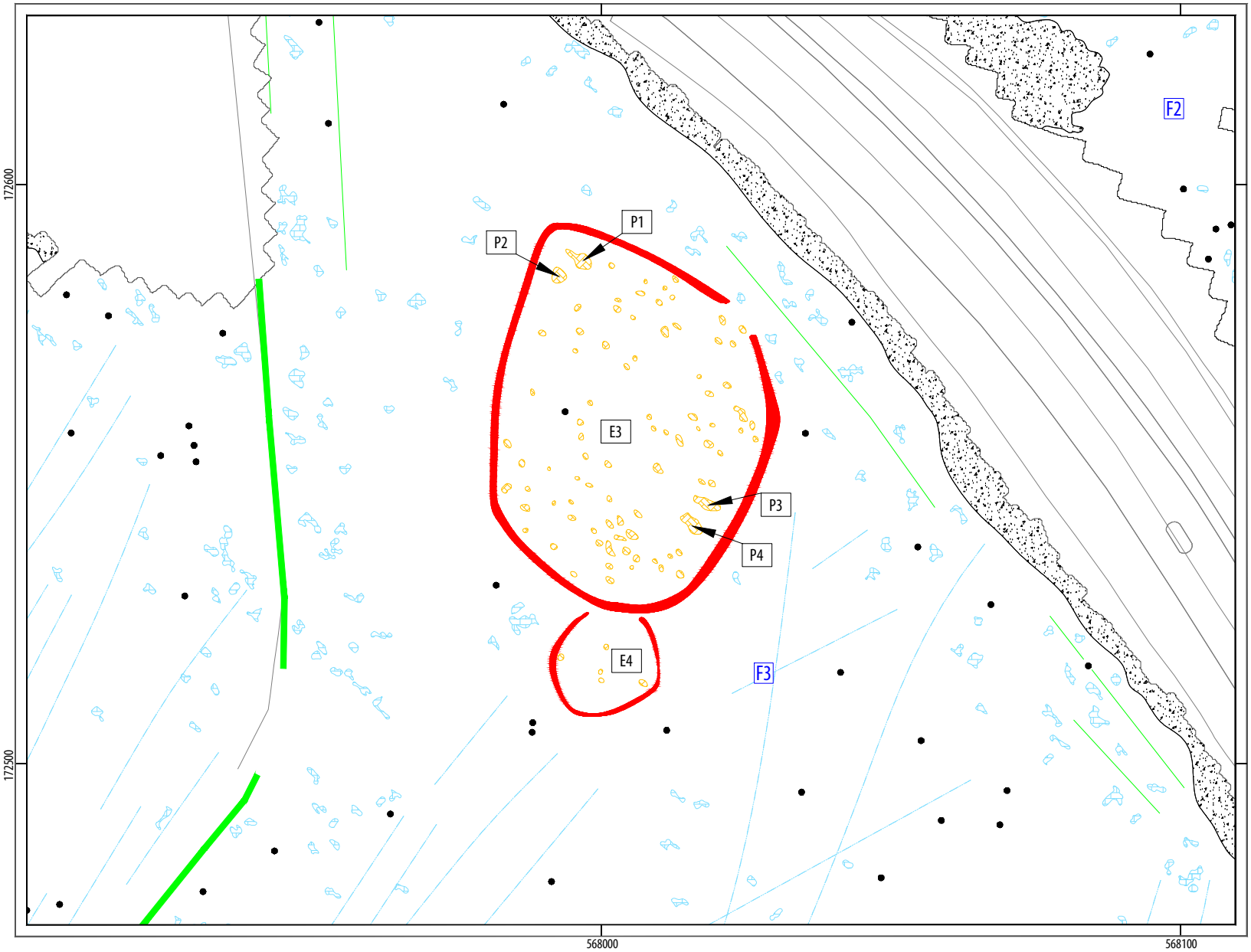
ILLUS 49 XY traceplot of minimally processed magnetometer data; AAA2



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

0 20m
1:1,000 @ A4

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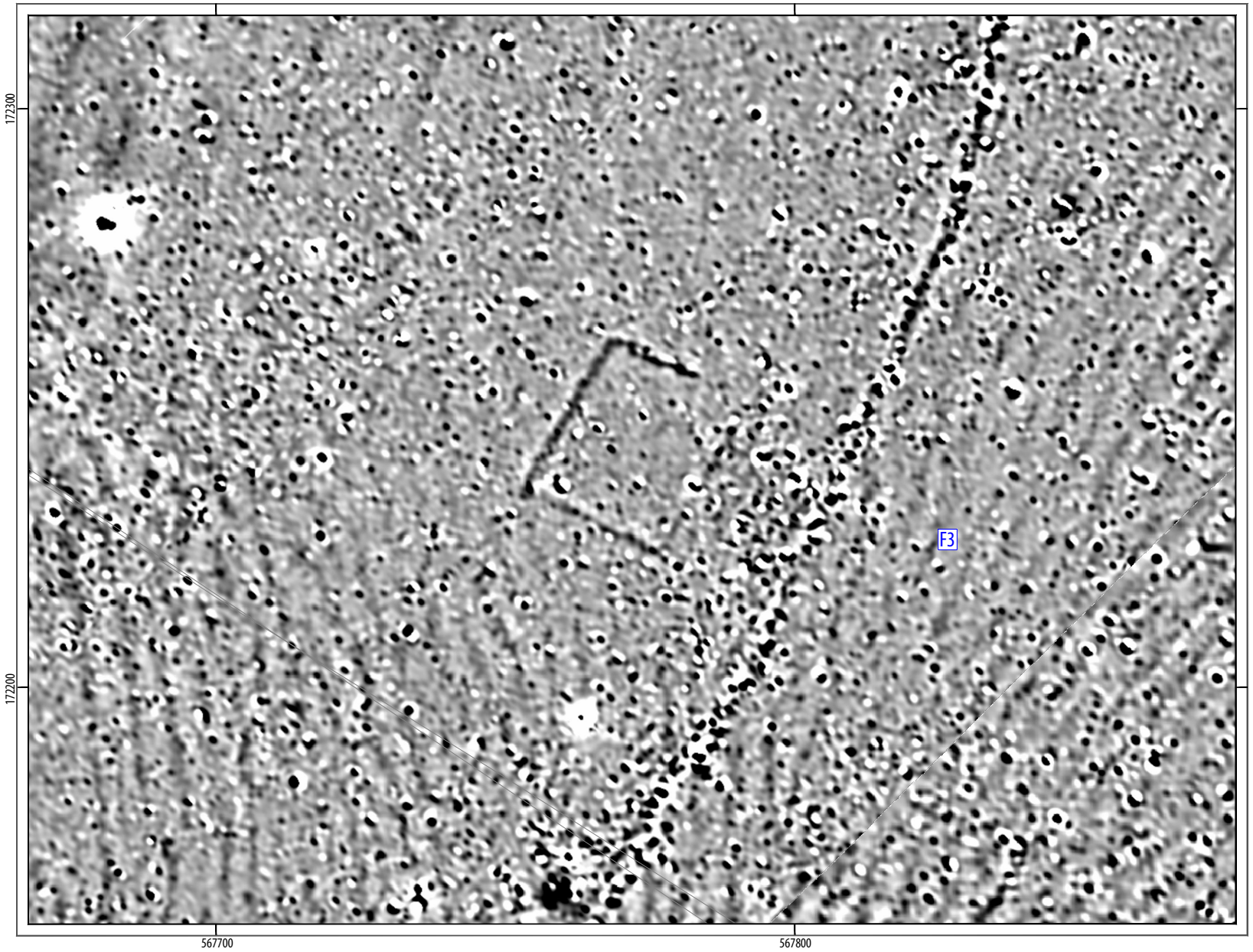
ILLUS 50 Interpretation of magnetometer data; AAA2



ILLUS 51 Greyscale magnetometer data; AAA3

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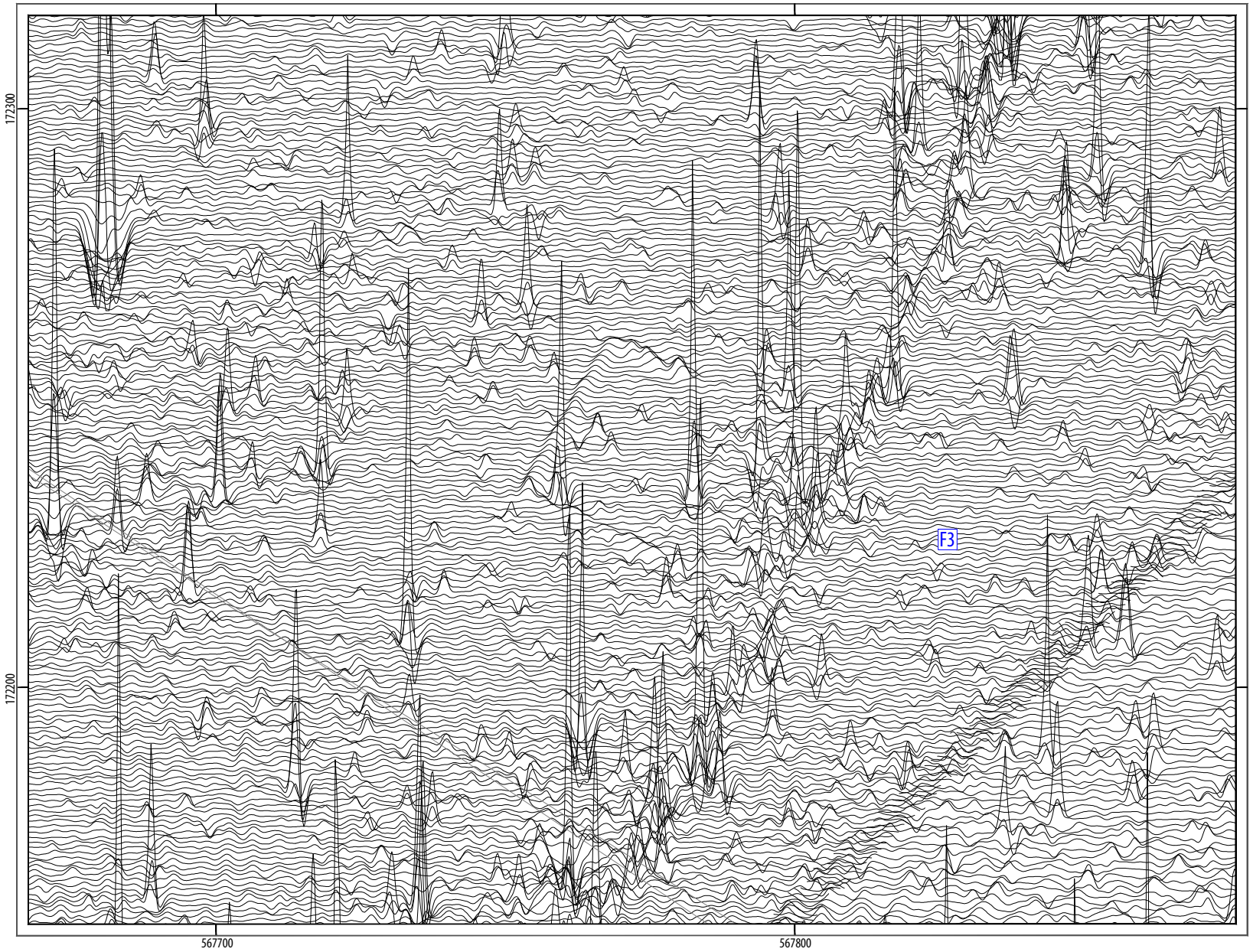

13.0nT/cm

0 20m

1:1,000 @ A4

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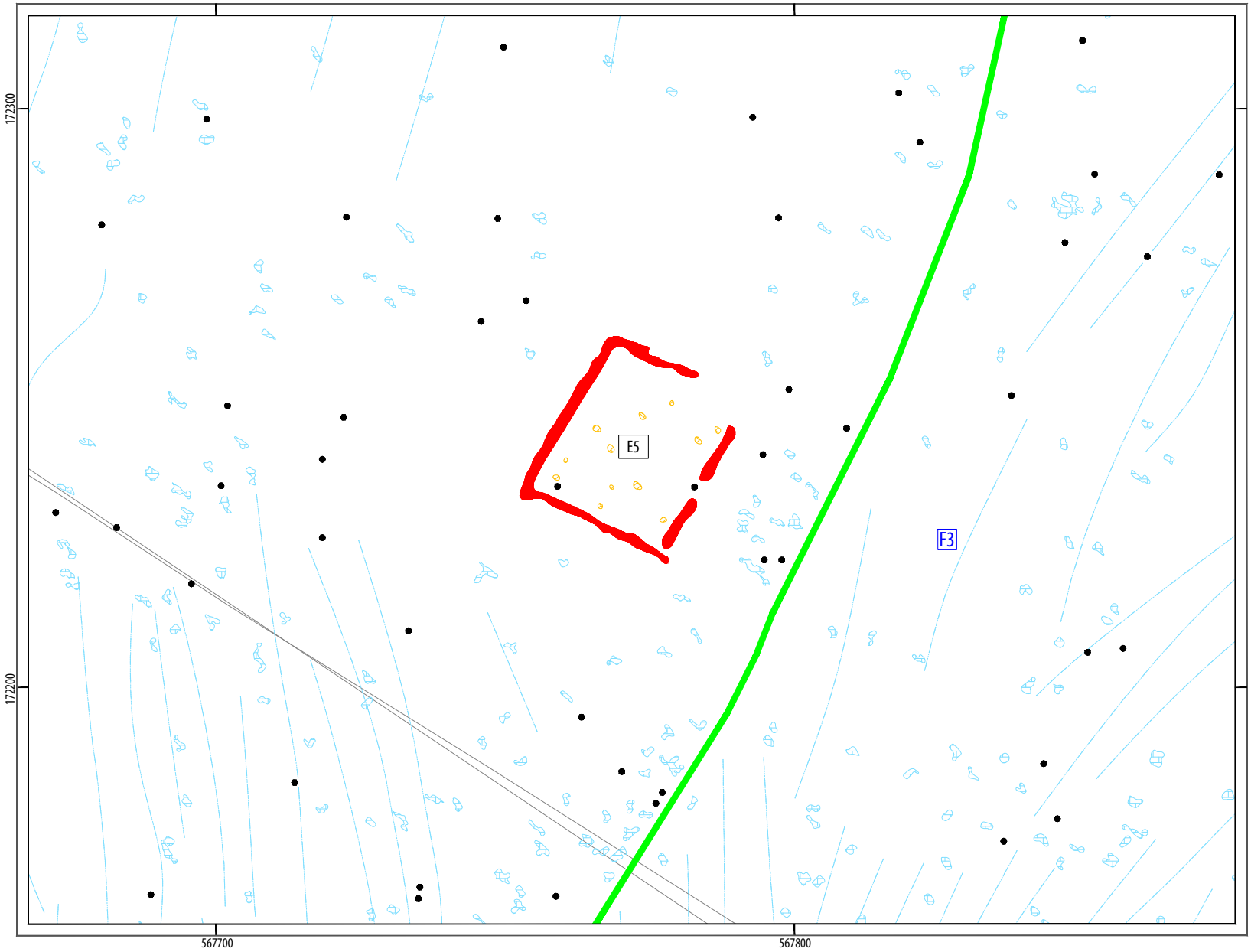
ILLUS 52 XY traceplot of minimally processed magnetometer data; AAA3



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

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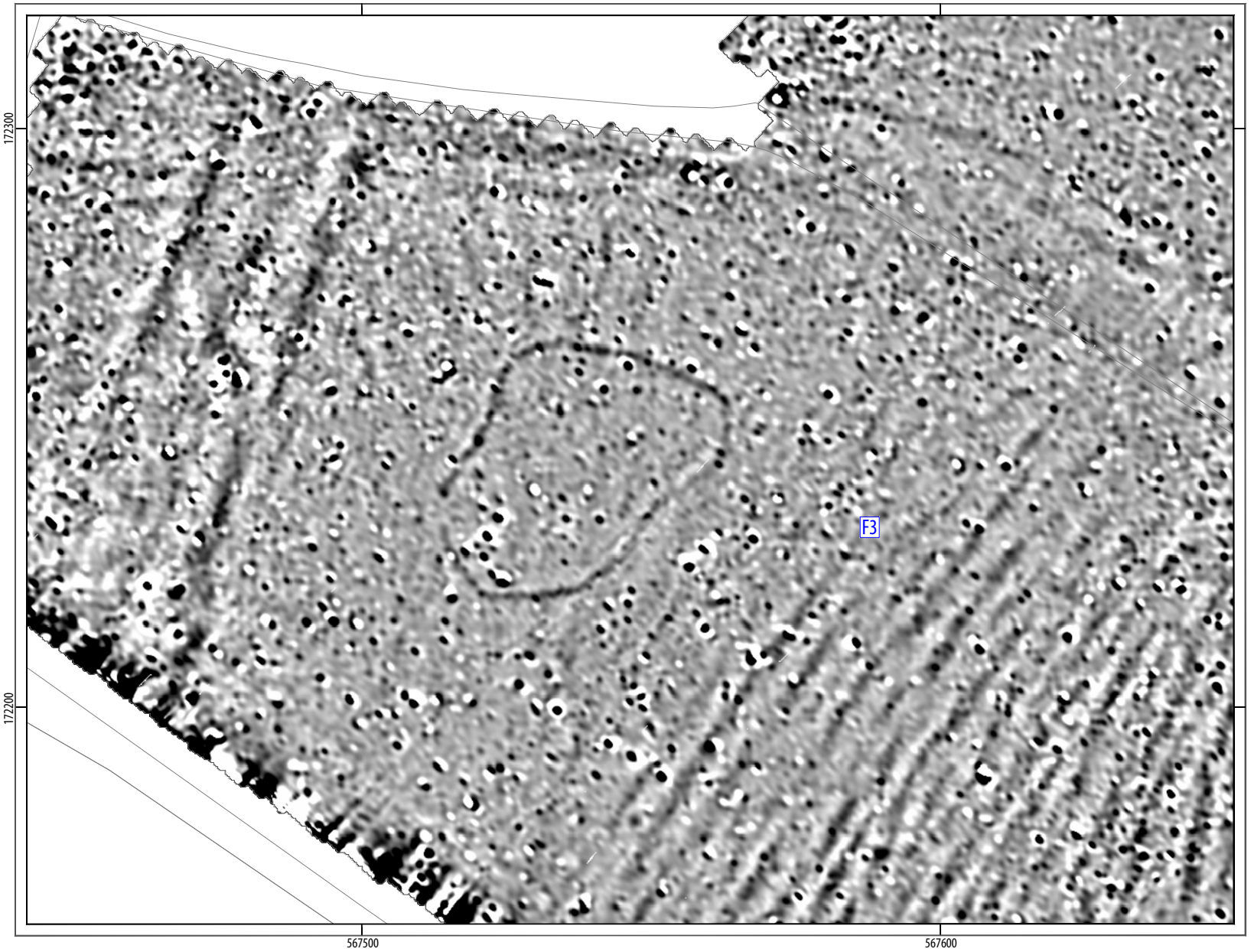
ILLUS 53 Interpretation of magnetometer data; AAA3



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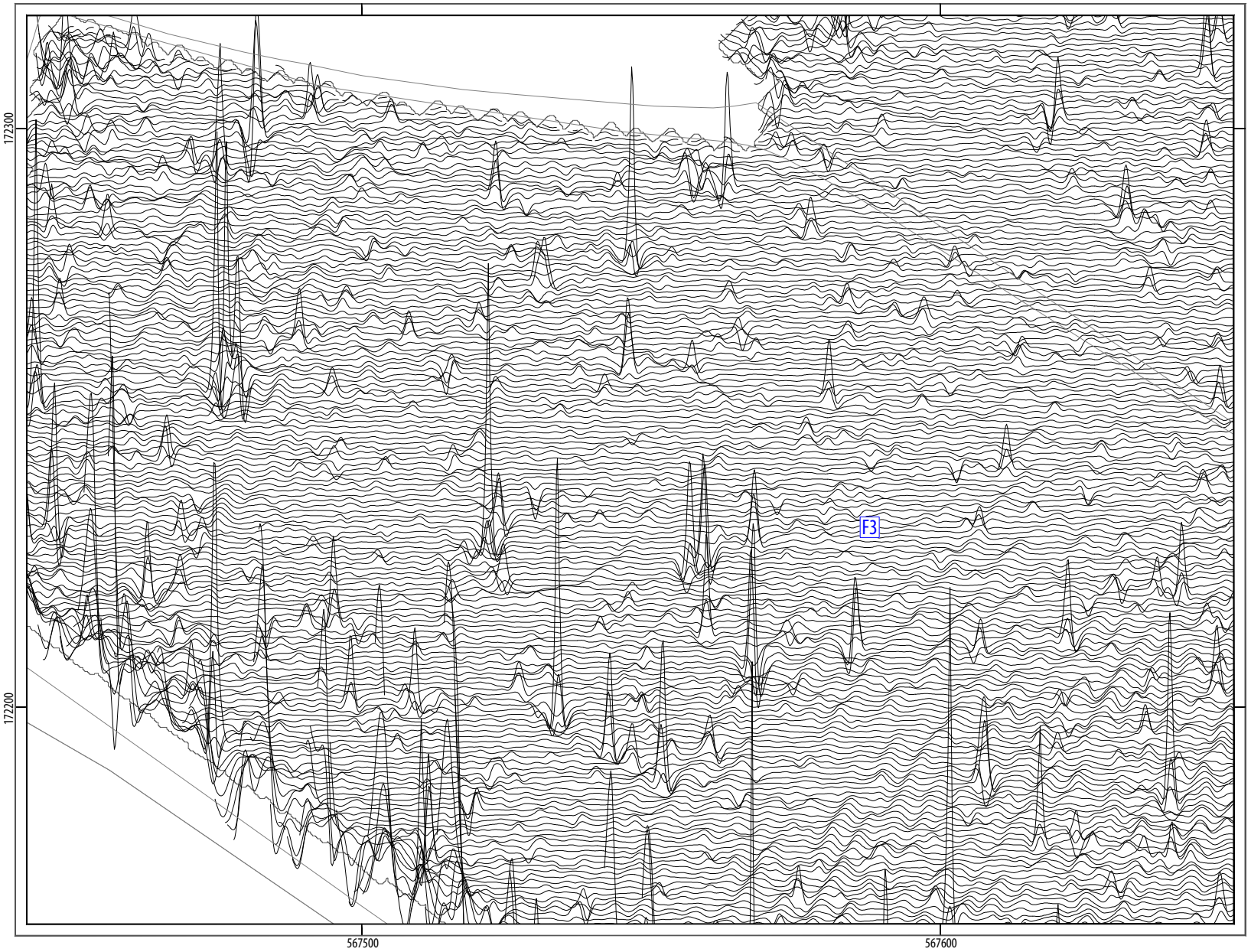
ILLUS 54 Greyscale magnetometer data; AAA4



13.0nT/cm

0 20m

1:1,000 @ A4

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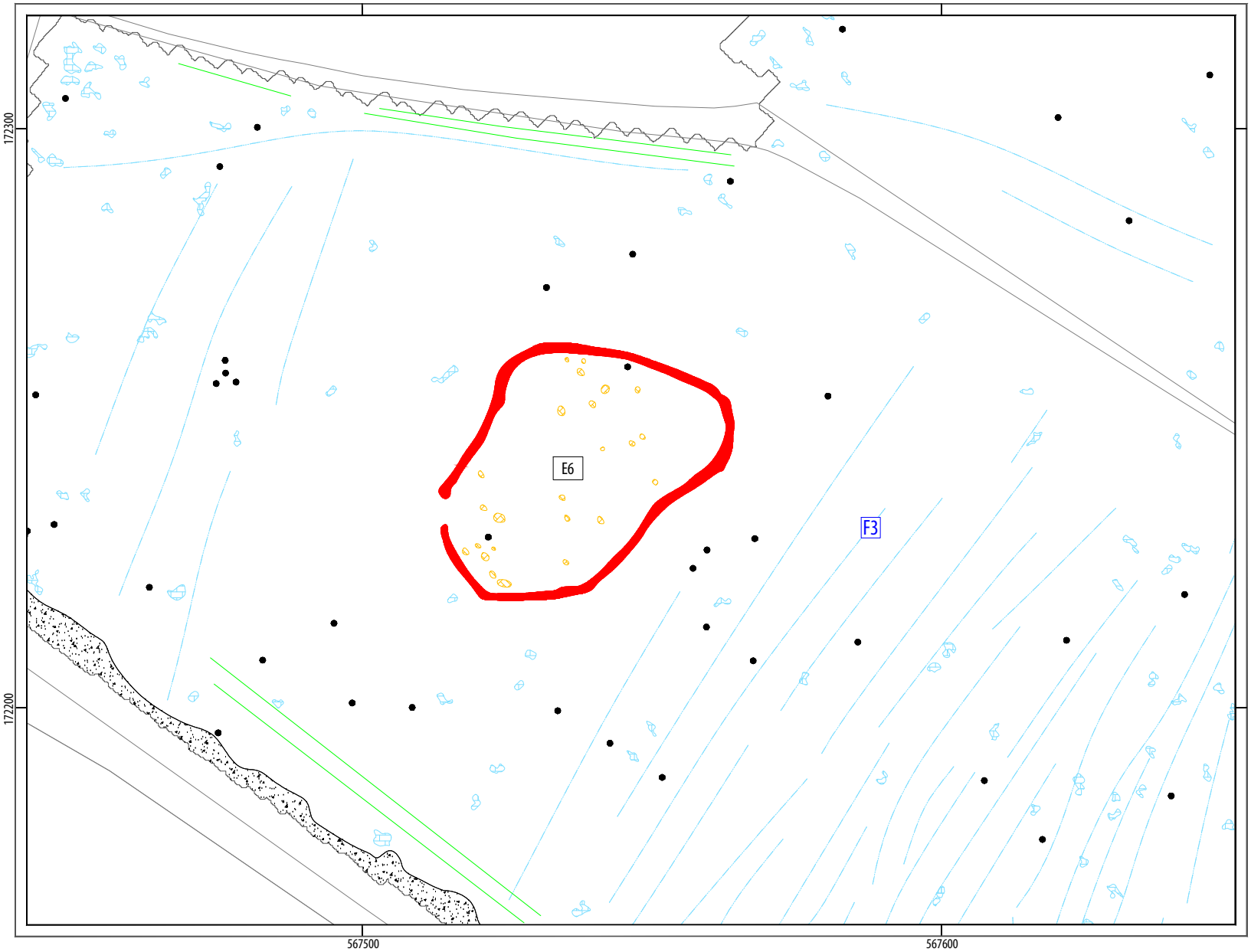
ILLUS 55 XY traceplot of minimally processed magnetometer data; AAA4



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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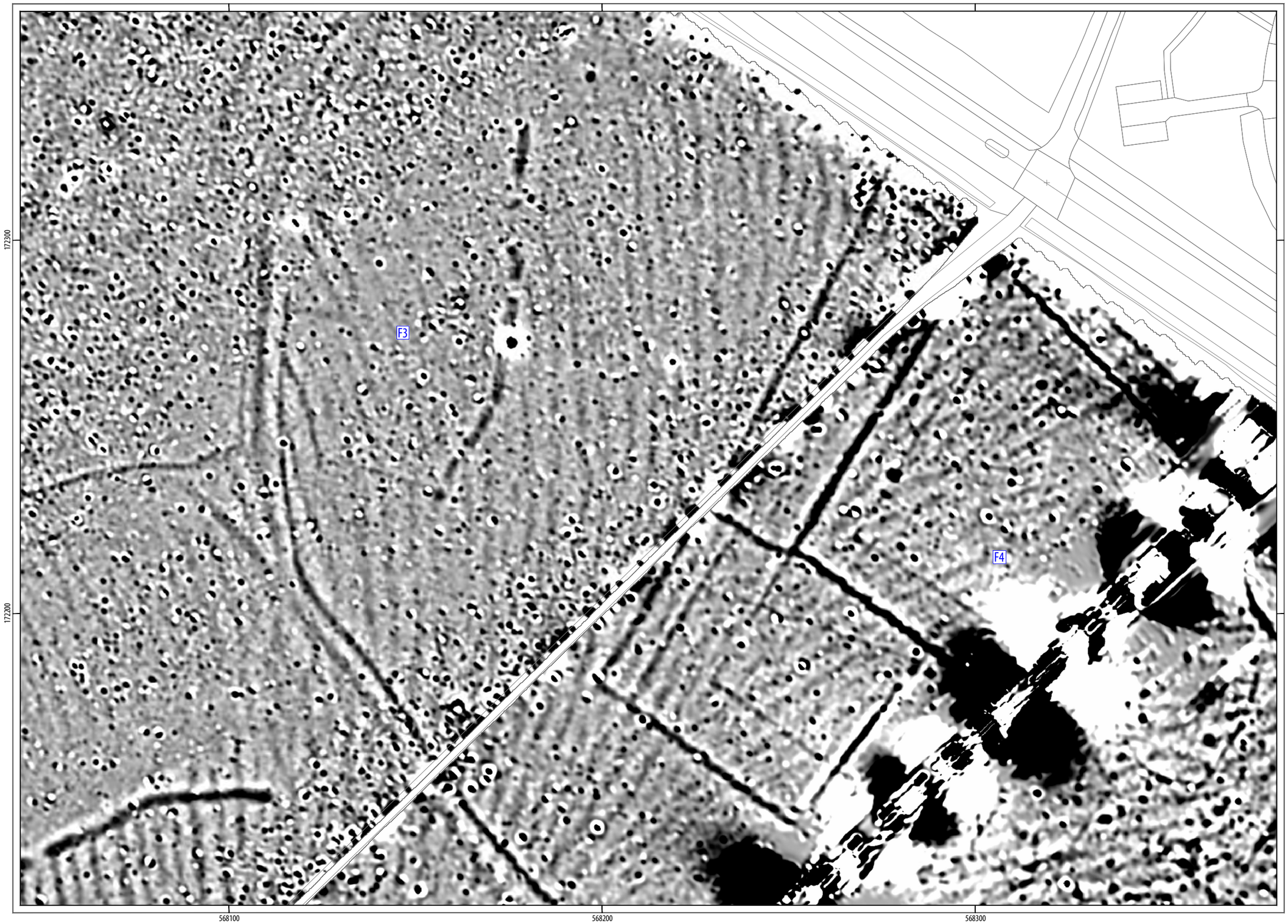
ILLUS 56 Interpretation of magnetometer data; AAA4



nT
-1.0
2.0

0
25m
1:1,000 @ A3

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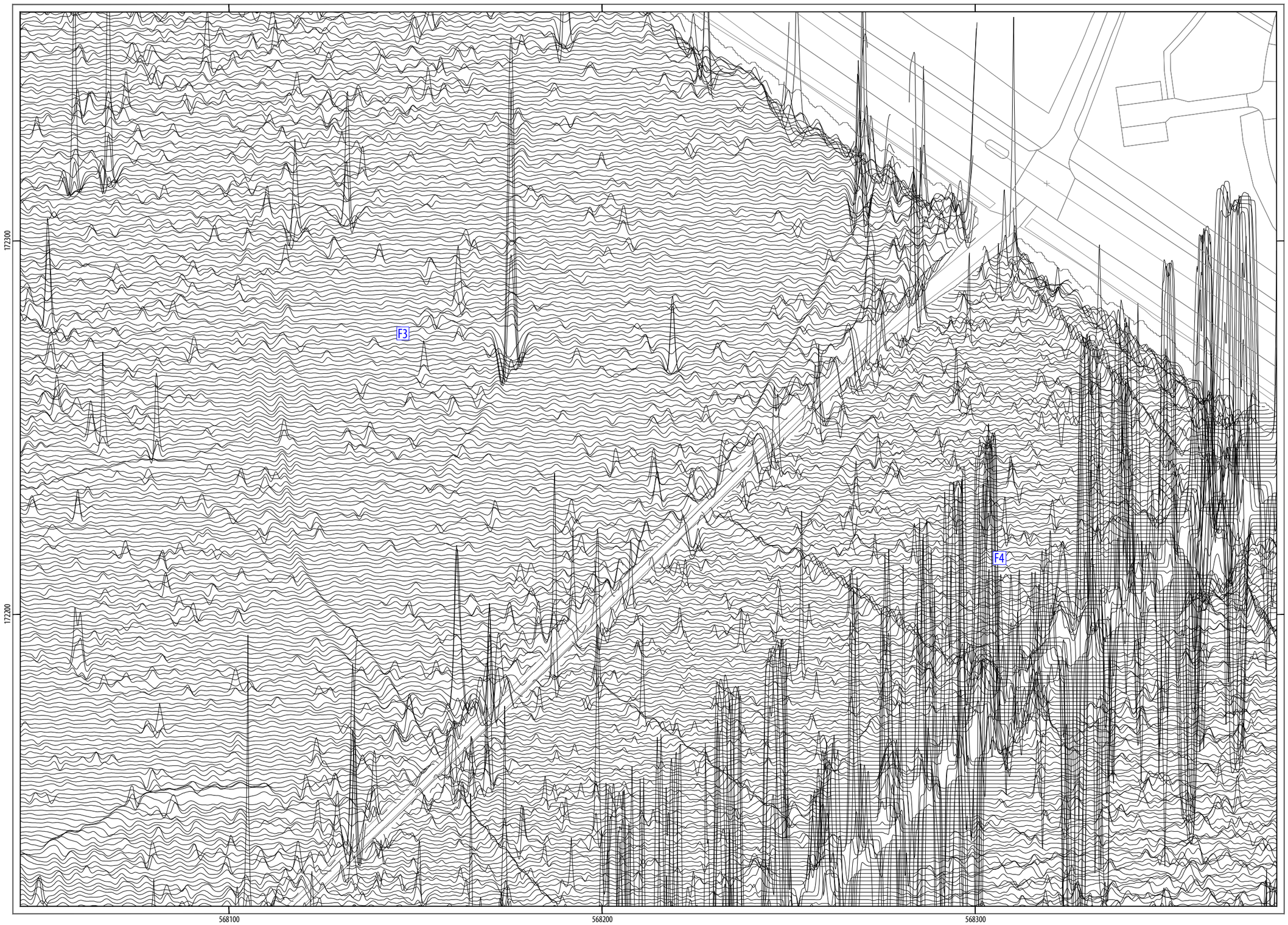
ILLUS 57 Greyscale magnetometer data; AAA5 (north)



13.0nT/cm

0 25m

1:1,000 @ A3

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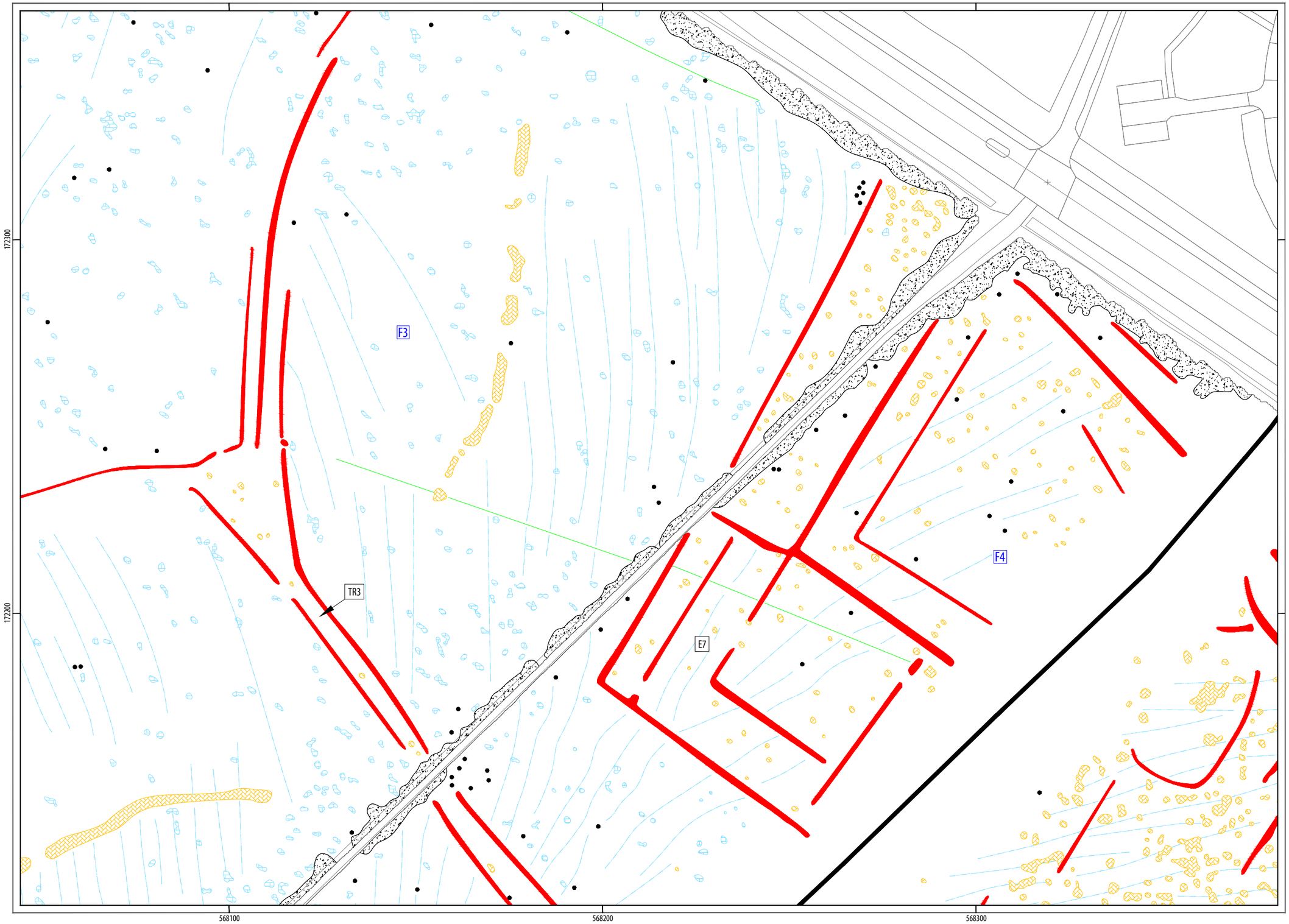
ILLUS 58 XY traceplot of minimally processed magnetometer data; AAA5 (north)



TYPE OF ANOMALY / INTERPRETATION

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 25m
1:1,000 @ A3

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ILLUS 59 Interpretation of magnetometer data; AAA5 (north)

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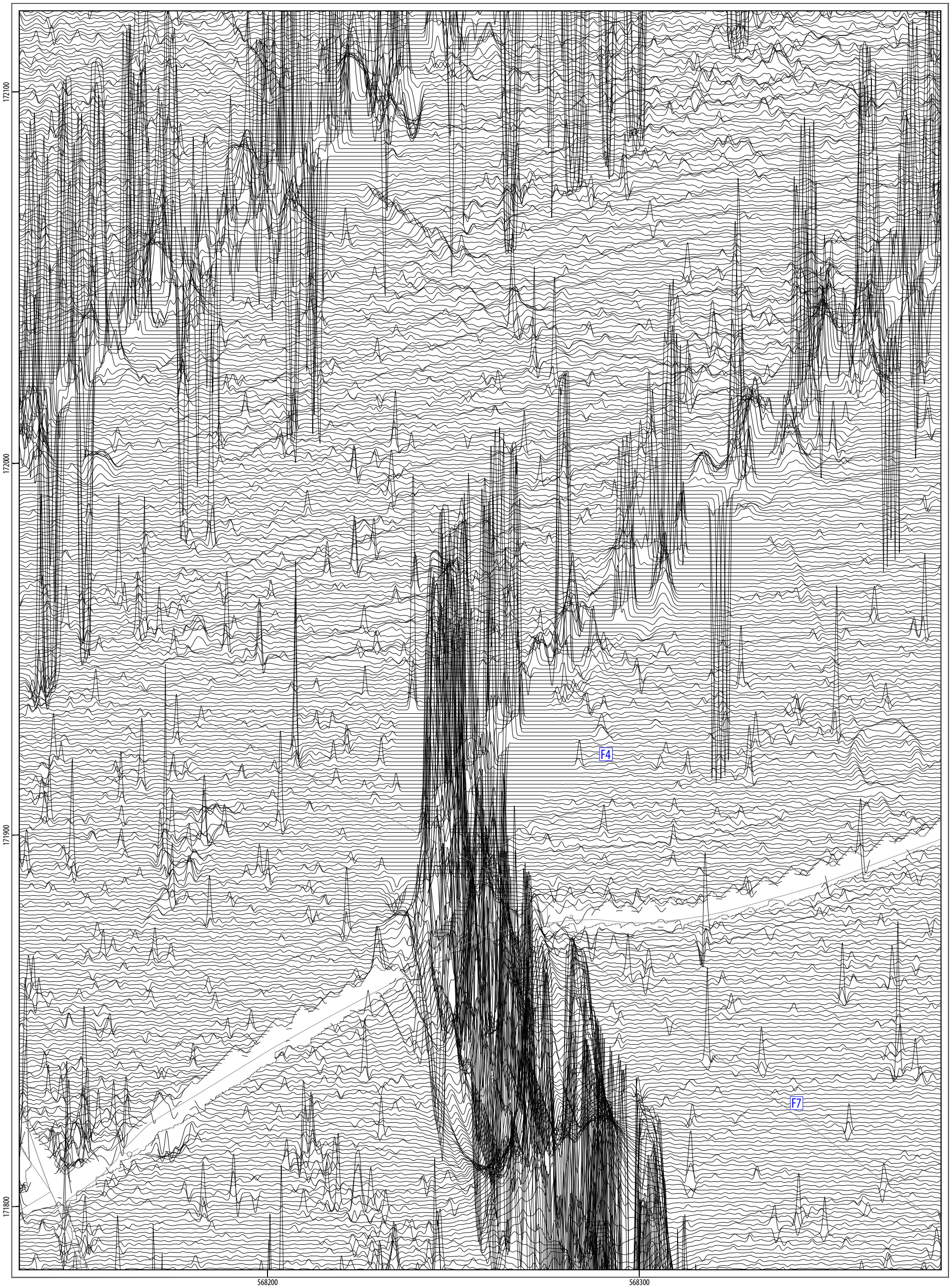
ILLUS 60 Greyscale magnetometer data; AAA5 (south)



13.0nT/cm

0 25m

1:1,000 @ A3

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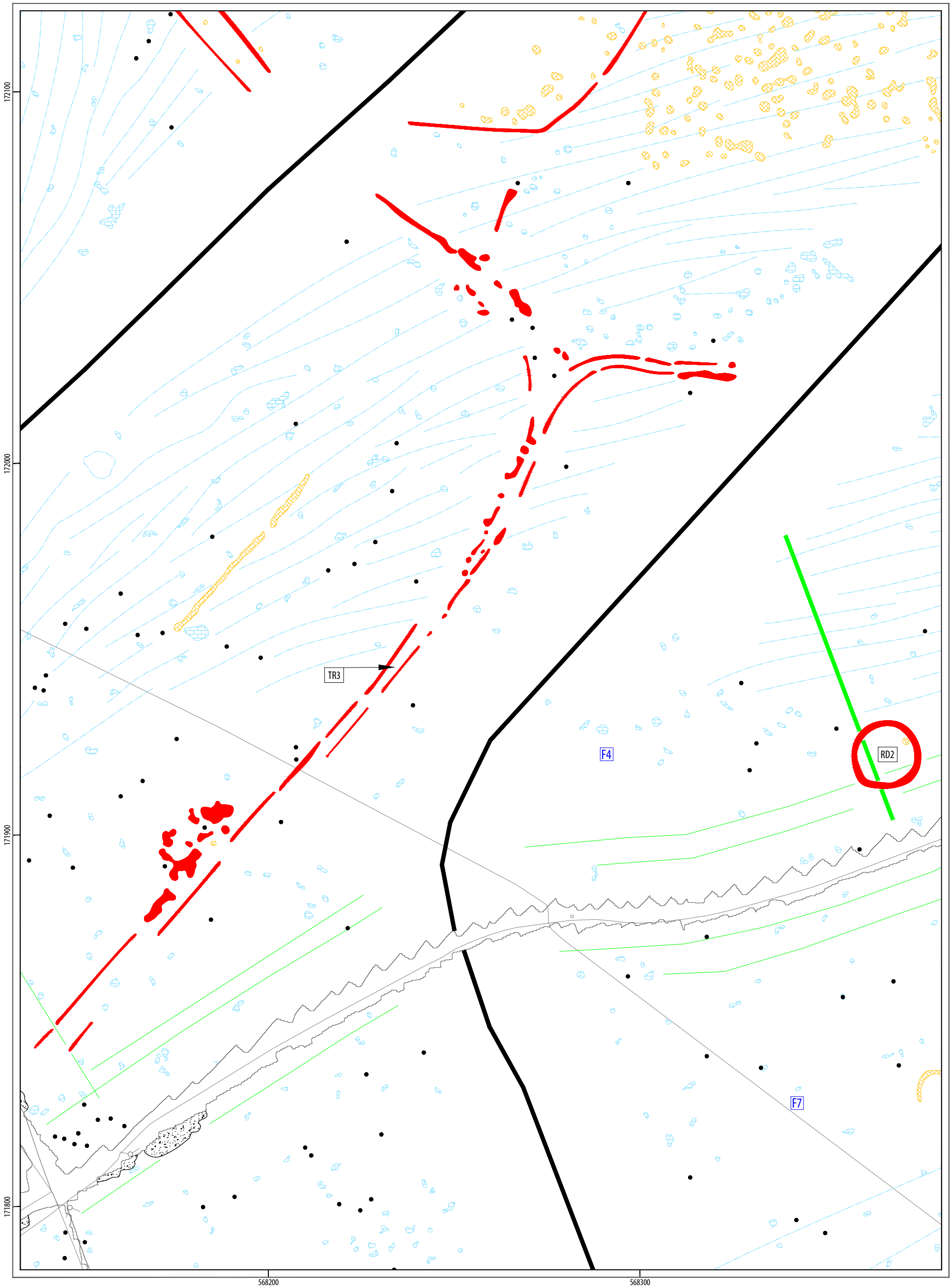
ILLUS 61 XY traceplot of minimally processed magnetometer data; AAA5 (south)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear	former field boundary
linear trend	geological variation

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

0 25m
1:1,000 @ A3

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ILLUS 62 Interpretation of magnetometer data; AAA5 (south)

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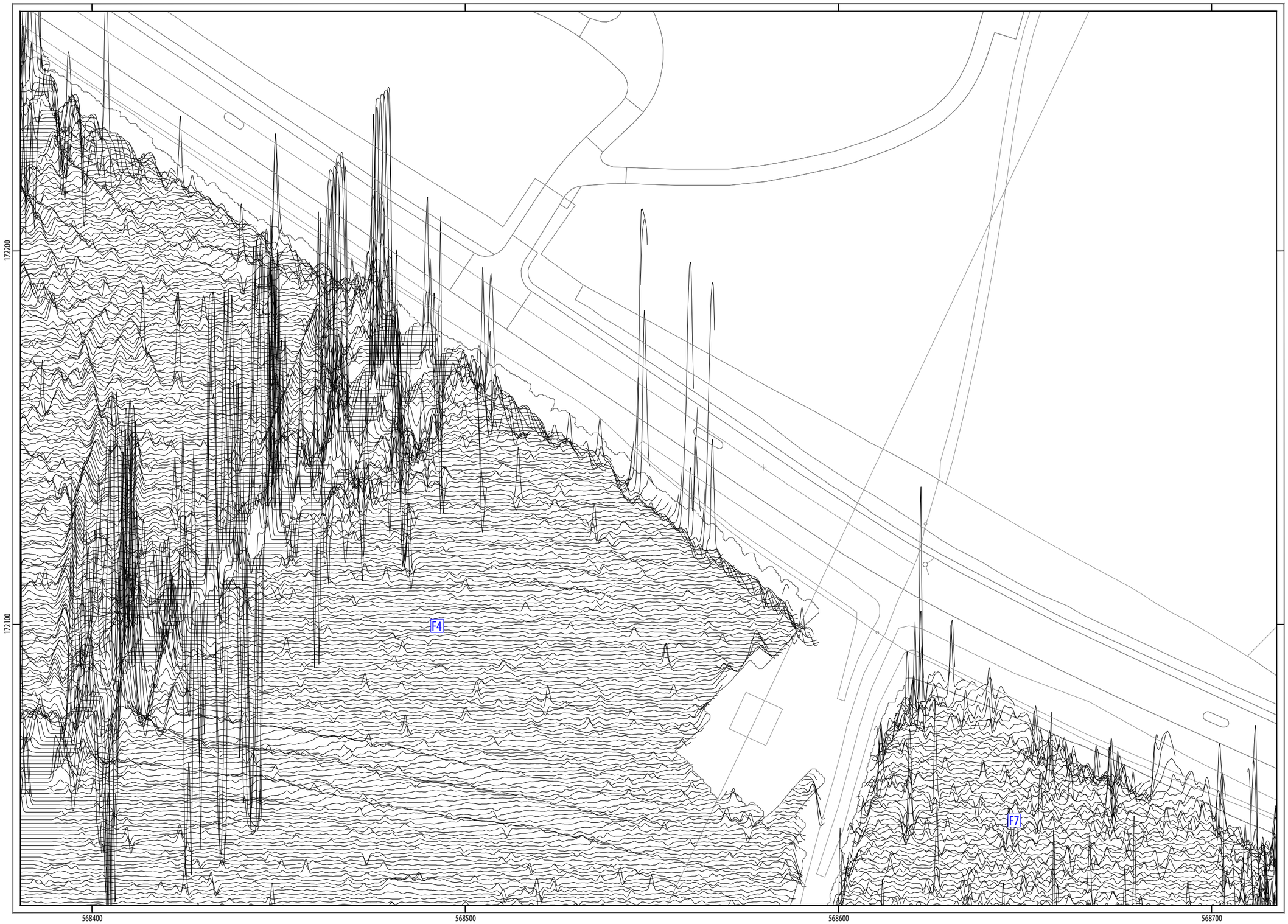
ILLUS 63 Greyscale magnetometer data; AAA5 (east)



13.0nT/cm

0 25m

1:1,000 @ A3

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ILLUS 64 XY traceplot of minimally processed magnetometer data; AAA5 (east)

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

TR1

F4

RD1

TR2

F7

172200

172100

568400

568500

568600

568700

0 25m

1:1,000 @ A3

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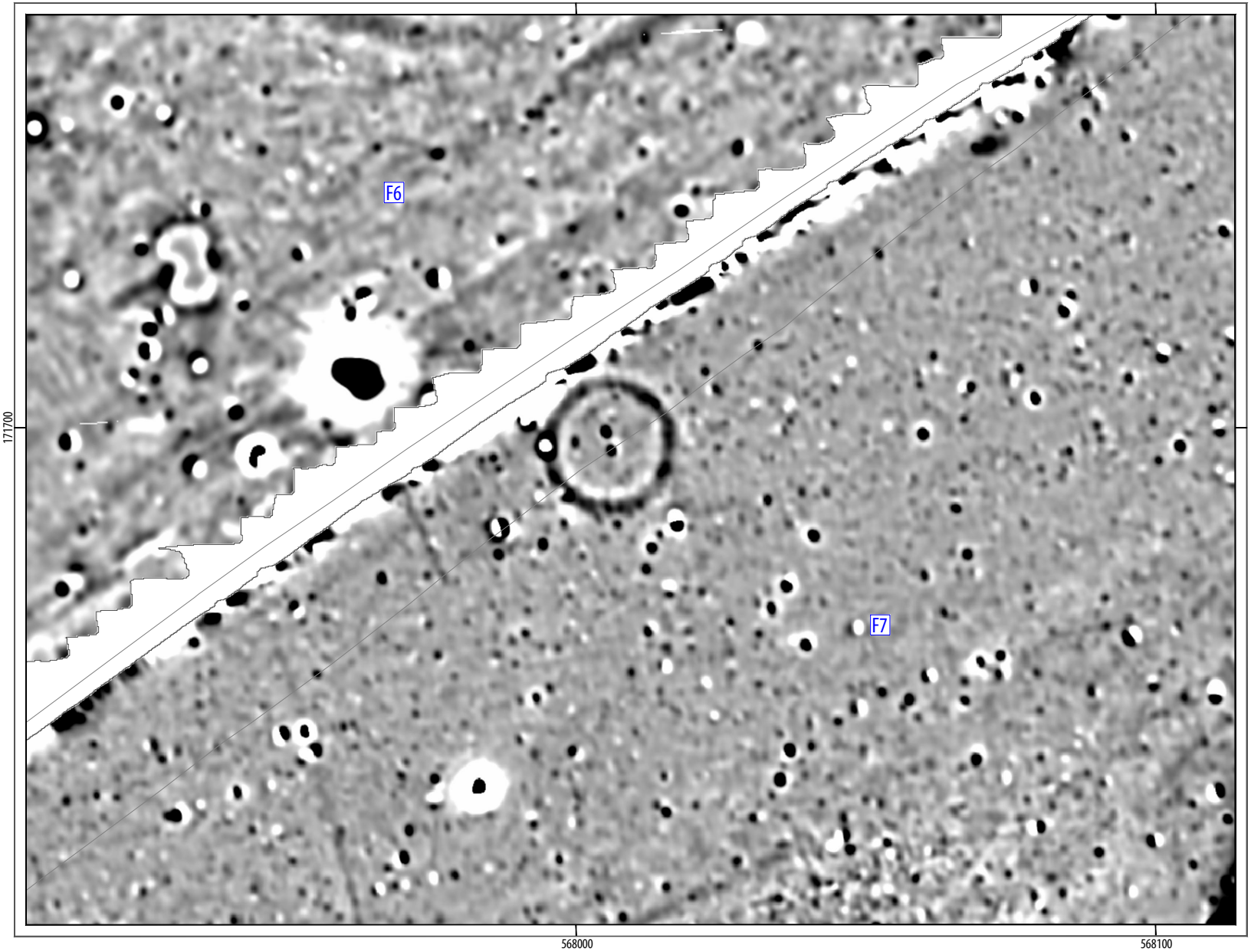
ILLUS 65 Interpretation of magnetometer data; AAA5 (east)



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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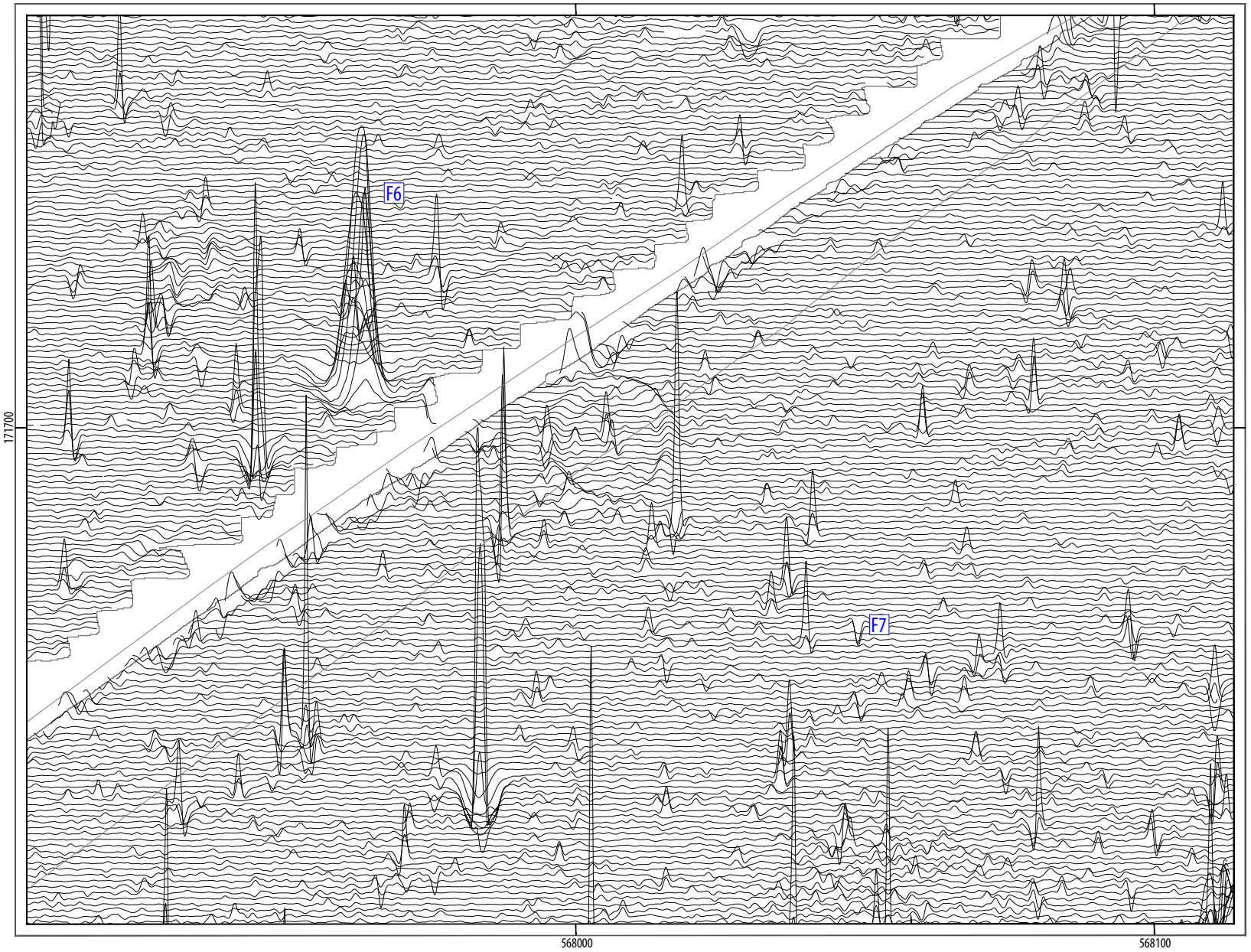
ILLUS 66 Greyscale magnetometer data; AAA6



13.0nT/cm

0 20m

1:1,000 @ A4

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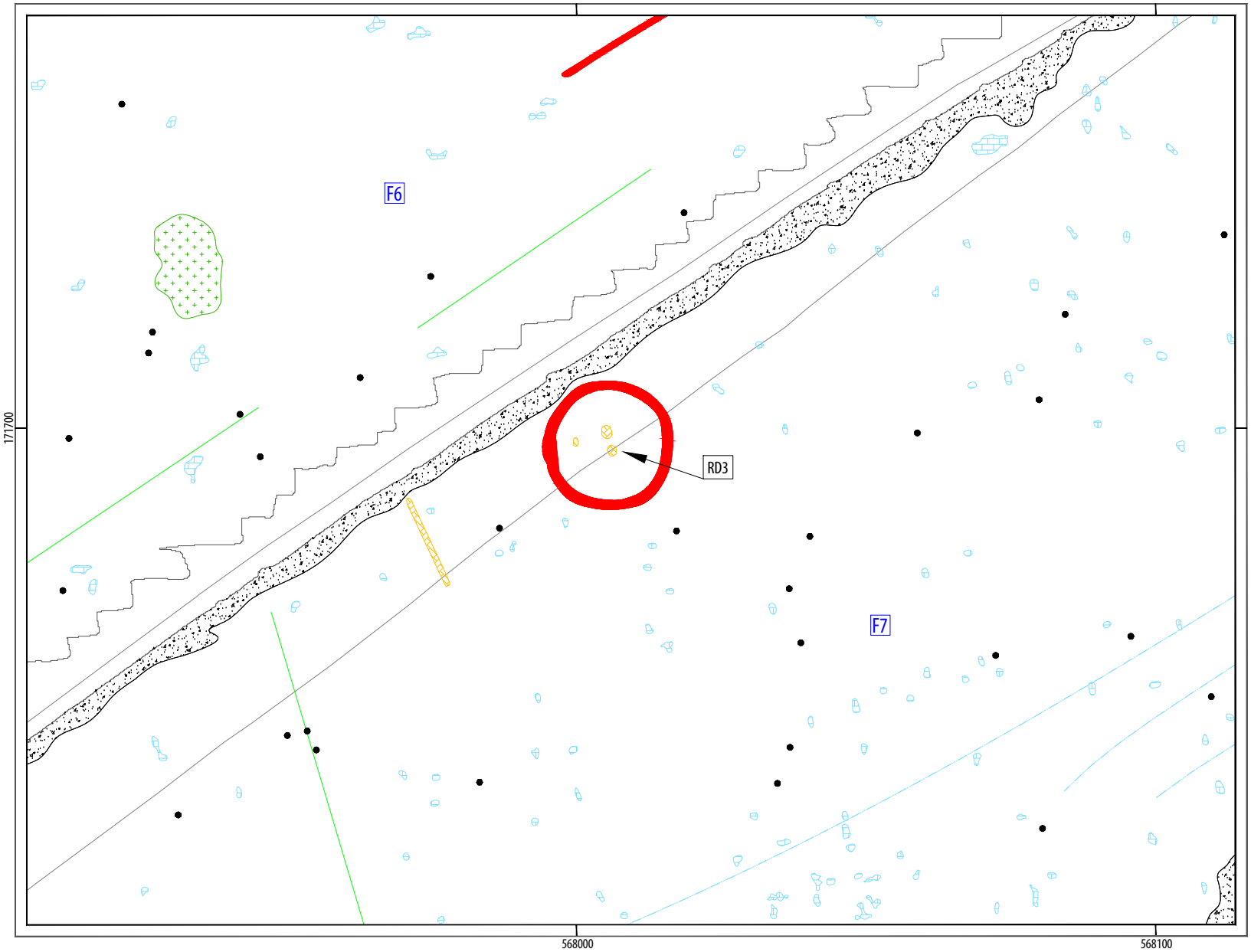
ILLUS 67 XY traceplot of minimally processed magnetometer data; AAA6



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	golf bunkers
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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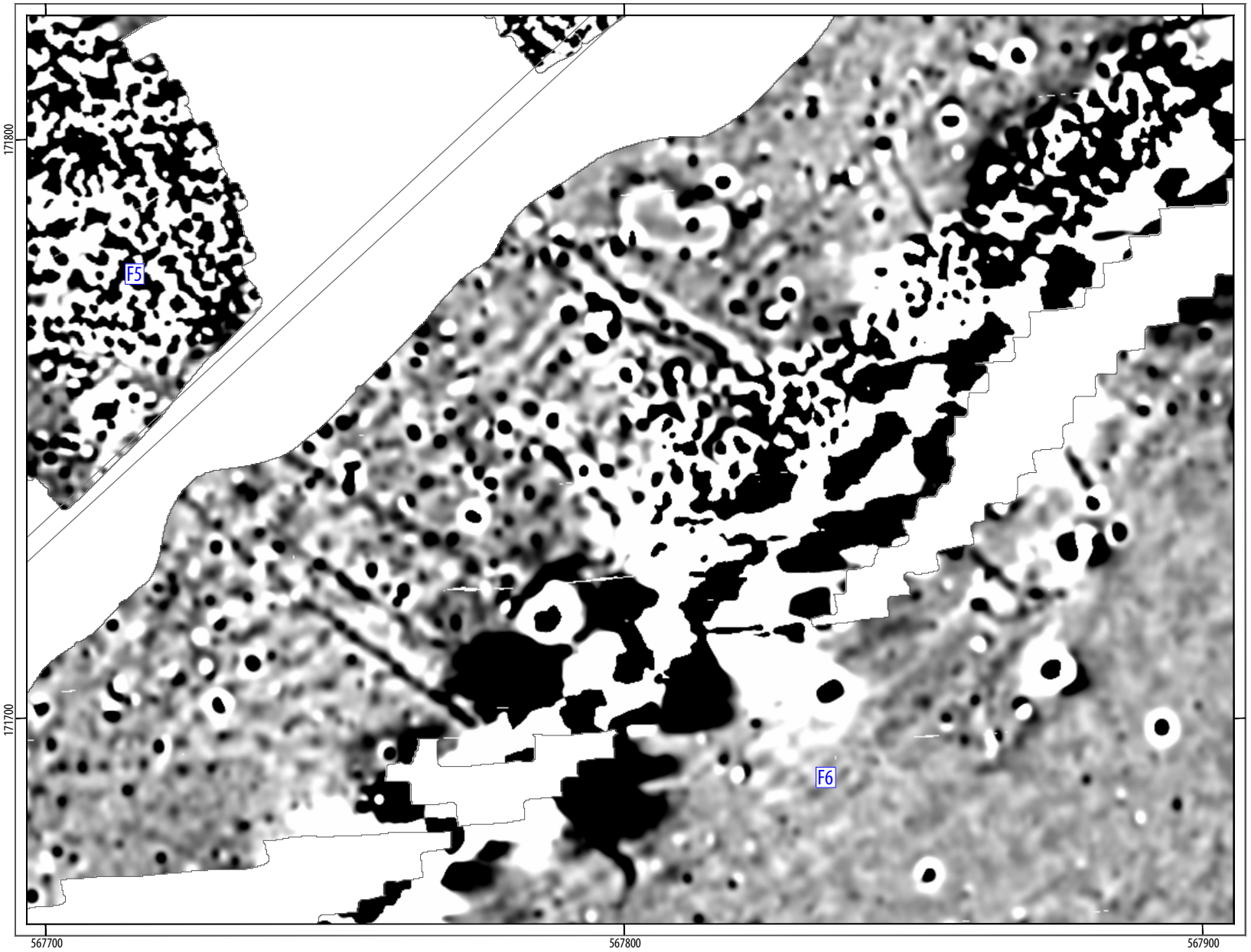
ILLUS 68 Interpretation magnetometer data; AAA6



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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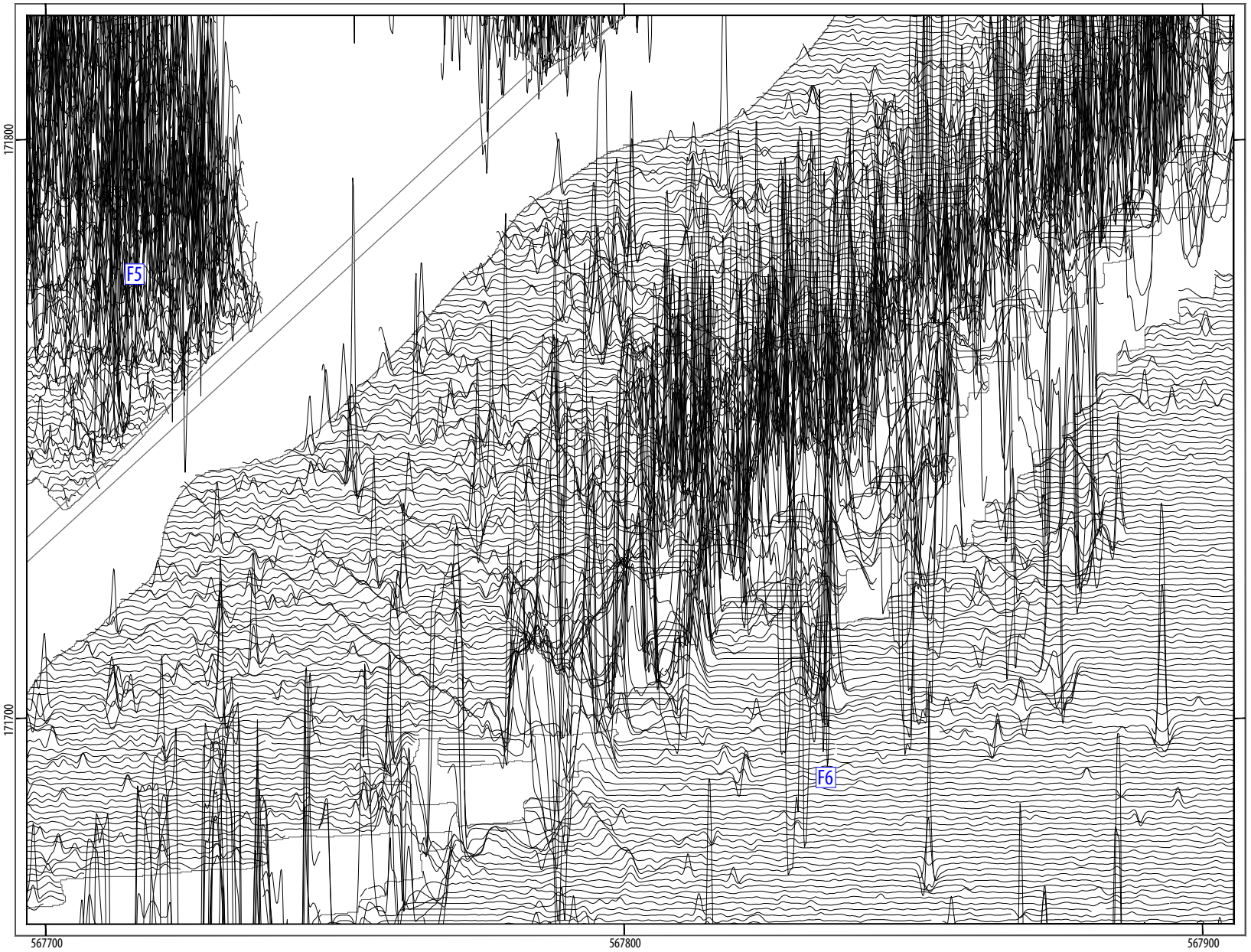
ILLUS 69 Greyscale magnetometer data; AAA7



13.0nT/cm

0 20m

1:1,000 @ A4

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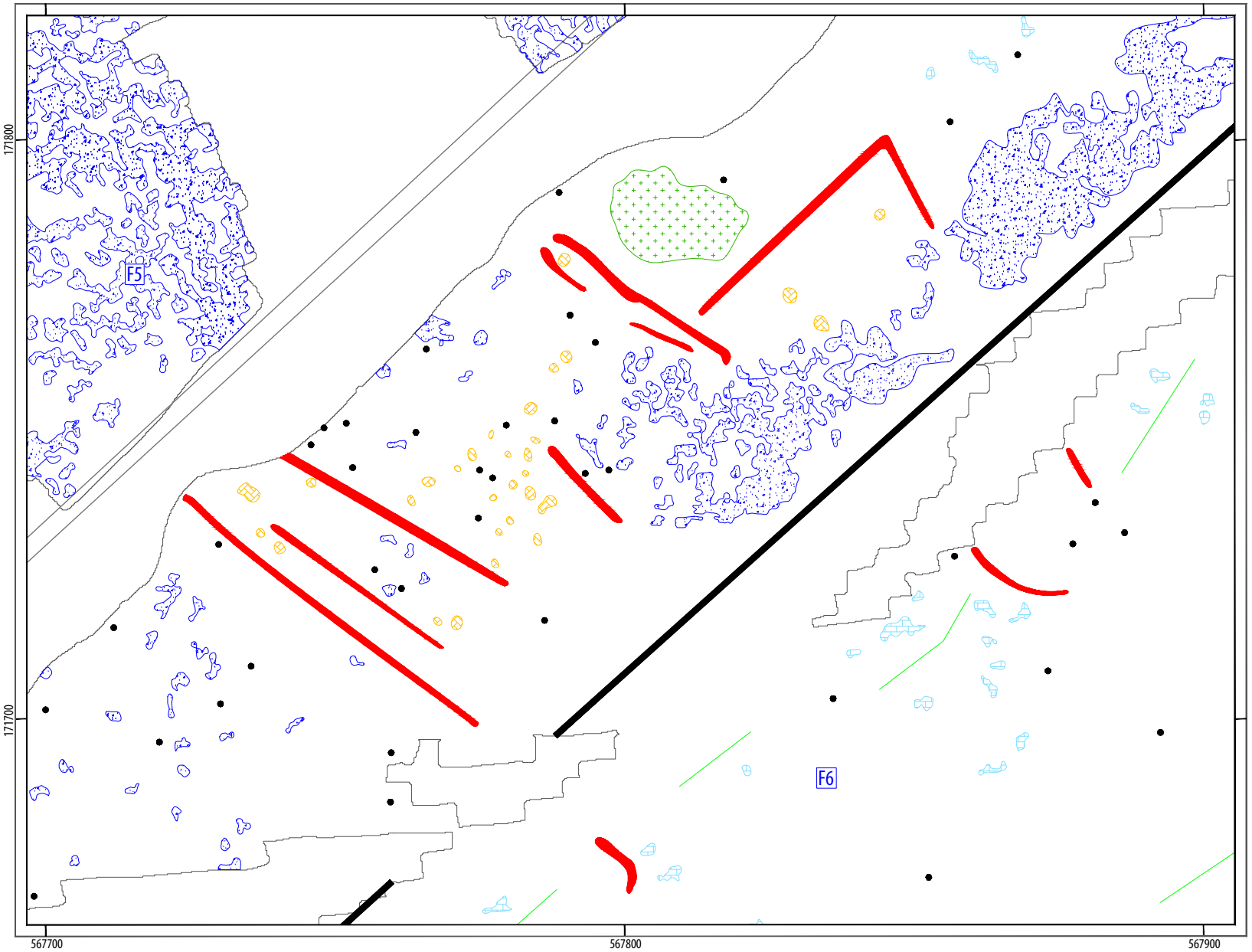
ILLUS 70 XY traceplot of minimally processed magnetometer data; AAA7



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
dipolar linear	service pipe
magnetic disturbance	modern
magnetic disturbance	golf bunkers
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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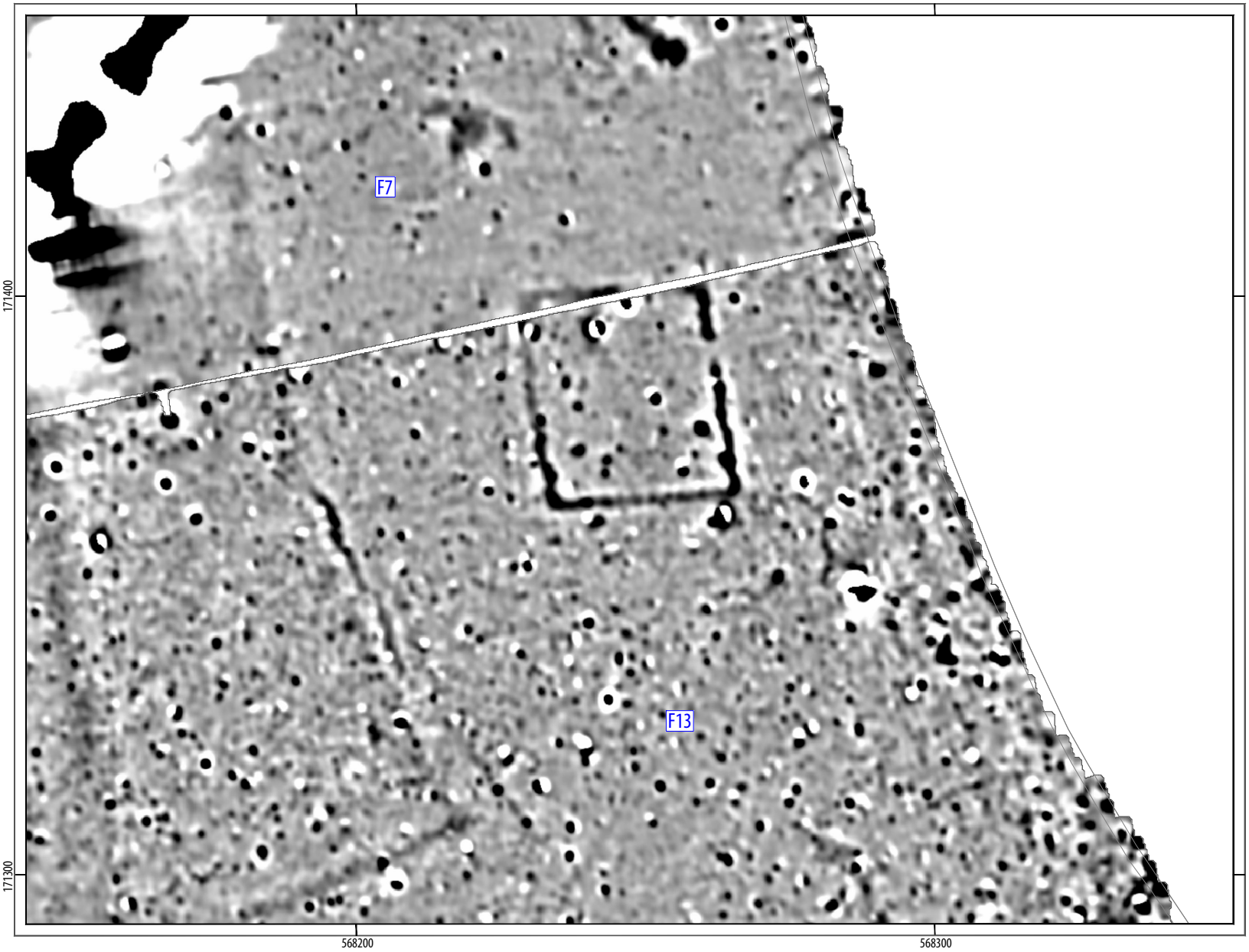
ILLUS 71 Interpretation of magnetometer data; AAA7



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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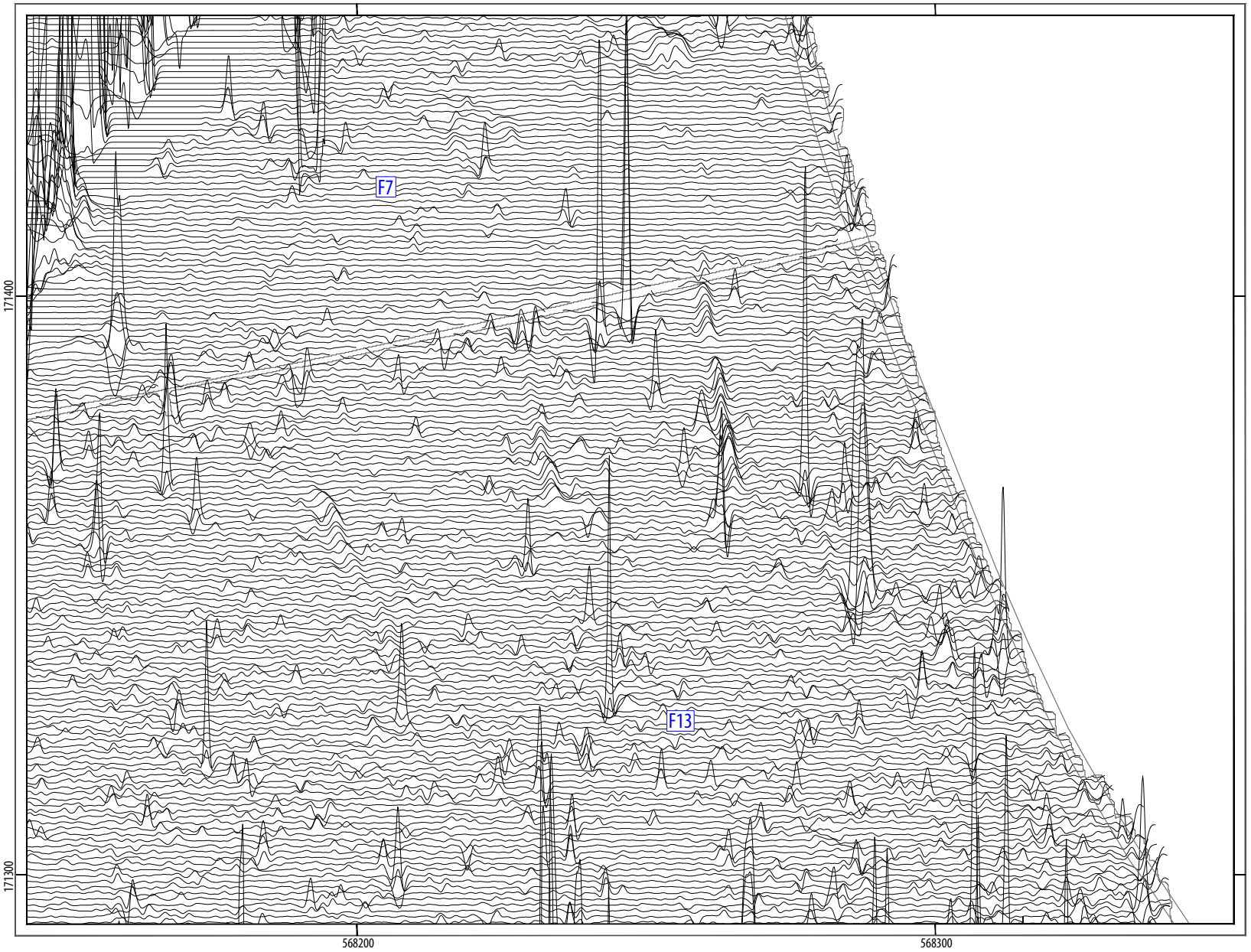
ILLUS 72 Greyscale magnetometer data; AAA8



13.0nT/cm

0 20m

1:1,000 @ A4

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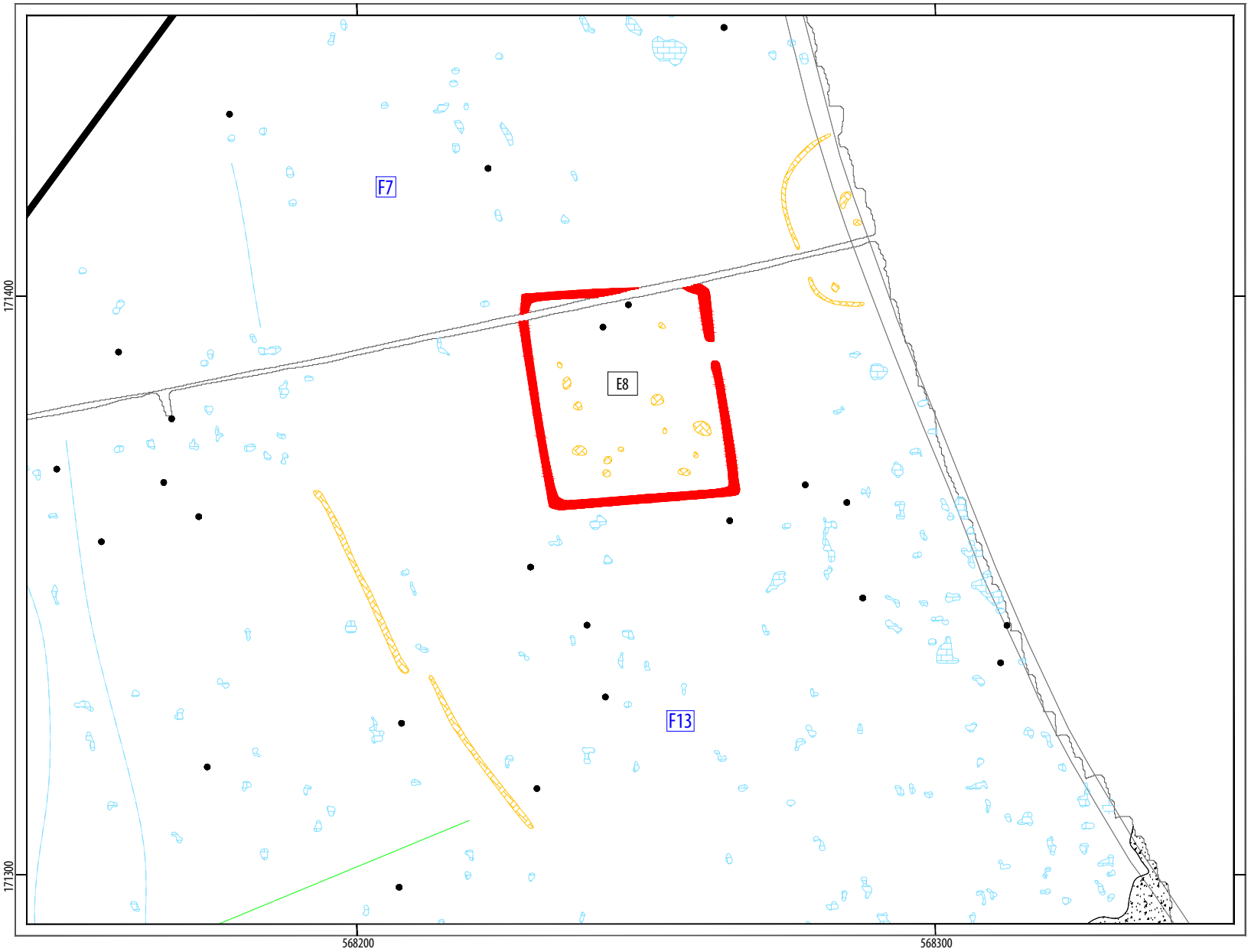
ILLUS 73 XY traceplot of minimally processed magnetometer data; AAA8



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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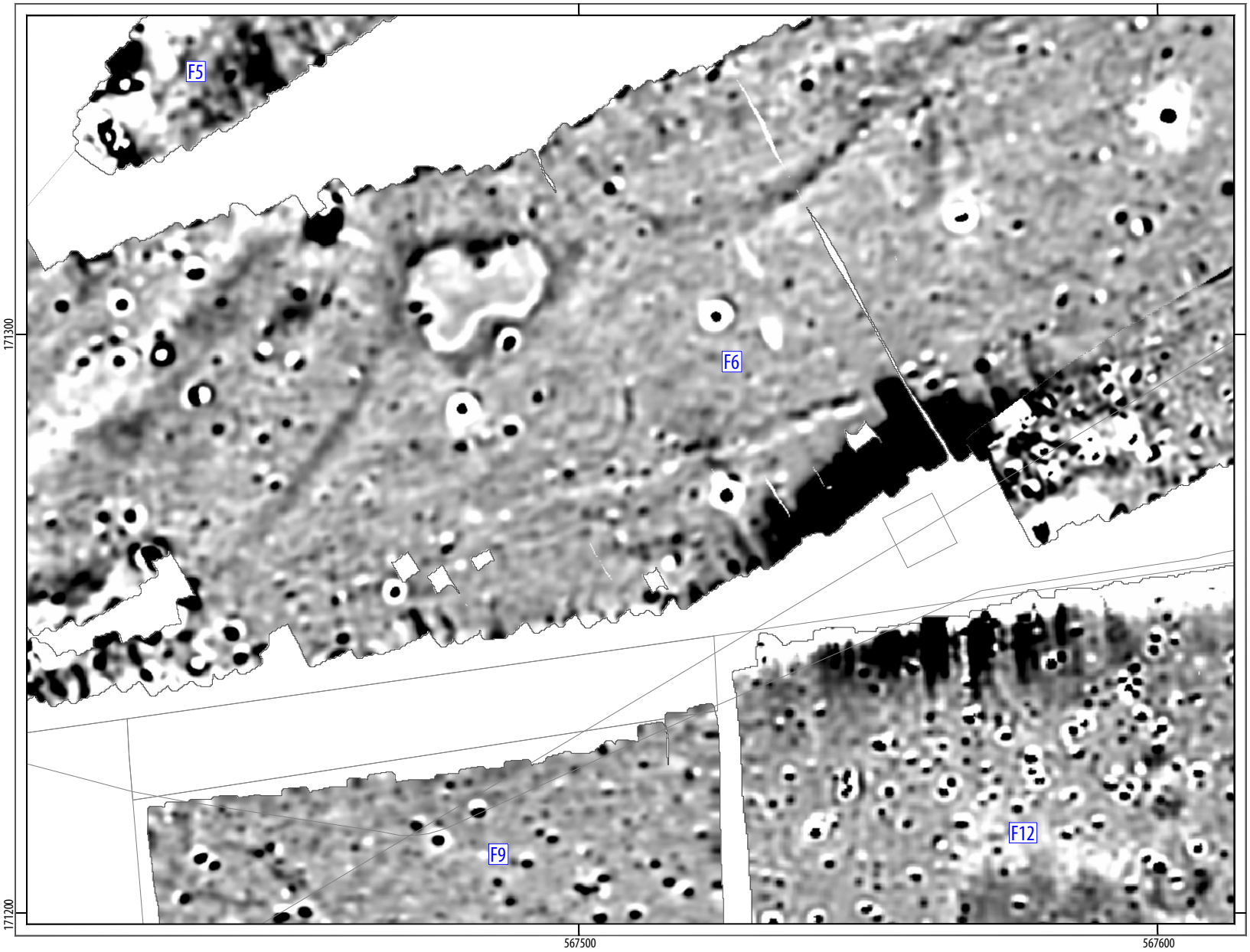
ILLUS 74 Interpretation of magnetometer data; AAA8



nT
-1.0
2.0

0
20m
1:1,000 @ A4

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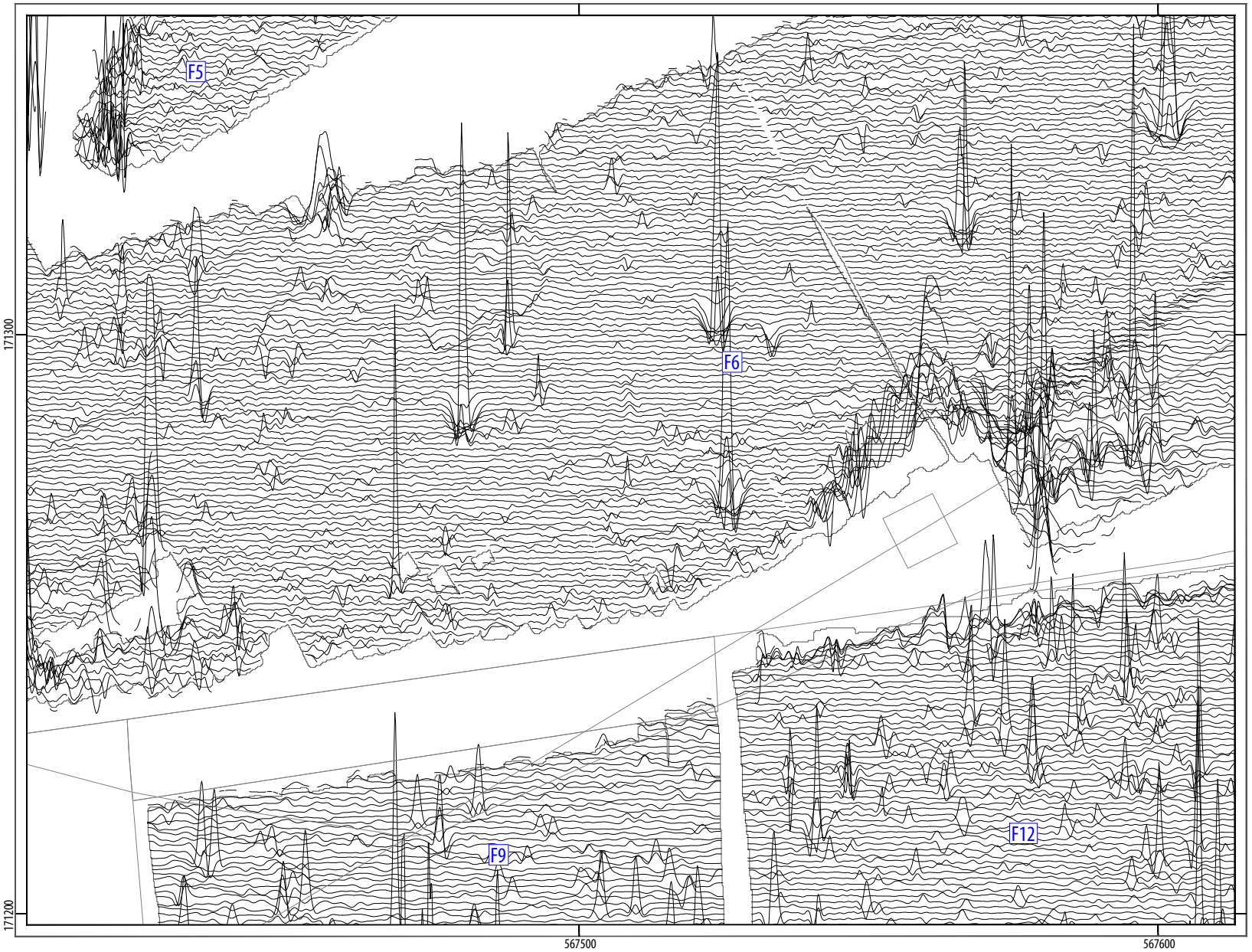
ILLUS 75 Greyscale magnetometer data; AAA9



13.0nT/cm

0 20m

1:1,000 @ A4

PROJECT LTCK18
Lower Thames Crossing
Phase 1
Kent

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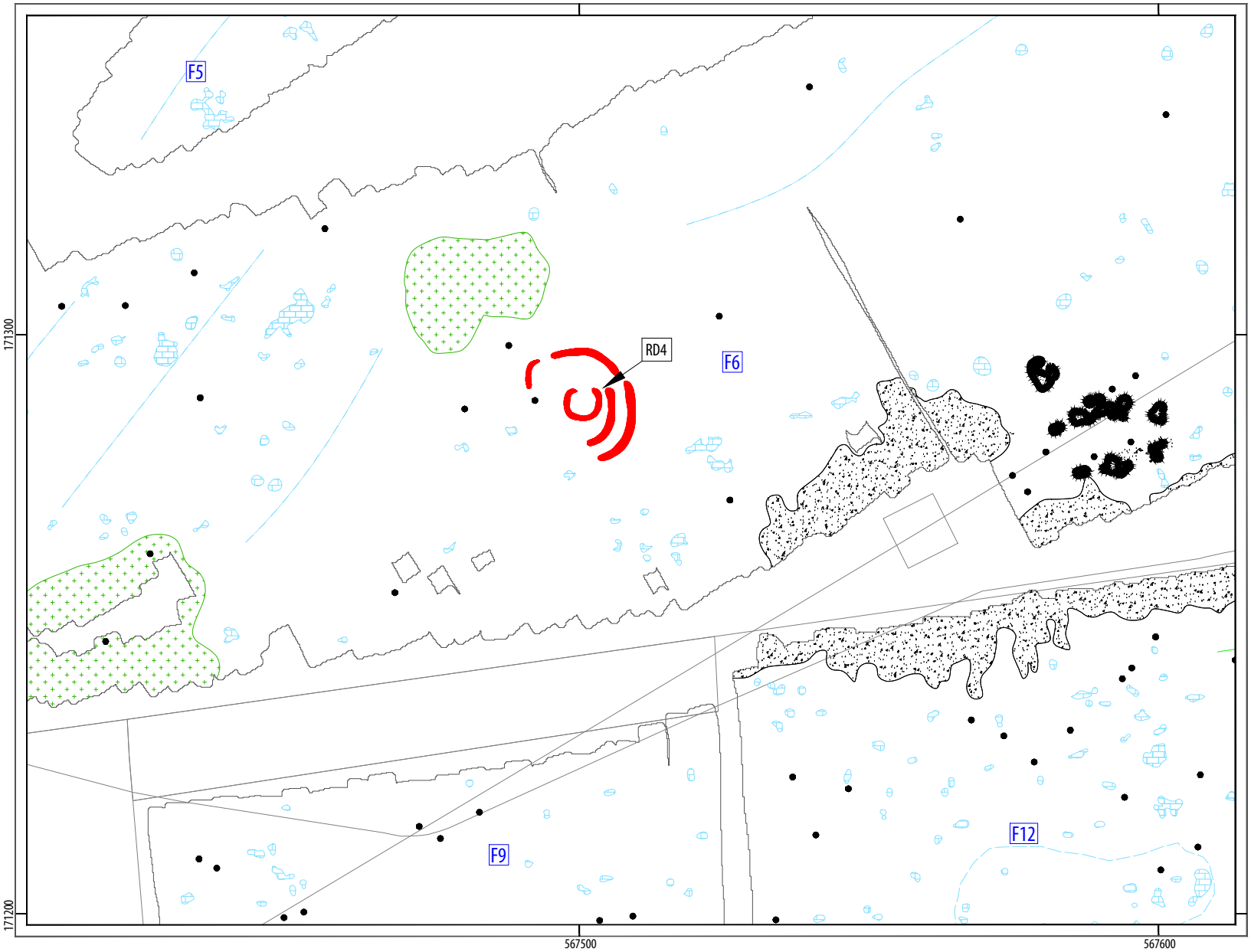
ILLUS 76 XY traceplot of minimally processed magnetometer data; AAA9



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	golf bunkers
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology

0 20m
1:1,000 @ A4

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ILLUS 77 Interpretation of magnetometer data; AAA9

nT
-1.0 2.0

0 25m
1:1,000 @ A3

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ILLUS 78 Greyscale magnetometer data; AAA10

F19

F21

F22

170700

170600

566900

567000

567100

567200

13.0nT/cm

0 25m

1:1,000 @ A3

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ILLUS 79 XY traceplot of minimally processed magnetometer data; AAA10

F19
F21
E8
E9
E10
E11
E12
TR4
F22

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

170700
170600
566900
567000
567100
567200

0 25m
1:1,000 @ A3

PROJECT LTCK18
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ILLUS 80 Interpretation of magnetometer data; AAA10

7 APPENDICES

7.1 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.

Lightning-induced remnant magnetisation (LIRM)

LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical currents associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

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.

7.2 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.

7.3 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.

7.4 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.

7.5 Appendix 5 Oasis Data Collection Form: England

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