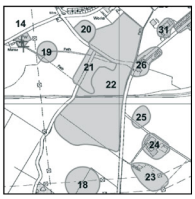
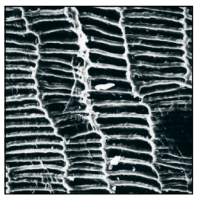
CPAL21










COTTAM PARKWAY RAILWAY STATION, LANCASHIRE

GEOPHYSICAL SURVEY REPORT

commissioned by Jacobs
on behalf of Lancashire County Council

June 2021

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

COTTAM PARKWAY RAILWAY STATION, LANCASHIRE

GEOPHYSICAL SURVEY REPORT

commissioned by Jacobs
on behalf of Lancashire County Council

June 2021

This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **CPAL21** / NGR **SD 48904 31454** / Parish **Preston** / Local Authority **Lancashire County Council** / Fieldwork Date **04/03/2021 - 05/03/2021** / OASIS Ref. **Headland5-417779**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **Alistair Webb** / Fieldwork **Eleanor Culverhouse, Peter Heykoop, Robbie House** / Graphics **Beata Wieczorek-Oleksy, Sam Harrison**

Approved by **Sam Harrison** .....

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HEADLAND ARCHAEOLOGY

part of the RSK Group

REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

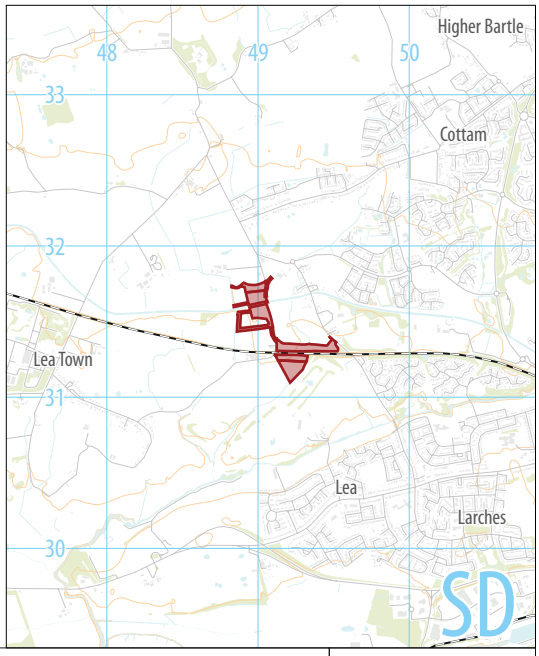
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering approximately 9 hectares on land at Cottam on the western periphery of Preston, where a new railway station and associated infrastructure is to be located. The results of the survey will help inform an Environmental Statement and may also inform future archaeological strategy at the site, if required.

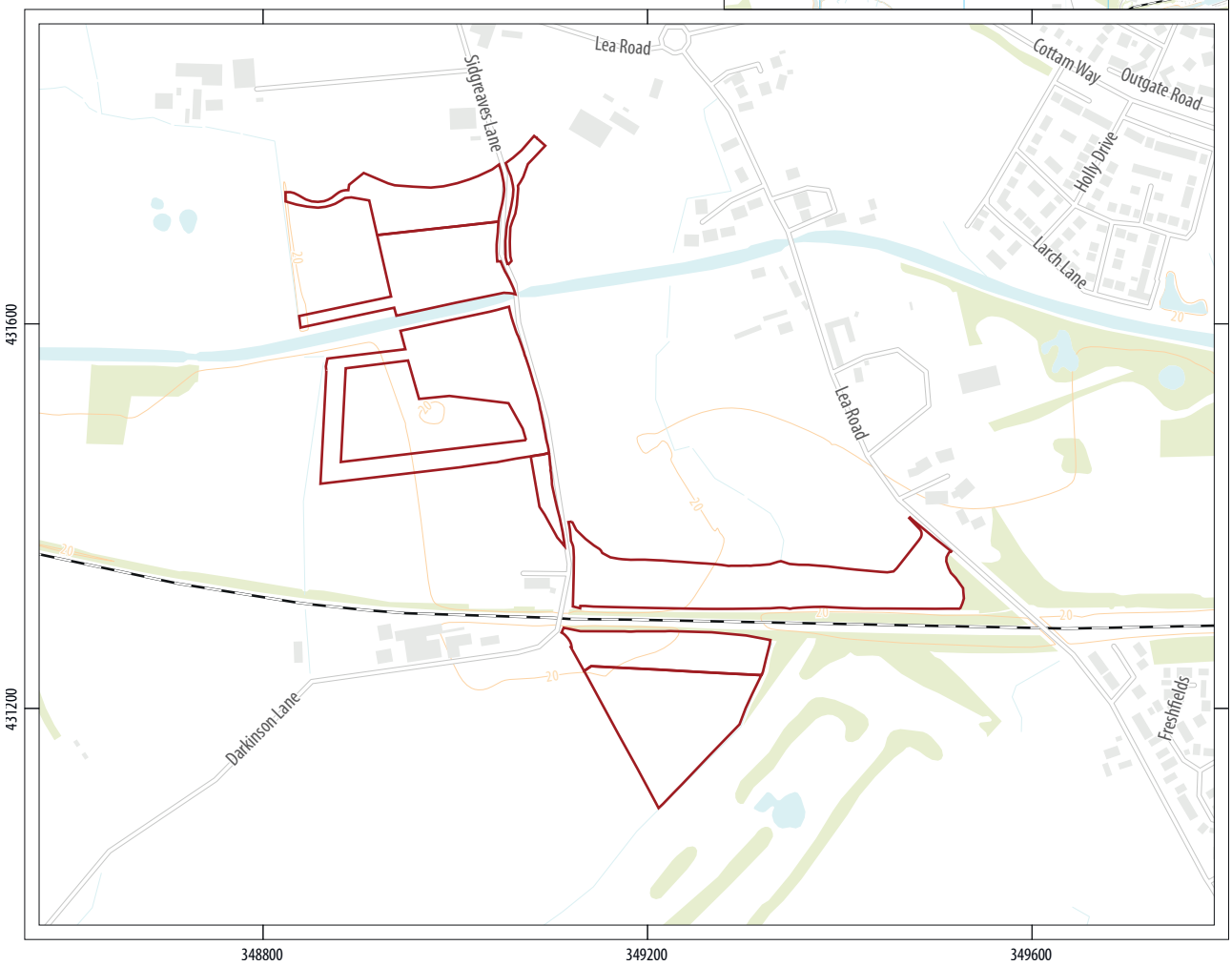
The survey has successfully evaluated the Geophysical Survey Area (GSA) and has identified ten anomalies which probably locate areas of burning caused by small-scale, localised, brick manufacture. These brick clamps would likely have used clay (marl) from the many marl pits in the immediate vicinity; another anomaly locates an example of such an infilled pit. These anomalies are assessed as of local historical interest. There is no evidence of the postulated Roman Road. No other anomalies of archaeological potential have been identified by the survey. The results are in line with the conclusions of a previous cultural heritage study.

CONTENTS

LIST OF ILLUSTRATIONS

Cottam Parkway Station and Access Road
Cottam
Lancashire





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ILLUS 1 Site location

COTTAM PARKWAY RAILWAY STATION, LANCASHIRE

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Jacobs (the Consultant) on behalf of Lancashire County Council (the Client) to undertake a geophysical (magnetometer) survey on land on the western periphery of Preston, at Cottam, where it is proposed to site a new station platform and other associated railway infrastructure, including car parking facilities, access road, ticket office and footbridges, adjacent to the existing railway line. The survey comprised several discrete blocks either side of the railway line (to the south) and the Lancaster Canal (to the north) and covered approximately 9 hectares (Illus 1).

The survey was undertaken to assess the impact of the development on the historic environment and will inform an Environmental Statement together with the Cultural Heritage Desk-Based Study (CHDBS - Jacobs 2021). The survey was undertaken in accordance with guidance within the National Planning Policy Framework (MHCLG 2019) and in line with current best practice (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

The survey was carried out on March 4th and March 5th 2021.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The geophysical survey area (GSA) comprises four separate, but contiguous blocks centred at SD 48904 31454 in parts of six fields (Illus 6 - F1 to F6 inclusive); to the east and west of Sidgreaves Lane to the immediate north of Lancaster Canal, west of Sidgreaves Lane and immediately south of the canal, between Sidgreaves Lane and Lea Road immediately north of the railway line and south of the railway line to the east of Darkinson Lane (Illus 1).

The survey areas were under permanent pasture with small parts being unsuitable for survey due to ongoing tree clearance and ground investigation works (Illus 2 to Illus 5 inclusive).

Topographically the overall area gently undulates between 21m Above Ordnance Datum (AOD) in the north to 17m AOD in the south.

1.2 GEOLOGY AND SOILS

The underlying bedrock geology comprises Sherwood sandstone which is overlain by superficial deposits of Devensial Till (Diamicton) (UKRI 2021).

The soils are classified in the Soilscape 18 Soil Association being characterised as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

The Cultural Heritage Desk-Based Study (Jacobs 2021) details the recorded assets within the GSA and the wider overall study area and it is not proposed to repeat this information in detail.

In brief, 26 non-designated assets have been identified within the overall study area. Of these 12 comprise post-medieval structures (no longer extant) or industrial (marl) pits (now infilled) all of which are assessed as of low or negligible value. Eleven assets are of uncertain date but predominantly include features of agricultural origin such as ridge and furrow earthworks and former field boundaries, again all designated as of low value. Two assets relate to Roman Road 703 Ribchester to Pouton-le-Fylde which is postulated to run east/

ILLUS 2 F1, looking north-east

west along the northern edge of the survey area in F3. However, the assessment concluded that *'based on the known archaeological remains within the baseline, there is a low to moderate potential for the discovery of unknown archaeological remains within the construction area of the Scheme'* (Jacobs 2021).

3 AIMS, METHODOLOGY AND PRESENTATION

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

The specific archaeological objectives of the geophysical survey were:

- to gather enough information to inform the extent, condition, character and date (as far as circumstances permit) of any archaeological features and deposits within the survey areas;
- to obtain information that will contribute to an evaluation of the significance of the scheme upon cultural heritage assets thus providing information for the Environmental Statement; 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 (Illus 5). 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 V3.0.37.0 (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 1:4,000. Illus 2–4 show typical ground conditions at the time of survey. Illus 5 shows the location of GPS swaths at 1:4,000. Site location plans, showing the processed greyscale data and interpretation, are presented in Illus 6 and Illus 7, also at a scale of 1:4,000. Fully processed (greyscale) data, minimally processed data (XY trace plot) and interpretative plans are presented at a scale of 1:1,000, by sector, in Illus 8 to Illus 19 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

ILLUS 3 F3, looking west

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

The survey methodology, report and any recommendations comply with guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey (OS) 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 display and interpret the data to best effect. The interpretations are based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Ground conditions were generally very good throughout the GSA where survey was possible leading to a high standard of data that required minimal processing. As noted previously ongoing site works prohibited survey in a strip immediately south of Lancaster Canal (Illus 6).

The geology and soils across the GSA have generally proved receptive to magnetic prospection with anomalies visible against the generally variable magnetic background.

A general classification of anomalies based on their response characteristics is outlined below.

4.1 FERROUS AND MODERN 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 introduced into the topsoil during manuring or tipping/infilling. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons. 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.

Two large areas of magnetic disturbance are also identified in the data. In F3 a semi-circular area of high magnitude responses correlates with the location of a marl pit/pond recorded on the first edition Ordnance Survey map and since infilled (Illus 11–13 – IP1).

A larger rectilinear area of magnetic disturbance is recorded in F6, immediately south of the railway line. Whilst there are no structures recorded at this location on historic mapping it is likely that the disturbance results from the tipping of material, either from a demolished (but unrecorded) structure or (more likely) material resulting from the construction of the railway embankment immediately to the north.

Other linear bands of magnetic disturbance are prevalent around the field edges and/or adjacent to the roads, railway or canal which define the boundaries of the survey areas. This disturbance is due to ferrous material within, or adjacent to, these boundaries and features and is of no archaeological interest.

ILLUS 4 F5, looking east

Ten thermoremanent anomalies indicative of likely burning are identified, four in F3, one in F4 and five in F5. The most clearly defined is regular rectilinear anomaly, K1 (Illus 13) which is very characteristic of the response from the burned remnants of a brick clamp, probably utilising clay extracted from the marl pit, (IP1) in the south of this survey block. Two other burned responses (Illus 13 – K2 and K3) are also identified in F3 and these are both also interpreted as the remains of likely brick clamps. Another similar anomaly, K4, right in the north-western corner of F3 probably locates a fourth such feature but as it is right on the edge of the survey block not enough of the response is visible to make this interpretation confidently. In F5 five similar anomalies (Illus 7 - K5 to K10 inclusive) are also identified, three in a cluster on the eastern field edge. A single response, K10, is also recorded in F4. All these anomalies are interpreted as the likely locations of small-scale brick firing and/or manufacture.

4.2 AGRICULTURAL ANOMALIES

A series of parallel linear anomalies aligned north-north-west/south-south-east and north-north-east/south-south-west in F5 are caused by field drains. Similar anomalies in F6 are also interpreted as of likely agricultural origin, either drains or possibly indicative of ploughing. A single drain is also identified in F1 (Illus 10) aligned north-east/south-west.

5 CONCLUSION

The survey has successfully evaluated the GSA and has identified ten anomalies which probably locate areas of burning caused by small-scale, localised, brick manufacture. These brick clamps would likely have used clay (marl) from the many marl pits in the immediate vicinity; another anomaly locates an example of such an infilled pit. All these anomalies are assessed as of local historical interest.

There is no evidence in the data for the postulated Roman Road. No other anomalies of archaeological potential have been identified by the survey and the results overall support the conclusions of the CHDBS.

6 REFERENCES

Chartered Institute for Archaeologists (ClfA) 2014 ***Standard and guidance for archaeological geophysical survey*** (Reading) https://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_3.pdf accessed 22nd March 2021

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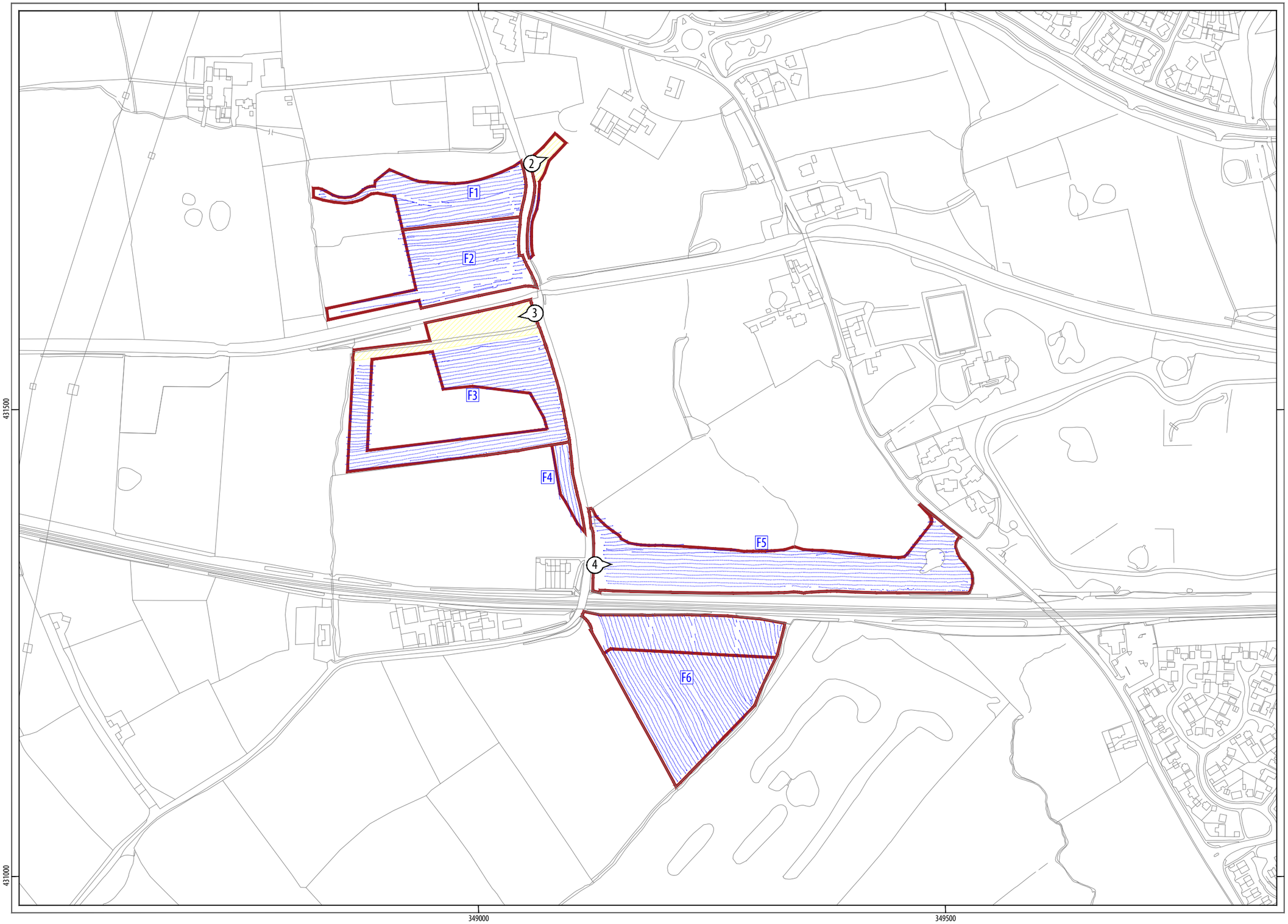

geophysical survey area
GPS swaths
area unsuitable for survey
location and direction of ILLUS 2-9

0 100m
1:4,000 @ A3

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ILLUS 5 Geophysical survey location showing GPS swaths

geophysical survey area

area unsuitable for survey

nT
-1.0 2.0

0 100m
1:4,000 @ A3

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ILLUS 6 Processed greyscale magnetometer data

SECTOR1
SEE ILLUS 8-10

SECTOR2
SEE ILLUS 11-13

SECTOR3
SEE ILLUS 14-16

SECTOR4
SEE ILLUS 17-19

F1
F2
F3
F4
F5
F6

K1
K2
K3
K4?
K5
K6
K7
K8
K9
K10

IP1

431500
431000
349000
349500

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	extraction
linear trend	agricultural
linear trend	field drain
magnetic enhancement	archaeology?
magnetic enhancement	kiln/burning

ABBREVIATIONS

IP	infilled pit
K	kiln

0 100m
1:4,000 @ A3

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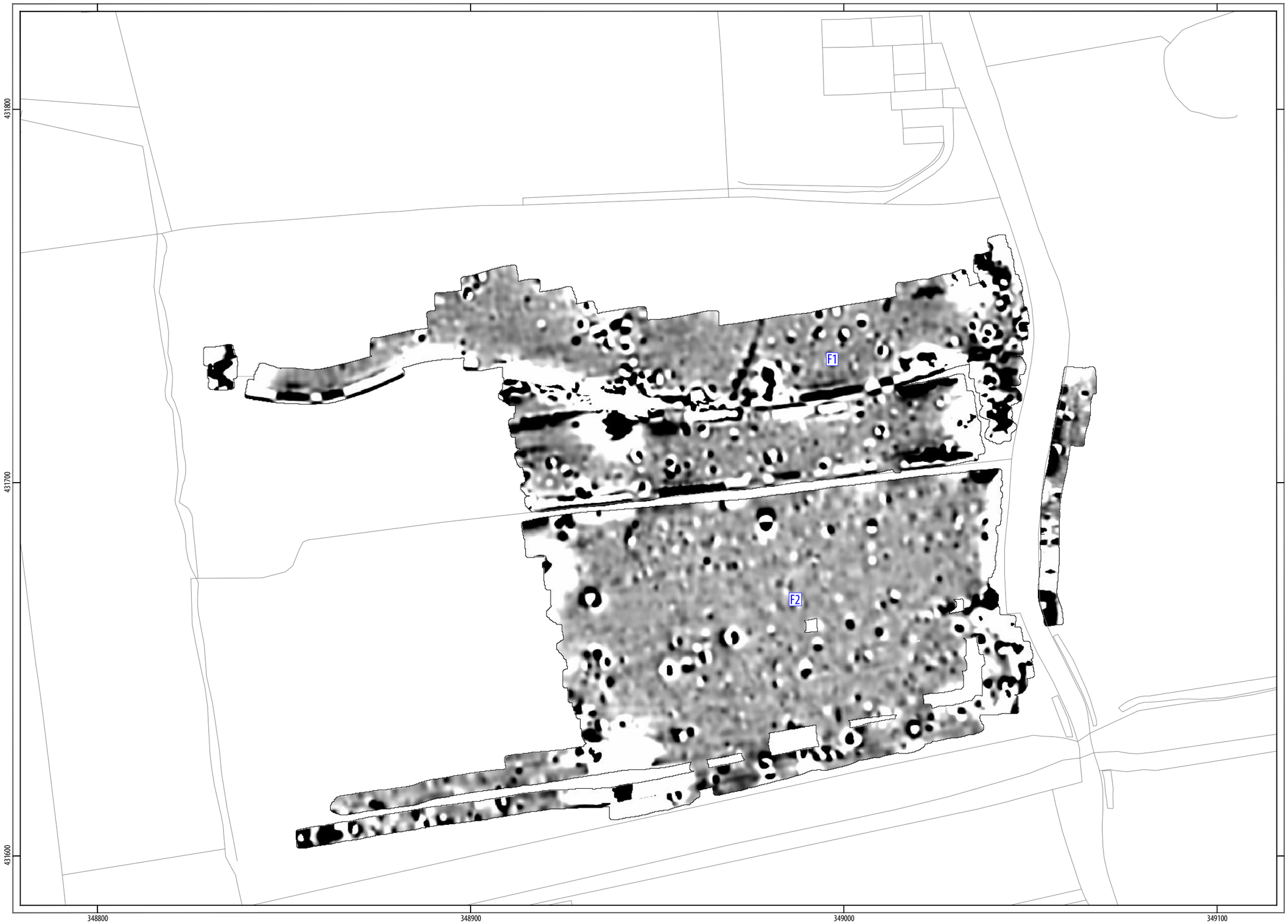
ILLUS 7 Interpretation of magnetometer data



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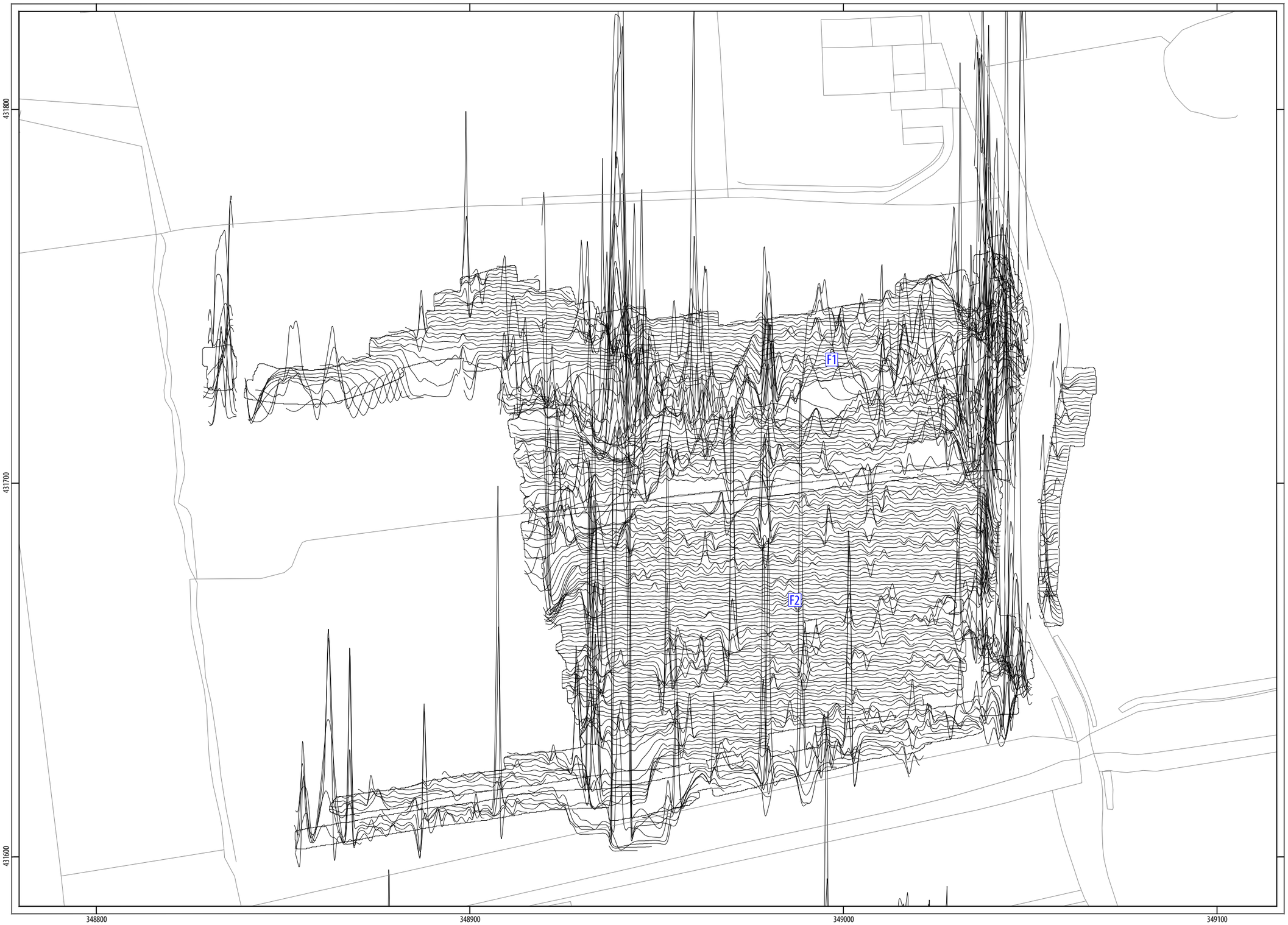
ILLUS 8 Processed greyscale magnetometer data; Sector 1



62.5nT/cm

0 25m

1:1,000 @ A3

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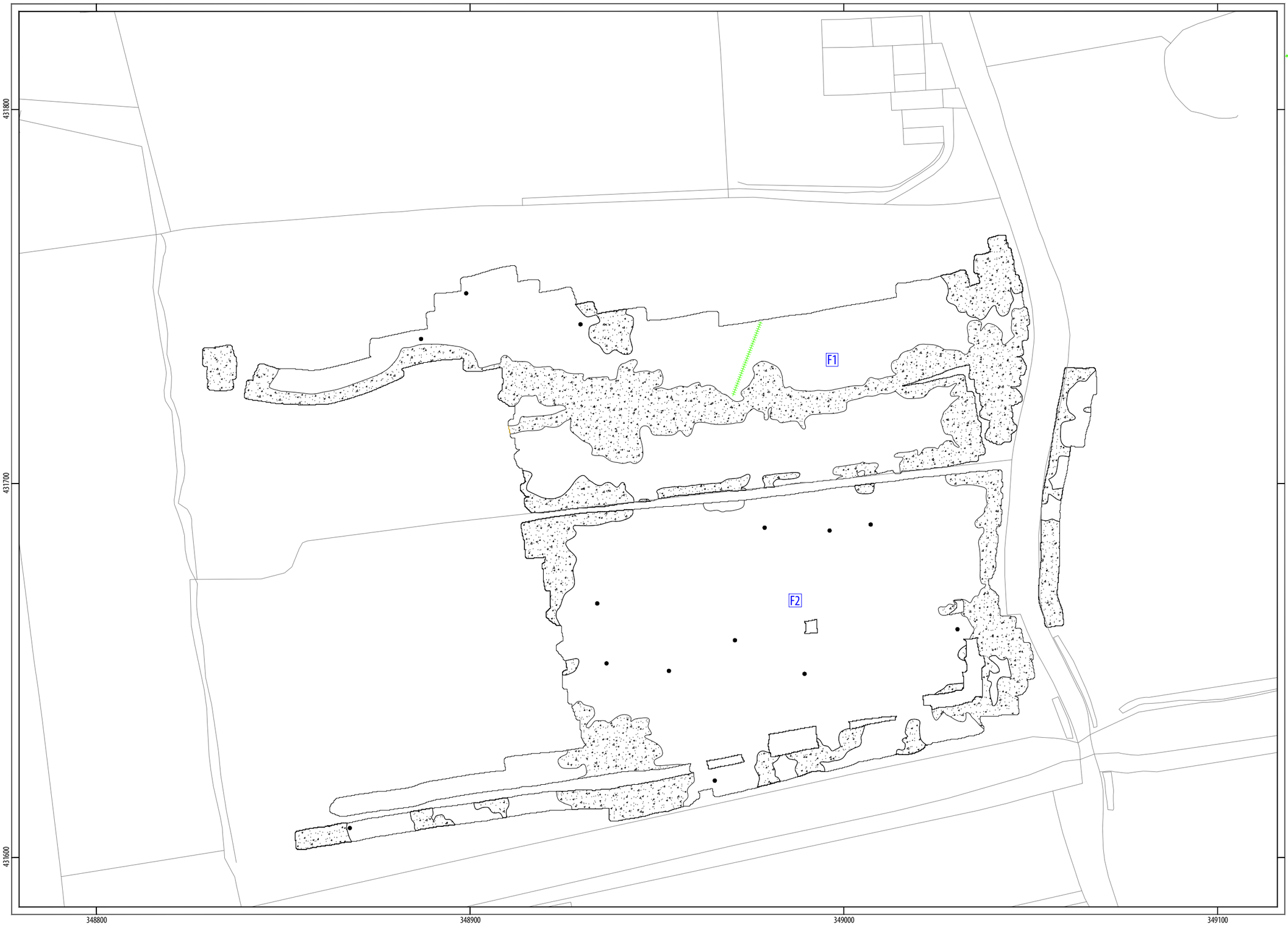
ILLUS 9 XY trace plot of minimally processed magnetometer data; Sector 1



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	field drain

0 25m
1:1,000 @ A3

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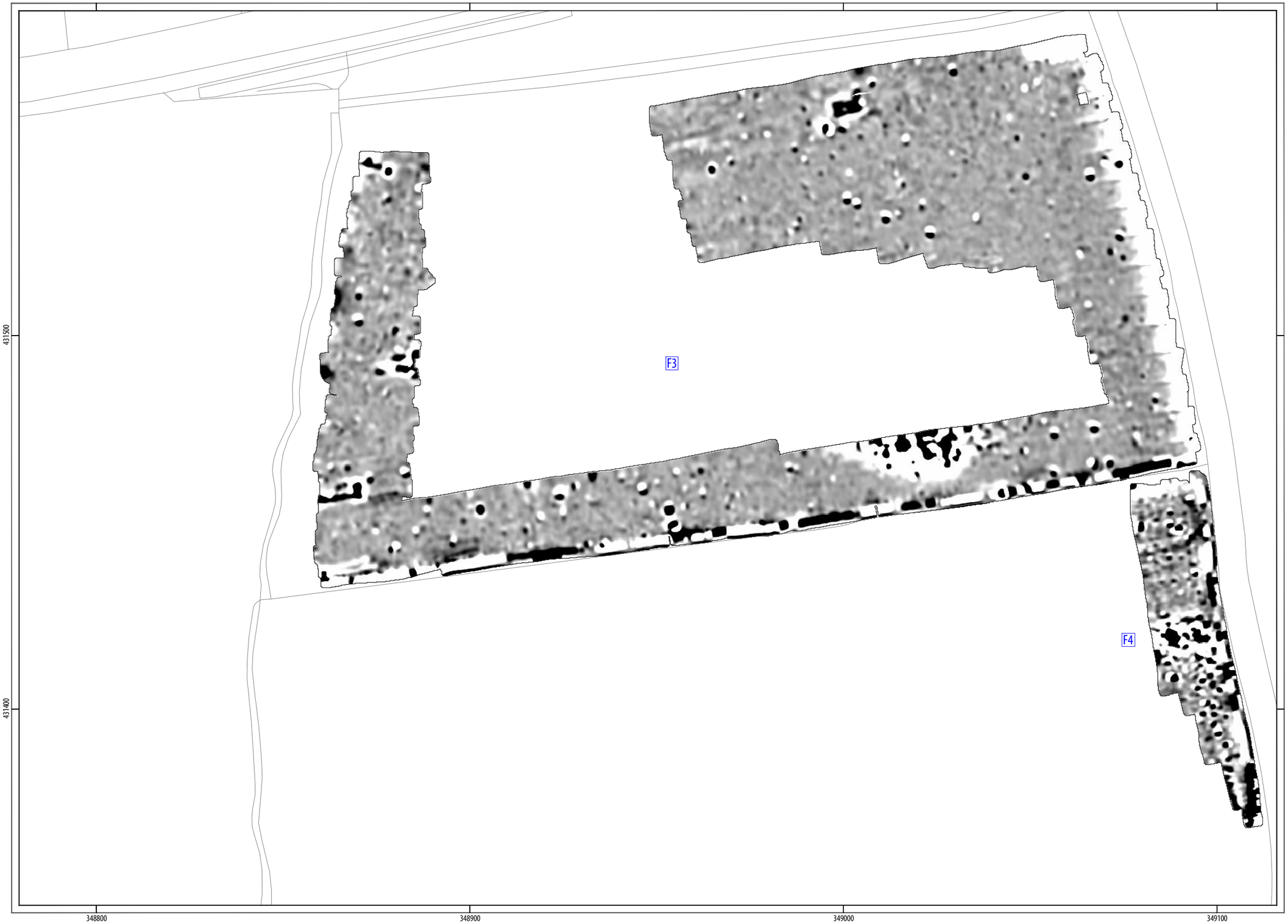
ILLUS 10 Interpretation of magnetometer data; Sector 1



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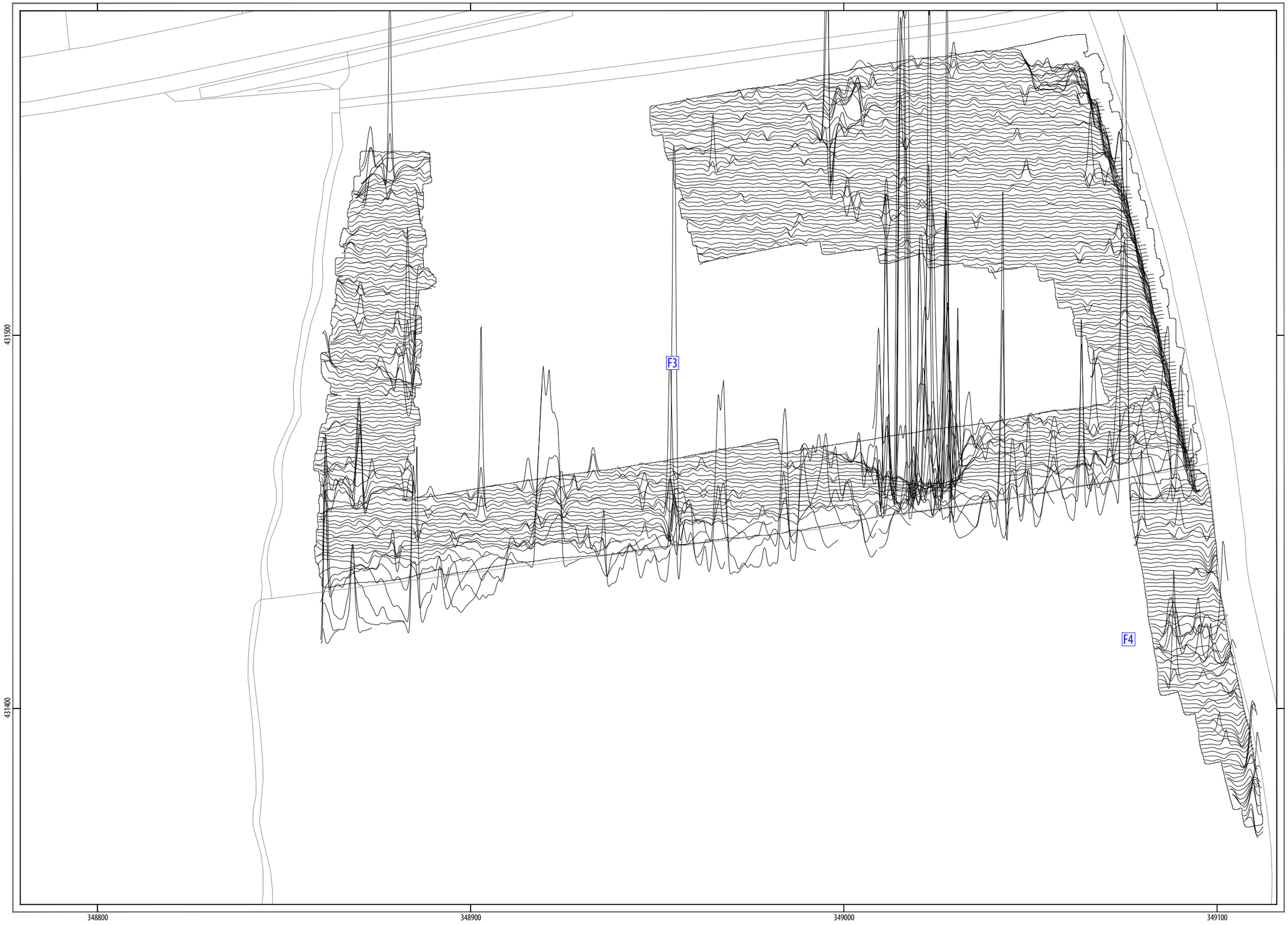
ILLUS 11 Processed greyscale magnetometer data; Sector 2



62.5nT/cm

0 25m

1:1,000 @ A3

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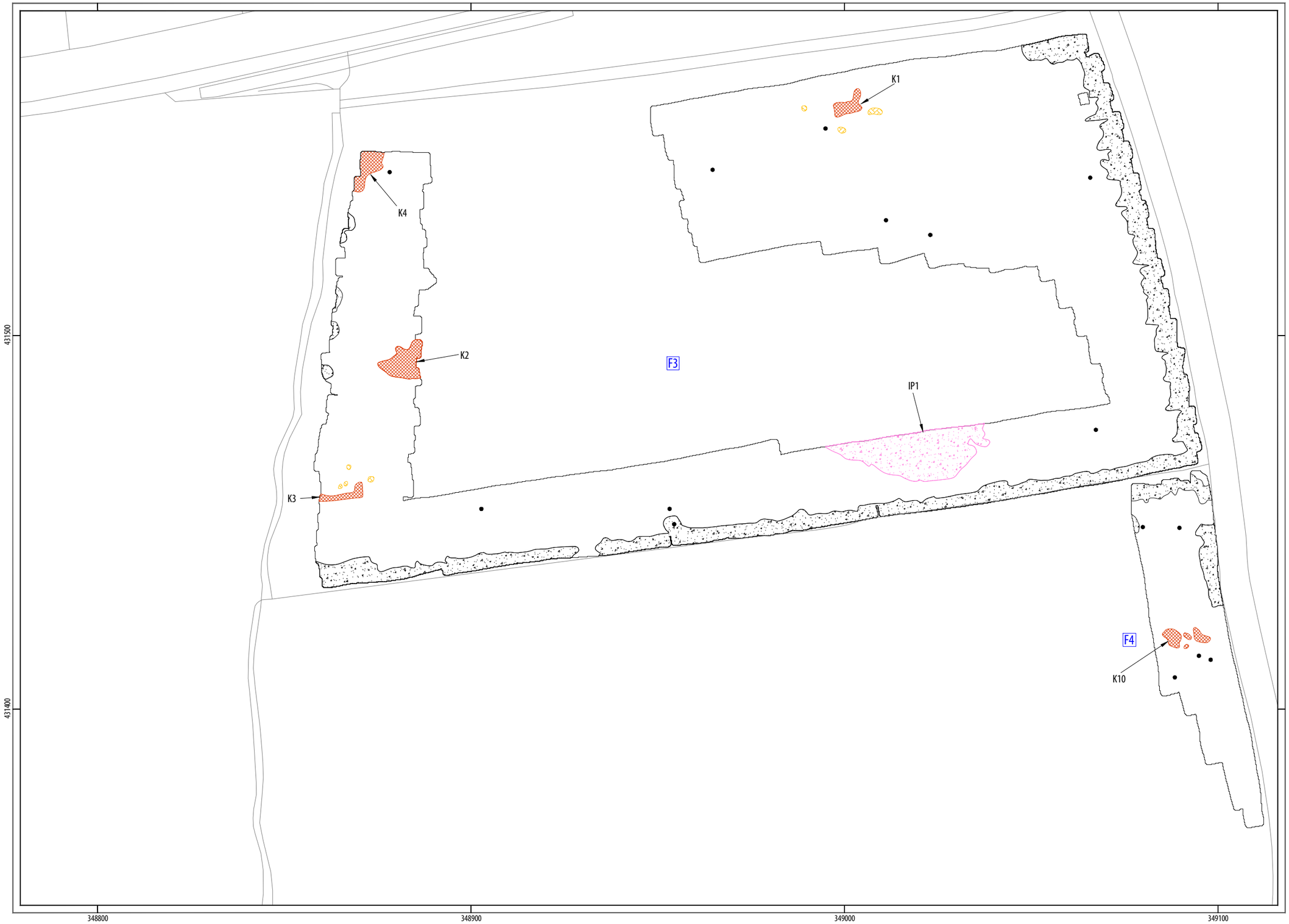
ILLUS 12 XY trace plot of minimally processed magnetometer data; Sector 2



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	extraction
magnetic enhancement	archaeology?
magnetic enhancement	kiln/burning

ABBREVIATIONS

IP	infilled pit
K	kiln

0 25m
1:1,000 @ A3

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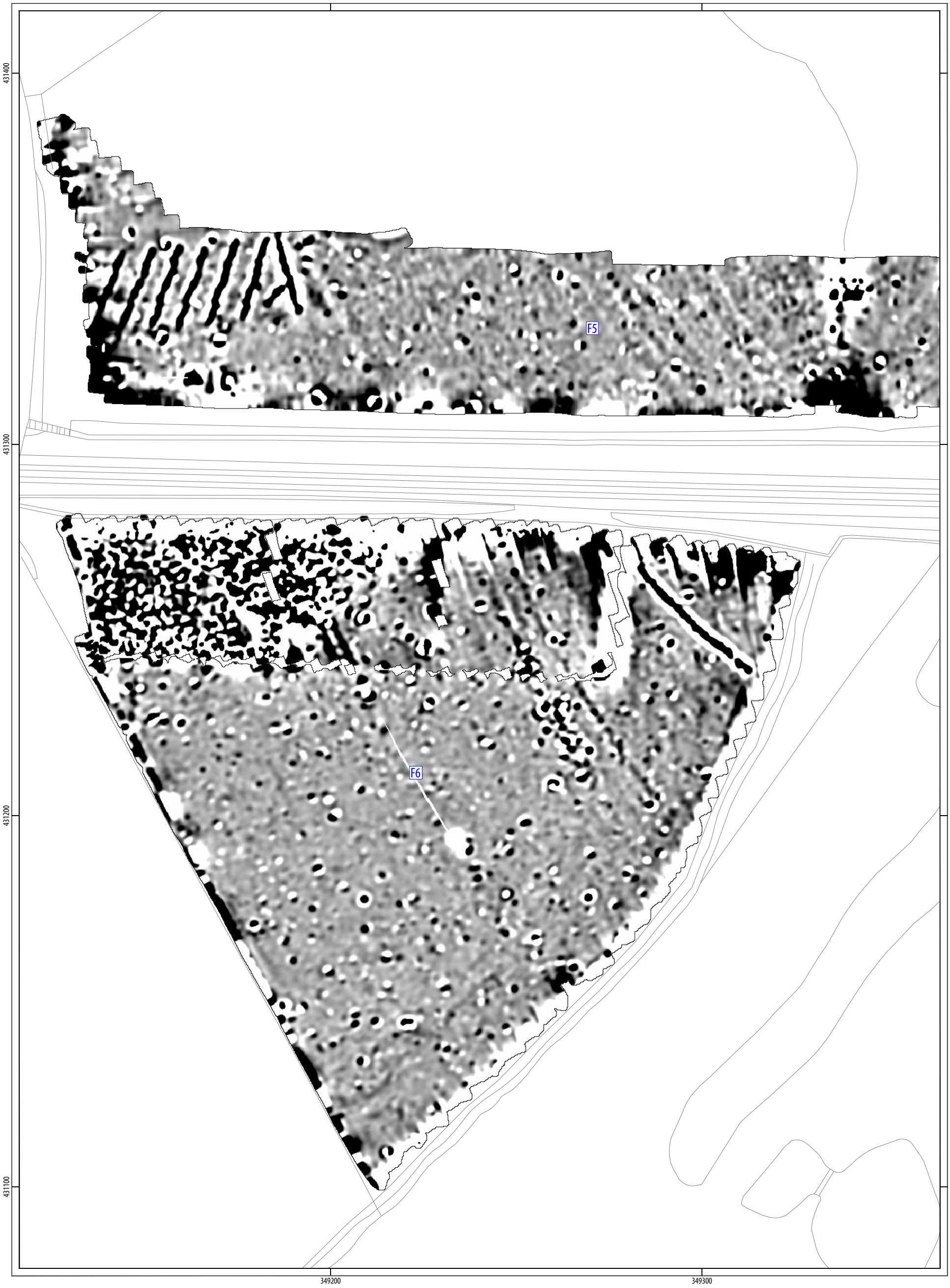
ILLUS 13 Interpretation of magnetometer data; Sector 2



nT
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2.0

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25m
1:1,000 @ A3

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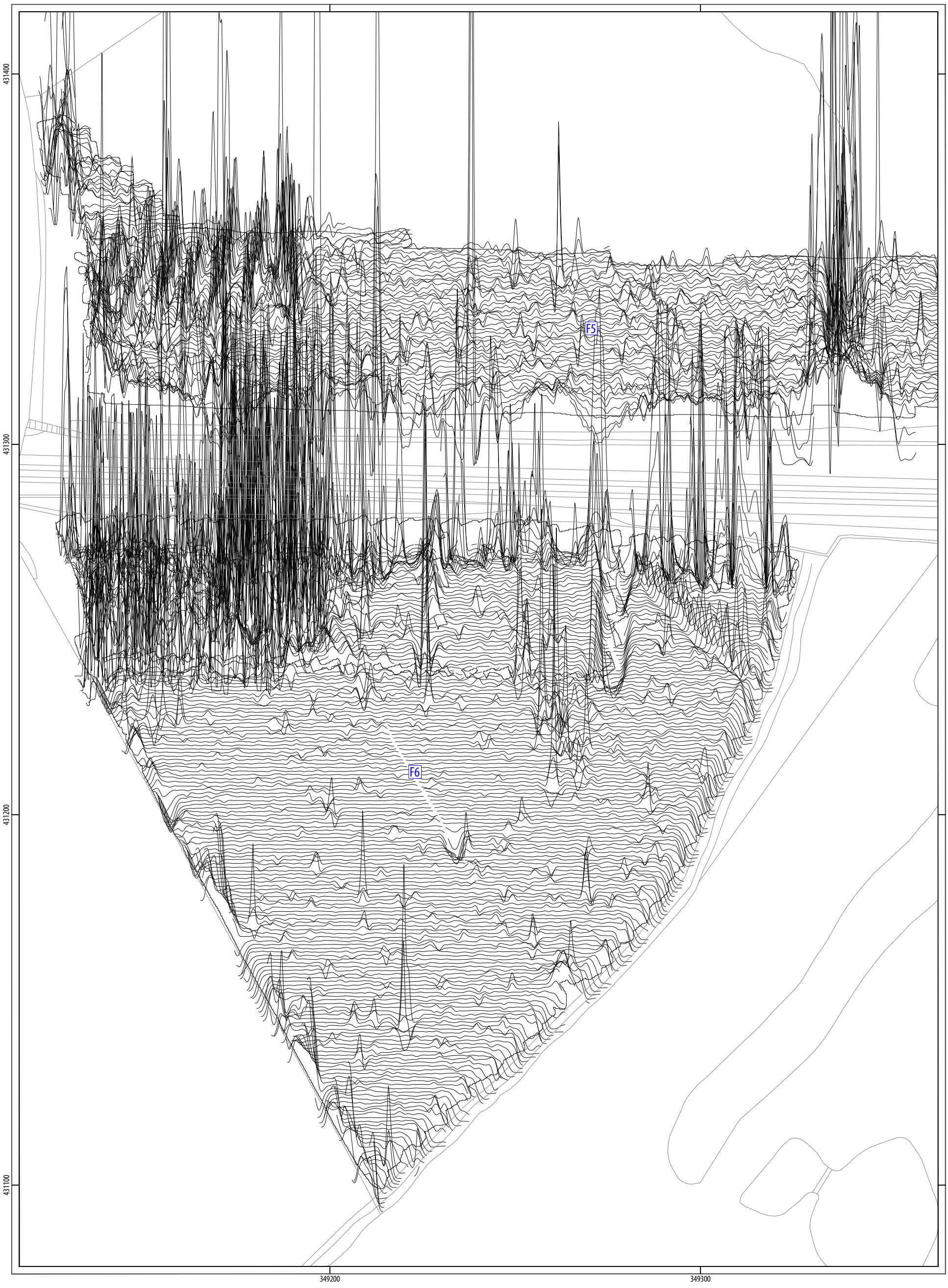
ILLUS 14 Processed greyscale magnetometer data; Sector 3



62.5nT/cm

0 25m

1:1,000 @ A3

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ILLUS 15 XY trace plot of minimally processed magnetometer data; Sector 3

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
linear trend	field drain
magnetic enhancement	kiln/burning

ABBREVIATIONS

K kiln

0 25m

1:1,000 @ A3

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ILLUS 16 Interpretation of magnetometer data; Sector 3

nT
-1.0
2.0

0
25m
1:1,000 @ A3

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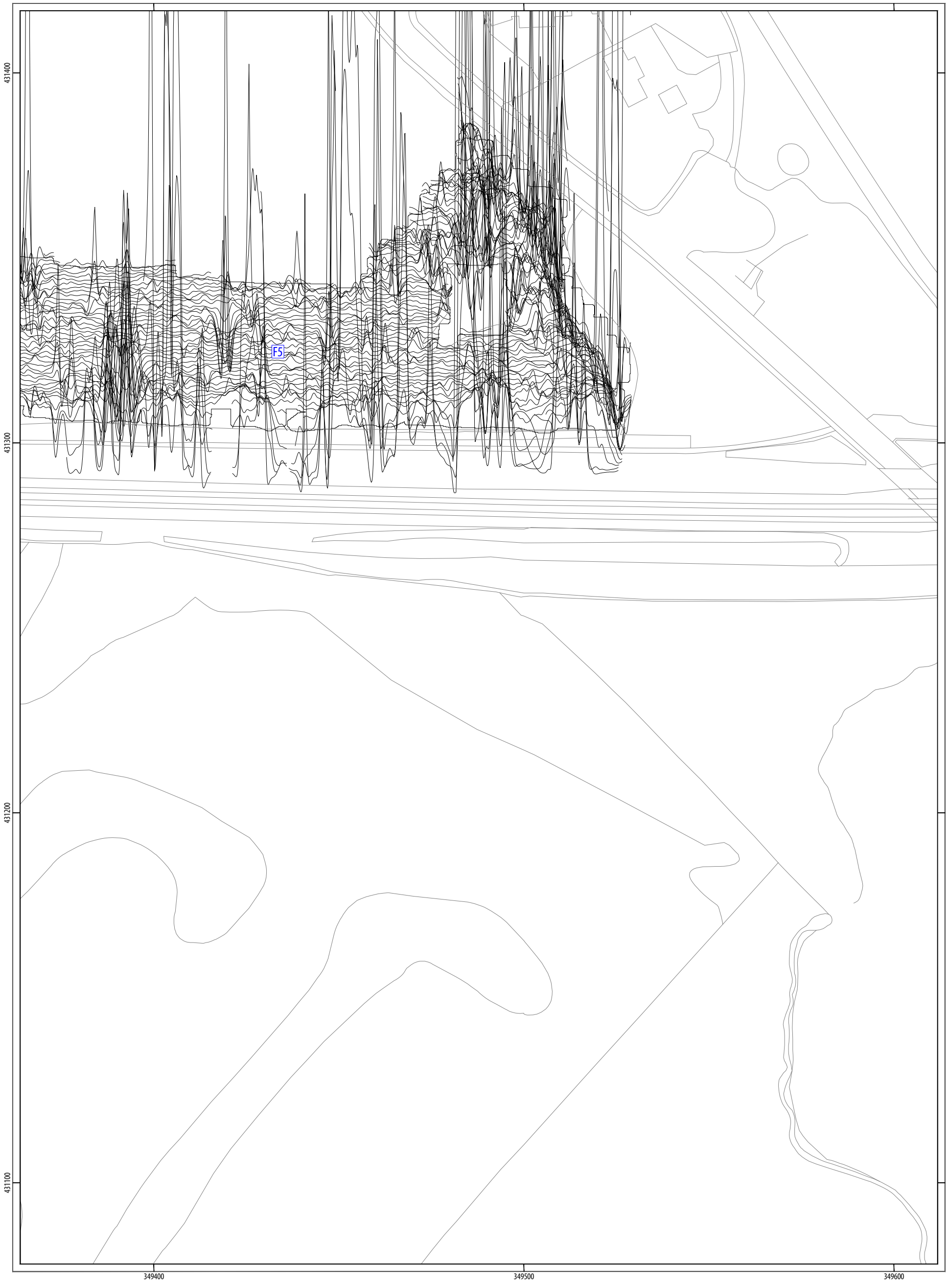
ILLUS 17 Processed greyscale magnetometer data; Sector 4



62.5nT/cm

0 25m

1:1,000 @ A3

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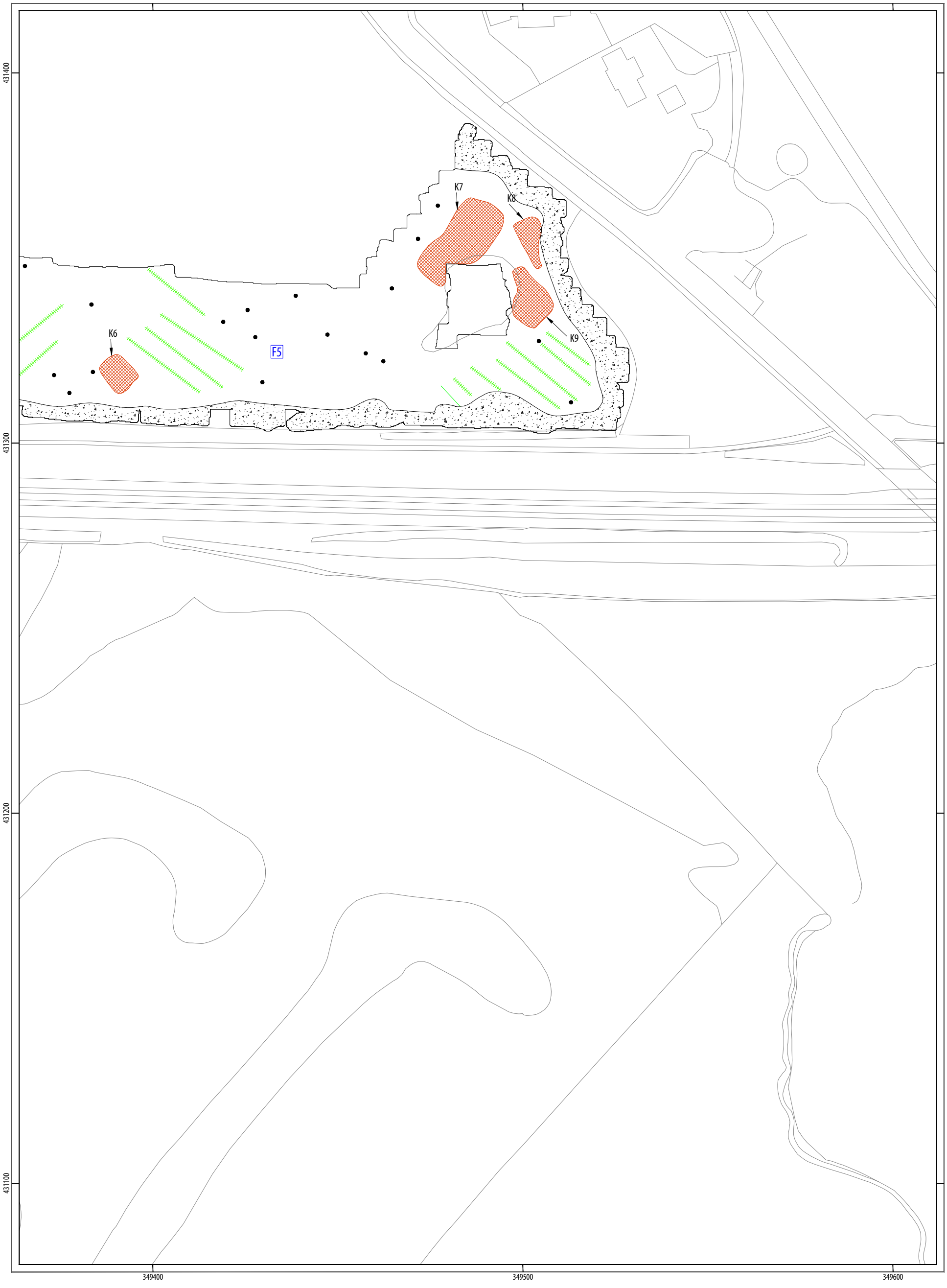
ILLUS 18 XY trace plot of minimally processed magnetometer data; Sector 4



TYPE OF ANOMALY | INTERPRETATION

- dipolar isolated — ferrous material
- magnetic disturbance — ferrous material
- linear trend — field drain
- magnetic enhancement — kiln/burning

ABBREVIATIONS

K kiln

0 25m

1:1,000 @ A3

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ILLUS 19 Interpretation of magnetometer data; Sector 4

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.

Lightning-induced remnant magnetisation (LIRM) LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical current 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.

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: headland5-417779

PROJECT DETAILS	
Project name	Cottam Parkway Railway Station
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering approximately 9 hectares on land at Cottam on the western periphery of Preston, where a new railway station and associated infrastructure is to be located. The results of the survey will help inform an Environmental Statement and may also inform future archaeological strategy at the site, if required. The survey has successfully evaluated the GSA and has identified ten anomalies which probably locate areas of burning caused by small-scale, localised, brick manufacture. These brick clamps would likely have used clay (marl) from the many marl pits in the immediate vicinity; another anomaly locates an example of such an infilled pit. These anomalies are assessed as of local historical interest. There is no evidence of the postulated Roman Road. No other anomalies of archaeological potential have been identified by the survey. The results are in line with the conclusions of a previous cultural heritage study.
Project dates	Start: 04-03-2021 End: 05-03-2021
Previous/future work	No / Not known
Any associated project reference codes	CPAL21 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 1 - Minimal cultivation
Monument type	None
Monument type	None
Significant Finds	None
Significant Finds	None
Methods & techniques	'Geophysical Survey'
Development type	Rail links/railway-related infrastructure (including Channel Tunnel)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology (other)	Sherwood Sandstone
Drift geology (other)	Diamicton
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	Lancashire Preston Preston Cottam parkway Railway Station
Postcode	PR4 0AB
Study area	9 Hectares
Site coordinates	SD 489040 314540 53.776692083932 -2.7754402535556 53 46 36 N 002 46 31 W Point
Height OD / Depth	Min: 17m Max: 21m
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	Consultant
Project design originator	Jacobs
Project director/manager	Alistair Webb
Project supervisor	Peter Heykoop
Type of sponsor/funding body	County Council

Name of sponsor/funding body	Lancashire County Council
PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	Headland Archaeology
Digital Contents	'none'
Digital Media available	'Geophysics'
Paper Archive Exists?	No
Entered by	alistair webb (alistair.webb@headlandarchaeology.com)
Entered on	21 March 2021

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