

BFSP21



BURCOT FARM SOLAR PLANT AND BATTERY STORAGE, ABINGDON ROAD, CLIFTON HAMPDEN, OXFORDSHIRE

GEOPHYSICAL SURVEY

PLANNING REF. PRE-APPLICATION

commissioned by Public Power Solutions Ltd

April 2021

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PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering approximately 78 hectares on land at Burcot, Oxfordshire, where a solar plant and battery storage site is being proposed. The survey extended across three fields and was undertaken to assess the impact of the proposed development on the historic environment with the results informing any future archaeological strategy at the site, if required.

The geophysical survey successfully evaluated the proposed development area (PDA) identifying two distinct, well defined and localised areas of archaeological activity in the southern half of the site. The first is a complex series of contiguous enclosures, ditches, pit-like features and other anomalies indicative of settlement activity, which was identified in the location of recorded Historic England National Mapping Programme (NMP) cropmark data and HER entries relating to Roman activity. The second was located approximately 120m to the west of this and comprised a single open-ended rectangular enclosure that was identified on a similar orientation.

Elsewhere a low density of remains comprising several linear, curvilinear and clusters of discrete high magnitude anomalies of uncertain origin have been identified in addition to varying patterns of ridge and furrow cultivation, former boundaries and broad anomalies that are likely to be natural in origin. A large number of magnetic spike anomalies across a majority of the survey area likely confirms the spreading of 'green waste' in recent times.

Based on these findings the two identified areas of archaeological activity in the southern half of the proposed development area are assessed as of very high archaeological potential with the rest of the site deemed of low-moderate potential.

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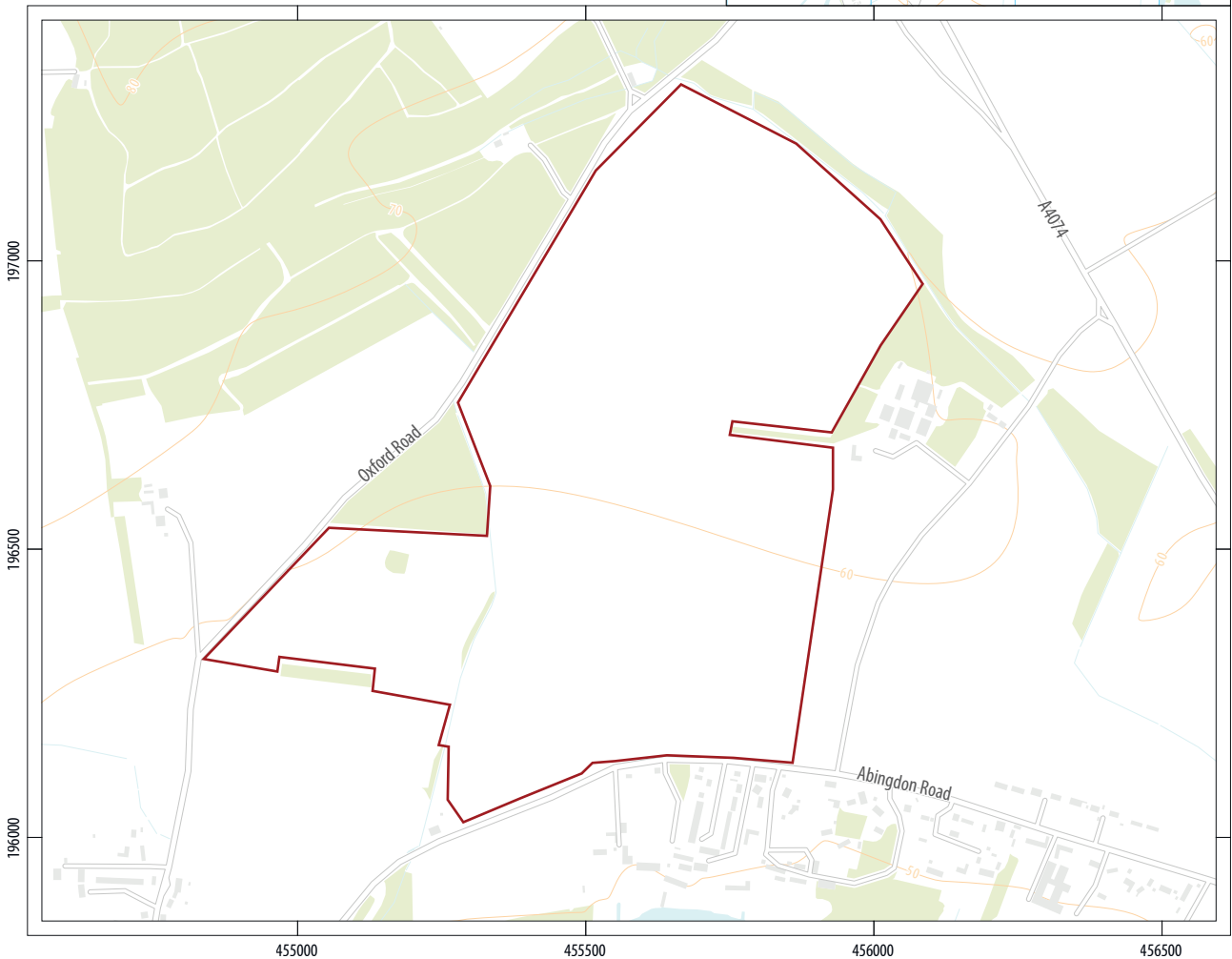
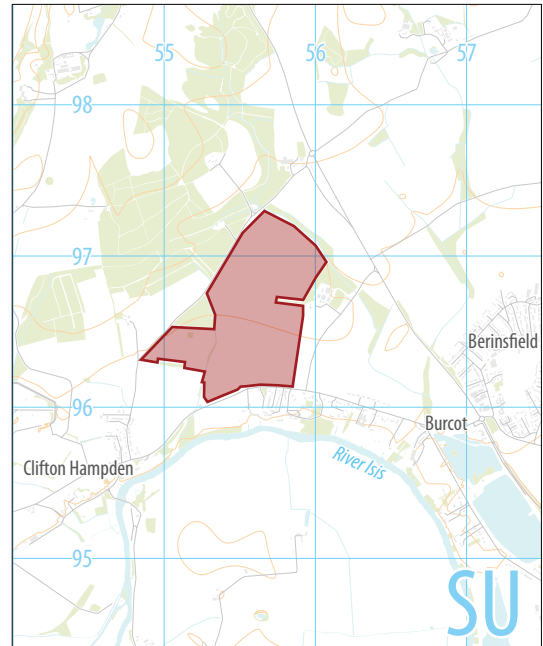
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Burcot Farm Solar Plant and Battery Storage
Abingdon Road
Clifton Hampden
Oxfordshire



0 200km
1:12,500,000 @ A4



0 250m
1:12,500 @ A4

 geophysical survey area

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BURCOT FARM SOLAR PLANT AND BATTERY STORAGE, ABINGDON ROAD, CLIFTON HAMPDEN, OXFORDSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Public Power Solutions Ltd (The Client) to undertake a geophysical (magnetometer) survey on land at Burcot Farm, Clifton Hampden, Oxfordshire where the site of a solar plant and battery storage is being proposed. The survey extended across three fields covering approximately 78 hectares (Illus 1).

The results of the survey will be submitted in support of a future planning application and will inform any future archaeological strategy at the site, if required. The survey was undertaken to assess the impact of the proposed development on the historic environment. It was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI; Headland Archaeology 2021), approved by Richard Oram Lead Archaeologist at Oxfordshire County Council, 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 surveys were carried out between February 18th 2021 and February 25th 2021.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises an irregularly shaped area of three fields immediately west of Burcot Farm, 1km north-east of Clifton Hampden and 1.5km west of Berinsfield, centred at NGR 455525 196515 (Illus 1). The survey area is bound to the south by the A415 and to the north-west by the B4015 (Oxford Road). At the time of survey all three fields contained young crops (Illus 2-4). The surrounding area is characterised by agricultural

land use with Clifton Heath woodland to the north-west. The River Thames lies approximately 300m to the south.

Topographically the PDA rises from south to north, from about 55m Above Ordnance Datum (AOD) along the southern PDA boundary to 64m AOD to the north.

1.2 GEOLOGY AND SOILS

The underlying bedrock geology comprises Lower Greensand Group (sandstone). There are no recorded superficial deposits over the majority of the PDA except for a small band of alluvium along the northernmost PDA boundary adjacent to a minor watercourse (UKRI 2021).

The prevailing soils are classified in the Soilscape 10 Association being characterised as freely draining slightly acid sandy soils (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

An Archaeological Desk-based Assessment (EDP in prep.) is in the process of being drafted, but data collated from the Oxfordshire Historic Environment Record (HER), including Historic England National Mapping Programme (NMP) cropmark data, shows that the PDA is located within a landscape of high archaeological potential (Illus 6). Within the PDA there are five records of previously identified or potential archaeological remains. These comprise a series of linear cropmark features (HER MOX6051) recorded in the north of the PDA, a possible later Prehistoric or Roman field system (MOX6093) to the east, the location of a possible Roman Villa (MOX6016) towards the



ILLUS 2 F1, looking west

south of the site, a possible enclosure and pit (MOX27829) and a find spot of Roman coins and pottery (MOX6024) in the south-east of the PDA.

Further evidence of archaeological activity in the vicinity of the PDA has been recorded by previous geophysical surveys to the west (HER Event ID EOX6399 – Headland Archaeology 2016 and EOX6778 Headland Archaeology 2020), a number of cropmark features to the south-west (MOX8715) and east (MOX6085) and individual findspots in Burcot.

Cartographic sources indicate the PDA has remained agricultural in nature since the late 19th century. Field boundaries aligned north/south and east/west in the northern half of F2 were established and subsequently removed over the course of the 20th century. A former brick works and associated structures are recorded on early 20th century mapping on the opposite side of Oxford Road in Clifton Heath woodland approximately 150m west of the northern part of the PDA.

Based on the findings within the PDA and wider area it was considered that there was a high potential for currently unknown archaeological remains to be present within the PDA.

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 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 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 PDA;
- › to obtain information that will contribute to an evaluation of the significance of the scheme upon cultural heritage assets; 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



ILLUS 3 F2, looking west

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 V3.0.36.0 (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 1:12,500. Illus 2–4 show typical ground conditions in each of the fields at the time of survey. The location of GPS swaths and a site location plan with Historic England NMP cropmark data are displayed at 1:6,000 in Illus 5 and Illus 6 respectively. Overall processed greyscale data, interpretation and interpretation overlain the Historic England

NMP cropmark data, are presented in Illus 7–9 inclusive at a scale of 1:6,000. Fully processed (greyscale) data, minimally processed data (XY trace plot) and interpretative plans are presented at a scale of 1:2,500, in Illus 10 to Illus 18 with the Areas of Archaeological Activity (AAAs – see below) presented at a scale of 1:1,000 in Illus 19 to Illus 27 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) will be included as Appendix 5 in the final version of this report.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (WSI; Headland Archaeology 2021), 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.



ILLUS 2 F3, looking south

4 RESULTS AND DISCUSSION

Ground conditions were generally very good throughout the PDA leading to a high standard of data acquisition requiring minimal processing. All suitable areas of the PDA were surveyed in full. Small areas in the north of F1 and south of F2 could not be surveyed due to tree cover.

The geology and soils across the PDA have generally proved receptive to magnetic prospection with a range of magnetically enhanced anomalies and archaeological features visible, particularly in the southern half of the PDA.

Some variation is evident across the site however with a more homogenous natural background recorded in F1, possibly due to overlying flood deposits from the adjacent watercourse and a more varied background containing a large number of discrete high magnitude and spike anomalies covering F2 and F3. Despite this 'noisier' magnetic background the survey results are thought to provide a reliable indication of the extent of any sub-surface features.

Two Areas of well-defined Archaeological Activity (AAA1 and AAA2 North/South; Illus 19–27) have been identified as localised within the southern half of F2 recording an area of settlement and enclosure extending approximately 470m south from Burcot Farm and 450m across the southern part of F2 and F3. The archaeological features present in these areas and other anomalies of possible archaeological origin recorded elsewhere in the PDA are discussed in detail below with comment on any relationships to cropmark data made where

appropriate. A general classification of anomalies based on their response type 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. In this instance the widespread distribution of magnetic spike anomalies across F2 and F3 is likely a result of the spreading of 'green waste' as soil conditioner mentioned by the landowner. The exact cause of the magnetic response is not fully understood but is thought to be generated by a combination of the presence of magnetic compounds in the soil created during decomposition processes and the presence of frequent ferrous contaminants within the waste material. The prevalence of these spike anomalies has not hindered the interpretation of the strongly magnetic anomalies associated with the AAAs (Illus 19–27) but has made the confident interpretation of more ephemeral and discrete anomalies elsewhere in the PDA more difficult. Nonetheless, the presence of this material has caused minimal issues with the processing and interpretation of the data and has not undermined confidence in the overall interpretation of the spread of archaeological remains and identification of concentrations of possible features.

Strongly magnetic linear dipolar anomalies (SP1; Sectors 2 and 3 Illus 13–18) extending east-west across the southern part of F2 to the southern boundary of F3 are caused by buried parallel service pipes or cables.

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

4.2 AGRICULTURAL ANOMALIES

Varying patterns of elongated, slightly curving and parallel, low magnitude anomalies are typical of different regimes of ridge and furrow cultivation. The anomaly response is caused by the magnetic contrast between the soil infilling the furrows and former ridges. These anomalies are evident to varying degrees in all three fields. The often low magnitude responses are likely a combination of poor preservation and weak magnetic properties of the soils generating limited contrast needed to identify the feature.

Five former boundaries FB1–FB4 (Sector 1; Illus 10–12), FB5 (Sector 2; Illus 13–15) and FB1 and FB6 (Sector 3; Illus 16–18) which have been removed since the publication of the first edition OS mapping of the area are identifiable as linear anomalies of varying strengths in the survey data. Other field boundaries oriented east/west across the northern and central parts of F2 depicted on historic mapping are not evident in the survey data.

Elongated, sinuous and parallel, low magnitude anomalies, aligned parallel with the surrounding field boundaries, are typical effects of modern cultivation. Examples of these are present along the headland in all three fields.

4.3 GEOLOGICAL ANOMALIES

Broad, high magnitude, sinuous anomalies in F1 and in western and north-western parts of F2 are interpreted as natural in origin and may be due to the deposition of flood material from nearby watercourses. A similar cause is probable for isolated clusters of high magnitude discrete anomalies in these locations for which no discernible pattern is evident.

Occasional and sporadic discrete low magnitude anomalies visible throughout the PDA, but predominantly in F2 and F3, are likely due to localised variations in the depth and composition of the topsoil and are not thought to be of any archaeological potential.

4.4 POSSIBLE ARCHAEOLOGY

Outside of the AAAs located in localised parts in the southern half of the PDA, there are no geophysical responses indicative of a definite archaeological origin although there are several anomalies of uncertain origin, which may be of archaeological potential and these are described below.

A cluster of discrete high magnitude, pit-like responses (P1; Sector 1 Illus 10–12) next to low magnitude, ephemeral parallel linear anomalies (L1 and L2; Illus 10–12) in the central northern part of F2. Though located approximately 120m further north these responses

may be associated with undated linear cropmark features recorded in the HER (MOX6051). The isolated nature of these anomalies recorded in an area where the magnetic background is more variable restricts any greater degree of interpretation.

Towards the north-east part of F2 are further discrete high magnitude anomalies of possible archaeological origin. An isolated pit-like anomaly (P2; Illus 10–12) stands out against the magnetic background and away from previously identified deposits of likely natural origin close to the former boundary, FB1. There is little archaeological context to support a definite archaeological interpretation for this isolated anomaly (which is highlighted based on the character and strength of response), except for its location relatively near other similar anomalies (P1–P3 and L1–L3; Illus 10–12). A natural origin is equally plausible.

Three low magnitude linear and curvilinear response, possibly ditches, are identified within close proximity to each other at L3 (Illus 10–12). Barely discernible from the natural magnetic background these responses have primarily been highlighted as possibly archaeological in origin based on their proximity to each other and subtly elevated magnetic properties although an agricultural origin cannot be dismissed.

A cluster of strongly magnetic and discrete high magnitude anomalies (P3; Illus 10–12) are recorded close to the north-east corner of the PDA where former boundaries FB3 and FB4 are depicted joining on the 1877 OS County Series map of Oxfordshire. The strength of response from these anomalies and location in the corner of a field close to Burcot Farm suggest they may relate to agricultural activity or areas of burning.

In the very north-east corner of F1 (Sector 2) are a further group of discrete high magnitude pit-like responses (P4; Illus 13–15). These anomalies remain only subtly different from similarly strong responses likely resulting from natural flooding deposits visible elsewhere in F1 and F2 adjacent to the watercourse. It remains plausible these anomalies are similarly natural in origin but have been identified as possible archaeology given their proximity to other linear (L4) and curvilinear (RD1) responses nearby which have also been interpreted as potentially archaeological.

Parallel to the watercourse marking the eastern boundary of F1 is a curving linear anomaly (L4; Illus 13–15). The regular nature of this anomaly suggests a ditch feature possibly marking the partial extent of an enclosure approximately 190m long which may be associated with further linear anomalies L5 and L6 at its southern extent.

A possible ring ditch (RD?1; Illus 13–15) approximately 20m in diameter is tentatively interpreted in the north-east corner of F1. Almost imperceptible from the magnetically 'quiet' background the circular appearance of a separate anomaly may simply be a distortion of the ridge and furrow and arrangement of weakly magnetic discrete anomalies in this area and not a separate anomaly. Its setting within the corner of L4 and proximity to pit-like anomalies (P4) however adds some weight to its identification as a separate anomaly, although alternative explanations cannot be entirely ruled out.

A weakly magnetic linear anomaly (L5; Illus 13–15) identified as part of a series of linear anomalies (L4–L6), likely ditches, in the eastern half of F1 is partially recorded as one of the sides to the small enclosure identified in the NMP data as MOX27829. There is no indication in the magnetic data that this linear anomaly forms part of a rectilinear enclosure and pit indicated by the cropmark data at this location. L5 is more likely associated with the parallel linear, L4, or ridge and furrow cultivation running perpendicular to the north.

Extending north-east from the western boundary of F2 is a series of parallel linear anomalies of varying strengths (L7–L9; Illus 13–18). L7 is the most distinct of these anomalies, arranged in an 'L' shape with a clear high magnitude anomaly set inside the angle of the linear anomalies. Anomalies at L8 and L9 appear as more regular ditch-like features possibly relating to drainage given the location adjacent the watercourse to the west.

4.5 AREAS OF ARCHAEOLOGICAL ACTIVITY

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. Whilst there is confidence in the identification of the concentration of possible settlement remains and the interpretation of the larger anomalies, taking into consideration the variable magnetic background and the presence of 'green waste', some of the anomalies interpreted as pits may in fact be of geological or other non-archaeological origin. For this reason, most of the discrete anomalies surrounding the areas of archaeological activity have been ascribed a possible archaeological origin except where the responses are particularly broad or high in magnitude, interpreted as of non-archaeological origin.

AAA1 (Illus 21 to 23)

Oriented north-north-east/south-south-west is a rectilinear enclosure (E1) with possible entrances to the north and south measuring approximately 115m x 80m located towards the south-west corner of F2. There are few distinguishable anomalies within the enclosure itself except for indeterminate high magnitude responses (P5–P7) located towards the northern corners and central southern extent of the enclosure. The low magnitude response from these anomalies possibly identifies pit-like features.

The most conspicuous discrete high magnitude anomalies, possibly pit-like responses immediately surrounding the enclosure, are identified though there appears to be no pattern to their distribution. A cluster of strongly magnetic anomalies (Q1), possibly the response from infilled areas of former localised quarrying lay immediately outside the enclosure to the west.

Other anomalies within AA1 include parallel linear anomalies (L6) extending north-west towards F1 located approximately 60m to the south-west of E1 and a former boundary (FB6) which surrounds the enclosure (E1). There are no recorded HER entries or cropmarks recorded in the NMP data in the area delineated by AAA1.

AAA2 North (Illus 22 to 24)

This area, south-west of Burcot Farm in the northern part of F3 and adjacent to the area of F2, marks the northern extent of the system of enclosure and settlement activity within AAA2. Archaeological features identified within AAA2 extend for approximately 470m south of Burcot Farm and 250m across the southern parts of F2 and F3 between the eastern boundary of the PDA and former boundary FB6.

The arrangement of enclosures in this location appears to be in two directions, almost split by the former boundary (FB1). Those enclosures to the west of this boundary extend southwards oriented north-north-east/south-south-west remaining almost parallel to the boundary. It is in this location where there is good correlation between the survey results and NMP cropmark data and an HER reference to a possible later Prehistoric or Roman field system (MOX6093) (Illus 9).

East of the boundary FB1, heading towards the eastern extent of the survey area are a series of curving parallel enclosures oriented roughly east/west. Within one of the first sub-divisions of this string of enclosures to the west is a strongly magnetic anomaly (K1) indicative of a kiln or area of burning. Towards the eastern extent of these contiguous enclosures is a three-sided partial enclosure (E2) on a separate alignment roughly north-east/south-west. This enclosure measures approximately 70m in diameter and is positioned immediately north of two curvilinear anomalies, interpreted as possible ring ditches (RD1), the westernmost of which measures 13m in diameter.

AAA2 South (Illus 25 to 27)

Towards the south-east corner of the PDA spread across F2 and F3 are an agglomeration of contiguous enclosures oriented north-north-east/south-south-west and a continuation of settlement features identified in AAA2 North. The concentration of ditches, pits, strongly magnetic anomalies indicative of kilns or areas of burning (K2 and K3) and other high magnitude responses suggestive of localised quarrying (Q2 and Q3) are all indicative of further settlement activity in this location.

Two groupings of settlement features are identifiable either side of the current field boundary (an extension of FB1) separating F2 and F3. There is limited evidence for the continuation of linear anomalies across the boundary despite the settlement features either side being on the same alignment.

Those enclosures and settlement features to the west of the field boundary occur in the recorded location of a possible Roman villa (MOX6016) recorded in the HER and the settlement activity mapped east of the boundary lies immediately north-west of a find spot of Roman coins and pottery (MOX6024).

5 CONCLUSION

The geophysical survey has successfully evaluated the proposed development area, augmenting the Oxfordshire HER records with the identification of two distinct, localised and well-defined areas

of archaeological activity. Despite the presence of widespread magnetic spike anomalies, likely a result of the spreading of 'green waste', the plan and extent of concentrated settlement activity in the south-east corner of the PDA is clearly discernible.

A rectangular enclosure with possible entrances and evidence for localised quarrying lay approximately 120m west of a complex series of contiguous enclosures, ditches and pit-like features indicative of settlement activity. Amongst these features which generally correlate to NMP cropmark data are further magnetic anomalies indicative of quarrying and anomalies likely resulting from kilns or areas of burning. This dense concentration of archaeological activity coincides with HER records of a possible Roman villa, field system and findspot of Roman coins and pottery.

In the wider site, a low density of several linear, curvilinear and clusters of discrete high magnitude anomalies of uncertain origin have been identified in addition to varying patterns of ridge and furrow cultivation, former boundaries and broad anomalies likely natural in origin.

Based on these findings the two identified well-defined and localised areas of archaeological activity in the southern half of the proposed development area are assessed as of very high archaeological potential with the rest of the site (comprising the majority of the PDA) deemed of low-moderate potential.

6 REFERENCES

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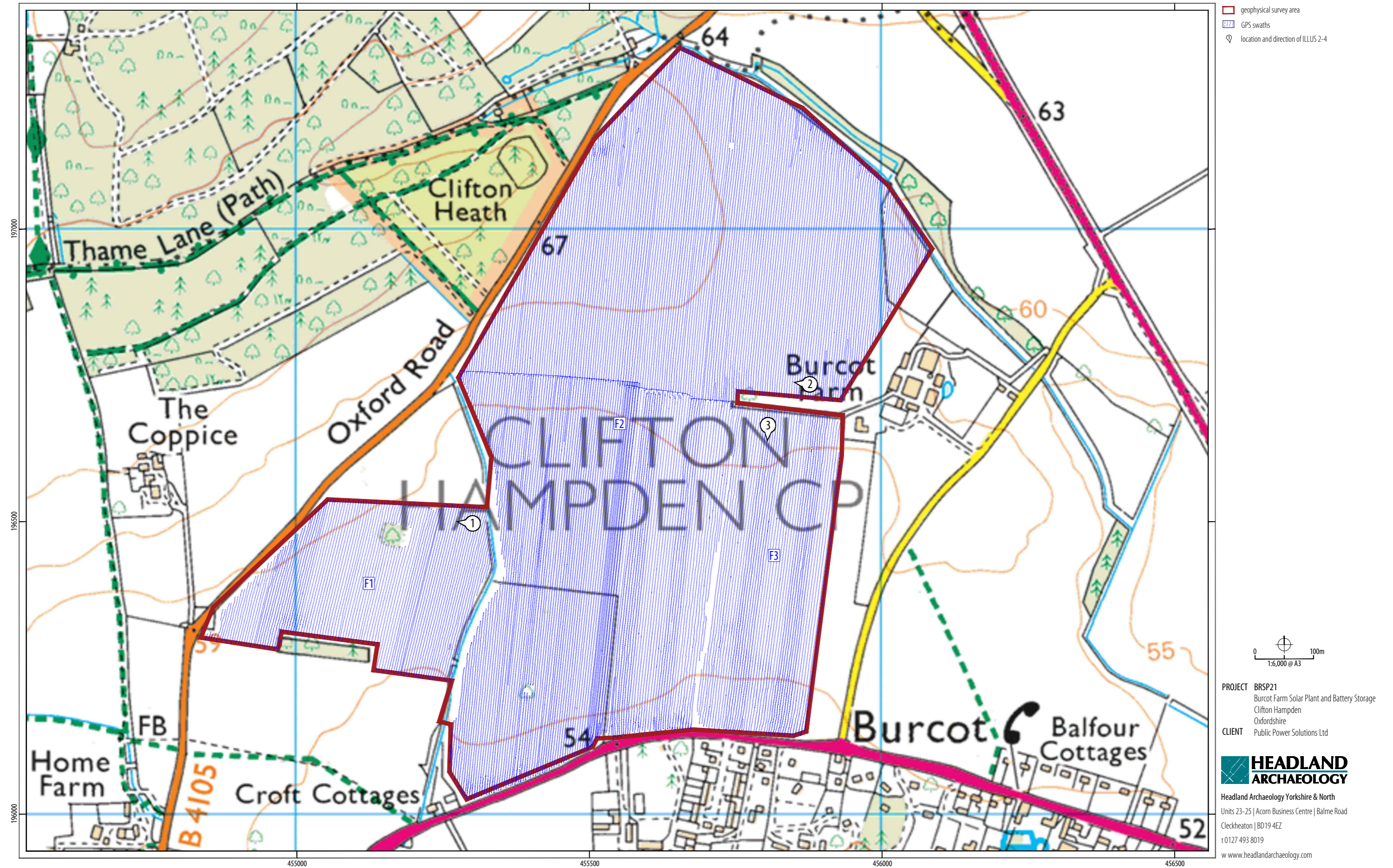
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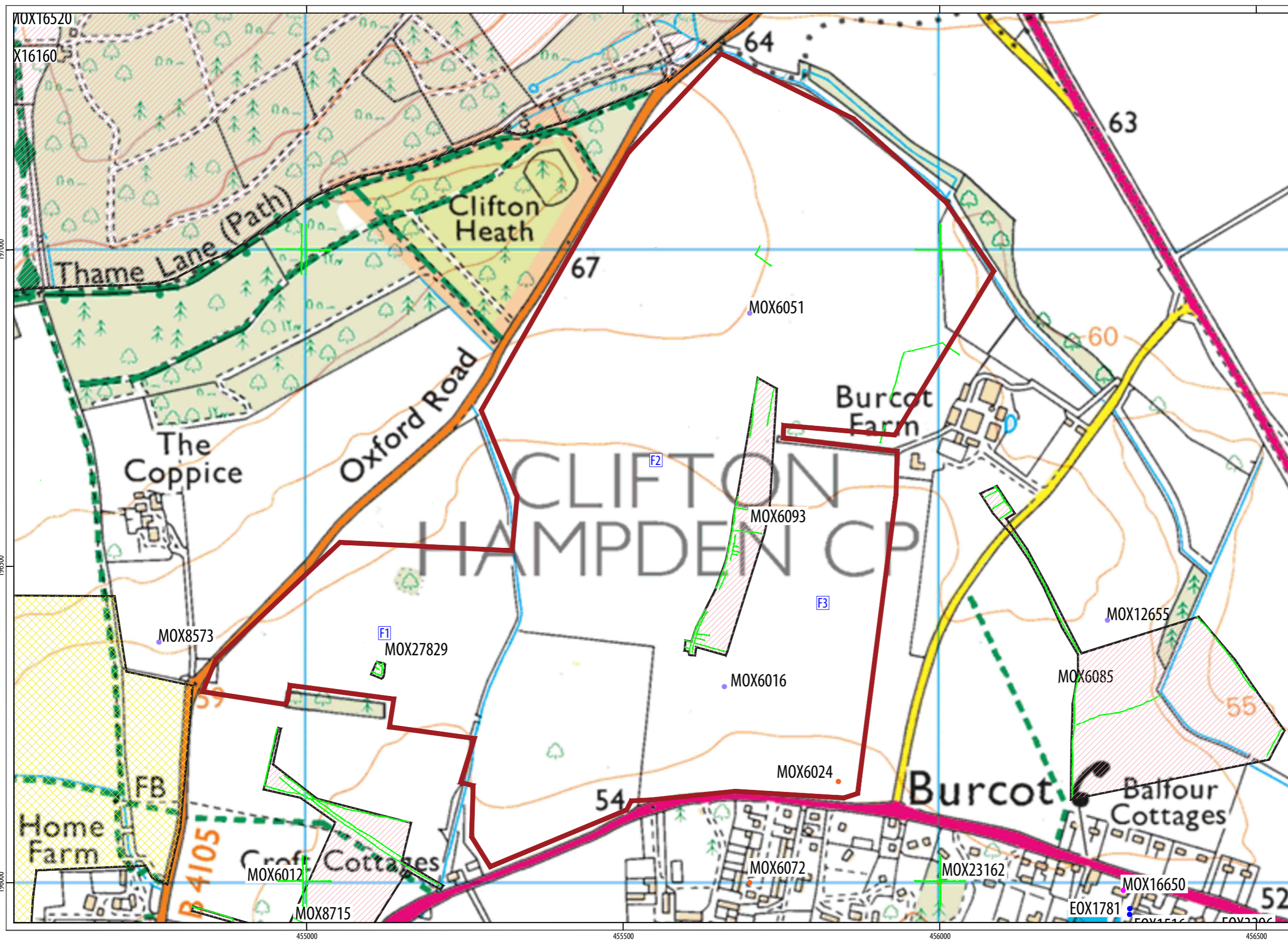
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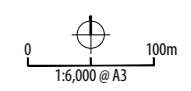
Natural Environment Research Council (UKRI) 2021 *British Geological Survey* <http://www.bgs.ac.uk/> accessed 9th March 2021



ILLUS 5 Survey location showing GPS swaths and photo locations (1:6,000)



- geophysical survey area
- HER record of geophysical survey
- HER cropmark polygon
- HER monument
- HER findspot
- HER event
- HER building
- + NMP Cropmark (Historic England)



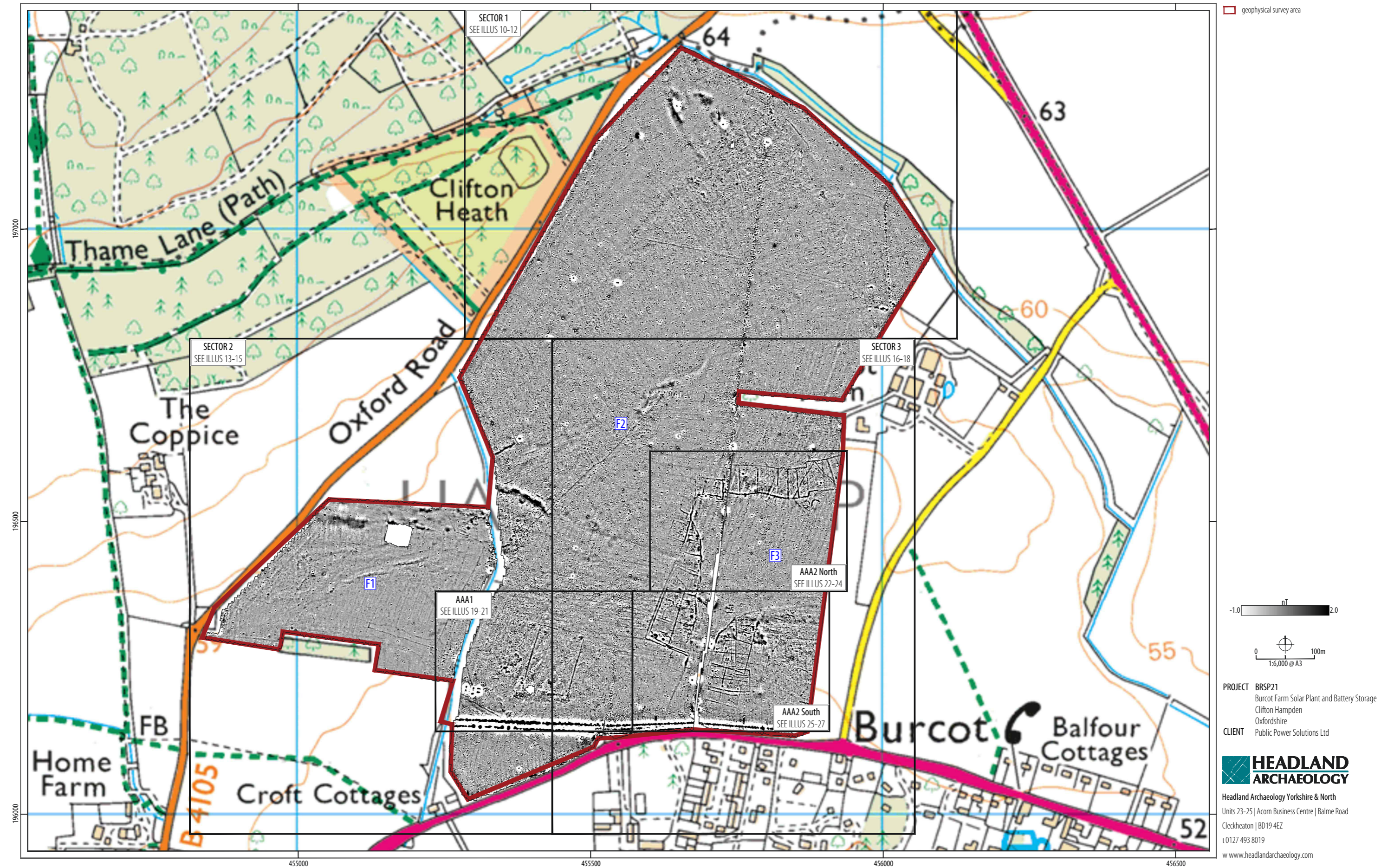
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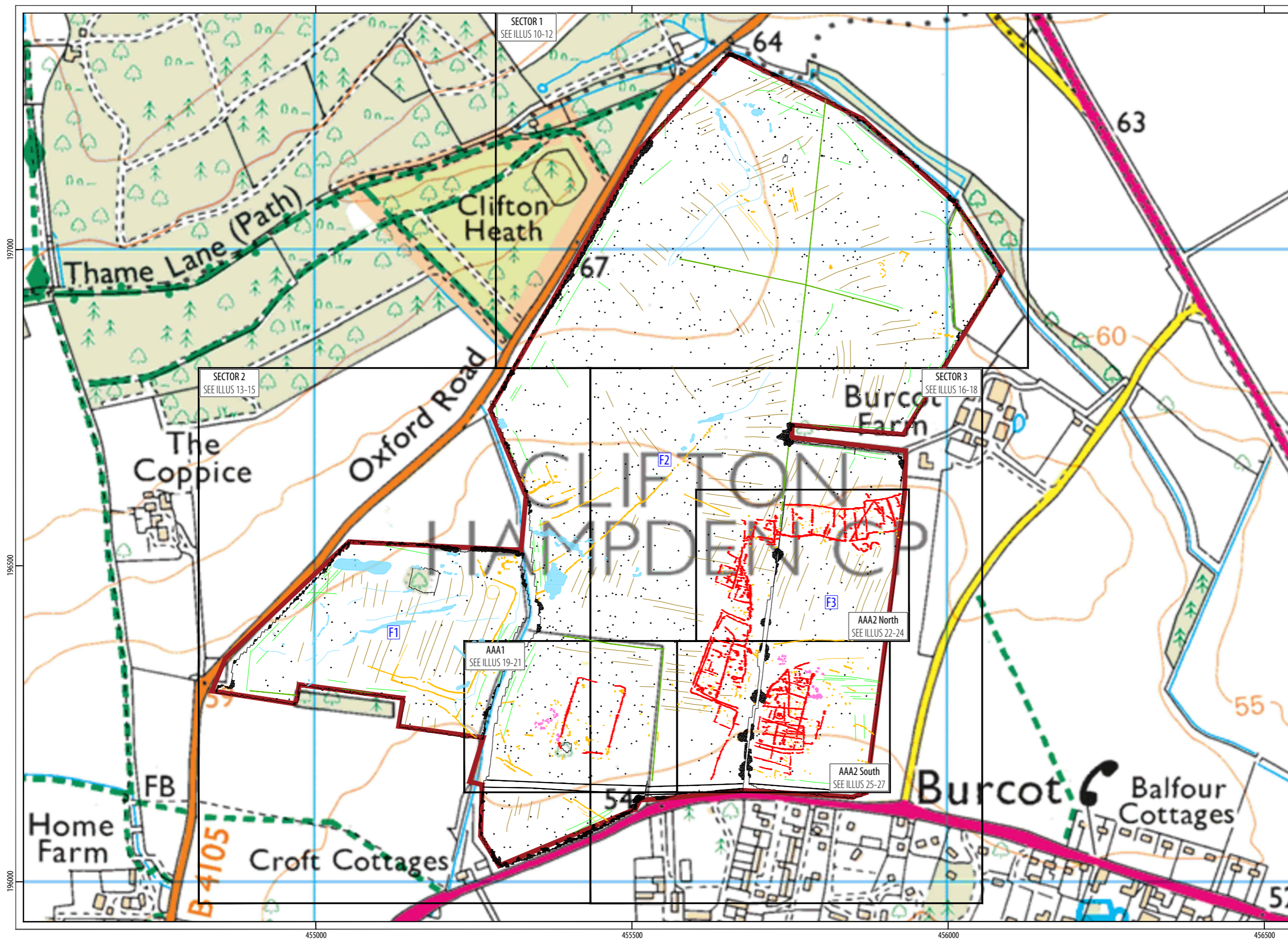


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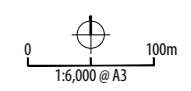
ILLUS 6 Survey location showing Historic England NMP cropmark data (1:6,000)



ILLUS 7 Overall greyscale plot of processed magnetometer data (1:6000)



TYPE OF ANOMALY	INTERPRETATION
• dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
— dipolar linear	service pipe
○ null value	overhead cables
⊗ magnetic xxxxxxxx	quarrying
⊙ magnetic disturbance	former building
⊕ magnetic enhancement	LIRM
— linear trend	ridge and furrow
— linear trend	agricultural
— linear trend	field drain
— linear	former field boundary
— linear	former field boundary?
— linear trend	geological variation
⊕ magnetic enhancement	geology
— linear trend	archaeology?
⊗ magnetic enhancement	archaeology?
⊙ magnetic enhancement	kiln/burning
● magnetic enhancement	archaeology



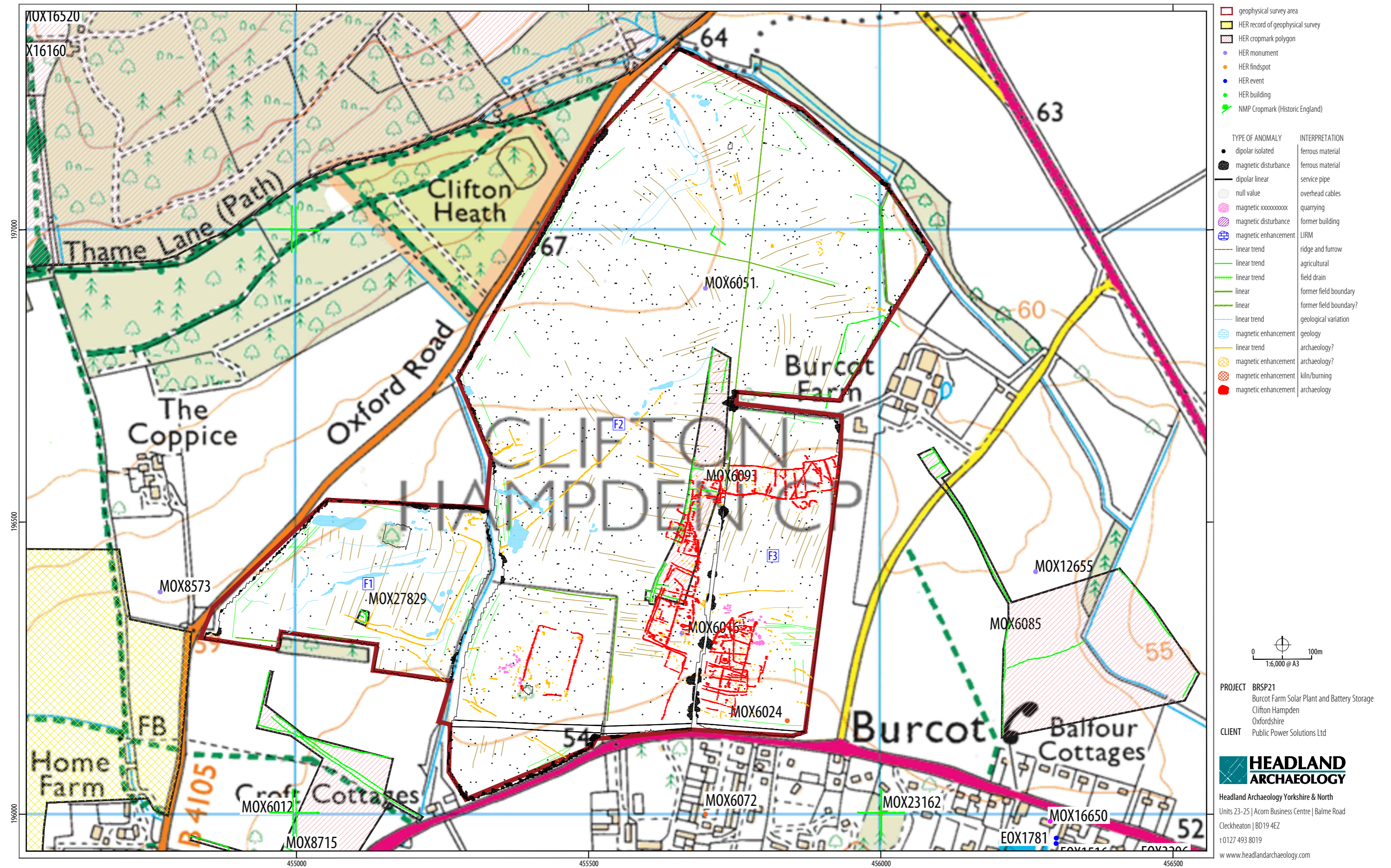
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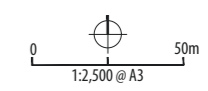
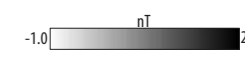
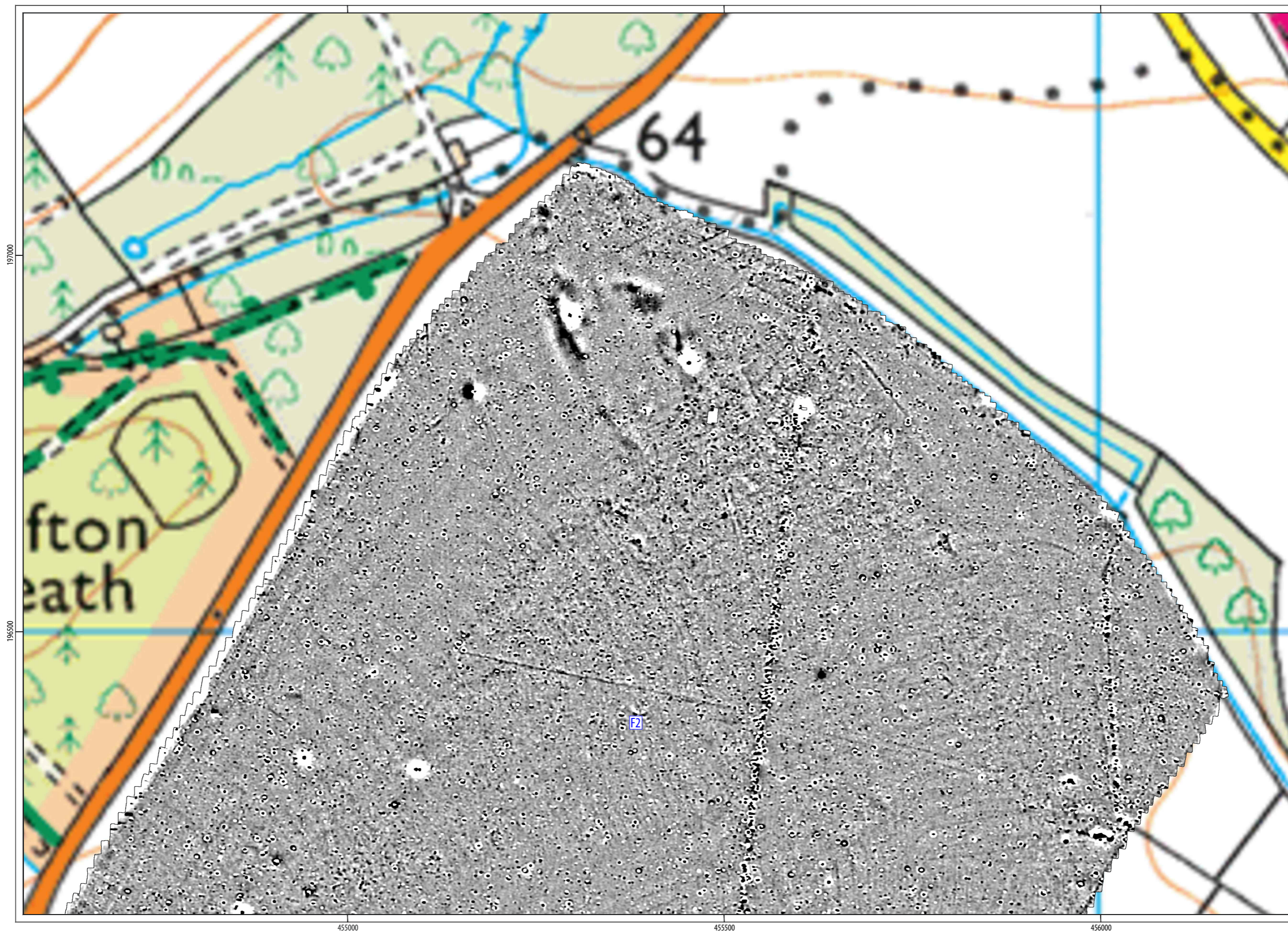
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ILLUS 8 Overall interpretation of magnetometer data (1:6000)



ILLUS 9 Overall interpretation of magnetometer data showing Historic England NMP cropmark data (1:6000)

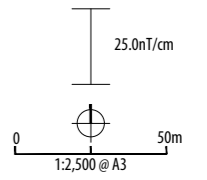
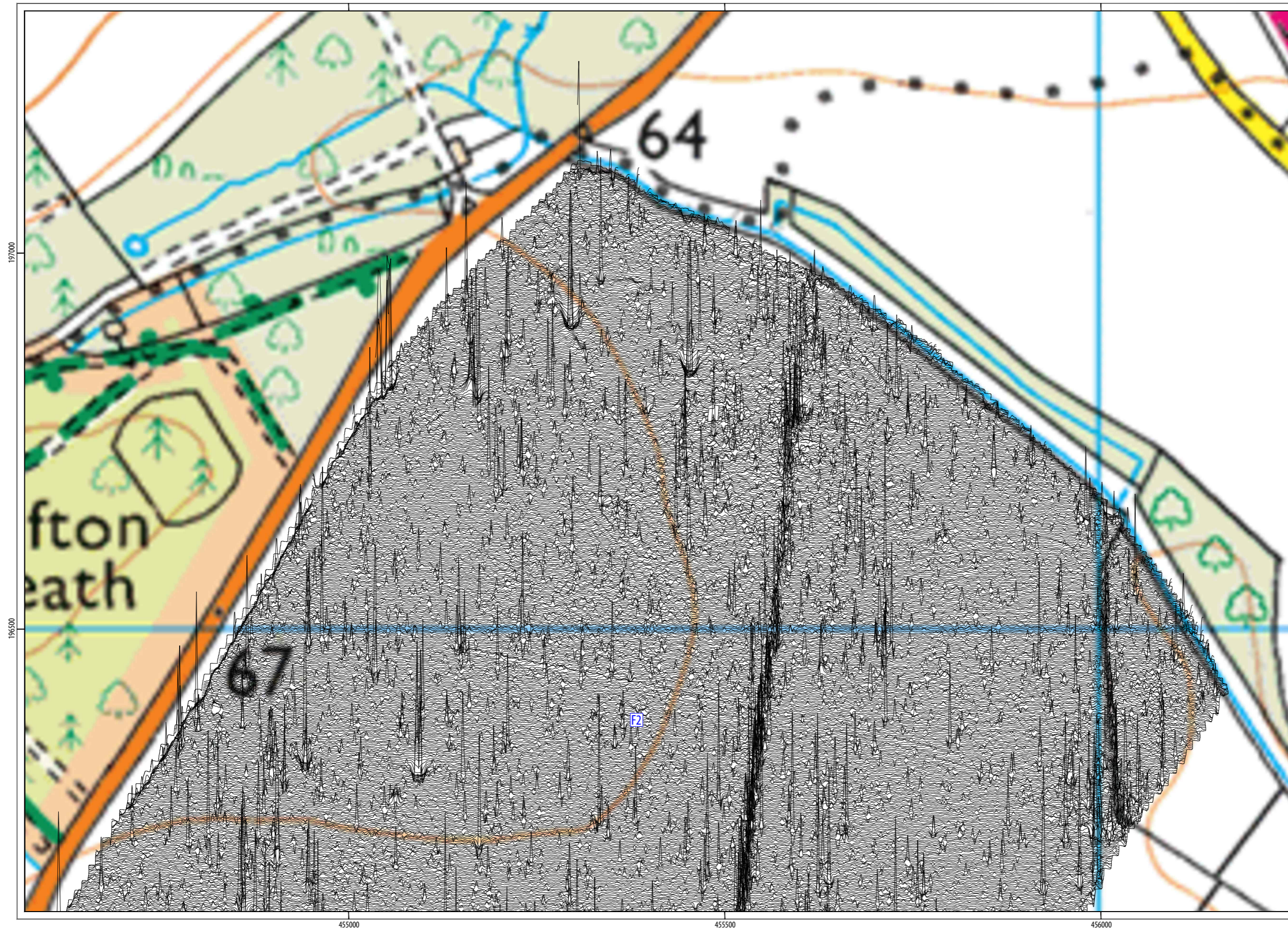


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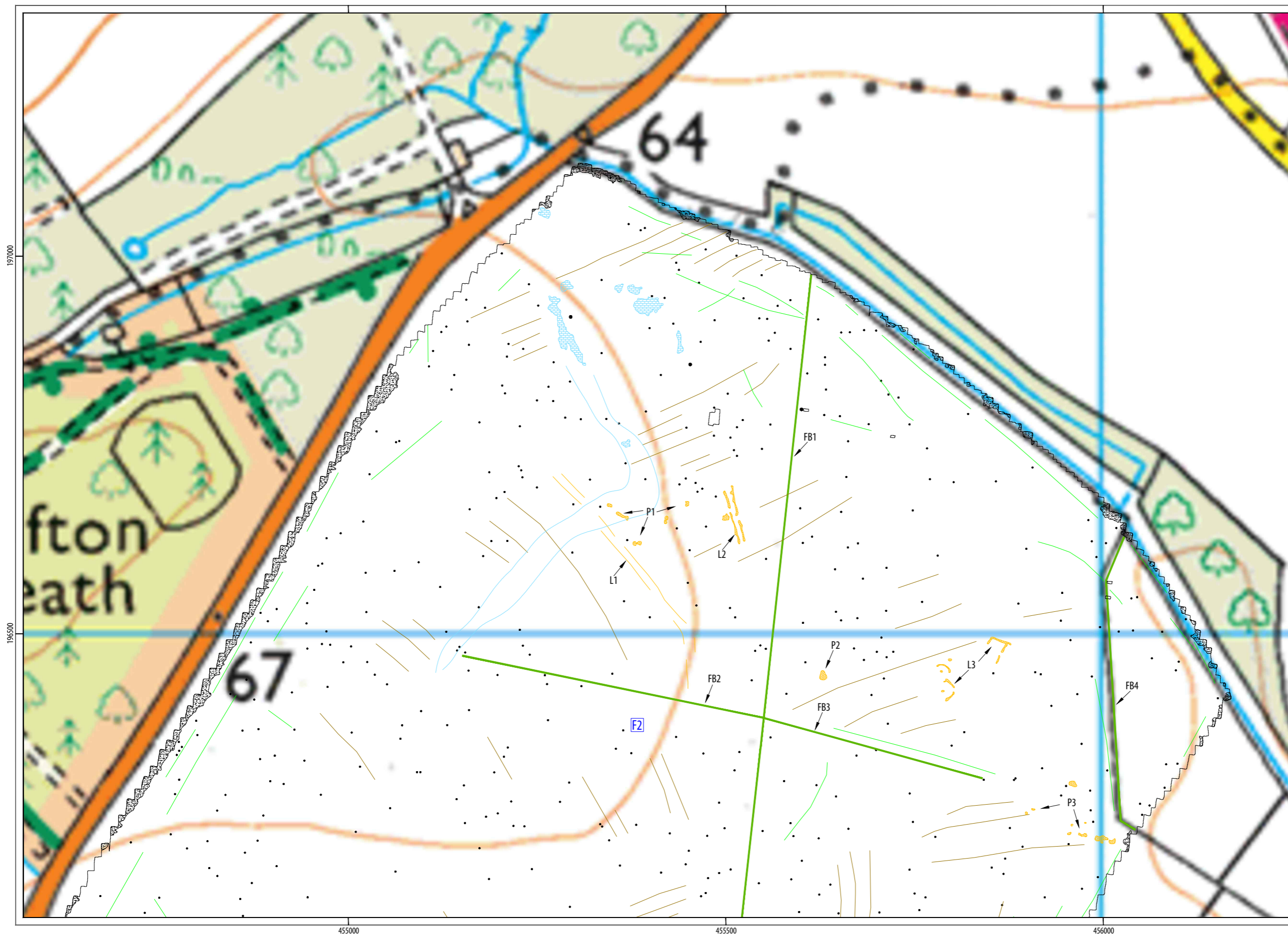
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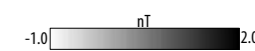


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ILLUS 11 XY trace plot of minimally processed magnetometer data; Sector 1 (1:2,500)



TYPE OF ANOMALY	INTERPRETATION
• dipolar isolated	ferrous material
• magnetic disturbance	ferrous material
— dipolar linear	service pipe
— null value	overhead cables
• magnetic xxxxxxxx	quarrying
• magnetic disturbance	former building
• magnetic enhancement	LIRM
— linear trend	ridge and furrow
— linear trend	agricultural
— linear trend	field drain
— linear	former field boundary
— linear	former field boundary?
— linear trend	geological variation
• magnetic enhancement	geology
— linear trend	archaeology?
• magnetic enhancement	archaeology?
• magnetic enhancement	kiln/burning
• magnetic enhancement	archaeology

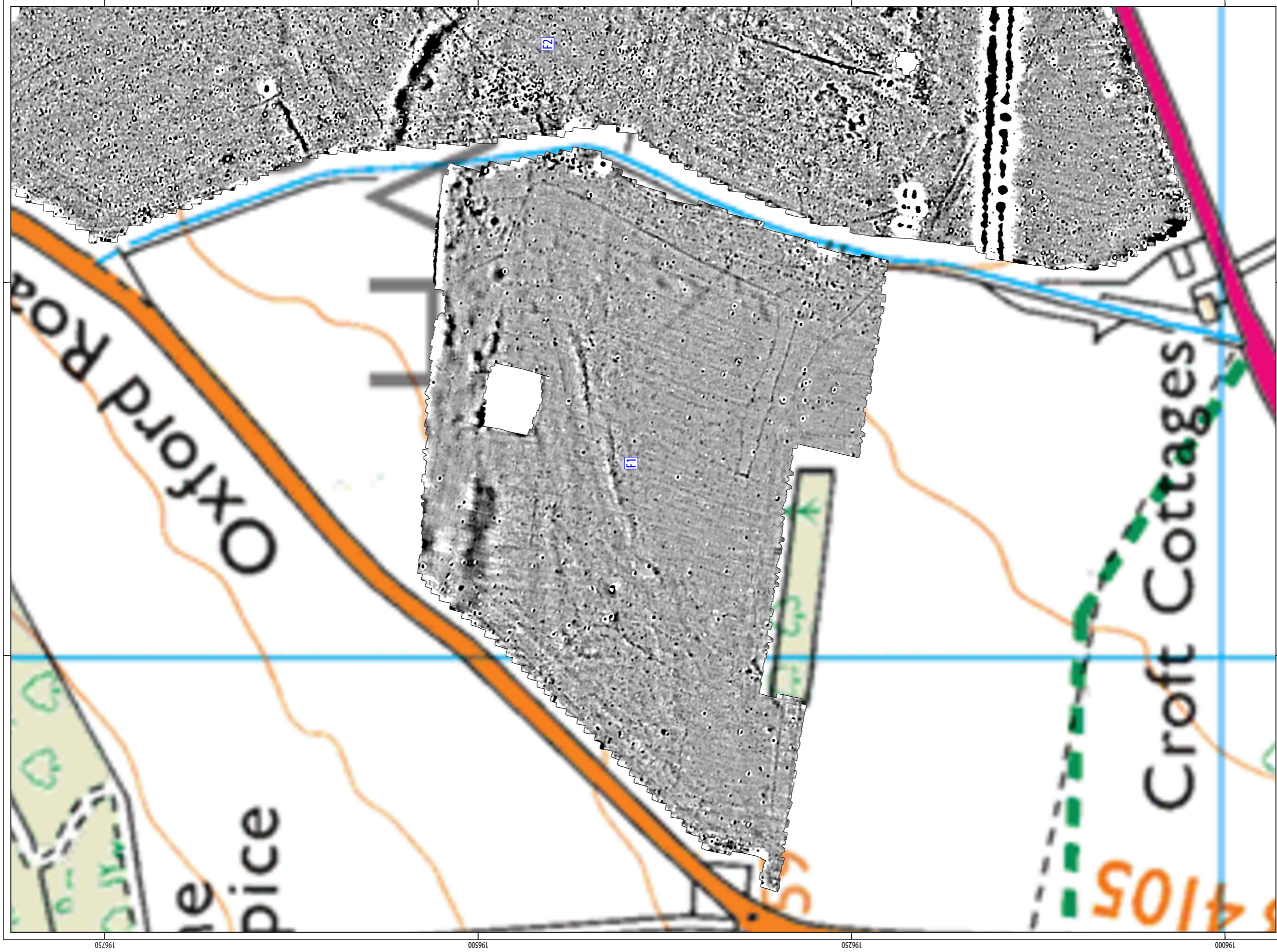


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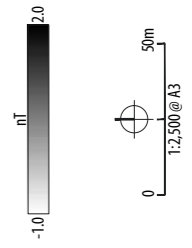
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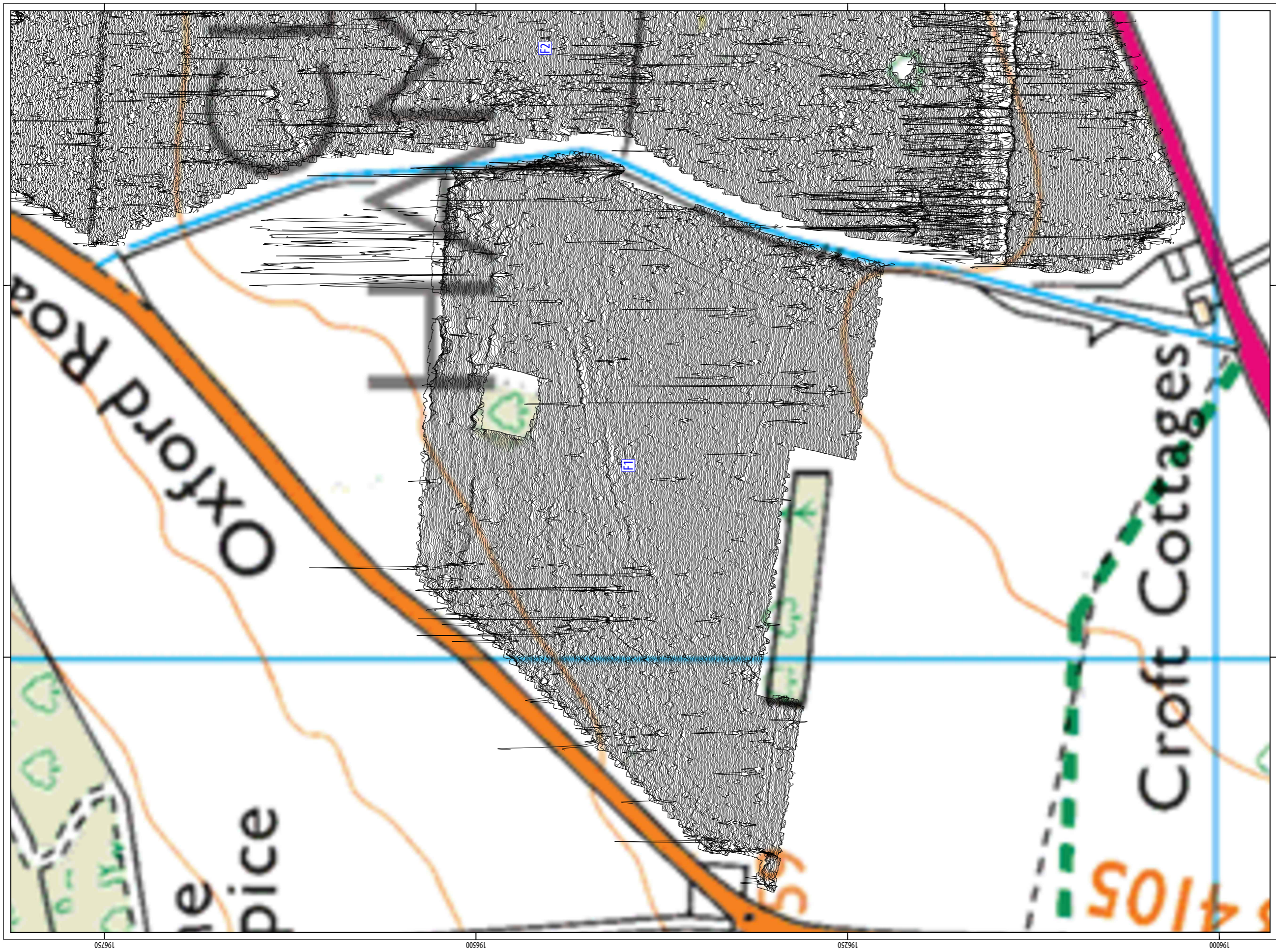
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ILLUS 13 Processed greyscale magnetometer data; Sector 2 (1:2,500)



45250

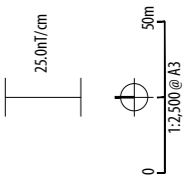
45500

196750

196500

196250

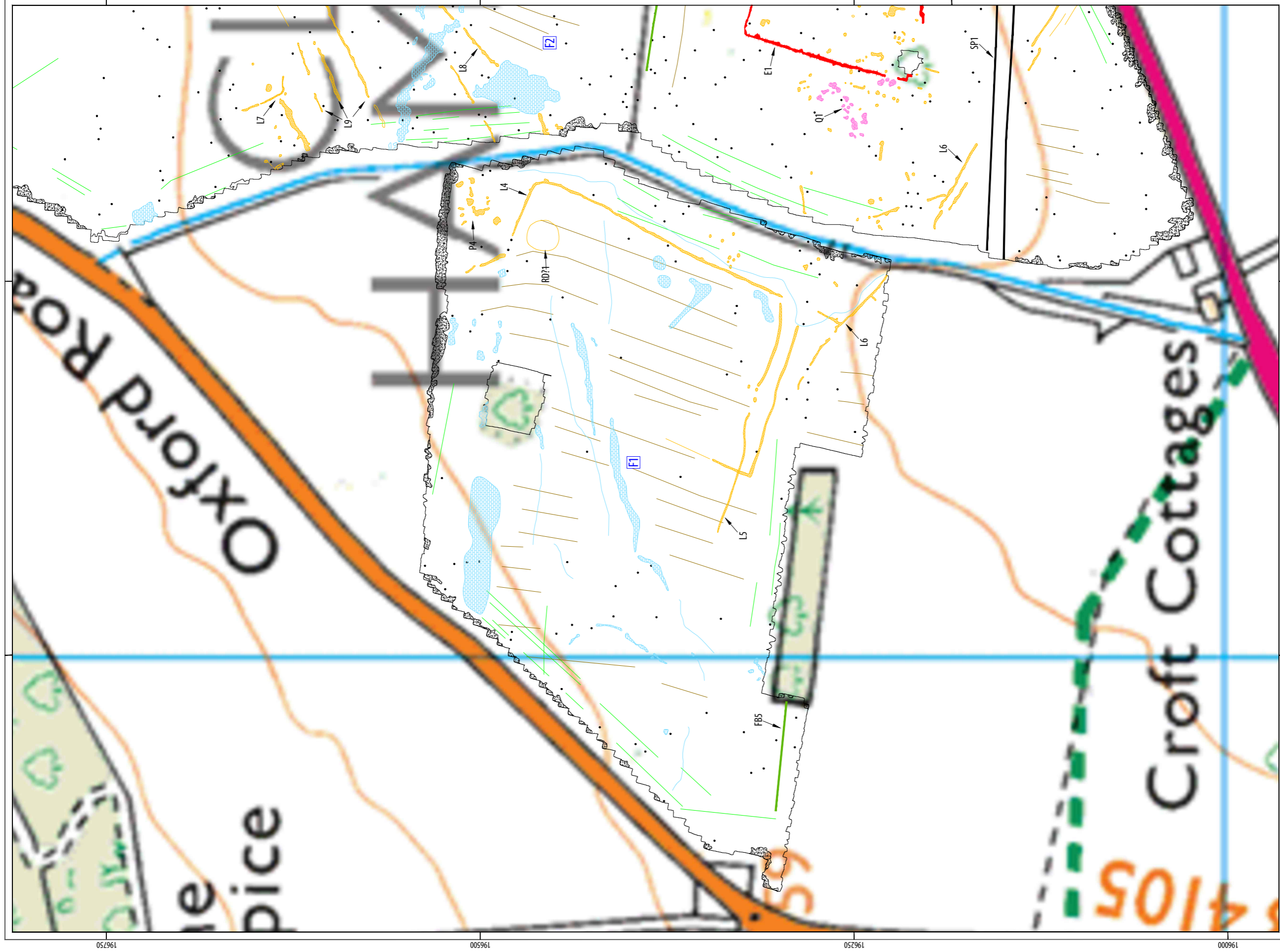
00900



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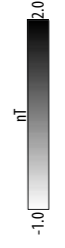
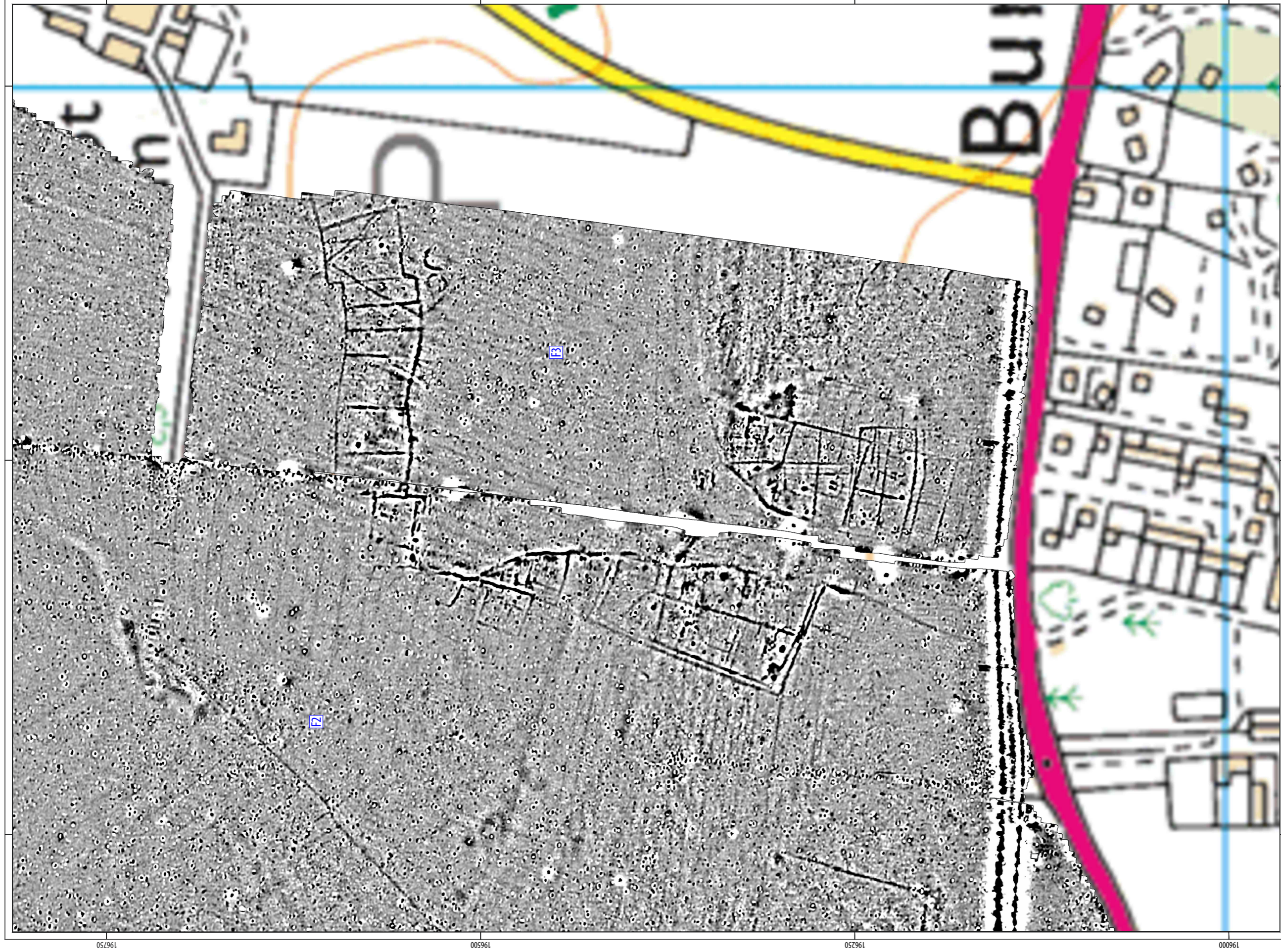
TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION
<ul style="list-style-type: none"> • dipolar isolated • magnetic disturbance — dipolar linear — null value — magnetic disturbance 	<ul style="list-style-type: none"> ferrous material ferrous material service pipe overhead cables quarrying former building 	<ul style="list-style-type: none"> — magnetic enhancement — linear trend — linear trend — linear trend — linear 	<ul style="list-style-type: none"> ridge and furrow agricultural field drain former field boundary former field boundary? 	<ul style="list-style-type: none"> — linear trend — magnetic enhancement — linear trend — magnetic enhancement — magnetic enhancement — magnetic enhancement 	<ul style="list-style-type: none"> geological variation geology archaeology? archaeology? kill/burning archaeology 	<ul style="list-style-type: none"> — linear trend — magnetic enhancement — linear trend — magnetic enhancement — magnetic enhancement — magnetic enhancement 	<ul style="list-style-type: none"> geological variation geology archaeology? archaeology? kill/burning archaeology

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Scale: 1:2,500 @ A3
 0 50m

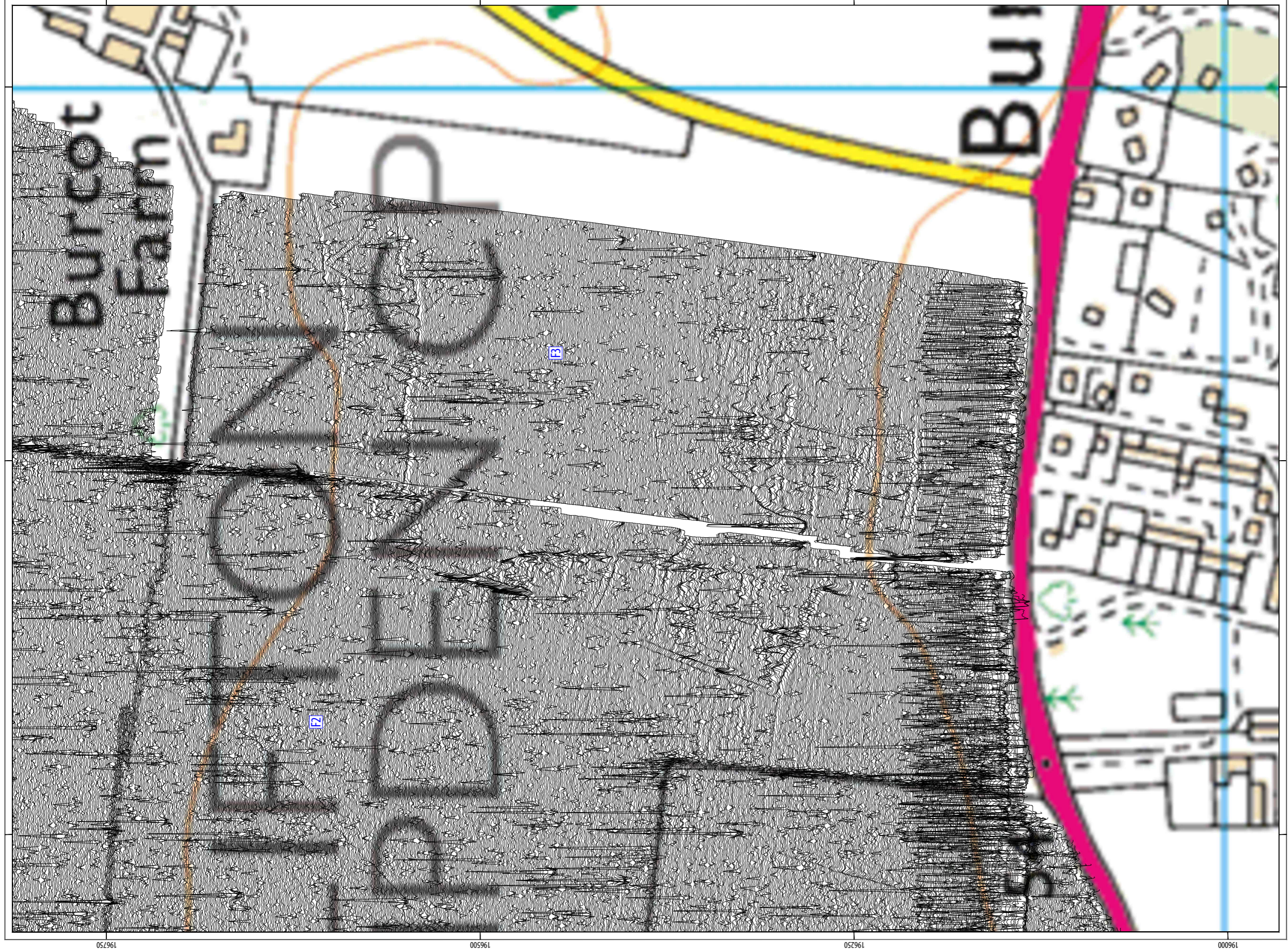
ILLUS 15 Interpretation of magnetometer data; Sector 2 (1:1,2500)



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25.0m Tr/cm

0 50m

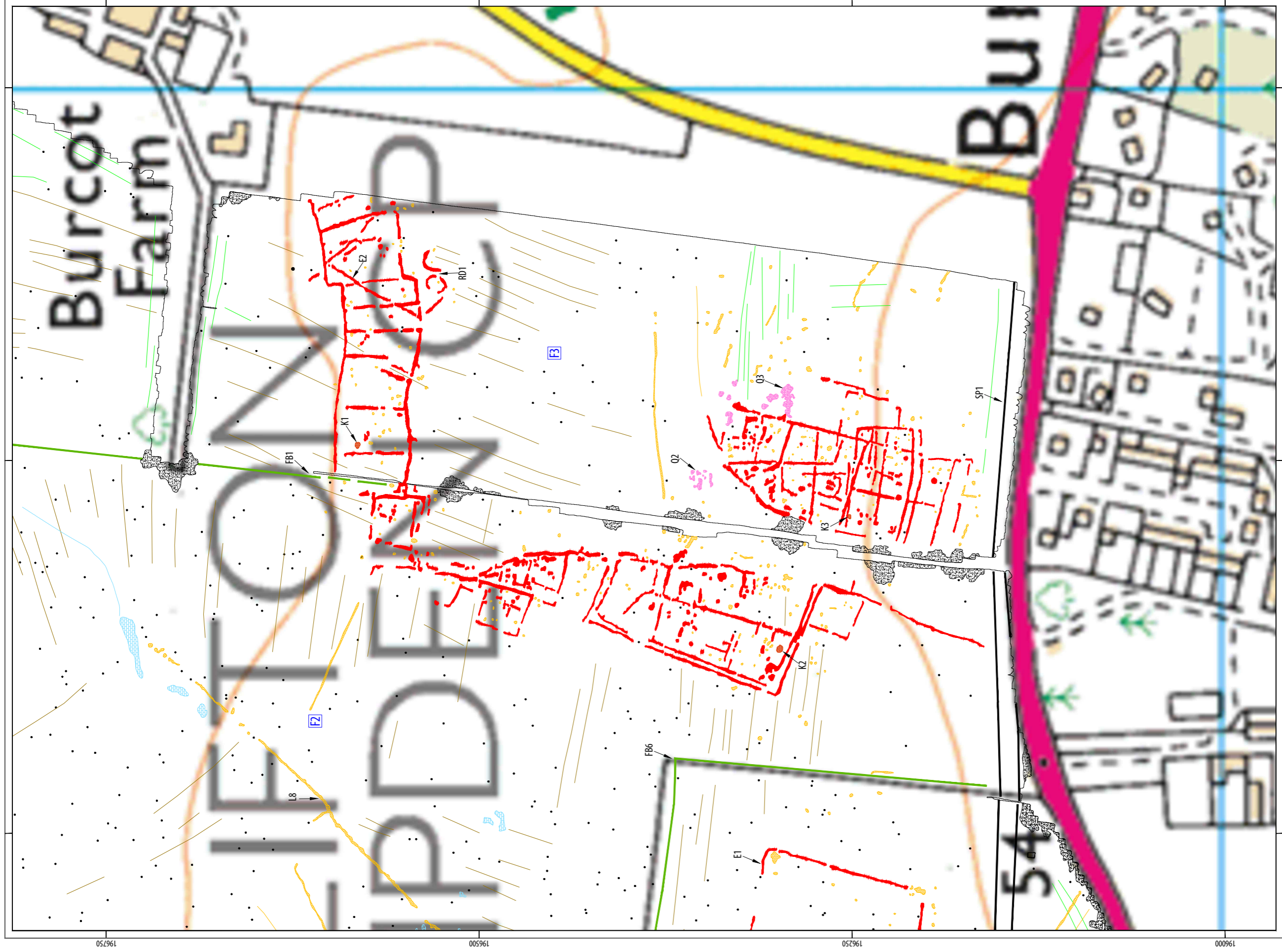
1:2,500 @ A3

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ILLUS 17 XY trace plot of minimally processed magnetometer data; Sector 3 (1:2,500)



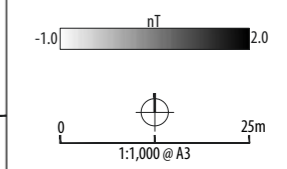
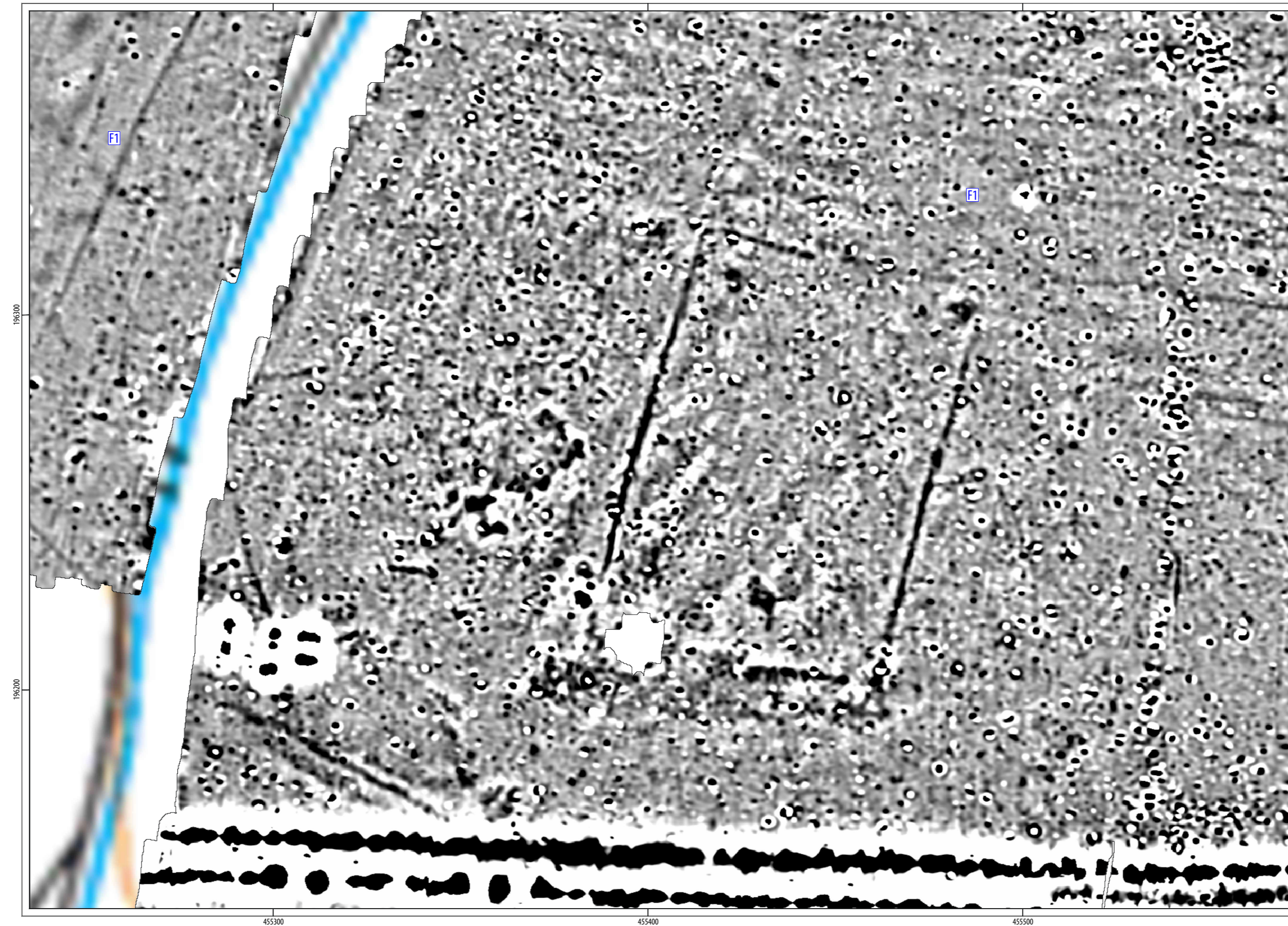
<p>TYPE OF ANOMALY</p> <ul style="list-style-type: none"> • dipolar isolated ● magnetic disturbance — dipolar linear ○ null value ⊗ magnetic disturbance 	<p>INTERPRETATION</p> <ul style="list-style-type: none"> ferrous material ferrous material service pipe overhead cables quarrying former building 	<p>TYPE OF ANOMALY</p> <ul style="list-style-type: none"> ● magnetic enhancement — linear trend — linear trend — linear trend — linear — linear 	<p>INTERPRETATION</p> <ul style="list-style-type: none"> LIRM ridge and furrow agricultural field drain former field boundary former field boundary? 	<p>TYPE OF ANOMALY</p> <ul style="list-style-type: none"> — linear trend ● magnetic enhancement — linear trend ● magnetic enhancement ● magnetic enhancement ● magnetic enhancement 	<p>INTERPRETATION</p> <ul style="list-style-type: none"> geological variation geology archaeology? archaeology? kill/burning archaeology
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ILLUS 18 Interpretation of magnetometer data; Sector 3 (1:1,2500)



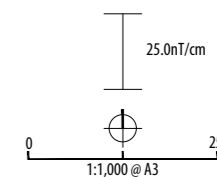
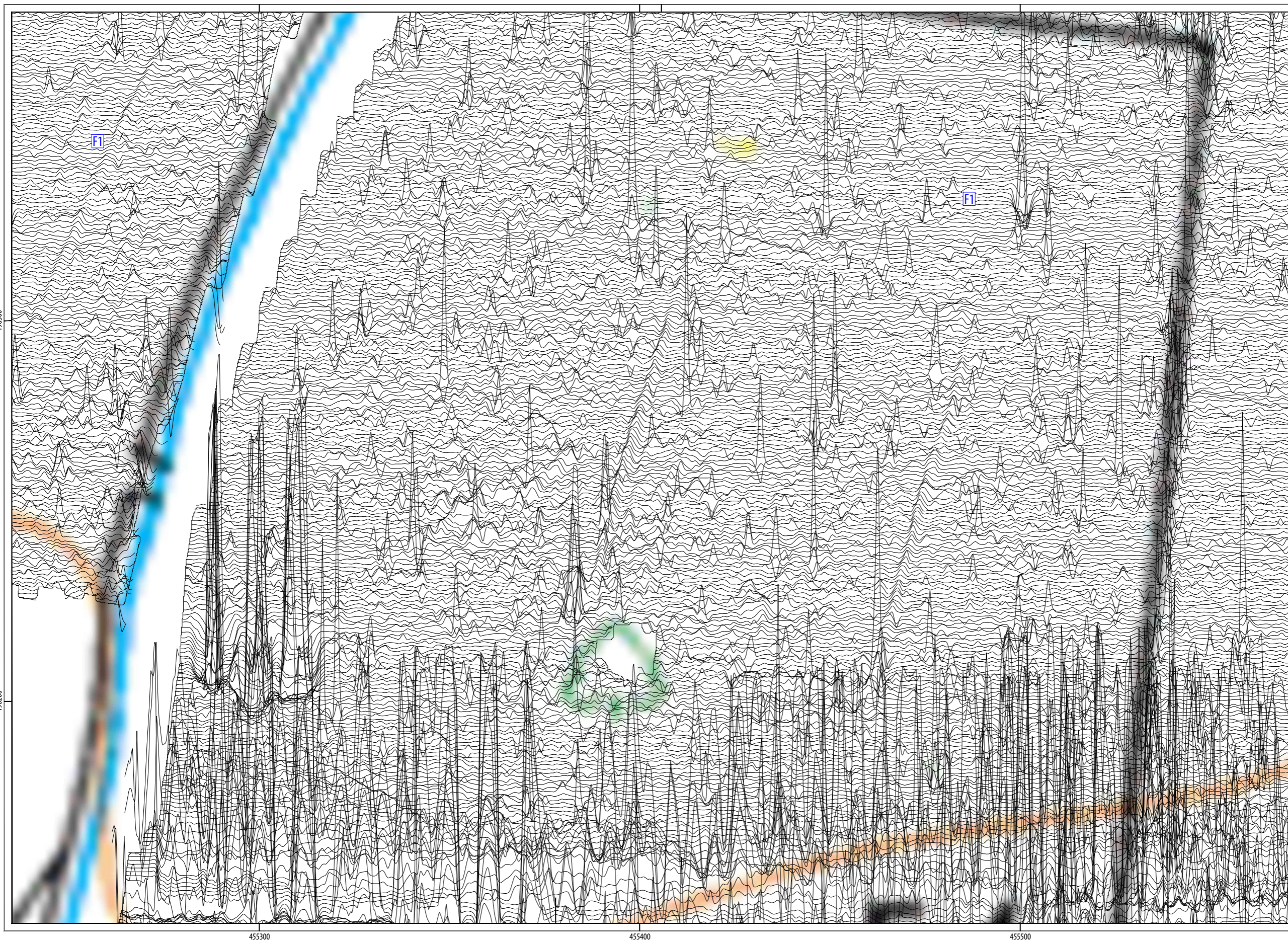
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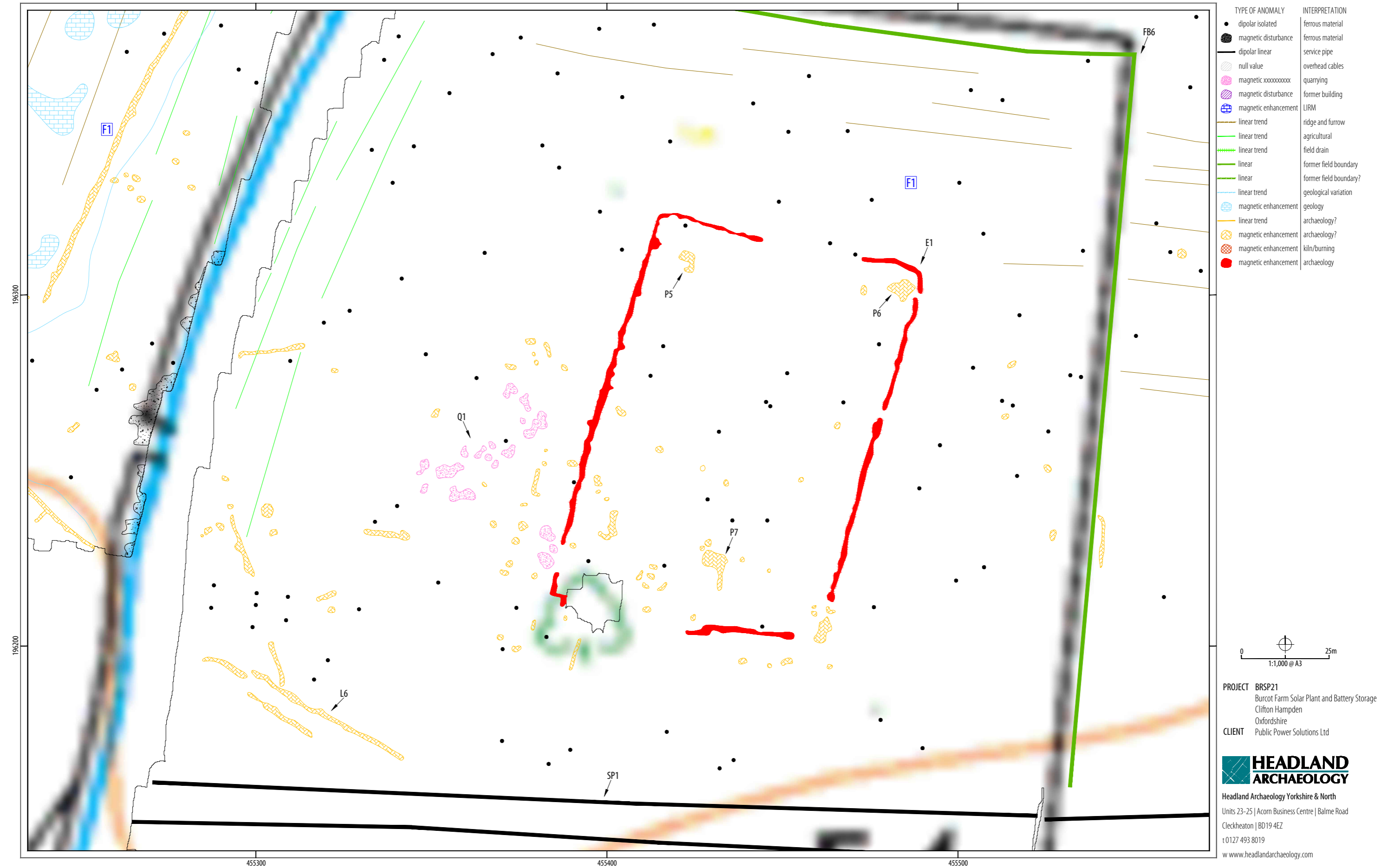
ILLUS 19 Processed greyscale magnetometer data; AAA1 (1:1,000)



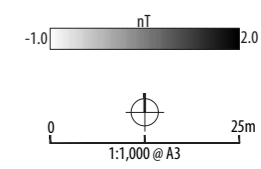
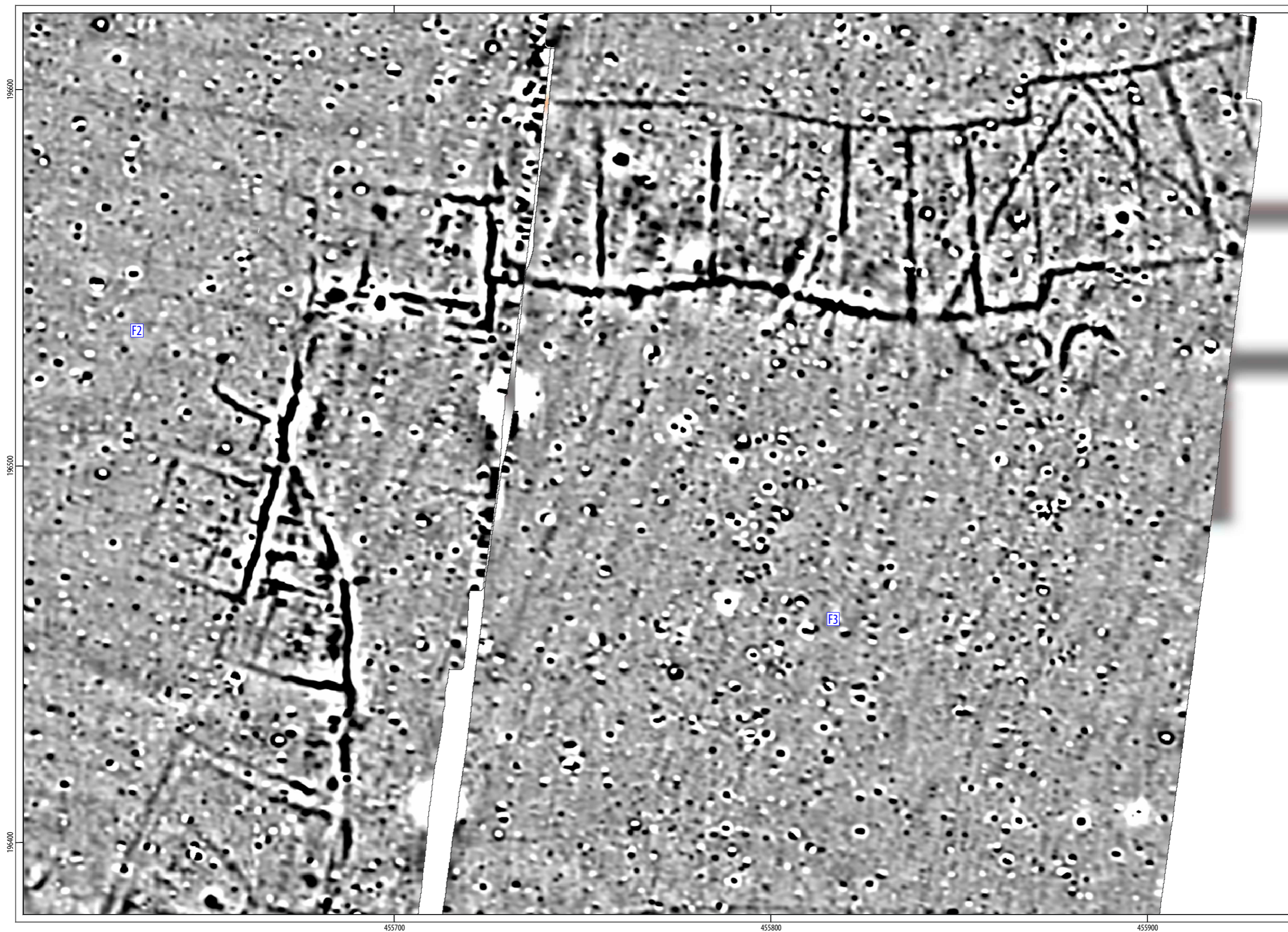
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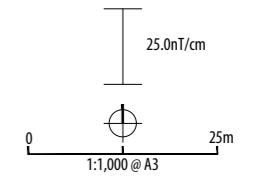
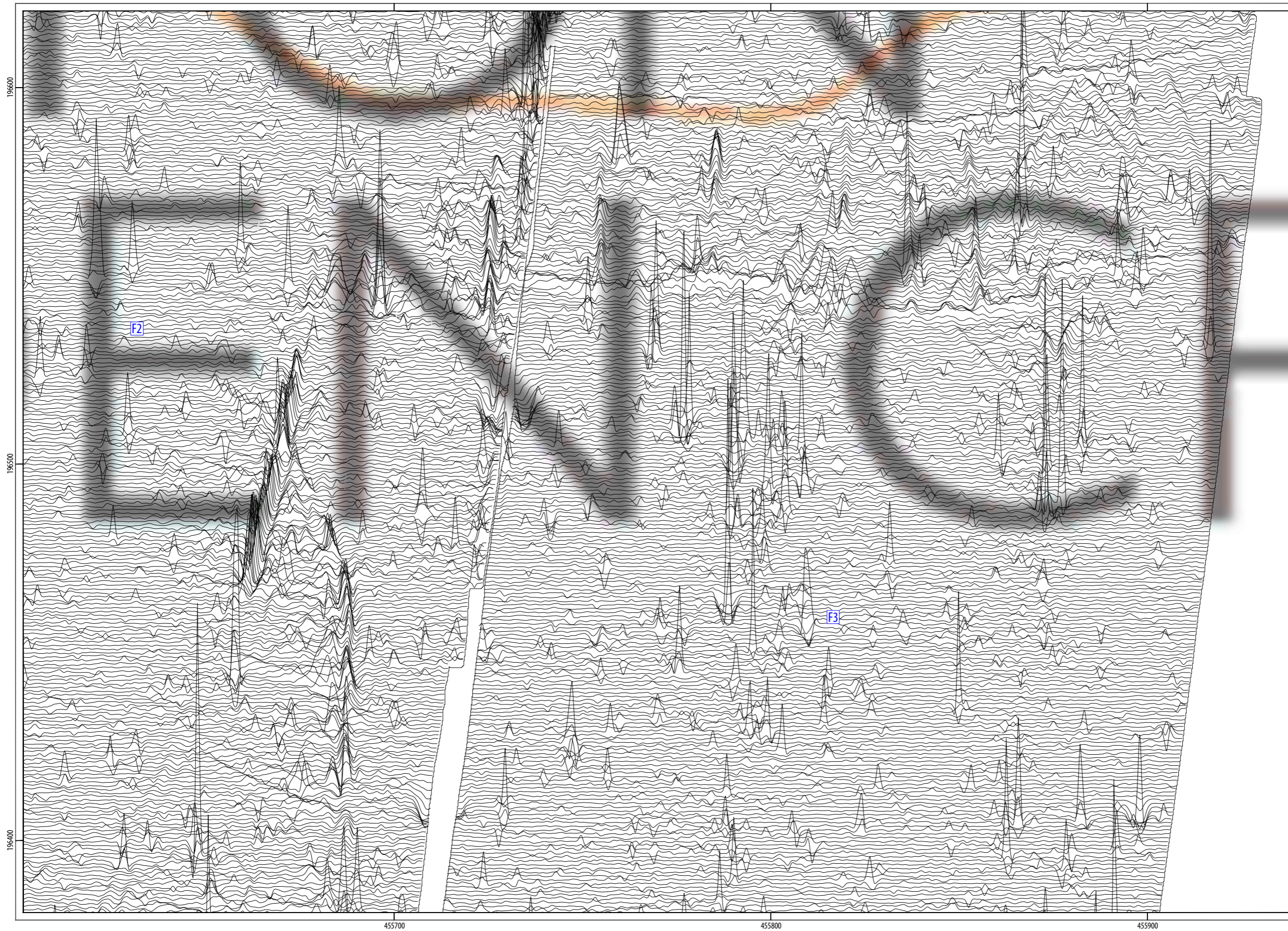
ILLUS 21 Interpretation of magnetometer data; AAA1 (1:1,000)



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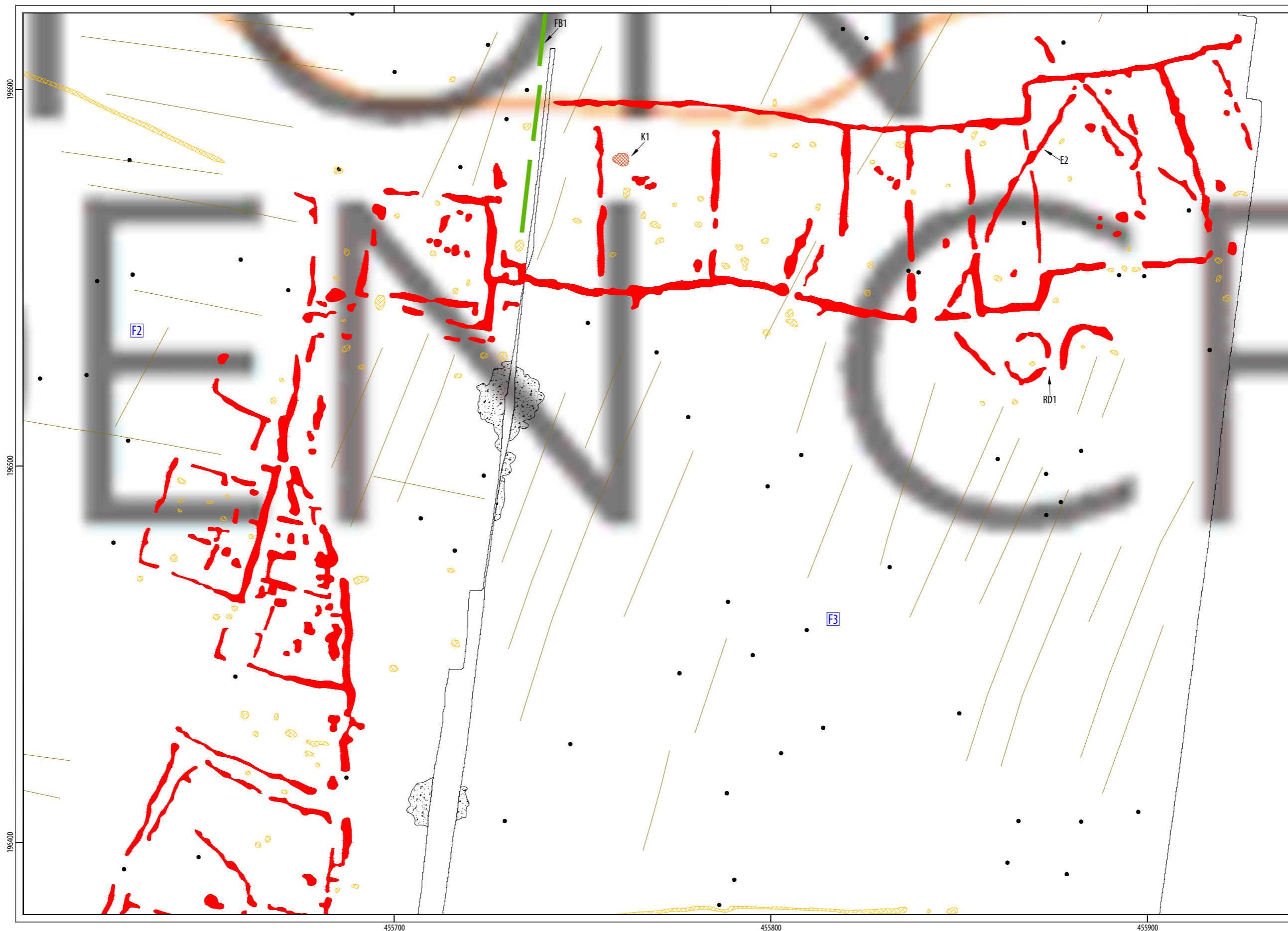


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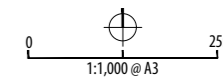


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ILLUS 23 XY trace plot of minimally processed magnetometer data; AAA2 North (1:1,000)



TYPE OF ANOMALY	INTERPRETATION
● dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
— dipolar linear	service pipe
○ null value	overhead cables
■ magnetic xxxxxxxxxx	quarrying
■ magnetic disturbance	former building
■ magnetic enhancement	LIRM
— linear trend	ridge and furrow
— linear trend	agricultural
— linear trend	field drain
— linear	former field boundary
— linear	former field boundary?
— linear trend	geological variation
■ magnetic enhancement	geology
— linear trend	archaeology?
■ magnetic enhancement	archaeology?
■ magnetic enhancement	kiln/burning
● magnetic enhancement	archaeology



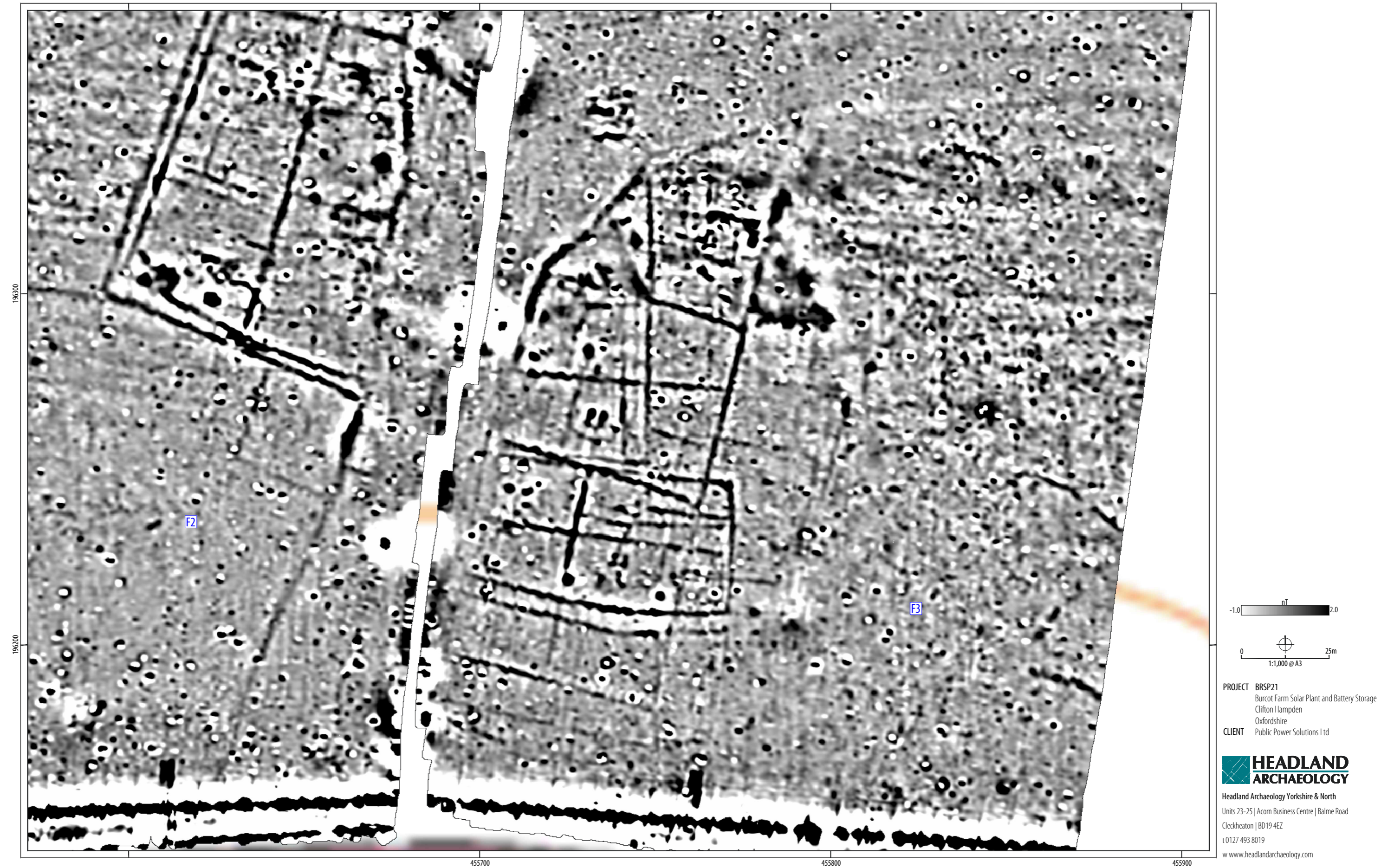
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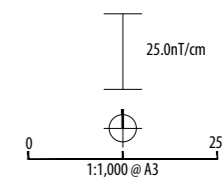
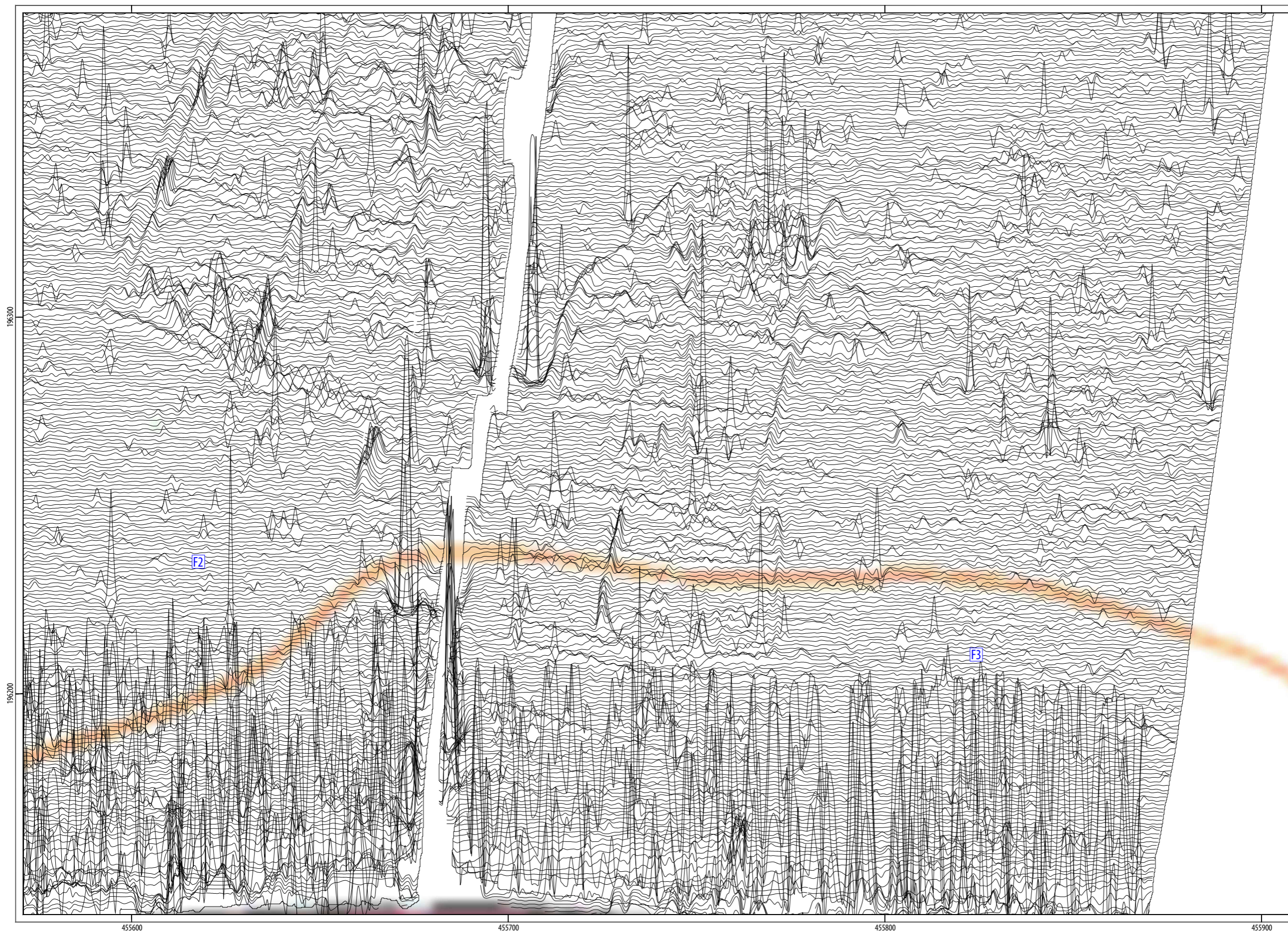


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ILLUS 25 Processed greyscale magnetometer data; AAA2 South (1:1,000)

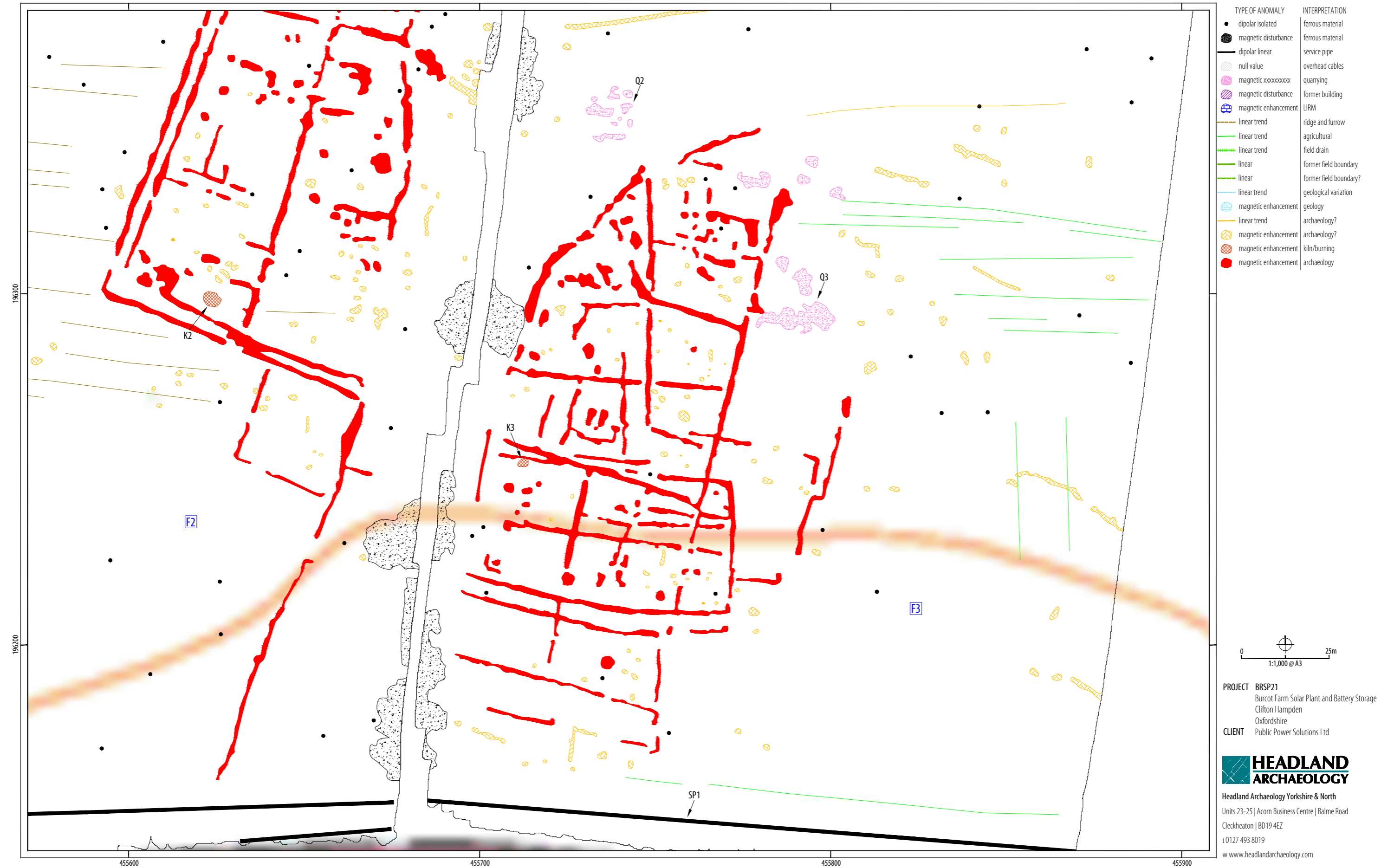


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ILLUS 26 XY trace plot of minimally processed magnetometer data; AAA2 South (1:1,000)



ILLUS 27 Interpretation of magnetometer data; AAA2 South (1:1,000)

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 associated 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: *headland5-419211***PROJECT DETAILS**

Project name	Burcot Farm Solar Plant and Battery Storage, Abingdon Road, Clifton Hampden, Oxfordshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering approximately 78 hectares on land at Burcot, Oxfordshire, where a solar plant and battery storage site is being proposed. The survey extended across three fields and was undertaken to assess the impact of the proposed development on the historic environment with the results informing any future archaeological strategy at the site, if required. The geophysical survey successfully evaluated the proposed development area (PDA) identifying two distinct, well defined and localised areas of archaeological activity in the southern half of the site. The first is a complex series of contiguous enclosures, ditches, pit-like features and other anomalies indicative of settlement activity, which was identified in the location of recorded Historic England National Mapping Programme (NMP) cropmark data and HER entries relating to Roman activity. The second was located approximately 120m to the west of this and comprised a single open-ended rectangular enclosure that was identified on a similar orientation. Elsewhere a low density of remains comprising several linear, curvilinear and clusters of discrete high magnitude anomalies of uncertain origin have been identified in addition to varying patterns of ridge and furrow cultivation, former boundaries and broad anomalies that are likely to be natural in origin. A large number of magnetic spike anomalies across a majority of the survey area likely confirms the spreading of 'green waste' in recent times. Based on these findings the two identified areas of archaeological activity in the southern half of the proposed development area are assessed as of very high archaeological potential with the rest of the site deemed of low-moderate potential.
Project dates	Start: 18-02-2021 End: 25-02-2021
Previous/future work	Not known / Not known
Any associated project reference codes	BFSP21 – Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 – Character Undetermined
Monument type	N/A
Significant Finds	N/A
Methods & techniques	"Geophysical Survey"
Development type	Solar farm and battery storage
Prompt	National Planning Policy Framework – NPPF
Position in the planning process	Pre-application
Solid geology	Lower Greensand
Drift geology (other)	Small band of alluvium along north boundary
Techniques	Magnetometry

PROJECT LOCATION

Country	England
Site location	Oxfordshire, South Oxfordshire, Clifton Hampden, Burcot Farm Solar Plant and Battery Storage, Abingdon Road, Clifton Hampden, Oxfordshire
Study area	78 Hectares
Site coordinates	SU 455525 196515 50.973928825664 -1.351121290284 50 58 26 N 001 21 04 W Point

PROJECT CREATORS

Name of Organisation	Headland Archaeology
Project brief originator	EDP
Project design originator	Headland Archaeology
Project director/manager	Sam Harrison
Project supervisor	Neil Paveley
Type of sponsor/funding body	Developer

PROJECT ARCHIVES

Physical Archive Exists?	No
Digital Archive recipient	Headland Archaeology
Digital Contents	"other"
Digital Media available	"GIS", "Geophysics", "Images vector"
Paper Archive Exists?	No

PROJECT BIBLIOGRAPHY 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Burcot Farm Solar Plant and Battery Storage, Abingdon Road, Clifton Hampden, Oxfordshire: Geophysical Survey
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