Note: Outline Planning Application (OPA) Site Boundary

The following report was produced prior to the finalisation of the application site boundary. The final application site boundary is shown on Figure 1.1 in ES Appendix 1.1. Therefore, references within the report to the site boundary do not reflect the site area and site boundary submitted with the OPA.

The reports were correct at the time of preparation, and all information within the Environmental Statement assessment reflects the latest relevant information.

OPHK17

OTTERPOOL PARK, KENT

GEOPHYSICAL SURVEY

commissioned by Arcadis Consulting (UK)

November 2018

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

OTTERPOOL PARK, KENT

GEOPHYSICAL SURVEY

commissioned by Arcadis Consulting (UK)

November 2018

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

PROJECT INFO:

HA Project Code **OPHK17** / NGR **Area 1 – TR 1133 3731; Area 2 – TR 1210 3712; Area 3 – TR 1186 3671; Area 4 – TR 1158 3576; Area 5 – TR 1297 3704** / Parish **Area 1 – Sellindge / Stanford; Area 2 – Stanford; Area 3 – Stanford; Area 4 – Lympne; Area 5– Saltwood** / Local Authority **Kent** / OASIS Ref. **headland5-308008**

PROJECT TEAM:

Project Manager **Alistair Webb** / Author **David Harrison** / Fieldwork **Nick Adams, Ross Bishop, Neil Paveley, Aaron Rawlinson** / Graphics **David Harrison, Rafael Maya-Torcelly**

Approved by **Alistair Webb** [redacted].....

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HEADLAND ARCHAEOLOGY

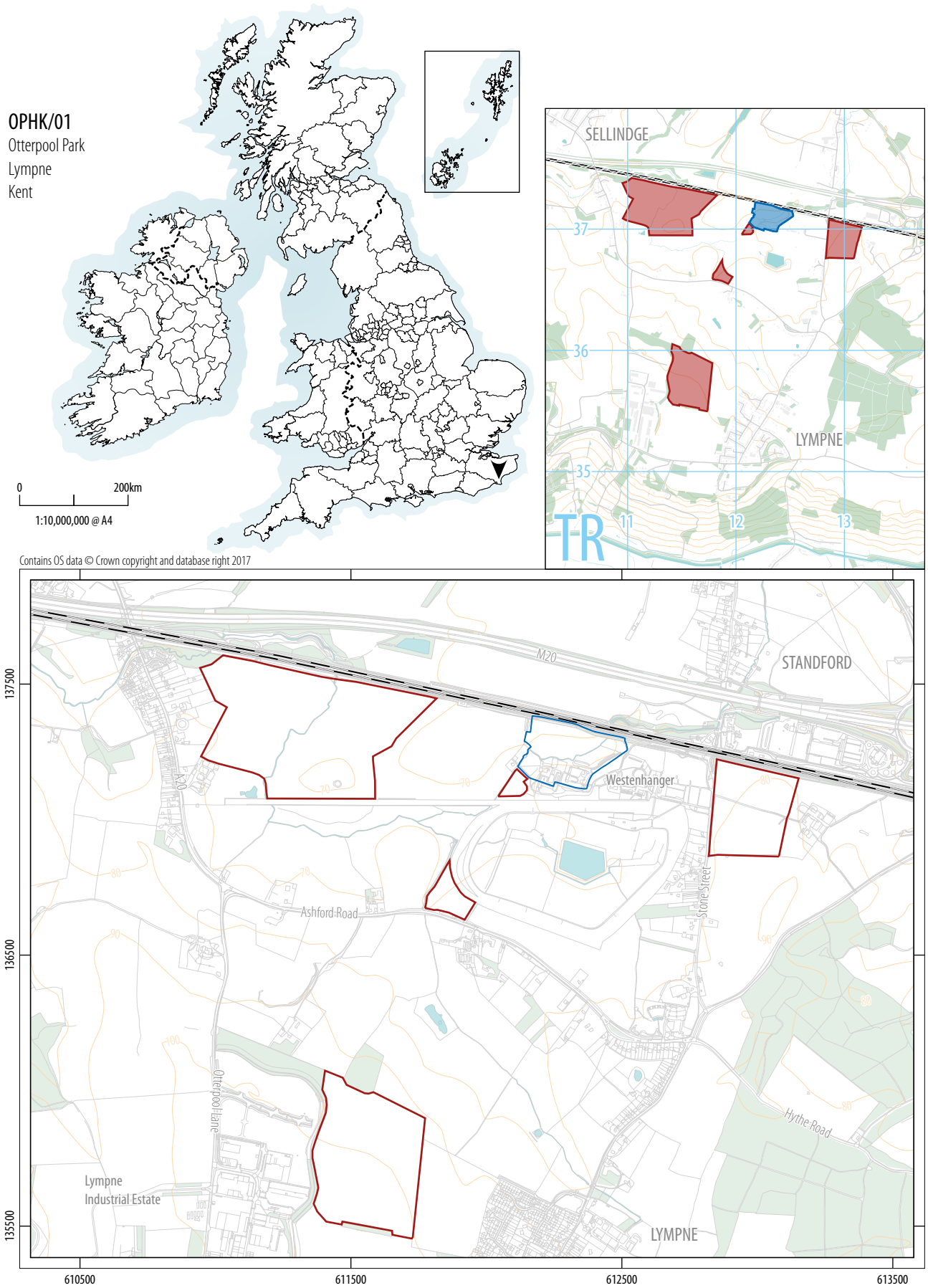
PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey at five locations within a 709 hectare site near Hythe, Kent, as part of a baseline assessment of the heritage potential of the site. This information will help guide archaeological strategy in advance of the proposed development of a garden settlement. The survey has successfully evaluated the five areas and provided evidence for a probable Roman field system with trackways, small-scale quarrying, a deer park boundary and possible settlement on land east of Lympne Industrial Park. Broad areas of magnetic disturbance within the same field are thought to be due to demolished infrastructure associated with RAF Lympne. This area is assessed as of high archaeological potential. East of Barrowhill, a possible field system and a possible ring-ditch are identified whilst only slight magnetic variation has been recorded over a second possible ring-ditch which is recorded on the Kent Historic Environment Record. In the south-west corner of Folkestone Racecourse, a broad linear anomaly may locate a trackway which is thought to have provided access to Westenhanger Castle. Thermoremnant anomalies east of Westenhanger probably locate an area of post-medieval/ modern industrial brick and tile manufacture. These anomalies are also considered to be of moderate archaeological potential. A former field boundary located in the west of the survey area is thought to also be the western pale of the deer park associated with Westenhanger Castle.

No anomalies have been identified to locate an enclosure which is clearly visible on recent satellite imagery east of Westenhanger. As is the case with the ring-ditches, it is likely that there is insufficient magnetic contrast over the prevailing sandstone bedrock for some soil-filled features to manifest as magnetic anomalies. For this reason, the archaeological potential of the areas surveyed to date may be greater than indicated by the survey.

CONTENTS

LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

OTTERPOOL PARK, KENT

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Arcadis Consulting (UK) (The Client) to undertake a geophysical (magnetometer) survey of five areas with known or suspected archaeological potential near Hythe, Kent, where a garden settlement is being proposed. The survey was carried out as part of a baseline study which aims to assess the heritage potential of the site, and therefore the impact of the proposed development on the historic environment. The survey was carried out in order to provide information on the archaeological potential of the possible development and to help guide future development proposals.

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2017), produced on behalf of the client and approved by Kent County Council, and was undertaken in accordance with guidance contained within the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out between April 27th and May 9th, 2017.

The work was commissioned by Arcadis Consulting (UK) who acting on behalf of Folkestone & Hythe District Council and Cozumel Estates. It was undertaken prior to an outline planning application for a new garden settlement – Otterpool Park – to accommodate up to 8,500 homes(use class C2 and C3) and use class D1, D2, A1, A2, A3, A4, B1a, B1b, B2, C1 development with related highways, green and blue infrastructure (access, appearance, landscaping, layout and scale matters to be reserved).

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The proposed development area (PDA) covers a large block of land measuring 709 hectares and centred on TP 1123 3650. It comprises land between the M20 to the north and the B2067 Aldington Road, close to the village of Lympne, and bisected by the A20 Ashford Road (see Illus 1). The geophysical survey covered five discrete blocks (Area 1 to Area 5) over 55 hectares. Field numbers used in this report have been allocated to the wider development area and are not sequential.

Area 1 is located immediately east of Barrowhill, centred at TP 1133 3731. It comprised two fields (F1 and F2) which are bound to the north by the Channel Tunnel Rail Link, to the west by properties in Barrowhill, to the south by Folkestone Racecourse and by a mature field boundary to the east. The two fields are divided north/south by the winding course of the East Stour River at 64m above Ordnance Datum (AOD) with the land in each field sloping gradually towards it from approximately 68m AOD. The south of F2 rises more steeply to an elevation of 72m AOD (see Illus 2). At the time of the survey, Area 1 was under a young arable crop.

Area 2 is located within a single field (F3) to the immediate south-west of Westenhanger Castle, centred at TP 1210 3712. It is bound to the west by the East Stour River, to the north and east by an access track to Farm Cottage and by Folkestone Racecourse to the south. F3 is flat at approximately 68m AOD and was under pasture at the time of the survey.

Area 3 also comprised a small field (F4) at the south-western corner of Folkestone Racecourse, centred at TP 1186 3671. It is bound by the racecourse to the north, by the A20 Ashford Road to the south and by field boundaries to the east and west. The site is flat at approximately 72m AOD and was also under pasture at the time of the survey (see Illus 3).

Area 4 comprised a large arable field (F6) on the north-eastern edge of Lympne Industrial Park, centred at TP 1158 3576. It is bound by the Industrial Park to the west and by agricultural land on all other sides. A large bund is located along the southern boundary of the field. Area 4 is situated in a prominent topographical location on a gentle north-facing slope between 103m AOD in the south and 91m AOD in the north. At the time of the survey, the field was fallow (see Illus 4).

Area 5 is located immediately east of Westenhanger, centred at TP 1297 3704. It comprised two fields (F76 and F77) which are bound to the north by the Channel Tunnel Rail Link, to the west by Stone Street Roman Road and by agricultural land to the south and east. The two fields are divided east/west by a metalled farm track (see Illus 5) and were under pasture at the time of the survey.

1.2 GEOLOGY AND SOILS

The underlying bedrock is variable (see Illus 7) with Area 1 to Area 3 mainly comprising Sandgate Formation (sandstone, mudstone and siltstone), Area 4 comprising Hythe Formation (sandstone and limestone) and Area 5 comprising Folkestone Formation (sandstone). Superficial deposits of Head (clay and silt) cover most of Area 1 and the southern half of Area 4 and Alluvium (clay, silt, sand and gravel) is recorded along the East Stour River. No superficial deposits are recorded in Area 5 (NERC 2017).

The soils vary in accordance with the underlying geology. Those in Area 1 to Area 3 are classified in the Soilscape 22 association, being characterised as loams with naturally high groundwater. In Area 4 and Area 5 the soils are classified as freely draining loams -Soilscape 7 and Soilscape 6 respectively (Cranfield University 2017).

2 ARCHAEOLOGICAL BACKGROUND

A Cultural Heritage Desk-based Assessment (Arcadis Consulting 2016) concluded that the potential for unknown archaeological remains is low to moderate with the exception of specific zones of high archaeological potential including in and around Westenhanger Castle, to the north of the East Stour River where barrows are recorded on the Kent HER (see Illus 8) and at Lympne airfield where prehistoric remains are recorded.

Analysis of historical mapping (Old-maps 2017) indicates that the division and layout of land within the geophysical survey areas has largely retained its agricultural nature as depicted on the first edition Ordnance Survey (OS) map in 1873. However, some fields have become larger post-war enclosures with the removal of several field boundaries.

The boundaries of a former deer park associated with Westenhanger Castle are thought to follow the route of Ashford Road and Stone Street in the south and east respectively. The western boundary partly reverses the site in the north-east/south-west direction (see Illus 8).

3 SURVEY OBJECTIVES

The general aim of the geophysical survey was to target areas of known archaeological potential, particularly those under arable cultivation before crop growth prevented survey. The survey aimed to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the survey areas. This would, 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 characterise the archaeological resource;
- to provide information about the nature and possible interpretation of any anomalies identified; and
- to prepare a report summarising the results of the survey.

4 METHODS

4.1 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 V3.0.31.4 (DWConsulting) software was used to process and present the data.

4.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:20,000. Illus 2-5 inclusive are site condition photographs. Illus 6 is a 1:10,000 scale survey location plan showing the GPS swaths. Bedrock and superficial geology data are shown on Illus 7, also at 1:10,000. The Kent HER data is shown in Illus 8 overlying the 1888–1913 six inch Ordnance Survey map. The processed greyscale data and an overall interpretation plot are also presented at 1:10,000 on Illus 9 and Illus 10 respectively. Detailed data plots of the fully processed data (greyscale), the minimally processed data (XY traceplot) and accompanying interpretative plots, are presented at a scale of 1:2,500 in Illus 11 to Illus 25 inclusive, with the exception of Area 4 which is shown at a scale of 1:2,000 in Illus 20 to Illus 22 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

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

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

5 RESULTS AND DISCUSSION

A low level of magnetic background variation has been detected across the majority of the survey areas with slightly increased variation across Area 1 and Area 4. This is thought to be due to the homogenous properties of the Sandgate and Folkestone sandstone bedrock and the alluvial deposits along the East Stour River. Conversely, slightly increased levels of variation within Area 1 and Area 4 are caused by the heterogeneous properties of the Hythe Formation (sandstone and limestone bedrock and the Head (colluvium) superficial deposits. Ground conditions were generally good across the site and the data quality was correspondingly good throughout. It is therefore assessed that the results provide a reasonable indication of the extent of the sub-surface archaeological remains. However, it is worth considering that the detection of soil-filled features in Area 1 to Area 3 and Area 5 may be hampered by low magnetic contrast in the surrounding soils and/or the depth of the alluvial and colluvial superficial deposits.

Against this background, numerous linear and discrete anomalies have been identified and are discussed below. For ease of discussion non-archaeological anomalies, which are common throughout the areas, are discussed first, followed by a discussion of the results by Area. All anomalies are cross-referenced to specific areas on the interpretative drawings, where appropriate.

5.1 MAGNETOMETER SURVEY

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 present as a consequence of manuring or tipping/infilling.

High magnitude dipolar linear anomalies (SP1 – SP3) are identified on varying alignments across Area 1 (see Illus 11–13). These anomalies are caused by sub-surface pipes. A broad negative rectilinear anomaly (SP4) skirting the western and northern edge of Area 4 locates a foul sewer (see Illus 20–22).

Magnetic disturbance around the field edges is due to ferrous material within or close to the adjacent field boundaries and is of no archaeological interest. The magnetic disturbance is particularly prevalent along the Channel Tunnel Rail Link which forms the northern boundary of Area 1 and Area 5.

Agricultural anomalies

Six former field boundaries (FB1-FB6) have been identified as high magnitude linear anomalies. All are recorded on the 1888-1913 six inch Ordnance Survey map (see Illus 8). The anomalies are caused by modern magnetic material (e.g. brick, tile, concrete) within the soil-fill of the ditch, rather than any magnetic contrast in the soils. FB1, in the west of Area 1, is thought to be the part of the western pale of the deer park associated with Westenhanger Castle, which was subsequently retained as a field boundary. Two former farm tracks (FT1; Illus 17-19 and FT2; Illus 23-25) are identified as north-east/south-west linear areas of magnetic enhancement in Area 3 and Area 5 respectively. The anomalies are caused by magnetic material within the buried surface of the former track. FT2 may be of archaeological potential and is discussed below.

Closely-spaced parallel linear trends within Area 1 and Area 5 are aligned parallel with the adjacent field boundaries and are characteristic of modern cultivation. Speckled linear anomalies, oblique to the surrounding boundaries, probably locate field drains.

Geological anomalies

Numerous discrete anomalies are visible throughout the datasets. These are interpreted as geological in origin and are due to minor

ILLUS 2 Area 1 (south-east), looking west

variations in the depth and composition of the topsoil. Broader, curvilinear anomalies along the course of the East Stour River are caused by alluvial deposits whereas other broad areas of variation, such as that in the north-east of Area 1, are due to variation in the Head superficial deposits.

Area 1 (Illus 11–13)

Area 1 was surveyed in order to determine the presence of possible barrows, other than the one recorded, on the Kent HER, east of Barrowhill (see Illus 8). A roughly circular area of magnetic enhancement (RD1) within the south of F2, centred at TP 1145 3713, corresponds to a possible barrow (TR13 NW1) which is clearly visible as a circular cropmark on modern satellite images. No anomalies have been identified to accurately locate the cropmark although it may be defined by a very faint circular trend, 37m in diameter. Discrete anomalies within the interior of the possible ring-ditch may be due to pits.

A second possible ring-ditch (RD2) is identified 440m north-west of RD1 as a negative sub-circular anomaly, centred at TP 1100 3728. The anomaly may be caused by a soil-filled ditch, approximately 24m in diameter, with less magnetic properties than the surrounding subsoil. Discrete anomalies within the interior of the possible ring-ditch may locate pits. A probable Bronze Age Barrow (TR13 NW9) and a possible ring-ditch (TR13 NW190) are recorded on the Kent HER at Barrowhill, within 130m of RD2 (see Illus 8).

Negative rectilinear anomalies (D1-D4) are identified across the north-west of F1 on an east/west-north/south alignment. The anomalies, caused by soil-filled ditches, do not correspond to any known historic boundaries and therefore may be archaeological in origin, perhaps locating a former field system. However, in the absence of a clear archaeological pattern, an agricultural origin cannot be dismissed and the anomalies may locate field drains.

Area 2 and Area 3 (Illus 14–19)

These areas aimed to investigate the potential for a possible causeway which is postulated to have provided access to Westenhanger Castle. A band of magnetic enhancement (FT2 Illus 17–19) aligned north-east/south-west across Area 3 corresponds closely with a former track which is shown on early OS maps (see Illus 8). The anomaly is thought to have been created as a diverson for the racecourse and is caused by magnetically enhanced material within the buried surface of the former track.

In the south of Area 3, an isolated area of magnetic enhancement (ME) may be of interest, perhaps being due to a spread of material. However, a modern origin cannot be discounted.

No anomalies of clear archaeological potential have been identified within Area 2, immediately south–east of Westenhanger Castle. The broad area of magnetic disturbance within the east of the field is probably modern in origin, perhaps being due to tipping or infilling.

ILLUS 3 Area 3, looking north-west

Area 4 (Illus 20–22)

Unless otherwise specified the anomalies of archaeological and/or possible archaeological potential in Area 4 are caused by soil-filled features such as pits or ditches often forming clear patterns of enclosure and land division. With the variable magnetic background, it is difficult to confidently discriminate between discrete anomalies which may be due to archaeological features, such as pits, which may be indicative of occupational activity and those that are probably due to localised geological variation. For this reason, most of the discrete anomalies within enclosures have been ascribed a possible archaeological origin with those outside, except where the responses are particularly broad or high in magnitude, interpreted as of non-archaeological origin.

An extensive complex of linear and rectilinear anomalies has been identified aligned north-east/south-west throughout Area 4, centred at TP 1155 3577. The complex, measuring at least 210m east/west and 360m north-south, comprises at least six enclosures (E1 – E6), two trackways (TR1 – TR2) and six likely quarry pits (Q1 – Q6). E2 is subdivided into several smaller rectangular enclosures, perhaps indicating an area of settlement. Numerous discrete anomalies within the interior of the enclosures are ascribed a possible archaeological origin, perhaps being due to pits and post-holes. Whilst the northern extent of the complex is clearly defined by E2, TR1 and TR2, the anomalies fade and there is less definition in the south. This disparity is caused by the presence of Head (clay and silt) superficial deposits across the southern half of the field. Nevertheless, several fragmented linear anomalies (D5 – D10) are identified on the same north-east/south-west alignment and, for this reason, are ascribed a probable archaeological origin. Towards the south-east of the field, a series of faint linear and curvilinear anomalies (D11 – D20) are identified on varying alignments. It is possible that these anomalies are archaeological in origin, perhaps locating soil-filled ditches, although a geological origin is possible, the anomalies may be caused by localised variations in the superficial deposits. Prehistoric activity is recorded on the Kent HER to the immediate west of Area 4 (see Illus 8) although the rectilinear morphology of the identified anomalies is suggestive of later Roman activity.

The broad band of high magnitude magnetic disturbance aligned north-west/south-east across the centre of Area 4 is modern in origin, being caused by dense concentrations of ferrous material (e.g. iron, brick concrete) within the topsoil. However, no features are shown in this location on historic OS maps. The anomalies are thought to relate to the use of the field as a WWII airfield and are thought to locate at least one rectangular structure within the centre of the field and perhaps a second in the north-west corner. The gap in the data towards the north-west of the field is caused by an extant pillbox (TR13 NW140) in this location (Illus 8).

Broad low magnitude trends aligned north-west/south-east across the south-west of the magnetic dataset correspond to an area of modern ground disturbance which is visible on recent satellite images and is of no archaeological interest.

ILLUS 4 Area 4 (west), looking north

Area 5 (Illus 23–25)

Area 5 is located in an area of high archaeological potential as recorded on the Kent HER (see Illus 8). No anomalies of clear archaeological potential have been identified by the survey although a clearly defined high magnitude rectangular anomaly (BC) at the northern edge of the field may be of interest. The anomaly is located 120m south of a brick and tile works which are shown on the 1888-1913 six inch OS map and the same approximate distance from a Roman site, Roman Field System and multi-phase features which are recorded on the HER. The XY trace plot (Illus 24) is characteristic of an area which has been affected by intense heating/burning and is interpreted as locating a possible brick clamp. A brick clamp was a basic method of firing bricks which involved the stacking of bricks around a series of stoke holes – there was no permanent structure. The anomaly is caused by the thermoremanent magnetisation of the ground during the firing process.

No anomalies have been identified which might locate an enclosure which is recorded on the Kent HER (TR13 NW176) and which is clearly visible as a cropmark on recent satellite images (Infoterra & Bluesky 2017). If present, it is possible that there is insufficient magnetic contrast between the soil-fill of cut features and the surrounding soils over the Folkestone sandstone bedrock.

6 CONCLUSION

The geophysical survey has successfully evaluated five areas within the possible development area and has provided evidence for a probable Roman settlement site, with a field system, trackways and small-scale quarrying. The complex is located on the east of Lympne Industrial Park where magnetic disturbance is thought to relate to former airfield infrastructure. This area is assessed as of moderate to high archaeological potential.

Several anomalies of possible archaeological potential have also been identified including, two possible ring-ditches and a possible field system have been identified east of Barrowhill and a possible brick clamp which may be associated with post-medieval industrial activity. A former field boundary that is postulated to be the western pale of the deer park associated with Westenhanger Castle has also been identified.

No anomalies have been identified to locate an enclosure which is clearly visible on recent satellite imagery east of Westenhanger. If present, it is possible there is insufficient magnetic contrast over the prevailing sandstone bedrock for some soil-filled features to manifest as magnetic anomalies. For this reason, the archaeological potential of the site may be greater than indicated by the survey. However, there are still large parts of the site where no anomalies

ILLUS 5 Field 76 (south) and Field 77 (north), looking east

of archaeological potential have been identified and based on the results of the survey, the archaeological potential across these areas is considered to be moderate to low, corroborating the results of the Cultural Heritage Desk-Based Assessment.

7 REFERENCES

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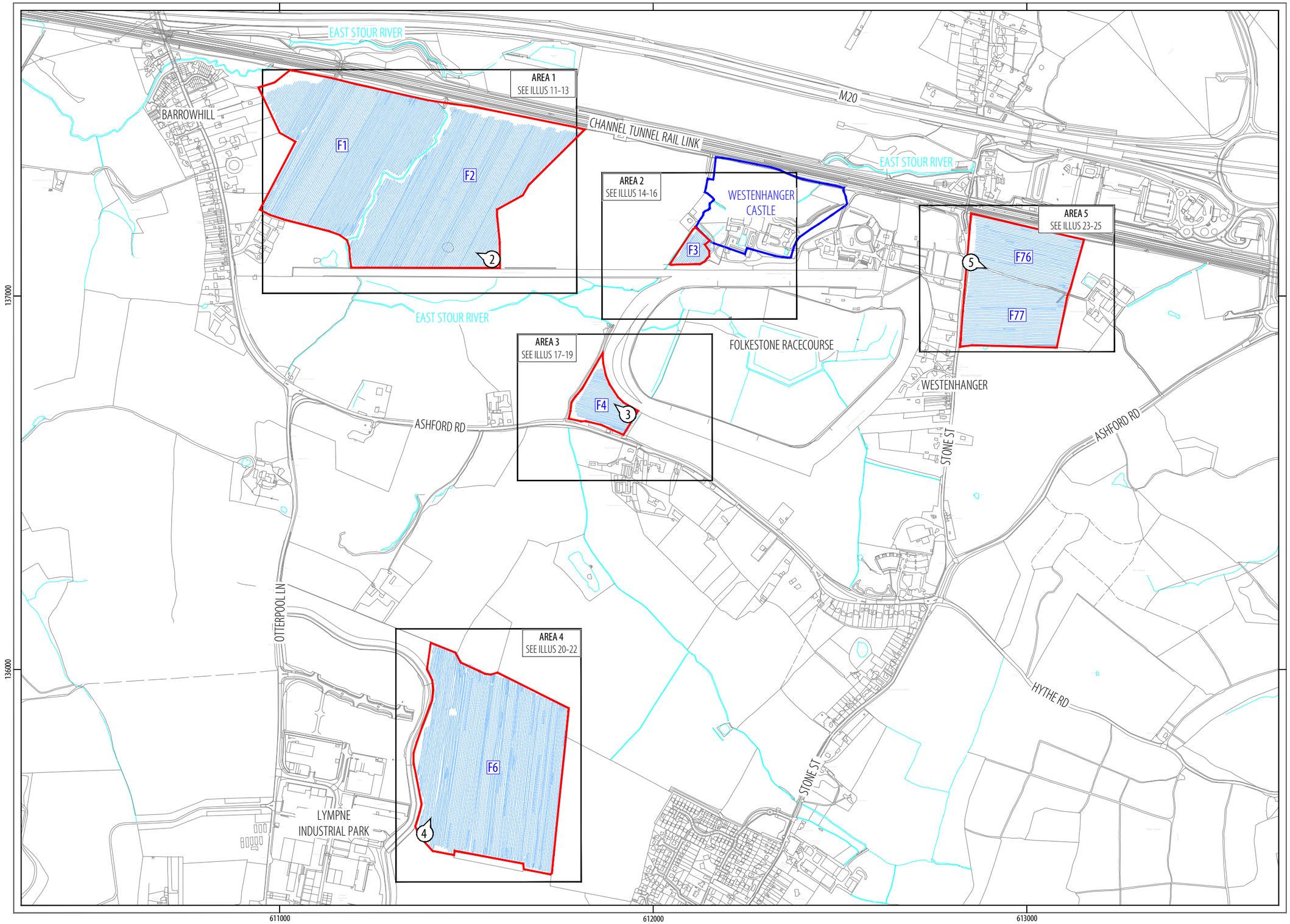

geophysical survey area
scheduled monument
GPS swaths
location and direction of ILLUS 2-5

0 200m
1:10,000 @ A3

PROJECT OPHK17
Otterpool Park
Hythe
Kent

CLIENT Arcadis Consulting (UK)

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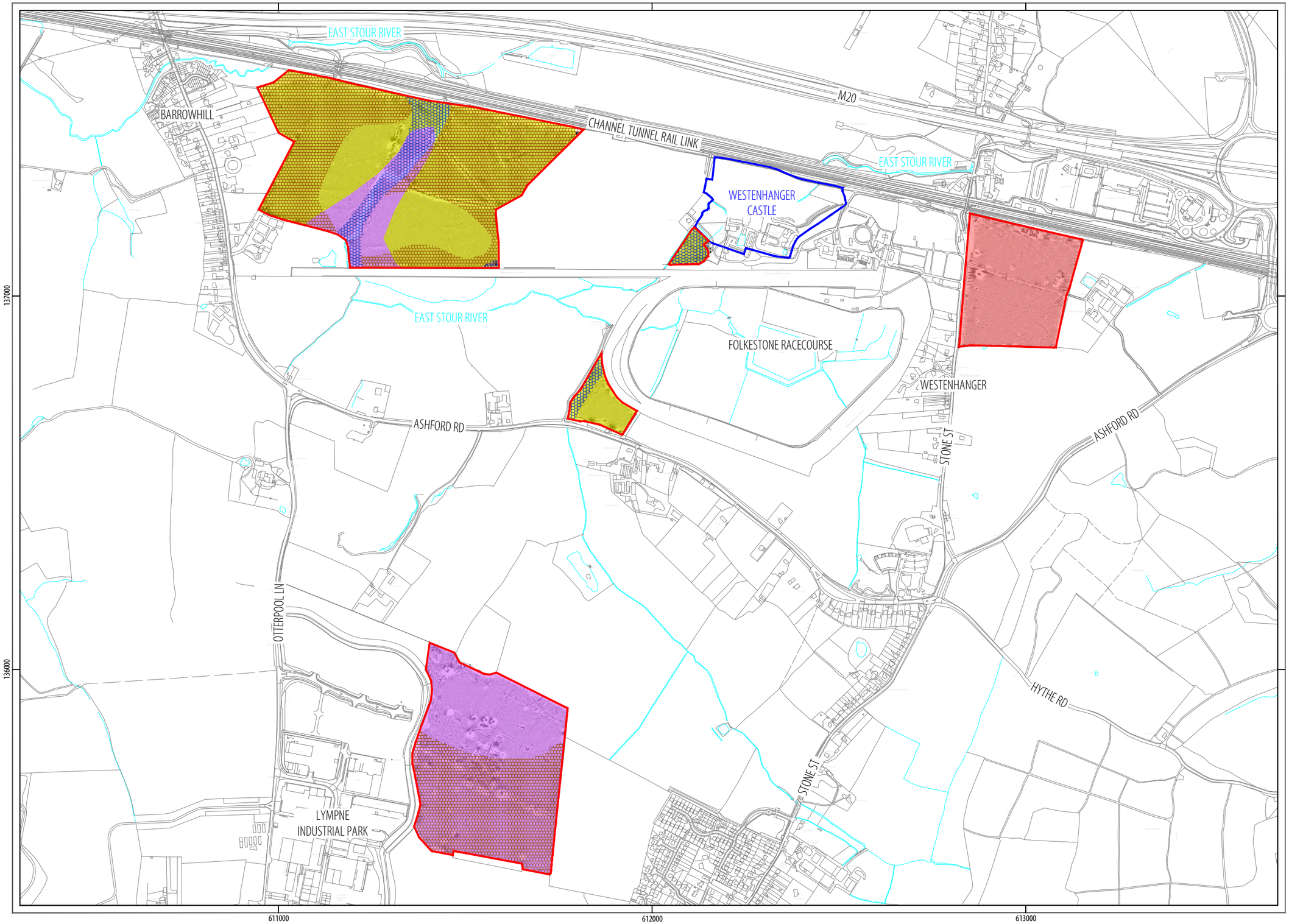
ILLUS 6 Survey location showing GPS swaths (1:10,000)



geophysical survey area
scheduled monument

BEDROCK GEOLOGY
Sandgate Formation - sandstone, siltstone, mudstone
Hythe Formation - sandstone and limestone
Folkstone Formation - sandstone

SUPERFICIAL GEOLOGY
Alluvium - clay, silt, sand and gravel
Head - clay and silt

nT
-1.0 2.0

0 200m
1:10,000 @ A3

PROJECT OPHK17
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Hythe
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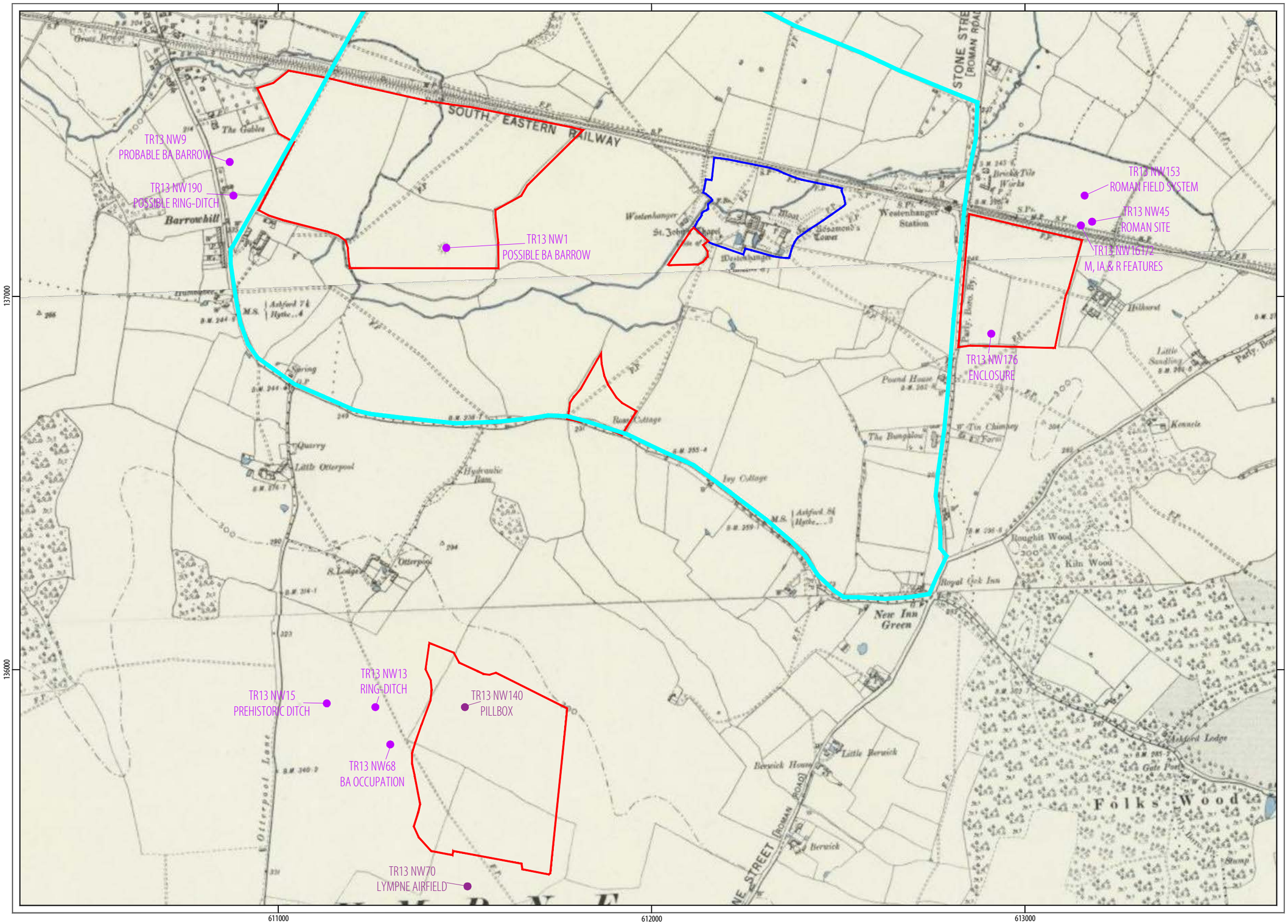
ILLUS 7 Survey location showing geology data (1:10,000)



geophysical survey area
scheduled monument
Kent HER data
deer park boundary

0 200m
1:10,000 @ A3

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Otterpool Park
Hythe
Kent
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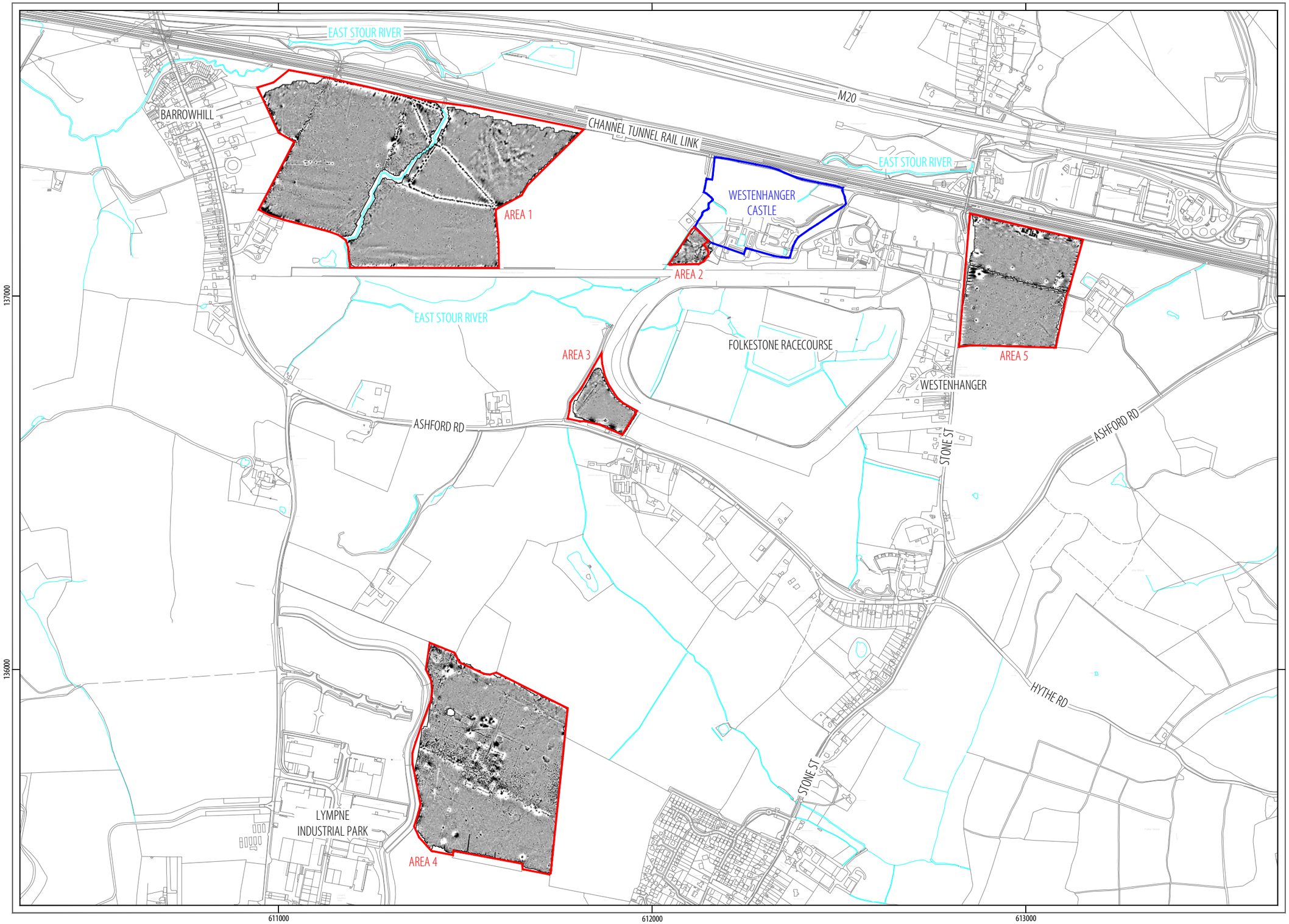
ILLUS 8 Survey location showing Kent HER data overlying 1888-1913 six inch Ordnance Survey map (1:10,000)



geophysical survey area
scheduled monument

nT
-1.0 2.0

0 200m
1:10,000 @ A3

PROJECT OPHK17
Otterpool Park
Hythe
Kent

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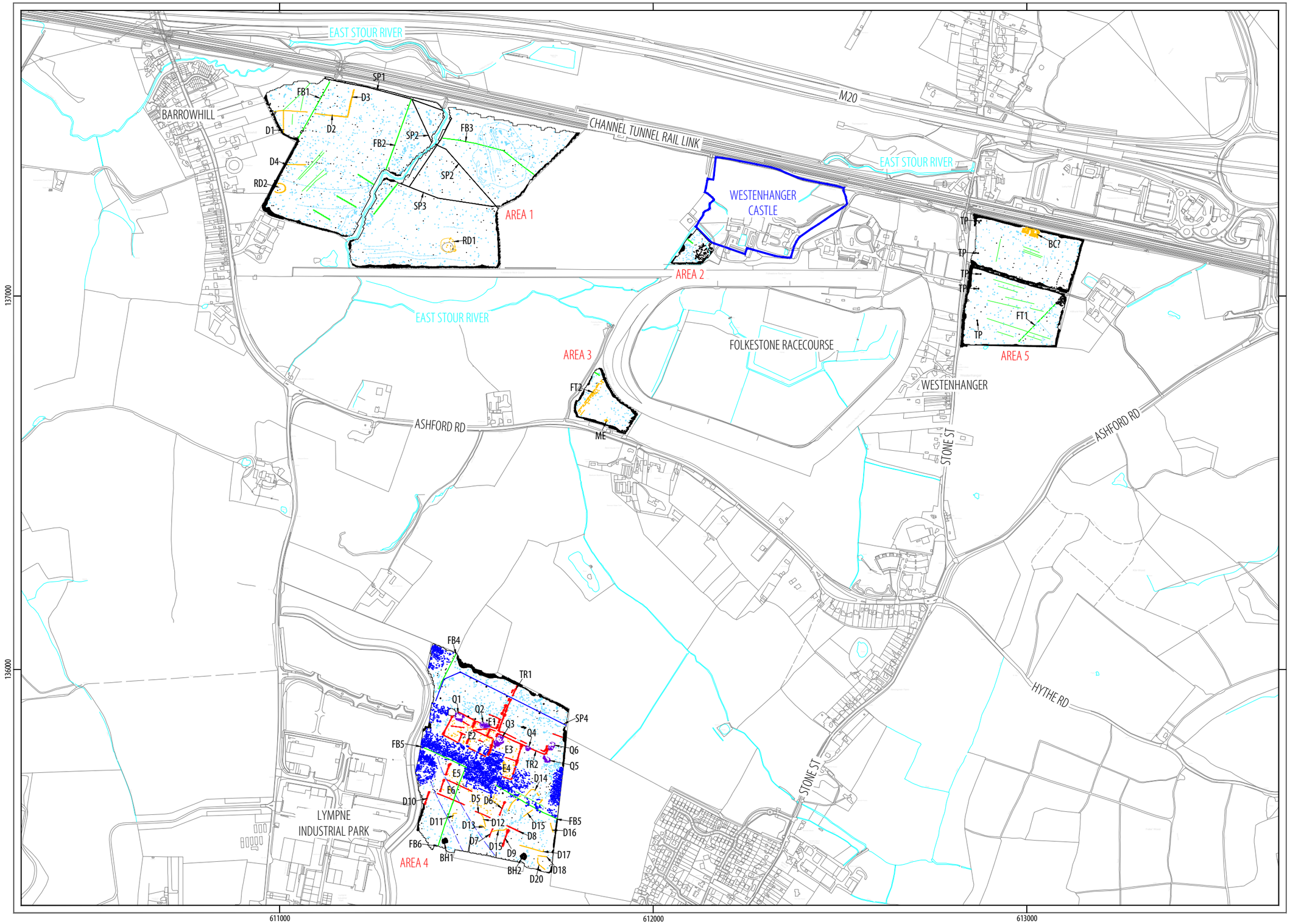
ILLUS 9 Overall processed greyscale magnetometer data (1:10,000)



scheduled monument

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	field drain
linear	former field boundary
linear	geology
magnetic enhancement	geology
magnetic disturbance	former airfield
magnetic enhancement	quarrying?
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

ABBREVIATIONS

BC	brick clamp
D	ditch
E	enclosure
FB	former boundary
FT	former trackway
Q	quarry
RD	ring-ditch
SP	service pipe
TP	telegraph pole
TR	trackway

0 200m
1:10,000 @ A3

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Otterpool Park
Hythe
Kent

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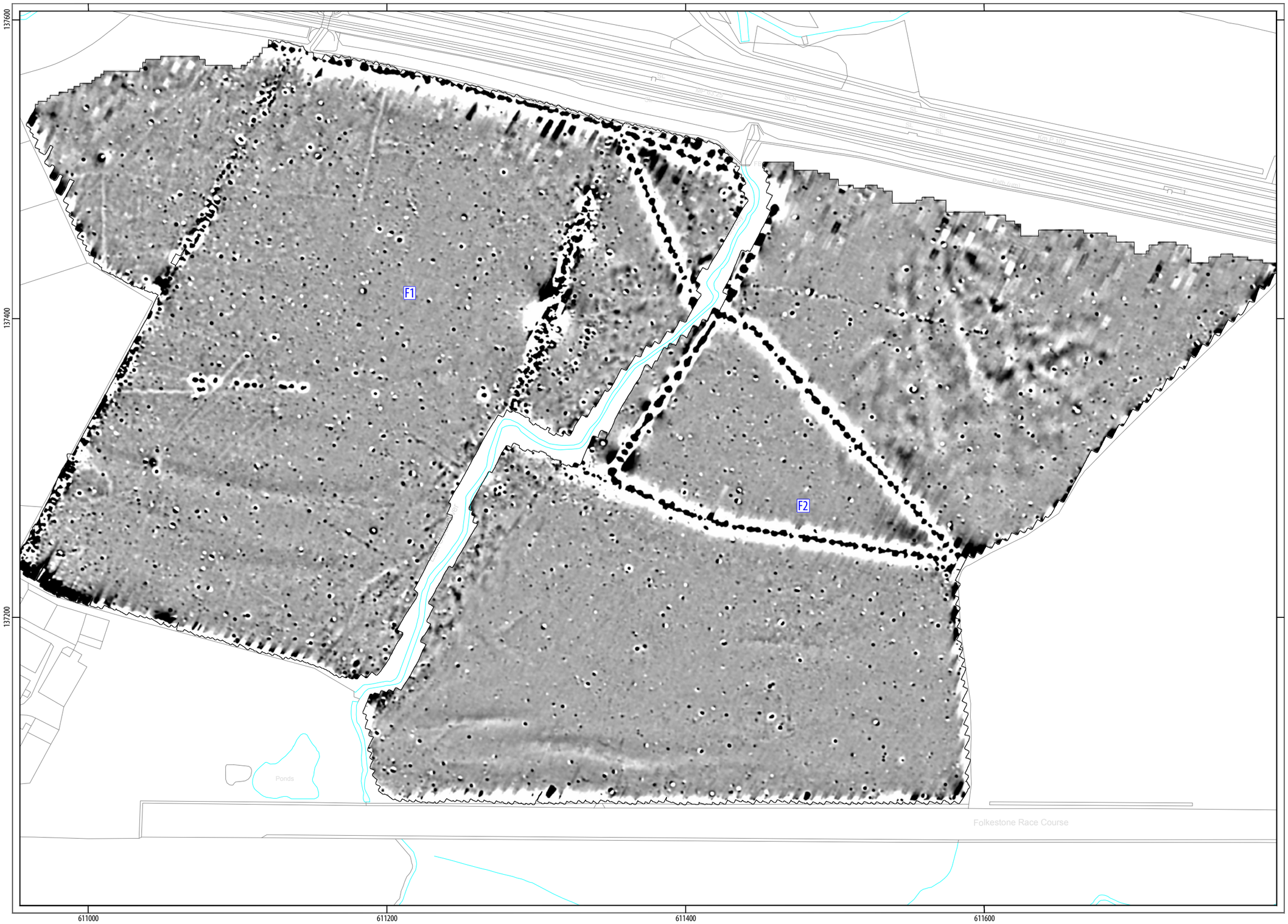
LLLUS 10 Overall interpretation of magnetometer data (1:10,000)



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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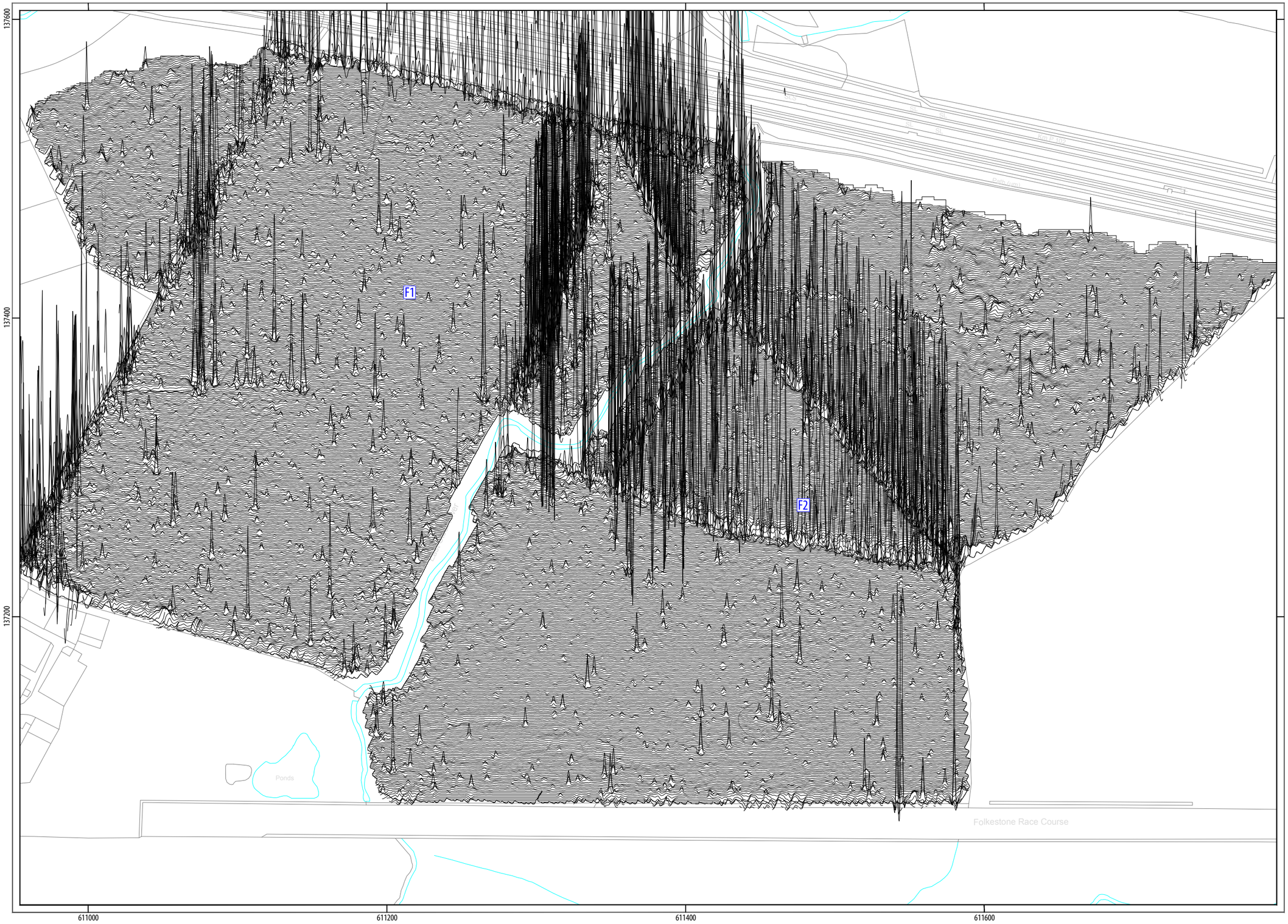
ILLUS 11 Processed greyscale magnetometer data; Area 1 (1:2,500)



35.0nT/cm

0 50m
1:2,500 @ A3

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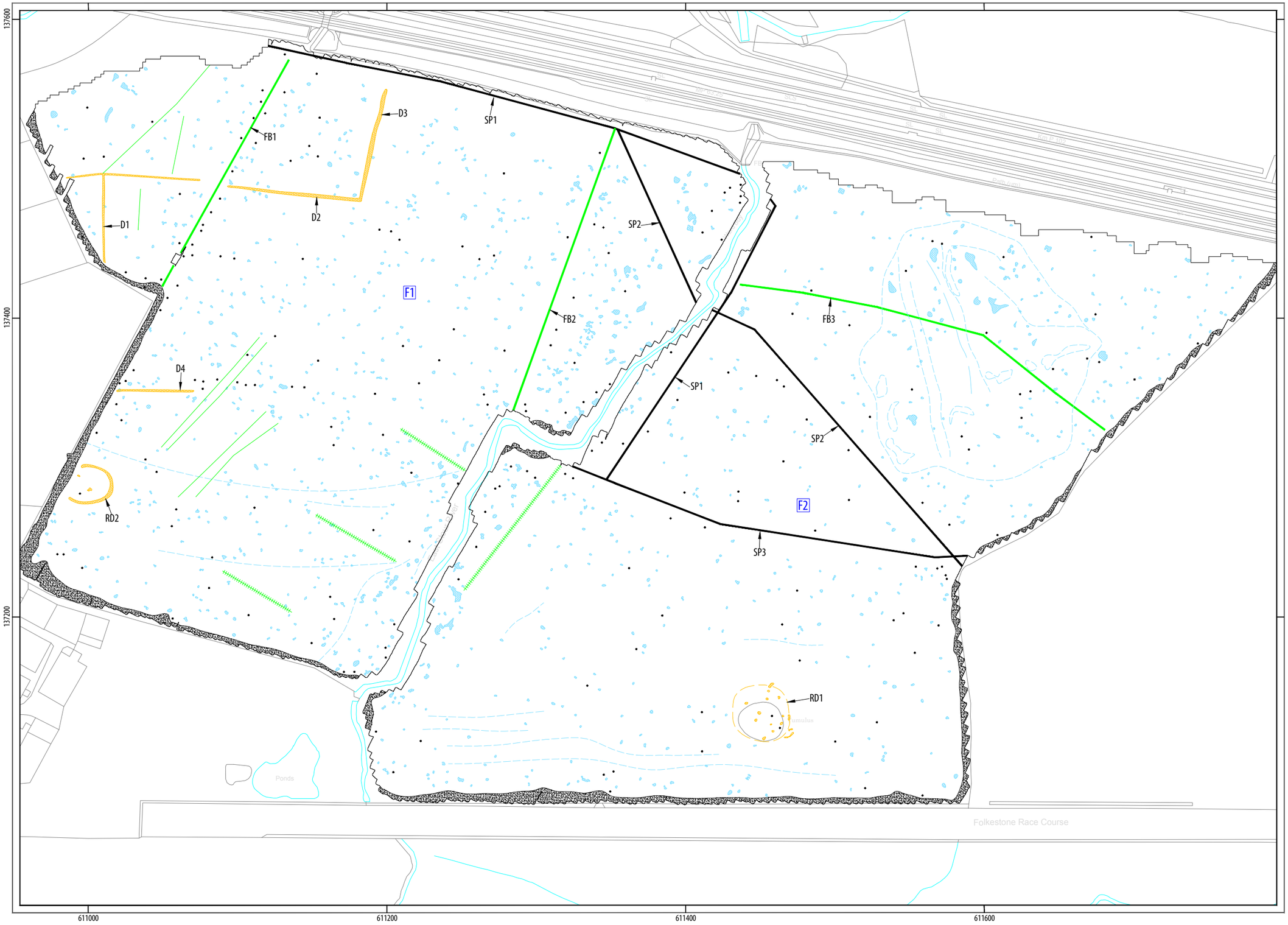
ILLUS 12 XY trace plot of minimally processed magnetometer data; Area 1 (1:2,500)



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	field drain
linear	former field boundary
linear	geological variation
magnetic enhancement	geology
linear trend	archaeology?
magnetic enhancement	archaeology?

ABBREVIATIONS

D	ditch
FB	former boundary
RD	ring-ditch
SP	service pipe

0 50m
1:2,500 @ A3

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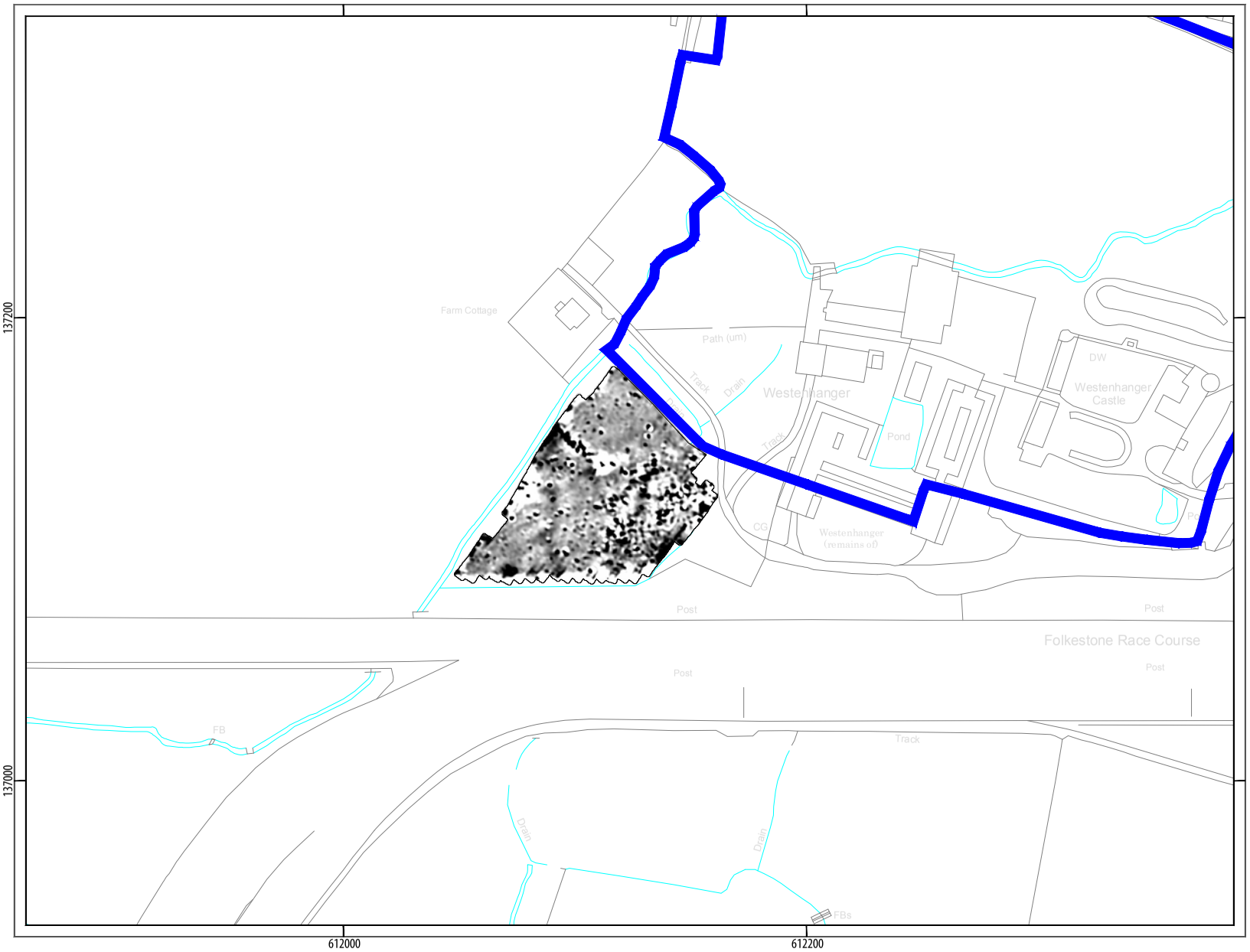
ILLUS 13 Interpretation of magnetometer data; Area 1 (1:2,500)



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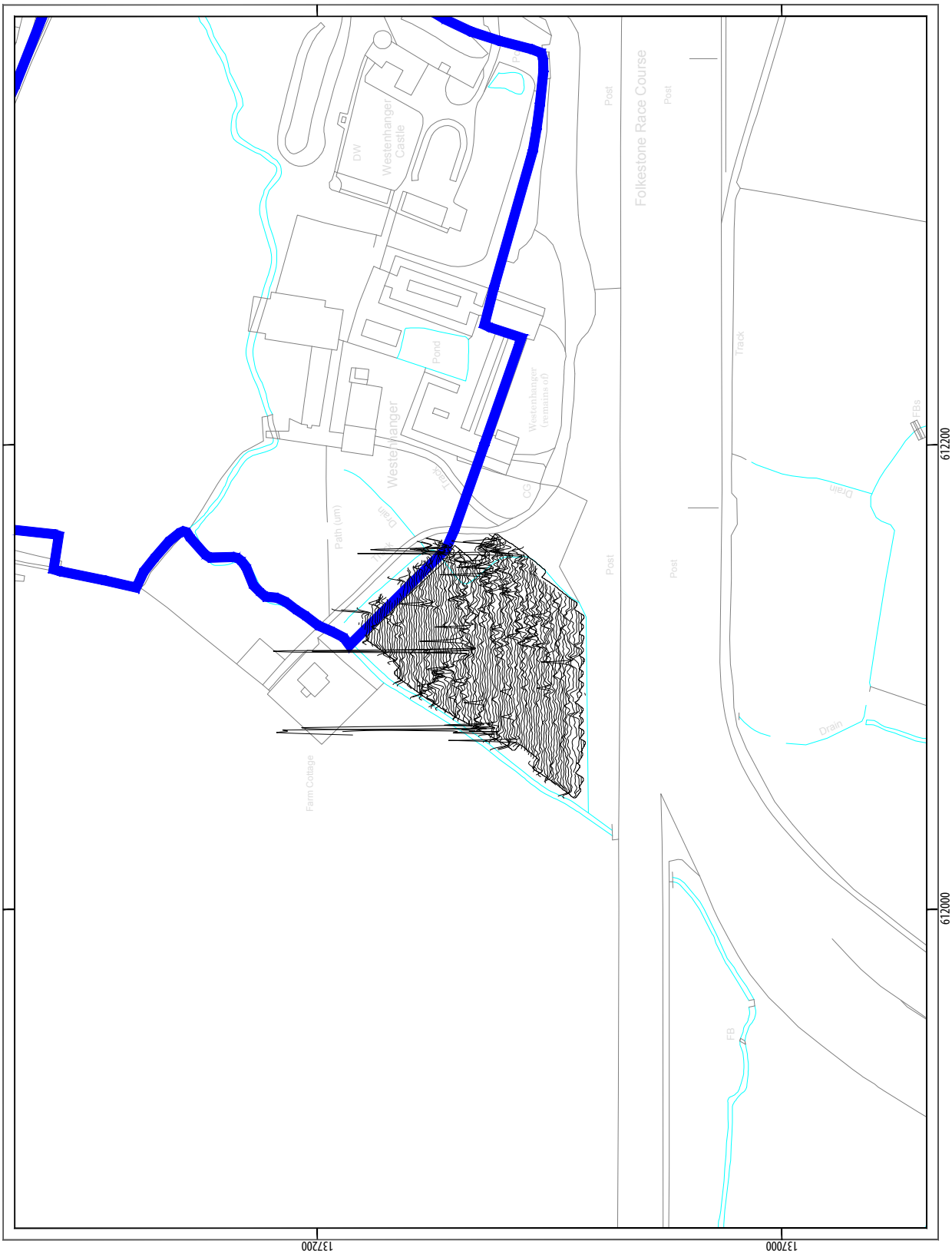
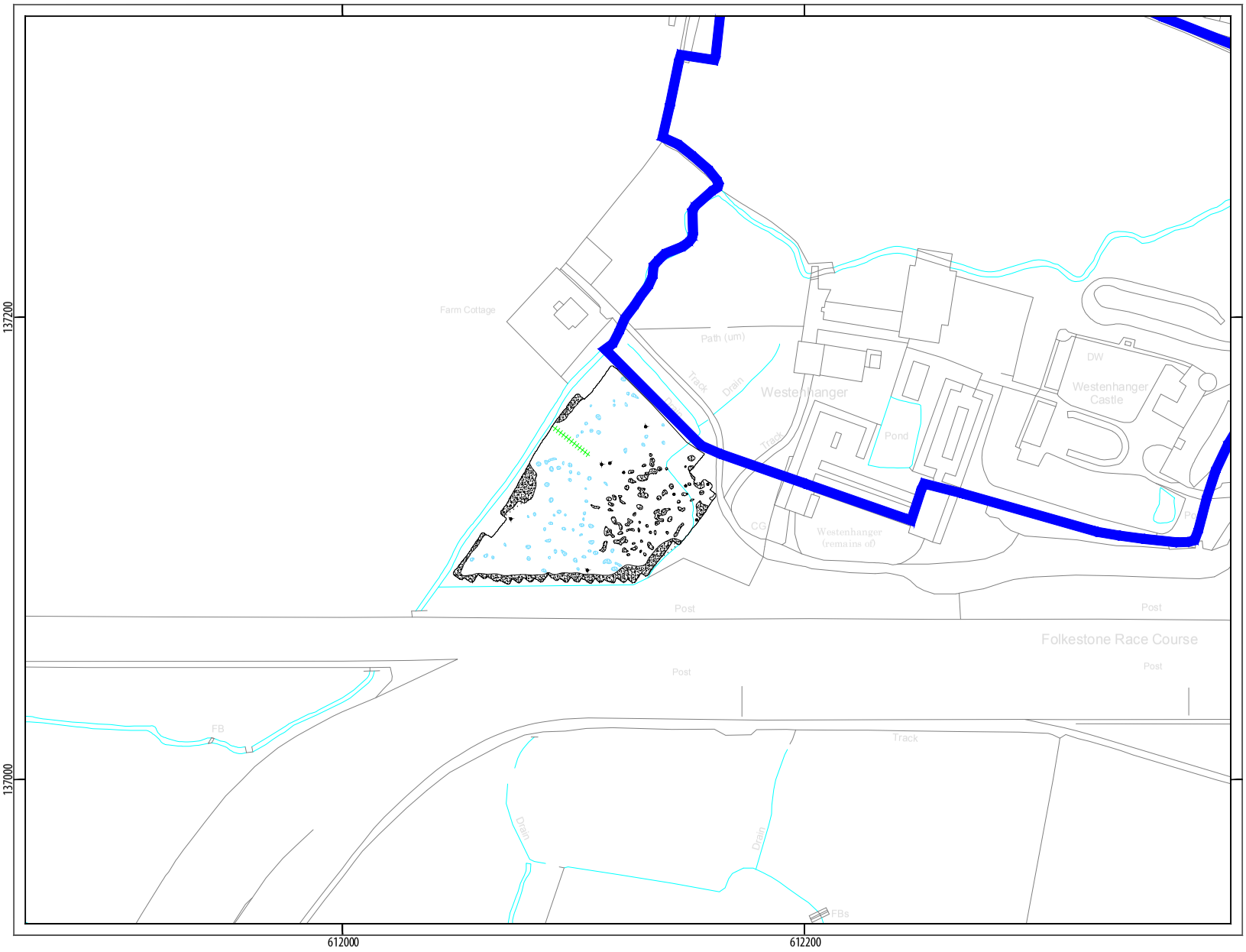
ILLUS 14 Processed greyscale magnetometer data; Area 2 (1:2,500)



ILLUS 15 XY trace plot of minimally processed magnetometer data; Area 2 (1:2,500)



scheduled monument

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

0 50m
1:2,500 @ A4

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ILLUS 16 Interpretation of magnetometer data; Area 2 (1:2,500)

ILLUS 17 Processed greyscale magnetometer data; Area 3 (1:2,500)

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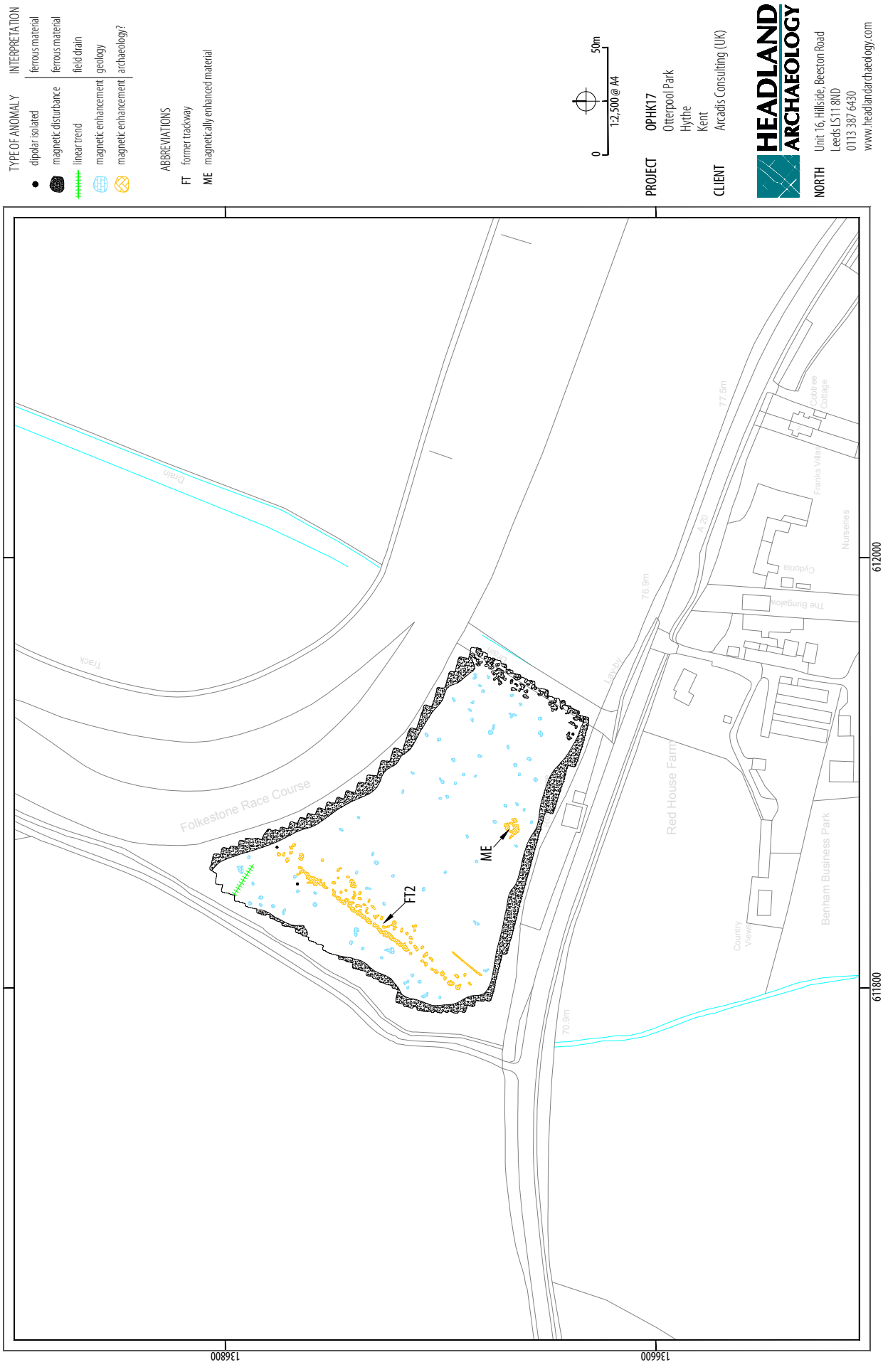
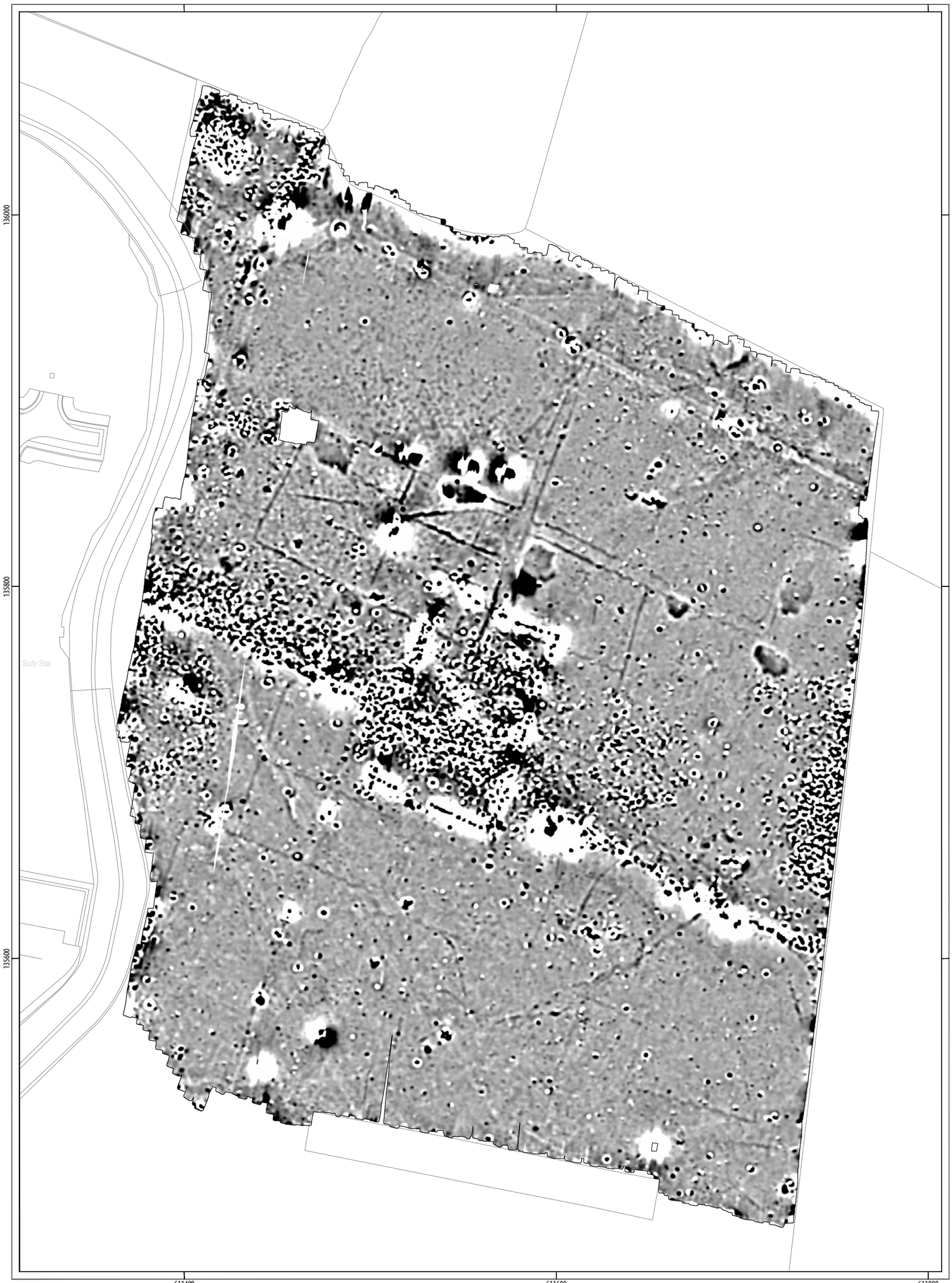
ILLUS 18 XY trace plot of minimally processed magnetometer data; Area 3 (1:2,000)



ILLUS 19 Interpretation of magnetometer data; Area 3 (1:2,500)



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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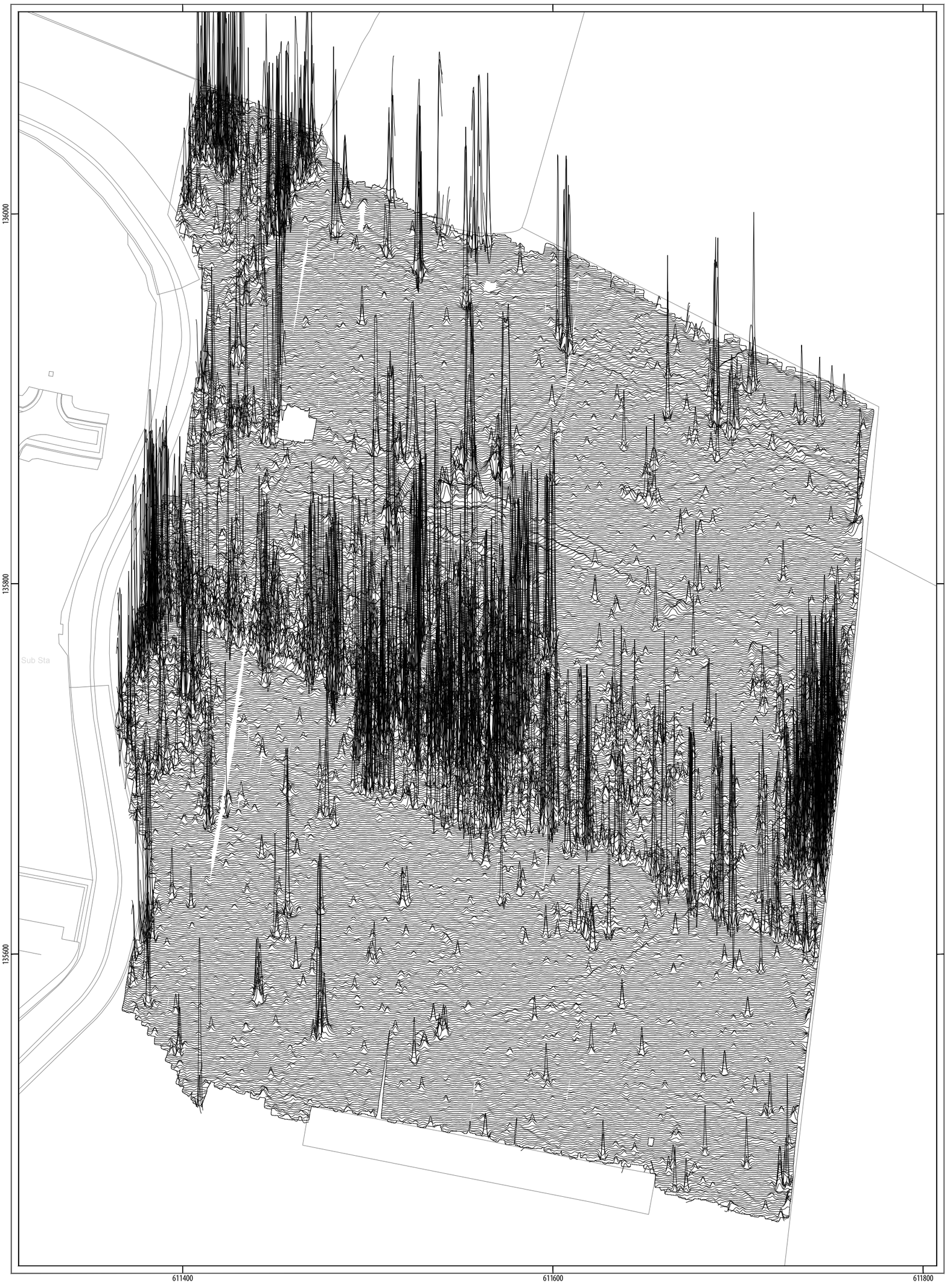
ILLUS 20 Processed greyscale magnetometer data; Area 4 (1:2,000)



25.0nT/cm

0 50m

1:2,500 @ A3

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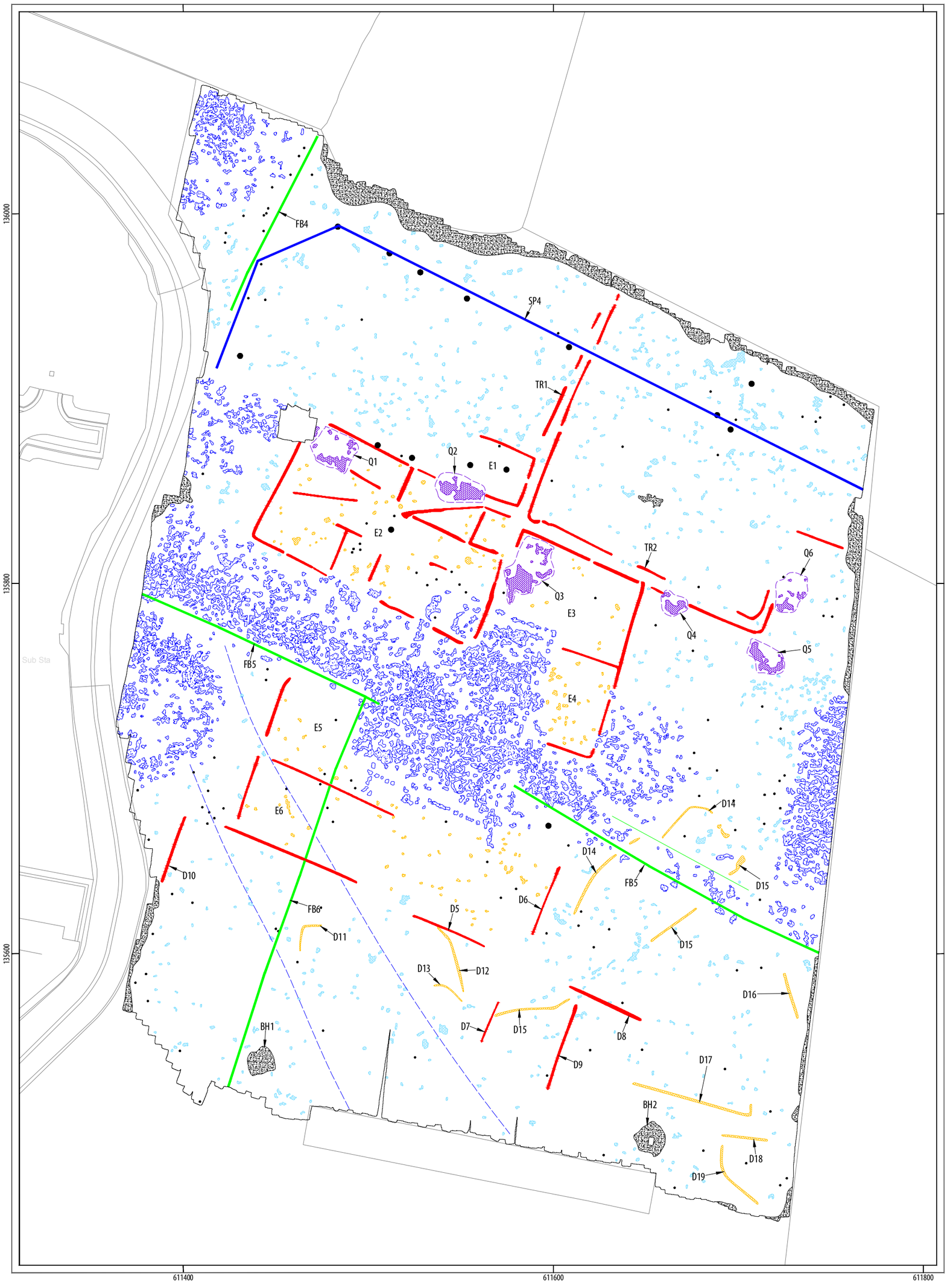
ILLUS 21 XY trace plot of minimally processed magnetometer data; Area 4 (1:2,000)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	former airfield
linear	service pipe
linear	modern groundworks
linear	former field boundary

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

ABBREVIATIONS

FB	former boundary	Q	quarry
D	ditch	RD	ring-ditch
E	enclosure	SP	service pipe
FB	former boundary	TR	trackway

0 50m
1:2,500 @ A3

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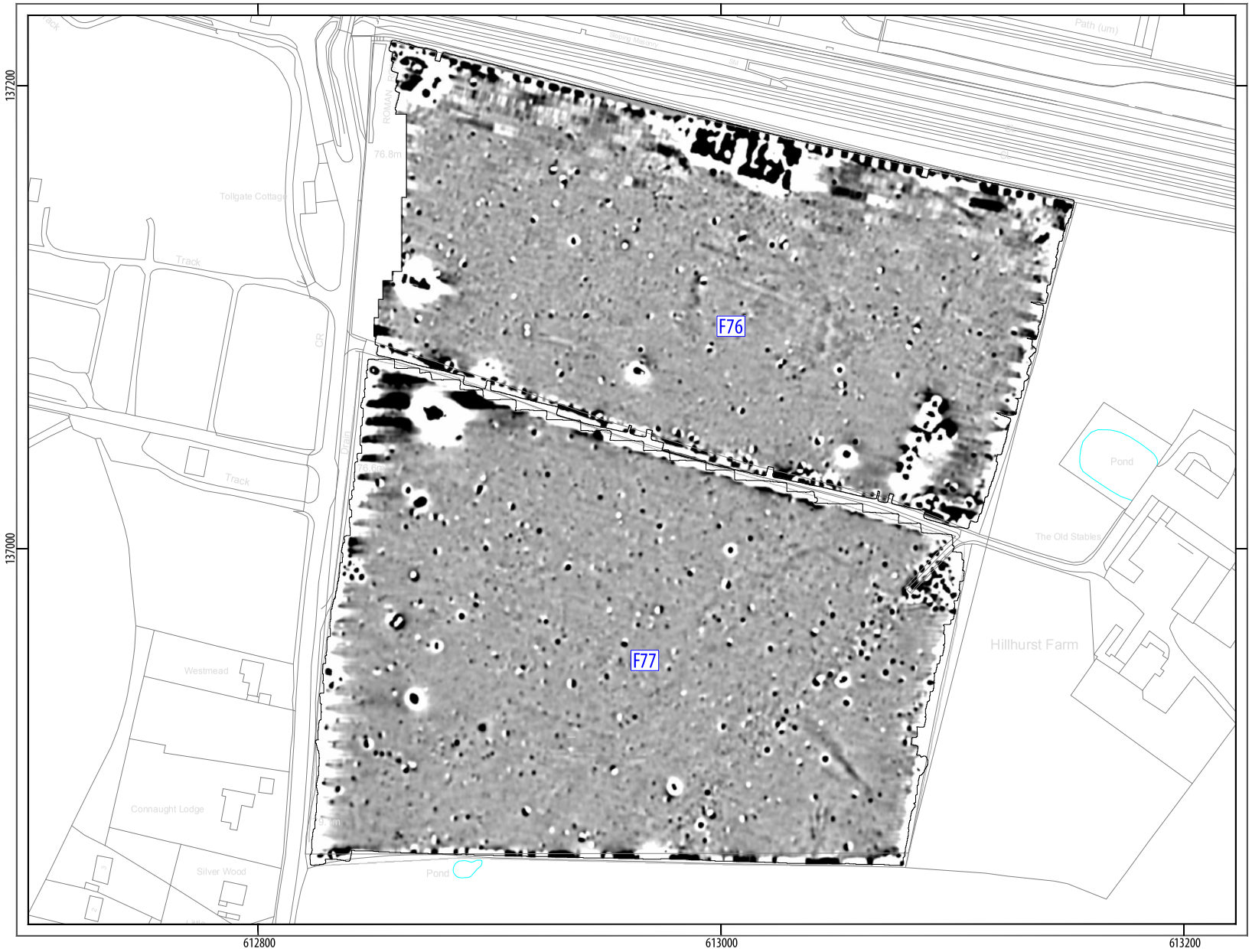
ILLUS 22 Interpretation of magnetometer data; Area 4 (1:2,000)



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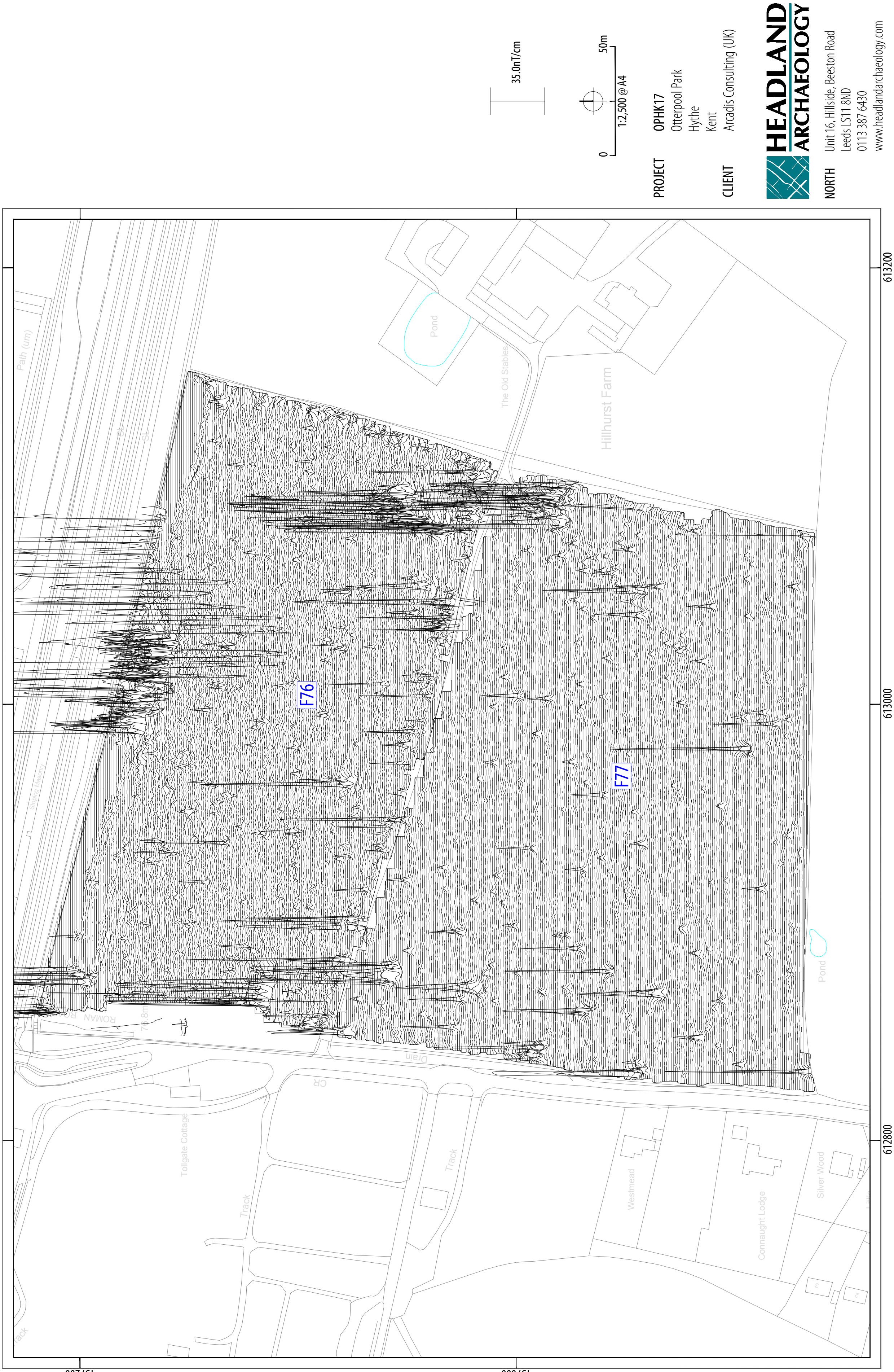
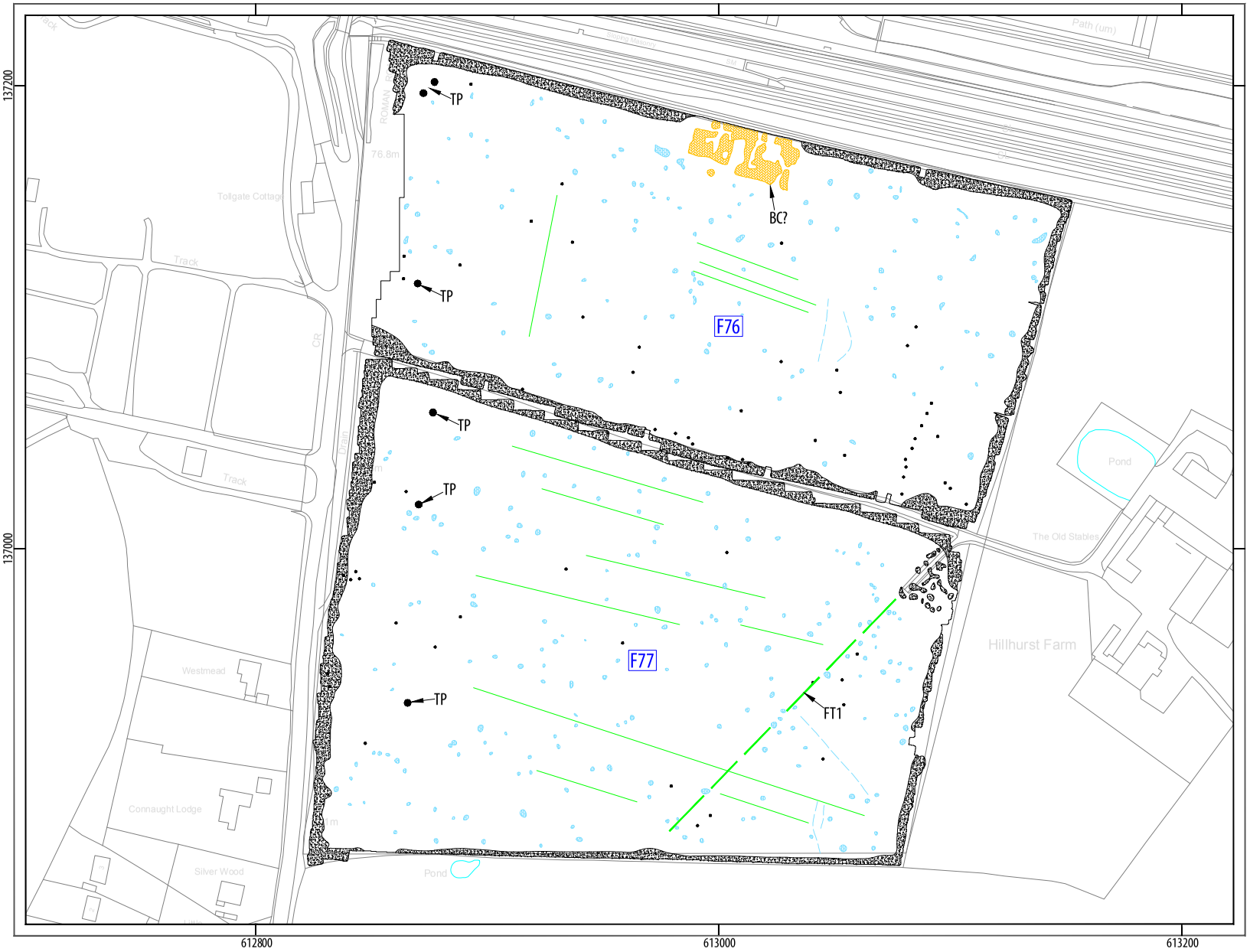
ILLUS 23 Processed greyscale magnetometer data; Area 5 (1:2,500)



ILLUS 24 XY trace plot of minimally processed magnetometer data; Area 5 (1:2,500)



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear	former farm track
linear	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?

ABBREVIATIONS

BC	brick clamp?
FT	former trackway
TP	telegraph pole

0 50m
1:2,500 @ A4

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ILLUS 25 Interpretation of magnetometer data; Area 5 (1:2,500)

8 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

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

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

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

Types of magnetic anomaly

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

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

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

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

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

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

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

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

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

APPENDIX 2 SURVEY LOCATION INFORMATION

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

Project details	
Project name	Otterpool Park, Kent
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey at five locations within a 709 hectare site near Hythe, Kent, as part of a baseline assessment of the heritage potential of the site. This information will help guide archaeological strategy in advance of the proposed development of a garden settlement. The survey has successfully evaluated the five areas and provided evidence for a probable Roman field system with trackways, small-scale quarrying, a deer park boundary and possible settlement on land east of Lympne Industrial Park. Broad areas of magnetic disturbance within the same field are thought to be due to demolished infrastructure associated with RAF Lympne. This area is assessed as of high archaeological potential. East of Barrowhill, a possible field system and a possible ring-ditch are identified whilst only slight magnetic variation has been recorded over a second possible ring-ditch which is recorded on the Kent Historic Environment Record. In the south-west corner of Folkestone Racecourse a broad linear anomaly may locate a trackway which is thought to have provided access to Westenhanger Castle. Thermoremnant anomalies east of Westenhanger probably locate an area of post-medieval/ modern industrial brick and tile manufacture. These anomalies are also considered to be of moderate archaeological potential.A former field boundary located in the west of the survey area is thought to also be the western pale of the deer park associated with Westenhanger Castle. No anomalies have been identified to locate an enclosure which is clearly visible on recent satellite imagery east of Westenhanger. As is the case with the ring-ditches, it is likely that there is insufficient magnetic contrast over the prevailing sandstone bedrock for some soil-filled features to manifest as magnetic anomalies. For this reason, the archaeological potential of the areas surveyed to date may be greater than indicated by the survey.
Project dates	Start: 27-04-2017 End: 09-05-2017
Previous/future work	Not known / Not known
Any associated project reference codes	OPHK17 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Methods & techniques	'Geophysical Survey'
Development type	Extensive green field commercial development (e.g. shopping centre, business park, science park, etc.)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Head and Alluvium
Drift geology (other)	Sandgate Formation, Hythe Formation and Folkestone Formation
Techniques	Magnetometry
Project location	
Country	England
Site location	KENT SHEPWAY STANFORD Otterpool Park, Kent
Study area	55 Hectares
Site coordinates	TR 1133 3731 51.095464938779 1.01849245871 51 05 43 N 001 01 06 E Polygon; TR 1210 3712 51.093472931507 1.029362596637 51 05 36 N 001 01 45 E Polygon; TR 1186 3671 51.089880093651 1.025699360826 51 05 23 N 001 01 32 E Polygon; TR 1158 3576 51.081452466163 1.021150131214 51 04 53 N 001 01 16 E Polygon; TR 1297 3704 51.092430436931 1.041722682514 51 05 32 N 001 02 30 E Polygon
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	Consultant
Project design originator	Headland Archaeology

Project director/manager	Harrison, S
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer
Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	'other'
Digital Media available	'Geophysics'
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Otterpool Park, Kent
Author(s)/Editor(s)	Harrison, D.
Other bibliographic details	OPHK17
Date	2018
Issuer or publisher	Headland Archaeology
Place of issue or publication	Edinburgh
Description	A4 Bound report and PDF/A
Entered by	Sam Harrison (sam.harrison@headlandarchaeology.com)
Entered on 1 February 2018	

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