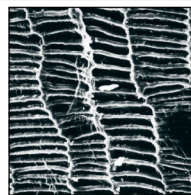
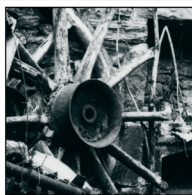
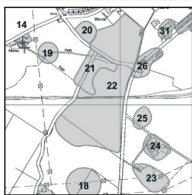


NFID20



LAND AT NORTH FILHAM, IVYBRIDGE, DEVON

GEOPHYSICAL SURVEY REPORT

commissioned by Bloor Homes South West

March 2020

LAND AT NORTH FILHAM, IVYBRIDGE, DEVON

GEOPHYSICAL SURVEY REPORT

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March 2020

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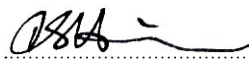
PROJECT INFO:

HA Project Code **NFID20** / NGR **SX 6518 5602** / Parish **Ugborough** / Local Authority **Devon County Council** / OASIS Ref. **headland5-384505**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **Alistair Webb** / Fieldwork **Michail Kaikas, Ross Bishop** / Graphics **David Harrison, Rafael Maya-Torcelly**

Approved by **Sam Harrison**



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PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 9 hectares on land at North Filham, Ivybridge, prior to the submission of a planning application for a proposed housing development. The survey has identified a distinct area of archaeological activity in the south of the Proposed Development Area (PDA) comprising a sub-square enclosure with internal divisions and discrete anomalies which may indicate settlement activity. The enclosure is assessed as of high archaeological potential. Elsewhere, numerous linear anomalies are identified across the PDA, most of which reflect the post-medieval agricultural landscape in the form of ploughing and former boundaries as depicted on historic mapping - others are interpreted as being due to land drains. Broad high magnitude and amorphous anomalies across the site are due to both localised variations in the bedrock and to colluvial deposits accumulated locally along the base of slopes. Therefore, on the basis of the survey, the majority of the site is assessed as of low archaeological potential with the exception of the enclosure in the south which is assessed as of high archaeological potential.

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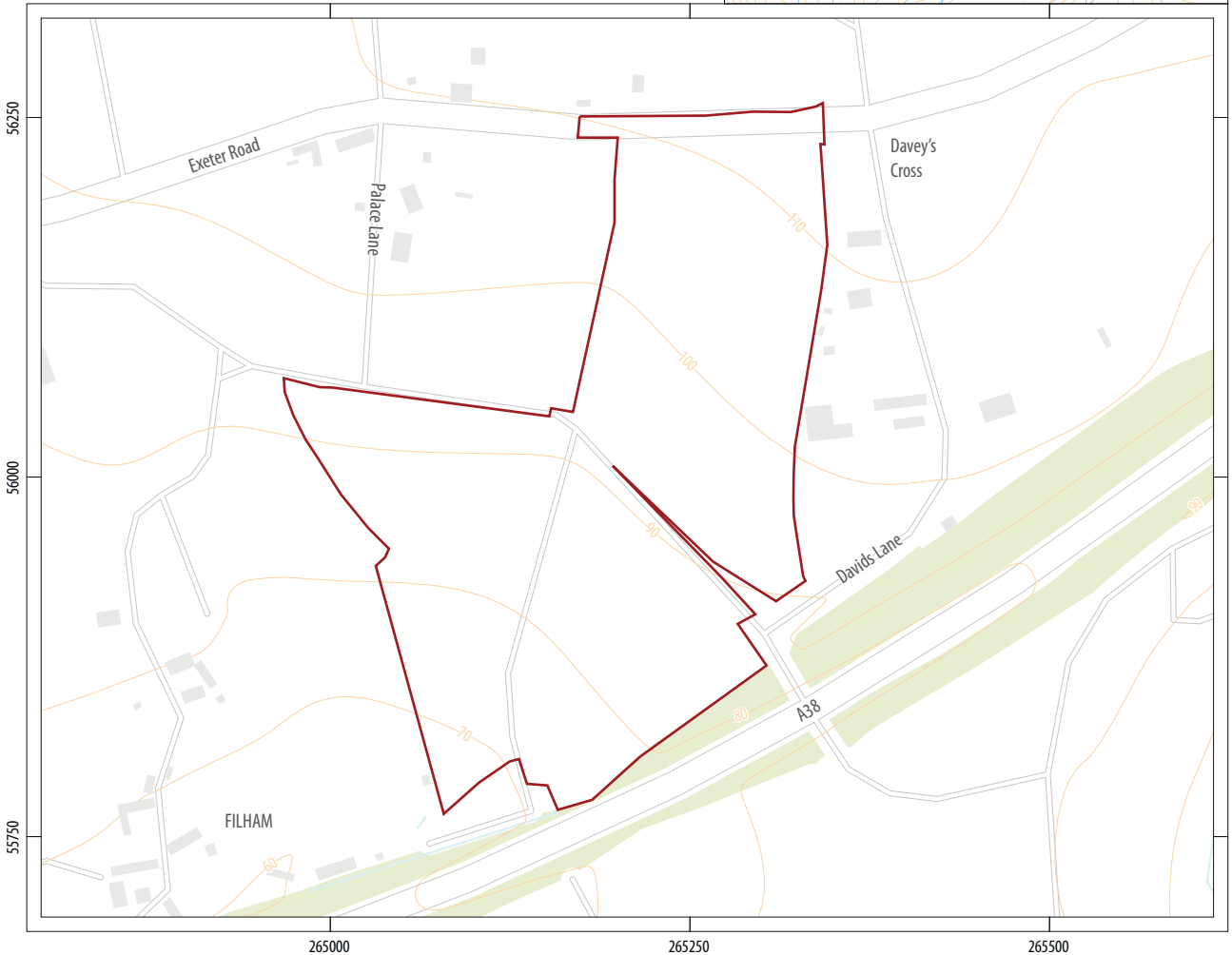
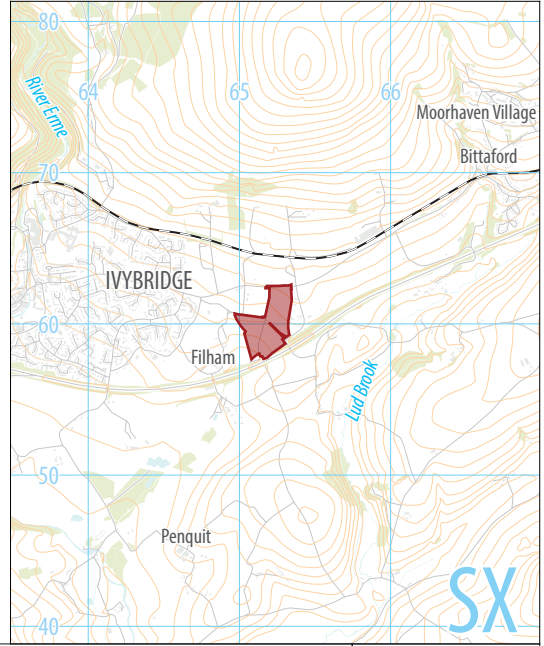
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Land at North Filham
Ivybridge
Devon



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



0 100m
1:5,000 @ A4

 proposed development area

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LAND AT NORTH FILHAM, IVYBRIDGE, DEVON

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by The Environmental Dimension Partnership Ltd (the Consultant) on behalf of Bloor Homes South West LLP (the Client) to undertake a geophysical survey on land at North Filham, Ivybridge (ie 'the PDA'). The results of the survey will be submitted to inform a planning application for a proposed housing development and will inform future archaeological strategy at the site.

The survey was undertaken in order to assess the impact of the proposed development on the historic environment and was undertaken in accordance with the Specification for Archaeological Geophysical Survey (Devon County Council 2018) and in line with guidance contained within the National Planning Policy Framework (MHCLG 2019) and with current best practice (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) comprises three fields (F1-F3) within an irregularly shaped block of land, centred on SX 6518 5602, covering approximately 9 hectares (Illus 1). It is bound to the north by the B3213 Exeter Road and to the south by the A38 Devon Expressway. Farmland extends east and west from the PDA, interspersed by isolated residential properties. F1-F3 are separated by minor unnamed lanes.

At the time of survey all the fields were under permanent pasture (Illus 2 and Illus 3).

The PDA is located towards the base of the south-facing slope of Western Beacon, Dartmoor, being at 110m Above Ordnance Datum

(AOD) along the B3213 Exeter Road and at 72m AOD along the A38 Devon Expressway. Locally, the topography falls towards the minor unnamed lane which separates F2 and F3.

The survey was carried out on the 17th and 18th of February 2020.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Middle Devonian Slate. Localised bands of igneous bedrock (pyroclastic basaltic rock) are recorded on a north-east/south-west alignment in the surrounding landscape although none are recorded within the PDA. The majority of the PDA contains no superficial deposits although a broad north-south band of Head (clay, silt, sand and gravel) is recorded following the lower contours of the hillside (NERC 2020; Illus 4).

The soils are classified in the Soilscape 6 Association, characterised as freely draining acid loams (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

An Archaeological and Heritage Assessment (EDP 2018) has established that:

'The available evidence suggests that the site is located in an area of low potential for significant archaeological remains dating from the prehistoric to medieval periods, with any remains of these dates (if present), likely to comprise nothing more than stray finds. Post-medieval and later activity is likely to be represented by nothing more than 'very low value' features such as buried furrows, plough soils and former boundaries'



ILLUS 2 Field 1, looking south

Previous archaeological investigations (South West Archaeology 2017; Cotswold Archaeology 2018) 250m to the south of the PDA have identified features consistent with Middle Bronze Age settlement including two sunken-floored roundhouses, up to 8m in diameter, and the remnants of a contemporary field system.

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 provide information about the nature and possible interpretation of any magnetic anomalies identified;
- › to therefore determine the likely presence/absence and extent of any buried archaeological features; and
- › to produce a comprehensive site archive and report.

3.1 MAGNETOMETER SURVEY

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

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

MLGrad601 and MultiGrad601 (Geomar Software Inc) software was used to collect and export the data. Terrasurveyor V3.0.35.1 (DWConsulting) software was used to process and present the data.



ILLUS 3 Field 2, looking south

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:5,000. Illus 2 and Illus 3 are site condition photographs. Illus 4 is a 1:2,000 survey location plan showing the direction of survey as GPS swaths and superficial deposits. Large scale (1:1,500) fully processed (greyscale) data, minimally processed (XY trace plot) data and an accompanying interpretation plot are presented in Illus 5, Illus 6 and Illus 7.

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 Specification for Archaeological Geophysical Survey (Devon County Council 2018), with guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey (OS) mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably

display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Ground conditions were very good across the PDA (see Illus 2 and Illus 3) and have contributed to a high standard of data throughout. A variable magnetic background has been identified throughout the site with clear magnetic contrast between soil-filled features and the surrounding soils. Numerous anomalies have been identified and are cross-referenced to specific examples on the interpretation drawing (Illus 7), where appropriate.

4.1 MODERN AND FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a result of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

A broad area of magnetic disturbance in the north-east of F2 (TP1, Illus 7) is caused by a telegraph pole with supporting stay. Other areas of magnetic disturbance along the field edges is due to the presence of ferrous material within and adjacent to the field boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historical mapping indicates that the division and layout of land within the PDA has undergone considerable alterations since the publication of the 1843 Tithing Map of Ugborough in 1843, with the removal of nine field boundaries to create larger fields. All of these former boundaries have been detected by the survey as clear linear anomalies (FB1–FB9). FB1–FB5 and FB9 manifest as parallel linear anomalies. These are typical of traditional Devon hedges and are caused by the magnetic contrast between the buried stone foundations/facing flanking either side of an earthen bank (now removed). In F2, FB6–FB8 manifest as single, broadly parallel, linear anomalies and are probably caused by soil-filled ditches. Numerous fainter parallel linear trend anomalies are identified throughout the PDA, mostly parallel with the former and/or extant field boundaries. These are due to former ploughing.

Several linear and rectilinear anomalies do not follow this pattern, being oblique to the surrounding boundaries. These are mostly located at the lowest-lying part of the site in the south of F2/F3 and are thought to be due to land drains – ‘issues’, ‘sinks’ and a ‘water pump’ are depicted on historic maps immediately south-west of the PDA, attesting to poor drainage locally.

4.3 GEOLOGICAL ANOMALIES

A broad band of magnetic enhancement has been identified north/south through the centre of the PDA corresponding with the base of the slopes. The band broadly corresponds to the superficial deposit of Head (colluvium) and is most likely due to localised variation between the sand, gravel silts and clays.

Several isolated, high magnitude, short, linear anomalies have been identified, mostly in F1 and F3. These may be archaeological in origin, perhaps being due to soil-filled features, but in the absence of any clear patterns a geological origin is preferred. The anomalies are broadly aligned north-east/southwest and may be due to igneous intrusions within the slate bedrock. Elsewhere, numerous discrete

areas of magnetic enhancement are identified throughout the PDA and are due to localised variation in the depth and composition of the topsoil.

4.4 ARCHAEOLOGICAL AND POSSIBLE ARCHAEOLOGICAL ANOMALIES

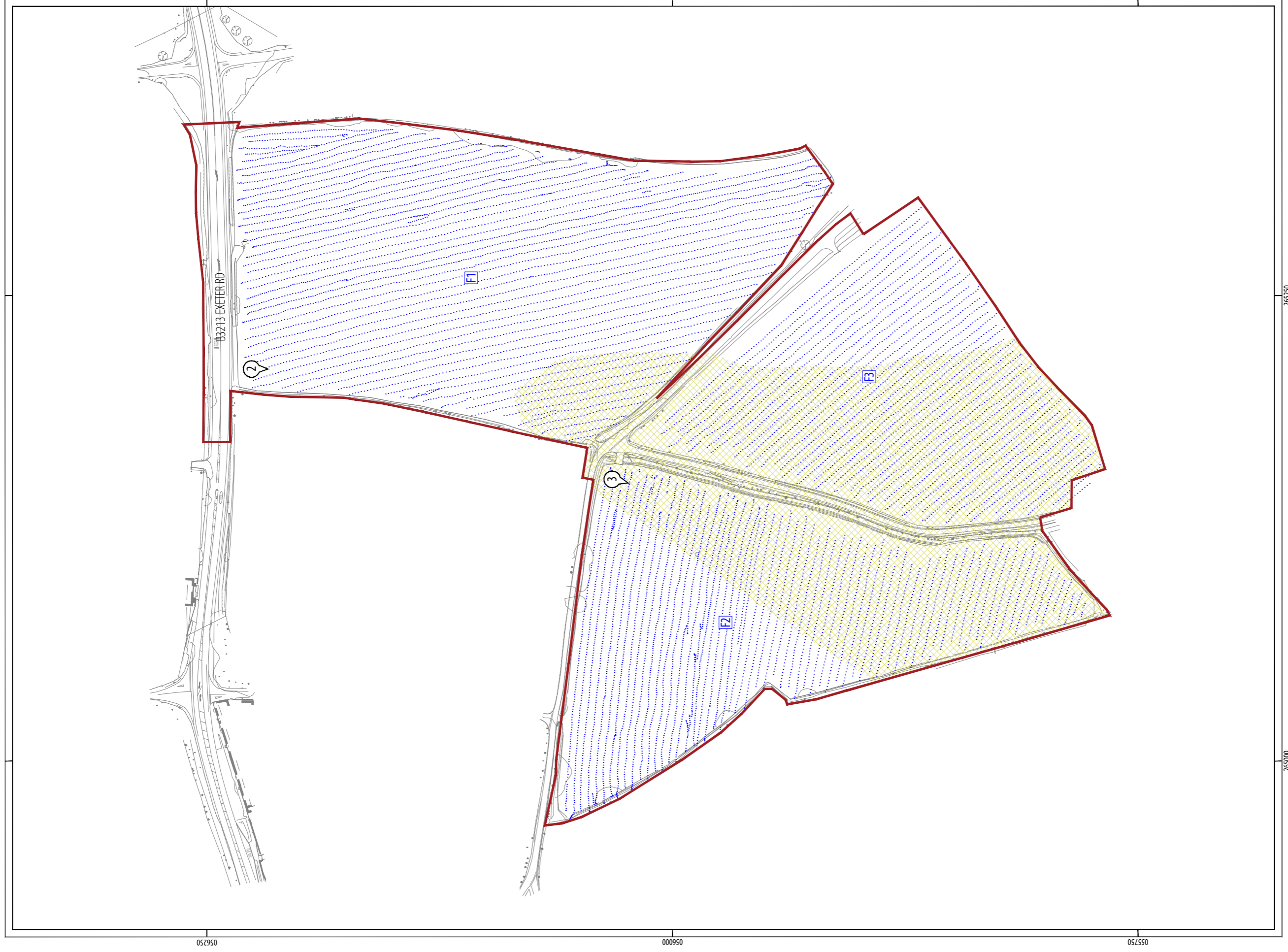
A clear area of archaeological activity has been identified in the south of F3, centred on SX 5616 5580, comprising the eastern extent of a sub-square enclosure with a clear east/west internal division. The enclosure measures 45m north/south and at least 48m east/west – the western extent appearing to extend beyond the limit of the survey. Broad high magnitude anomalies in the southern half of the enclosure may be due to enhanced deposits within soil-filled archaeological features. The anomalies measure up to 8m in diameter and are similar in size and form to the magnetic anomalies caused by the Middle Bronze Age sunken roundhouses 250m south of the PDA (South West Archaeology 2017). It is possible that the anomalies are caused by similar settlement activity although no direct relationship can be inferred. Several other discrete anomalies are ascribed as possibly archaeological in origin, perhaps being due to pits, although no clear patterns are discernible. The enclosure is assessed as of high archaeological potential.

5 CONCLUSION

The survey has successfully evaluated the Proposed Development Area (PDA) and has identified a distinct area of archaeological activity in the south of the site comprising a sub-square enclosure with internal divisions and discrete anomalies which may indicate settlement activity. The enclosure is assessed as of high archaeological potential. Elsewhere, numerous linear anomalies are identified across the PDA, most of which reflect the post-medieval agricultural landscape in the form of ploughing and former field boundaries as depicted on historic mapping - others are interpreted as being due to land drains. Broad high magnitude and amorphous anomalies across the site are due to both localised variations in the bedrock and to colluvial deposits accumulated locally along the base of slopes. Therefore, on the basis of the survey, the majority of the site is assessed as of low archaeological potential with the exception of the enclosure in the south which is assessed as of high archaeological potential.

6 REFERENCES

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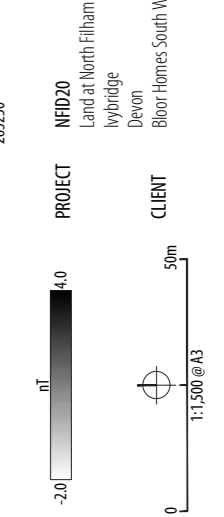


- proposed development area
- GPS swaths
- superficial geology - Head (clay, silt, sand and gravel)
- 📍 location and direction of ILLUS 2-3

ILLUS 4 Survey location showing GPS swaths and superficial deposits



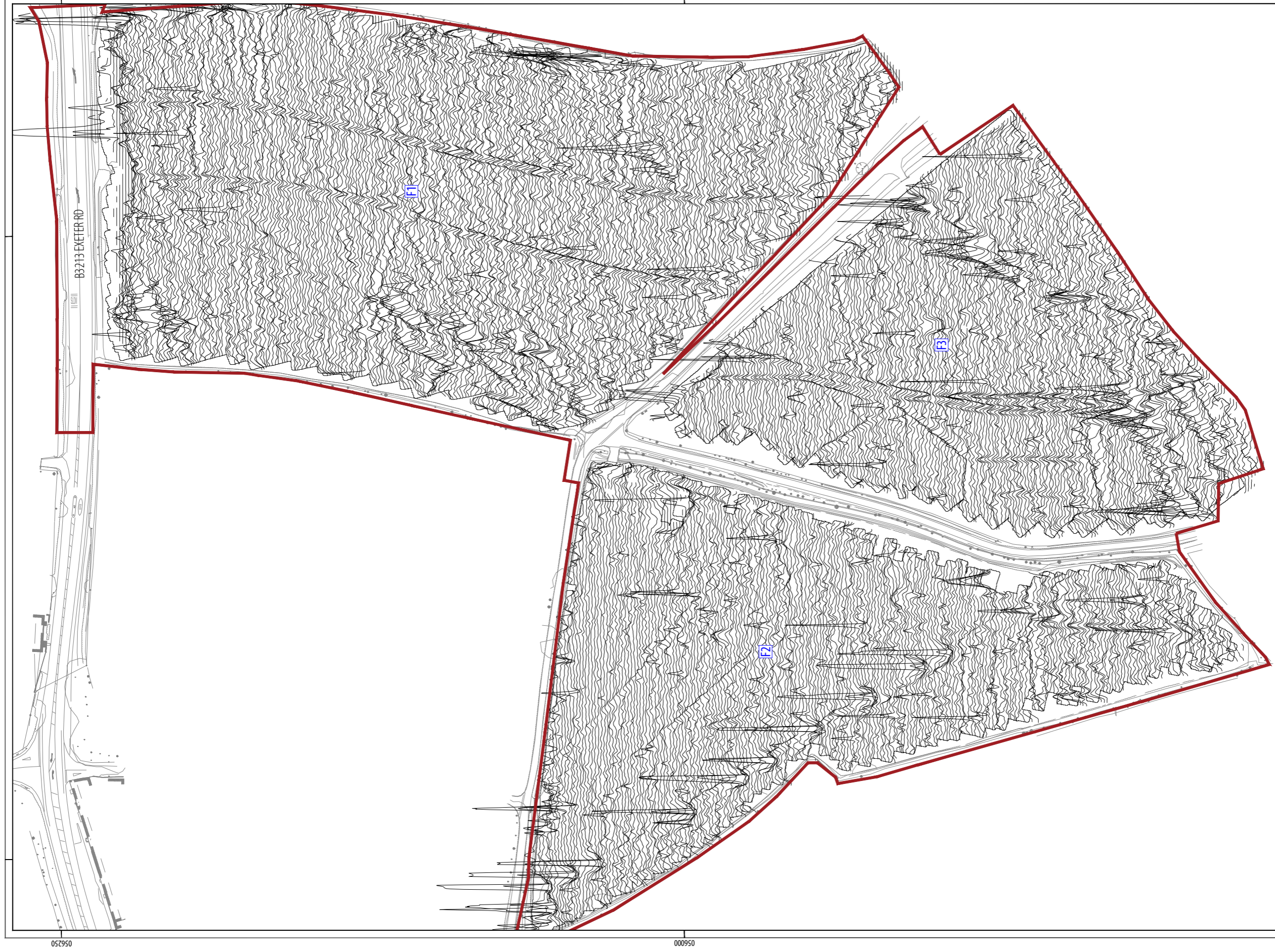
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PROJECT
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Land at North Filham
Ivybridge
Devon

CLIENT
Bloor Homes South West

proposed development area



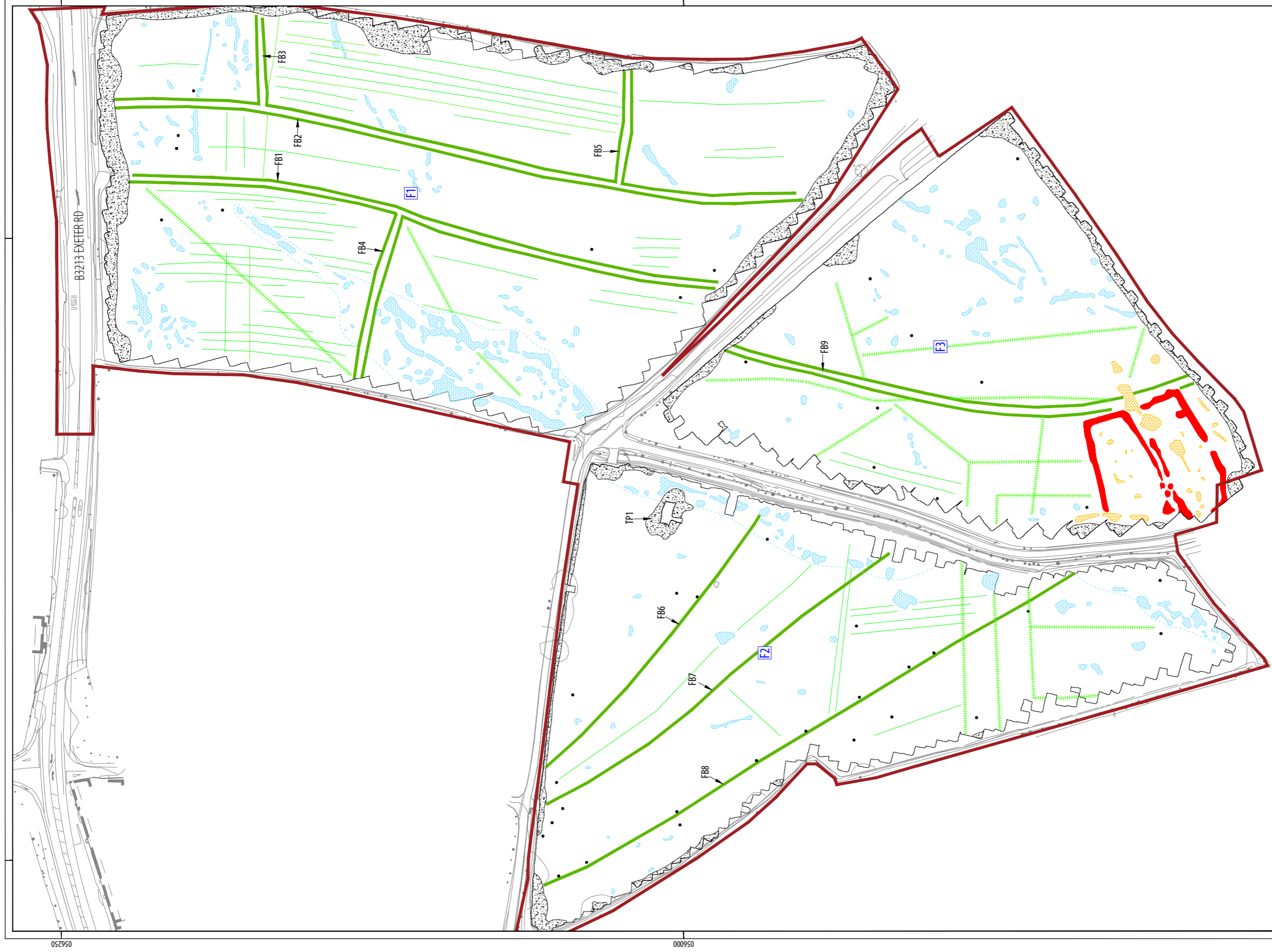
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 proposed development area

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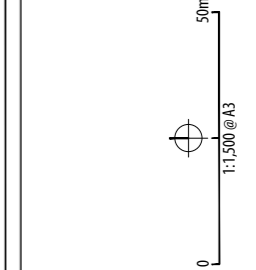
ILLUS 6 XY trace plot of minimally processed magnetometer data



TYPE OF ANOMALY	INTERPRETATION
proposed development area	ferrous material
dipolar isolated	ferrous material
magnetic disturbance	agricultural
linear trend	field drain
linear trend	former field boundary
linear	

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

ABBREVIATIONS	INTERPRETATION
FB	former boundary
TP	telegraph pole



PROJECT	CLIENT
NFD20 Land at North Filham Ivybridge Devon	Bloor Homes South West

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ILLUS 7 Interpretation of magnetometer data

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 currents associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

Lineartrend 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: *headland5-384505***PROJECT DETAILS**

Project name	Land at North Filham, Ivybridge
Short description of the project	Geophysical survey
Project dates	Start: 17-02-2020 End: 20-02-2020
Previous/future work	Not known / Not known
Type of project	Field evaluation
Methods & techniques	'Geophysical Survey'
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Solid geology (other)	Middle Devonian Slates - slate
Drift geology (other)	head (clay, silt, sand and gravel)
Techniques	Magnetometry

PROJECT LOCATION

Country	England
Site location	Devon South Hams Ivybridge Land at North Filham, Ivybridge
Study area	9 Hectares
Site coordinates	SX 6518 5602 50.387964840859 -3.896751252077 50 23 16 N 003 53 48 W Point
Entered by	Sam Harrison (sam.harrison@headlandarchaeology.com)
Entered on	12 February 2020



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