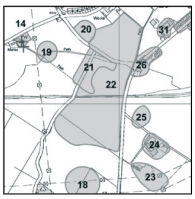
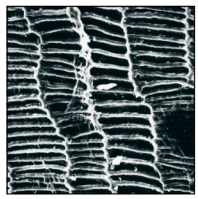
GWEY20








GOODMANHAM WOLD FARM, MARKET WEIGHTON, EAST RIDING OF YORKSHIRE

GEOPHYSICAL SURVEY REPORT

PLANNING REF. DC/19/03942/PLF

commissioned by M & J Pickering

March 2020

HEADLAND ARCHAEOLOGY

REGISTERED CIfA ORGANISATION

GOODMANHAM WOLD FARM, MARKET WEIGHTON, EAST RIDING OF YORKSHIRE

GEOPHYSICAL SURVEY REPORT

PLANNING REF. DC/19/03942/PLF

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March 2020

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

PROJECT INFO:

HA Project Code **GWEY20** / NGR **SE 9137 4497** / Parish **Goodmanham** / Local Authority **East Riding of Yorkshire Council** / OASIS Ref. **headland5-388374**

PROJECT TEAM:

Project Manager **David Harrison** / Author **Ross Bishop** / Fieldwork **Ross Bishop** / Graphics **Eleanor Winter, Ross Bishop**

Approved by **David Harrison** D Harrison.....

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part of the RSK Group

REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 0.7 hectare site at Goodmanham Wold Farm, Market Weighton, where a pig finishing unit is proposed. The site is situated within a rich archaeological landscape containing archaeological activity from the prehistoric period onwards including cropmark evidence for a possible trackway which crosses the Proposed Development Area (PDA). A clear linear anomaly has been identified by the survey corresponding to the cropmark data and is ascribed high archaeological potential, probably being due to an infilled ditch and possibly forming part of a trackway or linear boundary feature. No further anomalies of archaeological potential have been identified by the survey and therefore the majority of the site is assessed as of low archaeological potential, and locally high in the vicinity of the probable ditch.

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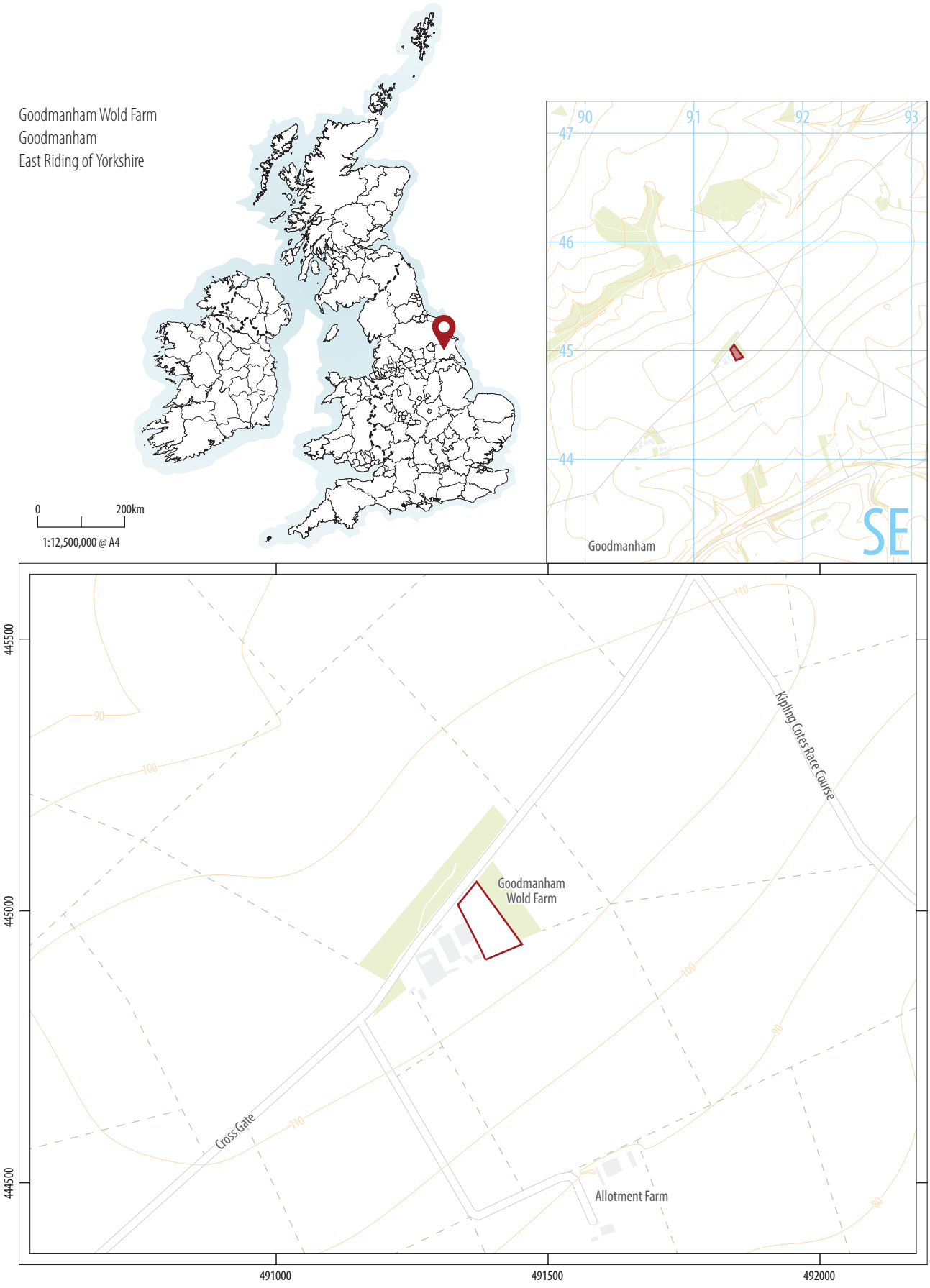
LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

GOODMANHAM WOLD FARM, MARKET WEIGHTON, EAST RIDING OF YORKSHIRE

GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by M & J Pickering (the Client), to undertake a geophysical (magnetometer) survey on land at Goodmanham Wold Farm, Market Weighton, East Yorkshire, where a rig finishing unit is proposed. The survey has been commissioned in response to comments (HER/PA/CONS/27737) received from James Goodyear (Archaeological Advisor to the East Riding of Yorkshire Council and Hull City Council) relating to a planning application (Ref DC/19/03942/PLF) for construction of the unit. The results of the survey 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 an Archaeological Written Scheme of Investigation (WSI) (Bishop 2019), 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).

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Geophysical Survey Area (GSA) is located north-east of Goodmanham at Goodmanham Wold Farm, centred on SE 9137 4497 (Illus 1). It comprises a single, rectangular field immediately east of the farm, and is bound to the north by Cross Gate Road, to the east by a wooded copse, and to the south by arable farmland.

The GSA is flat at approximately 114m Above Ordnance Datum. At the time of survey, the field was under pasture (Illus 2). A broad and shallow linear earthwork was visible, aligned north-east/south-west across the width of the GSA (Illus 3) and is thought to correspond to the cropmark data (see below).

The survey was carried out on the 3rd March 2020.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Burnham Chalk Formation (chalk). No superficial deposits are recorded (NERC 2020).

The soil is classified in the Soilscape 5 Association, characterised as freely draining lime-rich loams (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

The archaeological advisor to the East Riding of Yorkshire Council has commented that:

> *'The GSA lies within a landscape containing an abundance of evidence for prehistoric and Romano-British activity. This is highlighted by three ditches running through the application plot itself in a north-east to south-west direction. These ditches are part of a trackway extending from a group of cropmarks to the north-east and likely ending at another south-east to north-west trackway which has been plotted to the south-west of the farm. Further cropmarks in the area include those of enclosures, field systems and more significantly, funerary monuments.'*

ILLUS 2 GSA, looking south-east

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 GSA. 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 GSA;
- 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 buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

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

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

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2 and Illus 3 are site condition photographs with Illus 3 highlighting a linear earthwork across the width of the site. Illus 4 is a 1:1,250 survey location plan showing the direction of survey as GPS swaths and the cropmark data (transcribed from Stoertz 1997). The data is presented in greyscale and XY trace formats, at a scale of 1:1,250, in Illus 5 and Illus 6. Illus 7 is an interpretation plot of the data also at a scale of 1:1,250.

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 (Bishop 2020), 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).

ILLUS 3 GSA showing linear earthwork, looking north-east

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 good throughout contributing to a high standard of data collection. A variable magnetic background has been identified throughout the GSA characterised by several linear and discrete areas of magnetic enhancement.

Against this background a number of anomalies have been identified and cross-referenced to specific examples on the interpretation figure (Illus 6), where appropriate.

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 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.

Broad areas of magnetic disturbance along the southern and western edges of the GSA are due to the presence of farm machinery and to adjacent farm buildings and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

A series of low magnitude parallel linear trend anomalies are identified throughout the GSA, aligned north-east/south-west, parallel with, and at right-angles to, the historic field boundaries. The anomalies are thought to be due to ploughing.

4.3 GEOLOGICAL ANOMALIES

Occasional discrete low magnitude areas of magnetic enhancement are due to localised variation in the depth and composition of the topsoil.

4.4 ARCHAEOLOGICAL ANOMALIES

A single, clear high magnitude north-east/south-west linear anomaly (D1, Illus 7) is identified corresponding with cropmark data and with a broad shallow linear earthwork visible on the ground surface. The anomaly is thought to be due to the magnetic contrast between the soil-fill of a ditch and the surrounding soil. D1 is notably wider and higher in magnitude than the surrounding ploughing trends and appears fractionally oblique to them. Contrary to the cropmark data, the survey has only detected a single probable ditch and it is possible that some of the parallel cropmarks are due to ploughing activity. The ditch may form part of a trackway or a boundary feature.

5 CONCLUSION

The survey has successfully evaluated the geophysical survey area and has identified a clear linear anomaly corresponding to cropmark data. The anomaly is ascribed high archaeological potential, probably being due to an infilled ditch and possibly forming part of a trackway or linear boundary feature. No further anomalies of archaeological potential have been identified by the survey and therefore the majority of the site is assessed as of low archaeological potential, and locally high in the vicinity of the probable ditch.

6 REFERENCES

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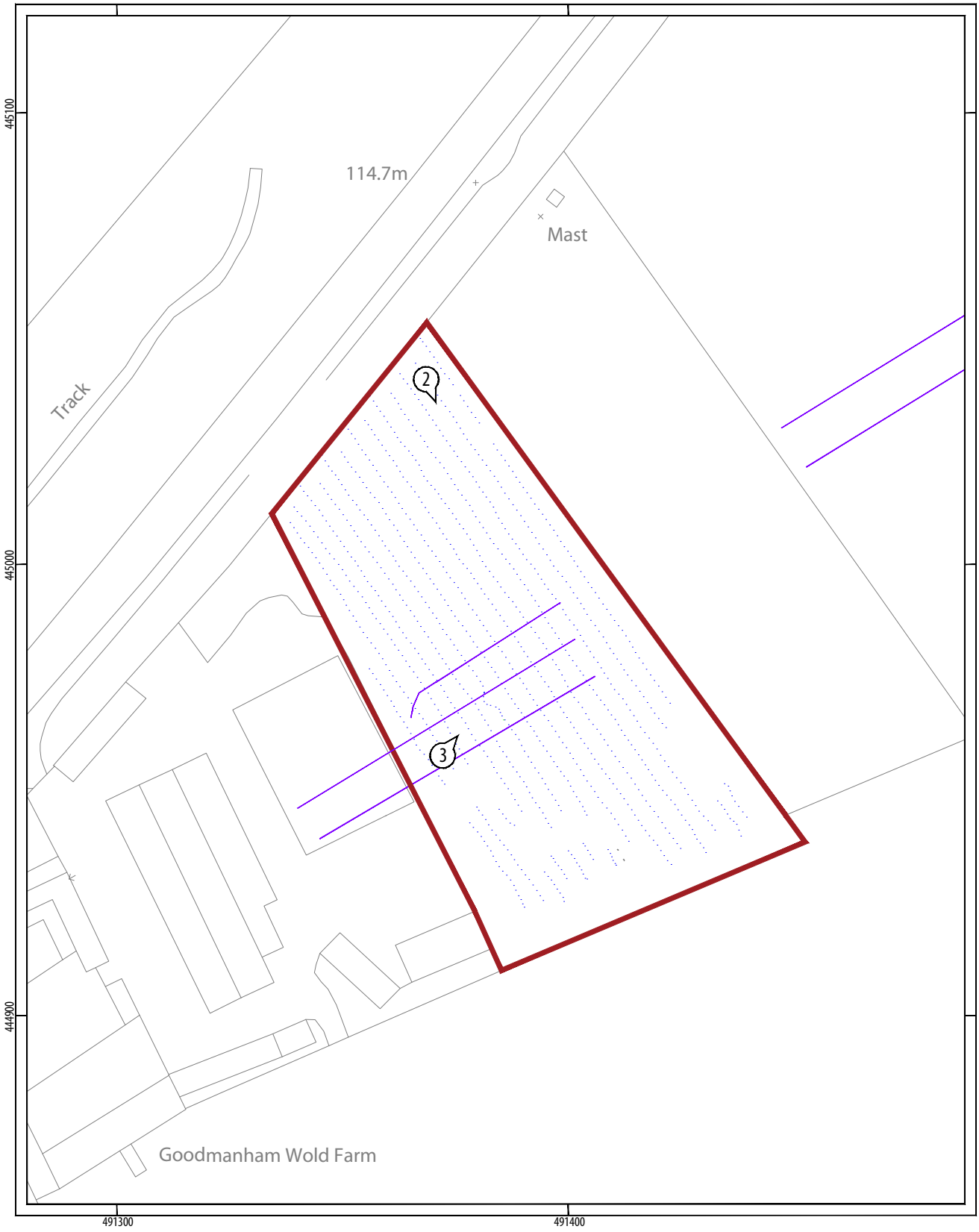

geophysical survey area
GPS swaths
location and direction of ILLUS 2-3
cropmark data

0 25m
1:1,250 @ A4

PROJECT GWEY20
Goodmanham Wold Farm
Market Weighton
East Yorkshire

CLIENT M & J Pickering

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ILLUS 4 Survey location showing GPS swaths and cropmark data (1:1,250)

nT
-1.0 2.0

0 25m
1:1,250 @ A4

PROJECT GWEY20
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Market Weighton
East Yorkshire

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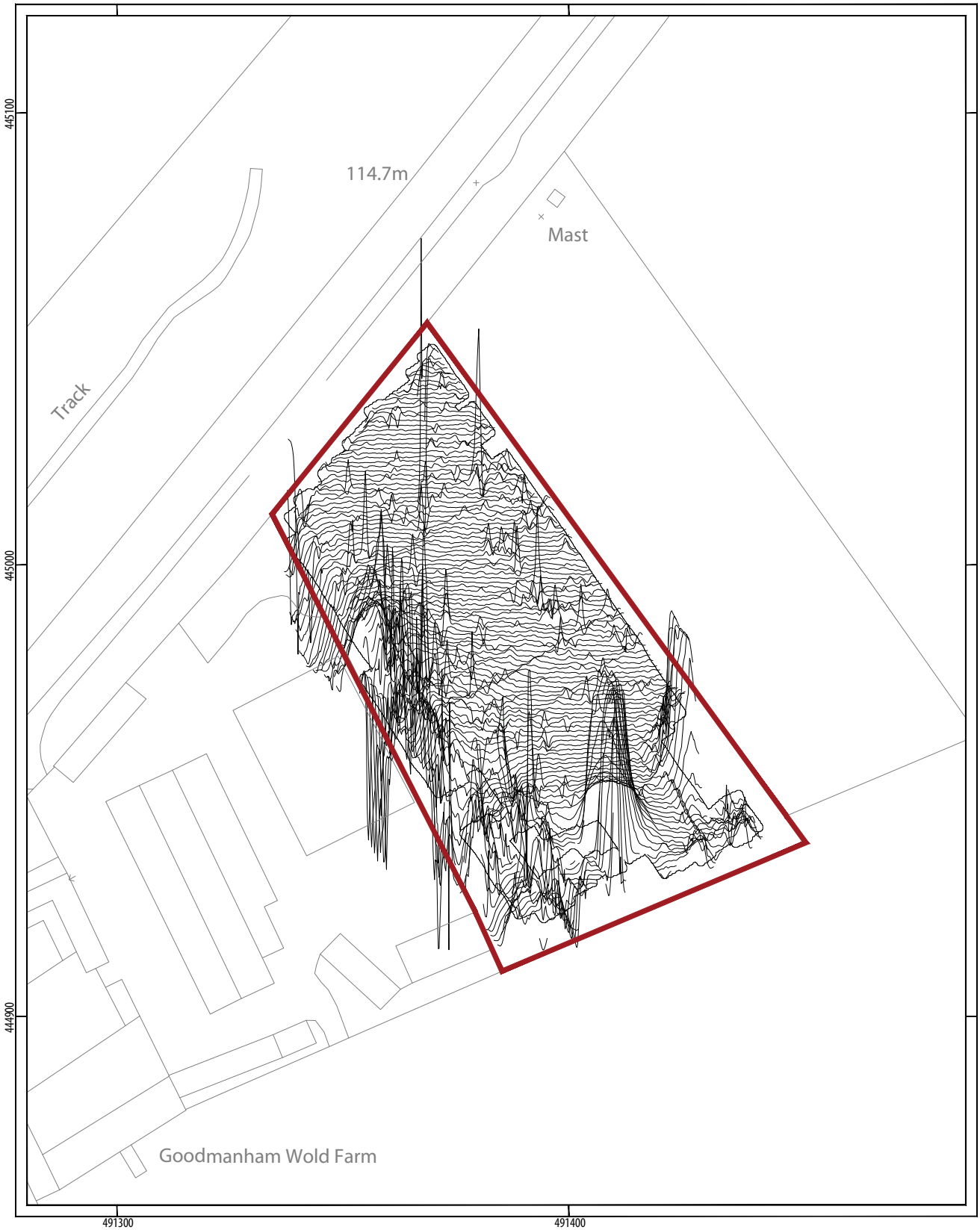
ILLUS 5 Processed greyscale magnetometer data (1:1,250)



18.0nT/cm

0 25m

1:1,250 @ A4

PROJECT GWEY20
Goodmanham Wold Farm
Market Weighton
East Yorkshire

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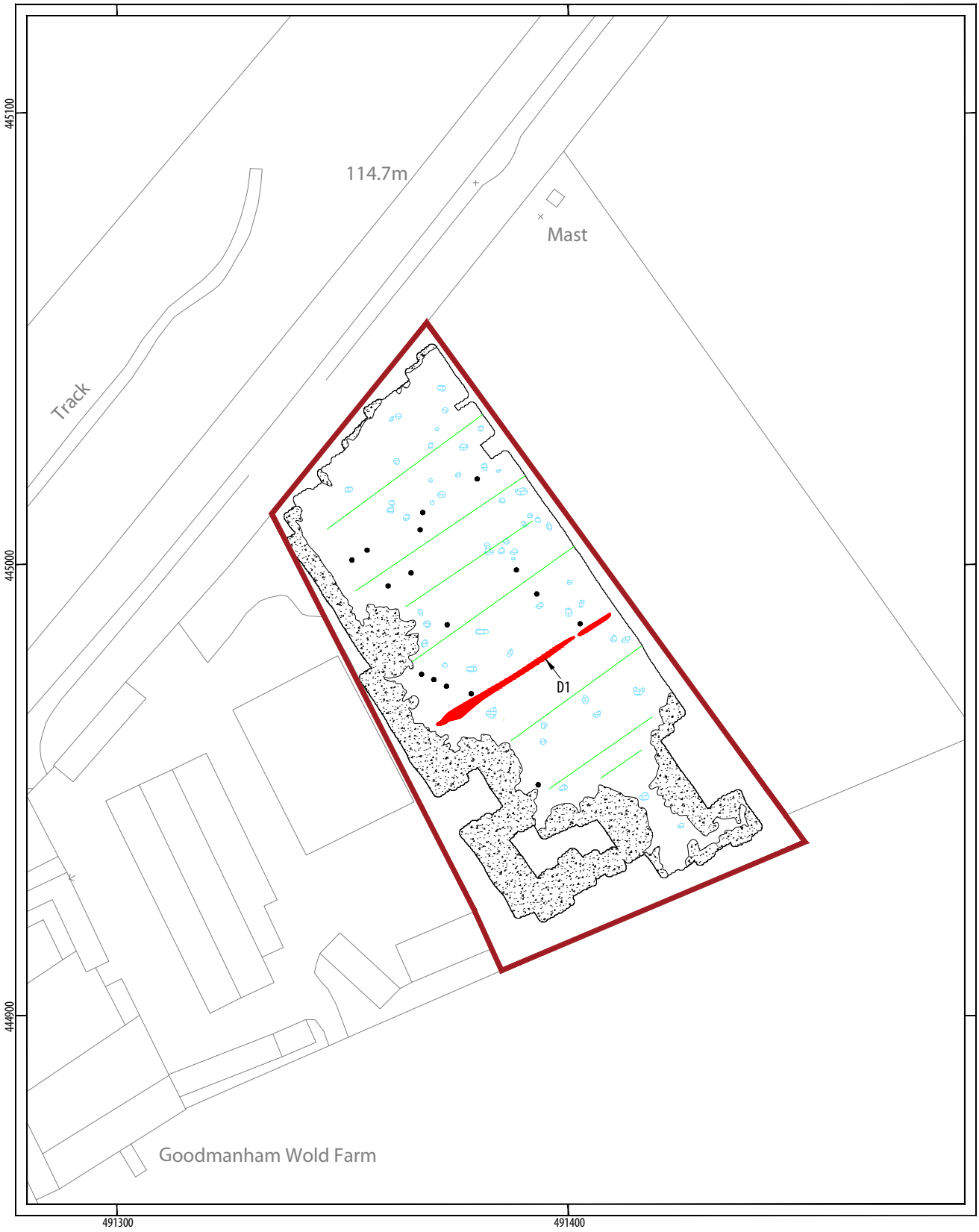
ILLUS 6 XY trace plot of minimally processed magnetometer data (1:1,250)



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

ABBREVIATIONS
D ditch

0 25m
1:1,250 @ A4

PROJECT GWEY20
Goodmanham Wold Farm
Market Weighton
East Yorkshire
CLIENT M & J Pickering

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ILLUS 7 Interpretation of magnetometer data (1:1,250)

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.

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

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

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

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-388374

PROJECT DETAILS	
Project name	Goodmanham Wold Farm, Market Weighton, East Riding of Yorkshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 0.7 hectare site at Goodmanham Wold Farm, Market Weighton, where a pig finishing unit is proposed. The site is situated within a rich archaeological landscape containing archaeological activity from the prehistoric period onwards including cropmark evidence for a possible trackway which crosses the Proposed Development Area (PDA). A clear linear anomaly has been identified by the survey corresponding to the cropmark data and is ascribed high archaeological potential, probably being due to an infilled ditch and possibly forming part of a trackway or linear boundary feature. No further anomalies of archaeological potential have been identified by the survey and therefore the majority of the site is assessed as of low archaeological potential, and locally high in the vicinity of the probable ditch.
Project dates	Start: 03-03-2020 End: 03-03-2020
Previous/future work	No / Yes
Any associated project reference codes	GWEY20 – Contracting Unit No.
Any associated project reference codes	DC/19/03942/PLF – Planning Application No.
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 5 – Character undetermined
Monument type	None
Monument type	None
Significant Finds	None
Significant Finds	None
Methods & techniques	"Geophysical Survey"
Development type	Farm infrastructure (eg barns, grain stores, equipment stores, etc)
Prompt	National Planning Policy Framework – NPPF
Position in the planning process	Between deposition of an application and determination
Solid geology	Chalk (including red chalk)
Drift geology (other)	None
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	East Riding of Yorkshire, Goodmanham, Goodmanham Wold Farm
Study area	0.7 Hectares
Site coordinates	SE 9137 4497 53.892637476505 -0.609491417159 53 53 33 N 000 36 34 W Point
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	Headland Archaeology
Project director/manager	David Harrison
Project supervisor	Ross Bishop
Type of sponsor/funding body	Developer

PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"none"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Goodmanham Wold Farm, Market Weighton, East Riding of Yorkshire
Author(s)/Editor(s)	Ross Bishop
Date	2020
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
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Entered on	11 March 2020

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