WYAS Archaeological Services

Hainsworth Road,

Silsden,

West Yorkshire

Geophysical Survey

Report no. 3735
March 2022

Client: BWB Consulting Ltd.

Hainsworth Road,
Silsden,
West Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey was undertaken on approximately 1.2 hectares of land located off Hainsworth Road, Silsden, West Yorkshire. The geophysical survey has detected a number of magnetic anomalies associated with the more recent agricultural use of the site. This includes a former field boundary, field drains and medieval or later ridge and furrow cultivation. Magnetic disturbance around the survey area are due to metal fencing within the boundaries.

Based on the results of this geophysical survey the site has a low archaeological potential.

WYAS
Archaeological Services

Report Information

Client:	BWB Consulting Ltd
Address:	Whitehall Waterfront, 2 Riverside Way, Leeds
Report Type:	Geophysical Survey
Location:	Hainsworth Road, Silsden,
County:	West Yorkshire
Grid Reference:	SE 0456 4576
Period(s) of activity:	Modern
Report Number:	3735
Project Number:	XF07
Site Code:	HWR22
OASIS ID:	archaeol11- 505232
Date of fieldwork:	February 2022
Date of report:	March 2022
Project Management:	Emma Brunning BSc MCIfA
Fieldwork:	Alastair Trace BSc MSc
	Jake Freeman BA
Illustrations:	Emma Brunning
Photography:	Alastair Trace
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Authorisation for distribution: ----------

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1 Introduction

Archaeological Services ASWYAS has been commissioned by BWB Consulting Ltd to undertake a geophysical survey at land at Hainsworth Road, Silsden, West Yorkshire. This was undertaken in line with current best practice (CIfA 2020; Schmidt et al. 2016). The survey was carried out on the 25th February 2022 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The site is located on the south side of Silsden, between the Leeds and Liverpool canal to the north and fields bounding Hainsworth Road to the south, 1.15km to the north east of Steeton and Silsden Railway Station. The site is centred at National Grid Reference SE 0456 4576.

The site encompasses approximately 1.2ha, comprising a rectangular field currently pasture. The remainder of the site contains a series of caravans and temporary structures, with the residential bungalow named 'The Willows' to the south. The site is bounded by hedgerows to the north and east, a post and wire fence and a hedgerow to the south and fencing to the west.

The site is situated at approximately 105m above Ordnance Survey Datum at its northern end and slopes gently towards the south.

Soils and geology

The underlying bedrock geology at the site is sandstone of the Nesfield Sandstone Formation and New Pit Chalk Formation, which are undifferentiated. In terms of superficial deposits, the site is underlain by Devensian Till. The bedrock within the wider area primarily comprises Mudstone, Siltstone and Sandstone of the Millstone Grit Group, with similar Devensian Till superficial deposits (BGS 2022). Soils are described as slowly permeable seasonally wet acid loamy and clayey soils (Soilscape 17) (CSAI 2022).

2 Archaeological Background

The archaeological background below is taken from an assessment by Jessop Consultancy (2019). This concluded that the development area contains remains which are likely to represent ploughed down ridge and furrow, probably indicative of medieval arable agriculture. These remains may preserve earlier remains beneath them. The likelihood of there being surviving coherent archaeological remains within the development area is considered to be high and the proposed development will result in the removal of below ground archaeology.

Excavation to the south of the site recorded archaeological features appear to date to the Bronze Age and Pre-Roman Iron Age and include a large double ring ditch, a square barrow

and a pit alignment, with additional agricultural features from the medieval period to the modern period. Finds recovered from the excavation include two collared urns and an iron spearhead (Scales 2018)

The development area is located close to but outside the Leeds and Liverpool Canal Conservation Area. The proposed development would have no impacts on the fabric of the conservation area and impacts would on solely on its setting.

3 Aims, Methodology and Presentation

The aims and objectives of the programme of geophysical survey were to gather sufficient information to establish the presence/absence, character and extent, of any archaeological remains within the specific area and to inform an assessment of the archaeological potential of the site. To achieve this aim, a magnetometer survey covering all amenable parts of the Site was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The cart-based survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays processed magnetometer data at a scale of 1:1000 whilst Figure 3 shows an overview of the interpretation at the same scale. Processed and minimally processed data, together with interpretation of the survey results are presented in Figures 2 to 4 inclusive at a scale of 1:1000.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by the European Archaeological Council (Schmidt *et al*. 2015) and by the Chartered Institute for Archaeologists (CIfA 2020). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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

4 Results and Discussion (see Figures 2 to 4)

Ferrous anomalies and magnetic disturbance

Ferrous anomalies, as individual 'spikes', or as large discrete areas 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 or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Magnetic disturbance along the limits of the survey areas are due to be metal wire fencing within the field boundaries and interference from the modern housing towards the west.

Agricultural anomalies

A former field boundary has been detected in the survey area which is recorded on first edition Ordnance Survey mapping dating from 1855 (NLS 2022) but by the 20th century the boundary has been removed. Two strong linear responses can be seen which are on the same alignment as the former field boundary, these are likely to represent field drains.

Other parallel linear trends and are associated with modern ploughing and medieval or later ridge and furrow cultivation.

5 Conclusions

The geophysical survey has detected a number of magnetic anomalies associated with the more recent agricultural use of the site. This includes a former field boundary, field drains and medieval or later ridge and furrow cultivation. Magnetic disturbance around the survey area are due to metal fencing within the boundaries.

Based on the results of this geophysical survey the site has a low archaeological potential.

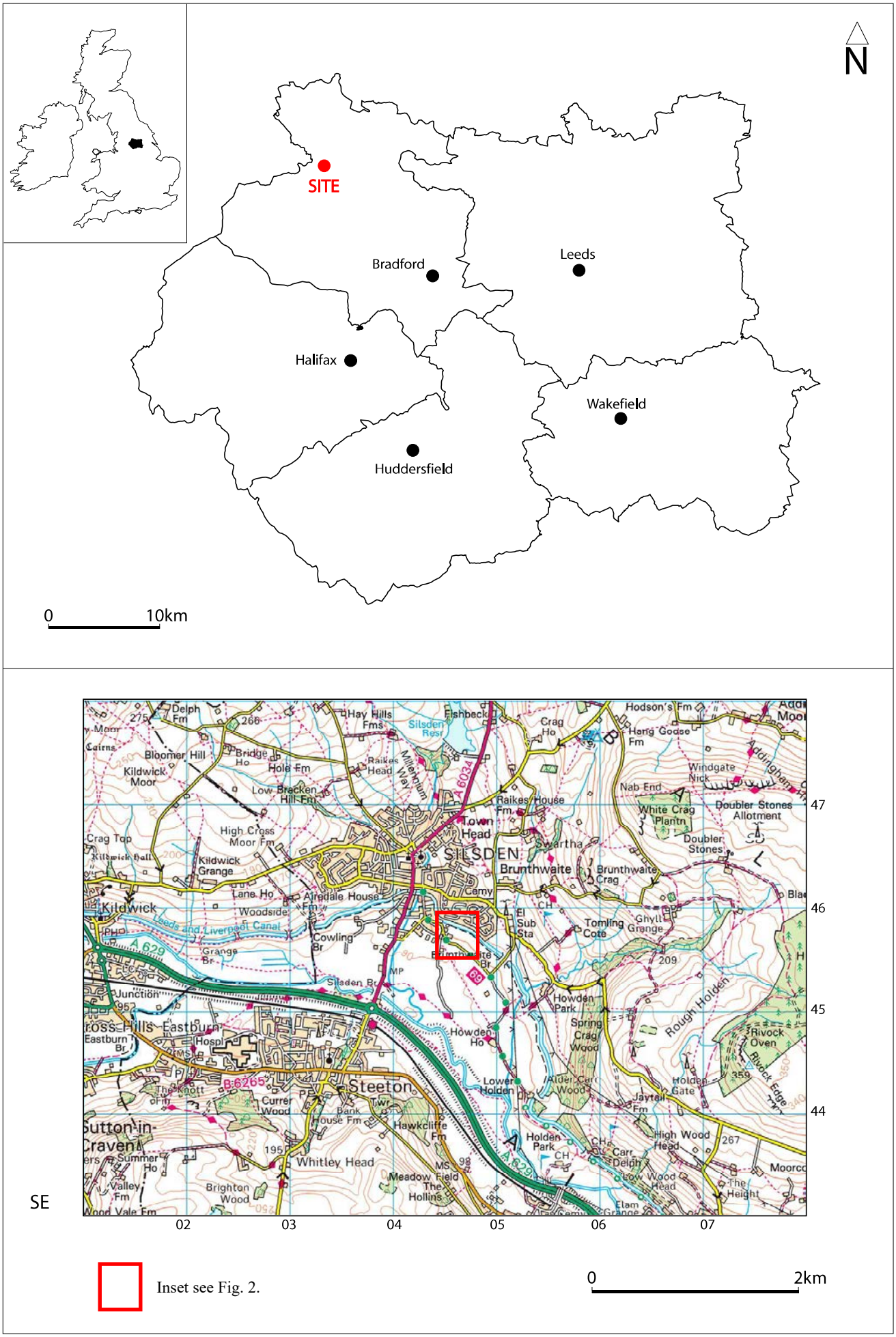
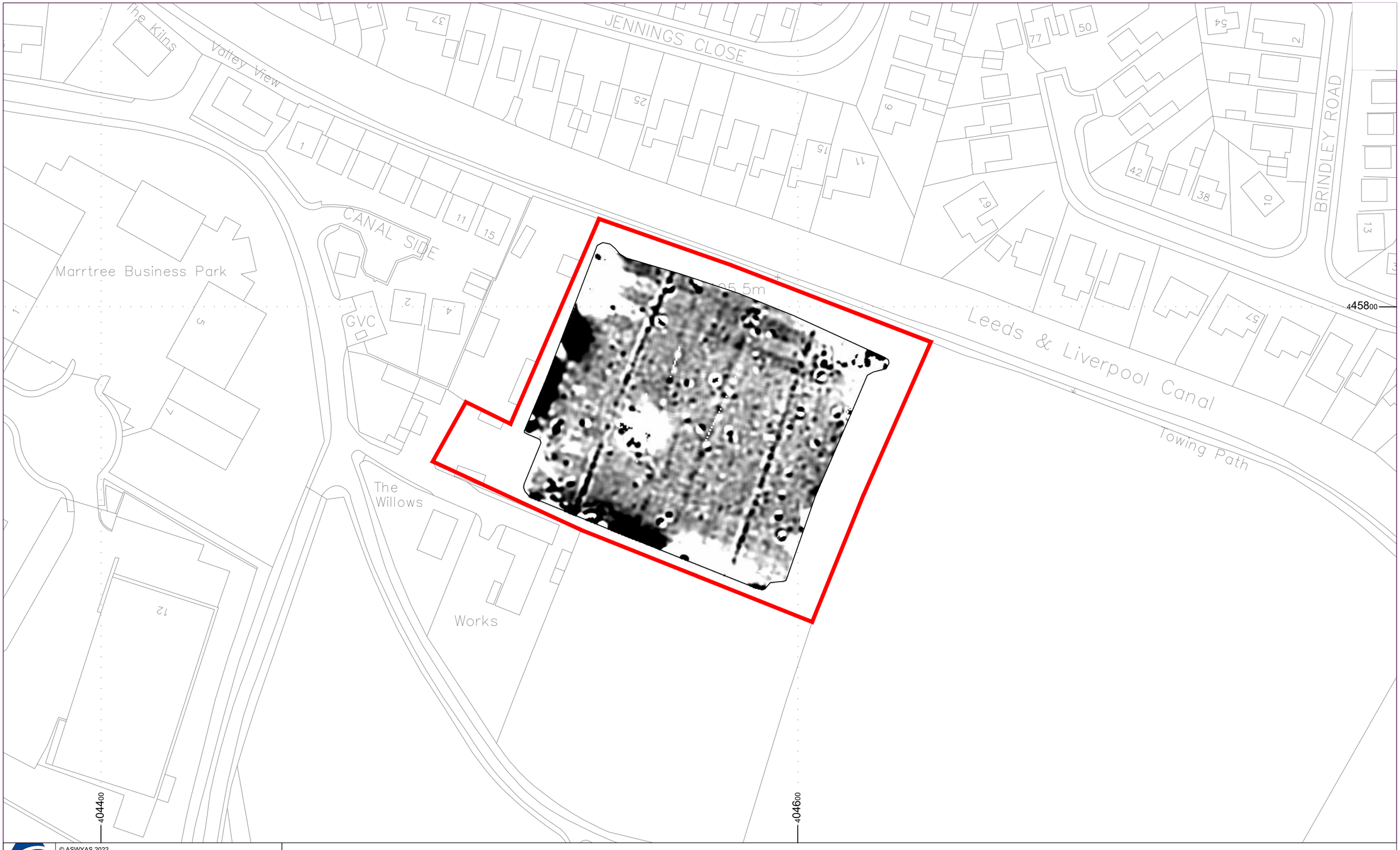


Fig. 1. Site location



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Project ID: XF07_HWR22

Processed greyscale magnetometer data

Fig.X

Title

SURVEY AREA

-1.0 2.0
nT

0 50m

1:1000 @ A3

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XY trace plot of minimally processed magnetometer data

Fig.3

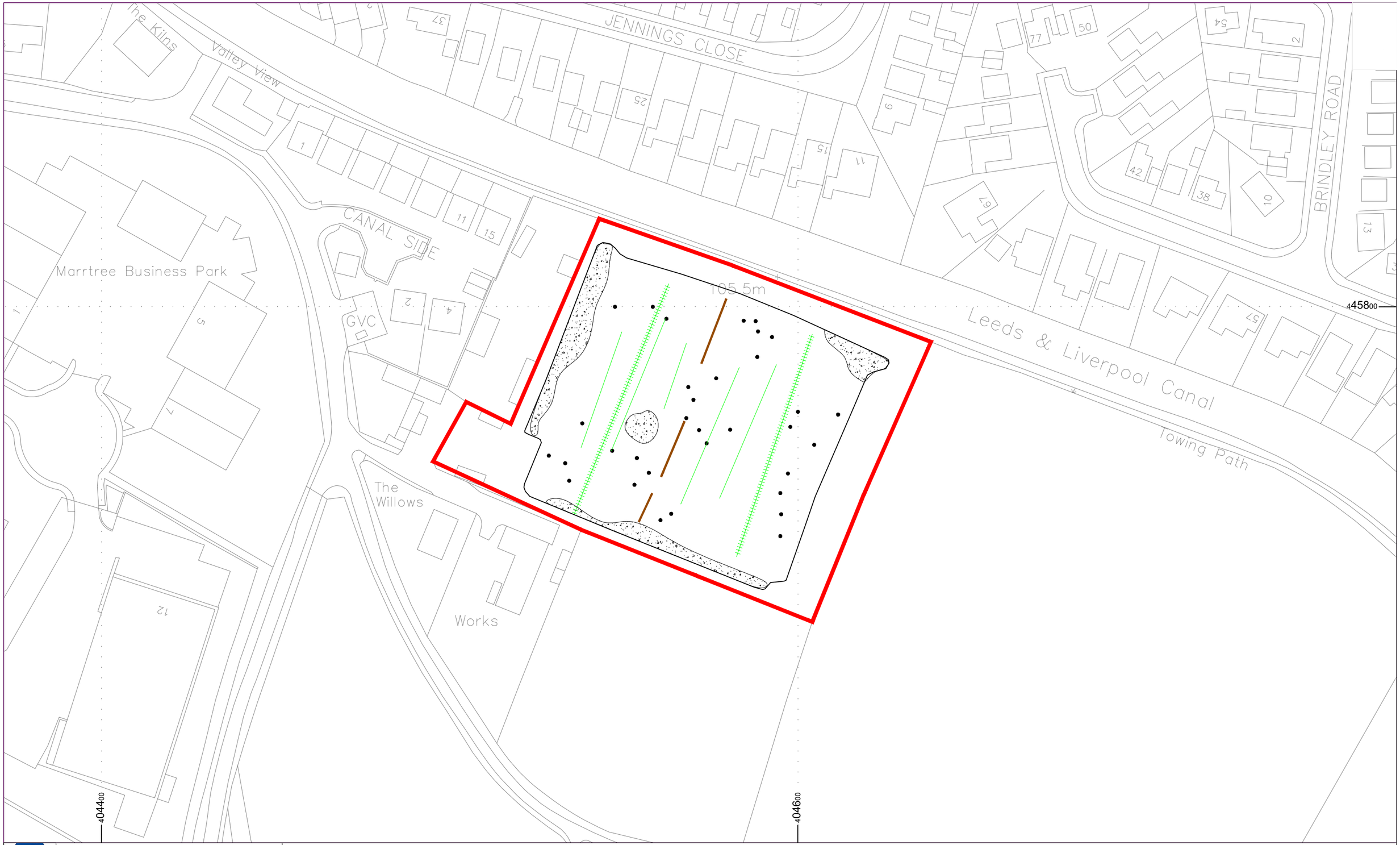
Title

SURVEY AREA

15.0 nT/cm

0 50m

1:1000 @ A3



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Interpretation of magnetometer data

Fig.4

Title

SURVEY AREA

Interpretation

- FERROUS
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- AGRICULTURAL
- FORMER FIELD BOUNDARY

0 50m

1:1000 @ A3

Plate 1. General view of survey area, facing northwest

Plate 2. General view of survey area, facing northeast

Appendix 1: Magnetic survey - technical information

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 haemetite. 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. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because 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 and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

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 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.

Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

During this survey an eight channel Sensys MX V3 system containing eight FGM650 sensors was also used which was towed across the area using an ATV. Readings were taken every 20MHz (between 0.05 and 0.1m). Data was be recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids 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 co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive and metadata

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2003), and graphics files (Adobe Illustrator CS6 and AutoCAD 2017) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the West Yorkshire Historic Environment Record).

Appendix 4: Oasis form

Summary for archaeol11-505232

OASIS ID (UID)	archaeol11-505232
Project Name	Geophysical Survey at Hainsworth Road, Silsden
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Archaeological Services WYAS
Project Dates	25-Feb-2022 - 25-Feb-2022
Location	Hainsworth Road, Silsden NGR : SE 04560 45760 LL : 53.9079781173167, -1.93207514257257 12 Fig : 404560,445760
Administrative Areas	Country : England County : West Yorkshire District : Bradford Parish : Silsden
Project Methodology	The cart-based survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data.
Project Results	A geophysical (magnetometer) survey was undertaken on approximately 1.2 hectares of land located off Hainsworth Road, Silsden, West Yorkshire. The geophysical survey has detected a number of magnetic anomalies associated with the more recent agricultural use of the site. This includes a former field boundary, field drains and medieval or later ridge and furrow cultivation. Magnetic disturbance around the survey area are due to metal fencing within the boundaries. Based on the results of this geophysical survey the site has a low archaeological potential.
Keywords	
HER	West Yorkshire HER - unRev - STANDARD
HER Identifiers	
Archives	

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