WYAS Archaeological Services

Lundhill Road

Wombwell

South Yorkshire

Geophysical Survey

Report no. 3075
February 2018

Client: Persimmon Homes West Yorkshire

West Yorkshire Joint Services

Lundhill Road, Wombwell, Barnsley, South Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 5 hectares, was undertaken on land to the east of Lundhill, Road, Wombwell, South Yorkshire. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected anomalies associated with medieval ridge and furrow cultivation and areas of magnetic disturbance. Magnetic responses synonymous with geological anomalies have been detected across the site. Former field boundaries have been identified, along with a small rectangular shaped structure which may be archaeological in origin. Overall the archaeological potential of the site is deemed to be low.

WYAS
Archaeological Services

Report Information

Client:	Persimmon Homes West Yorkshire
Address:	Persimmon House, Fulford, York, YO19 4FE
Report Type:	Geophysical Survey
Location:	Wombwell
County:	South Yorkshire
Grid Reference:	SE 4042 0191
Period(s) of activity:	Post medieval? / modern
Report Number:	3075
Project Number:	6978
Site Code:	LRW18
OASIS ID:	Archaeol11-309203
Date of fieldwork:	January 2018
Date of report:	February 2018
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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Persimmon Homes West Yorkshire to undertake a geophysical (magnetometer) survey on land to the east of Lundhill, Road, Wombwell, Barnsley, South Yorkshire. This is in advance of a proposed development. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out on the 11th and 12th January 2018.

Site location, topography and land-use

The proposed development site covers an area of approximately 5 hectares, across two fields on the south-eastern edge of Wombwell, centred at SE 4042 0191. The site is located to the east of Lundhill Road, to the south of Dove Road and to the west of Elsecar Canal. The land to the south of the proposed development is occupied by a single residential property and its surrounding land. The site is situated on ground sloping gently from north to south between approximately 49m AOD and 42m AOD. The land is currently occupied by grass meadow.

Soils and geology

The underlying geology of the proposed development site comprises Pennine Middle Coal Measures Formation, described as sedimentary bedrock formed approximately 309 to 312 million years ago in the Carboniferous Period, no superficial deposits are recorded (BGS 2018). The soils are classified as Rivington 1 association and are described as well drained coarse loamy soils over sandstone (Soil Survey of England and Wales 1983).

2 Archaeological Background

The following information has been taken from Lundhill Road, Wombwell: Desk-based archaeological assessment (Moon 2016).

The proposed development site occupies land that was used for agricultural purposes until fairly recently and remains undeveloped to the present day. This lack of development might facilitate the survival of earlier (e.g. prehistoric or Roman) activity.

The site also lies in an area of known medieval activity, close to the site of a former medieval manor house, so the possibility of encountering further medieval remains should not be discounted.

The archaeological desk-based assessment established that there is a medium potential for archaeological remains within the proposed development site based on the known heritage assets close to the proposed development site and mining activity in the vicinity, but in the absence of any known archaeological interventions, evidence for earlier activity cannot be excluded.

3 Aims, Methodology and Presentation

The main aim of the geophysical survey was to provide additional information on the known archaeology within the area. To achieve this, a magnetometer survey covering all available parts of the PDA 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 site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble R6 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) 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 shows a more detailed site location plan at a scale of 1:2500. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 3 and 5 inclusive at a scale of 1:1250.

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 English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). 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 Figs 2 to 5)

Ferrous anomalies

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.

There are large areas of magnetic responses which are likely to be related to the construction of the adjacent housing, services and associated ground disturbance within these fields.

Geological anomalies

Across the whole of the survey area, a number of magnetic responses, have been interpreted as geological. These are thought to be associated with variations in soil depth, but it is also possible they are associated with deeper furrows of the former ploughing.

Agricultural anomalies

Throughout the survey, but most prominent at the eastern and western boundaries regularly spaced linear anomalies have been recorded and are associated with medieval or post-medieval ridge and furrow cultivation.

Possible archaeological anomalies

Within the eastern field, a small, rectangular, "playing card" shaped anomaly has been identified (**A**). It measures (28m x 13m) and may have been fragmented by later agricultural practices. As the magnetic values are comparable to the ridge and furrow it may be geological material which has been brought to the surface. To the south, (**B)** comprises two large trends on a north-west /south-east axis, these could be archaeological in nature, given their proximity to **A**, but may also have a geological origin.

5 Conclusions

The magnetic survey has detected anomalies which have a possible archaeological origin. There is evidence of post-medieval ridge and furrow cultivation across the site and two former field boundaries have been recorded.

On a whole, the data are dominated by magnetic disturbance caused by ground disturbance related to neighbouring house construction. Some geological anomalies have been detected, largely due to material being brought to the surface by agricultural practices.

The archaeological potential for this site, therefore is deemed to be low.

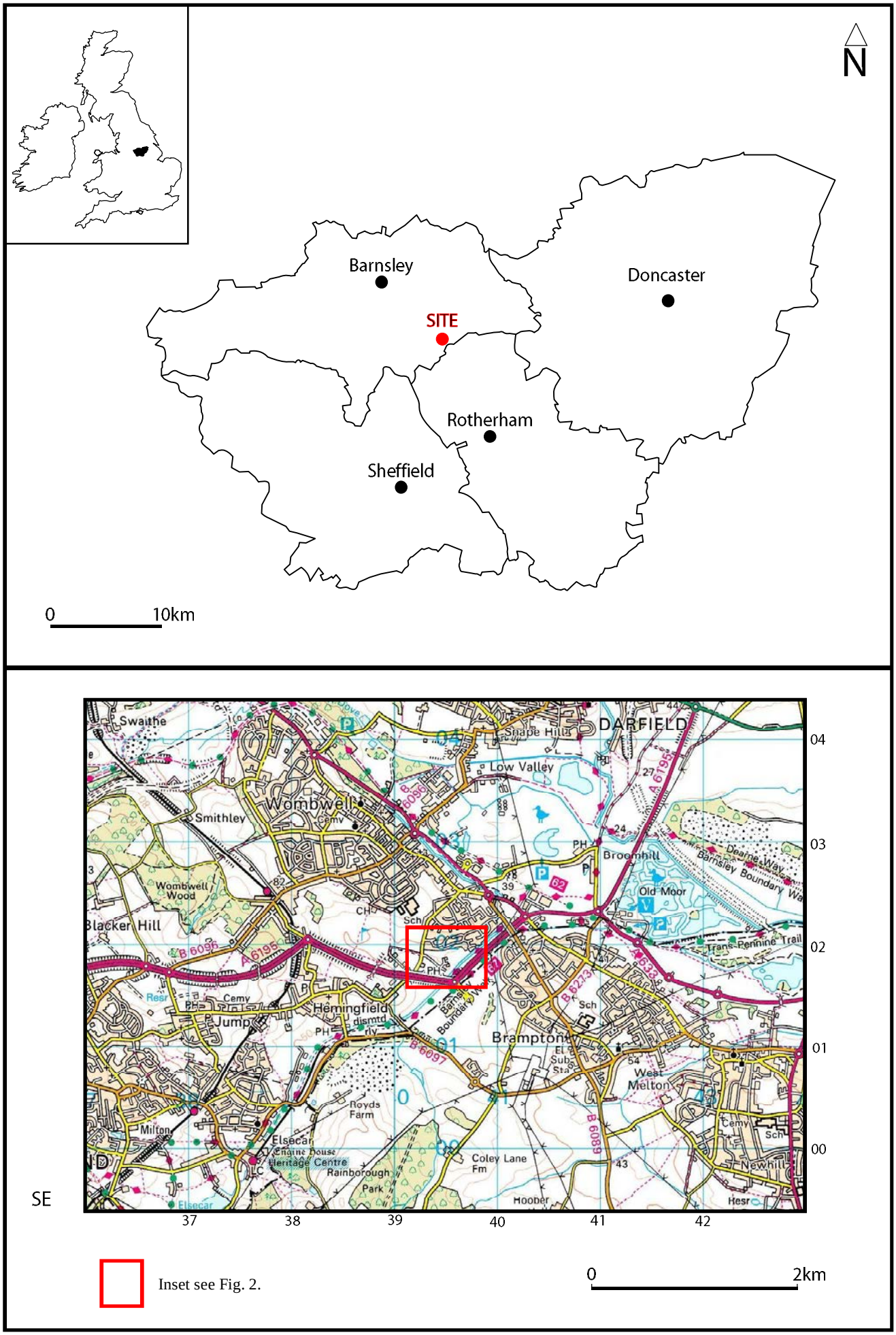


Fig. 1. Site location

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Fig. 2. Overall survey location showing processed magnetometer data (1:2500 @ A3)



Fig. 3. Processed greyscale magnetometer data (1:1250 @ A3)

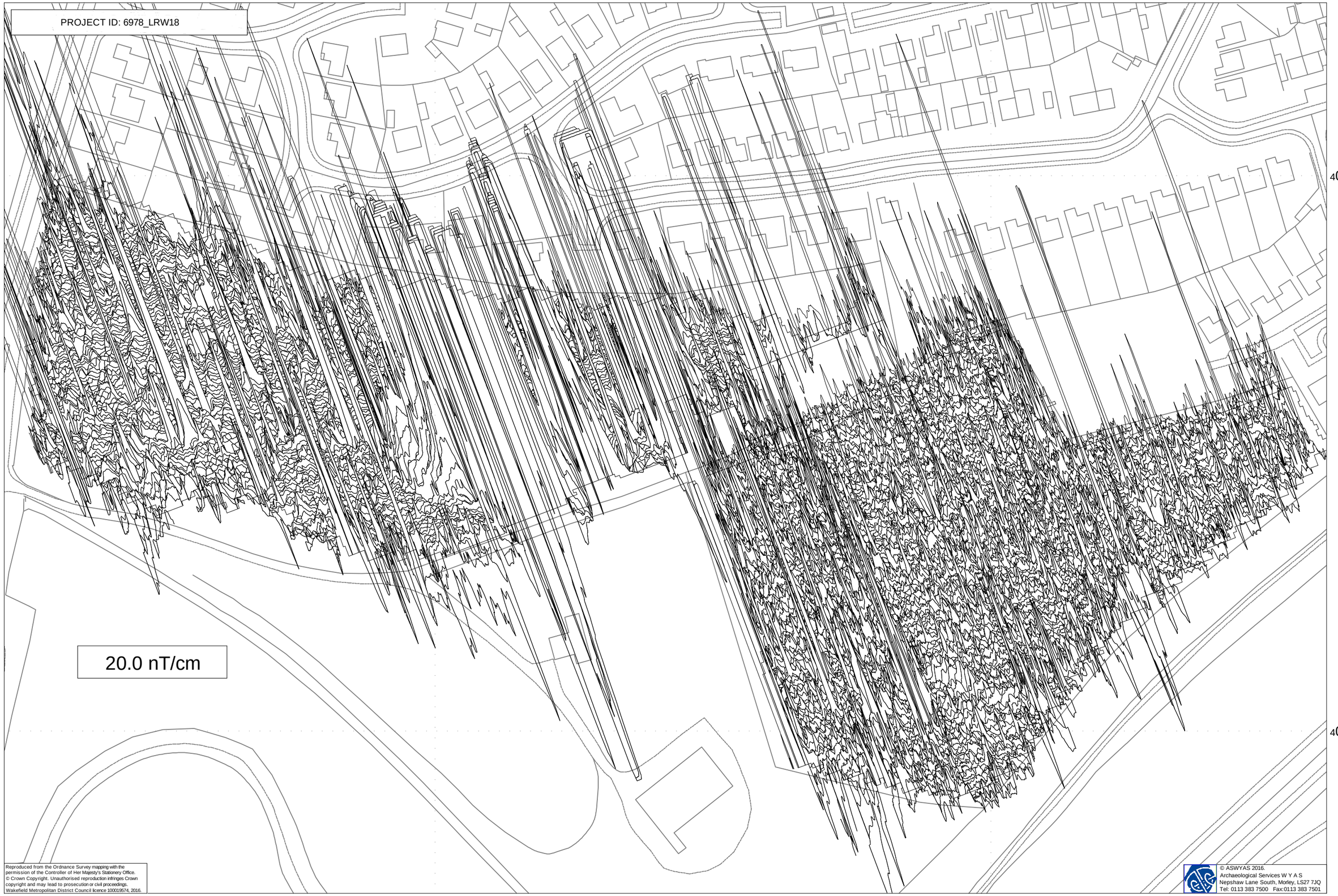


Fig. 4. XY trace plot of minimally processed magnetometer data (1:1250 @ A3)

PROJECT ID: 6978_LRW18

4020 00

4018 00

A

B

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	DIPOLAR LINEAR	SERVICE PIPE
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	FORMER FIELD BOUNDARY
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?

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4404 00

4406 00

Fig. 5. Interpretation of magnetometer data (1:1250 @ A3)



Plate 1. General view of west of site, looking south-west



Plate 2. General view of south-western edge of site, looking south-west



Plate 3. General view of overgrown areas along northern edge of site, looking north-east



Plate 4. General view of eastern edge of site, looking east

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.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

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

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS6 and AutoCAD 2008) 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 South Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-309203

Project details

Project name	Lundhill Road, Wombwell
Short description of the project	A geophysical (magnetometer) survey, covering approximately 5 hectares, was undertaken on land to the east of Lundhill, Road, Wombwell, South Yorkshire. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected anomalies associated with medieval ridge and furrow cultivation and areas of magnetic disturbance. Magnetic responses synonymous with geological anomalies have been detected across the site. Former field boundaries have been identified, along with a small rectangular shaped structure which may be archaeological in origin. Overall the archaeological potential of the site is deemed to be low.
Project dates	Start: 11-01-2018 End: 12-01-2018
Previous/future work	No / Not known
Any associated project reference codes	6978 - Sitecode
Type of project	Field evaluation
Current Land use	Grassland Heathland 4 - Regularly improved
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	PENNINE MIDDLE COAL MEASURES
Drift geology (other)	loamy soils over sandstone
Techniques	Magnetometry

Project location

Country	England
Site location	SOUTH YORKSHIRE BARNSLEY WOMBWELL Lundhill Road, Wombwell
Study area	5 Hectares
Site coordinates	SE 4042 0191 53.512067601789 -1.390410469137 53 30 43 N 001 23 25 W Point
Height OD / Depth	Min: 42m Max: 49m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Persimmon Homes
Project design originator	Persimmon Homes
Project director/manager	E. Brunning
Project supervisor	M. Rose

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Persimmon Homes
Digital Contents	"Survey"
Digital Media available	"Geophysics","Images raster / digital photography","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Lundhill Road, Wombwell
Author(s)/Editor(s)	Brunning, E
Author(s)/Editor(s)	Sykes, C
Date	2018
Issuer or publisher	ASWYAS
Place of issue or publication	Leeds
Description	A4 report with A3 figures

Entered by	Emma Brunning (emma.brunning@aswyas.com)
Entered on	14 February 2018

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