WYAS Archaeological Services

Land East of Stumpcross Lane

Pontefract

West Yorkshire

Geophysical Survey

Report no. 2757
May 2015

Client: Taylor Wimpey Yorkshire

West Yorkshire Joint Services

Land East of Stumpcross Lane
Pontefract
West Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 1.1 hectares, was carried out on agricultural land immediately to the east of Stumpcross Lane, Pontefract, prior to the proposed development of the site. Anomalies indicative of recent magnetic disturbance on the site were identified, but also evidence for the continuation of an Iron Age/Roman field system previously identified through crop mark evidence. As a result, the archaeological potential of this site is deemed to be medium.

WYAS
Archaeological Services

Report Information

Client:	Taylor Wimpey Yorkshire
Address:	Sandpiper House, Peel Avenue, Wakefield. WF2 7UA
Report Type:	Geophysical Survey
Location:	Pontefract
County:	West Yorkshire
Grid Reference:	SE 47077 23094
Period(s) of activity:	modern
Report Number:	2757
Project Number:	4402
Site Code:	SCL15
OASIS ID:	archaeol11-211407
Planning Application No.:	
Museum Accession No.:	n/a
Date of fieldwork:	May 2015
Date of report:	May 2015
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Authorisation for distribution: ----------

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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Taylor Wimpey Yorkshire (the Client), to undertake a geophysical (magnetometer) survey of land to the east of Stumpcross Lane, Pontefract. The work was undertaken in order to inform a planning application for the proposed development of the site and in accordance with policy contained within the National Planning Policy Framework (DCLG 2012), in line with current best practice (CIfA 2014; David *et al.* 2008) and to a Project Design (Richardson 2015) approved by the Client. The survey was carried out on May 1st 2015 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The proposed development area (PDA) comprises of a single field located directly to the east of Stumpcross Lane, and directly to the north of Sowgate Lane, Pontefract. The field is centred at SE 47077 23094. The land is flat, and is covered by short scrub vegetation. The natural topography of the site gently undulates from *c*. 30 m Above Ordnance Datum (AOD) in the north to *c*. 22 m AOD in the south.

Soils and geology

The underlying bedrock comprises sedimentary Dolostone of the Cadeby Formation (British Geological Survey 2015). The soils in this area are classified in the Aberford association, and consist of well drained calcareous fine loamy soils over limestone (Soil Survey of England and Wales 1983).

2 Archaeological Background

A desk-based assessment (DBA) produced by CgMs Consulting (2013), on behalf of the client, revealed no designated archaeological assets within the site boundary and that the development of this land would not have any impact the setting of any designated assets in the vicinity. The DBA also determined that the potential for the discovery of archaeological features of Saxon or early medieval date was low, as well as that for more recent features.

However, there is evidence that the wider area in which the site is situated would once have been an area of Iron Age and Roman activity. The site sits within a wider landscape of crop marks relating to this period, some of which have been investigated and confirmed to be of this date. The site falls within the area covered by asset HER 989, which is listed as agricultural crop marks identified from various aerial photographs, and is a HER Class III monument, thus warranting field investigation. The potential for assets of this period to exist within the site was determined to be high.

3 Aims and Methodology

Magnetometer Survey

The aim of the geophysical survey as described in the Project Design (Richardson 2015) is to, as far as possible, identify the presence or absence, and extent and layout, of buried archaeological remains across the PDA, through the interpretation of magnetic anomalies identified following the processing of data gathered during the survey.

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. Features 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 and Gater 2003). Further information on types of anomaly is provided as Appendix 1.

On this site Bartington Grad601 magnetic gradiometers were used. These instruments are calibrated to take readings at 0.25m intervals on zig-zag traverses 1m apart within a series of 30m by 30m grids resulting in 3600 readings per 30m grid square. The data are stored in the memory of the instrument before being downloaded to a lap-top computer each day in preparation for data processing and interpretation.

The survey grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model) providing an accuracy greater than 0.01m. The locations of the survey grid and anomalies are available as a DXF file. 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.

Data processing

The gradiometer data has been presented in this report in XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from 'iron spikes'. The data in the greyscale images has been interpolated and selectively filtered, using Geoplot 3 (Geoscan Research) software 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.

Presentation

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows the extent of the survey areas together with the processed data at a scale of 1:2500. Detailed data plots ('raw' and processed) and interpretative figures are presented at a scale of 1:1000 in Figures 3 to 5 inclusive.

Further information on magnetic survey and characterisation and interpretation of anomaly types are given in Appendix 1. Appendix 2 describes the composition and location of the site archive and Appendix 3 reproduces the OASIS entry.

The survey methodology, report and any recommendations comply with the Project Design (Richardson 2015) and 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).

Disclaimers

The figures 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 figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

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.

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

4 Results and Discussion (see Figures 2 and 5)

The nature of the modern land use of the survey area has meant that this site has a high level of magnetic background variation, which can make the identification of magnetic anomalies problematic. The site includes a combination of larger areas of magnetic disturbance alongside individual ferrous contaminants.

Ferrous responses, either as individual 'spike' anomalies or more extensive areas of magnetic disturbance, are typically caused by modern ferrous (magnetic) debris, either on the ground surface or in the plough-soil, or are due to the proximity of magnetic material in field

boundaries, buildings or other above ground features. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as 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 to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

There are three main areas of magnetic disturbance situated in the western half of the survey area and at its entrance to the south-west, anomalies **A**, **B** and **C** respectively. Anomaly A is caused by the presence of a telegraph pole within the hedge that forms the western boundary of the site (see Plates 1 and 2), whilst Anomaly **B** relates to an area of dumped construction waste, the ferrous spikes within this area are explained by three standing iron stakes. Anomaly **C** was an area which appeared to have been used for cement mixing (see Plate 2).

Agricultural anomalies

Three linear trends are observed in the northern half of the survey, evenly spaced and running parallel to the extant field boundary in on a north-north-west/south-south-west alignment. These are caused by post-medieval cultivation of the land – specifically ploughing activity.

Geological anomalies

Throughout the site several small discrete anomalies are recorded. These anomalies are likely to be due to minor variation in the upper soil horizons or to recent localised ground disturbance.

Possible archaeological anomalies

Two possible linear anomalies were identified in the centre of the survey area, **D** and **E**, it is possible these are the remains of former field boundaries. The two anomalies both run for approximately 40m and intersect each other at an oblique angle. Examination of the wider landscape, see Figure 2, show that these linears lie on the same alignment as a number of crop marks located 200m to the north east of the site. The crop marks, designated as asset HER 989, have already been identified as relating to field system of Iron Age or Roman date, and it is possible the anomalies **D** and **E** represent an extension of this field system, albeit previously unmapped.

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

5 Conclusions

The survey has detected anomalies indicative of modern activity and geological variation. Evidence of recent agricultural activity is also apparent in the data. Two features of possible archaeological origin were identified, which could relate to previously identified Iron Age and Roman agricultural activity in the area, therefore the archaeological potential of this site is considered to be medium.

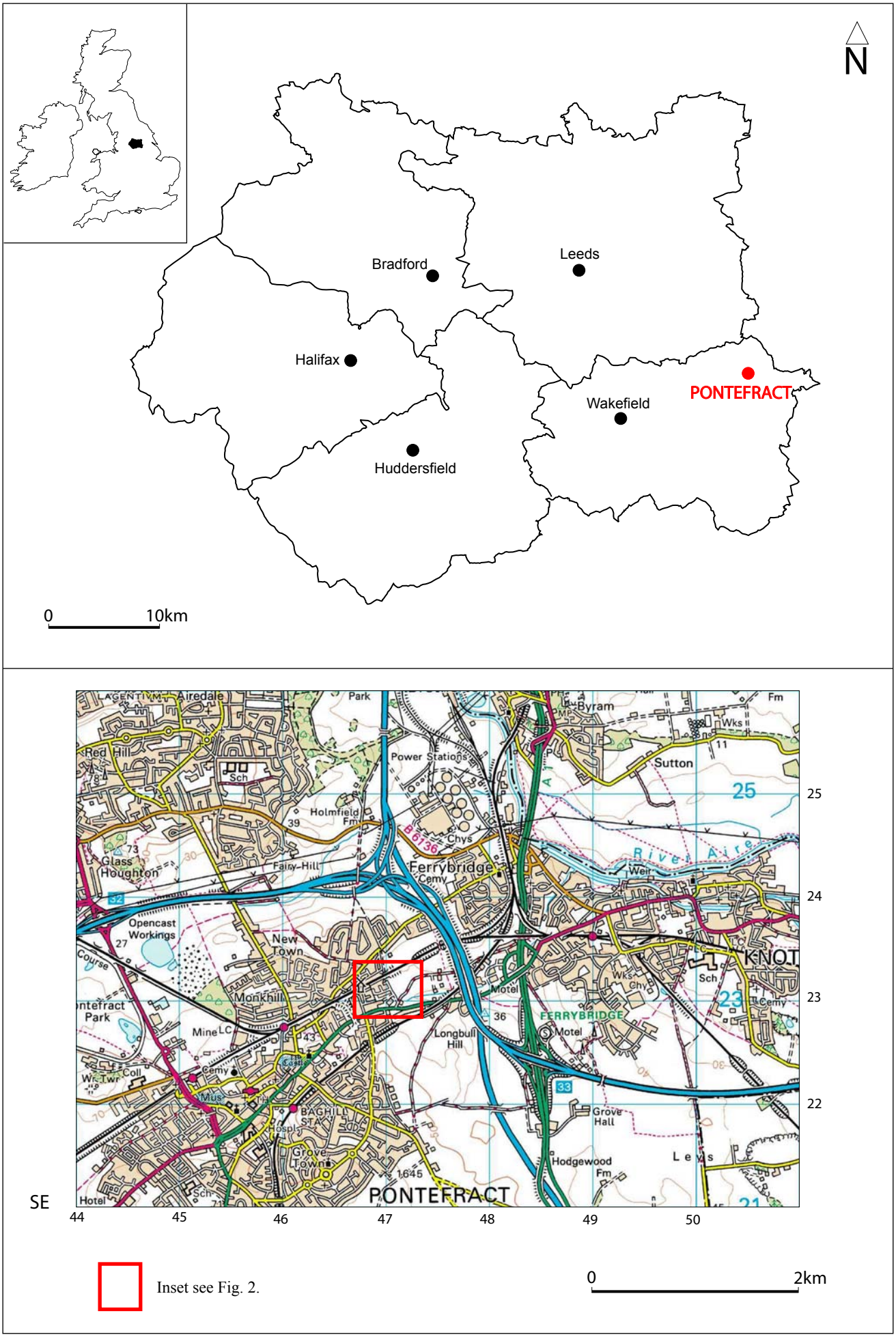

Fig. 1. Site location

	PROPOSED DEVELOPMENT BOUNDARY
1	LOCATION AND DIRECTION OF PLATES
	CROPMARK DETAIL

N

4236 00

4232 00

4228 00

4468 00

4472 00

2.0

-1.0

nT

0 100m

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Fig. 2. Survey location showing greyscale magnetometer data and cropmarks (1:3000 @ A3)

Fig. 3. Processed greyscale magnetometer data (1:750 @ A3)

N

25.1 nT/cm

Stone

Stone

STUMPCROSS WAY

STUMPCROSS LANE

SS CLOSE

SOWGATE LANE

Pontefract Fire Station

Nursery

Sewage Works

4232 00

4231 00

4230 00

4470 00

4471 00

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0 30m

Fig. 4. XY trace plot of minimally processed magnetometer data (1:750 @ A3)

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
—	DIPOLAR LINEAR	SERVICE PIPE
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	FIELD DRAIN
	LINEAR TREND	RIDGE AND FURROW
	LINEAR TREND	AGRICULTURAL
	LINEAR TREND	GEOLOGY
	MAGNETIC ENHANCEMENT	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY - DITCH

N

Stone

Stone

A

D

E

B

C

STUMPCROSS WAY

STUMPCROSS LANE

SOWGATE LANE

Pontefract Fire Station

Nursery

Sewage Works

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4232 00
4231 00
4230 00
447 00
447 1 00

0 30m

Fig. 5. Interpretation of magnetometer data (1:750 @ A3)

Plate 1. General view of survey area, looking south

Plate 2. General view of survey area, looking north-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. An advantage of magnetic susceptibility over magnetometry is that a certain amount of occupational activity will cause the same proportional change in susceptibility, however weakly magnetic is the soil, and so does not depend on the magnetic contrast between the topsoil and deeper layers. Susceptibility survey is therefore able to detect areas of occupation even in the absence of cut features. On the other hand susceptibility survey is more vulnerable to the masking effects of layers of colluvium and alluvium as the technique, using the Bartington system, can generally only measure variation in the first 0.15m of ploughsoil.

Types of Magnetic Anomaly

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

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

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

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

Isolated dipolar anomalies (iron spikes)

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

Areas of magnetic disturbance

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

Linear trend

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

Areas of magnetic enhancement/positive isolated anomalies

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

Linear and curvilinear anomalies

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

Appendix 2: 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 CS2 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 Cambridgeshire Historic Environment Record).

Appendix 3: OASIS Form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: archaeol11-211407

Project details

Project name	Land East of Stumpcross Lane
Short description of the project	A geophysical (magnetometer) survey, covering approximately 1.1 hectares, was carried out on agricultural land immediately to the east of Stumpcross Lane, Pontefract, prior to the proposed development of the site. Anomalies indicative of recent magnetic disturbance on the site were identified, but also evidence for the continuation of an Iron Age/Roman field system previously identified through crop mark evidence. As a result, the archaeological potential of this site is deemed to be medium.
Project dates	Start: 01-05-2015 End: 02-05-2015
Previous/future work	Yes / Not known
Any associated project reference codes	SCL15 - Sitecode
Any associated project reference codes	4402 - Contracting Unit No.
Type of project	Recording project
Site status	None
Current Land use	Grassland Heathland 2 - Undisturbed Grassland
Monument type	NONE None
Significant Finds	NONE None
Investigation type	"Geophysical Survey"
Prompt	National Planning Policy Framework - NPPF
Solid geology (other)	Dolostone of the Cadeby Formation
Drift geology (other)	Aberford association
Techniques	Magnetometry

Project location

Country	England

Site location	WEST YORKSHIRE WAKEFIELD PONTEFRACT Land East of Stumpcross Lane
Study area	1.10 Hectares
Site coordinates	SE 47077 23094 53.7019280825 -1.28682058303 53 42 06 N 001 17 12 W Point
Height OD / Depth	Min: 22.00m Max: 30.00m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Contractor (design and execute)
Project design originator	Archaeological Services WYAS
Project director/manager	C. Sykes
Project supervisor	Evans, M.
Type of sponsor/funding body	Developer
Name of sponsor/funding body	Taylor Wimpey Yorkshire

Project archives

Physical Archive Exists?	No
Digital Archive recipient	N/A
Digital Contents	"none"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land East of Stumpcross Lane, Pontefract, West Yorkshire: Geophysical Survey
Author(s)/Editor(s)	Goulding, R.
Other bibliographic details	Report No. 2757
Date	2015
Issuer or publisher	Archaeological Services WYAS
Place of issue or publication	Morley
Description	A4 Bound paper report

Entered by	Zoe Horn (zhorn@aswyas.com)
Entered on	18 May 2015

OASIS:

Please e-mail Historic England for OASIS help and advice

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