

LAND EAST OF NEWBOROUGH ROAD, PETERBOROUGH

GEOPHYSICAL SURVEY

commissioned by the Environmental Dimension Partnership on behalf of the Church Commissioners for England, Calco101 Ltd and Taylor Wimpey Homes Ltd

December 2016





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project info

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering approximately 70 hectares, on land east of Newborough Road, Peterborough, to inform future archaeological strategy in relation to the proposed development of the site. The survey has identified three discrete areas of probable archaeological activity which are all possibly associated with the post-medieval manufacture of bricks and/ or tiles. An extensive rectangular anomaly is interpreted as a possible brick clamp. An area of industrial activity and an area of possible industrial dumping have also been clearly defined. Two anomalies of uncertain origin are also identified as well as anomalies due to an extensive network of field drains and to former boundaries. On the basis of the geophysical survey, the archaeological potential across the majority of the site as assessed as being low or very low but with a moderate to high potential in the vicinity of the probable industrial activity.

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ILLUS 1 Site location

LAND EAST OF NEWBOROUGH ROAD, PETERBOROUGH

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Rob Johns of the Environmental Dimension Partnership (the Consultant) on behalf of The Church Commissioners for England, Calco101 Ltd and Taylor Wimpey Homes Ltd (the Clients) to undertake a geophysical (magnetometer) survey of land east of Newborough Road, Peterborough (Illus 1). The results of the survey will inform any further evaluation and the appropriate treatment of any archaeological remains.

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2016), submitted to the Consultant and approved by Peterborough Archaeological Services, and was undertaken in accordance with guidance contained within the National Planning Policy Framework (DCLG 2012). All work was also undertaken in line with current best practice (English Heritage 2008, CIFA 2014).

The survey was carried out between October 17th and October 27th 2016 in order to provide information on the archaeological potential of the site.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The proposed development area (PDA) is located on the northeastern periphery of Peterborough, centred at TF 2060 0300 (see Illus 1), and comprises fourteen fields (F1–F14) within an irregularlyshaped parcel of land. The PDA is bound to the west by Newborough Road, by the A16 to the east and by the A47 to the south. Car Dyke defines the northern boundary.

Most of the PDA is located on a slight plateau in the landscape at between 11m and 12m above Ordnance Datum (AOD) with the land sloping down to the north, towards Car Dyke, at approximately 8m AOD, and up to 13m AOD to the south adjacent to the A47.

At the time of the survey the fields were mostly fallow but with some low growing brassicas (see Illus 2–5). Two small areas were overgrown and/or wooded and were unsuitable for survey (Illus 6).

1.2 GEOLOGY AND SOILS

The underlying bedrock consists of Oxford Clay Formation mudstone which is overlain in the south and west by sands and gravels of the third river terrace deposit. There is a small pocket of Head (clay, silt, sand and gravel) in the north-east (NERC 2016).

The soils are classified in the Soilscape 22 association, characterised as loams with naturally high groundwater (Cranfield University 2016).

2 ARCHAEOLOGICAL BACKGROUND

Car Dyke, which forms the northern site boundary, is believed to be a catchwater dyke associated with the drainage of the fenlands in the Roman period. It is a scheduled monument (HE List Entry 1021133).

In addition there are two entries on the Peterborough Historic Environment Record within the PDA. Fragmentary cropmarks identified on aerial photographs are interpreted as possible ditches and enclosures. The former location of a post-medieval mill, dismantled in 1838, is also within the PDA.

3 AIMS, METHODOLOGY AND PRESENTATION

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of any proposed development on any sub-surface archaeological remains, if present.

The general archaeological objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore model the presence/absence and extent of any buried archaeological features; and



ILLUS 2 Field 4, looking north ILLUS 3 Field 5, looking east ILLUS 4 Field 9, looking east

> 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. 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 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 is programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses 4m apart. These readings are stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system is 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 has been used to collect and export the data. Terrasurveyor V3.0.31.0 (DWConsulting) software has been 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 – Illus 5 are site condition photographs. Illus 6 is a 1:5,000 scale



ILLUS 5 Field 11, looking east

survey location plan showing the GPS swaths overlying the 1888 six inch Ordnance Survey map. Fully processed greyscale data and accompanying interpretative drawing, both at a scale of 1:5,000, are shown as Illus 7 and Illus 8 respectively.

Detailed data plots of the fully processed data (greyscale) and minimally processed data (XY trace plot) and interpretative illustrations of the four sectors into which the site is broken down, are presented at a scale of 1:2,500 in Illus 9 to Illus 20 inclusive.

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 (Headland Archaeology 2016) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (ClfA 2014). All illustrations reproduced from Ordnance Survey mapping are 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 site and the data quality was correspondingly good throughout. There is nothing in the data or from other lines of evidence to suggest that the results provide anything other than a reliable indication of the sub-surface conditions across the site.

The magnetic background across the PDA is fairly homogenous except in the area of the head superficial deposits where the background is variable over a small area. Against this background numerous anomalies have been identified which are discussed below by type and origin and cross-referenced to specific anomalies on the interpretative illustrations, 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 or material is common on most sites, often being present as a consequence of manuring or tipping/infilling.

Magnetic disturbance around the field edges is mainly due the proximity of perimeter fencing and other ferrous material within or close to the field boundaries or to adjacent to buildings or structures.

Three small discrete areas of magnetic disturbance PU1, PU2 and PU3, (Illus 8) correspond with the location of wind pumps shown

on the 1888 OS mapping and are likely to be due to the remains of the pump base.

4.2 AGRICULTURAL ANOMALIES

Several linear trend anomalies, FB1–FB7, (see Illus 8), correspond with field boundaries, all of which are recorded on the 1888 six inch OS map, which have been removed over the last century to increase field size. An eighth anomaly, FB8, (Illus 8 and Illus 20) is also interpreted as a likely (but unmapped) former boundary based on its alignment.

Numerous other linear trend anomalies are recorded throughout the PDA on varying alignments. The majority of these anomalies are interpreted as field drains with the more closely spaced anomalies indicative of the direction of recent cultivation.

4.3 GEOLOGICAL ANOMALIES

Numerous discrete anomalies are visible throughout the magnetic dataset. These anomalies are interpreted as geological in origin and are due to minor variations in the depth and composition of the upper soil horizons and the influence of the sands and gravels in the underlying superficial deposits.

A particularly noticeable cluster of enhanced responses, GV1, (Illus 8 and Illus 14) in the east of F5, corresponds with the recorded location of an outcropping of sand and gravel superficial Head deposits.

4.4 ARCHAEOLOGICAL ANOMALIES

Three distinct areas of archaeological activity (AoAA) have been identified, each with its own characteristic magnetic responses, which are considered likely to be associated with the small-scale production of bricks and/or tiles of likely post-medieval date.

The first area, AoAA1 (Illus 8 and Illus 15), is located immediately south-east of Leeds Cottage and comprises a very clearly defined rectangular area of enhanced magnetic response, which measures approximately 65m by 25m. The anomaly is aligned north-east/ south-west along its long axis and clearly pre-dates the track (recorded on the 1888 OS mapping) which cuts across the centre of the anomaly. The X-Y trace response (Illus 16) is characteristic of an area which has been affected by heating/burning and is interpreted as locating a possible brick clamp. A brick clamp was a basic method of firing bricks which involved the stacking of bricks around a series of stoke holes – there was no permanent structure. The anomaly is caused by the thermoremanent magnetisation of the ground during the firing process. Several smaller discrete anomalies, including rectangular anomalies P1 and P2, to the north of the possible clamp may also be associated with this activity.

Two hundred and fifty metres north of the possible brick clamp, immediately south of Norwood Lane in F11, is a second area of archaeological interest, AoAA2, (Illus 8 and Illus 11). This area is identified as a cluster of well defined, high magnitude, sub-square anomalies which may be indicative of small scale industrial activity.

The final area, AoAA3, is located immediately west of AoAA2 (Illus 8 and Illus 11), in the corner of F11. The magnetic responses are different

again from the other two areas being of much higher magnitude but with no regular pattern that might suggest structural remains. This area may be another area of industrial activity but the most favoured interpretation is that it is an area of dumping or infilling. Numerous fragments of fired material, thought to be fragments or wasters of hand-made brick or tile, were observed during the survey in this part of the field. It is considered likely that corner of this field at the junction of Norwood Lane and Newborough Road is the likely site of small scale brick and/or tile manufacture.

4.5 ANOMALIES OF UNCERTAIN ORIGIN/POSSIBLY ARCHAEOLOGICAL ANOMALIES

Several anomalies of uncertain origin have also been identified. These anomalies cannot be confidently interpreted as either agricultural or modern in origin and therefore have been interpreted as of possible archaeological origin. These include a short linear anomaly, D1, on the eastern edge of F6, and an L-shaped anomaly, D2, in F7.

5 CONCLUSION

The geophysical survey has successfully identified and defined the extent of three discrete areas of archaeological activity to the west of the PDA all of which are considered likely to be associated with post-medieval brick manufacture. The archaeological potential of these areas is assessed as moderate to high. Two linear anomalies of uncertain origin are also recorded and interpreted as of possible archaeological origin.

The remainder of the PDA is assessed as of low or very low potential with anomalies indicative of an extensive system of land drains and several former field boundaries being identified.

6 **REFERENCES**

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ILLUS 6 Survey location showing GPS swaths overlying 1888 six inch OS map





ILLUS 7 Overall processed greyscale magnetometer data





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-1.0	2.0
	0 50m scale 1:2,500 @ A3
PROJECT	ENRP/01
CLIENTS	Peterborough Taylor Wimpey Calco Church Commissioners for England
	HEADLAND ARCHAEOLOGY
NORTH	Unit 16, Hillside, Beeston Road Leeds LS11 8ND 0113 387 6430 www.headlandarchaeology.com

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Land east of Newborough Road Peterborough CLIENTS Taylor Wimpey Calco Church Commissioners for England



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ILLUS 12 Processed greyscale magnetometer data; Sector 2

	1
-	-1.0 <u>nT</u> 2.0
	scale 1:2,500 @ A3 PROJECT ENRP/01 Land east of Newborough Road Peterborough CLIENTS Taylor Wimpey Calco Church Commissioners for England MERADLAND ARCHAEOLOGY NORTH Unit 16, Hillside, Beeston Road Leeds LS11 8ND 0113 387 6430



ILLUS 13 XY trace plot of minimally processed magnetometer data; Sector 2



ILLUS 14 Interpretation of magnetometer data; Sector 2

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	10	nT
	-1.0	2.0
		50m 50m 50m 50m 50m
	PROJECT	ENRP/01 Land east of Newborough Road Peterborough
	CLIENTS	Taylor Wimpey Calco Church Commissioners for England
		HEADLAND ARCHAEOLOGY
	NORTH	Unit 16, Hillside, Beeston Road Leeds LS11 8ND 0113 387 6430
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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.

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 (<u>http://guides.archaeologydataservice.</u> <u>ac.uk/g2gp/Geophysics_3</u>). 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.

Data is also clipped to remove extreme values and to improve data contrast.

PROJECT DETAILS		
Project name	Land east of Newborough Road, Peterborough	
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering approximately 70 hectares, on land east of Newborough Road, Peterborough, to inform future archaeological strategy in relation to the proposed development of the site. The survey has identified three discrete areas of probable archaeological activity which are all possibly associated with the post-medieval manufacture of bricks and/or tiles. An extensive rectangular anomaly is interpreted as a possible brick clamp. An area of industrial activity and an area of possible industrial dumping have also been clearly defined. Two anomalies of uncertain origin are also identified as well as anomalies due to an extensive network of field drains and to former boundaries. On the basis of the geophysical survey, the archaeological potential across the majority of the site as assessed as being low or very low but with a moderate to high potential in the vicinity of the probable industrial activity.	
Project dates	Start: 17-10-2016 End: 27-10-2016	
Previous/future work	Not known / Not known	
Any associated project reference codes	ENRP/01 - Contracting Unit No.	
Type of project	Field evaluation	
Site status	None	
Current Land use	Cultivated Land 4 - Character Undetermined	
Monument type	N/A None	
Monument type	N/A None	
Significant Finds	N/A None	
Significant Finds	N/A None	
Methods & techniques	"Geophysical Survey"	
Development type	Not recorded	
Prompt	National Planning Policy Framework - NPPF	
Position in the planning process	Pre-application	
Solid geology (other)	Oxford Clay Formation	
Drift geology	RIVER TERRACE DEPOSITS	
Techniques	Magnetometry	

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

PROJECT LOCATION		
Country	England	
Site location	CAMBRIDGESHIRE PETERBOROUGH PETERBOROUGH Land east of Newborough Road	
Postcode	PE4	
Study area	70 Hectares	
Site coordinates	TF 2060 0300 52.611003562683 -0.218679077396 52 36 39 N 000 13 07 W Point	

PROJECT CREATORS		
Name of Organisation	Headland Archaeology	
Project brief originator	The Environmental Dimension Partnership	
Project design originator	Headland Archaeology	
Project director/manager	Harrison, S	
Project supervisor	Bishop, R	

LAND EAST OF NEWBOROUGH ROAD, PETERBOROUGH ENRP/01

Type of sponsor/funding body

Developer

PROJECT ARCHIVES		
Physical Archive Exists?	No	
Digital Archive Exists?	No	
Digital Media available	"Geophysics"	
Paper Archive Exists?	No	
Paper Media available	"Report"	
PROJECT BIBLIOGRAPHY 1		

Publication type	Grey literature (unpublished document/manuscript)
Title	Land east of Newborough Road, Peterborough
Author(s)/Editor(s)	Webb, A.
Date	2016
lssuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	A4 bound report
Entered by	David Harrison (david.harrison@headlandarchaeology.com)
Entered on	5 December 2016

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