WYAS Archaeological Services

Land at Easington Road

Hartlepool

Cleveland

Geophysical Survey

Report no. 2980
June 2017

Client: BWB Consulting Limited

West Yorkshire Joint Services

Land at Easington Road, Hartlepool, Cleveland

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 1.8 hectares was undertaken on agricultural land to the east of Easington Road, Hartlepool in advance of a proposed planning application. The survey has detected modern ploughing remnants, a number of ferrous responses and geological anomalies. Curvilinear responses have been identified centrally within the survey area, they are very likely to be responses from geological material which has been brought to the surface from recent ploughing across the whole survey area. However an anthropogenic origin cannot be dismissed. Therefore, based on this survey, the archaeological potential of the site is deemed to be low.

WYAS
Archaeological Services

Report Information

Client:	BWB Consulting Limited
Address:	Whitehall Waterfront, 2 Riverside Way, Leeds, LS1 4EH
Report Type:	Geophysical Survey
Location:	Easington Road, Hartlepool
County:	Cleveland
Grid Reference:	NZ 4824 3624
Period(s) of activity:	Modern
Report Number:	2980
Project Number:	6731
Site Code:	ERH17
OASIS ID:	archaeol11-287549
Date of fieldwork:	June 2017
Date of report:	June 2017
Project Management:	Chris Sykes BA MSc
Fieldwork:	Chris Sykes
	Alastair Trace BSc MSc
Report:	Chris Sykes
Illustrations:	Chris Sykes
Photography:	Chris Sykes

Authorisation for distribution: ----------

Nepshaw Lane South, Morley, Leeds LS27 7JQ
Telephone: 0113 383 7500.
Email: admin@aswyas.com

Contents

List of Figures

List of Plates

1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by BWB Consulting, to undertake a geophysical (magnetometer) survey on land to the east of Easington Road, Hartlepool, Cleveland to inform a planning application for proposed residential properties. 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 7th June 2017 to provide additional information on the archaeological resource of the Proposed Development Area (PDA).

Site location, topography and land-use

The PDA is located approximately 1.6km to the northeast of the village of Hart. It is bound to the north boundary by a field, the A1086 to the west, the existing Newcastle to Middlesbrough railway line and the south by residential properties associated with Hartville Road (see Fig. 1). The survey area is centred at NZ 4824 3624 and consisted of weathered deep plough. Until recently the field had been grazing pasture, evidenced by the dilapidated stable building in the northwest corner of the site. An area in the southeast corner was unsuitable for survey because of the furrows caused by the depth of plough. The topography of the site slopes down from the north to the south with a height above Ordnance Datum (aOD) of approximately 37m along the northern boundary and sloping to the southeast corner to 32m.

Soils and geology

The survey area lies on the Seaham Formation, comprising of limestone. Superficial deposits have been recorded as Devensian glaciofluvial sands and gravels (BGS 2017). Soils of the area belong to the Duneswick association (711p) comprising slowly permeable seasonally waterlogged fine loamy and clayey soils (SSEW 1983).

2 Archaeological Background

The archaeological background and investigation history of areas within a 1km radius of the site are discussed in brief below and are based upon the Heritage Appraisal document prepared by BWB Consulting (BWB Consulting 2017).

Within 1km of the survey area, finds from a variety of different archaeological epochs have been discovered. Prehistoric scatters have been found, and to the west of the site a solitary roman pottery sherd.

To the north, a possible medieval settlement around Middlethorpe Farm, has been ploughed out and to the west of the PDA, medieval ridge and furrow has been detected during previous Desk Based Assessments (DBA) and aerial photography analysis.

To the east of the PDA, the former Hart to Haswell railway line is evidence of the industrial heritage that ran along the coast. Pillboxes and artillery batteries relating to World War II coastal defences are within 1km of the survey area.

A series of DBA's, geophysical surveys and trial trenching has taken place close to the survey area and have identified no archaeological anomalies but have suggested archaeological potential, especially around Middlethorpe Farm.

3 Aims and Methodology

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. To achieve this aim, a magnetometer survey covering all amenable 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.

Presentation

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 1:2000. The

processed and minimally processed XY data, together with an interpretation of the survey results are presented in Figures 3 to 5 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 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.

4 Results and Discussion (see Figures 3-5)

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.

Geological anomalies

The survey has detected low magnitude anomalies that have been interpreted as geological in origin. It is thought that the responses have been detected because of the variation in the composition and depth of the soils and deposits of superficial material in which they derive. The survey area generally appears to generally have a uniform geology.

Within the centre of the survey area curvilinear trends have been detected that have a slightly different magnetic response to the other geological material on the site. There is a possibility that they are of an anthropogenic origin although it is likely that they may be the results of geological material being brought to the surface.

Agricultural anomalies

Modern cultivation has been detected and is most prevalent on the southern part of the survey area. This can be seen on the surface as weathered deep plough.

5 Conclusions

The geophysical survey has identified a handful of curvilinear trends of some potential archaeological interest. However, as they are isolated and due to the site conditions it is likely that they are agricultural or geological in origin. Magnetic responses of geological and magnetic disturbance have been detected, along with traces of modern ploughing to the south, beyond the break of slope. Therefore, the archaeological potential of this site is low.

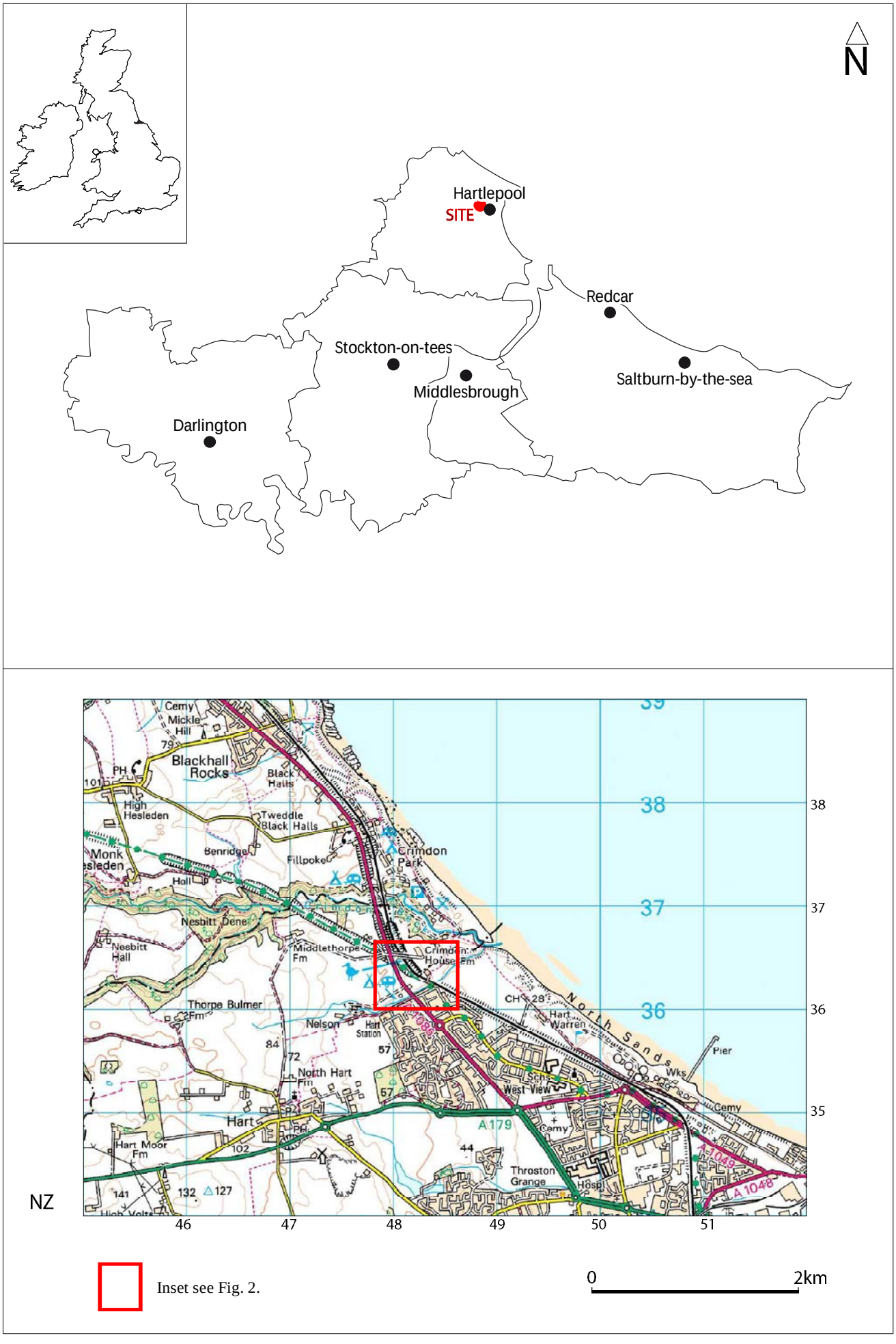

Fig. 1. Site location

PROJECT ID: 6731_ERH17

SURVEY BOUNDARY

LOCATION AND DIRECTION OF PLATES

UNSUITABLE FOR SURVEY

2.0

-1.0

nT

N

Caravan Site

Path

Seaview Park

HARTVILLE ROAD

RENNEV DAOR

VERNER CL

NAECO DAOR

REDWOOD CL

REDWOOD LC

GREYWOOD CL

SILVERWOOD CL

RAVENSWORT

LANE

5364 00

5362 00

5360 00

4480 00

4482 00

4484 00

4486 00

0 100m

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500

Fig. 2. Survey location showing greyscale magnetometer data (1:2000 @ A3)

PROJECT ID: 6731_ERH17

N

2.0

-1.0

nT

HARTVILLE RENREV

ROAD

Seaview

Park

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500

536200

448200

448400

0

50m

Fig. 3. Processed greyscale magnetometer data (1:1000 @ A3)

PROJECT ID: 6731_ERH17

N

20.0 nT/cm

HARTVILLE RENREV ROAD

Seaview Park

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500

536200

448200

448400

0 50m

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1000 @ A3)

PROJECT ID: 6731_ERH17

UNSUITABLE FOR SURVEY

TYPE OF ANOMALY		INTERPRETATION
●	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	GEOLOGY?

N

ROAD

HARTVILLE RENREV

Seaview

Park

5362 00

4482 00

4484 00

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500

0 50m

Fig. 5. Interpretation of magnetometer data (1:1000 @ A3)

Plate 1. General overview of site, facing east

Plate 2. General overview of site, facing southwest

Plate 3. General overview of site, facing west

Plate 4. General view of unsurveyable area, facing south

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 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 Redcar and Cleveland Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-287549

Project details

Project name	Easington Road, Hartlepool
Short description of the project	A geophysical (magnetometer) survey, covering approximately 1.8 hectares was undertaken on agricultural land to the east of Easington Road, Hartlepool in advance of a proposed planning application. The survey has detected modern ploughing remnants, a number of ferrous responses and geological anomalies. Curvilinear responses have been identified centrally within the survey area, they are very likely to be responses from geological material which has been brought to the surface from recent ploughing across the whole survey area. However an anthropogenic origin cannot be dismissed. Therefore, based on this survey, the archaeological potential of the site is deemed to be low.
Project dates	Start: 07-06-2017 End: 07-06-2017
Previous/future work	No / Not known
Any associated project reference codes	6731 - Sitecode
Type of project	Field evaluation
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)	Seaham Formation
Drift geology	GLACIAL SAND AND GRAVEL
Techniques	Magnetometry

Project location

Country	England

Site location	CLEVELAND HARTLEPOOL HARTLEPOOL Land at Easington Road, Hartlepool
Study area	1.8 Hectares
Site coordinates	NZ 4824 3624 54.718738003881 -1.251029197235 54 43 07 N 001 15 03 W Point
Height OD / Depth	Min: 32m Max: 37m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	BWB Consulting
Project design originator	BWB Consulting
Project director/manager	C. Sykes
Project supervisor	C. Sykes

Project archives

Physical Archive Exists?	No
Digital Archive recipient	BWB Consulting
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	Land at Easington Road, Hartlepool
Author(s)/Editor(s)	Sykes, C
Date	2017
Issuer or publisher	ASWYAS
Place of issue or publication	Morley, Leeds
Description	A4 report with A3 figures

Entered by	Emma Brunning (emma.brunning@aswyas.com)
Entered on	15 June 2017

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