Archaeological Services
University of Durham

High Haswell Wind Farm, Haswell, County Durham

geophysical surveys

on behalf of
Wardell Armstrong International Ltd

Report 1731
September 2007

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Wheal Jane, Baldhu, Truro, Cornwall TR3 6EH

Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of a proposed wind farm and associated infrastructure on land at High Haswell, Haswell, County Durham.

1.2 The works were commissioned by Wardell Armstrong International Ltd and conducted by Archaeological Services in accordance with a methods statement provided by Archaeological Services and approved by the Assistant County Archaeologist.

Results

1.3 The surveys identified curvilinear and linear anomalies possibly reflecting soil-filled features of archaeological origin. Two of these anomalies probably represent former field boundaries.

1.4 Probable soil-filled pits of indeterminate origin have also been detected in Area 1.

1.5 A very discontinuous anomaly detected in Area 2 may be of archaeological origin.

1.6 Traces of ridge and furrow have been detected across both surveys.

2. Project background

Location (Figure 1)

2.1 The study area is located at High Haswell, Haswell, County Durham (NGR centre: NZ 4365 5431). The site is bounded by Durham Lane (the B1283) at the south-west, Green Lane at the north and open fields on all other boundaries. Two surveys were undertaken, totalling four hectares.

Development proposal

2.2 The geophysical surveys were conducted in advance of a planning application for a proposed wind farm comprising two turbines with associated access routes, cabling and sub-station.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in advance of development.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions provided by Wardell Armstrong International Ltd and a methods statement prepared by Archaeological Services and approved by the Assistant Archaeology Officer at Durham County Council (DCC).

Dates

2.5 Fieldwork was undertaken between 6th and 7th September 2007. This report was prepared between 9th and 14th September 2007.

Personnel

2.6 Fieldwork was conducted by Lorne Elliott (Supervisor), Louise Robinson, Natalie Swann and Richie Villis. This report was prepared by Lorne Elliott, with illustrations by Dr David Webster and Janine Wilson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **DHH07**, for **D**urham**, H**igh **H**aswell 20**07**. The survey archive will be supplied on CD to the Bowes Museum. Archaeological Services is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is **archaeol3-31165**.

Acknowledgements

2.8 Archaeological Services is grateful for the assistance of the farmer Mr David Forster in facilitating this scheme of works, moving straw bales and providing local knowledge.

3. Archaeological and historical background

3.1 A comprehensive desk-based assessment of the archaeological and historical resource of the study area and its environs was undertaken in November 2006 (Archaeological Services 2006). In summary, the assessment indicated that evidence relating to prehistoric activity in the area is sparse: a Bronze Age settlement has been recorded at Shadforth, south-west of the study area; a Bronze Age round barrow has been excavated at East Murton, north-east of the site; a bronze axe head has been found at Ludworth to the south, and north of the hamlet of High Haswell is the Bronze/Iron Age settlement of Pig Hill (SMR 402).

3.2 The name Haswell is believed to derive from the Anglo-Saxon word *Hessewelle*, meaning 'Hazel Well' or 'Hazel Spring'. This name suggests an Anglo-Saxon presence in the Haswell area, and would indicate that the settlement is of considerable age. This is further reinforced by the proximity of Ludworth village to the south of the study site. This also has an Old English place name, this time meaning 'Luda's farmstead' or possibly 'farmstead on the loud stream' although no direct evidence of Anglo-Saxon habitation has been found in the Haswell area.

3.3 Haswell was a small, fragmented settlement during the medieval period, with the village of High Haswell as the nucleus of the community. Haswell, Haswell Plough, Haswell Moor and Elemore Grange, known as Little Haswell, are referred to as subdivisions of the settlement.

3.4 Three Scheduled Ancient Monuments are located within the surrounding area: Ludworth Tower (SAM DU76) is to the south of the application boundary; Haswell Colliery Engine House (SAM 30930) is to the east of the site; and Haswell Medieval Chapel (SAM 34584) is to the north of the application boundary.

3.5 A recent programme of geophysical survey and trial trench evaluation at the adjacent Haswell Moor Farm to the south (Archaeological Services 2007a & 2007b) has revealed a rectilinear enclosure and associated features, including ditches, pits and a palisade, typical of late prehistoric settlement in County Durham. The investigations also identified areas of former ridge and furrow cultivation and a number of former field boundaries.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised one large arable field. Straw bales were present in Area 2.

4.2 The elevation of the site varies between 140-150m OD.

4.3 The underlying solid geology of the area comprises Magnesian Limestone (Permian), which is overlain by boulder clay and morainic drift.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation* (David 1995); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on desk-top evidence, it was considered possible that cut features, such as ditches and pits, might present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting each of the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record minute anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 For survey purposes the proposed development area was divided into two survey areas: Area1 to the south of the track on a north-east/south-west axis and Area 2 to the north of the track on a north-west/south-east axis (Figure 2).

5.6 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system (GPS) with subsequent RINEX calibration.

5.7 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

5.8 Data were downloaded on-site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.9 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 3 and 4; the trace plots are provided in Appendix I. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.10 The following basic processing functions have been applied to each dataset:

clip	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.
destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
despike	locates and suppresses random iron spikes in gradiometer data.
interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.11 Colour-coded geophysical interpretation plans are provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches.
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids.
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

Interpretation: features

General comments

5.12 Colour-coded archaeological interpretation plans are provided.

5.13 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter and/or by burning.

5.14 Small, discrete dipolar magnetic anomalies have been detected in both survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

Area 1 (Figure 3)

5.15 A curvilinear positive magnetic anomaly has been detected near the midpoint of this area, and appears to continue beyond the southern limit of the survey. The anomaly almost certainly represents the remains of a soil-filled ditch, possibly circular and approximately 25m in diameter. This could be associated with a round barrow, roundhouse or other archaeological structure.

5.16 Additional weak linear positive magnetic anomalies possibly reflecting soil-filled ditch features have been detected, with a broadly north-east/south-west alignment, parallel with the track along the top of the ridge.

5.17 Clusters of relatively strong positive magnetic anomalies detected at the south-western and north-eastern limits of the area may reflect pits, of indeterminate origin.

5.18 A series of parallel weak positive magnetic anomalies was detected throughout the survey with a north-west/south-east orientation. These anomalies almost certainly reflect traces of former ridge and furrow cultivation and are more evident in the eastern half of the area. A strong linear anomaly parallel with the ridge and furrow probably reflects a former field boundary, shown on the 1856 Ordnance Survey (OS).

5.19 A chain of intense dipolar magnetic anomalies aligned broadly north-south across the area almost certainly reflects a ferrous service pipe.

5.20 A large concentration of intense dipolar magnetic anomalies in the south-western part of the area reflects rubble infill deposited in the 1970s to lessen the steep undulating slopes (pers. comm. D Forster).

Area 2 (Figure 4)

5.21 A series of parallel weak positive magnetic anomalies almost certainly reflects a continuation of the traces of former ridge and furrow cultivation detected in

Area 1. A strong linear positive magnetic anomaly detected along the centre of the survey and parallel with the ridge and furrow reflects a former field boundary depicted on the OS map of 1856.

5.22 Very weak discontinuous positive magnetic anomalies detected at the northern limit of the area could reflect truncated soil-filled ditches of archaeological origin.

5.23 A chain of intense dipolar magnetic anomalies detected traversing the southern half of the survey almost certainly reflects a continuation of the ferrous pipe detected in Area 1.

5.24 The ridge and furrow immediately west of the pipe appears to have cut through an area of enhanced magnetic susceptibility, perhaps a large pit or bonfire site.

5.25 A cluster of small dipolar magnetic anomalies detected in the northern part of the survey probably reflects a concentration of fired/ferrous debris.

6. Conclusions

6.1 Fluxgate gradiometer surveys have been undertaken on land at High Haswell, Haswell, County Durham, in advance of a proposed wind farm and associated infrastructure.

6.2 The surveys identified one curvilinear anomaly and several other anomalies, which could reflect soil-filled ditches and pits of archaeological origin. Two of the probable ditch features probably represent former field boundaries.

6.3 Traces of former ridge and furrow cultivation were detected across both surveys.

7. Sources

Archaeological Services 2006 *Haswell Wind Farm, Haswell, County Durham; archaeological desk-based assessment*. Unpublished report **1561** for Wardell Armstrong International, Archaeological Services Durham University.

Archaeological Services 2007a *Haswell Wind Farm, Haswell, County Durham; geophysical surveys*. Unpublished report **1652** for Halcrow Group Ltd, Archaeological Services Durham University.

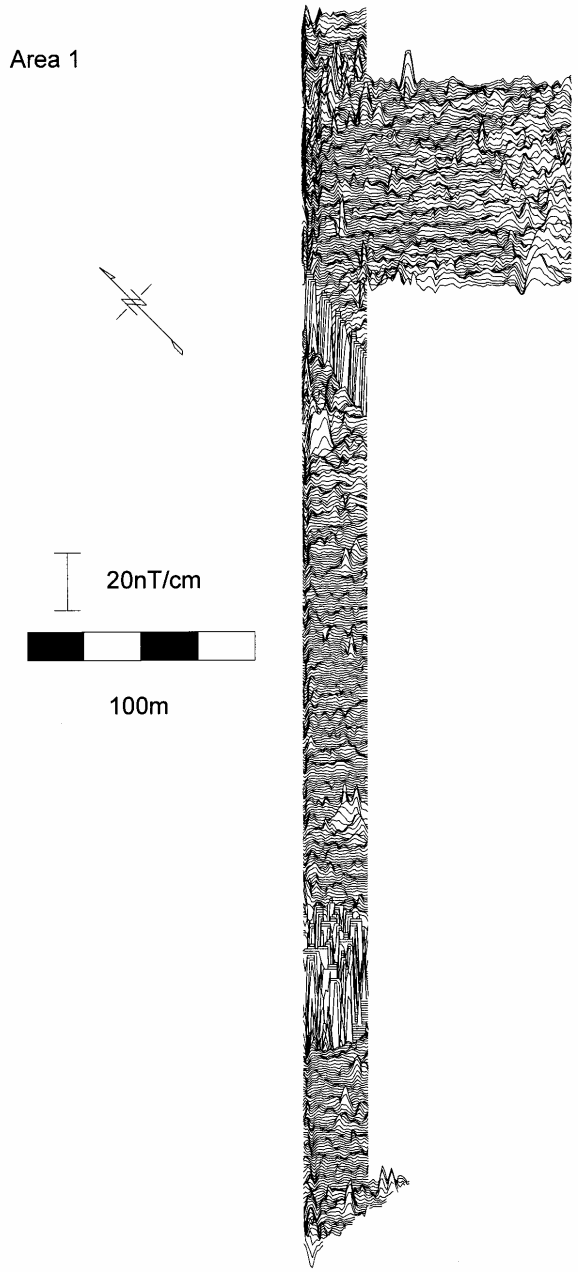
Archaeological Services 2007b *Haswell Wind Farm, Haswell, County Durham; archaeological evaluation*. Unpublished report **1702** for Halcrow Group Ltd, Archaeological Services Durham University.

David, A, 1995 *Geophysical survey in archaeological field evaluation,* Research and Professional Services Guideline **1**, English Heritage.

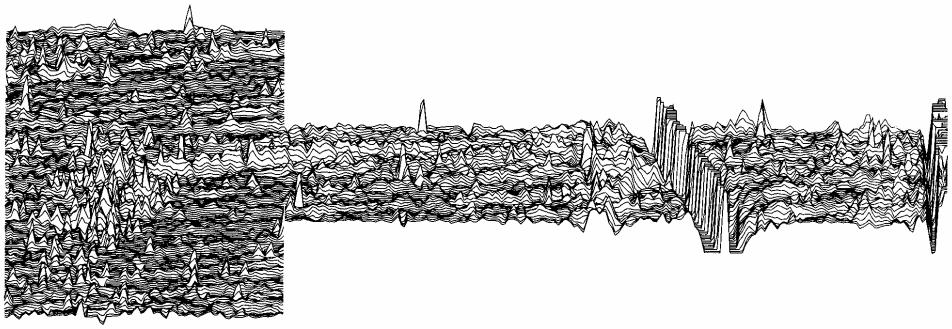
Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists.

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service.

Appendix I: Trace plots of geophysical data



Area 2



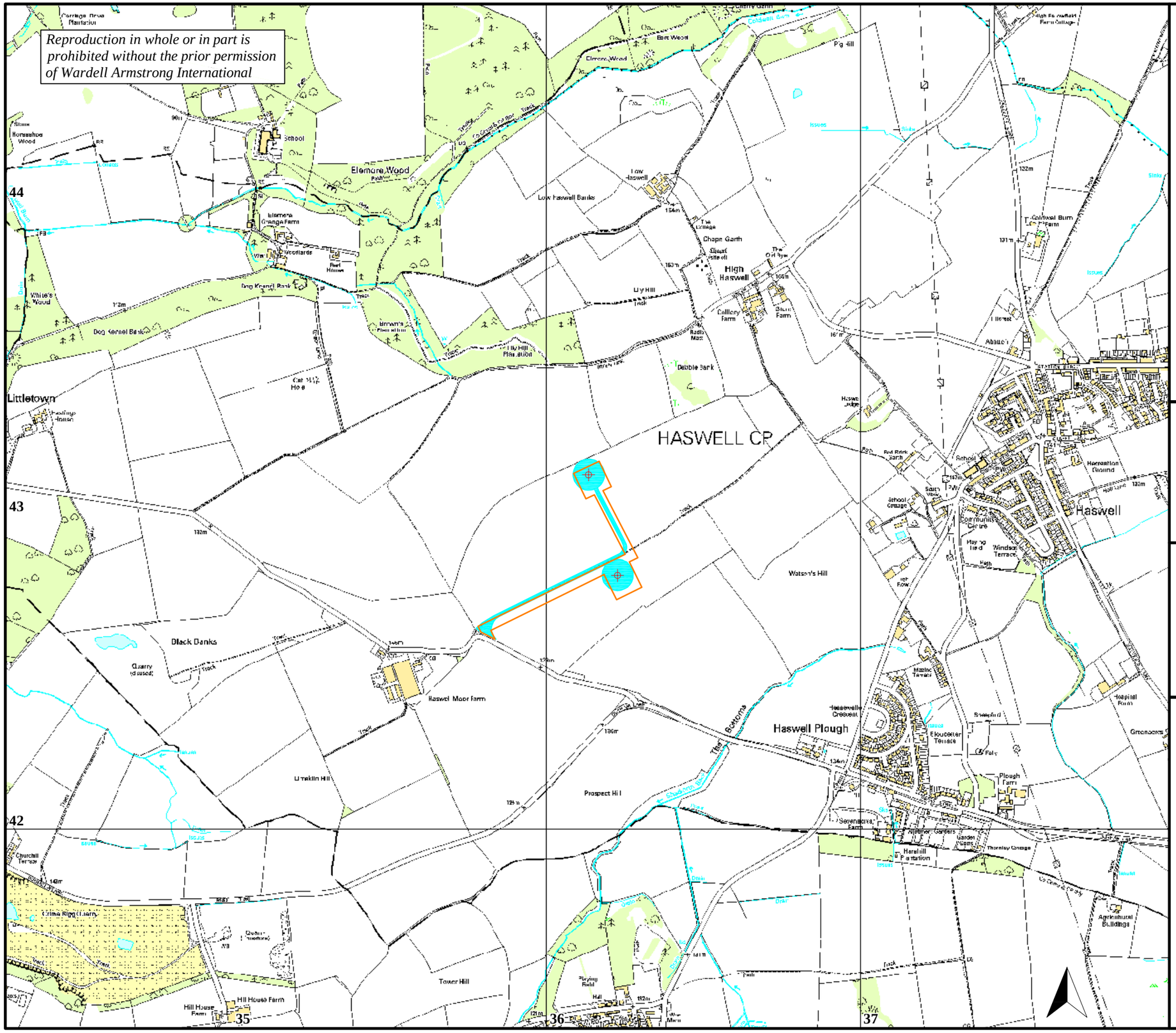


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Figure 1

Location of the proposed wind farm and geophysical surveys

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Figure 2

Proposed development and location of geophysical surveys

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0 250m

scale 1:5000 - for A3 plot

- outline of survey area
- Met mast & guides
- Turbine locations
- Indicative grid connection
- Planning boundary
- Site boundary
- Track centre line
- Turbine foundation
- Crane pad hard standing
- On site control building
- Control building foundation
- Set down area
- On site tracks

Area 1

Area 2

HASWELL CP

Mast

Dabble Bank

GREEN LANE

Lily Hill Plantation

Track

Track

Track

Haswell Moor Farm

CG

CG

146m

139m

136m

DURHAM LANE

Bottoms

43

36

a

b

c

a) Geophysical survey

outline of survey area

5
4.17
3.33
2.5
1.67
0.83
0
-0.83
-1.67
-2.5
-3.33
-4.17
-5 nT

b) Geophysical interpretation

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

c) Archaeological interpretation

soil-filled features

service pipes

orientation of ridge and furrow

stone/rubble

rubble infill

0 50m

scale 1:1000 - for A1 plot

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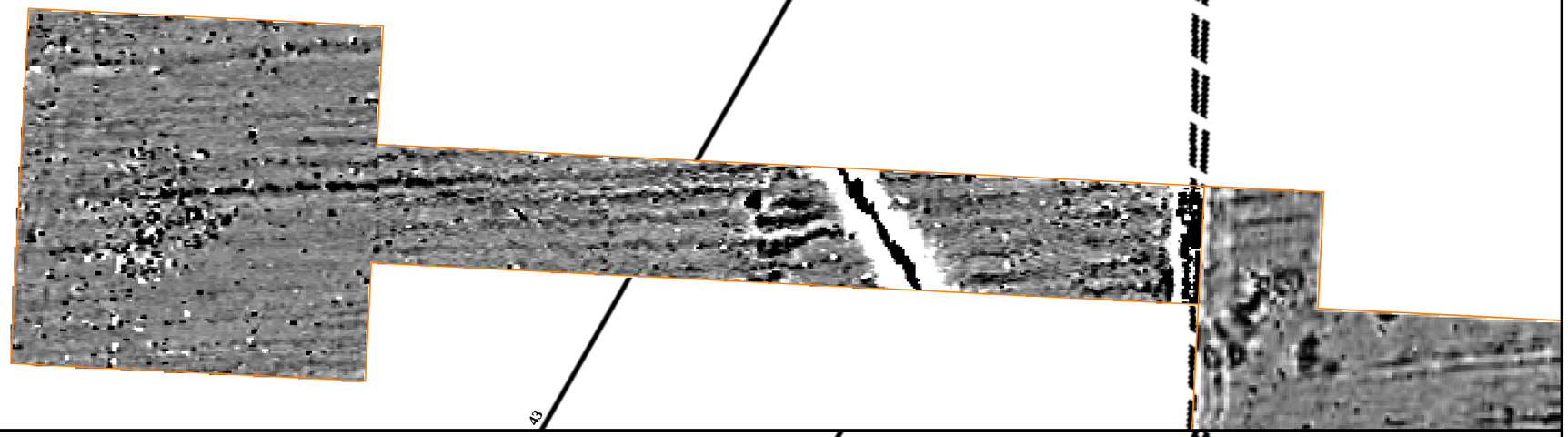
Figure 3

Area 1, geophysical surveys, geophysical and archaeological interpretations

a



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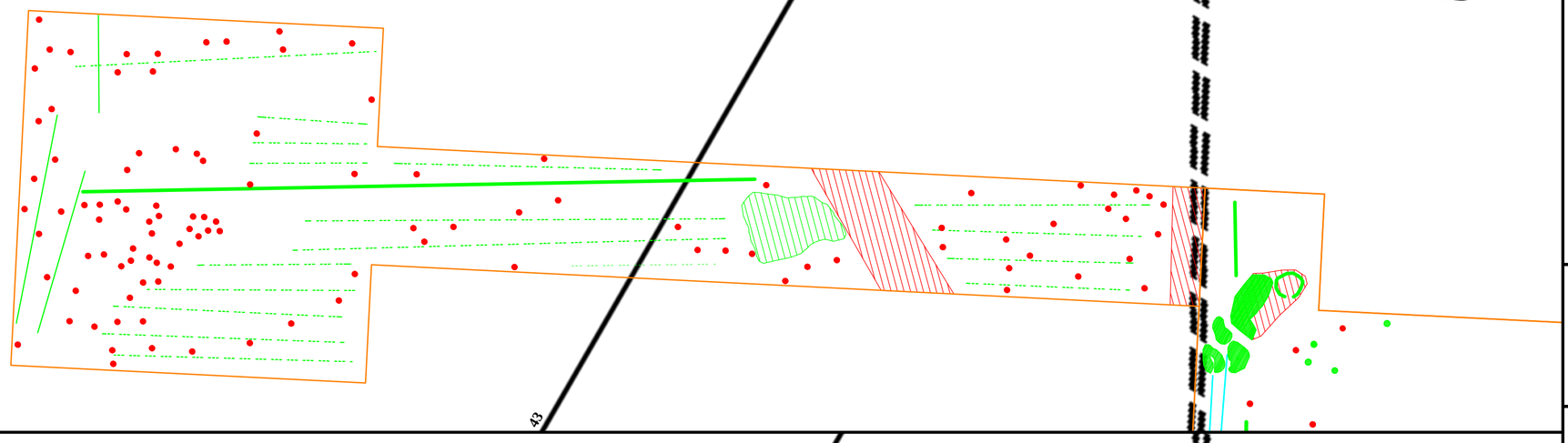
b



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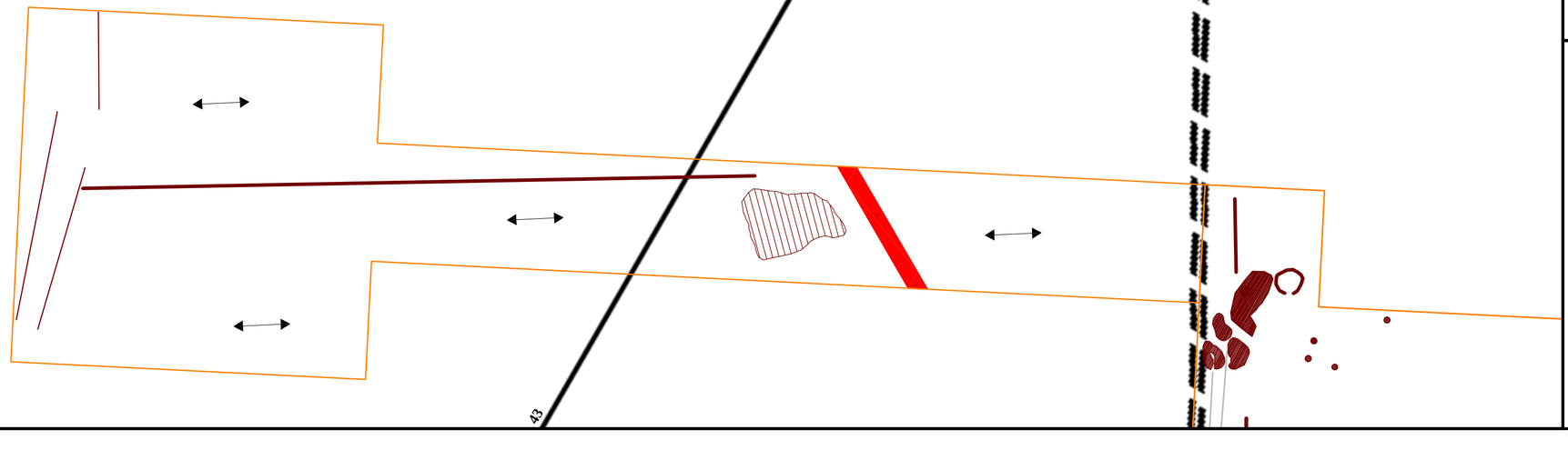
c



a) Geophysical survey

outline of survey area

5
4.17
3.33
2.5
1.67
0.83
0
-0.83
-1.67
-2.5
-3.33
-4.17
-5 nT

b) Geophysical interpretation

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

c) Archaeological interpretation

soil-filled features

service pipes

orientation of ridge and furrow

stone/rubble

0 50m

scale 1:1000 - for A2 plot

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Figure 4

Area 2, geophysical surveys, geophysical and archaeological interpretations