Archaeological Services
University of Durham

Foxton Lane Wind Farm, Sedgefield, County Durham

geophysical surveys

on behalf of
Wind Prospect Developments Ltd

Report 2350
January 2010

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12 Waddington Street, Durham DH1 4BG

Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at land to the east of Foxton Lane, near Sedgefield, County Durham. The works comprised five survey areas totalling 3.3ha.

1.2 The works were commissioned by Wind Prospect Developments Ltd and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled ditch features were identified in Areas 2, 3, 4 and 5. The feature in Area 4 corresponds to a former field boundary marked on early Ordnance Survey editions. The features in Area 5 could reflect the remains of enclosures, possibly associated with stock management or settlement. The potential significance of these features is perhaps enhanced by their proximity to the known remains of Shotton deserted medieval village, 400m to the south-east.

1.4 Traces of former ridge and furrow cultivation were almost certainly identified in Areas 1, 2, 4 and 5.

2. Project background

Location (Figures 1 & 2)

2.1 The study area was located on land to the east of Foxton Lane, near Sedgefield, County Durham (NGR centre: NZ 3603 2610). Five surveys totalling 3.3ha were conducted in four land parcels.

Development proposal

2.2 The proposed development is a wind farm comprising three turbines, an anemometer mast, associated access and a construction compound.

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 from the client and a Written Scheme of Investigation (ref DH09.402) provided by Archaeological Services Durham University, approved by Durham County Council Archaeology Section.

Dates

2.5 Fieldwork was undertaken between 18th and 19th January 2010. This report was prepared between 20th and 26th January 2010.

Personnel

2.6 Fieldwork was conducted by Edward Davies and Richie Villis (Supervisor). Data were processed by Richie Villis and Duncan Hale. This report was prepared by Richie Villis with illustrations by Edward Davies and David Graham, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **SFL10**, for **S**edgefield **F**oxton **L**ane 20**10**. The survey archive will be supplied on CD to Peter Cardwell for deposition with the project archive in due course. Archaeological Services Durham University 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 survey is **archaeol3-70926**.

Acknowledgements

2.8 Archaeological Services Durham University is grateful for the assistance of the landowners, Mr Roy Johnson of Heley House Farm and Mr Greg Hart of Foxton Farm, in facilitating this scheme of works.

3. Archaeological and historical background

3.1 The known archaeological resource of the proposed development area comprises possible traces of former ridge and furrow cultivation, former field boundaries and a single sherd of medieval pottery.

3.2 The proposed location of turbine T3 (survey Area 5) lies approximately 400m north-west of the deserted medieval village of Shotton.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised three fields of recently sown arable land and one field of pasture.

4.2 The proposed development area was on gently rolling agricultural land ranging between 80-85m OD.

4.3 The underlying geology is Late Permian Seaham Formation, predominantly thin-bedded limestone with some dolostone, which is generally overlain by till, with alluvium/head alongside Shotton Beck.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for 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 2002).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on 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 it was considered likely that cut features such as ditches and pits might be 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 the types of feature mentioned above.

This technique involves the use of hand-held magnetometers to detect and record 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 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 with real-time correction.

5.6 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 0.03nT, the sample interval 0.25m and the traverse interval 1.0m, thus providing 3,600 sample measurements per 30m grid unit.

5.7 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

5.8 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 2-7; the trace plots are provided in Figure 8. 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.

5.9 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.
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 0.25m x 0.25m intervals.

Interpretation: anomaly types

5.10 Colour-coded geophysical interpretation plans are provided. Two 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.
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

5.11 Colour-coded archaeological interpretation plans are provided.

5.12 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 ditches, pits or furrows) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Small, discrete dipolar magnetic anomalies have been detected in all of the 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

5.14 A series of parallel positive magnetic anomalies aligned broadly north-east/south-west almost certainly reflects traces of former ridge and furrow cultivation; similar anomalies have also been identified on a perpendicular alignment. Together these could represent two phases of ridge and furrow cultivation.

Area 2

5.15 The large and strong dipolar magnetic anomalies detected in this area represent a temporary anemometer mast and associated fastenings.

5.16 The series of parallel positive magnetic anomalies aligned broadly north-east/south-west almost certainly reflects former ridge and furrow cultivation. This is most apparent in the north-east of the survey.

5.17 Several linear positive magnetic anomalies have been detected perpendicular to the ridge and furrow traces. These probably reflect soil-filled ditch features, and could have defined former tracks or droveways. It is not clear if these features pre- or post-date the ridge and furrow remains.

Area 3

5.18 A long, curvilinear positive magnetic anomaly aligned broadly north/south, and several smaller anomalies, have been detected. These could reflect former ditch features.

Area 4

5.19 The north/south aligned linear positive magnetic anomaly detected across the eastern corner of the survey area corresponds to a former field boundary shown on all Ordnance Survey editions until 1967.

5.20 Former ridge and furrow cultivation has almost certainly been detected aligned broadly north-east/south-west. As in Area 1 there are perpendicular lineations which could represent another phase of ridge and furrow cultivation.

5.21 A third series of parallel positive magnetic anomalies was detected aligned east/west. These anomalies are very straight and more widely spaced and are more likely to reflect land drains.

Area 5

5.22 The series of broadly north/south aligned positive magnetic anomalies almost certainly reflects former ridge and furrow cultivation.

5.23 A number of other linear positive magnetic anomalies have been detected which could reflect soil-filled ditch features. Some of these anomalies are relatively strong and some appear to form small rectilinear enclosures. The potential significance of these features is perhaps enhanced by their proximity to the known remains of Shotton deserted medieval village, 400m to the south-east.

6. Conclusions

6.1 Geomagnetic surveys were undertaken on land to the east of Foxton Lane, near Sedgefield, County Durham, prior to a proposed wind farm development.

6.2 Probable soil-filled ditch features were identified in Areas 2, 3, 4 and 5. The feature in Area 4 corresponds to a former field boundary marked on early Ordnance Survey editions. The features in Area 5 could reflect the remains of enclosures, possibly associated with stock management or settlement.

6.3 Traces of former ridge and furrow cultivation were almost certainly identified in Areas 1, 2, 4 and 5.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation, 2nd edition*. 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, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

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Figure 1
Site location

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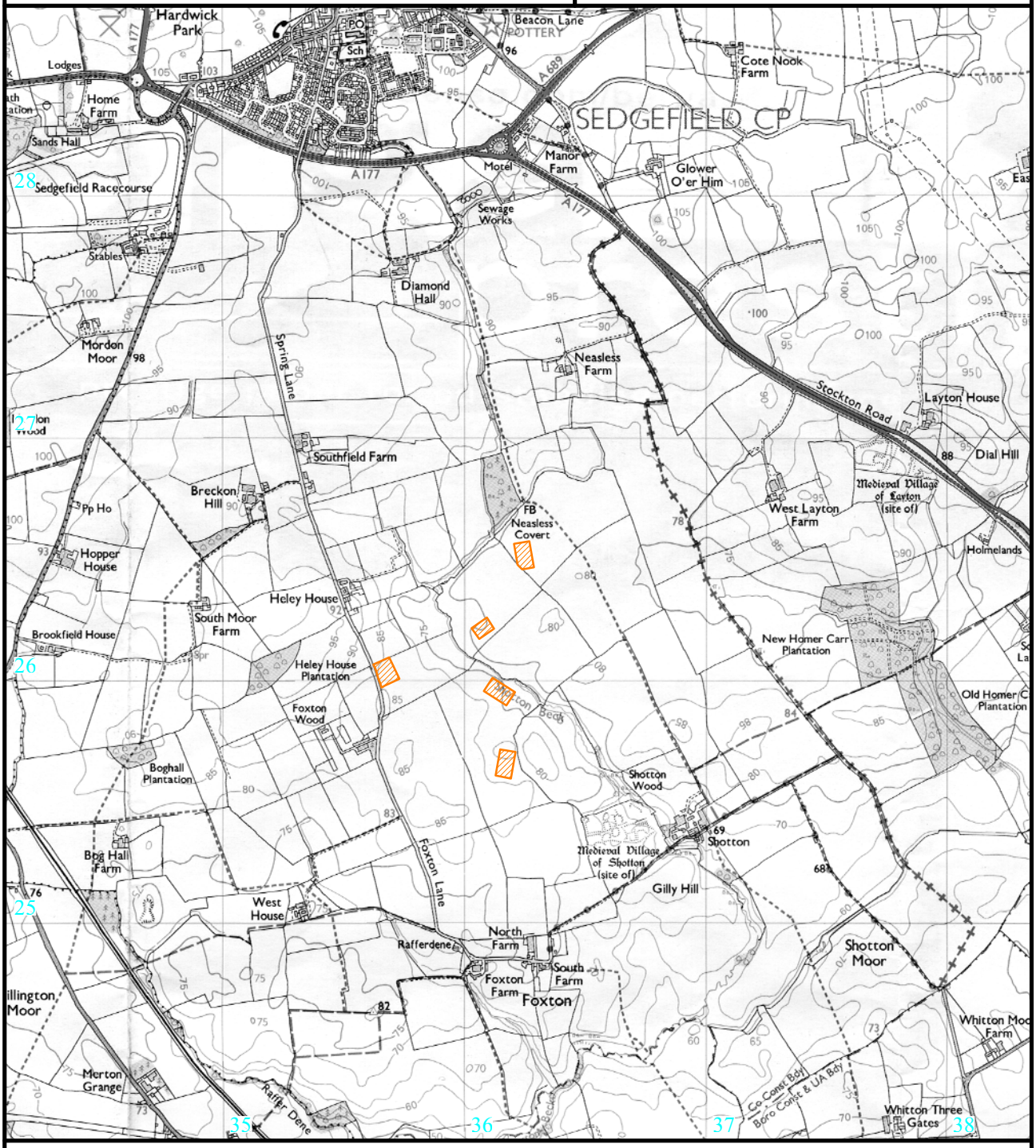

survey locations

0 1km

scale 1:25 000 - for A4 plot

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Figure 2

Geophysical survey overview

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0 250m

scale 1:5000 - for A3 plot

outline of survey area

proposed development

3.00
2.50
2.00
1.50
1.00
0.50
0
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

Area 1

Area 2

Area 3

Area 4

Area 5

88m

Track

Foxton Wood

FOXTON LANE

Shotton Beck

Shott Woo

Issues

CG

26

36

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0 50m

scale 1:1000 - for A3 plot

- outline of survey area
- positive magnetic anomalies
- dipolar magnetic anomalies
- orientation of ridge and furrow
- proposed development

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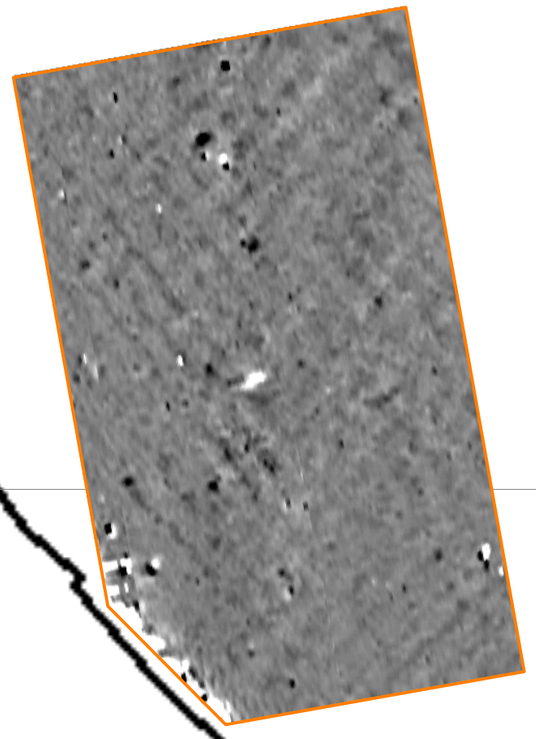
Figure 3
Area 1, geophysical survey and interpretations

266

Area 1



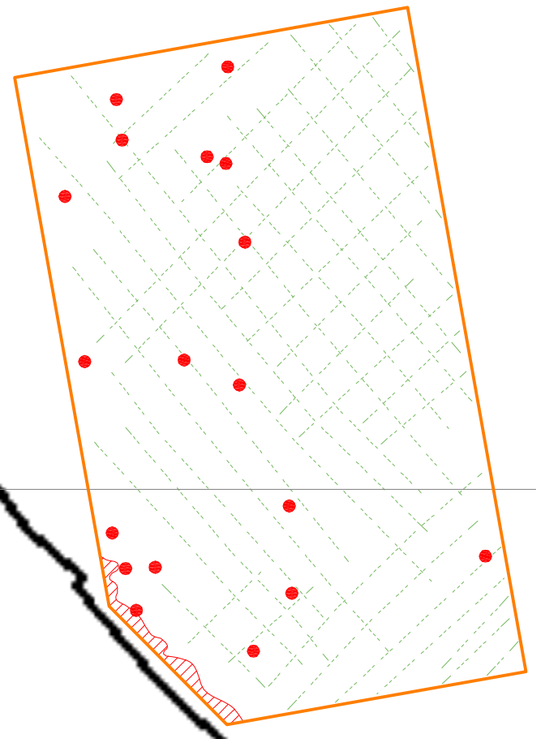
3.00
2.50
2.00
1.50
1.00
0.50
0
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

265

362 363

266

Area 1

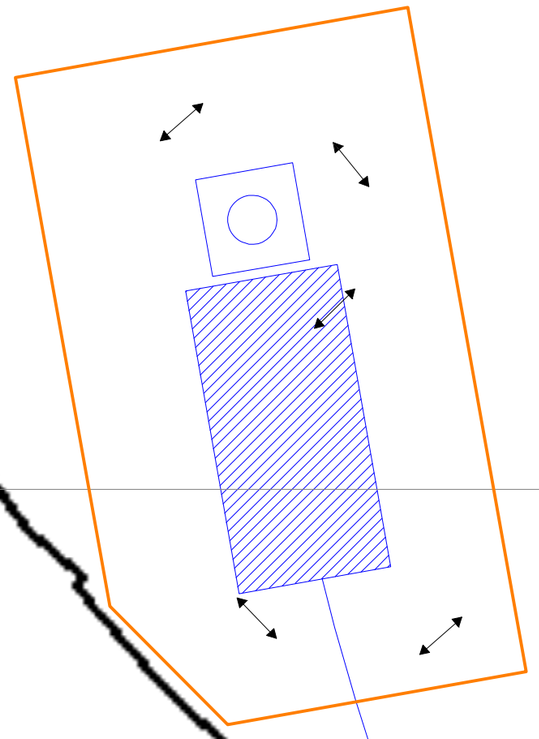


265

362 363

266

Area 1



265

362 363

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0 50m

scale 1:1000 - for A3 plot

outline of survey area
positive magnetic anomalies
dipolar magnetic anomalies
soil-filled features
orientation of ridge and furrow
anemometer mast
proposed development

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Figure 4
Area 2, geophysical survey and interpretations

263 263 263

Area 2 **Area 2** **Area 2**

262 262 262

5.00
4.17
3.33
2.50
1.67
0.83
0
-0.83
-1.67
-2.50
-3.33
-4.17
-5.00 nT

361 361 361

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0 50m

scale 1:1000 - for A3 plot

outline of survey area

positive magnetic anomalies

dipolar magnetic anomalies

soil-filled features

proposed development

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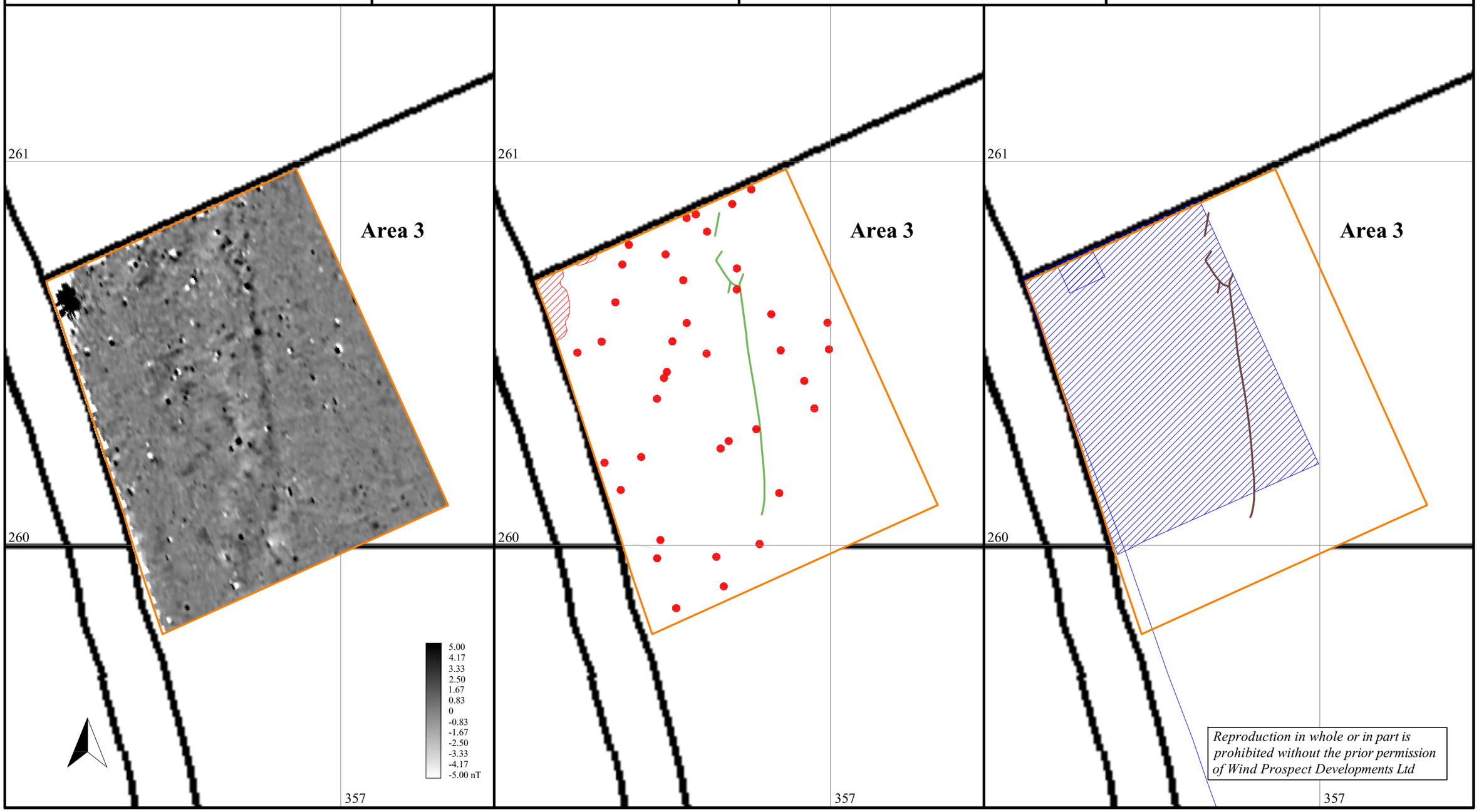
Figure 5
Area 3, geophysical survey and interpretations



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0 50m

scale 1:1000 - for A3 plot

outline of survey area
positive magnetic anomalies
dipolar magnetic anomalies
soil-filled features
orientation of ridge and furrow
land drains
proposed development

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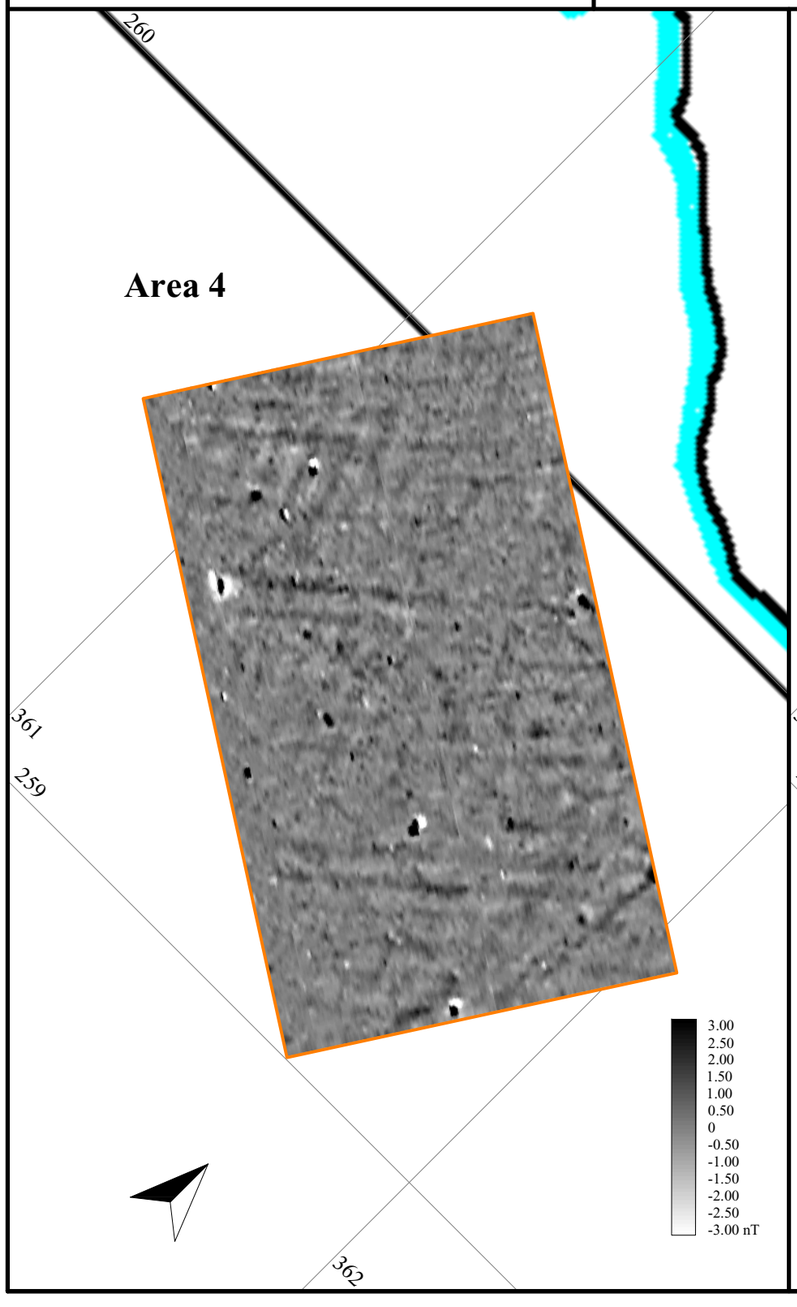
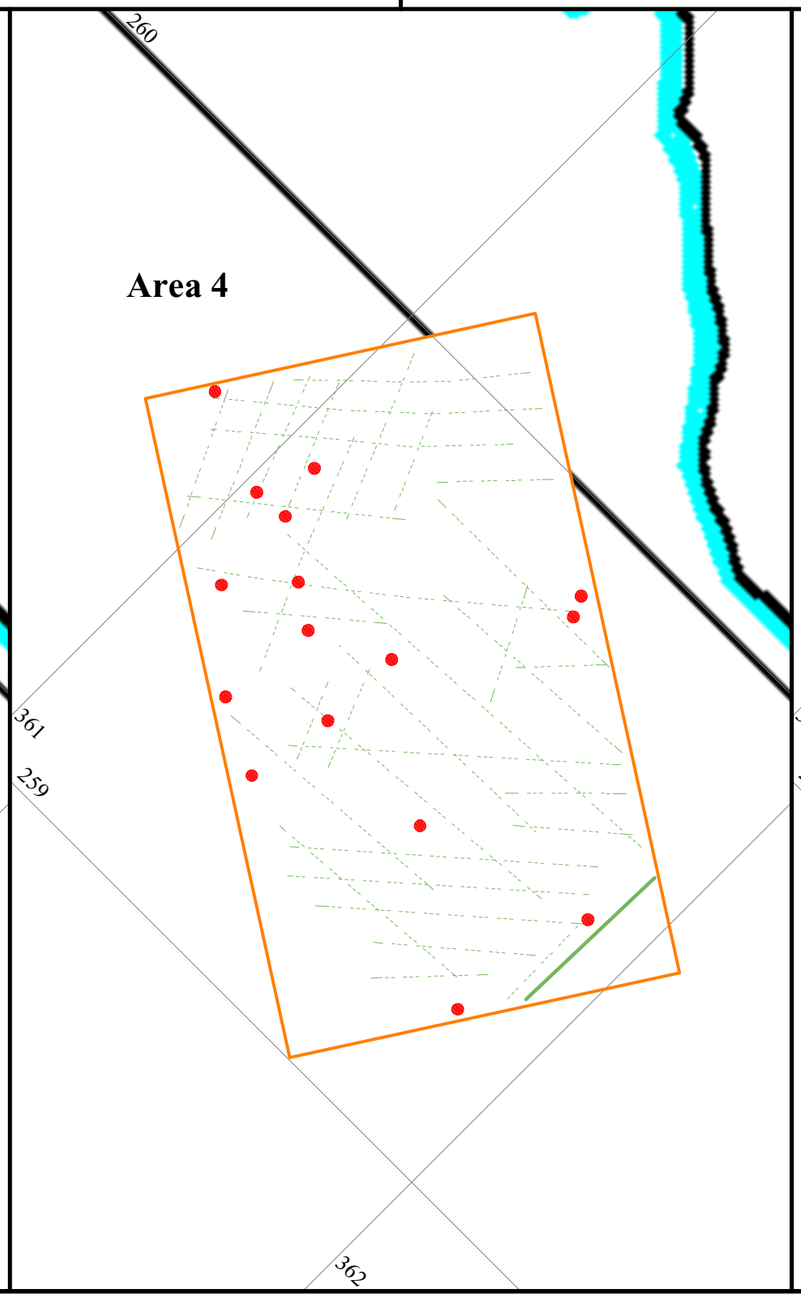
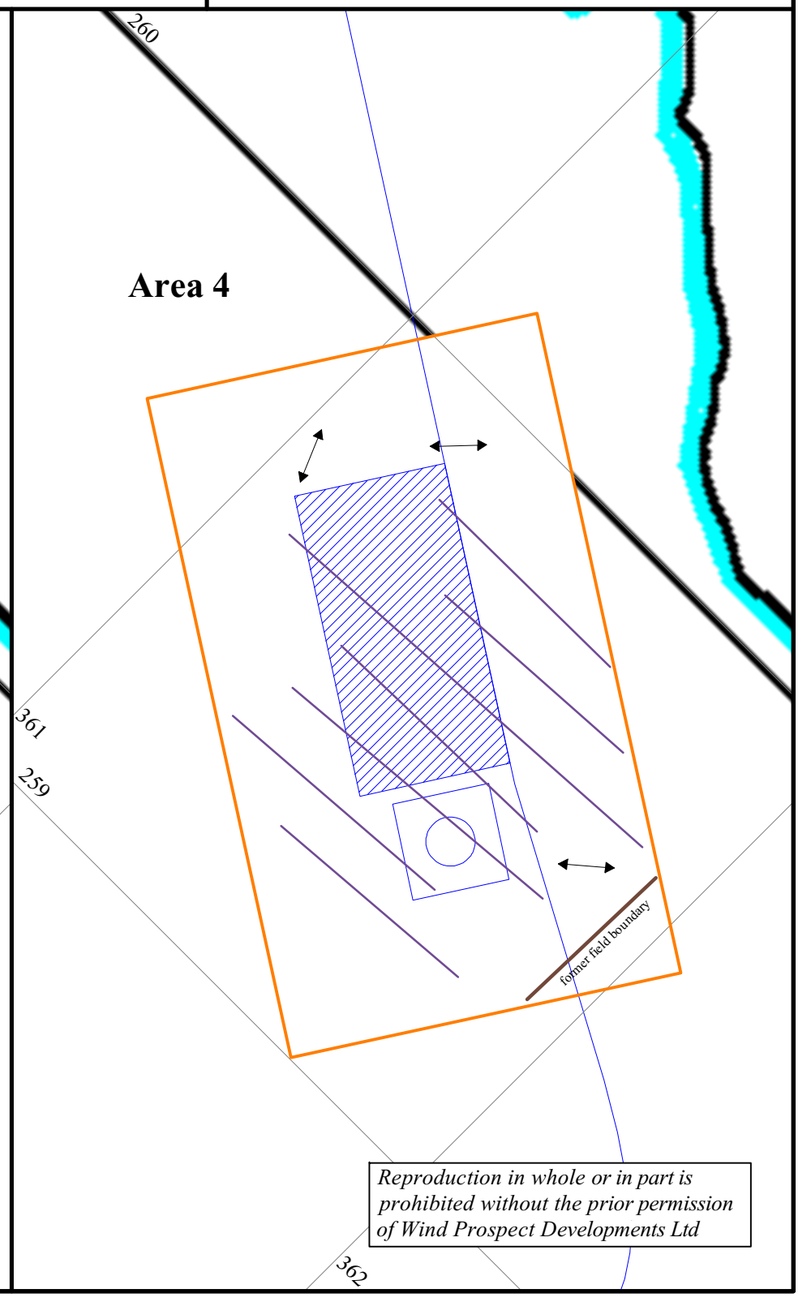
Figure 6
Area 4, geophysical survey and interpretations







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0 50m

scale 1:1000 - for A3 plot

outline of survey area

positive magnetic anomalies

dipolar magnetic anomalies

soil-filled features

orientation of ridge and furrow

proposed development

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Figure 7
Area 5, geophysical survey and interpretations

Area 5

258

257

362

3.00
2.50
2.00
1.50
1.00
0.50
0
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

Area 5

258

257

362

Area 5

258

257

362

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Figure 8: Trace plots of geomagnetic data