ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey

report 2999
September 2012

Durham University

Contents

Figures

South Road · Durham · DH1 3LE · tel 0191 334 1121 · fax 0191 334 1126
archaeological.services@durham.ac.uk · www.dur.ac.uk/archaeological.services

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at Thorington Barn, near Belstead, Ipswich, Suffolk. The works comprised geomagnetic survey of two proposed turbine locations and associated access tracks totalling approximately 7.2ha.

1.2 The works were commissioned by AMEC and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled ditch features relating to aerial photographic features have been identified in Area T1. Two of these may form part of a double-ditched enclosure.

1.4 A probable former stream course has been identified in Area T2.

1.5 The possible remains of a ring-ditch have been tentatively identified in Area 2, as well as former field boundary, which is shown on historic Ordnance Survey (OS) maps.

1.6 A probable in-filled sand pit has been identified in Area 5, also shown on early OS maps.

1.7 Features relating to modern agricultural regimes have been identified.

1.8 Much of the proposed access track could not be surveyed due to dense crop cover. This may be surveyed after harvest.

2. Project background

Location (Figure 1)

2.1 The proposed development area was located at Thorington Barn, near Belstead, Ipswich, Suffolk (NGR centre: TM 1381 4059). Seven surveys totalling approximately 7.2ha were conducted in three land parcels. Open farmland surrounded the survey area, with the village of Belstead to the north-west, Thorington Hall to the east, Pannington Hall to the south-east, and The Street and Wherstead Wood to the south-west. A railway traversed the proposed development area aligned north-east/south-west.

Development proposal

2.2 The development proposal is for a two-turbine wind farm, associated structures and access tracks.

Objective

2.3 The principal aim of the survey 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 relation to the development.

Methods statement

2.4 The survey was undertaken in accordance with instructions from the client and with national standards and guidance (below, para. 5.1).

Dates

2.5 Fieldwork was undertaken on 3rd-5th September 2012. This report was prepared for 26th September 2012.

Personnel

2.6 Fieldwork was conducted by Nathan Thomas and Richie Villis (Supervisor). The geophysical data were processed by Duncan Hale. This report was prepared by Richie Villis, with illustrations by David Graham and Janine Watson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **ITH12**, for **I**pswich **TH**orington Barn 20**12**. The survey archive will be supplied on CD to the client 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 project is **archaeol3-134265**.

3. Historical and archaeological background

3.1 An archaeological desk-based assessment (DBA) and aerial photographic survey (Sommers, Palmer & Breen 2009) has previously been undertaken to the north, the extent of which included part of the current proposed development area (PDA). The following summary is taken from this.

3.2 There is potential for sites of archaeological importance to be present within the PDA as indicated by sites and finds dating from the Mesolithic, Bronze Age, Iron Age, Roman, medieval and post-medieval periods which have been recorded in the County HER.

3.3 Areas of undated field systems and a possible ring-ditch identified from aerial photographic survey are also present within the PDA (survey Area T1).

3.4 A polished flint axe, pottery and flint spreads have been recovered from fieldwalking exercises in the vicinity of survey Area T2.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development extended across four arable fields. Two fields comprised cut and baled wheat and one field was harvested potato ridges. It was not possible to collect data in the fourth field, along the proposed route of the main access track in the central part of the development area, due to a mature beet crop. This area may be surveyed after harvest.

4.2 The area was predominantly level with a mean elevation of approximately 40m OD.

4.3 The underlying solid geology of the area comprises Pliocene sand of the Red Crag Formation, which is overlain in the main by Pleistocence glaciofluvial deposits of sand and gravel.

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 (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

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, based on aerial photographic cropmark evidence, it was considered likely that cut features such as ditches and pits would 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 Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

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 nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, 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 (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-9; the trace plots are provided in Figure 10. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.

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

clip	clips 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 geomagnetic 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 0.25 x 0.25m intervals

Interpretation: anomaly types

5.10 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

5.11 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 or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 In this instance, there is very little contrast between the magnetic susceptibility of the probable soil-filled features and that of the surrounding soil. It could be that the features are truncated or deeply buried, or that they were backfilled soon after being opened.

5.14 Parallel, weak, positive and negative magnetic lineations have been detected across all the survey areas. These anomalies reflect the modern ploughing regime.

5.15 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 T1 (Figures 3-5)

5.16 Several very weak positive magnetic anomalies have been detected in the north of this area. These broadly correspond to cropmarks identified by aerial photographic survey and almost certainly reflect soil-filled ditch features. Two parallel rectilinear anomalies may reflect part of a double-ditched enclosure.

5.17 A curvilinear, broad and diffuse, positive magnetic anomaly has been detected in the south of the area. This may reflect a soil-filled ditch feature, such as a ring-ditch, measuring approximately 20m in diameter. This anomaly corresponds to a ring-ditch of unknown date identified by aerial photographic survey and recorded on the HER.

Area 1 (Figures 3-5)

5.18 No features of potential archaeological significance have been identified in this area. Two parallel positive magnetic anomalies detected at the edge of the area, close to the field boundary, are likely to reflect modern agricultural features. A strong dipolar magnetic anomaly detected at the eastern limit of the area reflects a nearby pylon.

Area 2 (Figures 3-5)

5.19 An extremely weak curvilinear positive magnetic anomaly has been detected in this area. This could possibly reflect the remains of a soil-filled ditch feature.

5.20 A broadly east/west aligned positive magnetic anomaly has been detected in this area. This broadly corresponds to the location of a former field boundary as shown on the Ordnance Survey (OS) 1st edition map and subsequent revisions.

Area 3 (Figures 3-5)

5.21 A linear positive magnetic anomaly has been detected parallel to the field boundary and perpendicular to the modern ploughing regime; this almost certainly reflects a plough headland.

Area T2 (Figures 6-8)

5.22 A broad and diffuse positive magnetic anomaly has been detected in the northern part of this area. This broadly corresponds to a topographic hollow in the field and almost certainly reflects a palaeochannel or former stream course.

Area 4 (Figures 6-8)

5.23 A linear negative magnetic anomaly has been detected at the west end of this area. This corresponds to the edge of the modern ploughing.

Area 5 (Figure 9)

5.24 A large concentration of intense dipolar magnetic anomalies has been detected at the east end of this area. This almost certainly reflects an area of disturbed ground. A sand-pit is recorded in this vicinity on OS maps from the 1st edition in 1882 until the 2nd revision of 1926. These anomalies almost certainly reflect material used to backfill the pit.

5.25 The magnetic striations across the remainder of this area reflect potato ridges.

6. Conclusions

6.1 Approximately 7.2ha of geomagnetic survey was undertaken on land at Thorington Barn, near the village of Belstead, Ipswich, Suffolk, prior to proposed wind farm development.

6.2 Probable soil-filled ditch features relating to aerial photographic features have been identified in Area T1. Two of these may form part of a double-ditched enclosure.

6.3 A probable former stream course has been identified in Area T2.

6.4 The possible remains of a ring-ditch have been tentatively identified in Area 2, as well as former field boundary, which is shown on historic OS maps.

6.5 A probable in-filled sand pit has been identified in Area 5, also shown on early OS maps.

6.6 Features relating to modern agricultural regimes have been identified.

6.7 Much of the proposed access track could not be surveyed due to dense crop cover. This may be surveyed after harvest.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

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

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2011 *Guide to Good Practice: Geophysical Data in*

Sommers, M, Palmer, R, & Breen, T, 2009 *Land south of Grove Hill, Belstead: archaeological desk-based assessment.* Unpublished report **2009/280**, SCCAS

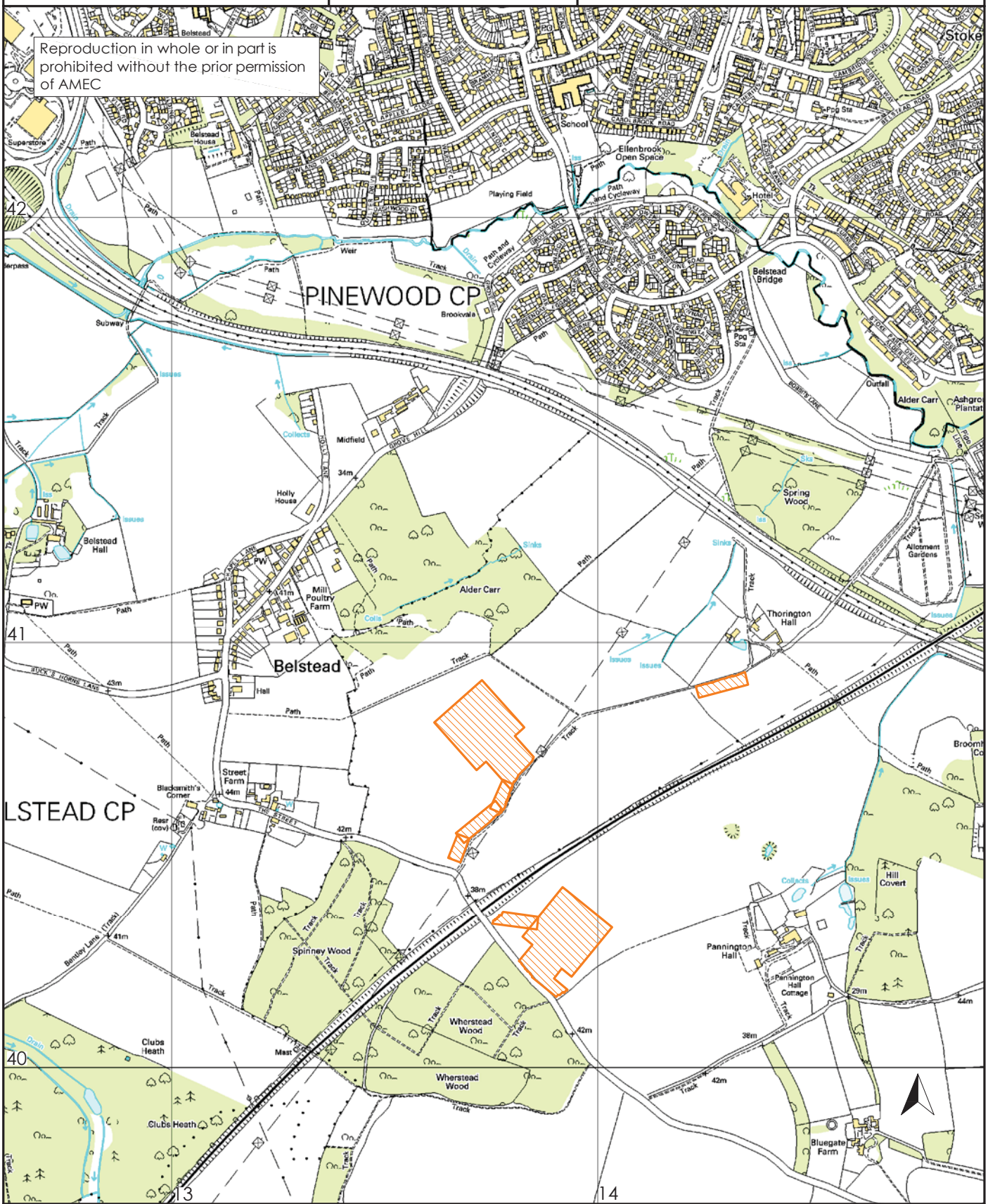
ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 1: Site location



site location

0 500m
scale 1:12 500 for A4 plot

Alder Carr
Colls
Path
Track
Path
Issues
Issues
Thorington Hall
Path
Area 5
Turbine 1
Area 3
Track
Area 2
Area 1
42m
38m
Turbine 2
Area 4
Track
Wood
Track
Wherstead Wood
Track
42m
Collects
Issues
Track
Pannington Hall
Track
Pannington Hall Cottage
29m
Track
38m

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 2: Geophysical survey overview

0 200m
scale 1:4000 for A3 plot

magnetic survey

409

408

407

406

405

136

137

138

Turbine 1

Area 3

Area 2

Area 1

magnetic survey

-5 nT 5

0 50m

scale 1:1000 for A2 plot

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 3: Areas 1-3 & T1, geophysical survey

409

408

407

406

405

136

137

138

Turbine 1

Area 3

Area 2

Area 1

magnetic survey

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

0 50m

scale 1:1000 for A2 plot

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 4: Areas 1-3 & T1, geophysical interpretation

409

408

Turbine 1

407

Area 3

406

Area 2

Area 1

405

136

137

138

magnetic survey

soil-filled feature

former field boundary

0 50m

scale 1:1000 for A2 plot

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 5: Areas 1-3 & T1, archaeological interpretation

Turbine 2

Area 4

404

403

402

138

139

140

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

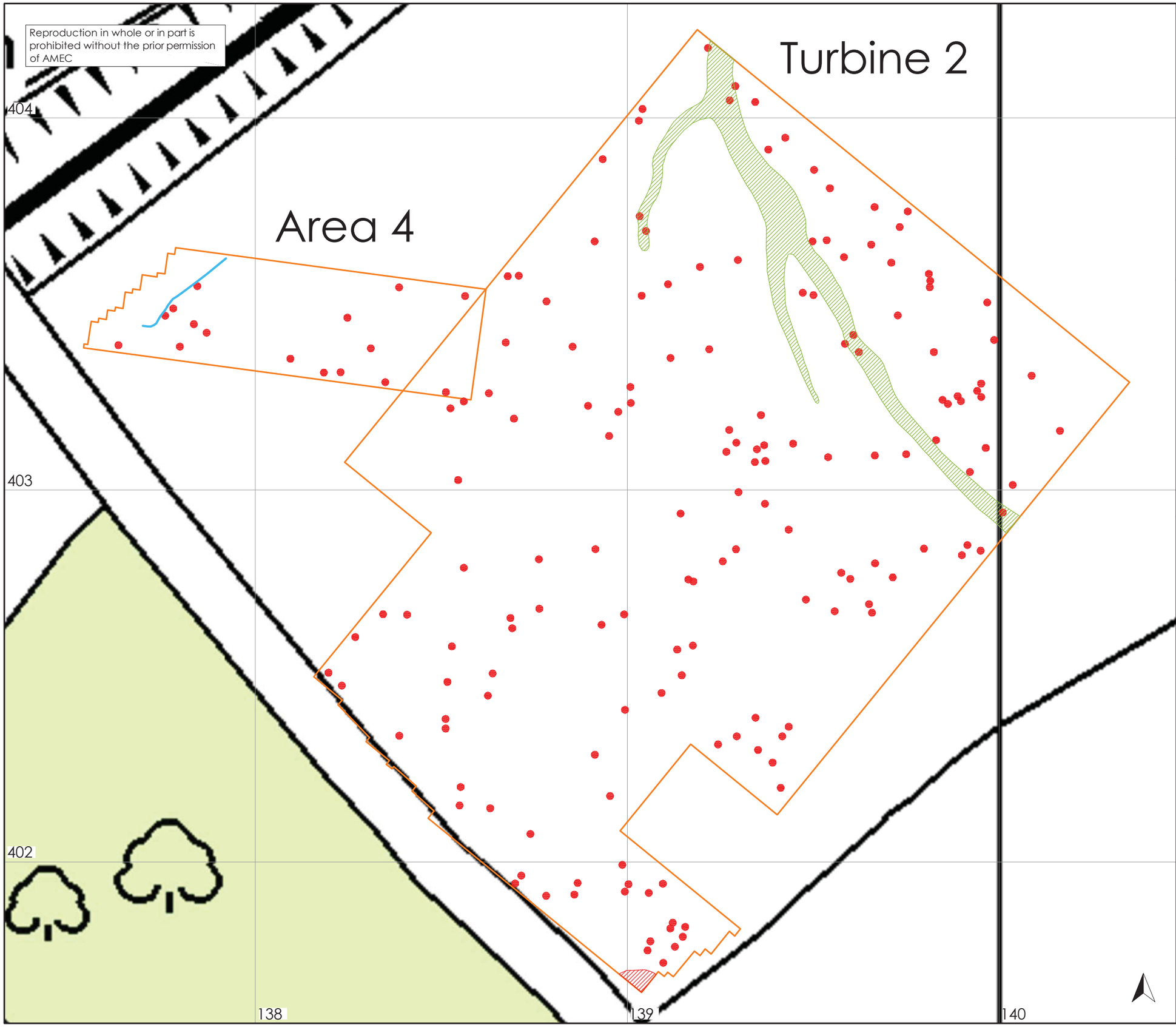
geophysical survey
report 2999

Figure 6: Areas 4 & T2, geophysical survey

0 50m
scale 1:1000 for A3 plot

magnetic survey

-5 nT 5



ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

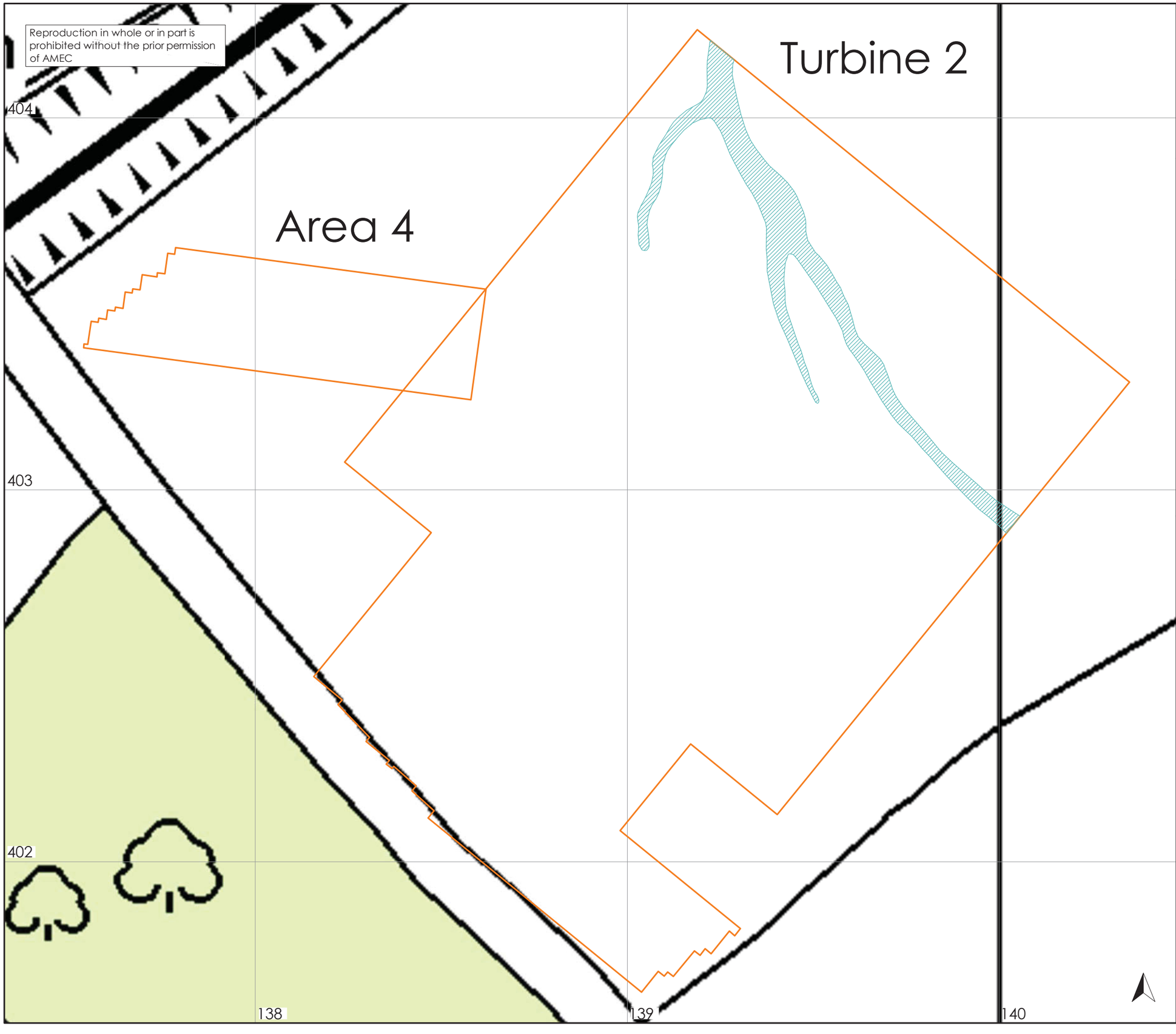
Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 7: Areas 4 & T2, geophysical interpretation

0 50m
scale 1:1000 for A3 plot

- magnetic survey
- dipolar magnetic anomaly
- positive magnetic anomaly
- negative magnetic anomaly



ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 8: Areas 4 & T2, archaeological interpretation

0 50m
scale 1:1000 for A3 plot

magnetic survey

geological feature

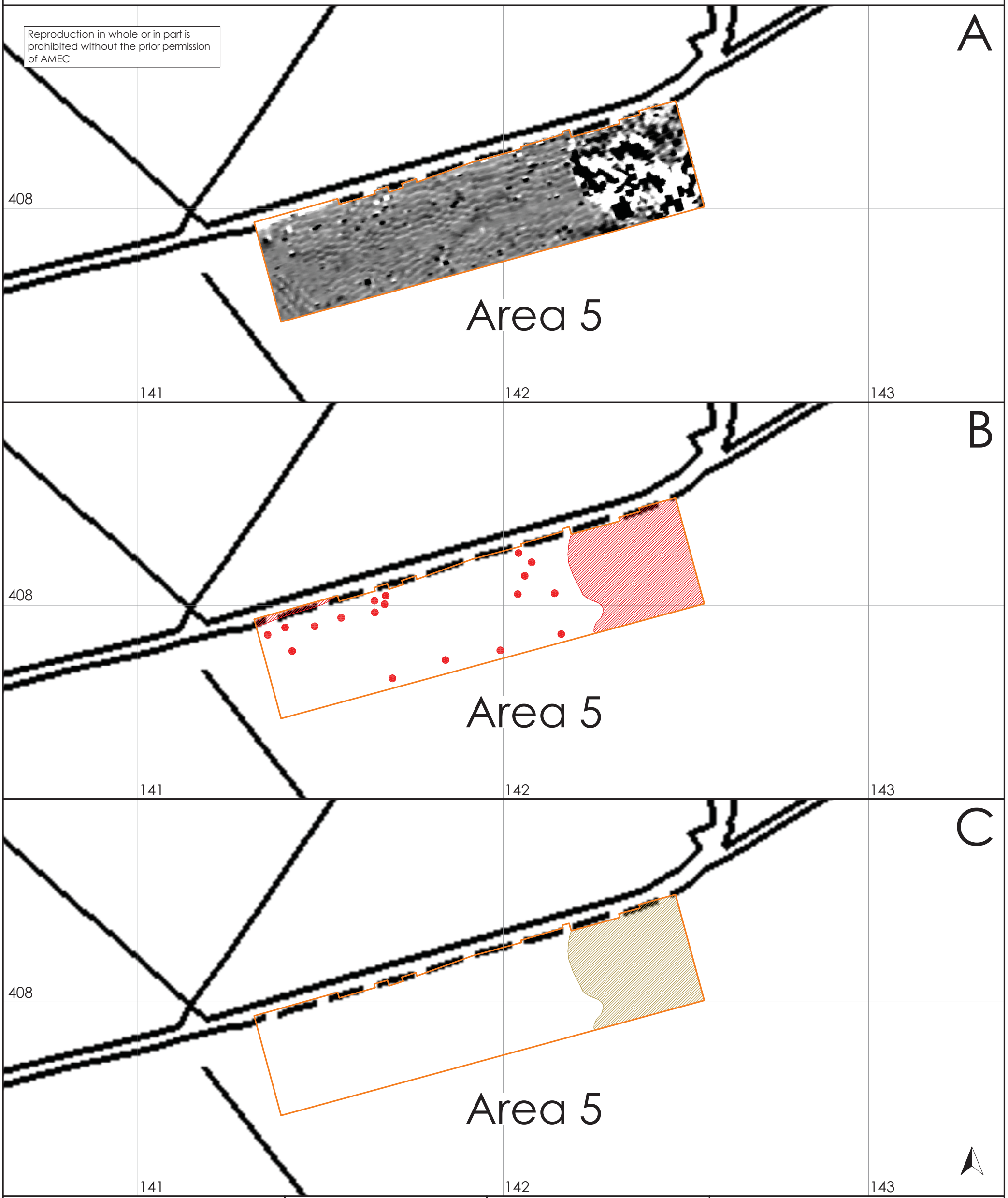
A magnetic survey

B dipolar magnetic anomaly

C disturbed area

-5 nT 5

A



B

C

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AMEC

0 50m
scale 1:1000 for A3 plot

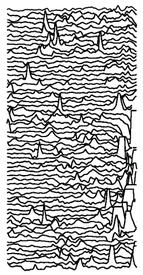
Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 9: Area 5, geophysical survey (A) and geophysical (B) and archaeological (C) interpretations

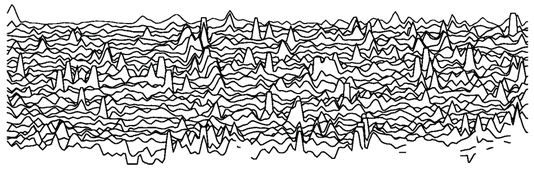
Area 1

22.70nT/cm



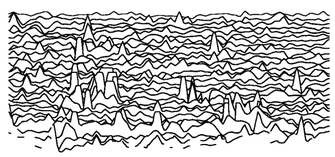
Area 2

8.60nT/cm



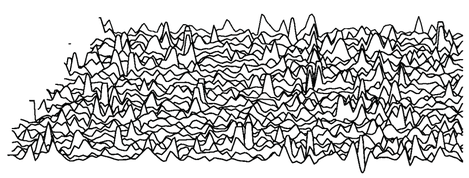
Area 3

11.30nT/cm



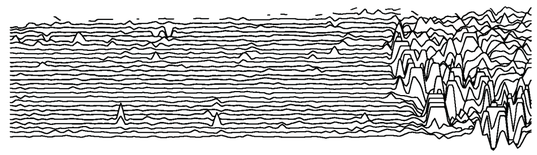
Area 4

5.00nT/cm



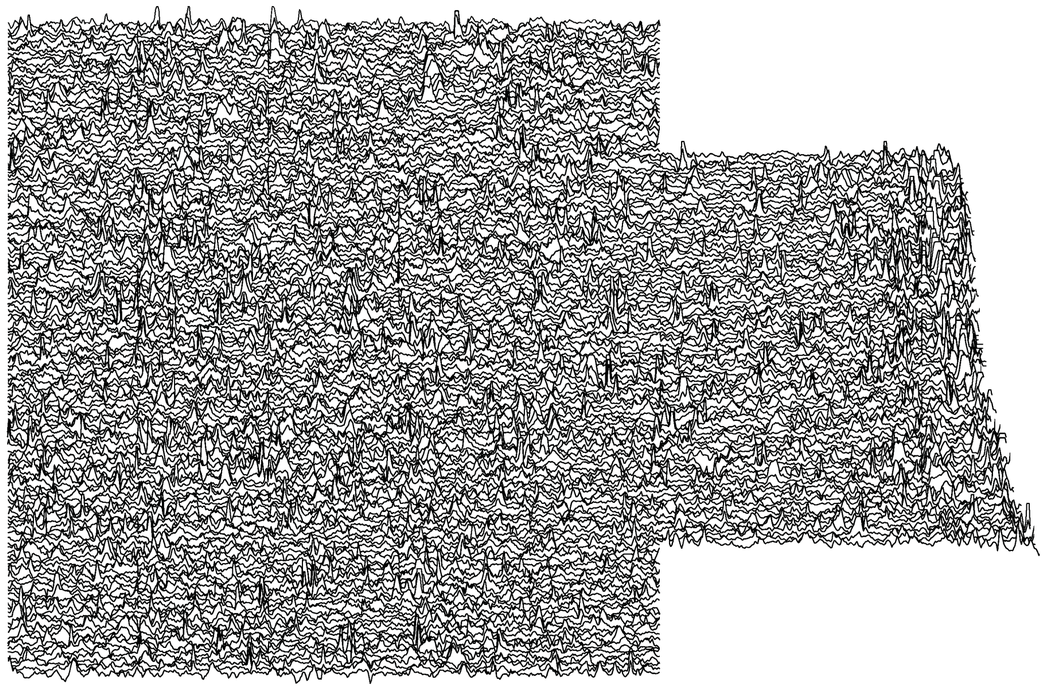
Area 5

38.40nT/cm



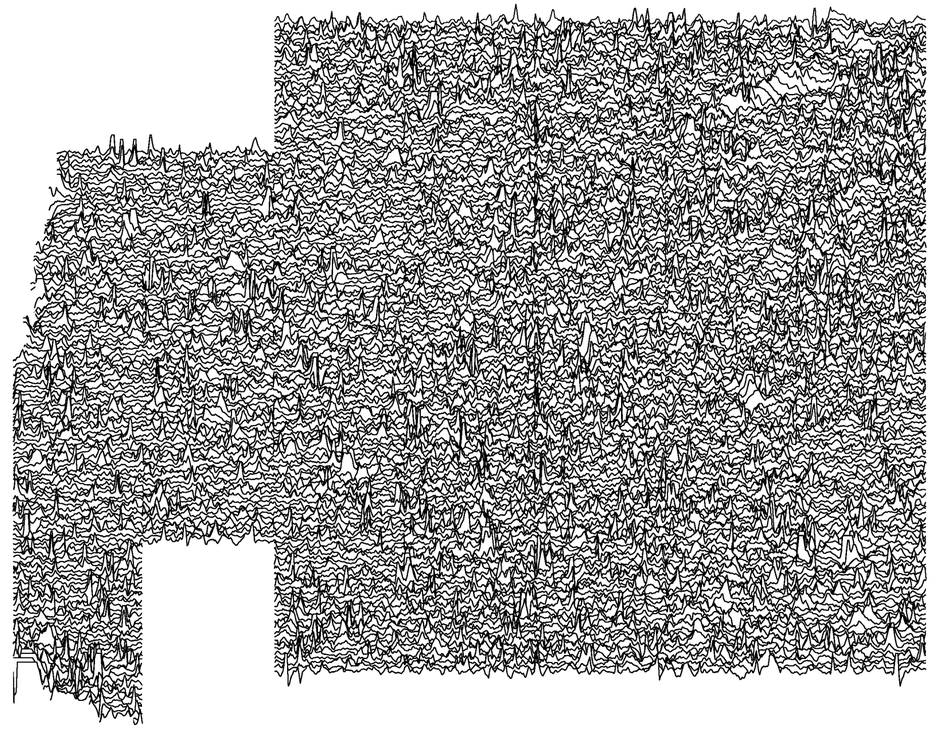
Turbine 1

6.70nT/cm



Turbine 2

8.00nT/cm



0 50m

scale 1:1000 for A2 plot

on behalf of
AMEC

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

Thorington Barn
Ipswich
Suffolk

geophysical survey
report 2999

Figure 10: Trace plots of geomagnetic data