ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
AOC Archaeology Group

Beechwood Farm
Inverness
Highland Region

geophysical survey

report 2462
August 2010

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 a geophysical survey conducted in advance of proposed development at Beechwod Farm, Inverness. The works comprised detailed geomagnetic surveys of available areas.

1.2 The works were commissioned by AOC Archaeology Group and conducted by Archaeological Services Durham University.

Results

1.3 A few disparate and very weak anomalies in Areas 2a, 2b, 2c and 2d could possibly reflect the remains of soil-filled features such as ditches.

1.4 Some intense anomalies could possibly reflect burnt materials, though no specific anomalies have been identified as probable former burnt mounds.

1.5 Other anomalies detected almost certainly reflect traces of former ridge and furrow cultivation, a more recent plough regime, boreholes, existing services and associated inspection chambers.

2. Project background

Location (Figures 1 & 2)

2.1 The proposed development area was located at Beechwood Farm, Inverness, Inverness-Shire, in the Highland Region of Scotland (NGR centre: NH 6090 4518). To the west of the site was the A9 road; to the north was the principal railway from Inverness south to Perth and Edinburgh; and to the east and south was agricultural land and the settlement of Westhill.

2.2 The proposed development area covers approximately 21ha, of which 3ha were surveyed geomagnetically; seven surveys were undertaken in three land parcels.

Development proposal

2.3 The proposal is for a mixed development on a greenfield site within the administrative area of Highland Council, which is advised on archaeological matters by Highland Council Archaeology Unit (HCAU).

Objective

2.4 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 relation to the development.

Methods statement

2.5 A programme of archaeological works was specified by HCAU (ref: CHG660) and was required in keeping with the policies outlined in Scottish Planning Policy (Scottish Government, February 2010) and PAN 42. The geophysical surveys were undertaken in accordance with a Written Scheme of Investigation provided by Archaeological Services Durham University and approved by the client and HCAU.

Dates

2.6 Fieldwork was undertaken between 19th and 21st July 2010. This report was prepared for 11th August 2010.

Personnel

2.7 Fieldwork was conducted by Natalie Swann (Supervisor) and Richie Villis. The geophysical data were processed by Duncan Hale. This report was prepared by Duncan Hale, the Project Manager, with illustrations by Janine Watson.

Archive/OASIS

2.8 The site code is **IBF10**, for **I**nverness **B**eechwood **F**arm 20**10**. 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 **archaeol3-80912**.

3. Historical and archaeological background

3.1 A desk-based archaeological assessment of the development area was undertaken by AOC (2008). The summary information provided below is taken from that assessment.

3.2 The proposed development area provided extensive evidence of prehistoric activity including three burnt mounds (MHG29238 & NMRS NH64NE 625). The NMRS NH64NE 625 site (two burnt mounds and associated features) was excavated in 1999 (Cressey & Strachan 2003). Lithic artefacts, flakes and scrapers (MHG3674, NMRS NH64NE105), were also recovered from within the Phase 1 development area boundaries.

3.3 In the wider area to the south lie cropmarks indicating pit circles (MHG3683, Scheduled Ancient Monument 11535) and a ring-ditch (MHG3740, Scheduled Ancient Monument 11535). A further set of cropmarks including a linear feature, a pit and a pit circle (MHG3059) are located near the western boundary of the site.

3.4 The richness of the prehistoric settlement in the area is further indicated by several sites within the 500 metres of the development area. These include seven ring-ditches (MHG24763, NMRS NH64NE40), ring-groove roundhouses (NMRS NH64NE 15), an enclosure, a pit alignment, a Bronze Age cemetery and large sub-circular feature (NMRS NH64NE40), a possible borrow and enclosure (NMRS NH74NW 112), a cairn (NMRS NH54NE 6), several microliths and pits (NMRS NH64SE 246 & NMRS NH74NW 114) and flint scrapers and cores (NMRS NH64SE 47 & NMRS NH64NE 106). Raigmore Cairn (NMRS NH64SE 47) was originally located east of the proposed development area. Further hut circles may also have lain just south-east of the proposed development area (NMRS NH74SW 12). Additionally an enclosure at Castlehill (NMRS NH64SE 240**8**) and a linear feature at Raigmore (NMRS NH64SE 60) may also be of prehistoric date.

3.5 In January 2009 an archaeological evaluation was undertaken on two land parcels lying to the north (NGR: NH 6894 4538) and south-west (NGR: NH 6913 4463) of the site (AOC 2009). This work revealed numerous features of archaeological significance within the northern land parcel (the area to the south-west proving archaeologically sterile) including several linear ditches of unknown date, a large enclosure ditch and terminus of probable prehistoric date and a variety of pit and post-hole features. Artefacts recovered from the pit features included a single flint flake and prehistoric pottery sherds including Neolithic Grooved Ware. A large quantity of impressed daub was recovered from within the ditch terminus.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised 8 land parcels. Due to known current landuse, it had already been determined that survey would not be practicable in the areas of mature cereal crops (parcels 1, 4 & 12). At the time of survey, however, it was not possible to collect data in the fodder rape fields either (6 and 9), where the dense growth was up to 1.5m high.

4.2 It was possible to collect data around the edges of field 2, where the land had been mown, and in the former pasture fields 3 and 8.

4.3 The area was predominantly level with a mean elevation of approximately 30m OD. Parcel numbers in the table below correspond to those used on a supplied landuse plan dated 30 June 2010.

Parcel/area no.	Survey (ha)	Landuse	Topography
1	-	mature cereal	generally flat
2	1.72	hay	generally flat
3	0.54	former pasture	gentle west-facing slope
4	-	mature cereal	generally flat
6	-	fodder rape	generally flat
8	0.90	former pasture	generally flat
9	-	fodder rape	generally flat
12	-	mature cereal	generally flat

4.4 The underlying solid geology of the area comprises Devonian Hillhead Sandstone Formation, which is overlain by sands and gravels.

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, based on previous work and aerial photographic cropmark evidence, 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 burnt mounds, 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 20m grid was established at five locations around the perimeter of field 2 (survey Areas 2a-2e). A 30m grid was established in Areas 3 and 8. Each grid was 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 20m or 30m grid units, as above. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 1,600 and 3,600 sample measurements per 20m and 30m grid unit respectively.

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 3-4; the trace plots are provided in Figure 5. 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 the data:

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 (Area 2b only)
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. 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 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 2a

5.14 A series of parallel, weak, positive and negative magnetic anomalies has been detected in the southern part of this survey. These anomalies could reflect traces of former ridge and furrow cultivation.

5.15 Similar, though more closely spaced, anomalies which have been detected further north in this survey area, are aligned parallel to the existing field boundary and are more likely to reflect a recent plough regime.

5.16 A linear positive magnetic anomaly aligned broadly east-west in the central part of this area could reflect the remains of a soil-filled ditch.

Area 2b

5.17 Several very weak positive magnetic anomalies have been detected in the eastern half of this survey, which could reflect the remains of soil-filled features.

Areas 2c, 2d and 2e

5.18 The only land available for survey on the east side of this field was a mown strip along the field boundary. Service plans indicate that both a water main and a waste water pipe run parallel to the field boundary in this area. The pipes themselves have not been detected and are therefore almost certainly polyethylene, however, some of the large intense dipolar magnetic anomalies in these surveys almost certainly reflect the ferrous collars and fittings along at least one of the pipes. A linear negative magnetic anomaly, which is most evident in Area 2d, almost certainly reflects the trench for the other pipe. The pipe trenches may be evident in Area 2c as linear areas of disturbance containing ferrous litter.

5.19 A watching brief was conducted during topsoil stripping associated with the construction of the waste pipe in 1999. Two burnt mounds and other features were identified and excavated during this work (Cressey & Strachan 2003). The grid reference for Burnt Mound 1 (NH 6919 4516) would place this within survey Area 2e; the grid reference for Burnt Mound 2 would place that one in survey Area 2d. Both of these surveys (and each of the other surveys) contain some intense anomalies that could be consistent with burnt material, though the two burnt mounds here are presumed to have been removed by archaeological excavation or by pipe trench excavation.

5.20 A short linear positive magnetic anomaly detected at the southern end of Area 2c could reflect a ditch feature associated with those tentatively identified in Area 2b.

5.21 Extremely weak positive magnetic anomalies, which have been identified in the north-eastern end of Area 2d, could possibly reflect the remains of soil-filled ditches.

5.22 Geotechnical boreholes were noted on the ground in Areas 2c and 2d and these are evident in the data as intense dipolar magnetic anomalies.

Area 3

5.23 No features of likely archaeological significance have been identified in this area, although some intense anomalies could possibly reflect burnt materials.

5.24 The area is magnetically 'noisy' due to the relatively high concentration of small dipolar magnetic anomalies.

5.25 Although no boreholes were noted in this area, there are two relatively large, intense dipolar magnetic anomalies which appear to reflect vertical ferrous cylinders. A very large and intense anomaly on the south-eastern edge of the survey almost certainly reflects a buried ferrous tank or reinforced concrete chamber.

Area 8

5.26 No features of likely archaeological significance have been identified in this area, although some intense anomalies could possibly reflect burnt materials.

5.27 This area is also magnetically 'noisy' due to the relatively high concentration of small dipolar magnetic anomalies.

5.28 An intense anomaly in the north-eastern corner of the survey reflects an adjacent ferrous gate. A large and intense anomaly on the southern edge of the survey area corresponds to a sunken concrete inspection chamber noted on the ground.

5.29 A linear negative magnetic anomaly aligned north-west/south-east across the southern half of this area corresponds to a polyethylene water main.

6. Conclusions

6.1 Geomagnetic surveys have been undertaken over available areas within a proposed development area at Beechwood Farm, Inverness.

6.2 A few disparate and very weak anomalies in Areas 2a, 2b, 2c and 2d could possibly reflect the remains of soil-filled features such as ditches.

6.3 Some intense anomalies could possibly reflect burnt materials, though no specific anomalies have been identified as probable former burnt mounds.

6.4 Other anomalies detected almost certainly reflect traces of former ridge and furrow cultivation, a more recent plough regime, boreholes, existing services and associated inspection chambers.

7. Sources

AOC 2008 *East Beechwood, Inverness: Desk Based Assessment*. Unpubl AOC Archaeology client report

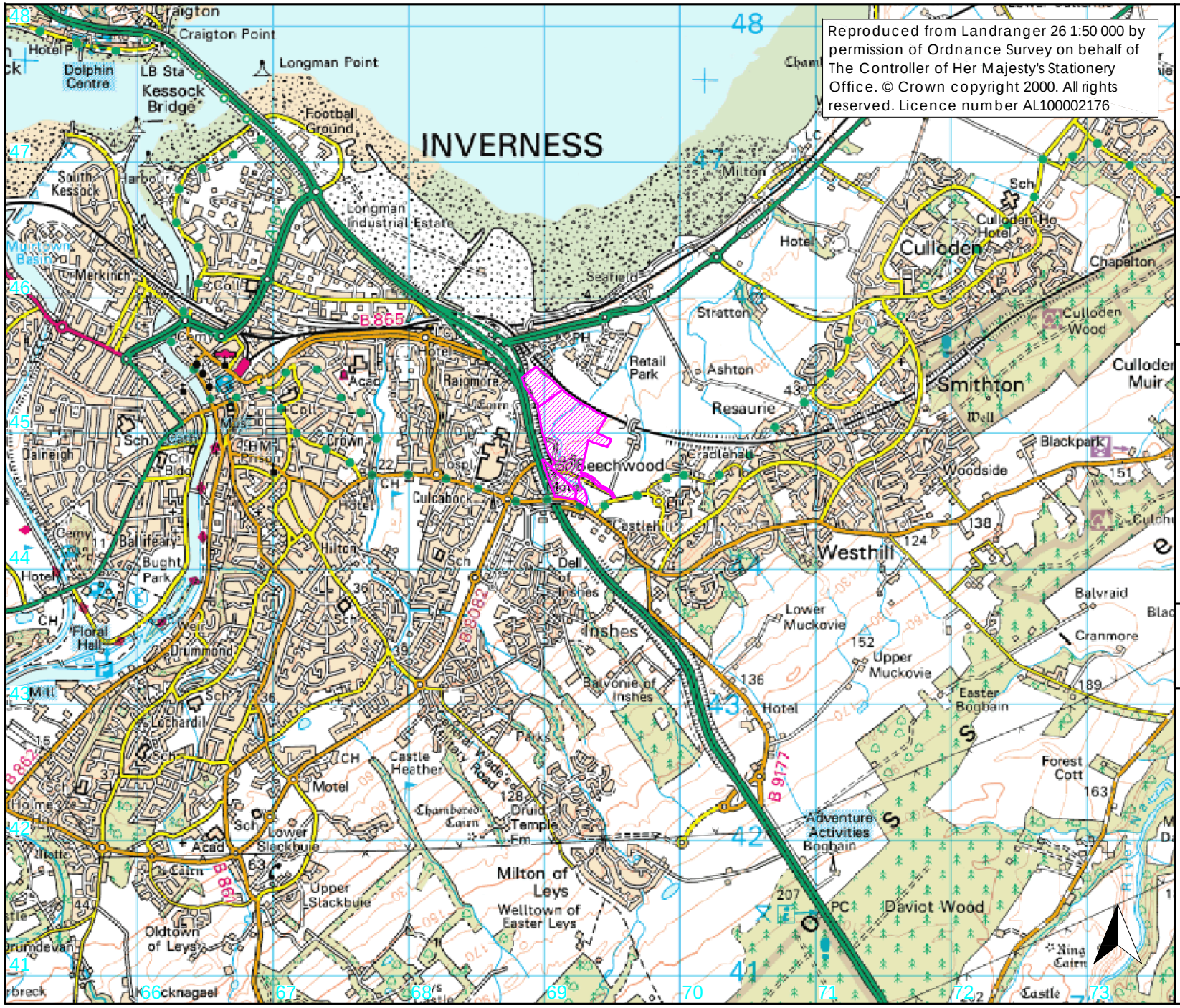
AOC 2009 *East Beechwood Farm, Inverness, Highland, Archaeological Evaluation Phase 1, Stage 1: Data Structure Report*. Unpubl AOC Archaeology archive report

Cressey, M & Strachan, R 2003 The excavation of two burnt mounds and a wooden trough near Beechwood Farm, Inshes, Inverness, 199. *Proc Soc Antiq Scot* 1333, 2003, 191-203

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

Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice.* Archaeology Data Service, Arts and Humanities Data Service



ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of

AOC Archaeology Group

Beechwood Farm
Inverness
Highland Region

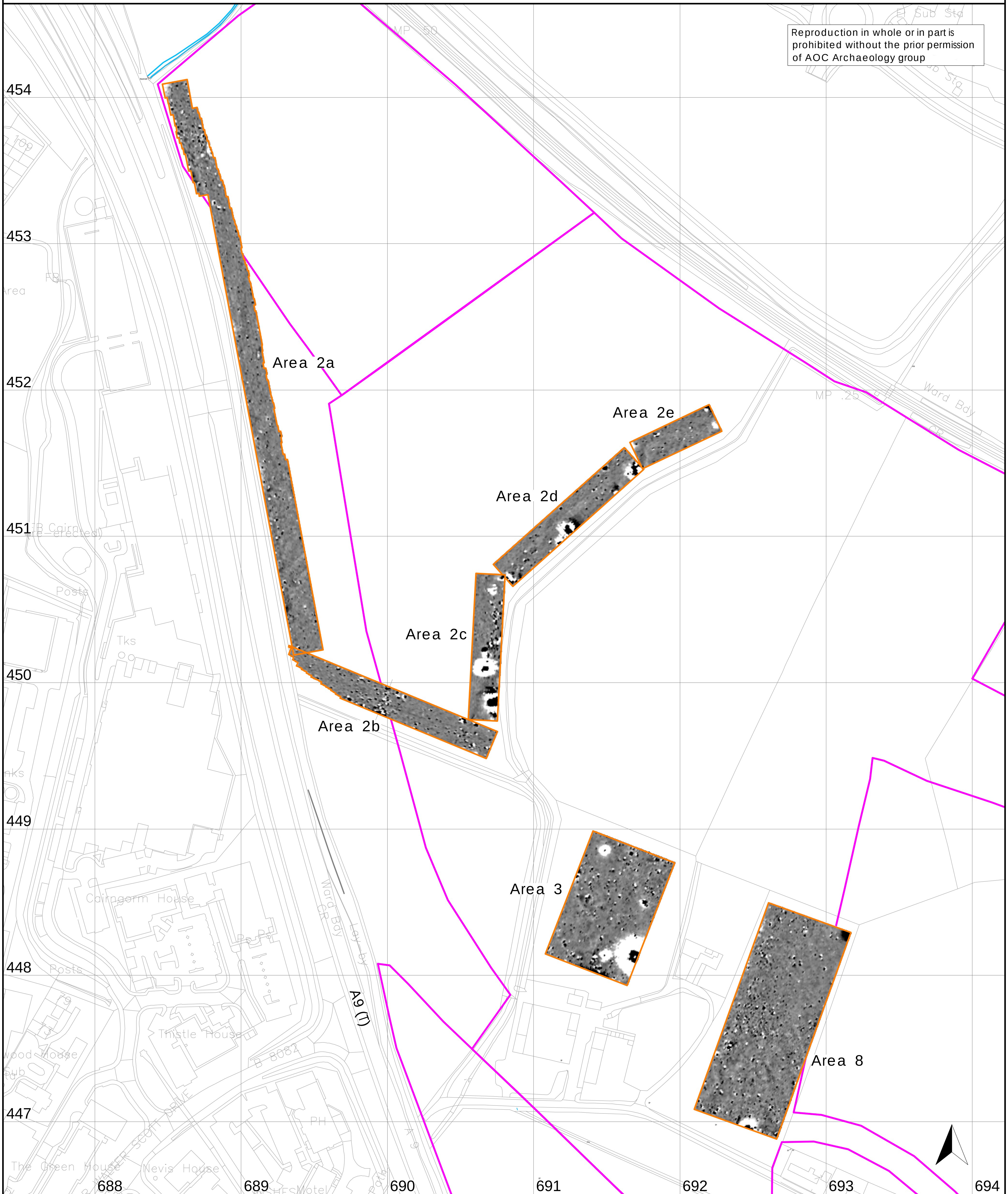
geophysical survey
report 2462

Figure 1: Site location

magnetic survey

site boundary

-5 nT 5



ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

on behalf of

AOC Archaeology Group

0 100m

scale 1:2500 for A3 plot

Beechwood Farm
Inverness
Highland Region

geophysical survey
report 2462

Figure 2: Survey overview

A

B

C

Area 2e

Area 2d

Area 2a

Area 2b

Area 2c

454

453

452

451

450

691

692

689

690

A - geophysical survey

magnetic survey

-5 nT 5

site boundary

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

C - archaeological interpretation

possible soil-filled feature

possible ridge and furrow

borehole

water main

0 50m

scale 1:1000 for A1 plot

on behalf of

AOC Archaeology Group

ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

Beechwood Farm
Inverness
Highland Region

geophysical survey
report 2462

Figure 3: Area 2 geophysical surveys and interpretations

A

B

C

450
449
448
447
446
691
692
693

Area 3
Area 8
FB
Sheep Wash
buried tank / chamber
inspection chamber

A - geophysical survey
- magnetic survey
- -5 nT 5
- site boundary

B - geophysical interpretation
- dipolar magnetic anomaly
- positive magnetic anomaly
- negative magnetic anomaly

C - archaeological interpretation
- ridge and furrow
- possible borehole
- water main

0 50m
scale 1:1000 for A1 plot

on behalf of
AOC Archaeology Group

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

Beechwood Farm
Inverness
Highland Region

geophysical survey
report 2462

Figure 4: Areas 3 and 8
geophysical surveys and
interpretations

Beechwood Farm
Inverness
Highland Region

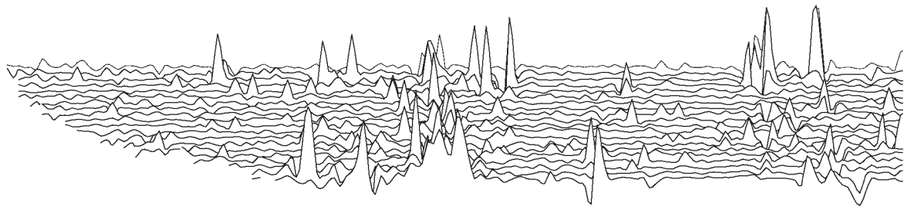
geophysical survey
report 2462

Figure 5:
Trace plots of geomagnetic data

Area 2b

18.00nT/cm

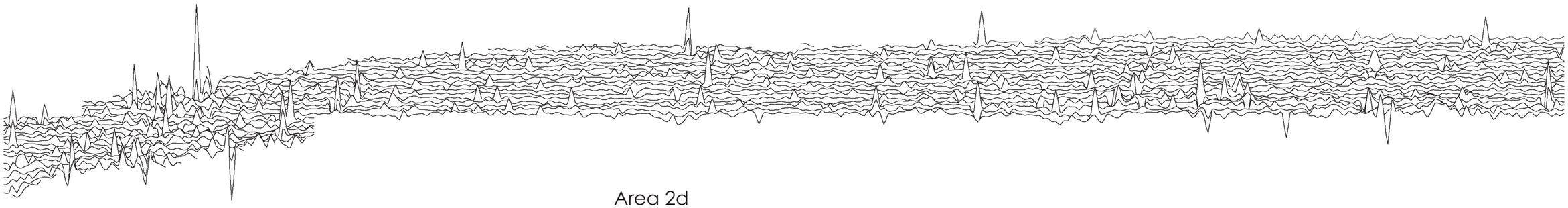
0 50m
scale 1:1000



Area 2a

17.60nT/cm

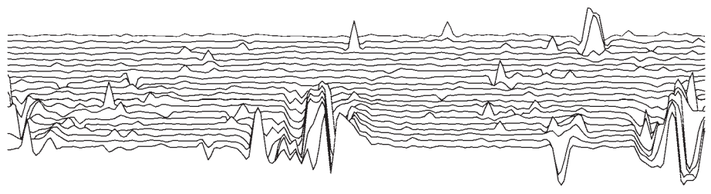
0 50m
scale 1:1000



Area 2d

34.70nT/cm

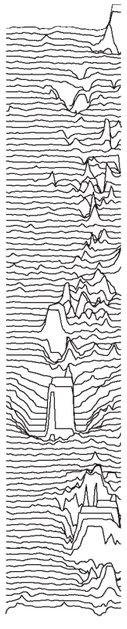
0 50m
scale 1:1000



Area 2c

50.50nT/cm

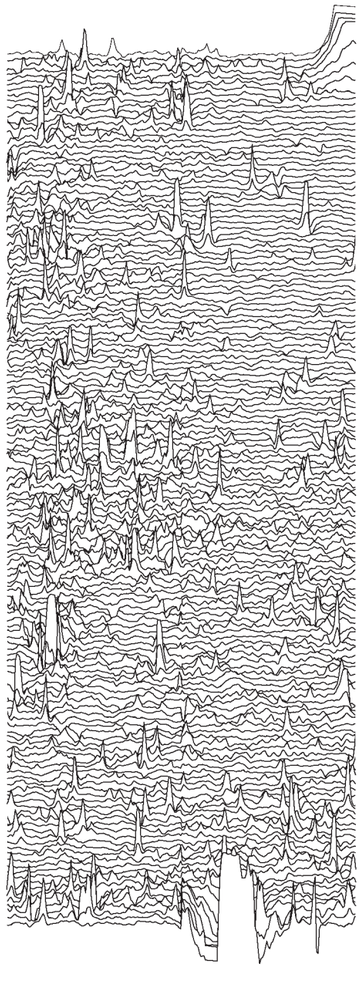
0 50m
scale 1:1000



Area 8

21.90nT/cm

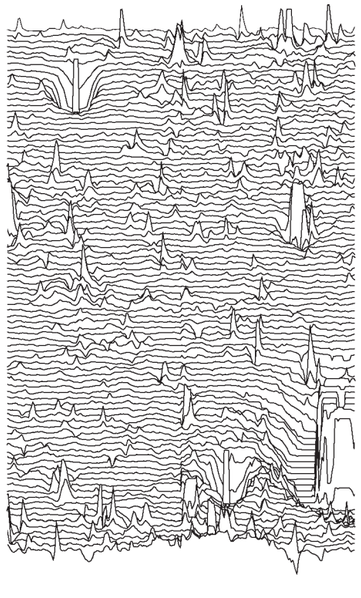
0 50m
scale 1:1000



Area 3

28.80nT/cm

0 50m
scale 1:1000



Area 2e

19.90nT/cm

0 50m
scale 1:1000