ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Taylor Wimpey

# Earsdon Road
# West Monkseaton
# North Tyneside

## geophysical survey

report 2881
April 2012

Durham University

## Contents



## Figures




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# 1. Summary

## The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at land north of Earsdon Road, West Monkseaton, North Tyneside. The works comprised the geomagnetic survey of 6ha of arable farm land.

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

## Results

1.3 A capped mineshaft and a possible ditch or track were identified in Area 1.

1.4 Broad anomalies in Area 2 may be associated with more recent mining and quarrying activities rather than archaeological features.

1.5 Three former field boundaries and many land drains were detected in Area 2.

1.6 Probable recent services were also identified in Area 2.

# 2. Project background

### **Location** (Figure 1)

2.1 The study area was located north of Earsdon Road, West Monkseaton, North Tyneside (NGR centre: NZ 3291 7245). Two surveys totalling 6ha were conducted in two land parcels. To the north and east was residential housing, to the west allotment gardens and open farmland and to the south the A192 Earsdon Road.

### Development proposal

2.2 The development proposal is for housing and associated infrastructure.

### 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 survey 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 surveys have been undertaken in accordance with instructions from the client and in line with national standards and guidance (see para. 5.1 below).

### Dates

2.5 Fieldwork was undertaken on 27th and 28th March 2012. This report was prepared for 12th April 2012.

### Personnel

2.6 Fieldwork was conducted by Nigel Cavanagh, Tony Liddell and Natalie Swann (Supervisor). The geophysical data were processed by Natalie Swann. This report was prepared by Natalie Swann, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

### Archive/OASIS

2.7 The site code is **WME12**, for **W**est **M**onkseaton **E**arsdon Road 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 **archaeol3-122257**.

# 3. Historical and archaeological background

### Previous archaeological works

3.1 A cultural heritage appraisal has been undertaken for the site (Scott Wilson 2009). The results of that appraisal are summarised below.

### **The prehistoric period** (up to AD 70)

3.2 There is little evidence of Neolithic or Bronze Age settlement in the area with the exception of a Neolithic polished axe discovered near Earsdon.

3.3 The field immediately north-west of the proposed development area contains the cropmarks of an Iron Age rectilinear enclosure, possibly containing roundhouses, which was identified from aerial photographs.

3.4 An oval cropmark has been noted north of Earsdon, with a rectilinear enclosure recorded south of the village. A geophysical survey conducted between Shiremoor and Earsdon detected two circular features tentatively identified as roundhouses (T&WMS 2000).

3.5 An excavation at Chapel Lane, Monkseaton (Archaeological Services 2006) revealed evidence of an Iron Age or Romano-British settlement.

**The Roman period** (AD 70 to 5th century)

3.6 There is little evidence of Roman occupation in the wider area with the exception of a terracotta lamp discovered in Monkseaton.

**The medieval period** (5th century to 1540)

3.7 During the medieval period Monkseaton and Earsdon belonged to the Priory of Tynemouth, the earliest documentary evidence for the villages dates to the 12th century. The proposed development area lies outside the medieval villages and was probably farmland during this period.

**The post-medieval period** (1541 to 1899)

3.8 Several collieries were established south-west of Easdon and south of Monkseaton in the 19th century, though there is no evidence for mining activity of this date within the proposed development area.

3.9 The Ordnance Survey map for 1865 indicates Earsdon Well within the south-west part of the proposed development area. The 1860 map shows a quarry located immediately south-west of the proposed development area.

**The modern period** (1900 to present)

3.10 The eastern part of the proposed development area was subject to opencast mining between 1948 and 1951. A former mineshaft lies within the south-west corner of the proposed development area; this was capped in 1977.

## 4. Landuse, topography and geology

4.1 At the time of fieldwork both survey fields were arable land. It was not possible to collect data in the north-eastern part of Area 1 due to a wire fence and overgrown vegetation.

4.2 Area 1 was predominantly level with a mean elevation of approximately 35m OD. There was a gentle slope in Area 2 from 37m OD in the north-west to 33m OD in the south.

4.3 The underlying solid geology of the area comprises Pennine Middle Coal Measures overlain by drift geology of glacial till.

# 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 and a cultural heritage appraisal, 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 related 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 2-4; the trace plots are presented 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 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 0.25m x 0.25m intervals |

### Interpretation: anomaly types

5.10 Colour-coded geophysical interpretations 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 interpretations are provided.

5.12 Both survey areas contain high concentrations of intense dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and/or fired debris, some of which will probably be mining waste in this instance. A sample of these anomalies is shown on the geophysical interpretations, however, they have been omitted from the archaeological interpretations and the following discussion.

### Area 1

5.13 An intense dipolar magnetic anomaly detected at the west end of this survey area corresponds to the location of a capped mineshaft identified during geotechnical investigations of the site (Sirius Geotechnical 2010).

5.14 Towards the western end of the survey area a linear positive magnetic anomaly was detected aligned approximately north-south. This anomaly could reflect a soil-filled feature such as a former ditch or possibly a track associated with the mineshaft.

5.15 The modern plough regime was detected as a series of parallel positive magnetic anomalies aligned approximately north-east/south-west; these anomalies have been omitted from the interpretation drawings.

### Area 2

5.16 A number of broad and diffuse positive magnetic anomalies were detected in the north-western part of this survey area which may reflect broad soil-filled features. These anomalies are not typical of archaeological features and may be associated with more recent mining and quarrying activities.

5.17 Three linear positive magnetic anomalies have been detected, which correspond to former field boundaries shown on historic Ordnance Survey maps.

5.18 Two series of parallel positive magnetic anomalies were detected; one series aligned north-east/south-west and the other approximately east-west. These anomalies almost certainly reflect land drains.

5.19 Two chains of dipolar magnetic anomalies were detected in the south-east corner of this area; these probably reflect recent services.

## 6. Conclusions

6.1 Six hectares of geomagnetic survey was undertaken at West Monkseaton prior to proposed development.

6.2 A capped mineshaft and a possible ditch or track were identified in Area 1.

6.3 Broad anomalies in Area 2 may be associated with more recent mining and quarrying activities rather than archaeological features.

6.4 Three former field boundaries and many land drains were detected in Area 2.

6.5 Probable recent services were also identified in Area 2.

## 7. Sources

Archaeological Services 2006 *Chapel Lane, Monkseaton: archaeological evaluation.* Unpublished report **1423**, Archaeological Services Durham University

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 Archaeology*. Archaeology Data Service

Scott Wilson 2009 *Land at West Monkseaton Early Risk Appraisal: Cultural Heritage*

Sirius Geotechnical 2010 *Earsdon Road West Monkseaton Geoenvironmental evaluation*

Tyne and Wear Museums Service 2000 *Shiremoor Off Site Sewers, North Tyneside, Archaeological Assessment.*

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Figure 1: Site location

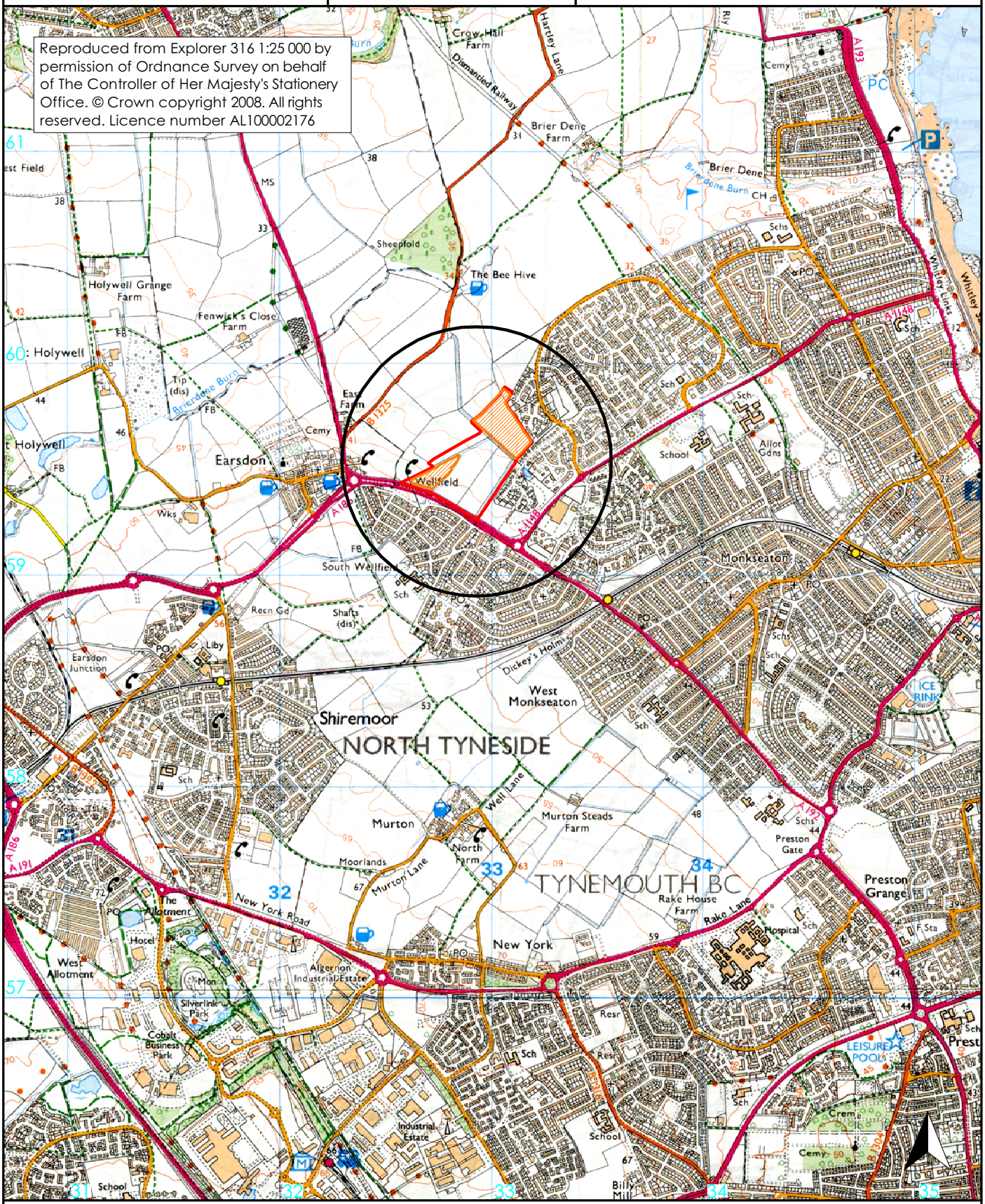

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Figure 2: Geophysical survey overview




site boundary

survey area

0 200m

scale 1:4000 for A4 plot

A

Area 1

726

724

326

327

328



B

Area 1

726

724

326

327

328

C

Area 1

726

724

326

327

328

A - geophysical survey

magnetic survey

-8 nT 8

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

C - archaeological interpretation

soil-filled feature

mine shaft

0 50m

scale 1:1000 for A2 plot

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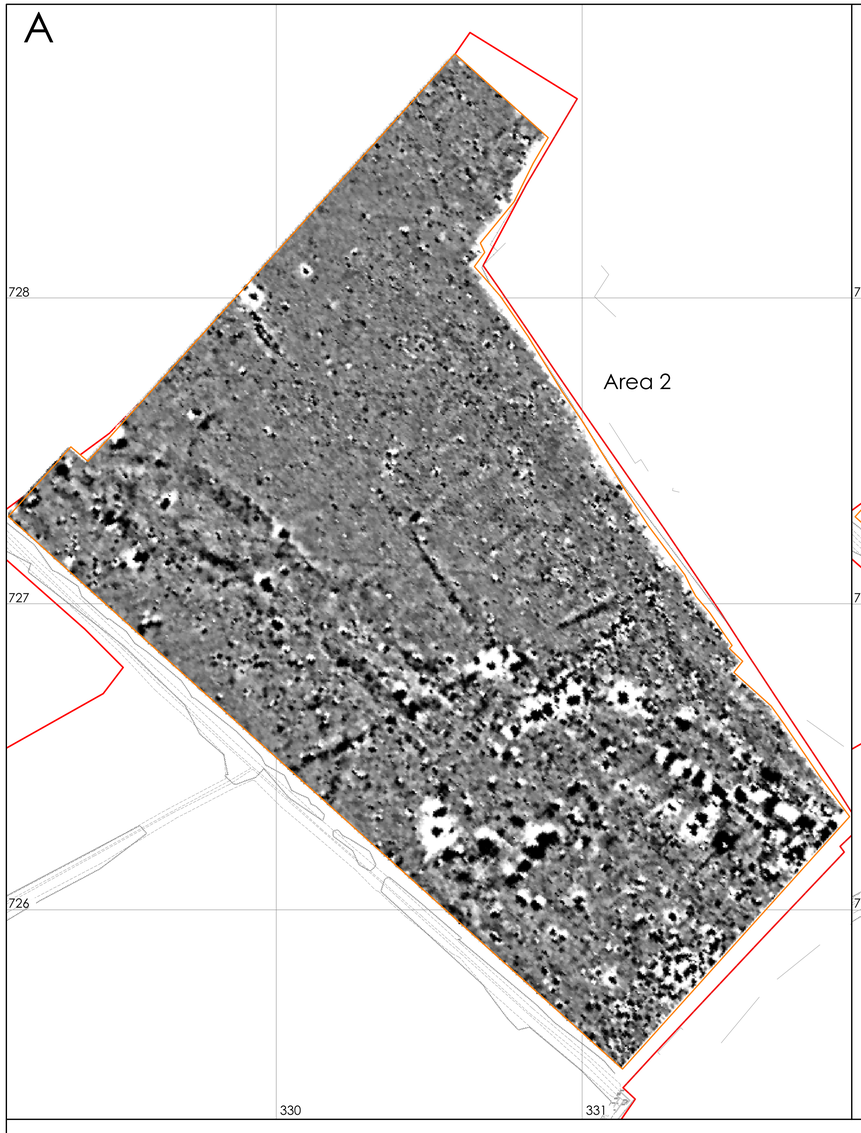
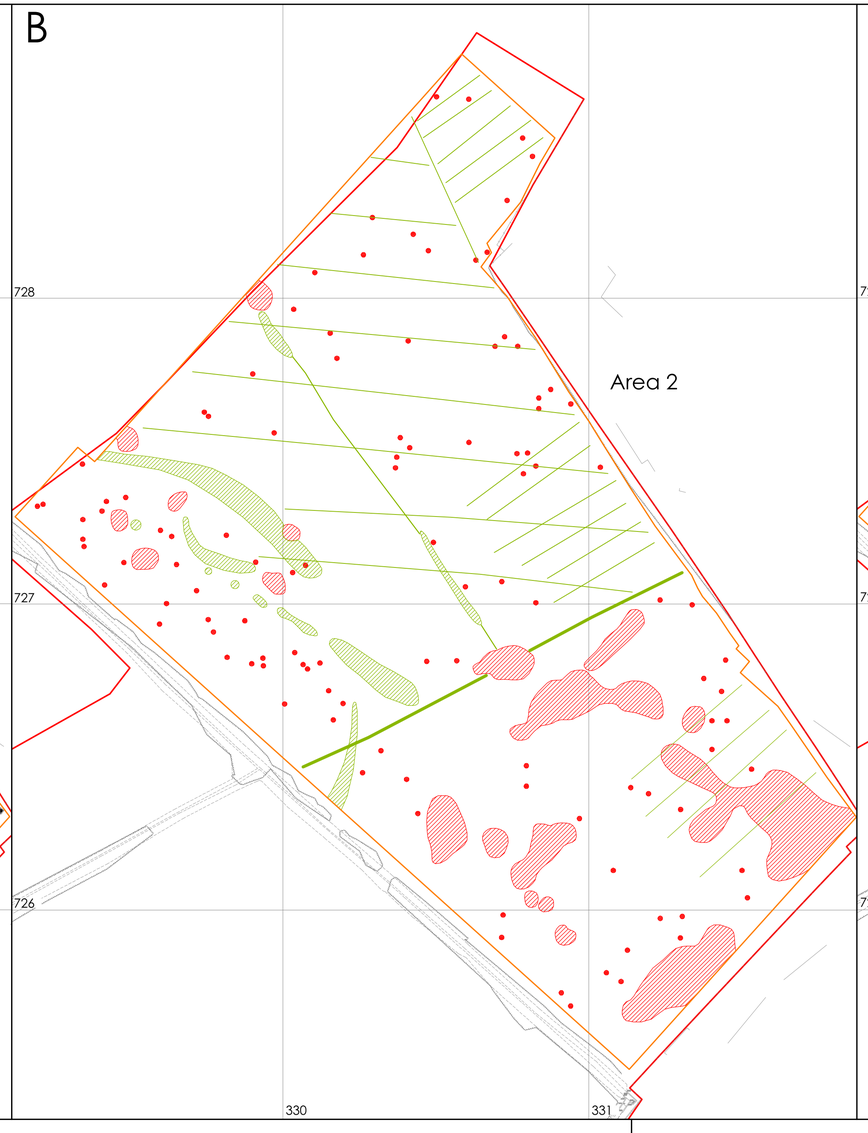
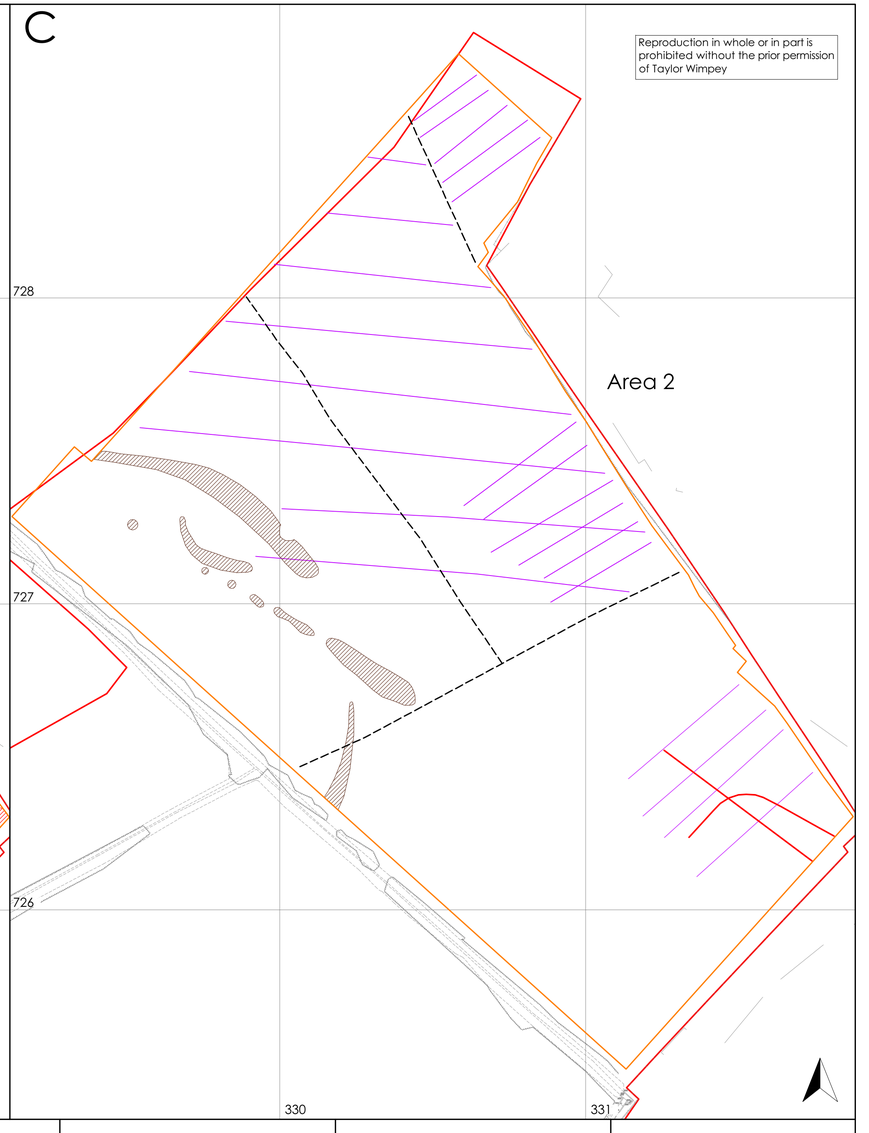
Figure 3: Area 1 geophysical survey and interpretation






A - geophysical survey

magnetic survey

-5 nT 5

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

C - archaeological interpretation

soil-filled feature

land drain

service pipe/cable

former field boundary

0 50m

scale 1:1000 for A1 plot

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Figure 4: Area 2 geophysical survey and interpretation

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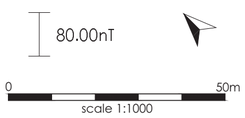
Figure 5:
Trace plots of geomagnetic data

Area 1




Area 2