



Archaeological Services
University of Durham

Land north of Belton Road, Sandtoft, North Lincolnshire

geophysical surveys

on behalf of

On-Site Archaeology

Report 1807
January 2008

***Archaeological Services
Durham University***

South Road

Durham DH1 3LE

Tel: 0191 334 1121

Fax: 0191 334 1126

archaeological.services@durham.ac.uk

www.durham.ac.uk/archaeological.services

Land north of Belton Road, Sandtoft, North Lincolnshire

geophysical surveys

Report 1807

January 2008

Archaeological Services Durham University

on behalf of

On-site Archaeology

25A Milton Street, York YO10 3EP

Contents

1. Summary	1
2. Project background	2
3. Archaeological and historical background	2
4. Landuse, topography and geology	3
5. Geophysical survey	3
6. Conclusions	6
7. Sources	6

Figures (inside back cover)

- Figure 1 Site location
- Figure 2 Geophysical survey
- Figure 3 Geophysical interpretation
- Figure 4 Archaeological interpretation

1. Summary

The project

- 1.1 This report presents the results of geophysical surveys conducted in advance of a proposed development north of Sandtoft Roof Tiles, Belton Road, Sandtoft, North Lincolnshire. The works comprised the geomagnetic survey of two areas totalling 3.5ha.
- 1.2 The works were commissioned by On-Site Archaeology and conducted by Archaeological Services in accordance with a methods statement provided by Archaeological Services.

Results

- 1.3 In Area 1 a number of probable land drains were detected. Several other positive magnetic anomalies, which may represent soil-filled features such as ditches, were also detected.
- 1.4 In Area 2 a number of other probable drains were detected. Additional linear and L-shaped positive magnetic anomalies could reflect further ditches of possible archaeological origin.

2. Project background

Location (Figure 1)

- 2.1 The study area is located north of Belton Road, Sandtoft, North Lincolnshire (NGR: SE 758083). The proposed development area is 7.8ha in size and is bounded by Belton Road to the south and industrial units to the north, east and west. The survey areas lie between former runways on a disused airfield.

Development proposal

- 2.2 The development proposal is for an industrial estate with general industrial, storage and distribution usages.

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 a method statement provided by Archaeological Services.

Dates

- 2.5 Fieldwork was undertaken between 15th and 16th January 2008. This report was prepared between 18th and 23rd January 2008.

Personnel

- 2.6 Fieldwork was conducted by Jamie Armstrong and Natalie Swann (Supervisor). 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 **SBR08**, for Sandtoft **Belton Road 2008**. The survey archive will be supplied on CD to On-Site Archaeology for deposition with the project archive. Archaeological Services is registered with the **Online AccesS** to the **Index of archaeological investigationS** project (OASIS). The OASIS ID number for this project is **archaeol3-36576**.

3. Archaeological and historical background

- 3.1 The proposed development area lies within an area of archaeological interest. Aerial photographs have revealed an extensive complex of cropmarks to the west of the former airfield. The cropmarks may represent occupation and agricultural activity dating to the later prehistoric and Romano-British periods.
- 3.2 Flint tools of an earlier prehistoric date have been recorded to the north of the proposed development area.

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised disused runways and associated buildings, lighting and services, and two areas of overgrown scrub land.
- 4.2 The survey area was predominantly level at a mean elevation of 4m OD.
- 4.3 The underlying solid geology of the area comprises Triassic Mudstones, which are overlain by deposits of blown sand and alluvium.

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 forthcoming 2008); 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, earth 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 aerial photographic 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 track-ways, 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 type 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 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points.

- 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 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.
- 5.7 Data were downloaded on site to 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 continuous tone greyscale images of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-4. 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:
- | | |
|---------------------------|---|
| <i>zero mean traverse</i> | 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. |
| <i>destagger</i> | corrects for displacement of anomalies caused by alternate zig-zag traverses. |
| <i>despike</i> | locates and suppresses random iron spikes in gradiometer data. |
| <i>interpolate</i> | increases the number of data points in a survey to match sample and traverse intervals. In this instance the gradiometer data have been interpolated to 0.25 x 0.25m intervals. |

Interpretation: anomaly types

- 5.10 A colour-coded geophysical interpretation plan is provided. Three types of geomagnetic anomaly have been distinguished in the data:
- | | |
|--------------------------|--|
| <i>positive magnetic</i> | 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. |
| <i>negative magnetic</i> | 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. |
| <i>dipolar magnetic</i> | 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

- 5.11 A colour-coded archaeological interpretation plan is provided.

General comments

- 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 furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.
- 5.13 A high concentration of small, discrete dipolar magnetic anomalies has been detected across both survey areas. These anomalies 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 plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

Area 1

- 5.14 The dipolar magnetic anomalies along the south-eastern edge of the area reflect the presence of a steel fence around the boundary of the site. The dipolar magnetic anomaly along the north-eastern edge of the area reflects hardcore and tarmac along the edge of a former runway.
- 5.15 Two series of parallel positive magnetic anomalies aligned north-south and north-west/south-east are likely to represent ceramic land drains. These appear to join a linear dipolar magnetic anomaly aligned east-west, which is likely to be the main collector drain.
- 5.16 On the north-western edge of the survey area is a rectilinear positive magnetic anomaly. It is possible that this represents soil-filled ditches or gullies. Two other linear positive magnetic anomalies were also detected in this area, one aligned approximately north-south and the other north-east/south-west. These may also represent soil-filled features such as gullies. It is possible that these features have an archaeological origin.

Area 2

- 5.17 Dipolar magnetic anomalies along the north-western edge of the survey area reflect the hardcore shoulder of a former runway. The dipolar magnetic anomaly along the south-western edge of the survey area almost certainly reflects an adjacent ferrous service pipe.
- 5.18 Two chains of dipolar magnetic anomalies cross the survey area, one aligned approximately north-south and the other east-west. These meet at an inspection cover noted on the ground and are almost certainly drains.

- 5.19 A number of negative magnetic anomalies cross the survey area; these probably represent further land drains, either perforated plastic pipe or 'French' stone drains.
- 5.20 In the western corner of the survey an L-shaped positive magnetic anomaly may represent a soil-filled ditch or gully. A similar L-shaped positive magnetic anomaly in the south-east of the survey area may also represent a ditch.
- 5.21 Further ditches may be indicated by linear positive magnetic anomalies aligned approximately east-west and north-south. These probable ditches could also have archaeological origins.

6. Conclusions

- 6.1 Geomagnetic surveys have been conducted on parts of a former airfield at Sandtoft in North Lincolnshire.
- 6.2 In Area 1 a number of probable land drains were detected. Several other positive magnetic anomalies, which may represent soil-filled features such as ditches, were also detected.
- 6.3 In Area 2 a number of other probable drains were detected. Additional linear and L-shaped positive magnetic anomalies could reflect further ditches of possible archaeological origin.

7. Sources

- David, A, 2008 forthcoming *Geophysical survey in archaeological field evaluation*, 2nd Edition, 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



Archaeological Services
University of Durham

Land north of Belton Road, Sandtoft,
North Lincolnshire
geophysical surveys

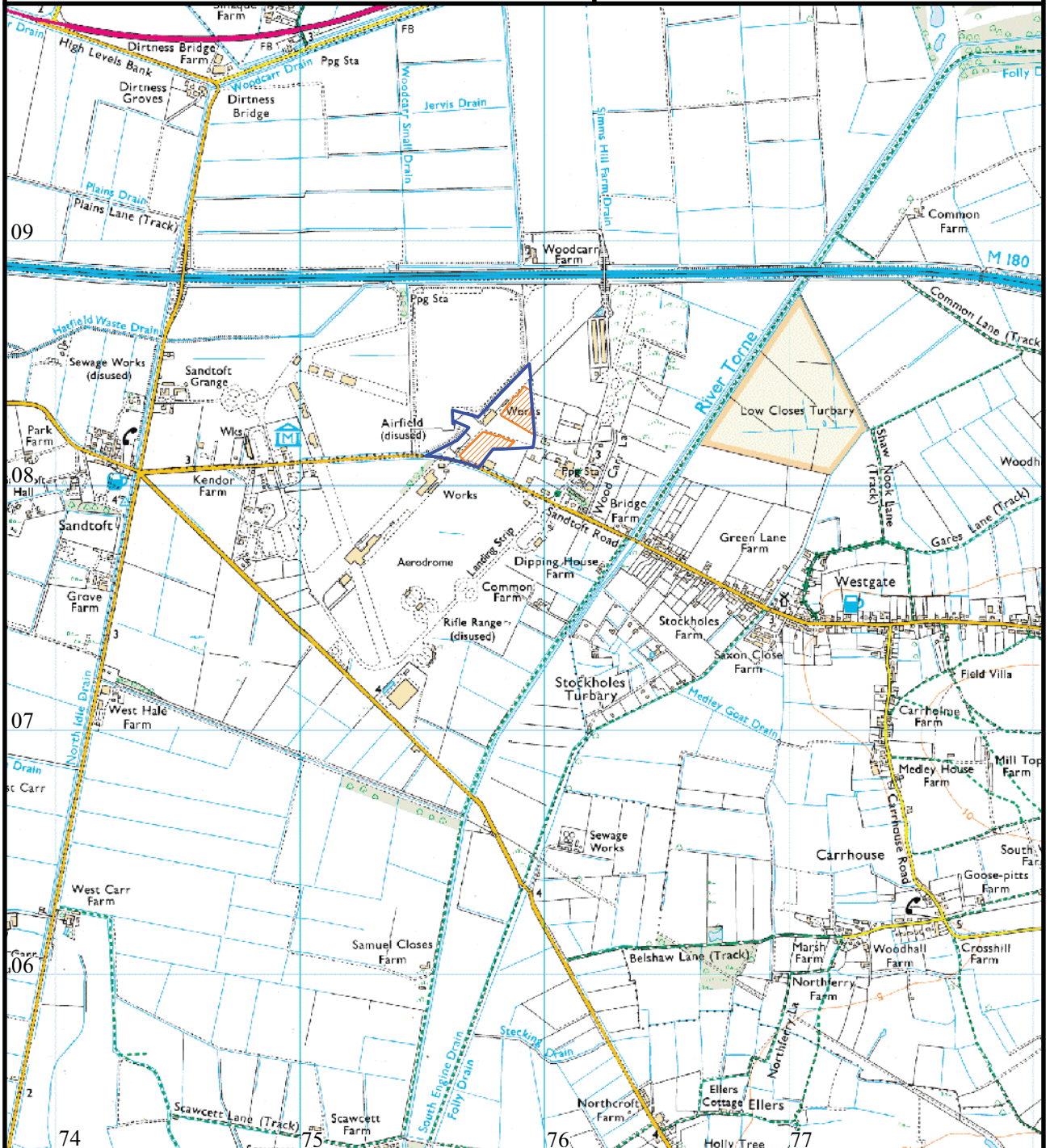
Report 1807

Figure 1

Location of the surveys

on behalf of
On-Site Archaeology

Reproduced from Explorer 280 1:25 000 by
permission of Ordnance Survey on behalf of
The Controller of Her Majesty's Stationery
Office. © Crown copyright 1995. All rights
reserved. Licence number AL100002176



site boundary
parcel A



survey area



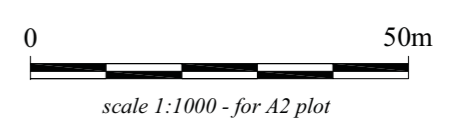
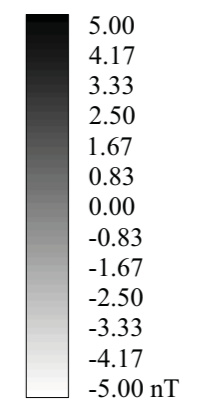
scale 1:25 000 - for A4 plot



Reproduction in whole or in part is prohibited without the prior permission of On-Site Archaeology



- site boundary parcel A
- outline of survey area



on behalf of
On-Site Archaeology



**Land north of Belton Road, Sandtoft,
North Lincolnshire**

geophysical surveys

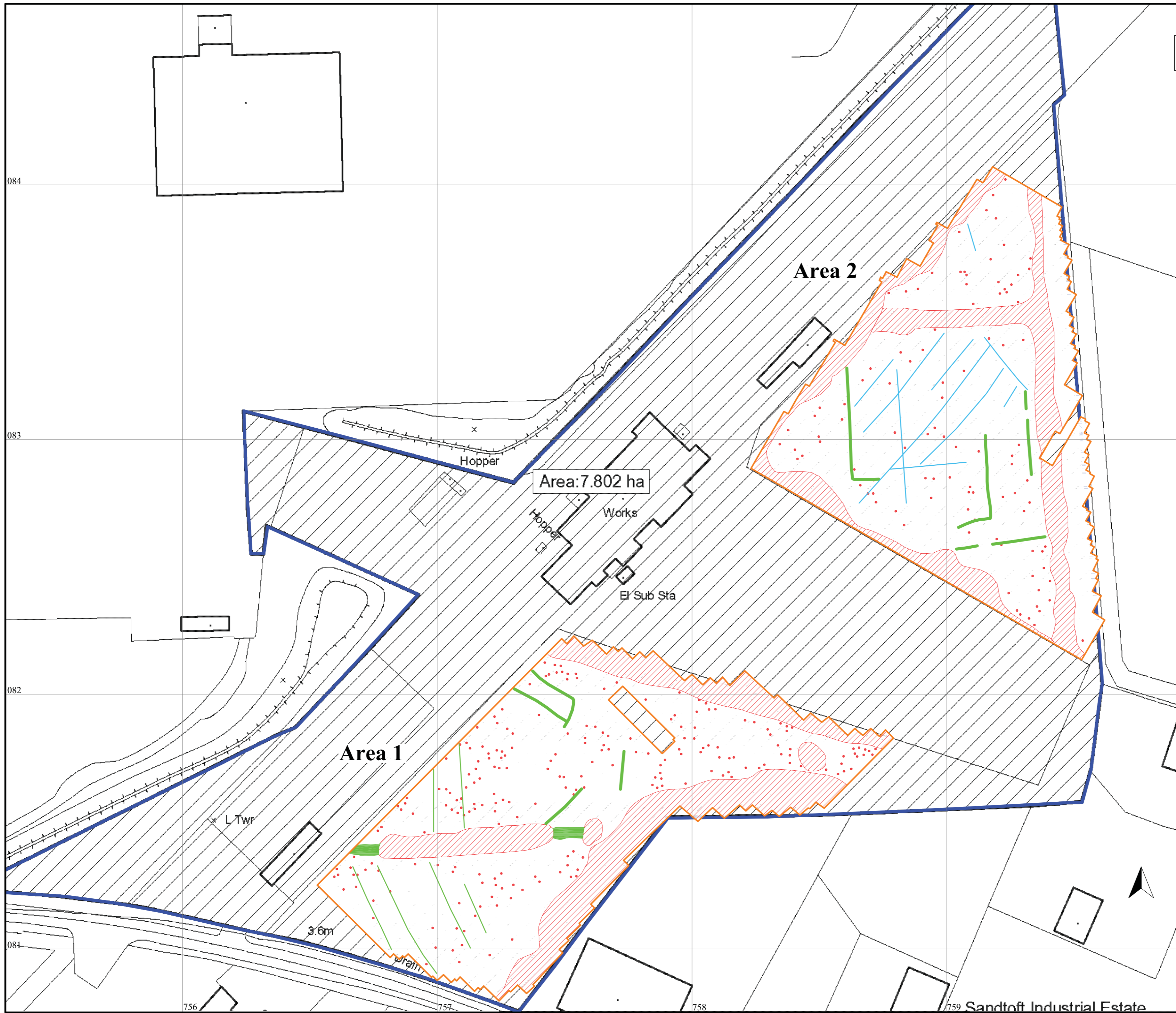
Report 1807

Figure 2

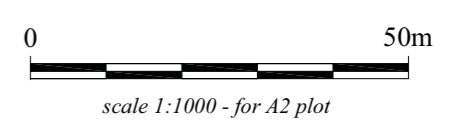
Areas 1 & 2, geophysical surveys

Sandtoft Industrial Estate

Reproduction in whole or in part is prohibited without the prior permission of On-Site Archaeology



- site boundary parcel A
- outline of survey area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies



on behalf of
On-Site Archaeology



**Land north of Belton Road, Sandtoft,
North Lincolnshire**

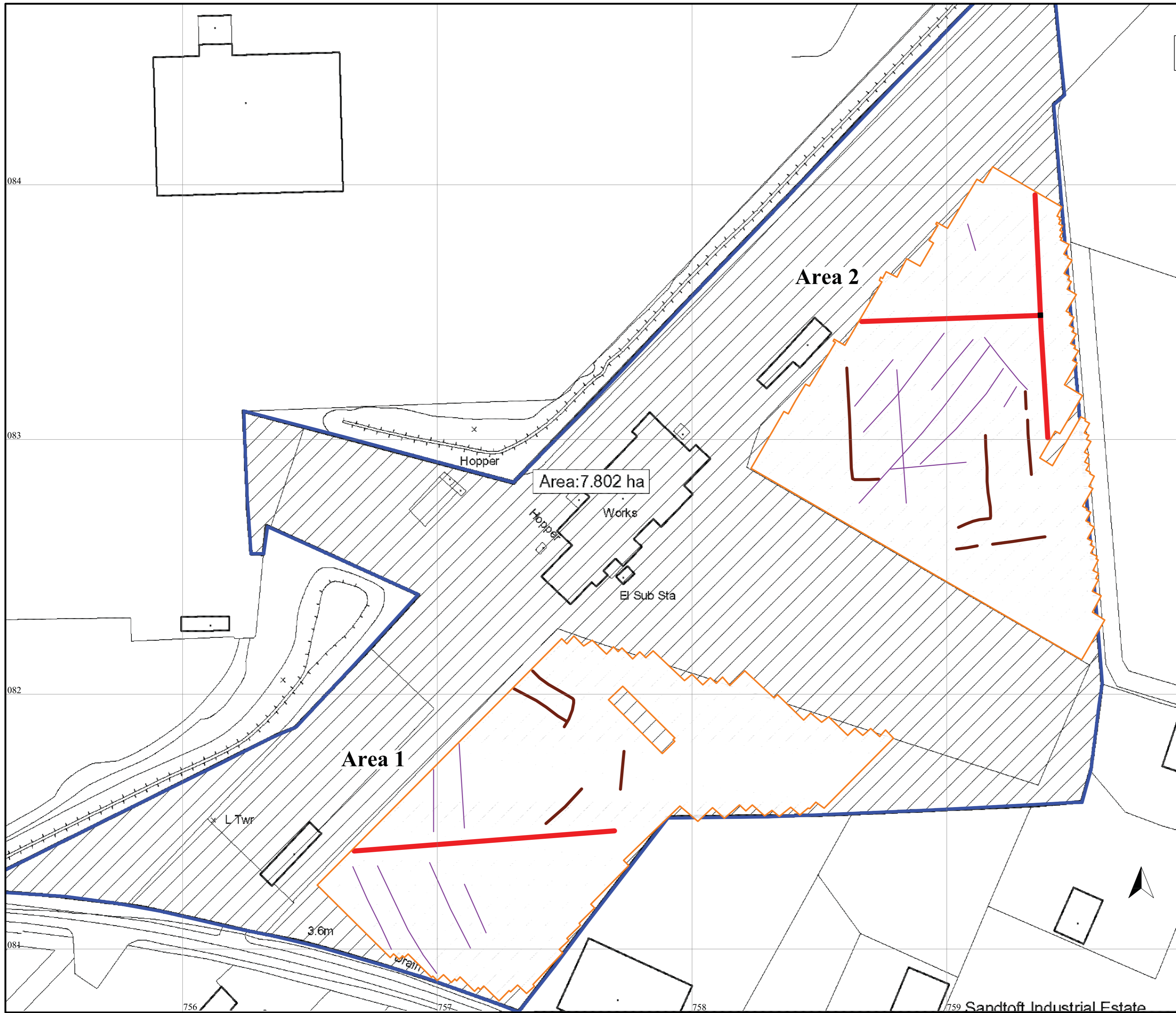
geophysical surveys

Report 1807

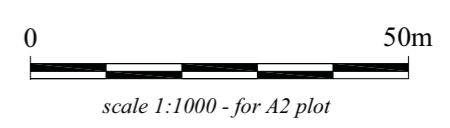
Figure 3

Areas 1 & 2, geophysical interpretation

Reproduction in whole or in part is prohibited without the prior permission of On-Site Archaeology



- site boundary parcel A
- outline of survey area
- soil-filled features
- service pipes
- land drains
- inspection cover



on behalf of
On-Site Archaeology



**Land north of Belton Road, Sandtoft,
North Lincolnshire**

geophysical surveys

Report 1807

Figure 4

*Areas 1 & 2, archaeological
interpretation*

Sandtoft Industrial Estate