ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Harlaxton Engineering Services Limited

Toll Bar Road
Marston
Lincolnshire

geophysical survey

report 4100
March 2016

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development at the Harlaxton Engineering Site, Toll Bar Road, south of Marston, Grantham, Lincolnshire. The works comprised two hectares of detailed geomagnetic survey.

1.2 The works were commissioned by Harlaxton Engineering Services Limited and conducted by Archaeological Services Durham University.

Results

1.3 Traces of probable former ridge and furrow cultivation have been identified in the east of the survey area, outside the proposed works boundary.

1.4 No further features of likely archaeological significance have been identified.

1.5 Features recorded on early Ordnance Survey map editions have been detected, including a former field boundary, an open drain and a pond.

1.6 Modern ground disturbance has been detected, including a large area of dumped material in the western part of the area and possible buried ferrous waste close to the abandoned building.

2. Project background

Location (Figure 1)

2.1 The survey area was located at the Harlaxton Engineering Site, Toll Bar Road, south of Marston, Grantham, Lincolnshire (NGR centre: SK 8800 4162). A single survey of two hectares was conducted. To the north was the Harlaxton Engineering works; to the west were Toll Bar Road and an industrial estate; to the east was farmland; to the south was the A1 Great North Road.

Development proposal

2.2 The proposed development is for a recycling facility.

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.

2.4 This survey has the potential to address regional research priorities as set out in *East Midlands Heritage: an updated research agenda and strategy for the historic environment of the East Midlands* (Knight *et al*. 2012).

Methods statement

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

Dates

2.6 Fieldwork was undertaken on 25th February 2016. This report was prepared for March 2016.

Personnel

2.7 Fieldwork was conducted by Rosie Morris and Richie Villis (supervisor). Geophysical data processing and report preparation was by Richie Villis, with illustrations by Helen Drinkall. The report was edited by Duncan Hale. The Project Manager was Daniel Still.

Archive/OASIS

2.8 The site code is **MTB16**, for **M**arston **T**oll **B**ar Road 20**16**. The survey archive will be retained at Archaeological Services Durham University and a copy 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 **archaeol3-244474**.

3. Historical and archaeological background

3.1 The following provides a summary of the known historic resource within the vicinity of the area, taken from Historic England's PastScape resource (www.pastscape.org.uk).

3.2 Historic England's PastScape resource records four entries within a 1km radius of the centre of the survey area: a probable Iron Age or Roman settlement, possibly a villa site, *c*. 200m to the south; two areas of medieval ridge and furrow, *c*. 400m to the east and *c*. 700m to the north-west; and a WWII bombing decoy, 1km to the south-west, for RAF Bottesford.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised scrubland to the south and east of an engineering works. It was not possible to collect data in some western parts due to spoilheaps and heaps of stone and railway ballast. An abandoned building stood in the south of the area, along with piles of clearance waste and bonfires. Wheel ruts and patches of waterlogged mud were noted across the western part of the area, which has previously been stripped. Machinery, piles of metal fencing and other ferrous waste stood to the north-west of the area. The southern boundary was a tall conifer hedge with patches of intruding scrub, the west boundary of the area was a metal fence to Toll Bar Road, with a now un-used large metal gate.

4.2 The area was predominantly level with a mean elevation of approximately 31m OD.

4.3 The underlying solid geology of the area comprises Jurassic strata of the Charmouth Mudstone Formation, which are overlain by River Terrace Deposits of sand and gravel. Jurassic ironstone of the Sand Beck Nodule Bed is recorded to the north-east of the area (BGS 2016).

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2014); the CIfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013).

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 possible 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 the survey area and related to the Ordnance Survey (OS) National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 5-10mm 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 a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. The greyscale image and interpretations are presented in Figures 2-4; the trace plot is provided in Figure 5. In the greyscale image, 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 the geomagnetic 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
de-stagger	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 A colour-coded geophysical interpretation plan is 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

5.11 A colour-coded archaeological interpretation is provided.

5.12 Broadly north/south aligned, parallel, weak positive magnetic anomalies have been detected in in the eastern part of the survey area. These almost certainly reflect traces of former ridge and furrow cultivation. The orientation of these anomalies suggests that they pre-date the field boundaries. Further evidence of possible ridge and furrow cultivation is visible as crop-marks on Google Earth aerial photographs of the survey area and adjacent fields.

5.13 The western part of the area is characterized by a large concentration of dipolar magnetic anomalies. This almost certainly reflects dumped material, possibly locally quarried ironstone, such as the piles of railway ballast which stood to the north. Ground disturbance was noted in this area, including wheel ruts and some evidence of topsoil removal. Whether this material is dumped on the surface or has been used to infill the area has not been determined. At least one small part of this disturbance reflects in-filled ground, corresponding to a former pond shown on 20th-century OS maps.

5.14 A north-west/south-east aligned band of strong dipolar magnetic anomalies in the central-eastern part of the area corresponds to a former open drain shown on 19th-centurt OS map editions. A perpendicular field boundary is also recorded, to the west of the former building. This has been detected as a disparate alignment of dipolar magnetic anomalies.

5.15 Large and strong dipolar magnetic anomalies have been detected in the vicinity of the abandoned building. These almost certainly reflect large items of buried ferrous waste. Anecdotal evidence suggests that agricultural machinery parts may be buried in the area.

5.16 Small, discrete, dipolar magnetic anomalies have been detected across the area, and are likely to reflect near-surface items of ferrous and fired waste, such as brick fragments, and ironstone. Dipolar magnetic anomalies detected at the edges of the area correspond to metal components in the adjacent field boundaries and metal items close to the surveyed area.

6. Conclusions

6.1 Approximately two hectares of detailed geomagnetic survey was undertaken at the Harlaxton Engineering Site, Toll Bar Road, south of Marston, Grantham, Lincolnshire, prior to proposed development.

6.2 Traces of probable former ridge and furrow cultivation have been identified in the east of the survey area, outside the proposed works boundary.

6.3 No further features of likely archaeological significance have been identified.

6.4 Features recorded on early OS map editions have been detected, including a former field boundary, an open drain and a pond.

6.5 Modern ground disturbance has been detected, including a large area of dumped material in the western part of the area and possible buried ferrous waste close to the abandoned building.

7. Sources

BGS 2016 online *Geology of Britain viewer* available from: http://mapapps.bgs.ac.uk/geologyofbritain/home.html accessed on the 2nd March 2016

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Knight, D, Vyner, B, & Allen, C, 2012 *East Midlands Heritage: an updated research agenda and strategy for the historic environment of the East Midlands*. Nottingham Archaeol. Monographs **6**

Schmidt, A, 2013 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service & Digital Antiquity, Oxbow

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Figure 1: Site location

proposed works boundary

0 1km
scale 1:25 000 for A4 plot

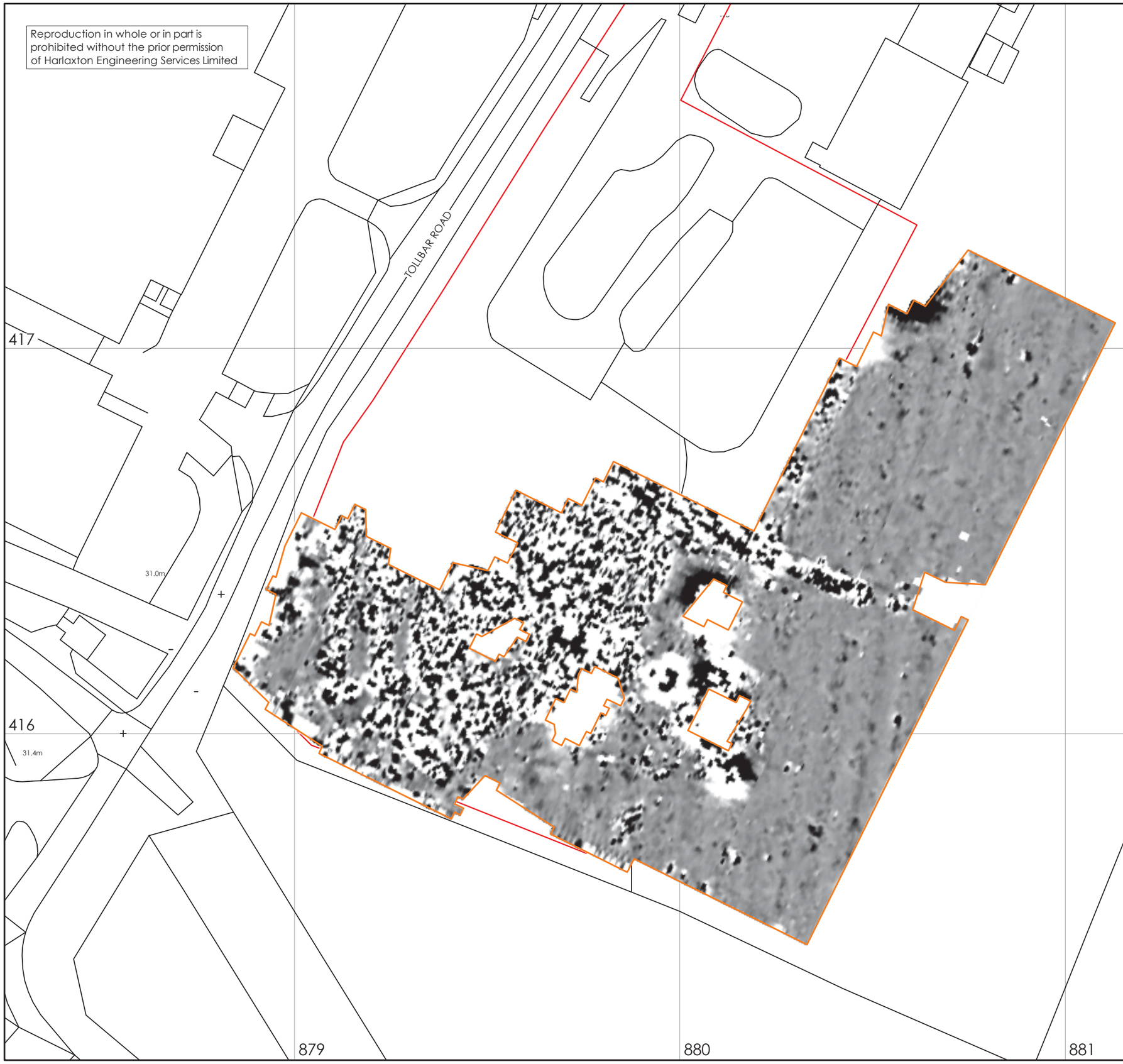

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Figure 2: Geophysical survey

0 50m
scale 1:1000 for A3 plot

proposed works boundary

magnetic survey

-8 nT 12

TOLLBAR ROAD

417

31.0m

416

31.4m

879

880

881

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Figure 3: Geophysical interpretation

0 50m
scale 1:1000 for A3 plot

- proposed works boundary
- magnetic survey
- dipolar magnetic anomaly
- positive magnetic anomaly

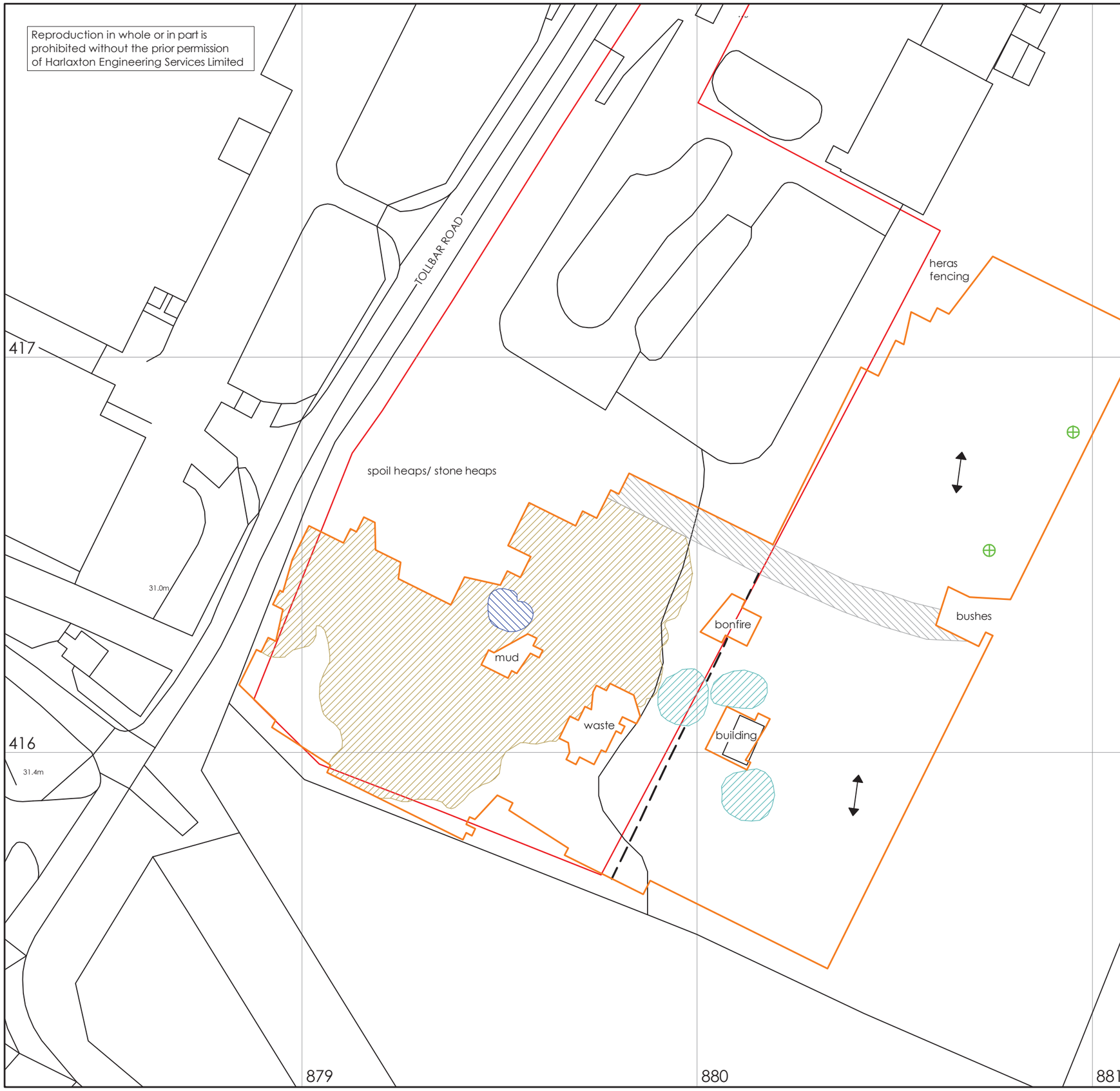

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Figure 4: Archaeological interpretation

0 50m
scale 1:1000 for A3 plot

- proposed works boundary
- magnetic survey
- former open drain
- dumped materials
- buried ferrous waste
- infilled pond
- probable former ridge and furrow
- former field boundary
- tree

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Figure 5: Trace plot of geomagnetic data

0 50m
scale 1:1000 for A3 plot