ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
CgMs Consulting

Land at Arleston Dawley Road, Telford Shropshire

geophysical surveys

report 2591
January 2011

Durham University

Contents

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

Figures

Figure 1: Site location
Figure 2: Geomagnetic surveys
Figure 3: Geophysical interpretations of geomagnetic surveys
Figure 4: Resistance surveys
Figure 5: Geophysical interpretations of resistance surveys
Figure 6: Archaeological interpretation
Figure 7: Trace plots of geomagnetic and resistance data

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development of land at Arleston, Telford, Shropshire. The works comprised *c*. 1.3ha of geomagnetic and electrical resistance survey.

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

Results

1.3 No anomalies indicative of chapel remains have been identified in the surveys.

1.4 Probable service trenches were detected.

1.5 An area of disturbed and boggy ground was detected in the south-east of the site.

2. Project background

Location (Figure 1)

2.1 The survey area was located at Chapel Yard Field, Arleston, off Dawley Road in Telford, Shropshire (NGR centre: SJ 6659 1046). Approximately 1.3ha of geomagnetic and earth electrical resistance survey was conducted in three land parcels. To the north-east was Arleston Lane, to the south was Arleston Manor Development, to the west and north-west was a wooded area.

Development proposal

2.2 The proposal is for a residential development.

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 with current national standards and guidance (see para. 5.1 below).

Dates

2.5 Fieldwork was undertaken on 24th and 25th January 2011. This report was prepared for 31st January 2011.

Personnel

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

Archive/OASIS

2.7 The site code is **TAC11**, for **T**elford, **A**rleston, **C**hapel Yard Field 20**11**. 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 **archaeol3-92143**.

3. Historical and archaeological background

3.1 The survey area is located immediately north of a recent housing development and an early 17th-century, timber-framed, Grade II* Listed manor house, Arleston Manor.

3.2 A detailed archaeological desk-based assessment has been conducted (Patrick 2010). This concluded that a number of earthworks have been previously noted and that there is a possibility that chapel remains may survive in Chapel Yard Field.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised two fields of pasture used for grazing horses. The larger field was sub-divided into two paddocks by a temporary electric fence aligned broadly north-south in the west. For survey purposes the three areas are referred to as Area 1 (central); Area 2 (western) and Area 3 (eastern). Small parts of each area were inaccessible due to brambles, particulary at the edges of areas.

4.2 The survey area sloped gently towards the south-west before dropping away more steeply. A number of undulations were noted in the field. The land dropped away quite steeply to the north-west of the survey area towards a public footpath and wooded area. The mean elevation was approximately 128 m OD.

4.3 The underlying solid geology of the area comprises the Pennine Middle Coal Measures Formation of mudstone, siltstone and sandstone, which are overlain by Devensian till with Devensian glaciofluvial deposits of sands and gravels at the east and north-east of the survey area.

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) *Draft Standard and Guidance for archaeological geophysical survey* (2010); 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* (draft 2nd edition, Schmidt & Ernenwein 2010).

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 desktop 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 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.

5.5 Given the possible presence of wall-footings and other structural remains an electrical resistance survey was also considered appropriate. Earth electrical resistance survey can be particularly useful for mapping stone and brick features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values.

Field methods

5.6 A 20m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system with real-time correction.

5.7 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 grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1.0m, thus providing 1,600 sample measurements per 20m grid unit.

5.8 Measurements of earth electrical resistance were determined using Geoscan RM15D Advanced resistance meters and MPX15 multiplexers with mobile twin probe separations of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.5ohm, the sample interval to 1m and the traverse interval to 1m, thus providing 400 sample measurements per 20m grid unit.

5.9 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

5.10 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 2-6; the trace plots are provided in Figure 7. In the greyscale images, positive magnetic and high resistance anomalies are displayed as dark grey and negative magnetic and low resistance anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla for the geomagnetic data and ohm for the electrical resistance data.

5.11 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

destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
despike	locates and suppresses iron spikes in gradiometer data
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

5.12 The following basic processing functions have been applied to the resistance data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
add	adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges
despike	locates and suppresses spikes in data due to poor contact resistance
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

5.13 Colour-coded geophysical interpretation plans are provided. One type of geomagnetic anomaly has been distinguished in the data:

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

5.14 Two types of resistance anomaly have been distinguished in the data:

high resistance	regions of anomalously high resistance, which may reflect foundations, tracks, paths and other concentrations of stone or brick rubble
low resistance	regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches

Interpretation: features

5.15 A colour-coded archaeological interpretation plan is provided.

5.16 A curvilinear chain of dipolar magnetic anomalies, aligned broadly north-west/south-east, has been detected along the east edge of the Area 1. This corresponds to a linear area of anomalously low resistance. These anomalies are likely to reflect the course of a service trench. The dipolar magnetic anomaly is likely to reflect the presence of brick rubble or a fired clay service pipe; the low resistance reflects a relative increase in the moisture content of the backfilled trench.

5.17 A similar chain of dipolar magnetic anomalies, coupled with an area of anomalously low resistance, has also been detected aligned broadly north-south in the west of Area 1. This is likely to reflect a service trench, or rubble-filled trench.

5.18 The high concentration of strong dipolar magnetic anomalies in the south-east of the site (Area 3 and the east of Area 1) are likely to reflect an area of disturbed ground, perhaps associated with the recent construction of the Arleston Manor development immediately south of the survey area. The relatively low resistance values in this area reflect the boggy ground conditions and surface water.

5.19 Areas of anomalously high resistance have been detected in the north and west of the site (Areas 1 and 2). These do not correspond to any magnetic anomalies are unlikely to reflect structural archaeological features. The areas of higher resistance have been detected at the brows of the natural slopes and may reflect differences in the natural drainage of the soils or rockhead topography.

5.20 The large and strong dipolar magnetic anomaly detected at the southern edge of Area 1 reflects the proximity of a metal fence and the houses to the south.

5.21 The intense dipolar magnetic anomalies recorded near the south-east corner of Area 1 reflect an adjacent metal shed.

5.22 The only other anomalies detected here are small, discrete dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments.

6. Conclusions

6.1 Approximately 1.3ha of geomagnetic and earth electrical resistance survey was undertaken on land at Arleston, off Dawley Road inTelford, Shropshire, prior to proposed development.

6.2 No anomalies indicative of chapel remains have been identified in the surveys.

6.3 Probable service trenches were detected.

6.4 An area of disturbed and boggy ground was detected in the south-east of the site.

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 2010 *Draft Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Patrick, C, 2010 *Archaeological desk-based assessment draft for pre-application discussion: land at Arleston, Telford.* Unpublished report **CP/HH/8738**, CgMs Consulting Ltd

Schmidt, A, & Ernenwein, E, 2010 (draft) *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

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Figure 1: Site location

site location

0 1km

scale 1:25 000 for A4 plot

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Figure 2: Geomagnetic surveys

0 50m
scale 1:1000 for A3 plot

magnetic survey

-5 nT 5

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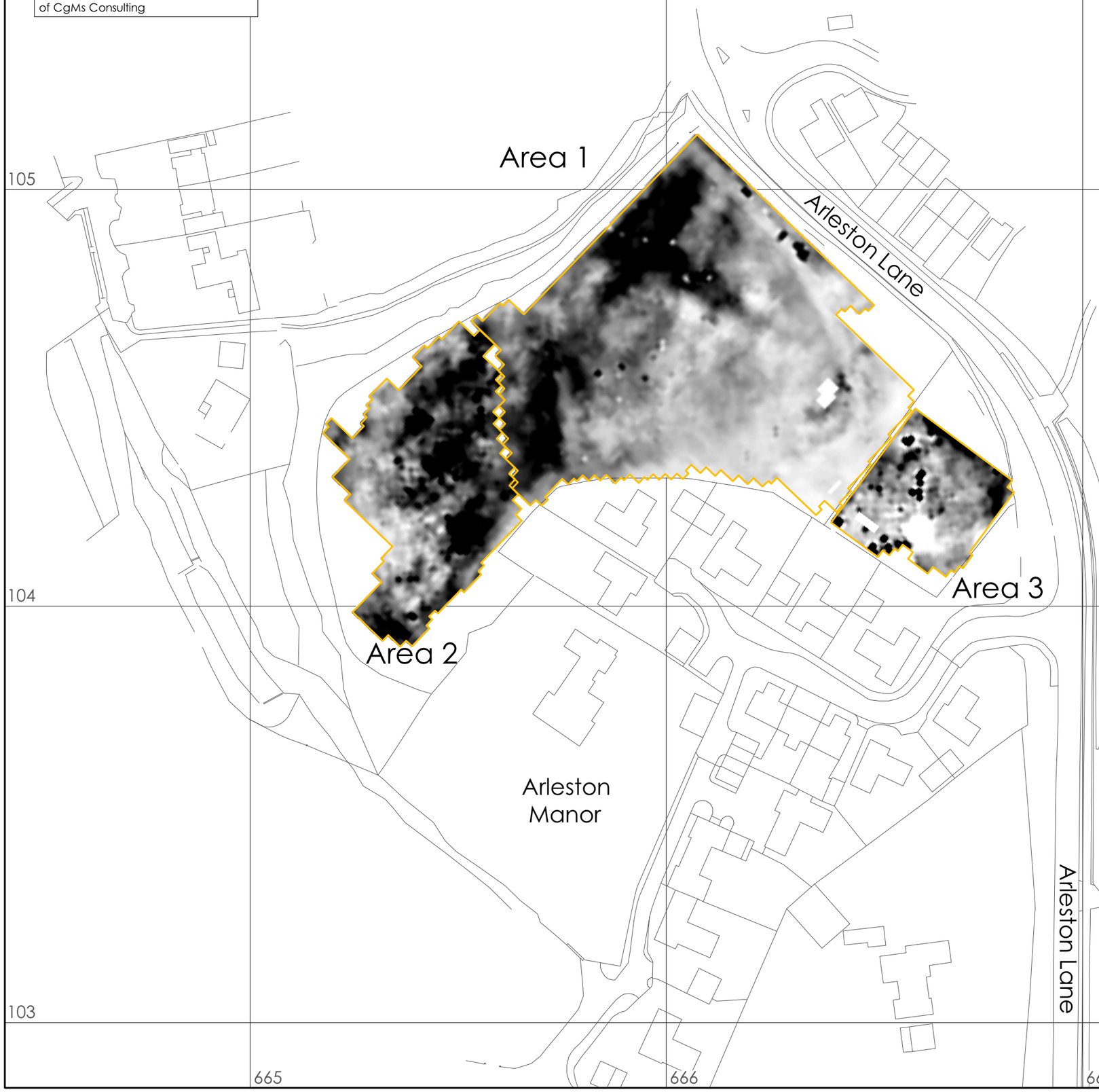
report 2591

Figure 3: Geophysical interpretations of geomagnetic surveys

0 50m
scale 1:1000 for A3 plot

magnetic survey

dipolar magnetic anomaly



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Shropshire

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Figure 4: Resistance surveys

0 50m
scale 1:1000 for A3 plot

resistance survey

20 ohm 50

Area 1

Area 2

Area 3

Arleston Lane

Arleston Manor

Arleston Lane

105

104

103

665

666

667

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Telford
Shropshire

geophysical surveys
report 2591

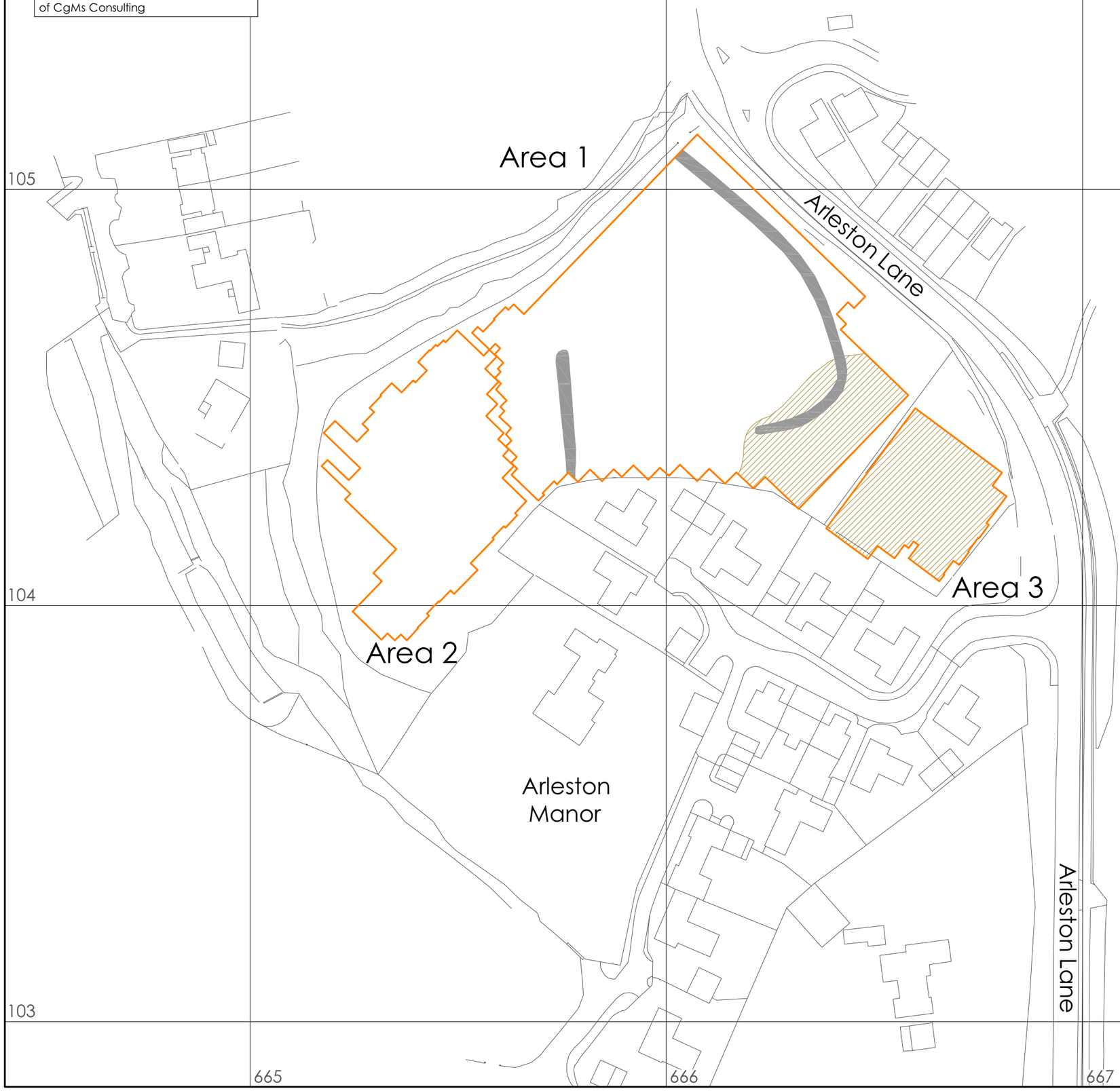
Figure 5: Geophysical interpretations of resistance surveys

0 50m
scale 1:1000 for A3 plot

resistance survey

high resistance anomaly

low resistance anomaly



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Telford
Shropshire

geophysical surveys
report 2591

Figure 6: Archaeological interpretation

0 50m
scale 1:1000 for A3 plot

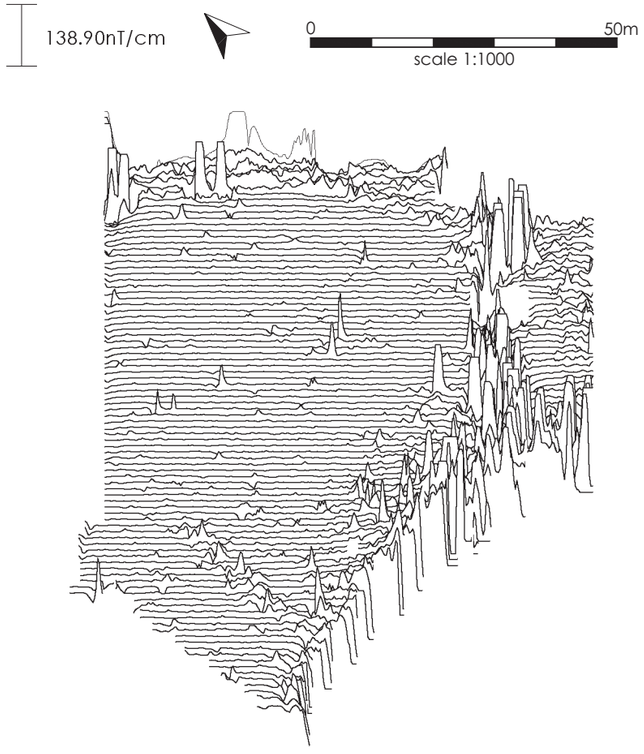
magnetic survey

disturbed area

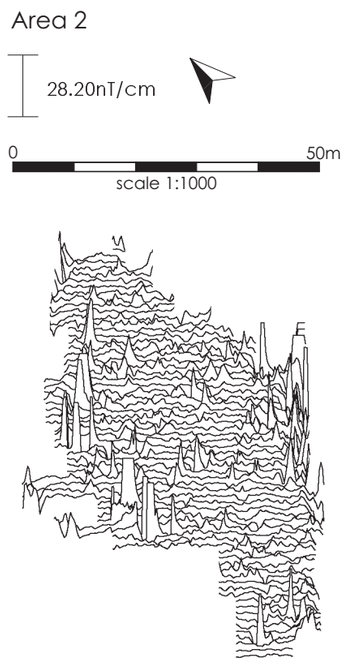
rubble filled trenches

Geomagnetic surveys

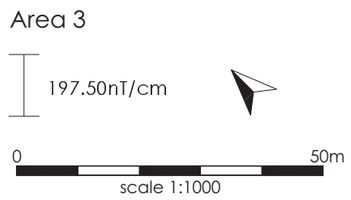
Area 1



Area 2

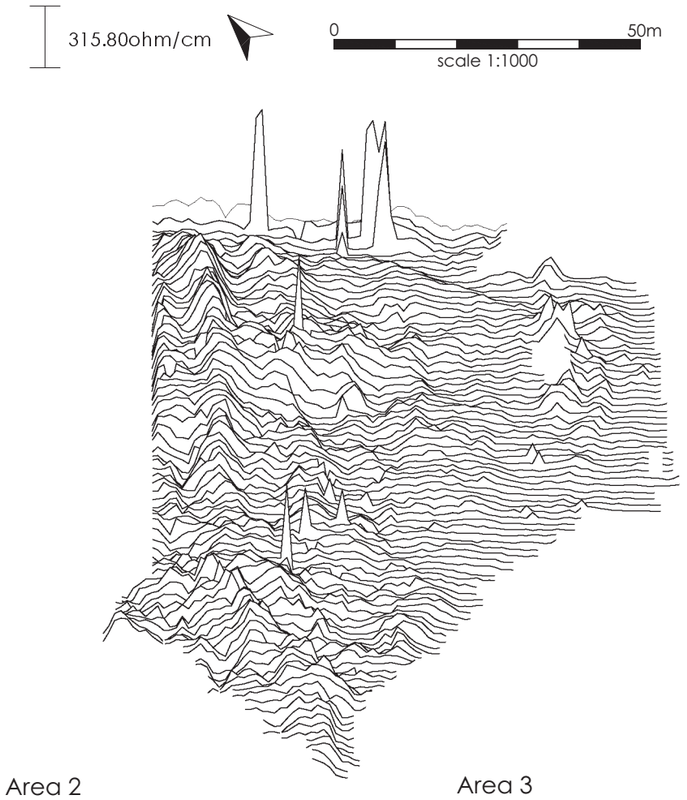


Area 3

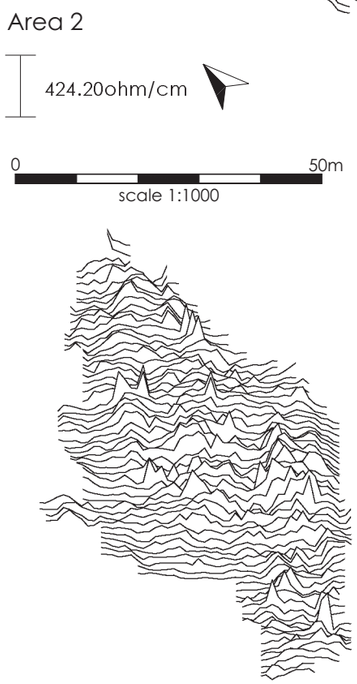


Resistance surveys

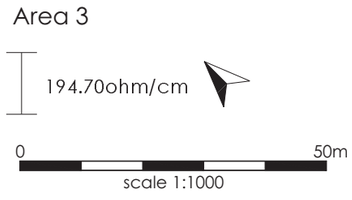
Area 1



Area 2



Area 3



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Shropshire

geophysical surveys
report 2591

Figure 7:
Trace plots of geomagnetic and resistance data