Hanwood Road, Shrewsbury, Shropshire

Detailed Gradiometer Survey Report

Prepared for:
CgMs Consulting
43 Temple Row
Birmingham
West Midlands
B2 5LS

Prepared by:
Wessex Archaeology
Unit R6
Sheaf Bank Business Park
Prospect Road
Sheffield
S2 3EN

www.wessexarch.co.uk

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Summary

A detailed gradiometer survey was conducted over land off Hanwood Road, near Shrewsbury, Shropshire. The project was commissioned by CgMs Consulting with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The site comprises two pasture fields to the northwest of Hanwood Road, approximately 2.3km southwest of the centre of Shrewsbury. The site slopes gently from west to east, and is surrounded to the south, west and north by agricultural land, with the outskirts of Shrewsbury to the east.

The gradiometer survey covered 5.1 ha and has demonstrated the presence of few anomalies of possible archaeological interest within the survey area, along with a region of increased magnetic response.

Within the northernmost area, a possible pit-cluster and linear anomaly have been identified, although their origins are unclear and they may be associated with agricultural activity. A linear response appears to divide the linear anomaly and extends NE-SW across the northern field; it is possible that this relates to a former field boundary.

Within the southern field, numerous trends oriented east-west across the survey area are consistent with the remnants of ridge and furrow. Two stronger linear anomalies may indicate the locations of former field boundaries or ploughing headlands. A large pit-like anomaly lies towards the southeastern corner of the site, although this too may be associated with agriculture.

Elsewhere, weak linear trends and isolated pit-like responses can be seen distributed randomly throughout the survey area. Although it is not possible to determine their origins conclusively, it is thought likely that they relate to agricultural practices.

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The fieldwork was undertaken by Alexander Cassels, Michael Keech, Phillipp Maier, Andrew Reid, Phil Roberts and Matthew Weightman. Ben Urmston processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Kenneth Lymer. The project was managed on behalf of Wessex Archaeology by Andrew Norton.

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1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by CgMs Consulting Ltd to carry out a geophysical survey of land off Hanwood Road, Shrewsbury, Shropshire (**Figure 1**), hereafter "the Site" (centred on NGR 346925 311585). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The survey area comprises Pasture fields off A488 Hanwood Road, some 2.3km southwest of the centre of Shrewsbury (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 5.1 ha.

1.2.2 The Site lies on the edge of developed land, sloping from around 70m above Ordnance Datum (aOD) in the west to c. 65m aOD in the east. The survey area lies 1.6km northeast of the A5 ring road, with the other extents of the survey area defined by Hanwood Road to the southeast, field boundaries to the north, west and south, and private property to the east.

1.2.3 The soils underlying the Site are likely to be typical stagnogley soils of the 711q (Pinder) association and the typical brown earths of the 541u (Ellerbeck) (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 18th and 19th November 2013. Field conditions at the time of the survey were good, with the survey area being under pasture.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest across the Site, along with a number of modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1,250 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 At the northern extent of the survey area, cluster of pit-like anomalies **4000** lies close to the field boundary. It is possible that these responses are associated with agricultural activity, although an archaeological original cannot be excluded.

3.2.2 Close to the curve in the northern boundary, strong anomalies **4001** appear as an interrupted linear band of positive responses surrounded by a region of increased magnetic response. It is difficult to determine the function of these anomalies, although it is possible that they are archaeological in origin. However, the negative linear response

bisecting **4001** extends northeast to southwest across the field, appearing as a faint trend to the southwest; this anomaly is consistent with a former boundary.

3.2.3 Curving trends **4002** can be seen across the southern portion of the northern field. These are likely to be agricultural in origin, although their broad responses may indicate a geological feature. To the west of these trends, a sub-circular region of increased and ferrous responses can be seen in close proximity to noticeable ploughing trends. It is therefore possible that ploughing has disturbed near-surface deposits of magnetic material, although the nature of these deposits is unclear from geophysical survey alone.

3.2.4 The most visible anomalies within the southernmost field comprise a series of linear anomalies and weaker trends, largely oriented east-west. The majority of these are consistent with the remnants of ridge and furrow ploughing, with two stronger anomalies **4003** and **4004** interpreted as being of possible archaeological interest due to the potential for them relating to former field boundaries of ploughing headlands.

3.2.5 Towards the southeastern extent of the survey area, sub-circular anomaly **4005** is considered to be of possible archaeological interest although, given the nearby indications of historic ploughing, it is possible that it relates to agricultural activity.

3.2.6 Elsewhere within the dataset, weak linear and curvilinear trends can be seen along with occasional isolated pit-like anomalies. Whilst an archaeological interpretation cannot be entirely excluded, it is considered likely that many of these relate to natural or agricultural activity.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 No modern services were identified through the gradiometer survey, although this does not necessarily demonstrate their absence. Some construction methods may not produce detectable magnetic anomalies and the use of a cable avoidance tool is recommended before any intrusive work.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the Site, in addition to regions of increased magnetic response.

4.1.2 Few anomalies of possible archaeological interest have been identified and it is possible that these relate to historic ploughing, perhaps remnants of ridge and furrow. The majority of these linear anomalies are confined to the southern field, with a possible former field boundary and potential pit cluster in the northern survey area.

4.1.3 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. However, given that ephemeral features such as ploughing trends have produced measurable magnetic anomalies in this geological setting, it is considered likely that more substantial archaeological features would have also been detectable, were any to be present.

5 REFERENCES

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No 1, 2nd edition.

Soil Survey of England and Wales, 1983. *Sheet 3, Soils of Midland and Western England*. Ordnance Survey, Southampton.

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.