STRATASCAN

Geophysical Survey Report

Mill Lane Brockworth
Gloucestershire

for

Gifford and Partners

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J2207

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1 SUMMARY OF RESULTS

A geophysical survey was carried out on redundant farmland to the south of Mill Lane, Brockworth. The survey area was significantly reduced due to the presence of overgrown and dense vegetation. Little to no archaeological features have been identified within the survey area. Ridge and furrow can be seen within Field 3 with further evidence of agricultural marks within Fields 1 and 2. Discrete positive anomalies identified in the south of Field 1 may represent cut features, such as pits, but may also be associated with ground disturbance.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Gifford and Partners to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation undertaken by Gifford and Partners.

2.2 Site location

The site is located east of Gloucester, between the A46 and A417 at OS ref. SO 9005 1650.

2.3 Description of site

The survey area is approximately 2.9ha of agricultural land. The site is currently redundant farm land consisting of three fields of rough pasture. Field 1 gently slopes from east to west, with high ground centred on Millcroft Cottage. A wide double hedged boundary separates Fields 1 and 2. Field 2 is approximately 1-2m lower than Field 1 and gradually slopes to the south and west. The survey area has been reduced due to the substantial areas of overgrown and dense vegetation. The survey area within Field 3 has been considerably reduced due to dense vegetation.

Plate 1: Looking southwest across Field 2

Plate 2: Looking west along the southern field boundary of Field 1

2.4 Geology and soils

The underlying geology is Lower Lias with overlying sands, gravels and alluvial flood deposits (British Geological Survey South Sheet, Fourth Edition Solid, 2001; First Edition Quaternary, 1977). The overlying soils are known as Evesham 2 soils which are typical calcareous pelosols. These consist of slowly permeable calcareous clayey and fine loamy over clayey soils (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

An archaeological desk based assessment was carried out by Gifford and Partners (Report No. 13395.R01. June 2006).

No recorded archaeological remains have been identified within the survey area, although the site lies within an ancient landscape that contains archaeological remains of many periods. The presence of ridge and furrow within and around the survey area testifies to the adoption of arable cultivation, probably during the medieval period.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be assessed prior to development.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 2 days from the 21-22nd August 2006. Weather conditions during the survey were overcast but dry.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced using a System 500 Leica DGPS.

3.3 Survey equipment

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements increasing the sensitivity to small changes in the Earths magnetic field.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

The Grad601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed gradiometer data used in this report:

1. *Despike* (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

   Geoplot parameters:
   X radius = 1, y radius = 1, threshold = 3 std. dev.
   Spike replacement = mean

2. *Zero mean grid* (sets the background mean of each grid to zero and is useful for removing grid edge discontinuities)

   Geoplot parameters:
   Threshold = 0.25 std. dev.

3. *Zero mean traverse* (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

   Geoplot parameters:
   Least mean square fit = off

In addition the following processing has been carried out to further enhance the data: Extreme high and low values were removed in an attempt to reveal weak geophysical anomalies.

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the raw data both as greyscale (Figure 3) and trace plots (Figure 4 and 5), together with a greyscale plot of the processed data (Figure 6). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 7).

4 RESULTS

The survey area was significantly reduced due to the presence of overgrown and dense vegetation. Large areas of magnetic debris and disturbance have also been identified around the perimeter of the survey areas. These strong magnetic responses can often obscure faint anomalies that may be of archaeological origin.

A large area of strong positive response has been identified in the northeast corner of Area 2 (**1**). This area anomaly is likely to be associated with ground disturbance and with the nearby buildings. Areas of magnetic disturbance have also been identified around the perimeter of the survey area; these anomalies are likely to be associated with the nearby field boundaries and buildings.

Three discrete areas of magnetic debris can be seen within Field 1 (**2**, **3** and **4**). These area anomalies may represent areas of ground disturbance with the presence of near surface ferrous objects. A smaller discrete area of magnetic response also appears within Field 1 (**5**). This strong bipolar anomaly is probably associated with a near surface ferrous object. A large number of positive anomalies with associated negative returns can be seen within all three fields. These anomalies may represent near surface ferrous objects.

Field 3 is dominated by a series of parallel positive linear anomalies running in a northeast to southwest orientation (**6**). These anomalies are likely to be associated with ridge and furrow and are of agricultural origin. Further evidence for agricultural marks can be seen within the north of Field 1 (**7**) and weak linear responses within Field 2 (**8**).

Two faint positive linear anomalies have been identified within Fields 1 and 2 (**9** and **10**). These linear anomalies may represent cut features of archaeological origin; however they may also be associated with localised ground disturbance from agricultural activity.

A series of discrete positive anomalies can be seen in the southwest corner of Field 1 (**11**). These anomalies or of uncertain origin and may represent discrete cut features, such as pits, or indicate a further area of ground disturbance.

5 CONCLUSION

The survey area has been significantly reduced due to areas of dense and overgrown vegetation. Areas of magnetic debris and disturbance situated within the survey may obscure the presence of faint anomalies that may relate to archaeological activity. Little to no evidence of features of possible archaeological origin has been identified within the survey area. Field 3 is dominated by agricultural marks, likely to be associated with ridge and furrow. Further evidence for agricultural activity can be seen in the north of Field 1 and weaker evidence in Field 2.

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremnant* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremnance is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremnant archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.