STRATASCAN

Geophysical Survey Report

Soundborough Farm, Sevenhampton, Gloucestershire

for

Place Archaeological Consultants Ltd

October 2004

J1928

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REGISTERED IFA ORGANISATION

Document Title:	**Geophysical Survey Report** **Soundborough Farm, Sevenhampton, Gloucestershire**
Client:	**Place Archaeological Consultants Ltd**
Stratascan Job No:	**J1928**
Techniques:	**Detailed magnetic survey (gradiometry)**
National Grid Ref:	**SP 0525 2162**

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1 SUMMARY OF RESULTS

A detailed magnetic survey was conducted over 2.5ha of arable land at Soundborough Farm near Sevenhampton in Gloucestershire. The survey located a number of geophysical anomalies within the site but low magnitude response has made abstraction and interpretation difficult. Although geological or pedological features may have been located it is possible that curvilinear and linear responses may relate to cut features such as infilled ditches within the site that may be of archaeological interest.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Place Archaeological Consultants Ltd to undertake a geophysical survey of an area outlined for development as a quarry by Eland Farms Ltd. This survey forms part of an archaeological investigation requested by Gloucestershire County Council in advance of determining the planning application.

2.2 Site location

The site is located at Soundborough Farm, Sevenhampton near Cheltenham in Gloucestershire at OS ref. SP 0525 2162.

2.3 Description of site

The survey area is approximately 2.5ha of agricultural land currently within an arable field which slopes to the east. The land to the south has been used as a quarry for limestone abstraction.

2.4 Geology and soils

The underlying geology is Great Oolite Limestone (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils are known as Elmton 1 soils which are brown rendzinas. These consist of shallow well drained brashy calcareous fine loamy soils over limestone (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

The site is located 140m southwest of two scheduled round barrows and is surrounded by fields containing flint scatters (Place 2004, An Archaeological Desk-based Assessment of Land at Soundborough Farm, Sevenhampton, Gloucestershire).

Although no direct archaeological evidence of settlement or funerary monument has been found within the site it is possible that archaeological features, for example trackways or former field boundaries, may be located by geophysical survey.

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 two days on the 14th and 15th of October 2004. Weather conditions during the survey were showery, however this would have no effect on the results.

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 to suitable topographic features around the perimeter of the site.

3.3 Survey equipment

The magnetic survey was carried out using dual FM256 Fluxgate Gradiometers, manufactured by Geoscan Research. The gradiometers are suspended on a frame CF6. One gradiometer acts as a master trigger that controls the second slave gradiometer. The instruments each consist of two fluxgates mounted 0.5m vertically apart and very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.

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 FM256 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

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 detailed magnetic survey located a number of geophysical anomalies within the site. All anomalies are of very low magnitude and have been coded 1-10 for ease of reference (see Figure 7).

In the west of the survey area several fragmented positive curvilinear anomalies appear to surround a curvilinear negative anomaly (1) with an approximate diameter of 10m. This anomaly may be a response to the magnetically enhanced material within a circular cut feature which surrounds a former embankment although the general low magnitude of anomalies makes it difficult to be certain.

Two curvilinear anomalies appear to form two sides of a generally oval feature (2) in the southwest of the survey area. This oval feature has dimensions of approximately 6m by 10m and is surrounded on the eastern side by another positive curvilinear anomaly approximately 24m across.

In the northeast of the survey area another low magnitude positive curvilinear anomaly with a diameter of approximately 24m appears to surround a negative circular anomaly approximately 3.5m in diameter (3). It is possible that anomalies (1, 2 and 3) relate to circular cut features and an archaeological origin should be considered.

From the western edge of the survey area a positive linear anomaly extends in a south-easterly direction (4) where it meets part of a linear anomaly (5) and splits into two linears, one to the southwest and one extending south through anomaly (2). Anomaly (4) also bisects anomaly (1) and may be a response to the magnetically enhanced fill of a ditch. Positive curvilinear anomalies (6) may form part of a circular cut feature but this is not certain.

A broadly curving linear anomaly (7) can be seen in the north of the survey area and appears to bisect anomaly (3), this is of uncertain origin.

Towards the eastern edge of the survey area are two parallel positive linear anomalies (8). These anomalies are approximately 10m apart and are parallel with the eastern field boundary. It is possible that these anomalies may have an association with former agricultural activity, however the age of these features cannot be determined from the survey. Another positive linear anomaly (9) oriented almost east – west is located west of (9) may also have an agricultural origin.

Several strong discrete positive anomalies with negative returns (10) are located across the site and indicate the presence of ferrous objects in the topsoil which are likely to be modern in origin.

5 CONCLUSION

The detailed magnetic survey located a number of very low magnitude linear and curvilinear anomalies within the site. It is possible that the site contains three generally circular anomalies which may relate to cut features with an archaeological origin, two of these features may surround a former embankment. Within the east of the site positive linear anomalies may have been caused by former agricultural activity.

It is difficult to be certain of the origin of these anomalies as the general low magnitude of the responses has made abstraction and interpretation problematic. There are many variables that may be associated with the cause of the low magnitude responses. These may include increased depth of soils, characteristics of ferrous compounds within the soil and volume of material derived from human activity. It cannot therefore be simply assumed that the low magnitude of response is directly related to a low level or insignificant amount of previous human activity across the surveyed area. Equally, geological and pedological variations should not be ruled out as an origin for some of the anomalies.

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.