STRATASCAN

Geophysical Survey Report

Calor Terminal, Canvey Island, Essex

for

RPS Planning, Transport and Environmental

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National Grid Ref: **SZ 785 823**

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LIST OF FIGURES

1 SUMMARY OF RESULTS

A detailed magnetic survey was carried out over 7ha at the Calor Terminal, Canvey Island.

The results have returned noisy data making the identification of any weak archaeological responses difficult.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by RPS Planning, Transport and Environmental to undertake a geophysical survey of an area of land surrounding a gas terminal.

2.2 Site location

The site is located at Calor Terminal, Canvey Island at OS ref. SZ 785 823.

2.3 Description of site

The survey area is approximately 7ha of land surrounding a gas storage facility. The area is mostly covered by grass with a line of trees to the north and an area covered in shingle to the south. Whilst most of the site is open there are obstructions to the south caused by gas cylinders.

2.4 Geology and soils

The underlying geology is London Clay (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Efford 2 Glaciofluvial drift. These consist of well drained fine loamy soils over gravel at variable depth (Soil Survey of England and Wales, Sheet 6 South East England).

2.5 Site history and archaeological potential

The site is known to contain a red hill to the south-west. These are burnt features of earth and pottery related to the salt making industry. Several World War II defences are also known to have been positioned within the area. Just outside the survey area to the west of the stream a Roman cremation has been discovered.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological origin, and in particular red hills which are likely to have a strong magnetic character.

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 5 days from 27th September to the 4th October 2005. Weather conditions during the survey were sunny.

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 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

The 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 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 & 4) and trace plots (Figure 4 and 5), together with a greyscale plot of the processed data (Figure 7 & 8). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 9 & 10).

4 RESULTS

The gradiometer data has shown the site to be very noisy. This is likely to be the result of a long industrial history leading to a large amount of ferrous debris being scattered on, or just beneath the surface. Within the high background levels two discrete areas of magnetic disturbance are defined. These are likely to be caused by finite isolated features. While it is more likely they are related to ferrous objects it is possible they are associated with burnt features.

Several strong linear anomalies are also observed which are likely to be caused by buried pipes.

5 CONCLUSION

The magnetic survey data is shown to be very noisy making the identification of any weak archaeological responses impossible.

REFERENCES

British Geological Survey, 2001. *Geological Survey Ten Mile Map, South Sheet, Third Edition (Solid)*. British Geological Society.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 6 South East England*.

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.