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REPORT ON GEOPHYSICAL SURVEY

WOODHALL SPA
Lincolnshire

Survey No: 97/08

Work Commissioned by:

CITY OF LINCOLN ARCHAEOLOGY UNIT

EVENT LI1791
SOURCE LI6559
PRN 43137 LI43137

SITE SUMMARY SHEET

97 / 08 Woodhall Spa, Lincolnshire

NGR: TF 1855 6300

Location, topography and geology

The area of the proposed development lies on the western edge of Woodhall Spa, Lincolnshire. The land is flat and contained a young crop. The area is surrounded by a mixture of housing, agricultural land and a construction site.

The site soils are typical stagnogleys formed over a parent of chalky till and glaciofluvial drift. Such soils usually comprise slowly permeable, seasonally waterlogged fine and coarse loamy over clayey soils.

Archaeology

There was no evidence for archaeological sites or artefacts within the proposed building development. However, SMR references exist for occasional find spots nearby, while evidence for more substantial activity can be found 1km to the south where there are remains of an Abbey.

Aims of Survey

A gradiometer survey was undertaken to investigate whether there is any geophysical evidence for buried archaeology within the proposed development. This was achieved using the gradiometer in both scanning and detailed modes.

Summary of Results *

Scanning at the site revealed few clear magnetic anomalies. Three areas were identified for detailed survey. The results from these areas confirmed the low magnetic background and the general lack of response. However, some linear or sub-linear anomalies were found although their origin is uncertain. A single pit type anomaly has been identified, although the lack of context for it would indicate that the interpretation must remain tentative.

*** It is essential that this summary is read in conjunction with the detailed results of the survey.**

For the use of City of Lincoln Archaeology Unit

SURVEY RESULTS

97 / 08 Woodhall Spa, Lincolnshire

1. Survey Areas

1.1 The survey area is indicated in Figure 1 and covers approximately 3.6ha. The whole of this area was scanned while the position of a 1ha sample, divided between three blocks, is also indicated on this diagram at a scale of 1:1000.

1.2 The survey grid was established and tied-in using an EDM by **Geophysical Surveys of Bradford**. Detailed tie-in information has been lodged with the client.

2. Display

2.1 Figure 2 displays the data from the detailed survey areas as a summary greyscale image at a scale of 1:1000. A summary interpretation, at the same scale, is provided in Figure 3.

2.2 The data from the detailed recorded survey areas are displayed as XY traces and dot density plots at a scale of 1:500. Interpretation diagrams are also provided at the same scale.

2.3 The display formats referred to above are discussed in the *Technical Information* section, at the end of the text. A list of figures included in this report precedes the diagrams.

3. General Considerations - Complicating factors

3.1 Ground conditions were suitable with the survey being undertaken in a field with an established, but low, crop. The land was level and free of obstructions, although a line of manholes was positioned in the centre of the survey.

3.2 There are a few ferrous type responses within the data, including some associated with manholes and buried pipes. The covers and pipes had zones of magnetic noise that extended for a maximum of 10m. Archaeological type anomalies near these features will be masked by this noise.

3.3 On the basis of the soil characteristics and past surveys over similar soils, one would expect a generally quiet response, although such soils are capable of strong magnetic enhancements.

4. Results of the Scan

4.1 The whole of the area was scanned using the gradiometers in 'free-range' mode, with a traverse interval of 10m. The magnetic background was found to be very low. There were very few anomalies identified during the scan, and those that were noted were believed to be tentative. Three blocks were placed over the anomalies in such a way to give a reasonable spatial coverage for the 1ha sample.

5. Results of Detailed Survey

The results will be described and interpreted by area

5.1 **Area A.** This sample measures 40 x 100m. The majority of the anomalies are the product of small pieces of ferrous material situated in the topsoil. It is likely that they are modern in origin. A few faint linear traces have also been noted. It is probable that these are the product of natural variation in the subsoil, or even modern ploughing.

5.2 **Area B.** This sample measures 60 x 60m. The data set collected in this area indicates few anomalies. The majority of the responses are again ferrous in origin. A few possible natural linear anomalies have been found, although they are also very weak and, therefore, the interpretation is cautious.

5.3 **Area C.** This narrow transect is 20 x 120m in size. As in the previous areas, the majority of the anomalies can be identified as being due to ferrous material in the topsoil. However, some trends are apparent in the data and while they are likely to be natural, an archaeological origin may be possible. A single anomaly, which was located during the initial scan, has been interpreted as being of possible archaeological origin. However, the lack of context for this anomaly would suggest that the interpretation must be tentative

6. Conclusions

6.1 The initial scan of the area revealed few anomalies that were thought to be archaeological. The detailed survey verified the scan although a number of weak trends were identified. It is believed that they are likely to be natural, although an archaeological interpretation may be a possibility. While a single pit type anomaly has been found, a lack of context would suggest that the interpretation must remain inconclusive.

Project Co-ordinator: Dr C F Gaffney
Project Assistants: J A Gater, A Shields and C Stephens.

Start of Survey: 21st January 1997
Date of Report: 4th February 1997

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD (GSB)** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GSB.**

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method.

(b) Resistance Meter - Geoscan RM4 or RM15

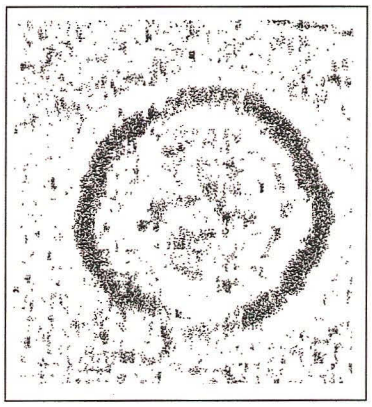
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections".

(c) Magnetic Susceptibility

Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

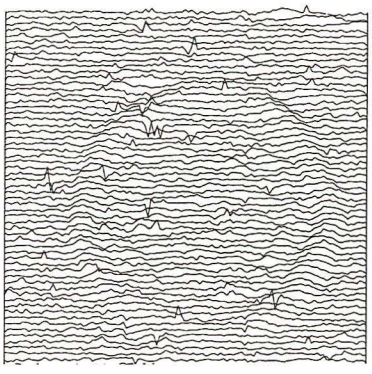
Display Options

The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.



(a) Dot-Density

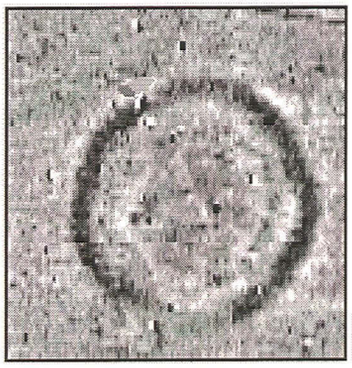
In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.



(b) X-Y Plot

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the indiviual anomalies. Results are produced on a flatbed plotter.

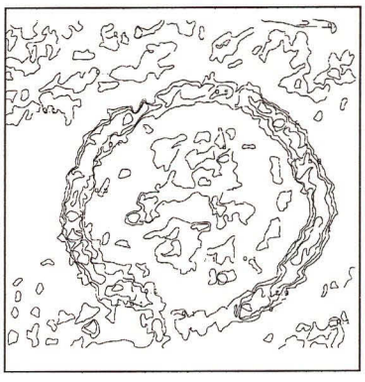
Display Options cont'd



(c) Grey-Scale

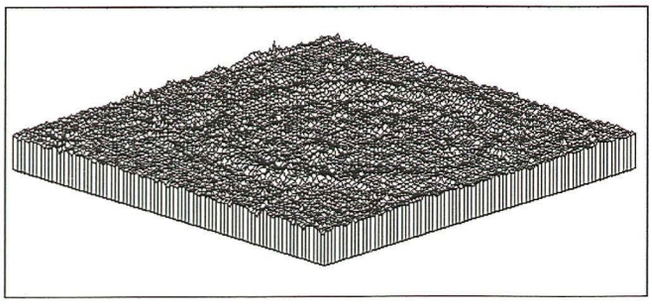
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. While colour plots can look impressive and can be used to highlight certain anomalies, grey-scales tend to be more informative.



(d) Contour

This display format is commonly used in cartographic displays. Data points of equal value are joined by a contour line. Closely packed contours indicate a sharp gradient. The contours therefore highlight an anomalous region. The range of contours and contour interval are selected manually and the display is then generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.

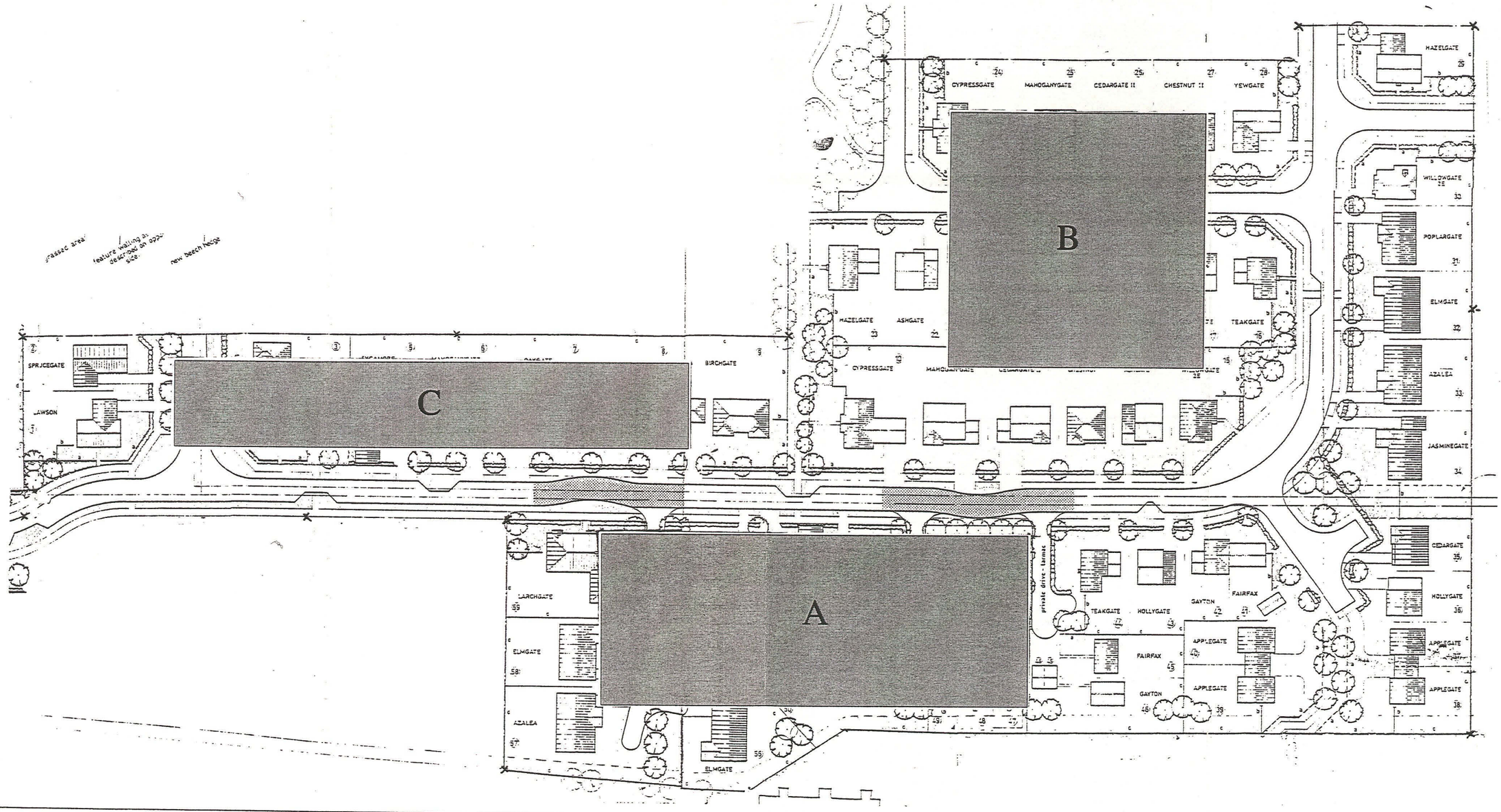


(e) 3-D Mesh

This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (b) above).

LIST OF FIGURES

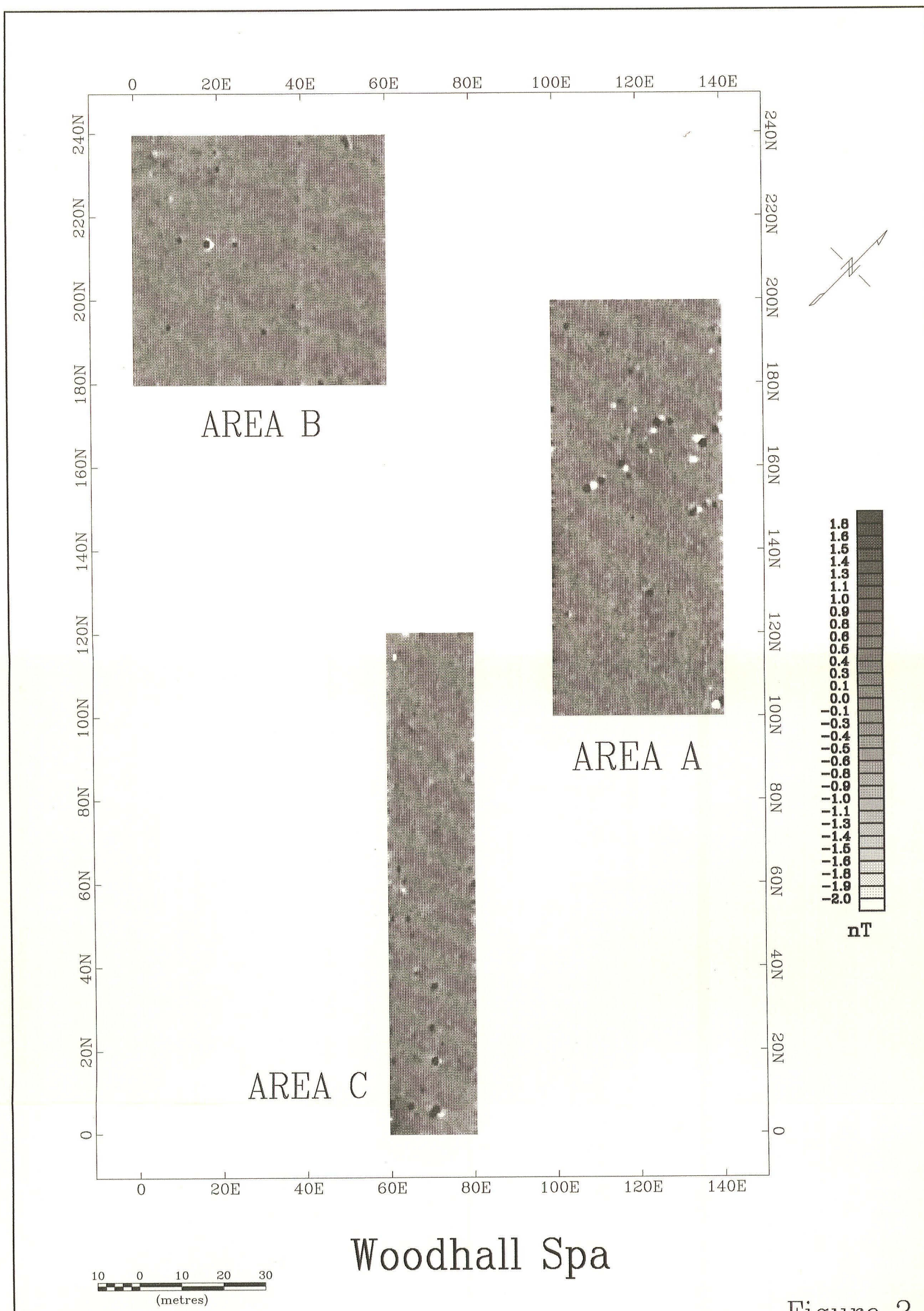
WOODHALL SPA
Location of Survey Areas



Based on a plan supplied by
Broadgate Homes

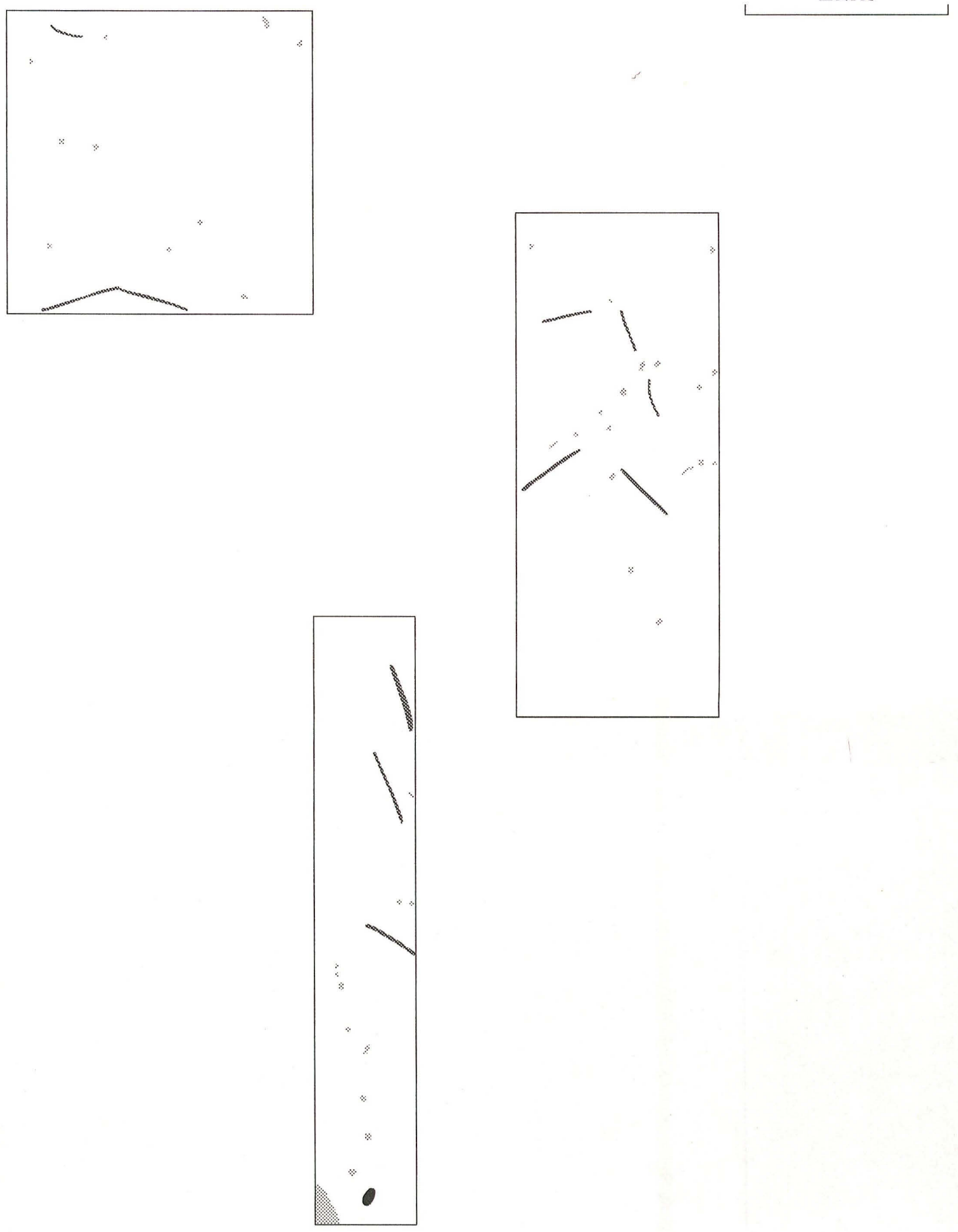
1:1000

Figure 1



Woodhall Spa

Figure 2



?Archaeology

?Natural

Ferrous

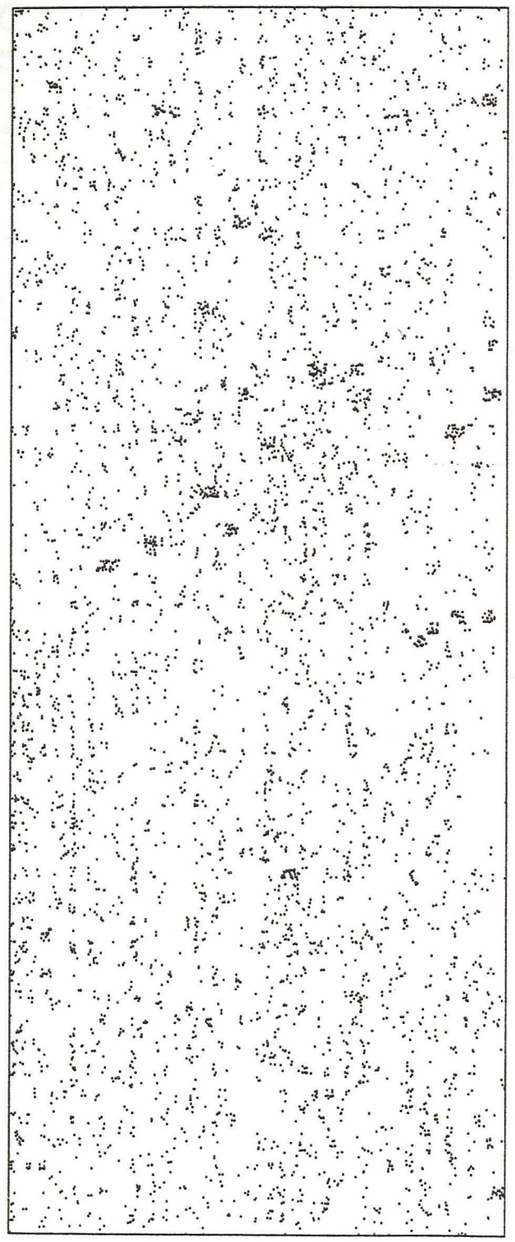
GEOPHYSICAL SURVEYS OF BRADFORD

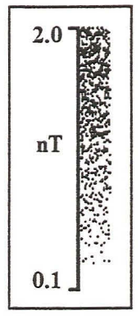
PROJECT: WOODHALL SPA, LINCS

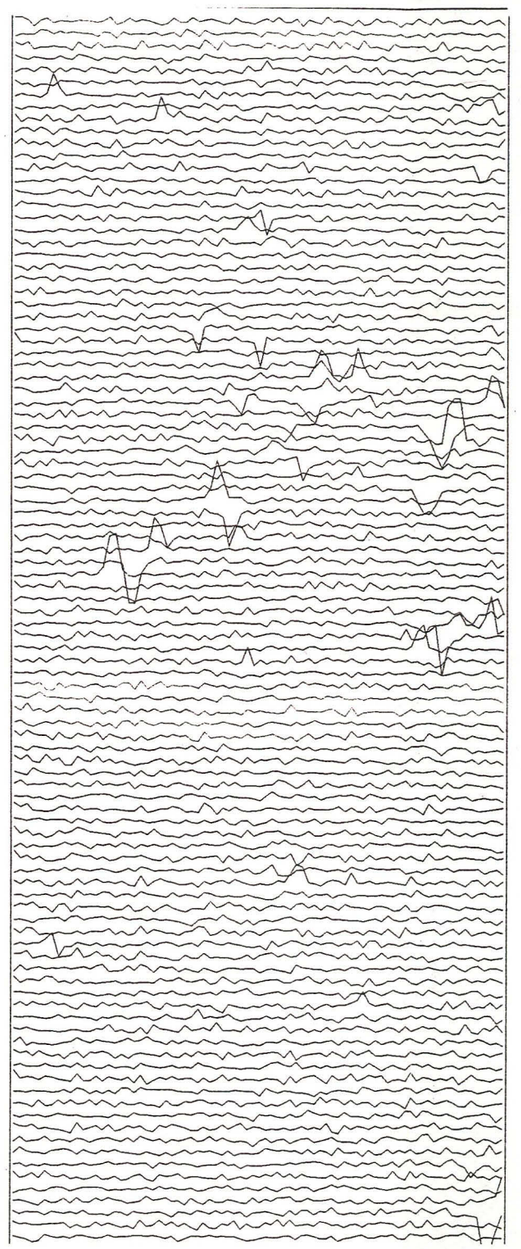
TITLE: Summary Interpretation Diagram

Figure 3

WOODHALL SPA
Area A







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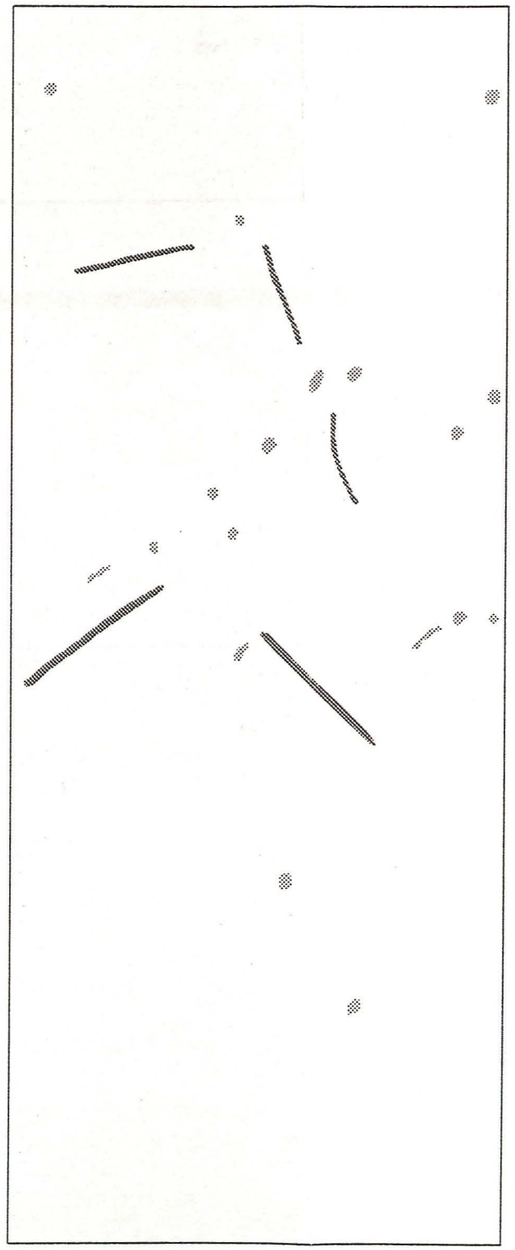


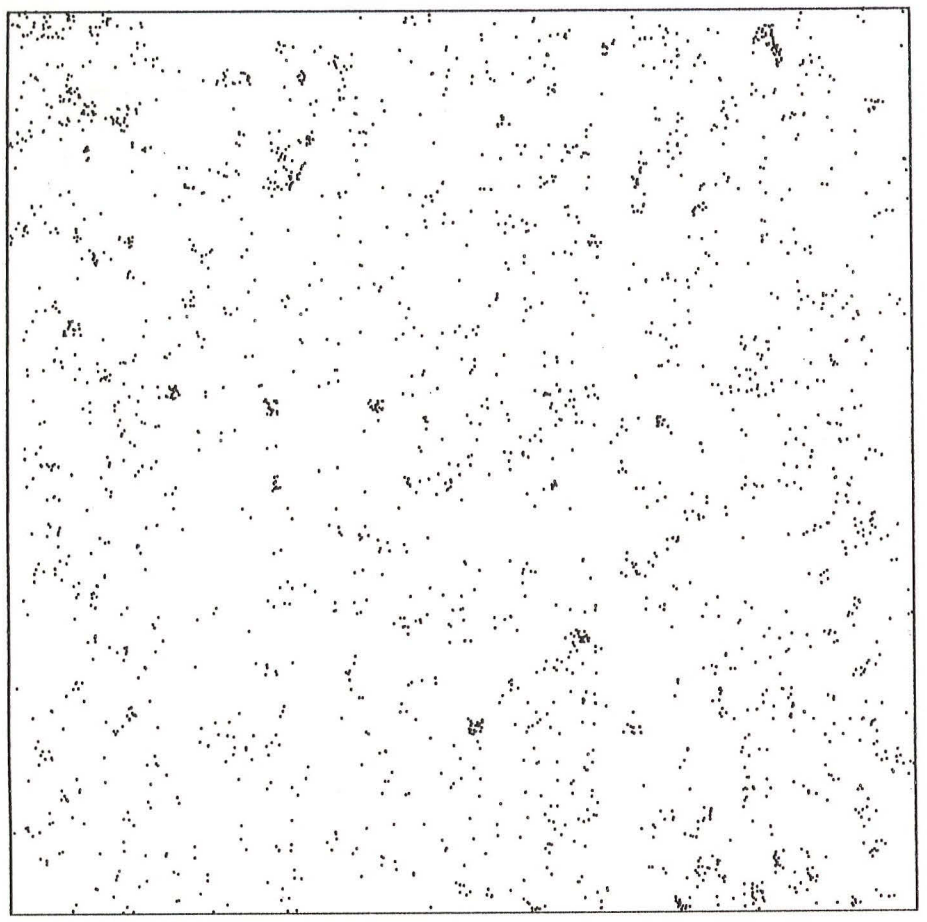
?Natural

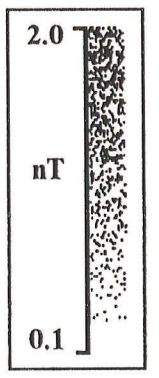
Ferrous

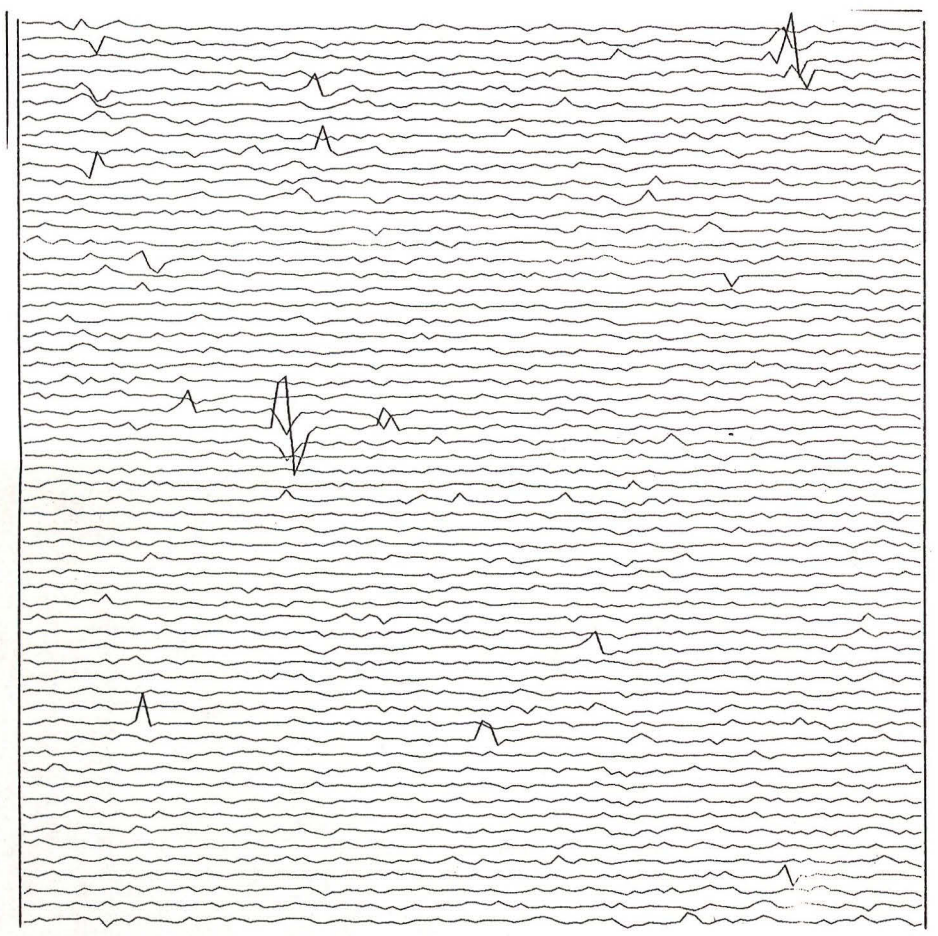
0 m 20

Figure 4

WOODHALL SPA
Area B







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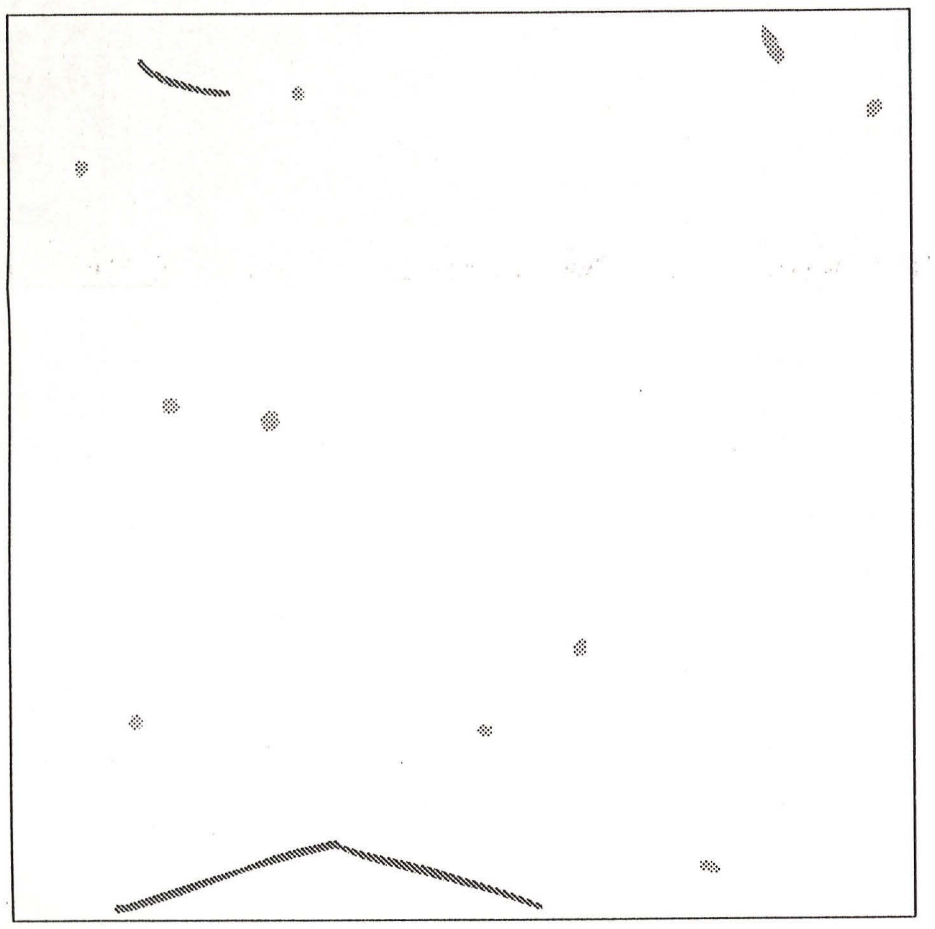
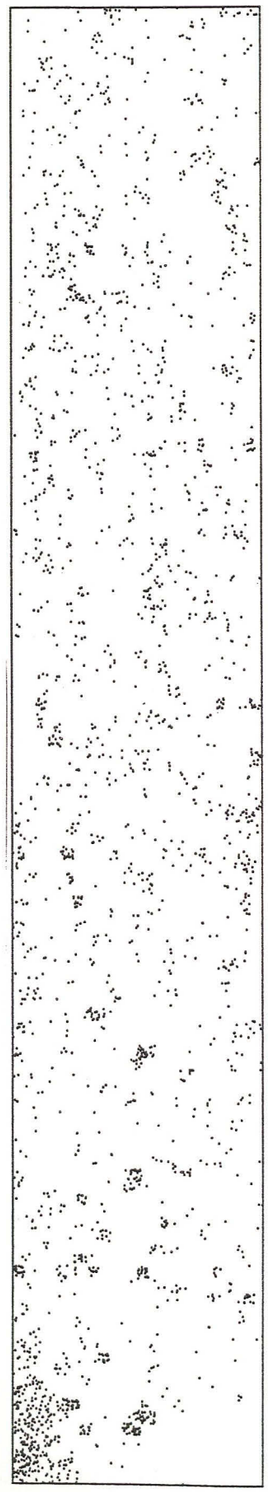


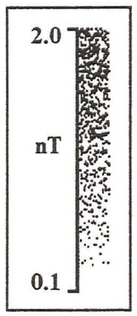
?Natural

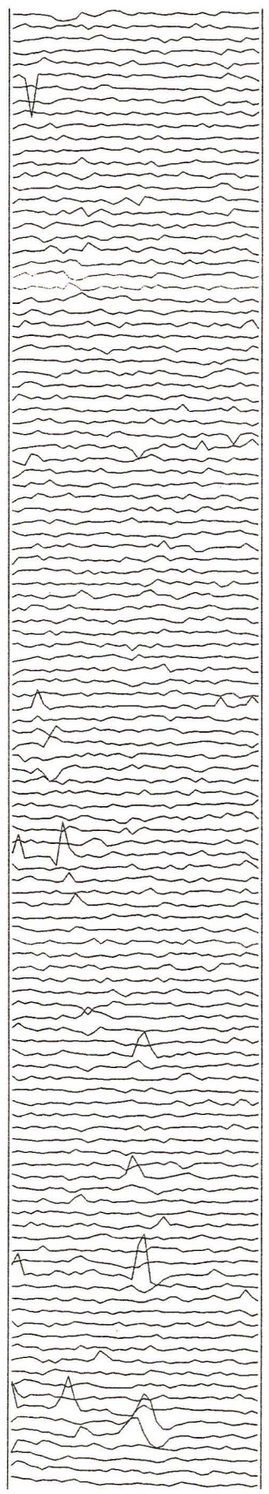
Ferrous

0 m 20

Figure 5







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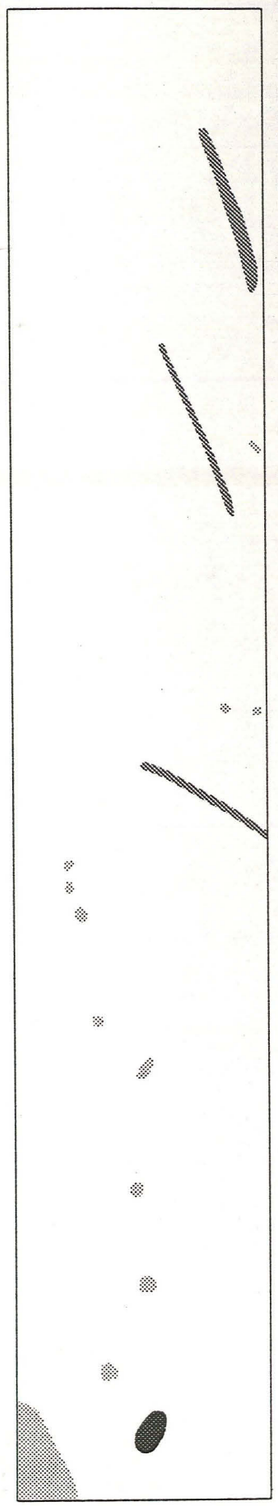

WOODHALL SPA
Area C

?Archaeology

?Natural

Ferrous

0 m 20

Figure 6