College Fields

Banbury

Oxfordshire

Geophysical Survey

Contents

Summary

A geophysical evaluation comprising magnetic scanning followed by selected detailed survey was undertaken at a site south of Banbury covering a total area of approximately 92 hectares. The detailed survey has confirmed that the variation in the magnetic background, noted during the scanning, is linked with the changes in the underlying geology although it is not thought that these changes are likely to have adversely affected the potential of the survey to identify any archaeological features. The practice of ridge and furrow ploughing has been confirmed in Blocks 7 and 9 but almost all the other linear anomalies are caused by modern field drainage systems. The area surrounding Blocks 2 and 3 is considered to have the highest archaeological potential. Although many of the anomalies here are interpreted as geological in origin some of the more linear responses could be indicative of archaeological activity, perhaps associated with the localised extraction of ironstone. Nevertheless, on the basis of the geophysical survey and the archaeological assessment, the archaeological potential of the site is deemed to be low.

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1. *Introduction and Archaeological Background*

1.1 Archaeological Services WYAS was commissioned to carry out a geophysical (magnetometer) evaluation of a site immediately east of Bodicote and south of Banbury (see Fig. 1), by Ben Stephenson of CPM Environmental Planning and Design on behalf of their clients J. J. Gallagher Limited and Hallam Land Management.

1.2 The area for evaluation (centred at NGR SP 4650 3860) comprised approximately 93 hectares of agricultural land, divided into several large fields, (see Fig. 2) which is the site of a proposed housing development. The site is bounded to the south by a sports centre, to the east by the Oxford Canal and field boundaries, and to the north and west by roads. Ground conditions for survey were ideal with the majority of the fields planted with a young cereal crop. Two fields were still under stubble and a third, containing extant earthworks, was under permanent pasture. The field at the extreme northern end of the site was covered with established scrub vegetation. Scanning was undertaken in this field but it was not suitable for detailed survey (see below). The fieldwork was carried out between January 17th and February 3rd 2005.

1.3 Topographically the site is generally flat to the south and west at about 115m AOD sloping fairly steeply through the centre of the site, where there are several springs, down towards the canal at the eastern boundary at 90m AOD. Geologically the site is quite complex (see Fig. 2) with outcropping Marlstone rock (which contains Ironstone) and Upper Lias clays predominating on the higher ground and Lower and Middle Lias clays on the slopes and the flatter low lying land adjacent to the canal. The Soil Survey of England and Wales map sheet for South East England (Sheet 6, 1983) shows the site to be mainly covered by soils of the Banbury Association. These soils are well drained and ferruginous. A narrow strip of soils of the Wickham 2 Association (soils subject to surface water wetness formed above a parent material of drift over Jurassic and Cretaceous clay or mudstone) runs parallel with the canal.

1.4 An Archaeological Assessment (CPM 2001) established that no previous archaeological work had been carried out within the site boundaries, that it does not lie within a Conservation Area and contains no Scheduled Ancient Monuments. This assessment of the archaeological and historical information concluded that the main archaeological potential of the site was likely to be for remains of medieval and post-medieval field systems; a study of air photographs and a site visit identified remains of ridge and furrow ploughing and former field systems under areas of permanent pasture and arable cultivation within part of the proposed development area. However, it was recognised that there was potential for chance finds or previously unknown archaeological deposits from the prehistoric period and Roman periods within the proposed site. Indeed a prehistoric flint scraper was found during a preliminary site visit at SP 4703 3842.

2. Methodology and Presentation

2.1 The general objectives of the geophysical evaluation were:

- to identify any areas of archaeological potential
- to establish the extent of any areas of archaeological potential
- to determine the nature of any archaeological magnetic anomalies.

2.2 As the overall area that may be impacted by the proposed development is relatively large (approximately 92 hectares), it was determined that magnetic scanning, undertaken using Geoscan FM36 fluxgate gradiometers, would be the most effective method of achieving the first objective. This method is particularly useful as a means of rapidly identifying areas of archaeological potential so that limited detailed survey can be focussed to best effect.

2.3 Magnetic scanning requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to identify. The relatively coarse sampling interval also means that discrete features, or linear features that are parallel or broadly oblique to the direction of traverse, may not be detected. The drawbacks mentioned above mean that ‘negative’ results from magnetic scanning should always be checked by an agreed amount of detailed survey.

2.4 The second and third objectives would be achieved by carrying out selected detailed survey of areas of potential highlighted by the scanning and of any other areas selected by the client. Detailed survey employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.5m or 0.25m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey therefore allows the visualisation of weaker anomalies that may not have been identified during the magnetic scanning.

2.5 Subsequent detailed survey would then be undertaken to cover between a minimum of 10% and a maximum of 20% of the proposal area. However, approximately 20 hectares of the site are to be retained as open space and will not be affected by any groundworks. Consequently it was determined that the agreed 10% minimum detailed site survey would equate to 7.5 hectares with an upper limit of 15 hectares. Apparently ‘blank’ areas as well as those identified as of potential were targeted.

2.6 The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David 1995) and by the IFA (Gaffney, Gater and Ovenden 2002). All figures reproduced from Ordnance Survey mapping are done so with the permission of the controller of Her Majesty’s Stationery Office. © Crown copyright.

2.7 A general site location plan, incorporating the 1:50000 Ordnance Survey mapping, is shown in Figure 1. Figure 2 is a site location plan with a digitised geological map, showing the processed greyscale gradiometer data, superimposed onto an Ordnance Survey digital base map supplied by the client, at a scale of 1:5000. The data is displayed in greyscale and XY trace plot (processed and 'raw') formats and interpreted in Figures 3 to 38 inclusive, at a scale of 1:1000.

2.8 Further technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the archive.

The figures in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

3. Results: Magnetometer Scanning

3.1 During scanning it was observed that the background soil noise varied dramatically across the site. In some places, particularly on the higher ground, the background was extremely perturbed, often fluctuating by +/- 3nT or more whilst in other areas, predominantly on the lower ground near to the canal, it was distinctly 'flat'. This variation is undoubtedly due to the underlying changes in geology, perhaps the most important contributory factor being the depth below the surface of the outcropping ironstone (see Fig. 2 – Marlstone rock bed). Certainly large pieces of stone could be seen on the surface of the fields in places and other large stones could be seen at the bottom of the hedgerows. Nevertheless it was anticipated that any occupational activity within the survey area would still be likely to be identifiable by magnetic scanning and/or detailed survey.

3.2 Linear anomalies were identified in most parts of the site; these anomalies were evaluated in Blocks 5, 6, 11, 12, 13, 14 and 15. Although these anomalies were not thought to be archaeologically significant the relative strength and frequency of the anomalies could have been masking the response from potentially weaker underlying archaeological features. Other areas with archaeological potential were evaluated by detailed survey in Blocks 7, 9 and 10. Block 7 was centred on the extant ridge and furrow earthworks and Block 9 sought to investigate an area of high background noise (+/- 5nT) identified as Church Ground on the first edition Ordnance Survey map of the area. Block 10 was centred on the spot where a flint tool was found during a preliminary site visit to ascertain whether there might be any associated activity. Block 8 sought to explain the extremely variable readings (+/- 9nT) noted during scanning, presumed to be the effect of the outcropping ironstone. Blocks 1, 2, 3 and 4 were located to sample as close as possible to areas where anomalies were identified during scanning but which, under the current proposals, are within areas designated for public open space and therefore will not be disturbed.

3.3 Several ferrous ‘raw water’ pipes were traced during the scanning and the approximate position and alignment of these pipes is also shown in Figure 2.

3.4 At the very northern end of the site (see Fig. 2) the readings indicated a massive degree of ferrous contamination over the whole of the field. Indeed the ground level of the field was raised in relation to that bordering it to the south-east. Substantial tipping has obviously taken place making any detailed survey in this area pointless.

3.5 The low height (less than 0.1m) of the young cereal crop at the time of survey meant that visibility was ideal for finds spotting. However, only occasional sherds of post-medieval pottery were noted during the scanning.

4. Results: Detailed Survey

4.1 Block 1 (Figs 3, 4 and 5)

4.1.1 Block 1 was positioned to the north of the site on ground sloping away to the north-east and was the only block located on the Lower Lias clays. The most noticeable characteristic of the data is the very ‘flat’ magnetic background that is due to the homogeneous nature of the clay geology and soils. This area when scanned was quiet with only a few discrete anomalies identified.

4.1.2 Present within the block are several weak linear trend anomalies aligned from north-west to south-east that reflect either field drains or a recent ploughing regime. Oblique to these agricultural anomalies are two other weak, positive linear anomalies. A modern (agricultural?) origin is considered the most likely interpretation.

4.1.3 A cluster of dipolar (‘iron spike’) anomalies, which are likely to be caused by modern ferrous debris in the topsoil, is identified towards the south-east corner of the block.

4.2 Block 2 (Figs 6, 7 and 8)

4.2.1 This block was positioned immediately adjacent to an area, which under the current proposals will not be affected by the development, but where several anomalies were identified during scanning.

4.2.2 The magnetic background is again generally ‘flat’ in this block reflecting the Middle Lias clay geology but at the northern end of the block there are several irregular areas of variable magnetic response, some with a pronounced negative component. Although some of these anomalies have a degree of linearity it is considered likely that these responses have a geological origin.

4.3 Block 3 (Figs 9, 10 and 11)

4.3.1 Block 3 was also positioned near to a possible area of interest located in the scanning. Originally the block measured 120m by 40m but was later expanded to resolve and help interpret anomalies identified in the initial survey that were thought to be possibly archaeological in origin.

4.3.2 Numerous areas of variable magnetic background have been recorded in this block, particularly in the north-east and south-west corners. However, the very broad nature of most of these responses is indicative of an underlying geological cause, possibly by the Marlstone bedrock outcropping near the surface.

4.3.3 Three short linear anomalies aligned broadly from west to east have also been identified. It is difficult to be confident of the cause of these anomalies but an archaeological origin cannot be dismissed.

4.4 Block 4 (Figs 12, 13 and 14)

4.4.1 Numerous linear trends aligned from north-west to south-east are caused by field drains whilst the linear anomalies perpendicular to the drains are due to recent ploughing activity. A few small areas of magnetic enhancement are likely to be caused by recent ground disturbance associated with the installation of the drains.

4.5 Blocks 5 and 6 (Figs 15, 16 and 17)

4.5.1 Blocks 5 and 6 were located on either side of a large field where the magnetic background was noted to vary during the scanning being ‘quiet’ to the north and ‘noisy’ to the south. Two blocks were located in this field to investigate whether the change in magnetic susceptibility could be archaeologically significant.

4.5.2 Field drains are again present across the whole of Block 5 but there are three small discrete anomalies in the north-eastern corner that could be caused by infilled archaeological features such as a pits. However, given the lack of any supporting information modern disturbance associated with the drains or localised variation in the topsoil are considered to be far more likely explanations for the identified anomalies.

4.5.3 A series of linear trend anomalies aligned from north-east to south-west divide the drainage derived anomalies in Block 6. These anomalies are also interpreted as agricultural in origin probably being indicative of a former field boundary or of a main drain. They are not thought to be archaeological in origin.

4.5.4 The variation noted during the scanning appears to be related to the change in geology (see Fig. 2) from high susceptibility Marlstone rock in Block 5 to clay that is mainly low susceptibility.

4.6 Blocks 7 and 8 (Figs 18, 19 and 20)

4.6.1 Block 7 was positioned over the extant ridge and furrow. The earthworks are readily apparent as the broad linear anomalies aligned from north-west to south-east. Apart from some magnetic disturbance caused by ferrous material in the field boundary at the south-eastern end of the block no other anomalies have been identified.

4.6.2 Block 8 was located to establish the cause of the extreme variation noted during the scanning. Figure 2 shows that this block is right on the boundary of the Upper Lias clays but predominantly on the marlstone rock bed. Therefore the variation is interpreted as geological in origin.

4.7 Block 9 (Figs 21, 22 and 23)

4.7.1 Block 9 was positioned within a small, enclosed field called Church Ground on the first edition Ordnance Survey mapping. The whole of the field was very noisy during scanning and a block was placed here to ascertain whether or not the ‘noise’ could have an archaeological origin.

4.7.2 A raised trackway through the middle of the block manifests as the linear band of magnetic disturbance aligned from north-west to south-east. Very strong linear anomalies indicative of ridge and furrow ploughing are also present across the whole block. The numerous 'iron spikes' anomalies are caused by ferrous debris incorporated into the topsoil when the field was divided into allotments.

4.8 Block 10 (Figs 24, 25 and 26)

4.8.1 This block was positioned to locate a former field boundary and to evaluate an area of 'noise' near to where a flint tool was discovered during a preliminary site visit.

4.8.2 Although the field boundary has not been identified its location is implied by the gap between, and change in orientation of, the linear anomalies that are caused by a system of field drains. No other anomalies were located that could have been associated with the flint tool find. The source of the 'noise' was not discovered from the detailed survey but the geology map of the area does show a change in geology immediately to the north-east, which could be the explanation for the change in readings.

4.9 Block 11 (Figs 27, 28 and 29)

4.9.1 This block was placed where a number of scanning hits were located. However, the major anomalies in this block are those caused by the two alignments of field drains. A single discrete anomaly has also been identified. Whilst the response could be due to an infilled pit the lack of any other potentially archaeological anomalies in the vicinity reduce the likelihood of an archaeological origin and a modern or geological cause is considered probable.

4.10 Block 12 (Figs 30, 31 and 32)

4.10.1 This block was positioned over a number of weak, positive anomalies noted during the scanning. The detailed survey has again identified two alignments of field drains although the resultant magnetic anomalies are significantly weaker than those from drains located in other blocks across the site.

4.11 Blocks 13 and 14 (Figs 33, 34 and 35)

4.11.1 These blocks were positioned towards the south-eastern end of the site. Block 13 was positioned to locate the former field boundary and to test a number of linear responses. The gap between the two systems of field drains correlates with a ridge in the field and although there is no geophysical evidence for this, it would seem sensible to interpret this as the position of the former field boundary. There is also a small cluster of dipolar anomalies located in the 'blank' area between the field drains. This adds to the implication that the field boundary ran in this 'blank' area as ferrous material often accumulates in hedge boundaries.

4.11.2 Block 14 also contains field drains but the anomalies here are a lot weaker in strength than in Block 13. Figure 2 shows that the two blocks are on different geologies, Block 13 being on the Upper Lias clays whilst Block 14 is on the Marlstone Rock. The difference in magnetic susceptibility between the mainly low susceptibility of the clay and the relatively high susceptibility of the Marlstone rock means that the anomaly caused by the drain will appear 'stronger' where the susceptibility is lower and the magnetic contrast greatest (i.e in Block 13).

4.11.3 The dipolar responses located in a cluster towards the northern end of the block are not considered to be archaeological in nature.

4.11.4 Several areas of magnetic enhancement have also been identified. Whilst any of these anomalies could be potentially archaeological in nature it is considered probable that all are caused by recent ground disturbance associated with the installation of the field drains to which all the anomalies are immediately adjacent.

4.12 Block 15 (Figs 36, 37 and 38)

4.12.1 Two high susceptibility linear trends, aligned from north-east to south-west and located in close proximity to a service pipe noted during the scanning (see Fig. 2) align with the extant track to the north which now deviates to the west. It is therefore considered that these anomalies may be due to a trackway, or the ditch of a field boundary, that pre-date the first edition Ordnance Survey map.

4.12.2 The small area of magnetic enhancement again has the potential to be archaeological but the preponderance of anomalies with an obviously modern origin, including the ubiquitous field drains, again mean that a recent origin for this anomaly is considered probable.

5. Discussion and Conclusions

5.1 The detailed survey has confirmed that the variation in the magnetic (soil noise) background, noted during the scanning, is demonstrably linked with the changes in the underlying geology. The 'flattest' (least variable) background is evident in Block 1 located on the Lower Lias clays and the most variable being located in Blocks 3 and 8 on the boundary between the Middle Lias clays and the Marlstone Rock where strong anomalies, interpreted as being caused by the ironstone outcropping near to the surface, have been identified. However, it is not thought that the changes in geology are likely to have adversely affected the potential of the survey to identify any archaeological features.

5.2 Anomalies have been located in all the areas indicated by the scanning. However, almost all the linear anomalies are caused by modern field drainage systems. The practice of ridge and furrow ploughing has been confirmed in Blocks 7 and 9, both of which are still under permanent pasture. Given the distance between the two blocks it is considered likely that many other fields within the site are also likely to have been under cultivation in the medieval and post-medieval periods but that decades of modern ploughing have removed any evidence for this practice.

5.3 The part of the site that is considered to have the highest archaeological potential is the area surrounding Blocks 2 and 3. Although many of the anomalies here are interpreted as geological in origin some of the more linear responses could be indicative of archaeological activity, perhaps associated with the localised extraction of ironstone. Immediately south-east of Block 2 is a relatively flattish plateau where several anomalies were identified during scanning. Topographically this could have been a favourable location for occupation being in the lee of the ridge and above a spring line further down the slope. No detailed blocks were positioned here as this part of the site and that to the south-east of Block 3 are currently earmarked as open-spaces and will therefore not be impacted under the current development proposals.

5.4 Nevertheless, on the basis of the geophysical survey and the archaeological assessment the archaeological potential of the site is deemed to be low.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains.

Bibliography

David, A., 1995. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines* No. 1. English Heritage

Randell, S., 2001 *Land at Bodicote, Banbury, Oxfordshire.* Archaeological Assessment. Unpublished CPM

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Appendices

Appendix 1

Magnetic Survey: Technical Information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. Less magnetic material such as masonry or plastic service pipes that intrude into the topsoil may give a negative magnetic response relative to the background level.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed ***'positive'***. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as ***'negative'*** anomalies that, conversely, means that the response is negative relative to the mean magnetic background. Such negative anomalies are often very faint and are commonly caused by modern, non-ferrous, features such as plastic water pipes. Infilled natural features may also appear as negative anomalies on some geological substrates.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies that are interpreted as modern in origin may be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. An agricultural origin, either ploughing or land drains is a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an X–Y trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Magnetic Susceptibility Survey

There are two methods of measuring the magnetic susceptibility of a soil sample. The first involves the measurement of a given volume of soil, which will include any air and moisture that lies within the sample, and is termed volume specific susceptibility. This method results in a bulk value that it not necessarily fully representative of the constituent components of the sample. The second technique overcomes this potential problem by taking into account both the volume and mass of a sample and is termed mass specific susceptibility. However, mass specific readings cannot be taken in the field where the bulk properties of a soil are usually unknown and so volume specific readings must be taken. Whilst these values are not fully representative they do allow general comparisons across a site and give a broad indication of susceptibility changes. This is usually enough to assess the susceptibility of a site and evaluate whether enhancement has occurred.

Methodology: Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***magnetic scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10m apart. The instrument logger is not used and there is therefore no data collection. Once anomalous responses are identified they are marked in the field with bamboo canes and approximately located on a base plan. This method is usually employed as a means of selecting areas for detailed survey when only a percentage sample of the whole site is to be subject to detailed survey.

The disadvantages of magnetic scanning are that features that produce weak anomalies (less than 2nT) are unlikely to stand out from the magnetic background and so will be difficult to detect. The coarse sampling interval means that discrete features or linear features that are parallel or broadly oblique to the direction of traverse may not be detected. If linear features are suspected in a site then the traverse direction should be perpendicular (or as close as is possible within the physical constraints of the site) to the orientation of the suspected features. The possible drawbacks mentioned above mean that negative results from magnetic scanning should **always** be checked with at least a sample detailed magnetic survey (see below).

The second method is referred to as ***detailed survey*** and employs the use of a sample trigger to automatically take readings at predetermined points, typically at 0.5m intervals, on zig-zag traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation. Detailed survey allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

The Geoscan FM36 fluxgate gradiometer and Bartington Grad601 magnetometer were used for the detailed gradiometer survey. Readings were taken, on the 0.1nT range, at 0.25m intervals on zig-zag traverses 1m apart within 20m by 20m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

Data Processing and Presentation

The detailed gradiometer data has been presented in this report in greyscale and XY trace plot format having been selectively processed and interpolated using Geoplot (Geoscan Research) software. The greyscale plots are displayed using a linear incremental scale as indicated on the display plots.

X-Y trace plot format allows the full range of data to be viewed, dependent on the clip, allowing the 'shape' of individual anomalies to be discerned and potentially archaeological anomalies differentiated from ferrous 'iron spike' responses.

Appendix 2

Survey Location Information

A Geotronics 600 series Geodimeter was used to set out the corners of the survey blocks. Due to the large size of the site several different grid alignments were used. Temporary reference points (survey marker stakes) were left in place for accurate geo-referencing and the grids tied-in relative to these markers and to field boundaries. The survey grids were then superimposed onto an Ordnance Survey map base as a best fit to produce the grid locations and the co-ordinates listed below. Overall there was a good correlation between the local survey and the digital map base and it is estimated that the average 'best fit' error is better than ±1.5m. However, it should be noted that Ordnance Survey 1:2500 Superplan mapping has an error of ±1.9m at 95% confidence. These potential errors must be considered if distances are measured off, or if the tie in survey is used in GPS systems, for relocation purposes.

The locations of the temporary reference points are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below.

Station	Easting	Northing
A	446624.7	238954.1
B	446647.4	238986.2
C	446744.8	238980.7
D	446767.4	238601.3
E	446806.8	238548.8
F	446886.2	238557.0
G	446900.9	238563.9
H	446996.1	238536.7
I	447072.2	238513.9
J	447049.9	238356.3
K	447086.2	238271.7
L	447193.1	238217.3
M	446832.0	238022.0
N	446760.1	237913.9
O	446469.3	238382.7
P	446424.6	238343.9
Q	446371.4	238350.6

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party or for the removal of any of the survey reference points.

Appendix 3

Geophysical Archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Word 2000), and graphics files (CorelDraw8 and AutoCAD 2000) files.
- a full copy of the report

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the relevant Sites and Monument Record Office).