



Plate 1. Trench 4, ditch 109, looking north-west



Plate 2. Trench 7, gully 103, looking south-east



Plate 3. Trench 9, general shot of ditch 143 and 145, looking east



Plate 4. Trench 9, ditch 145, looking east



Plate 5. Trench 28, ditch 127, looking south-west



Plate 6. Trench 29, ditch 123, looking north



Plate 7. Trench 34, post-holes 132 and 135, looking east



Plate 8. Field F looking east following backfilling.



Plate 9. Dam area looking east following backfilling.



Plate 10. Field G looking north-west following backfilling.



Plate 11. Section through a field drain, Trench 45.



Plate 12. Sondage through palaeochannel, Trench 76.

Appendix 1: Written Scheme of Investigation

Ripon Flood Alleviation Scheme Birkby Nab North Yorkshire

Written Scheme of Investigation for a Programme of Archaeological Works

1. Introduction

- 1.1 An archaeological scheme of recording is required in advance of the construction phase of the proposed Ripon Flood Alleviation Scheme at Birkby Nab. This document is prepared to fulfil the North Yorkshire County Council (Heritage and Environment Section) requirement for a programme of archaeological work as a condition of approval of the planning application and is produced by Archaeological Services WYAS at the request of Phil Catherall, of the Environment Agency.

2. Site location

- 2.1 The site is located approximately 3km north-west of Ripon on the River Laver and is centred at SE 2755 7265. Topographically the site gently rises to the north-west being situated at about 60m above Ordnance Datum. The geology comprises drift deposits of sands and gravels and alluvial material overlying Lower Magnesian Limestone. The soils are deep, well-drained loams prone to seasonal waterlogging.

3. Archaeological Background

- 3.1 Geophysical survey covering 16 hectares has been undertaken at several locations (Catherall 2004 and Harrison and Webb 2006) prior to the finalisation of the construction design proposals. These non-intrusive surveys have identified several anomalies that have been interpreted as potentially archaeological in nature as well as others due to agricultural practice and geology/soils.

4. Evaluation Methodology

Aims

- 4.1 The aim of this stage of the evaluation is to provide detailed information on the presence or absence of the extent, character, date, depth of burial and degree of survival of archaeological deposits and features identified within the three areas within the site and to provide an indication of their extent character, date, significance and level of survival.

Scope of Work

4.2 Two areas for further evaluation have been identified following geophysical survey:-

- Field F – this area is the preferred location of the borrow pit from which material will be quarried for the construction of the earthwork dam. Geophysical survey has been undertaken here and potentially archaeological anomalies identified. Trial Trenching to cover 5% of the area (4600m²) will be undertaken in this area (see attached plan and rationale below).
- Southern limb of the dam. Trial trenching to cover the dam area will be undertaken to cover 5% of the area (412m²). This may necessitate some supplementary geophysical survey prior to the determination of trench location.

An additional area for initial evaluation has also been identified:-

- Field G – material from this location will also be extracted for use in the construction programme. Geophysical survey to cover the full area (3.8 hectares) will be undertaken (see attached figure). Following consultation a scheme of trial trenching (up to 5% of the area – 1910m²) will be proposed to evaluate any anomalies identified as well as apparently 'blank' areas.

Rationale – Field F

Trench No.	Area	Rationale
1	50m x 2m	Investigate linear anomalies
2	50m x 2m	Investigate two magnetic anomalies
3	50m x 2m	Investigate apparently 'blank' area
4	50m x 2m	Investigate apparently 'blank' area
5	50m x 2m	Investigate apparently 'blank' area
6	50m x 2m	Investigate apparently 'blank' area
7	25m x 4m	Investigate linear magnetic anomaly
8	50m x 2m	Investigate apparently 'blank' area
9	20m x 5m	Investigate linear anomaly
10	50m x 2m	Investigate 'blank' area
11	25m x 4m	Investigate linear alignment of discrete anomalies
12	50m x 2m	Investigate 'blank' area
13	20m x 5m	Investigate linear anomaly
14	25m x 4m	Investigate cluster of discrete anomalies

Trench No.	Area	Rationale
15	50m x 2m	Investigate discrete anomaly
16	25m x 4m	Investigate terminus of linear anomaly
17	25m x 4m	Investigate cluster of discrete anomalies
18	25m x 4m	Investigate area of enhanced magnetic background
19	25m x 4m	Investigate large discrete area of magnetic enhancement
20	50m x 2m	Investigate apparently 'blank' area
21	50m x 2m	Investigate apparently 'blank' area
22	50m x 2m	Investigate apparently 'blank' area
23	50m x 2m	Investigate apparently 'blank' area
24	50m x 2m	Investigate discrete areas of enhancement
25	25m x 4m	Investigate discrete areas of enhancement
26	50m x 2m	Investigate discrete areas of enhancement
27	10m x 10m	Investigate discrete areas of enhancement
28	25m x 4m	Investigate discrete areas of enhancement
29	50m x 2m	Investigate linear anomalies
30	25m x 4m	Investigate discrete areas of enhancement
31	50m x 2m	Investigate linear anomalies
32	10m x 10m	Investigate four discrete anomalies
33	50m x 2m	Investigate linear anomalies
34	50m x 2m	Investigate linear anomalies
35	50m x 2m	Investigate apparently 'blank' area
36	50m x 2m	Investigate linear anomalies
37	50m x 2m	Investigate apparently 'blank' area
38	50m x 2m	Investigate apparently 'blank' area
39	50m x 2m	Investigate apparently 'blank' area
40	50m x 2m	Investigate apparently 'blank' area
41	50m x 2m	Investigate apparently 'blank' area
42	50m x 2m	Investigate apparently 'blank' area
43	25m x 4m	Investigate discrete areas of enhancement
44	50m x 2m	Investigate apparently 'blank' area
45	50m x 2m	Investigate apparently 'blank' area
46	50m x 2m	Investigate linear anomalies

Trench No.	Area	Rationale
TOTAL	4600m²	

Rationale – Dam Site

Trench No	Area	Rationale
47	20m x 2m	Investigate apparently 'blank' area
48	20m x 2m	Investigate apparently 'blank' area
49	20m x 2m	Investigate apparently 'blank' area
50	20m x 2m	Investigate apparently 'blank' area
51	20m x 2m	Investigate linear anomaly
52	20m x 2m	Investigate apparently 'blank' area
53	20m x 2m	Investigate apparently 'blank' area
54	20m x 2m	Investigate apparently 'blank' area
55	20m x 2m	Investigate linear anomaly
56	20m x 2m	Investigate apparently 'blank' area
57	20m x 2m	Investigate apparently 'blank' area
TOTAL	440m²	

Methodology

Geophysical Survey

- 4.3 Archaeological Services WYAS will set out all survey areas using a Trimble 5600 total station theodolite. The site grid will be tied into permanent landscape features and superimposed onto digital data supplied by the client. Survey stations and semi-permanent marker pegs will be left on site, so that the grid can be accurately re-located by a third party.
- 4.4 A fluxgate gradiometer (Bartington Grad601) will be used. Readings will be taken at 0.25m intervals on zig-zag traverses 1m apart within 20m by 20m grids such that 1600 readings will be taken in each grid. These readings are stored in the memory of the instrument and are later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software will be used to process and present the data. The data will be interpreted and presented at suitable scales and located on Ordnance Survey base maps as requested. Processed greyscale, raw XY trace plots and interpretations will be presented at a scale no less than 1:1000 in the report.

4.5 The survey methodology, report and any recommendations will comply with guidelines outlined by English Heritage (David *et al* 2008) 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).

4.6 Interim plots and interpretations will be produced immediately on completion of the fieldwork so that a trenching proposal can be produced. The survey results will be incorporated into the trial trench evaluation report. This will include all relevant information including archaeological and planning background, aims, results, discussion and conclusion as well as all technical and processing information. A project archive will be prepared in accordance with recent good practice guidelines and submitted to the client in acceptable formats. The geophysical archive will comprise:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Word 2000), and graphics files (Adobe Illustrator and AutoCAD 2007) files.
- a full copy of the report

Trial Trenching

4.7 The controlled stripping of ploughsoil, to the archaeologically required level, shall be carried out using a 360° tracked excavator equipped with a toothless ditching bucket under archaeological supervision. Stripping will take place in level spits to the top of the first archaeological horizon or undisturbed natural. The resulting surface will be inspected for archaeological remains. Where archaeological remains require clarification, the relevant area will be cleaned by hand. Under no circumstances will the machine be used to cut arbitrary trenches down to natural deposits, nor shall plant run upon the stripped area unless it is agreed with the supervising archaeologist.

4.8 Archaeological Services WYAS will first plan and then manually excavate a sample of all archaeological features in an archaeologically controlled and stratigraphic manner in order to meet the aims and objectives outlined above. The features will be investigated employing the following sampling strategies:

- Linear features: sufficient excavation will be carried out to investigate the depth, profile and fills of a ditch or gully and to recover dating and environmental evidence from its fills. Normally this will involve a minimum of 10% sample dispersed along the length of the feature (each sample section to be not less than 1m), or a minimum of a 1m sample section if the feature is less than 10m long or if only a small part of it is exposed. With respect to trial trenches, one 1m section will be located and recorded adjacent to the trench edge. Feature intersections will always be excavated in such a way to determine a stratigraphic relationship.

- Discrete features: pits, post-holes and other discrete features will normally be half-sectioned to determine and record their form with a minimum sample of 50% of discrete features in each area. The complete excavation of such features may be appropriate, but only following consultation with the North Yorkshire Heritage Unit.
- 4.9 A full written, drawn and photographic record of all material revealed during the course of the work shall be made. The excavation limits will be surveyed using electronic survey equipment with larger scale hand drawn plans of features at 1:20 or 1:50, as appropriate. Sections of linear and discrete features will be drawn at 1:10. All sections, plans and elevations will include spot-heights related to Ordnance Datum in metres as correct to two decimal places and survey. Tie-in information will be undertaken during the course of the evaluation and will be fixed in relation to nearby permanent structures and roads and to the National Grid.
- 4.10 All artefacts recovered will be retained and removed from the site for assessment and analysis, and where it is appropriate finds shall be recorded three dimensionally. Non-modern artefacts will be collected from the excavated topsoil and subsoil. Finds material will be stored in controlled environments, where appropriate. All artefacts recovered will be retained, cleaned, labelled and stored as detailed in the guidelines laid out in the IFA Guidelines for Finds Work. Any conservation work will be undertaken by approved conservators working to UKIC guidelines.
- 4.11 Archaeological Services WYAS shall fully record all excavated archaeological contexts by detailed written records giving details of location, composition, shape, dimensions, relationships, finds, samples, and cross-references to other elements of the record and other relevant contexts, in accordance with best practice and in accordance with methods previously approved by the North Yorkshire Heritage Unit. All contexts, and any small finds and samples from them will be given unique numbers. Bulk finds will be collected by context. Colour digital and monochrome negative photographs at a minimum format of 35mm will be taken.
- 4.12 A soil-sampling programme shall be undertaken during the course of the investigation for the identification and recovery of carbonised and waterlogged remains, vertebrate remains, molluscs and small artefactual material. Environmental and soil specialists will be consulted during the course of the excavation with regard to the implementation of this sampling programme. Provision should be made for the removal of soil samples of between 10 and 30 litres (where appropriate), from deposits with clear potential, and larger samples from any rich carbonised deposits. Particular attention will be paid to the sampling of primary ditch fills and any surviving buried soils beneath banks or other positive features. Environmental material removed from site will be stored in appropriate controlled environments. The collection and processing of environmental samples will be undertaken in accordance with guidelines set out in the Association for Environmental Archaeology's (1995) Working Paper No. 2, "Environmental Archaeology and Archaeological Evaluations - Recommendations concerning the environmental archaeology component of archaeological evaluations in England". In addition, the processing of environmental samples will only take place within facilities approved for such purposes by English Heritage's Regional Science Advisor.

- 4.13 In the event of human remains being discovered they will be left in situ and covered and protected in the first instance. The removal of human remains will only take place in compliance with the Burial Act 1857 and with an exhumation licence obtained from the Ministry of Justice (MoJ) prior to the removal of the remains. Provision will be made for the specialist reporting of the remains by a recognised osteoarchaeologist.
- 4.14 Provision will be made for the recovery of samples suitable for scientific dating (e.g. radiocarbon / AMS dating, archaeomagnetic and dendrochronological dating).
- 4.15 All finds of gold and silver and associated objects shall be reported to HM Coroner according to the procedures relating to the Treasure Act 1997, after discussion with the Environment Agency and the North Yorkshire Heritage Unit.

5. Analysis and Reporting

- 5.1 The site archive will contain all the data collected during the excavation, including records, finds and environmental samples. It will be quantified, ordered, indexed and internally consistent. Adequate resources will be provided during fieldwork to ensure that all records are checked and internally consistent. Archive consolidation will be undertaken immediately following the conclusion of fieldwork:
- the site record will be checked, cross-referenced and indexed as necessary;
 - all retained finds will be cleaned, conserved, marked and packaged in accordance with the requirements of the recipient museum;
 - all retained finds will be assessed and recorded using pro forma recording sheets, by suitably qualified and experienced staff. Initial artefact dating will be integrated within the site matrix;
 - all retained environmental samples will be processed by suitably experienced and qualified staff and recorded using pro forma recording sheets.
- 5.2 The archive will be assembled in accordance with the specification set out in English Heritage's *Management of Archaeological Projects* (English Heritage 1991; Appendix 3). In addition to the site records, artefacts, ecofacts and other sample residues, the archive shall contain:
- site matrices where appropriate;
 - a summary report synthesising the context record;
 - a summary of the artefact record;
 - a summary of the environment record.

- 5.3 The integrity of the primary field record will be preserved. Security copies will be maintained where appropriate.
- 5.4 Provision will be made for the deposition of the archive, artefacts and environmental material, subject to the permission of the relevant landowner (and if no further archaeological work is to be initiated), in the appropriate recipient museum, in this instance Malton Museum, Old Town Hall, Market Place, Malton. The museum will be advised of the timetable of the proposed investigation prior to excavation commencing. The archive will be prepared in accordance with the guidelines published in "Guidelines for the preparation of Excavation Archives for long-term storage" (United Kingdom Institute for Conservation, 1990) and Standards in the Museum care of archaeological collections (Museums and Galleries Commission 1994). Provision will be made for the stable storage of paper records and their long-term storage.
- 5.5 Upon completion of the investigations, the artefacts, ecofacts and stratigraphic information shall be assessed as to their potential and significance for further analysis.
- 5.6 An assessment report will be prepared within an agreed following the completion of on-site archaeological investigations and include the following:
- a non-technical summary of the results of the work;
 - a summary of the project's background;
 - the site location;
 - an account of the method;
 - the results of the excavation, including phasing and interpretation of the site sequence and spot-dating of artefacts, if recovered;
 - an assessment of the stratigraphic and other written, drawn and photographic records;
 - a catalogue of the archaeological material recovered during the excavation
 - a summary of the contents of the project archive and its location
 - recommendations for any further work.
- 5.7 The report will be produced within an agreed timetable. It will be supported by an overall plan of the site, accurately identifying the location of the trial excavations.
- 5.8 Finally, the report will outline the archaeological significance of the deposits identified, and provide an interpretation of the results in relation to other sites in the vicinity.

- 5.9 Copies of the report will be supplied to the Environment Agency and to the NYCC, who shall also receive a digital copy.
- 5.10 A final report, including all finds analysis and scientific dating results, shall be produced in accordance with English Heritage's Management of Archaeological Projects (English Heritage 1991).
- 5.11 Upon completion of the work, the archaeological contractor should make their work accessible to the wider research community by submitting digital data and copies of reports online to OASIS (<http://ads.ahds.ac.uk/project/oasis/>). Submission of data to OASIS does not discharge the planning requirements for the archaeological contractor to notify the Historic Environment Team, NYCC of the details of the work and to provide the Historic Environment Record (HER) with a report on the work.
- 5.12 It is possible that the excavation findings will warrant wider publication. This shall be effected either through one of Archaeological Service WYAS's in-house series of publications or through publication with an appropriate archaeological journal.

6. Copyright, Confidentiality and Publicity

6.1 Copyright in the documentation prepared by the archaeological contractor and specialist sub-contractors should be the subject of additional licences in favour of the repository accepting the archive and North Yorkshire County Council to use such documentation for their statutory educational and museum service functions, and to provide copies to third parties as an incidental to such functions.

6.2 Under the Environmental Information Regulations 2005 (EIR), information submitted to the HER becomes publicly accessible, except where disclosure might lead to environmental damage, and reports cannot be embargoed as 'confidential' or 'commercially sensitive'.

6.3 Requests for sensitive information are subject to a public interest test, and if this is met, then the information has to be disclosed. The archaeological contractor should inform the client of EIR requirements, and ensure that any information disclosure issues are resolved before completion of the work. Intellectual property rights are not affected by the EIR.

6.4 Unless the Client commissioning the project wishes to state otherwise, the copyright of any written, graphic or photographic record and reports will rest with the originating body (Archaeological Services WYAS).

7. Health and Safety

7.1 Archaeological Services WYAS has its own Health and Safety policy which has been compiled using national guidelines such as SCAUM. These guidelines conform to all relevant Health and Safety legislation.

7.2 In addition each project undergoes a 'Risk Assessment' which sets project specific Health and Safety requirements to which all members of staff are made aware of prior to on-

site work commencing. Health and safety will take priority over archaeological matters. Necessary precautions will be taken over underground services and overhead lines at the outset of the project.

8. Insurance

8.1 Archaeological Services WYAS is covered by the insurance and indemnities of the City of Wakefield Metropolitan District Council. Insurance has been effected with: Zurich Municipal Insurance, Park House, 57-59 Well Street, Bradford, BD1 5SN (policy number RMP 03GO39-0143). Any further enquiries should be directed to: The Chief Financial Officer, Insurance Section, Wakefield MDC, PO Box 55, Newton Bar, Wakefield WF1 2TT.

9. Monitoring

9.1 Access to the site should be arranged through the commissioning body.

9.2 It is the archaeological contractor's responsibility to ensure that Health and Safety requirements are fulfilled.

9.3 The project will be monitored by the Historic Environment Team, North Yorkshire County Council to whom written documentation should be sent before the start of the work confirming:

- the date of commencement,
- the names of all finds and archaeological science specialists likely to be used in the evaluation, and
- notification to the proposed archive repository of the nature of the works and opportunity to monitor the works.

9.4 Where appropriate, the advice of the Regional Advisor for Archaeological Science (Yorkshire and the Humber Region) at English Heritage will be called upon.

9.5 It is the responsibility of the archaeological contractor to ensure that any significant results are brought to the attention of the Historic Environment Team, North Yorkshire County Council and the commissioning body as soon as is practically possible. This is particularly important where there is any likelihood of contingency arrangements being required.

9.6 It is the archaeological contractor's responsibility to ensure that monitoring takes place by arranging monitoring points as follows:

- a meeting or discussion prior to the commencement of the work to
- agree in writing the locations of the proposed works.
- progress meeting(s) during the fieldwork phase at appropriate

- points in the work schedule, to be agreed.
- a meeting during the post-fieldwork phase to discuss the draft
- report and archive before completion.

10. Resources and Programming

10.1 Project personnel :

Project Management:	Alistair Webb BA MifA
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Project Supervisor:	TBA
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10.2 Post-excavation specialists :

Prehistoric pottery specialists:	Dr Chris Cumberpatch
Roman pottery specialist:	Dr Ruth Leary
Medieval pottery specialist:	Dr Chris Cumberpatch
Flint specialist:	Dr Ian P Brooks
Environmental specialist:	Dr Jane Richardson
Faunal analyst:	Dr Jane Richardson
Human bone specialist:	Malin Holst MA
Metalwork specialist:	Dr Hilary Cool
Artefact conservationist:	Karen Barker

10.3 The list of Archaeological Services WYAS project personnel may be subject to change.

Appendix 2: 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 interpreted as modern in origin might 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 XY 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 is 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 a 'negative' scanning result should be validated by 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 0.25m 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 allows the visualisation of weaker anomalies that may not have been detected by magnetic scanning.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m 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 XY trace and greyscale formats. In the former format the data shown is 'raw' with no processing other than grid biasing having been done. The data in the greyscale images has been interpolated and

selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

An XY plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm has been employed to block out lines behind major 'spikes' and the data has been clipped. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from 'iron spikes'. Geoplot 3 software was used to create the XY trace plots.

Geoplot 3 software was used to interpolate the data so that 3600 readings were obtained for each 30m by 30m grid. The same program was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

Appendix 3: Survey location information

The site grid was laid out using a Geodimeter 600s total station theodolite and tied in to the corners of buildings and other permanent landscape features and to temporary reference points (survey marker stakes) that were established and left in place following completion of the fieldwork for accurate geo-referencing. The locations of the temporary reference points are shown on Figure 2 and the Ordnance Survey grid co-ordinates tabulated below. The internal accuracy of the survey grid relative to these markers is better than 0.05m. The survey grids were then superimposed onto a map base provided by the client as a 'best fit' to produce the displayed block locations. 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 $\pm 1.5\text{m}$. However, it should be noted that Ordnance Survey co-ordinates for 1:2500 map data have an error of $\pm 1.9\text{m}$ at 95% confidence. This potential error must be considered if co-ordinates are measured off for relocation purposes.

Station	Easting	Northing
A	427797.4	472540.3
B	427833.1	472557.5
C	427612.2	472553.4

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 4: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2007) 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).

Appendix 5: Inventory of primary archive

Phase	File/Box No	Description	Quantity
Evaluation	File no.1	Context register sheets	3
		Drawing sheet register	1
		Drawing register	2
		Levels sheets	28
		Sample register sheets	1
		Trench sheets	77
		Photo register sheets	18
		Film ID sheets	11
		Digital photograph record sheets	9
		Colour negative strips	
		B&W negative strips	
		Daily site recording form	
		Small drawing sheets	9
		Context sheets	55

Appendix 6: Concordance of contexts

Context	Trench	Description	Artefacts and environmental samples
100	7	Dark grey brown silty clay, topsoil	
101	7	Mid-reddish brown silty clay, subsoil	
102	7	Dark reddish brown silty clay, single fill of gully 103	GBA 1
103	7	Cut of linear gully	
104	7	Light yellowish brown clay and stone, natural	
105	4	Dark greyish brown silty clay, topsoil	
106		Void	
107	4	Blackish brown silty clay and stones, secondary fill of ditch 109	GBA 2
108	4	Dark reddish brown silty clay and stones, primary fill of ditch 109	
109	4	Cut of ditch	
110	4	Dark reddish brown mottled orange clay, natural	
111	45	Mid- greyish brown silty clay, topsoil	
112	45	Mid to dark greyish brown silt, fill of field drain 113	
113	45	Cut of field drain	
114	45	Light to mid-orangey/yellowish brown sandy clay, natural	
115	45	Mid-mottled greyish/orangey brown silty clay, fill of land drain 116	
116	45	Cut of field drain	
117	41	Mid-greyish brown silty clay, topsoil	
118	41	Mid-greyish brown silt, fill of land drain 119	
119	41	Cut of field drain	
120	41	Mid-orangey/yellowish brown sandy clay, natural	
121	29	Mid-greyish brown silty clay, topsoil	
122	29	Mid-orangey brown sandy silt, fill of ditch 123	GBA 3
123	29	Cut of linear ditch	
124	29	Mid-orangey/yellowish brown sandy clay, natural	
125	28	Dark greyish brown silty clay, topsoil	
126	28	Mid-brownish grey silty clay, primary fill of ditch 127	GBA 6 and 1 fragment of horse shoe
127	28	Cut of linear ditch	
128	28	Mid-orangey brown sandy clay, natural	
129	34	Mid-greyish brown clayey silt, topsoil	
130	34	Mid-orangey brown sandy clayey silt, subsoil	
131	34	Light yellowish brown clayey silt and	GBA 4

		charcoal, single fill of post-hole	
132	34	Cut of post-hole	
133	34	Light yellowish brown sandy silt, backfill of post-hole 135	
134	34	Mid-yellowish brown sandy silty clay and charcoal, fill of post-hole 135	GBA 5
135	34	Cut of post-hole	
136	34	Mid to light orangey brown sandy clay and gravel, natural	
137	28	Mid-orangey brown silty sand, secondary fill of ditch 127	
138	68	Mid-orangey greyish brown sandy silt, fill of land drain	
139	68	Cut of land drain	
140	9	Mid-greyish brown clayey silt, topsoil	
141	9	Mid-orangey brown sandy silt, subsoil	
142	9	Dark orangey brown clayey/sandy silt and stones, single fill of ditch 143	GBA 7
144	9	Cut of linear ditch	
145	9	Same as 142	GBA 8
146	9	Mid-yellowish brown sandy clay and gravel, natural	
147	51	Mid-greyish brown sandy silt, topsoil	
148	51	Mid-orangey brown sandy silt, subsoil	
149	51	Mid-greyish brown silty sand, silting up of palaeochannel 150	
150	51	Cut of possible palaeochannel	
151	51	Light brown clayey sand and gravel, natural	
152	68	Mid-greyish brown sandy silt, topsoil	
153	68	Light yellowish/greyish brown silty sand and gravel, natural	
154	60	Mid-to dark orangey brown sandy silt and clay, possible palaeochannel	
155	60	Cut of possible palaeochannel	

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