ARCHAEOLOGICAL SERVICES WYAS

Longbenton Community College
Longbenton
North Tyneside

Geophysical Survey

December 2008

Report No. 1903

White Young Green

Longbenton Community College
Longbenton
North Tyneside

Geophysical and Earthwork Survey

Summary

A geophysical (magnetometer) survey covering approximately 4 hectares was undertaken in the grounds of Longbenton Community College, Newcastle. Anomalies due to modern disturbance and features and equipment associated with the sports ground have been identified. Faint linear trends aligned west/east are due to ridge and furrow ploughing although there were no upstanding remains. To the west of the survey area slight, discontinuous, earthworks aligned north/south, indicative of ridge and furrow ploughing, were noted and their extent surveyed. No anomalies of obvious archaeological potential have been noted. On the basis of the geophysical survey the site is considered to have a relatively low archaeological potential.

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Report Information

Client:	White Young Green Arndale Court, Headingley, Leeds, LS6 2UJ
Report Type:	Geophysical Survey
Location:	Longbenton School, Newcastle
County:	Newcastle
Grid Reference:	NZ 2705 6950
Period(s) of activity represented:	Post-medieval
Report Number:	1903
Project Number:	3374
Site Code:	LBC08
Planning Application No.:	08/02200/LAREG3
Museum Accession No.:	n/a
Date of fieldwork:	December 2008
Date of report:	December 2008
Project Management:	Sam Harrison BSc MSc AIFA
Fieldwork:	Emma Watson BSc Ian Wilkins BSc MSc
Report:	Alistair Webb BA MIFA
Illustrations:	Sam Harrison BSc MSc AIFA
Photography:	n/a
Research:	n/a
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Authorisation for distribution:	----------

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Certificate No. 125/93

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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Kirsten Holland of White Young Green to undertake a geophysical (magnetometer) survey at Longbenton Community College, Newcastle (see Fig. 1) in advance of the proposed re-development of part of the site to accommodate replacement buildings for the Special Glebe School and Goathland Primary School.

Site location, land use and topography

The college site, centred at NZ 2705 6950, is situated at the end of Halisham Avenue and occupies an area of just over 13 hectares. The survey covered approximately 4 hectares, this being the area which will be physically disturbed by the proposed new buildings, infrastructure and access road (see Fig. 2). The survey area was flat comprising sports fields and short grassed areas, which are believed to have undergone some landscaping, around existing college buildings. No problems were encountered during the survey which was carried out on December 10th and 11th 2008.

Geology and soils

The solid geology comprises Upper Carboniferous Coal Measures overlain by superficial glacial deposits. The soils are classified in the Dunkeswick association being described as permeable, seasonally waterlogged, fine loams (Survey of England and Wales 1983).

2 Archaeological and Historical Background

An archaeological desk-based assessment of the site (Tyne and Wear Museums 2008) concluded that, whilst there are no known archaeological sites within the application area and that documentary sources do not indicate significant archaeological potential, the fact that the site has remained as open fields since the post-medieval period increases the potential for prehistoric archaeology to survive.

Slight ridge and furrow earthworks, aligned north/south, are still visible to the west of the site although they were not visible within the actual geophysical survey area. These earthworks were surveyed as part of this evaluation.

3 Aims and Objectives

The general aims of the surveys were to obtain information that would contribute to an evaluation of the archaeological potential of the site. This information would then enable further evaluation and/or mitigation measures to be designed in advance of the proposed development of the site. These aims were to be achieved by undertaking detailed (recorded) magnetometer survey in the areas of proposed new build and to map any surviving ridge and

furrow earthworks in the wider site area. Specifically the survey sought to provide information about the nature and possible interpretation of magnetic anomalies identified during the survey and thereby determine the likely extent, presence or absence of any buried archaeological remains in the proposed development area. The survey was undertaken in accordance with a specification provided to the client by the Tyne and Wear Archaeology Officer.

4 Methodology

Magnetometer survey

A Bartington Grad601 magnetic gradiometer was used to take readings at 0.25m intervals on zig-zag traverses 1m apart within 30m by 30m grids so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1. Detailed survey allows the visualisation of weaker anomalies that may not be readily identifiable by evaluation techniques such as magnetometer (magnetic) scanning.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey mapping, is shown in Figure 1. Figure 2 shows the processed greyscale magnetometer data on a site location plan at a scale of 1:5000. The unprocessed (XY trace) and processed (greyscale) magnetometer data from the survey together with an interpretation figure, are presented at a scale of 1:1000 in Figures 3, 4 and 5. The survey of the visible ridge and furrow earthworks is presented at a scale of 1:1000 in Figure 6.

The geophysical survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the IFA (Gaffney *et al.* 2002). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 describes the composition and location of the survey 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.

5 Results and Discussion

The anomalies from this survey have been divided into three categories.

Ferrous anomalies/magnetic disturbance

Ferrous ('iron spike') anomalies have been located across all parts of the site. These anomalies are indicative of ferrous objects or other magnetic material in the topsoil/subsoil and, although archaeological artefacts may cause them, they are more often caused by modern cultural debris that has been introduced into the topsoil. There are no obvious clusters and therefore these anomalies are not considered to be archaeologically significant.

Three of the largest 'spike' anomalies are due to the proximity of goalposts. Other very strong ferrous anomalies locate drains on a cricket wicket and a long jump pit.

Concentrations of these anomalies forming distinct areas of magnetic disturbance have been identified in several blocks particularly along the proposed route of the new access road. This disturbance is due to the proximity of fencing, buildings and previous ground disturbance.

Linear trends

Across the eastern half of the survey area a series of weak, parallel, linear trend anomalies can be discerned. These anomalies are caused by the former practice of ridge and furrow ploughing with the anomalies being due to the magnetic contrast between the former ridges and infilled furrows.

Two linear anomalies aligned broadly north/south locate a former field boundary, still visible as a slight earthwork and discontinuous line of trees, and a former pathway.

Magnetic enhancements

At the western side of the survey area several small, discrete, areas of magnetic enhancement have been identified. These are interpreted as being most probably due to small natural variation in the subsoil or to modern disturbance associated with the creation of the playing fields.

A cluster of these anomalies to the east of the cricket wicket are also thought likely to have a modern origin.

6 Conclusions

No anomalies of obvious archaeological potential have been identified other than those attributable to the former agricultural practice of ridge and furrow ploughing. On the basis of the geophysical survey the site would appear to have limited archaeological potential.

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. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

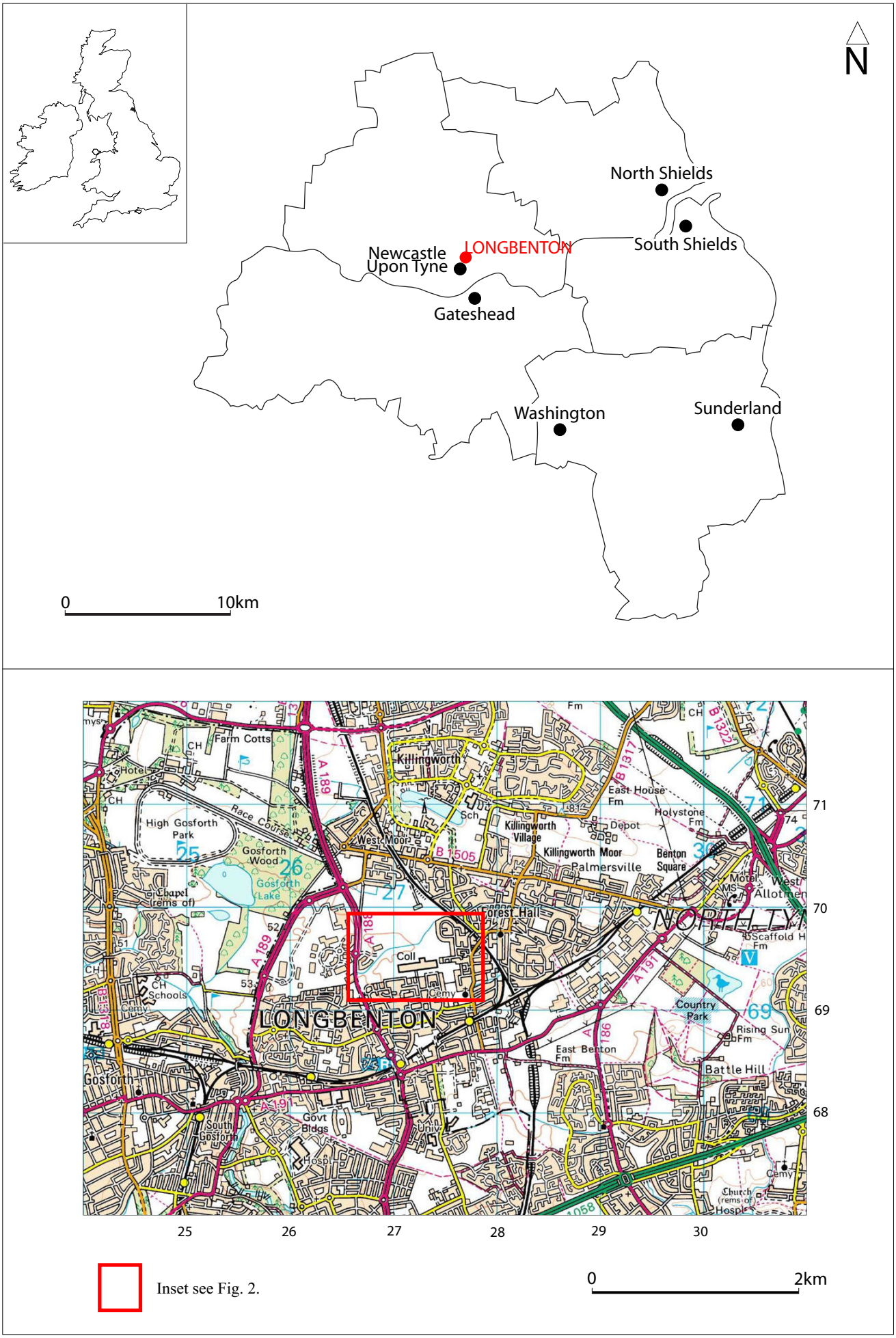

Fig. 1. Site location

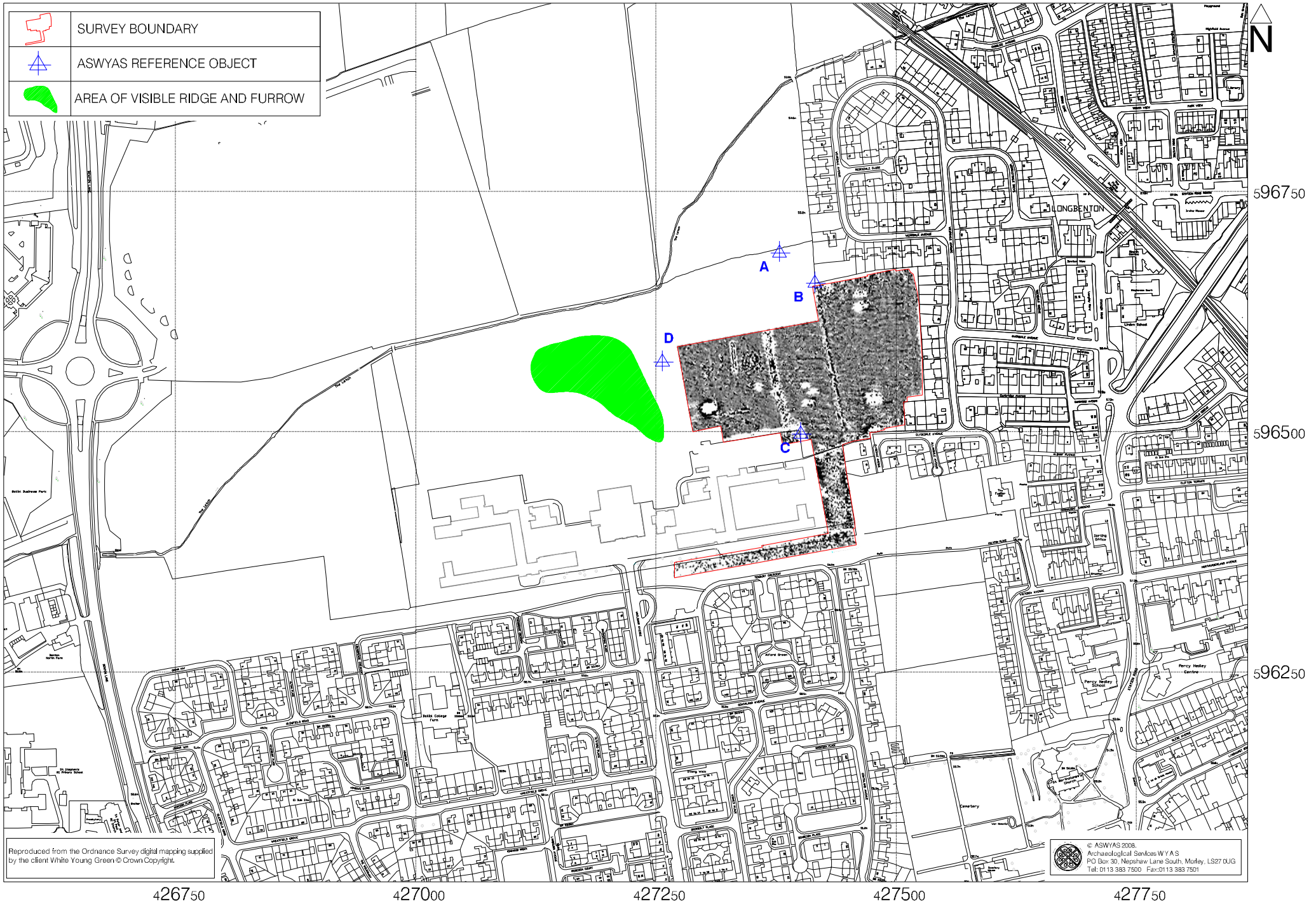

Fig. 2. Site location showing greyscale magnetometer data (1:5000 @ A4)

N

5696 25

5695 00

5693 75

4273 75

4275 00

2.0

-1.0

nT

CLYDEDALE AVENUE

TENBURY CRESCENT

Path

54.9m

53.9m

BM 55.72m

0 50m

Fig. 3. Processed greyscale magnetometer data (1:1000 @ A3)

Fig. 4. XY trace plot of unprocessed magnetometer data (1:1000 @ A3)

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	RIDGE AND FURROW
	MAGNETIC ENHANCEMENT	MODERN/GEOLOGY

N

FORMER PATHWAY

CRICKET WICKET

GOAL POSTS

FORMER FIELD BOUNDARY

GOAL POSTS

LONG JUMP PIT

GOAL POSTS

GOAL POSTS

5696 25

5695 00

5693 75

4273 75

4275 00

0 50m

CLYDEDALE AVENUE

TENBURY CRESCENT

Path

54.9m

53.9m

BM 55.72m

Reproduced from the Ordnance Survey digital mapping supplied by the client White Young Green 2008 © Crown Copyright.

Fig. 5. Interpretation of magnetometer data (1:1000 @ A3)

Fig. 6. Extent of ridge and furrow earthworks (1:1000 @ A4)

Plate 1. Northern end of playing fields, facing west

Plate 2. Northern end of playing fields, facing east

Plate 3. Condition of road corridor in south, facing east

Plate 4. Condition of playing fields showing ridge and furrow earthworks, facing north

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 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 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 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 2: 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 ±1.5m. However, it should be noted that Ordnance Survey co-ordinates for 1:2500 map data have an error of ±1.9m at 95% confidence. This potential error must be considered if co-ordinates are measured off for relocation purposes.

Station	Easting	Northing
A	427378.6554	569686.1846
B	427415.3981	569654.5420
C	427400.7045	569497.8605
D	427256.7902	569572.5268

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 (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 4: OASIS form

OASIS DATA COLLECTION FORM: England

List of Projects | Search Projects | New project | Change your details | HER coverage | Change country | Log out

Printable version

OASIS ID: archaeol11-53067

Project details

Project name	Longbenton Community College
Short description of the project	A geophysical (magnetometer) survey covering approximately 4 hectares was undertaken in the grounds of Longbenton Community College, Newcastle. Anomalies due to modern disturbance and features and equipment associated with the sports ground have been identified. Faint linear trends aligned west/east are due to ridge and furrow ploughing although there were no upstanding remains. To the west of the survey area slight, discontinuous, earthworks aligned north/south, indicative of ridge and furrow ploughing, were noted and their extent surveyed. No anomalies of obvious archaeological potential have been noted. On the basis of the geophysical survey the site is considered to have a relatively low archaeological potential.
Project dates	Start: 10-12-2008 End: 11-12-2008
Previous/future work	Yes / Not known
Any associated project reference codes	3374 - Contracting Unit No.
Any associated project reference codes	LBC08 - Sitecode
Site status	None
Current Land use	Other 14 - Recreational usage

Project location

Country	England
Site location	TYNE AND WEAR NEWCASTLE UPON TYNE NEWCASTLE UPON TYNE Longbenton Community College
Study area	4.00 Hectares
Site coordinates	NZ 2705 6950 55.0192376426 -1.576891153670 55 01 09 N 001 34 36 W Point

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Self (i.e. landowner, developer, etc.)
Project design originator	Archaeological Services WYAS

Project director/manager	T. S. Harrison
Project supervisor	Harrison, S
Type of sponsor/funding body	Developer
Name of sponsor/funding body	White Young Green

Project archives

Physical Archive Exists?	No
Digital Archive recipient	ADS
Digital Media available	'Geophysics'
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Longbenton Community College, Longbenton, North Tyneside: Geophysical and Earthwork Survey
Author(s)/Editor(s)	Webb, A.
Other bibliographic details	Report No. 1903
Date	2008
Issuer or publisher	Archaeological Services WYAS
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Entered by	Zoe Horn (zhorn@aswyas.com)
Entered on	19 December 2008

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