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Kendal Rugby Club
Kendal
Cumbria

Geophysical Survey

Report no. 2756

May 2015

Client: WYG Environment Planning Transport Ltd

Kendal Rugby Club
Kendal
Cumbria

Geophysical Survey

Summary

A geophysical (magnetometer) survey covering approximately 2 hectares, was carried out on land at Kendal Rugby Club, prior to the proposed development of the site. No anomalies indicative of archaeological activity have been recorded within the survey area. Only anomalies due to the proximity of ferrous objects in and around the rugby pitches, a field drain and variation in the soils and alluvial deposits have been identified. Consequently, on the basis of the survey, the archaeological potential of the site is considered to be very low.

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Report Information

Client:	WYG Environment Planning Transport Ltd
Address:	Arndale Court, Headingley, Leeds, LS6 2UJ
Report Type:	Geophysical Survey
Location:	Kendal
County:	Cumbria
Grid Reference:	SD 520 941
Period(s) of activity:	n/a
Report Number:	2756
Project Number:	4395
Site Code:	SRR15
OASIS ID:	archaeol11- 211109
Planning Application No.:	SL/13/1120
Museum Accession No.:	n/a
Date of fieldwork:	April 2015
Date of report:	May 2015
Project Management:	David Harrison BA MSc MCIfA
Fieldwork:	Mark Evans BSc
	Becky Goulding BSc MSc
Report:	Sam Harrison BSc MSc MCIfA
Illustrations:	Sam Harrison
Photography:	Mark Evans
Research:	n/a

Authorisation for distribution: ----------

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1 Introduction

Archaeological Services WYAS (ASWYAS) was commissioned by Kirsten Holland of WYG Environment Planning Transport Ltd (the Client), to undertake a geophysical (magnetometer) survey of land at Kendal Rugby Club, Kendal, Cumbria. The work was undertaken to inform a planning application for the proposed development of the site, in accordance with policy contained within the National Planning Policy Framework (DCLG 2012), in line with current best practice (CIfA 2014; David *et al.* 2008) and to a Project Design (Harrison 2015) approved by the Client. The survey is the first stage of works in relation to Planning Condition no. 25 on planning permission SL/13/1120. The survey was carried out on April 20th 2015 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The Proposed Development Area (PDA), centred at SD 5200 9410 (see Fig. 1), is located at Kendal Rugby Club, immediately west of Shap Road and south of Mint Bridge Road (see Fig. 2). The site currently comprises two rugby pitches (see plates), and is flat at approximately 53m above Ordnance Datum, being situated on the flood plain of the River Mint. Areas around the periphery of the rugby pitches were unsuitable for survey due to buildings, advertising hoardings, spectator stands, fencing and car parks (see plates).

Soils and geology

The underlying bedrock comprises sandstone of the Kirkby Moor Formation overlain by alluvial deposits of clay, silt, sand and gravel. The soils are classified in the Denbigh 1 association, characterised as well-drained fine loams and silts (Soil Survey of England and Wales 1983).

2 Archaeological Background

Although there is no DBA or previous archaeological assessment completed the for the development site it is known that the River Kent valley is an area known to contain prehistoric remains. There is a record of a prehistoric axe find spot close to the site. Investigations at Sparrowmire Farm to the west of the site in advance of residential development identified a Bronze Age burnt mound although analysis of macrofossils did not yield further information about the mounds use.

The site is located approximately 300m south of the medieval village of Mint (SMR 3269). The village was recorded in the Domesday Book in 1086 but was not recorded on the Lay Subsidy Rolls of 1334-1336. There is therefore considered to be potential for prehistoric and medieval remains to be recorded within the wider landscape.

3 Aims, Methodology and Presentation

The general objective of the geophysical survey was to provide information about the presence/absence, character, and extent of any archaeological remains identified within the PDA and to help inform further strategies, should they be required.

Specifically, the objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble 5800 model). Bartington Grad601 magnetic gradiometers were used during the survey, taking readings at 0.25m intervals on zig-zag traverses 1.0m 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.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. A large scale (1:2500) survey location plan, showing the processed data, is provided as Figure 2. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 3 to 5 inclusive, at a scale of 1:1000.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1 and Appendix 2. Appendix 3 describes the composition and location of the archive. The OASIS record of the survey is located in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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.

4 Results and Discussion (see Figures 3 to 5 inclusive)

Ferrous Anomalies

Ferrous anomalies, as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the topsoil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on sites, often being present as a consequence of historic manuring or modern detritus. There is no obvious pattern or clustering to their distribution to suggest anything other than a random background scatter of ferrous debris in the topsoil, except where stated below.

The most notable anomalies detected in the magnetometer survey are distinct areas of magnetic disturbance, **A** and **B** in Field 1 and **C** and **D** in Field 2. These anomalies have been caused by the proximity of the ferrous rugby posts (see Plate 4). Other areas of magnetic disturbance, present along the perimeter of each sports pitch, are caused by buildings, advertising hoardings (see plates), spectator stands, fencing and car parks.

Geological Anomalies

Throughout the site the magnetic background is fairly variable, hence the number of discrete anomalies of enhanced magnetic response. These anomalies are thought to be geological in origin being caused by variation in the composition of the soils which is due to the changes in magnetic response from the bands of sand, gravel, silt and clay which comprise the alluvial deposits (BGS 2015).

Agricultural Anomalies

A single linear anomaly, **E**, is interpreted as being of likely agricultural origin. This is probably caused by a drain.

5 Conclusions

The magnetometer survey has not identified any anomalies that might be indicative of archaeology. The only anomalies that have been recorded within the application boundary are related to ferrous objects in and around the rugby pitches and a single field drain or are caused by variations within the alluvial soils and superficial deposits. During the course of the fieldwork it was noted that there was a low earthen bund, located toward the northern end of the rugby pitches. The lack of any other evidence for both cut or fill across the site suggests that the site was relatively flat and may have required limited levelling to create the platform. Consequently, on the basis of the survey, the archaeological potential of the site is considered to be very low.

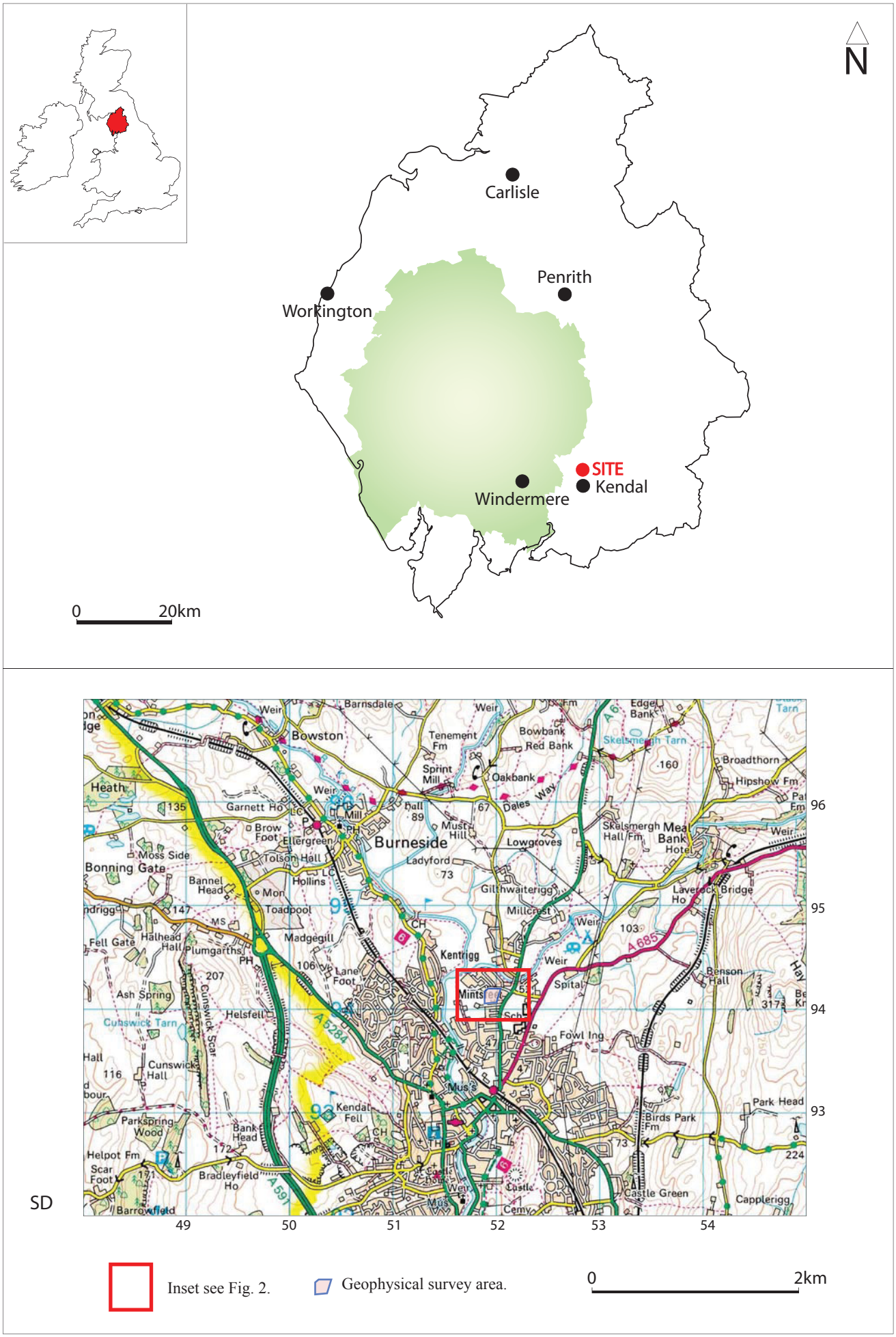

Fig. 1. Site location

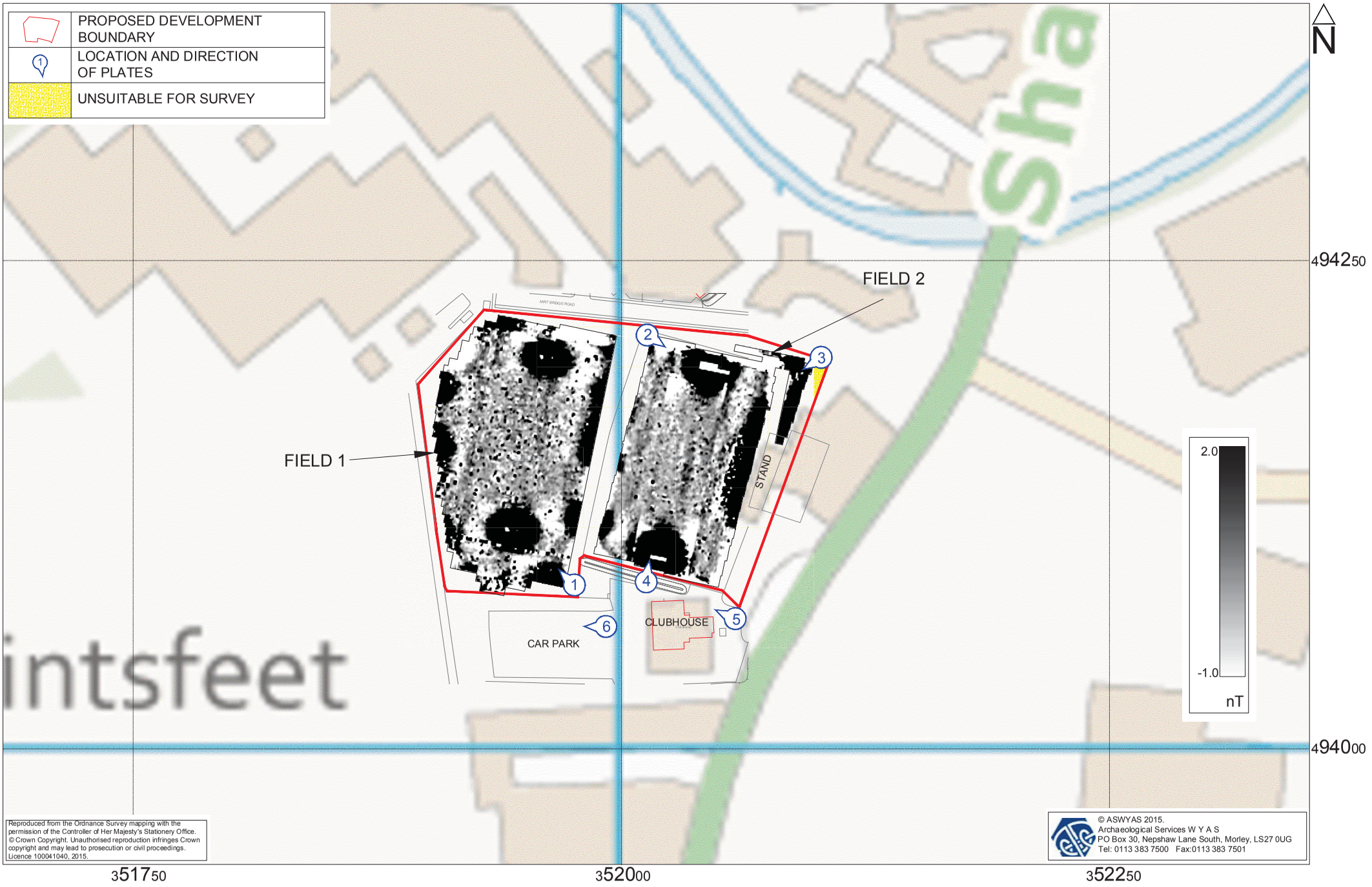

Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A4)

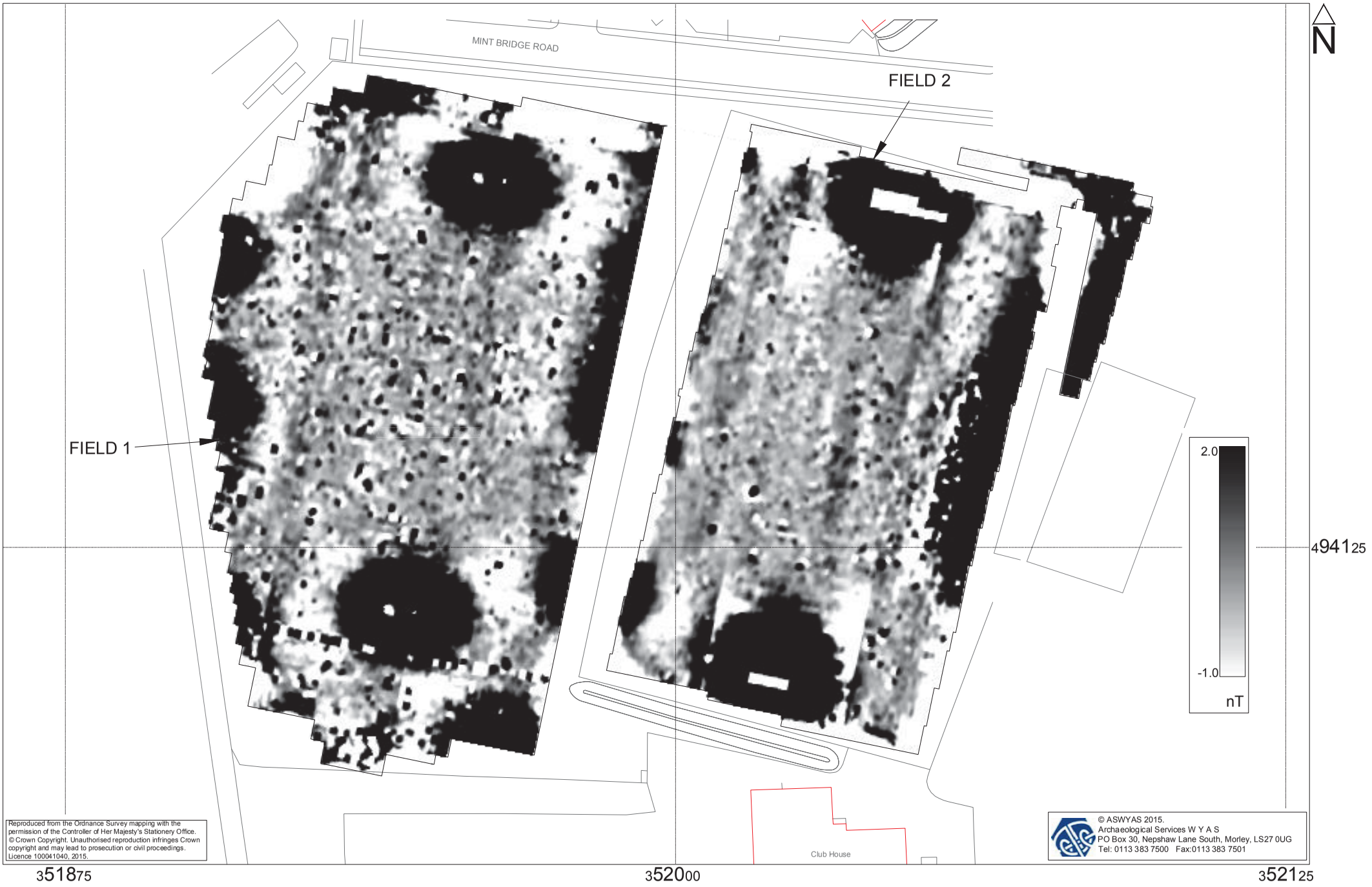

Fig. 3. Processed greyscale magnetometer data (1:1000 @ A4)

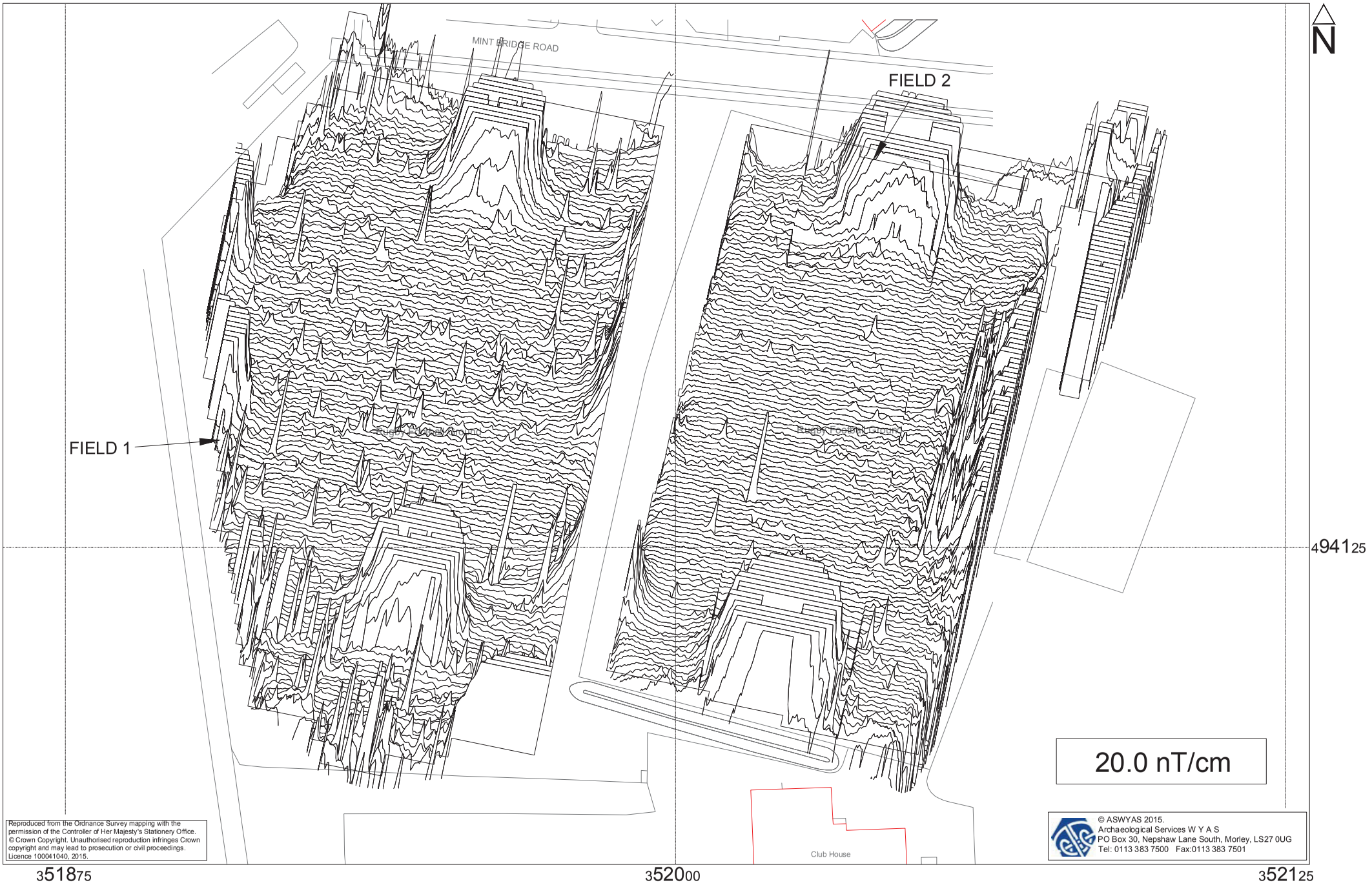

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1000 @ A4)

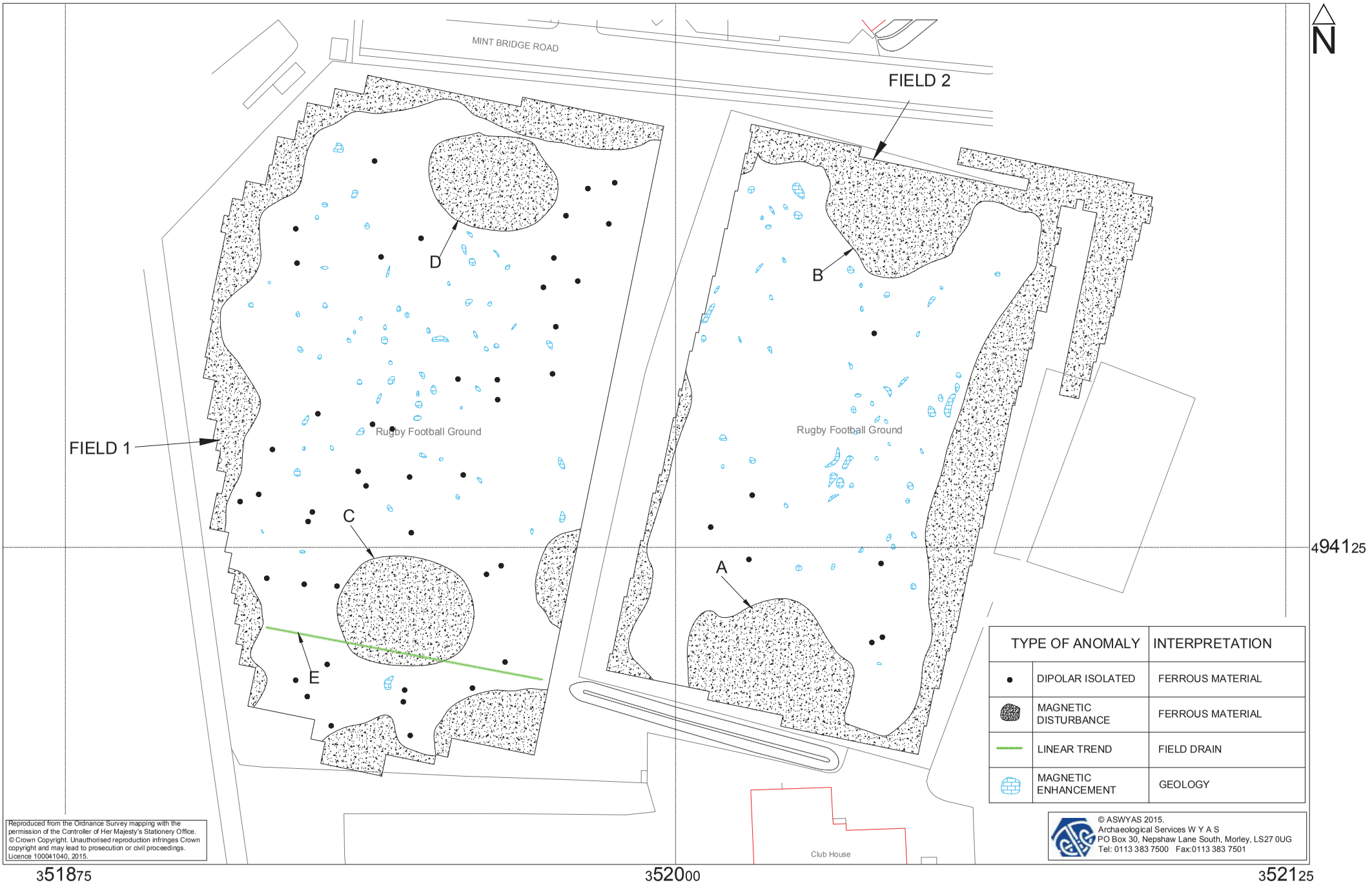

Fig. 5. Interpretation of magnetometer data (1:1000 @ A4)

Plate 1. General view of Field 1, looking north-west

Plate 2. General view of Field 2, looking south-east

Plate 3. General view of Field 2, looking south-west

Plate 4. View of Field 2 showing barrier, looking north

Plate 5. View of Field 2 showing barrier, looking north-west

Plate 6. View of car park, looking west

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. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because 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. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough. An advantage of magnetic susceptibility over magnetometry is that a certain amount of occupational activity will cause the same proportional change in susceptibility, however weakly magnetic is the soil, and so does not depend on the magnetic contrast between the topsoil and deeper layers. Susceptibility survey is therefore able to detect areas of occupation even in the absence of cut features. On the other hand susceptibility survey is more vulnerable to the masking effects of layers of colluvium and alluvium as the technique, using the Bartington system, can generally only measure variation in the first 0.15m of ploughsoil.

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.

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. These anomalies are often caused by agricultural activity, either ploughing or land drains being 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.

Appendix 2: Survey location information

The site grid was laid out using a Trimble dual frequency Global Positioning System (GPS) with two Rovers (Trimble 5800 models) working in real-time kinetic mode. The accuracy of such equipment was better than 0.02m. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off for relocation purposes.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

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 2008) files; and
- 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 Cumbria Historic Environment Record).

Appendix 4: OASIS Form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: archaeol11-211109

Project details

Project name	Kendal Rugby Club
Short description of the project	A geophysical (magnetometer) survey covering approximately 2 hectares, was carried out on land at Kendal Rugby Club, prior to the proposed development of the site. No anomalies indicative of archaeological activity have been recorded within the survey area. Only anomalies due to the proximity of ferrous objects in and around the rugby pitches, a field drain and variation in the soils and alluvial deposits have been identified. Consequently, on the basis of the survey, the archaeological potential of the site is considered to be very low.
Project dates	Start: 20-04-2015 End: 20-04-2015
Previous/future work	Not known / Not known
Any associated project reference codes	SRR15 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Other 14 - Recreational usage
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Kirkby Moor Formation sandstone
Drift geology	ALLUVIUM
Techniques	Magnetometry

Project location

Country	England

Site location	CUMBRIA SOUTH LAKELAND KENDAL Kendal Rugby Club
Postcode	LA9 6DW
Study area	24100.00 Square metres
Site coordinates	SD 520 941 54.3400418675 -2.73837840969 54 20 24 N 002 44 18 W Point
Height OD / Depth	Min: 53.00m Max: 53.00m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	WYG
Project design originator	Archaeological Services WYAS
Project director/manager	D. Harrison
Project supervisor	Evans, M.
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive recipient	N/A
Digital Contents	"none"
Digital Media available	"Geophysics","Images raster / digital photography","Survey"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
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Please e-mail Historic England for OASIS help and advice

Bibliography

British Geological Survey, 2015. www.bgs.ac.uk/discoveringGeology/geology OfBritain/viewer.html. (Viewed May 6th 2015)

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for archaeological geophysical survey.* CIfA

David, A., N. Linford, P. Linford and L. Martin, 2008. *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines (2nd edition)* English Heritage

DCLG, 2012. *National Planning Policy Framework*. Department of Communities and Local Government

Harrison, D. 2015. *Kendal Rugby Club, Kendal, Cumbria: Geophysical Survey Project Design.* Unpublished ASWYAS document

Soil Survey of England and Wales, 1983. *Soil Survey of England and Wales: Soils of Northern England*, Sheet 1