Archaeological Services & Consultancy Ltd

GEOPHYSICAL SURVEY:
RADCLIFFE SCHOOL SITE
WOLVERTON
MILTON KEYNES

for
NJL Consulting on behalf of Milton Keynes Council
and Radcliffe School

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March 2007

ASC: 884/WRS/02

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Site Data

ASC project code:	WRS	*ASC Project No:*	840
Event No:	1100	*Accession No:*	
County:	Milton Keynes Unitary Authority		
Village/Town:	Wolverton		
Civil Parish:	Wolverton CP		
NGR (to 8 figs):	SP 8073 4080 (centre)		
Present use:	School playing fields and recreation ground		
Planning proposal:	Housing and mixed development		
Planning application ref/date:	tba		
Local Planning Authority:	Milton Keynes		
Date of fieldwork:	20th – 23rd February 2007		
Client:	Milton Keynes Council & Radcliffe School (Joint Venture) c/o NJL Consulting, Adamson House, Towers Business Park, Wilmslow Road, Didsbury, Manchester, M20 2YY		
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Internal Quality Check

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Revisions:		*Date:*	
Edited/Checked By:		*Date:*	

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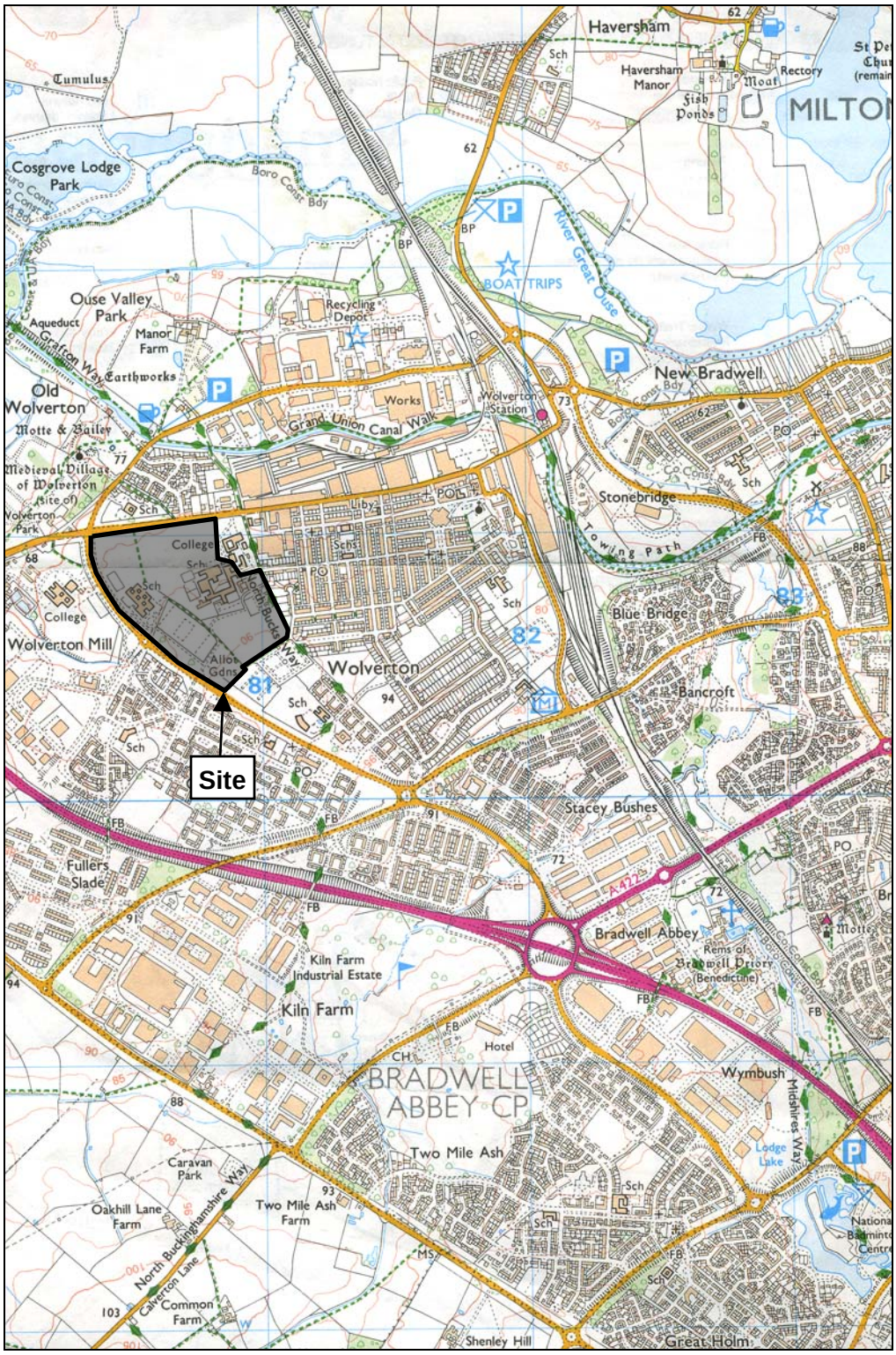

Figure 1: General location *(scale 1:25,000)*

Summary

Geophysical survey (magnetic scanning and detailed magnetometry) was carried out by ASC Ltd at the Radcliffe School Site, Wolverton, Milton Keynes. Significant modern disturbance to the southern part of the proposed development area was identified. Remnants of ridge and furrow were present at the east of the school playing field and archaeological features defining the location of two probable enclosures containing settlement activity were identified adjacent to the western boundary of the playing field.

1. Introduction

1.1 *General*

Archaeological Services and Consultancy Ltd (ASC) was commissioned by *NJL Consulting,* to carry out a programme of magnetometer (fluxgate gradiometer) survey on behalf of *Milton Keynes Council* and *Radcliffe School* at an area of proposed development located in Wolverton, Milton Keynes (NGR TL 2963 4080, site centre: Fig. 1). The geophysical survey consisted of magnetic scanning of suitable areas of the site (*c.*13.5 ha) and subsequent detailed magnetometer survey over 30% of the site (*c.*4.05 ha) to examine identified targets and test areas where geophysical anomalies were not identified (Fig 2).

Fieldwork commenced on the 20th February 2007 and was completed on the 23rd February 2007. Prevailing weather conditions during the fieldwork were cold and overcast with intermittent showers. Groundcover at the time of survey was short grass.

1.2 *Planning Background*

The proposed development forms part of the Wolverton West End Development Framework, which was adopted by Milton Keynes Council as Supplementary Planning Guidance in September 2004, and was reiterated in Milton Keynes Local Plan 2001-2015 (MKC 2005). The geophysical survey was undertaken as part of pre-planning assessment after advice from the Archaeological Advisor of Milton Keynes Council (AA).

1.3 *Proposed Development*

The proposed development comprises residential, mixed and recreational areas. The areas examined by geophysical survey included a strip of land adjacent to the western periphery of the site, which would be affected by residential development. The majority of the eastern parts of the proposed development area would remain as open space

1.4 *Location & Description*

The application area is located to the west of Wolverton town centre, in the administrative district of Milton Keynes (centred on NGR 8073 4080: Fig. 1). It comprises a roughly rectangular area of land of *c.*26ha, bounded to the north by Stratford Road, to the south-west by Great Monks Street, to the south by allotments and a cemetery, and to the east by existing housing and commercial developments of Wolverton.

The area suitable for examination by geophysical survey comprised *c.*13.5 hectares of the site and lay north and south of the buildings and sports facilities of Radcliffe School. The northern area was an irregularly shaped parcel of land in use as the playing fields of Radcliffe School and the southern area consisted of Woburn Avenue Recreation Ground and an adjoining field marked as Allotment Gardens on recent OS mapping.

1.5 *Geology & Topography*

The soils of the area belong to the *Badsey 1 Association*, which are characterised as "*well drained calcareous and non-calcareous fine loamy soils over limestone gravel. Some deep fine loamy soils and fine loamy soils over gravel, and similar but shallower soils affected by groundwater"* (Soil Survey, 1983, 511h). The underlying geology is characterised as *river terrace gravel.* The site lies on the south side of the Great Ouse valley, *c.*1.5km south of the river, at an elevation of between *c.*80-90m AOD, on ground steadily rising from north-west to south-east.

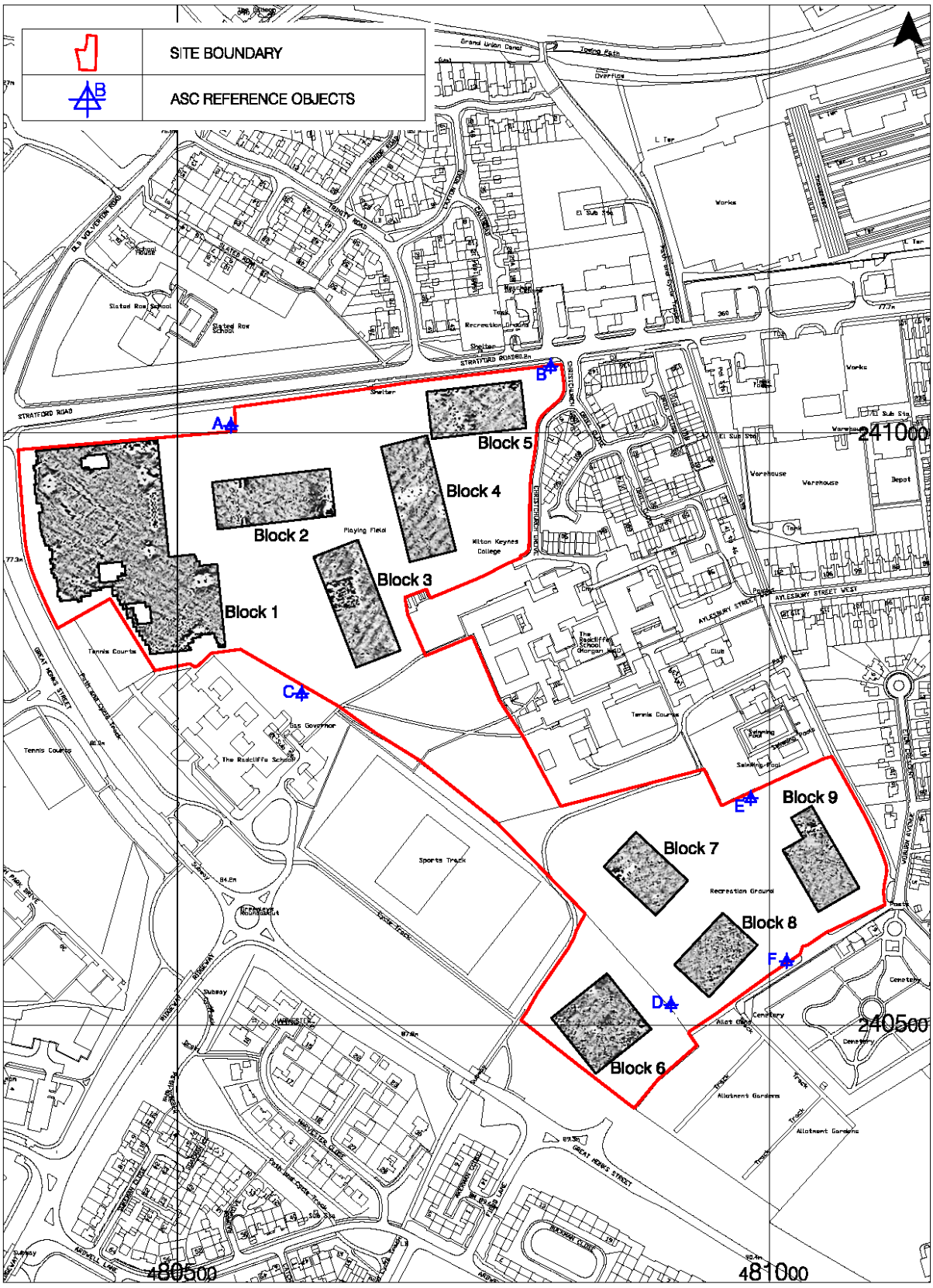

Figure 2: Area scanned and location of detailed survey blocks

2. Archaeological & Historical Evidence

2.1 The local and regional settings of archaeological sites are factors that are taken into consideration when assessing the planning implications of development proposals. The following sections provide a summary of the archaeological and historical background presented in a desk-based assessment focussed on the proposed development (Zeepvat & Rouse 2006).

2.2 *Archaeological & Historical Background*

2.2.1 The Wolverton area is one of considerable archaeological and historical importance, and a variety of archaeological sites are situated in the area. The archaeology and history of the parish are summarised in *The Changing Landscape of Milton Keynes* (Croft & Mynard 1993, 179-193).

2.2.2 *Prehistoric - Iron Age (before AD43)*

Evidence of earlier prehistoric activity has not been recovered within the immediate environs of the proposed development. The presence of Bronze Age settlement has been suggested by excavations at the Wolverton Mill Training College, which is located immediately west of the proposed development (Preston forthcoming).

Ring ditches denoting the location of ploughed out burial mounds were excavated at Moon Street School, 1km west of the site, at Warren Farm, 0.5km to the west and also at the Training College, immediately west of the proposed development (Green 1974).

2.2.3 *Romano-British (AD43-c.450)*

During the Romano-British period the Milton Keynes area fell within the *civitas* (tribal area) of the *Catuvellauni*. A major Roman road, latterly known as *Watling Street*, lies 1.2km southwest of the site.

An extensive villa was excavated at Bancroft (Williams & Zeepvat 1994), *c.*1km east of the application area. This was linked with an impressive 2nd-century temple-mausoleum (*ibid*), located on the adjoining Blue Bridge site. Evidence of a possible Roman building was also recovered from service trenches at Manor Farm Cottages, 0.5km north of the site.

Romano-British sites of lesser status are recorded at Kiln Farm, 1km southwest of the proposed development, and near Stonebridge Farm, *c.*1.25km to the northeast. A small amount of Roman material, possibly originating from manure scatters, has been found in recent excavations located immediately west of the proposed development (Thorne 2005).

2.2.4 *Saxon (c.450-1066)*

Several burials of suggested Saxon date were found just beyond the northwest corner of the proposed development in 1956 (Green 1957). Recent archaeological evaluation by ASC in advance of housing development near the northwest corner of the proposed development did not reveal any

archaeological features (Fell 2000). A watching brief on services in the same area was also negative (Crank 2005).

In 1969, aerial photography revealed the existence of a rectangular enclosure in the area now occupied by the Wolverton Mill Training College. Excavations in 1971 revealed the east corner of the enclosure (Preston forthcoming) and subsequent excavations in 1992 and 1994 (*ibid*), confirmed that it dated to the middle Saxon period. More recent excavations (Thorne 2005) discovered two early to middle Saxon grübenhauser, and late Saxon plots which contained timber buildings with associated pits, a well, cess pits and a malting/drying oven. Late Saxon finds, including coins and metalwork, have also been found near the parish church, 0.3km north of the site.

2.2.5 *Medieval (1066-1500)*

Wolverton is mentioned in the Domesday Survey (1086), where it appears as *Wlverintone*. This place-name may be of 8th or 9th-century origin, and translates as 'Wulfhere's Tun', or 'Wulfhere's estate' (Croft & Mynard 1993, 191).

The medieval village of Wolverton is a scheduled ancient monument and lies to the north of the proposed development, it is perhaps the best-preserved medieval village in Milton Keynes. It is centred on the parish church and adjacent motte-and-bailey castle, built in the late 11th or early 12th century.

A survey of the available evidence for ridge-and-furrow ploughing has shown that the development area formed part of the medieval open field system of Wolverton.

2.2.6 *Post-Medieval (1500-1900)*

No archaeological features or finds of this period are known from the site. The site appears on the Radcliffe estate map of 1742, and the Ordnance Survey First Edition sheet of 1885 as open fields. The lane forming the eastern boundary of the site is shown as a footpath on the 1742 map, and is therefore likely to be of some antiquity.

2.2.7 *Modern (1900-present)*

The Ordnance Survey sheet of 1938 shows the site as open fields, though housing development in Wolverton has reached its eastern boundary. Radcliffe School was constructed on the site in the late 1960s, and the adjacent open-air swimming pool opened in 1970. The site was subsequently further developed for extensions to the school and for Milton Keynes College. The present school buildings on Great Monks Street were constructed in the 1990s.

3. Aims, Methodology and Report Presentation

3.1 The fieldwork and report adhere to the aims and methods detailed in ASC's project design (Hancock 2007).

3.2 ***Aims***

The aims of the geophysical surveys were:

- To determine the presence/absence of subsurface archaeological features.
- To define the spatial extent of any archaeological features present.
- To attempt interpretation of the form and function of any archaeological features.

3.3 ***Methods***

The methods adopted for the project were:

- Magnetic scanning of suitable areas of the proposed development identified as having medium archaeological potential (*c.*13.5 hectares) along parallel transects spaced 10m apart.
- Detailed magnetometer survey of 30% (*c.*4.05 hectares) of the scanned area at a sample interval of 0.5m x 1.0m. Detailed survey blocks will be centred on geophysics targets and/or located to test "blank" areas. Survey blocks will have a minimum size of 60m x 40m.

3.4 The survey, corresponding report and data treatment follow the recommendations outlined in English Heritage (David 1995), IFA (Gaffney *et al.* 2002) and ADS (Schmidt 2003) guidelines as a minimum standard. All figures reproduced from Ordnance Survey mapping are done so with the permission of the controller of Her Majesty's Stationery Office, © Crown copyright.

3.5 A general site location plan incorporating the 1:25000 Ordnance Survey mapping is presented in Figure 1. Figure 2 (1:5000) shows the area magnetically scanned and the relative position of the detailed survey blocks. The processed greyscale gradiometer data and accompanying interpretations are presented in Figures 3 to 6 at a scale of 1:1250. XY trace plots (1:1250) of the unprocessed "raw" gradiometer data are presented in Appendix 4.

3.6 Comprehensive technical details on the underlying principles of magnetic survey, the equipment used and general geophysical survey methodology are given in Appendix 1. Details on data processing and display are also given in Appendix 1. Survey location information is presented in Appendix 2 and the composition of the archive described in Appendix 3.

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 ASC staff.

4. Magnetic Scanning

4.1 Dipolar "Iron spike' responses (Appendix I) were identified distributed across all of the survey area. These are indicative of ferrous material in the topsoil or subsoil and, although archaeological artefacts may cause them, they are more often caused by modern material. Unless there is strong supporting evidence to the contrary, for example if they are located close to areas of archaeological activity, they are assumed to be non-archaeological in origin.

4.3 The magnetic background of the Recreation Ground and the small field west of it was heavily disturbed. Frequent fluctuations in instrument reading illustrated the presence of numerous small, medium and large ferrous objects. Areas of made/disturbed ground were also identified. The strength and frequency of the magnetic disturbance was such that it was impossible to determine whether archaeological features were present in this part of the survey area through magnetic scanning. Four randomly positioned detailed survey blocks were surveyed to examine this part of the site for archaeological features.

4.4 Generally the magnetic background was much "quieter" on the school playing field although an increase in the amount of iron spikes was noted along the perimeter of the field and some large areas of disturbance were also present. Magnetic anomalies characteristic of cut and infilled archaeological features were not identified in the eastern two thirds of the field, but weak rhythmic fluctuation in instrument readings suggested that detailed survey blocks may show weak, parallel linear magnetic anomalies caused by the vestigial remnants of a past ploughing regime. Magnetic anomalies suggesting the presence of archaeological features were identified in the western third of the field. Five survey blocks were positioned over identified geophysical targets to determine their origin.

5. Results and Discussion

Detailed magnetometer survey was undertaken in nine blocks (Fig. 2). Isolated dipolar anomalies ("iron spikes" – Appendix 1) are evident in all survey blocks. These "iron spike" anomalies are usually indicative of ferrous objects or other magnetic material in the topsoil/subsoil and are often caused by modern cultural debris. Archaeological artefacts may cause them and significant clusters associated with other substantiating evidence may be included in the following discussion.

5.1 Block 1 (Figs 3-4)

5.1.1 A 120m x 60m block was located over "archaeological" type magnetic anomalies. Examination of collected data showed that cut and infilled archaeological features were present and the survey block was expanded to the east and southeast to define their extent.

5.1.2 Five oval areas of magnetic disturbance containing two large dipolar anomalies are identified and their spacing and distribution throughout the block illustrates that they are caused by buried ferrous bases of goalposts. A large rectangular anomaly near the eastern perimeter of the block originates from the hardcore base of an area of astroturf noted at this location. A north-south aligned area of disturbance parallel with the western edge of the survey block at its northwestern corner is caused by accumulation of modern debris in an extant shallow boundary ditch.

5.1.3 Large areas of magnetic disturbance are evident at the northeastern and southeastern perimeter of the block. This type of anomaly is often caused by inclusion of modern ferrous or fired material in areas of made/disturbed ground. Smaller areas of magnetic disturbance are also distributed throughout the survey block and suggest the presence of modern disturbance although an archaeological origin cannot be discounted as thermoremanent features such as kilns, furnaces or hearths may produce similar magnetic anomalies.

5.1.4 A weakly developed northwest-southeast aligned linear trend is identified running through the centre of the survey block. The orientation and position of this magnetic anomaly is similar to a field boundary marked on first edition OS mapping and it is probable that the linear trend locates the shallow remnants of this boundary.

5.1.5 Anomalies characteristic of cut and infilled archaeological ditches and pits are present at the northwest of the survey block. The western limit of an area showing a concentration of archaeological ditches and pits is formed by a discontinuous northwest-southeast aligned probable ditch (**A**) which extends *c.*85m into the survey block then returns to run for *c.*15m along a northeast southwest alignment. An area of magnetic disturbance (**B**) at the southwestern end of the ditch could locate a thermoremanent feature, *e.g.* kiln. It is difficult to determine from the magnetic data whether the discontinuous nature of magnetic anomaly **A** is a consequence of truncation/damage done to an infilled ditch by later ploughing or if the magnetic anomalies actually locate discrete ditch segments and aligned pits.

5.1.6 It seems likely that the full extent of suggested ditch **A** has not been defined by the geophysical survey, possibly as a consequence of truncation/damage by later ploughing, and definitive characterisation of the exact form of the archaeological features present is therefore difficult. A tentative interpretation may suggest that the external ditch (**A**) of an enclosure bounds an area which contains a smaller rectangular enclosure (**C**) which lies at a slightly different alignment to **A** and could therefore pre or post date it. A number of discrete magnetic anomalies indicating the position of infilled pits are identified within smaller enclosure (**C**), three (**D**) of these discrete anomalies are large and may locate structural features.

5.1.7 Two anomalies suggesting the presence of infilled pits and a concentration of discrete areas of magnetic enhancement and weakly positive linear anomalies are identified southeast of the suggested enclosure ditches. Some of these magnetic anomalies could result from the presence of infilled archaeological pits and shallow ditches although it is likely that most result from relatively modern agricultural activity or ground disturbance.

5.1.8 Other disparate areas of magnetic enhancement and weakly positive linear anomalies are identified east and southeast of the suggested enclosure ditches. Some of these anomalies may be caused by cut and infilled archaeological features although a modern origin is thought more probable.

5.2 Block 2 (Figs 3-4)

5.2.1 Block 2 targeted a north-south aligned linear area of magnetic disturbance which is shown toward the western end of the block. Two aligned but unconnected double dipolar anomalies are evident on the eastern side of the linear area of magnetic disturbance. The linear area of magnetic disturbance is aligned with remnants of a field boundary observed to the north and south of the block and appears to define the position of infilled remnants of it. The double dipolar anomalies may be caused by the metalling of a footpath, although the reason for the gap between the two sections is unclear. These magnetic anomalies have a relatively modern origin.

5.2.2 An east west aligned rectangular area of disturbance located near the centre of the block was identified during a conversation with a groundsman as locating the rubble base of a disused and buried cricket pitch.

5.2.3 A large area of magnetic disturbance at the eastern end of the block likely identifies an area of modern ferrous debris or of made/disturbed ground.

5.2.4 Magnetic anomalies suggesting the presence of archaeological features are not identified in this survey block.

5.3 Block 3 (Figs 3-4)

5.3.1 The 100m x 40m block was located to investigate a large area of disturbance, which is identified against the western boundary of the survey block. This square area of strong magnetic disturbance was subsequently identified as the rubble base of a cricket square during a conversation with a groundsman.

5.3.2 Parallel, NE-SW orientated, weakly positive linear magnetic trends are identified throughout the survey block. This type of anomaly is characteristic of denuded ridge and furrow. A similarly weak WNW-ESE aligned linear anomaly at the southwestern corner of the block probably identifies the position of a plough headland.

5.3.3 Magnetic anomalies suggesting the presence of archaeological features are not identified in this survey block.

5.4 Block 4 (Figs 3-4)

5.4.1 The 100m x 40m block was located over an area of weak parallel anomalies noted during scanning and NE-SW orientated, weakly positive linear magnetic trends are identified throughout the survey block. This type of anomaly is characteristic of denuded ridge and furrow.

5.4.2 Two areas of magnetic disturbance are evident in the survey block. The disturbance suggests the presence of modern ferrous objects or made/disturbed ground.

5.4.3 Magnetic anomalies indicating the presence of archaeological features are not identified in this survey block.

5.5 Block 5 (Figs 3-4)

5.5.1 The 80m x 40m block was located to examine a large area of magnetic disturbance. Areas of magnetic disturbance are identified and are caused by the proximity to the northern boundary of the site and/or the presence of modern subsurface ferrous objects or made/disturbed ground.

5.5.2 NE-SW orientated, weakly positive linear magnetic trends are identified in the survey block. They are not as prevalent as in Blocks 3 and 4 but similarly identify denuded remnants of ridge and furrow.

5.5.3 Magnetic anomalies suggesting the presence of archaeological features are not identified in this survey block.

5.6 Block 6 (Figs 3-4)

5.6.1 The 60m x 60m survey block was randomly located in an area affected by proposed residential development.

5.6.2 Frequent iron spikes and a small number of areas of disturbance are identified. The frequency of these anomalies illustrates intensive modern exploitation of this parcel of land.

5.6.3 Two parallel weak positive linear anomalies are identified. These may have an archaeological origin although it is more probable that they are caused by vestigial remnants of denuded ridge and furrow or are shallow modern features related to the recent use of this area as allotment gardens.

5.7 Blocks 7 and 8 (Figs 3-4)

5.7.1 The two 60m x 40m survey blocks were randomly located in the recreation ground.

5.7.2 Frequent iron spikes and areas of disturbance are identified in the blocks. The frequency of these anomalies illustrates intensive modern utilisation of this parcel of land.

5.7.3 Magnetic anomalies suggesting the presence of archaeological features are not identified in this survey block.

5.8 Block 9 (Figs 3-4)

5.8.1 The 80m x 40m survey block was randomly located in the recreation ground.

5.8.2 Numerous iron spikes and areas of disturbance are identified. The frequency of these anomalies illustrates intensive modern utilisation of this parcel of land.

5.8.3 A discrete area of magnetic enhancement is present at the southeast of the survey block. This magnetic anomaly could be caused by a cut and infilled archaeological pit although a modern origin is equally likely.

Figure 3: Greyscale plot of gradiometer data; Blocks 1, 2, 3, 4 and 5

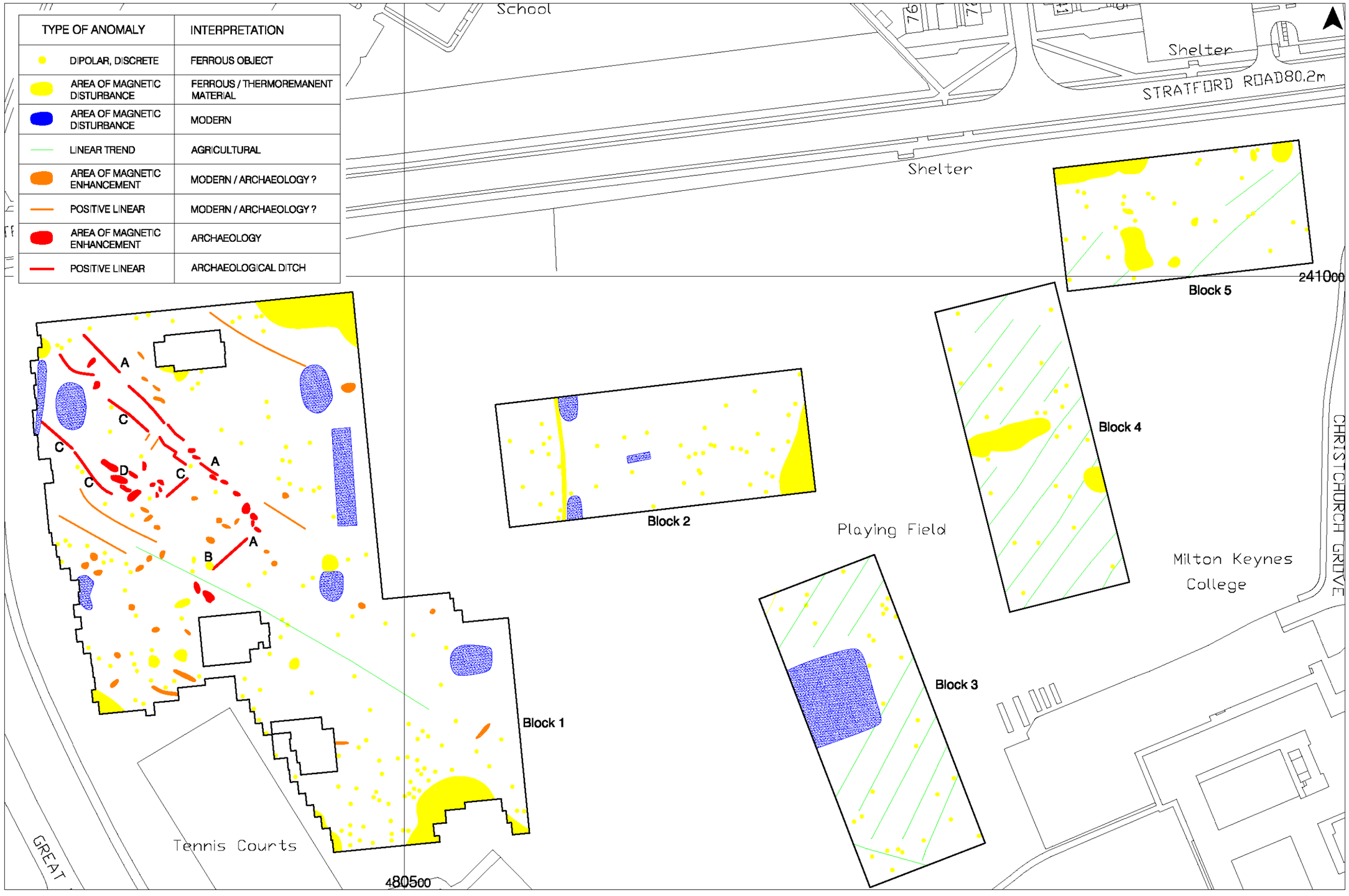

Figure 4: Interpretation of gradiometer data; Blocks 1, 2, 3, 4 and 5

Figure 5: Greyscale plot of gradiometer data; Blocks 6,7, 8 and 9

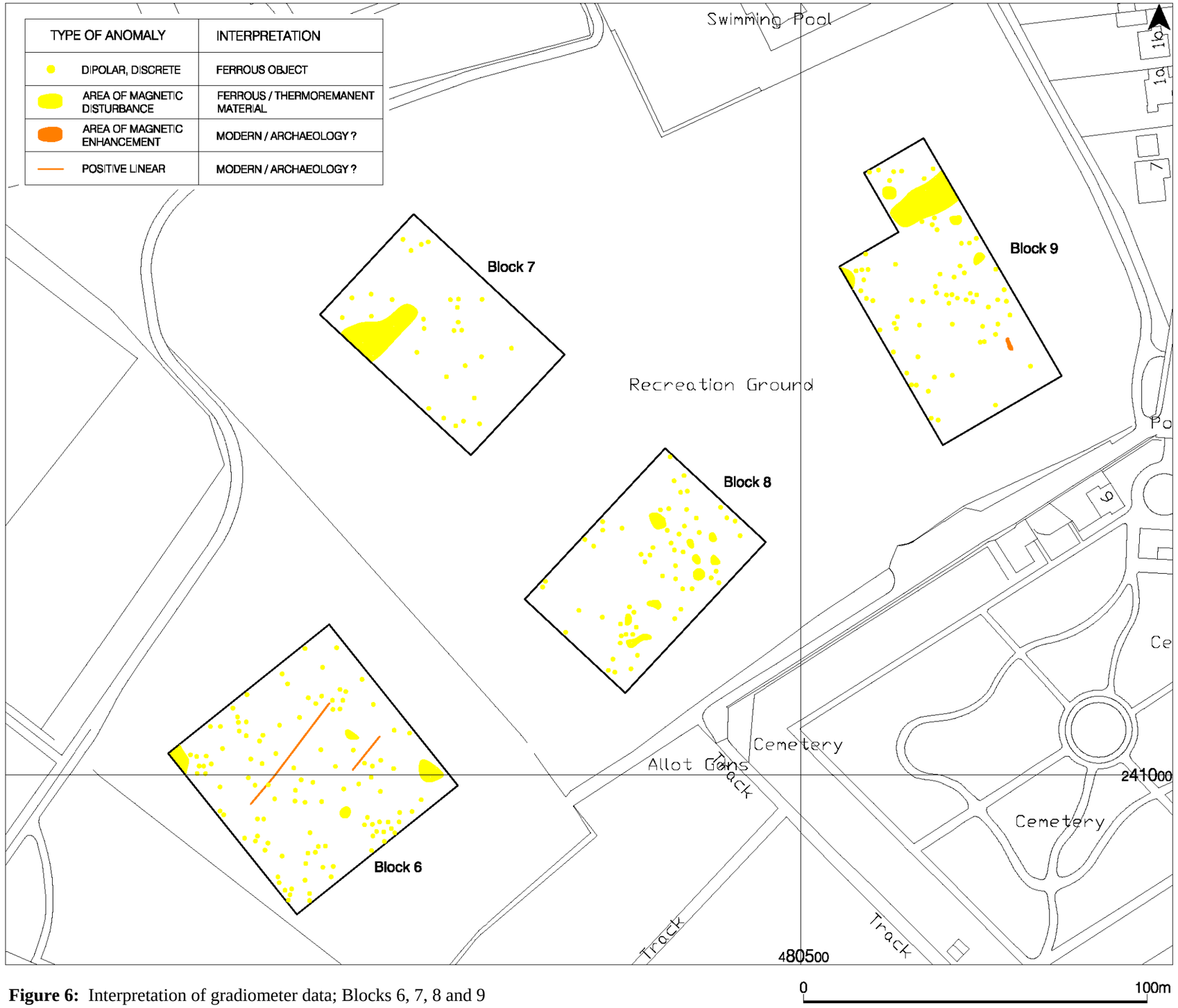

Figure 6: Interpretation of gradiometer data; Blocks 6, 7, 8 and 9

6. Conclusions

6.1 Intense modern activity is illustrated by the sheer number of iron spikes and other areas of magnetic disturbance present in all of the survey blocks. The level of disturbance is greatest in the southern part of the examined area and is consistent with recent use as a recreation ground and allotment gardens.

6.2 Two weak, positive linear anomalies and a discrete area of magnetic enhancement are identified at the southern part of the site in Blocks 6 and 9 respectively and could identify the position of archaeological features. However, the use of this area as a recreation ground and allotment gardens suggests that a relatively modern intrusive or agricultural origin is more probable. It is suggested that the southern area has limited archaeological potential.

6.3 Survey blocks located in the eastern part of the school playing fields show the characteristic signature of denuded ridge and furrow. Large areas of disturbance are also present in these blocks and these magnetic anomalies illustrate significant levels of modern activity associated with sporting and recreational pursuits

6.4 Magnetic anomalies characteristic of those caused by cut and infilled archaeological features are present at the western part of the school playing fields in survey Block 1. The segmented nature of the identified ditches suggests damage inflicted by past ploughing regimes and hinders definitive interpretation of the exact nature of the archaeology present. Nonetheless, it is tentatively suggested that the identified ditches and pits define the position of two enclosures within which evidence of settlement is present. The date of the enclosures remains uncertain although the presence of excavated middle and late Saxon archaeological features immediately to the west could be indicative.

6.5 Other linear and discrete magnetic anomalies of less certain archaeological origin are identified in survey Block 1. The focus of these anomalies is southwest of the enclosure ditches and while it is probable that some will originate from archaeological features, many will result from modern intrusive or agricultural activity.

6.6 The summarised evidence indicates that the archaeological potential of the western part of the school playing fields is high, reducing to medium/low at the east.

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.

7. References

Standards & Specifications

Clark 1995 *Research & Professional Services Guideline No 1: Geophysical survey in archaeological field evaluation.* English Heritage (London).

Gaffney C, Gater J and Ovenden S 2002 *The use of Geophysical Techniques in Archaeological Evaluations.* IFA Paper No. 6.

Hancock A 2007 *Project Design for Geophysical Survey.* Archaeological Services & Consultancy report, ASC 884/WRS/01.

NJL Consulting 2006 EIA Scoping Report: Wolverton West End, Milton Keynes. NJL Consulting 2006.009/Scoping Report

Schmidt A. 2003 *Geophysical Data in Archaeology: A Guide to Good Practice.* Archaeology Data Service.

Secondary Sources

Brown, Dr O, 1987 *Stony Stratford: the town on the road,* Wolverton & District Archaeol. Soc, Wolverton.

CAT 1992 *Manor Farm, Old Wolverton, Milton Keynes, Buckinghamshire: Archaeological Assessment,* Cotswold Archaeological Trust report no. 92100.

Crank, N, 2005 *Watching brief on flood alleviation scheme, Church Street, Wolverton, Milton Keynes,* Archaeological Services & Consultancy report, 620/WCS/01.

Croft R A & Mynard D C, 1993 *The changing landscape of Milton Keynes.* Buckinghamshire Arch. Soc. Monograph Series **5** (Aylesbury).

Fell, D, 2000 *Archaeological evaluation: Milton Keynes College, Wolverton,* Archaeological Services & Consultancy report, ASC/M/MCW00/1.

Green, C, 1957 `Review of finds 1957', *Wolverton Dist. Archaeol. Soc Newsletter* **2**, 5.

Green, H.S, 1974 `Early Bronze Age burial, territory and population in Milton Keynes, Buckinghamshire, and the Great Ouse valley', *Archaeol. J.* **131**, 75-139.

Green H S & Sofranoff S 1985 'A Neolithic settlement at Stacey Bushes, Milton Keynes' *Records of Buckinghamshire* **27**, 10-37.

Hyde, F.E., 1945 *Wolverton: a short history of its economic and social development* (Wolverton).

OA 2002 *Post Office Trade Centre, Wolverton Mill, Milton Keynes, Buckinghamshire: Archaeological Evaluation.* Oxford Archaeology, ref. 14585.

Preston S forthcoming *Excavations and fieldwork at the Post Office Training Centre, Wolverton, 1991-1994.* manuscript copy in MK SMR.

Soil Survey 1983 *1:250,000 soil map of England and Wales, and accompanying legend* (Harpenden).

Thorne, A 2005 'Wolverton, Wolverton Mill, Great Monks Street', *South Midlands Archaeol.* **35**, 19-20.

Williams, R J & Zeepvat, R J 1994 *Bancroft: a late Bronze Age/early Iron Age settlement, Roman villa and temple-mausoleum* (2 vols). Buckinghamshire Arch. Soc. Monograph Series **7** (Aylesbury).

Wilson, N and Abrams, J 2003 *Watching brief: Manor Farm, Old Wolverton,* Archaeological Services & Consultancy report, MFW02/4.

Zeepvat, R J and Rouse, C 2006 *Archaeological Desk-Based Assessment: Land Adjacent to Radcliffe School, Wolverton, Milton Keynes.* Archaeological Services & Consultancy report, ASC 840/WRS/01.

8. Acknowledgements

The author is grateful to Rob White of *NJl Consulting* for commissioning this work on behalf of *Milton Keynes Council* and *Radcliffe School*. Nick Crank of *Milton Keynes Council* is also thanked for monitoring the project. Bob Zeepvat BA MIFA edited the report.

Fieldwork

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K Semmelmann BA MA AIFA

Report

A. Hancock

Graphics

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Appendix 1: Magnetic Survey: Technical Information

1. Magnetic Susceptibility and Soil Magnetism

1.1 Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. 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. These effects are often observable by measuring the magnetic susceptibility of the topsoil, which can enable identification of areas where human occupation or settlement has occurred by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently fills features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

1.2 In general, it is a contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of the surrounding matrix, i.e topsoils, subsoils and rocks, into which these features have been cut that causes the most recognisable archaeological 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 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.

1.3 An alternative method of enhancement to the magnetic properties of soil or archaeological features is through sustained heating. This can lead to the detection of features such as hearths, kilns or burnt areas through thermoremanent magnetism.

2. Types of Magnetic Anomaly

2.1 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 geologies.

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

2.3 It should be noted that some anomalies that are 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 origin of the anomaly.

2.4 The types of response mentioned above can be divided into five main categories which 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. This type of anomaly is characterised by very strong, 'spiky' variations in the magnetic background. 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 of an area of magnetic disturbance or of an 'iron spike' (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post holes or by kilns, with the latter often being characterised by a strong, positive double peak response. 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.

3. Methodology

3.1 Gradiometer Survey

There are two main methods of using the fluxgate gradiometer for commercial evaluations. The first of these is referred to as ***scanning*** and requires the operator to visually identify anomalous responses on the instrument display panel whilst covering the site in widely spaced traverses, typically 10-15m 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. In favourable circumstances scanning may be used to map out the full extent of features located during a detailed survey.

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.

A Bartington Grad 601-2 fluxgate gradiometer was 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.

3.2 Data Processing and Presentation

The detailed gradiometer data has been presented in this report in X-Y trace and greyscale formats. The former option shows the 'raw' data with no processing other than grid biasing whilst in the latter the data has been selectively filtered to remove spurious errors such as striping effects and edge discontinuities caused by instrument drift and inconsistencies in survey technique caused by poor field conditions.

An X-Y 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 at 5nT. 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'. Archaeosurveyor was used to create the X-Y trace plots.

Archaeosurveyor was used to process the data and produce the greyscale images and XY trace plots. All greyscale plots are displayed using a linear incremental scale.

Appendix 2: Survey Location Information

1. The survey blocks were established using a Trimble TS315 total station theodolite. Survey block points at 60m intervals were set out with the total station theodolite and points at 20m intervals were set out as required using 100m tapes.

2. The survey grids were superimposed onto an Ordnance Survey digital map base. 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 ±2m. It should be noted that Ordnance Survey 1:2500 mapping 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 from points other than those listed below or if anomalies are relocated using GPS technology.

Station	Easting	Northing
A (wooden stake)	480545.15	241006.31
B (wooden stake)	480815.31	241056.38
C (wooden stake)	480604.96	240780.06
D (wooden stake)	480916.91	240517.50
E (wooden stake)	480984.32	240691.61
F (wooden stake)	481014.53	240554.10

ASC Ltd 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; plot meshes and composites, report text (Word 2000), and graphics files (CorelDraw12 and AutoCAD 2000) files.
- a full copy of the report

At present the archive is held by ASC Ltd 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). An online OASIS form will be completed.

Appendix 4: XY Trace Plots of Raw Gradiometer Data (1:1250)

Figure 7: XY trace plot of raw gradiometer data; Blocks 1, 2, 3, 4 and 5

Figure 8: XY trace plot of raw gradiometer data; Blocks 6, 7, 8 and 9

Appendix 5: ASC OASIS Form

PROJECT DETAILS						
Project Name:	Geophysical Survey Radcliffe School Site, Wolverton, Milton Keynes					
Short Description:	A magnetometer survey was carried out at the site of proposed housing development. Remnants of ridge and furrow plus archaeological ditches and pits defining the position of two probable enclosures of unknown date were located					
Project Type: (indicate all that apply)	DBA	FW	Geophys	Survey	Bldg Rec	Post-Exc
	WB	Strip&Rec	Trenching	Test pits	Exc	Other
Site status: (eg. none, SAM, Listed)	None		Previous work: (eg. SMR refs)		DBA	
Current land use:	School playing fields, and Recreation ground		Future work: (yes / no / unknown)		Yes	
Monument type:	na		Monument period:		na	
Significant finds: (artefact type & period)	Enclosure ditches and associated pits					
PROJECT LOCATION						
County:	Milton Keynes		OS reference: (to at least 8 figures)		SP 8073 4080 (centre)	
Site address: (with postcode if known)	Radcliffe School Site, Wolverton, Milton Keynes					
Study area: (sq. m. or ha)	*c.*13.5 ha		Height OD: (metres)		*c.* 80 -90m	
PROJECT CREATORS						
Organisation:	Archaeological Services & Consultancy Ltd					
Project brief originator:			Project design originator:		A Hancock	
Project Manager:	B Zeepvat		Director/Supervisor:		A. Hancock	
Sponsor / funding body:	NJL Consulting					
PROJECT DATE						
Start date:	20th February 2007		End date:		23rd February 2007	
PROJECT ARCHIVES						
	Location (Accession no.)		Content (eg. pottery, animal bone, files/sheets)			
Physical:	None		None			
Paper:	ASC Ltd		Fieldwork report			
Digital:	ASC Ltd		Report text, geophysical data, illustrations, basemap			
BIBLIOGRAPHY (Journal/monograph, published or forthcoming, or unpublished client report)						
Title:	Geophysical Survey, Radcliffe School Site, Wolverton, Milton Keynes					
Serial title & volume:	Unpublished client report					
Author(s):	A Hancock					
Page nos	1 - 32		Date:9th March 2007			