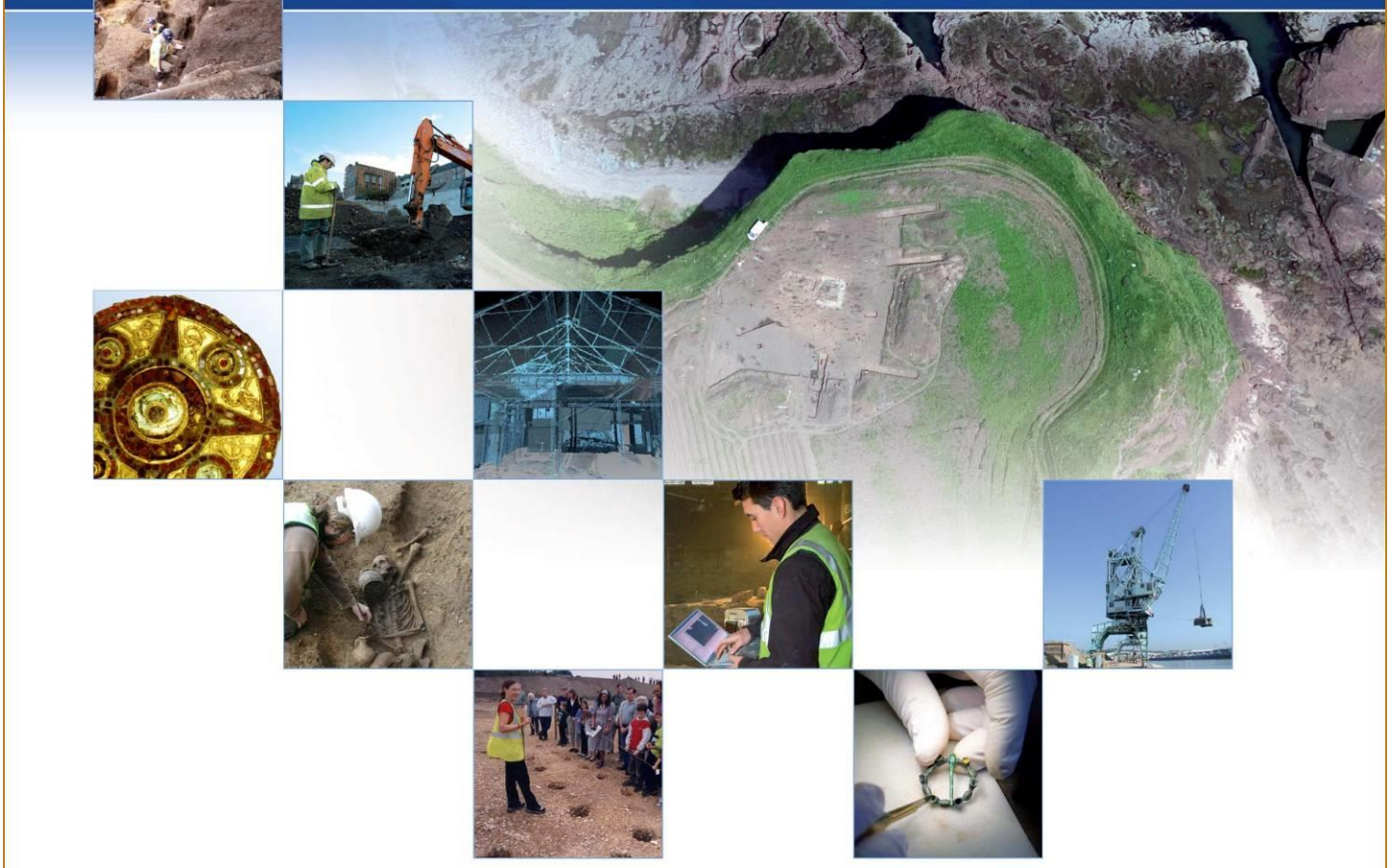
# Land at Nether Moor Drive, Wickersley, South Yorkshire

## Archaeological Geophysical Survey

National Grid Reference Number: SK 48359 90851

AOC Project No: 51595

Date: December 2016



AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

# Land at Nether Moor Drive, Wickersley, South Yorkshire

# Archaeological Geophysical Survey

| | |
|---|---|
| **On Behalf of:** | **Harron Homes**<br>**Colton House**<br>**Temple Point**<br>**Bullerthorpe Lane**<br>**Leeds**<br>**LS15 9JL** |
| **National Grid Reference (NGR):** | **SK 48359 90851** |
| **AOC Project No:** | **51595** |
| **Prepared by:** | **James Lawton and Alistair Galt** |
| **Illustrations by:** | **Kimberley Teale** |
| **Date:** | **December 2016** |

**This document has been prepared in accordance with AOC standard operating procedures.**

| | |
|---|---|
| **Author: James Lawton** | **Date: January 2017** |
| **Approved by: Graeme Cavers** | **Date: January 2017** |
| **Report Stage: Final Draft** | **Date: January 2017** |

**Enquiries to:** AOC Archaeology Group
The Raylor Centre
James Street
York
YO10 3DW

Tel. 01904 413404
e-mail. york@aocarchaeology.com

# Contents

Contents ..... ii
List of Figures ..... iii
List of Plates ..... iii
Non-Technical Summary ..... iv

1 Introduction ..... 1
2 Site Location and Description ..... 1
3 Archaeological Background ..... 1
4 Aims ..... 3
5 Methodology ..... 3
6 Results and Interpretation ..... 4
7 Conclusion ..... 5
8 Statement of Indemnity ..... 6
9 Bibliography ..... 6

Appendix 1: Survey Information ..... 9
Appendix 2: Archaeological Prospection Techniques, Instrumentation and Software Utilised ..... 10
Appendix 3: Summary of Processes used in Geoplot ..... 11
Appendix 4: Survey Processing Steps ..... 12
Appendix 5: Technical Terminology ..... 13
Appendix 6: Individual Characterisation of Identified Anomalies ..... 15

## List of Figures

Figure 1 Site Location

Figure 2 Location of survey areas 1: 1500

Figure 3 Unprocessed gradiometer survey results greyscale plot 1: 1500

Figure 4 Processed gradiometer survey results greyscale plot 1: 1500

Figure 5 Interpretation of gradiometer survey results 1: 1500

## List of Plates

Plate 1 Southern area looking east and east from north west corner

Plate 2 Southern area looking south from north west corner

Plate 3 Northern area looking north from centre of site

Plate 4 Northern area looking south from centre of site

## Non-Technical Summary

*AOC Archaeology Group was commissioned by Harron Homes to undertake an archaeological geophysical (gradiometer) survey to investigate the potential for buried archaeological remains on a proposed residential development to the east of Nether Moor Drive, Wickersley in the Borough of Rotherham, South Yorkshire (centred at* SK 48359 90851*).*

*The proposed development site consists of two separate areas situated to the north and south of Second Lane, totalling an area of 6.2ha. The larger southern area covers 3.9ha and is under arable cultivation, with the area to the north covering 2.3ha of permanent pasture. The site as a whole has been allocated for residential development by Rotherham Metropolitan Borough Council.*

*The geophysical survey results of both survey areas have identified possible archaeological remains, which most likely differ in age.*

*The northern area is likely to contain remains of medieval to modern date; consisting of anomalies indicative of ridge and furrow ploughing which are also visible as upstanding earth works. Tracks that were identified, which are also visible as earthworks, are more likely to be modern in age.*

*The southern area by contrast would appear to contain a rectilinear enclosure approximately 90m wide by 100m in length, along with two further smaller circular enclosures that may be related, but could predate / postdate the enclosure. The shape and size of this enclosure would likely suggest a prehistoric origin. A number of pit like anomalies were also detected, along with other tentative circular and linear trends located within the enclosures that could be relate to archaeological activity within the features themselves.*

*The northern area contains a number of ploughing tends however surprisingly these do not show as clearly in the data set as it would have been expected and are far more visible as upstanding earthworks in the field. The southern area by contrast contains very prominent north-south modern ploughing trends along with older ridge and furrow.*

*Both survey areas contain zones of modern magnetic disturbance, in particular in the northern field where a number of electric fences criss-cross the data. More modern disturbance is prevalent in the northern field also due to its current land use as horse paddocks.*

# 1 Introduction

1.1 AOC Archaeology Group was commissioned by Harron Homes to undertake an archaeological geophysical survey of land at Nether Moor Drive, Wickersley, South Yorkshire, as part of a wider scheme of archaeological assessment in advance of the proposed development of the site.

1.2 The survey was carried out to provide information on the extent and significance of potential buried archaeological remains within the proposed development site.

# 2 Site Location and Description

2.1 The proposed development site is situated on the southern edge of Wickersley, South Yorkshire and is divided into two areas (centred at SK 48359 90851; see Figures 1 and 2).

2.2 The largest area is situated to the south of Second Lane and consists of a single field covering approximately 3.9ha. It is bounded to the west by the rear of mid-20th century housing along Newhall Avenue and Morthen Road, to the south by the rear of houses to the north of Moat Lane, and to the east by fields (see Plates 2).

2.3 The southern field is currently under arable cultivation, and is bounded by mature hedgerows and tree lines along its southern and western sides. The ground level in this block slopes gradually upwards towards the south-west, from a height of around 120m above Ordnance Datum at the western end of the Second Lane to approximately 130m aOD in the south-western corner of the site.

2.4 The smaller, northernmost, block covers approximately 2.3ha, and is situated to the north of Second Lane. It is bounded to the west by the rear of properties on Morthen Road and to the north by First Lane and the boundaries of adjacent houses, as well as the south-west corner of Wickersley Wood. Its eastern side is bounded by mature hedge and tree lines beyond which are fields currently under pasture.

2.5 This block is under permanent pasture and its southern half is sub-divided into a series of small paddocks by wooden fencing, between which a track runs north-east from the south-western corner of the site to a range of stables and agricultural buildings, situated along the field boundary. An electrical sub-station is also situated adjacent to the block's south-west corner (see Plates 3 to 4).

2.6 The ground level in this block slopes upwards towards the north, from a height of around 120m aOD at the western end of the Second Lane to over 130m aOD at the north-eastern corner of the site.

2.7 The bedrock geology within the proposed development site as a whole is divided into sandstone of the Wickersley Rock formation on the northern part of the site and mudstone, siltstone and sandstone of the Pennine Upper Coal Measures across the site's southern half (BGS 2016).

2.8 These are overlain by slowly permeable seasonally wet acid loamy and clayey soils and freely draining slightly acid loamy soils (Soilscapes 2016).

# 3 Archaeological Background

3.1 The archaeological background below is drawn from the desk-based assessment of the site produced by AOC Archaeology (Pollington 2016). The figure numbers, HER record numbers and references are located in the full Desk based assessment. This is meant to only inform the reader of the archaeological background as a basis for the geophysical survey.

## Prehistoric and Roman Periods (up to c. AD 410)

3.2 There is no recorded evidence for prehistoric activity within the proposed development site or the wider study area. However, the National Mapping Programme (NMP), undertaken by English Heritage between 1993 and 1997, recorded numerous and extensive areas of field systems, enclosures and trackways identified as cropmarks across South Yorkshire. Part of what appears to be a sub-rectangular enclosure was identified in fields to the west of Morthen Road, approximately 250m to the west of the south-western corner of the proposed development site, and a complex of enclosures aligned along what may be a trackway has been recorded to the north of Slacks Farm (**17**), about 850m to the east of the site (see Figure 2). An extensive area of cropmarks was also identified outside the north-eastern edge of the study area at Sandy Lane. These were investigated through geophysical survey in 1993 that was followed by an archaeological evaluation by trial trenching, which confirmed that these features probably dated to the late Iron Age and Roman periods (ASWYAS 1993).

3.3 A number of Roman stray finds have also been discovered in the area to the north-east of the proposed development site, including a Roman fibula brooch found in fields in 1980, of bronze with enamel inlay (**14**), and a coin dating to the reign of Aurelian found in 1938 (**15**). A further coin dating to Aurelian's reign was also apparently found near Flash Lane, Bramley in 1938 (**16**). These finds, close to an area of extensive cropmarks, also suggest Roman period occupation or activity in this area.

## Medieval period (c. 410 to c.1500)

3.4 There is no recorded evidence for medieval activity within the proposed development site.

3.5 Wickersley is first recorded in the Domesday Book of 1086, where it is referred to as *Wicresleia* and was held by Aestan of Wysall at the time of the Conquest, indicating that it had earlier Anglo-Saxon origins. In the mid-12th century, Wickersley was held by Richard FitzTurgis (who adopted the name de Wickersley), who was one of the founders of Roche Abbey in 1147 (see Page 1974, 153). The Church of St Alban probably originally dates to this period, although the surviving elements of the fabric, including windows (**5**) as well as a stone coffin (**3**) are probably 15th century in date, and the majority of the church was rebuilt in the 19th century.

3.6 A possible medieval moated site is situated approximately 250m to the south-east of the south-eastern corner of the proposed development site (**13**) at Moat Farm (Le Patourel 1973, 129), although following a site visit in 1965, the Ordnance Survey stated that the site *'consists of two artificial ponds, one dry, and a 'ha-ha' [and] cannot be identified as a moat'* (NMR ref. SK 49 SE 3). The only other recorded evidence dating to the medieval period within the study area is the discovery of a medieval key, found to the north of the site in Wickersley Wood (**11**).

3.7 During the medieval period the proposed development site and the surrounding area would have been agricultural in character. The reverse-S alignment of the field boundaries which are depicted on the historical Ordnance Survey mapping for across both the northern and southern blocks of the site (see Figure 3) suggest that these preserved the line of earlier medieval strip fields, enclosed in the early 19th century. Indeed, earthwork remains of ridge and furrow, aligned north-south, survive within the pasture on the northern side of the proposed development site, together with possibly related boundary ditches (see Plates 9 to 11), which could be of a late medieval or early post-medieval date.

## Post-medieval period (c. 1500 to c.1900)

3.8 The proposed development site and the surrounding area remained primarily agricultural in character through the post-medieval period. In the early 19th century the remaining open fields within Wickersley were enclosed, following an Act of Parliament of 1817 (Rotherham Archives ref. 142/B). The proposed development site was divided into a series of fields, orientated north-south up the hill sides on either

side of Second Lane, the curving boundaries of which preserved the alignment of the earlier, medieval, strip fields (see Figure 3; Ordnance Survey 1854).

### Modern Period (c. 1900 to present)

3.9 The field layout across the proposed development site remained the same through into the mid-20th century as it had been laid out in the early 19th century (see Figures 3 to 6), although in the second half of the 20th century the central field boundary was removed, presumably to allow for more intensive modern agricultural practices.

3.10 By the 1930s suburban development had spread southward from Wickersley along Morthen Road (then Nether Moor Lane), with the construction of houses to the west and south of the southern block of the proposed development site (see Figure 5). This was followed in the immediate post-war period by the construction of Newhall Avenue and Nether Moor Drive to the immediate east of the site (see Figure 6), creating the present suburban landscape adjacent to the site.

### Previous archaeological investigations

3.11 There have been no previous archaeological excavations or surveys undertaken within the proposed development site, or within the 1km study area.

3.12 The proposed development site lies within the area covered by the English Heritage NMP, but no archaeological features were identified within the proposed development site as part of this project.

## 4 Aims

4.1 The aim of the geophysical survey was to identify any potential archaeological anomalies that would enhance the current understanding of the archaeological resource within the proposed development site.

4.2 Specifically the aims of the gradiometer survey were;

- Locate, record and characterise any surviving sub-surface archaeological remains within the site
- To help determine the next stage of works as part of the current planning application
- Provide an assessment of the potential significance of any identified archaeological remains in a local, regional and (if relevant) national context
- Produce a comprehensive site archive and report

## 5 Methodology

5.1 Parameters were selected that were suitable for the prospective aims of the survey and in accordance with recommended professional good practice (David *et al.* 2008, 8).

5.2 The gradiometer survey was carried out using Bartington Grad601-2 fluxgate gradiometers (see Appendix 1 and 2). Data was collected on an east-west alignment using zig-zag traverses, with a sample interval of 0.25m and a traverse interval of 1m.

5.3 A total of 90 full or partial 30m by 30m grids were surveyed within the proposed site, totalling a surveyed area of approximately 6.2ha. Attention was taken to attempt to avoid metal obstacles present within the survey area. Gradiometer survey is affected by 'above-ground noise' and therefore avoiding metallic objects improves the overall data quality and results obtained.

5.4 All geophysical survey work was carried out in accordance with recommended good practice specified in guideline documents published by English Heritage (David *et al.* 2008), and the

Chartered Institute for Archaeologists *Standard and Guidance for archaeological geophysical survey* (2014). Data processing, storage and documentation were carried out in accordance with the good practice specifications detailed in the guidelines issued by the Archaeology Data Service (Schmidt and Ernenwein 2011).

5.5 The gradiometer data were downloaded using Bartington Grad601 PC Software v313 and processed using Geoscan Geoplot v3.0. The details of these processes can be found in Appendices 3 and 4.

5.6 Interpreted point, polyline and polygon layers were created as layers in AutoCAD and technical terminology used to describe identified features can be found in Appendix 5.

# 6 Results and Interpretation

6.1 Gradiometer survey results have been visualised as greyscale plots with raw data plotted at -1nT to 2nT (Figure 3) and processed data plotted at -1nT to 2nT (Figures 4). An interpretation of each area has also been completed and these gradiometer survey results are shown in Figure 5. An individual characterisation of identified anomalies can be found in Appendix 6.

6.2 This results and interpretation section has been separated out into two separate survey areas (northern and southern) due to the complexity of the results in each section.

### Archaeology

6.3 No definitive archaeological anomalies have been detected within either survey area. However a number of tentative linear, rectilinear and circular trends have been recorded, some of which might form possible enclosures and could be archaeological in origin. These will be discussed in more detail in the area descriptions below.

### Northern Area

6.4 A number of discrete linear trends were recorded in the data (**W1**). These have the potential to be archaeological though they form no real shape or defined feature. Therefore these features are described as uncertain in origin.

6.5 Agricultural features have been detected in a predominantly north south direction throughout the area (**W2**). These would appear to resemble responses related to ridge and furrow ploughing.

6.6 Several modern features are recorded in the data; these contain a track way (**W3**), two pipes (**W4**) and several boreholes (**W5**). These combined with electric fences including (**W6**) visible in the data set mean that the northern area looks particularly noisy in terms of magnetic responses.

6.7 Across the data set there is a large quantity of isolated dipolar anomalies / iron spikes (e.g. **W7**). These are commonly caused by ferrous or high magnetically susceptible material on the surface or within the topsoil of the site, and it is likely that modern agricultural activity has changed the magnetic properties of the top soil and created a high level of background ‘noise’ within the data set.

### Southern Area

6.8 The southern area contains a number of tentative linear and curvilinear trends. These trends consist of increased signals compared to the background values however poor patterning of these response values and weaker anomaly strength makes interpretation difficult and more tentative.

6.9 The most prominent of these anomalies forms a large rectangular enclosure measuring approximately 90m by 100m (**W8**). The shape of this anomaly is similar to enclosures identified from the prehistoric or Roman period. Within this enclosure are a number of discrete trends which are circular in shape. These could be part of a structure associated with activity within the larger possible enclosure (**W9**).

6.10 A smaller discrete and tentative rectilinear enclosure is identified to the west of the larger enclosure (**W10**). It is difficult to ascertain whether this anomaly is associated with the larger enclosure. The two enclosure do appear to partly cross one another suggesting they were in use at different periods, however further investigation would be required to identify which anomaly predates the other.

6.11 A further smaller more tentative enclosure is located in the south east corner of the larger enclosure (**W11**). The anomaly falls directly across the southern enclosure extent, and suggests that it was not in use at the same time as the larger enclosure. Again further investigation would be required to identify which enclosure predates which.

6.12 Throughout this data set a number of linear trends running north to south are visible. These relate to a combination of modern agricultural ploughing trends and older possible medieval ridge and furrow ploughing trends (**W12**). These anomalies consist of a series of regular anomalies of a linear form, comprising in this case a mixture of both increased and decreased signal values compared to the background site values. They are normally parallel and narrower in spacing compared to field drainage trends.

6.13 Several parallel magnetic trends of a modern date are identified in the data and relate to field drains (**W13**). These all run west to east across the southern area and are likely to provide drainage to the surrounding land.

6.14 An old field boundary has been detected in the data of the southern area which correlates with historic ordnance mapping from 1854 (**W14**) (Old-maps, 2017). This consists of an isolated long linear anomaly that may appear inconsistent but the patterning and positioning, especially when compared with historic mapping, suggests such anomalies belong to former field division systems.

6.15 A number of areas of magnetic disturbance have been detected in the results (**W15**). These are located along the edges of the survey boundaries and may well be the remains of modern activity or larger pieces of magnetic debris from agricultural activities. Areas of modern disturbance are characterised by significant increases or decreases in values compared with background readings.

6.16 Across the data set there are a large quantity of isolated dipolar anomalies / iron spikes (e.g. **W16**). These are commonly caused by ferrous or high magnetically susceptible material on the surface or within the topsoil of the site, and it is likely that modern agricultural activity has changed the magnetic properties of the top soil and created a high level of background ‘noise’ within the data set.

# 7 Conclusion

7.1 The gradiometer survey has identified no definitive archaeological anomalies or features. However several potential archaeological features have been noted, in particular the possible rectilinear enclosure within the southern survey area along with a further two tentative enclosures located closeby.

7.2 The data set from the northern survey area would suggest that any archaeological remains are likely to be related to medieval ploughing or post-medieval/modern activity.

7.3 The southern survey area by contrast has the potential for prehistoric remains to be present, and further more intrusive evaluation would be required to determine if indeed this is a prehistoric enclosure with associated settlement or other activity.

7.4 An old field boundary has been detected in the southern field which correlates with historic ordnance mapping of 1854 (Old-maps, 2017).

7.5 Across both survey areas a number discrete linear trends were identified but due to their poor anomaly strength and patterning only a tentative interpretation can be formed as to their origin, and many of these could appear to be geological variations in the soils.

7.6 A number of agricultural trends, most likely related to former ploughing regimes, have also been identified. Field drains and magnetic disturbance of a more modern date were also identified.

# 8 Statement of Indemnity

8.1 Although the results and interpretation detailed in this report have been produced as accurately as possible, it should be noted that the conclusions offered are a subjective assessment of collected data sets.

8.2 The success of a geophysical survey in identifying archaeological remains can be heavily influenced by several factors, including geology, seasonality, field conditions, the technique used and the properties of archaeological features being detected. Therefore geophysical survey may only reveal certain archaeological features and not create a complete plan of all the archaeological remains within a survey area.

# 9 Bibliography

Bartington Instruments, 2007 User Manual

BGS, 2016 British Geological Survey website, *http://www.bgs.ac.uk/data/mapViewers/home.html* (last accessed 12th December 2016)

CIfA 2014 *Standards and Guidance for archaeological geophysical survey*

Clark, A., 1996 *Seeing Beneath the Soil: Prospecting Methods in Archaeology*, Second Edition. London

David, A. Linford, N. Linford, P., 2008 *Geophysical Survey in Archaeological Field Evaluation*, Swindon

Gaffney, C. and Gater, J., 2003 *Revealing the Buried Past Geophysics for Archaeologists*. Stroud: Tempus Publishing Ltd.

Heron, C. and Gaffney, C., 1987 'Archaeogeophysics and the site: ohm sweet ohm? in C. Gaffney and V. Gaffney (eds.) *Pragmatic Archaeology: Theory in crisis?* British Archaeological Report, British Series 167:71-81.

Kearey, P. and Brooks, M. 1991 *An Introduction to Geophysical Exploration (2nd ed.)*

Old-maps - OS mapping, 2017, *https://www.old-maps.co.uk/* (last accessed 3rd January 2017)

Pollington, M 2016. *Land at Nether Moor Drive, Wickersley, South Yorkshire: Historic Environment Assessment.* AOC Archaeology, Project no. 51552.

Schmidt, A. and Ernenwein, E., 2009 *Guide to Good Practice: geophysical data in archaeology*

Scollar, I., Tabbagh, A., Hesse, A. and Herzog, I., 2011 *Archaeological prospecting and remote sensing*

Sharma, P.V., 1997 *Environmental and Engineering Geophysics*

Soilscapes, 2016, *http://www.landis.org.uk/soilscapes/* (last accessed12th December 2016)

Plate 1. Southern area looking east and east from north west corner

Plate 2. Southern area looking south from north west corner

Plate 3. Northern area looking north from centre of site

Plate 4. Northern area looking south from centre of site

## Appendix 1: Survey Information

| Field | Description |
|---|---|
| Surveyor | AOC Archaeology |
| Client | Harron Homes |
| Site | Wickersley |
| County | South Yorkshire |
| NGR | SK 48359 90851 |
| Solid geology | Bedrock Geology: Wickersley Rock- Sandstone; Pennine Upper Coal Measures- Mudstone, Siltstone and Sandstone (BGS 2016) |
| Soil composition | These are overlain by Slowly permeable seasonally wet acid loamy and clayey soils and freely draining slightly acid loamy soils (Soilscapes 2016). |
| Historical documentation/ mapping on site | None |
| Known archaeology on site | No |
| Scheduled Ancient Monument | No |
| Land use/ field condition | Pasture-permanent, young wheat crop |
| Duration | 08/12/16 - 09/12/16 |
| Weather | Mixed dry & showers |
| Survey type | Gradiometer Survey |
| Instrumentation | Trimble GXOR system<br>Bartington Grad 601-2 |
| Area covered | Approx 6.2 ha (90 full or partial grids) |
| Data collection staffing | James Lawton, Kimberley Teale, Alistair Galt |
| Download software | Grad601 PC Software v313 |
| Processing software | Geoplot v3.0 |
| Visualisation software | AutoCAD LT 2009 |
| Report title | Land at Nether Moor Drive, Wickersley, South Yorkshire |
| Project number | 51595 |
| Report Author | James Lawton |
| Report approved by | Graeme Cavers |

# Appendix 2: Archaeological Prospection Techniques, Instrumentation and Software Utilised

## Gradiometer survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall *et al.*, 2008, 23; Sharma, 1997, 105). Human inhabitation often causes alterations to the magnetic properties of the ground (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremnant magnetization (Aspinall *et al.*, 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the top soil is generally suggested to have a greater magnetisation than the subsoil caused by human habitation. Also areas of burning or materials which have been subjected to heat commonly have high magnetic signatures, examples include: hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24). It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared with the surrounding soil, the surrounding soil will consequently have a greater magnetisation resulting in the feature displaying a negative signature. For example stone materials of a structural nature that are composed of sedimentary rocks are considered non-magnetic and so will appear a negative features within the data set.

Ferrous objects- i.e. iron and its alloys- are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data, though it is not usually possible to determine whether these relate to archaeological or modern objects.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

## Gradiometer survey instrumentation

AOC Archaeology's gradiometer surveys are carried out using Bartington Grad601-2 magnetic gradiometers. The Grad601-2 is a high-stability fluxgate magnetic gradient sensor, which uses a 1m sensor separation. The detection resolution is from 0.03 nT/m to 0.1nT/m, depending on the sensor parameters selected, making the Grad601-2 an ideal instrument for prospective survey of large areas as well as detailed surveys of known archaeology. The instrument stores the data collected on an on-board data-logger, which is then downloaded as a series of survey grids for processing.

## Gradiometer survey software

Following the survey, gradiometer data was downloaded from the instrument using Grad601 PC Software v313. Survey grids were then assembled into composites and enhanced using a range of processing techniques are applied to the data using Geoscan's Geoplot v3.0 (see Appendix 3 for a summary of the processes used in Geoplot and Appendix 4 for a list of processes used to create final data plots).

## Appendix 3: Summary of Processes used in Geoplot

| Process | Effect |
|---|---|
| Clip | Replaces data values outside a specified range, in order to display important data with relative values stretched across the display range. |
| De-spike | Removes exceptionally high values represented in the data that can obscure the visibility of archaeological features. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground; in gradiometer survey, these can be caused by highly magnetic items such as buried ferrous objects. |
| De-stagger | Counteracts the striping effect caused by misalignment of data when collected on a zig-zag traverse pattern. |
| Edge Match | Counteracts edge effects in grid composites by subtracting the difference between mean values in the two lines either side of the grid edge. |
| High pass filter | Removes low-frequency, large scale detail in order to remove background trends in the data, such as variations in geology. |
| Interpolate | Increases the resolution of a survey by interpolating new values between surveyed data points |
| Low Pass filter | Uses a Gaussian filter to remove high-frequency, small scale detail, typically for smoothing or generalising data. |
| Periodic Filter | Used to either remove or reduce amplitudes of constant and reoccurring features that distort other potential patterns. An example of which is plough lines. |
| Wallis filter | Applies a locally adaptive contrast enhancement filter. |
| Zero Mean Grid | Resets the mean value of each grid to zero, in order to counteract edge discontinuities in composite assemblies. |
| Zero Mean Traverse | Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects. |

## Appendix 4: Survey Processing Steps

| Process | Extent |
|---|---|
| Survey Area | |
| Zero Mean Traverse | All LMS =on, threshold -5 to 5 |
| Despike | X=1 Y=1 Thr = 3 Repl = Mean |
| Clip | Min =-5 Max = 5 |
| Destagger | All grids dir Shift = 2<br>Line Pattern 34-78 Dual-DS |
| Low Pass filter | X=1 Y=1 Wt=G |
| Interpolate | Y, Expand – Expand –SinX/X x2 |
| Raw Palette Scale | Grey55<br>Min= - Max= 2 |
| Palette Scale | Grey55<br>Min= -1 Max= 2 |

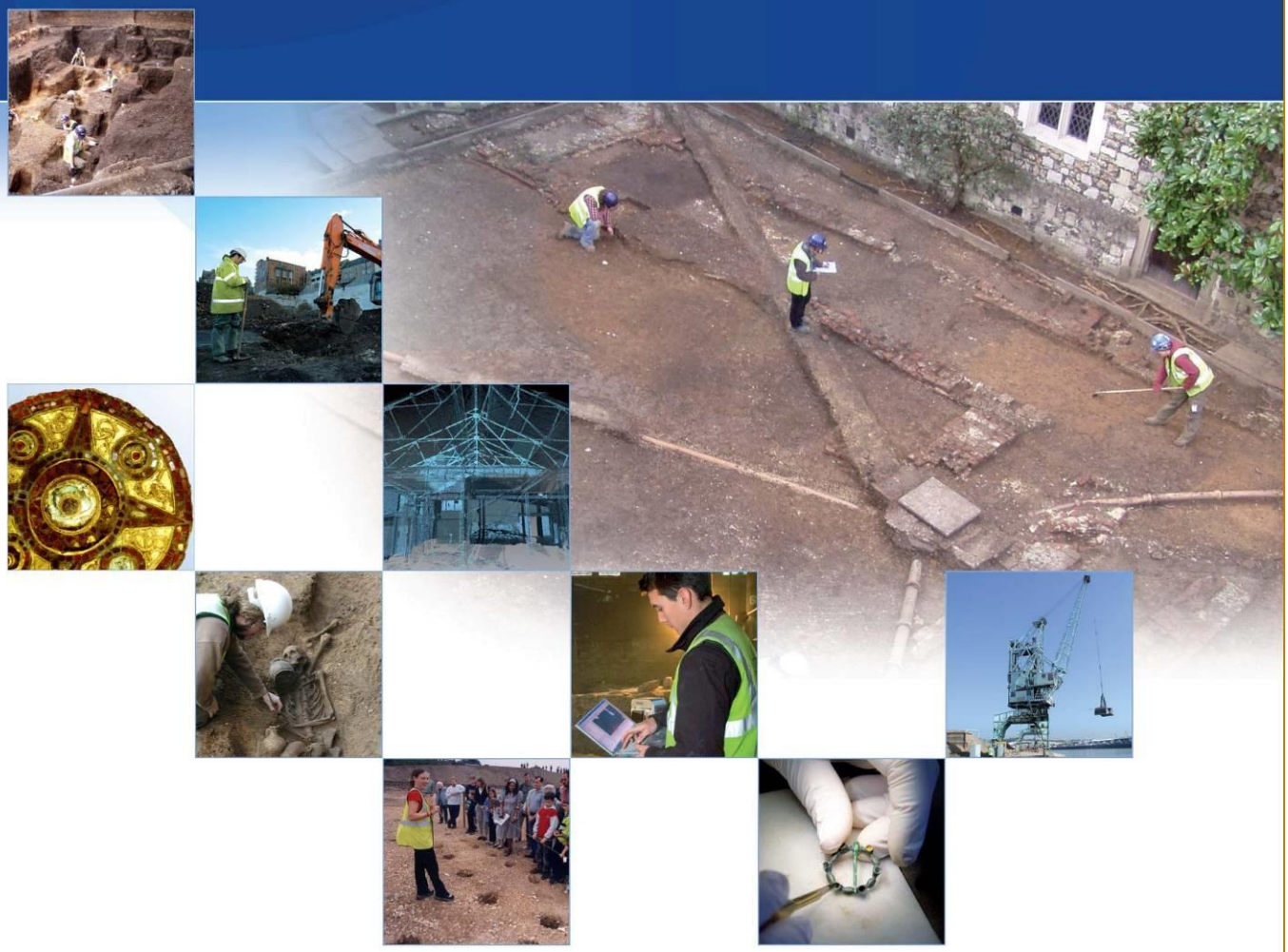
# Appendix 5: Technical Terminology

| Type of Anomaly | Description |
|---|---|
| ***Archaeology (Isolated Linear trends)*** | |
| Linear trend (field boundary) | Isolated long linear anomalies that are likely to relate to field boundaries. Signal may appear inconsistent but patterning and positioning, especially when compared with historic mapping suggests such anomalies belong to former field division systems |
| Linear trend (field boundary?) | Anomalies of a long linear form, but lack the necessary patterning, signal strength or positioning to be positively identified as field boundaries. |
| ***Archaeology*** | |
| Linear trend (fortification) | Linear anomalies that are composed of a patterning and positioning that is likely to relate to structural remains such as town fortifications. These anomalies can be composed of either an increase or decrease in magnetic values, relating to in-filled ditches or buried walls. |
| Linear trend (road) | A regular linear trend that is identified through the absence of buried remains, especially through areas containing a variety of rectilinear anomalies that appear to have structural associations. |
| Linear trend (archaeology) | These can either be isolated linear anomalies or rectilinear in form and often suggest the presence of structural remains. Anomalies are either characterised by an increase or decrease in signal compared to background values depending on the properties of the feature being recorded. |
| Disturbed area (archaeology) | These are characterised by a general increase or decrease in the magnetic background over a localised area but do not appear as having a linear form. These anomalies do not have the high dipolar response which are manifested in an 'iron spike' anomaly, and can be the result of in-filled pits and post-holes, or kilns. |
| Pit | Isolated circular anomalies composed of an increase in magnetic values with a patterning that is suggestive of buried remains such as the infill of a pit |
| ***Discrete*** | |
| Linear trend (archaeology?) | Anomalies of a linear form either composed of an increased or decreased signal compared to background values. It is possible these anomalies belong to structural remains, but poor patterning or response values makes interpretation difficult. |
| Disturbed area (archaeological?) | Anomalies with an increase or decrease in values compared with background reading over a localised area. Poor patterning or weak signal changes creates difficulty in defining the nature of the archaeology and so interpretation is fairly tentative. On certain geologies these anomalies could be caused by in-filled natural features, and it would be necessary to undertake intrusive archaeological investigation to establish their form and character. |
| Possible archaeology (Unclear to origins of the remains) | Anomalies composed of a weak change in signal values compared to background reading or are composed of incomplete patterning. Consequently, interpretation is tentative and it is unclear to whether anomalies belong to an archaeological nature. |

| | |
|---|---|
| (Archaeology?)<br>(Unclear to origins of the remains) | Like with above, but located in an area previously excavated so is either potentially a product of excavation related activity or relates to subtle changes in the magnetic properties in the soil caused by earlier activity, which was not detected during pervious archaeological assessment works. |
| Area of Disturbance<br>(archaeology?) | A large area of general disturbance which could relate to earlier human activity which has caused an increase in the magnetic properties of the soil. Generally these areas contain a variety of increased and decreased magnetic values, but lack sufficient patterning for detailed interpretation. They could indicate the presence of buried rubble relating to fallen structures, or instead denote modern material either caused by quarrying or agricultural activity. |
| Pit? | Isolated circular anomalies composed of an increase in magnetic values with a patterning that may be suggestive of buried remains such as the infill of a pit. |
| Linear trend<br>(plough lines) | A series of regular anomalies of a linear form either composed of an increased or decreased signal compared to background values. Likely to denote the presence of ploughing and relating to archaeological agricultural activity such as ridge and furrow. |
| ***Non- Archaeology*** | |
| Linear trend<br>(plough lines) | A series of regular anomalies of a linear form either composed of an increased or decreased signal compared to background values. Likely to denote the presence of ploughing and relating to modern agricultural activity. |
| Linear trend<br>(agricultural) | Series of linear anomalies, of an indeterminate date, likely to have been caused by agricultural activity such as ploughing and land drainage |
| Linear trend<br>(modern?) | Anomalies of a linear form that are likely to belong to modern features, but are composed of values, patterning or positioning which makes definite interpretation difficult |
| Disturbed area<br>(modern?) | Area of disturbance that is composed of significant increases or decreases in values compared with background readings. It is highly likely that these readings are caused by modern disturbances, but interpretation is tentative. |
| Linear trend<br>(modern) | Anomalies of a linear form often composed of contrasting positive and negative values. Such anomalies usually signify a feature with a high level of magnetisation and are likely to belong to modern activity such as pipe lines |
| Disturbed area<br>(modern) | Area of disturbance that is likely to be caused by modern disturbances and is characterised by significant increases or decreases in values compared with background readings. |
| Isolated dipolar anomalies (iron spikes) | Response normally caused by ferrous materials on the surface or within the top soil of the site, which cause a 'spike' representing a rapid variation in the magnetic response. These are generally not assessed to be archaeological when surveying on rural sites, and generally represent modern material often re-deposited during manuring. |
| Geology | Area of disturbance that is composed of irregular significant increase or decreases in values compared with background readings and are likely to indicate natural variations in soil composition or geology |

## Appendix 6: Individual Characterisation of Identified Anomalies

| **Anomaly Identifier (Site Name: Land at Nether Moor Drive, Wickersley)** | **Type of Archaeology** |
|---|---|
| Gradiometer survey | |
| W1 | Discrete linear trends |
| W2 | Linear trend (agricultural ploughing) |
| W3 | Disturbed area (modern) trackway |
| W4 | Disturbed area (modern) pipe |
| W5 | Disturbed area (modern) borehole |
| W6 | Disturbed area (modern) electric fence |
| W7 | Isolated dipolar anomalies |
| W8 | Archaeology? Possible archaeology |
| W9 | Discrete linear trends |
| W10 | Discrete linear trends enclosure? |
| W11 | Discrete linear trends enclosure? |
| W12 | Linear trend (agricultural ploughing) |
| W13 | Linear trend (drains) |
| W14 | Linear trend (field boundary?) |
| W15 | Modern disturbance |
| W16 | Isolated dipolar anomalies |



**AOC Archaeology Group**, The Raylor Centre, James Street, York, YO10 3DW
**tel: 01904 413 404** | **e-mail: york@aocarchaeology.com**