WYAS Archaeological Services

# Newall Old Hall

# Otley

# West Yorkshire

## Geophysical Survey

Report no. 3172
August 2018

**Client:** Johnson Mowat

West Yorkshire Joint Services

# Newall Old Hall,
# Otley,
# West Yorkshire

## Geophysical Survey

*Summary*

*A geophysical survey (magnetometer and earth resistance) with a topographical survey, was undertaken on land behind Newall Old Hall. Magnetic disturbance dominates the magnetometer readings, however three trends of possible interest have been identified. The earth resistance was able to indicate sub-surface readings, which may suggest the remains of part of a structure. They also document the low resistance readings indicative of disturbed ground which probably relates to a former structure. The topographical data in places corroborates with the resistance data and also a former field boundary noted on old mapping. Therefore based on these survey techniques the archaeological potential of this site is deemed to be low.*

WYAS Archaeological Services

## Report Information

| | |
|---|---|
| Client: | Johnson Mowat Heritage |
| Address: | Coronet House, Queen Street, Leeds, LS1 2TW |
| Report Type: | Geophysical Survey |
| Location: | Otley |
| County: | West Yorkshire |
| Grid Reference: | SE 200 464 |
| Period(s) of activity: | Modern |
| Report Number: | 3172 |
| Project Number: | 8332 |
| Site Code: | NOH18 |
| OASIS ID: | Archaeol11-326088 |
| Date of fieldwork: | August 2018 |
| Date of report: | August 2018 |
| Project Management: | Christopher Sykes BA MSc MCIfA |
| Fieldwork: | Christopher Sykes |
| | Jake Freeman BA |
| | Alastair Trace BSc MSc |
| | Jamie Ranaldi BSc MSc |
| Report: | Christopher Sykes & Emma Brunning BSc MCIfA |
| Illustrations: | Christopher Sykes |
| Photography: | Christopher Sykes |
| Research: | Jake Freeman |

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


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# 1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Johnson Mowat,Heritage on behalf of their client, Basil Houldsworth and Son Ltd, to undertake a geophysical (magnetometer and earth resistance) survey on land to the east of Newall Hall. A topographical survey was also undertaken. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out on 3rd August 2018.

### Site location, topography and land-use

The survey area is centred on National Grid Reference SE 200 464 and located to the immediate east of Newall Hall on Newall Carr Road. The survey area is relatively flat, sitting at approximately 74m above Ordnance Datum (aOD). The survey area is approximately 0.3 hectares within a solitary field of scrub grassland behind the old church hall. The survey area is bounded to the north by a residential estate associated with The Crescent, to the east by a playing field, and a council owned recreation ground to the south.

### Soils and geology

The underlying bedrock geology belongs to the Millstone Grit Group - mudstone, siltstone and sandstone. Sedimentary bedrock formed approximately 319 to 329 million years ago in the Carboniferous Period. Superficial deposits have been recorded as Till, Devensian – Diamicton, which formed up to 2 million years ago in the Quaternary Period (BGS 2018). The overlying soils are of the Dunkeswick association and are described as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (SSEW 1983).

# 2 Archaeological Background

The following information has been derived from a heritage statement prepared by Johnson Mowat Heritage with regards to the proposed planning:

The former location of Newall Old Hall is positioned directly south of the survey area. The hall itself is known to have been the manorial seat of the Fawkes family, with documented evidence of occupation by the 13th century. Records of buildings standing by the 17th century suggest the possible site of a Pele tower on land to the south east with a likely 14th or 15th century foundation. The site of the current church hall is on an area of land shown on mapping as being occupied by a series of agricultural buildings separate from the site of the Old Hall which is within the area of recreation ground to the south.

The current church hall building was constructed around 1927 as a Sunday school by Otley Parish Church. The extant church hall has limited archaeological and historical value within the context of the earlier Old Hall site.

Several other heritage assets of varying occupation periods are also located within 1km of the survey area. These consist of a Late Neolithic/Bronze Age rock carving and possible flint working site in Wharfemeadows Park approx. 900m to the south east of survey area, and Otley Bridge, which was built in the medieval period and retains five of its original arches, located approximately 600m south of the survey area (Pastscape 2018).

## 3 Aims, Methodology and Presentation

The main aim of the geophysical survey was to provide additional information on the known archaeology within the area. To achieve this, a magnetometer and targeted earth resistance survey covering the site was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic and resistance anomalies identified;
- to therefore determine the extent of the 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 R6 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed 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.

**Earth resistance survey**

The survey was undertaken using a Geoscan RM15 resistance meter. These were employed taking readings at 0.5m intervals on zig-zag traverses 0.5m apart within 30m by 30m grids. 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 2.

**Topographic survey**

The topographic survey was undertaken using a Trimble R6 Real Time Kinetic (RTK) differential Global Positioning System (dGPS). Readings were taken every two metres along two metre traverses. A total of 558 points were recorded and the results were processed using ESRI ArcGIS software to create a 3D surface.

### Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows a more detailed site location plan at a scale of 1:1000. Figure 3 is a combined magnetometer and interpretation at the same scale. Figure 4 details the stages of earth resistance processing and interpretation at the same scale. Figure 5 is a 3D representation of the topographical survey. Figure 6 is a combined interpretation over first and second edition mapping at a scale of 1:1000.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2 and 3. Appendix 4 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 5.

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 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 Figs 4 to 6)

### Magnetometer anomalies

The whole of the magnetic survey area has been subject to disturbance likely to have been caused by land development. However, two linear anomalies have been identified. Anomaly **A** broadly correlates with a former field boundary documented on early mapping.

Anomaly **B**, appears to be an almost semi-circular linear feature, which may reflect the distribution of demolition material caused by the removal of buildings from the site in 1934. Alternatively it may be a feature which predates those resistance responses detailed below.

### Earth Resistance anomalies

Across the survey area a number of responses of both high and low resistance have been identified. Anomaly **C** correlates with an area documented on first edition mapping, through until 1934 as being a structure (Johnson Mowat 2018). The low resistance response is indicative of disturbed ground caused by the removal and destruction of a building.

Anomalies **D** represent a high resistance square feature, surrounded by a low resistance linear feature which appears to partially enclose the square anomaly. There is no evidence of a former structure in this part of the survey area and may form the remains of an ancillary building associated with the former hall.

### Topographical survey

The topographical survey clearly shows the slight slope in the field running up from east to west. A slight rise has been noted on the profile graph (Fig 5) at 15m, this roughly corresponds to the former field boundary depicted on the early mapping. A dip in the profile graph at 35m roughly corresponds to the square high resistance feature **D**.

## 5 Conclusions

Across the site there is evidence of disturbance caused by the demolition of former structures. Within the magnetic disturbance there is limited potential to determine the location of a former field division.

Despite being undertaken within an unseasonal dry summer, the earth resistance results were able to determine the location of the former building to the north of the church hall. Rain two days prior to commencing on site, was able to provide sufficient ground moisture to undertake the survey. Most notably the high resistance features can be determined along the southern boundary of the site.

Overall the archaeological potential of the site is deemed to be low.

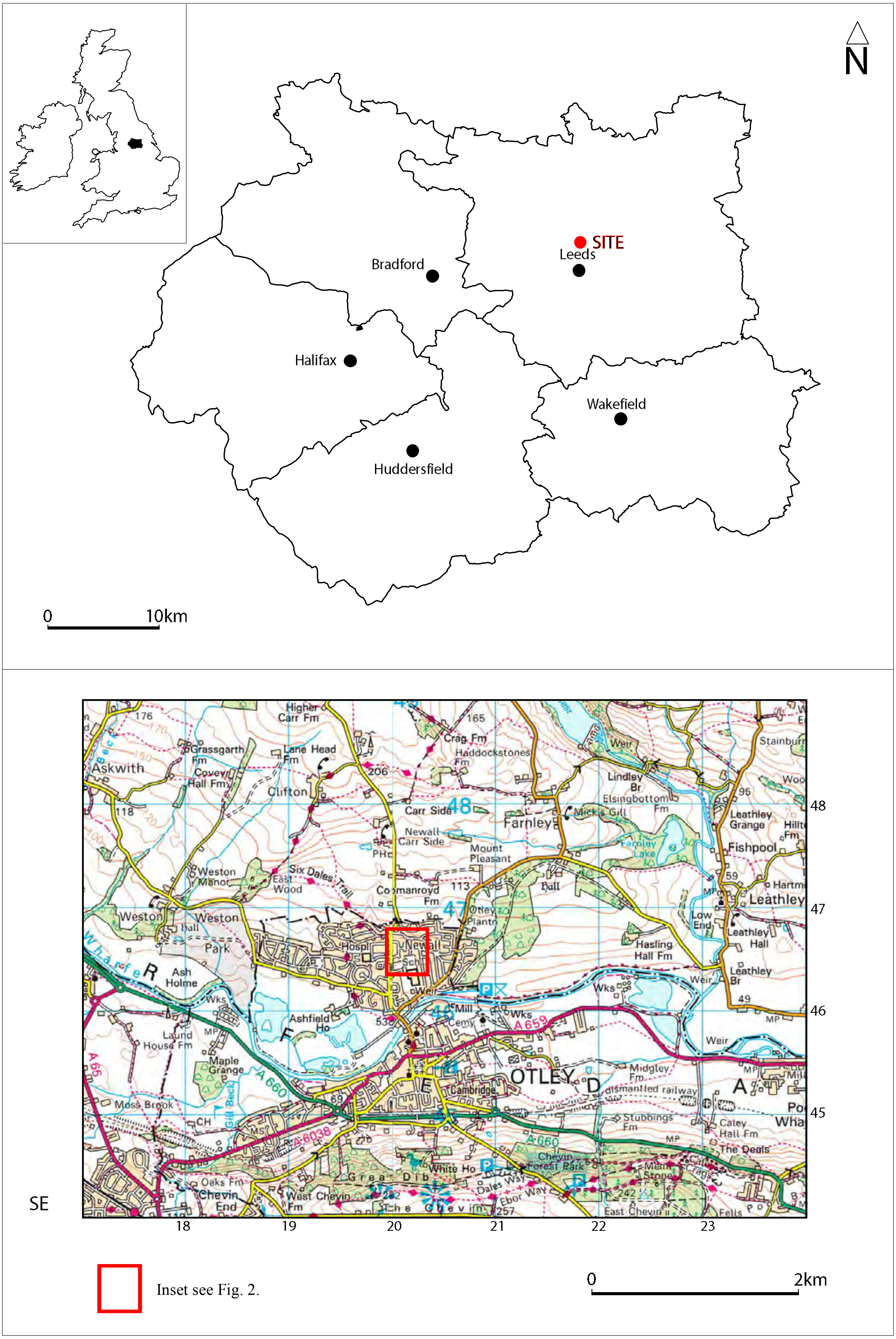



*Fig. 1. Site location*

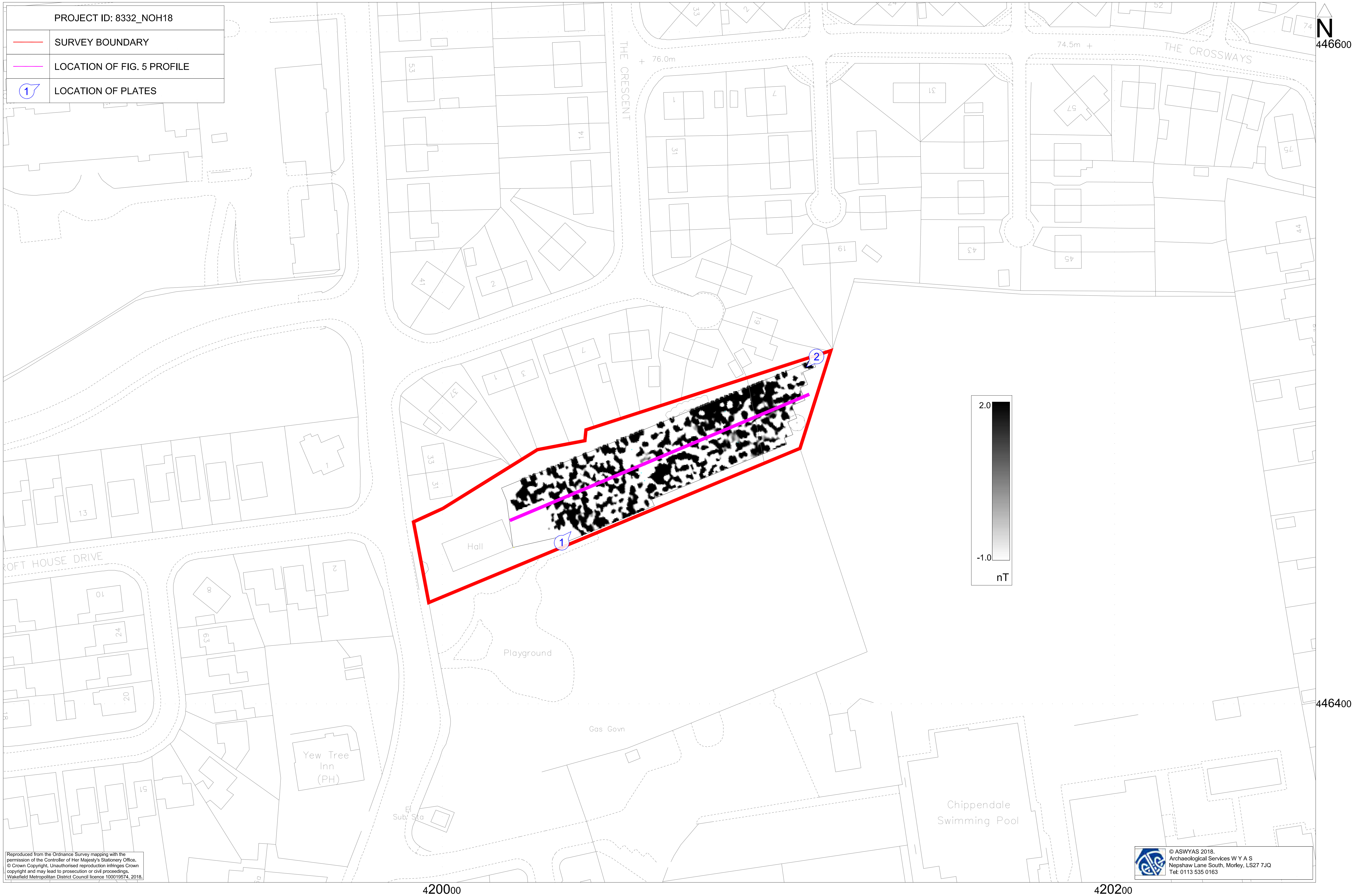



*Fig. 2. Site location showing processed greyscale magnetometer data (1:1000 @ A3)*

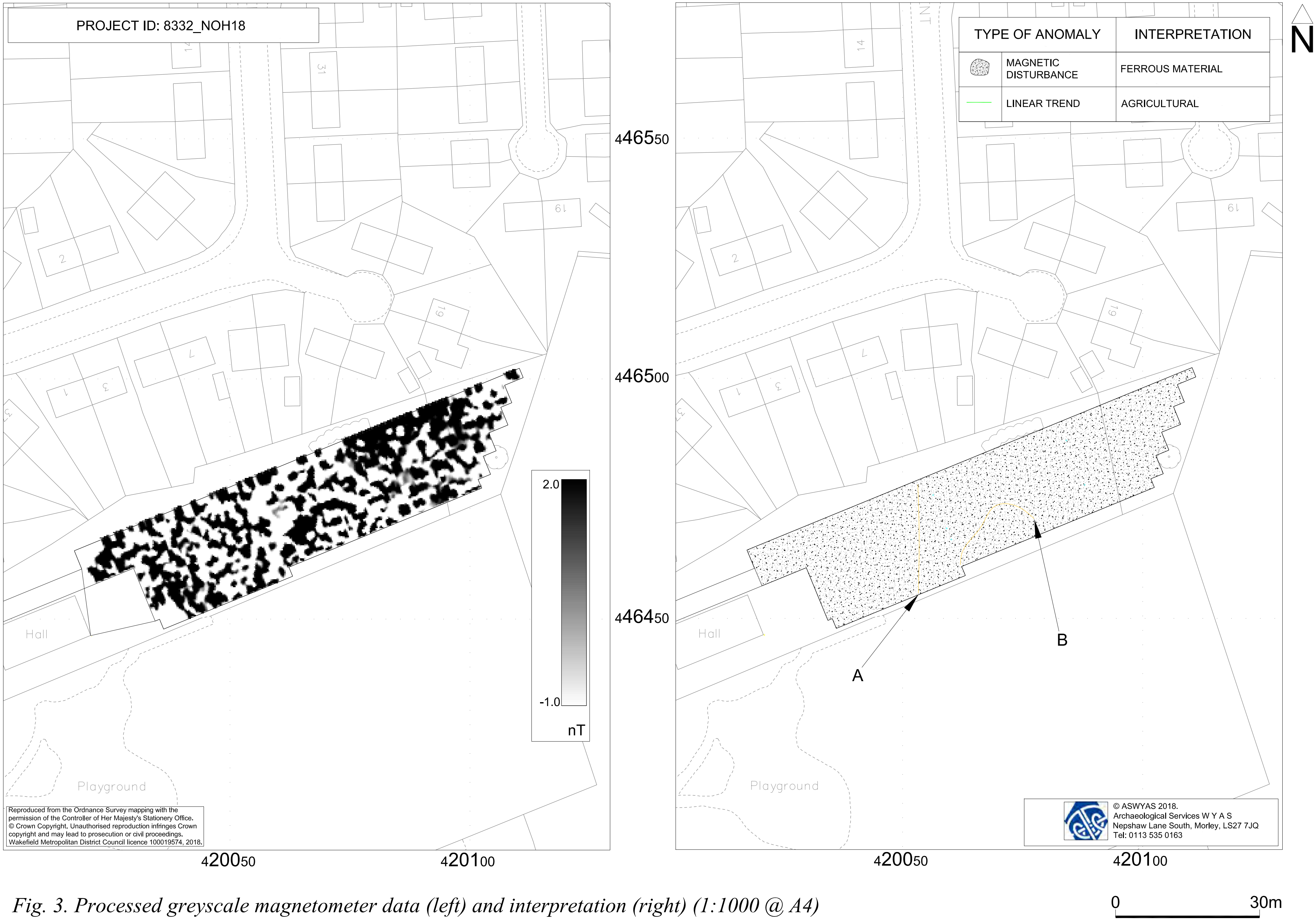



*Fig. 3. Processed greyscale magnetometer data (left) and interpretation (right) (1:1000 @ A4)*

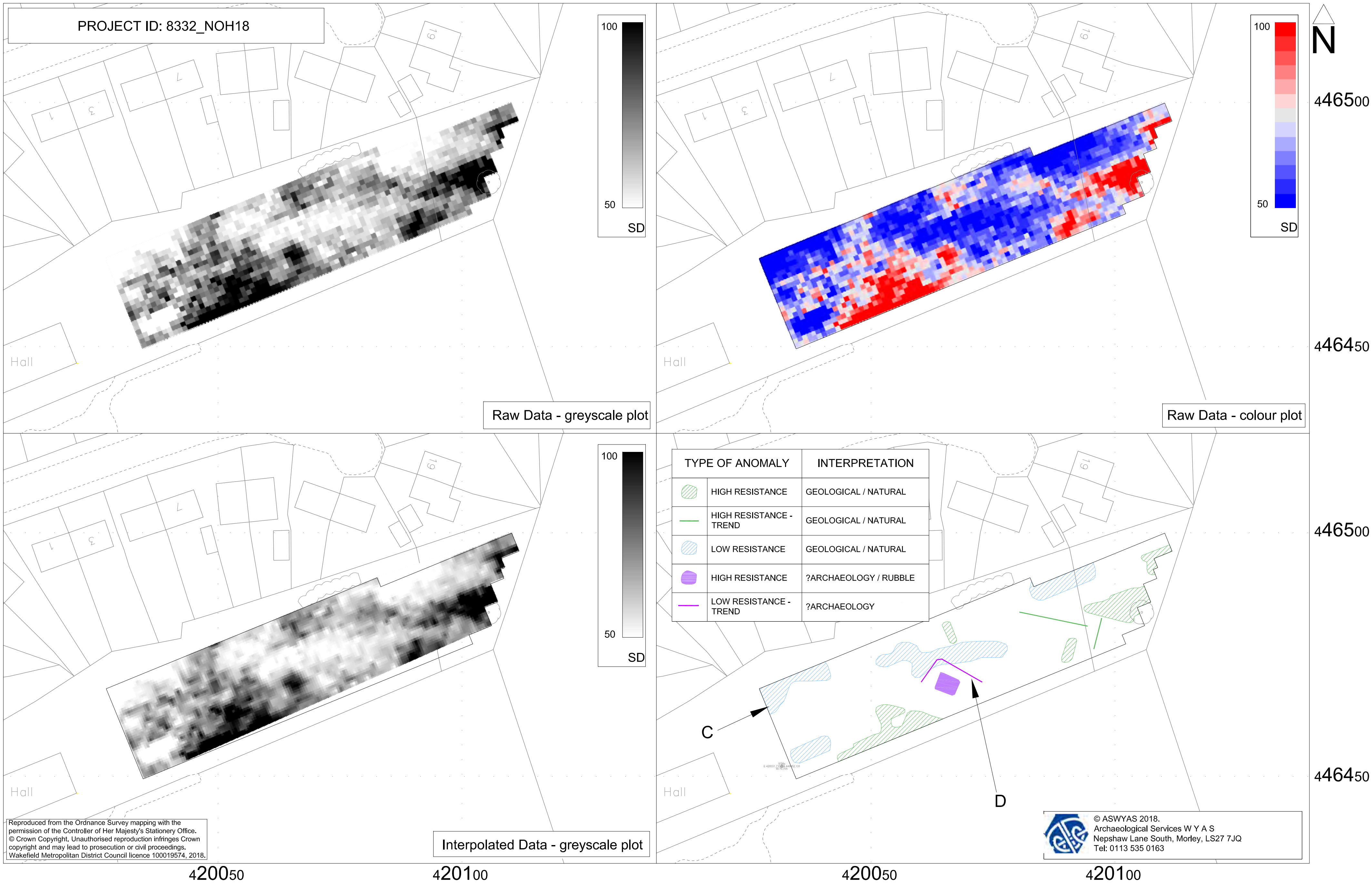
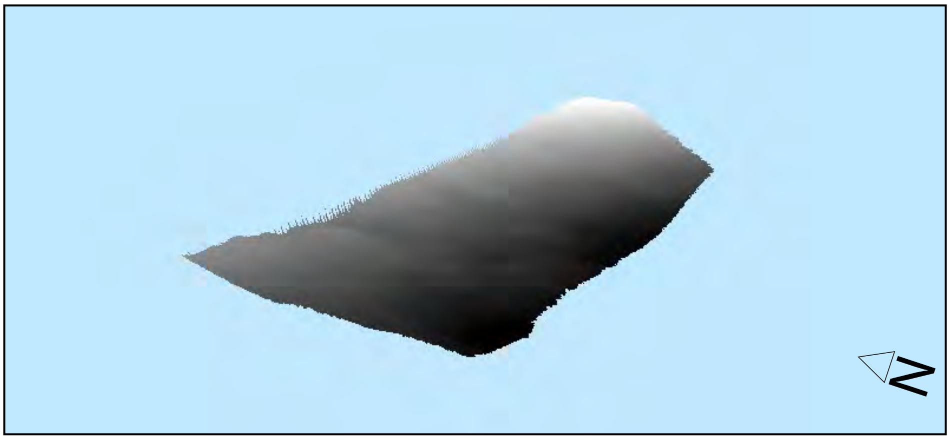
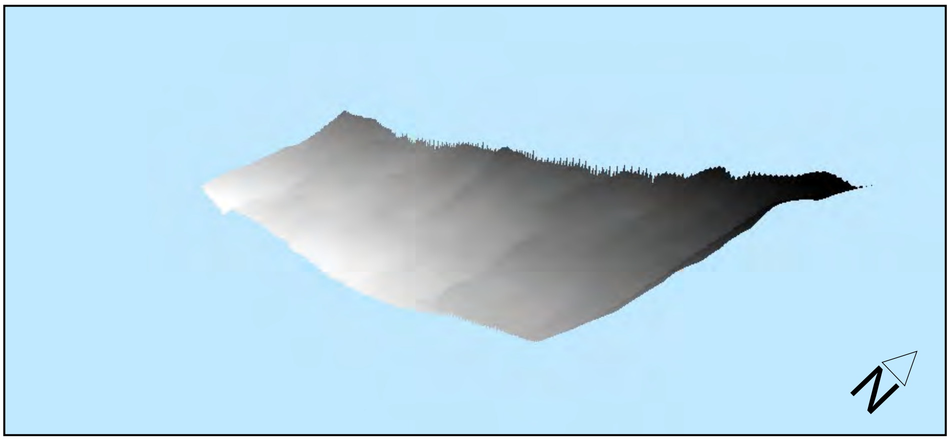


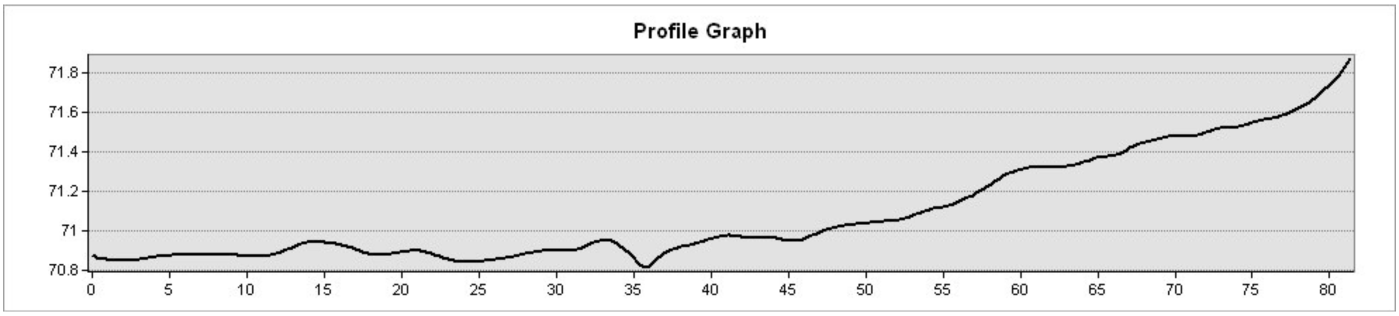

*Fig. 4. Earth resistance data processing stages and interpretation (1:1000 @ A4)*




*3D Topographical survey*




*3D Topographical survey*




*Profile graph running SE-NW across the survey area*

*Figure 5. Topographical survey*

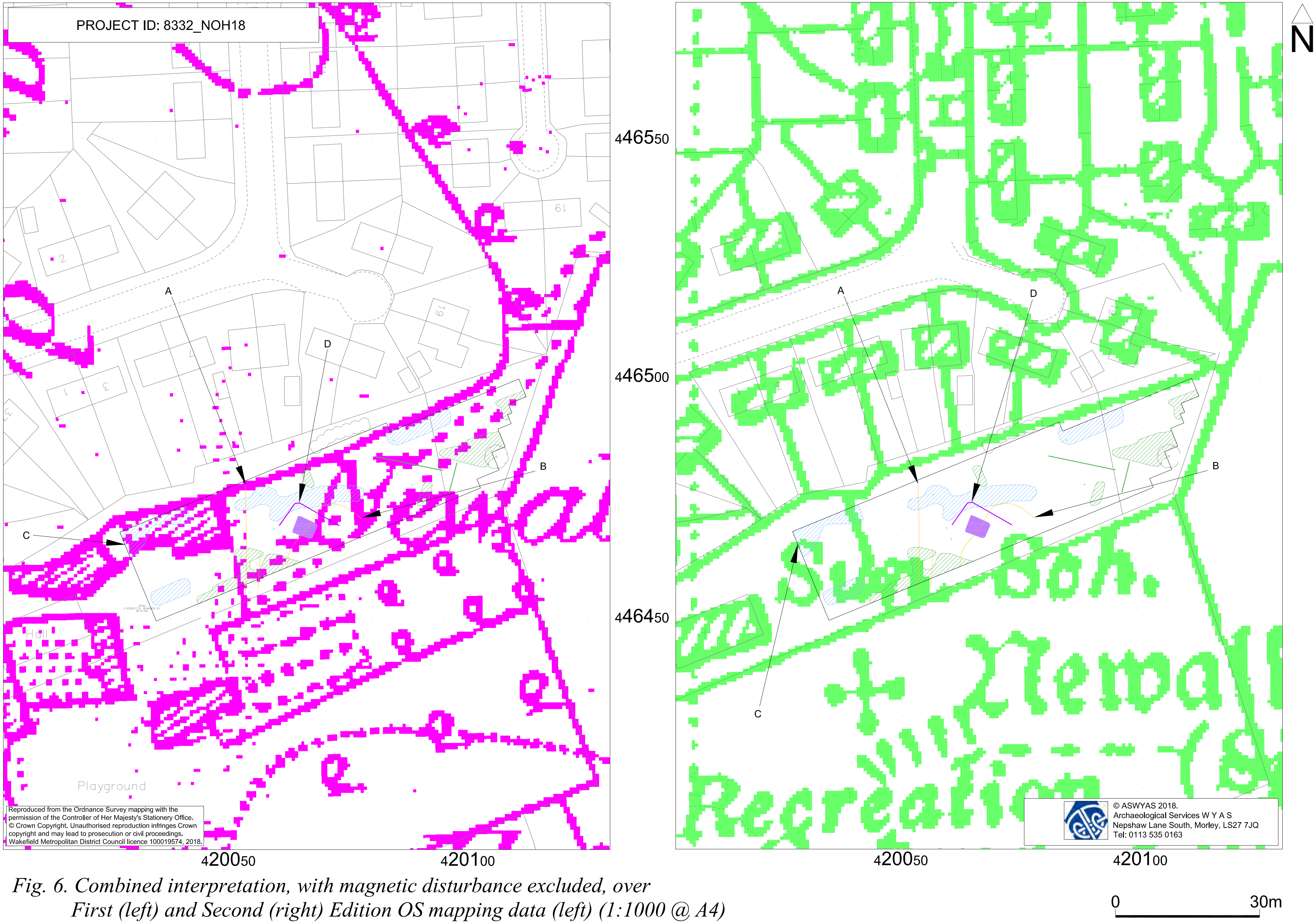



*Fig. 6. Combined interpretation, with magnetic disturbance excluded, over First (left) and Second (right) Edition OS mapping data (left) (1:1000 @ A4)*

*Plate 1. General view of site, facing northeast*

*Plate 2. General view of site, facing southwest*

# 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.

## 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 on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

*Linear and curvilinear anomalies*

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

## Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

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.

## Appendix 2: Earth resistance survey - technical information

### Soil Resistance

The electrical resistance of the upper soil horizons is predominantly dependant on the amount and distribution of water within the soil matrix. Buried archaeological features, such as walls or infilled ditches, by their differing capacity to retain moisture, will impact on the distribution of sub-surface moisture and hence affect electrical resistance. In this way there may be a measurable contrast between the resistance of archaeological features and that of the surrounding deposits. This contrast is needed in order for sub-surface features to be detected by a resistance survey.

The most striking contrast will usually occur between a solid structure, such as a wall, and water-retentive subsoil. This shows as a resistive high. A weak contrast can often be measured between the infill of a ditch feature and the subsoil. If the infill material is soil it is likely to be less compact and hence more water retentive than the subsoil and so the feature will show as a resistive low. If the infill is stone the feature may retain less water than the subsoil and so will show as a resistive high.

The method of measuring variations in ground resistance involves passing a small electric current (1mA) into the ground via a pair of electrodes (current electrodes) and then measuring changes in current flow (the potential gradient) using a second pair of electrodes (potential electrodes). In this way, if a structural feature, such as a wall, lies buried in a soil of uniform resistance much of the current will flow around the feature following the path of least resistance. This reduces the current density in the vicinity of the feature, which in turn increases the potential gradient. It is this potential gradient that is measured to determine the resistance. In this case, the gradient would be increased around the wall giving a positive or high resistance anomaly.

In contrast a feature such as an infilled ditch may have a moisture retentive fill that is comparatively less resistive to current flow. This will increase the current density and decrease the potential gradient over the feature giving a negative or low resistance anomaly.

### Survey Methodology

The most widely used archaeological technique for earth resistance surveys uses a twin probe configuration. One current and one potential electrode (the remote or static probes) are fixed firmly in the ground a set distance away from the area being surveyed. The other current and potential electrodes (the mobile probes) are mounted on a frame and are moved from one survey point to the next. Each time the mobile probes make contact with the ground an electrical circuit is formed between the current electrodes and the potential gradient between the mobile and remote probes is measured and stored in the memory of the instrument.

A Geoscan RM15 resistance meter with MPX multichannel adapter, were used during this survey, with the instrument logging each reading automatically at 0.5m intervals on traverses

0.5m apart. The mobile probe spacing was 0.5m with the remote probes 15m apart and at least 15m away from the grid under survey. This mobile probe spacing of 0.5m gives an approximate depth of penetration of 1m for most archaeological features. Consequently a soil cover in excess of 1m may mask, or significantly attenuate, a geophysical response.

## Appendix 3: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. 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 hard copies of the mapping rather than using the digital co-ordinates.

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

## Appendix 4: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS6 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 West Yorkshire Historic Environment Record).

## Appendix 5: Oasis form

# OASIS DATA COLLECTION FORM: England

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

## Printable version

## OASIS ID: archaeol11-326088

### Project details

| | |
|---|---|
| Project name | Newall Old Hall |
| Short description of the project | A geophysical survey (magnetometer and earth resistance) with a topographical survey, was undertaken on land behind Newall Old Hall. Magnetic disturbance dominates the magnetometer readings, however three trends of possible interest have been identified. The earth resistance was able to indicate sub-surface readings, which may suggest the remains of part of a structure. They also document the low resistance readings indicative of disturbed ground which probably relates to a former structure. The topographical data in places corroborates with the resistance data and also a former field boundary noted on old mapping. Therefore based on these survey techniques the archaeological potential of this site is deemed to be low. |
| Project dates | Start: 03-08-2018 End: 03-08-2018 |
| Previous/future work | No / Not known |
| Any associated project reference codes | 8332 - Sitecode |
| Type of project | Field evaluation |
| Current Land use | Grassland Heathland 2 - Undisturbed Grassland |
| Monument type | HALL Post Medieval |
| Significant Finds | NONE None |
| Methods & techniques | "Geophysical Survey" |
| Development type | Housing estate |
| Prompt | National Planning Policy Framework - NPPF |
| Position in the planning process | Not known / Not recorded |
| Solid geology (other) | Millstone grit |
| Drift geology (other) | loam and clay |
| Techniques | Magnetometry |
| Techniques | Resistivity - area |

## Project location

| | |
|---|---|
| Country | England |
| Site location | WEST YORKSHIRE LEEDS OTLEY Newall Old Hall, Otley |
| Study area | 0.3 Hectares |
| Site coordinates | SE 200 464 53.913162595185 -1.695490781525 53 54 47 N 001 41 43 W Point |
| Height OD / Depth | Min: 74m Max: 74m |

## Project creators

| | |
|---|---|
| Name of Organisation | Archaeological Services WYAS |
| Project brief originator | Johnson Mowat Heritage |
| Project design originator | Johnson Mowat Heritage |
| Project director/manager | E Brunning |
| Project supervisor | C. Sykes |

## Project bibliography 1

| | |
|---|---|
| Publication type | Grey literature (unpublished document/manuscript) |
| Title | Newall Old Hall, Otley, West Yorkshire |
| Author(s)/Editor(s) | Sykes, C |
| Author(s)/Editor(s) | Brunning, E |
| Date | 2018 |
| Issuer or publisher | ASWYAS |
| Place of issue or publication | Leeds |
| Description | A4 report with A4 and A3 figures |

| | |
|---|---|
| Entered by | Emma Brunning (emma.brunning@aswyas.com) |
| Entered on | 16 August 2018 |

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