



WYAS
**Archaeological
Services**

**Land off Boroughbridge
Road
York
North Yorkshire**

Geophysical Survey

Report no. 3293
June 2019

Client: Surface Property



Land off Boroughbridge Road

York

North Yorkshire

Geophysical Survey

Summary

A geophysical survey (magnetometry) was undertaken on approximately 2.8 hectares of land to the immediate south of Boroughbridge Road, as part of a planning application for residential development. Clear anomalies synonymous with ridge and furrow, a former field boundary and modern agricultural practices have been detected. Geological responses have also been identified. Subtle and ephemeral anomalies have been identified, as possible archaeology. Overall the archaeological potential of the survey area is deemed to be low, although work on nearby sites indicates that the contrast between archaeological anomalies and the underlying geology is weak. Some archaeological features may be present, yet not detected by the survey because of the geological conditions.



Report Information

Client: Arcus Consultancy Services Ltd. T/A Surface Property
Address: 7th Floor, 114 West George Street, Glasgow, G2 2HG
Report Type: Geophysical Survey
Location: Boroughbridge Road, York
County: North Yorkshire
Grid Reference: SE 56589 53122
Period(s) of activity: Modern/ post-medieval
Report Number: 3293
Project Number: 8559
Site Code: BOB19
OASIS ID: archaeo111- 355375
Date of fieldwork: June 2019
Date of report: June 2019
Project Management: Alastair Trace BSc MSc
Fieldwork: Christopher Sykes BA MSc MCIfA
Matthew Worrall
Report: Alastair Trace and Christopher Sykes
Illustrations: Jake Freeman BA

Authorisation for
distribution: -----



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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Surface Property, the trading name of Arcus Consultancy Services Ltd., to undertake a geophysical (magnetometer) survey on land off Boroughbridge Road, York. This is in advance of a proposed development. Guidance contained within the National Planning Policy Framework (MFCLG 2019) was followed, in line with current best practice (CifA 2014; David *et al.* 2008). The survey was carried out on 11th June 2019.

Site location and land use

The Proposed Development Area (PDA) covers an area of 2.8ha to the immediate north west of York, centred on SE 56589 53122 (Fig.1). The site comprises part of a single, irregular-shaped field, containing adolescent wheat. It is located directly south of Boroughbridge Road (A59) approximately 1.2km south east of Upper Poppleton, North Yorkshire. The site is bounded to the north by the A59, to the east by modern housing developments and to the west by Wheatlands House and its associated lands. The site has a generally flat topography, gently sloping into the north west corner, and lies between 20-22m above Ordnance Datum (aOD).

Soils and geology

The underlying bedrock deposits belong to the Sherwood Sandstone Group. These formed approximately 237 to 272 million years ago in the Triassic and Permian Periods. Superficial deposits are recorded as belonging to the Poppleton Glaciofluvial Member, a sand, gravelly deposit that formed up to 2 million years ago in the Quaternary Period (BGS 2019). The soils are recorded as belonging to the Escrick 2 association (571q) and are described as deep, well drained, often reddish coarse loamy soils deposited as a result of Glaciofluvial drift (SSEW 1983).

2 Archaeological and Historical Background

The following is a summary of information taken from a Desk-Based Assessment (DBA) of the area undertaken by Surface Property (Jones and Turner 2014) and available from the City of York HER.

A portion of medieval ridge and furrow is the only known archaeological asset within the survey area. However within a wider 1km radius, from the centre of the survey area, a number of heritage assets have been detected.

The DBA identified a total of 21 features within a wider study area of c.1km. This identified that there were no Registered Historic Parks and Gardens, Registered Battlefields, World Heritage Sites, Scheduled Monuments or Listed Buildings situated within the wider study area.

Prehistoric features within the local area are limited. Approximately 750m towards the west of the site, the truncated remains of a possible Bronze Age round barrow were recorded during the investigations for the Poppleton Bar Park and Ride (Keefe 2013). To the north (approximately 100m) of Boroughbridge Road possible prehistoric cremations have also been identified (Bruce and Keefe 2014). The follow up evaluation work at the British Sugar Site (YAT 2014; O'Brien and Bruce 2015) also identified prehistoric remains that were not apparent from an earlier geophysical survey (Bruce *et al.* 2014).

Romano-British sites in the local area include the course of a Roman Road (801) approximately 1.5km to the east of the site, with Roman Road 8a approximately 500m to the south west (Margary 1973). Additional Romano-British sites have been recorded at the Poppleton Park and Ride (Keefe 2013), 750m to the north west of the PDA where finds suggest limited Romano-British activity. Further Romano-British activity has been recorded at Wheatlands, 750m south west of the survey area (Wells 2015). Along the northern side of Boroughbridge Road, a boundary ditch suggesting Romano-British activity from early Roman to 4th-century date was also detected (O'Brien and Bruce 2015). In all cases, the geophysical survey could not clearly define the archaeological anomalies.

One record of medieval ridge and furrow borders the site development and lies partially within the development site itself (Bruce *et al.* 2014). A medieval/post-medieval pottery sherd was found in the topsoil during the excavations at Manor School, approximately 400m to the north. Ridge and furrow remnants were also identified and dated to the medieval period at Manor School (Pollington 2006; Harrison 2006; Chadwick 2007).

Post-medieval activity recorded in the HER include a heavy anti-aircraft battery dated to WWII, recorded to the east of Knapton approximately 1.2km to the south of the site.

3 Aims, Methodology and Presentation

The main aim of the survey was to provide additional information on the known archaeology within the area. To achieve this, a magnetometer survey covering all available parts of the Proposed Development Area 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 anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The site grid was laid out using a Trimble R6 GNSS system. 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. Bespoke in-house software and Geoplot 3.0 was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows a more detailed site location plan at a scale of 1:2500. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 3 to 5 inclusive at a scale of 1:1000. Figure 6 is presented at a scale of 1:1000 which shows greyscale data at a narrower nano-tesla range, to highlight subtle features in the survey area.

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. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

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

The figures in this report have been produced following analysis of the data in 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 (Figs 3 and 6)

Ferrous anomalies

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural/greenfield sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Geological anomalies

The survey has detected two low magnitude anomalies along the southern boundary of the site. These anomalies have been interpreted as geological in origin. These responses have

been detected because of variation in the composition and depth of the soils and deposits of superficial material in which they derive. This will have been caused by agricultural machinery churning the ground as it traverses the site, either for seeding or crop spraying.

Natural trends have been identified centrally within the survey area. It is thought to be geological response caused by the topography of the PDA, where the soils are at their thinnest.

Agricultural anomalies

The survey area contains a number of faint linear trends orientated roughly west/east, across the whole field. These trends reflect the agricultural practices undertaken on site. These cultivation anomalies may represent earlier medieval ridge and furrow cultivation. There are some additional, thinner, linear trends orientated north west/south east likely to represent modern ploughing.

There are two linear anomalies present to the south of the survey area. These anomalies are thought to be associated with a modern trackway visible on site, where constant use has compacted the ground to a greater degree than the surrounding area.

An alternating dipolar response along the southern boundary is associated with an informal pathway, again caused by compaction.

A former field boundary recorded on the 1853 OS map and removed by the 1893 map has been detected. Agricultural activity and the magnetic characteristics of the soils mean the clarity of this feature has been reduced.

Possible archaeological anomalies

Examination of the data at a narrow nano-tesla range (Fig. 6) has detected a number of anomalies which may have possible archaeological potential. They are identified as linear trends, but would be consistent with a former field boundaries.

Anomaly **P1** is the strongest of the possible responses which bisects the field from west to east. To the north of this anomaly, **P2** appears to form a linear feature which projects northwards at its western end. This may be evidence of a former field system. Both of these anomalies appear to be connected by a positive magnetic linear response which is orientated north to south, but this may also be a geological response as it roughly corresponds with the gentle slope of the topography of the PDA.

P3 is a positive magnetic linear response which runs parallel with the identified former field boundary. Again this may be a geological response rather than an archaeological feature, but the orientation of this anomaly suggests a possible archaeological interpretation. **P4** is a positive magnetic linear which is at right angles to **P3**, close to Boroughbridge Road.

5 Conclusions

Within the survey area, a number of faint linear trends orientated roughly east-west have been identified, associated with former ridge and furrow across the site. Some narrower trends orientated north west-south east have been identified as modern ploughing trends. Two strong magnetic responses present in the southern portion of the site may be geological in origin. A former field boundary has also been identified.

Overall the archaeological potential of the site, based on the geophysical survey results, is deemed to be low, although work in the wider area suggests that the underlying sands and gravels produce a magnetic signature similar to the archaeological features. Narrowing the band of nano-tesla readings helps provide an indication that archaeological anomalies may be present on site.

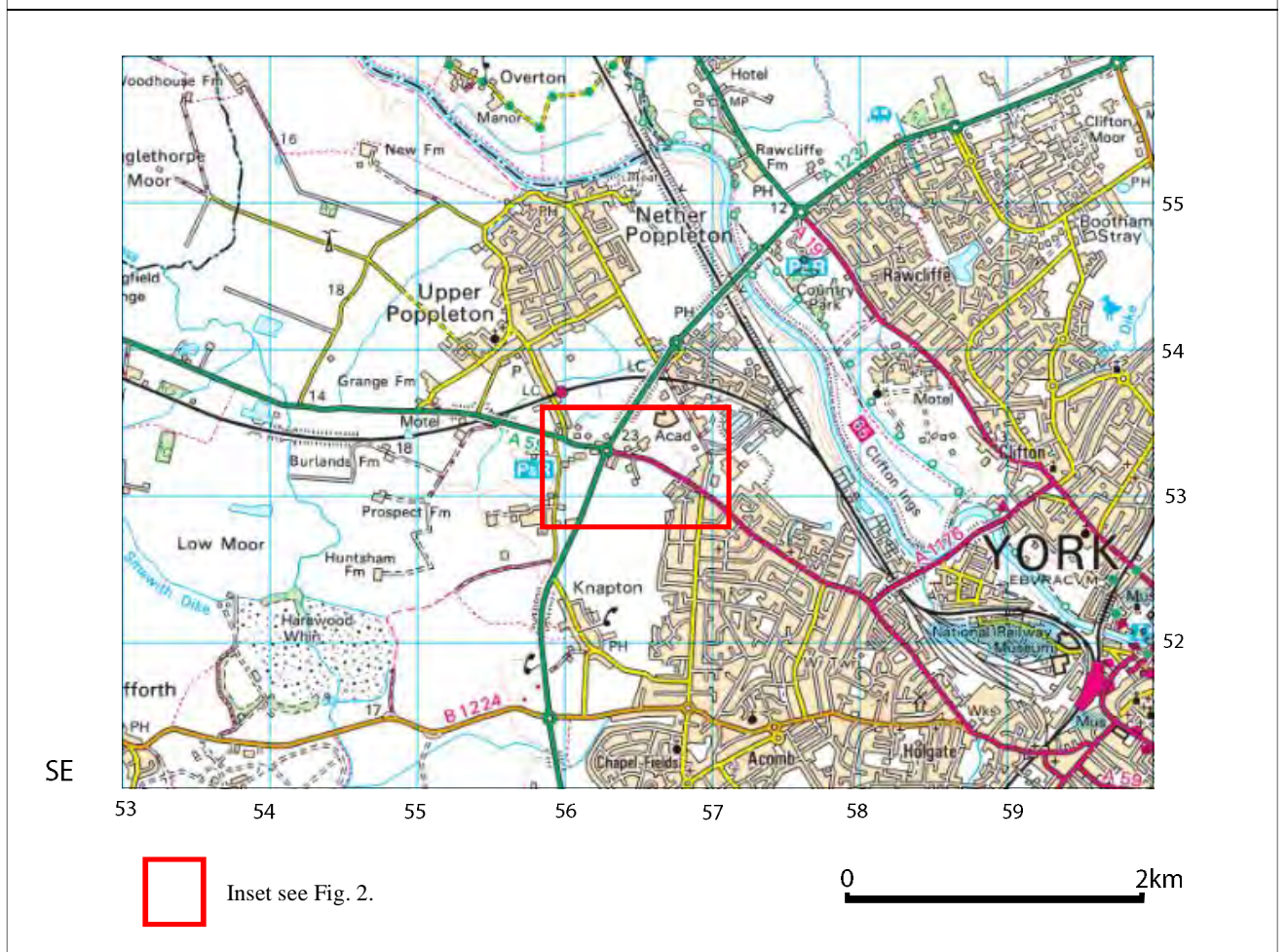
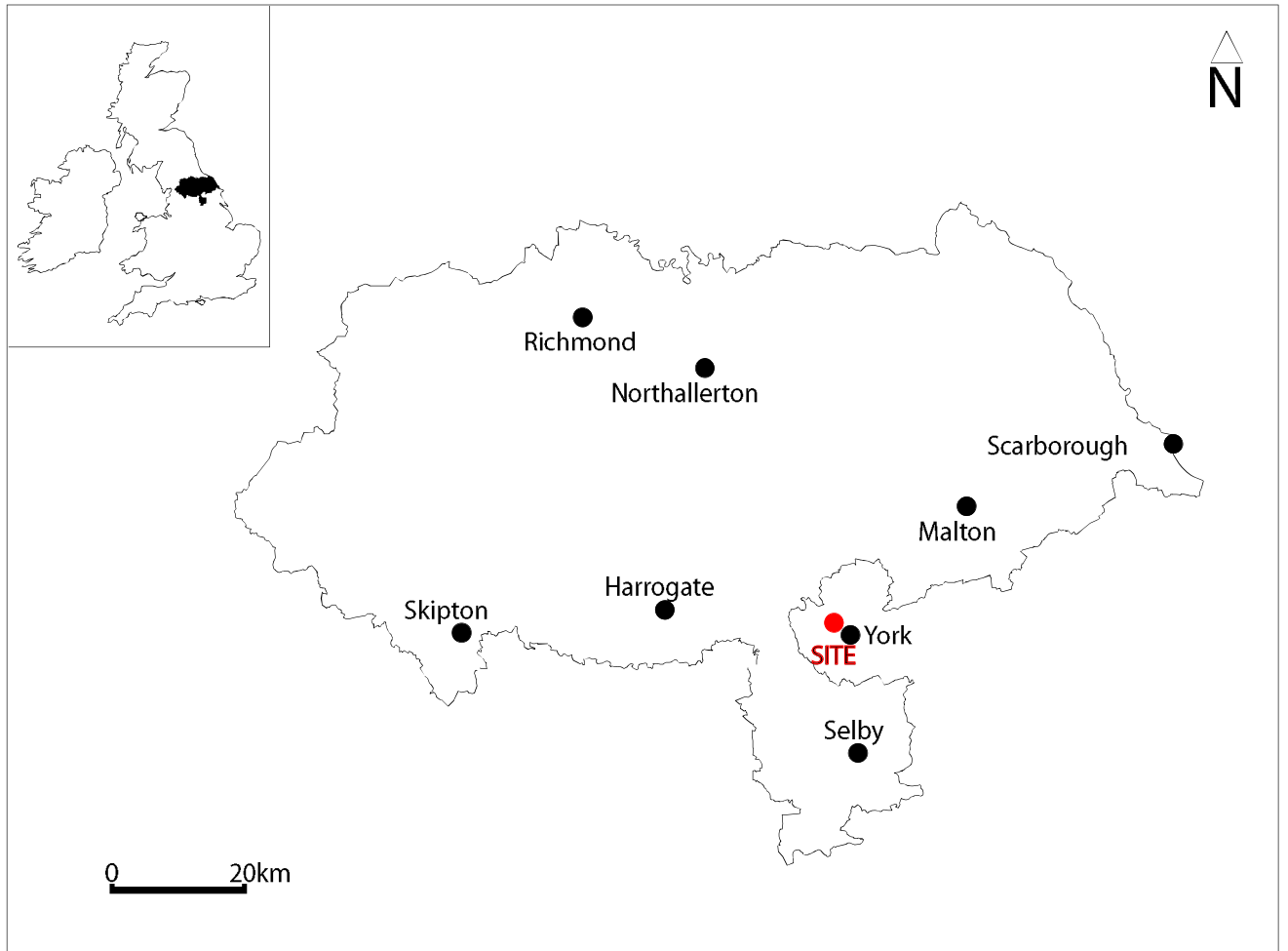


Fig. 1. Site location

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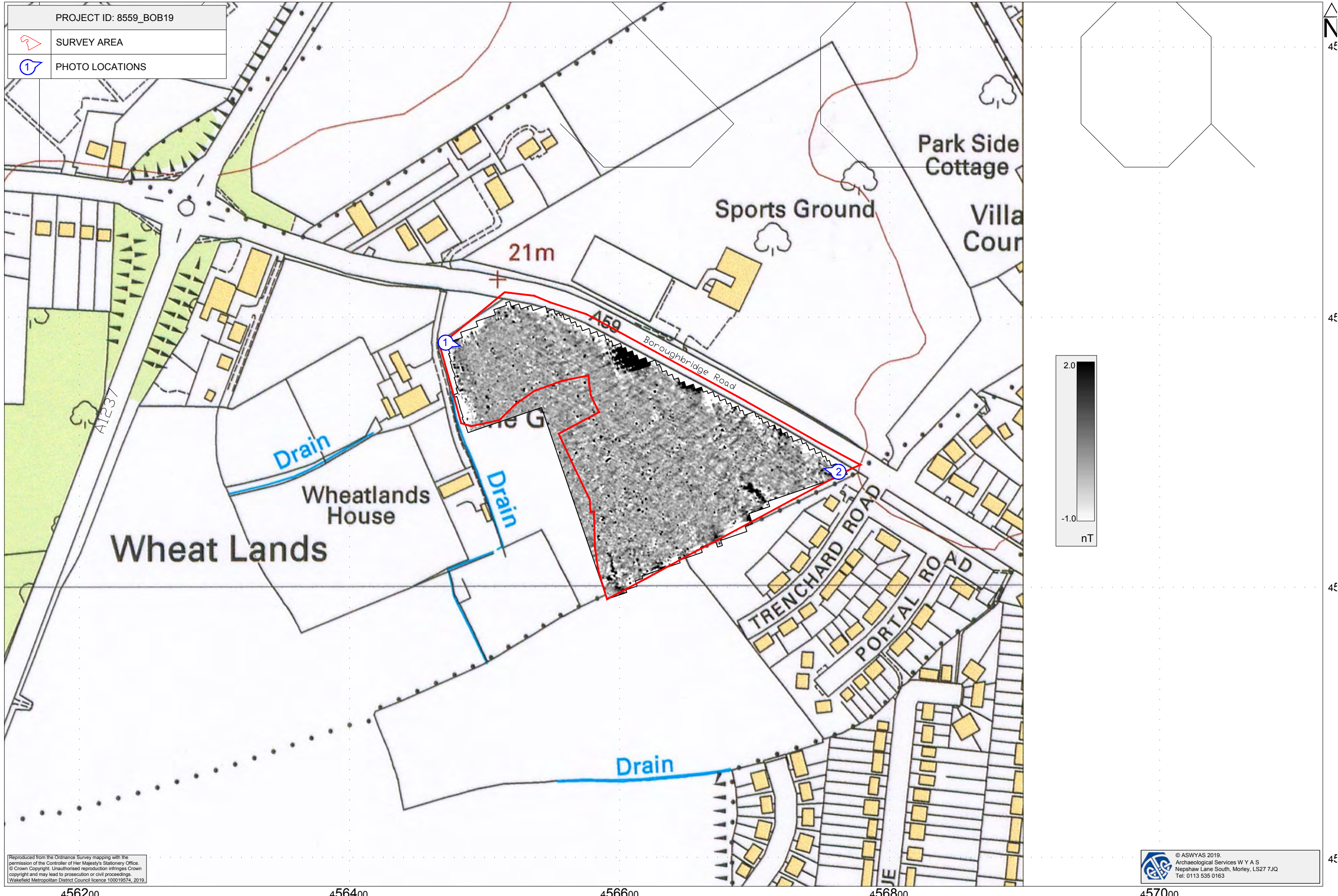
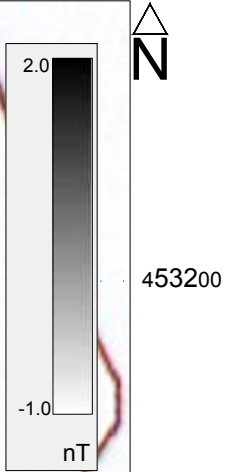


Fig. 2. Survey location showing processed greyscale magnetometer data (1:2500 @ A3)

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



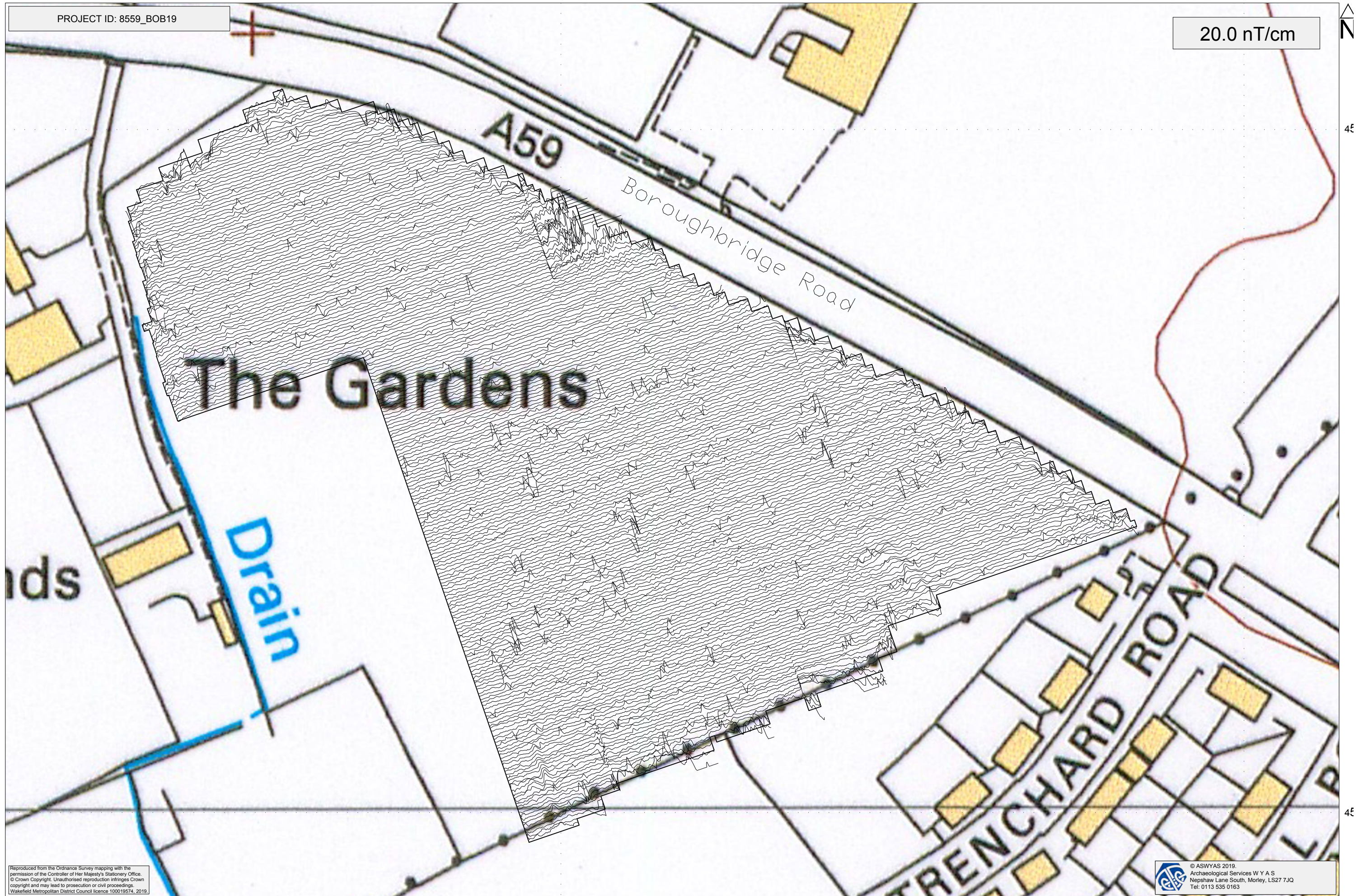
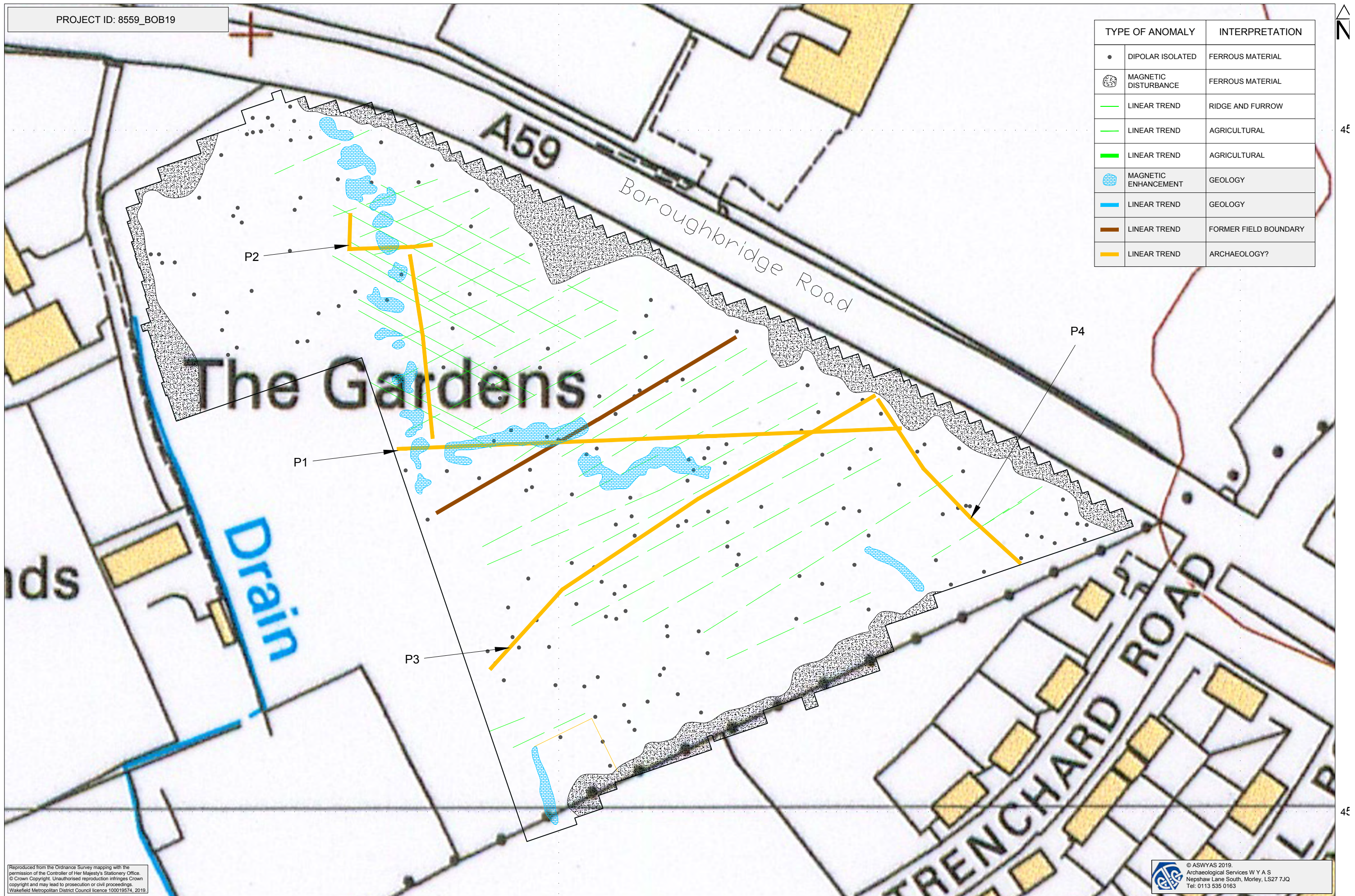


Fig. 4. XY trace plot of minimally processed magnetometer data (1:1000 @ A3)



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





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Fig. 6. Processed greyscale of magnetometer data, displayed at a narrow nano-tesla range (1:1000 @ A3)

0 50m



Plate 1. General overview of site, looking south



Plate 2. General overview of site, looking north west

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

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.

Data Processing and Presentation

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

Geoplot 3.0 was used to produce the greyscale images. All greyscale plots are displayed using a linear incremental scale.

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: 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 3: Geophysical archive

The geophysical archive comprises:-

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

Appendix 4: 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: archaeol11-355375

Project details

Project name	Land off Boroughbridge Road, York, North Yorkshire
Short description of the project	A geophysical survey (magnetometry) was undertaken on approximately 2.8 hectares of land to the immediate south of Boroughbridge Road, as part of a planning application for residential development.
Project dates	Start: 11-06-2019 End: 11-06-2019
Previous/future work	Not known / Not known
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 1 - Minimal cultivation
Monument type	RIDGE AND FURROW Post Medieval
Monument type	NONE None
Significant Finds	NONE None
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)	Sherwood Sandstone Group
Drift geology	GLACIAL SAND AND GRAVEL
Techniques	Magnetometry

Project location

Country	England
Site location	NORTH YORKSHIRE YORK UPPER POPPLETON Land off Boroughbridge Road, York, North Yorkshire
Postcode	YO26 6QD
Study area	2.8 Hectares

Site coordinates SE 56589 53122 53.970873266861 -1.137207569655 53 58 15 N 001 08 13
W Point

Height OD / Depth Min: 20m Max: 22m

Project creators

Name of Organisation Archaeological Services WYAS

Project brief originator Arcus Consultancy Services Ltd

Project design originator Archaeological Services WYAS

Project director/manager A. Trace

Project supervisor J Freeman

Project archives

Physical Archive Exists? No

Digital Archive recipient ASWYAS

Digital Contents "none"

Digital Media available "Geophysics", "Images raster / digital photography", "Survey", "Text"

Paper Archive recipient ASWYAS

Paper Contents "none"

Paper Media available "Map", "Report"

Entered by Jake Freeman (Jake.Freeman@aswyas.com)

Entered on 13 June 2019

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