



LAND NORTH-WEST OF SELBY FORK INTERCHANGE, SOUTH MILFORD, NORTH YORKSHIRE

GEOPHYSICAL SURVEY REPORT

commissioned by RSK ADAS Ltd

July 2020





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PROJECT INFO:

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Cool

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PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of an approximately 4.8 hectare site on land west of the Selby Fork Interchange at Junction 42 of the A1(M). No anomalies of clear archaeological potential have been identified, with most anomalies identified as modern service pipes or being agricultural in nature. Overall, based on the anomalies present in the survey results the archaeological potential of the site is assessed as low.

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GEOPHYSICAL SURVEY REPORT

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by RSK ADAS Ltd (the Client), to undertake a geophysical (magnetometer) survey on land north-west of Selby Fork Interchange at Junction 42 of the A1(M)). The results of the survey will inform future archaeological strategy at the site, if required.

The survey was undertaken in order to assess the impact of the proposed development on the historic environment. It was undertaken in accordance with an Archaeological Written Scheme of Investigation (WSI) (RSK ADAS 2020), with guidance within the National Planning Policy Framework (MHCLG 2019) and in line with current best practice (Chartered Institute for Archaeologists 2014, Europae Archaeologia Consilium 2016).

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) comprises an irregularly shaped field west of the A1(M) centred on SE 47165 30033 (Illus 1). The area covers 4.8 hectares and is bound to west by the north bound slip road of Junction 42 of the A1(M), to the south by the A63 and to the east by an unnamed road. The site location is recorded to lie at a height of 51m above ordnance datum (AOD).

At the time of the survey the field was covered by mature grass (Illus 2-3). Survey coverage was reduced in the north-west corner due to a patch of overgrown vegetation.

The survey was carried out on the 1st of July 2020.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Edlington formation (calcareous mustone) with the southern half of the PDA overlain with Harrogate till formation (clay, sandy, gravelly) (NERC 2020).

The soils are classified in the Soilscape 5 Association, characterised as freely draining lime-rich loams (Cranfield University 2020).

2 ARCHAEOLOGICAL BACKGROUND

There are no designated heritage assets recorded within the PDA. Within a wider 1km study area the Written Scheme of Investigation (RSK ADAS 2020) identifies a number of non-designated heritage assets, predominantly cropmarks of various forms recorded in the North Yorkshire HER and West Yorkshire SMR. The following brief summary of the archaeological background to the PDA is drawn from the WSI.

The nearest heritage asset identified in the North Yorkshire HER is of an indistinct cropmark 130m to the east which may represent ring ditches (MNY10275). Further cropmarks recorded in the HER include an enclosure (MNY16774) and vague cropmarks (MNY10277) located 900m and 960m north of the PDA respectively. A trackway



ILLUS 2 PDA, looking north ILLUS 3 PDA, looking south-east

of unknown date (MNY16759) and further indistinct cropmarks thought to represent and enclosure or boundary (MNY16775) are located 800m and 860m south of the site respectively.

Additional cropmarks are recorded in the West Yorkshire SMR, the nearest being a rectilinear enclosure (PRN986) with associated ditches approximately 520m to the west. Lying further west just beyond the study area is an Iron Age/Roman rectilinear enclosure and trackway (PRN1086).

Previous archaeological events within the wider 1km study area have recorded a number of archaeological findings. Various interventions including geophysical and walkover surveys and excavations associated with the Kirkhamgate to Brayton Barff Water Pipeline (PRN14451), enclosing the PDA to the west and north, have recorded various Iron Age/Roman features. Strip and record archaeological investigations by Oxford Archaeology in 2003 (PRN15000) along the Darrington to Dishforth A1M revealed a group of probable prehistoric pits and segmented ditch boundaries. Earlier magnetometer geophysical surveys conducted by Archaeological Services, University of Durham in 2001 as part of the same scheme identified areas of possible ridge and furrow as well as ditches belonging to a possible field system.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide enough information to establish the presence/absence, character and extent of any archaeological remains within the PDA. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

- to gather enough information to inform the extent, condition, character and date (as far as circumstances permit) of any archaeological features and deposits within the PDA;
- to obtain information that will contribute to an evaluation of the significance of the scheme upon cultural heritage assets; and
- > to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.35.1 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus. 1 at a scale of 1:25,000. Illus 2–3 are site photographs highlighting survey conditions across the site. Illus 4 is a 1:1,250 survey location plan showing the direction of survey as GPS swaths and site photographs. Large-scale, fully processed (greyscale) data, minimally processed data (XY trace plot) and an interpretative plot at a scale of 1:1,250 are presented in Illus 5–7 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (RSK ADAS 2020), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (ClfA 2014). All illustrations from Ordnance Survey (OS) mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Ground conditions across the site were good contributing to a high standard of data collection. The survey has detected a moderate level of background magnetic variation which is characterised by frequent, scattered, discrete low magnitude anomalies. This is likely due to the depth and composition of the topsoil and the natural superficial deposits from which they derive and has thus not been identified in the interpretation.

4.1 FERROUS AND MODERN ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', 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 is common on most sites, this one being no exception, often being present as a result of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

Magnetic disturbances around the field edges are due to ferrous material within, or adjacent to the boundaries, and road or track verges, and are of no archaeological interest.

Two linear anomalies are found in the northern part of the field. A broad anomaly running east-west and arching north-west (SP1), and a comparatively thinner dipolar linear anomaly (SP2) running southwest to north-east. These are most likely caused by modern service pipes.

An area of magnetic disturbance running parallel to the south of the broad anomaly SP1 corresponds to the location of a drain as seen on the 1984 OS map.

4.2 AGRICULTURAL ANOMALIES

A number of discreet linear anomalies running parallel to the present field boundaries have been identified by the survey. These anomalies predominantly run north-south, with the exception of a few linear trends running east-west in the north-west corner of the field and are typical of modern agricultural ploughing regimes.

A former field boundary, known from early OS maps has been identified as weak magnetic linear trend running approximately north-south through the middle of the PDA (FB1).

4.3 GEOLOGICAL ANOMALIES

Across the PDA a number of discrete low magnitude anomalies have been detected. These anomalies are interpreted to be of geological origin and are likely due to the depth and composition of the topsoil and the natural superficial deposits from which they derive.

In the southern half of the PDA a faint linear trend running east-west across the field is identified. Whilst an agricultural origin cannot be excluded, its orientation and location are consistent with a recorded change of geological superficial deposits.

5 CONCLUSION

The survey has successfully evaluated the PDA and has not identified any anomalies of clear archaeological potential. Several anomalies have been detected which are consistent with modern activity including buried service pipes, agricultural ploughing regimes and land drainage. A former field boundary evidenced from early OS maps has been identified running approximately north-south down the centre of the PDA. Overall, on the basis of the geophysical survey, the site is assessed to be of very low archaeological potential.

6 REFERENCES

Chartered Institute for Archaeologists (CIfA) 2014 Standard and guidance for archaeological geophysical survey (Reading) http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf accessed 15 July 2020

Cranfield University 2019 Cranfield Soil and Agrifood Institute
Soilscapes http://www.landis.org.uk/soilscapes/ accessed 15
July 2020

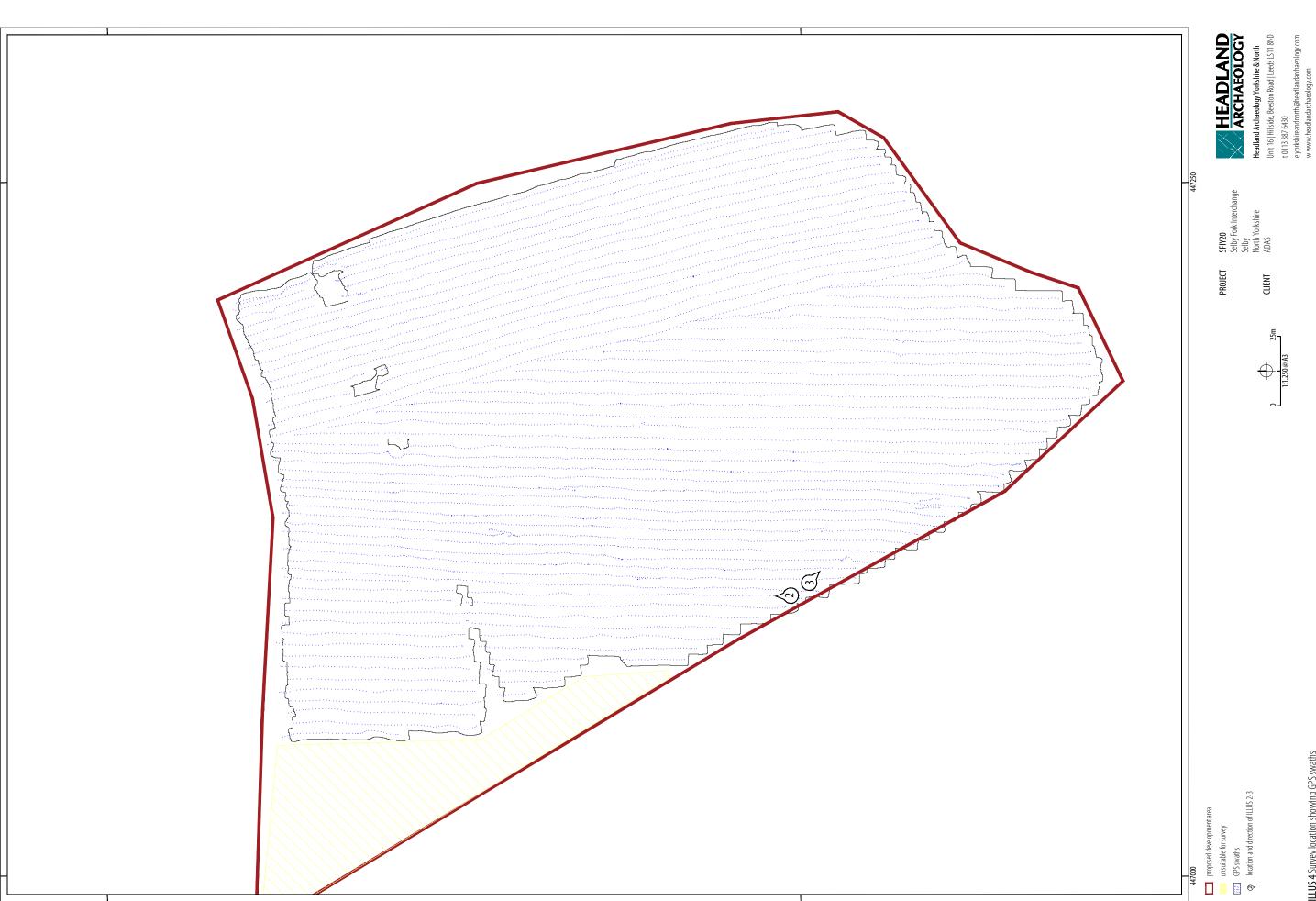
Europae Archaeologia Consillium (EAC) 2016 EAC Guidelines for the Use of Geophysics in Archaeology: Question to Ask and Points to Consider (Namur, Belgium)http://www.old.europeanarchaeological-council.org/files/eac_guidelines_2_final.pdf accessed 15 July 2020

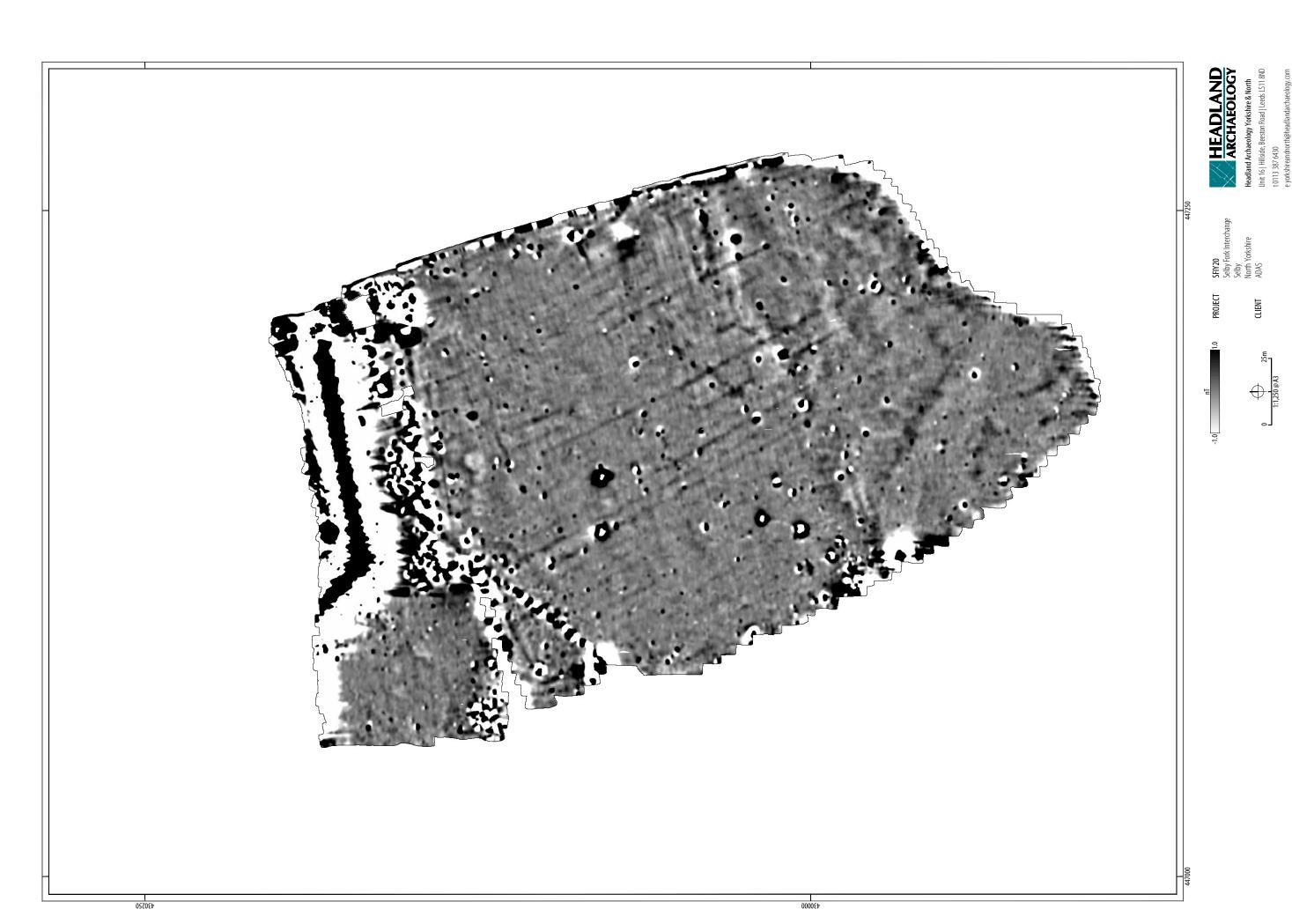
Gaffney C & Gater J 2003 Revealing the Buried Past: Geophysics for Archaeologists Stroud

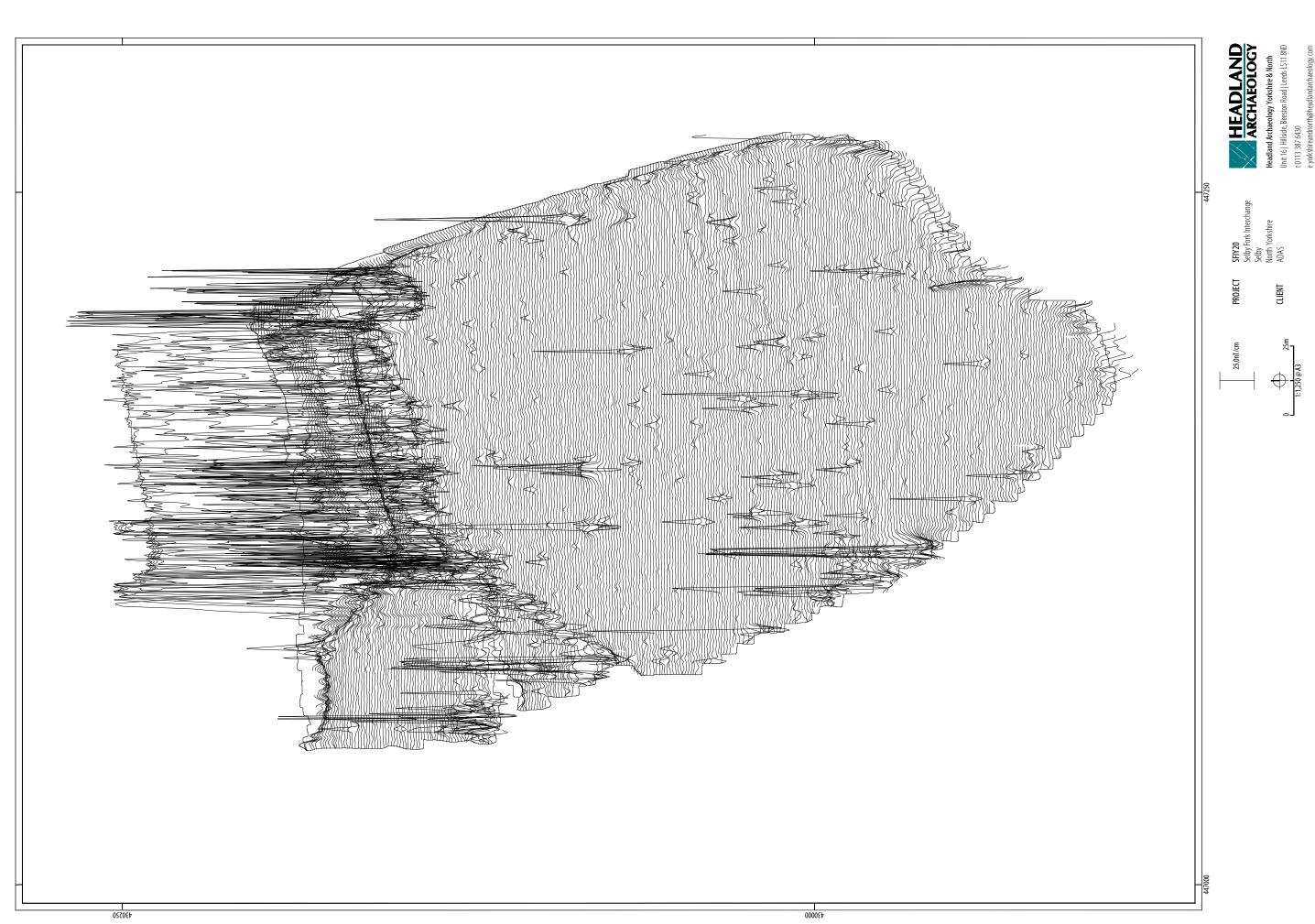
Ministry of Housing, Communities and Local Government MHCLG) 2019 National Planning Policy Framewor https://assers.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/81017/NPPF_Feb_2019_revised.pdf accessed 15 July 2020

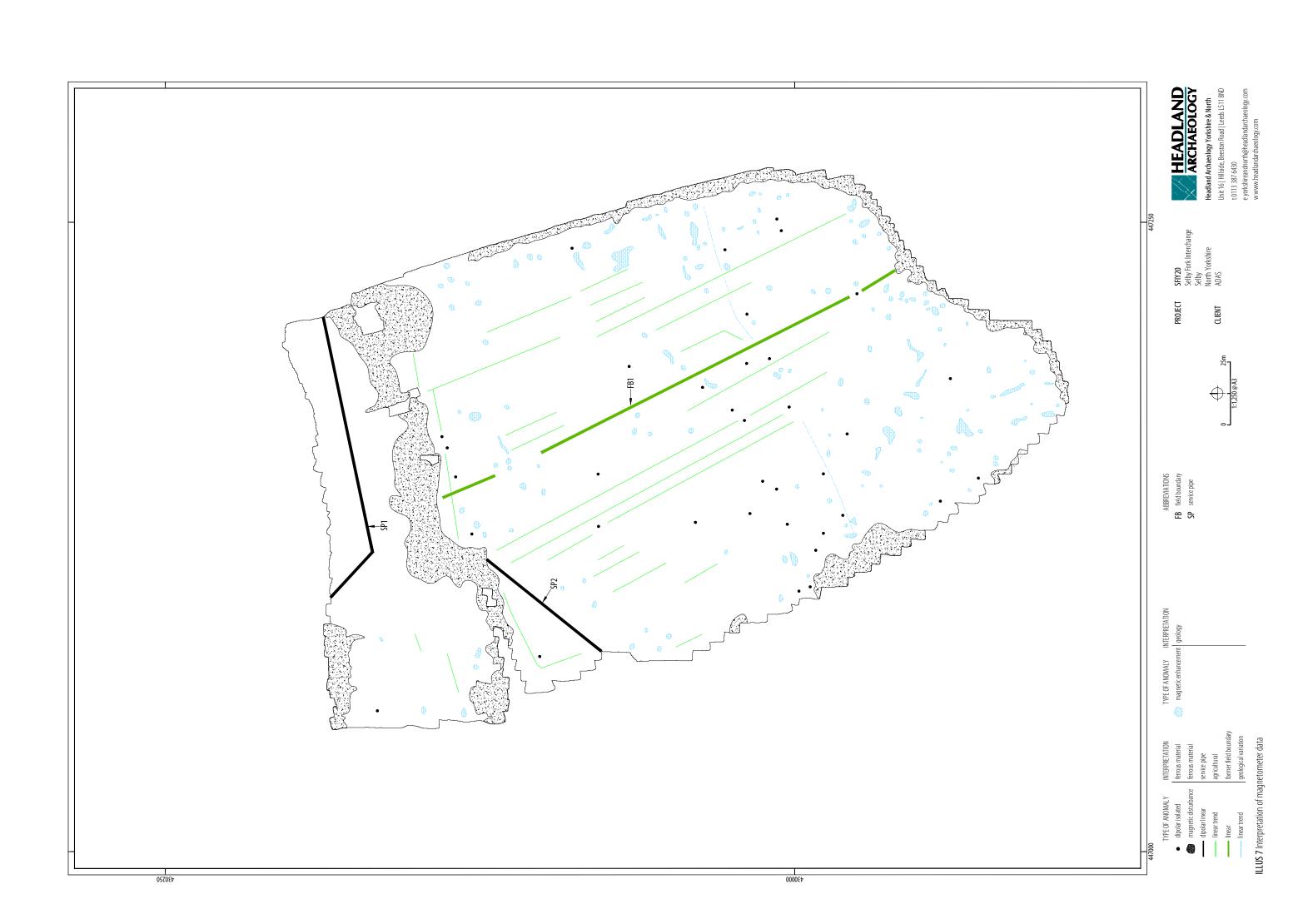
Natural Environment Research Council (NERC) 2018 *British Geological Survey* http://www.bgs.ac.uk/ accessed 15 July 2020

RSK ADAS 2020 Written Scheme of Investigation for an Archaeological Geophysical Survey and Field Evaluation Selby Forks, North Yorkshire [unpublished client document] RSK ADAS Ref SFY20









7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

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 haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue 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. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

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.

Lightning-induced remnant magnetisation (LIRM) LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical current associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

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

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator

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and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data 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 coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

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Digital Contents

"other"

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

PROJECT DETAILS	
Project name	Land north-west of Selby Fork Interchange
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of an approximately 4.8 hectare site on land west of the Selby Fork Interchange at Junction 42 of the A1(M). No anomalies of clear archaeological potential have been identified, with most anomalies identified as modern service pipes or being agricultural in nature. Overall, based on the anomalies present in the survey results the archaeological potential of the site is assessed as low.
Project dates	Start: 01-07-2020 End: 01-07-2020
Previous/future work	Not known / Not known
Any associated project reference codes	SFIY20 - Site code
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	National Planning Policy Framework – NPPF
Position in the planning process	Pre-application
Solid geology (other)	Edlington formation
Drift geology (other)	Harrogate till formation
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	NORTH YORKSHIRE SELBY SOUTH MILFORD Land north-west of Selby Fork Interchange
Study area	4.8 hectares
Site coordinates	SE 47165 30033 53.764290712175 -1.284429085783 53 45 51 N 001 17 03 W Polygon
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	RSK ADAS Ltd
Project design originator	Headland Archaeology
Project director/manager	Harrison S
Project supervisor	Vansassenbrouck O
Type of sponsor/funding body	Developer
PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	In house

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

Paper Archive Exists? No

PROJECT BIBLIOGRAPHY 1

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