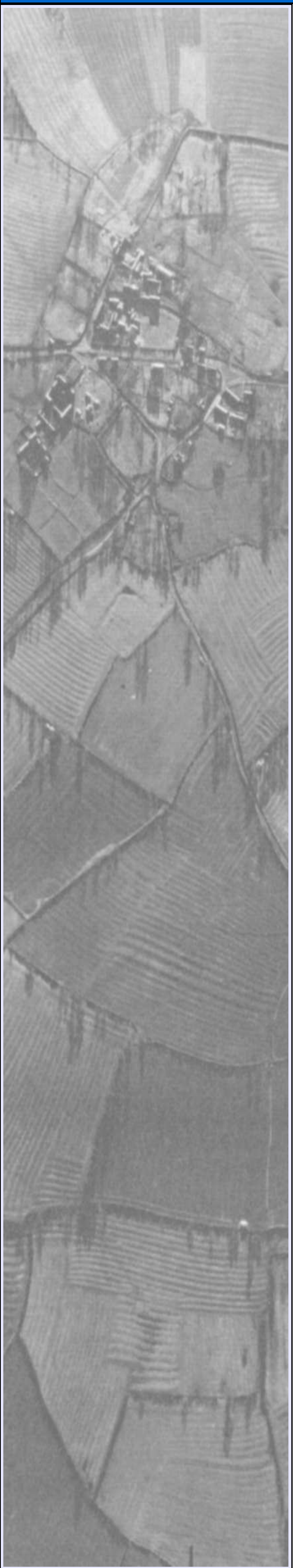

West Barrow
Leighterton
Gloucestershire

MAGNETOMETER SURVEY REPORT

for

Gloucestershire County Council
Archaeology Service

David Sabin and Kerry Donaldson

May 2013

Ref. no. 477

ARCHAEOLOGICAL SURVEYS LTD

West Barrow
Leighterton
Gloucestershire

Magnetometer Survey Report

for

Gloucestershire County Council
Archaeology Service

Report and fieldwork by
David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey dates – 25th & 28th April 2013
Ordnance Survey Grid Reference – **ST 81918 91290**

Archaeological Surveys Ltd
1 West Nolands, Nolands Road, Yatesbury, Calne, Wiltshire, SN11 8YD
Tel: 01249 814231 Fax: 0871 661 8804
Email: info@archaeological-surveys.co.uk
Web: www.archaeological-surveys.co.uk

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Registered office address, Griffon House, Seagry Heath, Great Somerford, Chippenham, SN15 5EN.

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SUMMARY

A detailed magnetometer survey surrounding the Neolithic long barrow known as West Barrow, at Leighterton in Gloucestershire, was undertaken by Archaeological Surveys Ltd. The survey was commissioned by Gloucestershire County Council Archaeology Service as part of works aiming to prevent further damage to the monument by badgers. The results revealed a number of large amorphous quarry pits surrounding the barrow. Two ring ditches have also been located to the south of the barrow, with some evidence for internal features and their small diameters (approximately 8-10m) suggesting they may relate to former round houses. The survey also located widespread discrete anomalies and while some may have archaeological potential, it is possible that many are associated with natural features.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Gloucestershire County Council Archaeology Service to undertake a magnetometer survey of an area of land surrounding the Neolithic long barrow known as West Barrow at Leighterton in Gloucestershire. The barrow contains an active badger sett which is causing considerable damage and the survey is intended to inform mitigation works associated with excluding the badgers from the barrow.

1.1.2 West Barrow, Leighterton is a Scheduled Monument, No 22885. It is owned and managed by Gloucestershire County Council in tenanted land.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin, so that they may be assessed ahead of any mitigation works. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* and Institute for Archaeologists (2002) *The use of Geophysical Techniques in Archaeological Evaluations*. The work has been carried out to the Institute for Archaeologists (2011) *Standard and Guidance for Archaeological Geophysical Survey.*

1.3 Site location, description and survey conditions

1.3.1 The site is located at Leighterton in Gloucestershire with the eastern edge of the survey area being just over 100m west of Leighteron Primary School. The survey was originally conducted within the scheduled area, but excluding the barrow itself which contains dense tree cover. The initial results indicated that the full extent of the quarry pits was not covered and an extra 40m wide strip was surveyed immediately to the east of the scheduled area. The survey is centred on Ordnance Survey National Grid Reference (OS NGR) ST 81918 91290, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 1.8ha within three land parcels containing grass at the time of the work. The site is generally flat although contains a number of shallow depressions relating to the barrow quarry pits. The northern part of the site contains an artificial badger sett.

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during the survey were mainly fine.

1.4 Site history and archaeological potential

1.4.1 The barrow is listed by English Heritage as Scheduled Monument No 22885 - West Barrow: a long barrow 200m west of Leighterton School. It outlines that it is a mound comprised of small stones, trapezoidal in shape and oriented east west. The dimensions are 82m by 50m, which includes the external spread of material from the barrow, and stands to a height of up to 4m. The flanking ditches are recorded to survive as a buried feature to the south and an earthwork to the north.

1.4.2 Crawford (1923) describes the barrow as one of the highest he has seen, being 20 feet tall at the eastern end. He states that the barrow was excavated by Matthew Huntley in around 1700 where he uncovered three chambers on the northern side. These were described by Aubrey as “vaults arched over like ovens, and at the entrance of each was found and earthen jar containing burnt human bones, but the skulls and thigh bones were found unburnt”. Aubrey also noted a megalith at the eastern end of the barrow.

1.4.3 There is no evidence for the chambers, or any megaliths and the mound is densely covered with tree and shrub growth. It is surrounded by dry stone walling around the main barrow, with the spread material and flanking quarry pits extending beyond.

1.4.4 Long barrows were built as funerary monuments and West Barrow is one of over 220 of this type, also known as Megalithic Chambered Tombs of the Cotswold-Severn region (Corcoran, 1969; Darvill, 2004). Constructed during the Neolithic period and used for multiple burials, recent radiocarbon dates show that construction of some of these monuments began around 3800BC and that burial ended around 3625BC (Bayliss et al, 2007). West Barrow despite excavations, badger damage and tree cover is a good example of this type of monument and the survey aims to locate and determine the extent of the flanking quarry ditches or pits and also any other archaeological features within the immediate environs.

1.5 Geology and soils

1.5.1 The underlying geology is limestone from the Forest Marble Formation (BGS, 2013).

1.5.2 The overlying soils across the site are from the Elmton 1 association which are brown rendzinas. These consist of shallow, well drained, brashy, calcareous, fine loamy soils over limestone (Soil Survey of England and Wales, 1983).

1.5.3 Detailed magnetometer surveys carried out over similar soils and geology has produced good results, with the fill of cut features displaying a strong contrast to the surrounding material. However, naturally formed features, such as joints and cracks and tree hollows, can also result in the appearance of ditch-like and pit-like anomalies which can be difficult to distinguish from those with an anthropogenic origin.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a Bartington Grad 601-2 gradiometer. The instrument effectively measures a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally.

2.2.2 The instrument is extremely sensitive and is able to measure magnetic variation to 0.01nanoTesla (nT), with an effective resolution of 0.03nT. The data are limited to ±100nT when surveying with the highest sensitivity. All readings are saved to an integral data logger for analysis and presentation.

2.2.3 The instrument is operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change.

2.2.4 It can be very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that may be associated with large ferrous objects, geological/pedological features, 'magnetic debris' within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme.

2.2.5 The Bartington gradiometer undergoes regular servicing and calibration by the manufacturer. A current assessment of the instrument is shown in Table 1 below.

Sensor type and serial numbers	Bartington Grad - 01 – 1000 Nos. 084, 085
Date of certified calibration/service	Sensors 084 and 085 - 17th August 2012 (due Aug 2014)
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instrument was considered to be in good working order prior to the survey, with no known faults or defects.

2.2.6 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 20m by 20m grids (400m²) giving 1600 measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 2008).

2.2.7 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Leica GS10 RTK GPS. The GPS is used in conjunction with Leica's SmartNet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

2.2.8 The survey area was set out to cover the scheduled area, however an additional 40m wide strip was also surveyed on the eastern edge, aimed at covering the full extent of the barrow quarries.

2.3 Data processing and presentation

2.3.1 Magnetometry data downloaded from the Grad 601-2 data logger are analysed and processed in specialist software known as ArcheoSurveyor. The software allows greyscale and trace plots to be produced for presentation and display. Survey grids are assembled to form an overall composite of data (composite file) creating a dataset of the complete survey area. Appendix C contains specific information concerning the survey and data attributes and is derived directly from ArcheoSurveyor; this should be used in conjunction with information provided by Figure 02.

2.3.2 Only minimal processing is carried out in order to enhance the results of the survey for display. Raw data are always analysed, as processing can modify anomalies. The following schedule sets out the data and image processing used in this survey:

- clipping of the raw data at ±10nT to improve greyscale resolution,
- clipping of processed data at ±3nT to enhance low magnitude anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix B for further information on the specific processes carried out on the data. Appendix C metadata includes details on the processing sequence used.

2.3.3 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.4 The main form of data display prepared for this report is the greyscale plot. Both 'raw' and 'processed' data have been shown followed by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.5 Graphic raster images in bitmap format (.BMP) are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by ArcheoSurveyor from left to right; this corresponds to a direction of south to north in the field. Prior to displaying against base mapping, raster graphics require a rotation of 96° anticlockwise to restore north to the top of the image upon insertion into AutoCAD.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2009 and AutoCAD LT 2007, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.

2.3.7 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over 1.8ha within three land parcels surrounding the barrow.

3.1.2 Magnetic anomalies located can be generally classified as positive and variable magnetic responses of archaeological potential, positive and negative anomalies of an uncertain origin, linear anomalies of an agricultural origin, areas of magnetic debris and strong discrete dipolar anomalies relating to ferrous objects.

3.1.3 Anomalies have been numbered and are described below with subsequent discussion in Section 4.

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics.

Report sub-heading CAD layer names and plot colour	Description and origin of anomalies
Anomalies with archaeological potential AS-ABST MAG POS DISCRETE ARCHAEOLOGY AS-ABST MAG POS CURVILINEAR RING DITCH AS-ABST MAG VARIABLE ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc..
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS AREA UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.

Table 2: List and description of interpretation categories

3.4 List of anomalies

Area centred on OS NGR 381918 191290, see Figures 04 & 05.

Anomalies of archaeological potential

(1) – The barrow is surrounded on the north east, south east, south west and north west corners by generally positive amorphous anomalies relating to quarry pits associated with the barrow.

(2) – Weakly magnetically variable response surrounding much of the barrow. This appears to relate to the mound surrounding the barrow, which is described as the material slippage from the barrow itself. There are no clearly definable structural elements, and it appears that the material is made up of small stones and soil.

(3) – In the southern part of the site are two positive curvilinear anomalies that appear to relate to ring ditches with some internal features.

Anomalies with an uncertain origin

(4) – In the northern part of the site is an area of generally positive responses that appear to be associated with a negative rectilinear anomaly. The response is generally similar to anomaly (2) indicating a mixed material. It is located close to a quarry pit and depression within the field, and also to the artificial badger sett close to the northern edge. It is, therefore, not clear if the anomaly is associated with the construction of the barrow, but an archaeological origin cannot be ruled out.

(5) – A positive linear anomaly extends across the southern part of the site. It appears to have a possible curvilinear anomaly at its eastern end, and other linear anomalies are located close by. While it is possible that this, and the other linear anomalies, relate to cut ditch-like features, it is not possible to determine their origin.

(6) – A cluster of positive linear, discrete and curvilinear responses is located between the two southern quarry pits (1). There is a depression within the field at the northern edge of this group of anomalies, although it is not possible to determine an association.

(7) – The survey area contains widespread and numerous discrete positive responses. While some of these anomalies may relate to pits with an anthropogenic or archaeological origin, it is possible that many of the responses are naturally formed, such as a build up of topsoil within natural pits and cracks within the underlying bedrock.

Anomalies with an agricultural origin

(8) – Alternate bands of parallel positive and negative linear anomalies are most evident in the north eastern part of the site, although there are also weaker ones in the south eastern part. These are likely to relate to agricultural cultivation. The northern part of the site is mapped as containing allotment gardens during the early part of 20th century, and an association with this method of cultivation is possible.

Anomalies associated with magnetic debris

(9) – Close to the northern field boundary is a zone containing highly magnetic material. This is likely to be associated with the artificial badger sett located in this part of the site.

4 DISCUSSION

4.1.1 The survey area contains several amorphous anomalies with a positive response bordered by a negative anomaly, although there is some degree of variability. The irregular shape of the anomalies indicates that they relate to the fill of the barrow quarry pits, rather than regularly shaped flanking ditches. There is some correlation with extant depressions located to the north and south of the barrow. The north eastern part of the site contains several pit-like anomalies, but it is probable that at least the two largest here are part of the same pit separated by the extant field boundary. Although irregularly shaped, there is some similarity in the dimensions of the two most eastern large pits, with the north eastern pit having dimensions of up to 50m by 15m and the south eastern large pit, 48m by 18m. The complete area covered by all of the pits is over 2670m²

4.1.2 The main barrow appears to sit on a low mound which spreads about 15m around the barrow towards, but not obviously covering the quarry pits. The pits therefore lie outside the area of the low mound or slumping.

4.1.3 The site also contains two ring ditches. The northernmost one has an external diameter of approximately 10m, defining an internal space approximately 7.5m wide, while the southern one has an 8.5m external diameter, enclosing a 5.7m wide space. There is some evidence that they both contain a discrete positive response which may indicate a pit or area of burning/hearth. There is also a central negative response perhaps indicating some form of flooring. It is possible that these anomalies relate to former round houses.

5 CONCLUSION

5.1.1 The detailed magnetometer survey located a number of amorphous anomalies that relate to the quarry pits, originally excavated to construct the barrow. The response is generally positive, with some variability indicative of a mixed fill. Their amorphous shape is similar to quarry pits seen elsewhere within the Cotswold-Severn group of barrows, rather than the more regularly shaped quarry ditches seen flanking barrows on the chalk. They are associated with extant surface depressions and border a low mound on which the barrow sits. The quarry pits lie between 8m and 25m away from the edge of the main barrow structure.

5.1.2 The whole site contains a large number of smaller pit-like anomalies, and while it is possible for some of these to have archaeological potential, a natural origin is feasible for many of the responses.

5.1.3 Towards the northern part of the site a generally positive zone appears to contain some negative rectilinear elements. It is unclear as to whether this zone also relates to quarrying associated with construction of the barrow.

5.1.4 To the south of the barrow are two previously unidentified ring ditches which appear to contain possible internal floor surfaces and pits or areas of burning, and they may relate to former round houses.

6 REFERENCES

Baliss, A., Wysocki, M., Whittle, A., Meadows, J., van der Plicht, J., Bronk Ramsay, C., 2007. 'The times of their lives: building histories for prehistory.' *Research News*, No 6. English Heritage, pp 4-7.

British Geological Survey, 2013. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed 4/5/2013].

Corcoran, J.X.W.P., 1969. 'The Cotswold-Severn Group, 1. Distribution, Morphology and Artifacts', in Powell, T.G., Corcoran, J.X.W.P., Lynch, F., and Scott, J.G., *Megalithic enquiries in the west of Britain*. Liverpool: Liverpool University Press, pp 13-72.

Crawford, O.G.S., 1925. *Long Barrows of the Cotswolds*. Gloucester. Bellows.

Darvill, T. 2004. *Long Barrows of the Cotswolds.* Stroud. Tempus.

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.* 2nd ed. Swindon: English Heritage.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IfA Paper No. 6. IfA, University of Reading.

Institute for Archaeologists, 2011. *Standard and Guidance for archaeological geophysical survey*. IfA, University of Reading.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England.*

Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±5nT and ±1nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

De-stagger

Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount. Data lost at the end of each traverse are extrapolated from adjacent value in the same row.

Deslope

Corrects for striping and distortion caused by metal objects/services etc.. The process calculates a curve based on a polynomial best fit mathematical function for each traverse. This curve is then subtracted from the actual data.

Edge Match

Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. It then subtracts the difference between the means from all datapoints in the selected area.

FFT (Fast Fourier Transform) spectral filtering

A mathematical process used to determine the frequency components of a traverse. Repetitive features, such as plough marks, produce characteristic spectral zones that can be suppressed allowing greyscale images to appear clearer.

Appendix C – survey and data information

Raw magnetometer data

COMPOSITE
Filename: J477-mag-raw.xcp
Description:
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 28/04/2013
Assembled by: on 28/04/2013
Direction of 1st Traverse: 96 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

Dimensions
Composite Size (readings): 560 x 180
Survey Size (meters): 140 m x 180 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 10.00
Min: -10.00
Std Dev: 2.65
Mean: -0.01
Median: -0.05
Composite Area: 2.52 ha
Surveyed Area: 1.8072 ha

PROGRAM
Name: ArcheoSurveyor
Version: 2.5.19.3

Processes: 2
1 Base Layer
2 Clip from -10.00 to 10.00 nT

Source Grids: 59
1 Col:0 Row:1 grids\01.xgd
2 Col:0 Row:2 grids\02.xgd
3 Col:0 Row:3 grids\03.xgd
4 Col:0 Row:4 grids\04.xgd
5 Col:0 Row:5 grids\05.xgd
6 Col:0 Row:6 grids\06.xgd
7 Col:0 Row:7 grids\50.xgd
8 Col:0 Row:8 grids\51.xgd
9 Col:1 Row:1 grids\07.xgd
10 Col:1 Row:2 grids\08.xgd
11 Col:1 Row:3 grids\09.xgd
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33 Col:4 Row:0 grids\27.xgd
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35 Col:4 Row:2 grids\26+29.xgd
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53 Col:6 Row:2 grids\42.xgd
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55 Col:6 Row:4 grids\44.xgd
56 Col:6 Row:5 grids\45.xgd
57 Col:6 Row:6 grids\46.xgd
58 Col:6 Row:7 grids\64.xgd
59 Col:6 Row:8 grids\65.xgd

Processed magnetometer data

COMPOSITE
Filename: J477-mag-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.56
Mean: 0.06
Median: 0.00
Composite Area: 2.52 ha
Surveyed Area: 1.7831 ha

Processes: 5
1 Base Layer
2 Clip from -10.00 to 10.00 nT
3 Search & Replace From: -100 To: 100 With: Dummy (Area: Top 80, Left 480, Bottom 110, Right 550)
4 DeStripe Median Traverse: Grids: All
5 Clip from -3.00 to 3.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire (see inside cover for address). Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

Surveys are reported on in hardcopy (recycled paper) using A4 for text and A3 for plots (all plots are scaled for A3).

This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.5.19.3 (geophysical data analysis),
- ProgeCAD Professional 2009 (report graphics),
- AutoCAD LT 2007 (report figures),
- OpenOffice.org 3.0.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data produced by the survey and report include the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- AutoCAD DWG files in 2000 and 2007 versions,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures,
- photographic record in JPEG format.

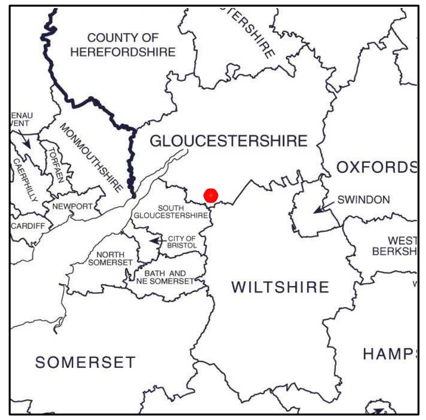
Archaeological Surveys Ltd

Geophysical Survey
West Barrow
Leighterton
Gloucestershire

Map of survey area

N

Survey location



● Survey location

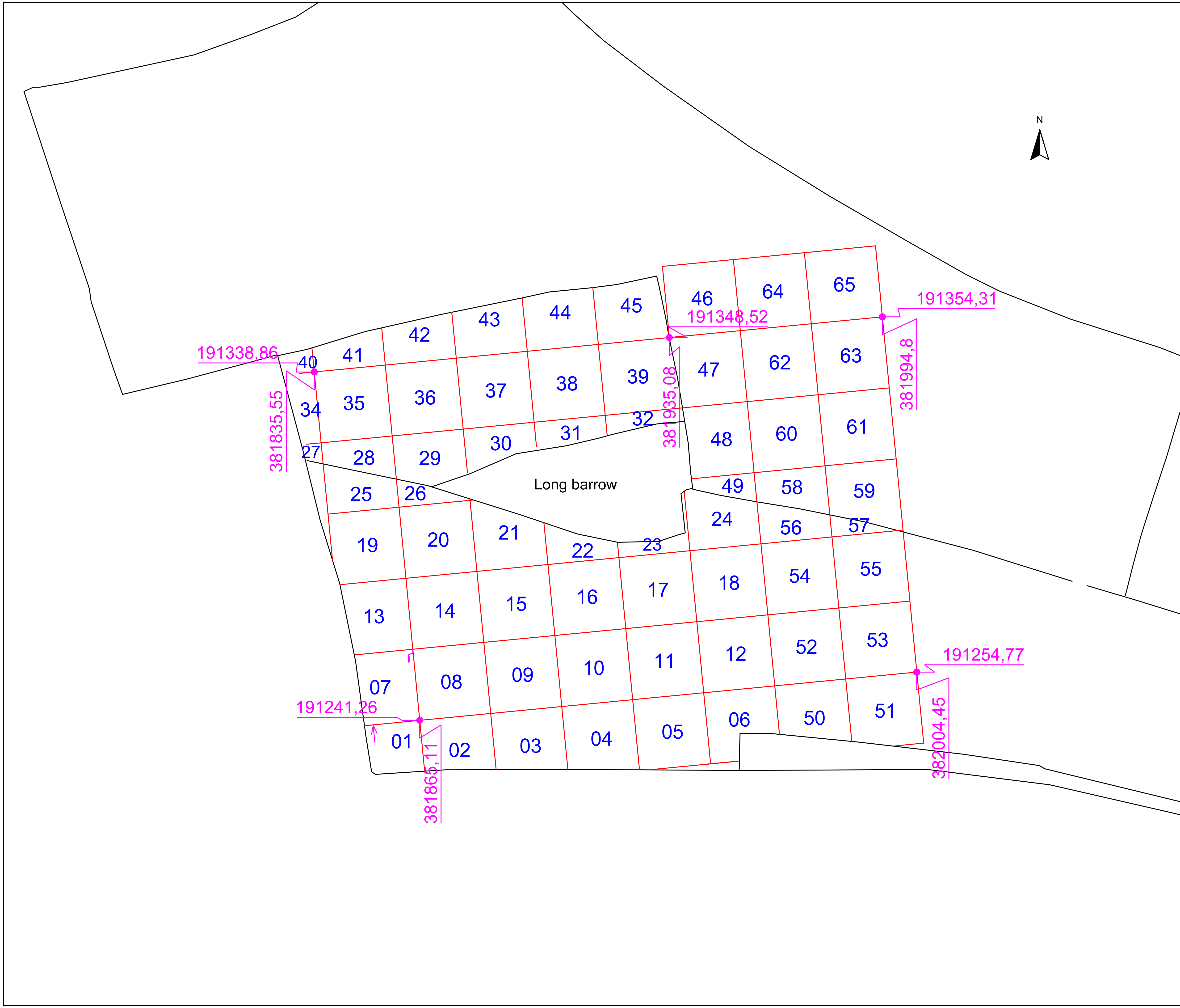
Site centred on OS NGR
ST 81918 91290

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01



Archaeological Surveys Ltd

Geophysical Survey
West Barrow
Leighterton
Gloucestershire

Referencing information

Grid coordinates based on Ordnance Survey OSGB36 datum

Grids set out using RTK GPS with Leica SmartNet correction data RTCMv2 format OSTN02 transformation

Survey grid size = 20m

Survey start and traverse direction

01 Grid reference number and filename

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 02

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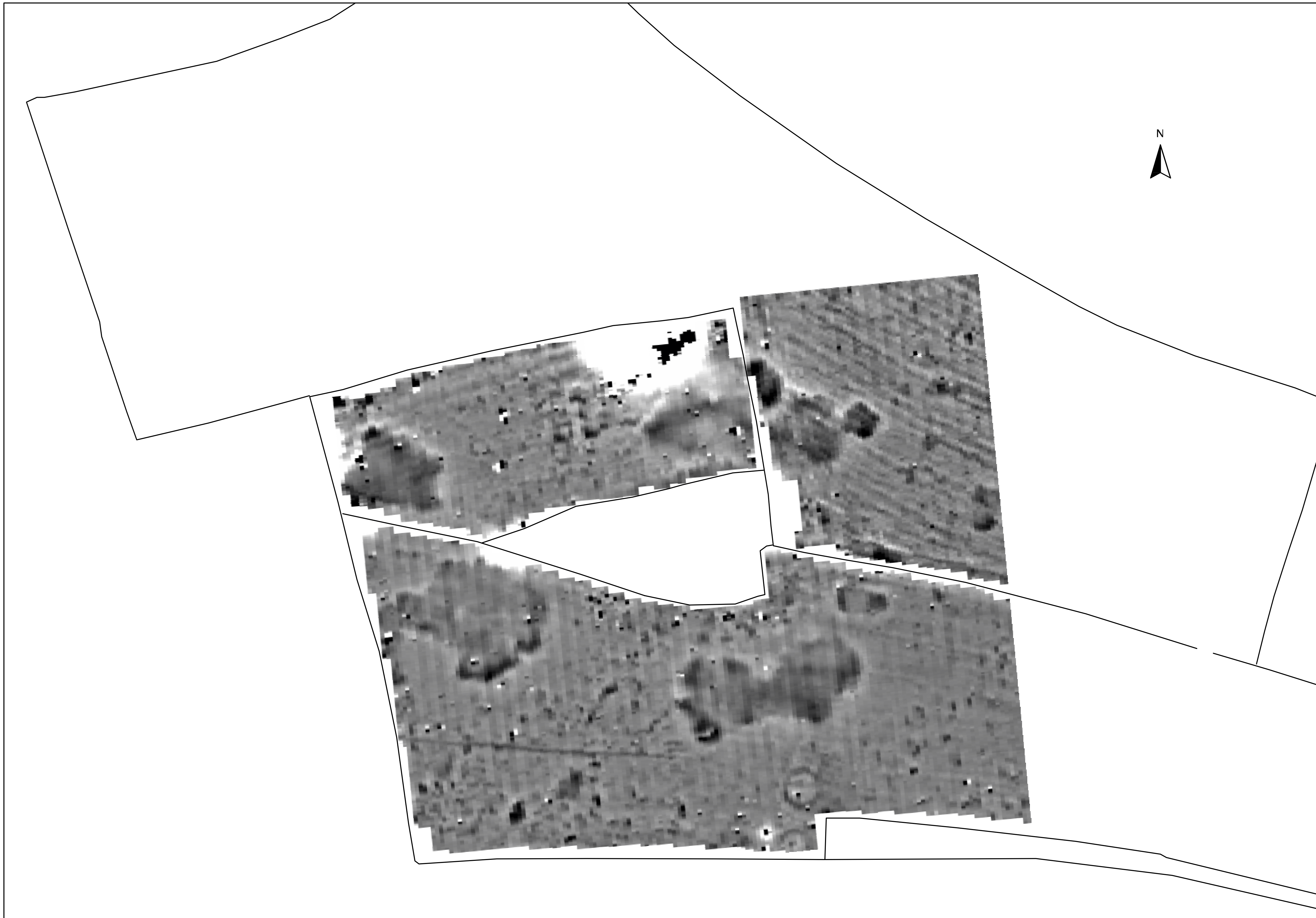
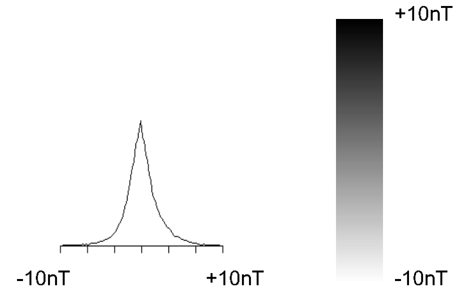
Geophysical Survey
West Barrow
Leighterton
Gloucestershire



Greyscale plot of raw magnetometer data

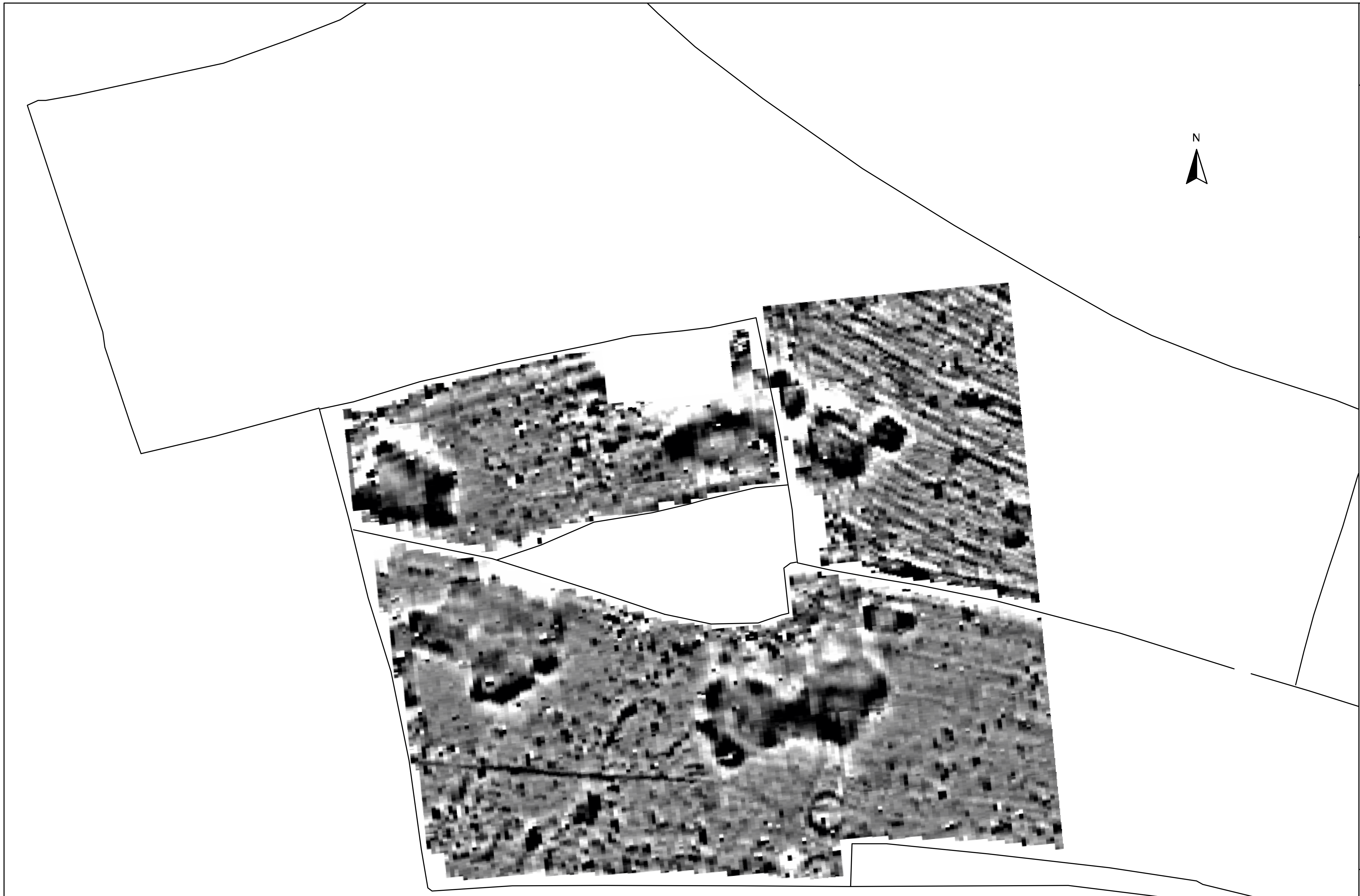


SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 03



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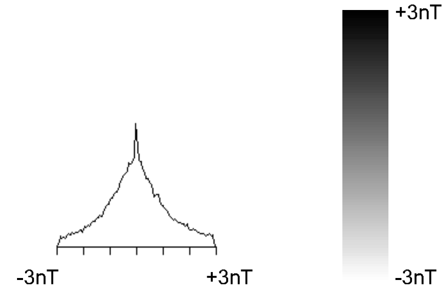
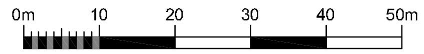
Geophysical Survey
West Barrow
Leighterton
Gloucestershire

Greyscale plot of processed magnetometer data



SCALE 1:1000



SCALE TRUE AT A3

FIG 04

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Geophysical Survey
West Barrow
Leighterton
Gloucestershire

Abstraction and interpretation of magnetometer anomalies

Positive curvilinear anomaly - ring ditch

Positive linear anomaly - possible ditch-like feature

Negative linear anomaly - material of low magnetic susceptibility

Linear anomaly - of agricultural origin

Discrete positive response - cut feature of archaeological origin

Discrete positive response - possible pit-like feature

Variable magnetic response - associated with mound beneath barrow

Positive anomaly - magnetically enhanced material

Magnetic debris - spread of magnetically thermoremnant/ferrous material

Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05