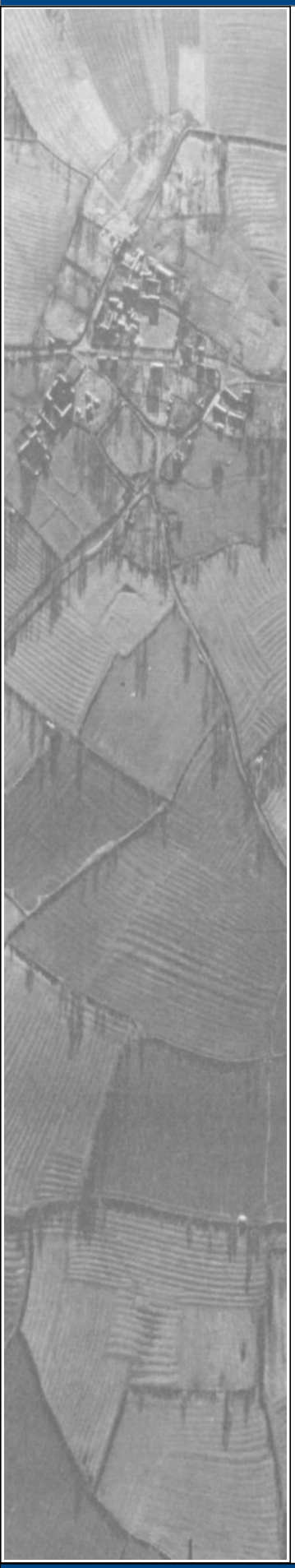

Shaw Ridge Linear Park
Swindon

MAGNETOMETER SURVEY REPORT

for

Swindon Borough Council

Kerry Donaldson & David Sabin

December 2021

Ref. no. J897

ARCHAEOLOGICAL SURVEYS LTD

Shaw Ridge Linear Park
Swindon

MAGNETOMETER SURVEY REPORT

for

Swindon Borough Council

Fieldwork by David Sabin BSc (Hons) MCIfA
Report by Kerry Donaldson BSc (Hons) MCIfA
Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey date – 7th December 2021
Ordnance Survey Grid Reference – **SU 11440 84790**

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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SUMMARY

Detailed magnetometry was carried out by Archaeological Surveys Ltd, for Swindon Borough Counci,l over 4 areas of land at Shaw Ridge Linear Park that have been outlined for tree planting. The Wiltshire and Swindon Historic Environment Record indicated that the eastern part of the site contained evidence for Romano-British kiln debris, with evidence for prehistoric, Roman and medieval occupation within the Shaw Ridge Primary School just to the north east. The results of the survey indicate the presence of a number of strongly magnetic anomalies that could relate to features with intense burning, such as kilns. A number of rectilinear enclosures and pits close by appear to be associated and their morphology may be indicative of Romano-British features. Although the majority of the archaeological features lie outside of the areas outlined for planting, some archaeological features, including the corner of an enclosure and at least two strongly magnetic responses are situated within these proposed areas. Within the rest of the site a small number of discrete anomalies have also been located, but it is not clear if they relate to features with archaeological potential or more modern features.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Swindon Borough Council to undertake a magnetometer survey of four areas of land at Shaw Ridge Linear Park. The site has been outlined for a proposed tree planting under the Great Western Community Forest scheme.

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 prior to tree planing. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 Geophysical survey can provide useful information on the archaeological potential of a site; however, the outcome of any survey relies on a number of factors and as a consequence results can vary. The success in meeting the aims and objectives of a survey is, therefore, often impossible to predetermine.

1.3 Standards, guidance and recommendations for the use of this report

1.3.1 The survey and report follow the recommendations set out by: European Archaeological Council (2015) *Guidelines for the Use of Geophysics in Archaeology;* Institute for Archaeologists (2002) *The use of Geophysical*

Techniques in Archaeological Evaluations. The work has been carried out to the Chartered Institute for Archaeologists (2014) (updated 2020) *Standard and Guidance for Archaeological Geophysical Survey.*

1.3.2 Archaeological Surveys Ltd provide a detailed geophysical survey report and it is recommended that where possible the contents should be considered in full. The Summary provides a brief overview of the results with more detail available in the Discussion and/or Conclusion. The *List of anomalies* within the Results provides a detailed assessment of the anomalies within separate categories which can be useful in inferring a level of confidence to the interpretation. Quality and factors influencing the interpretation of anomalies is also set out within the results.

1.3.3 It is recommended that the full report should always be considered when using data and interpretation plots; where this is not possible, in the field for example, the abstraction and interpretation plots should retain their colour coding and be used with a corresponding legend.

1.3.4 Where targeting of anomalies by excavation is to be carried out, care should be taken to place trenches over solid lines or features visible on the abstraction and interpretation plots. Archaeological Surveys abstraction and interpretation avoids the use of dashed or dotted line formats, and broken or fragmented lines used in interpretive plots may well correspond closely with truncation of archaeological features.

1.4 Site location, description and survey conditions

1.4.1 The survey areas are located within the Shaw Ridge Linear Park, in the parish of West Swindon. The site is centred on Ordnance Survey National Grid Reference (OS NGR) SU 11440 84790, although the survey areas are centred on: Area 1 – SU 11720 84880, Area 2 – SU 11637 84928, Area 3 – SU 11527 84827 and Area 4 – SU 11243 84773, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 3ha split between the four separate areas. Areas 1, 2 and 3 lie within the eastern part of the park to the east of Tewkesbury Way and Area 4 to the west. Area 1 comprised two small linear areas outlined for planting and a wider zone was surveyed for context. Area 4 comprised six blocks of proposed planting and these were conjoined to form a ring of survey around the edge of the open space.

1.4.3 All of the survey areas contained short grass cover at the time of survey, Areas 2 – 4 were also waterlogged. Area 1 is mainly level ground on an elevated area at approximately 115m above ODN. The western boundary is a metalled path and the survey avoided steel benches and lamp posts along the edge of the path due to the associated high magnitude magnetic disturbance. The north eastern boundary is a hedgerow with mature trees separating the area from the grounds of Shaw Ridge Primary School. Area 2 lies a short distance to the north west of Area 1 on land sloping down to the west. This

small zone of survey is located to the south and south west of an area of existing woodland. Area 3 lies further to the west towards the base of a north facing slope. This area was very waterlogged and lies to the south of an existing copse. Area 4, to the west of Tewkesbury Way, is mainly level or gently sloping ground surrounded by trees and hedgerows, a metalled path crosses through the western part of the area.

1.4.4 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during the survey were very wet and windy.

Plate 1: Survey Area 1 looking south

1.5 Site history and archaeological potential

1.5.1 The Wiltshire and Swindon Historic Environment Record indicates that a number of Romano-British pottery wasters and kiln debris were located during excavation in 1982 within Area 1 (MWI16484) and a scatter of Romano-British courseware pottery was identified during observation of tree planting in 1987 just to the south east of Area 1 (MWI16475). During excavation of Shaw Ridge Primary School in 2008, immediately to the north east of Area 1, a number of early Romano-British and early Medieval ditches were located as well as evidence for Bronze Age and Iron Age activity (MWI16563, MWI75085, MWI75086 MWI75087, MWI75088, MWI75089, MWI75089). To the north of Area 2 are a number of linear earthworks identified from aerial photographs (MWI16573 & MWI16115). To the north of Area 3 Romano-British pottery and tile was recorded (MWI16470) as well as medieval walling (MWI16544) and to the north and west of Area 4 was the location of a Wick Farm, a medieval farmstead, with holloway and house platforms (MWI16522).

1.5.2 The surrounding area contains evidence for widespread prehistoric, Romano-British and medieval occupation, with evidence for a kiln within Area 1. There is, therefore, high potential for location archaeological features within the site.

1.6 Geology and soils

1.6.1 The underlying geology in Area 1 in the far eastern part of the site is mudstone from the Kimmeridge Clay Formation, with mudstone from the Ampthill Clay Formation within the rest of the site (BGS, 2017).

1.6.2 The overlying soil across the site is from the Denchworth association and is a pelo-stagnogley soil. It consists of a slowly permeable, seasonally waterlogged, clayey soil (Soil Survey of England and Wales, 1983).

1.6.3 The underlying geology and soils are frequently associated with low magnetic contrast and low levels of magnetic susceptibility. However, cut features of archaeological potential may be located where human activity has altered the magnetic characteristics of the soil sufficiently. The underlying geology and soils are, therefore, considered acceptable for magnetic survey.

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 (also known as thermoremanence) are factors associated with the formation of localised fields.

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). Additional details are set out in 2.2 below and

within Appendix A.

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20Hz. The cart is pushed at walking speed and not towed. Each sensor is not zeroed in the field as the vertical axis alignment is precisely fixed leaving sensor offsets that are removed during data processing. The fixing of the vertical alignment ensures the sensors are not unduly influenced by localised magnetic fields and that the vertical component of a magnetic anomaly is measured. The gradiometers have a measurement range of ±8000nT, although the recorded range is ±3000nT, and resolution is around 0.1nT. They are linked to a Leica GS10 RTK GNSS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA computer system.

2.2.2 Due to the fixed offsets within the fluxgate sensors, as a result of the manufacturing and tensioning process, the survey data do not provide a visually useful dataset until a zero median traverse algorithm is applied. It is recognised that this has the potential to affect some anomalies detrimentally by removing linear features orientated parallel to survey transects. However, this has not been noted as a particular problem with the system due to the high resolution data collection, generally long length of traverses and variability within the magnetic characteristics of a linear anomaly.

2.2.3 Data are collected along a series of parallel survey transects to achieve 100% coverage of the surveyable land. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps maintain the correct separation between adjacent traverses. Data are not collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).

2.2.4 Fluxgate sensors are highly sensitive to temperature change and this manifests as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift, data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <100s.

2.3 Data processing and presentation

2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. The software effectively allocates a geographic position for each data point and

can compensate for fixed offsets present within the FGM650 sensors. The offsets are positive or negative values present on all fluxgate gradiometer sensors. Some systems use manual or electronic balancing to effectively zero the sensors; however, this is a short term measure that is prone to drift through temperature changes and vibration and can easily be incorrectly set due to localised magnetic fields. The FGM650 sensors are very accurately aligned to the vertical magnetic gradient and are highly stable showing negligible drift on long traverses. The offset values are removed using TerraSurveyor software.

2.3.2 Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display within TerraSurveyor. The removal of the offset values (compensation) of the sensors is also carried out in TerraSurveyor using a zero median traverse function. Data are then considered to be minimally processed. Note: without the zero median traverse function it is not possible to create a meaningful data plot as all sensors have a different offset value. Although a zero median traverse algorithm can remove anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

2.3.3 The minimally processed data are collected between limits of ±3000nT and clipped for display at ±3nT. A second image for Area 1 has been created with the data clipped between ±40nT, with anomalies over 30nT highlighted in red and below -30nT in blue. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on processing.

2.3.5 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. With regard to the Sensys MXPDA, minimally processed data are considered by the manufacturer to be data that are compensated by SENSYS MAGNETO DLMGPS software, see 2.3.1 and 2.3.2. Note: traceplots are not considered to be appropriate as they do not provide an accurate or useful assessment of the magnetic anomalies due to the very high density of data collection. In addition, traceplots cannot be meaningfully plotted against base mapping and in areas of complexity traces may be lost or highly confused. Traceplots may be used to demonstrate characteristic magnetic profiles across discrete features where it is considered beneficial.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2021, creating DWG (2018) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features

using GNSS, resection method, etc.

2.3.7 An abstraction and interpretation is drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing. Appendix E sets out CAD layer names with colour and graphic content for each interpretation category, see 3.3.

2.3.8 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.

2.3.9 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 a total of four survey areas covering approximately 3ha.

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

3.1.3 Anomalies located within each survey area have been numbered and are described in 3.4 to 3.7 below.

3.2 Statement of data quality and factors influencing the interpretation of anomalies

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

3.2.2 Despite the generally low levels of magnetic susceptibility typically associated with the soils formed on the type of clay geology within the site, the data demonstrate the presence of useful magnetic contrast. Positive and negative linear anomalies have been caused by former ridge and furrow cultivation and several strong anomalies associated with archaeological features were located in Area 1.

3.2.3 Although modern steel objects have caused magnetic disturbance in Areas 1 and 4, magnetic debris of modern origin appears to be confined to the

southern end of Area 1. The high magnitude anomalies associated with the magnetic disturbance and debris has the potential to obscure anomalies within those survey areas, although this is considered most likely to occur in Area 1 only.

3.2.4 The small areas covered by the survey may prevent confident interpretation of anomalies that are incomplete and extend beyond the coverage. However, adjacent land was generally unsuitable for additional survey due to the presence of trees and hedgerows. Anomalies of archaeological origin located in Area 1 are likely to be the western limit of features already investigated and recorded ahead of the construction of Shaw Ridge Primary School.

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 general explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, see Table 1.

Interpretation category	Description and origin of anomalies
Anomalies with archaeological potential	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc. The category is used where there is a high level of confidence which may be due to additional supporting information where morphology is unclear or uncharacteristic.
Anomalies with an uncertain origin	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. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. 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	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. This category does not include agricultural features of early date or considered to be of archaeological potential (e.g. animal stockades, enclosures, farmsteads, etc).
Anomalies relating to land management	Anomalies are mainly linear and may positive, generally associated with infilled ditches, or negative, often associated with extant ditches. Land drains can appear in a classic herringbone pattern of interconnected multiple dipolar linear anomalies, or as parallel linear anomalies. The multiple dipolar response indicates ceramic land drains.
Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are 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, hearths and nail spreads from former wooden structures or rooves 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.
Anomalies with a modern origin	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 411720 184880, see Figs 03 – 07.

Anomalies of archaeological potential

(1) – The northern part of Area 1 contains at least four strong, discrete anomalies with responses of 40-90nT. This indicates an association with intense burning and such responses can be associated with hearths or kilns, although there is not widespread magnetic debris which would normally indicate pottery wasters and kiln debris. They have a discrete high magnitude response indicative of a firing chamber with some appearing to have a connected weaker linear or discrete response that could suggest a stokehole. Two of them lie within the northern area outlined for planting.

(2) – Positive rectilinear anomalies relate to a series of rectilinear enclosure ditches. They are on the same orientation as, and likely to be a continuation of, other enclosure features recorded on the HER and situated 25m to the north in the school grounds. Their morphology may be indicative of Romano-British enclosures.

(3) – Situated generally within the confines of the enclosures (2) are a number of discrete positive responses. The anomalies are consistent with pits and/or burnt material and are indicative of settlement features.

(4) – To the west of the enclosures (2) are small zones of weakly magnetically enhancement (<1nT) which appear to have a rounded boundary on the northern side. The response may suggest an association with occupation debris.

Anomalies with an uncertain origin

(5) – The central part of the survey area contains a number of positive and negative linear anomalies. They are indistinct and lack a coherent morphology as they are generally not parallel with the rectilinear enclosures (2), and although it is possible that they relate to later activity, such as landscaping or disturbance during formation of the park, an archaeological origin is possible.

Anomalies associated with magnetic debris

(6) – A zone of very strongly magnetic debris can be seen at the southern end of the survey area. This type of response is generally associated with ground infill and make up and a small pond is mapped during the 19th and early 20th centuries just to the west. It is possible that this material is associated with a spread of infill.

(7) – Strong, discrete, dipolar anomalies are responses to ferrous and other magnetically thermoremnant objects within the topsoil. All the survey areas contain such responses to a greater, or lesser degree.

Anomalies with a modern origin

(8) – Magnetic disturbance is a response to adjacent lamp posts and benches along the edge of the survey area.

3.5 List of anomalies - Area 2

Area centred on OS NGR 411637 184928, see Figs 03 – 06.

Anomalies of uncertain origin

(9) – A discrete positive anomaly with a response of over 30nT could be associated with a pit-like feature or have an association with burning. Several other discrete, but weaker, pit-like responses are located close by. The origin of the anomalies is uncertain.

(10) – Located in the eastern part of the survey area and generally outside the area outlined for planting are a number of positive and negative linear anomalies. It is not possible to determine their origin.

Anomalies with an agricultural origin

(11) – A series of parallel linear anomalies relates to former ridge and furrow.

3.6 List of anomalies - Area 3

Area centred on OS NGR 411527 184827, see Figs 03 – 06.

Anomalies of uncertain origin

(12) – Weakly positive linear and curvilinear anomalies appear to be associated with a very strongly magnetic response at the north eastern edge of the survey area. While this type of response could relate to a relatively modern buried ferrous object, it does appear to be surrounded by a curvilinear feature with a linear feature extending south.

Anomalies related to land management

(13) – Negative linear anomalies correspond to shallow linear gullies visible on the land surface. Although there are no field boundaries mapped from the early 19th century onwards, the features are indicative of gullies associated with land drainage.

Anomalies with an agricultural origin

(14) – A series of parallel linear anomalies are related to ridge and furrow.

3.7 List of anomalies - Area 4

Area centred on OS NGR 411243 184773, see Figs 08 – 09.

Anomalies of uncertain origin

(15) – Positive and negative curvilinear and linear anomalies can be seen in the eastern part of the survey area, outside of the areas outlined for planting. A number of other positive linear anomalies are located elsewhere. They all lack a coherent morphology and cannot be confidently interpreted.

Anomalies with an agricultural origin

(16) – A series of parallel linear anomalies are related to ridge and furrow.

Anomalies with a modern origin

(17) – Magnetic debris relates to material used in construction of the pathway that divides the survey area and magnetic disturbance is from lamp posts at the edge of the path.

4 CONCLUSION

4.1.1 The geophysical survey has located a number of anomalies in the far eastern part of the site (Area 1) that appear to be associated with industrial activity and settlement features. The anomalies consist of strongly magnetic discrete features which indicate an association with intense burning, with a series of rectilinear enclosures and associated pits. This part of the site contains previously recorded Romano-British kiln debris and the strong, discrete anomalies appear to relate to such features. The majority of the archaeological features lie outside of the outlined areas for planting, but some archaeology is contained within these zones.

4.1.2 Within the other three survey areas anomalies generally lack a coherent morphology, and although there is a discrete strong response within Area 2 and a larger very strong response that appears to be surrounded by a curvilinear feature in Area 3, their origin is uncertain.

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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 SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm 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 magnetic field. The difference between the two sensors will relate to the strength of the magnetic field created by the buried feature.

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. 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 data from 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 differences between the offset values of the gradiometer sensors. The process can remove archaeological features that run along a traverse but with the high resolution datasets created by the Sensys FGM650 sensors and the method of data collection this has not been a notable problem. In fact, the removal of offsets using software avoids carrying out a balancing procedure on site, which inevitably can never be done in magnetically clean conditions and results in improperly aligned fluxgate sensors and/or electronic adjustment values.

Appendix C – survey and data information

Area 1

Filename: J897-mag-Area1-prod.xcp
Instrument Type: Sensys DLMGPS
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 411677.70, 184942.60m
Southeast corner: 411751.20, 184823.20 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Dimensions
Survey Size (meters): 73.5 m x 119 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 94100, Recorded: 94100
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.46
Mean: 0.04
Median: -0.02
Composite Area: 0.87759 ha
Surveyed Area: 0.4261 ha

PROGRAM
Name: TerraSurveyorPre
Version: 3.0.36.24
Processes: 1
1 Base Layer

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00

Filename: J897-mag-Area1-proc-40nT.xcp
Stats
Max: 44.20
Min: -44.00
Std Dev: 7.47
Mean: 0.26
Median: 0.00
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -40.00 to 40.00

Area 2

Filename: J897-mag-Area2-proc.xcp
Northwest corner: 411606.11, 184958.95 m
Southeast corner: 411670.76, 184907.80 m
Dimensions
Survey Size (meters): 64.7 m x 51.2 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 54200, Recorded: 54200
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.67
Mean: 0.00
Median: 0.00
Composite Area: 0.33068 ha
Surveyed Area: 0.242 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00

Area 3
Filename: J897-mag-Area3-proc.xcp

Northwest corner: 411484.53 184860.98m
Southeast corner: 411579.63, 184806.38 m
Dimensions
Survey Size (meters): 95.1 m x 54.6 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 69200, Recorded: 69200
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.79
Mean: 0.01
Median: 0.01
Composite Area: 0.51925 ha
Surveyed Area: 0.2943 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00

Area 4
Filename: J897-mag-Area4-proc.xcp
Northwest corner: 411107.73, 184839.22 m
Southeast corner: 411375.63, 184707.37 m
Dimensions
Survey Size (meters): 268 m x 132 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 447199, Recorded: 447199
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.99
Mean: 0.10
Median: 0.00
Composite Area: 3.5323 ha
Surveyed Area: 1.9342 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. 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.

A PDF copy will be supplied to the Wiltshire Historic Environment Record with greyscale images and abstraction layers made available on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J897-mag-**[area number/name]**.asc J897-mag-**[area number/name]**.xcp J897-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J897-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J897-**[version number]**.dwg	CAD file in 2018 dwg format
Report	J897 report.odt	Report text in LibreOffice odt format

Table 2: Archive metadata

Appendix E – CAD layers for abstraction and interpretation plots

The table below sets out Archaeological Surveys Ltd CAD layer names with associated colours and graphical content. Where CAD files are available layers may be extracted for further CAD/GIS use. Note: hatched polygon boundaries are contained within layers with the RGB colour code 254, 255, 255 (near white) in order to prevent their visibility.

Report sub-heading and associated CAD layer names	Colour with RGB index		Layer content
Anomalies with archaeological potential			
AS-ABST MAG POS DISCRETE ARCHAEOLOGY		Red 255,0,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS ARCHAEOLOGY		Red 255,0,0	Polygon (cross hatched ANSI37)
AS-ABST MAG POS LINEAR ARCHAEOLOGY		Red 255,0,0	Polyline or polygon (solid)
AS-ABST MAG POS ENCLOSURE DITCH		127,0,255	Line, polyline or polygon (solid)
Anomalies with an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG NEG LINEAR UNCERTAIN		Blue 0,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
Anomalies relating to land management			
AS-ABST MAG EXTANT DRAIN		0,153 ,204	Line or polyline
Anomalies with an agricultural origin			
AS-ABST MAG RIDGE AND FURROW		0,127,63	Line, polyline or polygon (cross hatched ANSI37)
Anomalies associated with magnetic debris			
AS-ABST MAG DEBRIS		132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR		132, 132, 132	Solid donut, point or polygon (solid)
Anomalies with a modern origin			
AS-ABST MAG DISTURBANCE		132, 132, 132	Polygon (hatched ANSI31)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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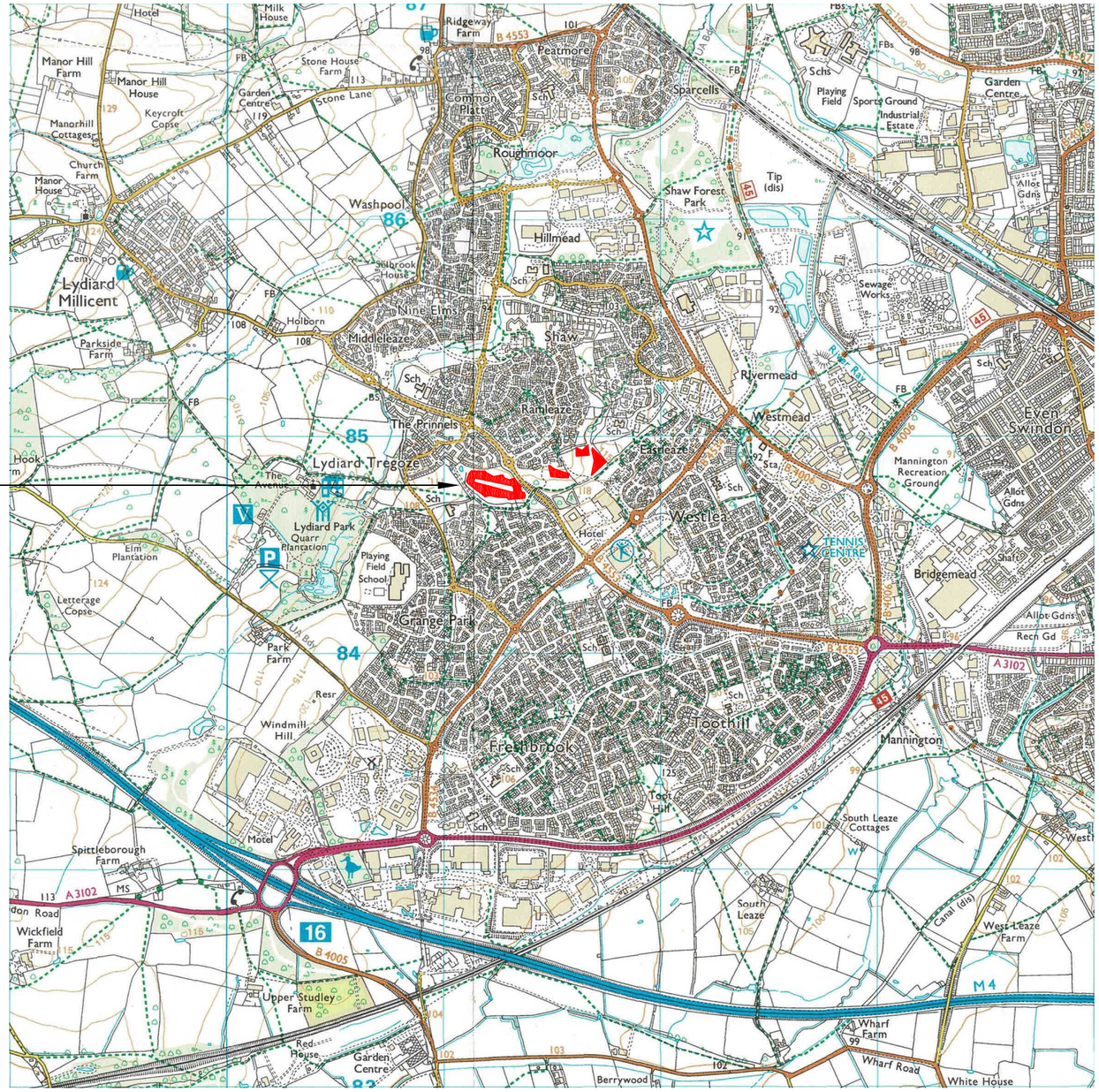
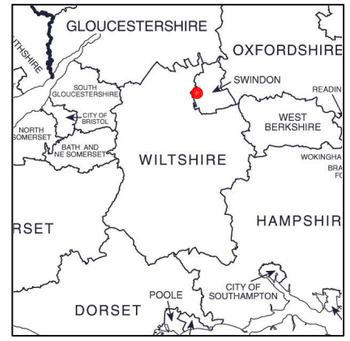
www.archaeological-surveys.co.uk
info@archaeological-surveys.co.uk
Tel: 01249 814 231

Survey location



N



Survey location

Site centred on OS NGR
SU 11440 84790

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Swindon

Map of survey area

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

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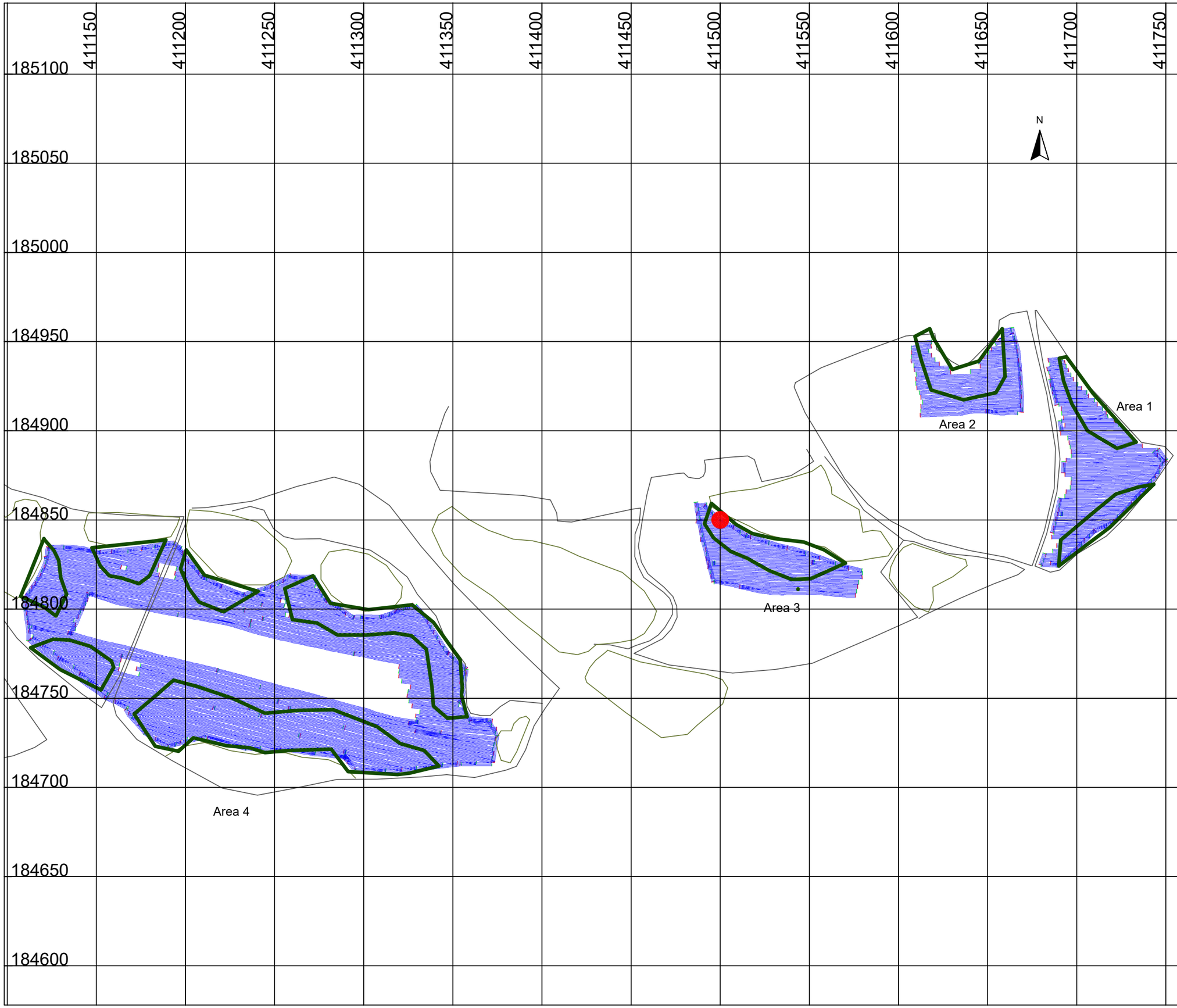
Referencing information



Referencing grid to OSGB36 datum at 50m intervals

411450 184850

Survey tracks

Survey track start

Survey track stop

Proposed tree planting area

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

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KTD	DJS	FIG 02

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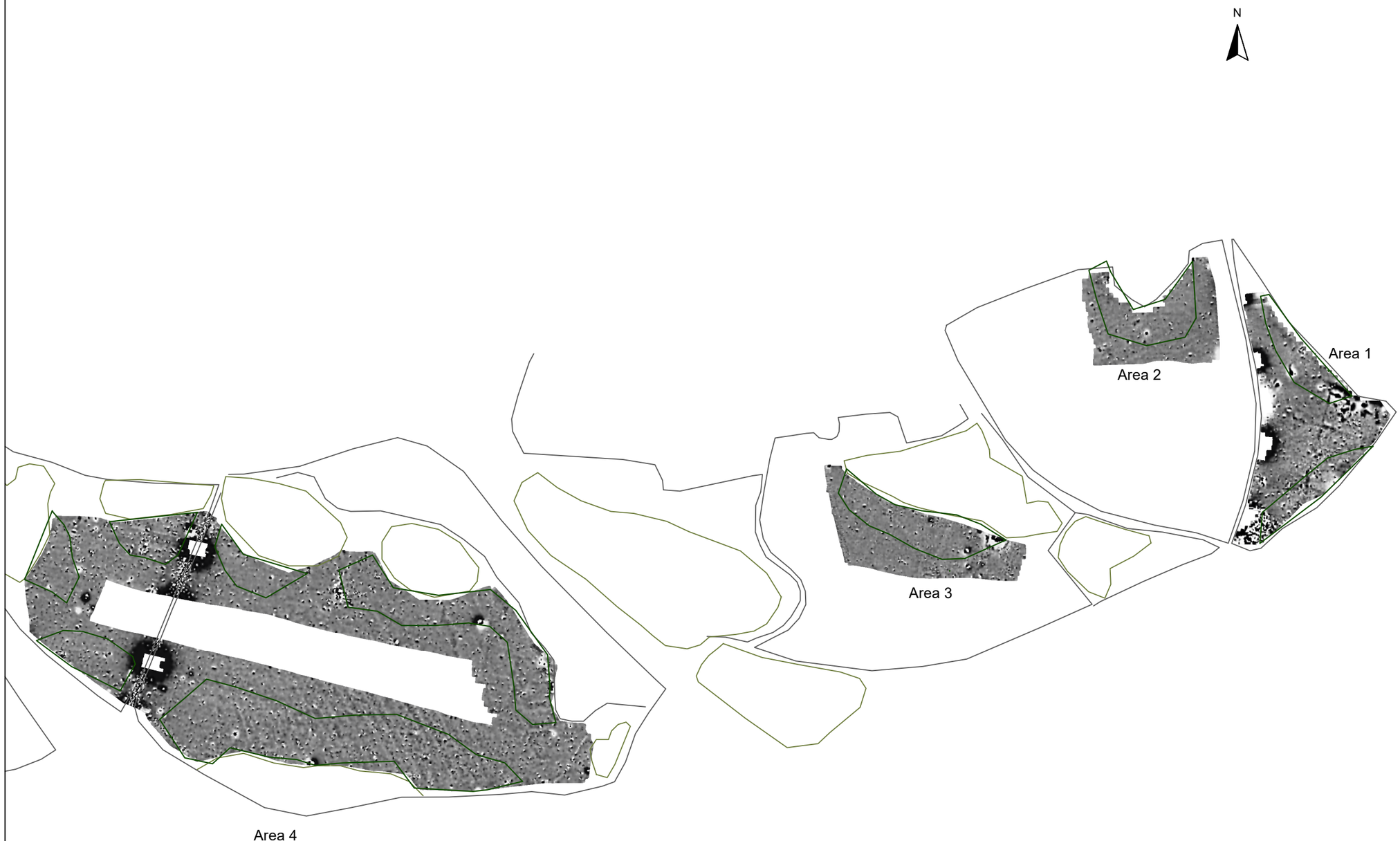
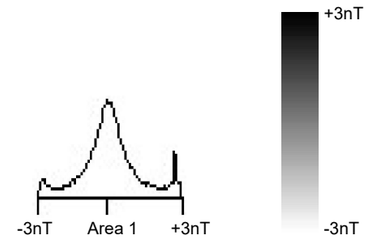
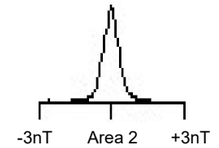
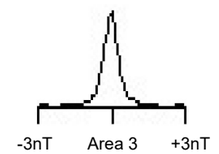
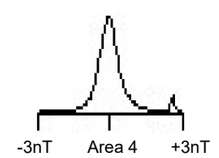
Greyscale plot of minimally processed magnetometer data











Proposed tree planting area

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

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Abstraction and interpretation of magnetic anomalies

- Positive linear anomaly - cut feature of archaeological potential
- Positive rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - ridge and furrow
- Strong discrete response - associated with intense burning
- Discrete positive response - cut feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetic enhancement of archaeological potential
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous / magnetically thermoremnant object
- Proposed tree planting area

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

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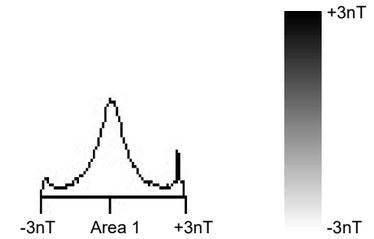
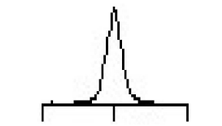
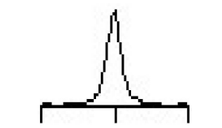
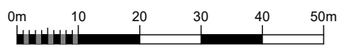
Greyscale plot of minimally processed magnetometer data - Areas 1 to 3 (east)







SCALE 1:1000



SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

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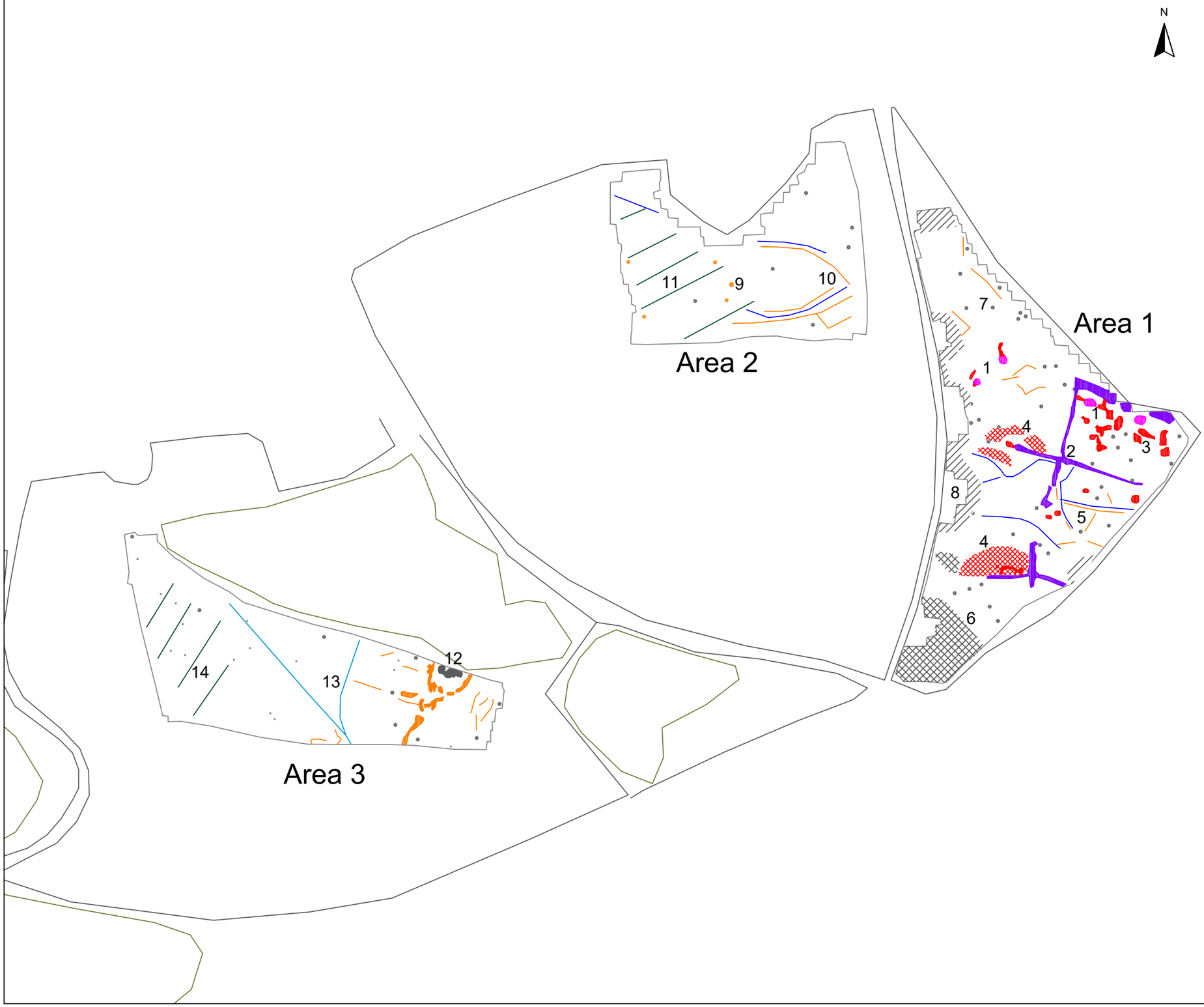
Abstraction and interpretation of magnetic anomalies - Areas 1 to 3 (east)



- Positive linear anomaly - cut feature of archaeological potential
- Positive rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - ridge and furrow
- Linear anomaly - linear depression/drain
- Strong discrete response - associated with intense burning
- Discrete positive response - cut feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetic enhancement of archaeological potential
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous / magnetically thermoremnant object

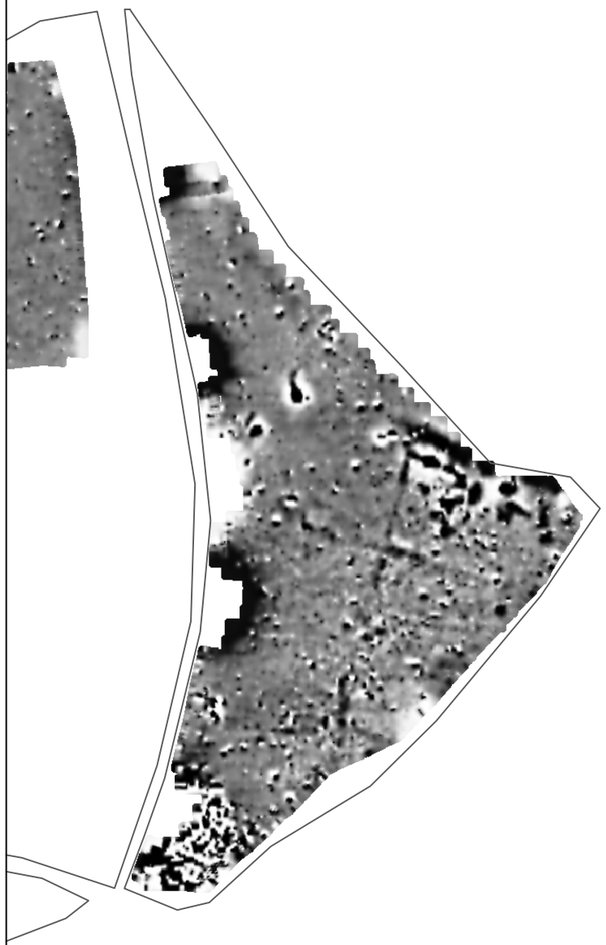
SCALE 1:1000

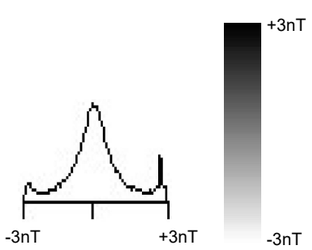
0m 10 20 30 40 50m

SCALE TRUE AT A3

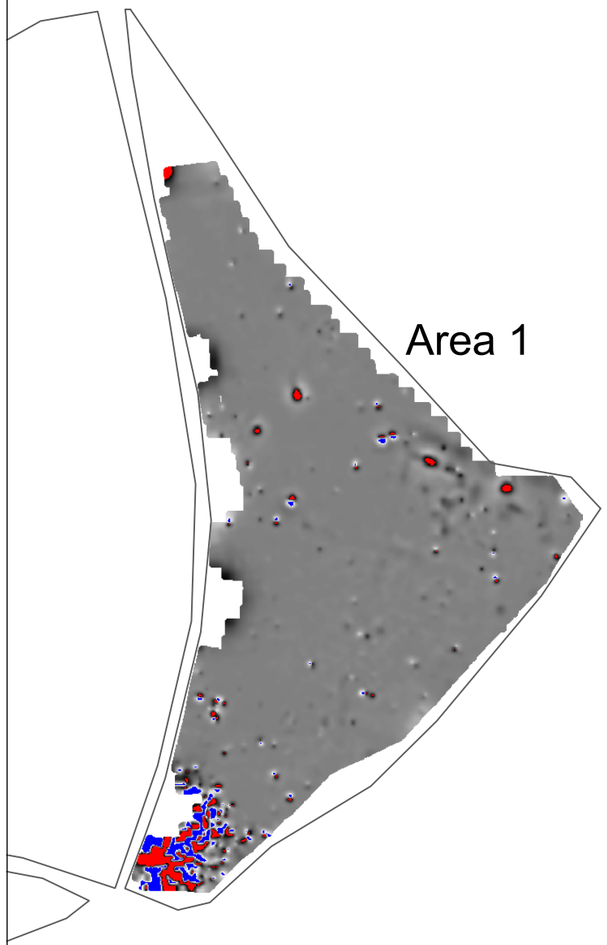
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 06

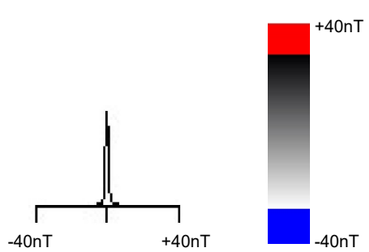
Greyscale plot of minimally processed magnetometer data clipped at ±3nT



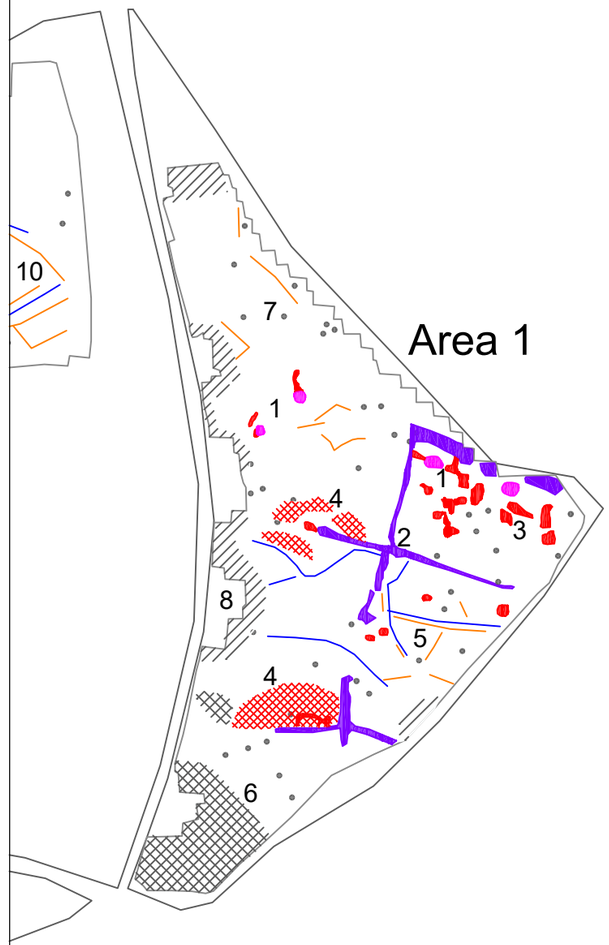


Greyscale plot of minimally processed magnetometer data clipped at ±40nT





Abstraction & interpretation of magnetic anomalies



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Greyscale of magnetometer data & abstraction & interpretation of magnetic anomalies - Area 1

- Positive linear anomaly - cut feature of archaeological potential
- Positive rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - ridge and furrow
- Strong discrete response - associated with intense burning
- Discrete positive response - magnetically enhanced feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetic enhancement of archaeological potential
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous / magnetically thermoremnant object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

KTD	DJS	FIG 07

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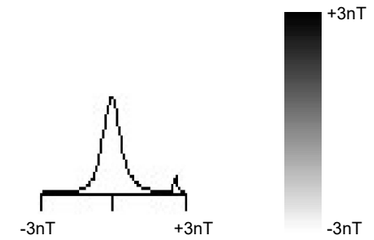
Greyscale plot of minimally processed magnetometer data - Area 4 (west)

Area 4



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08

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Abstraction and interpretation of magnetic anomalies - Area 4 (west)

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - ridge and furrow
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 09