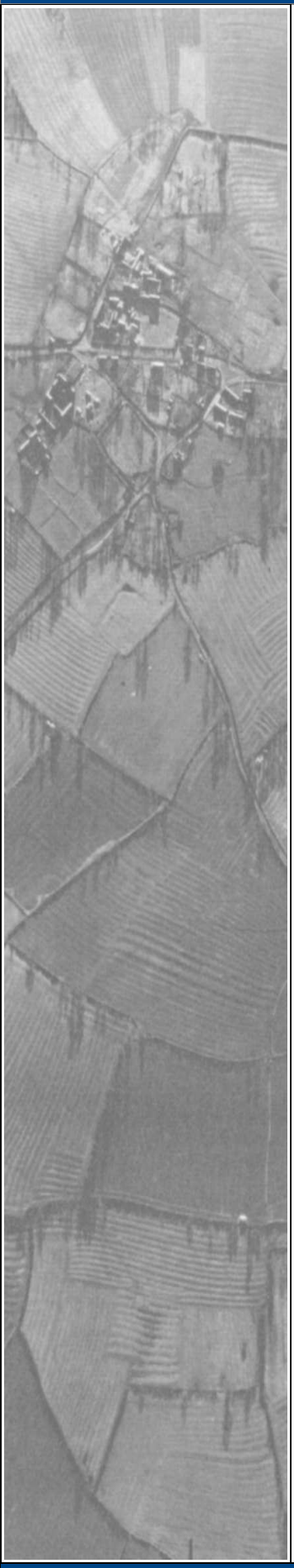

Land off Park Road
Malmesbury
Wiltshire

MAGNETOMETER SURVEY REPORT

for

White Lion Land (Malmesbury) Limited

Kerry Donaldson & David Sabin

July 2020

Ref. no. J826

ARCHAEOLOGICAL SURVEYS LTD

Land off Park Road
Malmesbury
Wiltshire

MAGNETOMETER SURVEY REPORT

for

White Lion Land (Malmesbury) Limited

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

Survey dates – 17th & 18th July 2020
Ordnance Survey Grid Reference – ST 92335 88040

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SUMMARY

Detailed magnetometry was undertaken by Archaeological Surveys Ltd over a 5ha land parcel on the north western edge of Malmesbury ahead of a proposed residential development. The results indicate the presence of a broad, curving anomaly in the north western part of the site that could relate to former fluvial feature and/or possible quarrying. The site also contains a number of pit-like responses, which although can relate to naturally formed features or agricultural activity, do appear in several clusters and an anthropogenic origin is possible. Two discrete responses are moderately strong which may be indicative of burning. Elsewhere, positive linear anomalies lack a coherent morphology, and one broad, fragmented linear response could relate to agricultural activity or a possible junction in the underlying geology, but it cannot be confidently interpreted.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by the Environmental Dimension Partnership (EDP), on behalf of White Lion Land (Malmesbury) Limited, to undertake a magnetometer survey of an area of land on the north western edge of Malmesbury in Wiltshire. The eastern part of the site has been outlined for a proposed residential development of 50 affordable homes, and the survey forms part of an archaeological assessment.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2020) and issued to Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council, prior to commencing the fieldwork.

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 development of the site. 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) *Standard and Guidance for Archaeological Geophysical Survey.* Note: currently Historic England (2018) no longer support the guidelines set out in English Heritage (2008) *Geophysical survey in archaeological field evaluation* and there are currently no plans to update the document. As a consequence other sources of written guidance referring to this document may be out of date and/or contain unsupported information (e.g. Chartered Institute for Archaeologists, 2014).

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 site is located on the north western edge of Malmesbury in Wiltshire and centred on Ordnance Survey National Grid Reference (OS NGR) ST 92335 88040, see Figs 01 and 02. The geophysical survey covers approximately 5ha within a single field that had been recently mown for hay. It is bounded to the north by Park Road, to the west by Park Lane with small plots of agricultural land to the east and south west along with a playing field and residential dwellings within White Lion Park to the south. Only 1ha in the eastern part of the site has been outlined for the residential development and the remaining area has been included in the survey for context.

1.4.2 Land boundaries are mainly hedgerows with the exception of those to the rear of residential dwellings where there is fencing that includes the use of ferrous material. The south western half of the field is mainly flat, with the exception of the north western part which tends to dip towards the north west. The north

eastern half slopes down to the north east with an increasing gradient forming a convex profile. During the survey the area was in frequent use by walkers and for exercising dogs.

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

Plate 1: Survey area looking south east

1.5 Site history and archaeological potential

1.5.1 A desk-based archaeological assessment has been carried out by EDP (2019). It outlines that there is a former 19th century outfarm in the south eastern corner of the site under dense vegetation. Approximately 250m to the east is the location of middle to late Bronze Age ditch and approximately 400m to the north lie a series of Romano-British enclosures, ditches and pits at Tetbury Hill. The site is likely to have been within the agricultural hinterland of Malmesbury since at least the medieval period, although there are no recorded ridge and furrow earthworks within it, and mapping shows the site has remained as a single land parcel since the 19th century.

1.6 Geology and soils

1.6.1 The underlying solid geology across the majority of the site is limestone from the Cornbrash Formation with mudstone from the Forest Marble Formation within the northern part of the site (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Sherborne association

and is a brown rendzina. It consists of a shallow, well drained, brashy, calcareous, clayey soil over limestone (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry survey carried out across similar soils has produced good results. 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. 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 2016, creating DWG (2010) 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 the 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.

2.3.9 The abstraction and interpretation procedure has been supported by analysis

of a digital terrain model derived from the Environment Agency's LiDAR 1m resolution data. Shaded relief plots are created using Surfer 15 using the parameters of Azimuth:0, Altitude:210, Z factor:10 (Fig 05).

2.3.10 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 5ha within a single land parcel.

3.1.2 Magnetic anomalies located can be generally classified as positive anomalies of an uncertain origin, anomalies associated with quarrying, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines.

3.1.3 Anomalies located within each survey area have been numbered and are described in 3.4 below with subsequent discussion in Section 4.

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. The soils and geology across the survey area appear to support useful magnetic contrast.

3.2.2 Minor zones of magnetic disturbance and debris were located close to some of the field boundaries, and these are considered very unlikely to obscure archaeologically significant anomalies.

3.2.3 Although in general it can be stated that there is little evidence for naturally formed anomalies, which are often located on areas with similar geology, a broad curvilinear feature with a variable, though mainly positive response, was located in the north western part of the site. This may indicate a former fluvial channel as it is associated with a dip in the field; however, the feature has been interpreted as of uncertain origin, see 3.4 and 4.1.1 below.

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 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 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. 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.
Anomalies associated with ground disturbance/quarrying	Magnetically variable anomalies which may be negative indicating a response to geology/drift deposits and/or positive indicating an increased depth of topsoil. Very strongly magnetic anomalies are a response to highly magnetic material of modern origin which can be used to infill a quarry depression. It should be considered that former quarry pits may be of archaeological potential.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Area centred on OS NGR 392335 188040, see Figs 03 & 04.

Anomalies with an uncertain origin

(1 & 2) - Located in the western part of the site is a broad, curving magnetically variable feature. Its morphology is indicative of a former fluvial feature; however, it contains discrete areas of magnetically enhanced infill (2) and some irregularity to the edges which indicates that it could relate to quarrying. It appears to have a surface expression in the form of a notable dip or depression within the field.

(3) - A fragmented positive response in the north eastern part of the site could relate to agricultural activity, but it is at a slightly different orientation to anomalies (12) and is broader and more magnetically enhanced than those linear anomalies. Although an anthropogenic origin is possible, the response could also relate to a junction within the underlying geology.

(4) - The survey area contains a number of discrete positive responses. Some are isolated, while others appear to be in groups. They may relate to former pit-like features, although it is impossible to determine whether they are naturally or

anthropogenically formed.

(5) - A group of positive anomalies are located close to the eastern corner of the site close to a modern gateway and also close to a former track and field entrance that lead to the former outfarm to the south. The responses could, therefore, be associated with relatively modern disturbance.

(6) - Situated in the south western part of the site are two discrete magnetic anomalies. They have a response of 40-60nT, which would generally indicate an association with intense burning.

(7) - A weakly positive linear anomaly could be a continuation of anomaly (3), or it could relate to agricultural activity (12).

(8) - A Small number of weakly positive linear anomalies, with no coherent morphology or pattern, can be seen within the site. It is not possible to determine their origin.

(9) - Two small patches of magnetic enhancement are located in the central western part of the site and at the northern edge. The type of response may be indicative of the fill of a former pit formed by quarrying or ground disturbance.

Anomalies associated with quarrying

(10) - A small, irregularly shaped, magnetically variable response is located towards the north western corner of the site. This type of anomaly usually indicates an association with former quarrying.

Anomalies with an agricultural origin

(11) - The survey area contains parallel linear anomalies extending across the width of the survey area and appearing to relate to former ridge and furrow cultivation.

(12) - A series of linear anomalies parallel with the southern boundary also relate to agricultural activity. They appear to have truncated the earlier ridge and furrow (11).

Anomalies associated with magnetic debris

(13) - Magnetic debris in the south eastern corner of the site is associated with demolition material derived from the adjacent former outfarm. A linear zone along the eastern edge appears to be associated with a former track from the outfarm to Park Road to the north.

(14) - A patch of magnetic debris can seen in the central, southern part of the site. This could relate to dumped material, burning in-situ or occupation debris.

(15) - The entire survey area contains widespread and numerous strong, discrete, dipolar responses, with only the strongest abstracted. This indicates that ferrous and other magnetically thermoremnant material has become incorporated into the

topsoil through the process of manuring etc.

Anomalies with a modern origin

(16) - A strongly magnetic linear response can be seen extending through the centre of the survey area. This is indicative of the response to a buried cable or other service.

4 DISCUSSION

4.1.1 The morphology of the curving anomaly (1) in the western part of the site indicates that it could relate to a former water channel, but topographically it lies 7m above the River Avon to the north. LiDAR imagery also indicates that it lies within a shallow depression. The edges of the feature contain discrete, irregular pit-like anomalies (2) with a response of 10-20nT which indicates an enhanced fill. It is possible, therefore, that the feature is associated with episodic quarrying perhaps related to shallow overburden at the edges of the depression, although such responses can be associated with former palaeochannels. A small zone of what also appears to be quarrying (10) lies 45m to the north. The anomaly has also been crossed by later ridge and furrow (11), so is at the latest post-medieval and likely to be earlier. However, as a former fluvial channel it may be of considerable age, perhaps forming through the Pleistocene.

4.1.2 The site also contains a number of discrete, pit-like anomalies (4), with several appearing to be in groups. One group appears to form two arcs towards the south eastern corner of the field; however, they are located 20m to the north of a demolished outfarm, and the close proximity could indicate an association, although the origin of the anomalies is uncertain. Such anomalies can relate to pit-like features with an anthropogenic origin, but natural features, tree throws pits and general disturbance of the shallow Cornbrash geology can lead to similar anomalies. Other discrete responses in the western part of the site (6) have a response of 40-60nT, which could indicate an association with burning.

4.1.3 A number of positive linear anomalies have also been located within the site, but they are short and lack a coherent morphology. One broad positive response (3) could relate to agricultural activity, but it is broader, more fragmented and on a slightly different orientation to the series of parallel agricultural anomalies (12) that extend throughout the length of the site. Although this anomaly could have been caused by anthropogenic activity, it is also possible that it could relate to the change in geology between the Cornbrash limestone and the Forest Marble mudstone.

5 CONCLUSION

5.1.1 The geophysical survey results show the presence of a broad curving anomaly in the western part of the survey area that could relate to a former fluvial feature with possible episodic quarrying along its sides. It appears to pre-date the overlying ridge and furrow.

5.1.2 The site also contains several pit-like anomalies, and although these could relate to ground disturbance through agricultural activity or tree throws, interpretation is uncertain as there are groups or clusters and similar anomalies can be formed by a number of different processes.

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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.

Despike

Removal of data points that exceed the mean/median/threshold by selecting a window size of data points and replace by mean/median/threshold. Magnetic spikes can be caused iron objects on the surface or within the topsoil. Despike can improve the appearance of data and remove extreme readings that may affect further processing.

High Pass Filter

Removes low frequency anomalies within the data that are not considered to be archaeologically significant and may be natural in origin. A window passes over the data, the mean of all the data within the window is subtracted from the centre value. The size of the window is adjusted as is the weighting which may be uniform or Gaussian. The process is used to improve the visibility of anomalies of interest.

Low Pass Filter

Removes high frequency anomalies or 'noise' within datasets and provides a smoother output. A window passes over the data, the mean of all the data within the window is used to replace the centre value. The size of the window is adjusted as is the weighting. The process is used to improve the visibility of anomalies of interest.

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

Filename: J826-mag-proc.xcp
Description: Imported as Composite from: J826-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 392149.30, 188184.62 m
Southeast corner: 392533.15 187893.17 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 1279800
Dimensions
Composite Size (readings): 2559 x 1943
Survey Size (meters): 384 m x 291 m
Grid Size: 384 m x 291 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.16
Mean: 0.06
Median: 0.02
Composite Area: 11.187 ha
Surveyed Area: 5.0303 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 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. 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	J826-mag-**[area number/name]**.asc J826-mag-**[area number/name]**.xcp J826-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J826-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J826-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J826 report.odt	Report text in Open Office 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 an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
Anomalies with an agricultural origin			
AS-ABST MAG AGRICULTURAL		Green 0,255,0	Line or polyline
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)
AS-ABST MAG SERVICE		132, 132, 132	Line or polyline
Anomalies associated with ground disturbance/quarrying			
AS-ABST MAG QUARRYING/ GROUND DISTURBANCE		255,255, 127 or 255,223,127	Polygon (net)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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

Survey location

Application boundary

N

● Survey location

Site centred on OS NGR
ST 92335 88040

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Land off Park Road
Malmesbury
Wiltshire

Map of survey area

392150 392200 392250 392300 392350 392400 392450 392500 392550

188150
188100
188050
188000
187950
187900

N

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Land off Park Road
Malmesbury
Wiltshire

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

392450 187950

Survey tracks

Survey track start

Survey track stop

Ownership boundary

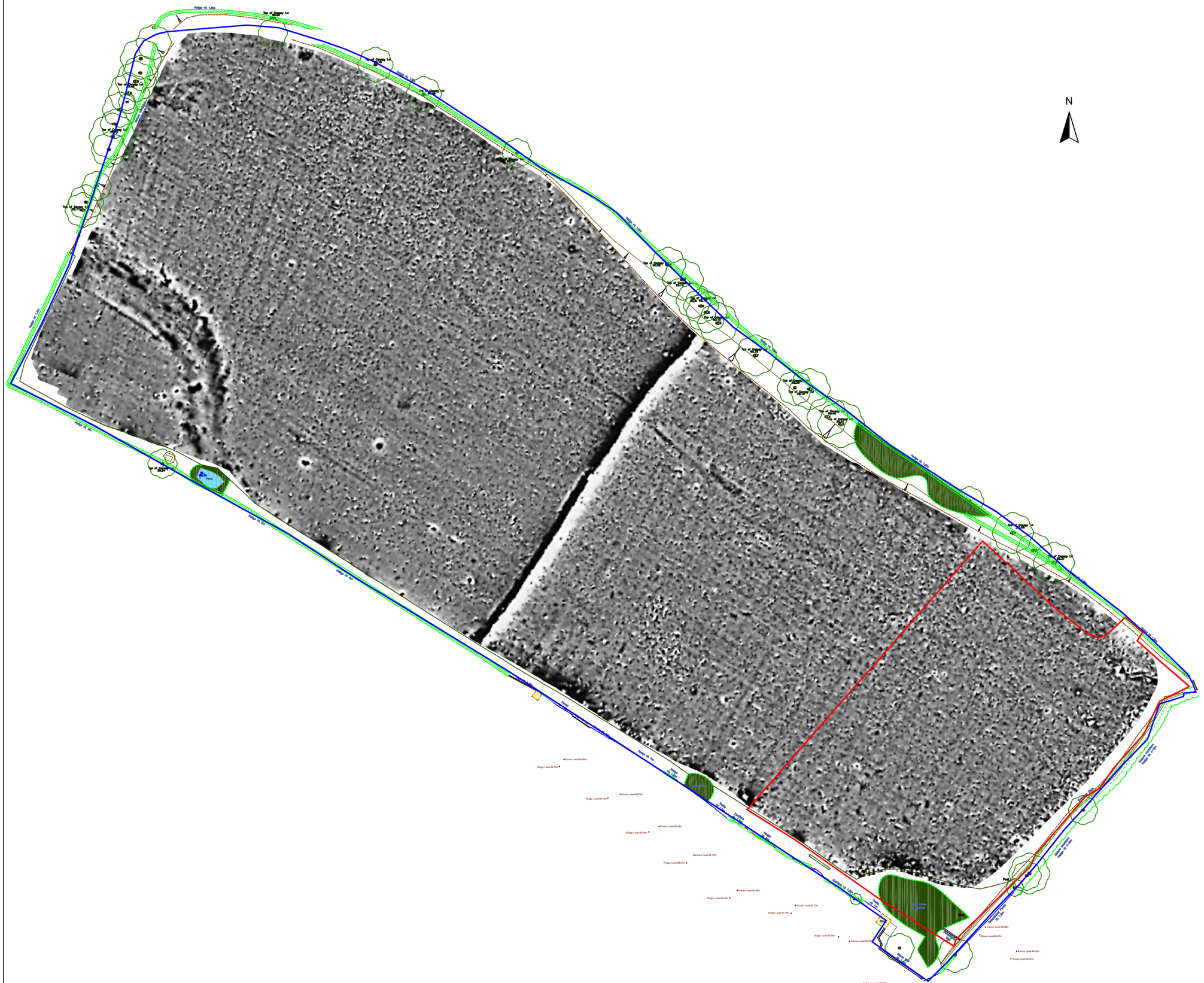
Application boundary

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02



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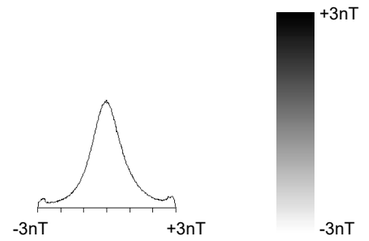
Geophysical Survey
Land off Park Road
Malmesbury
Wiltshire

Greyscale plot of minimally processed magnetometer data



SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

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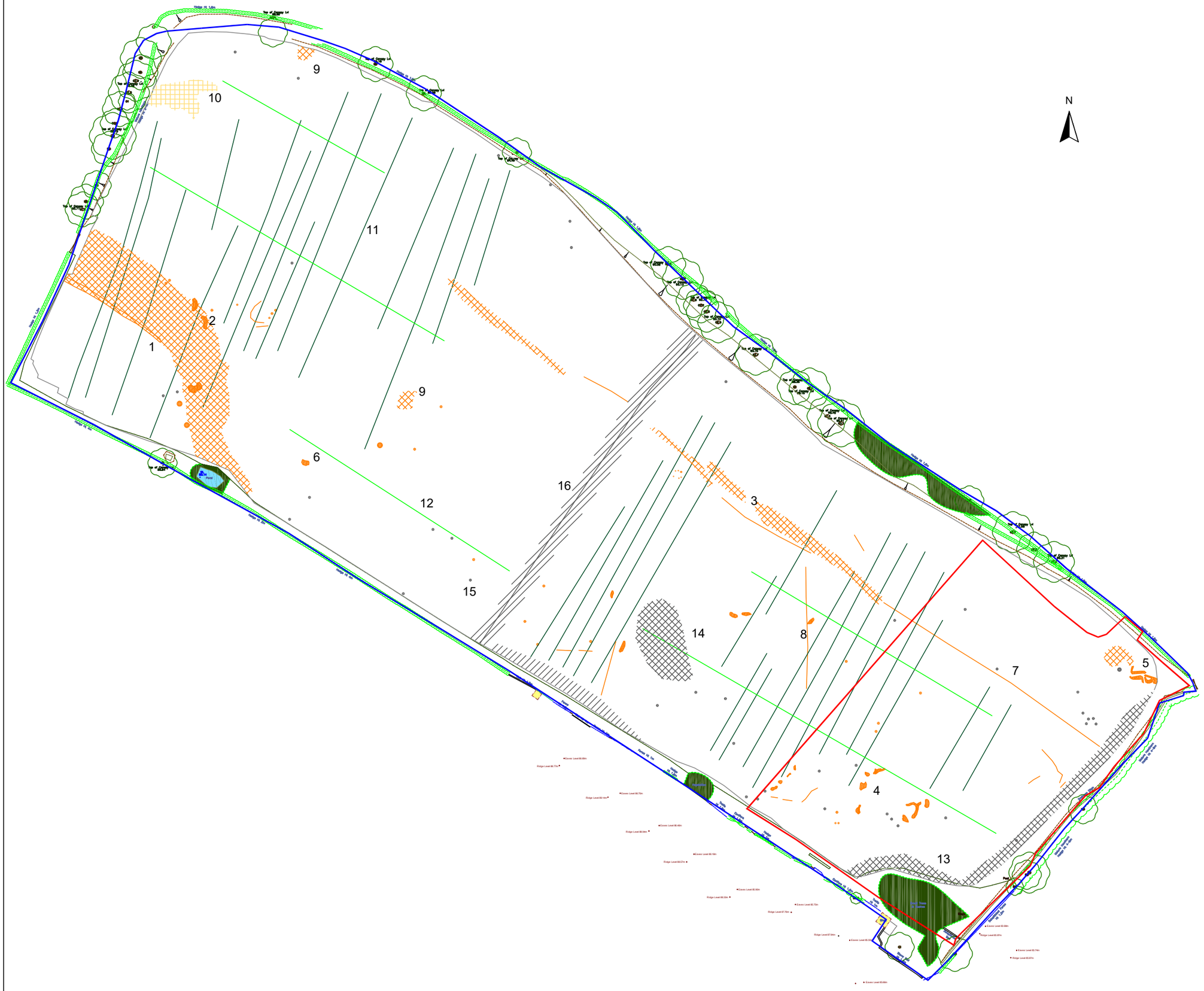
Wiltshire

Abstraction and interpretation of magnetic anomalies



- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Linear anomaly - ridge and furrow
- Discrete positive response - possible pit-like feature
- Magnetically variable anomaly - of uncertain origin
- Variable magnetic response - former quarrying
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar linear anomaly - possible cable
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

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Digital Terrain Model

Derived from Environment Agency's LiDAR data 1m resolution

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05