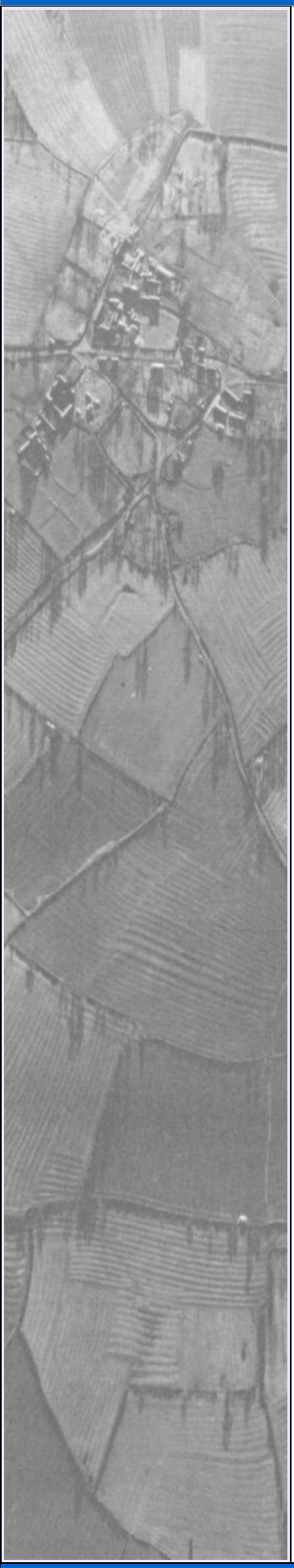


Chippenham Rugby Football Club
Chippenham
Wiltshire

MAGNETOMETER SURVEY REPORT

for

Foundations Archaeology

Kerry Donaldson & David Sabin

April 2019

Ref. no. J785

ARCHAEOLOGICAL SURVEYS LTD

Chippenham Rugby Football Club
Chippenham
Wiltshire

Magnetometer Survey Report

for

Foundations Archaeology

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 date – 29th March 2019
Ordnance Survey Grid Reference – **ST 89815 74170**

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

CONTENTS

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

SUMMARY

Detailed magnetometry was carried out by Archaeological Surveys Ltd at the Chippenham Rugby Football Club ahead of redevelopment to an artificial grass pitch. The results revealed an L-shaped ditch within the area of the pitch and a linear ditch further east, both of which are visible on aerial photographs. In addition, a weak linear ditch-like feature with a similar orientation was identified within the eastern part of the site. Several pit-like anomalies have also been located, and while some may relate to natural features or modern disturbance of the underlying Cornbrash, some could relate to archaeological features.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Foundations Archaeology, on behalf of Chippenham Rugby Football Club, to undertake a magnetometer survey of the rugby pitch as part of a redevelopment to provide a World Rugby compliant Third Generation artificial grass pitch with associated hard and soft landscaping. Material removed from the pitch is due to be used within earth bunds along the eastern edge of the site and these areas were also surveyed to gain a fuller understanding of any buried archaeology that may be present. The survey was carried out with approval by Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council.

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 generally 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 lines; broken or fragmented anomalies may well correspond closely with subsurface truncation.

1.4 Site location, description and survey conditions

1.4.1 The site is located at Chippenham Rugby Football Club to the east of Chippenham, Wiltshire. The survey area is centred on Ordnance Survey National Grid Reference (OS NGR) ST 89815 74170, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 2ha in total with 1ha covering the rugby pitch and another hectare to cover the area of proposed earth bunds. A wider zone was surveyed in order to place anomalies in context. The site is flat and ground cover consisted of short grass at the time of survey. Several obstacles to survey were encountered and these include advertising hoardings, goalposts and lights.

1.4.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Numerous sources of magnetic disturbance were identified and these include the obstacles mentioned above with the addition of steel mesh boundary fencing and a large pylon. Weather conditions during the survey were fine.

Plate 1: Main pitch looking north west

Plate 2: East side of site looking east

1.5 Site history and archaeological potential

1.5.1 The site lies within an area containing a number of archaeological features. Aerial photographs show an L-shaped ditch within the centre of the rugby pitch (MWI74145), with a long linear ditch parallel with its long axis situated 70m to the east (MWI74143). Prior to the construction of the adjacent A350,

excavations revealed an undated oval enclosure (MWI2278), a Bronze Age pit (MWI2227), Iron Age (MWI2230) and Romano-British pottery fragments (MWI2239) and post medieval ditches (MWI2265) immediately to the east of the site. Aerial photographs of the adjacent area reveal a double-ditched enclosure 130m to the north west, likely to relate to an Iron Age or Romano-British settlement (MWI2272) and a single-ditched enclosure is also visible 140m to the south (MWI73495). Another series of enclosures are located 370m to the south west (MWI2235) also appearing to relate to an Iron Age or Romano-British farmstead.

1.5.2 Three scheduled monuments are listed in the locality. Approximately 800m to the north east is the *Roman site at Manor Farm* (SM ref. 1425267), 1km to the west is the *Medieval Settlement of Sheldon* (SM ref. 1018428) and approximately 2km west north west is *Lanhill Barrow: a long barrow 300m south of Sparrow Farm* (SM ref. 1010908).

1.5.3 The presence of archaeological features visible on aerial photographs within the survey area indicate that there is a high potential for the geophysical survey to locate these, and possibly other unknown buried features.

1.6 Geology and soils

1.6.1 The underlying geology is Jurassic limestone from the Cornbrash Formation (BGS, 2017).

1.6.2 The overlying soil across the site 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 carried out over similar geology and soil has produced good results. The site is, therefore, considered suitable for magnetic survey. However, disturbance of the shallow geology, through natural causes, agricultural practices and modern land use can result in pit-like anomalies that can be difficult to distinguish from those with an archaeological 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 SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20 Hz. 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 range of recording data between ±0.1nT and ±10,000nT. They are linked to a Leica GS10 RTK GPS 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 <60s.

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 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 ±10000nT and clipped for display at ±10nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 Additional data processing has been carried out in the form of high pass filtering. This effectively removes low frequency variation along a traverse that has been caused by large magnetic bodies, such as fencing and hoarding. Data treated to additional processing has been compared to unprocessed data to ensure that no significant anomalies have been removed.

2.3.5 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.

2.3.6 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.

2.3.7 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 GPS, resection method, etc.

2.3.8 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.

2.3.9 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.

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 a total of 2ha within the pitch and along the eastern edge of the site.

3.1.2 Magnetic anomalies located can be generally classified as positive linear responses of archaeological potential, positive anomalies of an uncertain origin, anomalies associated with land management, linear anomalies of an agricultural origin, areas of magnetic disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines. Anomalies located within each survey area have been numbered and are described in 3.4 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. Magnetic disturbance associated with above surface steel objects has caused localised magnetic disturbance that has the potential to obscure weak anomalies of archaeological potential. Additional high pass filtering has helped to minimise the size of areas obscured by the disturbance.

3.2.2 The results appear to demonstrate good magnetic contrast between cut features and the natural subsoil. There is clearly a good correlation between ditch-like anomalies and cropmarks visible of aerial photographs of the site. The results are consistent with those obtained from other survey areas over similar geology and soil in the vicinity.

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, 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 relating to land management	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation. 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 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	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 centred on OS NGR 389815 174170, see Figs 03 – 05.

Anomalies of archaeological potential

(1) - Positive linear anomalies appear to form an L-shaped feature, possibly part of a truncated rectilinear enclosure located within the rugby pitch. This anomaly relates to the cropmark feature seen on aerial photographs. The long axis is oriented north east to south west and is 35m long, the short axis is oriented east south east to west north west and is only 8m long. Another short positive linear anomaly appears to be located at the end of this short axis, but it is not clear if it relates to an associated cut feature, or if it is a naturally formed anomaly.

(2) - Located 75m to the east of and parallel with the long axis of anomaly (1) is a positive linear anomaly. This anomaly also relates to a linear feature seen on aerial photographs and which extends throughout the length of the site, beyond the limits of the survey area.

(3) - Located approximately 50m to the east of and parallel with the long axis of anomaly (2) is a weak positive linear anomaly. The feature does not appear to correlate with any cropmark evidence but its orientation appears very similar to anomalies (1) & (2) which may indicate that it is also a ditch of archaeological potential.

Anomalies with an uncertain origin

(4) - A number of discrete pit-like responses can be seen within the rugby pitch area, with a distinct cluster to the north west of anomaly (1). It is not clear if these relate to modern disturbance, agricultural disturbance, natural features or archaeological features.

(5) - A discrete positive response located in the eastern part of the survey area. While such an anomaly could be modern, agricultural or natural, a Bronze Age pit was located in 1997 approximately 50m to the east ahead of construction of the A350 and an archaeological origin should be considered. Several other pit-like responses can also be seen elsewhere in the eastern part of the site, but again, their origin is uncertain.

(6) - A positive linear anomaly extends along the eastern edge of the survey area and may also correspond to a feature seen on aerial photographs. However, it is parallel with the eastern boundary and the A350 and a modern origin is likely.

(7) - In the northern part of the survey area, just to the west of the former field boundary (8), is a zone of magnetic enhancement. It is not possible to determine the cause of this enhancement.

Anomalies associated with land management

(8) - A broad, positive linear anomaly with associated magnetic debris relates to the line of a formerly mapped field boundary.

Anomalies with an agricultural origin

(9) - A negative linear anomaly is parallel with other linear anomalies (10) and while it appears to have been caused by agricultural activity, it could indicate a former field boundary. It also correlates with a ditch-like feature seen on aerial photographs.

(10) - Parallel linear anomalies, oriented east south east to west north west, relate to agricultural activity, possibly ridge and furrow.

(11) - Narrowly spaced, parallel linear anomalies are orientated north south and are present throughout much of the survey area. They relate to more recent agricultural activity.

Anomalies associated with magnetic debris

(12) - Strong, discrete, dipolar anomalies are responses to ferrous and other magnetically thermoremnant objects in the topsoil. A cluster of them are evident towards the south western corner of the rugby pitch.

Anomalies with a modern origin

(13) - Magnetic disturbance has been caused by fencing, lights and hoarding along the edges of the rugby pitch and along the south eastern edge of the site.

(14) - Two, double dipolar anomalies relate to buried goalpost supports.

(15) - A negative linear anomaly crosses the centre of the survey area and the rugby pitch. This type of response indicates a buried pipe or service of non-magnetic material.

(16) - A short, strong, multiple, dipolar linear anomaly in the southern part of the survey area also relates to a buried service or pipe made of ferrous material.

4 CONCLUSION

4.1.1 The presence of an L-shaped possible enclosure and a linear ditch visible on aerial photographs have been confirmed by the magnetometer survey and are considered features of archaeological potential. A weak, ditch-like anomaly in the eastern part of the survey area was also located. It has a similar orientation and appears parallel with the ditches visible on aerial photographs; it may, therefore, also be of archaeological potential.

4.1.2 Further archaeological features have not been clearly defined; however, the site does contain a number of pit-like anomalies. Natural hollows, agricultural activity and modern activity can cause such anomalies; however, an archaeological origin should also be considered. Agricultural activity and services can also be seen within the site as well as a former field boundary.

5 REFERENCES

Aspinall, A., Gaffney, C. and Schmidt, A. 2009. *Magnetometry for Archaeologists*. Lanham (US), AltaMira Press.

British Geological Survey, 2017. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed 28/3/2019].

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for archaeological geophysical survey*. CIfA, University of Reading.

European Archaeological Council, 2015. *EAC Guidelines for the Use of Geophysics in Archaeology: Questions to Ask and Points to Consider.* Europae Archaeologia Consilium and Association Internationale sans But Lucratif, Belgium.

Historic England, 2018. Geophysical Survey Advice [online] available from https://historicengland.org.uk/advice/technical-advice/archaeological-science/geophysics/ [accessed July 2018].

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

Schmidt, A., 2013. *Geophysical Data in Archaeology: A Guide to Good Practice.* Oxbow Books.

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 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. It has been found that clipping data to ranges between ±5nT and ±3nT 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 (destripe) 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 differences between the baseline value of gradiometer sensors.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks, modern agricultural features and other large magnetic bodies within or adjacent to survey areas.

Low Pass Filtering

A mathematical process used to remove high frequency anomalies relating to uneven ground, vibration, etc.

Appendix C – survey and data information

Filename: J785-mag-proc.xcp
Description: Imported as Composite from: J785-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 389666.70, 174324.65 m
Southeast corner: 389894.406, 174051.65 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 599600
Dimensions
Composite Size (readings): 1518 x 1820
Survey Size (meters): 228 m x 273 m
Grid Size: 228 m x 273 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 11.05
Min: -11.00
Std Dev: 3.87
Mean: 0.25
Median: 0.01
Composite Area: 6.2162 ha
Surveyed Area: 2.1185 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 -10.00 to 10.00 nT

Stats
Max: 11.05
Min: -11.00
Std Dev: 2.76
Mean: 0.04
Median: -0.02
Composite Area: 6.2162 ha
Surveyed Area: 2.1185 ha

Filename: J785-mag-proc-hpf.xcp

GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 10.00 nT
5 High pass Uniform (median) filter: Window dia: 300
6 Clip from -10.00 to 10.00 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 printed copies on request. The greyscale images as tifs with tfws and the CAD abstraction layers as a dwg can also be made available to the HER 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	J785-mag-**[area number/name]**.asc J785-mag-**[area number/name]**.xcp J785-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J785-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J785-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J785 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 archaeological potential			
AS-ABST MAG POS LINEAR ARCHAEOLOGY		Red 255,0,0	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 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 relating to land management			
AS-ABST MAG BOUNDARY		127,0,0	Line, polyline or polygon (solid or 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

Table 3: CAD layering

Appendix F – copyright and intellectual property

This report may contain material that is non-Archaeological Surveys Ltd copyright (eg Ordnance Survey, Crown Copyright) or the intellectual property of third parties, which we are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Archaeological Surveys Ltd. Users remain bound by the conditions of the Copyright, Design and Patents Act 1988 with regard to multiple copying and electronic dissemination of this report.

Archaeological Surveys Ltd shall retain intellectual property rights for the materials and records created as part of this project. A non-exclusive, transferable, sub-licensable, perpetual and royalty-free licence shall be granted to the client on full payment of works in order for them to use, reproduce and enhance the reports, documentation, graphics and illustrations produced as part of this project for the purpose for which they were commissioned. Copyright licence will also be granted to the local authority for planning use and within in the Historic Environment Record for public dissemination upon payment by the client. Any document produced to meet planning requirements may be freely copied for planning, development control, research and outreach purposes without recourse to the originator, subject to all due and appropriate acknowledgements being provided and to the terms of the original contract with the client. Archaeological Surveys Ltd shall retain the right to be identified as the author and originator of the material.

The report, data and any associated material produced by Archaeological Surveys Ltd cannot be freely used for any commercial activity other than those set out above. Any unauthorised use will be considered to be in breach of copyright.

Title of Goods remains with Archaeological Surveys Ltd until payment has cleared. Late payment may jeopardise any planning decision as there will be no transfer of title, licensing or any other right of copy or use of this report. Archaeological Surveys Ltd do not give permission for use of the report and associated data in cases of late payment. Any such use will be considered to be in breach of copyright. Late payment may also incur interest at 8% over the Bank of England base rate. Non-payment will be pursued by legal action.

Survey location

Survey location

Site centred on OS NGR
ST 89815 74170

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

Archaeological Surveys Ltd

Geophysical Survey
Chippenham RFC
Chippenham
Wiltshire

Map of survey area

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Chippenham RFC
Chippenham
Wiltshire

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02

389700 174150

Survey tracks

Survey track start

Survey track stop

SCALE 1:1500

0m 10 20 30 40 50m

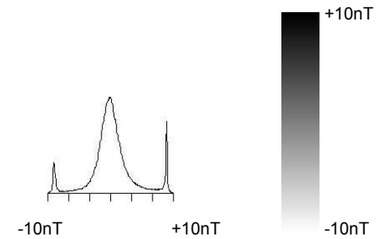
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

Archaeological Surveys Ltd

Geophysical Survey
Chippenham RFC
Chippenham
Wiltshire

Greyscale plot of minimally processed magnetometer data



N

SCALE 1:1000

0m 10 20 30 40 50m

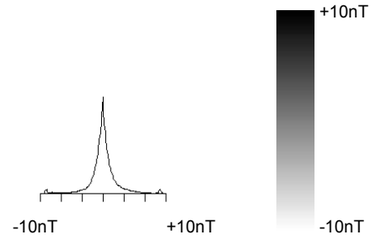
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

Archaeological Surveys Ltd

Geophysical Survey
Chippenham RFC
Chippenham
Wiltshire

Greyscale plot of filtered magnetometer data



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Chippenham RFC
Chippenham
Wiltshire

Abstraction and interpretation of magnetic anomalies

N

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Positive linear anomaly - former field boundary
- Positive anomaly - area of magnetic enhancement
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- 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 05