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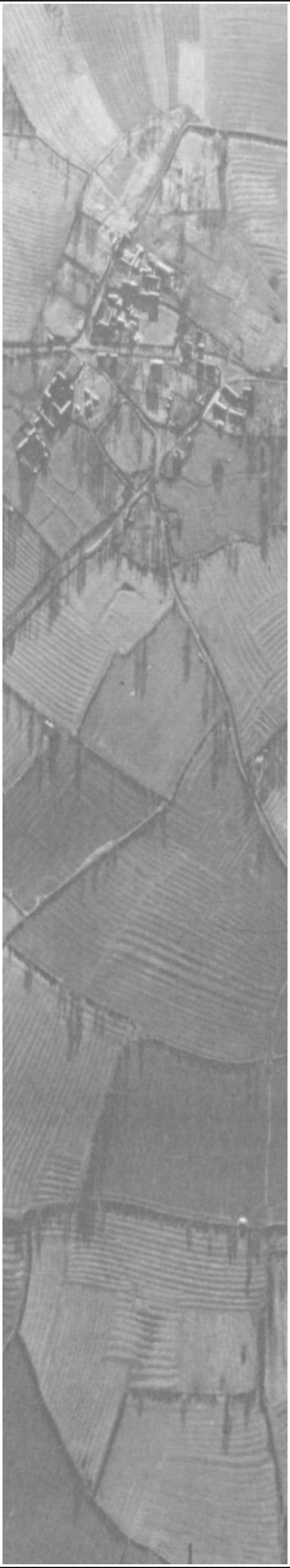

Land at Church Lane
Sway
Hampshire

MAGNETOMETER SURVEY REPORT

for

Cotswold Archaeology

Kerry Donaldson & David Sabin

March 2022

Ref. no. J913

ARCHAEOLOGICAL SURVEYS LTD

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Sway
Hampshire

MAGNETOMETER SURVEY REPORT

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Cotswold Archaeology

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 – 9th March 2022
Ordnance Survey Grid Reference – **SZ 28055 98360**

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SUMMARY

Detailed magnetometry was carried out by Archaeological Surveys Ltd within a 2ha field at Sway, Hampshire. The results indicate the presence of naturally formed features within the underlying River Terrace Deposits along with evidence for land drainage. A small number of positive linear anomalies have also been located, but it is not clear if they relate to former cut features or if they have an association with land drainage.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Cotswold Archaeology to undertake a magnetometer survey of an area of land at Sway in Hampshire. The site has been outlined for a proposed residential development.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2022).

1.2 Survey objectives and techniques

1.2.1 The objectives of the survey are to use non-intrusive geophysical techniques to establish the presence/absence, extent, condition, character, quality and date of any archaeological deposits within the proposed development area.

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 Archaeological Surveys Ltd is a Registered Organisation with the Chartered Institute for Archaeologists and both company directors are Members of the Chartered Institute for Archaeologists (MCIfA) and have therefore been assessed for their technical competence and ethical suitability and abide by the CIfA Codes of Conduct. 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 site lies to the south east of Church Lane and north and west of Birchy Hill on the south eastern edge of Sway in the New Forest, Hampshire, see Fig 1. The central OS Grid Reference is SZ 28055 98360.

1.4.2 The geophysical survey covers approximately 2ha of pasture within a single field, cattle were present during surveying. The field boundaries are mainly a mixture of hedgerows and mature trees with additional wire fencing within the north western and south western boundaries. The field margins were overgrown in places, particularly along the southwestern hedge where briars and scrubby ground cover impeded survey.

1.4.3 Although the southern part of the survey area is generally on level ground, numerous deep ruts relating to agricultural activity were encountered. The north eastern part of the site tends to slope down towards the north east. The western field entrance was extremely boggy and poached, survey could not be carried out in this part of the site. Steel pens were also avoided close to the field entrance. Temporary steel fencing associated with geotechnical investigations was present along parts of the north western and south western edges of the field. A large area of boggy ground, caused by emerging springs or associated with land drainage, was encountered along the north eastern side of the site, and survey was also avoided here due to the poor ground conditions. The boggy area is associated with a steep break of slope particularly on its southern side. Other parts of the site were waterlogged at the time of survey.

1.4.4 The ground conditions across the site were variable but the majority of the area was considered to be favourable for the collection of magnetometry data, with the exception of those zones already outlined. Weather conditions during the survey were fine.

1.5 Site history and archaeological potential

1.5.1 A Heritage Desk-Based Assessment has been produced by Cotswold Archaeology (2022) which outlines that there are no designated or undesignated heritage assets within the site; however, it has not been subject to previous archaeological investigation. In the surrounding area are two Neolithic findspots including a polished flint knife found c600m south west and a polished stone axe located c570m to the south east. A Bronze Age flat bonze axe was located c520m to the north, a curvilinear enclosure is located c800m to the south of the site and the nearest Bronze Age barrow cemetery is located c1.4km to the east. The village of Sway has origins in the early medieval period and the land is believed to have been within its agricultural hinterland during the medieval and post medieval periods. Features identified from LiDAR imagery include possible ridge and furrow, a possible earthwork and ditches within the site

1.5.2 It is possible that the geophysical survey may locate anomalies associated with the possible earthwork and ditches identified from the LiDAR imagery and there is always potential for the survey to locate previously unrecorded archaeological features should they exist within the site.

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is Palaeogene clay, silt and sand from the Headon Beds and Osborne Beds with overlying Quaternary River Terrace Deposits of sand and gravel (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Hurst association and is a typical argillic gley soil. It consists of a coarse and fine, loamy, permeable soil mainly over gravel (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry survey carried out across similar geology and soils has produced variable results as they can be 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. 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, cultivation or rapid temperature change. Data treated to additional processing have 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. 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.

2.3.7 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.

2.3.8 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 approximately 2ha within a single pasture field.

3.1.2 Magnetic anomalies located can be generally classified as positive linear anomalies of an uncertain origin, anomalies associated with land management, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects. 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. There are no significant defects within the dataset.

3.2.2 Small zones of magnetic disturbance, caused by modern ferrous objects, were encountered mainly close to the north western edge of the site. The high magnitude anomalies associated with the disturbance has the potential to obscure weak magnetic features should they occur within the zones.

3.2.3 Widespread naturally formed anomalies occur within the site and these have the potential to be confused with anomalies of anthropogenic origin as many appear to have a linear morphology. However, there are common trends to the orientation of these linear anomalies and irregularities in their shape and magnitude that can help to improve confidence in their interpretation. They generally trend north north east to south south west and become more frequent towards the north eastern part of the survey area. It is likely that they are related to shallow, naturally formed features within the underlying River Terrace Deposits.

3.2.4 In order to further understand the magnetic characteristics of the soil and underlying geology, samples were taken from material excavated during geotechnical investigations that occurred at the time of survey. One small sample of topsoil and one sample of a gravelly clay were analysed, the latter possibly being derived from the solid geology of Palaeogene clay relating to the Headon Beds and Osborne Beds rather than the superficial River Terrace Deposits that underlie the topsoil. The magnetic susceptibility of the samples was measured at low frequency (lf) and high frequency (hf) using a Bartington MS2 meter with MS2B sensor. The topsoil produced a low frequency average value (X_{lf}) of 3.5 $10^{-8}m^3kg^{-1}$; the underlying geology an average value of 8.5 $10^{-8}m^3kg^{-1}$. The high frequency average value (X_{hf}) of the topsoil was 4.9 $10^{-8}m^3kg^{-1}$; the underlying geology was 9.3 $10^{-8}m^3kg^{-1}$. The higher values of X_{hf} are very unusual but further analysis of the cause is beyond the scope of this report.

3.2.5 The magnetic susceptibility of the topsoil is very low and is consistent with soils of low iron content and high acidity. Movement of iron minerals from the topsoil into the subsoil (illuviation) is probably the cause of the low iron content, with iron enrichment of deeper layers possibly partly responsible for increased magnetic susceptibility at depth. The mobility and sorting of iron minerals within the River Terrace Deposits may well be the origin of the naturally formed anomalies within the site. In general, the very low topsoil magnetic susceptibility is consistent with less than optimum conditions for magnetometry.

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 relating to land management	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	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.
Anomalies with a natural origin	Naturally formed magnetic anomalies are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to anomalies within more solid geology.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Area centred on OS NGR 428055 98360, see Figs 03 – 05.

Anomalies with an uncertain origin

(1) – A small number of positive linear anomalies are located towards the north eastern corner of the survey area. It is not possible to determine if they relate to cut, ditch-like features, or if they could be associated with land drainage.

(2) – A weakly positive linear anomaly is located in the south western part of the site. It not not clear if the anomaly relates to a cut feature, land drainage or agricultural activity.

Anomalies associated with land management

(3) – Linear anomalies either associated with magnetic debris or with a weak, multiple dipolar response appear to relate to land drains.

Anomalies with an agricultural origin

(4) – Negative linear anomalies in the south western part of the survey area are associated with agricultural vehicle ruts.

Anomalies with a natural origin

(5) – The survey area contains widespread anomalies with a response of 4-7nT. They are oriented south west to north east and appear to relate to features associated with the underlying superficial River Terrace Deposits (see 3.2.3).

Anomalies associated with magnetic debris

(6) – A patch of magnetic debris is evident towards the north western corner of the site. The land immediately north, adjacent to the gate, was heavily poached by livestock and waterlogged and not accessible for survey. The magnetic debris is likely to relate to material used in ground consolidation or other dumped ferrous material within this part of the site.

(7) – Strong, discrete, dipolar anomalies are responses to ferrous and other magnetically thermoremnant objects, such as brick/tile within the topsoil.

Anomalies with a modern origin

(8) – Magnetic disturbance from ferrous material and objects within and adjacent to the site.

4 CONCLUSION

4.1.1 The geophysical survey located widespread, naturally formed anomalies and evidence of land drainage. A small number of positive linear anomalies that could relate to cut features were located; however, an association with land drainage is also possible.

5 REFERENCES

Archaeological Surveys, 2022. *Land at Church Lane, Sway, Hampshire, Geophysical Survey Written Scheme of Investigation.* Unpublished typescript document.

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

British Geological Survey, 2017. *Geology of Britain viewer, [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html [accessed 7/3/2022].

Chartered Institute for Archaeologists, 2014 (updated 2020). *Standard and Guidance for archaeological geophysical survey*. CIfA, University of Reading.

Cotswold Archaeology, 2022. Land at Church Lane, Sway, Hampshire, Heritage Desk-Based Assessment. CA Report: AN0473_1. Unpublished typescript document.

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.

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 6 South East 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. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

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.

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

Minimally processed data

Filename: J913-mag-proc.xcp
Instrument Type: Sensys DLMGPS
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 427971.41, 98449.11m
Southeast corner: 428152.76, 98256.36 m
Sensors: 5
Dummy Value: 32702
Dimensions
Survey Size (meters): 181 m x 193 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 618475, Recorded: 618475

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.33
Mean: 0.03
Median: 0.01
Composite Area: 3.4955 ha
Surveyed Area: 1.9296 ha
PROGRAM
Name: TerraSurveyorPre
Version: 3.0.36.24
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

Filtered data

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.21
Mean: 0.03
Median: -0.01
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 175
5 Clip from -3.00 to 3.00

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 Hampshire 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	J913-mag.asc J913-mag.xcp J913-mag-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J913-mag-proc.tif J913-mag-proc-hpf	Image in TIF format
Drawing	J913-CAD.dwg	CAD file in 2018 dwg format
Report	J913 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 an uncertain origin		
AS-ABST MAG POS LINEAR UNCERTAIN	255,127,0	Line, polyline or polygon (solid)
Anomalies relating to land management		
AS-ABST MAG LAND DRAIN	Cyan 0,255,255	Line or polyline
Anomalies with an agricultural origin		
AS-ABST MAG AGRICULTURAL	Green 0,255,0	Line or polyline
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)
Anomalies with a natural origin			
AS-ABST MAG NATURAL FEATURES		Yellow 255,255,0	Polygon (cross hatched ANSI37)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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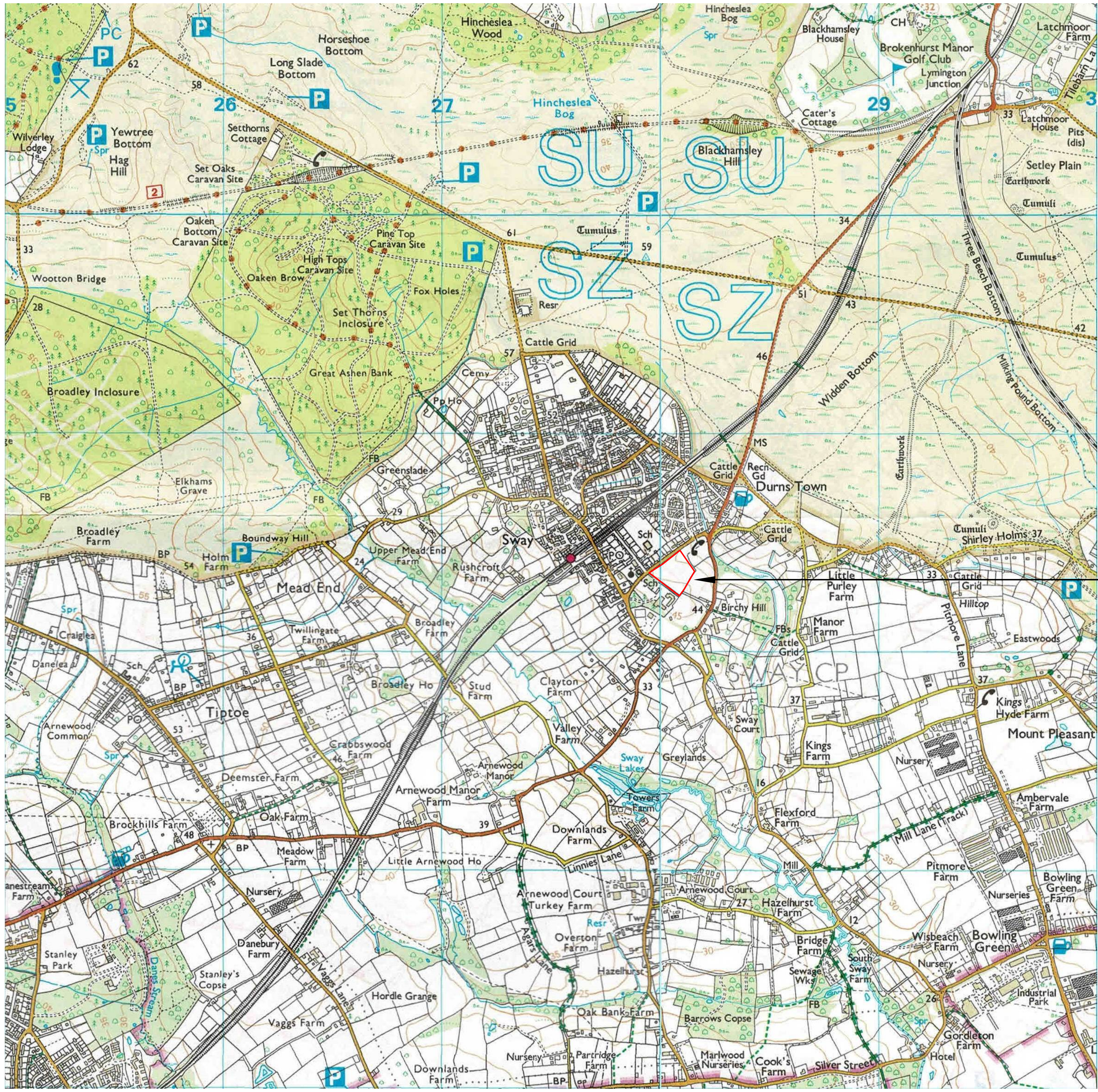
Sway
Hampshire**

Map of survey area

N



Survey location

● Survey location

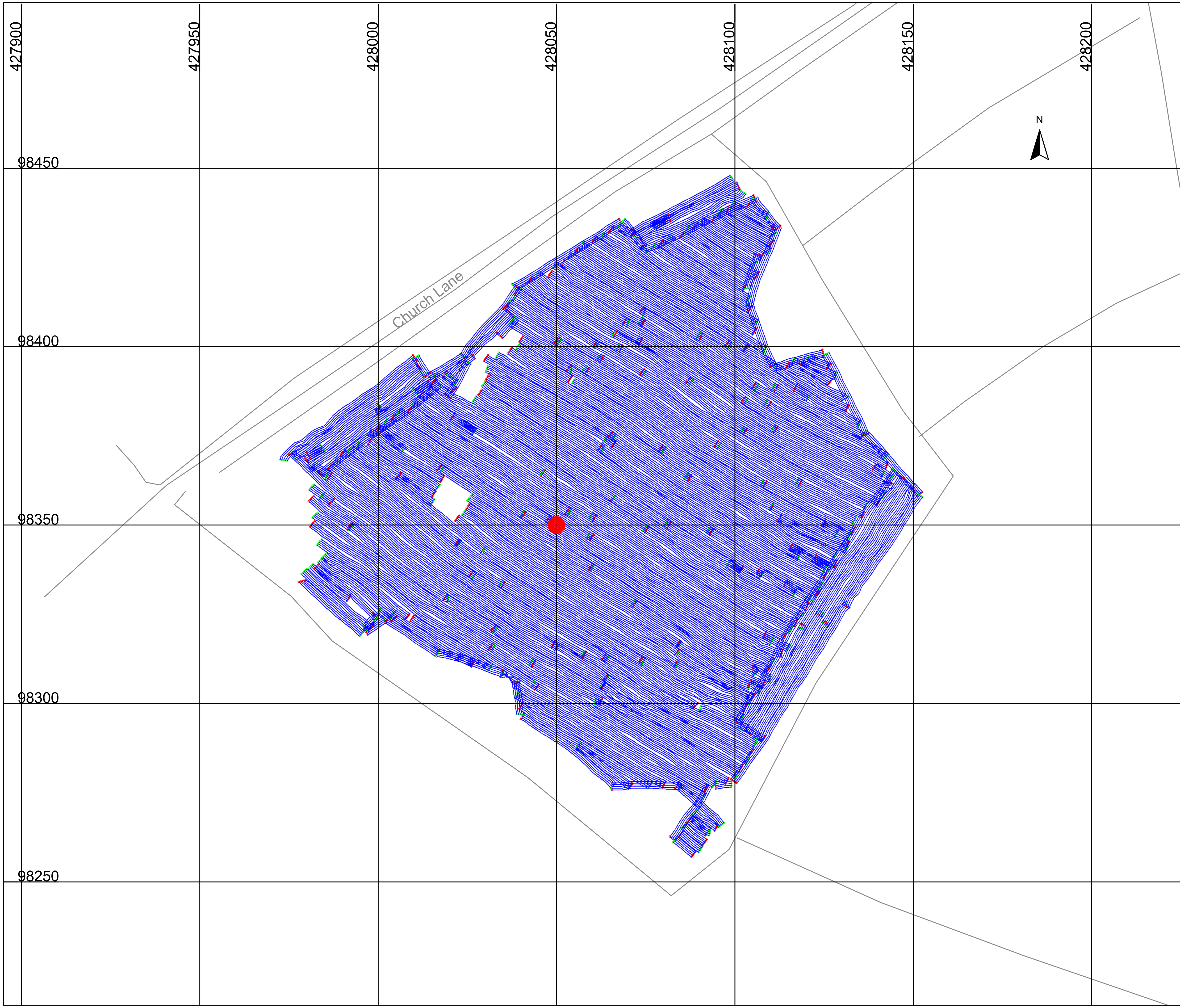
Site centred on OS NGR
SZ 28055 98360

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

- 428050 98350
- Survey tracks
- Survey track start
- Survey track stop

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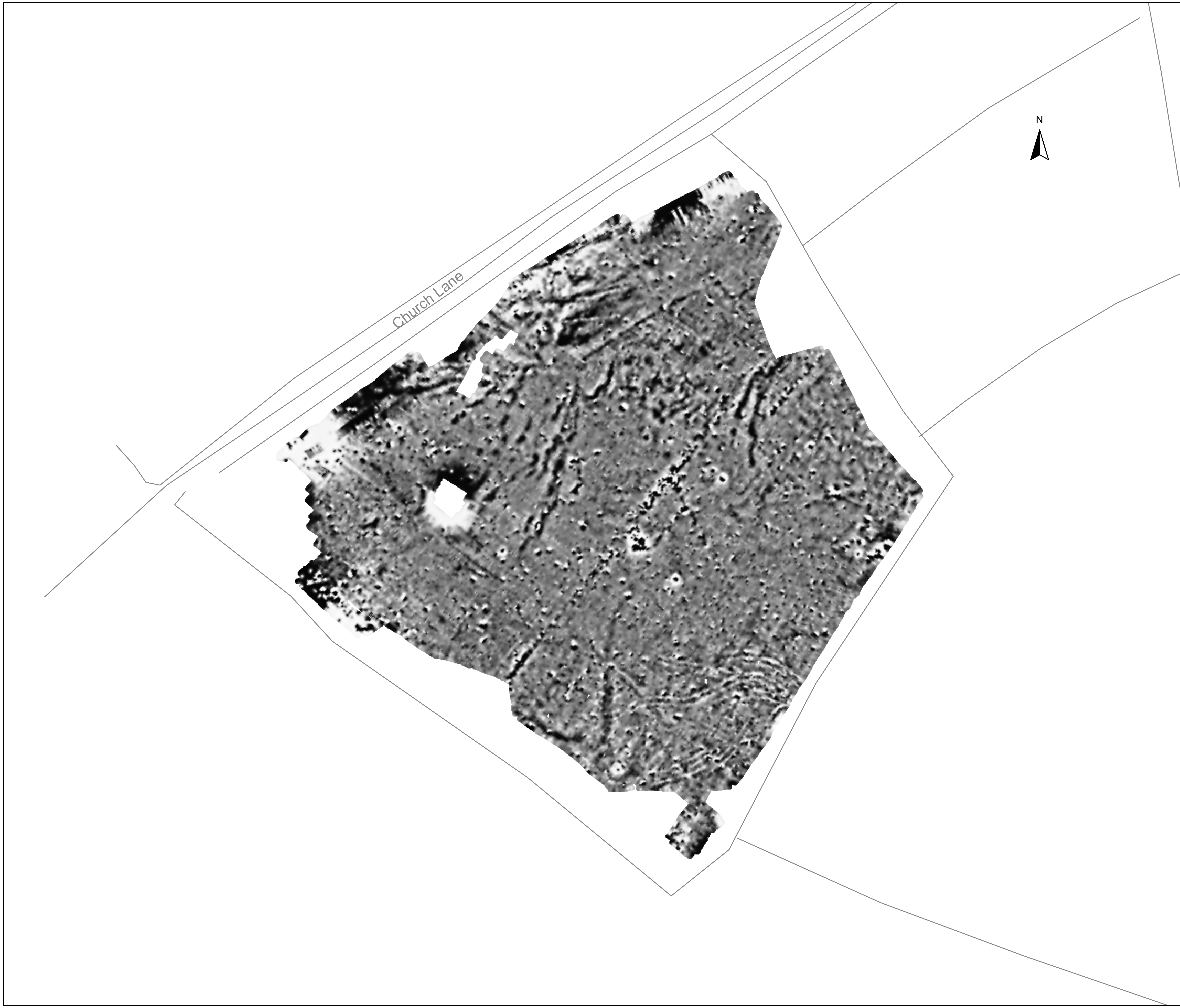
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02



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Greyscale plot of minimally processed magnetometer data

SCALE 1:1000

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SCALE TRUE AT A3

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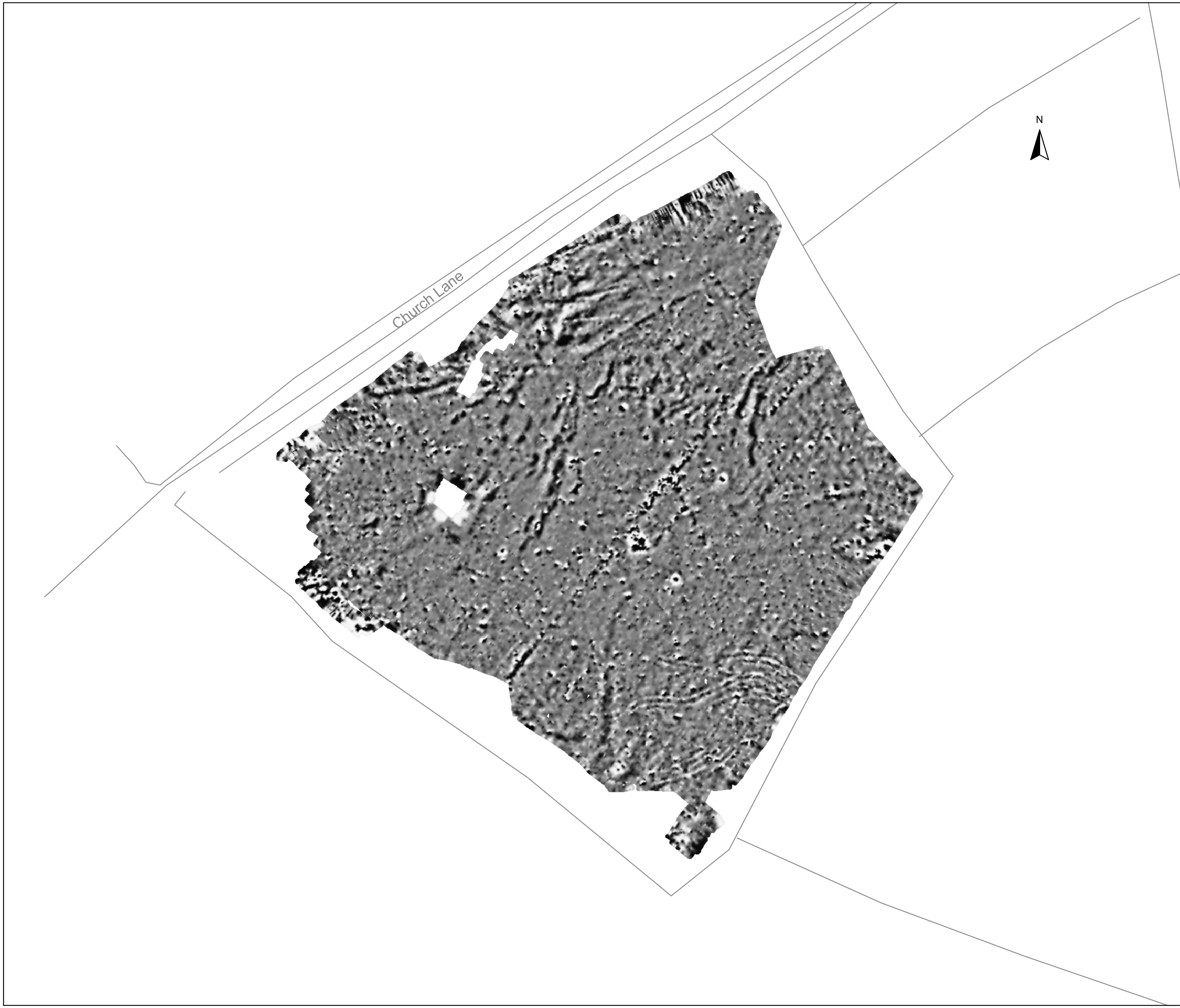
KTD	DJS	FIG 03



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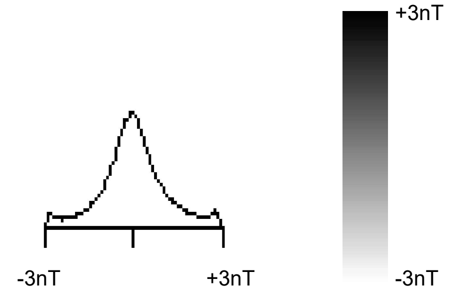
Greyscale plot of
filtered magnetometer data



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SCALE TRUE AT A3

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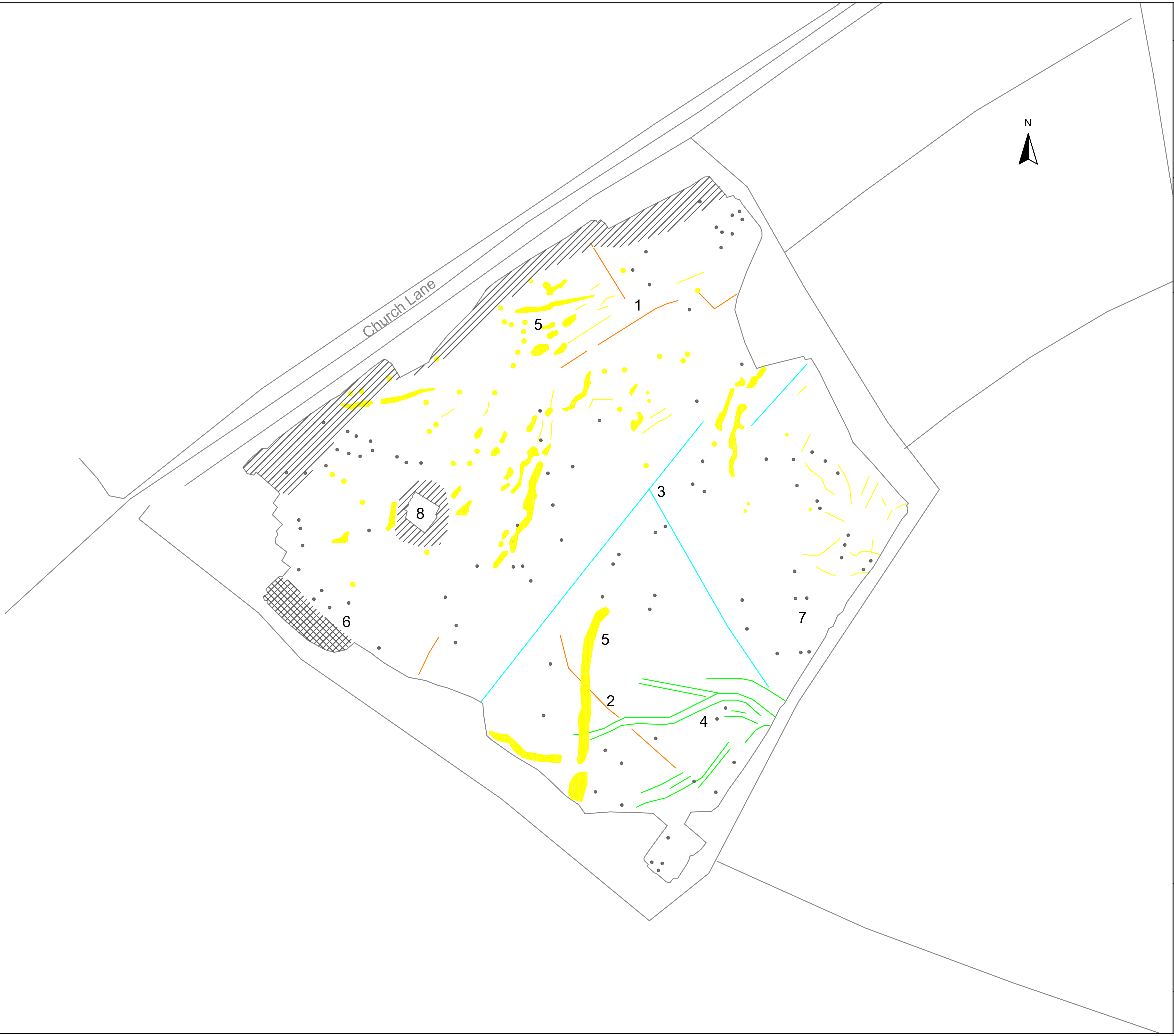

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Abstraction and interpretation of magnetic anomalies

- Positive linear anomaly - of uncertain origin
- Positive/weak multiple dipolar linear anomaly - possible land drain
- Linear anomaly - of agricultural origin (vehicle rut)
- Linear anomaly - of natural origin
- Discrete positive response - of natural origin
- 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

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KTD	DJS	FIG 05