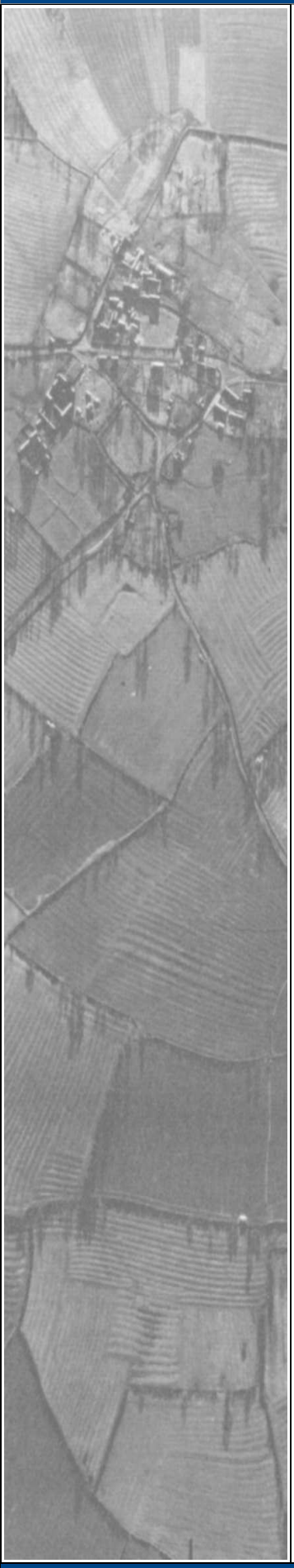


Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

MAGNETOMETER SURVEY REPORT

for

Enviromena Power Systems Limited

Kerry Donaldson & David Sabin

September 2020

Ref. no. J828

ARCHAEOLOGICAL SURVEYS LTD

Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

MAGNETOMETER SURVEY REPORT

for

Enviromena Power Systems 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 – 13th, 14th, 20th, 21st, 24th & 25th August 2020
Ordnance Survey Grid Reference – **SU 45800 34900**

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 TABLES

SUMMARY

A geophysical survey, comprising detailed magnetometry, was carried out over 38ha on land to the north of Winchester. The results indicate the presence of a number of linear anomalies relating to a formerly recorded field system as well as the continuation of Worthy Down Ditch beyond its scheduled area. A single ring ditch was also evident, close to the western end of Worthy Down Ditch. In the north eastern part of the site a curvilinear enclosure with associated linear and rectilinear ditches and pits and/or areas of burning have been located. There is also evidence for later chalk quarrying, with such activity dating to the medieval period recorded on the Historic Environment Record. Further west there appears to be another rectilinear anomaly forming an enclosure feature. Extensive magnetic debris and disturbance relates to the 20th century military use of the site, while ground make-up is evident along the northern edge.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Pegasus Group, on behalf of Enviromena Power Systems Limited, to undertake a magnetometer survey of an area of land to the north of Winchester. The site has been outlined for a proposed development of a solar farm 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 the client prior to carrying out the fieldwork.

1.1.3 There are two scheduled monuments adjacent to the survey area, with a Neolithic long barrow situated within woodland known as Worthy Grove and a Bronze Age boundary feature, known as Worthy Down Ditch, located immediately adjacent to the eastern side of the survey area. The survey avoids these scheduled monuments but the unscheduled continuation of Worthy Down Ditch can be seen from cropmarks to extend into the survey area.

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 lies on agricultural land, known as Worthy Down, to the north of the Three Maids Hill roundabout between the A34 and A272. It is situated to the south west of South Wonston and lies within the parish of Headbourne Worthy, north of Winchester. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 45800 34900, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 38ha of agricultural land

containing stubble with weed regrowth at the time of survey. A small part of the site was unsuitable for survey due to overgrown vegetation, scrub and uneven ground surfaces. The site is made up of three land parcels which were sub-divided for ease of survey and data processing. These are numbered as Area 1 in the south east, Area 2 in the central east, Area 3 in the north east, Area 4 in the central north and Area 5 in the north west.

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 variable with periods of heavy rain.

1.5 Site history and archaeological potential

1.5.1 The following archaeological background has been provided by Pegasus Group and is based on a review of the National Heritage List for England, Winchester Historic Environment Record data available online, and historic maps available online.

1.5.2 Located within the woodland outlying the western boundary of the site is the Scheduled Monument of a Neolithic funerary monument (MWC1839) (Long barrow 1km south of Larkwhistle Farm HE List Entry no: 1013200). Located within the eastern boundary of the site (and extending to the north-east, beneath what is now the A34) is the Scheduled Monument of Worthy Down Ditch, comprising a bank and ditch believed to represent the remnants of a Bronze Age ranch boundary (MWC1837) (HE List entry no: 1001907). Its south-westerly continuation is marked as an earthwork on all OS maps pre-dating 1962; it has since been ploughed out but is indicated by a cropmark.

1.5.3 A possible Bronze Age roundhouse was discovered, during archaeological works for the A34, to the east of the site (MWC6020). Other cropmarks recorded within the site have been interpreted as signifying the buried archaeological remains of Bronze or Iron Age field systems (MWC1836, MWC1841); these are also recorded on all OS maps pre-dating 1977. Findspots of a Neolithic axe (MWC1834) and four Roman coins (MWC546, MWC547, MWC548, MWC1835) are reported from within the site. The A272 along the western boundary of the site is thought to trace the Roman road from Winchester to Cirencester.

1.5.4 The site likely comprised downland grazing throughout the historic periods. Clumps of trees are shown in the northern part of the site on all OS maps pre-dating 1977. The site lies adjacent to Worthy Down Camp, which was variously used as an RFC training station (1918–1921), bombing station (1926–1931), RN airfield (1931–1960), and RA Pay Corps headquarters (post-1960) (MWC4109). A Royal Navy Research Archive map from 1940 shows that the northern part of the survey area was part of a western extension of the military site. It has mapped a compass base, radar base, hangars and at least 45 Dutch Barns, with the majority within the woodland of Worthy Grove, but some within the northern and north western part of the site. Gallops are

shown within the site on maps from the 1960s through to the 1980s.

1.5.5 The location of designated and non-designated heritage assets within the site indicates that there is a high potential for the survey to locate geophysical anomalies relating to archaeological features.

1.6 Geology and soils

1.6.1 The underlying solid geology within Area 1, in the south eastern part of the site, is from the Seaford Chalk Formation with a band of limestone from the Stockbridge Rock Member and Newhaven Chalk Formation in the north west. Head deposits are also located in the southern part of Area 1. Area 2 has a band of the limestone from the Stockbridge Rock Member with Seaford Chalk Formation in the centre oriented north to south and Newhaven Chalk Formation Member along the north and west and head deposits in the central eastern part. Areas 3, 4 and 5 are all underlain by the Newhaven Chalk Formation Member. Some overlying head deposits of clay, silt, sand and gravel are located in the central eastern and southern part of the site BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Andover 1 association and is a brown rendzina. It consists of a shallow, well drained, calcareous, silty soils over chalk (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry survey carried out across similar soils has produced good results, although there can be naturally formed anomalies that can at times be difficult to distinguish from those with an anthropogenic origin. The underlying geology and soils are, therefore, considered acceptable for magnetic survey.

1.6.4 During the course of the survey ground observations within Areas 3 and 4, within the northern part of the site, indicated some potential for landscaping and ground make-up. The original soil and geology may, therefore, be buried within the northernmost portion of the site and as a consequence, any features within the original surface may not be located by the 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 ±3000nT, 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 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.

2.3.8 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 each survey area.

2.3.10 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model derived from the Environment Agency's LiDAR data. Shaded relief plots are created using Surfer 15 (see Fig 33).

2.3.11 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 5 survey areas covering approximately 38ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of archaeological potential, positive and negative anomalies of an uncertain origin, anomalies relating to land management, anomalies relating to former quarrying, linear anomalies of an agricultural

origin, anomalies of a natural 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. Anomalies located within each survey area have been numbered and are described in 3.4 to 3.11 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 The soils and underlying geology appear to support useful magnetic contrast, allowing the location of former cut features of archaeological potential to be located where they contain a magnetically enhanced fill. Numerous naturally formed anomalies are also present with the data; it can be impossible to separate some naturally formed anomalies from those of archaeological potential particularly where they have a similar magnitude and morphology.

3.2.3 A large steel gas pipe crosses through Areas 1 – 3 and is associated with very high magnitude magnetic disturbance that may obscure archaeological features along a wide corridor centred over the pipe. The northern part of the site, mainly Area 4 but also part of Area 3, contains widespread magnetic debris likely to be associated with ferrous material spread during ground make-up and landscaping. The material may be derived from Worthy Down Camp or wartime structures etc. known to have been present across this part of the site. The depth of ground make-up and presence of widespread magnetic debris would prevent the location of archaeological features should they be present in this part of the site.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A general explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, see Table 1.

Interpretation category	Description and origin of anomalies
Anomalies with archaeological potential	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc. The category is used where there is a high level of confidence which may be due to additional supporting information where morphology is unclear or uncharacteristic.
Anomalies with an uncertain origin	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies 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	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.
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 1 south

Area centred on OS NGR 445945 134340, see Figs 06 – 08.

Anomalies of archaeological potential

(1) - Located at the southern end of the survey area is a single positive linear anomaly. It is parallel with, and situated 360m south east of, Worthy Down Ditch (6) and is likely to relate to a linear ditch.

(2) - A narrow, weakly positive linear anomaly is parallel with, and 170m south east of, Worthy Down Ditch (6) and 190m north west of linear anomaly (1). An archaeological origin should, therefore, be considered for this anomaly.

Anomalies with an uncertain origin

(3) - A large, pit-like anomaly is located 20m north of anomaly (1). Although situated in the base of a dry valley within a zone of colluvium (4), which is associated with numerous small discrete anomalies of a natural origin, this anomaly is much larger

with a diameter of 7.6m and although a natural feature, such as an infilled solution hollow, could account for the anomaly, an anthropogenic origin is also possible.

Anomalies with a natural origin

(4) - A broad, linear zone of magnetic enhancement relates to the increased depth of topsoil (colluvium) within a dry valley caused by weathering and slope processes.

(5) - Much of the site contains widespread and numerous discrete positive anomalies and although similar responses can relate to archaeological features, such large and widespread numbers of these features, which lack any coherent pattern, are likely to relate to naturally formed features such as tree throw pits or infilled solution features caused by chemical weathering.

3.5 List of anomalies - Area 1 north

Area centred on OS NGR 445825 134623, see Figs 09 – 11.

Anomalies of archaeological potential

(6) - A positive linear anomaly relates to the continuation of Worthy Down Ditch, believed to be a Bronze Age ranch boundary feature.

(7) - A small, rectilinear anomaly appears to join to the south western end of anomaly (6) and could relate to an associated cut feature.

(8) - A single positive curvilinear anomaly appears to relate to a ring ditch likely to represent a late prehistoric round house with an external diameter of 10.5m. Two internal discrete positive responses could be associated with a pit and/or hearth, although they are very similar to the multitude of natural pits evident throughout the site.

(9) - Two broad, positive linear anomalies, spaced 7m apart, are located 30m to the north of (8) and can only be seen clearly extending for 100m in the western part of the site. They have been truncated by anomaly (15) and cannot be clearly seen to emerge to the east; however, it is possible that they do continue eastwards as anomalies (11). The parallel linear anomalies could relate to trackway ditches.

(10) - Extending northwards from anomaly (9) are two fragmented positive linear anomalies that appear to relate to further linear ditches.

(11) - Two parallel linear anomalies appear to relate to linear ditches. They could be a continuation of anomalies (9), although they are much narrower and are only spaced 4m apart. They appear to cross anomaly (6), with one then appearing to extend along the northern side of the large ditch for a short distance.

(12 & 13) - Two fragmented positive linear anomalies are parallel with anomalies

(11) and appear to have been truncated by agricultural activity and an archaeological origin should be considered.

Anomalies with an uncertain origin

(14) - A number of positive linear, curvilinear and discrete responses can be seen close to anomaly (8). It is possible that they relate to further cut features with an archaeological origin; however, they lack a coherent morphology preventing confident interpretation.

Anomalies with a modern origin

(15) - A strong, multiple dipolar, linear anomaly extends northwards from the south western corner of the survey area throughout Areas 1, 2 and 3 and relates to a gas main. It has truncated several archaeological features and caused widespread strong magnetic disturbance which has obscured the extent of some of the archaeological features.

3.6 List of anomalies - Area 2 south

Area centred on OS NGR 445865 134885, see Figs 12 – 14.

Anomalies with an uncertain origin

(16) - A discrete positive response appears to associated with a negative rectilinear anomaly. It is not clear if this is of anthropogenic or natural origin.

(17) - A number of weakly positive linear anomalies can be seen in the southern part of the survey area. They are not clearly defined, but it is possible that they relate to further archaeological features.

3.7 List of anomalies - Area 2 centre

Area centred on OS NGR 445835 135160, see Figs 15 – 17.

Anomalies of archaeological potential

(18 - 20) - Positive linear anomalies with associated negative responses on the western side relate to features associated with a field system that can be seen in LiDAR imagery (see Fig 33). The positive response would generally indicate the fill of a cut feature, but where there is an extant earthwork feature, the positive and negative responses can be associated with the bank.

(21) - A broad positive response is also associated with the former field system, relating to a low earthwork that the defines the land at the top of a dry valley to the

north and east.

(22) - Fragmented positive linear anomalies appear to relate to cut features, with one appearing to have been truncated by anomaly (18).

Anomalies with an uncertain origin

(23) - A number of positive and negative discrete, circular and curvilinear responses can be seen in the western part of the survey area. It is not certain if they relate to features with a natural or anthropogenic origin.

(24) - A broad negative response could relate to a feature associated with a field system.

3.8 List of anomalies - Area 2 north

Area centred on OS NGR 445840 135305, see Figs 18 – 20.

Anomalies of archaeological potential

(25) - A positive linear anomaly extends north westwards into Area 3. To the south is a positive rectilinear anomaly that relates to a further cut feature.

Anomalies with an uncertain origin

(26) - Positive linear anomalies in the northern part of the survey area cannot be clearly distinguished from anomalies associated with colluvium. The linear morphology and close proximity to archaeology in Area 3 to the north does, however, indicate that there is some archaeological potential, possibly relating to a continuation of linear ditch (30).

(27) - Discrete pit-like anomalies could relate to naturally formed features; however, an archaeological origin should also be considered.

3.9 List of anomalies - Area 3

Area centred on OS NGR 445765 135505, see Figs 21 – 23.

Anomalies of archaeological potential

(28) - A positive curvilinear anomaly relates to an enclosure with dimensions of 50m by 45m. It appears to have an entrance with linear ditches extending towards it in the east and it contains discrete anomalies that may relate to pits or areas of burning.

(29) - A number of linear, rectilinear and discrete responses surround anomaly (28) and relate to associated ditches, enclosures and pits.

(30) - A sinuous positive linear anomaly relates to a linear ditch.

(31) - An irregularly shaped positive linear anomaly, with some complexity at its eastern end appears to relate to a further sinuous linear ditch. Although obscured by magnetic debris and disturbance, it should be considered as having archaeological potential.

Anomalies with an uncertain origin

(32) - An area of magnetic enhancement can be seen in the south western corner of the enclosure (28). It is not clear if this relates to a spread of material relating to occupation debris, or if it is an infilled quarry pit similar to anomalies (37) to the north, one of which appears to have truncated the enclosure.

(33) - Located to the west of anomaly (30) are a number of curvilinear and discrete anomalies. It is not clear if they relate to natural or anthropogenically formed features.

(34) - A narrow, weakly positive linear anomaly extends across the survey area. It is not possible to determine its origin.

(35) - A number of positive and negative linear, curvilinear and discrete anomalies are located within the south eastern part of the survey area. This part of the site contained woodland until the late 20th century and it is not clear if the anomalies are associated with cut features, or with the removal of trees and scrub or with other natural features.

Anomalies associated with land management

(36) - A positive linear anomaly appears to relate to a feature bounding the northern edge of a former gallops. A parallel anomaly can be seen to the south.

Anomalies associated with quarrying

(37) - A number of magnetically variable responses can be seen in the central, northern part of the survey area. They appear to form a ring of features, the largest 18m across, the smallest 8m. Several appear to have truncated earlier features including the northern edge of the curvilinear enclosure (28) and partial truncation of linear anomaly (30). The HER indicates that medieval chalk quarrying was evident within the site and these infilled anomalies are likely to be associated.

Anomalies associated with magnetic debris

(38) - A zone of magnetic debris overlies the archaeological features (28) & (29) and relates to magnetic material that was used in construction of a military access track across the site. The survey area contains several patches of magnetic debris that

are associated with the military use of the site and demolition of former military structures.

Anomalies with a modern origin

(39) - Strong, discrete, dipolar anomalies with associated magnetic disturbance relate to formerly military structures/apparatus.

3.10 List of anomalies - Area 4

Area centred on OS NGR 445405 135440, see Figs 24 – 26.

Anomalies of archaeological potential

(40) - Positive anomalies that appear to correspond to an earthwork feature visible on LiDAR imagery associated with the field system seen in Area 2 to the east.

Anomalies with an uncertain origin

(41) - A number of weakly positive linear anomalies can be seen primarily along the eastern edge of the survey area. Several are parallel, which could suggest former agricultural activity.

Anomalies associated with magnetic debris

(42) - The majority of Area 4 and the northern part of Area 3 contain widespread magnetic debris indicative of ground make-up with a high ferrous content. The LiDAR imagery shows that this area is higher than the surrounding land also indicating widespread ground make-up.

(43) - Strong, discrete, dipolar anomalies are responses to ferrous and other magnetically thermoremnant objects within the topsoil.

3.11 List of anomalies - Area 5

Area centred on OS NGR 445342 135257, see Figs 27 – 32.

Anomalies of archaeological potential

(44) - Positive and associated negative responses relate to a low earthwork seen on LiDAR imagery, but which appears to form an enclosure with anomalies (45) and (47).

(45) - A fragmented positive linear anomaly extend towards the south eastern corner of anomaly (44) and it also extends towards, but it does not join, anomaly

(46).

(46) - A positive curvilinear anomaly could form the south western corner of an enclosure with anomalies (44), (45) and (47), although it does not join (45) and has a much stronger response (6nT) than the majority of the archaeological features.

(47) - A positive linear anomaly appears to form the northern edge of an enclosure with anomalies (44) and (45), although it also appears to cross anomaly (44), possibly indicating that it post-dates it. A rectilinear anomaly can be seen at the western end, which appears to relate to an enclosure.

(48) - Two positive linear anomalies in the north eastern part of the survey area relate to linear ditches although their full extent cannot be seen in the data due to adjacent magnetic debris. Their morphology could indicate a former trackway, although they appear to converge with the northern extent of anomaly (44).

Anomalies with an uncertain origin

(49) - Located immediately east of the south eastern corner of anomaly (44) are several positive anomalies. It is not clear if they relate to infilled cut features as they are situated on the former gallops, but an archaeological origin should be considered.

(50) - The survey area contains a large number of pit-like anomalies. While such anomalies, especially located within an enclosure, could have an archaeological origin, elsewhere within the site numerous pit-like responses relate to naturally formed features. Ground disturbance associated with the military use of the site could also cause such responses. The anomalies are, therefore, uncertain in origin.

Anomalies with an agricultural origin

(51) - Parallel linear anomalies relate to former agricultural activity. They appear to have partially truncated the earlier archaeological features.

Anomalies associated with magnetic debris

(52) - Patches of magnetic debris relate to spreads of ferrous and other magnetically thermoremnant material associated with the military use and activity on the site (eg demolished barns/hangars).

4 CONCLUSION

4.1.1 The geophysical survey has located a number of archaeological features within the site including several linear anomalies that relate to previously recorded linear boundaries associated with a field system and a continuation of the Bronze Age ranch boundary, known as Worthy Down Ditch, beyond the scheduled area.

4.1.2 In the north eastern part of the site, the survey has located a number of anomalies that relate to previously unrecorded archaeological remains including a curvilinear enclosure, with a number of linear ditches, rectilinear enclosure and pits or areas of burning in the vicinity. Also within this part of the site are a number of anomalies that may relate to former quarry pits, some of which appear to have truncated the earlier archaeology.

4.1.3 The former military use of the site is evident with a number of zones of magnetic debris associated with a former track and demolished structures, as well as strong magnetic responses to former military structures. The northern part of the site appears to have been subject to widespread ground make-up. The western part of the site also contains magnetic debris derived from the military use of the site and a number of anomalies appear to form a large, rectilinear enclosure.

5 REFERENCES

Archaeological Surveys, 2020. *Three Maids Hill, Solar Farm, Headbourne Worthy, Winchester, 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 3D (Beta version), 1:50 000 scale [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain3d/index.html? [accessed 30/7/2020].

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 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.

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

Area 1 minimally processed data
Filename: J828-mag-Area1-proc.xcp
Description: Imported as Composite from: J828-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 445655.67, 134786.19 m
Southeast corner: 446037.72, 134190.09 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 1832400
Dimensions
Composite Size (readings): 2547 x 3974
Survey Size (meters): 382 m x 596 m
Grid Size: 382 m x 596 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.29
Mean: 0.03
Median: 0.00
Composite Area: 22.774 ha
Surveyed Area: 10.242 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Area 1 filtered data

Filename: J828-mag-Area1-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.95
Mean: 0.03
Median: -0.01
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 150
5 Clip from -3.00 to 3.00 nT

Area 2 minimally processed data

Filename: J828-mag-Area2-proc.xcp
Northwest corner: 445712.49, 135390.77 m
Southeast corner: 445965.09 134717.87 m
Source GPS Points: 2210000
Dimensions
Composite Size (readings): 1684 x 4486
Survey Size (meters): 253 m x 673 m
Grid Size: 253 m x 673 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.50
Mean: 0.03
Median: -0.01
Composite Area: 16.997 ha
Surveyed Area: 13.692 ha
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

Area 2 filtered data
Filename: J828-mag-Area2-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.24
Mean: 0.04
Median: -0.01

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 3 minimally processed data
Filename: J828-mag-Area3-proc.xcp
Northwest corner: 445504.52, 135603.11 m
Southeast corner: 445945.07, 135385.31 m
Source GPS Points: 1173800
Dimensions
Composite Size (readings): 2937 x 1452
Survey Size (meters): 441 m x 218 m
Grid Size: 441 m x 218 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.68
Mean: -0.02
Median: 0.03
Composite Area: 9.5952 ha
Surveyed Area: 6.5221 ha
Area 3 filtered data

Filename: J828-mag-Area3-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.56
Mean: -0.02
Median: 0.00
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 4 minimally processed data

ilename: J828-mag-Area4.xcp
Description: Imported as Composite from: J828-mag-Area4.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):
Northwest corner: 445334.41, 135565.32 m
Southeast corner: 445521.01, 135155.52 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 1
Dummy Value: 32702

Source GPS Points: 823300

Dimensions
Composite Size (readings): 1244 x 2732
Survey Size (meters): 187 m x 410 m
Grid Size: 187 m x 410 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.97
Mean: -0.09
Median: -0.02
Composite Area: 7.6469 ha
Surveyed Area: 3.1553 ha

Area 4 filtered data
Filename: J828-mag-Area4-proc-hpf.xcp
Stats
Max: 11.05
Min: -11.00
Std Dev: 4.46
Mean: -0.07
Median: -0.01
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -10.00 to 10.00 nT

Area 5 minimally processed data
Filename: J828-mag-Area5-proc.xcp
Northwest corner: 445199.63, 135443.47 m
Southeast corner: 445424.63, 135080.47 m
Source GPS Points: 602100
Dimensions
Composite Size (readings): 1500 x 2420
Survey Size (meters): 225 m x 363 m
Grid Size: 225 m x 363 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.35
Mean: 0.01
Median: 0.01
Composite Area: 8.1675 ha
Surveyed Area: 3.8222 ha

Area 5 filtered data
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.32
Mean: 0.03
Median: 0.02
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. 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 Winchester/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	J828-mag-**[area number/name]**.asc J828-mag-**[area number/name]**.xcp J828-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J828-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J828-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J828 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 DISCRETE ARCHAEOLOGY		Red 255,0,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS ARCHAEOLOGY		Red 255,0,0	Polygon (cross hatched ANSI37)
AS-ABST MAG POS LINEAR ARCHAEOLOGY		Red 255,0,0	Polyline or polygon (solid)
AS-ABST MAG POS CURVILINEAR RING DITCH		Magenta 255,0,255	Polyline or polygon (solid)
AS-ABST MAG NEG LINEAR ARCHAEOLOGY		127,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS ENCLOSURE DITCH		127,0,255	Line, polyline or polygon (solid)
Anomalies with an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG NEG LINEAR UNCERTAIN		Blue 0,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG NEG DISCRETE UNCERTAIN		Blue 0,0,255	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
AS-ABST MAG NEG UNCERTAIN		Blue 0,0,255	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
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 with a natural origin			
AS-ABST MAG NATURAL FEATURES		Yellow 255,255,0	Polygon (cross hatched ANSI37)
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

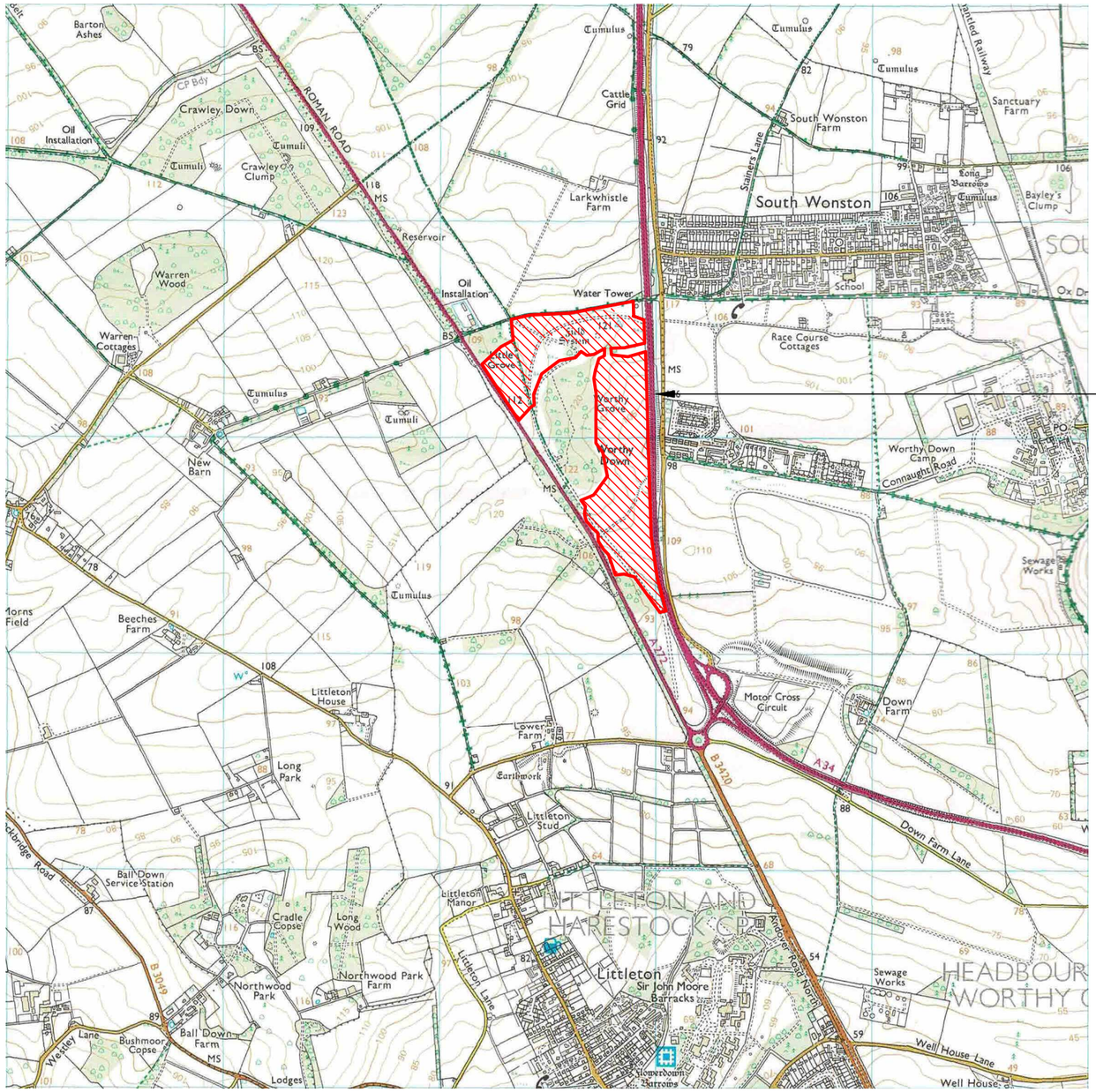
This report may contain material that is non-Archaeological Surveys Ltd copyright (eg Ordnance Survey, Crown Copyright) or the intellectual property of third parties, which we are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is 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.

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



Reproduced from OS Explorer map no. 132 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright. All rights reserved. Licence number 100043739.

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Map of survey area

● Survey location

Site centred on OS NGR
SU 45800 34900

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
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Referencing information

Referencing grid to OSGB36 datum at 100m intervals

445300 135300

Survey tracks

Survey track start

Survey track stop

Development boundary

SCALE 1:6000

0m 60 120 180 240 300m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data

+3nT

-3nT

SCALE 1:6000

0m 60 120 180 240 300m

KTD	DJS	FIG 03

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data

+3nT

-3nT

SCALE 1:6000

0m 60 120 180 240 300m

KTD	DJS	FIG 04

Archaeological Surveys

Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies

- Positive linear anomaly - cut feature/magnetic enhancement of archaeological origin
- Positive curvilinear anomaly - ring ditch
- Positive curvilinear anomaly - enclosure ditch
- Negative anomaly - earthwork/bank
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - cut feature/area of burning of archaeological origin
- Discrete positive response - possible pit-like feature
- Positive anomaly - earthwork/bank
- Negative anomaly - material of low magnetic susceptibility
- Positive anomaly - magnetically enhanced material
- Magnetically variable response - former quarry pit
- Variable magnetic response - colluvium
- Numerous pit-like anomalies - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - gas pipeline
- Strong dipolar anomaly - ferrous object

SCALE 1:6000

0m 60 120 180 240 300m

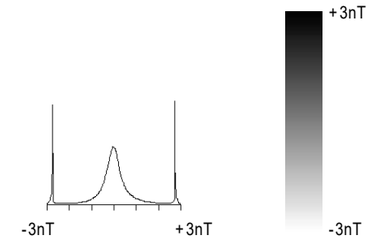
SCALE TRUE AT A3

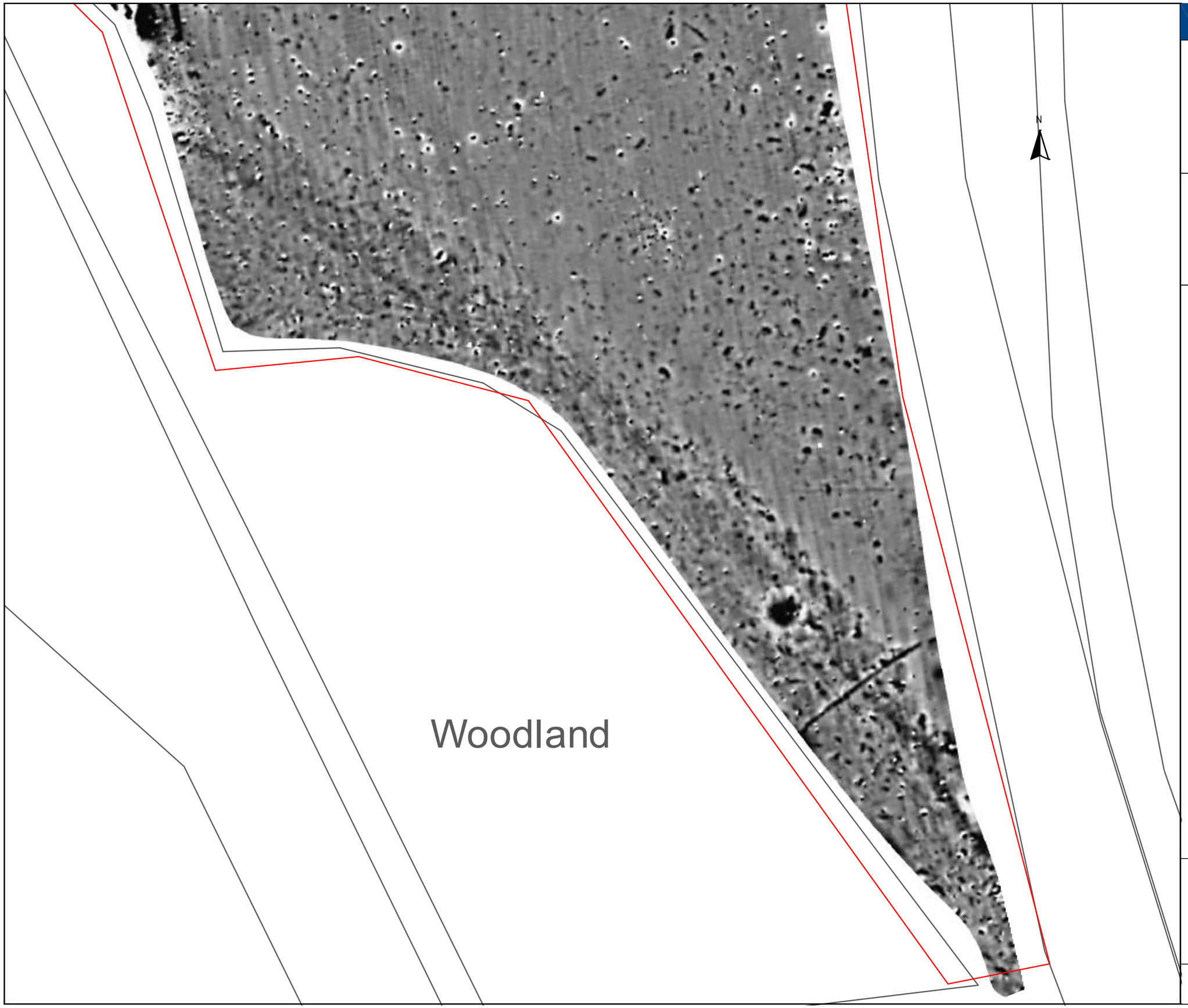
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 1 south





SCALE 1:1000

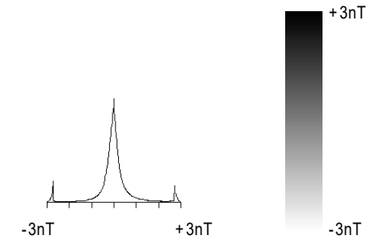
0m 10 20 30 40 50m

KTD	DJS	FIG 06

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 1 south



SCALE 1:1000

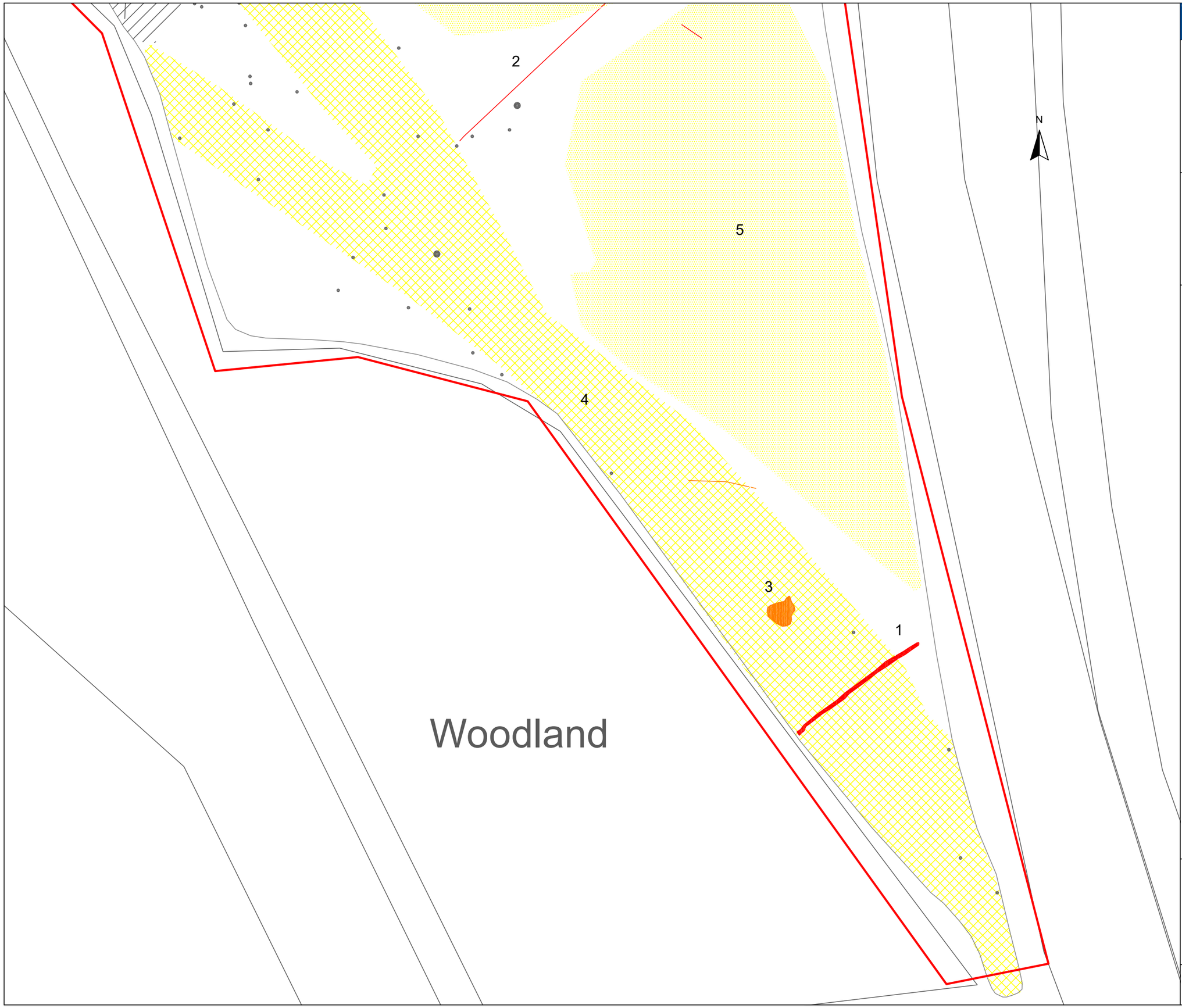
0m 10 20 30 40 50m

KTD	DJS	FIG 07

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 1 south



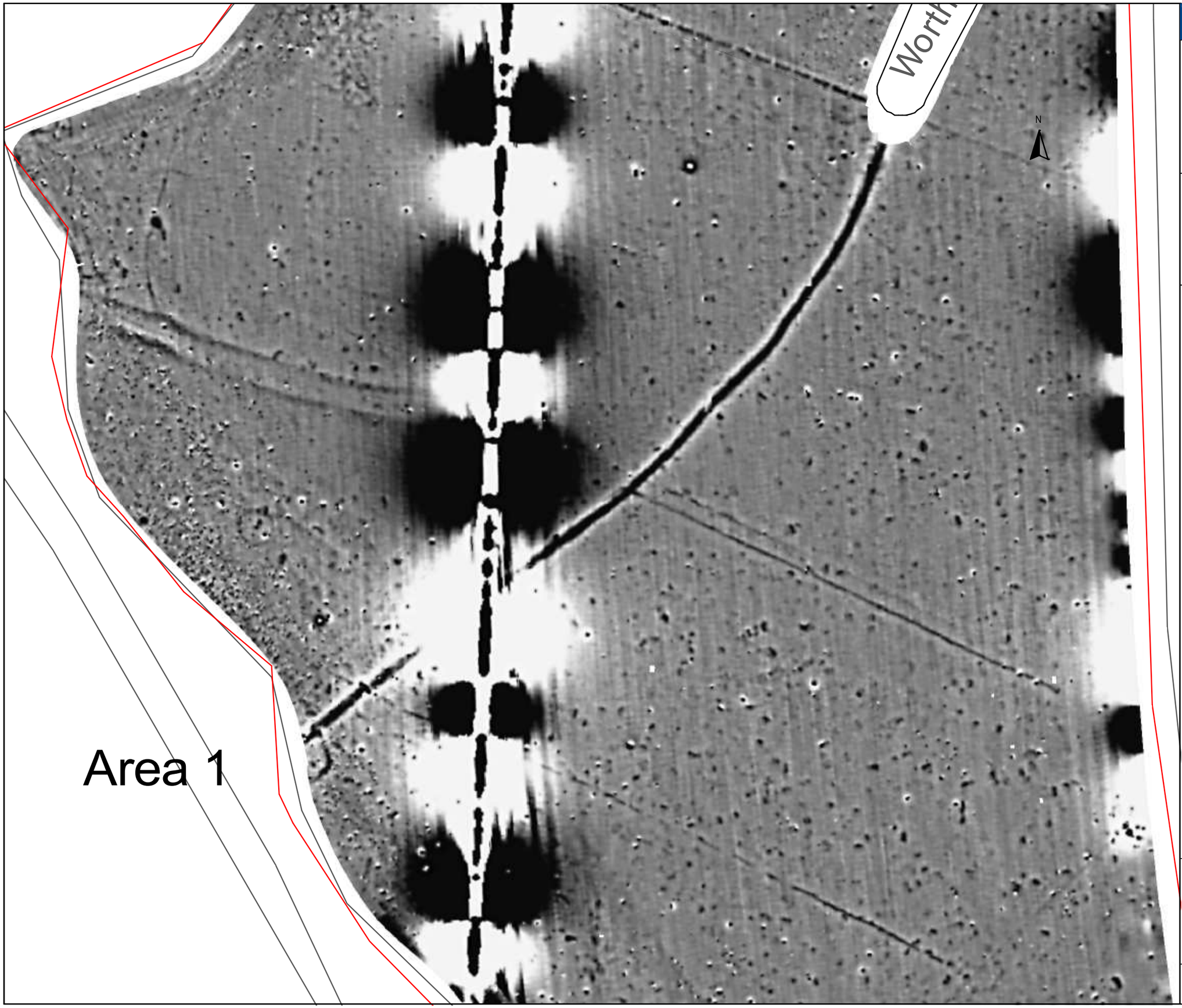
- Positive linear anomaly - cut feature of archaeological origin
- Positive linear anomaly - possible ditch-like feature
- Discrete positive response - possible pit-like feature
- Variable magnetic response - colluvium
- Numerous pit-like anomalies - of natural origin
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

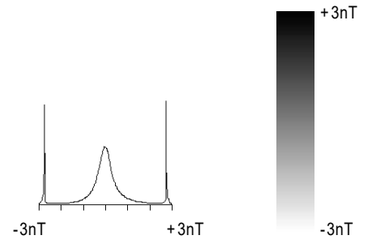
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08



Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 1 north



SCALE 1:1000

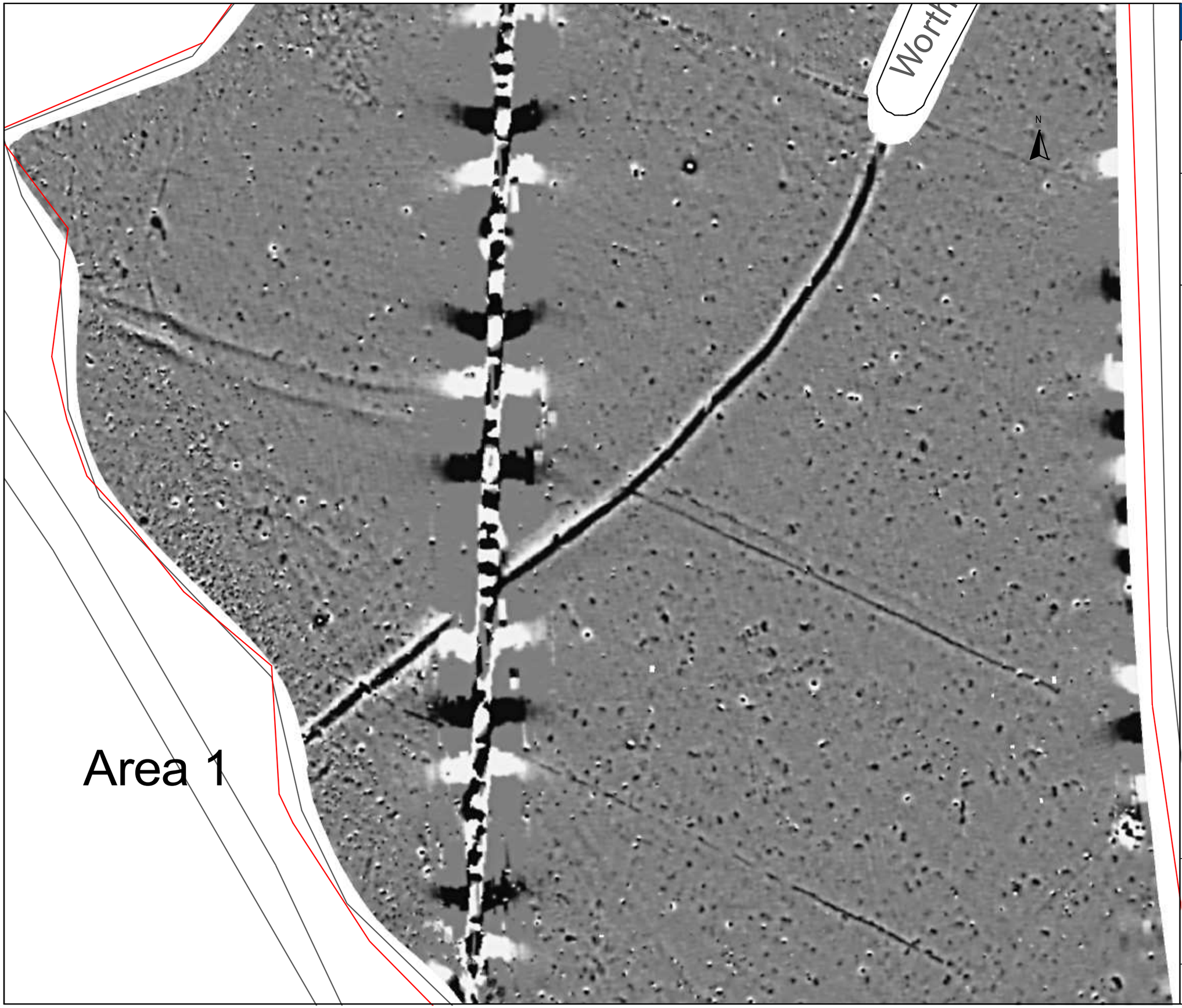
0m 10 20 30 40 50m

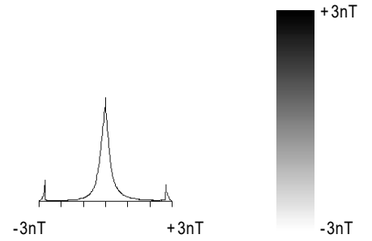
KTD	DJS	FIG 09

Archaeological Surveys
Specialist Geophysical Surveyors

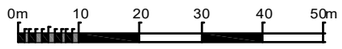
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 1 north





SCALE 1:1000



KTD	DJS	FIG 10

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 1 north

Area 1

N

Worth

- Positive linear anomaly - cut feature of archaeological origin
- Positive curvilinear anomaly - ring ditch
- Positive linear anomaly - possible ditch-like feature
- Discrete positive response - possible pit-like feature
- Numerous pit-like anomalies - of natural origin
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - gas pipeline
- Strong dipolar anomaly - ferrous object

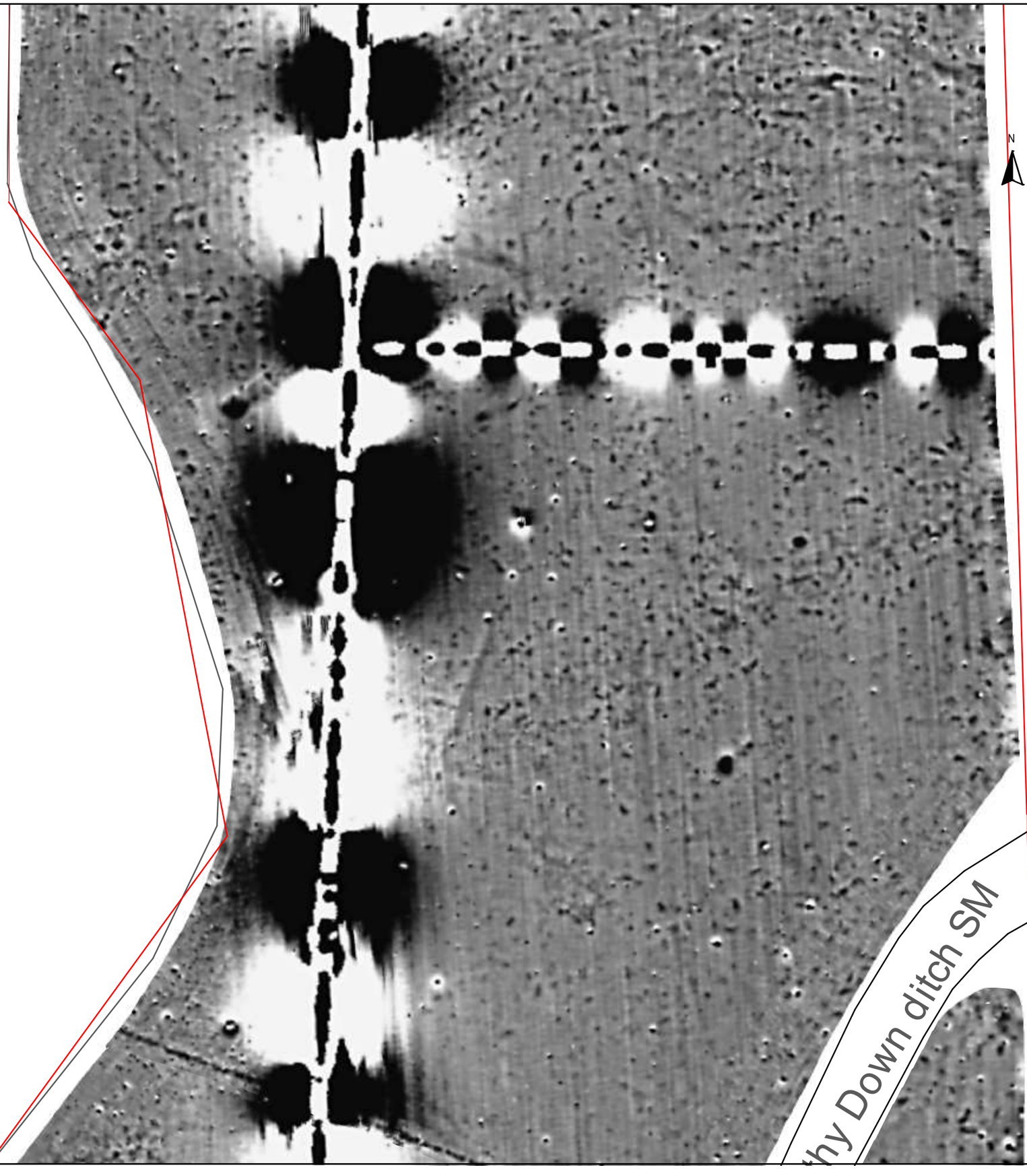
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 11

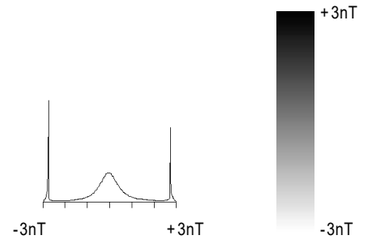
Area 2



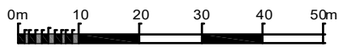
Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 2 south

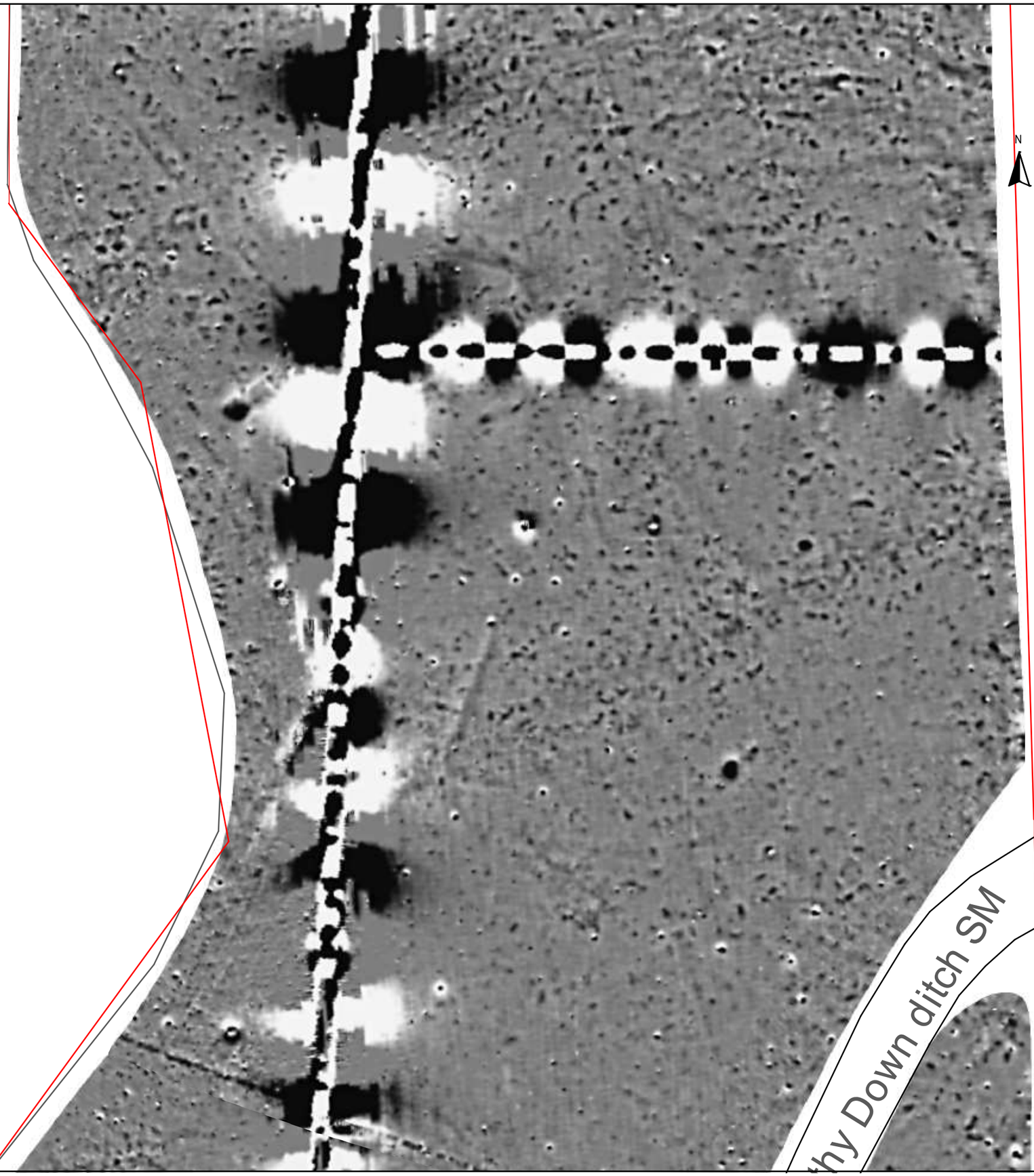


SCALE 1:1000



KTD	DJS	FIG 12

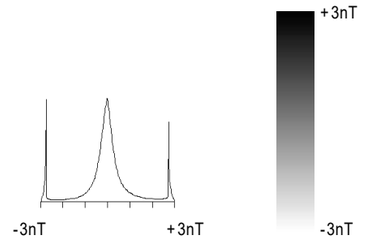
Area 2



Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 2 south



SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 13

Area 2

16

17

18

Thy Down ditch SM

N

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 2 south

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Numerous pit-like anomalies - of natural origin
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - gas pipeline
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

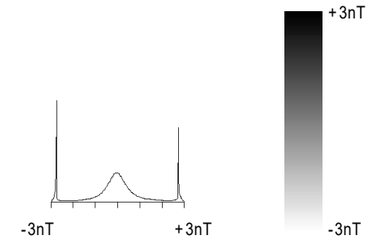
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 14

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 2 centre



Area 2

A34

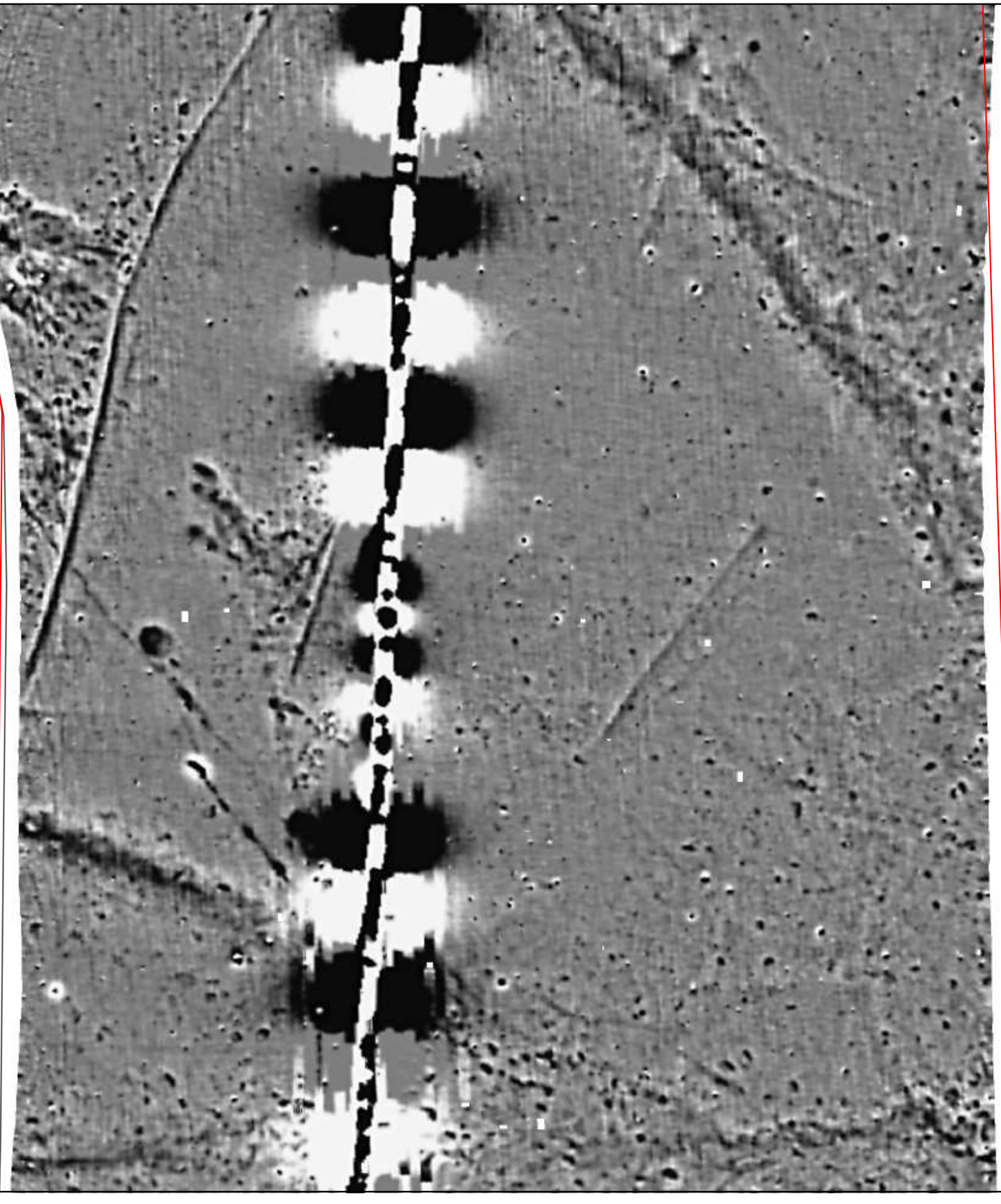
N

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 15

Area 2



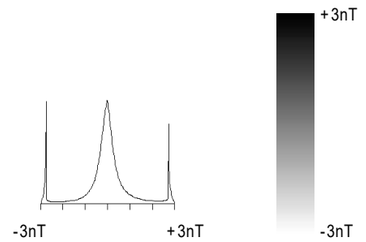
N

A34

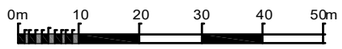
Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 2 centre



SCALE 1:1000



KTD	DJS	FIG 16

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 2 centre

Area 2

N

18
19
24
20
19
21
22
23
A34

- Positive linear anomaly - magnetic enhancement of archaeological origin
- Negative linear anomaly - earthwork/bank
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetic enhancement of archaeological origin
- Negative anomaly - material of low magnetic susceptibility
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - colluvium
- Numerous pit-like anomalies - of natural origin
- 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

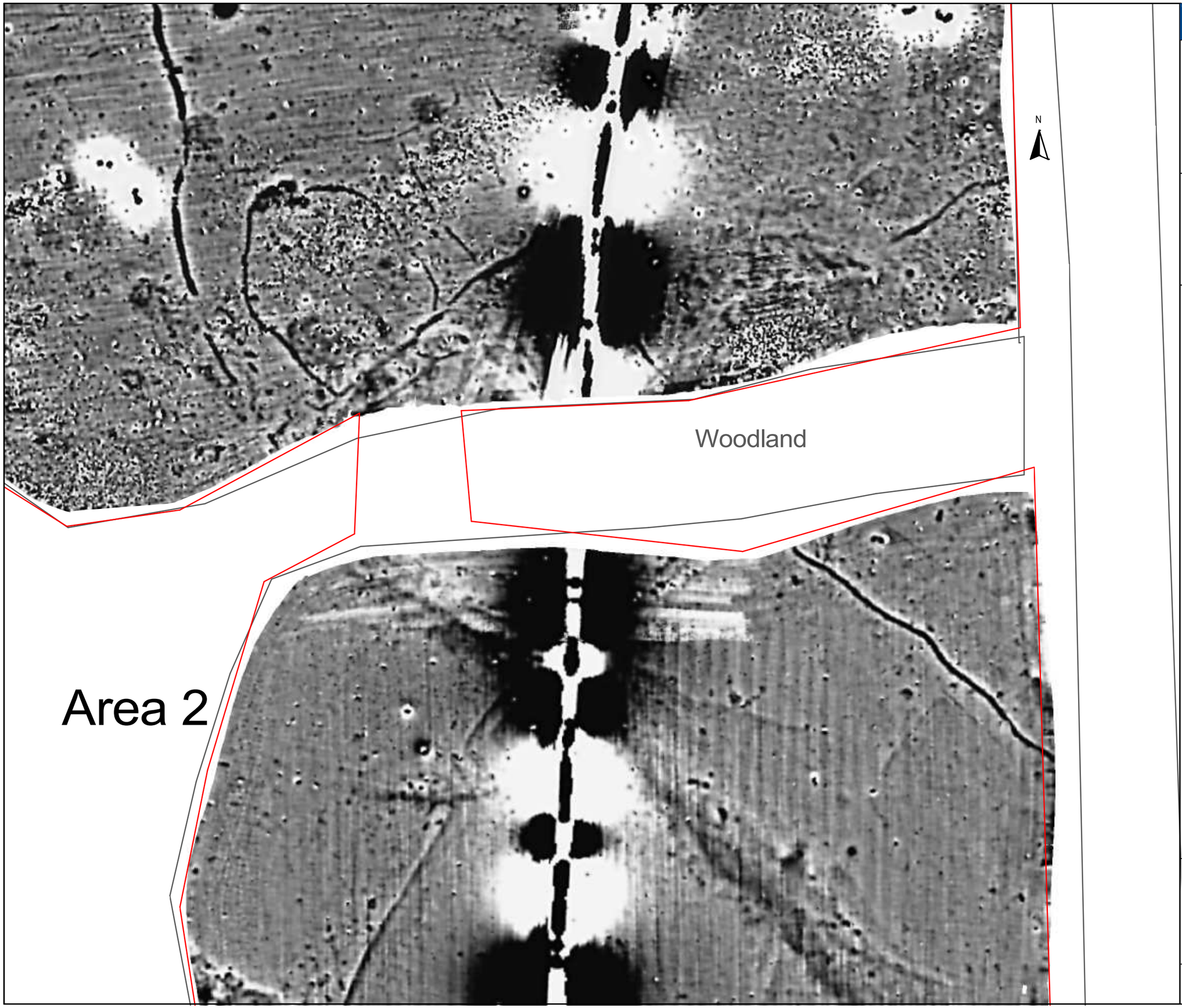
SCALE TRUE AT A3

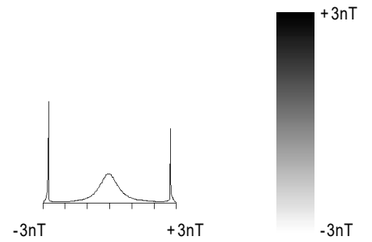
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 17

Archaeological Surveys
Specialist Geophysical Surveyors

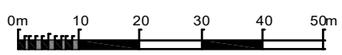
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 2 north





SCALE 1:1000

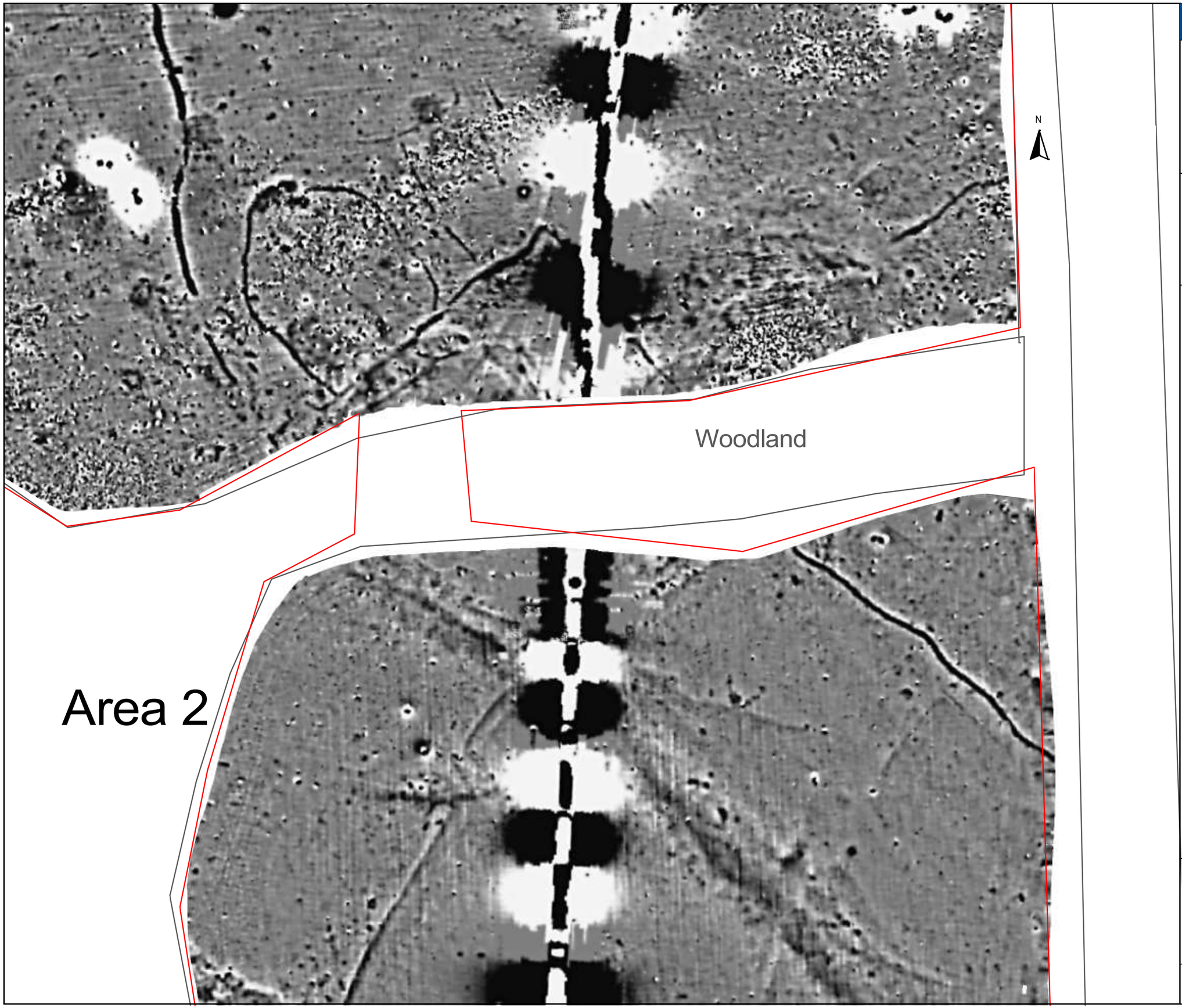


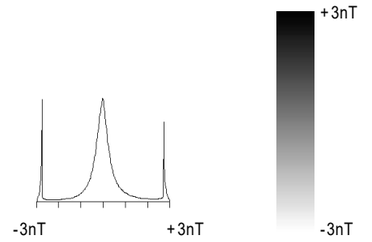
KTD	DJS	FIG 18

Archaeological Surveys
Specialist Geophysical Surveyors

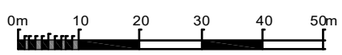
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 2 north





SCALE 1:1000



KTD	DJS	FIG 19

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 2 north

Area 2

38
29
39
30
35
33
32
28
Woodland
N
26
27
25

- Positive linear anomaly - magnetic enhancement of archaeological origin
- Negative linear anomaly - earthwork/bank
- Positive linear anomaly - possible ditch-like feature
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - colluvium
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - gas pipeline
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

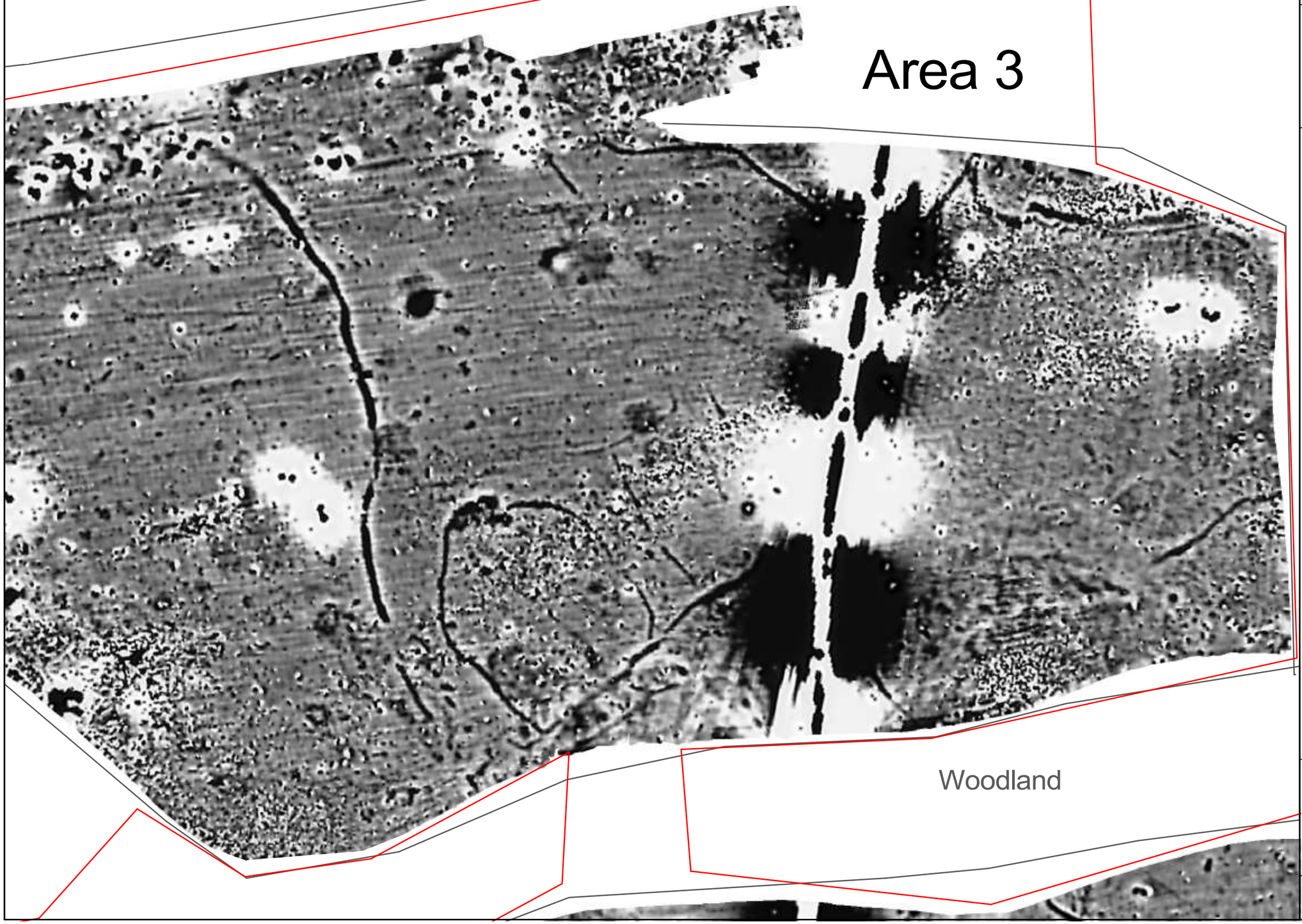
SCALE TRUE AT A3

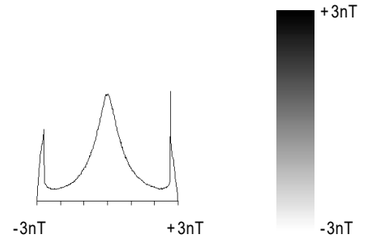
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 20

Archaeological Surveys
Specialist Geophysical Surveyors

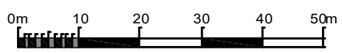
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 3





SCALE 1:1000

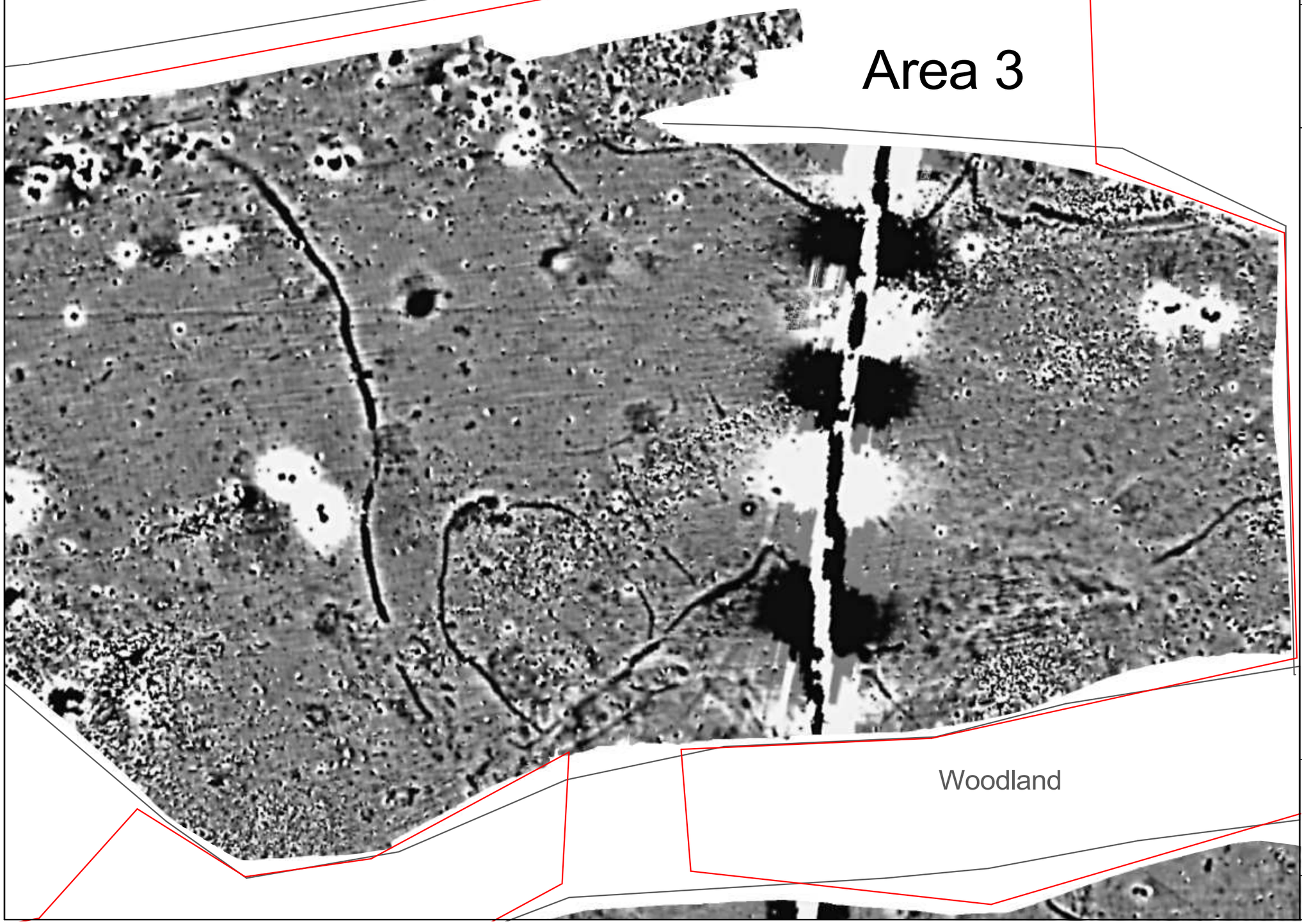


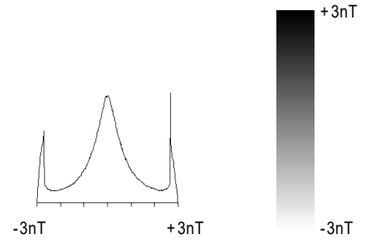
KTD	DJS	FIG 21

Archaeological Surveys
Specialist Geophysical Surveyors

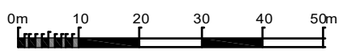
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 3





SCALE 1:1000



KTD	DJS	FIG 22

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 3

Area 3

N

Water tower

Woodland

31
36
37
34
39
38
29
39
30
33
32
28
35

- Positive linear anomaly - cut feature of archaeological origin
- Positive curvilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - cut feature of archaeological origin
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Magnetically variable anomaly - former quarry pit
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

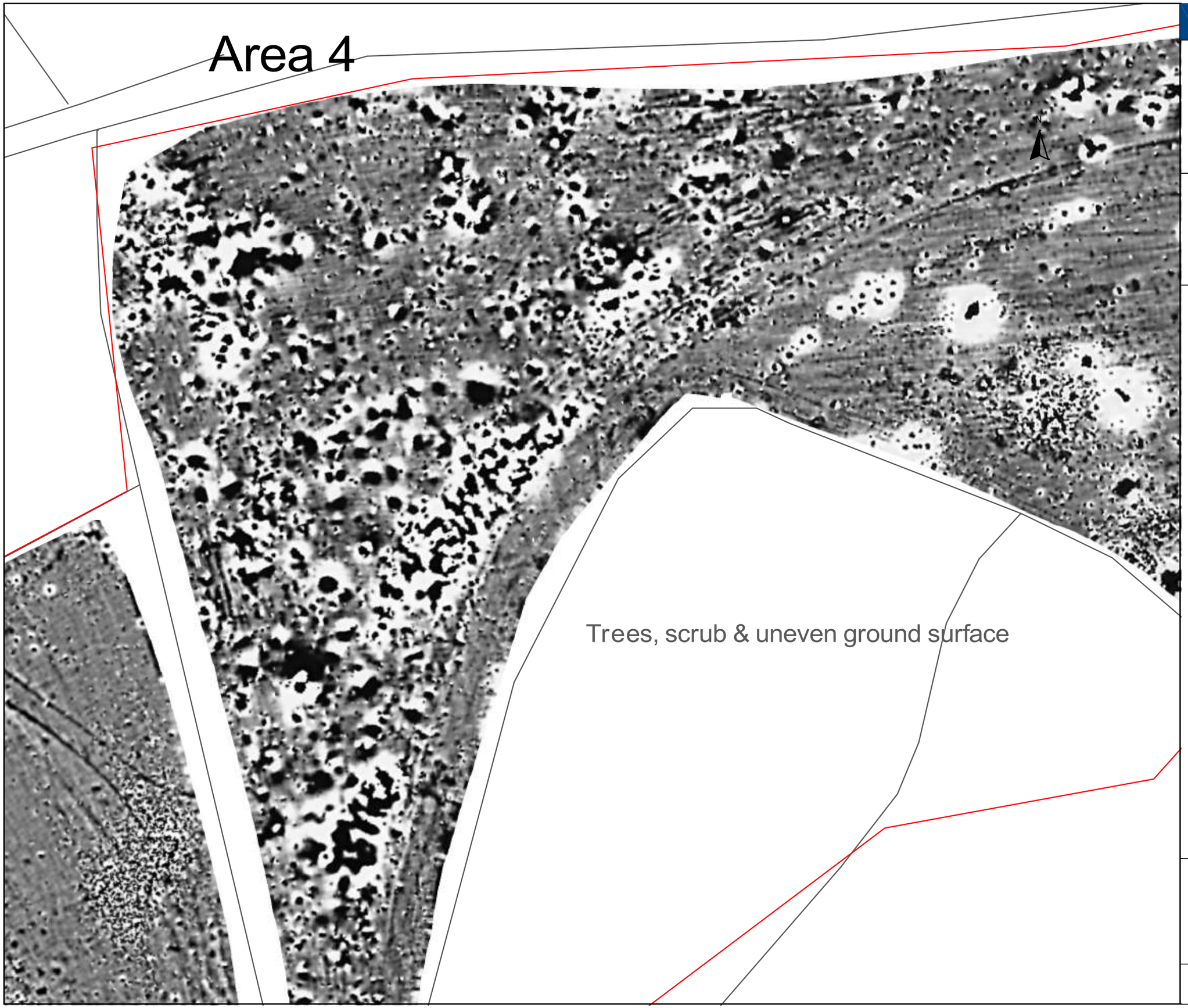
SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 23

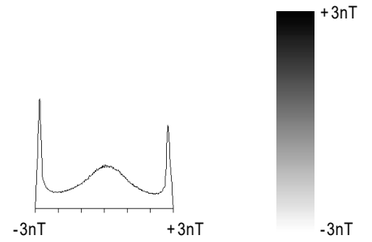
Area 4



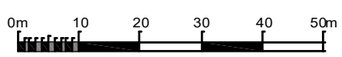
Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 4



SCALE 1:1000



KTD	DJS	FIG 24

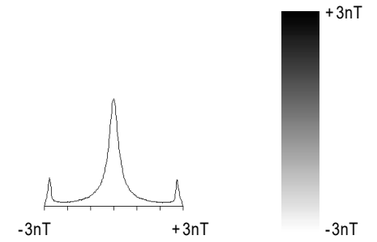
Area 4

Trees, scrub & uneven ground surface

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 4

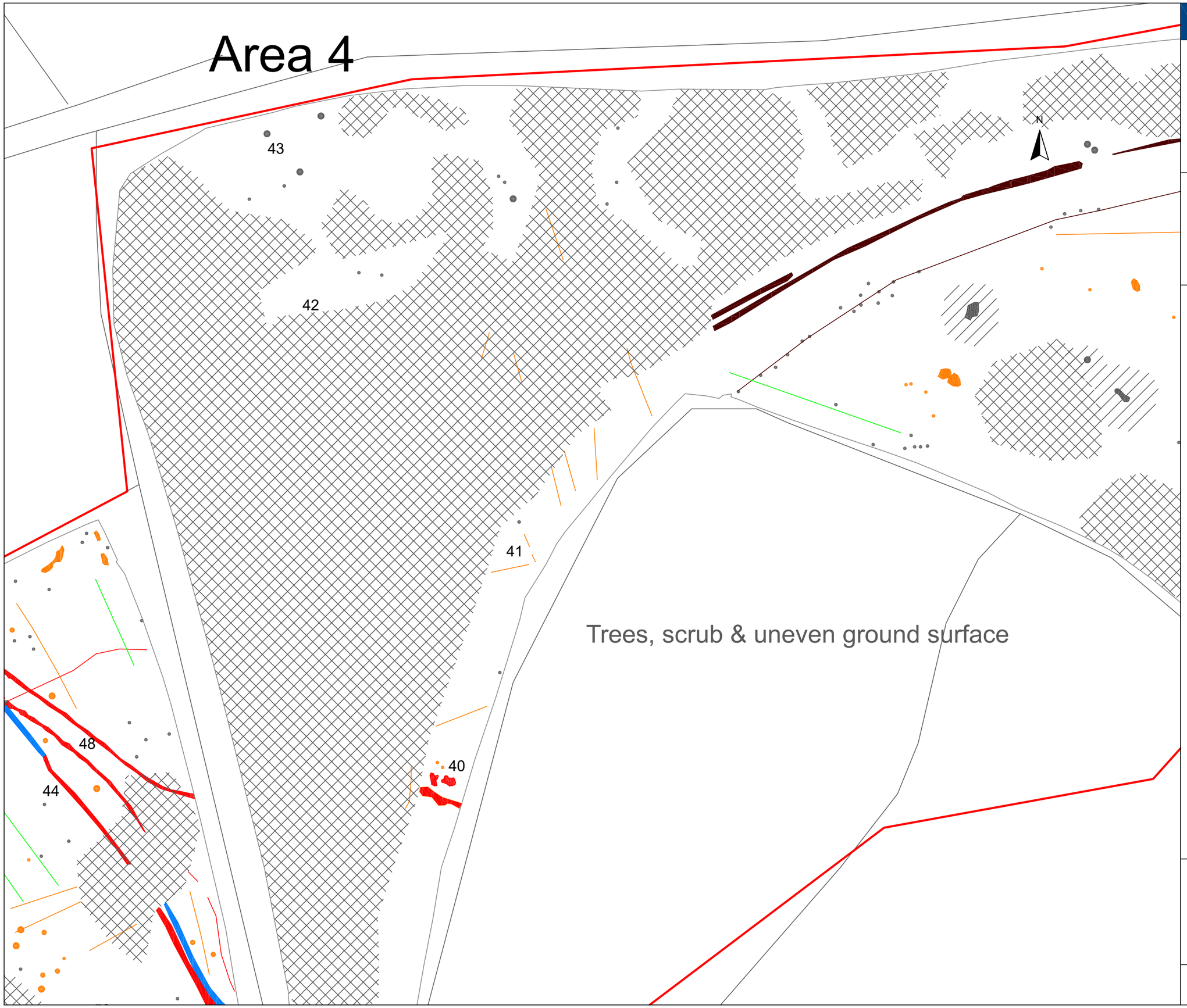


SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 25

Area 4



Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 4

- Positive linear anomaly - magnetic enhancement archaeological origin
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Positive linear anomaly - former field boundary
- Discrete positive response - magnetic enhancement archaeological origin
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 26

Woodland

Area 5

Trees, scrub

N

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 5 north

+3nT

-3nT +3nT -3nT

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 27

Woodland

Area 5

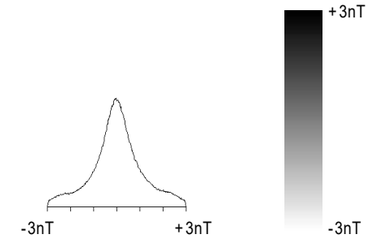
Trees, scrub

N

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 5 north



SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 28

Woodland

Area 5

Trees, scrub

N

41

47

48

44

40

51

50

44

49

52

45

46

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 5 north

- Positive linear anomaly - magnetic enhancement of archaeological origin
- Negative linear anomaly - earthwork/bank
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

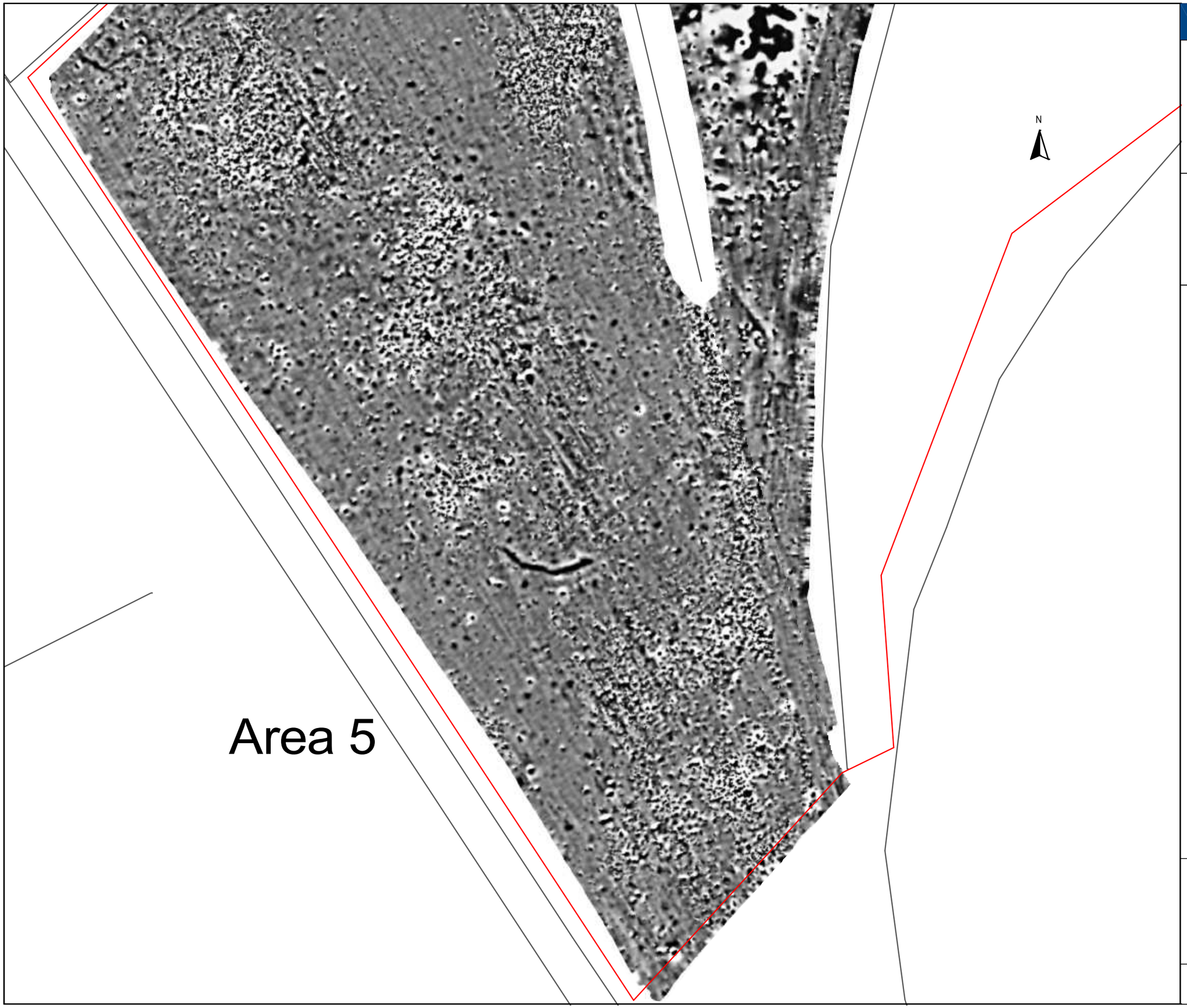
SCALE TRUE AT A3

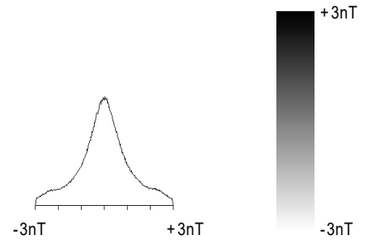
DRAWN BY	CHECKED BY	
KTD	DJS	FIG 29

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of minimally processed magnetometer data - Area 5 south





SCALE 1:1000

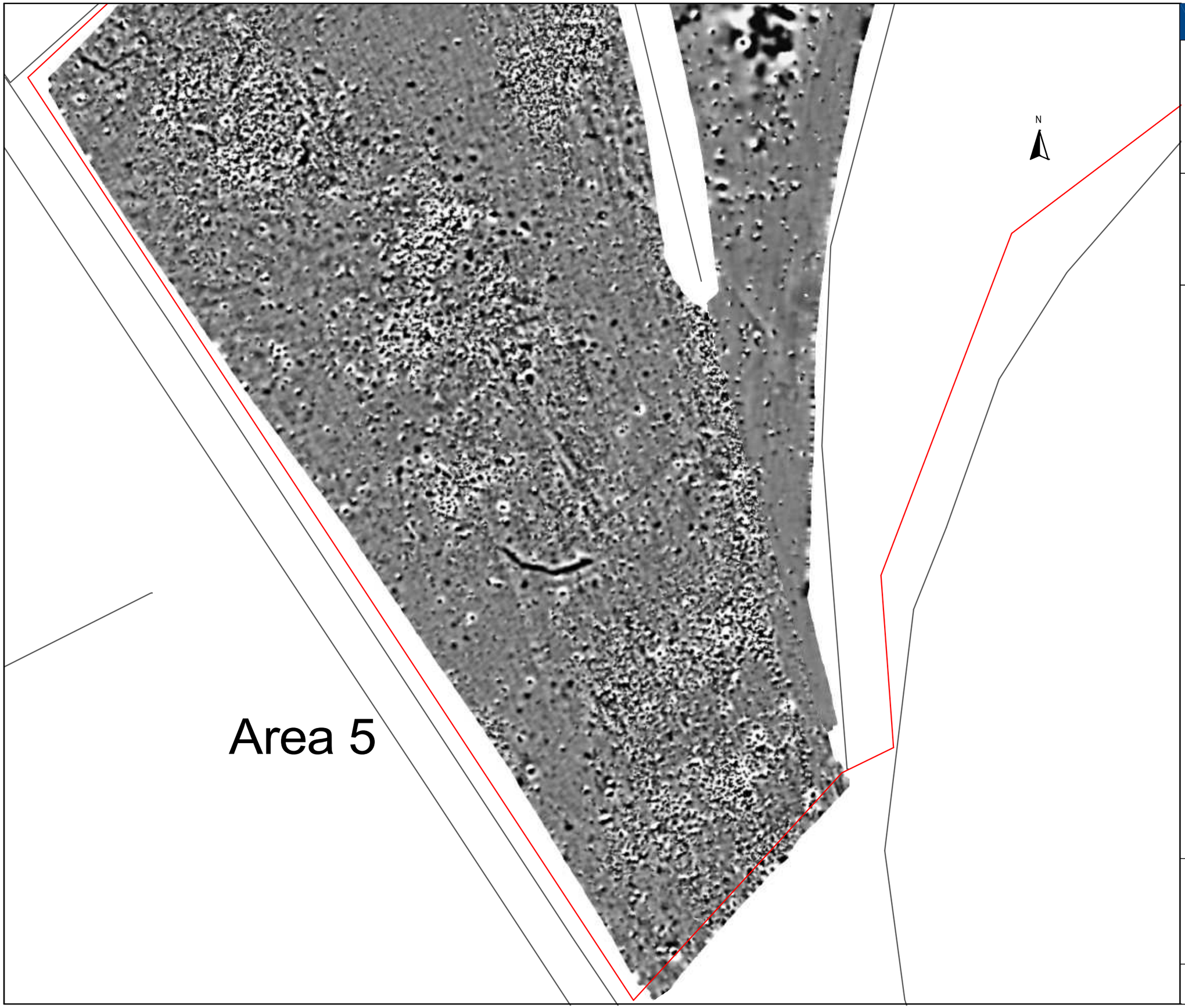
0m 10 20 30 40 50m

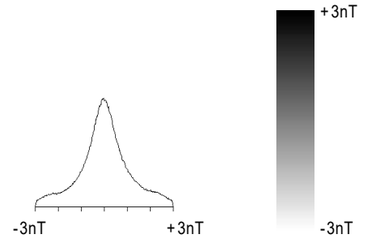
KTD	DJS	FIG 30

Archaeological Surveys
Specialist Geophysical Surveyors

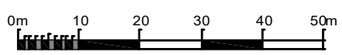
Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Greyscale plot of filtered magnetometer data - Area 5 south





SCALE 1:1000



KTD	DJS	FIG 31

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Abstraction and interpretation of magnetic anomalies - Area 5 south

51
50
44
49
52
45
46

Area 5

N

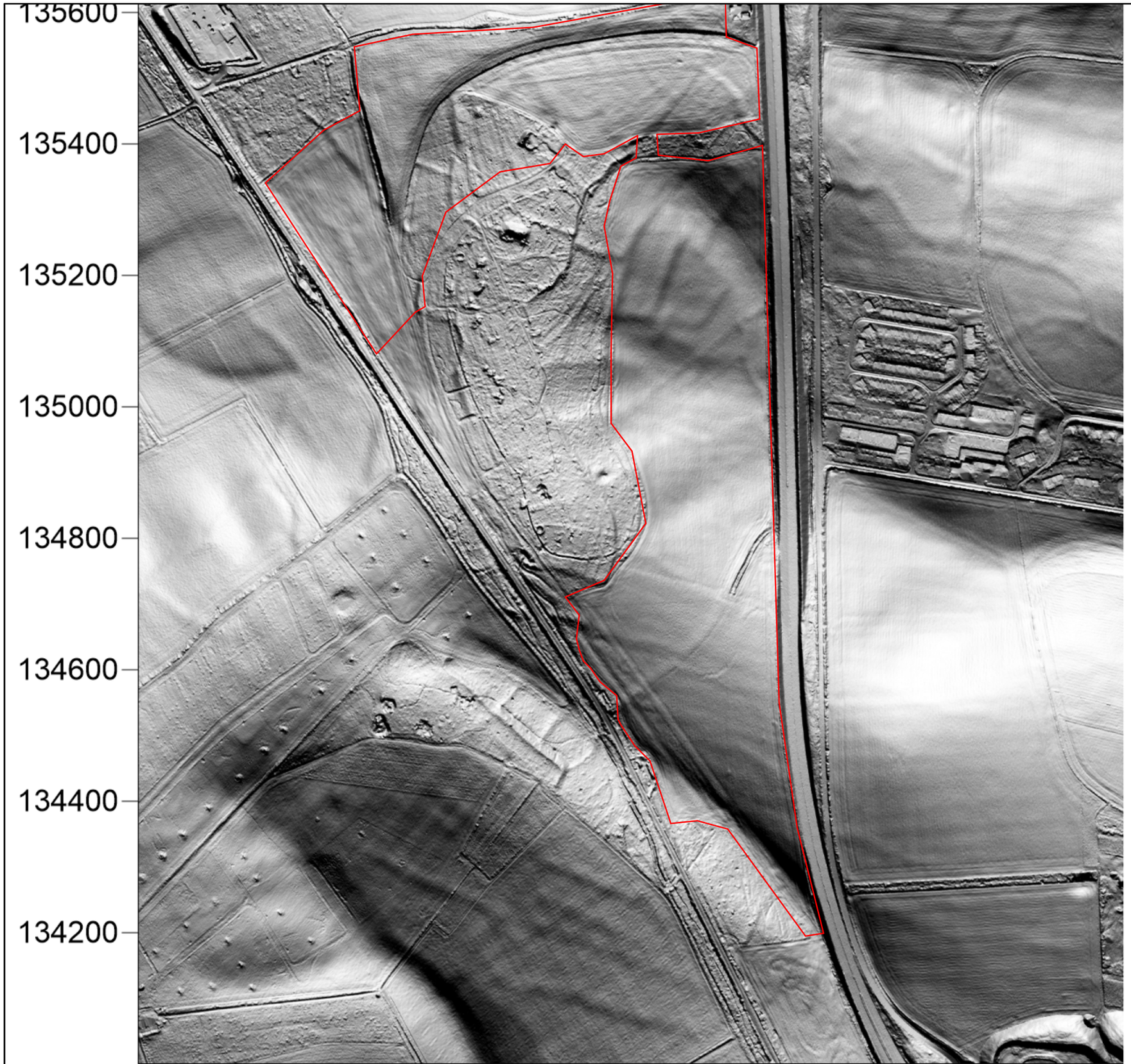
- Positive linear anomaly - magnetic enhancement of archaeological origin
- Negative linear anomaly - earthwork/bank
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 32



Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Three Maids Hill Solar Farm
Headbourne Worthy
Winchester

Digital Terrain Model

Derived from Environment Agency's LiDAR data 1m resolution

SCALE 1:6000

0m 60 120 180 240 300m

KTD	DJS	FIG 33