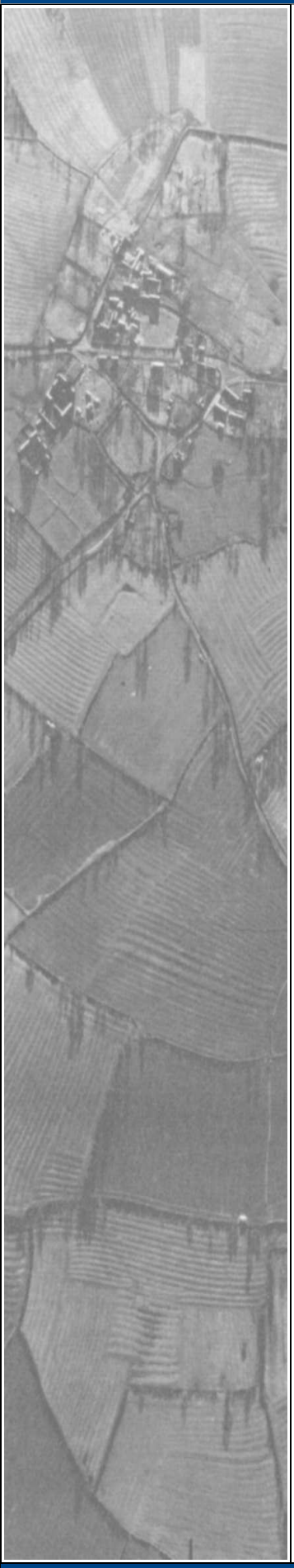

Land off Woolavington Road
Puriton
Somerset

MAGNETOMETER SURVEY REPORT

for

Pegasus Group

on behalf of

Gladman Developments Ltd

Kerry Donaldson & David Sabin

July 2020

Ref. no. J824

ARCHAEOLOGICAL SURVEYS LTD

Land off Woolavington Road
Puriton
Somerset

MAGNETOMETER SURVEY REPORT

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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 – 30th June & 7th July 2020
Ordnance Survey Grid Reference – **ST 32730 41390**

Somerset HER no. 42218

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CONTENTS

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

SUMMARY

A detailed magnetometry survey was carried out by Archaeological Surveys Ltd on land to the south of Woolavington Road, Puriton in Somerset. The results indicate the presence of a rectilinear enclosure and another L-shaped rectilinear ditch in the north eastern part of the site. Further weakly positive and some negative anomalies could relate to further cut features, but they generally lack a coherent morphology and a non-archaeological origin is also possible. The site contains evidence of former quarrying, and ground reinstatement with strongly magnetic debris indicates a fill containing ferrous material.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Pegasus Group, on behalf of Gladman Developments Ltd, to undertake a magnetometer survey of an area of land off Woolavington Road, on the eastern edge of Puriton in Somerset. The survey forms part of an archaeological assessment of the site which has been outlined for a proposed residential development (Sedgemoor District Council planning application number 42/20/00014).

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2020). Somerset Historic Environment Record has also issued the HER event number 42218 for the survey.

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 the eastern edge of Puriton, to the south of Woolavington Road and bounded to the east by a link road between the A39 to the south west and the new Huntspill Energy Park (former Royal Ordnance Factory) to the north east. The road is currently under construction and is therefore unmapped. The site is centred on Ordnance Survey National Grid Reference (OS NGR) ST 32730 41390, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 5ha within four land parcels. Area 1, forming the southern part of the site, contained a heavily overgrown manure heap, a low bund along the eastern side associated with the new road construction and dense patches of thistles and nettles that were unsurveyable. The ground cover in general was long grass with wild vegetation that was difficult to traverse. The most dense zone of nettles and thistles appear to be related to an area where land reinstatement after quarrying has occurred. The land slopes down slightly towards the north west and there is a woodland to the west which covers reinstated land, a hedgerow along the northern

boundary and new wire mesh fencing with some Heras temporary fencing bounding the new road to the east. The low bund associated with the road construction was located within the field and prevented survey within several metres of the new fencing.

1.4.3 Area 2 is a small field forming the north western part of the site. The ground cover in general was similar to Area 1 with long grass and wild vegetation producing difficult conditions for survey. The area slopes down towards the north and there is a linear depression in the south part of the site probably related to drainage. The base of a small structure was noted close to the western boundary. Field boundaries are formed by hedgerows and wire fencing with an area of woodland to the south covering reinstated land after quarrying.

1.4.4 Area 3 is a small field forming the bulk of the northern part of the site. The ground cover in general was similar to other areas, and as a consequence traversing was difficult. A small zone in the central part of the field was unsurveyable due to tall nettles and thistles along with two troughs; this zone is located within a notable depression that probably relates to former quarrying followed by ground reinstatement. Field boundaries are formed by hedgerows.

1.4.5 Area 4 is a narrow triangular piece of land forming the north eastern part of the site. It is the western part of a former field now divided by a new road which lies immediately to the east of the survey area. Adjacent to wire net fencing along the eastern side there is a low bund which continues south into Area 1; the bund could not be surveyed so the survey limit is several metres in from the wire fencing. The northern and eastern boundaries are formed by hedgerows and the land slopes down slightly towards the north.

1.4.6 The ground conditions across the site were generally considered to be poor for the collection of magnetometry data due to very long grass and wild vegetation. Weather conditions during the survey were very wet on the first day of survey but fine on the second.

Plate 1: Area 3 looking north east

1.5 Site history and archaeological potential

1.5.1 The Somerset Historic Environment Record (HER) lists that a geophysical survey was carried out ahead of a new link road immediately to the east of the present survey area (HER no. 41280). The survey located a number of parallel linear ditches and pits that could relate to prehistoric and/or Romano-British features (Wessex Archaeology, 2012). Post medieval quarrying had truncated some of the features. A Roman settlement was located c650m to the north east (HER no.15974) and a medieval settlement c450m to the north west (HER no.12817). Post medieval quarrying is indicated to the east and west on Ordnance Survey mapping.

1.5.2 The location of archaeological features recorded during a previous geophysical survey on land immediately to the east indicates that there is high potential for the site to contain further features. Evidence of former quarrying is also possible.

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is interbedded Triassic and Jurassic mudstone and limestone from the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Sherborne association and is a brown rendzina. It consists of a shallow, well drained, brashy, calcareous, clayey soil over limestone, associated with slowly permeable calcareous clayey soils (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry survey carried out across similar soils has produced good

results. The underlying geology and soils are therefore considered acceptable for magnetic survey. However, the extent of ground reinstatement after former quarrying is unknown as is the potential for spreads of soil and other material prior to quarrying.

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 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 1m resolution data. Shaded relief plots are created using Surfer 15 using the parameters of Azimuth:225, Altitude:325, Z factor:10 (Fig 09).

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 four survey areas covering approximately 5ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative responses of archaeological potential, positive and negative anomalies of an uncertain origin, anomalies associated with quarrying, 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 the site 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 Zones of high magnitude magnetic disturbance were located within the central part of Area 3 and the western part of Area 1. Smaller zones of disturbance associated with magnetic debris were also located within the southern and western parts of Area 2. It is likely that the zones within Areas 1 and 3 are associated with dumped modern material used to infill areas of former quarrying, so it is unlikely that the high magnitude anomalies obscure weaker anomalies of archaeological significance as complete truncation of the subsurface will have occurred. It is possible that weak anomalies within a few metres of these areas have been obscured by the response to the nearby buried ferrous material. In addition, a small number of traverses were adversely affected by the high values recorded and this has produced some banding of the data after compensation. Additional high pass filtering effectively removes the banding but may remove anomalies with a similar orientation; to ensure that no significant anomalies are removed, a comparison is made with the minimally processed dataset.

3.2.3 Dipolar magnetic anomalies within the southern part of Area 2 indicate more deeply buried ferrous objects compared to the other areas and to what would normally be expected from other sites. The additional depth may well relate to

surface make-up associated with reinstatement of a quarry immediately to the south. It is possible that the original topsoil still exists as no quarrying was mapped in this part of the site, although it is impossible to determine its depth of burial and, therefore, whether the survey is likely to have responded to archaeologically significant anomalies should they be present. It is also possible that the zone may have been quarried and not mapped or heavily disturbed by the adjacent quarrying with later reinstatement.

3.2.4 The results indicate useful magnetic contrast within soils not disturbed by quarrying and ground reinstatement. Linear anomalies relating to cultivation are visible as well as a former ditch-like feature of archaeological potential.

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	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 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 unmapped quarry pits may be of archaeological potential.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Site centred on OS NGR 332730 141390 see Figs 03 – 08.

Anomalies of archaeological potential

(1) - A positive rectilinear anomaly is situated within the northern part of Area 4 in the eastern part of the site, with its south western corner just extending into Area 3. This relates to an enclosure ditch that extends into the area of new road construction immediately to the east.

(2) - A fragmented positive rectilinear anomaly situated to the north of, but on a different orientation to, anomaly (1) relates to a further enclosure ditch. It appears to contain an area of material of low magnetic susceptibility within the interior of the corner. This type of response indicates material such as subsoil or rock.

(3) - A discrete positive anomaly situated to the north of a possible gap within the northern edge of rectilinear anomaly (2) relates to a possible pit or discrete area of burning and could be associated with the enclosure.

Anomalies with an uncertain origin

(4) - A number of positive anomalies are located close to the north eastern corner of anomaly (2) and could relate to further cut features with archaeological potential.

(5) - A number of positive linear, possible curvilinear and discrete responses appear to be located within the confines of anomaly (1) and could relate to associated cut features.

(6) - A group of positive and negative responses appear to form a curvilinear feature to the south of enclosure (1). Their archaeological potential is uncertain.

(7) - Short, fragmented positive responses located within the north eastern corner of Area 3 appear to have been truncated by ridge and furrow and could relate to an extension of anomaly (2).

(8) - A number of discrete and linear responses can be seen to the south west of anomaly (1) within Area 3. A land drain does extend through the responses, but their position and orientation could suggest an association with anomaly (1).

Anomalies associated with land management

(9) - Two small amorphous zones of magnetic enhancement within Area 3 could

relate to patches of quarrying.

(10) - A positive anomaly within Area 2 appears to be a continuation of a drainage gully which is visible as an extant feature in the southern part of the survey area.

(11) - The site contains a number of short positive linear responses as well as small zones of enhancement, and negative linear anomalies. They lack a coherent morphology and cannot be confidently interpreted as cut features.

Anomalies associated with quarrying

(12) - Zones containing magnetically enhanced material and strong dipolar responses relate to material either within the fill of former quarry pits, or associated with make-up of adjacent land. Former quarry depressions can be seen on LiDAR imagery (see Fig 09).

Anomalies associated with land management

(13) - Linear anomalies within Area 3 that appear to extend towards the centre of the survey area are associated with land drainage and can be seen on LiDAR imagery.

Anomalies with an agricultural origin

(14) - Parallel linear anomalies relating to former ridge and furrow can be seen within all of the survey areas.

Anomalies associated with magnetic debris

(15) - Very strongly magnetic debris is generally associated with infilled quarrying. The strong response indicates a high ferrous content, indicative of relatively modern infill.

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

Anomalies with a modern origin

(17) - Magnetic disturbance from ferrous material within and surrounding the site.

4 CONCLUSION

4.1.1 The geophysical survey has located a rectilinear enclosure and a further L-shaped rectilinear response in the north eastern part of the site. Further positive and negative anomalies are located in the vicinity, but due to their indistinct response and lack of coherent morphology, it is not clear if they

relate to further cut features. There are several similar linear and discrete responses located throughout the site, but these too lack a coherent morphology.

4.1.2 Widespread quarrying and subsequent ground reinstatement with soil containing ferrous material is apparent within the central, western and south western parts of the site. The ferrous content is associated with strongly magnetic debris which may be a proxy for a very variable content containing different materials.

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Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material. Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field. Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried magnetic field. The difference between the two sensors will relate to the strength of the magnetic field created by the buried feature.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Despike

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

High Pass Filter

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

Low Pass Filter

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

Zero Median/Mean Traverse

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

Appendix C – survey and data information

Area 1 minimally processed data

Filename: J824-mag-Area1-proc.xcp
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 332637.00, 141430.50 m
Southeast corner: 332809.95, 141205.50 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 467200
Dimensions
Composite Size (readings): 1153 x 1500
Survey Size (meters): 173 m x 225 m
Grid Size: 173 m x 225 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.45
Mean: -0.07
Median: 0.02
Composite Area: 3.8914 ha
Surveyed Area: 1.3389 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 1 filtered data

Filename: J824-mag-Area1-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.41
Mean: -0.08
Median: -0.04
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: 300
5 Clip from -3.00 to 3.00 nT

Area 2 minimally processed data

Filename: J824-mag-Area2-proc.xcp
Northwest corner: 332564.91, 141539.53 m
Southeast corner: 332663.31, 141401.23 m
Source GPS Points: 329500
Dimensions
Composite Size (readings): 656 x 922
Survey Size (meters): 98.4 m x 138 m
Grid Size: 98.4 m x 138 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.69
Mean: -0.02
Median: 0.03
Composite Area: 1.3609 ha
Surveyed Area: 0.91461 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: J824-mag-Area2-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.53
Mean: 0.00
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: 300
5 Clip from -3.00 to 3.00 nT

Area 3 minimally processed data

Filename: J824-mag-Area3-proc.xcp
Northwest corner: 332634.74, 141589.03m
Southeast corner: 332799.29, 141424.03m
Source GPS Points: 762600
Dimensions
Composite Size (readings): 1097 x 1100
Survey Size (meters): 165 m x 165 m
Grid Size: 165 m x 165 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.65
Mean: -0.02
Median: 0.00
Composite Area: 2.7151 ha
Surveyed Area: 1.814 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 3 filtered data

Filename: J824-mag-Area3-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.52
Mean: -0.02
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: 300
5 Clip from -3.00 to 3.00 nT

Area 4 minimally processed data

Filename: J824-mag-Area4-proc.xcp
Northwest corner: 332758.26, 141594.18m
Southeast corner: 332811.66, 141439.98m
Source GPS Points: 176500
Dimensions
Composite Size (readings): 356 x 1028
Survey Size (meters): 53.4 m x 154 m
Grid Size: 53.4 m x 154 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.31
Mean: 0.06
Median: 0.03
Composite Area: 0.82343 ha
Surveyed Area: 0.44123 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 4 filtered data
Filename: J824-mag-Area4-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.23
Mean: 0.04
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: 300
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 Somerset Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS) and a summary of the results will be placed in the Somerset Archaeology 2020 section of the forthcoming Proceedings of the Somerset Archaeological and Natural History Society.

Archive contents:

File type	Naming scheme	Description
Data	J824-mag-**[area number/name]**.asc J824-mag-**[area number/name]**.xcp J824-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J824-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J824-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J824 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 NEG ARCHAEOLOGY		127,0,255	Polygon (cross hatched ANSI37)
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 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 LAND DRAIN		Cyan 0,255,255	Line or polyline
Anomalies with an agricultural origin			
AS-ABST MAG RIDGE AND FURROW		0,127,63	Line, polyline or polygon (cross hatched ANSI37)
Anomalies associated with magnetic debris			
AS-ABST MAG DEBRIS		132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR		132, 132, 132	Solid donut, point or polygon (solid)

Anomalies with a modern origin			
AS-ABST MAG DISTURBANCE		132, 132, 132	Polygon (hatched ANSI31)
AS-ABST MAG SERVICE		132, 132, 132	Line or polyline
Anomalies associated with ground disturbance/quarrying			
AS-ABST MAG QUARRYING/ GROUND DISTURBANCE		255,255, 127 or 255,223,127	Polygon (net)
AS-ABST MAG ROCK		102, 178,204	Polygon (net)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Land off Woolavington Road
Puriton
Somerset

Map of survey area

Survey location

Site centred on OS NGR
ST 32730 41390

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

323700 141450

Survey tracks

Survey track start

Survey track stop

Development boundary

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

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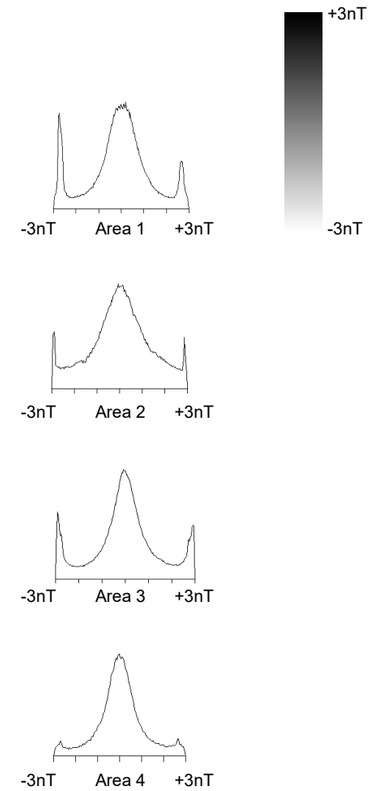
Greyscale plot of minimally processed magnetometer data



SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

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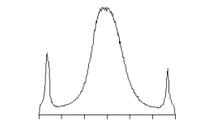
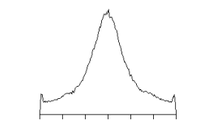
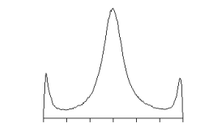
Greyscale plot of filtered magnetometer data

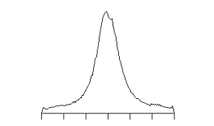
+3nT

-3nT







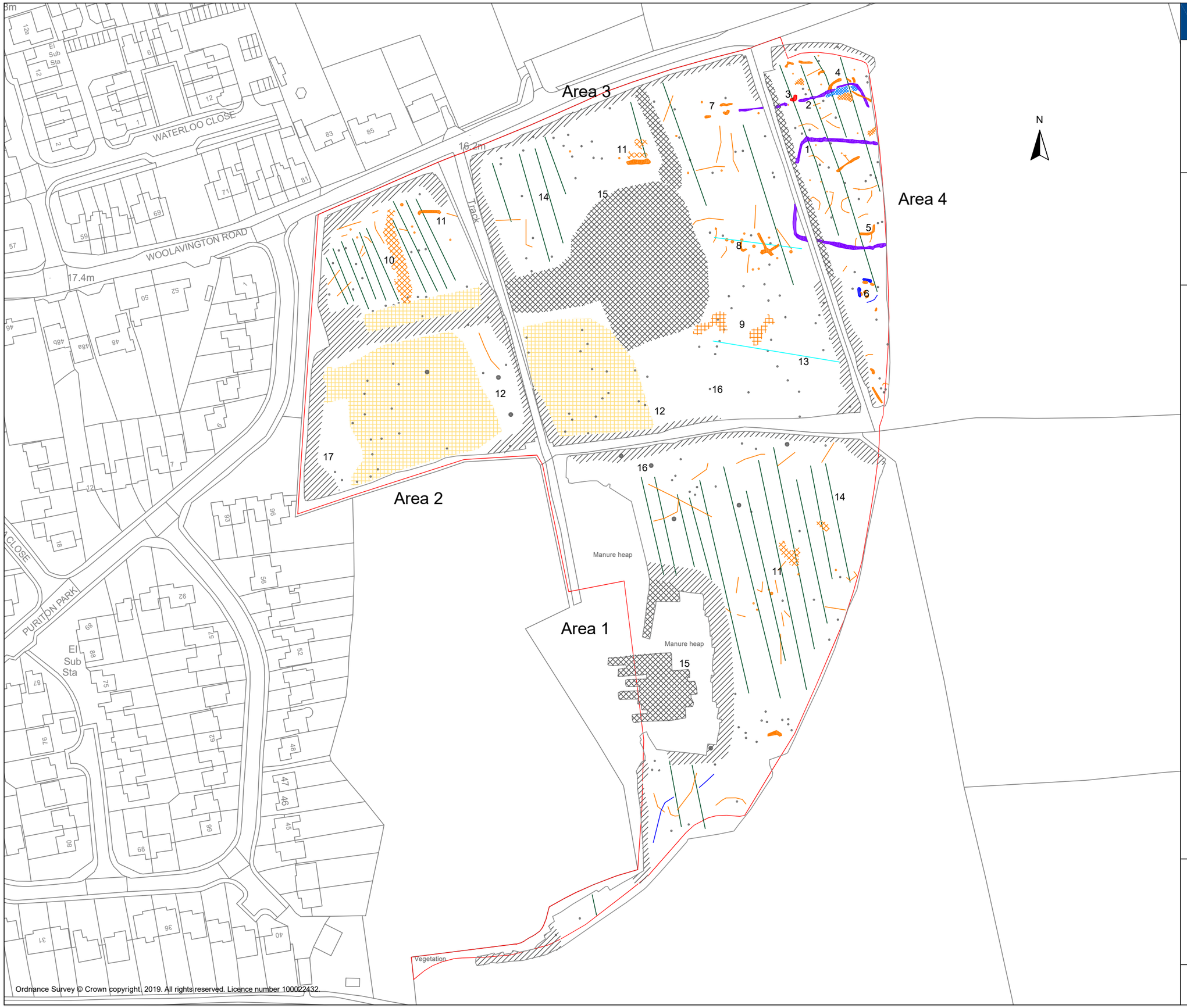


SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04



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Abstraction and interpretation of magnetic anomalies

- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Linear anomaly - land drain
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - cut feature of archaeological potential
- Discrete positive response - possible pit-like feature
- Negative anomaly - material of low magnetic susceptibility of archaeological potential
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - former quarry/ground disturbance
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

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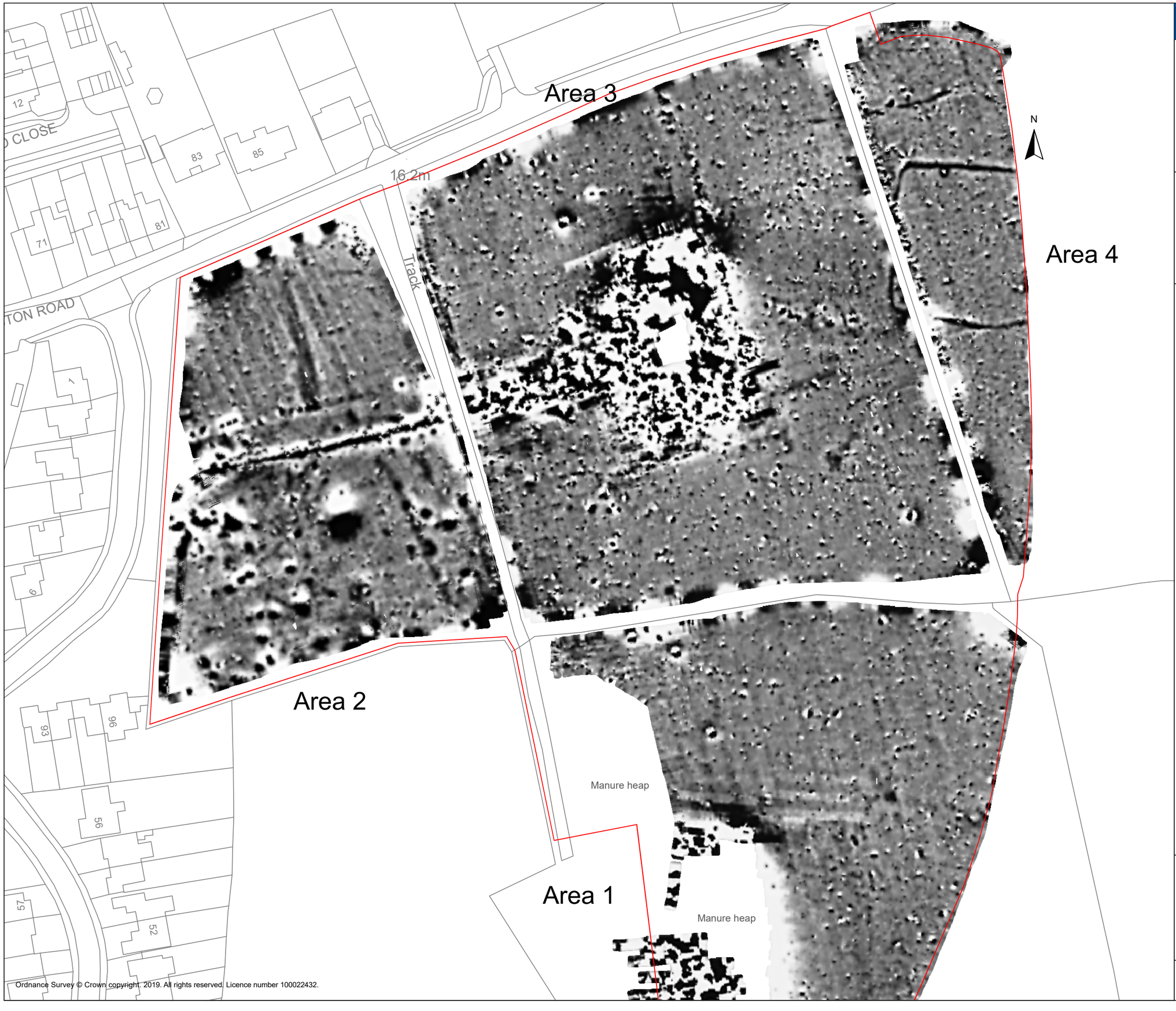
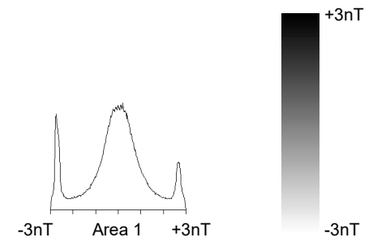
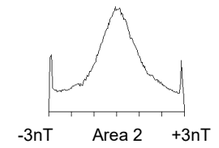
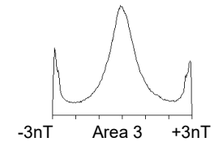
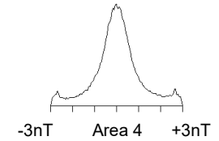
Greyscale plot of minimally processed magnetometer data - north











SCALE 1:1000

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 06

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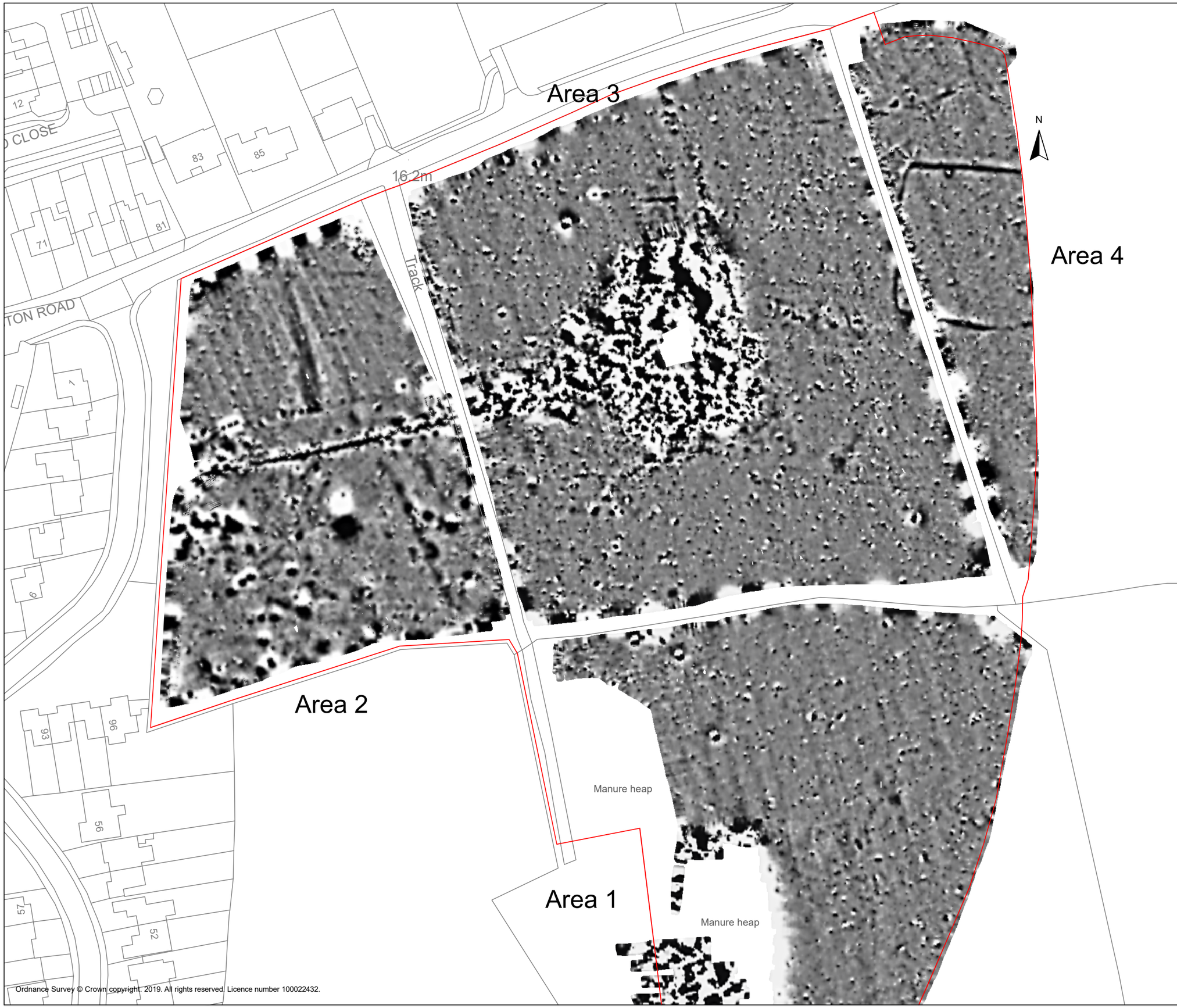
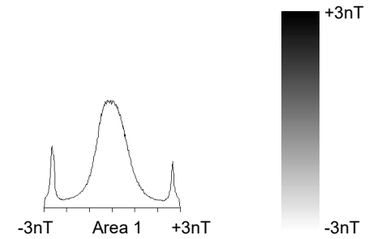
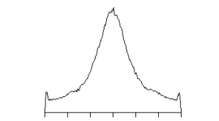
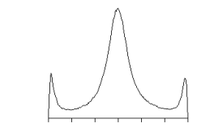
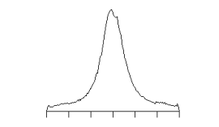
Greyscale plot of filtered magnetometer data - north











SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 07

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Abstraction and interpretation of magnetic anomalies - north

Area 3

Area 4

Area 2

Area 1

Track

16.2m

Manure heap

Manure heap

N

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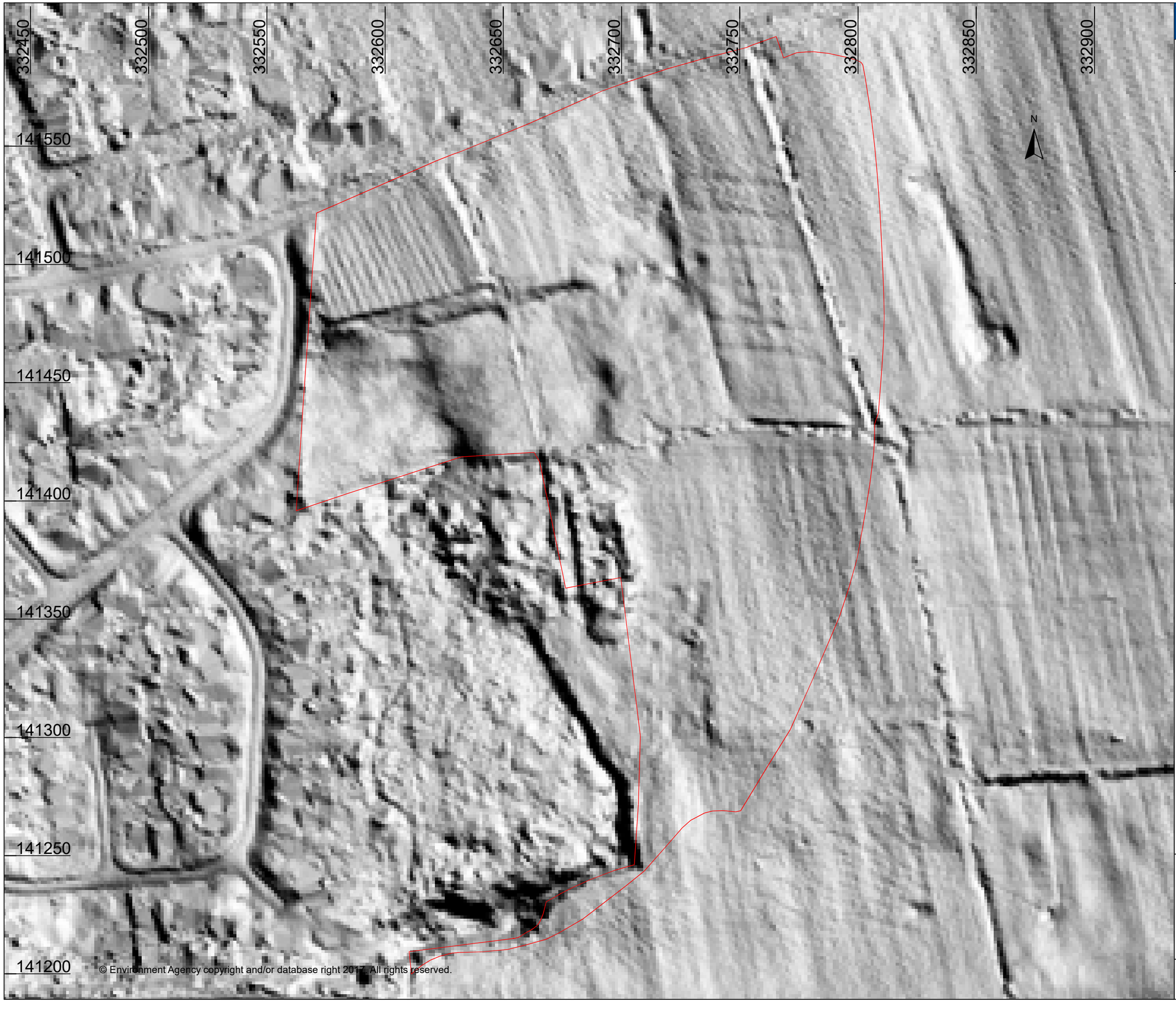
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08



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Digital Terrain Model

Derived from Environment Agency's LiDAR data 1m resolution

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

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KTD	DJS	FIG 09