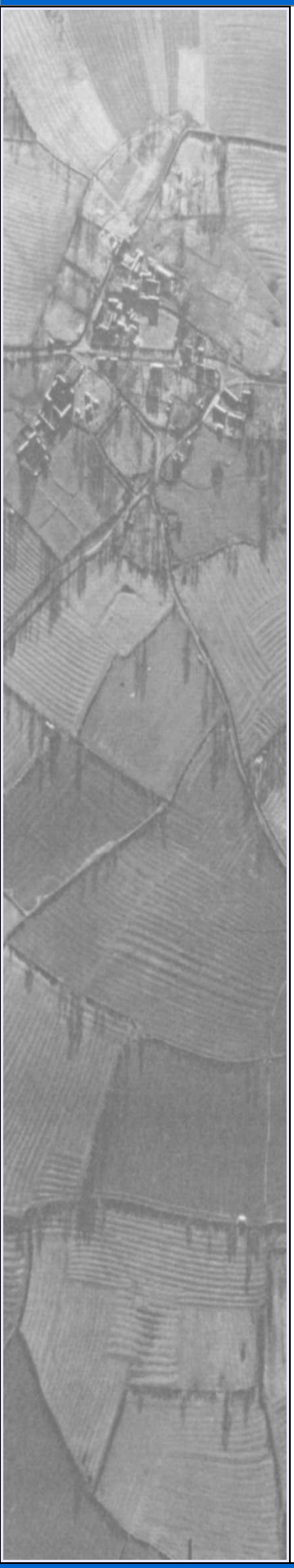

Land off Cobthorn Way
Congresbury
North Somerset

MAGNETOMETER SURVEY REPORT

for

Sunley Estates Ltd

Kerry Donaldson & David Sabin

August 2015

Ref. no. 623

ARCHAEOLOGICAL SURVEYS LTD

Land off Cobthorn Way
Congresbury
North Somerset

Magnetometer Survey Report

for

Sunley Estates Ltd

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Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

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Ordnance Survey Grid Reference – **ST 44320 63860**

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SUMMARY

A detailed magnetometer survey was carried out by Archaeological Surveys Ltd, at the request of Sunley Estates Ltd, within three fields to the south of Cobthorn Way on the eastern edge of Congresbury, North Somerset. The results of the survey indicate that there are a number of positive linear, possible rectilinear and discrete responses in the north western part of the site that may relate to cut features, such as ditches and pits. An arc of discrete positive responses, including some very strong responses, are located in the vicinity. However, the anomalies generally lack a coherent morphology and the main axis of many is parallel with the linear trend of agricultural features also seen within the site. Magnetic debris and strong, discrete, dipolar anomalies, typical of shallow ferrous objects, are widespread. In the southern part of the site is a strongly magnetic anomaly which may relate to a discrete zone of intense burning. However it is situated at the junction of, and may partly overlie, a former boundary. The northern part of the site contains a number of parallel linear anomalies that are associated with strip field cultivation boundaries. Further south, narrow agricultural gullies contain a series of ceramic land drains.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Sunley Estates Ltd to undertake a magnetometer survey of an area of land to the south of Cobthorn Way, Congresbury, North Somerset. The survey aims to provide information on the archaeological potential of land outlined for a residential development and associated infrastructure in the north western part of the site, with an allocation of public open space within the remainder of the site.

1.1.2 A desk-based assessment was undertaken by Foundations Archaeology (2015) that identified potential for archaeological finds and features within the site. In light of these findings a geophysical survey of the site was required by the archaeological advisor to North Somerset Council.

1.1.3 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2014) and issued to Vince Russett, County Archaeologist for North Somerset Council, prior to commencing 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 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* and 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.*

1.3 Site location, description and survey conditions

1.3.1 The site is located to the south of Cobthorn Way on the eastern edge of Congresbury, North Somerset. It is centred on Ordnance Survey National Grid Reference (OS NGR) ST 44320 63860, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 8.1ha of pasture within 3 fields labelled Areas 1 - 3 for the purposes of this report. Areas 1 and 2 lie immediately to the south and east of residential areas with land sloping down towards the south. Area 3 is located on lower flatter land that extends to the River Yeo and is bounded along the southern side by a meandering stream channel. All of the fields contain numerous linear undulations associated with both former land management and land drainage. The northern half of Area 1 contains several electricity poles.

Plate 1: Survey Area 1 looking north west

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Some small zones around the periphery of the fields were unsurveyable due to tall vegetation and rough ground. Weather conditions during the survey were fine and occasionally hot.

1.4 Site history and archaeological potential

1.4.1 An Archaeological Desk-Based Assessment has been carried out by Foundations Archaeology (2015). It outlines that the there is one HER entry for a palaeochannel along the south eastern part of the site, possibly indicating the original course of the River Yeo. There are a number of prehistoric sites and findspots in the wider vicinity, including evidence for Neolithic and Bronze occupation within the site of the Iron Age and Saxon period multivallate hillfort of Cadbury Castle approximately 1km to the north. There is some evidence for Roman activity and settlement to the north east of the site, with evidence for possible kiln sites. Roman mosaics have also been located 500m to the north west. Further pottery scatters have also been recorded to the west and south west of the site.

1.4.2 The Congresbury tithe map shows the site sub-divided into six plots of land, with a mixture of pasture and orchard recorded. The internal land boundaries had been removed by the mid 1970s. A number gullies or land divisions that may indicate medieval strip fields can be seen within aerial photographs within the eastern and southern part of the site.

1.4.3 A geophysical survey has been conducted within the north eastern field (Area 1) by the Yatton, Congresbury, Claverham and Cleeve Archaeological Research Team (YCCCART, 2014), in order to establish the extent of a Roman kiln site. A number of magnetic anomalies were located and interpreted as relating to possible kilns.

1.4.4 There is potential for the survey to locate geophysical anomalies that relate to previously unrecorded archaeological remains should they exist within the site. Evidence for previous land division and land use is also likely.

1.5 Geology and soils

1.5.1 The underlying geology is Triassic Mudstone and Halite-stone from the Mercia Mudstone Group with overlying alluvial deposits within the southernmost field (BGS, 2015).

1.5.2 The overlying soil across the majority of the survey area is from the Whimple 1 association and is a stagnogleyic argillic brown earth. It consists of reddish, fine, loamy over clayey soil with slowly permeable subsoil. In the southernmost field the soil is from the Compton association and is a pelo-alluvial gley consisting of stoneless, mostly reddish, clayey soil affected by groundwater (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry survey carried out across similar soils has produced variable results, often with poor magnetic magnetic contrast, especially if archaeological features are buried beneath alluvium. However, where there is evidence for long term occupation and industrial activity there can be sufficient magnetic contrast for features to be visible within the data. The underlying geology and soils are therefore considered acceptable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers spaced 0.5m apart with readings recorded at 20Hz. The gradiometers have a range of recording data between 0.1nT and 10,000nT. The system is linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged computer.

2.2.2 Data are collected along a series of parallel survey tracks wherever possible. The length of each track is variable and relates to the size of the survey area and other factors including ground conditions. A visual display aids accurate placing of tracks and their separation.

2.2.3 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).

2.3 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. Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display using TerraSurveyor.

2.3.2 The data are collected between limits of ±10000nT and clipped for display at ±3nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.12m along each survey track. A zero median traverse function is required in order to remove fixed offset values present within the sensors which do not undergo a zeroing procedure in the field. The approach ensures that the gradiometer sensors are very accurately aligned and fixed to the vertical magnetic field and are not influenced by localised magnetic fields or disturbed by vibration. 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 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 any processes, such as clipping, carried out on the data.

2.3.4 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.

2.3.5 The raster images are combined with base mapping using ProgeCAD Professional 2014, creating DWG (2010) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GPS, resection method, etc.

2.3.6 An abstraction and interpretation is also 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.

2.3.7 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. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.8 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model and contour plot derived from GPS height data automatically logged during the survey. The heights are converted from the

ETRS89 ellipsoid using the National Geoid Model OSGM02 to obtain ODN (Ordnance Datum Newlyn) + the GPS antenna height (approximately 1.5M). Shaded relief plots are created using Surfer 10.

2.3.9 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 three survey areas covering approximately 8.1ha.

3.1.2 Magnetic anomalies located can be generally classified as positive and negative anomalies of an uncertain origin, anomalies associated with land management, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance and strong discrete dipolar anomalies relating to ferrous objects.

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

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset. Some linear data artefacts have been caused by magnetic debris and disturbance; however, these are aligned with survey tracks and do not obscure or alter other anomalies across 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 basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading **CAD layer names and plot colour**	**Description and origin of anomalies**
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in

AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS UNCERTAIN AS-ABST MAG NEG UNCERTAIN	this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. 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 AS-ABST MAG BOUNDARY AS-ABST MAG LAND DRAIN	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 a ceramic land drain.
Anomalies with an agricultural origin AS-ABST MAG STRIP CULTIVATION BOUNDARY	The anomalies are generally linear, and regularly spaced. They can be positive or negative and correspond to extant earthworks or ditches within the field.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is 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, or hearths 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 AS-ABST MAG DISTURBANCE	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 such 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 and with hysteresis adjacent to strong magnetic sources.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 344370 163895, see Figures 05 & 06.

Anomalies with an uncertain origin

(1) - A linear group of positive anomalies are situated in the north western part of the survey area along the line of a linear cultivation boundary. The response is highly magnetic in places, generally 30-80nT along the length, peaking at over

190nT. This type of response indicates ferrous and magnetically thermoremnant material, although it is in a linear layout and lacks definable features. To the south and south east are a discrete positive response and a negative linear anomaly within a broad zone of magnetic debris (11), and it is possible that these are associated.

(2) - Positive and associated negative broad linear responses can be seen to extend across the western part of the survey area. Although these type of responses can indicate a boundary feature or lynchet, they do not have a corresponding surface expression and do not appear to extend westwards into Area 2. It appears that they may have been crossed or truncated by agricultural anomalies (10).

(3) - In the northern part of the field are a group of predominantly negative responses, with some associated positive responses. They are broad, linear and curvilinear but do not have a coherent morphology preventing confident interpretation. A natural origin, such as variations within the underlying geology is a possible cause of the responses.

(4) - A number of weakly positive responses can be seen towards the south eastern part of the survey area. They are broad, linear, with some possible curvilinear form and have a response of 0.5-1nT. Cultivation boundaries have crossed or truncated through the responses, which may indicate that they area shallow. It is possible that they relate to naturally formed features but their origin is uncertain.

(5) - A discrete positive response is located close to an electricity pole (14) in the northern part of the field. It is possible that it is associated with the pole, but this is not certain.

(6) - The survey area contains a small number of weakly positive linear anomalies. They are short, isolated and lack a coherent morphology preventing confident interpretation.

(7) - A negative linear anomaly in the northern part of the survey area may relate to a cultivation boundary (10), although it is short and not as straight.

Anomalies associated with land management

(8) - An "L" shaped positive linear anomaly relates to a formerly mapped field boundary. A cluster of strong, discrete, dipolar anomalies, relating to ferrous objects, are located at the corner of the boundary.

(9) - In the southern part of the field are a series of weakly multiple dipolar linear anomalies that relate to ceramic land drains. These have been inserted into drainage ditches or gullies which are visible on the ground surface, but not visible within the magnetic data.

Anomalies with an agricultural origin

(10) - A number of parallel linear anomalies extend along the length of the survey area. They are either positive or negative and have a corresponding surface expression. They would appear to relate to former strip field cultivation boundaries.

Anomalies associated with magnetic debris

(11) - A zone of magnetic debris is located along the north western edge of the field, bounded generally by a linear strip field boundary and anomaly (1). The response is to very weakly magnetically thermoremnant material.

(12) - The entire site contains strong, discrete, dipolar anomalies. They are a response to ferrous and other magnetically thermoremnant objects within the topsoil. As they are so widespread and numerous, this type of response can be caused by ferrous material being incorporated into the topsoil during the process of manuring.

(13) - Two weakly dipolar responses are located in the eastern part of the field. They are much weaker (±3-4nT) and have a more diffuse response compared to other dipolar anomalies (12). This type of response may indicate a deeply buried object, and can be associated with a steel or iron collar on non-ferrous pipes. The origin is therefore uncertain.

Anomalies with a modern origin

(14) - Magnetic disturbance from an electricity pole, another lies to the south west.

(15) - Very strongly magnetic disturbance is a response to ferrous material within the infill of a former pond or depression close to the north eastern corner of the field. Ferrous material (corrugated iron) within the adjacent field boundaries has also caused magnetic disturbance.

3.5 List of anomalies - Area 2

Area centred on OS NGR 344245 163950, see Figures 07 & 08.

Anomalies with an uncertain origin

(16) - A positive linear anomaly, 65m long and 1.6m wide, can be seen in the north eastern part of the survey area. It has a response of generally 2-3nT, peaking at 11nT, and it appears to have an offset at the southern end. This type of response may indicate a cut, ditch-like feature; however, it is parallel with and in the middle of two strip field cultivation marks visible within the shaded relief height data. An association with the cultivation cannot be ruled out; however, it is possible that it is association with anomalies (17).

(17) - Positive linear anomalies appear to form part of a rectilinear feature associated with anomaly (16). They are not parallel with other magnetic anomalies or extant linear earthwork and ditch features within the site and they may relate to cut features. A number of short positive linear and discrete positive responses appear within the confines of anomalies (16) and (17) and may be associated.

(18) - A curvilinear group of discrete positive responses is situated to the east and north east of an area of magnetic disturbance caused by an electricity pole. The response of two of these anomalies, (second from the top and second from the bottom) is very strong, peaking at over 150nT, while others are 10-20nT. It is possible that some are associated with ferrous material or possibly intense burning.

(19) - The survey area contains a small number of positive linear anomalies. It is possible that they relate to cut features, but agricultural activity cannot be discounted.

(20) - A number of small, discrete positive anomalies are located in a line to the west of anomalies (18). They appear to relate to pit-like features in a line parallel with, but in between, the strip cultivation boundaries. Other isolated pit-like responses have also been located.

(21) - The survey area contains a number of weakly positive responses. They have no particular layout or pattern and are diffuse. While some are within the region of anomalies (18) & (20), others lie further south. This type of response can relate to natural features, and an association is possible with those to the south, while an association with other anomalies (16) to (20) is possible for those further north.

Anomalies associated with land management

(22) - In the south eastern part of the survey area are a small number of ceramic land drains.

Anomalies with an agricultural origin

(23) - A number of parallel linear anomalies are evident within the survey area. These relate to cultivation boundaries between adjacent strip fields.

Anomalies associated with magnetic debris

(24 & 25) - Magnetic debris is located within a narrow strip (24) and around the edges of the survey area (25). Anomaly (24) is associated with a shallow linear depression within the ground surface and it appears that the magnetic material has been used to infill this. Ferrous and other magnetically thermoremnant objects will be included in the material.

3.6 List of anomalies - Area 3

Area centred on OS NGR 344290 163720 see Figs 09 &10.

Anomalies with an uncertain origin

(26) - A curvilinear anomaly, or group of anomalies, is located in the northern half of the survey area. The response is generally ±25nT, with two horse-shoe shaped positive responses on the outside and negative in the centre. There are a small number of very strongly magnetic ferrous objects within and adjacent to the anomaly, and although it is not certain if these are directly associated. It is situated within the junction of two former linear boundary ditches, seen within the ground surface, possibly overlying the northern one. Although the feature may relate to former industrial activity, evidence of a recent bonfire was observed within the field further to the south west and a similar origin is possible.

(27) - A broad, generally weakly positive linear anomaly is located at the north eastern edge of the survey area. Several stronger responses are evident along its length. It lies in between two furrows evident on the ground surface, and although a response such as a buried service or pipe is possible, it does not appear to continue northwards into Area 1. The origin is, therefore, uncertain.

Anomalies associated with land management

(28) - A series of weakly dipolar, multiple linear anomalies relate to ceramic land drains inserted into former furrows.

Anomalies associated with magnetic debris

(29) - A patch of strongly magnetic debris relates to ferrous and other magnetically thermoremnant material. This may relate to dumped material or an area of burning and may be modern.

(30) - Within the south western part of the survey area are several zones of magnetic debris. This relates to ferrous and other magnetically thermoremnant material that has either been dumped, burnt or redeposited through flooding.

(31) - As with Areas 1 and 2, the survey area contains widespread and numerous strong, discrete dipolar anomalies, many of which relate to highly magnetic ferrous material.

4 DISCUSSION

4.1.1 Within Area 1 there is a linear group of strongly magnetic linear and discrete responses (1). They lie within a strip field boundary, and it is not clear if they relate to features in situ, or magnetically enhanced material that has been incorporated within a furrow or gully. A zone of weakly magnetic debris is located to the west of it. It appears that the strongly magnetic responses may be associated with ferrous material, burning or magnetically thermoremnant material, but a modern origin cannot be ruled out. It does lie parallel with a positive linear anomaly (16) within Area 2, but again this is parallel with the strip field boundaries. Other linear and discrete anomalies appear to be associated with (16). An arc of discrete positive responses to the south west of (16), some of which are highly magnetic may relate to ferrous material, areas of burning or pit-like features.

4.1.2 Area 1 also contains a number of weakly positive and negative responses with no coherent form, layout or pattern (2), (3) & (4). They do not correspond to any surface expression, but they do appear to have been "cut" by the strip field cultivation. A series of parallel linear anomalies within Areas 1 and 2 relate to former cultivation boundaries (10). In the southern part of Area 1 and Area 3, narrow gullies contain ceramic land drains.

4.1.3 Within Area 3, in the southern part of the site, there is a group of anomalies that may relate to intense burning or industrial activity (26). They appear as positive curvilinear anomalies, surrounding a negative response. The date and function cannot be determined, they appear to lie within, and possibly over a former boundary.

4.1.4 The entire site contains widespread and numerous strong, discrete, dipolar responses. While some appear to be situated around the field margins and within linear depressions, the majority are widespread across the site with no particular concentrations or associations with possible structures. This type of response, otherwise known as a ferrous or iron "spike" is almost always encountered within magnetic surveys, although the widespread nature of these responses indicates that ferrous and other magnetically thermoremnant objects have been spread across the entire site, presumably within the process of manuring. To the south of the survey area, on the southern bank of the River Yeo is the site of a former slitting mill, in which iron bars were cut into rods in the process of nail making during the early 18th century (Bedingfield, 1998). It is not known if waste was routinely spread amongst the agricultural fields as a soil 'conditioner', but the magnetic responses suggest that at times this may have been done.

5 CONCLUSION

5.1.1 The detailed magnetometer survey located a number of geophysical anomalies within the site. Within the north western part of the site (Area 2) are a number of positive linear and discrete anomalies that may relate to cut features, such as ditches and pits. A further, very strongly magnetic response is also located parallel with one of the linear anomalies to the east within Area 1. This strong response may relate to intense burning, magnetically thermoremnant or ferrous material. However, it is not possible to confidently interpret the origin of the anomalies as the main axis of the features is parallel with the linear trend of strip field cultivation boundaries that exist within the site. It cannot be determined whether the positive anomalies relate to magnetically enhanced material within cultivation features or to features that post-date them.

5.1.2 In the southern part of the site (Area 3) a discrete zone of strongly magnetic anomalies may relate to an area of intense burning, but this may overlie a former field boundary.

5.1.3 The entire site contains widespread magnetic debris, some of it relatively weak, relating to magnetically thermoremnant material. Stronger magnetic responses relate to shallow ferrous objects. Some concentrations of the material are adjacent to field margins and within former land parcels defined by the strip fields.

5.1.4 The site contains a number of linear strip field boundaries which have a corresponding surface expression. In the southern part of the site are a number of narrow linear gullies which contain ceramic land drains.

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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 field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature.

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

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±10nT and ±3nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero (destripe) Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise differences between the baseline value of gradiometer sensors.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks and modern agricultural features.

Appendix C – survey and data information

Area 1

COMPOSITE
Filename: J623-mag-Area1-proc.xcp
Description: Imported as Composite from: J623-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 344270.674458009, 164039.31739751 m
Southeast corner: 344494.834458009, 163747.11739751 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 1192100

Dimensions
Composite Size (readings): 1868 x 2435
Survey Size (meters): 224 m x 292 m
Grid Size: 224 m x 292 m
X Interval: 0.12 m
Y Interval: 0.12 m

Stats
Max: 2.00
Min: -2.00
Std Dev: 1.04
Mean: 0.02
Median: 0.01
Composite Area: 6.55 ha
Surveyed Area: 3.5527 ha

Processes: 1
1 Base Layer

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

COMPOSITE
Filename: J623-mag-Area2-proc.xcp
Description: Imported as Composite from: J623-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 344152.126554841, 164065.711378572 m
Southeast corner: 344305.126554841, 163833.511378572 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 656900

Dimensions
Composite Size (readings): 1275 x 1935
Survey Size (meters): 153 m x 232 m
Grid Size: 153 m x 232 m
X Interval: 0.12 m
Y Interval: 0.12 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.36
Mean: 0.03
Median: 0.01
Composite Area: 3.5527 ha
Surveyed Area: 2.1359 ha

Processes: 1
1 Base Layer

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 High pass Uniform (median) filter: Window dia: 300
4 Clip from -3.00 to 3.00 nT

Area 3

COMPOSITE
Filename: J623-mag-Area3-proc.xcp
Description: Imported as Composite from: J623-mag-Area3.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 344167.324004395, 163799.290322661 m
Southeast corner: 344395.024004395, 163659.040322661 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 391100

Dimensions
Composite Size (readings): 1518 x 935
Survey Size (meters): 228 m x 140 m
Grid Size: 228 m x 140 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.50
Mean: 0.02
Median: 0.02
Composite Area: 3.1935 ha
Surveyed Area: 1.2268 ha

Processes: 1
1 Base Layer

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

A PDF copy will be supplied to the North Somerset Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

Geophysical data Area 1 - path: J623 Congresbury\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
congres1\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	30/07/15	D.J.Sabin
congres1\MX\J623-mag-Area1.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	30/07/15	D.J.Sabin
Area1\comps\J623-mag-Area1.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	30/07/15	D.J.Sabin
Area1\comps\J623-mag-Area1-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	30/07/15	D.J.Sabin
Geophysical data Area 2 - path: J623 Congresbury\Data				
congres2\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	31/07/15	D.J.Sabin
congres1\MX\J623-mag-Area2.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	31/07/15	D.J.Sabin
Area2\comps\J623-mag-Area2.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	31/07/15	D.J.Sabin
Area2\comps\J623-mag-Area2-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	31/07/15	D.J.Sabin
Geophysical data Area 3 - path: J623 Congresbury\Data				
congres3\MX\ .prm .dgb .disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	30/07/15	D.J.Sabin
congres3\MX\J623-mag-Area3.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	30/07/15	D.J.Sabin
Area3\comps\J623-mag-Area3.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	30/07/15	D.J.Sabin
Area3\comps\J623-mag-Area3-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	30/07/15	D.J.Sabin
Graphic data - path: J623 Congresbury\Data				
Area1\graphics\ J623-mag-Area1-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.		D.J.Sabin

Area1\graphics\ J623-mag-Area1-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.		D.J.Sabin
Area2\graphics\ J623-mag-Area2-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.		D.J.Sabin
Area2\graphics\ J623-mag-Area2-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.		D.J.Sabin
Area3\graphics\ J623-mag-Area3-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.		D.J.Sabin
Area3\graphics\ J623-mag-Area3-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.		D.J.Sabin
CAD data - path: J623 Congresbury\CAD				
J623 version 1.dwg	ProgeCAD 2014	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.		K.T.Donaldson
Text data - path: J623 Congresbury\Documentation				
J623 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.		K.T.Donaldson

Appendix E – copyright and intellectual property

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Survey location

Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Map of survey area

● Survey location

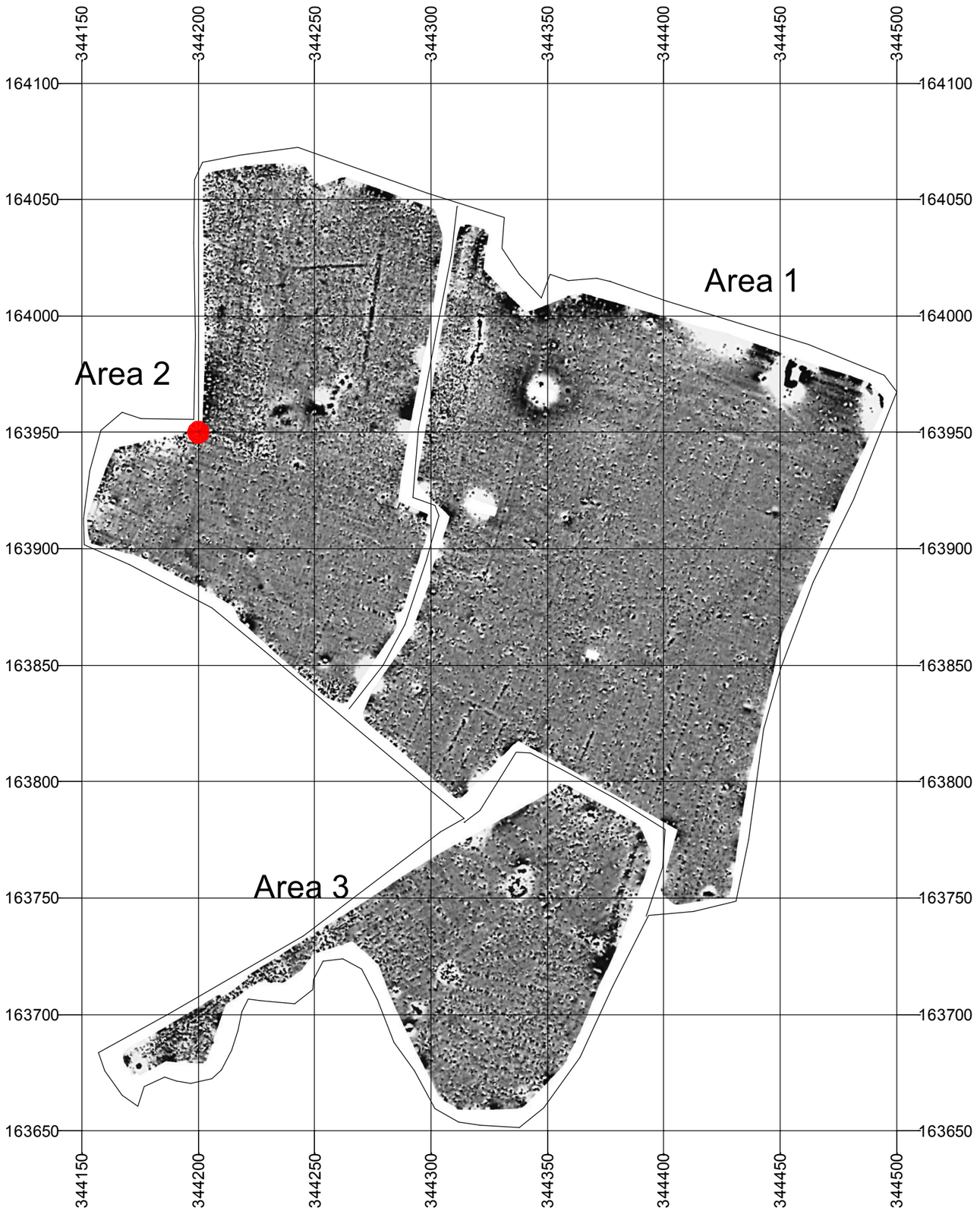
Site centred on OS NGR
ST 44320 63860

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01



Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

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

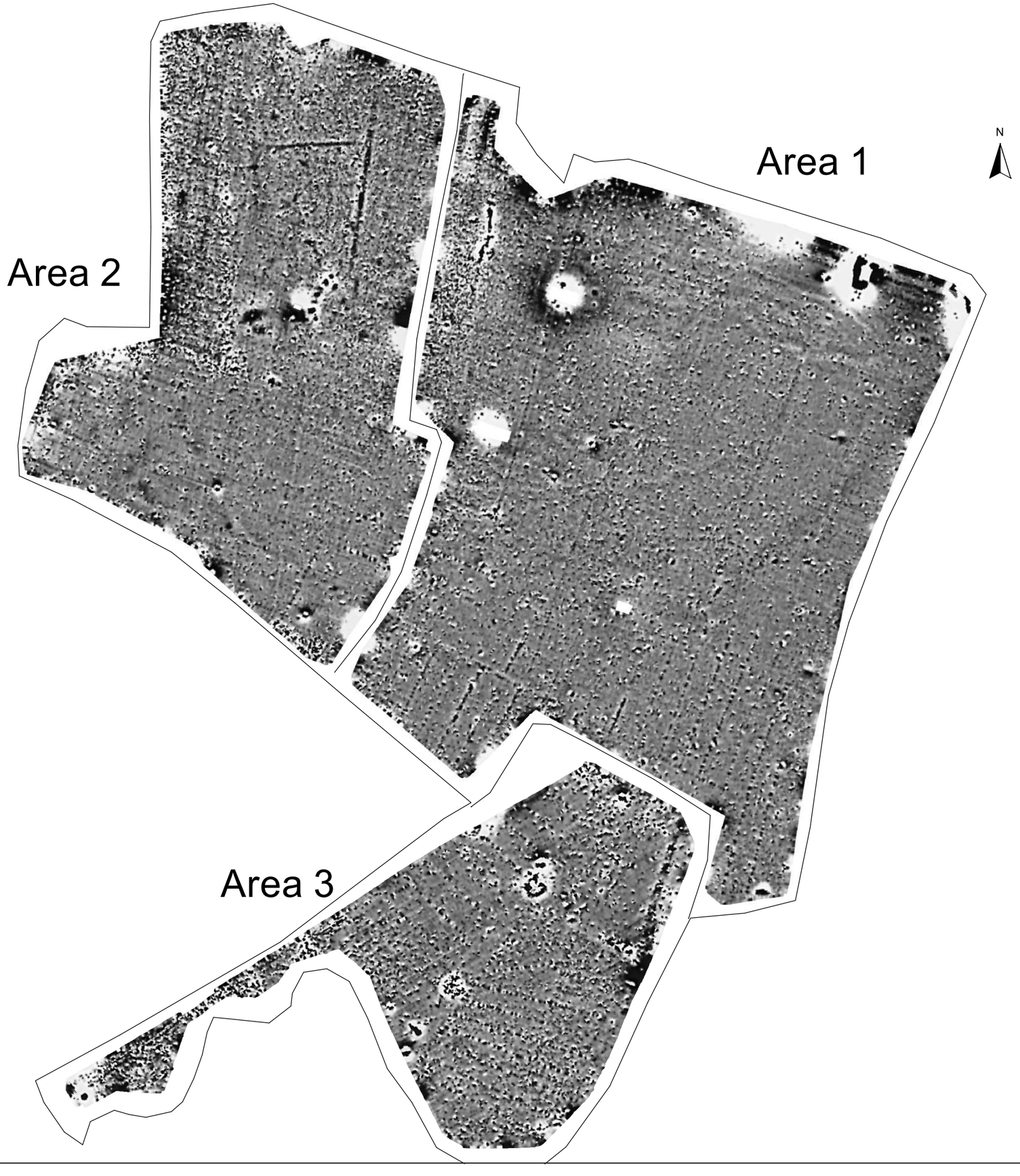
344200 163950

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

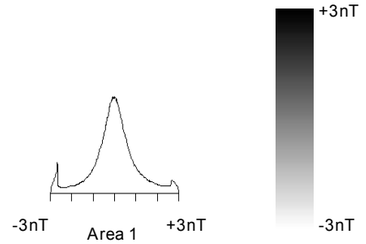
FIG 02



Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Greyscale plot of minimally processed magnetometer data



SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 03

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Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Abstraction and interpretation of magnetometer anomalies

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - strip field / cultivation boundary
- Positive linear anomaly - ceramic land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- 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

FIG 04

Area 1

2

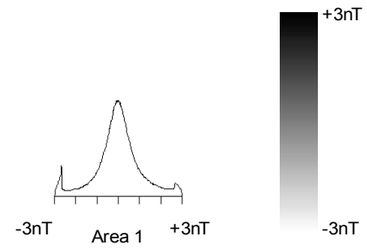
N

Area 3

Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Greyscale plot of minimally processed magnetometer data - Area 1



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Area 1

2

Area 3

N

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

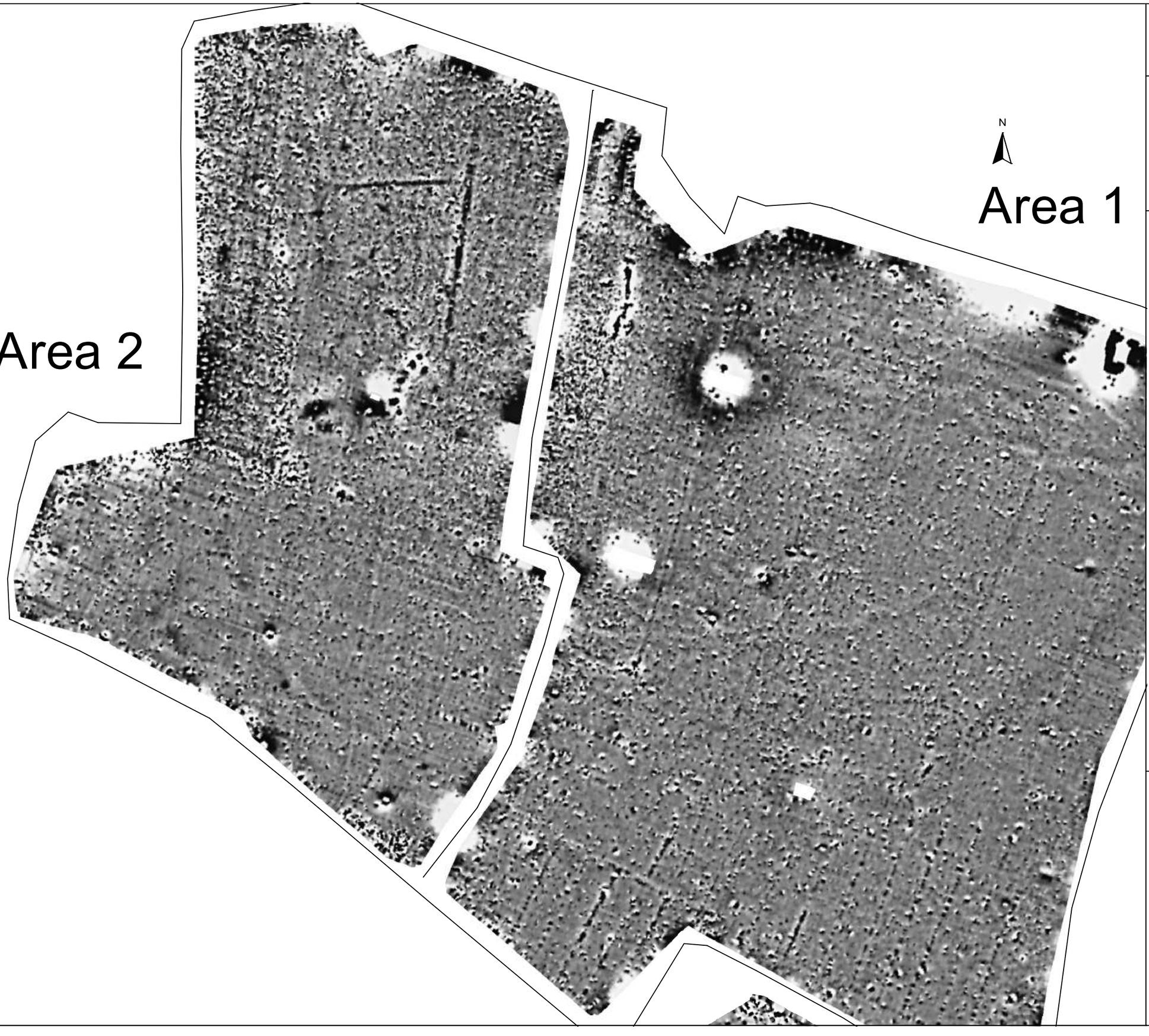
Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Abstraction and interpretation of magnetometer anomalies - Area 1

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - strip field / cultivation boundary
- Positive linear anomaly - ceramic land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

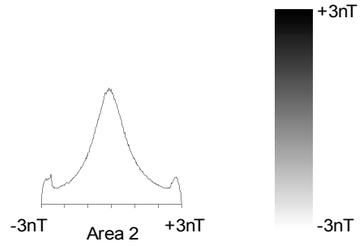
FIG 06



Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Greyscale plot of minimally processed magnetometer data - Area 2



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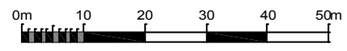

SCALE TRUE AT A3

FIG 07

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Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Abstraction and interpretation of magnetometer anomalies - Area 2

Area 1

Area 2

N

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - strip field / cultivation boundary
- Positive linear anomaly - ceramic land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- 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

FIG 08

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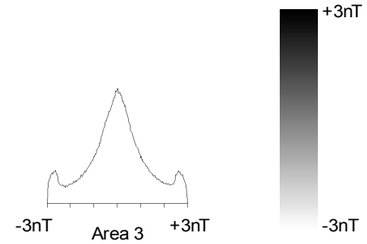
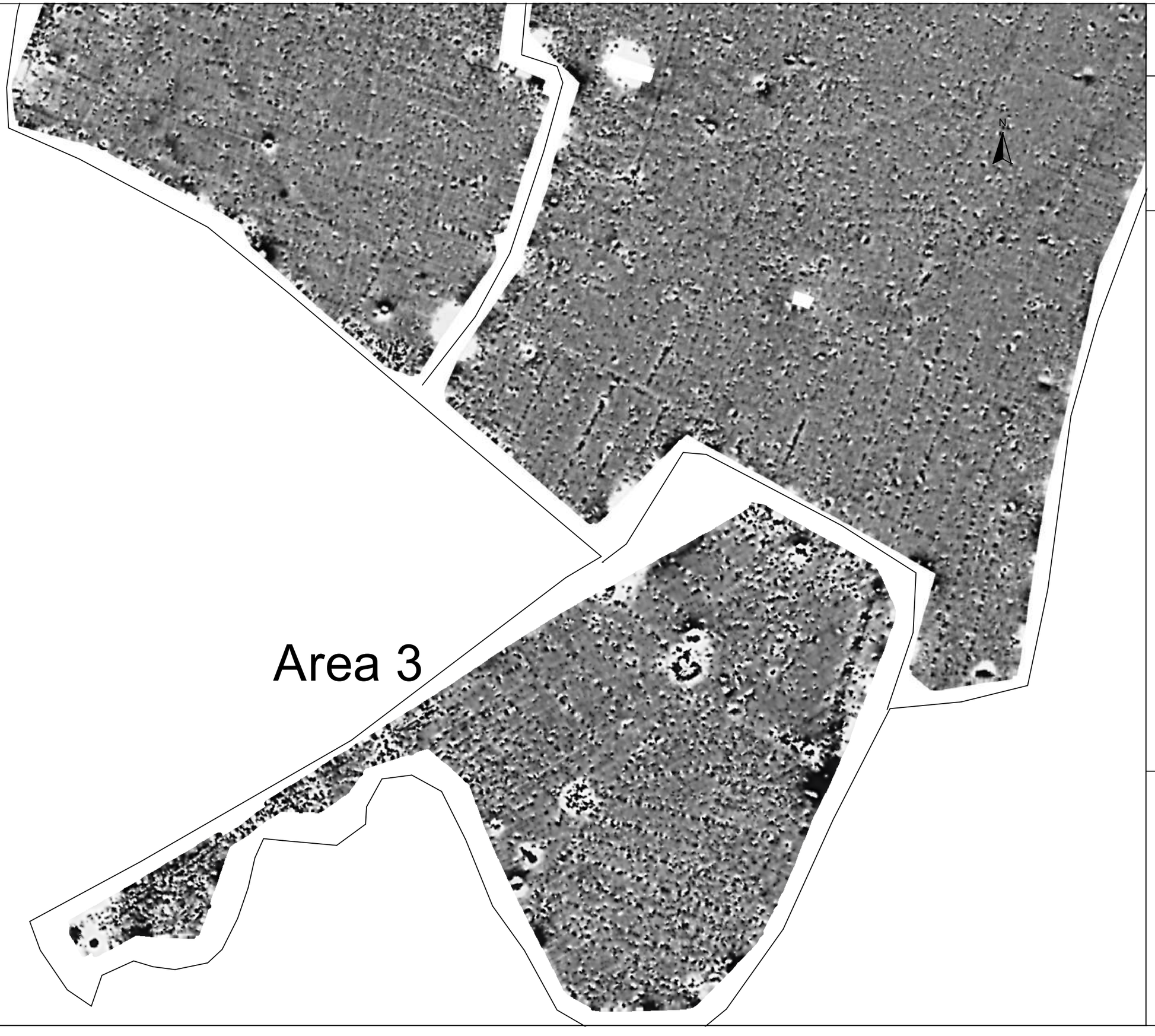
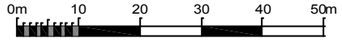
Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Greyscale plot of minimally processed magnetometer data





SCALE 1:1000



SCALE TRUE AT A3

FIG 09

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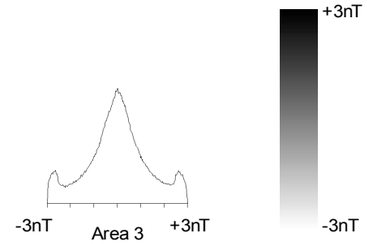
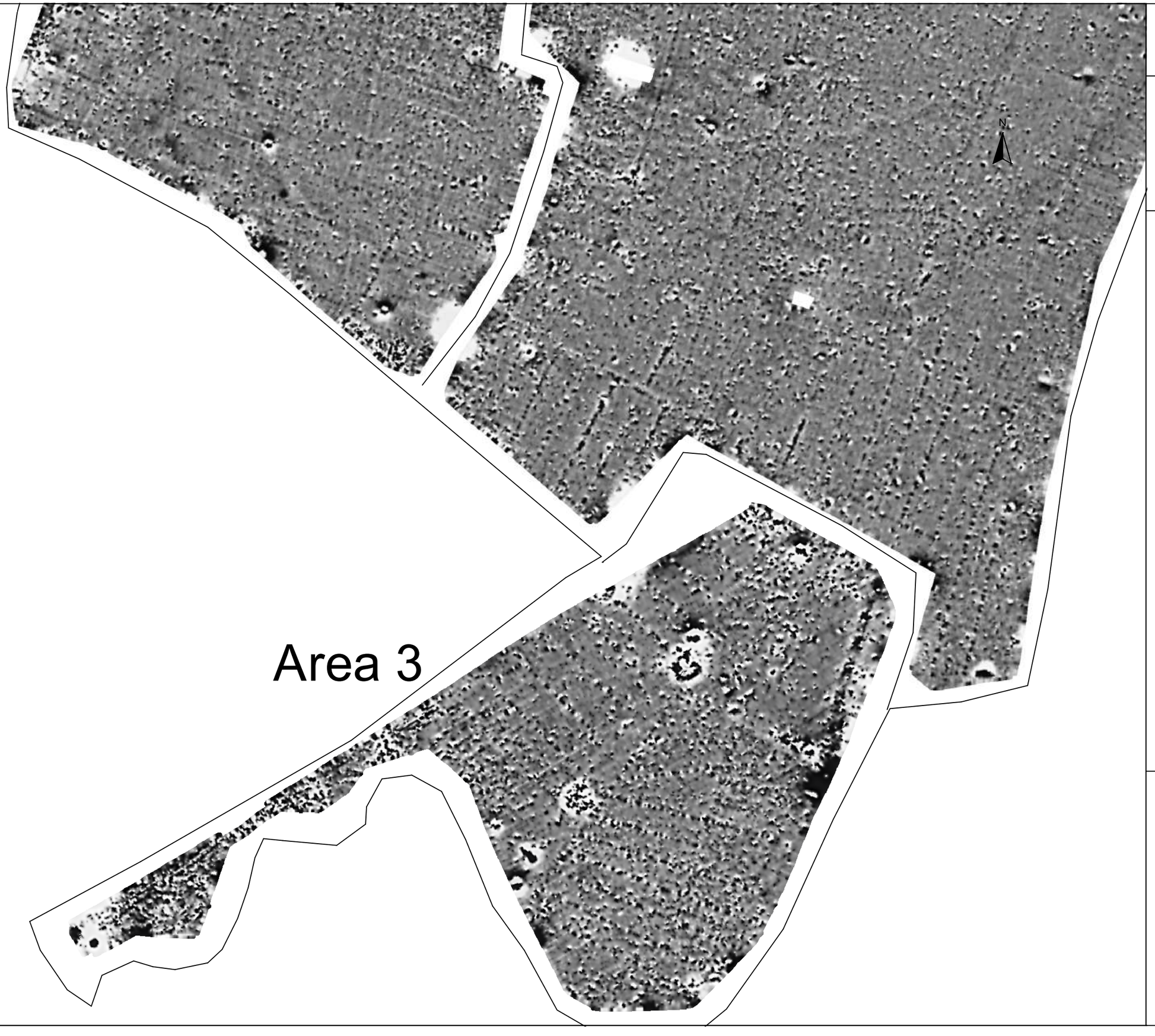
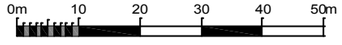
Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Greyscale plot of minimally processed magnetometer data





SCALE 1:1000



SCALE TRUE AT A3

FIG 09

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Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Abstraction and interpretation of magnetometer anomalies - Area 3

Area 3

N

11 12 13 2 4 21 23 22 10 13 9 27 26 31 28 29 30

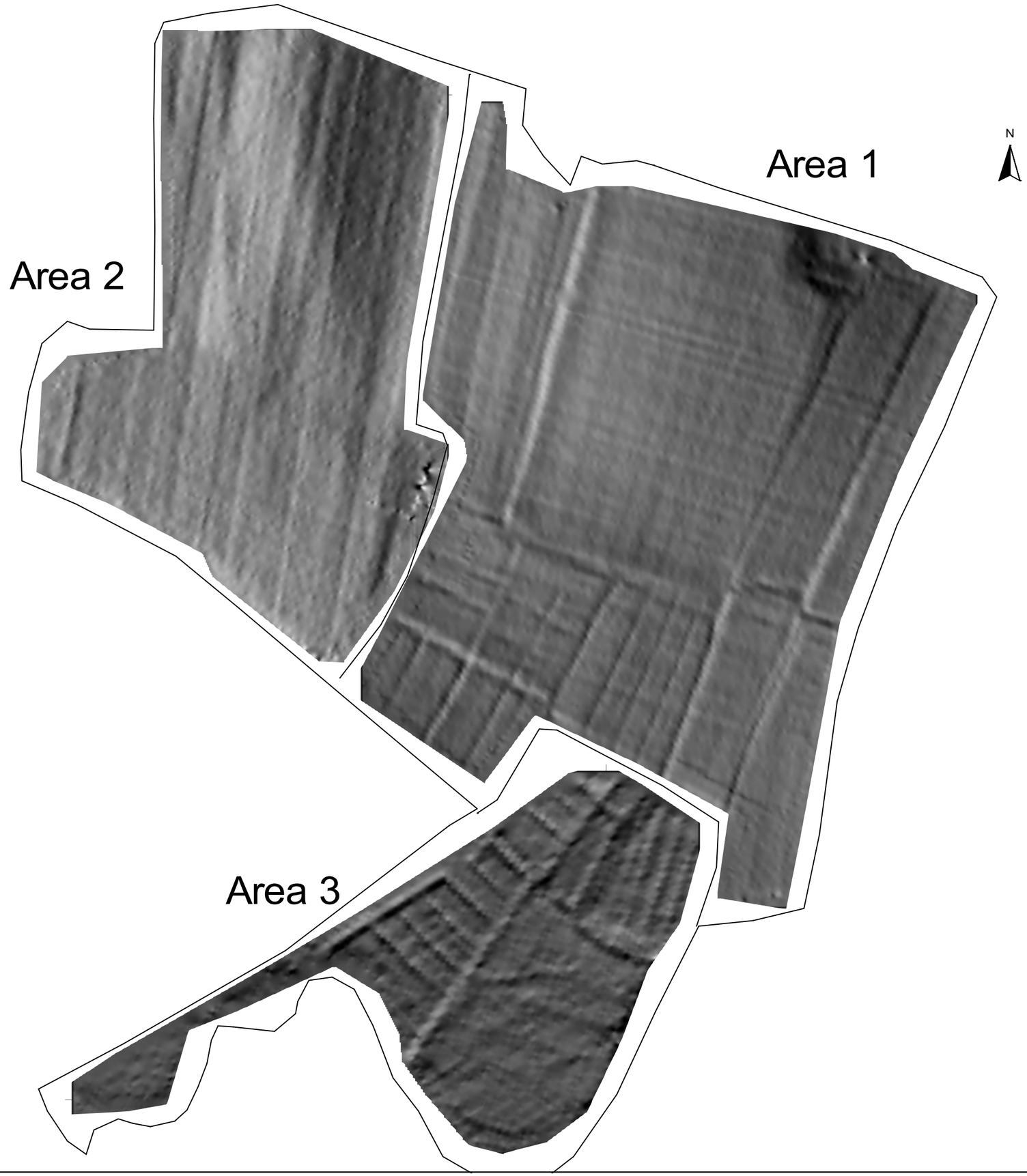
- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - ceramic land drain
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 10



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Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Shaded relief model

Height data collected using RTK GPS during magnetometer survey and converted from WGS84 to ODN plus antenna height of 1.5m using OSGM02

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 11

Archaeological Surveys Ltd

Geophysical Survey
Land off Cobthorn Way
Congresbury
North Somerset

Abstraction and interpretation of shaded relief features

- Boundary feature
- Linear ditch feature
- Ridge & Furrow / strip cultivation
- Depression - former pond?

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 12