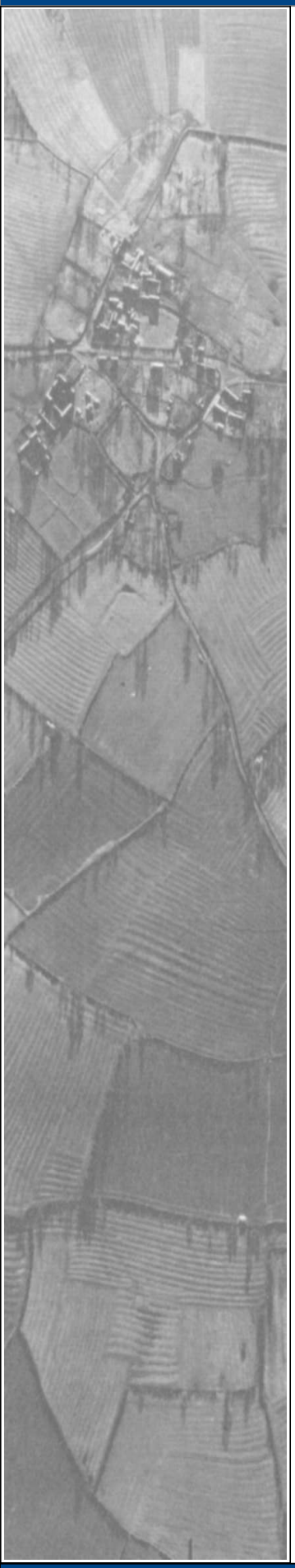

Land at Broadmayne
Dorset

MAGNETOMETER SURVEY REPORT

for

Southern Strategic Land LLP

Kerry Donaldson & David Sabin

October 2021

Ref. no. J879

ARCHAEOLOGICAL SURVEYS LTD

Land at Broadmayne
Dorset

MAGNETOMETER SURVEY REPORT

for

Southern Strategic Land LLP

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Report by Kerry Donaldson BSc (Hons)
Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

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Ordnance Survey Grid Reference – **SY 72355 86580**

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SUMMARY

Detailed magnetometry was carried out over 13ha at Broadmayne in Dorset by Archaeological Surveys Ltd. The results indicate the presence of a sub-circular enclosure on the higher ground, a 20m wide ring ditch likely to relate to a round barrow, and a number of rectilinear enclosures to the south west. A number of linear boundaries have also been located which may be associated with a former field system.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Southern Strategic Land LLP, at the request of the Environmental Dimension Partnership, to undertake a magnetometer survey of an area of land at Broadmayne in Dorset. The site has been outlined for a proposed residential development and the survey forms part of an archaeological assessment.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2021) and approved by Steve Wallis, Senior Archaeologist for Dorset Council, prior to commencing the fieldwork.

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) (updated 2020) *Standard and Guidance for Archaeological Geophysical Survey.*

1.3.2 Archaeological Surveys Ltd provide a detailed geophysical survey report and it is recommended that where possible the contents should be considered in full. The Summary provides a brief overview of the results with more detail available in the Discussion and/or Conclusion. The *List of anomalies* within the Results provides a detailed assessment of the anomalies within separate categories which can be useful in inferring a level of confidence to the interpretation. Quality and factors influencing the interpretation of anomalies is also set out within the results.

1.3.3 It is recommended that the full report should always be considered when using data and interpretation plots; where this is not possible, in the field for example, the abstraction and interpretation plots should retain their colour coding and be used with a corresponding legend.

1.3.4 Where targeting of anomalies by excavation is to be carried out, care should be taken to place trenches over solid lines or features visible on the abstraction and interpretation plots. Archaeological Surveys abstraction and interpretation avoids the use of dashed or dotted line formats, and broken or fragmented lines used in interpretive plots may well correspond closely with truncation of archaeological features.

1.4 Site location, description and survey conditions

1.4.1 The site is located on the western edge of Broadmayne in Dorset. It is centred on Ordnance Survey National Grid Reference (OS NGR) SY 72355 86580, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 13ha within two arable fields that had been recently harvested and contained stubble at the time of survey. These areas have been labelled Area 1 in the east and Area 2 in the west for the purposes of this report.

1.4.3 Area 1 has residential dwellings to the north east, south east and south west with Area 2 located to the north west. The boundary between the two areas is formed by a row of trees that lie along a ridge of comparatively high ground orientated north east to south west at a height of 70m above ODN. Area 1 slopes down to the south east into a dry valley at approximately 55m above ODN. The northern part of the field is crossed by a bridleway.

1.4.4 Area 2 is bounded by the A352 along its north eastern side with residential dwellings located along the northern part of the south eastern side and agricultural land to the north west, south west and south east. The field slopes down from 70m above ODN on the south eastern side into a dry valley at approximately 55m above ODN near the northern corner.

1.4.5 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during

the survey were fine and dry.

Plate 1: Survey Area 2 looking south west

1.5 Site history and archaeological potential

1.5.1 The Dorset Historic Environment indicates that site does not contain any designated or undesignated heritage assets; however, there are several in the immediate vicinity. These include a number of Bronze Age burials and barrows within 125-475m and the scheduled monument of Mayne stone circle (List entry no.1002697), located c175m north west of the site.

1.5.2 Evidence for Romano-British settlement has also been identified to the north of the southern land parcel (Area 1) with Roman pottery also found 250m to the north and evidence for a 3rd/4th century ditch containing building debris, located 350m to the east.

1.5.3 Evidence for medieval settlement includes five shrunken and deserted medieval settlements within 225-425m of the site, along with drove roads and former field boundaries, although it is likely that the site was within the agricultural hinterland of the village of Broadmayne during the medieval period. A number of post medieval chalk pits lie within the vicinity of the site, although none are recorded within it.

1.5.4 The Ordnance Survey map of 1888 shows that the site was subdivided by a drove road which was flanked by boundaries but which is now an unbounded bridleway.

1.6 Geology and soils

1.6.1 The underlying solid geology across the eastern and western parts of the site is from the Portsdown Chalk Formation with sand from the Poole Formation within the centre. Overlying head deposits of clay, sand, silt and gravel are also recorded along the eastern edge and north western corner of the site (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Andover 2 association which is a brown rendzina. It consists of a shallow, well drained, calcareous, silty soil over chalk (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.

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 ±5nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

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

2.3.5 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on processing.

2.3.6 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. With regard to the Sensys MXPDA, minimally processed data are considered by the manufacturer to be data that are compensated by SENSYS MAGNETO DLMGPS software, see 2.3.1 and 2.3.2. Note: traceplots are not considered to be appropriate as they do not provide an accurate or useful assessment of the magnetic anomalies due to the very high density of data collection. In addition, traceplots cannot be meaningfully plotted against base mapping and in areas of complexity traces may be lost or highly confused. Traceplots may be used to demonstrate characteristic magnetic profiles across discrete features where it is considered beneficial.

2.3.7 The raster images are combined with base mapping using ProgeCAD Professional 2021, creating DWG (2018) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GNSS, resection method, etc.

2.3.8 An abstraction and interpretation is drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing. Appendix E sets out CAD layer names with colour and graphic content for each interpretation category, see 3.3.

2.3.9 A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within the site which is considered as a whole.

2.3.10 A digital archive is produced with this report, see Appendix D below. The main archive is held at the offices of Archaeological Surveys Ltd.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of 2 survey areas covering approximately 13ha.

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 land management, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines. Anomalies located within each survey area have been numbered and are described in 3.4 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. Localised zones of magnetic disturbance in the vicinity of buried services have obscured a small section of an anomaly considered likely to have archaeological potential. It is possible that other weak or discrete anomalies within the vicinity of highly magnetic services have been obscured.

3.2.2 Magnetic debris relating to fragments of magnetic material is widespread across the site and may have been spread with manure or as part of soil conditioning, the material may also relate to spreads of dumped material and areas of former burning. The most dense areas have the potential to obscure weakly magnetic features if they area present.

3.2.3 The results demonstrate the presence of useful magnetic contrast between the fill of former cut features of anthropogenic origin and the surrounding soil or subsoil. Naturally formed anomalies are also present within the site although these are localised and unlikely to be confused with anomalies 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	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches) although with field systems there may also be an associated negative response to linear banks. 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.
Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, hearths and nail spreads from former wooden structures or rooves and may, therefore, be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.
Anomalies with a natural origin	Naturally formed magnetic anomalies are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to anomalies within more solid geology.
Anomalies associated with quarrying	Magnetically variable anomalies which may be negative indicating a response to geology/drift deposits and/or positive indicating an increased depth of topsoil. Very strongly magnetic anomalies are a response to highly magnetic material of modern origin which can be used to infill a quarry depression. It should be considered that former quarry pits may be of archaeological potential.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Site centred on OS NGR 372355 86580, see Figs 03 – 14.

Anomalies of archaeological potential

(1) – Situated in the central part and towards the highest point of the site, and dissected by a modern field boundary and a pipe/cable, is a sub-circular enclosure

with dimensions of 65m by 60m. It appears to relate to a double-ditched enclosure with an internal bank, with the north eastern section of the outer ditch appearing to have been partly truncated or removed by later activity. It contains a number of discrete positive responses which are likely to relate to pits and/or have an association with burning. It has a south east facing and 3.5m wide entrance which may be aligned on anomaly (6) situated 140m to the south east down the slope.

(2) – A weakly positive curvilinear anomaly in Area 2 may relate to a cut feature which may have truncated enclosure (1).

(3) – A positive curvilinear anomaly which extends towards and appears to partly truncate anomaly (1). It appears to surround a number of pits and a rectilinear feature appears to be joined to the southern end. Other anomalies within this area are weak and uncertain in origin.

(4) – Situated 100-150m to the south of enclosure (1) in Area 1 are a number of rectilinear enclosures. A number of other linear and discrete anomalies are associated with them.

(5) – A weakly positive rectilinear anomaly is situated 75m to the west of enclosures (4) and appears to relate to a further rectangular enclosure. A number of pit-like anomalies are situated within the interior, but it is not clear if they have archaeological potential or if they relate to naturally formed features.

(6) – A positive curvilinear anomaly forming a ring ditch with an exterior diameter of 20m is located in Area 1. The ring ditch is situated half way down the south east facing slope and is likely to relate to a Bronze Age round barrow ditch.

(7) – Positive linear anomalies situated in the western part of the site (Area 2) could be associated with the field system (13), or possibly a trackway.

Anomalies of uncertain origin

(8) – Negative anomalies appear to extend towards and into enclosures (4). Although the anomalies are not clearly defined, they could be associated with former holloways or surfaces associated with movement of animals into the enclosure, suggesting that they were used as stock enclosures.

(9) – Broad positive and negative anomalies appear to extend eastwards from enclosures (4) and could also be associated with the movement of animals.

(10) – Situated within the north western part of the site in Area 2 is a broad, weakly positive anomaly. It is possible that it is associated with the field system (13); however, it has a more sinuous, possibly fragmented, curvilinear form.

(11) – A number of weakly positive and discrete anomalies can be seen close to anomaly (3) in Area 2. It is possible that some are associated with linear anomalies (7), but they generally lack a coherent morphology.

(12) – Both survey areas contain a number of positive and negative linear and discrete positive responses. They are generally weak and lack a coherent morphology preventing confident interpretation.

Anomalies associated with land management

(13) – The site contains a number of broad positive and negative anomalies as well as narrow, positive linear responses that are parallel and orthogonal to them. They are likely to relate to former land division associated with a field system.

(14) – A broad positive and negative response corresponds to a low bank in the field and relates to a formerly mapped field boundary.

(15) – Magnetic debris and linear anomalies can be seen towards the centre of the site within Area 1. These are associated with a formerly mapped drove road (Broomhill Drove) that extended through the site from at least the 19th century until the 1960s/70s and now exists as a bridleway.

Anomalies associated with quarrying

(16) – The eastern and western parts of the site contain a number of discrete positive responses, often situated in rows or clusters. These lie on the bands of chalk within these parts of the site and relate to former extraction pits. However, they do not have a surface expression, are not associated with modern ferrous infill and could well relate to pits of some antiquity.

Anomalies with a natural origin

(17) – Magnetically variable responses can be seen in the southern part of Area 2 in the south west of the site. A large zone appears to be situated within the confines of enclosure (5) with a smaller area to the north east. Although there are a number of more pit-like responses of uncertain origin within them, the response is likely to relate to natural variations within the underlying geology. This is mapped as the edge of the Portsdown Chalk within this part of the site.

(18) – Two dipolar linear anomalies are located in the central part of Area 2. This type of response is usually indicative of lightning strikes.

Anomalies associated with magnetic debris

(19) – Situated in the far south western corner of the site (Area 2) are patches of magnetic debris and disturbance. This is likely to relate to modern material dumped within an infilled pond that was mapped in this area during the 19th and 20th centuries.

(20) – The eastern edge of the site contains large zones of magnetic debris which may relate to dumped material that has become more widespread through cultivation.

Anomalies with a modern origin

(21) – A strong, multiple dipolar anomaly relates to a buried pipe that extends along the northern edge of Area 2 where it then veers to the south east towards the field boundary. It either reappears 110m further to the south west where it crosses, or is crossed by another service (22) and continues into the field for another 70m where it appears to ends abruptly at a formerly mapped field boundary which has left no response.

(22) – A strongly positive linear anomaly with associated negative response either side extends along the north eastern edge of Area 2 and then south westwards into Area 1. It has truncated and partially obscured the full extent of enclosure (1) due to the associated magnetic disturbance. This type of response may be associated with a cable rather than a pipe, although this is uncertain.

(23) – A service/pipe extends through the eastern part of Area 1.

4 CONCLUSION

4.1.1 The geophysical survey located a number of anomalies with archaeological potential within the site. In the centre of the site, on the higher ground and crossing between both survey areas, is a sub-circular double-ditched enclosure. It appears to have a possible associated internal bank and a number of pits are evident within the confines of the enclosure. It has been truncated by a modern field boundary and service, which has partially obscured the full extent of the feature. A curvilinear anomaly appears to extend towards it and possibly partly truncate it. The enclosure has a south east facing entrance which may be aligned on a ring ditch, relating to a round barrow, situated 140m down slope to the south east.

4.1.2 A number of rectilinear anomalies have been located along the south western side of the site and there could be an association with the movement of animals within and to and from them indicating that they may relate to stock enclosures. A number of pits and other linear and curvilinear anomalies have also been located in the vicinity and they could indicate occupation.

4.1.3 Elsewhere within the site there are a number of linear responses that are likely to be associated with former field boundaries indicating a field system that generally pre-dates the existing or formerly mapped field boundaries.

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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.

High Pass Filter

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

Zero Median/Mean Traverse

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

conditions and results in improperly aligned fluxgate sensors and/or electronic adjustment values.

Appendix C – survey and data information

Area 1 minimally processed data

Filename: J879-mag-Area1-proc.xcp
Description: Imported as Composite from: J879-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 372156.94, 86654.87 m
Southeast corner: 372634.09, 86344.07 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Dimensions
Survey Size (meters): 477 m x 311 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 1870464, Recorded: 1870464
Stats
Max: 5.53
Min: -5.50
Std Dev: 2.41
Mean: 0.00
Median: 0.05
Composite Area: 14.83 ha
Surveyed Area: 6.3632 ha
PROGRAM
Name: TerraSurveyorPre
Version: 3.0.36.24
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -5.00 to 5.00

Area 1 filtered data

Stats
Max: 5.53
Min: -5.50
Std Dev: 2.24
Mean: -0.01
Median: 0.02
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Clip from -5.00 to 5.00

Area 2 minimally processed data

Filename: J879-mag-Area2-proc.xcp
Northwest corner: 372051.52, 86864.53 m
Southeast corner: 372516.37, 86523.73 m
Survey Size (meters): 465 m x 341 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 1795366, Recorded: 1795366
Stats
Max: 5.53
Min: -5.50
Std Dev: 2.01
Mean: 0.06
Median: 0.03
Composite Area: 15.842 ha
Surveyed Area: 6.6389 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 Clip from -5.00 to 5.00

Area 2 filtered data

Stats
Max: 5.53
Min: -5.50
Std Dev: 1.91
Mean: 0.06
Median: 0.02
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to UTM).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 300
5 Clip from -5.00 to 5.00

Appendix D – digital archive

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

A PDF copy will be supplied to the Dorset Historic Environment Record with greyscale images and abstraction layers made available on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J879-mag-**[area number/name]**.asc J879-mag-**[area number/name]**.xcp J879-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J879-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J879-**[version number]**.dwg	CAD file in 2018 dwg format
Report	J879 report.odt	Report text in LibreOffice odt format

Table 2: Archive metadata

Appendix E – CAD layers for abstraction and interpretation plots

The table below sets out Archaeological Surveys Ltd CAD layer names with associated colours and graphical content. Where CAD files are available layers may be extracted for further CAD/GIS use. Note: hatched polygon boundaries are contained within layers with the RGB colour code 254, 255, 255 (near white) in order to prevent their visibility.

Report sub-heading and associated CAD layer names	Colour with RGB index	Layer content
Anomalies with archaeological potential		
AS-ABST MAG POS DISCRETE ARCHAEOLOGY	Red 255,0,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS ARCHAEOLOGY	Red 255,0,0	Polygon (cross hatched ANSI37)
AS-ABST MAG POS LINEAR ARCHAEOLOGY	Red 255,0,0	Polyline or polygon (solid)
AS-ABST MAG POS CURVILINEAR RING DITCH	Magenta 255,0,255	Polyline or polygon (solid)
AS-ABST MAG NEG ARCHAEOLOGY	127,0,255	Polygon (hatched ANSI31)
AS-ABST MAG POS ENCLOSURE DITCH	127,0,255	Line, polyline or polygon (solid)
Anomalies with an uncertain origin		
AS-ABST MAG POS LINEAR UNCERTAIN	255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG NEG LINEAR UNCERTAIN	Blue 0,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN	255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG NEG DISCRETE UNCERTAIN	Blue 0,0,255	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN	255,127,0	Polygon (cross hatched ANSI37)
AS-ABST MAG NEG UNCERTAIN	Blue 0,0,255	Polygon (cross hatched ANSI37)
Anomalies relating to land management		
AS-ABST MAG BOUNDARY	127,0,0	Line, polyline or polygon (solid or cross hatched ANSI37)
AS-ABST MAG PATH/ROAD/TRACK	0, 153,153	Line, polyline or polygon (solid or partly cross hatched ANSI38)
Anomalies associated with magnetic debris		
AS-ABST MAG DEBRIS	132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR	132, 132, 132	Solid donut, point or polygon (solid)
Anomalies with a modern origin		
AS-ABST MAG DISTURBANCE	132, 132, 132	Polygon (hatched ANSI31)
AS-ABST MAG SERVICE	132, 132, 132	Line or polyline
Anomalies with a natural origin		
AS-ABST MAG NATURAL FEATURES	Yellow 255,255,0	Polygon (cross hatched ANSI37)
Anomalies associated with quarrying		
AS-ABST MAG QUARRYING	255,159,127	Polygon (net)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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

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

Survey location

Archaeological Surveys
Specialist Geophysical Surveyors

Geophysical Survey
Land at Broadmayne
Dorset

Map of survey area

Survey location

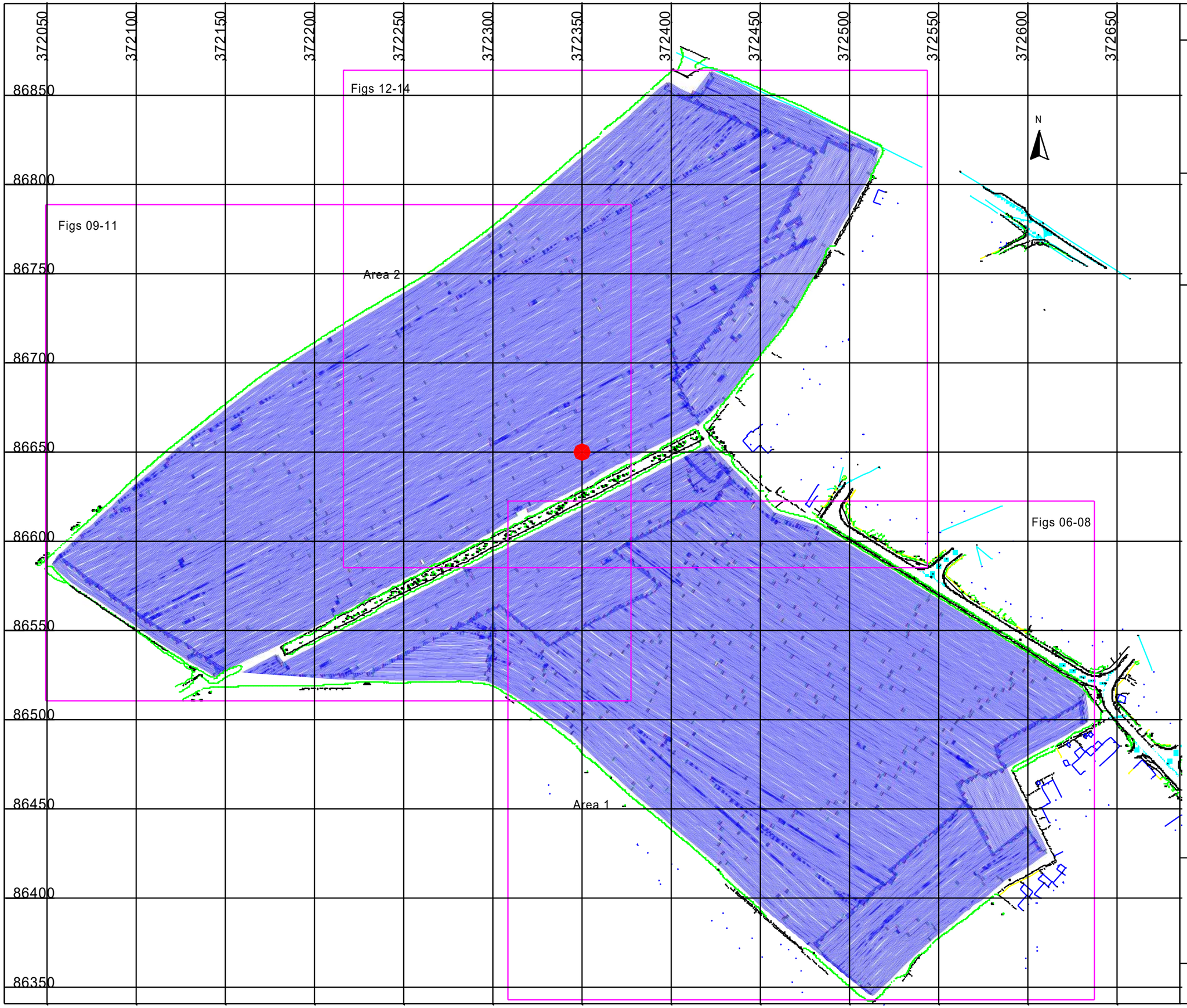
Site centred on OS NGR
SY 72355 86580

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02



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Dorset

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

372350 86650

Survey tracks

Survey track start

Survey track stop

SCALE 1:2000

0m 10 20 30 40 50m

KTD	DJS	FIG 02

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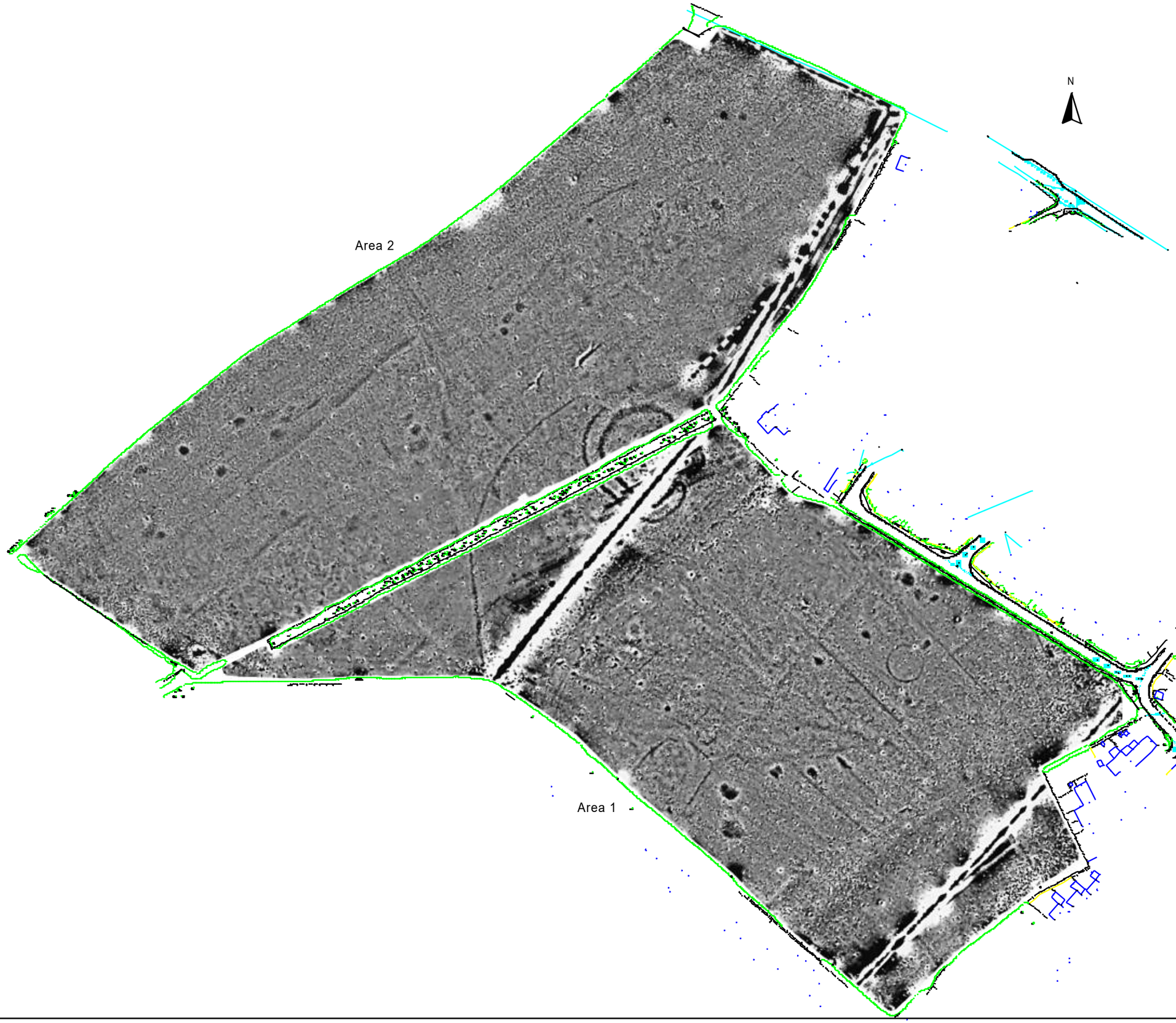
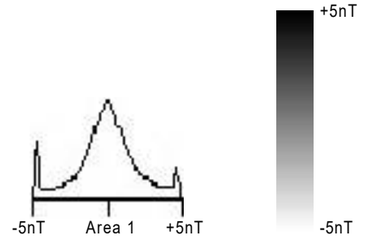
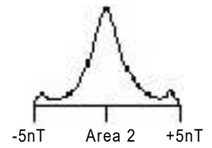
Land at Broadmayne
Dorset

Greyscale plot of minimally processed magnetometer data







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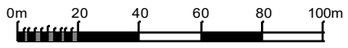

KTD	DJS	FIG 03

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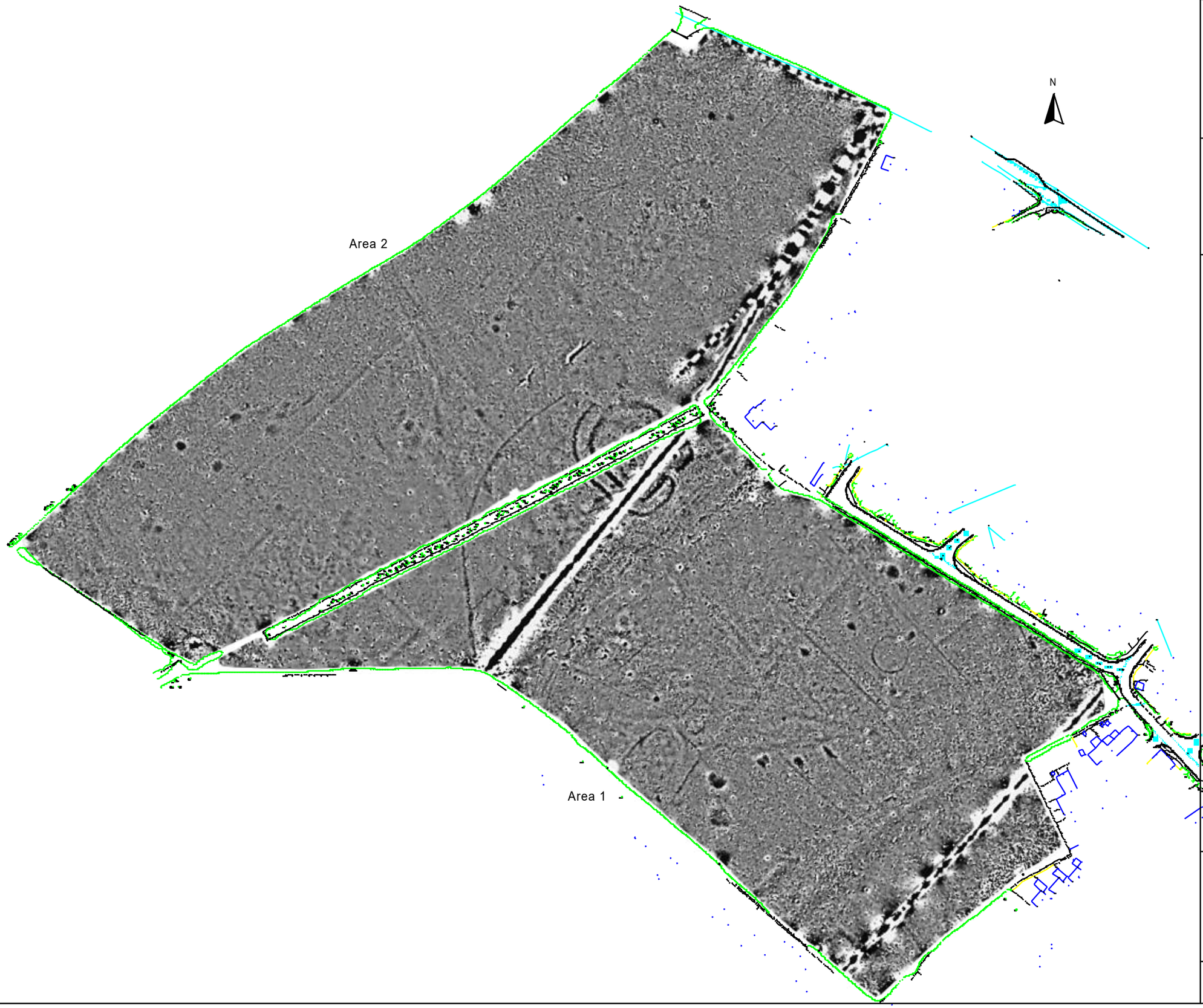
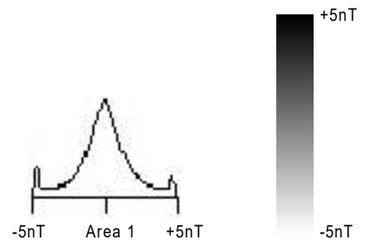
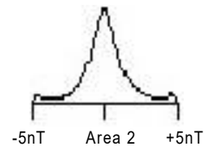
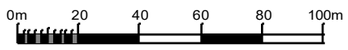
Greyscale plot of filtered magnetometer data







SCALE 1:2000



KTD	DJS	FIG 04

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Dorset

Abstraction and interpretation of magnetic anomalies

- Positive linear anomaly - cut feature of archaeological potential
- Positive curvilinear anomaly - ring ditch
- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Negative anomaly - associated with former road/track
- Positive anomaly - field system boundary
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - of uncertain origin
- Discrete positive response - cut feature/burnt area of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - material of low magnetic susceptibility of archaeological potential
- Magnetically variable response - field system boundary
- Magnetically variable response - formerly mapped boundary
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Positive response - former chalk extraction pit
- Variable magnetic response - of natural origin
- Dipolar response - lightning strike
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

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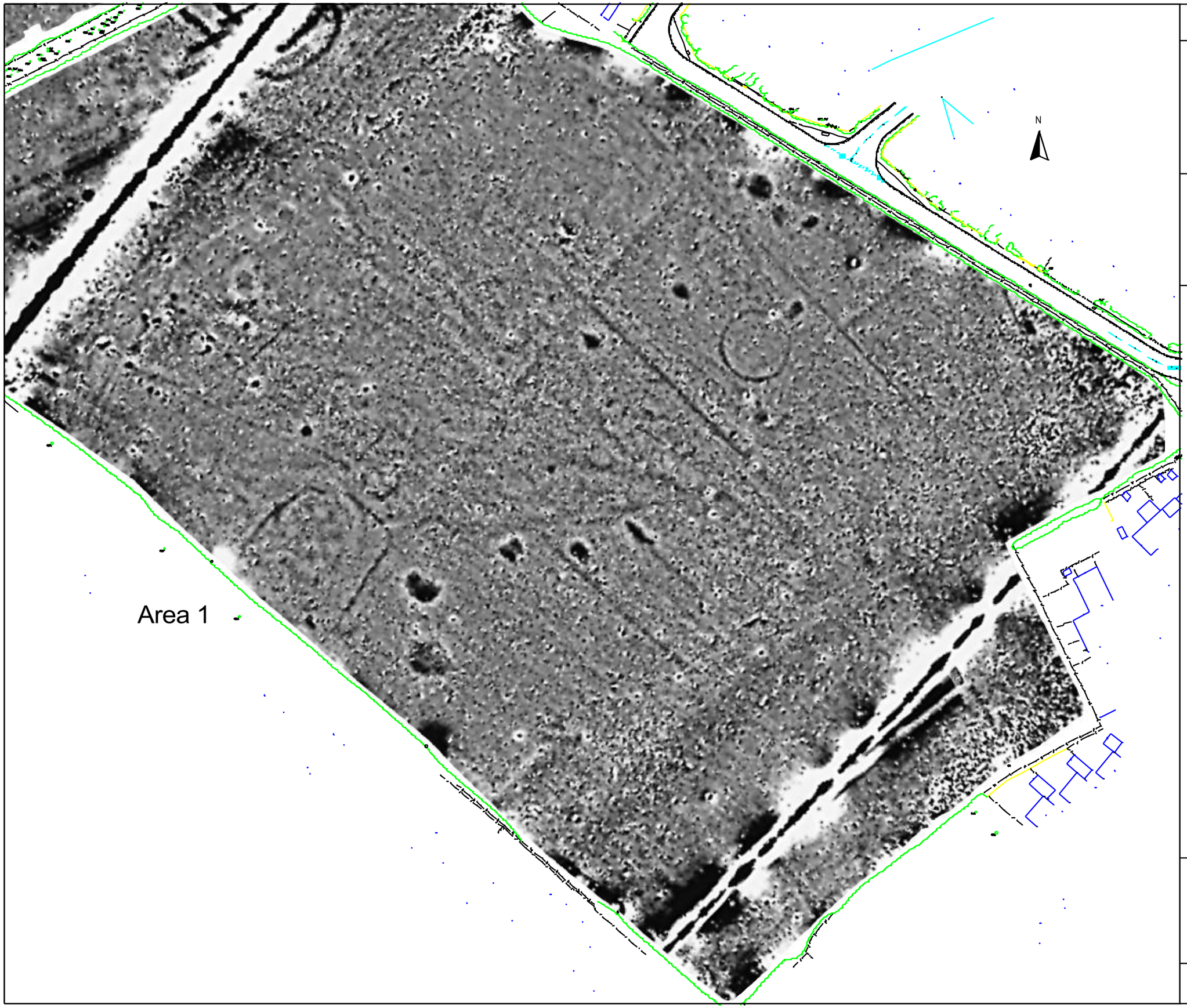
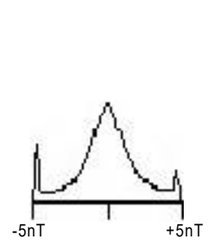
Dorset

Greyscale plot of minimally processed magnetometer data - Area 1





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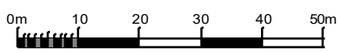

KTD	DJS	FIG 06

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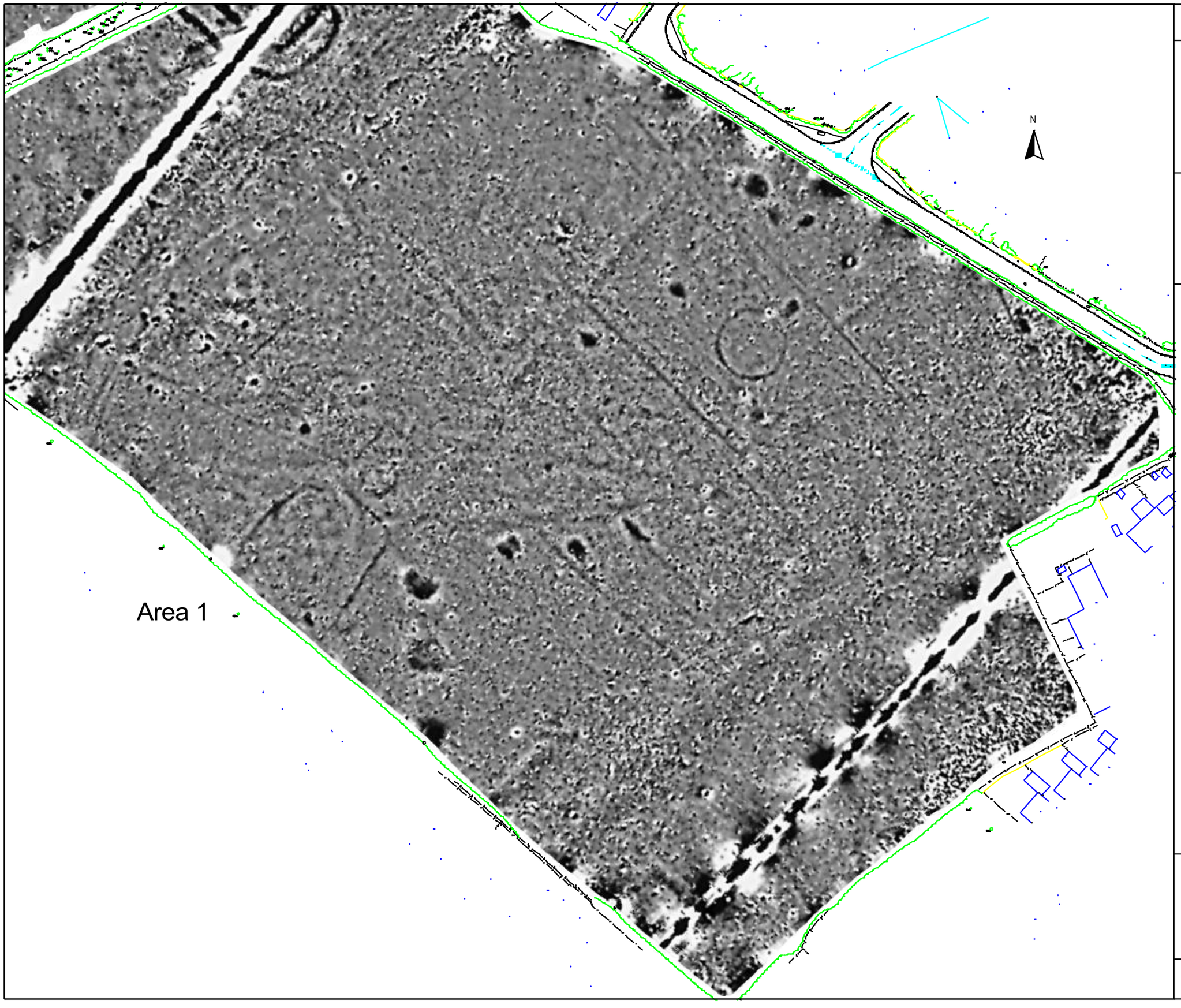
Dorset

Greyscale plot of filtered magnetometer data - Area 1



+5nT
-5nT
-5nT
+5nT

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 07

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Dorset

Abstraction and interpretation of magnetic anomalies - Area 1

N

Area 1

15
13
6
13
20
8
9
14
4
15
23
12

- Positive linear anomaly - cut feature of archaeological potential
- Positive curvilinear anomaly - ring ditch
- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Negative anomaly - associated with former road/track
- Positive anomaly - field system boundary
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - of uncertain origin
- Discrete positive response - cut feature/burnt area of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - material of low magnetic susceptibility of archaeological potential
- Magnetically variable response - field system boundary
- Magnetically variable response - formerly mapped boundary
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Positive response - former chalk extraction pit
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08

Area 2

N

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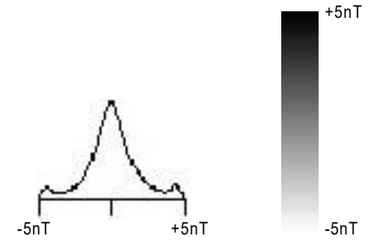
Dorset

Greyscale plot of minimally processed magnetometer data - Area 2 south



SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 09

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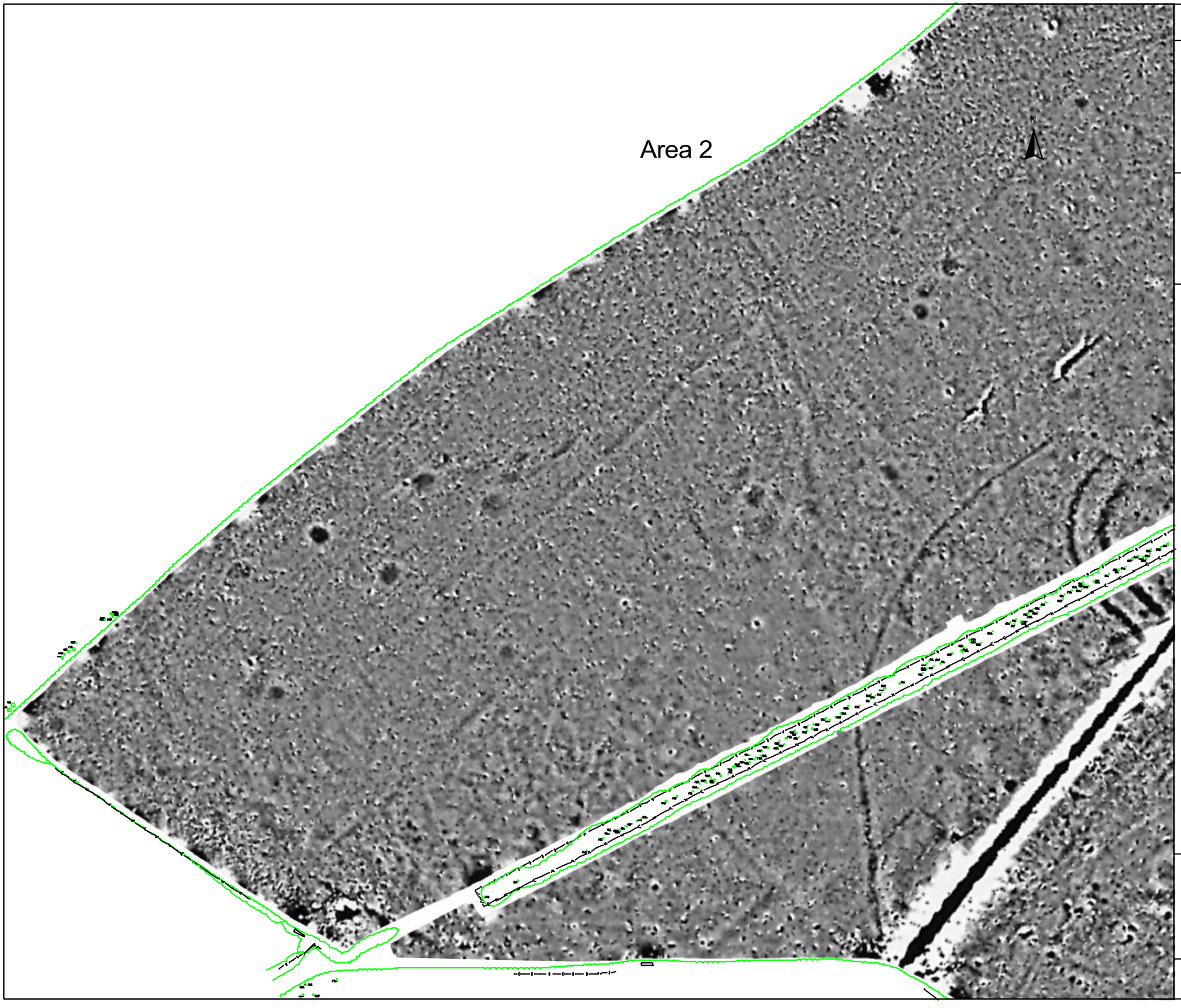
Greyscale plot of filtered magnetometer data - Area 2 south



-5nT +5nT

+5nT -5nT

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 10

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Geophysical Survey
Land at Broadmayne
Dorset

Abstraction and interpretation of magnetic anomalies - Area 2 south

Area 2

N

10

7

18

2

13

16

1

11

3

17

19

5

- Positive linear anomaly - cut feature of archaeological potential
- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - of uncertain origin
- Discrete positive response - cut feature/burnt area of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - material of low magnetic susceptibility of archaeological potential
- Magnetically variable response - field system boundary
- Positive anomaly - magnetically enhanced material
- Positive response - former chalk extraction pit
- Variable magnetic response - of natural origin
- Dipolar response - lightning strike
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 11

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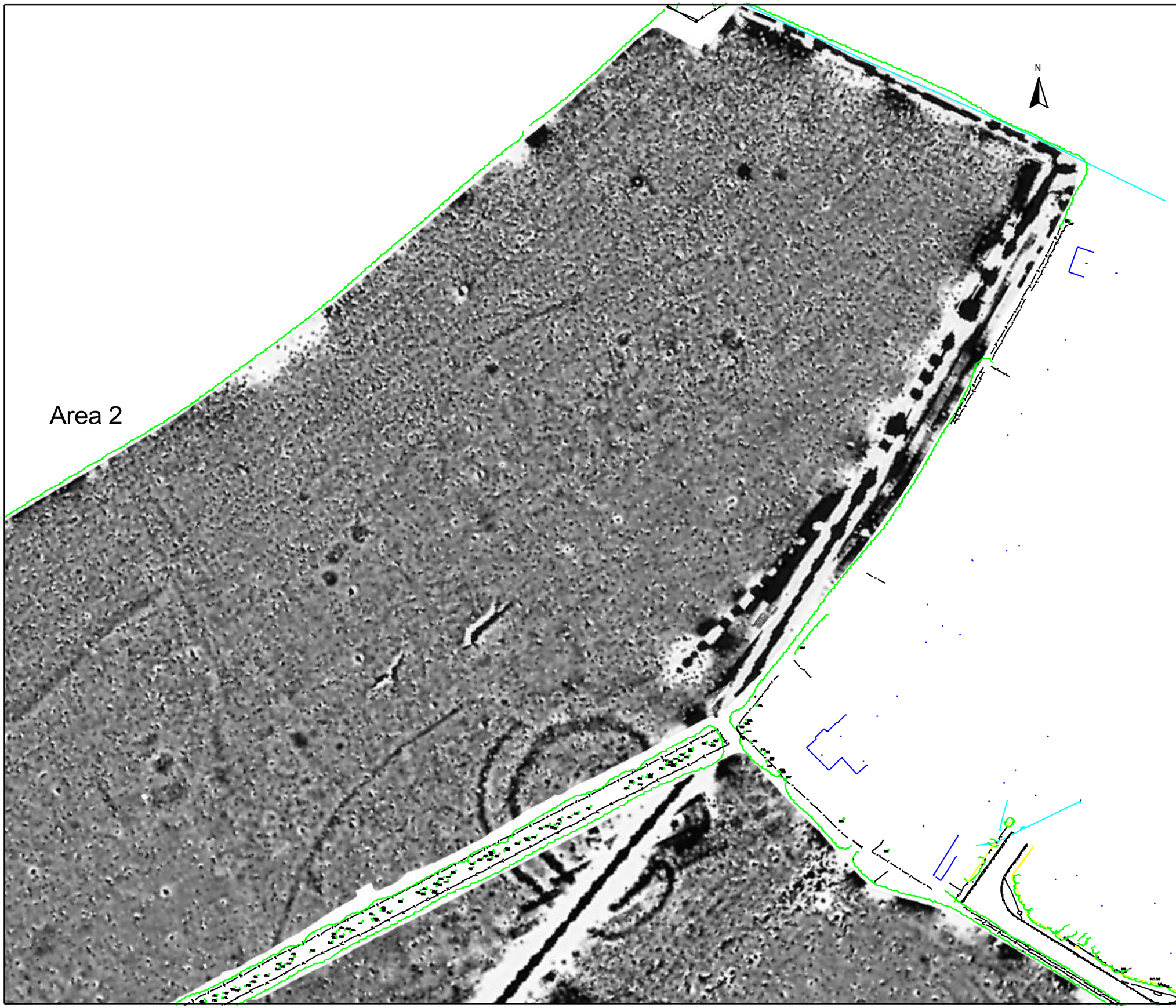
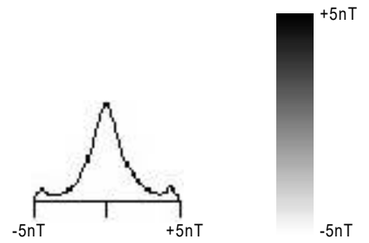
Greyscale plot of minimally processed magnetometer data - Area 2 north





SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 12

Area 2

N

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Land at Broadmayne
Dorset

Greyscale plot of filtered magnetometer data - Area 2 north

+5nT

-5nT +5nT

-5nT

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 13

Archaeological Surveys
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Dorset

Abstraction and interpretation of magnetic anomalies - Area 2 north

Area 2

21
10
12
22
7
18
2
21
13
1
3
11
15

N

- Positive linear anomaly - cut feature of archaeological potential
- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - of uncertain origin
- Discrete positive response - cut feature/burnt area of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - material of low magnetic susceptibility of archaeological potential
- Magnetically variable response - field system boundary
- Positive anomaly - magnetically enhanced material
- Positive response - former chalk extraction pit
- Variable magnetic response - of natural origin
- Dipolar response - lightning strike
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 14