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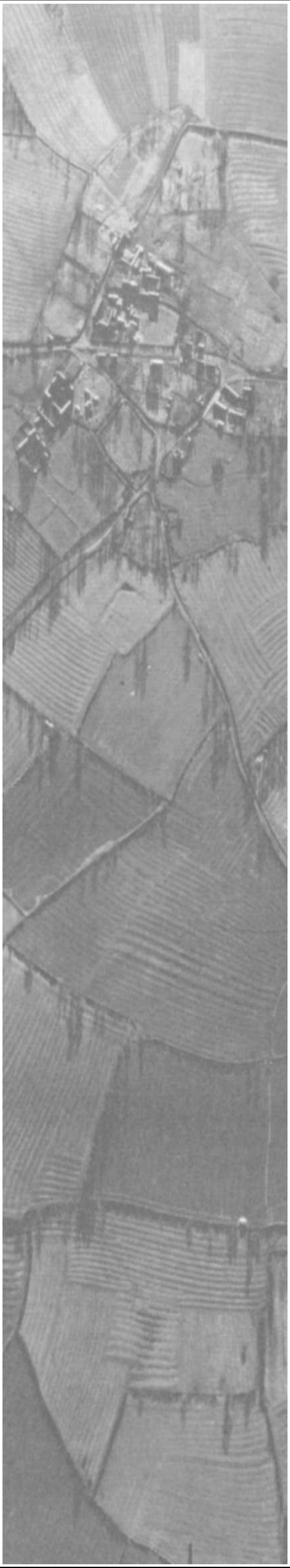

Bunkers Hill Solar Farm
Rotherwick
Hampshire

MAGNETOMETER SURVEY REPORT

for

JBM Solar Projects 18 Ltd

Kerry Donaldson & David Sabin

October 2020

Ref. no. J827

ARCHAEOLOGICAL SURVEYS LTD

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Survey dates – 20th to 24th July, 3rd, 4th, 7th, 15th, 21st & 22nd September 2020
Ordnance Survey Grid Reference – **SU 73265 56660**

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SUMMARY

Archaeological Surveys Ltd carried out a geophysical survey on land at Bunkers Hill Farm in Rotherwick, Hampshire, ahead of a proposed solar farm development. Detailed magnetometry was used within the site and this located a number of kiln structures in the southern part of the site that are associated with widespread magnetic debris and visible Roman brick and tile on the ground surface. Linear, rectilinear and discrete anomalies nearby appear to relate to cut features with archaeological potential. Evidence for burning can also be seen close to them, but it is not clear if it is associated or relates to relatively recent tree clearance. In the northern part of the site there are a number of positive and negative linear, rectilinear and discrete anomalies that could relate to further features with archaeological potential. Several of the survey areas in the lower lying fields contain responses to alluvial deposits and former fluvial channels. Many of the survey areas also contain anomalies associated with formerly mapped field boundaries, removed during the later 20th century.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Pegasus Group, on behalf of JBM Solar Projects 18 Ltd, to undertake a magnetometer survey at Bunkers Hill Farm, Rotherwick in Hampshire ahead of a proposed development of a solar farm. The survey forms part of an archaeological assessment.

1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2020) and issued to David Hopkins, Hampshire County Archaeologist, 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) *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 agricultural land surrounding Bunkers Hill Farm to the south of Mattingley village, but situated mainly within the parish of Rotherwick with a small area in the parish of Hook. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 73265 56660, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 84ha within fifteen survey areas. Areas 3, 5, 7, 8, 10, 12, 13, 14 & 15 contained grass used mainly for grazing cattle with Areas 1, 2, 4, 6, 9 & 11 containing oats, barley or beans. There is a general trend for land to slope from west to east with the highest areas near to the farmhouse, on the western edge of the site, around 80m ODN, and the eastern boundary close to the River Whitewater around 55m ODN. The low lying grass areas adjacent to the river contain evidence of former fluvial channels and drainage works and are known to be prone to flooding.

1.4.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Weather conditions during the survey were variable but mainly fine.

1.5 Site history and archaeological potential

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

1.5.2 There is limited evidence of prehistoric and Romano-British activity in the immediate vicinity of the site. A field in the centre of the site, due north-east of Bunker's Hill Farm, is the supposed location of Neolithic flint flakes discovered sometime before 1951 (HER Ref. 18875). In the field to the south of Damale's Copse, to the east of the site, Roman pottery sherds were found (HER Ref. 34809). Further afield, however, ditches suggestive of Iron Age and Romano-British field systems were recorded during archaeological investigations ahead of residential development on the north-east side of Hook (HER Refs. 69879, 70037).

1.5.3 There is no evidence of medieval or post-medieval activity recorded within the site and the landscape character is unknown; the site may have been wooded or may have comprised commons or open fields of nearby settlement. Bunkers Hill Farmhouse and Barn, which lie outside the western boundary of the site, are of 17^{th} century origin (HER Refs. 1118, 4507). Earthworks visible alongside the River Whitewater on LiDAR imagery could represent the channels of former water meadows, but there is no reference to such in the HER. Brick and tile manufacture is recorded in the vicinity (HER Ref. 55097), but not within the site.

1.5.4 The earliest mapping of the site that is available online is the 1842 tithe map for the parish of Rotherwick. It covers all but the south-eastern area of the site, which fell in the parish of Nateley Scures for which no tithe map is available. It shows the site to be subdivided into a greater number of fields than exists today, with a small copse to the south of Bunkers Hill Farm. By 1875, many of the fields had been consolidated. By 1912, another copse is shown to the north of the Farm; by 1961, another copse was shown further to its north. None of the plantations are extant.

1.5.5 Second World War defensive infrastructure, comprising pillboxes and anti-tank ditches, are recorded on a north/south alignment between Dipley Common and Borough Court Copse to the east of the site (HER Refs. 24363, 24364, 24365, 24366, 24346, 58264, 70595, 71174, 71176, 71177, 71178) and in a field on the west side of the B3349 opposite Bartlett's Farm (HER Ref. 59891). There is no suggestion from the HER of such features having been located within the site.

1.5.6 Although there are limited heritage assets within the site, this may be due to the lack of previous archaeological investigations. There is always potential for the geophysical survey to reveal anomalies that relate to previously unrecorded archaeological features, should they be located within the site.

1.5.7 During the course of the survey an area of ceramic building material was identified to the south of the farmhouse within Area 9. The material appeared consistent with over-fired Romano-British tile and possibly brick and was considered likely to relate to industrial activity. Anomalies located within this area are considered within the results. A high level of confidence is given to the identification of Roman tegula fragments; no Romano-British pottery was identified and no material indicative of a substantial dwelling was observed.

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is clay, silt and sand from the London Clay formation with overlying alluvial deposits in Areas 3, 8 & 15, as well as the eastern parts of Areas 2, 4, 7 & 13, derived from the River Whitewater which forms the eastern boundary of the site (BGS, 2017). Within fields adjacent to the River Whitewater former fluvial channels were observed.

1.6.2 The overlying soil across the survey area is from the Wickham 4 association and is a typical stagnogley. It consists of a slowly permeable, seasonally waterlogged, fine loamy over clayey and fine silty over clayey soil. The soil overlying the alluvial deposits along the eastern edge of the site is from the Fladbury 3 association and is a pelo-alluvial gley. It consists of stoneless, clayey, fine silty and fine loamy soil affected by groundwater (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry survey carried out across similar clay geologies and stagnogley soils have produced variable results generally due to low levels of magnetic susceptibility and a lack of magnetic contrast between cut features and the material into which they are cut. However, long term human occupation and industrial activity can result in increased magnetic contrast and the underlying geology and soils are, therefore, considered acceptable for magnetic survey. Naturally formed features may also produce anomalies particularly where the make-up of alluvial deposits varies or where former fluvial features are infilled by humic material, or soils that have higher or lower magnetic susceptibilities than the surrounding deposits.

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 towed using an ATV where possible with small areas of infill surveyed by manually pushing the cart. Each sensor is not zeroed in the field as the vertical axis alignment is precisely fixed leaving sensor offsets that are removed during data processing. The fixing of the vertical alignment ensures the sensors are not unduly influenced by localised magnetic fields and that the vertical component of a magnetic anomaly is measured. The gradiometers have a measurement range of ±8000nT, although the recorded range is ±3000nT, and resolution is around 0.1nT. They are linked to a Leica GS10 RTK GNSS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA computer system.

2.2.2 Due to the fixed offsets within the fluxgate sensors, as a result of the manufacturing and tensioning process, the survey data do not provide a visually useful dataset until a zero median traverse algorithm is applied. It is recognised that this has the potential to affect some anomalies detrimentally by removing linear features orientated parallel to survey transects. However, this has not been noted as a particular problem with the system due to the high resolution data collection, generally long length of traverses and variability within the magnetic characteristics of a linear anomaly.

2.2.3 Data are collected along a series of parallel survey transects to achieve 100% coverage of the surveyable land. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps maintain the correct separation between adjacent traverses. Data are not collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).

2.2.4 Fluxgate sensors are highly sensitive to temperature change and this manifests as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift, data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <100s.

2.3 Data processing and presentation

2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. The software effectively allocates a geographic position for each data point and can compensate for fixed offsets present within the FGM650 sensors. The offsets are positive or negative values present on all fluxgate gradiometer sensors. Some systems use manual or electronic balancing to effectively zero the sensors; however, this is a short term measure that is prone to drift through temperature changes and vibration and can easily be incorrectly set due to localised magnetic fields. The FGM650 sensors are very accurately aligned to the vertical magnetic gradient and are highly stable showing negligible drift on long traverses. The offset values are removed using TerraSurveyor software.

2.3.2 Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display within TerraSurveyor. The removal of the offset values (compensation) of the sensors is also carried out in TerraSurveyor using a zero median traverse function. Data are then considered to be minimally processed. Note: without the zero median traverse function it is not possible to create a meaningful data plot as all sensors have a different offset value. Although a zero median traverse algorithm can remove anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

2.3.3 The minimally processed data are collected between limits of ±3000nT and clipped for display at ±3nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 In order to remove low frequency variation along a traverse that has been caused by large magnetic bodies, cultivation or rapid temperature change additional data processing has been carried out in the form of high pass filtering within all the survey areas.

2.3.5 Additional data processing has also been carried out for Areas 10, 12, 13, 14

& 15 in the form of low pass filtering. This effectively removes high frequency variation along a traverse that has been caused by uneven ground and associated vibration. Data treated to additional processing have been compared to unprocessed data to ensure that no significant anomalies have been removed.

2.3.6 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.

2.3.7 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.

2.3.8 The raster images are combined with base mapping using ProgeCAD Professional 2016, creating DWG (2010) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GNSS, resection method, etc.

2.3.9 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.

2.3.10 A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area.

2.3.11 The abstraction and interpretation procedure has been supported by analysis of a digital terrain model derived from the Environment Agency's LiDAR 1m resolution data. Shaded relief plots are created using Surfer 15 (Azimuth:135, Altitude:45, Z factor:10), (Fig 33).

2.3.12 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 fifteen survey areas covering approximately 84ha.

3.1.2 Magnetic anomalies located can be generally classified as positive 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, anomalies with a natural origin, and strong multiple dipolar linear anomalies relating to buried services or pipelines. Anomalies located within each survey area have been numbered and are described in 3.4 to 3.12 below .

3.2 Statement of data quality and factors influencing the interpretation of anomalies

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset.

3.2.2 Localised zones of high magnitude magnetic disturbance has been caused by pylons and other modern ferrous objects. It is considered unlikely that features of archaeological significance have been obscured by the disturbance. Low magnitude noise is present in the form of linear anomalies relating to cultivation trends and disturbance from ferrous fencing materials. Additional filtering has been used to effectively remove the noise and to improve the visual appearance of the data. Both filtered and unfiltered data are analysed and assessed during the abstraction and interpretation process as it is known that additional filtering has the potential to remove important anomalies.

3.2.3 The eastern part of the site contains numerous anomalies relating to natural variability in the magnetic susceptibility of the soil and underlying deposits. Former fluvial features are also visible and show a moderate degree of enhancement that must relate to deposits of enhanced magnetic susceptibility caused very localised factors. It may be difficult to confidently separate some naturally formed anomalies from those of anthropogenic origin.

3.3 Data interpretation

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

Interpretation category	Description and origin of anomalies
Anomalies with archaeological potential	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc. The category is used where there is a high level of confidence which may be due to additional supporting information where morphology is unclear or uncharacteristic.

Anomalies with an uncertain origin	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation. Land drains can appear in a classic herringbone pattern of interconnected multiple dipolar linear anomalies, or as parallel linear anomalies. The multiple dipolar response indicates ceramic land drains.
Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, hearths and nail spreads from former wooden structures or rooves and may, therefore, be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.
Anomalies with a natural origin	Naturally formed magnetic anomalies are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to anomalies within more solid geology.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Areas 1 & 2

Areas centred on OS NGR 473325 157060, see Figs 06 – 08.

Anomalies with an uncertain origin

(1) – Situated in the northern part of the survey area are a number of positive linear and possible rectilinear anomalies. Although they are weak and poorly defined, it is possible that they relate to cut, ditch-like features and an archaeological origin is possible.

(2) – Irregularly shaped positive and negative anomalies are located in the north western part of Area 1. The positive response could indicate an association with burning, the negative response could indicate former structural remains and, therefore, the anomalies could be of archaeological potential.

(3) – Curvilinear weakly positive anomalies appear to flank a negative curvilinear anomaly. Although weak and poorly defined, this could relate to a feature with

archaeological potential.

(4) – A broad, positive response lies to the south of anomalies (1-3) and although such a response could relate to a natural feature, it is possible that the cause of the magnetic enhancement has been through anthropogenic activity.

(5) – A number of discrete positive responses have been located primarily in the northern part of the site and appearing to be associated with anomalies (1-5). Although such anomalies can relate to naturally formed pit-like features, these could relate to pits with archaeological potential.

Anomalies associated with land management

(6) – A positive anomaly in the south eastern part of Area 1 corresponds to the line of a formerly mapped field boundary.

(7) – A weak, multiple dipolar, linear anomaly in the south western part of Area 1 is likely to relate to a ceramic land drain; however, this could also be associated with a former boundary ditch.

Anomalies associated with magnetic debris

(8) – Extending along the western edge of Area 2 are linear patches of magnetic debris. This is likely to relate to material associated with a formerly mapped trackway.

(9) – Strong, discrete, dipolar anomalies are a response to ferrous and other magnetically thermoremnant objects within the topsoil. They are located within all of the survey areas and generally relate to material incorporated into the soil through the process of manuring. The floodplain areas also contain numerous anomalies which have been introduced during periods of flooding.

Anomalies with a natural origin

(10) – Small patches of magnetically variable responses at the southern end of Area 2 relate to former fluvial features.

3.5 List of anomalies - Area 3

Area centred on OS NGR 473697 157141, see Figs 09 – 11.

3.5.1 Area 3 lies within the floodplain of the River Whitewater and contains anomalies relating to alluvial deposits and former fluvial channels.

3.6 List of anomalies - Area 4

Area centred on OS NGR 473230 156765, see Figs 12 – 14.

3.6.1 Area 4 contains anomalies associated with formerly mapped field boundaries that flank a track. In the eastern part of the survey area is a large zone of magnetically variable responses which correspond to a low mound in the field likely to relate to an unmapped river terrace deposit. On the eastern edge are a number of discrete positive responses that are stronger at 7-9nT than the majority of the positive responses which are 1-2nT. Although naturally formed anomalies can have a stronger response, it is possible that the increased magnetism is caused by anthropogenic activity.

3.7 List of anomalies - Area 5

Area centred on OS NGR 472970 156255, see Figs 15 – 17.

3.7.1 Area 5 contains a zone in the northern part of the survey area that contains a number of pit-like responses. These relate to a former boundary and removed trees. Elsewhere are other pit-like responses, they too could relate to tree removal, but this is uncertain. Magnetic debris is also evident.

3.8 List of anomalies – Areas 6 & 7

Areas centred on OS NGR 473215 156505, see Figs 18 – 20.

3.8.1 A number of positive linear anomalies can be seen within Areas 6 & 7, and it is possible that they could relate to cut, ditch-like features. Formerly mapped field boundaries, land drains and fluvial features have also been located.

3.9 List of anomalies – Area 8

Area centred on OS NGR 473440 156424, see Figs 18 – 20 & 27 – 29.

3.9.1 Area 8 contains parallel linear anomalies that could relate to land drainage. Former fluvial channels are also evident as well as magnetic disturbance from an existing electricity pylon and a former pylon base.

3.10 List of anomalies - Areas 9, 10 & 11

Areas centred on OS NGR 473062 155975, see Figs 21 – 26.

Anomalies of archaeological potential

(11) – Three strongly magnetic anomalies with a response of 300-600nT are associated with intense burning indicative of industrial activity, such as kilns. They are associated with other positive linear and discrete responses and a widespread zone of magnetic debris. Roman tile and brick fragments were visible on the ground surface adjacent to the anomalies.

(12) – Positive linear, rectilinear and discrete responses appear to relate to cut features with a magnetically enhanced fill of archaeological potential.

(13) – Patches of magnetically variable responses adjacent to and containing anomalies (12) may indicate ground that has been subject to burning. Although this lies within an area of woodland that was in existence until the 20th century, and could therefore relate to relatively modern tree burning, an association with former charcoal burning is possible.

(14) – Two clusters of discrete positive responses are situated to the north of anomalies (11). They appear to relate to pit-like features and their proximity to anomalies (11) could indicate that they are associated.

Anomalies with an uncertain origin

(15 & 16) – A number of positive linear anomalies have been located in the southern (15) and northern (16) parts of the survey areas. It is possible that they relate to cut features, and an archaeological origin should be considered.

Anomalies associated with land management

(17) – Positive linear anomalies, some associated with magnetic debris, relate to formerly mapped field boundaries.

Anomalies associated with magnetic debris

(18) – Patches of magnetic debris are situated in the base of a linear depression and correspond to the edge of a former area of woodland.

Anomalies with a modern origin

(19) – Two strong dipolar anomalies are situated in the northern part of the survey area. They are part of a linear group of similar responses 170-175m apart that could relate to the bases of former electricity poles.

Anomalies with a natural origin

(20) – Linear zones of magnetically variable responses relate to naturally formed features.

3.11 List of anomalies – Areas 12 & 13

Areas centred on OS NGR 473352 156195, see Figs 27 – 29.

3.11.1 The survey areas contain a number of positive linear anomalies, some of which are a direct continuation of anomalies (16) seen within Area 11 to the west. Although weak and poorly defined, they could relate to cut, ditch-like features with archaeological potential. Former field boundaries are also evident, including the parish boundary between Rotherwick in the west and Hook to the east.

3.12 List of anomalies – Areas 14 & 15

Areas centred on OS NGR 473320 156013, see Figs 30 – 32.

3.12.1 Positive linear anomalies within Areas 14 and 15 are of uncertain origin. Land drains, removed field boundaries and former fluvial features were also located.

4 CONCLUSION

4.1.1 The geophysical survey located one main area with archaeological potential in the south western part of the site. This contained evidence for three very strongly magnetic anomalies surrounded by widespread magnetic debris and visible remains of Roman brick and tiles on the ground surface. The anomalies indicate responses to intense burning indicative of kilns. Positive linear, rectilinear and discrete response are located to the east and these appear to relate to cut features with archaeological potential. Evidence for burning can also be seen in the vicinity, although it is not clear if this relates to tree burning associated with the relatively recent clearance of a woodland or that of some antiquity, but its archaeological potential should be considered.

4.1.2 In the northern part of the site a number of weakly positive linear, possible rectilinear and discrete anomalies are generally indistinct and lack a coherent morphology. However, it is possible that they relate to further cut features with archaeological potential. This includes a discrete group of positive and negative anomalies that could relate to a structure associated with burning.

4.1.3 Elsewhere, the majority of the anomalies are associated with former fluvial channels within the floodplain of the River Whitewater as well as possible river terrace deposits. Evidence for formerly mapped field boundaries and land drainage has also been located.

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Appendix A – basic principles of magnetic survey

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

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

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

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

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

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

Appendix B – data processing notes

Clipping

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

Despike

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

High Pass Filter

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

Low Pass Filter

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

Zero Median/Mean Traverse

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

Appendix C – survey and data information

Area 1 minimally processed data

Filename: J827-mag-Area1-proc.xcp
Description: Imported as Composite from: J827-mag-Area1.asc/MX/bunkershillfm16
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 473082.655425227, 157277.271173714 m
Southeast corner: 473366.005425227, 156861.471173714 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 959500
Dimensions
Composite Size (readings): 1889 x 2772
Survey Size (meters): 283 m x 416 m
Grid Size: 283 m x 416 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.66
Mean: 0.01
Median: 0.00
Composite Area: 11.782 ha
Surveyed Area: 7.6403 ha
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 1 filtered data

Filename: J827-mag-Area1-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.62
Mean: 0.01
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 2 minimally processed data

Filename: J827-mag-Area2-proc.xcp
Description: Imported as Composite from: J827-mag-Area2.asc/MX/bunkershillfm17
Northwest corner: 473333.73, 157209.02 m
Southeast corner: 473587.83, 156861.62 m
Source GPS Points: 821300
Dimensions
Composite Size (readings): 1694 x 2316
Survey Size (meters): 254 m x 347 m
Grid Size: 254 m x 347 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.69
Mean: 0.00
Median: 0.00
Composite Area: 8.8274 ha
Surveyed Area: 6.4129 ha
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Arae 2 filtered data

Filename: J827-mag-Area2-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.65
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 3 minimally processed data

Filename: J827-mag-Area3-proc.xcp
Description: Imported as Composite from: J827-mag-Area3.asc/MX/bunkershillfm2 & 11
Northwest corner: 473529.08, 157435.32m
Southeast corner: 473918.18, 156868.77m
Source GPS Points: 1212800
Dimensions
Composite Size (readings): 2594 x 3777
Survey Size (meters): 389 m x 567 m
Grid Size: 389 m x 567 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.98
Mean: 0.03
Median: -0.01
Composite Area: 22.044 ha
Surveyed Area: 7.3413 ha
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 3 filtered data

Filename: J827-mag-Area3-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.85
Mean: 0.01
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Clip from -3.00 to 3.00 nT

Area 4 minimally processed data

Filename: J827-mag-Area4-proc.xcp
Description: Imported as Composite from: J827-mag-Area4.asc/MX/bunkershillfm12
Northwest corner: 473004.57, 157009.02 m
Southeast corner: 473496.12, 156591.12m
Source GPS Points: 1389700
Dimensions
Composite Size (readings): 3277 x 2786
Survey Size (meters): 492 m x 418 m
Grid Size: 492 m x 418 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.61
Mean: 0.00
Median: 0.00
Composite Area: 20.542 ha
Surveyed Area: 9.7877 ha
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 4 filtered data
Filename: J827-mag-Area4-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.61
Mean: 0.00
Median: 0.00
Composite Area: 20.542 ha
Surveyed Area: 9.7877 ha
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 5 minimally processed dat

Filename: J827-mag-Area5-proc.xcp
Description: Imported as Composite from: J827-mag-Area5.asc//MX/bunkershillfm3
Northwest corner: 472855.67, 156327.75 m
Southeast corner: 473070.92, 156160.80 m
Source GPS Points: 374600
Dimensions
Composite Size (readings): 1435 x 1113
Survey Size (meters): 215 m x 167 m
Grid Size: 215 m x 167 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.06
Mean: 0.06
Median: -0.01
Composite Area: 3.5936 ha
Surveyed Area: 2.1109 ha
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 5 filtered data

Filename: J827-mag-Area5-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.83
Mean: 0.02
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Clip from -3.00 to 3.00 nT

Area 6 minimally processed data

Filename: J827-mag-Area6-proc.xcp
Description: Imported as Composite from: J827-mag-Area6.asc/MX/bunkershillfm2 & 11
Northwest corner: 473008.02, 156628.23 m
Southeast corner: 473273.82, 156300.93m
Source GPS Points: 972700
Dimensions
Composite Size (readings): 1772 x 2182
Survey Size (meters): 266 m x 327 m
Grid Size: 266 m x 327 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.71
Mean: 0.00
Median: 0.00
Composite Area: 8.6996 ha
Surveyed Area: 5.9986 ha
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 6 filtered data

Filename: J827-mag-Area6-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.66
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Filename: J827-mag-Area7-proc.xcp
Description: Imported as Composite from: J827-mag-Area7.asc/MX/bunkershillfm1
Northwest corner: 473244.53, 156669.36 m
Southeast corner: 473382.23, 156372.66 m
Source GPS Points: 994200
Dimensions
Composite Size (readings): 918 x 1978
Survey Size (meters): 138 m x 297 m
Grid Size: 138 m x 297 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.85
Mean: -0.01
Median: 0.01
Composite Area: 4.0856 ha
Surveyed Area: 2.9998 ha
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 7 filtered data

Filename: J827-mag-Area7-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.75
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Clip from -3.00 to 3.00 nT

Filename: J827-mag-Area8-proc.xcp
Description: Imported as Composite from: J827-mag-
Survey corner coordinates (X/Y):
Northwest corner: 473376.61, 156688.38 m
Southeast corner: 473562.61, 156154.53 m
Source GPS Points: 813200
Dimensions
Composite Size (readings): 1240 x 3559
Survey Size (meters): 186 m x 534 m
Grid Size: 186 m x 534 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.05
Mean: 0.06
Median: -0.01
Composite Area: 9.9296 ha
Surveyed Area: 4.2774 ha
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 8 filtered data

Filename: J827-mag-Area8-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.94
Mean: 0.03
Median: -0.01
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Clip from -3.00 to 3.00 nT

Area 9 minimally processed data

Filename: J827-mag-Area9-proc.xcp
Description: Imported as Composite from: J827-mag-Area9.asc/MX/bunkershillfm15
Northwest corner: 472726.56, 156211.31 m
Southeast corner: 473219.91, 155690.66 m
Source GPS Points: 1924800
Dimensions
Composite Size (readings): 3289 x 3471
Survey Size (meters): 493 m x 521 m
Grid Size: 493 m x 521 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.93
Mean: -0.01
Median: 0.01
Composite Area: 25.686 ha
Surveyed Area: 13.13 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 9 filtered data

Filename: J827-mag-Area9-proc-hpf-lpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.65
Mean: -0.02
Median: 0.01
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Lo pass Uniform (median) filter: Window dia: 13
6 Clip from -3.00 to 3.00 nT

Area 10 minimally processed data

Filename: J827-mag-Area10-proc.xcp
Description: Imported as Composite from: J827-mag-Area10.asc/MX/bunkershillfm8
Northwest corner: 473080.49, 155990.18 m
Southeast corner: 473359.49, 155662.88 m
Source GPS Points: 280200
Dimensions
Composite Size (readings): 1860 x 2182
Survey Size (meters): 279 m x 327 m
Grid Size: 279 m x 327 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.72
Mean: 0.02
Median: 0.02
Composite Area: 9.1317 ha
Surveyed Area: 1.5472 ha
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 10 filtered data
Filename: J827-mag-Area10-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.90
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 11 minimally processed data

Filename: J827-mag-Area11-proc.xcp
Description: Imported as Composite from: J827-mag-Area11.asc/MX/bunkershillfm14
Northwest corner: 473036.45, 156272.26 m
Southeast corner: 473339.75, 155799.01 m
Source GPS Points: 977400
Dimensions
Composite Size (readings): 2022 x 3155
Survey Size (meters): 303 m x 473 m
Grid Size: 303 m x 473 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.76
Mean: 0.03
Median: -0.01
Composite Area: 14.354 ha
Surveyed Area: 7.0813 ha
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT

Area 11 filtered data
Filename: J827-mag-Area11-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.66
Mean: 0.01
Median: 0.00
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Clip from -3.00 to 3.00 nT

Area 12 minimally processed data

Filename: J827-mag-Area12-proc.xcp
Description: Imported as Composite from: J827-mag-Area12.asc/MX/bunkershillfm9
Northwest corner: 473208.40, 156359.99 m
Southeast corner: 473417.20, 155992.34 m
Direction of 1st Traverse: 90 deg
Source GPS Points: 500000
Dimensions
Composite Size (readings): 1392 x 2451
Survey Size (meters): 209 m x 368 m
Grid Size: 209 m x 368 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.01
Mean: 0.05
Median: 0.00
Composite Area: 7.6765 ha
Surveyed Area: 3.4044 ha
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 12 filtered data

Filename: J827-mag-Area12-proc-hpf-lpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.73
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Lo pass Uniform (median) filter: Window dia: 10
6 Clip from -3.00 to 3.00 nT

Area 13 minimally processed data

Filename: J827-mag-Area13-proc.xcp
Description: Imported as Composite from: J827-mag-Area13.asc/MX/bunkershillfm4
Northwest corner: 473303.30, 156393.27 m
Southeast corner: 473468.75, 156086.22m
Source GPS Points: 343400
Dimensions
Composite Size (readings): 1103 x 2047
Survey Size (meters): 165 m x 307 m
Grid Size: 165 m x 307 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.11
Mean: 0.09
Median: -0.04
Composite Area: 5.0801 ha
Surveyed Area: 2.0903 ha
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 13 filtered data

Filename: J827-mag-Area13-proc-hpf-lpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.79
Mean: 0.02
Median: 0.01
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Lo pass Uniform (median) filter: Window dia: 13
5 High pass Uniform (median) filter: Window dia: 223
6 Clip from -3.00 to 3.00 nT

Area 14 minimally processed data

Filename: J827-mag-Area14-proc.xcp
Description: Imported as Composite from: J827-mag-Area14.asc/MX/bunkershillfm6
Northwest corner: 473340.14, 156135.82m
Southeast corner: 473612.69, 155898.52m
Source GPS Points: 538100
Dimensions
Composite Size (readings): 1817 x 1582
Survey Size (meters): 273 m x 237 m
Grid Size: 273 m x 237 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 1.01
Mean: 0.03
Median: -0.01
Composite Area: 6.4676 ha
Surveyed Area: 3.5469 ha
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 14 filtered data

Filename: J827-mag-Area14-proc-hpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.66
Mean: 0.00
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 250
5 Lo pass Uniform (median) filter: Window dia: 10
6 Clip from -3.00 to 3.00 nT

Area 15 minimally processed data

Filename: J827-mag-Area15.xcp
Description: Imported as Composite from: J827-mag-Area15.asc/MX/bunkershillfm5
Northwest corner: 473494.26, 156201.86m
Southeast corner: 473714.61, 155916.71m
Source GPS Points: 584400
Dimensions
Composite Size (readings): 1469 x 1901
Survey Size (meters): 220 m x 285 m
Grid Size: 220 m x 285 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.94
Mean: 0.02
Median: 0.01
Composite Area: 6.2833 ha
Surveyed Area: 3.4484 ha
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 15 filtered data

Filename: J827-mag-Area15-proc-hpf-lpf.xcp
Stats
Max: 3.32
Min: -3.30
Std Dev: 0.88
Mean: 0.01
Median: 0.00
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 High pass Uniform (median) filter: Window dia: 253
5 Lo pass Gaussian filter: Window dia: 10
6 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 Hampshire Historic Environment Record with greyscale images and abstraction layers made available on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J827-mag-**[area number/name]**.asc J827-mag-**[area number/name]**.xcp J827-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J827-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J827-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J827 report.odt	Report text in Open Office odt format

Table 2: Archive metadata

Appendix E – CAD layers for abstraction and interpretation plots

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

Report sub-heading and associated CAD layer names	Colour with RGB index		Layer content
Anomalies with archaeological potential			
AS-ABST MAG POS DISCRETE ARCHAEOLOGY		Red 255,0,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS LINEAR ARCHAEOLOGY		Red 255,0,0	Polyline or polygon (solid)
AS-ABST MAG STRONG DIPOLAR ARCHAEOLOGY		Magenta 255,0,255	Polygon (solid)
Anomalies with an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG NEG LINEAR UNCERTAIN		Blue 0,0,255	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
Anomalies relating to land management			
AS-ABST MAG BOUNDARY		127,0,0	Line, polyline or polygon (solid or cross hatched ANSI37)
AS-ABST MAG LAND DRAIN		Cyan 0,255,255	Line or polyline
Anomalies with an agricultural origin			
AS-ABST MAG AGRICULTURAL		Green 0,255,0	Line or polyline
Anomalies associated with magnetic debris			
AS-ABST MAG DEBRIS		132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR		132, 132, 132	Solid donut, point or polygon (solid)
Anomalies with a modern origin			
AS-ABST MAG DISTURBANCE		132, 132, 132	Polygon (hatched ANSI31)
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)

Table 3: CAD layering

Appendix F – copyright and intellectual property

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Tel: 01249 814 231

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Hampshire

Map of survey area

N

Survey location

● Survey location

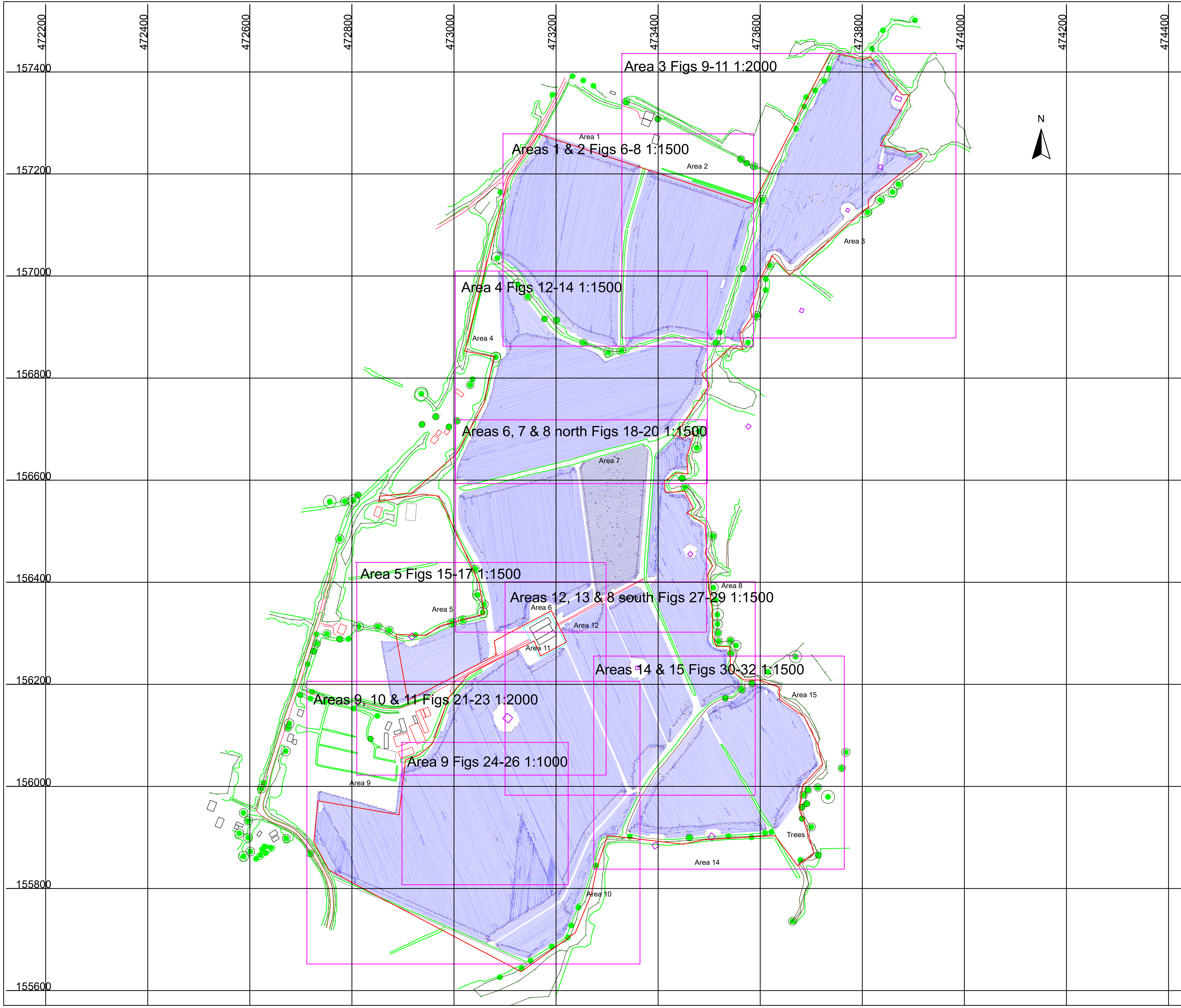
Site centred on OS NGR
SU 73265 56660

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01



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Referencing information

Referencing grid to OSGB36 datum at 200m intervals

Survey tracks

Survey track start

Survey track stop

Development boundary

SCALE 1:7000

0m 70 140 210 280 350m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

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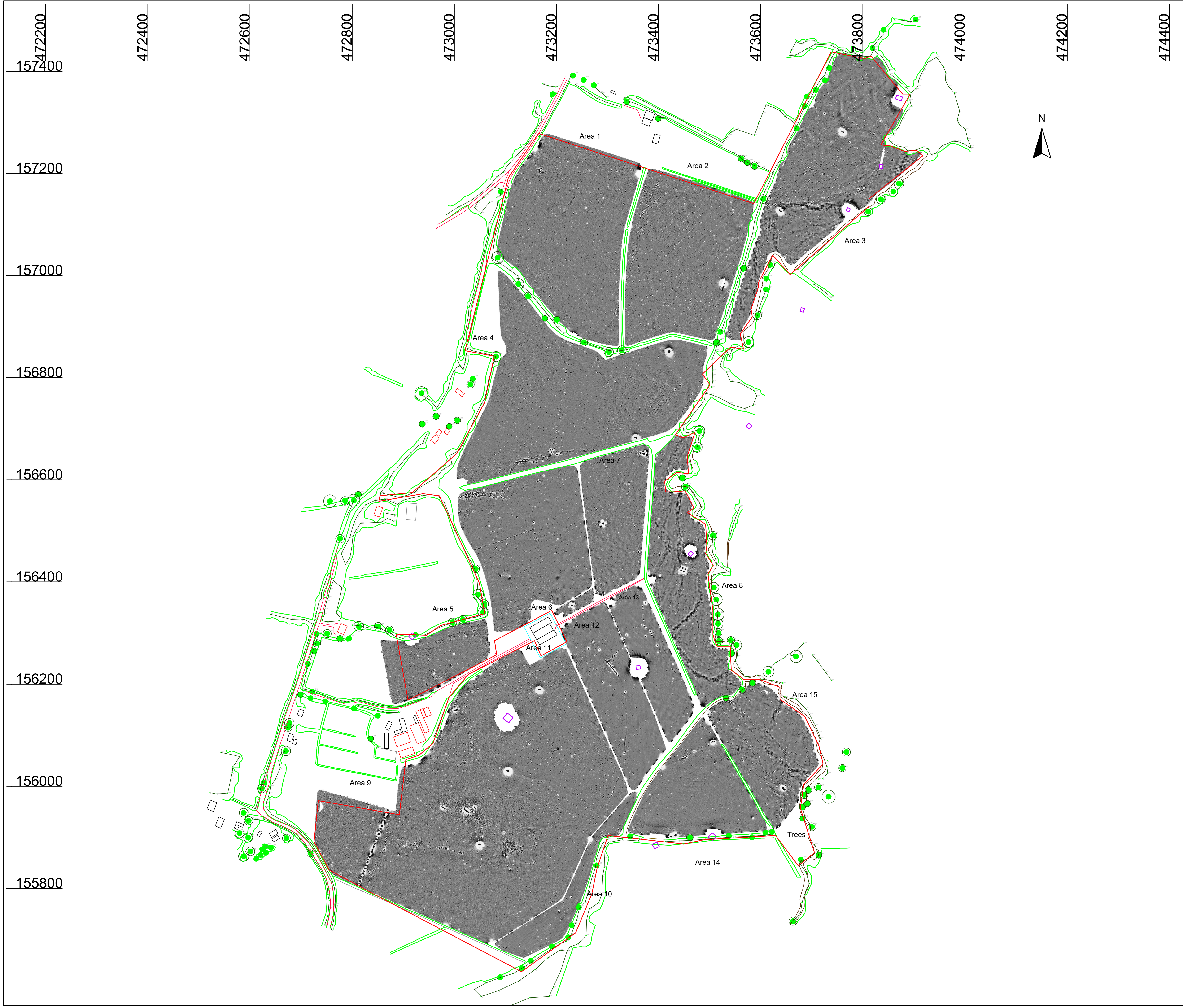
Greyscale plot of minimally processed magnetometer data

SCALE 1:7000

0m 70 140 210 280 350m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03



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Greyscale plot of filtered magnetometer data

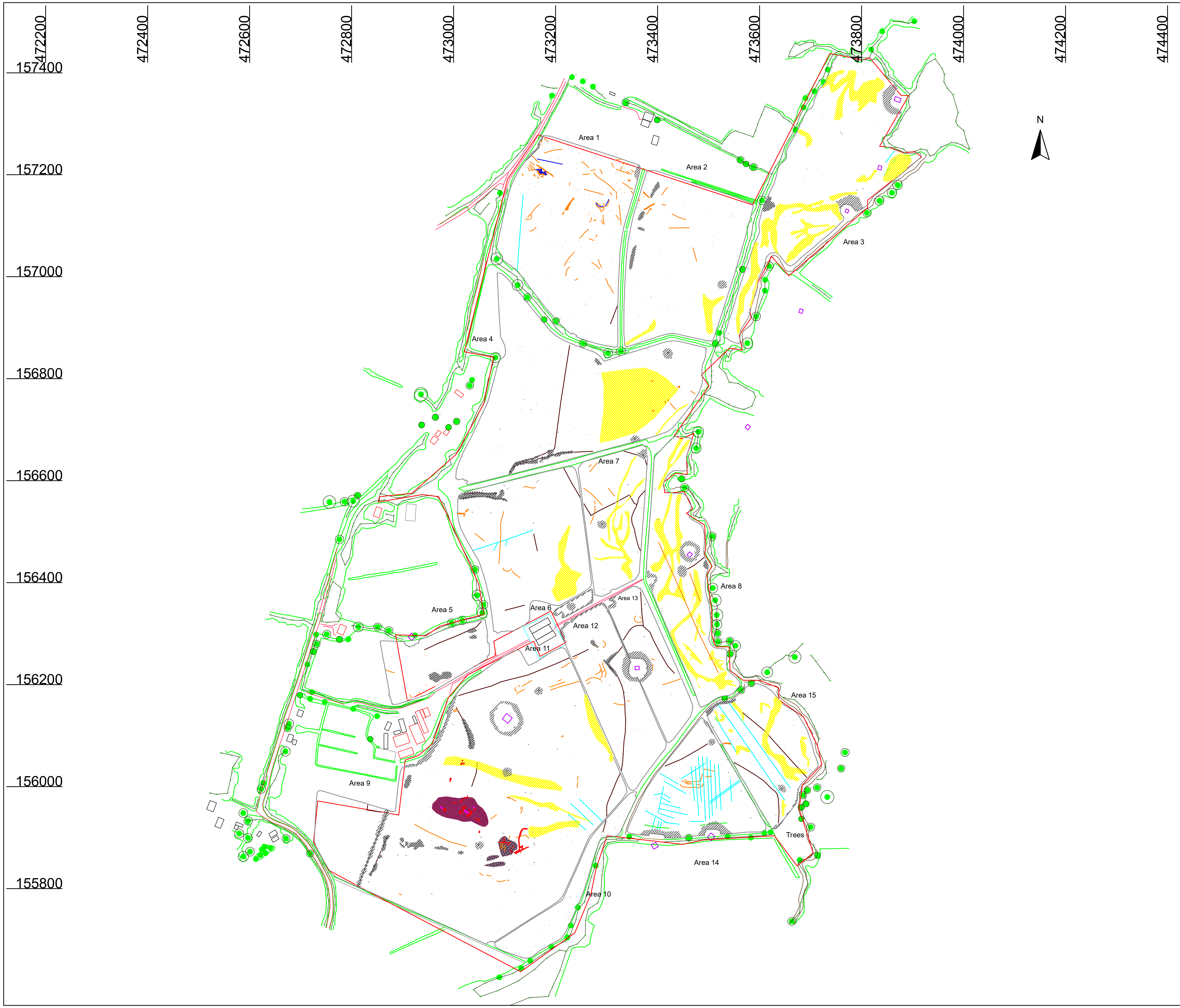
+3nT
-3nT

SCALE 1:7000

0m 70 140 210 280 350m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04



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Abstraction and interpretation of magnetic anomalies

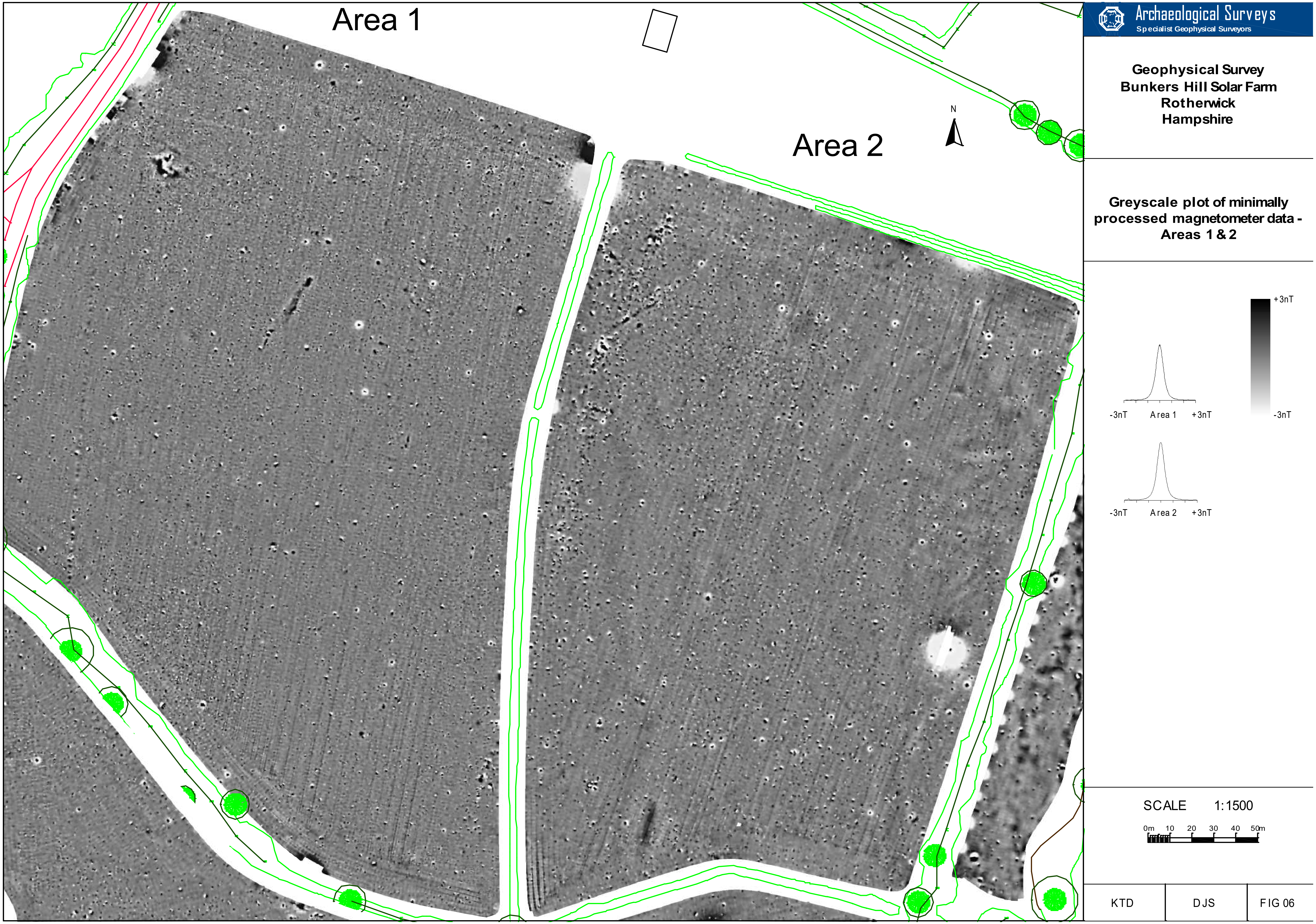
- Positive linear anomaly - cut feature/magnetic enhancement of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Positive/weak multiple dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - pit/area of burning of archaeological potential
- Discrete strong positive response - associated with intense burning
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of archaeological magnetically thermoremnant material
- Variable magnetic response - associated with burning
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - of natural origin
- 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 1:7000

0m 70 140 210 280 350m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05



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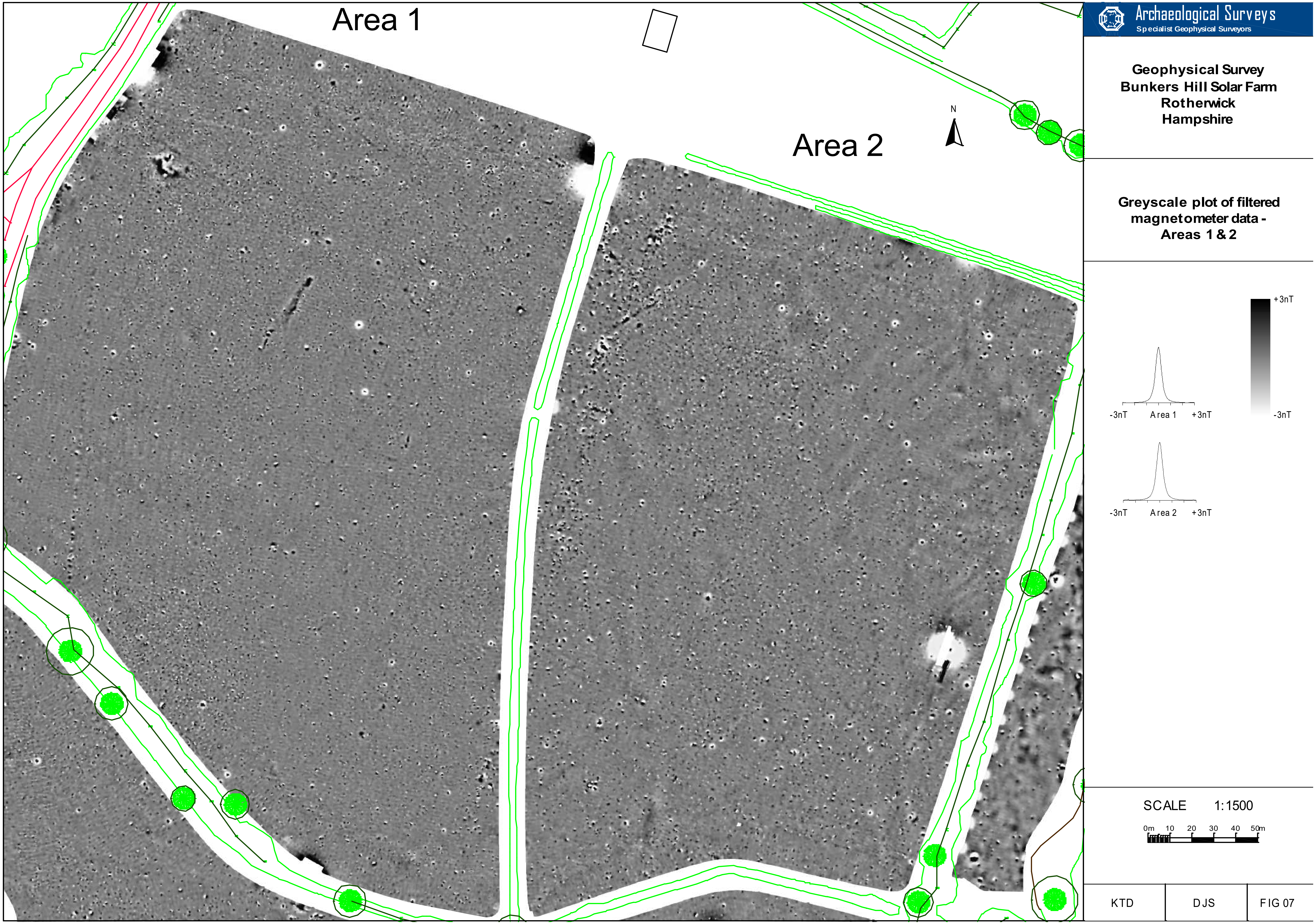
Greyscale plot of minimally processed magnetometer data - Areas 1 & 2

SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 06



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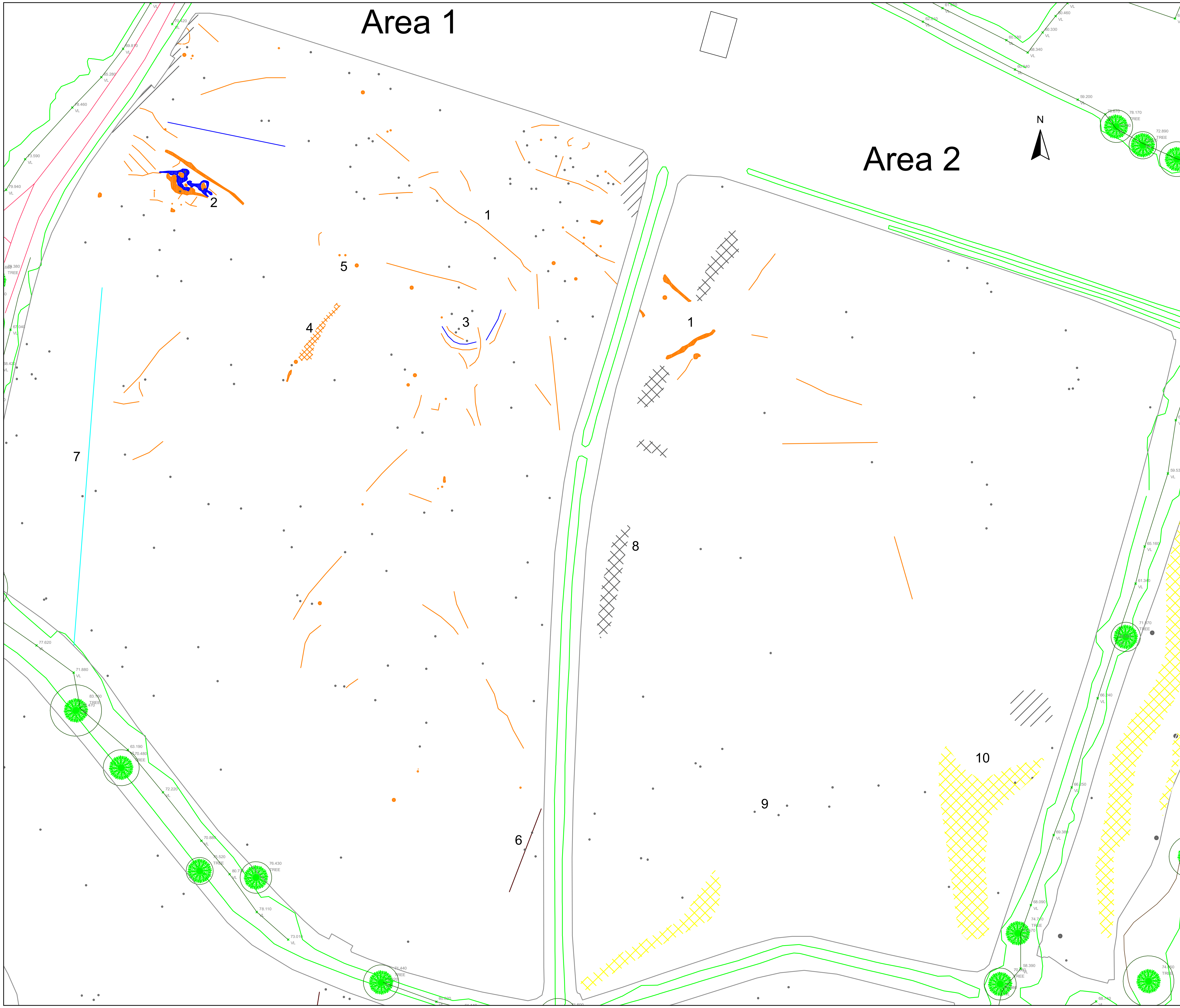
Greyscale plot of filtered magnetometer data - Areas 1 & 2

SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 07



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Abstraction and interpretation of magnetic anomalies - Areas 1 & 2

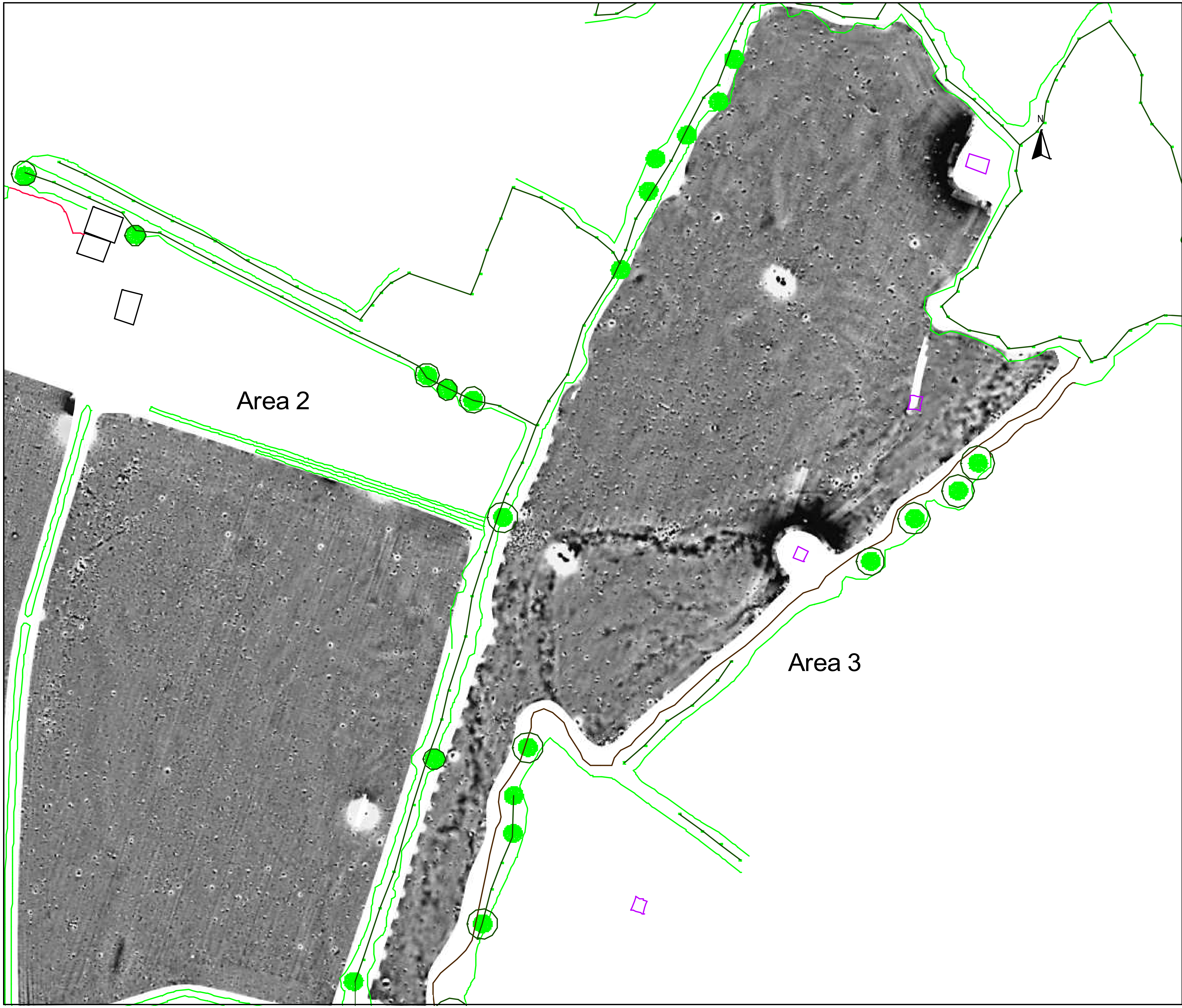
- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Positive linear anomaly - former field boundary
- Weak multiple dipolar linear anomaly - land drain
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08



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Greyscale plot of minimally processed magnetometer data - Area 3

SCALE 1:2000

0m 20 40 60 80 100m

KTD	DJS	FIG 09

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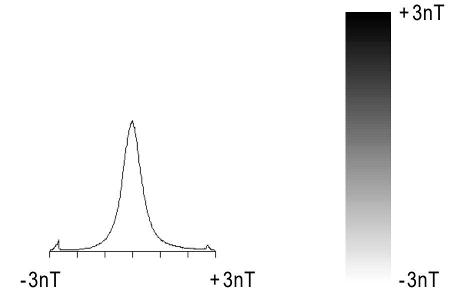
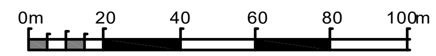
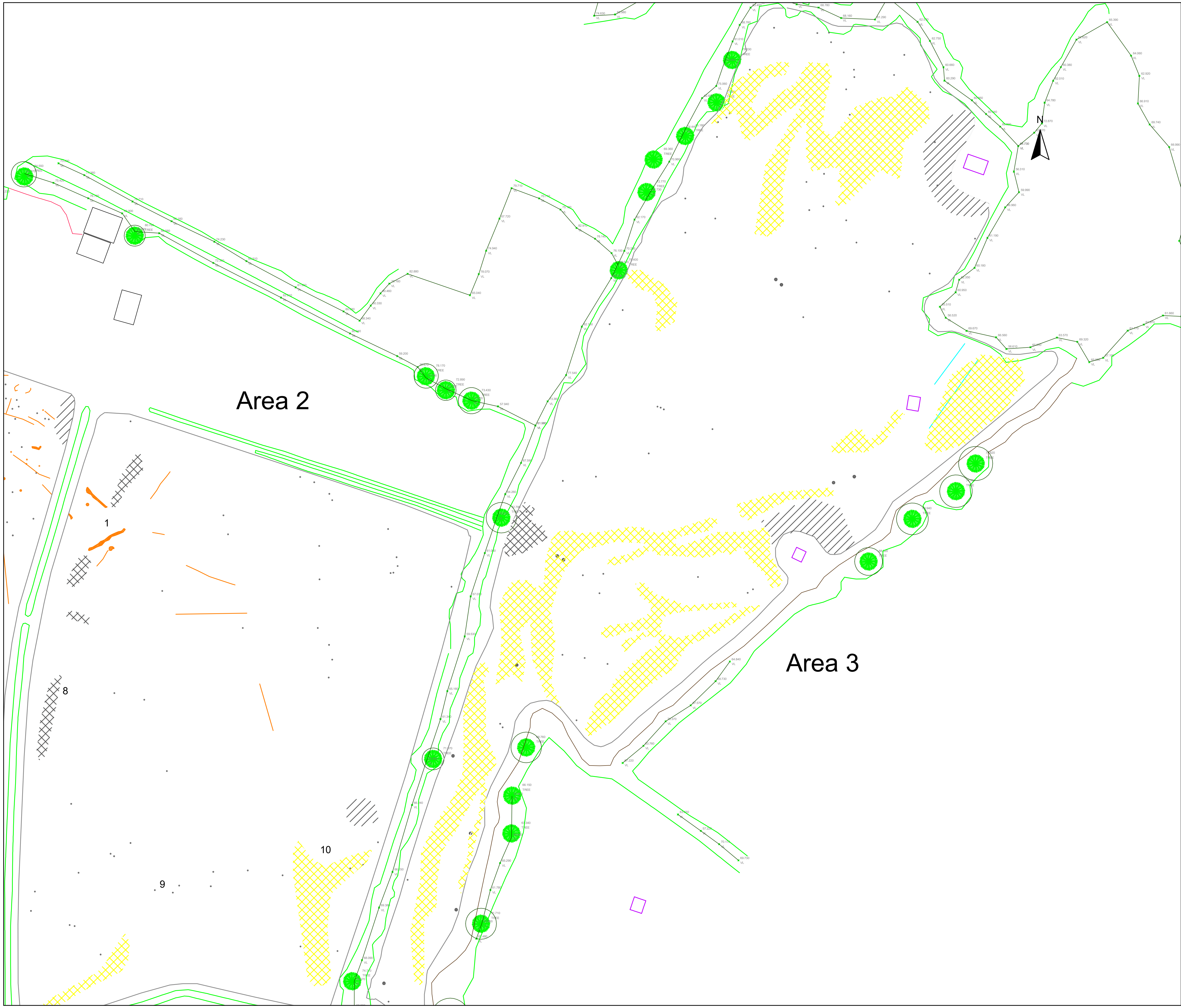
Greyscale plot of filtered magnetometer data - Area 3



SCALE 1:2000



KTD	DJS	FIG 10



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Abstraction and interpretation of magnetic anomalies - Area 3

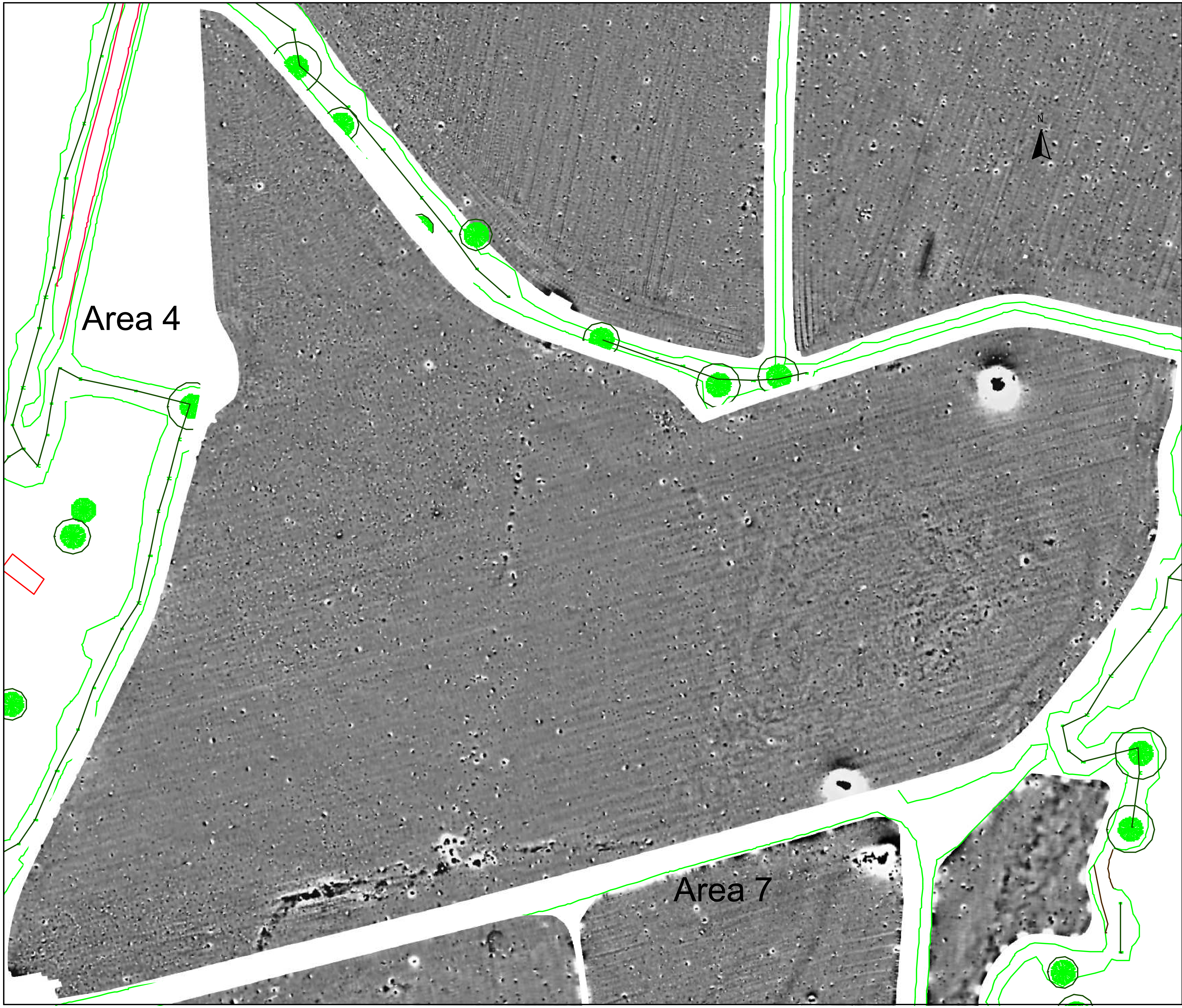
- Variable magnetic response - of natural origin (palaeochannel)
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:2000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 11



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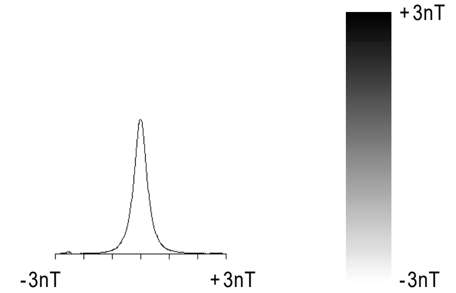
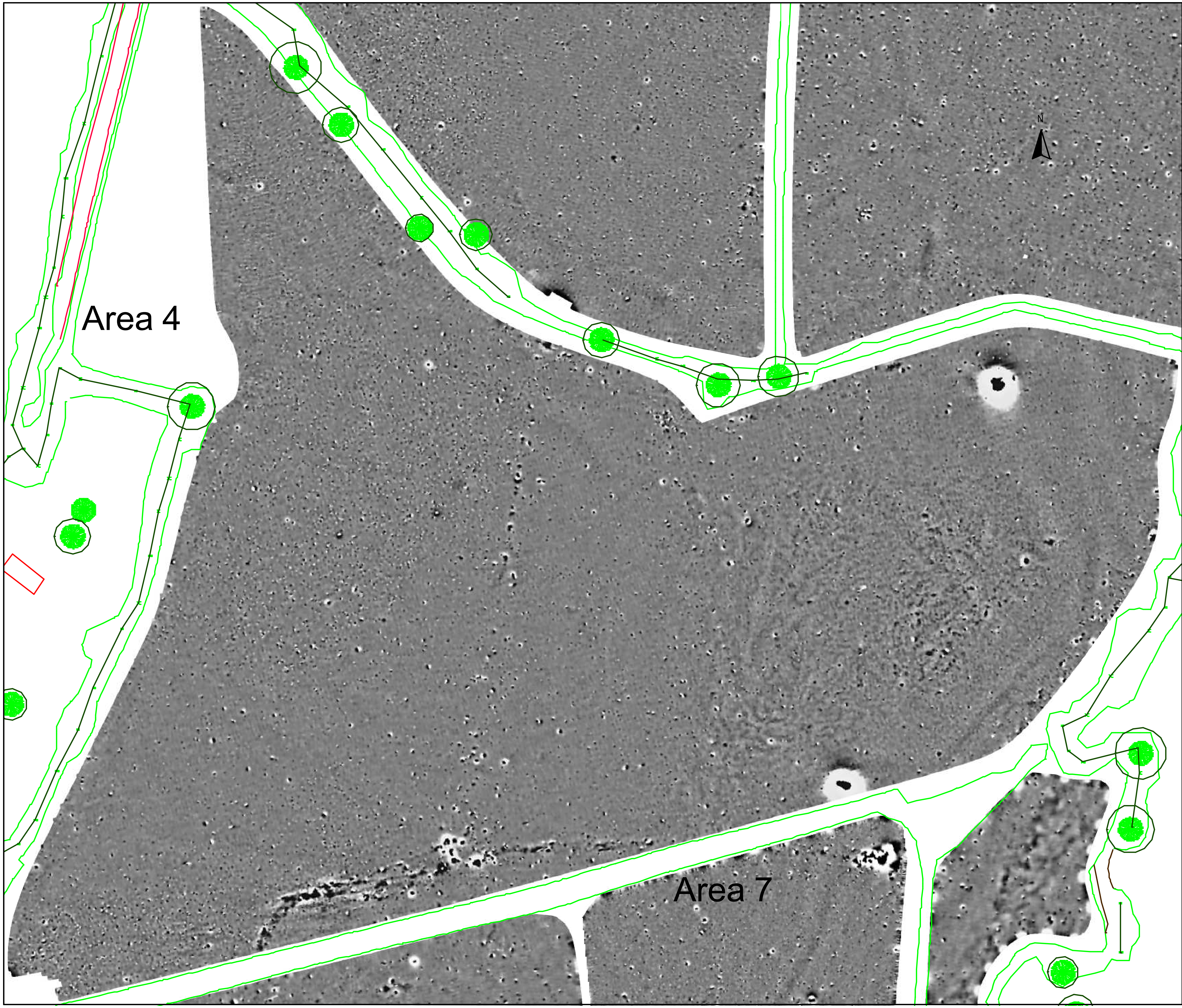
Greyscale plot of minimally processed magnetometer data - Area 4



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 12



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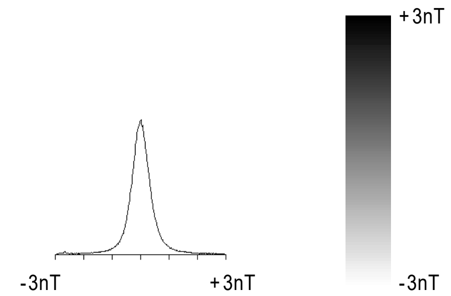
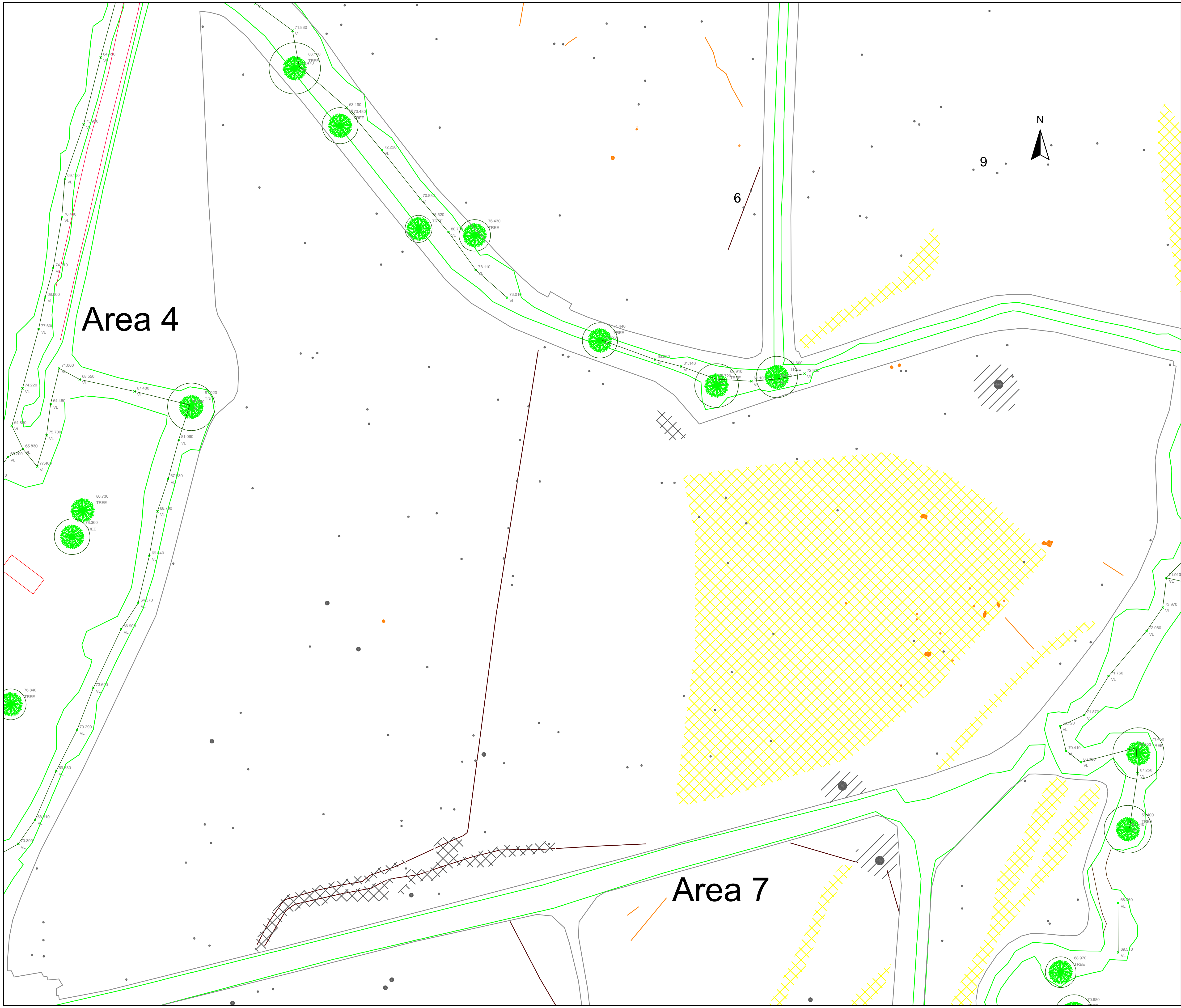
Greyscale plot of filtered magnetometer data - Area 4



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 13



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Abstraction and interpretation of magnetic anomalies - Area 4

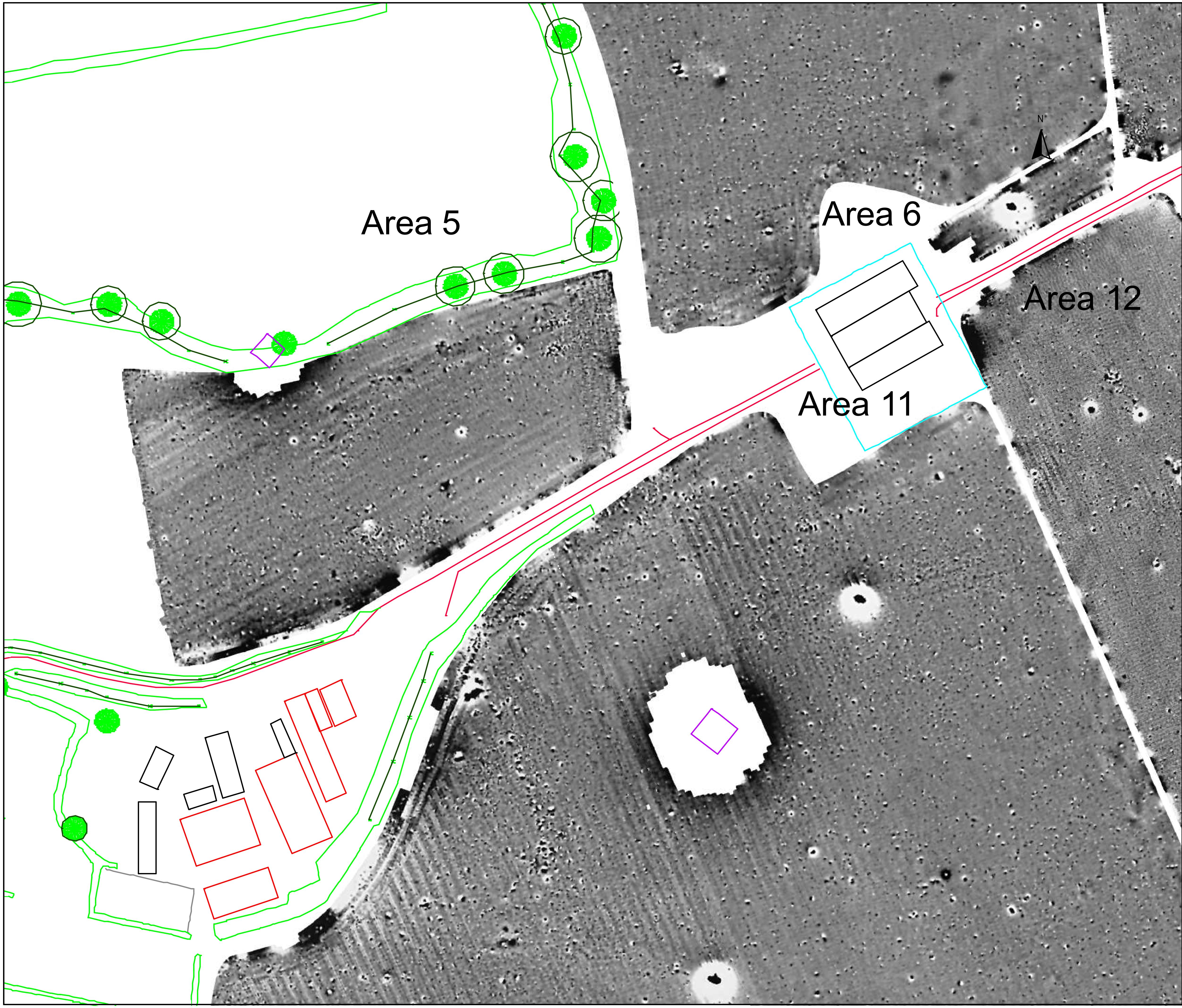
- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Discrete positive response - possible pit-like feature
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 14



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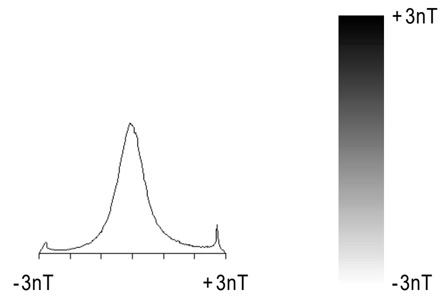
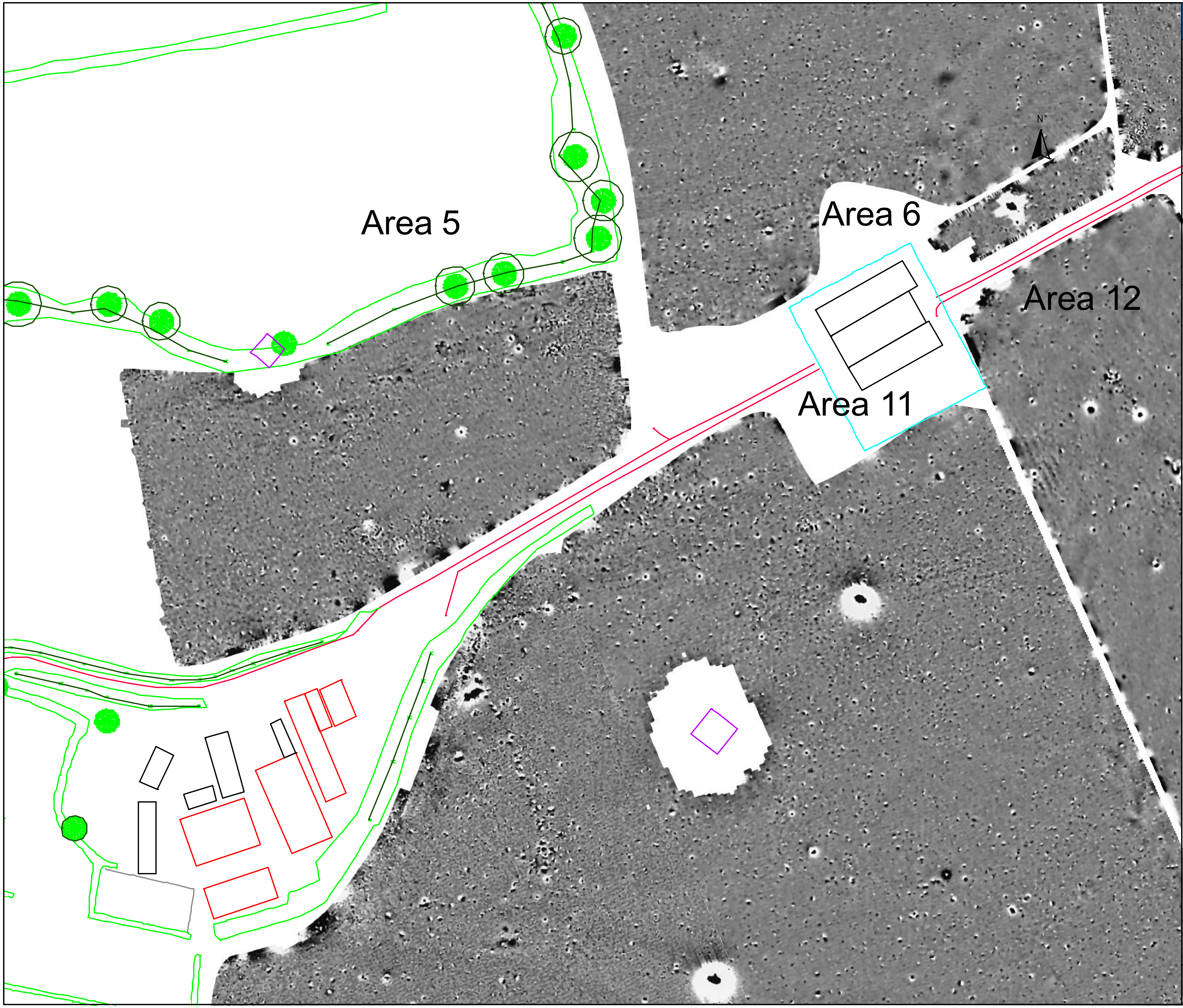
Greyscale plot of minimally processed magnetometer data - Area 5



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 15



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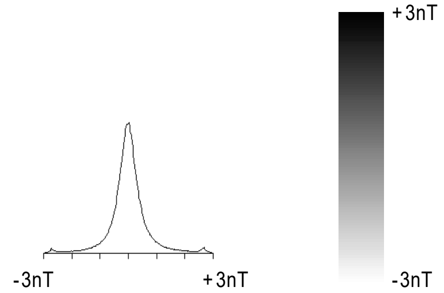
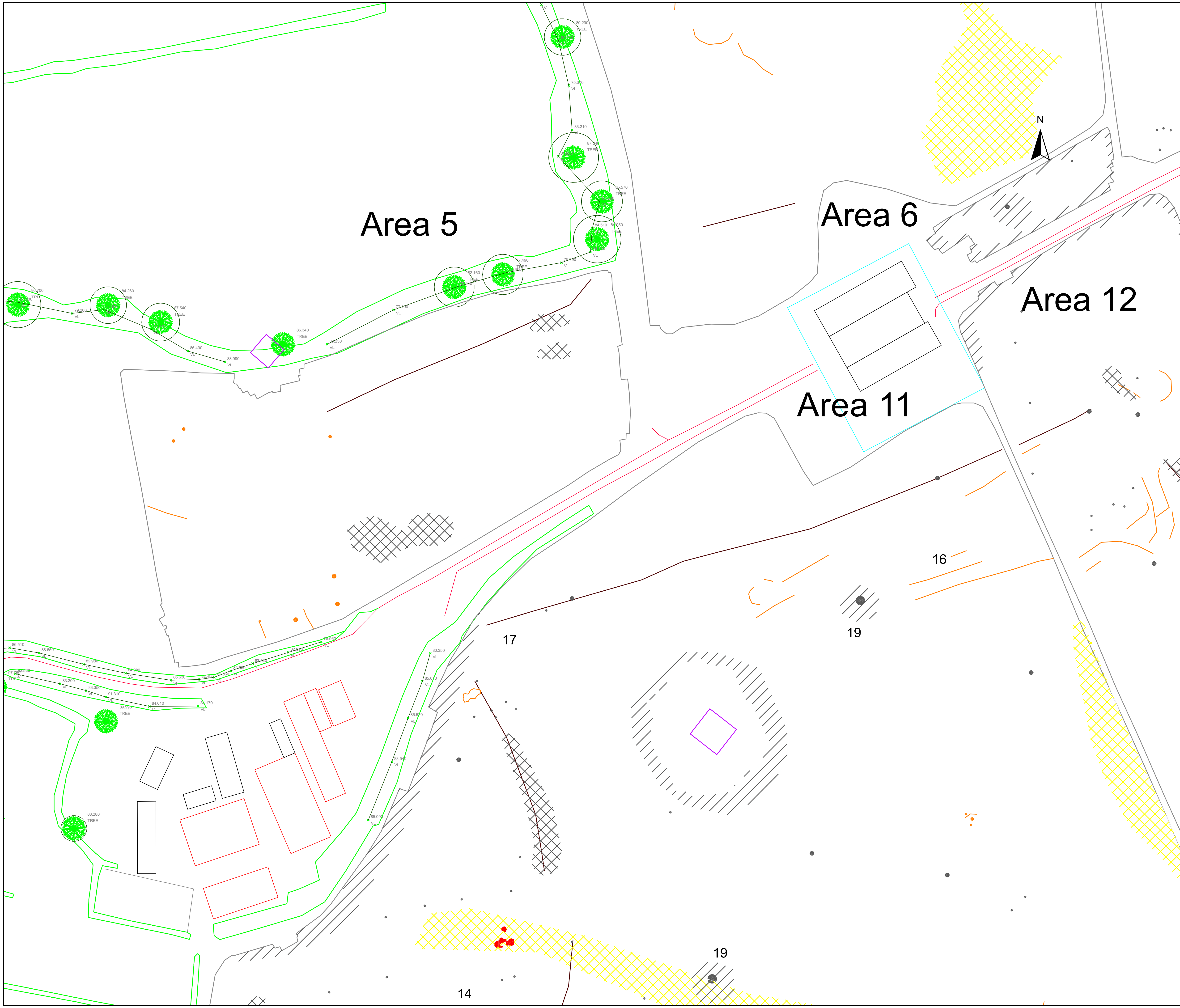
Greyscale plot of filtered magnetometer data - Area 5



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 16



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Abstraction and interpretation of magnetic anomalies - Area 5

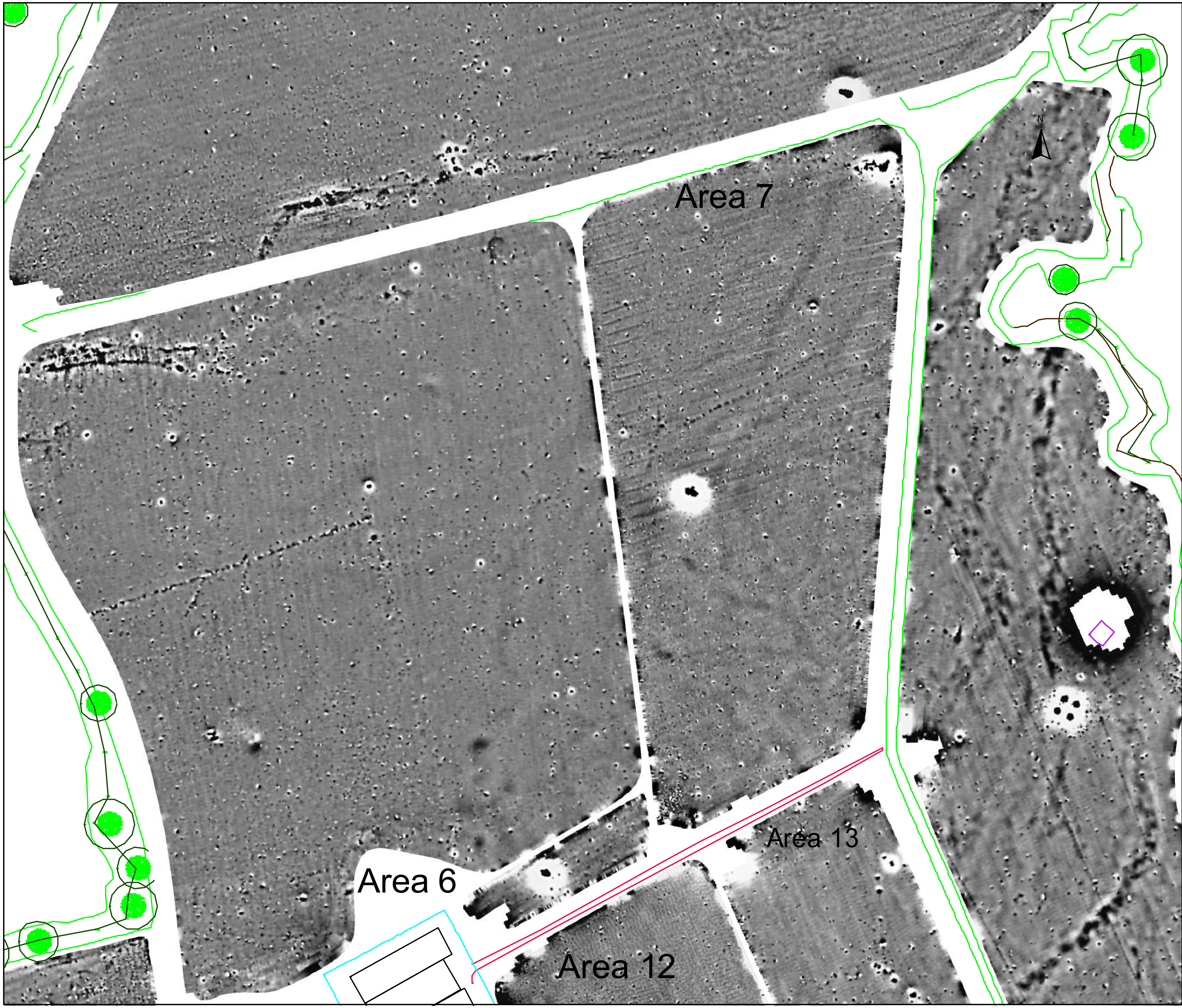
- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 17



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Greyscale plot of minimally processed magnetometer data - Areas 6, 7 & 8 north

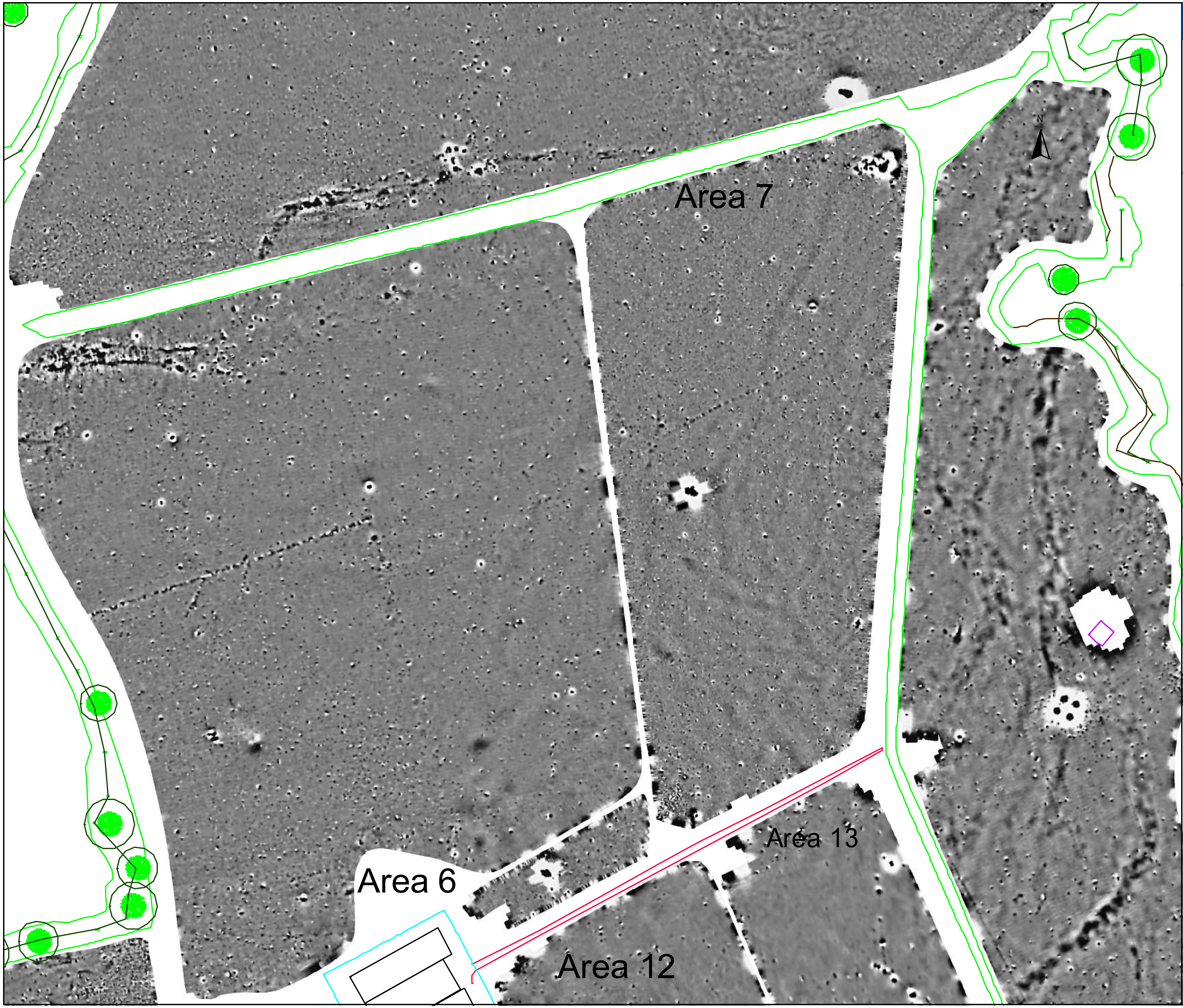
+3nT
-3nT

-3nT Area 6 +3nT
-3nT Area 7 +3nT
-3nT Area 8 +3nT

SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 18



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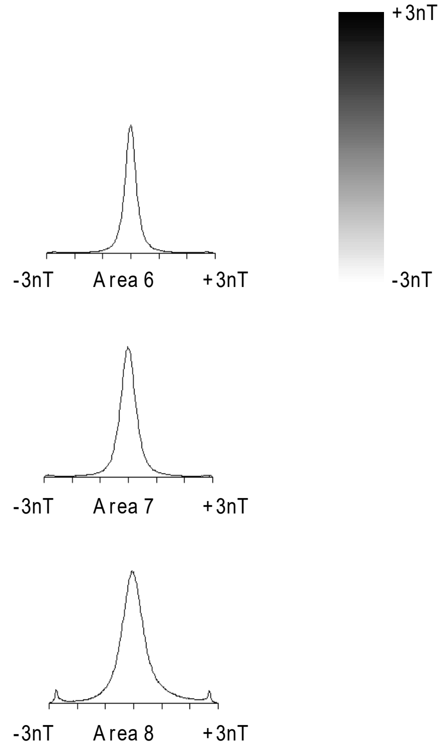
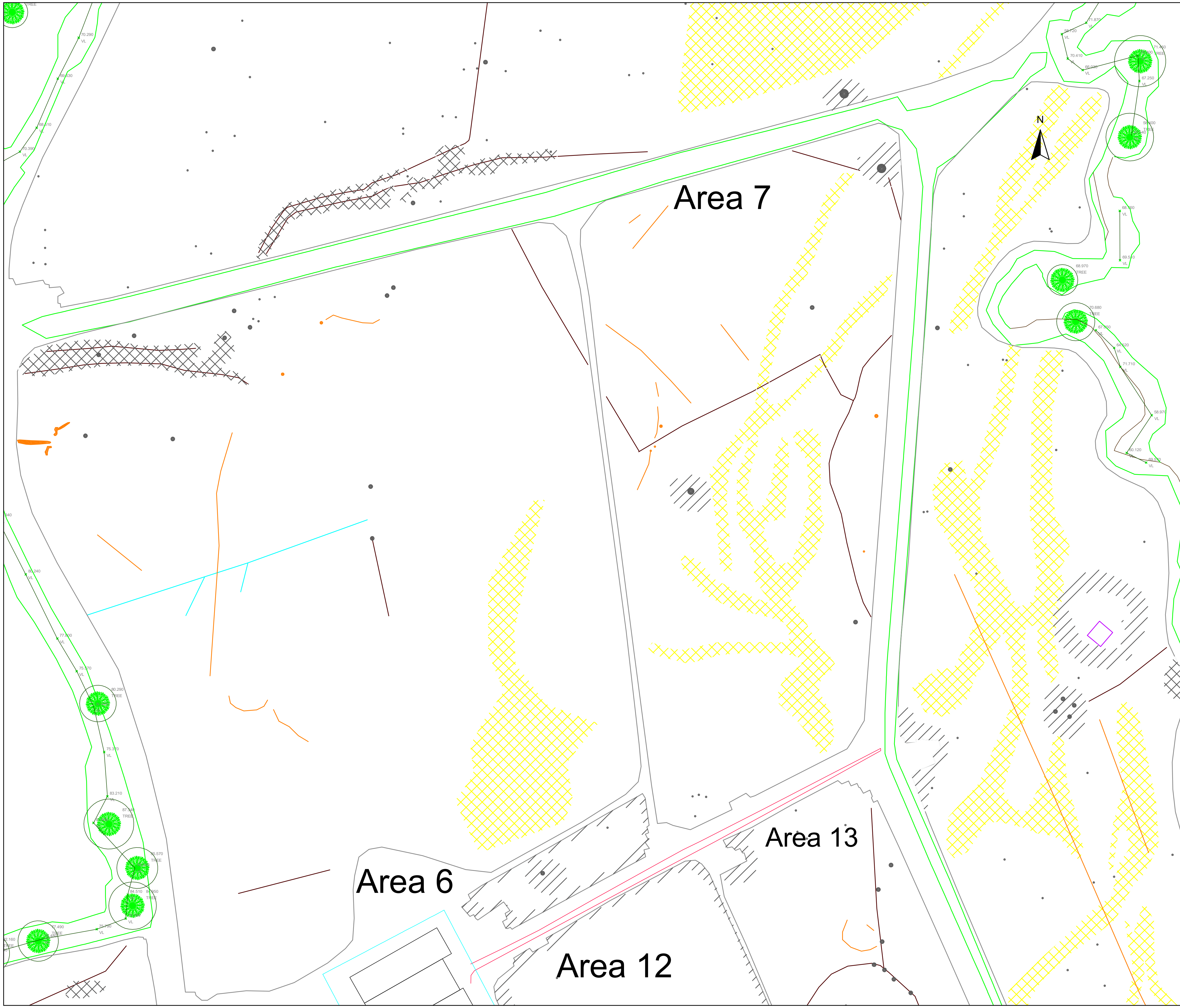
Greyscale plot of filtered magnetometer data - Areas 6, 7 & 8 north



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 19



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Abstraction and interpretation of magnetic anomalies - Areas 6, 7 & 8 north

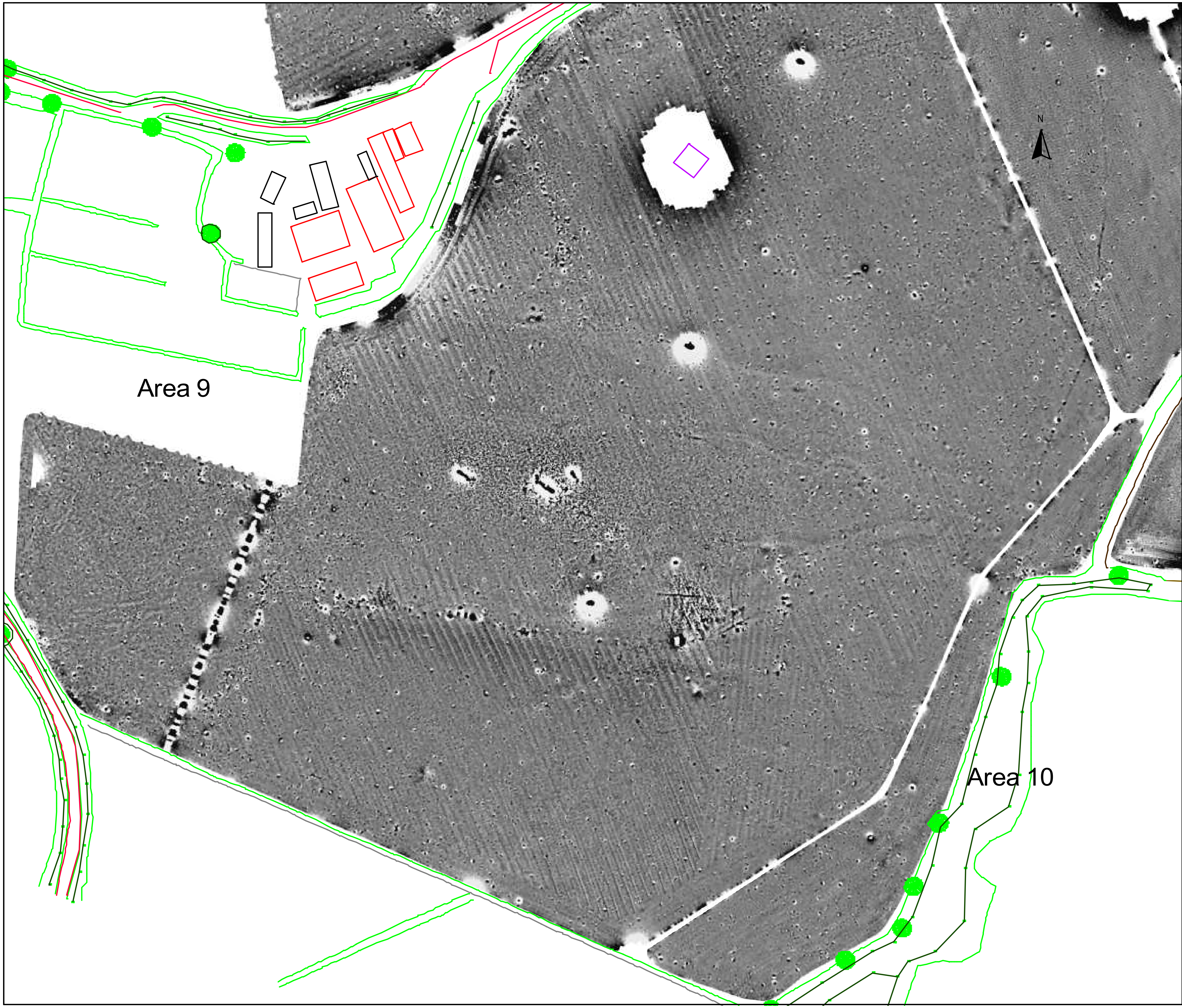
- Positive linear anomaly - possible ditch-like feature
- Positive/multiple dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Discrete positive response - possible pit-like feature
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 20



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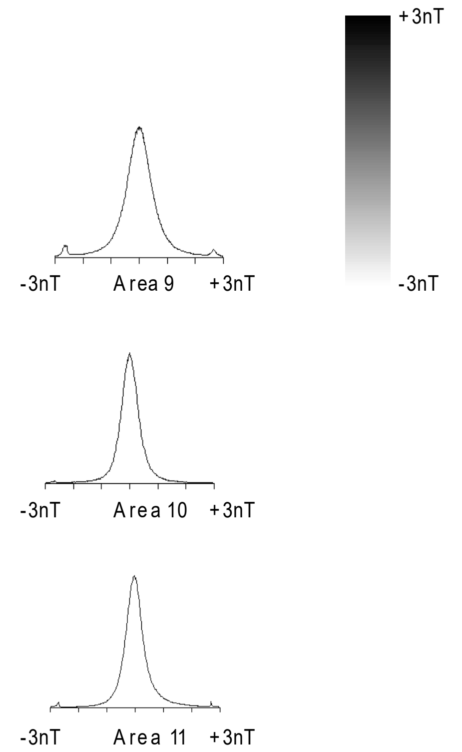
Greyscale plot of minimally processed magnetometer data - Areas 9, 10 & 11



SCALE 1:2000

0m 20 40 60 80 100m

KTD	DJS	FIG 21

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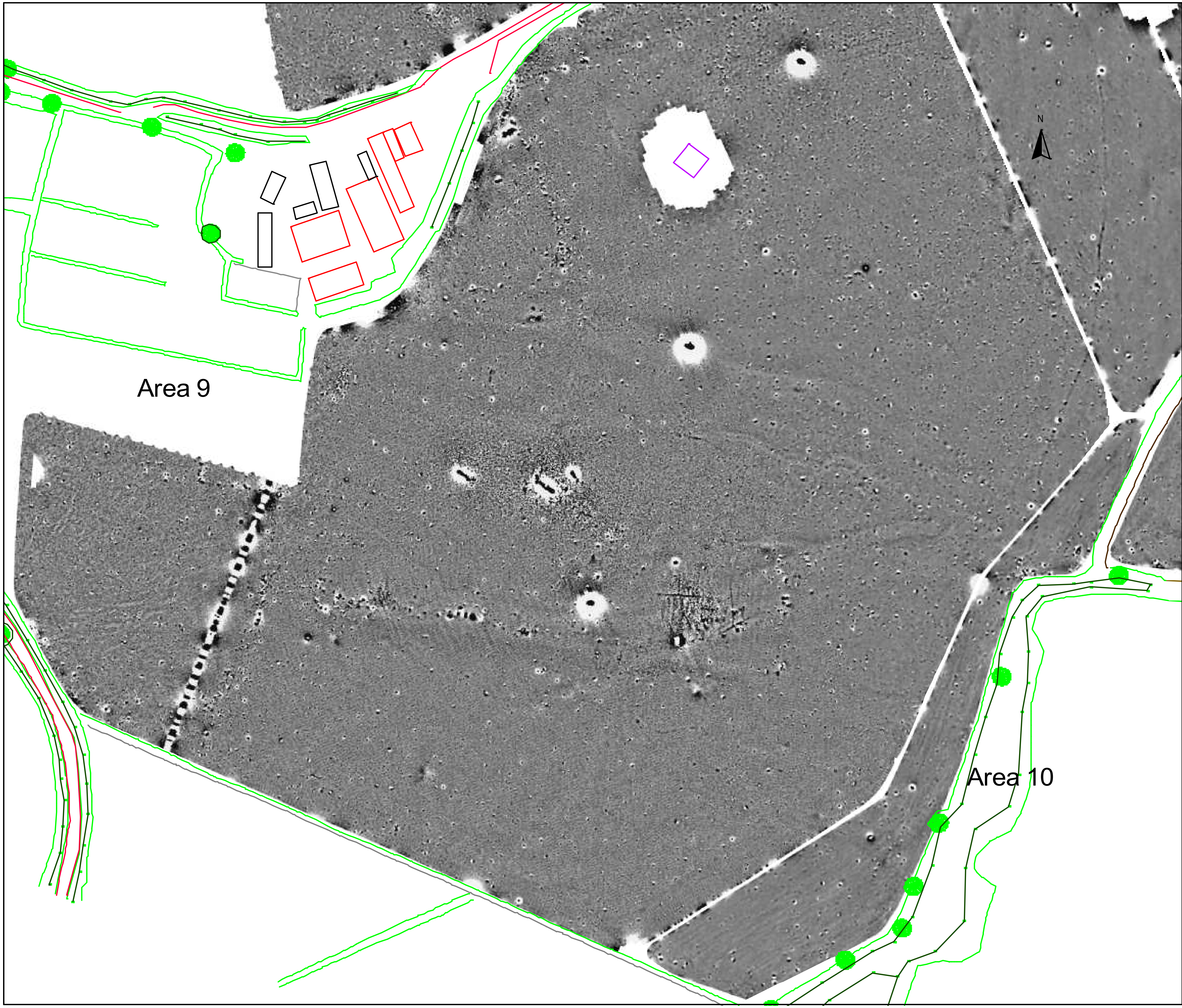
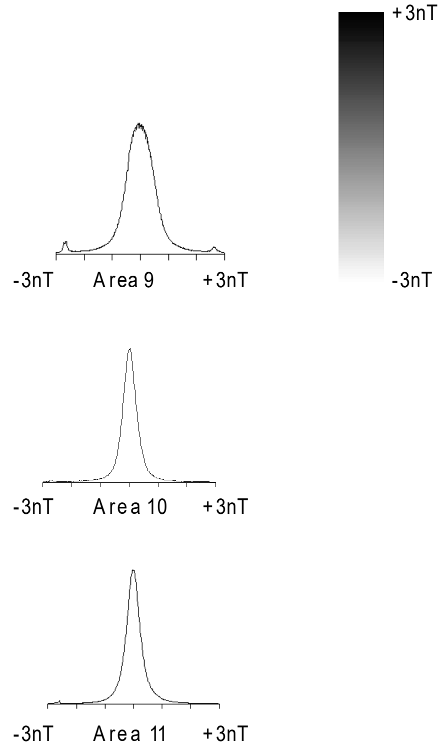
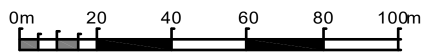


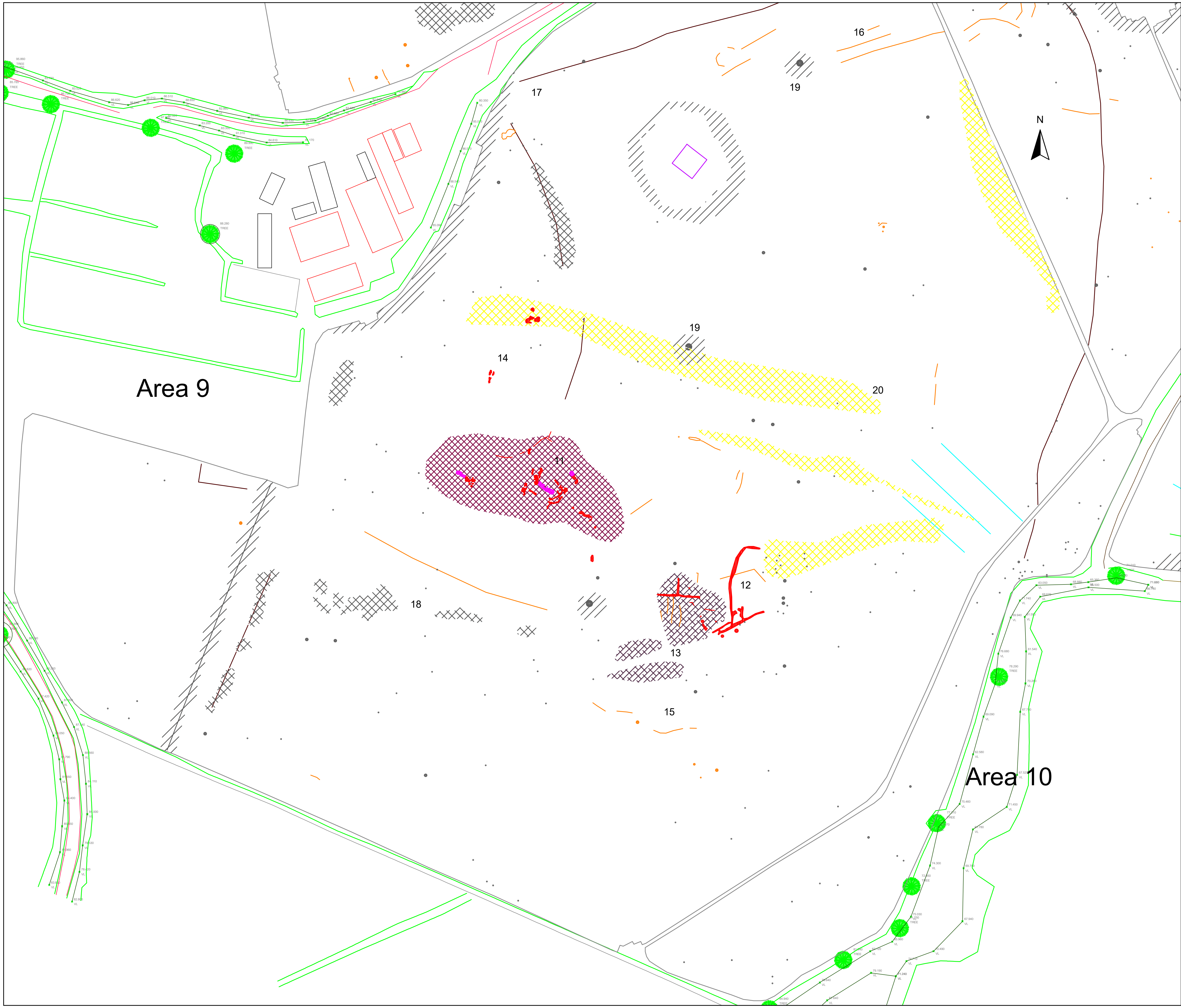
Greyscale plot of filtered magnetometer data - Areas 9, 10 & 11



SCALE 1:2000



KTD	DJS	FIG 22



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Abstraction and interpretation of magnetic anomalies - Areas 9, 10 & 11

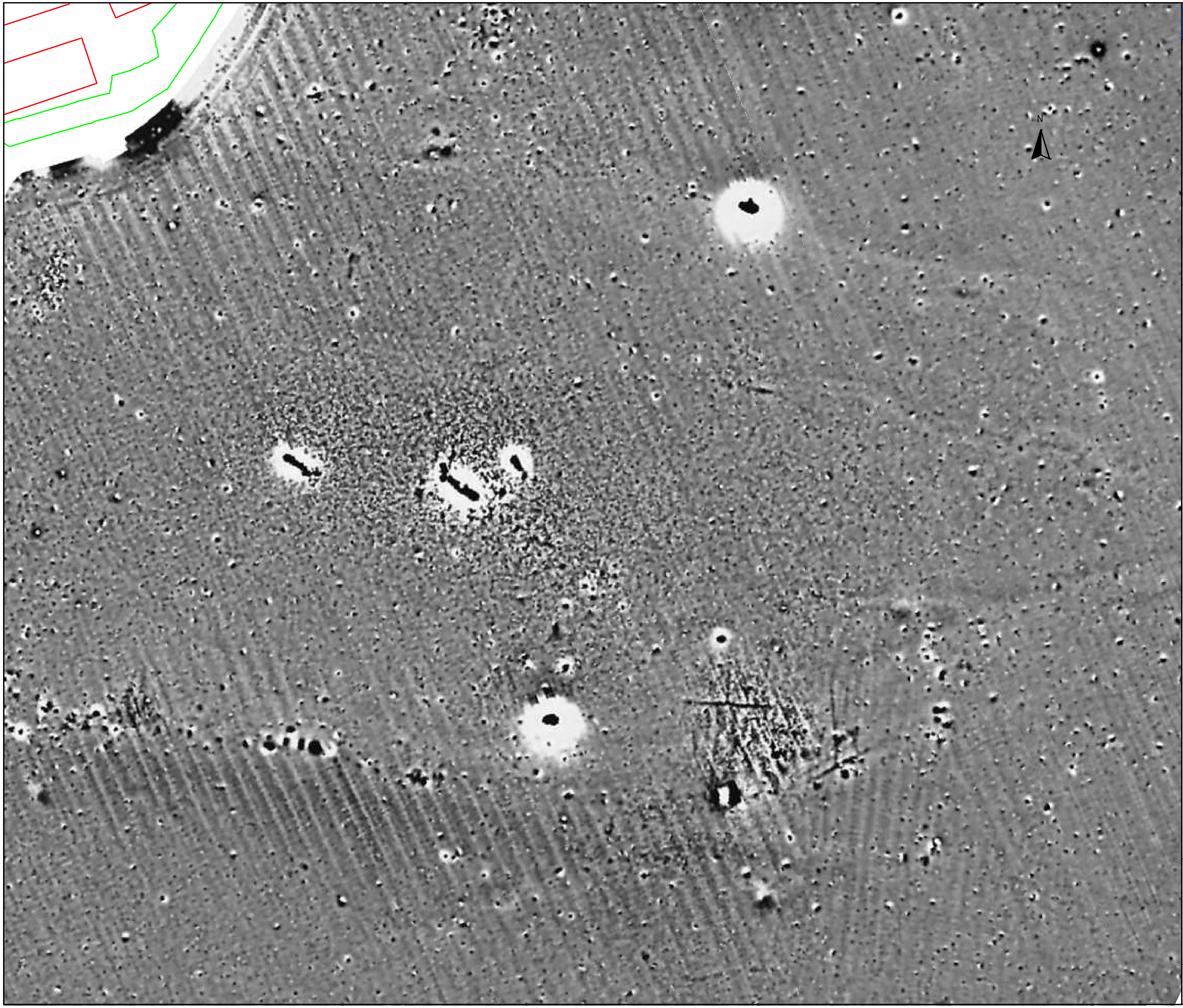
- Positive linear anomaly - cut feature/magnetic enhancement of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Positive/weak multiple dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Discrete positive response - pit/area of burning of archaeological potential
- Discrete strong positive response - associated with intense burning
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of archaeological magnetically thermoremnant material
- Variable magnetic response - associated with burning
- Variable magnetic response - of natural origin
- 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 23



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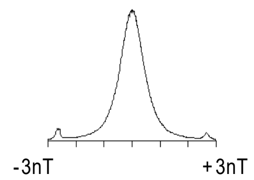
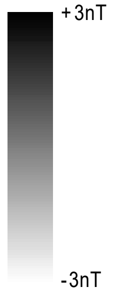
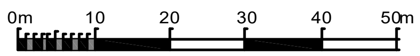
Greyscale plot of minimally processed magnetometer data - Area 9

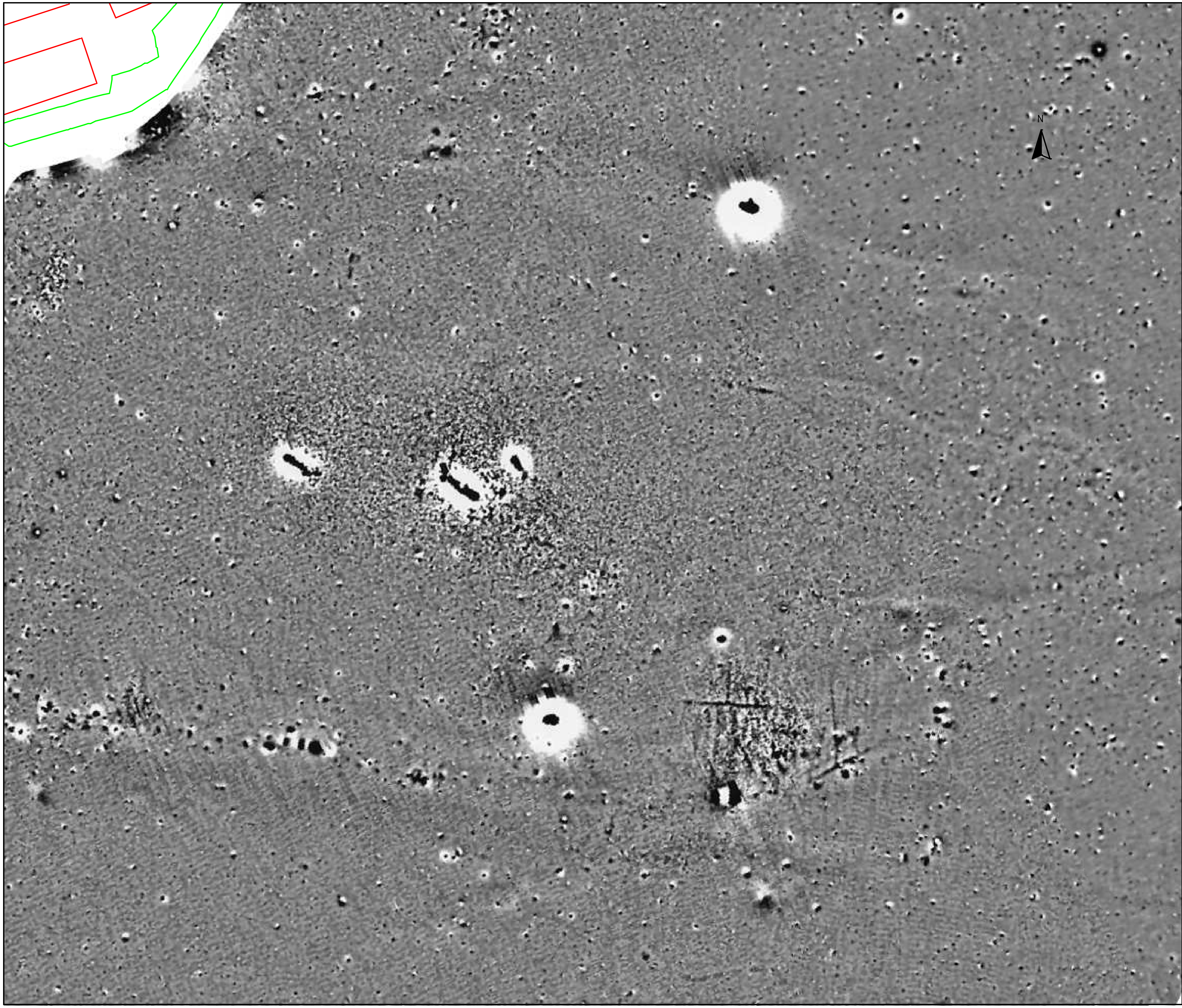




SCALE 1:1000



KTD	DJS	FIG 24



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Greyscale plot of filtered magnetometer data - Area 9

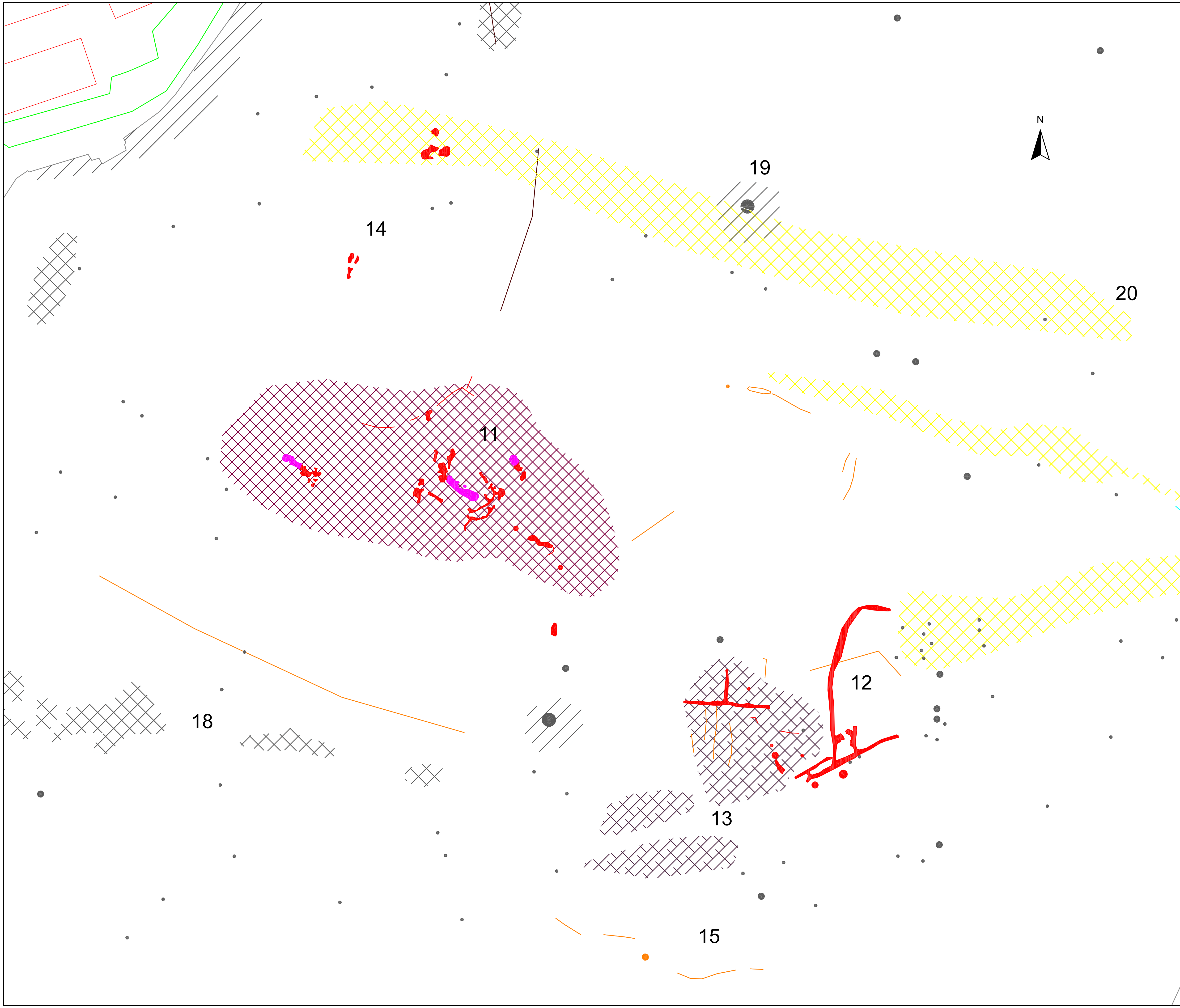
-3nT +3nT

+3nT
-3nT

SCALE 1:1000

0m 10 20 30 40 50m

KTD	DJS	FIG 25



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Abstraction and interpretation of magnetic anomalies - Area 9

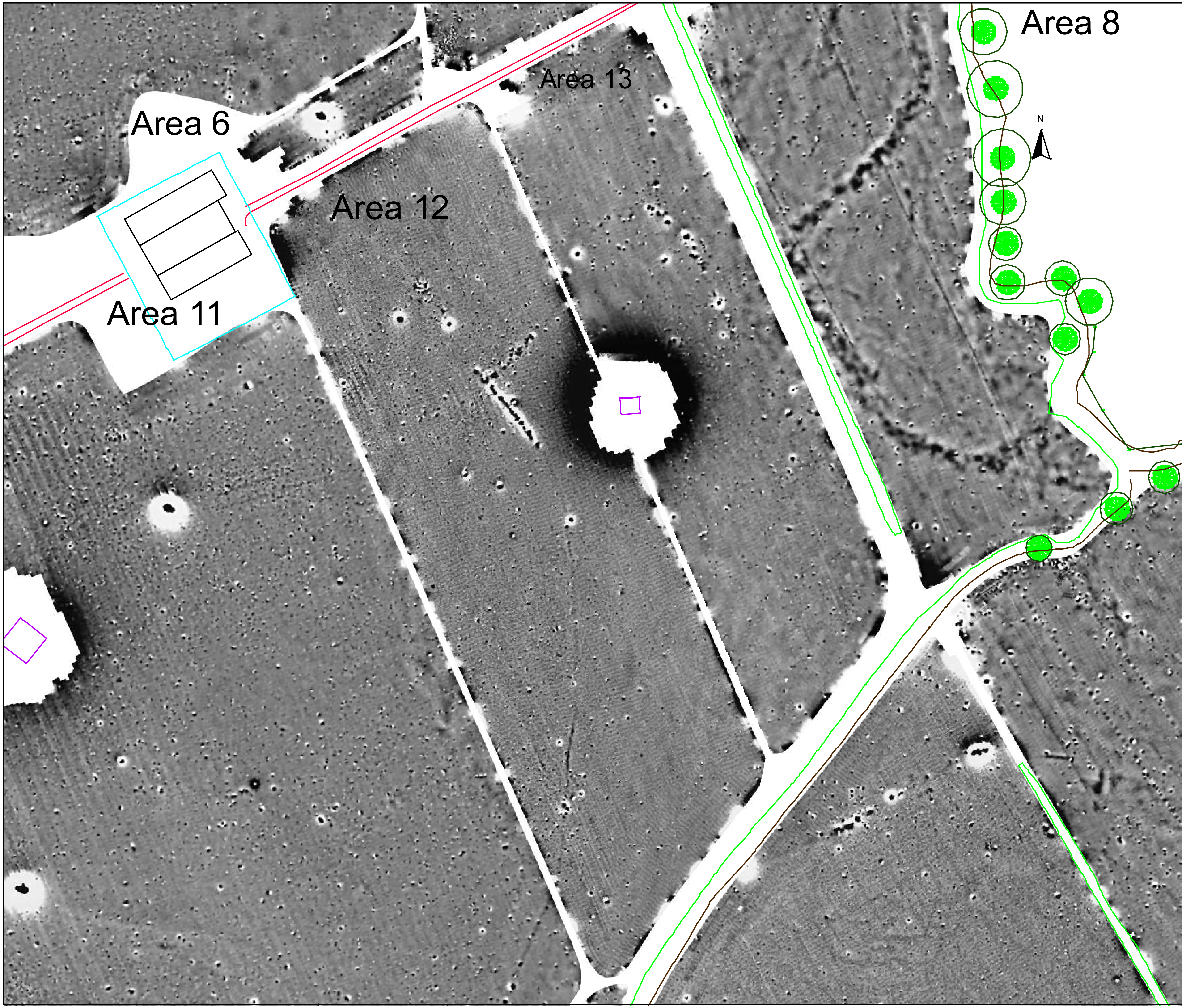
- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Discrete positive response - pit/area of burning of archaeological potential
- Discrete strong positive response - associated with intense burning
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of archaeological magnetically thermoremnant material
- Variable magnetic response - associated with burning of archaeological potential
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 26



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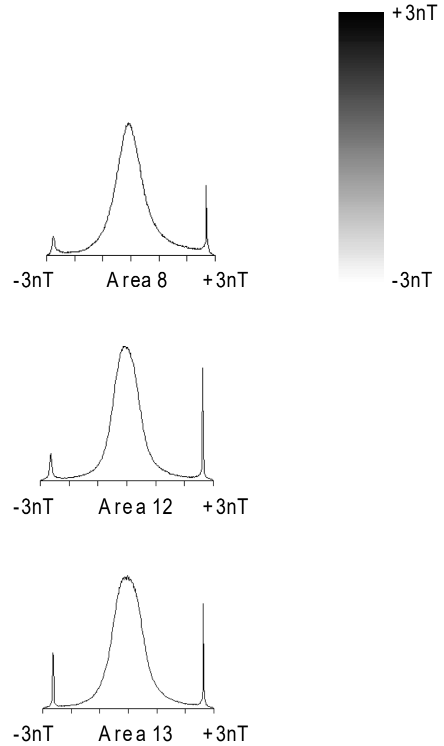
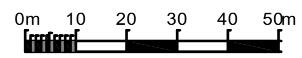
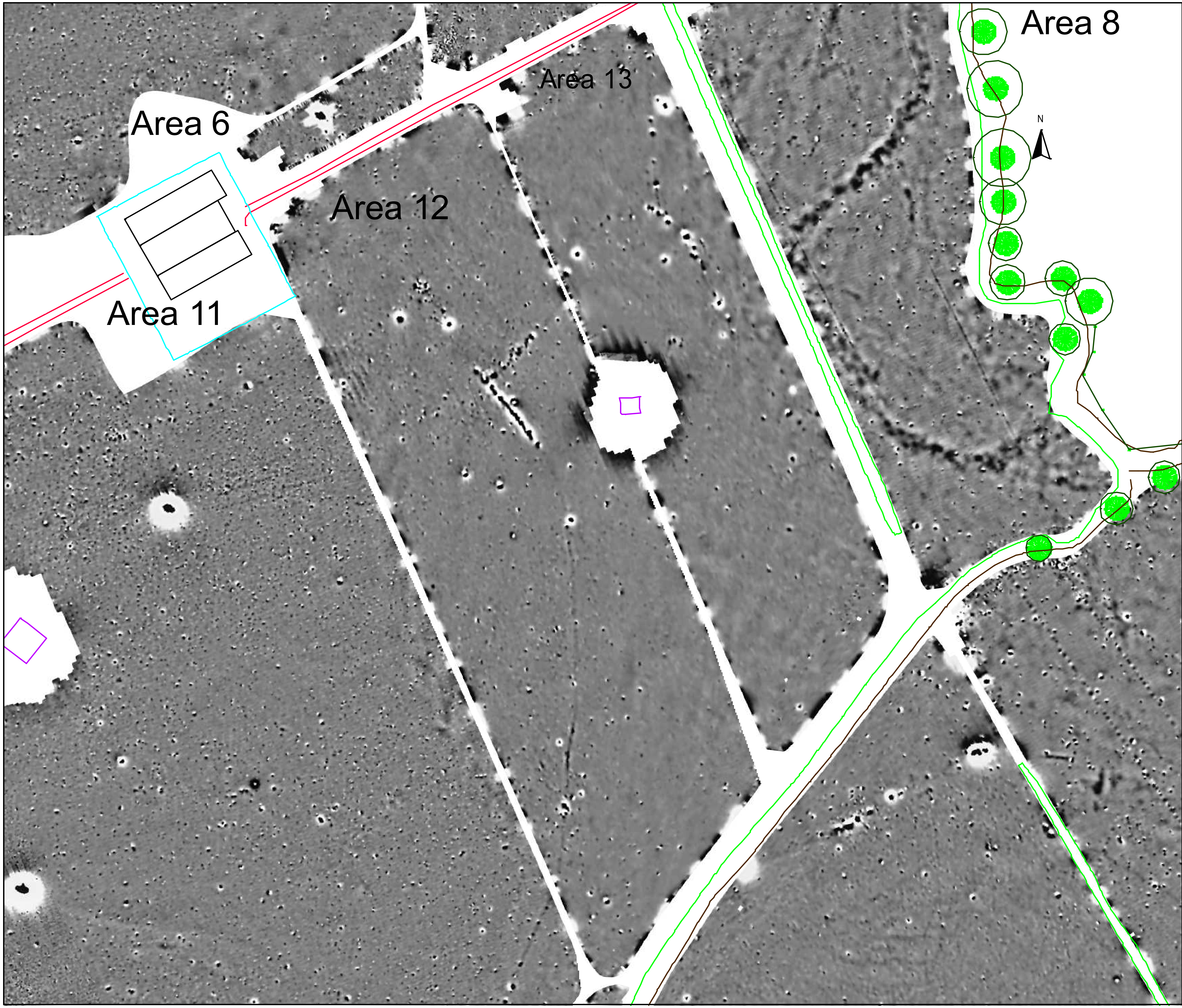
Greyscale plot of minimally processed magnetometer data - Areas 12, 13 & 8 south



SCALE 1:1500



KTD	DJS	FIG 27



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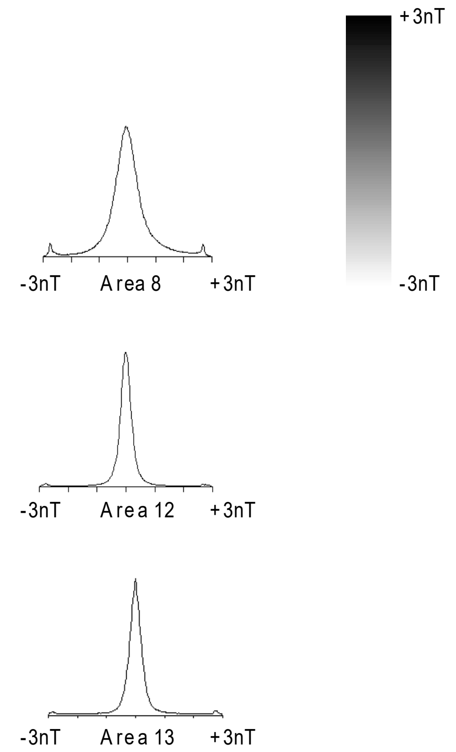
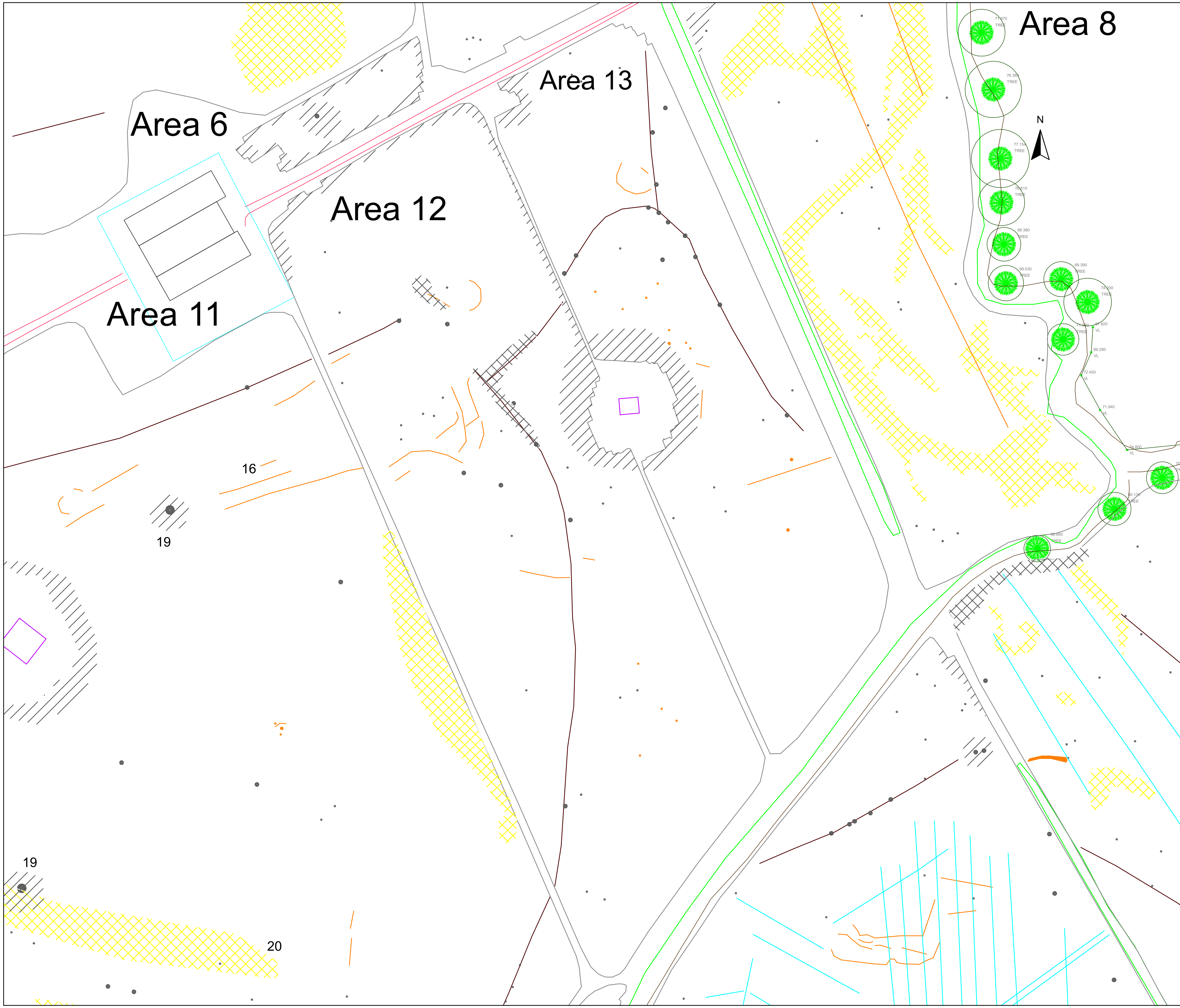
Greyscale plot of filtered magnetometer data - Areas 12, 13 & 8 south



SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 28



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Abstraction and interpretation of magnetic anomalies - Areas 12, 13 & 8 south

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Discrete positive response - possible pit-like feature
- Variable magnetic response - of natural origin
- 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

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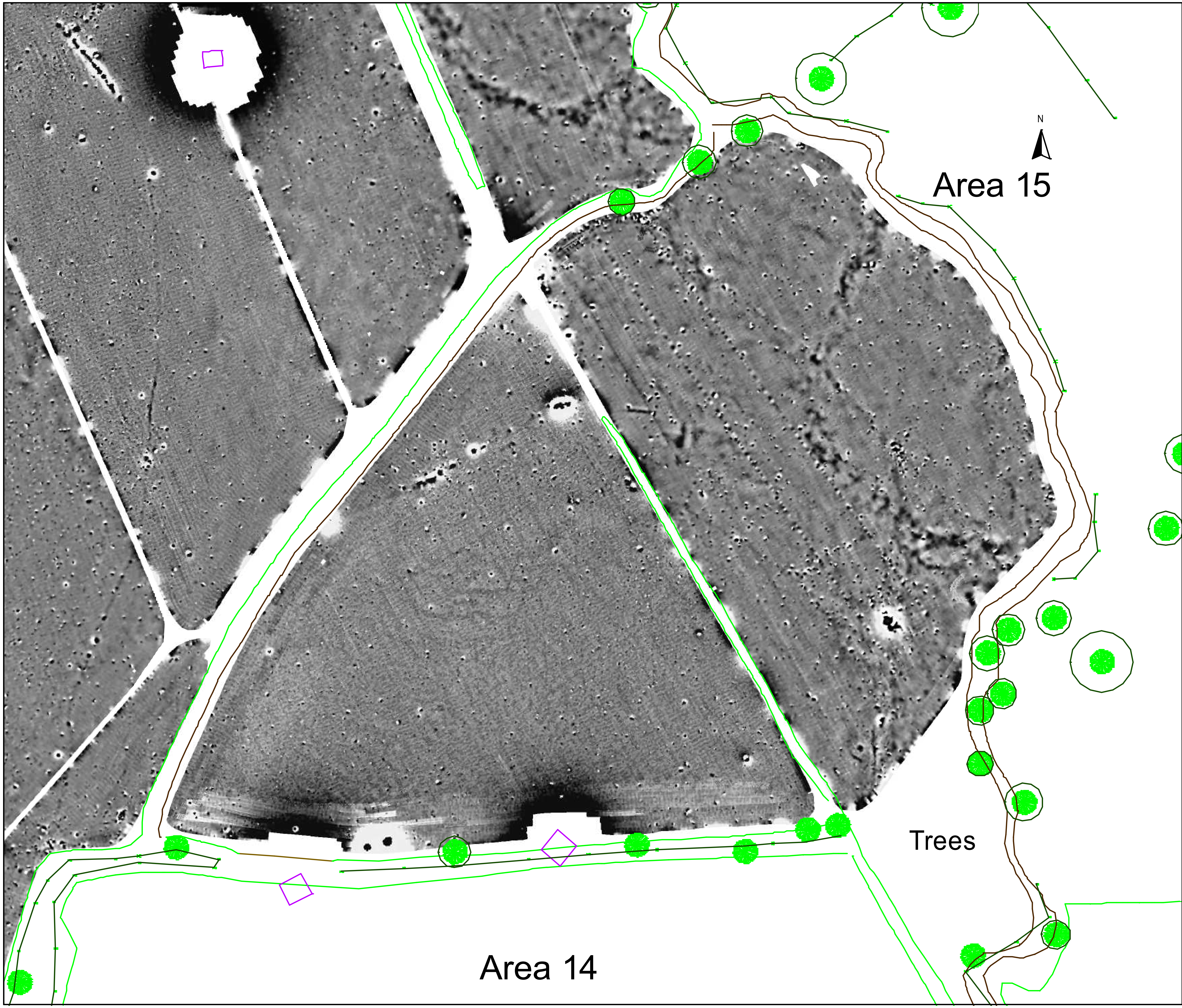
KTD	DJS	FIG 29



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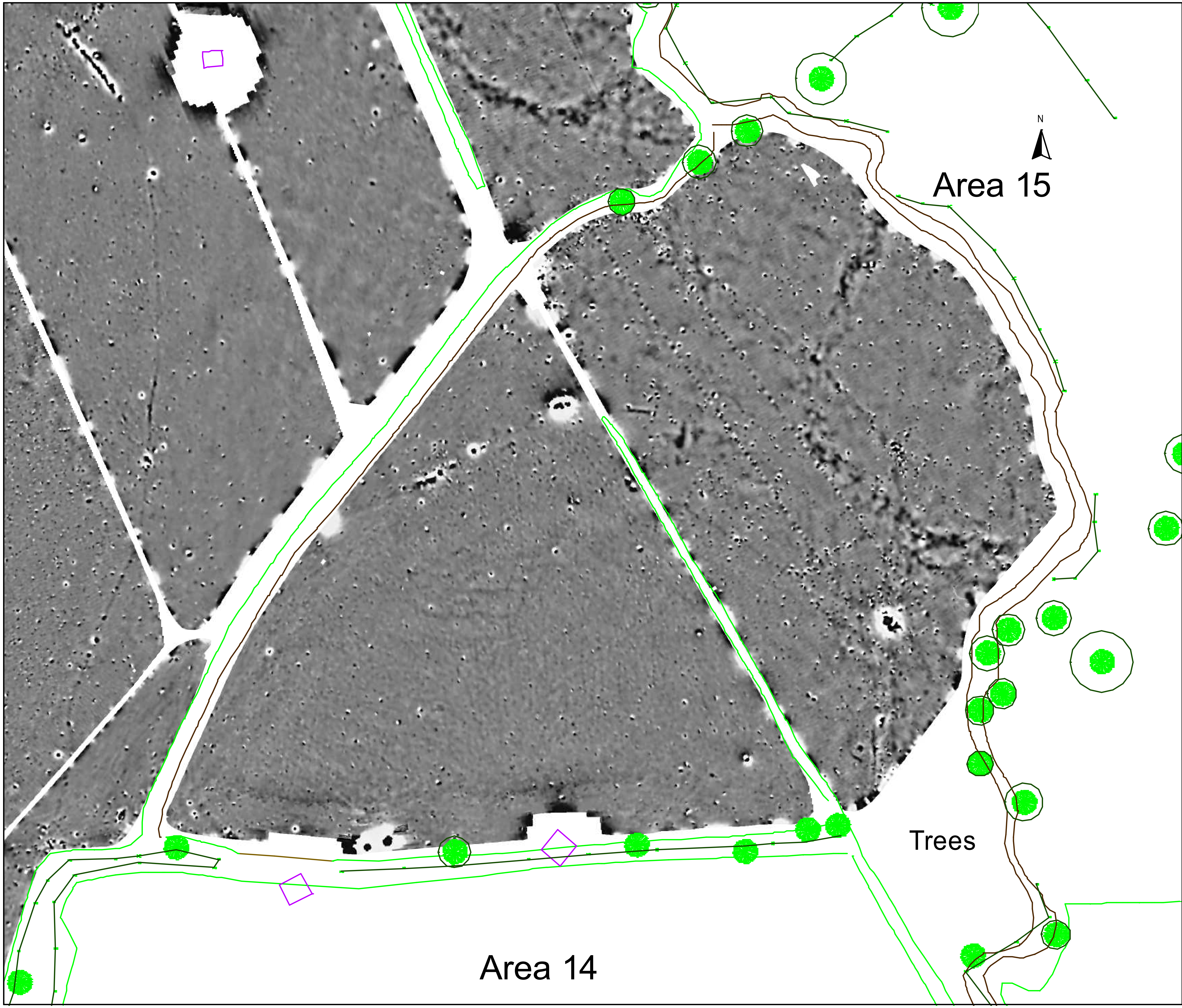
Greyscale plot of minimally processed magnetometer data - Areas 14 & 15

SCALE 1:1500

0m 10 20 30 40 50m

KTD	DJS	FIG 30



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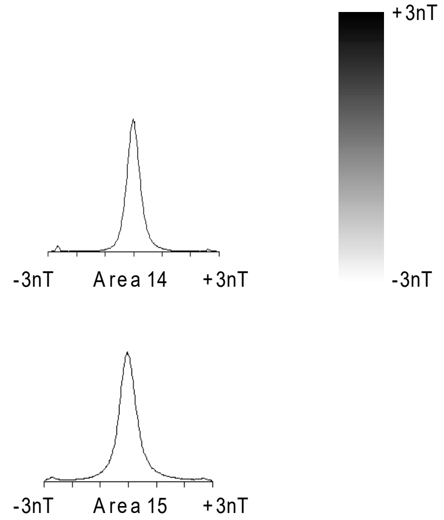
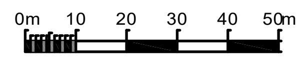
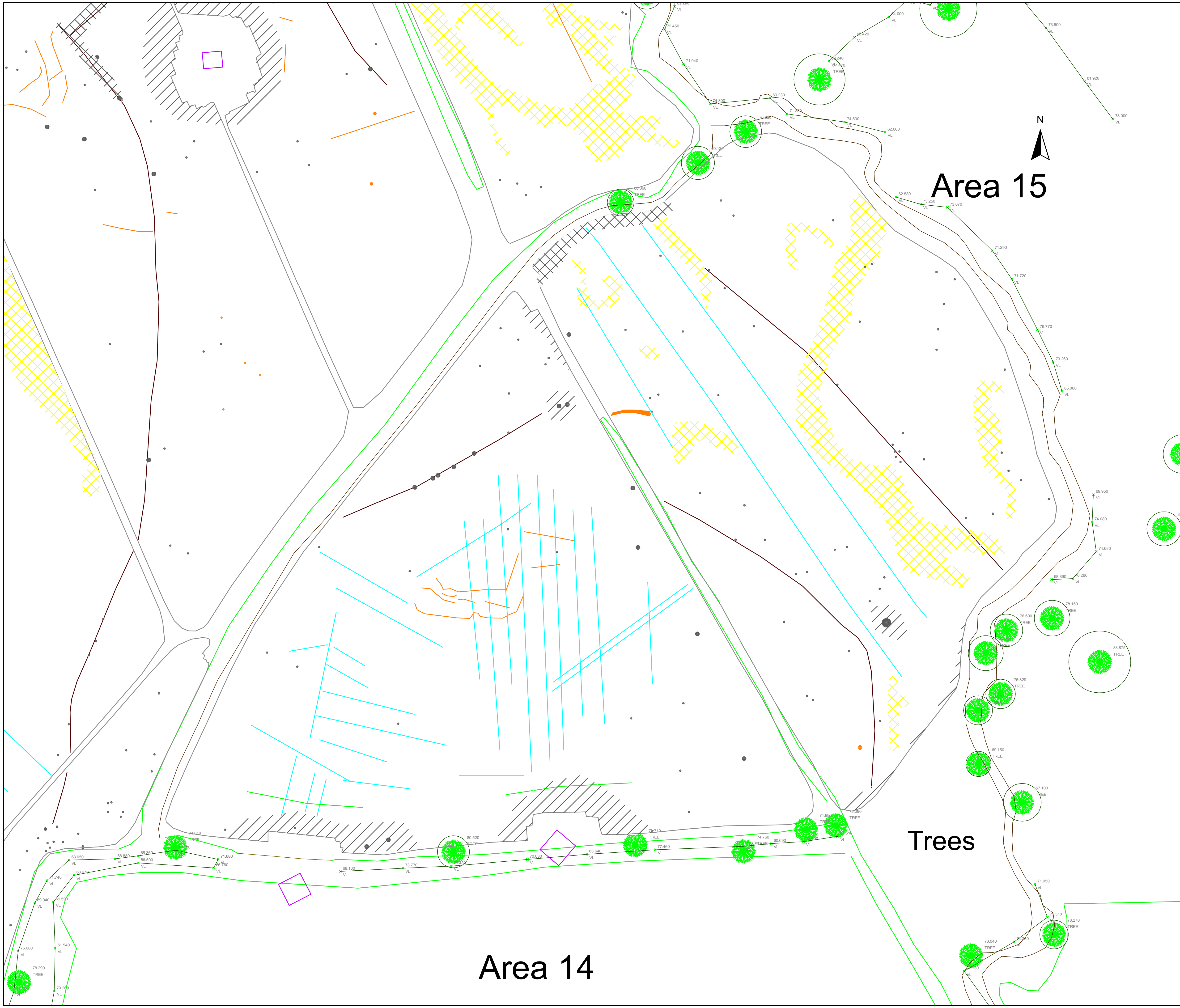
Greyscale plot of filtered magnetometer data - Areas 14 & 15



SCALE 1:1500



KTD	DJS	FIG 31



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Abstraction and interpretation of magnetic anomalies - Areas 14 & 15

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - former field boundary
- Positive/weak multiple dipolar linear anomaly - land drain
- Linear anomaly - of agricultural origin
- Variable magnetic response - of natural origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 32

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Digital Terrain Model

Derived from Environment Agency's LiDAR data 1m resolution

SCALE 1:7000

0m 70 140 210 280 350m

KTD	DJS	FIG 33