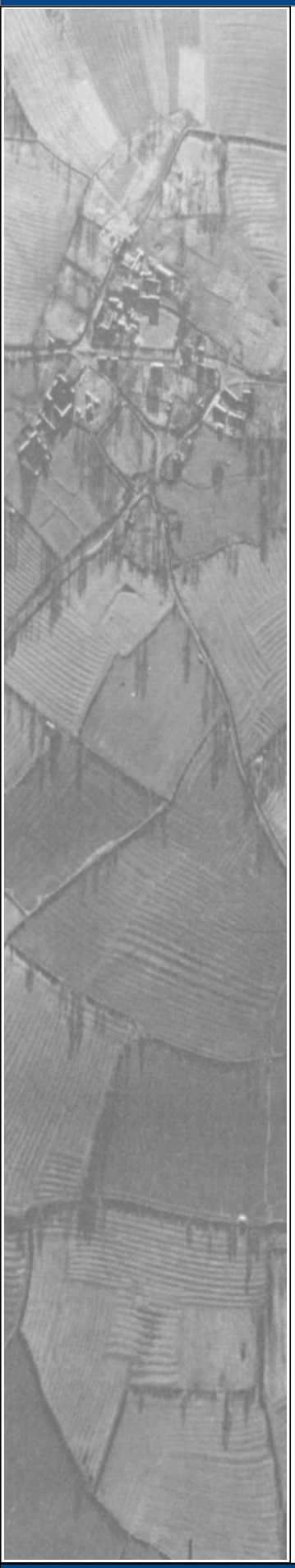

Kintbury Park Farm
Kintbury
West Berkshire

MAGNETOMETER SURVEY REPORT

for

Mr Ian Barratt

Kerry Donaldson & David Sabin

June 2021

Ref. no. J865

ARCHAEOLOGICAL SURVEYS LTD

Kintbury Park Farm
Kintbury
West Berkshire

MAGNETOMETER SURVEY REPORT

for

Mr Ian Barratt

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

Survey date – 10th June 2021
Ordnance Survey Grid Reference – **SU 39190 67120**

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SUMMARY

A geophysical survey was carried out within a 4.5ha area of land at Kintbury Park Farm in West Berkshire, ahead of construction of a new gallop track. The north eastern part of the site contains the remains of a Roman bath house, excavated in 1950-51. The results of the detailed magnetometry revealed anomalies that are likely to be associated with the bath house, although it is not clear if this is to distinctly definable features or to the backfilled material or a combination of the two. To the south of this are similar anomalies that could indicate a further small structure. These anomaly groups appear within a rectilinear enclosure, the western side of which continues to the south beyond the limit of the survey. Further west is a fragmented linear ditch of archaeological potential with a series of pit-like anomalies of uncertain origin within a north south linear zone. Other anomalies are generally weak and lack a coherent morphology preventing confident interpretation.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Bourne Rural Planning Consultancy Ltd, on behalf of Mr Ian Barratt, to undertake a magnetometer survey of an area of land at Kintbury Park Farm, Kintbury, West Berkshire. The site has been outlined for a proposed development of a new horse gallops and the survey forms part of an archaeological assessment under a condition of West Berkshire planning application no. 21/00151/COMIND.

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 Sarah Orr, Senior Archaeologist for West Berkshire Council. The north eastern part of the site contains the remains of a Roman building thought to be a bath house, excavated in the early 1950s, and due to the archaeological potential of this part of the site, a 4ha strip along the northern edge and covering a wider area around the bath house was required for survey by Sarah Orr. A slightly larger area was actually undertaken at the time of survey.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to the construction of the gallop track. 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 at Kintbury Park Farm on the north eastern edge of Kintbury, immediately to the south of the Kennet and Avon Canal and west of the sewage works. The survey covers a 4.5ha strip within the northern part of a larger 17ha field. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 39190 67120, see Figs 01 and 02. Only the northern part of the proposed gallop track was requested for survey due to the presence of the Roman bath house in the north eastern corner of the site.

1.4.2 The survey area slopes down towards the north where it is separated from the Kennet and Avon Canal by a hedgerow containing mature trees. A hedgerow bounds the eastern side of the area with the sewage works lying immediately to the east of it. The western limit of the survey is a metalled access road to the farm bordered by young trees. The north western part of the area contains

a grass track, waste material and some agricultural implements. The majority of the survey was carried out over rolled soil with emerging new grass cover.

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 fine.

Plate 1: Western part of survey area looking north east

1.5 Site history and archaeological potential

1.5.1 An archaeological desk-based assessment has been produced for the site (ASE, 2021). It outlines that within the north eastern corner of the survey area is the location of a Roman building excavated in 1949-51 and which revealed the ground plan of a building that included a hypocaust, traces of decorated wall plaster and fragments of a mosaic. It was interpreted as a bath house, given its small size and simple ground plan; however, quantities of pottery in surrounding rubbish pits indicate that a dwelling was nearby. Within the sewage works immediately to the east, further archaeological investigations recorded Roman pits, ovens and probable storage facilities. Also within the sewage works were features possibly relating to a Mesolithic occupation site, early Bronze Age pit deposits and a late Iron Age boundary ditch. Within the wider environs is the location of a ring ditch and quarry pits, likely to be Bronze Age in date and located 250m to the south west. Post medieval pottery findspots are recorded in the vicinity of the survey area, and it is bounded to the north by the Kennet and Avon Canal with a number of WW2 pillboxes located along the length of the canal.

1.5.2 The location of the Roman bath house within the site, as well as prehistoric

and Roman features directly to the east, indicates that there is high potential for the survey to locate anomalies associated with the known and possibly previously unrecorded archaeological features.

1.5.3 The surface conditions within the site were suitable for the observation of cultural material during the course of the survey. No significant scatters were noted.

1.6 Geology and soils

1.6.1 The underlying solid geology across the majority of the site is from the Newhaven Chalk Formation and from the Seaford Chalk Formation in the north eastern corner with head deposits just entering the south eastern corner of the survey area (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Frilsham association and is a typical argillic brown earth. It consists of a well drained, mainly fine, loamy 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 survey area. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.10 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 4.5ha within a single block along the northern edge of the field, including a slightly wider area at the eastern end.

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, linear anomalies of an agricultural origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines. Anomalies located within each survey area have been numbered and are described in 3.4 below with subsequent discussion in Section 4.

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 A localised zone of magnetic disturbance is present within data collected along the northern edge of the site and this relates to a buried service. Additional high pass filtering was carried out in order to minimise the effect of

this disturbance. Both filtered and unfiltered data were assessed to ensure no anomalies of archaeological potential were affected or removed by the additional processing.

3.2.3 The survey located linear and discrete anomalies of low to moderate magnitude that indicate the formation of enhanced magnetic susceptibility within the topsoil contrasting well with the subsoil and/or solid geology.

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 with an agricultural origin	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing. This category does not include agricultural features of early date or considered to be of archaeological potential (e.g. animal stockades, enclosures, farmsteads, etc).
Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, hearths and nail spreads from former wooden structures or rooves and may, therefore, be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 1: List and description of interpretation categories

3.4 List of anomalies

Area centred on OS NGR 439190 167120, see Figs 03 – 05.

Anomalies of archaeological potential

(1) – A group of positive and negative anomalies are situated close to the north eastern corner of the survey area. They are close to the recorded location of the Roman bath house and are highly likely to be associated with it; however, it is not clear if they just relate to in situ remains, such as walls, intact surfaces, areas of burning, or if they relate to different areas of backfilled material or a combination of both.

(2) – Located to the south of (1) are another cluster of positive and negative anomalies, contained within the corner of an L-shaped rectilinear anomaly. The responses also suggest further structural remains, although the morphology is not clearly defined, and a feature such as a crop drier is possible.

(3) – Positive linear anomalies relate to ditches that are likely to form at least one enclosure, the majority of which is likely to extend beyond the survey to the east. The western ditch extends beyond the southern limit of the survey and may relate to a conjoined enclosure or land boundary. The enclosure is likely to be Roman in origin as it contains anomaly groups (1) and (2).

(4) – Situated 100-150m west of enclosure (3) is a fragmented positive linear anomaly. Although a field boundary is mapped with a similar orientation from the late 20th century (see Fig 01) the response is 10m to the east, slightly curvilinear and is indicative of the magnetically enhanced fill of a linear boundary ditch with some antiquity.

Anomalies with an uncertain origin

(5) – Located close to the eastern edge of the survey area are a number of amorphous positive responses. It is not clear if they relate to magnetically enhanced material within disturbed ground close to the field boundary, or if they are directly associated with the enclosures and, therefore, have an archaeological origin.

(6) – A number of pit-like features are situated to the south of enclosure ditch (3). They are weak and indistinct, but they appear to form an arc, and an archaeological origin is possible.

(7) – Located within the central part of the survey area are a linear group of discrete positive responses. They extend northwards from the southern edge of the survey area for approximately 85m and then extend east north east for another 100m. They appear to be formed of pairs or small groups of irregularly spaced pits. It is not clear if they relate to naturally formed pit-like responses, possibly associated with tree throw pits, or if they relate to linear formation of pits with an archaeological origin.

(8) – Situated at the junction of where anomalies (7) change orientation is a positive linear anomaly. It is short and appears to be crossed by another short positive linear anomaly and although their morphology is not clearly defined, it is possible that this relates to a cut feature with archaeological potential.

(9) – A cluster of discrete positive and positive curvilinear anomalies are located to the west of anomaly (8). While the response is very weak and poorly defined, their morphology suggests that they could have archaeological potential.

(10 & 11) – The survey area contains a number of discrete pit-like anomalies (10) and weakly positive linear anomalies (11). They generally lack a coherent morphology and their origin is uncertain.

(12) – A group of positive anomalies are located at the western end of the survey area. They are weak and generally parallel with the existing field boundaries. It is, therefore, possible that they have some agricultural association such as a former headland or boundary, but this could be of some antiquity.

(13) – Located in the north eastern part of the survey area 25m west north west of anomalies (1) is a sub-circular negative response, containing discrete positive anomalies and it has an association with magnetic debris. It is possible that this has an association with burning, possibly a modern bonfire, but this is not certain and an archaeological origin cannot be ruled out.

Anomalies with an agricultural origin

(14) – The survey area contains two series of linear anomalies parallel with the field boundaries and which relate to different episodes of modern ploughing and cultivation.

Anomalies associated with magnetic debris

(15) – Patches of magnetic debris in the north western part of the survey area are associated with spreads of modern ferrous and magnetically thermoremnant material possibly derived from burnt waste.

(16) – The entire survey area contains numerous and widespread strong, discrete, dipolar anomalies which are a response to ferrous and other magnetically thermoremnant objects within the topsoil.

Anomalies with a modern origin

(17) – A strong, multiple dipolar, linear anomaly extends around the northern edge of the survey area and relates to a buried service. It has associated widespread magnetic disturbance.

4 DISCUSSION

4.1.1 The survey has located a cluster of anomalies (1) that are highly likely to be associated with the Roman bath house remains in the north eastern corner of the site. The anomalies relate to linear, discrete and amorphous positive responses, which could indicate pits and areas of burning or burnt material, and negative responses which could relate to walling and floor surfaces; however, the anomalies are not clearly rectilinear. The excavation revealed a simple plan of an isolated building 5.25m by 4.04m long with a small 2.13m by 1.52m extension to the south (West Berkshire HER no 3830). The anomalies are consistent with these general dimensions. It is possible that the anomalies could relate to the former structural remains and areas of burning such as a flue/furnace; however, since the bath house was fully excavated between 1949-51, the lack of clarity could relate to the back filling of the bath house, with the negative anomalies being a response to backfilled walling materials, flint and chalk and the positive responses to backfilled burnt material. It is of note that no evidence of structural remains or any cultural material was observed within the field despite very good surface conditions.

4.1.2 Situated 100m south of the anomalies associated with the bath house (1) are another group of positive and negative anomalies (2). These appear as discrete negative responses, possibly indicating structural remains, with some associated positive responses, indicative of cut features or areas of burning and they are located within the corner of an L-shaped linear feature. The responses are not well defined and the negative responses are more discrete rather than linear or rectilinear, and it is possible that they relate to former structural remains, such as a Roman corn drying oven, but another small building with dimensions similar to the bath house is possible. Both of the potential former structures are situated within a rectilinear enclosure (3) that probably extends well beyond the eastern limit of the survey. The western ditch of the enclosure extends beyond the limit of the survey to the south and may relate to a second enclosure or continue as a boundary ditch.

4.1.3 Located 100-150m to the west of the Roman enclosures is a fragmented positive linear anomaly (4). The anomaly is consistent with the response to the fill of a linear ditch. It is not clear if the fragmentation relates to deliberate gaps along the line of the ditch, or if they have been truncated by later agricultural activity. Situated approximately 35m west of and generally parallel with the linear ditch is a linear group of north to south aligned pits (7), which then extend east north east. While, such responses could relate to naturally formed pits within the underlying chalk geology, the grouping in pairs or clusters could indicate that they have an archaeological origin. The site contains other discrete positive responses, but these are either generally isolated or lack a coherent morphology or association with other features.

5 CONCLUSION

5.1.1 The geophysical survey has located a group of anomalies in the north eastern part of the site, that although do not have clearly defined rectilinear elements that would usually indicate a building, are highly likely to be associated with the Roman bath house that was excavated between 1949-51. However, it is possible the responses relate to backfilling material and/or the actual archaeological features. These anomalies are situated within a rectilinear enclosure which also contains evidence for further possible structural remains to the south, consisting of a group of positive and negative anomalies that lack a coherent morphology, but have archaeological potential.

5.1.2 Towards the centre of the survey area is a fragmented positive linear anomaly that indicates the presence of a linear ditch. To the west of this are a linear group of pits that although could relate to natural features, may have an archaeological origin. Elsewhere, the majority of anomalies lack a coherent morphology and cannot be confidently interpreted.

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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

Minimally processed data

COMPOSITE
Path: C:\Business\Jobs\J865 Kintbury Park Farm\Data\Mag\comps\
Filename: J865-mag-proc.xcp
Description: Imported as Composite from: J865-mag.asc
Instrument Type: Sensys DLMGPS
Units:
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 438958.365, 167188.463 m
Southeast corner: 439417.965, 167014.613 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Dimensions
Survey Size (meters): 460 m x 174 m
X&Y Interval: 0.15 m
Source GPS Points: Active: 1165186, Recorded: 1165186
Stats
Max: 5.53
Min: -5.50
Std Dev: 1.63
Mean: 0.05
Median: 0.03

Composite Area: 7.9901 ha
Surveyed Area: 4.6595 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

Filtered data

Stats
Max: 5.53
Min: -5.50
Std Dev: 1.64
Mean: 0.05
Median: 0.03
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 West Berkshire Historic Environment Record with printed copies 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	J865-mag.asc J865-mag.xcp J865-mag-proc.xcp J865-mag-proc-hpf.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J865-mag-proc.tif J865-mag-proc-hpf.tif	Image in TIF format
Drawing	J865-**[version number]**.dwg	CAD file in 2018 dwg format
Report	J865 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 LINEAR ARCHAEOLOGY		Red 255,0,0	Polyline or polygon (solid)

AS-ABST MAG NEG LINEAR ARCHAEOLOGY		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 POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
AS-ABST MAG NEG UNCERTAIN		Blue 0,0,255	Polygon (cross hatched ANSI37)
Anomalies 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

Table 3: CAD layering

Appendix F – copyright and intellectual property

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Specialist Geophysical Surveyors

Geophysical Survey
Kintbury Park Farm
Kintbury
West Berkshire

Map of survey area

● Survey location

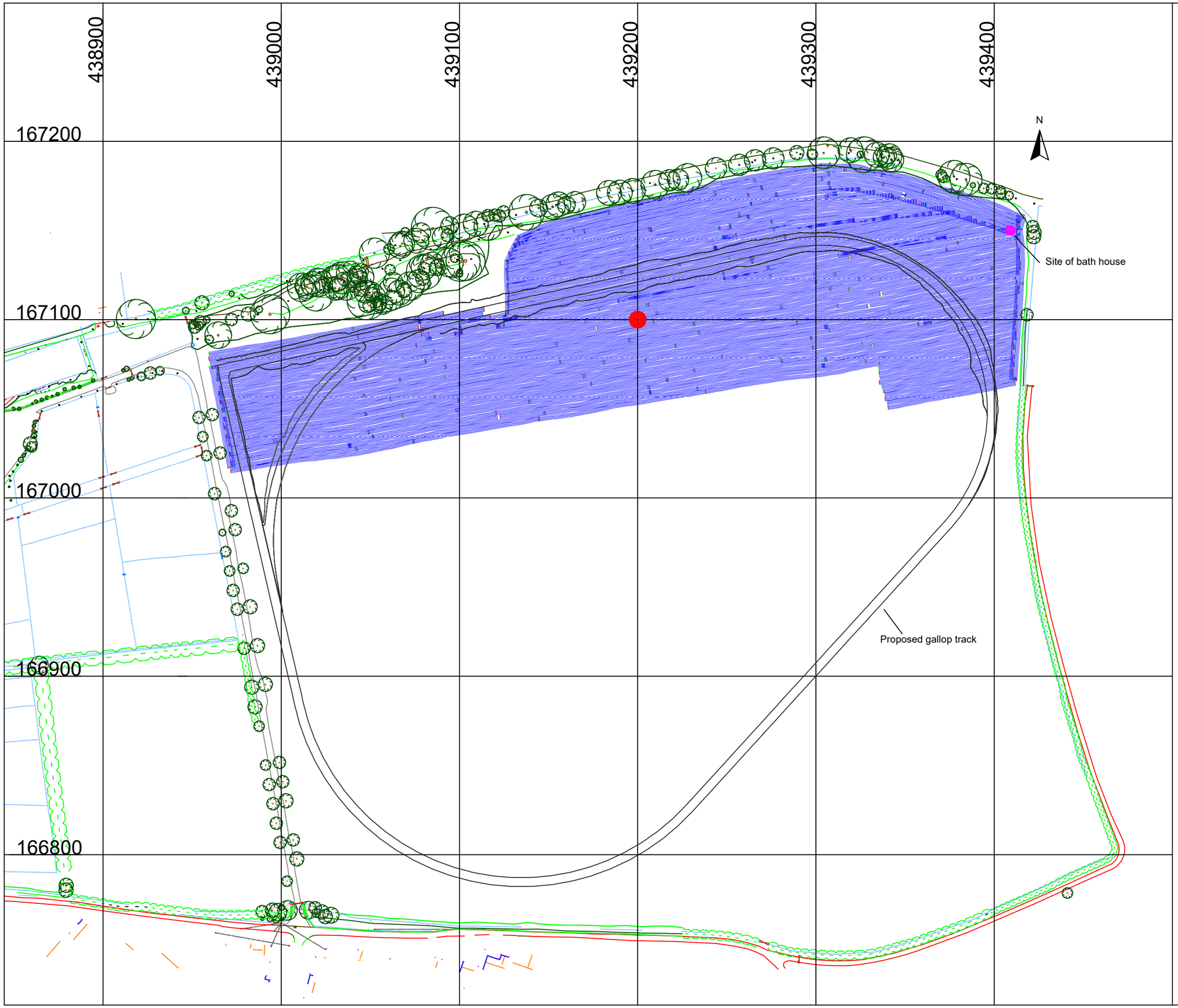
Site centred on OS NGR
SU 39190 67120

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 100m intervals

439200 167100

Survey tracks

Survey track start

Survey track stop

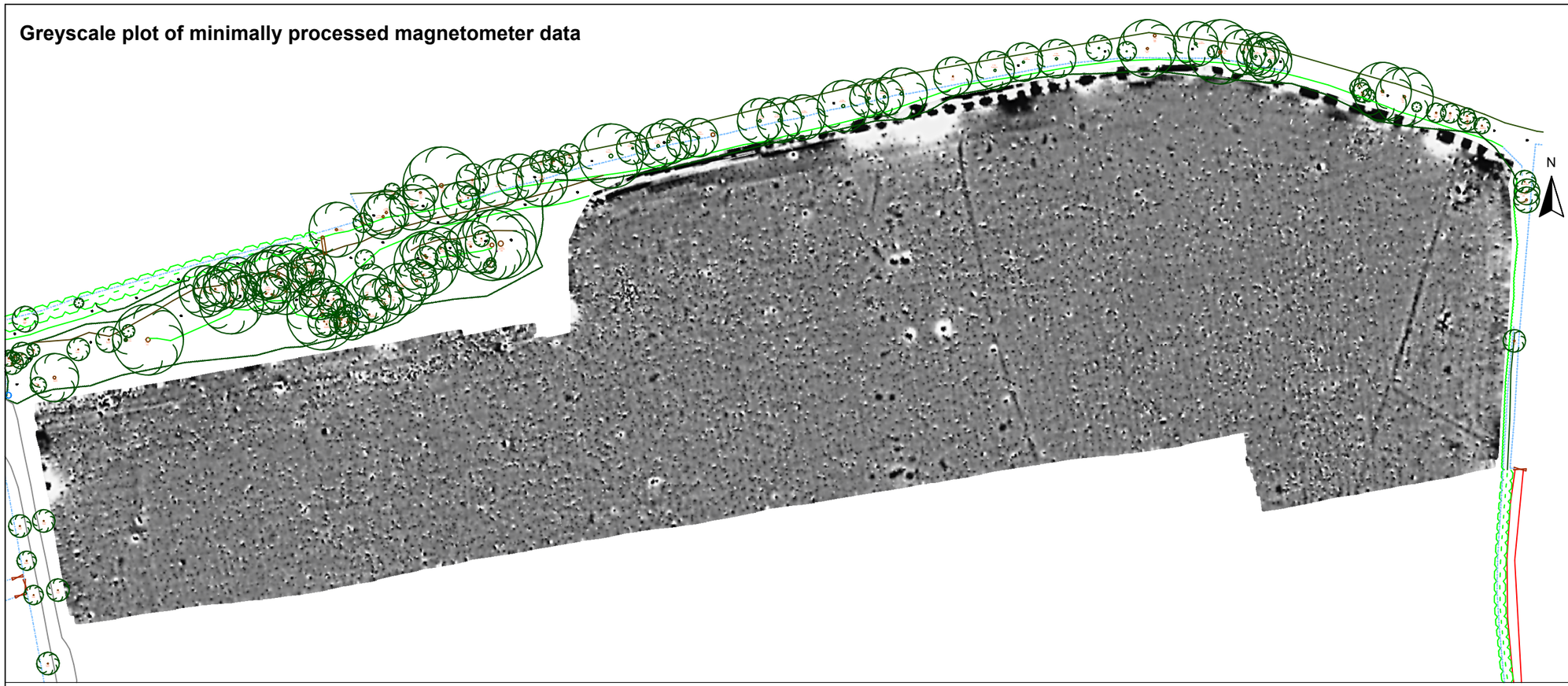
SCALE 1:2000

0m 20 40 60 80 100m

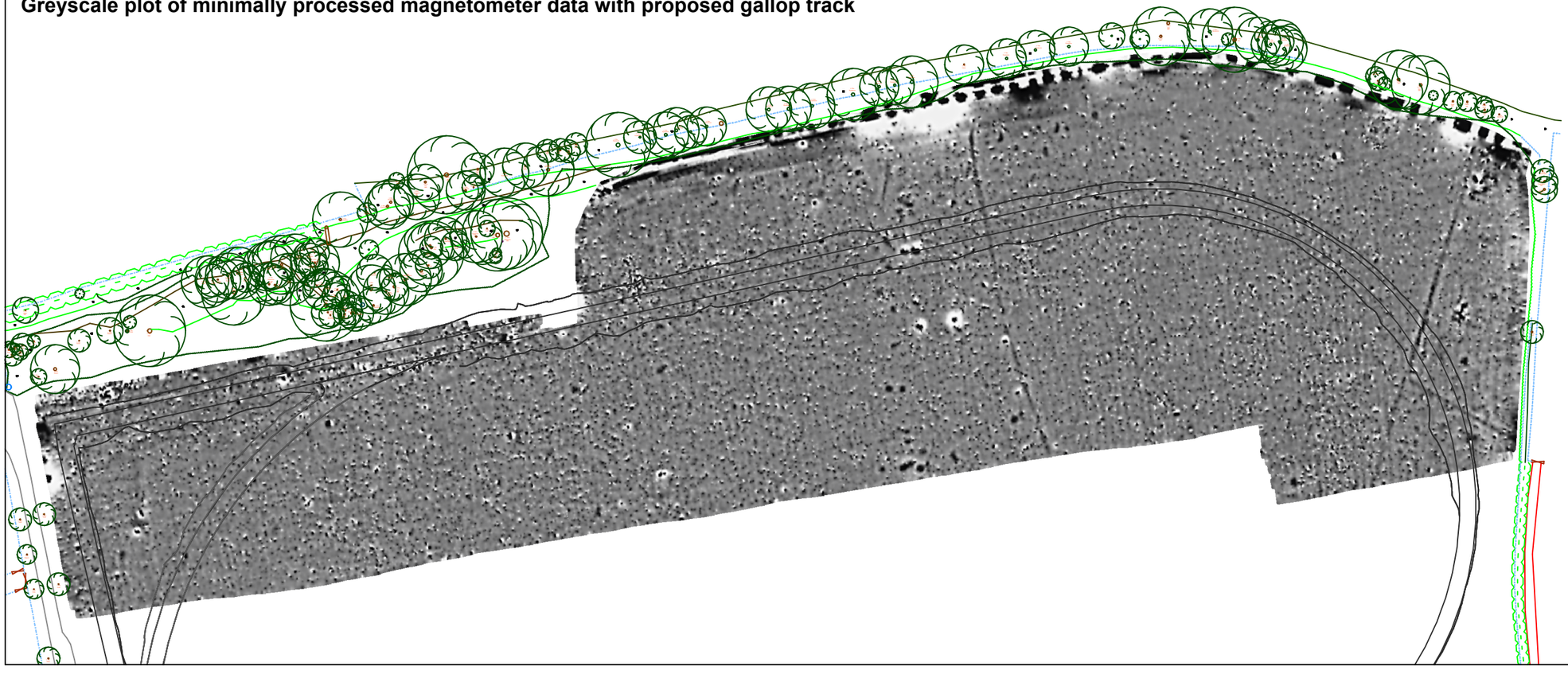
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

Greyscale plot of minimally processed magnetometer data



Greyscale plot of minimally processed magnetometer data with proposed gallop track



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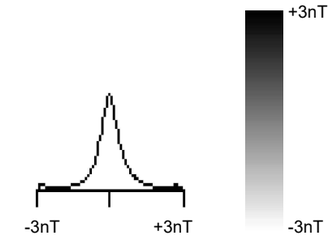
Greyscale plot of minimally processed magnetometer data



SCALE 1:1500

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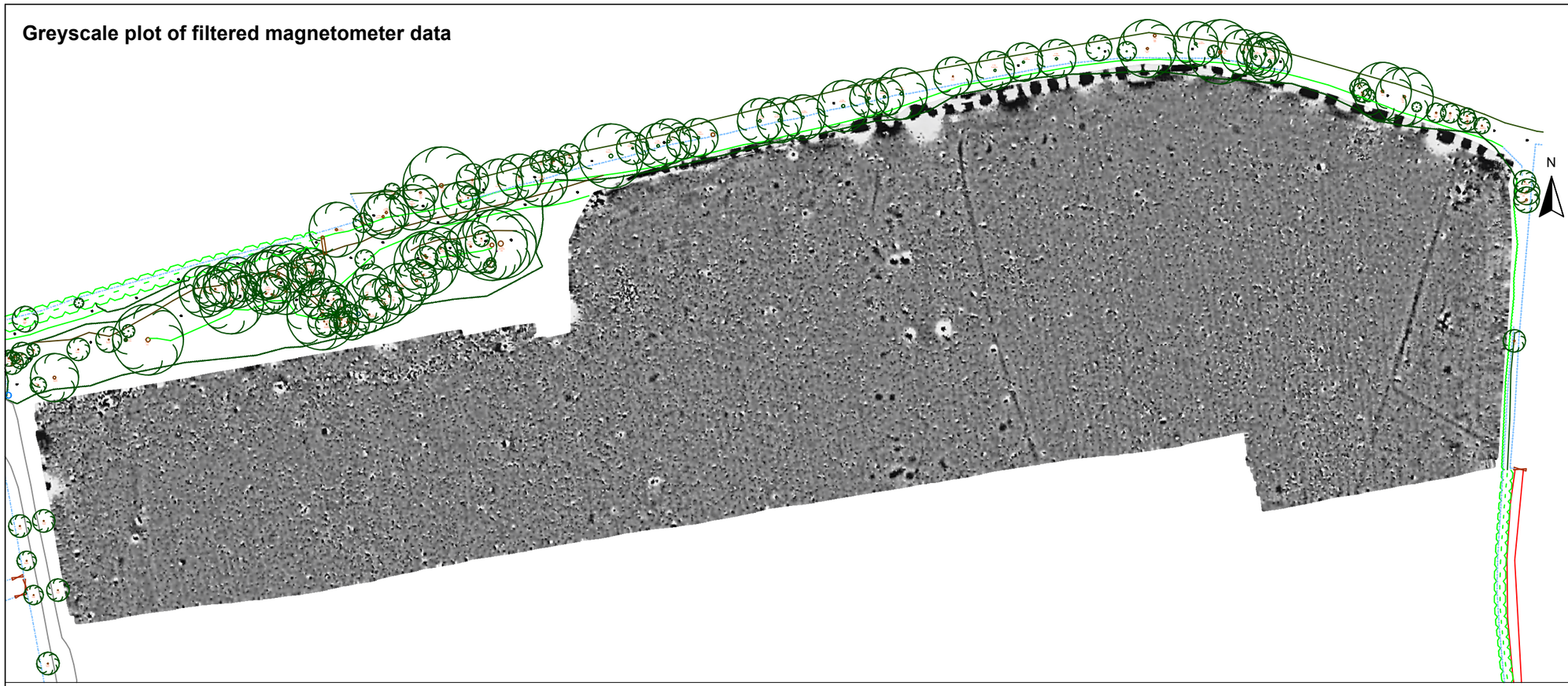
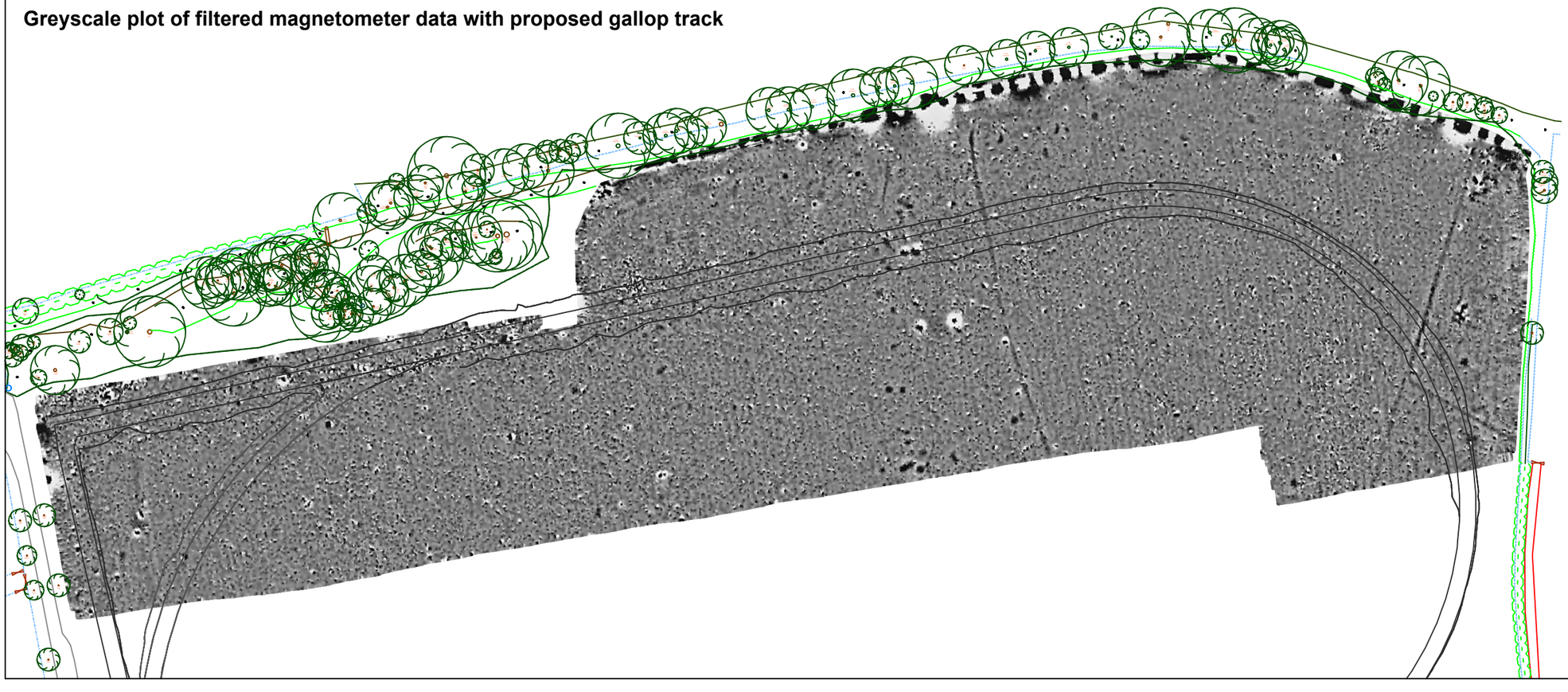
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

Greyscale plot of filtered magnetometer data



Greyscale plot of filtered magnetometer data with proposed gallop track



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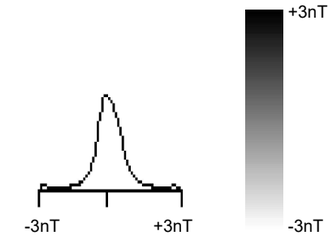
Greyscale plot of filtered magnetometer data



SCALE 1:1500

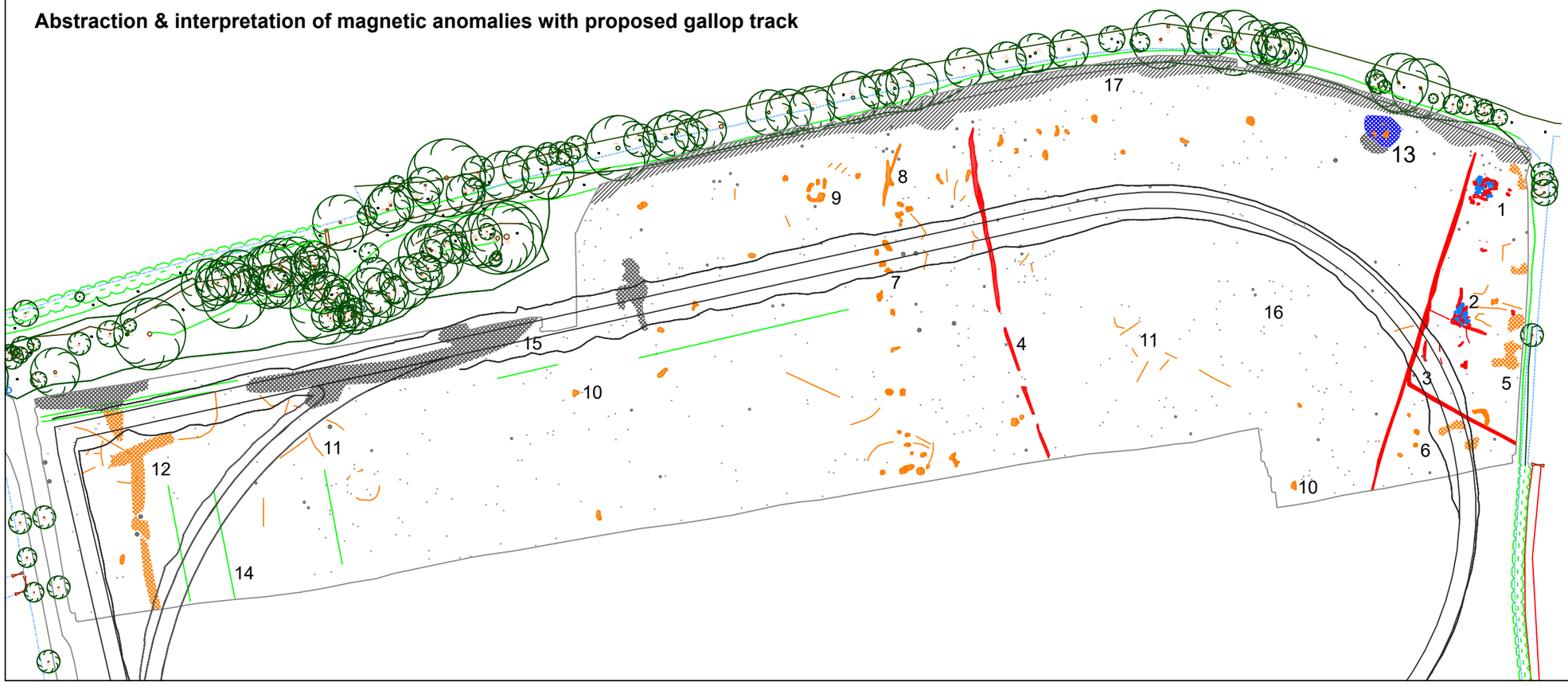
0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

Abstraction & interpretation of magnetic anomalies

Abstraction & interpretation of magnetic anomalies with proposed gallop track



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Abstraction & interpretation of magnetic anomalies

- Positive linear anomaly - cut feature of archaeological potential
- Negative linear anomaly - of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Discrete negative response - of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

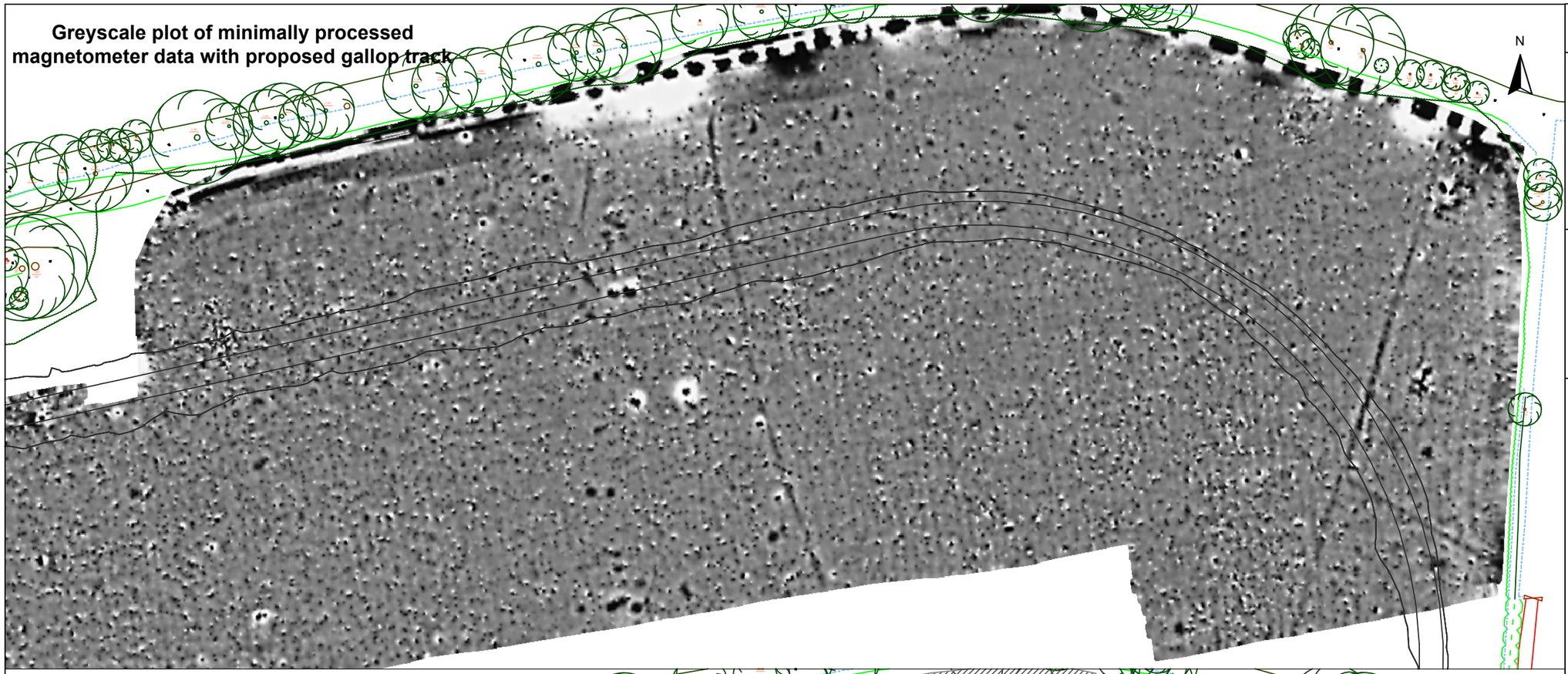
SCALE 1:1500

0m 10 20 30 40 50m

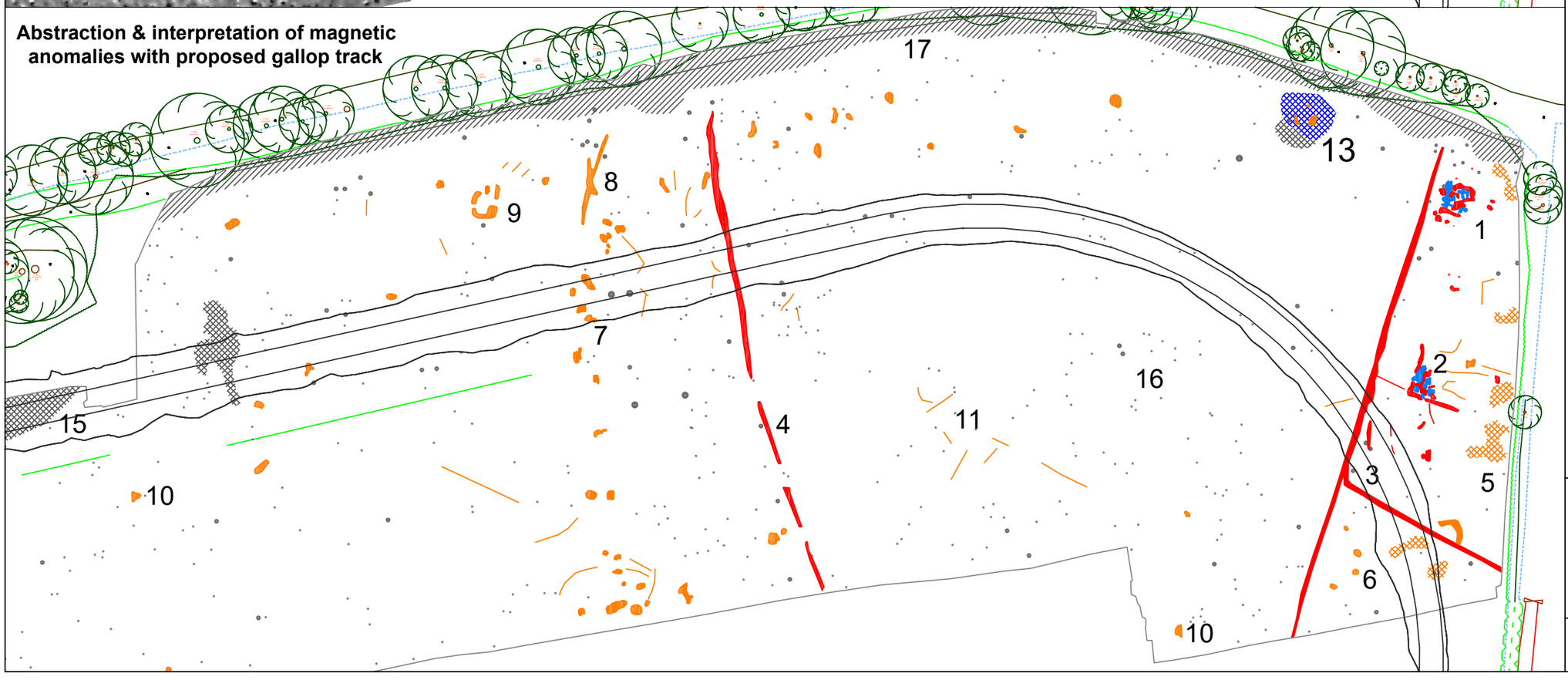
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

Greyscale plot of minimally processed magnetometer data with proposed gallop track



Abstraction & interpretation of magnetic anomalies with proposed gallop track



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Greyscale plot of minimally processed magnetometer data & abstraction & interpretation of magnetic anomalies

- Positive linear anomaly - cut feature of archaeological potential
- Negative linear anomaly - of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Discrete negative response - of archaeological potential
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Negative anomaly - material with low magnetic susceptibility
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong 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

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KTD	DJS	FIG 06