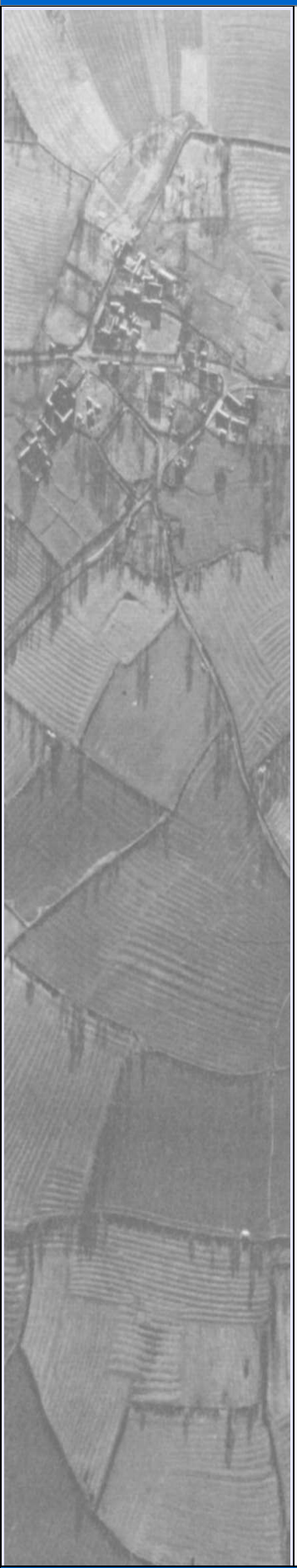

Yeovil Highway Improvements
Yeovil
Somerset

MAGNETOMETER SURVEY REPORT

for

AC Archaeology

Kerry Donaldson & David Sabin

January 2017

Ref. no. J699

ARCHAEOLOGICAL SURVEYS LTD

Yeovil Highway Improvements
Yeovil
Somerset

Magnetometer Survey Report

for

AC Archaeology

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

Survey dates – 12th & 13th December 2016
Ordnance Survey Grid Reference – **ST 53100 15330**

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SUMMARY

Detailed magnetometry was carried out by Archaeological Surveys Ltd, along the line of a new water pipeline within three fields adjacent to the Western Relief Road, on the western edge of Yeovil, Somerset. The results indicate the presence of a number of very weakly positive linear anomalies within the southern and central parts of the site, but due to the weak and poorly defined response, it is not possible to determine their origin. Close to the north western edge of the survey corridor are a small number of weak responses, again lacking a coherent morphology. Several anomalies associated with land drainage and agricultural activity were also located. An existing water main within the northern part of the site and adjacent to the eastern part of the site has resulted in magnetic disturbance.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by AC Archaeology, on behalf of Wessex Water, to undertake a magnetometer survey of an area of land on the western edge of Yeovil in Somerset. The site has been outlined for the proposed construction of a new water main and the survey forms part of an archaeological assessment of the site.

1.1.2 The geophysical survey was carried out in accordance with a magnetometry method statement produced by Archaeological Surveys and issued to Tanya James, Somerset County Council Historic Environment Officer, prior to commencing the fieldwork. This provides a framework against which the results of the survey can be measured.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation;* 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 Site location, description and survey conditions

1.3.1 The southern part of the site (Areas 1 & 2) lies within the parish of West Coker

and the northern part (Area 3), within the parish of Brympton to the west of Yeovil in Somerset. It is centred on Ordnance Survey National Grid Reference (OS NGR) ST 53100 15330, see Figs 01 and 02.

1.3.2 The geophysical survey covers approximately 4ha within three land parcels. Area 1, consisting of two survey zones, 1a and 1b, that are situated at the southern end of the site to cover a new access track and construction compound. Area 2 lies to the north of Area 1, with Area 3 forming the northern part of the corridor. The latter was split into two survey zones due to the construction corridor of a new sewer pipe. The north western corner was not surveyable due to the presence of a construction compound associated with the sewer pipe construction.

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data as the ground cover consisted of grass. Weather conditions during the survey were mainly fine.

1.4 Site history and archaeological potential

1.4.1 The Somerset Historic Environment Record outlines that the southern part of the site (Area 1) lies immediately north of an area previously subject to geophysical survey (PRN 28260) in 2005, where a number of weak and poorly defined anomalies were located. The subsequent evaluation (PRN 19379) revealed evidence for prehistoric activity with a single early Bronze Age cremation burial recorded. Immediately to the south west is the site of the former medieval hamlet of East Hescombe, with holloways and platforms recorded (PRN 54654); however, geophysical survey (PRN 28260) and evaluation (PRN 19379) did not locate any evidence for medieval activity. Approximately 450m to the south is the location of a series of co-axial linear features, enclosures and ring ditches identified through geophysical survey (PRN 32505) and dated through evaluation (PRN 32272) which showed the site had been occupied during the Bronze Age but predominately in the late Iron Age and Roman periods with the construction of a defended enclosure. To the north east of the site, a field has the name of "Chestre Mead" indicating a potential Roman site (PRN 29348) (South West Heritage Trust, 2017).

1.4.2 The location of archaeological features immediately to the south of the site may indicate that there is potential for them to extend into the survey area. However, the previous geophysical survey states that the anomalies are very weak and indistinct and so it may be difficult to interpret further anomalies.

1.5 Geology and soils

1.5.1 The underlying geology is sandstone from the Bridport Sand Formation (Lias Group) (BGS, 2016).

1.5.2 The overlying soil across the site is from the Curtisden association and is a stagnogleyic argillic brown earth. It consists of a silty soil over siltstone with

slowly permeable subsoils and slight seasonal waterlogging (Soil Survey of England and Wales, 1983).

1.5.3 The underlying geology and soils are frequently associated with low magnetic contrast and low levels of magnetic susceptibility. However, cut features of archaeological potential may be located where human activity has altered the magnetic characteristics of the soil sufficiently. The underlying geology and soils are therefore considered acceptable for magnetic survey.

2 METHODOLOGY

2.1 Technical synopsis

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

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

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

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

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20 Hz. 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 range of recording data between ±0.1nT and ±10,000nT. They are linked to a Leica GS10

RTK GPS 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 is manifest 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 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 ±10000nT and clipped for display at ±2nT. 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 for all survey areas 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, rapid temperature change. Low pass filtering has also been carried out to smooth the data. Data treated to additional processing has 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 is considered by the manufacturer to be data that is 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 very high density of data collection.

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

2.3.8 An abstraction and interpretation is also drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

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

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

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of three survey areas covering approximately 4ha.

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

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. Parts of the site were subject to high levels of magnetic disturbance associated with moving and stationary traffic immediately adjacent to the survey area and the presence of underground services. Data were filtered in order to improve their appearance and both filtered and unfiltered data were analysed to ensure that other anomalies were not adversely affected.

3.2.2 It should be noted that due to the random nature of traffic movement, it has not been possible to fully suppress the consequent magnetic disturbance, and this is occasionally visible in the data as very short linear or discrete anomalies within the eastern parts of the survey areas.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading **CAD layer names and plot colour**	**Description and origin of anomalies**
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS UNCERTAIN	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. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies.

	Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management AS-ABST MAG BOUNDARY AS-ABST MAG LAND DRAIN	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation. Land drains can appear in a classic herringbone pattern of interconnected multiple dipolar linear anomalies, or as parallel linear anomalies. The multiple dipolar response indicates a ceramic land drain.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL	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.
Anomalies associated with magnetic debris AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE AS-ABST MAG SERVICE	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. 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 1

Area 1a centred on OS NGR 353225 115035, Area 1b centred on OS NGR 353410 115010, see Figs 05 & 06.

Anomalies with an uncertain origin

(1) - Both Areas 1a and 1b contain a number of very weakly positive linear anomalies (<1nT). Due the weak and indistinct response and the lack of a coherent morphology, it is not possible to determine the origin of the anomalies.

(2) - A small number of discrete, weakly positive anomalies are located towards the south western corner of Area 1b. It is not possible to determine their origin.

Anomalies associated with land management

(3) - Both Area 1a and 1b contain weakly multiple dipolar linear anomalies which relate to ceramic land drains.

Anomalies associated with magnetic debris

(4) - Strong, discrete, dipolar anomalies are a response to buried ferrous and other magnetically thermoremnant objects within the topsoil. All survey areas contain these anomalies.

Anomalies with a modern origin

(5) - Magnetic disturbance from ferrous material adjacent to the edge of the survey area.

3.5 List of anomalies - Area 2

Area centred on OS NGR 353130 115263, see Figs 07 & 08.

Anomalies with an uncertain origin

(6) - A small number of weakly positive linear and possible rectilinear anomalies are located within Area 2. However, they are too weak and indistinct to confidently interpret their origin.

Anomalies associated with land management

(7) - Two short, weakly dipolar linear anomalies are located in the southern part of the survey area. Although there are only two such anomalies, rather than a series, the response indicates ceramic land drains.

Anomalies with a modern origin

(8) - A strong, multiple dipolar, linear anomaly extends across the survey area and relates to a buried service or pipe constructed of iron or steel.

(9) - Magnetic disturbance along the eastern edge of the survey area is a response generally to traffic on the adjacent Western Relief Road as well as ferrous material and an existing water main.

3.6 List of anomalies - Area 3

Area centred on OS NGR 353034 115625 see Figs 09 & 10.

Anomalies with an uncertain origin

(10) - In the north western corner of the survey corridor are a small number of weakly positive responses. They do not have a coherent morphology for their origin to be determined.

(11) - A negative linear anomaly extends across the width of the survey corridor towards the north eastern corner. This type of response may indicate the presence of a service or pipe, possibly made of plastic, but this is uncertain.

Anomalies associated with land management

(12) - A weakly positive linear anomaly and a cluster of strong dipolar responses are located in the position of a formerly mapped field boundary and are likely to be associated.

(13) - In the southern section of the survey area, weak, multiple dipolar, linear anomalies relate to land drains.

Anomalies with an agricultural origin

(14) - A series of parallel linear anomalies in the northern part of the survey area are associated with agricultural activity. They are parallel with removed field boundary (12).

Anomalies with a modern origin

(15) - Very strongly magnetic disturbance along the northern edge of the site is a response to an existing water main.

4 CONCLUSION

4.1.1 The geophysical survey located a number of very weakly positive linear anomalies in the southern and central part of the site. The responses are generally very weak and lack a coherent morphology preventing confident interpretation. However, former evaluation immediately to the south identified a number of prehistoric features and the archaeological potential of anomalies of uncertain origin should not be dismissed.

4.1.2 The survey also located evidence for land drainage, a former land boundary and linear anomalies associated with agricultural activity.

5 REFERENCES

Aspinall, A., Gaffney, C. and Schmidt, A. 2009. *Magnetometry for Archaeologists*. Lanham (US), AltaMira Press.

British Geological Survey, 2016. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://mapapps.bgs.ac.uk/geologyofbritain/home.html [accessed 10/1/2017].

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for archaeological geophysical survey*. IfA, University of Reading.

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.* 2nd ed. Swindon: English Heritage.

European Archaeological Council, 2015. *EAC Guidelines for the Use of Geophysics in Archaeology: Questions to Ask and Points to Consider.* Europae Archaeologia Consilium and Association Internationale sans But Lucratif, Belgium.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IfA Paper No. 6. IfA, University of Reading.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England.*

South West Heritage Trust, 2017. *The Somerset Historic Environment Record [online]* available from http://www.somersetheritage.org.uk/ [accessed 10/1/2017].

Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

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

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

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

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

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

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±5nT and ±3nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero (destripe) Median/Mean Traverse

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

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks, modern agricultural features and other large magnetic bodies within or adjacent to survey areas.

Low Pass Filtering

A mathematical process used to remove high frequency anomalies relating to uneven ground, vibration, etc.

Appendix C – survey and data information

Area 1a minimally processed magnetometer data

Filename: J699-mag-Area1a-proc.xcp
Description: Imported as Composite from: J699-mag-Area1a.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 353193.614287452, 115122.470363548 m
Southeast corner: 353293.664287452, 114954.020363548 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 265300

Dimensions
Composite Size (readings): 667 x 1123
Survey Size (meters): 100 m x 168 m
Grid Size: 100 m x 168 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 0.73
Mean: 0.01
Median: 0.00
Composite Area: 1.6853 ha
Surveyed Area: 0.84042 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

Processes: 1
1 Base Layer

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

Area 1b minimally processed magnetometer data

Filename: J699-mag-Area1b.xcp
Description: Imported as Composite from: J699-mag-Area1b.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 353347.462691355, 115058.791859689 m
Southeast corner: 353431.762691355, 114957.691859689 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 113300

Dimensions
Composite Size (readings): 562 x 674
Survey Size (meters): 84.3 m x 101 m
Grid Size: 84.3 m x 101 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.21
Mean: 0.00
Median: 0.04
Composite Area: 0.85227 ha
Surveyed Area: 0.40853 ha

Processes: 1
1 Base Layer

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

Area 1a filtered magnetometer data
Filename: J699-mag-Area1a-lpf.xcp

Processes: 3
1 Base Layer
2 Clip from -3.00 to 3.00 nT
3 Clip from -2.00 to 2.00 nT

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT
5 Lo pass Uniform (median) filter: Window dia: 13

Area 1b filtered magnetometer data

Filename: J699-mag-Area1b.xcp
Description: Imported as Composite from: J699-mag-Area1b.asc

Processes: 1
1 Base Layer

GPS based Proce7
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT
5 Lo pass Uniform (median) filter: Window dia: 13
6 High pass Uniform (median) filter: Window dia: 300
7 Clip from -2.00 to 2.00 nT

Area 2 minimally processed magenetometer data

Filename: J699-mag-Area2.xcp
Description: Imported as Composite from: J699-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB 36
Northwest corner: 353076.303064682, 115396.063181515 m
Southeast corner: 353218.653064682, 115167.463181515 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 313700

Dimensions
Composite Size (readings): 949 x 1524
Survey Size (meters): 142 m x 229 m
Grid Size: 142 m x 229 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 0.99
Mean: 0.00
Median: 0.02
Composite Area: 3.2541 ha
Surveyed Area: 1.1513 ha

Processes: 1
1 Base Layer

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

Area 2 filtered magnetometer data

Filename: J699-mag-Area2-proc-hpf..xcp
Description: Imported as Composite from: J699-mag-Area2.asc

Processes: 1
1 Base Layer

GPS based Proce7
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT
5 Lo pass Uniform (median) filter: Window dia: 13
6 High pass Uniform (median) filter: Window dia: 100
7 Clip from -2.00 to 2.00 nT

Area 3 minimally processed magnetometer data

Filename: J699-mag-Area3.xcp
Description: Imported as Composite from: J699-mag-Area3.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 352833.37487023, 115746.710415854 m
Southeast corner: 353098.42487023, 115395.710415854 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 394900

Dimensions
Composite Size (readings): 1767 x 2340
Survey Size (meters): 265 m x 351 m
Grid Size: 265 m x 351 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.32
Min: -3.30
Std Dev: 1.18
Mean: -0.01
Median: 0.01
Composite Area: 9.3033 ha
Surveyed Area: 1.6143 ha

Processes: 1
1 Base Layer

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

Area 3 filtered magnetometer data

Filename: J699-mag-Area3-proc-hpf.xcp
Description: Imported as Composite from: J699-mag-Area3.asc

Processes: 2
1 Base Layer
2 Clip from -2.00 to 2.00 nT

GPS based Proce6
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -3.00 to 3.00 nT
5 Lo pass Uniform (median) filter: Window dia: 13
6 High pass Uniform (median) filter: Window dia: 200

Appendix D – digital archive

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

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

Archive contents:

Geophysical data - path: J699 Yeovil pipeline\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
yeo1\MX\.prm,.dgb,.disp yeo2\MX\.prm,.dgb,.disp yeo3\MX\.prm,.dgb,.disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	13/12/16 13/12/16 14/12/16	D.J.Sabin
yeo1\MX\J699-mag-Area1a.asc yeo1\MX\J699-mag-Area1b.asc yeo2\MX\J699-mag-Area2.asc yeo3\MX\J699-mag-Area3.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	15/12/16	K.T. Donaldson
Area1\comps\J699-mag-Area1a.xcp Area1\comps\J699-mag-Area1b.xcp Area2\comps\J699-mag-Area2.xcp Area3\comps\J699-mag-Area3.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	15/12/16	K.T. Donaldson
Area1\comps\J699-mag-Area1a-proc.xcp Area1\comps\J699-mag-Area1b-proc.xcp Area2\comps\J699-mag-Area2-proc.xcp Area3\comps\J699-mag-Area3-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	15/12/16	K.T. Donaldson
Area1\comps\J699-mag-Area1a-proc-lpf.xcp Area1\comps\J699-mag-Area1b-proc-hpf.xcp Area2\comps\J699-mag-Area2-proc-hpf.xcp Area3\comps\J699-mag-Area3-proc-hpf.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt, high/low pass filter and clipping to ±2nT).	15/12/16	K.T. Donaldson
Graphic data - path: J699 Yeovil pipeline\Data				
Area1\comps\J699-mag-Area1a-proc.tif Area1\comps\J699-mag-Area1b-proc.tif Area2\comps\J699-mag-Area2-proc.tif Area3\comps\J699-mag-Area3-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	15/12/16	K.T.Donaldson
Area1\comps\J699-mag-Area1a-proc.tfw Area1\comps\J699-mag-Area1b-proc.tfw Area2\comps\J699-mag-Area2-proc.tfw Area3\comps\J699-mag-Area3-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	15/12/16	K.T.Donaldson
Area1\comps\J699-mag-Area1a-proc-lpf-2nT.tif Area1\comps\J699-mag-Area1b-proc-hpf-2nT.tif Area2\comps\J699-mag-Area2-proc-hpf-2nT.tif Area3\comps\J699-mag-Area3-proc-hpf-2nT.tif	TerraSurveyor 3.0.23.0	TIF file showing a filtered greyscale plot clipped to ±2nT.	15/12/16	K.T.Donaldson
Area1\comps\J699-mag-Area1a-proc-lpf-2nT.tfw Area1\comps\J699-mag-Area1b-proc-hpf-2nT.tfw Area2\comps\J699-mag-Area2-proc-hpf-2nT.tfw Area3\comps\J699-mag-Area3-proc-hpf-2nT.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	15/12/16	K.T.Donaldson
CAD data - path: J699 Yeovil pipeline\CAD				
J699 version 1.dwg	ProgeCAD 2016	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	08/12/16	K.T.Donaldson
Text data - path: J699 Yeovil pipeline\Documentation				
J699 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	10/01/16	K.T.Donaldson

Appendix E – copyright and intellectual property

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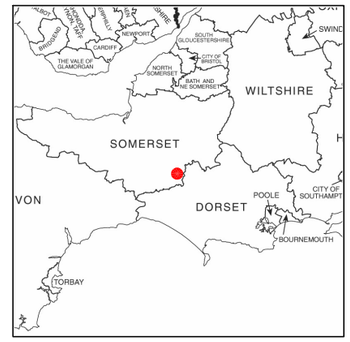
Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Map of survey area



Survey location

Site centred on OS NGR
ST 53100 15330

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Referencing information

Referencing grid to OSGB36 datum at 50m intervals

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

353400 115000

New water pipeline

Easement

Construction compound

SCALE 1:4000

0m 40 80 120 160 200m

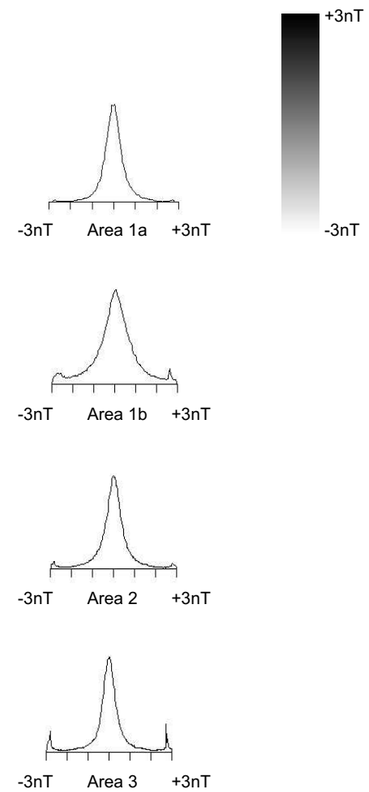
SCALE TRUE AT A3

FIG 02

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Greyscale plot of minimally processed magnetometer data



SCALE 1:3000

0m 30 60 90 120 150m

SCALE TRUE AT A3

FIG 03

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Abstraction and interpretation of magnetometer anomalies

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Linear anomaly - ridge and furrow
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:3000

0m 30 60 90 120 150m

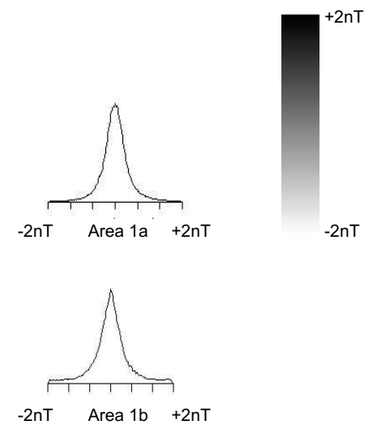
SCALE TRUE AT A3

FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Greyscale plot of filtered magnetometer data



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Abstraction and interpretation of magnetometer anomalies

Area 1a

Area 1b

- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible land drain
- Discrete positive response - possible pit-like feature
- Magnetic disturbance from ferrous material
- Strong dipolar anomaly - ferrous object

SCALE 1:1000

0m 10 20 30 40 50m

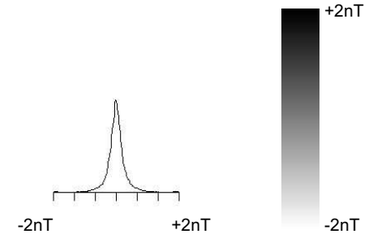
SCALE TRUE AT A3

FIG 06

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Greyscale plot of filtered magnetometer data - Area 2



Area 2

N

Council Offices

WESTERN RELIEF ROAD

El Sub Sta

Ed and Ward Bay

CR

Lynx Trading

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 07

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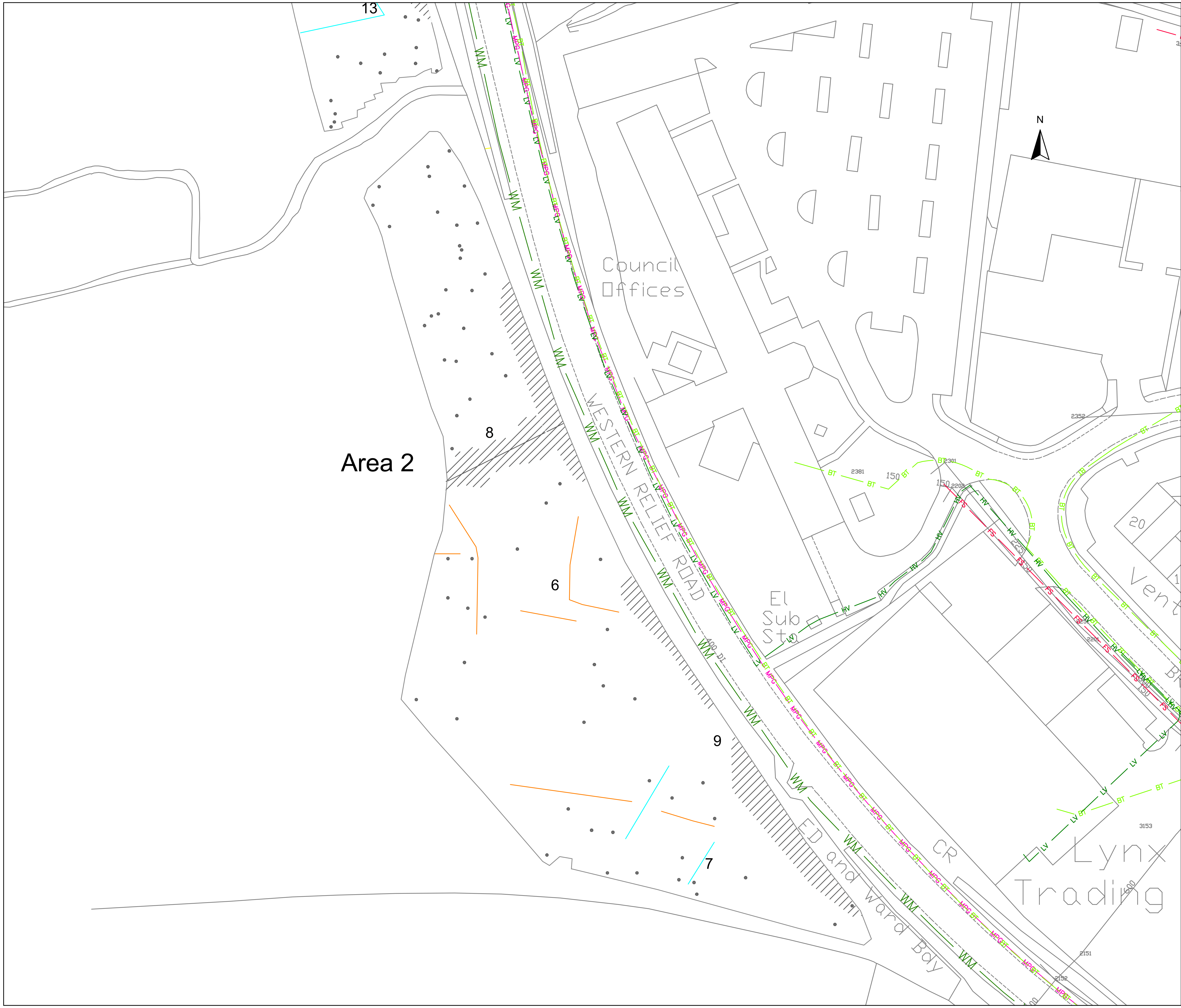
Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Abstraction and interpretation of magnetometer anomalies - Area 2



- Positive linear anomaly - possible ditch-like feature
- Positive linear anomaly - possible land drain
- 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

FIG 08

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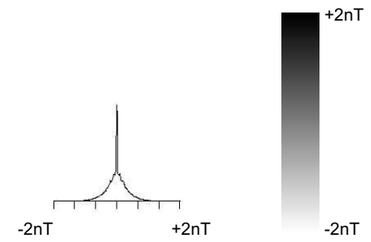
Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Greyscale plot of filtered magnetometer data - Area 3



Area 3

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 09

Archaeological Surveys Ltd

Geophysical Survey
Yeovil Highway Improvements
Yeovil
Somerset

Abstraction and interpretation of magnetometer anomalies - Area 3

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Positive linear anomaly - possible land drain
- Positive linear anomaly - possible former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Positive anomaly - magnetically enhanced material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - water pipe
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 10