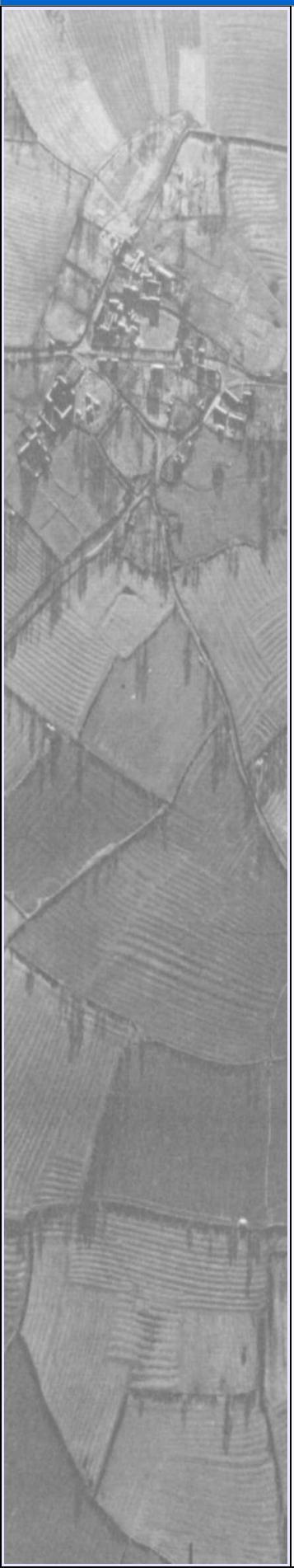

Warwickshire College
Moreton Morrell
Warwickshire
Additional Survey

MAGNETOMETER SURVEY REPORT

for

Archaeology Warwickshire

Kerry Donaldson & David Sabin

November 2016

Ref. no. J693

ARCHAEOLOGICAL SURVEYS LTD

Warwickshire College
Moreton Morrell
Warwickshire
Additional Survey

Magnetometer Survey Report

for

Archaeology Warwickshire

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 – 3rd & 4th November 2016
Ordnance Survey Grid Reference – **SP 30635 55310**

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CONTENTS

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

SUMMARY

Detailed magnetometry, carried out by Archaeological Surveys Ltd at Moreton Morrell College, revealed a continuation of a substantial Iron Age ditch in the north western part of the site, located during a previous geophysical survey. A number of parallel and orthogonal linear features were also located and these appear to form a series of rectilinear enclosures. A negative rectilinear anomaly may be a response to former structural remains, but the presence of services and ridge and furrow prevent confident interpretation. Within the remaining site the magnetic responses were generally associated with ridge and furrow, land drains, field boundaries removed in the 20th century and also a number of services. The archaeological features are contained within the north western part of the site.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Archaeology Warwickshire to undertake a magnetometer survey of an area of land at Moreton Morrell College in Warwickshire. The site has been outlined for a proposed development of sports pitches and the survey forms part of an archaeological assessment of the site.

1.1.2 A previous geophysical survey was carried out within the north western part of site in April 2016 (Archaeological Surveys, 2016). The results indicated the presence of a large ditch with a narrow ditch immediately to the west and another extending from it to the east. Other anomalies were less well defined, with several positive linear and discrete responses of uncertain origin and also several negative linear and possible rectilinear anomalies. The anomalies were subsequently evaluated by Archaeology Warwickshire (2016), with features containing late Iron Age and early Roman pottery.

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 site is located within the grounds of Warwickshire College, Moreton Morrell in Warwickshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) SP 30635 55310, see Figs 01 and 02.

1.3.2 The geophysical survey covers approximately 7ha of parkland divided into two by a fence and referred to as Areas 1 and 2 for the purposes of this report. Area 1 forms the eastern part of the site and is ground that slopes down towards the west. It surrounds a small area of woodland and contains a small pond near the north western corner that is presumably associated with cross-country horse riding. The ground cover consisted of grass and several inspection chamber covers were marked by cones in the southern part of the area.

Plate 1: Area 1 looking north east

Plate 2: Area 2 looking north west

1.3.3 Area 2 forms the western part of the site and lies immediately east of college buildings and their associated screening vegetation. The area is generally flat although tends to slope down gently to the west in places. A previous magnetometer survey by Archaeological Surveys Ltd forms the north western part of the survey area. At the time of survey, this zone was utilised as a building compound and contained construction materials, vehicles and steel containers surrounded by steel Heras fencing. Survey in the immediate vicinity was not possible due to very high magnitude magnetic disturbance. The northern part of the area also contained a tree and metal chair that were avoided.

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

1.4 Site history and archaeological potential

1.4.1 The previous magnetometer survey located a number of linear ditches (Archaeological Surveys, 2016) which were subsequently dated to the Iron Age and early Roman period (Archaeology Warwickshire, 2016). Several pieces Roman tile including imbrex and tegula were located in the north eastern part of the survey area, which may indicate the presence of a nearby building.

1.4.2 Just to the north west of the survey area a number of Iron Age and Roman pottery sherds were located during an excavation of a small trench during construction of an experimental Roman pottery kiln (Warwickshire Historic Environment Record MWA 4834). Other Roman pottery sherds, coins and a brooch have been located 600m to the south east (MWA7259). The Fosse Way Roman road is situated 1km to the east, with the Saltway located 500m to the south. The medieval core of Moreton Morrell (MWA9013) is located around Holy Cross Church (MWA1181), 480m to the north east. The site also lies to the north and west of an area containing surviving ridge and furrow (MWA19559) within the grounds of Moreton Hall, constructed and landscaped in 1906/07 (MWA8578). The area was also utilised as a military camp during the Second World War, including over 40 buildings, sports pitches and a firing range (MWA19333).

1.4.3 The location of archaeological features within the north western part of the site indicates that there is potential for additional features to extend into the current survey areas. It is also likely that the survey will locate evidence for previous field boundaries, removed for the construction of Moreton Hall in the early 20th century, and also evidence for ridge and furrow cultivation as well as possible modern use of the site.

1.5 Geology and soils

1.5.1 The underlying geology is limestone from the Langport Member (Lower Lias) (BGS, 2016).

1.5.2 The overlying soil across the site is from the Evesham 2 association and is a typical calcareous pelosol. It consists of a slowly permeable, calcareous, clayey soil (Soil Survey of England and Wales, 1983).

1.5.3 Magnetometry carried out over similar geology and soil has produced good results. The site is, therefore, considered suitable 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 ±3nT for Area 1 and ±8nT for Area 2. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 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.

2.3.5 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.

2.3.6 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.

2.3.7 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.

2.3.8 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.

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

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over a total of two survey areas covering approximately 7ha.

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

3.1.3 Anomalies located within each survey area have been numbered and are described below.

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset. Several services cross the survey areas and are associated with localised zones of magnetic disturbance that has the potential to obscure weak anomalies of archaeological potential.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A 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 archaeological potential AS-ABST MAG POS LINEAR ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc.
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE 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 RIDGE AND FURROW 	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 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 centred on OS NGR 430675 255290, see Figs 03 - 08.

Anomalies with an uncertain origin

(1) - A positive linear anomaly that may be associated with ground disturbance relating to a small pond that appears to be a feature used in cross-country horse riding.

(2) - Weakly positive possible rectilinear anomaly of uncertain origin.

(3) - A positive linear anomaly is located in the south eastern corner of the survey area. It appears to have truncated the ridge and furrow, but cannot be seen to extend northwards beyond the line of two strongly magnetic services (7). It may indicate a pipe or service.

Anomalies associated with land management

(4) - A positive linear anomaly, often associated with a pipe or service, extends through much of the western edge of the survey area and partially within Area 2. It relates to a formerly mapped field boundary.

(5) - Weakly dipolar linear anomalies relate to ceramic land drains within former furrows.

Anomalies with an agricultural origin

(6) - Parallel linear anomalies relate to ridge and furrow.

Anomalies with a modern origin

(7) - At least six services extend across the survey area.

3.5 List of anomalies - Area 2

Area centred on OS NGR 430580 255315, see Figs 03 - 08.

Anomalies of archaeological potential

(8) - A positive linear anomaly extends along the north western edge of the survey area. It is a continuation of the Iron Age linear ditch located immediately to the south west. The response is at least 2.5m wide and 8-15nT, which indicates a moderately enhanced fill within a moderately deep ditch. Anomaly (9) extends from it and joins anomaly (10), which is parallel with it, to form enclosures.

(9) - A positive linear anomaly, approximately 2m wide and 10-15nT in magnitude, extends away from anomaly (8) to the south east for 34m where it appears to join anomaly (10). It is possible that it extends further south east but this is uncertain.

(10) - A positive linear anomaly that is parallel with anomaly (8), but only between 1-2m wide and with a response of 2.5-4nT. A very narrow, weak, linear anomaly appears to be parallel with it just to the west. It has been truncated by a modern service (23); however, it is not clear if it extends to the south west of the service.

(11) - A positive linear anomaly, located in the previous survey, is parallel with anomaly (9). It is possible that it is associated with anomaly (14).

Anomalies with an uncertain origin

(12) - A negative rectilinear anomaly is located to the north of linear anomaly (11). The majority of this anomaly was found during the previous survey; however, the current results appear to have located the eastern side. The response does appear to form a rectangular feature, 11m by 7.5m and the evaluation trench, located 13m to the west, contained a number of Roman tile fragments. It should therefore be considered that this response may relate to a former structure.

(13) - Positive linear anomalies are located to the east of and are parallel with the short axis of anomaly (12) and also anomalies (10) and (14). They cannot be clearly seen to extend to the north of a modern service (24) but there does appear to be truncation by anomaly (23). They may, therefore, relate to archaeological features.

(14) - A positive linear anomaly extends south westwards from the eastern end of anomaly (11). It is parallel with anomaly (10) to the north and also anomalies (13). As it is weaker at 2-4nT than anomaly (11) at 7-8nT, it is not so well defined, and it also ends abruptly after approximately 20m. However, it is possible that it relates to a cut feature forming a rectilinear enclosure feature with anomaly (11) and may, therefore, be archaeological in origin.

(15) - Located to the south of anomaly (9) are a number of linear, rectilinear and curvilinear responses. Their morphology is not clear, but it is possible that they relate to further cut features with an archaeological origin.

(16) - Negative linear anomalies and positive linear anomalies, parallel with and located to the east of anomaly (14) appear to have been truncated by ridge and furrow.

(17) - Discrete positive responses may relate to pit-like features; however, an association with a line of trees is possible.

(18) - In the north eastern corner and along the northern edge of the survey area are negative linear anomalies. It is possible that they relate to buried pipes, but this is uncertain.

(19) - In the southern part of the survey area are a single pit-like feature and a short positive linear anomaly.

Anomalies with an agricultural origin

(20) - The survey area contains ridge and furrow. This is partly parallel with the archaeological features, which can make interpretation difficult.

Anomalies associated with magnetic debris

(21) - Magnetic debris is evident across much of the survey area. One linear zone appears to be associated with a former line of trees, others are associated with

dumped material and areas of burning.

(22) - The survey area is magnetically contaminated with strong, discrete, dipolar responses which relate to ferrous and other magnetically thermoremnant objects, such as brick and tile within the topsoil. As the site was utilised as a military camp during the Second World War, much of the material is likely to have been derived from military occupation and use of the site.

Anomalies with a modern origin

(23) - A negative linear anomaly extends across the survey area, partially truncating linear anomalies (13). It extends eastwards into Area 1 as a ceramic pipe or service, but within Area 2 it relates to material with low magnetic susceptibility such as plastic or stone.

(24) - The survey area contains at least six buried services or pipes.

4 CONCLUSION

4.1.1 The results of the detailed magnetometer within the grounds of Moreton Morrell College demonstrate the continuation of an Iron Age ditch that was found during a previous geophysical survey carried out in April 2016. Other linear anomalies extend away from it and are parallel with it, forming a series of rectilinear enclosures. A negative rectilinear anomaly may relate to former structural remains; however, this is uncertain as magnetic survey is frequently poor at locating and defining the slight negative responses caused by material of very low magnetic susceptibility such as limestone.

4.1.2 The wider site contains ridge and furrow, land drains, formerly mapped field boundaries and services as well as widespread magnetic debris. The debris in the western part of the site may be associated with a military camp constructed during the Second World War.

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Appendix A – basic principles of magnetic survey

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

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

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

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

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

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

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

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

Appendix B – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±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 1

Filename: J693-mag-Area1-proc.xcp
Description: Imported as Composite from: J693-mag-Area1.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 430534.767442756, 255469.426774884 m
Southeast corner: 430817.067442756, 255113.026774884 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 1332700

Dimensions
Composite Size (readings): 1882 x 2376
Survey Size (meters): 282 m x 356 m
Grid Size: 282 m x 356 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.40
Mean: 0.00
Median: -0.01
Composite Area: 10.061 ha
Surveyed Area: 4.6188 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0

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

GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -8.00 to 8.00 nT
5 Clip from -5.00 to 5.00 nT

Area 2

COMPOSITE
Filename: J693-mag-Area2-proc.xcp
Description: Imported as Composite from: J693-mag-Area2.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 430488.406816602, 255490.328894779 m
Southeast corner: 430700.056816602, 255138.278894779 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 544800

Dimensions
Composite Size (readings): 1411 x 2347
Survey Size (meters): 212 m x 352 m
Grid Size: 212 m x 352 m
X Interval: 0.15 m
Y Interval: 0.15 m

Stats
Max: 8.84
Min: -8.80
Std Dev: 3.86
Mean: -0.09
Median: 0.08
Composite Area: 7.4511 ha
Surveyed Area: 1.9804 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 -8.00 to 8.00 nT

Original survey area

Filename: J657-mag-proc.xcp
Description: Imported as Composite from: J657-mag.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 430482.413415995, 255444.820091857 m
Southeast corner: 430615.013415995, 255306.340091857 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702

Source GPS Points: 310100

Dimensions
Composite Size (readings): 1105 x 1154
Survey Size (meters): 133 m x 138 m
Grid Size: 133 m x 138 m
X Interval: 0.12 m
Y Interval: 0.12 m

Stats
Max: 8.00
Min: -8.00
Std Dev: 3.88
Mean: -0.10
Median: 0.03
Composite Area: 1.8362 ha
Surveyed Area: 1.1549 ha

Processes: 2
1 Base Layer
2 Clip from -8.00 to 8.00 nT

GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 10.00 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.

Three printed copies of the report and a PDF copy will be supplied to the Warwickshire Historic Environment Record. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS). A summary of the survey will also be supplied to *West Midlands Archaeology.*

Archive contents:

Geophysical data - path: J693 Moreton Morrell College\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
mmorr1\MX\.prm,.dgb,.disp mmorr2\MX\.prm,.dgb,.disp	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	03/11/16 04/11/16	D.J.Sabin
mmorr1\MX\J693-mag-Area1.asc mmorr2\MX\J693-mag-Area2.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	07/11/16	D.J.Sabin
Area1\comps\J693-mag-Area1.xcp Area2\comps\J693-mag-Area2.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	07/11/16	D.J.Sabin
Area1\comps\J693-mag-Area1-proc.xcp Area2\comps\J693-mag-Area2-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT). Processed composite data file (zmt and clipping to ±8nT).	07/11/16	D.J.Sabin
Graphic data - path: J693 Moreton Morrell College\Data				
Area1\graphics\ J693-mag-Area1-proc-3nT.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	07/11/16	K.T.Donaldson
Area1\graphics\ J693-mag-Area1-proc-3nT.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	07/11/16	K.T.Donaldson
Area2\graphics\ J693-mag-Area2-proc-8nT.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±8nT.	07/11/16	K.T.Donaldson
Area2\graphics\ J693-mag-Area2-proc-8nT.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	07/11/16	K.T.Donaldson
CAD data - path: J693 Moreton Morrell College\CAD				
J693 version 1.dwg	ProgeCAD 2016	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	31/10/16	K.T.Donaldson
Text data - path: J693 Moreton Morrell College\Documentation				
J693 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	09/11/16	K.T.Donaldson

Geophysical data - path: J657 Moreton Morrell\Data				
Path and Filename	**Software**	**Description**	**Date**	**Creator**
moretonmorr1\MX\ .prm .dgb	Sensys MXPDA	Proprietary data formats representing magnetometer survey traverses logged to a PDA.	13/04/16	D.J.Sabin

.disp				
moretonmorr1\MX\J657-mag.asc	Sensys DLMGPS	ASCII CSV (tab) file representing survey Area 1 in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number.	14/04/16	K.T.Donaldson
Mag\comps\J657-mag.xcp	TerraSurveyor 3.0.23.0	Composite data file derived from ASCII CSV.	14/04/16	K.T.Donaldson
Mag\comps\J657-mag-proc.xcp	TerraSurveyor 3.0.23.0	Processed composite data file (zmt and clipping to ±3nT).	14/04/16	K.T.Donaldson
Graphic data - path: J657 Moreton Morrell \Data				
Mag\graphics\ J657-mag-proc.tif	TerraSurveyor 3.0.23.0	TIF file showing a minimally processed greyscale plot clipped to ±3nT.	14/04/16	K.T.Donaldson
Mag\graphics\ J657-mag-proc.tfw	TerraSurveyor 3.0.23.0	World file for georeferencing TIF to OSGB36.	14/04/16	K.T.Donaldson
CAD data - path: J657 Moreton Morrell\CAD				
J657 version 1.dwg	ProgeCAD 2016	CAD file for creating plots of greyscales, abstraction, interpretation and mapping. Grid coordinates as OSGB. AutoCAD 2010 format.	08/04/16	K.T.Donaldson
Text data - path: J657 Moreton Morrell\Documentation				
J657 report.odt	OpenOffice.org 3.0.1 Writer	Report text as an Open Office document.	12/04/16	K.T.Donaldson

Appendix E – copyright and intellectual property

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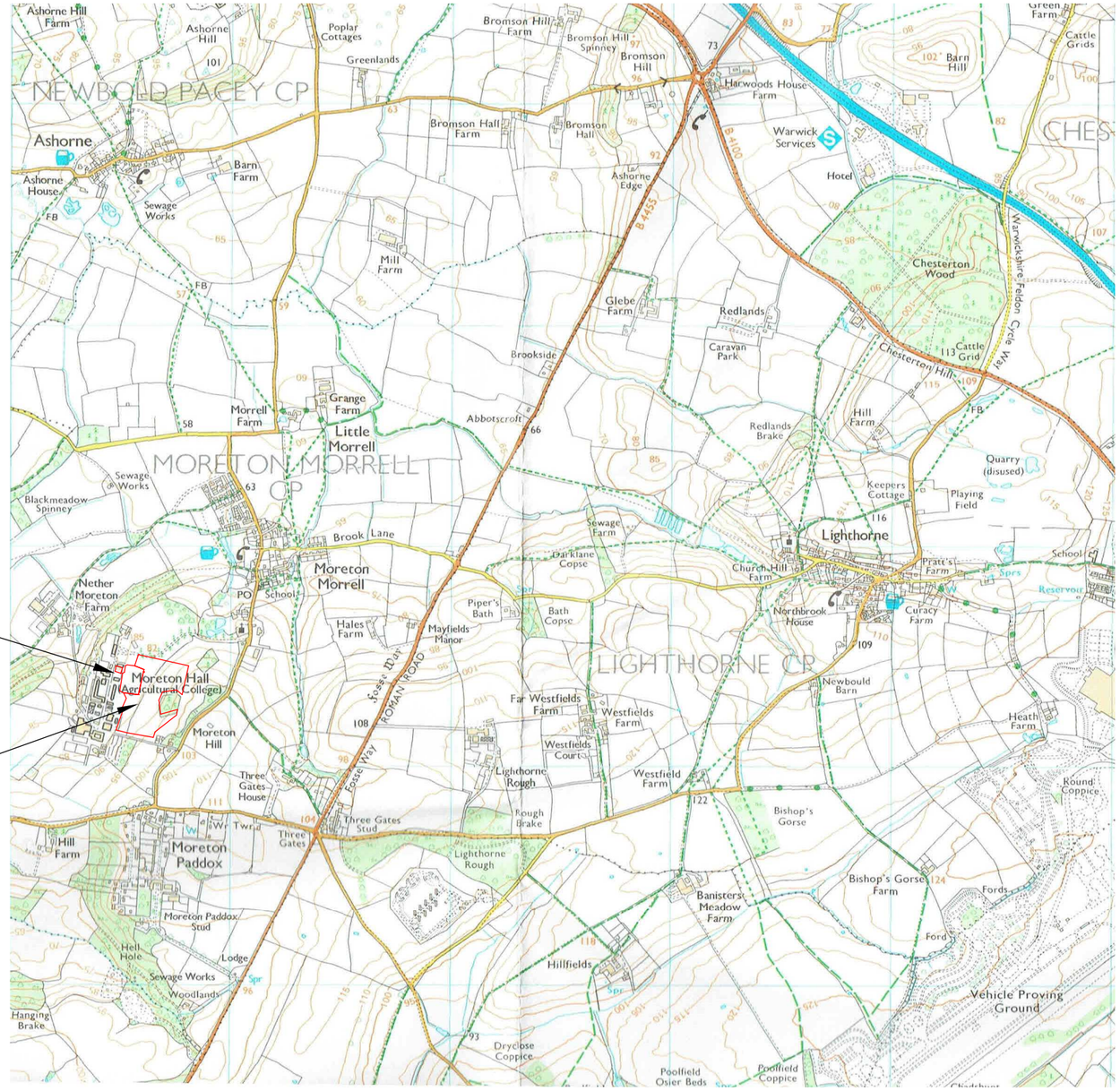
Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Additional Survey

Map of survey area



Previous survey location (April 2016)

Additional survey area (Nov 2016)

Survey location

Site centred on OS NGR
SP 30635 55310

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Additional Survey

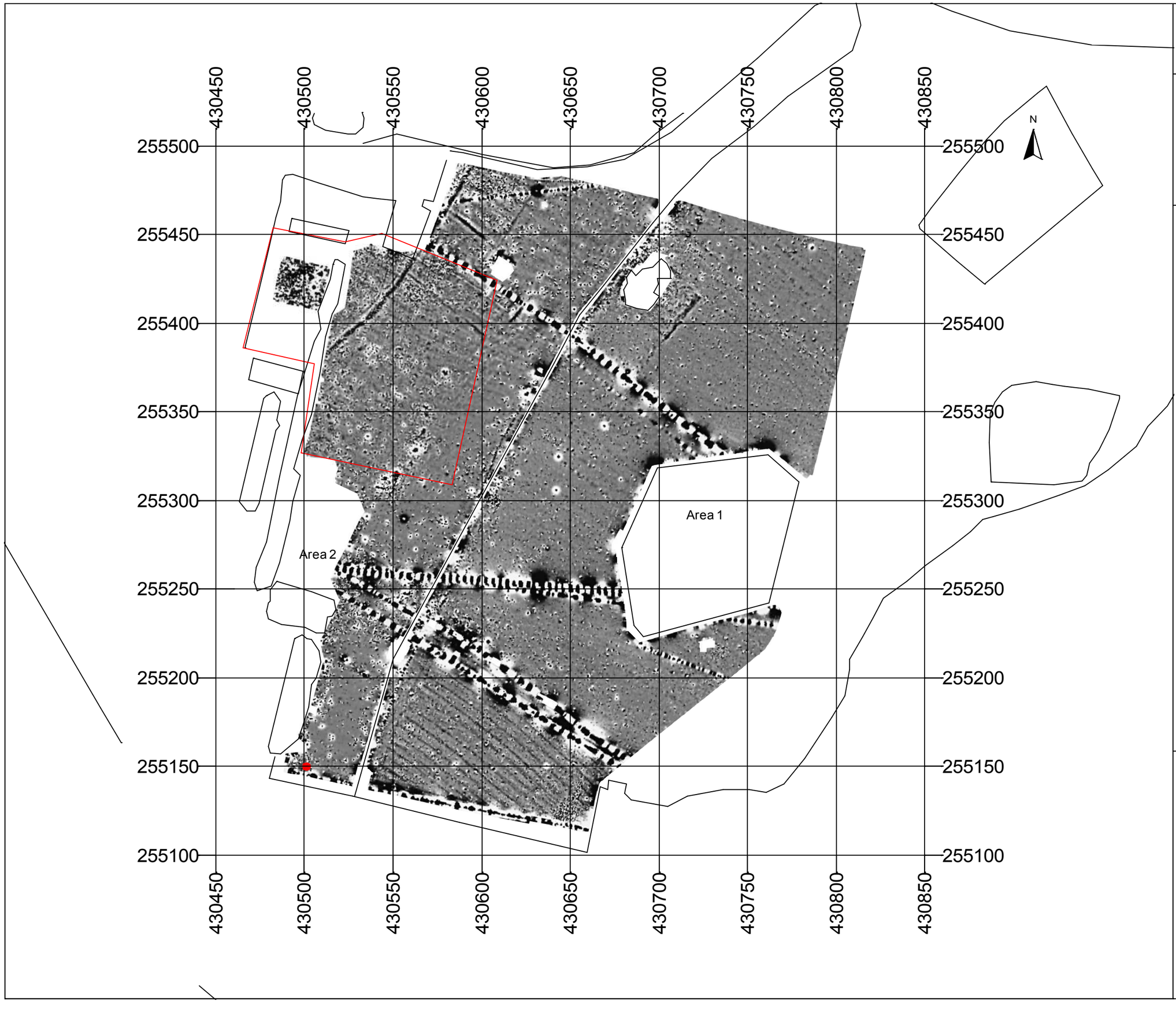
Referencing information

Referencing grid to OSGB36 datum at 50m intervals

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

430500 255150

Original survey area (April 2016)



SCALE 1:2000

0m 20 40 60 80 100m

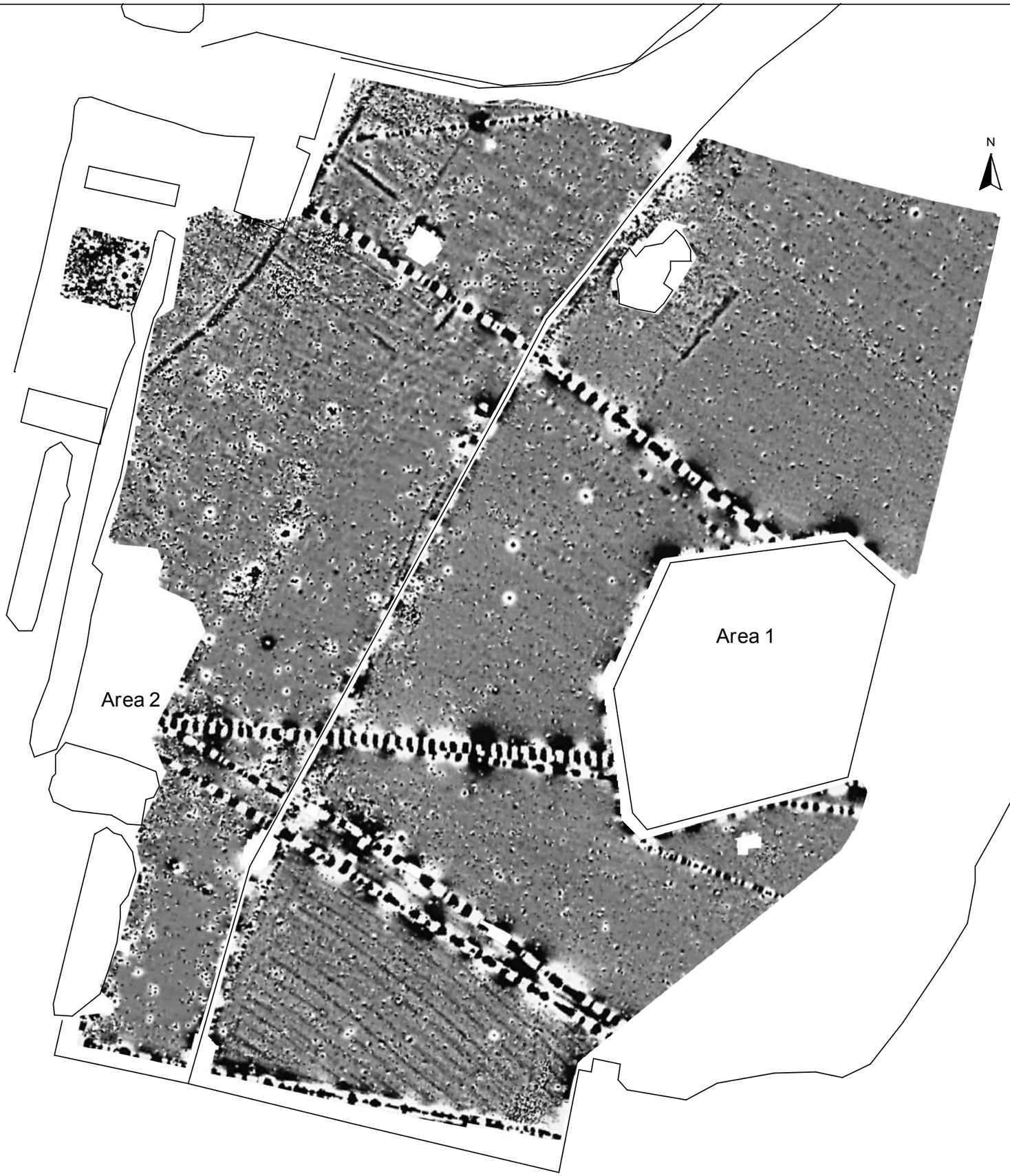
SCALE TRUE AT A3

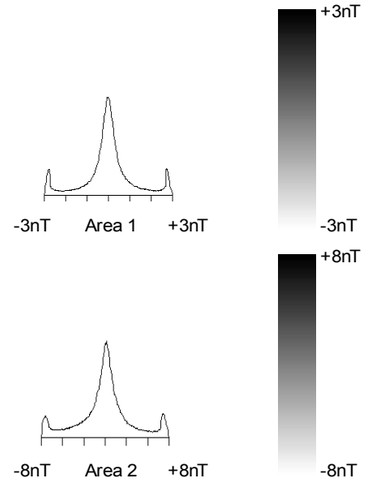
FIG 02

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Additional Survey

Greyscale plot of minimally processed magnetometer data





SCALE 1:1500

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 03

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Additional Survey

Abstraction and interpretation of magnetometer anomalies

- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Weakly dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- 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

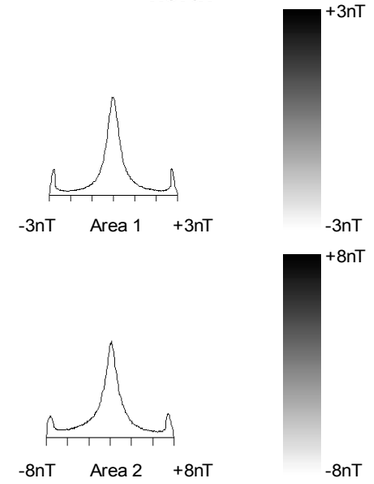
SCALE TRUE AT A3

FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Additional Survey

Greyscale plot of minimally processed magnetometer data - north



SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 05

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Warwickshire
Additional Survey

Abstraction and interpretation of magnetometer anomalies - north

- Positive linear anomaly - cut feature of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Weakly dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- 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

N

Area 1

Area 2

1 2 4 5 6 8 9 10 11 12 13 14 15 16 17 18 20 21 22 23 24

SCALE 1:1000

0m 10 20 30 40 50m

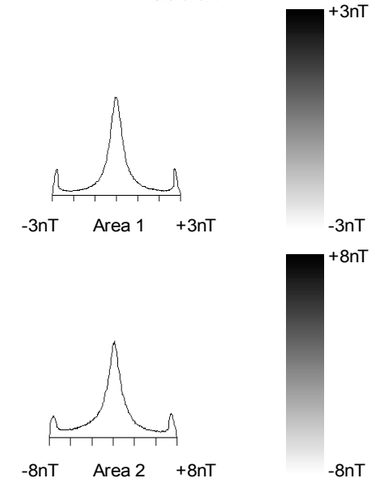
SCALE TRUE AT A3

FIG 06

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Warwickshire
Additional Survey

Greyscale plot of minimally processed magnetometer data - south



Area 1

Area 2

N

SCALE 1:1000

0m 10 20 30 40 50m

SCALE TRUE AT A3

FIG 07

Archaeological Surveys Ltd

Geophysical Survey
Warwickshire College
Moreton Morrell
Warwickshire
Additional Survey

Abstraction and interpretation of magnetometer anomalies - south

Area 1

Area 2

17
14
23
16
6
21
22
4
19
7
3

N

- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - ridge and furrow
- Weakly dipolar linear anomaly - land drain
- Positive linear anomaly - former field boundary
- Negative linear anomaly - material of low magnetic susceptibility
- Discrete positive response - possible pit-like feature
- 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

FIG 08