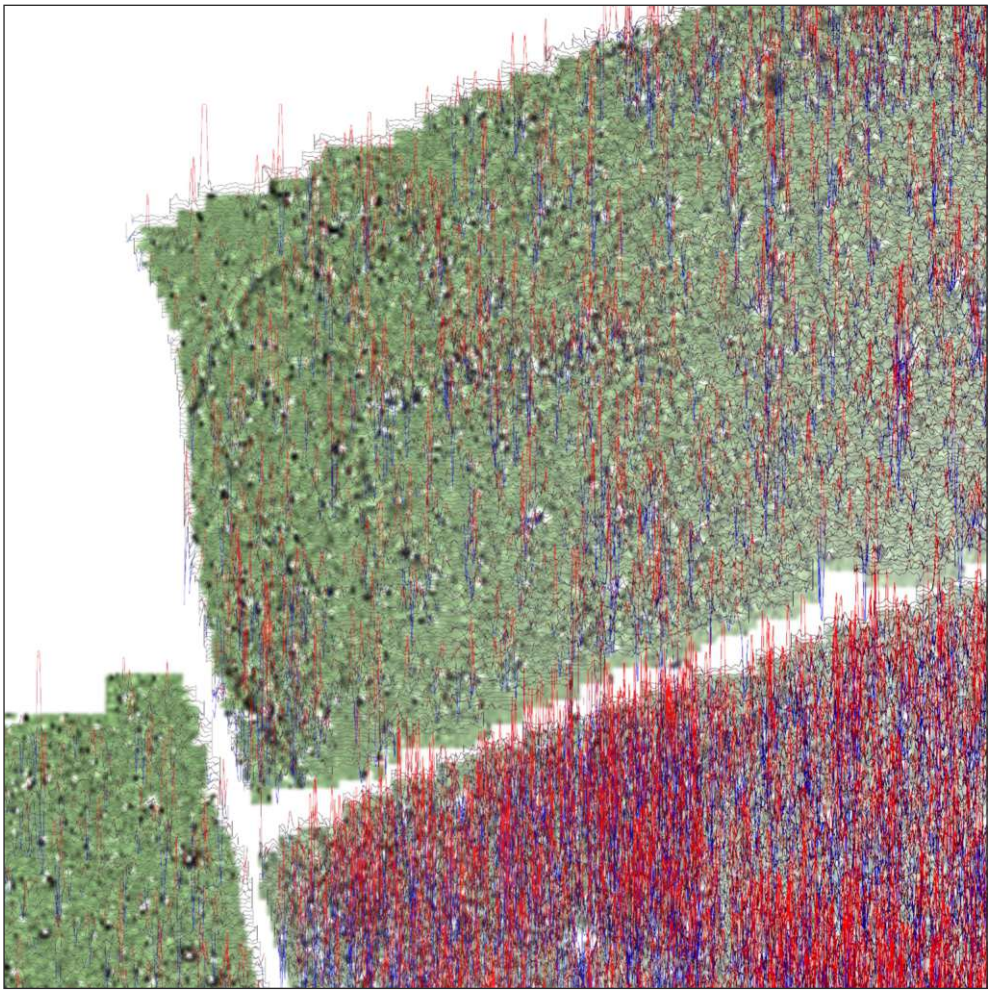
making sense of heritage

Monksham Farm Solar Farm
Marston Bigot, Somerset

Detailed Gradiometer Survey Report



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April 2013

geoservices

Monksham Farm Solar Farm
Marston Bigot, Somerset

Detailed Gradiometer Survey Report

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Monksham Farm Solar Farm
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Detailed Gradiometer Survey Report

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Summary

A detailed gradiometer survey was conducted over land at Monksham Farm, southwest of Frome, Somerset (centred on NGR 376375, 143000). The project was commissioned by Monksham Power Limited with the aim of establishing the presence and significance, or otherwise, of detectable archaeological features within the proposed development area. This information is intended to inform discussions on the nature and extent of any potential future development of the site and highlight any potential archaeological issues.

The site comprises three arable fields, approximately 5km SSW of the centre of Frome. The site occupies an area of relatively flat land that falls gradually to the north and south. The detailed gradiometer survey covered 17.4ha. This survey has demonstrated the presence of anomalies of definite, probable and possible archaeological interest within the survey area, along with regions of increased magnetic response and at least one modern service.

The geophysical data has revealed a few ditches that appear to relate to agricultural divisions in addition to some groups of smaller sub-oval pit-like features. None of the features identified appeared to fit with any of the former field boundaries visible in the early maps consulted in the archaeological desk-based assessment. There is scope for further remains given that much of the south eastern field is obscured by a dense concentration of ferrous responses.

The remaining features detected relate to more recent use of this area with modern ploughing trends, spreads of magnetic CBM and metallic debris detected.

The survey was undertaken between 2nd and 8th April 2013.

Monksham Farm Solar Farm
Marston Bigot, Somerset

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Monksham Power Limited through their agent Green Nation, and the assistance of Nigel Davie is gratefully acknowledged in this regard. Wessex Archaeology would also like to acknowledge the assistance of the landowner Mr. Twigger in granting access to the survey areas.

The data were acquired under the direction of Wessex Archaeology. Ross Lefort processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ben Urmston. Illustrations were prepared by Ken Lymer and Linda Coleman. The project was managed on behalf of Wessex Archaeology by Caroline Budd.

Monksham Farm Solar Farm
Marston Bigot, Somerset

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Monksham Power Limited, through their agent Green Nation, to carry out a geophysical survey of land near Monksham Farm, Marston Bigot, Somerset (**Figure 1**), hereafter "the Site" (centred on NGR 376375, 143000). The survey forms part of a programme of archaeological works being undertaken to inform decisions regarding potential future development at the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The survey area comprises three arable fields measuring 17.8ha in area, located approximately 5km SSW of Frome (**Figure 1**). A detailed gradiometer survey was undertaken covering the total available area of the Site (17.4ha).

1.2.2 The Site is located on a gently sloping spur of land that lies between the River Frome to the south and one of its smaller tributaries to the north. The centre of the Site lies at a height of approximately 90m above Ordnance datum (aOD) with the land dropping slightly towards the northern and the southern extents of the survey area (less than 85m aOD). The survey area is defined by the boundaries of the three fields.

1.2.3 The underlying geology of the area is made up of two main bedrock formations; Peterborough member mudstone to the northeast and Kellaways formation of sandstone and mudstone to the southwest. Both bedrock geologies present were formed in the Jurassic. Superficial deposits are not recorded over most of the site but some are recorded along the far south of the site. This superficial geology consists of terrace deposits (sand and gravel) and alluvium (clay, silt, sand and gravel) from deposits laid by the River Frome in the Quaternary. The soils underlying the Site are most likely pelo-stagnogley soils of the 712b (Denchworth) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken under the direction of Wessex Archaeology between 2nd April and 8th April 2013. Field conditions at the time of the survey were largely good.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS system, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data collected for the detailed survey were acquired at 0.25m intervals along transects spaced 1m apart. The system used has an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Detailed data were collected in the zigzag method.

2.2.3 Data from the detailed survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (typically ±10nT thresholds) applied to correct for any variation between the two Bartington sensors used and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of definite, probable and possible archaeological interest across the Site, together with a number of modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2500 (**Figures 2** to **4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale images and ±25nT at 50nT per cm for the XY trace plots. The number of data lines in the trace plots was halved to enable greater clarity in the final illustrations.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends. Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Detailed Gradiometer Survey Results and Interpretation

3.2.1 The southern field contains a few anomalies of definite and probable archaeological interest. The most convincing feature is an interrupted curvilinear anomaly at **4000**-**4002**; it has variable magnetic values along its length with values around +2.5nT at the strongest point and less than +1nT at the weakest points. The feature is aligned roughly northwest to southeast and fades out at either end and is not seen to run into or join up with existing field boundaries. The weaker areas have been classed as probable archaeology and the strongest region as definite archaeology. There are other curvilinear and linear anomalies at **4003**, **4004** and **4005**; they have much weaker values (typically less than +1.5nT) and are considered to be possible archaeology because of this.

3.2.2 There are other isolated small sub-oval shaped anomalies such as the example at **4006**; it has values around +5nT and is suspected to be a pit. There are several linear regions interpreted as increased magnetic response such as **4007**; they are made up of a series of bipolar responses (black and white) and are thought to represent ceramic field drains. The other, more irregular shaped, spreads of increased magnetic response (as at **4008**) are thought to represent spreads of Ceramic Building Material (CBM) and small ferrous objects.

3.2.3 The remaining anomalies in this field are either trends or small positive anomalies. The trends are either considered to be ploughing trends (**4009**) or may prove to be weakly contrasting archaeological features. The small positive anomalies are considered to possibly represent small cut features such as small pits or postholes; since they form no significant patterning in their spatial distribution they have been classed as possible archaeology.

3.2.4 The field to the southeast contains a large concentration of ferrous responses with much of the area of the field almost completely covered. Despite this magnetic disturbance, some anomalies of definite and possible interest were observed; it should be noted that should other anomalies of archaeological interest be present, they may be totally obscured by ferrous responses. The one anomaly considered to be of definite archaeological origin is at **4010** and extends northwards into the field above at **4017**; the feature cannot be traced much further south as it runs into the dense area of ferrous noise. This curvilinear feature will be discussed in more detail below. There are three positive linear anomalies visible in the data at **4011**, **4012** and **4013** that have been defined by trends for clarity. They have low magnetic values between +1nT and +2nT and are just visible between the gaps in the dense spread of ferrous responses; **4011** and **4012** are aligned parallel with the field boundary and are likely to relate to agricultural use.

3.2.5 There are other smaller anomalies of probable archaeological origin elsewhere at **4014** and **4015**; they range in shape from short linear features to sub-oval shapes with values around +4nT. They are considered to represent cut features such as pits but a fuller interpretation is hampered by the concentration of ferrous responses in this field.

3.2.6 A modern service is present at **4016** that runs into the next field at **4025**. This will be discussed in greater detail below. The remaining anomalies in this field are either trends or small positive anomalies. The small positive anomalies are considered to possibly represent small cut features such as small pits or postholes; since they form no significant patterning in their spatial distribution they have been classed as possible archaeology.

3.2.7 The field to the northeast contains the greatest concentration of anomalies of definite and probable archaeological interest. A broad curving feature can be seen running up the western boundary of this field at **4010**, **4017** and **4018**; it has magnetic values around

+3nT at its strongest points. This feature is considered to be a ditch relating to a field boundary or enclosure although it fades into the background at its northeastern extent. There are a number of smaller linear and pit-like anomalies within this curving arc at **4019** and **4022**; they have magnetic values around +4nT and are thought to represent short sections of ditches and pits.

3.2.8 A large irregular shaped positive anomaly is present at **4020** measuring 4.8m in length with magnetic values around +5nT. This feature has diffuse edges but is considered to be archaeological in origin, representing a large cut feature such as a pit. There are two short linear anomalies close by and these are considered to be of probable archaeological interest. A curvilinear anomaly is present at **4021** with weakly positive values around +1.5nT; this feature is considered to be of possible archaeological interest.

3.2.9 The remaining anomalies include spreads of increased magnetic response (**4023**) that are considered to be spreads of magnetic debris, ploughing trends, trends of possible archaeological interest (**4024**) and small positive anomalies. The small positive anomalies are considered to possibly represent small cut features such as small pits or postholes; since they form no significant patterning in their spatial distribution they have been classed as possible archaeology.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 There is one modern service located in the data at **4016**, **4025** and **4026**; it passes through the entire survey area and is aligned NNE-SSW. This service is known to be a buried telecom cable. There are several linear anomalies comprising ceramic responses (e.g. **4007**) running through the data that are considered to be ceramic field drains related to agriculture.

3.3.2 It is not clear from the geophysical data whether the service identified is in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

4 DISCUSSION

4.1 Summary

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of definite, probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and one modern service.

4.1.2 The geophysical data has revealed a curving ditch along with smaller possible lengths of ditch. It is possible that the ditch defines part of an earlier field system not marked on early mapping consulted in the Desk-Based Assessment (DBA) (Wessex Archaeology 2013). The other interesting anomalies within the dataset include probable pits that may also relate to some form of agricultural/industrial activity. As many of these features are not marked on recent mapping this may suggest that they date from an earlier period than the post-medieval.

4.1.3 The remaining features detected relate to more recent use of this area with ploughing trends, spreads of magnetic CBM and metallic debris and one modern service detected.

4.1.4 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the

materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies, however. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.

4.1.5 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. This is particularly the case for the field to the southeast where the wide and concentrated spread of ferrous responses will undoubtedly obscure any archaeological features that may be present. The wide area of geology present in the western field is not thought to be strong enough to obscure archaeological features.

5 REFERENCES

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1*, 2nd edition.

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

Wessex Archaeology, 2013. *Monksham Farm Solar Farm, Marston Bigot, Somerset: Archaeological Desk-Based Assessment*. Client report ref. 88960.02

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

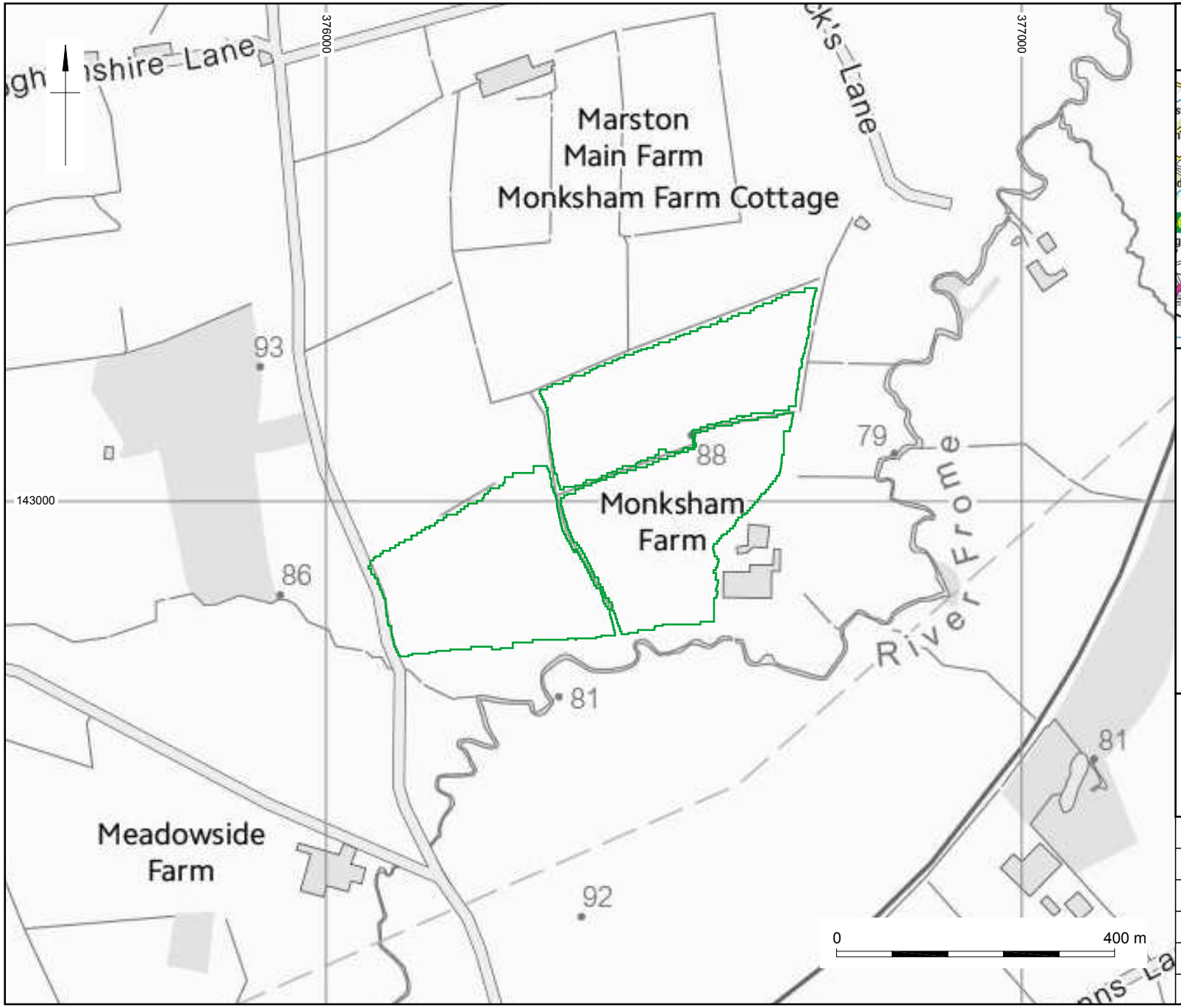
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



Geophysical survey area

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Site location plan

Figure 1

376000

37650

143000

Key

3nT

-2nT

0

100 m

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Geophysical survey area

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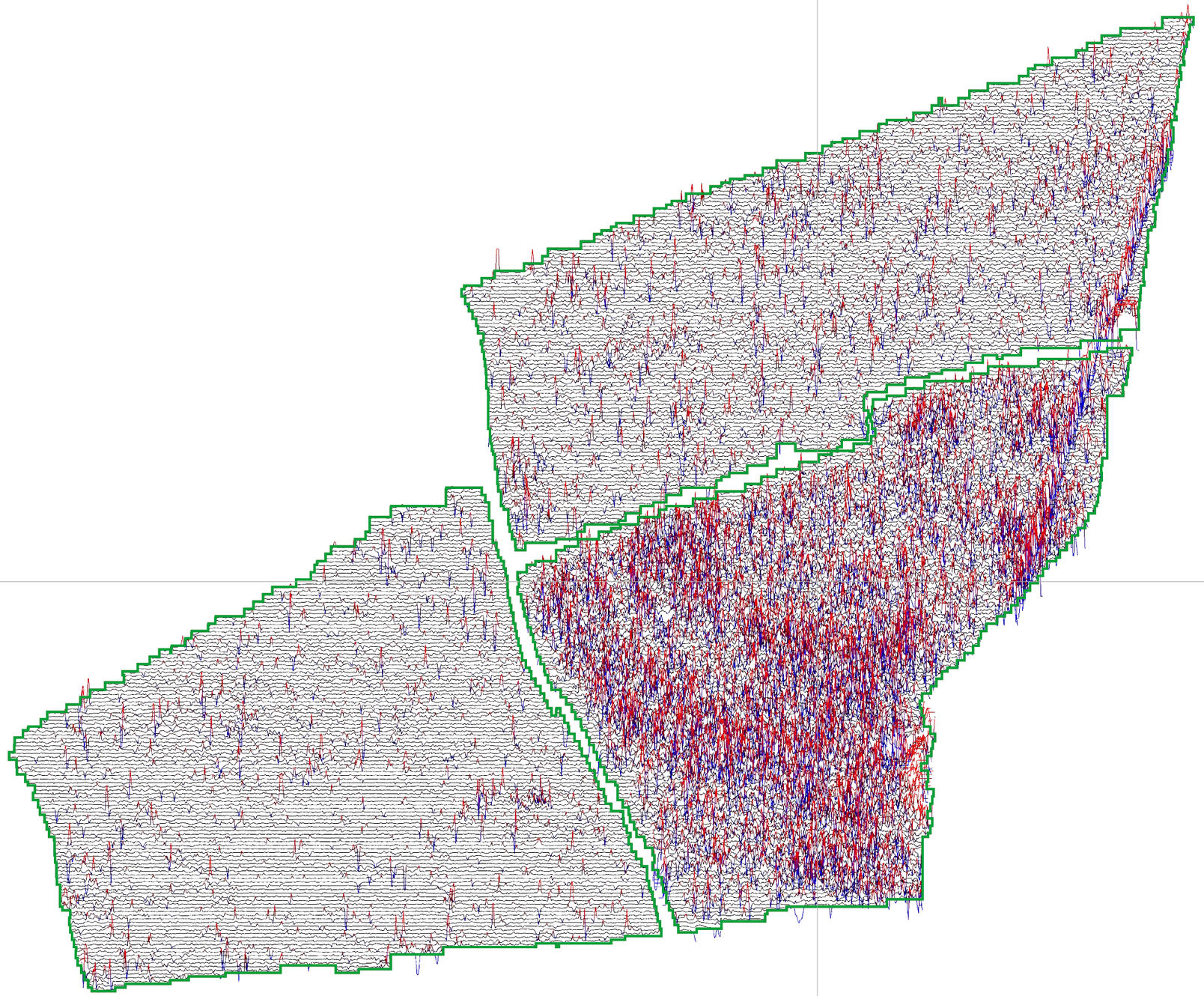
Greyscale plot

Figure 2

376000

376500

143000



Key

+25nT

-25nT

0 100 m

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Geophysical survey area

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XY trace

Figure 3

376000

376500

143000

4026
4024
4020
4025
4023
4018
4021
4019
4015
4022
4017
4011
4016
4010
4012
4009
4014
4004
4003
4002
4013
4005
4000
4001
4007
4006
4008

Archaeology
Probable Archaeology
Possible Archaeology
Trend
Increased Magnetic Response
Ferrous
Ploughing
Modern service
Superfical geology

0 100 m

Geophysical survey area

Date:	15/04/13	Revision Number:	0
Scale:	1:2500 at A3	Illustrator:	RL/BU/KL
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Interpretation

Figure 4

wessex archaeology

salisbury rochester sheffield edinburgh

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