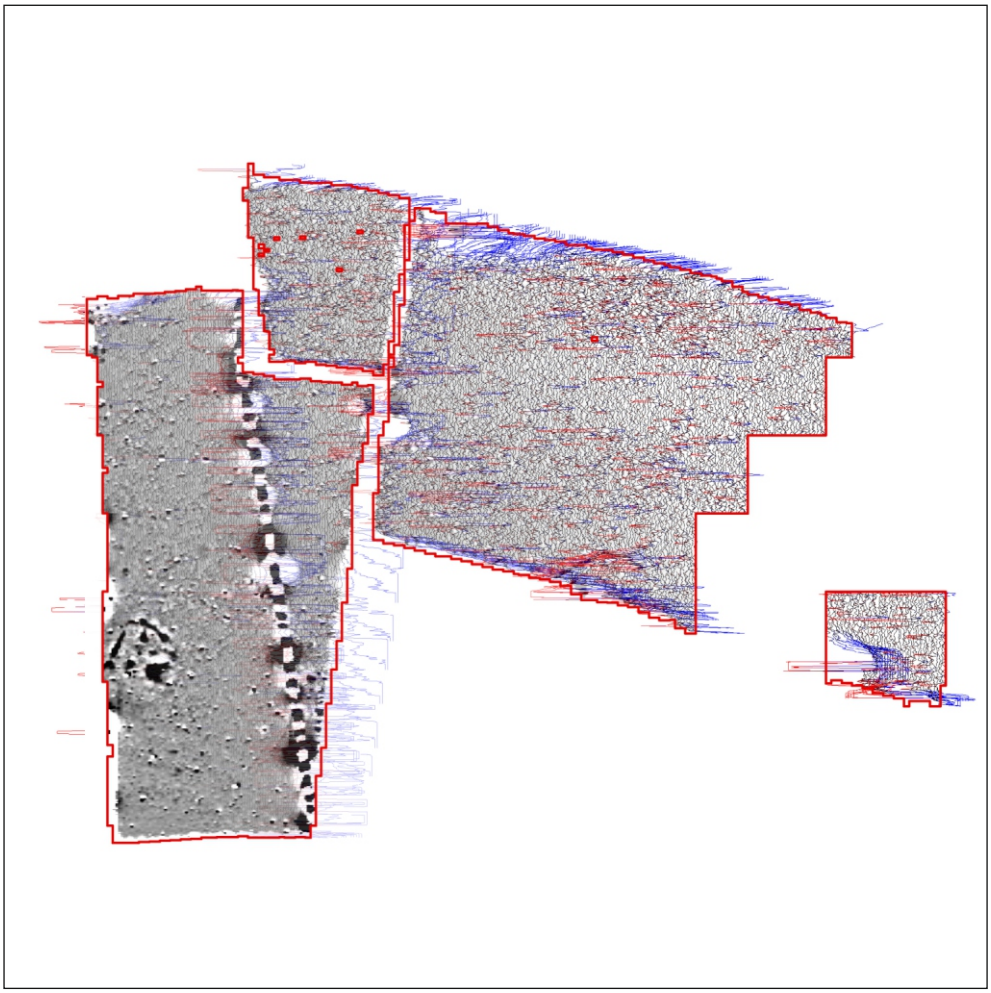
making sense of heritage

Taunton Racecourse Solar Farm
Taunton, Somerset

Detailed Gradiometer Survey Report



Ref: 103230.01
March 2014

geoservices

Taunton Racecourse Solar Farm
Taunton,
Somerset

Detailed Gradiometer Survey Report

Prepared for:
AEE Renewables Plc
Bath Office,
10 Bridge Street,
Bath,
Bath and NE Somerset,
BA2 4AS

Prepared by:
Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

www.wessexarch.co.uk

March 2014

Report Ref. 103230.01

Quality Assurance

Project Code	103230	**Accession Code**		**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	323791 121888		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	*LA*	*BCU*		12/03/2014
File:	X:\PROJECTS\103230\Geophysics\Report\103230_Geophysics_Report_BCU.Rtf				

* I = Internal Draft; E = External Draft; F = Final

Taunton Racecourse Solar Farm
Taunton,
Somerset

Detailed Gradiometer Survey Report

Contents

Figures

Taunton Racecourse Solar Farm
Taunton,
Somerset

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land off Taunton Racecourse, Taunton, Somerset. The project was commissioned for Wessex Archaeology by AEE Renewables Plc, with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The Site comprises largely flat pasture fields directly west of B3170, east of the M5, and approximately 2.5km south east of Taunton. The gradiometer survey has demonstrated the presence of a limited number of anomalies of definite and probable archaeological origins, along with extensive pit-like responses, regions of increased magnetic response and widespread ferrous anomalies. The survey also identified the presence of at least two modern services.

A sub-rectangular cluster of anomalies was identified towards the southwestern extent of the Site, considered to be of archaeological interest although it is difficult to ascertain the likely date. These anomalies comprise an enclosing ditch to the west and north and a series of large pit-like anomalies.

Extensive pit-like anomalies were identified across the Site considered to be of possible archaeological interest. However, the origins of these anomalies are unclear and, whilst an archaeological interpretation cannot be ruled out, it is possible that they relate to agricultural activity.

Ploughing trends, oriented NW-SE parallel with the existing field boundaries, can be seen across the north and eastern parts of the survey area. In places, the regular intervals between trends suggest that they may be associated with ridge and furrow.

Frequent ferrous anomalies are evident throughout the dataset, with a large area of extensive magnetic disturbance in the north.

Taunton Racecourse Solar Farm
Taunton,
Somerset

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by AEE Renewables Plc. The assistance of Tom Jones and Roland Billington is gratefully acknowledged in this regard. Wessex Archaeology would also like to thank Bob Young for his co-operation and assistance on site.

The fieldwork was undertaken by Clara Dickinson, Alistair Salisbury and Rachel Williams. Laura Andrews and Alistair Salisbury processed and interpreted the geophysical data and Laura Andrews wrote this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Richard Milwain. The project was managed on behalf of Wessex Archaeology by Caroline Budd.

Taunton Racecourse Solar Farm
Taunton,
Somerset

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by AEE Renewables Plc to carry out a geophysical survey over land west of Taunton Racecourse, Somerset (**Figure 1**), hereafter "the Site" (centred on NGR 323791 121888). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of a proposed solar farm development at the Site and follows a previous archaeological Desk-Based Assessment (ADBA).

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 pasture fields directly west of B3170, some 400m southeast of the M5 and approximately 2.5km southeast from the centre of Taunton (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 4.3 ha.

1.2.2 The Site occupies relatively flat land lying at 45m above Ordnance Datum (aOD). The survey area was bounded by field boundaries and agricultural land to the north, west and south; the main road B3170 and Taunton Racecourse lie to the east.

1.2.3 The soils underlying the Site are likely to be the stagnogleyic argillic brown earths of the 572f (Whimple 3) 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 gradiometer survey.

1.3 Historical & Archaeological Background

1.3.1 An ADBA of the Site has previously been undertaken (WYG 2013). This highlighted the presence of prehistoric, Romano British, medieval and post-medieval features surrounding the Site.

1.3.2 There are no records of any features of archaeological origin being found within the Survey Area. The ADBA indicates that there is apparently a low archaeological

potential for all periods, though if any archaeological features were to be found, existing evidence from the vicinity suggests that prehistoric to early medieval dates would be most likely.

1.3.3 Documentary and cartographic sources examined show that most of the Site has remained undeveloped pasture and farmland through the historic period.

1.3.4 A walkover survey was carried out in December 2013 which did not highlight any likely archaeological features on the Site, although one former field boundary was identified.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed gradiometer 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 by Wessex Archaeology's in-house geophysics team between 20th and 21st February 2014. Field conditions at the time of the survey were reasonable, with the survey area being under pasture.

2.2 Method

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

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

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT 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 identified an area of archaeological interest, extensive anomalies of possible archaeological interest across the Site, along with regions of magnetic disturbance and linear trends. Two modern services were also identified.

Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and 25nT/cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of a probable archaeological feature, potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). 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 Gradiometer Survey Results and Interpretation

3.2.1 At the southwestern extent of the survey, a sub-rectangular cluster of anomalies **4000** was identified, considered to be of definite archaeological interest. A number of anomalies of probable archaeological interest lie in close proximity and a region of increased magnetic response surrounds the cluster. Two ditch segments enclose the western and northern extents of the clusters, with a number of large pit-like anomalies within its centre.

3.2.2 Extensive anomalies of possible archaeological origin can be seen across the site, e.g. **4001** at the western extent of the Site. Whilst these responses have been interpreted as being of possible archaeological interest, it is conceivable that they are the result of agricultural or geological activity; an archaeological origin cannot be excluded entirely however.

3.2.3 A modern service **4002** extends across the west field, oriented NNW-SSE, with extensive magnetic disturbance that would have masked any weaker anomalies.

3.2.4 Ploughing trends **4003** are oriented NW-SE and their regular spacing suggests that they may represent remnants of ridge and furrow. Further such trends can be seen in the larger field to the southeast.

3.2.5 An extensive region of increased magnetic response can be seen at **4004**, towards the northeasternmost extent of the survey. Whilst the origin of this region is unclear, it is possible that it represents a near-surface deposit being ploughed to the surface, although it is unlikely to be of archaeological significance given the lack of anomalies of interest nearby.

3.2.6 Further pit-like anomalies can be seen throughout the survey area, appearing clustered in places, e.g. **4005**. This does not necessarily lend additional credence to an archaeological origin, however.

3.2.7 Curvilinear anomaly **4006** is consistent with a modern service. The purpose of the fork at its eastern extent is not clear and its apparent termination within the field is similarly unusual; its character is consistent with a modern or historic date however.

3.2.8 Extensive magnetic disturbance can be seen near the southeasternmost extent of the Site at **4007**. Given the magnitude of the response, it is possible that **4007** is associated with a modern service, although no characteristic anomaly is apparent, unlike at **4002**.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has detected anomalies of definite, probable and possible archaeological interest within the survey area, along with at least two modern services, a region of increased magnetic response and linear trends.

4.1.2 The anomalies of clearest archaeological interest are located near the southwestern extent of the Site and comprise a sub-rectangular enclosure surrounding a number of large pit-like anomalies. The enclosure appears to measure at least 20m x 20m, with a slightly longer axis oriented NW-SE. It is difficult to determine an exact date for these features from the geophysical survey as they are consistent with a range from the later prehistoric to medieval periods.

4.1.3 The survey has also detected widespread isolated pit-like anomalies, which have been interpreted as being of possible archaeological interest as it is not possible to exclude this entirely. However, natural features such as tree throws can produce similar responses and an alternative agricultural origin cannot be ruled out.

4.1.4 Given the detection of weakly magnetised anomalies such as ploughing trends, it is considered likely that more substantial archaeological features would have produced detectable anomalies, should any have been present.

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. *Soils of England and Wales: Sheet 5, South West England*. Ordnance Survey, Southampton.

WYG Planning & Environment, 2013. *Solar Farm on Land at Taunton Racecourse, Taunton, Somerset: Archaeology and Heritage Desk-Based Assessment*. Unpublished client Report: A085435

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 gradiometers 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 gradiometers 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 gradiometer;
- 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.

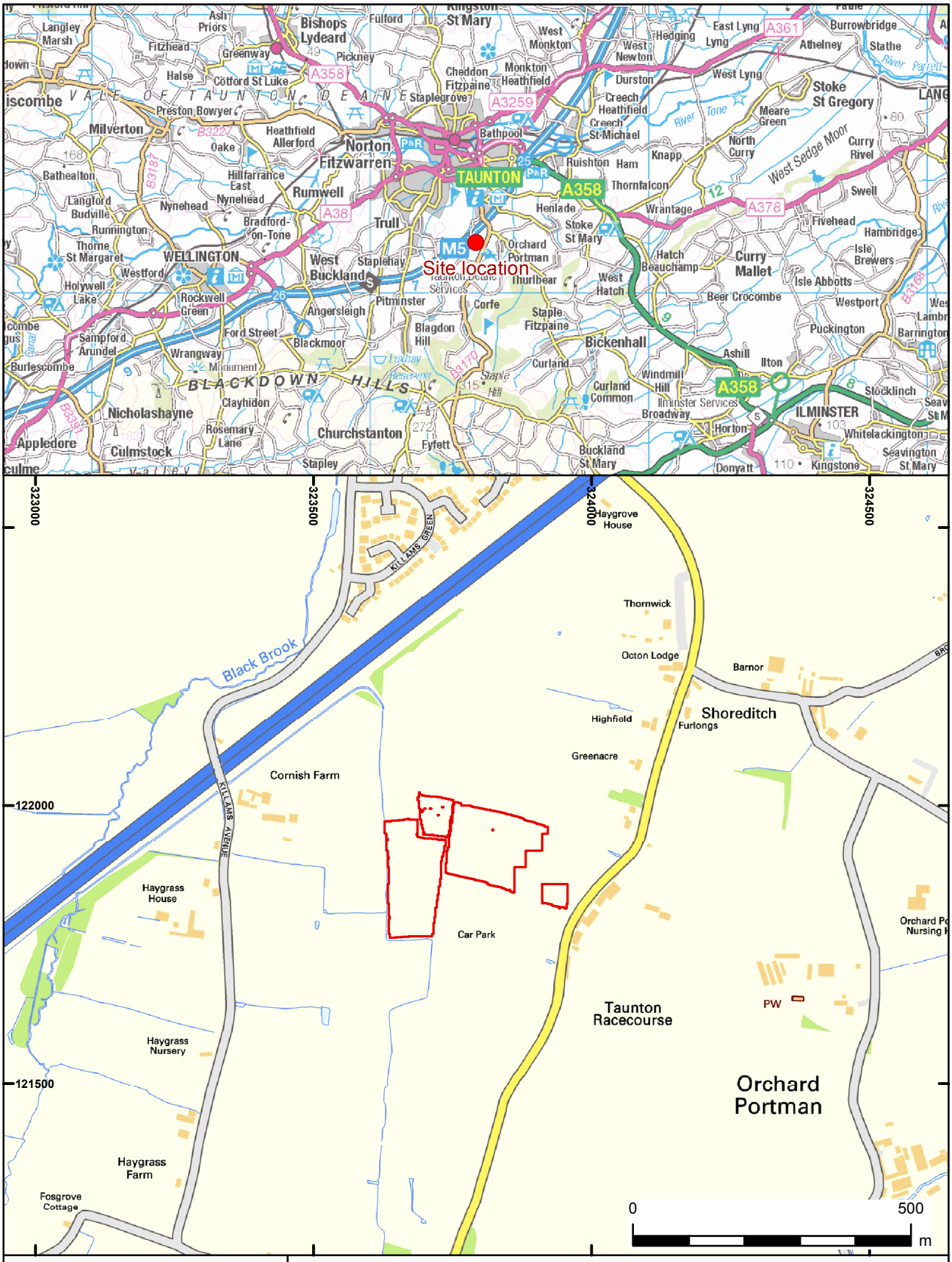
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



Survey Extents

Date:	11/03/14	Revision Number:	0
Scale:	1:200000 and 1:10000 at A4	Illustrator:	RAM
Path:	X:\PROJECTS\103230\GIS\FigsMXD\103230_Fig01.mxd		

Site location and survey extents

Figure 1

323600

323800

324000

122000

121800

+3nT

-2nT

0

100

m

Survey Extents

Date:	11/03/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\103230\GIS\FigsMXD\103230_Fig02.mxd		

Greyscale

Figure 2

323600

323800

324000

122000

121800

+25nT

-25nT

0

100

m

Survey Extents

Date:	11/03/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\103230\GIS\FigsMXD\103230_Fig03.mxd		

XY trace

Figure 3

323600

323800

324000

122000

121800

4000

4001

4002

4003

4004

4005

4006

4007

Survey Extents
Archaeology
Probable Archaeology
Possible Archaeology
Modern Service
Ferrous
Trend
Ploughing
Increased Magnetic Response

0 100 m

Date:	11/03/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\103230\GIS\FigsMXD\103230_Fig04.mxd		

Interpretation

Figure 4

wessex archaeology

salisbury rochester sheffield edinburgh

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk