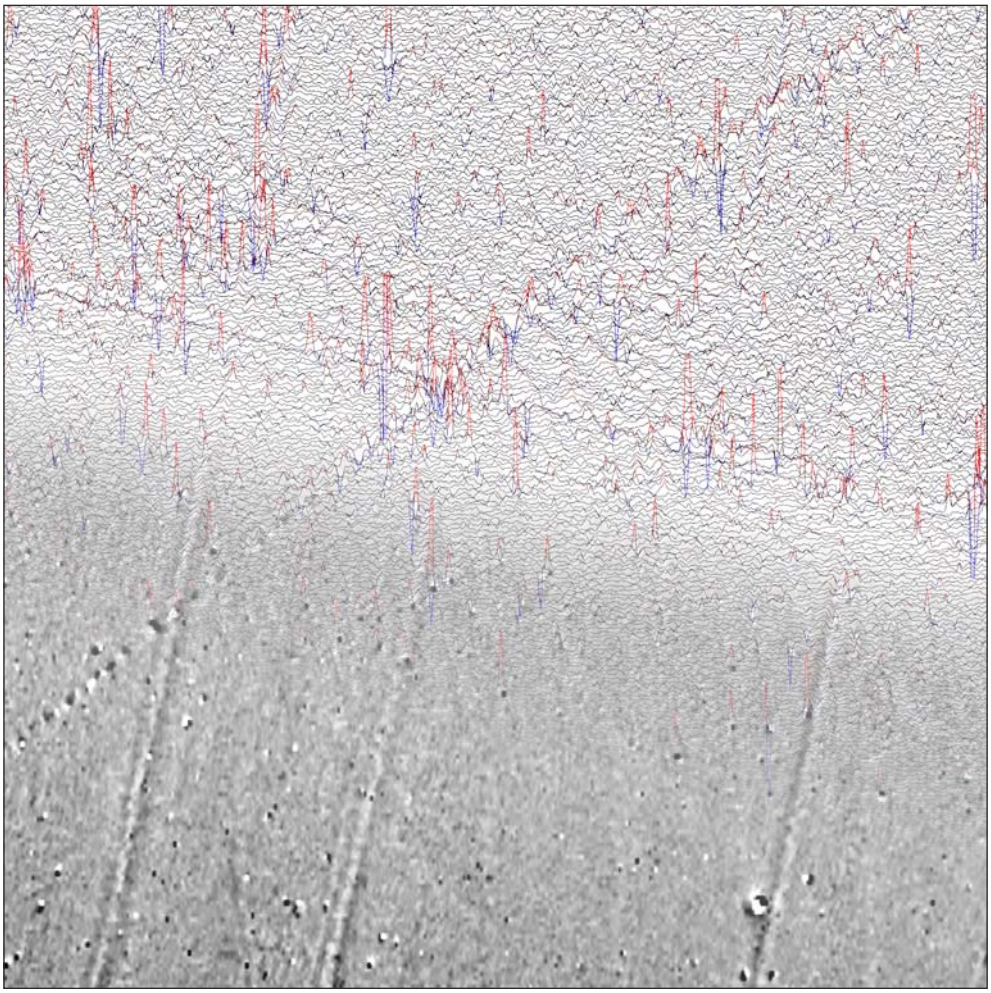
making sense of heritage

Great Curham Farm, Ash Thomas, Tiverton, Devon

Detailed Gradiometer Survey Report



Ref: 88610.01
February 2013

geoservices

Great Curham Farm, Ash Thomas
Tiverton, Devon

Detailed Gradiometer Survey Report

Prepared for:
Alder King LLP
15 Pembroke Road,
Bristol
BS8 3BA

On Behalf of:
Solar Power Generation Limited
Higher Hill Farm
Butleigh
Glastonbury
BA6 8TW

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

www.wessexarch.co.uk

February 2013

Report Ref. 88610.01

Quality Assurance

Project Code	88610	**Accession Code**		**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	300825 111245		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	E	*BCU*			06/02/2013
File:					
File:					
File:					
File:					
File:					

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

Great Curham Farm, Ash Thomas
Tiverton, Devon

Detailed Gradiometer Survey Report

Contents

Figures

Great Curham Farm, Ash Thomas
Tiverton, Devon

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Great Curham Farm in Ash Thomas, near Tiverton, Devon. The project was commissioned by Solar Power Generation Limited 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 arable fields to the northeast of Ash Thomas, approximately 5.5km SSE of Tiverton and lying either side of Chave Lane. The site lies within a low valley, sloping gently downwards from west to east, and was under cultivation at the time of survey. The gradiometer survey covered 16.6ha and 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 a modern service.

Three sub-rectangular enclosures were identified within the dataset at the western, central and southeastern extents of the survey area, which are of archaeological interest. The westernmost enclosure measures 47m N-S by at least 31m E-W, the central enclosure 37m N-S by at least 47m E-W and the southeastern enclosure 74m NE-SW by 68m NW-SE. Of the three, only the westernmost had been previously identified through aerial photography. Parts of each of the enclosures lie outside the survey area, and it has been possible to determine the full extents only of the southernmost enclosure.

Several other linear and rectilinear anomalies elsewhere within the data may relate to elements of further enclosures or other archaeological activity. A cluster of pit-like anomalies is also of probable archaeological interest, although the origins of these pits are unclear and they may be more modern in provenance.

An extensive former field system has been identified through the presence of former field boundaries, and is likely to correspond with the medieval field system, parts of which had been identified previously through extant earthworks. The field system comprises a network of narrow strip fields some 50m to 55m wide, oriented NNE-SSW along their longest axes.

Ploughing trends associated with the former field system and later agricultural activity can be seen throughout the dataset. Other weak trends may be of archaeological interest, although they are only weakly defined from the magnetic background and may represent chance alignments.

A modern service extends southwest across the site from Chave Farm, and appears to be ceramic in construction.

Great Curham Farm, Ash Thomas
Tiverton, Devon

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Mark Cullen of Alder King on behalf of Solar Power Generation Limited. The assistance of Mark Cullen is gratefully acknowledged in this regard.

The fieldwork was conducted by Stratascan. Ben Urmston processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Sue Farr.

Great Curham Farm, Ash Thomas
Tiverton, Devon

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Solar Power Generation Limited to carry out a geophysical survey of land at Great Curham Farm, near Tiverton, Devon (**Figure 1**), hereafter "the Site" (centred on NGR 300825 111245). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of a proposed solar farm 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 arable fields off Chave Lane, some 500m northeast of Ash Thomas and 5.5km ESE of the centre of Tiverton (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 16.6 ha.

1.2.2 The Site lies within a shallow valley, sloping from 75m above Ordnance Datum (aOD) at the west to c. 65m aOD at the eastern boundary. The survey area was bisected by Chave Lane and bordered by another lane to the south; it was surrounded by other arable fields.

1.2.3 The soils underlying the Site are likely to be typical brown earths of the 541b (Bromsgrove) association and typical cambic gleys of the 831c (Wigton Moor) (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 between 23rd and 25th January 2013. Field conditions at the time of the survey were acceptable and, although it was snowing at the time of survey, ground conditions are not considered to have had an effect on data quality.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a realtime-kinematic GPS, 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 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 been successful in identifying anomalies of definite, probable and possible archaeological interest across the Site, along with regions of increased magnetic response and a modern service. 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 at 50nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of 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 Near the northwestern corner of the survey area, the eastern portion of a sub-rectangular enclosure is apparent (**4000**). It is possible that several anomalies within the enclosure are of archaeological origins, although strong ploughing trends make their interpretation tentative. A linear anomaly extends approximately N-S across the northern circuit of **4000**, although it is unclear whether the two are associated.

3.2.2 To the northeast of enclosure **4000**, linear anomaly **4001** is likely to represent a ditch or former boundary. It is oriented ENE-WSW towards the northeastern corner of **4000**, although no direct relationship can be demonstrated. The orientation of **4001** is different to that of other anomalies nearby.

3.2.3 An extensive former field system can be seen extending throughout the entire dataset, comprising a series of rectangular fields. The westernmost parts of this field system can be seen at junctions **4002**, **4003** and **4004**. The majority of these former fields are oriented

NNE-SSW along their longest axes and many are of similar widths; it is possible that the anomalies associated with former boundaries bisecting some of the wider fields have been obscured through later ploughing.

3.2.4 Near the southwestern corner of the survey area, linear anomalies **4005** and **4006** lie on a somewhat different orientation from the former field system, e.g. **4004**, and are of probable archaeological interest; it is possible that they represent parts of enclosures on different alignments. Weak trends nearby may indicate more extensive archaeological remains.

3.2.5 Modern service **4007** extends NE-SW across the western portion of the survey area and can be seen at **4008**, **4009** and **4010**. Whilst it cannot be demonstrated conclusively that the service post-dates the former field system, this has been assumed given the character of its response. Its interrupted nature suggests that it is of ceramic, rather than ferrous, construction.

3.2.6 A band of near-surface geological changes is apparent across the northern portion of the survey area. The responses within this region suggest that it represents a network of former channels, e.g. **4011**, although they become more randomly oriented towards the southeast, e.g. **4012**.

3.2.7 The former field system noted to the west continues across the eastern portion of the survey area, e.g. **4013**. There is an apparent interruption at **4014**, although it is likely that this is a result of ploughing and the near-surface geological changes.

3.2.8 Towards the northeastern corner of the survey area, probable rectangular enclosure **4015** is well defined along its southern circuit; the responses over the ditches lack contrast with the general magnetic background along the possible western and northern circuits. Weak trends extending to the southwest may also be associated with the enclosure.

3.2.9 Two linear anomalies **4016** are oriented parallel with Chave Lane, which forms the northeastern boundary of the survey area. It is possible that they indicate part of a former field system.

3.2.10 Further south, probable ditches **4017** and **4018** are likely to be associated with the extensive former field system on the same alignment, although their lack of contrast makes this interpretation more tentative.

3.2.11 To the east of Chave Lane, a sub-rectangular enclosure comprises several dissociated rectilinear ditches **4019**; it is considered likely that these anomalies represent a continuous circuit, however. There appear to be several internal features **4020**, although many of these have been identified as regions of increased magnetic response rather than individual anomalies, which may indicate truncation through ploughing, should they relate to archaeological features. Two sub-annular trends have been identified through their form in plan, and exhibit only weak contrast with the local background; in general, ploughing trends within the enclosure are stronger than elsewhere in the vicinity, suggesting that more magnetic deposits have been disturbed through ploughing here.

3.2.12 It is likely that enclosure **4020** had an entrance **4021** along its eastern circuit; the anomalies forming the enclosure are particularly well defined along its eastern extent and are consistent with ditch termini. The interruptions in the anomalies at the northern and southern extents are consistent with the masking of the responses through truncation.

3.2.13 Towards the northern extent of the eastern field, several pit-like anomalies **4022** are visible. Given their proximity to the field boundary and a region of magnetic disturbance, their interpretation is somewhat tentative, and there is little evidence to suggest their origins; it is possible that they are the result of relatively recent agricultural activity or date from a period of more archaeological interest.

3.2.14 At the eastern extent of the survey area, short linear anomaly **4023** is well defined and consistent with archaeological activity. However, it appears to be isolated and on a different orientation from other anomalies nearby.

3.2.15 Along the southeastern extent of the survey area, ditches **4024** and **4025** represent elements of a former field system. Given the similarity of their alignments, it is considered likely that they date from a similar period as those identified further to the west, e.g. **4002** to **4004**, **4013**.

3.2.16 Elsewhere within the dataset, linear trends consistent with ploughing have been identified. The majority of these are oriented parallel with former field systems. Other linear and curvilinear trends may be of some archaeological interest, although these are only weakly defined from the magnetic background and may be chance alignments within the data.

4 CONCLUSION

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 a modern service.

4.1.2 Enclosure **4000** at the northwestern extent of the survey area is likely to correspond with a cropmark identified from aerial photography (Archaedia, 2012; Asset 7). It measures 47m N-S by at least 31m E-W, although the western portion of the enclosure lies outside the survey area.

4.1.3 The extensive former field system identified in the geophysical survey is likely to relate to the medieval field system already partially known (Archaedia, 2012; Assets 1, 2 and 3). Although the northern part of the field lies outside the survey area, many of the former enclosures measure 50m to 55m across their width, suggesting a network of similar sized fields on a common axis. The similarities between these results and the 1838 Tithe map are striking.

4.1.4 Two further enclosures have been identified, one to the west of Chave Lane (**4015**) and one to the east (**4019** & **4020**). **4015** measures 37m N-S and at least 47m E-W, although its eastern extents lie outside the survey area under Chave Lane. **4019** measures 74m NE-SW by 68m NW-SE, although its southwestern corner is under Chave Lane. The probable entrance in the eastern circuit is well defined, although it is conceivable that there is another to the west outside the survey area. The possible internal features are not well defined from the magnetic background.

4.1.5 It is interesting to note that the location of a former Ordnance Survey triangulation station (Archaedia, 2012; Asset 5) is close to the northern corner of enclosure **4019**; the magnitude of response is notably higher there and is consistent with such remnants. It is possible that the worked flint noted during a previous site visit (Archaedia, 2012; Asset 4) is associated with one of the two enclosures, although no specific locations were given.

4.1.6 It is not possible whether the service observed extending SW from Chave Farm across the survey area is live. It should be noted that the size of the magnetic anomaly may be different from the physical dimensions of the service.

5 REFERENCES

Archaedia, 2012. *Archaeological Assessment of Land on Great Curham Farm, Halberton, Devon*. Unpublished report ref. 12.19, project ref. 1062

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.

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.

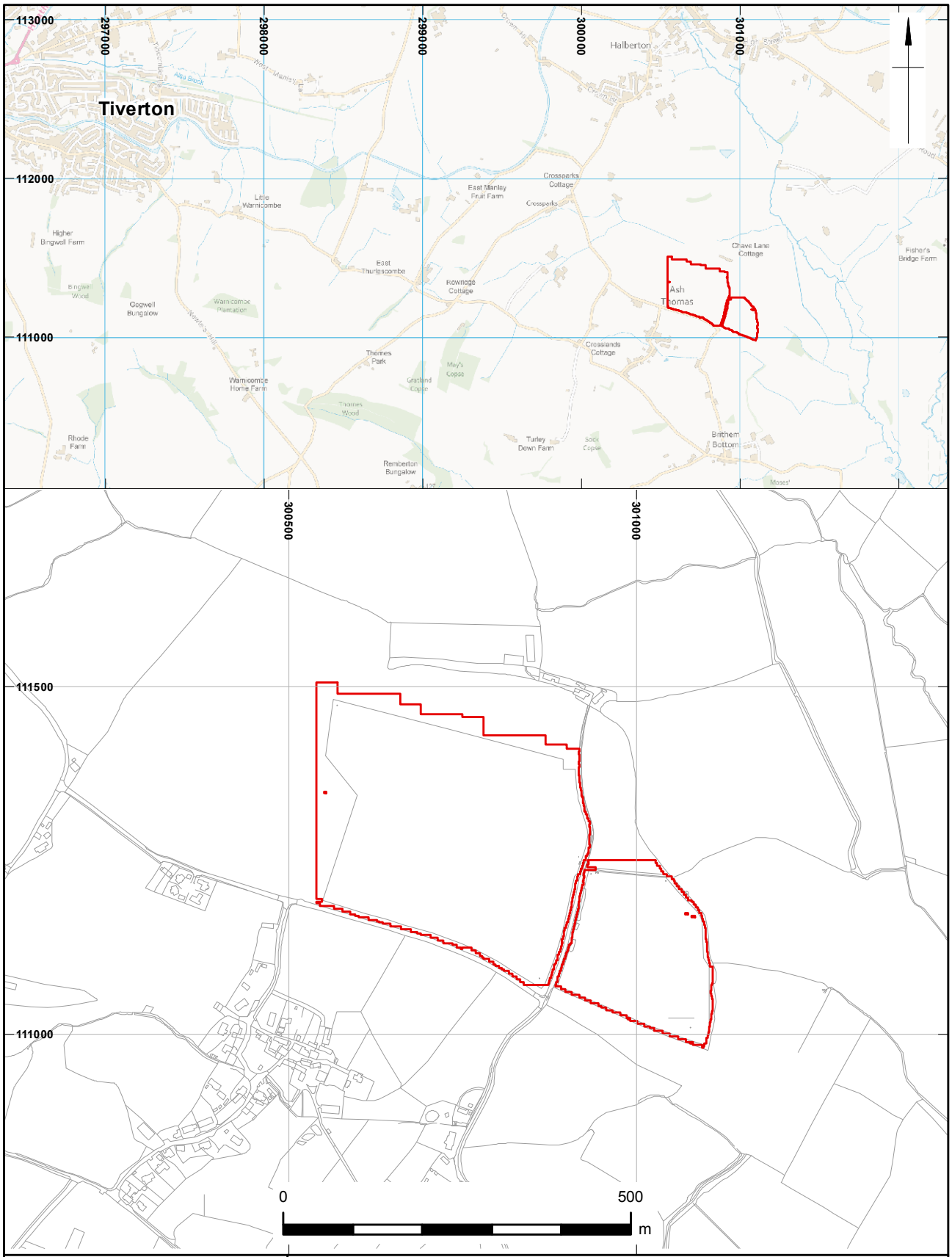
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



Survey Extents

Date:	06/02/13	Revision Number:	0
Scale:	1:8000 at A4	Illustrator:	LJC
Path:	X:\PROJECTS\88610\GIS\FigsMXD\88610_Fig01.mxd		

Site location & survey extents

Figure 1

111500

300800

111000

0

200

m

Survey Extents

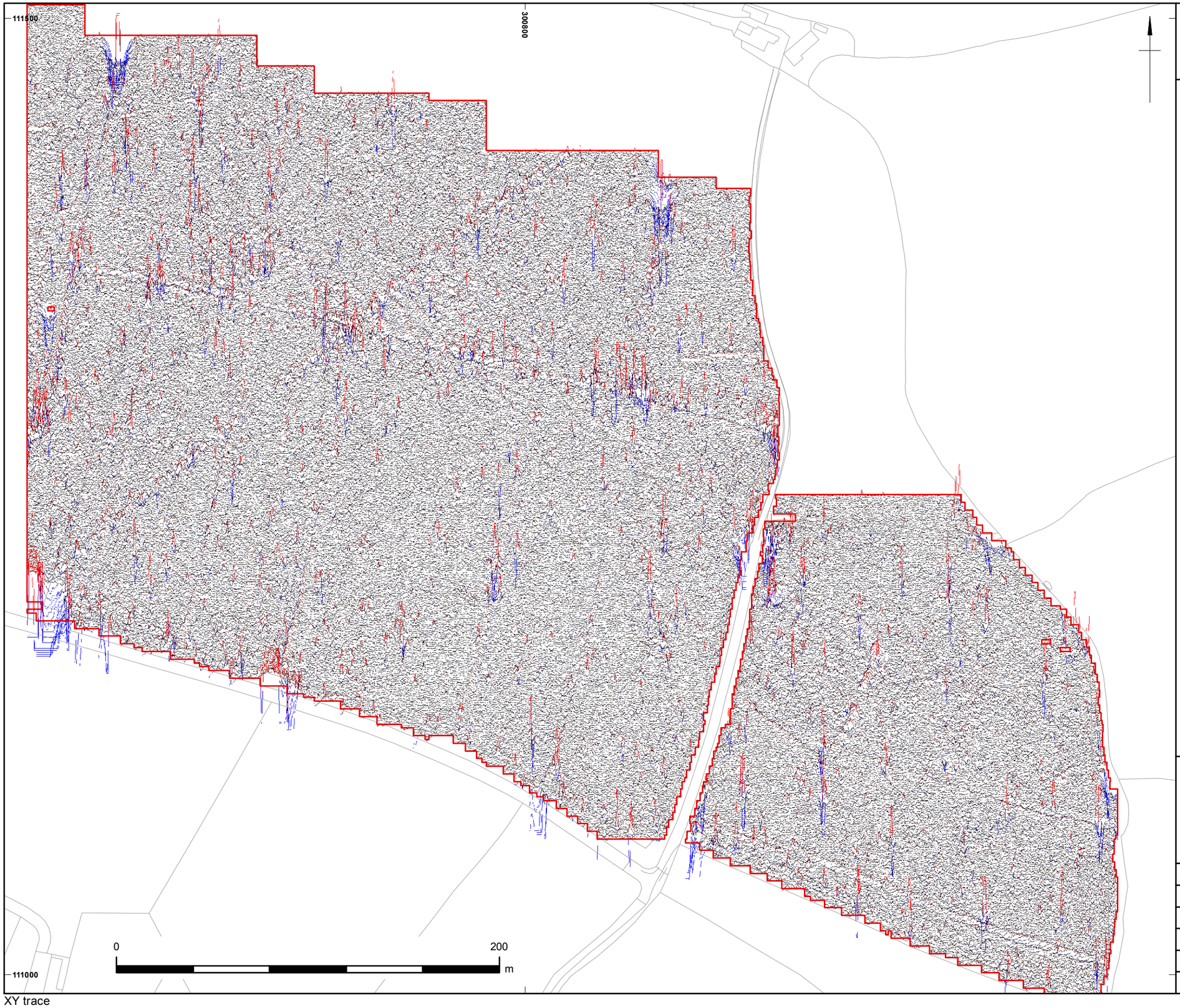
3nT

-2nT

Date:	06/02/13
Revision Number:	0
Scale:	1:2000 at A3
Illustrator:	LJC
Path:	X:\PROJECTS\88610\GIS\
	FigsMXD\88610_Fig02.mxd

Greyscale

Figure 2



Survey Extents

25nT

-25nT

Date:	06/02/13
Revision Number:	0
Scale:	1:2000 at A3
Illustrator:	LJC
Path:	X:\PROJECTS\88610\GIS\
	FigsMXD\88610_Fig03.mxd

XY trace

Figure 3

111500

300800

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

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

0
200
m

111000

Date:	06/02/13
Revision Number:	0
Scale:	1:2000 at A3
Illustrator:	LJC
Path:	X:\PROJECTS\88610\GIS\
	FigsMXD\88610_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