making sense of heritage

Stonebow Road, Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

Ref: 102520.01
February 2014

geoservices

Stonebow Road, Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

Prepared for:
CgMs Consulting
43 Temple Row
Birmingham
B2 5LS

Prepared by:
Wessex Archaeology
Unit R6
Sheaf Bank Business Park
Prospect Road
Sheffield
S2 3EN

www.wessexarch.co.uk

February 2014

Report Ref. 102520.01

Quality Assurance

Project Code	102520	**Accession Code**		**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	392729, 249239		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	*CH*	*BCU*		04/02/2014
File:	S:\Projects\102520\Report\Submitted\102300.01v01_Stonebow Road, Drakes_Broughton				
v02	E		*APN*		04/02/2014
File:	S:\PROJECTS\102520 (Stonebow Road, Drakes Broughton)\Report\Submitted				
File:					
File:					
File:					

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

Stonebow Road ,
Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

Contents

Figures

Stonebow Road, Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Stonebow Road, Drakes Broughton, Worcestershire (hereafter the 'Site') centred on NGR: 392729, 249239 (**Figure 1**). The project was commissioned by CgMs Consulting with the aim of establishing the presence and significance, or otherwise, of detectable archaeological features within the Site ahead of a proposed re-development.

The Site covers an area of 2.7ha and comprises grassed fields currently used as horse paddocks. The survey was undertaken between 6th and 7th January 2014.

The geophysical survey did not identify any anomalies of archaeological interest within the survey area. A number of trends typical of ploughing or field drains were noted aligned northwest to southeast, suggesting that more substantial archaeological features should have produced detectable magnetic anomalies.

Four linear bands of ferrous and other increased responses were noted oriented north-northeast to south-southwest within the eastern portion of the Site. These are consistent with the remnants of modern boundaries and are likely to be relatively modern in provenance.

Stonebow Road, Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned CgMs Consulting, and the assistance of Cathy Patrick is gratefully acknowledged in this regard.

The fieldwork was undertaken by Phil Roberts who was assisted by Matt Weightman. Chris Breeden processed the geophysical data and wrote this report with the assistance of Chris Harrison. The geophysical work was quality controlled by Ben Urmston. Illustrations were prepared by Chris Breeden. The project was managed on behalf of Wessex Archaeology by Andrew Norton.

Stonebow Road, Drakes Broughton, Worcestershire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by CgMs Consulting to carry out a geophysical survey on land at Stonebow Road, Drakes Broughton, Worcestershire (hereafter the 'Site'). The Site comprises grassed fields currently used as horse paddocks. It is bounded by a railway line and embankment to the northeast, by Stonebow Road to the east, and by field boundaries to the south and northwest (**Figure 1**).

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 (**Figure 1**) comprises 2.7ha of agricultural pasture to the north of Drakes Broughton. The Site slopes gently downwards from the southern boundary (28.75m AOD) towards the northeastern corner (27.43m AOD).

1.2.2 The underlying geology comprises interbedded mudstone and limestone overlain by clay, silt, sand and gravel (CgMs 2012). The soils underlying the Site are likely to comprise the typical calcareous pelosols of the 411d (Hanslope) association and the stagnogleyic argillic brown earths of the 572t (Bishampton 2) association (SSEW 1983). Such geological settings have been demonstrated to produce anomalies with magnetic contrasts suitable for survey with fluxgate gradiometers.

2 HISTORIC BACKGROUND

2.1.1 The following is summarised from the Desk-Based Assessment (DBA) provided by CgMs (2012).

2.1.2 Although no heritage assets are situated in the Site, those located in the surrounding area are considered relevant to the Site's wider contextual understanding.

2.2 Prehistoric and Roman

2.2.1 No evidence dating to the Prehistoric periods have been found within 1km of the Site. A small amount of unstratified finds dating to the Roman period have been recovered from the parishes of Stoulton, Drakes Broughton, and Wadborough and represent a low background of Roman activity in the area.

2.3 Early medieval

2.3.1 Drakes Broughton is included within the Domesday Survey as being held by the Church of St. Mary of Pershore and there will have been some form of settlement during the latter part of this period (Williams and Martin 1992). The Site itself would have formed part of an undeveloped rural landscape and may still have been within the bounds of Feckenham Forest during this period.

2.4 Medieval

2.4.1 The HER does not record an historic settlement at Drakes Broughton although, given the presence of Drakes Broughton in the Domesday Survey, it is likely that some form of settlement will have existed during the medieval period. The Site itself will have been located outside any such settlement and instead will have formed part of an undeveloped rural landscape.

2.4.2 A ridge and furrow survey has been carried out for the Parish of Drakes Broughton and a possible remnant of medieval field system may be represented on the 1884 Ordnance Survey map, which shows two elongated plots extending southeast from Stonebow Road, opposite the southwestern corner of the Site.

2.4.3 Unstratified medieval finds have been recovered from the parishes of Stoulton, Drakes Broughton and Wadborough which indicate a low level of background activity cross the landscape

2.5 Post-medieval and modern

2.5.1 The HER holds one record for the Site, relating to the Great Western Railway Oxford, Worcester and Wolverhampton railway line. This railway line forms the northeastern boundary of the Site.

2.5.2 Drakes Broughton is not depicted on either Saxton or Speed's maps of Worcestershire (1577 and 1610 respectively). Neither is the village included within a Tithe Map as the land fell within Pershore Holy Cross, a parish that was only partly commuted.

2.5.3 The First Edition Ordnance Survey map of 1884 shows that the Site is located within an entirely agricultural landscape, which is bisected by the northwest–southeast aligned Great Western Railway line forming the Site's northeastern boundary. The undesignated historic farmstead of Stone Hall Farm is located to the northeast of the Site and of the railway line. The Site is shown to be at a significant distance to the north of the village of Drakes Broughton.

2.5.4 The Site was sub-divided into three fields by 1977, with a small structure shown in the southeastern corner. The field boundaries within the Site were altered again, between 1977–1990, but no other change is shown and the Site itself remains as undeveloped fields to the present-day.

3 METHODOLOGY

3.1 Introduction

3.1.1 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).

3.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on 6th and 7th January 2014. Field conditions at the time of the survey were reasonable.

3.2 Method

3.2.1 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).

3.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. The detailed survey data 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.

3.2.3 Data from the detailed survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (typically ±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, a deslope function to remove errors created by the ZMT function in areas of broad and strong anomalies, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These three processing steps were used only with no interpolation applied to the data. Three survey grids to the western extent of the site were subject to periodic errors, this could potentially be attributed to the acquisition of an object with ferrous properties by the surveyor from detritus that was evident on the site surface. A periodic filter was applied to correct these errors.

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

4 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

4.1 Introduction

4.1.1 The gradiometer survey identified numerous ferrous anomalies and regions of increased magnetic response across the Site. Results are presented as a greyscale and XY plot at a scale of 1:1,250 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT/cm for the XY trace plots.

4.1.2 The interpretation of the datasets identifies the presence of ferrous anomalies, magnetic trends, areas of disturbance and anomalies attributed to ploughing (**Figure 4**). Full definitions of the interpretation term used in this report are provided in **Appendix 2**.

4.2 Detailed gradiometer survey results and interpretation

4.2.1 Four linear anomalies, **4001** to **4004**, can be seen oriented north-northeast to south-southwest at the eastern extent of the site and are characterized by linear bands of ferrous anomalies and regions of increased magnetic response. These areas are punctuated by gaps in the survey due to the presence of up-standing remains of a former fence line, and anomalies **4001** to **4004** are interpreted as being the result of this modern boundary. No boundaries are visible on the historical mapping pre-1983 in this area of the Site.

4.2.2 A number of parallel linear trends are aligned northwest to southeast across the entire area and are consistent with agricultural activity. Whilst this is likely to be the result of ploughing, it is possible that they relate to field drains.

4.2.3 Numerous individual and randomly distributed small ferrous anomalies along with occasional areas of increased magnetic response are present across the site but the absence of any coherent pattern in the anomalies suggests that they do not represent any identifiable features. It is possible that the ferrous anomalies represent the remains of fencing or modern detritus that have been randomly distributed across the Site by ploughing or similar.

5 CONCLUSION

5.1.1 The detailed gradiometer survey has not identified any anomalies considered to be of significant archaeological interest within the Site. Given that it has been possible to detect the presence of ploughing trends, it is considered likely that more substantial archaeological features would have produced measurable magnetic anomalies, should any have been present.

5.1.2 The survey successfully identified four linear features, **4001** to **4004**, which can be interpreted as the remains of modern boundaries along with numerous randomly distributed ferrous anomalies that are of modern provenance.

6 REFERENCES

CgMs Consulting Ltd., 2012, *Archaeological Desk-Based Assessment: Land at Stonebow Road, Drakes Broughton, Worcestershire*. CgMs Unpublished report CP/13865

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 3, Soils of Midland and Western England*. Ordnance Survey, Southampton

Williams, A. and Martin, G. H. Eds, 1992, *Domesday Book*

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)
- Periodic Filter – This function is used to reduce or remove the amplitude of regular, periodic artefacts present in the data. This is most commonly used to correct for operator error during the collection of 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.

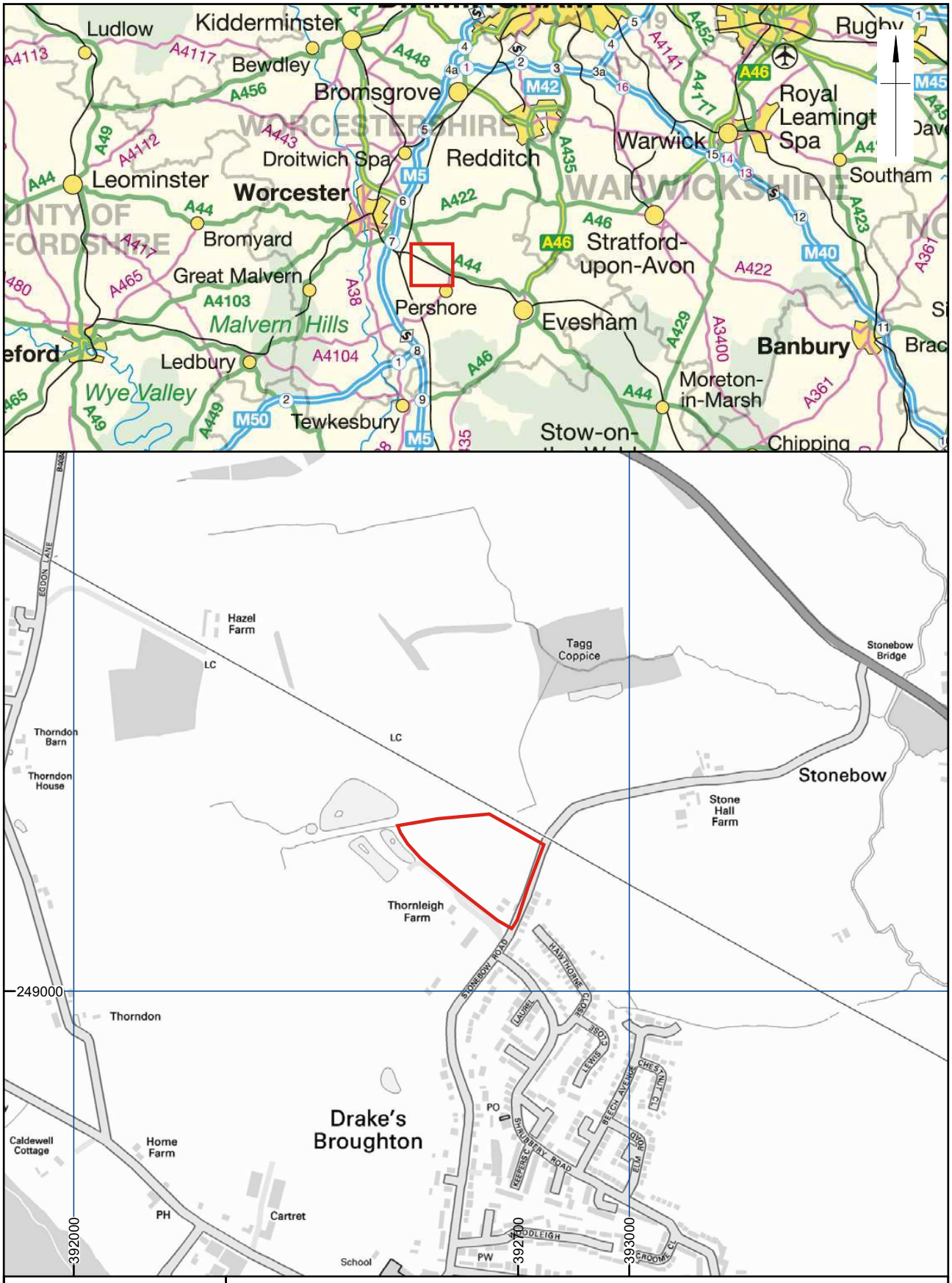
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

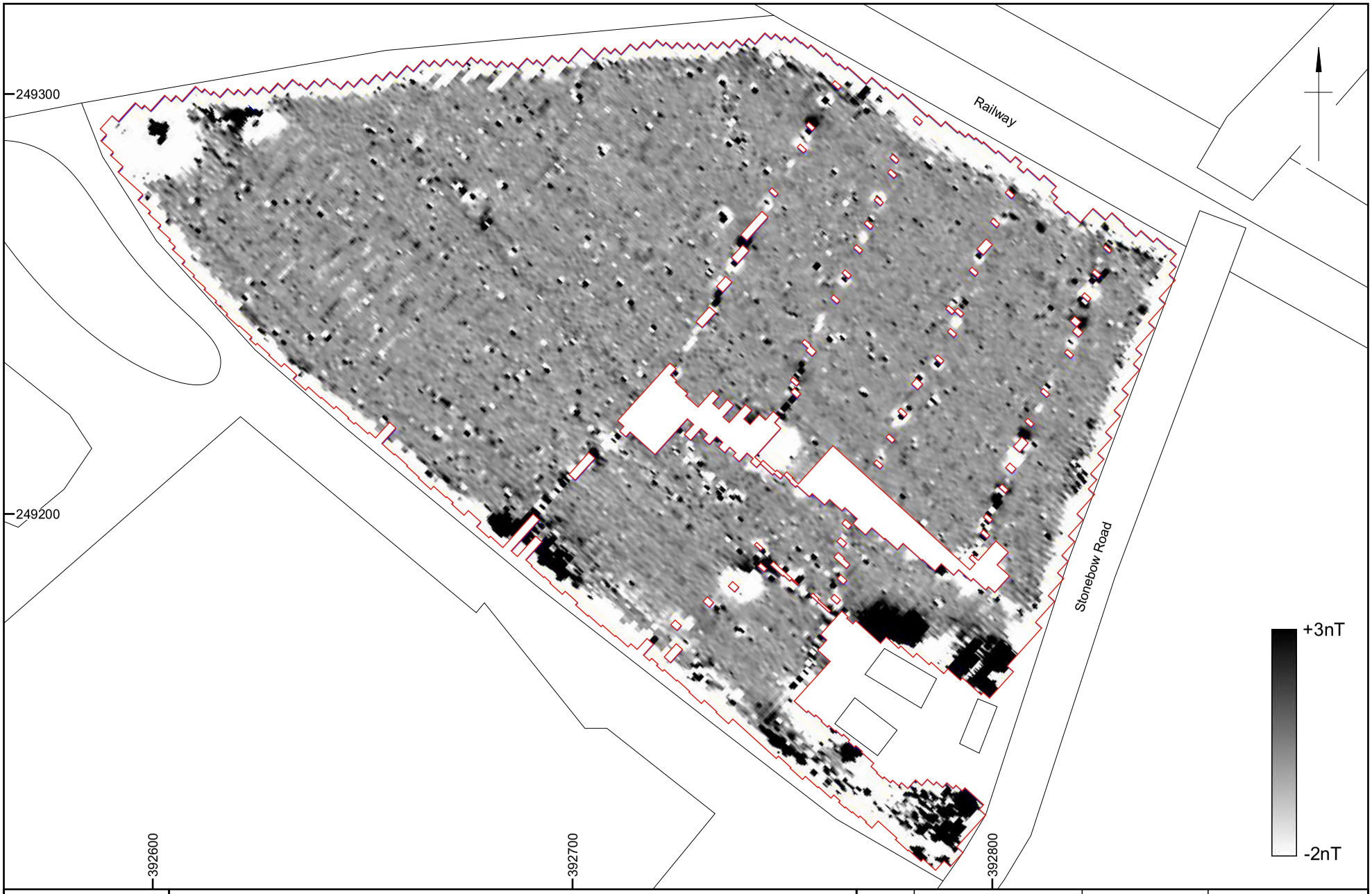
Finally, services such as water pipes are marked where they have been identified.



Date:	31/01/2014	Revision Number:	1.0
Scale:	Main graphic 1:10,000 @ A4	Illustrator:	CB
Path:	S:\PROJECTS\102520 (Stonebow Road, Drakes Broughton)\Geophysics\AutoCAD		

Site location

Figure 1

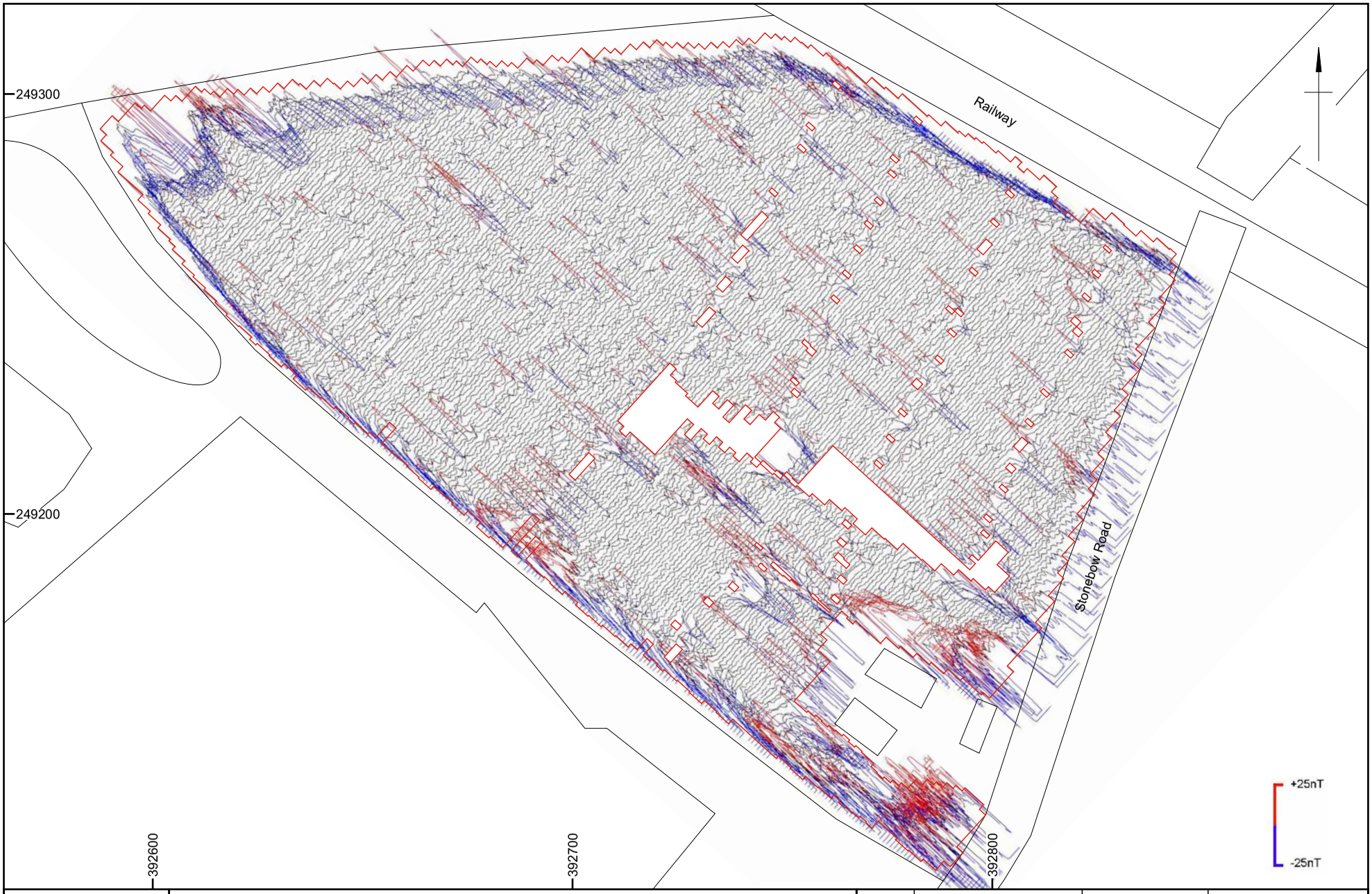


Detailed survey extents

Date:	31/01/2014	Revision Number:	1.0
Scale:	1:1250 @ A4	Illustrator:	CB
Path:	S:\PROJECTS\102520 (Stonebow Road, Drakes Broughton)\Geophysics\AutoCAD		

Greyscale

Figure 2



Detailed survey extents

Date:	31/01/2014	Revision Number:	1.0
Scale:	1:1250 @ A4	Illustrator:	CB
Path:	S:\PROJECTS\102520 (Stonebow Road, Drakes Broughton)\Geophysics\AutoCAD		

XY trace

Figure 3

Detailed survey extents

Date:	31/01/2014	Revision Number:	1.0
Scale:	1:1250 @ A4	Illustrator:	CB
Path:	S:\PROJECTS\102520 (Stonebow Road, Drakes Broughton)\Geophysics\AutoCAD		

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