



Woolbeding House Midhurst, West Sussex

Detailed Gradiometer Survey Report



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County West Sussex
National grid reference 487247 122544 (SU 87247 22544)
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Summary

A detailed gradiometer survey was conducted over land at Woolbeding House, Midhurst, West Sussex (centred on NGR 487247 122544). The project was commissioned by Heatherwick Studio, acting on behalf of The Woolbeding Charity, with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the construction of a display glasshouse with associated outdoor gardens / landscaping within the site.

The site comprises a pasture field, gardens, and a tennis court, covering an area of 0.7 ha located to the south of Woolbeding Gardens, 1.6 km north-west of Midhurst, in the county of West Sussex. The geophysical survey was undertaken on 15 February 2018.

The detailed gradiometer survey has not identified any anomalies that can be confidently interpreted as archaeology. Four pit features have been identified as being of a possible archaeological origin. However, the lack of any discernible pattern or any other archaeological anomalies within the site suggests they are more likely related to natural pitting in the sandstone bedrock.

The other anomalies identified include a former field boundary present on 1897 Ordnance Survey mapping, weak linear trends, and ferrous responses. The majority of these are thought to relate to modern agriculture.

Acknowledgements

Wessex Archaeology would like to thank Heatherwick Studio, Stuart A Johnson Consulting Ltd and The Woolbeding Charity for commissioning the geophysical survey. The assistance of Stepan Martinovsky, Stuart Johnson and Mark Woodruff is gratefully acknowledged in this regard. Wessex Archaeology would also like to thank Tom Dommert of National Trust for his assistance with approval of the survey works and written scheme of investigation.

The fieldwork was undertaken by Tom Richardson and Adrian Serbanescu. Tom Richardson processed and interpreted the geophysical data, as well as writing the report and preparing illustrations. The geophysical work was quality controlled by Alexander Schmidt and Lucy Parker. The project was managed on behalf of Wessex Archaeology by Naomi Brennan.



Woolbeding House, Midhurst, West Sussex

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Heatherwick Studio and Stuart A Johnson Consulting Ltd to carry out a geophysical survey at Woolbeding House, Midhurst, West Sussex (centred on NGR 487247 122544) (**Fig. 1**). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the construction of a display glasshouse with associated outdoor gardens and landscaping within the site.

1.2 Scope of document

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

1.3 The site

1.3.1 The proposed geophysical survey area is located to the south of Woolbeding Gardens, 1.6 km north-west of Midhurst, in the county of West Sussex.

1.3.2 The survey covers a 0.7 ha area comprising a field of pasture, gardens, and a tennis court. The site is bounded by Woolbeding Gardens to the north, Brambling Lane to the west, and further pasture fields to the east and south.

1.3.3 The site is generally flat, lying at between 28 m and 30 m above Ordnance Datum (aOD).

1.3.4 The solid geology comprises Sandstone of the Hythe Formation with overlying superficial sand and gravel Sussex rother terrace deposits in the south-east (BGS 2015).

1.3.5 The soils anticipated to be present within the proposed survey area are pelo-alluvial gley soils of the 813d (Fladbury 3) association (SSEW SE Sheet 6 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 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 An archaeological desk-based assessment (DBA) was prepared by Wessex Archaeology (2018a). This examined the potential for the survival of buried archaeological remains within the development area and a 2 km study area. The following background is not exhaustive, but is summarised from aspects of the DBA that are considered relevant to the interpretation of the geophysical survey data.



2.2 Summary of the archaeological resource

- 2.2.1 The site partially coincides with the Woolbeding Conservation Area, which covers the core of the Woolbeding Estate, centred on the main house, its formal gardens and parts of the parkland, and a small cluster of associated historic buildings including Manor Farm and All Hallows Church.
- 2.2.2 There are three scheduled monuments within 2 km of the site. These include a motte and bailey castle (NHLE 1012176) and fortified medieval house (NHLE 1017500) 1.5 km south-east of the site, and Woolbeding Bridge (NHLE 1005868) located 450 m to the south. This is also a Grade II* Listed Building (NHLE 1221570).
- 2.2.3 There are three Grade I and two Grade II*, listed buildings within 2 km of the site. The nearest of these to the site are the Grade I listed parish Church of All Hallows (NHLE No. 1221572), 70 m north-east of the site, and the Grade I listed Woolbeding House (NHLE No. 1221573), 120 m to the north-east. In addition, there are numerous Grade II listed properties, several of which are associated with Woolbeding House and the gardens.
- 2.2.4 Early prehistoric activity in the surrounding area is evidenced by nine find spots of worked flint recorded 400 m east of the site. Two Palaeolithic hand axes have also been found in Midhurst, to the south-east of the site. Later prehistoric activity recorded in the surrounding area includes two possible Bronze Age round barrows, 1.3 km to the south of the site on Midhurst Common. There is also a possible Bronze Age disc barrow identified from LiDAR imagery 2 km north of the site.
- 2.2.5 A possible Romano-British settlement site is recorded 400 m east of the site on Whiphill. This was identified through the discovery of quantities of Roman pottery and worked flint artefacts. Further find spots of Roman pottery are also recorded to the immediate north-west of the site within the grounds of the Church of All Hallows and 350 m to the east of the site.
- 2.2.6 There is limited Anglo-Saxon and medieval activity recorded in the area. However, the adjacent Church of All Hallows has a nave dated to the 11th century. The churchyard also contains a late Anglo-Saxon or early medieval stone coffin, which is believed to have originated from within the church. A large assembly of medieval pottery was discovered in the churchyard during the excavation of a drain and soak-away in 1996 and there has also been medieval pottery identified 350 m east of the site at Whiphill.
- 2.2.7 Within the site, an undated earthwork has been recorded close to the northern boundary of the survey area which may be evidence of a building platform. It is possible this could relate to Anglo-Saxon settlement activity as the nearby settlements at Steadham and Iping and have similar arrangements, with the church to the north and settlement to the south.
- 2.2.8 The post-medieval history of the area predominantly relates to the Woolbeding estate. During this period, the site underwent a number of changes and this is evident on historical mapping of the area. For example, the north-eastern part of the site was incorporated in the gardens to the east of Woolbeding House, while the south of the site remained open meadows. By the end of the 19th century the gardens had extended south to incorporate the majority of the site and the southern part of the site remained meadows.



3 METHODOLOGY

3.1 Introduction

3.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on 15 February 2018. Field conditions at the time of the survey were good, dry throughout the period of survey. An overall coverage of 0.6 ha was achieved, with the area not available for survey comprising gardens and a tennis court. The full methodology was outlined in a Written Scheme of Investigations (WSI) (Wessex Archaeology 2018b), which was submitted to Tom Dommert at The National Trust for approval, prior to the start of the geophysical survey.

3.2 Aims and objectives

3.2.1 The aims of the survey comprise the following:

- to conduct a detailed survey covering as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.

3.3 Fieldwork methodology

3.3.1 Individual survey nodes were established using a Leica Viva RTK GNSS instrument GPR surveys at regular intervals tailored for each survey area. The cart-based gradiometer system used a Leica Captivate RTK GNSS instrument, which receives corrections from a network of reference stations operated by the Ordnance Survey (OS) and Leica Geosystems. Both instruments allow positions to be determined with a precision of 0.02 m in real-time is precise to approximately 0.02 m and therefore exceed Historic England recommendations (2008).

3.3.2 The detailed gradiometer survey was undertaken using four Bartington Grad-01-1000L gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart with an effective sensitivity of 0.03 n. Data were collected at a rate of 10 Hz, producing intervals of c. 0.15 m along transects spaced 3.5 m apart, therefore exceeding Historic England guidelines (2008).

3.4 Data processing

3.4.1 Data from the survey was subject to minimal data correction processes. These comprise a 'Destripe' function (± 5 nT thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together.

3.4.2 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 detailed gradiometer survey has identified magnetic anomalies across the site, along with a large amount of ferrous response. Results are presented as a series of greyscale plots and archaeological interpretations at a scale of 1:1500 (**Figures 2 to 3**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale image.
- 4.1.2 The interpretation of the datasets highlights the presence of any potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 3**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 4.1.3 Numerous ferrous anomalies are visible throughout the dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- 4.1.4 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 present than have been identified through geophysical survey.
- 4.1.5 Gradiometer survey may not detect 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.

4.2 Gradiometer survey results and interpretation

- 4.2.1 The geophysical survey has not identified any anomalies that can be confidently interpreted as being archaeological.
- 4.2.2 Across the west of the site, four small discrete positive anomalies have been identified at **4000** and **4001**. These vary in diameter between 1 m and 2 m and are indicative of pit features. While it is possible these relate to archaeological pits, the lack of other archaeological anomalies suggests they more likely represent natural pits in the sandstone bedrock.
- 4.2.3 In the north-east of the site, a magnetically strong, dipolar linear anomaly has been identified at **4002**. This extends 31 m on a north-west to south-east alignment, with a 2.5 m break at its centre. This relates to a former field boundary present on the 1897 Ordnance Survey map of the area.
- 4.2.4 Numerous weak linear trends have been identified, generally on an east-west orientation across the site. The weak nature of these anomalies make interpretation difficult, but they are most likely related to agricultural activity.
- 4.2.5 Areas of magnetically strong dipolar responses have been identified along the western boundary of the site. These are indicative of ferrous objects and are likely related to the modern use of the site as pasture for horses. In addition, highly ferrous responses are noted on the northern and eastern periphery of the dataset. These are the result of a modern fence line.



5 DISCUSSION

- 5.1.1 The detailed gradiometer survey has not identified any anomalies that can be confidently interpreted as archaeology. There is no evidence for Anglo-Saxon activity, which the DBA found some potential for. However, the area of the proposed building platform in the north-east of the site is dominated by magnetically strong responses relating to the modern fence line and a post-medieval field boundary. It is possible these are obscuring small or weak responses, such as post-holes, that would be expected from an Anglo-Saxon building.
- 5.1.2 Four pit features have been identified as being of a possible archaeological origin. However, the lack of any discernible pattern or any other archaeological anomalies within the site suggests they are more likely related to natural pitting in the sandstone bedrock.
- 5.1.3 The other anomalies detected include weak linear trends and ferrous responses. The majority of these are thought to relate to modern agricultural land use.



REFERENCES

Bibliography

English Heritage 2008 *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No 1. Swindon (2nd Edition)

Schmidt, A, Linford, P, Linford, N, David, A, Gaffney, C, Sarris, A and Fassbinder, J. 2015 *Guidelines for the use of geophysics in archaeology: questions to ask and points to consider*. EAC Guidelines 2, Belgium: European Archaeological Council.

Wessex Archaeology 2018a *Land at Woolbeding Gardens, West Sussex: Archaeological Desk-based Assessment*. Unpublished client report, ref. 203210.01

Wessex Archaeology 2018b *Woolbeding House, Midhurst, West Sussex Written Scheme of Investigation for an Archaeological Geophysical Survey*. Unpublished method statement, ref. 203211.02

Cartographic and documentary sources

Ordnance Survey 1983 Soil Survey of England and Wales Sheet 6, Soils of South East England. Southampton.

Online resources

British Geological Survey Geology of Britain Viewer (accessed February 2018)
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

Old Maps (accessed February 2018) <https://www.old-maps.co.uk>



APPENDICES

Appendix 1: Survey Equipment and Data Processing

Survey methods and equipment

The magnetic data for this project will be acquired using a non-magnetic cart fitted with 4x Bartington Grad-01-1000L magnetic gradiometers. The instrument has four sensor assemblies fixed horizontally 1 m apart allowing four 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 0.03 nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25 m. All of the data are then relayed to a Leica Viva CS35 tablet, running the MLgrad601 program, which is used to record the survey data from the array of Grad601 probes at a rate of 10 Hz. The program also receives measurements from a GPS system, which is fixed to the cart at a measured distance from the sensors, providing real time locational data for each data point.

The cart-based system relies upon accurate GPS location data which is collected using a Leica Viva system with rover and base station. This 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 Historic England (English Heritage 2008) for geophysical surveys.

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 0.125 m intervals along traverses spaced up to 0.25m apart.

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington cart 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.

The cart-based system generally requires a lesser amount of post-processing than the handheld Bartington Grad 601-2 fluxgate gradiometer instrument. This is largely because mounting the gradiometers on the cart reduces the occurrence of operator error; caused by inconsistent walking speeds and deviation in traverse position due to varying ground cover and topography.

Typical data and image processing steps may include:

- GPS Destripe – Determines the median of each transect and then subtracts that value from each datapoint in the transect. May be used to remove the striping effect seen within a survey caused by directional effects, drift, etc.
- GPS Base Interpolation – Sets the X & Y interval of the interpolated data and the track radius (area around each datapoint that is included in the interpolated result).
- Discard Overlaps - Intended to eliminate a track(s) that have been collected too close to one another. Without this, the results of the interpolation process can be distorted as it tries to accommodate very close points with potentially differing values.

Typical displays of the data used during processing and analysis:



- 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.
- 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. These plots can be made available upon request.



Appendix 2: Geophysical Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural and uncertain origin/geological.

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.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological 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.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.



Appendix 3: OASIS form

Project Details:

Project name		Woolbeding House, Midhurst, West Sussex			
Type of project		Detailed gradiometer survey (Field evaluation)			
Project description		The detailed gradiometer survey has not identified any anomalies that can be confidently interpreted as archaeology. Four pit features have been identified as being of a possible archaeological origin. However, the lack of any discernible pattern or any other archaeological anomalies within the site suggests they are more likely related to natural pitting in the sandstone bedrock. The other anomalies detected include a former field boundary present on 1897 Ordnance Survey mapping, weak linear trends, and ferrous responses. The majority of these are thought to relate to modern agriculture.			
Project dates		Start: 15-02-2018		End: 15-02-2018	
Previous work		DBA			
Future work		Not known			
Project Code:	203211	HER event no.	N/A	OASIS form ID:	wessexar1-310519
		NMR no.	N/A		
		SM no.	N/A		
Planning Application Ref.					
Site Status		Conservation Area			
Land use		Cultivated Land 1 – Minimal cultivation			
Monument type		N/A	Period	N/A	

Project Location:

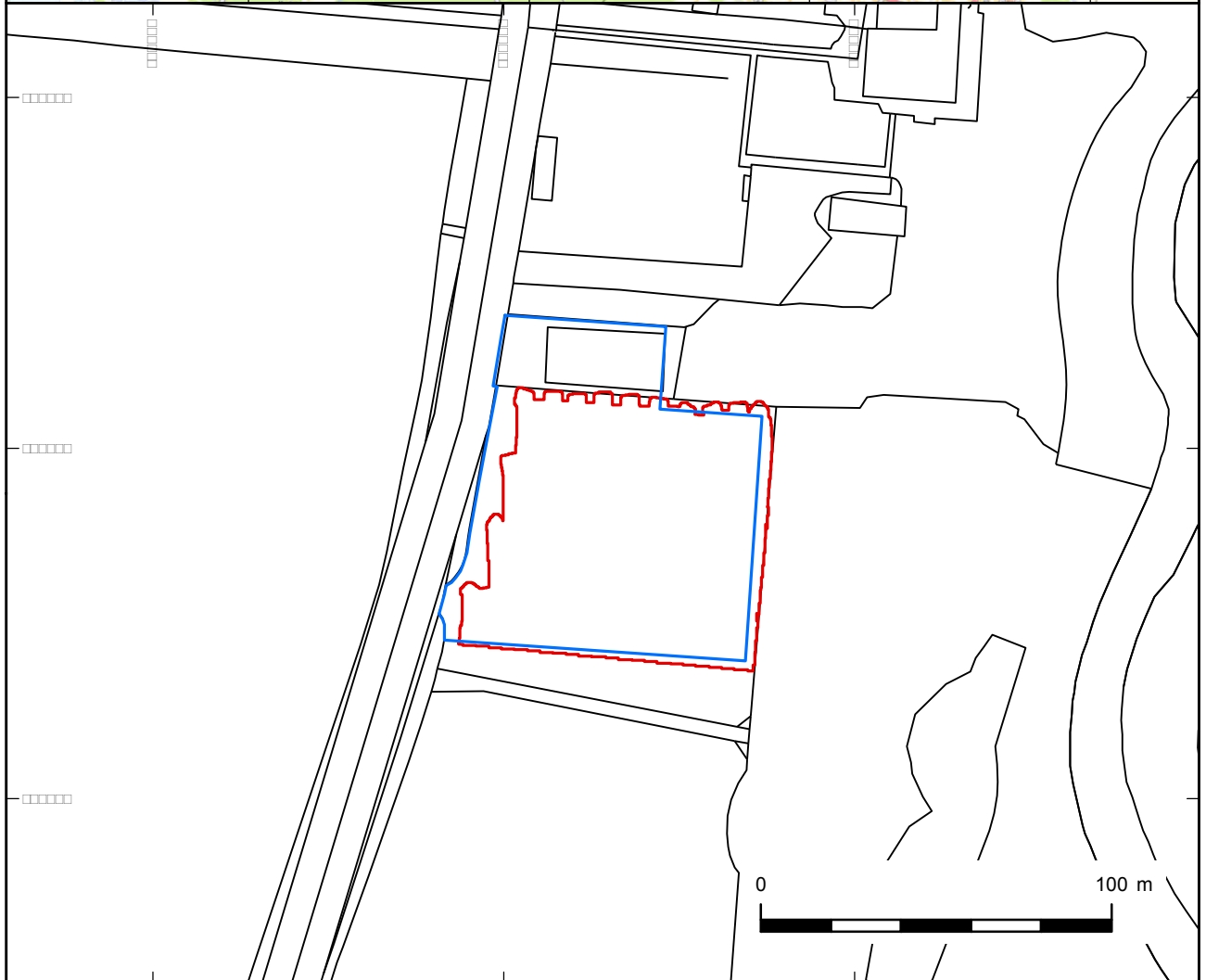
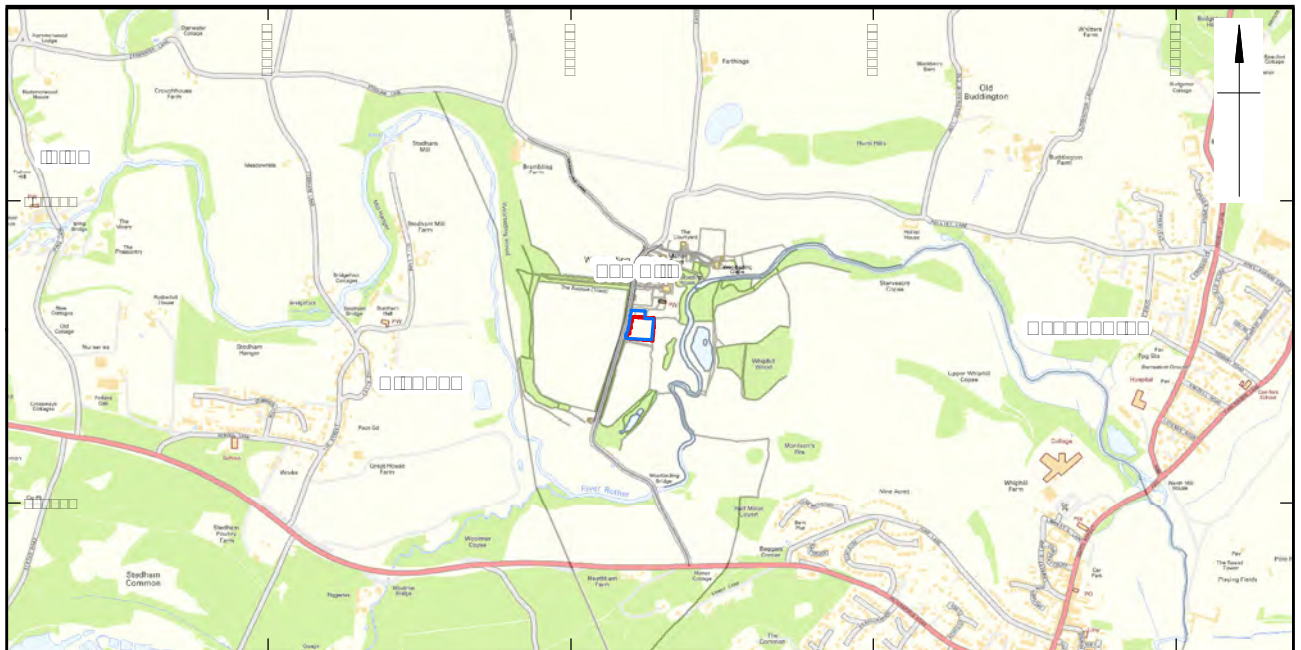
Site Address	Brambling Lane, Woolbeding, Midhurst			Postcode	GU29 9RR
County	West Sussex	District	Chichester	Parish	Woolbeding with Redford CP
Study Area	0.7 ha	Height OD	28 – 30 m aOD	NGR	SU 87247 22544

Project Creators:

Name of Organisation	Wessex Archaeology			
Project brief originator	Heatherwick Studio	Project design originator	Wessex Archaeology	
Project Manager	Naomi Brennan	Project Supervisor	Naomi Brennan	
Sponsor or funding body	The Woolbeding Charity	Type of Sponsor	Charity	

Project Archive and Bibliography:

Physical archive	N/A	Digital Archive	Geophysics, survey and report	Paper Archive	N/A
Report title	Woolbeding House, Midhurst, West Sussex			Date	2018
Author	Wessex Archaeology	Description	Unpublished report	Report ref.	203211.03



- Site Boundary
- Detailed Survey Extents



Coordinate system:
OSGB36 (OSTN15/OSGM15)

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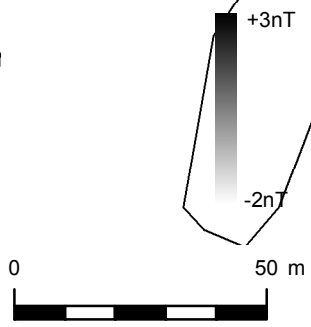
Date:	01/03/2018	Revision Number:	0
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Path:	X:\PROJECTS\203211\GIS\FigsMXD		


Site Location

Figure 1



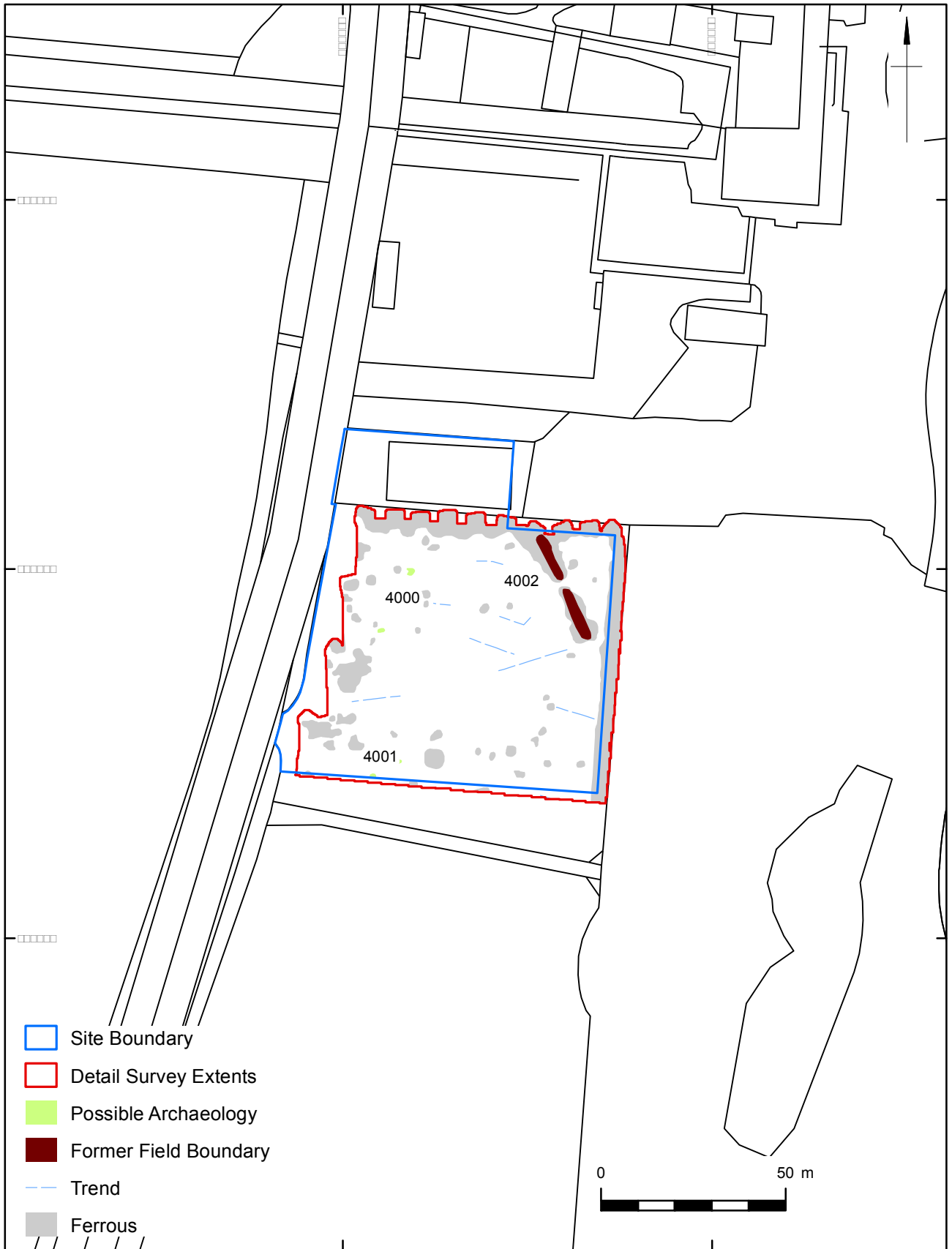
Site Boundary
 Detail Survey Extents




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Detailed Gradiometer Survey: Greyscale Plot

Figure 2



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Detailed Gradiometer Survey: Interpretation

Figure 3



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