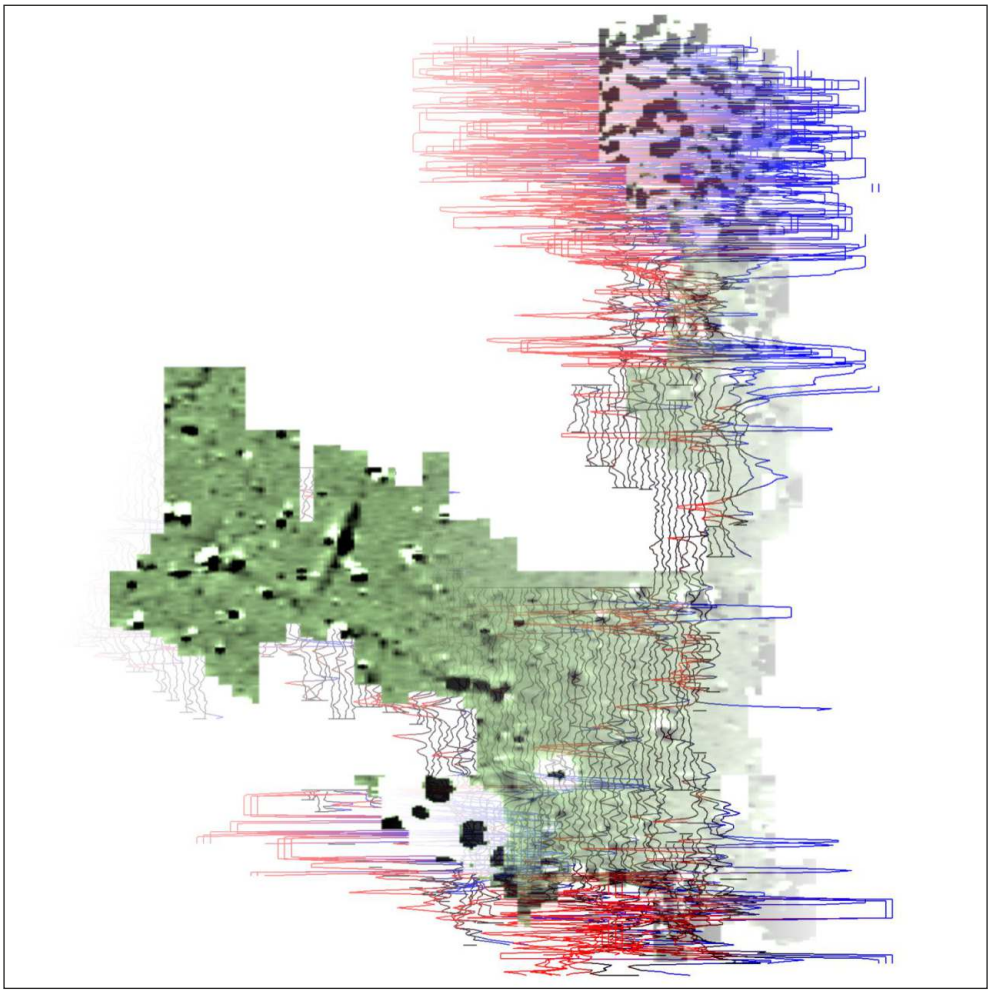
making sense of heritage

Crowdhill Green, Fair Oak Eastleigh, Hampshire

Detailed Gradiometer Survey Report



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geoservices

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Crowdhill Green, Fair Oak, Eastleigh, Hampshire

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land off Winchester Road (B3354), directly north of Fair Oak, Hampshire. The project was commissioned by Bloor Homes Southern 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 three fields bound to the east by B3354 and to the north and west of Crowdhill Copse, totalling approximately 17ha. Parts of the smaller field to the west of the Site and the south east corner of the easternmost field were found to be overgrown and were not surveyed. These surface obstructions reduced the size of the survey to a total of 12.9ha. The site is fairly flat in the east and central fields and slopes gently down towards the westernmost extents.

The survey has demonstrated the presence of a few anomalies of probable and possible archaeological interest within the survey area, along with regions of increased magnetic response and a modern service. The majority of detected anomalies appear to relate to agricultural activity with ploughing scars and possible ridge and furrow detected. A series of linear trends have been identified as a former field boundary in the westernmost section of the site, which has also been recorded on the HER. One feature of probable archaeological interest was detected which could represent a pit.

A modern service interpreted as a pipe was detected within the Site, which extends beyond the limits of the geophysical survey area. Extensive magnetic disturbance associated with the service and numerous small-scale ferrous responses were seen throughout the dataset.

It should be noted that the areas of the Site that were thought to be of high archaeological importance within the Heritage Statement (WA 2013) are the areas that were predominantly unsuitable for survey and therefore cannot be commented on within this report.

The geophysical survey has demonstrated an apparent low archaeological potential across the Site, although it is understood that a subsequent stage of archaeological evaluation will also be undertaken to test these initial results and to inform future archaeological mitigation, if deemed necessary.

The geophysical survey was undertaken between 20th and 23rd October 2014.

Crowdhill Green, Fair Oak, Eastleigh, Hampshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned Bloor Homes Southern. The assistance of Elaine Vashi of Bloor Homes, Philip Allin of Boyer Planning and Malcolm Mintram of the Highwood Group is gratefully acknowledged in this regard.

The fieldwork was directed by Laura Andrews with assistance from Rachel Chester, Patrick Dresch and Alistair Salisbury. Laura Andrews processed and interpreted the geophysical data in addition to writing this report. The geophysical work was quality controlled by Ross Lefort. Illustrations were prepared by Ken Lymer. The project was managed on behalf of Wessex Archaeology by Andrew Manning.

Crowdhill Green, Fair Oak, Eastleigh, Hampshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Bloor Homes Southern to carry out a geophysical survey of land directly west of Winchester Road (B3354), directly north of Fair Oak, (**Figure 1**), hereafter "the Site" (centred on NGR 448822 119547). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed 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 A Heritage Statement (HS) was carried out by WA prior to the geophysical survey that revealed a number of heritage assets within, and close to, the survey area including a number of features visible in aerial photography thought to possibly be the remains of Bronze Age activity and/or enclosed Iron Age or Romano-British settlement (WA 2013). There were also cropmarks visible that were thought to indicate the remains of a field system of medieval or later origin. The Site also formed part of a medieval deer park. The results of this assessment will be referred to, where relevant, in the interpretation of the geophysical data.

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

1.2 Site Location and Topography

1.2.1 The survey area comprises three fields directly west of Winchester Road (B3354), divided by a public footpath, measuring approximately 16.9 hectares in total. It lies within the parish of Fair Oak, approximately 3km to the east of Eastleigh and 2km from the River Itchen (**Figure 1**). The land to the west of the survey area is natural grassland and was largely overgrown at the time of survey which reduced the area covered by geophysical survey. The central field is used for arable and the field to the east is under pasture and is divided into horse paddocks with an overgrown area in the southeast which further reduced the surveyable area. Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 12.9ha of the original 17ha area.

1.2.2 The Site occupies the west facing slope of a stream valley close to a large area of woodland. The Site slopes gently from a fairly flat eastern plateau, at a height of over 55m above Ordnance Datum (aOD), down to 40m aOD at the western extents. An unnamed stream flows and curves past the north and west of the Site before flowing further southwest to meet its confluence with the River Itchen.

1.3 Soils and Geology

1.3.1 The Site spans three bedrock geology formations with London clay formation in the north, Whitecliff sand member and Wittering formation sand, silt and clay in the south. All three geological formations date to the Palaeogene period. No superficial deposits are recorded under the Site although it is possible that thin alluvial deposits may exist at the western extents close to the stream (BGS).

1.3.2 The soils underlying the Site are likely to be typical argillic brown earths of the 571g (Fyfield 4) 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 by Wessex Archaeology's in-house geophysics team between 20th and 23rd October 2014. Field conditions within the main survey area at the time of the survey were mostly good, though some areas were overgrown with nettles and scrub. The larger part of the field to the west of the survey area was completely overgrown and was deemed unsurveyable.

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 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 one anomaly of probable archaeological interest and few small anomalies of possible archaeological interest in addition to agricultural features and a modern service. Results are presented as a series of greyscale plots, XY trace plots and an archaeological interpretation, at a scale of 1:1500 (**Figures 2** to **7**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the dataset highlights the presence of probable archaeology, possible archaeology, potential trends, a modern service, ferrous/burnt objects, and magnetic trends (**Figures 4** and **7**). 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 There are very few anomalies of archaeological interest within the survey area. Within the west most section of the Site a possible former field boundary is visible as a series of distinct and trend-like responses around **4000** and it could tentatively be suggested that they relate to the cropmarks and features identified within the HS as a potential Iron Age/Romano-British settlement.

3.2.2 To the north of this field is a distinct area of strong ferrous responses (**4001**), thought to be modern in provenance, and could be due to landscaping of the area.

3.2.3 In the central field, a large sub-circular positive anomaly is visible at **4002** which is thought to be a cut archaeological feature such as a pit. It has been classed as probable archaeology due to its large size. A similar but smaller feature is visible approximately 30m to the south west at **4003**. This has a similar strong positive response and looks like it could represent a pit but is obscured by a large ferrous anomaly. This has been classed as possible archaeology to reflect the uncertainty in the interpretation of the feature.

3.2.4 There are several isolated small sub-circular positive anomalies scattered across the entire dataset with **4004** marking one of the largest of these. These anomalies have positive values around +2.5nT and measure less than 3m across. It is possible that these anomalies could represent cut archaeological features such as small pits and postholes but it is equally possible that they are natural features such as tree throws. They have been classed as possible archaeology to reflect this uncertainty in the interpretation.

3.2.5 There are three weak linear trends visible at **4005**, which are parallel but are in isolation to the rest of the field. It is possible that these could represent a former field boundary.

3.2.6 A modern service is visible in the data at **4006**; this will be discussed in more detail in the next section of the report.

3.2.7 In the easternmost field there are several linear parallel trends such as at **4007** that have a broad and diffuse form of alternating positive and negative anomalies. These anomalies look to be agricultural and may represent evidence of ridge and furrow.

3.2.8 Several weak linear trends are visible around the entire site such as the one visible at **4008**. These trends could represent archaeological features but are considered as uncertain origin as they form no clear pattern in their layout and could conceivably be caused by agricultural activity.

3.2.9 There are high concentrations of ferrous anomalies scattered across the dataset such as the large area visible at **4009**. It is not thought that their distribution is dense enough to have significantly reduced the ability to detect archaeological features and they are likely to be related to relatively modern activity.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 A single modern service is visible within the survey area at **4006** and is a known water pipe. It appears in the dataset at the northeast corner of the central field and extends diagonally across the site to the southwest corner and runs beyond the limit of the geophysical data. There is a tap in north east section of the field which has not been covered by geophysical data which may suggest that this is related to an agricultural installation.

3.3.2 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 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting a small anomaly of probable archaeological interest and few small anomalies of possible archaeological interest in addition to a modern service.

4.1.2 One feature of probable archaeological interest has been identified as a pit-like anomaly at **4002** with a similar anomaly to the southwest at **4003**. These have been singled out due to their large size and strength of responses. Several smaller anomalies of possible archaeological interest such as the example at **4004** have also been identified but are uncertain in their origin. It should be noted that it is possible that all these were created by natural formation processes.

4.1.3 As has been mentioned above there are a lot of ferrous responses visible in the data but it is not felt that their presence has reduced the ability to detect large scale archaeological features.

4.1.4 A linear feature identified as possible archaeology at **4000** could tentatively relate to cropmarks recorded in the HS as indicative of an Iron Age/Romano-British settlement. Further archaeological trenching would be needed in support of this interpretation.

4.1.5 Although the Heritage Statement found a high archaeological potential for Bronze Age and Iron Age/Romano-British activity within the western extents of the Site, the most part of this area was unsuitable for survey and therefore cannot be commented on in this report.

4.1.6 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.

4.1.7 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.

5 REFERENCES

British Geological Survey http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html

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

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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:

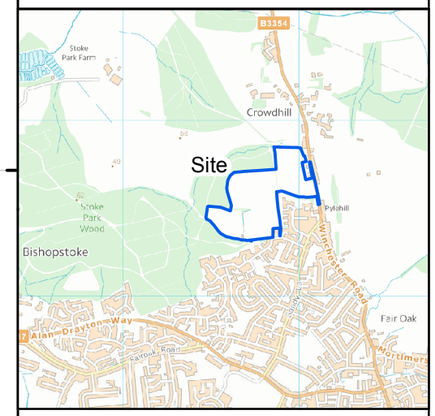
- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern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

448600
448800
449000
119800
119600
119400
0
200 m



Site Boundary

Geophyiscal Survey Extents

Date:	10/11/14
Revision Number:	0
Scale:	1:2500 at A3
Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS
	\FigsMXD\Terrestrial_Geophysics\Fig01.mxd

Site location and survey extents

Figure 1

448600
448700
448800
448900
119700
119600
119500
119400
119300
+3nT
-2nT
0
100 m

Site Boundary

Geophyiscal Survey Extents

Date:	13/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig02.mxd		

Greyscale southwest

Figure 2

448600
448700
448800
448900
119700
119600
119500
119400
119300
25nT
-25nT
0
100 m

Site Boundary

Geophyiscal Survey Extents

Date:	13/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig03.mxd		

XY plot southwest

Figure 3

448600
448700
448800
448900
119700
119600
119500
119400
119300
4000
4001
4002
4003
4004
4005
4006
0
100 m
Probable Archaeology
Possible Archaeology
Ploughing
Trend
Modern Service
Superficial Geology
Ferrous
Increased Magnetic Response
Site Boundary
Geophyiscal Survey Extents

Date:	10/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig04.mxd		

Interpretation southwest

Figure 4

448800
448900
449000
449100
119800
119700
119600
119500
119400
+3nT
-2nT
0
100 m

Site Boundary

Geophyiscal Survey Extents

Date:	10/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig05.mxd		

Greyscale northeast

Figure 5

448800
448900
449000
449100
119800
119700
119600
119500
119400
25nT
-25nT
0
100 m

Site Boundary

Geophyiscal Survey Extents

Date:	13/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig06.mxd		

XY plot northeast

Figure 6

448800
448900
449000
449100
119800
119700
119600
119500
119400
4007
4008
4009
4006
4004
4005
Probable Archaeology
Possible Archaeology
Ploughing
Trend
Modern Service
Superficial Geology
Ferrous
Increased Magnetic Response
0
150
Metres
Site Boundary
Geophyiscal Survey Extents

Date:	13/11/14	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\87712\GIS\FigsMXD\Terrestrial_Geophysics\Fig07.mxd		

Interpretation northeast

Figure 7