Geophysical Survey Report
Horton Priory
Monks Horton, Kent

NGR 610610 139295
(TR 10610 39295)

ASE Project No: 6898

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Non-technical summary

A multiple technique geophysical survey was undertaken at Horton Priory, Kent. The survey indicated potential archaeological features that may relate to the former priory and its ancillary buildings.

The strongest evidence for structural remains consisted of rectilinear anomalies in the west of the survey area. These anomalies suggest two possible buildings, offset and linked by a wall. The largest of these is approximately 10m across and suggests structures of a significant size.

A further series of rectilinear anomalies to the south of existing buildings may represent additional ranges of buildings as seen in other monastic complexes, possibly relating to dormitory and reredorter (latrine) blocks. However, the anomalies in this area are more fragmented, therefore suggesting ground disturbance, perhaps due to "robbing out" activity.

Two linear anomalies were noted within the area currently used for parking, and appear as right-angled features in the approximate location of the western end of the former north aisle of the nave. These anomalies are tentatively associated with possible structural material. A significant level of disturbance was also noted within this area.

In general, a significant level of disturbance was noted within the survey, especially to the east and south of the existing buildings. Where this disturbance is encountered in the near surface there is potential for deeper targets to be obscured. This was particularly noted in areas immediately adjacent to the existing buildings.

CONTENTS

1.0 INTRODUCTION

1.1 Site Background

1.1.1 Archaeology South-East (ASE) a division of the Centre for Applied Archaeology (CAA), Institute of Archaeology (IoA), University College London (UCL) was commissioned Philip Masters on behalf of the owners to undertake a geophysical survey at Horton Priory, Kent, henceforth referred to as 'the site' (NGR TQ 10610 39295; Figure 1). The surveyed area consisted of approximately 1.6ha of gardens and a parking area (Figure 2).

1.2 Geology and Topography

1.2.1 According to the British Geological Survey (BGS 2014) the geology at the site consists of Folkestone formation - sandstone overlain by head – clay and silt superficial deposits.

1.2.2 The site consisted of lawns and a parking area surrounding Horton Priory. A topographic survey of the site was undertaken by Archaeology South-East and is included as Appendix 2.

1.3 Aims of Geophysical Investigation

1.3.1 The aim of the project was to carry a detailed geophysical survey of the site and to produce an interpretative report on the potential of the site for archaeological remains.

1.4 Scope of Report

1.4.1 This report details the findings of the survey with a view to contributing to the overall and ongoing assessment of the archaeological potential of the site. The survey was conducted by John Cook with the assistance of Chris Russel, Catherine Douglas and Jim Ball. The geophysical survey was project managed by Neil Griffin (fieldwork) and by Jim Stevenson (post-excavation).

2.0 SURVEY METHODOLOGY

2.1 Magnetometry survey

2.1.1 A fluxgate gradiometer (magnetometry) survey was undertaken in the areas depicted in Figure 2 (NGR 515040 126090).

2.1.2 The field work was undertaken between Friday 5th and Tuesday 9th September 2014 when the weather was warm and dry.

2.2 Applied geophysical instrumentation

2.2.1 The Fluxgate Gradiometer employed was the Bartington Instrumentation Grad 601-2. The Grad 601-2 has an internal memory and a data logger that store the survey data. This data is downloaded into a PC and is then processed in a suitable software package.

2.2.2 30m x 30m grids were set out using a GPS (see below). Each grid was surveyed with 1m traverses; samples were taken every 0.25m.

2.2.3 Data was collected along north-south traverses in a zigzag pattern beginning in the south-west corner of each grid.

2.3 Instrumentation used for setting out the survey grid

2.3.1 The survey grid for the site was geo-referenced using a Leica Viva Smartrover. The GPS receiver collects satellite data to determine its position and uses the mobile phone networks to receive corrections, transmitting them to the RTK Rover via Bluetooth to provide a sub centimetre Ordnance Survey position and height. Each surveyed grid point has an Ordnance Survey position; therefore the geophysical survey can be directly referenced to the Ordnance Survey National Grid.

2.4 Data processing

2.4.1 All of the geophysical data processing was carried out using TerraSurveyor published by DW Consulting. Minimally processed data was produced using the following schedule of processing. Due to the very high positive readings of some of the magnetic disturbance the values were replaced with a dummy value so as to avoid detrimentally affecting the dataset when further processed. The first process carried out upon the data was to apply a DESPIKE to the data set which removes the random ‘iron spikes’ that occur within fluxgate gradiometer survey data. A ZERO MEAN TRAVERSE was then applied to survey data. This removes stripe effects within grids and ensures that the survey grid edges match. Figure 4 displays the processed survey data.

2.5 Data presentation

2.5.1 Data is presented using images exported from TerraSurveyor into Autocad software and inserted into the geo-referenced site grid. Data is presented (Figures 3 and 4) as raw data and processed data greyscale plots.

2.6 Earth resistance survey

2.6.1 The field work was undertaken between Friday 5th and Tuesday 9th September 2014 when the weather was warm and dry.

2.6.2 Using a 30m x 30m grid, a RM15 resistance meter attached to a PA1 twin probe frame with 0.5m probe separation was used to record sample readings at every 1.0m along 1.0m traverses.

2.7 Geophysical Survey Methods Used

2.7.1 The area covered by the resistivity survey is shown Figure 2.

2.7.2 The survey grid consisted of a 30 x 30 metre grid. The grid was surveyed with 1.0m traverses and samples were taken every 1.0m. The survey was undertaken over the course of one day in dry and sunny conditions, following a prolonged period of dry weather.

2.8 Applied Geophysical Instrumentation

2.8.1 The resistance survey was carried out using a twin probe array fitted with a Geoscan RM15 data logger. The twin probe array is popular within archaeology and combines convenience with ease of use. The two probes of the array had 0.5m spacing and were connected to two remote probes placed at least thirty times this distance from the array (15m). This is done to lessen the effect on the results of probe separation and to improve depth penetration (Clark 1996: 44). The penetration of the survey is dependent on the probe spacing, usually reaching a depth relative to half the probe space, in this case 0.25m.

2.8.2 The resistance survey uses an electric current to measure the relative water content of buried features. Features such as pits and ditches contain looser material than the surrounding geology and have an enhanced water-bearing capacity, allowing the current to pass through them more freely. These are measured as low resistance anomalies on the results. Stone and brick wall foundations prove a barrier to the electrical current and are shown as higher resistance anomalies (Gaffney & Gater 2003: 26). Resistance survey relies on detecting differences in water content between archaeological features and the surrounding geology and are ineffective in waterlogged or highly arid conditions. The SI unit of measurement for resistance is ohms.

2.9 Instrumentation Used for Setting out the Survey Grid

2.9.1 It is vitally important for the survey grid to be accurately set out. The English Heritage guidelines (David 1995) state that no one corner of any given survey grid square should have more than a few centimetres of error. The survey grid for the site was set out using a Leica TCRA 1205 total station. The grid points were then geo-referenced using a Leica System 1200 Differential Global Positioning System (DGPS). The GPS base station collects satellite position to determine its position. This data is processed in survey specific software to provide a sub centimetre Ordnance Survey position and height for the base station. The survey grid is then tied in to this known accurate position by using a roving satellite receiver that has its position corrected by the static base station. Each surveyed grid point has an Ordnance Survey position; therefore the geophysical survey can be directly referenced to the Ordnance Survey National Grid.

2.10 Data Processing

2.10.1 The resistance data was processed using Geoplot V3. The first step was to perform a DESPIKE to remove any spurious readings. The next step was to pass the results through a HIGH PASS FILTER which removed any low frequency spatial data and then a LOW PASS FILTER was applied, removing high frequency spatial data and enhancing larger weak features. The data was then INTERPOLATED in both the X and Y axes, improving the data presentation.

2.11 Survey Limitations

2.11.1 Several tree stumps, felled trees and a flower bed formed barriers to the geophysical survey. However, these were omitted from the survey and obscured only a small part of the survey area.

2.12 GPR survey methodology

2.1.2 The field work was undertaken between Tuesday 27th and Friday 31st October 2014 when the weather was sunshine and showers.

2.12.1 A Malå Ramac GPR system utilizing an antenna with a central frequency of 500MHz was used to record along traverses with a 2m separation.

2.13 Geophysical Survey Methods Used

2.13.1 The area covered by the survey is shown Figure 2.

2.13.2 The survey was carried out over four areas surveyed with 1.0m traverses. The survey was undertaken over the course of four days with sunshine and showers.

2.14 Applied Geophysical Instrumentation

2.14.1 The GPR survey was carried out using a Malå Ramac 500MHz cart system. In GPR the relative magnetic permeability of the ground is assumed to be uniform (Milsom and Eriksen 2011). Therefore, variations in the radar signals are considered to be due to changes in the conductivity and the relative electric permittivity. The depth of penetration of a GPR system relies largely on the central frequency of the emitting antenna (Gaffney & Gater 2003). With lower frequencies (longer wavelengths) there is an increased depth of penetration with a corresponding decrease with higher frequencies (shorter wavelengths). However, longer wavelengths will reduce the resolution of the survey meaning only larger objects will be detectable at depth (English Heritage 2008). The resolution of a 500MHz antenna in damp soil would be between 0.05m and 0.135m (Basson 1992) with a velocity of radar energy calculated at 0.12m/nsec and a range setting of 64nsec a theoretical depth of scan is 3.84m.However, the indicative depth of investigation for a 500MHz radar would be approximately 2m.

2.15 Instrumentation Used for Setting out the Survey Grid

2.15.1 English Heritage guidelines (English Heritage 2008) state that no one corner of any given survey grid square should have more than a few centimetres of error. The survey grid for the site was set out using a Leica Viva Network rtk Global Positioning System (GPS). This data is processed in survey specific software to provide a sub centimetre Ordnance Survey position. Each surveyed grid point has an Ordnance Survey position; therefore the geophysical survey can be directly referenced to the Ordnance Survey National Grid.

2.16 Data Processing

2.16.1 The radar data collected on site was processed and abstracted using Reflexw software. Processing was undertaken on the data. This involves a series of filters to reduce background noise and surface response. The processing consisted of:

Subtract-mean (dewow)
Manual y-gain
Move start time
Band pass filter

2.17 Survey Limitations

2.17.1 The interface between the radar antenna and the ground surface can give a strong reflection. Therefore near surface features may be obscured in GPR. Strong reflections which potentially obscured below ground features were encountered in several areas of paving (figure 15, SR1) as well as the area known to be a former tennis court (figure 15, SR2). In addition, the resolution of a GPR survey decreases with depth due to the conical spread of energy.

3.0 Magnetometry survey results (figures 3-5)

3.1 Introduction to results

3.1.1 The results should be read in conjunction with the figures at the end of this report. The types of features likely to be identified are discussed below.

3.1.2 Positive Magnetic Anomalies
Positive anomalies generally represent cut features that have been in-filled with magnetically enhanced material.

3.1.3 Negative Magnetic anomalies
Negative anomalies generally represent buried features such as banks or compacted ground that have a lower magnetic signature in comparison to the background geology.

3.1.4 Magnetic Disturbance
Magnetic disturbance is generally associated with interference caused by modern ferrous features such as fences and service pipes or cables.

3.1.5 Magnetic Debris
Low amplitude magnetic debris consists of a number of dipolar responses spread over an area and is indicative of ground disturbance.

3.1.6 Dipolar Anomalies
Dipolar anomalies are positive anomalies with an associated negative response. These anomalies are usually associated with discreet ferrous objects or may represent buried kilns or ovens.

3.1.7 Bipolar Anomalies
Bipolar anomalies consist of alternating responses of positive and negative magnetic signatures. Interpretation will depend on the strength of these responses; modern pipelines and cables typically produce strong bipolar responses.

3.1.8 Thermoremanence
Thermoremanence is most commonly encountered through the magnetizing of clay through the firing process although stones and soils can also acquire thermoremanence.

3.2 Interpretation of fluxgate gradiometer results (figure 5)

3.2.1 The survey area assigned for geophysical survey was situated on a gentle south facing slope bounded by hedgerows, over an area of lawn and rough grass.

3.2.2 Evidence for possible archaeological features in the form of discrete and linear moderate positive anomalies representing possible cut features are noted throughout the survey with a concentration of anomalies in the north-west corner of the area of survey (M1).

3.2.4 Bipolar anomalies with associated magnetic disturbance are observed (M2). These anomalies correspond to below ground services such as a pipes and cables.

3.2.5 Areas of magnetic debris may indicate ground disturbance or made ground the most obvious example of this being in the area of the former tennis court (M3).

3.2.7 A scattering of dipolar anomalies (M4) across the area may represent archaeological features such as kilns or ovens, but more likely they indicate discrete ferrous objects, such as inspection covers.

3.3 Discussion

3.3.1 The most significant features noted in the survey were possible ditches and linear areas interpreted as possible archaeological in origin in the north-west of the survey area (M1). Evidence for archaeological features was also noted as a number of possible discrete cut features

3.4 Earth resistance survey results (figures 6-8)

3.4.1 The results should be read in conjunction with the figures at the end of this report. The types of features likely to be identified are discussed below.

3.4.2 Positive Resistance Anomalies

These are areas where the current from the array has passed less easily due to relative scarcity of water content. They may relate to stone or brick foundations or rubble in an archaeological context.

3.4.3 Moderate Resistance Anomalies

These are areas where the resistance is not significantly different from surrounding areas but a trend is noted.

3.4.4 Negative Resistance Anomalies

These are areas where the current from the array has passed more easily due to relatively high water content. Low resistance anomalies may equate to pits or ditches in an archaeological context.

3.5 Interpretation of Resistance Survey Results (figure 8)

3.5.1 High and moderate resistance anomalies were observed across the area surveyed. The most significant anomalies are observed to the immediate south of the existing priory buildings (R1) and may relate to below ground structural remains such as walls or wall footings. The earth resistance survey was extended to the west of the priory to investigate the possible archaeological features noted in the magnetometry survey. In this area further high and moderate resistance anomalies (R2) were noted that may represent walls or wall footings along with a high resistance trend in a north west to south east orientation that may represent a surface (R3). It is difficult to elucidate much from the data in the east of the survey due to a large area of higher resistance data in the south east corner (R4) and lower resistance in the north east (R5). These maybe relate to a geological change or landscaping within these areas.

3.6 GPR survey Results (figures 9-14)

3.6.1 The results should be read in conjunction with the figures at the end of this report. The reflections recorded during the GPR survey are discussed below.

3.7 Interpretation of GPR Survey Results (figure 14)

3.7.1 A series of hyperbola anomalies are observed in a number of locations (G1). These anomalies are likely to relate to the reflections observed from a shallow pipe or cable.

3.7.2 A high concentration of strong complex anomalies are observed in the east of the survey area (G2). These anomalies indicate probable ground disturbance due to services as well as relating to the existing paths. However, these anomalies may also relate to the ground disturbance generated with the demolition of Horton Priory and later landscaping.

3.7.3 Strong complex anomalies to the south of the existing building (G3) may also relate to structural remains or significant ground disturbance as well as paving in the immediate vicinity of the building.

3.7.4 The strong complex anomalies to the west of the priory (G4) form the most convincing evidence for structural remains. In addition, the GPR survey covered a small part of the former tennis court (G5).

3.7.5 Also in the west of the survey area, a broad weak linear trend is noted in a north west to south east orientation (G6). This may represent evidence of a former channel. However, the anomalies are too weak for confident interpretation to be made.

3.7.6 Weak complex anomalies were observed across the area surveyed. It is difficult to elucidate much from the data. These anomalies may relate to structural remains although due to their strength are more likely to relate to areas of ground disturbance.

3.7.7 The GPR survey at Horton Priory has successfully revealed anomalies of possible archaeological origin. Strong complex anomalies in the west of the survey area are likely to relate to structural footings, or robbed-out features.

3.7.8 The survey also indicated a significant level of disturbance, represented by strong complex amorphous anomalies, that may be due to the robbing-out of structural features or levelling of the area for the gardens.

4.0 Conclusions (figure 15)

4.1 The magnetometry, earth resistance and GPR surveys have indicated potential archaeological features that may relate to the former priory and its ancillary buildings (figure 15). Three areas of particular interest are evident from the results:

- A series of rectilinear anomalies directly south of the existing buildings (C1) may represent additional ranges of buildings, with a suggestion of an east-west trending structure immediately to the south of the existing west wing of the house (C2), with further possible structures extending to the south from its eastern end almost as far as the ha-ha. Beyond the modern hedge (C3), a further set of anomalies in the grassy area to the east suggests a structural element extending parallel to the hedge, with a substantial stub at its southern end heading for a short distance to the east, perhaps indicative of further structures originally extending in this direction. Interpretation is difficult at this stage, without confirmatory fieldwork, but structural elements in this location might represent dormitories and reredorters (latrines) at the south-eastern corner of the cloister, with a possible infirmary complex to the east (possibly with its own cloister) – the north-south aligned ditch, corresponding to banks and ditches (28) in the gazetteer of sites, visible in the field immediately south of the ha-ha (T1) is intriguing and is ideally placed to form a drainage channel from a reredorter block.
- The rectilinear anomalies in the lawn to the west of the house and north of the tennis court (C4) may represent a sequence of agricultural buildings within the outer court of the priory, or may be of a later date and representing a phase of activity following dissolution but not represented on historic mapping. The results suggest two buildings, offset and linked by a wall(s), but of a significant size in relation to the existing house. Other interpretations could be a bell-tower, although the distance from the church indicates that this is improbable, or some form of gatehouse.
- The GPR results within the car park (C5) appear to show two linear anomalies meeting at right-angles, and associated with discrete patches of possible structural material – it is tempting to interpret these anomalies as the northern corner of the nave and aisles, mirroring the surviving fabric to the south. However, the anomalies within this area indicate a significant level of disturbance. Therefore any trends noted are faint.

4.2 The geophysical surveys have indicated a significant amount of ground disturbance. This may reflect both more modern disturbance related to services, and the modification of the site in 1913, as well as the demolition of the former priory at the dissolution.

4.3 A weak trend to the west of the priory (C6) may indicate a feature related to the water management of the site. However, the evidence is too faint to provide a definitive explanation.

4.4 Statement of Indemnity

4.4.1 Geophysical survey is the collection of data that relate to subtle variations in the form and nature of soil and which relies on there being a measurable difference between buried archaeological features and the natural geology. Geophysical techniques do not specifically target archaeological features and anomalies noted in the interpretation do not necessarily relate to buried archaeological features. As a result, geophysical detail survey may not always detect sub-surface archaeological features. This is particularly true when considering earlier periods of human activity, for example those periods that are not characterised by sedentary social activity.

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Acknowledgements

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Appendix 1 OASIS Form

OASIS ID: archaeol6-195270

Project details

Project name	Geophysical Survey
Short description of the project	Archaeology South East was commissioned undertake a multiple technique geophysical survey, consisting of magnetometry, earth resistance and ground probing radar (GPR) survey at Horton Priory, Monks Horton, Kent. The survey area consisted of approximately 1.6ha of gardens. The survey aimed to identify anomalies potentially relating to the surviving medieval ruins of Horton Priory. The magnetometry, earth resistance and GPR surveys have indicated potential archaeological features that may relate to the former priory and its ancillary buildings. The geophysical surveys have indicated a significant amount of ground disturbance. This may reflect both more modern disturbance related to services, and the modification of the site in 1911, as well as the demolition of the former priory. A weak trend to the west of the priory may indicate a feature related to the water management of the site. However, the evidence is too faint to provide a definitive explanation.
Project dates	Start: 05-09-2014 End: 31-10-2014
Previous/future work	Yes / Not known
Any associated project reference codes	6898 - Contracting Unit No.
Type of project	Field evaluation
Site status	Scheduled Monument (SM)
Current Land use	Residential 1 - General Residential
Monument type	MONASTERY Medieval
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	Scheduled Monument Consent
Position in the planning process	Pre-application
Solid geology (other)	Folkestone formation - sandstone

Drift geology (other)	Head - clay and silt
Techniques	Magnetometry
Techniques	Resistivity - area
Techniques	Ground penetrating radar

Project location

Country	England
Site location	KENT SHEPWAY MONKS HORTON Horton Priory
Postcode	TN25 6DZ
Study area	1.60 Hectares
Site coordinates	TR 10610 39295 51.1135576747 1.00938204013 51 06 48 N 001 00 33 E Point

Project creators

Name of Organisation	Archaeology South-East
Project brief originator	Archaeology South-East
Project design originator	Archaeology South-East
Project director/manager	Ron Humphrey
Project supervisor	John Cook

Project archives

Physical Archive Exists?	No
Digital Archive recipient	n/a
Digital Contents	"Survey"
Digital Media available	"Geophysics","Images raster / digital photography","Survey"
Paper Archive recipient	n/a
Paper Contents	"Survey"
Paper Media	"Report","Survey ","Unpublished Text"

available

Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Geophysical Survey
Author(s)/Editor(s)	Cook, J.
Date	2014
Issuer or publisher	ASE
Place of issue or publication	Portslade
Entered by	John Cook (john.cook@ucl.ac.uk)
Entered on	14 November 2014

Appendix 2 Topographic Survey