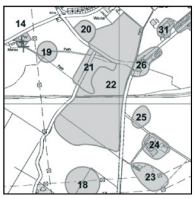
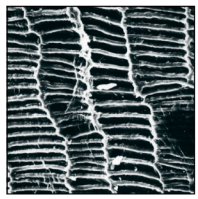
LRWM18










LAVENDERS ROAD, WEST MALLING, KENT

GEOPHYSICAL SURVEY

PLANNING REF. TM/18/02093

commissioned by Archaeology Collective

December 2018

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LAVENDERS ROAD, WEST MALLING, KENT

GEOPHYSICAL SURVEY

PLANNING REF. TM/18/02093

commissioned by Archaeology Collective

December 2018

This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **LRWM18** / NGR **TQ 6842 5755** / Parish **West Malling** / Local Authority **Kent** / OASIS Ref. **headland5-337482**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison** / Fieldwork **Bethany Shenton, Krasimir Dyulgerski, Olivier Vansassenbrouck, Richard McGregor Edwards** / Graphics **Caroline Norrman, David Harrison, Rafael Maya Torcelly**

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HEADLAND ARCHAEOLOGY

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 4 hectare site at West Malling, Kent, where a new residential development is proposed. The Proposed Development Area (PDA) is located immediately adjacent to St Marys Abbey, a medieval nunnery, which is protected as a Scheduled Monument. The PDA contains the crash site of a Battle of Britain Supermarine Spitfire, a Site of Protected Military Remains. No anomalies of definite archaeological potential have been identified by the survey and no anomalies have been identified to locate the Spitfire crash site. Fragmented parallel linear trends in the south-west of the site may locate soil-filled ditches flanking a trackway. A circular anomaly nearby may be due to ring-ditch. These anomalies are ascribed moderate to high archaeological potential. Broad clusters of high magnitude discrete anomalies may be caused by infilled pits. However, in the absence of any clear pattern, a geological origin cannot be dismissed. They anomalies may be due to soil-filled solution hollows in the bedrock, or even to infilled tree root boles, and are ascribed moderate archaeological potential. Survey was restricted in the north-west quadrant of the site by mature trees and a manége and the magnetic data here is dominated by modern magnetic disturbance. No confident archaeological interpretation of this area can be given. Therefore, on the basis of the geophysical survey, the archaeological potential in the south-west of the site, adjacent to the Abbey precinct wall, is assessed as moderate, and low in the east.

CONTENTS

1 INTRODUCTION 1

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE 1

1.2 GEOLOGY AND SOILS 1

2 ARCHAEOLOGICAL BACKGROUND 1

3 AIMS, METHODOLOGY AND PRESENTATION 2

3.1 MAGNETOMETER SURVEY 2

3.2 REPORTING 3

4 RESULTS AND DISCUSSION 3

4.1 FERROUS ANOMALIES 3

4.2 AGRICULTURAL ANOMALIES 4

4.3 GEOLOGICAL ANOMALIES 4

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES 4

5 CONCLUSION 4

6 REFERENCES 4

7 APPENDICES 9

APPENDIX 1 MAGNETOMETER SURVEY 9

APPENDIX 2 SURVEY LOCATION INFORMATION 10

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE 10

APPENDIX 4 DATA PROCESSING 10

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND 11

LIST OF ILLUSTRATIONS

ILLUS 1 SITE LOCATION VIII

ILLUS 2 PDA, LOOKING SOUTH-WEST 2

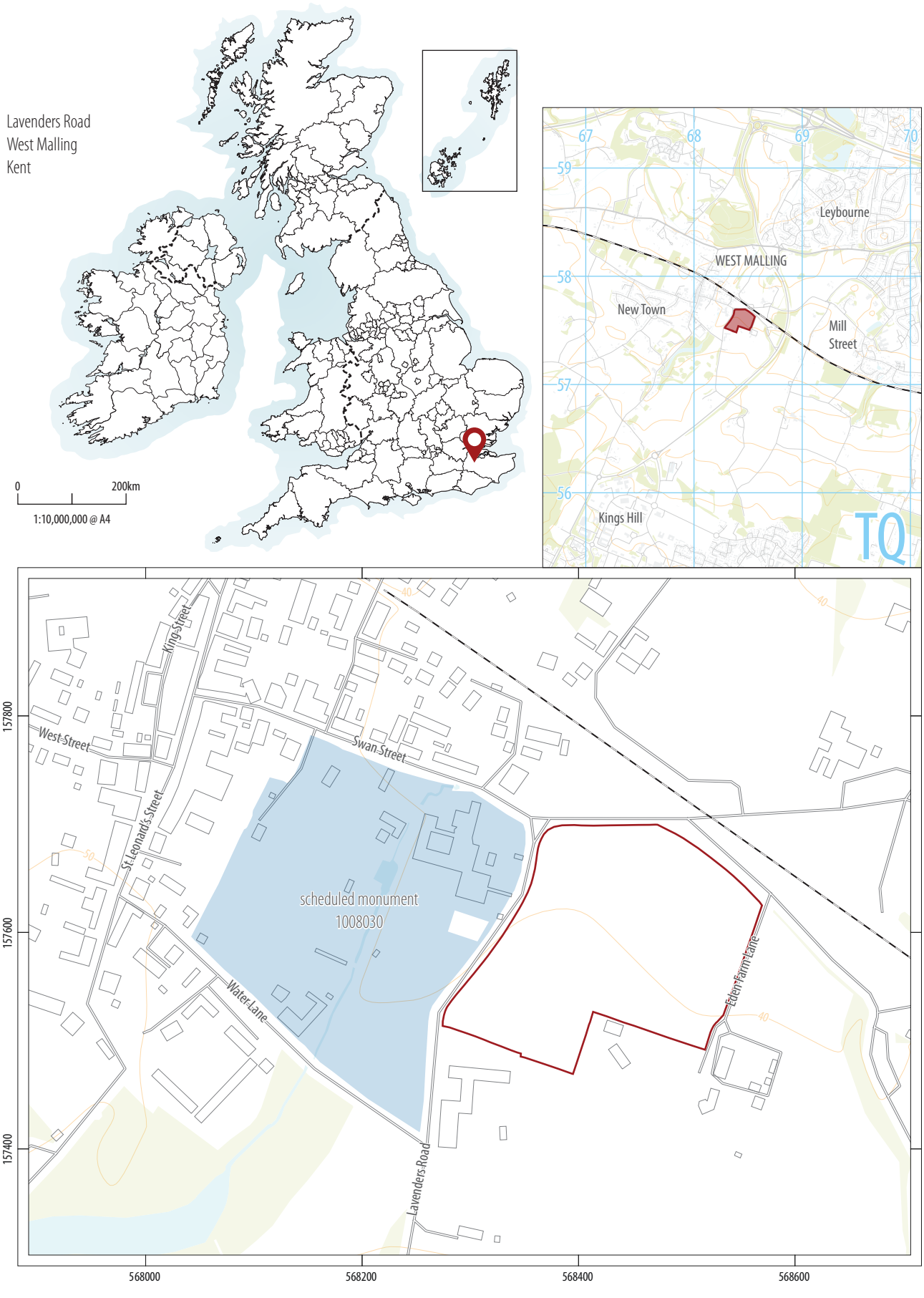
ILLUS 3 PDA, LOOKING NORTH-WEST 3

ILLUS 4 SURVEY LOCATION SHOWING GPS SWATHS (1:2,500) 5

ILLUS 5 PROCESSED GREYSCALE MAGNETOMETER DATA (1:1,500) 6

ILLUS 6 XY TRACE PLOT OF MINIMALLY PROCESSED MAGNETOMETER DATA (1:1,500) 7

ILLUS 7 INTERPRETATION OF MAGNETOMETER DATA (1:1,500) 8



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ILLUS 1 Site location

LAVENDERS ROAD, WEST MALLING, KENT

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Archaeology Collective (the Consultant), on behalf of Bellway Homes Limited, to undertake a geophysical (magnetometer) survey at West Malling, Kent, where a new residential development is proposed. The work has been recommended by the Senior Archaeological Officer at Kent County Council in response to an Outline Planning Application (Ref TM/18/02093). The results of the survey will inform future archaeological strategy at the site.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2018) which was submitted to and approved by the Senior Archaeological Officer, with guidance within the National Planning Policy Framework (MHCLG 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was carried out on the 13th and 14th December 2018.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) comprises an irregularly-shaped block of land located on the east side of Lavenders Road, between the market town of West Malling and West Malling Station, centred on TQ 6842 5755 (see Illus 1). It is bounded on the west by Lavenders Road, on the north by Swan Street, on the east by Eden Farm Lane and on the south by the property boundaries of Lavenders Residential Care Home and Eden House and Farm. The north-west quadrant of the PDA contains a former tennis court, now a paddock and manége (horse riding school).

At the time of the survey, the PDA was under short grass (see Illus 2) with the north-west quadrant being under mature trees and overgrown vegetation. The manége was unsuitable for survey.

The PDA is sited on a gentle north-east facing slope being at 42m Above Ordnance Datum (AOD) in the south-west corner and 36m AOD in the north-east.

1.2 GEOLOGY AND SOILS

The bedrock geology mainly comprises Hythe Formation (sandstone and limestone, interbedded) with Sandgate Formation (sandstone and mudstone) recorded in the south-east. No superficial deposits are recorded (NERC 2018).

The soils are classified in the Soilscape 7 association, characterised as freely-draining base-rich soils (Cranfield University 2018).

2 ARCHAEOLOGICAL BACKGROUND

The PDA is located immediately east of the precinct of a medieval nunnery, St Mary's Abbey, which is protected as a Scheduled Monument (HE1008030).

An Archaeological Desk-Based Assessment (Archaeology Collective 2018) concluded that:

> *'Based on the information within the Kent Historic Environment Record, there is considered to be a low potential for encountering undisturbed archaeological remains of very high, high or medium significance within the proposed development site. There is a possibility that the field was used to host medieval and later annual fairs, in which case there is a high potential*

ILLUS 2 PDA, looking south-west

for the survival in the topsoil of unstratified artefact scatters of medieval and post-medieval date, of low significance.'

The PDA contains the crash site of a Battle of Britain Supermarine Spitfire, which is designated as a Site of Protected Military Remains (Aircraft) and recorded on the Kent Historic Environment Record (HER TQ 65 NE 401, see Illus 4).

Historic map regression (Archaeology Collective 2018) has shown that the PDA has been farmland from at least the middle of the 18th century and probably longer. In the mid-20th century, the southern and eastern parts of the site was an orchard. The north-western corner of the PDA was a garden during the last century and, during the Second World War, a large area of hardstanding was built, a feature which was subsequently been adapted for use as a tennis court and subsequently as a manége.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the PDA. This will, therefore, enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains if present.

The specific archaeological objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to, therefore, model the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 0.5m intervals (0.5m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble

ILLUS 3 PDA, looking north-west

R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:5,000. Illus 2 and Illus 3 are site condition photographs. Illus 4 is a 1:2,500 survey location plan showing the direction of survey as GPS swaths. Large-scale, fully processed (greyscale) data, minimally processed (XY trace plot) data, and an accompanying interpretative plot are presented at a scale of 1:1,500 in Illus 5–7 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2018), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2016). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

With the exception of the manége and mature trees in the north-west of the PDA, ground conditions were good (see Illus 2) contributing to a high standard of data throughout.

The survey has detected a variable magnetic background throughout the PDA manifesting across the dataset as discrete low magnitude anomalies which are caused by localised variations in the depth and composition of the soils. Against this background, several linear and discrete anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figures, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground

surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

The paddock in the north-west of the PDA is dominated by magnetic disturbance throughout. The disturbance is due to interference from manége apparatus and other ferrous contamination within the topsoil. Disturbance of this magnitude and extent may mask or obscure any low magnitude anomalies of archaeological potential, if present, within the affected area.

Three high magnitude dipolar linear anomalies (SP1–SP3; see Illus 5–7) crossing the south and east of the PDA, locate buried service pipes.

Magnetic disturbance around the field edges is due to ferrous material within, or adjacent to the boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

A single linear trend aligned north-west/south-east along the field boundary probably locates a former ploughing headland.

4.3 GEOLOGICAL ANOMALIES

Numerous discrete low-magnitude anomalies have been identified throughout the PDA. The frequency and distribution of these anomalies preclude against an archaeological interpretation and the anomalies are thought to be caused by localised variation in the depth and composition of the topsoil.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Faint parallel linear trends (D1 and D2, see Illus 5–7) have been identified, 8m apart, and aligned east/west within the south-west of the PDA. The anomalies may be due to soil-filled ditches flanking either side of a trackway. However, the anomalies are aligned parallel with the extant and historic field boundaries and an agricultural origin is possible. A faint curvilinear trend, RD1, 14m north of the possible trackway, may locate a ring-ditch, 12m in diameter, with the discrete internal anomalies perhaps locating pits. These anomalies are ascribed moderate archaeological potential.

The cluster of high magnitude pit-type anomalies within the centre of the PDA may be archaeological in origin and is interpreted as an Area of Archaeological Potential (AAP1, see Illus 5-7). The anomalies form no coherent pattern and whilst it is possible that they are due to soil-filled solution hollows in the Hythe Formation (sandstone/ limestone) bedrock, or to infilled tree root boles, an archaeological origin cannot be dismissed. A smaller cluster of pit-type anomalies of a similar magnitude is identified in the west as AAP2. These anomalies are also assessed as of moderate archaeological potential.

Within the south-east corner of the PDA, a vague, fragmented linear anomaly (D3?) may locate an infilled ditch although interpretation is hampered by magnetic interference from the nearby buried service pipes.

5 CONCLUSION

The survey has successfully evaluated the site and has not identified any anomalies of definite archaeological potential nor have any anomalies been identified to locate the Spitfire crash site. Fragmented parallel linear trends in the south-west of the site may locate soil-filled ditches flanking a trackway. A circular anomaly nearby may be due to ring-ditch. These anomalies are ascribed moderate archaeological potential. Broad clusters of high magnitude discrete anomalies may be caused by infilled pits. However, in the absence of any clear pattern, a geological origin cannot be dismissed. These anomalies may be due to soil-filled solution hollows in the bedrock, or even to infilled tree root boles, and are therefore ascribed moderate archaeological potential. Survey was restricted in the north-west quadrant of the site by mature trees and a manége and the magnetic data here is dominated by modern magnetic disturbance. No confident archaeological interpretation of this area can be given. Therefore, on the basis of the geophysical survey, the archaeological potential in the south-west of the site, adjacent to the Abbey precinct wall, is assessed as moderate, and low in the east.

6 REFERENCES

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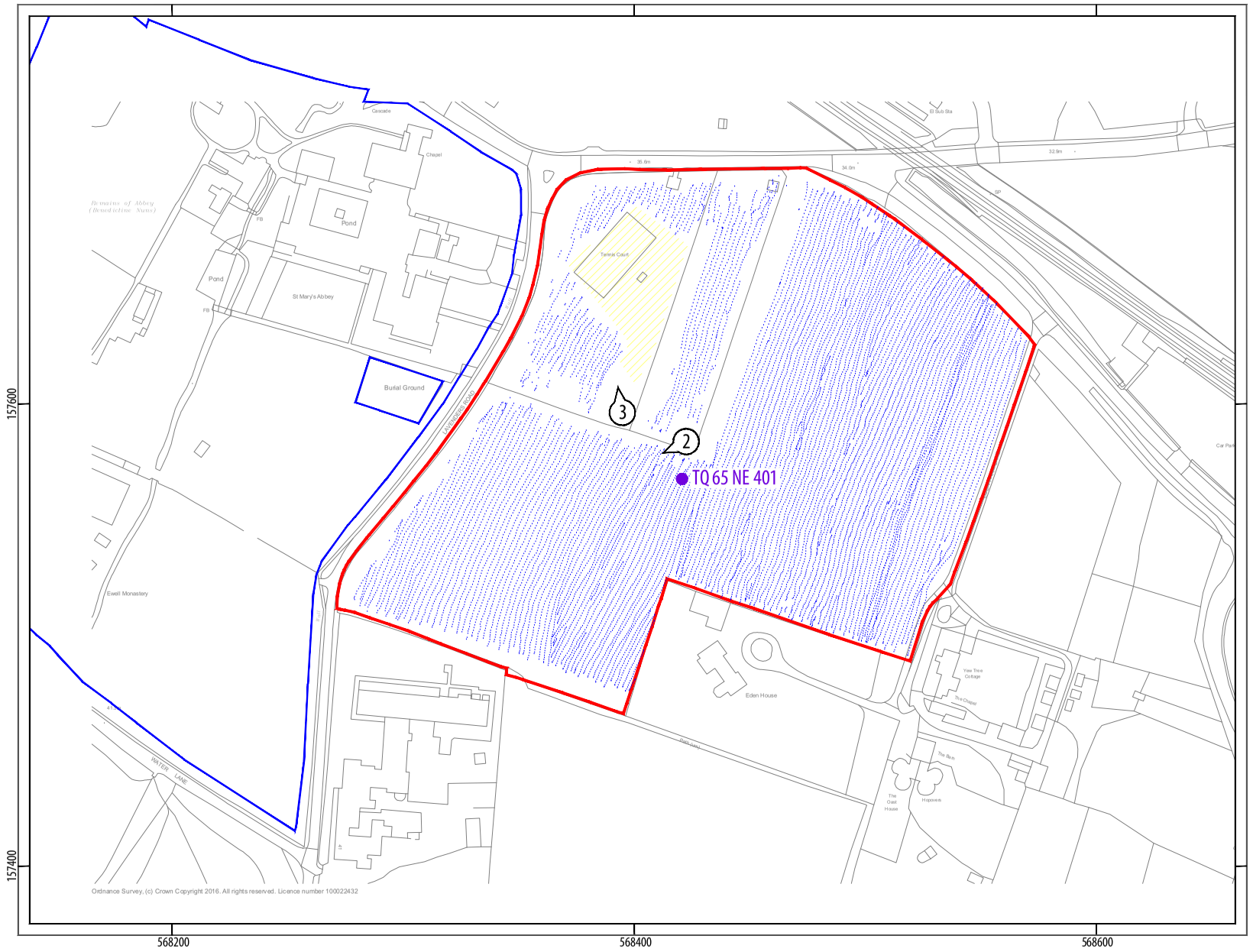

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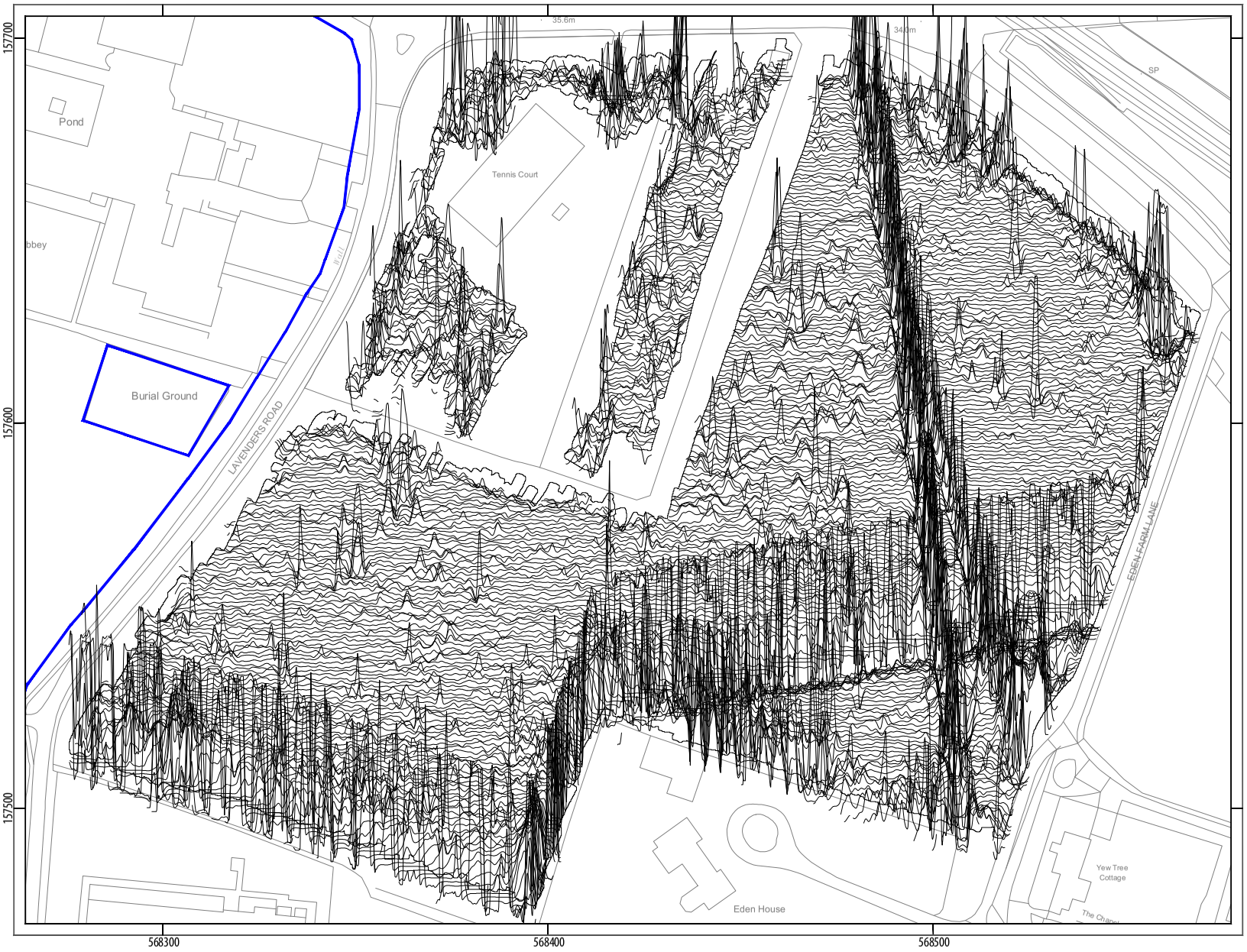
ILLUS 4 Survey location showing GPS swaths (1:2,500)

ILLUS 5 Processed greyscale magnetometer data (1:1,500)



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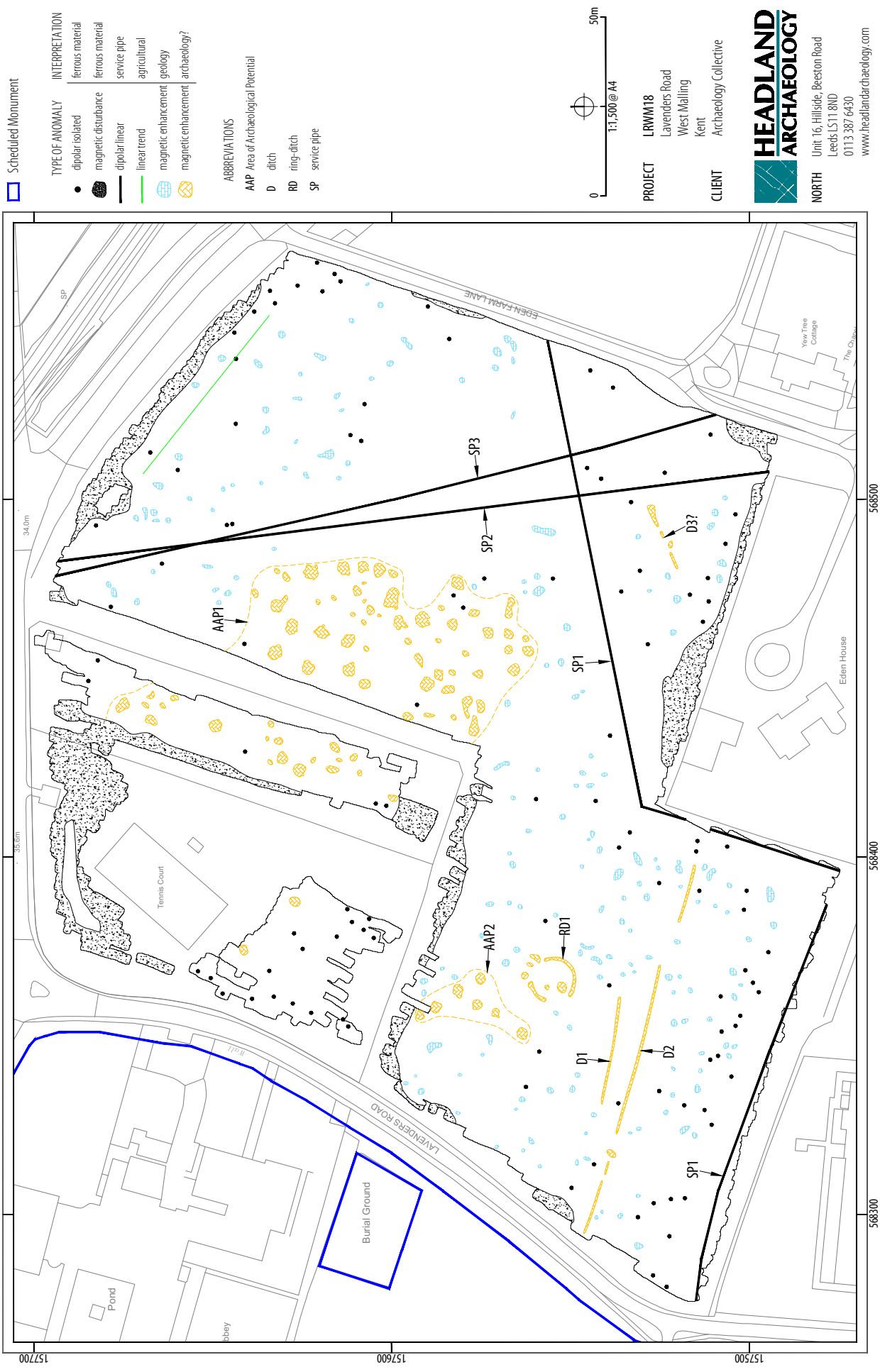
ILLUS 6 XY trace plot of minimally processed magnetometer data (1:1,500)



ILLUS 7 Interpretation of magnetometer data (1:1,500)

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas, where human occupation or settlement has occurred, can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances, anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However, some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can, therefore, remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often, therefore, be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-337482

PROJECT DETAILS	
Project name	Lavenders Road, West Malling, Kent
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 4 hectare site at West Malling, Kent, where a new residential development is proposed. The Proposed Development Area (PDA) is located immediately adjacent to St Marys Abbey, a medieval nunnery, which is protected as a Scheduled Monument. The PDA contains the crash site of a Battle of Britain Supermarine Spitfire, a Site of Protected Military Remains. No anomalies of definite archaeological potential have been identified by the survey and no anomalies have been identified to locate the Spitfire crash site. Fragmented parallel linear trends in the south-west of the site may locate soil-filled ditches flanking a trackway. A circular anomaly nearby may be due to ring-ditch. These anomalies are ascribed moderate to high archaeological potential. Broad clusters of high magnitude discrete anomalies may be caused by infilled pits. However, in the absence of any clear pattern a geological origin cannot be dismissed. They anomalies may be due to soil-filled solution hollows in the bedrock, or even to infilled tree root boles, and are ascribed moderate archaeological potential. Survey was restricted in the north-west quadrant of the site by mature trees and a manége and the magnetic data here is dominated by modern magnetic disturbance. No confident archaeological interpretation of this area can be given. Therefore, on the basis of the geophysical survey, the archaeological potential in the south-west of the site, adjacent to the Abbey precinct wall, is assessed as moderate, and low in the east.
Project dates	Start: 13-12-2018 End: 14-12-2018
Previous/future work	Not known / Not known
Any associated project reference codes	LRWM18 - Contracting Unit No.
Any associated project reference codes	TQ65NE401 - Related HER No.
Type of project	Field evaluation
Site status	Protected sites under the Protection of Military Remains Act 1986
Current Land use	Grassland Heathland 5 - Character undetermined
Current Land use	Other 14 - Recreational usage
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Position in the planning process	After outline determination (eg. As a reserved matter)
Solid geology (other)	Hythe Formation; Sandgate Formation
Drift geology (other)	None
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	KENT TONBRIDGE AND MALLING WEST MALLING Lavenders Road, West Malling
Study area	4 Hectares
Site coordinates	TQ 6842 5755 51.291591706787 0.415746021334 51 17 29 N 000 24 56 E Point
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	Archaeology Collective
Project design originator	Headland Archaeology
Project director/manager	Harrison, D

Project supervisor	Vansassenbrouck, O.
Type of sponsor/funding body	Developer

PROJECT ARCHIVES

Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No

PROJECT BIBLIOGRAPHY 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Lavenders Road, West Malling, Kent; Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Date	2018
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	PDF[A]
Entered by	David Harrison (david.harrison@headlandarchaeology.com)
Entered on	20 December 2018

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