Geophysical Survey Report

Land Off Walkern Road,

Watton-at-Stone, East Hertfordshire

For

RPS Group Ltd

On behalf of

Fairview Estates (Housing) Ltd

Magnitude Surveys Ref: MSTL1519

HER Event Number: EHT 9138

OASIS Number: magnitud1-5160000

May 2023

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Abstract

Magnitude Surveys Ltd was commissioned to locate and assess the potential for sub-surface archaeological remains over a c. 2.4ha area of land at Walkern Road, Watton-at-Stone, East Hertfordshire. A fluxgate gradiometer survey has been successfully undertaken across the survey area and detected anomalies of archaeological, natural and undetermined origin. Probable archaeological anomalies have been identified as a ring ditch with a possible entrance and additional internal ditches. Natural variations in the superficial geology are present as bands of alluvium throughout the survey area. A number of linear and curvilinear anomalies have been interpreted to be undetermined origin. These anomalies are likely of natural or agricultural origin, however due to the close proximity of probable archaeological anomalies, archaeological interpretation cannot be discounted. Small spreads of ferrous materials are present throughout the survey area which may be obscuring anomalies of anthropogenic origin, if present.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by RPS Group Ltd on behalf of Fairview Estates (Housing) Ltd to undertake a geophysical survey over a c. 2.4ha area of land off Walkern Road, Watton-at-Stone, East Hertfordshire (TL 29556 20000).

1.2. The geophysical survey comprised a hand-carried GNSS-positioned fluxgate gradiometer survey. The magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al*., 2008).

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al*., 2008), the Chartered Institute for Archaeologists (CIfA, 2020) and the European Archaeological Council (Schmidt *et al.,* 2015).

1.4. It was conducted in line with a WSI produced by MS (Dyulgerski, 2023).

1.5. The survey commenced on 08/03/2023 and took one day to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).

2.2. The directors of MS are involved in cutting-edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London and a Member of CIfA, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.

2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

3.1. The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area was located c. 680m north/ northeast of the town Watton-at-Stone, East Hertfordshire (Figure 1). A gradiometer survey was undertaken across one field under pasture. The survey (Figure 2) area is bordered to the north by the A602, to the east by the Walkern Road, and is located north of a small estate on Beane Road.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The survey area consisted of a flat pasture field.	The survey area was bordered to the north, east and south by a hedgerow. To the west, there was no border as the field continues in that direction. It is noteworthy that at the immediate south of the survey area, there are trees along the river Beare. Two boreholes were noticed in the middle of the survey area.

4.3. The underlying geology is comprised of Chalk of the Lewes Nodular Chalk Formation and Seaford Chalk Formation. The superficial deposits are Glaciofluvial and consisted of Sand and Gravel (British Geological Survey, 2023).

4.4. The soils are freely draining and slightly acid-loamy (Soilscapes, 2023).

5. Archaeological Background

5.1. The following is a summary of a Desk-Based assessment produced and provided by RPS Group Ltd (Cook N., 2020).

5.2. A singular Palaeolithic handaxe was recorded 1.2km north of the survey area. An artefact scatter comprising Neolithic flint cores and a small axe, along with medieval pottery, were recorded c. 400m west of the survey area.

5.3. Within the survey area, cropmarks representative of a ring ditch and a linear ditch have been recorded, which may date from the Bronze Age. A curvilinear ditch has been recorded c. 100m east of the survey area. Cropmarks of two further ring ditches were recorded c. 350m southeast of the survey area. Crop marks indicative of two possible Bronze Age barrows were recorded c. 600m west of the survey area, excavations at this site recorded Bronze Age charcoal, crushed antler, and sherds of a bucket urn. Further Prehistoric cropmarks representative of possible linear ditches, ring ditches and pits were recorded at multiple unspecified locations in the wider landscape.

5.4. The Romano-British road from St Albans to Colchester is recorded oriented southwest to northeast, c. 1km south of the survey area. In close proximity to this, early settlement evidence has been recorded in the form of chalk floors, beam slots, Romano-British coins and pottery. A possible Romano-British bathhouse and villa site was recorded c. 1km northwest of the survey area. A Romano-British ditch containing infant skeletons was recorded c.1.6km west of the survey area, in proximity to an Iron Age cremation burial.

5.5. A mid-Saxon cremation cemetery was recorded, with a related curvilinear ditch containing semi-complete pottery jars and a bowl dated to the 6th to 8th century, c. 920m south of the survey area. A Saxon battle was recorded as taking place in 1016 c.800m northwest of the survey area, where a cache of iron weapons was recorded.

5.6. The Church of St Andrew & St Mary located c.1.2km south of the survey area, largely dates to the 15th century, with some 13th century features.

6. Methodology

6.1.Data Collection

6.1.1. Magnetometer surveys are generally the most cost-effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. The geophysical survey, therefore, comprised the magnetic method as described in the following section.

6.1.2. Geophysical prospection comprised the magnetic method as described in the following table.

Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.3. The magnetic data were collected using MS' bespoke hand-carried GNSS-positioned system.

6.1.3.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2.Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.2 in David *et al.,* 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al.* (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3.Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images (Figure 4), as well as the total field data from the lower sensors (Figure 3). The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high-contrast materials. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 6). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2023) was also consulted, to compare the results with recent land use.

6.3.3. Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1.Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2.Discussion

7.2.1. The geophysical results are presented in combination with satellite imagery overlaid with historical maps (Figure 7).

7.2.2. The geophysical survey was completed across the survey area. The fluxgate gradiometer survey generally responded well to the environment of the survey area. Anomalies of archaeological and natural origins have been identified. Modern Interference was generally limited to field boundaries, with small spreads of ferrous material located in the centre of the survey area.

7.2.3. A singular annular anomaly was identified in the east of the survey area. This anomaly presents a signal that has the morphological characteristics of a ring ditch, with a break in the signal which is suggestive of the presence of an entrance and possible internal features. The anomaly measures c. 24m which might suggest a funerary context such as a ploughed-out barrow. This is further supported by the presence of Bronze Age barrows in close proximity to the survey area.

7.2.4. The natural alluvial geology of the survey area, and proximity to a stream to the southwest has formed alluvial terracing across the survey area which is visible in the form of weakly enhanced bands running parallel to the river channel. Occasionally, it is magnetically enhanced and thus, it may have covered possible weaker anomalies.

7.2.5. Multiple weak curvilinear anomalies have been identified and classified as ‘Undetermined’. These lack any obvious pattern or morphology and have no contextual evidence and are likely the result of natural, modern or agricultural features, though an archaeological origin cannot be ruled out.

7.3.Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.

7.3.1.3. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.

7.3.1.4. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles, and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.

7.3.1.5. **Undetermined** – Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally distinct from those caused by ferrous sources.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Archaeology Probable and Possible (Weak)** – A weak, positive anomaly **[1a]** with penannular shape was recorded in the east of the survey area (Figure 3, 4). Its external radius is c.24m and there is a gap on the northern side of the anomaly. Within the ring ditch two further anomalies of weak, positive signal were detected (Figure 3, 4). They have semi-circular and curvilinear shapes, and they may be related to the ring ditch, maybe forming additional ditches (Figure 5). However, it is uncertain whether they are correlated with the ring ditch or are the result of geological variations. The radius of this anomaly is suggestive of it being a ploughed-out barrow, this combined with the presence of other ring ditches in the wider landscape suggests this anomaly is a bronze age funerary feature.

7.3.2.2. **Natural (Strong & Weak)** – Amorphous anomalies have been identified across the survey area which relate to the underlying alluvial geology of the survey area and proximity to a stream which has caused alluvial terracing (Figures 3, 4, 5).

7.3.2.3. **Undetermined (Strong & Weak)** – In the centre of the survey area, several curvilinear anomalies have been identified (Figure 5). These anomalies present signals which are partially magnetically enhanced due to the natural geological

background and thus may be natural in origin. These anomalies may also be archaeological, modern or agricultural in origin, however due to a lack of contextual evidence they have been given an undetermined classification.

8. Conclusions

8.1. The fluxgate gradiometer survey was successfully undertaken across the survey area. The survey technique generally responded well to the environment of the survey area and anomalies of anthropological, natural, and undetermined origins were Identified. Magnetic interference is generally limited to field boundaries.

8.2. Probable archaeological anomalies were recorded close to the survey area's east border and have been identified as a ring ditch likely associated with the Bronze Age remains recorded in the area.

8.3. Variations to the survey area's natural geology were recorded either as bands or zones.

8.4. Undetermined and fragmented anomalies of oval or curvilinear shape were recorded in the centre of the survey area. They may be the result of the area's geological background. Due to the presence of the ring ditch an anthropological origin cannot be excluded.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

10.1. Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

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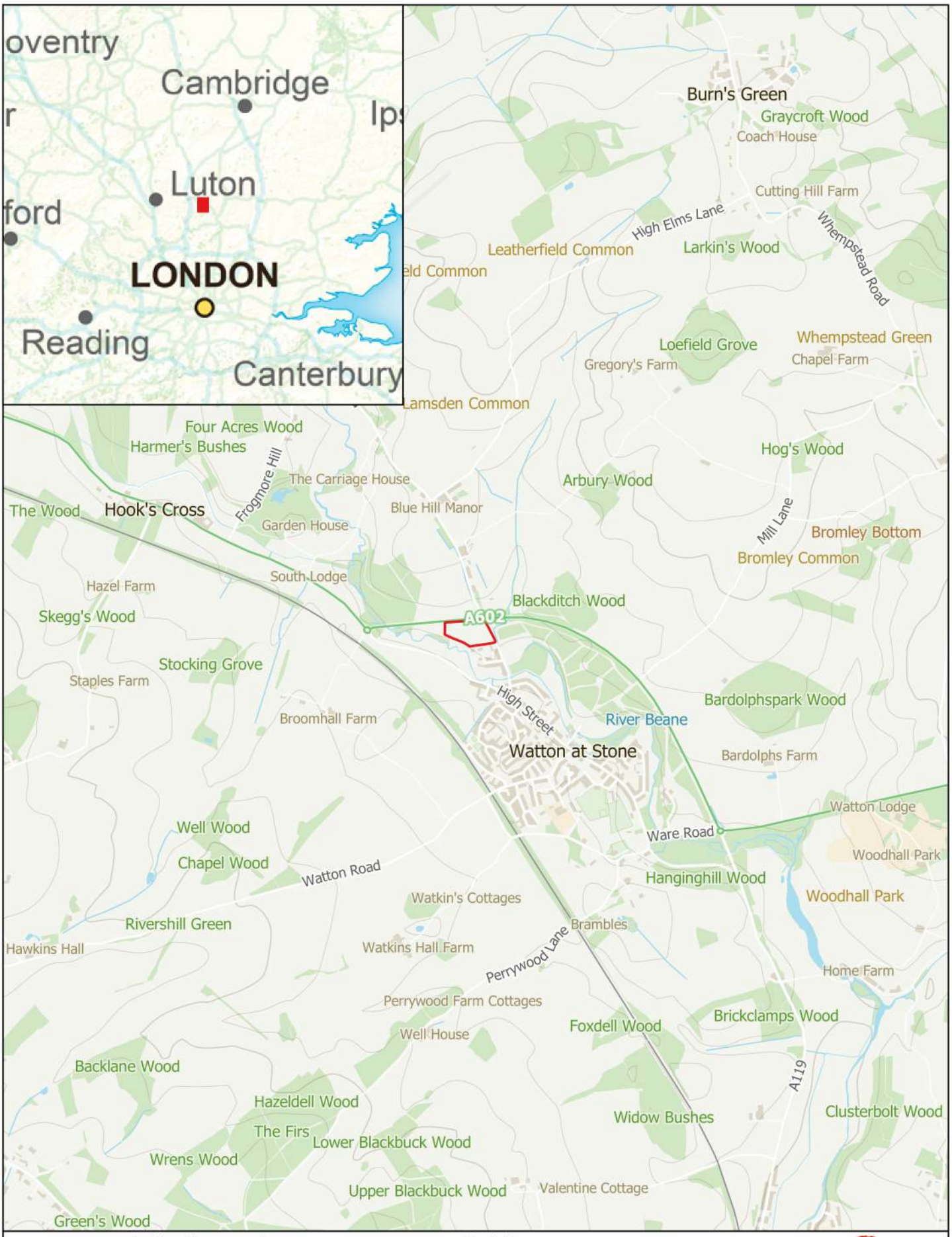
12. Project Metadata

MS Job Code	MSTL1519
Project Name	Land Off Walkern Road, Watton-at-Stone, East Hertfordshire
Client	RPS Group Ltd.
Grid Reference	TL 29556 20000
Survey Techniques	Magnetometry
Survey Size (ha)	2.40ha (Magnetometry)
Survey Dates	2023-03-06
Project Lead	Krasimir Dyulgerski BA MRes
Project Officer	Krasimir Dyulgerski BA MRes
HER Event No	EHT 9138
OASIS No	Magnitud1-5160000
S42 Licence No	N/A
Report Version	0.5

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	PD	JH	16 March 2023
0.2	Corrections following project lead review	PD	JH KD	17 March 2023
0.3	Corrections following project lead review	IT	JH KD	29 March 2023
0.4	Draft For Director Sign Off	IT	FPC	30 March 2023
0.5	Corrections from Client	CL	KD	23 May 2023



MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys

529000
530000
220500
220500
Garden House
South Lodge
Blue Hill House
Walkern Road
Blackditch Wood
A602
Area 1
Area 1
Beane Road
Mill Lane
Lammas Road
Toes Wood
219600
219600
Broomhall Farm
High Street
Great Innings North
River Beane
Other Sports Facility
Play Space
Great Innings South
Hazeldell
Watton at Stone
The Grove
Rivershill

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 2 - Location of Survey Area
1:5,000 @ A3

Survey Extent

N

0 150 300 450 m

magnitude surveys

529375

529650

Blue Hill House

A602

220050

220050

Area 1

Walkern Road

219900

219900

Beane Road

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,500 @ A3

48,997 nT 49,005

N

0 50 100 150 m

magnitude surveys

529375

529650

Blue Hill House

A602

220050

220050

Area 1

Walkern Road

219900

219900

Beane Road

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 4 - Magnetic Gradient
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

529375

529650

Blue Hill House

A602

220050

220050

1a

Walkern Road

Beane Road

219900

219900

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 5 - Magnetic Interpretation
1:1,500 @ A3

- Archaeology Probable (Weak)
- Archaeology Possible (Weak)
- Natural (Strong)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Weak)
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

529375

529650

Blue Hill House

A602

220050

220050

Walkern Road

219900

219900

Beane Road

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 6 - XY Trace Plot
30nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

magnitude surveys

529000
529500
530000
220200
219900
Ash Tree
Sur. 264·1
The Rookery
Blue Hill
B.M.241·4
Def.
Blackditch Wood
C.R.
B.M.204·4
M.S.
T.B.M.
Und.
204
B.P.
200
194
Wagon & Horses
P.H.
Malthouse

MSTL1519 - Land off Walkern Road, Watton-at-Stone, East Hertfordshire
Figure 7 - Magnetic Interpretation Over Historical Maps and Satellite Imagery
1:3,000 @ A3

Contains historical mapping © CLS Data 2023: Ordnance Survey, 6" 2nd edition c. 1882-1913
Contains satellite imagery © Bing Satellite 2023

- Archaeology Probable (Weak)
- Archaeology Possible (Weak)
- Natural (Strong)
- Natural (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Weak)
- Ferrous (Spike)

N

0 100 200 300 m

magnitude surveys