magnitude surveys

Geophysical Survey Report

of

Swanwood,

Henley-on-Thames, Oxfordshire

For

RPS Cheltenham

On Behalf Of

SWE Construction Ltd

Magnitude Surveys Ref: MSSU694

June 2020

Unit 17, Commerce Court

Challenge Way

Bradford

BD4 8NW

01274 926020

info@magnitudesurveys.co.uk

Report By:

Alison Langston BA PCIfA

Bradley Falcus MESci (Hons) FGS

Report Approved By:

Dr Kayt Armstrong MCIfA

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.11 ha area of land at Swanwood, Henley-On-Thames, Oxfordshire. A fluxgate gradiometer survey was successfully completed across the survey area. No anomalies suggestive of significant archaeological features were identified; however, a strong and unusual anomaly was found, c.7m in diameter, of undetermined origins. The anomaly has a peculiar form, as a strong negative with a slight internal positive peak. This might be an unusual thermal structure such as a kiln, or ferrous material in a peculiar orientation in the ground. Elsewhere, the geophysical survey has detected anomalies of an agricultural origin, in the form of ploughing regimes in the north of the survey area. Natural variations have been identified across most of the survey area, relating to the unconsolidated superficial deposits. Linear and curvilinear anomalies of undetermined classification have also been identified. The impact of modern activity on the results is limited to disturbance from ferrous material in boundaries or nearby structures at the edges of the survey areas.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by RPS Cheltenham on behalf of SWE Construction Ltd to undertake a geophysical survey on a c.11ha area of land off Swanwood, Henley-On-Thames, Oxfordshire (SU 6991 8570).

1.2. The geophysical survey comprised a hand-carried GNSS-positioned fluxgate gradiometer survey.

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, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. It was conducted in line with a Written Scheme of Investigation (WSI) produced by MS (Magnitude Surveys, 2020).

1.5. The survey commenced on 10/06/2020 and took two days 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 of Archaeological Prospection).

2.2. The directors of MS are involved in the cutting edge of 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. Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is a Member of CIfA, the Editor of ISAP News, and is the UK Management Committee representative for the COST Action SAGA; Dr. Paul Johnson has a PhD in archaeology from the University of Southampton, 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 have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

3. Objectives

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

4. Geographic Background

4.1. The site was located c.6km north west from the centre of Henley-on-Thames (Figure 1). Survey has been undertaken across fields bounded by agricultural land to the north, 'Swan Wood' to the west, 'Little Meadow House' and an unnamed road to the south, and the B481 and 'Henge Wood' to the east (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The area consisted of flat grassland.	Bounded to the north by a row of trees and a road, to the east and south by metal fencing and hedgerows and trees, and to the west by woodland. A pond was present in the northeast corner. A fenced off area containing trees was present in the east and was not able to be surveyed.
2	The area consisted of grassland with uneven terrain.	Bounded to the north and east by a wire fence and woodland, to the south by a line of trees and a road with a wooden fence on the eastern half of the southern boundary and to the west by woodland. A pylon was present in the northeast of the field, with overhead cables crossing the eastern side of the field in a southeast to northwest orientation.

4.3. The underlying geology comprises a combination of the Lewes Nodular chalk formation, Seadford Chalk Formation and the Newhaven Chalk formation. Superficial deposits comprise clay, silt, sand and gravel of the clay-with-flints formation (British Geological Survey, 2020).

4.4. The soils consist of slightly acid, loamy and clayey soils (Soilscapes, 2020).

5. Archaeological Background

5.1. The following is a summary of an HER monument full report produced by Oxfordshire HER (Oxfordshire Historic Environment record, 2020) and provided by RPS.

5.2. Neolithic activity has been recorded in the form of a flint axe (MOX6424), identified c. 500m south of Area 1.

5.3. Iron Age activity has been recorded in the form of Mongewell Grim's ditch (MOX7092), identified at its closest point running c.10m north of Area 2 and around the eastern boundary of the field.

5.4. Roman activity has been recorded c.30m northwest of the survey area in the form of Roman pottery sherds and burnt clay (MOX6454), thought to be a pottery kiln and enclosure located from fieldwalking in that area.

5.5. Medieval and post-medieval activity has been identified in the form of a Tudor cottage (MOX17000), located c.615m southeast of Area 1. Further activity has been recorded in the

form of a possible coaxial enclosure (HOX6726), thought to be pre 18th century in date, located c.275m southwest of Area 2. Two further pre 18th century enclosures (HOX7680 & HOX7688) have been identified c. 475m east of Area 2 and c. 110m south of Area 1, respectively.

6. Methodology

6.1. Data Collection

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

6.1.2. 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 Historic England's standards for "raw or minimally processed data" (see sect 4.2 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, as well as the total field data from the lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. 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 at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 7). XY trace plots visualise the magnitude and form of the geophysical response, aiding in 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, historic maps, LiDAR data, and soil and geology maps. Google Earth (2020) was consulted as well, to compare the results with recent land usages.

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 of further work in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery and historic maps (Figure 6).

7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. The geophysical survey has primarily detected modern agricultural activity in the form of ploughing. The survey has recorded a slightly enhanced magnetic background, due to the erosion and weathering process of the underlying chalk geology, and the unconsolidated superficial deposits. These natural variations are recorded in the form of diffuse zones of mottled magnetic data, these relating to the various materials of sand and gravel which comprise the unconsolidated superficial deposits (Section 4.3). Modern interference is limited to ferrous material in boundaries or nearby structures at the edges, such as a pylon and an infilled pond (Section 4.2).

7.2.3. A strong magnetic anomaly has been identified within the survey area. The undetermined anomaly consists of a strong negative magnetic signal, with a slight internal positive peak. This may indicate a thermal structure such as a kiln, though the anomaly form is atypical; a much larger positive centre would be expected. There is one already identified Roman pottery kiln (Section 5.4) in the immediate area. Conversely, the unusual anomaly form might relate to more deeply buried (but substantial) ferrous material with an unusual orientation in the ground. The anomaly is isolated, with little in the surrounding area to offer a context to help discriminate between these interpretations, so it has been classified as ‘undetermined’, but an archaeological origin cannot be ruled out at this stage.

7.2.4. Agricultural activity has been recorded in the form of modern ploughing trends, relating to ploughing regimes across the northeast and centre of the survey area. These appear to run in different orientations and spacings, indicating multiple ploughing directions, and possibly multiple phases of use.

7.2.5. In the centre of the survey area, a series of undetermined anomalies have been identified. These do not appear to align with modern ploughing trends, or with any former field boundaries (Figure 6), however an agricultural origin cannot be ruled out. An archaeological origin is equally as likely, however these anomalies remain undetermined due to the limited context given in a small survey area, as well as their diffuse borders.

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. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures along the edges of the field have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure the response of any weaker underlying features, should they be present, often over a greater footprint than the structure they are being caused by.

7.3.1.3. **Ferrous (Spike)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of isolated modern metallic debris on or near the ground surface.

7.3.1.4. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentrated deposition of discrete, dipolar ferrous anomalies and other highly magnetic material.

7.3.1.5. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant 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 not ferrous in nature.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Undetermined (Strong)** – A small discrete circular anomaly [**2a**] has been identified in the northwest region of Area 2 (Figure 5). The anomaly has an unusual magnetic signal, comprising of a single positive peak measuring less than c.1m in diameter encompassed by a c.7m strong negative magnetic signal, which is explicit in the XY Trace Plot data (Figure 7). This might relate to a thermal structure such as a kiln and given the presence of an identified pottery kiln of Roman origin north of the survey area (Section 5.4), it is possible this anomaly is also archaeological in origin. However, the anomaly is a-typical of a kiln, which would normally have a broader (possibly double peaked) positive centre, with a negative halo much smaller than the positive centre. The peculiar anomaly form might also be caused by a large but more deeply buried ferrous body with unusual dimensions or orientation in the ground. As such, the

anomaly has been categorised as 'undetermined' but it is of potential archaeological interest.

7.3.2.2. **Undetermined (Weak)** – In the south and north of Area 2, a series of weak linear and curvilinear anomalies have been identified (Figure 5), most explicit in the total field data (Figure 3). These anomalies do not match any mapped field boundaries (Figure 6), although the linearity of these features is suggestive of anthropogenic activity. However, the magnetic signal of these anomalies is diffuse around their perimeter and this indicates a more natural or agricultural origin. Due to their isolation and weak magnetic strength, they have been classified as undetermined.

7.3.2.3. **Natural (Weak/Zone)** – In the central part of Area 2, weak amorphous bands of natural variations have been identified, most explicit in the total field data (Figure 3). These are likely due to weathering and erosion processes on the underlying chalk geology (Section 4.3). In the eastern and western sections of Area 2, two large diffuse zones of mottled variations have been identified (Figure 5). These spreads of anomalies have been produced by unconsolidated clay, silt, and gravel which comprise the superficial deposits of the area (Section 4.3).

7.3.2.4. **Agricultural (Trend)** – A series of linear trends have been identified in the centre and east of Area 2 (Figure 5), running in multiple orientations.

7.3.2.5. **Ferrous/Debris (Spread)** – A patch of small strong dipolar anomalies, indicative of magnetic or ferrous debris in the topsoil, has been identified in the northwest corner of Area 1 (Figure 5). The spread is most explicit in the XY Trace Plot data (Figure 7). This spread of anomalies collocates to a former pond seen in 2nd edition historic mapping (Figure 6). The strong anomalies are likely caused by the debris used to fill the pond; suggesting that bricks or other ceramic building materials are present.

8. Conclusions

8.1. A fluxgate gradiometer survey has successfully been undertaken across the survey area. The geophysical survey has detected a range of different types of anomalies of agricultural, natural, and undetermined classification, along with a former infilled pond. The underlying geology has contributed to the quiet enhancement of the magnetic background of the area. Natural variations have been identified relating to the erosion and weathering process of the chalk geology and to the underlying unconsolidated superficial deposits. Modern interference is limited to the edges of the survey area, a pylon in the northeast area, and an infilled pond in the southwest corner.

8.2. No anomalies strongly suggestive of significant archaeological features were identified. However, an unusual anomaly of undetermined origin was recorded in the north-west of the survey area. With a pronounced negative c.7m across and a strong positive centre less than c.1m across this could be an unusual form of thermal structure, such as a kiln, or more deeply

buried ferrous material of unusual dimensions. Given the presence of Roman period kilns north of the survey area, an archaeological origin cannot be ruled out at this stage.

8.3. Agricultural activity has been detected in the northeast and centre of the survey area, in the form of modern ploughing regimes. Linear anomalies of an undetermined classification have also been identified in the centre and north of the survey area; these are likely to have a natural or agricultural origin, although an archaeological origin cannot be ruled out.

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 the any dictated time embargoes.

10. Copyright

10.1. Copyright and the 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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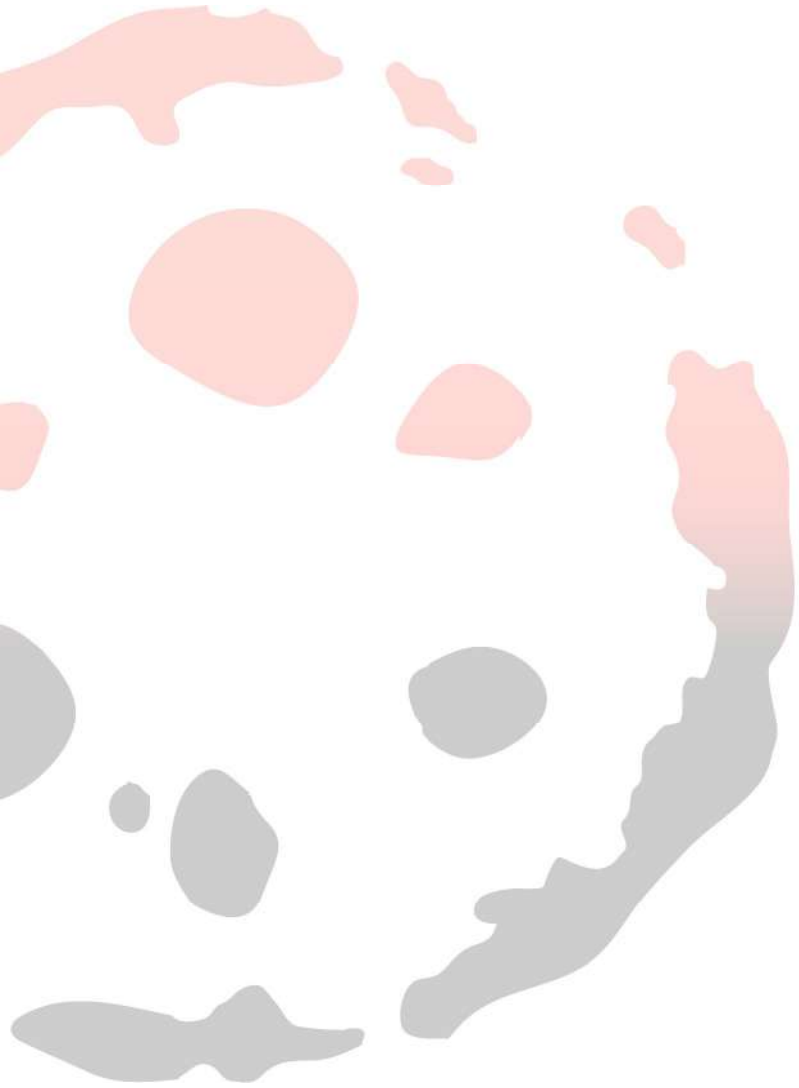
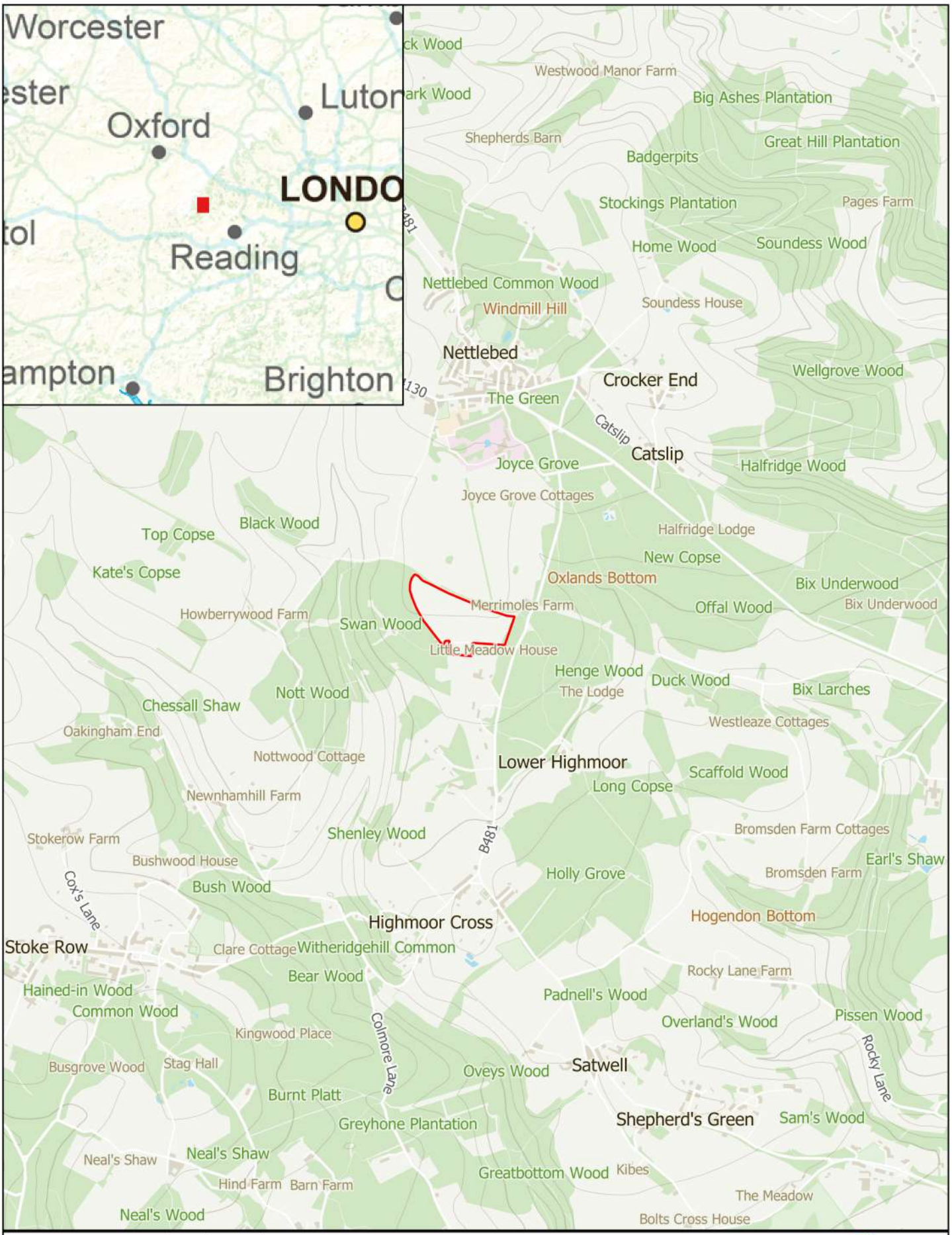


12. Project Metadata

MS Job Code	MSSU694
Project Name	Swanwood, Henley-On-Thames
Client	RPS Cheltenham
Grid Reference	SU 6991 8570
Survey Techniques	Magnetometry
Survey Size (ha)	11ha (Magnetometry)
Survey Dates	2020-06-10 to 2020-06-11
Project Lead	Frederick Salmon BSc FGS ACIfA
Project Officer	Lauren Beck BA
HER Event No	N/A
OASIS No	N/A
S42 Licence No	N/A
Report Version	Final

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	AL	FS	19 June 2020
0.2	Initial draft for Director Review	BF	KA	23 June 2020
0.3	Final draft for Director Approval	BF	KA	23 June 2020
Final	Minor corrections from the Client	BF	FS	26 June 2020



MSSU694 - Swanwood, Henley-on-Thames
Figure 1 - Site Location
1:25,000 @ A4
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Site Location

N

0 0.5 1 km

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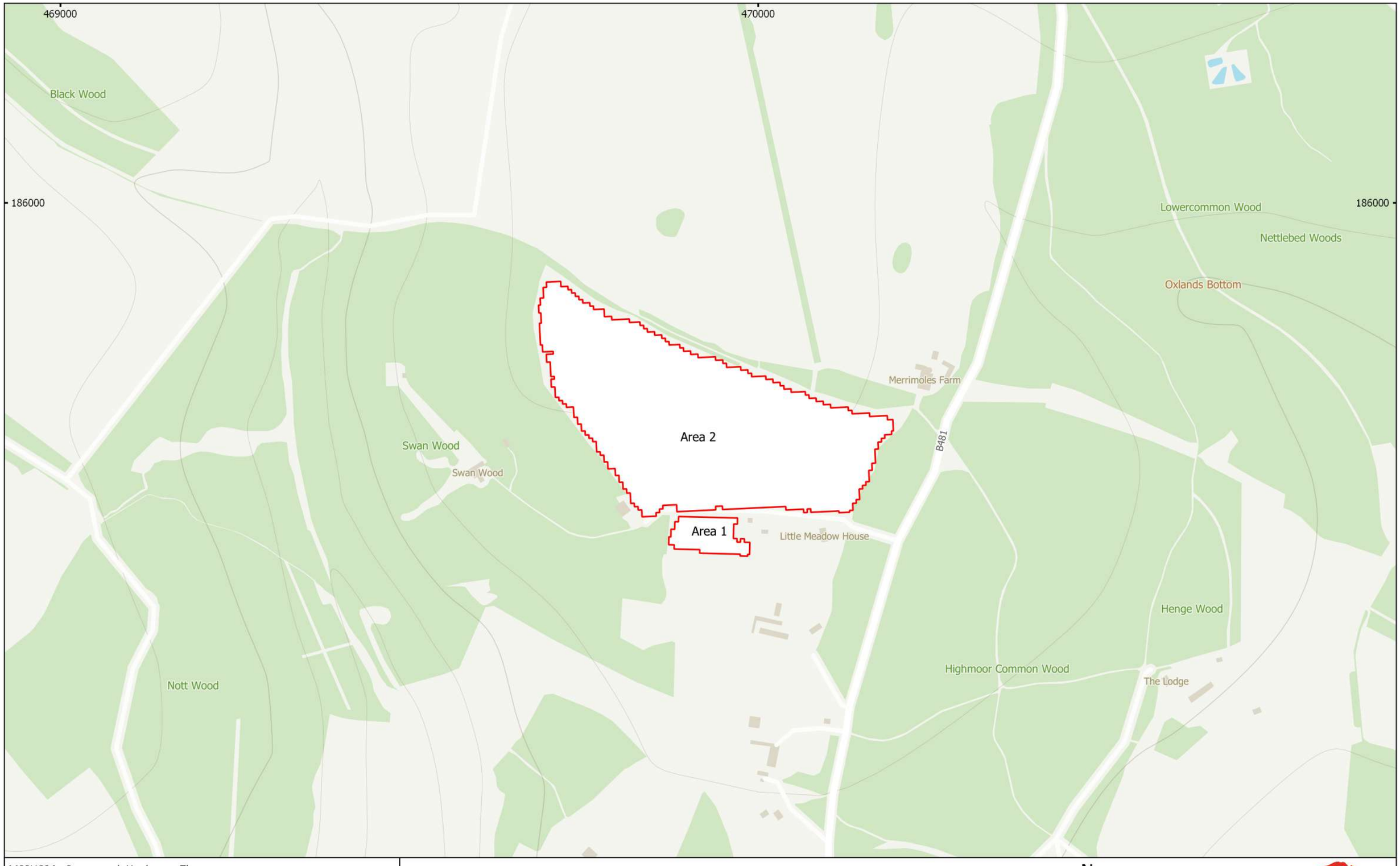

MSSU694 - Swanwood, Henley-on-Thames
Figure 2 - Location of Survey Areas
1:5,000 @ A3
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Survey Extent

N

0 150 300 450 m

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469800

470100

185800

185800

185600

185600

Area 2

Area 1

Little Meadow House

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Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,500 @ A3
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48,997 nT 49,005

N

0 50 100 150 m

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469800

470100

185800

185800

185600

185600

Area 2

Area 1

Little Meadow House

MSSU694 - Swanwood, Henley-on-Thames
Figure 4 - Magnetic Gradient
1:1,500 @ A3
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-1 nT 2

N

0 50 100 150 m

magnitude surveys

469800

470100

185800

185800

185600

185600

Area 2

2a

Area 1

Little Meadow House

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Figure 5 - Magnetic Interpretation
1:1,500 @ A3
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- Natural (Weak)
- Natural (Zone)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Agricultural (Trend)
- Ferrous (Spike)

N

0 50 100 150 m

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MSSU694 - Swanwood, Henley-on-Thames
Figure 6 - Magnetic Interpretation Over Combined Satellite and Historic Maps
1:5,000 @ A3
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Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland
Contains satellite imagery © 2020 Bing Satellite

Natural (Weak)
Natural (Zone)
Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Agricultural (Trend)
Ferrous (Spike)

N

0 100 200 300 m

magnitude surveys

469800

470100

185800

185800

185600

Area 2

Area 1

Little Meadow House

MSSU694 - Swanwood, Henley-on-Thames
Figure 7 - XY Trace Plot (with zoomed localised XY Trace Plot)
30nT/cm at 1:1,500 @ A3
Inset map: 6nT/cm in blue, 18nT/cm in yellow, 60nT/cm in red at 1:300 @ A3
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N

0 50 100 150 m

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