magnitude surveys

Geophysical Survey Report

of

Land at Standlake Road,

Ducklington, West Oxfordshire

For

Cotswold Archaeology

On Behalf Of

Rosconn Strategic Land

Magnitude Surveys Ref: MSSP267

April 2018

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Report Issued:

13 April 2018

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a *c*. 2.1ha area of pasture land at Standlake Road, Ducklington, West Oxfordshire. A fluxgate magnetometer survey was successfully completed, and anomalies of probable and possible archaeological origin have been detected. The geophysical results primarily reflect archaeological activity in the form of ditch-like anomalies forming two possible enclosures. Some internal anomalies in the western enclosure have also been detected showing pit-like responses and possible subdivisions. Other responses on the site relate to agricultural and modern activity. A high degree of ferrous responses has impacted the results particularly on the perimeter of the survey areas.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Cotswold Archaeology on behalf of Rosconn Strategic Land to undertake a geophysical survey on a c.2.1ha area of land at Standlake Road, Ducklington, West Oxfordshire (SP 3627 0719).

1.2. The geophysical survey will support proposals for residential development within the site. The requirement for geophysical survey has been specified by Hugh Coddington, Principal Archaeologist at Oxfordshire County Council.

1.3. The geophysical survey comprised hand-pulled, cart-mounted fluxgate magnetometer survey.

1.4. 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); and in accordance with the Method Statement prepared for, and approved by, Hugh Coddington on 26 March 2018.

1.5. The survey commenced on 4 April 2018 and was completed the following day.

2. Quality Assurance

2.1. 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 (2014) and the European Archaeological Council (Schmidt et al., 2015); and in accordance with the Method Statement prepared for, and approved by, Hugh Coddington on 26 March 2018.

2.2. 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).

2.3. Director Graeme Attwood is a Member of CIfA, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of the International Society for Archaeological Prospection.

2.4. 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. A heritage desk-based assessment prepared by Cotswold Archaeology (Pratt 2018; Report No. 18044) has established that the buried archaeological remains of a partially-excavated Romano-British farmstead are likely to survive within the survey area. The geophysical survey aimed to further assess the subsurface archaeological potential of the survey area; specifically, regarding the location and extent of the probable Romano-British farmstead and other features.

4. Geographic Background

4.1. The site is located on the eastern edge of Ducklington, north of the A415, 2.8km southeast of Witney, Oxfordshire (Figure 1). Survey was undertaken across three pasture fields containing sheep, each field was bounded entirely by wire fences. The A415 runs adjacent to the southern boundary of the site, Standlake Road borders the north, some houses off Standlake Road back onto the site (Figure 2). The topography of the site was generally flat, and ground conditions slightly wet and only soft and muddy in small patches.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Flat, pasture field with muddy patches on the east and west boundaries near the gateways. A depression was present in the topography in the central of the area.	Two large metal feed troughs were present in the western half of the area, while metal gateways were present on the east and west boundaries. The area was bounded by wire fences.
2	Flat, pasture field with muddy patches on the east and west boundaries near the gateways.	A number of large metal feed troughs were present in the eastern half of the area, while metal gateways were present on the east and west boundaries. The area was bounded by wire fences.
3	Flat, pasture field with a muddy area on the western boundary at the gateway.	A metal gateway was present on the western boundary. The area was bounded by wire fences.

4.3. The underlying geology comprises Oxford clay formation and West Walton formation (undifferentiated) mudstone. Superficial deposits of Northmoor sand and gravels are present across most of the site, with a small section in the centre of site having no superficial deposits recorded (British Geological Survey, 2018).

4.4. The soils consist of freely draining lime-rich loamy soils (Soilscapes, 2018).

5. Archaeological Background

5.1. The following archaeological background summarises a heritage desk-based assessment produced by Cotswold Archaeology (Pratt 2018; Report No. 18044). Cropmarks within the survey area appear to reflect one or two Romano-British trackways or boundary ditches, with the northern edge of two adjoined rectilinear enclosures present at the southern extent of the central field. These cropmarks extend under the road and into the field to the south. Excavation prior to the construction of the Standlake Road both within the bypass corridor and the central and eastern fields of the survey area revealed pits, ditches, post holes and pottery sherds from the mid-3rd century to the 5th century AD. In the western field the 1921 OS map depicts a circular earthwork, identifiable in historic aerial photographs and identified by the Thames Valley NMP as former gravel pits. Immediately to the east of the survey area excavations prior to the Standlake Road bypass identified a grave pit with two young adults, one child and finds dating from the 7th century AD.

5.2. In close proximity to the survey area an archaeological evaluation to the north of Standlake Road revealed a probable sunken-feature building containing Late Saxon pottery, which was likely associated with an adjacent grave, possible trackway, ditch, gully and posthole features. Further to the north, on the edge of Ducklington, gravel extraction revealed two burials with grave goods attributed to the 7th century AD just east of St Bartholomew's Church. To the south of the survey area cropmarks appear to highlight possible Bronze to Iron Age ring ditches, field boundaries, and trackways just to the west of Home Farm.

5.3. Historic maps for the area date back to Davis's Map of Oxfordshire from 1797. This map depicts a loose collection of buildings in the approximate location of the survey area. A Tithe Map from 1838 shows four separate arable fields extending southwards from the survey area, and a structure fronting Standlake Road in the central field. In the first edition OS map field boundaries surrounding the survey areas change, but not within the site itself. In the OS map of 1921 the structure in the central field has been demolished, and a dwelling known as the Red Lodge was constructed on the boundary between this and the easternmost field. Two bungalow dwellings are identifiable in the OS map for 1971-73 and third was added between 1983 and 1991. Standlake Road bypass truncated the survey area from the fields to the south in 1974.

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-pulled cart system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna 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 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 upper and/or 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 8). 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, and soil and geology maps. Google Earth (2018) was consulted as well, to compare the results with recent land usages.

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 (Figure 6) and historic maps (Figure 7).

7.2.2. The fluxgate magnetometer survey has generally responded well to the survey area's environment; however, the results have been affected by the large amount of ferrous present on the site. The field boundaries comprising wire fencing and metal feeding troughs across the site have produced broad, and magnetically strong, responses which may have masked weaker anomalies if any were present. The superficial geology across much of the site comprises sands and gravels. The anomalous responses caused by the magnetic variation within the geology are very similar in form and magnitude to what would be expected of archaeological features, this similarity has further complicated the interpretation. A confident classification for some of the anomalies has proved difficult resulting in the classification of 'Undetermined'; however, given the context it is likely that some of these anomalies will be archaeological in origin. Despite these conditions, the survey has detected numerous archaeological anomalies throughout site.

7.2.3. The survey has revealed the archaeological features outlined in section 5.1, including the ditches and possible trackways associated with the Romano-British farmstead identified by the previous archaeological investigations undertaken ahead of and during the construction of the Standlake Road bypass in the 1970s. The geophysical survey results show numerous linear ditch-like anomalies, some of which may form part of enclosures. Other responses of probable archaeological origin possibly represent internal features of these enclosures, including some divisions and pit-like anomalies. Some agricultural responses have also been identified on the site representing past ploughing regimes.

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. **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.

7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated deposition of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Archaeology** – The western half of Area 2 is densely packed with probable archaeological features; however, broad linear ditch-like responses have been recorded across most of the site. The majority of these linear features follow a general NW-SE orientation or run perpendicular to ditches on this alignment. These ditch-like anomalies comprise strong positive magnetic responses caused by the ditch fill being more magnetically enhanced than the surrounding subsoil. The strength of these anomalies suggests prolonged and repeated use of these ditched anomalies.

7.3.2.2. A long linear anomaly [**1a**, **2a**], *c.*82m in length, spans the eastern half of Area 1 and the southwest corner of Area 2, the full extent of this linear response may have been masked by the broad ferrous anomalies on the boundaries of the site. A perpendicular linear response [**2b**], measuring *c.*52m, abuts [**2a**]; together these appear to delineate the southern and eastern edges of a possible enclosure or boundary ditch. There may be a return response on the north of [**2b**], however the results here, [**2c**], are less clearly defined. The possible enclosure formed by [**2a**, **2b**, and **2c**] contains a number of internal features including several pit-like anomalies measuring *c.*2m in diameter [**2d**]. A possible partial enclosure [**2e**], measuring at least 12m in diameter (with the western edge obscured), is adjoined to the northern boundary of the larger enclosure. An internal ditch-like response running parallel to [**2a**] has also been identified which may have been a sub-division of the large enclosure. This is situated approximately 12m north of [**2a**] and measures 30m in length, though again its

true extent has likely been masked by ferrous anomalies and the limit of the survey area.

7.3.2.3. A second possible enclosure is located on a parallel alignment *c*.7m west of the first, this contains significantly fewer internal features and may measure approximately 50m x 40m. This second enclosure is comprised of several ditch-like features, [**2f**] and possibly [**2g**]. [**2g**] is isolated from the rest of the ditch-like features and it is conceivable that it does not represent the terminus of the possible enclosure, however the alignment of this linear feature would suggest it has some relationship with the other ditched anomalies on the site.

7.3.2.4. Other anomalies marked as "Probable Archaeology" have a similar strength of magnetic enhancement and linear ditch-like form. Those south and west of [**1a**] in Area 1 are slightly weaker in magnitude but follow the same NW-SE alignment. The weaker response in this area could be due to its placement slightly apart from the foci of archaeological activity on the site, known as the habitation effect. The "Possible Archaeology" classification has been used where the anomalous responses are more amorphous in form or have a weaker level of enhancement, it is likely these represent archaeology however other origins cannot be ruled out.

7.3.2.5. **Undetermined** – Weak linear anomalies classified as undetermined in Area 2 may be agricultural in origin, given their parallel formation and the presence of former ploughing regimes in other areas of the site. However, given the proximity to archaeological anomalies and the relatively wide spacing of the linear responses an archaeological origin is possible.

7.3.2.6. **Agricultural** - A series of parallel linear anomalies have been identified in the east of Area 1, these likely represent a former ploughing regime on a sub north-south alignment. Area 3 contains a similar, though weaker, series of parallel linear trends but on a NW-SE alignment.

7.3.2.7. **Ferrous** – The broad dipolar anomalies present across the site relate to wire fences on the perimeter of the surveys areas, or metal feeding trough within the fields. The small area of ferrous spread correlates with a slight depression visible on the ground surface, this may be related to the gravel pit referenced in section 5.1 as it is located in the approximate recorded position.

8. Conclusions

8.1. The fluxgate gradiometer survey has responded well to the environment of the survey area. The presence of wire fences surrounding each field and metal feeding troughs across the site have produced strong broad responses; these, as well as the superficial geology of sands and gravels has affected the results to some degree. Despite this, an extensive set of archaeological remains have been detected. As described by previous archaeological evaluations on the site a number of ditches and possible enclosures are present.

8.2. Ditch-like linear features have been identified with significant magnetic enhancement suggesting prolonged and repeated use. The alignment of these ditched anomalies suggests two large but closely spaced enclosures. The western enclosure contains a number of internal features including pit-like anomalies, a linear ditch-like response and a possible small internal enclosure adjoined to the northern edge. The southern boundary ditch of this enclosure extends west into the neighbouring field, the full extent has likely been obscured by the ferrous anomalies on the perimeter of the areas. The eastern possible enclosure has fewer internal features, and the anomaly suggested to form its eastern extent is uncertain due to its relative isolation from the other ditched anomalies forming the possible enclosure.

8.3. Other responses on the site relate to agricultural use in the form of former ploughing regimes, or modern activity, with an area of ferrous spread likely linked to a gravel pit noted on historic mapping.

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.

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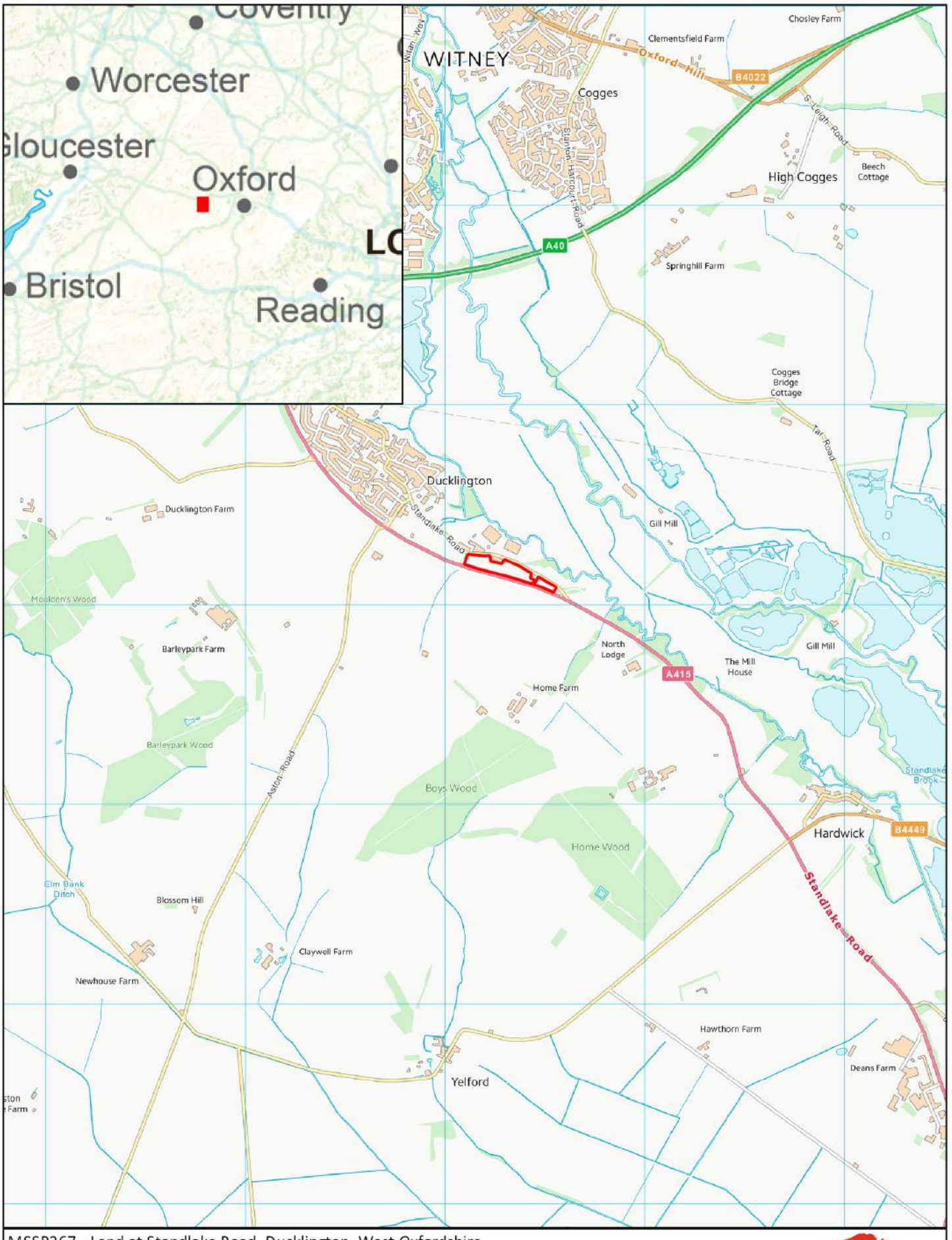

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys

208000
436000
437000
208000
Ducklington
Standlake Road
Gill Mill
Area 1
Area 2
Area 3
207000
207000
North

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 2 - Location of Survey Areas
1:5000 @ A3

Survey Extents

N

0 150 300 450 m

magnitude surveys

436100 436200 436300 436400 436500 436600

207300

207200

207100

Area 1

Area 2

Area 3

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1500 @ A3

48,997 nT 49,005

N

0 20 40 60 m

magnitude surveys

436100 436200 436300 436400 436500 436600

207300 207200 207100

Area 1

Area 2

Area 3

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 4 - Magnetic Gradient
1:1500 @ A3

-2 nT 3

N

0 20 40 60 m

magnitude surveys

436100 436200 436300 436400 436500 436600

207300 207200 207100

Area 1

Area 2

Area 3

1a

2a 2b 2c 2d 2e 2f 2f 2g

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 5 - Magnetic Interpretation
1:1500 @ A3

Archaeology Probable (Strong)
Archaeology Probable (Weak)
Archaeology Probable (Trend)
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Agricultural (Weak)
Agricultural (Trend)
Undetermined (Strong)
Undetermined (Weak)
Ferrous (Dipolar)
Ferrous (Spread)/Magnetic Disturbance

N

0 20 40 60 m

magnitude surveys

436100 436200 436300 436400 436500 436600

207300 207200 207100

Area 1

Area 2

Area 3

1a

2a 2b 2c 2d 2e 2f 2f 2g

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:1500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Trend)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Agricultural (Trend)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance

N

0 25 50 75 m

magnitude surveys

436000 436100 436200 436300 436400 436500 436600 436700

207400 207300 207200 207100 207000

255

F.B.

Ducklington Mill

W

F.B.

B.M. 251·5

Area 1

1a

Area 2

2a 2b 2c 2d 2e 2f 2f 2g

Area 3

249

MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 7 - Magnetic Interpretation Over Historic Maps
1:2000 @ A3

Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Trend)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Weak)
- Agricultural (Trend)
- Undetermined (Strong)
- Undetermined (Weak)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance

N

0 20 40 60 m

magnitude surveys

436100
436200
436300
436400
436500
436600
207300
207200
207100
Area 1
Area 2
Area 3
MSSP267 - Land at Standlake Road, Ducklington, West Oxfordshire
Figure 8 - Magnetic XY Trace Plot
30nT/cm at 1:1500 @ A3

N
0
20
40
60 m
magnitude surveys