Geophysical Survey Report

Gosforth Site, Bicester Road, Kidlington, Oxfordshire

For

Pre-Construct Archaeology Ltd

On Behalf of

Hill

Magnitude Surveys Ref: MSSP1470

HER Event Number: TBC

March 2023

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of c. 4.3ha of land at Kidlington, Oxford. A fluxgate gradiometer survey was conducted across the survey area and identified anomalies of agricultural, undetermined and modern origin. Modern interference around field edges and a pylon was identified, however, this has not impeded interpretation. Agricultural anomalies in the form of ridge and furrow trends have also been identified within the survey area. Weak curvilinear anomalies were also identified across the south of the survey area, and do not appear to form any coherent shapes. They are likely to be modern or agricultural in origin, but an archaeological origin cannot be fully ruled out.

Contents

List of Figures

1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Pre-Construct Archaeology Ltd to undertake a geophysical survey over a c. 4.3ha area of land arable land at Water Eaton Lane, Kidlington, Oxford, Oxfordshire (SP 50237 13146).

1.2. The geophysical survey comprised quad towed GNSS-positioned fluxgate gradiometer survey. 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 (Dacre, 2022).

1.5. The survey commenced on 17th February 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 has served as 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 Chair of the Archaeological Prospection Community 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. 1.15km to the southeast of the centre of Kidlington (Figure 1). Gradiometer survey was undertaken across one field under arable cultivation. The survey area is bordered by Bicester Road to the west, by a housing estate to the north, by Water Eaton Lane to the east, and by further arable fields to the south.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The area consisted of a flat arable field.	The northern boundary was formed by a wooden residential fence. The site was bordered to the east by a hedge and metal fence, to the west and southwest by a hedge, and to the south by a ditch. A pylon was located in the centre of the field, with overhead cables running northeast to southwest.

4.3. The underlying geology comprises mudstone of the Oxford Clay Formation and West Walton Formation. Superficial deposits are recorded in the northeast of the survey area as alluvial clay, silt, sand and gravel deposits (British Geological Survey, 2022).

4.4. The soils in the survey area consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (Soilscapes, 2022).

5. Archaeological Background

5.1. The following is a summary of a desk-based assessment of Gosforth Site, Bicester Road, Kidlington, produced and provided by Pre-Construct Archaeology (Koussiounelos, 2017).

5.2. Roads of presumed Roman origin have been recorded around the survey area, one of which is represented by Oxford Road c. 550m to the southwest of the survey area. No further evidence of Roman activity has been identified within or surrounding the survey area.

5.3. Medieval farming activity has been recorded in the fields immediately south and north of the survey area in the form of a ploughing system and ridge and furrow cultivation respectively.

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. 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.

6.1.3. 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

6.1.4. The magnetic data were collected using MS' bespoke quad-towed cart system.

6.1.5. MS' cart 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.

6.1.5.1. 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.

6.1.5.2. 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, 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 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 and historical maps (Figure 7).

7.2.2. A fluxgate gradiometer survey was successfully completed across the survey area and identified anomalies of agricultural, undetermined and modern origins. The impact of modern interference is limited to the edges of the field, and around a pylon.

7.2.3. Anomalies of agricultural origin have been identified across the survey area in the form of weak linear anomalies that do not correlate with any features visible on historical maps or satellite images (Figure 7). Due to their parallel, linear morphology, regular spacing and correlation with identified field boundaries, these have been given the classification of ridge and furrow.

7.2.4. Across the south of the survey area, weak curvilinear anomalies were identified (Figure 5). These anomalies do not appear to correspond with any anomalies visible on satellite imagery or historical mapping, and while it is likely that they are agricultural or modern in origin, an archaeological origin cannot be fully 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. **Ridge & Furrow (Trend)** – Weak parallel linear anomalies have been identified across the entirety of the survey area, running on an approximately east to west orientation (Figure 5). These anomalies are characteristic of ridge and furrow cultivation, which had previously been identified close to the survey area (Section 5.4).

7.3.2.2. **Undetermined (Weak)** – In the south of the survey area, four weak curvilinear anomalies have been detected (Figure 5). These anomalies have no specific shape, and do not correspond with any features visible on available mapping. Due to the lack of certainty, they have been classified as undetermined.

8. Conclusions

8.1. A geophysical survey was undertaken across the survey area at Kidlington, Oxford, and successfully identified anomalies of agricultural, undetermined and modern origin. The impact from modern disturbance can be seen at field boundaries and around a pylon; however, this has had no significant impact on interpretation.

8.2. Anomalies of an agricultural origin have been identified in the form of ridge and furrow cultivation.

8.3. Anomalies were identified in the south of the survey which have no distinct shape, due to the lack of certainty, they have been classified as undetermined.

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

British Geological Survey, 2023. Geology of Britain. Kidlington, Oxfordshire. [http://mapapps.bgs.ac.uk/geologyofbritain/home.html/]. Accessed 22/02/2023.

Chartered Institute for Archaeologists, 2020. Standards and guidance for archaeological geophysical survey. CIfA.

Dacre, E., 2022. Written Scheme of Investigation for a Geophysical Survey of Kidlington, Oxfordshire. MSSP1470. Magnitude Surveys Ltd.

David, A., Linford, N., Linford, P. and Martin, L., 2008. Geophysical survey in archaeological field evaluation: research and professional services guidelines (2nd edition). Historic England.

Google Earth, 2023. Google Earth Pro V 7.1.7.2606.

Koussiounelos, D., 2017. Gosforth Site, Bicester Road, Kidlington: A Desk-Based Assessment. Pre-Construct Archaeology. PCA Report Number: R12999.

Olsen, N., Toffner-Clausen, L., Sabaka, T.J., Brauer, P., Merayo, J.M.G., Jorgensen, J.L., Leger, J.M., Nielsen, O.V., Primdahl, F., and Risbo, T., 2003. Calibration of the Orsted vector magnetometer. Earth Planets Space 55: 11-18.

Schmidt, A. and Ernenwein, E., 2013. Guide to good practice: geophysical data in archaeology (2nd edition). Oxbow Books: Oxford.

Schmidt, A., Linford, P., Linford, N., David, A., Gaffney, C., Sarris, A. and Fassbinder, J., 2015. Guidelines for the use of geophysics in archaeology: questions to ask and points to consider. EAC Guidelines 2. European Archaeological Council: Belgium.

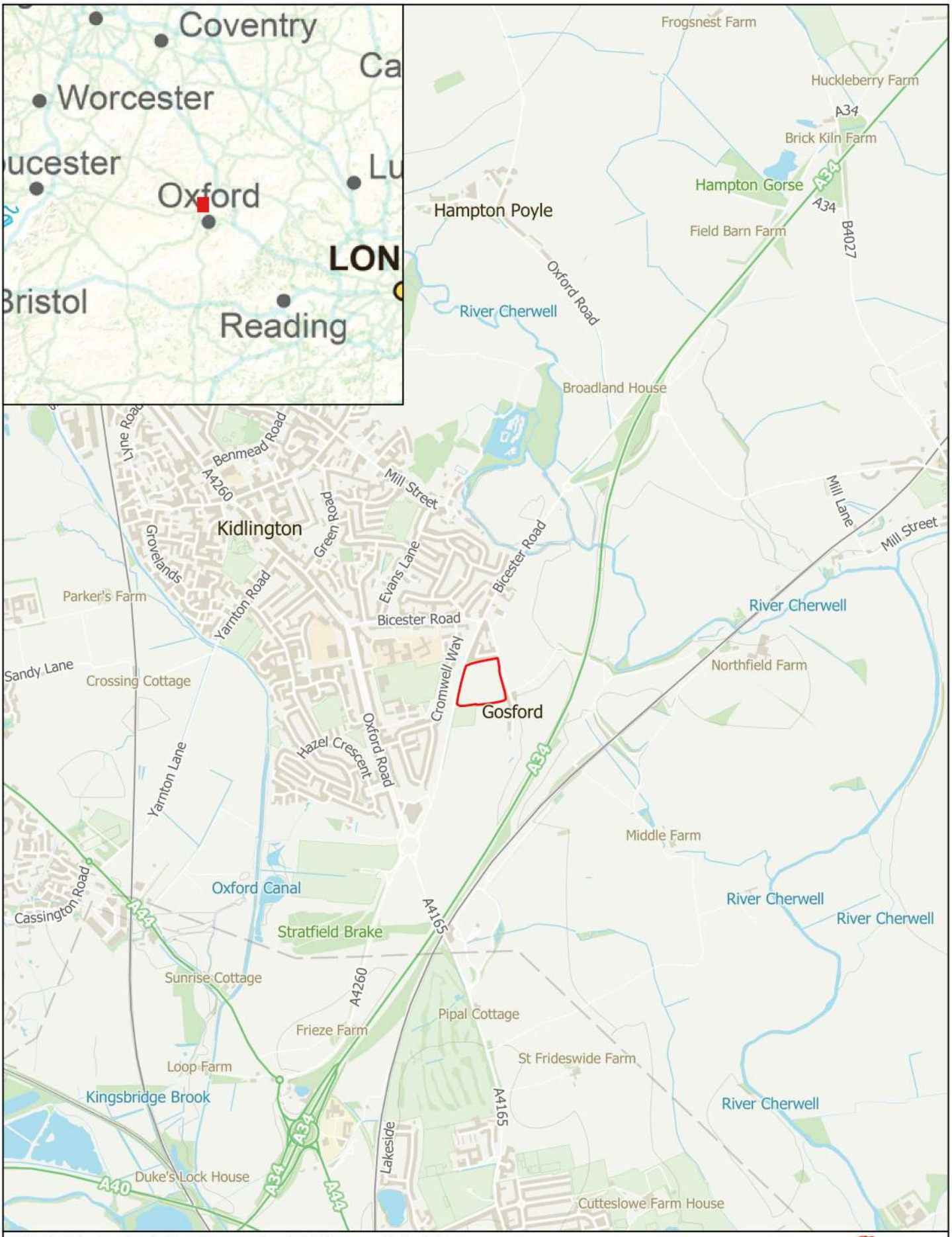
Soilscapes, 2023. Kidlington, Oxfordshire. Cranfield University, National Soil Resources Institute. [http://landis.org.uk]. Accessed 22/02/2023.

12. Project Metadata

MS Job Code	MSSP1470
Project Name	Geophysical Survey Report of Kidlington, Oxfordshire
Client	Pre-Construct Archaeology Ltd
Grid Reference	SP 50237 13146
Survey Techniques	Magnetometry
Survey Size (ha)	4.3ha (Magnetometry)
Survey Dates	17/02/2023
Project Lead	Jake Dolan BSc FGS
Project Officer	Jake Dolan BSc FGS
HER Event No	TBC
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.2

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Officer to Review	JH	AL	01 March 2023
0.2	Corrections from Project Officer	AL	PSJ	07 March 2023



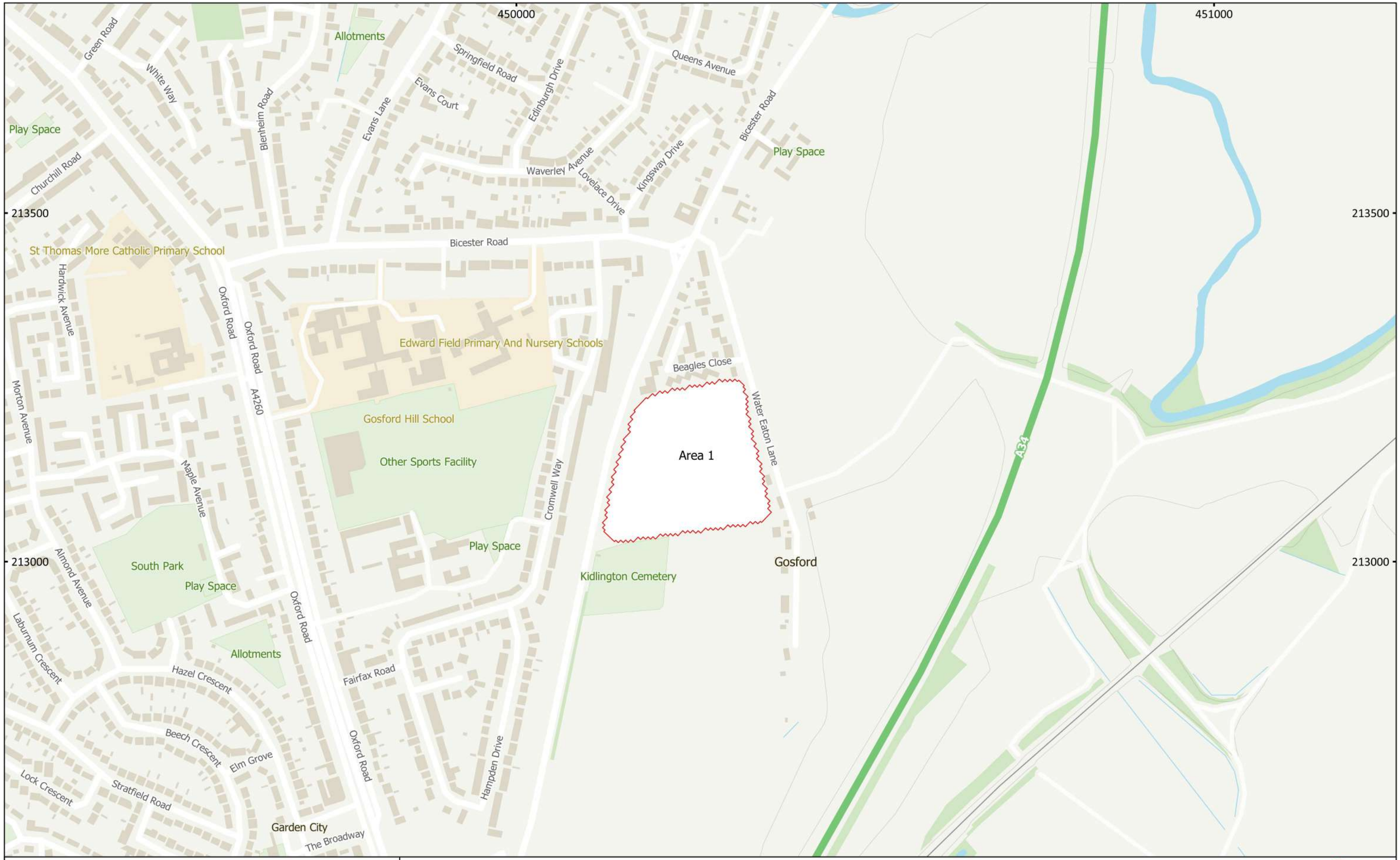
MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys



MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 2 - Location of Survey Area
1:5,000 @ A3

Surveyed Extent

N

0 150 300 450 m

magnitude surveys

450000
450200
450400
213200
213200
213000
213000
Cleveland Close
Beagles Close
Cromwell Way
Water Eaton Lane
Play Space
Kidlington Cemetery
Gosford
Area 1

MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,500 @ A3

48,997 nT 49,005

N

0 50 100 150 m

magnitude surveys

MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 4 - Magnetic Gradient
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

450000
450200
450400
213200
213000
Cleveland Close
Beagles Close
Cromwell Way
Water Eaton Lane
Play Space
Area 1
Gosford
Kidlington Cemetery

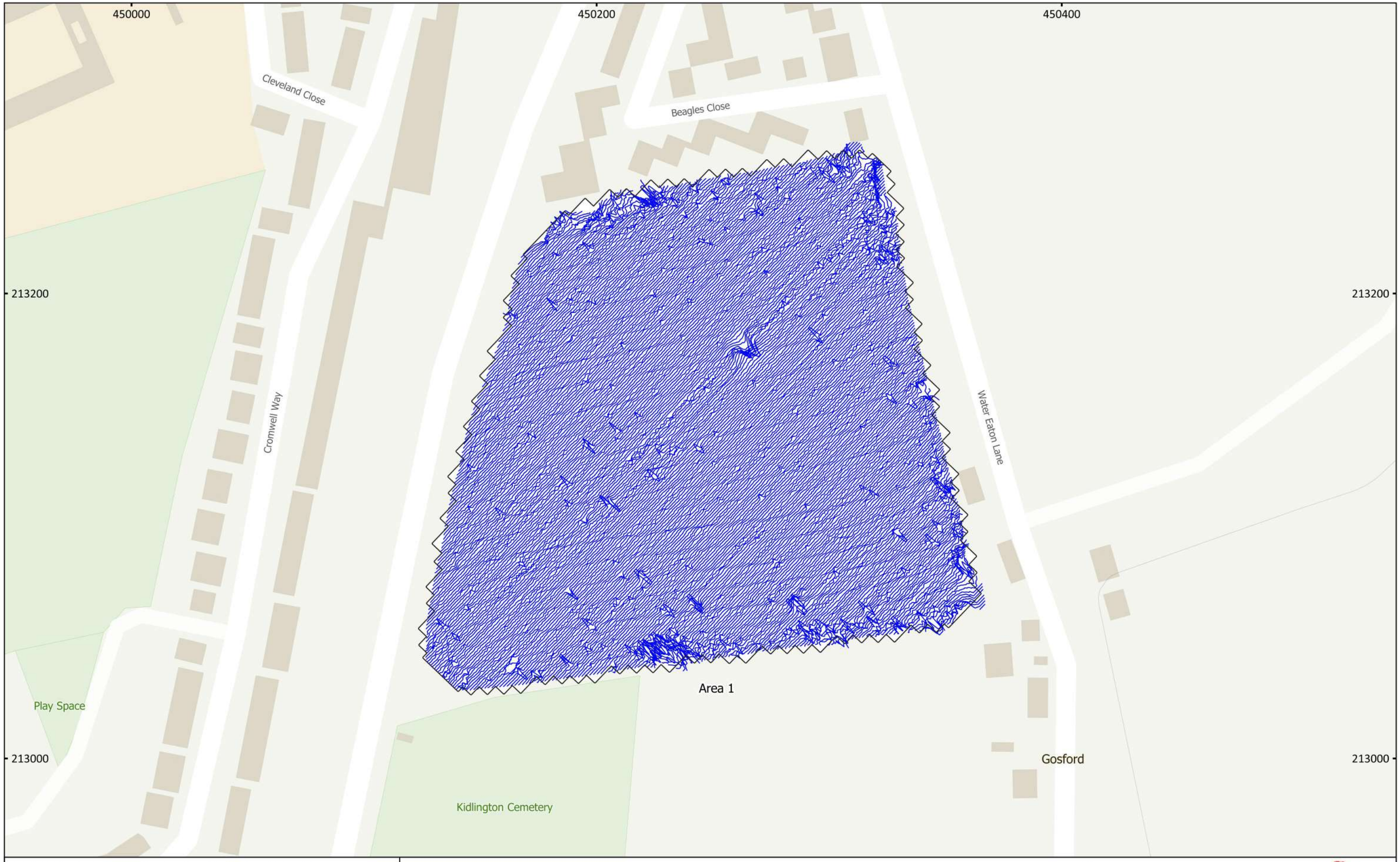
MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 5 - Magnetic Interpretation
1:1,500 @ A3

- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Weak)
- Ridge and Furrow (Trend)
- Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys



MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 6 - XY Trace Plot
30nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

magnitude surveys

449800 450000 450200 450400 450600 450800

213400 213200 213000 212800

Area 1

MSSP1470 - Gosforth Site, Bicester Road, Kidlington, Oxfordshire
Figure 7 - Magnetic Interpretation Over Historical Maps and Satellite Imagery
1:3,000 @ A3

- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Undetermined (Weak)
- Ridge and Furrow (Trend)
- Ferrous (Spike)

N

0 100 200 300 m

magnitude surveys