Geophysical Survey Report

of

Land off Bury Road, Woolpit

For

CgMs Heritage (part of the RPS group)

On Behalf Of

Hopkins Homes Ltd

Magnitude Surveys Ref: MSTL310

HER Parish Code: WPT 059

OASIS ID: magnitud1 - 317947

June 2018

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Report Issued:

14 June 2018

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.19ha area of land off Bury Road, Woolpit, Suffolk. A fluxgate magnetometer survey was successfully completed and no anomalies of probable or possible archaeological origin were identified. The geophysical results primarily reflect agricultural activity, with possible changes in field structure and layout present. Throughout the site several responses correlate with former field boundaries and have been categorised as such. Further linear features have been identified, while these are in alignment with the mapped boundaries they themselves do not appear on the available historic mapping, it is likely that these reflect unmapped boundaries. Further anomalies indicative of natural variation and extant ferrous items have also been detected, while a large highly magnetic anomaly in the centre of Area 2 possibly represents a concrete base.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by CgMs Heritage (part of he RPS group) on behalf of Hopkins Homes Ltd to undertake a geophysical survey on a c.20ha area of land to the North of Woolpit, Mid Suffolk, Suffolk (TL 9718 6292).

1.2. The geophysical survey comprised hand-carried GNSS-positioned fluxgate magnetometer 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. The survey commenced on 29 May 2018 and took three 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. 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.

2.3. 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 geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located c25km northwest of Ipswich, Suffolk and immediately to the north of the village of Woolpit, Suffolk (Figure 1). The survey area was bounded by Elm Road to the west, The Street to the south west, a large agricultural field to the north, and a sports ground to the east by treelines. To the south and southeast the survey area is separated from a housing estate by a fence line. The site is split into two areas, Areas 1 and 2, these are separated by a field boundary marked by trees and hedges and a track running along the boundary in Area 2 (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Sloping gently downwards from the southern boundary, generally even underfoot.	Arable agricultural use under mature barley crop at the time of survey. Crossed west to east by power cables, just north of the southern boundary. Another power cable runs sub north-south along the eastern boundary of the area. Two bore holes are located towards the south western corner and another is located along the eastern boundary.
2	Generally flat terrain, which is even underfoot	Arable agricultural use, under mature bean crop. The west to east power cable noted for Area 1 extends into and beyond Area 2. One borehole is located along the western boundary and another is located towards the centre of the area.

4.3. The underlying geology of the southwest corner of Area 1 is undifferentiated chalk of the Lewes nodular, Seaford, Newhaven and Culver chalk formations, while the rest of site is underlain by sand of the Crag group. Along the southern boundary the superficial geology of the site is sand and gravel of the Croxton sand and gravel member, while the rest of the site to the north is underlain by diamicton of the Lowestoft formation (British Geological Survey, 2018).

4.4. The soils are freely draining, slightly acidic and sandy (Soilscapes, 2018).

5. Archaeological Background

5.1. The following archaeological background is summarised from a desk-based assessment provided by the client (Price 2018) with the addition of information about the site history supplied by the landowner during survey (Prior pers. comm.). Each heritage asset discussed below is quoted with the preferred Historic Environment reference in parentheses

5.2. Heritage assets noted within the survey area include a scatter of Medieval metalwork found through metal detecting towards the centre of Area 1 (WPT 032), towards the southeast corner of Area 2 are findspots of a small Bronze Age blade fragment and a Medieval lead scallop shaped ampulla (WPT 017). In the fields immediately surrounding the survey area several findspots have been recorded: a socketed Bronze Age axe fragment in field to the northeast (WPT 016), a scatter of Roman grey and Samian wares in a field to the north (WPT 015), and a Bronze Age sword findspot in the field to the west of the survey area (WPT 003).

5.3. In the wider landscape prehistoric activity is highlighted by a Palaeolithic flint hand axe findspot c.500m southwest of the survey area (WPT 006), Late Palaeolithic cattle and deer remains c.500m to the east, and scatters of flintwork c.680m to the north. Romano-British evidence in the wider landscape is restricted to findspots of coins (WPT 007, WPT 001), and an iron shackle (WPT 026).

5.4. Saxon and Early Medieval activity is also restricted to find spots of an Early Saxon hanging bowl c.790m northeast of the site (EWL 025) and a scatter of Late Saxon metalwork c.880m northeast of the site (EWL 025). Medieval activity is represented by a holy well (the Lady Well, a scheduled monument) and a moated site c.130m east of the site (WPT 002), a scatter of Metalwork c.790m to the northeast (EWL 025), and a thin spread of pottery and metal finds c.880m northeast of the site (EWL 010). The field pattern from historic map evidence suggests open strip fields over the site during the Medieval period. During survey, the landowner indicated the presence of a former well in Area 2 discovered during the installation of a field drain; this he believed to be the “Lord’s Well”, a counterpart to the Lady Well, however no documentary evidence can be found to support the existence of such a monument.

5.5. The earliest map evidence depicting field boundaries for the site is the 1845 Woolpit Tithe Map, highlighting narrow strips of land likely to result from the enclosure of a Medieval open-field system. Larger fields on the map are likely to reflect an amalgamation of the smaller field strips, while a trackway is shown to enter the site from the north east corner. In the 1st ed. OS map of 1889 the survey area is shown to encompass four larger fields. The present layout of two fields is identifiable, minus the farmyard in the northwest corner of Area 2, in an OS map from 1981. The farmyard buildings appear on aerial photographs of the site from 2000 on Google Earth, where an eastern segment of Area 1 appears to be covered in rectilinear structures. In present aerial images of the site the rectilinear structures are subsumed into Area 1.

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 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, 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 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, LiDAR data, 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 responded well to the survey area's environment. Survey results are relatively quiet, though anomalies reflecting a variety of origins have been detected throughout the data set. Broad weak anomalies and towards the south of Area 2, and in the southern and western parts of Area 1 reflect subtle variations in the survey area's sand and gravel superficial geology. Discrete small-scale pit-like variations in the soil and geology create a speckled effect throughout both survey areas. Ferrous interference from extant sources have largely been limited to the edge of the survey area and are represented by large strong ferrous 'halos'. The anomalies largely reflect modern metallic structures, including boundary fences, pylons, boreholes and neighbouring buildings (see 4.2). Small ferrous spikes can be seen throughout the dataset and reflect items of ferrous or fired material in the topsoil. A strong response along the western boundary of Area 2 and a weaker anomaly at the southern end of Area 1 correspond to the tarmacked farm track that runs through the site. Two anomalies show a response that is characteristic of a concrete base.

7.2.3. Anomalies of archaeological origins have not been identified from the survey results; however, the results do highlight the presence of former field boundaries identifiable on historic maps. The most prominent anomalies across the survey areas are linear anomalies that match well with the field boundaries recorded on the 1845 Tithe map. In addition to these are two roughly parallel linear anomalies in the north-east of Area 1; the southernmost of these seems to be a continuation of one of the boundaries noted on historic mapping and are likely to reflect unrecorded field divisions.

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. **Recorded Historic Field Boundaries –** Two linear positive magnetic anomalies orientated along an approximate north south axis reflect the remains of field boundaries recorded in the historic OS maps and the tithe map of 1845 (**1a**, **2a, 2c**). Further anomalies correspond with location and orientation of field boundaries noted in the tithe map and aerial photos (**1b, 2b**).

7.3.2.2. **Unrecorded Field Boundaries -** Two anomalies [**1c & 1d**] in the north-western part of Area 1 are classed as agricultural. While they do not correspond to any features recorded in historic mapping; the southernmost of these [**1c**] appears to be a continuation of the recorded field boundary immediately to its west, while [**1d**] occurs on the same orientation to [**1c**] approximately 50m to its north. It is possible that these represent earlier sub divisions of fields which have been removed to form larger plots of land by the time of the survey for the Tithe map.

7.3.2.3. **Possible Drain** – The southern half of the former boundary running approximately north-south through Area 2 [**2b**] shows a more enhanced character to the rest of the length [**2a**]; while on the site the landowner (Prior pers. Comm.) indicated to the field team that a field drain had been laid along the southern end the boundary, this boundary was extant until the early 1970s.

7.3.2.4. **Concrete Base** - A large, highly ferrous anomaly [**2d**] has been located in the vicinity of a 'well' discovered during excavation of the drain (7.3.2.3) (Prior pers. comm.), but the size, approximately 9-10m in diameter, and strength of this anomaly makes it unlikely to be a well or later capping thereof. Google Earth (2018) shows a sub-circular cropmark in this location, the LiDAR data (Price 2018) indicates a corresponding hollow. A similar anomaly [**1e**] had also been detected at the southern end of [**1a**], although the response is slightly confused by the location next to the metallic boundary fence, this may point to a different origin. The response form in both instance is similar to one expected of a concrete support structure.

7.3.2.5. **Farm Track** – The material used to form the existing farm track has created ferrous like anomaly along the length of track [**2e**]. A further length of the track is visible in the southern end of Area 1 [**1f**] although the response along this stretch is not as pronounced.

8. Conclusions

8.1. The survey has responded well to the survey conditions. A broad range of responses have been identified across the site, these largely reflect the agricultural use of the land including several former field boundaries, both mapped and unmapped. Further to these are numerous ephemeral and small-scale variations in the soil and geology. Ferrous anomalies from modern extant features have largely been restricted to the edges of the survey area. No anomalies of a possible or probable archaeological origin have been detected. A large, highly magnetic anomaly has been detected in Area 2, with a similar occurrence in Area 1 and may be indicative of a concrete base.

8.2. Field system changes have occurred throughout the site, the data shows clear linear trends across the survey area dissecting the field; many of which collocate with the historic mapping (Figure 7). A number of these linear anomalies, largely located in the north of site do not have any corresponding map evidence, however their alignment, orientation and anomaly form point these also being agricultural boundaries.

8.3. Anomalies indicative of small-scale natural variation within the soils and geology have been detected throughout the site and are characteristic of those detected over sands and gravel formations such as those at the site.

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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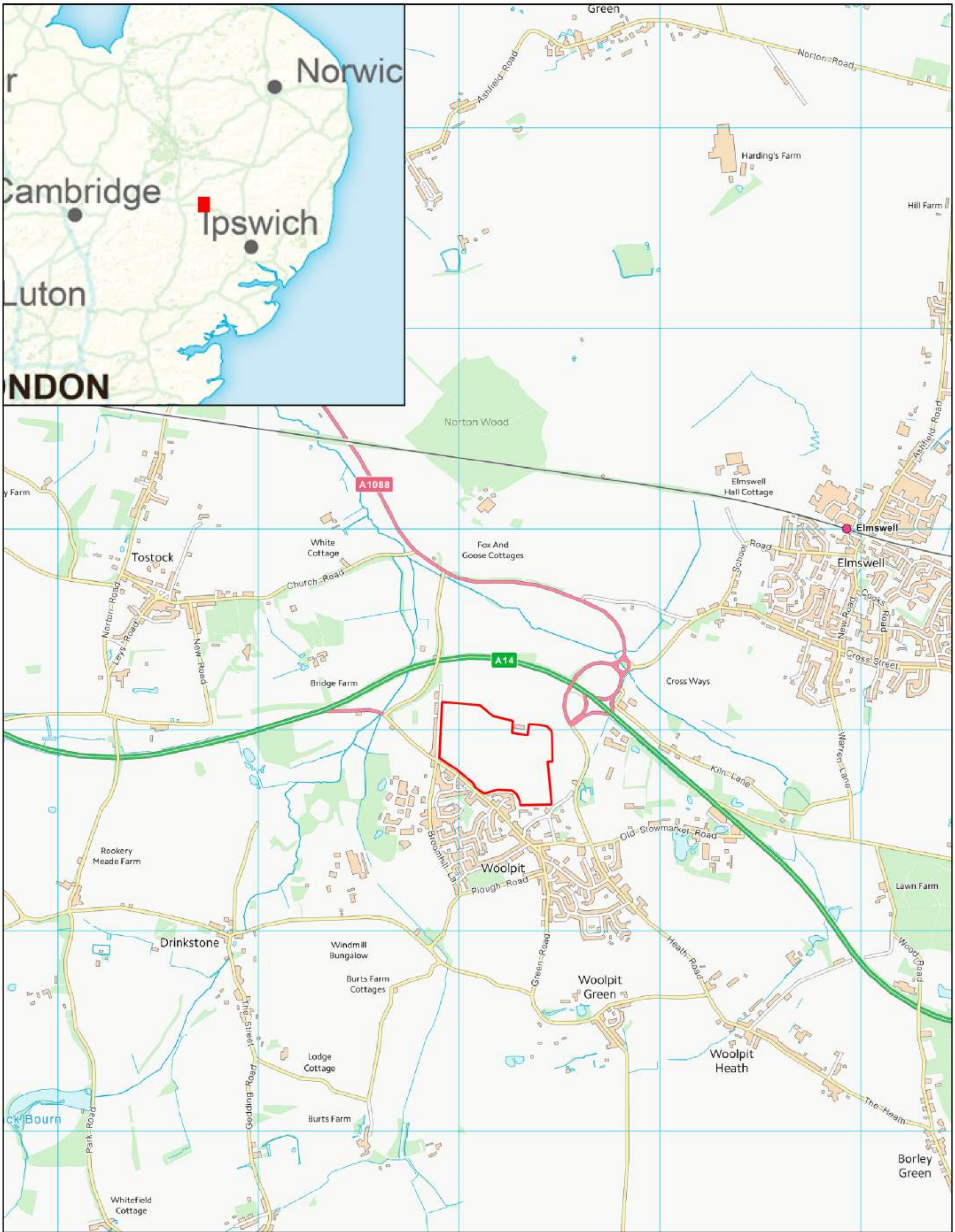
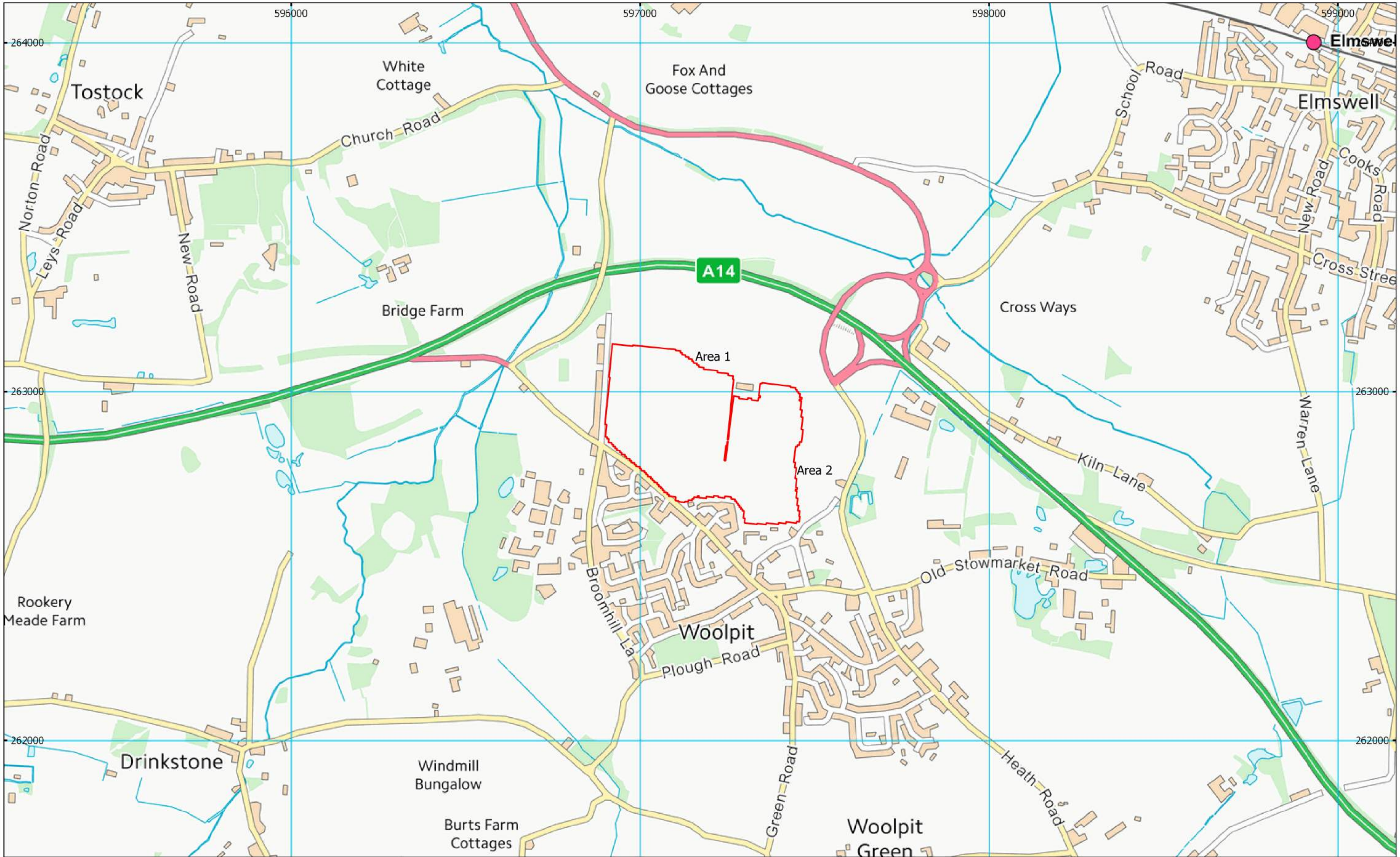
Soilscapes, 2018. [Woolpit, Suffolk]. Cranfield University, National Soil Resources Institute [http://landis.org.uk]. [Accessed 07/06/2018].



MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 1 - Site Location
1:25,000 @ A4

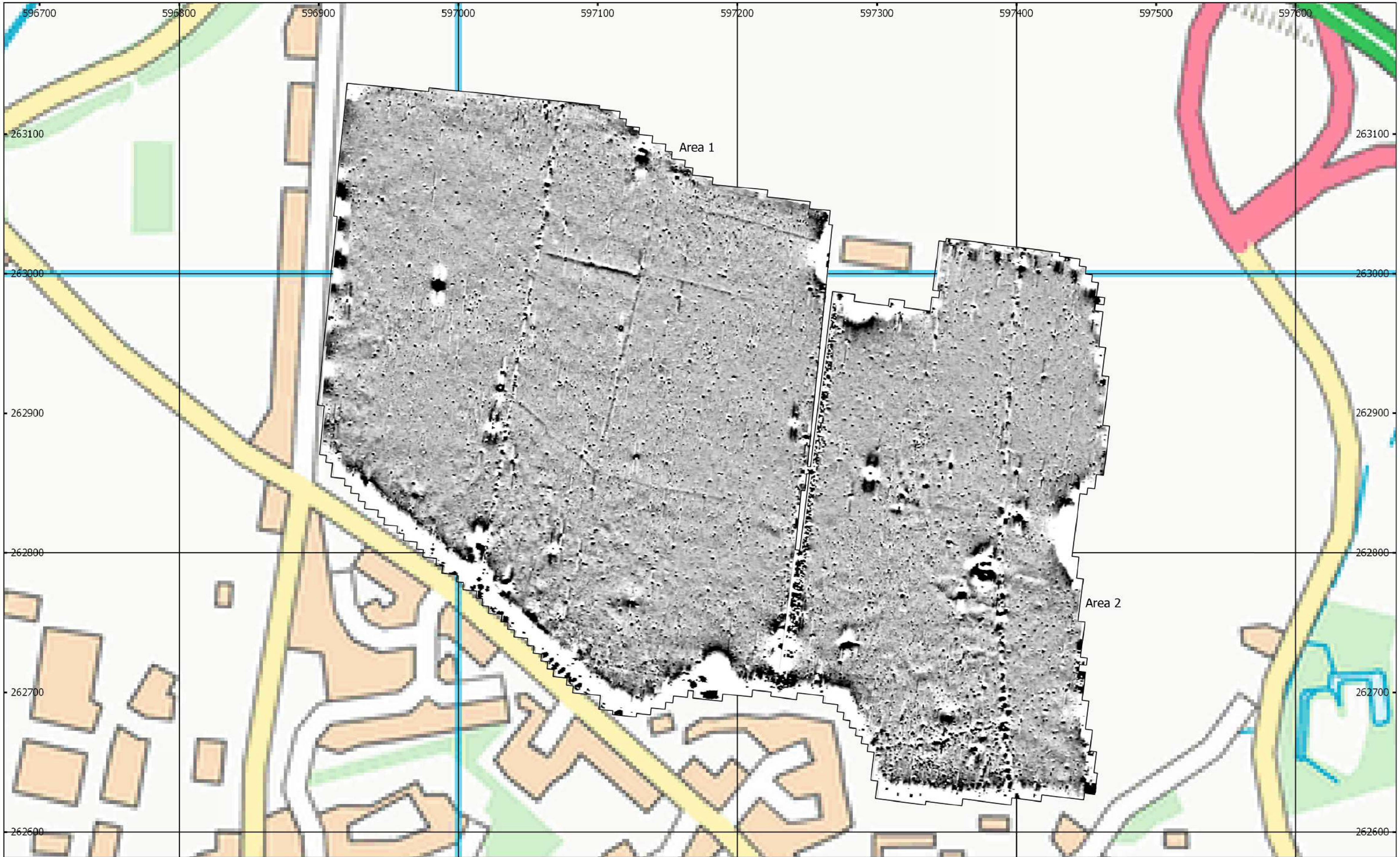
Site Boundary

magnitude surveys



MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 2 - Location of Survey Areas
1:10,000 @ A3

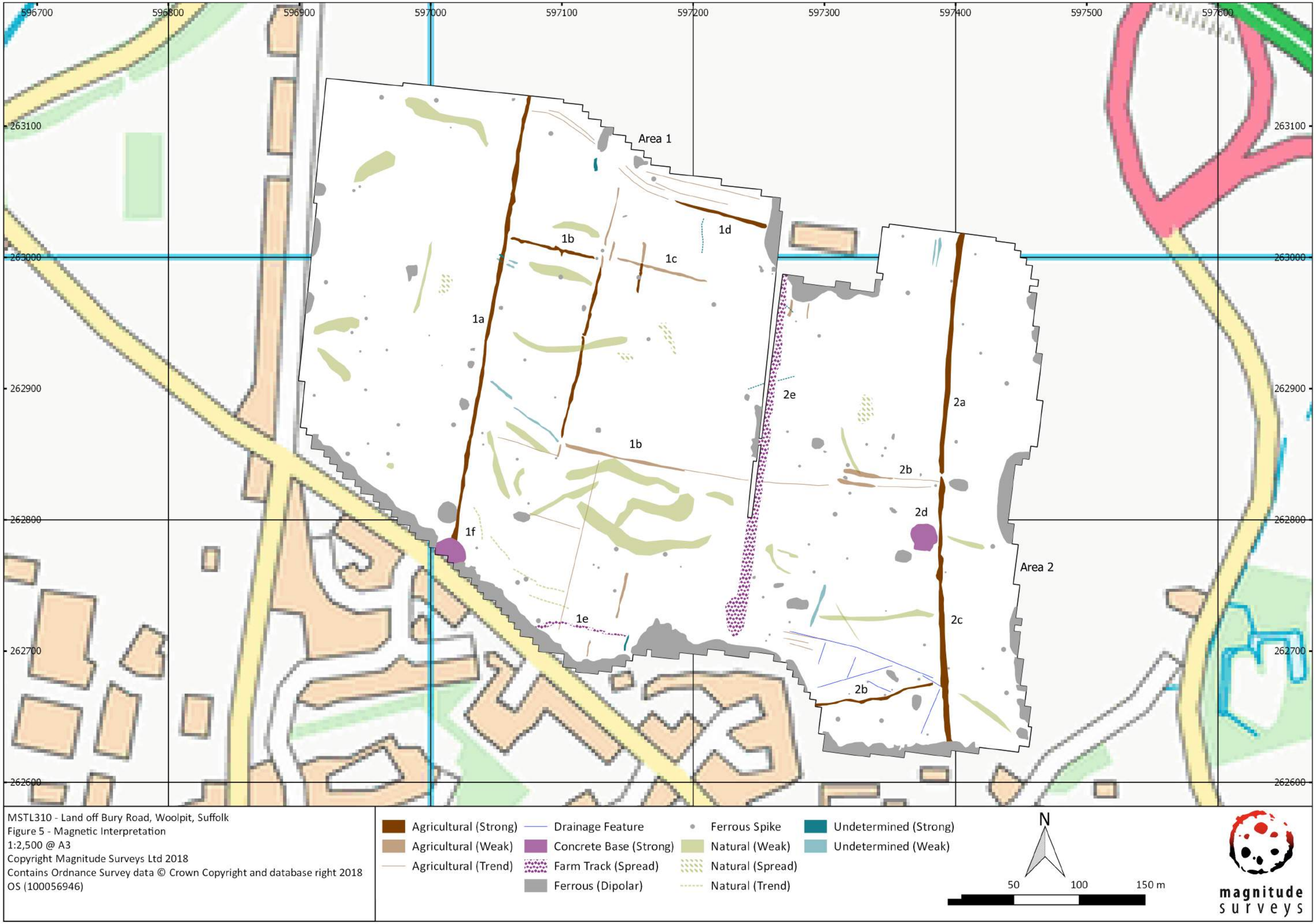
magnitude surveys



MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 3 - Magnetic Total Field (Lower Sensor)
1:2,500 @ A3

magnitude surveys

MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 4 - Magnetic Gradient
1:2,500 @ A3



MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 5 - Magnetic Interpretation
1:2,500 @ A3

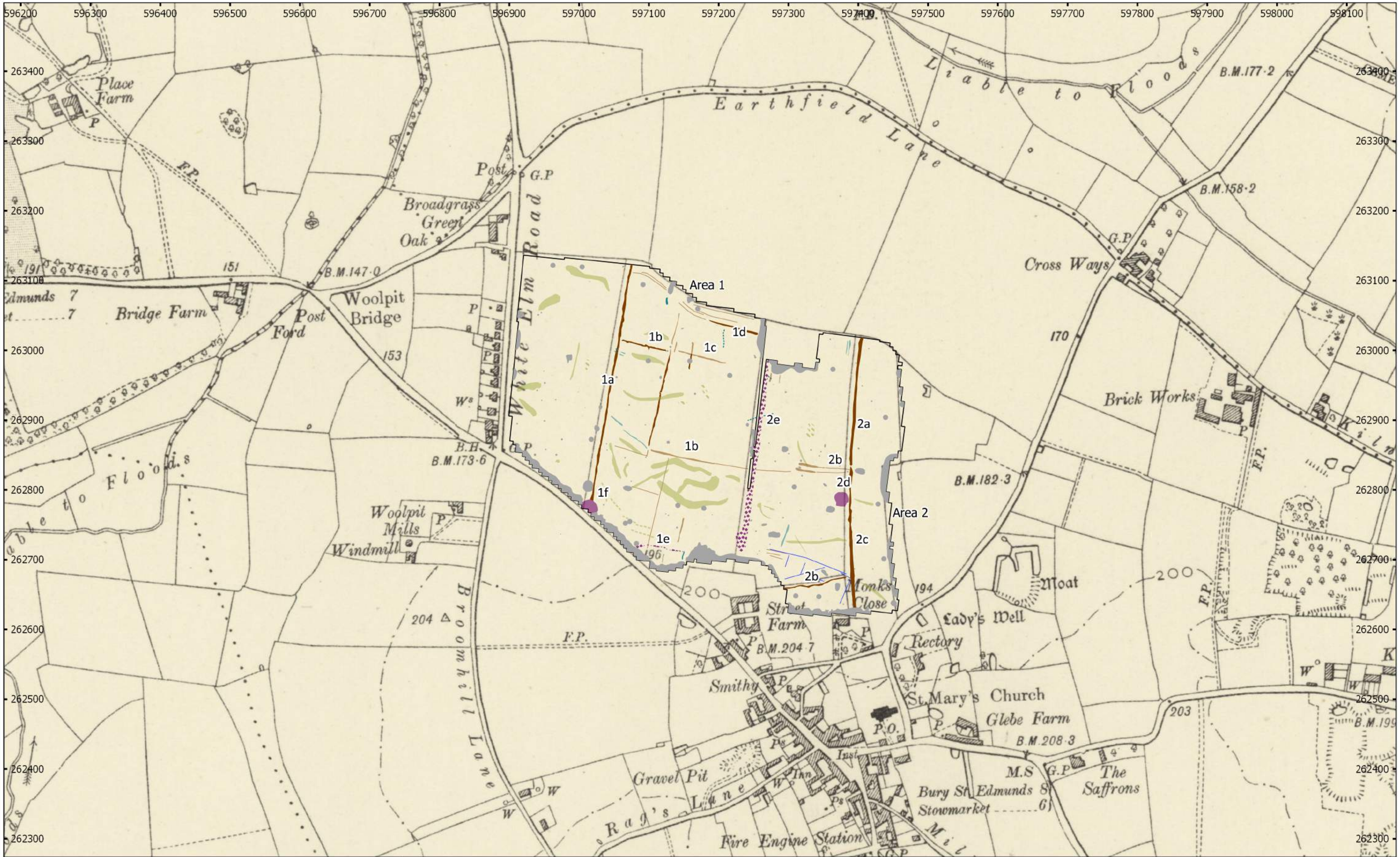
MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:2,500 @ A3

Agricultural (Strong)
Agricultural (Weak)
Agricultural (Trend)
Drainage Feature
Concretet Base (Strong)
Farm Track (Spread)
Ferrous (Dipolar)
Ferrous Spike
Natural (Weak)
Natural (Spread)
Natural (Trend)
Undetermined (Strong)
Undetermined (Weak)

N

0 50 100 150 m

magnitude surveys



MSTL310 - Land off Bury Road, Woolpit, Suffolk

Figure 7 - Magnetic Interpretation Over Historic Maps

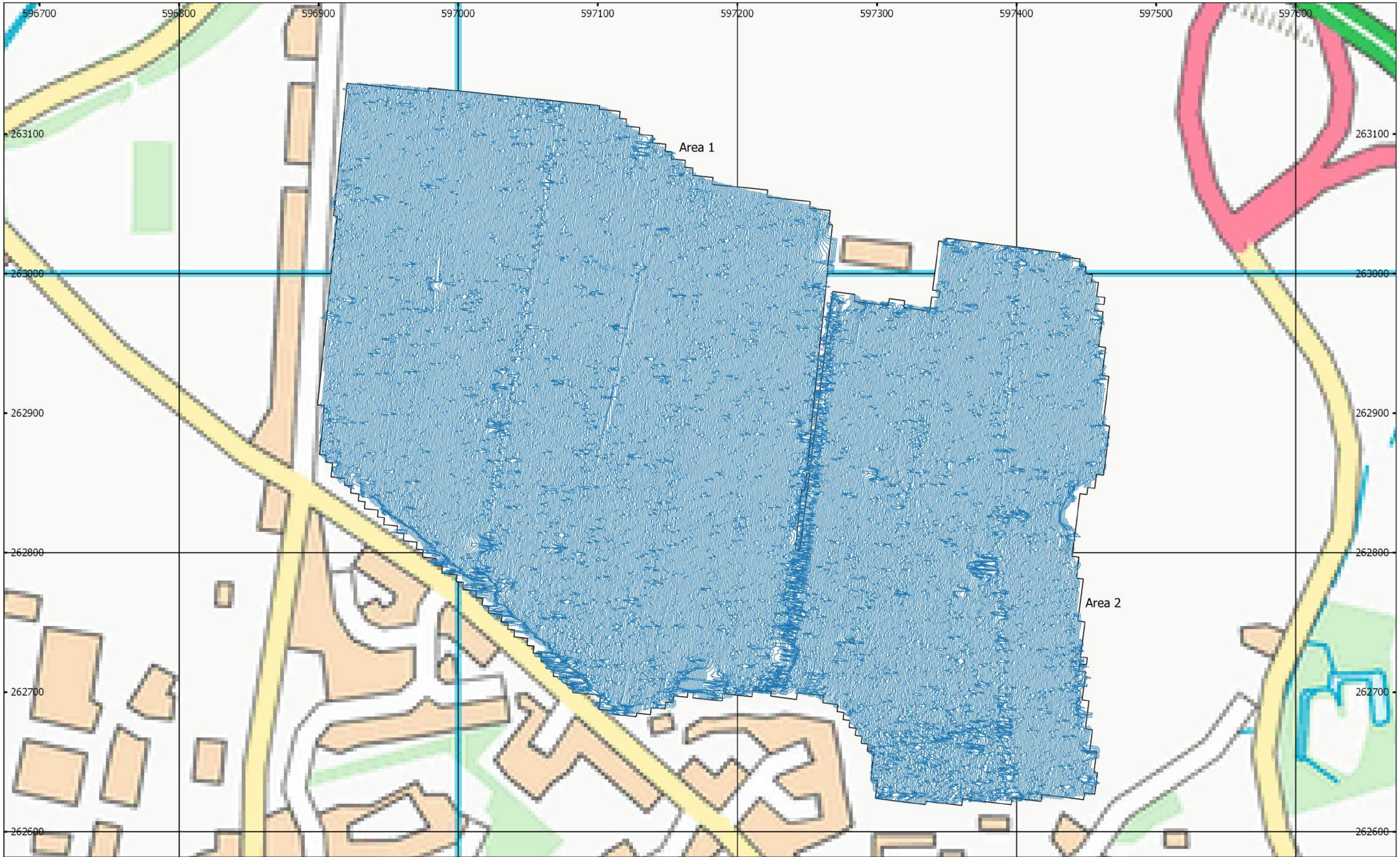
1:5,000 @ A3

- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Trend)
- Drainage Feature
- Concrete Base (Strong)
- Farm Track (Spread)
- Ferrous (Dipolar)
- Ferrous Spike
- Natural (Weak)
- Natural (Spread)
- Natural (Trend)
- Undetermined (Strong)
- Undetermined (Weak)

N

0 100 200 300 m

magnitude surveys



MSTL310 - Land off Bury Road, Woolpit, Suffolk
Figure 8 - XY Trace Plot
50nT/cm at 1:2,500 @ A3

magnitude surveys

12. Appendix 1

Method Statement

For a Geophysical Survey

of

Land North of Woolpit

Suffolk

For

CgMs Heritage (Part of the RPS Group PLC)

Magnitude Surveys Ref: MSTL310

May 2018

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Contents

1. Introduction

1.1. This document details a Method Statement for a geophysical survey by Magnitude Surveys Ltd (MS) for CgMs Heritage (Part of the RPS Group PLC). The survey comprises a c.19 ha area of agricultural land north of Woolpit, Suffolk (TL 9718 6292).

1.2. The geophysical survey will comprise hand-pulled/quad-towed, cart-mounted or hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK for 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 earth houses, and industrial activity (David *et al*., 2008).

1.3. The survey will be 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).

2. Objective

2.1. The objective of this geophysical survey is to assess the subsurface archaeological potential of the survey area.

3. Quality Assurance

3.1. 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).

3.2. 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.

3.3. 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.

3.4. MS has developed a bespoke geophysical system whereby data are live-streamed from the field back to the office while fieldwork is ongoing. This allows for data to be regularly monitored not only in the field, but by managers in a controlled office environment. Coverage gaps or small errors within the data can be quickly identified and rectified, improving quality control of field survey. The live data streaming allows MS to provide processed data to the client at regular intervals, allowing all parties to be informed of the field survey's progress. Should it become apparent that the survey is being compromised by local conditions, such as the spreading of green waste, this will be reported back to the client and a mitigation strategy can be devised if necessary.

4. Risk Assessment

4.1. MS' standard magnetic fieldwork risk assessment and site-specific risk assessment have been appended to the end of this document. Before geophysical survey will commence, a brief walkover will be undertaken to identify any additional hazards of an unusual or site-specific nature. If any additional hazards are identified, the site-specific risk assessment will be updated to include these hazards and all surveyors will be informed of the risk. If appropriate mitigation factors cannot be put in place, then the field or part thereof will not be surveyed.

4.2. Field staff will attend a site induction if required. Necessary PPE will be supplied and worn. Wet and cold/hot weather protection is also supplied.

4.3. All surveyors have been issued company mobile phones. Survey teams are expected to make regular contact with the office to keep all parties updated with survey progress. Any change in conditions that may affect the health and safety of the survey team must be reported immediately.

4.4. The survey van contains suitable welfare facilities. Antiseptic hand gel is provided, as is bottled drinking water. A first aid kit is stored in the cab of the van, with a second kit near personnel within the survey area.

4.5. The nearest NHS urgent care centre is at West Suffolk Hospital, Hardwicke Lane IP33 2QZ. Should toilets be unavailable on site the nearest public accessible toilet is located at Tothill Service Station, Stowmarket, IP14 3QQ.

5. Methodology

5.1. Data Collection

5.1.1. Geophysical survey will comprise the magnetic method as described in the following table.

5.1.2. Table of survey strategies:

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

5.1.3. Magnetic data will be collected using MS' bespoke, [hand-pulled/quad-towed cart system OR hand-carried GNSS-positioned system]. MS' [cart OR hand-carried] system will be comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing will be 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 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.

5.1.4. Magnetic and GPS data will be stored on an SD card within MS' bespoke datalogger. The datalogger is continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allows data collection, processing and visualisation to be monitored in real-time as fieldwork is ongoing (see 3.6).

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5.3. Data Visualisation and Interpretation

5.3.1. The report will present 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 will be used for data interpretation.

5.3.2. Geophysical results will be 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 (2018) will be consulted as well, to compare the results with recent land usages.

6. Reporting

6.1. A detailed report of the survey will be produced after data collection is completed. The Planning Archaeologist will be provided with a draft report for approval, and the approved report will be submitted to the HER. The final report will include as standard:

- Abstract
- Introduction – Details site location and client details.
- Quality Assurance – Details the expertise of Magnitude Surveys and Magnitude Surveys employees undertaking the work.
- Objectives—Details survey objectives.
- Geographic Background – Details the soils and geology of the survey area, as well as providing a general summary of site conditions at time of survey.
- Archaeological Background – Details a brief summary of the archaeological and historical background of the site and its immediate environs. While this will not be an exhaustive assessment of the known sites, it will draw on elements relevant to the results obtained during survey.
- Methodology—Details survey strategy employed, instruments used, data collection strategy, data processing and visualisation methods.
- Survey Considerations – Details specific points of note for each survey area, including topography, upstanding obstructions or neighbouring objects.
- Results—Details the results and interpretation of the geophysical survey, both in a general context and discusses specific anomalies of archaeological interest. Geophysical reports will be discussed in consideration with satellite imagery, historic mapping and LiDAR data—if freely available—as supporting interpretative evidence.
- Conclusions
- Archiving
- Copyright
- References
- Figures—The site location and individual survey areas will be presented. Greyscale images and corresponding interpretations will be displayed at appropriate scales. Interpretations will also be displayed over satellite imagery, historic mapping and LiDAR—as applicable—to provide further context to the interpretations. All figures will include a detailed scale bar, north arrow and key.

7. Archiving

7.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This archive stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report. A copy of this archive will be included in a disk with the final printed report.

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

7.3. An OASIS form will be filled in on completion of the survey, providing permission from the client.

8. Copyright

8.1. 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.

9. References

Chartered Institute for Archaeologists, 2014. Standards and guidance for archaeological geophysical survey. CIfA.

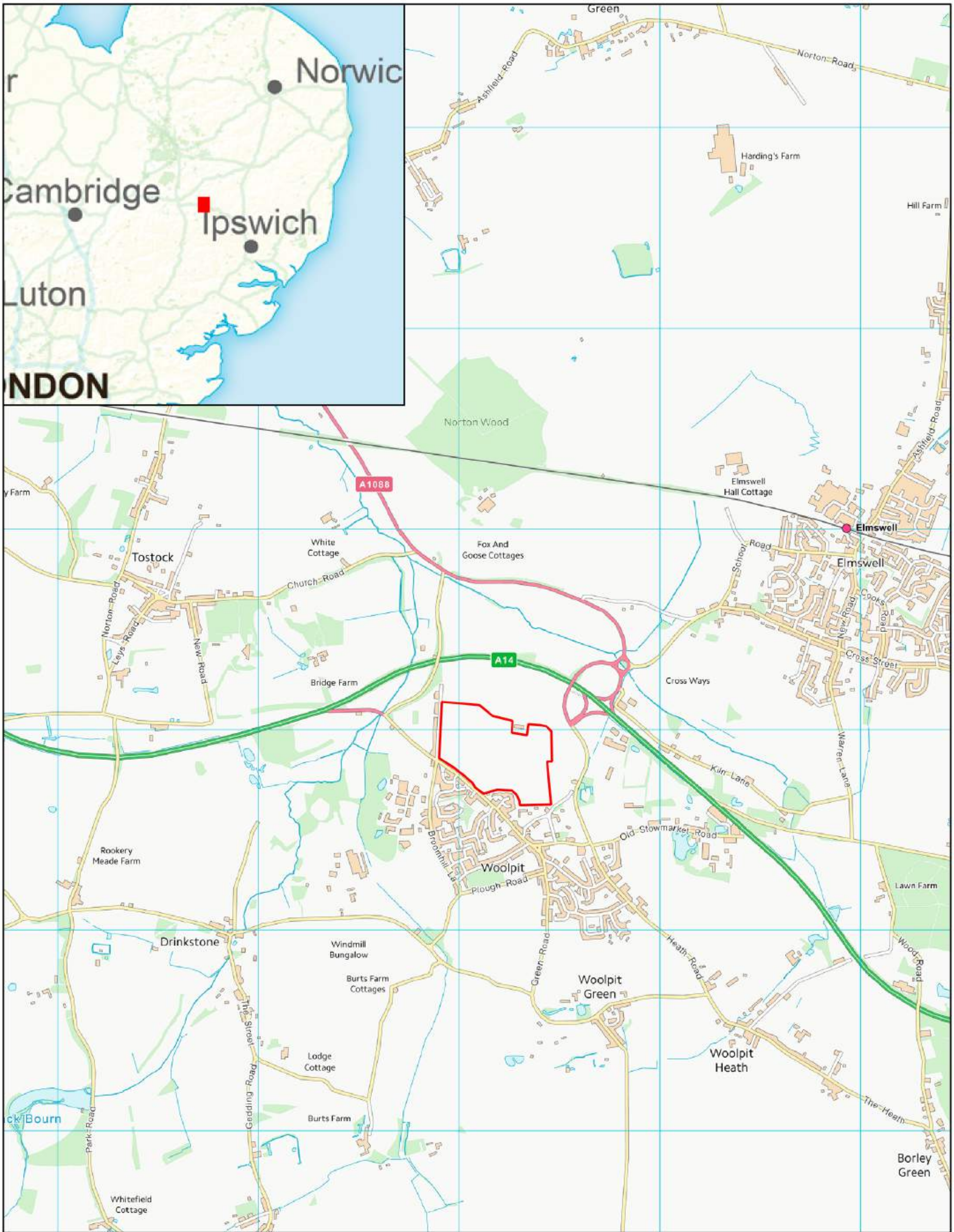
David, A., Linford, N., Linford, P. and Martin, L., 2008. Geophysical survey in archaeological field evaluation: research and professional services guidelines (2nd edition). Historic England.

Google Earth, 2018. Google Earth Pro V 7.1.7.2606.

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 ed., Oxbow Books, Oxford.

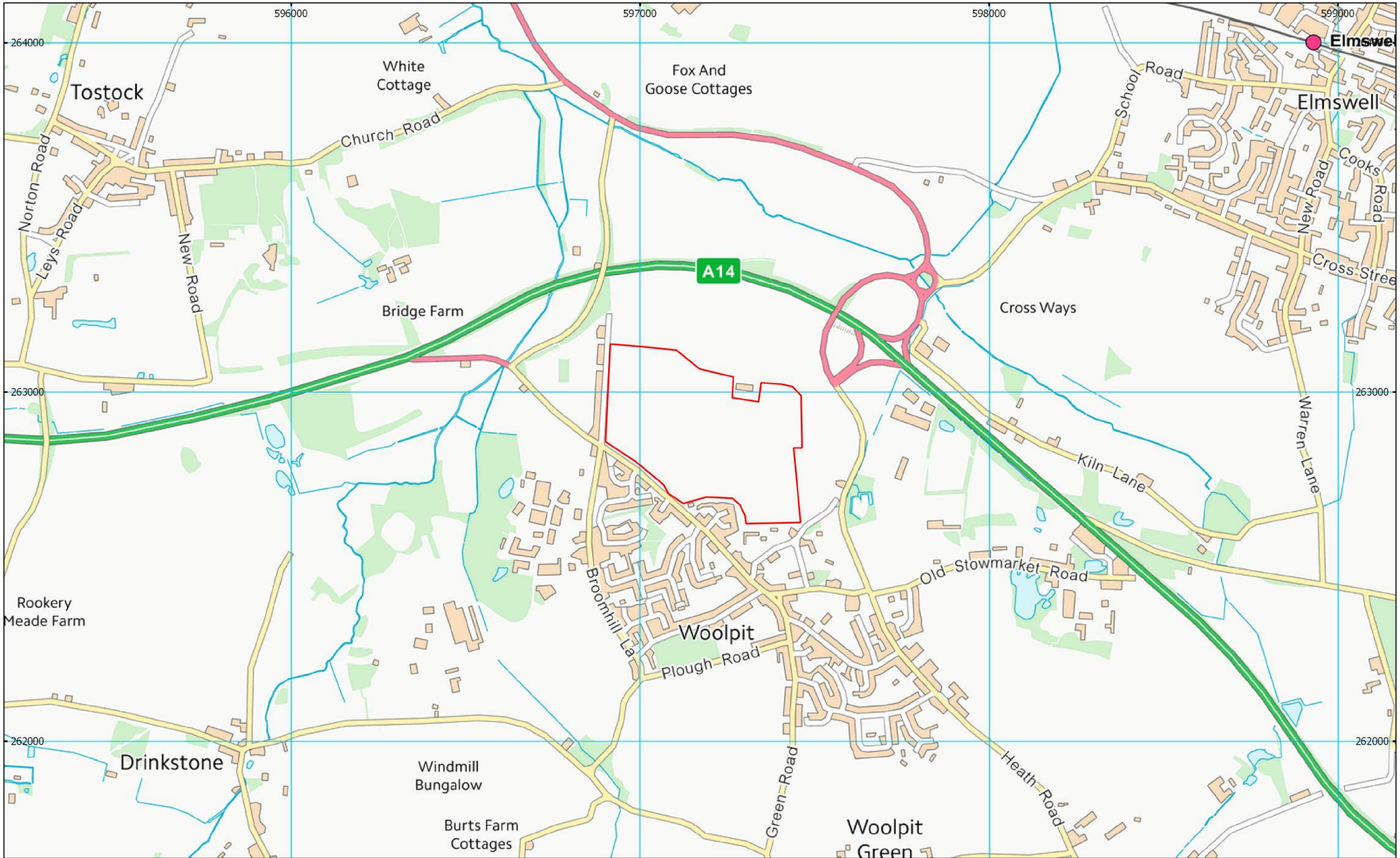
Schmidt, A., Linford, P., Linford, N., David, A., Gaffney, C., Sarris, A. and Fassbinder, J., 2015. Guidelines for the use of geophysics in archaeology: questions to ask and points to consider. EAC Guidelines 2.



MSTL310 - Woolpit
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

magnitude surveys



MSTL310 - Woolpit
Figure 2 - Location of Survey Areas
1:10,000 @ A3

Survey Extents

magnitude surveys

STANDARD MAGNETIC FIELDWORK RISK ASSESSMENT

Likelihood of Accident/Incident Occurring	Severity of Consequences
1. Highly improbable 2. Probable – annually 3. Infrequent – 2-3 times/year 4. Occasional – monthly 5. Frequent – weekly	1. Minor injury minor damage to plant/equipment/buildings 2. Injury (no time lost) damage repair costs are low 3. Injury (time lost) high damage repair costs 4. Major reportable injury very high damage repair costs 5. Fatality major damage and major costs

Details of tasks to be carried out	Potential Hazard	A Likelihood	B Severity Rating	Overall Risk Rating A x B	Control Measures	Action	Revised Risk Rating
Driving company vehicle	Losing control of vehicle, sudden breaking or swerving. Hitting another road user, pedestrian or stationary object.	2 2	5 5	10 Moderate 10 Moderate	Do not drive vehicle if feeling unwell or tired. Take regular breaks on long journeys. Take turns driving when working in groups. Try to avoid driving in adverse weather	If weather is severe pull over. Stay in a hotel if work has been delayed or weather conditions are extreme.	1x5=5 Low 1x5=5 Low
Parking company vehicle	Parking in an unsafe location, such as a blind corner or hidden dip or on the side of a major highway. Pausing while farm gates are opened in order to exit highway.	3 4	5 4	15 High 16 High	Where possible park off-road in car parks, farm yards, fields or lay-bys. If it is not possible to access a survey area in a safe manner, stop and make new arrangements, such as obtaining keys or codes to locked gates. Use vehicle lights, such as dipped headlights, and hazards. Avoid packing or unpacking the vehicles in the dark. When performing reversing procedures while entering or exiting fields, position a colleague in a safe place where they can be seen and heard in order to direct and	Wear high visibility clothing when working around vehicles. Use the floodlight when necessary and safe to do so. Return early during winter months to prevent working in dusk conditions Only stop on highway if safe to do so. Use hazard lights.	1x5=5 Low 1x4=4 Low

STANDARD MAGNETIC FIELDWORK RISK ASSESSMENT

Likelihood of Accident/Incident Occurring	Severity of Consequences
1. Highly improbable 2. Probable – annually 3. Infrequent – 2-3 times/year 4. Occasional – monthly 5. Frequent – weekly	1. Minor injury minor damage to plant/equipment/buildings 2. Injury (no time lost) damage repair costs are low 3. Injury (time lost) high damage repair costs 4. Major reportable injury very high damage repair costs 5. Fatality major damage and major costs

					communicate information on the road traffic.		
Loading and unloading the cart	Muscle strain, dropping equipment, slips trips and falls.	4	2	8 Moderate	Work in a pair, never lift the cart in or out on your own. Move the cart to the edge of the van and then lower to the ground. Never step out the van while lowering to the floor. Follow manual handling training.	Clear both the interior and surrounding van area before attempting to lift the cart in or out the van.	2x1=2 Low
Entering and commencing work in a new survey area	Coming into contact with unknown hazards in a new survey area.	4	2	8 Moderate	Where possible, arrange for livestock to be removed from survey areas before work is begun. Liaise with farmer with regard to livestock. Complete a walkover survey and dynamic risk assessment of the survey area to identify any hidden or unusual hazards, remove or reduce the hazard as best as possible and inform all other staff members of both the hazard and the measures that are being implemented to minimise the risk.	Provide a project questionnaire a to be completed by the client before commencement of fieldwork to reduce or eliminate hazards before commencing fieldwork.	2x1=2 Low
Balancing the magnetic sensors	To complete the sensors' calibration requires the cart to be lifted and turned upside down.	4	3	12 Moderate	When the cart must be lifted, ensure it is set up by two people. Before the cart is lifted, a set of steps and commands should be agreed, who will perform each step and when. If either party feels uncomfortable with the procedure, they should immediately let their partner now and safely put the cart down together.		3x2=6 Low

STANDARD MAGNETIC FIELDWORK RISK ASSESSMENT

Likelihood of Accident/Incident Occurring	Severity of Consequences
1. Highly improbable 2. Probable – annually 3. Infrequent – 2-3 times/year 4. Occasional – monthly 5. Frequent – weekly	1. Minor injury minor damage to plant/equipment/buildings 2. Injury (no time lost) damage repair costs are low 3. Injury (time lost) high damage repair costs 4. Major reportable injury very high damage repair costs 5. Fatality major damage and major costs

					The cart should not be lifted in high winds or when the ground is slippery underfoot.		
Surveying with the cart	Slips, trips and falls while walking with instrument. Strains to muscles while pulling cart.	4	3	12 Moderate	Care taken when working in field. Work not to be undertaken where there are poor field conditions, such as heavy plough or thick vegetation - where a clear view of the underfoot condition is not possible.	Safety survey boots to be worn while walking. Warm up/ down in cold conditions.	3x2=6 Low
Working in all weather conditions.	Hypothermia and heat stroke.	3	3	9 Moderate	Stop survey and take shelter in heavy rain and strong wind to avoid accidents and illness. Take regular breaks in hot weather.	Appropriate PPE to be worn, full waterproofs and safety boots are provided. Make use of the provided, water, sun tan lotion and aftersun. Wear a hat.	3x1=3 Low

Site Specific Risk Assessment

Project Name: Project No:
Client: Assessor:
Date of Survey: Signature:

Description:

Hazard	Who could be harmed?	Mitigation strategies?	Any further action required?	Who should take action? When?	Has the hazard been resolved?

13. Appendix 2

OASIS DATA COLLECTION FORM: England

List of Projects | Manage Projects | Search Projects | New project | Change your details | HER coverage | Change country | Log out

Printable version

OASIS ID: magnitud1-317947

Project details

Project name	Land North of Woolpit, Suffolk
Short description of the project	Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.19ha area of land off Bury Road, Woolpit, Suffolk. A fluxgate magnetometer survey was successfully completed and no anomalies of probable or possible archaeological origin were identified. The geophysical results primarily reflect agricultural activity, with possible changes in field structure and layout present. Throughout the site several responses correlate with former field boundaries and have been categorised as such. Further linear features have been identified, while these are in alignment with the mapped boundaries they themselves do not appear on the available historic mapping, it is likely that these reflect unmapped boundaries. Further anomalies indicative of natural variation and extant ferrous items have also been detected, while a large highly magnetic anomaly in the centre of Area 2 possibly represents a concrete base.
Project dates	Start: 29-05-2018 End: 14-06-2018
Previous/future work	Not known / Not known
Any associated project reference codes	MSTL310 - Sitecode
Any associated project reference codes	WPT 059 - Related HER No.
Type of project	Field evaluation
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	FIELD BOUNDARY Uncertain
Monument type	FIELD DRAIN Uncertain
Significant Finds	NONE None
Methods & techniques	'"Geophysical Survey"'
Development type	Not recorded
Prompt	Unknown
Position in the planning process	Not known / Not recorded
Solid geology	CHALK (INCLUDING RED CHALK)
Solid geology (other)	Crag group sand
Drift geology	SAND AND GRAVEL OF UNCERTAIN AGE OR ORIGIN
Drift geology (other)	Lowestoft formation Diamicton

Techniques	Magnetometry

Project location

Country	England
Site location	SUFFOLK MID SUFFOLK WOOLPIT Land North of Woolpit Sufolk
Postcode	IP30 9TU
Study area	19 Hectares
Site coordinates	TL 9718 6292 52.228636695169 0.88754812747 52 13 43 N 000 53 15 E Point
Lat/Long Datum	Unknown

Project creators

Name of Organisation	Magnitude Surveys Ltd
Project brief originator	CgMs Heritage
Project design originator	Magnitude Surveys Ltd
Project director/manager	Graeme Attwood
Project supervisor	Peter Turner
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Suffolk HER
Digital Archive ID	MSTL310
Digital Contents	"Survey"
Digital Media available	"Geophysics","Text","GIS"
Paper Archive Exists?	No

Project bibliography 1

Publication type	A forthcoming report
Title	Geophysical Survey Report of Land off Bury Road, Woolpit
Author(s)/Editor(s)	Turner, P.
Other bibliographic details	MSTL310
Date	2018
Issuer or publisher	Magnitude Surveys Ltd.
Place of issue or publication	Bradford
Description	Digital Report in PDF format

Entered by	Andres (a.perez@magnitudesurveys.co.uk)
Entered on	3 July 2018

OASIS: