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**Geophysical Survey Report
of
Land at Church Road
Stutton, Suffolk**

**For
CgMs Heritage (Part of the RPS Group Plc)**

**On Behalf Of
Hopkins Homes Ltd**

Magnitude Surveys Ref: MSTM388

HER Parish Code: STU 094

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Draft 1.0	Initial Draft	Peter Turner BSc MSc & Hugo Kesterton BSc	Peter Turner BSc MSc	Peter Turner BSc MSc	12 October 2018
Draft 1.1	Minor revisions for clarification	Robert Legg BSc MSc	Robert Legg BSc MSc	Chrys Harris BA MSc PhD	15 th October 2018
Final 2.0	Client amendments	Robert Legg BSc MSc	n/a	Marta Fortuny BA MA	16 th October 2018

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 1.6ha area of land at Church Road Stutton, Suffolk. A fluxgate magnetometer survey was successfully conducted across most of the site; however, 0.3ha of the site could not be surveyed due to the presence of dense vegetation. The survey has detected a wide range of anomalies including comparatively subtle historic ploughing trends. The results reflect magnetic disturbance from modern activity, agricultural anomalies, and the sand and gravel superficial geology. No anomalies of probable or possible archaeological origin have been classified.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by CgMs Heritage (Part of the RPS Group Plc) on behalf of Hopkins Homes Ltd to undertake a geophysical survey on a c.1.6ha area of land at Church Road, Stutton, Suffolk (TM 1519 3470).
- 1.2. The geophysical survey comprised hand-pulled, cart-mounted 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 05/10/2018 and took 1 day to complete. A small area, c. 0.3ha in size, could not be surveyed due to the presence of dense vegetation.

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 in Stutton, Suffolk, immediately west of Church Rd, towards the southeast edge of the village (Figure 1). Survey was undertaken across a single field of recently cut scrubland, bounded by Church Road to the west, and by housing on all other sides, beyond which is the B1080 Holbrook Road to the north, Lower Street to the south, and Sutton Close to the east (Figure 2).
- 4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Generally flat. Ground cover consisted of recently cut scrubland, with bumpy ground towards the northeast corner and the southwest corner. A small area in the southwest corner could not be surveyed due to dense, overgrown vegetation.	There was a pile of cut vegetation towards the centre of the survey area and another one towards the southern boundary, obstructing survey and requiring navigation around. There was a van and trailer parked within the survey area, on the boundary between the unsurveyable area in the southwest corner and the surveyed area. Bounded by hedgerow on the northern boundary, wooden fence on the eastern and southern boundary, and bushes on the western boundary.

- 4.3. The underlying geology comprises sand of the Crag Formation. Superficial deposits comprise sand and gravel of the Kesgrave Catchment Subgroup (British Geological Survey, 2018).
- 4.4. The soils consist of slightly acid loamy and clayey soils with impeded drainage (Soilscapes, 2018).

5. Archaeological Background

- 5.1. The following archaeological background provides a summary of the known archaeology of the site and surrounding area, based upon information provided by the Suffolk County Council Archaeological Service. Additionally, a map regression examining the survey area was carried out using available modern and historic maps.
- 5.2. No archaeological sites or finds are recorded within the survey area.
- 5.3. Adjacent to the site, immediately north of the survey area, a findspot of a Neolithic stone axe is recorded.
- 5.4. South and east of the village of Stutton, extensive archaeological remains identified from aerial photography are documented, though these have not been investigated at ground level and as such are not accurately dated. Field systems, enclosures, and trackways have been identified.
- 5.5. A map regression shows two field boundaries running parallel in a north-northwest to south-southeast alignment within the survey area, dividing it into three fields visible on OS maps between 1881 and 1958. The central field is shown as an 'Orchard' on OS maps up to 1899 but appears to have been converted to a 'Nursery' on the 25" OS map of 1904.

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 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 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 9). 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), historic maps (Figure 7), and LiDAR (Figure 8).

7.2.2. The fluxgate magnetometer survey has responded well to the survey area's environment; although the results do exhibit some ferrous interference from fencing at the field edges, and some portions of the site could not be surveyed due to dense, overgrown vegetation. The results primarily reflect agricultural activity, ferrous anomalies (especially from fencing around neighbouring properties) and natural magnetic variations in the soil and superficial geology.

7.2.3. Agricultural activity has been identified in the form of previous ploughing trends running approximately north-west to south-east, which is approximately parallel to a historic field boundary on the 2nd ed. OS map (see Figure 7). Relatively pronounced anomalies running parallel to the present field boundaries likely to reflect headlands resulting from the ploughing activity visible on the LiDAR imagery (Figure 8).

7.2.4. In the eastern portion of the site are a number of regions of enhanced bands, typical of natural variation in the kind of the sand and gravel superficial geology underlying the site.

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. **Agricultural** -. Anomalies for ploughing are marked by linear striations aligned approximately north-west to south-east, parallel to a historic field boundary identifiable on the second edition OS map (see Figure 7). In addition to the ploughing trends are anomalies [1a] that run parallel to the northern, western, and southern boundaries and which correspond to the headland at the edge of the ploughed area (visible in the LiDAR data, Figure 8)

- 7.3.2.2. **Undetermined** – Scattered anomalies in the northern part of the site do not present as clear ferrous dipoles and may be the result of agricultural activity, but this cannot be determined without further information.

8. Conclusions

- 8.1. A magnetometer survey was successfully conducted across most of the site; however, some portions of the site could not be surveyed due to the presence of dense vegetation. The survey has detected a wide range of anomalies including comparatively subtle historic ploughing trends. The results reflect magnetic disturbance from modern activity along the field edges, agricultural anomalies and natural variation in the soil and superficial geology. No anomalies of probable or possible archaeological origin have been classified. Several anomalies have been classified as 'Undetermined' in origin; although these may likely be resultant from agricultural or natural processes.
- 8.2. Agricultural activity has been identified in the form of ploughing trends and anomalies associated with the headland at the edges of the ploughed area. Bands of enhanced material in the eastern part of the site are indicative of natural variation in the soil and superficial geology.

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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MSTM388 - Land at Church Road, Stutton

Figure 1 - Site Location

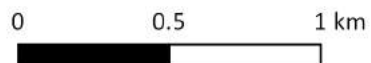
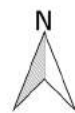
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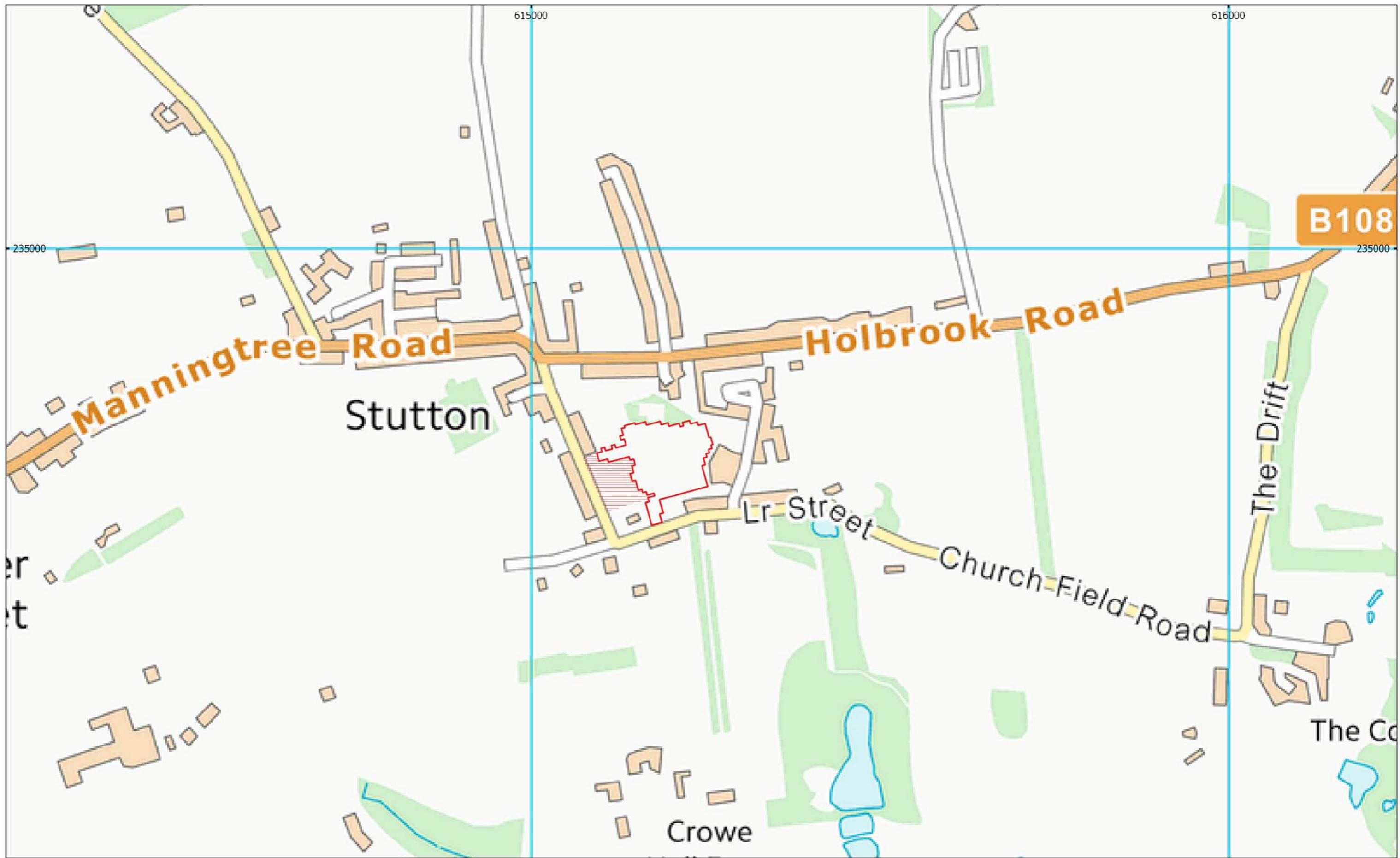
Contains Ordnance Survey data © Crown Copyright and database right 2018

OS (100056946)

 Site Boundary

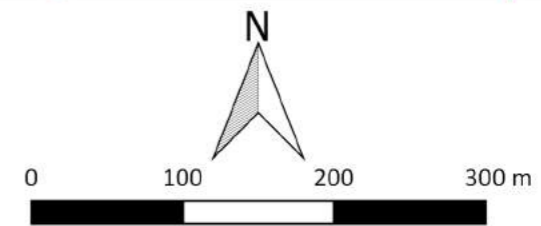


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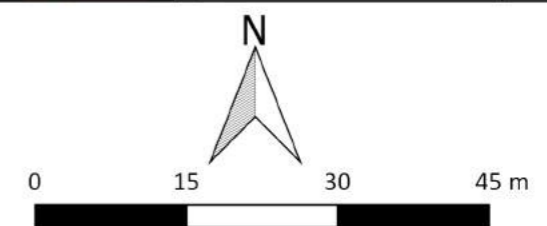
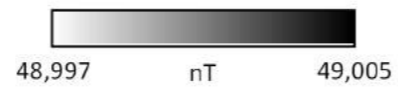
MSTM388 - Land at Church Road, Stutton
 Figure 2 - Location of Survey Area
 1:5000 @ A3
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 OS (100056946)

- Survey Extent
- Area not surveyed





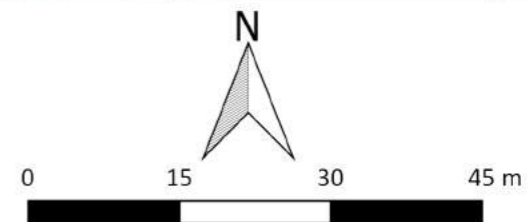
MSTM388 - Land at Church Road, Stutton
Figure 3 - Magnetic Total Field (Lower Sensor)
1:750 @ A3
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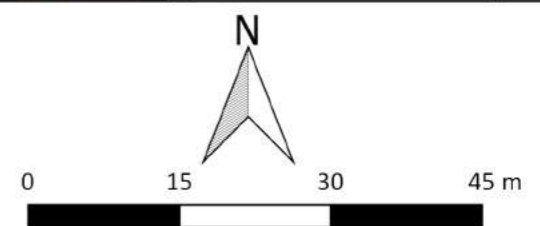
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Figure 4 - Magnetic Gradient
1:750 @ A3
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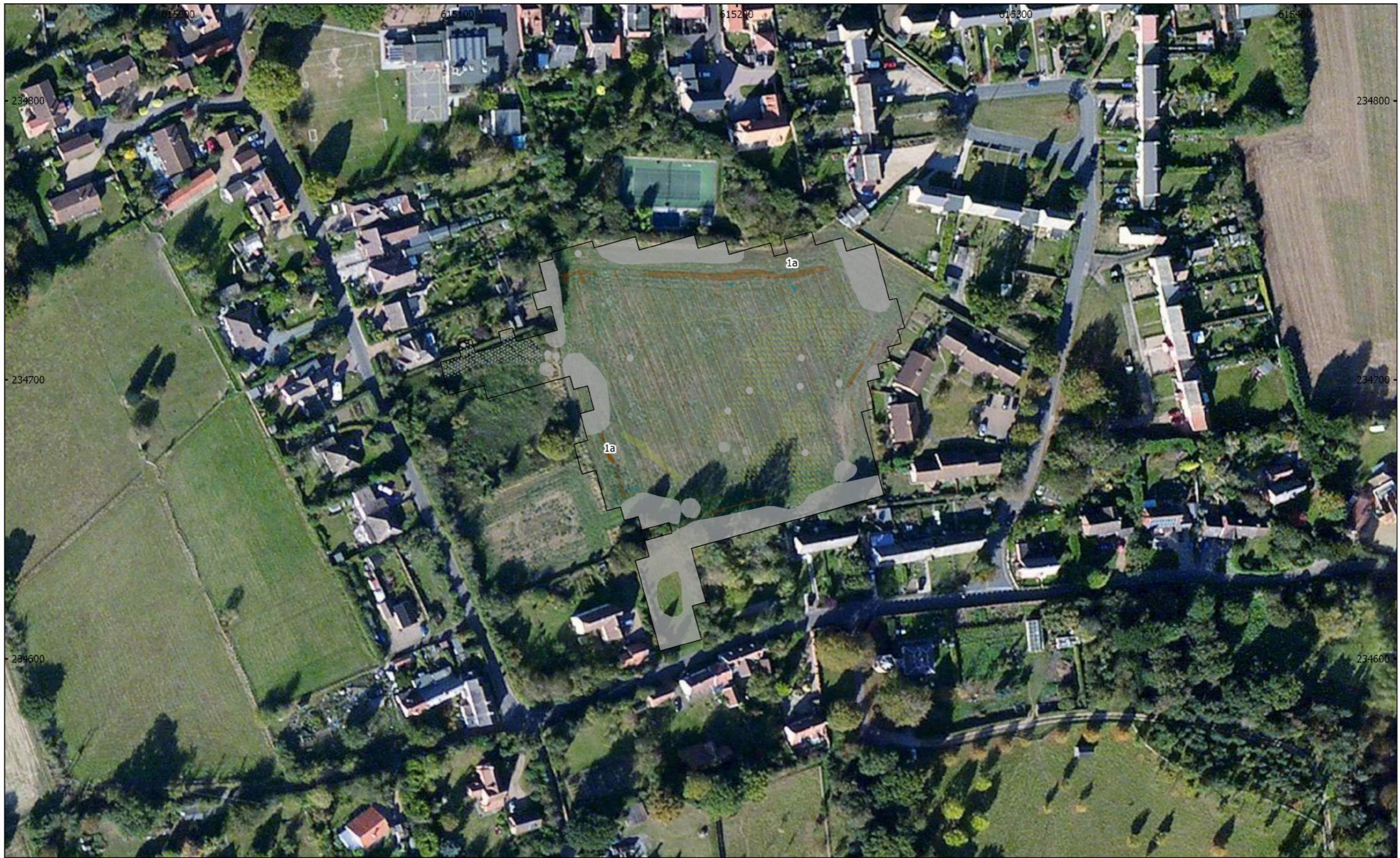




MSTM388 - Land at Church Road, Stutton
 Figure 5 - Magnetic Interpretation
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 OS (100056946)

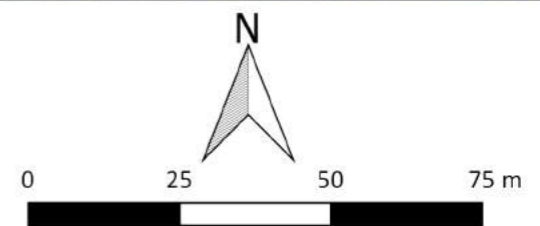
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|-----------------------|------------------|---------------------------------------|
| Agricultural (Strong) | Natural (Trend) | Undetermined (Strong) |
| Agricultural (Weak) | Natural (Weak) | Ferrous (Dipolar) |
| Agricultural (Trend) | Natural (Spread) | Ferrous (Spread)/Magnetic Disturbance |





MSTM388 - Land at Church Road, Stutton
 Figure 6 - Magnetic Interpretation Over Satellite Imagery
 1:1,250 @ A3
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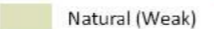
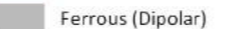


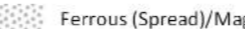
- | | | |
|-----------------------|------------------|---------------------------------------|
| Agricultural (Strong) | Natural (Trend) | Undetermined (Strong) |
| Agricultural (Weak) | Natural (Weak) | Ferrous (Dipolar) |
| Agricultural (Trend) | Natural (Spread) | Ferrous (Spread)/Magnetic Disturbance |

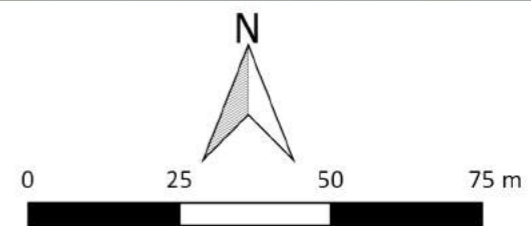


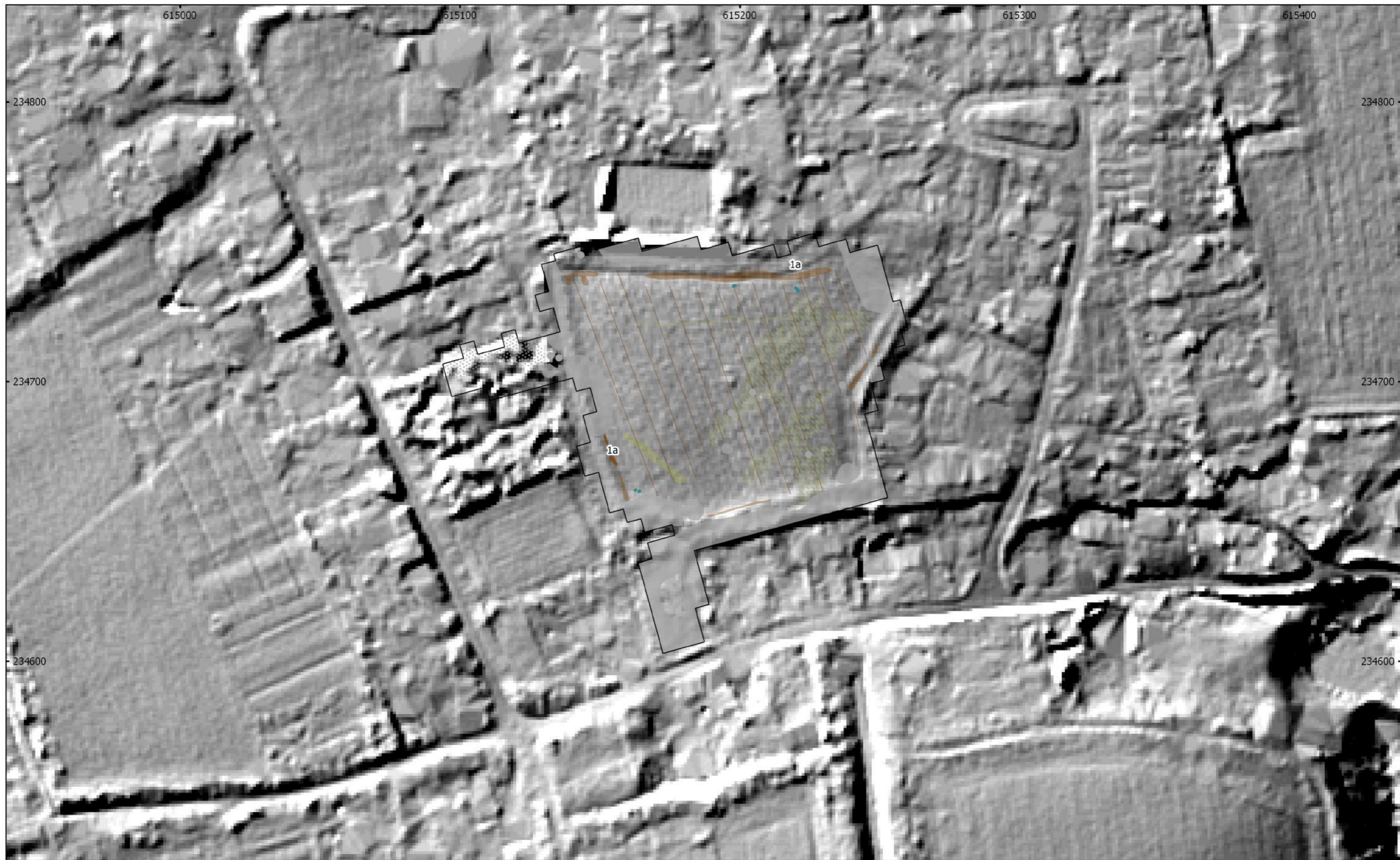
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MSTM388 - Land at Church Road, Stutton
 Figure 7 - Magnetic Interpretation Over Historic Maps
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 Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 ©
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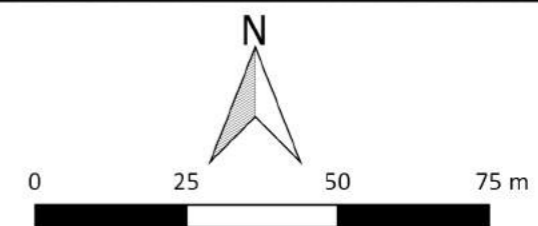
- | | | |
|--|--|---|
|  Agricultural (Strong) |  Natural (Trend) |  Undetermined (Strong) |
|  Agricultural (Weak) |  Natural (Weak) |  Ferrous (Dipolar) |
|  Agricultural (Trend) |  Natural (Spread) |  Ferrous (Spread)/Magnetic Disturbance |

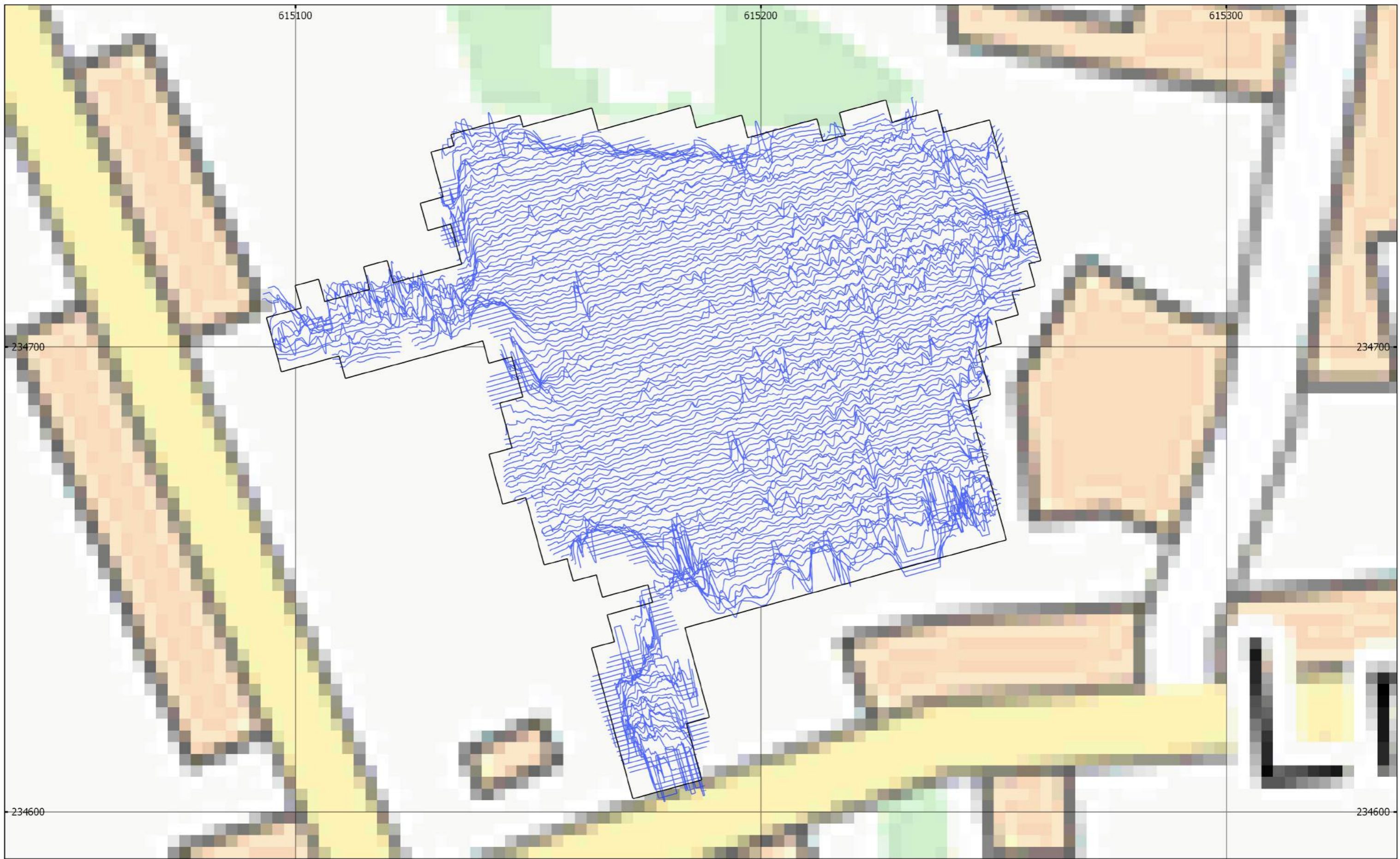




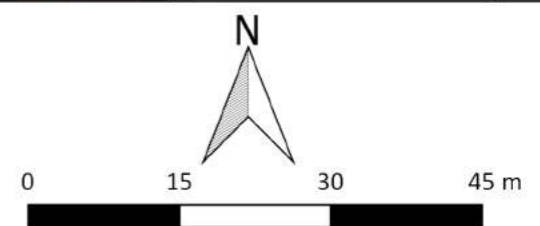
MSTM388 - Land at Church Road, Stutton
 Figure 8 - Magnetic Interpretation Over LiDAR (Composite DSM)
 1:1,250 @ A3
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 Contains LiDAR data: © Environment Agency copyright and/or database right 2015

- | | | |
|--|--|---|
|  Agricultural (Strong) |  Natural (Trend) |  Undetermined (Strong) |
|  Agricultural (Weak) |  Natural (Weak) |  Ferrous (Dipolar) |
|  Agricultural (Trend) |  Natural (Spread) |  Ferrous (Spread)/Magnetic Disturbance |





MSTM388 - Land at Church Road, Stutton
Figure 9 - XY Trace Plot
15nT/cm at 1:750 @ A3
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OASIS ID: magnitud1-333851

Project details

Project name	Land at Church Road Stutton, Suffolk
Short description of the project	Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 1.6ha area of land at Church Road Stutton, Suffolk. A fluxgate magnetometer survey was successfully conducted across most of the site; however, 0.3ha of the site could not be surveyed due to the presence of dense vegetation. The survey has detected a wide range of anomalies including comparatively subtle historic ploughing trends. The results reflect magnetic disturbance from modern activity, agricultural anomalies, and the sand and gravel superficial geology. No anomalies of probable or possible archaeological origin have been classified
Project dates	Start: 05-10-2018 End: 16-10-2018
Previous/future work	Not known / Not known
Any associated project reference codes	STU 094 - HER event no.
Any associated project reference codes	MSTM388 - Sitecode
Type of project	Field evaluation
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	BOUNDARY DITCH Uncertain
Monument type	PLOUGH MARKS Uncertain
Significant Finds	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	unkown
Position in the planning process	Not known / Not recorded
Solid geology (other)	Kesgrave Catchment Subgroup
Drift geology	CRAG
Techniques	Magnetometry

Project location

Country England

Site location	SUFFOLK BABERGH STUTTON Land at Church Road, Stutton, Suffolk
Postcode	IP9 2SQ
Study area	1.6 Hectares
Site coordinates	1519 3470 1519 00 00 N 3470 00 00 E Point
Lat/Long Datum (other)	1
Height OD / Depth	Min: 1m Max: 1m

Project creators

Name of Organisation	Magnitude Surveys Ltd
Project brief originator	Unknown
Project design originator	Magnitude Surveys Ltd
Project director/manager	Chrys Harris
Project supervisor	Marta Fortuny

Project archives

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

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land at Church Road Stutton, Suffolk
Author(s)/Editor(s)	Turner, P.
Author(s)/Editor(s)	Kesterton, H.
Other bibliographic details	MSTM388-
Date	2018
Issuer or publisher	Magnitude Surveys Ltd
Place of issue or publication	Bradford
Description	Digital Report in PDF format
Entered by	Marta Fortuny (info@magnitudesurveys.co.uk)
Entered on	15 November 2018

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