Geophysical Survey Report

of

Land off Poplar Hill, Stowmarket

For

Pegasus Group

On Behalf Of

Gladman Developments Ltd

Magnitude Surveys Ref: MSTM330

OASIS Ref: magnitud1-323873

HER Parish Code: SKT 089

August 2018

Unit 17, Commerce Court

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Draft 1.1	Initial draft to line manager	Leanne Swinbank BA ACIfA	Leanne Swinbank BA ACIfA	Finnegan Pope-Carter BSc MSc FGS	09 August 2018
Draft 1.2	Final draft to client	Leanne Swinbank BA ACIfA	Leanne Swinbank BA ACIfA	Finnegan Pope-Carter BSc MSc FGS	10 August 2018
Final 2.0	Report corrections and amendments from client	Leanne Swinbank BA ACIfA	Leanne Swinbank BA ACIfA	Finnegan Pope-Carter BSc MSc FGS	20 August 2018
Final 2.1	Requested addition from Suffolk HER.	Leanne Swinbank BA ACIfA	N/A	Leanne Swinbank BA ACIfA	04 June 2019

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 8.5ha area of land off Poplar Hill, Stowmarket, Suffolk. A fluxgate magnetometer survey was successfully completed and no anomalies of possible or probable archaeological origin have been detected. The geophysical results primarily reflect agricultural and modern activity. Three former field boundaries have been identified which correspond with historic maps and ridge and furrow trends have also been detected within one of these boundaries. Modern agricultural activity on the site includes repeated tractor movement and modern plough at the edges of the field, and strong linear anomalies which may represent drainage. Modern activity on the site consists of pipelines, overhead cables, and ferrous responses along the perimeter of the field.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Pegasus Group on behalf of Gladman Developments Ltd to undertake a geophysical survey on a c.8.5ha area of predominantly agricultural land off Poplar Hill, Stowmarket (TM 0456 5694).

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 was conducted in line with the Written Scheme of Investigation produced by Magnitude Surveys (Swinbank 2018).

1.5. The survey commenced on 1 August 2018 and was completed the same day.

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 to the southeast of Poplar Hill, 1.8km south of Stowmarket. The site comprises a single field which was under stubble at the time of survey. The field is bounded by Poplar Hill to the west and northwest, houses off Church Road to the northeast, Church road to the east, and further agricultural fields in the south (Figure 2). Topography of the field is sloping and two overhead services cut across the site.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Stubble field, sloping down from north to south. An area of pasture was noted in the northeast corner.	The site was crossed by two overhead service lines, one in the south on a east-west alignment, and one in the eastern half of the site aligned north-south. A pylon was situated in the southwest corner. Four wooden posts were noted in the south and east of the site, possibly markers for underground services. The site was bounded by garden fences in the northeast, a ditch and hedgerow in the southeast and south, and a grass verge in the west.

4.3. The bedrock geology comprises sand of the Crag group. Superficial deposits consist of diamicton of the Lowestoft formation over the majority of the site, with a band of Head diamicton along the southeast edge of the site (British Geological Survey, 2018).

4.4. The soils consist of lime-rich loamy and clayey soils with impeded drainage (Soilscapes, 2018).

5. Archaeological Background

5.1. The following is a summary of information obtained from an Archaeology and Built Heritage Assessment provided by Pegasus Group (Pegasus Group, 2018).

5.2. No prehistoric finds or features are recorded within the boundaries of the site. In the field immediately to the southeast a flint scatter of approximately 120 worked flints is recorded, mostly of Early Bronze Age date with a few Early Mesolithic flints included (HER 21731). Approximately 995m northwest of the site a socketed bronze axe of Bronze Age date was discovered in 1880 (HER 5413), the true location of this find spot is unclear.

5.3. No Romano-British finds or features are recorded within the boundaries of the site. A Roman ditch containing Roman pottery is recorded in the field immediately northwest of the site (HER 31370). Two find spots of Roman coins are recorded in the wider area, one from the second century AD, 705m north of the site (HER 20503), the other from late first century to second century AD, 815m northeast (HER 5394).

5.4. The site would have been located within the Combs parish in the Medieval period. Combs is a shrunken Medieval village c.170m east of the site (HER 11786). Remains of Combs include earthworks of roads and tenements visible in aerial photographs. The site was likely part of the agricultural hinterland of the settlement of Combs. 15m to the east of site the earthwork of a Medieval fishpond is recorded likely associated with Combs. A ditch system in the field immediately northwest of the site contained Medieval pottery dating from the 11-14th century (HER 31370).

5.5. Post Medieval maps show variations in the field boundary in the south of the site. The land within the site has been in agricultural use since at least the 18th century and has continued to be so until the present.

6. Methodology

6.1. Data Collection

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

6.1.2. Table of survey strategies:

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

6.1.3. The magnetic data were collected using MS' bespoke hand-carried, GNSS-positioned system.

6.1.3.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing. A number of lines were repeat collected to ensure consistency and repeatability of the data, as per WSI instruction.

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. The site presents a relatively quiet magnetic background with minor natural variations in the soils and superficial geology being present, mostly in the west. Modern activity has impacted the site but is generally limited to the boundaries of the survey area with two pipelines being identified on the northern and southern edge of the site. Overhead powerlines and an associated pylon have produced areas of magnetic disturbance which may mask weak or ephemeral magnetic responses.

7.2.3. Other anomalies identified on the site are mostly agricultural in origin. Many relate to mapped former field boundaries, ridge and furrow ploughing trends, and modern ploughing features. The 1710 Combs Hall Estate Map gives names to a number of the former fields encompassed by the site, these include "Mill Mount Field". The field name suggests the potential for a mill structure within the site boundary, however, no evidence for such a structure has been identified. The highest point on the site and most likely position for a windmill, the northern corner, has been disturbed by the presence of a modern service line; whereas by the brook, in the east, anomalies only reflect the shifting former field boundaries. A number of strong linear features which do not correspond with former field boundaries have been identified, the straight nature of these anomalies suggests a modern origin, likely of agricultural use. A small number of drains have also been identified in the north of 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** – A number of responses have been identified which correspond with former field boundaries denoted on various historic maps. The curvilinear response [**1a**] consists of a number of fragmented linear anomalies in the southeast corner of the site; together these correspond with a former field boundary noted only on the 1710 Combs Hall Estate Map. To the northeast of these anomalies [**1b**] forms a linear response which corresponds with the boundary of a "Hop Yard" on the 1710 map, the boundary is subsequently denoted on the 1772 Map of Lands in Comb Parish. Contained within [**1a**] a spread of anomalies has been identified [**1c**], this represents the former field boundary in this location denoted from the 1772 map to the recent 1977-78 OS Plan. The difference in magnetic signal between [**1c**] and the other confirmed former field boundaries is likely due to a difference in materials used to backfill the boundaries.

7.3.2.2. **Ridge and Furrow** – A series of parallel linear trends have been detected in the northeast corner of the survey area, on a northwest to southeast alignment. These trends are contained within the [**1b**] response. The form and spacing of the trends suggest they represent a ridge and furrow ploughing regime, however, an association with the "Hop Yard" denoted on historic maps cannot be ruled out.

7.3.2.3. **Agricultural** – Three strong, positive linear anomalies in the eastern half of the site do not correspond with any mapped features on historic or modern maps. The strength and straight linear form suggest a modern origin for these features, likely with an agricultural usage. The fact that no former boundaries are recorded in these locations, on a site which is otherwise well recorded, indicates perhaps another function, possibly drainage related. The responses appear as though they may converge east of the limits of the survey area, though without the additional data this is a tentative assessment. The weaker north-south aligned response which appears to be associated with these stronger responses, may only appear weaker due to it falling along the same alignment as the surveyed traverses.

7.3.2.4. **Agricultural** – weak agricultural trends in alignment with the current field boundaries likely relate to repeated tractor movement and modern ploughing regimes.

7.3.2.5. **Drainage Features** – A number of ephemeral linear responses have been detected in the north of the site likely reflecting drainage in this area.

8. Conclusions

8.1. The magnetometer survey has successfully detected a range of anomalies of varying magnetic enhancement, both natural and anthropogenic in origin. No anomalies of probable or possible archaeological origin have been detected. The majority of anomalies identified in the survey are modern ferrous responses and agricultural anomalies.

8.2. Former field boundaries have been identified in the southeast of the site which correspond with historic maps of the area. Other strong linear features identified as agricultural in origin may have a different function, possibly drainage, as these do not correspond with any mapped features. Agricultural trends of the site include a ridge and furrow ploughing regime and modern tractor movement near the perimeter of the site.

8.3. Modern activity has impacted the survey area particularly along the boundaries in the north, northwest, and west. Pipelines have been identified on the southern border, and in the northwest corner. Overhead power cables are also present on the site causing slight magnetic disturbance in the east, and a strong ferrous anomaly in the west due to a pylon.

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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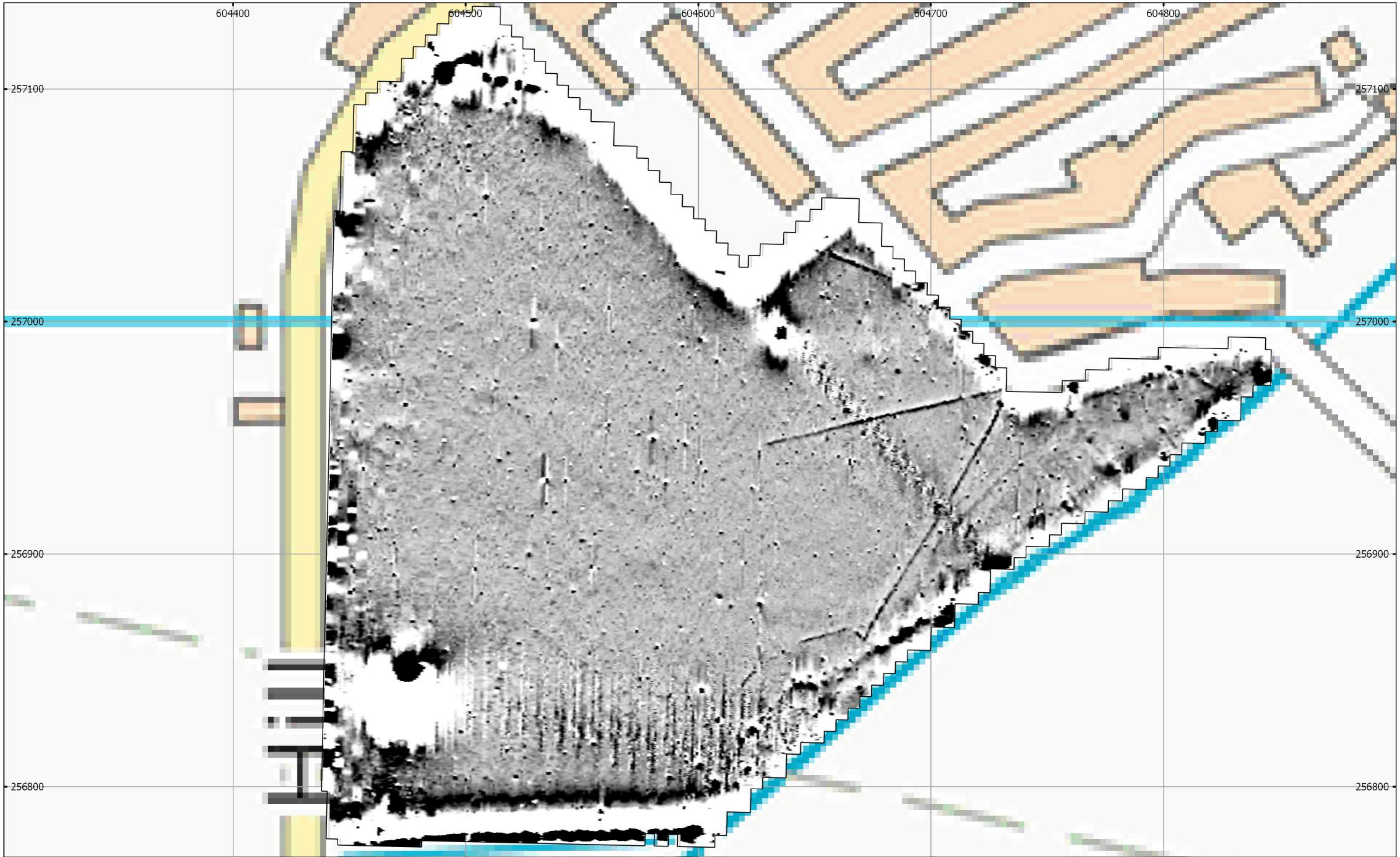
MSTM330 - Land off Poplar Hill, Stowmarket
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

magnitude surveys

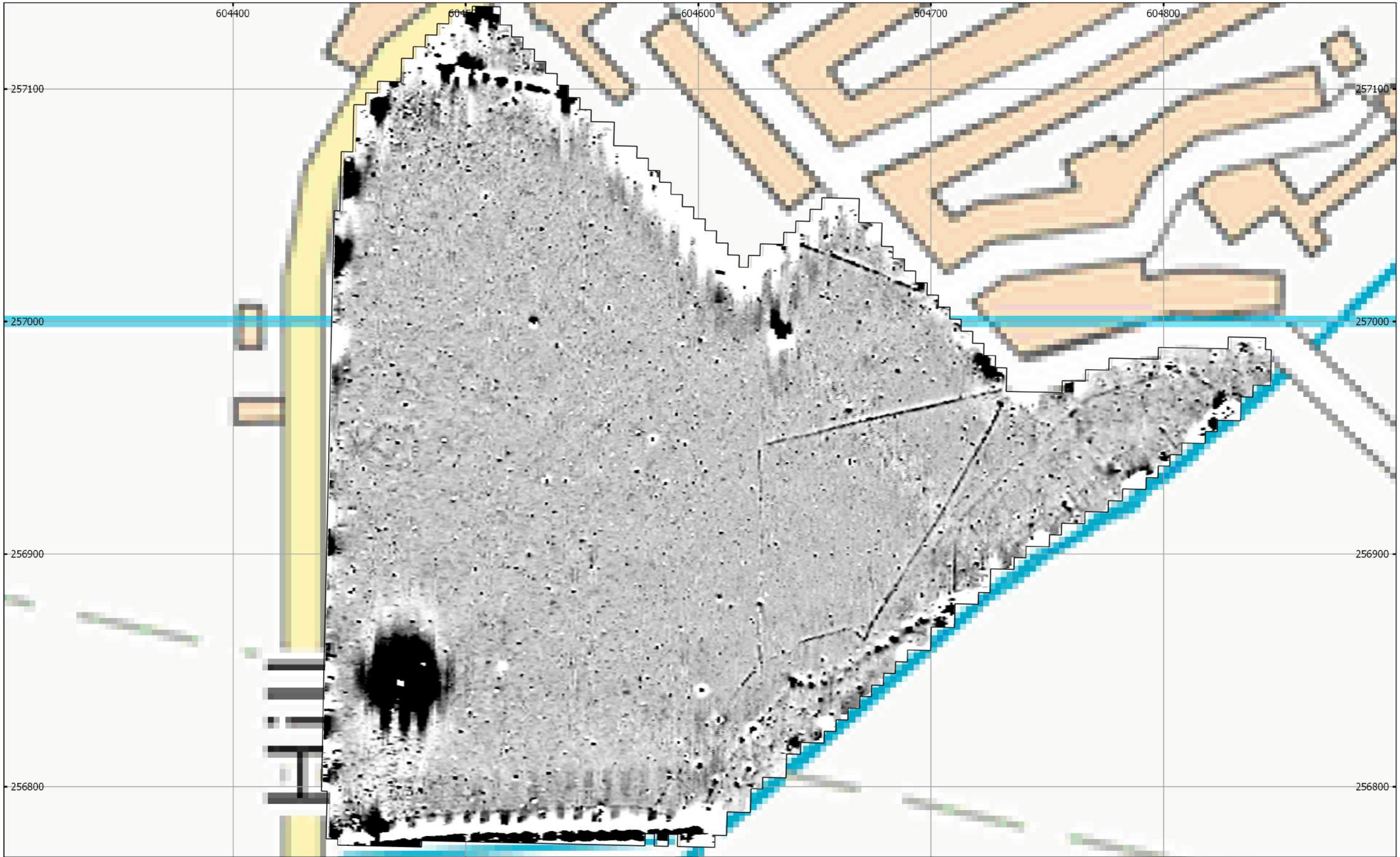
MSTM330 - Land off Poplar Hill, Stowmarket
Figure 2 - Location of Survey Area
1:5000 @ A3

magnitude surveys



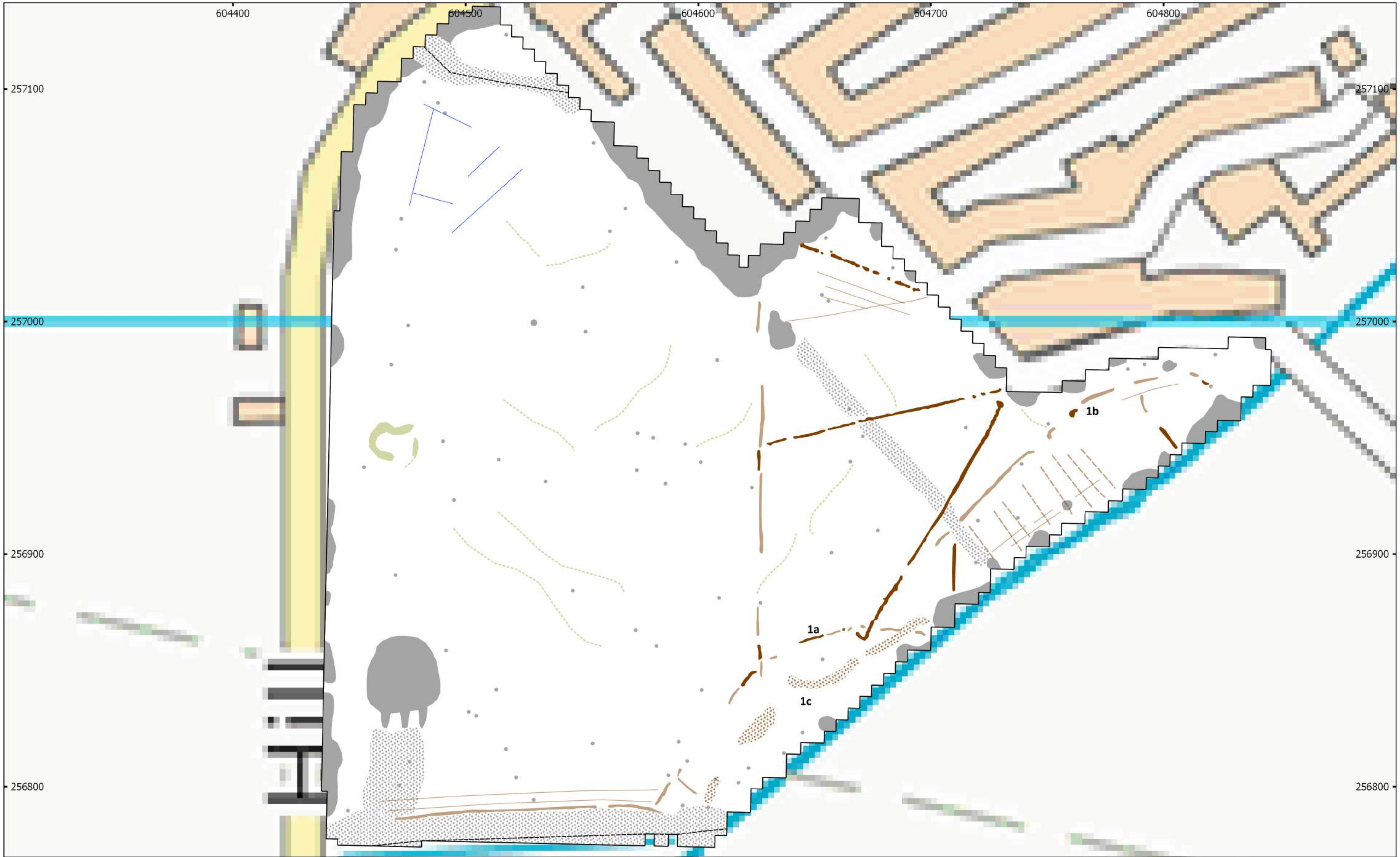
MSTM330 - Land off Poplar Hill, Stowmarket
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,500 @ A3

magnitude surveys



MSTM330 - Land off Poplar Hill, Stowmarket
Figure 4 - Magnetic Gradient
1:1,500 @ A3

magnitude surveys



MSTM330 - Land off Poplar Hill, Stowmarket
Figure 5 - Magnetic Interpretation
1:1,500 @ A3

- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Agricultural (Trend)
- Ridge and Furrow (Trend)
- Natural (Weak)
- Natural (Trend)
- Ferrous (Dipolar)
- Ferrous (Spread)/Magnetic Disturbance
- Service
- Drainage Feature

N

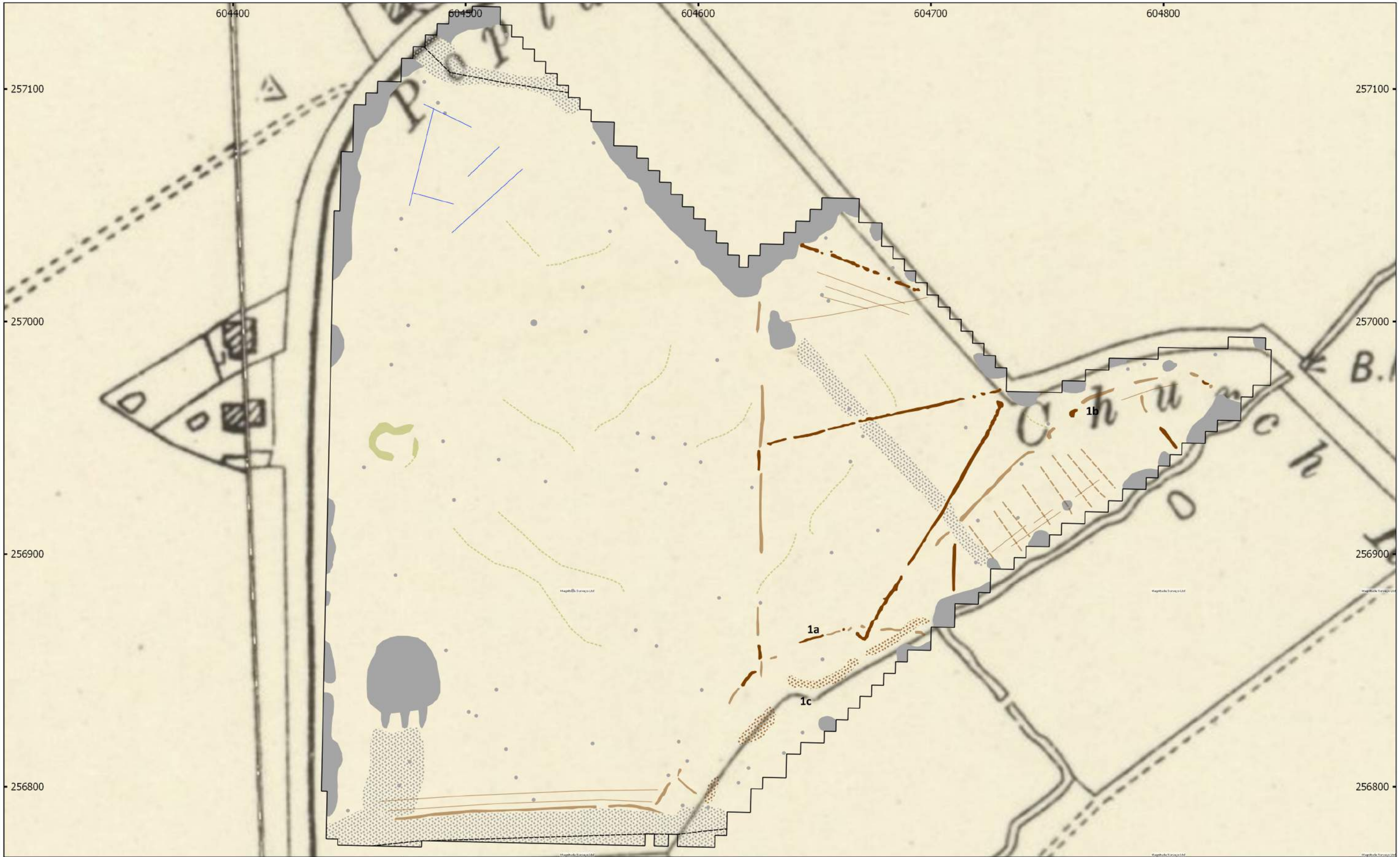
0 20 40 60 m

magnitude surveys

MSTM330 - Land off Poplar Hill, Stowmarket
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:1500 @ A3

Agricultural (Strong)
Agricultural (Weak)
Agricultural (Spread)
Agricultural (Trend)
Ridge and Furrow (Trend)
Natural (Weak)
Natural (Trend)
Ferrous (Dipolar)
Ferrous (Spread)/Magnetic Disturbance
Service
Drainage Feature

magnitude surveys



MSTM330 - Land off Poplar Hill, Stowmarket
Figure 7 - Magnetic Interpretation Over Historic Maps
1:1,500 @ A3

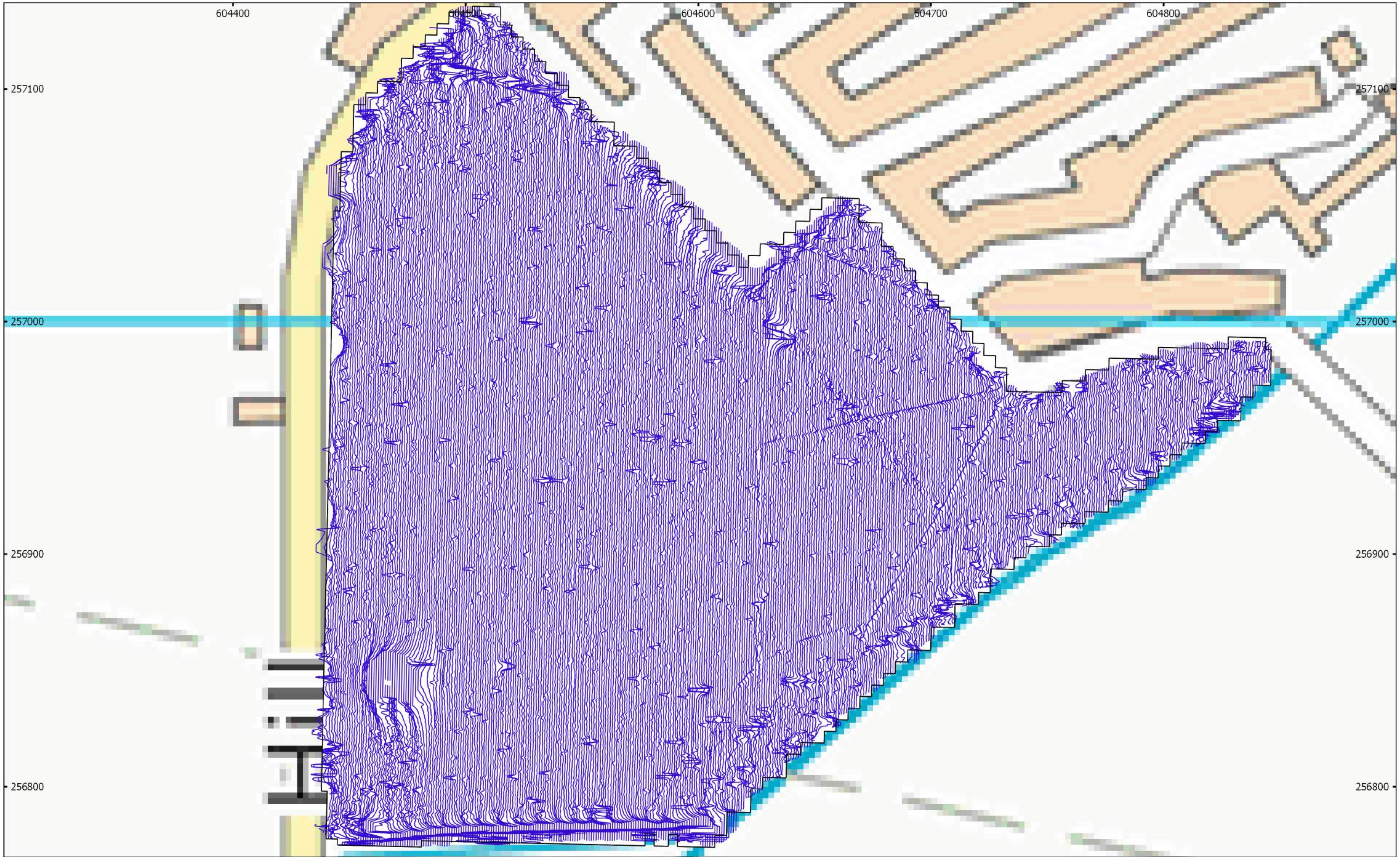
Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

Agricultural (Strong)
Agricultural (Weak)
Agricultural (Spread)
Agricultural (Trend)
Ridge and Furrow (Trend)
Natural (Weak)
Natural (Trend)
Ferrous (Dipolar)
Ferrous (Spread)/Magnetic Disturbance
Service
Drainage Feature

N

0 20 40 60 m

magnitude surveys



MSTM330 - Land off Poplar Hill, Stowmarket
Figure 8 - XY Trace Plot
30nT/cm at 1:1,500 @ A3

magnitude surveys

Written Scheme of Investigation

For a Geophysical Survey

of

Land off Poplar Hill, Stowmarket

For

Pegasus Group

On behalf of

Gladman Developments Ltd.

Magnitude Surveys Ref: MSTM330

HER Parish Code: Requested

July 2018

Version	Purpose/ Revision	Author/ Revisions by	Figures by	Approved By	Date Issued
Ver 1.0	Sent to client	Leanne Swinbank BA ACIfA	Leanne Swinbank BA ACIfA	Graeme Attwood MSc MCIfA	23 July 2018
Ver 1.1	Correction from client	Leanne Swinbank BA ACIfA	Leanne Swinbank BA ACIfA	Graeme Attwood MSc MCIfA	23 July 2018
Ver 1.2	Corrections from SCCAS	Chrys Harris BA MSc PhD	Leanne Swinbank BA ACIfA	Chrys Harris BA MSc PhD	26 July 2018

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Contents

1. Introduction

1.1. This document details a Written Scheme of Investigation for a geophysical survey by Magnitude Surveys Ltd (MS) for Pegasus Group on behalf of Gladman Developments Ltd. The survey comprises a c.8.5 ha area of predominantly agricultural land off Poplar Hill, Stowmarket, Suffolk (TM 0456 5694).

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. Geographic Background

3.1. The site is located to the southeast of Poplar Hill, 1.8km south of Stowmarket. The site comprises a single field in arable use. The field is bounded by Poplar Hill to the west and northwest, houses off Church Road to the northeast, Church Road to the east, and further agricultural fields in the south.

3.2. The bedrock geology comprises sand of the Crag group. Superficial deposits consist of diamicton of the Lowestoft formation over the majority of the site, with a band of Head diamicton along the southeast edge of the site (British Geological Survey, 2018).

3.3. The soils consist of lime-rich loamy and clayey soils with impeded drainage (Soilscapes, 2018).

4. Archaeological Background

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4.5. Post Medieval maps show variations in the field boundary in the south of the site. The land within the site has been in agricultural use since at least the 18th century and has continued to be so until the present.

5. Quality Assurance

5.1. 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).

5.2. 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.

5.3. 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.

5.4. 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.

6. Risk Assessment

6.1. 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.

6.2. 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.

6.3. 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.

6.4. 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.

6.5. The nearest NHS urgent care centre is at The Ipswich Hospital, Health Road, Ipswich, IP4 5PD. Should toilets be unavailable on site the nearest public accessible toilet is located at Stowmarket train station, Station Road East, IP14 1RQ.

7. Methodology

7.1. Data Collection

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

7.1.2. 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

7.1.1. Magnitude Surveys employs a modular cart system, which can easily be configured to be towed by quad, pulled by hand, or carried depending on what is most suitable for the site configuration and conditions. Consisting of a cart frame, and backpack system survey can be undertaken should conditions preclude survey with the wheels. The hand carried system retains all of the advantages of a cart system because it is still GNSS positioned and the sensors are maintained at a consistent height.

7.1.2. 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 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.

7.1.3. 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 5.4).

7.1.4. A navigation system will be integrated with the RTK GPS will be used to guide the surveyor. Data will be collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing. A number of lines will be repeated collected to ensure consistency and repeatability of the data.

7.2.Data Processing

7.2.1. Magnetic data will be 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 will be calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

Zero Median Traverse – The median of each sensor traverse will be 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 will be 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 will be interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation. Images are generated as geotiffs.

7.3.Data Visualisation and Interpretation

7.3.1. 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.

7.3.2. 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.

8. Reporting

8.1. 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.

9. Archiving

9.1. 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.

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

9.3. An OASIS form will be filled in on completion of the survey.

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

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.

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MSTM330 - Land off Poplar Hill, Stowmarket
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

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MSTM330 - Land off Poplar Hill, Stowmarket
Figure 2 - Location of Survey Area
1:5000 @ A3

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QUAD RISK ASSESSMENT

A: Likelihood of Accident/Incident Occurring	B: 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
Loading and unloading the quad into / out of the van	Slipping and tripping when quad is loaded / unloaded	3	4	12 Moderate	Work in a pair, never drive the quad in on your own. Roll the quad out making sure you have a firm grip of the breaks. Align the quad on the ramps before moving on to them. Fully empty van prior to loading. Correctly secure ramps using ratchet straps.	Check conditions of the ground where the quad is to be unloaded. Remove any obstacles that might be in the way. Check the ramp is stable to be driven over.	1x4=4 Low
	Quad moving around when the van is driven	2	3	6 Moderate	Roll the quad to the front of the van. Properly secure quad at four points to van using ratchets provided.	Check the ratchets are properly secured before setting off. Make sure the quad is in park mode before moving van.	1x3=3 Low
Refuelling tank	Fuel spillage	3	4	12 Moderate	All refueling to be carried out using a funnel or a container with the appropriate spout. Have spill kit and fire extinguisher to hand. Wear gloves to protect skin.	To be done in a ventilated area. Keep away from any source of ignition	1x2=2 Low

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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

Attaching cart to the quad	Cart detaching from quad / Damaging of survey equipment.	3	3	9 Moderate	Properly secure cart to the hitch point of the quad. When driving, regularly check the condition of the cart. Do not collect data on poor ground conditions	Follow manufacturer advice.	1x3=3 Low
Driving quad on site	Being thrown off due to quad tipping or a collision into an obstacle.	3	5	15 High	Always wear the provided helmet and PPE. Only those who have passed the Lantra Training to use the quad. Don't overload racks.	Drive with care and attention at all times. Follow correct procedures taught during training. Maintain low speed. Maintain correct posture when driving quad. Do not carry passengers	1x5=5 Low
	Quad failure.	3	3	9 Moderate	Drive quad according to manufacturer's directions. Check level of liquids (fuel, oil, brakes) and tyre pressure.	Do daily maintenance checks. Immediately report any observed damage on the quad.	2x3=6 Low

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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

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					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

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					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**

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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?

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: magnitud1-323873

Project details

Project name	Land off Poplar Hill, Stowmarket
Short description of the project	Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 8.5ha area of land off Poplar Hill, Stowmarket, Suffolk. A fluxgate magnetometer survey was successfully completed and no anomalies of possible or probable archaeological origin have been detected. The geophysical results primarily reflect agricultural and modern activity. Three former field boundaries have been identified which correspond with historic maps and ridge and furrow trends have also been detected within one of these boundaries. Modern agricultural activity on the site includes repeated tractor movement and modern plough at the edges of the field, and strong linear anomalies which may represent drainage. Modern activity on the site consists of pipelines, overhead cables, and ferrous responses along the perimeter of the field.
Project dates	Start: 01-08-2018 End: 01-08-2018
Previous/future work	Not known / Not known
Any associated project reference codes	MSTM330 - Contracting Unit No.
Any associated project reference codes	SKT 089 - Related HER No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	FIELD BOUNDARY Post Medieval
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 (other)	sand of the Crag group
Drift geology (other)	diamicton of the Lowestoft formation over the majority of the site, with a band of Head diamicton
Techniques	Magnetometry

Project location

Country	England
Site location	SUFFOLK MID SUFFOLK STOWMARKET Land off Poplar Hill, Stowmarket
Postcode	IP14 2AZ
Study area	8.5 Hectares
Site coordinates	TM 444 5699 52.172786 0.99008929 52 10 22 N 000 59 24 E Point
Lat/Long Datum	Unknown
Height OD / Depth	Min: 0m Max: 0m

Project creators

Name of Organisation	Magnitude Surveys Ltd
Project brief originator	Pegasus Group
Project design originator	Magnitude Surveys Ltd
Project director/manager	Finnegan Pope-Carter
Project supervisor	Leanne Swinbank
Type of sponsor/funding body	Developer
Name of sponsor/funding body	Gladman Developments Ltd

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Magnitude Surveys
Digital Archive ID	MSTM330
Digital Contents	"other"
Digital Media available	"GIS","Geophysics","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Geophysical Survey Report of Land off Poplar Hill, Stowmarket
Author(s)/Editor(s)	Swinbank, L
Other bibliographic details	MSTM330
Date	2019
Issuer or publisher	Magnitude Surveys
Place of issue or publication	Bradford
Description	Digital Report in PDF format

Entered by	Leanne Swinbank (l.swinbank@magnitudesurveys.co.uk)
Entered on	4 June 2019

OASIS: