GEOPHYSICAL SURVEY REPORT

Land South of Green Lane, Chesterton, Oxfordshire

Client

Orion Heritage Ltd

For

Wates Developments Ltd

Survey Report

05787

OASIS Ref. No.

sumogeop1-504556

Date

10 February 2022

Survey Report 05787: Land South of Green Lane, Chesterton, Oxfordshire

Survey dates	17-21 January 2022
Field co-ordinator	Simon Lobel BSc
Field Team	Robert Ottolangui MSc
Report Date	10 February 2022
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3 SURVEY TECHNIQUE

3.1 Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2	Traverse Interval 1.0m	Sample Interval 0.25m
Bartington Cart System	Traverse Interval 1.0m	Sample Interval 0.125m

The only processes performed on data are the following unless specifically stated otherwise:

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes instrument striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

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4 SUMMARY OF RESULTS

4.1 A magnetometer survey of 14ha of land south-west of Chesterton, Oxfordshire, has identified two small 'rings', two or more rectilinear enclosures and a possible trackway, all of which are archaeological interest. Ridge and furrow cultivation regimes plus former field boundaries have been mapped along with a number of uncertain magnetic responses and two areas of magnetic disturbance.

5 INTRODUCTION

5.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of a residential development. This survey forms part of an archaeological investigation being undertaken by **Orion Heritage Ltd** on behalf of **Wates Developments Ltd**.

5.2 Site Details

NGR / Postcode	SP 5577 2096 /
Location	The site is located *c.*3km south-west of Bicester, Oxfordshire, in a triangle of land between the M40 and A41 roads. The two fields under investigation lie on the south south-west of the village of Chesterton. Green Lane (Akeman Street Roman Road) forms the northern boundary; residential housing and a cricket ground lie to the north-east and agricultural fields lie to the south-east and south. A minor road leading to Little Chesterton is to the west of the site.
HER	Oxfordshire
OASIS Ref. No.	sumogeop1-504556
District	Cherwell District Council
Parish	Chesterton CP
Topography	Gently undulating between 72m and 75m aOD
Land Use	Arable agriculture
Geology (BGS 2022)	Bedrock: Cornbrash Formation – Limestone (west) Kellaways Clay Member – Mudstone (east). Superficial: River Terrace Deposits, 2 - sand and gravel (west)
Soils (CU 2022)	Soilscape 5: freely draining lime-rich loamy soils
Archaeology (Orion 2022)	The DBA has identified no designated or non-designated archaeological assets within the study site. The study site lies immediately south of the course of a Roman road, Akeman Street. The study site forms part of the agricultural hinterland of known settlement and is considered to have low potential for all historic periods. The potential for previously unrecorded prehistoric to Romano-British remains has considered the results of intrusive archaeological investigations, lidar and aerial photographic evidence and proximity to known occupation sites recorded on the Oxfordshire Historic Environment Record. Based on an appraisal of these sources the potential for significant remains is considered low.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	14 ha (linear corridor)

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5.3 ***Aims and Objectives***

5.3.1 To locate and characterise any anomalies of possible archaeological interest within the survey area.

6 RESULTS

6.1 *The survey covers two fields but they are considered together; specific anomalies of interest been given numerical labels [1] [2] which appear in the text below, as well as on the Interpretation Figure(s).*

6.2 ***Probable / Possible***

6.2.1 In the north-west of the survey area there is a small (c.8m x 7m) irregular-shaped 'ring' anomaly [1] which could be small paddock, a barrow ditch or conceivably a round house gulley. Some 5m to the south-west is a second irregular-shaped response [2] (c13m x 12m) which appears to comprise a 'ring' of possible closely spaced post-pits, though the responses could indicate a plough-damaged ditch of gulley. Both of these responses are considered to be of archaeological interest.

6.2.2 In the south-western corner of the site several well-defined linear anomalies are visible and they form at least two partial rectilinear enclosures [3] and [4]; the latter measures 55m x 42m. A weaker linear response [5] extends southwards from [3] while a possible third enclosure formed by weaker trends [6] is appended to [4]. There are several discrete anomalies within the enclosures and these could be pit features.

6.2.3 Parallel linear anomalies [7] approximately 2.5m apart run from near the north-west corner of the field for some 30m before they fade into trends and apparently disappear. They would appear to be a trackway and as such they could be associated with the archaeological features [1] and [2]. The linears are visible on several images on Google Earth, especially in2004 which appears to show the track extending as far as the southern field boundary. While a possible archaeological interpretation has been assigned, the feature could be modern.

6.3 ***Uncertain***

6.3.1 A cluster of responses [8] appears to be geological or a result of extraction, though the presence of the tentative trackway [7] and nearby features [1] and [2] suggests that an archaeological origin cannot be ignored, hence the uncertain interpretation category.

6.3.2 Very weak linear trends [9] are just discernible in the data, but without the evidence of the enclosures to the west (see6.2.2) the trends would probably be dismissed as simply being agricultural; an uncertain interpretation is thus appropriate. The same applies to the cluster of pit-like responses [10] which could reflect material spread in the topsoil (see below 6.6).

6.4 ***Former Field Boundary – Corroborated / Conjectural***

6.4.1 Linear responses and trends are visible in the data which coincide with former field boundaries marked on historic Ordnance Survey maps.

6.5 ***Agricultural – Ridge and Furrow***

6.5.1 Parallel linear anomalies throughout the western field indicate ridge and furrow ploughing patterns carried out on differing alignments.

6.6 ***Magnetic Disturbance / Ferrous***

6.6.1 Two areas of strong magnetic disturbance are visible in the eastern field; each comprises a large ferrous component which is deemed to be modern debris, possibly reflecting infilled

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ponds. This field contains more ferrous debris in the topsoil compared to the western one, and may reflect material spread across the field from the two concentrations. It is possible that the debris derives from the adjacent new residential development which occupies what was once the northern half of this field.

6.6.2 Ferrous responses close to boundaries are due to adjacent fences and gates; two pylons are present in the eastern field.

7 DATA APPRAISAL & CONFIDENCE ASSESSMENT

7.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is good to variable. The results from this survey indicate the presence of a range of anomalies including archaeological features and as such the technique is deemed to have worked successfully.

8 CONCLUSION

8.1 The magnetometer survey has recorded several magnetic responses which are clearly of archaeological interest; they comprise small ‘rings’, rectilinear enclosures and a possible trackway. Ridge and furrow cultivation patterns are visible in the data along with former field boundaries. A few uncertain magnetic responses have been identified and two areas of magnetic disturbance have been mapped.

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9 REFERENCES

BGS 2022 British Geological Survey, Geology of Britain viewer [accessed 07/02/2022] *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

CIfA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Amended 2020. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf

CU 2022 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 07/02/2022] *website: http://mapapps2.bgs.ac.uk/ukso/home.html*

EAC 2016 *EAC Guidelines for the Use of Geophysics in Archaeology,* European Archaeological Council, Guidelines 2.

EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/ (now withdrawn)

Orion 2020 *Land south of Green Lane, Chesterton, Oxfordshire, Historic Environment Desk-Based Assessment,* Orion Heritage Ltd, PN2738/HEDBA, unlublished.

10 ARCHIVE

10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO Geophysics Ltd.'s** digital archive, on an internal RAID configured NAS drive in the Midland's Office. These data are also backed up to the Cloud for off-site storage**.**

10.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months

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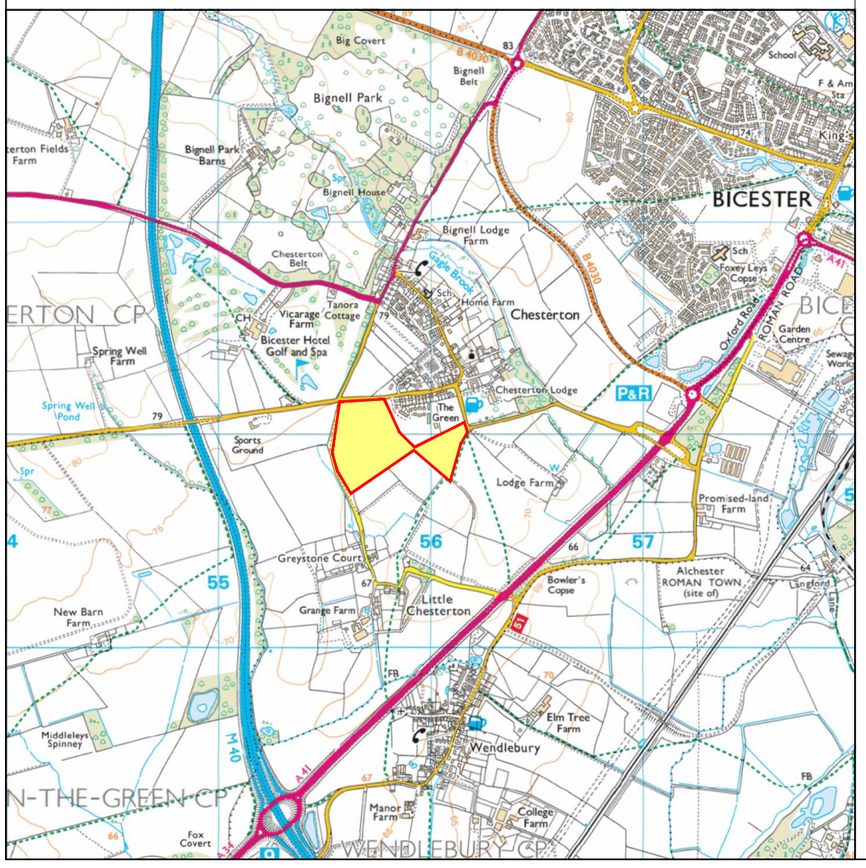

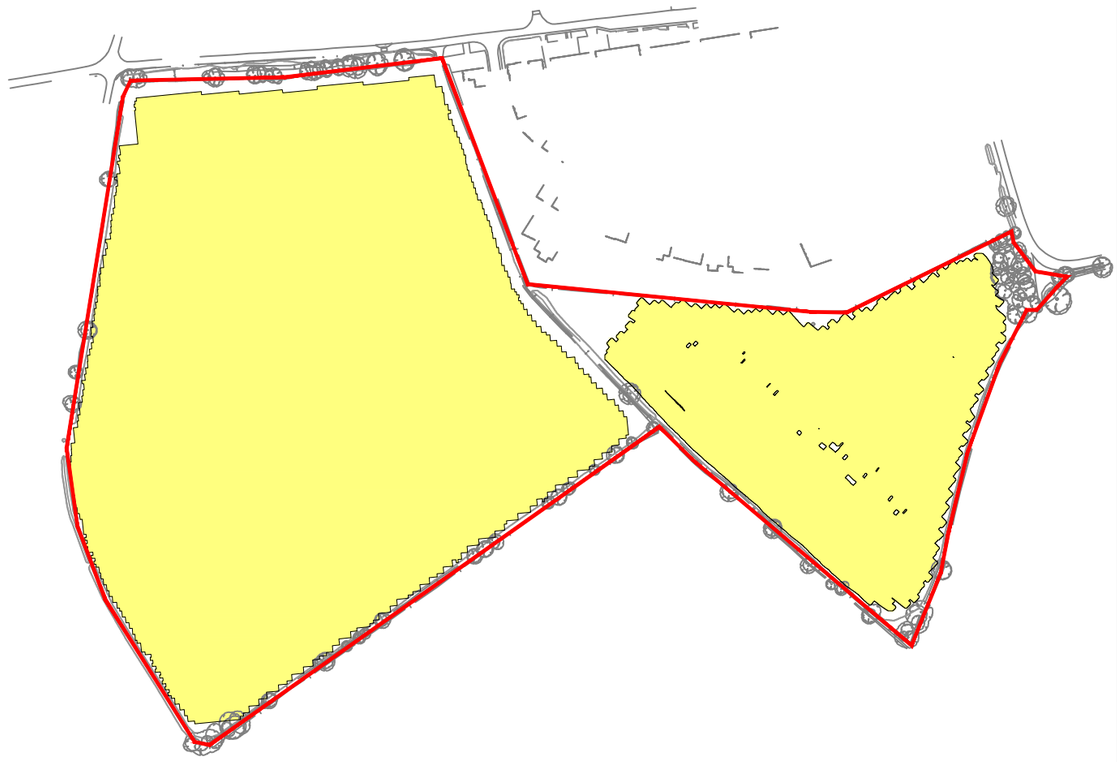

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Survey Areas

N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Site Location

Client:
Orion Heritage Ltd

Project:
05787 - Chesterton, Oxfordshire

Scale:
NOT TO SCALE

Fig No:
01

N

+2nT

-1nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:

Magnetometer Survey - Greyscale Plots

Client:

Orion Heritage Ltd

Project:

05787 - Chesterton, Oxfordshire

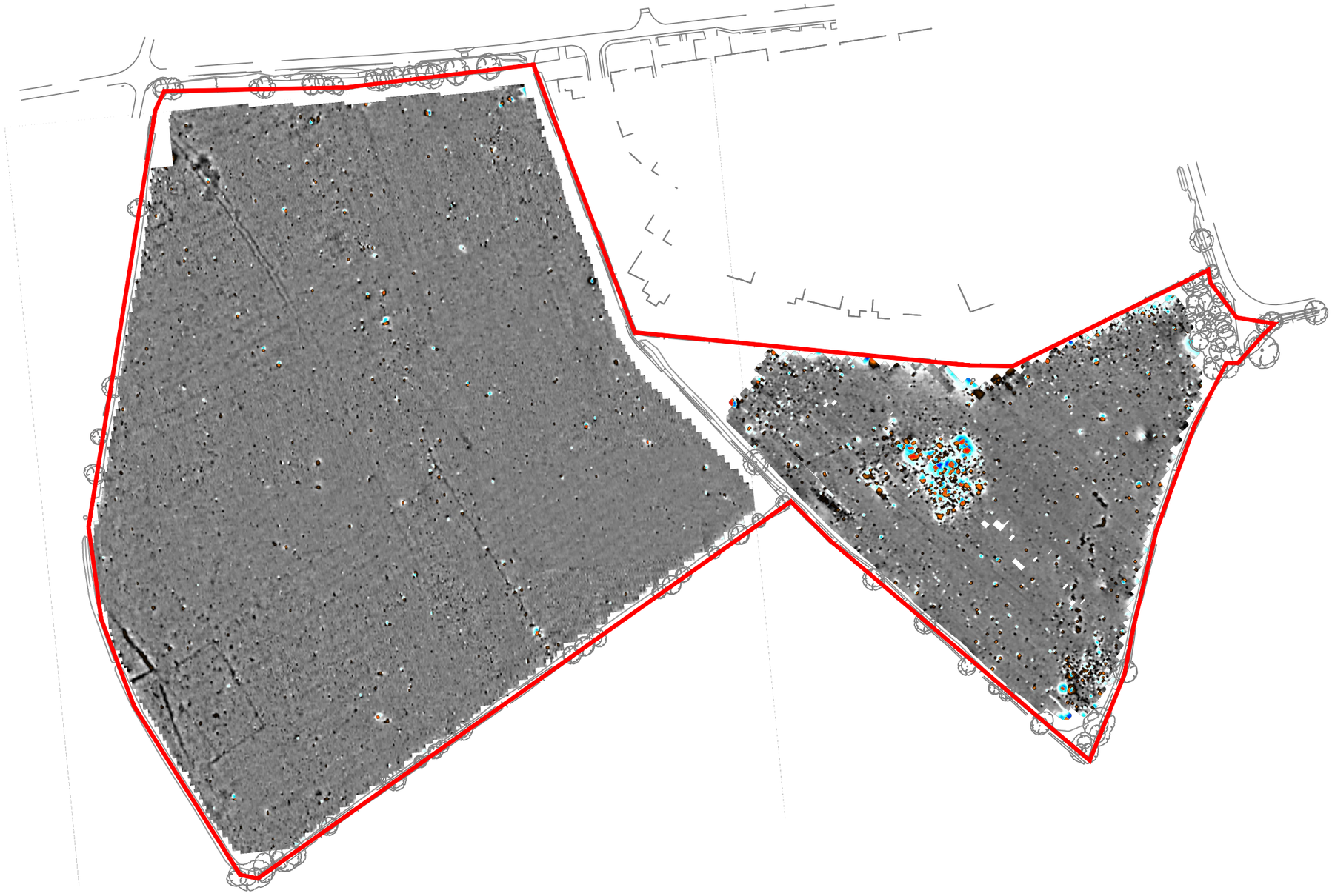
Scale:

0 metres 125

1:2500 @ A3

Fig No:

02



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-100nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:

Magnetometer Survey - Colour Plots

Client:

Orion Heritage Ltd

Project:

05787 - Chesterton, Oxfordshire

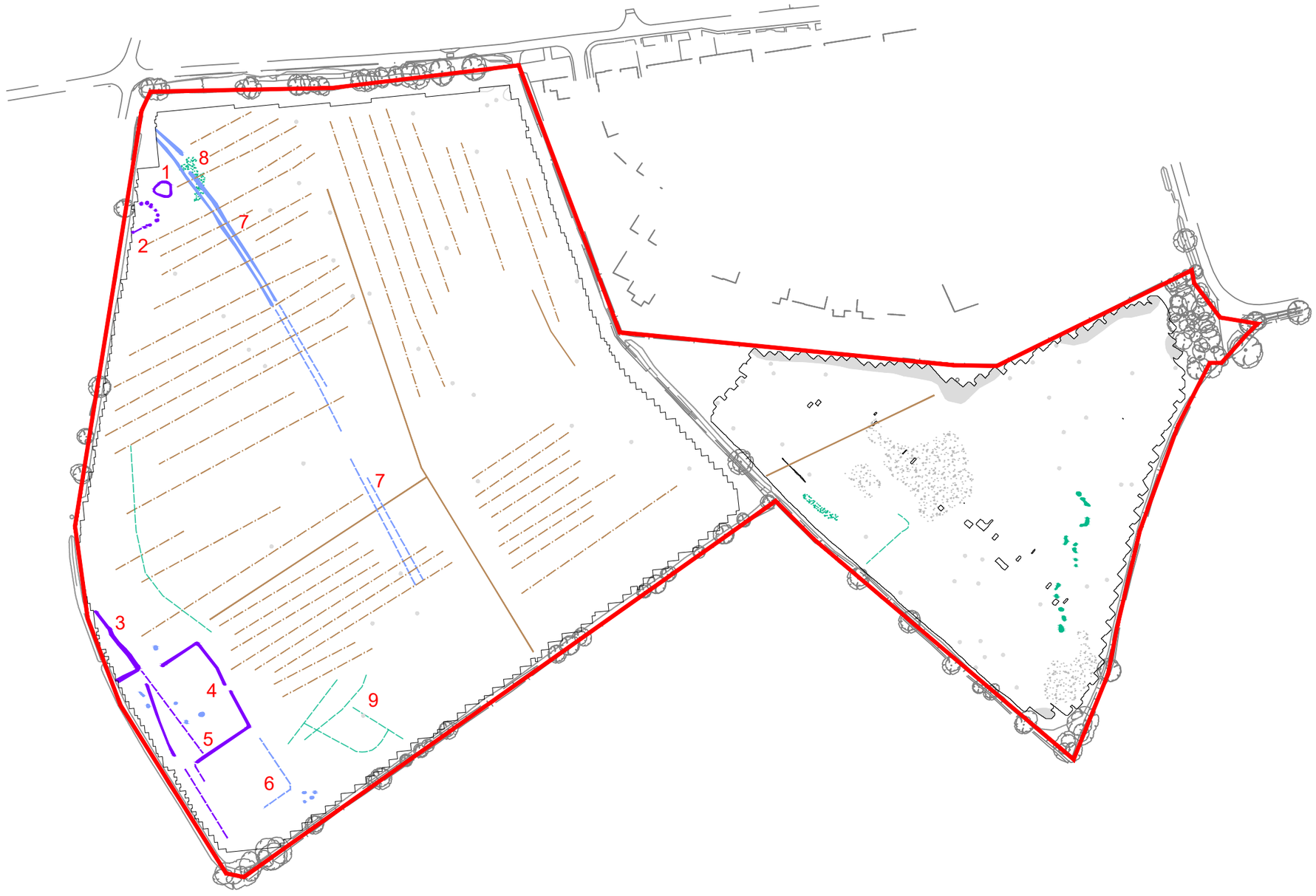
Scale:

0 metres 125

1:2500 @ A3

Fig No:

03



N

KEY

	Probable archaeology (discrete anomaly / trend)
	Possible archaeology (discrete anomaly / trend)
	Uncertain Origin (discrete anomaly / trend / Increased response)
	Former field boundary (corroborated)
	Agriculture (ridge and furrow)
	Service
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

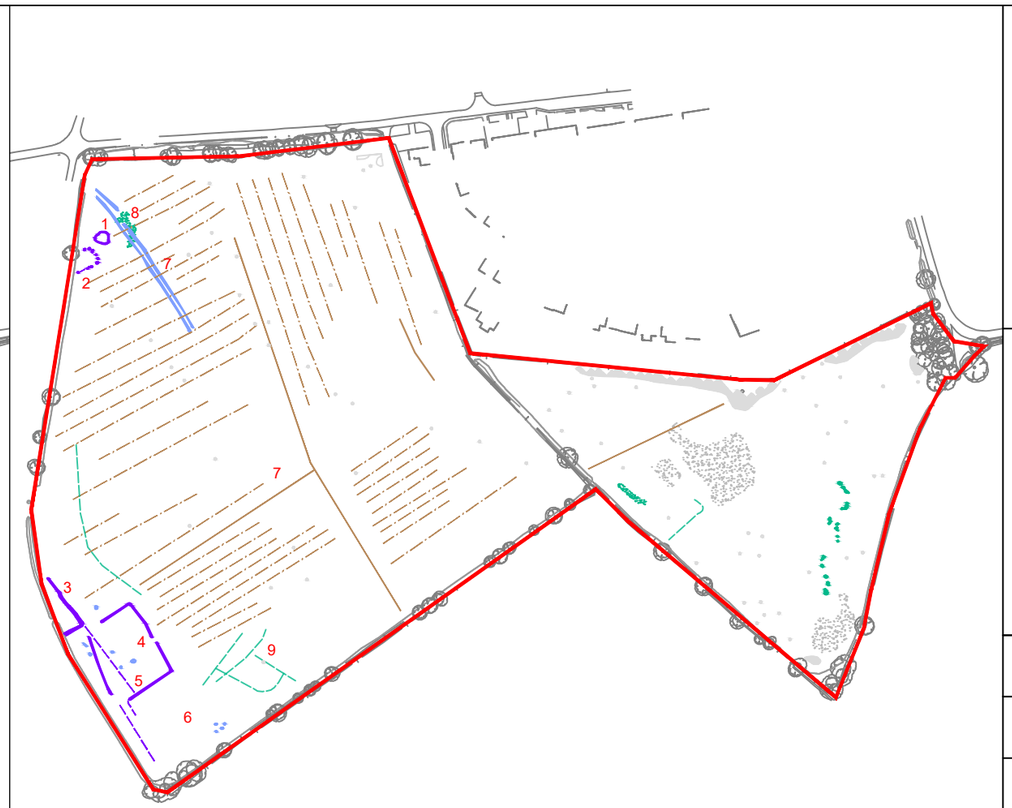
Title:
Magnetometer Survey - Interpretation

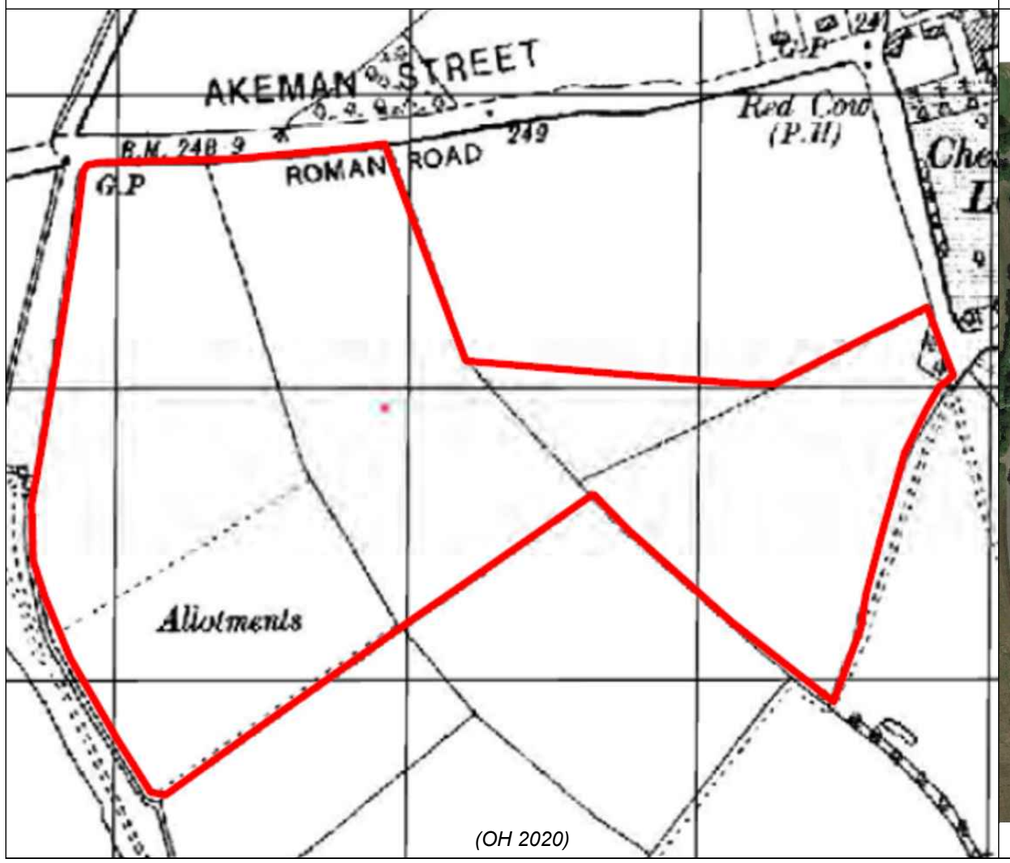
Client:
Orion Heritage Ltd

Project:
05787 - Chesterton, Oxfordshire

Scale:
0 metres 125
1:2500 @ A3

Fig No:
04





©2022 GoogleEarth

N

+2nT

-1nT

KEY

	Probable archaeology (discrete anomaly / trend)
	Possible archaeology (discrete anomaly / trend)
	Uncertain Origin (discrete anomaly / trend / Increased response)
	Former field boundary (corroborated)
	Agriculture (ridge and furrow)
	Service
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

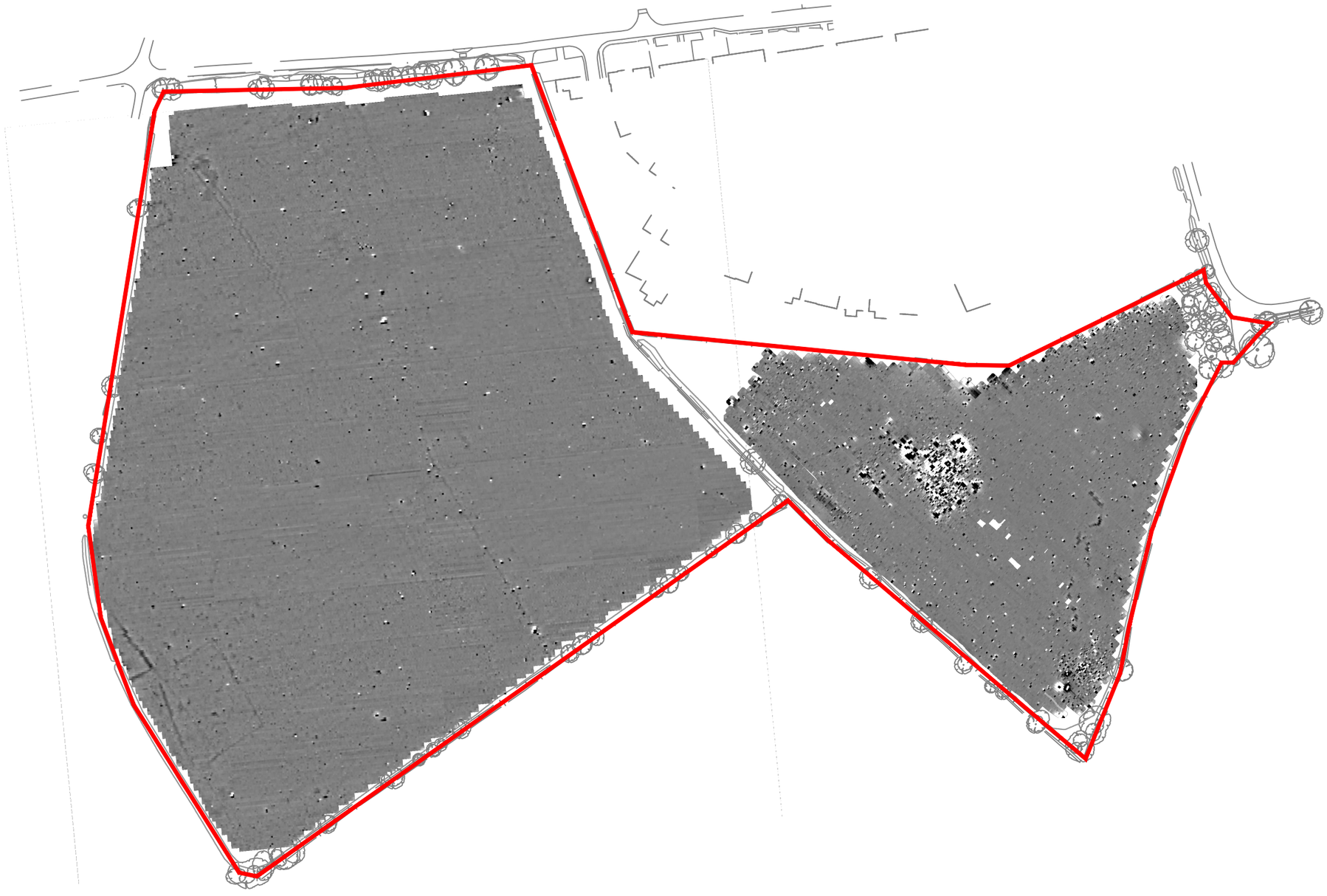
Title: Magnetometer Survey - Greyscale Plot / Interpretation / 1923 Ordnance Survey Mapping / 2020 Aerial Imagery

Client: Orion Heritage Ltd

Project: 05787 - Chesterton, Oxfordshire

Scale: NOT TO SCALE

Fig No: 05



N

+10nT

-10nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:

Minimally Processed Data - Greyscale Plots

Client:

Orion Heritage Ltd

Project:

05787 - Chesterton, Oxfordshire

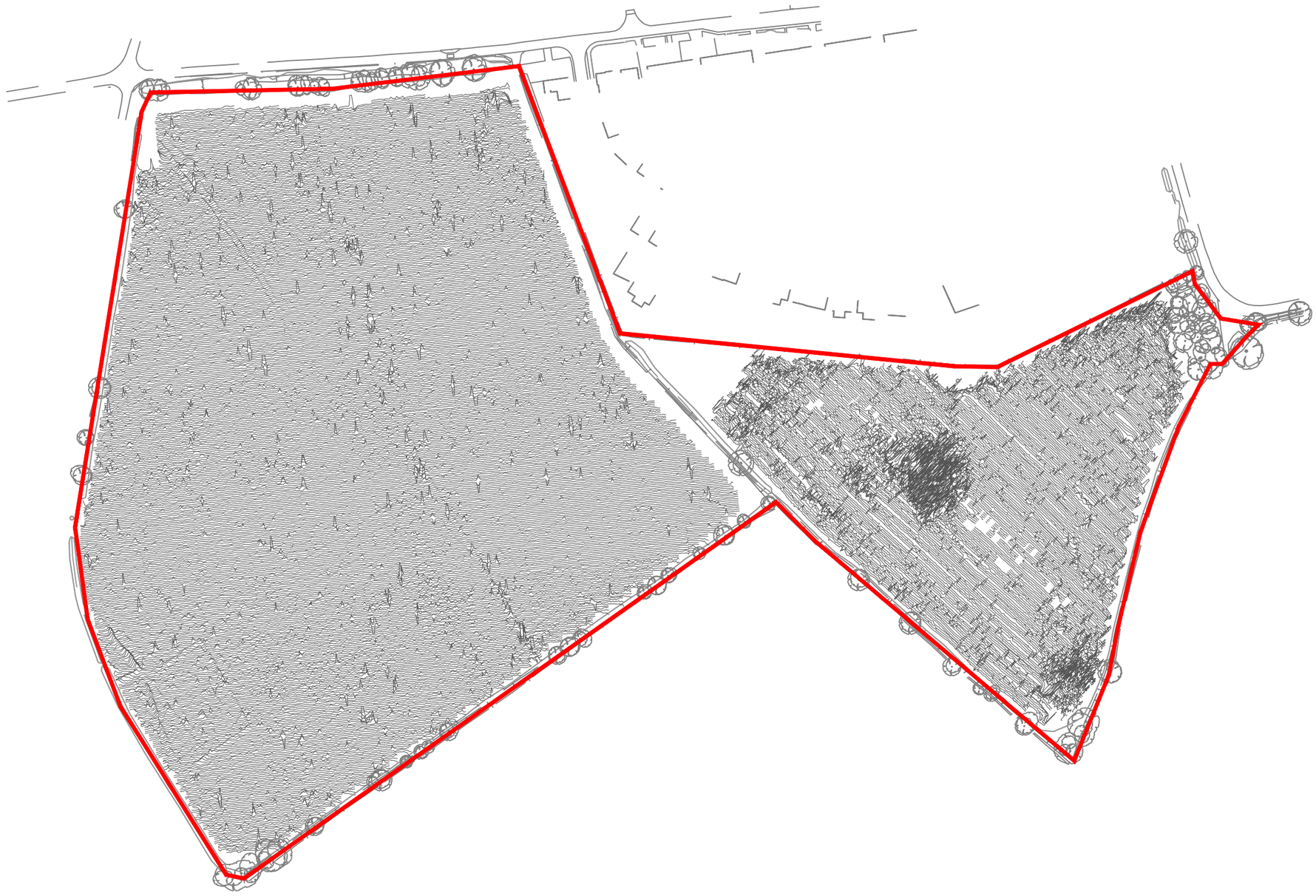
Scale:

0 metres 125

1:2500 @ A3

Fig No:

06



N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
XY Trace Plots (clipped at +/-15nT)

Client:
Orion Heritage Ltd

Project:
05787 - Chesterton, Oxfordshire

Scale:
0 metres 125
1:2500 @ A3

Fig No:
07

Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

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Presentation of results and interpretation

The presentation of the results includes a ‘minimally processed data’ and a ‘processed data’ greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the ‘Interpretation’ drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

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Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

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Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.

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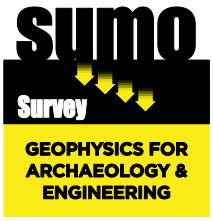
Summary for sumogeop1-504556

OASIS ID (UID)	sumogeop1-504556
Project Name	Geophysical Survey at Land South of Green Lane, Chesterton, Oxfordshire
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	05787
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	17-Jan-2022 - 21-Jan-2022
Location	Land South of Green Lane, Chesterton, Oxfordshire NGR : SP 55848 20955 LL : 51.8843706382127, -1.19000098234245 12 Fig : 455848,220955
Administrative Areas	Country : England County : Oxfordshire District : Cherwell Parish : Chesterton
Project Methodology	A temporary grid system will be established over the site and marked out using canes. The location of the grid will be set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co-ordinates. Data will be collected using a cart carrying four paired Bartington magnetic sensors. Four sensors mounted 1m horizontally apart and very accurately aligned to nullify the effects of the earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.
Project Results	The magnetometer survey has recorded several magnetic responses which are clearly of archaeological interest; they comprise small 'rings', rectilinear enclosures and a possible trackway. Ridge and furrow cultivation patterns are visible in the data along with former field boundaries. A few uncertain magnetic responses have been identified and two areas of magnetic disturbance have been mapped.
Keywords	Pit - UNCERTAIN - FISH Thesaurus of Monument Types Oval Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Rectangular Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Ditch - UNCERTAIN - FISH Thesaurus of Monument Types Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types Ridge And Furrow - MEDIEVAL - FISH Thesaurus of Monument Types
HER	Oxfordshire HER - unRev - STANDARD
HER Identifiers	
Archives	



- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

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