GEOPHYSICAL SURVEY REPORT

Land at Broyleside, Ringmer, East Sussex

Client

Orion Heritage Ltd

For

Catesby Strategic Land Ltd

Survey Report

18794

OASIS Ref. No.

Sumogeop1-527348

Date

08 January 2025

Survey Report 18794: Land at Broyleside, Ringmer, East Sussex

Survey dates	16 - 19 December 2024
Field co-ordinator	Robert Knight BA MA
Field Team	Gabriel Mazeski BA
Report Date	08 January 2025
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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. All survey techniques followed the guidance set out by CIfA (2020) and the European Archaeology Council (EAC) (2016).

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.

4 EXECUTIVE SUMMARY OF RESULTS

4.1 A magnetometer survey of 16.4 hectares of land at Broyleside, Ringmer, has not detected any responses which would normally be associated with buried archaeological remains. Possible ridge and furrow plus former field boundaries / trackways have been recorded, along with a few uncertain responses, not thought to be of specific interest. Natural anomalies are visible in the northern half of the site which reflect the differing geology.

5 INTRODUCTION

5.1 **SUMO GeoSurveys** was commissioned to undertake a geophysical survey of an area outlined for residential development. This survey forms part of an archaeological investigation being undertaken by **Orion Heritage Ltd** on behalf of **Catesby Strategic Land Ltd**.

5.2 Site Details

NGR / Postcode	TQ 4572 1363 / BN8 5PE
Location	The site lies approximately 10km northeast of Lewes and 7km northeast of Ringmer. And occupies fields north of the B2192 and west of the hamlet of Broyle Side. Residential housing off Broyle Lane forms the eastern limits of the survey area, while agricultural fields are present on the other three sides along with a small, wooded area. A l stream / watercourse flows through the southern third of the site.
HER	East Sussex (ESHER)
OASIS Ref. No.	Sumogeop1-527348
District	Lewes District Council
Parish	Ringmer CP
Topography	Generally level at c. 16m aOD
Land Use	Agricultural fields, mainly pasture
Geology (BGS 2024)	Bedrock & Superficial: South: Lower Greensand Group - Sandstone, siltstone and mudstone plus Head deposits – Clay, sand and gravel North: Weald Clay Formation – Mudstone A band of alluvium follows the stream
Soils (CU 2024)	18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	16.4 ha

5.3 ***Archaeological Background*** *(OH 2024)*

5.3.1 There are no designated archaeological heritage assets within the study site. The only designated archaeological heritage asset within the wider 1km study area is the medieval ringwork at Clay Hill (NHLE 1013064), which is located c. 775m to the north-west. There are no non-designated heritage assets on the study site. The DBA concludes that the survey area has a low potential to contain archaeological finds and features from any period.

5.4 ***Aims and Objectives***

5.4.1 To locate and characterise any anomalies of possible archaeological interest within the study area.

6 RESULTS

6.1 *The survey has been divided into eight survey areas (Areas 1-8).*

6.2 ***Probable / Possible Archaeology***

6.2.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest apart from a small area of possible ridge and furrow cultivation (see 6.3).

6.3 ***Ridge and Furrow***

6.3.1 A small zone of broadly spaced parallel, weak linear responses in the south-east corner of Area 8 have tentatively been interpreted as indicating former ridge and furrow cultivation.

6.4 ***Uncertain***

6.4.1 A few poorly defined linear and curvilinear trends are visible in the data; however, they are at the limits of detection and do not have the characteristic responses of anomalies normally associated with archaeological features. They are more likely to be modern agricultural effects or have a natural / geological explanation.

6.5 ***Former Field Boundary / Track / Footpath - Corroborated***

6.5.1 Linear trends in Areas 6 and 7 mark the line of a former boundary visible on the 1878 Ordnance Survey map. Similarly, a narrow band of magnetic disturbance aligned approximately northwest to southeast and running through Area 2, coincides with a former track visible on the same map and a modern path showing on aerial imagery (see Figure 05).

6.6 ***Agricultural***

6.6.1 Closely spaced parallel linear trends reflect modern ploughing.

6.7 ***Natural / Geological / Pedological***

6.7.1 Amorphous bands of increased magnetic response, particularly in the northern half of the survey, reflect the mudstone geology in this part of the site.

6.8 ***Ferrous / Magnetic Disturbance***

6.8.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

7 DATA APPRAISAL & CONFIDENCE ASSESSMENT

7.1 Historic England Table 4 (EH 2008) states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of a range of responses, consequently, there is no *a priori* reason why archaeological features would not have been detected.

8 CONCLUSION

8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. A small area of possible ridge and furrow cultivation has been identified, along with an old field boundary and a track. There are a few uncertain responses, which are most likely to be agricultural of natural in origin; definite geological responses are also visible in the data.

9 REFERENCES

BGS 2024 *Geology of Britain Viewer,* British Geological Survey, website: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

ClfA 2020 *Standard and Guidance for Archaeological Geophysical Survey.* 2014 amended 2020. ClfA Guidance note. Chartered Institute for Archaeologists, Reading https://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_3.pdf

CU 2024 *The Soils Guide*. www.landis.org.uk. Cranfield University, UK. 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.

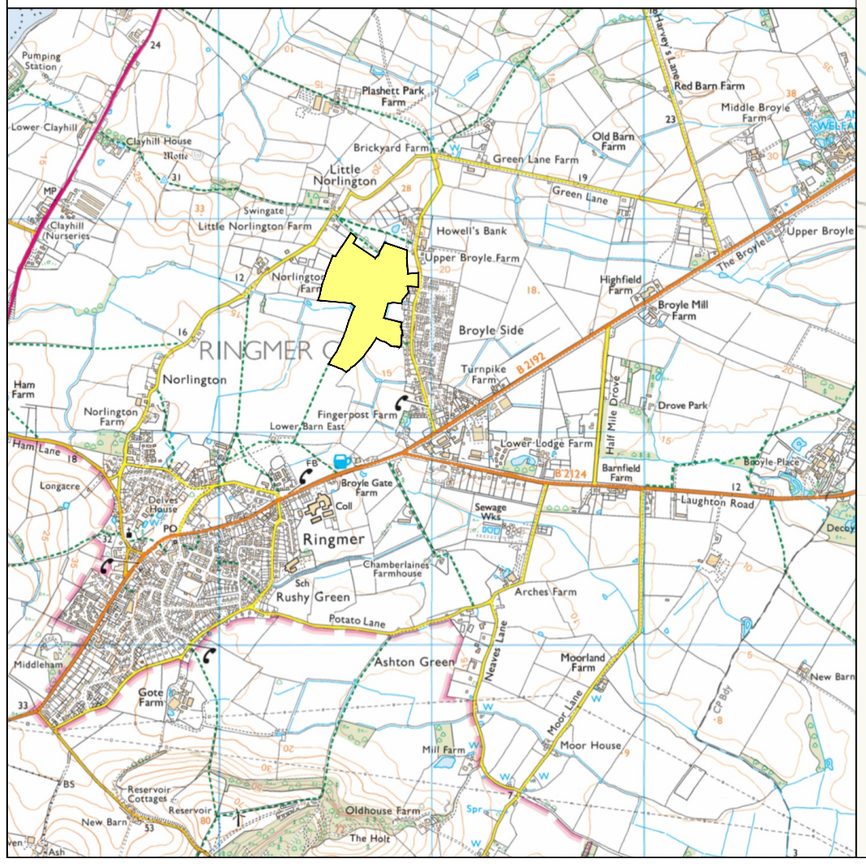
EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon (now withdrawn, but used for evaluating suitability of soil types)

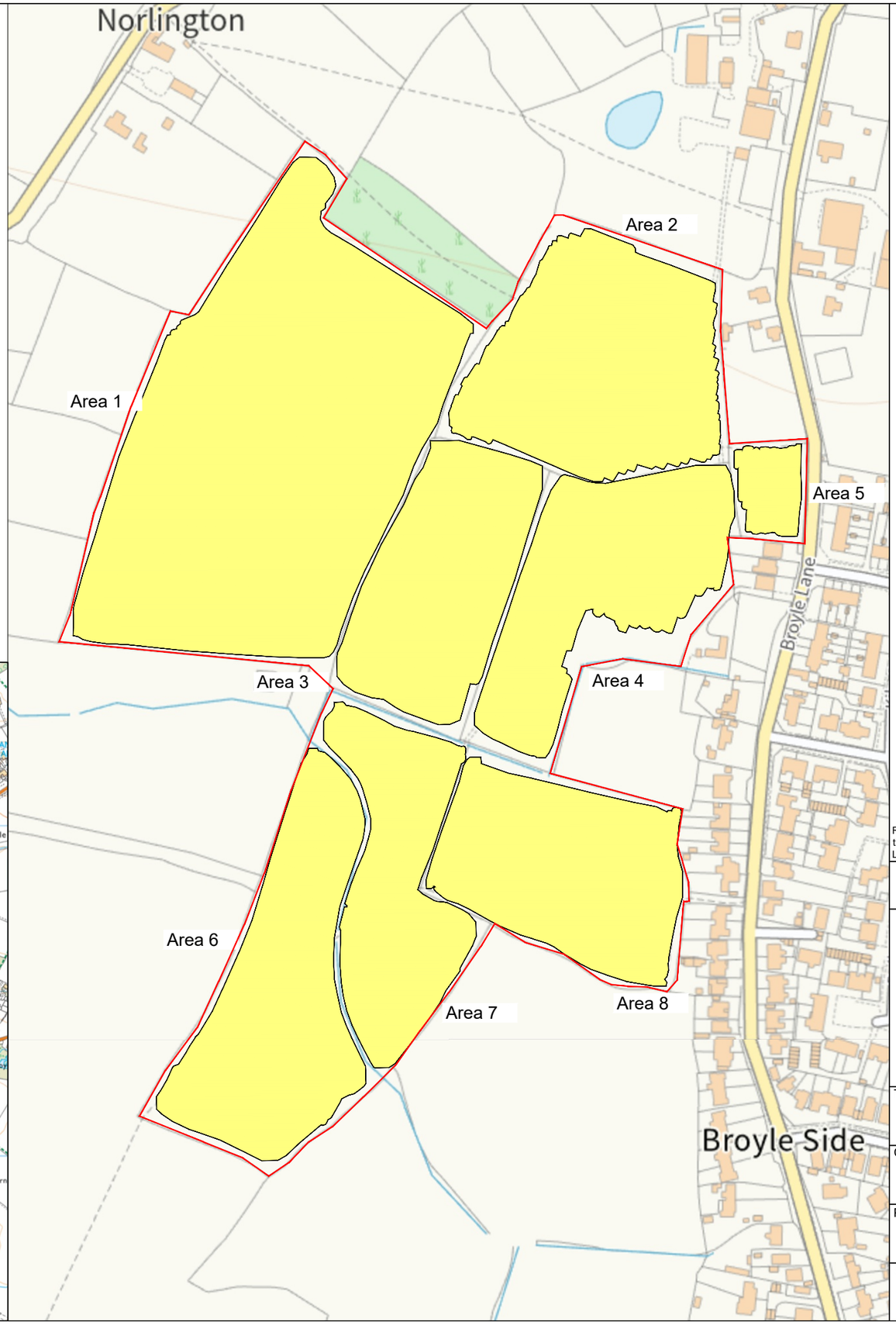
OH 2024 *Land at Broyleside, Ringmer Historic Environment Desk-Based Assessment,* Orion Heritage Ltd unpublished report PN3560 HEDBA

10 ARCHIVE

10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO GeoSurveys'** digital archive, on an internal RAID configured NAS drive in the Midlands 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.





N

Survey Areas

sumo GeoSurveys

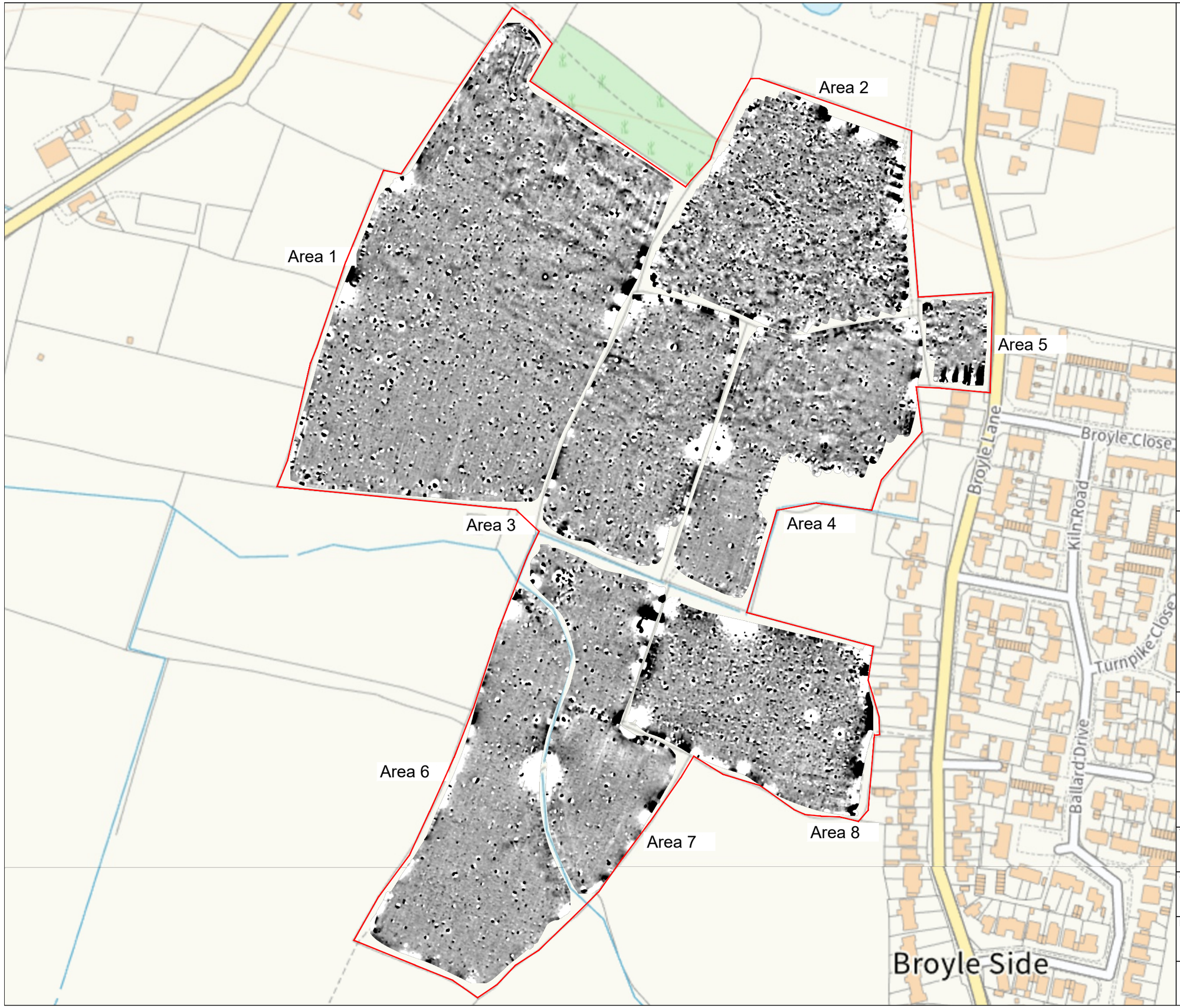
Title: Site Location

Client: Orion Heritage

Project: SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale: NOT TO SCALE

Fig No: 01



N

+2nT

-1nT

sumo GeoSurveys

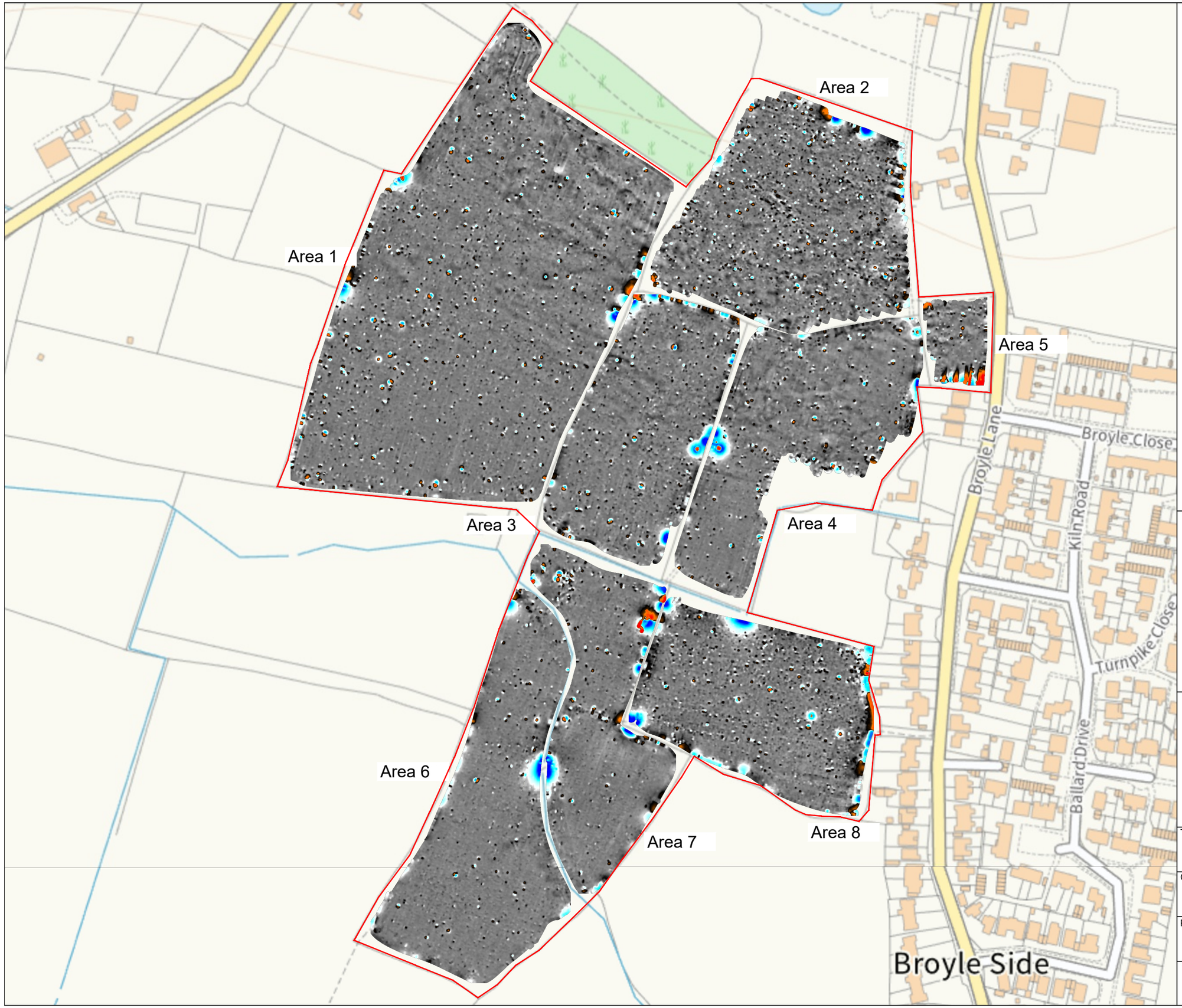
Title:
Magnetometer Survey - Greyscale Plots

Client:
Orion Heritage

Project:
SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale:
0 metres 120
1:2400 @ A3

Fig No:
02



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+100nT

-100nT

sumo GeoSurveys

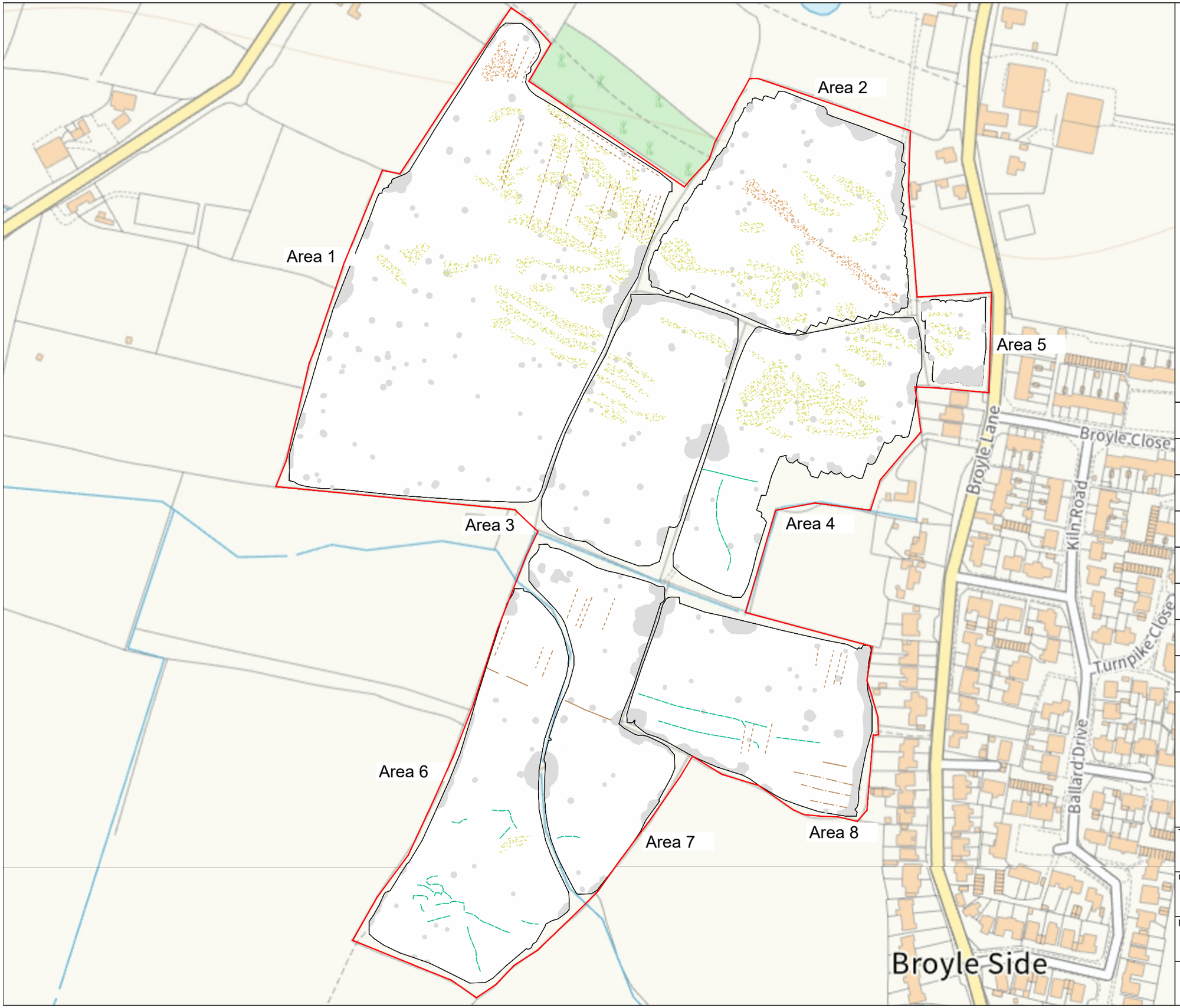
Title:
Magnetometer Survey - Colour Plots

Client:
Orion Heritage

Project:
SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale:
0 metres 120
1:2400 @ A3

Fig No:
03



N

KEY

	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Agriculture (plough)
	Natural (e.g. geological / pedological)
	Magnetic disturbance - footpath
	Ferrous

sumo GeoSurveys

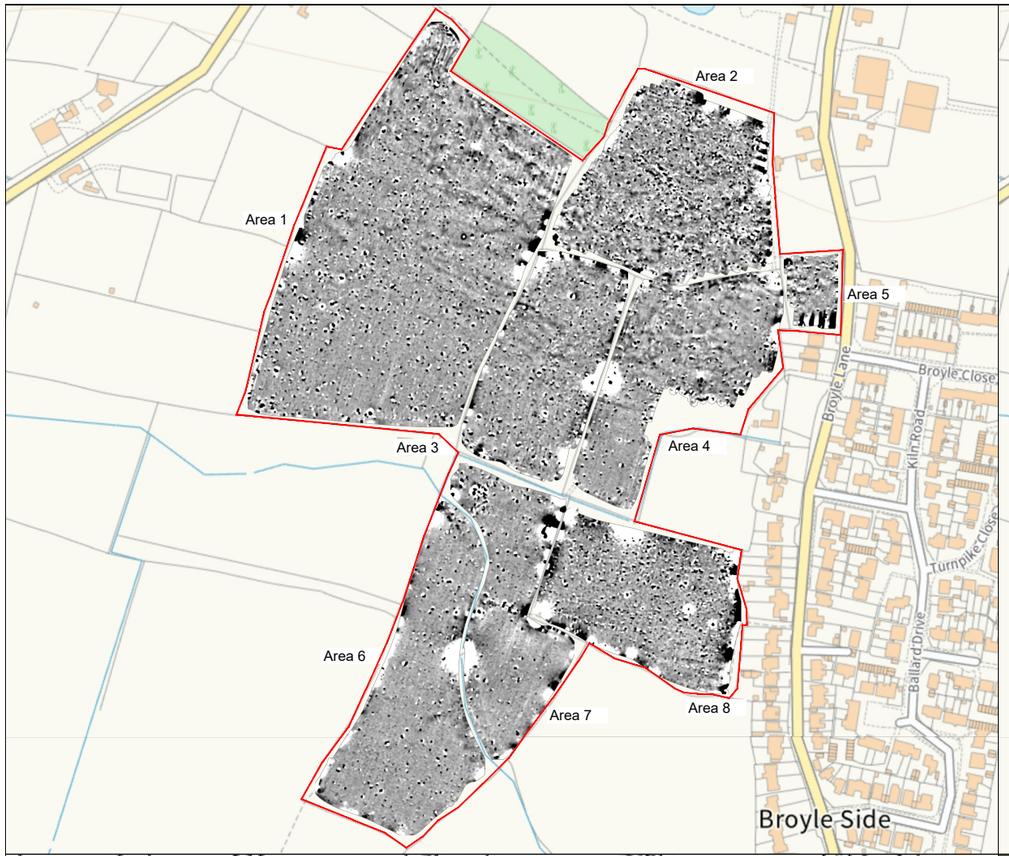
Title: Magnetometer Survey - Interpretation

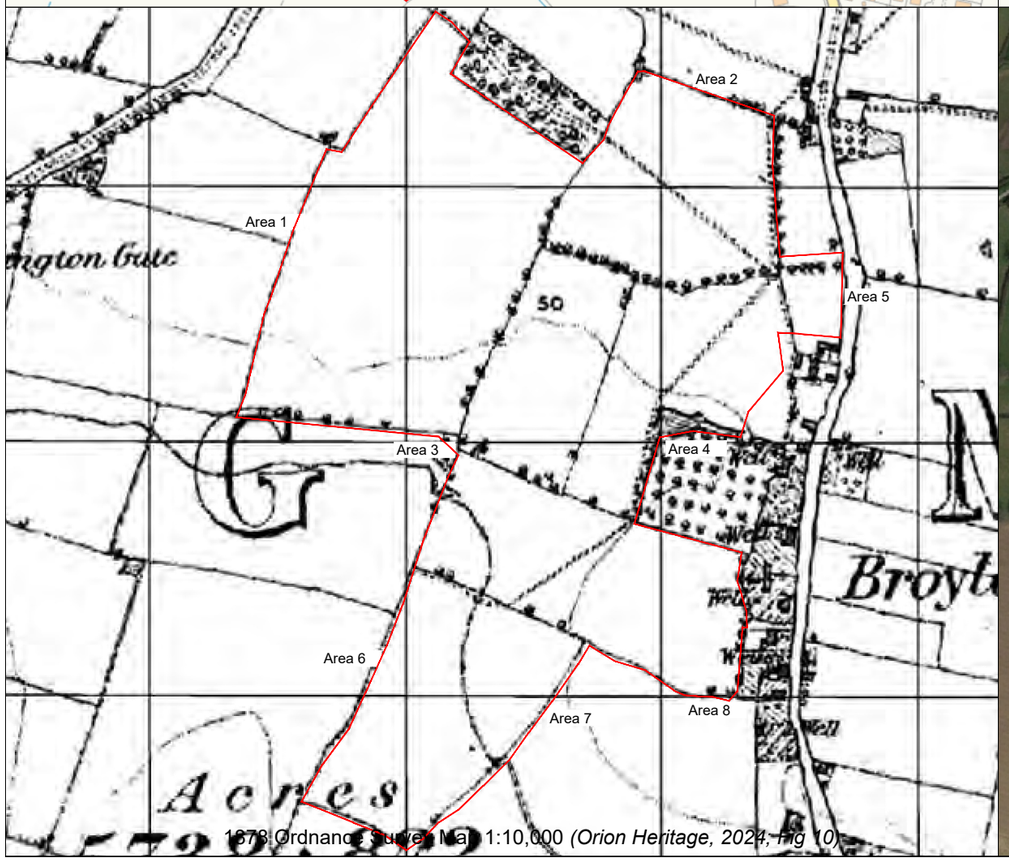
Client: Orion Heritage

Project: SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale: 0 metres 120
1:2400 @ A3

Fig No: 04





1878 Ordnance Survey Map 1:10,000 *(Orion Heritage, 2024, Fig 10)*

N

+2nT

-1nT

KEY

	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Agriculture (plough)
	Natural (e.g. geological / pedological)
	Magnetic disturbance - footpath
	Ferrous

sumo GeoSurveys

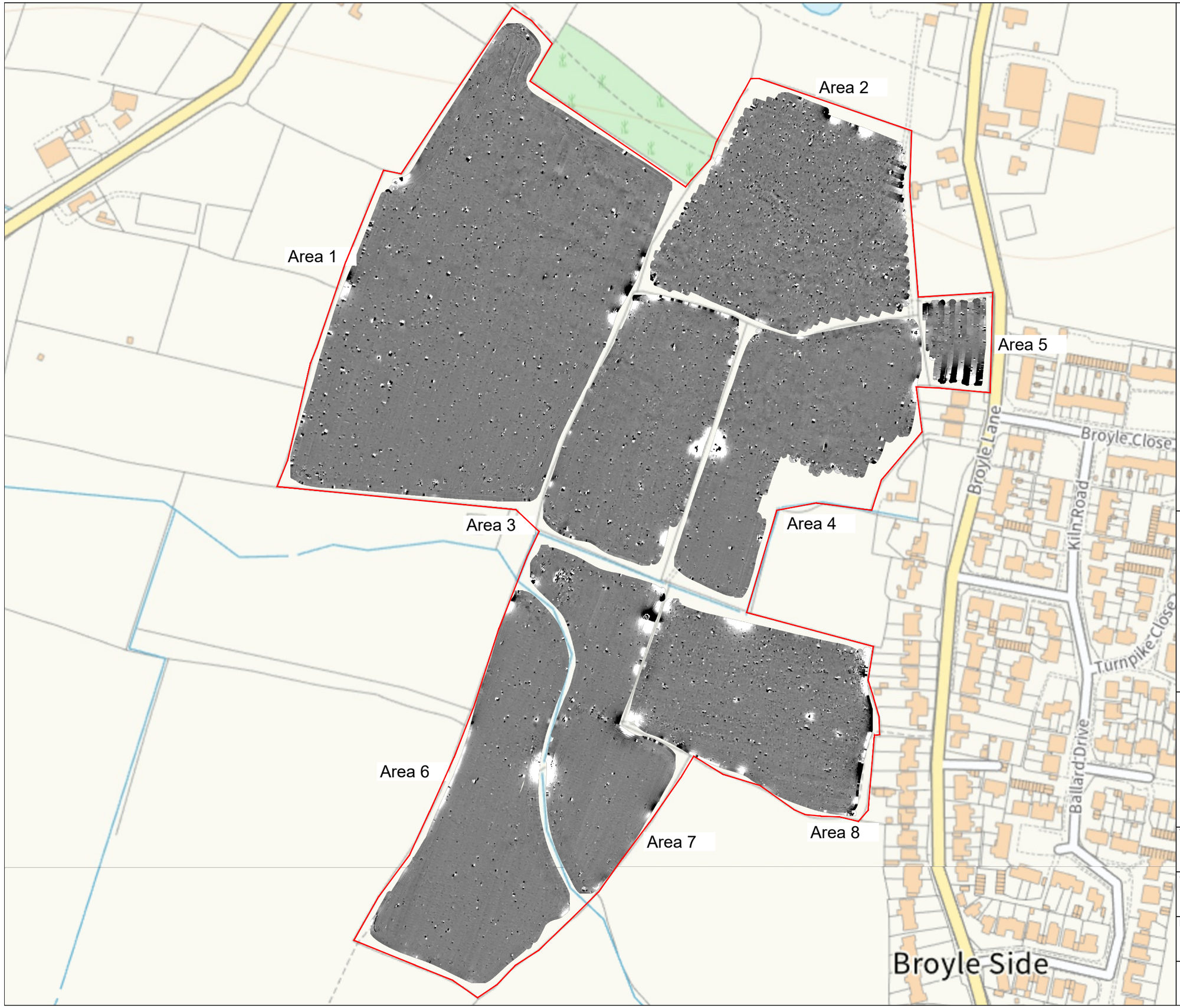
Title: Greyscale Plots / Interpretation / 1878 Ordnance Survey Map / 2022 Aerial Image

Client: Orion Heritage

Project: SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale: NOT TO SCALE

Fig No: 05



N

+10nT

-10nT

sumo GeoSurveys

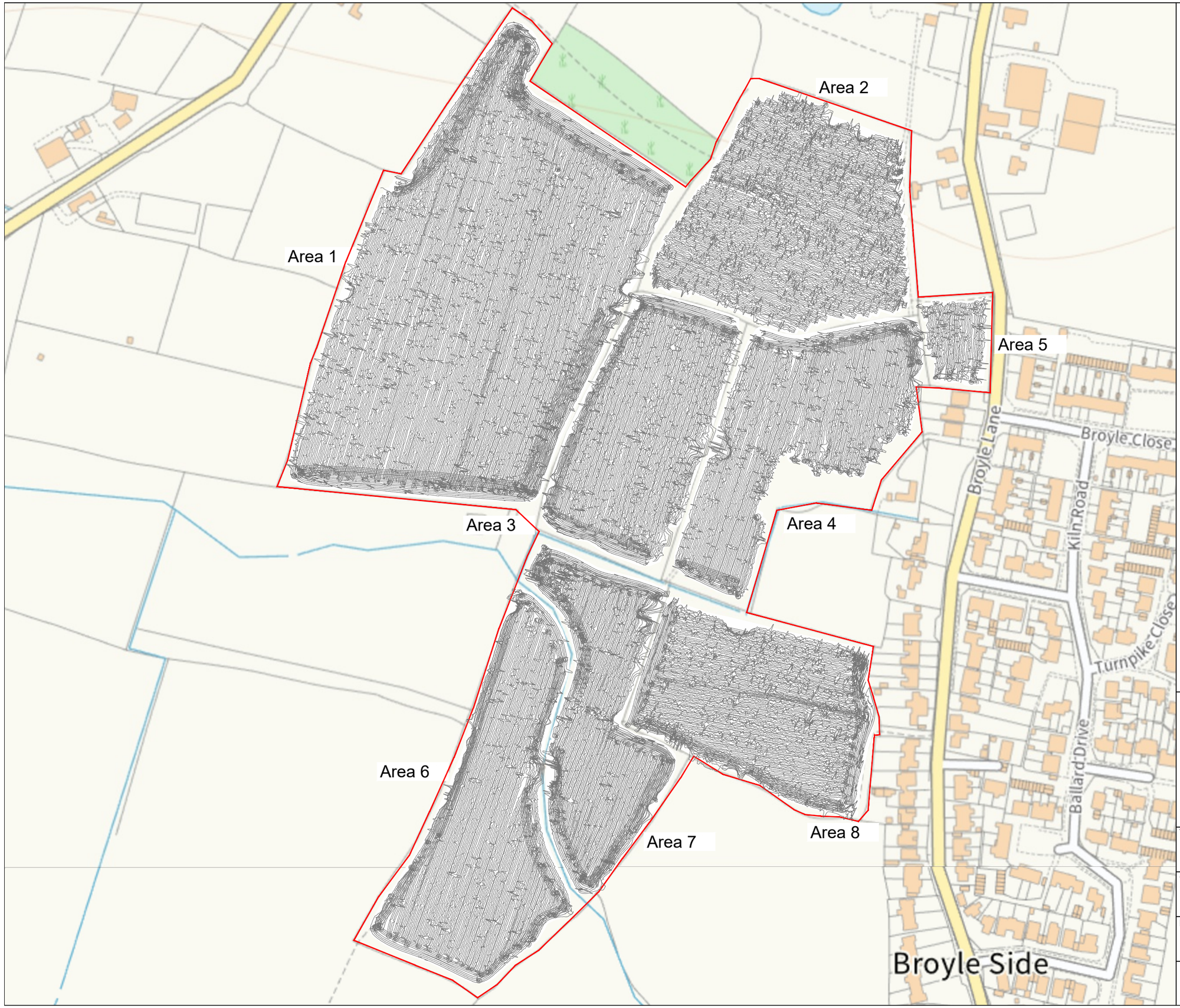
Title:
Minimally Processed Data - Greyscale Plots

Client:
Orion Heritage

Project:
SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale:
0 metres 120
1:2400 @ A3

Fig No:
06



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SUMO GeoSurveys

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

Client:
Orion Heritage

Project:
SUMO 18794: Land at Broyleside, Ringer, East Sussex

Scale:
0 metres 120
1:2400 @ A3

Fig No:
07

Appendix A - Technical Information: Magnetometer Survey Method

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	1.0m	0.25m
Magnetometer	Bartington Cart System	1.0m	0.125m

Instrumentation:

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted horizontally, 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.

Bartington Grad 601-2

Hand-Held: Data will be collected using a Bartington Grad 601-2. The instrument consists of two paired sensors and readings are logged at 0.25m centres along traverses 1.0m apart across 30m grids. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution as per Historic England guidelines

Bartington Cart System

Data will be collected using a cart carrying four paired Bartington magnetic sensors. 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.

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.

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).

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.

Appendix C - OASIS Summary Sheet

OASIS Summary for sumogeop1-527348

OASIS ID (UID)	sumogeop1-527348
Project Name	Geophysical Survey, Magnetometry Survey at Land at Broyleside, Ringmer, East Sussex
Sitename	Land at Broyleside, Ringmer, East Sussex
Sitecode	18794
Project Identifier(s)	18794
Activity type	Geophysical Survey, Magnetometry Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	16-Dec-2024 - 19-Dec-2024
Location	Land at Broyleside, Ringmer, East Sussex NGR : TQ 45660 13669 LL : 50.90412683737908, 0.070221850799476 12 Fig : 545660,113669
Administrative Areas	Country : England County/Local Authority : East Sussex Local Authority District : Lewes Parish : Ringmer
Project Methodology	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. All survey techniques followed the guidance set out by CIfA (2020) and the European Archaeology Council (EAC) (2016). Bartington Cart SystemTraverse Interval 1.0mSample Interval 0.125m
Project Results	a magnetometer survey of 16.4 hectares of land at Broyleside, Ringmer, has not detected any responses which would normally be associated with buried archaeological remains. Possible ridge and furrow plus former field boundaries / trackways have been recorded, along with a few uncertain responses, not thought to be of specific interest. Natural anomalies are visible in the northern half of the site which reflect the differing geology.
Keywords	Ridge And Furrow - POST MEDIEVAL - FISH Thesaurus of Monument Types Footpath - POST MEDIEVAL - FISH Thesaurus of Monument Types Plough Marks - POST MEDIEVAL - FISH Thesaurus of Monument Types Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types
Funder	Private or public corporation Orion Heritage
HER	East Sussex HER - noRev - LITE
Person Responsible for work	Rebecca Fradgley
HER Identifiers	
Archives	

Report generated on: 08 Jan 2025, 09:13

Appendix D – Data Management Plan & Archive Selection Strategy

Data Management Plan

Project ID / OASIS ID

SUMO-18794 / sumogeop1-527348

Project Name

Land at Broyleside, Ringmer, East Sussex

Project Description

Detailed magnetic survey over approximately 16.4 hectares at Ringmer, East Sussex.

Client

Orion Heritage

Project Manager

Rebecca Fradgley

Field Leader

Robert Knight

Date DMP created

08/01/2025

Date DMP last updated

08/01/2025

Version

1

Technique - data

Detailed magnetic survey.

Manual – cart - other

ATV Cart system

Documentation and metadata

All documentation and data produced are stored on SUMO servers in a specific job file.

Data storage, access and back-up

- SUMO Secure server during the project life set up in a RAID configuration (a RAID configuration incorporates a level of data redundancy meaning if a single hard drive in fails data can still be restored).
- Snap shots of the data will be made at several intervals during the day to allow data to be restored for up to 30 days if changed / deleted.
- Once the final report has been completed data will be moved onto NAS drive set up in a RAID configuration.
- All data is backed up to an off-site location (Cloud storage).

Archive Selection Strategy

Digital Data

Selection

It is proposed that only the final version of all born digital documents (reports, images and CAD files) will be selected for inclusion in the Preserved Archive. All raw and processed survey data will be included in the preserved archive. Below is what will constitute the selected archive:

- Raw data in XYZ format .csv and .png plus .pgw world file
- Processed data as .png plus .pgw world file
- Final survey report .pdf
- CAD and Vector graphics (interpretations) in .dwg format

De-selected digital data

The de-selected material will be retained on the SUMO Secure server and Cloud storage.

Documents

Not applicable – no archive

Materials

Not applicable – no archive

- Archaeological Geophysics
- Engineering Geophysics
- Measured Building Services
- Utility and Topographic Services
- Aerial Surveys
- Rail Surveys

SUMO GeoSurveys is a trading name of SUMO Geophysics Ltd.
SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL