

GEOPHYSICAL SURVEY

Land north east of Harpenden, Hertfordshire AL5 5HS

Oasis id: SUMO-21405

NGR: TL14500 16051

Ref: 794-PLN-HER-00885
April 2025

GEOPHYSICAL SURVEY REPORT

**Land North East of Harpenden,
Hertfordshire**

Survey Report

SUMO-21405

OASIS Ref. No.

Sumogeop1-532135



Survey Report SUMO-21405: Land North East of Harpenden, Hertfordshire

Survey dates	14-17 April 2025
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Report Date	24 April 2025
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TABLE OF CONTENTS

1	LIST OF FIGURES	3
2	LIST OF APPENDICES	3
3	SURVEY TECHNIQUE	3
4	SUMMARY OF RESULTS	4
5	INTRODUCTION	4
6	RESULTS.....	5
7	DATA APPRAISAL & CONFIDENCE ASSESSMENT	6
8	CONCLUSION.....	6
9	REFERENCES	6
10	ARCHIVE	6

1 LIST OF FIGURES

Figure 01	NTS	Site Location
Figure 02	1:3000	Magnetometer Survey - Greyscale Plots
Figure 03	1:3000	Magnetometer Survey - Colour Plots
Figure 04	1:3000	Magnetometer Survey - Interpretation
Figure 05	1:2100	Magnetometer Survey - Greyscale Plots (Areas 1, 2 & 3)
Figure 06	1:2100	Magnetometer Survey - Colour Plots (Areas 1, 2 & 3)
Figure 07	1:2100	Magnetometer Survey - Interpretation (Areas 1, 2 & 3)
Figure 08	1:2200	Magnetometer Survey - Greyscale Plots (Areas 4, 5 & 6)
Figure 09	1:2200	Magnetometer Survey - Colour Plots (Areas 4, 5 & 6)
Figure 10	1:2200	Magnetometer Survey - Interpretation (Areas 4, 5 & 6)
Figure 11	NTS	Greyscale Plots / Interpretation / 1888-1915 Ordnance Survey Map / 2024 Aerial Image
Figure 12	NTS	Greyscale and Colour Plots / Interpretation / LiDAR Data Plot
Figure 13	1:3000	Minimally Processed Data - Greyscale Plots
Figure 14	1:2100	XY Trace Plots (Areas 1, 2 & 3 clipped at +/-15nT)
Figure 15	1:2200	XY Trace Plots (Areas 3, 4 & 5 clipped at +/-15nT)

2 LIST OF APPENDICES

Appendix A	Technical Information: Magnetometer Survey Methods, Processing and Presentation
Appendix B	Technical Information: Magnetic Theory
Appendix C	OASIS Data Collection Sheet
Appendix D	Data Management Plan & Archive Selection Strategy

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 ClfA (2020) and the European Archaeology Council (EAC) (2016).

Bartington Cart System	Traverse Interval 1.0m	Sample Interval 0.125m
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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.
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4 EXECUTIVE SUMMARY OF RESULTS

- 4.1 A magnetometer survey of land North East of Harpenden, Hertfordshire has recorded magnetic responses that have been interpreted as being of archaeological interest. A series of enclosures are visible in Areas 4 and 5 along with numerous other ditches and pit-like responses. Magnetically weaker anomalies though Areas 2, 3 and 5 are also likely to have archaeological origins. Historic ridge and furrow cultivation has been detected in Area 2. Uncertain responses have been marked across the site which are probably due to a combination of natural variations, agricultural processes or buried debris. Former field boundaries and natural anomalies have also been plotted.

5 INTRODUCTION

- 5.1 **SUMO GeoSurveys** was commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **RPS**.

5.2 Site Details

NGR / Postcode	TL 14500 16051 / AL5 5HS
Location	The site is located 6.5km south-east of Luton and on the north-eastern outskirts of Harpenden. The survey area is bounded to the north-west by Nower Heath Lane (B652), to the east by Common Lane and to the south by houses off Someries Road / Noke Shot Road / Pickford Hill.
HER	Hertfordshire
OASIS Ref. No.	Sumogeop1-532135
District	St. Albans District (B)
Parish	Harpenden Town CP / Wheathampstead CP
Topography	Undulating
Land Use	Pasture
Geology (BGS 2025)	Bedrock: Chalk Rock Member - Chalk. Lewes Nodular Chalk Formation and Seaford Chalk Formation - Chalk Holywell Nodular Chalk Formation and New Pit Chalk Formation - Chalk
Soils (CU 2025)	Superficial: Clay-with-flints Formation - Clay, silt, sand and gravel Soilscape 8: Slightly acid loamy and clayey soils with impeded drainage
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	30 ha (3.5ha unsurveyable)

5.3 **Archaeological Background** (RPS 2024)

- 5.3.1 An archaeological desk-based assessment has been produced by RPS. In terms of relevant nationally significant designated heritage assets, no World Heritage Sites, Historic Wreck or Historic Battlefield have been identified within the site, or within the vicinity. There are no locally designated archaeological sites on or particularly near the study site as defined by the St Albans City and District Council Albans (SACDC) Local Plan. Based on current evidence, the DBA states there is a moderate potential for the remains of Iron Age field ditches of low significance, open field systems (ploughed-out ridge and furrow) and for Post-Medieval field boundaries. A low archaeological potential is identified for all other periods.

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 nine survey areas (Areas 1-9) and specific anomalies have been given numerical labels [1] [2] which appear in the text below, as well as on the Interpretation Figure(s). Access issues for Area 7 and horses in Areas 8 and 9 rendered these three land parcels unsurveyable.*

6.2 **Probable / Possible Archaeology**

- 6.2.1 Numerous ditch-like responses, trends and pit-like anomalies have been detected in Areas 4 and 5. They have been assigned to the categories of *Probable* and *Possible Archaeology* in accordance with their magnetic strengths and morphologies. Concentrations of these anomalies are visible straddling Areas 4 and 5; they appear to form a cluster of smaller enclosures [1]. Numerous other ditches extend beyond this cluster and make up larger enclosures, many of these extend northwards and eastwards beyond the limits of the survey. Some of the larger pits [2] in Areas 4 and 5 could have archaeological origins, however, they may have also been caused by the infilling of former chalk pits, consequently they have been assigned to the category of *Possible Archaeology*.
- 6.2.2 In Area 2 trends and pits [3] have tentatively been assigned to the category of *Possible Archaeology* but they could have been caused by agricultural processes.

6.3 **Ridge and Furrow**

- 6.3.1 Broad and parallel linear responses have been marked in Area 2 which have been caused by historic ridge and furrow cultivation.

6.4 **Uncertain**

- 6.4.1 Numerous trends and pit-like responses have been recorded throughout the survey which have been assigned to the category of *Uncertain*. They generally lack the defined morphology of anomalies that would ordinarily warrant an archaeological interpretation. They have probably been caused by natural variations, agricultural processes or buried debris. However, given the proximity of archaeological responses (see 6.2), archaeological origins for some of these anomalies cannot be entirely ruled out.

6.5 **Former Field Boundary – Corroborated**

- 6.5.1 A number of linear responses in Areas 2, 3 and 4 correspond with the locations of former field boundaries that are visible on historic mapping (see Figure 11).

6.6 **Natural / Geological / Pedological**

- 6.6.1 Discreet anomalies, sinuous trends and zones of increased response are visible across most of the survey areas which have been caused by variations in the underlying geology.

6.7 **Ferrous / Magnetic Disturbance**

- 6.7.1 Zones of magnetic disturbance have been recorded in Areas 1, 2 and 3 which are likely to be due to spreads of modern debris. 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 generally good. The results from this survey indicate the presence of enclosures, ditches and pits; consequently, the survey is deemed to have worked well.

8 CONCLUSION

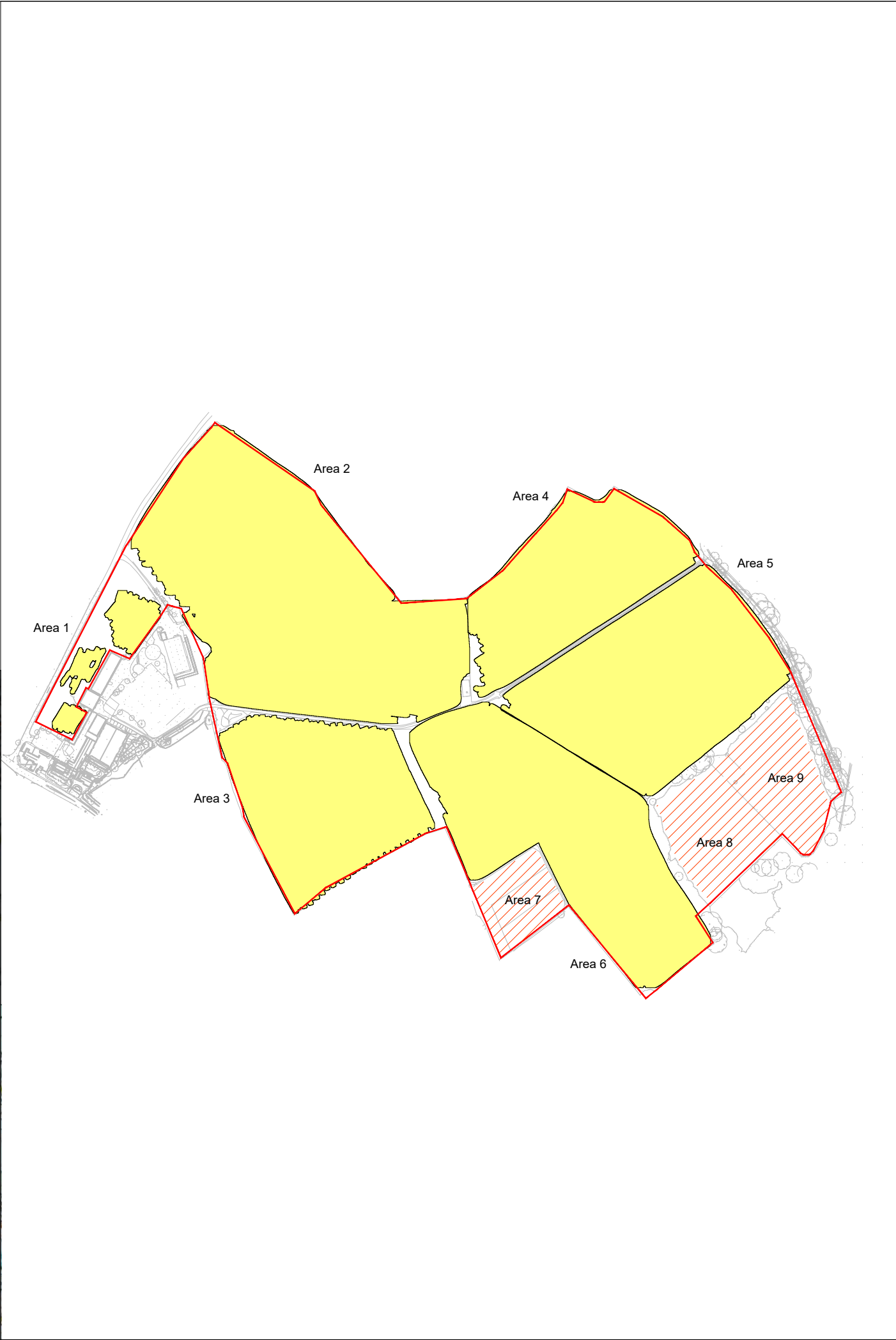
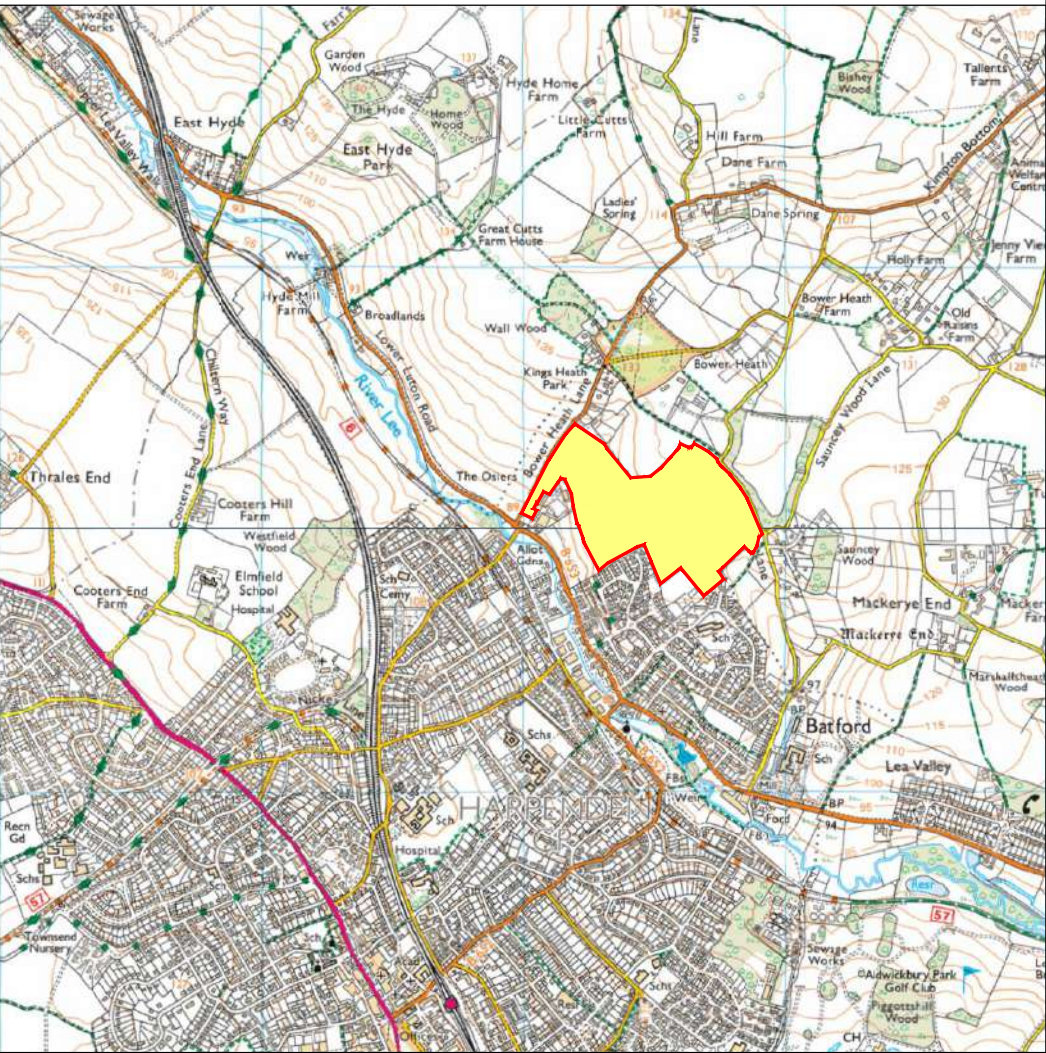
- 8.1 The magnetometer survey has recorded magnetic responses that have been interpreted as being of archaeological interest. Ditch-like responses, trends and pit-like anomalies have been detected in the survey, including several enclosures of varying size in Areas 4 and 5. Weaker responses though Areas 2, 3 and 5 are also likely to have archaeological origins. Ridge and furrow cultivation has also been detected in Area 2. Uncertain anomalies have been marked across the site which are probably due to a combination of natural variations, agricultural processes or buried debris. Former field boundaries and natural anomalies have also been plotted across the data.

9 REFERENCES

- BGS 2025 *Geology of Britain Viewer*, British Geological Survey, website:
(<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
- CIfA 2020 *Standard and Guidance for Archaeological Geophysical Survey*. 2014 amended 2020. CIfA Guidance note. Chartered Institute for Archaeologists, Reading
https://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_3.pdf
- CU 2025 *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)
- RPS 2024 *Archaeological Desk Based Assessment Land North East of Harpenden, Hertfordshire AL5 5EG*. RPS, London

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.

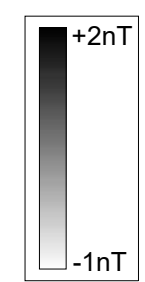
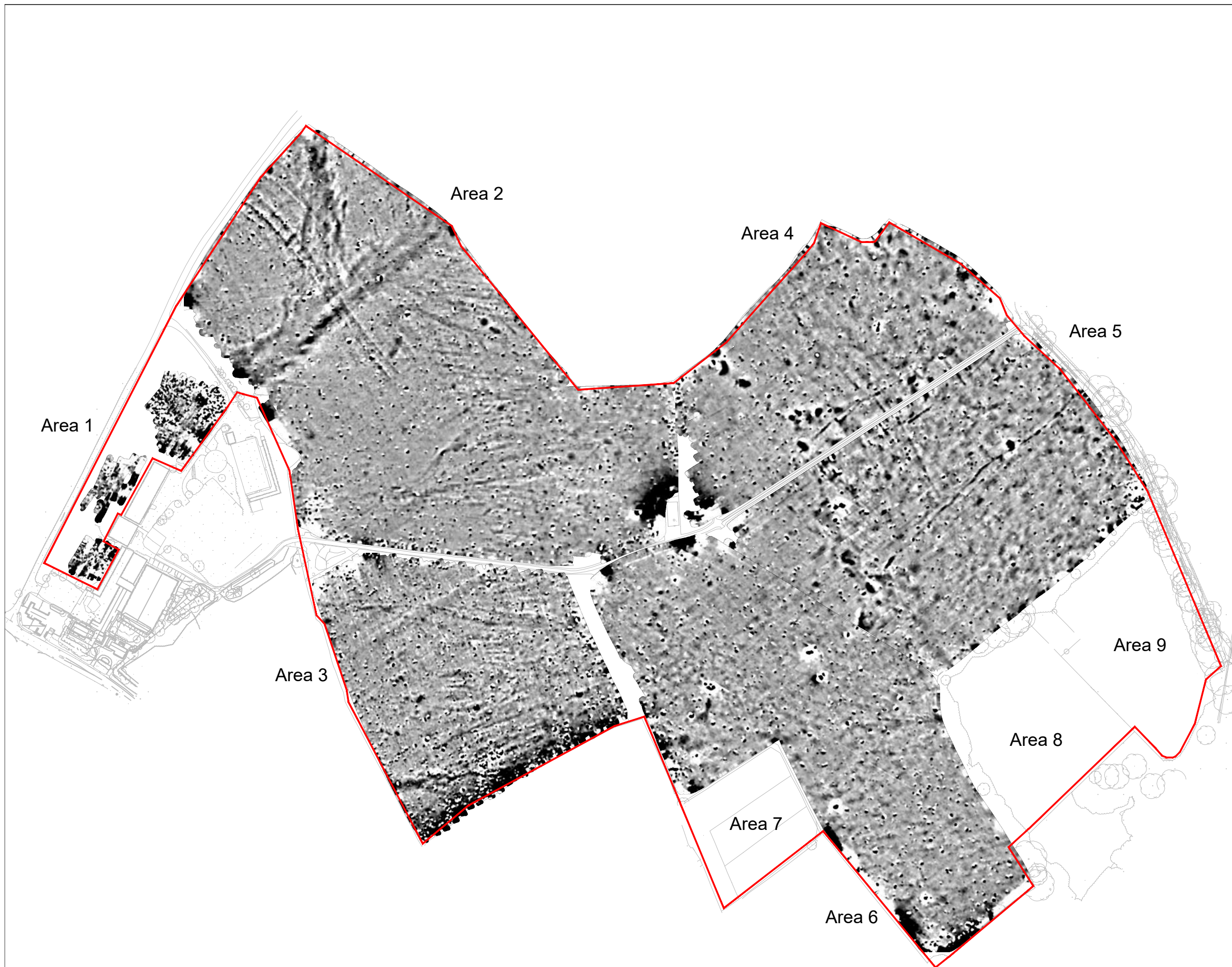




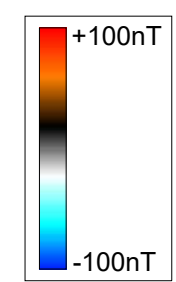
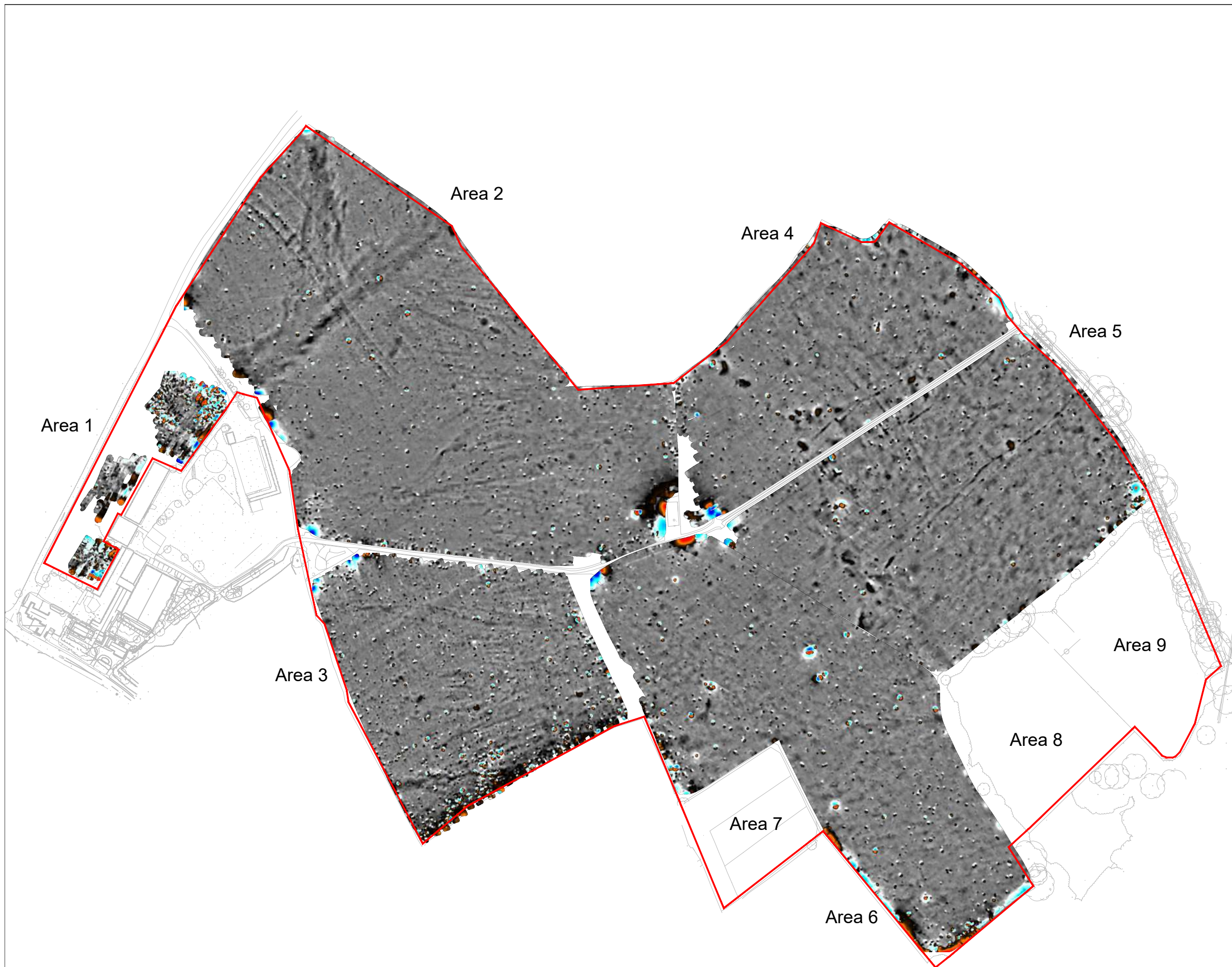
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	Survey Areas
	Unsurveyable Area

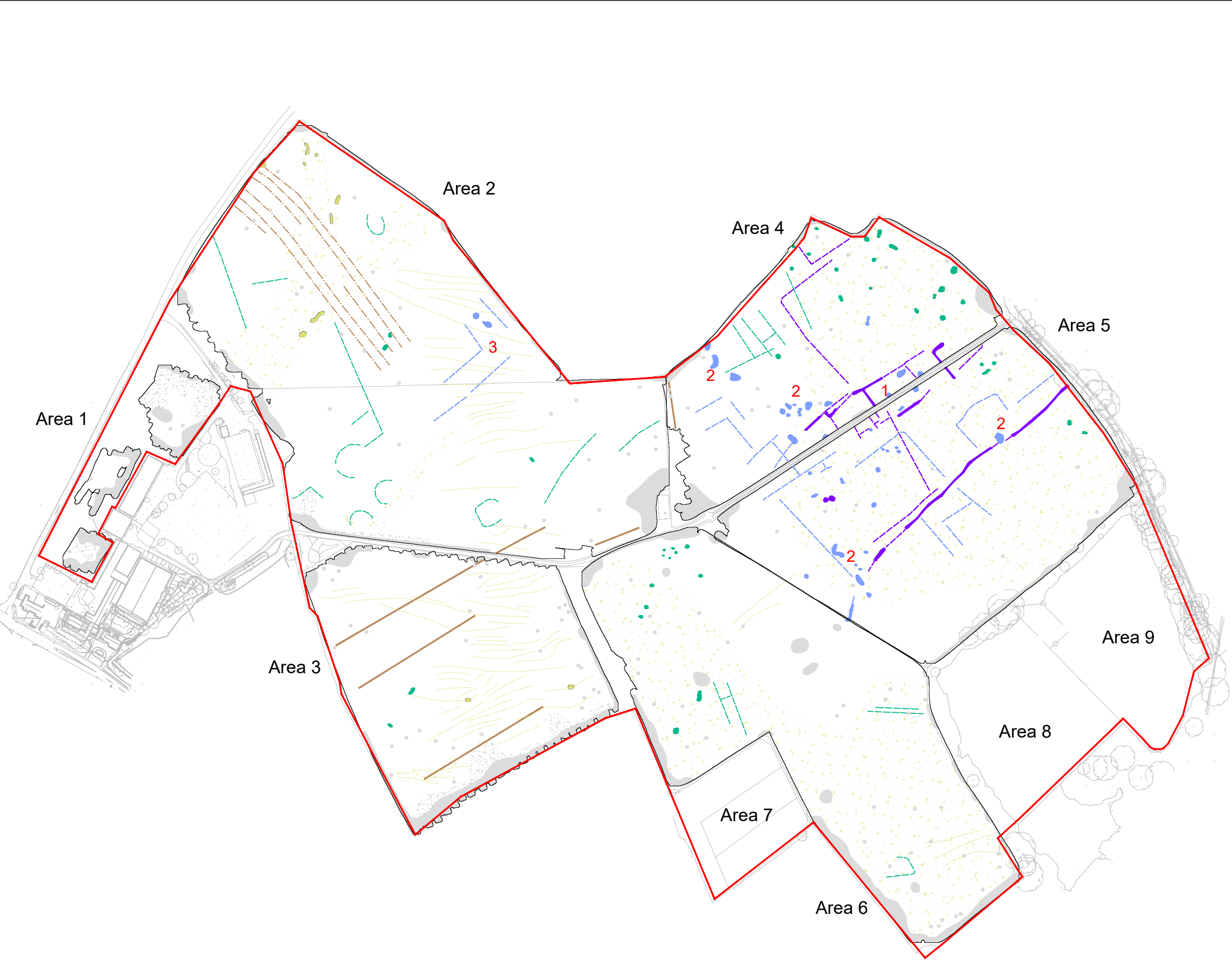
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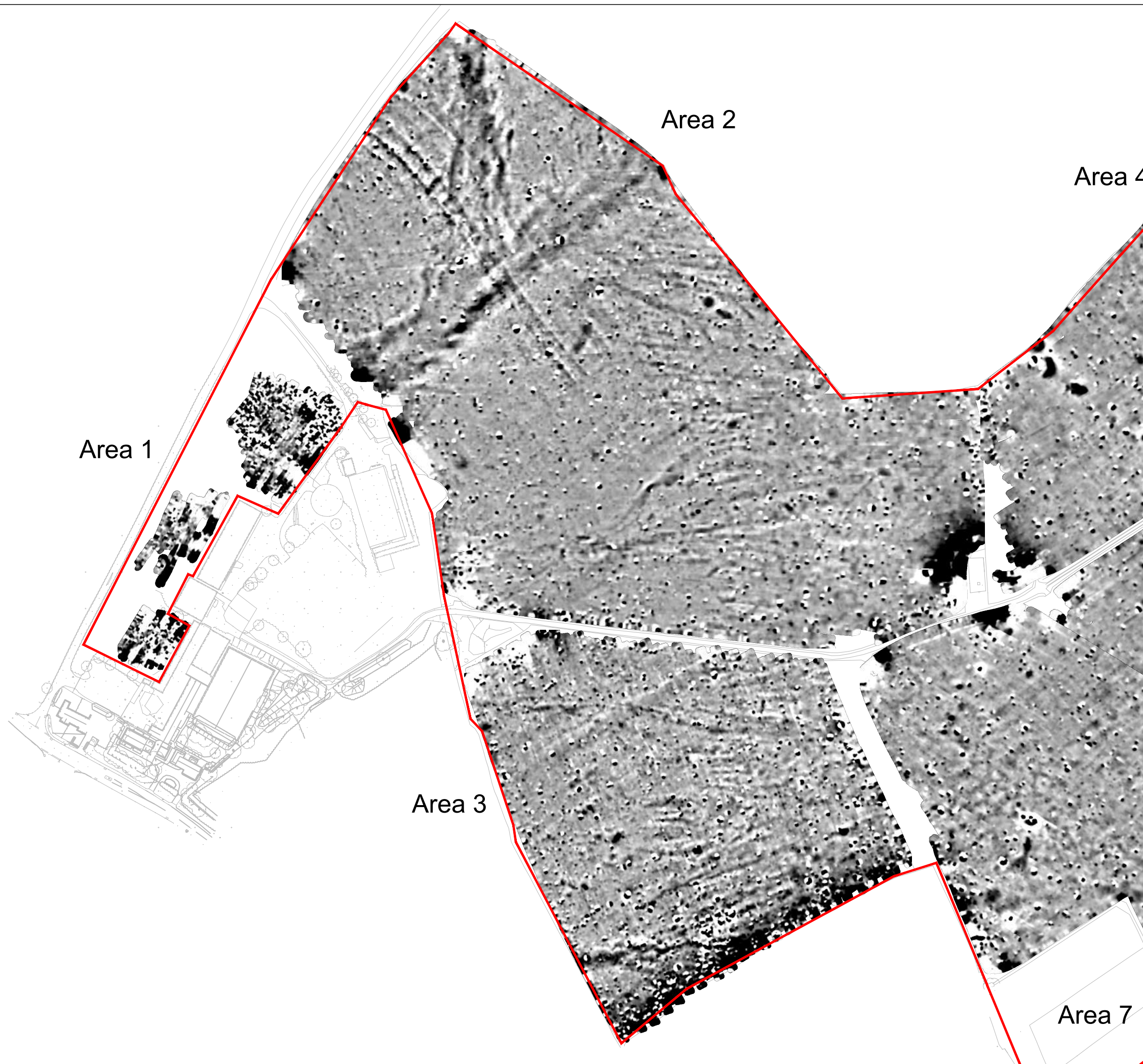
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KEY

	Probable archaeology (discrete anomaly / trend / increased response)
	Possible archaeology (discrete anomaly / trend / increased response)
	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

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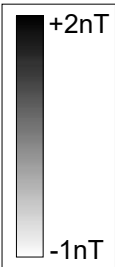
Area 1

Area 2

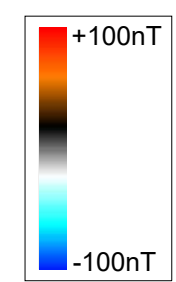
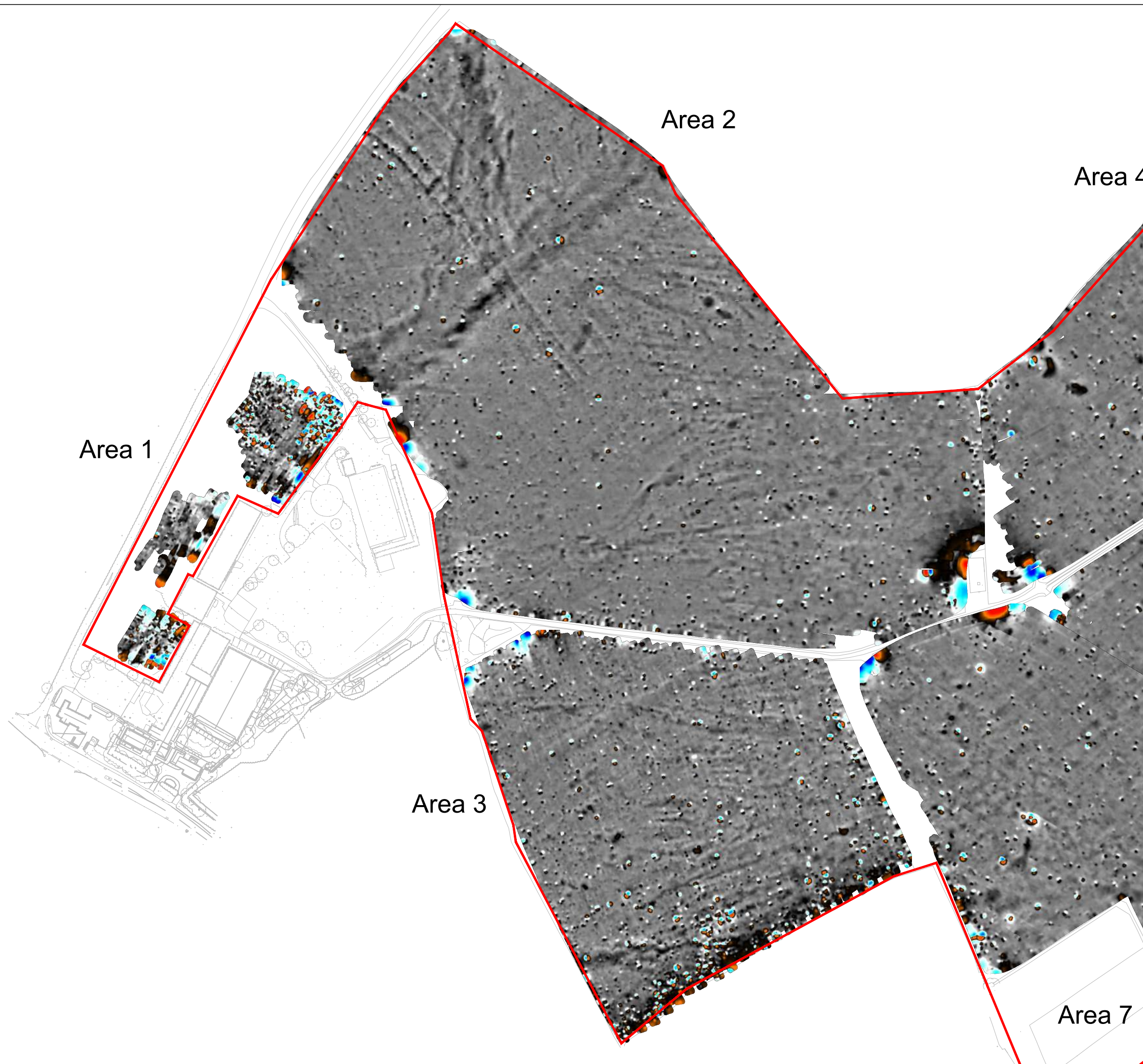
Area 4

Area 3

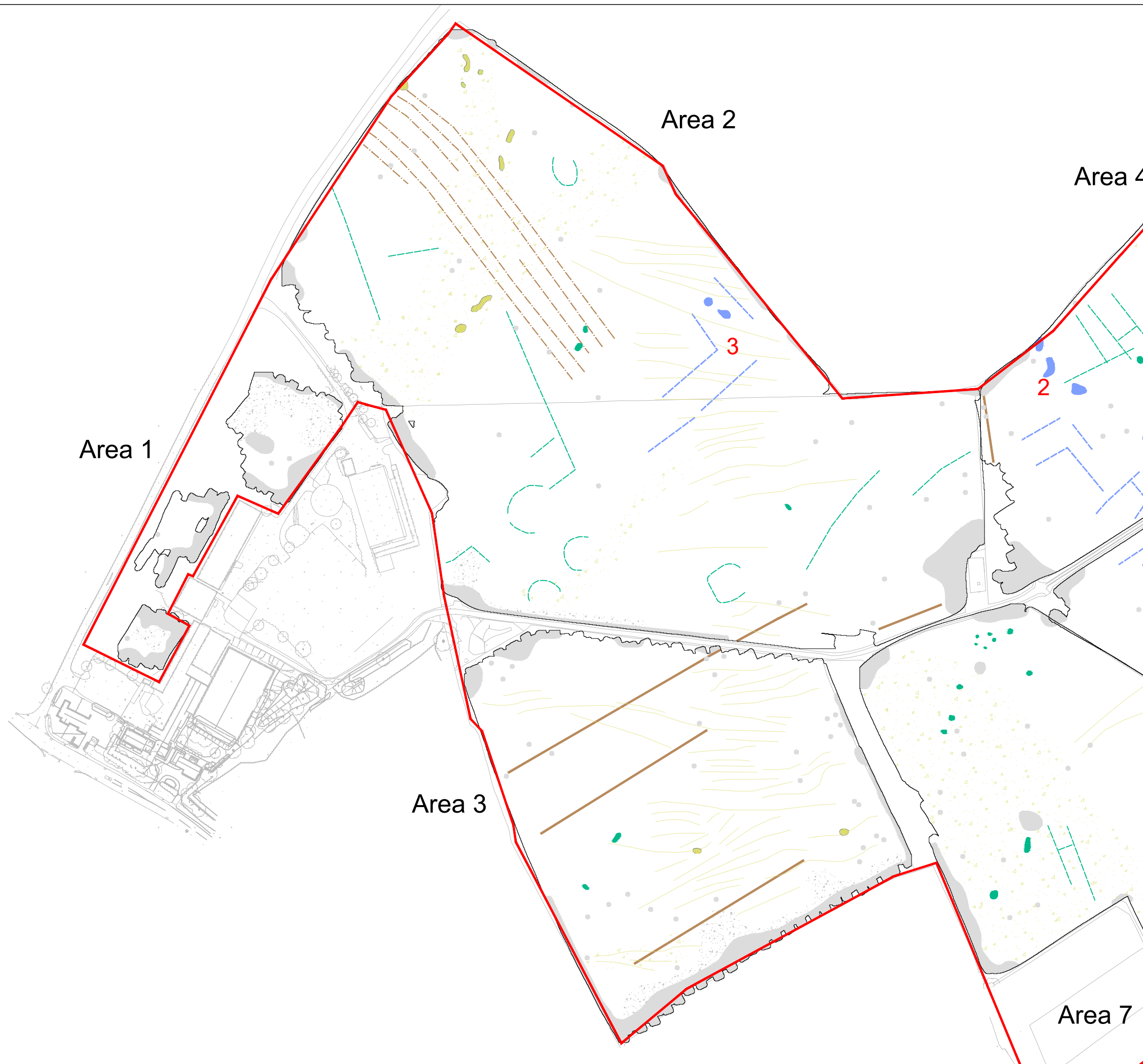
Area 7



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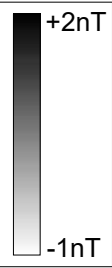
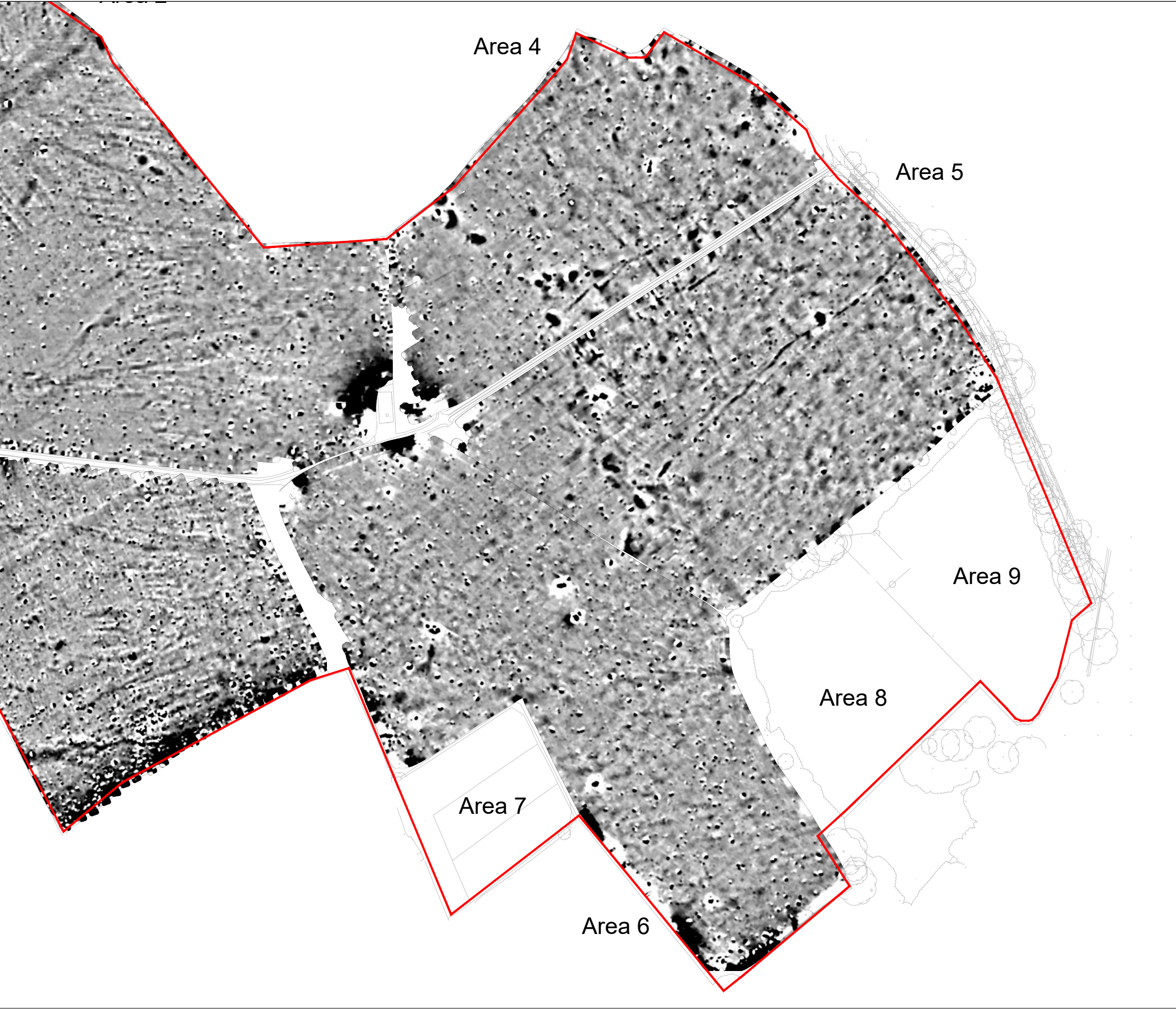
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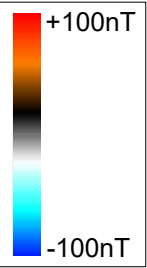
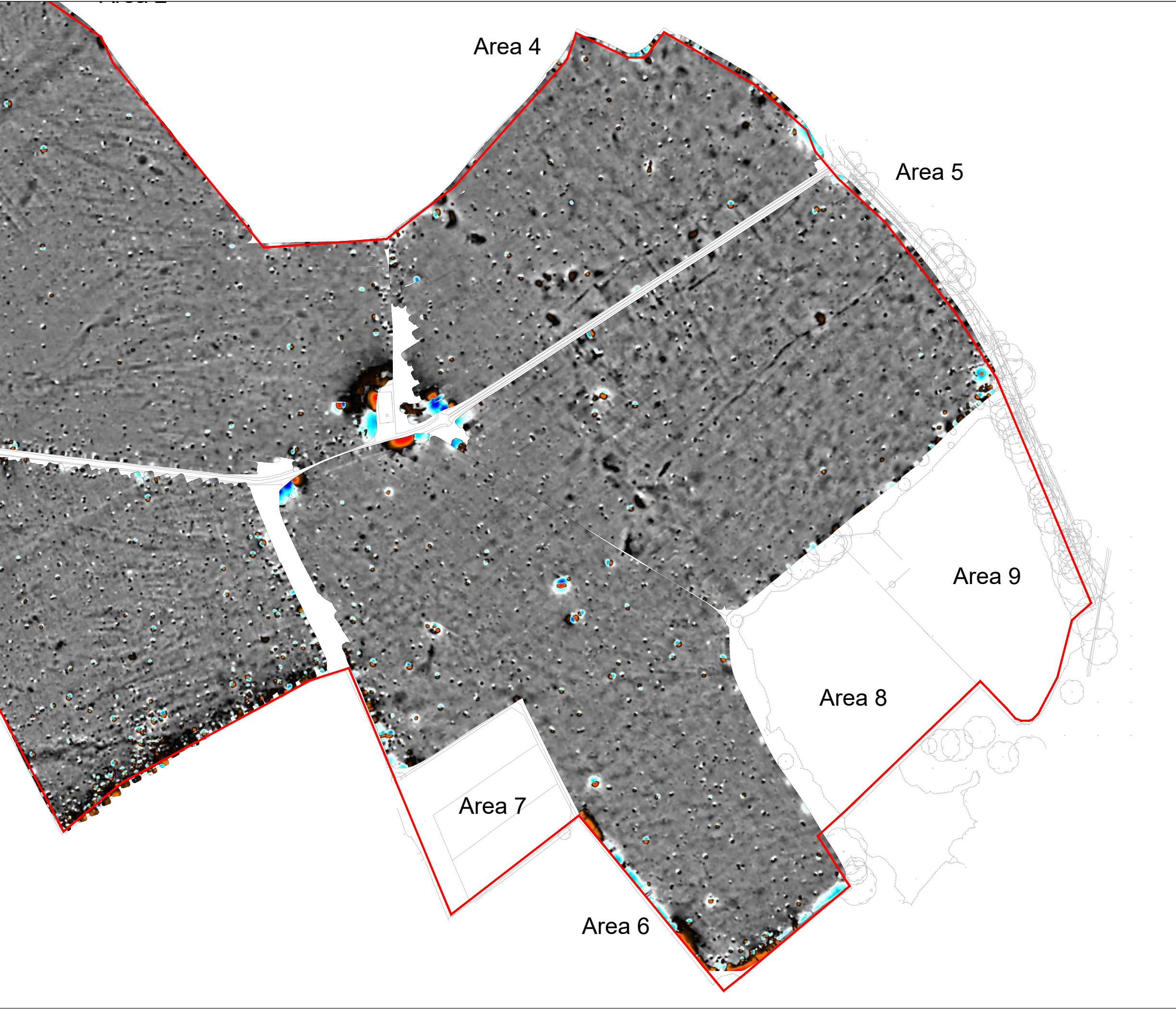
KEY

	Probable archaeology (discrete anomaly / trend / increased response)
	Possible archaeology (discrete anomaly / trend / increased response)
	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

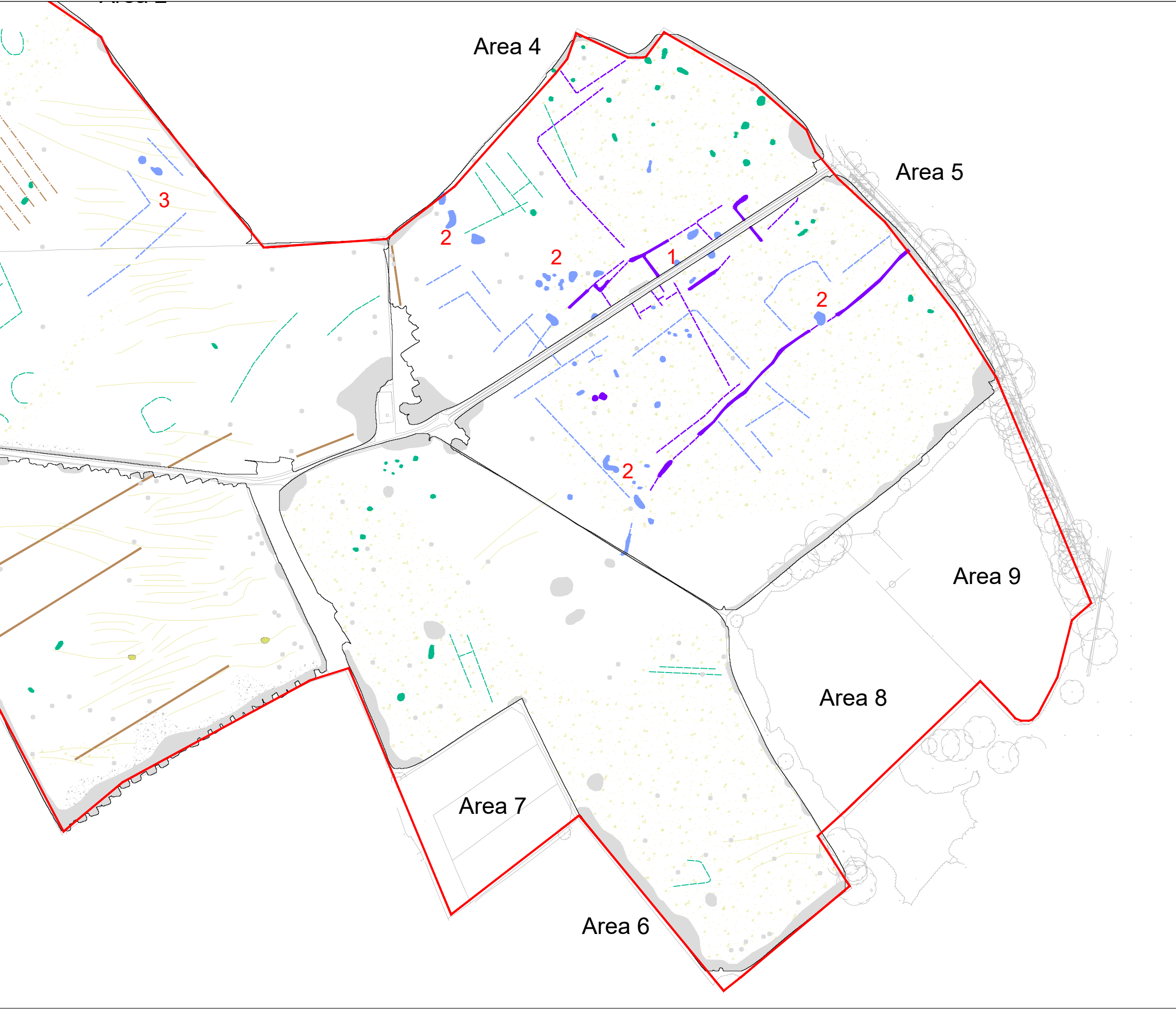
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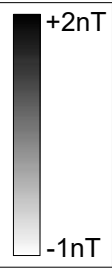
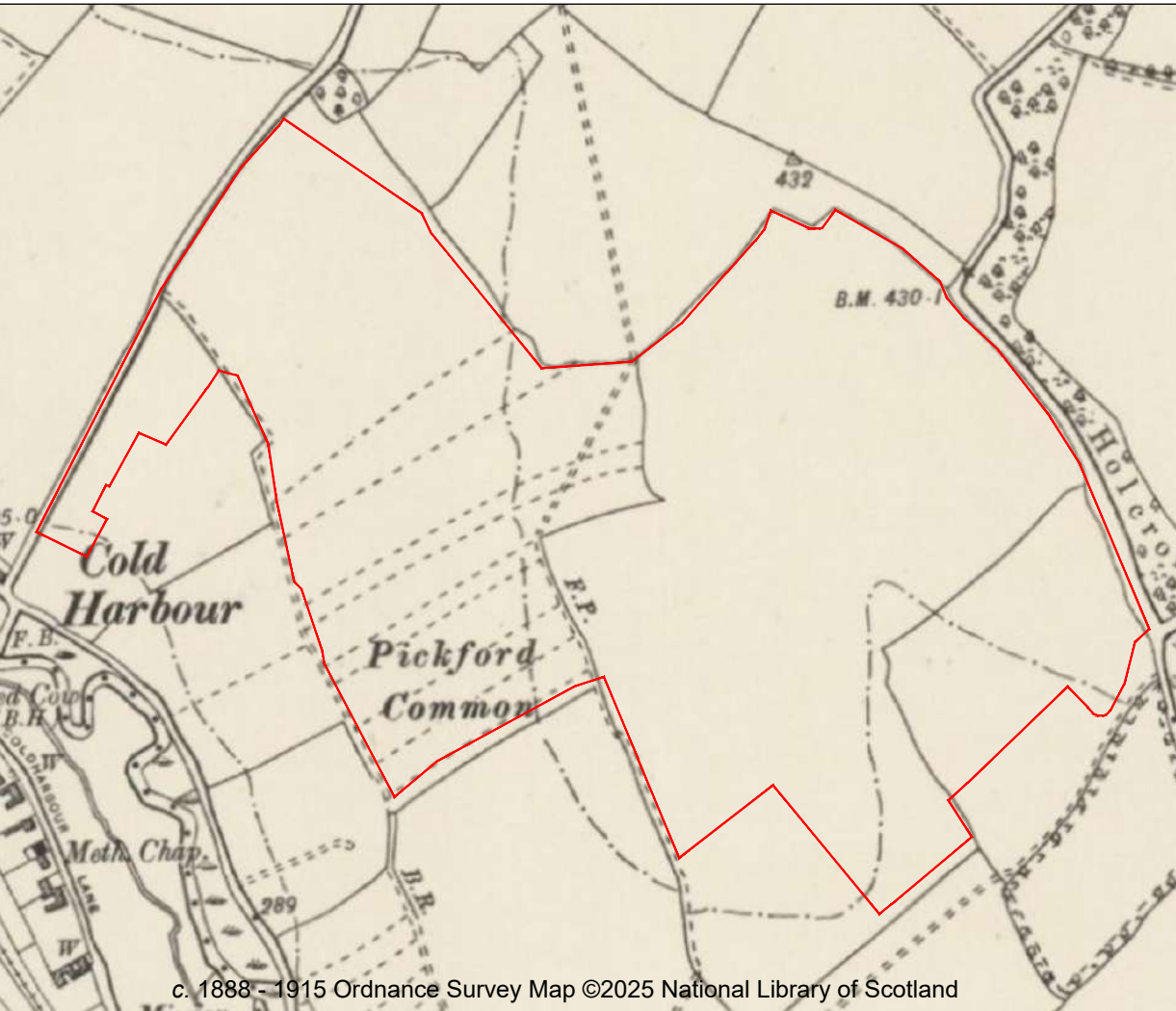
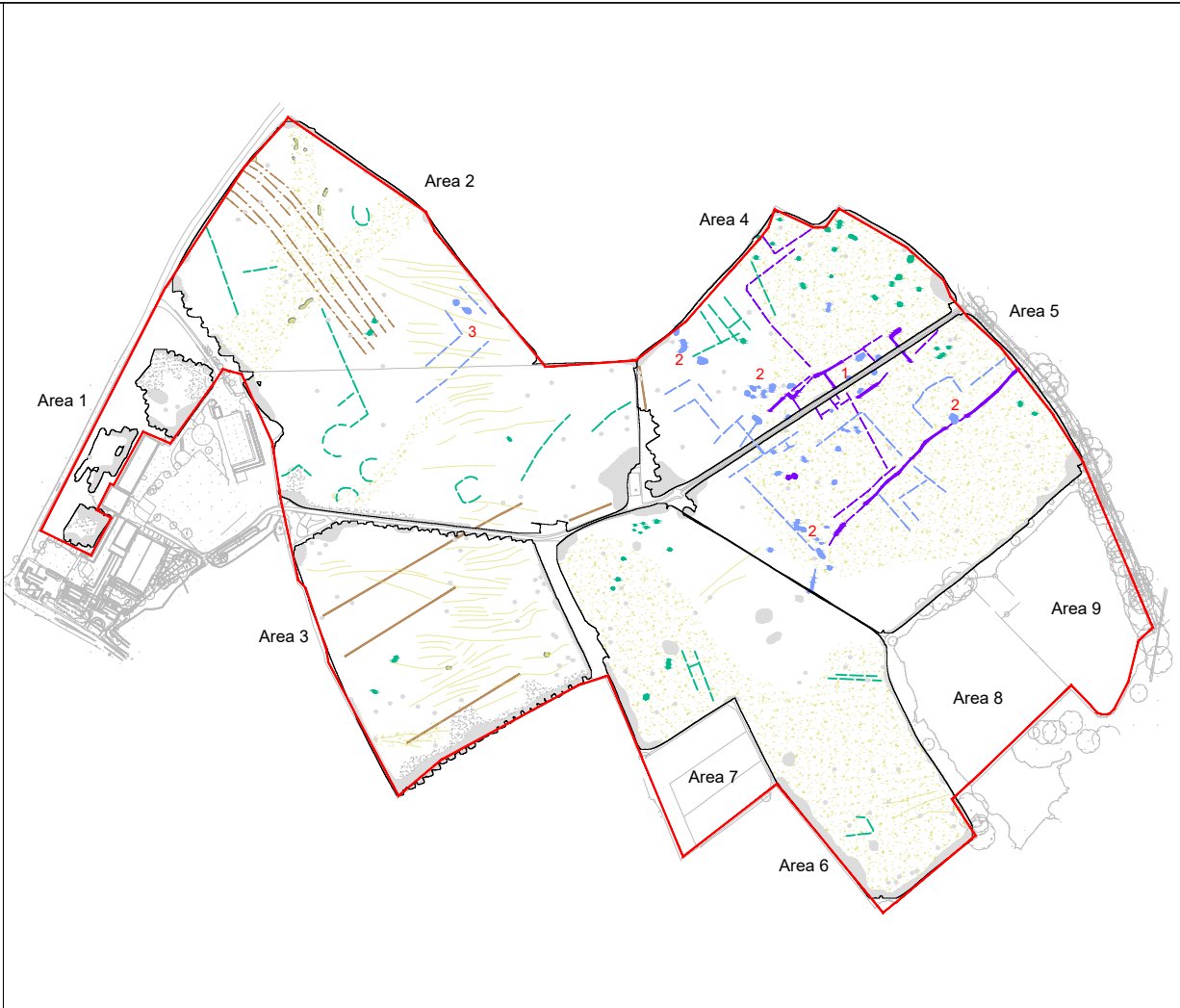
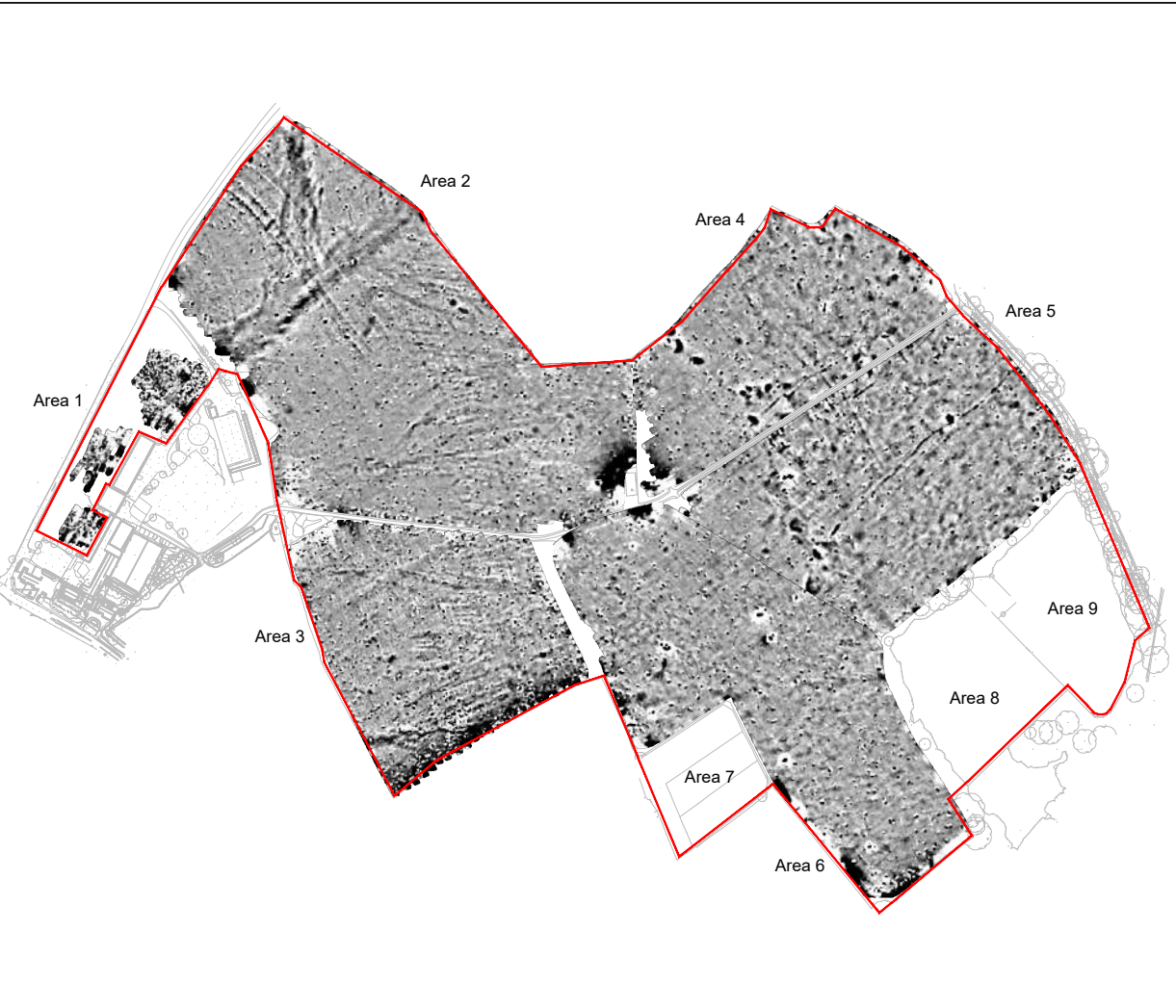
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KEY

	Probable archaeology (discrete anomaly / trend / increased response)
	Possible archaeology (discrete anomaly / trend / increased response)
	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

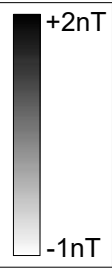
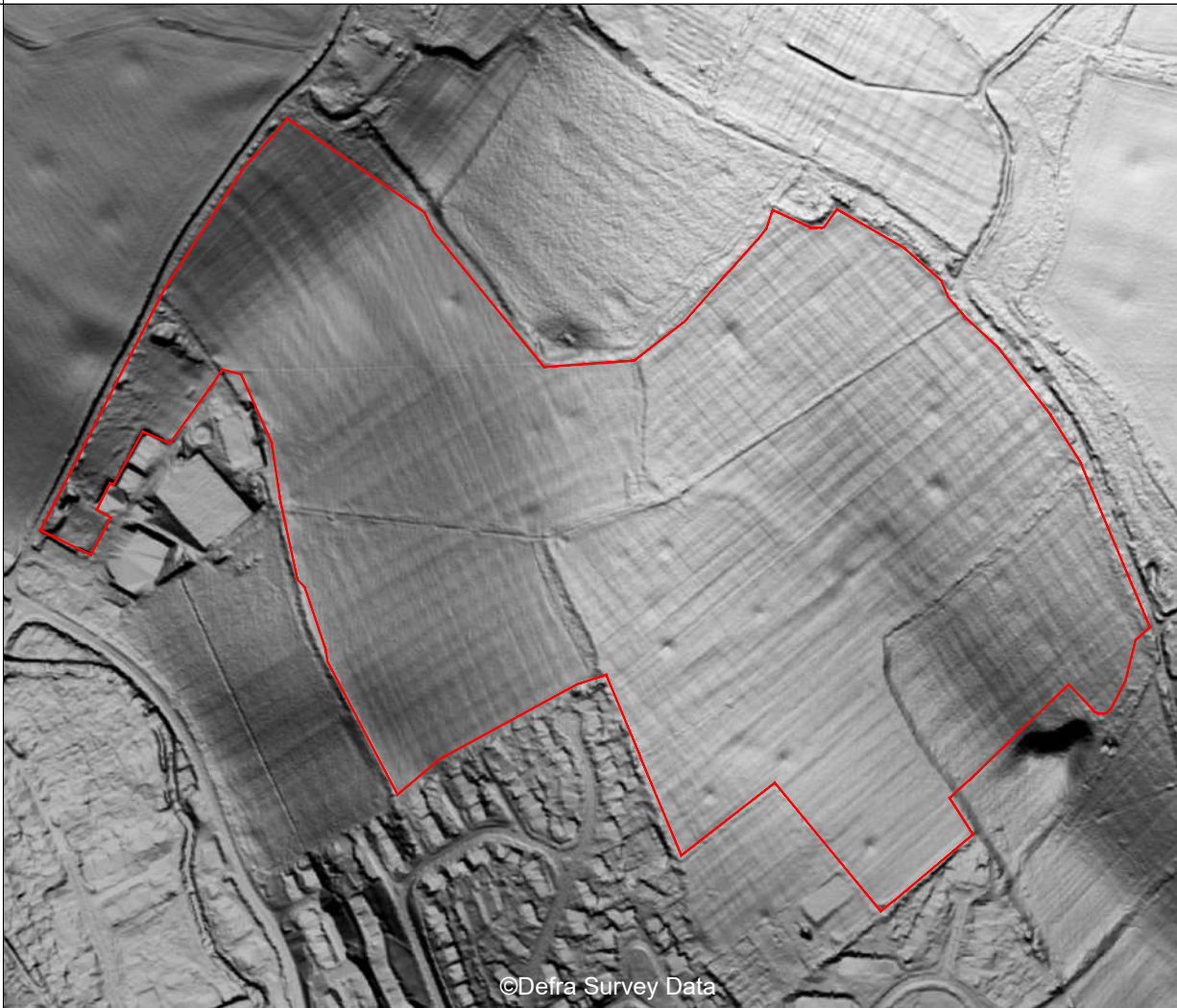
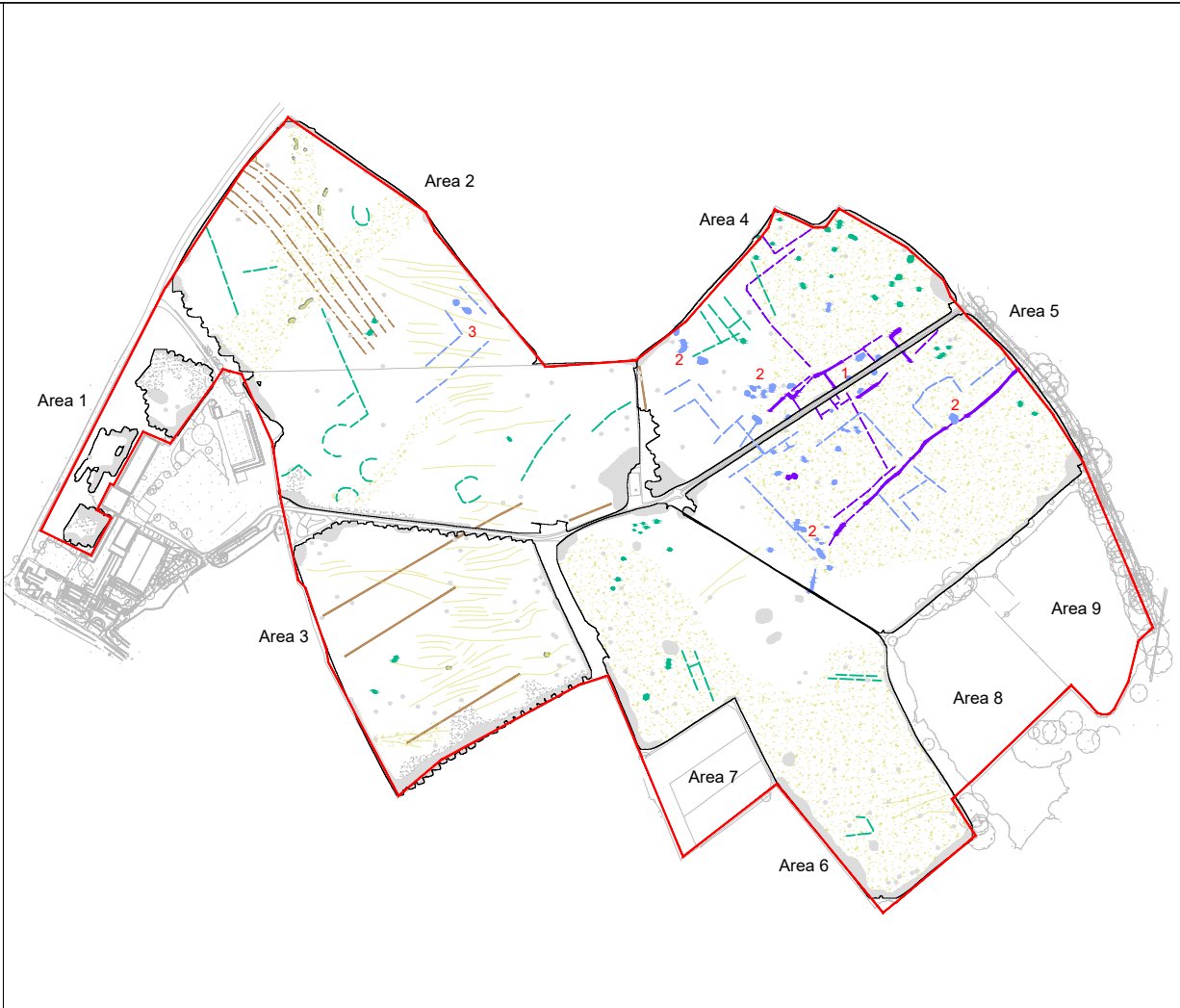
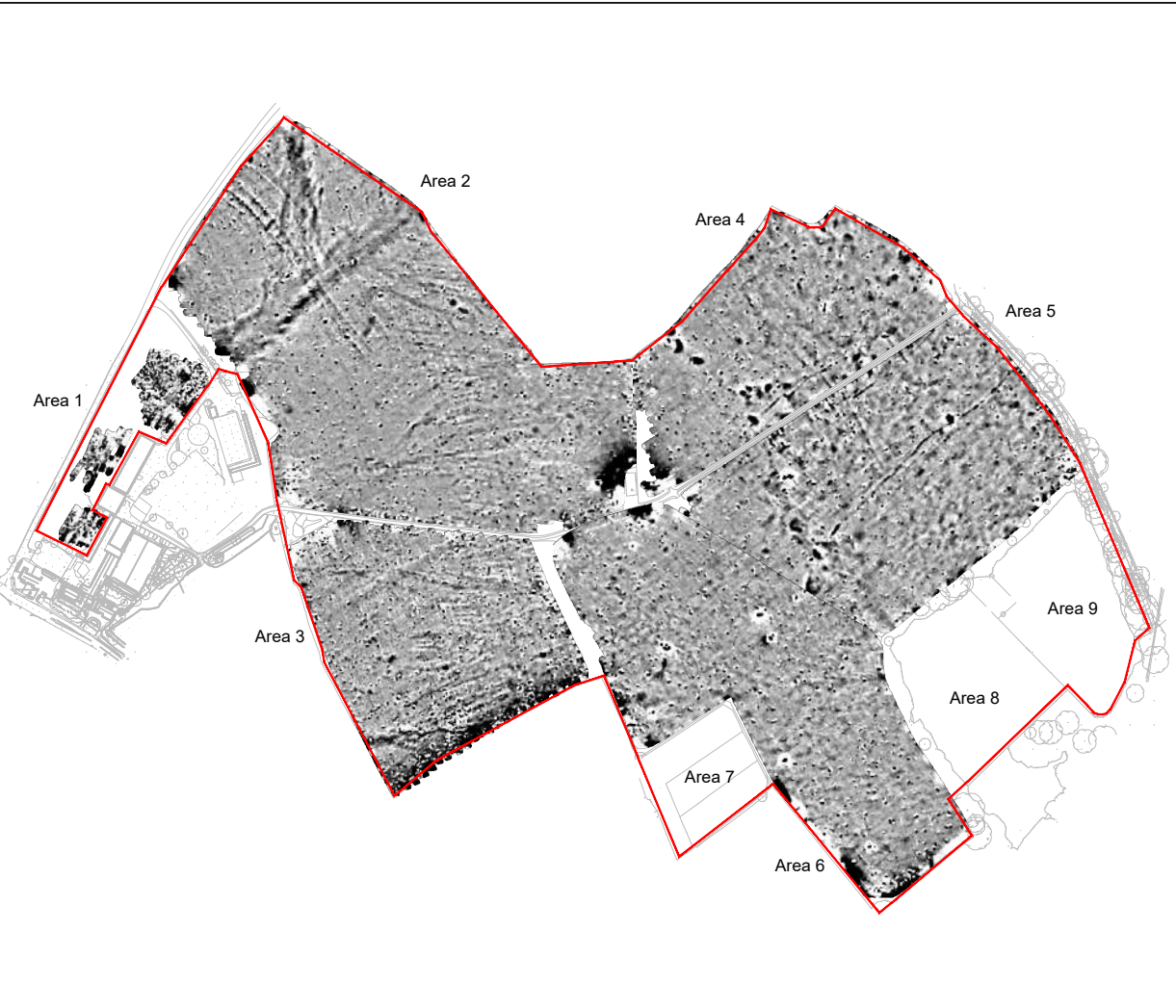
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KEY

	Probable archaeology (discrete anomaly / trend / increased response)
	Possible archaeology (discrete anomaly / trend / increased response)
	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

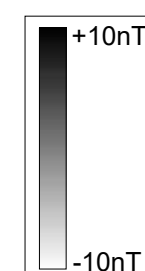
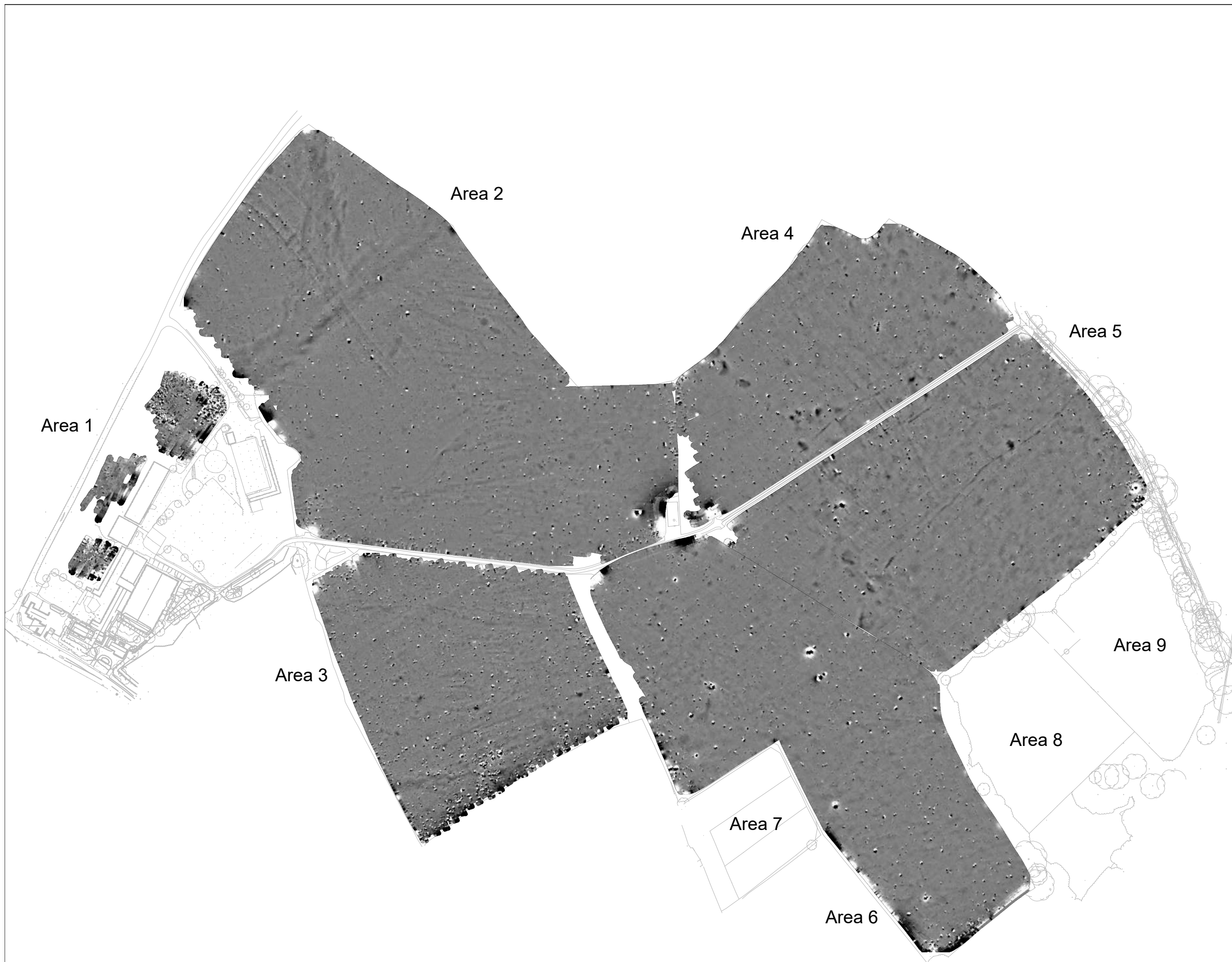
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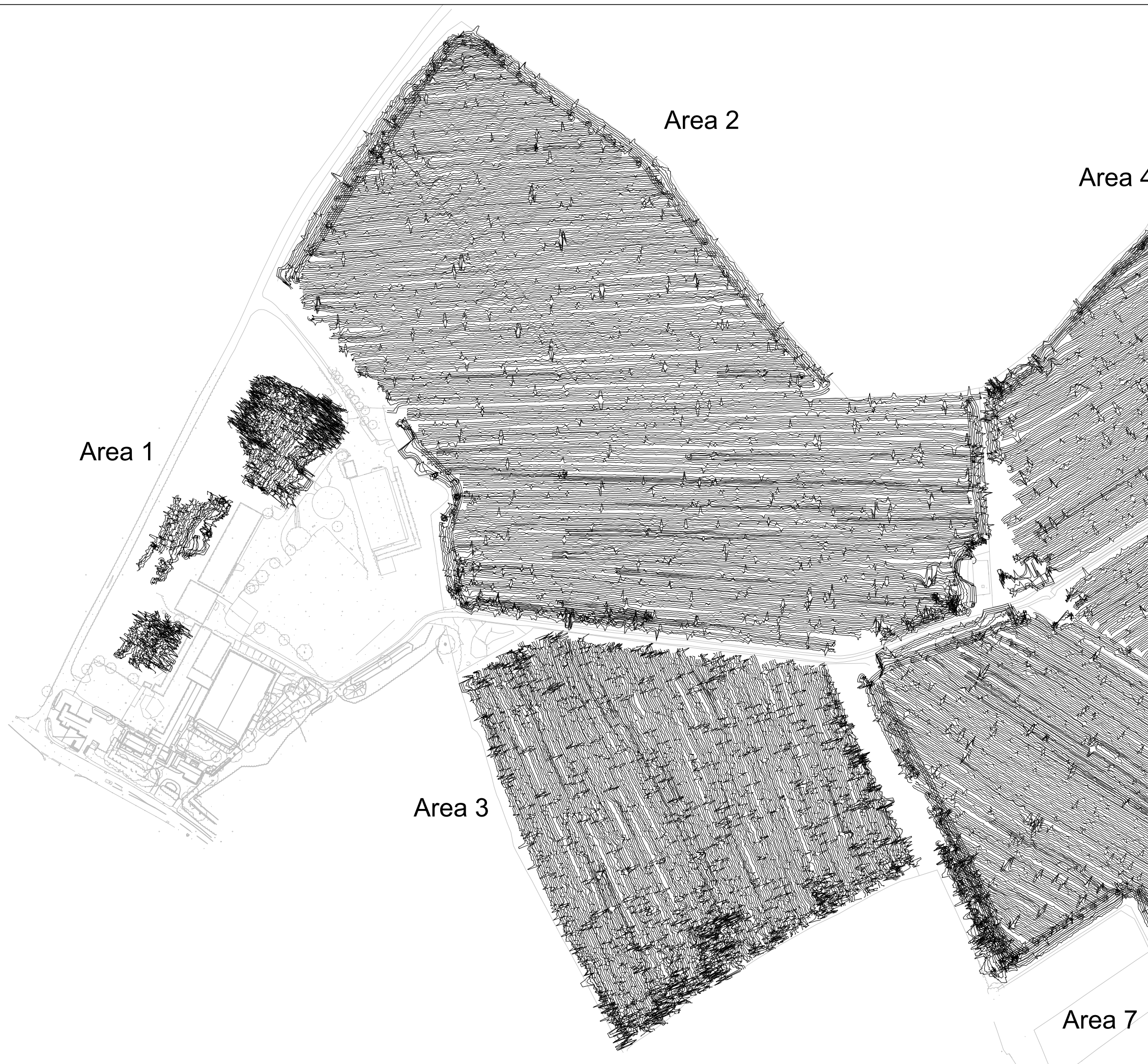
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	Probable archaeology (discrete anomaly / trend / increased response)
	Possible archaeology (discrete anomaly / trend / increased response)
	Ridge and furrow
	Uncertain Origin (discrete anomaly / trend / increased response)
	Former field boundary (corroborated)
	Natural (e.g. geological / pedological)
	Magnetic disturbance
	Ferrous

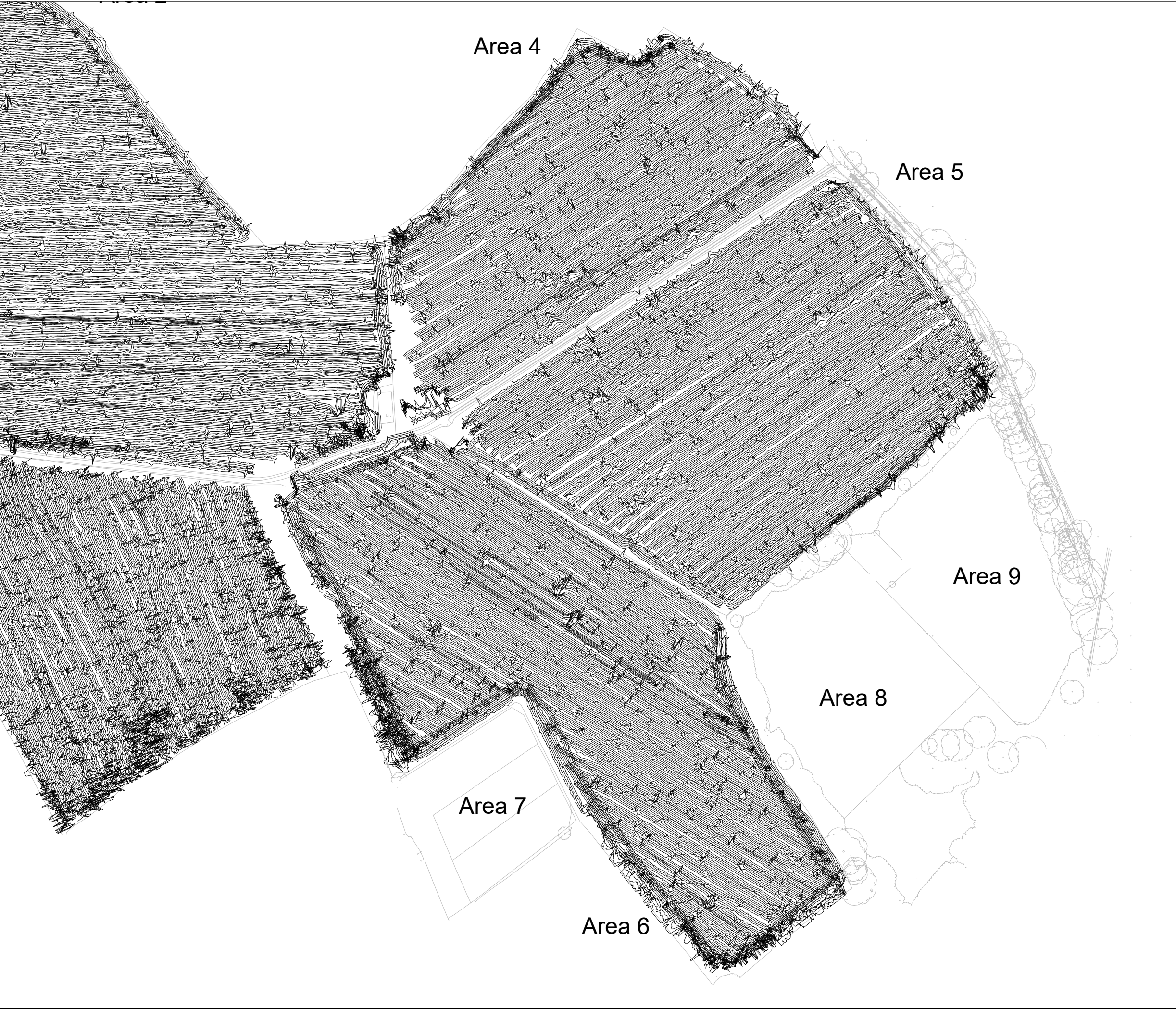
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Scale: 0 150 metres 1:3000 @ A3	Fig No: 13



Title: XY Trace Plots (Areas 1, 2 & 3 clipped at +/-15nT)	
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Scale: 0 105 metres 1:2100 @ A3	Fig No: 14



Title: XY Trace Plots (Areas 3, 4 & 5 clipped at +/-15nT)	
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Project: SUMO-21405: Land North East of Harpenden, Hertfordshire	
Scale: 0 110 metres 1:2200 @ A3	Fig No: 15

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
Magnetometer	MACS Cart System (Foerster)	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.

MACS Cart System (Foerster)

A multi-sensor array cart system (MACS) utilising 4 Foerster 4.032 Ferex CON 650 gradiometers, spaced at 1m intervals, with a control unit and data logger was used for the magnetic survey. Each data point is geographically referenced using an on-board RTK GNSS system. Readings will be taken at 0.125m centres along traverses 1.0m apart.

Data Processing

Zero Mean	This process sets the background mean of each traverse within each grid to zero.
Traverse	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.

<i>Archaeology / Probable Archaeology</i>	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.
<i>Possible Archaeology</i>	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.
<i>Industrial / Burnt-Fired</i>	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.
<i>Former Field Boundary (probable & possible)</i>	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.
<i>Ridge & Furrow</i>	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.
<i>Agriculture (ploughing)</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Land Drain</i>	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.
<i>Natural</i>	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
<i>Magnetic Disturbance</i>	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
<i>Service</i>	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.
<i>Ferrous</i>	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

OASIS ID (UID)	sumogeop1-532135
Project Name	Geophysical Survey at Land North East of Harpenden, Hertfordshire
Sitename	Land North East of Harpenden, Hertfordshire
Sitecode	SUMO-21405
Project Identifier(s)	SUMO-21405
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	14-Apr-2025 - 17-Apr-2025
Location	Land North East of Harpenden, Hertfordshire NGR: TL 14451 16079 LL: 51.83160908910373, -0.340472587577997 12 Fig: 514451,216079
Administrative Areas	Country: England County/Local Authority: Hertfordshire Local Authority District: St Albans Parish: Harpenden Parish: Wheathampstead
Project Methodology	Data was 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 were 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 magnetic responses that have been interpreted as being of archaeological interest. Ditch-like responses, trends and pit-like anomalies have been detected in the survey, including several enclosures of varying size in Areas 4 and 5. Weaker responses though Areas 2, 3 and 5 are also likely to have archaeological origins. Ridge and furrow cultivation has also been detected in Area 2. Uncertain anomalies have been marked across the site which are probably due to a combination of natural variations, agricultural processes or buried debris. Former field boundaries and natural anomalies have

	also been plotted across the data.
Keywords	Ditched Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Ditch - UNCERTAIN - FISH Thesaurus of Monument Types Pit - UNCERTAIN - FISH Thesaurus of Monument Types Rectangular Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types Ridge And Furrow - MEDIEVAL - FISH Thesaurus of Monument Types Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types
Funder	Private or public corporation RPS
HER	
Person Responsible for work	Thomas Cockcroft
HER Identifiers	
Archives	

Report generated on: 24-04-2025:1015

Appendix D – Data Management Plan & Archive Selection Strategy

Data Management Plan

Project ID / OASIS ID

SUMO-21405 / sumogeop1-532135

Project Name

Land North East of Harpenden, Hertfordshire

Project Description

Detailed magnetic survey over approx. 30ha

Client

RPS

Project Manager

Thomas Cockcroft

Field Leader

Simon Lobel

Date DMP created

06.03.2025

Date DMP last updated

24.04.2025

Version

2

Technique - data

Detailed magnetic survey.

Manual – cart - other

ATV/Cart magnetometers

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



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