

GEOPHYSICAL SURVEY

Thornbridge Hall Park and Gardens, Derbyshire

ARS Report N°: 2022/61



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Thornbridge Hall Park and Gardens, Derbyshire Report on a Geophysical Survey

ARS LTD REPORT 2022/61



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Approved for issue by:	Dr Roger Doonan
Planning Reference:	N/A
Local Authority:	Peak District National park Ltd
Site central NGR:	SK 19985 70864

EXECUTIVE SUMMARY

Project Name:	Geophysical Survey Report: Thornbridge Hall Park and Gardens.
Planning Authority:	Peak District National Park Authority.
Planning Reference:	N/A.
Location:	Thornbridge Hall Park and Gardens, Derbyshire.
Parish:	Great Longstone and Ashford-in-the-Water.
Hard Geology:	Widmerpool Formation - Mudstone.
Superficial Geology:	None recorded.
Soil Type:	Slowly permeable seasonally wet acid loamy and clayey soils.
NGR:	SK 19985 70864
Date of Fieldwork:	22 nd March to 31 st March 2022
Date of Report:	May 2022

This report presents the results of a geophysical survey undertaken on land at Thornbridge Hall Park and Gardens in Derbyshire. The survey was commissioned to support the Clients appeal against an enforcement notice which was issued after a new access road, car park and café was constructed prior to planning consent. The survey was carried out in March 2022 using a Bartington Grad 601 dual sensor fluxgate gradiometer.

The geophysical survey has not revealed any clear evidence of significant archaeological activity in addition to the probable remains of medieval or post-medieval agricultural activity represented by former field boundaries and ridge and furrow cultivation. However, the results have revealed some anomalies that could provide subtle evidence of archaeological activity.

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I INTRODUCTION

1.1 Project and Planning Background

Archaeological Research Services Ltd was commissioned by Emery Planning Ltd on behalf of Andromeda Park Ltd (the client) to conduct a Geophysical Survey in the agricultural fields surrounding a new access road and car-park at Thornbridge Hall Park and Gardens, Derbyshire.

The client constructed the access road, car park and new café building with associated tarmac surface prior to planning consent and, as a result, was issued an enforcement notice (Ref: ENF:21/0034), by the Peak District National Park Authority (PDNPA). The enforcement notice demands the complete removal of the development and the return of the development area back to its original state. The survey was conducted to support the clients appeal against the enforcement notice.

1.2 Site Description

The 'red line boundary' of the development area (hereafter 'DA') is depicted by a red polygon on Figure 1. The DA comprises a Registered Park and Gardens (NHLE 1001275), which contains 17 listed assets that includes the Grade II Listed Thornbridge Hall building (NHLE 1158698), and is predominantly surrounded by landscaped park dating to the late 19th/early 20th century with some active farms in the surrounding vicinity.

The new access road bisects the DA which now encompasses five agricultural fields (Fig. 2) comprising a total of c. 7.4 ha. The DA slopes down from an elevation of c. 170m aOD (above Ordnance Datum) in the north-east to c. 150m aOD in the south-west. A locally steep bank is present in the south-east of fields 4 and 5.

1.3 Geology and Soils

1.3.1 The underlying solid geology of the DA comprises "Widmerpool Formation - Mudstone. Sedimentary Bedrock formed approximately 329 to 337 million years ago in the Carboniferous Period." There are no superficial deposits recorded by the British Geological Survey (BGS 2022).

1.3.2 The soils of the DA are classified by the Soilscales interactive online viewer as belonging to the Soilscales 17 soils unit. These soils are described as "Slowly permeable seasonally wet acid loamy and clayey soils" (Cranfield University 2022).

1.4 Archaeological and Historical Background

1.4.1 A full and detailed archaeological and historical background is contained within the accompanying Archaeological Desk Based Impact Assessment (Jacklin 2021). The assessment concluded that Thornbridge Park has undergone significant landscaping in the past; however, if the soil depth identified in the 1939 borehole log is replicated throughout, it is possible that the road construction and car park has not impacted any below-ground archaeological remains. The depth of the soil throughout the park is not fully understood, and numerous field boundaries and possible ridge and furrow has been identified in the 1995 archaeological survey (Bevan 1995) and on LiDAR. Therefore, where the road crosses said features, it may have impacted upon any surviving below-ground archaeology relating to the sites agricultural past. It is worth noting that even though excavation has taken place to a c.300mm below-ground level, the road and car park follow closely the topography of the park.

2 METHOD STATEMENT

2.1 Introduction

2.1.1 Magnetometry is a non-intrusive scientific prospecting technique that is the preferred geophysical technique used to determine the presence or absence of buried archaeological features when site and geological conditions are favourable. It is an efficient and effective method for locating anomalies corresponding with archaeological features. The instrument chosen for this survey was a Bartington Grad 601 dual sensor fluxgate gradiometer which can detect weak changes in the Earth's magnetic field caused by buried features.

2.1.2 All fieldwork and reporting was undertaken following Historic England's (2008) Geophysical Survey in Archaeological Field Evaluation and The Chartered Institute for Archaeologists (CifA) Code of Conduct (CifA 2014a) and Standards and Guidance for Archaeological Geophysical Survey (CifA 2014b).

2.1.3 The 30m by 30m survey grids were located to cover the entire DA and aligned as shown in Figure 2. In total 110 survey grids (including partial grids) were set out and accurately positioned using a Leica Zeno 20 GNSS which was connected to Leica Smartnet to receive corrections resulting in an accuracy of typically better than 0.5m. Each grid was then surveyed at 1m traverse intervals with the sampling at 0.250m (4 readings per metre) intervals. The survey was carried out in 'zig-zag' mode with each alternate traverse walked in opposite directions. The range of the instrument was set at 100nT (0.01nT resolution).

2.1.4 The survey was carried out by ARS Ltd in late March 2022. The weather during the survey was variable but the ground conditions were firm, the grass was short and the DA was suitable for geophysical survey.

2.1.5 Prior to commencing the survey the gradiometer was balanced and calibrated to the local conditions and this was repeated regularly throughout the day. At the end of each day, the data were downloaded into a computer, checked and archived on the ARS Ltd server. The data were downloaded using Bartington Instruments' Grad 601 Communication Application.

3 GEOPHYSICAL SURVEY RESULTS

3.1 Introduction

3.1.1 The data was minimally processed using Geoplot software. The data were "clipped" (clipping parameters selected on the mean and standard deviation data values), and the striping that can often appear in gradiometer data was removed by utilising the "zero mean traverse" function with thresholds applied. Finally, the data were interpolated. To enhance the visibility of subtle features the data were viewed under a number of different clip plotting parameters.

3.1.2 Occasionally processing the data to compensate for directional sensitivity can inadvertently disguise anomalies that may be of archaeological origin, particularly long linear features in the direction of the traverses. The data has therefore been analysed in a number of different formats and at each stage of processing.

3.1.3 Not all anomalies have been included in the results and discussion. Dipolar anomalies, many notable by their size yet showing no clustering or pattern to their distribution, are most likely to relate to miscellaneous ferrous litter associated with the modern land use as agricultural fields

and parkland/ gardens. These anomalies have not been analysed further but could be sampled/ targeted as part of any future evaluation.

3.1.4 The data analysis is presented graphically in Figures 3 to 9. A greyscale shade plot of the processed gradiometer data is presented in Figure 3 and an interpretative plan in Figure 4. Trace plots of the processed gradiometer data are presented in Figures 5 to 9.

3.2 Anomalies

3.2.1 Field 1

3.2.1.1 The majority of field 1 is affected by strong magnetic disturbance which indicates probable modern tipping or landscaping. The magnetic disturbance has prevented the recording of any meaningful data across the majority of the field and no conclusion can be drawn about the presence or absence of archaeological remains in this part of the DA. A small area in the south-east of the surveyed area appears to be unaffected and a pair of curvilinear anomalies (1a) were recorded. It is possible that it represents a short section of bank and ditch but due to the location on the edge of the lake the anomalies could equally be a result of variable water levels affecting the composition of the soils.

3.2.2 Field 2

3.2.2.1 An intermittent linear anomaly (2a) recorded in the north of the field comprises a combination of responses of mixed polarity and cannot be interpreted with any certainty. The anomaly could be worthy of further investigation although the possibility that it is the result of a buried pipe or culvert should be considered. To the south of (2a) a poorly defined negative linear anomaly (2b) could represent a section of bank of unknown age and function. Even further to the south a group of poorly defined linear/ curvilinear anomalies of both positive and negative polarity (2c) could provide a subtle hint of archaeological activity but this cannot be confirmed without further investigation.

3.2.2.2 In the east of the field a higher concentration of positive discrete anomalies (2d), interspersed with dipolar anomalies, indicating ferrous litter or modern disturbance, are most likely to be natural or a result of agricultural activity but evidence of archaeological activity cannot be ruled out. The area could be targeted during any future evaluation to confirm the origin of the anomalies. A linear anomaly comprising alternating positive and negative responses (2e), with an area of magnetic disturbance immediately to the west (2f), is most likely to indicate the surviving remains of a former field boundary and buried pipe evident on historic mapping (Jacklin 2021). The remains of probable ridge and furrow on two different alignments (2g and 2h), congruent to the alignment of the former field boundaries (*ibid*), and the remains of another former field boundary (2i) (*ibid*) have also been detected by this survey. Numerous anomalies were detected within the areas of probable ridge and furrow, including a curvilinear anomaly (2j), but the majority are largely indeterminate and cannot be delimited without further investigation.

3.2.3.4 In the southern part of the field the data are dominated by the strong response generated by modern services or pipes (2k). Further, the disturbance associated with the recent installation of a new sewer (2l) was clearly detected to the north and south of the modern services and this was also visible on the ground as a fresh soil mark. A group of linear anomalies of both positive and negative polarity (2m) could provide subtle evidence of archaeological activity and could be worthy of further investigation.

3.2.3 Field 3

3.2.3.1 No anomalies of archaeological interest were recorded in field 3. At the time of the survey the field had been fenced to provide a small livestock enclosure with various livestock shelters and farm paraphernalia. The magnetic properties of the materials used in the aforementioned fencing and shelters reduced the area which could be surveyed without encountering magnetic contamination. Only evidence of modern disturbance and services or pipes (3a and 3b) was revealed, the latter appear to be continuations of the services or pipes recorded at the southern end of field 2.

3.2.4 Field 4

3.2.4.1 A linear anomaly (4a) was recorded in the lowest part of the field and can be seen to align with an extant ditch that runs between fields 4 and 5. The northern part of the anomaly also corresponds to the location of a former field boundary depicted on historical mapping (Jacklin 2021). The anomaly is likely to represent a silt filled ditch. To the south-east of anomaly (4a) a number of weak anomalies which are approximately parallel and of both positive and negative polarity could provide a subtle hint of archaeological activity but could also be natural or a result of modern agricultural activity. Numerous dipolar anomalies were recorded which are most likely to be a result of modern disturbance and ferrous litter associated with the land use.

3.2.5 Field 5

3.2.5.1 Linear anomaly (5a) is likely to be a result of the same former field boundary detected in field 4 (anomaly 4a). The anomaly is most clearly defined in the south-west of the field and becomes more indeterminate towards the north-east. Amorphous anomaly (5b) is most likely to be natural and weakly defined linear anomalies (5c and 5d) suggest the presence of land drains.

4 DISCUSSION AND CONCLUSIONS

4.1.1 The geophysical survey has confirmed that the remains of medieval or post-medieval agricultural activity, represented by former field boundaries and ridge and furrow cultivation (Jacklin 2021, Figs. 8 to 12), survive as sub-surface remains. The survey has not revealed any clear evidence of significant archaeological activity in addition to these features but has some anomalies that could provide subtle evidence of further archaeological activity although these could simply be hitherto unrecorded natural, agricultural or landscape features.

4.1.2 The response to the geophysical survey was good and the results of the survey are considered to be reliable. All the anomalies have been accurately located and extensive 'blank areas' defined by the absence of anomalies.

5 PUBLICITY, CONFIDENTIALITY AND COPYRIGHT

5.1.1 Any publicity will be handled by the client.

5.1.2 ARS Ltd will retain the copyright of all documentary and photographic material under the Copyright, Designs and Patent Act (1988).

6 STATEMENT OF INDEMNITY

13.1 All statements and opinions contained within this report arising from the works undertaken are offered in good faith and compiled according to professional standards. No responsibility can be accepted by the author/s of the report for any errors of fact or opinion

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7 ARCHIVE

7.1.1 One bound copy of the final report with an attached digital PDF/A copy on disc will be deposited with Derbyshire HER. The disc will also include a digital archive, consisting of relevant ESRI shapefiles or CAD files, for use of updating the HER database.

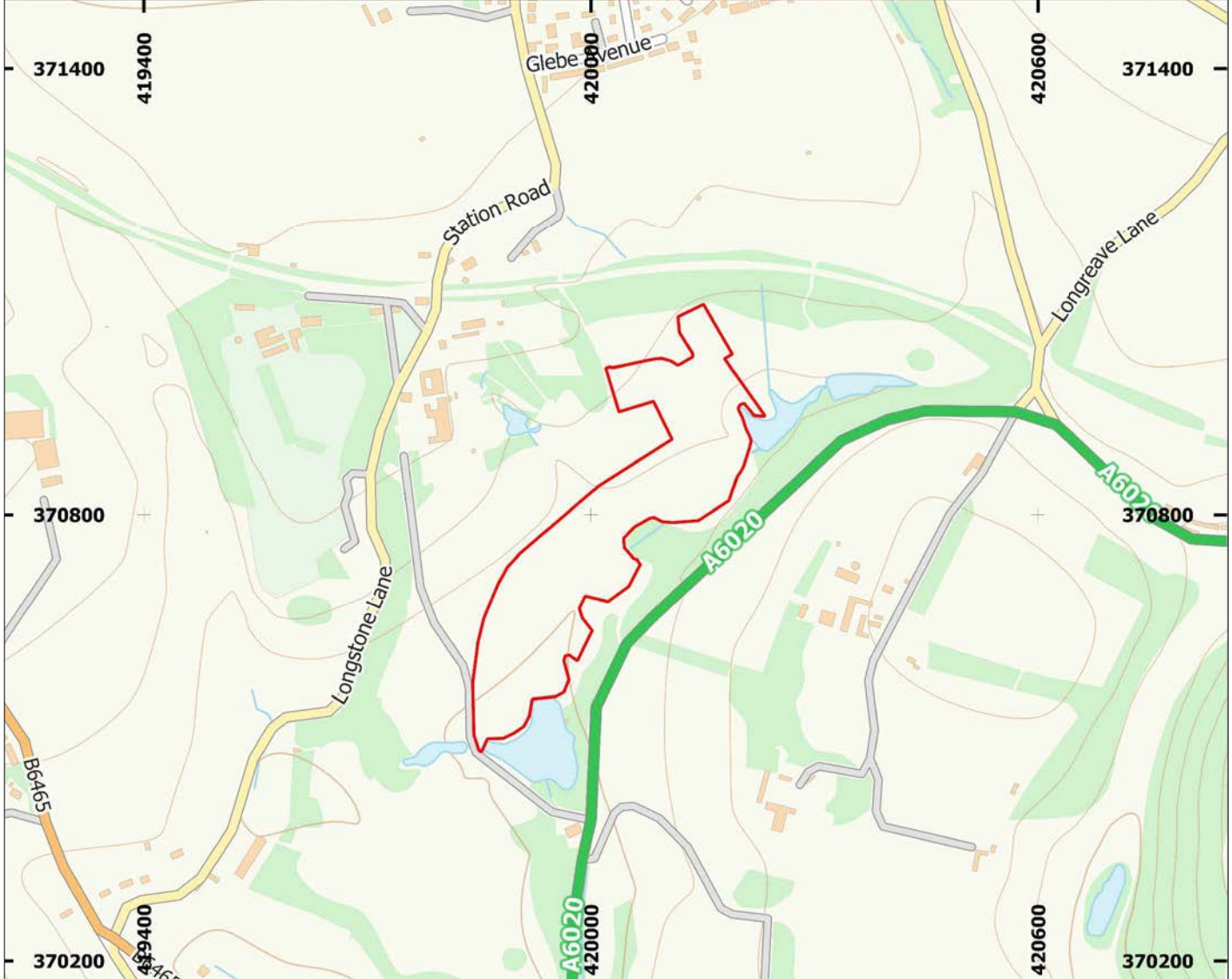
8 ACKNOWLEDGEMENTS

8.1.1 ARS Ltd would like to thank Emery Planning for commissioning this survey on behalf of Andromeda Park Ltd and the landowners and tenant farmer for allowing access to carry out the survey and moving livestock around as required.

9 REFERENCES

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<http://mapapps.bgs.ac.uk/geologyofbritain/home.html> [accessed February 2022]
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- Jacklin, A. 2021. Thornbridge Hall and Gardens, Derbyshire: Archaeological Desk-Based Impact Assessment. Unpublished ARS Ltd report 2021/101.

APPENDIX I FIGURES



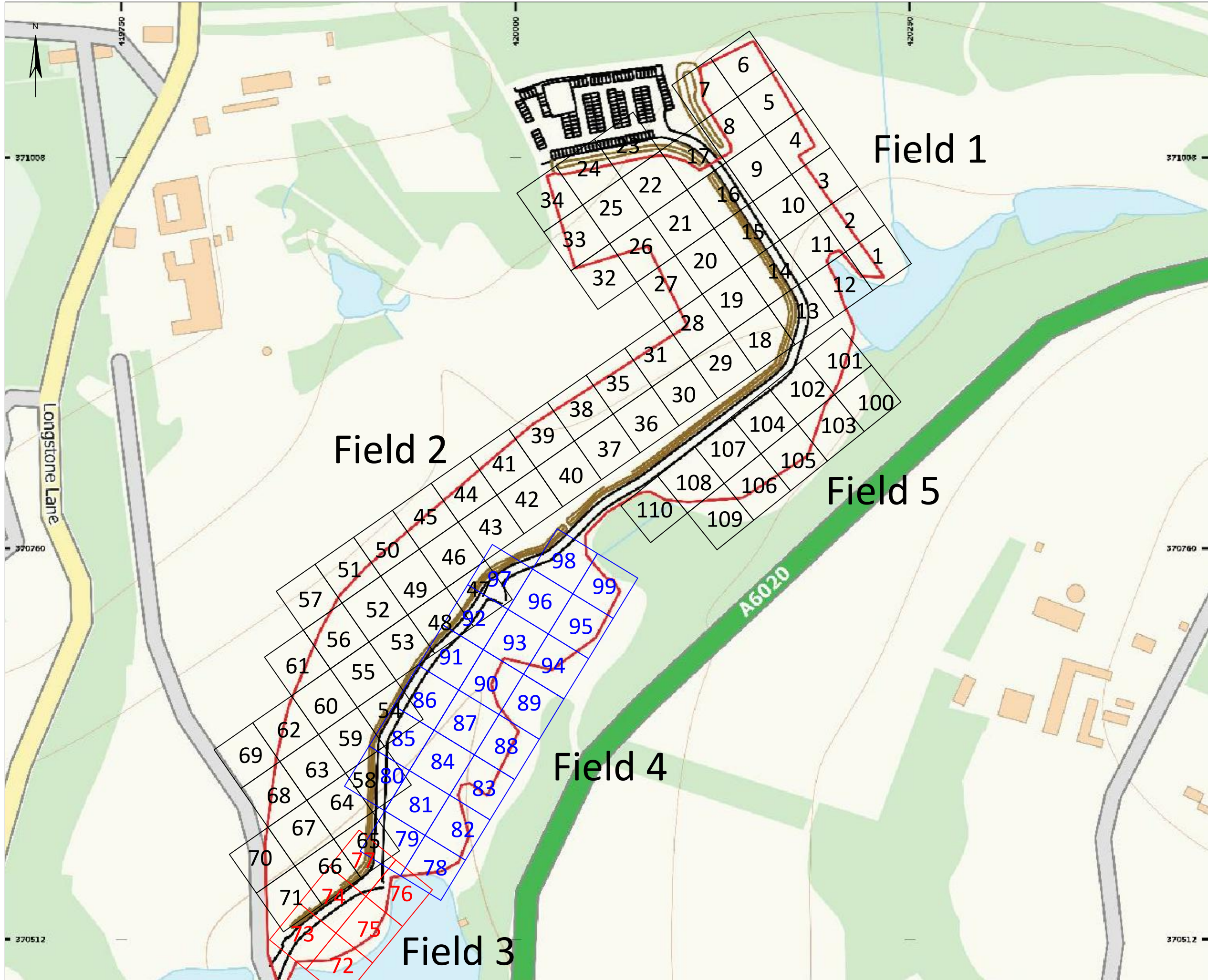
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Figure 1
Site Location

Key:

- Development area (DA)
- Peak District National Park Authority
- Site location

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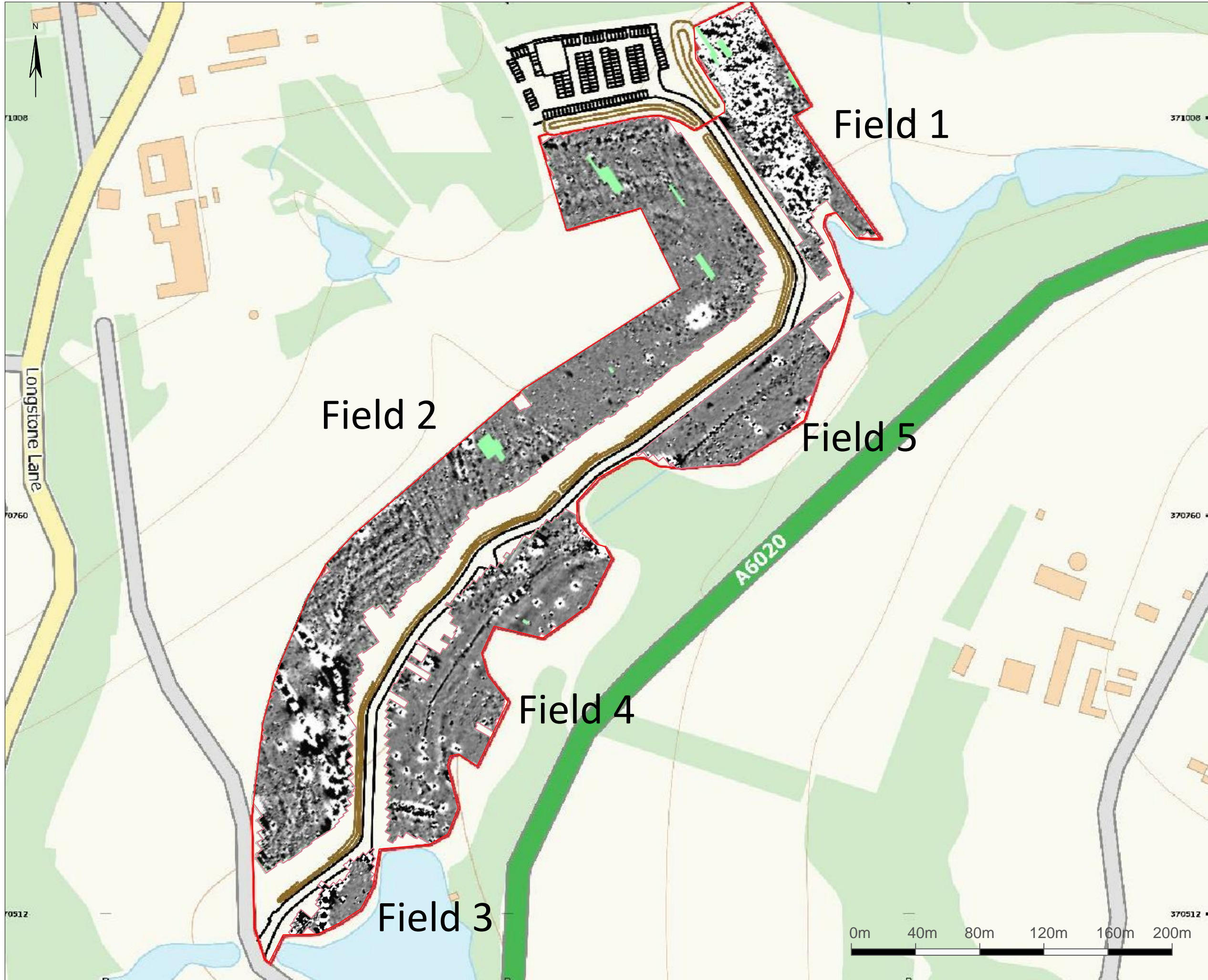
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Location of survey
 grids

Key:
 1 30m x 30m
 survey grids

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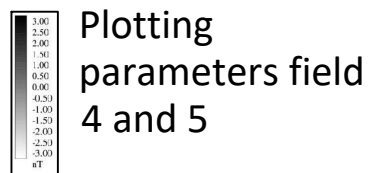
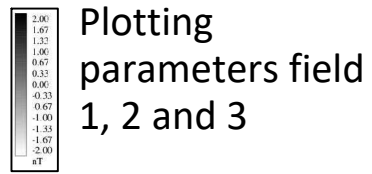
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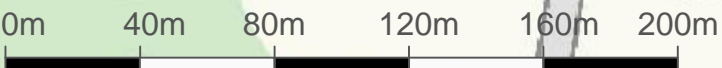
Greyscale Shade
 Plot of Processed
 Gradiometer Data

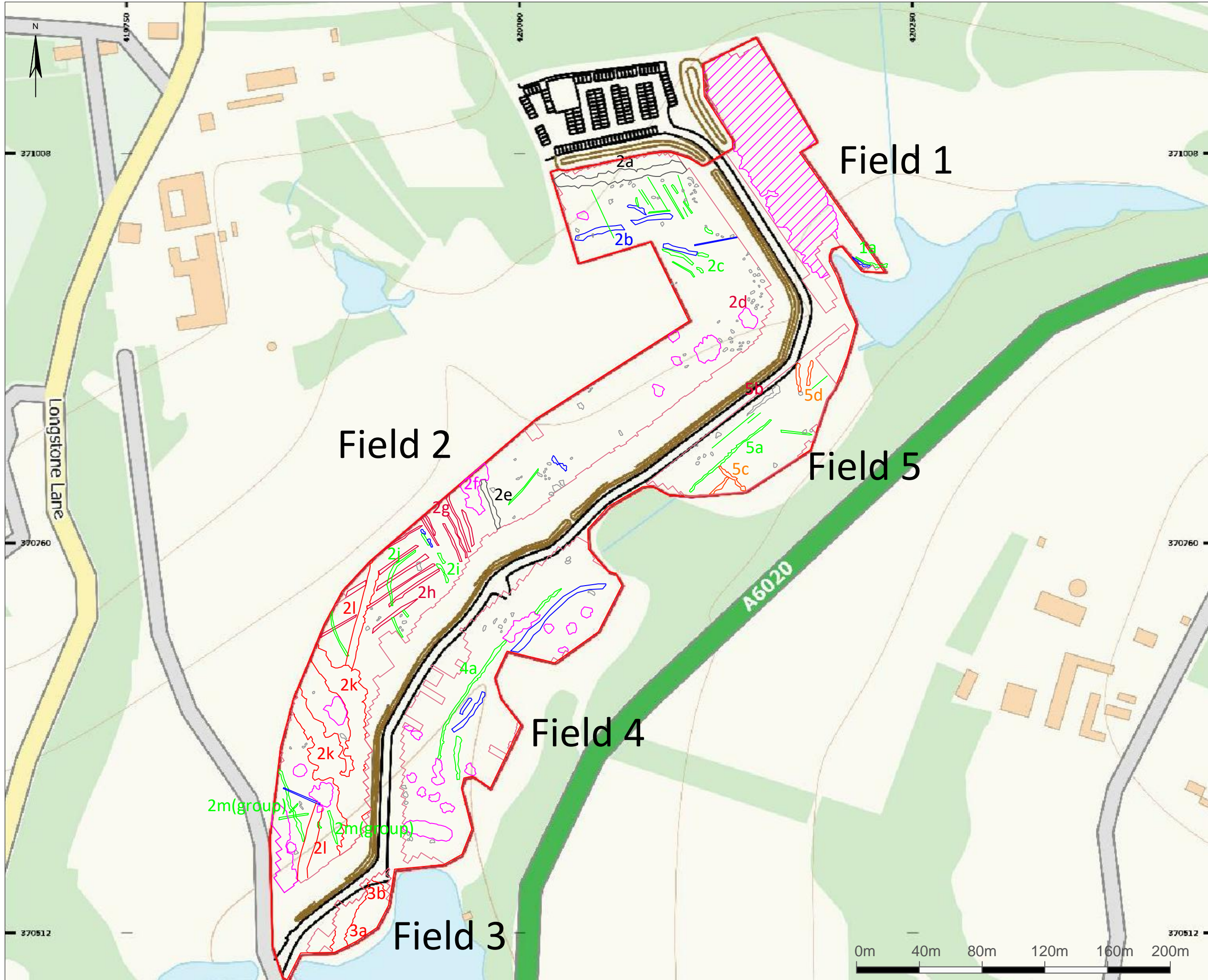
Key:

- Development area
- Geophysical survey area



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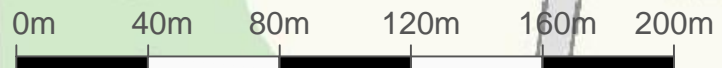
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 Drawing Ref. Figure 4
 Date: May 2022
 Drawn: RD
 Scale: As Shown

Interpretative Plan

Key:

- Development area
- Geophysical survey area
- Linear anomaly
- Linear anomaly (negative)
- Probable ridge and furrow
- Discrete anomalies
- Ferrous/ modern disturbance
- Modern tipping/ landscaping
- Probable land drainage

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<p>Archaeological Research Services Ltd Angel House Portland Square Bakewell Derbyshire DE45 1HB</p>	<p>Figure 5 Trace Plot of Processed Gradiometer Data - Field 1</p>	<p>Copyright/Licencing: This drawing © A.R.S. Ltd</p>
<p>Site Code: TH_22 Drawing Ref: Figure 5 Date: May 2022 Drawn: RD Scale: As shown</p>	<p>Key:</p> <ul style="list-style-type: none"> Development area Geophysical survey area 	



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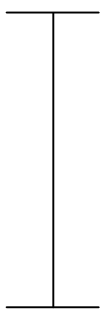
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Trace Plot of
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Gradiometer Data
- Field 2

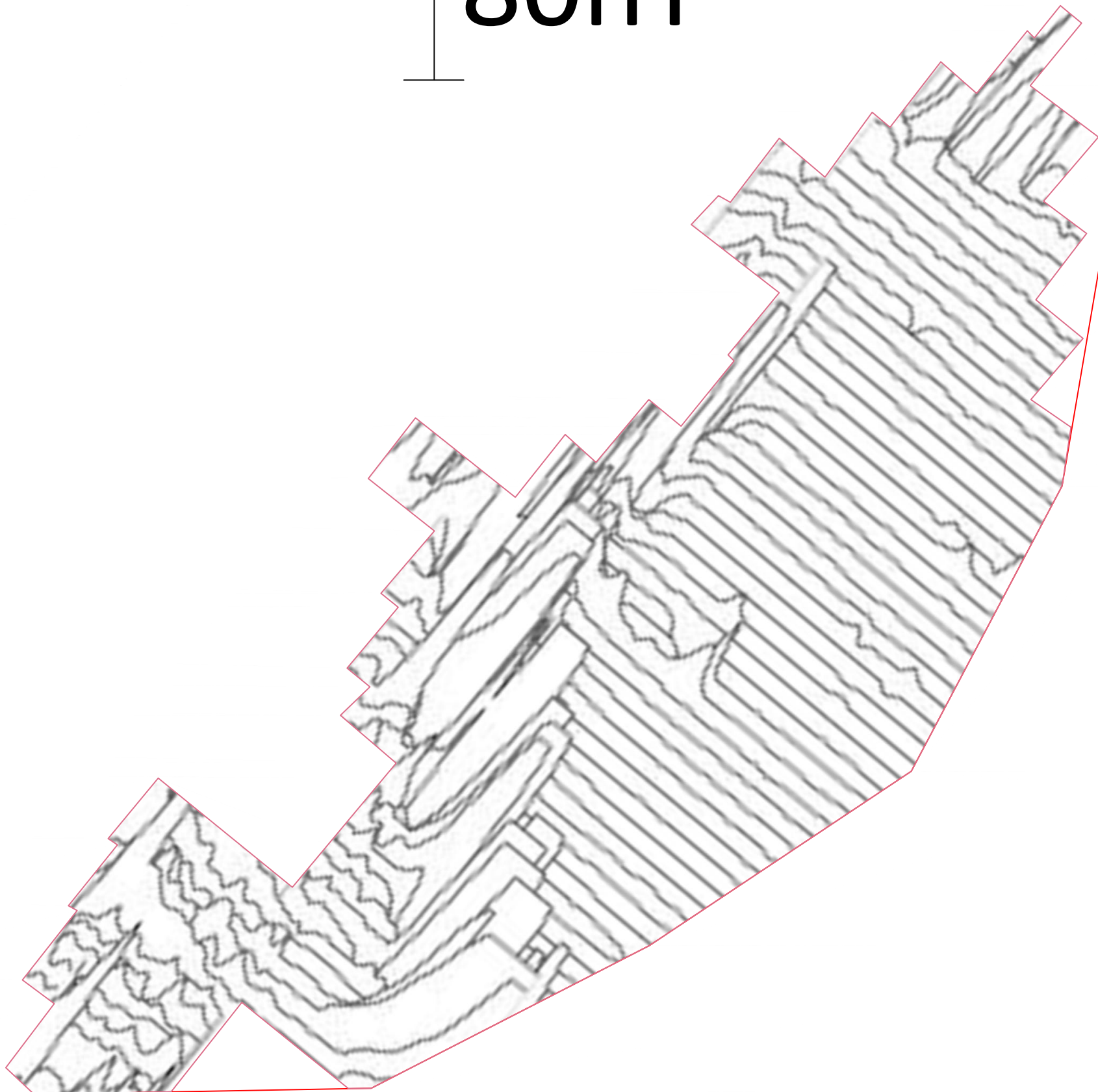
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



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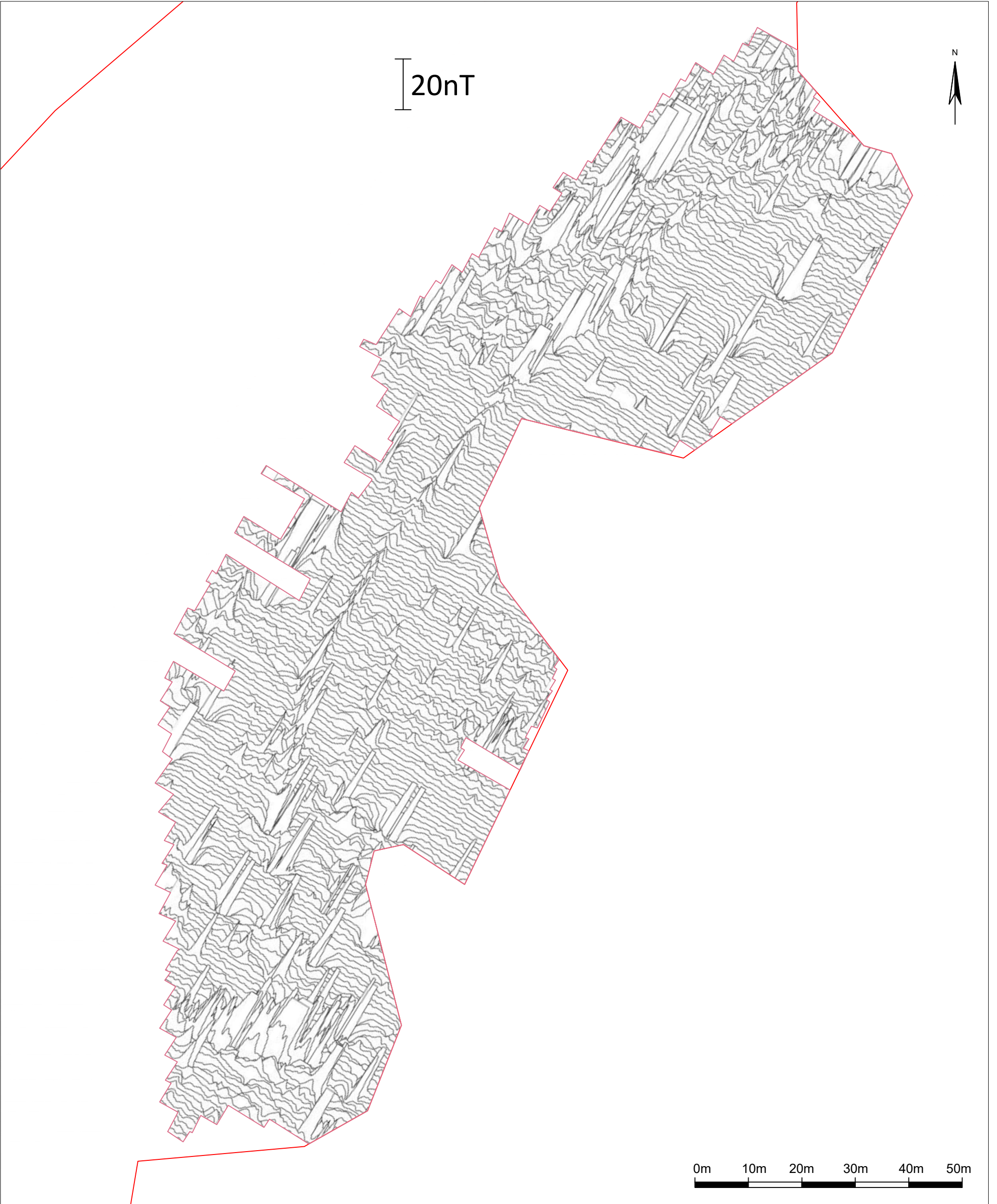
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Figure 7
Trace Plot of Processed Gradiometer Data - Field 3

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Figure 8
 Trace Plot of Processed Gradiometer Data - Field 4

Key:

- Development area
- Geophysical survey area

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Trace Plot of
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- field 5

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 -  Geophysical survey area

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GEOPHYSICAL SURVEY

Land at Thornbridge Hall, Bakewell, Derbyshire

ARS Report N^o: ARS21-228

OASIS ID: archaeol5-507936



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Geophysical Survey of land at Thornbridge Hall, Bakewell, Derbyshire.

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Checked by: Joel Goodchild
Approved for issue by: Dr Roger Doonan
Planning Reference: APP/M9496/C/21/3279072
Local Authority: Peak District National Park Authority
Site central NGR: SK 19985 70864
OASIS ID: archaeo15-507936

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EXECUTIVE SUMMARY

Project Name:	Thornbridge Hall, Bakewell, Derbyshire
Site Code:	THO22
Planning Authority:	Peak District National Park Authority (PDNPA)
Planning Reference:	Planning reference number (refer to WSI)
Location:	Thornbridge Hall, Bakewell, Derbyshire DE45 1NZ
Parish:	Longstone/Ashford-in-the-Water
Hard Geology:	Sedimentary bedrock – Widmerpool Formation – Mudstone
Superficial Geology:	None recorded (BGS 2022)
Soil Type:	Freely draining slightly acid loamy soils
NGR:	SK 19985 70864
Date of Fieldwork:	17/06/2022 – 23/06/2022
Date of Report:	July 2022

This report presents a summary of the results of a geophysical survey undertaken on land at Thornbridge Hall, Bakewell, Derbyshire. The aim of the programme of works is, in line with the *National Planning Policy Framework (NPPF)* paragraph 194 (MHCLG 2021), to require an applicant to describe any significance of any heritage or archaeological assets affected including any contribution made by their setting.

The geophysical survey was undertaken in two phases; Phases 1 and 2 took place during March and June 2022 respectively. Phase 1 was limited to a c. 60m perimeter following the new access road and car park (Figure 2). The first survey identified some possible archaeological remains of agricultural activity (Durkin 2022; refer to Appendix III). Phase 2 reported here has also identified some similar evidence of past agricultural activity.

The second phase of survey covered the car park (Area 1) and a parcel of land between the survey area of Phase 1 and Thornbridge Hall (Area 2). Area 1 contains magnetic disturbance across the survey area. Despite less than ideal conditions the survey identified a pit-like anomaly and linear features. Area 2 contains anomalies relating to former agricultural practice and land enclosure.



I INTRODUCTION

1.1 Project and Planning Background

- 1.1.1 Archaeological Research Services Ltd (ARS Ltd) was commissioned by Emery Planning Ltd (the client) to undertake a geophysical survey on land at Thornbridge Hall, Bakewell, Derbyshire DE45 1NZ.
- 1.1.2 Works were undertaken in compliance with the Written Scheme of Investigation (WSI; see Appendix II) approved by Dr Roger Doonan and took place on 17/06/2022 and 23/06/2022.

1.2 Site Location & Description

- 1.2.1 The proposed development area (PDA) is indicated in the red line boundary on Figure 1. The site is located c. 3km northwest from Bakewell town centre and c. 1km north from Ashton-in-the-water. The survey area is bounded to the north by a disused railway, roughly centred on NGR SK 19985 70864.
- 1.2.2 The 'red line boundary' of the proposed development is depicted by a red polygon on Figure 1 and covers a total area of c. 7.4ha in area, centred on NGR SK 19985 70864.
- 1.2.3 The site comprises of two parcels of land located at Thornbridge Hall, Bakewell, Derbyshire, which lies approximately 160–170m above Ordnance Datum.

1.3 Geology and Soils

- 1.3.1 The underlying solid geology of the site is characterised by the Widmerpool Formation which comprises of Mudstone. It is sedimentary bedrock that formed when the local environment was previously dominated by sub-aqueous slopes; approximately 329 to 337 million years ago in the Carboniferous Period. No superficial geology has been recorded for this area (BGS 2022).
- 1.3.2 The soils in Area 1 are characterised by the Cranfield Soil and Agrifood Institute as freely draining slightly acid loamy soils while Area 2 also contains slowly permeable seasonally wet acid loamy and clayey soils (Soilscape 6 and Soilscape 17 respectively; Cranfield University 2022).

1.4 Archaeological and Historical Background

- 1.4.1 A full and detailed archaeological and historical background is contained in the accompanying written scheme of investigation (WSI) and Desk Based Assessment (DBA; Jacklin 2021).
- 1.4.2 To briefly summarise, while prehistoric activity has been recorded in the area, the landscape surrounding Thornbridge Hall appears to have its origins in the medieval period as agricultural and pastoral land. The hall as it stands today was built somewhere between 1752 and 1790 within a landscape of enclosed medieval strip fields. By 1899 the remaining fields were landscaped to create the Thornbridge Hall parkland.

2 METHOD STATEMENT

2.1 Introduction

- 2.1.1 Magnetometry is a non-intrusive scientific prospecting technique that is the preferred geophysical technique used to determine the presence or absence of buried archaeological features when site and geological conditions are favourable. It is an efficient and effective method for locating anomalies corresponding with archaeological features. The instrument chosen for this survey was a Bartington Grad 601 dual sensor fluxgate gradiometer which can detect weak changes in the Earth's magnetic field caused by buried features. Areas identified as 'blank' in the dataset do not necessarily represent an absence of archaeological features. Rather, gradiometry is used as a survey technique to inform further investigation.
- 2.1.2 All fieldwork and reporting was undertaken following Historic England's (2008) Geophysical Survey in Archaeological Field Evaluation and The Chartered Institute for Archaeologists (CifA) Code of Conduct (CifA 2014a) and Standards and Guidance for Archaeological Geophysical Survey (CifA 2014b).
- 2.1.3 The 30m by 30m survey grids were located to cover each field in turn and aligned as shown in Figure 2. In total 47 survey grids (including partial grids) were set out and accurately positioned using a Leica GNSS field controller with GS05 antenna cap which was connected to Leica Smartnet to receive corrections resulting in an accuracy of typically 0.5m. Each grid was then surveyed at 1m traverse intervals with the sampling at 0.25m (4 readings per metre) intervals. The survey was carried out in 'zig-zag' mode with each alternate traverse walked in opposite directions. The range of the instrument was set at 100nT (0.01nT resolution).
- 2.1.4 The survey was carried out by ARS Ltd on 17th and 23rd June 2022. Both survey days were clement, sunny and dry.
- 2.1.5 Prior to commencing the survey the gradiometer was balanced and calibrated to the local conditions and this was repeated regularly throughout the day. At the end of the day, the data was downloaded into a computer, checked and archived on the ARS Ltd server. The data was downloaded using Bartington Instruments' Grad 601 Communication Application.

2.2 Survey Aims and Objectives

- 2.2.1 The project will aim to gather sufficient information to establish the presence/absence of potentially significant archaeological anomalies and the character and extent of those anomalies within the survey area. It should also identify areas of land where geological or recent deposits (e.g. disturbed ground, alluvium, or colluvium) or modern features (e.g. culverts, pipelines, cellar activity) could be masking the detection of anomalies or have removed anomalies.
- 2.2.2 The following objectives will contribute towards accomplishing this aim.
- To develop an appropriate scanning and targeted survey strategy using appropriate techniques to enable the targeted evaluation of archaeological features through trial trenching.
 - To determine the presence, extent and number of archaeological features.

- To provide a detailed interpretative subsoil map of the site including archaeological anomalies and blank areas to assist in scoping any further stages of evaluation/mitigation that might be required.

3 GEOPHYSICAL SURVEY RESULTS

3.1 Introduction

- 3.1.1 The data was minimally processed using Geoplot v4.0 software. The data was “clipped” (clipping parameters selected on the mean and absolute data values), and the striping that can often appear in gradiometer data was removed by utilising the “zero mean traverse” function with thresholds applied. To enhance the visibility of subtle features the data was viewed under a number of different clip plotting parameters.
- 3.1.2 Occasionally processing the data to compensate for directional sensitivity or to remove iron spikes caused by miscellaneous ferrous objects can also inadvertently disguise anomalies that may be of archaeological origin, particularly long linear features in the direction of the traverses. The data has therefore been analysed in a number of different formats and at each stage of processing.
- 3.1.3 Not all anomalies have been included in the results and discussion. Dipolar anomalies with no clustering or pattern to their distribution are common on most sites and almost certainly relate to natural variations in the soils and geology, agricultural disturbance and miscellaneous ferrous litter on the surface of the field. These anomalies have not been analysed further.
- 3.1.4 A greyscale shade plot of the processed gradiometer data is presented in Figures 5 and 6 and the minimally processed data is presented in figures 14 and 15. Trace plots of the survey areas are presented in figures 9-13, and an interpretative plan in figures 7 and 8.

3.2 Anomalies

Area 1

- 3.2.1 Magnetic interference produced a striping effect which obscures underlying features and makes this dataset more difficult to interpret. A large anomaly has been identified toward the east of the survey area (1a), with a linear feature extending toward the west (1b and 1c), however, surrounding disturbance has prevented any meaningful interpretation from the greyscale image and the XY traceplot.

Area 2

- 3.2.2 A mix of weak linear anomalies and positive anomalies have been identified in the east of the survey area that are most likely a result of agricultural activity. The remains of probable ridge and furrow are visible as weak negative anomalies (2a and 2b) with a strong positive anomaly running parallel to the east that may represent the boundary of a strip field (2f). Further north is a weak linear anomaly (2d) that appears to line up with the probable strip field and it is feasible to suggest it is a continuation of anomaly 2f or a field boundary. In between the probable ridge and furrow (2g) is a linear anomaly indicative of a plough headland that has been disturbed due to modern agricultural activity, though an

area of magnetic disturbance and ferrous material in close proximity to this feature may have affected the gradiometer response over the area.

- 3.2.3 Coinciding with the possible strip field boundary (2f) are two small negative anomalies that are consistent with either a ditch or a pit (2e). It is possible that these features may relate to treeboles as historic OS mapping from 1883 – 1955 (Jacklin 2021) show more trees in the area than is currently present. Towards the centre of the survey area is a response that is typical of a pit-like anomaly towards the south (2p).
- 3.2.4 In the northwest of the survey area a curvilinear feature has been identified and interpreted as a possible holloway (2h, 2i and 2j).
- 3.2.5 Towards the southwest, linear anomalies have been identified within the data that are consistent with field boundaries/enclosures (2m and 2o). Anomaly 2n has been identified as a possible field boundary from the 1883 OS map (Jacklin 2021). Northeast of the former field boundary lies a linear anomaly (2l) that aligns with 2n and has a similar response that suggests that feature 2n continues across the field, but this is not evident on historic OS mapping. The feature lies perpendicular to the ridge and furrow (2b) and it is possible that the response represents a plough headland that was later partially incorporated into a field boundary.
- 3.2.6 In the northeastern extent of the survey area, weak anomalies have been identified that are most congruent with modern ploughing (2c) along an orientation of northeast/east to west.
- 3.2.7 Area 2 has dipolar responses scattered throughout that are the result of ferrous material being present. The larger ferrous spikes have been identified in the interpretation. A large dipolar response is present from the northwest corner to the southeast that is indicative of a modern service such as a pipe (2k and 2q). Also, the metal fence that denotes the boundary of Area 2 has left a ferrous response along the northern and western edge of the dataset (2r, 2s and 2t).

4 DISCUSSION AND CONCLUSIONS

- 4.1.1 The results from Phase 1 (refer to Appendix III for the full report) and Phase 2 of the survey have revealed the probable remains of medieval agricultural activity. There is a possibility of a pit-like anomaly and linear feature in Area 1 but further investigation would be required to assess their archaeological significance.
- 4.1.2 The survey of Area 2 has revealed the remains of ridge and furrow cultivation, plough headlands and field boundaries that may be medieval in origin. These features follow the same alignment of those depicted on Brailsford's redrawing of Senior's 17th century map of Ashford Manor, which depicts the landscape prior to the establishment of parkland surrounding Thornbridge Hall (Scurfield 1992). In this way the site encapsulates the transition from an agrarian medieval landscape to the formalised parks and gardens associated with the gentry in the post medieval period.

5 PUBLICITY, CONFIDENTIALITY AND COPYRIGHT

- 5.1.1 Any publicity will be handled by the client.
- 5.1.2 ARS Ltd will retain the copyright of all documentary and photographic material under the Copyright, Designs and Patent Act (1988).

6 STATEMENT OF INDEMNITY

- 6.1.1 All statements and opinions contained within this report arising from the works undertaken are offered in good faith and compiled according to professional standards. No responsibility can be accepted by the author/s of the report for any errors of fact or opinion resulting from data supplied by any third party, or for loss or other consequence arising from decisions or actions made upon the basis of facts or opinions expressed in any such report(s), howsoever such facts and opinions may have been derived.

7 ARCHIVE

- 7.1.1 One bound copy of the final report with an attached digital PDF/A copy on disc will be deposited with the Peak District National Park Authority. The disc will also include a digital archive, consisting of relevant ESRI shapefiles or CAD files, for use of updating the HER database.

8 ACKNOWLEDGEMENTS

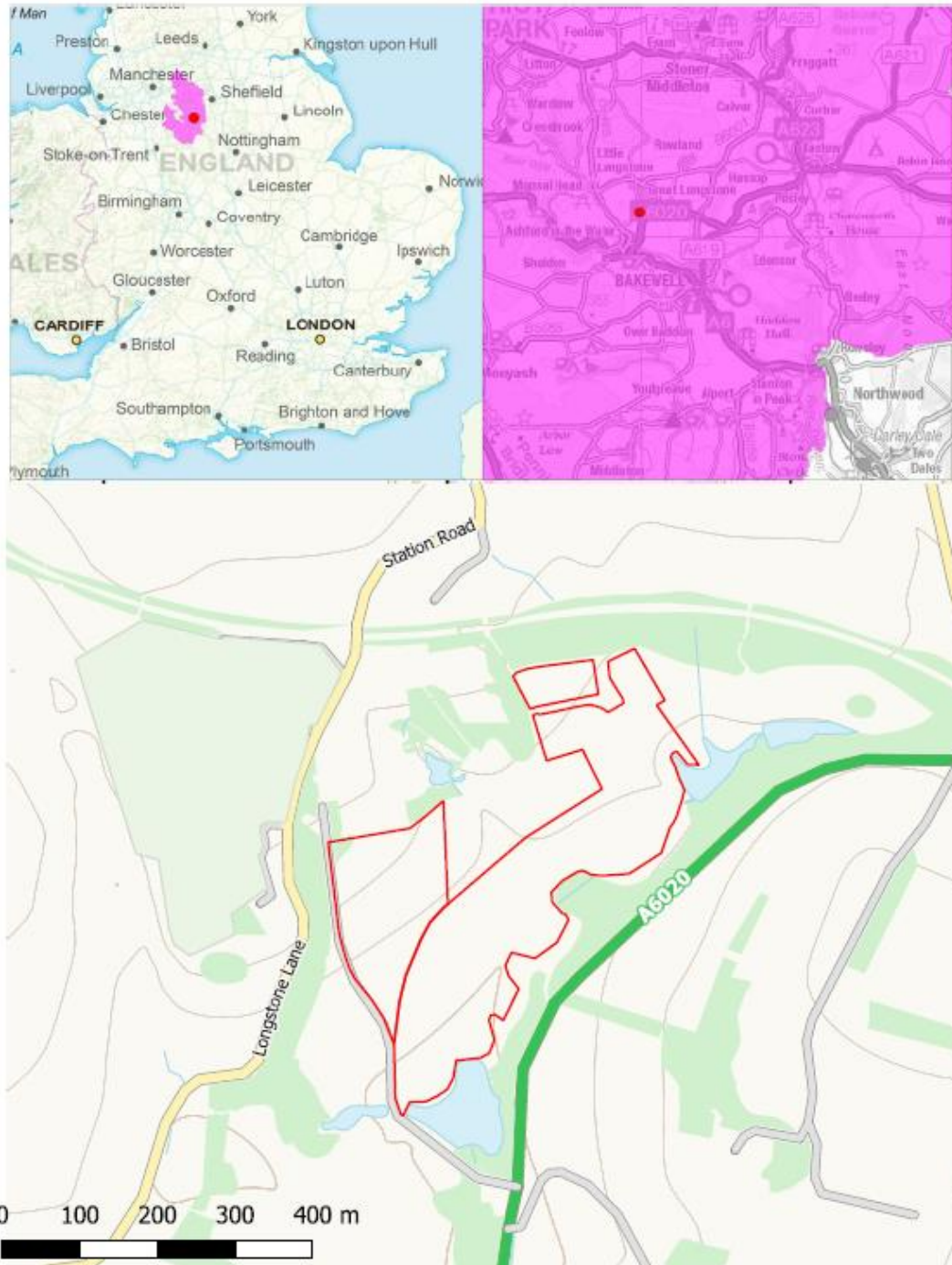
- 8.1.1 ARS Ltd would like to thank to thank Emery Planning Ltd for commissioning the project on behalf of the landowners of Thornbridge Hall. We would also like to thank the tenant farmer and groundskeeper for their assistance with land access.

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APPENDIX I FIGURES

Figure 1: Site location.



Site name: Thornbridge Hall
 Date: June 2022
 Drawn by: KP
 Scale: Varies

Figure 1: Site Location

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● Location of Surevy Area
 ■ Peak District National Park Authority
 □ Survey Area





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Figure 2: Survey Area (Phases 1&2)

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Key

Survey Area

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Figure 3: Survey Area of Phase 2

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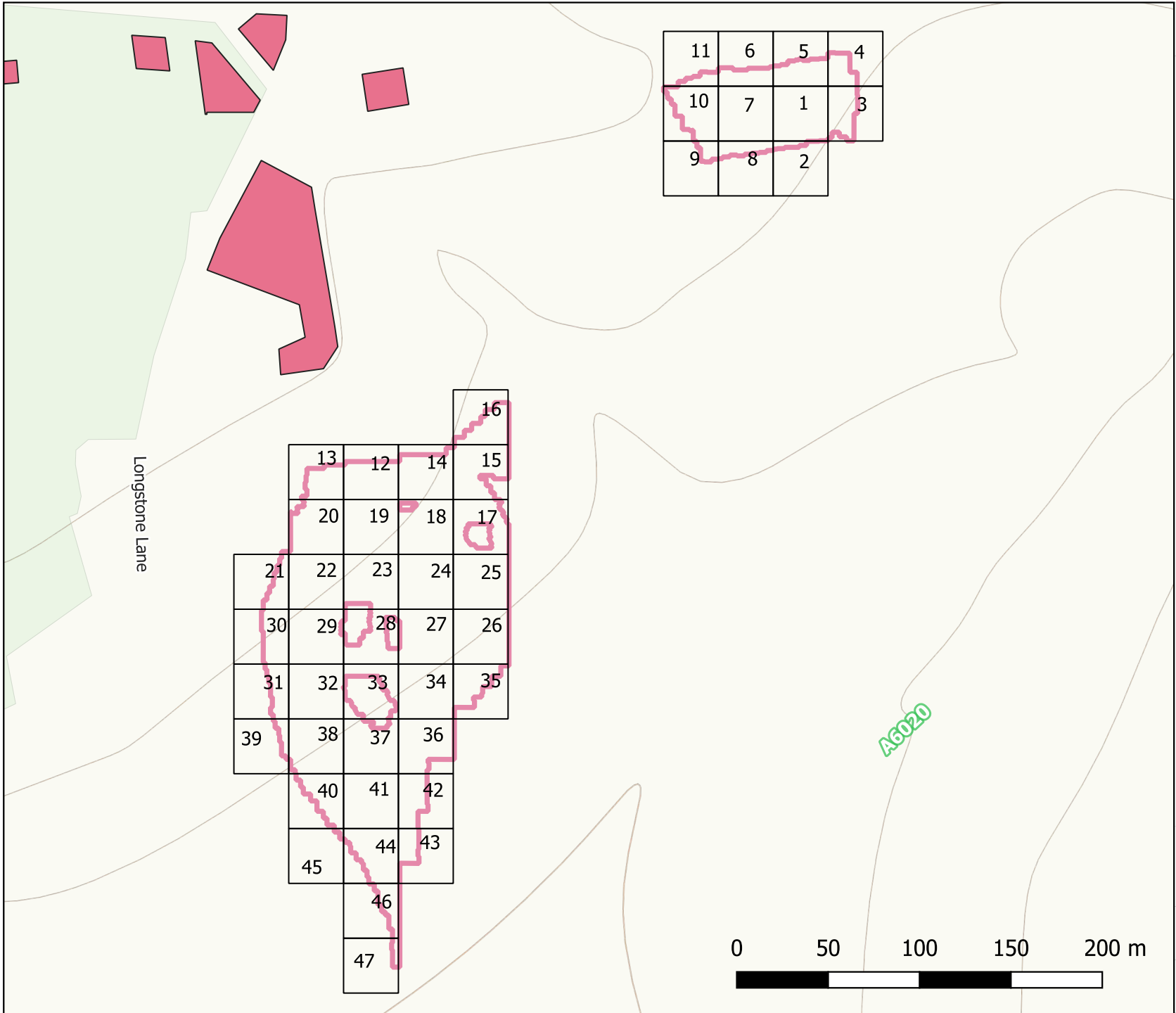




Figure 4: Location of Survey Grids

Key

-  Grid Lines
-  Survey Area

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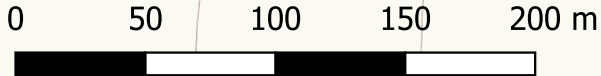
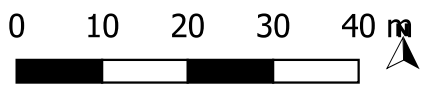
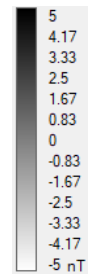


Figure 5: Processed Geophysical Data (Area 1)

Key

 Survey Area



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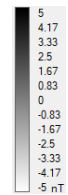
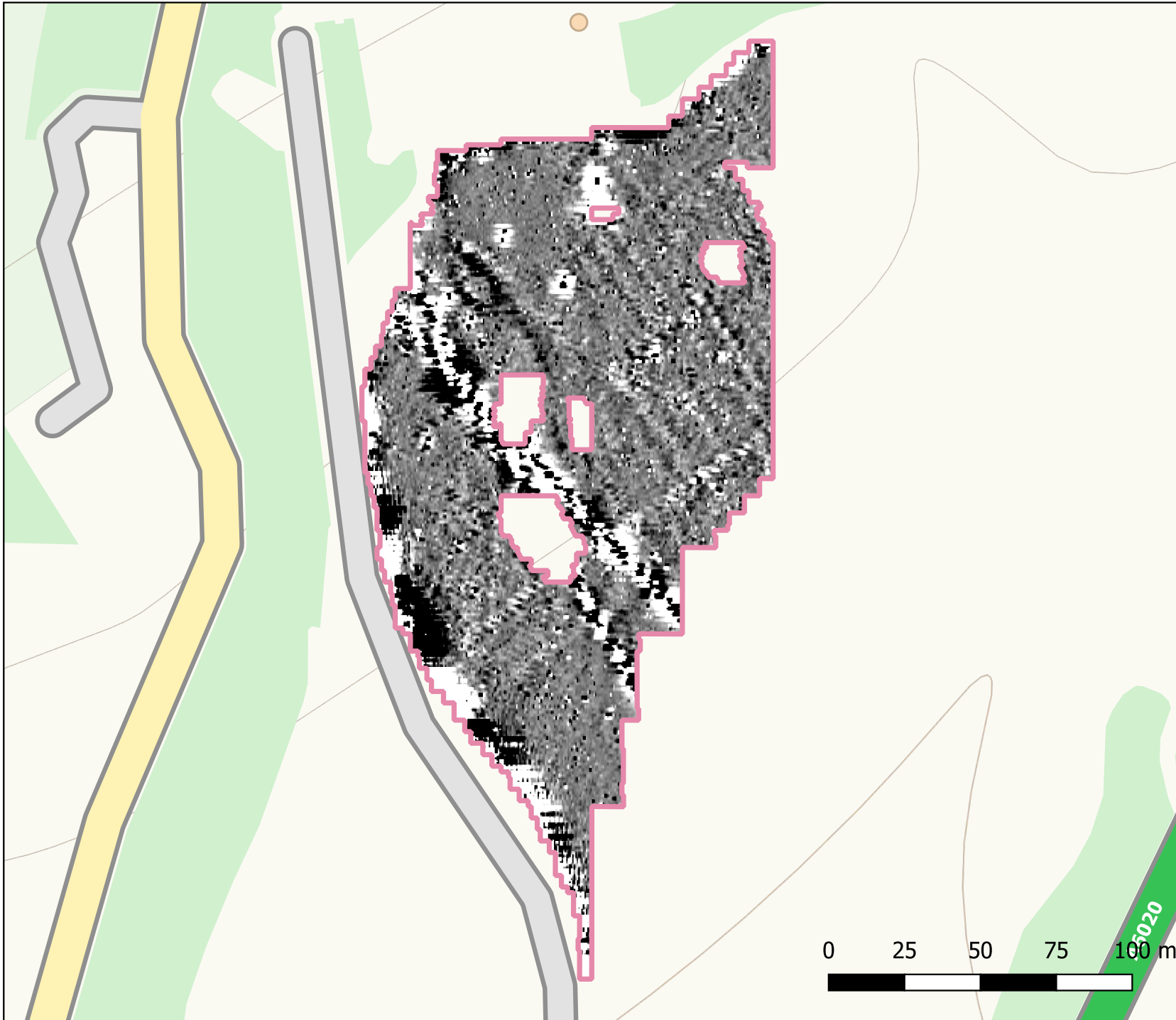
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Figure 6: Processed Geophysical Data (Area 2)

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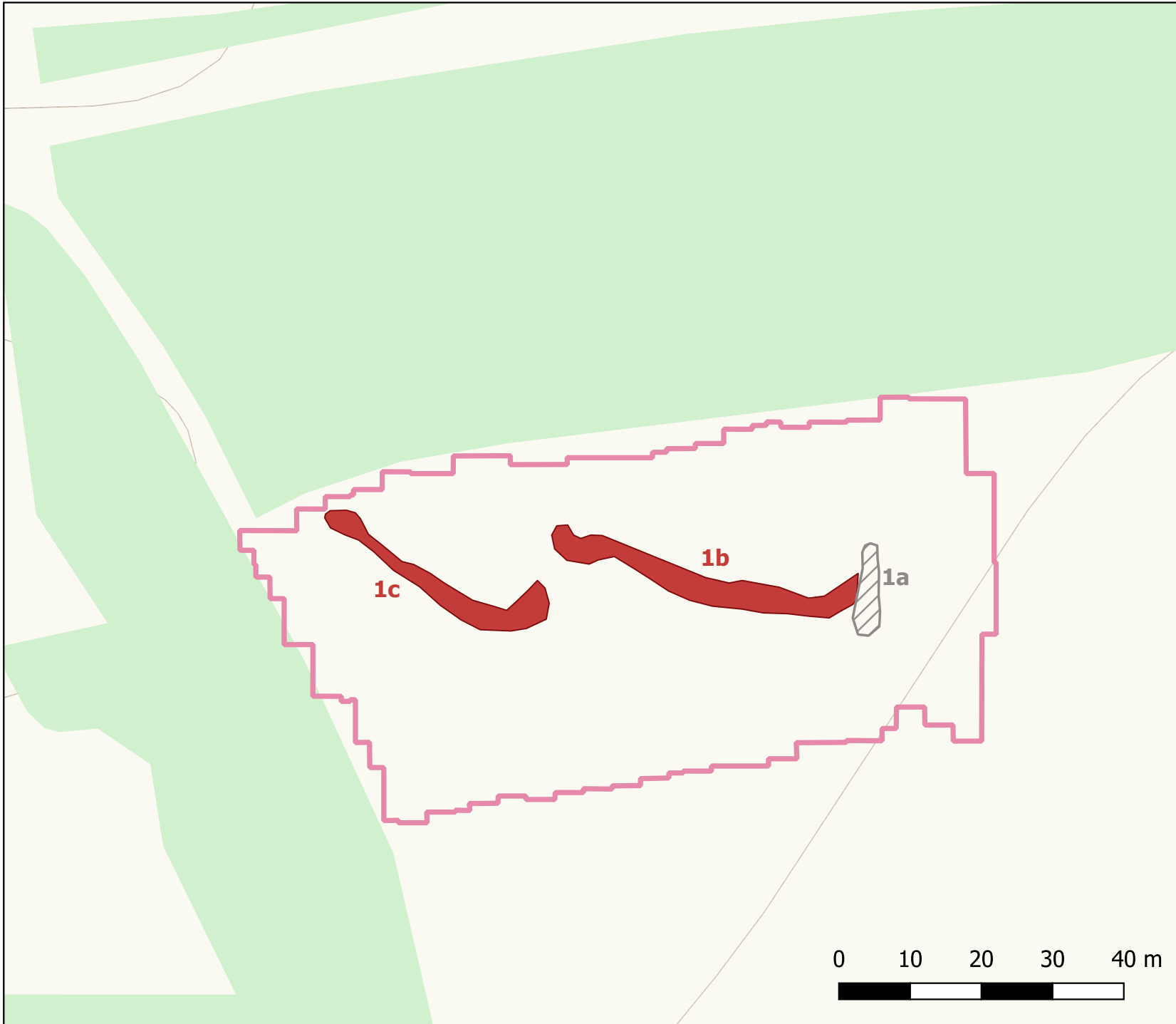


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**Figure 7: Interpretative Plan
(Area 1)**

Key

-  Survey Area
-  Magnetic Disturbance/Modern
-  Linear Anomaly



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Figure 8: Interpretative Plan (Area 2)



Key

-  Survey Area
-  Modern Ploughing
-  Possible Field Boundary
-  Ridge and Furrow
-  Magnetic Disturbance/Modern
-  Possible Archaeology
-  Ferrous Material
-  Pipe/Drain



0 25 50 75 100 m

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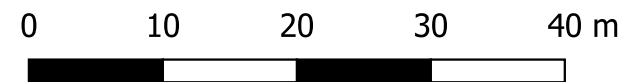
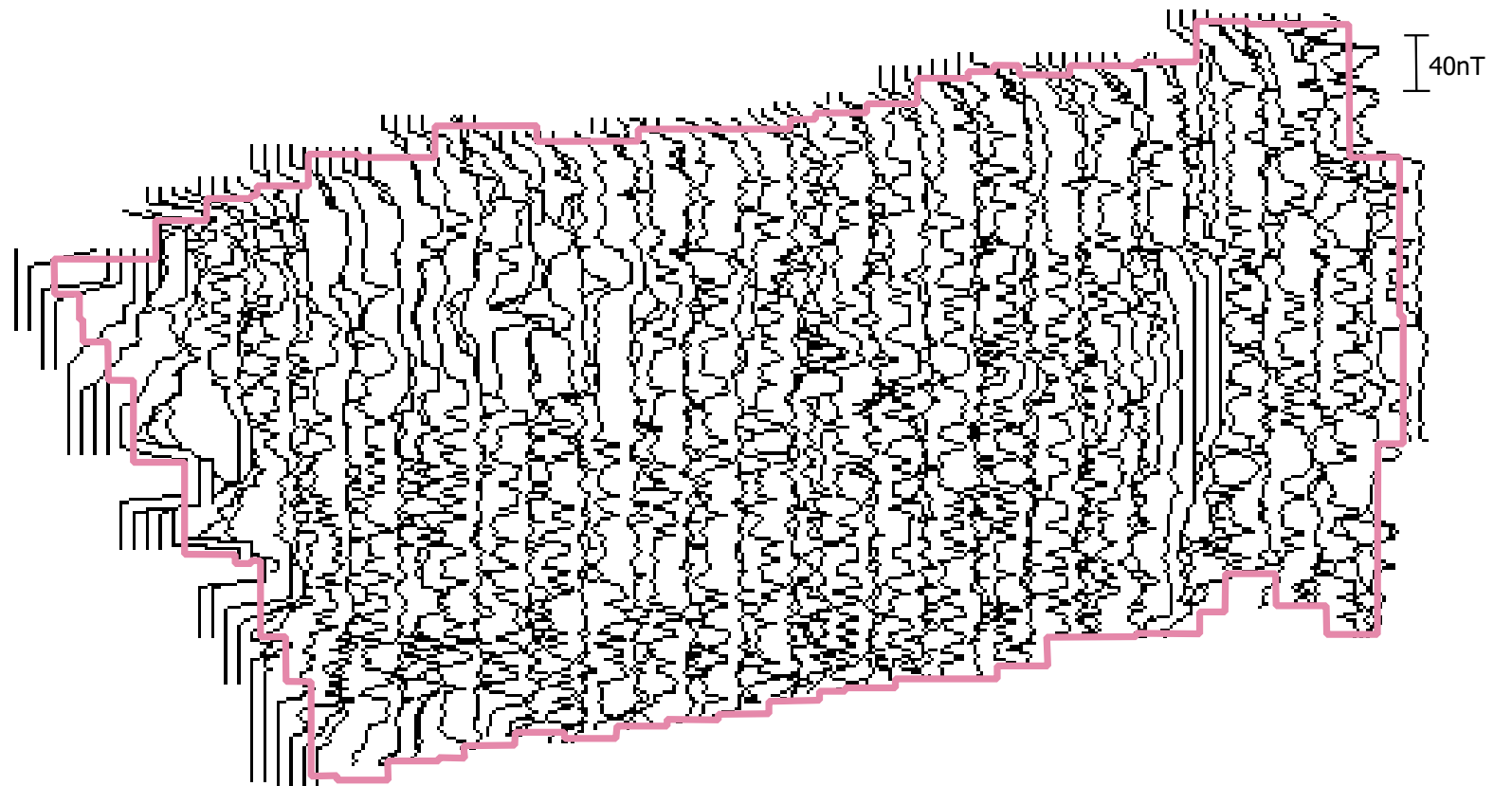
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Figure 9: Traceplot at 40nT for Area 1

Key

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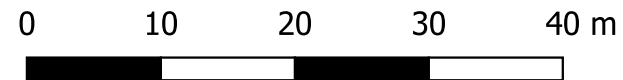
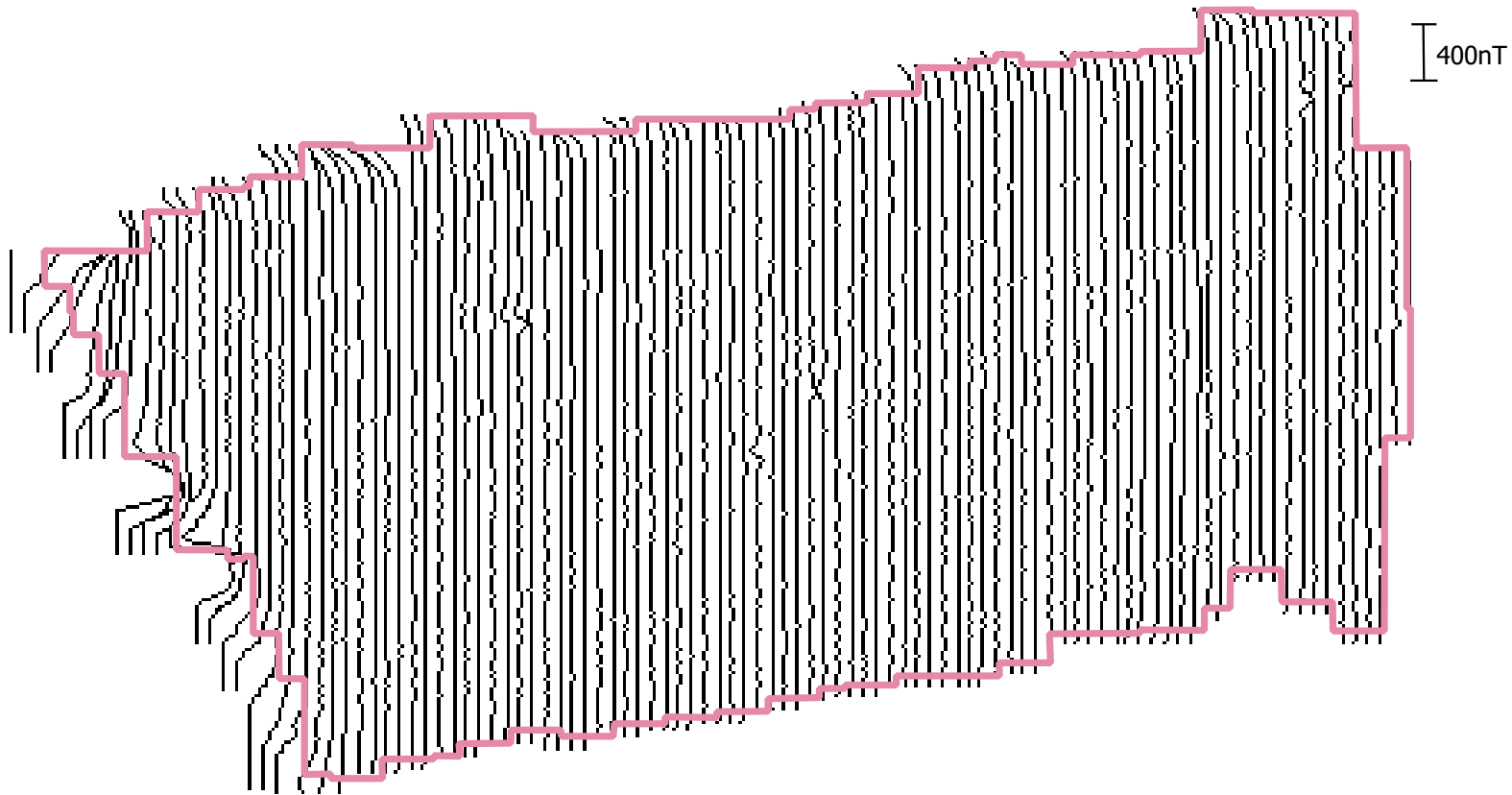


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Figure 10: Traceplot at 400nT for Area 1

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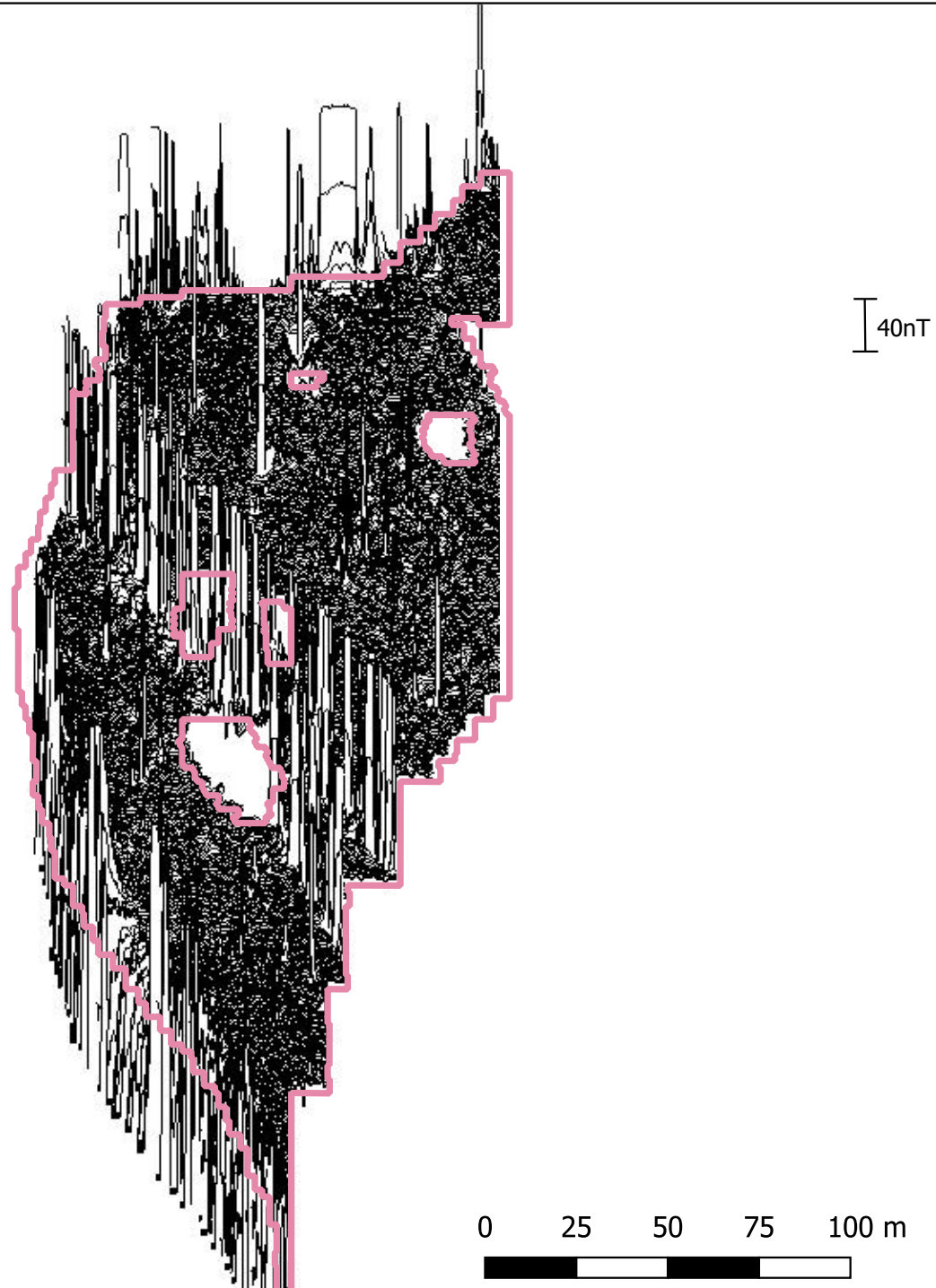
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Figure 11: Traceplot at 40nT for Area 2



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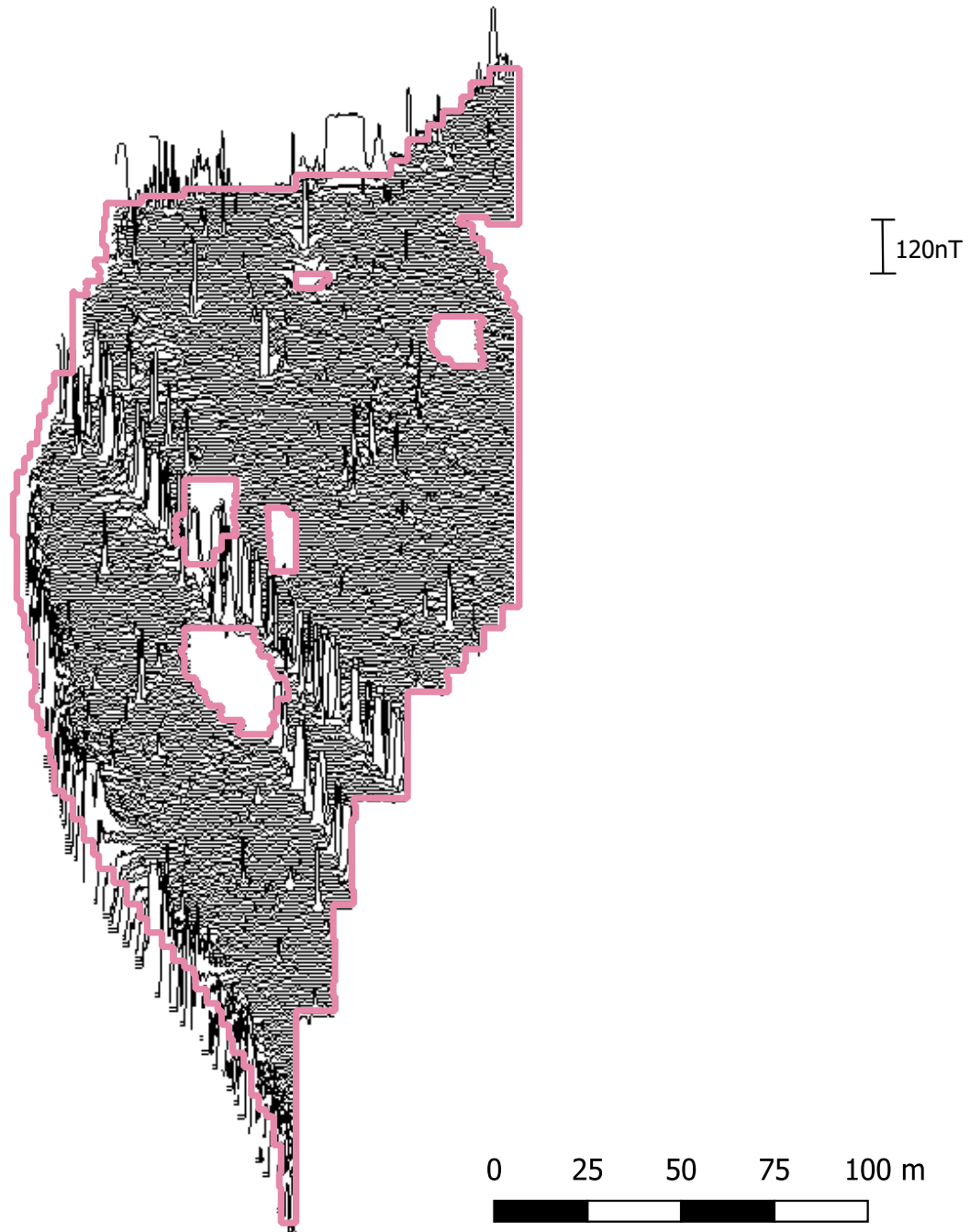
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Figure 12: Traceplot at 120nT for Area 2



Key

 Survey Area



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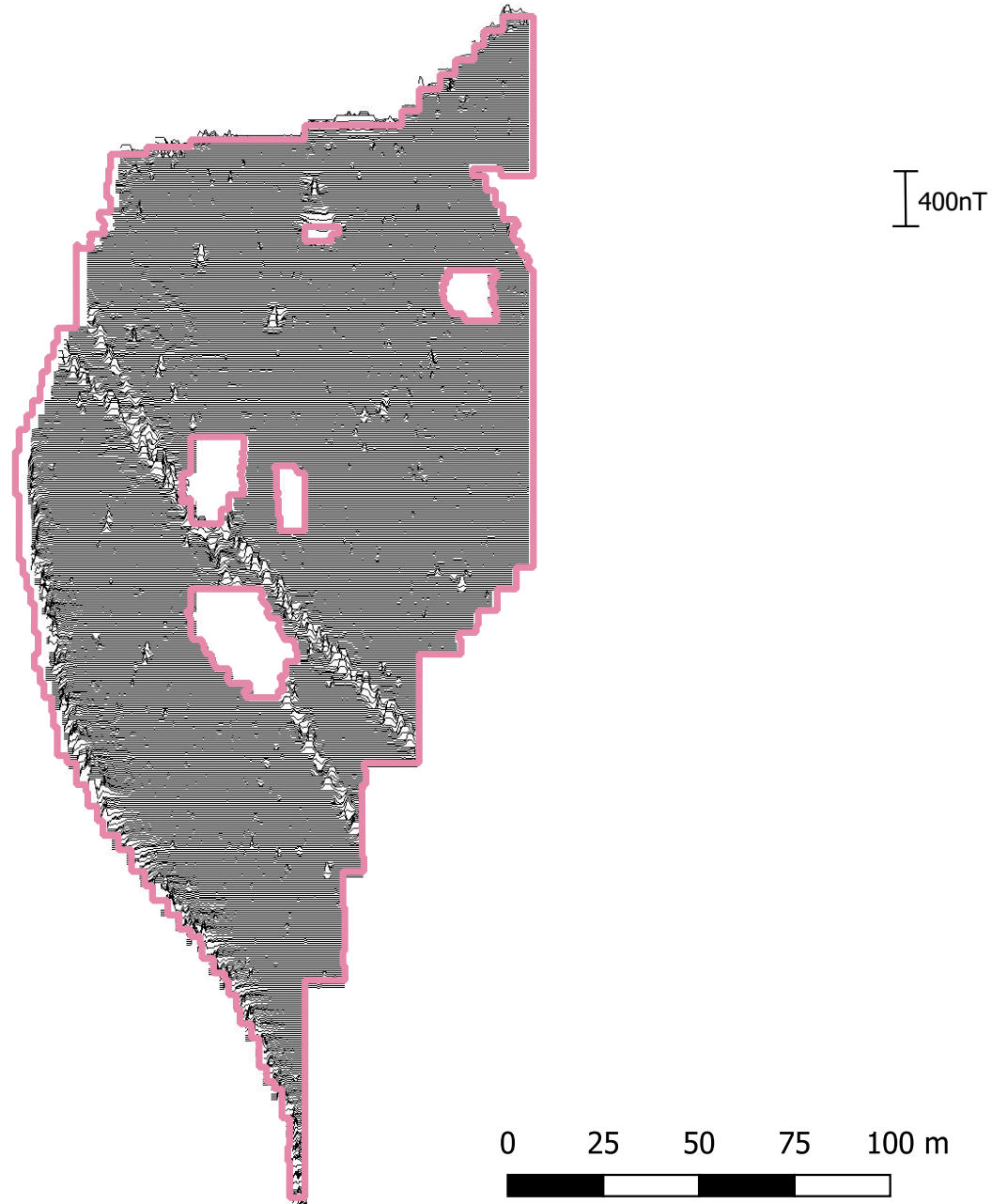


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Figure 13: Traceplot at 400nT for Area 2



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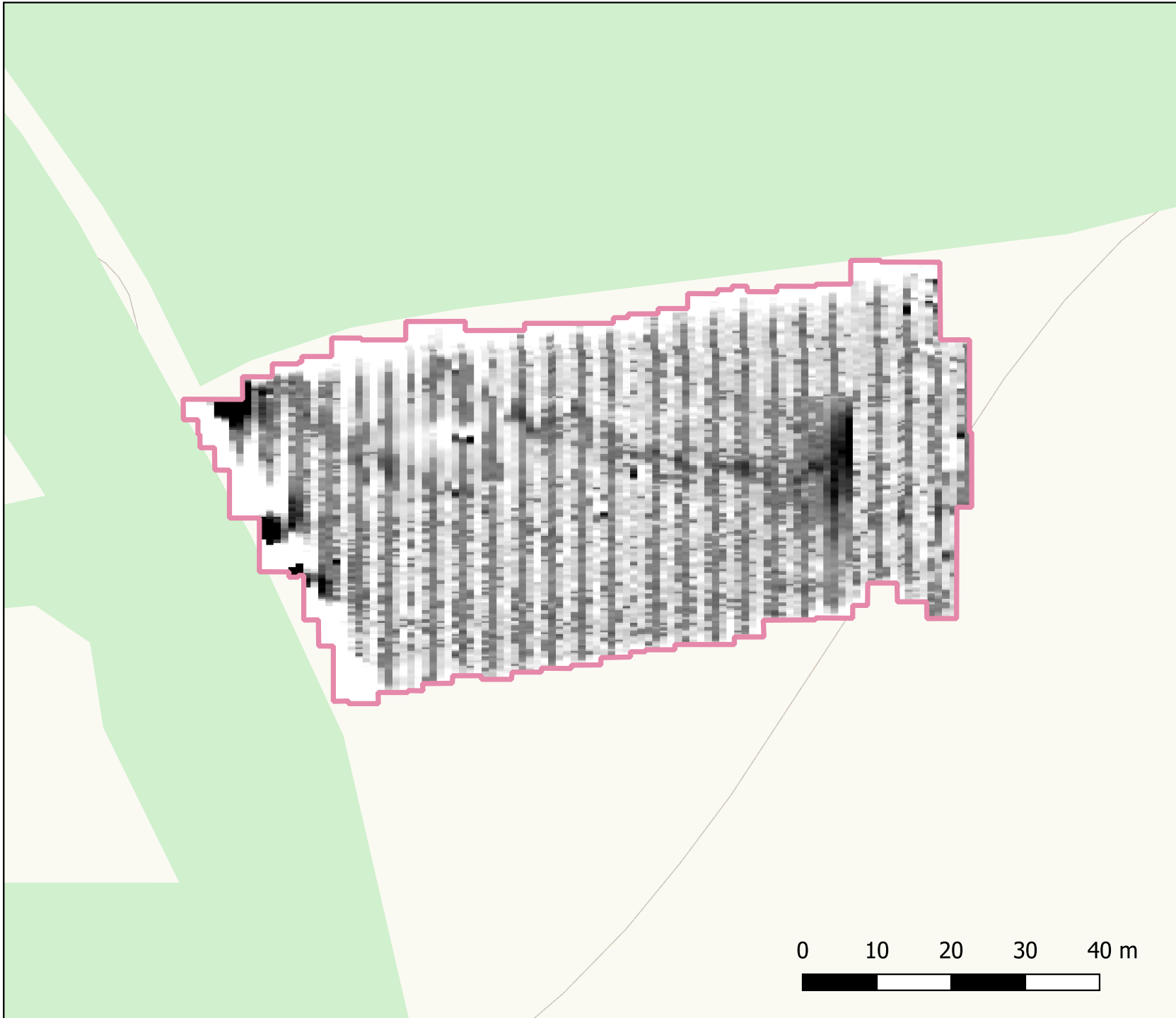


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Figure 14: Minimally Processed Data from Area 1



Key

 Survey Area



0 10 20 30 40 m



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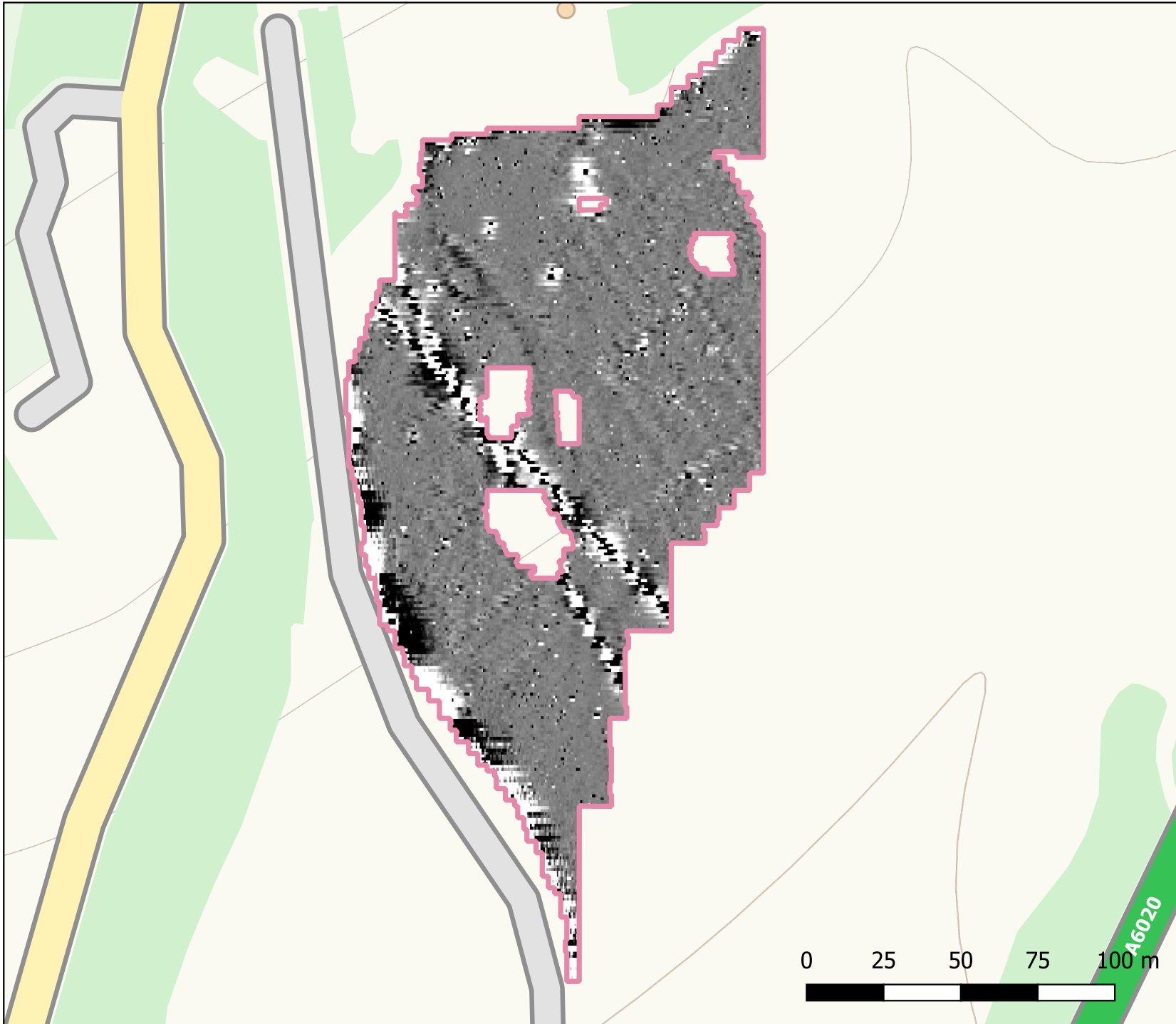
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Figure 15: Minimally Processed Data from Area 2



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APPENDIX II WRITTEN SCHEME OF INVESTIGATION

Thornbridge Hall and Park, Derbyshire

Written Scheme of Investigation for a Geophysical Survey

January 2022



**ARCHAEOLOGICAL
RESEARCH SERVICES LTD**
Digging with Purpose

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Angel House, Portland Square, Bakewell, Derbyshire, DE45 1HB

www.archaeologicalresearchservices.com

Prepared on behalf of: Emery Planning Ltd

Date of compilation: January 2022

Compiled by: William Rigby ACIfA

Local Authority: Peak District National Park
Authority

Site central NGR: SK 19985 70864

1 INTRODUCTION

1.1 Project Background

1.1.1 This Written Scheme of Investigation (WSI) has been prepared by Archaeological Research Service Ltd (ARS Ltd) for Emery Planning Ltd on behalf of Andromeda Park Ltd. It details a scheme for a geophysical survey on land at the Grade II Listed (List No.1158698) Thornbridge Hall and Park, Derbyshire. The client constructed a access road and car park with associated tarmac surface prior to planning consent, and as a result was issued an enforcement notice (Ref: ENF:21/0034), by the Peak District National Park Authority (PDNPA). This work forms part of retrospective mitigation works by the client in order to assess the impact on any affected heritage assets of archaeological interest that may survive below-ground within the area of the development.

1.1.2 The survey area has been the subject of an archaeological desk-based impact assessment (Jacklin 2021) which, along with a previous assessment (Bevan 1995), has identified evidence of ridge and furrow and a lynchet of medieval and post-medieval origin, and multiple post-medieval field boundaries within the survey area. Therefore, a scheme of geophysical survey is required, to ensure any surviving below-ground archaeological remains that have been impacted are properly evaluated. This is in line with *National Planning Policy Framework (NPPF)* paragraph 205 (MHCLG 2021, 57) ‘to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible.’

1.2 Site Description and Location

1.2.1 The ‘red line boundary’ of the survey area is depicted by a red polygon on Figure 1 and covers a total area of c. 10.3ha, centred on NGR SK 19985 70864.

1.2.2 The survey area is located at Thornbridge Hall and Park in Ashford in the Water, c. 2.5km from Bakewell, Derbyshire. The surveyable area is bisected by access road and soil bunds but will be treated as one survey area (Figure 2) detailed below.

Field	Area (m ²)	Area (ha)
1 (Phase 1)	74108.723	7.41
1 (Phase 2)	24525.159	2.45
2 (Phase 2)	4560.992	0.46
Total	103194.874	10.32

1.3 Geology and Soils

1.3.1 The underlying solid geology of the survey area comprises “Widmerpool Formation - Mudstone. Sedimentary Bedrock formed approximately 329 to 337 million years ago in the Carboniferous Period” (British Geological Survey 2022). There are no superficial deposits recorded. (ibid)..

1.3.2 The soils in the survey area belong to Soilscales 17 soils unit. These are described as “*slowly permeable seasonally wet acid loamy and clayey soils*” (Cranfield University 2022).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 The following archaeological and historical background is a summary of an archaeological desk based assessment report produced by Archaeological Research Services Ltd (Jacklin 2021).

2.2 There is limited evidence for the Prehistoric-Romano-British periods within the environs of the survey area. A Prehistoric flint flake (DHER MDR2034) and a Bronze Age hammer (DHER MDR2100), were found as surface finds c. 1km to the northwest and west of the survey area. It is probable that there was very little prehistoric activity in this area, despite evidence for Bronze Age activity within the Peak District as a whole. While the proposed route of Brough to Carsington Roman Road (DHER MDR11383) is recorded c. 600m to the west of the survey area.

2.4 Medieval activity has been recorded within the vicinity of the survey area, Thornbridge Hall itself is bounded by settlements and farm land with Medieval origins. A number of former outfarms are recorded as well as strip lynchets cultivation c. 400m to the west of the survey area (DHER MDR2052). Further, possible ridge and furrow cultivation has been identified on LiDAR data with the survey area, while the PDNPA have recorded extant ridge and furrow c. 200m to the north of the survey area (Jacklin 2021, 9).

2.5 It was during the Post-Medieval period that Thornbridge Hall as it is known today was constructed. It was built between 1752 and 1790 and removed several enclosed and open fields within the survey area. There is significant documentation of the area in 19th century tithe maps marking the majority of land as pastoral. As Thornbridge hall developed, more of this land was removed and by 1899 the remaining fields within the survey area were removed to create Thornbridge Hall Parkland.

3 AIMS AND OBJECTIVES

3.1 Regional Research Aims and Objectives

3.1.1 Research topics have been identified in East Midlands Historic Environment Research Framework (Research Frameworks 2021) for the following periods.

Medieval

- ◆ 6.1.7: Can we identify social/political boundaries (e.g. surviving linear earthworks and natural barriers) and/or estate centres in the Early Medieval?
- ◆ 6.7.5: To what extent did woodland regenerate in the post-Roman period and how were woodlands used and managed?

- ◆ 7.7.1: Can we shed further light upon the origins and development of the open-field system and its impact upon agricultural practices?
- ◆ 7.7.3: What can we deduce about changes in woodland management and animal or crop husbandry (including new crops, crop rotation, field systems, more intensive cultivation of clay soils and larger animals, particularly sheep)?

Post-Medieval

- ◆ 8.2.1: Can we elucidate further the use of social space in buildings and across the landscape, the manipulation of vistas and the integration of gardens with the wider landscape?
- ◆ 8.2.2: How were garden designs influenced by changing fashions and by a familiarity with Continental garden styles?
- ◆ 8.2.3: What horticultural methods, planting schemes and water management methods were employed by garden planners?
- ◆ 8.2.5: Can we establish regional typologies of parklands, parkland structures and the villages and cottages associated with estates?
- ◆ 8.3.1: How can we improve our understanding of the early landscapes of enclosure and improvement and the interrelationship between arable, pasture, woodland, commons and waste?
- ◆ 8.3.2: How did water management and land drainage change the landscape during this period?

3.1.2 It should be noted that other research objectives may come to the fore should any archaeological features from other periods be identified as a result of the geophysical survey or any further stages of evaluation/mitigation that might be required.

3.1.3 Provision should be made for updating *The Archaeology of the East Midlands: A framework for research* where the results of a fieldwork project contribute towards agenda topics. This should be done using the interactive digital resource at <https://researchframeworks.org/emherf/> and noted explicitly in the conclusions of the relevant report.

3.2 Geophysical Survey Aims and Objectives

3.2.1 The project will aim to gather sufficient information to establish the presence/absence of potentially archaeologically significant anomalies and the character and extent of those anomalies within the survey area. It should also identify areas of land where geological or recent deposits (e.g. disturbed ground, alluvium or colluvium) or modern features (e.g. culverts, pipelines, cellar activity) could be masking the detection of anomalies or have removed anomalies.

3.2.2 The following objective will contribute towards accomplishing this aim.

- ◆ To develop an appropriate scanning and targeted survey strategy using appropriate techniques to enable the targeted evaluation of archaeological features through trial trenching, if required.
- ◆ To determine the presence, extent and number of archaeological features.
- ◆ To provide a detailed interpretative sub-soil map of the site including archaeological anomalies and blank areas to assist in scoping any further stages of evaluation/mitigation that might be required.

4 PROFESSIONAL STANDARDS

4.1 ARS Ltd is a Registered Organisation with the Chartered Institute for Archaeologists (CifA). Registered Organisations are continuously assessed to ensure that the highest standards of work are carried out, in line with CifA's *Code of Conduct* (2019). In addition to key management staff, who have achieved the highest grade of corporate CifA membership, many of our field staff also hold corporate grade membership.

4.2 The presentation and interpretation of the results will be carried out in accordance with the CifA's *Code of Conduct* (2019) and will follow the English Heritage guidelines (2008) *Geophysical Survey in Archaeological Field Evaluation*, CifA's *Standard and Guidance for archaeological geophysical survey* (2020) and EAC *Guidelines for The Use of Geophysics in Archaeology* (2015).

4.3 ARS Ltd is a corporate member of the International Society of Archaeological Prospection (ISAP).

4.4 All staff employed on the project will be suitably qualified for their respective project roles and have substantial experience of geophysical survey. All staff will be made aware of the circumstances and potential archaeological importance of the work and will be fully briefed on the requirements of this specification.

4.5 All site operations will be carried out in a safe manner in accordance with ARS Ltd's health and safety policy. A risk assessment will be prepared before commencement on site.

5 GEOPHYSICAL SURVEY

5.1 Coverage

5.1.1 It is intended to conduct a geophysical (magnetometer) survey to provide 100% coverage of all surveyable areas to evaluate and determine the presence of archaeological features (Figure 2).

5.2 Selected Technique

5.2.1 The geophysical survey technique selected for the site is magnetometry. Magnetometry using Fluxgate Gradiometer instruments is the preferred geophysical technique utilised for the detection of buried features such as iron-based features

and objects, or those subjected to firing such as kilns, hearths and even the buried remains of brick walls. It is also used to locate subtle features such as boundary or enclosure ditches, pits and post holes which have been gradually in-filled by more humic material. The breakdown of organic matter through microbiotic activity leads to the humic material becoming rich in magnetic iron oxides when compared with the subsoil allowing features to be detected. In addition to this, variations in the magnetic susceptibility between the topsoil, subsoil and bedrock have a localised effect on the Earth's magnetic field enabling the detection of features such as backfilled ditches or pits due to the fact that the topsoil has more magnetic properties than the subsoil or bedrock, resulting in a 'positive' magnetic anomaly. Conversely, earthwork or embankment features can also be identified as 'negative' magnetic anomalies due to the action of placing less magnetic subsoil on top of more magnetic top soil.

Allowance will be made where possible to limit the potential effect of magnetic interference produced by metal fencing, modern field boundaries or ferrous features upon the data, to limit distortion of the overall geophysical results

5.3 Methodology

5.3.1 A survey grid comprising 30m x 30m individual grids will be set up over the selected survey area. The grids will be accurately positioned using a Leica Zeno 20 GNSS field controller connected to Leica Smartnet to receive corrections resulting in an accuracy of typically +0.1m or better.

5.3.2 These grids will then be surveyed using a Bartington Grad 601-2 gradiometer. The Grad 601-2 has two gradiometer sensors and therefore collects two lines of data during each traverse. Data are collected in a zigzag fashion within the grid if possible starting in the south-west corner, facing north. Readings are taken every 0.25m on traverses 1m apart. This equates to 3600 readings in a complete 30mx30m grid. Sensor balance will be checked and adjusted at regular intervals.

5.3.3 At the end of the day the data will be downloaded to a PC or laptop using Geoscan Geoplot V3.

5.4 Data Processing, Interpretation and Report

5.4.1 Data processing will be undertaken by a geophysicist using Geoscan *Geoplot* V3. Anomalies will be digitised and geo-referenced. They will be colour coded using ARS Ltd's standard scheme to provide the most likely interpretation. Anomalies will be numbered and catalogued as systematic groups or individual anomalies as appropriate.

5.4.2 The results of the gradiometer survey should be processed and the results then discussed between ARS Ltd, the Client and the DCC. The results of the gradiometer survey should be presented in at least two different formats at a minimum 1:1000 scale, one of which must be an X/Y trace plot. There must also be an accompanying interpretation drawing at an appropriate scale.

5.4.3 The final report will include a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and

conclusions about any likely archaeology. The report will describe the work undertaken and the results obtained. It will (as a minimum) include the following.

- ◆ A non-technical summary
- ◆ Introduction
- ◆ Geological and topographical setting
- ◆ Methodology
- ◆ Discussion of archaeological and historical background
- ◆ Discussion on the results of the survey
- ◆ Conclusions and recommendations
- ◆ Sources
- ◆ Copy of brief
- ◆ Figure showing location of the site
- ◆ Figure showing location of survey grids and referencing
- ◆ Figure showing processed data
- ◆ Figure showing trace plots of processed data
- ◆ Figure showing abstraction and interpretation of anomalies.

5.4.4 The digital data created during the geophysical survey will be deposited with the Archaeology Data Service (ADS) digital archive repository. This consists of the raw data deposited as xyz data, rendered images in TIF format as well as associated metadata. The archive will be prepared in line with *Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation* (Brown 2007), ClfA's (2020b) *Standard and Guidance for the creation, compilation, transfer and deposition of archaeological archives*, *Archaeology Data Service/Digital Antiquity Guides to Good Practice* (ADS/Digital Antiquity 2011) and *EAC Guidelines for the Use of Geophysics in Archaeology* (Schmidt et al 2016).

5.4.5 One digital copy of the final report in PDF/A format will be deposited with the Derbyshire Historic Environment Record (HER) and the PDNPA HBSMR. A copy of the report will be uploaded as part of the OASIS record (see below) for online access via the Archaeological Data Service.

5.4.6 At the start of work an OASIS online record <http://ads.ahds.ac.uk/project/oasis/> will be initiated and key fields completed. All parts of the OASIS online form will be completed for submission to the HER. This will include an uploaded .pdf version of the entire report for release into the ADS Library.

5.5 Staffing and Timetable

5.5.1 All staff employed on the project will be suitably qualified and experienced for their respective project roles and have practical experience of archaeological prospection. All staff will be made aware of the archaeological importance of the area surrounding the site and will be fully briefed on the work required by this

specification. Each member of staff will be fully conversant with the aims and methodologies and will be given a copy of this WSI to read. All members of staff employed by ARS Ltd are fully qualified and experienced archaeologists, this will ensure that appropriate decisions regarding survey will be made in the field.

5.5.2 The outline timetable for the works is as follows. This will be updated by email as the project progresses.

Proposed Commencement Date	Task
From March 22	1. Geophysical survey
Completion of Task 1	2. Geophysical survey report

5.5.3 The report will be completed within four weeks of undertaking the survey

5.5.4 The Project Manager for the geophysical survey will be Dr Roger Doonan, Project Manager at ARS Ltd. The Geophysical Surveyor will be Richard Durkin ACIfA.

5.5 Monitoring Arrangements

5.5.1 ARS Ltd acknowledges that it is the responsibility of the Archaeologist for DCC to monitor the archaeological works. Reasonable notice, ideally no less than 5 working days, shall be provided before the commencement of works and to arrange monitoring visits.

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Senior Conservation Archaeologist
Peak District National Park Authority
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5.5.2 ARS Ltd will liaise with the Archaeologist for DCC at regular intervals throughout the course of the work.

5.5.3 The client will afford reasonable access to the Archaeologist for DCC or his representative, for the purposes of monitoring the archaeological mitigation.

6 GENERAL ITEMS

6.1 Health and Safety

6.1.1 All work will be carried out in accordance with The Health and Safety at Work Act 1974. Specific health and safety policies exist for all our workplaces and all staff employed will be made aware of the policy and any relevant issues. The particular risks involved with this project will be assessed, recorded and relevant mitigation

measures put in place as part of a full risk assessment, which will be compiled in advance of fieldwork and will be read and signed by all on-site operatives. ARS Ltd retains Citation as its expert health and safety consultants and the appointed Health and Safety Officer for the company is Mark Potter.

6.2 Insurance Cover

6.2.1 ARS Ltd holds full Employer's Liability (£10 million), Public Liability (£10 million) and Professional Indemnity (£10 million) insurance, which also cover community groups and volunteers working under the supervision of ARS Ltd staff.

6.3 Community Engagement and Outreach

6.3.1 Any opportunities will be sought for engaging the local community in any archaeological investigations and findings, for example through participating in further excavations, a guided site tour and/or dissemination of information via ARS Ltd's and the client's websites and social media.

6.4 Changes to the Written Scheme of Investigation

6.4.1 Changes to the approved methodology or programme of works will only be made with prior written approval of the Archaeologist for DCC.

6.5 Publication and dissemination

6.5.1 In the event of significant remains being encountered, there may be the need for a more formal publication than in the summary form. The requirement for, and the final form of, any publication arising from the project will be agreed with the DCC County Archaeologist and the client dependent on the results of the fieldwork. Provision will be made for publicising the results of the work locally, e.g. via ARS Ltd's website, social media and local media (at the client's discretion) and talking to local societies.

6.6 Publicity and Copyright

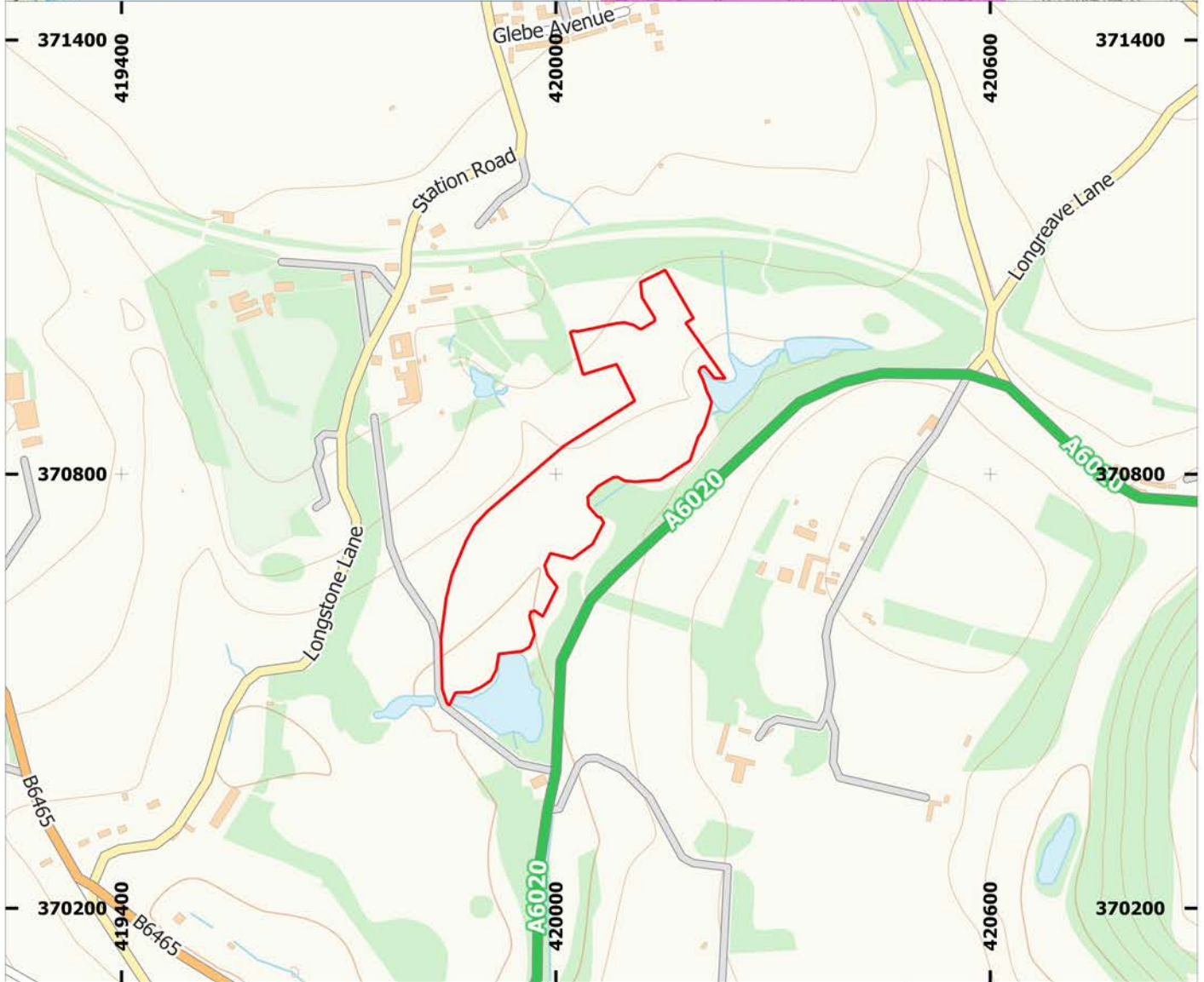
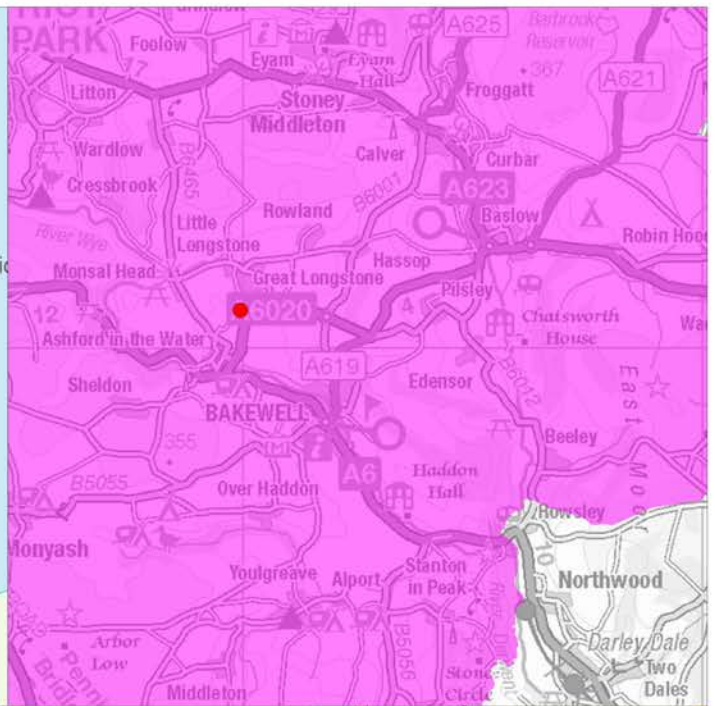
6.6.1 Any publicity will be handled by the client. ARS Ltd will retain the copyright of all documentary and photographic material under the Copyright, Designs and Patent Act (1988).

7 REFERENCES

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FIGURES





Site name: Thornbridge Hall
 Date: January 2022
 Drawn by: WR
 Scale: Varies

**Figure 1:
 Site location**

- Location of Surevy Area
- Peak District National Park Authority
- Survey Area

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 DE45 1HB



Tel: 01629 814540

www.archaeologicalresearchservices.com

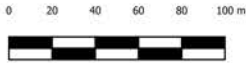
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Figure 2: Geophysical Survey Area

- Survey Area
- Thornbridge Hall Access Road and Car Park
- Thornbridge Hall Soil Bunds



Site name: Thornbridge Hall
 Date: January 2022
 Drawn by: WR
 Scale: 1:3,500 @ A4

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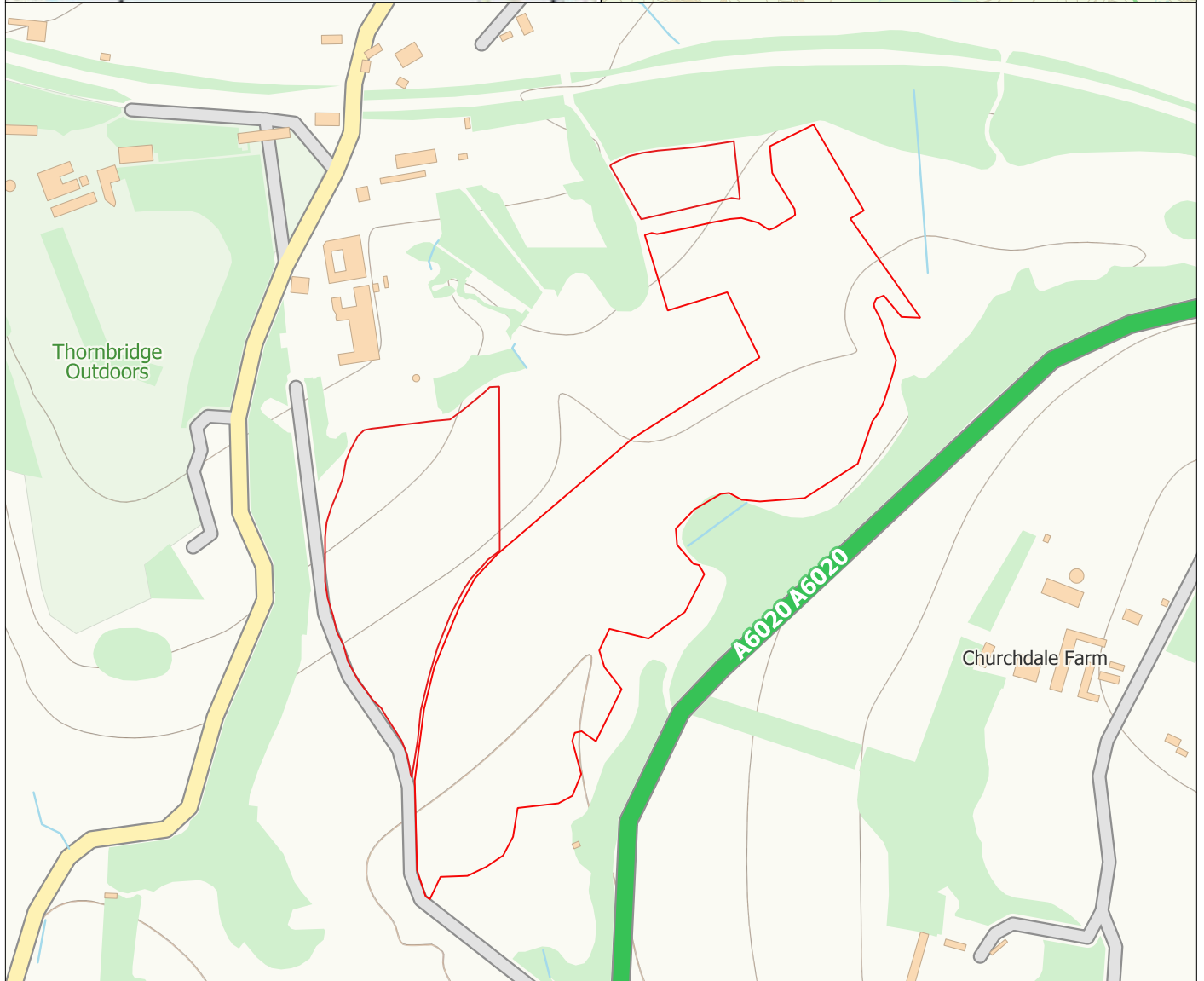
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Site name: Thornbridge Hall
 Date: June 2022
 Drawn by: KP
 Scale: Varies

Figure 3: Site location (Phases 1&2)



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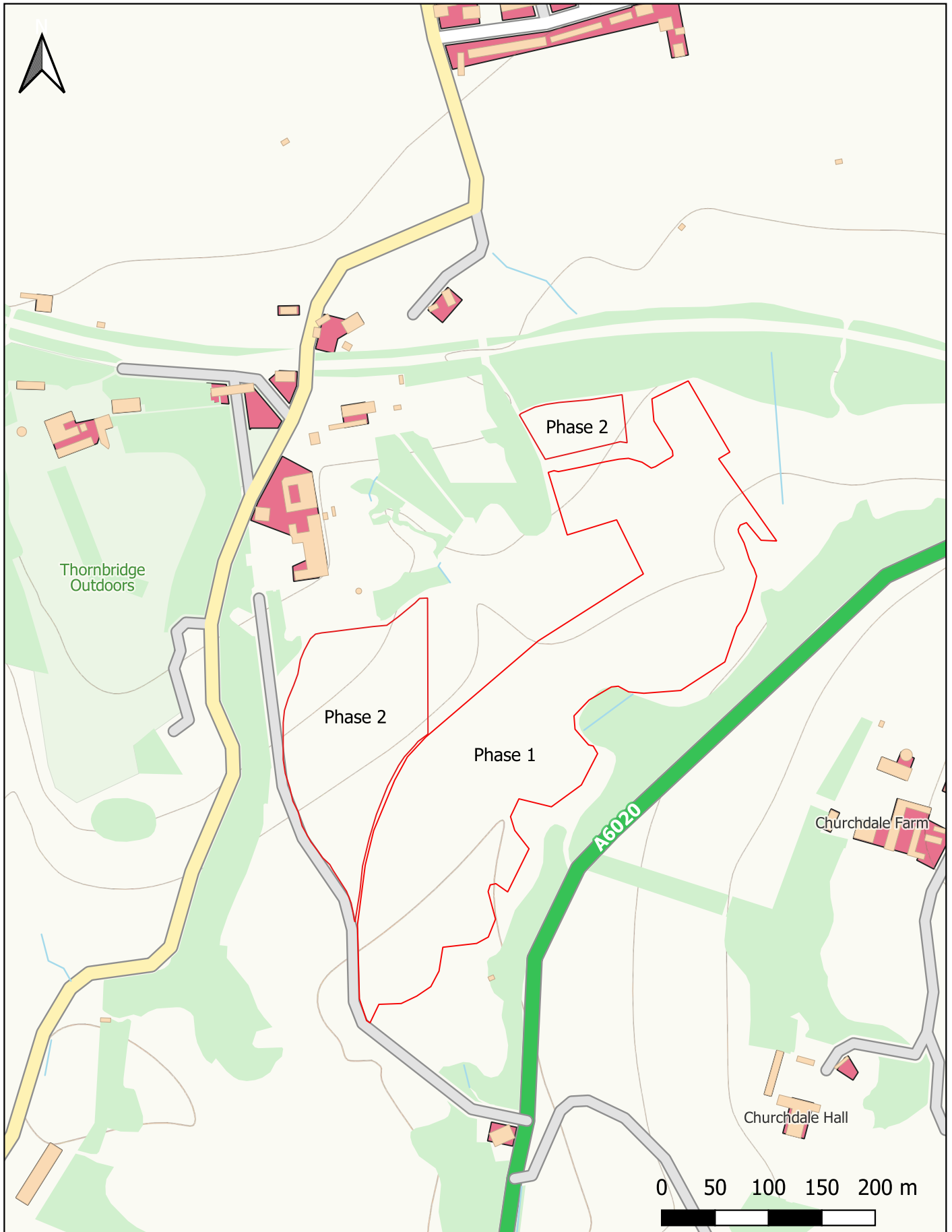
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Legend

- Survey Area
- Peak District National Park Authority
- Site Location



Site name: Thornbridge Hall
 Date: June 2022
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 Scale: As shown @ A4

Figure 4: Survey Area (Phases 1&2)

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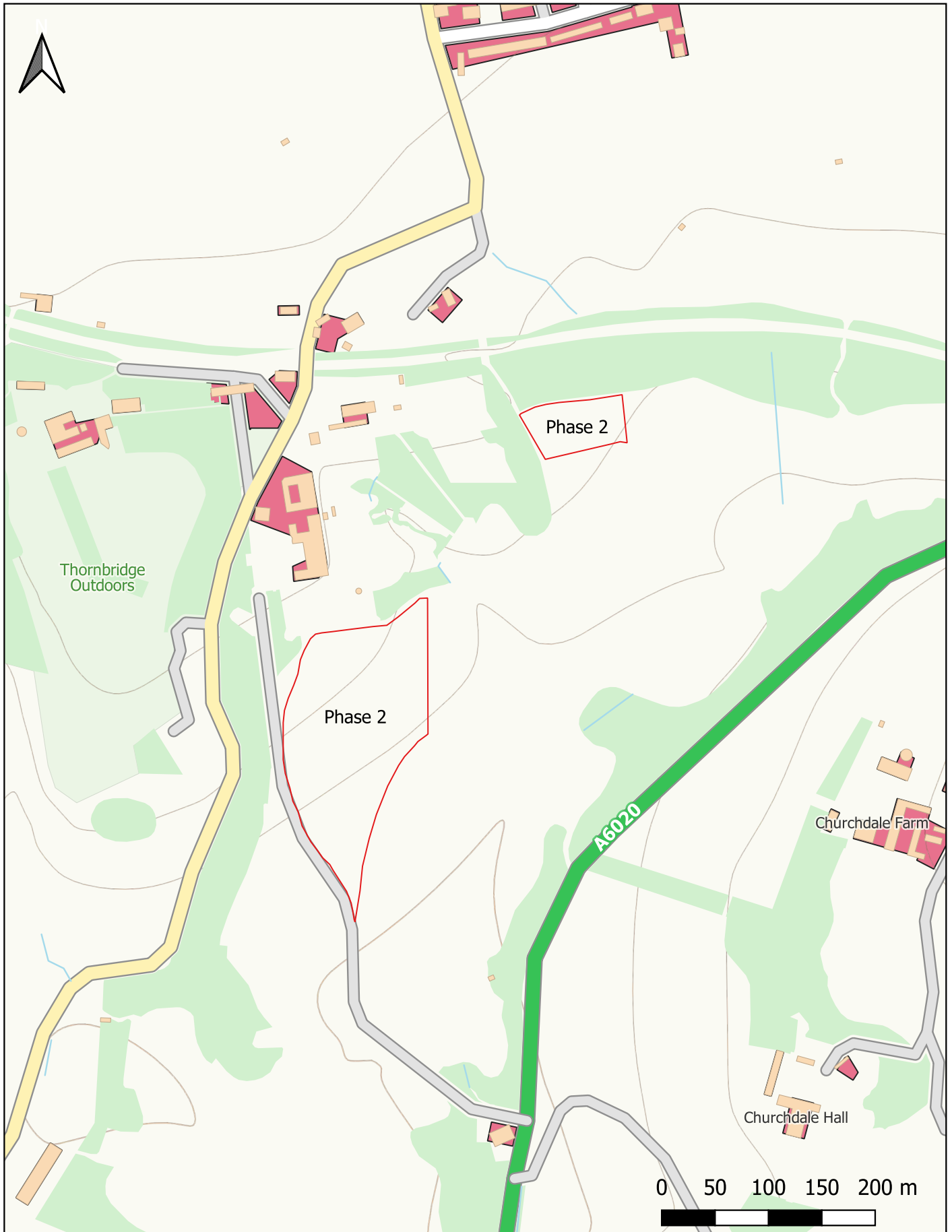
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Legend

Survey Area

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Figure 5: Survey Area of Phase 2

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Legend

Survey Area

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