ARCHAEOLOGICAL EVALUATION REPORT:

GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND AT LOWTHER CASTLE AND GARDENS, PENRITH, CUMBRIA

NGR: NY 52025 24155
AAL Site Code: PELC22
OASIS Reference Number: allenarc1-517407

Report prepared for Lowther Castle Limited

By
Allen Archaeology Limited
Report Number AAL2023092

July 2023

Allenarchaeology

Contents

List of Appendices

List of Plates

List of Figures

Document Control

Element:	Name:	Date:
Report prepared by:	Robert Evershed BSc (Hons)	11/07/2023
Illustrations prepared by:	Robert Evershed BSc (Hons)	07/07/2023
Report edited by:	Chris Clay BA MA (Hons)	11/07/2023
Report reviewed by:	Tobin Rayner BSc (Hons) MSc ACIfA	14/07/2023
Version no:	1.0	

Cover image: One of the students surveying, looking south

Executive Summary

- Lowther Castle Limited commissioned Allen Archaeology Limited to undertake a geophysical survey using magnetometry on land at Lowther Castle and Gardens to help train students from the University of Central Lancashire and to potentially reveal features for the current student excavations and for possible future excavations.

- Lowther Park has been subject to a number of archaeological and historic investigations, with the specific area relating to this survey being part of an earthwork survey undertaken in 1997. The earliest activity within Lowther Park dates to the prehistoric period, with a couple of cairns and standing stones. The Iron Age is represented by a hillfort at the very north of the park, with a Roman settlement located in the centre of the park.

- The geophysical survey is targeted over part of the location of the former Lowther medieval village, and a potential trackway running from the village to the Castlesteads ringwork structure to the west and just outside the survey area within woodland.

- The survey revealed a large number of potential archaeological features, directly related to the earthworks representing the former medieval village of Lowther. The survey also identified features likely corresponding to the former road/trackway between the village and the Castlesteads ringwork structure.

- A former trackway running across the entire site was also identified, potentially indicating the transformation of a former path seen on historic mapping into a proper metalled track potentially related to activity during the 2nd World War.

- A number of buried modern services were also revealed running across the site.

- The survey has already proved useful allowing a proposed trench to be moved away from a buried modern service and has allowed the targeting of a trench across the east-west trackway and an adjacent positive anomaly/feature.

1.0 Introduction

1.1 Lowther Castle Limited commissioned Allen Archaeology Limited (AAL) to undertake a geophysical survey using magnetometry on land at Lowther Castle and Gardens to help train students from the University of Central Lancashire and to potentially reveal features for the current student dig and for future excavations.

1.2 The site works and reporting conform to current national guidelines, as set out in '*EAC Guidelines for the Use of Geophysics in Archaeology*' (EAC 2016), '*The Use of Geophysical Techniques in Archaeological Evaluations*' (Gaffney *et al*. 2002), and the Chartered Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2020).

2.0 Site Location and Description

2.1 Lowther Castle and Gardens is located approximately 6.4km to the south of Penrith and 31.4km to the north of Kendal. The area of investigation lies immediately to the northeast of the outer castle walls and comprises 5.0 hectares of pasture, centred on NGR NY 52025 24155 (Figure 1).

2.2 The local geology comprises a bedrock geology of Tynebottom Limestone Member with superficial deposits of glacial till (http://mapapps.bgs.ac.uk/geologyofbritain/home.html). The response of magnetometers over limestone deposits is generally good while the response to the superficial deposits is variable, mostly moderate to good (English Heritage 2008).

3.0 Planning Background

3.1 This scheme of work is being undertaken to aid understanding of the wider archaeological landscape and potentially inform the current and future excavations for the University of Central Lancaster (UCLan), and therefore lies outside the planning system.

4.0 Archaeological and Historical Background

4.1 Lowther Park has been subject to a number of archaeological investigations including two survey reports (LUAU 1997 and Oxford Archaeology North 2007b), a conservation plan (Landscape Agency 2002), an evaluation (Oxford Archaeology North 2007a) and a watching brief (Oxford Archaeology North 2008). The following archaeological and historical background is a brief summary taken from these reports.

4.2 Prehistoric activity is limited to a round cairn to the south of Lowther Park and a pair of standing stones and associated round cairn to the north of the Park. The Castlesteads hillfort, at the very north of the park, dates from the Iron Age.

4.3 There are a number of Roman settlements in the area, with one in the Greatholme Plantation in the centre of Lowther Park, one to the north of the Castlesteads hillfort at Yanwath Wood, and two further settlements 3km to the west of Lowther.

4.4 Medieval activity is represented with the location of the former Lowther village located to the north of the current castle, with this is the associated Castlesteads ringwork structure immediately to the west. St Michael's church, to the north is likely also associated with the village and former castle site.

4.5 The construction of the first house at Lowther is likely of later medieval date, with the re-building of this taking place between 1677-1693. Between 1806 and 1814 the current castle was constructed. The castle was closed in 1936, then the castle and grounds were requisitioned by the military during World War 2 for nighttime tank training. The interior of the house was dismantled in 1956 and the shell retained as a landmark within the park.

5.0 Methodology

5.1 The geophysical survey consisted of a detailed gradiometer survey of as much of the area as was suitable totalling approximately 2.6 hectares. A further 2.0 hectares was then surveyed on a traverse alignment at 90° to the original survey. The surveys were undertaken in a series of 30m grids across the site.

Summary of Survey Parameters

5.2 Fluxgate Magnetometer

Instrument:	Bartington Grad601-2 Dual Fluxgate Gradiometer
Sample Interval:	0.25m
Traverse Interval:	1.00m
Traverse Separation:	1.00m
Traverse Method:	Zigzag
Resolution:	0.01nT
Processing Software:	3.0.36.0
Surface Conditions:	Slightly overgrown pasture
Area Surveyed:	2.61 and 2.03 hectares
Date Surveyed:	Monday 26th to Friday 30th June 2023
Surveyors:	Robert Evershed BSc (Hons) and the students: Danny Brown, Morgan Frith-Jones, Greta Halasz, Ed McLaughlin, Dom Scott, Jay Thompson and Jack Tobias
Data Interpretation:	Robert Evershed BSC (Hons)

Data Collection and Processing

5.3 The grids were marked out using pre-programmed grids on the Leica GS08 Netrover. Magnetic data was collected on a north-northwest to south-southeast alignment. A traverse pattern close to north-south is preferable as the fluxgate gradiometer is set up and balanced with respect to the cardinal points. Since the data is plotted as north-south traverses there is considerable merit sampling the north-south response of a magnetic anomaly with as many data points as is possible, this is accomplished as the density collected along the traverse line is greater than that between traverses (Aspinall *et al*. 2008). On this occasion the grids were aligned on a north-northwest to south-southeast orientation due to the orientation of the field.

5.4 The data collected from the survey has been analysed using Terrasurveyor 3.0.37.30. The resulting data set plots are presented with positive nT/m values and high resistance as black and negative nT/m values and low resistance as white.

The data sets have been subjected to processing using the following filters:

- De-striping

- Clipping
- De-staggering

5.5 The de-stripe process is used to equalise underlying differences between grids or traverses. Differences are most often caused by directional effects inherent to magnetic surveying instruments, instrument drift, instrument orientation (for example off-axis surveying or heading errors) and delays between surveying adjacent grids. The de-stripe process is used with care as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.

5.6 The Bartington Grad 601-2 is set to record data within the range between -100 and 100 nT/m. The clipping process is used to remove extreme data point values which can mask fine detail in the data set. Excluding these values allows the details to show through. The de-staggering process compensates for data correction errors caused by the operator commencing the recording of each traverse too soon or too late. It shifts each traverse either forward or backwards by a specified number of intervals.

5.7 The de-staggering process compensates for data correction errors caused by the operator commencing the recording of each traverse too soon or too late. It shifts each traverse either forward or backwards by a specified number of intervals.

5.8 Plots of the data are presented in processed linear greyscale (smoothed) with any corrections to the measured values or filtering processes noted, and as separate simplified graphical interpretations of the main anomalies detected.

5.9 The area suitable for surveying was initially surveyed by the students from the University of Central Lancaster (UCLan) after training by the author using traverses aligned north-northwest to south-southeast. Once the entire area had been surveyed, 2 hectares of the site was re-surveyed with traverses on the alignment east-northeast to west-southwest. The majority of the surveying for this second phase was by the author.

6.0 Results (Figures 2 – 6)

6.1 For the purposes of interpreting the anomalies, the survey data has been processed to the values of -3 to 3 nT/m. This enhances faint anomalies that may otherwise not be noted in the data, with a number of anomalies identified across the data set. These are discussed in turn and noted as single- or double-digit numbers in square brackets (Figure 4).

6.2 Unfortunately due to the rewilding of the entire estate it was not possible to survey the entire proposed area. However a fair amount of the field had been mowed, including the earthworks relating to the medieval village and the east-west trackway between the medieval castle and the village. Within the mowed area there were two small areas which could not be surveyed due to a couple of large trees and overgrown vegetation in the immediate vicinity, [1] and [2]. It was also possible to survey a small area within the avenue of trees which extends north-northeast from the castle.

6.3 There were a few dipolar linear features running through the survey area, [3], [4], [5] and [6]. These all produced magnetic readings of -100 to 100 nT/m and represent buried modern services.

6.4 The area of magnetic noise [7], with readings up to -100 to 100 nT/m, represents a combination of the buried modern service in that area as well as the marquee erected immediately to the northeast for the student dig.

6.5 There were a couple of small areas of magnetic noise [8] and [9], -100 to 100 nT/m and -10 to 50 nT/m respectively, likely representing buried modern material.

6.6 Running through the majority of the site from north-northwest to south-southeast and then curving slightly at the southern end to the southeast, [10], [11] and [12], was a pair of parallel positive linear features, 4 nT/m, measuring roughly 1.5 to 2m apart. Between the linear positive features the survey revealed either a single or a pair of negative linear features running parallel with the feature as a whole. The earthwork survey (Figure 7) appears to correspond with the geophysical survey in suggesting that this feature does not appear to respect the topography of the site, and cuts through some of the medieval earthworks. This feature is shown on the 2nd Edition OS map (Figure 8) as a footpath, and on historic Google Earth images as a simple track – although this feature is not visible within the site now. The geophysical readings are very suggestive of a more substantial feature than a simple footpath, potentially indicating some metalling of the feature, possibly related to use of the area during WW2 when the area was used for tank training.

6.7 There are a large number of linear and amorphous positive and negative features close to the northeastern edge of the main survey area [13], [14], [15] and [16]. These have produced readings of between -10 and 10 nT/m, and the shapes formed by some of the curvilinear features appear to correspond well to features visible on site and present within the results of the earthwork survey. These features almost certainly represent the landscaping for the medieval village, specifically the house platforms, with ditches and banks around the platforms. The amorphous positive features within the potential house platforms may represent features associated with the village, such as pits or possibly structural features relating to former buildings.

6.8 Within the northwestern part of the extra surveyed area (corresponding with the avenue of trees) there are a few amorphous positive and potential linear features [17], 4 to 10 nT/m. These potentially represent a continuation of features [16], possibly representing more features from the former medieval village.

6.9 The parallel positive linear features [18], 1 nT/m, aligned roughly north-northwest to south-southeast, likely represent ploughing, possibly very narrow ridge and furrow. This could indicate post-Medieval farming.

6.10 Aligned roughly east to west are a combination of potential positive linear features and positive amorphous features [19], 2 to 4 nT/m. These correspond with the location of the east-west aligned trackway/road running between the castle earthworks and the village.

6.11 There are two positive linear features running roughly east to west across the northern part of the site [20] and [21], 1 to 2 nT/m. These could represent boundary ditches or drainage features of uncertain date.

6.12 There is a roughly linear sub-rectangular positive feature [22], which runs roughly north to south within the northern part of the site, 3 to 6 nT/m. This feature corresponds with an earthwork bank clearly visible within the site, and previously recorded in the earthwork survey.

6.13 There are a few amorphous positive features [23], which do not correspond with any of the earthworks within the site, 4 to 8 nT/m. These could represent former pits, soil-filled hollows or former small ponds.

6.14 At the very southern end of the site there is a positive linear feature [24], aligned roughly east-northeast to west-southwest, 10 to 30 nT/m. This corresponds with the road running alongside the edge of the castle.

6.15 The negative linear feature [25], -2 nT/m, may represent a modern drainage feature.

6.16 The parallel negative linear features [26], -1 to -2 nT/m, may correspond with modern drainage features.

6.17 Towards the northern end of the site there are three large dipolar spikes [27], with readings up to -100 to 100 nT/m. These likely represent modern buried features, potentially related to one another.

6.18 Scattered randomly throughout the site are several weak and strong dipolar responses, examples of which are highlighted as [28]. The characteristic dipolar response of pairs of positive and negative 'spikes' suggest near-surface ferrous metal or other highly fired material in the topsoil, which could represent small pieces of metal such as nails, horseshoes or parts of a tractor.

7.0 Discussion and Conclusions

7.1 The geophysical survey has revealed a large number of potential archaeological features across the entire area. The majority of these features correspond with the earthworks relating to the former medieval village, with positive and negative features relating to earthwork banks and house platforms. Potentially some of the survey features may relate to former structures situated on the house platforms.

7.2 The survey also revealed positive linear and amorphous features likely relating to the road/trackway between the Castlesteads ringwork structure and the medieval village. While on site the preliminary results from the geophysical survey were used to place a trench across the road/trackway and an adjacent positive anomaly.

Plate 1: Excavation of Trench 3 over the road/trackway and positive anomaly, looking north

Plate 2: Potential remains relating to the road/trackway

7.3 The survey also identified buried modern services running across the site and was also used to relocate a trial trench which was initially placed close to one of the buried services.

7.4 A former path/trackway running across the site, seen on historical OS mapping and Google Earth images was also revealed very clearly in the results. This feature produced very clear and distinct readings, which may suggest this feature had been metalled in the past, possibly relating to use of the area for tank training during the 2nd World War.

8.0 Effectiveness of Methodology

8.1 The non-intrusive evaluation methodology employed was particularly appropriate to the scale and nature of the site to be surveyed and has identified the key areas of interest for further investigation with some confidence. Magnetometry was the prospection technique best suited to the identification of archaeological remains on the site. Other techniques would have required further justification and may have proved too time consuming or cost prohibitive. The technique was also suitable for training the students relatively quickly allowing them to survey the entire field.

9.0 Acknowledgements

9.1 Allen Archaeology Limited would like to thank Lowther Castle Limited for this commission, Dr Sophie Thérèse Ambler for organising the project and the students from UCLan for all their help in surveying the site.

10.0 References

Aspinall, A., Gaffney, C., and Schmidt, A., 2008, *Magnetometry for Archaeologists*, Plymouth: Altamira Press

CIfA, 2014, *Standard and guidance for archaeological geophysical survey,* Reading: Chartered Institute for Archaeologists

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage

Europae Archaeologiae Consilium (EAC), 2016, *EAC Guidelines for the use of geophysics in Archaeology, Questions to Ask and Points to Consider. EAC Guidelines 2.* European Archaeological Council

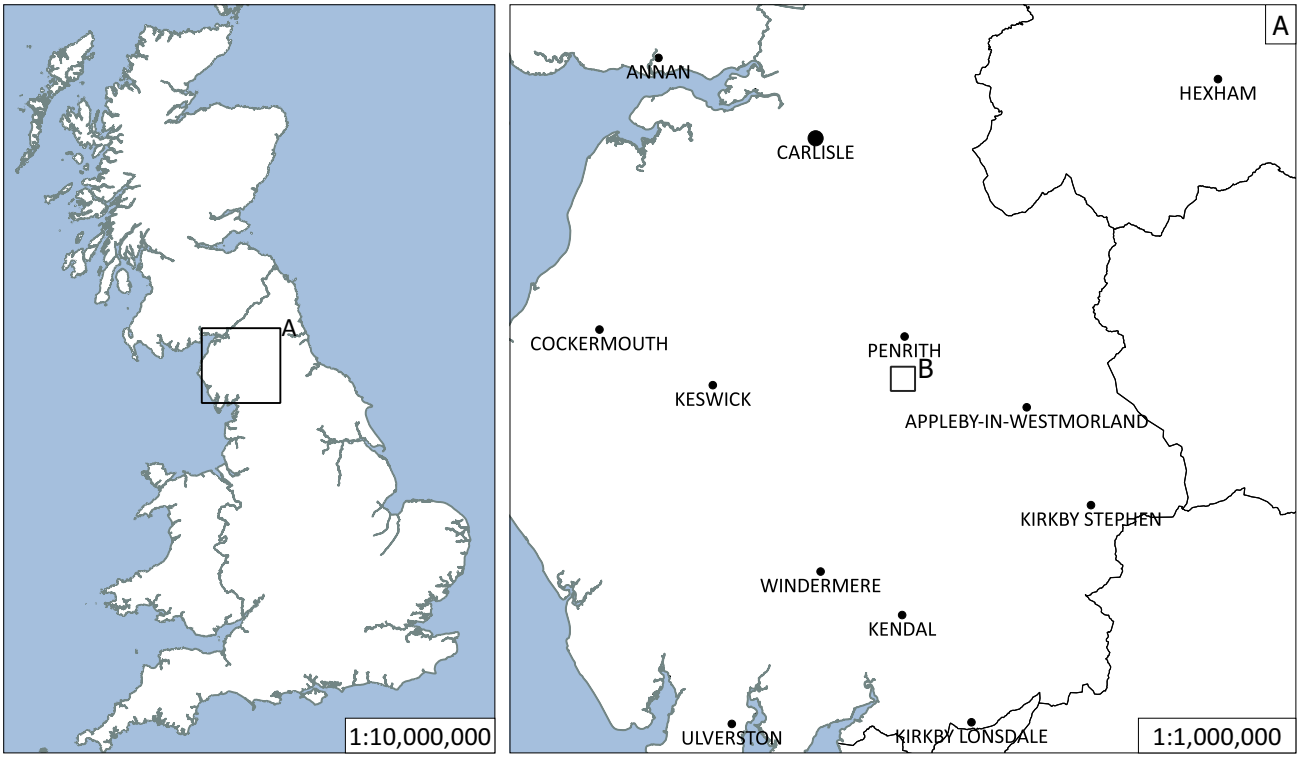
Gaffney, C., Gater, J., and Ovenden, S, 2002, *The Use of Geophysical Techniques in Archaeological Evaluations*, IFA Paper No. 6, Reading: The Institute for Archaeologists

LUAU, 1997, *Lowther Park, Cumbria. Archaeological Survey Report.* Lancaster University Archaeological Unit

Oxford Archaeology North, 2007a, *Lowther Castle, Cumbria. Archaeological Evaluation.* Oxford Archaeology North, Issue Number 2007-8/712, OA Job Number L9866

Oxford Archaeology North, 2007b, *Lowther* Castle Gardens, Cumbria, Archaeological Survey Report, Oxford Archaeology North, Issue Number 2007-8/682, OA Job Number L9842

Oxford Archaeology North, 2008, *Lowther Castle Chicken Sheds, Cumbria. Archaeological Watching Brief*, Oxford Archaeology North, Issue Number 2008-9/987, OAN Job Number L10059



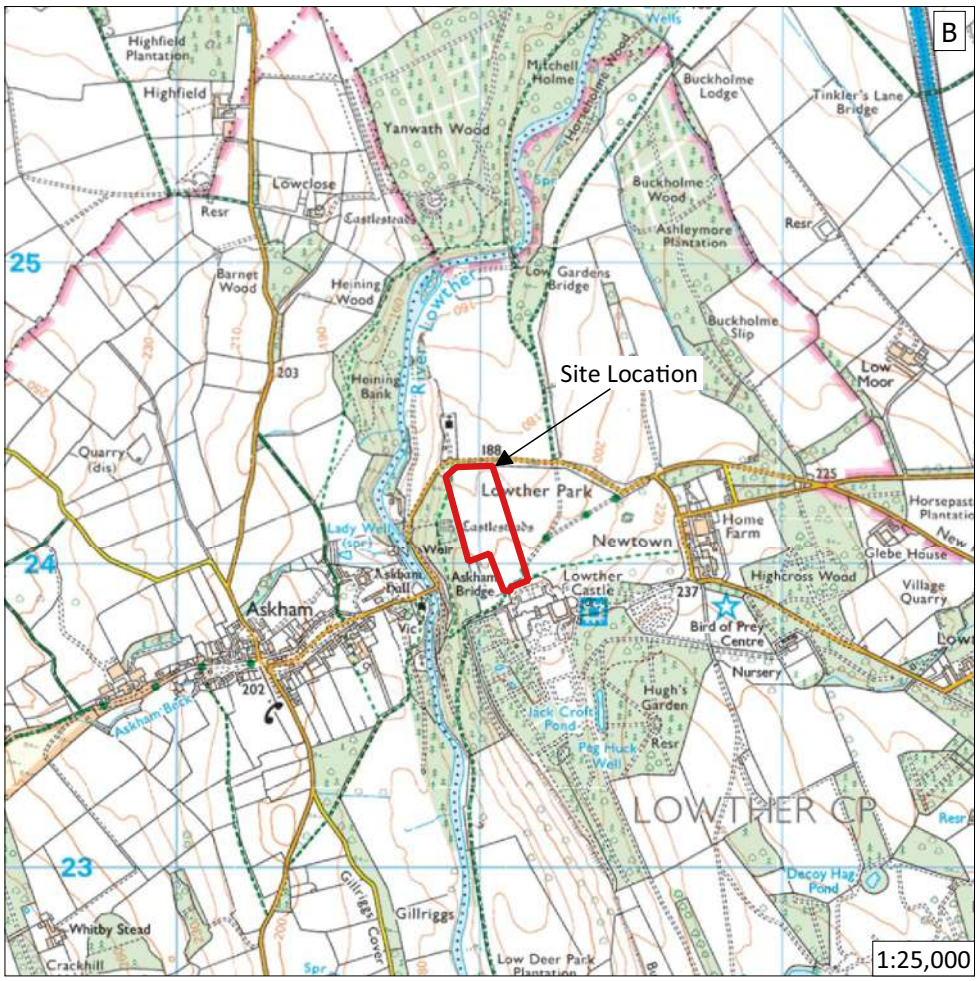
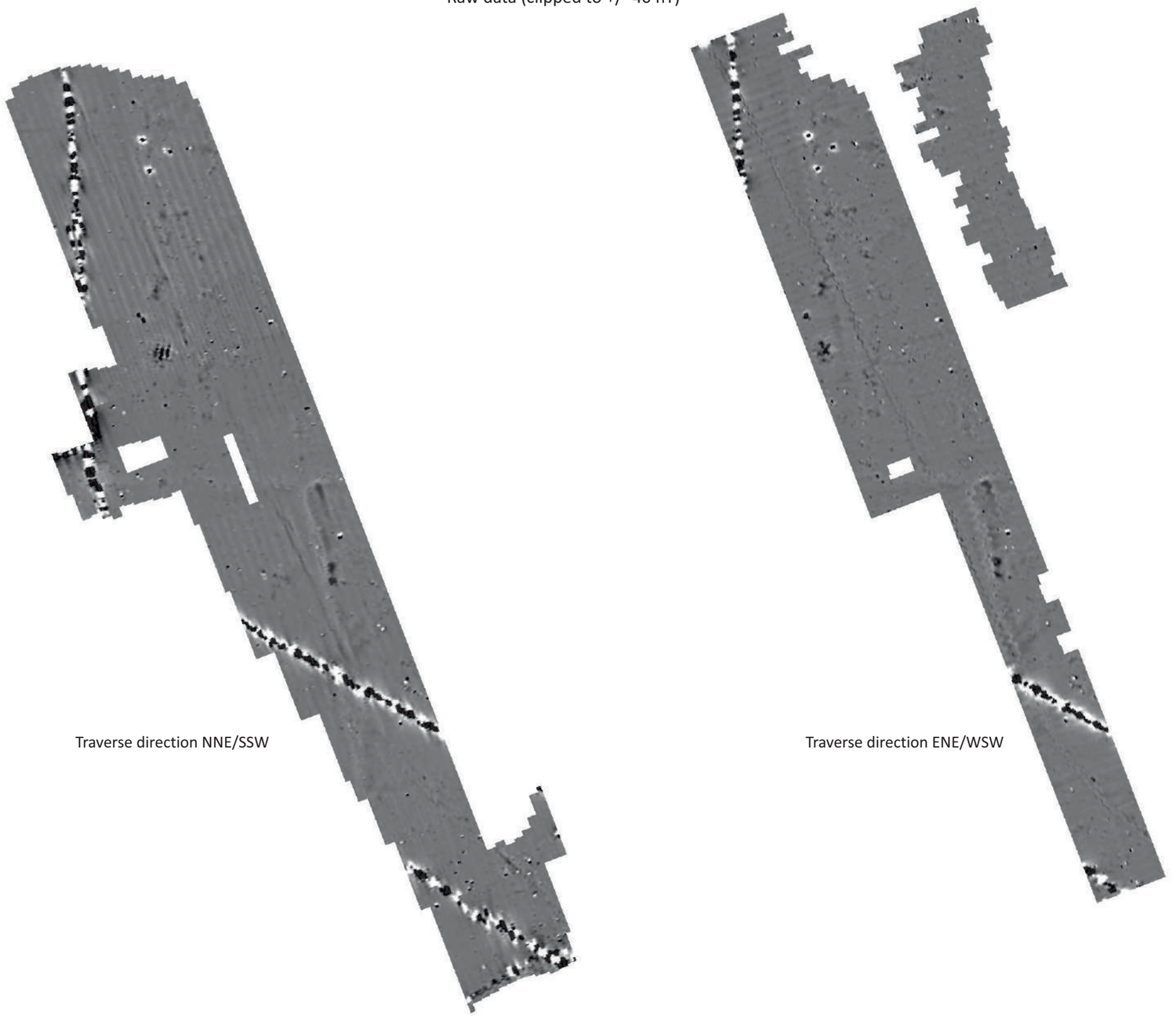


Figure 1: Site location outlined in red

Site Code	PELC 22
Scale	1:10,000,000 1:1,000,000 1:25,000 @ A4
Drawn by	R Evershed
Date	06/07/2023

Allenarchaeology
Lincoln
Birmingham
Cambridge
Preston
Southampton
www.allenarchaeology.co.uk

Raw data (clipped to +/- 40 nT)

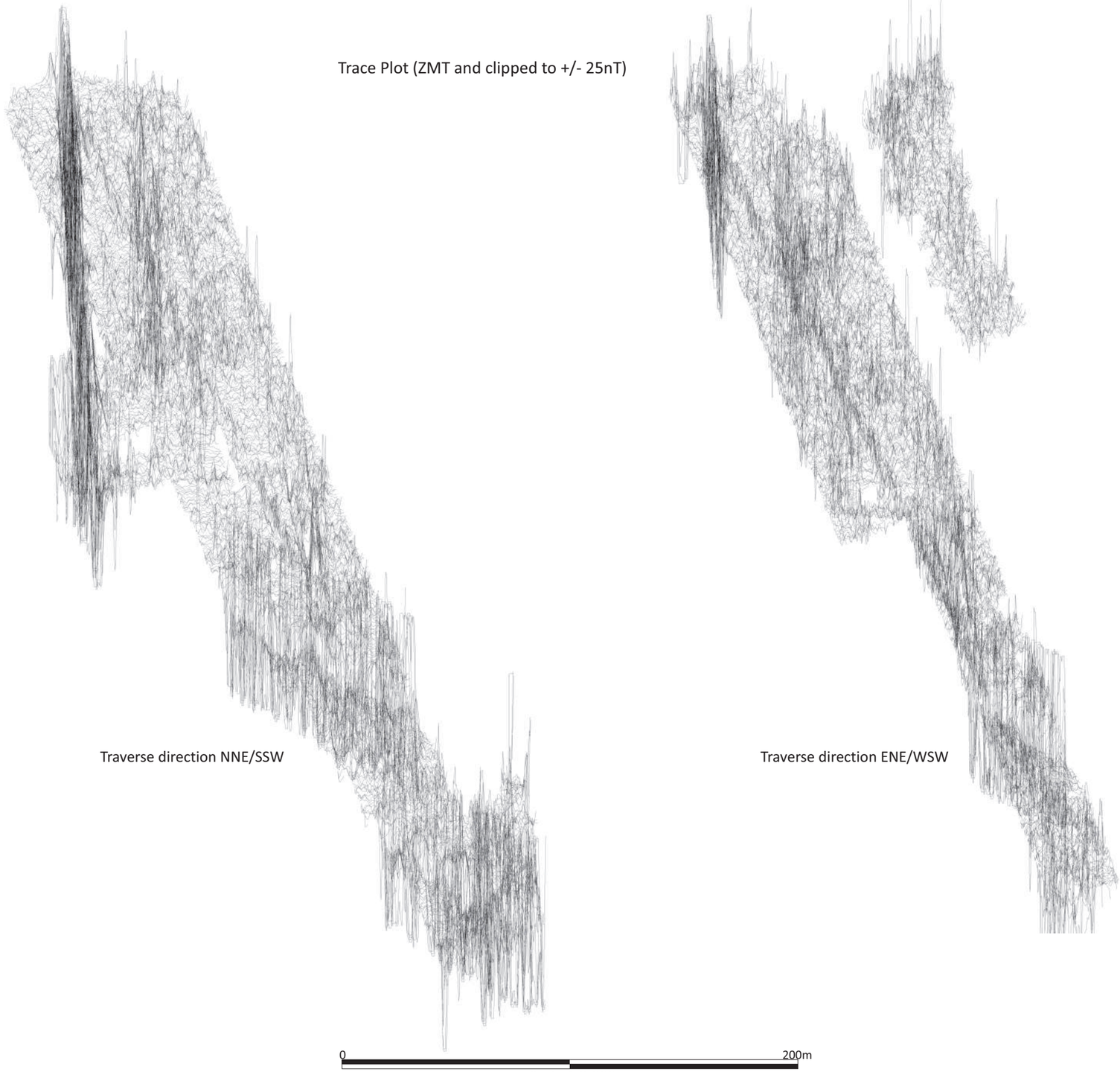


Site Code	PELC 22
Scale	1:2,000 @ A3
Drawn by	R Evershed
Date	05/07/23

Allenarchaeology
Lincoln
Birmingham
Cambridge
Southampton
www.allenarchaeology.co.uk

Figure 2: Greyscale raw data

Trace Plot (ZMT and clipped to +/- 25nT)



25nT

Traverse direction NNE/SSW

Traverse direction ENE/WSW

N

0 200m

Scale 1:2,000

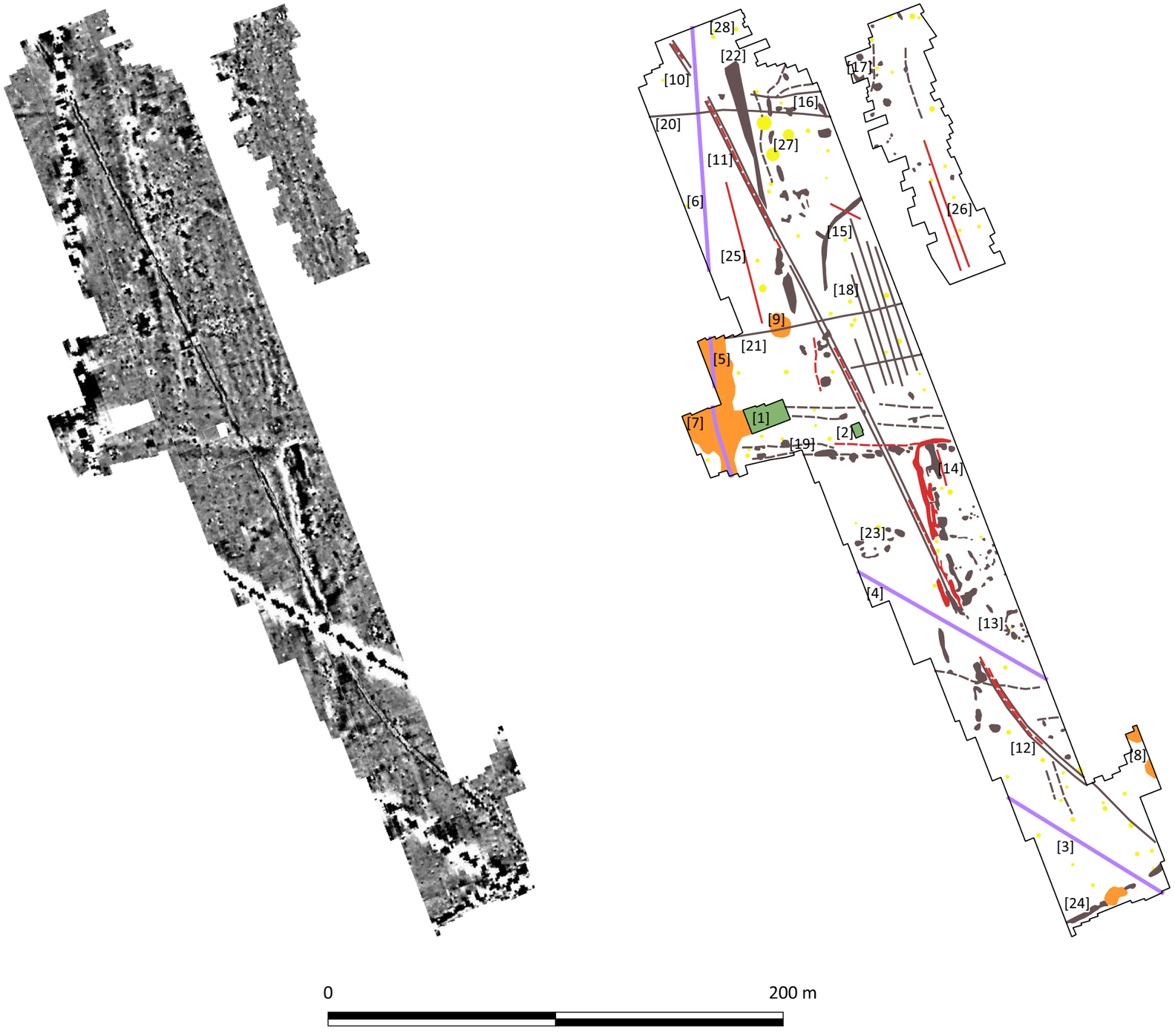
Site Code	PELC 22
Scale	1:2,000 @ A3
Drawn by	R Evershed
Date	05/07/23

Allenarchaeology

Lincoln
Birmingham
Cambridge
Southampton

www.allenarchaeology.co.uk

Figure 3**:** Processed trace plots



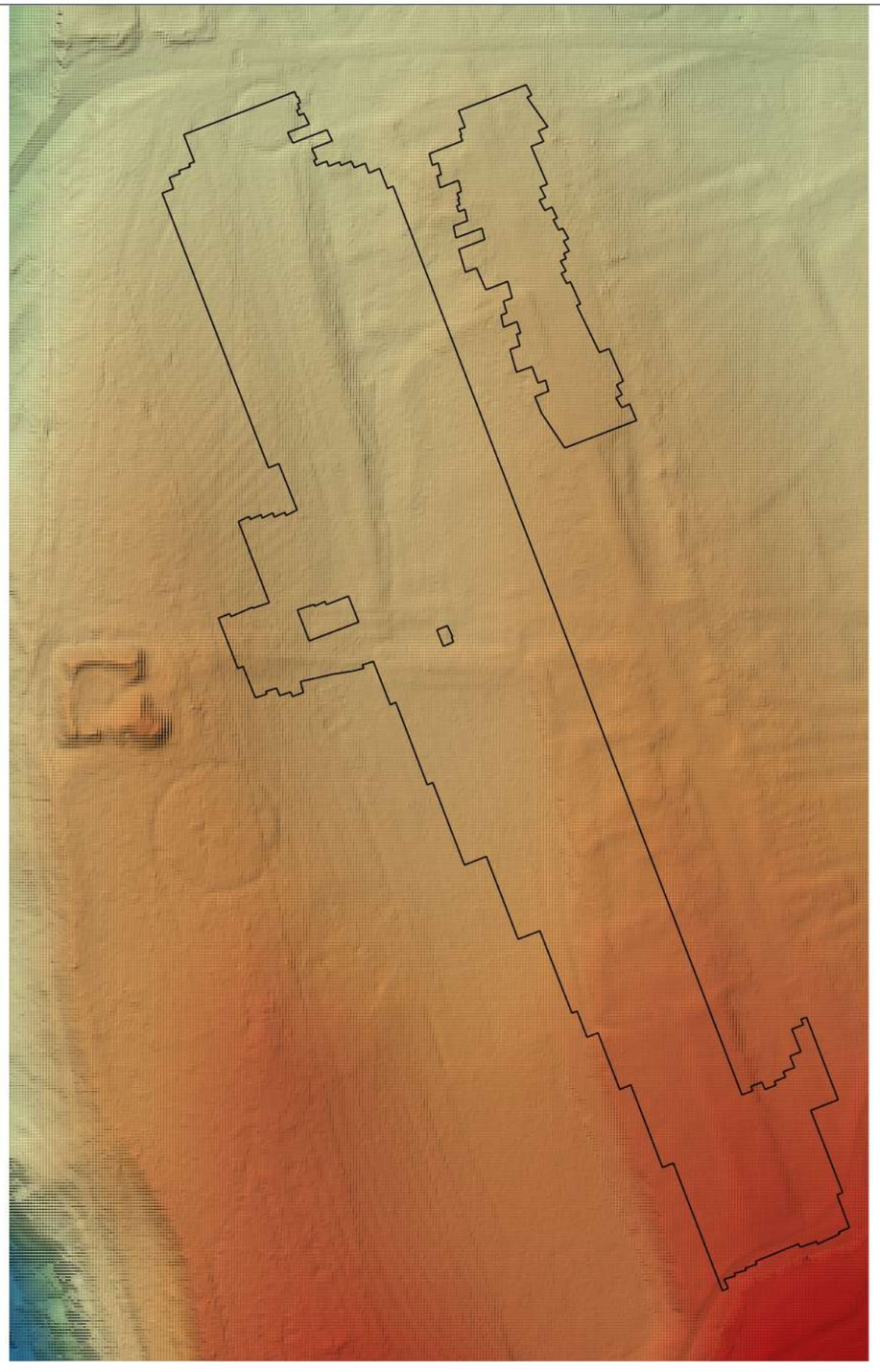
Site Code	ASAR 14
Scale	1:2,000 @A3
Drawn by	Robert Evershed
Date	06/07/2023

Allenarchaeology
Lincoln
Birmingham
Cambridge
Southampton
www.allenarchaeology.co.uk

Figure 4: Combined processed greyscale plots and interpretation

Figure 5: Processed greyscale location superimposed over the Earthwork Survey

Figure 6: Geophysical interpretation location superimposed over the Earthwork Survey



N

0 200 m

Key

Survey boundary

Height (m) OD

- 210.76
- 198.90
- 187.04
- 175.18
- 163.32

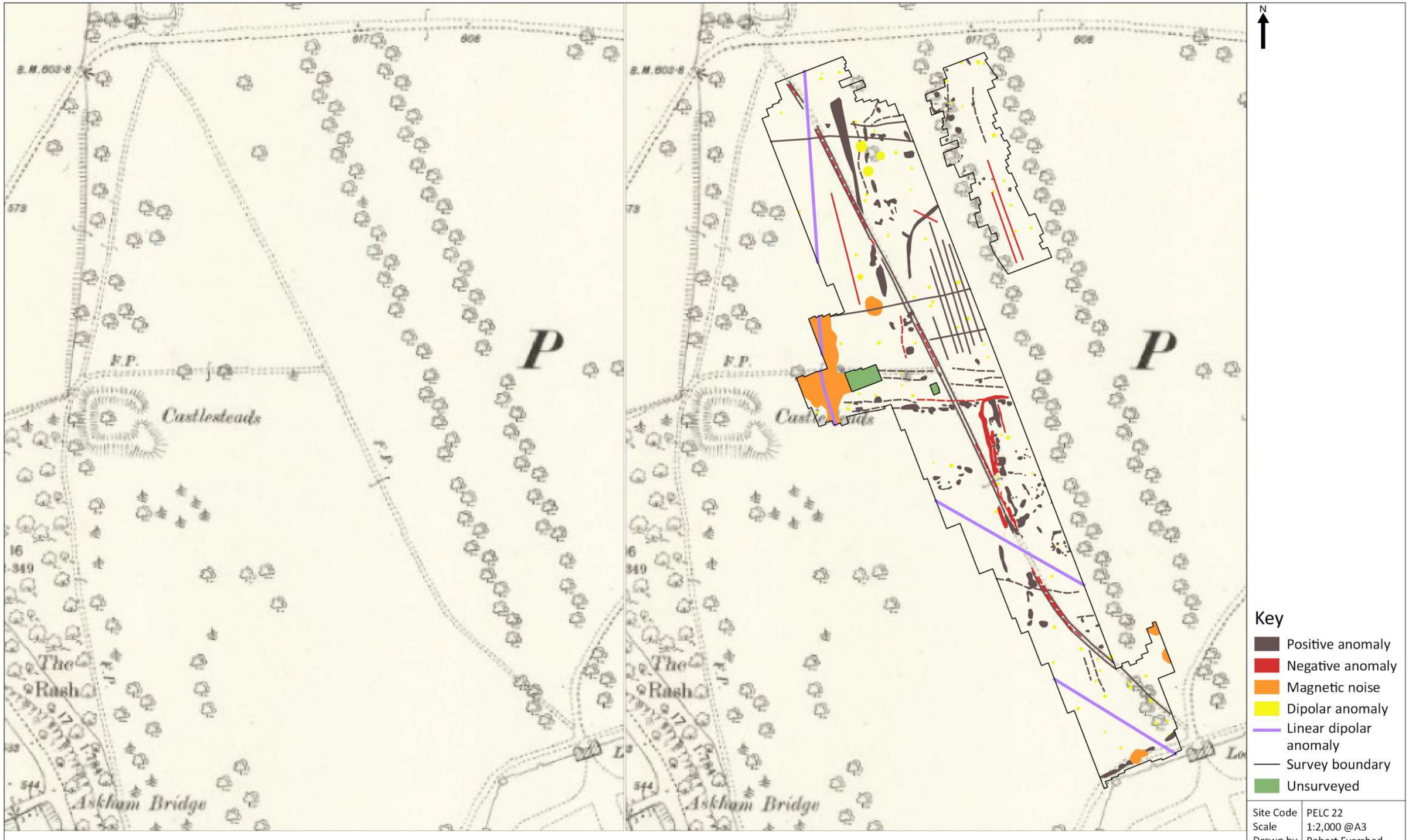
Site Code	PELC 22
Scale	1:2,000 @A3
Drawn by	Robert Eversheed
Date	06/07/2023

Allenarchaeology

Lincoln
Birmingham
Cambridge
Southampton

www.allenarchaeology.co.uk

Figure 7: Survey boundary superimposed over Lidar data and Earthwork Survey



Site Code	PELC 22
Scale	1:2,000 @A3
Drawn by	Robert Evershed
Date	07/07/2023

Allenarchaeology
Lincoln
Birmingham
Cambridge
Southampton
www.allenarchaeology.co.uk

Figure 8: 2nd Edition 1898 OS map with geophysical interpretation

Allen Archaeology Limited
www.allenarchaeology.co.uk

Company Registered in England and Wales No: 6935529

Lincoln
Whisby Lodge
Hillcroft Business Park
Whisby Road
Lincoln
Lincolnshire
LN6 3QL

T: +44 (0) 1522 685356
E: info@allenarchaeology.co.uk

Northeast
Office 17, Birtley Business Centre
85 Station Lane
Birtley
Chester-le-Street
County Durham
DH3 1QT

T: +44 (0) 7710 099045
E: northeast@allenarchaeology.co.uk

Northwest
Office 4
Barbury House,
8 Hardy Close,
Nelson Court Business Centre,
Preston,
PR2 2XP

T: +44 (0) 1772 963039
M: +44 (0) 7710 099052
E: northwest@allenarchaeology.co.uk

West
Arion Business Centre
Harriet House
118 High Street
Birmingham
B23 6BG
T: +44 (0) 800 610 2545
E: birmingham@allenarchaeology.co.uk

East
Wellington House
East Road
Cambridge
Cambridgeshire
CB1 1BH
T: +44 (0) 800 610 2550
E: cambridge@allenarchaeology.co.uk

South
International House
Southampton International Business Park
George Curl Way
Southampton
SO18 2RZ
T: +44 (0) 800 610 2555
E: southampton@allenarchaeology.co.uk