ARCHAEOLOGICAL EVALUATION REPORT:

GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND TO THE SOUTHEAST OF TATTERSHALL CASTLE, TATTERSHALL, LINCOLNSHIRE

NGR: TF 21098 57542
AAL Site Code: TACA 15
OASIS Reference Number: allenarc1-205443

Report prepared for the National Trust

By
Allen Archaeology Limited
Report Number AAL2015026

May 2015

Allenarchaeology

Contents

List of Appendices

List of Figures

Document Control

Element:	**Name:**	**Date:**
Report prepared by:	Robert Evershed BSc (Hons)	08/05/2015
Illustrations prepared by:	Robert Evershed BSc (Hons)	05/03/2015
Report edited by:	Mark Allen BSc (Hons) CMIfA	09/05/2015
Report reviewed by:	Chris Clay BA (Hons) MA	09/05/2015
Version no.	1.2	09/05/2015

Cover image: View of the site taken from the southeast corner looking west northwest towards the castle

Executive Summary

- Allen Archaeology Ltd (hereafter AAL) was commissioned by the National Trust to undertake a geophysical survey using magnetometry on the Tiltyard field at Tattershall Castle in Lincolnshire. The aim of the survey was to compare the results with a previous survey of the Tiltyard, identify any additional potential buried archaeological remains and also be used as a teaching exercise for four University of Nottingham students.

- The geophysical survey has identified a few features of archaeological interest including a long curvilinear positive anomaly approximately 50 to 60m in length that may be a former ditch, a few amorphous positive anomalies that may represent pits and a roughly circular curvilinear positive anomaly that could represent a broadly circular ditch feature. These were also identified in the 2009 survey. The 2009 survey suggested the linear features in the western half of the survey potentially related to a former course for the moat, whereas the 2015 survey suggested they represent ridge and furrow cultivation. This discrepancy in interpretation demonstrates the limitation of non-intrusive surveys, and to fully understand the anomalies revealed by the surveys a more intrusive investigation, such as trial trenches, will be necessary.

- It is possible that some potential archaeological features have been masked by magnetic noise across the site and specifically along the northern edge. The general level of magnetic noise may be the result of dumping of material when the castle's moat was cleared out. The magnetic noise along the northern edge of the site is due to a service pipe connecting the moat with the nearby river.

1.0 Introduction

1.1 Allen Archaeology Ltd (hereafter AAL) was commissioned by the National Trust to undertake a geophysical survey using magnetometry on the Tiltyard field at Tattershall Castle in Lincolnshire. The aim of the survey was to compare the results with a previous survey of the Tiltyard, identify any additional potential buried archaeological remains and also facilitate a teaching exercise for four University of Nottingham students.

1.2 The site works and reporting conform to current national guidelines, as set out in '*Geophysical Survey in Archaeological Field Evaluation*' (English Heritage 2008), '*The Use of Geophysical Techniques in Archaeological Evaluations*' (IFA Paper 6) and the Chartered Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2014).

2.0 Site Location and Description

2.1 The village of Tattershall is 12.3km south-southwest of Horncastle and 18.2km northwest of the centre of Boston within the county of Lincolnshire. The castle is located at the southwest end of the settlement, adjacent to the A153 Sleaford Road. Tattershall Castle is centred on NGR TF 21098 57542, and occupies low lying land to the west of the River Bain, at approximately 6m above Ordnance Datum. The area surveyed comprised the Tiltyard, a field immediately to the east southeast of the castle and moat (Figures 1 and 2).

2.2 The local solid geology is the Ampthill Clay Formation (British Geological Survey 1995). The drift geology varies across the site; to the east of the Tiltyard are deposits of alluvium and to the west are Lower River Terrace Deposits.

3.0 Planning Background

3.1 The geophysical survey was commissioned to provide information regarding the archaeological resource within the castle grounds to help inform future conservation management at the site, and lies outside the planning process.

3.2 The work was carried out under a Section 42 Licence, required for geophysical survey on Scheduled Ancient Monuments, issued by English Heritage.

4.0 Archaeological and Historical Background

4.1 There is some evidence for prehistoric activity in the landscape surrounding the castle grounds. This includes isolated artefacts such as a Neolithic polished stone axe head found in 1957 c.400m to the southeast on the river bank (Lincolnshire Historic Environment Record (hereafter LHER) Reference: 40176) and a further Neolithic stone axe from gravel pits approximately 400m to the southwest (LHER Reference: 40158).

4.2 More substantial evidence for prehistoric activity was identified during the Witham Valley National Mapping Programme by English Heritage in 2005 (LHER Reference: 46443). The survey highlighted a ring ditch, probably representing a round barrow of later Neolithic or Bronze Age date, c.450m to the northwest of the site.

4.3 Tattershall is first mentioned in the Domesday Survey of 1086 as being under the ownership of Eudo, son of Spirewic (Morgan and Thorn 1986). At the time of the survey the settlement was known as Tatesala, from the Old English meaning '*Tāthere's nook of land*' (Cameron 1998).

4.4 A detailed history of the castle was prepared in 2009 (Oxford Archaeology 2009), so is not repeated here.

4.5 The Tiltyard, and other elements of the Tattershall Castle holdings were subject to a geophysical survey in 2009 (AAL 2009). This identified a number of anomalies, including the edge of the Outer Moat which was backfilled c.1594 (Oxford Archaeology 2009) and several circular anomalies of potential interest.

5.0 Methodology

5.1 The geophysical survey consisted of a detailed gradiometer survey of as much of the designated areas as was possible, totalling approximately 0.7 hectares. It was not possible to survey areas that were too overgrown. The survey was undertaken in a series of 20m grids.

5.2 The fieldwork was carried out by a team of two experienced geophysicists from AAL, assisted by four students from the University of Nottingham, over a period of one working day, Friday 13th February 2015. The survey area was accurately located using a Leica GS08 Netrover receiving RTK corrections. This accurately 3D plotted the area of investigation and tied it into the National Grid.

5.3 The survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an on-board automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the on-board data logger.

5.4 Data collection was undertaken in a zigzag traverse pattern, using a sample interval of 0.25m and a traverse interval of 1m.

Summary of Survey Parameters

5.5 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:	0.01 nT
Processing Software:	Terrasurveyor 3.0.25
Surface Conditions:	Slightly overgrown pasture
Area Surveyed:	0.7 hectares
Date Surveyed:	Friday 13th February 2015
Surveyor:	Robert Evershed BSc (Hons)

Survey Assistants: Rupert Birtwhistle MA BA (Hons)
Data Interpretation: Robert Evershed BSc (Hons)

Data Collection and Processing

5.6 The grids were marked out with tape measures and recorded using the Leica GS08 Netrover. The collection of magnetic data using a north – south traverse pattern 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 2008). On this occasion magnetic data was collected close to a north – south alignment.

5.7 The data collected from the survey has been analysed using the current version of Terrasurveyor 3.0.25. 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

5.8 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 however as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.

5.9 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.

5.10 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 forward or backwards by a specified number of intervals.

5.11 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.

6.0 Results

6.1 For the purposes of interpreting the anomalies, the survey data has been processed to the values of -3 to 3 nT/m (Figure 4). This enhances faint anomalies that may otherwise not be noted in the data. The survey results mirrored the previous survey results from 2009, with a number of anomalies identified across the data set, and these are discussed in turn and noted as single or double digit numbers in square brackets.

6.2 Immediately noticeable is the area of magnetic noise [1], producing readings between -100 and 20 nT/m, running along the northern boundary of the site. This represents a metal fence along this boundary and potentially a modern service pipe (as suggested by a member of the National Trust working at the castle) used to pump water into the castle moat from the river close by. The pump house is located just outside the northeastern edge of the site and may also contribute to some of the magnetic noise.

6.3 The linear dipolar feature [2], -10 to 10 nT/m, running roughly north to south across the centre of the site is consistent with readings for a modern service.

6.4 The positive anomaly along the northwest edge of the site [3], 10 to 30 nT/m, represents the stone lining of the exterior wall of the castle's moat. This is likely to continue further to the east but is masked by the magnetic noise [1].

6.5 In the western third of the site, running roughly east-northeast to west-southwest are a series of parallel positive and negative linear features [4], the negative features produced readings of -4 nT/m, whilst the positive produced readings of 2 nT/m. Morphologically these resemble the remains of medieval ridge and furrow cultivation; however the 2009 results also showed these lines and it was suggested that they may relate to the former course of the moat.

6.6 In the eastern half of the site there is a possible curvilinear anomaly roughly running east to west that appears to join with a roughly circular positive anomaly [5]. There are a number of amorphous positive anomalies that appear associated with these features. The amorphous anomalies likely represent pits or soil-filled hollows and the curvilinear anomalies potentially relate to ditches, boundaries or tracks/paths. The curvilinear positive anomaly produced readings of approximately 4 nT/m, whilst the amorphous anomalies produced readings of 4 to 10 nT/m.

6.7 There are a number of amorphous positive anomalies [6], 4 to 6 nT/m, that likely represent pits or soil-filled hollows.

6.8 The potential positive curvilinear anomaly [7], 2 to 3 nT/m, possibly represents a ditch, former boundary, path or track.

6.9 The amorphous positive anomaly [8], 2 to 3 nT/m, may represent a pit or soil-filled hollow.

6.10 The curvilinear/amorphous positive anomaly [9], 4nT/m, may represent a ditch/boundary or a pit/soil-filled hollow, although as the anomaly is located at the edge of the survey any interpretation remains tentative.

6.11 Scattered randomly throughout the site are a number of strong and weak dipolar responses, examples of which are highlighted as [10]. The characteristic dipolar response of pairs of positive and negative 'spikes' suggest near surface ferrous metal or other highly fired material in the ploughsoil.

7.0 Discussion and Conclusions

7.1 The survey revealed some features of archaeological interest within the field known as the Tiltyard. The area was particularly noisy, especially along the northern edge of the site where a buried pipe connecting the castle's moat and the nearby river is located. There is a small pump house located just outside the site to the northeast, which allows the moat to be filled from the river. It is highly likely that when the moat was cleared during the castle's restoration by Lord

Curzon material/detritus from the moat was dumped on the Tiltyard due to its proximity. This would explain the general magnetic noise across the entire site.

7.2 In the western third of the field linear positive and negative features were noted. These are highly characteristic of medieval ridge and furrow cultivation trends, although the location of these is surprising, so another interpretation cannot be discounted. There are a number of amorphous positive anomalies across the site, particularly close to the eastern end of the stone-lined moat wall. These may represent pits or soil-filled undulations such as those formed by animal disturbance.

7.3 In the eastern half of the site there was a long curvilinear positive anomaly approximately 50 to 60m in length that may be evidence of a ditch or former boundary. Along this line there are a few amorphous positive anomalies that may represent pits. At the western end of the curvilinear it appears to join up with a roughly circular curvilinear positive anomaly. This could represent a roughly circular ditched feature. There are a number of amorphous positive anomalies close to this feature that may represent pits relating to it.

7.4 The 2015 survey compares well to the 2009 version, with the 2015 survey potentially revealing more information about the eastern half of the site. The differences between the two surveys may be down to changes in the surface vegetation and any natural/man-made changes on the site in the intervening 6 years. The 2015 survey suggested that the positive and negative linears in the western half of the site relate to ridge and furrow cultivation whereas the 2009 survey suggested they could represent a former course for the moat. The discrepancy in interpretation demonstrates the limitation of non-intrusive surveys, and to fully understand the anomalies revealed by the surveys a more intrusive investigation, such as trial trenches, will be necessary.

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. 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.

9.0 Acknowledgements

9.1 Allen Archaeology Limited would like to thank The National Trust for this commission, and the help of the students from Nottingham University.

10.0 References

AAL, 2009, *Archaeological Evaluation Report: Geophysical Surveys at Tattershall Castle, Lincolnshire*. Allen Archaeology Ltd Report No 2009059

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

British Geological Survey, 1995, Horncastle. England and Wales Sheet 115. Solid and Drift Geology. 1:50,000 Series. Keyworth, Nottingham

CIfA, 2014, S*tandard and guidance for archaeological geophysical survey*, Chartered Institute for Archaeologists, Reading

Department for Communities and Local Government, 2012, *National Planning Policy Framework*. London, Department for Communities and Local Government

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

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

Oxford Archaeology, 2009, *Tattershall Castle: Conservation Management Plan 2009*. Unpublished client report

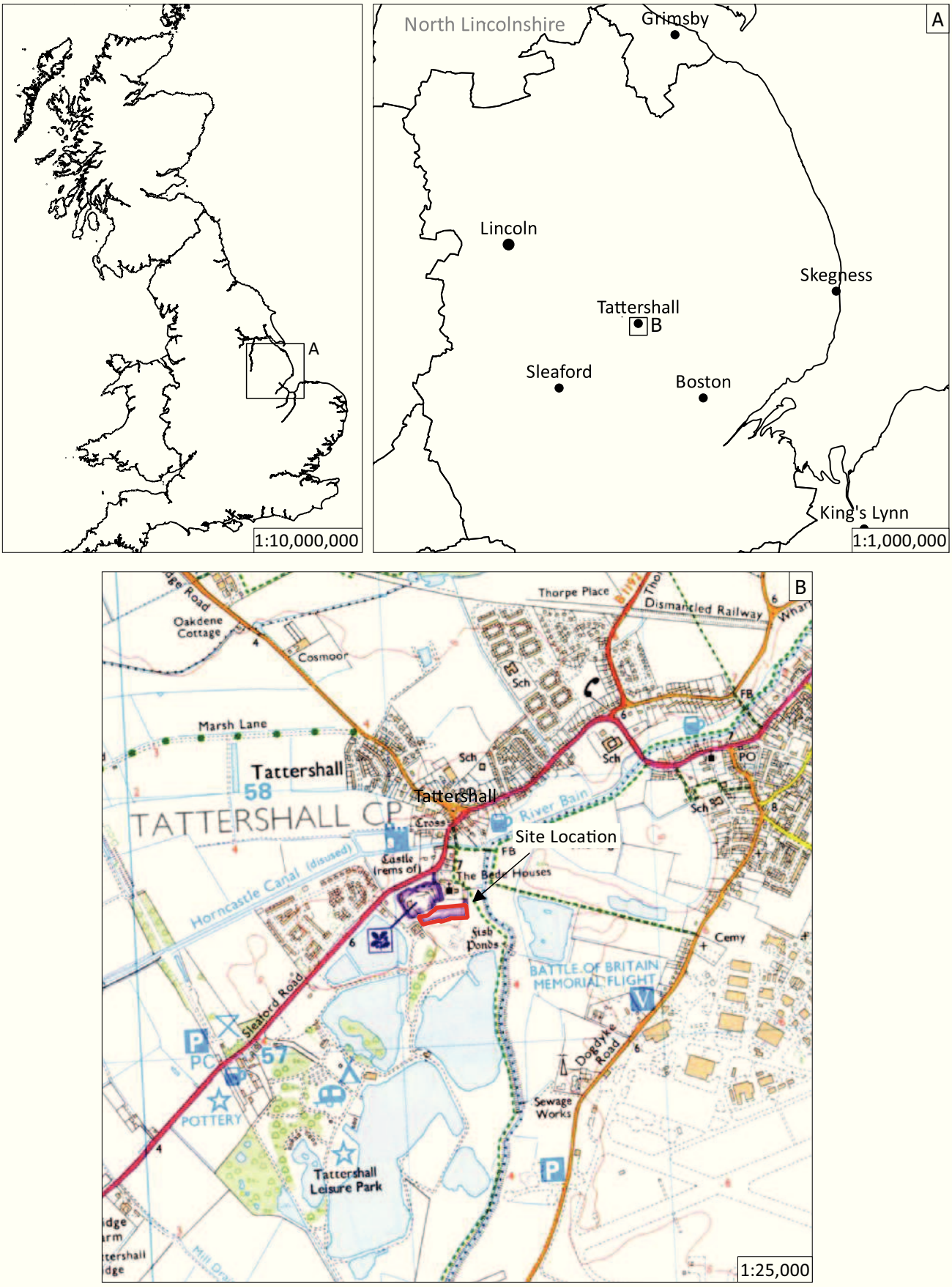


Figure 1: Site location outlined in red

Site Code	TACA 15
Scale	1:25,000 @ A4
Drawn by	IP
Date	08/05/15

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

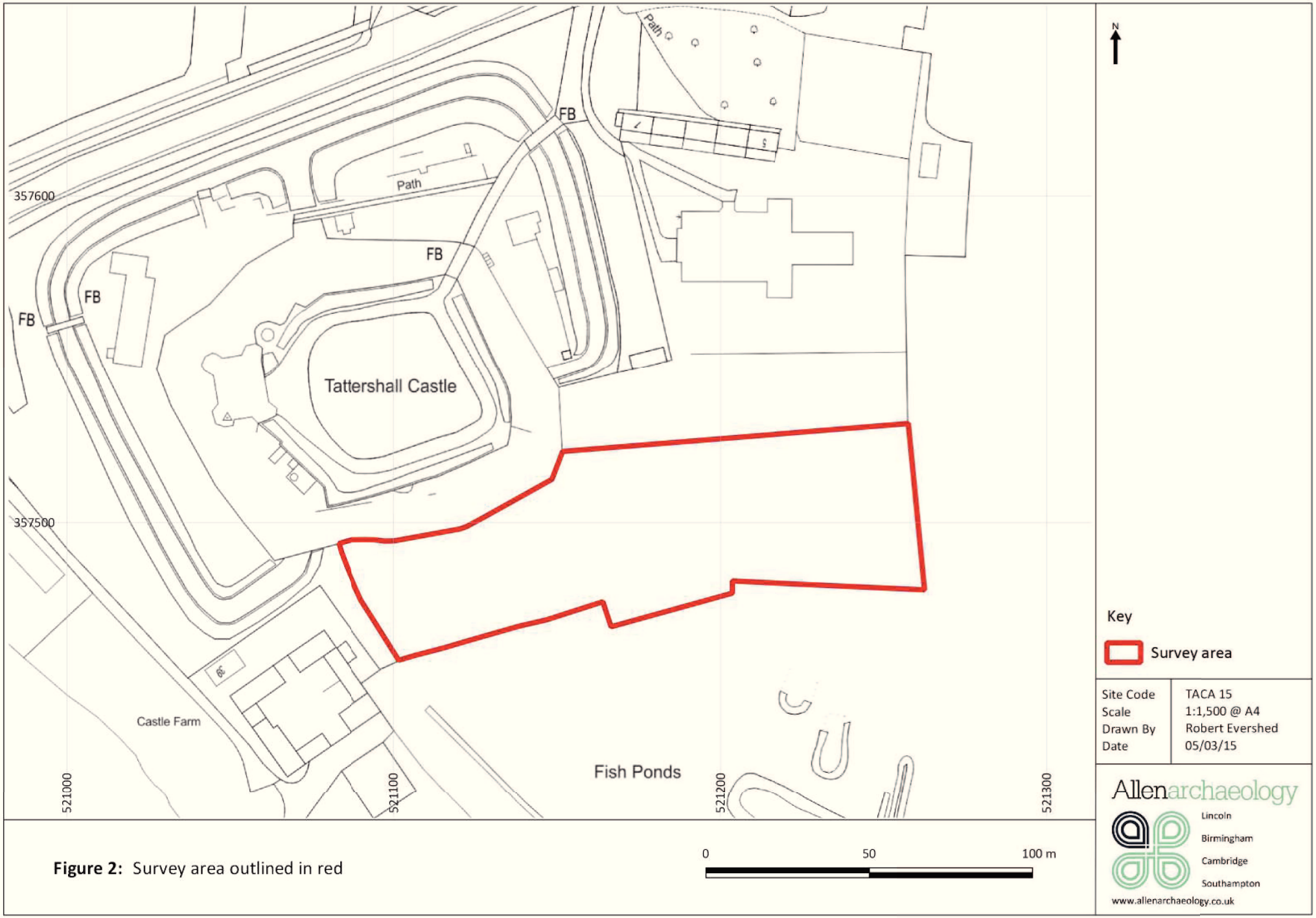
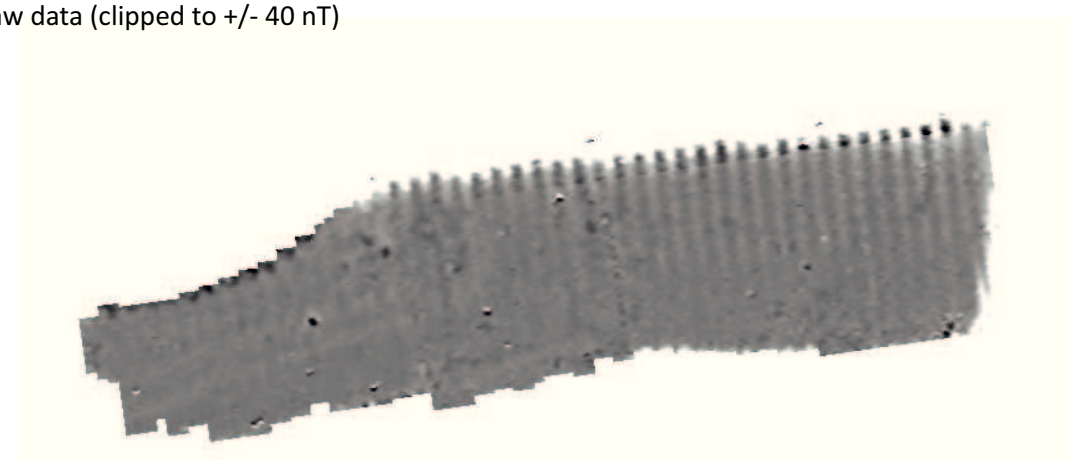


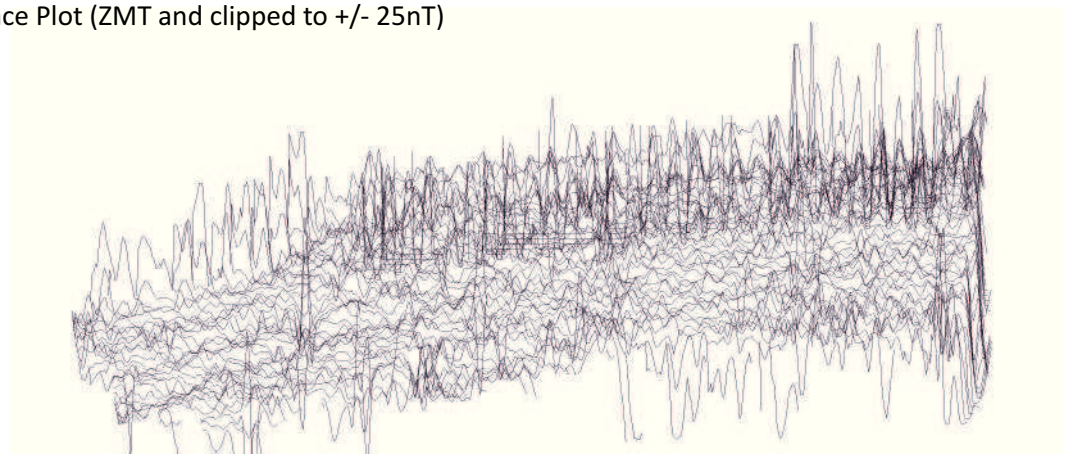
Figure 2: Survey area outlined in red

N

Raw data (clipped to +/- 40 nT)



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



0 300m

Scale 1:3,000

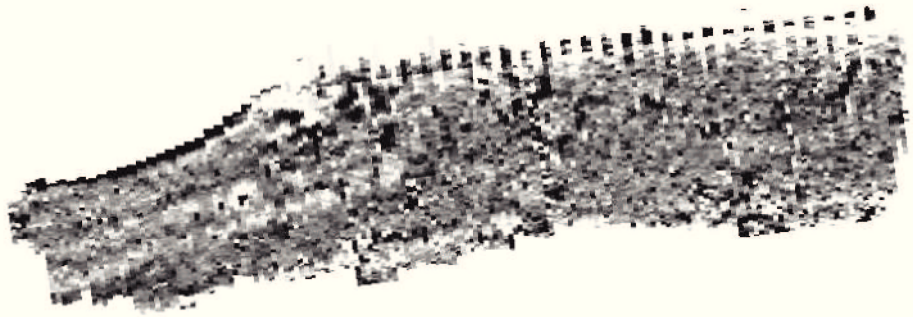
Site Code	TACA 15
Scale	1:3,000 @ A4
Drawn by	Robert Evershed
Date	05/03/15

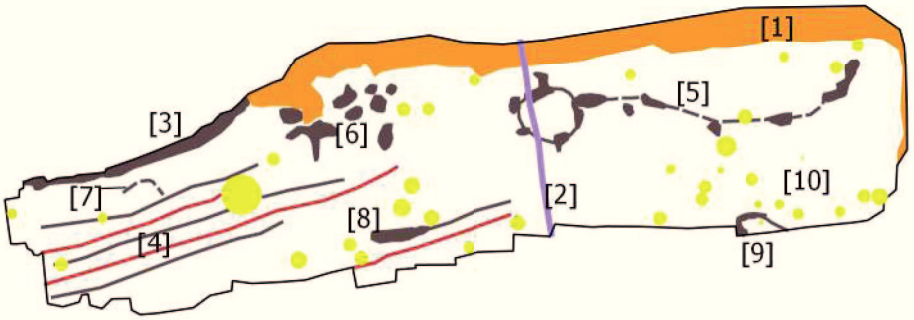
Allenarchaeology

Lincoln
Birmingham
Cambridge
Southampton

www.allenarchaeology.co.uk

Figure 3: Greyscale raw data and processed trace plot





0 50 100 m

N

Key

3
nT
-3

Key

Survey Boundary
Positive anomaly
Negative anomaly
Magnetic noise
Dipolar anomaly
Linear dipolar anomaly

Site Code	TACA 15
Scale	1:1,500 @ A4
Drawn By	Robert Evershed
Date	05/03/2015

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

Figure 4: Processed greyscale plot and interpretation

Figure 5: Location of processed greyscale plot

Figure 6: Location of geophysical interpretation

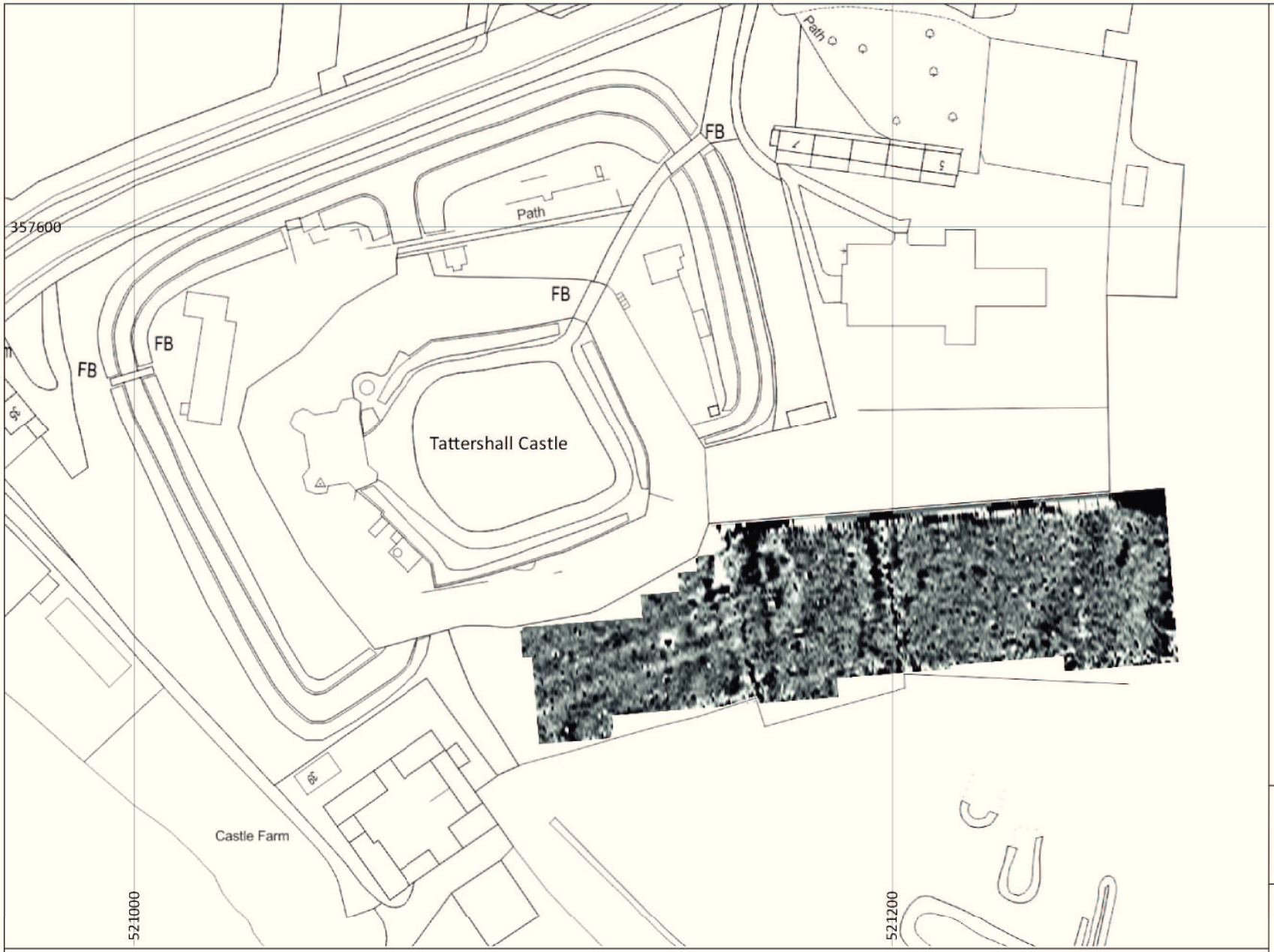


Figure 7: Geophysical greyscale from the 2009 magnetometry survey

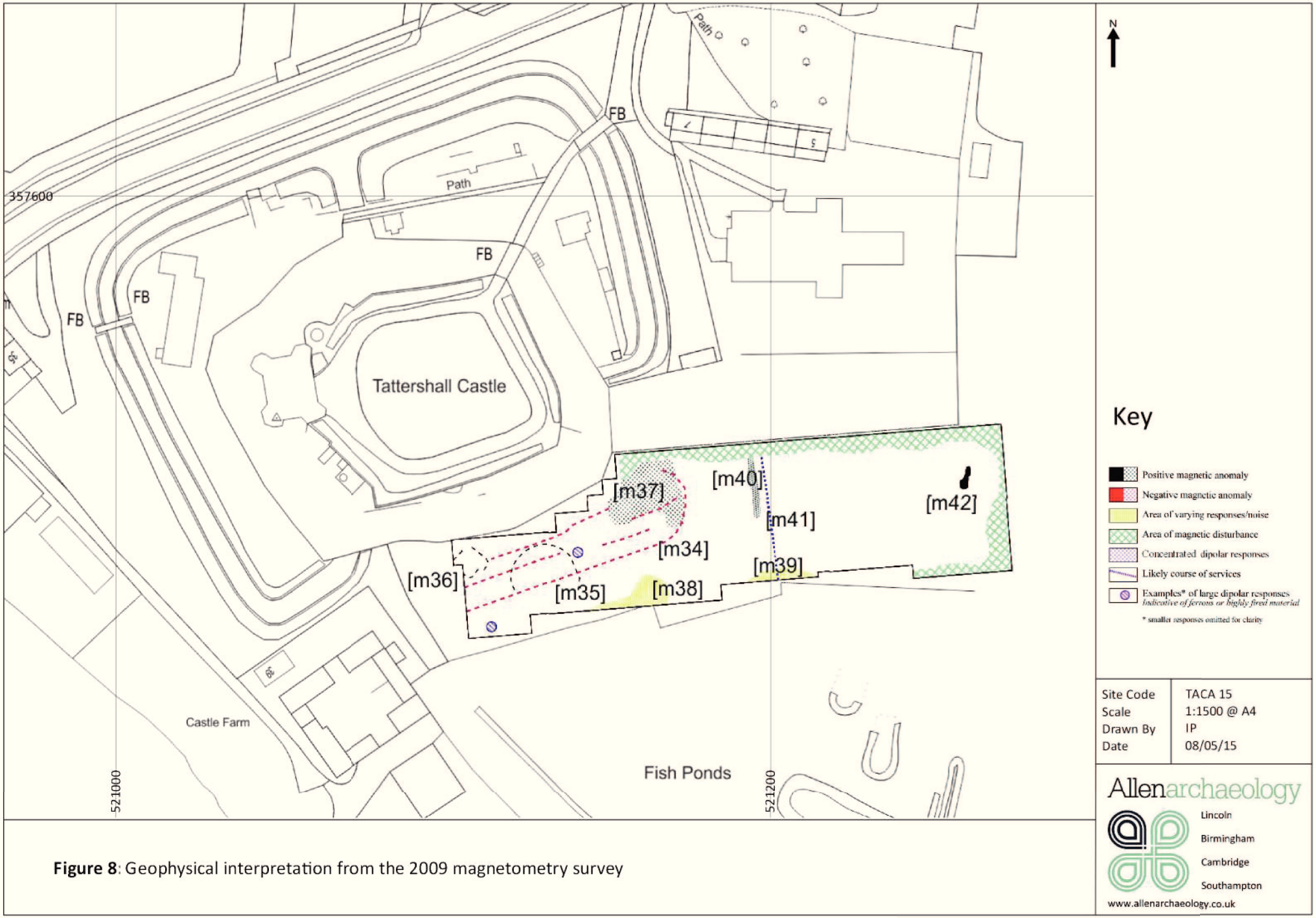


Figure 8: Geophysical interpretation from the 2009 magnetometry survey

Allen Archaeology Limited
Website: www.allenarchaeology.co.uk

Company Registered in England and Wales No: 6935529

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

Tel/Fax: +44 (0) 1522 685356
Email: info@allenarchaeology.co.uk

Birmingham
Arion Business Centre
Harriet House
118 High Street
Birmingham
B23 6BG

Tel/Fax: +44 (0) 800 610 2545
Email: birmingham@allenarchaeology.co.uk

Cambridge
Wellington House
East Road
Cambridge
CB1 1BH

Tel/Fax: +44 (0) 800 610 2550
Email: cambridge@allenarchaeology.co.uk

Southampton
International House
Southampton International Business Park
George Curl Way
Southampton
SO18 2RZ

Tel: +44 (0) 800 610 2555
Email: southampton@allenarchaeology.co.uk