

**ARCHAEOLOGICAL EVALUATION REPORT:
GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND OFF JUNCTION 11, M40/DAVENTRY ROAD,
BANBURY, OXFORDSHIRE**

NGR: SP 47064 42233
AAL Site Code: BADR 18
Planning Reference: 18/00243/PREAPP
OASIS Reference Number: allenarc1-364701



Report prepared for PWA Planning

By
Allen Archaeology Limited
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Allenarchaeology



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Cover image: View from the southern end of the site looking north

Executive Summary

- Allen Archaeology Limited was commissioned by PWA Planning to undertake a geophysical survey using magnetometry on land off Junction 11 M40/Daentry Road, Banbury, Oxfordshire, in support of a hybrid planning application for development on the site.
- The site lies in an area of some archaeological potential with the Jurassic Way thought to run close to the area, and with a prehistoric enclosure identified on the aerial photographs close to the northern edge of the site. There is some evidence for Bronze and Iron Age settlement close by, but no evidence for Roman activity. Medieval activity in the surrounding area consists of ridge and furrow agriculture, and this is seen across the site as well.
- The survey has revealed a large amount of magnetic noise across the majority of the site, most likely the result of contamination of the ground with modern debris during the construction of the M40 motorway which runs adjacent to the western edge of the site. Despite the magnetic noise, the survey revealed features that corresponded with the ridge and furrow agricultural cultivation seen on aerial photographs and the Lidar image of the site.
- Modern service pipes were also identified within the northern part of the site, along with a few positive linear and curvilinear features that could represent archaeological activity, such as potential boundary features or settlement activity. There were also a large number of amorphous positive features at the northern end of the site which could represent former shallow mining pits, soil-filled hollows or former ponds.
- The large amount of magnetic noise may have the unwelcome effect of masking more ephemeral archaeological features, so the survey results may not represent the full archaeological potential of the site.

1.0 Introduction

- 1.1 Allen Archaeology Limited was commissioned by PWA Planning to undertake a geophysical survey using magnetometry on land off Junction 11 M40/Daventry Road, Banbury, Oxfordshire, in support of a hybrid planning application for development on the site.
- 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), the Institute for Archaeologists '*Standard and guidance for archaeological geophysical survey*' (CIfA 2014) and a specification by this company (AAL 2019).

2.0 Site Location and Description

- 2.1 The site is located immediately to the northeast of Banbury, in the administrative district of Cherwell District Council. It is approximately 34km northwest of the centre of Oxford and 40km southwest of Northampton. The site is approximately 13.2ha and presently is open grassland. The site is centred at NGR SP 47064 42233 and is c.100m above Ordnance Datum.
- 2.2 The bedrock geology comprises limestone and mudstone attributed to the Charmouth Mudstone Formation, laid down between the Sinemurian and Pliensbachian Ages, whilst no superficial geological deposits were recorded within the proposed development area (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>).

3.0 Planning Background

- 3.1 This geophysical survey was commissioned to inform a hybrid planning application for the development of a new priority junction to the A361, internal roads and associated landscaping with 2 no. commercial buildings having a maximum floor space of 33,110m² and with a flexible use [to enable changes in accordance with Part 6 Class V of the Town and Country Planning (General Permitted Development) Order 2015 (as amended)] within Class B2 or B8 of the Town and Country Planning (Use Classes) Order 1987 as amended, and ancillary Class B1 offices; for the development of up to 2 no. commercial buildings having a maximum floorspace of 16,890m² and having a flexible use [to enable changes in accordance with Part 6 Class V of the Town and Country Planning (General Permitted Development) Order 2015 (as amended)] within Class B2 or B8 of the Town and Country Planning (Use Classes) Order 1987 as amended, and ancillary Class B1 offices, with all other matters reserved for future approval.
- 3.2 The approach adopted is consistent with the guidelines that are set out in the National Planning Policy Framework (NPPF) (The Ministry of Housing, Communities and Local Government 2018).

4.0 Archaeological and Historical Background

- 4.1 An archaeological desk-based assessment has previously been prepared for the site (AAL 2016), and the information presented below is a summary of this data.
- 4.2 There is some limited evidence for later prehistoric activity in the landscape surrounding the proposed development site. A prehistoric enclosure was noted on aerial photographs c.800m from the northern edge of the development site, this may now be lost following the construction of the M40. Additionally the Jurassic Way is also thought to run close to the survey

area. Two small pits and a possible field boundary in the vicinity date to the Neolithic period, whilst there is some evidence of Bronze Age and Iron Age settlement close by.

- 4.3 Banbury lies between three Roman roads: Fosse Way, Ackman Street and Watling Street. There is however no physical evidence of Roman activity in the survey area.
- 4.4 The name Banbury derives from the Old English *Banna* and *burh*, meaning a fortified place attributed to a personal name. The suburb of Grimsbury, which lies between the site and Banbury, represents the corruption of an Old English name relating to a defended enclosure. Grimsbury's position has been noted in earthworks seen across several fields, and excavations have recorded ceramics of Anglo-Saxon date. An associated field system dating from this period has also been recorded, consisting of a series of ditches to the north of the settlement.
- 4.5 Banbury appears in the Domesday Book of 1086 as a large settlement with a population of 76 villagers, 17 smallholders and 14 slaves, with lands owned by the Bishop of Lincoln. The village of Grimsbury is also mentioned within the Domesday Book, and is listed as a settlement of 15 villagers, three smallholders and four slaves, with lands owned by Gunfrid of Chocques. Excavations of the deserted settlement of Grimsbury have also recovered ceramics of 12th to 15th century date, indicating continuity throughout the medieval period.
- 4.6 The most significant evidence of medieval activity in the surrounding area is of ridge and furrow agriculture, this is recorded in the Oxfordshire Historic Environment Record (OHER) by LiDAR survey and by an assessment of aerial photography.
- 4.7 Throughout much of the medieval period and until the mid-18th century, Grimsbury played an integral role in the cheese making trade of Banbury, which was highly coveted during this period but rarely mentioned by the 19th century. There is no recorded evidence of this activity indicated in the OHER within the study area.
- 4.8 The motorway infrastructure surrounding the western and southern borders of the site began construction in 1988, and the M40 was opened in January 1991. This has resulted in several changes to the site and its immediate surroundings, including the loss of Huscote House and Mill, and the use of the most northern field of the development site as a construction compound during works.

5.0 Methodology

- 5.1 The geophysical survey consisted of a detailed gradiometer survey of 10.87ha within the development area. The survey was undertaken in a series of 30m grids across the site.
- 5.2 The survey was carried out by the author over a period of 6 days, Wednesday 7th to Thursday 8th, Monday 12th to Wednesday 14th and Friday 16th August 2019. The area surveyed was located using a Leica GS08 RTK NetRover GPS. This accurately 3D plotted the area of investigation and tied it into the National Grid.
- 5.3 The geophysical 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:	0.01nT
Processing Software:	3.0.35.10
Surface Conditions:	Short grass
Area Surveyed:	10.87 hectares
Date Surveyed:	Wednesday 7 th to Thursday 8 th , Monday 12 th to Wednesday 14 th and Friday 16 th August 2019
Surveyors:	Robert Evershed BSc (Hons) and Aoife O'Reilly BSc (Hons)
Survey Assistant:	Richard Brennan BSc (Hons)
Data Interpretation:	Robert Evershed BSc (Hons)

Data Collection and Processing

- 5.6 The grids were marked out using pre-programmed grids on the Leica GS08 Net rover. A north-south alignment 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). For this survey a north to south orientation was used.
- 5.7 The data collected from the geophysical survey has been analysed using Terrasurveyor 3.0.35.10. 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. However, 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.

- 5.9 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

Geophysical Survey

- 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 3). This enhances faint anomalies that may otherwise not be noted in the data, with a number of anomalies identified across the data set, and these are discussed in turn and noted as single digit numbers in square brackets.
- 6.2 The site comprised 5 separate fields (Areas 1 to 5) (Figure 2 and Figure 3), and each field is discussed in turn. All of the fields that lay directly next to the M40 motorway produced results showing large amounts of magnetic noise within them. This has had the unfortunate consequence of potentially masking possible ephemeral archaeological features which could be located within them.

Area 1

- 6.3 The magnetic noise [1] along the eastern edge of area 1 produced readings of -20 to 20 nT/m, with some higher spikes. The magnetic noise is likely a combination of a build-up of debris and metal within the fence along the field edge. The entire field has a large amount of magnetic noise within it.
- 6.4 Magnetic noise [2] represents the magnetic effect of the gateway between Areas 1 and 3, and the metal contained within the fencing itself. This produced readings between -100 and 100 nT/m.
- 6.5 The two parallel positive linear features [3] running in a west to east alignment from the south western edge of the field, 30 nT/m, likely represent a former trackway. These lines are consistent with a trackway observed on the 1885 OS map (Figure 6).
- 6.6 The potential linear positive features [4] running east to west, 10 nT/m, mirror a former field boundary seen on historic mapping (Figure 6).
- 6.7 Aligned roughly north to south across the southeast corner of the field are a number of roughly parallel positive linear features [5], 10 to 15 nT/m. These correspond with very clear ridge and furrow cultivation which is seen throughout the field and on LiDAR mapping (Figure 6). The ridge and furrow was clearly visible throughout the entire field, so it is likely that the large amount of magnetic noise within the field is masking it within the surveyed results in the other parts of the field (Plate 1).



Plate 1: View across the ridge and furrow earthworks looking west

- 6.8 There are a number of potential parallel positive linear features aligned roughly east to west within the southeast corner of the field [6], 5 to 10 nT/m. These may represent a different, and possibly earlier, cultivation trend to the main ridge and furrow which runs north to south.
- 6.9 The potential linear positive feature [7] aligned roughly north to south, 6 to 10 nT/m, may represent a continuation of the ridge and furrow cultivation within the field; alternatively it may represent a former field boundary identified in historic mapping (Figure 6).
- 6.10 The potential positive linear features [8], 8 to 15 nT/m, may represent field drains, or cultivation trends, the north to south aligned feature could represent a continuation of the ridge and furrow within the field.
- 6.11 The potential positive linear and curvilinear features [9] and [10], 6 and 8 nT/m respectively, may represent short ditches or land drains within the field.
- 6.12 Within the northeastern part of the field, there are a linear series of dipolar spikes aligned north to south and east to west [11], -100 to 100 nT/m. These dipolar spikes match up with a former field boundary seen on the 1885 OS map (Figure 6) and as such probably represent former fence posts.
- 6.13 Scattered randomly throughout the site are a very large number of strong and weak dipolar responses, examples of which are highlighted as [12]. The characteristic dipolar response of pairs of positive and negative 'spikes' suggest near-surface ferrous metal or other highly fired material in the ploughsoil. It is possible that material from the construction of the M40 adjacent is responsible for the large amount of dipolar spikes and magnetic noise within the site.

Area 2

- 6.14 Within Area 2 there are a number of parallel positive linear features aligned roughly east to west [13], 10 to 20 nT/m. These correspond with the ridge and furrow seen on the site and clearly visible on the LiDAR image of the site (Figure 6).

- 6.15 In the northwest corner of the field there are a couple of parallel linear dipolar features [14], -100 to 100 nT/m. These represent modern service pipes, and the easternmost one can be seen continuing in Area 4.

Area 3

- 6.16 The magnetic noise on the southern edge of Area 3 follows the fenced boundary between areas 1 and 3. The magnetic noise along the southwestern field boundary [15], -50 to 50 nT/m, is likely a combination of the adjacent M40, a build-up of waste along the field edge and ferrous material with the fence along the field boundary.
- 6.17 The linear positive feature aligned east to west at the northern edge of the field [16], 5 to 10 nT/m, corresponds with a linear bank clearly visible within the site and on the LiDAR image (Figure 6). This likely represents former ridge and furrow cultivation, potentially indicating that the field boundaries were once located slightly differently as within the rest of the field the ridge and furrow cultivation runs roughly north to south.
- 6.18 The parallel positive linear features [17], 5 to 10 nT/m, aligned roughly north to south, correspond with ridge and furrow features identified within the field. As they curve slightly within the field part of the features run parallel with our survey traverses, this means that the process of de-striping the survey data may have removed evidence for these features throughout a large part of the field.

Area 4

- 6.19 The parallel positive linear features [18], 1 to 2 nT/m, aligned roughly north to south correspond with ridge and furrow features within the field and seen on the LIDAR image (Figure 6). This field has much less magnetic noise than the rest of the site, potentially because it is not lying directly next to the M40 motorway and has not been contaminated by material from the construction of that.
- 6.20 There is a short positive linear feature [19], 4 to 8 nT/m, which could correspond to an elongated pit or a short ditch.
- 6.21 The northern part of Area 4 consisted of a concreted area and a small shed, which meant the area was not suitable for surveying (Plate 2).



Plate 2: Northern part of Area 4, looking south

Area 5

- 6.22 Towards the western end of the field there is a large metal structure [20], -100 to 100 nT/m. This relates to activity by the Environment Agency (Plate 3). There are three linear dipolar features which appear to run across the field and converge under the structure. These have all produced readings of -100 to 100 nT/m, and likely represent modern water pipes.



Plate 3: Metal structure within the field

- 6.23 In the western part of the field immediately north and running parallel with one of the linear dipolar features is a potential linear positive feature [21], 5 nT/m. This could represent a former ditch, potentially relating to features to the south of the linear dipolar feature.

- 6.24 To the south of the linear dipolar feature in the western part of the field are a number of linear and curvilinear positive features [22]. These have produced readings of 5 to 15 nT/m. Due to the large amount of magnetic noise within the field, it is impossible to see the full extent and nature of these features, but it is possible that they represent archaeological features such as ditches, boundary features or even settlement activity.
- 6.25 The linear dipolar feature close to the southern edge of the field in the western part of it [23], -100 to 100 nT/m, likely represents a modern service feature.
- 6.26 There are a number of amorphous positive features across the field, with a greater concentration of these towards the centre of the field and potentially along a north to south axis [24]. These features have produced readings of 50 to 100 nT/m, and may represent pits, soil-filled hollows or former ponds. It is possible that they could represent small areas of previous digging within the field. There are other amorphous positive features at the northern edge of the area [25], producing similar readings, that may relate to them.
- 6.27 Within the centre part of the site close to some of the amorphous positive features are a number of short positive linear features [26], 10 to 20 nT/m. These features could relate to the amorphous ones, representing potential short ditches, or could represent former water action within this area.
- 6.28 Close to the southeast corner of the field there is a very large dipolar area [27], producing readings of -100 to 100 nT/m. This could represent a buried ferrous or highly fired object, or possibly a former pit filled with highly magnetic material.
- 6.29 At the northeastern corner of the field there is an area of magnetic noise [28], -100 to 100 nT/m, which represents a combination of a buried modern service and a metal gate at the entrance to the field.

7.0 Discussion and Conclusions

- 7.1 The survey has revealed a large amount of magnetic noise across the majority of the site. This is likely the result of contamination of the field with modern waste during the construction of the M40 motorway which runs adjacent to the western edge. The large extent of the magnetic noise means that it is quite possible that more ephemeral archaeological features have been masked.
- 7.2 Even with all the magnetic noise present, a number of archaeological features can still be identified from the results. Clearly visible on the site across Areas 1 to 4 are the remains of ridge and furrow cultivation, and the survey has produced results that correspond well with earthworks in the fields themselves. Within Area 1 former field boundaries and a trackway were also identified. At the southern end of Area 1 parallel linear features aligned roughly northwest to southeast may well represent cultivation trends, although it is impossible to tell whether these pre- or post-date the ridge and furrow.
- 7.3 Within Area 4 a small linear/amorphous positive feature may represent a small pit or short ditch. This field was relatively magnetically quiet compared to the rest of the site, and this may be because it does not lie directly next to the M40.
- 7.4 In Area 5 there are a number of modern service pipes along with a metallic structure towards the western end. There are also a number of linear and curvilinear positive features which could represent ditches, boundaries or settlement activity. There are also a large number of

amorphous positive features which could represent small surface mining, pits, soil-filled hollows or former ponds.

- 7.5 Since it is possible that the areas of magnetic noise have masked more subtle archaeological features, it is not possible to make a full judgement on the archaeological potential of the site. There are potential archaeological features in the very northern area, which might suggest that there is more with the southern areas than the survey has revealed.

8.0 Effectiveness of Methodology

- 8.1 Due to the large amount of magnetic noise across the majority of the site the non-intrusive survey methodology employed was not as appropriate as initially anticipated, however it has still revealed that there is some archaeological potential for the site.

9.0 Acknowledgements

- 9.1 Allen Archaeology Limited would like to thank PWA Planning for this commission.

10.0 References

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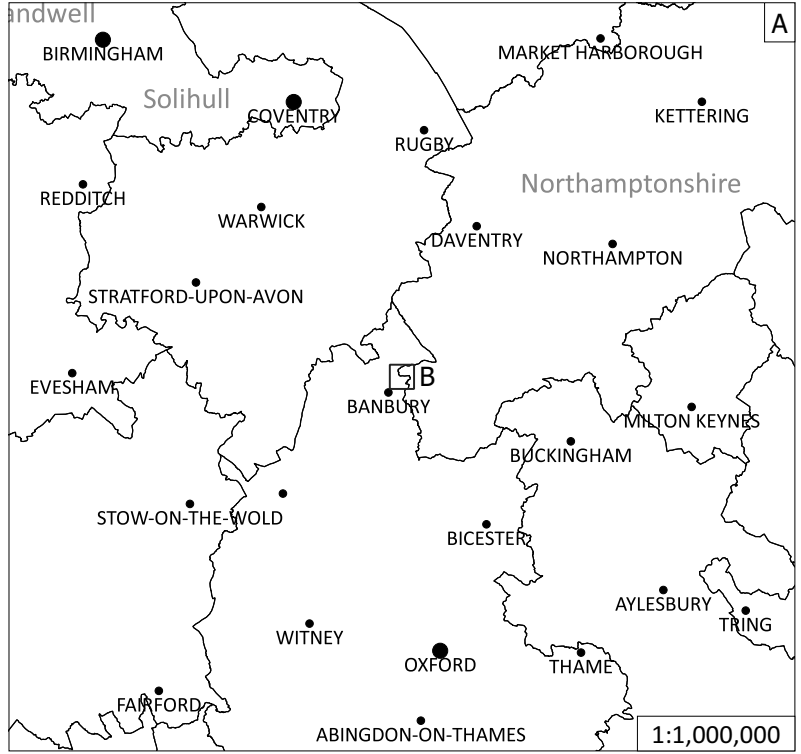


Figure 1: Site location outlined in red

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Site Code	BADR 18
Scale	1:10,000,000 1:1,000,000 1:25,000 @ A4
Drawn by	R Evershed
Date	21/08/19

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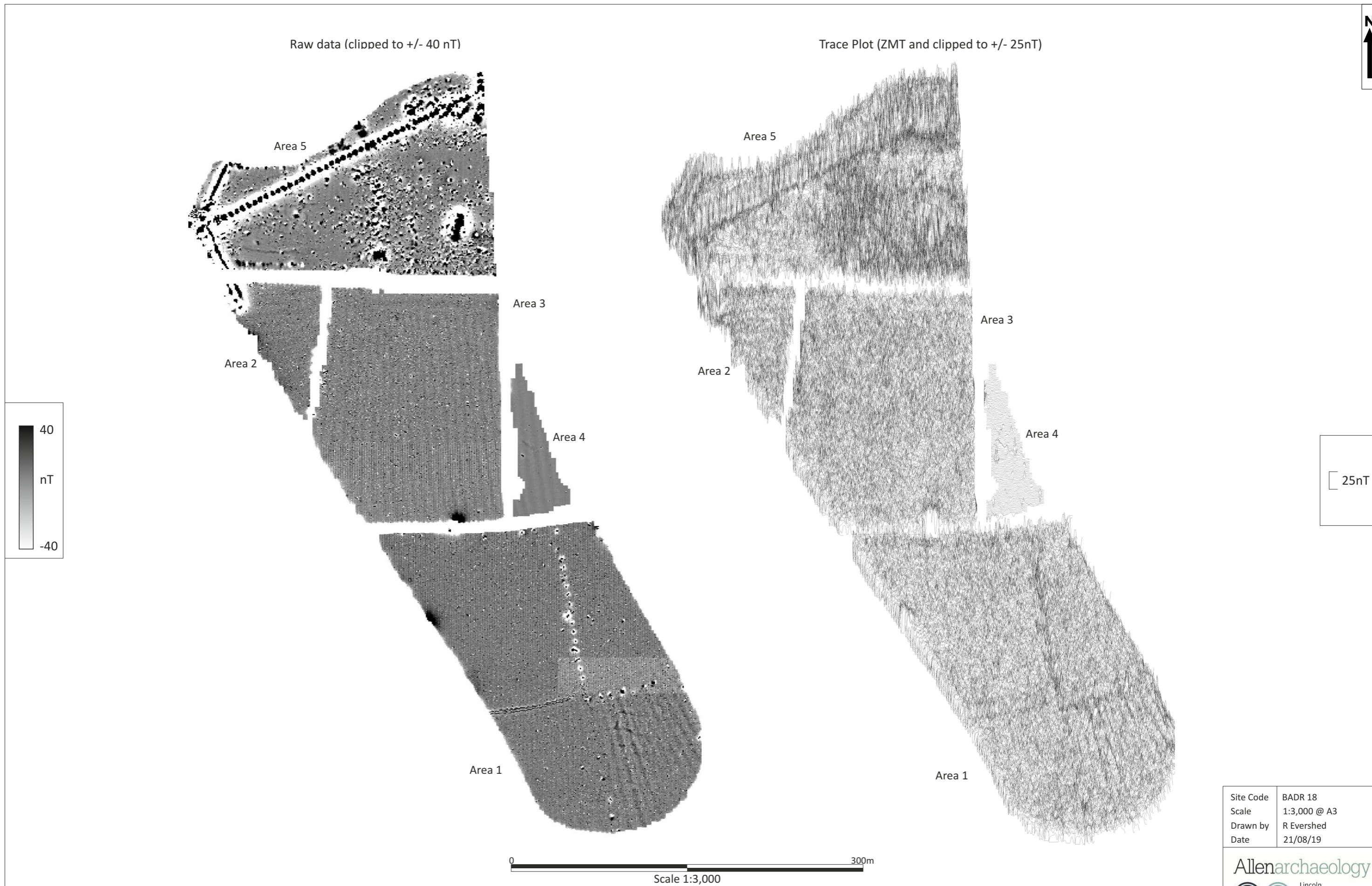


Figure 2: Greyscale raw data and processed trace plot



Figure 3: Processed greyscale plot and interpretation



Figure 4: Processed greyscale location



Figure 5: Geophysical interpretation location

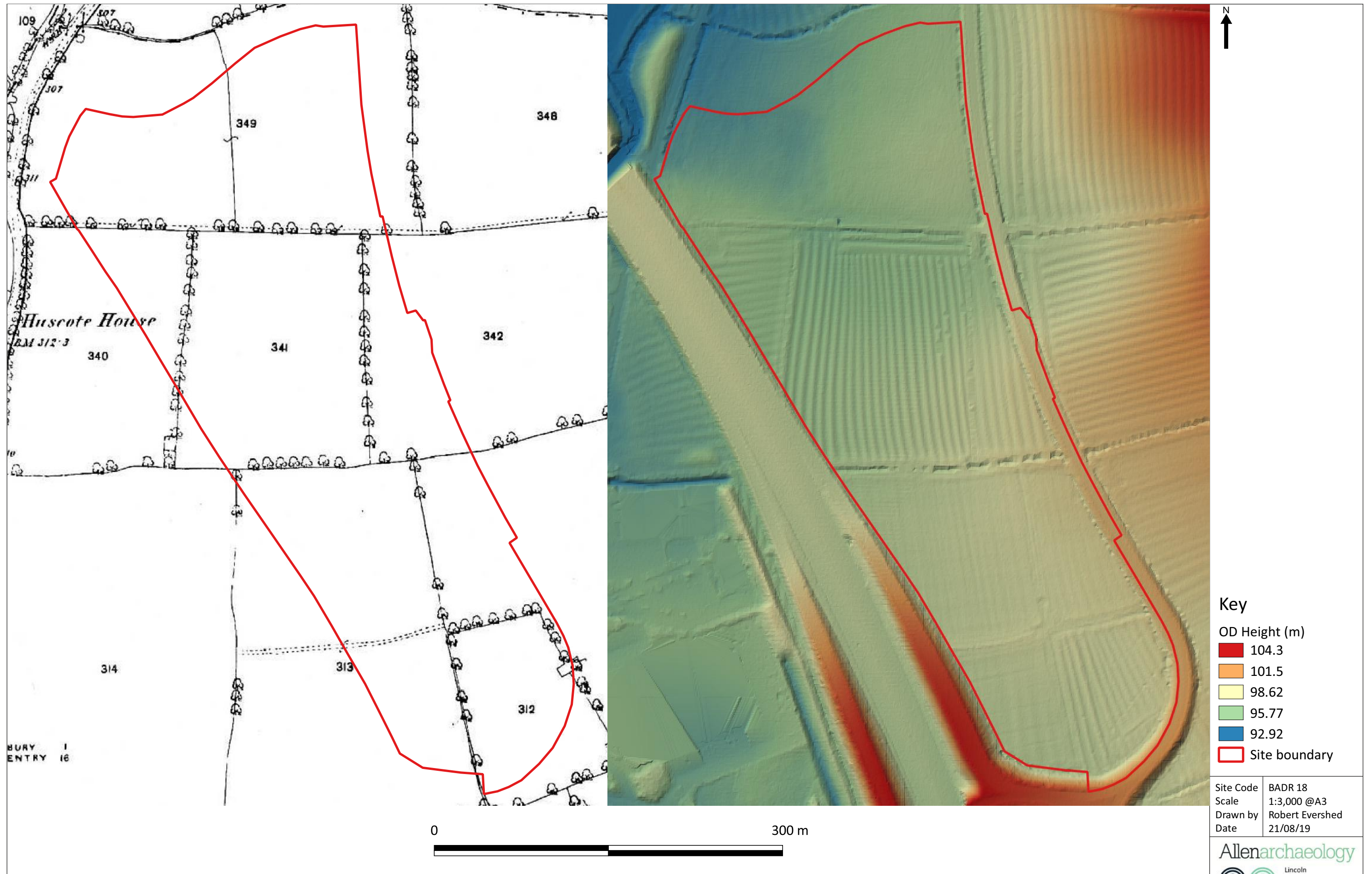


Figure 6: Site boundary superimposed over 1885 OS map and Lidar data



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