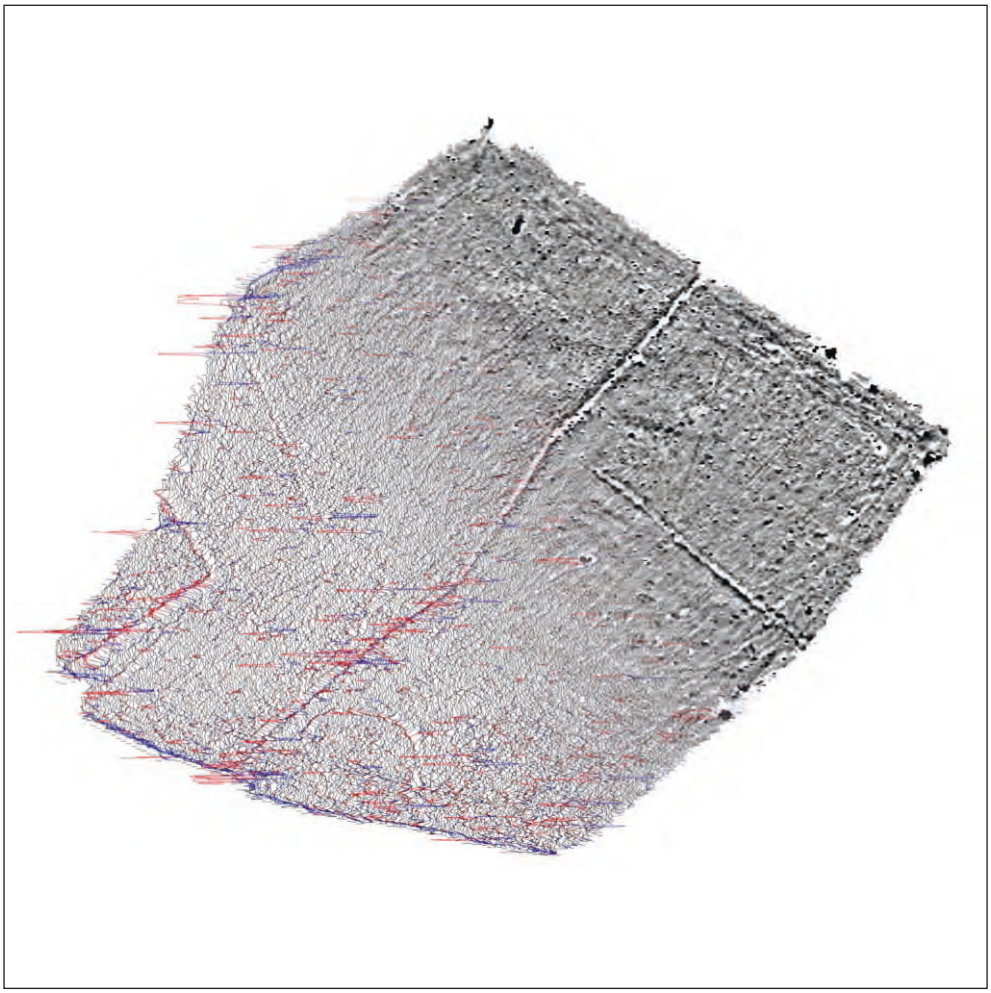
making sense of heritage

Gatehouse Farm, Dawlish
Teignbridge, Devon

Detailed Gradiometer Survey Report



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geoservices

Gatehouse Farm, Dawlish, Teignbridge, Devon

Detailed Gradiometer Survey Report

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Gatehouse Farm, Dawlish, Teignbridge, Devon. The project was commissioned by Gatehouse Park Developments Ltd. with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The site comprises several arable and pasture fields to the north of Langdon Road, approximately 1.5km north of the centre of Dawlish and some 700m west of the A379. The site occupies the base of a low valley, sloping up towards the northwestern and southwestern extents. The gradiometer survey covered 14.9ha and has demonstrated the presence of anomalies of definite, probable and possible archaeological interest within the survey area, along with a region of increased magnetic response and a modern service.

Two probable partial enclosures were identified at the southwestern extent of the survey area, one rectangular and the other sub-circular. These are considered to be of definite archaeological interest.

A probable trackway extends NE-SW through the eastern fields and, whilst its southernmost extents are obscured by magnetic disturbance, it is likely that it extends across the site.

Numerous other linear and pit-like anomalies have been identified across the site. Whilst it is possible that some of these will be of some archaeological interest, others have been interpreted as such due to the uncertainty over their origins. It is possible for natural and agricultural processes to create similar magnetic anomalies, such as infilled hollows and tree throws.

Dense ploughing trends can be seen throughout the survey area, and in places there is the possibility that archaeological features have been truncated.

A modern service was detected parallel with the southern boundary near Langdon Lane.

Extensive magnetic disturbance is visible in the southeastern corner of the site, close to Gatehouse Farm, and numerous small-scale ferrous responses were seen throughout the dataset.

Gatehouse Farm, Dawlish, Teignbridge, Devon

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Acknowledgements

The detailed gradiometer survey was commissioned by PLC Planning, on behalf of Gatehouse Park Developments Ltd, and the assistance of Jeremy Smalley is gratefully acknowledged in this regard.

The fieldwork was directed by Jennifer Smith and assisted by Laura Andrews and Alistair Salisbury. Ben Urmston and Rachel Williams processed and interpreted the geophysical data and Ben Urmston wrote this report. The geophysical work was quality controlled by Dr Paul Baggaley. Illustrations were prepared by Richard Milwain. The project was managed on behalf of Wessex Archaeology by Andy Crockett.

Gatehouse Farm, Dawlish, Teignbridge, Devon

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Gatehouse Park Developments Ltd to carry out a geophysical survey of land at Gatehouse Farm, Dawlish, Teignbridge, Devon (**Figure 1**), hereafter "the Site" (centred on NGR 295995 077921). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed residential development at the Site.

1.1.2 The geophysical survey follows a previous archaeological Desk-Based Assessment (WA 2012) and its update (WA 2014), which identified the potential for archaeological remains to exist within the Site. The likelihood of the presence of features dating from the prehistoric, medieval and post-medieval periods was considered to be moderate to high and geophysical survey was suggested as an appropriate methodology to inform future intrusive work at the Site.

1.1.3 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.4 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The survey area comprises several arable and pasture fields off Langdon Road, some 1.5km north of the centre of Dawlish (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 14.9ha encompassing the 9.5ha proposed for development.

1.2.2 The Site occupies sloping fields, extending NE-SW, sloping from 45m above Ordnance Datum (aOD) at the western corner to c. 15m aOD along the eastern boundary. The survey area lies 1.5km north of the centre of Dawlish, with the other extents of the survey area defined by Langdon Road to the south, field boundaries to the west and north, and Secmaton Lane to the east.

1.2.3 The soils underlying the Site are likely to be typical brown sands of the 551a (Bridgnorth) association. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 19th and 25th March 2014. Field conditions at the time of the survey were good, with the survey area being under pasture.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of definite, probable and possible archaeological interest within the Site, along with a modern service and several regions of increased magnetic response. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2,000 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 At the western extent of the survey area, rectilinear ditch **4000** is likely to represent the eastern corner of a rectangular enclosure; a possible entrance is visible along the

southeastern circuit of the ditch, with a weaker sub-circular anomaly within the apparent gap. A region of increased magnetic response can be seen immediate northwest of the possible entrance, although this area of textured magnetic background is not conclusively archaeological in origin.

3.2.2 A series of less well-defined rectilinear anomalies **4001** can be seen apparently flanking **4000**. There is no direct evidence for an association between these responses, although the close proximity and similarity of orientation suggests that they may be contemporary.

3.2.3 Linear anomaly **4002** is aligned parallel with the eastern circuit of **4000** and there is the suggestion of a southwestward branch at its southern extent. The similar orientation suggests some relationship between **4000**, **4001** and **4002**.

3.2.4 Sub-annular ditch **4003** lies close to the southern boundary, although its southernmost extents are not clear; strong ploughing trends oriented parallel with the extant boundary can be seen where the ditch response is weakest, suggesting that it may have been truncated. There is an apparent break within the northern circuit of the ditch, although it is not possible to demonstrate this interpretation conclusively. It is also not possible to establish a relationship with other discrete anomalies within the circuit of the ditch.

3.2.5 Between **4000** and **4003**, region of increased response **4004** is likely to be natural in origin and probably relates to near-surface geological changes.

3.2.6 Linear anomaly **4005** is typical of former field boundaries in the region and is consistent with a historic boundary. A further orthogonal boundary **4006** can be seen a short distance to the southeast, with an apparent field entrance separating them.

3.2.7 At the northernmost extent of the southwestern field, linear and amorphous anomalies **4007** and **4008** are considered to be of possible archaeological interest, and further isolated pit-like anomalies can be seen close by to the south. None of these anomalies are definitively archaeological in origin and it is possible that they are agricultural or natural, although an archaeological interpretation cannot be excluded entirely.

3.2.8 Cluster of anomalies **4009** is coincident with a region of increased response and it is considered to be of possible archaeological interest, although an agricultural origin cannot be ruled out.

3.2.9 Further clusters of similar pit-like anomalies **4010**, **4011** and **4012** along the eastern boundary of this field are consistent with either natural or archaeological origins.

3.2.10 Several anomalies of possible archaeological interest can be seen in the small fields immediately west of Gatehouse Farm. Linear anomaly **4013** is oriented parallel with other anomalies further to the northeast and may be related (e.g. **4018**); however, it is on the same orientation as the nearby field boundary, suggesting it may rather be agricultural in origin.

3.2.11 Rectangular anomaly **4014** lies close to the field corner and is consistent with the remnants of a demolished structure. A modern service can be seen immediately south of **4014**, parallel with the course of Langdon Lane.

3.2.12 The southwestern fields are dominated by localised regions of magnetic disturbance, with occasional windows of quieter data, e.g. **4015**, **4016** and **4017**. Trends within the disturbance suggest some coherency and therefore possible underlying features;

however, these are likely to be modern or historic in origin, given the strength of the responses.

3.2.13 Linear anomaly **4018** extends NE-SW, leading from a region of magnetic disturbance towards the south to a better defined anomaly near the northern boundary of the field. Similar responses further northeast at **4019** continue on the same orientation, becoming somewhat fragmentary before a second flanking linear anomaly appears at **4020**. These anomalies extend northeast where their responses are lost in a region of magnetic disturbance before a single anomaly appears at **4021**. Given the colinearity of these anomalies, it is presumed that they are related and it is likely that they represent a former track. Numerous pit-like anomalies can be seen northwest of **4018**, although it is possible that these are the result of different agricultural practices rather than relating to archaeological features associated with the putative track.

3.2.14 Within the northernmost field, region of increased magnetic response **4022** is of uncertain, but probably geological, origins. Further broad anomalies at **4023** are more typical of near-surface geological changes.

3.2.15 At the northernmost extent of the Site, short linear anomaly **4024** lies close to the field corner although its response suggests it may be of some archaeological interest. Further to the east, linear region of increased response **4025** may be associated with the strong ploughing trends seen there, although it is conceivable it is associated with a truncated linear anomaly.

3.2.16 Ploughing trends can be seen throughout most of the survey area, appearing more densely packed in places. It is possible that the variation in their responses is due top sub-surface deposits being truncated through ploughing, although it is not clear whether these deposits are of archaeological interest, if any.

3.2.17 Other linear and curvilinear trends are visible within the dataset, and in places it is possible that they are associated with archaeological features. However, given the appearance of clear ploughing trends, it is possible that they are agricultural in origin.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of definite, probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and a modern service.

4.1.2 The features of clearest archaeological potential are located at the southwestern extent of the survey area. Rectangular ditches **4000** form part of an apparent enclosure at least 75m NE-SW x 43m NW-SE; assuming that anomalies **4001** and **4002** are associated, this makes the complex at least 125m x 100m. Although the full extent of **4000** does not lie within the Site boundary, it is consistent with later prehistoric, Romano-British or medieval features. Undated cropmarks have been identified a short distance to the north (WA 2014), although a relationship between the anomalies and the cropmarks cannot be demonstrated here.

4.1.3 Curvilinear ditch **4003** along the southern boundary is more typical of late prehistoric archaeology; it does not appear to respect the existing boundary, although it is not possible to state this conclusively given the likely truncation to its southern extent.

4.1.4 The probable trackway extending NE-SW through the eastern fields can be traced southwards at least as far as the regions of magnetic disturbance in the south. It is

unlikely that these relate directly to the probable track, as the responses further north are different in character. It is considered likely that they are later in date than the track, and it is of interest to note, whilst the track is oriented parallel with the existing boundary, it does not appear to represent a continuation or previous alignment; it also does not appear on historic mapping (WA 2014).

4.1.5 The two former field boundaries identified in the southwestern field appear on the 1839 tithe map (WA 2014) and the boundary oriented NW-SE had been removed by 1890. The other, aligned NE-SW, existed in 1955, making its removal a recent event.

4.1.6 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies, however. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.

4.1.7 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.

5 REFERENCES

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Soil Survey of England and Wales, 1983. *Sheet 5, Soils of South West England*. Ordnance Survey, Southampton.

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Wessex Archaeology, 2014. *Gatehouse Farm, Dawlish, Devon: Archaeological Desk-Based Assessment*. Client report 86311.01

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

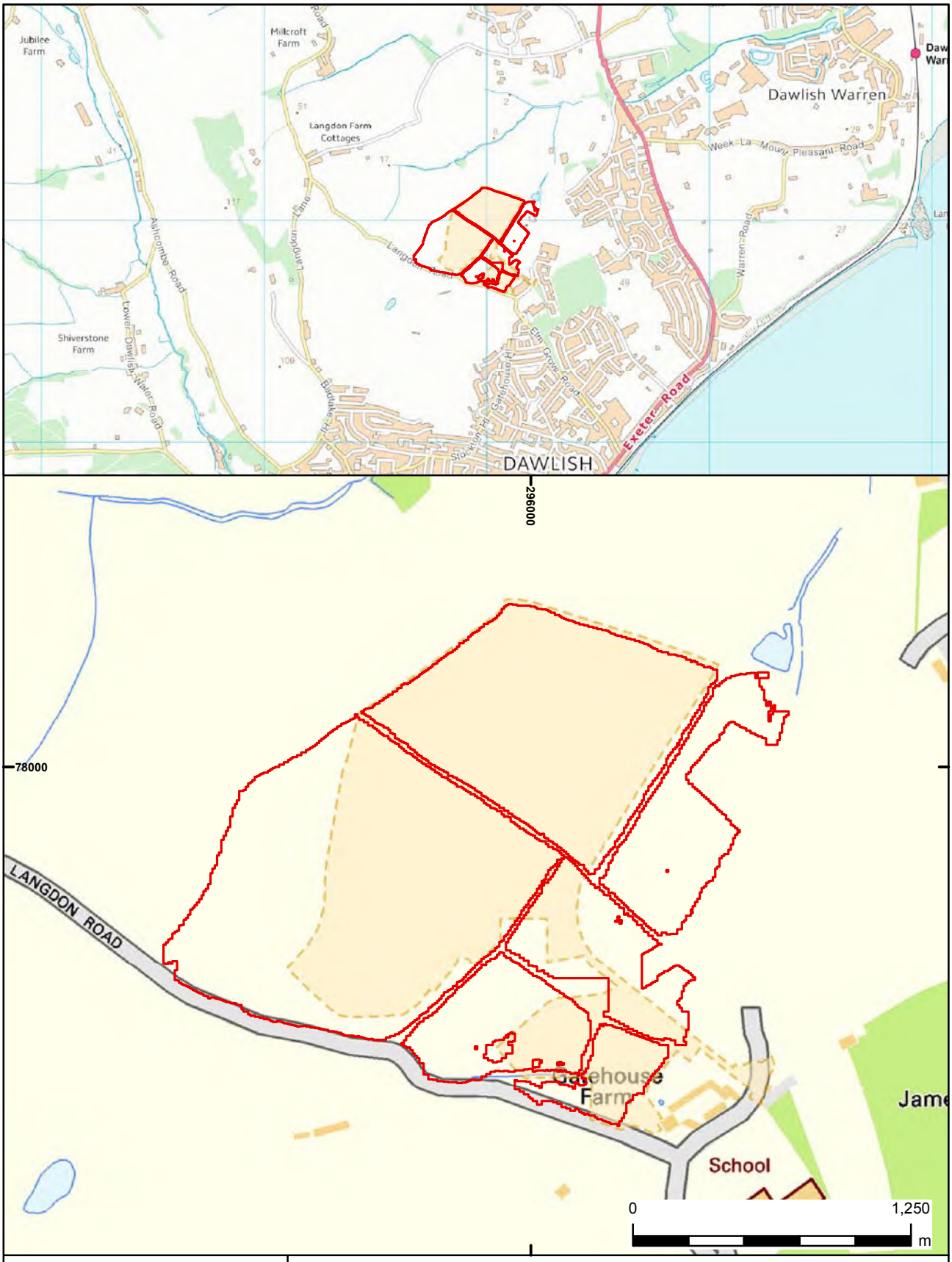
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



Site

Survey Extents

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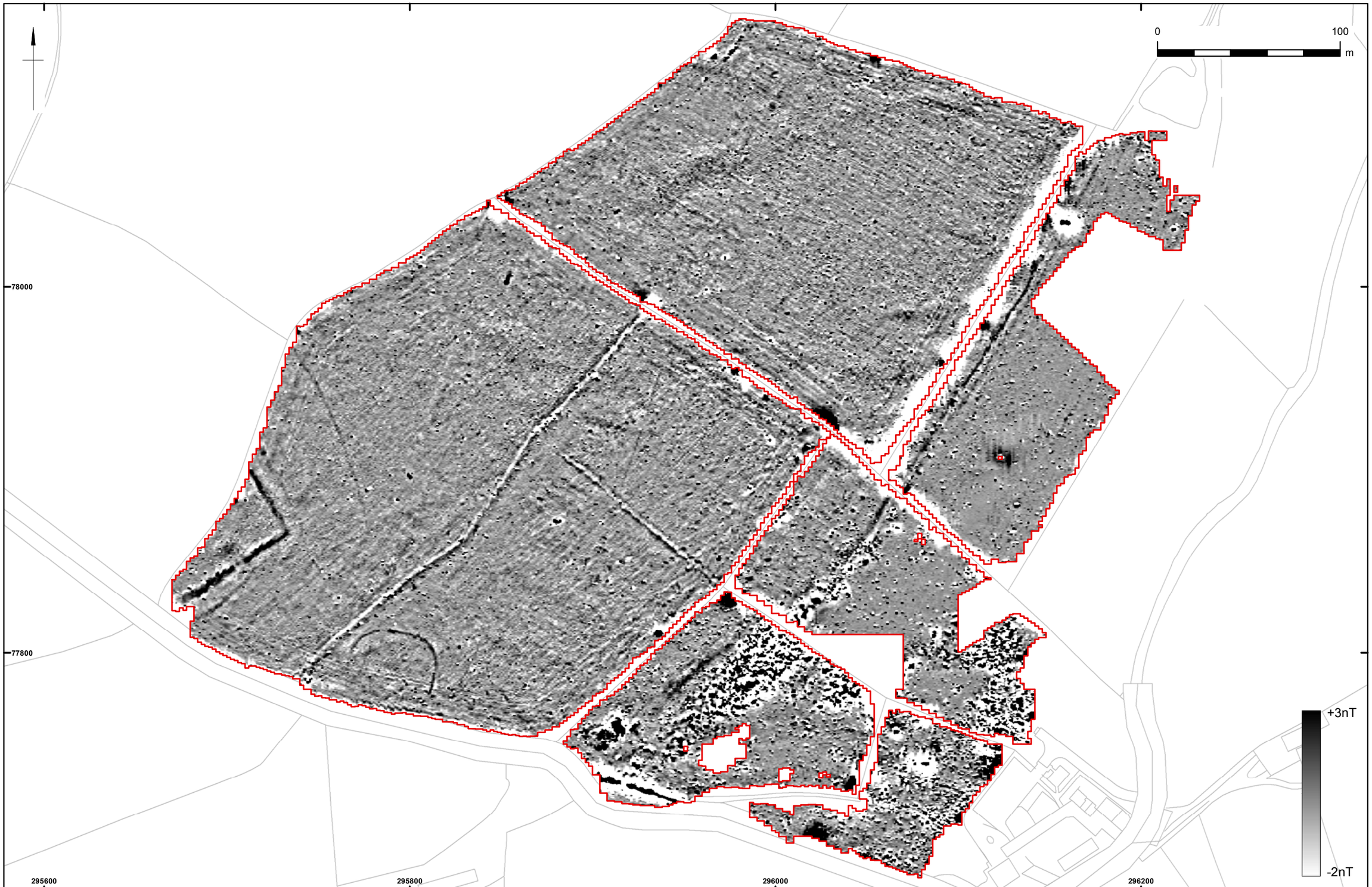
Site location and survey extents

Figure 1



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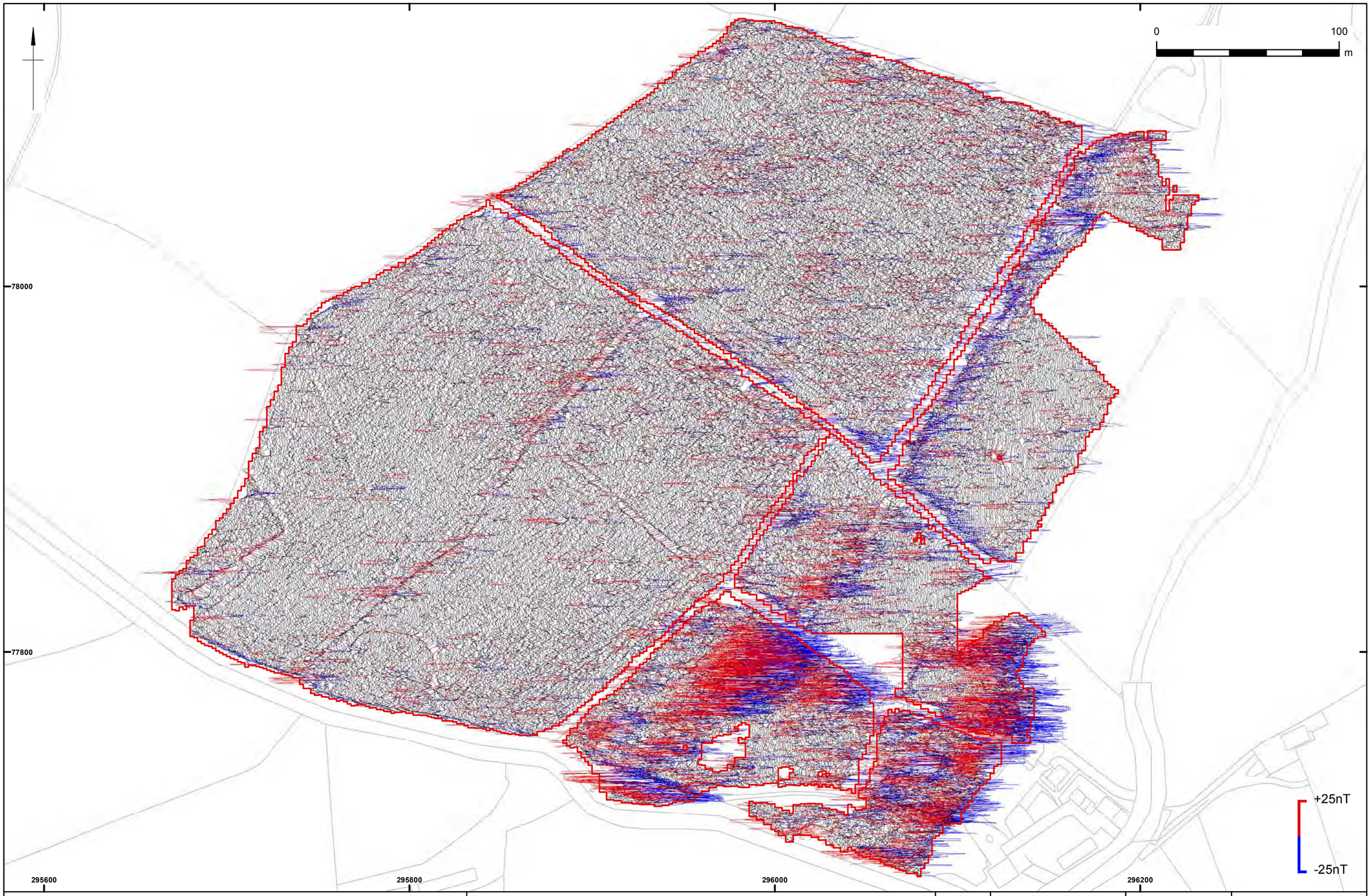
Greyscale

Figure 2



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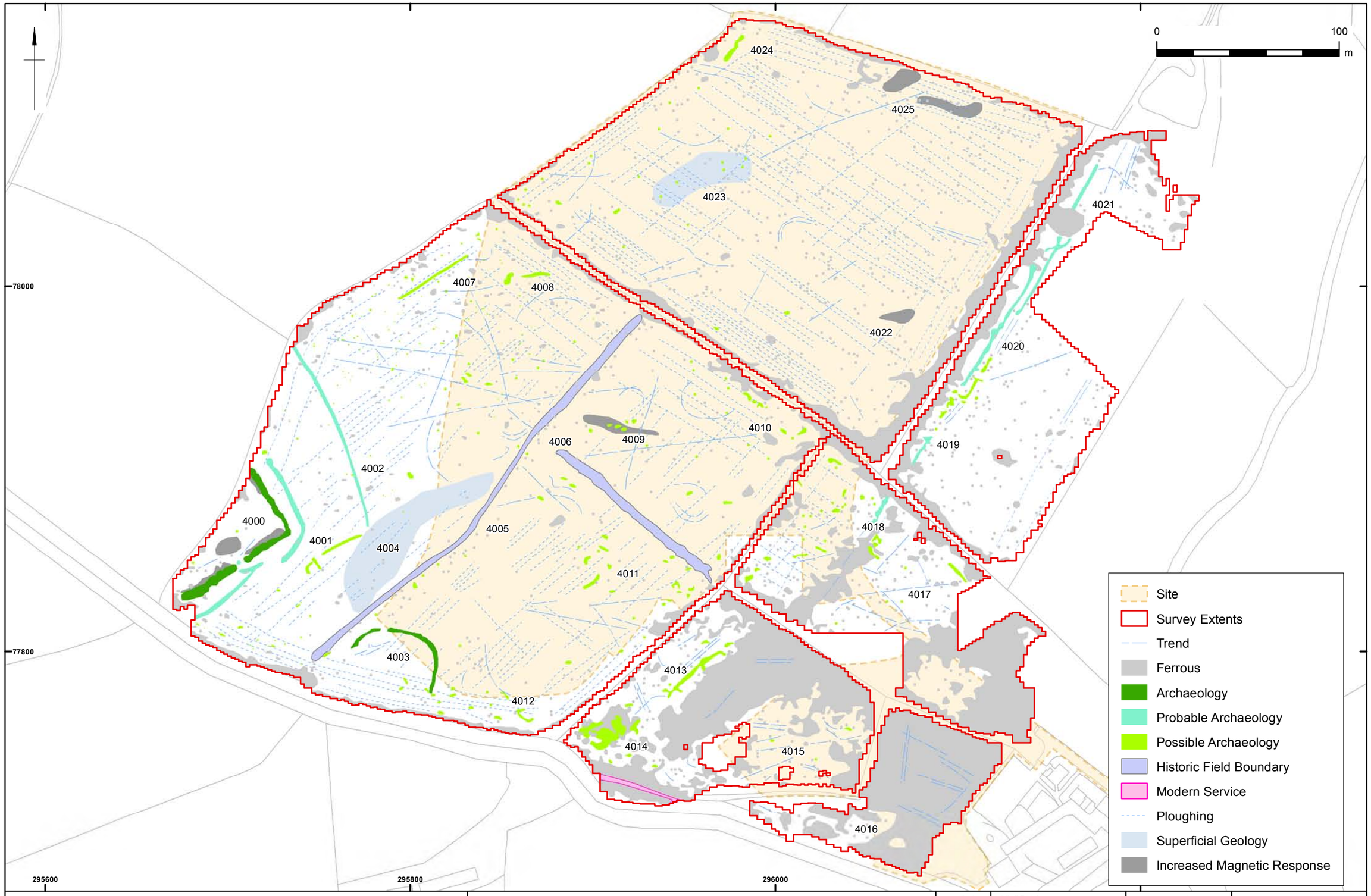
XY trace

Figure 3



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Interpretation

Figure 4

wessex archaeology

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