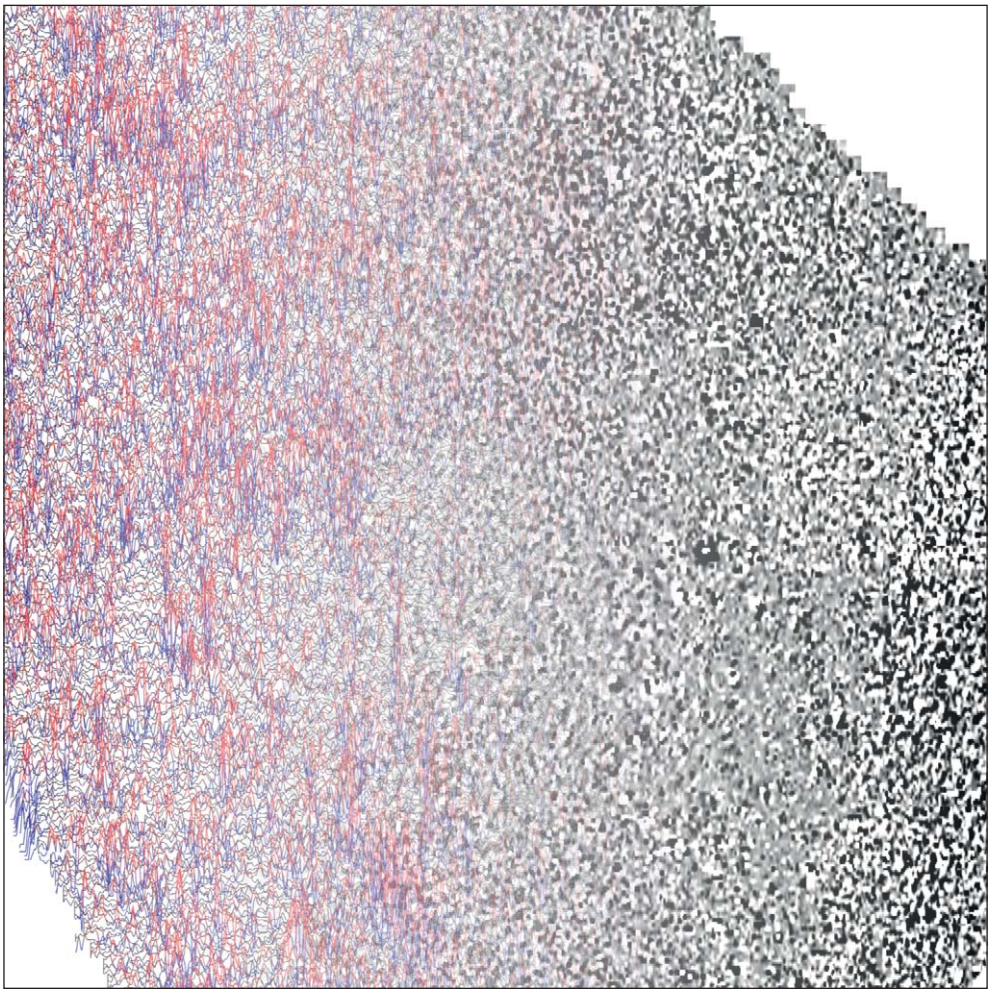
making sense of heritage

Land at Grove Farm
Creeting St Peter, Suffolk

Detailed Gradiometer Survey Report



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geoservices

Land at Grove Farm
Creeting St Peter, Suffolk

Detailed Gradiometer Survey Report

Prepared for:
MS Power Projects Limited
Development 53
Chandos Place
London
WC2N 4HS

Prepared by:
Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

www.wessexarch.co.uk

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Creeting St Peter, Suffolk

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Summary

A detailed gradiometer survey was conducted over land off the A14, near Creeting St Peter, Suffolk. The project was commissioned by MS Power Projects Limited with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed solar farm development. The survey area is centred on NGR 608950 257450.

The site comprises two arable fields to the northeast of the A14, approximately 1.3km southeast of Creeting St Peter. The gradiometer survey covered 26.8ha and has been unsuccessful, in this instance, in demonstrating the presence/absence of anomalies of archaeological interest within the survey area. This lack of success stems from a dense concentration of ferrous responses that were detected across the majority of the site. These ferrous responses acted to obscure any archaeological features that may be present making interpretation very difficult.

The geophysical survey has not been effective in informing on the archaeological potential of the Site and it is considered that any future trenching should be targeted on alternative sources such as aerial photography and the results of the desk-based assessment.

The survey was conducted between 20th and 24th May 2013.

Land at Grove Farm
Creeting St Peter, Suffolk

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by MS Power Projects Limited. The assistance of Mr Chris Brake is gratefully acknowledged in this regard.

The data were acquired under the direction of Wessex Archaeology. Jennifer Smith processed the geophysical data and this was interpreted by Ross Lefort who also wrote this report. The geophysical work was quality controlled by Dr. Paul Baggaley. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Caroline Budd.

Land at Grove Farm
Creeting St Peter, Suffolk

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by MS Power Projects Limited to carry out a geophysical survey of land off the A14, near Creeting St Peter, Suffolk (**Figure 1**), hereafter "the Site" (centred on NGR 608950 257450). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of a proposed solar farm development at the Site.

1.1.2 A Desk-Based Assessment (DBA), an Environmental Statement (ES) and a Written Scheme of Investigation (WSI) have been prepared by Wessex Archaeology (2013a, 2013b and 2013c respectively). These documents identified the potential for the presence of archaeological remains within the proposed development area and outlined the aims and proposed methodology for this survey. The geophysical survey will form part of the initial programme of archaeological works necessary for the Site and will aim to identify any previously unknown areas of archaeological activity, along with better defining the known archaeology at the Site.

1.1.3 The specific aims of the geophysical survey set out in the WSI are to:

- Conduct a detailed gradiometer survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- Clarify the presence/absence and extent of any detectable buried archaeological remains within the Site;
- Characterise any sites identified during the detailed survey;
- Produce a report which will present the results of the geophysical survey in sufficient detail to allow an informed decision to be made concerning the Site's archaeological potential.

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 two arable fields off the A14, some 1.3km southeast of the centre of Creeting St Peter (**Figure 1**). Detailed gradiometer survey was undertaken over all accessible parts of the Site, a total of 26.8ha.

1.2.2 The Site occupies the south eastern facing slope of a gentle ridge that is flanked on either side by two tributaries of the River Gipping. The land slopes from just under55m above Ordnance Datum (aOD) at the northern corner of the site to less than 30maODat the southern corner. The south-western edge of the survey area runs alongside the A14, with the other extents of the survey area defined by field boundaries.

1.2.3 The soils underlying most of the Site are likely to be typical calcareous pelosols of the 411d (Hanslope) association and there are likely to be pelo-alluvial gley soils of the 813a (Midelney) close to the south of the site (SSEW 1983). 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 (EH 2008).

2.1.2 The geophysical survey was undertaken under the direction of Wessex Archaeology between 20th and 24th May 2013. Field conditions at the time of the survey were good.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using an 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 (EH 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 (±10nT 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 unsuccessful in identifying anomalies of probable and definite archaeological interest across. This was due to the dense concentrations of ferrous responses present in the dataset. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2** to **8**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 50nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of possible archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figures 6**, **7** and **8**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 The survey area is dominated by ferrous responses that cover most of the Site. These responses possibly derive from ferrous/ceramic material added to the field during past agricultural/industrial activity. The strength of these ferrous responses is sufficiently high enough to mask the much weaker responses measured from archaeological deposits. It is very difficult to assess the presence/absence of archaeological features in these conditions.

3.2.2 The main features of interest are a group of seven short linear anomalies at **4000** that appear to form a longer linear feature measuring over 30m in length. This continues further to the north, beyond the extents of the Site. This feature may be a coincidental arrangement of positive responses relating to ferrous anomalies and has been termed possible archaeology to reflect this uncertainty in the interpretation. A similar but smaller group of positive anomalies can be seen at **4001** and again the interpretation of these features is unclear due to the dense concentration of ferrous resulting in them being classed as possible archaeology.

3.2.3 The remaining positive anomalies spread across the site are small sub-circular or sub-oval shaped responses. These are considered to perhaps represent some form of archaeological feature although there is a strong possibility that many are associated with ferrous responses which have created a misleading positive response.

3.2.4 As was mentioned above the dense concentration of ferrous has made interpretation of the data very difficult. There are large spreads of continuous ferrous responses, as at **4003**, that may have obscured archaeological features. The spread at **4003** has covered an area where cropmarks thought to be indicative of two possible ring ditches were discovered from aerial photography (Wessex Archaeology 2013). Even with the positions of these two ring ditches known it is not possible to find and define them in the geophysical data.

3.2.5 The remaining features identified are linear and curvilinear trends. Some, such as those around **4002**, are set at differing alignments to the modern field boundaries and may be archaeological. Others, such as those around **4004**, are aligned with

the modern field boundary and are more likely to relate to modern ploughing activity.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 No clear services could be identified in the geophysical data. It is possible that small or weakly contrasting responses from services may be obscured by the dense concentration of ferrous responses spread across most of the Site.

3.3.2 It is not clear from the geophysical data whether there are any active services in the survey area or not. It should be noted that gradiometer data would not necessarily locate and identify all services present on a site, even where clear of obscuring ferrous responses. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been unsuccessful in detecting any anomalies of probable or definite archaeological interest within the Site. The cause of this is the dense concentration of ferrous responses found across the entire survey area. This has made any assessment of the presence/absence of archaeology impossible from the gradiometer data alone. This assertion is supported by the failure to detect known features such as the ring ditches previously identified from the study of aerial photography (Wessex Archaeology 2013). In this instance gradiometer survey has proved to be ineffective due to the wide spread of ferrous/ceramic material across the site; other sources should be used to locate any targets for the evaluation.

4.1.2 The interpretation of the few anomalies detected is very uncertain. Many of the responses termed possible archaeology may turn out to be ferrous responses that presented a regular shape in plan. Some trends may also turn out to be coincidental patterns formed by the spreads of ferrous responses.

5 REFERENCES

English Heritage, 2008.Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1, 2nd edition.

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Wessex Archaeology, 2013b. *Grove Farm, Mill Lane, Environmental Statement: Chapter 9 Archaeology.* Quod reference: forthcoming.

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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.

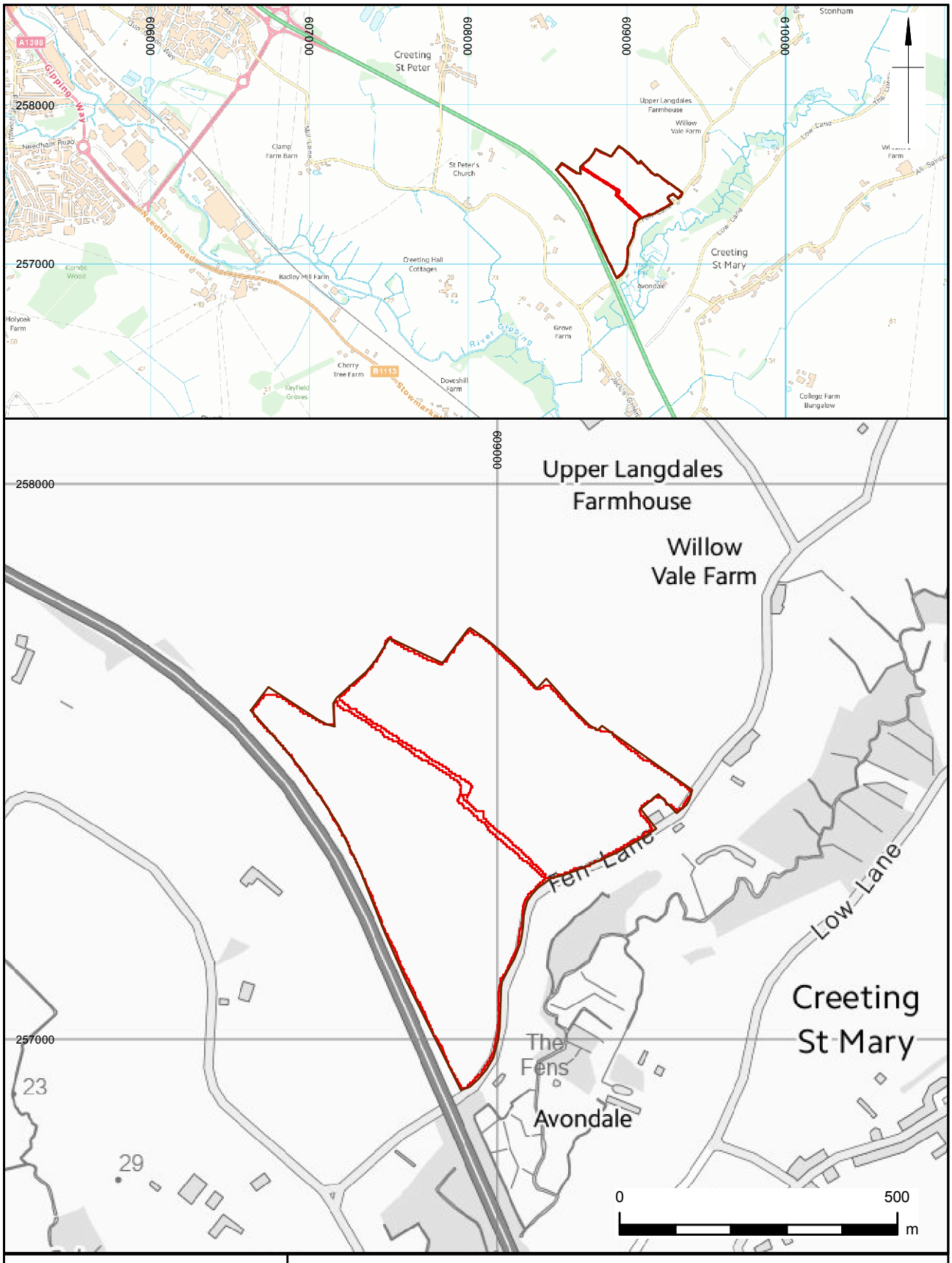
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



The Site

Survey Extents

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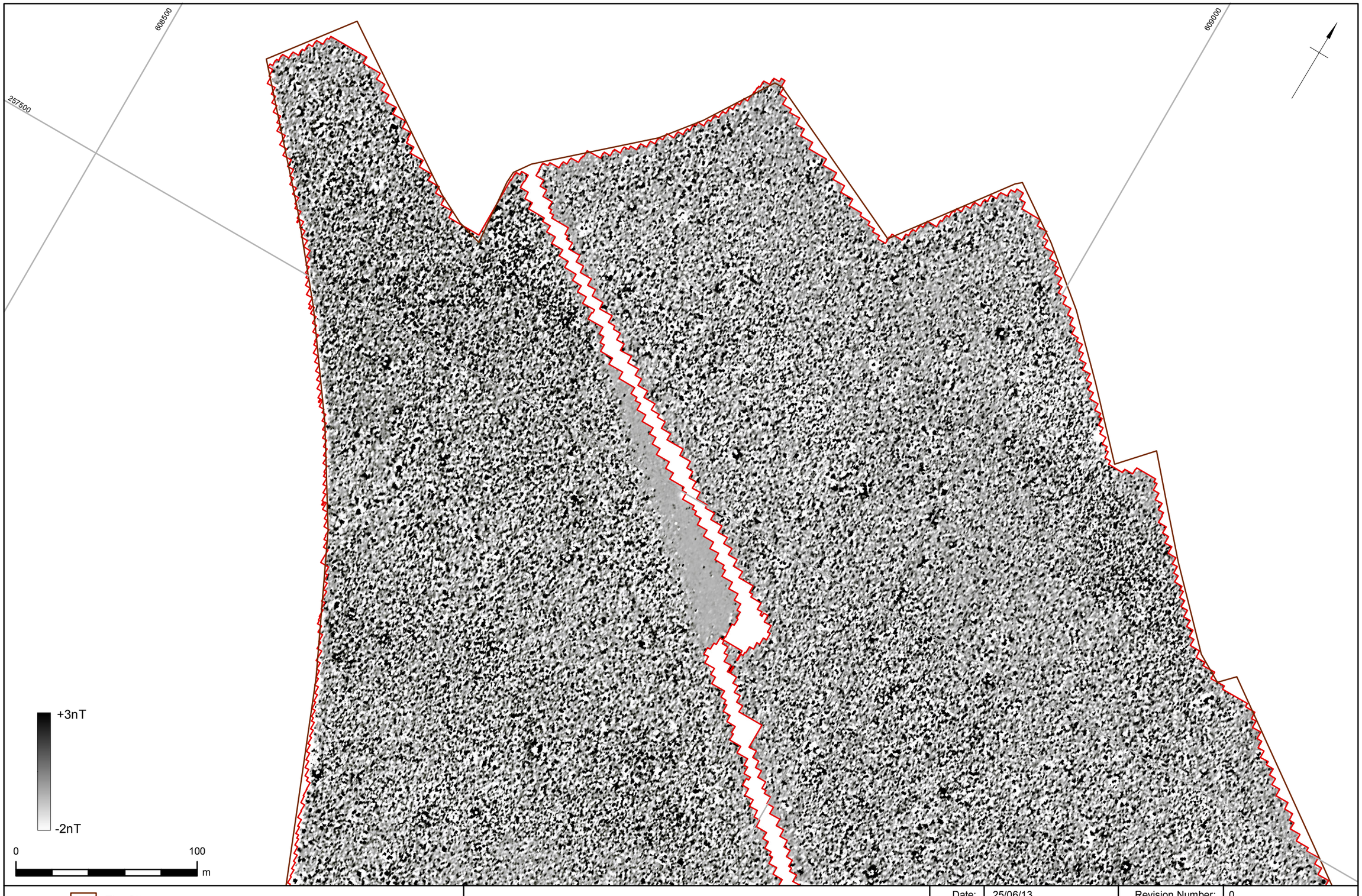
Site location and survey extents

Figure 1



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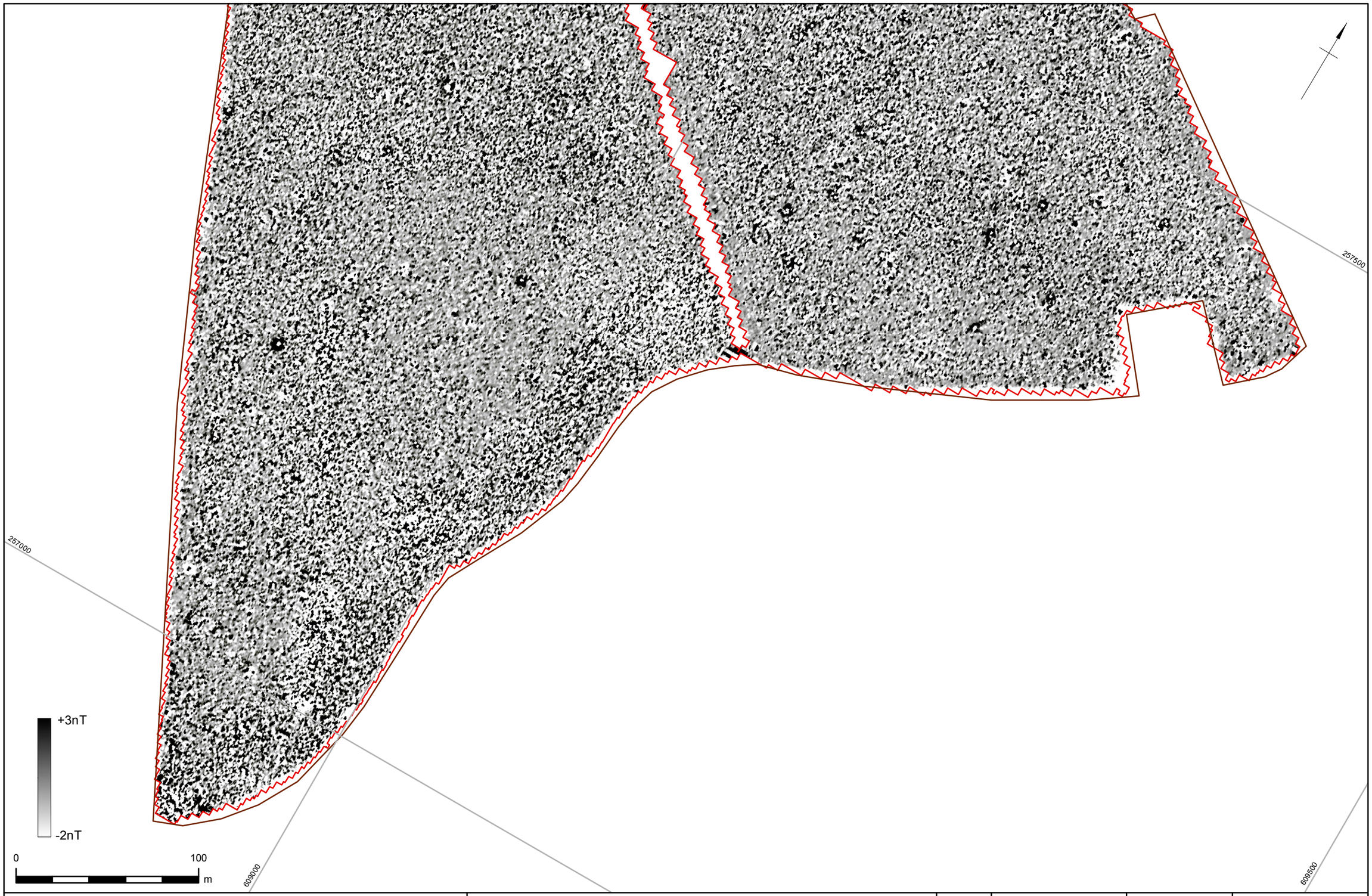
Greyscale, northern half of site

Figure 2



The Site

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Greyscale,southern half of site

Figure 3

608500

609000

257500

+50nT

-50nT

0 100 m

The Site

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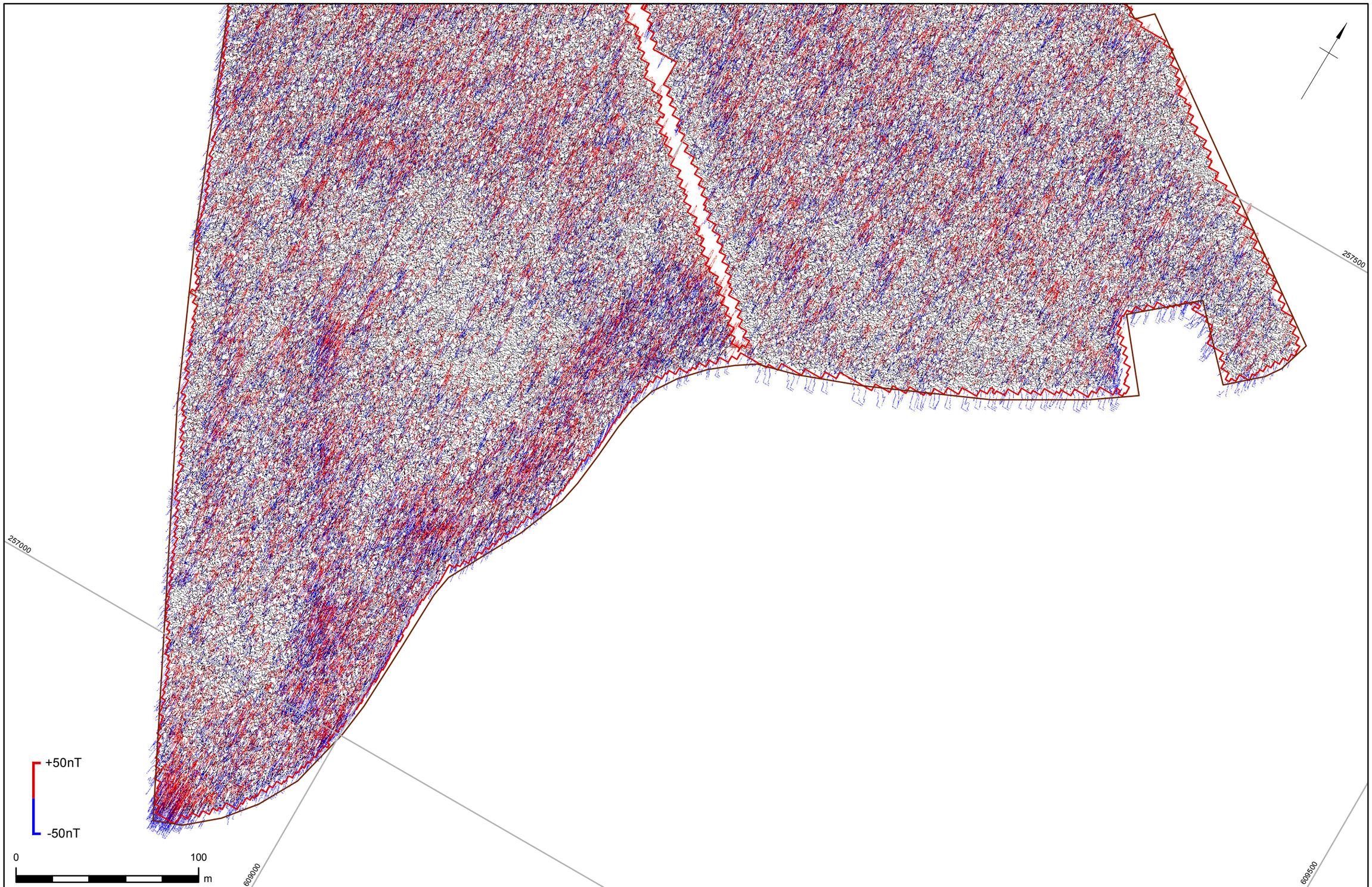
XY trace, northern half of site

Figure 4



The Site

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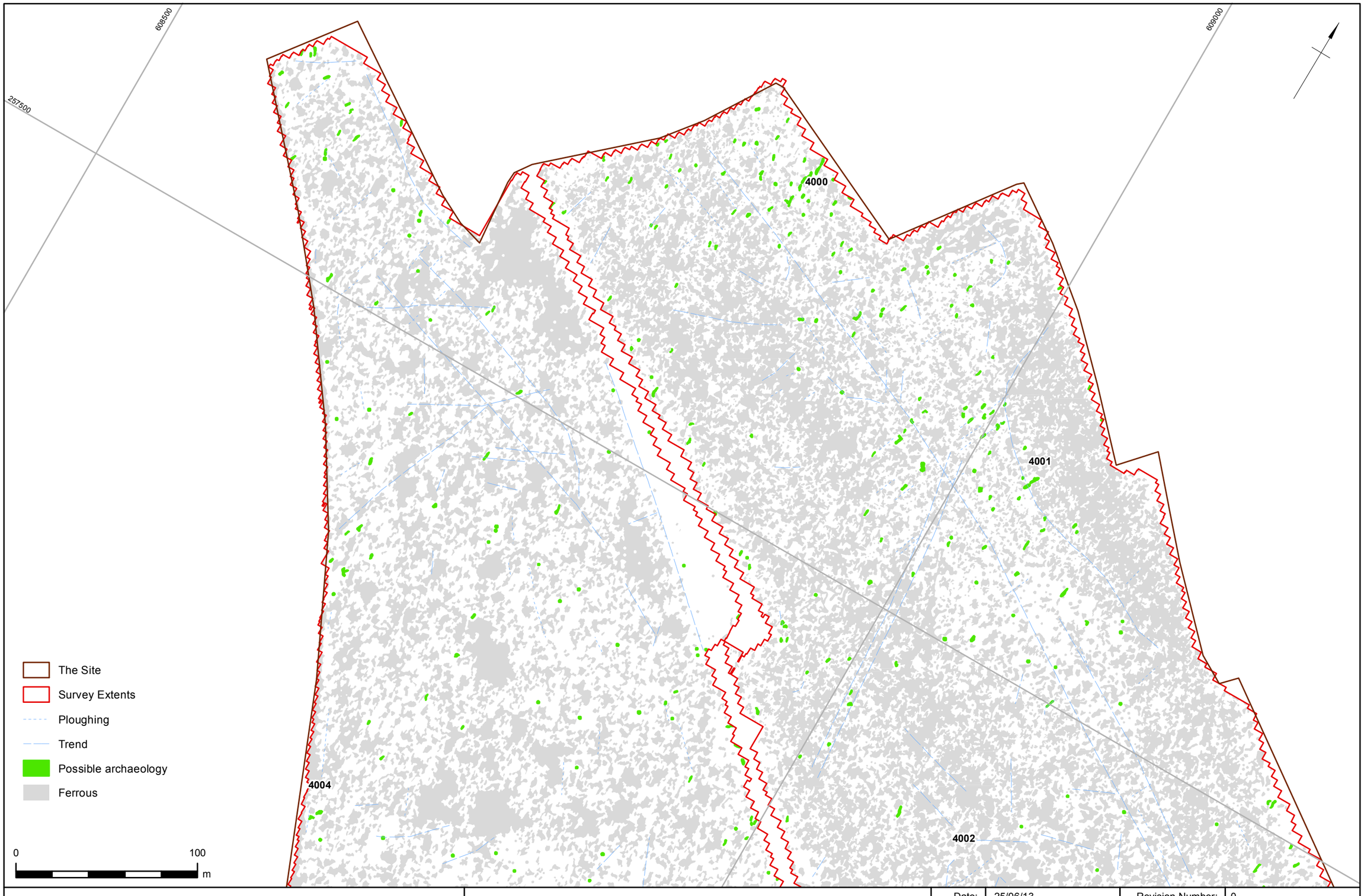
XY trace, southern half of site

Figure 5



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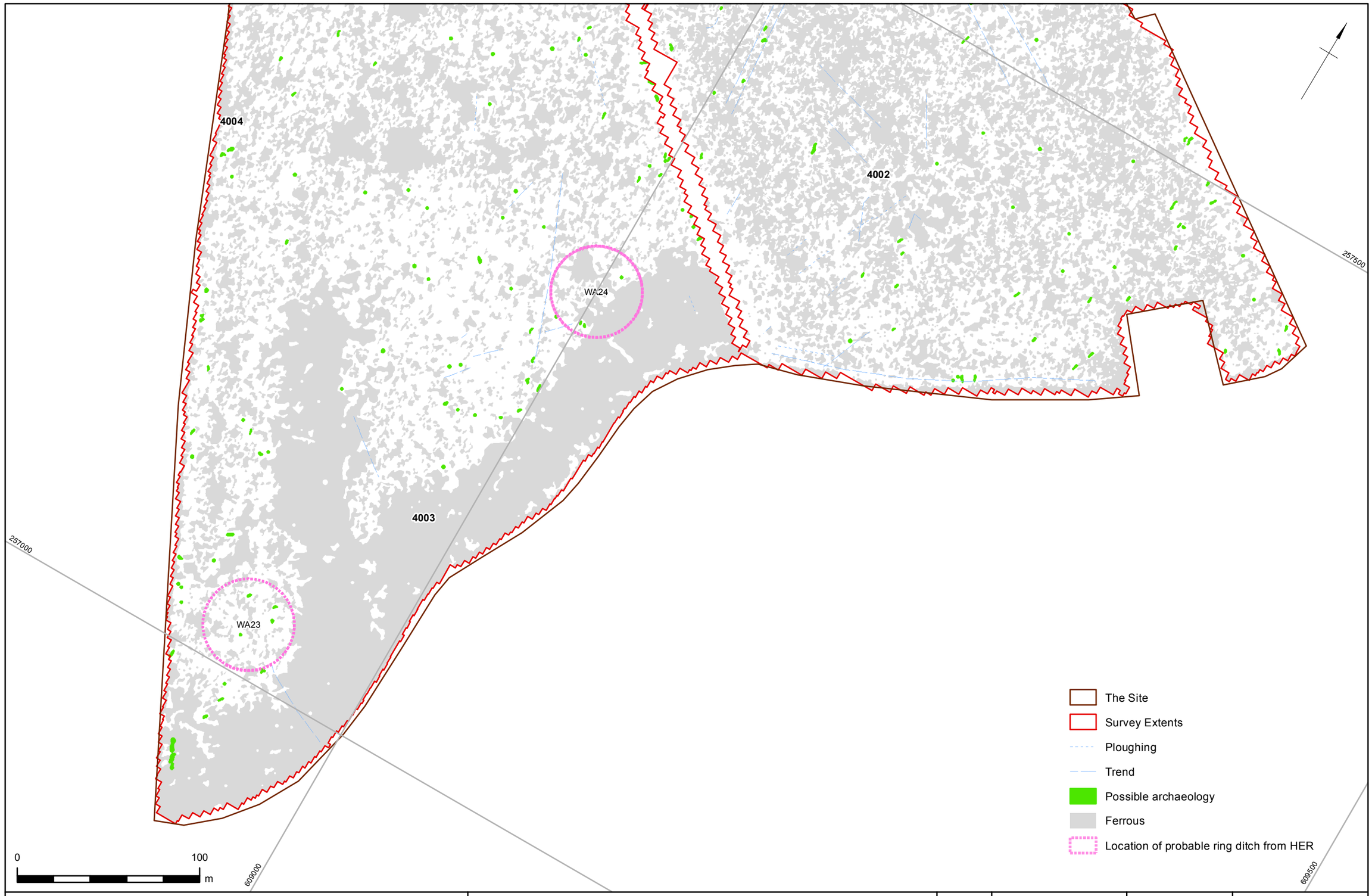
Interpretation, northern half of site

Figure 6



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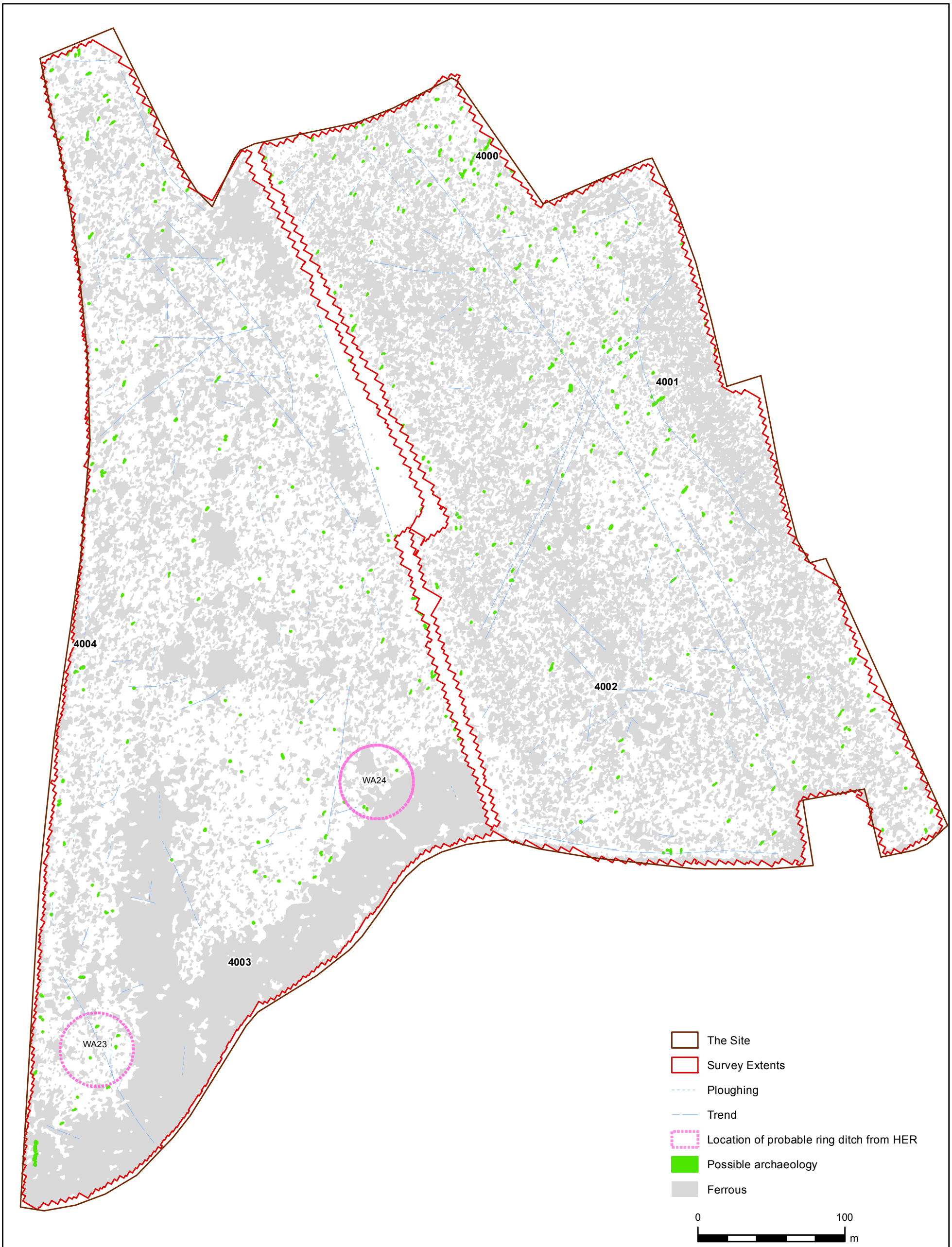
Interpretation, southern half of site

Figure 7



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Interpretation

Figure 8

wessex archaeology

salisbury rochester sheffield edinburgh

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk

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