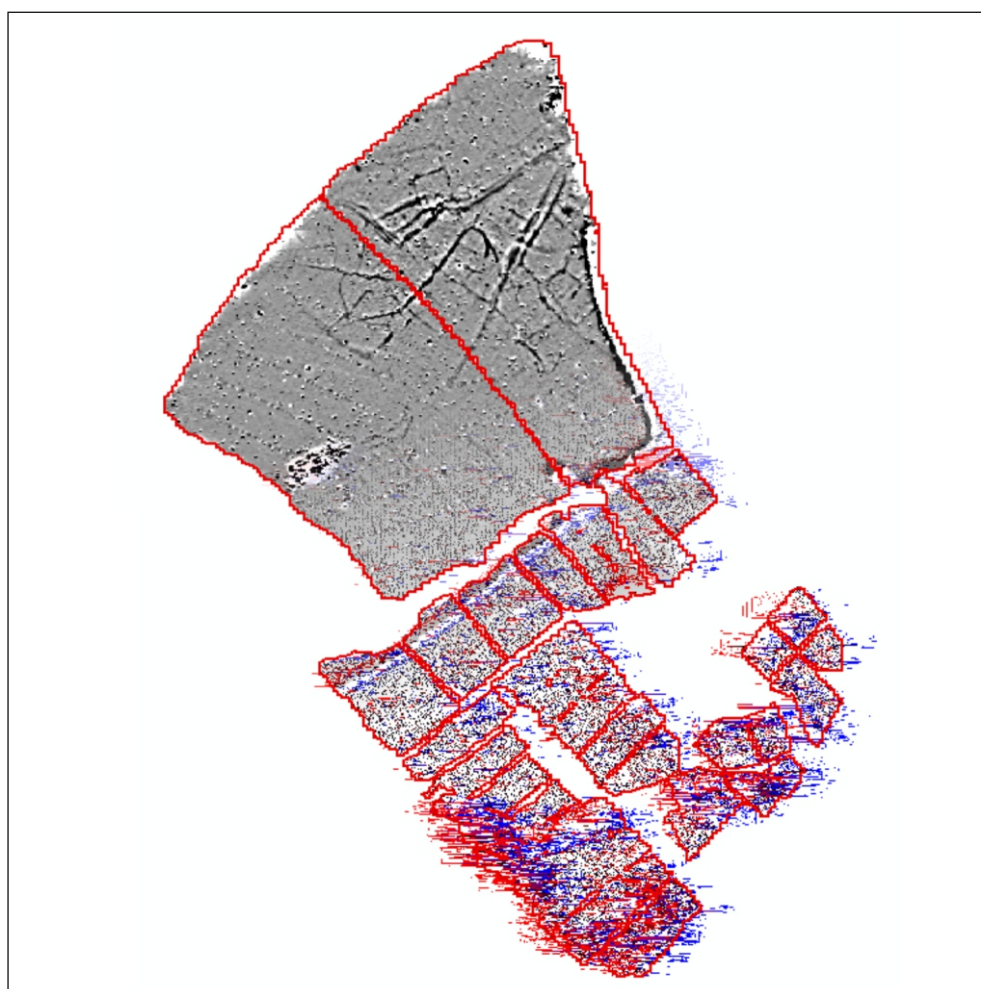




making sense of heritage

Land at Glenmore Farm Westbury, Wiltshire

Detailed Gradiometer Survey Report



Ref: 105111.01
September 2014



Land at Glenmore Farm, Westbury, Wiltshire

Detailed Gradiometer Survey Report

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Glenmore Farm, Hawkeridge Road, Westbury, Wiltshire (NGR 386371, 152855) with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of proposed development of the site for residential and business use. The project was commissioned by Taylor Wimpey UK Limited, following the recommendations of a desk-based assessment undertaken by Wessex Archaeology which established the potential for the presence of buried archaeological remains.

The survey area consists of a single large field to the north-west and another area around the farm complex to the south-east subdivided in many smaller rectangular enclosures, it has a mixed use of arable and pasture. The gradiometer survey was undertaken between 27th and 29th August 2014 using Bartington Grad601 instruments, and has demonstrated the presence of anomalies of likely, probable and possible archaeological interest along with ploughing, some trends of uncertain origin and three modern services.

In the northernmost portion of the Site, the geophysical data revealed a concentration of several interconnecting linear and curvilinear anomalies, interpreted as ditches and enclosures. They indicate the presence of a settlement of unknown date but archaeological evidence from previous archaeological evaluations and geophysical survey on land to the east of the Site suggests origins in the prehistoric or Romano-British periods.

Other features identified included ploughing trends and probable ceramic field drains, also visible as cropmarks on satellite imagery. The southern half of the Site is heavily disturbed by modern services, numerous field divisions and a large amount of ferrous material; and extensive areas of medieval or post-medieval ploughing were recorded. Apart from these, few anomalies of archaeological potential have been identified in these areas.



Land at Glenmore Farm, Westbury, Wiltshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Taylor Wimpey UK Limited. The assistance of Mark Thorne is gratefully acknowledged in this regard.

The fieldwork was undertaken by Patrick Dresch and Alistair Black. Ross Lefort processed the geophysical data which was interpreted by Jennifer Smith and Genevieve Shaw. The report was written by Genevieve Shaw. The geophysical work was quality controlled by Dr. Paul Baggaley, Ross Lefort and Ben Urmston. Illustrations were prepared by Richard Milwain. The project was managed on behalf of Wessex Archaeology by Nicholas Cooke.



Land at Glenmore Farm, Westbury, Wiltshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Taylor Wimpey UK Limited to carry out a geophysical survey on land at Glenmore Farm, Westbury, Wiltshire (**Figure 1**), hereafter “the Site” (centred on NGR 386371, 152855). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the development of the Site for residential and business use. A Desk-Based Assessment (DBA) has been completed by WA, which established the likelihood of the presence of buried archaeological remains (WA 2014).

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

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

1.2 Site Location and Topography

1.2.1 The survey area consists of a single large field to the northwest and another area around the farm complex to the southeast, which has been subdivided using wooden and electric fencing resulting in a total land area of approximately 9.7 hectares. The southeastern area is currently used for grazing while the northeastern field is utilised for hay (**Figure 1**).

1.2.2 The Site is bounded to the north-west by the West Wiltshire Trading Estate, to the east by Hawkeridge Road, to the south-east by the road known as The Ham, to the south-west by the residential properties of Hawkeridge Park and to the west by agricultural fields. A mature hedgerow separates the north-western and south-eastern areas.

1.2.3 The topography is generally level at an elevation of approximately 66m above Ordnance Datum (aOD). The Site encompasses 9.7ha, of which a total of 7.9ha was surveyable; this reduced area was due to the presence of field boundaries.

1.3 Soils and Geology

1.3.1 The bedrock geology under the Site is recorded as the Oxford Clay formation, though adjacent to The Ham is an area mapped as limestone of the Todber Freestone Member with a small area shown as of the Hazelbury Bryan Formation sandstone within this area and adjacent to Hawkeridge Park. There are no superficial deposits recorded at the Site (BGS).

1.3.2 The soils underlying most of the Site are likely to be a mix of pelo-stagnogley soils of the 712b (Denchworth) association and typical calcareous pelosols of the 411a (Evesham 1) association (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.

1.4 Archaeological Background

The DBA undertaken by WA provides a comprehensive archaeological background to the Site (WA 2014). **Figure 2** is a summary of the archaeological potential and known archaeological features identified during previous archaeological evaluations in the vicinity of the Site. Reference to archaeological information from the DBA is included where relevant to the geophysical interpretation.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad 601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (English Heritage 2008).

2.1.2 The geophysical survey was undertaken by WA's in-house geophysics team between 27th and 29th August 2014. 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 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 ($\pm 5\text{nT}$ 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 a few anomalies of likely, probable and possible archaeological interest across the Site, along with two modern services. Results are presented as a series of greyscale and XY plots, with corresponding archaeological interpretations, at a scale of 1:2000 (**Figures 3 to 5**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 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 5**). 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 The most significant anomalies are concentrated in the northern fields within an area approximately 150m x 150m. There are several large linear and curvilinear positive anomalies orientated north-east to south-west interpreted as ditches with numerous short linear features interconnecting. They have been interpreted overall as an area of enclosure and settlement but of unknown date.
- 3.2.2 Within the northeastern field, band of anomalies **4000** comprises a positive linear anomaly extending westwards from the eastern field boundary and terminating in three shorter parallel segments of ditch at the southwestern end. This ditch may therefore extend outside the survey area to the east. A sub-rectangular group of anomalies lie to the north of **4000**, and probably represent an enclosure with a further possible second enclosure attached.
- 3.2.3 At **4001** is a curvilinear positive anomaly, which forks at one end while the straight section of the ditch runs into a rectangular enclosure at the south-western end at **4004**; the relationship between the linear anomaly and the enclosed rectangular area is not apparent from the geophysical data alone. Within the enclosed area at **4001** are further subdivisions.
- 3.2.4 Between **4000** and **4004** are further interconnecting rectilinear positive anomalies as well as smaller, weaker and shorter linear positive anomalies with responses between 0.5nT and 3nT. These could represent further enclosures but it is unknown if they are contemporary or not as they are within an area crossing the current field boundary.
- 3.2.5 At **4002** is another archaeological anomaly in the form of a two parallel positive linear anomalies interpreted as ditches which then combine into a single ditch at the southwestern end. There are definite breaks in these linear anomalies, possibly indicating entrances or through-routes across what would have probably been a larger boundary earthwork; it is not possible to determine whether these interruptions were caused by later truncation however.
- 3.2.6 At **4005** the linear and curvilinear ditch features extend further southeast but are weaker magnetically, typically in the region of +0.5nT compared to the positive magnetic responses around **4000** - **4002** which are typically +3-5nT and peak at +10nT around



4002. This could possibly be attributed to a 'habitation effect', whereby anomalies are strongest near the centre of an area of activity and become weaker with distance from the centre or core occupation area of the Site; the main area of occupation activities would take the form of fires, burning and refuse disposal, all of which would increase the magnetic enhancement of the material infilling cut features (Gaffney and Gater 2003).

- 3.2.7 Further out at **4006** is a long linear positive anomaly on a similar alignment to the rectangular enclosure at **4004** and therefore possibly associated. It is weaker in response, approximately 1nT, and this could possibly be due to the 'habitation effect' mentioned above.
- 3.2.8 At **4010** are a series of regularly spaced linear anomalies interpreted as ceramic field drains. They are orientated north-west to south-east whereas at **4011** they are orientated north-east to southwest. In between these two areas is a larger oval shaped area containing a large amount of ferrous debris, possibly an infilled quarry area, which is likely to be modern in origin.
- 3.2.9 Within the southeastern area isolated anomalies **4007** and **4008** are weak and approximately linear, interpreted as possible archaeology. They could be possible ditches potentially former field boundaries.
- 3.2.10 In the smaller divided fields within the south-eastern area such as at **4007**, **4012**, and **4013**, weak positive linear trends are interpreted as ploughing, probably dated to the medieval or post-medieval periods; all are oriented northwest to southeast parallel with existing boundaries.
- 3.2.11 The remaining anomalies detected throughout the dataset include isolated pit-like anomalies of possible archaeological interest and weak linear trends of uncertain origin. It is unclear whether these features indicate the presence of archaeological features or are of modern or geological in origin.
- 3.2.12 The southeastern area is subdivided into numerous small rectangular enclosures delineated by wire and wooden fencing. There are also large concentrations of ferrous especially around **4008** – **4009** and **4014** - **4015** increasing in density around the farm buildings and housing estate to the south. This is likely to be related to the spreading of modern debris and in response to the modern services running through these areas. While ploughing trends are visible in some of the enclosures that have lower concentrations of ferrous, in other areas any weaker responses of archaeological potential will be masked by the much stronger ferrous response.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

- 3.3.1 Three modern services have been identified at **4012**, **4008** to **4014** and **4015**; they mainly extend across the field to the south of Glenmore Farm with one service running into the Farm itself.
- 3.3.2 It is not clear from the geophysical data whether the services identified are in active use. It should also be noted that gradiometer survey may not detect all services present on Site. 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 successful in detecting anomalies of likely, probable and possible archaeology as well as ploughing and agricultural trends, a large amount of magnetic disturbance and two modern services.
- 4.1.2 The most interesting anomalies are the interconnecting linear and curvilinear anomalies around **4000 – 4005** interpreted as enclosures or settlement area. While a rectangular enclosure has previously been identified by a cropmark within the north-western field (Wiltshire HER Ref: MWI1585), this was thought to be associated with modern drainage features. The geophysical data have revealed a much larger area of settlement activity consisting of several rectangular enclosures, one of which is possibly the recorded cropmark.
- 4.1.3 The Site was identified in the DBA as an area of multi-period use ranging from the Bronze Age to the post-medieval and 19th century. The adjacent area that was subject to evaluation discovered Iron Age and Romano-British occupation; however, previous evaluations to the north at Hawkeridge Farm, and further east of the Site at Blenches Mill Farm, identified post-medieval field systems and settlement features connected with agricultural and mill-working practices (WA 2011 and WA 2013 respectively).
- 4.1.4 An evaluation undertaken immediately to the east of the Site in 2003 as part of the archaeological works for the Westbury bypass (WA 2004). These trenches revealed an area of ditched enclosures containing large amounts of pottery dating to the 2nd to 4th centuries AD with the overall site interpreted as a Romano-British field system. No settlement features in the form of dwellings or industrial activity were excavated suggesting that the core settlement area contributing the large amount of pottery and two inhumations has still not been found.
- 4.1.5 The 'habitation effect' commented on above does not necessarily mean that the core settlement area has been identified within the Site. The main ditch anomalies lie on the same orientation as those in the Westbury Bypass evaluation immediately to the east, which may suggest they are contemporary parts of the same field system.
- 4.1.6 The remaining anomalies appear to be agricultural in origin, mainly in the form of ploughing trends and regularly spaced ceramic field drains. From the DBA (WA 2014) it can be seen that the field boundaries from the Site have not changed since the 1st edition OS map and no further anomalies have been identified within the Site that contradict this. The ploughing identified in the southern half of the site clearly predates this enclosure of the landscape and is likely to be medieval or post-medieval in date.
- 4.1.7 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.
- 4.1.8 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. In the south-eastern area especially few anomalies of archaeological potential have been identified due to the strong magnetic response from modern services,



wire fencing and areas of ferrous debris. The archaeological potential in these areas are probably low with few archaeological features surviving.



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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 ± 100 nT 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 four main categories: archaeological, modern, agricultural and uncertain origin/geological.

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 modern category is used for anomalies that are presumed to be relatively modern in date:

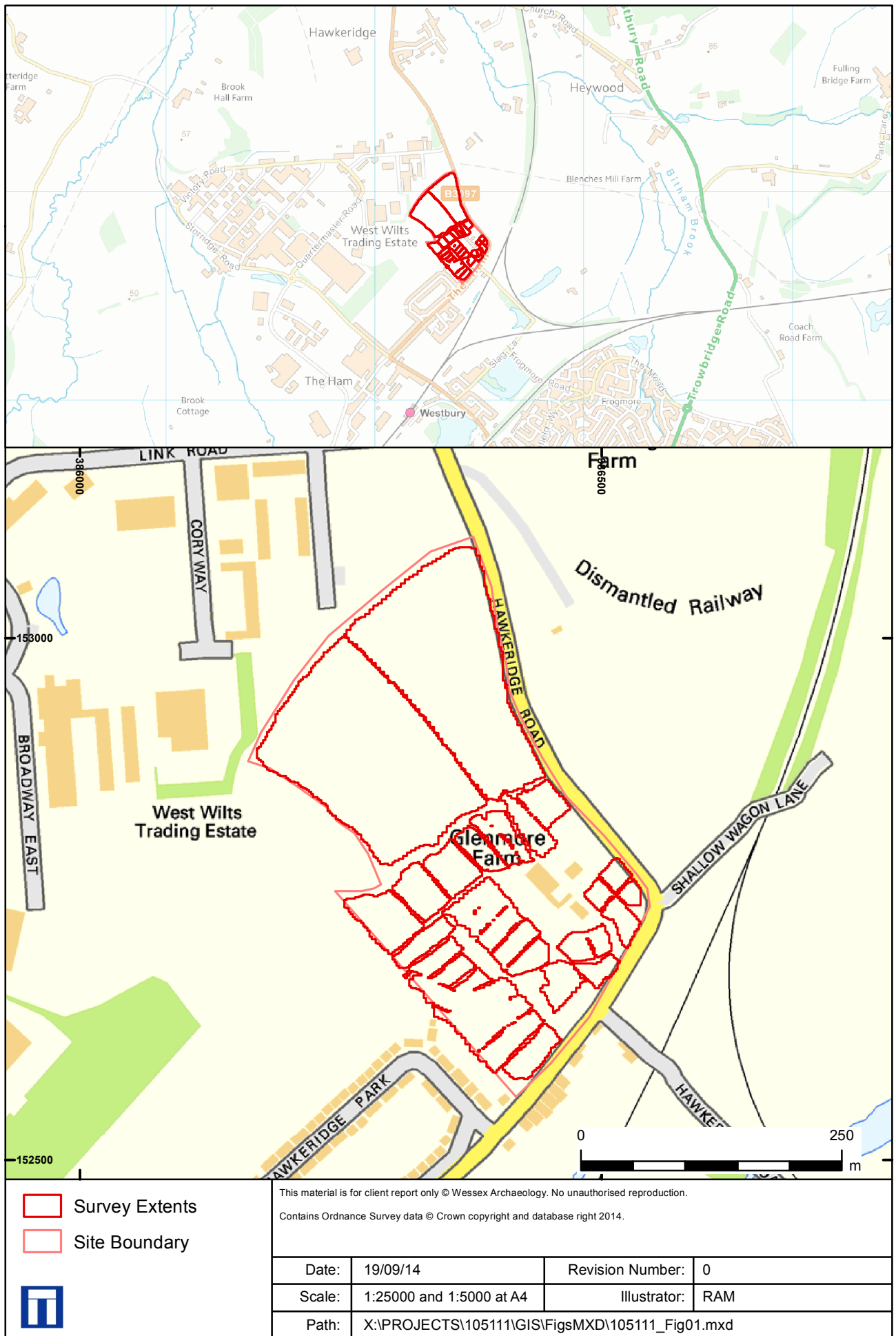
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

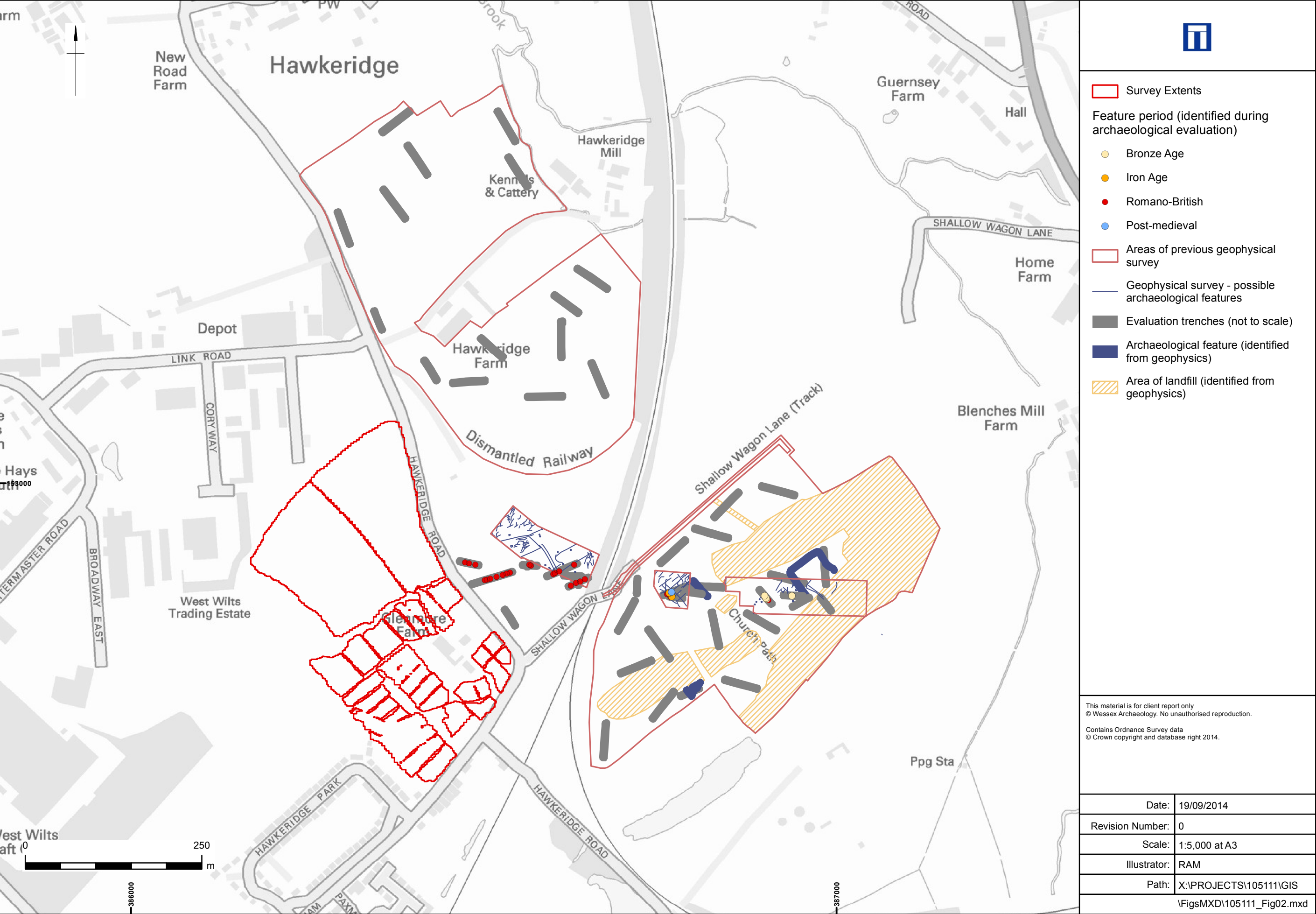
The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- 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.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.



Site location and detailed survey extents


Figure 1



Previous archaeological work

Figure 2



 Survey Extents

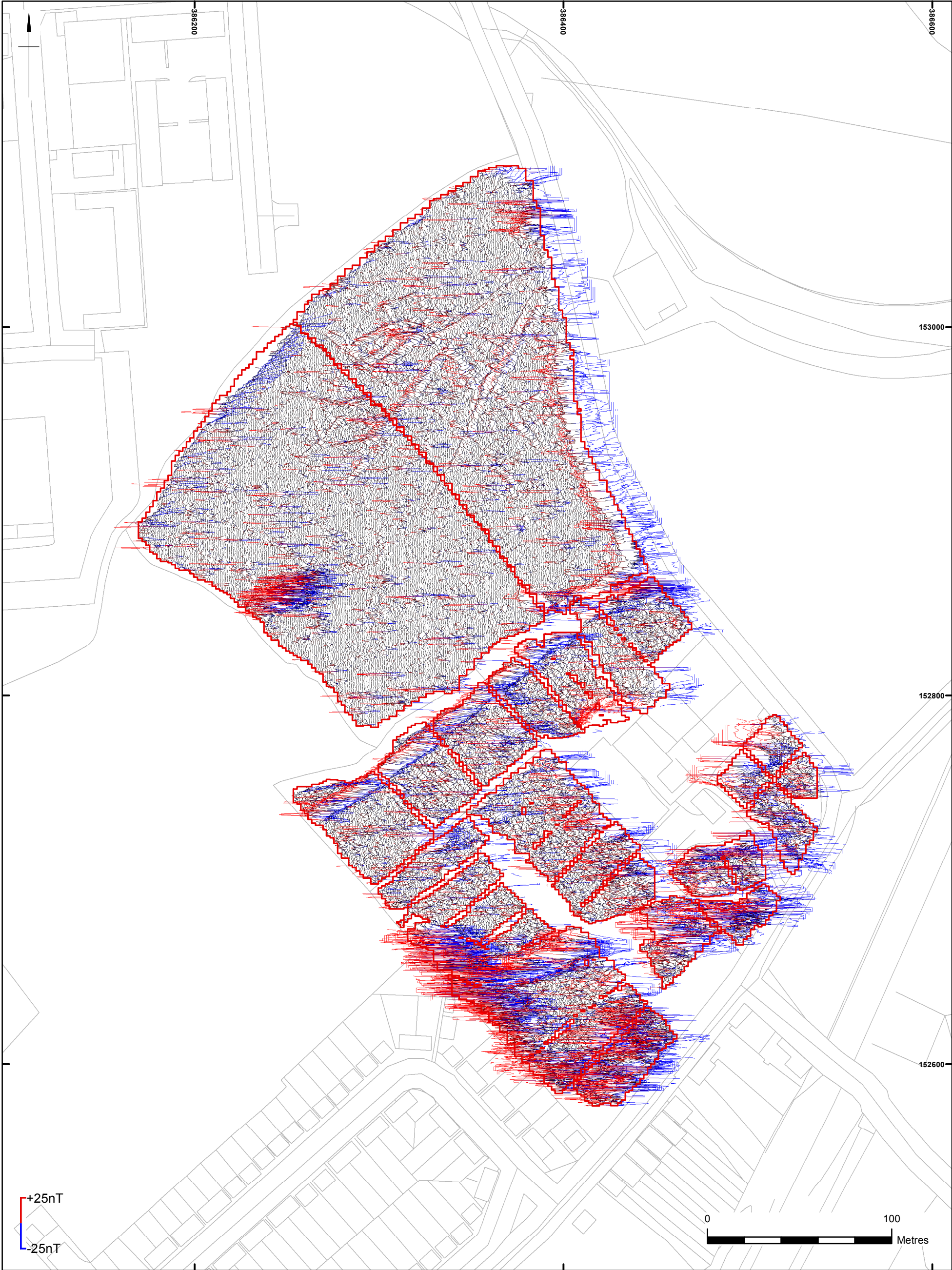


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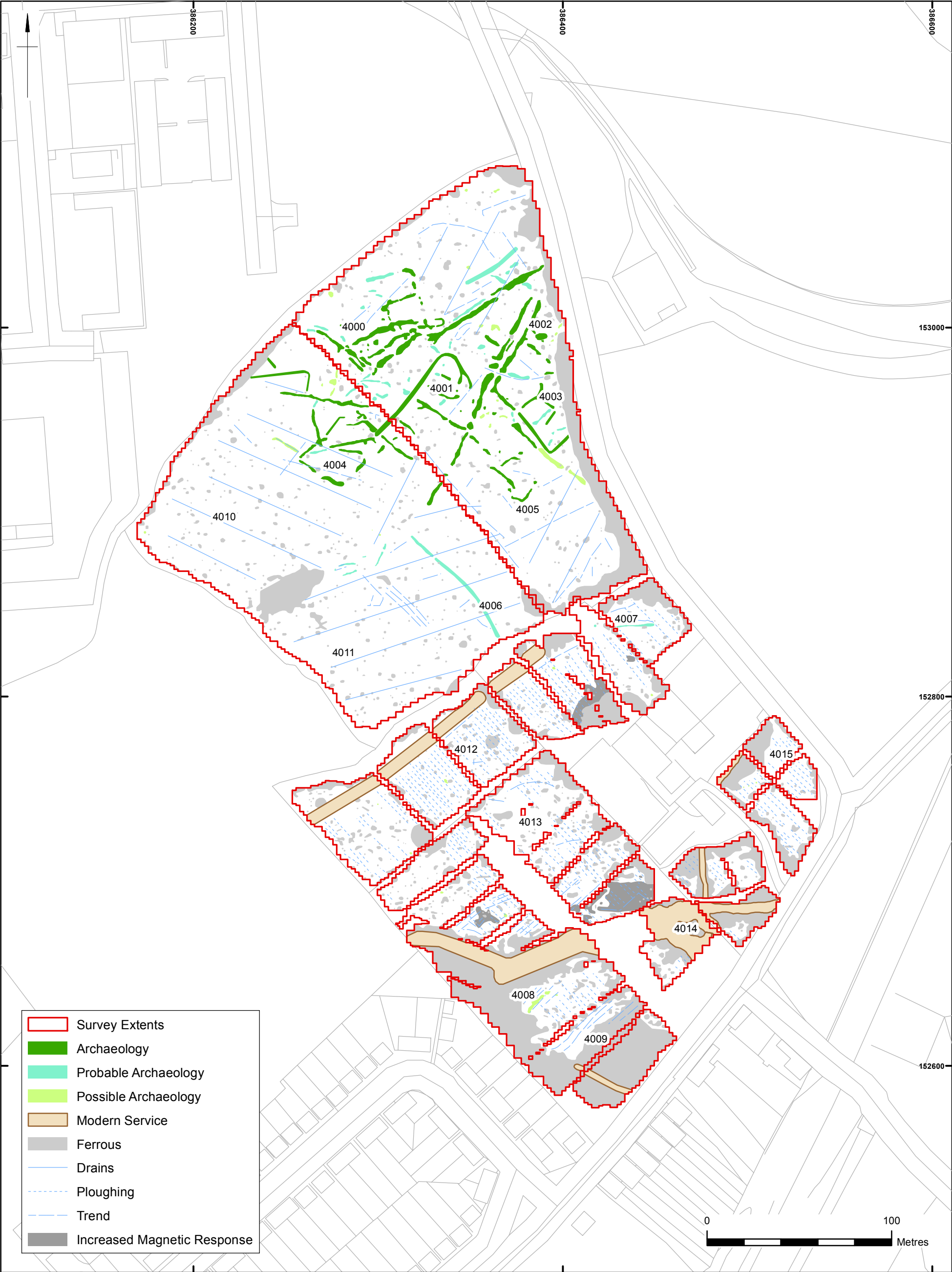
Greyscale plot

Figure 3



XY trace plot

Figure 4



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