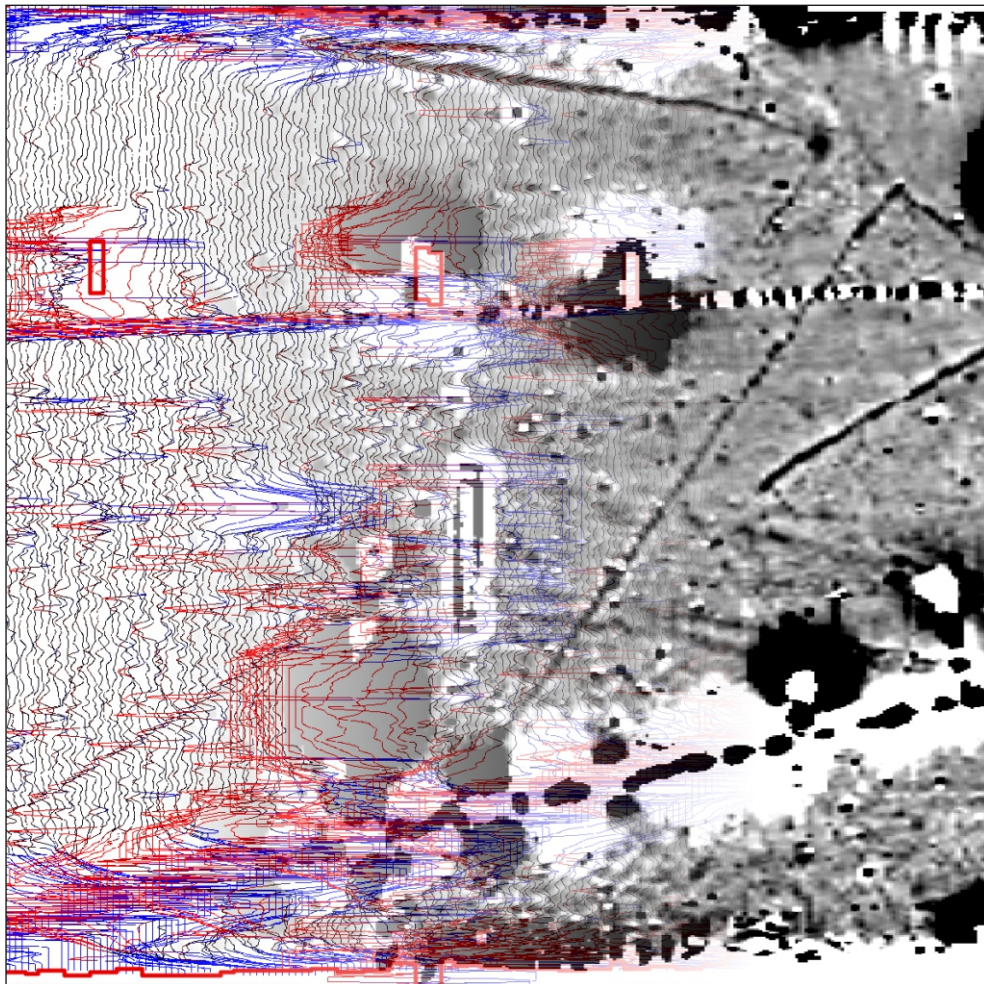




making sense of heritage

Larkhill Officer and SNCO Mess Development

Detailed Gradiometer Survey Report



Ref: 107944.01
August 2015



Larkhill Officer and SNCO Mess Development

Detailed Gradiometer Survey Report

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Larkhill Camp, Durrington, Salisbury (centred on NGR 413000, 145300). The project was commissioned by Aspire Defence Capital Works with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of The Army Basing Programme for Larkhill, Perham Down and Tidworth Military Camps.

The site is located on the northern extent of Larkhill Camp and comprises recreational fields, small wooded copses and a number of buildings. A total of 4.7ha was surveyed out of a proposed survey area of 9.5ha due to a number of obstructions. The geophysical survey was undertaken on 27th and 28th July 2015. The detailed gradiometer survey has demonstrated the presence of anomalies of possible archaeological interest, a number of modern services and a significant amount of ferrous located within the recreational ground relating to its current use as sports pitches.

The anomalies identified as being of archaeological interest are predominantly linear ditch-like features possibly relating to a former road and trackway across the area identified from available historic mapping. Several partial rectilinear ditches have been identified which, within the context of the site as a military camp established in the early 20th century, could potentially have some relevance to features relating to its development, or to military training and practice. A short curvilinear ditch-like feature is identified in the southeast of the Site and has been interpreted as of possible archaeological origin.



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Detailed Gradiometer Survey Report

Acknowledgements

Wessex Archaeology would like to thank Aspire Defence Capital Works for commissioning the geophysical survey.

The fieldwork was directed by Jennifer Smith with the assistance of Alistair Salisbury. Alistair Salisbury processed and interpreted the geophysical data and also wrote the report. The geophysical work was quality controlled by Genevieve Shaw and Paul Baggaley. Illustrations were prepared by Karen Nichols. The project was managed on behalf of Wessex Archaeology by Simon Cleggett.



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Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Aspire Defence Capital Works to carry out a geophysical survey at Larkhill Camp, Durrington, Salisbury (**Figure 1**), hereafter “the Site” (centred on NGR 413000, 145300). The survey forms part of an ongoing programme of archaeological works being undertaken in support of The Army Basing Programme.

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 gradiometer survey results and the archaeological interpretation of the geophysical data.

1.2 Site location and topography

1.2.1 The Site is located 3km west of the village of Durrington and 15km north of Salisbury, Wiltshire.

1.2.2 The proposed survey area is the Recreation Ground and occupies an area of land currently used as recreational fields, buildings and wooded copses used by the British Army. The Site is bounded by a byway on the edge of Salisbury Plain to the north and west with hedgerow/wooded copse field boundaries screening the area on all other extents. The Pavillion building is located on the south side of the Recreation Ground.

1.2.3 The Site is on a flat parcel of land located on the top of a hill at approximately 145m aOD. The Site encompasses 9.5ha of which 4.7ha was surveyable,. The surveyable area was limited by artificial obstructions including goal posts and areas of wooded copse in the south and southeast of the Site.

1.3 Soils and geology

1.3.1 The solid geology comprises chalks with flints of the White Chalk Subgroup of the Upper Cretaceous. These include discrete marl and flint seams. No superficial geology is noted (BGS 2015).

1.3.2 The soils underlying the Site are likely to consist of shallow, well drained calcareous soils of the 341 (Icknield 3) association (SSEW SE Sheet 5 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

- 1.4.1 A Desk-Based Assessment (DBA) was undertaken by WA and provides a comprehensive archaeological background to the Site (Wessex Archaeology 2014). A brief summary is provided below of the archaeological potential and known archaeological features within the immediate vicinity of the Site. Reference to archaeological information from the DBA is included where relevant to the geophysical interpretation.
- 1.4.2 The DBA established archaeological interest for the Site as Larkhill Camp is located within an area of unparalleled importance in terms of prehistoric archaeology (Wessex Archaeology 2014). The southernmost edge of the military camp lies within the Stonehenge portion of the Stonehenge and Avebury Associated Sites World Heritage Site (WHS) whilst the entirety of the camp also lies within an Area of Special Archaeological Significance, as defined within the Salisbury District Local Plan (2011).
- 1.4.3 As a result, the principal archaeological interest for the Site derives from the potential for the presence of buried remains relating to prehistoric funerary monuments, settlement and agricultural practices. There are two scheduled monuments within 1km of the Site which are of at least national significance. Knighton Long Barrow (National List no. 1012167) is located approximately 75m to the west of the Site and Long Barrow (National List no. 1010052) is approximately 1km to the southwest of the Site. There are two Bronze Age axe findspots in the immediate vicinity of the Site (Pastscape ID 219385; 218921) and traces of potentially regionally significant prehistoric settlement activity was revealed within the camp during an archaeological watching brief (Wessex Archaeology 2009).
- 1.4.4 In contrast to the significant prehistoric potential of the area, there is little recorded evidence of Iron Age to post-medieval date activity within the vicinity of Larkhill Camp. Cropmarks have been identified from aerial photographs within and immediately to the northeast of the camp that may be of Iron Age and/or Romano-British date (Pastscape ID 218967) and reports of Romano-British pottery discovered to the south of the camp suggest some degree of activity during this period (Wessex Archaeology 2014).
- 1.4.5 There is little evidence of Anglo-Saxon or medieval activity within the immediate vicinity however, it is possible that Anglo-Saxon burials may be encountered in the vicinity of any prehistoric monuments within the Site (Wessex Archaeology 2014).
- 1.4.6 The Larkhill Camp Recreation Ground first appears on available historic mapping in 1924 with the area enclosed and a Pavillion building at its west end, prior to this there was a road and a smaller track or pathway crossing the Site (Ordnance Survey 1924; 1901 respectively). The potential was highlighted for sub-surface remains of importance to the development of the military camp and the Royal School of Artillery at Larkhill (Wessex Archaeology 2014). These might include early 20th century practice trenches, the military railway, features relating to military airfields, or evidence relating to the role of the camp during the First and Second World Wars. Military practice trenches from World War I are visible as earthworks to the north of the Site (Pastscape ID1353629) and slit trenches from World War II are recorded to the south of the Site (Pastscape ID 1353631; 1353638).



2 METHODOLOGY

2.1 Introduction

- 2.1.1 The detailed gradiometer survey was conducted using a Bartington Grad 601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with Historic England guidelines (English Heritage 2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on the 27th and 28th July 2015. Field conditions at the time of the survey were good, with dry conditions throughout the period of survey. An overall coverage of 4.7 ha was achieved.

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 Historic England recommendations (English Heritage 2008).
- 2.2.2 The detailed gradiometer 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 Historic England guidelines (English Heritage 2008). Data were collected in the zigzag method.
- 2.2.3 Data from the survey were subject to minimal data correction processes. These comprise a zero mean traverse function ($\pm 5nT$ 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 throughout the survey area, 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 detailed gradiometer survey has identified magnetic anomalies across the Site, along with areas of increased magnetic response and a large amount of ferrous. Results are presented as a series of greyscale plots, XY plots and archaeological interpretations at a scale of 1:1500 (**Figures 2 to 4**). 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 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 dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- 3.1.4 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 present than have been identified through geophysical survey.
- 3.1.5 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

3.2 Gradiometer survey results and interpretation

- 3.2.1 The most significant features of interest are several strongly positive linear and rectilinear anomalies identified across the Site at **4000 to 4004**. Their similar magnetic response and layout suggests they are related. Available historic mapping does not show any former field systems in this area (Ordnance Survey, 1879) therefore they may have an association with the military camp. These potentially extend beyond the boundaries of the geophysical survey. Initially thought to be drainage constructed for the recreational ground, the proximity of locations of archaeological interest detailed by the DBA may determine otherwise (Wessex Archaeology 2014). Most pertinent are the recorded locations of WWI and WWII slit trenches to the north (Pastscape ID 1353629) and to the south (Pastscape ID 1353631; 1353638).
- 3.2.2 A distinct, large anomaly with a defined linear area of weaker magnetic response is identified bisecting the Site on an approximate northwest to southeast orientation from **4005 to 4006**. An area of weaker magnetic response can be indicative of a former bank or can be in response to an area of compacted ground. This linear feature corresponds to the location of a track or road identified from historic mapping (Ordnance Survey, 1879) and is interpreted as a Former Track. The feature extends outside of the survey area (Ordnance Survey, 1879) but is masked and has been truncated here to the southeast by a modern service (**4014**). The track or road does not appear after 1901 (Ordnance Survey 1901; 1924). The width of the negative linear area is approximately 20m and along its outer extents there are several intermittent, linear positive anomalies which suggest narrow ditch-type features. These are likely to be associated with the larger negative linear anomaly due to their location and similar alignment but have been characterised as Possible Archaeology as this is unconfirmed. There are numerous linear anomalies that



span the central section of the former trackway. Although some may suggest ditch anomalies, they don't bear the clear characteristics of cut features and have less of a magnetic response to the surrounding matrix. They have been characterised as Trends of uncertain origin but may still have archaeological potential.

- 3.2.3 A second, similar distinct linear area of weaker magnetic response is visible at **4007** as a negative contrast compared to the surrounding matrix and aligned north-northwest to south-southeast. This suggests that no obvious cut features are related to the anomaly but the weakly negative trends may instead be associated with an area of compacted ground, consistent with the origin of a track or path. This anomaly corresponds to the location of a path on historic mapping (Ordnance Survey, 1879) and is interpreted as a Former Track.
- 3.2.4 To the southeast of the survey area at **4008** is part of a positive curvilinear anomaly with several weakly positive oval and sub-oval shaped pit-type anomalies. The feature has unclear extents and is not well defined and has been characterised as Possible Archaeology. It may form part of a larger feature but it is not possible to be certain from the dataset as there is a large amount of ferrous in this area potentially masking weaker anomalies.
- 3.2.5 Narrow pairs of positive linear anomalies are observed at **4009** and **4010** extending northeast-southwest and approximately west-east respectively. Although not appearing on historic mapping, they have the shape and form of thoroughfares possibly used by past agricultural activity.
- 3.2.6 Numerous sub-circular anomalies are scattered throughout the site such as at **4010**. Their nature suggests the form of pit-type features. Due to the unsystematic positioning of these, it is not possible to know their provenance and they are characterised as Possible Archaeology. They could also be of natural origin, such as a tree-throw hole.
- 3.2.7 Weaker linear trends such as at **4011** may be related to variations in the soil structure or any underlying geology.
- 3.2.8 In the westernmost area around **4012**, almost the whole area is covered by magnetic disturbance caused by large iron objects scattered on the ground. Any potential for archaeological anomalies relating to the long barrow described in the DBA (Wessex Archaeology 2014) may have been masked by these highly ferrous readings. A few weak, linear trends were identified but no anomalies of more substantial interest.
- 3.2.9 A number of football posts and rugby posts are arranged on the Site which has left a number of discrete areas obscured by a strong ferrous 'halo' response. No anomalies have been identified within these areas as the strong ferrous response will have masked them.
- 3.2.10 At the very centre of the Site the geophysical survey has detected the AstroTurf cricket wicket.

3.3 Modern Services

- 3.3.1 Numerous modern services were detected by the geophysical survey. They are located throughout the Site. There are two larger services extending right across the Site from the western extents to the eastern and these are at **4014** and **4015**. The modern service at **4015** likely truncates the Former Track identified at **4006**. As well as these there are



several smaller services located on the outer extents of the Recreation Ground at **4012**, **4013** and **4016**.

4 CONCLUSION

- 4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest across the Site, some of them possibly related to the military functions of Larkhill Camp. In addition to these anomalies interpreted as former thoroughfares, numerous trends and a large amount of ferrous disturbance have been identified.
- 4.1.2 The linear and rectilinear ditch-type anomalies at **4000** to **4004** are interpreted as Possible Archaeology as they do not correspond to former field boundaries and are not characteristic in their magnetic response of ceramic drainage. They are visible on available satellite imagery as an intricate pattern of linear trends and within the context of the Site and its known archaeology are potentially related to the military camp. Early 20th century practice trenches are recorded to the north (Pastscape ID 1353629) and to the south (Pastscape ID 1353631; 1353638) and the potential for sub-surface remains of importance to the development of the military camp and the Royal School of Artillery at Larkhill was highlighted in the DBA (Wessex Archaeology 2014).
- 4.1.3 The Former Track at **4005** to **4006** bisecting the Site laterally corresponds to the location of a former road or trackway that was once a thoroughfare linking The Bustard with Durrington from at least the late 19th century. It appears to have become disused somewhere between 1901 and 1924 with the enclosure of this area by the construction of the Recreation Ground (Ordnance Survey, 1879; 1901; 1924). This is also the case for the Former Track interpreted at **4007**.
- 4.1.4 The partial curvilinear ditch-type anomaly at **4008** with further possible pit-type anomalies in the same area is difficult to characterise further due to the amount of stronger ferrous anomalies in this area masking these potential weaker archaeological anomalies.
- 4.1.5 Regularly spaced sub-circular ferric halos can be seen across the site. These are the locations of the football and rugby posts currently across the Site.
- 4.1.6 In the vicinity of the modern services and in the southwest area of the survey around **4012** few or no anomalies of archaeological potential have been identified due to this strong magnetic response. Around **4012** especially, while there are a number of modern services located here which have potentially truncated any archaeological remains. A large amount of ferrous debris was also present on the surface that will have masked any weaker magnetic anomalies of potential archaeological interest.



5 REFERENCES

5.1 Bibliography

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

Wessex Archaeology, 2014. *Archaeological Desk-Based Assessment, Project Allenby/Connaught Larkhill, Wiltshire*. Unpublished Client Report ref: 101480.41

5.2 Cartographic and documentary sources

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

Ordnance Survey County Wiltshire, 1879, 1:2500

Ordnance Survey County Wiltshire, 1901, 1:2500

Ordnance Survey County Wiltshire, 1924, 1:2500

5.3 Online resources

UK Soil Observatory, <http://www.ukso.org> [accessed July 2015]

British Geological Survey, <http://www.bgs.ac.uk> [accessed July 2015]



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 Historic England (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 Historic England (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:

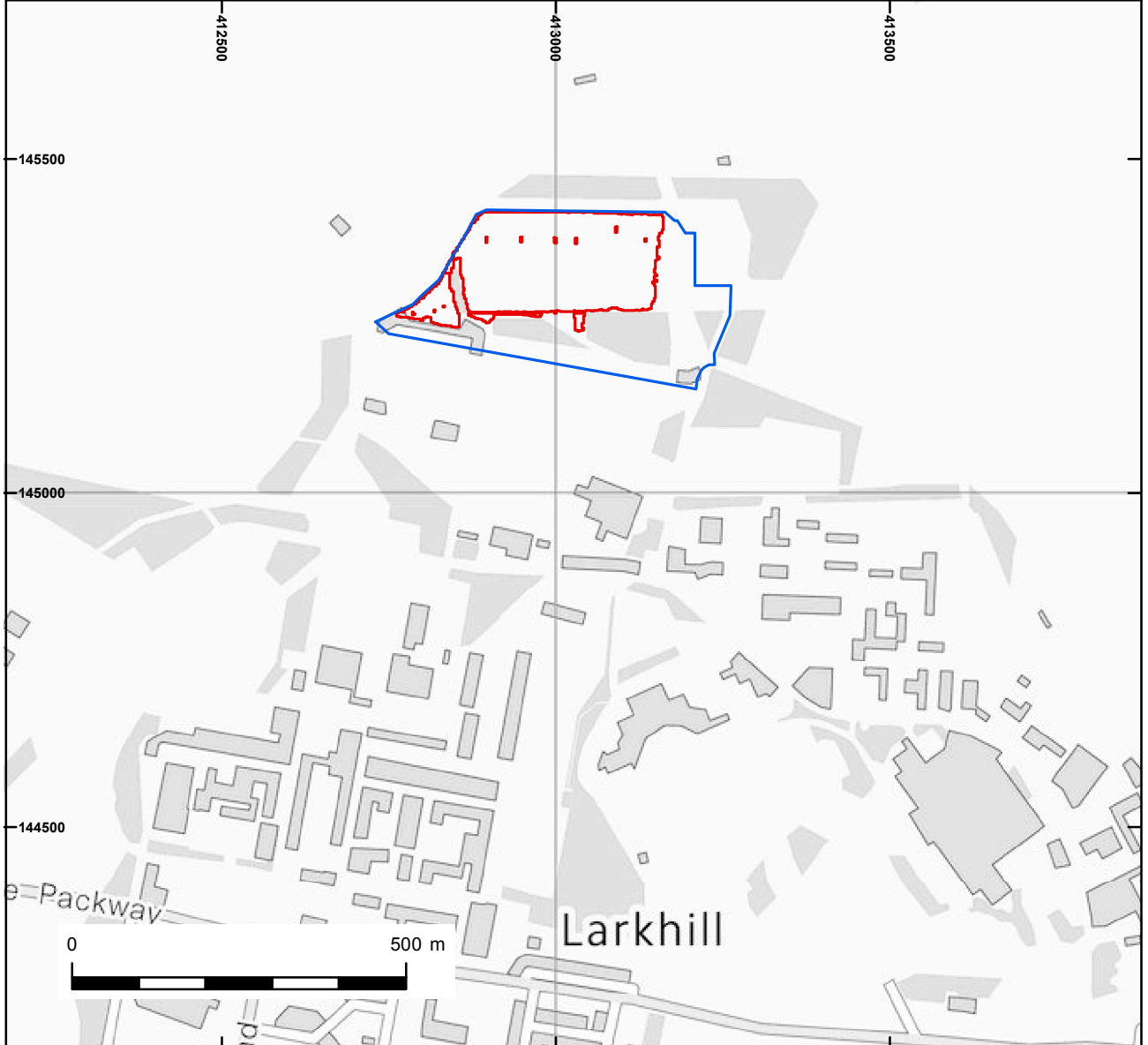
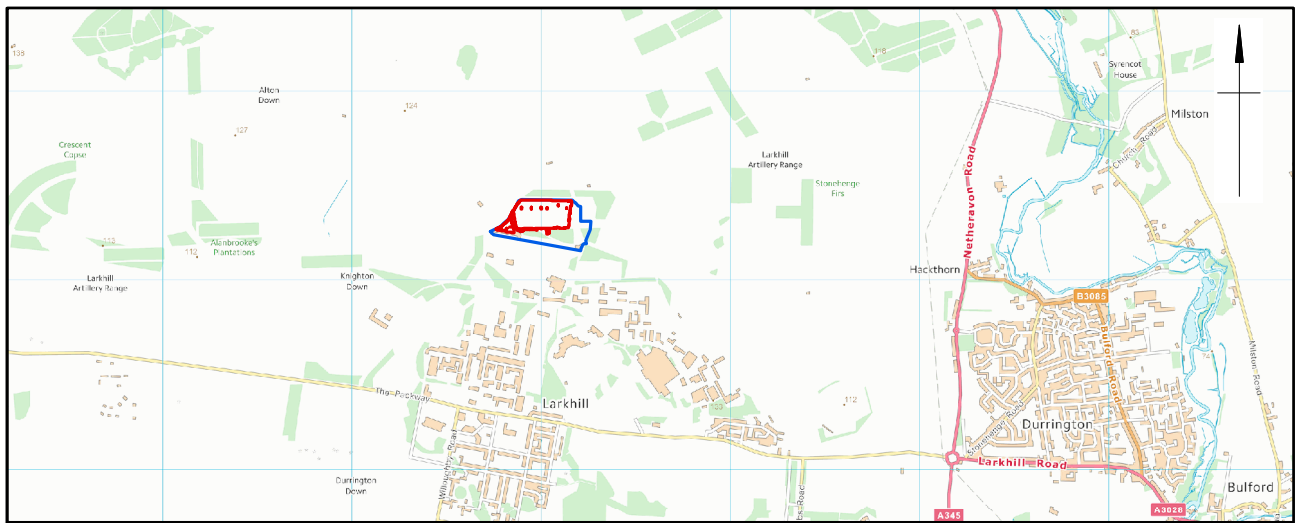
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be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

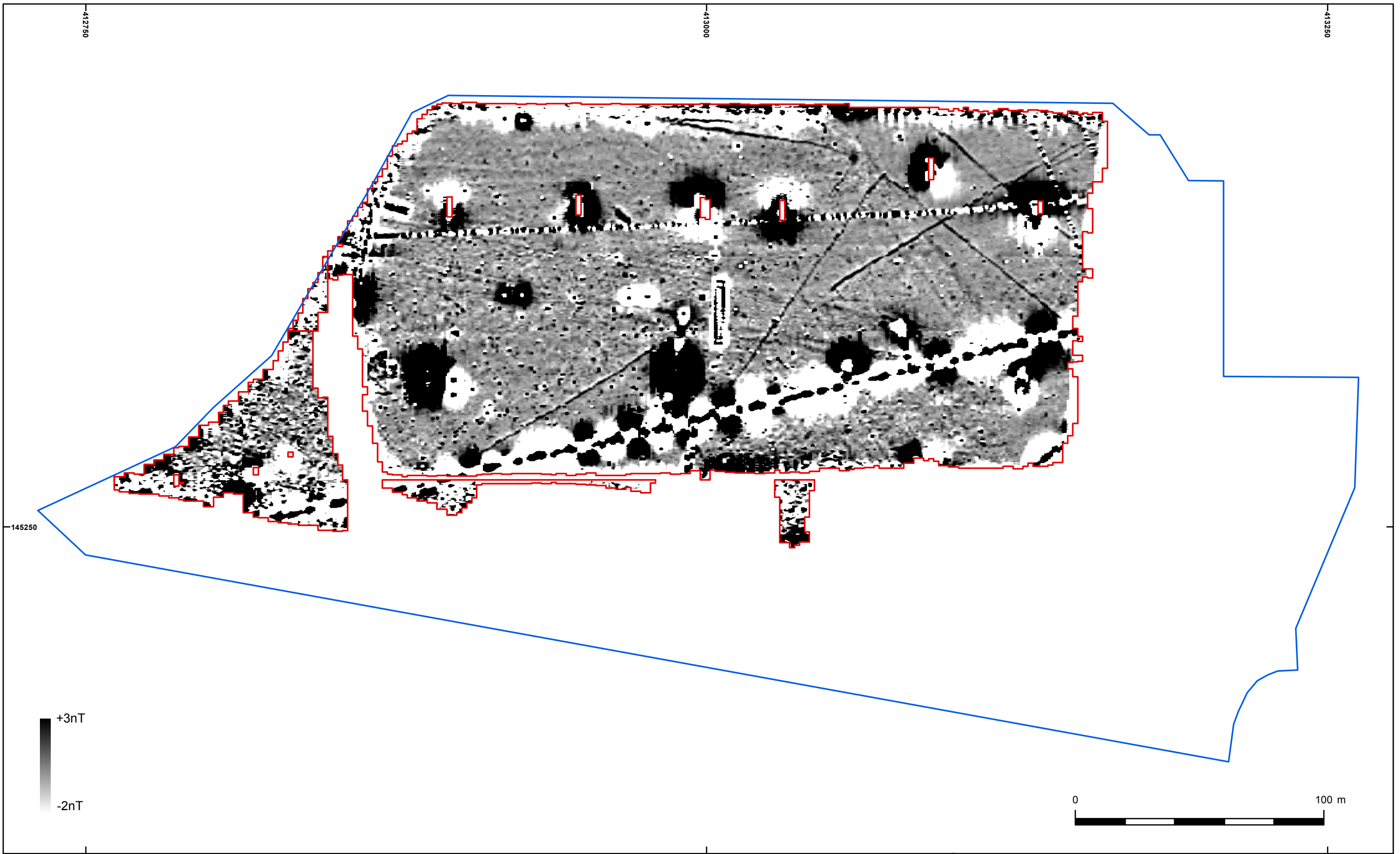


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Site location

Figure 1



 Site boundary
 Detail survey extents

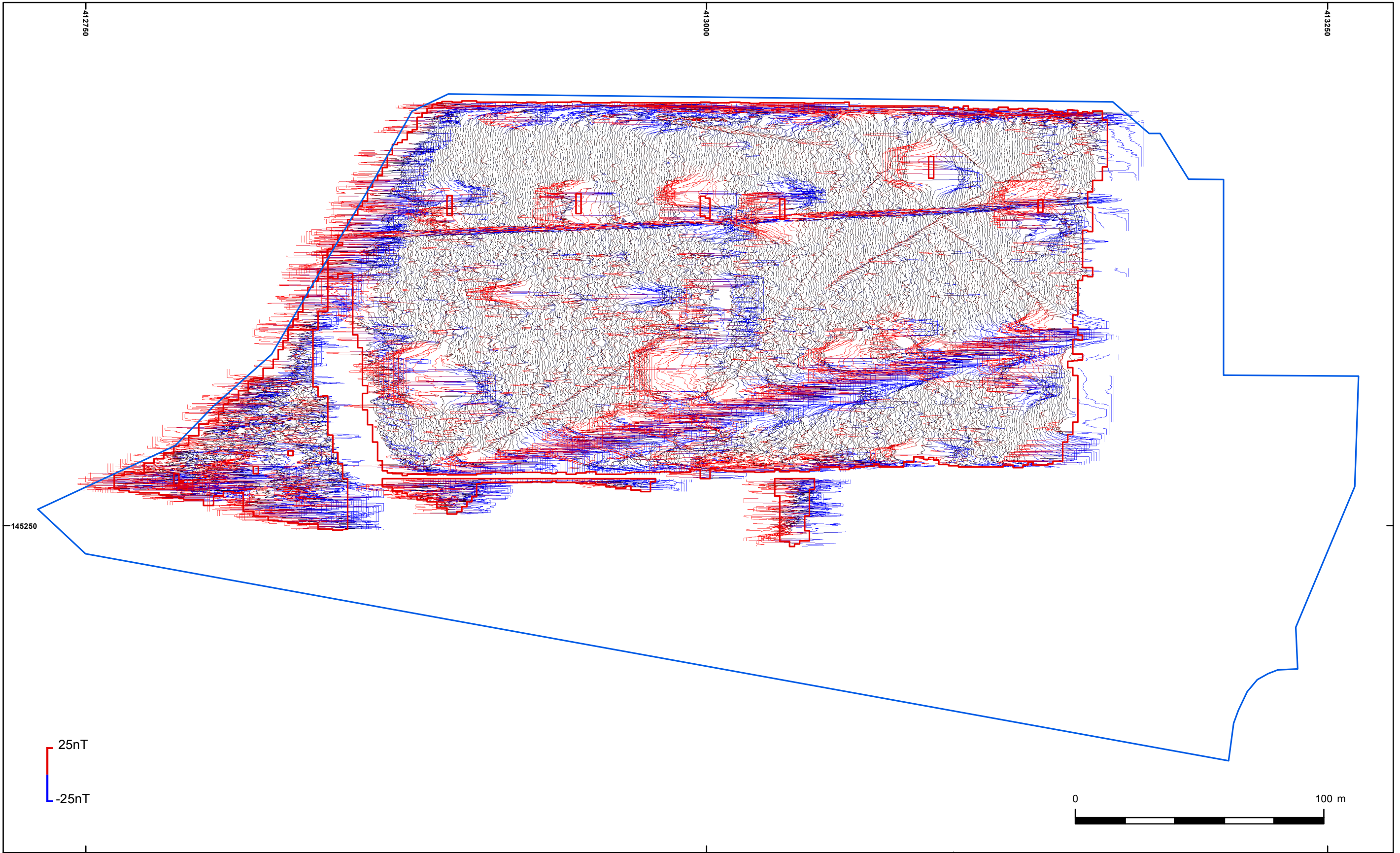


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Greyscale plot

Figure 2




Site boundary
Detail survey extents



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XY Trace plot

Figure 3



- Site boundary
- Detail survey extents
- Possible archaeology
- Former track
- Modern service
- Trend
- Ferrous
- Superficial geology



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