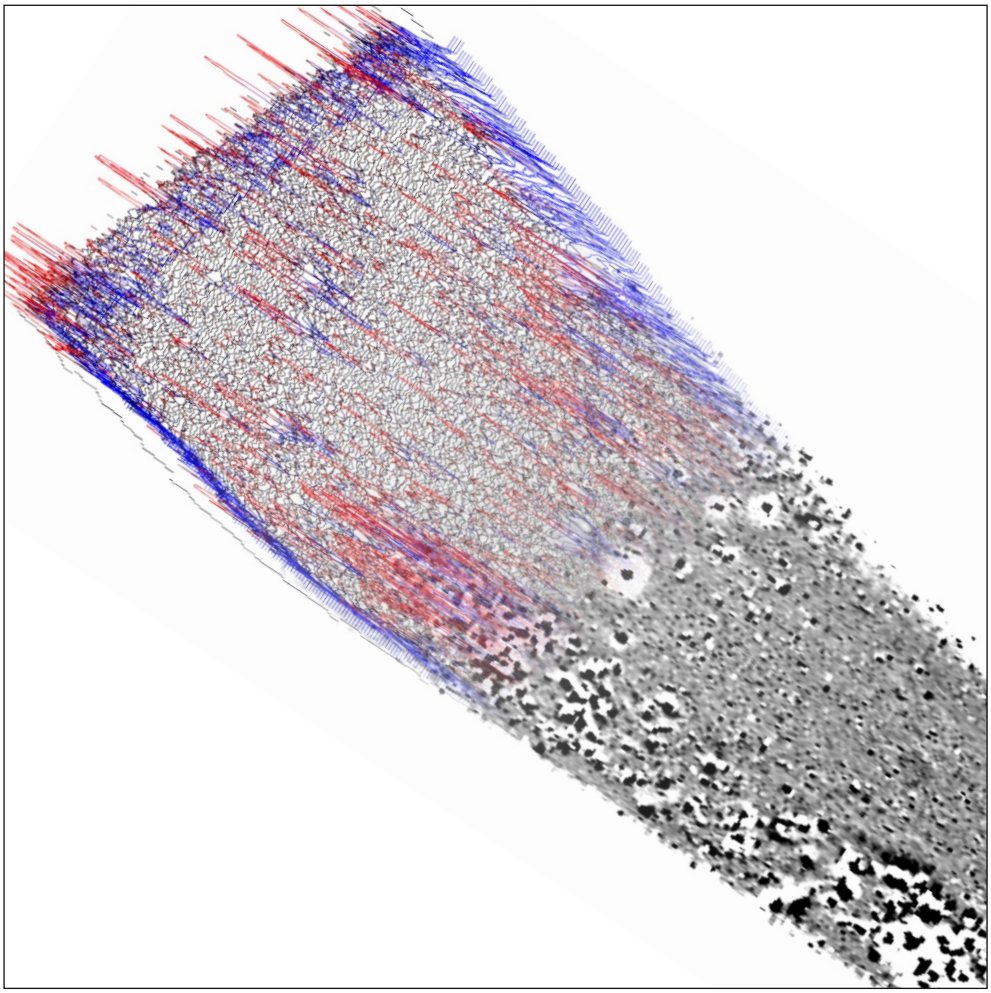
making sense of heritage

Land by Castle Park, Dorchester, Dorset

Detailed Gradiometer Survey Report



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geoservices

Land by Castle Park
Dorchester, Dorset

Detailed Gradiometer Survey Report

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* I = Internal Draft; E = External Draft; F = Final

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Summary

Wessex Archaeology was commissioned by CgMs on behalf of their client CG Fry to undertake a detailed gradiometer survey of land south of Dorchester, Dorset (centred on NGR 368161, 089221). The aim of the work was to establish the presence, or otherwise, and nature of detectable archaeological features on the site as part of a programme of archaeological works ahead of proposed development at the Site.

The site is located approximately 1.33km southwest of the centre of Dorchester and 9.7km north of Weymouth. The site comprises one agricultural field, a playing field and a grassed area adjacent to housing located to the north of the A35 and just south of Dorchester town.

Detailed gradiometer survey was undertaken over all accessible parts of the site, a total of 5.6ha, and has demonstrated the presence of only a few small anomalies of possible archaeological significance. The majority of detected features relate to agricultural activity with at least one former field boundary and numerous ploughing trends detected.

The survey was undertaken between 16th and 20th October 2014.

Land by Castle Park
Dorchester, Dorset

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by CgMs Consulting on behalf of their client CG Fry. The assistance of Matthew Smith of CgMs is greatly appreciated in this regard.

The fieldwork was carried out by Rachel Chester and Jen Smith. The geophysical data was processed and interpreted by Ross Lefort and Alistair Salisbury. This report was written by Alistair Salisbury. The geophysical work was quality controlled by Dr. Paul Baggaley and Ross Lefort. Illustrations were prepared by Ross Lefort and Linda Coleman. The project was managed on behalf of Wessex Archaeology by Dr. Paul Baggaley.

Land by Castle Park
Dorchester, Dorset

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by CgMs on behalf of their client CG Fry to carry out a programme of geophysical survey over land adjacent to the A36 near Castle Park, Dorchester, Dorset (**Figure 1**), hereafter "the Site" (centred on NGR 368175, 89200). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at the Site.

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 Site is located approximately 1.25km southwest of the centre of Dorchester on the very edge of the town suburbs within the A35 bypass road. The Site comprises a large field that has been subject to both arable and pasture agriculture in recent years. A small grassed playing field area and a grassed strip running close to a residential area also lies within the survey area but were not accessible at the time of survey (**Figure 1**). The survey area is bounded by field boundaries to the west, the A35 to the south and east and a housing estate to the north.

1.2.2 The survey area lies in a shallow valley that is oriented roughly east-west. The height of the land falls from just over 70m above Ordnance Datum (aOD) at the western end of the Site to under 65m aOD at the eastern extents. The Iron Age hillfort Maiden Castle lies to the southwest of the Site and is a high point in the area at 134m aOD.

1.3 Soils and Geology

1.3.1 The bedrock geology under the Site is composed of Seaford and Newhaven chalk formations (undifferentiated) that date to the Cretaceous period. There are few superficial deposits recorded with only some head deposits (clay, silt, sand and gravel) that date to the Quaternary recorded in the base of the dry valley (BGS).

1.3.2 The soils underlying the Site are recorded as typical brown calcareous earths of the 511f (Coombe 1) association (SSEW 1983). These are well drained calcareous fine, silty soils. 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) has been prepared by CgMs consulting (2014); this will be referred to, where relevant, in the interpretation of the geophysical data.

1.4.2 The DBA revealed no designated heritage assets within the survey area but has identified 21 scheduled monuments within 2km of the site including the Iron Age hillfort of Maiden Castle and its associated settlement to the north. The site is considered to have a high theoretical potential for Bronze Age remains and a moderate-high potential for Neolithic, Iron Age and Roman remains (CgMs 2014).

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using Bartington Grad601-2 dual fluxgate gradiometer systems. 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 16th and 20th October 2014. Field conditions at the time of the survey were good, with firm conditions under foot. In total the geophysical survey covered 5.6ha of the 6.8ha site.

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 were subject to minimal data correction processes. These comprise a Zero Mean Traverse (ZMT) 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. The deslope and function was used to account for errors in the ZMT function and to remove grid edge discontinuities. These three 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 identified few anomalies of possible archaeological interest; the majority of detected anomalies relate to relatively recent agricultural activity. Results are presented as a greyscale plot, an XY trace plot and an archaeological interpretation, at a scale of 1:2000 (**Figures 2** to **4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscales and ±25nT at 25nT per cm for the XY traces.

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 The Site contains few anomalies of archaeological interest. There are singular anomalies that may represent pits or postholes featured in the dataset; two of these are highlighted at **4000** and **4001** and have magnetic values around +3nT. These anomalies are classed as possible archaeology although it should be noted that a geological explanation is also possible for their formation.

3.2.2 A linear feature can be seen at **4002** that is partially defined by ferrous anomalies. Historic Ordnance Survey (OS) maps show this feature to coincide with a field boundary recorded from the 1956 edition map up to the 1980 edition. This field boundary was most likely removed following the construction of the A35 bypass and this construction may account for the dense spreads of ferrous such as the spread at **4003**.

3.2.3 Other trends can be seen in the data at **4004** that are aligned parallel with the field boundary at **4002**; these trends may be related to agricultural activity in this former field system.

3.2.4 There are diffuse edged, weakly positive anomalies in the data such as at **4005**; this feature is considered to be geological.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 No modern services have been identified in the geophysical data however it should 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 detected only a few isolated anomalies of possible archaeological interest. The majority of the features detected relate to relatively modern agricultural activity.

4.1.2 Although the proximity of Maiden Castle and 20 other scheduled monuments may suggest a high chance of finding archaeological features none of any importance has been discovered in the dataset. The only anomalies of any interest are some small pit-like anomalies scattered across the dataset although they do not appear to form clear anthropogenic patterns in their spatial distribution.

4.1.3 The small positive anomalies scattered across the data such as at **4000** and **4001** are considered being of possible archaeological interest but it is also possible for these anomalies to have been formed by natural processes. Previous surveys carried out by WA that have been followed up by excavation over similar geology have shown that pits and tree throws can produce identical responses in geophysical data. This makes the task of determining whether isolated pit-like responses are archaeological or natural in origin difficult.

4.1.4 Although there are dense spreads of ferrous responses in places it is not thought that any are broad enough to obscure large archaeological features such as settlement enclosures. It is possible however for these ferrous anomalies to obscure small isolated features such as pits.

4.1.5 The majority of features detected appear to relate to agricultural activity with at least one former field boundary detected along with numerous ploughing scars.

4.1.6 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

5.1 Bibliography

CgMs Consulting, 2014. *Cultural Heritage Desk Based Assessment: Land by Castle Park Dorchester Dorset.* Unpublished client report. CgMs ref: CB/17902.

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

5.2 Cartographic Sources

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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 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:

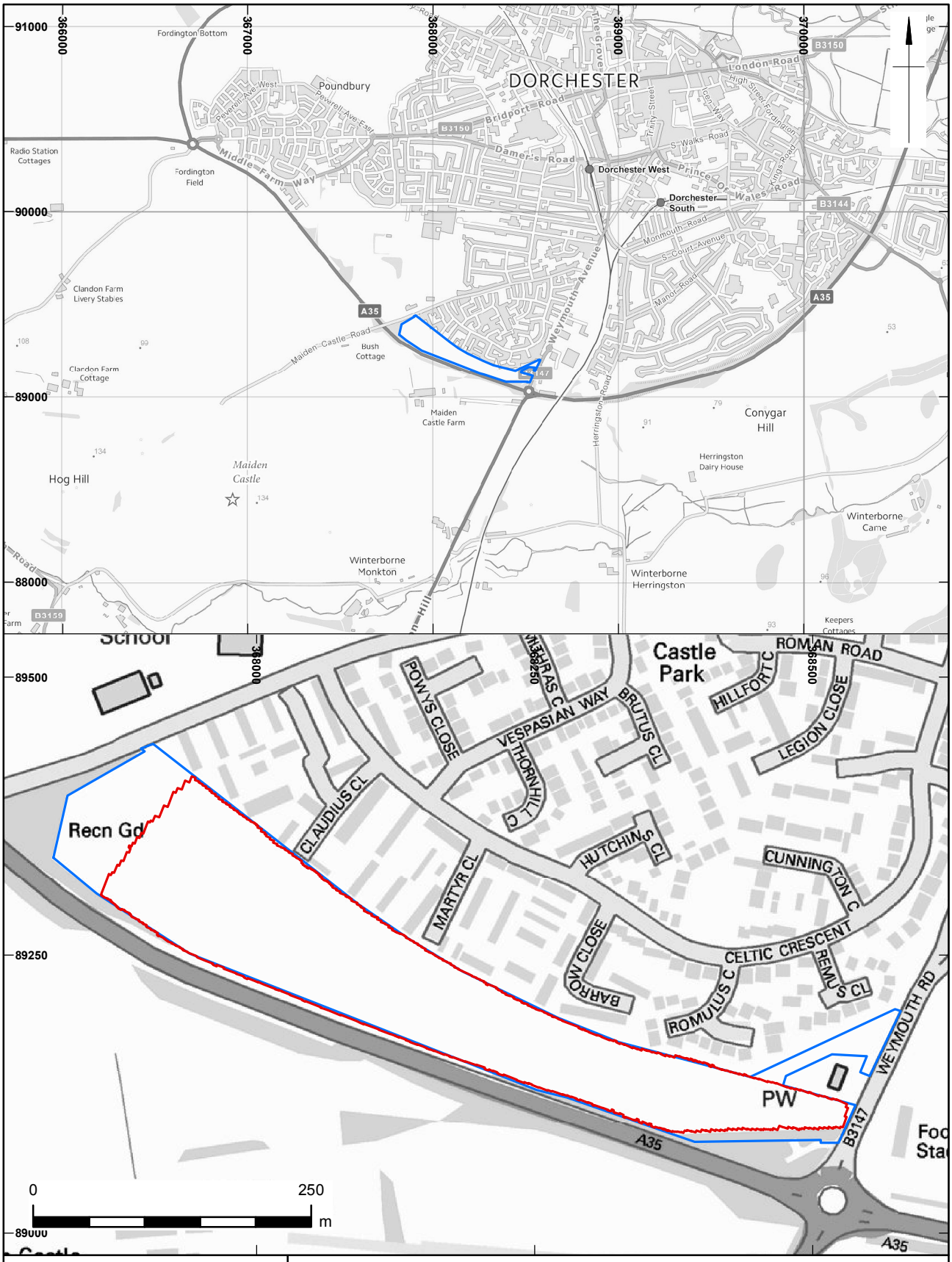
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be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



Detailed Survey Extents

Site Boundary

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Site location and detailed survey extents

Figure 1

Detailed Survey Extents

0 100 m

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Scale:	1:2000 at A3	Illustrator:	RDL
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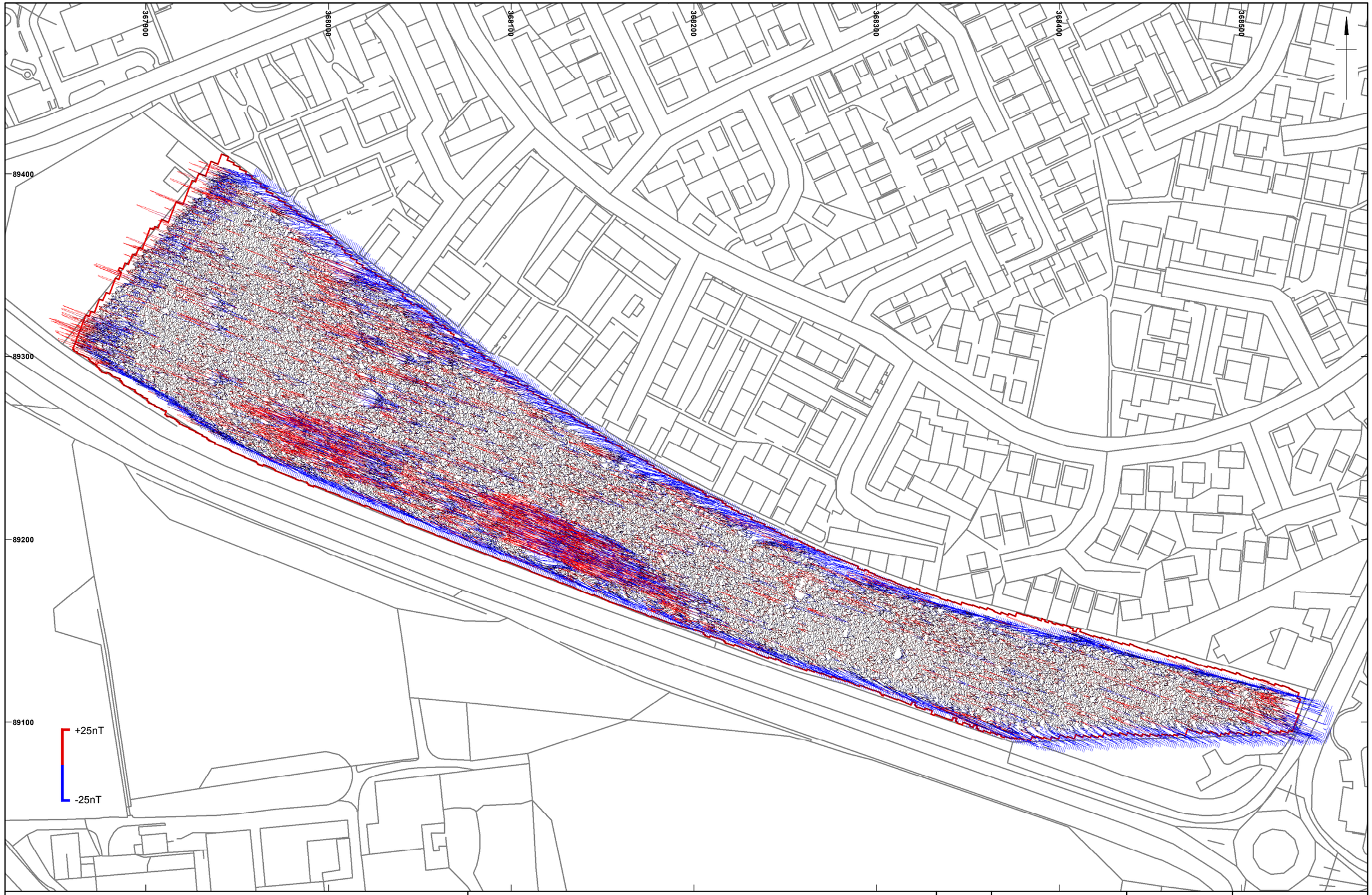
Greyscale plot

Figure 2



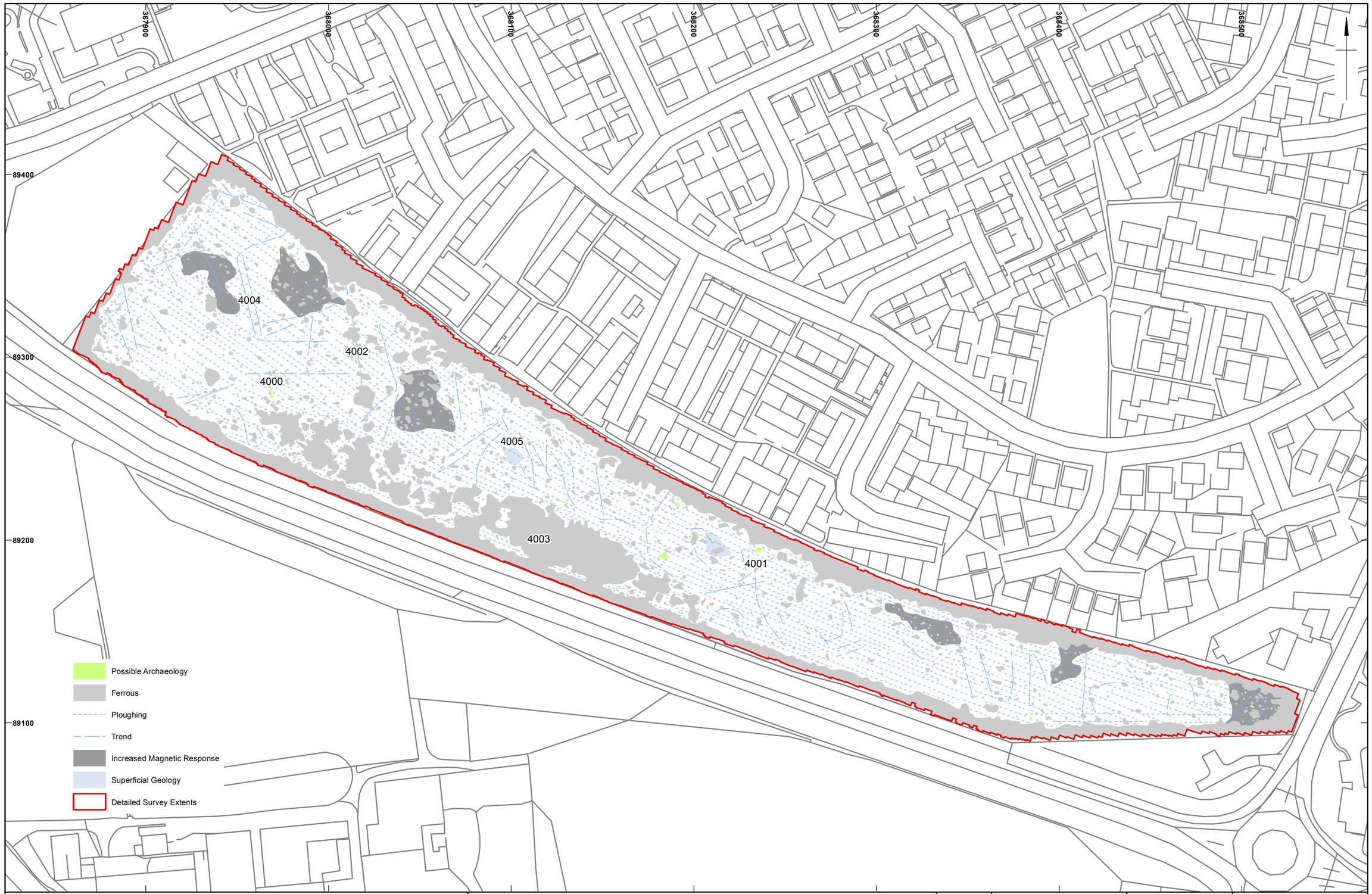
Detailed Survey Extents

0 100 m

Date:	03/11/2014	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RDL
Path:	X:\PROJECTS\106850\GIS\FigsPDF\Geophysics_2014_10_27		

XY trace plot

Figure 3



Date:	03/11/2014	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RDL
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Interpretation

Figure 4

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