



**Proposed Development at Brook Farm,
Dowbridge, Kirkham, Lancashire**

Geophysical Survey Report MSSD09

**For
Centre for Applied Archaeology
Salford University**

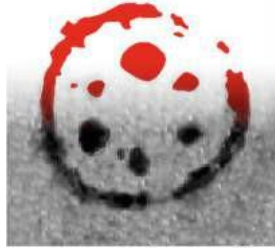
On Behalf Of



Hollins Strategic Land LLP

Magnitude Surveys Ref: MSSD09

January 2015



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Abstract

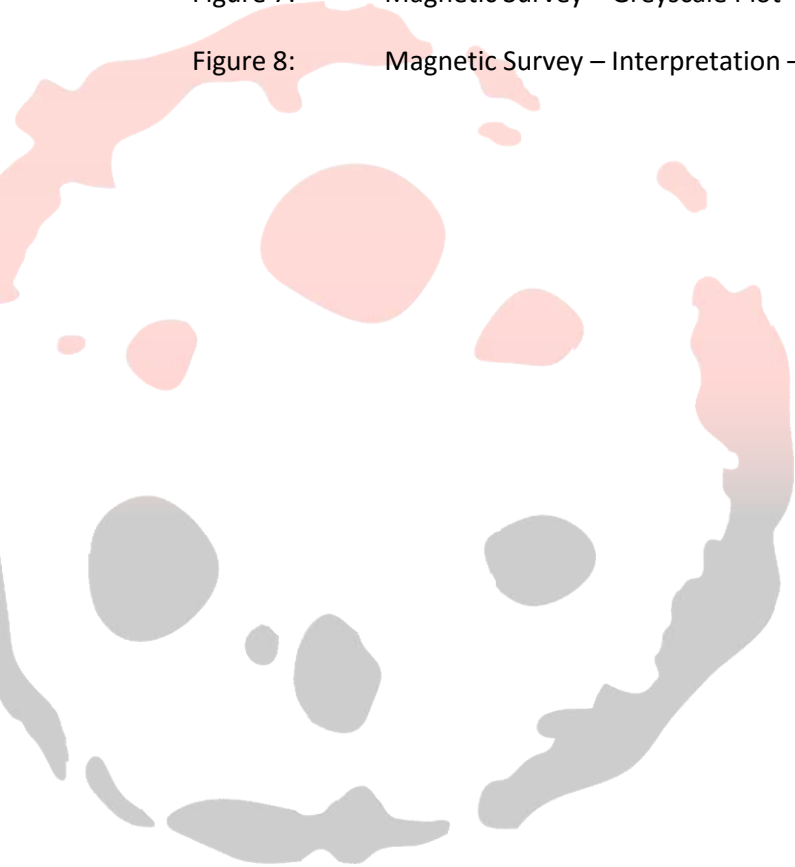
Magnitude Surveys was commissioned to assess the archaeological potential of land at Brook Farm, Dowbridge, near Kirkham, Lancashire using geophysical survey. An area of approximately 11Ha comprising the proposed development area, except the area of farm buildings, has been surveyed. Anomalies pertaining to the site's agricultural heritage have been identified. A linear positive magnetic anomaly at survey's eastern edge may be associated with a current pond, possibly indicating a trackway used to remove quarried material, the subsequent pit later forming the pond.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Centre for Applied Archaeology, Salford University (CfAA) on behalf of Hollins Strategic Land LLP (HSL) to undertake a geophysical survey on land at Brook Farm, Dowbridge, southeast of Kirkham (SD 435 320).
- 1.2. The geophysical survey comprised:
 - 1.2.1. Hand pulled, cart-mounted fluxgate gradiometer survey.
- 1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England and the Chartered Institute of Field Archaeologists (CIfA, 2014; David *et al.*, 2008).
- 1.4. This survey was undertaken between the 19 and 21 January 2016.

2. Quality Assurance

- 2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David *et al.*, 2008).
- 2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.3. Finnegan Pope-Carter is a Fellow of the London Geological Society, the Chartered UK body for geophysicists and geologists.

3. Objectives

- 3.1. The geophysical survey aimed to assess the potential archaeological landscape of the survey area.
- 3.2. The survey forms part of the archaeological mitigation required by the planning archaeologist and shall be used to inform the location of any trenches, should they be required.

4. Geographic Background

- 4.1. The underlying geology comprises Breckells mudstone member (mudstone) with superficial deposits of till - Devensian in the eastern third of the site; Glaciofluvial ice contact deposits, Devensian in the centre and Head – clay, gravelly, silty, sands in the western third (BGS 2016). Historic England guidelines state mudstone geology can produce average magnetic responses (David *et al.*, 2008).
- 4.2. The soils consist slightly acid, loamy and clayey soils with impeded drainage (Soilscape, 2015).
- 4.3. The site was divided into five survey areas. Due to the extremely heavy rainfall recorded throughout Lancashire in the months preceding survey, much of the land was waterlogged, with Areas 2 and 4 being particularly boggy. However, these conditions did not affect the quality of collected data. In some parts of Area 4 and 5, closest to the Carr Brook, it was not possible to collect data due to both the saturated ground and standing water, we have been advised by HSL that these areas are within Flood Zone 3 and are therefore undevelopable.

5. Archaeological Background

- 5.1. The following is a brief summary of the archaeological and historic background of the proposed development area (PDA); for a more detailed discussion see Miller, I., 2015 which also contains a summary of sites within the vicinity of the PDA.
- 5.2. The proposed development area is situated to the northeast of Kirkham Roman Fort, which increases the potential for the PDA of containing archaeological deposits. For example, there was potential for the PDA to contain a conjectured, but yet unconfirmed, route of the Roman road (PRN 26142 & PRN 37846) that would have linked this Kirkham Roman Fort with Ribchester, approximately 20km to the east. Also within the bounds of the PDA is a medieval/post-medieval hollow way. This hollow way divides survey Areas 2 and 3 and ends at the entrance to survey Area 4. The Brook Farm (PRN 39743), a 19th century establishment, has been expanded and altered over subsequent years and covers much of the projected route of the Roman road.
- 5.3. A clay pit, brickfield (PRN 37847) and pond are also recorded on the historic mapping.

6. Methodology

6.1. Data Collection

6.1.1. Geophysical prospection comprised magnetic methods as described in the following table.

6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments 1000L fluxgate gradiometer	1m	10Hz reprojected to 0.125m

6.1.3. Magnetic data were collected using a bespoke hand-pulled cart system.

6.1.4. The cart system supports the magnetic and GPS instruments with a bespoke datalogger. The magnetic instruments comprise two Bartington Instruments 1000L fluxgate gradiometers operating in NMEA mode. Positional referencing is through a Hemisphere S320 RTK GPS outputting in NMEA mode. Corrections were made through Topcon TopNet. Data from both instruments were logged in a bespoke datalogger. Data were transferred to a laptop computer for processing.

6.1.5. A series of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, to ensure that the data was efficiently collected and processed.

6.2. Data Processing

6.2.1. Data were processed in bespoke in-house software produced by MS.

6.2.2. Magnetic processing steps were limited to:

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics. Assessment between filtered and unfiltered data ensures linear trends running parallel to the survey direction are not removed.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation

6.3.1. Greyscales should be viewed alongside the accompanying XY trace plots; these plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

7. Survey Considerations

Survey Area	No. Survey Blocks	Surveyed Y/N	Ground Conditions	Further notes:
1	1	Y	Short Grass, soft muddy	Wire fences along all boundaries. The farm complex bounds the southeastern edge.
2	3	Y	Short grass, very wet, slightly boggy, very boggy in places	Area contains paddocks and stables and was bounded by farm complex and slurry pit.
3	1	Y	Short Grass	Wire fences along all boundaries, contained a large pond, possibly a former clay pit.
4	1	Y	Short grass, very wet, slightly boggy, very boggy in places	Contained a number of inspection covers and a small stream. It was not possible to survey the whole of this area due to the wet conditions within Flood Zone 3 (FZ3)
5	1	Y	Short Grass, soft muddy.	Wire fences along all boundaries. Contained a row of mature trees that form the remains of a former field boundary. It was not possible to survey the whole of this area due to the wet conditions within FZ3.

Refer to Figure 2 for survey area location.

8. Results

8.1. Qualification

8.1.1. *Geophysical techniques are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.*

8.2. Discussion

8.2.1. The geophysical results, both greyscale images and XY traces, were interpreted in consideration with historic mapping (c.1882-1913 2nd edition OS 6" from maps.nls.uk) and satellite imagery (©2016 Infoterra Ltd. and BlueSky from Google Earth).

8.2.2. Magnetic survey has responded well to the survey area's geological and pedological environment, detecting modern soil disturbances and anomalies associated with agricultural processes. A number of anomalies have been detected and classified as *Undetermined*; these anomalies exhibit characteristics of anomalies of an agricultural, geological or pedological origin but are often isolated and therefore difficult to classify further.

8.3. Interpretation

8.3.1. General Statements

8.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually. Specific anomalies discussed within the text have been assigned numbers, which are emboldened within square parenthesis e.g. [1].

8.3.1.2. The combined greyscales and interpretations have been split into different figures for print purposes:

8.3.1.2.1. Figures 3 and 4: Areas 1, 2 & 4 greyscale and interpretation, respectively.

8.3.1.2.2. Figures 5 and 6: Area 5 greyscale and interpretation, respectively.

8.3.1.2.3. Figures 7 and 8: Area 3 greyscales and interpretation, respectively.

8.3.1.3. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are

likely to be the result of agricultural, geological or pedological processes; although an archaeological origin cannot be entirely ruled out. They are generally not ferrous in nature.

- 8.3.1.4. **Ferrous** – A number of discrete ferrous-like anomalies have been mapped across the entire survey area. These responses are likely to be the result of modern metallic disturbance on or near the ground surface. Broad ferrous responses from modern metallic features such as fences, gates, feeders and pipes may mask any weaker underlying archaeological anomalies. Further larger areas of ferrous disturbance have been demarcated as zones, in this case these appear to be resultant of spreads of material dumped on wet ground to firm up fields and tracks.

8.3.2. Specific Anomalies and Features

- 8.3.2.1. **Agricultural** – Ridge and furrow anomalies [1] have been identified within Area 1 (Figure 4). These anomalies are broad and slightly curving in form. The ploughing shares an alignment with the present northern field boundary, suggesting the current form of the field boundary had been established at the time the cultivation took place. The anomalies also respect two former field boundaries that have been identified within the same area; these field boundaries are also denoted on the historic mapping.
- 8.3.2.2. **Agricultural** – Linear anomalies associated with field boundaries in the historic mapping are classified as former field boundaries. The former field boundaries [2] in Area 1 and 4 have a strong magnetic signal (Figure 4); whereas the field boundary anomalies identified in Area 5 [4] (Figure 6) and Area 3 [3] (Figure 8) have a comparably weaker signal. An explanation for the stronger signal in the boundaries [2], is the possibility of being inlaid with drainage systems before being filled, which would cause an increase in cumulative anomalous response.
- 8.3.2.3. **Undetermined** – A strong, positive magnetic [5], linear anomaly has been detected at the southeastern corner of Area 3 (Figure 8). [5] extends from the pond / clay pit to the field gate on New Hay Lane, at its junction with the medieval hollow way. Due to the nature of this responses and the anomaly's orientation, it is therefore possible [5] represents a track or similar infrastructure used to remove material from the field, in turn forming a hollow which became the current pond.
- 8.3.2.4. **Drains** – A number of drains have been detected at the northern end of Area 3 (Figure 8). These have been detected at the foot of the slope and drain into the nearby ditches that bound the survey area.

9. Conclusions

- 9.1. No anomalies of a probable or possible archaeological source have been identified. A single linear anomaly extending from the entrance to New Hay Lane to the pond / clay extraction pit has been detected. This may reflect a track built to move extracted materials to the road.
- 9.2. Anomalies related to the site's agricultural past have been detected including a series of field boundaries and former ploughing systems. Modern drainage schemes and ferrous zones, thought to reflect the laying of rubble hard-core to firm up wet fields, have also been identified.

10. Archiving

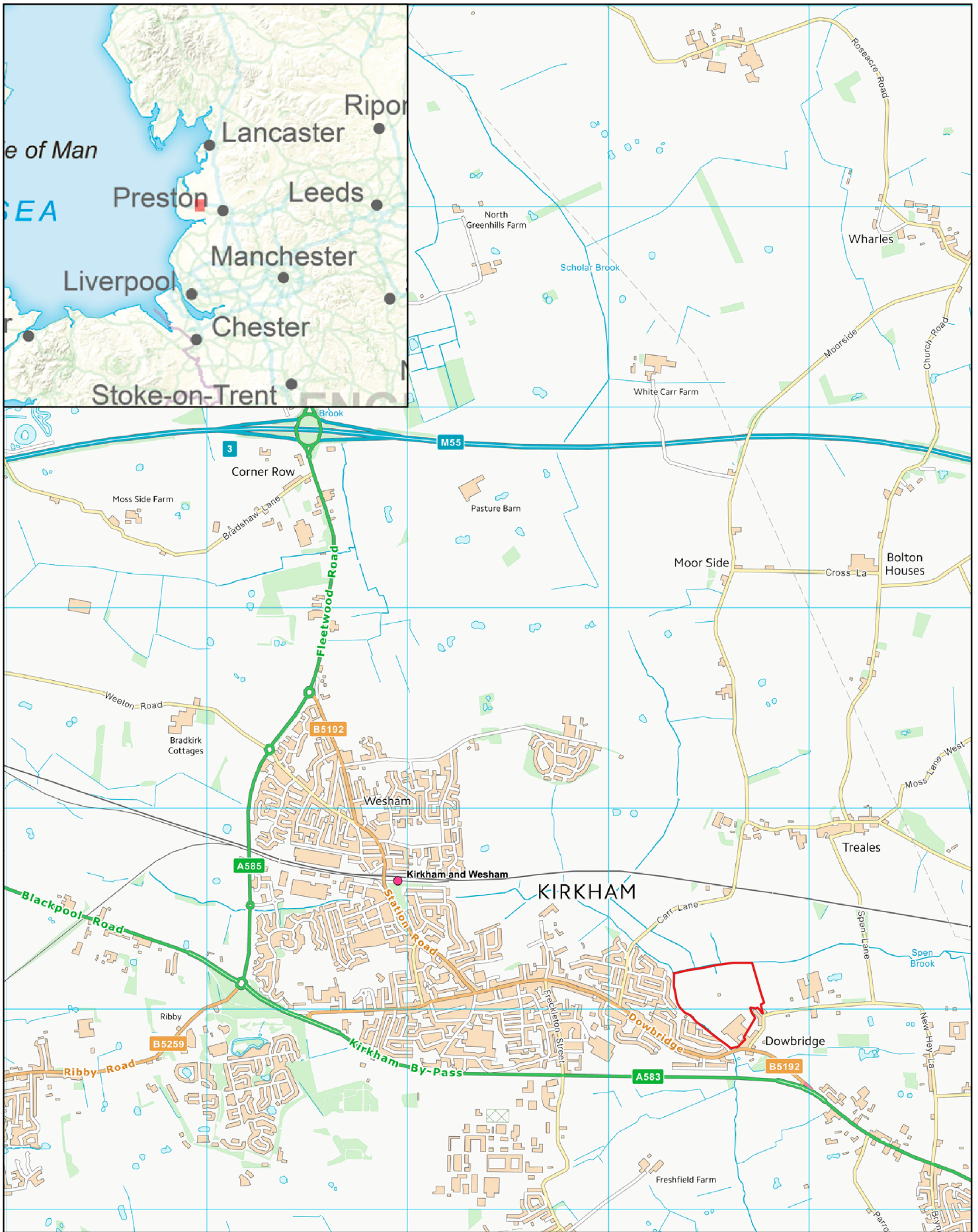
- 10.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein, 2013.
- 10.2. MS contributes all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.
- 10.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data this can be achieved in discussion with MS.

11. Copyright

- 11.1. Copyright and the intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd. is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

12. References

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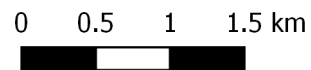
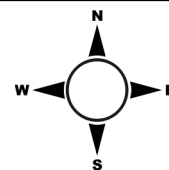
Figure 1 - Site Location

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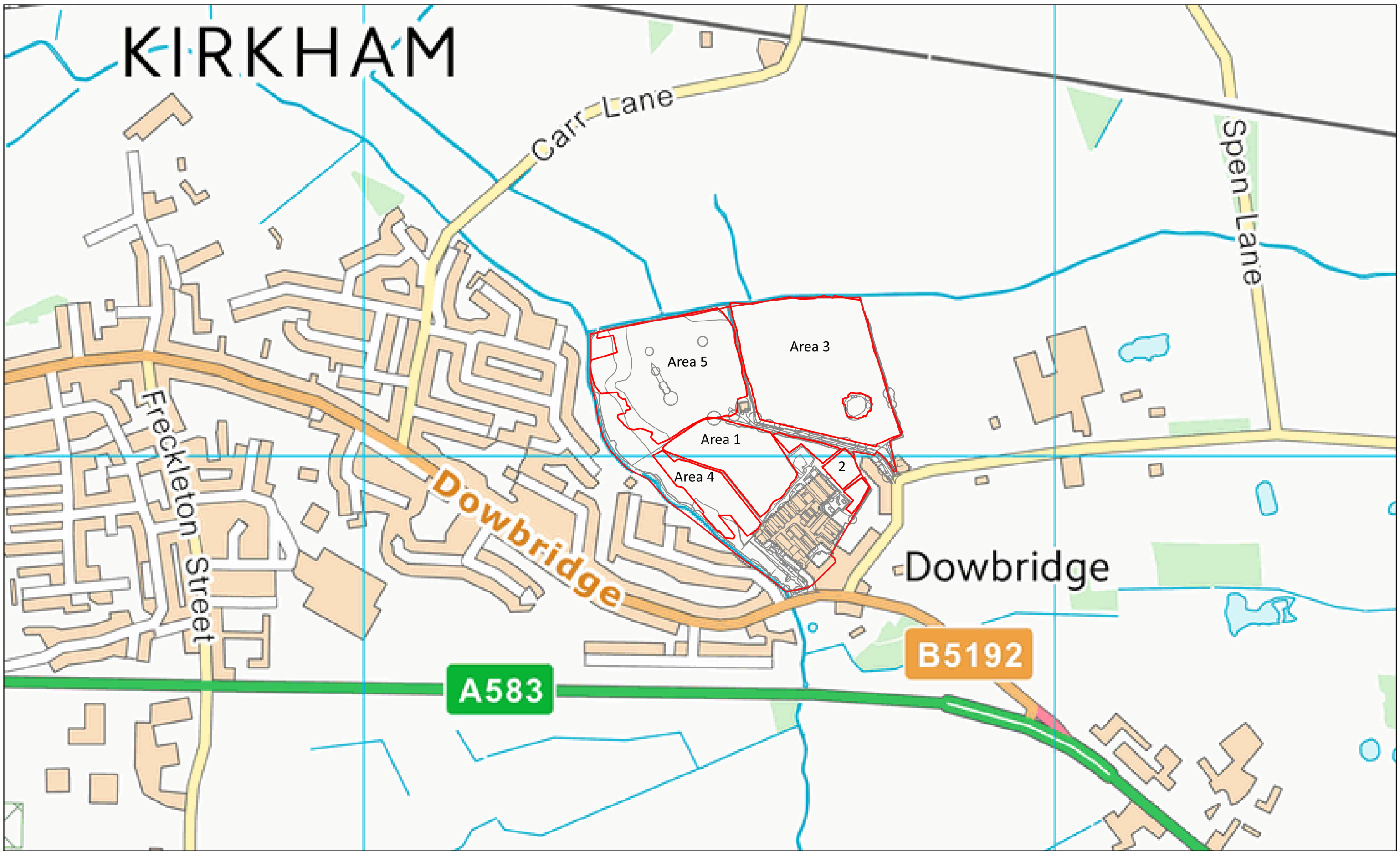
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— Area of Proposed Development



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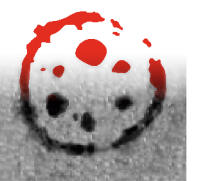
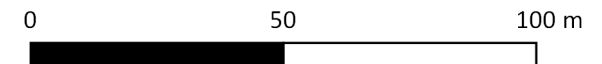
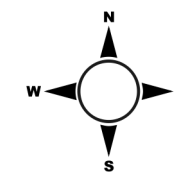
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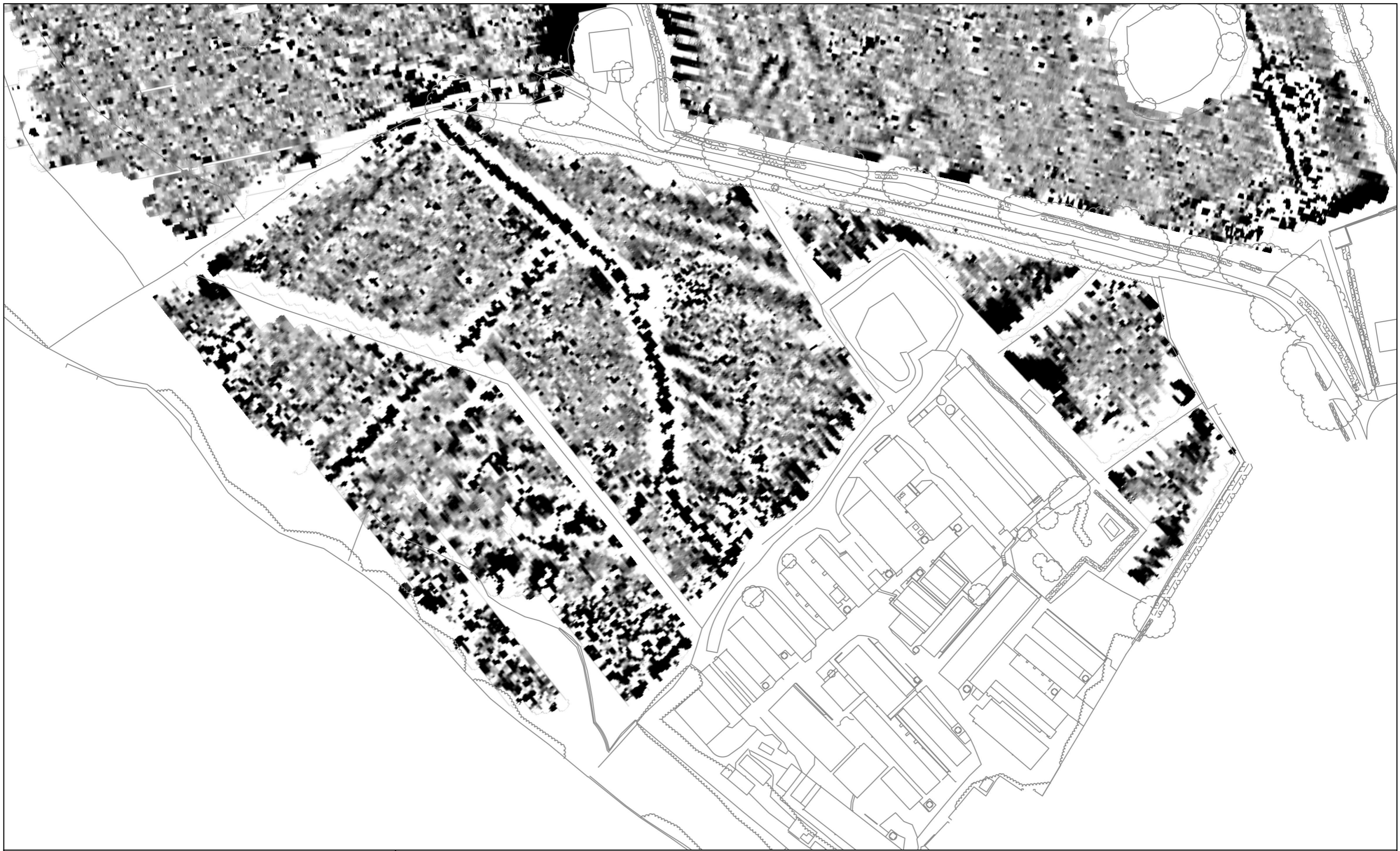
MSSD09 - Proposed Development at Brook Farm, Dowbridge, Kirkham
Figure 2- Location of Survey Areas
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— Proposed Development Area

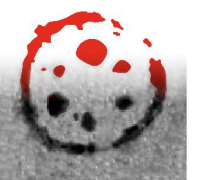
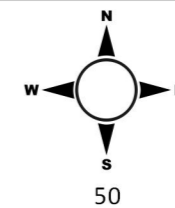
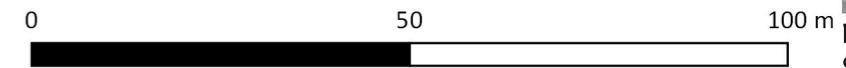
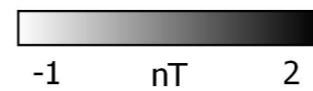


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Figure 3 - Magnetic Survey - Greyscale Plot - Area 1, 2 & 4
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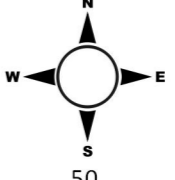
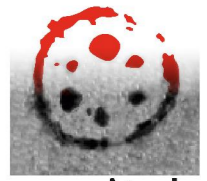
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 Figure 4 - Magnetic Survey - Interpretation - Area 1, 2 & 4
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- | | |
|---|---|
|  Agricultural Strong |  Ferrous |
|  Agricultural Weak Anomaly |  Ferrous Zone |
|  Undetermined Strong Anomaly |  Drain |
|  Undetermined Weak Anomaly |  Survey Border |

0 50 100 m

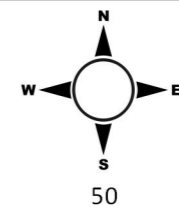
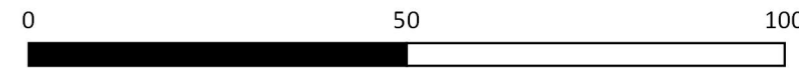
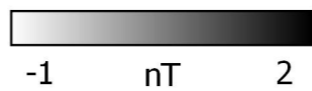



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Figure 5 - Magnetic Survey - Greyscale Plot - Area 5
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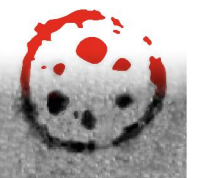
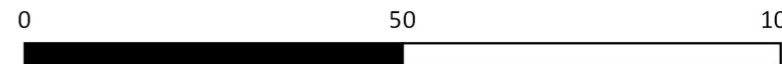
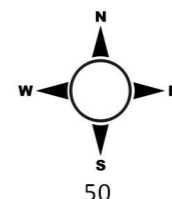
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 Figure 6 - Magnetic Survey - Interpretation - Area 5
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- | | | | |
|---|-----------------------------|---|---------------|
|  | Agricultural Strong |  | Ferrous |
|  | Agricultural Weak Anomaly |  | Ferrous Zone |
|  | Undetermined Strong Anomaly |  | Drain |
|  | Undetermined Weak Anomaly |  | Survey Border |

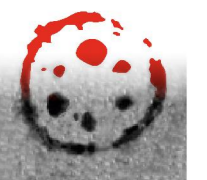
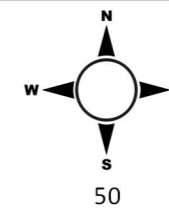
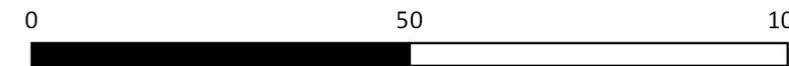
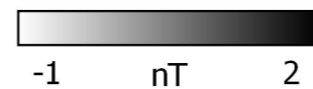


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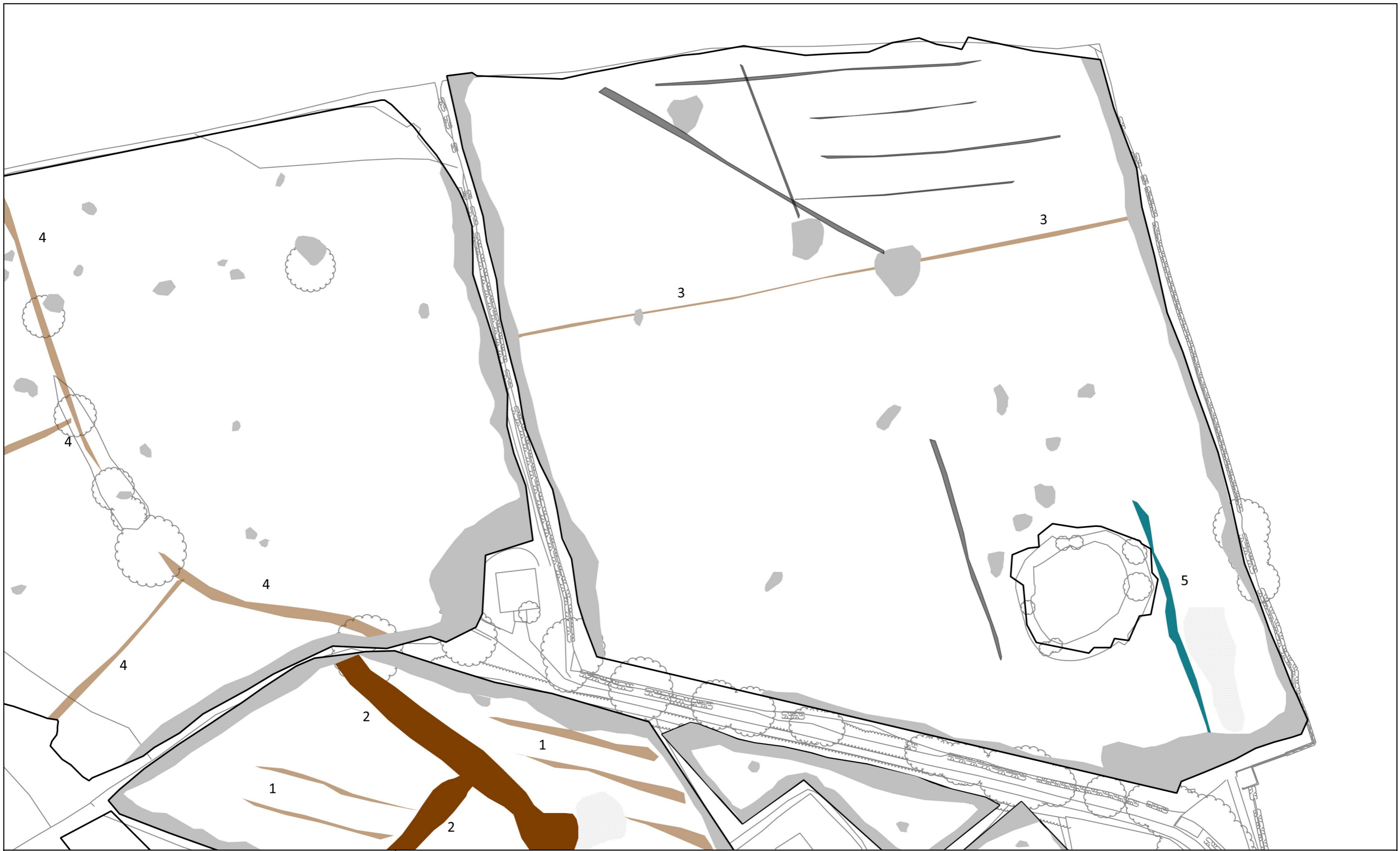


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Figure 7 - Magnetic Survey - Greyscale Plot - Area 3
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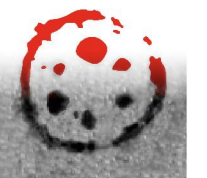
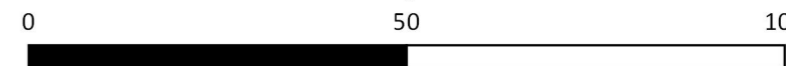
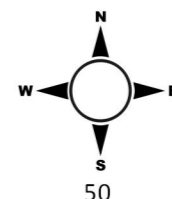
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 Figure 8 - Magnetic Survey - Interpretation - Area 3
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|---|-----------------------------|---|---------------|
|  | Agricultural Strong |  | Ferrous |
|  | Agricultural Weak Anomaly |  | Ferrous Zone |
|  | Undetermined Strong Anomaly |  | Drain |
|  | Undetermined Weak Anomaly |  | Survey Border |



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