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Engineering Archaeological Services Ltd.

Caerau Farm, Llandewi Velfrey, Pembrokeshire: Geophysical Survey 2

Analysis by
I.P. Brooks

EAS Client report 2018/12

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Commissioned by Trysor

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Engineering Archaeological Services Ltd is

Registered in England No 286978

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NGR

Centred on: SN 13711 16263

Location and Topography (Figures 1 and 2)

The survey area was approximately 280 m NNW of Caerau Farm, Llanddewi Velfrey, Narberth, Pembrokeshire and 300 m east of Henllan Farm. It was located at the north western end of a field. The survey area was largely flat, except for the southern half of grids 14 and 15 (Figure 2) which had moderate slopes down to the stream which divides this field from the field in which an earlier survey took place.

At the time of survey, the field was under permanent pasture, although there was marked poaching in places, particularly in the north west and south west corners of the survey area where it is possible that there were small field ponds, now in-filled.

The survey took place on 17st October 2018.

Archaeological Background

It is intended to construct a stable complex within the survey area (Pembrokeshire Planning number 18/0422/PA). An earlier fluxgate gradiometer survey (Brooks 2018), in a field approximately 185 m to the south west, was initially commissioned, however, this revealed a set of magnetic anomalies which have been interpreted as part of an extended settlement, probably associated with the Caerau Gaer defended enclosure (https://www.archwilio.org.uk/arch/query/page.php?watprn=DAT4905&dbname=dat&tbname=core). Mike Ings of the Dyfed Archaeological Trust, acting as advisers to Pembrokeshire County Council, has recommended an archaeological field evaluation, to include the current geophysical survey and a desk-top study, before any works are undertaken.

The current survey was commissioned by Trysor as part of the field evaluation.

Aims of Survey

To investigate, define and record any potentially archaeological features within the survey areas.

SUMMARY OF RESULTS

A broad band of magnetic disturbance crosses the survey area, within this and defining its edges, are a series of linear anomalies dividing the area into two or three possible enclosures. Within two of the possible plots are further anomalies suggestive of possible structures. There are also other linear anomalies which cross the band of magnetic disturbance at an angle. Magnetic Susceptibility samples show enhanced readings probably associated with the possible structures. Outside the band of disturbance are a limited number of anomalies, some of which can be related to either the modern land usage or topographic features in the landscape.

Methods

The survey consisted of parts of eight 20 x 20 m grid squares laid out as in Figure 2. Readings were taken at 0.25 m intervals along transects 1 m apart using a Geoscan FM256 Fluxgate Gradiometer. Grey scale plots were produced using Geoscan Research "Geoplot" v.3.00v and X - Y and Colour Contour plots were produced using Golden Software "Surfer" v. 10.7.972.

Small soil samples were taken for Magnetic Susceptibility analysis from the grid squares (Figure 6). These were dried, sieved through a 2mm sieve and analysed using a Bartington MS2 Magnetic Susceptibility meter and MS2B detector

Survey Results:

Area

0.31 Ha

Display

The results are displayed as a grey scale image (Figure 3), colour contour plot (Figure 4) and as X-Y trace plot (Figure 5). Interpretation plots are shown as Figure 6 and the data is summarised in Figure 8.

Results:

Fluxgate Gradiometer Survey

Two areas of ferromagnetic disturbance have been recorded within the survey which are shown in blue on Figure 6. Both of these can be related to the modern use of the field with Anomaly A marking the position of the gateway into the field and Anomaly B the response to a reinforced concrete ring which is being used as an animal feeder.

There are also five strong magnetic anomalies within the plot, some of which can be related to other activity within the field. Anomaly C, appears to mark the southern edge of a wet and poached area in the corner of the field and is, therefore, probably related to an in-filled pond in this corner. Anomalies D and E and particularly Anomalies F and G, have a distinctive magnetic structure. They have a band of negative readings to the west of a band of positive readings with a range of -11 - +11 nT, for Anomalies F and G. These signals are not typical of metal pipes, where the signals tend to align with the earth's magnetic field, and may therefore be the response to fired clay. One possibility is that they relate to field drains near to the surface, however this seems unlikely given the moderate slopes where Anomalies F and G are located. Anomalies D and E also seem to form part of the pattern discussed below.

Crossing the survey area at an angle of approximately 14° to the modern field alignment is a broad band of slight magnetic disturbance, approximately 21 m wide. This is best seen on the X-Y trace plot (Figure 5) where particularly the southern side of this area can be clearly seen. Defining the edges of, and dividing this area, are a series of linear magnetic anomalies (Anomalies D, E, H, I, J, M and N). Surprisingly these divisions can be seen clearly on the filled colour contour plot (Figure 4). Whilst the anomaly marking the northern edge of the band (Anomaly I) is not very clear, that marking the southern edge (Anomaly J) is a distinct feature. Particularly where it runs through Grid Squares 14 and 15 it also marks the brake of slope between the relatively flat area of the field and the slope down to the stream. Running, roughly, at right angles to Anomalies I and J area a series of linear anomalies which appear to divide the space into a series of rectilinear enclosures. At the eastern end of the survey Anomaly H consists of two parallel anomalies, approximately 3 m apart, linked at their southern end. A second "double boundary" is formed by Anomalies M and N which also run at roughly a 3 m separation. Anomaly N, however, also has an extension to the west where it runs parallel to Anomaly J at a separation of approximately 2 m. Parallel with these two "double anomalies" are Anomaly L and Anomalies D and E. Whilst Anomaly L has a similar magnetic signal to the other possible boundaries, as has been discussed above, Anomalies D and E have stronger, distinctly structured, responses. It is not clear whether, the alignment of these anomalies is fortuitous suggesting they may be related to the draining of the in-filled pond in the corner of the field, or that these anomalies relate to the possible field system.

Within the possible enclosures are two, or three, possible structures. Anomaly O forms a rough rectangle approximately 3.5 x 5.5m in size, which appears to be aligned to Anomaly N and the general pattern of anomalies. Between Anomalies M and L is, at least one, and possibly two, circular anomalies. Anomaly Q is approximately 6 m in diameter and is the clearest of the possible circular anomalies. The other (Anomaly R) is less clear, but appears to be approximately 4.5 m in diameter.

There are two linear anomalies (Anomalies K and P) which cross the band of magnetic disturbance, but do not appear to align themselves with the rest of the anomalies. Anomaly K is a very feint and runs roughly north-south. Anomaly P, however runs approximately NW – S, crossing the edge of Anomaly Q and therefore probably from a different phase of activity. The function, nor origins of either of the anomalies is uncertain.

Magnetic Susceptibility (Figure 6)

It was possible to take soil samples in order to assess the magnetic susceptibility of the soils. It was not possible, however, to obtain a subsoil sample for comparison. The location of the magnetic susceptibility samples is shown on Figure 7.

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 10	35	48.6
Grid 11	30	41.7
Grid 12	35	47.3
Grid 13	41	53.9
Grid 14	35	45.5
Grid 15	57	85.1
Grid 16	55	83.3
Grid 17	47	61.0

In general, the susceptibilities, as measured, are of moderate values, suggesting that magnetic conditions are suitable for magnetic survey. There is a degree of variability within the measured values with high values particularly in Grid Squares 15 and 16. Magnetic susceptibility can be used as a proxy for the level of archaeological activity within the general area of the sample (Clark 1996, 106), thus the increased values from the survey would suggest increased activity in Grid Squares 15 and 16. These would roughly correlate with the results of the fluxgate gradiometer survey with the possible rectilinear anomaly (Anomaly O) in Grid Square 16 and the possible circular anomaly (Anomaly Q) on the boundary between Grid Squares 11 and 15.

Conclusions (Figures 8)

It is a fundamental axiom of archaeological geophysics that the absence of features in the survey data does not mean that there is no archaeology present in the survey area only that the techniques used have not detected it. The general character of the anomalies recorded in the current survey are distinctly different from those previously recorded from nearer to the Caerau Gaer defended enclosure (Brooks 2018) and are, therefore, probably from a different phase of activity.

The key features from within the current survey would appear to be a broad band of magnetic disturbance which has been subdivided into a series of possible enclosures. Within these enclosures are at least two, and possibly three structures which may, or may not, relate to the possible field system. Most likely, Anomaly O, a rectilinear anomaly, is contemporary with the possible field system, whilst the possible circular anomalies (Anomalies Q and R) may be from a different phase of activity.

More recent activity and disturbance is largely concentrated along the modern field boundaries, or are associated with features within the current field. The exception are two anomalies (Anomalies F and G) in the south eastern corner of the survey which do not appear to relate to the other anomalies recorded and whose function are unknown.

References

Brooks, I.P 2018 *Caerau Farm, Llandewi Velfrey, Pembrokeshire: Geophysical Survey*. EAS Client Report 2018/11

Clark, A. 1996. *Seeing Beneath the Soil. Prospecting Methods in Archaeology.* Routledge, London

Acknowledgements

This survey was commissioned by Trysor and the help of Jenny Hall and Paul Sambrook for commissioning the survey and for providing background information is gratefully acknowledged. Access to the field was permitted by Mr. Benjamin Lewis.

Techniques of Geophysical Survey:

Magnetometry:

This relies on variations in soil magnetic susceptibility and magnetic remenance which often result from past human activities. Using a Fluxgate Gradiometer these variations can be mapped, or a rapid evaluation of archaeological potential can be made by scanning.

Resistivity:

This relies on variations in the electrical conductivity of the soil and subsoil which in general is related to soil moisture levels. As such, results can be seasonally dependant. Slower than Magnetometry this technique is best suited to locating positive features such as buried walls that give rise to high resistance anomalies.

Resistance Tomography

Builds up a vertical profile or pseudosection through deposits by taking resistivity readings along a transect using a range of different probe spacings.

Magnetic Susceptibility:

Variations in soil magnetic susceptibility occur naturally but can be greatly enhanced by human activity. Information on the enhancement of magnetic susceptibility can be used to ascertain the suitability of a site for magnetic survey and for targeting areas of potential archaeological activity when extensive sites need to be investigated. Very large areas can be rapidly evaluated and specific areas identified for detailed survey by gradiometer.

Instrumentation:

1. Fluxgate Gradiometer - Geoscan FM256

2. Resistance Meter - Geoscan RM4/DL10

3. Magnetic Susceptibility Meter - Bartington MS2

4. Geopulse Imager 25 - Campus

Methodology:

For Gradiometer and Resistivity Survey 20m x 20m or 30m x 30m grids are laid out over the survey area. Gradiometer readings are logged at either 0.5m or 1m intervals along traverses 1m apart. Resistance meter readings are logged at 0.5m or 1m intervals. Data is down-loaded to a laptop computer in the field for initial configuration and analysis. Final analysis is carried out back at base.

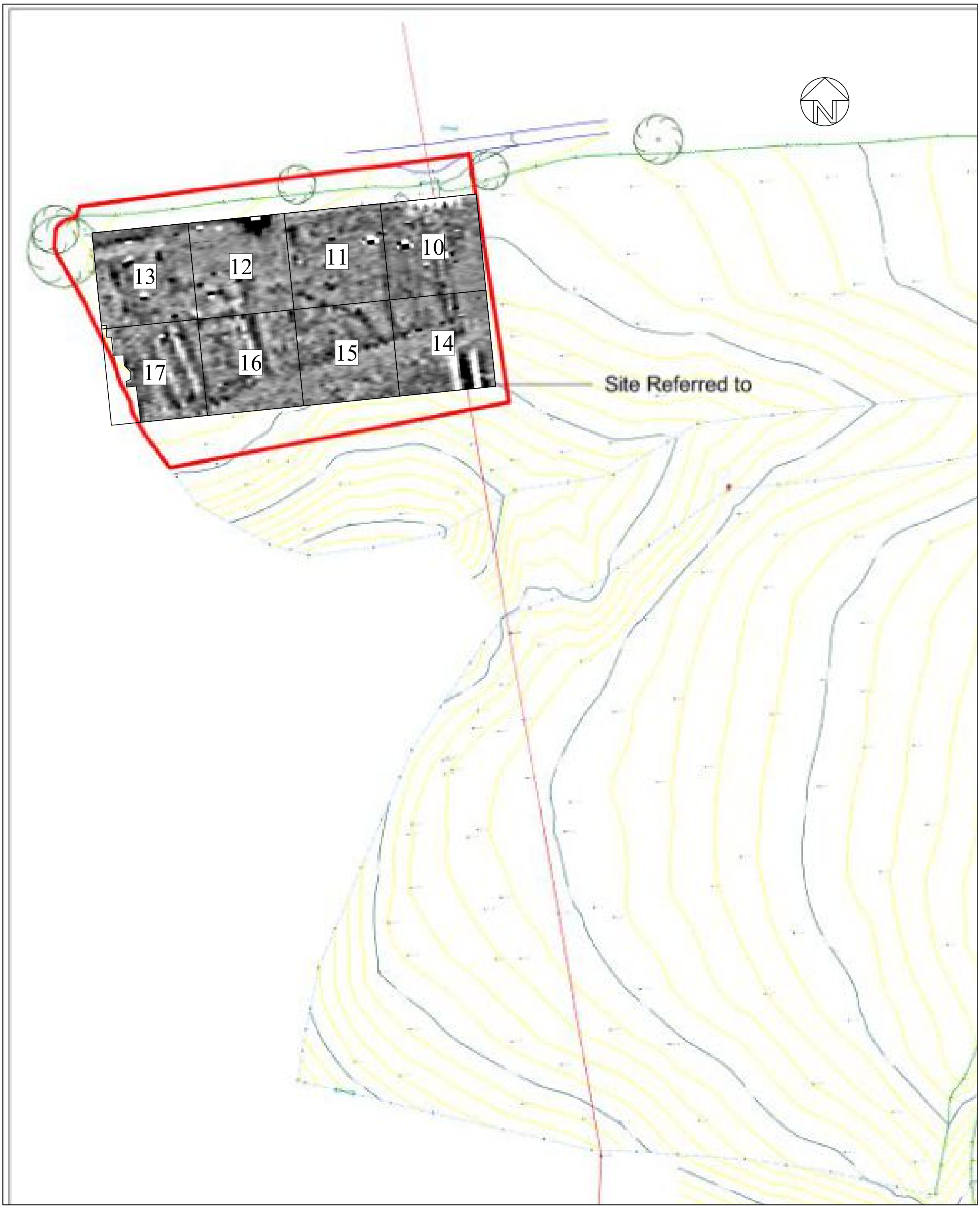
For scanning transects are laid out at 10m intervals. Any anomalies noticed are where possible traced and recorded on the location plan.

For Magnetic Susceptibility survey, a large grid is laid out and readings logged at 20m intervals along traverses 20m apart, data is again configured and analysed on a laptop computer.

Copyright:

Extract from the 1953 Ordnance Survey Pembrokeshire XXIX.NE map

Figure 1: Location
Scale 1:5,000



Based on drawing 01A by
Ken Morgan Design and
Building Management Ltd

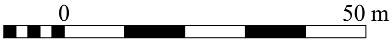


Figure 2: Location of the Survey Area
Scale 1:1,250

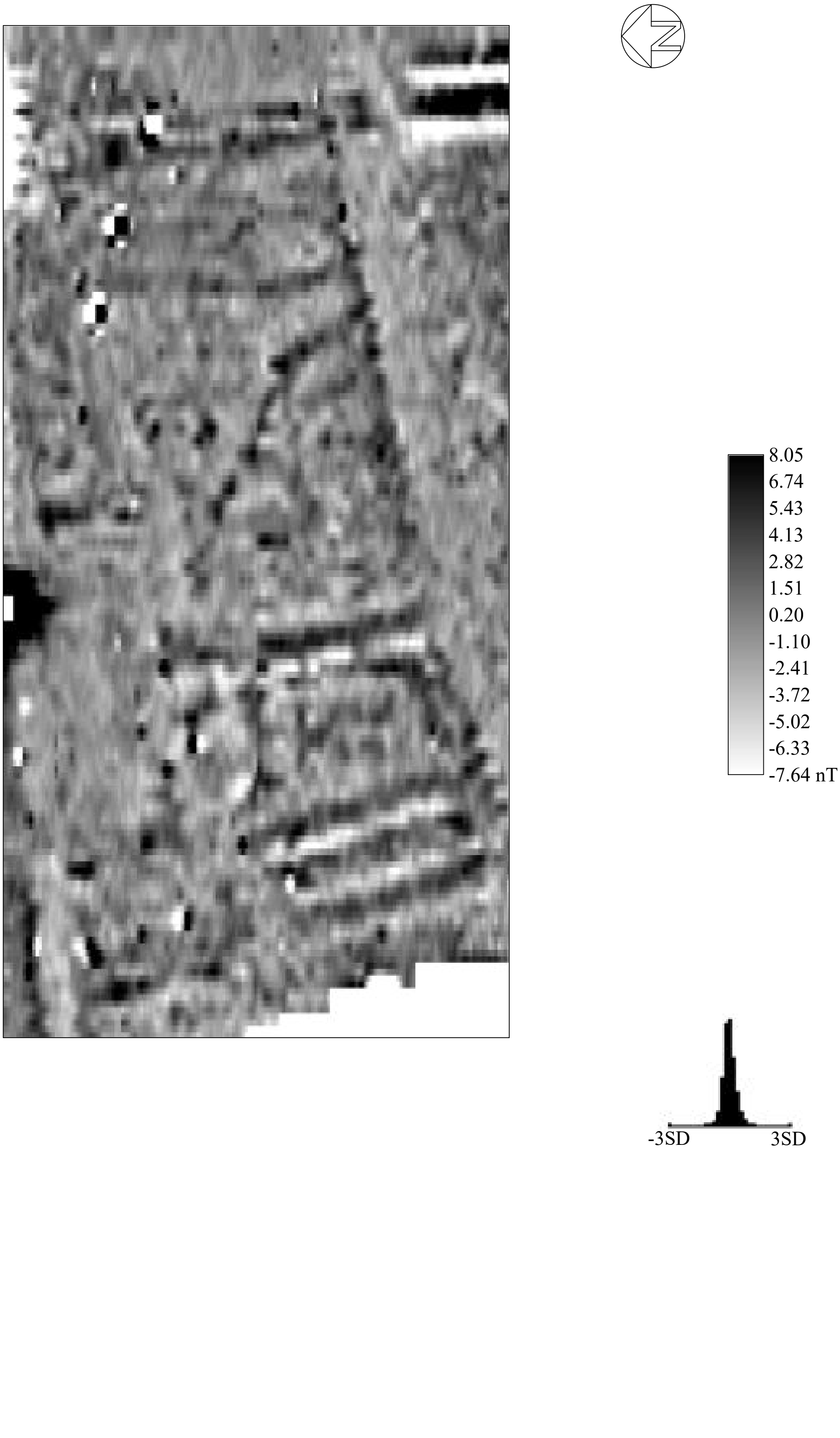


Figure 3: Grey Scale Plot
Scale 1:500

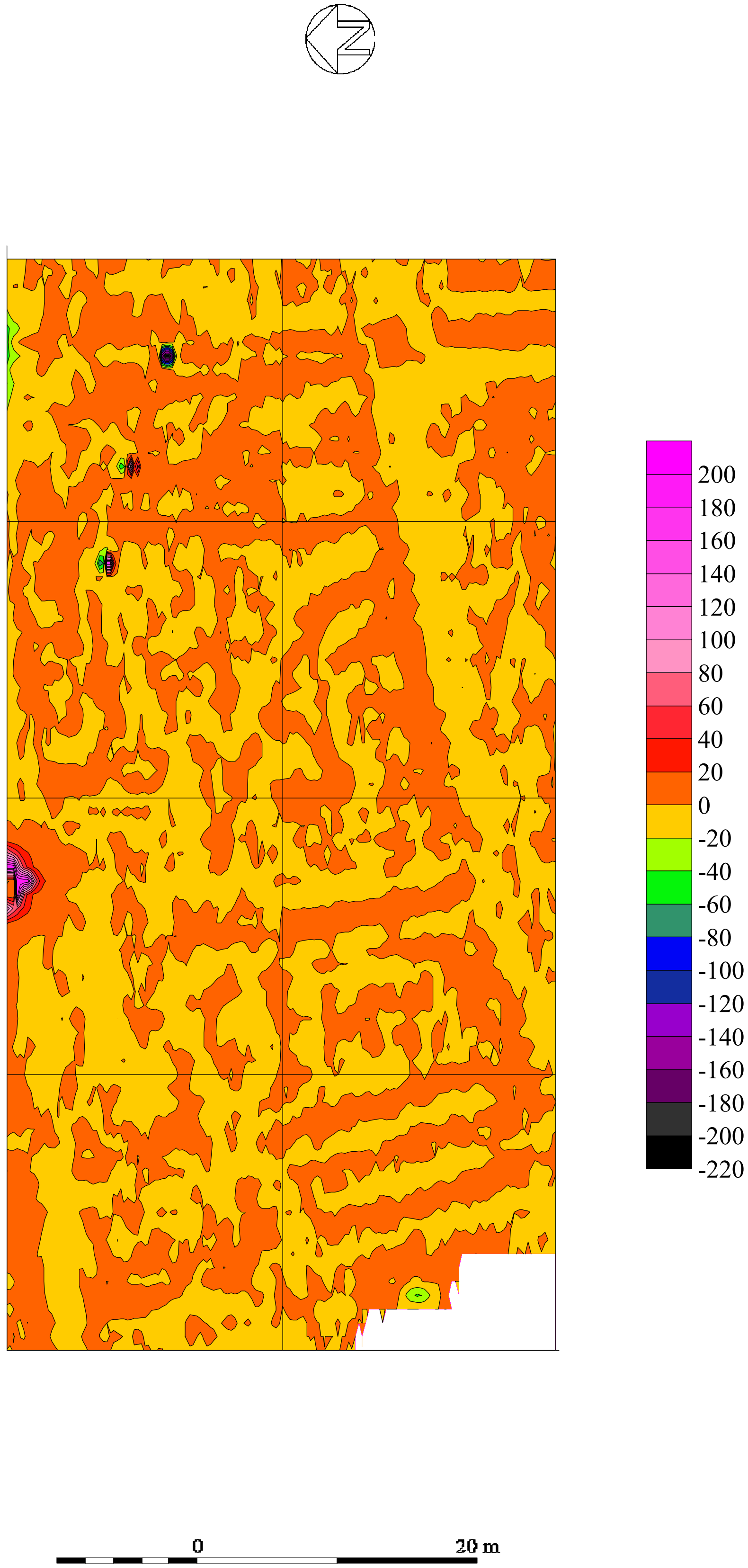


Figure 4: Colour Contour Plot
Scale 1:500

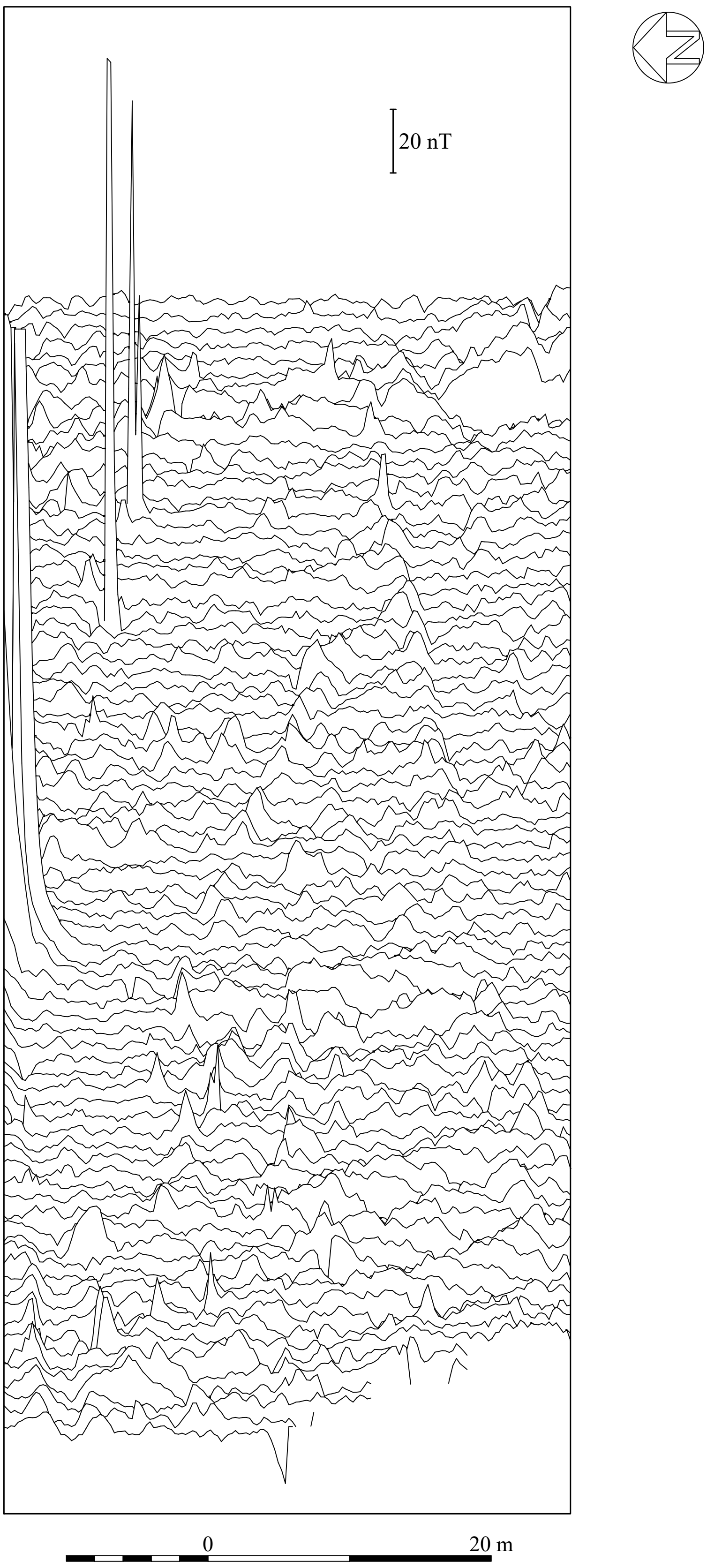
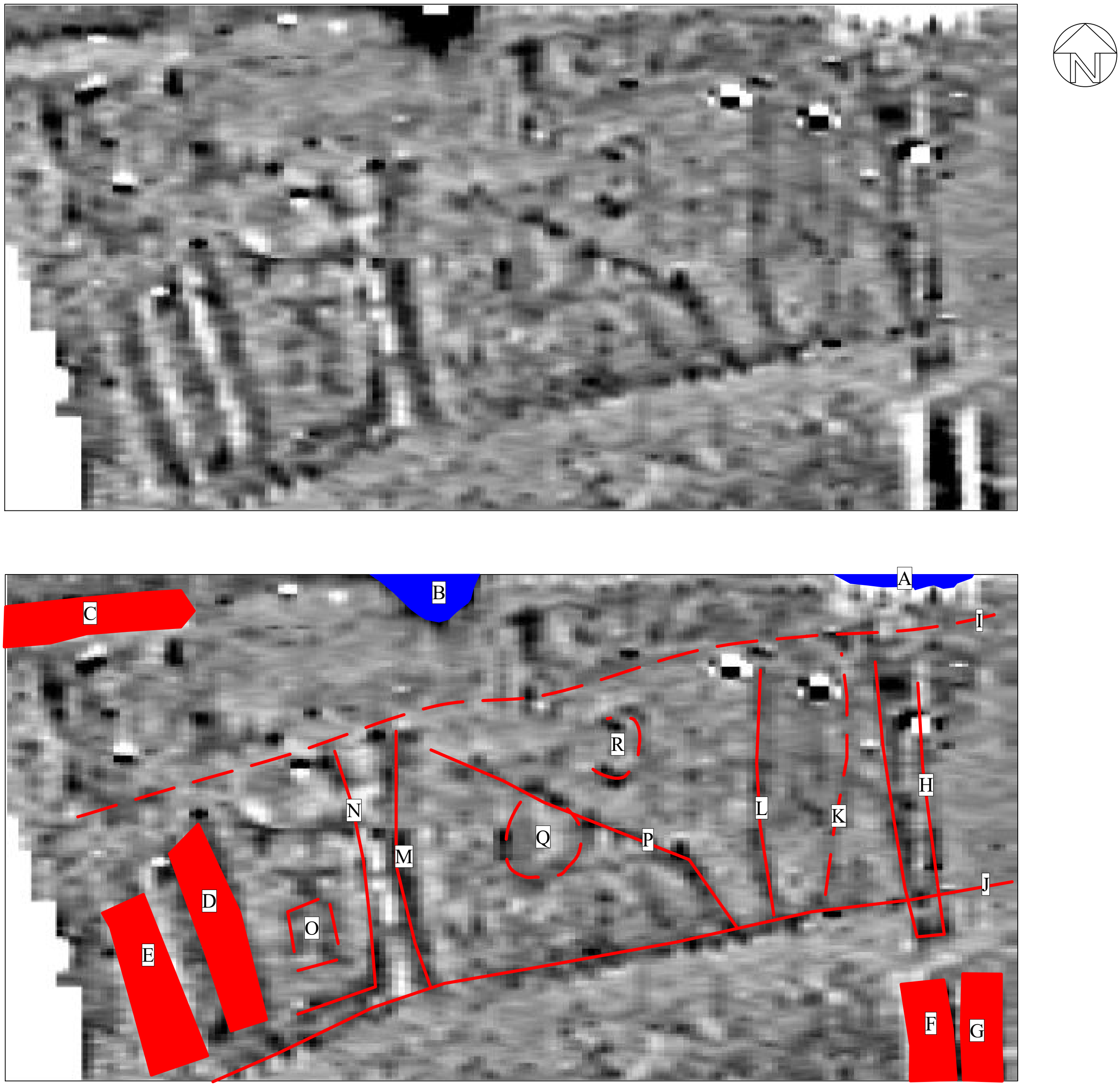


Figure 5: X-Y Plot
Scale 1:500



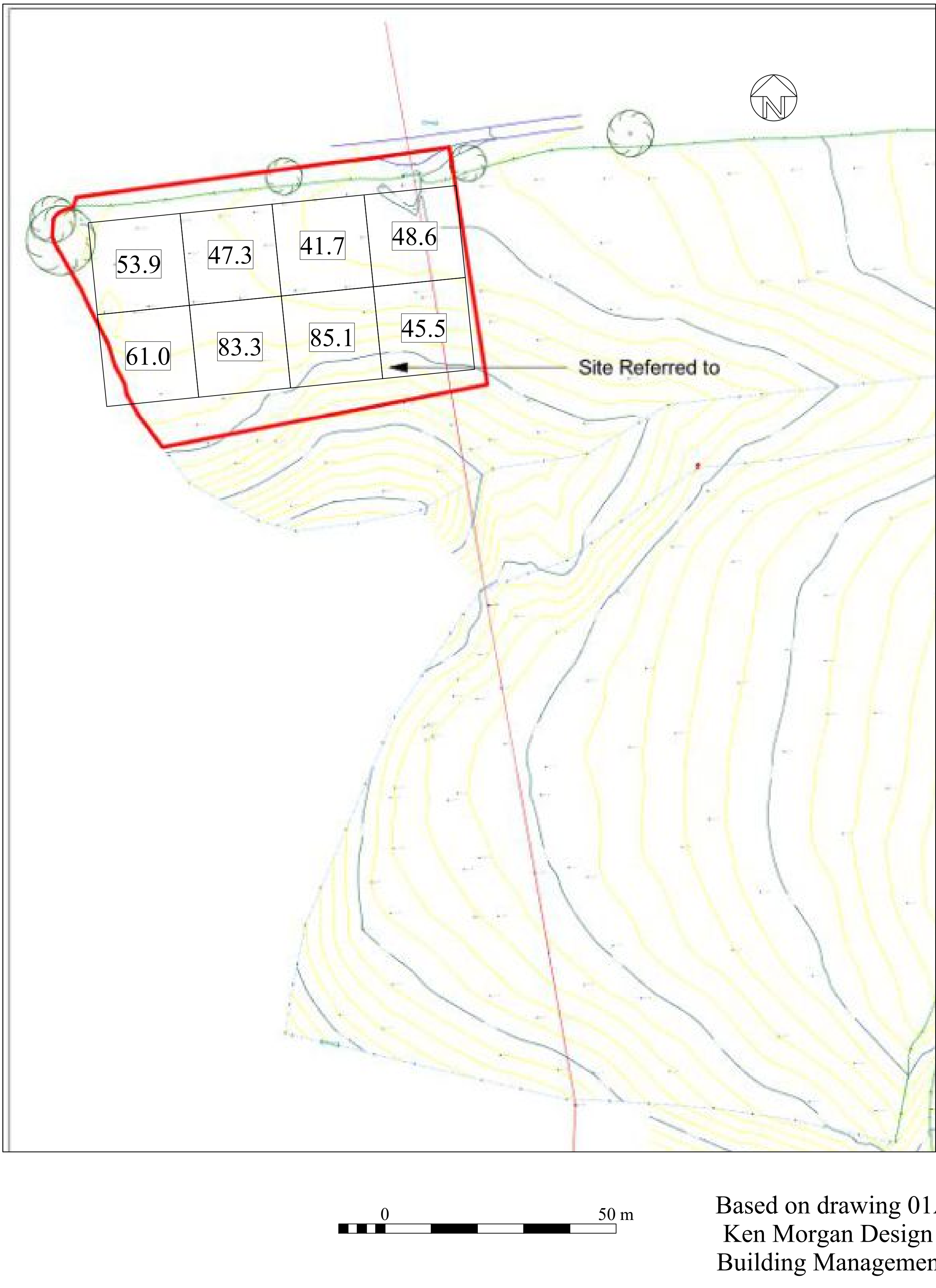
Linear anomaly (archaeology)

Possible linear anomaly (archaeology)

Ferromagnetic response

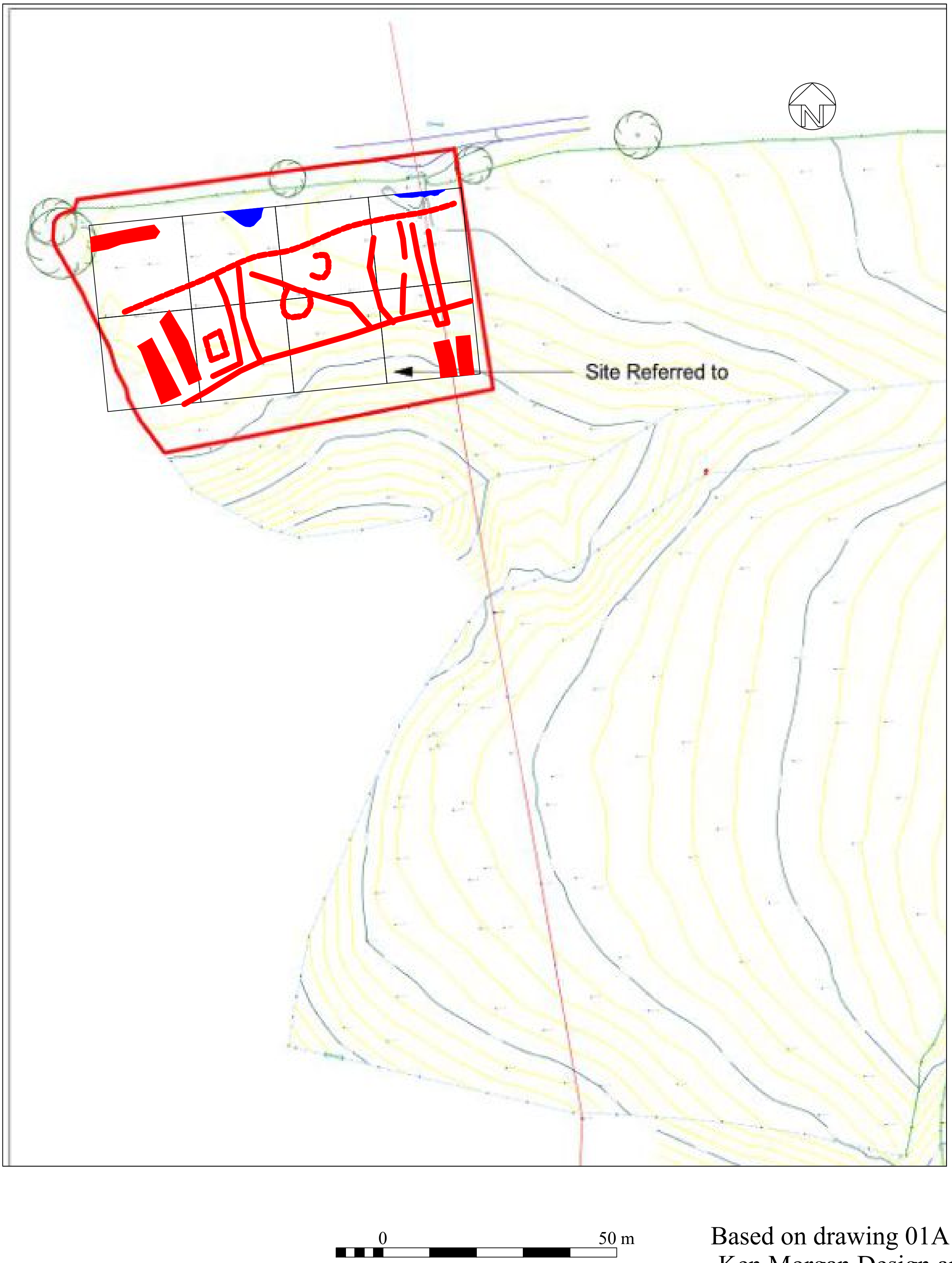
0 50 m

Figure 6: Interpretation
Scale 1:750



Based on drawing 01A by Ken Morgan Design and Building Management Ltd

Figure 7: Magnetic Susceptibility Results
Scale 1:1250



Based on drawing 01A by Ken Morgan Design and Building Management Ltd

Linear anomaly (archaeology)

Possible linear anomaly (archaeology)

Ferromagnetic response

Figure 8: Summary
Scale 1:1,250