eas

Engineering Archaeological Services Ltd.

Pentraeth Flood Protection Scheme: Geophysical Survey

Commissioned by

Eifion Glyn Davies

YGC, Gwynedd Council

Analysis by

I.P. Brooks

Engineering Archaeological Services Ltd

EAS Client Report 2018/07

CONTENTS

List of Illustrations

NGR

From: SH 52397 78011

To: SH 51878 78066

Location and Topography (Figures 1 and 2)

The total length of the proposed flood alleviation scheme is approximately 560 m running from adjacent to the A5025 (Ffordd Pentraeth), just south of the village of Pentraeth, to outfall in the Afon Nodwydd near the Pentraeth Corn Mill (NPRN 407846, ttp://map.coflein.gov.uk/index.php?action=do_details&numlink=407846&cache_name=ZXh0ZW50dHlwZSxCT1hfbWlueCwyNTE0NTRfbWlueSwzNzc3ODlfbWF4eSwzNzg5MDRfbWF4eCwyNTI5MzFfc2VhcmNodHlwZSxhZHZhbmNlZF9vcmE=). It skirts the southern end of the Nant y Felin housing estate in the process. In general, the route crosses two terraces running roughly parallel with the Afon Nodwydd with the upper terrace at approximately 35m OD, to the east, and the lower terrace at 23m OD, to the west. At the eastern end, the route (Figure 2, Area 1) starts in the area of a silted-up pond (Plate 1) with a stone-built dam (Plate 2) at its northern end. The pond is triangular in shape, approximately 60 m long and 30 wide and is crossed by a narrow causeway (Plate 3) leading from a, now blocked, wrought iron kissing gate (Plate 4). This area of the survey is separated from the main area of the upper terrace by a natural rocky ridge.

Areas 2 and 3 are on the upper terrace which slopes gently down to the north and west. Within Area 2 there is a low natural rocky mound, whilst Area 3 is crossed by a small stream and is bounded, to the north, by a ditch along part of its length. All of the fields on the upper terrace were under pasture.

Areas 4, 5, 6 and 7 are on the lower terrace, a relatively flat area under damp pasture. Area 7, in particular, was used for horses and the field was particularly poached. The eastern end of Area 4 is marked by a small stream at the foot of the slope from the upper terrace, whilst Area 7 is separated from the rest of the survey by Bron Ffinan, the lane linking Pentraeth to Pen Ceint. Areas 5 and 6 are also crossed by the line of a gas pipeline as is shown by the aerial marker in the hedge.

The survey took place on 15th and 17th May 2018.

Archaeological Background

YGC, Gwynedd Council working on behalf of Ynys Môn County Council are currently designing a flood alleviation scheme at Pentraeth, Ynys Môn. The scheme consists of the digging of a channel which will be flanked on both sides by a bund from SH 52397 78011 to SH 51878 78066. This will protect the Nant-y-Felin, housing estate. Although there is no previously known archaeological records from the route of the scheme, the Pentraeth area, in general, has a high potential for prehistoric archaeology. Several barrows (burial mounds) are recorded locally and there are also a number of recorded discoveries of stone axes which indicate a general potential for further remains, although the exact find spots for these tools is unknown.

Aims of Survey

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

SUMMARY OF RESULTS

There appears to be a differential response on each of the terraces crossed by the scheme. The eastern (upper) terrace has a series of linear anomalies some of which appear to define part of a field system. At the eastern end of the scheme the silted-up pond has two anomalies running along its western edge suggesting there may be a formal structure to this side of the pond. The pond is also crossed by a linear anomaly which follows the line the footpath on a raised causeway from the kissing gate on the eastern side of the pond.

Few magnetic anomalies were recorded on the lower terrace, except for the very high readings from the gas pipeline. The magnetic susceptibility samples, however, would suggest that the lower terrace was less suitable for magnetic survey.

Methods

A series of 15, 30 x 30 m squares were 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 plots using Golden Software "Surfer" v. 10.7.972.

Small soil samples were taken for Magnetic Susceptibility analysis from some of the grid squares (Figure 25). These were dried, sieved through a 2mm sieve and analysed using a Bartington MS2 Magnetic Susceptibility meter and MS2B detector

Survey Results:

Area

The total area investigated was 1.38 Ha

Display

The results are displayed as grey scale images (Figures 3, 6, 9, 12, 15, 18, 19, 22) and as X-Y trace plots (Figure 4, 7, 10, 13, 16, 20, 23). The interpretation plots are shown as Figures 5, 8, 11, 14, 17, 21 and 24 and the data is summarised in Figure 26.

Results:

Fluxgate Gradiometer Survey (Figures 3 – 24)

There is a difference in the occurrence of magnetic anomalies likely to be the result of archaeological activity on the two terraces of the survey. The upper terrace, to the east has a number of linear anomalies, possibly suggesting previous field systems, whilst the lower terrace does not appear to have the same density of anomalies present. Whilst this may reflect the pattern of exploitation in the past with the lower, wetter, terrace seeing less activity, it is also possible that this pattern reflects the underlying geology of the survey area.

Within Area 1 (Figure 5) the magnetic anomalies identified can be directly related to the topographic features within the survey area. Anomaly A marks the line of a narrow causeway (Plate 3) crossing the damp area of the silted-up pond. This feature acted as a footpath leading to the kissing gate (Plate 4). Anomaly B marks the western edge of the pond suggesting that there may be a formal edge to this feature, such as a brick will. Parallel to this Anomaly C is approximately 4 m away from Anomaly B, possibly suggesting a trackway alongside the pond.

The linear anomalies within Area 2 (Figure 8) are less clear than those within Area 1, however four linear anomalies have been defined together with an area of slight magnetic disturbance (Anomaly D) This area of magnetic disturbance is the effect of a natural rock outcrop within the survey area. The linear anomalies (Anomalies E – H) make no clear patter, although Anomalies E and F would appear to be at right angles to each other and may represent part of a field system. The ferromagnetic responses (Anomaly I) along the southern side of the survey reflect the proximity of the wire fence and the wider area at the western end of this anomaly shows the position of the metal gate.

The anomalies in Area 3 are clearer (Figure 11). With a linear anomaly (Anomalies J and L) crossing the small stream dividing the survey area. This anomaly appears to follow the southern side of an access route currently being used to cross the stream, however this may be coincidental. Linking in to this anomaly, Anomaly K would suggest that Anomalies J and L are not necessarily related to the modern land use. West of the stream, there are two linear anomalies running parallel to Anomaly L (Anomalies M and N) of unknown function. There are a series of feint linear anomalies (Anomalies O – S) running roughly at right angles to Anomaly J/L which are assume to show the direction of agricultural activities in the past, possibly the use of ridge and furrow agriculture. Two areas of ferromagnetic response (Anomalies T and U) are the result of modern activities. Anomaly T is adjacent to the stream crossing and Anomaly U marks the cleaning of the ditch running along the side of the survey area.

On the lower terrace, Area 4 (Figure 14) has only on feint linear anomaly (Anomaly V) of uncertain function. There is also an area of ferromagnetic response (Anomaly W) which is a result of the proximity of the fence surrounding the garden at this point. A similar pattern is found in Areas 5 and 6 (Figures 17 and 21) with only one feint linear anomaly (Anomaly X) being recognised. These areas are dominated by a large ferromagnetic response (Anomaly Z) which marks the line of a gas pipeline crossing the survey area. The size of this anomaly is only partly a reflection of the size of the pipe used for this pipeline, as welded gas pipelines carry a cathodic protection charge, thereby increasing the magnetic signature of the pipe. There is also a smaller ferromagnetic anomaly (Anomaly Y) which is probably a fragment of agricultural iron within the topsoil.

No anomalies of archaeological origins have been recognised within Area 7 (Figure 24) with only a zone of ferromagnetic responses (Anomaly AA) along the fence to the north west of the survey area.

Magnetic Susceptibility (Figure 25)

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 25.

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 2	36	49.3
Grid 3	43	58.9
Grid 4	76	108.6
Grid 5	70	92.1
Grid 6	95	126.7
Grid 7	82	107.9
Grid 8	108	166.2
Grid 10	15	21.7
Grid 11	10	15.4
Grid 14	17	24.3
Grid 15	14	18.9

Sample	Volume susceptibility χ_v	Mass susceptibility χ_m
Grid 16	12	18.5
Grid 17	13	20.6
Grid 18	14	26.9
Grid 20	36	48.0

There is a clear pattern within the susceptibility readings with higher values on the upper terrace. This would suggest that the magnetic regime was considerably better on the upper terraces and that the low values on the lower terrace was not ideal for magnetic survey.

There is also some patterning within the samples from the upper terrace with increased readings towards the western side of the terrace. This also reflects the number of anomalies recorded and thus may reflect the general level of archaeological activity.

Conclusions (Figures 7)

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.

There is a clear difference between the anomalies recorded on the upper and lower terraces which is probably, at least in part, a reflection of the underlying geology of the survey areas. It was noticeable, however that the fields of the lower terrace were much wetter and therefore the pattern recorded could reflect the previous land-use pattern.

On the upper terrace a series of linear anomalies suggest a previous land division system which is not followed by the current fields. The dating of this relict field system is unknow, but the possible ridge and furrow may suggest a medieval or later date. The anomalies in Area 1, however, can be directly related to the silted-up pond and its associated features.

The main anomalies in the surveys on the lower terrace are related to modern activities in this area, particularly a gas pipeline crossing the survey area.

Acknowledgements

This survey was commissioned by Eifion Glyn Davies for YGC Gwynedd Council. It was monitored by J Emmett for the Gwynedd Archaeological Planning Service.

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:

Plate 1: The pond in Area 1, looking north

Plate 2: The dam, looking south

Plate 3: Footpath on a causeway

Plate 4: Kissing gate

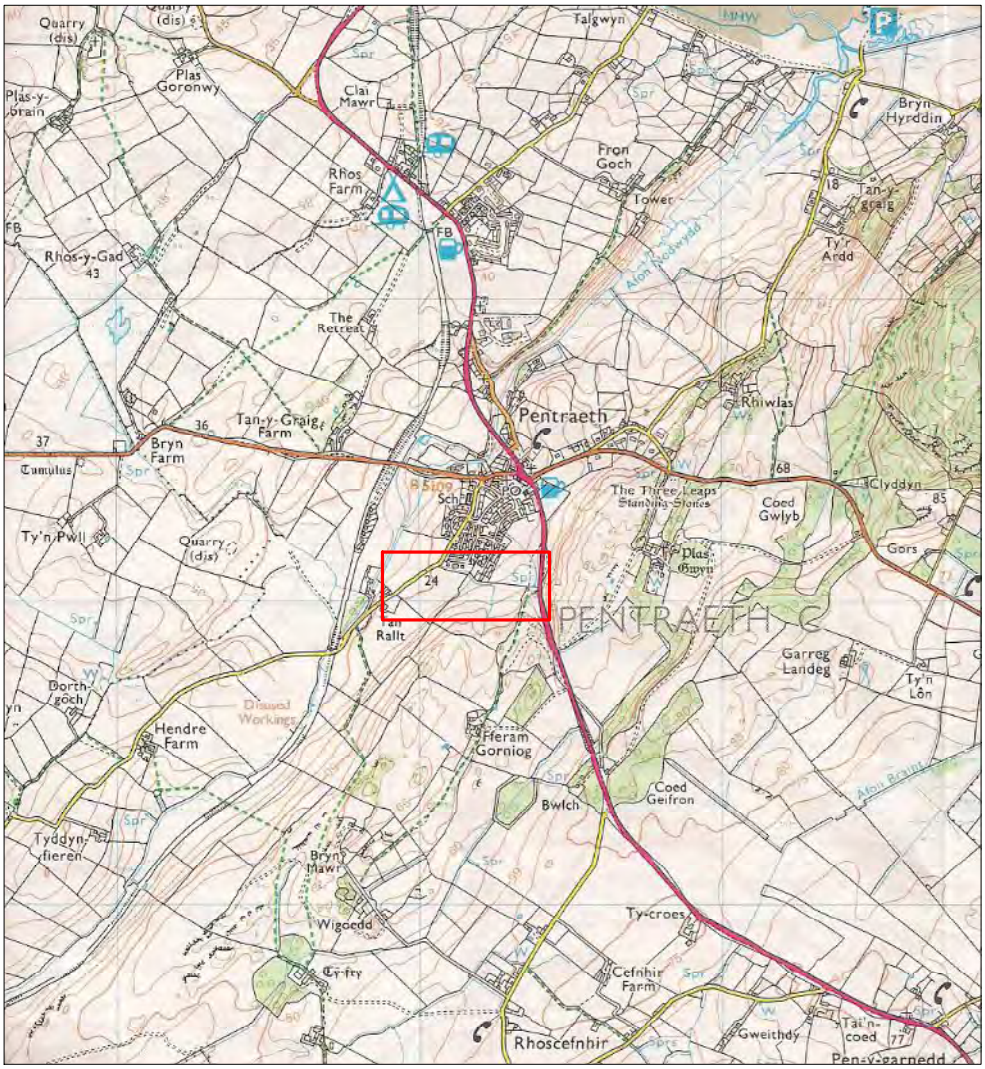

Figure 1: Location
Scale 1:25,000

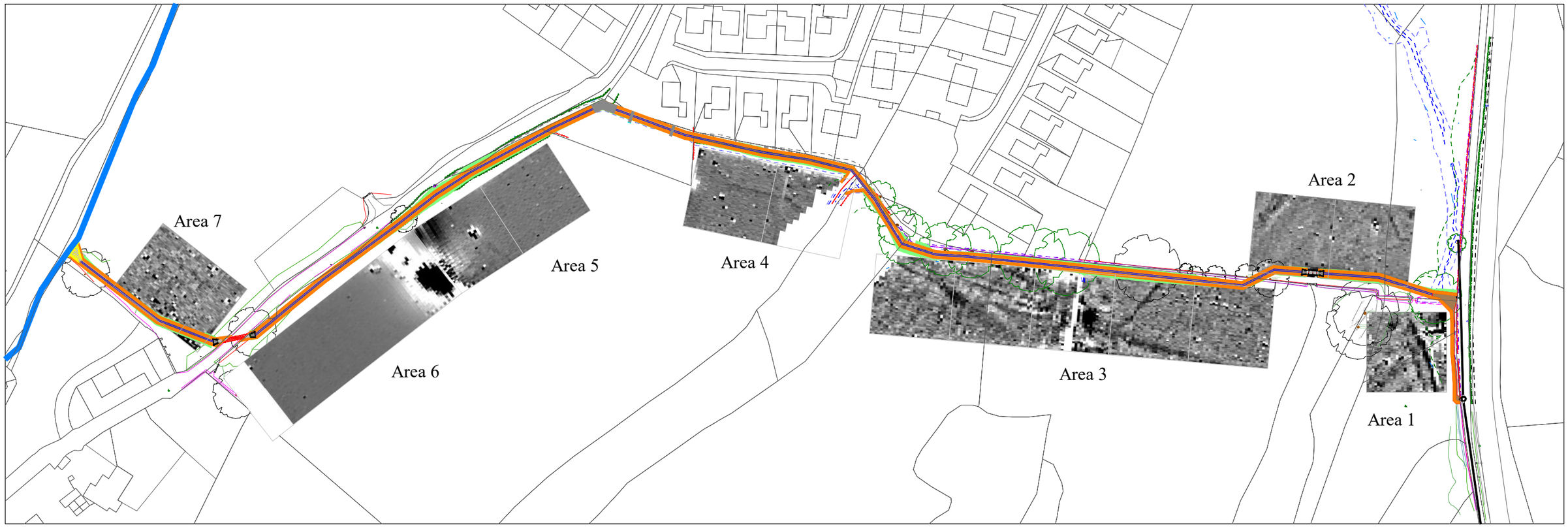

Figure 2: Location of the Survey Areas
Scale 1:1,500

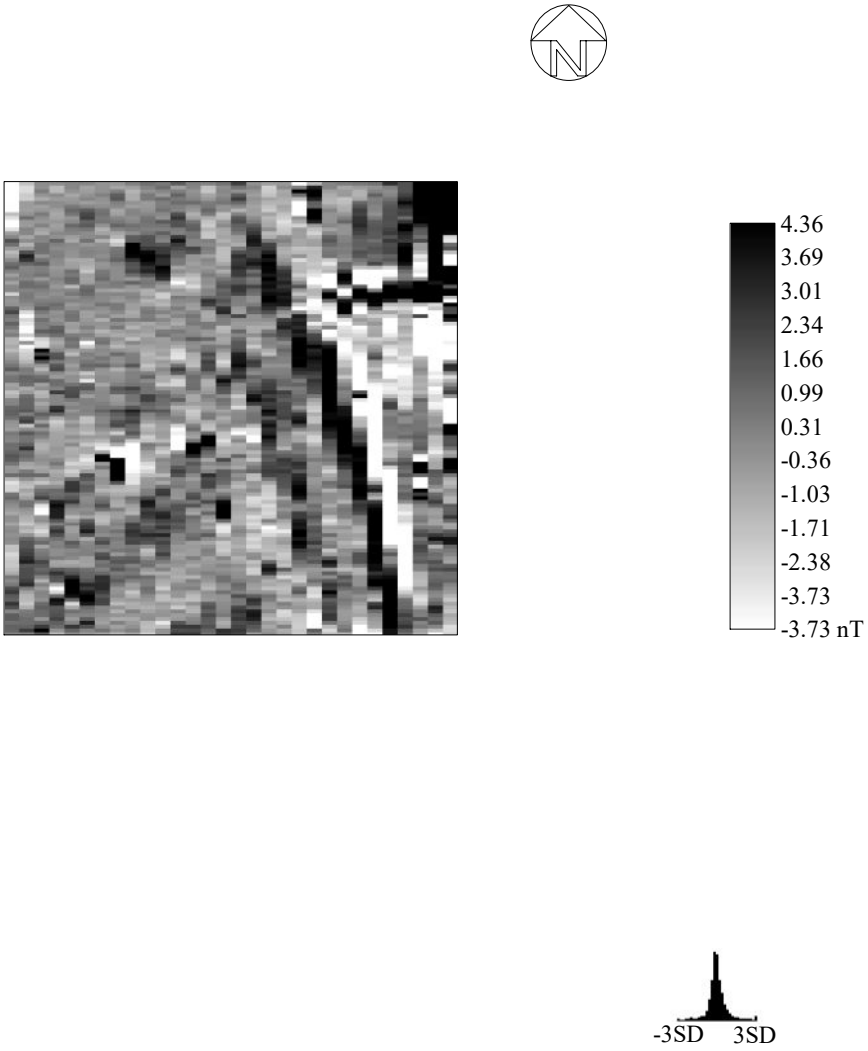

Figure 3: Area 1 Grey Scale Plot
Scale 1:500

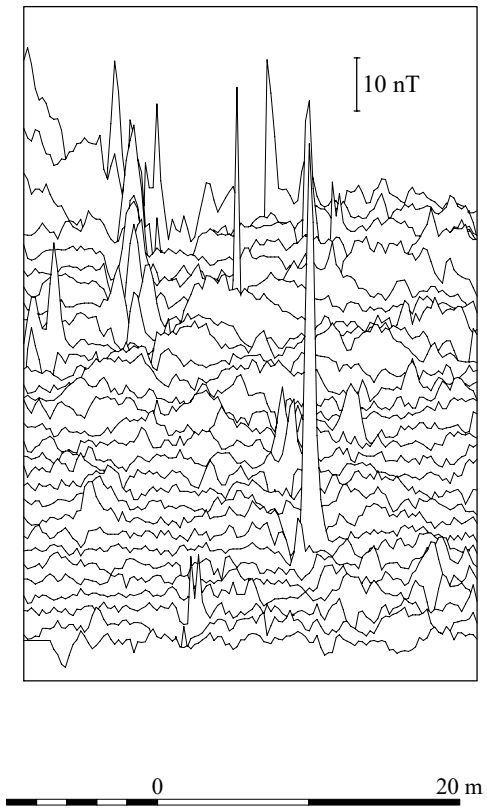

Figure 4: Area 1, X-Y Plot
Scale 1:500

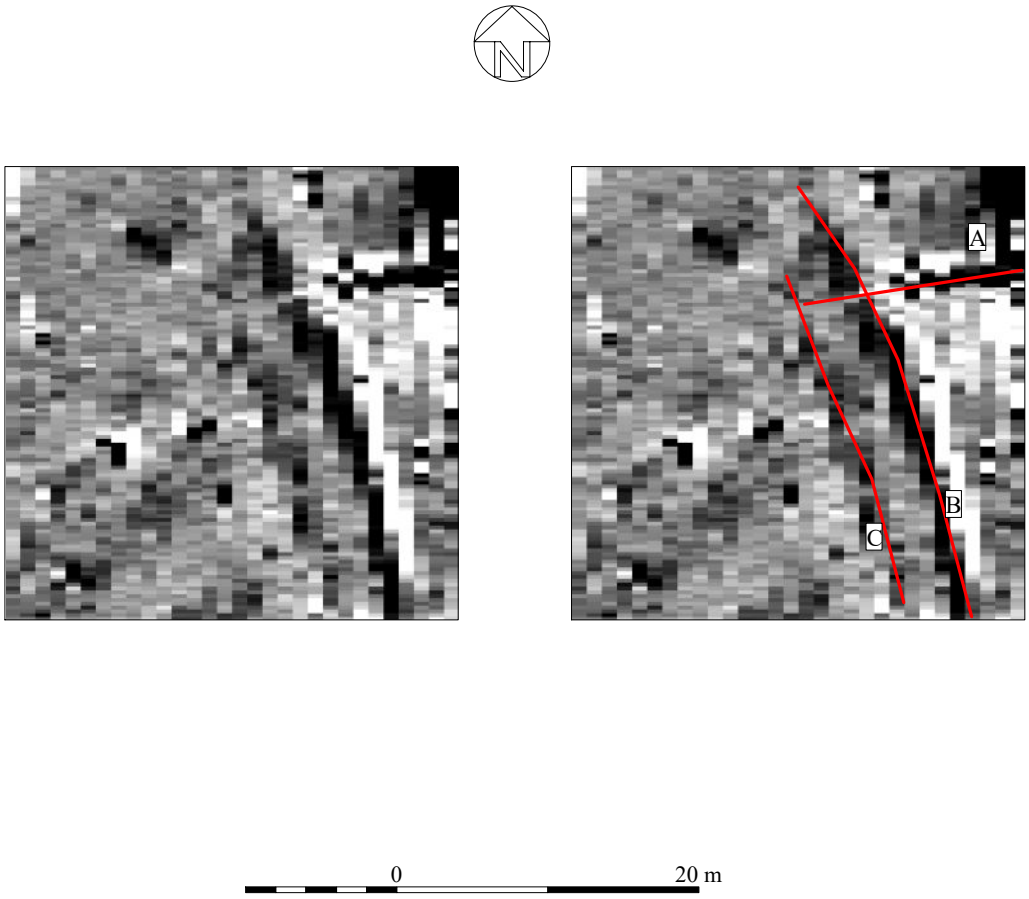

Figure 5: Area 1, Interpretation
Scale 1:500

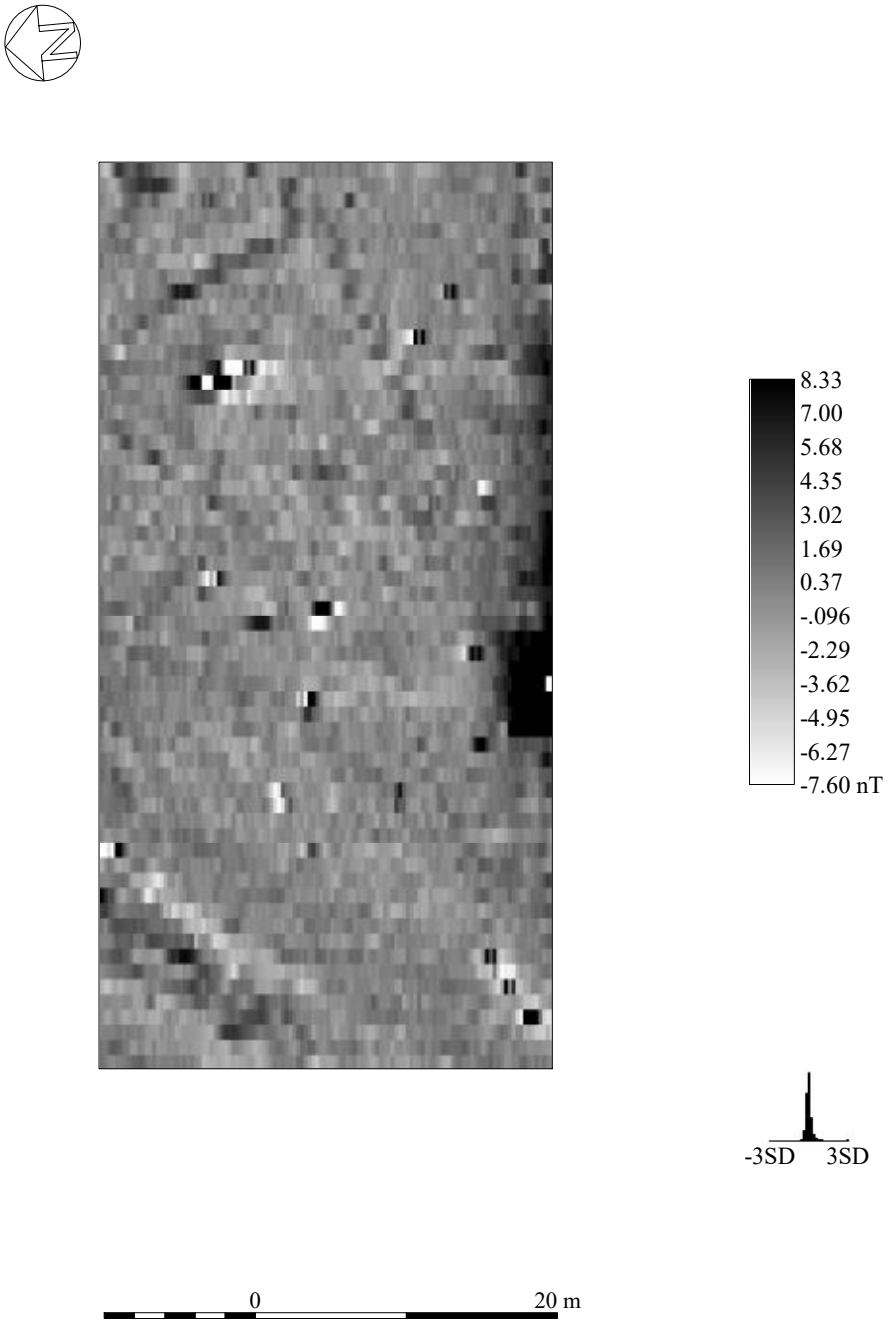

Figure 6: Area 2, Grey Scale Plot
Scale 1:500

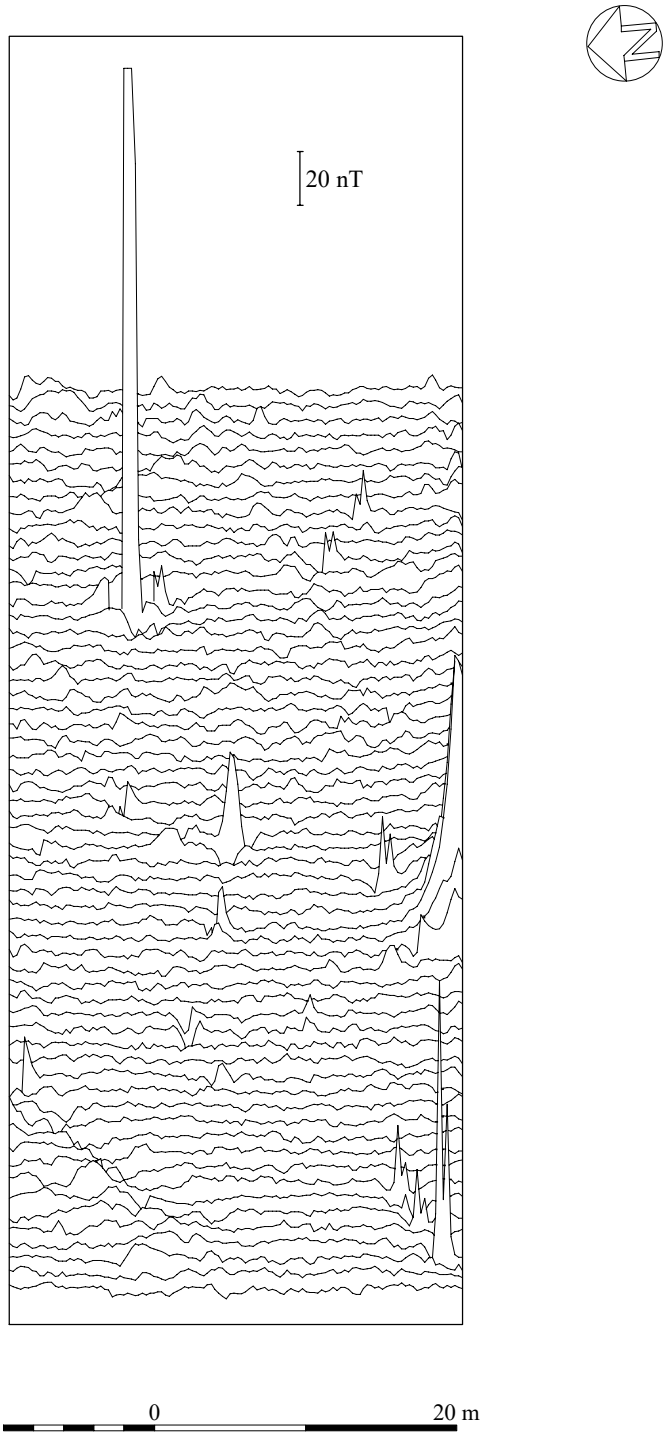

Figure 7: Area 2, X-Y Plot
Scale 1:500

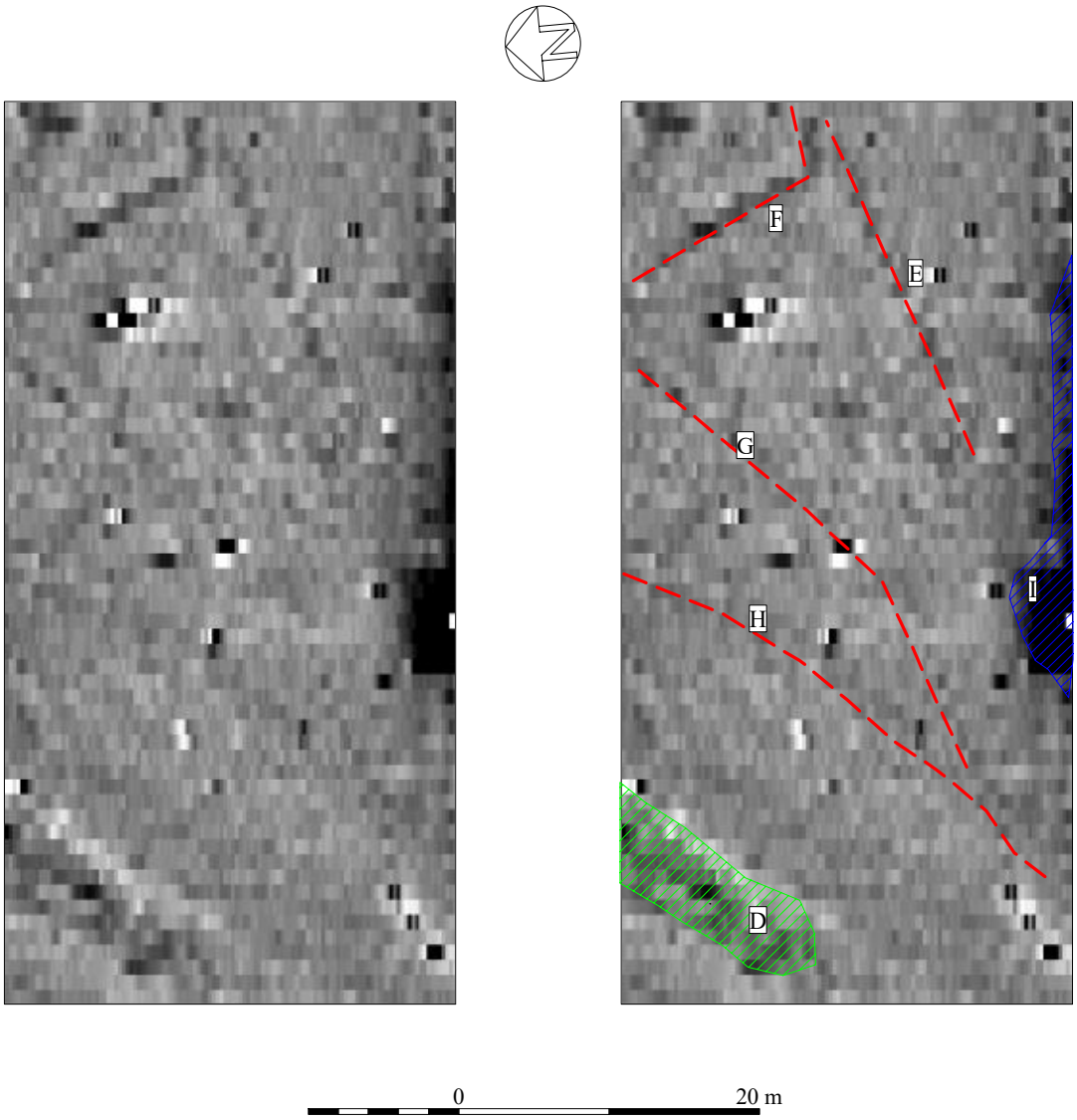

Figure 8: Area 2, Interpretation
Scale 1:500

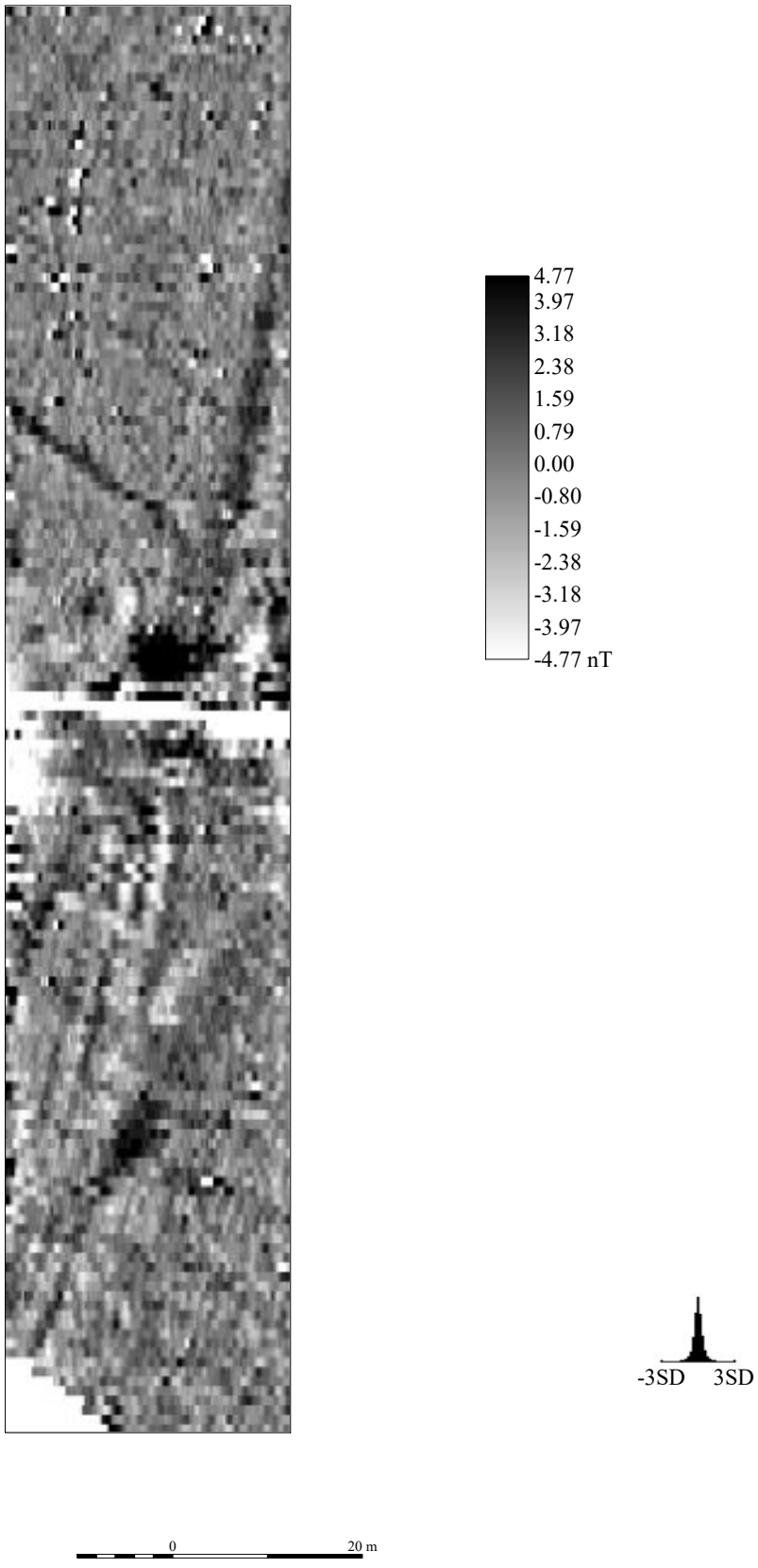

Figure 9: Area 3, Grey Scale Plot
Scale 1:750

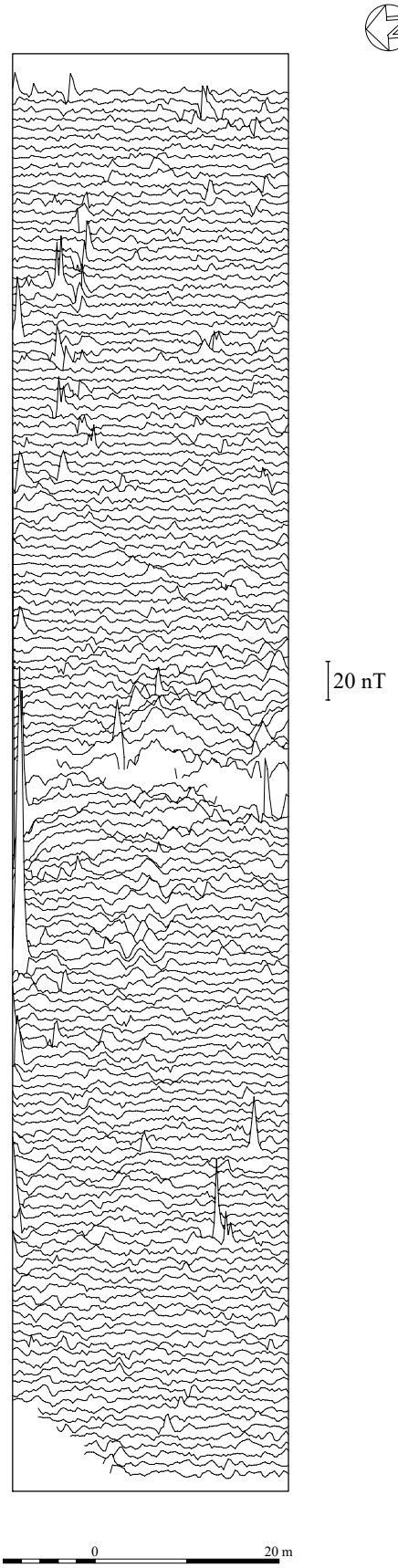

Figure 10: Area 3, X-Y Plot
Scale 1:750

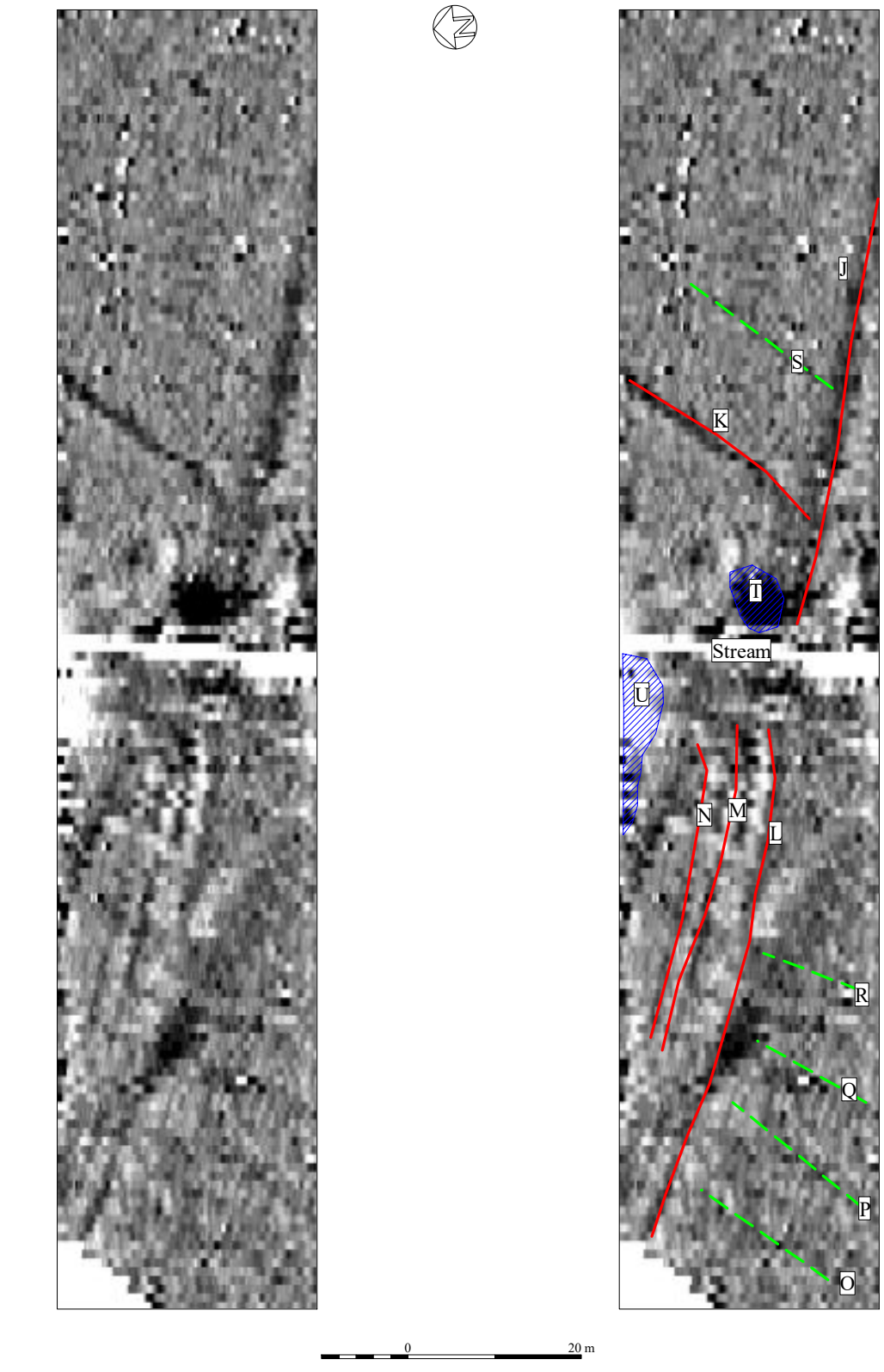

Figure 11: Area 3, Interpretation
Scale 1:750

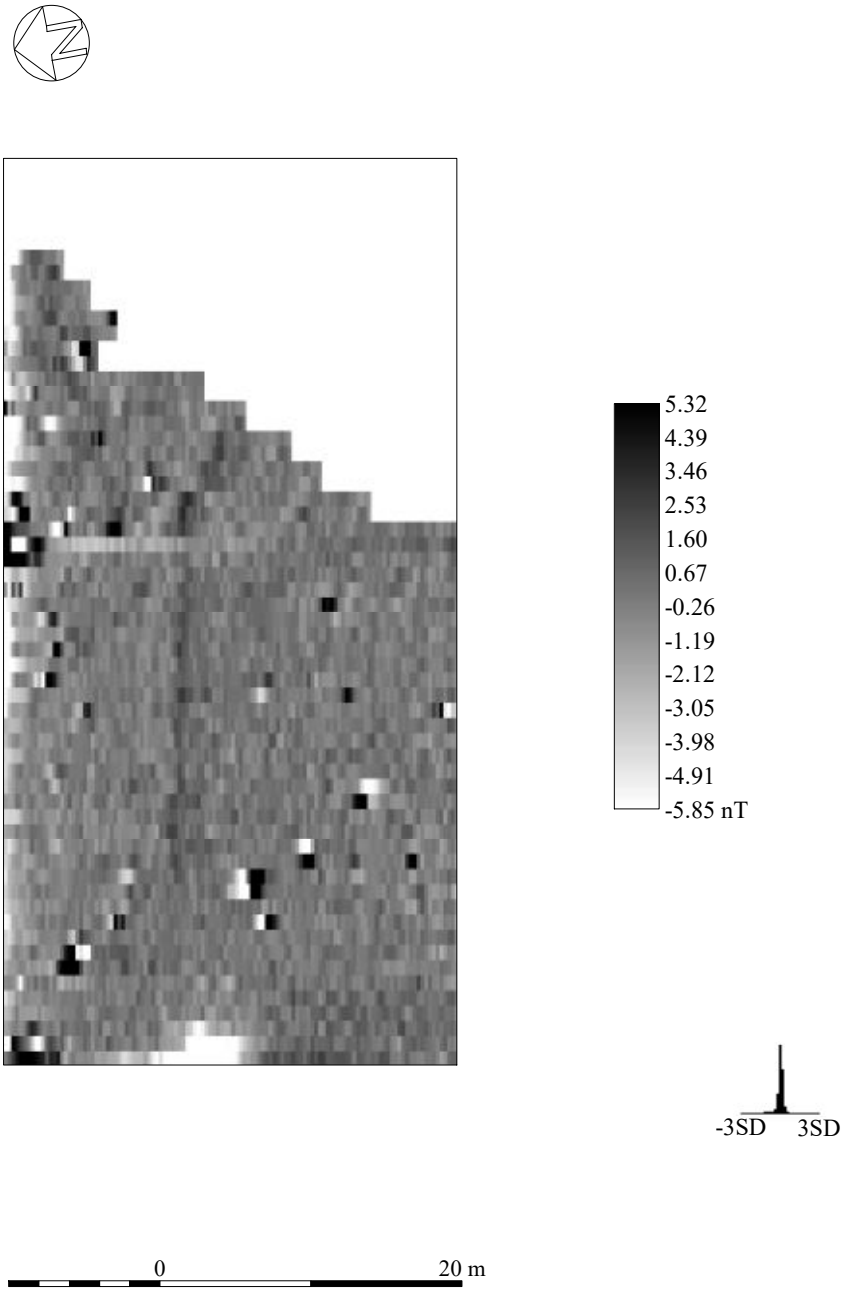

Figure 12: Area 4, Grey Scale Plot
Scale 1:500

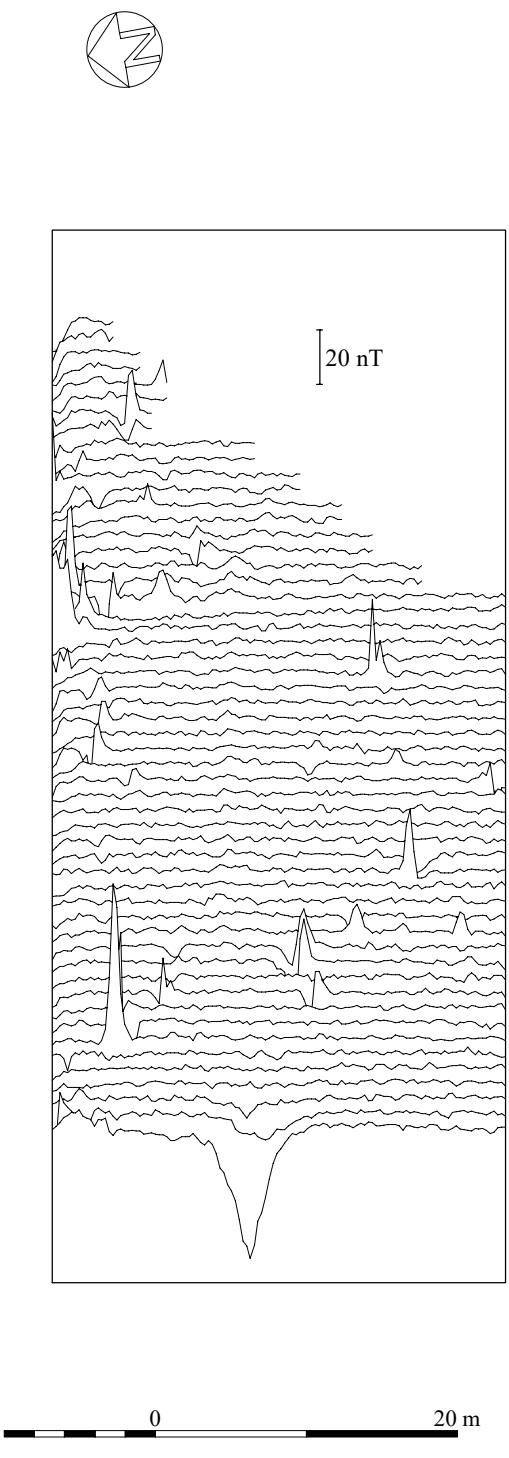

Figure 13: Area 4, X-Y Plot
Scale 1:500

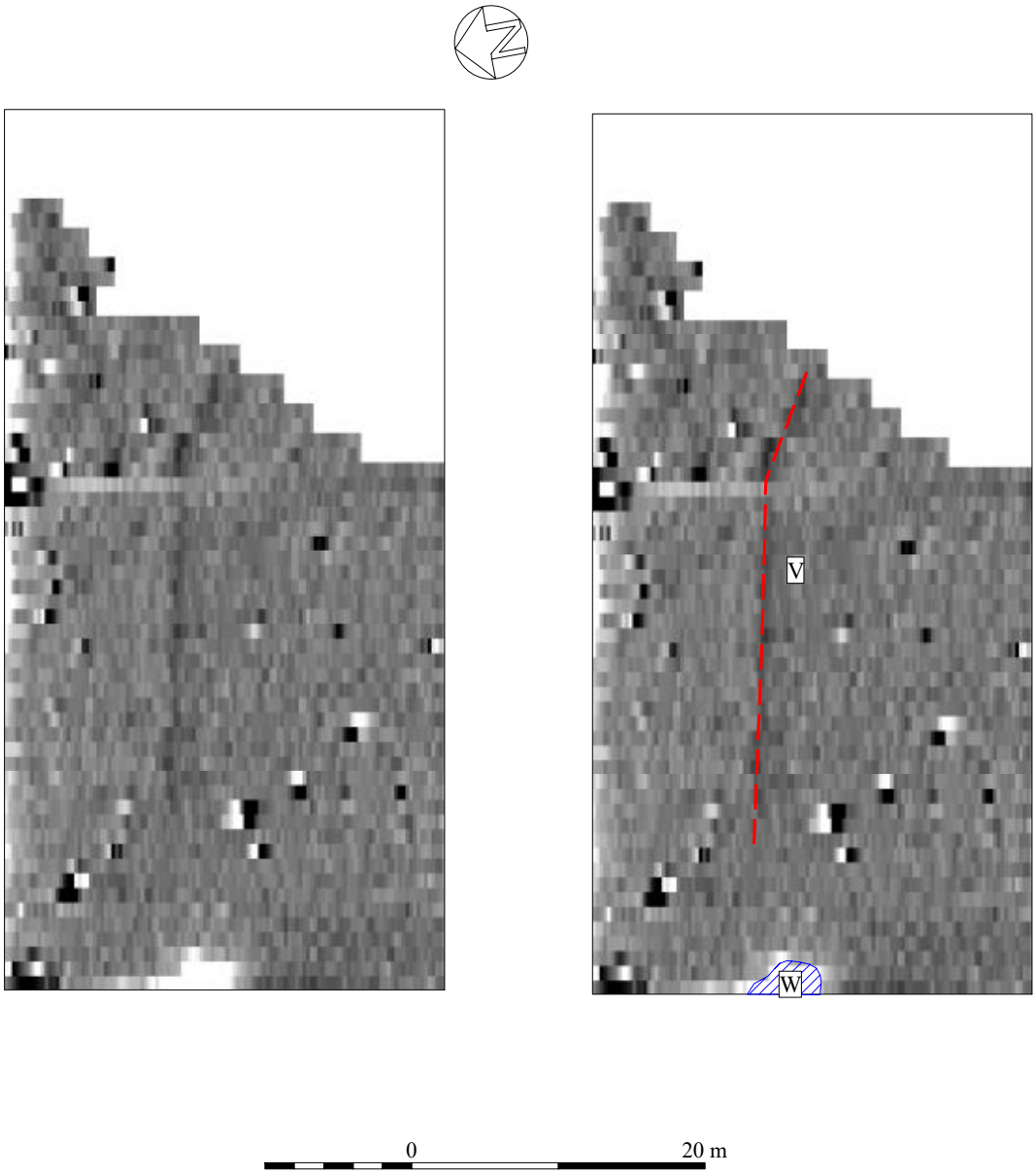

Figure 14: Area 4, Interpretation
Scale 1:500

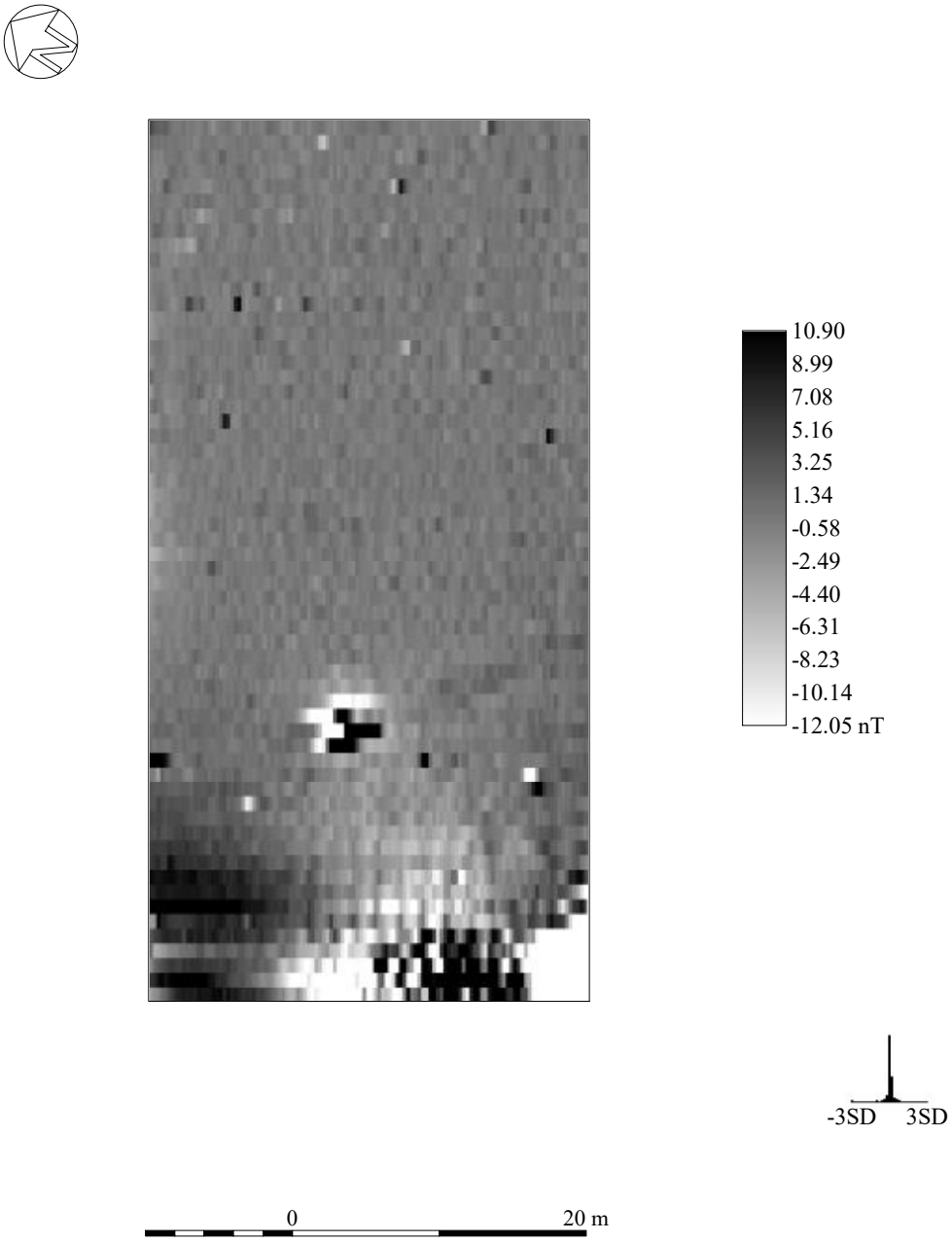

Figure 15: Area 5, Grey Scale Plot
Scale 1:500

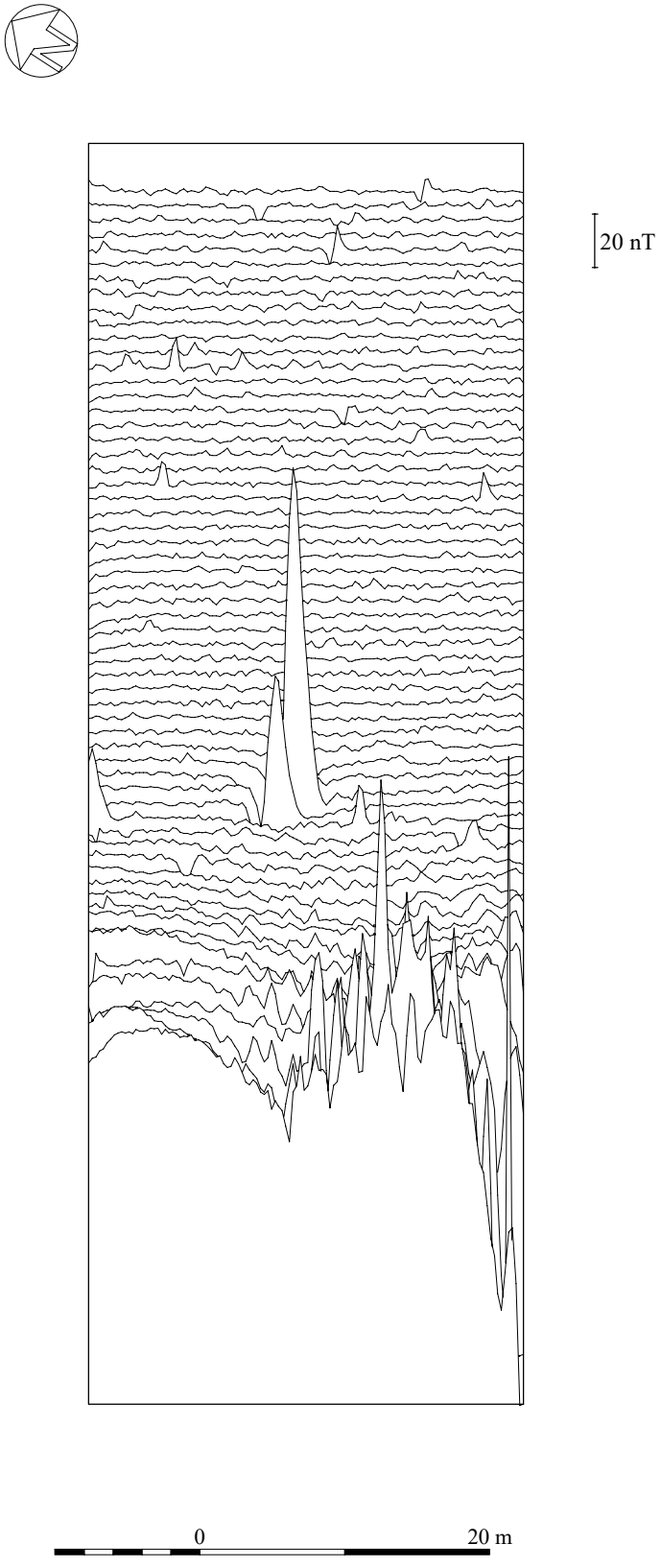

Figure 16: Area 5, X-Y Plot
Scale 1:500

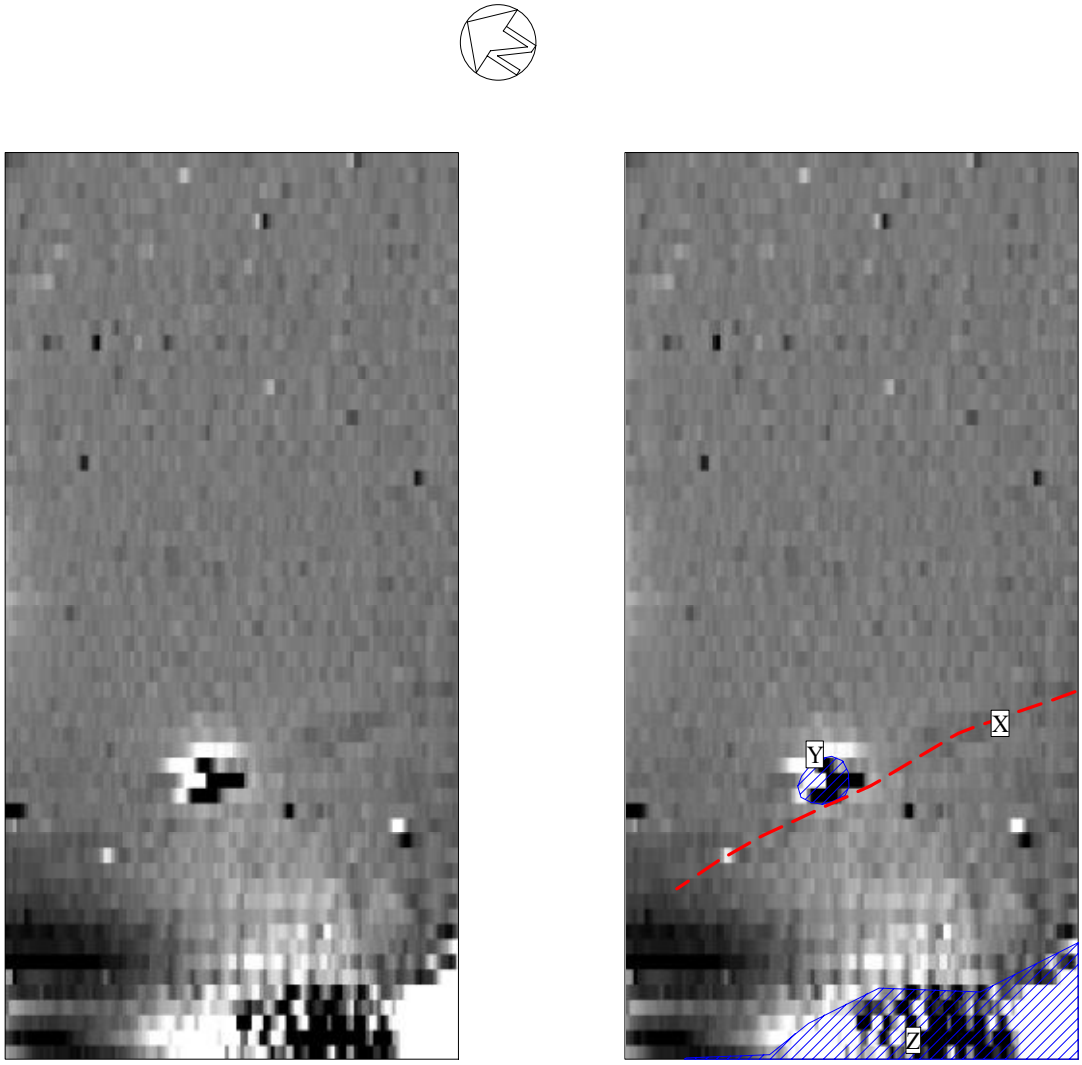

Figure 17: Area 5, Interpretation
Scale 1:500

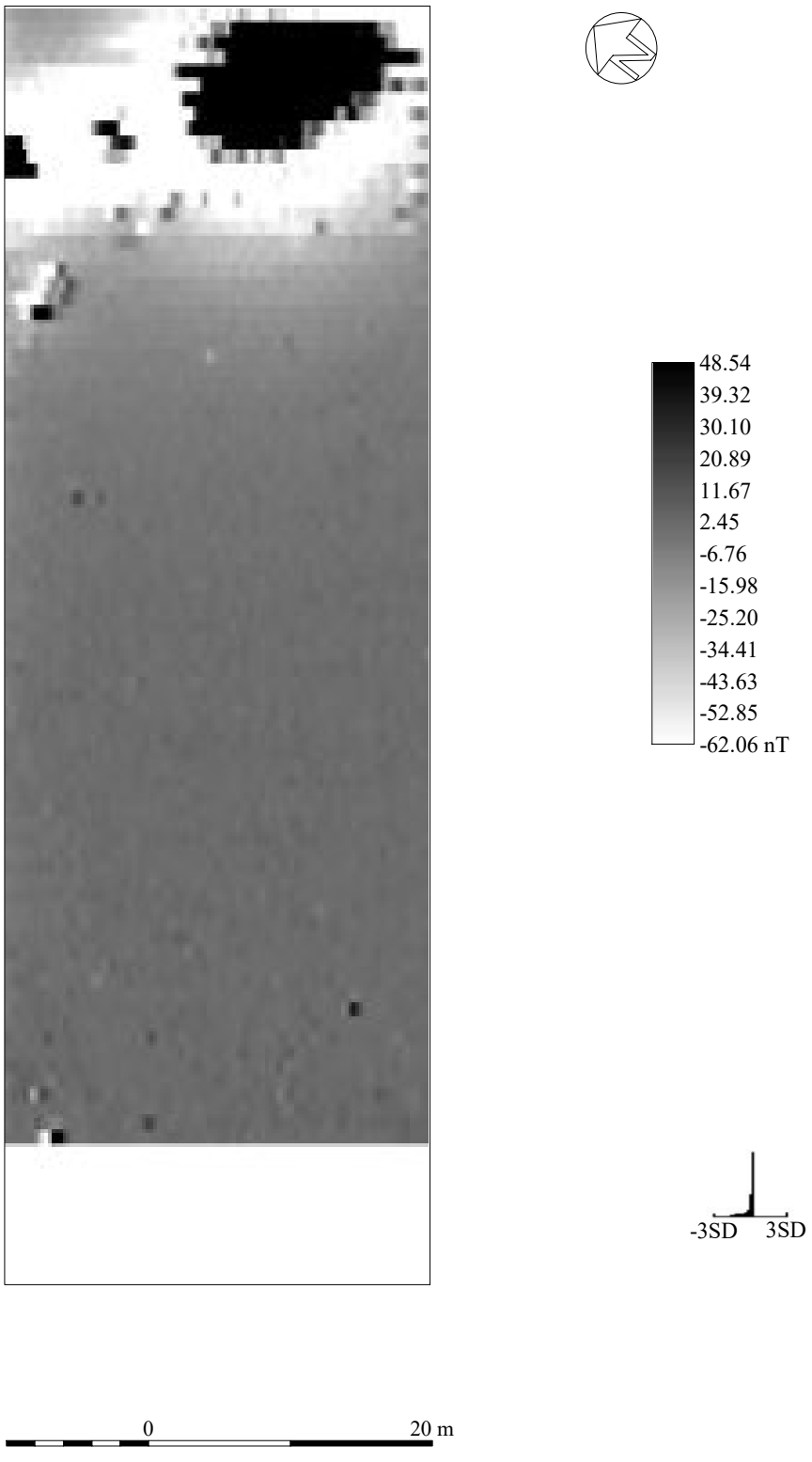

Figure 18: Area 6, Grey Scale Plot
Scale 1:500

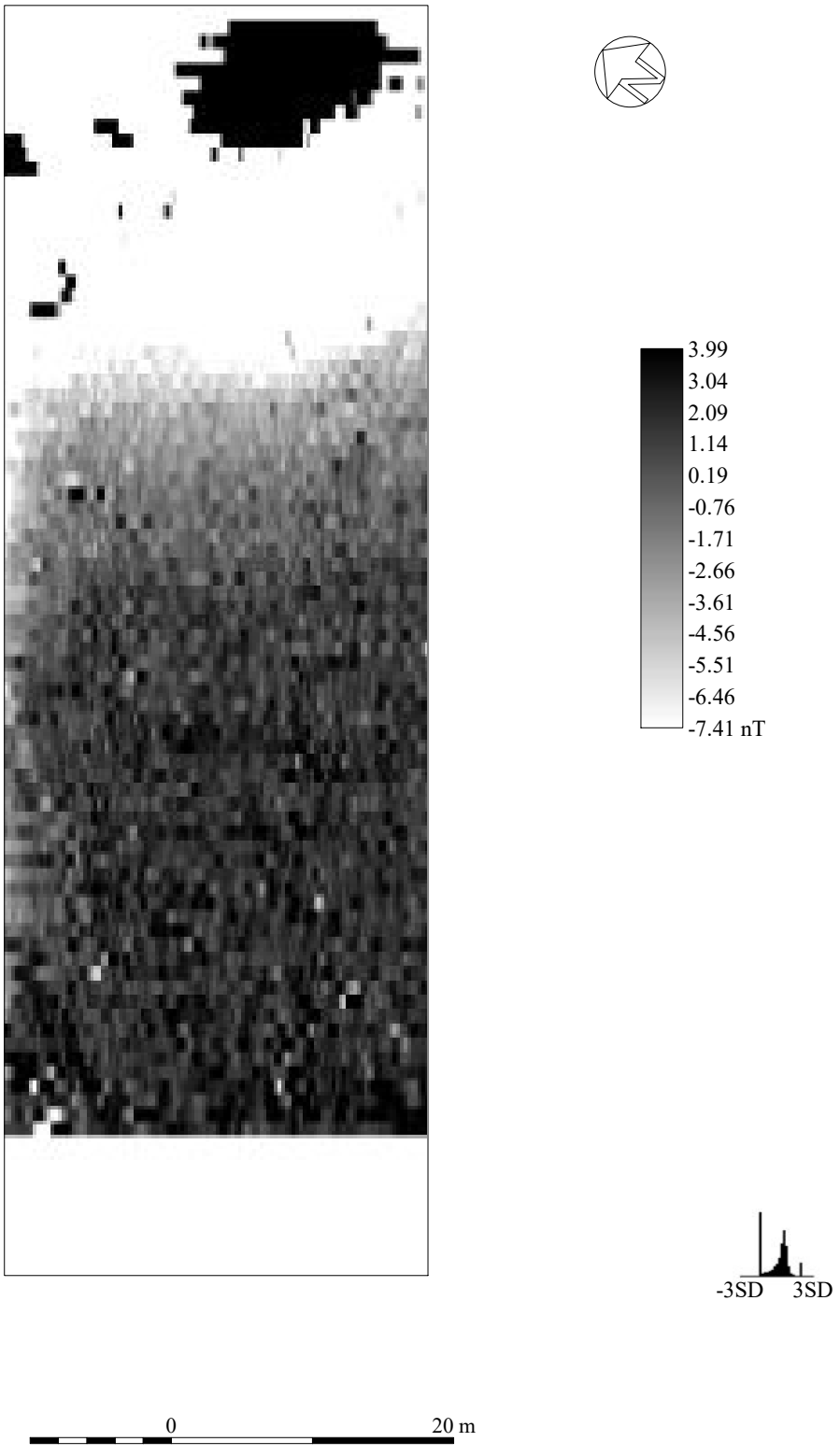

Figure 19: Area 6, Grey Scale Plot clipped to +/- 10 nT
Scale 1:500

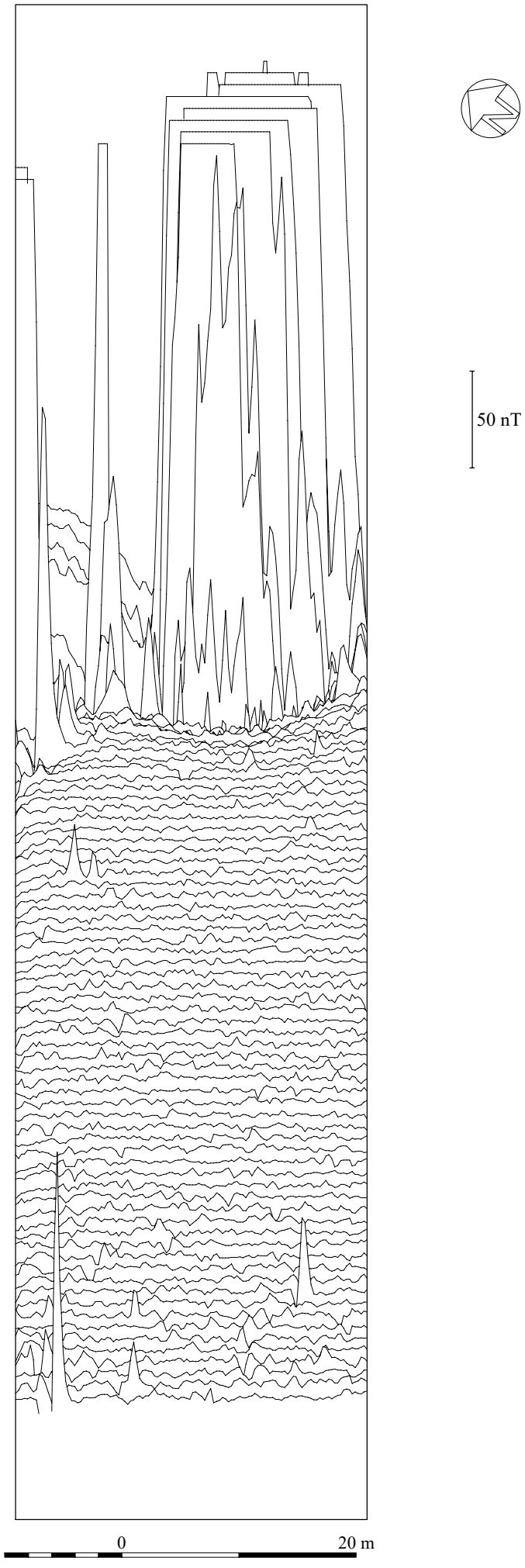

Figure 20: Area 6, X-Y Plot
Scale 1:500

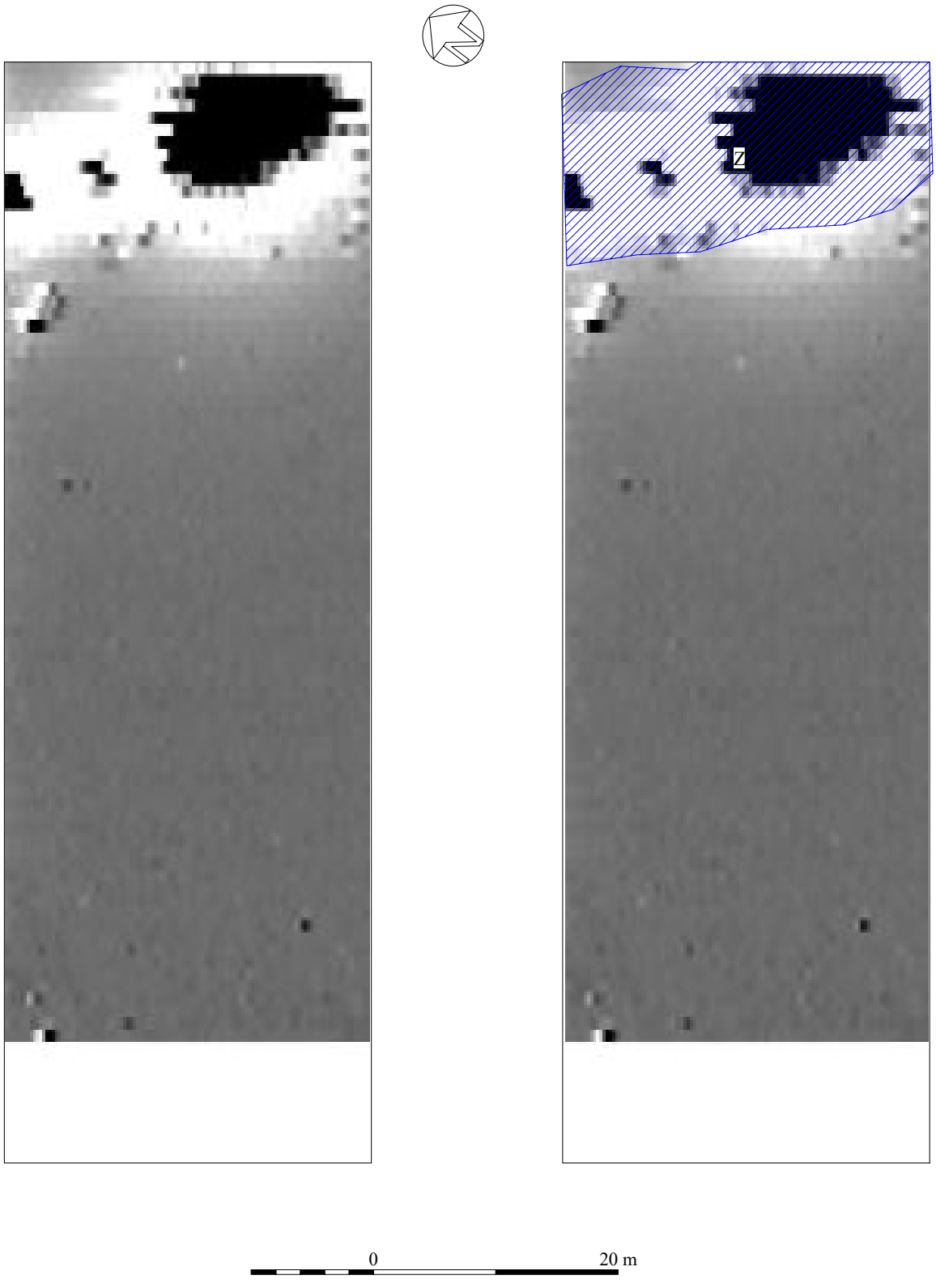

Figure 21: Area 6, Interpretation
Scale 1:500

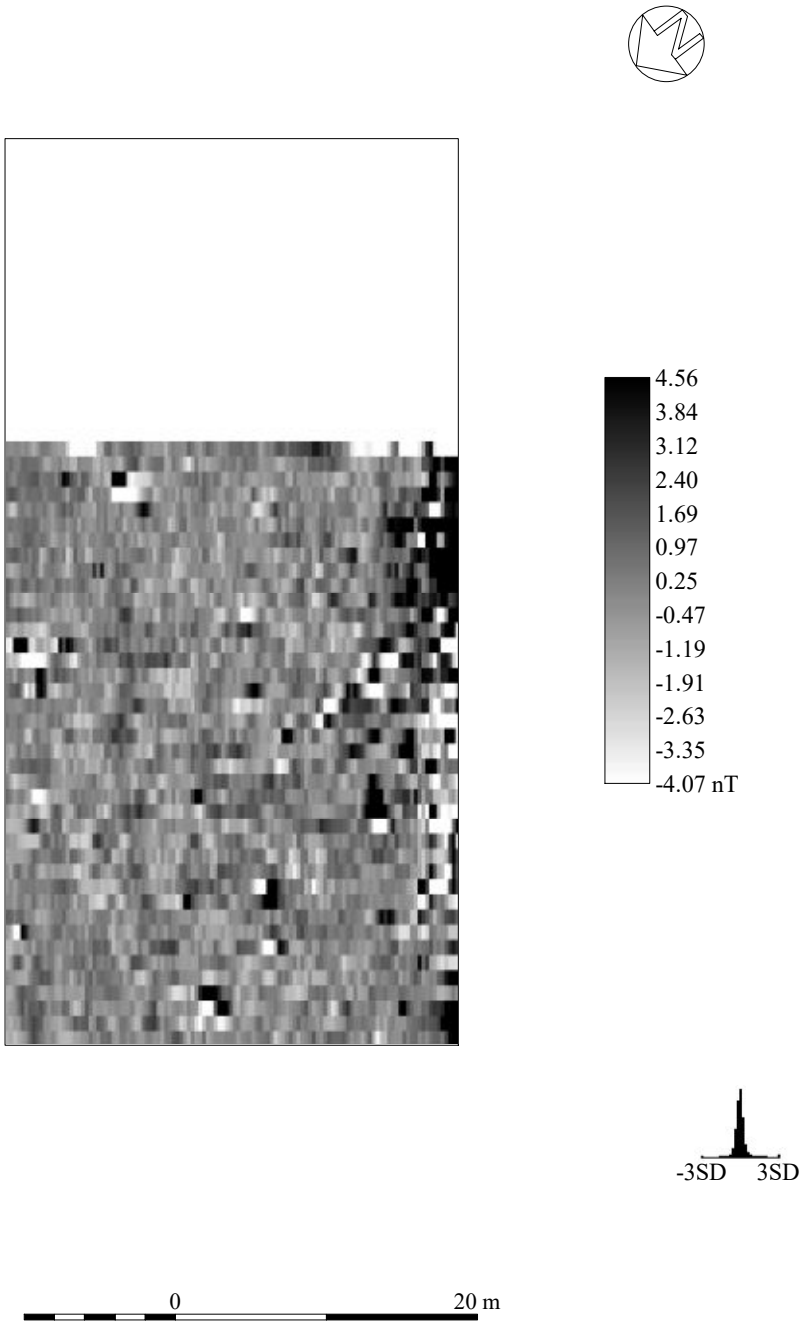

Figure 22: Area 7, Grey Scale Plot
Scale 1:500

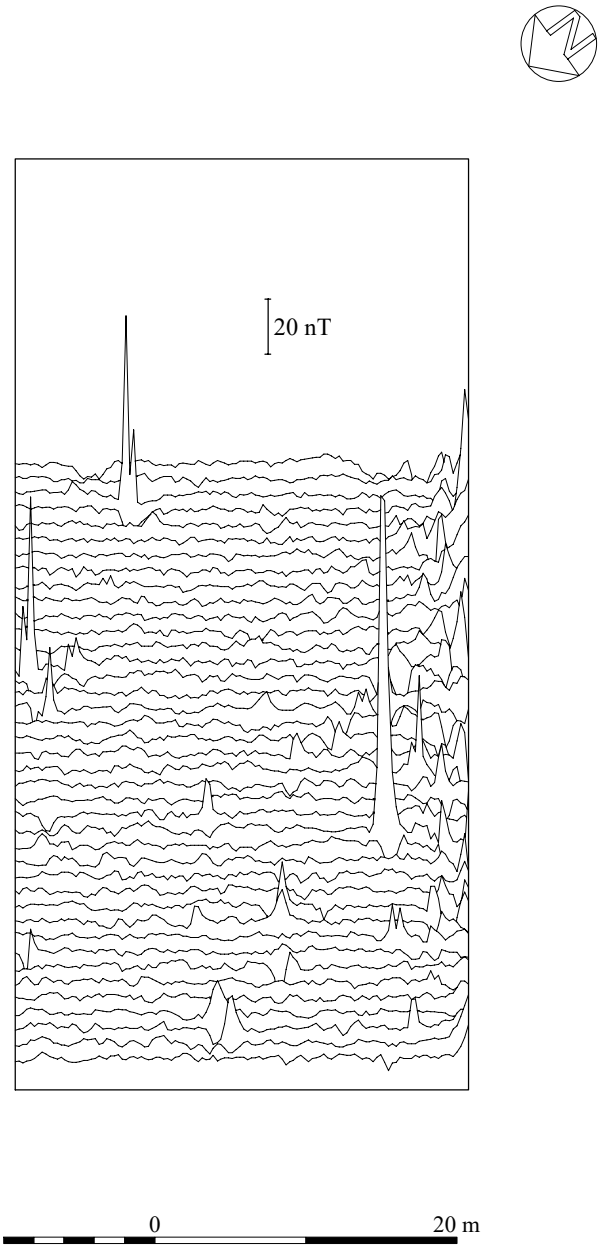

Figure 23: Area 7, X-Y Plot
Scale 1:500

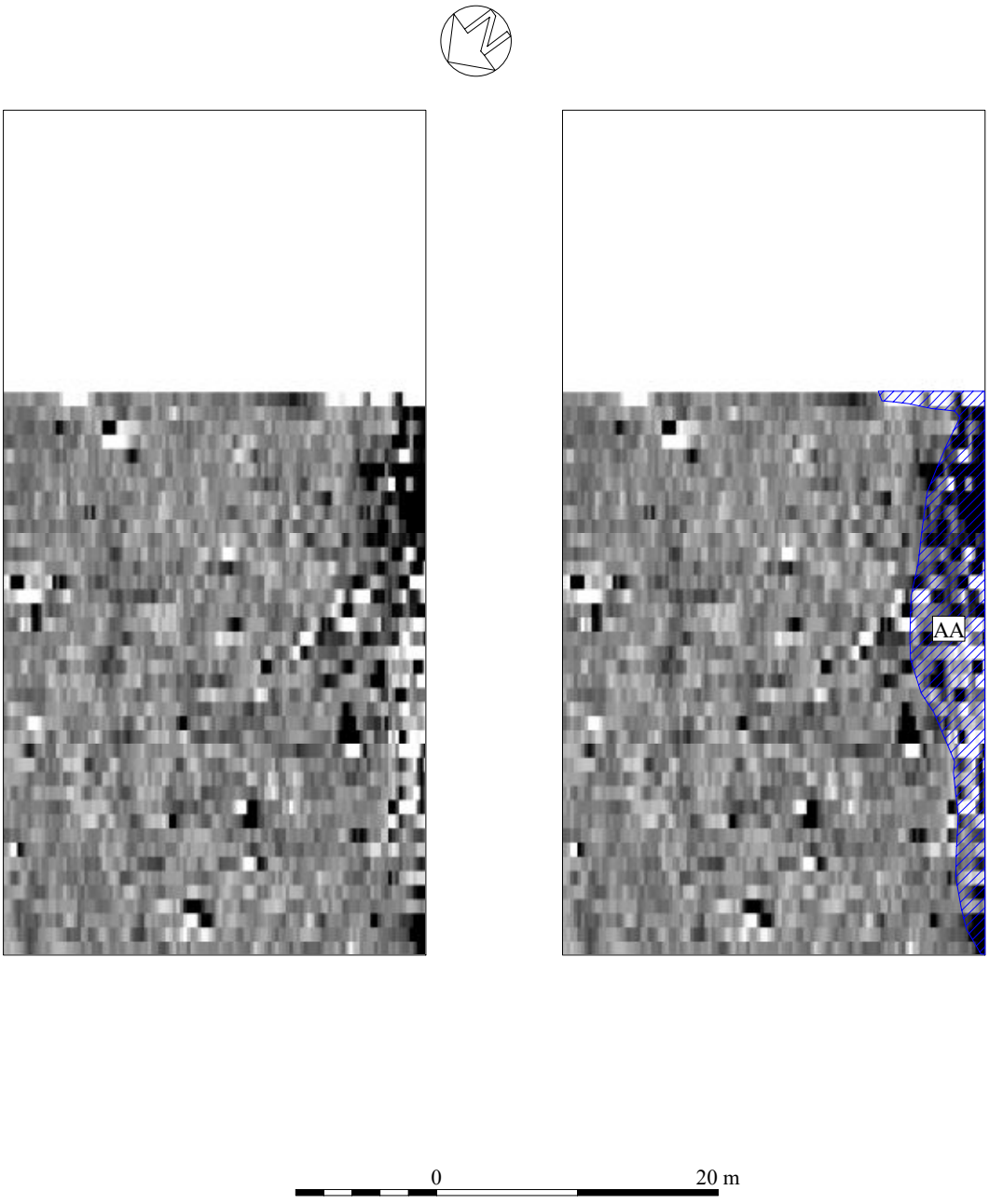

Figure 24: Area 7, Interpretation
Scale 1:500

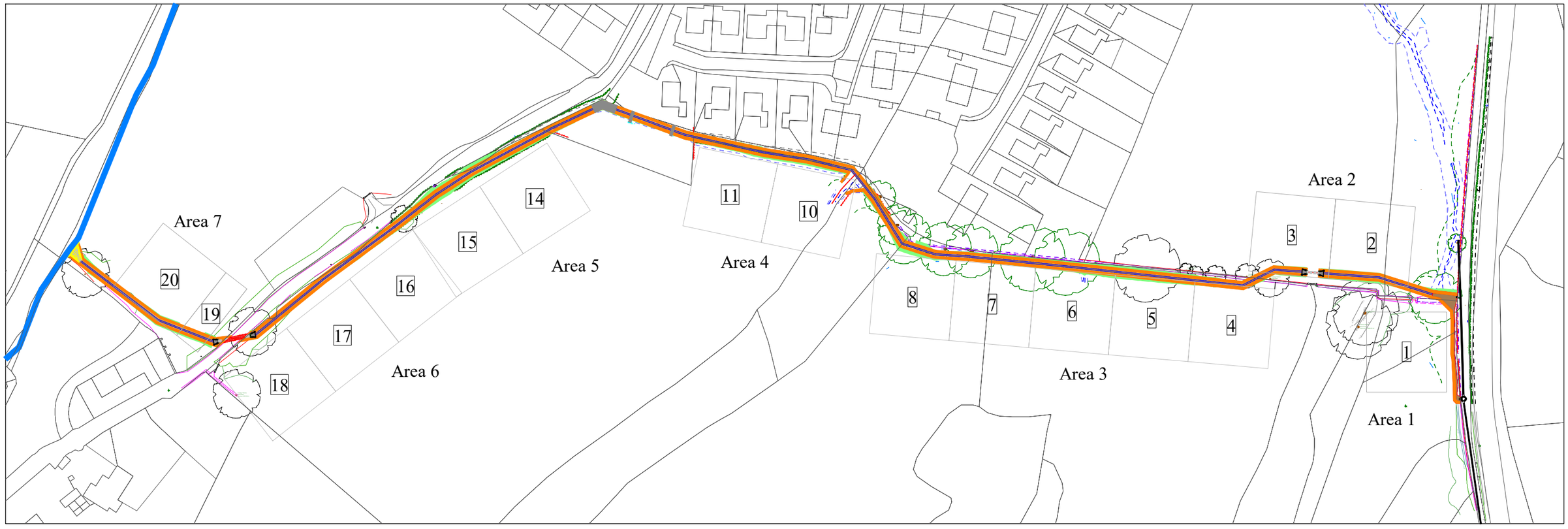

Figure 25: Location of the Magnetic Susceptibily Samples
Scale 1:1,500

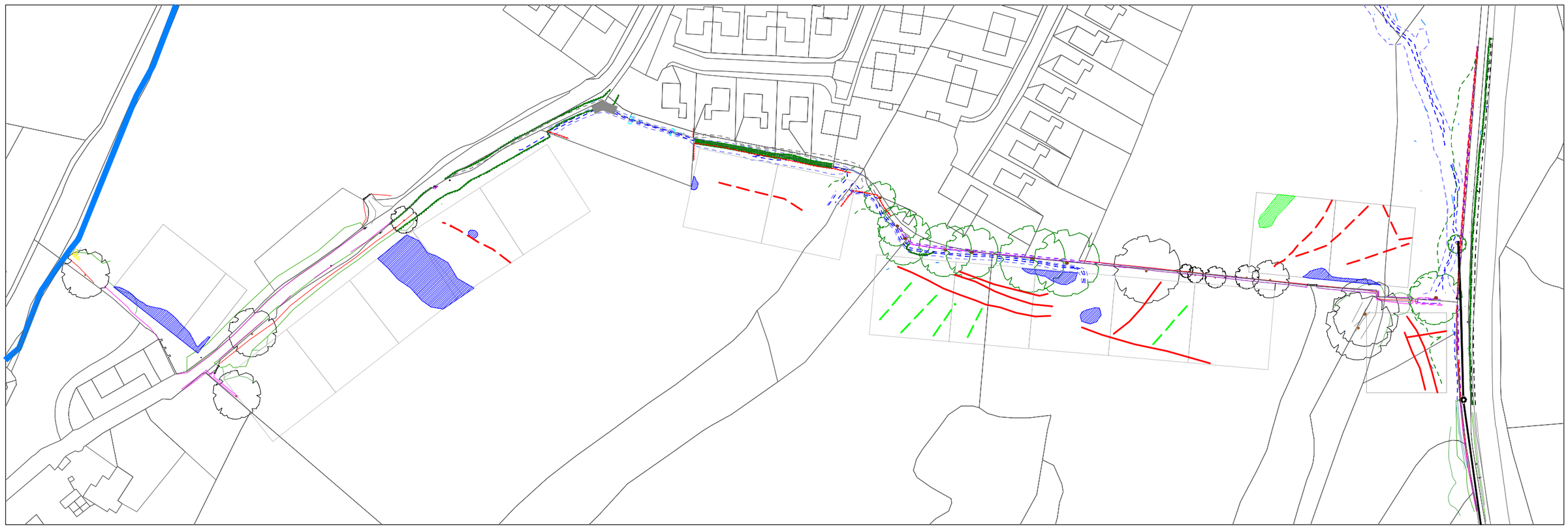

Figure 26: Summary
Scale 1: 1,500