Lostrigg Solar Scheme
Cumbria

Archaeological geophysical survey

Project No. ARC/3733/1402

August 2024

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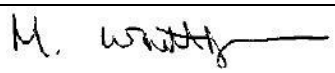
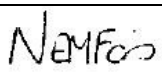
Signature		Signature	
Date	02/08/24	Date	06/08/24

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1. SUMMARY

Phase Site Investigations Ltd was commissioned to carry out a magnetic gradient survey at the site of the Lostrigg Solar Scheme in Cumbria. The aim of the survey was to help establish the presence / absence, extent, character, relationships and date (as far as circumstances and the inherent limitations of the technique permits) of archaeological features within the survey area.

The survey was undertaken using a Phase Site Investigations Ltd multi-sensor array cart system (MACS). The MACS comprised 4 Foerster 4.032 Ferex CON 650 gradiometers with a control unit and data logger. The MACS data was collected on profiles spaced 1 m apart with readings taken at between 0.1 and 0.15 m intervals.

Some parts of the site have an unusually large number of isolated responses, which have produced a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material or modern activity. In some areas the number of isolated responses / extent of the magnetic disturbance means that it is not possible to differentiate between the responses associated with modern material or any isolated responses that could have potential to be related to archaeological features / activity. The strength of the responses within the majority of the areas of magnetic disturbance suggest that most of them are caused by a surface / near surface spread of material, rather than significant made ground, although there are some areas suggestive of fill material or other made ground. A coal mining report highlights that there are a large number of recorded mineshafts within the site as well as some adits and areas of possible opencast mining. It is likely that many of the larger / stronger isolated responses and some areas of magnetic disturbance and strong responses are related to mining activity; either shafts, bellpits, areas of opencast mining or associated mining waste / spoil.

The majority of the remaining anomalies identified by this survey relate to modern material / objects, agricultural activity (including ridge and furrow), drainage regimes / features and possible natural variations / features. There are a number of linear / curvi-linear anomalies that are indicative of sub-surface features but it in many cases it is not certain if these are modern (such as drainage features) or archaeological. There are some areas where there is possible archaeological activity but the interpretation is not certain and it has not been possible to definite the extent of any such activity.

It is worth noting in some areas that former field boundaries, shown on historic maps, do not have a corresponding magnetic response, although in other areas they do, and the strength of responses associated with agricultural activity varies across the site, being clear and well-defined in some areas and weaker and more fragmented in others. This indicates that the magnetic susceptibility of the soils varies across the site. This could mean that in some parts of the site, where the magnetic background is more uniform and responses from agricultural activity are weaker, sub-surface features may only produce weak or intermittent responses. It is possible that not all archaeological features / activity across the site may have been detected.

2. INTRODUCTION

2.1 Overview

Phase Site Investigations Ltd was commissioned by Wardell Armstrong LLP to carry out an archaeological geophysical survey at the site of the proposed Lostrigg Solar Scheme, Cumbria utilising magnetic gradiometers.

The aim of the survey was to help establish the presence / absence, extent, character, relationships and date (as far as circumstances and the inherent limitations of the technique permits) of archaeological features within the survey area.

The location of the site is shown in drawing ARC_3733_1402_01.

2.2 Site description

The site encompassed numerous fields, across several parcels of land, and is located between approximately 3.5 km and 5 km east of Workington and between approximately 6.5 km and 10.5 km south-west of Cockermouth, Cumbria. The approximate north-eastern extent of the survey area is at NGR NY 05414, 28240 and the approximate south-western extent of the survey area is at NGR NY 02829, 25254.

The overall size of the area that could potentially have been surveyed was approximately 223.5 ha, once areas of woodland and other areas not suitable for survey were excluded. However, a number of fields within this 223.5 ha contained areas of dense / tussocky vegetation which were not safe / suitable for survey and some fields contained mature crops and livestock so the actual area that could be surveyed was reduced. The majority of the fields were pasture / rough pasture with some arable fields and areas of 'scrub' vegetation.

The geology of the site varies across the survey areas but generally consists of mudstone or sandstone of the Pennine Lower or Pennine Middle Coal Measures Formations with a mix of superficial deposits present (British Geological Survey, 2024). A summary of the geology for each survey area that was surveyed is provided in Section 4.

2.3 Archaeological and historical background

An archaeological / heritage desk-based assessment, or other archaeological background information, was not available at the time of writing this report.

A coal mining report (The Coal Authority, 2024) highlights that there are a large number of recorded mineshafts within the site as well as some adits and areas of opencast mining.

Historic maps (maps.nls.uk, 2024) indicate that the majority of the site has been used for agriculture but the Coal Authority report highlights that there has been mining activity across significant parts of the site. Several field boundaries are shown on historic maps that are no longer visible on site.

2.4 Scope of work

The survey areas were specified by the client. Each survey area was allocated a name by the client but, during the course of the survey, several areas were removed, new areas added and the numbering system was revised. The naming convention used for this report is based upon the revised numbering system. An exception to this is Areas 28a and 28b. Area 28a was in the original numbering system but this area was removed from the survey plan after it had already been surveyed. It has still been shown in this report as Area 28a and the new Area 28 is shown as Area 28b.

A number of areas / fields could not be accessed / surveyed due to a combination of mature crops, livestock (that could not be moved) and areas of dense vegetation and uneven ground.

Areas totalling approximately 168.1 ha were covered by the survey. Although some parts of these areas may not have been fully surveyed, such where there was dense vegetation adjacent to field boundaries or surface obstructions.

The survey was carried on days between 29 April and 21 June 2024.

3. SURVEY METHODOLOGY

3.1 Magnetic survey

The survey was undertaken using a Phase Site Investigations Ltd multi-sensor array cart system (MACS).

The MACS comprised 4 Foerster 4.032 Ferex CON 650 gradiometers with a control unit and data logger. The Foerster gradiometers do not require balancing as each sensor is automatically 'zeroed' using the control unit software.

The MACS utilises an RTK GNSS system which means that survey grids do not have to be established. Instead an area is surveyed over a series of continuous profiles and the position of each data point is recorded using an RTK GNSS system. The sensors have a separation of 1 m which means that data was collected on profiles spaced at 1 m apart. Readings were taken at between 0.1 m and 0.15 m intervals.

Data is collected on zig-zag profiles along the full length or width of a field, although fields can be sub-divided if they are particularly large. Marker canes are set-out along field boundaries at set intervals and these are used to align the profiles. The survey profiles are usually offset from field boundaries, buildings and other metallic features by several metres to reduce the detrimental effect that these surface magnetic features have on the data. The location of the MACS data is converted direct to Ordnance Survey co-ordinates using the UK OSTN15 projection. As the survey is referenced direct to Ordnance Survey National Grid co-ordinates temporary survey stations are not established.

3.2 Data processing and presentation

The MACS data was stored direct to a laptop using in-house software which automatically corrects for instrument drift and calculates a mean value for each profile. A positional value is assigned to each data point based on the sensor number and recorded GNSS co-ordinates. The data is gridded using in-house software and parameters are set based on the sensor spacing and mean values. No additional processing is required. The gridded data is then displayed in Surfer 9 (Golden Software) and image files of the data are created. The data was exported as greyscale raster images (PNG files)

The site is large and covers an extensive area. For context a drawing showing the survey areas has been presented at a scale 1:12500 and then drawings showing data plots for larger parcels of land encompassing numerous survey areas are presented at a scale of 1:5000. The data for these is shown at a range of -2 nT to 3 nT.

Data plots are also presented, with accompanying interpretations, at a scale of 1:2000. This is a relatively small-scale for an archaeology survey but given the large size of the site and also the relatively large size of a number of fields it was felt that showing entire fields on the same drawing allowed for a better presentation of the data and interpretation, rather than splitting the fields into a greater number of drawings. Should any area need to be examined in more detail, to target or view specific anomalies, then this can be easily achieved using the digital drawings, which have been provided alongside this report.

The data for the 1:2000 plots been shown at a range of -5 nT to 5 nT. This is a relatively wide range for archaeology surveys but has been selected as the data across the majority of the site is relatively 'noisy', with a generally disturbed / variable magnetic background. The relatively wide range 'smooths out' the data and can make it easier to identify some anomalies but it should be noted that very weak responses may not be visible at this range (although they would also be masked by the 'noise' at a narrower range in the wider range).

The two different ranges that the data has been displayed at show that the magnetic disturbance, although present across the majority if the site, is less noticeable in the wider range (-5 nT to 5 nT). This indicates that much of the magnetic disturbance is probably caused by a spread of surface / near surface material and / or natural variations rather than a significant depth or amount of made ground. Although there could be some areas of stronger magnetic disturbance that relate to greater concentrations of modern material.

The data has been displayed relative to a digital Ordnance Survey base plan provided by the client as drawing *'OS_MasterMap_Topography_Layer_895052_1140500_OS_Mastermap .dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey grids / data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position. The base drawing did not show all of the field boundaries for all of the survey areas but the client also provided field reference area boundaries which approximated to field boundaries and so these have been shown on the survey drawings to provide context for some of the survey areas.

X-Y trace plots were examined for all of the data and overlain onto the greyscale plot to assist in the interpretation, primarily to help identify dipolar and bipolar responses that will probably be associated with surface / near-surface iron objects. However, X-Y trace plots have not been presented here as they do not show any additional anomalies that are not visible in the greyscale data. A digital drawing showing the X-Y trace plot overlain on the greyscale plot is provided in the digital archive.

All isolated responses have been assessed using a combination of greyscale and X-Y trace plots. There are a large number of small / relatively weak isolated dipolar and bipolar anomalies present in the data. There is no evidence to suggest that these small / relatively weak responses are associated with archaeological features and so these have not been shown in the interpretation. Numerous larger / stronger isolated dipolar and bipolar anomalies have been shown. These are also not thought to be archaeologically significant but is it likely that a number of them relate to mining / possible mining activity.

In some instances it is not always possible to determine where a feature causing an anomaly with strong responses may be located and so the overall extent of the strong responses is shown. This could extend well beyond the underlying feature.

Anomalies associated with agricultural and / or drainage regimes are present in the data but each individual anomaly within a regime has not been shown on the interpretation. Instead the general orientation of the regime is indicated.

The data was examined over several different ranges during the interpretation to ensure that the maximum information possible was obtained from the data.

The anomalies have been categorised based on the type of response that they exhibit and an interpretation as to the cause(s) or possible cause(s) of each anomaly type is also provided.

A general discussion of the anomalies is provided for the entire site and then the results are discussed on an area by area basis. Some areas have been grouped together where the anomalies within them are similar. A discussion of the general categories of anomaly which have been identified by the survey is provided in Appendix 1.5.

The geophysical interpretation drawing must be used in conjunction with the relevant results section and appendices of this report.

4. RESULTS

4.1 General

The data quality across the majority of the survey area is very good allowing the data to be viewed at a narrow range of readings to better identify weak anomalies. There are several areas that have a more disturbed / variable magnetic background but this is due to the presence of magnetic material in the topsoil or sub-surface, rather than low data quality.

Some parts of the site have an unusually large number of isolated responses, which have produced a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material or modern activity. In some areas the number of isolated responses / extent of the magnetic disturbance means that it is not possible to differentiate between the responses associated with modern material or any isolated responses that could have potential to be related to archaeological features / activity.

A coal mining report (The Coal Authority, 2024) highlights that there are a large number of recorded mineshafts within the site as well as some adits and areas of possible opencast mining. Where the report shows that any of these fall within an area they are mentioned in the report, although it should be noted that it is not always possible to determine if an anomaly relates to a mining feature or has a different cause. Details of mining activity provided in this report is based purely on information provided in the Coal Authority report and should not be taken as a definitive indication on the presence / absence of mining related features.

4.2 Anomaly types

The categories of anomalies identified by this survey and their potential causes are summarised below.

4.2.1 Isolated dipolar and bipolar responses – probable modern features / activity / material

Isolated dipolar responses (iron spikes) contain a strong positive and negative component and are indicative of ferrous or fired material on or near to the surface. **Isolated bipolar** have strong positive and negative components but are not technically magnetic dipoles. They tend to be caused by ferrous or fired material on or near to the surface and are usually produced from larger, or more strongly magnetic, objects (compared to dipolar anomalies) or a concentration of strongly magnetic smaller objects. In the large majority of cases these two types of isolated responses will be caused by modern material. However, the potential for some of these to be associated with archaeological features / material may be increased slightly by their proximity to other anomalies / features.

Generally, isolated dipolar and small / weak bipolar responses located away from clear archaeological activity are all assumed not to be of archaeological significance and have not been shown on the interpretation. Larger / stronger isolated bipolar responses have been shown on the interpretation because they are considered to be more likely to be associated with more significant sub-surface features or material. These responses are not usually of archaeological interest but some could be related to mining activity.

There are a number of isolated responses in one field (Area 2b) that could be related to modern material but they have an unusual response and it is possible that they are artificial responses related to an intermittent connection issues with one of the sensors. The presence of these has not affected the reliability of the interpretation.

4.2.2 Areas of magnetic disturbance and strong responses – probable modern features / activity / material

Areas of **magnetic disturbance** contain relatively strong bipolar and dipolar responses are usually associated with concentrations of relatively modern magnetic material and at this site they are not considered to be archaeologically significant. Some of the areas could be related to mining activity, such as a spread of mining spoil or infilled opencast / quarry features.

The very strong responses around the perimeter of individual fields are usually associated with adjacent strongly magnetic modern features. Other strong responses within fields are probably related to strongly magnetic (probably modern) features within the survey area. Some of these could be above ground features, such as cable posts, and others could be sub-surface features, including possible mining features / material. The extents of the areas with strong responses are usually shown as a **limit of very strong response.** It should be noted that the strong response often extends beyond the feature and so the limit of the response may not correspond to the actual size or location of the feature within it.

4.2.3 Linear / curvi-linear anomalies – agricultural and drainage features / activity

There are numerous anomalies present that are indicative of either an agricultural, or a drainage, regime. These can be positive, negative, bipolar or a combination of these, depending on the type of feature and, in the case of drains, what they are made from.

Where a series of broadly parallel anomalies are present the general orientation of the regime is shown, rather than highlighting individual anomalies. In some instances the exact type of activity is not certain, for example anomalies related to straight ridge and furrow can look similar to some types of drainage regime.

Individual responses have been shown, where they are not part of a regime and some anomalies have been interpreted as probable former field boundaries, where they correspond with features shown on historic maps.

4.2.4 Isolated positive responses

Isolated positive responses can have a variety of causes including natural features / variations, buried ferrous or fired material, accumulations of topsoil related to agricultural activity, infilled features or areas of burning. At this site it is possible that some of the isolated positive responses are caused by discrete features but a large majority will have a non-archaeological cause. Most of them will be caused by relatively modern, ferrous or fired material or natural variations. Some could relate to mining activity.

4.2.5 Linear / curvi-linear trends / positive anomalies – possible sub-surface features and uncertain cause

Numerous **trends** are present that are either relatively weak, diffuse, short, fragmented or a combination of these. The cause of many of these anomalies is not certain, particularly if they do not form any obvious patterns or relationships. The majority are probably caused by agricultural, or other relatively modern activity or natural features / variations but some could be related to parts of infilled features. Some trends have been labelled in each area if they form regular patterns or stand out because they are more coherent than other trends in the area and these could have greater potential to be related to sub-surface features. Some weak, short and / or diffuse trends may not have been highlighted but it is possible that some of these could be related to parts of sub-surface features, although the majority are probably not of archaeological significance.

There are a number of **linear / curvi-linear positive responses** across the site, which are stronger or more coherent than the trends. Some of these responses may be related to agricultural activity, drainage features or natural features / variations but others may be caused by infilled linear / curvi-linear features. Anomalies of this type could be related to archaeological features but could also be a product of modern features.

4.3 Area 1

Field not accessible / suitable for survey due to a mature crop.

4.4 Area 2

Field / Area descriptions: Two grass fields partially divided by a watercourse with adjacent dense vegetation. The area was relatively firm underfoot, except in the areas adjacent to the stream in the north, where the ground was soft and uneven. The area was bounded by post and wire fencing and hedgerows. Overhead cable posts were present in the west of Area 2a.

Mining information: A recorded mineshaft is shown to be present within this area.

Basic topography (A2a): Downwards slope to the south-east but undulating throughout.

Basic topography (A2b): Downwards slope to the north, east and west from an area of higher ground in the south.

Geology summary: Predominately mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation in the west of the area. Overlain by till.

Interpretation drawing(s): ARC_3733_1402_07

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

There are a number of isolated responses in Area 2b that could be related to modern material but they have an unusual response and it is possible that they are artificial responses related to an intermittent connection issue with one of the sensors.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases

the feature causing the strong response may be located beyond the survey area.

A series of relatively straight linear responses. These could be related to a drainage regime or the remnants of ridge and furrow.

There is a series of linear responses indicative of a drainage regimes and another series that could be related to drainage features but which could also be a product of other agricultural activity.

There are broad, diffuse areas of positive and / or negative responses. These could be caused by natural features / variations but they could also be related to modern material / activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

There are a number of relatively strong positive linear / curvi-linear anomalies and some associated weaker trends (all shown as **Anomalies 2A**) in the north of Area 2a. There are several trends (**Anomalies 2B**) that could be related to Anomalies 2A but these are aligned with agricultural activity and so it is not certain if these are a product of agricultural activity or are related to sub-surface features. Anomalies 2A, and possibly Anomalies 2B, are suggestive of infilled ditches and so could be archaeological in origin but there are a number of anomalies that could be related to drainage features (**Anomalies 2C**) which appear to respect some of Anomalies 2A. This could mean that some of Anomalies 2A are also related to drainage, or other relatively modern features. However, the interpretation of Anomalies 2C as drainage features is not certain and so the exact cause of these of these anomalies is not known.

There is a fragmented positive linear response (**Anomaly 2D**) that is broadly parallel with the western boundary of the field. It is not certain if this is caused by a sub-surface feature (and could be related to Anomalies 2A, and 2B) or if it is a product of agricultural activity.

Anomalies 2E, in the south-west of the area, are also positive responses (with some trends). These are relatively irregular and in areas where there is a variable / disturbed background from either natural variations or modern activity. They could be natural, such as infilled

fissures in the bedrock, or they could be anthropogenic. If they are anthropogenic then they could be archaeological but they could also be modern features.

A number of other trends and positive linear / curvi-linear anomalies stand out (**Anomalies 2F**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could possibly be caused by archaeological features. **Anomalies 2G** are trends located in areas of magnetic disturbance. These could be related to modern features / activity and could possibly be caused by mining features but there is also a slight possibly that these could be a product of other industrial activity and so an archaeological cause cannot be ruled out.

There are several discrete areas of magnetic disturbance or stronger / larger isolated responses that stand out (**Anomalies 2H**). These are probably related to modern material and there is potential for some of them to be associated with mining activity. **Anomaly 2I**, in the north-east of the area, is an elongated area of magnetic disturbance that will be related to a modern feature / material.

There are a number of unusual isolated responses in Area 2b. These sometimes form alignments along the direction the data was collected which suggests that they could be an artificial data construct, possibly related to an intermittent faulty cable connection. Their presence has not affected the overall reliability of the data or the interpretation and they are not present on any other areas.

4.5 Area 3

Field / Area descriptions: Grass field. The area was firm underfoot and bounded by post and wire fencing and hedgerows.

Mining information: There is no recorded mining activity within this area.

Basic topography: Relatively steep downwards slope to the south-east.

Geology summary: Predominately sandstone of the Pennine Middle Coal Measures Formation with mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation along the eastern boundary. There are no recorded superficial deposits over the majority of site with till recorded along the northern and eastern boundaries.

Interpretation drawing(s): ARC_3733_1402_09.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of an infilled feature but it is not certain if it is archaeological or modern.

Further discussion / additional information:

The magnetic background for the majority of Area 3 is strongly variable with a large number of isolated responses present. These will be related to a spread of modern material. Only selected larger / stronger responses have been shown. The number and extent of these responses is such that they could possibly mask / partially mask responses from underlying features.

The large area of strong magnetic disturbance in the south-west of the field (**Anomaly 3A**) corresponds with a quarry shown on historic maps and will be caused by material infilling this feature. There is a very large / strong response associated with an isolated bipolar anomaly (A**nomaly 3B**). This will be related to a modern feature / object. There is a small discrete area of magnetic disturbance and several stronger / larger isolated responses that stand out (**Anomalies 3C**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity.

There are a number of relatively strong positive linear / curvi-linear anomalies and some weaker / more diffuse trends, some of which may form linear / regular patterns (**Anomalies 3D**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are a product of natural or modern features.

A number of other trends stand out (**Anomalies 3E**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features /

variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.6 Area 4

Field / Area descriptions: Grass field. The area was firm underfoot and bounded by post and wire fencing in all directions, with hedgerows to the north, south and west. There was an area of dense vegetation and waterlogged ground in the west and an area of dense vegetation with a manure heap in the north-west. Overhead cable posts were present in the west of the field.

Mining information: Recorded mineshafts are shown to be present within this area.

Basic topography: Relatively steep downwards slope to the south-east but undulating throughout.

Geology summary: Predominately mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation along part of the northern boundary. The majority of site is overlain by till with no recorded superficial deposits in the north.

Interpretation drawing(s): ARC_3733_1402_09.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. A number of larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of diffuse relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

The magnetic background for the northern part of Area 4 is strongly variable with a large number of isolated responses present. These will be related to a spread of modern material. Only selected larger / stronger responses have been shown. The number and extent of these responses is such that they could possibly mask / partially mask responses from underlying features.

There are two discrete areas of magnetic disturbance and a number of stronger / larger isolated responses that stand out (**Anomalies 4A**). These are probably related to modern material and there is potential for some of them to be associated with mining activity.

There are a number of trends that stand out slightly. **Anomalies 4B** are broadly parallel with each other. They are suggestive of drainage features but could be related to the remnants of boundary ditches / field divisions. **Anomalies 4C** stand out but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.7 Area 5

Field / Area descriptions: Grass field. The area was firm underfoot and bounded by post and wire fencing in all directions, with hedgerows to the north, east and south. There is a ditch and area of dense vegetation in the south-west. An electricity pylon was present in the south of the area and overhead cables cross the site from this on a south-west to north-east alignment.

Mining information: Recorded mineshafts are shown to be present within this area.

Basic topography: Undulating with relatively steep slopes in places. A general downwards slope to the east

Geology summary: Predominately mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation in part of the north-east. The area is overlain by till.

Interpretation drawing(s): ARC_3733_1402_11.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant

relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Series of diffuse, weak relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

A diffuse, linear trend, with dipolar / bipolar components, corresponds with the position of a former field boundary and will be related to this feature and / or associated features / material.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown. Several responses are unusually large / strong.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

The large area of strong magnetic disturbance in the west of the field (**Anomaly 5A**) is indicative of an area of infill material or made ground. It could be related to feature, such as an infilled quarry, or a spread of mining waste but it could also be caused by a concentration of other modern material.

There are several discrete areas of magnetic disturbance or stronger / larger isolated responses that stand out (**Anomalies 5B**). These are probably related to modern material and there is potential for some of them to be associated with mining activity. Several large / strong isolated positive responses (**Anomalies 5C**) could be related to infilled features or they could be associated with areas of burning or industrial activity. These could be archaeological, could be related to mining activity or could have a different modern cause.

There are a number of positive linear / curvi-linear anomalies and weaker / more diffuse trends, some of which may form linear / regular patterns (**Anomalies 5D**). Some responses

are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.8 Areas 6, 7 and 8

Field / Area descriptions: Pasture fields. The fields were relatively firm underfoot and bounded by post and wire fencing and hedgerows.

Mining information: Recorded mineshafts are shown to be present within these areas.

Basic topography: Variable / undulating.

Geology summary: Mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till.

Interpretation drawing(s): ARC_3733_1402_13.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some areas of very strong responses the approximate position of the material / feature causing the anomaly can be determined (shown as an isolated bipolar response) but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects.

Several series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Linear trends correspond with the position of a former field boundary and are probably related to this feature.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is

not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of an infilled feature but it is not certain if it is archaeological or modern.

Further discussion / additional information:

There are a number of discrete areas of magnetic disturbance and numerous stronger / larger isolated responses that stand out (**Anomalies 6A, 7A and 8A**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity.

There is a general alignment of trends, broadly running north-east to south-west, across these areas (**Anomalies 6B, 7B and 8B**). These could be a product of a natural feature / variation or they could be related to anthropogenic activity, such as agricultural, drainage or other modern features /activity. It is possible that some of the responses could be caused by infilled features but there is no evidence to suggest an archaeological cause.

In Area 8 there is a suggestion of several trends (**Anomalies 8C**) that may respect one of Anomalies 8B. Anomalies 8C could be related to drainage features and if so Anomalies 8B (and by inference 6B and 7B) could also be drainage features but this interpretation is not certain.

In the east of Area 8 there are a number of anomalies (**Anomalies 8D**) that appear to form a regular shape, with some suggestions of anomalies forming returns. These could be related to archaeological features but some of the anomalies are also on the same alignment as ridge and furrow and other agricultural activity and so it is also possible that they are a product of different agricultural / drainage regimes.

Towards the west of Area 8 there are several strong curvi-linear anomalies. These have been defined by an area of very strong responses with trends within it (**Anomalies 8E**). The curvi-linear anomalies have been shown as trends as it is not certain if they directly relate to sub-surface features or if they are a product of near-surface material. The responses are suggestive of a modern feature(s) / material but there is a slight possibility that they could be related to some type of industrial feature / activity. They could be related to mining activity but their exact cause is not certain.

A number of other trends stand out (**Anomalies 6C, 7C** and **8F**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.9 Area 9

Field / Area descriptions: Arable field under immature crop. The area was firm underfoot and bounded by hedgerows in all directions with post and wire fencing to the north, south and west.

Mining information: Recorded mineshafts are shown to be present within this area.

Basic topography: Variable with relatively steep downward slopes to the north / north-east.

Geology summary: Mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till.

Interpretation drawing(s): ARC_3733_1402_13.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some areas of very strong responses the approximate position of the material / feature causing the anomaly can be determined (shown as an isolated bipolar response) but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects.

Several series of weak, relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other series of responses are present that are indicative of drainage regimes

Linear trends, some with dipolar / bipolar components, broadly correspond with the position of former a field boundary and are probably related to this feature and / or associated features / material.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is

not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if it is archaeological or modern.

Further discussion / additional information:

There are a number of discrete areas of magnetic disturbance and numerous stronger / larger isolated responses that stand out (**Anomalies 9A**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity. **Anomalies 9B** are areas of magnetic disturbance that are broadly aligned with a former field boundary. These could be related to material associated with the former boundary or they could be caused by other, relatively modern activity.

Anomaly 9C in the far east of the area is suggestive if an archaeological ditch but as the anomaly is located on the edge of the survey area this interpretation is not certain.

There are a number of other positive linear / curvi-linear anomalies and some weaker / more diffuse trends, some of which appear to form linear / regular patterns (**Anomalies 9D**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are a product of natural or modern features.

A number of other trends stand out (**Anomalies 9E**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.10 Area 10

Field not accessible / suitable for survey due to the presence of livestock that could not be moved.

4.11 Areas 11, 12 and 13

Area descriptions: Pasture / grass fields. The fields were firm underfoot and bounded by hedgerows with post and wire fencing to some boundaries. The area in the east of Area 12 contained some farm equipment.

Mining information: Recorded mineshafts are shown to be present within these areas.

Basic topography: Variable. The eastern fields generally sloped downwards to the west and the western fields downwards to the east.

Geology summary: The underlying geology was a mix of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation and sandstone of the Pennine Middle Coal Measures overlain by till.

Interpretation drawing(s): ARC_3733_1402_15.

Summary of anomalies:

Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some areas of very strong responses the approximate position of the material / feature causing the anomaly can be determined (shown as an isolated bipolar response) but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects.

Several series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes. A linear bipolar anomaly is probably related to a drainage feature.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

There are a number of discrete areas of magnetic disturbance and numerous stronger / larger isolated responses that stand out (**Anomalies 11A, 12A and 13A**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity.

There are a number of relatively strong positive linear / curvi-linear anomalies and some weaker / more diffuse trends, some of which may form linear / regular patterns (**Anomalies 11B, 12B** and **13B**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are a product of natural or modern features.

A number of other trends stand out (**Anomalies 11C, 12C** and **13C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

Anomaly 12D is an elongated area of magnetic disturbance that contains two large, irregular bipolar responses. These are suggestive of relatively modern sub-surface features but their exact cause is not certain.

4.12 Areas 15, 16 and 18

Field / Area descriptions: Pasture fields. The areas were firm underfoot and bounded by hedgerows with some post and wire fencing. An electricity pylon was present in the south of Area 15 and a second pylon was laid down on the ground adjacent to the upright pylon. The south of Area 15 was covered in dense vegetation. A livestock pen was present in the north of Area 16. An electricity pylon was present in the south of the Area 18 and a second pylon was laid down on the ground adjacent to the upright pylon.

Mining information: Recorded mineshafts are shown to be present within these areas.

Basic topography: Area 15 had a downwards slope to the west. Area 16 had a downwards slope to the east and Area 18 had a downwards slope to the south-east.

Geology summary: The underlying geology was a mix of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation and sandstone of the Pennine Middle Coal Measures. The majority of the areas were overlain by till with Lacustrine Alluvium deposits recorded in the south of Area 18.

Interpretation drawing(s): ARC_3733_1402_17.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes or individual field drains.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

There are a number of discrete areas of magnetic disturbance and numerous stronger / larger isolated responses that stand out (**Anomalies 15A, 16A** and **18A**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity.

There are a number of relatively strong positive linear / curvi-linear anomalies in Area 15 (**Anomalies 15B**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are related to drainage, agricultural or other modern features / activity.

A number of other trends stand out (**Anomalies 15C, 16B** and **18B**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.13 Areas 14 and 17

Field / Area descriptions: Area 14 was a pasture field and Area 17 was two pasture fields divided by a stream. The fields were relatively firm underfoot and bounded by hedgerows with some post and wire fencing.

Mining information: Recorded mineshafts are shown to be present within these areas.

Basic topography: Area 14 had a relatively steep downwards slope to the east. Area 17a had a relatively steep downwards slope to the east and south. Area 17b had a downwards slope to the west and north.

Geology summary: The underlying geology was a mix of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation and sandstone of the Pennine Middle Coal Measures overlain by till.

Interpretation drawing(s): ARC_3733_1402_15.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

There are a very large number of stronger / larger isolated responses that stand out. The majority of these are probably related to mining features / activity. They are too numerous to label individual anomalies and it should be considered that any isolated responses in these, and the adjacent parts of adjoining areas, have potential to be associated with mining activity.

Anomaly 17A is a relatively large area of magnetic disturbance that is probably caused by a combination of anomalies related to discrete mining features and material associated with mining, or other modern activity. **Anomalies 17B** are discrete areas of magnetic disturbance. These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity.

There are a number of relatively strong positive linear / curvi-linear anomalies and some weaker / more diffuse trends, some of which may form linear / regular patterns (**Anomalies 14A and 17C**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are a product of drainage, agricultural or other modern features / activity.

A number of other trends stand out (**Anomalies 14B** and **17D** and other trends within parts of both areas which have not been labelled because the area around them is too congested with other anomalies). It has not been possible to reliably determine the cause of these anomalies. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features. There is also potential for some of these to be related to mining activity.

Towards the east of Area 17b there is a strong linear anomaly that has been defined by an area of very strong response with a trend within it (**Anomaly 17E**). The linear anomaly has been shown as a trend as it is not certain if it directly relates to a sub-surface feature or if they it is a product of near-surface material. The responses are suggestive of a modern feature(s) / material, including mining activity, but there is a slight possibility that they could be related to some type of industrial feature / activity.

4.14 Areas 19 and 20

Field / Area descriptions: Pasture fields. The fields were firm underfoot and bounded by hedgerows in all directions with some post and wire fencing. A small area of boggy / overgrown ground was present in the north-east of Area 19. Two upright electricity pylons were present in the south of Area 20 and an additional pylon was laid down on the ground next to each upright one.

Mining information: Recorded mineshafts are shown to be present within these areas.

Basic topography: Variable with a general slope downwards to the east.

Geology summary: Predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation in the north-eastern corner. The areas are predominantly overlain by till with Lacustrine Alluvium deposits recorded in parts of the south-west / west.

Interpretation drawing(s): ARC_3733_1402_17.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They

are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Several series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes or individual field drains.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

There are numerous anomalies indicative of field drainage regimes and individual field drains across these two areas.

There are numerous stronger / larger isolated responses that stand out (**Anomalies 19A** and **20A**). These are probably related to modern material and there is potential for some of these anomalies to be associated with mining activity. A cluster of these responses in the north of Area 19 are probably a continuation of intensive mining activity present in Areas 14 and 17 to the north.

A number of other trends stand out slightly (**Anomalies 19B** and **20B**). It has not been possible to reliably determine the cause of these anomalies. Some responses are relatively straight and could be caused by additional drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features. There is also potential for some of these to be related to mining activity.

4.15 Area 21

Field / Area descriptions: Pasture field. The area was firm underfoot and bounded by post and wire fencing and hedgerows. A feeding through was present in the centre of the field.

Mining information: Part of this area is shown to be within an area of an unlicensed opencast site.

Basic topography: Downwards slope to the east.

Geology summary: Mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till in the north with mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation with no recorded superficial deposits in the south.

Interpretation drawing(s): ARC_3733_1402_19.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mining activity.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects. It is possible that some of these anomalies could be related to mining activity

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

The majority of this area is dominated by an extensive area of strong magnetic disturbance which will be related to a spread of relatively modern material. There are a number of features shown on historic maps in this area, including buildings and part of this area is shown to be within an area of an unlicensed opencast site. It is likely that the spread of material is related to made ground, building rubble or fill material / spoil associated with

these. There are a number of large / strong isolated bipolar responses within the magnetic disturbance and these could indicate the presence of larger features / objects associated with the former land use (these could be a concentration of brick / tile rather than *in situ* features). It is understood that there are no recorded mine workings in the vicinity of this area but, given there is extensive activity within the wider site, it is possible that some of the isolated responses in this area are related to unrecorded mining activity.

There is a slight suggestion that some trends (**Anomalies 21A**) may form linear patterns. It is possible that these relate to parts of sub-surface features but they could also be a product of responses within the areas of magnetic disturbance that coincidently appear to form linear patterns or possibly agricultural or drainage activity.

4.16 Area 22a

Field / Area descriptions Rough pasture / scrub field. The area was firm underfoot and bounded by post and wire fencing.

Mining information: This area is shown to be within an area of an unlicensed opencast site.

Basic topography: Gradual downwards slope to the west.

Geology summary: Mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till.

Interpretation drawing(s): ARC_3733_1402_19.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mining activity.

An area of magnetic disturbance associated with relatively modern features / material. It is possible that this anomaly could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. It is possible that some of these anomalies could be related to mining activity.

A series of weak, relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Several trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features.

Several isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

This area is shown to be within an area of an unlicensed opencast site. It is possible therefore that some of the anomalies could be related to mining activity.

4.17 Area 22b, 30, 32, 33, 35, 36, 42, 43, 44, 47, 48 and 49

Field / area not accessible / suitable for survey due vegetation cover. Reeds, 'tussocky' grass and other vegetation were present that were dense / high in some areas and generally made the ground too uneven underfoot to survey safely.

4.18 Areas 23, 24, 26 and 28b

Field / Area descriptions: Areas 23, 24 and 28b were pasture / rough pasture. field. The areas were firm underfoot and bounded by a combination of post and wire fencing and hedges. Area 26 was an arable field. An area of dense vegetation was present in the west of Area 26.

Mining information: Parts of these areas are shown to be within an area of an unlicensed opencast site.

Basic topography: Areas 23 and 24 had a gradual downwards slope to the west and Area 26 and 28b sloped downwards to the east.

Geology summary: Areas 23 is mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till.

Area 24 is mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till in the north with mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation with no recorded superficial deposits in the south.

Area 26 is predominantly mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation with no recorded superficial deposits with mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till along the eastern edge of the area.

Area 28b is predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till. In the south-west the geology consists of mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation with no recorded superficial deposits.

Interpretation drawing(s): ARC_3733_1402_21 and ARC_3733_1402_23.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been

shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects.

Series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

Parts of these areas are shown to be within an area of an unlicensed opencast site. It is possible therefore that some of the anomalies could be related to mining activity. The data seems to suggest that there has not been opencast activity across all of the areas but there may have been localised extraction as defined by some of the areas of strong responses, large / strong isolated responses and areas of magnetic disturbance (**Anomalies 23A**, **24A**, **26A** and **28A**). There are also linear / curvi-linear anomalies in Area 24 and Area 28b (**Anomalies A24B** and **A28B**) that are suggestive of sub-surface features. These could be related to infilled ditches but it is also possible that some are agricultural, drainage or other modern features.

A number of other trends stand out (**Anomalies 23B, 24C, 26B** and **28C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

Anomaly 24D is a small area of magnetic disturbance adjacent to a number of trends. The responses in this area suggestive of those obtained from an historic lightning strike on the ground but this interpretation is not certain and they could be related to other features / activity, including possible mining activity.

4.19 Area 25, 27 and 28a

Field / Area descriptions: Pasture. The areas were firm underfoot and bounded by a combination of hedgerows and post and wire fencing. Area 25 had a gradual downwards slope to the west. Area 27 was generally undulating and Area 28a sloped downwards to the east.

Mining information: No recorded mining activity.

Geology summary: Areas 25 and 27 are mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till. With alluvium deposits recorded along the eastern boundary of Area 27.

Area 28a is mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation in the south and south-west with sandstone of the Pennine Middle Coal Measures Formation in the north and north-east. This area is predominantly overlain by till with alluvium deposits in several areas in the east.

Interpretation drawing(s): ARC_3733_1402_21 and ARC_3733_1402_23.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

Linear bipolar anomalies associated with sub-surface utility apparatus (pipes, drain or cable).

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond

the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects.

Several series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes or individual field drains.

Linear trends, some with dipolar / bipolar components, correspond with the position of former field boundaries and will be related to these features and / or associated features / material.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

There is no recorded mining activity in these areas but, given the level of mining activity within the general area, there is potential for some responses to be related to unrecorded mining activity. **Anomalies 27A** are larger / stronger responses that could have potential to be caused by mining features but they could all be a product of other modern material / activity. **Anomalies 28D** also stand out and whilst these could also be a product of other modern material / features, including mining activity, it is possible that some could be related to areas of burning or other industrial activity and an archaeological cause for some of them cannot be ruled out.

Anomaly 27B is similar to responses in nearby fields that could be related to mining activity but this corresponds with surface metal objects and will be a product of this material.

In the north of Area 27 there are a number of responses that are indicative of drainage features. There are other linear anomalies (**Anomalies 27C**) in that part of the site that are suggestive of sub-surface features and are oblique to the obvious drainage regime. These could be a product of additional drainage features but it is possible that some of them could be caused by infilled ditches and so have potential to be archaeological.

There are a number of other relatively strong positive linear / curvi-linear anomalies and some weaker / more diffuse trends, some of which may form linear / regular patterns

(**Anomalies 27D** and **28B**). These anomalies are suggestive of sub-surface features and some of them could be related to infilled ditches but it is also possible that some are a product of natural or modern features.

A number of other trends stand out (**Anomalies 27E** and **28C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

Anomaly 28E is a small area of magnetic disturbance adjacent to, and containing, a number of trends. The responses in this area suggestive of those obtained from a historic lightning strike on the ground but this interpretation is not certain and they could be related to other features / activity, including possible mining activity.

4.20 Area 29

Field / Area descriptions: Pasture field with large tussocks. The area was firm underfoot and bounded by post and wire fencing. An area of large rocks / rubble was present in the north-east of the field.

Mining information: No recorded mining activity.

Basic topography: The western half of field was relatively level. The eastern half of the field was a downwards slope to the west.

Geology summary: Predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation in the north. The west is overlain with alluvium deposits and the east with till.

Interpretation drawing(s): ARC_3733_1402_23.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a

response is caused by a spread of material or discrete features / objects.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

A linear trend corresponds with the position of a former field boundary and will be related to this feature.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

There is no recorded mining activity in this area but, given the level of mining activity within the general area, there is potential for some responses to be related to unrecorded mining activity. **Anomalies 29A** are larger / stronger responses that could have potential to be caused by mining features but they could all be a product of other modern material / activity.

There are a number of broad, diffuse but relatively strong anomalies in this area that are generally linear / curvi-linear (**Anomalies 29B**) and there is a general area of magnetic disturbance (**Anomaly 29C**) around some of these anomalies. These responses could all be related to natural features / variations or they could be a product of anthropogenic activity. If the latter is the cause of the anomalies then it is possible that some could be caused by parts of infilled ditches and / or industrial activity but they could all be modern, including possible mining activity. Some of Anomalies 29B have been shown as an area of positive responses with an overlying trend as it is not certain if they are caused by linear / curvi-linear features or if there is a general spread of material that forms a linear / curvi-linear shape.

A number of other trends stand out (**Anomalies 29D** but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.21 Area 31

Field / Area descriptions: Grass field. The area was firm underfoot and bounded by post and wire fencing.

Basic topography: Relatively level but with some undulations / variations.

Geology summary: Predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation with sandstone of the Pennine Middle Coal Measures Formation in the north. Predominantly

overlain with till but the western boundary and the north-east is overlain by Alluvium deposits.

Interpretation drawing(s): ARC_3733_1402_25.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Linear trends that broadly correspond with the position of a former field boundary. The responses are probably related to the boundary or associated features / activity.

There is a broad, diffuse area of positive and / or negative responses. This could be caused by natural features / variations but they could also be related to anthropogenic material / activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

There is no recorded mining activity in this area but, given the level of mining activity within the general area, there is potential for some responses to be related to unrecorded mining activity. **Anomalies 31A** are larger / stronger responses that could have potential to be caused by mining features but they could all be a product of other modern material / activity.

There is a diffuse, curvi-linear area of positive / negative responses, which as been defined as an area with general curvi-linear trends (**Anomalies 31B**) and several other nearby diffuse trends (**Anomalies 31C**). These could be associated with natural features / variations but it is also possible that some of the anomalies could be related to anthropogenic features and an archaeological cause for some of them cannot be ruled out.

Several other trends stand out (**Anomalies 31D**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.22 Area 34

Field / Area descriptions: Two pasture fields partially divided by a hedgerow and a track. The area was bounded by post and wire fencing.

Mining information: No recorded mining activity.

Basic topography: Downwards slope to the south-west.

Geology summary: Sandstone of the Pennine Middle Coal Measures Formation. The area is overlain by till in the east and north-east and by alluvium deposits in the south. There are no recorded superficial deposits in the north-west and west.

Interpretation drawing(s): ARC_3733_1402_25.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired

material or natural variations but some could be related to sub-surface features. Only larger / stronger responses of this type have been shown.

A positive linear anomaly of uncertain origin.

Further discussion / additional information:

There are a number of tracks shown on historic maps crossing this area. It is likely that the positive linear anomaly (**Anomaly 34A**) is related to a historic track or field boundary but its exact cause is not certain and it could have a different origin. The areas of magnetic disturbance and strong responses are probably related to material associated with the historic land use.

Several other trends stand out (**Anomalies 34B**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.23 Area 37

Field / Area descriptions: Pasture field with large tussocks. The area was firm underfoot and bounded by post and wire fencing. Areas of dense vegetation were present in various places.

Mining information: No recorded mining activity.

Basic topography: Steep downwards slope to the south-west but undulating throughout.

Geology summary: Predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation but a band of sandstone of the Pennine Middle Coal Measures Formations runs through its centre. The area is overlain by till.

Interpretation drawing(s): ARC_3733_1402_27.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

An area of magnetic disturbance associated with a relatively modern feature / material. It is possible that this could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond

the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects. It is possible that some of these anomalies could be related to mining activity.

A series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

There is no recorded mining activity in this area but, given the level of mining activity within the general area, there is potential for some responses to be related to unrecorded mining activity. **Anomalies 37A** are larger / stronger responses that could have potential to be caused by mining features but they could all be a product of other modern material / activity. **Anomaly 37B** also stands out and whilst this could also be a product of other modern material / features, including mining activity, it is possible that it could be related to an area of burning or other industrial activity and an archaeological cause cannot be ruled out.

Several other trends stand out (**Anomalies 37C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.24 Areas 38, 39, 40 and 41

Field / Area descriptions: Four pasture fields. The fields were relatively firm underfoot and bounded by post and wire fencing and hedgerows.

Basic topography: General downwards slope to the west and south.

Mining information: Parts of these areas are shown to be within an area of an unlicensed opencast site.

Geology summary: Predominantly mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation overlain by till. The north of Area 38 consists of sandstone of the Pennine Middle Coal Measures Formation overlain by till. The south of Area 39 and south-east of Area 40 consists of mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation with no recorded superficial deposits.

Interpretation drawing(s): ARC_3733_1402_29 and ARC_3733_1402_31.

Summary of anomalies:

Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects. It is possible that some of these anomalies could be related to mining activity.

Series of relatively straight linear responses. These could be related to drainage regimes, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes or individual field drains.

A linear trend, with dipolar / bipolar components, corresponds with the position of a former field boundary and will be related to this feature and / or an associated feature, such as a field drain.

Linear trends that broadly correspond with the position of a former field boundary. The responses are probably related to the boundary or associated features / activity.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of sub-surface features but the exact type of feature is not certain.

Further discussion / additional information:

Parts of these areas are shown to be within an area of an unlicensed opencast site. It is possible therefore that some of the anomalies could be related to mining activity. The data seems to suggest that there has not been opencast activity across all of the areas but there may have been localised extraction as defined by some of the areas of strong responses, large / strong isolated responses and areas of magnetic disturbance (**Anomalies 38A, 39A, 40A** and **41A**).

There are several alignments of relatively strong positive linear anomalies (**Anomalies 38B**, **40B** and **41B**). These responses are suggestive of drainage features but this interpretation is not certain and it is possible that some of them could be caused by other infilled features.

A number of other trends stand out (**Anomalies 38C** and **40C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

An area of magnetic disturbance adjacent to the southern and south-eastern edges of Area 38 and the eastern boundary of Area 40 correspond with a track shown on the map base and will be caused by material associated with this feature.

4.25 Areas 45 and 46

Field / Area descriptions: Two pasture fields. The fields were relatively firm underfoot and bounded by post and wire fencing and hedgerows. Feeding troughs were present in the east of Area 45. A large tree was present in the west of Area 46, waste / scrap in the east and patches of dense vegetation in the north.

Mining information: Area 45 is shown to be within an area of an unlicensed opencast site. Area 46 has no recorded mining activity.

Basic topography: Undulating / variable.

Geology summary: The west and south consists of mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation. The north and south-east consists of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation. The east consists of sandstone of the Pennine Middle Coal Measures Formation. Both areas are predominantly overlain by till, except for the west of Area 45, where there are no recorded superficial deposits.

Interpretation drawing(s): ARC_3733_1402_33.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant

relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

Linear bipolar anomalies associated with sub-surface utility apparatus (pipes, drain or cable).

An area of magnetic disturbance associated with relatively modern features / material. It is possible that some of the magnetic disturbance could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects. It is possible that some of these anomalies could be related to mining activity.

Series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity. Other responses are present that are indicative of drainage regimes or individual field drains.

A linear trend corresponds with the position of a former field boundary and will be related to this feature.

Numerous trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Positive linear / curvi-linear responses. These are suggestive of infilled features but it is not certain if these are archaeological or modern.

Further discussion / additional information:

The magnetic background for parts of these areas is strongly variable with a large number of isolated responses present. These will be related to a spread of modern material, some of which may be associated with mining waste. Only selected larger / stronger responses have been shown. The number and extent of these responses is such that they could possibly mask / partially mask responses from underlying features.

Area 45 is shown to be within an area of an unlicensed opencast site. It is possible therefore that some of the anomalies could be related to mining activity. The data seems to suggest

that there has not been opencast activity across all of the area but there may have been localised extraction, as defined by some of the areas of strong responses, large / strong isolated responses and areas of magnetic disturbance (**Anomalies 45A**). There is no recorded mining activity Area 46 but, given the level of mining activity within the general area, there is potential for some responses to be related to unrecorded mining activity. **Anomalies 46A** are larger / stronger responses that could have potential to be caused by mining features but they could all be a product of other modern material / activity.

There are a number of linear / curvi-linear anomalies in Area 46 that form regular patterns. Some of these could be related to archaeological features but it is worth noting that some responses are suggestive of drainage features and other anomalies may respect these. It is possible that the drainage / agricultural regimes could coincidently have the same alignment as underlying archaeological features and so some anomalies that may appear to be drainage or agricultural could actually be archaeological. **Anomalies 46B** could be archaeological but some could be related to drainage / agricultural activity. **Anomalies 46C** could be related to drainage / agricultural regimes / activity but it is possible that some could be caused by archaeological features.

A number of other trends stand out (**Anomalies 45B,** and **46D**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features / variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

4.26 Areas 50 and 51

Field / Area descriptions: Two grass fields. The fields were relatively firm underfoot and bounded by post and wire fencing and hedgerows.

Mining information: Area 51 and part of Area 50 are shown to be within an area of an unlicensed opencast site.

Basic topography: Undulating / variable.

Geology summary: The west consists of mudstone, siltstone and sandstone of the Pennine Middle Coal Measures Formation. The north and east consists of mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation. Both areas are predominantly overlain by till, except for the centre and north-east of Area 45, where there are no recorded superficial deposits.

Interpretation drawing(s): ARC_3733_1402_35.

Summary of anomalies: Numerous small / weak isolated dipolar and bipolar responses are present that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects. It is possible that some of these anomalies could be related to mine workings.

A linear bipolar anomaly associated with sub-surface utility apparatus (pipes, drain or cable).

Areas of magnetic disturbance associated with relatively modern features / material. It is possible that some of these anomalies could be related to mining activity.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area. For some strong responses the approximate position of the material / feature causing the anomaly can be determined but for others it is not clear and it is not certain if a response is caused by a spread of material or discrete features / objects. It is possible that some of these anomalies could be related to mining activity.

Series of relatively straight linear responses. These could be related to a drainage regime, the remnants of ridge and furrow or modern agricultural activity.

A number of trends of uncertain origin. Some trends may be related to agricultural or drainage activity / features, some could be natural but others may be caused by infilled features. It is not certain if any potential infilled features will be modern or archaeological.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural variations but some could be related to sub-surface features, including possible mine workings. Only larger / stronger responses of this type have been shown.

Further discussion / additional information:

The magnetic background for most of these areas is strongly variable with a large number of isolated responses present. These will be related to a spread of modern material, some of which may be associated with mining waste. Only selected larger / stronger responses have been shown. The number and extent of these responses is such that they could possibly mask / partially mask responses from underlying features.

The majority of the areas are shown to be within an area of an unlicensed opencast site. It is possible therefore that some of the anomalies could be related to mining activity. The data seems to suggest that there has not been opencast activity across all of the areas but there may have been localised extraction as defined by some of the areas of strong responses, large / strong isolated responses and areas of magnetic disturbance (**Anomalies 50A** and **51A**).

In the north of Area 51 there are several broadly linear positive responses (**Anomalies 51B**). These could be related to parts of linear features, such as the remnants of ridge and furrow or other agricultural activity, or they could be caused by discrete features / material.

A number of trends stand out slightly (**Anomalies 50B,** and **51C**) but it is not possible to reliably determine their cause. Some responses are relatively straight and could be caused by drainage or agricultural features, others are irregular and could be related to natural features /

variations but it is possible that any of these could be related to other modern activity and some could be caused by archaeological features.

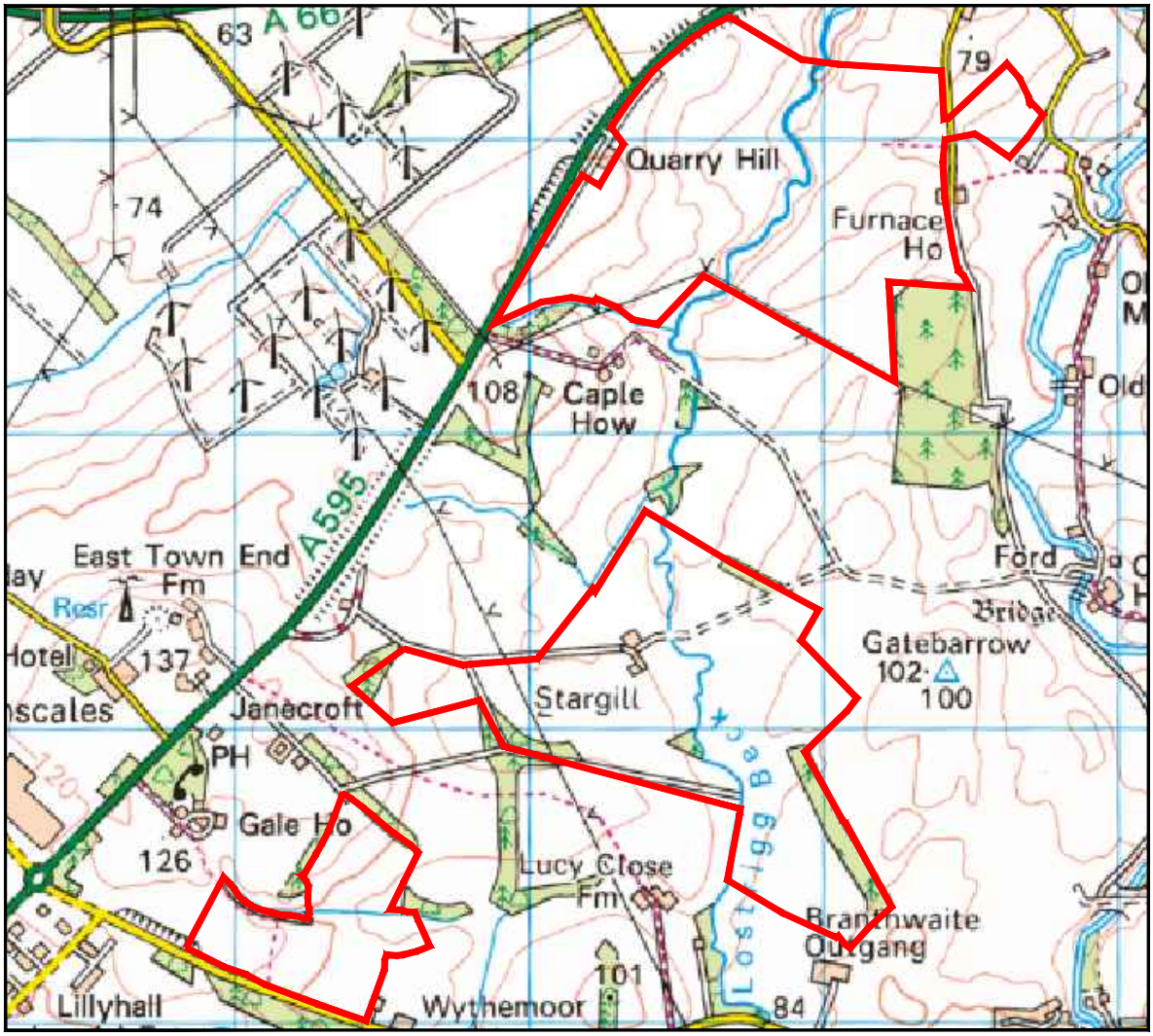
5. DISCUSSION AND CONCLUSIONS

Some parts of the site have an unusually large number of isolated responses, which have produced a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material or modern activity. In some areas the number of isolated responses / extent of the magnetic disturbance means that it is not possible to differentiate between the responses associated with modern material or any isolated responses that could have potential to be related to archaeological features / activity. The strength of the responses within the majority of the areas of magnetic disturbance suggest that most of them are caused by a surface / near surface spread of material, rather than significant made ground, although there are some areas suggestive of fill material or other made ground. A coal mining report highlights that there are a large number of recorded mineshafts within the site as well as some adits and areas of possible opencast mining. It is likely that many of the larger / stronger isolated responses and some areas of magnetic disturbance and strong responses are related to mining activity; either shafts, bellpits, areas of opencast mining or associated mining waste / spoil.

The majority of the remaining anomalies identified by this survey relate to modern material / objects, agricultural activity (including ridge and furrow), drainage regimes / features and possible natural variations / features. There are a number of linear / curvi-linear anomalies that are indicative of sub-surface features but it in many cases it is not certain if these are modern (such as drainage features) or archaeological. There are some areas where there is possible archaeological activity but the interpretation is not certain and it has not been possible to definite the extent of any such activity.

It is worth noting in some areas that former field boundaries, shown on historic maps, do not have a corresponding magnetic response, although in other areas they do, and the strength of responses associated with agricultural activity varies across the site, being clear and well-defined in some areas and weaker and more fragmented in others. This indicates that the magnetic susceptibility of the soils varies across the site. This could mean that in some parts of the site, where the magnetic background is more uniform and responses from agricultural activity are weaker, sub-surface features may only produce weak or intermittent responses. It is possible that not all archaeological features / activity across the site may have been detected.

It should be noted that a geophysical survey does not directly locate sub-surface features - it identifies variations or anomalies in the background response caused by features. The interpretation of geophysical anomalies is often subjective and it is rarely possible to identify the cause of all such anomalies. Not all features will produce a measurable anomaly and the effectiveness of a geophysical survey is also dependant on the site-specific conditions. The main factors that may limit whether a feature can be detected are the composition of a feature, its depth and size and the surrounding material. It is not possible to guarantee that a geophysical survey will identify all sub-surface features. Confirmation on the identification of anomalies and the presence or absence of sub-surface features can only be achieved by intrusive investigation.



APPROXIMATE LOCATION OF SURVEY AREAS

SCALE

0m 500m 1000m

NOTE

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Scale [A4 Sheet]	Drawing	Status
AS SHOWN	ARC_3733_1402_01	FINAL

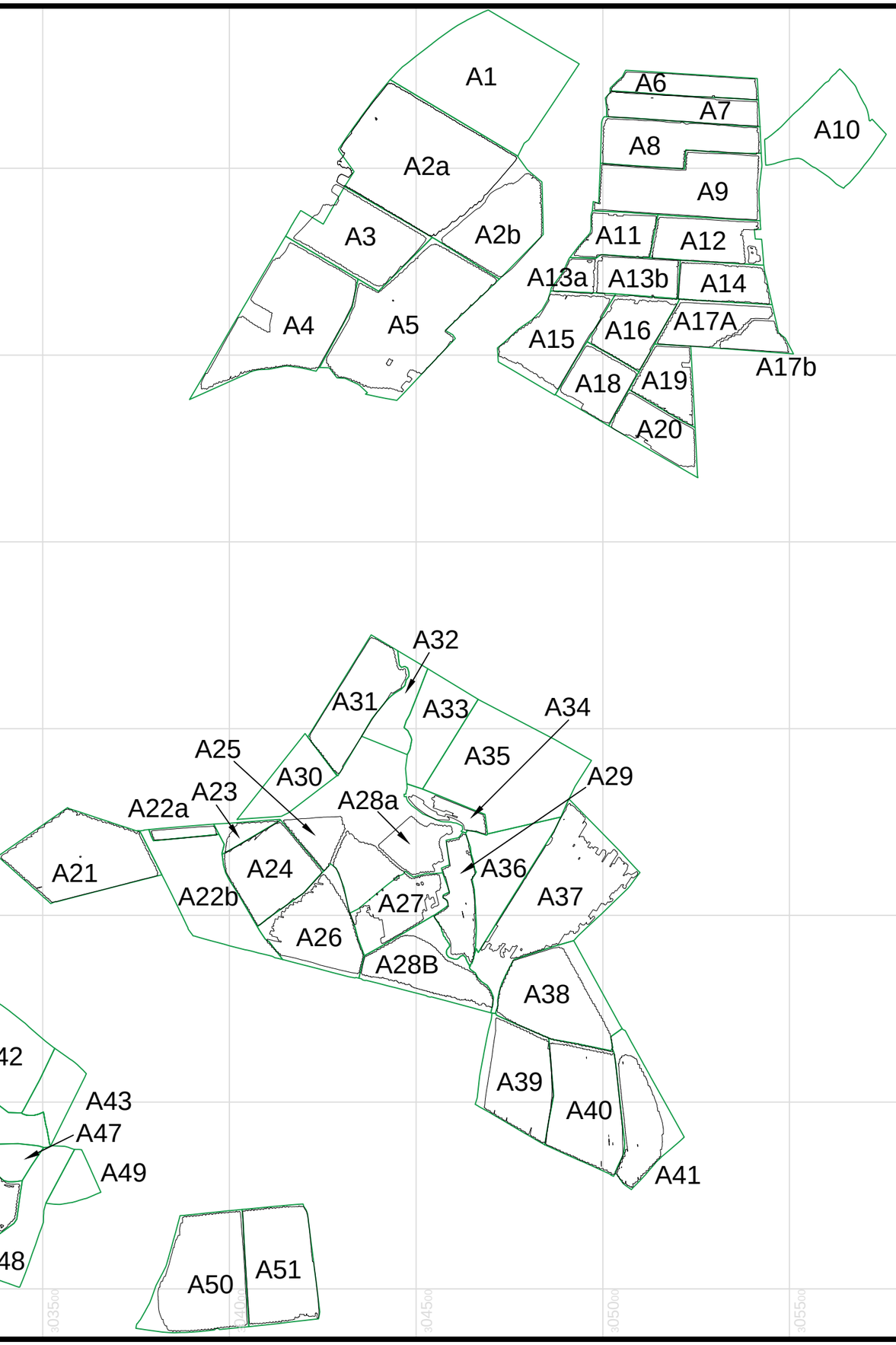
Client: WARDELL ARSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: SITE LOCATION MAP

Job No: ARC_3733_1402

		Drawn	NF
Chk.	MW	Date	06/08/2024



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KEY

A19 — FIELD REFERENCE AREA

——— EXTENTS OF MAGNETIC GRADIENT SURVEY

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Scale [A3 Sheet]	Drawing	Status
1:12500	ARC_3733_1402_02	FINAL

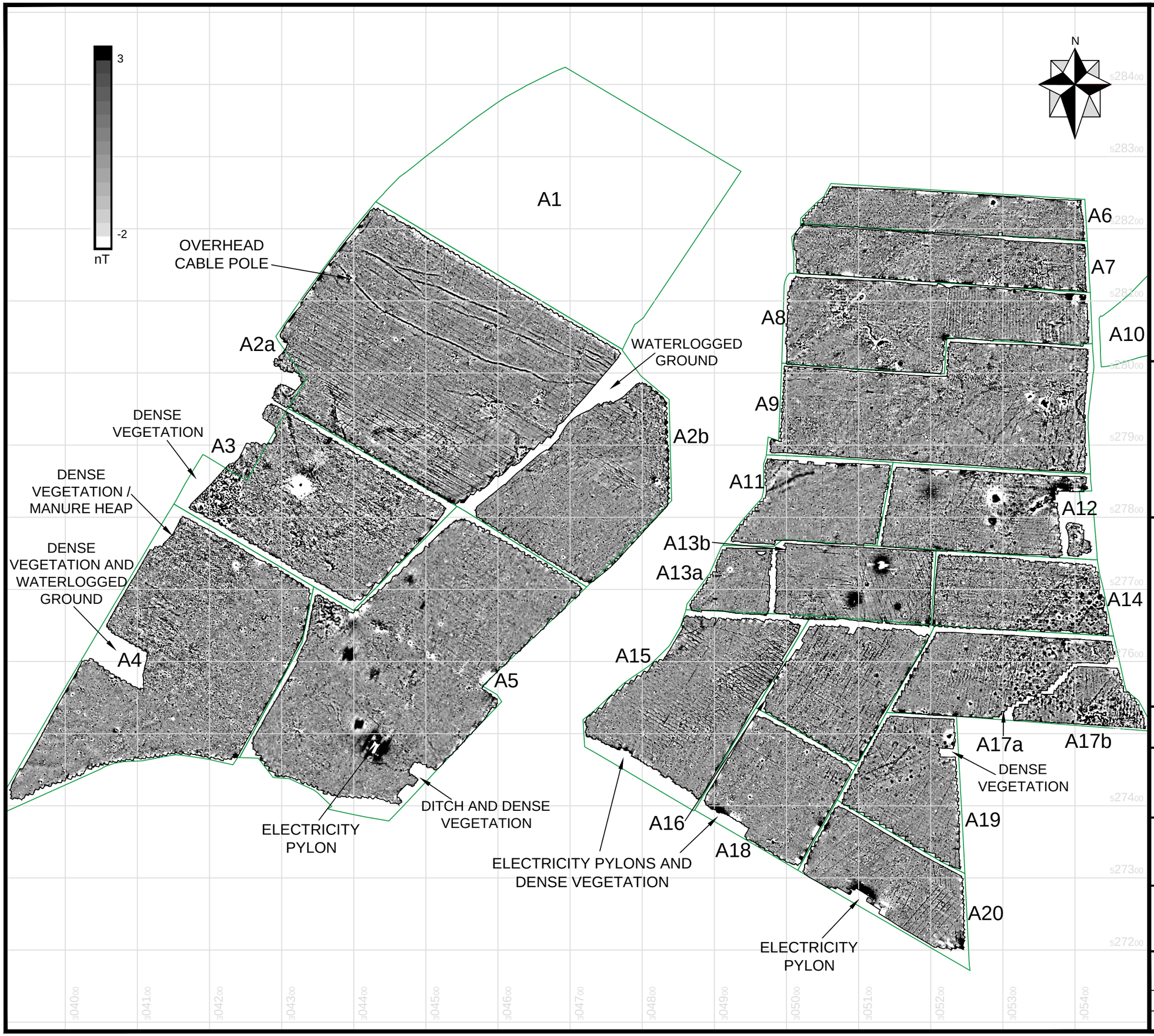
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
LOCATION OF MAGNETIC GRADIENT SURVEY AREAS

ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



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A19 FIELD REFERENCE AREA

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Scale [A3 Sheet]	Drawing	Status
1:5000	ARC_3733_1402_03	FINAL

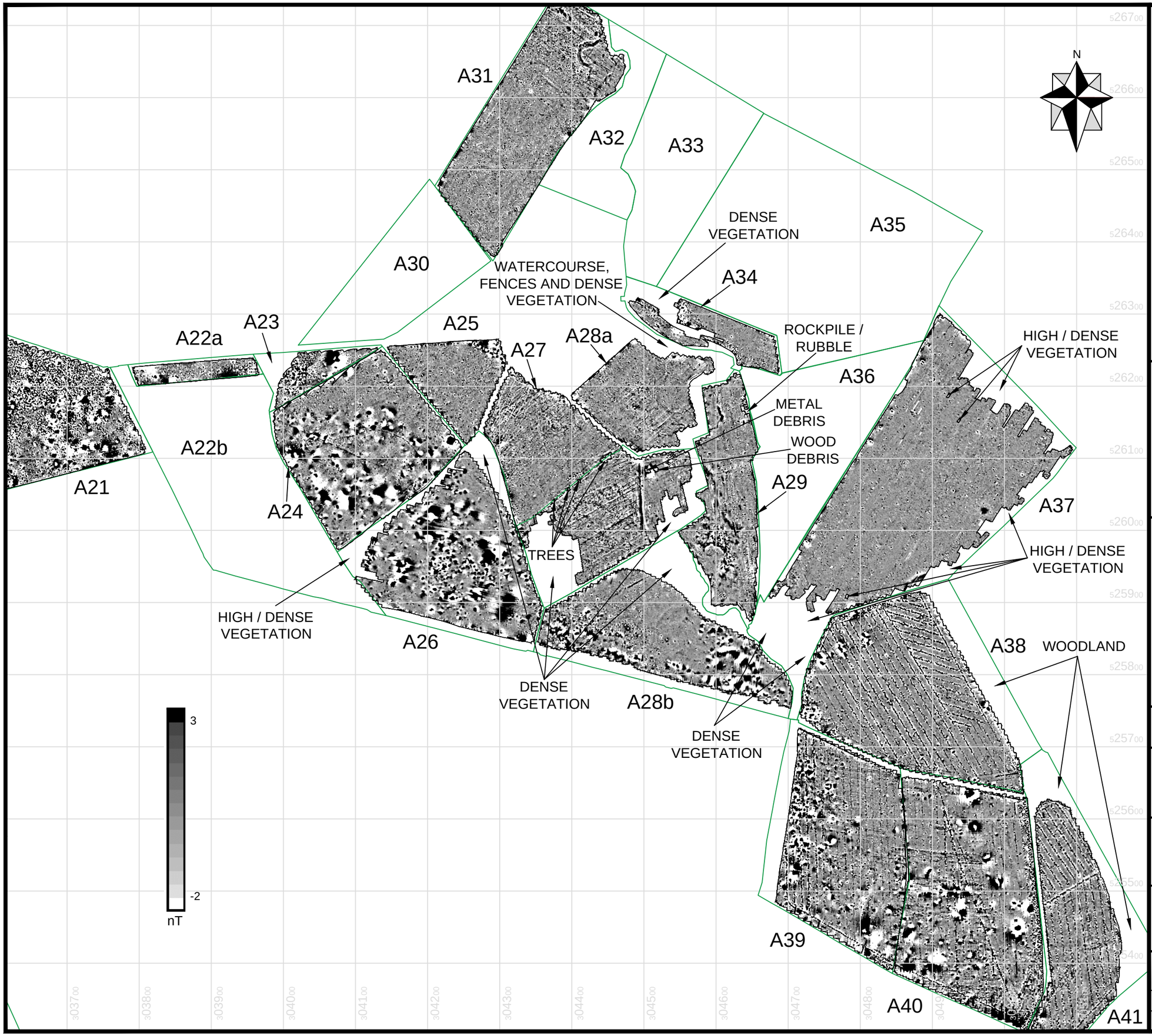
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: NORTHERN PART OF SITE ('STANDARD' RANGE)

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



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A19 — FIELD REFERENCE AREA

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Scale [A3 Sheet]	Drawing	Status
1:5000	ARC_3733_1402_04	FINAL

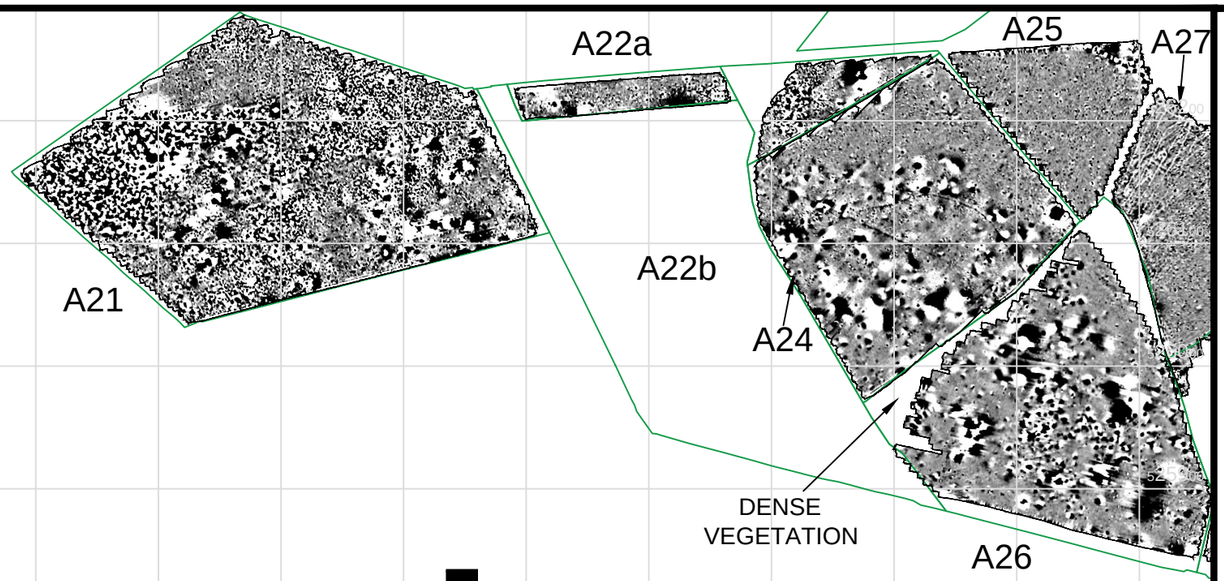
Client: WARDELL ARMSTRONG LLP CARLISLE

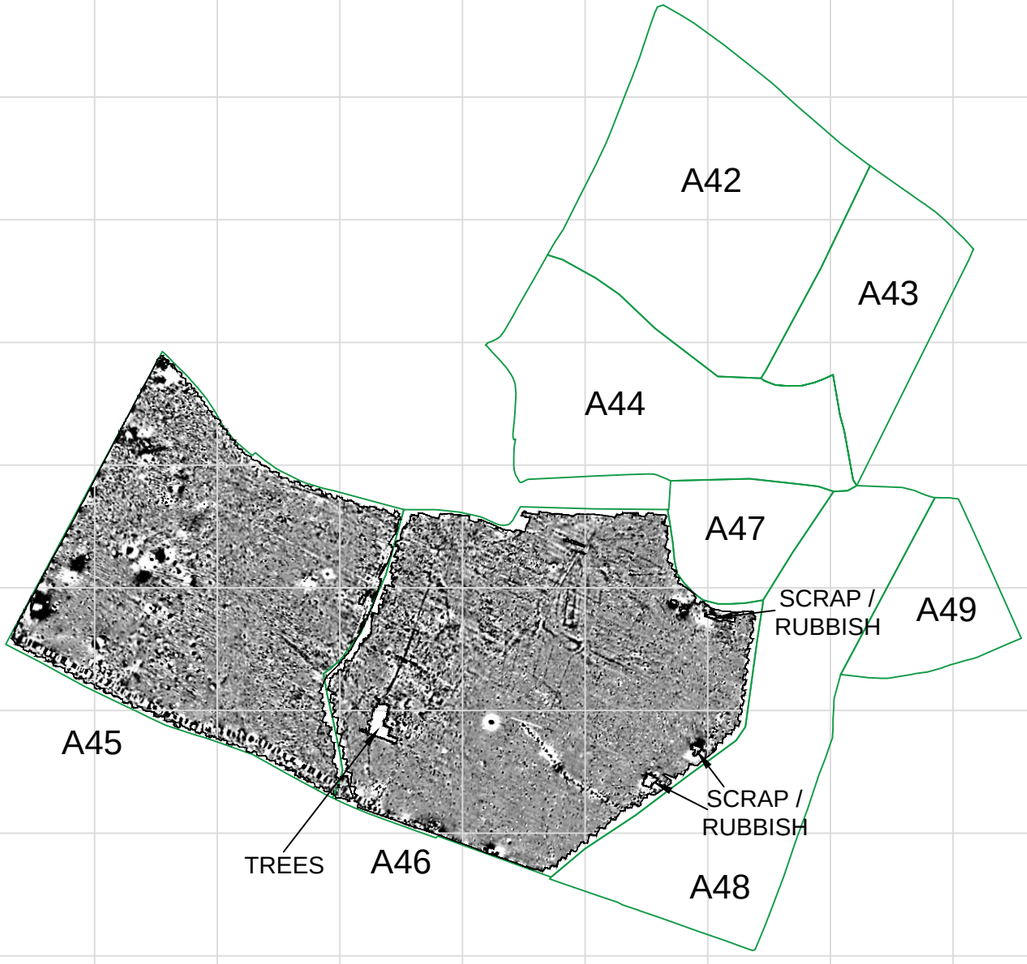
Site: LOSTRIGG SOLAR SCHEME CUMBRIA

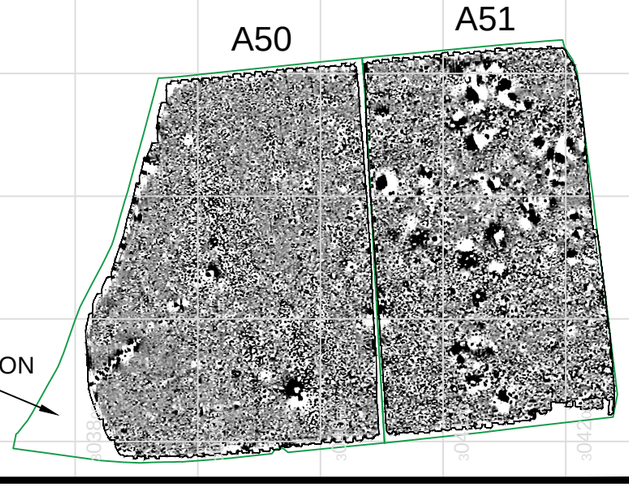
Title: GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: CENTRAL PART OF SITE ('STANDARD' RANGE)

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024







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A19 FIELD REFERENCE AREA

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Scale [A3 Sheet]	Drawing	Status
1:5000	ARC_3733_1402_05	FINAL

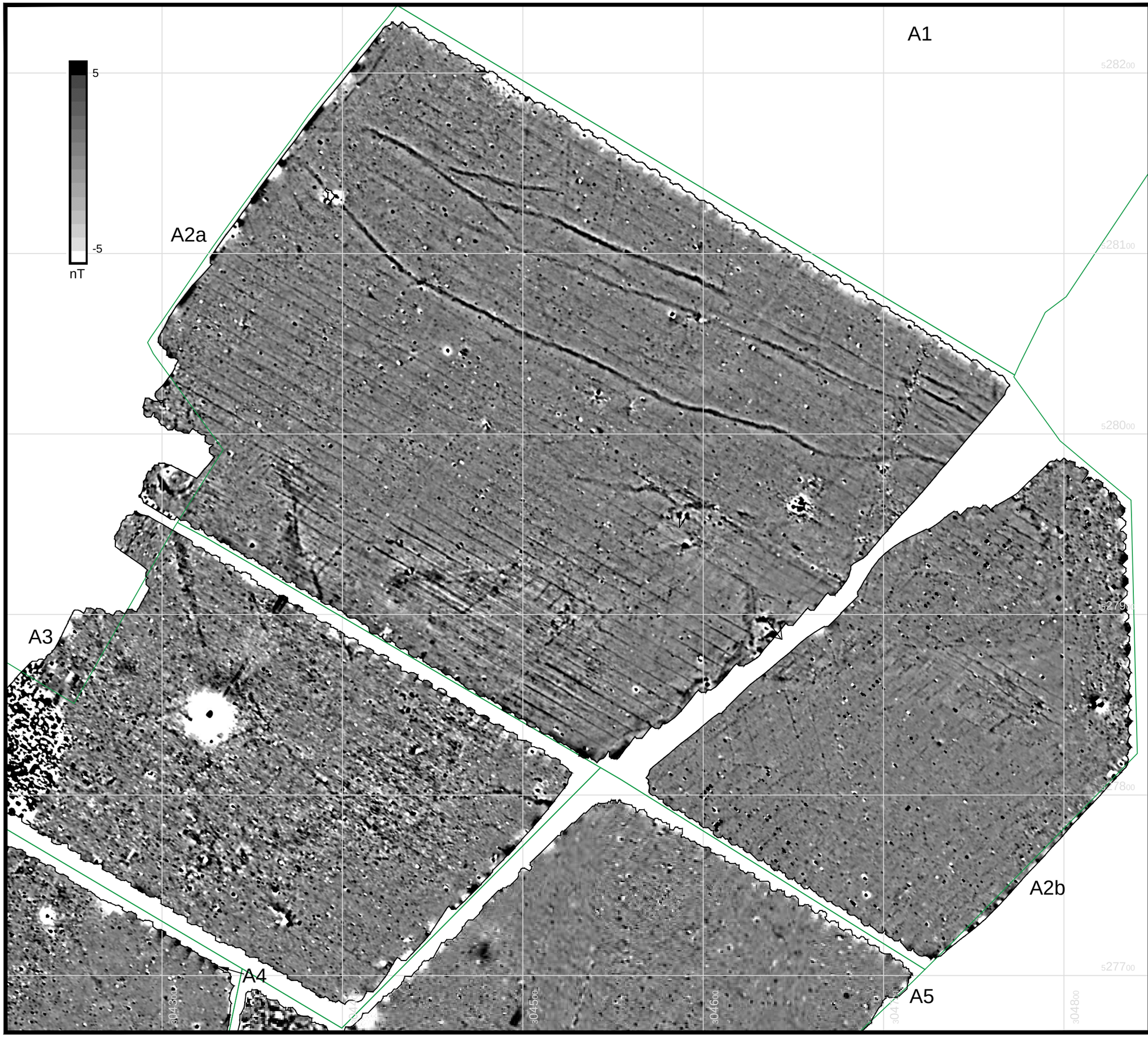
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: SOUTHERN PART OF SITE ('STANDARD' RANGE)

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_06	FINAL

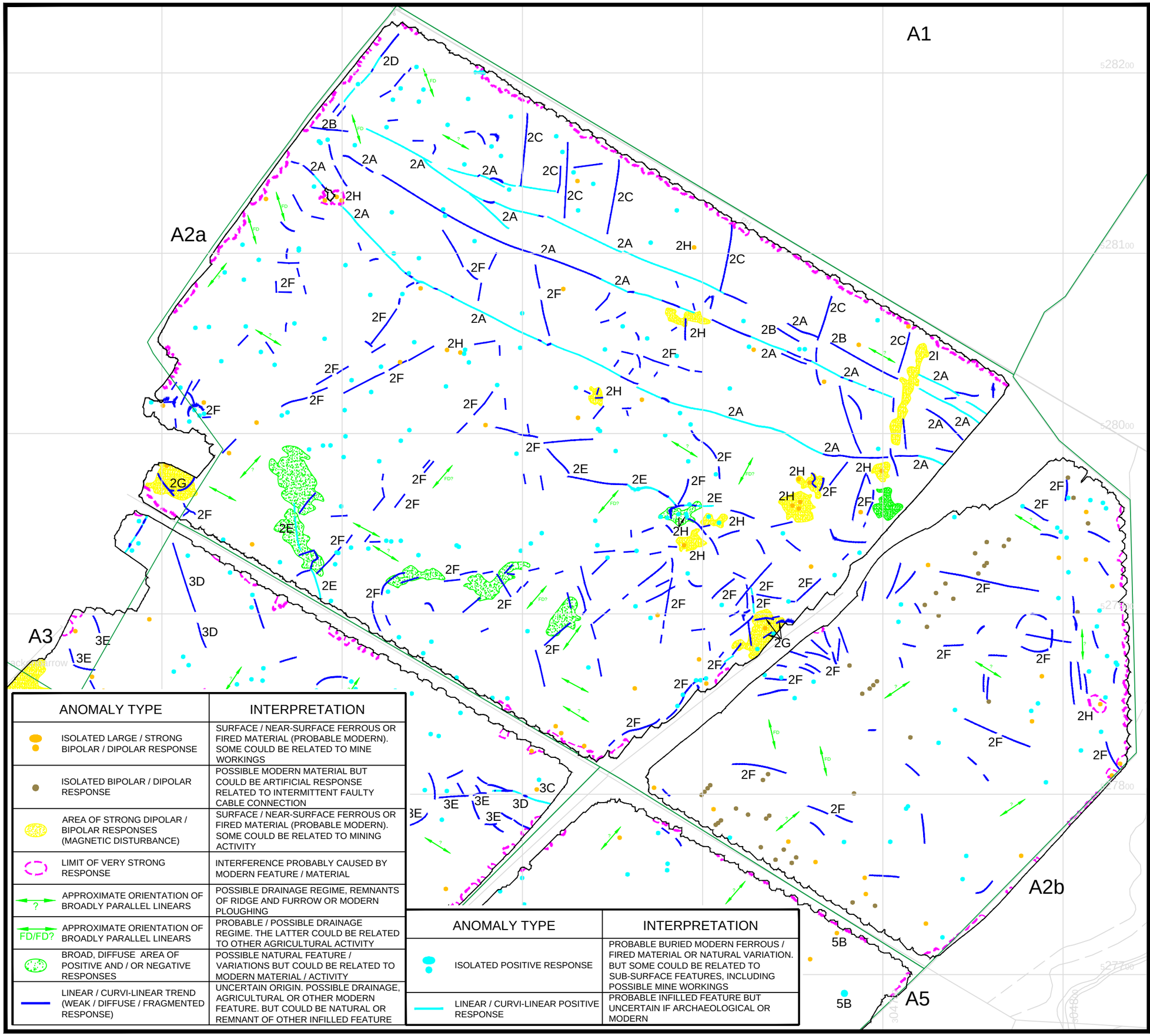
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA
(RELATIVELY WIDE RANGE):
A2a, A2b AND PARTS OF A3, A4 AND A5

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
ISOLATED BIPOLAR / DIPOLAR RESPONSE	POSSIBLE MODERN MATERIAL BUT COULD BE ARTIFICIAL RESPONSE RELATED TO INTERMITTENT FAULTY CABLE CONNECTION
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
BROAD, DIFFUSE AREA OF POSITIVE AND / OR NEGATIVE RESPONSES	POSSIBLE NATURAL FEATURE / VARIATIONS BUT COULD BE RELATED TO MODERN MATERIAL / ACTIVITY
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE

ANOMALY TYPE	INTERPRETATION
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_07	FINAL

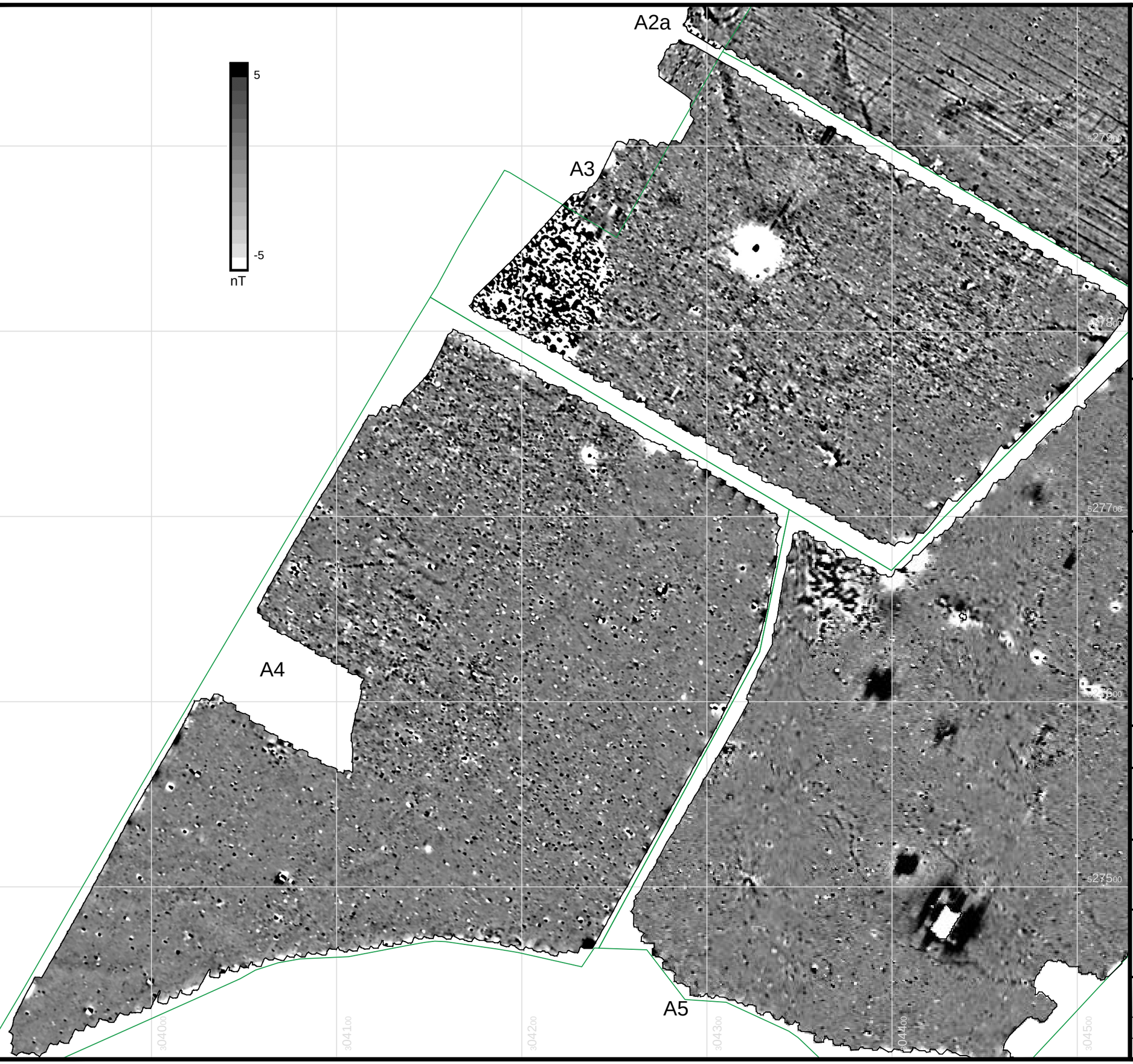
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA:
A2a, A2b AND PARTS OF A3 AND A5

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_08	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

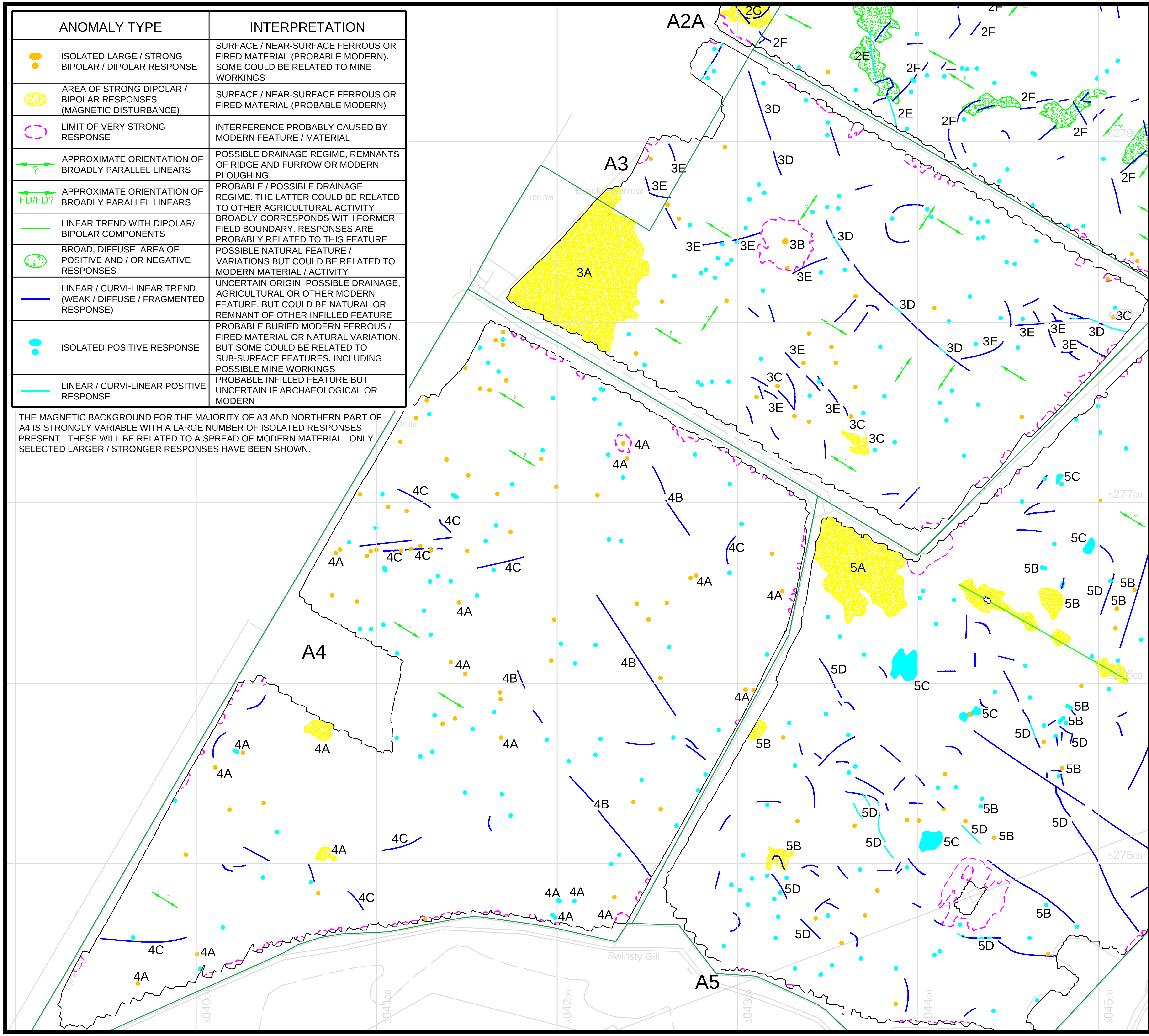
Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE): A3, A4 AND PARTS OF A2a AND A5

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
FD/FD? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR TREND WITH DIPOLAR/ BIPOLAR COMPONENTS	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
BROAD, DIFFUSE AREA OF POSITIVE AND / OR NEGATIVE RESPONSES	POSSIBLE NATURAL FEATURE / VARIATIONS BUT COULD BE RELATED TO MODERN MATERIAL / ACTIVITY
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THE MAGNETIC BACKGROUND FOR THE MAJORITY OF A3 AND NORTHERN PART OF A4 IS STRONGLY VARIABLE WITH A LARGE NUMBER OF ISOLATED RESPONSES PRESENT. THESE WILL BE RELATED TO A SPREAD OF MODERN MATERIAL. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_09	FINAL

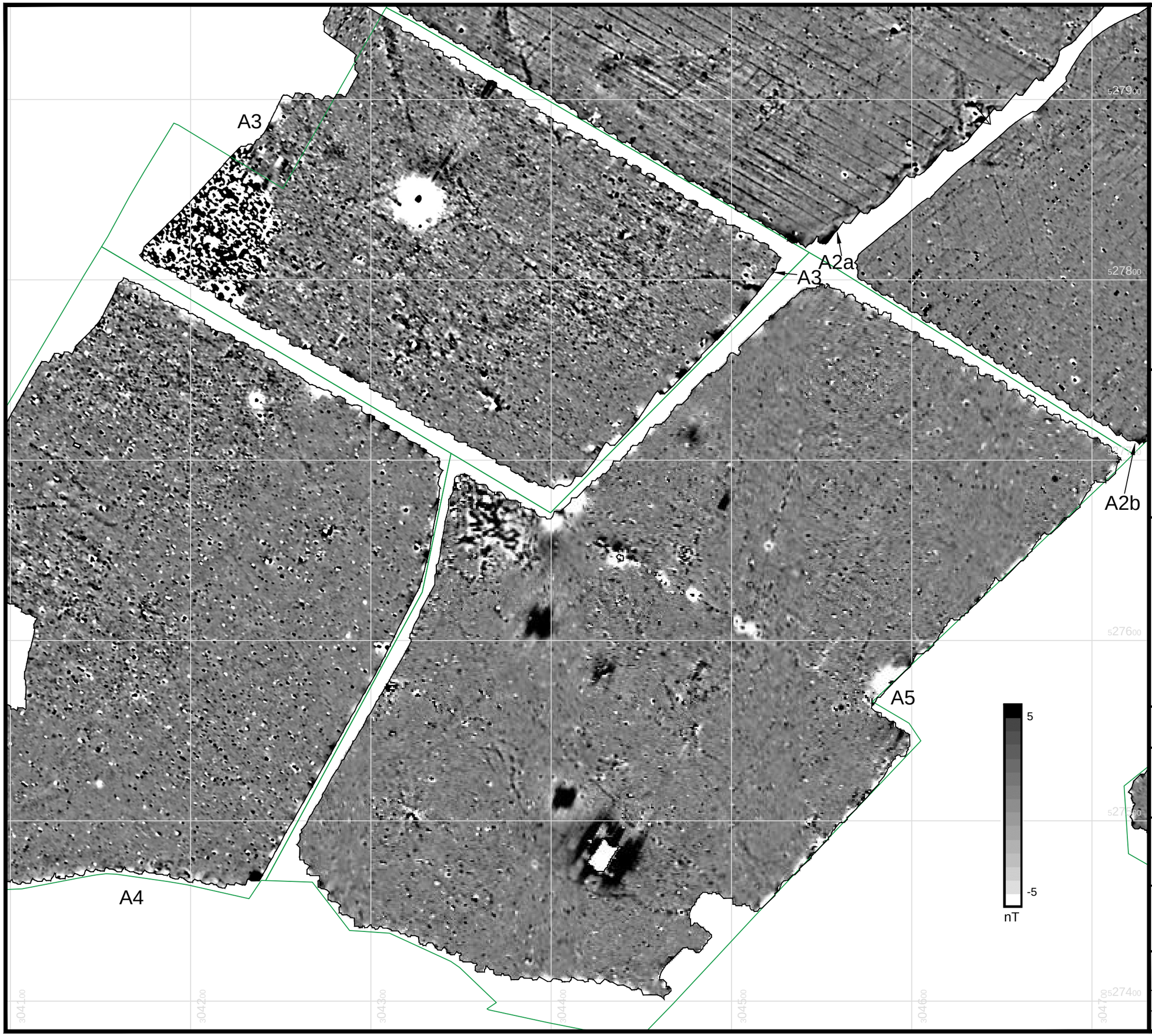
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A3, A4 AND PARTS OF A2 AND A5

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_10	FINAL

Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

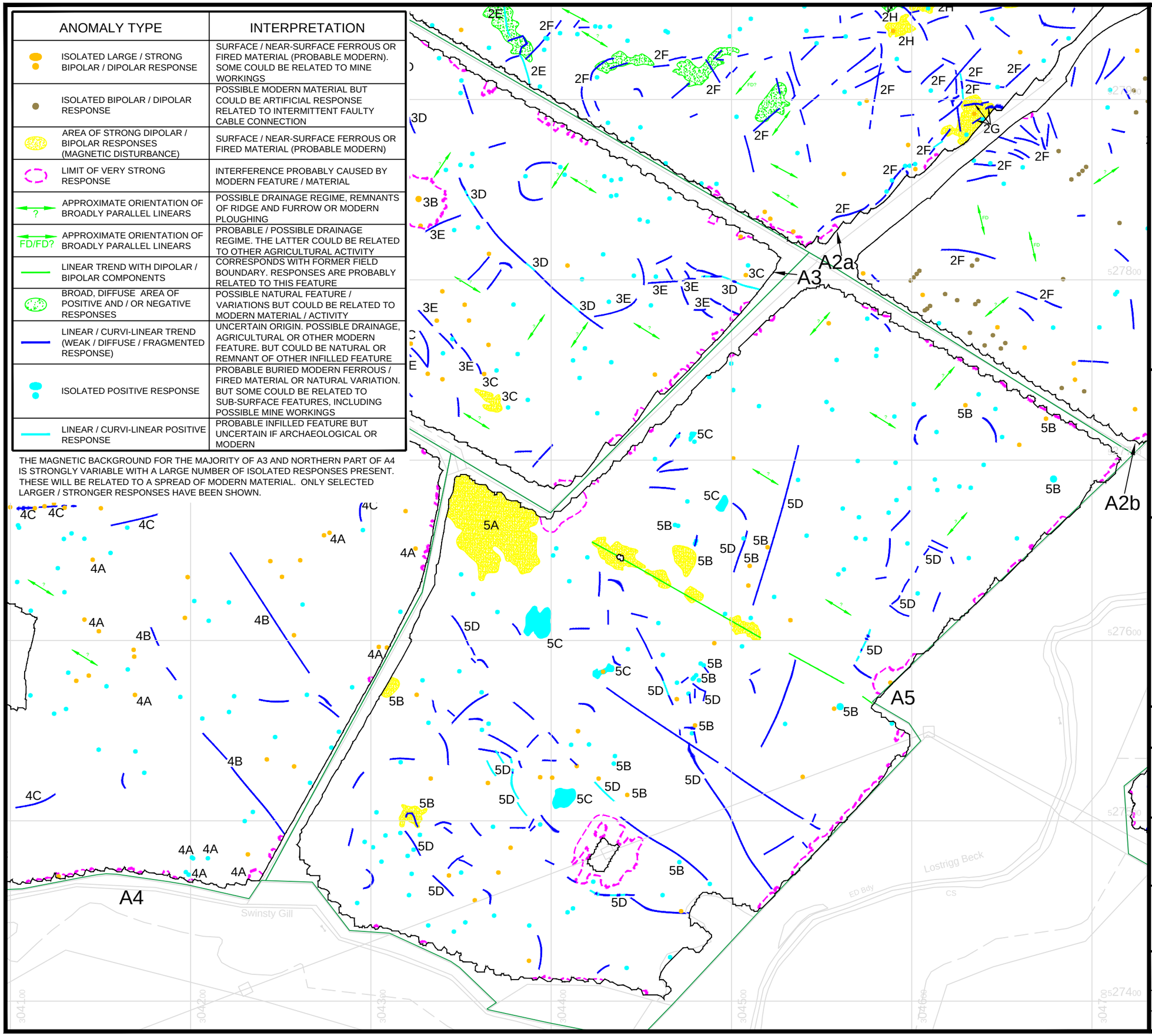
Title: GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE): A5 AND PARTS OF A2a, A2b, A3 AND A4

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
ISOLATED BIPOLAR / DIPOLAR RESPONSE	POSSIBLE MODERN MATERIAL BUT COULD BE ARTIFICIAL RESPONSE RELATED TO INTERMITTENT FAULTY CABLE CONNECTION
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
BROAD, DIFFUSE AREA OF POSITIVE AND / OR NEGATIVE RESPONSES	POSSIBLE NATURAL FEATURE / VARIATIONS BUT COULD BE RELATED TO MODERN MATERIAL / ACTIVITY
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THE MAGNETIC BACKGROUND FOR THE MAJORITY OF A3 AND NORTHERN PART OF A4 IS STRONGLY VARIABLE WITH A LARGE NUMBER OF ISOLATED RESPONSES PRESENT. THESE WILL BE RELATED TO A SPREAD OF MODERN MATERIAL. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_11	FINAL

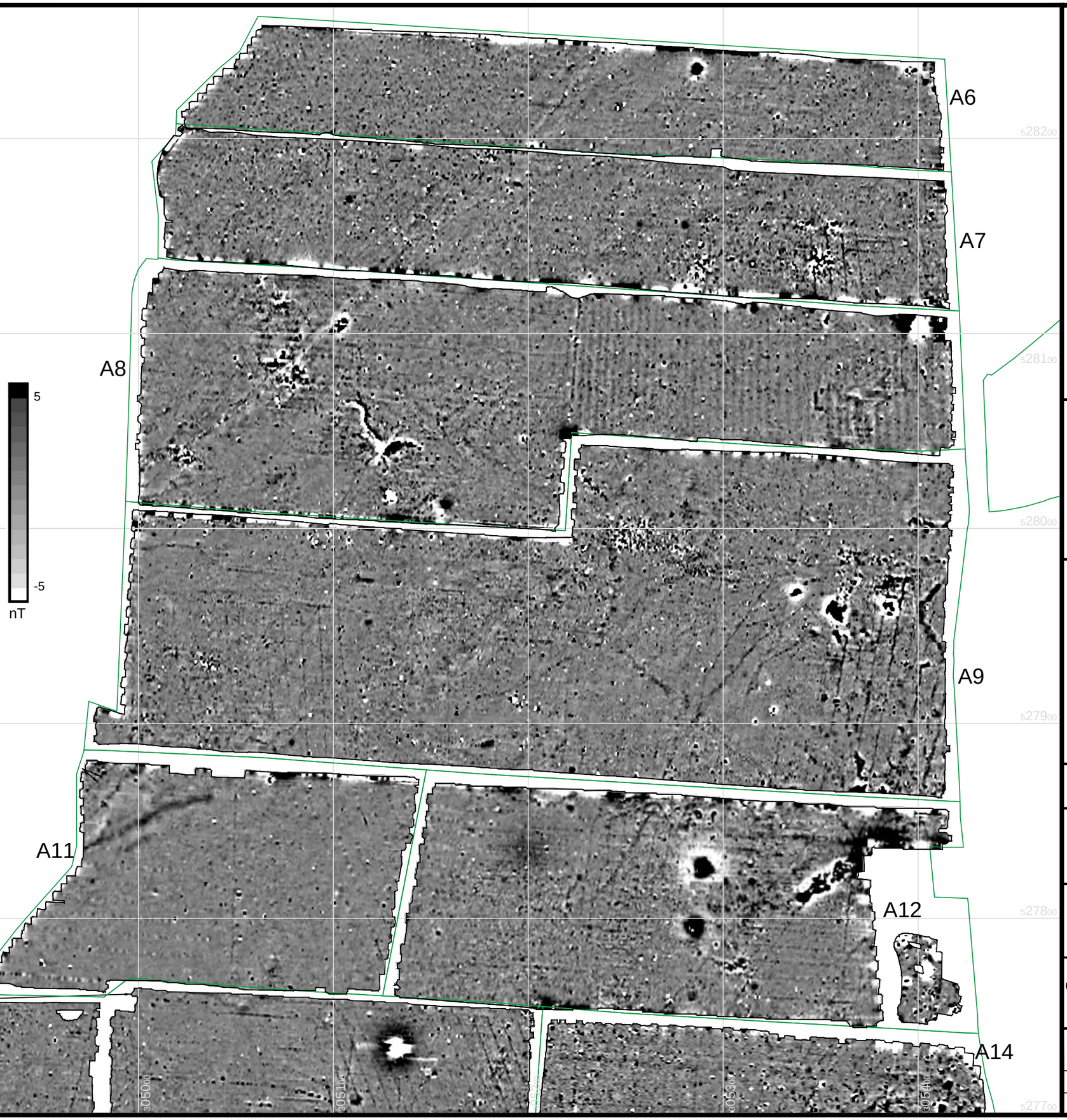
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A5 AND PARTS OF A2a, A2b, A3 AND A4

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_12	FINAL

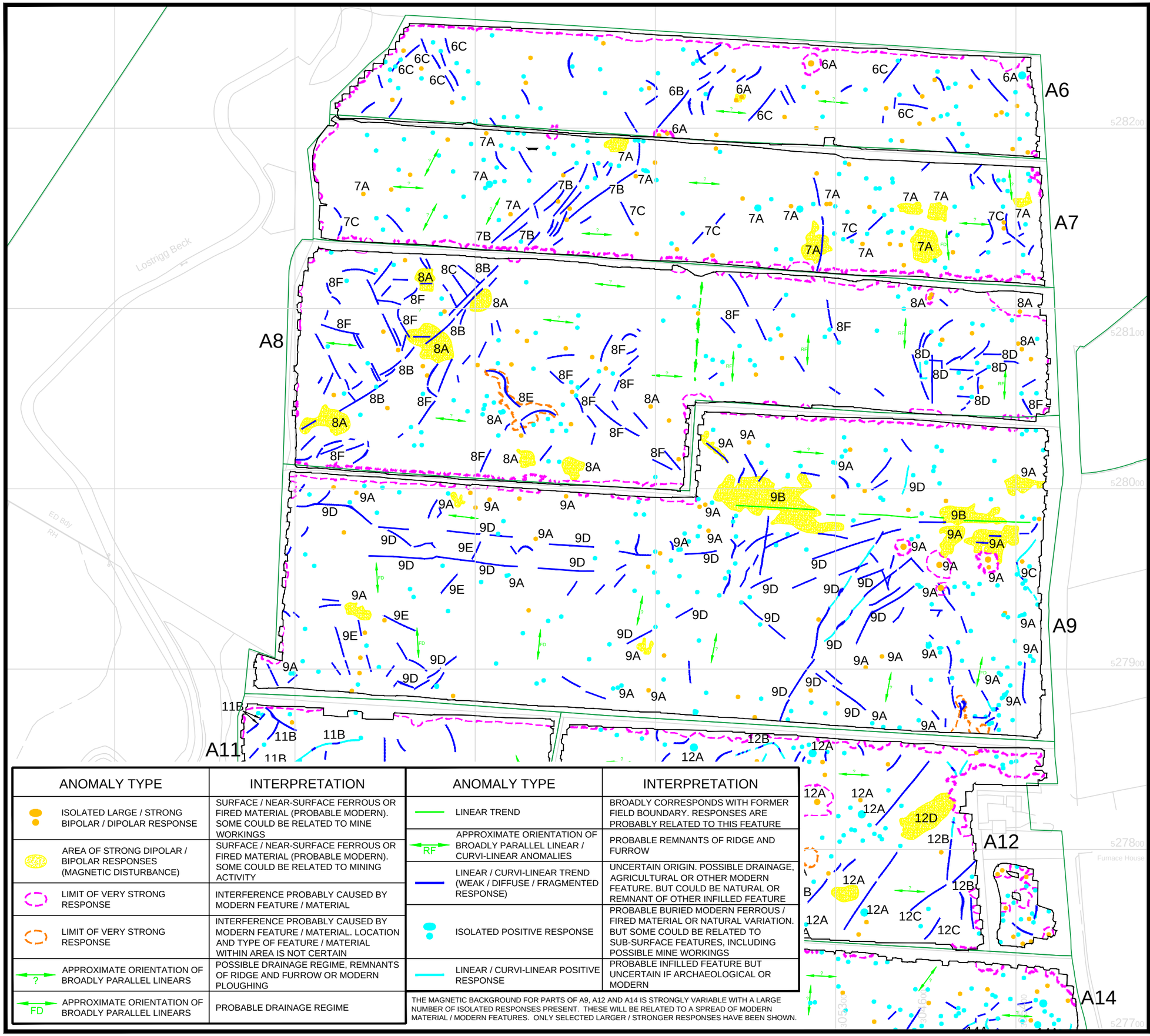
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE):: A6, A7, A8, A9, A11, A12 AND PARTS OF A13a, A13b AND A14

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
FD APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE DRAINAGE REGIME

ANOMALY TYPE	INTERPRETATION
LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
RF APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEAR / CURVI-LINEAR ANOMALIES	PROBABLE REMNANTS OF RIDGE AND FURROW
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THE MAGNETIC BACKGROUND FOR PARTS OF A9, A12 AND A14 IS STRONGLY VARIABLE WITH A LARGE NUMBER OF ISOLATED RESPONSES PRESENT. THESE WILL BE RELATED TO A SPREAD OF MODERN MATERIAL / MODERN FEATURES. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_13	FINAL

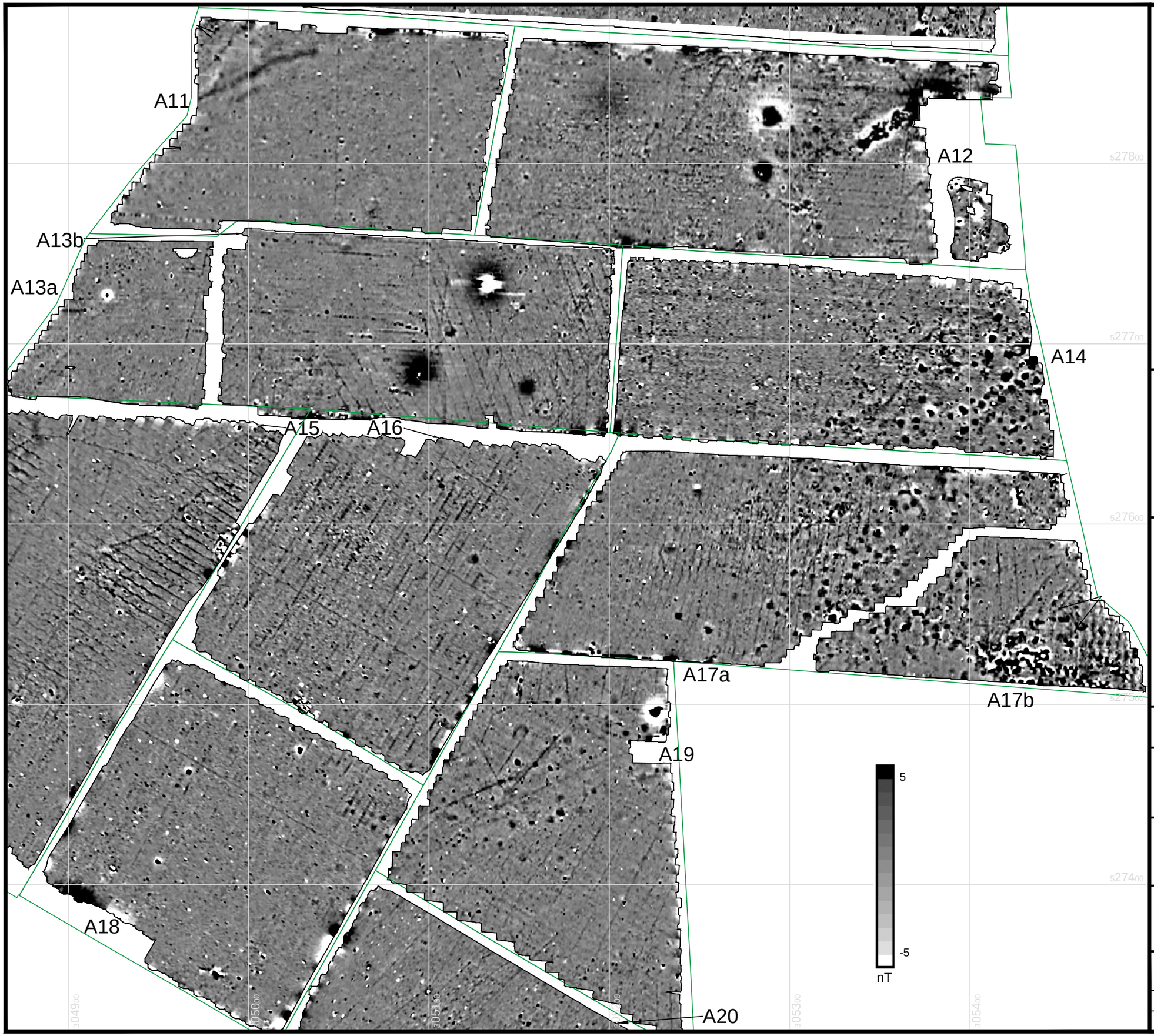
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA:
A6, A7, A8, A9 AND PARTS OF A11, A12 AND A14

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_14	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE): A11, A12, A13a, A13b, A14, A16, A17a, A17b, A18, A19 AND PARTS OF A15 AND A20

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

NOTES

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ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
FD APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE DRAINAGE REGIME

A LARGE NUMBER OF ISOLATED RESPONSES IN AREAS 14, 17a AND 17b WILL BE RELATED TO MINING FEATURES. THEY ARE TOO NUMEROUS TO LABEL INDIVIDUAL ANOMALIES AND IT SHOULD BE CONSIDERED THAT ANY ISOLATED RESPONSES IN THESE, AND THE ADJACENT PARTS OF ADJOINING AREAS, HAVE POTENTIAL TO BE ASSOCIATED WITH MINING ACTIVITY.

ANOMALY TYPE	INTERPRETATION
LINEAR TREND (POSITIVE, NEGATIVE OR BIPOLAR)	PROBABLE DRAINAGE FEATURE
RF APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEAR / CURVI-LINEAR ANOMALIES	PROBABLE REMNANTS OF RIDGE AND FURROW
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_15	FINAL

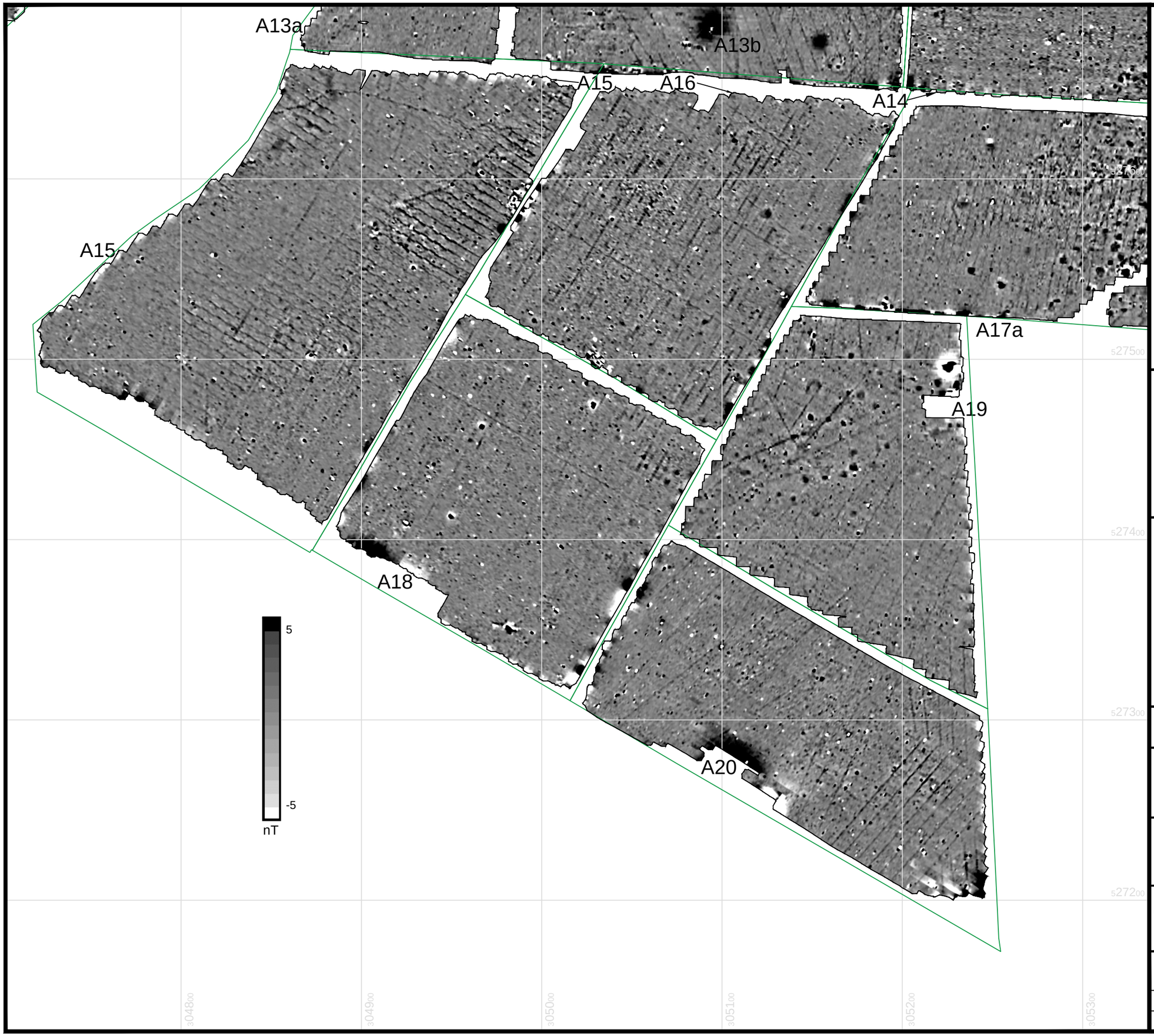
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA:
A11, A12, A13a, A13b, A14, A16, A17a, A17b AND PARTS OF A15, A18 AND A19

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_16	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE): A15, A16, A18, A19, A20 AND PARTS OF A13a, A13b, A14 AND A17a

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

NOTES

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ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
FD APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE DRAINAGE REGIME
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
RF APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEAR / CURVI-LINEAR ANOMALIES	PROBABLE REMNANTS OF RIDGE AND FURROW
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE

A LARGE NUMBER OF ISOLATED RESPONSES IN AREAS 14, 17a AND 17b WILL BE RELATED TO MINING FEATURES. THEY ARE TOO NUMEROUS TO LABEL INDIVIDUAL ANOMALIES AND IT SHOULD BE CONSIDERED THAT ANY ISOLATED RESPONSES IN THESE, AND THE ADJACENT PARTS OF ADJOINING AREAS, HAVE POTENTIAL TO BE ASSOCIATED WITH MINING ACTIVITY.

ANOMALY TYPE	INTERPRETATION
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

PHASE SITE INVESTIGATIONS

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_17	FINAL

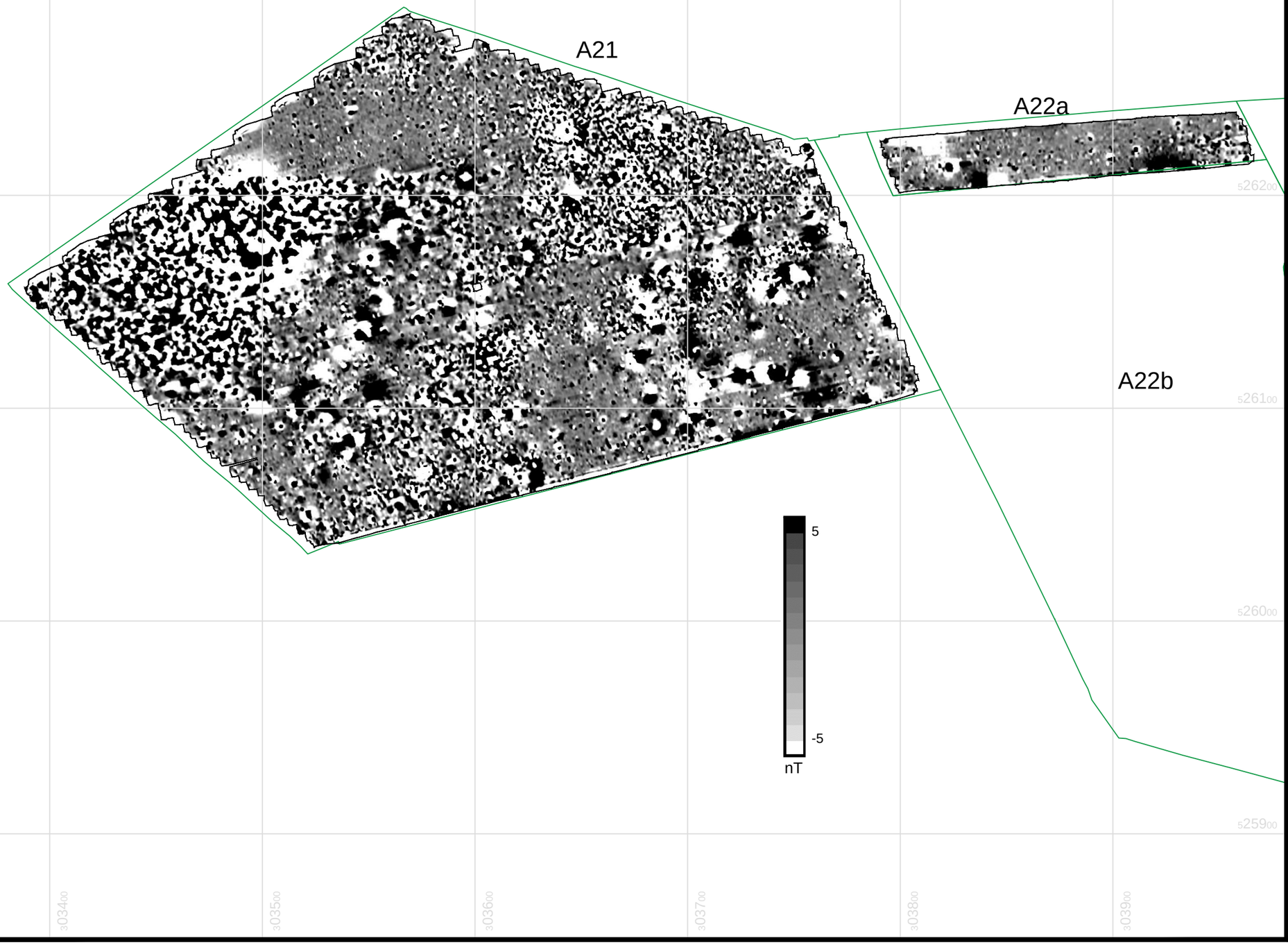
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA:
A15, A16, A18, A19, A20 AND PARTS OF A13a, A13b, A14 AND A17a

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_18	FINAL

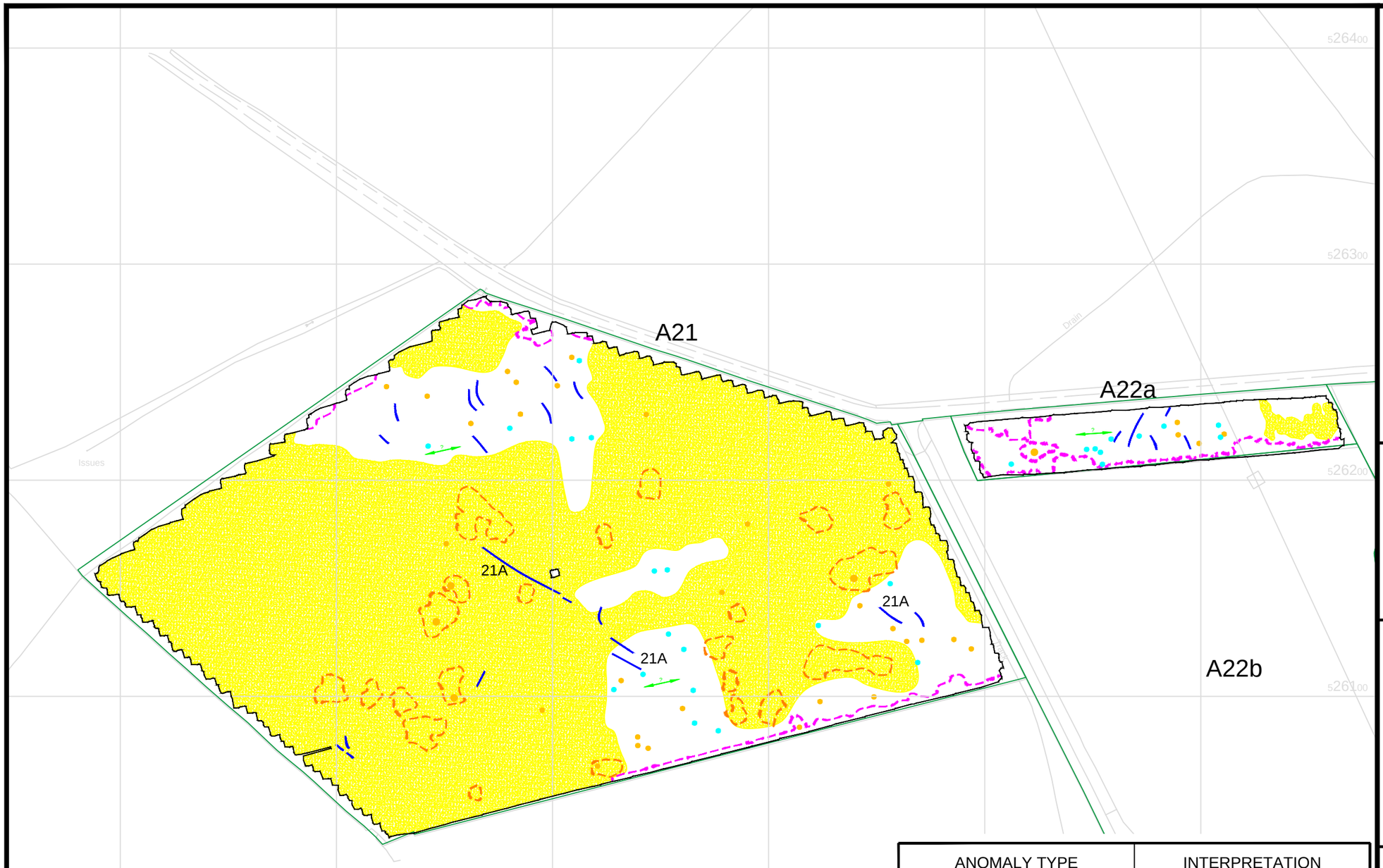
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA (RELATIVELY WIDE RANGE): A21 AND A22a

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS

PHASE SITE INVESTIGATIONS

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_19	FINAL

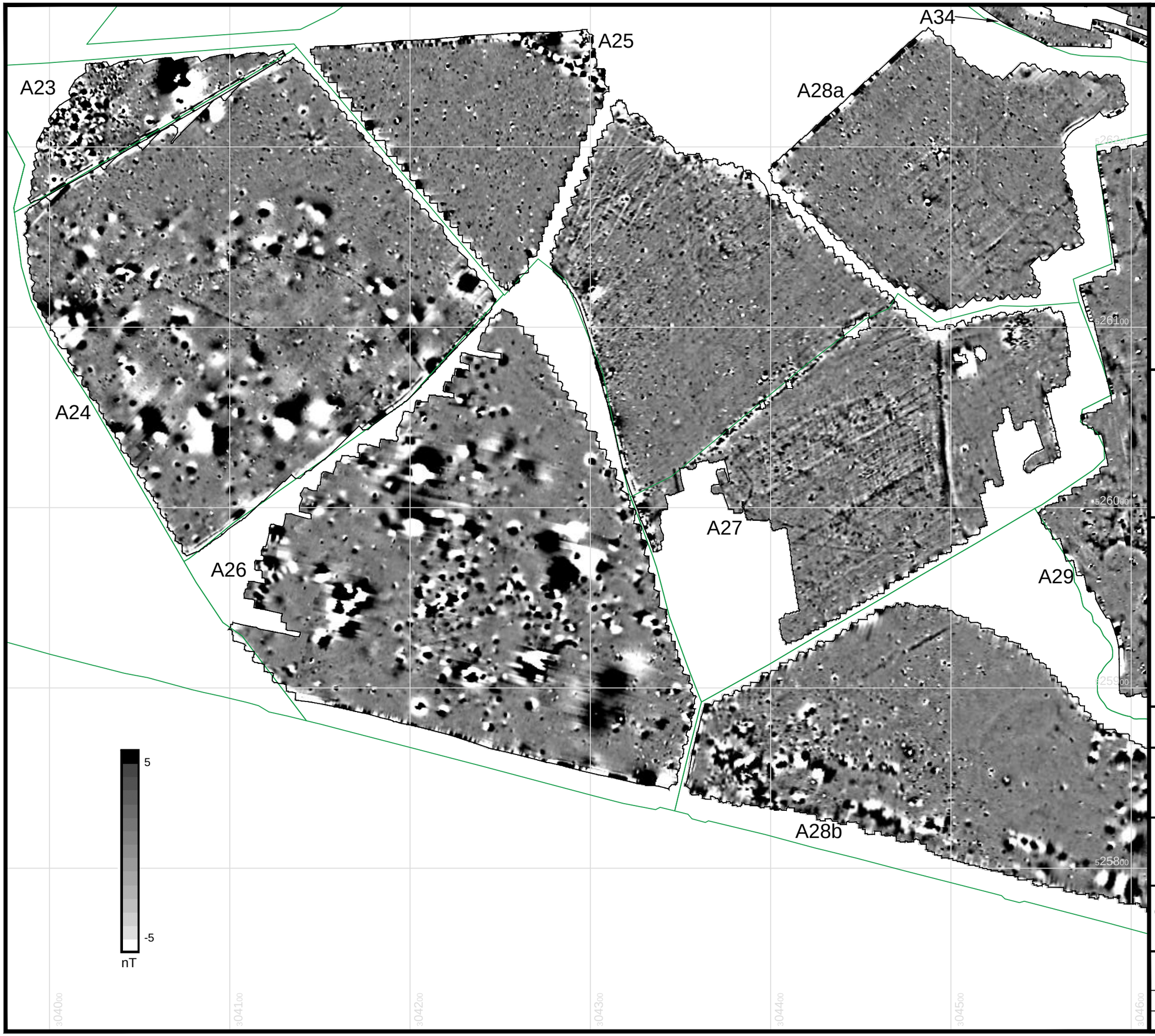
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: A21 and A22a

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_20	FINAL

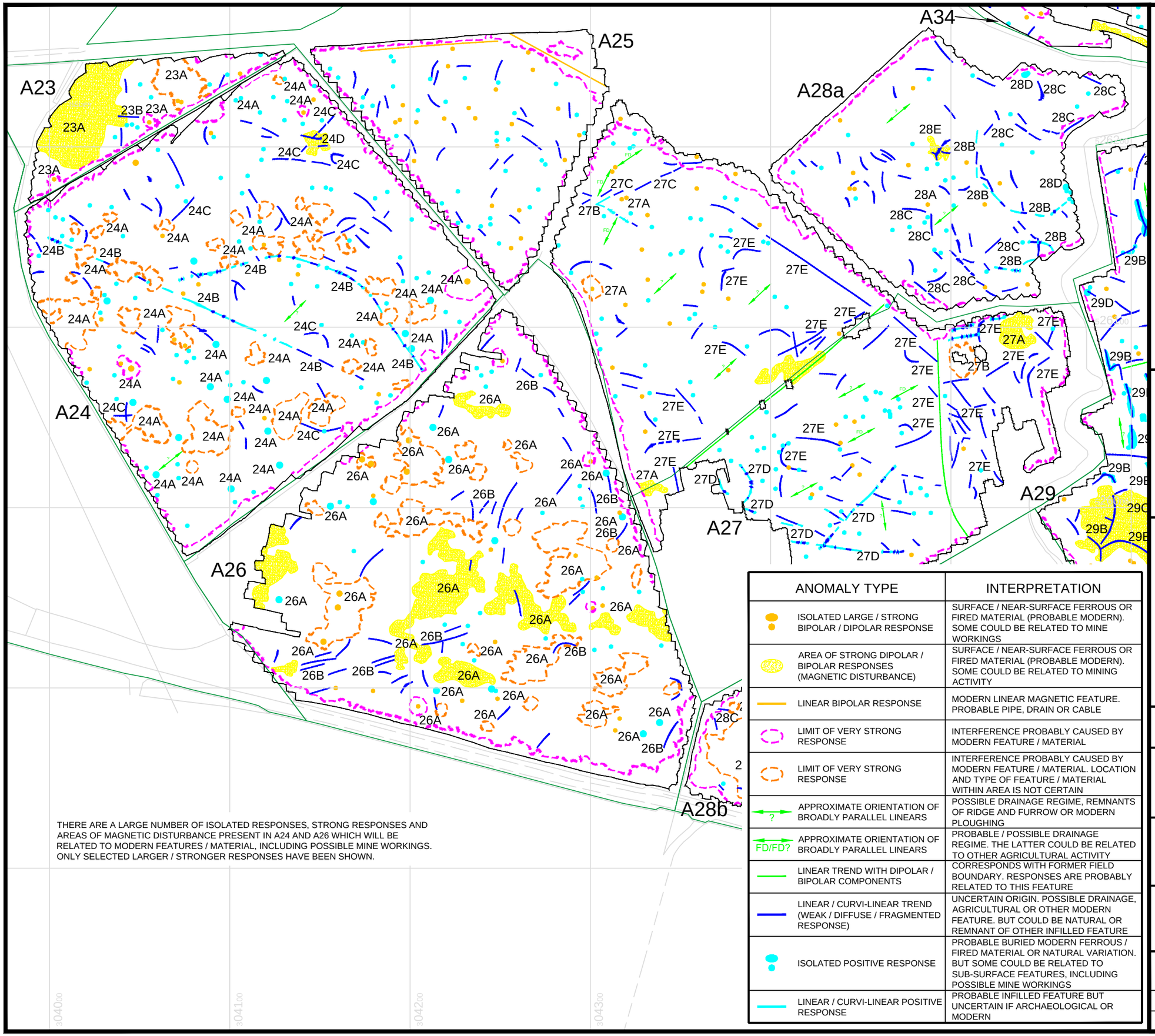
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A23, A24, A25, A26, A27, A28a AND PARTS OF A28b, A29 AND A34

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE, DRAIN OR CABLE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_21	FINAL

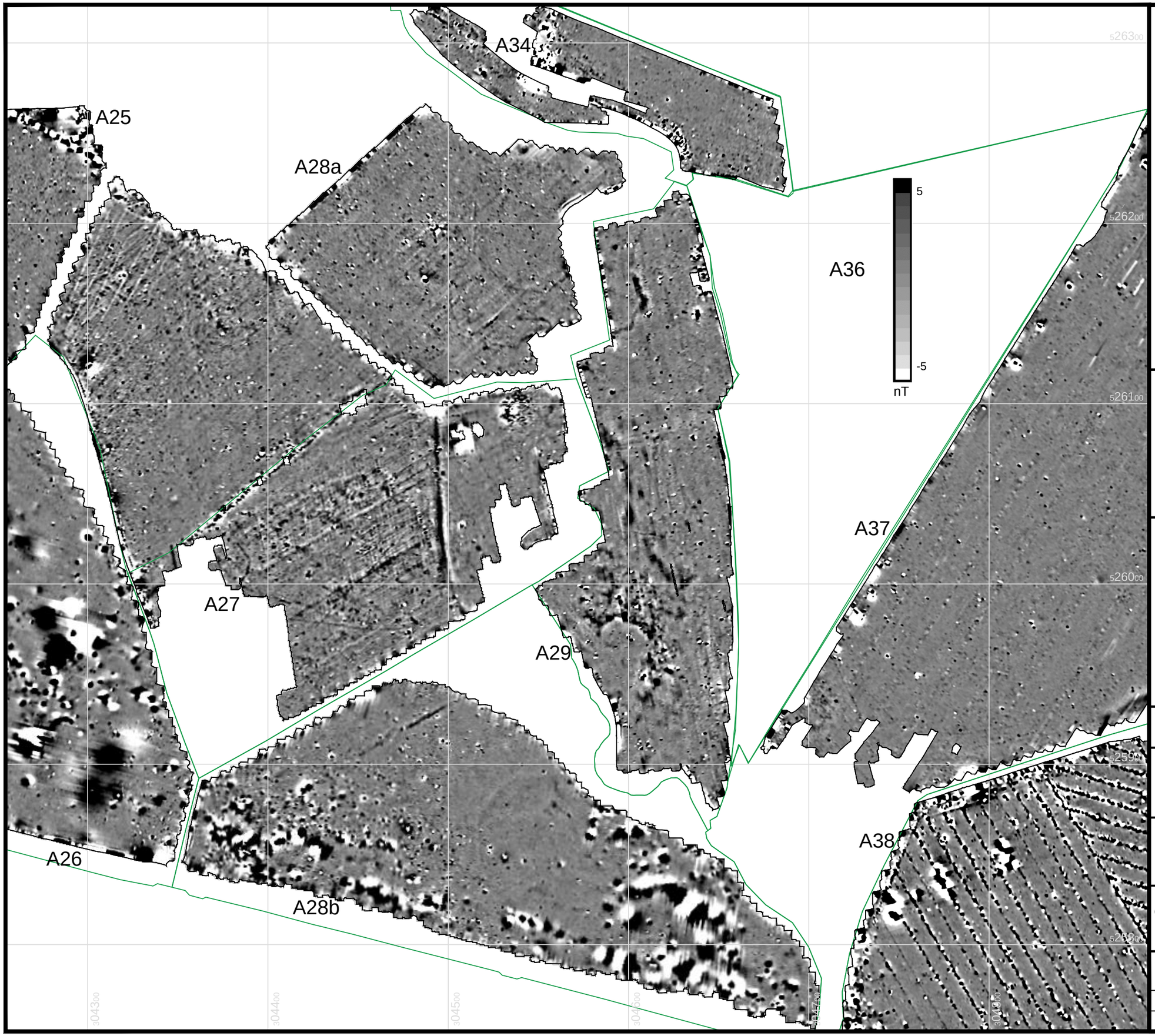
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: A23, A24, A25, A26, A28a AND PARTS OF A27, A28b, A29 AND A34

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_22	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A27, A28a, A28b, A29, AND PARTS OF A25, A26, A34, A37 and A38

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE, DRAIN OR CABLE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
FD/FD? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR RESPONSE. MAY HAVE DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN A26, A28b AND PARTS OF A38 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_23	FINAL

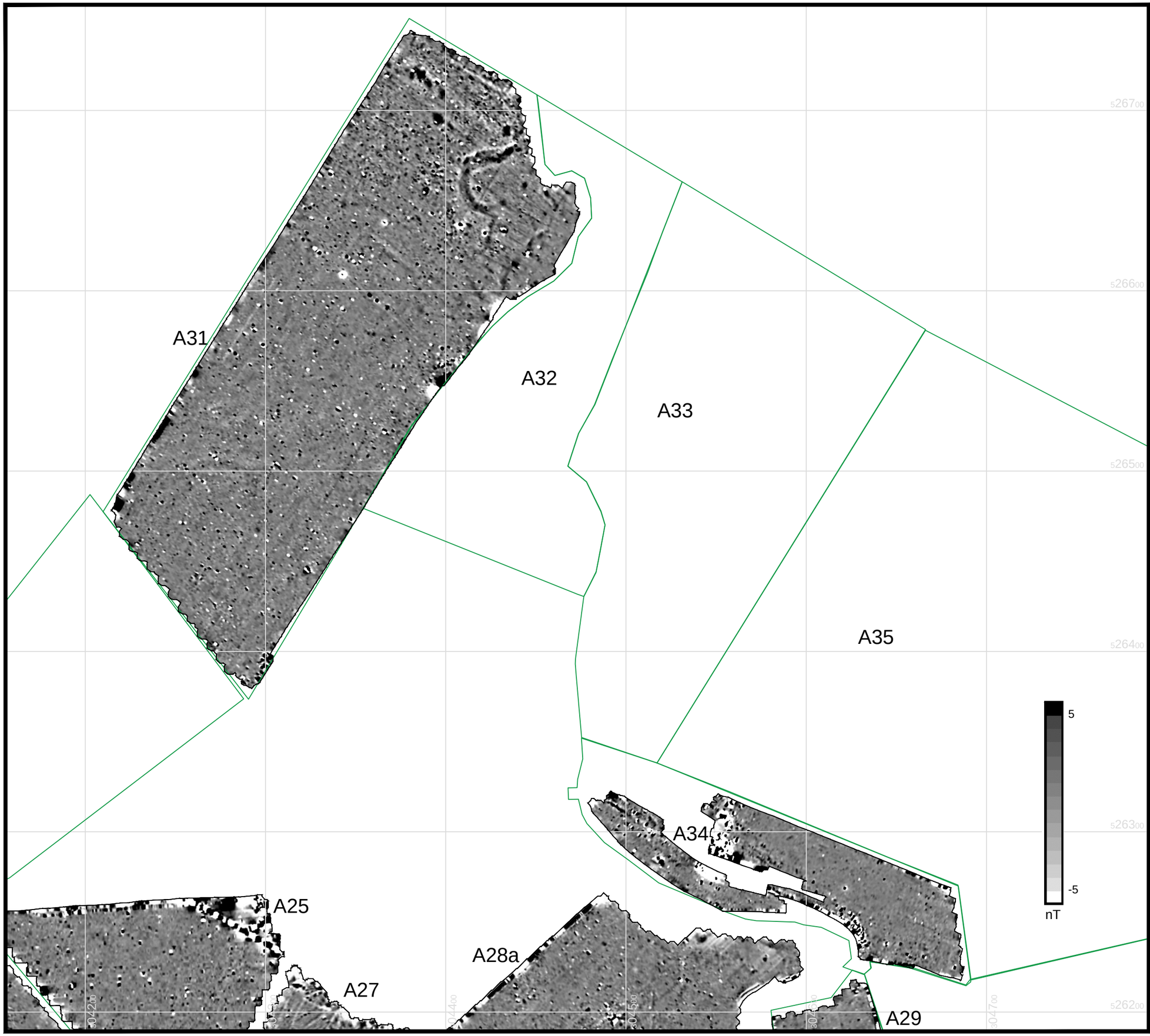
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A27, A28a, A28b, A29 AND PARTS OF A25, A26, A34, A37 and A38

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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2. THIS DRAWING IS BASED UPON DRAWING 'OS_MasterMap_Topography_Layer_895052_1140500_OS _Mastermap.dwg' PROVIDED BY THE CLIENT. THE ORDNANCE SURVEY CO-ORDINATES OBTAINED FOR THIS SURVEY WERE MEASURED USING THE UKOSTN15 PROJECTION. THIS PROJECTION SHOULD BE TAKEN INTO ACCOUNT IF THE SURVEY GRID IS RELOCATED.
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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_24	FINAL

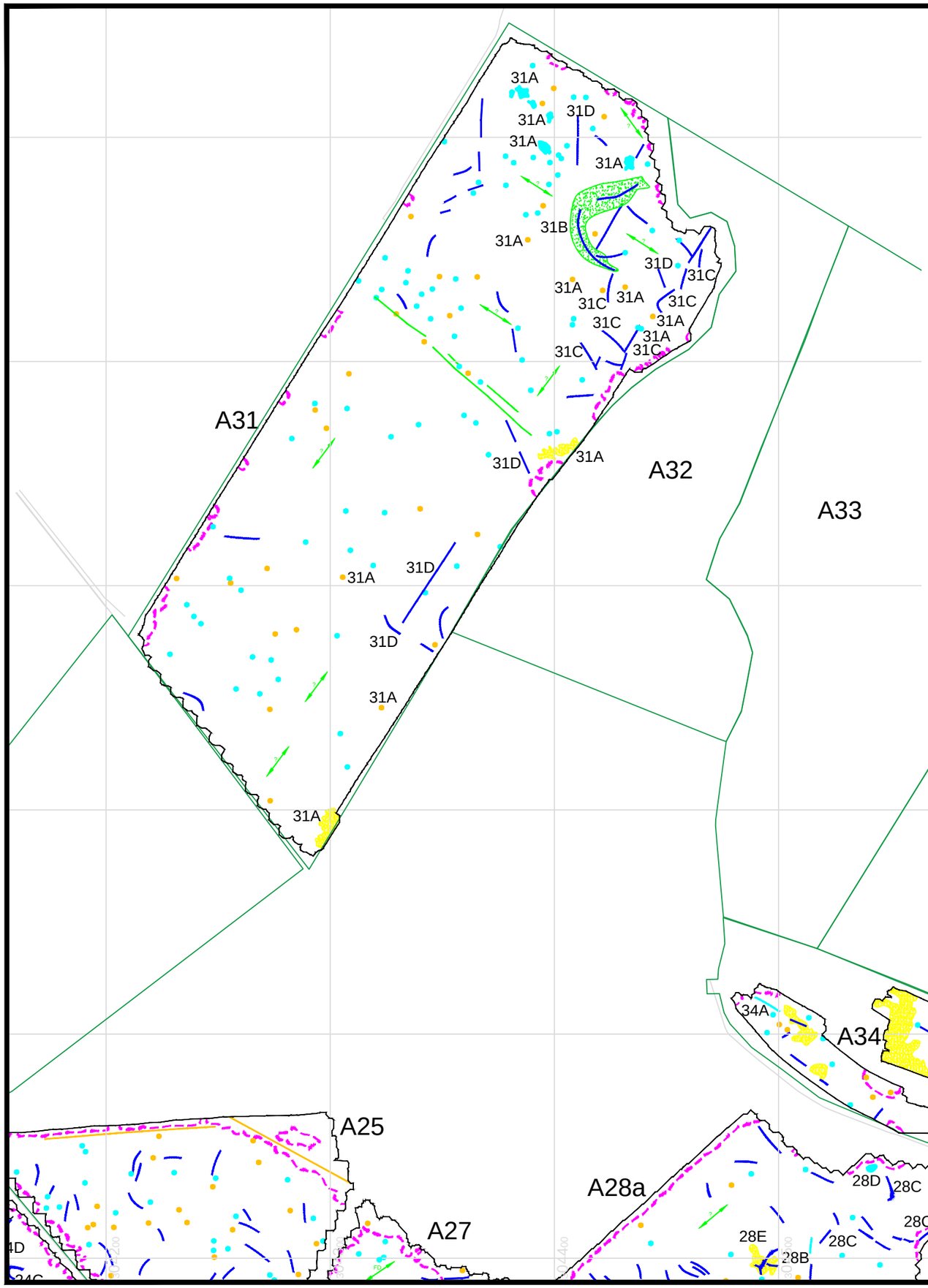
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A31, A34 AND PARTS OF A25, A27, A28a AND A29

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE, DRAIN OR CABLE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
BROAD, DIFFUSE AREA OF POSITIVE AND / OR NEGATIVE RESPONSES	POSSIBLE NATURAL FEATURE / VARIATIONS BUT COULD BE RELATED TO ANTHROPOGENIC FEATURE / ACTIVITY
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

NOTES

1. THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE ACCOMPANYING REPORT (ARC_3733_1402_RPT .PDF) WHICH PROVIDES DETAILS OF THE TECHNIQUES EMPLOYED, THEIR INHERENT LIMITATIONS AND ANY SITE SPECIFIC ISSUES.
2. THIS DRAWING IS BASED UPON DRAWING 'OS_MasterMap_Topography_Layer_895052_1140500_OS _Mastermap.dwg' PROVIDED BY THE CLIENT. THE ORDNANCE SURVEY CO-ORDINATES OBTAINED FOR THIS SURVEY WERE MEASURED USING THE UKOSTN15 PROJECTION. THIS PROJECTION SHOULD BE TAKEN INTO ACCOUNT IF THE SURVEY GRID IS RELOCATED.
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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_25	FINAL

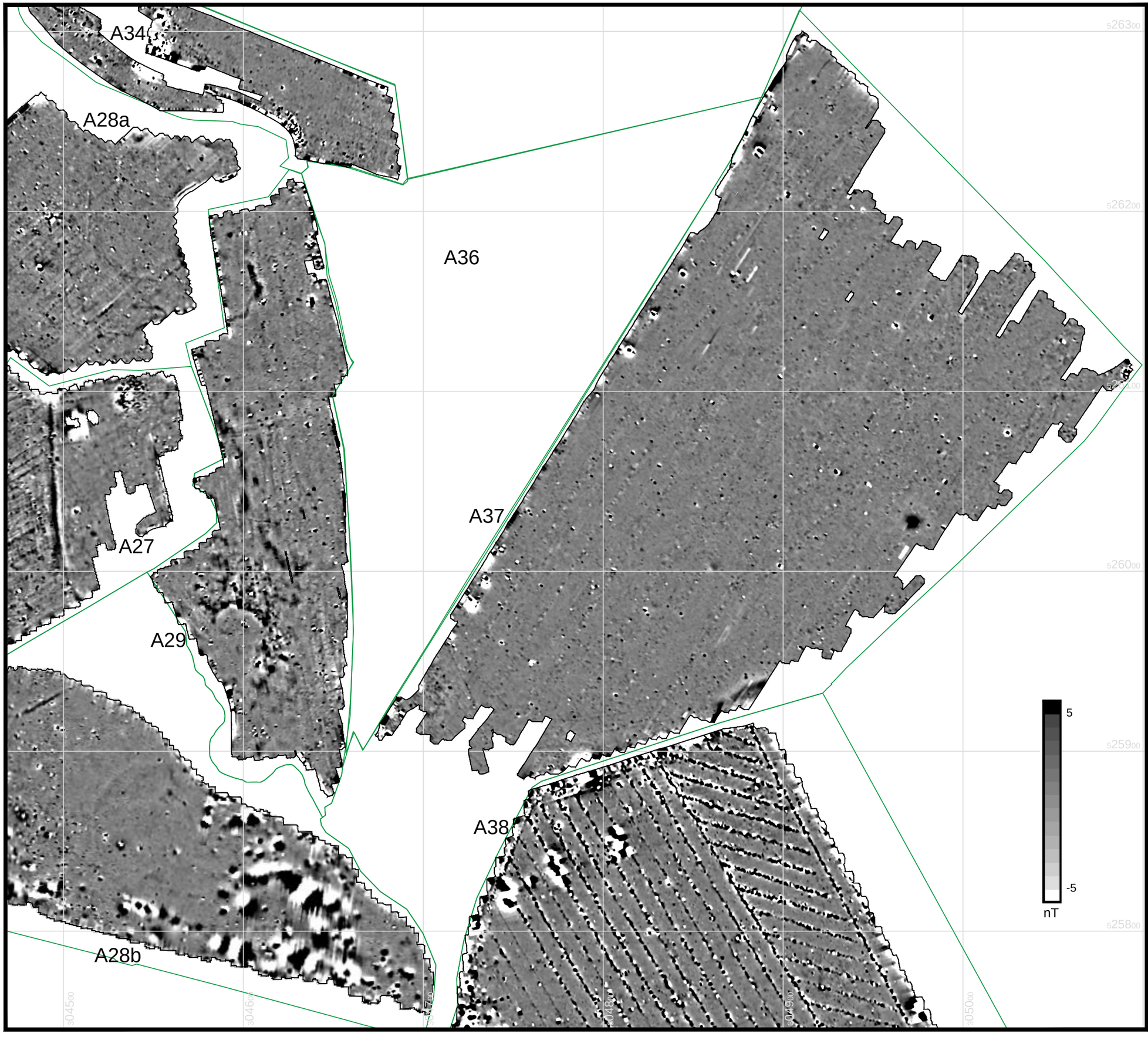
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A31, A34 AND PARTS OF A25, A27, A28a AND A29

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_26	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

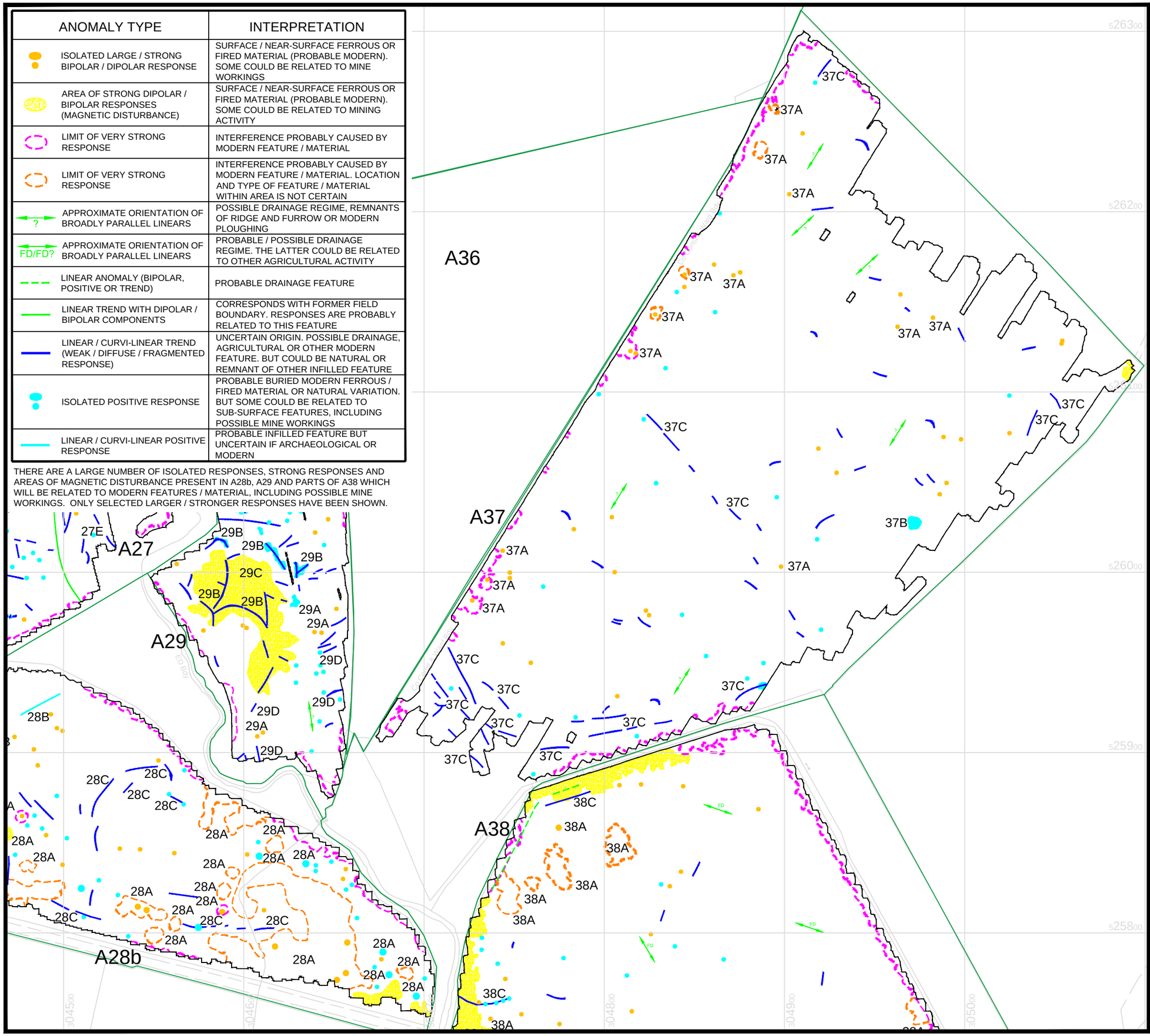
Title
GREYSCALE PLOTS OF
GRADIENT DATA (RELATIVELY WIDE RANGE):
A29, A37 AND PARTS OF
A27, A28a, A28b, A34 AND A38

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE / POSSIBLE DRAINAGE REGIME. THE LATTER COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN A28b, A29 AND PARTS OF A38 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_27	FINAL

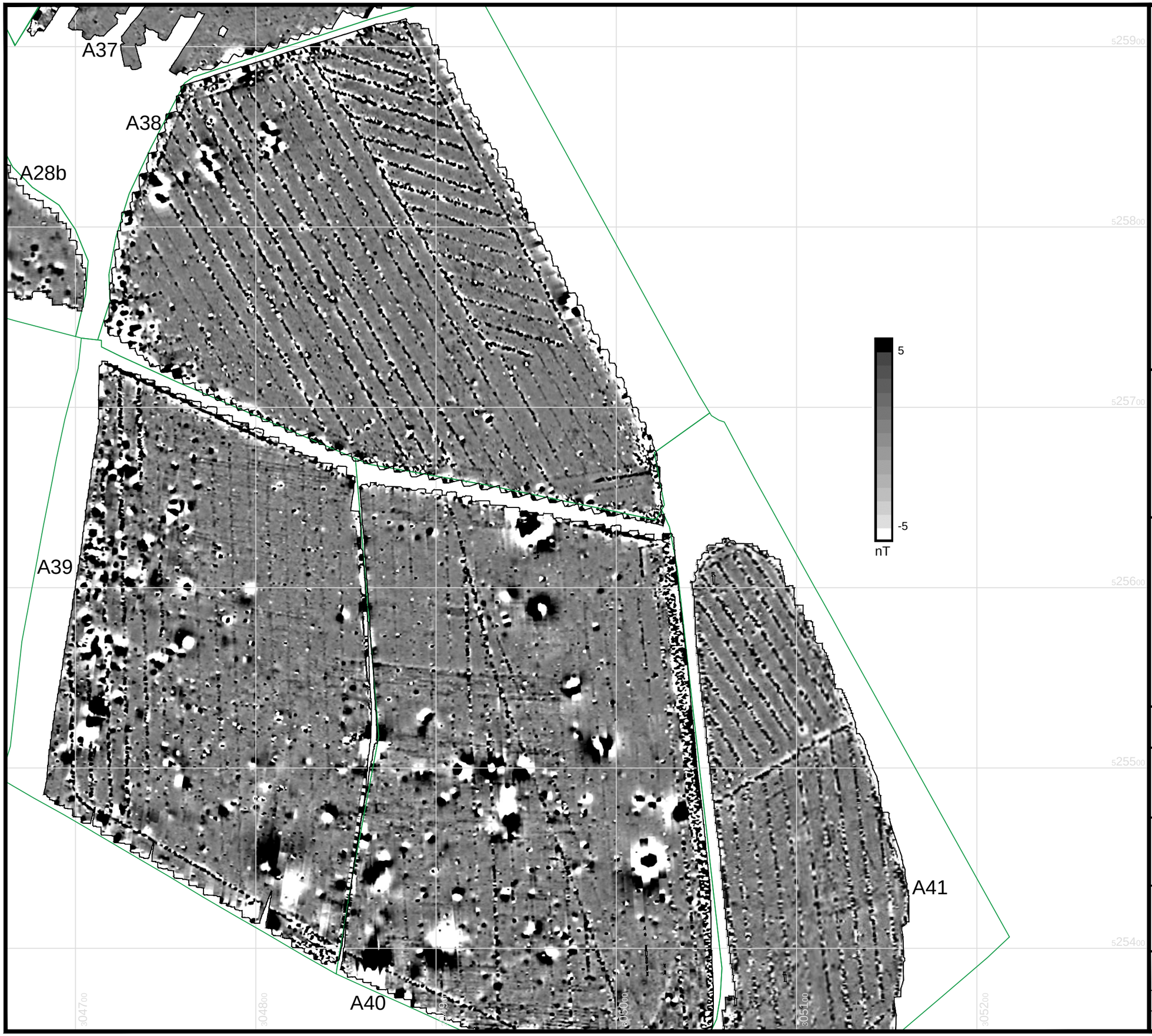
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: A37 AND PARTS OF A27, A28b, A29 AND A38

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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2. THIS DRAWING IS BASED UPON DRAWING 'OS_MasterMap_Topography_Layer_895052_1140500_OS _Mastermap.dwg' PROVIDED BY THE CLIENT. THE ORDNANCE SURVEY CO-ORDINATES OBTAINED FOR THIS SURVEY WERE MEASURED USING THE UKOSTN15 PROJECTION. THIS PROJECTION SHOULD BE TAKEN INTO ACCOUNT IF THE SURVEY GRID IS RELOCATED.
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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_28	FINAL

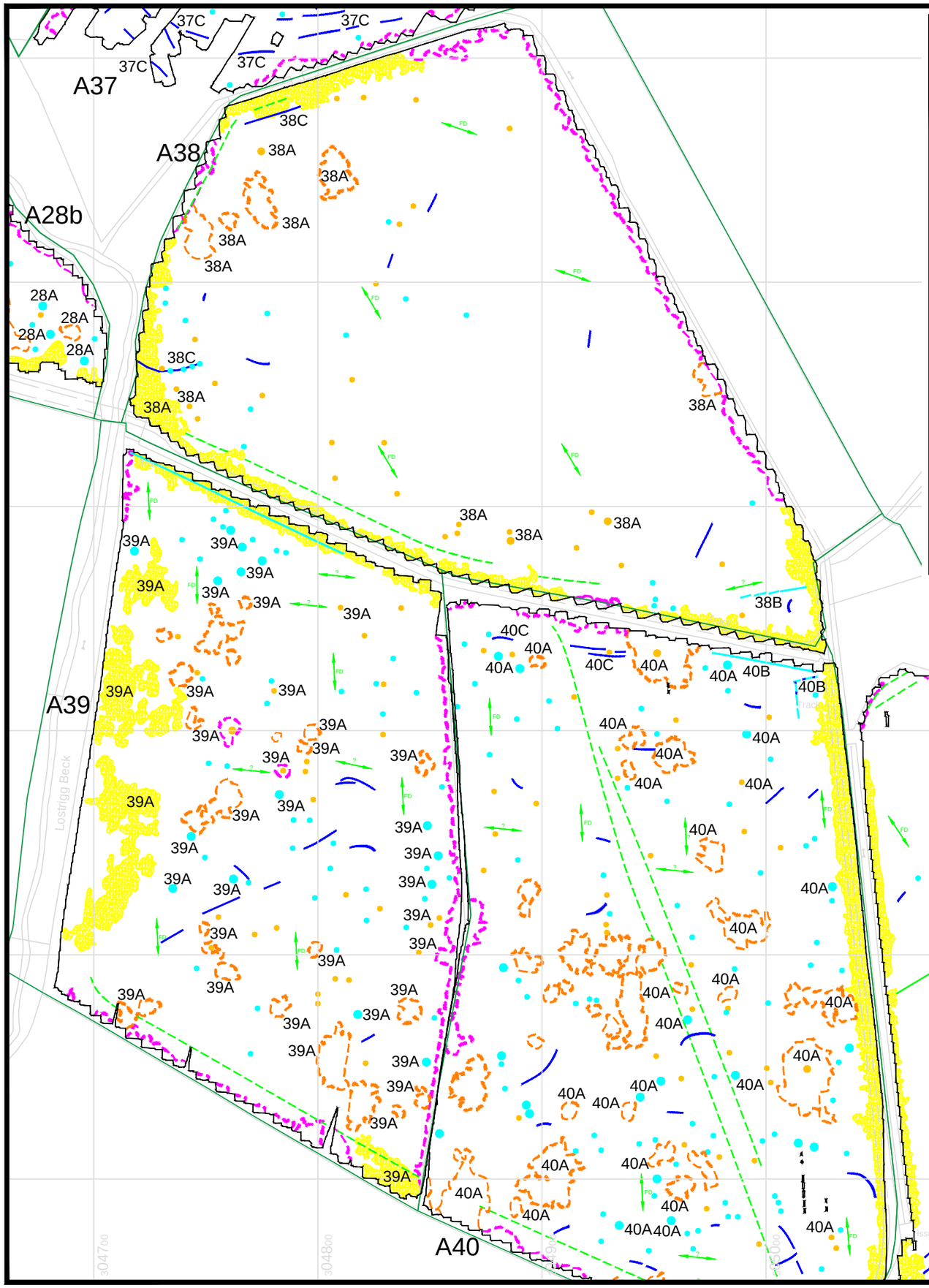
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A38, A39 AND PARTS OF A28b, A37, A40 AND A41

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	PROBABLE DRAINAGE REGIME
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE INFILLED FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN A39, A40 AND PARTS OF A28b and A38 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_29	FINAL

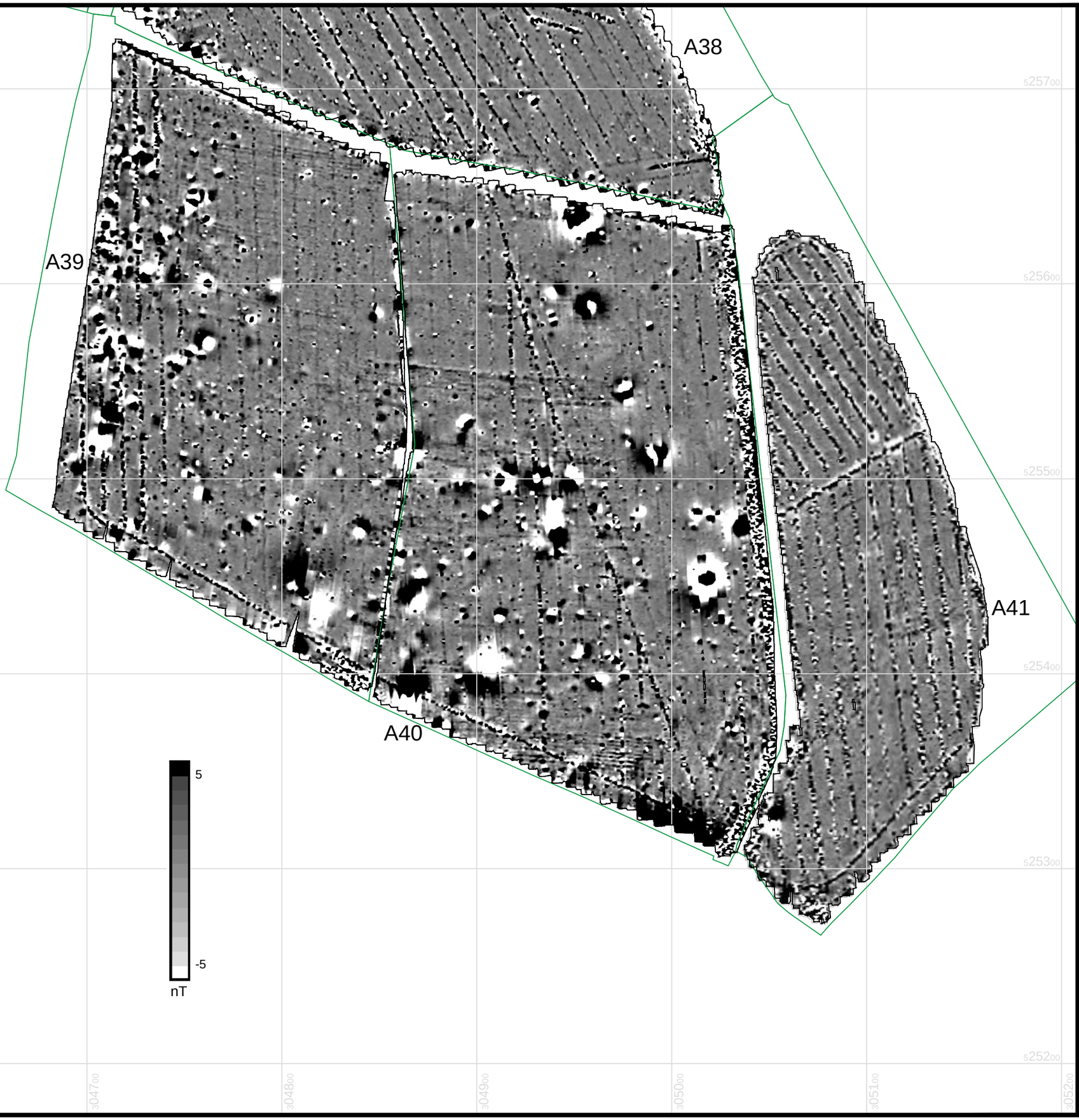
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: A38, A39 AND PARTS OF A28b, A37, A40 AND A41

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_30	FINAL

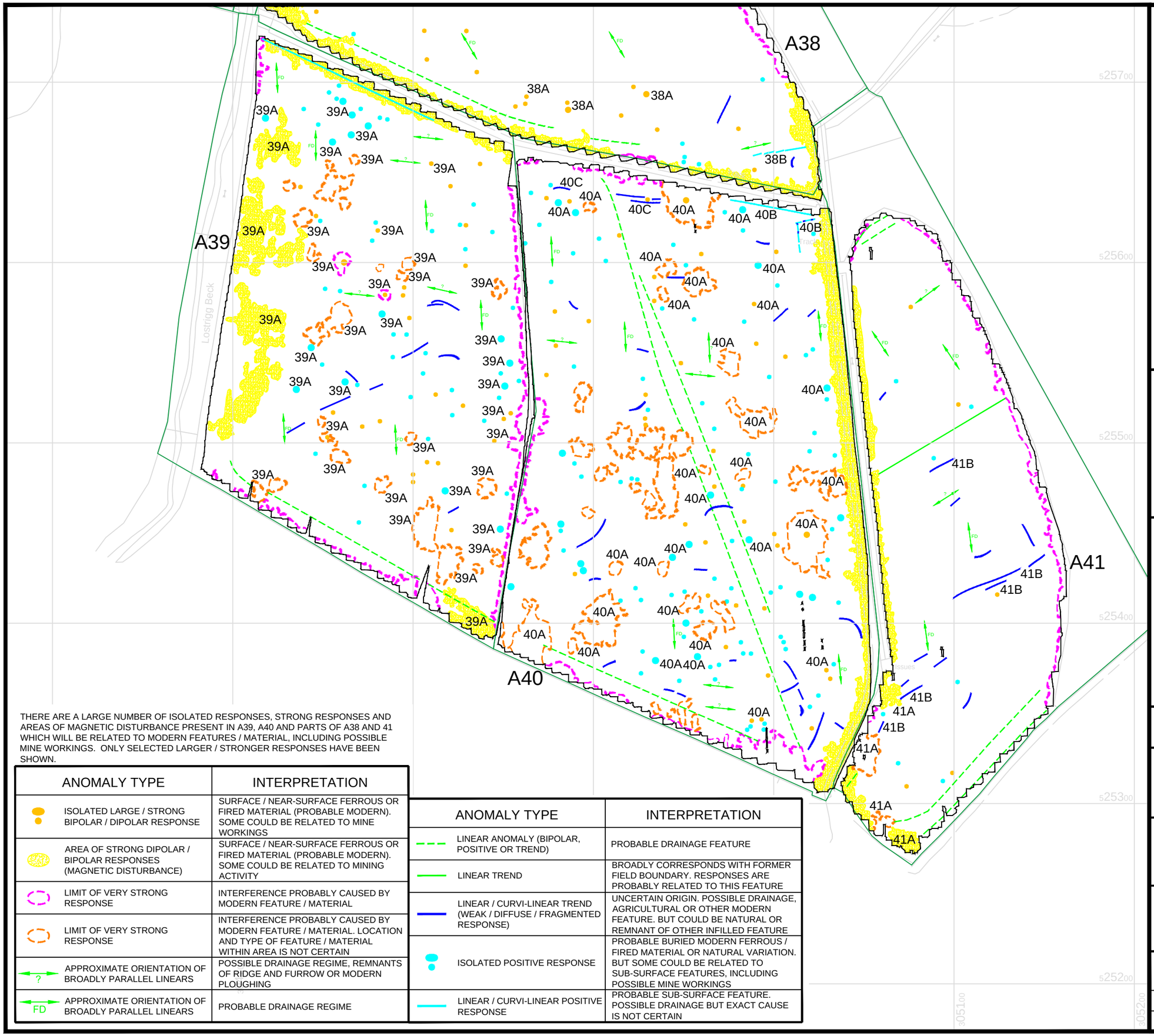
Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A39, A40, A41 AND PART OF A38

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN A39, A40 AND PARTS OF A38 AND 41 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS (?)	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS (FD)	PROBABLE DRAINAGE REGIME

ANOMALY TYPE	INTERPRETATION
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE SUB-SURFACE FEATURE. POSSIBLE DRAINAGE BUT EXACT CAUSE IS NOT CERTAIN

NOTES

1. THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE ACCOMPANYING REPORT (ARC_3733_1402_RPT .PDF) WHICH PROVIDES DETAILS OF THE TECHNIQUES EMPLOYED, THEIR INHERENT LIMITATIONS AND ANY SITE SPECIFIC ISSUES.
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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_31	FINAL

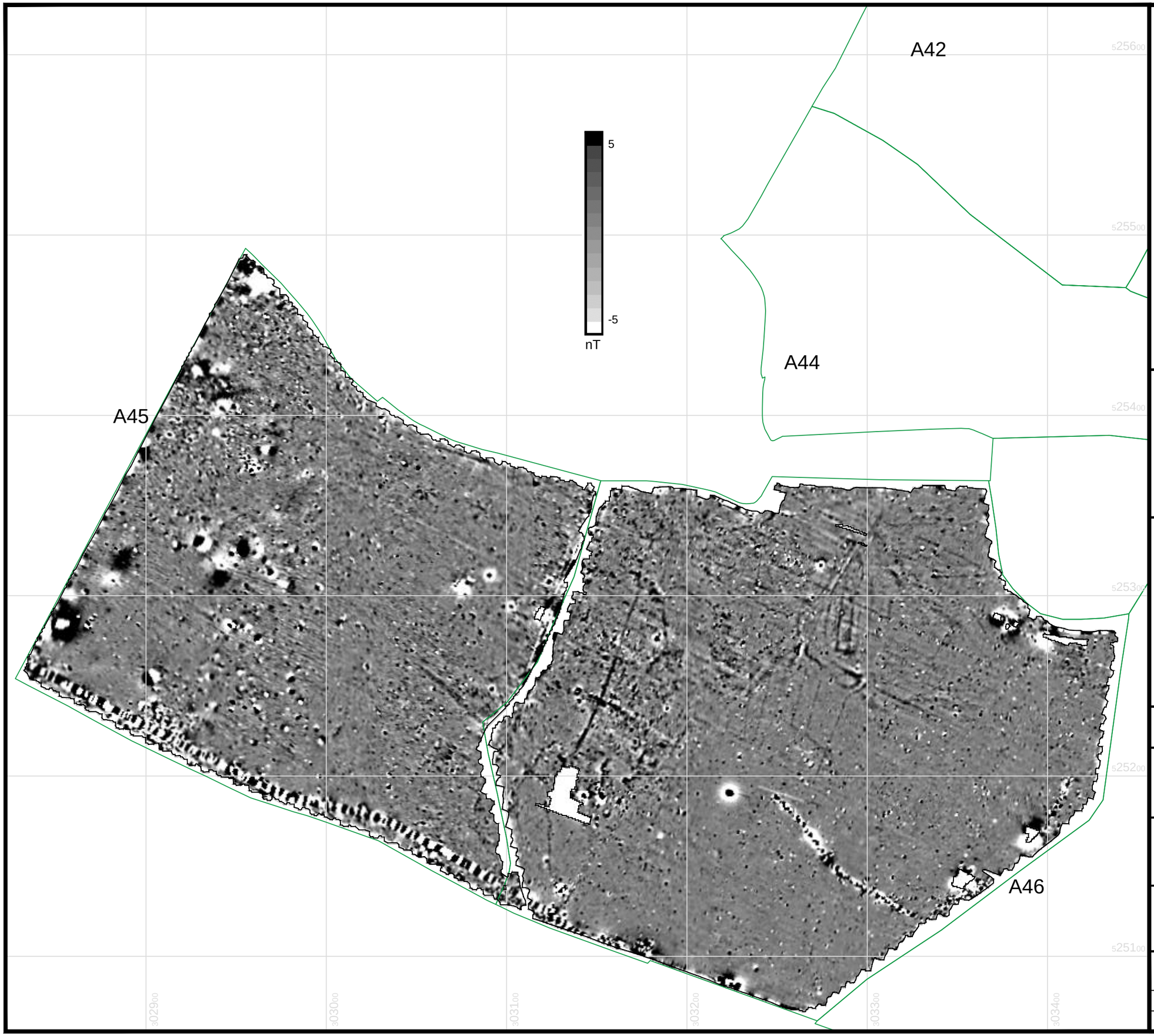
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A39, A40, A41 AND PART OF A38

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_32	FINAL

Client: WARDELL ARMSTRONG LLP CARLISLE

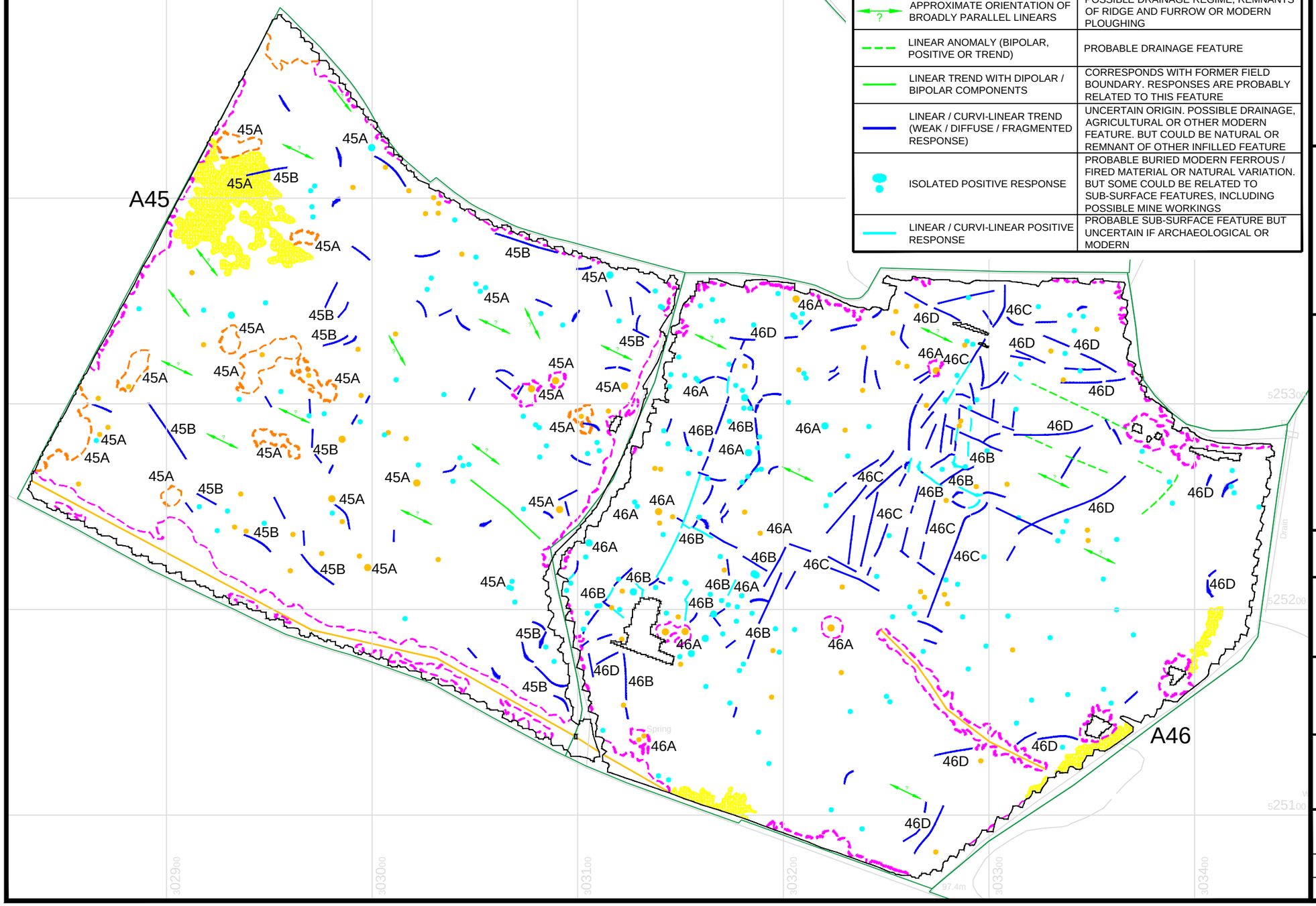
Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A45 AND A46

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN PARTS OF A45 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.



ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE, DRAIN OR CABLE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
LINEAR ANOMALY (BIPOLAR, POSITIVE OR TREND)	PROBABLE DRAINAGE FEATURE
LINEAR TREND WITH DIPOLAR / BIPOLAR COMPONENTS	CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES ARE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	PROBABLE SUB-SURFACE FEATURE BUT UNCERTAIN IF ARCHAEOLOGICAL OR MODERN

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_33	FINAL

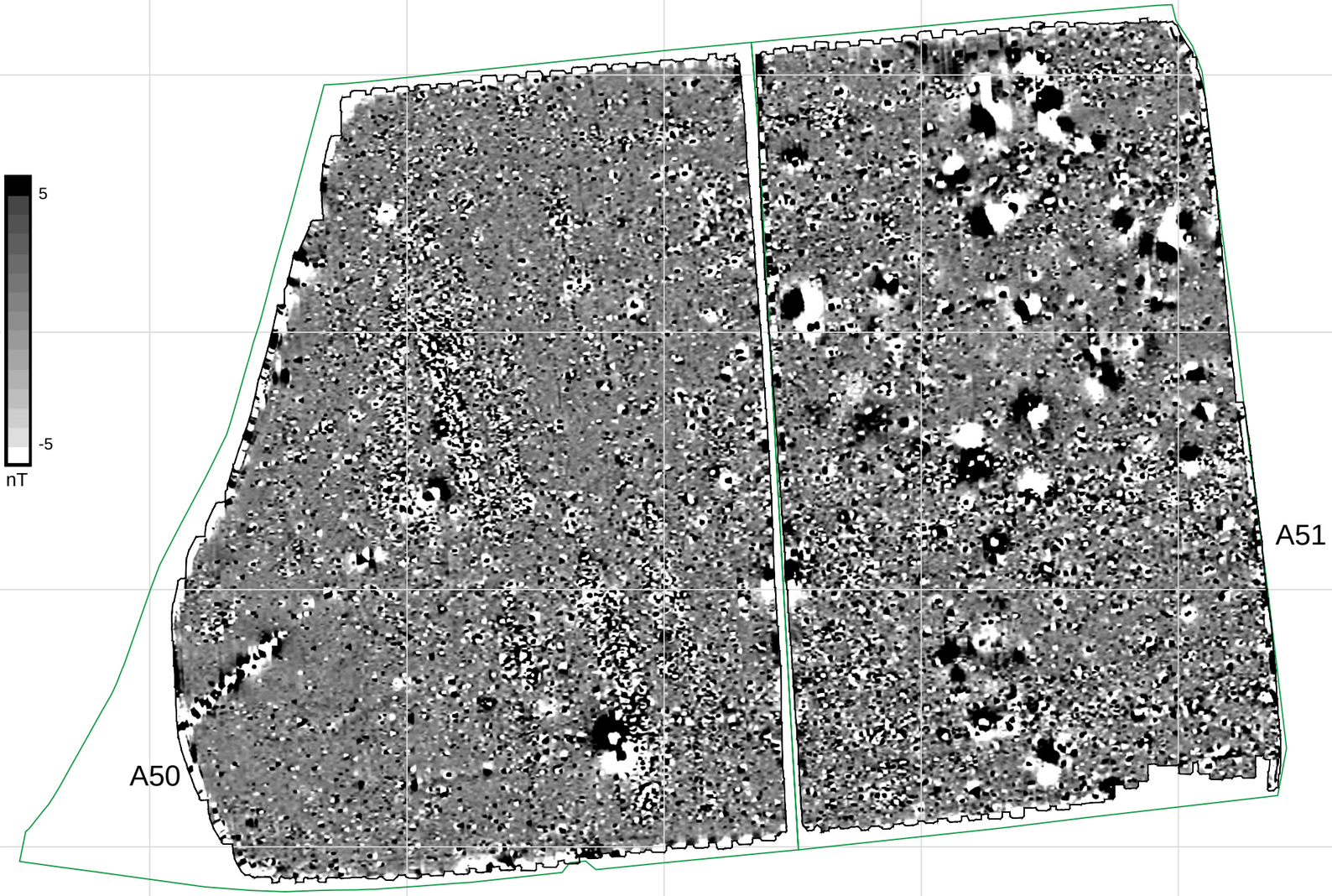
Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: A45 AND A46

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024



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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_34	FINAL

Client: WARDELL ARMSTRONG LLP CARLISLE

Site: LOSTRIGG SOLAR SCHEME CUMBRIA

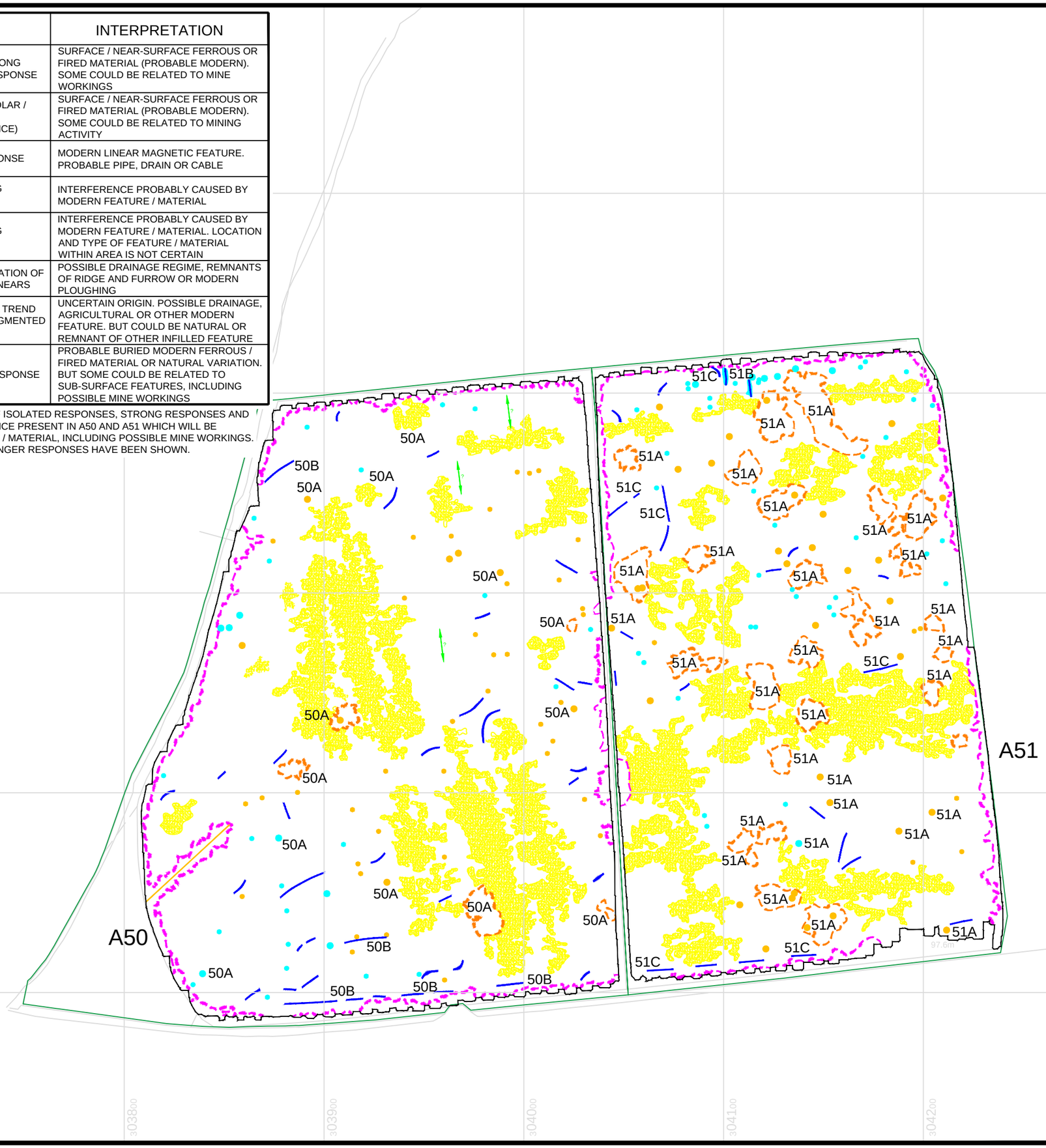
Title: GREYSCALE PLOTS OF GRADIENT DATA (RELATIVELY WIDE RANGE): A50 AND A51

Job No: ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

ANOMALY TYPE	INTERPRETATION
ISOLATED LARGE / STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINE WORKINGS
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN). SOME COULD BE RELATED TO MINING ACTIVITY
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE, DRAIN OR CABLE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE PROBABLY CAUSED BY MODERN FEATURE / MATERIAL. LOCATION AND TYPE OF FEATURE / MATERIAL WITHIN AREA IS NOT CERTAIN
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	POSSIBLE DRAINAGE REGIME, REMNANTS OF RIDGE AND FURROW OR MODERN PLOUGHING
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL OR NATURAL VARIATION. BUT SOME COULD BE RELATED TO SUB-SURFACE FEATURES, INCLUDING POSSIBLE MINE WORKINGS

THERE ARE A LARGE NUMBER OF ISOLATED RESPONSES, STRONG RESPONSES AND AREAS OF MAGNETIC DISTURBANCE PRESENT IN A50 AND A51 WHICH WILL BE RELATED TO MODERN FEATURES / MATERIAL, INCLUDING POSSIBLE MINE WORKINGS. ONLY SELECTED LARGER / STRONGER RESPONSES HAVE BEEN SHOWN.



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Scale [A3 Sheet]	Drawing	Status
1:2000	ARC_3733_1402_35	FINAL

Client
WARDELL ARMSTRONG LLP
CARLISLE

Site
LOSTRIGG SOLAR SCHEME
CUMBRIA

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: A50 AND A51

Job No
ARC_3733_1402

Surveyed	JW, RS, SB, MP	Drawn	MW
Chk.	NF	Date	21/06/2024

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APPENDIX 1

Magnetic survey: technical information

1.1 Theoretical background

1.1.1 Magnetic instruments measure the value of the Earth's magnetic field; the units of which are nanoTeslas (nT). The presence of surface and sub-surface features can cause variations or anomalies in this magnetic field. The strength of the anomaly is dependent on the magnetic properties of a feature and the material that surrounds it. The two magnetic properties that are of most interest are magnetic susceptibility and thermoremnant magnetism.

1.1.2 Magnetic susceptibility indicates the amount of ferrous (iron) minerals that are present. These can be redistributed or changed (enhanced) by human activity. If enhanced material subsequently fills in features such as pits or ditches then these can produce localised increases in magnetic responses (anomalies) which can be detected by a magnetic gradiometer even when the features are buried under additional soil cover.

1.1.3 In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. Less magnetic material such as masonry or plastic service pipes which intrude into the topsoil may give a negative magnetic response relative to the background level. The strength of magnetic responses that a feature will produce will depend on the background magnetic susceptibility, how rapidly the feature has been infilled, the level and type of human activity in the area and the size and depth of a feature. Not all infilled features can be detected and natural variations can also produce localised positive and negative anomalies.

1.1.4 Thermoremnant magnetism indicates the amount of magnetism inherent in an object as a result of heating. Material that has been heated to a high temperature (fired), such as brick, can acquire strong magnetic properties and so although they may not appear to have a high iron content they can produce strong magnetic anomalies

1.1.5 The magnetic survey method is highly sensitive to interference from surface and near-surface magnetic 'contaminants'. Surface features such as metallic fencing, reinforced concrete, buildings or walls all have very strong magnetic signatures that can dominate readings collected adjacent to them. Identification of anomalies caused by sub-surface features is therefore more difficult, or even impossible, in the vicinity of surface magnetic features. The presence of made ground also has a detrimental effect on the magnetic data quality as this usually contains magnetic material in the form of metallic scrap and brick. Identification of features beneath made ground is still possible if the target feature is reasonably large and has a strong magnetic response but smaller features or magnetically weak features are unlikely to be identified.

1.1.6 The interpretation of magnetic anomalies is often subjective and it is rarely possible to identify the cause of all magnetic anomalies. Not all features will produce a measurable magnetic response and the effectiveness of a magnetic survey is also dependant on the site-specific conditions. The main factors that may limit whether a feature can be detected are the

composition of a feature, its depth and size and the surrounding material. It is not possible to guarantee that a magnetic survey will identify all sub-surface features.

1.1.7 Most high resolution, near surface magnetic surveys utilise a magnetic gradiometer. A gradiometer is a hand-held instrument that consists of two magnetic sensors, one positioned directly above the other, which allows measurement of the magnetic gradient component of the magnetic field. A gradiometer configuration eliminates the need for applying corrections due to natural variations in the overall field strength that occur during the course of a day but it only measures relative variations in the local magnetic field and so comparison of absolute values between sites is not possible.

1.1.8 Features that are commonly located using magnetic surveys include archaeological ditches and pits, buried structures or foundations, mineshafts, unexploded ordnance, metallic pipes and cables, buried piles and pile caps. The technique can also be used for geological mapping; particularly the location of igneous intrusions.

1.2 Instrumentation

1.2.1 A multi-sensor array cart system (MACS) utilising 4 Foerster 4.032 Ferex CON 650 gradiometers, spaced at 1 m intervals, with a control unit and data logger was used for the magnetic survey.

1.3 Survey methodology

1.3.1 The MACS utilises an RTK GNSS system which means that survey grids do not have to be established. Instead an area is surveyed over a series of continuous profiles and the position of each data point is recorded using an RTK GNSS system. The sensors have a separation of 0.5 m which means that data was collected on profiles spaced at 0.5 m apart. Readings were taken at between 0.1 m and 0.15 m intervals.

1.3.2 Data is collected on zig-zag profiles along the full length or width of a field, although fields can be sub-divided if they are particularly large. Marker canes are set-out along field boundaries at set intervals and these are used to align the profiles. The survey profiles are usually offset from field boundaries, buildings and other metallic features by several metres to reduce the detrimental effect that these surface magnetic features have on the data. The location of the MACS data is converted direct to Ordnance Survey co-ordinates using the UK OSTN15 projection. As the data is related direct to Ordnance Survey National Grid co-ordinates temporary survey stations are not established.

1.3.3 The Foerster gradiometers have a resolution of 0.2 nT but the stability of the cart system significantly reduces noise caused by instrument tilt and movement when compared with a traditional hand-held gradiometer system and the increased data intervals provide a higher resolution data set. The sensors have a range of ± 10,000nT and readings are taken at 0.1 nT resolution.

1.4 Data processing and presentation

1.4.1 The MACS data is stored direct to a laptop using in-house software which automatically corrects for instrument drift and calculates a mean value for each profile. A positional value is assigned to each data point based on the sensor number and recorded GNSS co-ordinates. The data is gridded using in-house software and parameters are set based on the sensor spacing and mean values. No additional processing is required. The gridded data is then displayed in Surfer 9 (Golden Software) and image files of the data are created.

1.4.2 The site is large and covers an extensive area. For context a drawing showing the survey areas has been presented at a scale 1:12500 and then drawings showing data plots for larger parcels of land encompassing numerous survey areas are presented at a scale of 1:5000. The data for these is shown at a range of -2 nT to 3 nT.

1.4.3 Data plots are also presented, with accompanying interpretations, at a scale of 1:2000. This is a relatively small-scale for an archaeology survey but given the large size of the site and also the relatively large size of a number of fields it was felt that showing entire fields on the same drawing allowed for a better presentation of the data and interpretation, rather than splitting the fields into a greater number of drawings. Should any area need to be examined in more detail, to target or view specific anomalies, then this can be easily achieved using the digital drawings, which have been provided alongside this report.

1.4.4 The data for the 1:2000 plots been shown at a range of -5 nT to 5 nT. This is a relatively wide range for archaeology surveys but has been selected as the data across the majority of the site is relatively 'noisy', with a generally disturbed / variable magnetic background. The relatively wide range 'smooths out' the data and can make it easier to identify some anomalies but it should be noted that very weak responses may not be visible at this range (although they would also be masked by the 'noise' at a narrower range in the wider range).

1.4.5 The data has been displayed relative to a digital Ordnance Survey base plan provided by the client as drawing *'OS_MasterMap_Topography_Layer_895052_1140500_OS_Mastermap .dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey grids / data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position. The base drawing did not show all of the field boundaries for all of the survey areas but the client also provided field reference area boundaries which approximated to field boundaries and so these have been shown on the survey drawings to provide context for some of the survey areas.

1.5 Interpretation

1.5.1 The anomalies have been categorised based on the type of response that they have and an interpretation as to the cause(s) or possible cause(s) of each anomaly type is also provided. The following anomaly types may be present within the data:

Dipolar, bipolar and strong responses

Dipolar and bipolar responses are those that have a sharp variation between strongly positive and negative components.

In the majority of cases these responses are usually caused by modern ferrous features / objects, although fired material (such as brick), some ferrous or industrial archaeological features and strongly magnetic gravel could also produce dipolar and bipolar responses.

Isolated dipolar responses are those that have a single positive and negative element. They are usually caused by isolated, ferrous or fired material on or near to the surface. The objects that cause dipolar responses are usually relatively small, such as spent shotgun cartridges, iron nails and horseshoes (hence they are often referred to as 'iron spikes') or pieces of modern brick or pot. Some types of archaeological artefacts can also produce this type of response but unless there is strong supporting evidence to the contrary they are assumed not to be of archaeological significance.

Bipolar anomalies have strong positive and negative components but are not technically magnetic dipoles. The majority of **isolated bipolar responses** are caused by ferrous or fired material on or near to the surface. These responses tend to be produced from larger

objects, compared to dipolar anomalies, or a concentration of smaller objects. Some archaeological features/ activity, including areas of burning or industrial activity can also produce this type of response but unless there is strong supporting evidence to the contrary they are assumed not to be of archaeological significance.

Smaller isolated dipolar and bipolar responses have not been shown on the interpretation as there is no evidence to suggest that they are related to archaeological activity. Numerous larger isolated bipolar responses have been shown as these could be associated with more significant sub-surface features or material. In this instance the majority of these responses are not thought to be of archaeological interest but some could be related to mining activity.

Bipolar linear anomalies are usually produced by metallic buried pipes / cables, although some ceramic pipes or features containing fired material, such as brick structures or foundations, can also produce bipolar anomalies. In some instances the anomaly can extend for a significant distance beyond the feature that produces the anomaly. Bipolar anomalies are often very strong and can potentially mask responses from other sub-surface features in the vicinity of the underlying feature.

Areas containing numerous **strong dipolar / bipolar responses** (**magnetic disturbance)** are usually caused by greater concentrations of ferrous or fired material and are often found adjacent to field boundaries where such material tends to accumulate. Above ground metallic or strongly magnetic features, such as fences, gates, pylons and buildings can also produce very strong bipolar responses. If an area of magnetic disturbance is located away from existing field boundaries then it could indicate a former field boundary, several large isolated objects in close proximity, an area where modern material has been tipped or an infilled cut feature, such as a quarry pit. Areas of dipolar / bipolar response can occasionally be caused by features / material associated with archaeological industrial activity or natural deposits that have varying magnetic properties but they are usually caused by modern activity. Responses in areas of magnetic disturbance can sometimes be so strong that archaeological features located beneath them may not be detected.

Very strong responses, notably bipolar anomalies, from modern features can dominate the data for a significant distance beyond the feature. The extent of these areas is usually shown either as part of the bipolar anomaly or as a **limit of very strong response.** It should be noted that this effect extends beyond the feature and so the limit of the response does not correspond to the actual size or location of the feature within it. In many cases where these strong responses are present at the edge of survey area the feature causing the anomaly be actually be located beyond the survey area. It should be recognised that other sub-surface features located within these areas may not be detected.

There are a number of **relatively strong isolated anomalies** in one area that may be related to modern material but they have an unusual response and it is possible that they are artificial responses related to an intermittent connection issue with one of the sensors.

Negative linear / curvi-linear anomalies

Negative linear / curvi-linear anomalies occur when a feature has lower magnetic readings than the surrounding material and can often be associated with ploughing regimes or plastic / concrete pipes or natural features.

They can also indicate the presence of a feature that cuts into magnetic soils or bedrock and which is infilled with less magnetic material and in certain geologies can be associated with archaeological features.

Any negative linear anomalies in this data set are thought to relate to agricultural or other relatively modern activity.

Linear / curvi-linear anomalies (probable agricultural)

In many geological / pedological conditions agricultural features / regimes can produce magnetic anomalies due to the accumulation / alignment of magnetic topsoil. In most cases these are exhibited as a series of **broadly parallel positive linear** anomalies. The majority of these responses are associated with modern ploughing regimes but in some instances, where the responses are broader and more widely spaced, they can indicate the presence of the remnants of ridge and furrow.

Field drain systems can also produce linear anomalies, usually where the drains are made from fired ceramic or infilled with magnetic gravels.

Where a series of parallel anomalies are present then the approximate orientation of the anomalies are shown on the interpretation drawing to indicate the direction of the agricultural regime but for the sake of clarity individual anomalies have not been shown.

Individual anomalies may be shown if the response is not part of a regime.

Broad area of positive / negative responses

Broad areas of positive / negative responses can have a variety of causes. If the areas are generally quite large and irregular in shape then they are usually suggestive of natural features, such as lenses of sand and gravel deposits, palaeochannels or other natural features / variations where the natural material differs from the surrounding sub-surface. In some instances anomalies of this type can be associated with anthropogenic (usually modern) activity.

Linear / curvi-linear trends

An anomaly is categorised as a **trend** if it is not certain that the response is associated with an extant sub-surface feature. Trends are usually weak, irregular, diffuse or discontinuous and it is usually not certain what their cause is, if they represent significant sub-surface features or even if they are associated with definite features.

It is possible that some of the trends are associated with geological / pedological variations. Others may be produced by artificial constructs within the data, either caused by processing or in some instances by intersecting anomalies (usually different agricultural regimes) that give the appearance of curving or regular shapes. Many trends are a product of weak, naturally occurring responses that happen to form a regular pattern but which are not associated with a sub-surface feature.

In some instances former features that have been severely truncated can still produce broad, diffuse or weak responses even if the underlying feature has been removed. This is due to the presence of magnetic soils associated with the former feature still being present along its route. In other instances the magnetic properties of the soils filling a feature may vary and so the magnetic signature of the feature can change, even if the sub-surface feature itself remains uniform. If a response from a feature becomes significantly weak or diffuse then part of the anomaly may be shown as a trend as it is uncertain if the feature is still present or has been severely truncated or removed.

Isolated positive responses

Isolated positive responses can occur if the magnetism of a feature, area or material has been enhanced or if a feature is naturally more magnetic than the surrounding material. It is often difficult to determine which of these factors causes any given responses and so the origin of this type of anomaly can be difficult to determine. They can have a variety of causes including geological variations, infilled archaeological features, areas of burning (including hearths), industrial archaeological features, such as kilns, or deeper buried ferrous material and modern fired material.

The large number of isolated responses and lack of an obvious pattern to their distribution suggests that these the majority of these anomalies are probably associated with geological / pedological variations or deeper buried ferrous or fired material. Only the larger or stronger areas of positive response have been shown on the interpretation. The majority, if not all of these responses, will be related to natural variations or relatively modern material but have been shown as their exact cause cannot be determined with certainty. Some of these anomalies may be related to mining activity.

Positive linear / curvi-linear anomalies

Positive magnetic anomalies indicate an increase in magnetism and if the resulting anomaly is linear or curvi-linear then this can indicate the presence of a man-made feature. **Positive linear / curvi-linear** anomalies can be associated with agricultural / drainage activity, or sometimes infilled natural features, but they can also be caused by ditches that are infilled with magnetically enhanced material and as such can indicate the presence of archaeological features.

The cause of the majority of the positive linear / curvi-linear anomalies at this site is not certain.

1.5.2 Several different ranges of data were used in the interpretation to ensure that the maximum information possible is obtained from the data.

1.5.3 X-Y trace plots were examined for all of the data and overlain onto the greyscale plot to assist in the interpretation, primarily to help identify dipolar / bipolar responses that will probably be associated with surface / near-surface iron objects. X-Y trace plots have not been used in the report as they do not show any additional anomalies that are not visible in the greyscale data. A digital drawing showing the X-Y trace plot overlain on the greyscale plot has been provided in the digital archive.

1.5.4 All isolated responses have been assessed using a combination of greyscale and X-Y trace plots.

1.5.5 Anomalies associated with agricultural and drainage regimes are present in the data. The general orientation of these regimes has been shown on the interpretation but, for the sake of clarity, each individual anomaly has not been shown.

1.5.6 The greyscale plots and the accompanying interpretations of the anomalies identified in the magnetic data are presented as 2D AutoCAD drawings. The interpretation is made based on the type, size, strength and morphology of the anomalies, coupled with the available information on the site conditions. Each type of anomaly is displayed in separate, easily identifiable layers annotated as appropriate.

1.6 Limitations of magnetic surveys

1.6.1 The magnetic survey method requires the operator to walk over the site at a constant walking pace whilst holding the instrument. The presence of an uneven ground surface, dense, high or mature vegetation or surface obstructions may mean that some areas cannot be surveyed.

1.6.2 The depth at which features can be detected will vary depending on their composition, size, the surrounding material and the type of magnetometer used for the survey. In good conditions large, magnetic targets, such as buried drums or tanks can be located at depths of more than 4 m. Smaller targets, such as buried foundations or archaeological features can be located at depths of between 1 m and 2 m.

1.6.3 A magnetic survey is highly sensitive to interference from surface and near-surface magnetic 'contaminants'. Surface features such as metallic fencing, reinforced concrete, buildings or walls all have very strong magnetic signatures that can dominate readings collected adjacent to them. Identification of anomalies caused by sub-surface features is therefore more difficult or even not possible in the vicinity of surface and near-surface magnetic features.

1.6.4 The presence of made ground also has a detrimental effect on the magnetic data quality as this usually contains magnetic material in the form of metallic scrap and brick. Identification of features beneath made ground is still possible if the target feature is reasonably large and has a strong magnetic response but smaller features or magnetically weak features are unlikely to be identified.

1.6.5 It should be noted that anomalies that are interpreted as modern in origin may be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

1.6.6 A magnetic survey does not directly locate sub-surface features - it identifies variations or anomalies in the local magnetic field caused by features. It can be possible to interpret the cause of anomalies based on the size, shape and strength of response but it should be recognised that a magnetic survey produces a plan of magnetic variations and not a plan of all sub-surface features. Interpretation of the anomalies is often subjective and it is rarely possible to identify the cause of all magnetic anomalies. Geological or pedological (soil) variations or features can produce responses similar to those caused by man-made (anthropogenic) features.

1.6.7 Anomalies identified by a magnetic survey are located in plan. It is not usually possible to obtain reliable depth information on the features that cause the anomalies.

1.6.8 Not all features will produce a measurable magnetic response and the effectiveness of a magnetic survey is also dependant on the site-specific conditions. It is not possible to guarantee that a magnetic survey will identify all sub-surface features. A magnetic survey is often most-effective at identifying sub-surface features when used in conjunction with other complementary geophysical techniques.