BWB
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HERITAGE

Vistry Yorkshire Ltd, Countryside Properties (UK) Ltd & Miller Homes Ltd

Blackmoorfoot Road
Huddersfield

Trial Trenching Specification

May 2024

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Notice

CONTENTS

FIGURES

APPENDICES

APPENDIX 1: Archaeological Standards and Guidelines

APPENDIX 2: Geophysical Survey Report

1. INTRODUCTION

1.1 This Specification has been prepared by BWB the 'Consultant' on behalf of Vistry Yorkshire Ltd, Countryside Properties (UK) Ltd & Miller Homes Ltd. It describes the objectives and methodology for a programme of archaeological trial trenching within the site at Blackmoorfoot Road, Huddersfield. The works are being undertaken prior to residential development which includes a number of dwellings, access, infrastructure, landscaping and open space.

1.2 A geophysical survey was undertaken in 2023 by Phase Site Investigations. The results of this were discussed with the Principal Archaeologist for the West Yorkshire Archaeology Advisory Service (WYAAS) and it was agreed that some trenching would be required to test some of the more ambiguous features in the absence of any clear archaeological anomalies.

1.3 Approval for the Specification will be sought from the Principal Archaeologist for WYAAS.

1.4 The results of the trial trenching and the geophysical survey will aid in the design of a mitigation strategy (if required). This will be discussed with the Principal Archaeologist following completion of the trial trenching.

1.5 The Specification has been prepared in line with the written Code of Conduct of the Chartered Institute for Archaeologists (CIfA 2022), the Standard and guidance for archaeological field evaluation (2023) and other best practice guidelines (**Appendix 1**).

1.6 The archaeological works specified in this document will be undertaken by West Yorkshire Archaeology Service (ASWYAS; 'the Contractor'), under the supervision of the Consultant.

1.7 The archaeological fieldwork, post-survey assessment, archiving, analysis and preparation of the fieldwork report text will be undertaken by the Contractor, unless otherwise specified in this Specification.

2. SITE INFORMATION

2.1 The Site is located to the north of Blackmoorfoot Road on the southwestern edge of Huddersfield. It is centred approximately on National Grid Reference SE 11381 14768 (**Figure 1**) and comprises eight fields which surround buildings associated with the former Standard Fireworks Factory site, including the former office block, factory buildings, stores, sheds and distribution units and former quarries.

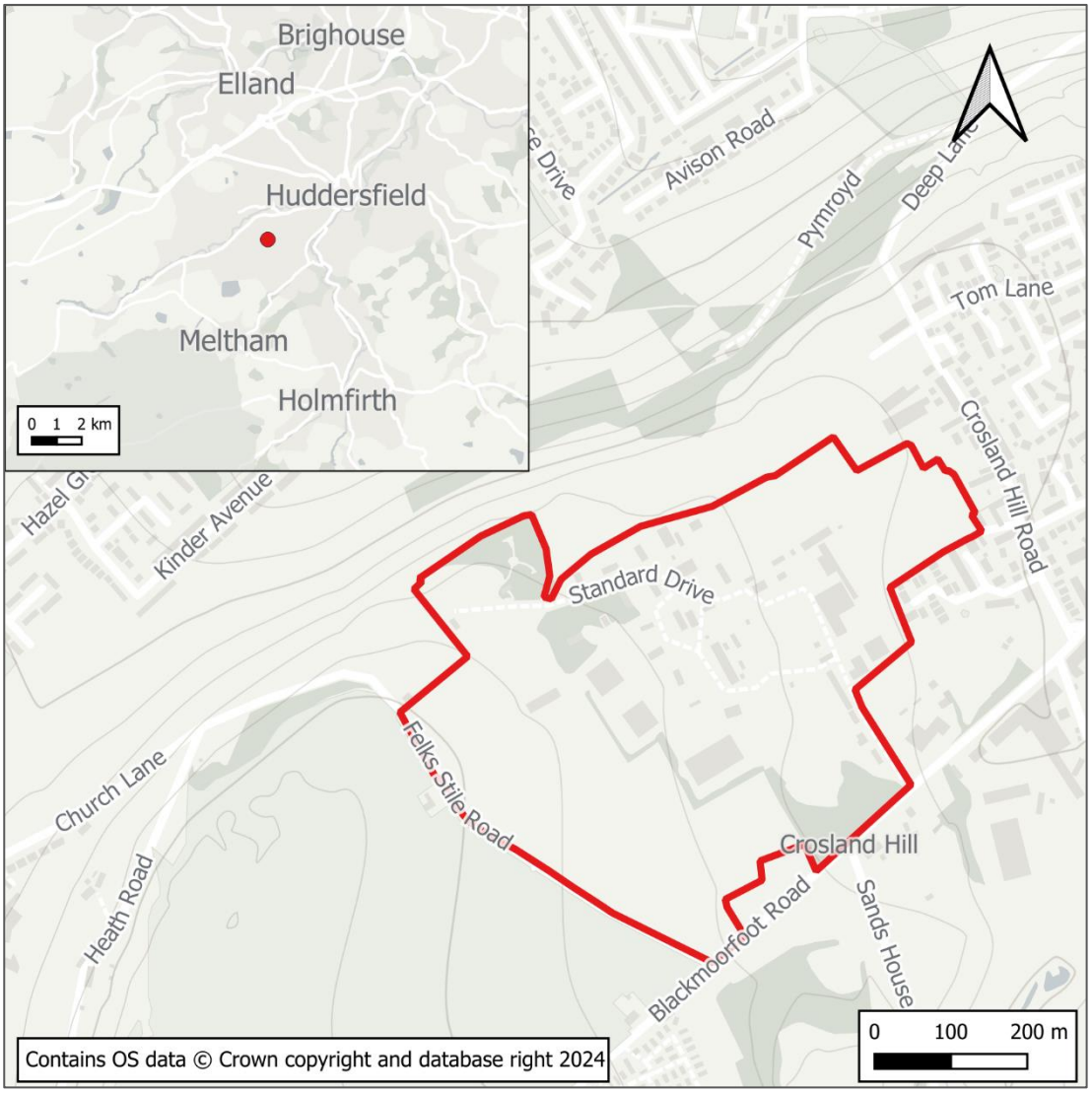

Figure 1 *Site Location*

Geology and Soils

2.2 Bedrock geology across the Site comprises Rough Rock sandstone. No superficial deposits are recorded.

3. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 An historic environment desk-based assessment was prepared by RPS in 2020. This states that there are no known archaeological sites or assets within the areas either side of the former Standard Fireworks Site which occupies much of the central part of the site. The assessment refers to various 19th century maps including the 1850 South Crosland Tithe Map which shows the area in agricultural use, with small fields to the south and open areas to the north. The aforementioned map also depicts two small quarries roughly within the centre of the site.

3.2 Within much of the central part of the site was the Standard Fireworks Factory which was founded by James Greenhalgh as a subsidiary of his father's Drapery business. The company started out buying products made by other companies and rebranding them. In 1891, Standard Fireworks started manufacturing their own products. At first many of these fireworks were made by outsourced workers including coal miners who were supplementing their incomes. From this inconspicuous start the business grew taking on multiple buildings in the town centre of Huddersfield. It soon became apparent that a purpose-built site would be required if the company was going to be able to keep up with demand. In 1910 the company moved its production to the former Crossland Hill Quarry to the southwest of Huddersfield while retaining its offices within the town centre.

3.3 The former quarry was chosen as it had extensive lands and existing gunpowder stores on site while the former quarries could be used for testing products. The 1913 Ordnance (OS) map records the extent of the site shortly after Standard moved its production. Over the following years multiple applications were made to amend and add further buildings to the complex. While none of the structures from the earliest phase of the factory now survive the style of the functional sheds remained the same. A plan for the alteration of filling sheds from 1915 provides an accurate elevation of these earliest phases.

3.4 A plan from 1915 denotes the layout of the site showing the growth of the site in just five years, with new sheds for the filling and packing of fireworks, stores and a purpose-built dining room. The Greenhalgh family took their social responsibilities very seriously including subsidising meals for their workers, the construction of a purpose-built dining hall. In 1914, Standard Fireworks switched from the production of Fireworks to manufacturing munitions and hand grenades for the war effort. Developments and expansions continued to be made throughout the site during World War I to meet the demands of the military.

3.5 In 1939 a planning application was submitted for a grand new office complex and associated new entrance road. This altered the approach to complex from the existing northeast road which led into the narrow historic core of Crossland Moor, to a more functional southeast approach from Blackmoorfoot Road. Standard Drive as it would provided a straight path to the heart of the complex which would end at the new and Art-Deco office block. This was the culmination of a large expansion of the factory between the wars.

3.6 When the Second World War was declared in September of 1939 Standard Fireworks had already produced all its products for the annual bonfire night celebrations due just two months hence. These were put into storage and once again the company joined

the war effort. At the end of World War II there was huge demand for fireworks for the many celebrations that were held across the country. Standards store of pre-war fireworks was used at many prominent displays including the London Victory Celebrations Display in the June of 1946. The companies' products continued to be used a major event around the UK and within the British Empire and subsequently at Commonwealth events.

3.7 The operations continued to expand post war and the site grew to meet this demand many of the older buildings were replaced and in 1959 the company floated on the stock market. In 1988 the Standard Fireworks bought Scottish outfit Brock Fireworks and moved all manufacturing to the Crossland Hill site, this would ultimately become the last action in the growth of the manufactory as by 1998 Standard Fireworks would go into receivership and were bought by Chinese firework makers Black Cat Fireworks. This led to all production being shifted away from Crossland Hill to China with the site becoming the UK headquarters and a distribution hub. Much larger sheds on raised plinths to load straight into HGVs characterise this period. These sheds were the last stage in growth before the decline of a site which finally closed in 2021.

4. GEOPHYSICAL SURVEY

4.1 In 2023 Phase Site Investigation undertook a geophysical survey (**Appendix 2**) of those parts of the site which had not been disturbed by the former quarries or the fire works factory.

4.2 The predominance of the anomalies identified by the survey relate to modern material / objects, agricultural activity (including possible ridge and furrow) and natural variations. There are several anomalies of uncertain origin, some of which may relate to possible archaeological features, however, it is suggested that most of these do not form any clear patterns or relationships that would infer an archaeological origin. It is likely that most of them will be associated with agricultural activity, drainage features or natural features /variations.

4.3 The survey identified a large number of isolated responses which are likely to relate to spread(s) of modern material.

5. SCOPE OF WORKS

5.1 The trial trenching will be carried out in accordance with this specification. This design takes account of the Chartered Institute for Archaeologists' Standard for archaeological field evaluation (2023), the Universal guidance for archaeological field evaluation (2023) and the CIfA Code of Conduct (CIfA, 2022).

5.2 Other relevant and current best practice standards and guidance (**Appendix 1**) will be adhered to by the Contractor.

5.3 It is the responsibility of the Contractor to ensure that the works undertaken are carried out in accordance with the latest versions of the standards and guidelines. The works will also be undertaken with due regard to the relevant frameworks and strategies including updated Research Agendas.

Specific Works

5.4 The trial trench evaluation will comprise the excavation of eighteen 50 x 1.8m trenches as shown on **Figures 2, 3** and **4**. These are designed to test the ambiguous features identified by the geophysical survey.

5.5 The trenches should be positioned using metric-survey equipment to an accuracy of ± 100mm of the specified trench location.

5.6 It may be necessary for the Contractor to undertake a preliminary assessment of ground conditions prior to the commencement of the fieldwork. The Contractor will notify the Consultant of any areas that in their opinion are unsuitable for evaluation.

5.7 All trenches are to be the stated dimensions at their base.

6. OBJECTIVES

6.1 The objective of the trenching is to gain an understanding of some of the anomalies revealed by the geophysical survey. The objectives are detailed below:

- to characterise and date the anomalies identified in the geophysical survey;
- to determine the likely range, quality and quantity of artefactual and environmental evidence present;
- to inform the scope of archaeological mitigation works, where necessary;
- to assess apparent blank areas; and
- to record all remains to an appropriate level.

7. CONTINGENCY

7.1 The 'Contractor' should make provision for a contingency for up to 10% of the area covered by the trenching outlined in Section 5. The use of the contingency will depend upon the results obtained during the works and will be implemented (if required) with the agreement of BWB and the Principal Archaeologist. The decision to invoke all or part of the contingency will be issued in writing, in retrospect after site discussions if necessary.

8. METHODOLOGY

General Details

8.1 All anthropogenic archaeological features that are revealed will be investigated. Hand excavation and feature sampling will be sufficient to establish date and character, and to allow appropriate levels of recording.

8.2 The trenches will be stripped under constant archaeological supervision by an experienced archaeologist provided by the Archaeological Contractor. The trenches will be located and set out using industry standard DGPS in accordance with the plans set out in this specification. Any deviations to the locations should be advised by the

Archaeological Contractor to the Archaeological Consultant in advance of excavation with a justification for the consideration and approval by the Principal Archaeologist. The locations of the trenches will be scanned by an archaeologist qualified in the use of a cable avoidance tool (CAT) prior to the excavation commencing. Service plans will be provided.

8.3 The excavation of trenches will be undertaken by an experienced machine operator in a controlled and methodical manner. Any Topsoil and subsoil will be stripped mechanically with a smooth bladed, toothless ditching bucket and separated and stockpiled at a safe working distance from the excavation sides.

8.4 Excavation shall continue under archaeological supervision, removing deposits down to the first significant archaeological horizon or the natural substrate, whichever is encountered first. The machine excavation will proceed in level splits of no more than 200mm to allow the monitoring archaeologist an appropriate window of opportunity to assess the horizon for archaeological remains and finds. This supervision will be conducted by an appropriately qualified and experienced archaeologist. The top of the first significant archaeological horizon may be exposed by machine but will then be cleaned by hand as necessary and inspected for features. All excavated deposits and exposed surfaces will be visually scanned for the presence and collection of dating artefacts.

8.5 Soil stripping will be carried out using a 360-degree mechanical tracked excavator. The size of the machine will be appropriate to the area to be stripped. No trenches will be backfilled until they have been viewed by the Archaeological Consultant and 'signed off' by the Principal Archaeologist.

8.6 Metal detector searches must take place at all stages of the evaluation by a named, experienced metal detector user, including reference either to their contributions to the PAS database or to other published archaeological projects they have worked on. Metal detecting should be carried out before trenches are stripped, with trench bases and spoil scanned once trenches have been opened.

8.7 The metal detector should not be set to discriminate against Iron.

8.8 On completion, and only after permission has been given, the trenches will be backfilled in reverse order, commencing with subsoil followed by topsoil. Trenches will be compacted by machine tracking over the backfilled deposits. No surfaces will be reinstated.

8.9 The appropriateness of the methodology will be kept under review. Any variations to this Specification will be put in writing and agreed by the relevant stakeholders including HAP, the Client and the Archaeological Consultant.

8.10 Care should be taken to not damage any areas containing significant remains. The Principal Archaeologist, in their role as advisor to the Local Planning Authority, must be informed immediately if remains of significance are encountered, or remains that would require a separate approach to excavation, and a revision of the methodology within a separate specification.

9. EXCAVATION AND SAMPLING STRATEGY

9.1 A sufficient sample of any archaeological features and deposits revealed will be hand excavated in an archaeologically controlled and stratigraphic manner to establish their extent, form, date, function and relationship to other features. Excavation and sampling strategies will be proportionate to record and characterise the features.

9.2 Archaeological deposits and layers (including buried soils) will be sampled sufficiently to enable a confident interpretation of their character, date and relationships with other features. Hand excavation will be undertaken in an archaeologically controlled and stratigraphic manner in order to meet the objectives of the evaluation. Care must be taken to excavate stratigraphically and allocate all recovered artefacts to their correct deposit. A sufficient number of deposits or features will be investigated through sample excavation in each trench to record the horizontal and vertical extent of the stratigraphic sequence down to the level of undisturbed natural deposits. No archaeological deposit should be entirely removed unless this is unavoidable or necessary to meet the aims and objectives of the evaluation. Excavation must be undertaken with a view to minimising damage to any features or deposits which would be better understood during future stages of work and those which appear to be worthy of preservation in-situ.

9.3 It is envisaged that the following sampling strategy will be used. However, this may be varied following discussions with the Principal Archaeologist if the specific circumstances of the identified remains, or if the features can be characterised to a suitable level of detail with a lesser sampling strategy. Archaeological recording, where not precluded by Health & Safety considerations, will consist of:

- A 100% sample should be taken of all stake-holes;
- An initial 50% sample should be taken of all post-holes, which should then be 100% excavated to maximise recovery of artefacts and palaeo-environmental samples;
- A 50% sample should be taken of pits with a diameter of up to 1.5m;
- A minimum 25% sample should be taken of pits with a diameter of over 1.5m; however, this should include a complete section across the pit to recover its full profile;
- A minimum 20% sample should be taken of all ditches; and
- All junctions / intersections and corners of linear features will be investigated, and their stratigraphic relationships determined, and all ditch terminals will be excavated.

9.4 Investigation slots through all linear features will be at least 1m in width or greater if required to achieve the aims and objectives. Particular attention will be given to terminals and intersections to ascertain stratigraphic and physical relationships. Excavated sections/ segments should be placed against the trench edge where possible and sections drawn perpendicular to the feature's alignment. Overly oblique sections should be avoided.

9.5 All finds recovered will be recorded by context on industry standard pro-forma recording sheets. Unique context numbers will only be assigned if artefacts are

retrieved, or stratigraphic relationships between archaeological deposits are discernible. Where assigned, each context will be described in full on a pro-forma context record sheet in accordance with the accepted context record conventions including a 'Harris' matrix where stratified deposits are recorded.

9.6 Artefacts of 19th and 20th century date can be noted and discarded, unless associated with a feature of significance, in which case they will be retained. All retained artefacts shall be removed from site for specialist examination and analysis, and if deemed necessary, conservation. Cleaning of objects may take place on site, or upon removal as is deemed appropriate. Finds of particular interest will be retrieved as Small Finds and located on plans in three dimensions.

9.7 All recording, cleaning, storage and conservation of finds will be in accordance with the Chartered Institute for Archaeologists' Standards and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials[1] and Watkinson and Neal.[2]

Human Remains and Treasure

9.8 Any human remains must be left in-situ, covered and protected. If removal is essential, it can only take place under appropriate Home Office and environmental health regulations and the Burial Act 1857. Prior written notice is also to be given to the Local Planning Authority. Removal of human remains will follow best practice standards and guidelines including SCCAS' Mineral Preserved Organics guidance (MPO's) Excavating Inhumations for Mineral Preserved Organic Guidance (2023).

9.9 Any remains classified as 'treasure' under the Treasure Act 1996 will be removed to a secure location, and where removal cannot be undertaken on the same day as discovery, suitable security measures will be put in place to protect the find(s) from theft.

9.10 A Treasure Receipt (obtainable from either the Finds Liaison Officer (FLO) or the DCMS website) must be completed and a report submitted to the Coroner's Office and the FLO within 14 days of understanding the find is Treasure. Hand cleaning of archaeological features, sections and surfaces, will be sufficient to establish the stratigraphic sequence exposed.

10. REPORTING

10.1 An interim report will be made available to the Archaeological Consultant one week after the completion of the fieldwork. This will be followed by an excavation report on the results of the fieldwork in PDF electronic format. The report will be prepared and submitted to the Local Planning Authority within 2 weeks of completion of the fieldwork (subject to required specialist analysis of samples and finds). Reporting will be undertaken in accordance with relevant archaeological standards and national guidelines.

[1] CIfA, (2020), Standards and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials
[2] Watkinson D. and Neal V. (1997), First Aid for Finds. Rescue and United Kingdom Institute for Conservation Archaeology Section, 3rd Edition

10.2 The assessment report should include:

i. The Archaeological Contractor's site code;

ii. A title page, with the name of the project, the name of the Contractor and author(s) of the report, the title of the report and date of the report and grid reference;

iii. A non-technical summary of the findings;

iv. A description and a background to the nature of the works, including dates of fieldwork, personnel, commissioning body, and nature of the Proposed Development;

v. A brief description of the Site location (including grid references), any previously known archaeology in the survey area, geology and soil conditions and known previous disturbance to the Site;

vi. Description of the methodology employed;

vii. Site location plan require (e.g. OS 1:1250) showing investigation area and development site in relation to surrounding locality and street pattern;

viii. Discussion on the nature, extent, date, condition and overall significance of the features, finds and environmental results of the investigation, site phasing and interpretation and discussion of the results within the local and regional context, to include specialist analysis as necessary. The report will describe the areas of disturbance, non-archaeological deposits and changes in the natural substrate where appropriate;

ix. Illustrative material including maps, plans, sections, drawings and photographs as necessary. Photographs should include images of work in progress together with any features revealed;

x. A summary of the contents of the project archive and its location and programme for deposition;

xi. References and bibliography of all sources used;

xii. Copy of the OASIS form; and,

xiii. Supporting appendices containing a list and summary descriptions of all contexts recorded as well as any additional supporting appendices as necessary.

10.3 The report should include supporting illustrations and plans, suitably captioned, at appropriate scales. To include as a minimum: a location map and a site plan. Drawings must include AOD levels and information to relate them accurately to the OS National Grid.

10.4 The report will be supported by photographs to place the investigation works within context and include colour photographs of identified archaeological features and artefacts.

10.5 The digital copy of the draft report will be sent to the Archaeological Consultant for initial review and any edits actioned by the Archaeological Contractor. The Consultant will forward the draft report to the Principal Archaeologist. The Archaeological Contractor shall rectify any defects and make any amendments as identified by the Principal Archaeologist and shall subsequently submit the final report within one week of their comments. Once approved, a final copy will be submitted to the Principal Archaeologist. Any variation to the reporting protocol will need to be agreed with the Principal Archaeologist in advance.

10.6 Digital copies of each report will include one full set of interpretative drawings in AutoCAD or GIS compatible format. Copies of each report should be produced and submitted to: BWB Consulting (pdf); The Client (pdf); West Yorkshire Historic Environment Record (hard copy and pdf); and the Archaeological Data Service, OASIS (pdf).

11. MONITORING, PROGRESS REPORTS & MEETINGS

11.1 The fieldwork will be subject to suitable monitoring visits by the Consultant and the Principal Archaeologist who will have unrestricted access to the site, site records or any other information. The work will be inspected to ensure that it is being carried out to the required standards and that it will achieve the stated objectives.

11.2 During fieldwork monitoring visits the Principal Archaeologist will take digital photographs which may be published on the Advisory Service's social media feeds as part of an ongoing strategy to enable public access to information about current fieldwork in the county.

11.3 Weekly written progress reports will be provided to the Consultant by the Contractor during the fieldwork.

11.4 Progress meetings between the Consultant, the Principal Archaeologist and the Contractor will be held on site during the course of the fieldwork. These meetings will be arranged by the Consultant.

11.5 The Contractor will only accept instruction from the Consultant and the Principal Archaeologist.

12. ARCHIVE PREPARATION & DEPOSITION

12.1 The site archive will be ordered and compiled using the CIfA and Historic England 'Toolkit for Selecting Archaeological Archives' and with reference to Brown and CIFA 'Guidance for the creation, compilation, transfer and deposition of archaeological archives'. It will be quantified, ordered, indexed and internally consistent. Adequate resources will be provided during fieldwork to ensure that all records are checked and internally consistent. The appointed Archaeological Contractor will obtain an accession number prior to works commencing.

12.2 Before commencing any fieldwork, the archaeological contractor must contact the Museum to determine the museum's requirements for the deposition of the excavation archive. Deposition should be confirmed in writing by the Contractor; with correspondence copied to the Principal Archaeologist.

12.3 The material to be deposited by the Contractor will consist of the physical archive, Context register sheets, Drawing register sheets, Group context register sheets, Sample register sheets, Digital photo register sheets, Photo ID sheets, Context cards, Context register sheets, Trench sheets, Context cards, Permatrace sheets, Specialists analysis reports and a copy of the report.

12.4 No bulk finds have been noted as likely to be present in such quantity as to necessitate the implementation of a selection strategy during the excavation. The overall responsibility for bulk finds selection decisions are the Project Manager for the Contractor and the representative of the collecting Archive. The project finds specialists are also responsible for shaping selection decisions regarding those categories of material. The Consultant will be informed of the decisions on finds selection.

12.5 All bulk finds recovered will be included in the working archive, subject to continuous assessment by the Contractor.

12.6 The digital data selected for inclusion in the archive will include Digital Photographs and GPS survey data produced during the fieldwork. This will be reviewed at the analysis stage and included in the digital archive.

12.7 The archive will meet all of the digital repository (ADS) deposition requirements.

13. PUBLICATION

13.1 If significant results are obtained and it is likely that further stages of archaeological work will be required, publication shall be deferred until such time as the project works are substantially complete.

14. CONFIDENTIALITY & PUBLICITY

14.1 All communication regarding this project is to be directed through the Consultant. The Contractor will refer all inquiries to the Consultant without making any unauthorised statements or comments.

14.2 The Contractor will not disseminate information or images associated with the project for publicity or information purposes without the prior written consent of the Consultant.

15. COPYRIGHT

15.1 The Contractor shall retain full copyright of any commissioned reports, tender documents or other project documents, under the Copyright, Designs and Patents Act 1988 with all rights reserved; excepting that it will provide an exclusive licence to the client for the use of such documents by the client in all matters directly relating to the project as described in the Specification subject to due acknowledgement. The

Contractor should agree to assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79).

15.2 Please note that by depositing the report, the contractor gives permission for the material presented within the document to be used by the Principal Archaeologist, in perpetuity, although the Contractor retains the right to be identified as the author of all project documentation and reports as specified in the Copyright, Designs and Patents Act 1988 (chapter IV, section 79). The permission will allow the Principal Archaeologist to reproduce material, including for commercial use by third parties, with the copyright owner suitably acknowledged.

16. ADHERENCE TO SPECIFICATION

16.1 Prior to the commencement of the work, the Contractor must confirm adherence to this specification in writing via email to the Consultant.

16.2 If, on first visiting the site or at any time during the course of the recording exercise, it appears in the Contractors professional judgement that:

i. a part or the whole of the site is not amenable to recording as detailed above, and/or;

ii. an alternative approach may be more appropriate or likely to produce more informative results;

16.3 then it is expected that the Contractor will contact the Principal Archaeologist and the Consultant as a matter of urgency in order that the matter can be resolved in liaison with the developer and the Local Planning Authority.

16.4 It is the Contractor's responsibility to ensure that they have obtained the Principal Archaeologist's consent in writing to any variation of the specification prior to the commencement of on-site work or (where applicable) prior to the finalisation of the tender. Unauthorised variations may result in the Principal Archaeologist being unable to recommend determination of the planning application to the Local Planning Authority based on the archaeological information available and are therefore made solely at the risk of the Contractor.

17. ACCESS ARRANGEMENTS AND WELFARE

17.1 Access to the site is restricted to authorised personnel only.

17.2 The Consultant will organise access to the site.

18. RESOURCES AND TIMETABLE

18.1 Any on-site archaeological works will be undertaken by a suitably qualified Archaeological Contractor. The Archaeological Contractor will be required to hold appropriate levels of Public Liability Insurance and Professional Indemnity Insurance for the project. The Archaeological Contractor will be a Registered Organisation with the

Chartered Institute for Archaeologists (CIfA) or is able to demonstrate that they have equivalent experience, capability and quality management systems in place. CVs of key staff involved in the project may be requested.

18.2 The Archaeological Contractor's team need to demonstrate experience of managing similar archaeological projects of similar size and complexity for their relevant levels of responsibility. The Project Director holds corporate membership of the Chartered Institute for Archaeologists at Member level. The Site Director or Project Officer for any on-site recording will be expected to hold corporate membership of the Chartered Institute for Archaeologists at Associate level or demonstrate experience equivalent to this. The Archaeological Consultant will notify the Principal Archaeologist at least one week in advance prior to the commencement of the works.

18.3 An interim report will be made available to the Archaeological Consultant one week after the completion of the fieldwork. This will include an overview of the works and will provide a preliminary interpretation of the archaeology encountered. It will be supported by annotated plans at an appropriate scale and a quantification of the primary archive including contexts, finds and samples.

18.4 The Archaeological Consultant will provide the Principal Archaeologist with progress reports until the completion of fieldwork. The Planning Archaeologist will be able to visit the site during the works in order to monitor the works and ensure adherence to the Specification.

19. INSURANCES & HEALTH AND SAFETY

19.1 The Contractor will provide the Consultant with details of public and professional indemnity insurance.

19.2 The Contractor will have their own Health & Safety policies compiled using national guidelines and which conform to all relevant Health & Safety legislation.

19.3 The Contractor will undertake a risk assessment detailing project specific Health & Safety requirements. The risk assessment shall be submitted to the Consultant for approval prior to the commencement of site work. Health & Safety will take priority over archaeological issues.

19.4 The supervisor will keep a record of staff site attendance.

19.5 All site personnel will familiarise themselves with the following:

- site emergency and evacuation procedures;
- the first aider; and
- the location of the nearest hospital and doctors surgery.

19.6 All site personnel will wear full P.P.E consisting of hard hat, steel toe-capped boots and high-visibility vest or jacket at all times. Additional P.P.E will be issued by the Contractor as required, i.e. goggles, ear defenders, masks, gloves etc. In addition, site personnel will ensure that any visitors to the site are equipped with suitable P.P.E prior to entry. The

Contractor has the right to prevent access on to the site if visitors do not have the proper P.P.E.

19.7 The Contractor will make a record of all parties attending the site including time attended and time left. The Contractor will also inform the visitors of the Health and Safety procedures, emergency evacuation procedures, the location of the nearest doctor's surgery and hospital and who the site first aider is.

19.8 The Site will be left in a tidy and workman-like condition and the Contractor will ensure they remove all materials brought onto the site.

20. STAFFING

20.1 All archaeological personnel involved in the project should be suitably qualified and experienced professionals. The Contractor shall provide the Consultant with staff CVs of the Project Manager, Site Supervisor and any proposed specialists. Site assistants' CVs will not be required, but all assistants should have an appropriate understanding of excavation procedures.

21. GENERAL PROVISIONS

21.1 Any technical queries arising from this document will be addressed to the Consultant without delay.

21.2 All communications on archaeological matters will be directed through the Consultant.

21.3 This specification is valid for a period of 6 months from date of issue. After that time it may need to be revised to take account of new discoveries, changes in policy, standards and guidelines or the introduction of new working practices or techniques.

22. BIBLIOGRAPHY

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Watkinson D. and Neal V., 1997, First Aid for Finds. Rescue and United Kingdom Institute for Conservation Archaeology Section, 3rd Edition

FIGURES

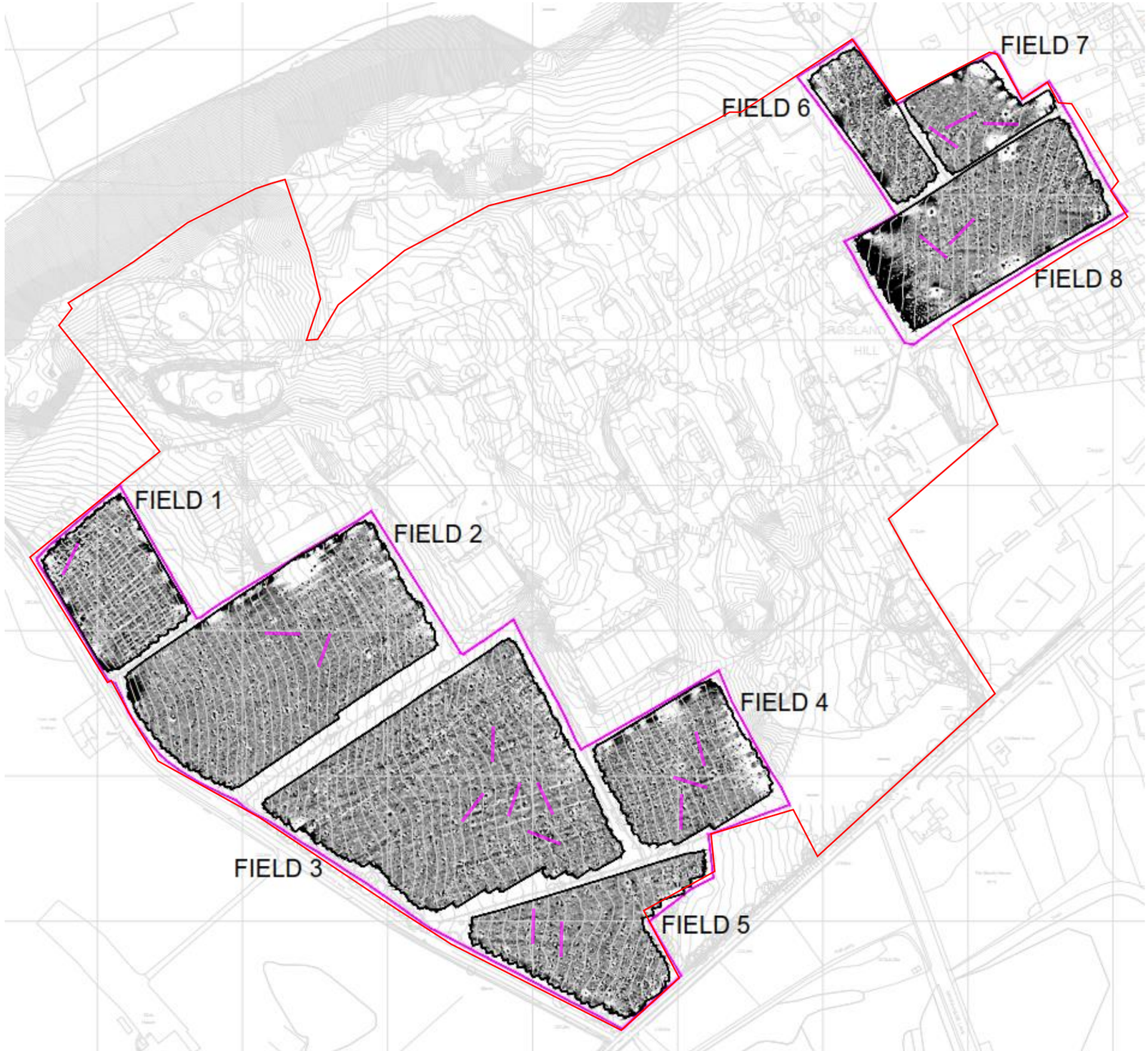

Figure 3 Location of Trenches overlaid on to geophysical survey grey scale plot

Figure 3 Location of Trenches overlaid on to geophysical survey interpretation

Figure 4 Location of Trenches overlaid on to geophysical survey interpretation and proposed development layout

APPENDICES

APPENDIX 1
Archaeological Standards and Guidelines

ARCHAEOLOGICAL STANDARDS AND GUIDELINES

Advisory Panel on the Archaeology of Burials in England (APABE) 2013. Science and the Dead: A guideline for the destructive sampling of archaeological human remains for scientific analysis

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APPENDIX 2
Geophysical Survey Report

Land off Blackmoorfoot Road
Huddersfield
West Yorkshire

Archaeological geophysical survey

Project No. ARC/3602/1354

September 2023

Land off Blackmoorfoot Road
Huddersfield
West Yorkshire

Archaeological geophysical survey

Project No. ARC/3602/1354

Report prepared by		Report checked by	
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Signature		Signature	
Date	21/09/23	Date	22/09/23

Table of Contents

1. SUMMARY

Phase Site Investigations Ltd was commissioned to carry out a magnetic gradient survey at land off Blackmoorfoot Road, Huddersfield, West Yorkshire, 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 survey was undertaken using a Phase Site Investigations Ltd multi-sensor array cart system (MACS). The MACS comprised 8 Foerster 4.032 Ferex CON 650 gradiometers with a control unit and data logger. The MACS data was collected on profiles spaced 0.5 m apart with readings taken at between 0.1 and 0.15 m intervals.

The majority of the anomalies identified by this survey relate to modern material / objects, agricultural activity (including possible ridge and furrow) and natural variations. There are a number of anomalies of uncertain origin, some of which could be related to parts of archaeological features, but, in the majority of instances, these do not form any clear patterns or relationships that would indicate an archaeological origin and it is likely that the majority of them will be associated with agricultural activity, drainage features or natural features / variations.

There are a large number of isolated responses across the site, the majority, if not all, of which will relate to modern material and are indicative of a spread of modern material. They could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or it could be from a general spread of modern debris.

There are several areas where very strong responses or magnetic disturbance from modern features / material dominate the surrounding data. It should be recognised that the strength of the strong responses could mask anomalies from other sub-surface features in the area.

2. INTRODUCTION

2.1 Overview

Phase Site Investigations Ltd was commissioned by BWB Consulting Ltd to carry out an archaeological geophysical survey at land off Blackmoorfoot Road, Huddersfield, West Yorkshire, 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_3602_1354_01.

2.2 Site description

The site is situated to the north of Blackmoorfoot Road on the south-western edge of Huddersfield, West Yorkshire. The survey area was separated into two parts, the western part has its approximate centre at NGR SE 112 145 and the eastern part has its approximate centre at NGR SE 116 149.

The site encompassed 8 fields, which were located within a wider site which encompassed former quarries, buildings, access roads and hardstanding ground. The fields were under grass and were relatively firm underfoot at the time of the survey. There was a gradual slope downwards to the north-east across the site. The fields were bounded by dry stone walls and fencing.

The geology of the site consists of Rough Rock sandstone with no recorded superficial deposits (British Geological Survey, 2023).

2.3 Archaeological background

An historic environment desk-based assessment for the wider site (RPS, 2020) states that there are no known archaeological sites or assets within the areas covered by this survey. It indicates that the areas covered by the survey have been used for agriculture since before 1850 and were not subject to the development and / or quarrying that other parts of the wider site were. Many of the current dry stone wall boundaries around and within the survey areas are shown on Tithe and First Edition OS maps but there are a number of other field boundaries that are shown on historic maps within the survey areas that are no longer present.

A significant part of the wider site was developed and used as a firework factory and this use continued into the present day. During the First and Second World Wars the factory complex was used to manufacture munitions.

2.4 Scope of work

The survey areas were specified by the client. They were located within a wider site but areas around current buildings, access roads, hardstanding ground and former quarries were not suitable for a magnetic survey and so the survey was restricted to 8 agricultural fields.

For the purposes of this survey each field that could be surveyed has been given a number, as shown in drawing ARC_3602_1354_02, which also shows the extents of the survey areas.

Areas adjacent to field boundaries, where there is likely to be disturbance from modern material, were left unsurveyed. An area of approximately 9.1 ha was covered by the magnetic survey.

No problems were encountered during the survey which was carried out the 21 and 22 August 2023.

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 8 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 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.

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). Data for the entire site is presented at a scale of 1:3000 and plots for individual fields (or parts of fields) with accompanying interpretations are shown at a scale of 1:1250. All greyscale plots were clipped at -2 nT to 3 nT. Greyscale plots have been 'smoothed' using a visual interpolation

The data has been displayed relative to a digital base plan provided by the client as drawing *'20220505 S17-338 Topographical Survey 2D rev A.dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position.

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 they are associated with archaeological features and so these have not been shown in the interpretation. A number of larger / stronger isolated bipolar anomalies have been shown but these are also not thought to be archaeologically significant.

Anomalies associated with agricultural and / or drainage regimes are present in the data but each individual anomaly 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 a field by field basis. 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 and a number of very strong responses but these are due to the presence of magnetic material in the topsoil / sub-surface or ferrous features objects within or adjacent to the site, rather than low data quality.

There are a large number of isolated responses across the site, the majority, if not all, of which will relate to modern material and are indicative of a spread of modern material. They could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or it could be from a general spread of modern debris.

4.2 Fields 1 to 5

Basic topography: Gradual slope downwards to the north-east.

Field descriptions: Grass (recently cut for silage). Relatively firm underfoot. Bounded by dry stone walls and fencing.

Summary of anomalies: A large number of isolated dipolar and small bipolar responses are present, a large majority, if not all, of which will be associated with relatively modern material. Several larger / stronger isolated dipolar and 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.

There are a number of regimes of broadly parallel linear responses. Most of these are probably associated with relatively modern ploughing / agricultural regimes, some could be caused by drainage features and it is possible that some could be associated with the remnants of ridge and furrow. In some cases it is not certain what the exact cause of a regime is but they will be one of the above.

Several linear tends (weak, diffuse or fragmented responses) are present that broadly correspond with former field boundaries. The anomalies are probably related to the former boundary or a feature associated with the former boundary, such as a track or drain.

There are a number of other trends of uncertain origin. Many of these could be related to drainage, agricultural, or other modern activity and others could be associated with natural features / variations but it is possible that some could be caused by parts of other infilled features.

Numerous isolated positive responses are present. There are a very large number of these responses and they will all be / are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

There are a number of anomalies (**Anomalies A**) that broadly correspond with field boundaries shown on historic maps. Anomaly A in Field 1 is a slightly stronger, broader negative response and it is possible that this relates to agricultural activity, rather than a field boundary. There are two broadly parallel Anomaly A responses in Field 2. It is possible that one of these relates to the former boundary and the other to agricultural activity but it is possible that one or both are associated with a feature, such as a track or drain, that respected the former boundary. Anomalies A in Fields 3 and 5 are relatively weak but probably relate to the remnants of the former boundaries.

There is evidence for agricultural and / or drainage activity in all of the fields. Several trends (**Anomalies B**) have a similar alignment to agricultural / drainage activity but stand out because they run slightly oblique to it or are slightly stronger. It is likely that these responses are also related to the agricultural / drainage activity but it is possible that some could be associated with sub-surface features.

Anomalies C, in Field 5 run parallel with the adjacent field boundary and are likely to be associated with agricultural activity, such as a headland or edge of cultivation, but its exact cause cannot be confirmed with certainty.

There are a number of linear / curvi-linear trends that are not obviously associated with agricultural activity. Some of these are quite irregular in shape (**Anomalies D**). It is likely that these anomalies are related to natural features / variations but it is possible that some of them could be related to parts of archaeological features.

There are several diffuse, but generally linear, anomalies in Field 5 (**Anomalies E**). It is not clear if these are related to agricultural activity or if they are related to infilled features, and as such an archaeological origin for them cannot be ruled out.

The remaining trends within the survey area are all too weak and short to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with anthropogenic sub-surface features and it is likely that they are a product of agricultural, or other modern, activity or natural features / variations.

There are numerous isolated positive responses across the survey area, some of which are relatively large or strong. This type of anomaly can have a variety of causes including natural features / variations, deeper 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 infilled discrete features but there is no obvious pattern or relationship to their distribution that would indicate an archaeological

origin and it is considered more likely that they are caused by natural variations or buried relatively modern, ferrous or fired material.

4.3 Fields 6 to 8

Basic topography: Gradual slope downwards to the north-east.

Field descriptions: Grass (pasture). Relatively firm underfoot. Bounded by dry stone walls and fencing.

Summary of anomalies: A large number of isolated dipolar and small bipolar responses are present, a large majority, if not all, of which will be associated with relatively modern material. Several larger / stronger isolated dipolar and 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.

There are a number of regimes of broadly parallel linear responses, which are probably associated with relatively modern ploughing / agricultural regimes, although it is possible that some could be caused by drainage features or older agricultural regimes.

There are a number of other trends of uncertain origin. Many of these could be related to drainage, agricultural, or other modern activity and others could be associated with natural features / variations but it is possible that some could be caused by parts of other infilled features.

Numerous isolated positive responses are present. There are a very large number of these responses and they will all be / are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Two sub-circular anomalies (**Anomalies F**) stand out in Field 7. It is possible that these are related to archaeological features, such as round houses or barrows and there are a number of diffuse, linear responses in the vicinity that could be related to infilled ditches (**Anomalies G**). However, Anomalies F could be caused by modern features, such as an area where a horse was tethered for a long time, and Anomalies G could have a different cause, (such as natural variations or agricultural activity). The anomalies are too diffuse and do not form a

clear pattern or relationships to determine their cause with any certainty. **Anomalies H** are other trends in these areas that are not obviously associated with agricultural activity and which stand out slightly. It is likely that these anomalies are related to natural features / variations or agricultural activity but it is possible that some of them could be related to parts of archaeological features.

The remaining trends within the survey area are all too weak and short to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with anthropogenic sub-surface features and it is likely that they are a product of agricultural, or other modern, activity or natural features / variations.

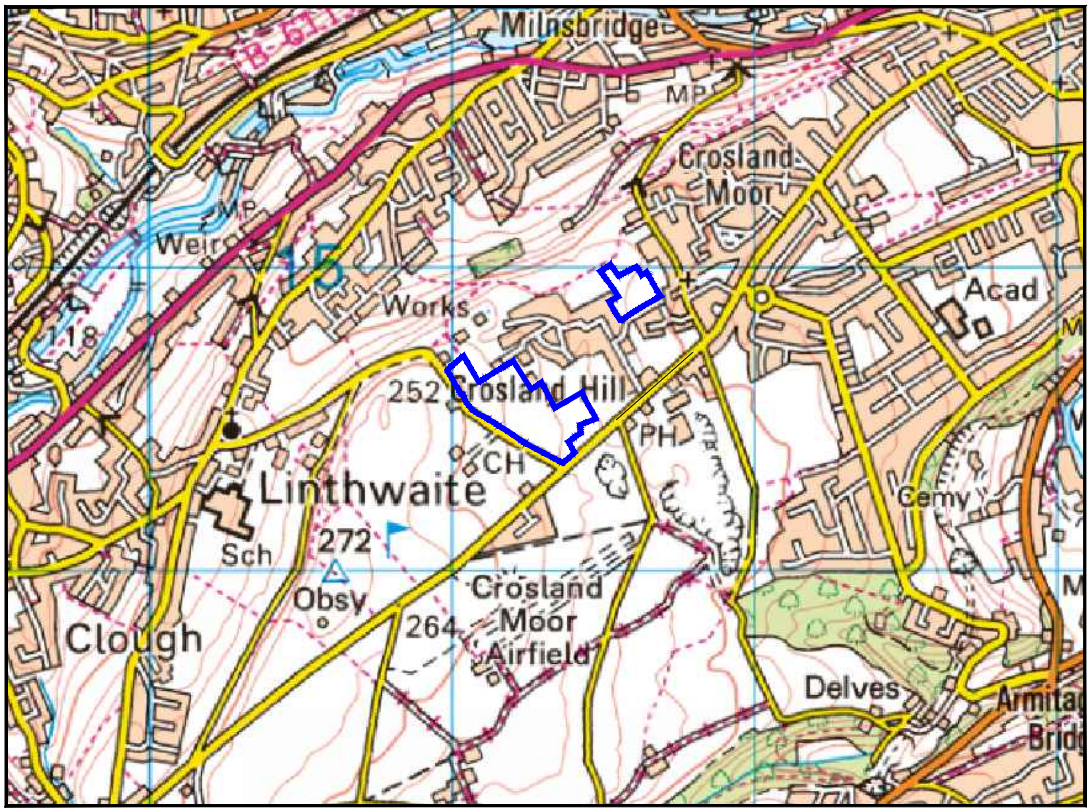
There are numerous isolated positive responses across the survey area, some of which are relatively large or strong. This type of anomaly can have a variety of causes including natural features / variations, deeper buried ferrous or fired material, accumulations of topsoil related to agricultural activity, infilled features or areas of burning. At this site it is possible that some of the isolated positive responses are caused by infilled discrete features but there is no obvious pattern or relationship to their distribution that would indicate an archaeological origin and it is considered more likely that they are caused by natural variations or buried relatively modern, ferrous or fired material.

5. DISCUSSION AND CONCLUSIONS

The majority of the anomalies identified by this survey relate to modern material / objects, agricultural activity (including possible ridge and furrow) and natural variations. There are a number of anomalies of uncertain origin, some of which could be related to parts of archaeological features, but, in the majority of instances, these do not form any clear patterns or relationships that would indicate an archaeological origin and it is likely that the majority of them will be associated with agricultural activity, drainage features or natural features / variations.

There are a large number of isolated responses across the site, the majority, if not all, of which will relate to modern material and are indicative of a spread of modern material. They could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or it could be from a general spread of modern debris.

There are several areas where very strong responses or magnetic disturbance from modern features / material dominate the surrounding data. It should be recognised that the strength of the strong responses could mask anomalies from other sub-surface features in the area.



SITE LOCATION

SCALE

0m 500m 1000m

NOTE

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PHASE SITE INVESTIGATIONS

Phase Site Investigations Ltd, 703A Whinfield Drive, Aycliffe Business Park, Newton Aycliffe, County Durham, DL5 6AU

T: +44 [0] 01325 311 751
E: enquiries@PhaseSI.com
W: www.PhaseSI.com

Scale [A4 Sheet]	Drawing	Status
AS SHOWN	ARC_3602_1354_01	FINAL

Client: BWB CONSULTING LTD
LEEDS

Site: LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title: SITE LOCATION MAP

Job No: ARC_3602_1354

		Drawn	CW
Chk.	NF	Date	12/09/2023

NOTES

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KEY

APPROXIMATE EXTENT OF SURVEY AREA

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Scale [A3 Sheet]	Drawing	Status
1:3000	ARC_3602_1354_02	FINAL

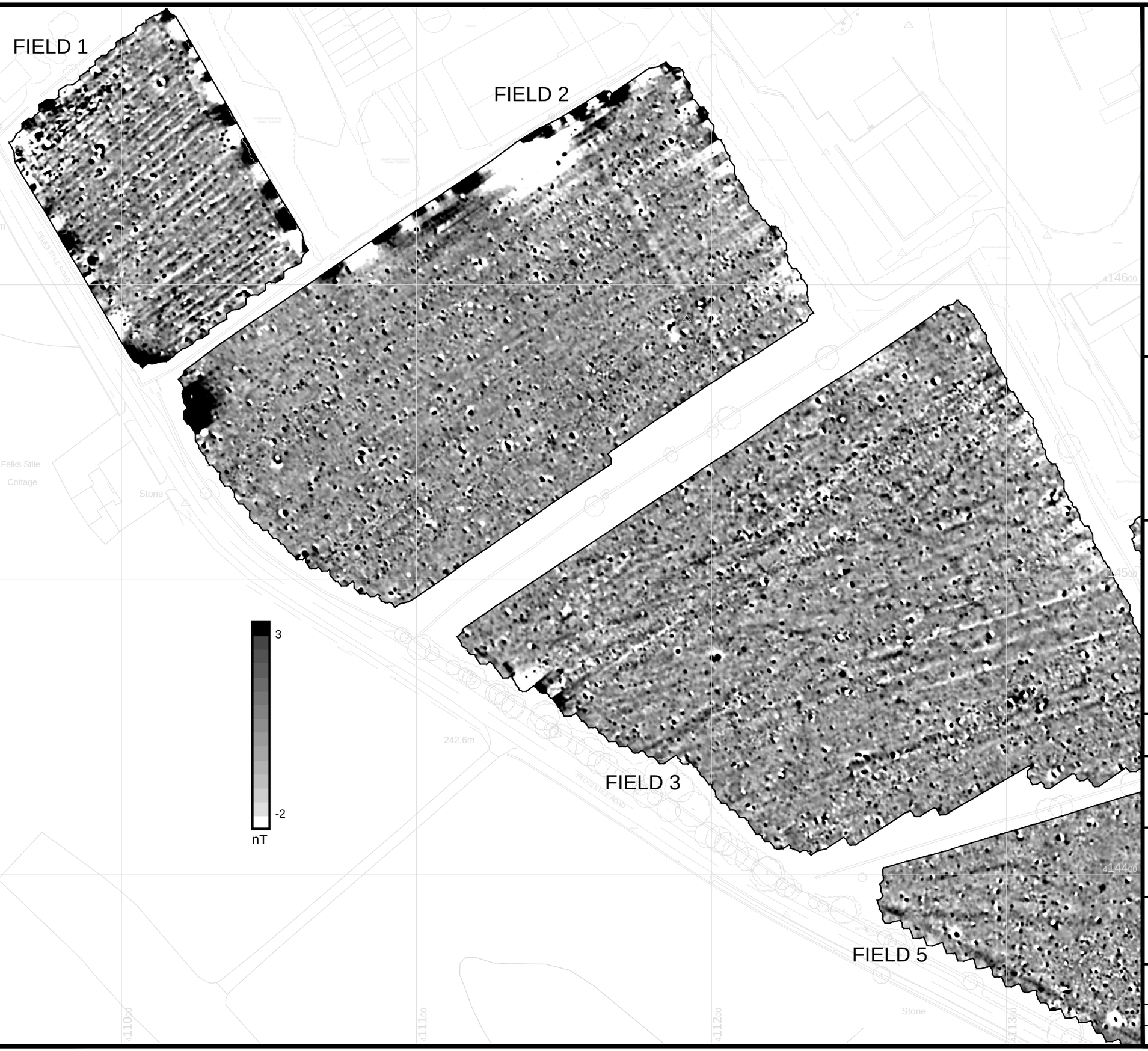
Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title
LOCATION OF SITE SHOWING
MAGNETIC GRADIENT DATA

Job No
ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023



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Scale [A3 Sheet]	Drawing	Status
1:1250	ARC_3602_1354_03	FINAL

Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: FIELDS 1, 2, 3 AND PART OF FIELD 5

Job No
ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023

FIELD 1

FIELD 2

FIELD 3

FIELD 5

ANOMALY TYPE	INTERPRETATION
ISOLATED STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME BUT SOME COULD BE DRAINAGE OR OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS ?	AGRICULTURAL ACTIVITY. POSSIBLE MODERN PLOUGHING REGIME BUT COULD BE DRAINAGE OR OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS FD?	AGRICULTURAL ACTIVITY. POSSIBLE DRAINAGE REGIME BUT COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS RF?	AGRICULTURAL ACTIVITY. POSSIBLE RIDGE AND FURROW BUT COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES WILL BE PROBABLY RELATED TO THIS, OR AN ASSOCIATED 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

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1250	ARC_3602_1354_04	FINAL

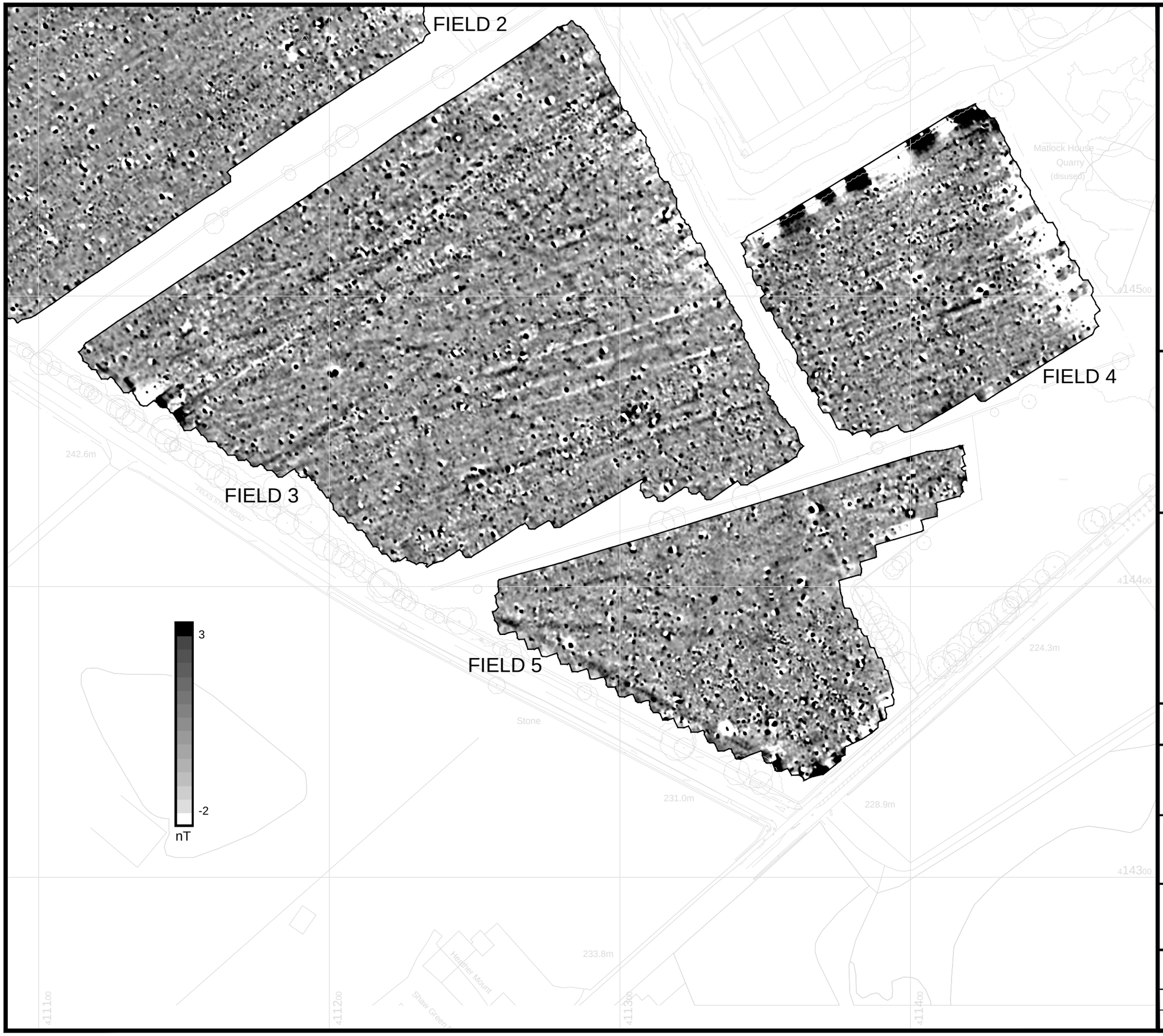
Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title INTERPRETATION OF MAGNETIC GRADIENT DATA: FIELDS 1, 2, 3 AND PART OF FIELD 5

Job No ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023



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PHASE SITE INVESTIGATIONS

Phase Site Investigations Ltd, 703A Whinfield Drive, Aycliffe Business Park, Newton Aycliffe, County Durham, DL5 6AU

Scale [A3 Sheet]	Drawing	Status
1:1250	ARC_3602_1354_05	FINAL

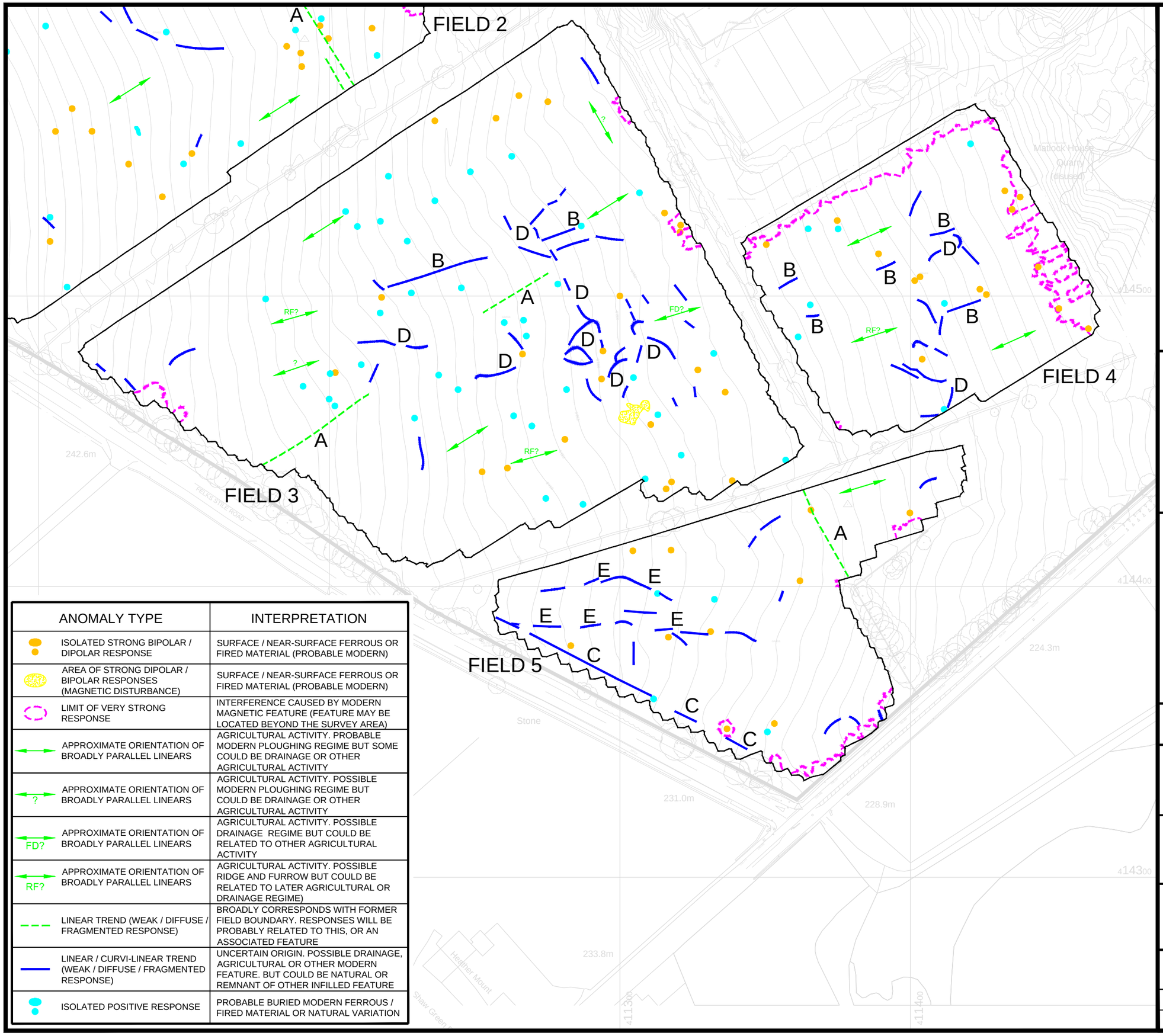
Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: FIELDS 3, 4, 5 AND PART OF FIELD 2

Job No
ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023



ANOMALY TYPE	INTERPRETATION
ISOLATED STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME BUT SOME COULD BE DRAINAGE OR OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS ?	AGRICULTURAL ACTIVITY. POSSIBLE MODERN PLOUGHING REGIME BUT COULD BE DRAINAGE OR OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS FD?	AGRICULTURAL ACTIVITY. POSSIBLE DRAINAGE REGIME BUT COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS RF?	AGRICULTURAL ACTIVITY. POSSIBLE RIDGE AND FURROW BUT COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES WILL BE PROBABLY RELATED TO THIS, OR AN ASSOCIATED 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

NOTES

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PHASE SITE INVESTIGATIONS

Phase Site Investigations Ltd, 703A Whinfield Drive, Aycliffe Business Park, Newton Aycliffe, County Durham, DL5 6AU

Scale [A3 Sheet]	Drawing	Status
1:1250	ARC_3602_1354_06	FINAL

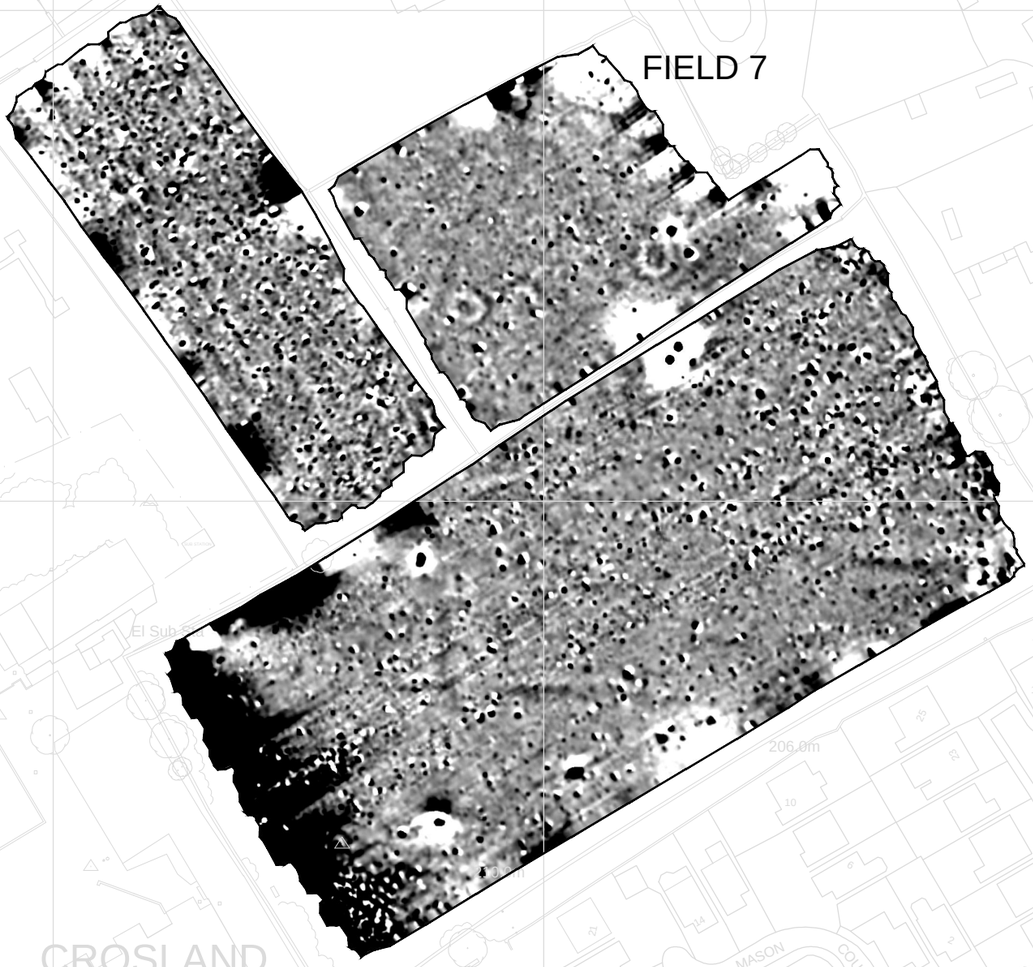
Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title INTERPRETATION OF MAGNETIC GRADIENT DATA: FIELDS 3, 4, 5 AND PART OF FIELD 2

Job No
ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1250	ARC_3602_1354_07	FINAL

Client
BWB CONSULTING LTD
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Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: FIELDS 6, 7 AND 8

Job No ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023

FIELD 6

FIELD 7

FIELD 8

H G F G H F H H G H G G H G G

CROSLAND HILL

ANOMALY TYPE		INTERPRETATION
	ISOLATED STRONG BIPOLAR / DIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
	AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
	LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
	APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME BUT SOME COULD BE DRAINAGE OR OTHER AGRICULTURAL 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

NOTES

1. THIS DRAWING MUST BE USED IN CONJUNCTION WITH THE ACCOMPANYING REPORT (ARC_3602_1354_RPT.PDF) WHICH PROVIDES DETAILS OF THE TECHNIQUES EMPLOYED, THEIR INHERENT LIMITATIONS AND ANY SITE SPECIFIC ISSUES.
2. THIS DRAWING IS BASED UPON DRAWING '20220505 S17-338 Topographical Survey 2D rev A.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
1:1250	ARC_3602_1354_08	FINAL

Client
BWB CONSULTING LTD
LEEDS

Site LAND OFF BLACKMOORFOOT ROAD
HUDDERSFIELD
WEST YORKSHIRE

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: FIELDS 6, 7 AND 8

Job No
ARC_3602_1354

Surveyed	JW, RS	Drawn	MW
Chk.	NF	Date	22/08/2023

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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 8 Foerster 4.032 Ferex CON 650 gradiometers, spaced at 0.5 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 data was exported as greyscale raster images (PNG files). Data for the entire site is presented at a scale of 1:3000 and plots for individual fields (or parts of fields) with accompanying interpretations are shown at a scale of 1:1250. All greyscale plots were clipped at -2 nT to 3 nT. Greyscale plots have been 'smoothed' using a visual interpolation.

1.4.3 The data has been displayed relative to a digital base plan provided by the client as drawing *'20220505 S17-338 Topographical Survey 2D rev A.dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position.

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. Several larger isolated bipolar responses have been shown as these could be associated with more significant sub-surface features or material (although in this instance they are not thought to be of archaeological interest).

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.

There are no bipolar linear anomalies in this data set.

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.

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.

There are no anomalies of this type in this data set.

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 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.

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.

There are no significant positive linear anomalies in this data set, other than those in the categories discussed above.

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 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.

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.

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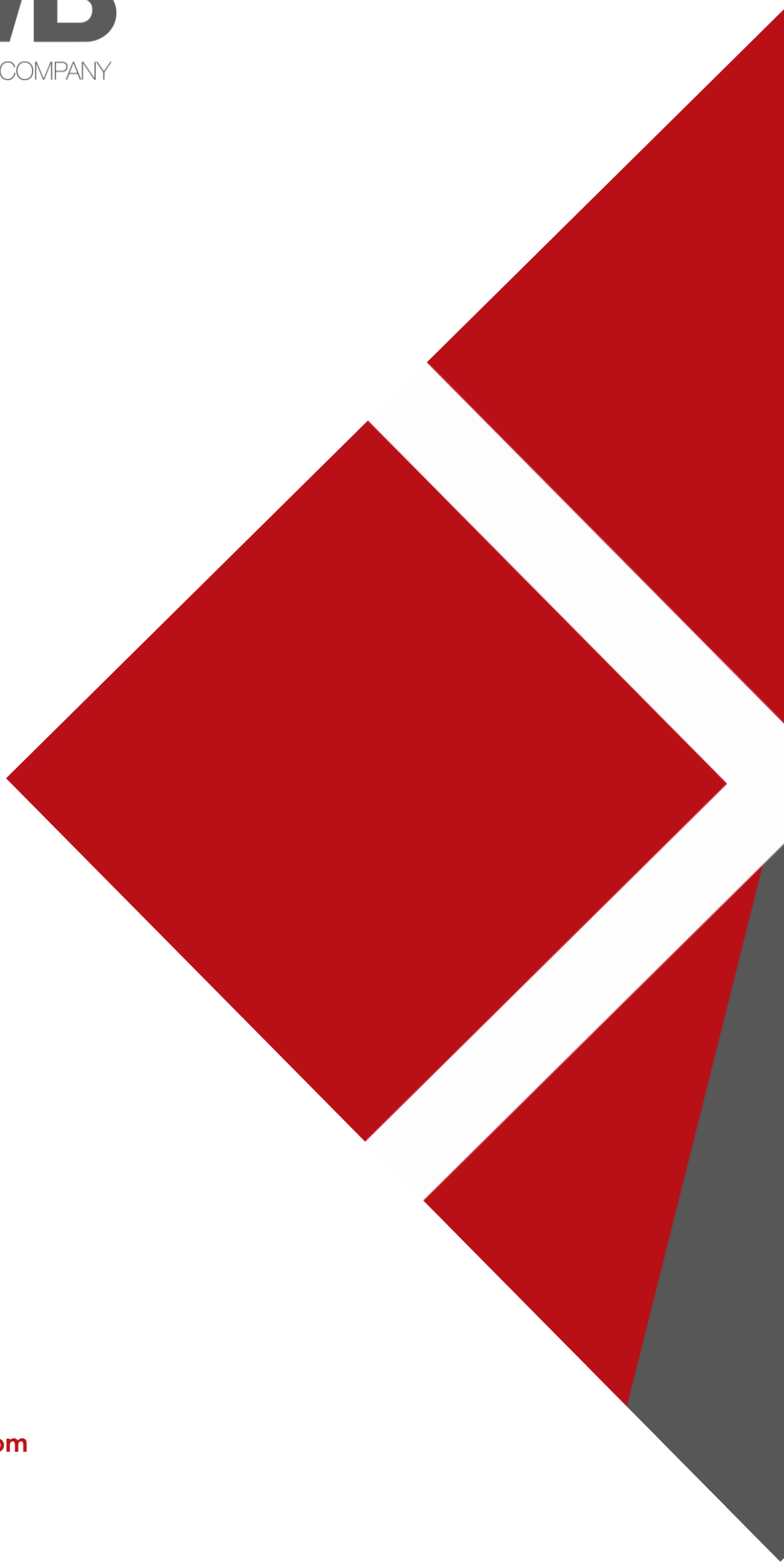

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