

ARCHAEOLOGICAL
SERVICES
DURHAM UNIVERSITY

on behalf of
The Archaeological Practice Ltd
for
Hall Construction Services Ltd

Eppleton Quarry Extension
Downs Pit Lane
Hetton-le-Hole
Sunderland

geophysical survey

report 2477
September 2010

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1. Summary

The project

- 1.1 This report presents the results of a geophysical survey conducted in advance of the proposed extension of Eppleton Quarry, Downs Pit Lane, Hetton-le-Hole, Sunderland. The works comprised 19ha of geomagnetic survey.
- 1.2 The works were commissioned by The Archaeological Practice Ltd for Hall Construction Services Ltd and conducted by Archaeological Services Durham University.

Results

- 1.3 Probable enclosure ditches and round-houses have been identified on the high ground in the north and east of the survey area, some of which may be filled with burnt material. Possible areas of burning have been identified, which may reflect features such as hearths and ovens. Due to the proximity of prehistoric findspots and funerary monuments, these features may represent a previously unidentified prehistoric settlement.
- 1.4 A number of probable pit features have also been identified.
- 1.5 A former field boundary shown on the 1st edition Ordnance Survey map has been identified.
- 1.6 A probable palaeochannel has been identified aligned broadly east/west, along the floor of the valley.
- 1.7 It is understood that a number of solution fissures opened up on the site in recent years and that these were probably infilled with colliery bricks. This would be a plausible explanation for at least some of the particularly intense linear anomalies in the north-west of the survey area.

2. Project background

Location (Figure 1)

- 2.1 The survey area was located to the north of Eppleton Quarry, Downs Pit Lane, Hetton-le-Hole, Sunderland (NGR centre: NZ 36220 48640). The survey area comprised 19ha of arable land. To the north and west was open farm land, to the south was Eppleton Quarry, and to the east the survey area was bounded by the access track to the quarry and Great Eppleton Wind Farm.

Development proposal

- 2.2 The proposal is for an extension to Eppleton Quarry. The planning application number is 07/05523/MID.

Objective

- 2.3 The principal aim of the survey was to assess the nature and extent of any sub-surface features of potential archaeological significance within the survey area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

Methods statement

- 2.4 The surveys have been undertaken in accordance with a specification provided by Tyne and Wear Specialist Conservation Team, reference number MON6048 (Appendix).

Dates

- 2.5 Fieldwork was undertaken between 18th and 25th August 2010. This report was prepared for 2nd September 2010.

Personnel

- 2.6 Fieldwork was conducted by Jamie Armstrong, Matt Claydon, Edward Davies, Natalie Swann and Richie Villis (supervisor). The geophysical data were processed and interpreted by Richie Villis. This report was prepared by Richie Villis, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

- 2.7 The site code is **HHE10**, for **Hetton-le-Hole, Eppleton Quarry Extension 2010**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **Online Access to the Index of archaeological investigationS project (OASIS)**. The OASIS ID number for this project is **archaeol3-81685**.

3. Historical and archaeological background

- 3.1 A desk-based assessment of the site was conducted by The Archaeological Practice Ltd (Archaeological Practice 2007). The following text summarises the assessment's conclusions.
- 3.2 There is evidence of prehistoric settlement and ritual activity within the vicinity of the site, dating to the Neolithic and Bronze Ages. The survey area overlooks the Copt Hill Barrow, which is an important site of prehistoric ritual activity. There is no

evidence from the survey area itself, but a number of prehistoric flints have been found in the immediate vicinity.

- 3.3 There is no evidence of later prehistoric or Roman activity in or around the immediate survey area.
- 3.4 The Copt Hill Barrow was re-used for an Anglo-Saxon burial, indicating continued ritual activity within the vicinity through the early medieval period.
- 3.5 Later medieval and post-medieval activity is recorded in documentary sources beginning in the 13th century, although it is likely that local villages such as Eppleton were established by the mid-12th century.
- 3.6 Tithe award maps from the 1830s and 1840s record the field systems of the development area. The present pattern of field boundaries is largely a product of enclosure, probably carried out in the 17th and 18th centuries, and the subsequent removal of boundaries to form larger arable holdings in the later 20th century.
- 3.7 No industrial features lie within the proposed development area, but the adjacent present extent of the Eppleton Reclamation Scheme includes a number of industrial features, notably Eppleton Colliery and associated roads and railways, and Great Eppleton, Eppleton and Curlew Hope quarries.
- 3.8 The potential for the discovery of large-scale settlement or industrial sites including substantial structural remains is unlikely, but there is potential that ephemeral features such as artefact scatters, pits, and other features of archaeological significance may be present.

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised a single field of arable land containing stubble from an oilseed rape crop. At the start of the survey a number of bails were piled around the site, which were collected as the survey progressed.
- 4.2 The area sloped from c. 150m OD in the east to c. 115m OD in the west. A steep-sided depression was aligned east-west through the centre of the survey area.
- 4.3 The underlying solid geology of the area comprises strata of Permian Magnesian Limestone of the Raisby Formation, which are overlain by Devensian till in the majority of the survey area; a band of glaciofluvial sands and gravels overlies the solid geology on the east boundary of the survey area.

5. Geophysical survey Standards

- 5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden

2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2002).

Technique selection

- 5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.
- 5.3 In this instance, based on desktop evidence, it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.
- 5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

- 5.5 A 30m grid was established across the survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system with real-time correction.
- 5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1.0m, thus providing 3,600 sample measurements per 30m grid unit.
- 5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

- 5.8 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and a trace plot of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; since many of the anomalies in this instance are so strong, a greyscale image with reduced contrast has also been included (Figure 3a). A trace plot is provided in Figure 6. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

- 5.9 The following basic processing functions have been applied to the geomagnetic data:
- clip* clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
 - zero mean grid* sets the background mean of each grid to zero; for removing grid edge discontinuities
 - zero mean traverse* sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
 - destagger* corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
 - despike* locates and suppresses iron spikes in gradiometer data
 - interpolate* increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.5m x 0.25m intervals

Interpretation: anomaly types

- 5.10 A colour-coded geophysical interpretation plan is provided. Three types of anomaly have been distinguished in the data:
- positive magnetic* regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
 - negative magnetic* regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
 - dipolar magnetic* paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

- 5.11 A colour-coded archaeological interpretation plan is provided.
- 5.12 Several curvilinear and rectilinear positive magnetic anomalies have been detected in the survey area, predominantly on the higher ground to the north and east. These anomalies reflect relative increases in high magnetic susceptibility materials and almost certainly represent the remains of soil-filled ditches.
- 5.13 The sub-circular curvilinear positive magnetic anomaly detected at the north of the survey measures c.65m x 85m and almost certainly reflects an enclosure ditch. Within this a number of circular positive magnetic anomalies, between 10-15m in diameter, have been detected. Given the proximity of known archaeological features

of prehistoric date, it is probable that these reflect the remains of ring-ditches associated with prehistoric round-houses.

- 5.14 A number of intense rectilinear and curvilinear magnetic anomalies have been detected, particularly in the north-west corner of the survey area. These would be consistent with ditch features filled by burnt materials with thermoremanent magnetism. It has been suggested that a number of solution fissures opened up on the site in recent years and that these were probably infilled with colliery bricks. This would be a plausible explanation for at least some of these particularly intense linear anomalies. A number of such features have been highlighted on the archaeological interpretation plan (Figure 5), though others may be present.
- 5.15 A large number of discrete sub-circular positive magnetic anomalies have also been detected. These are likely to reflect soil-filled pit features.
- 5.16 A series of relatively weak, parallel, positive and negative magnetic anomalies has been detected aligned broadly north-west/south-east across the whole survey area. These anomalies are likely to reflect the modern plough regime, rather than former ridge and furrow, but may respect the orientation of earlier agricultural practices.
- 5.17 A broad, diffuse positive magnetic curvilinear anomaly has been detected aligned broadly east/west in the middle of the survey area, at the floor of the valley. This is likely to reflect a shallow geological feature such as a palaeochannel.
- 5.18 A linear positive and dipolar magnetic anomaly has been detected aligned almost parallel with the possible palaeochannel. This is likely to reflect a former field boundary, which is shown on the 1st edition Ordnance Survey County Series map dated 1861.
- 5.19 A chain of dipolar magnetic anomalies has been detected at the very south of the area. This is likely to reflect a ferrous service pipe.
- 5.20 A linear negative magnetic anomaly has been detected along the south and south-west edge of the survey area. This reflects the presence of a tractor route along the edge of the field.
- 5.21 A large number of small, discrete dipolar magnetic anomalies has been detected. The anomalies almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance, however, those within the sub-circular and rectilinear enclosure systems could reflect a thermoremanent magnetism acquired by features such as hearths and ovens.

6. Conclusions

- 6.1 Nineteen hectares of geomagnetic survey was undertaken on land to the north of Eppleton Quarry, Downs Pit Lane, Hetton-le-Hole, Sunderland, prior to a proposed extension of the quarry.
- 6.2 Probable enclosure ditches and round-houses have been identified on the high ground in the north and east of the survey area, some of which may be filled with

burnt material. Possible areas of burning have been identified, which may reflect features such as hearths and ovens. Due to the proximity of prehistoric findspots and funerary monuments, these features may represent a previously unidentified prehistoric settlement.

- 6.3 A number of probable pit features have also been identified.
- 6.4 A former field boundary shown on the 1st edition Ordnance Survey map has been identified.
- 6.5 A probable palaeochannel has been identified aligned broadly east/west, along the floor of the valley.
- 6.6 Some of the particularly intense linear anomalies in the north-west of the site could reflect solution fissures which are believed to have opened up in recent years and been infilled with colliery bricks.
- 6.7 A programme of archaeological trial trenching may be required in order to validate the results of the geophysical survey and to provide further information such as dating evidence.

7. Sources

- Archaeological Practice 2007 *Eppleton Reclamation Scheme Extension, Eppleton, Sunderland: archaeological assessment*. Unpublished report **06/56**, The Archaeological Practice Ltd
- David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage
- Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists
- Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

Appendix: Project specification

Tyne and Wear Specialist Conservation Team

Specification for Geophysical Survey at Eppleton Quarry extension, Downs Pit Lane, Hetton-le-Hole, Sunderland

Planning Application: 07/05523/MID

Author: Jennifer Morrison, Tyne and Wear Archaeology Officer

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Date: 9 August 2010

County Archaeologist's Reference Number: MON6048

The Tyne and Wear Specialist Conservation Team is the curatorial service for archaeology, industrial archaeology and historic buildings throughout the Tyne and Wear districts. It helps and advises Newcastle, Gateshead, North Tyneside, South Tyneside and Sunderland Councils to carry out their statutory duties to care for the precious historic environment of Tyneside and Wearside. The Team can be found at the Strategic Housing, Planning and Transportation Division of the Environment & Regeneration Directorate of Newcastle City Council.

Introduction

Eppleton Quarry is to be extended. The primary mineral product from Eppleton is yellow sand. The overlying limestone will be removed and sold as aggregate.

Grid reference NZ 363 488

Description of Site

The client will provide a site location plan which will accompany this specification. The commissioning client will confirm the size of the extension site in hectares – thought to be 19 hectares.

Solid geology, drift geology, soil type, current land use and surface conditions

The site consists of drift deposits of glacial sand and gravel with boulder clay overlying the Lower Magnesian Limestone Plateau with marl slate at its base and coal seams beneath. The site is arable land, devoid of trees and hedgerows.

Previous Archaeological Work

An archaeological desk based assessment has been produced (The Archaeological Practice, November 2007). The appointed archaeologist must familiarize themselves with the results of the desk based assessment before starting work. The commissioning client will provide a copy of the report. The report concludes that although there are no known archaeological features within the site, there is a possibility that prehistoric and medieval remains could be present. The site lies close to the Seven Sisters Barrow at Copt Hill (SAM 32055). The barrow is within clear visual range of the site. A number of prehistoric flints, a scraper and a spearhead have been found near to Great Eppleton. Further flints were found in advance of the installation of a gas pipeline at Bracken Hill. There is a supposed rectilinear enclosure at Bracken Hill, although archaeological trenching there was inconclusive. The site lies close to the medieval villages of Hetton and Great Eppleton and was presumably used for agriculture during the medieval period. The earthwork remains of ridge and furrow, lynchets and a hollow way are known in the fields close to the site. Medieval pottery has been found around Great Eppleton Farm. The appointed archaeologist must familiarise themselves with the results of the desk based assessment before starting work. The commissioning client will provide a copy of the report.

Work Required

In accordance with PPS5 and UDP Policy B14, a programme of geophysical survey is required. All staff on site must understand the project aims and methodologies. Geophysical evaluation is required to inform the Planning Authority as to the likelihood that important archaeological sites might be encountered, to assist the Planning Authority in determining appropriate mitigation should deposits be found to survive on the site. The appointed archaeological contractor must be or must sub contract the work to a specialist in geophysical survey techniques. The survey cannot be undertaken when there is a crop on the field. All staff employed by the Archaeological Contractor shall be professional field archaeologists with appropriate skills and experience to undertake work to the highest professional standards. All fieldwork, data processing and reporting must comply with English Heritage guidelines of 2008 ("Geophysical Survey in Archaeological Field Evaluation"). Geophysical survey should be part of an integrated programme of research as promoted in

'Management of Research Projects in the Historic Environment' (MoRPHE). The purpose of this brief is to obtain tenders for this work. The report must be the definitive record for deposition in the Tyne and Wear HER, and it must contain recommendations for any further work needed on this site before development destroys any archaeological remains. **It is proposed that archaeological trial trenching will be undertaken after the geophysics to investigate any anomalies identified by the survey and to test 'blank' areas.**

Notification

The County Archaeologist needs to know when archaeological fieldwork is taking place in Tyne and Wear so that he can inform the local planning authority and can visit the site to monitor the work in progress. The Archaeological Contractor must therefore inform the County Archaeologist of the start and end dates of the Geophysical Survey. The Client will give the County Archaeologist reasonable access to the development to undertake monitoring.

Methodology

A programme of geophysical survey will be undertaken which provides 100% of the site. Any areas found to be disturbed should be excluded from the survey however, as these will not be conducive to producing reliable results. The survey aims to map subsoil disturbances and locate anomaly-producing structures or deposits which might indicate the presence of archaeological sites. To ensure fair and equal tendering, contractors will assume that this will be a 100% detailed magnetometer survey (scanning or magnetic susceptibility are not appropriate techniques). Survey must be conducted with a continuously recording magnetometer of appropriate sensitivity. If the appointed contractor thinks that a resistivity or ground penetrating radar survey would provide better results they must discuss this with the County Archaeology Officer before providing their client with a revised tender. The survey grid is the network of control points used to locate the geophysical survey measurements relative to base mapping and/or absolute position on the Earth's surface. Whether physically marked on the ground or measured while surveying using a global positioning system (GPS) these must be located to survey-grade accuracy (+/- 0.1m). The survey grid must be independently relocatable on the ground by a third party either by measurement to permanent features and/or by the use of GPS coordinates. The survey grid will be tied into known Ordnance Survey points with a total station etc. Care must be taken to ensure that any survey markers are not a hazard to people or animals. The data will be logged in 30m grid units. The sample interval will be set to 0.25m and the traverse interval to 1m. The geophysical survey will be conducted under the principle of repeatability – i.e. that within reason the data obtained should be capable of independent duplication.

Data Interpretation

The interpretation of survey data must be undertaken by a competent archaeological geophysicist who is knowledgeable of the archaeological and geomorphological conditions of the site. The interpretation of magnetometer data must endeavour to distinguish between anthropogenic from other causes of magnetic enhancement on the site. A clear distinction must be made between interpretation that is scientifically demonstrable and that which is based on informed speculation. Any reference to negative evidence must be fully explained. Lack of geophysical anomalies cannot be taken to imply a lack of archaeological features. Evaluation trial trenching should be considered in these cases.

The Report

The production of Site Archives will be undertaken according to English Heritage Guidelines (Managing Archaeological Projects 2nd Edition). A full report should be produced within three months of the completion of the field-work. All drawn work should be to publication standard. The report must contain and synthesise the results of the geophysical survey mentioned above. Some form of Digital Mapping, in CAD or GIS software that supports DFX or similar format would be greatly helpful to the Planning Authority. The report will include clear text supported by tables, figures, appendices and references. The report will stand independent of supporting material and should combine concise technical description linked to lucid and objective analysis and interpretation. It should be intelligible to specialists and non-specialists alike. The final section of the work should make recommendations for any required further work, particularly the need to do targeted field-walking and trial trenching to validate the results of the survey and test the suggestions that archaeological sites have been detected. Where evaluation is recommended, the finished report will include a suggested trench location plan. The report must have the following features:-

1. Site location plan with scale with survey grid superimposed on the plan
2. Site grid reference

3. Summary/Abstract
 4. Project background, objectives
 5. Date of work and personnel
 6. Historical and archaeological background
 7. Site land use, ground conditions, topography, solid and drift geology, soil type and weather
 8. Methodology – equipment, instrument and techniques employed and why, technique used for data processing, software used
 9. Results – description and analysis of results and their interpretation.
 10. Conclusions – discussion of the survey results with reference to the original objectives. Summary of the archaeological significance of the survey findings, the need for future archaeological work
 11. plots and plans:
 - survey location plan demonstrating relationships to other mapped features. Minimum scale 1:2500
 - an image of minimally processed survey data, preferred scale 1:1000
 - where appropriate a trace (or X-Y) plot of raw magnetic data. For very large sites a sample of data might be supplied instead, to support specific interpretation of anomalies on identified grayscale images.
 - A grayscale plot, or dot density plot. Minimum scale 1:1000
 - One or more interpretative plans or diagrams. Minimum scale 1:1000
- The location plan must be directly relatable to the OS National Grid. Reproduction of any part of an OS map requires copyright permission. Each plan and plot must have a bar scale or annotated metric grid and an accurately orientated north arrow. Greyscale, dot density and trace plots must also have annotated scales indicating the range of variables depicted.
12. List of all sources consulted, and their location
 13. A card cover with title, date, author, contractor organization and commissioning client
 14. Some form of binding that permits photocopying.

Report Dissemination

One paper copy of the report needs to be submitted

- for deposition in the County HER

Three pdf copies on CD are needed:

- one for the commissioning client
- one for the planning authority (Sunderland City Council)– to be submitted formally by the developer with the appropriate fee
- and one for deposition in the County HER. Please do not attach this to the report. The CD will also include the grayscale plot in a format that can be uploaded into the HER GIS system (Arcview 9.2) so that any archaeological features can be accurately digitized.

The report and CD for the HER must be sent by the archaeological consultant directly to the address below. If the report is sent via the planning department, every page of the report will be stamped with the planning application number which ruins the illustrations. The HER is often sent a photocopy instead of a bound colour original which is unacceptable.

Archiving

A viable digital copy of the raw survey data must be retained for future interrogation, together with adequate information on the location of the survey and the survey methodology. The archive must be stored on a secure medium. Survey practice and data files must be appropriately documented. The archiving of geophysical data should follow the advice in 'Geophysical Data in Archaeology: A Guide To Good Practice' by A. Schmidt 2002 (Oxbow) and 'Archaeological Archives: A Guide to Best Practice in Creation, Compilation, Transfer and Curation' by D.H. Brown 2007 (IFA on behalf of the Archaeological Archives Forum).

OASIS

The Tyne and Wear County Archaeologist supports the Online Access to the Index of Archaeological Investigations (OASIS) project. This project aims to provide an online index/access to the large and growing body of archaeological grey literature, created as a result of developer-funded fieldwork. The archaeological contractor is therefore required to register with OASIS and to complete the online OASIS form for their geophysical survey at <http://www.oasis.ac.uk/>. Please ensure that tenders for this work takes into account the time needed to complete the form. Once the OASIS record has been completed and signed off by the HER and NMR the information will be incorporated into the English Heritage Excavation Index, hosted online by the Archaeology Data Service. The ultimate aim of OASIS is for an online virtual library of grey literature to be built up, linked to the index. The unit therefore

has the option of uploading their grey literature report as part of their OASIS record, as a Microsoft Word document, rich text format, pdf or html format. The grey literature report will only be mounted by the ADS if both the unit and the HER give their agreement. The grey literature report will be made available through a library catalogue facility. Please ensure that you and your client understand this procedure. If you choose to upload your grey literature report please ensure that your client agrees to this in writing to the HER at the address below. For general enquiries about the OASIS project aims and the use of the form please contact: Mark Barratt at the National Monuments Record (tel. 01793 414600 or oasis@english-heritage.org.uk). For enquiries of a technical nature please contact: Catherine Hardman at the Archaeology Data Service (tel. 01904 8433954 or oasis@ads.ahds.ac.uk). Or contact the Tyne and Wear Archaeology Officer at the address below.

Monitoring

The Archaeological Contractor will inform the County Archaeologist of the start and end dates of the survey to enable the CA to monitor the work in progress. This specification is based on English Heritage, 2008, Geophysical Survey in Archaeological Field Evaluation. **If you need this information in another format or language, please contact Jennifer Morrison at the above address.**

Figure 1: Site location



 site location

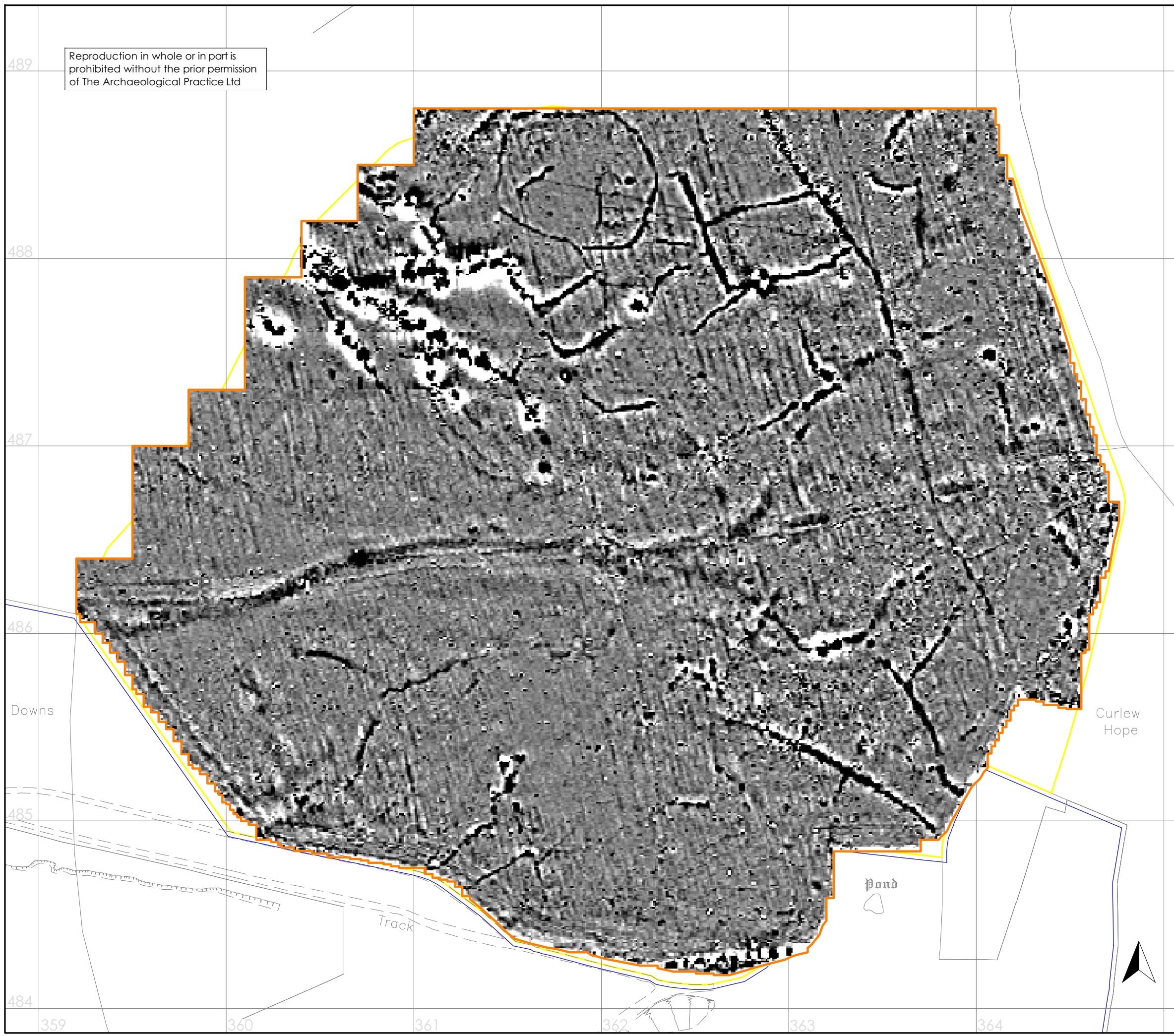
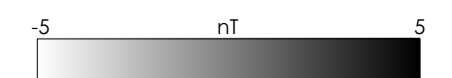
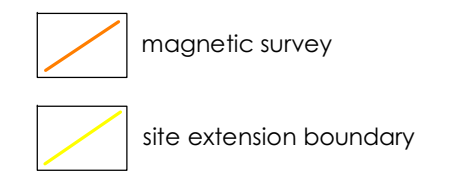
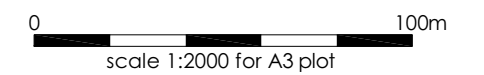
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scale 1:25 000 for A4 plot

on behalf of
The Archaeological Practice
Ltd

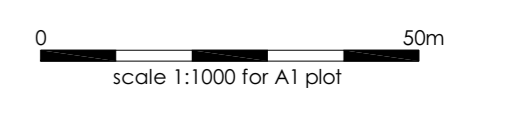
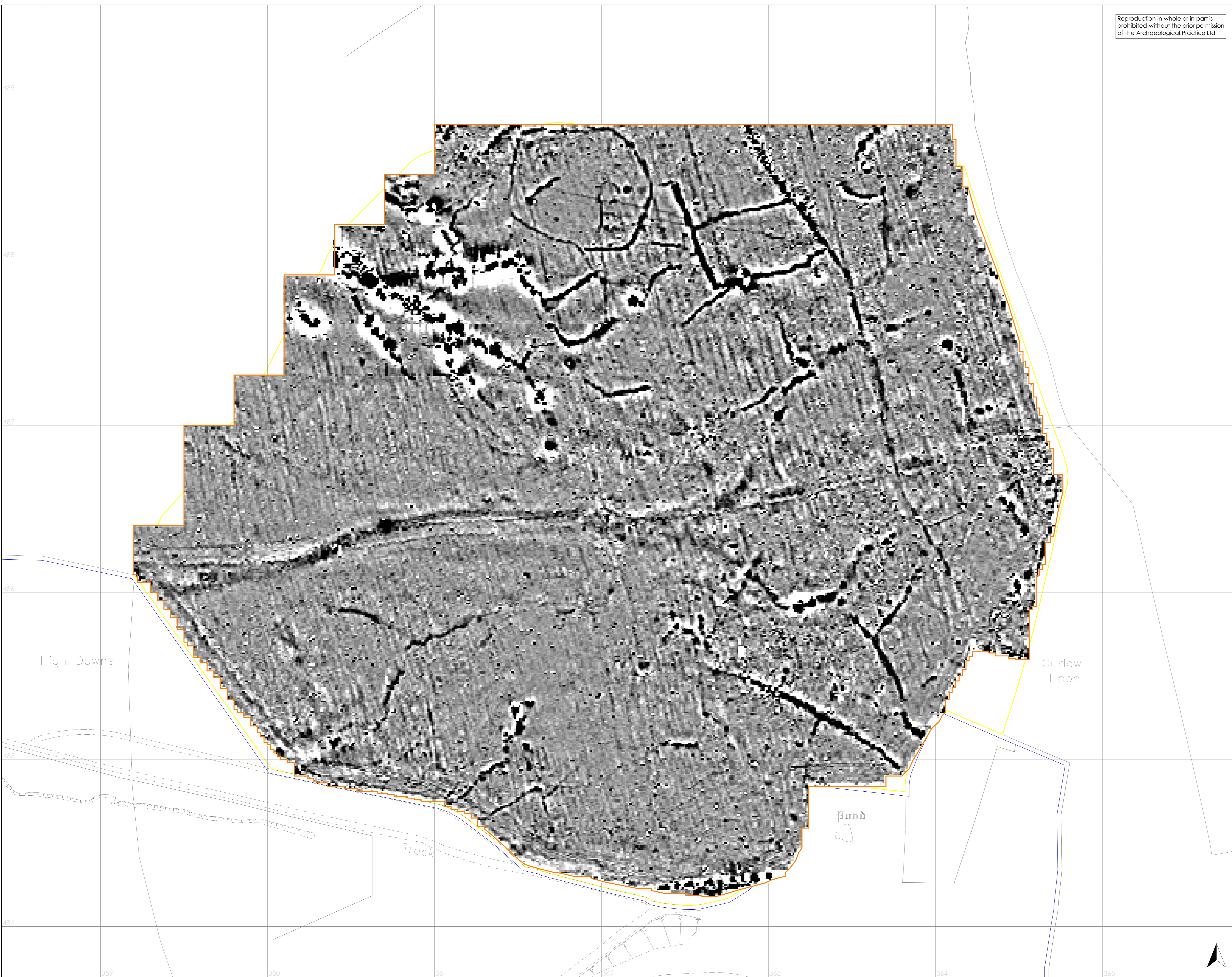
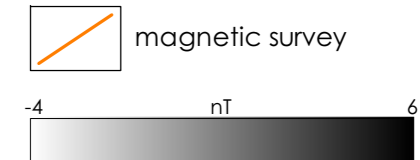
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geophysical survey
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Figure 2: Geophysical survey overview



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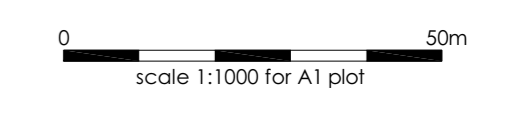
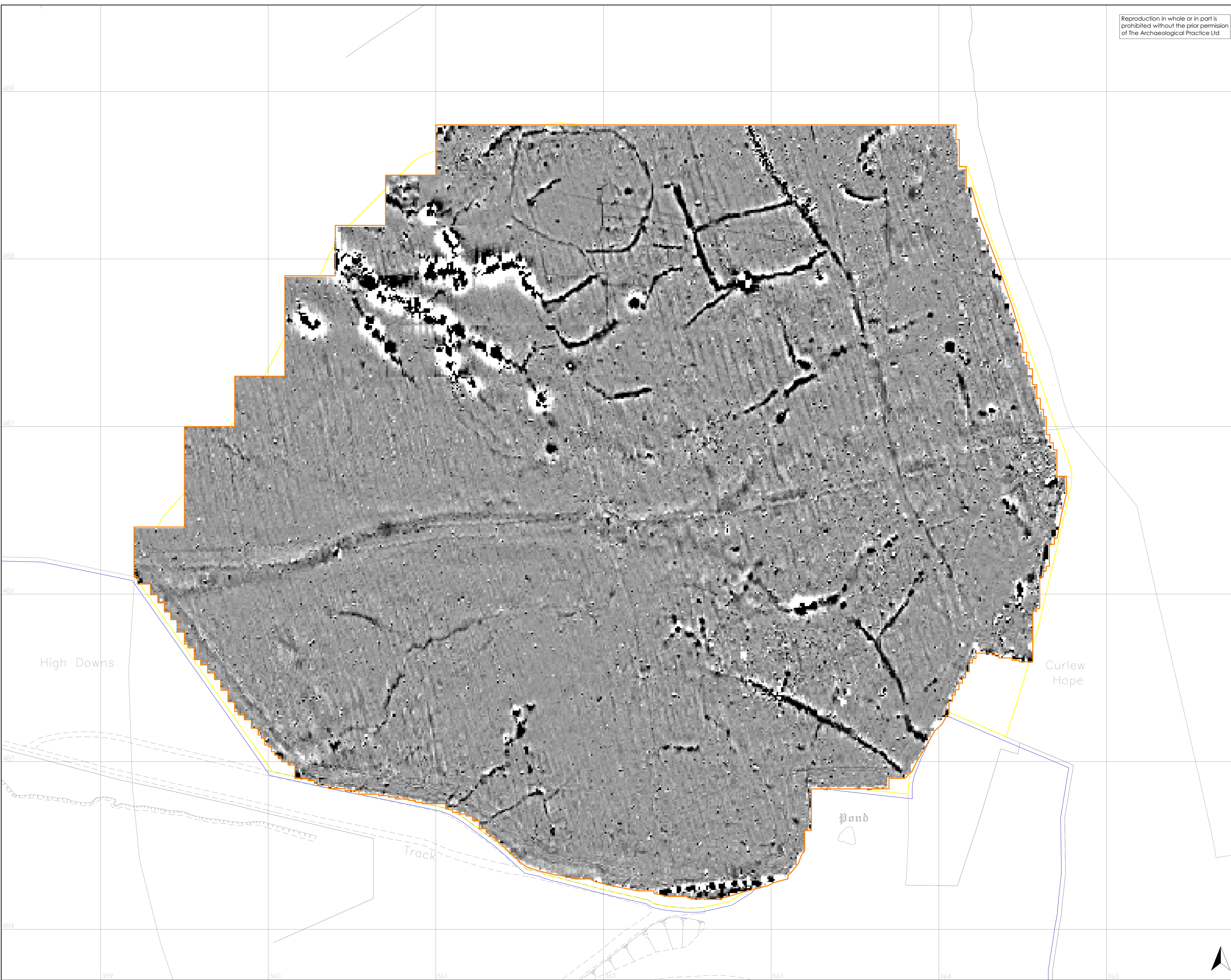
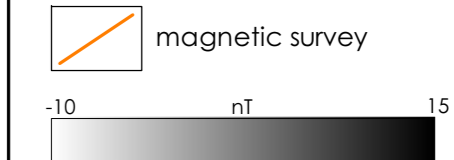
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Figure 3: Geophysical survey



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Figure 3a: Geophysical survey



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- magnetic survey
- dipolar magnetic anomaly
- positive magnetic anomaly
- negative magnetic anomaly



0 50m
scale 1:1000 for A1 plot

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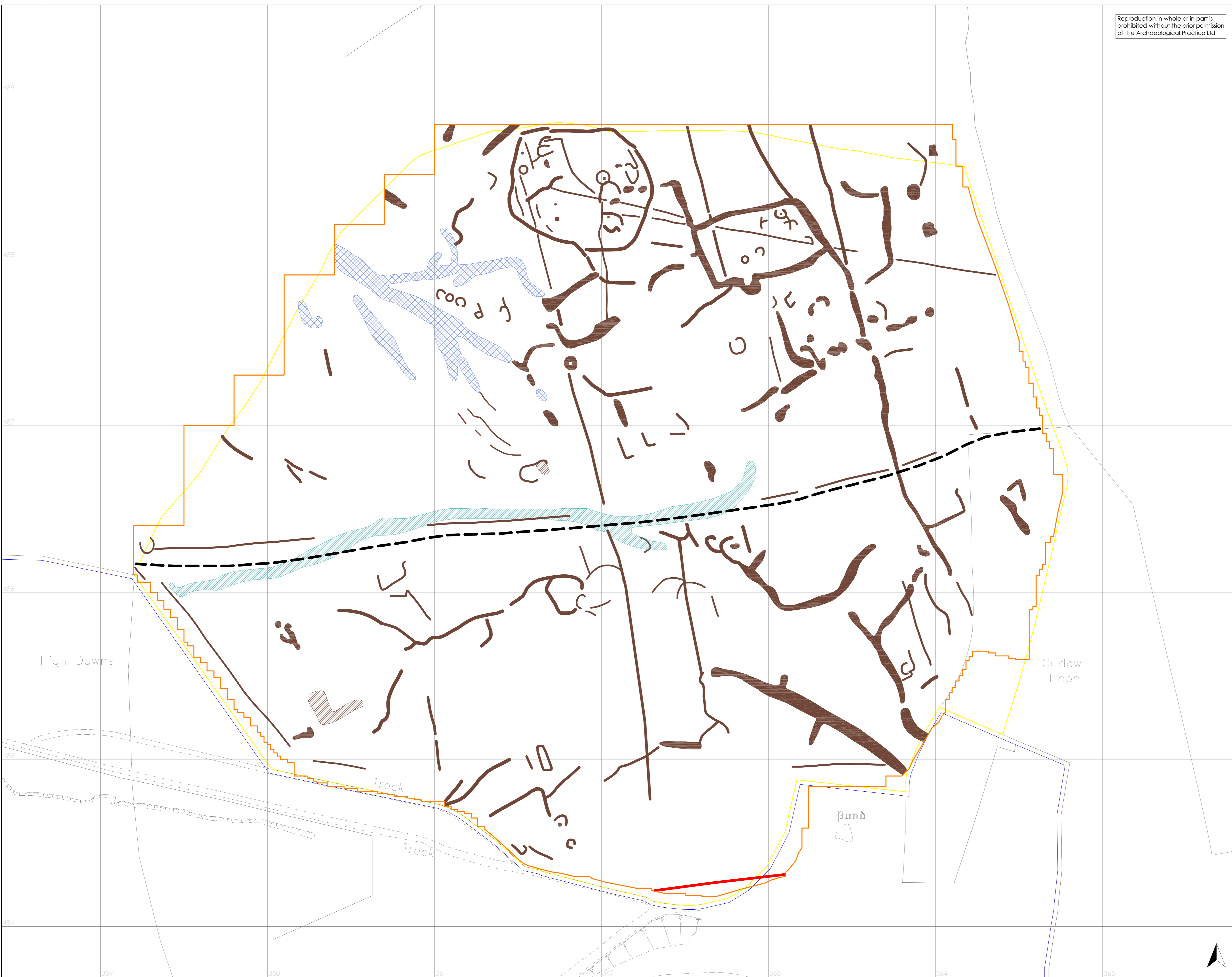
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Downs Pit Lane
Hetton-le-Hole
Sunderland

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Figure 4: Geophysical interpretation

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- magnetic survey
- soil-filled feature
- palaeochannel
- service pipe
- former field boundary
- solution fissure infilled with colliery bricks



0 50m
scale 1:1000 for A1 plot

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DURHAM UNIVERSITY

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Sunderland

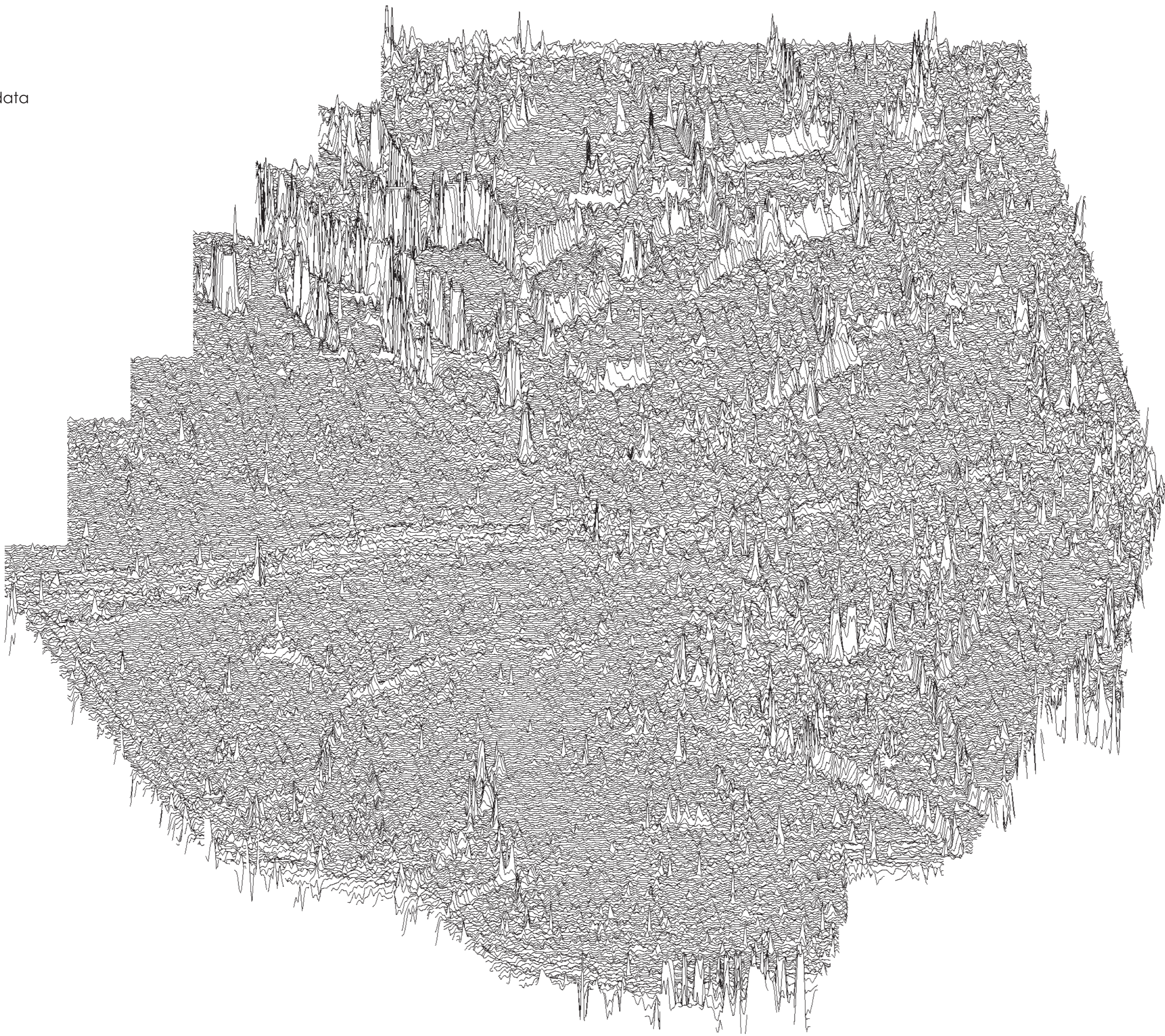
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Figure 5: Archaeological interpretation

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Figure 6:
Trace plot of geomagnetic data



43.15nT/cm



0 75m
scale 1:1500