

Land south of North Farm, Rennington, Northumberland

geophysical surveys

on behalf of

The Northumberland Estates

Report 2308

November 2009

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Estates Office, Alnwick Castle, Alnwick, Northumberland NE66 1NQ

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1. Summary

The project

- 1.1 This report presents the results of geophysical surveys conducted in advance of proposed development on land south of North Farm, Rennington, Northumberland. The works comprised the geomagnetic and resistance survey of 0.4ha of land.
- 1.2 The works were commissioned by The Northumberland Estates and conducted by Archaeological Services Durham University.

Results

- 1.3 Probable ridge and furrow cultivation was identified across the survey area, both as upstanding earthworks and sub-surface anomalies.
- 1.4 Two linear anomalies near the track in the northeast corner could reflect soil-filled ditches.
- 1.5 A linear anomaly identified in the southwest corner of the site almost certainly reflects a former field boundary shown on the 1st edition Ordnance Survey map.

2. Project background

Location (Figure 1)

- 2.1 The study area was located south of North Farm, Rennington, Northumberland (NGR centre: NZ 4210 6186). One area totalling 0.4ha was surveyed.

Development proposal

- 2.2 The development proposal is for affordable housing and associated infrastructure.

Objective

- 2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development 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 advance of development.

Methods statement

- 2.4 The surveys have been undertaken in accordance with a brief provided by Northumberland County Council Conservation Team, NCCCT ref: A32/1; 9368 (Appendix).

Dates

- 2.5 Fieldwork was undertaken on the 2nd November 2009. This report was prepared between 4th and 10th November 2009.

Personnel

- 2.6 Fieldwork was conducted by Ed Davies and Natalie Swann (Supervisor). This report was prepared by Natalie Swann with illustrations by Ed Davies and edited by Duncan Hale, the Project Manager.

Archive/OASIS

- 2.7 The site code is **RNF09**, for **Rennington North Farm 2009**. 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 **archaeol3-66835**.

3. Archaeological and historical background

- 3.1 There is documentary evidence of a settlement at Rennington from 1267 onwards. However, the current village is constructed on a different alignment to the earlier settlement and consequently cannot be used as an indication of the location, nature or extent of the earlier village.
- 3.2 In 2008 Archaeological Services (forthcoming) conducted a programme of archaeological works at a site approximately 200m from the proposed development area. The works revealed a hollow-way aligned northwest-southeast across the site, a substantial stone building to the west and the

remains of a chapel to the east. Post-excavation work is still to be completed but the initial pottery assessment dates the site to the 12th and 13th centuries.

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised part of a field of pasture to the west of Church Road, near the northern limits of the village. The site was bounded by stone walls to the east and south and a wire fence to the north; a stream ran along the east and south boundaries of the site.
- 4.2 The survey area sloped from 66m OD in the north to 64m OD in the south. A number of upstanding earthworks aligned approximately northwest-southeast cross survey area.
- 4.3 The underlying solid geology of the area comprises Alston Formation, a succession of Carboniferous sedimentary rocks including bioclastic limestones, sandstones, mudstones, siltstones and rare coals. These strata are overlain by drift geology of Devensian Till.

5. Geophysical survey

Standards

- 5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation 2nd edition* (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 previous work near the proposed development area, 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.

- 5.5 Also, given the likely presence of wall-footings or tracks, an electrical resistance survey was considered appropriate. Earth electrical resistance survey can be particularly useful for mapping stone and brick features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values.

Field methods

- 5.6 A 20m grid was established across the survey area and tied-in to known, mapped Ordnance Survey (OS) points.
- 5.7 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.
- 5.8 Measurements of earth electrical resistance were determined using a Geoscan RM15D resistance meter with a mobile twin probe separation of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1ohm, the sample interval to 1.0m and the traverse interval to 1.0m, thus providing 400 sample measurements per 20m grid unit.
- 5.9 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

- 5.10 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic/high resistance anomalies are displayed as dark grey and negative magnetic/low resistance anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla/ohm as appropriate.
- 5.11 The following basic processing functions have been applied to one or both datasets:

clip clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally

	makes statistical calculations more realistic (magnetic data).
<i>zero mean traverse</i>	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 (magnetic data).
<i>despike</i>	locates and suppresses iron spikes in gradiometer data/spikes due to poor contact resistance in resistance data (both).
<i>interpolate</i>	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals (both).

Interpretation: anomaly types

- 5.12 Colour-coded geophysical interpretations are provided. Three types of geomagnetic anomaly have been distinguished in the data:

<i>positive magnetic</i>	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.
<i>negative magnetic</i>	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.
<i>dipolar magnetic</i>	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.

- 5.13 Two types of resistance anomaly have been distinguished in the data:

<i>high resistance</i>	regions of anomalously high resistance, which may reflect foundations, tracks, paths and other concentrations of stone or brick rubble.
<i>low resistance</i>	regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches.

Interpretation: features

- 5.14 A colour-coded archaeological interpretation plan is provided.
- 5.15 A series of broad positive magnetic and high resistance anomalies aligned northwest-southeast have been detected. These anomalies correspond to upstanding earthworks and may be associated with former ridge and furrow cultivation, or possibly geomorphological features associated with palaeochannels of the stream which now runs along the eastern field boundary.

- 5.16 In the southwest corner of the survey area a discontinuous, linear positive magnetic anomaly and a corresponding low resistance anomaly have been detected. Both anomalies are likely to reflect a soil-filled feature such as a ditch or grubbed-out hedge. This appears to correspond to an historic field boundary shown on the 1st edition OS map.
- 5.17 Series of parallel, alternate positive and negative magnetic/high and low resistance anomalies have been detected to both the north and south of the historic field boundary. These anomalies are likely to reflect former ridge and furrow cultivation.
- 5.18 Towards the northeast corner of the site two linear positive magnetic anomalies have been detected, which could reflect soil-filled features such as ditches.
- 5.19 The dipolar magnetic anomalies in the northeast corner of the survey area, and a high electrical resistance anomaly, reflect the existing track and also possibly where the stream is culverted underground, as shown on the 1st edition OS map.
- 5.20 Two dipolar magnetic anomalies on the eastern edge of the survey area correspond to service inspection covers. A linear low resistance anomaly along the eastern edge of the survey area probably reflects the service pipe between these covers.
- 5.21 Across the site there are a number of discrete dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments.

6. Conclusions

- 6.1 0.4 ha of geomagnetic and earth resistance survey was undertaken on land south of North Farm, Rennington, Northumberland, prior to proposed development.
- 6.2 Probable ridge and furrow cultivation was identified across the survey area as upstanding earthworks and sub-surface anomalies.
- 6.3 Two linear anomalies near the track in the northeast corner could reflect soil-filled ditches.
- 6.4 A linear anomaly identified in the southwest corner of the site almost certainly reflects a former field boundary shown on the 1st edition Ordnance Survey map.

7. Sources

Archaeological Services forthcoming *Land off Church Road, Rennington, Northumberland: archaeological monitoring*. Unpublished report, Archaeological Services Durham University

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*, 2nd edition. 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

Northumberland Estates ref: CLB/sb
NCCCT ref: A32/1; 9368

LAND AT RENNINGTON, NORTHUMBERLAND

Brief for an Archaeological Geophysical Survey

1 Introduction

- 1.1 Northumberland County Council (NCC) Conservation Team has been consulted at a pre-application stage concerning the archaeological implications of a proposed housing development in Rennington (Fig 1). There are documentary references to a settlement at Rennington from 1267 onwards. The current village is constructed on a different orientation to the earlier village and consequently cannot be used as an indication of the nature, extent and location of the earlier village.
- 1.2 In 2008, Archaeological Services (Durham University) undertook a programme of archaeological investigation on a site known as the Orchard, c. 200m south-east of the proposed development area. While the work is ongoing and post-excavation work and reporting is still required, work on the site revealed a hollow way running c.north-west to south-east across the site with a substantial stone building to the west with associated remains and a chapel to the east. An initial on-site assessment of the pottery appears to indicate that the site was in use between the 12th and 13th centuries with very little evidence of activity or land-use after that date. There may also be some evidence of burning or intentional demolition in the medieval period. Further on-site investigation and post-excavation work will hopefully provide a more detailed understanding of the archaeological remains on this site.
- 1.3 The proposed development is located on a comparable alignment to the remains revealed to the south-east. The density, complexity and importance of those remains are such that it is vital to establish whether comparable remains are present on the proposed development area. NCC Conservation Team would therefore advise the planning authority and the Northumberland Estates that pre-determination work comprising geophysical survey followed by trial trenching would be required for a future planning application on this site.
- 1.4 This brief constitutes Northumberland County Council Conservation Team's justification for the investigation, its objectives and the strategy and procedures to apply to the programme of geophysical survey. **This brief does not constitute the 'written scheme of investigation'.**
- 1.5 The brief is intended to establish the project parameters to enable an archaeological consultant or contractor to tender for the work and once commissioned to prepare and submit an appropriate Method Statement, Project Design or Specification to the Conservation Team for approval prior to work commencing. The project design should be based on a thorough study of all relevant background information, in particular any assessment or evaluation reports or, in their absence, data held or referenced in Northumberland Historic Environment Record Office (HER).
- 1.6 The extent of the development (Fig 1) has been taken from plans provided by the Northumberland Estates. The archaeological consultant or contractor will need to confirm the extent of the development with the developer as part of the specification.

2 Site Specific Requirements

- 2.1 The geophysical survey is designed to discover whether there are any archaeological constraints on the planned development. The purpose of the geophysical survey is to quickly evaluate an area to identify the presence or absence of possible archaeological remains, their location and, if possible, a tentative interpretation of their function and date. The results of the survey will help to identify specific anomalies that may warrant further archaeological evaluation, the most likely form of which would be a programme of trial trenching.
- 2.2 Given the size of the development and the potential for stone-built structures and soil filled features on this site, geophysical survey will be required across the whole of this site comprising **both** resistivity and gradiometer surveys.
- 2.3 Access arrangements should be confirmed with the commissioning architect.

3 General Standards

- 3.1 All work will be carried out in compliance with the codes of practice of the Institute of Field Archaeologists (IFA) ¹ and will follow the IFA Standard and Guidance for Archaeological Field Evaluation² and the English Heritage Guidelines for Geophysical Survey³. Archaeological contractors must be able to prove that they have appropriate experience and current insurance to undertake the work.
- 3.2 All staff must be suitably qualified and experienced for their project roles.

4 Post excavation work, archive, and report preparation

4.1 Site Archive

- 4.1.1 The archive must be deposited in the appropriate local museum, within **6 months** of completion of the post-excavation work and report. This should comprise:
 - i) A copy of the report
 - ii) Raw data and original illustrations that are not included in the report
 - iii) A digital copy of the report and illustrations, where appropriate
- 4.1.2 Before the commencement of fieldwork, contact should be made with the landowners and with the appropriate local museum to make the relevant arrangements. Details of land ownership should be provided by the developer. Details of the appropriate museum can be provided by the Assistant County Archaeologist.
- 4.1.3 **Northumberland County Council will require confirmation that the archive had been submitted in a satisfactory form to the relevant museum.**

¹ Institute of Field Archaeologists, 2000, Code of Conduct

² Institute of Field Archaeologists, 2001, Standard and Guidance for archaeological field evaluation

³ David A, 1995. *Geophysical Survey in archaeological field evaluation*. English Heritage Research and Professional Services Guideline No. 1

4.2 Report

4.2.1 The geophysical survey is the first stage in a potential multi-staged programme of archaeological work and has been requested prior to the determination of planning permission.

4.2.2 The Conservation Team require two copies of the report (one bound and one unbound)

4.2.3 Each page and paragraph should be numbered within the report and illustrations cross-referenced within the text.

4.2.4 The report should include as a minimum the following:

- i) NCCI Conservation Team reference, OASIS reference number and an 8 figure grid reference
- ii) A location plan of the site at an appropriate scale of at least 1:10 000
- iii) A location plan showing the location of the blocks of geophysical survey. This must be at a recognisable planning scale, and located with reference to the national grid, to allow the results to be accurately plotted on the Sites and Monuments Record
- iv) Copies of the following plots:
 - i) trace
 - ii) grey scale
 - iii) interpretative
- v) A summary statement of the results
- vi) A discussion and interpretation of the results of the survey
- vii) **Any variation to the above requirements should be approved by the planning authority prior to work being submitted**

4.3 OASIS

4.3.1 Northumberland County Council Conservation Team and HER support the Online Access to Index of Archaeological Investigations (OASIS) Project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large scale developer funded fieldwork.

4.3.2 The archaeological consultant or contractor must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/>. If the contractors are unfamiliar with OASIS, they are advised to contact Northumberland HER prior to completing the form. Once a report has become a public document by submission to or incorporation into the HER, Northumberland HER will validate the OASIS form thus placing the information into the public domain on the OASIS website. **The archaeological consultant or contractor must indicate that they agree to this procedure within the specification/project design/written scheme of investigation submitted to Northumberland County Council Conservation Team for approval**

4.4 Publication

4.4.1 A summary should be prepared for 'Archaeology in Northumberland' and submitted to Liz Williams, Northumberland HER Officer, by December of the year in which the work is completed.

4.4.2 A short report of the work should also be submitted to a local journal if appropriate.

5 Monitoring

- 5.1 The County Archaeologist must be informed on the start date and timetable for the evaluation **in advance** of work commencing.
- 5.2 Reasonable access to the site for the purposes of monitoring the archaeological scheme will be afforded to the County Archaeologist or his/her nominee at all times.
- 5.3 Regular communication between the archaeological contractor, the County Archaeologist and other interested parties must be maintained to ensure the project aims and objectives are achieved.

6 Further Guidance

- 6.1 Any further guidance or queries regarding the provision of a specification should be directed to:

Karen Derham
Assistant County Archaeologist
Northumberland County Council
County Hall
Morpeth
Northumberland
NE61 2EF

Tel: 01670 534057
Fax: 01670 533409
e-mail: karen.derham@northumberland.gov.uk

3/4/09

FOR COPYRIGHT REASONS, ALL MAPS SUPPLIED BY NORTHUMBERLAND COUNTY COUNCIL MUST BE RETURNED TO THEM ON COMPLETION OF THE PROJECT



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Land south of North Farm, Rennington,
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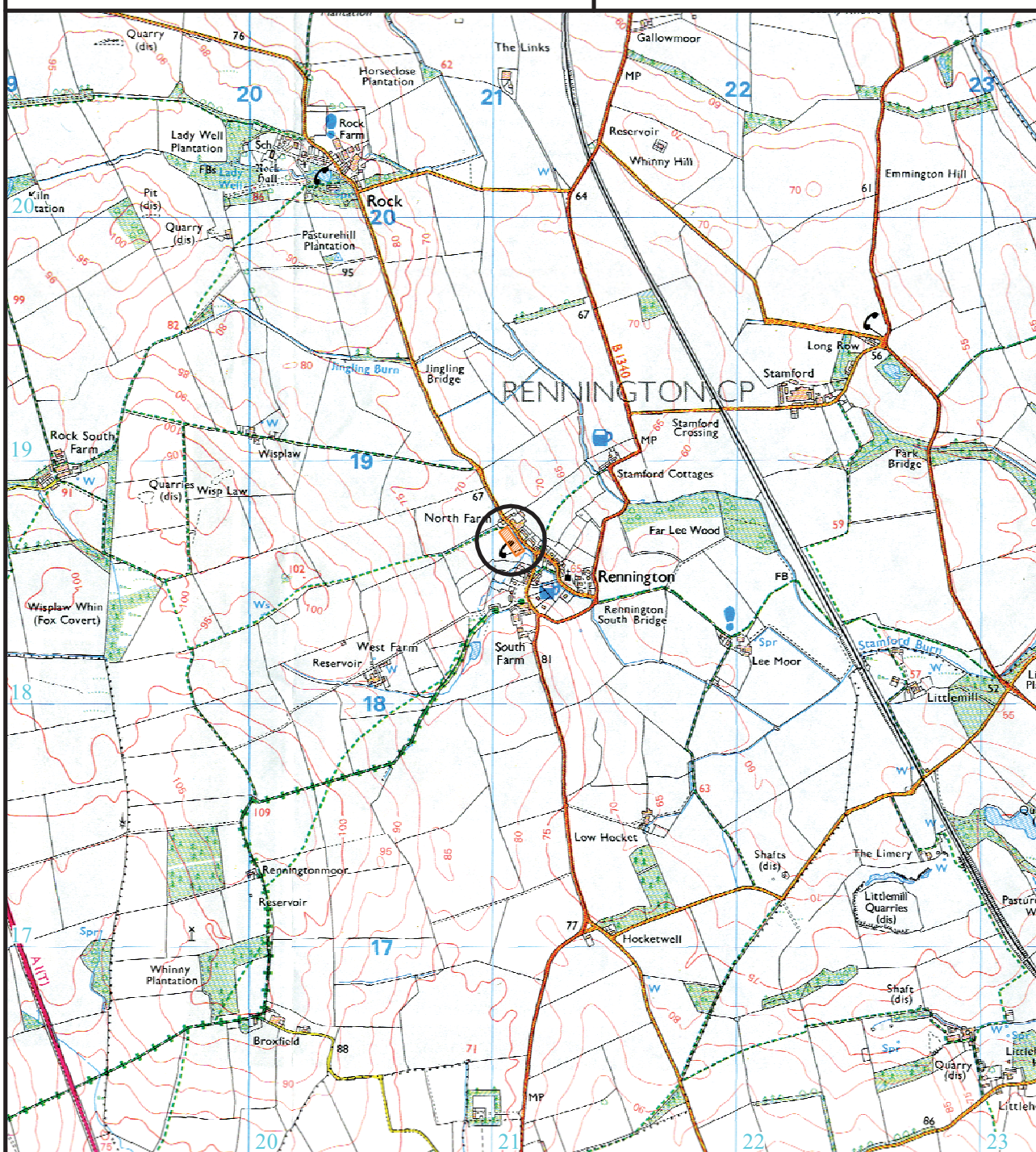
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Figure 1

Site location

on behalf of
The Northumberland Estates

*Reproduced from Explorer 332 1:25 000 by
permission of Ordnance Survey on behalf of
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location of surveys

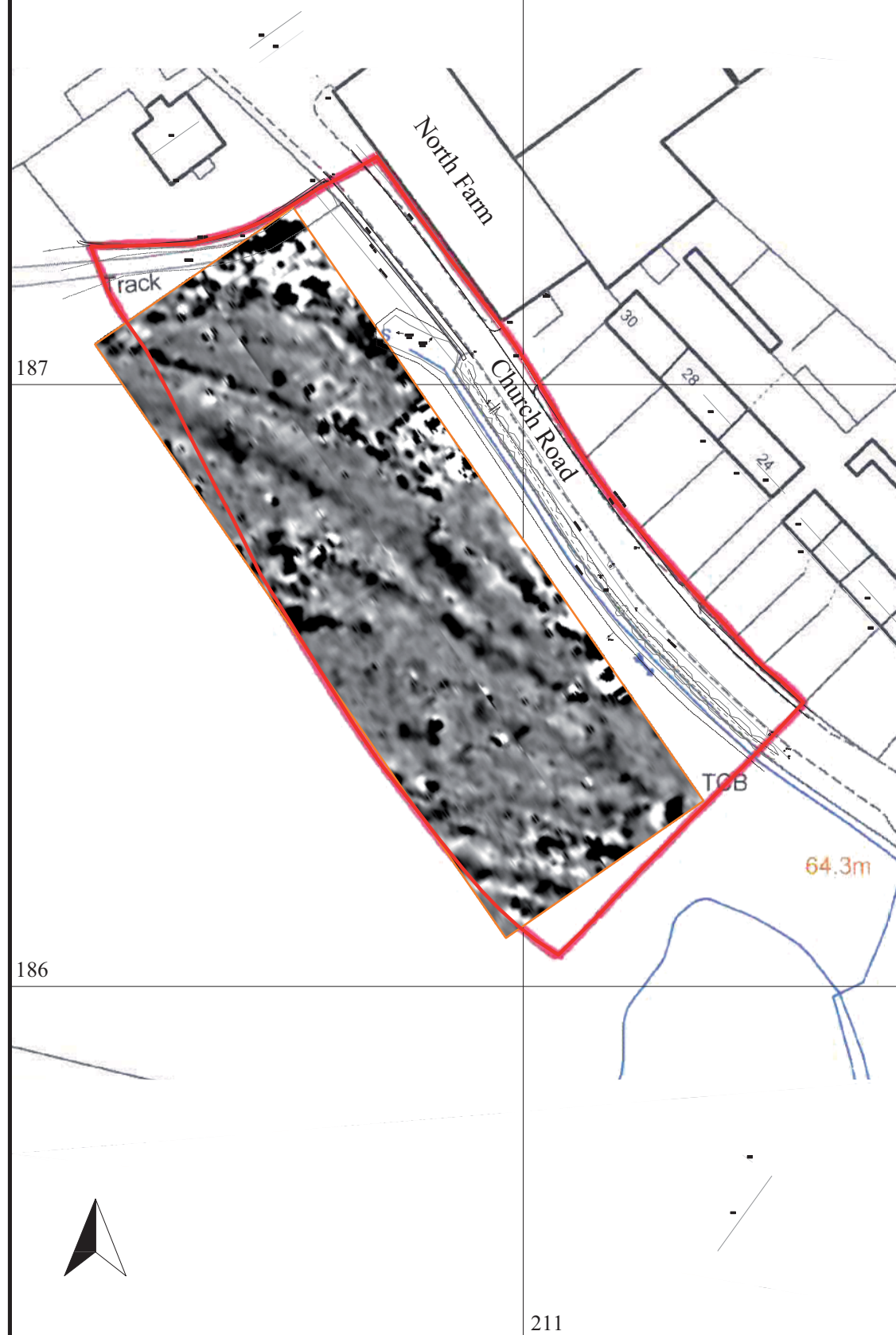
0 1km
scale 1:25 000 - for A4 plot



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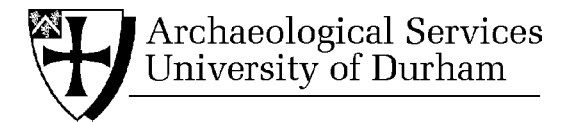
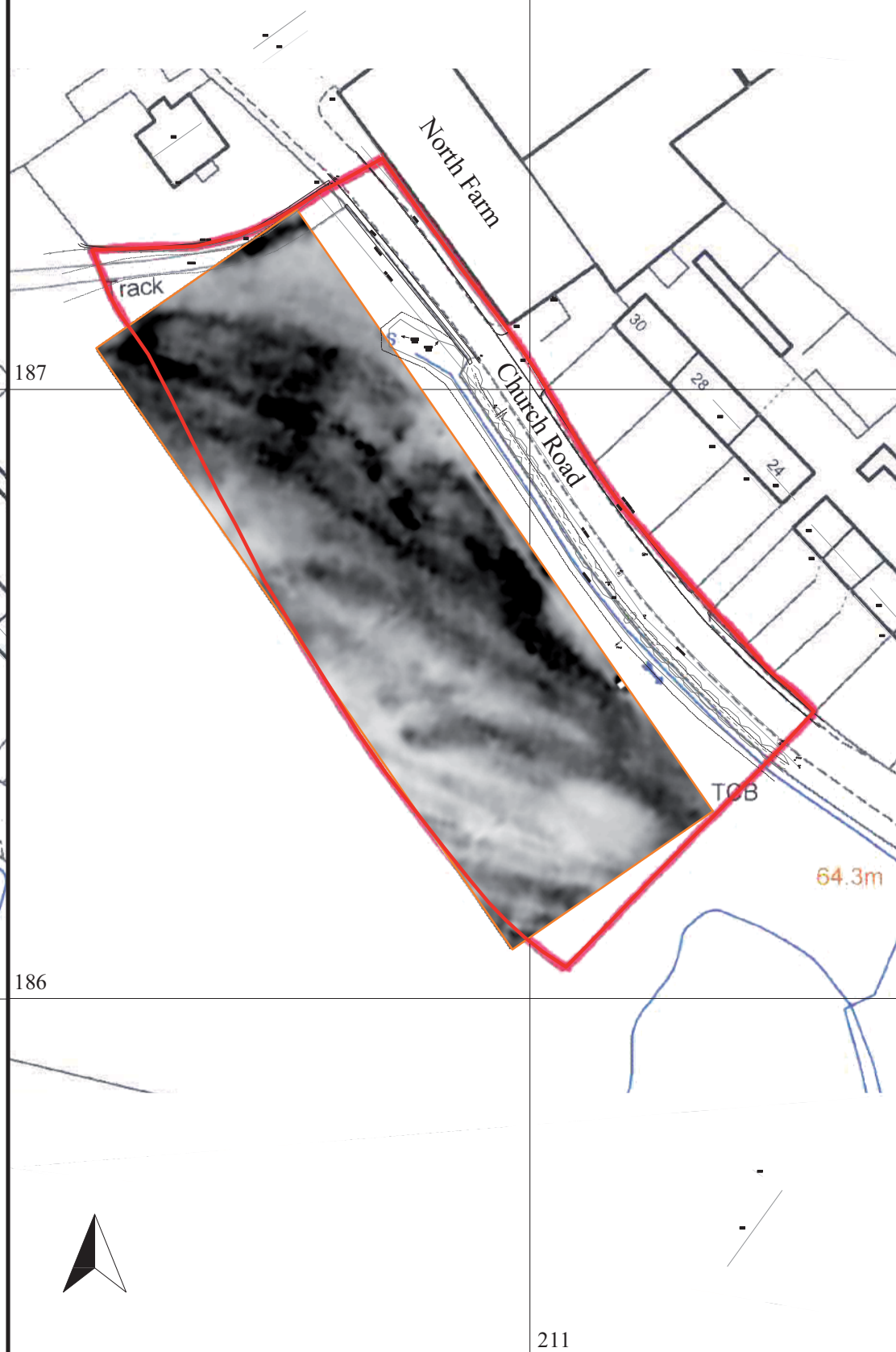
A

Geomagnetic



B

Resistance



Land south of North Farm,
Rennington, Northumberland

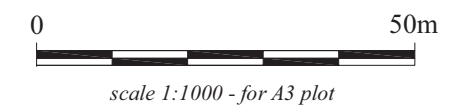
geophysical surveys

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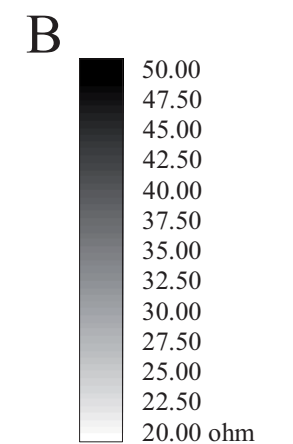
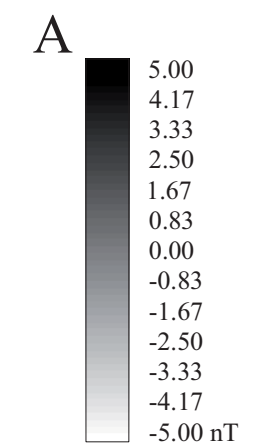
Figure 2

Geomagnetic and resistance surveys

on behalf of
The Northumberland Estates



 survey area



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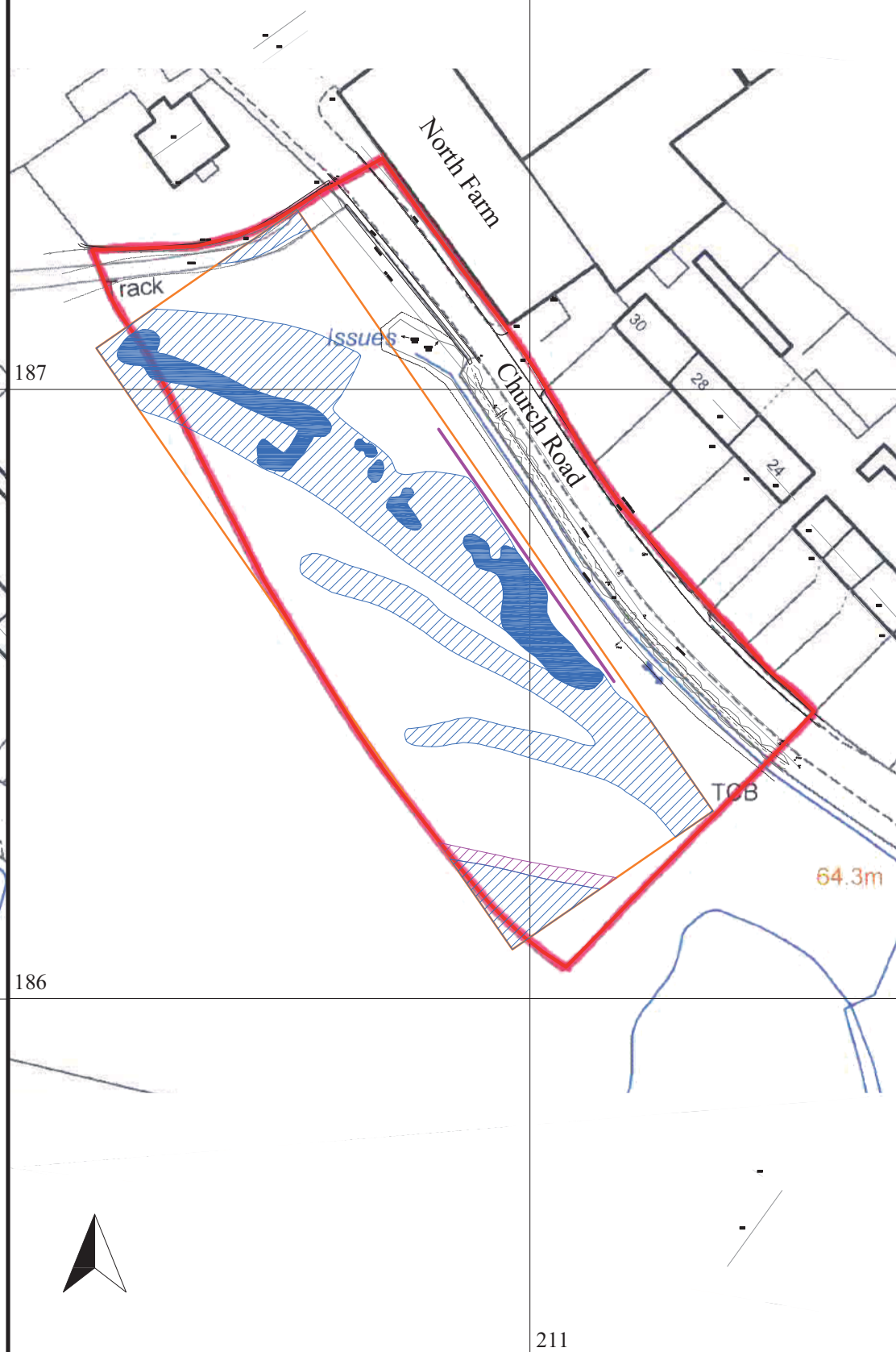
A

Geomagnetic



B

Resistance



Land south of North Farm,
Rennington, Northumberland

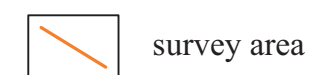
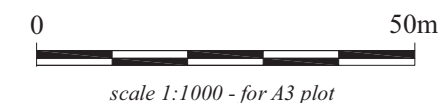
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Figure 3

Geophysical interpretations

on behalf of
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survey area

A positive magnetic anomalies

dipolar magnetic anomalies

B high resistance anomalies

low resistance anomalies



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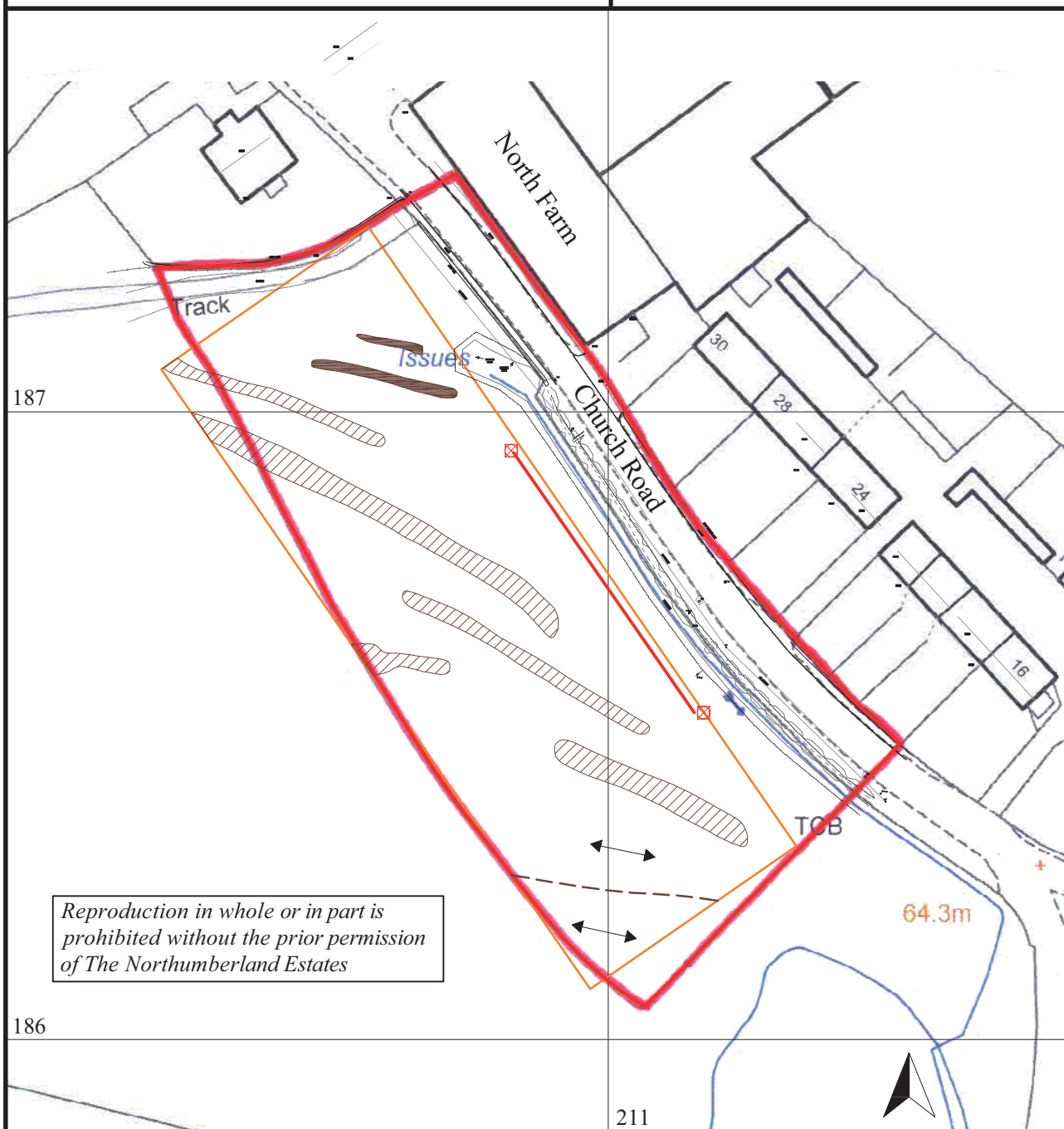
Figure 4

Archaeological interpretation

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0 50m

scale 1:1000 - for A4 plot



survey area



soil-filled
features



upstanding
earthworks



former field
boundary



manhole

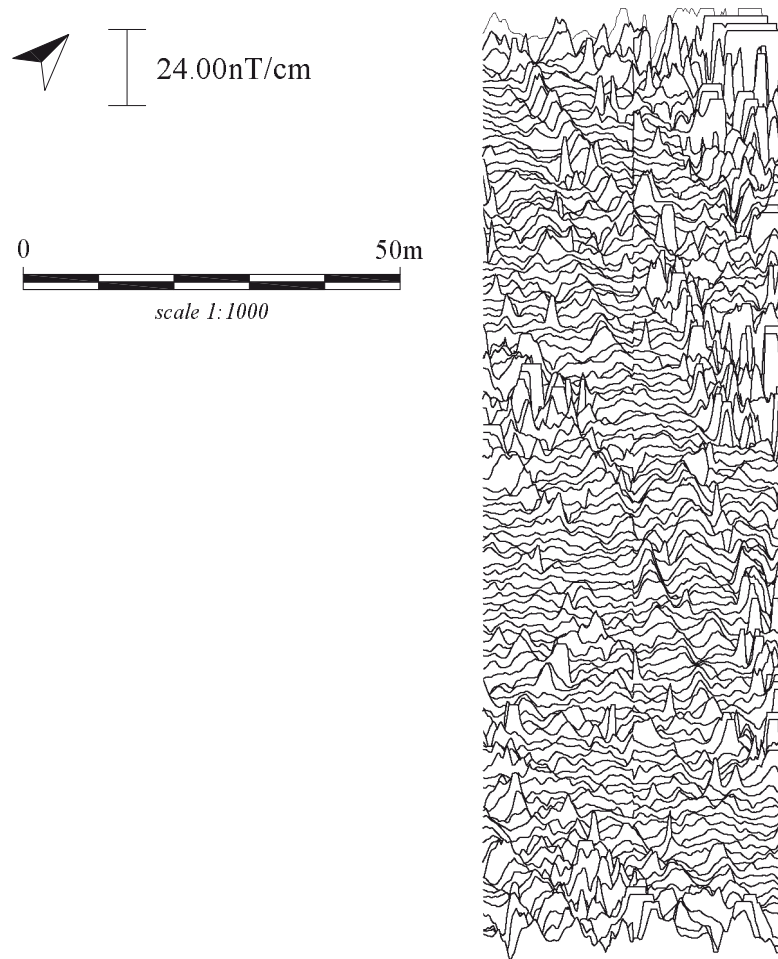


services



ridge and furrow

Magnetic survey



Resistance survey

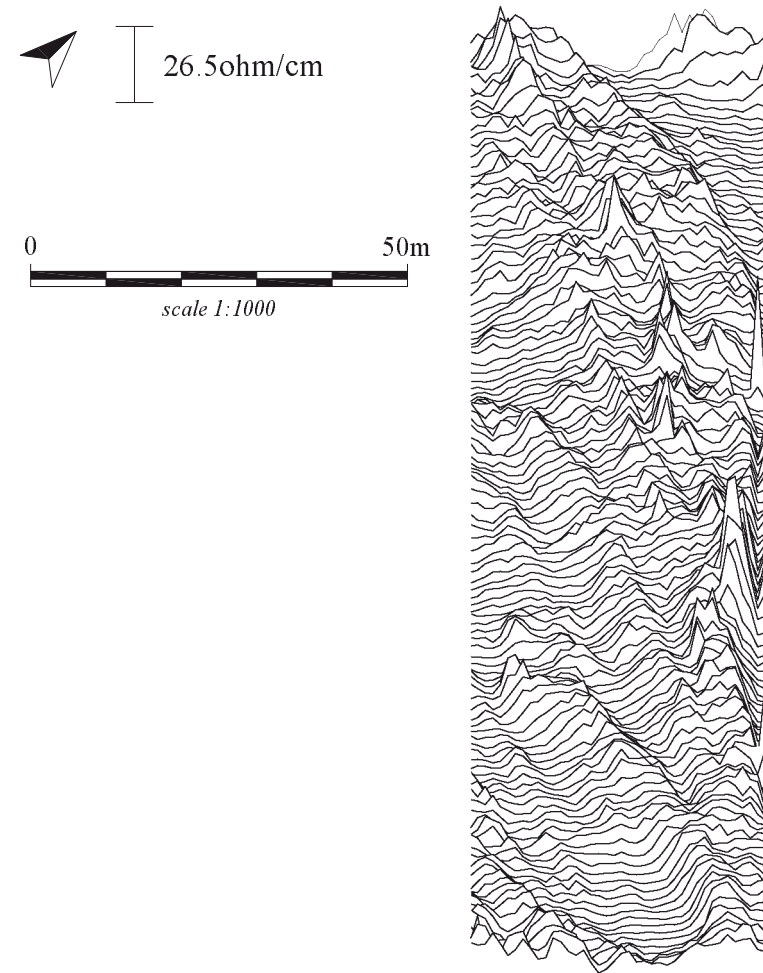


Figure 5: Trace plots of geomagnetic and resistance data