

Low Burnhall Wood, County Durham

geophysical surveys

on behalf of

The Woodland Trust

Report 2336
January 2010

Archaeological Services
Durham University
South Road
Durham DH1 3LE
Tel: 0191 334 1121
Fax: 0191 334 1126

archaeological.services@durham.ac.uk
www.durham.ac.uk/archaeological.services

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1. Summary

The project

- 1.1 This report presents the results of geophysical surveys conducted in advance of a proposed woodland development scheme on the north bank of the River Wear, County Durham. The works comprised the geomagnetic survey of 13 areas totalling 14ha.
- 1.2 The works were commissioned by The Woodland Trust and conducted by Archaeological Services Durham University.

Results

- 1.3 With the exception of Areas 41j-a and 41s, possible archaeological features were detected in all survey areas. Some of these correspond to former field boundaries and other features shown on early OS maps, the dates and functions of which are broadly known. However, the dates, functions and significance of many other features remain undetermined.
- 1.4 In Area 41e, on the relatively high plateau, possible ring-ditches and a possible sub-circular enclosure were identified; two worked flints were also collected here during survey. The former Croxdale Pit engine house and waggonway were also detected in 41e.
- 1.5 Probable rectangular enclosures, and possible ring-ditches, were identified in Area 41k. Other potential ditched enclosures were detected in Area 41f and the south of Area 41m-a.
- 1.6 Former field boundaries and tracks have been detected in Areas 41e, 41k-a, 41k-b and 41m-b.
- 1.7 Traces of former ridge and furrow cultivation have been detected in all but one of the areas surveyed, 41n.

Recommendations

- 1.8 Some of these features warrant further investigation by trial trenching in order to determine their date, function and significance; such evaluation may demonstrate that some anomalies do not reflect features of archaeological significance and may identify areas in which the proposed woodland scheme is unlikely to impact on an archaeological resource.

2. Project background

Location (Figures 1 & 2)

- 2.1 The study area was located north of the River Wear, east of the A167 and southwest of Durham City, County Durham (NGR centre: NZ 2673 3925). Thirteen surveys totalling 14ha were conducted in ten land parcels.

Development proposal

- 2.2 The development proposal is for tree planting and associated works, including some deep ploughing, to create a large publicly accessible native woodland on the edge of Durham City.

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 specification provided by Durham County Council Archaeology Section (Appendix) and a Written Scheme of Investigation prepared by Archaeological Services.

Dates

- 2.5 Fieldwork was undertaken between 14th and 17th December 2009. This report was prepared between 4th and 8th January 2010.

Personnel

- 2.6 Fieldwork was conducted by Matt Claydon, Ed Davies, David Graham, Andy Platell and Natalie Swann (Supervisor). Geophysical data were processed by Natalie Swann and Duncan Hale. This report was prepared by Natalie Swann and Duncan Hale, the Project Manager, with illustrations by Ed Davies.

Archive/OASIS

- 2.7 The site code is **DLB09**, for **Durham Low Burnhall 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 **archaeol3-70051**.

3. Archaeological and historical background

- 3.1 An archaeological assessment of the site was conducted prior to the surveys (Richardson 2009). This concluded that known medieval, post-medieval and industrial archaeological sites lie within the development area, including the remains of Croxdale Pit, an engine house, a waggonway and a clay pit. There is also aerial photographic evidence for medieval ridge and furrow and a medieval fish pond or mill site.

- 3.2 Prehistoric settlement and ritual sites are present in the immediate and wider area. Immediately northeast of the site boundary at Houghall Farm an oval shaped enclosure (HER 6921) was identified from aerial photographs and is possibly prehistoric in origin. Several barrow sites have also been recorded close to the northeast and east boundary of the site. At High Houghall a Bronze Age sword (HER 4945) was found within a test pit excavated by University of Sunderland engineers (Archaeological Services 1997). A prehistoric site is located 1.5km to the northeast at Mountjoy (HER 8620) where a series of large ditches define a promontory site with dating evidence extending from the Neolithic through to the Bronze Age period (TWM Archaeology forthcoming).

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised seven fields of arable land and three fields of set-aside land (Areas 41h, q & s).
- 4.2 The proposed development area slopes down from approximately 92m OD in the north (Area 41e) to approximately 45m OD in the south (Area 41s). Areas 41k and m were predominantly level at about 50m OD. There is also a slope from 50m OD at the western side of 41n down to about 45m OD in Area 41q.
- 4.3 The underlying solid geology of the area comprises Carboniferous Middle Coal Measures, which include bands of sandstone above and below the Durham Low Main coal seam. These are overlain by drift consisting of boulder clays, sands and gravels laid down during the last ice age (BGS 1977).

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 the desk-based assessment and aerial photographs of the 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.

Field methods

- 5.5 A 30m grid was established across each 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 0.03nT/m, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 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 trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 3-28; the trace plots are provided in Figure 29. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.

- 5.9 The following basic processing functions have been applied to each dataset:

<i>clip</i>	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
<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.
<i>destagger</i>	corrects for displacement of anomalies caused by alternate zig-zag traverses.
<i>despike</i>	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 0.25m x 0.25m intervals.

Interpretation: anomaly types

5.10 Colour-coded geophysical interpretation plans are provided. Three types of geomagnetic 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

General comments

5.11 Colour-coded archaeological interpretation plans are provided.

5.12 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These 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. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

Area 41e

5.14 Two of the linear positive magnetic anomalies which cross this survey area, one aligned northeast-southwest and the other northwest-southeast, reflect soil-filled features which correspond to old field boundaries as shown on the 1st edition Ordnance Survey (OS) map of 1857.

5.15 A number of curvilinear positive magnetic anomalies have been detected across the survey area; these anomalies could possibly reflect the remains of soil-filled features such as ring-ditches.

- 5.16 In the northeast corner of the survey area another possible curvilinear ditch has been detected, which is much larger than those to the west. This is also likely to reflect a soil-filled feature such as a ditch and may represent a sub-circular enclosure. Two pieces of worked flint, both flakes, were collected from the ground surface here during survey. Immediately north of this two parallel positive magnetic anomalies may also reflect soil-filled ditches.
- 5.17 Linear positive magnetic anomalies have also been detected in the northwest corner of the area, which may reflect soil-filled features such as ditches.
- 5.18 A series of parallel positive magnetic anomalies, aligned northwest-southeast, was detected across the survey area; these anomalies are likely to reflect former ridge and furrow cultivation. A second series of parallel positive magnetic anomalies aligned northeast-southwest probably reflects another phase of ridge and furrow cultivation.
- 5.19 In the east of the survey area, two linear and two rectangular concentrations of dipolar magnetic anomalies have been detected. These anomalies correspond to the remains of an engine house and waggonway from the Croxdale Pit, as shown on the 1st edition OS map.
- 5.20 In the southwest corner of the survey area a chain of dipolar magnetic anomalies has been detected, which almost certainly reflects a ferrous service pipe.

Area 41f

- 5.21 A chain of linear dipolar magnetic anomalies has been detected aligned north-south; this almost certainly reflects a ferrous service pipe.
- 5.22 A series of parallel positive magnetic anomalies has been detected aligned northwest-southeast across the survey area; these anomalies are likely to reflect former ridge and furrow cultivation.
- 5.23 A number of other linear positive magnetic anomalies have also been detected. These anomalies are likely to reflect soil-filled ditches, two of which may form one corner of an enclosure.

Area 41h

- 5.24 Former ridge and furrow cultivation has almost certainly been detected in this area as a series of parallel positive magnetic anomalies aligned approximately northeast-southwest.
- 5.25 A number of other linear and curvilinear positive magnetic anomalies have been detected across the survey area, which may reflect soil-filled ditches.
- 5.26 The dipolar magnetic anomaly near the centre of the survey area corresponds to a telegraph pole; the chain of dipolar magnetic anomalies north of this is likely to reflect an underground cable. Another pipe or cable has been detected across the southwestern corner of this survey.

Area 41j-a

- 5.27 Two series of parallel magnetic anomalies have been detected across the survey area, one series aligned northeast-southwest and the other northwest-southeast. These are likely to reflect two former phases of ridge and furrow cultivation.

Area 41j-b

- 5.28 At the southwest end of this area a number of positive magnetic anomalies have been detected which could reflect soil-filled pits and ditches.
- 5.29 A broad, diffuse positive magnetic anomaly has been detected in the central part of this area. This may reflect a geological feature, possibly a palaeochannel of the stream which is now adjacent to the track immediately south of here.
- 5.30 Parallel positive magnetic anomalies aligned northeast-southwest are likely to reflect former ridge and furrow cultivation of the area.

Area 41k-a

- 5.31 Ridge and furrow cultivation has almost certainly been detected across this area as a series of parallel alternate positive and negative magnetic anomalies, aligned northeast-southwest.
- 5.32 The linear positive and negative magnetic anomalies aligned northwest-southeast in the north end of the survey area are likely to reflect a headland, a former field boundary (shown on the 1st edition OS map) and an adjacent ditched trackway. The linear positive magnetic anomaly aligned northeast-southwest across the centre of the survey area also reflects a field boundary shown on the 1st edition OS map. Additional double-ditched tracks have probably been detected parallel to existing field boundaries in the east and north-east of this survey area.
- 5.33 In the northern half of the survey area a number of linear and rectilinear positive magnetic anomalies have been detected. These almost certainly reflect soil-filled features such as ditches and may represent enclosures and former field boundaries. A number of small, discrete positive magnetic anomalies which could reflect soil-filled pits were also detected in this area; others appear to form a very small rectilinear enclosure.
- 5.34 In the southern half of the survey area a number of curvilinear positive magnetic anomalies have been detected, which could possibly reflect ring-ditches.

Area 41k-b

- 5.35 A series of parallel, alternate positive and negative magnetic anomalies has been detected across the survey area aligned northeast-southwest; these anomalies are likely to reflect former ridge and furrow cultivation.

- 5.36 A linear positive magnetic anomaly detected across the centre of the survey area, also aligned northeast-southwest, corresponds to the former field boundary shown on the 1st edition OS map and detected in Area 41k-a.
- 5.37 Two parallel positive magnetic anomalies were detected aligned north-south; these may reflect the remains of ditches possibly associated with a former trackway.
- 5.38 The dipolar magnetic anomaly near the centre of the survey is likely to reflect a large item of ferrous debris.

Area 41m-a

- 5.39 A series of very weak parallel positive magnetic anomalies was detected across this survey area. These anomalies are likely to reflect former ridge and furrow cultivation of the area.
- 5.40 A number of other linear positive magnetic anomalies were also detected in this area, which may reflect soil-filled ditches. Some of these may be part of a ditched enclosure in the south of the survey.
- 5.41 Linear negative magnetic anomalies detected across the survey area are likely to reflect field drains.

Area 41m-b

- 5.42 A series of weak, parallel positive magnetic anomalies aligned northeast-southwest was detected across this survey area; these anomalies are likely to reflect former ridge and furrow cultivation.
- 5.43 The linear positive magnetic anomaly aligned broadly north-south towards the eastern side of the survey area corresponds to a former field boundary shown on the tithe map of 1838, but which is not shown on the later OS maps.
- 5.44 A number of other linear and curvilinear positive magnetic anomalies have been detected across this area. These anomalies may reflect soil-filled ditches.

Area 41n

- 5.45 A concentration of dipolar magnetic anomalies was detected on the western edge of the survey area. This may reflect ground disturbance or a concentration of near-surface ferrous or fired debris.
- 5.46 On the eastern edge of the area a number of lineations were detected which may reflect soil-creep or a similar geomorphological phenomenon.
- 5.47 Several discrete positive magnetic anomalies were also detected in the northeastern part of the survey area, which could reflect soil-filled pits.

Area 41o

- 5.48 An intense positive magnetic anomaly was detected in this area aligned broadly north-south; this could reflect a drain. In the western half of the survey

area another intense positive and a series of strong parallel negative magnetic anomalies was detected, aligned northwest-southeast; these could possibly all reflect drains.

- 5.49 Ridge and furrow cultivation was detected in the eastern half of this area as a series of alternate, parallel positive and negative magnetic anomalies aligned northeast-southwest.
- 5.50 Several other positive magnetic anomalies have been detected in the eastern half of the survey area, on different alignments to the ridge and furrow. These anomalies may reflect soil-filled features such as ditches, including a possible small ring-ditch.

Area 41q

- 5.51 Former ridge and furrow cultivation of this area is evident as upstanding earthworks in parts of the field. It has been detected in the northwest corner of the survey as two series of alternate, parallel positive and negative magnetic anomalies, with one series aligned northeast-southwest and the other northwest-southeast.
- 5.52 The positive magnetic anomaly aligned northeast-southwest across the survey area reflects an upstanding earthen bank, probably constructed as a flood defence.
- 5.53 The linear positive and negative anomalies detected in the northeast corner of the survey area may reflect a continuation of the field drain system seen in Area 41o, as well as possible former ploughing.
- 5.54 A number of discrete and linear positive magnetic anomalies have been detected across this area; these could reflect the truncated remains of earlier banks and ditches.

Area 41s

- 5.55 A series of alternate positive and negative magnetic anomalies was detected across this area aligned approximately north-south; these correspond to ridge and furrow remains which are upstanding in parts of the field.

6. Potential impacts

- 6.1 The proposed planting scheme will impact on approximately 46.86ha of the total 67.62ha woodland scheme. Approximately 30% (14ha) of the impact area has been subject to geophysical survey. The proposed habitats and wildflower seeding areas are shown in Figure 28, together with an overview of the archaeological interpretation of the geophysical survey.
- 6.2 The majority of the geophysical survey areas lie within the main areas of proposed tree planting (2250 trees/ha), while Areas 41q and 41s in the south are proposed for low intensity planting (1100 trees/ha). The potential archaeological features which have been identified in those areas will be

adversely impacted by tree planting and subsequent root growth. The significance of features such as former ridge and furrow cultivation, former field boundaries and associated tracks can be considered low, however, the potential significance of other anomalies is as yet undetermined; some of these could reflect enclosures and ring-ditches.

- 6.3 It is understood that the proposed wildflower seeding areas, principally along the western boundary of the site, will be deep ploughed prior to seeding, causing a direct impact on any potential archaeological resource there. Whilst potential archaeological features have been identified in those areas, they generally comprise small, irregular soil-filled features and traces of former ridge and furrow cultivation, and as such are considered to be of local significance and have limited research potential. One exception to this is a possible ditched enclosure and associated features at the southern end of the wildflower area (Area 41m-a).

7. Conclusions and recommendations

- 7.1 Fourteen hectares of geomagnetic survey was undertaken at Low Burnhall, on land between the River Wear and the A167 road immediately south of Durham City, prior to proposed tree planting.
- 7.2 With the exception of Areas 41j-a and 41s, possible archaeological features were detected in all survey areas. Some of these correspond to former field boundaries and other features shown on early OS maps, the dates and functions of which are broadly known. However, the dates, functions and significance of many other features remain undetermined.
- 7.3 In Area 41e, on the relatively high plateau, possible ring-ditches and a possible sub-circular enclosure were identified; two worked flints were also collected here during survey. The former Croxdale Pit engine house and waggonway were also detected in 41e.
- 7.4 Probable rectangular enclosures, and possible ring-ditches, were identified in Area 41k. Other potential ditched enclosures were detected in Area 41f and the south of Area 41m-a.
- 7.5 Former field boundaries and tracks have been detected in Areas 41e, 41k-a, 41k-b and 41m-b.
- 7.6 Traces of former ridge and furrow cultivation have been detected in all but one of the areas surveyed, 41n.
- 7.7 Some of these features warrant further investigation by trial trenching in order to determine their date, function and significance; such evaluation may demonstrate that some anomalies do not reflect features of archaeological significance and may identify areas in which the proposed woodland scheme is unlikely to impact on an archaeological resource.

- 7.8 Ferrous service pipes were identified in Areas 41e and 41f and a cable in 41h. Probable field drains were identified in Areas 41m-a, 41o and 41q.

8. Sources

Archaeological Services 1997 *A late Bronze Age Sword from Houghall Farm*. Unpublished report **422**, Archaeological Services Durham University

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

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Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

TWM Archaeology, forthcoming, *An Excavation of a Prehistoric Site at Mountjoy in County Durham* TWM Archaeology

Appendix: Project specification

Specification for GEOPHYSICAL SURVEY:

Low Burn Hall Woodland Trust Planting Scheme, Near Croxdale, County Durham

1.0 Site Location and background

1.1 This specification is for geophysical survey of a proposed large scale tree planting woodland development scheme on the north bank of the River Wear just north of Croxdale, Co. Durham. The site is centred on grid reference 426735539251

1.2 The Low Burn site is part of the Woodland Trust landholdings. They aim to develop a large publicly accessible wood on the edge of Durham City that will link into existing woodland which runs along the banks of the River Wear southwards from the city's centre.

1.3 The aim of this project will be to create a new native broadleaved wood by planting local provenance nursery stock across what is currently arable farming. These trees will be planted at a stocking density of 2250/ha. The pasture fields will also be planted but at a stocking density of 1100 trees/ha. Natural regeneration in some areas will also be encouraged. Archaeological remains are a finite, and non-renewable resource, in many cases highly fragile and vulnerable to destruction by inappropriate tree planting. Appropriate evaluation on this site is therefore essential to recover the maximum amount of evidence before ground preparation occurs.

2.0 The Development

2.1 The client for this work is the Woodland Trust. It is project managed by Gary Haley.

2.2 The client is proposing to create a large new woodland along the bank of the River Wear.

2.3 The total scheme covers some 67.62ha of arable, pasture and meadowland on the northern bank of the River Wear between Croxdale and Houghall.

2.4 The proposed planting scheme will only impact on approximately 46.86ha of site area as the other parts are either existing woodland, are not deemed suitable for planting, are to be left to regenerate naturally or are other habitats which are to be left as open areas within the scheme (see Figure 1 above for details).

3.0 Historical Background

3.1 An archaeological assessment has recently been conducted by T&WM (2009) and is available for consultation in the HER or from the client. The DBA should be referred to by the appointed geophysical surveyor.

3.2 The known archaeological sites within the curtilage of the development area consist of both Medieval and Post Medieval/Industrial sites which include the remains of Croxdale Pit, Brick and Tile Works, Engine House, Wagonway and a clay pit. There is also aerial photograph evidence for a polygonal enclosure, a medieval fish pond or a mill site and medieval/post medieval rig and furrow.

3.3 A high level of prehistoric settlement and ritual sites are present in the immediate and wider area. Also medieval farms, farm fields, post medieval/industrial sites and rig and furrow dating to the medieval/post medieval periods. It is likely that significant agricultural exploitation of the site has occurred on the site combined with mineral extraction in the 19th century in the area around Low Burnhall farm.

4.0 The Archaeological Brief

4.1. This brief sets out which archaeological works are required in order to assess and evaluate the site, and how they must be carried out. Any further works required to mitigate the impact of the proposed development may be dealt with under a separate brief as a condition of future detailed planning permission. The report on the current works must be submitted in support of the imminent planning application.

4.2. The brief must be read in conjunction with the recently issued *Yorkshire, The Humber and the North- East: Regional Statement of Good Practice for Archaeology in the Development Process* (2009). This is appended to the end of the specification document.

Geophysical Survey

4.3. In order to evaluate the archaeological potential for remains of any period the site will be subject to a 30% (14ha) geophysical survey to provide archaeological evaluation data from within the proposed development area (PDA). The use of remote sensing geophysical techniques (magnetometry) will be required to help define the potential archaeological features that may exist on the site.

4.4. A contingency for a further 20% survey must be costed into the project. This will be used, if necessary, to help define the extent of potential archaeological anomalies which appear to extend beyond the original sample areas. It is more suitable in the long term to be able to answer questions of this nature whilst the survey team is still (technically speaking) in the field. The contingency budget can only be utilised after a consultation meeting between the client, the contractor and the Durham County Council Archaeology Section.

4.5. The sample areas must provide good coverage across the landscape so that all areas are sampled except where ground conditions, vegetation or water cover makes it impracticable. In addition a buffer zone around field boundaries and buildings may be needed to reduce interference from fences, footpaths and debris often associated with field boundaries. Partial grids may be excluded if they prove to be impractical. The archaeological contractor must liaise with the client over development layout and discuss the final survey sample with the DCC Assistant Archaeology Officer.

4.6. The overall purpose of the geophysical survey will be:

to establish the presence/absence, and nature of any archaeological anomalies within the area specified so that they can be identified and utilised to plan the tree planting scheme (the aim is to use the geophysical survey results to inform avoidance of potential archaeological anomalies within the scheme)

to define the extent of any such anomalies, and to characterise, if possible

to establish the presence/absence, and nature of any known modern anomalies within the area of proposed development which may affect the results

to determine if the further survey is required to help define the extent of possible archaeological anomalies.

4.7. Methodologies must be clearly costed in the tender document and information on how the contractor proposes to conduct the work clearly set out in the written scheme of investigation submitted by the appointed contractor to the DCC Assistant Archaeology Officer for approval.

4.8. A survey grid of 30m x 30m must be placed across the site and must be accurately tied in to local topographic features and overlaid onto an appropriate OS map base. The grid tie-in information should be made available in, or with, the final report so that the location plan can be related to the OS National Grid. Once the survey is complete any markers used must be removed from site. The results, including archaeological interpretation of the data must be set out in a report format with maps and must be available to aid in the development of the tree planting scheme. Interpretation plans must include OS contour data.

4.9. Depending on the results of this evaluation phase, further works may be required to mitigate the impact of the development on any archaeological remains. This will be dealt with by a separate brief should this be required.

4.10. This brief does not constitute the “written scheme of investigation” which must be submitted by the appointed contractor for approval by Durham County Council Archaeology Section prior to work commencing.

5.0 OASIS

5.1 The Durham County Council Archaeology Section supports 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.

5.2 The archaeological contractor must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/> within 3 months of completion of the work. Contractors are advised to ensure that adequate time and costings are built into their tenders to allow the forms to be filled in.

5.3 Technical advice should be sought in the first instance from OASIS (Oasis@ads.ahds.ac.uk) and not from Durham County Council Archaeology Section.

5.4 Once a report has become a public document by submission to or incorporation into the SMR, Durham County Council Archaeology Section will validate the OASIS form thus placing the information into the public domain on the OASIS website.

5.5 The archaeological consultant or contractor must indicate that they agree to this procedure within the specification/project design/written scheme of investigation submitted to Durham County Council Archaeology Section for approval

6.0 The Report

6.1 This report may be first stage of a phased programme of archaeological works. The client has commissioned it to for the purpose of identifying areas of potential archaeological remains so that impact to them by the planting scheme can be avoided where possible. Based on the results of the evaluation further archaeological works may be required.

6.2 The evaluation report must include the following:

executive summary

a site location plan with NGR references at an appropriate scale to show both the site location within the wider area and specifically/detailed site location

OASIS reference number

- Unique Site code
 - contractor's details including dates work carried out
 - nature and extent of the proposed development, including developer/client details
 - description of the site location and geology
 - suggestions regarding the need for, and scope of, any further archaeological work
 - photographs, maps and plans to illustrate the report as necessary
 - discussion of potential impacts of the development on known and potential archaeological sites
 - geophysical technical and processing information
 - geophysical results
 - geophysical discussion and interpretation - this should be referenced to the previously produced DBA by T&WM (2009) to provide the contextual background to any potential archaeological anomalies
 - OS contour data must also be displayed on the interpretation plots
 - a plot of the raw geophysical data (to an appropriate scale)
 - geophysical plots must show the location of modern intrusions (i.e. services etc)
 - geophysical X-Y trace and greyscale and/or dot density plots (to an appropriate scale)
 - geophysical interpretative feature map (to an appropriate scale)
 - additional plans/map extracts to display noted and recorded archaeological features as appropriate
 - suggestions regarding the need for, and scope of, any further archaeological work, including publication
- references
- bibliography

6.3 The report must be presented in an ordered state and contained within a protective cover/sleeve or bound in some fashion (loose-leaf presentation is unacceptable). The report must contain a title page listing site/development name, district and County together with a general NGR, the name of the archaeological contractor and the developer or commissioning agent, as well as the OASIS reference number. The report must be page numbered and supplemented with sections and paragraph numbering for ease of reference. All maps, figures and photographs must be cross referenced to the text.

7.0 Publication

7.1 All assessments, evaluations and watching briefs which do not progress to further excavation and research (with the relevant post-excavation and publication scheme and costs), should have a time and budget allocation identified for publication. This must be to a minimum standard to include a summary of the work, findings, dates, illustrations and photographs and references to where the archive is lodged.

7.2 Editors of regional journals, either the *Durham Archaeological Journal* or *Archaeologia Aeliana* should be contacted for information on outline publication costs, fuller figures may be worked out on completion of the watching brief. As the final note is largely unpredictable in advance a contingency sum should be set aside at the outset of work in the tender.

8.0 The Tender

8.1 Tenders for the work must include the following information set out in a clearly understood fashion.

8.2 Brief details of the organisation and the number of staff who are proposing to carry out the work including any relevant specialisms or experience.

8.3 The earliest date at which the work can be commenced and the amount of notice required to initiate the assessment and geophysical survey.

8.4 Statement agreeing to complete the OASIS forms on completion of the assessment.

8.5 An estimate of how long the work will take broken down by time and cost in terms of data collection and report production. The tender should include a breakdown of costs attributable to:

- travelling and subsistence
- fieldwork – 30% survey sample
- report production
- administration
- archiving
- contingency for additional 20% survey sample
- other

9.0 Submission of Report

9.1 A final bound copy and a digital PDF copy of the report must be sent to the Archaeology Section, Durham County Council for inclusion into the County Durham Archaeological Archive (HER):

The County Archaeology Officer
Archaeology Section
Design & Historic Environment Team
Regeneration & Economic Development
Durham County Council
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS.

9.2 Additionally, at least three or more bound copies of the report must be submitted to the client for planning purposes (as required by client).

10.0 The Archive

10.1 The site archive comprising the original paper records and plans, photographs, negatives etc, must be deposited in the appropriate museum at the completion of post-excavation. This must be in accordance with the Durham County Council Archaeological Archive policy, a guidance note on which can be obtained from the Durham County Council Archaeology Service.



Archaeological Services
University of Durham

Low Burnhall Wood, County Durham

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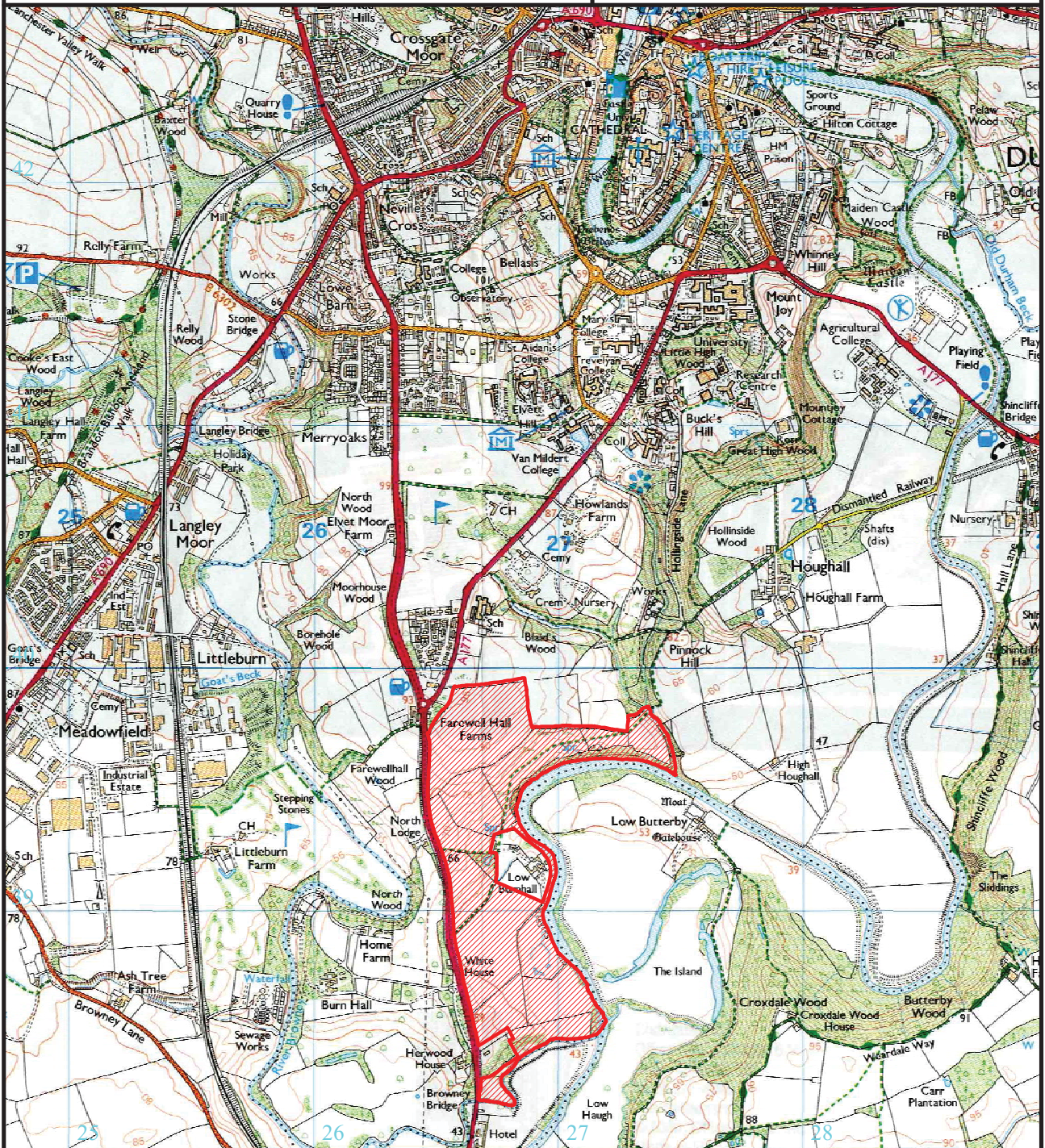
Figure 1

Site location

on behalf of

The Woodland Trust

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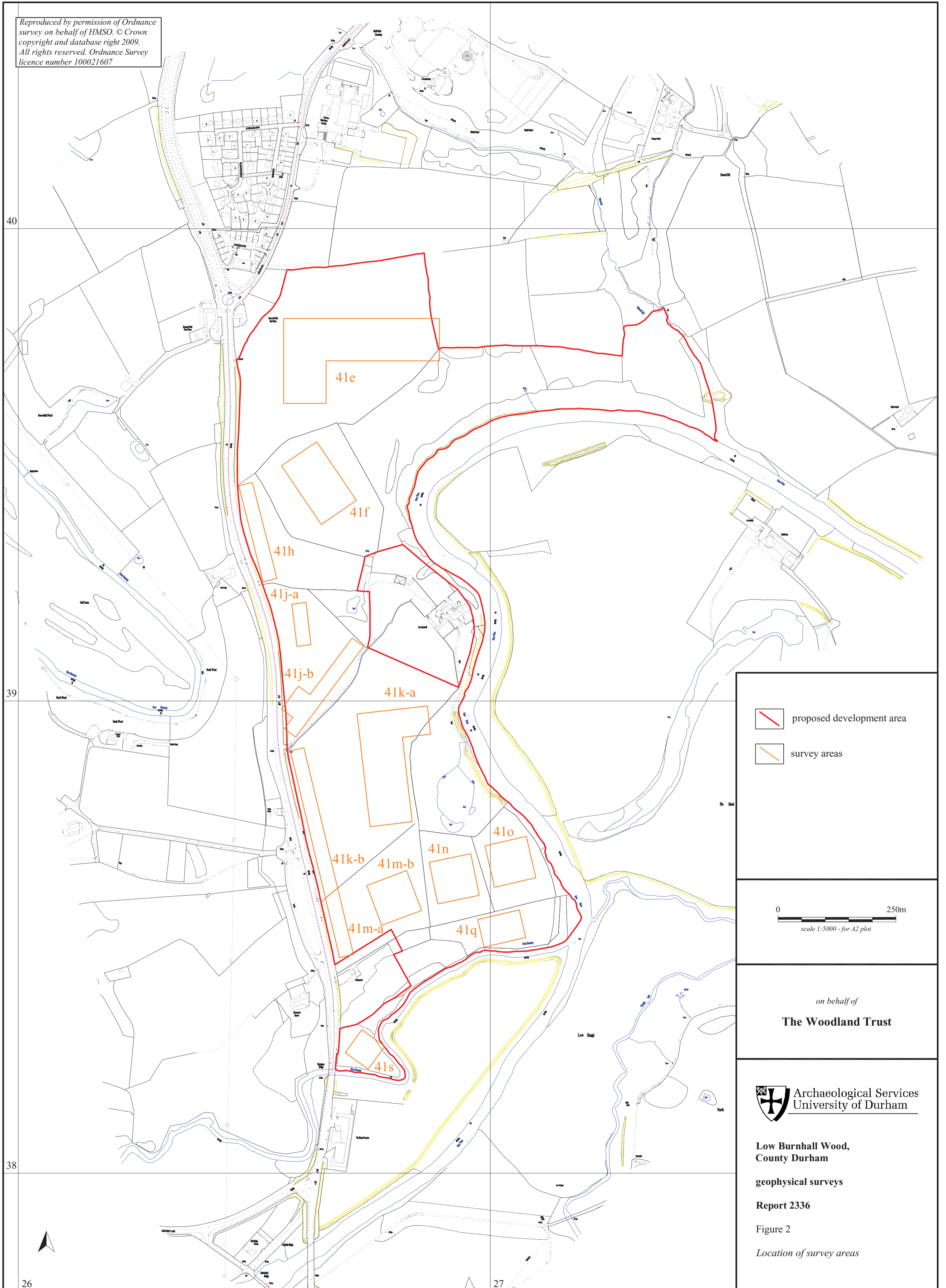
proposed development area





scale 1:25 000 - for A4 plot




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-  proposed development area
-  survey areas

0 250m
scale 1:5000 - for A2 plot

on behalf of
The Woodland Trust

 Archaeological Services
University of Durham

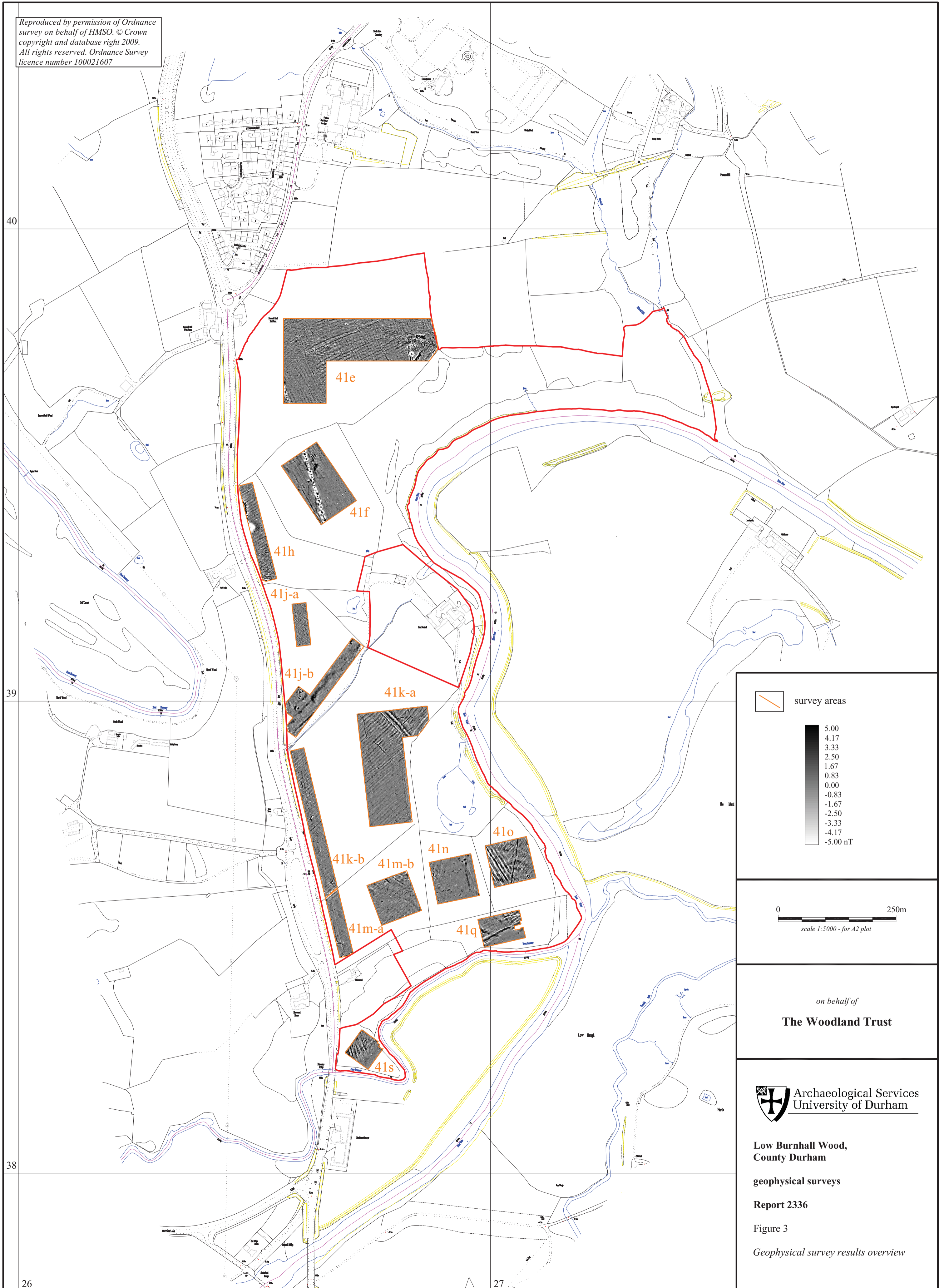
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geophysical surveys
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Figure 2

Location of survey areas

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survey areas

5.00
4.17
3.33
2.50
1.67
0.83
0.00
-0.83
-1.67
-2.50
-3.33
-4.17
-5.00 nT

0 250m
scale 1:5000 - for A2 plot

on behalf of
The Woodland Trust

 **Archaeological Services**
University of Durham

Low Burnhall Wood,
County Durham

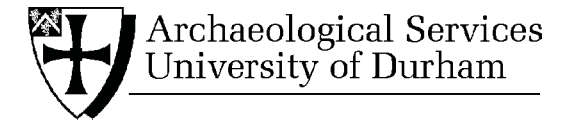
geophysical surveys

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Figure 3

Geophysical survey results overview

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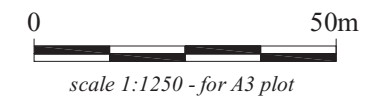
Report 2336

Figure 4

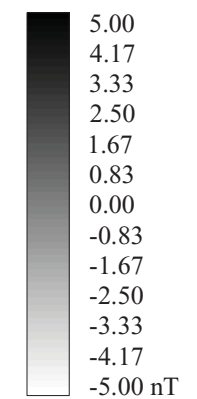
Area 41e, geophysical survey

on behalf of

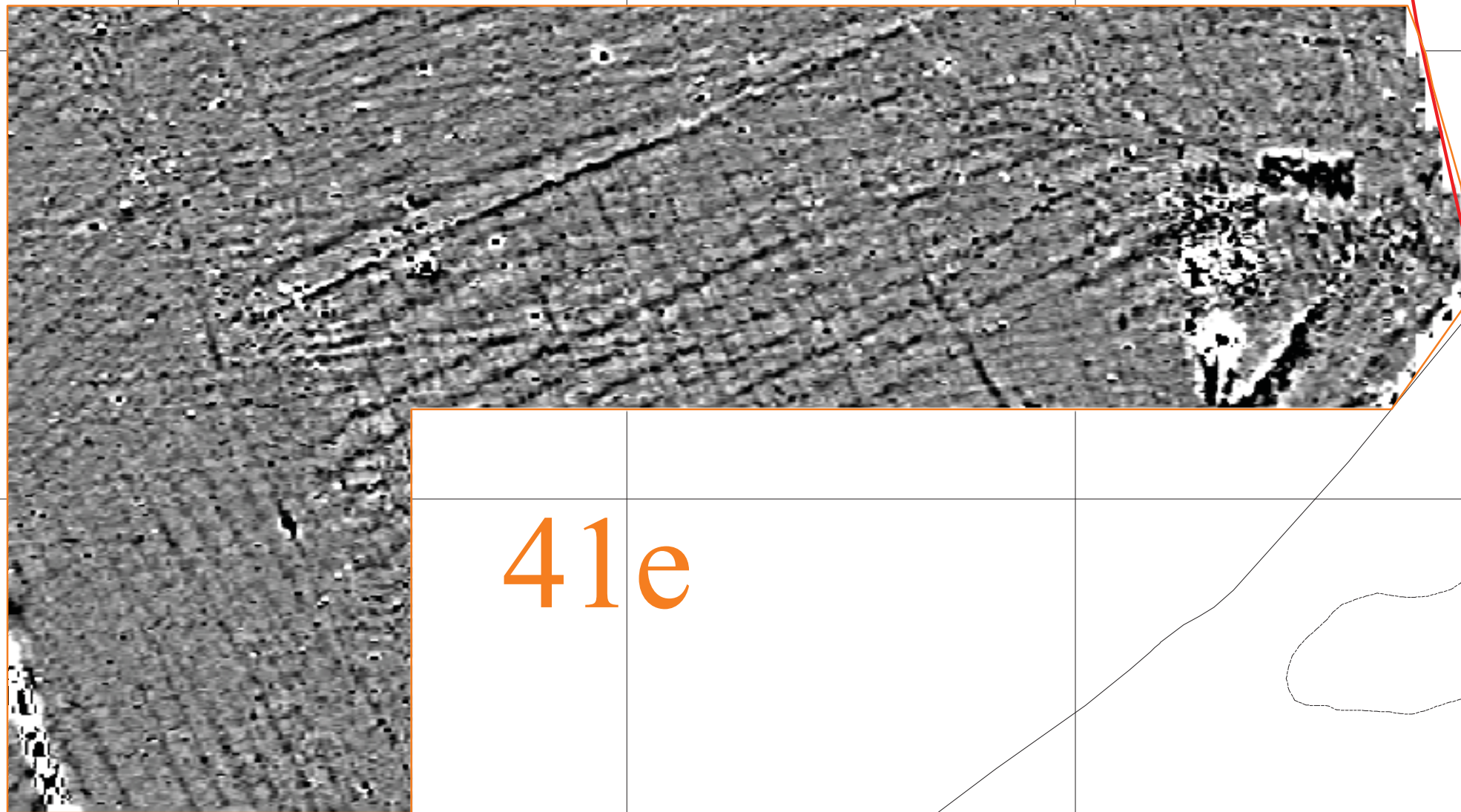
The Woodland Trust



 survey area



Hall
398



397

396

266

267

268

269

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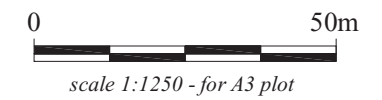
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



Figure 5

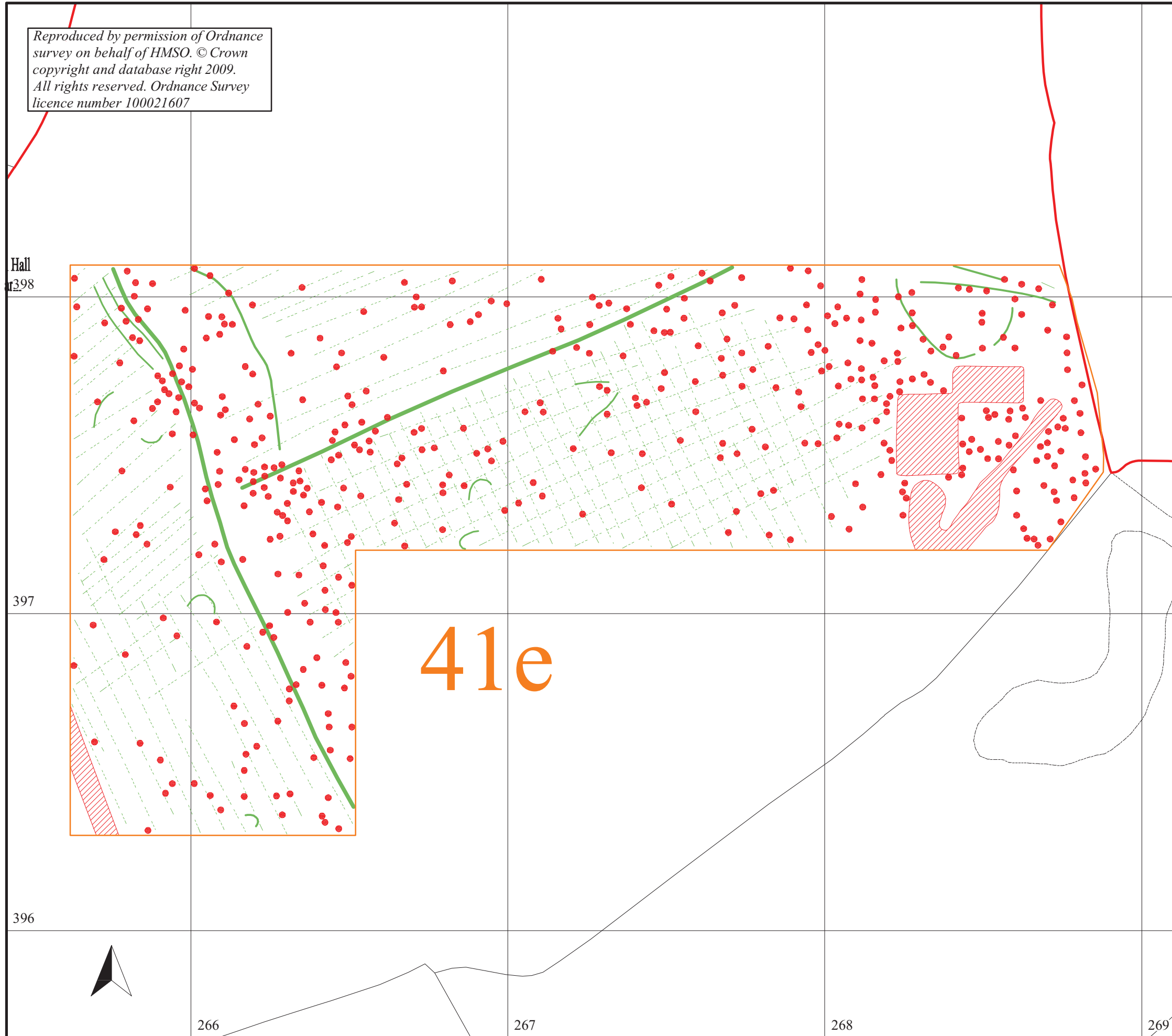
Area 41e, geophysical interpretation

on behalf of

The Woodland Trust



-  survey area
-  positive magnetic anomalies
-  negative magnetic anomalies
-  dipolar magnetic anomalies



Hall
398

397

396

266

267

268

269

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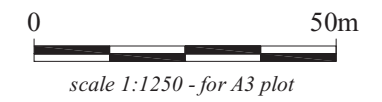
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


Figure 6

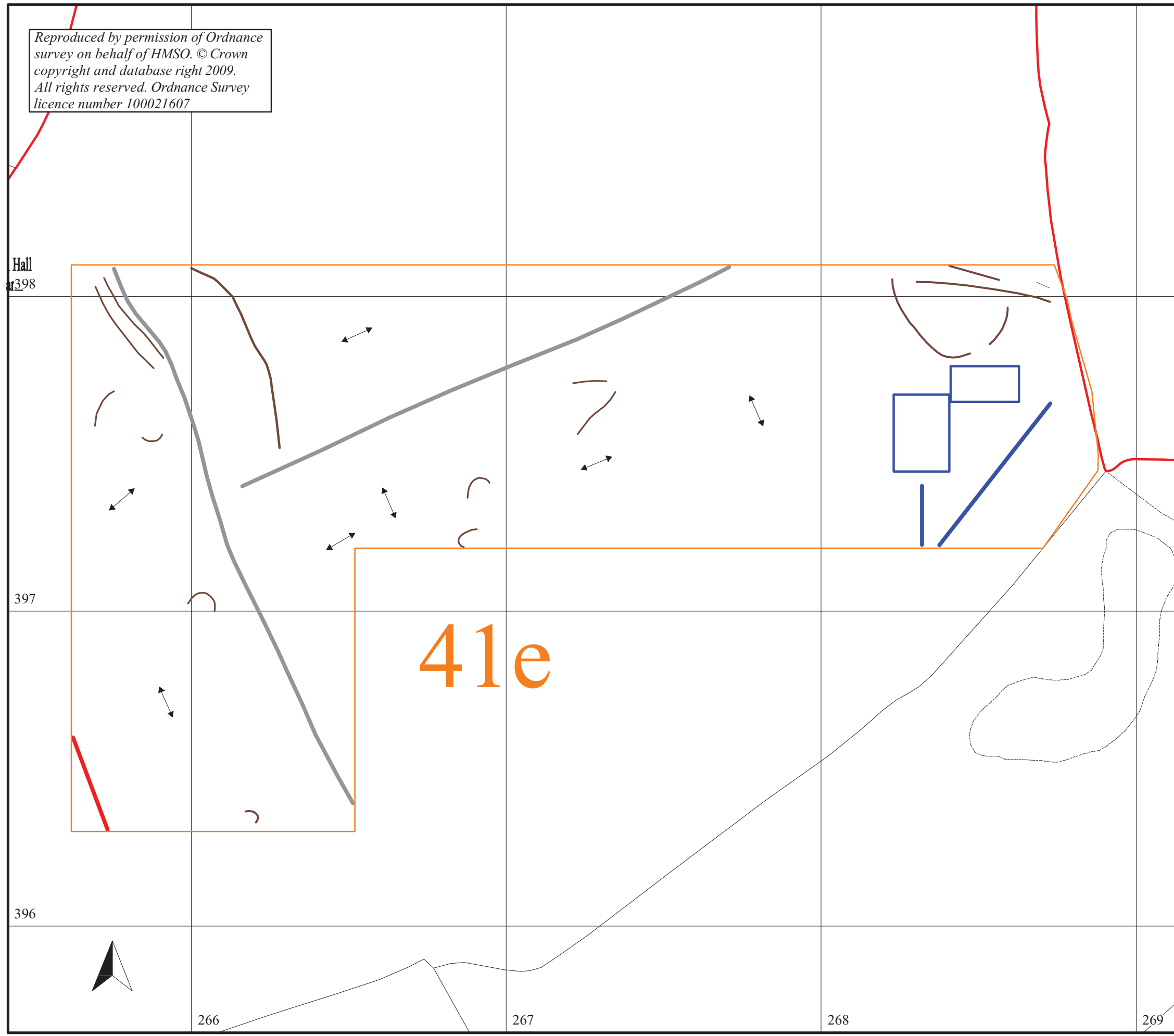
Area 41e, archaeological interpretation

on behalf of

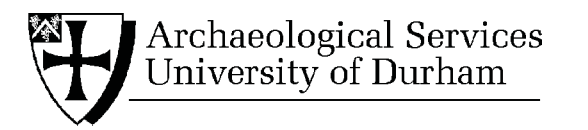
The Woodland Trust



-  survey area
-  soil-filled features
-  service pipes
-  orientation of ridge and furrow
-  former field boundary
-  former waggonway and engine house



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geophysical surveys

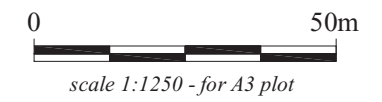
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Figure 7

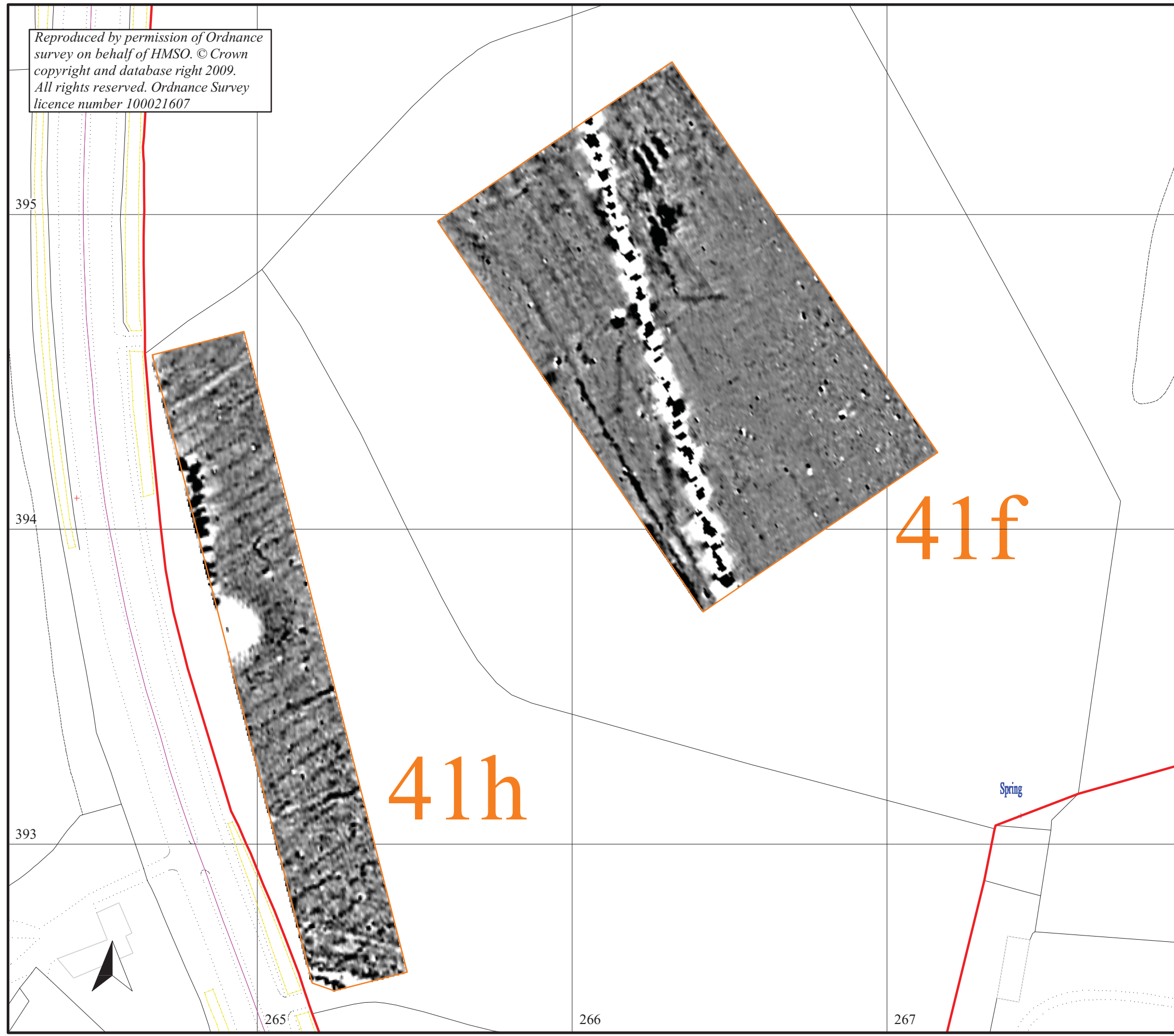
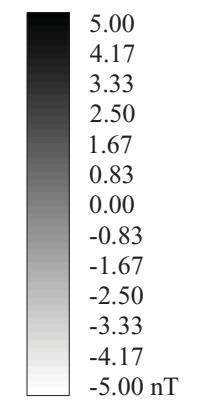
Areas 41f and 41h, geophysical survey

on behalf of

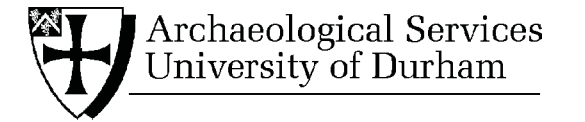
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survey areas



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geophysical surveys

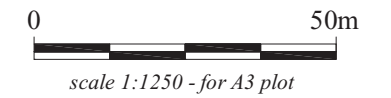
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Figure 8

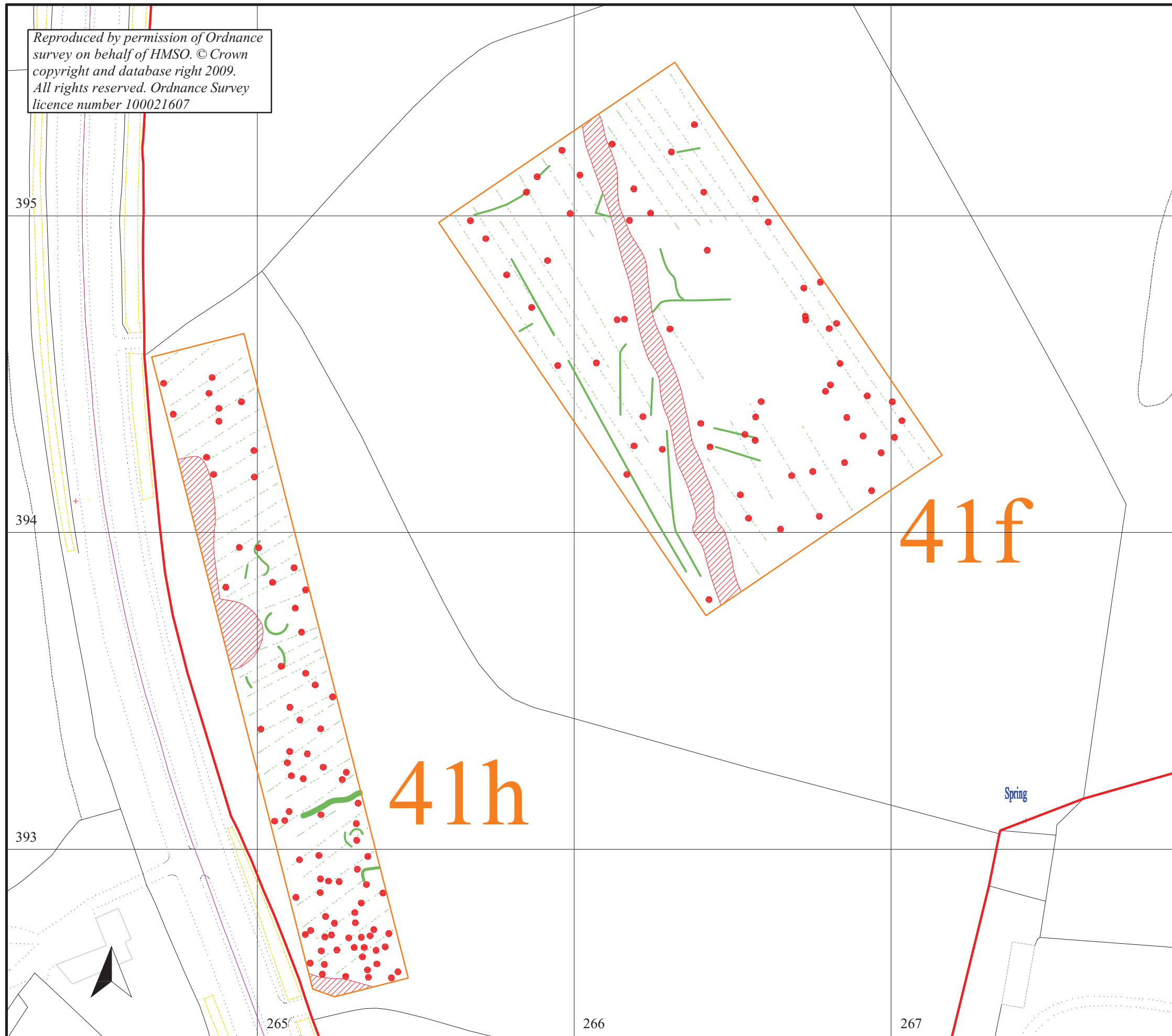
Area 41f and 41h, geophysical interpretation

on behalf of

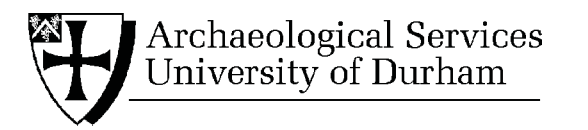
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- survey areas
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies



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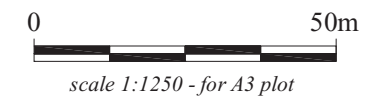
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Figure 9

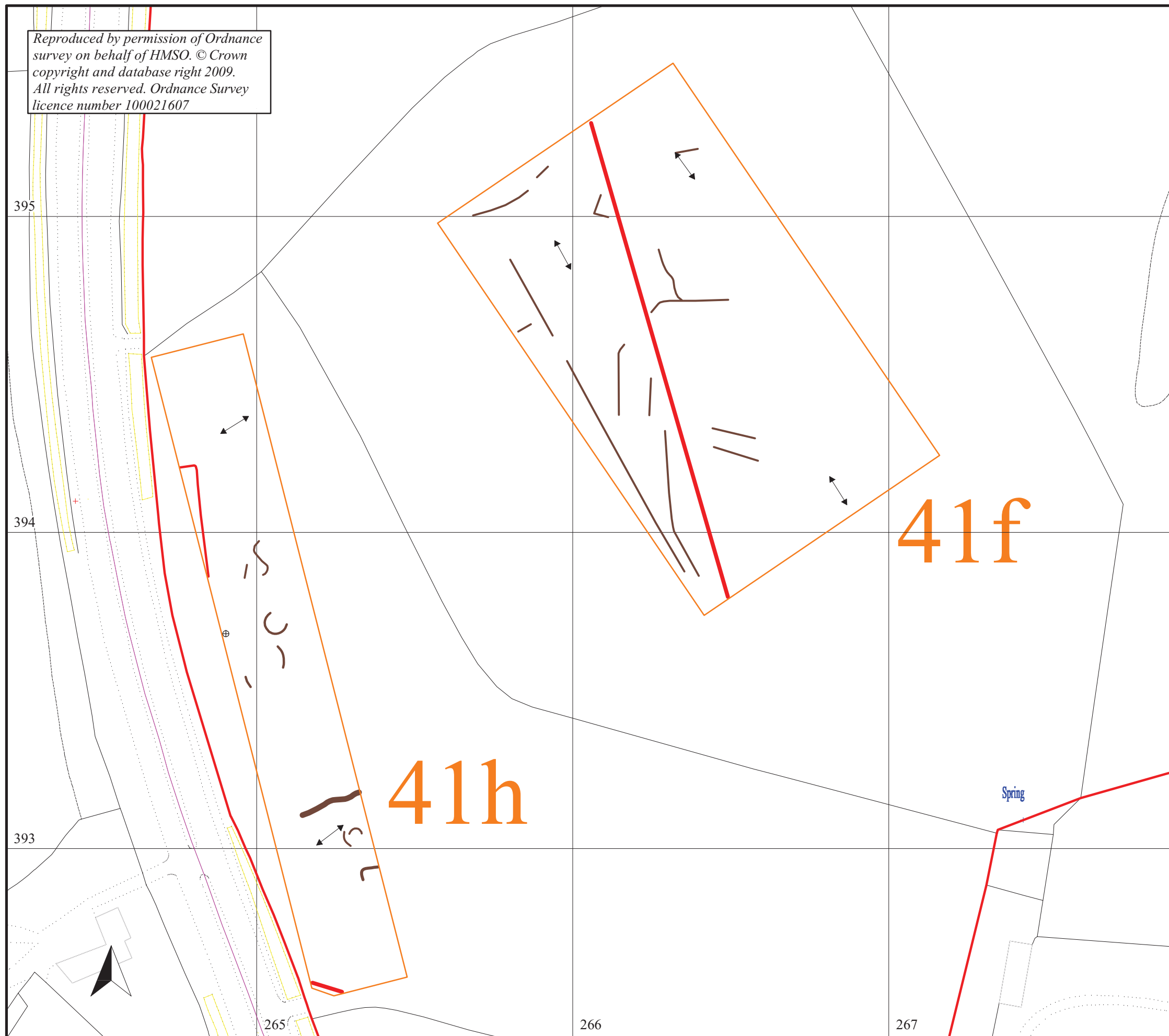
Area 41f and 41h, archaeological interpretation

on behalf of

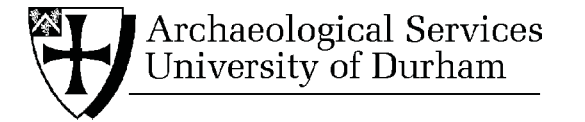
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-  survey areas
-  soil-filled features
-  services
-  orientation of ridge and furrow
-  telegraph pole



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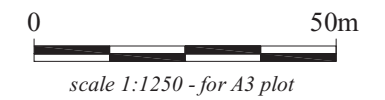
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Figure 10

Area 41j-a and 41j-b, geophysical
survey

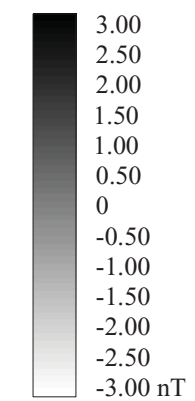
on behalf of

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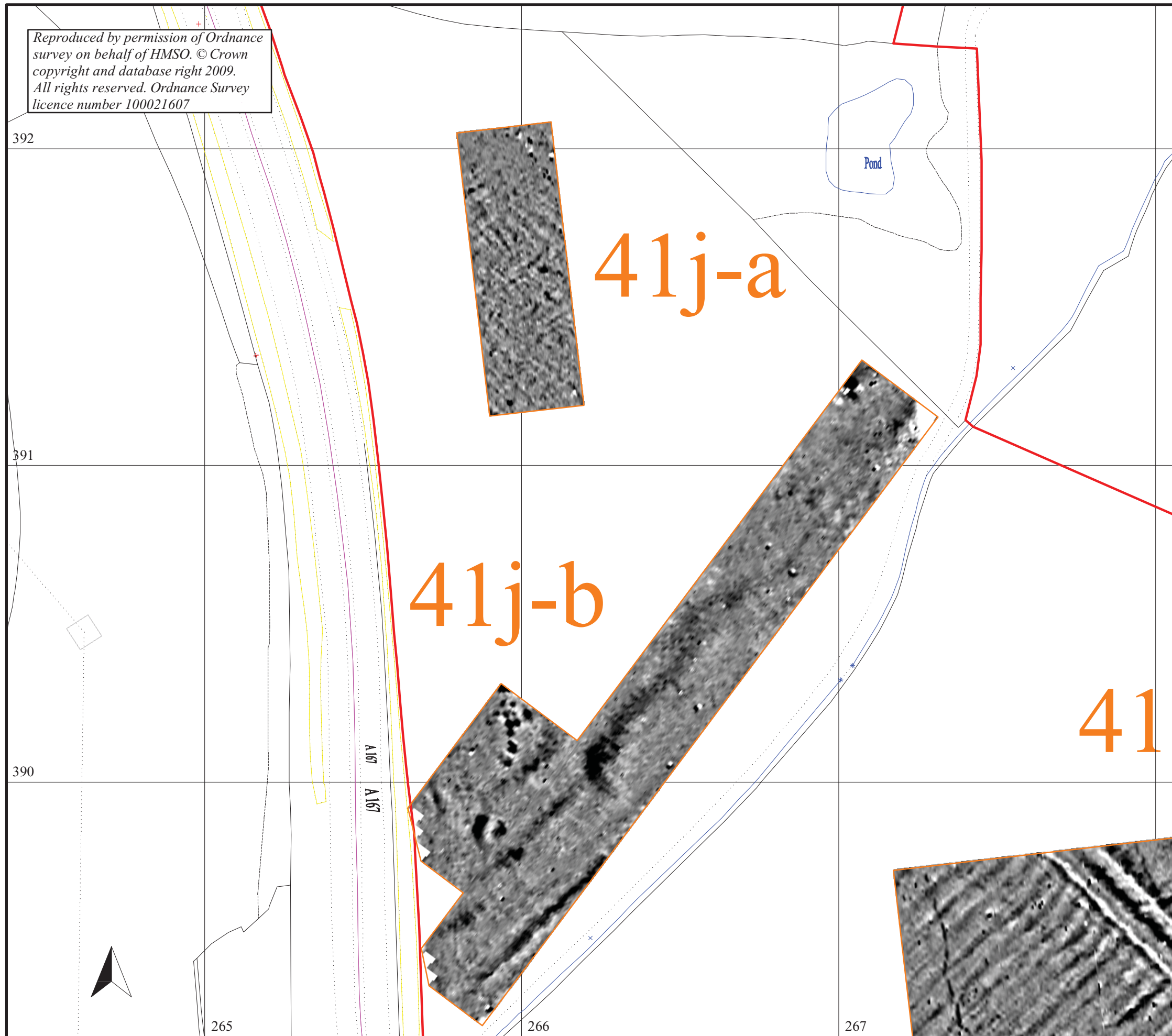
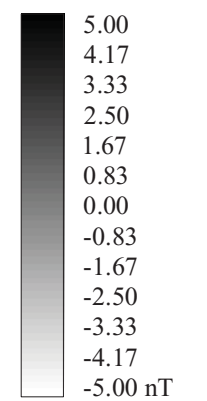


survey areas

scalebar for
area 41j-a



scalebar for
area 41j-b



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Figure 11

Areas 41j-a and 41j-b, geophysical interpretation

on behalf of

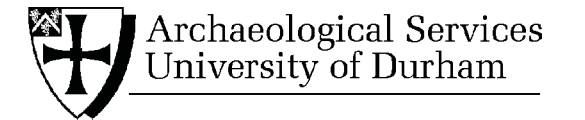
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0 50m
scale 1:1250 - for A3 plot

-  survey areas
-  positive magnetic anomalies
-  negative magnetic anomalies
-  dipolar magnetic anomalies



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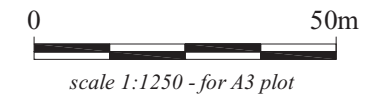
Report 2336

Figure 12

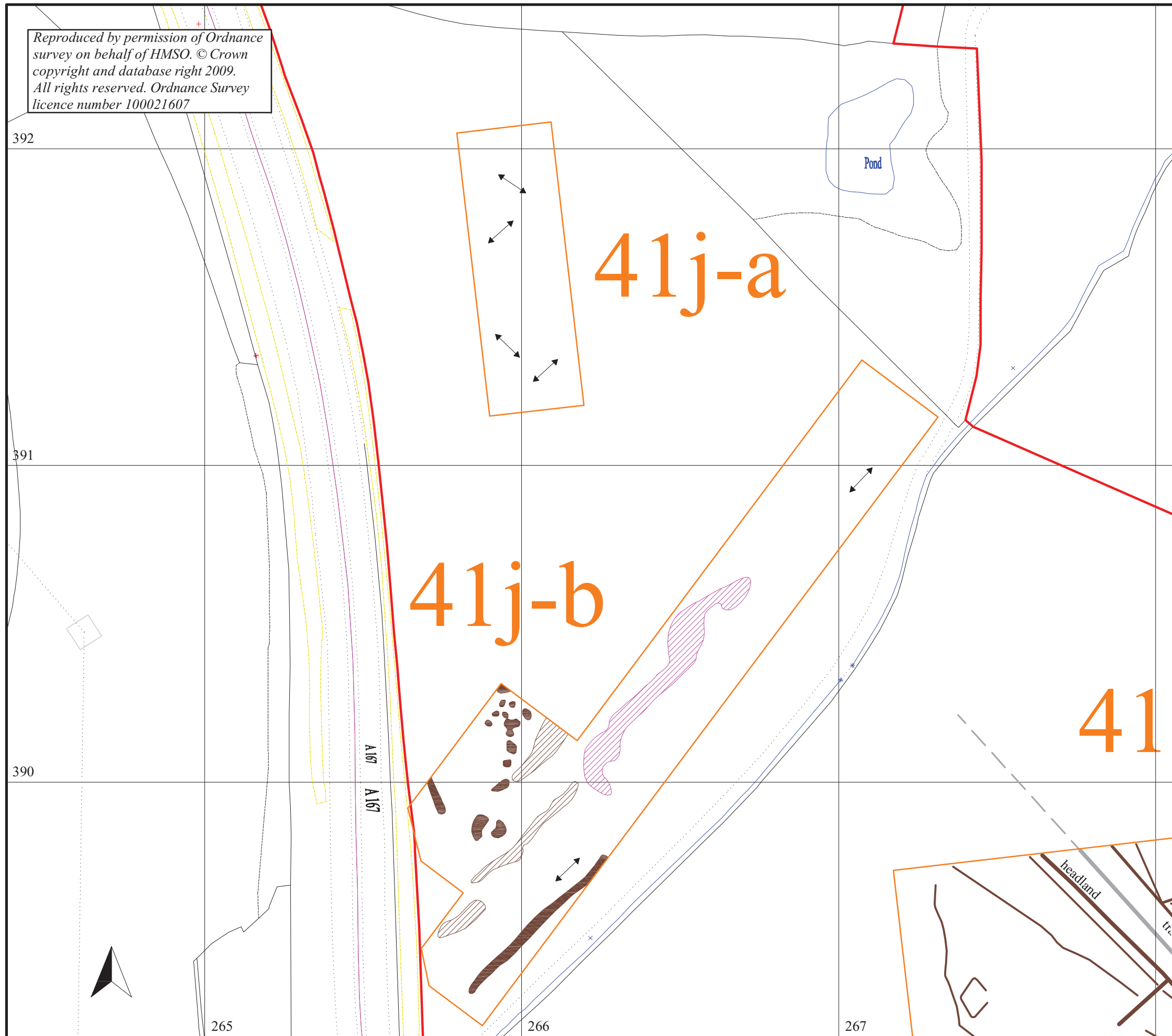
Area 41j-a 41j-b, archaeological
interpretation

on behalf of

The Woodland Trust

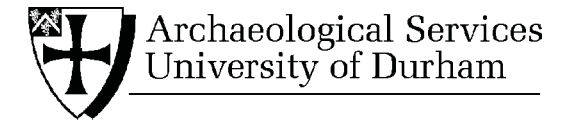


- survey areas
- soil-filled features
- orientation of ridge and furrow
- geological feature



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41k-a



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geophysical surveys

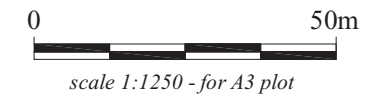
Report 2336

Figure 13

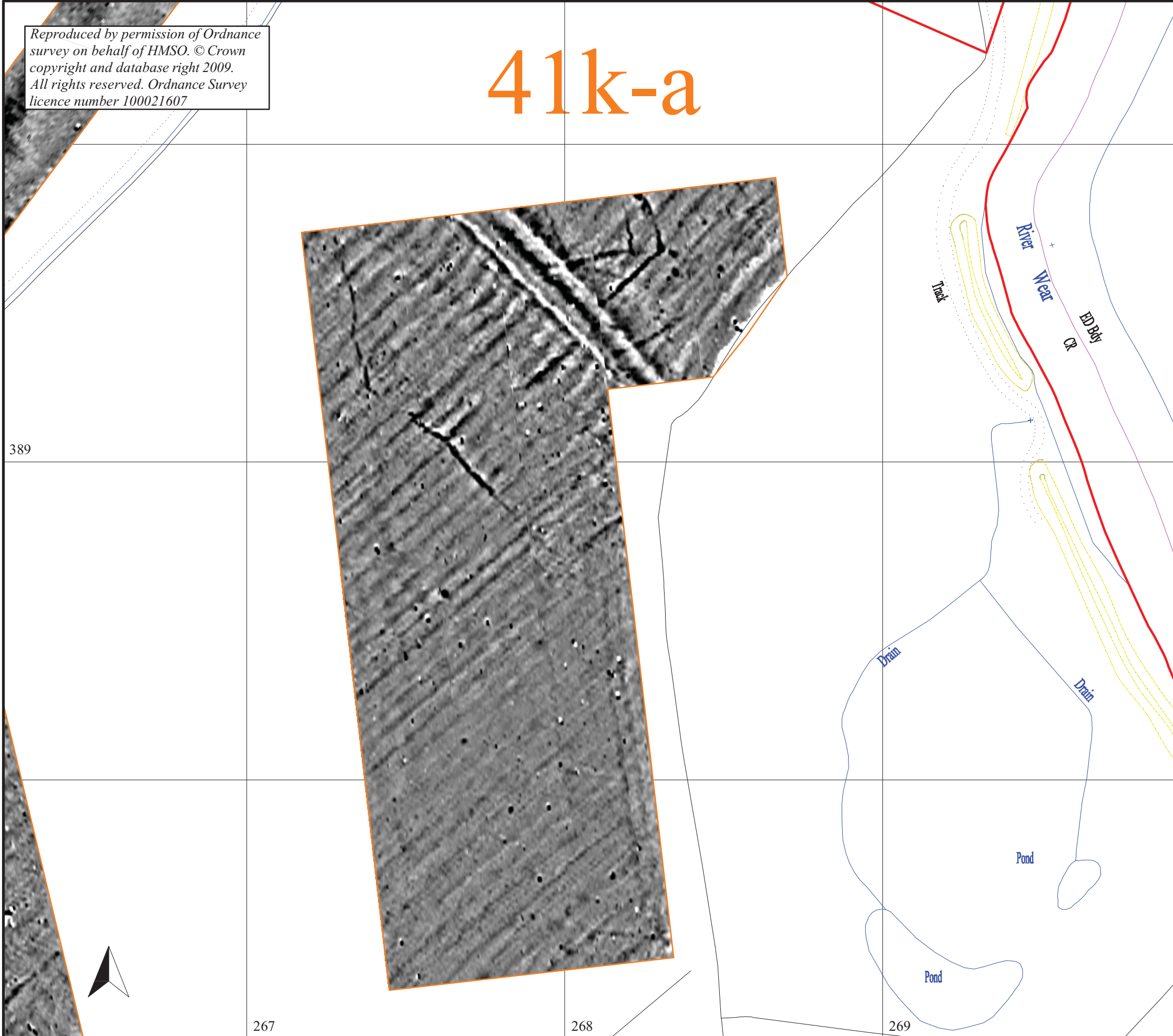
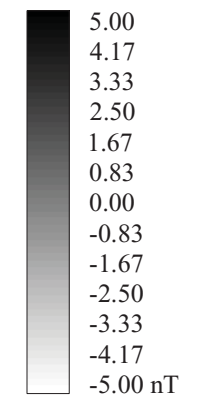
Area 41k-a, geophysical survey

on behalf of

The Woodland Trust

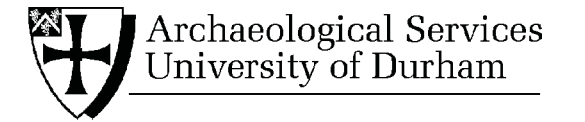


 survey area



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41k-a



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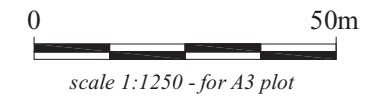
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Figure 14

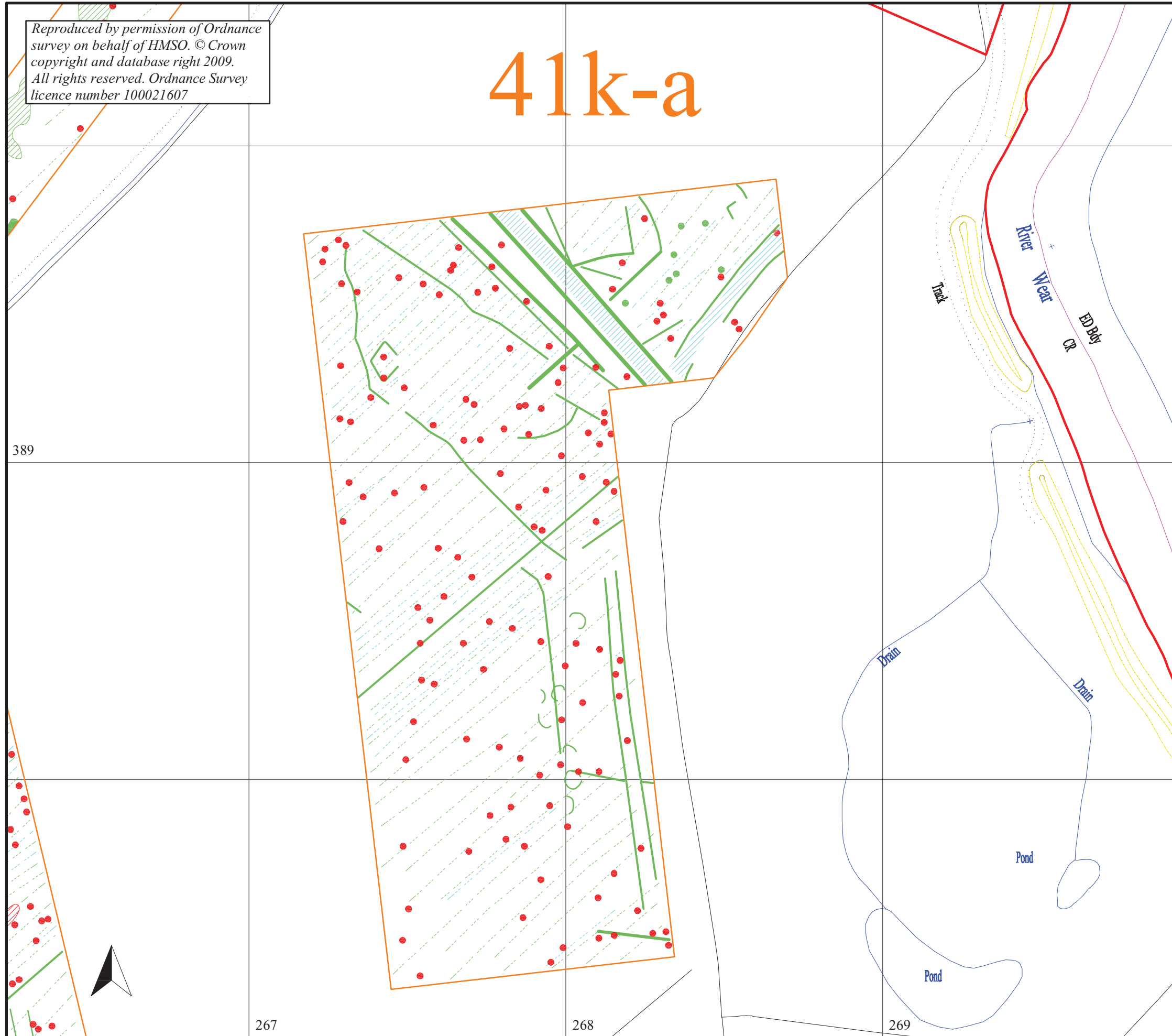
Area 41k-a, geophysical interpretation

on behalf of

The Woodland Trust

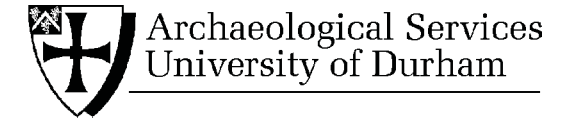


- survey area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies



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41k-a



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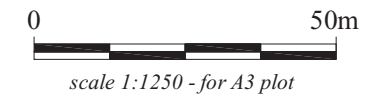
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Figure 15

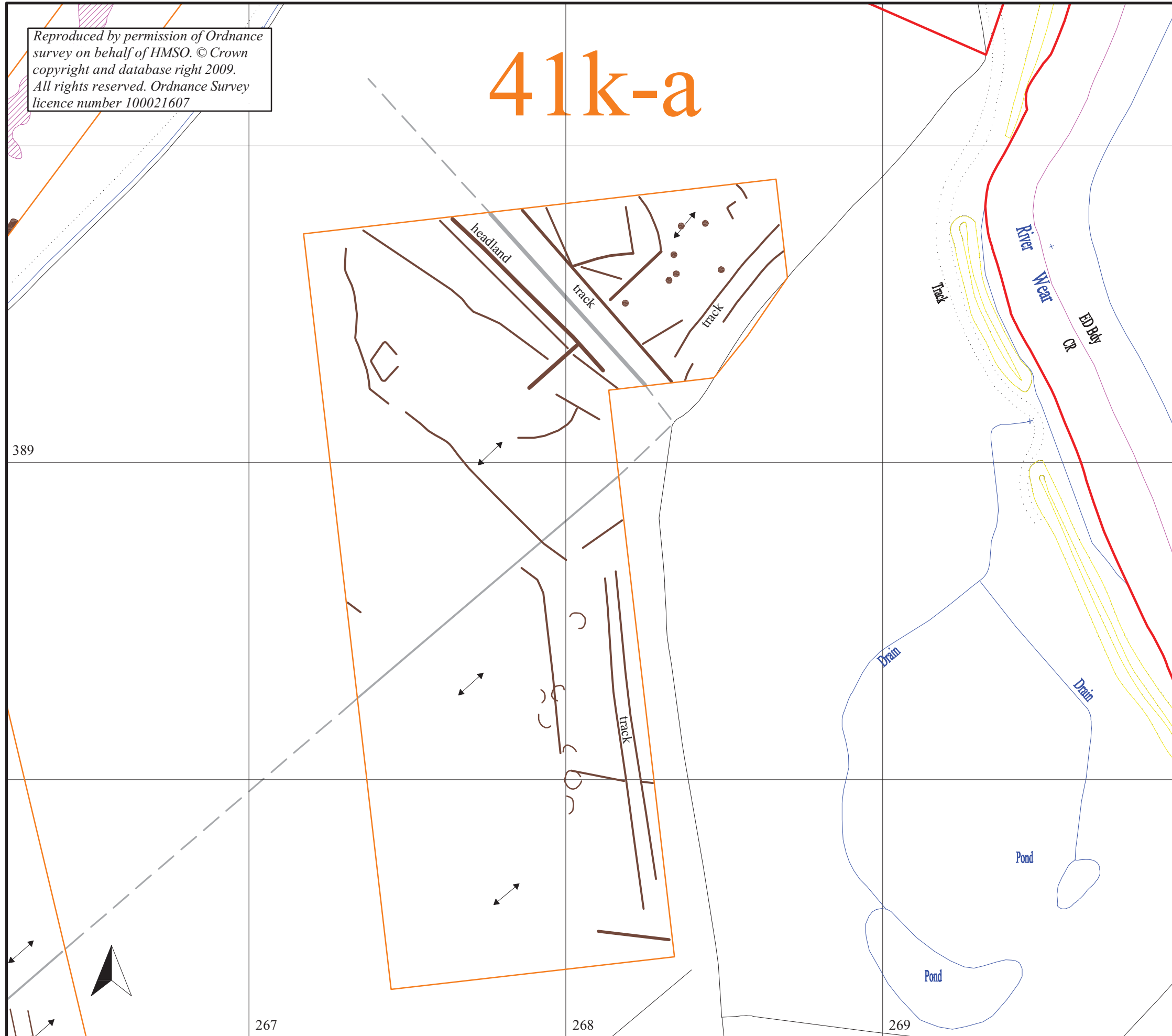
Area 41k-a, archaeological
interpretation

on behalf of

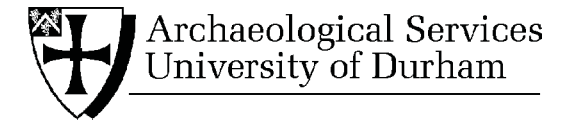
The Woodland Trust



- survey area
- soil-filled features
- former field boundary
- orientation of ridge and furrow



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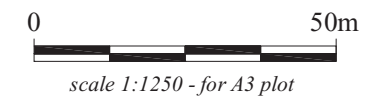
Report 2336

Figure 16

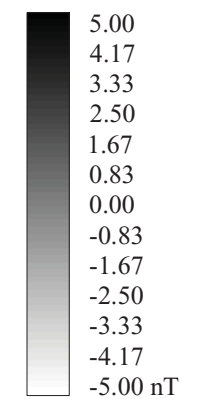
Area 41k-b, geophysical survey

on behalf of

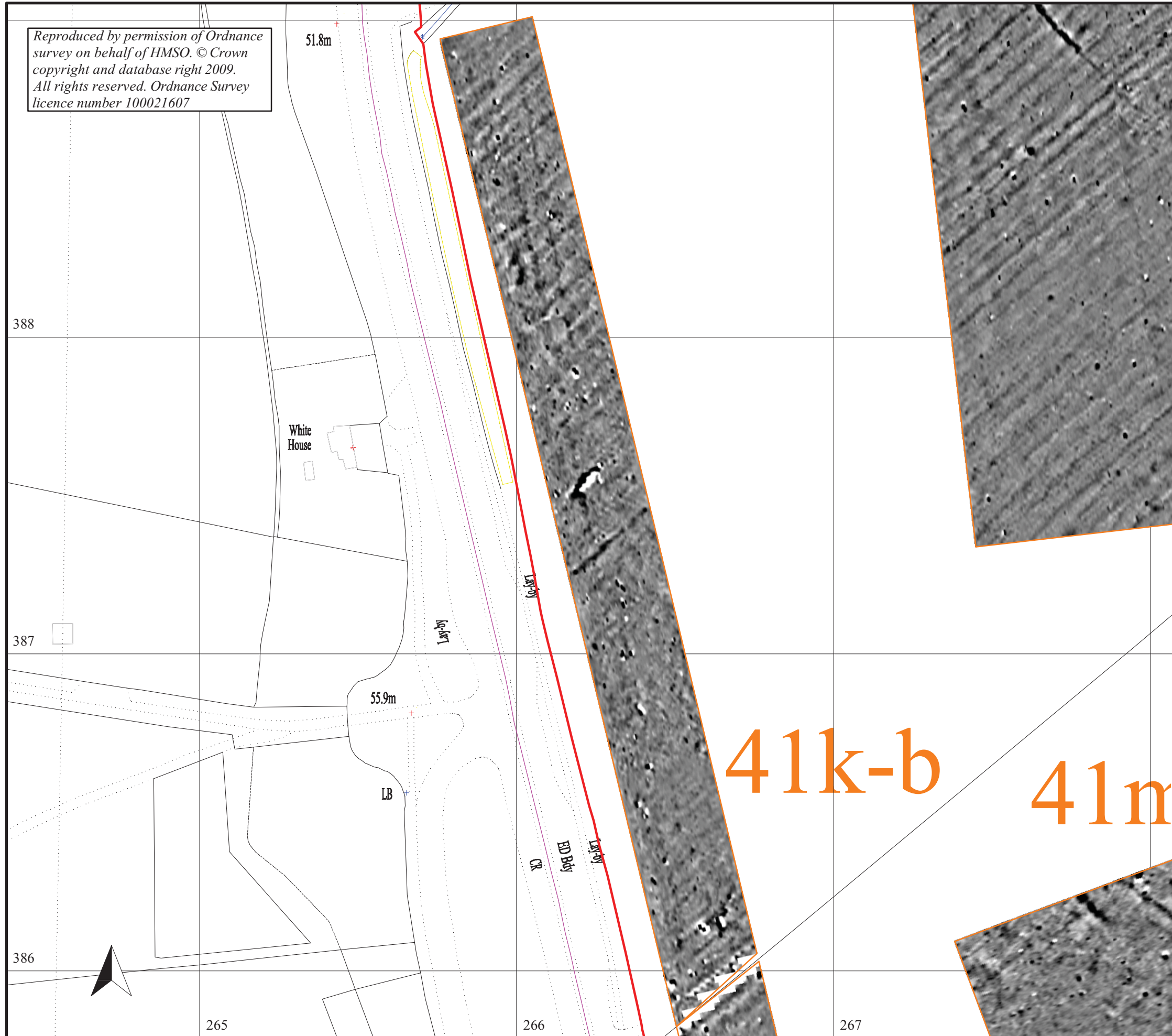
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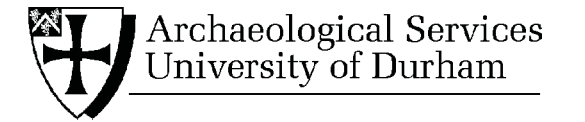
 survey area



41k-b 41n



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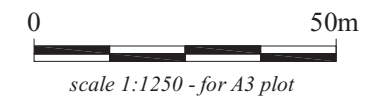
Report 2336

Figure 17

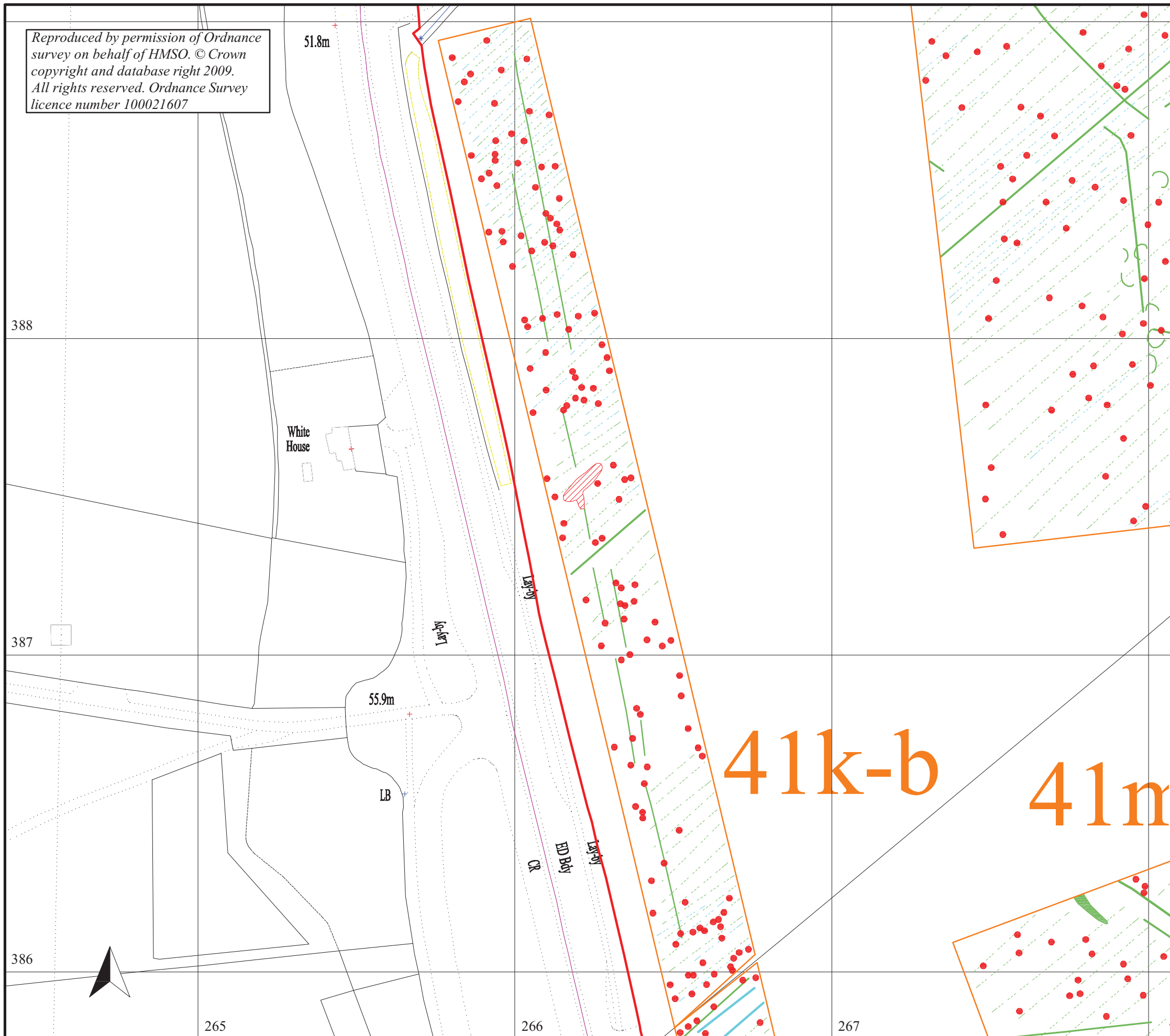
Area 41k-b, geophysical interpretation

on behalf of

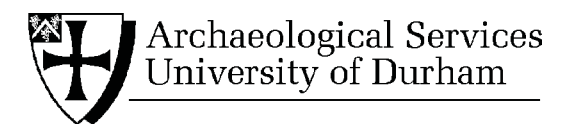
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- survey area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies



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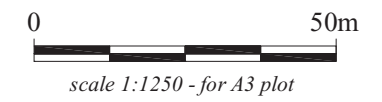
Report 2336

Figure 18

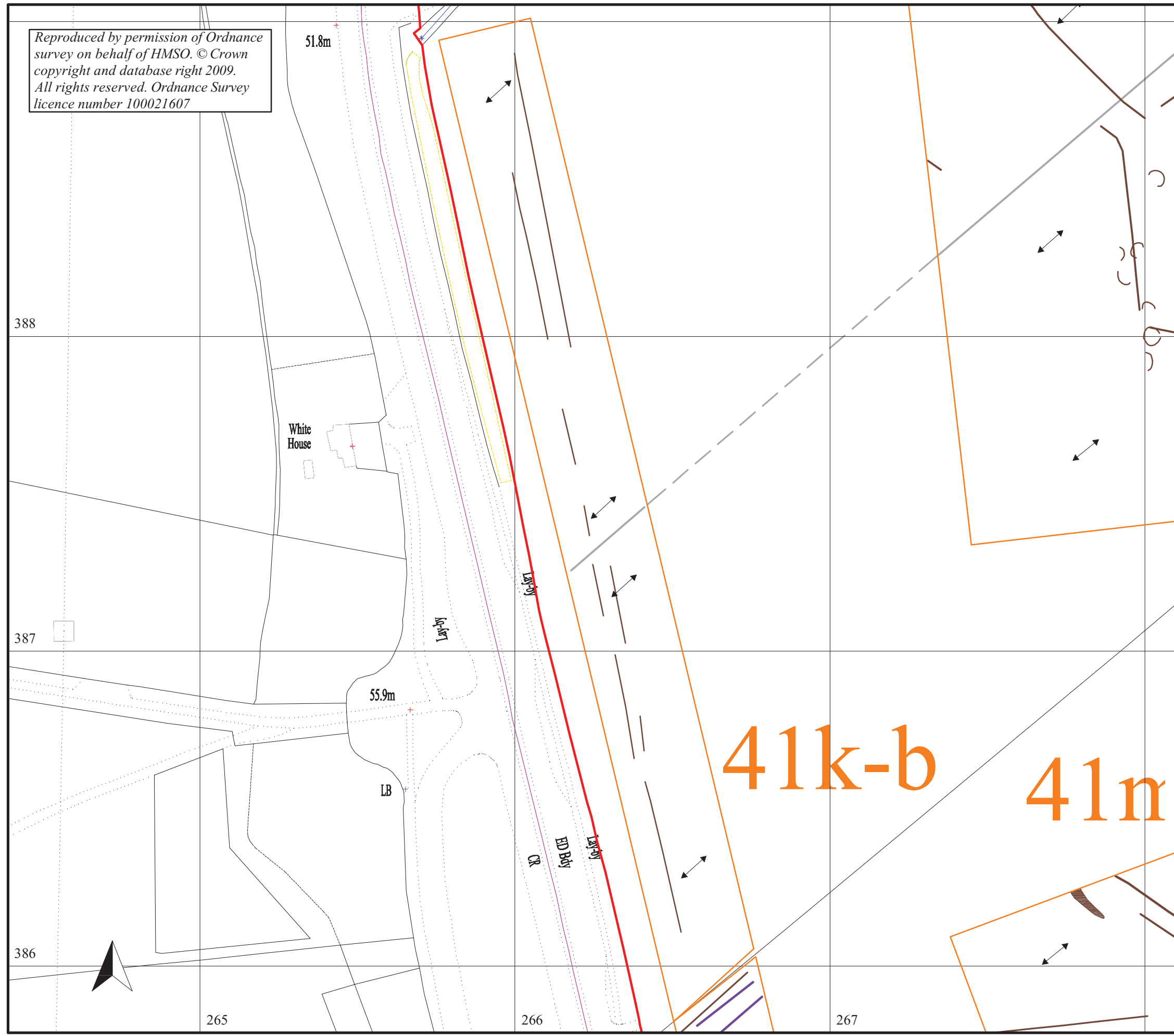
Area 41k-b, archaeological interpretation

on behalf of

The Woodland Trust



- survey area
- soil-filled features
- orientation of ridge and furrow
- former field boundary



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geophysical surveys

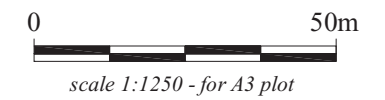
Report 2336

Figure 19

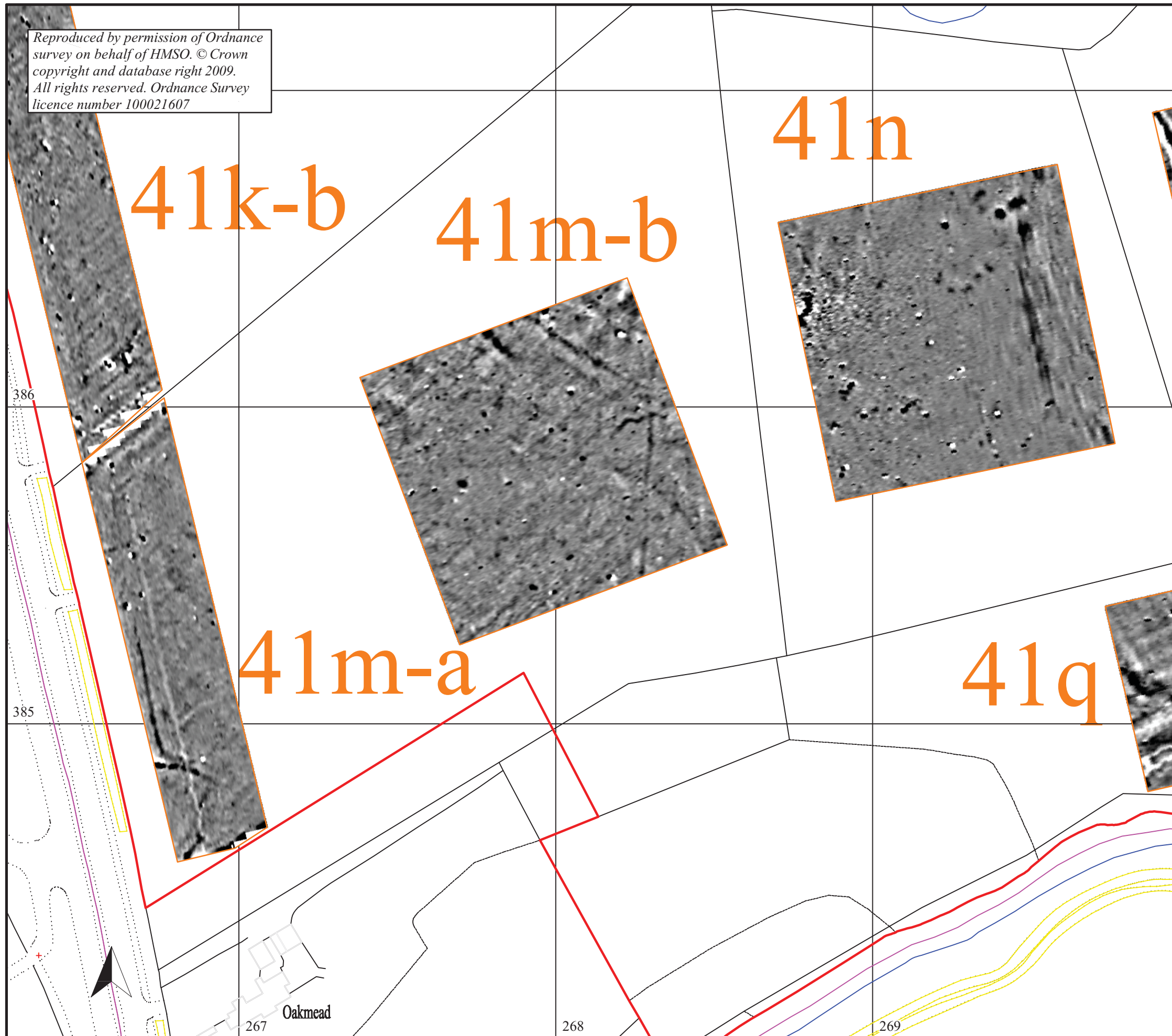
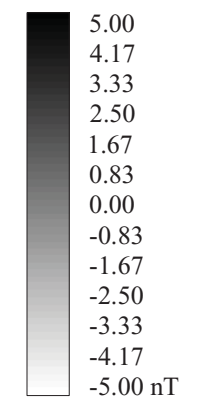
Areas 41m-a, 41m-b and 41n,
geophysical survey

on behalf of

The Woodland Trust



 survey areas



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Low Burnhall Wood,
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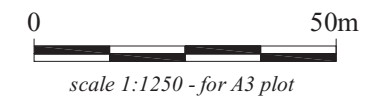
Report 2336





Figure 20

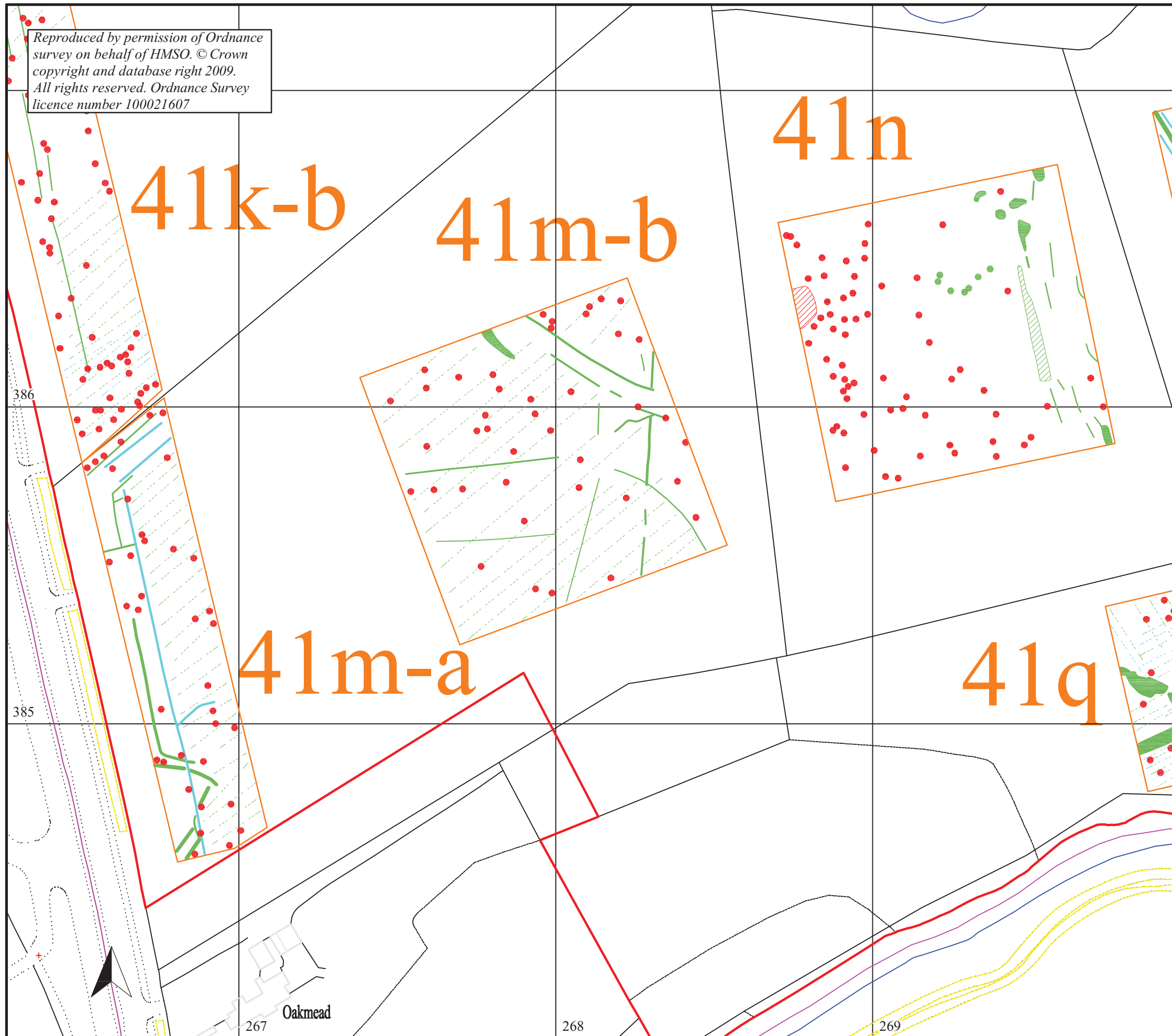
Area 41m-a, 41m-b and 41n,
geophysical interpretation

on behalf of

The Woodland Trust



-  survey areas
-  positive magnetic anomalies
-  negative magnetic anomalies
-  dipolar magnetic anomalies



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County Durham

geophysical surveys

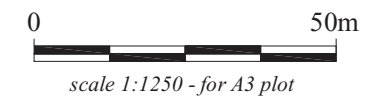
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Figure 21

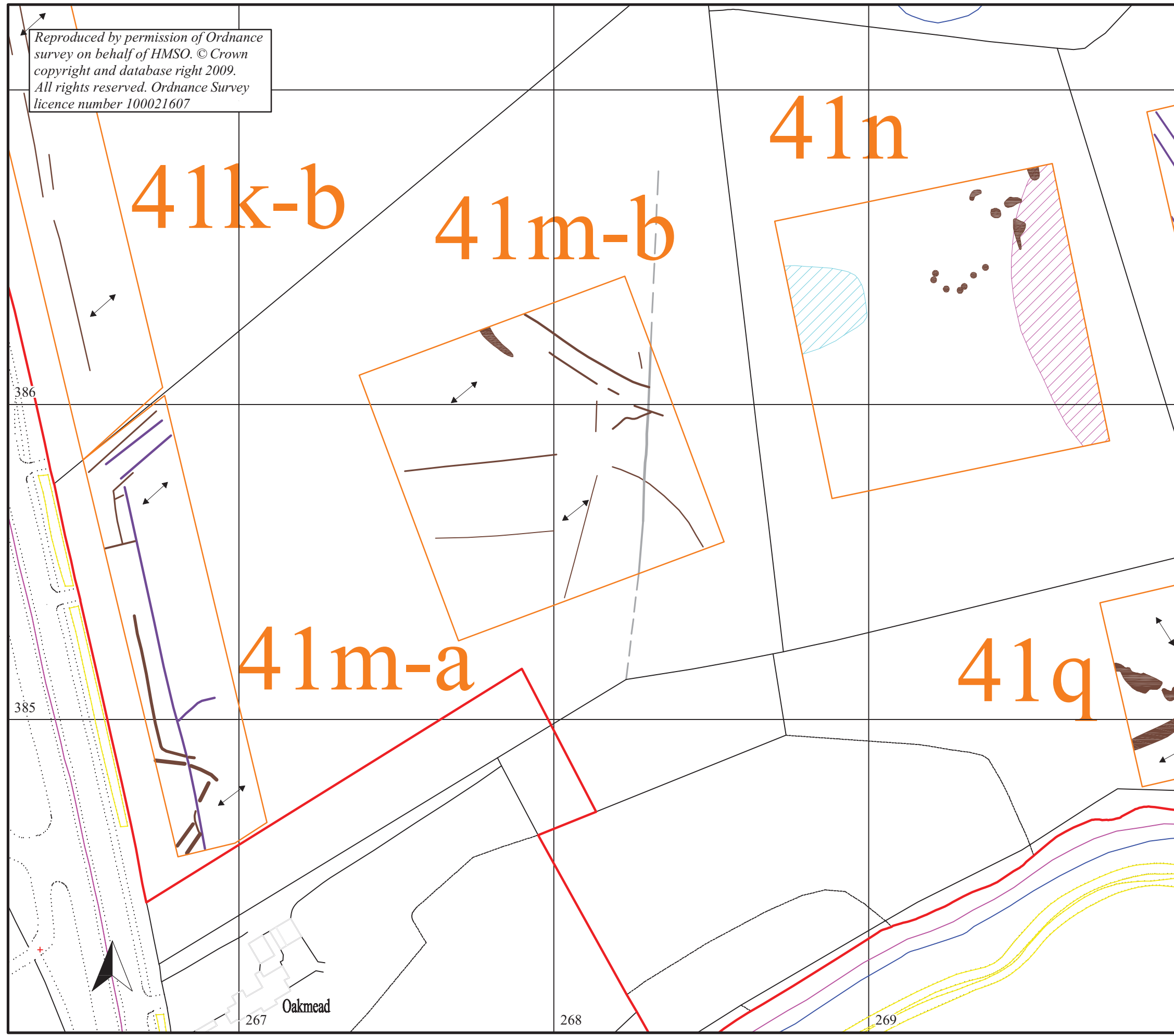
Area 41m-a, 41m-b and 41n,
archaeological interpretation

on behalf of

The Woodland Trust



-  survey areas
-  soil-filled features
-  disturbed ground
-  orientation of ridge and furrow
-  geological features
-  land drains
-  former field boundary



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Low Burnhall Wood,
County Durham

geophysical survey

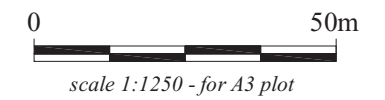
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Figure 22

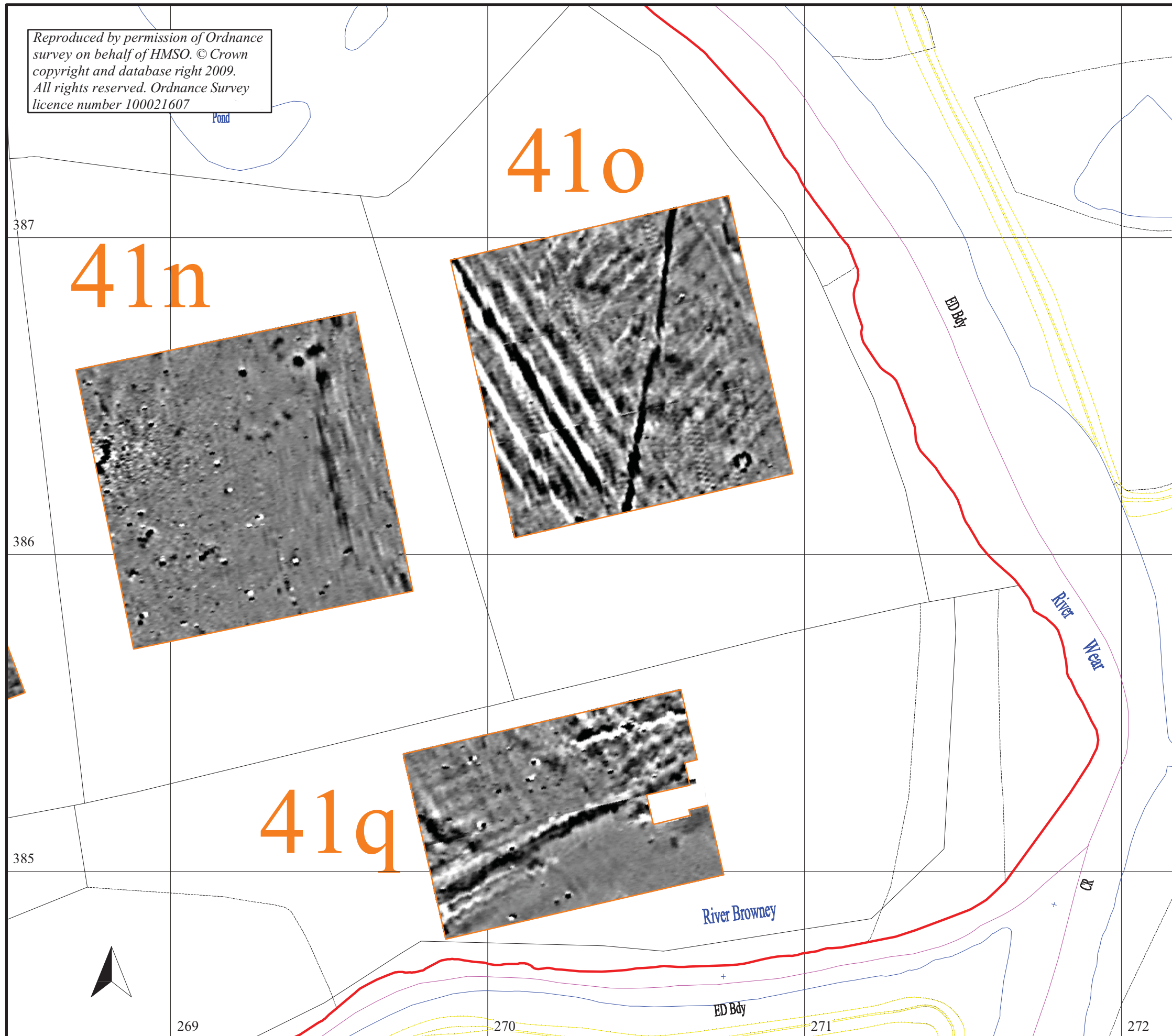
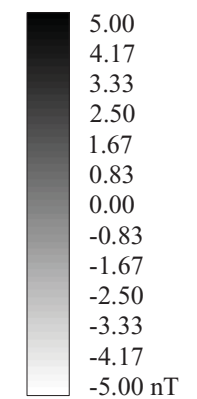
Area 41o and 41q, geophysical survey

on behalf of

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 survey areas



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



Figure 23

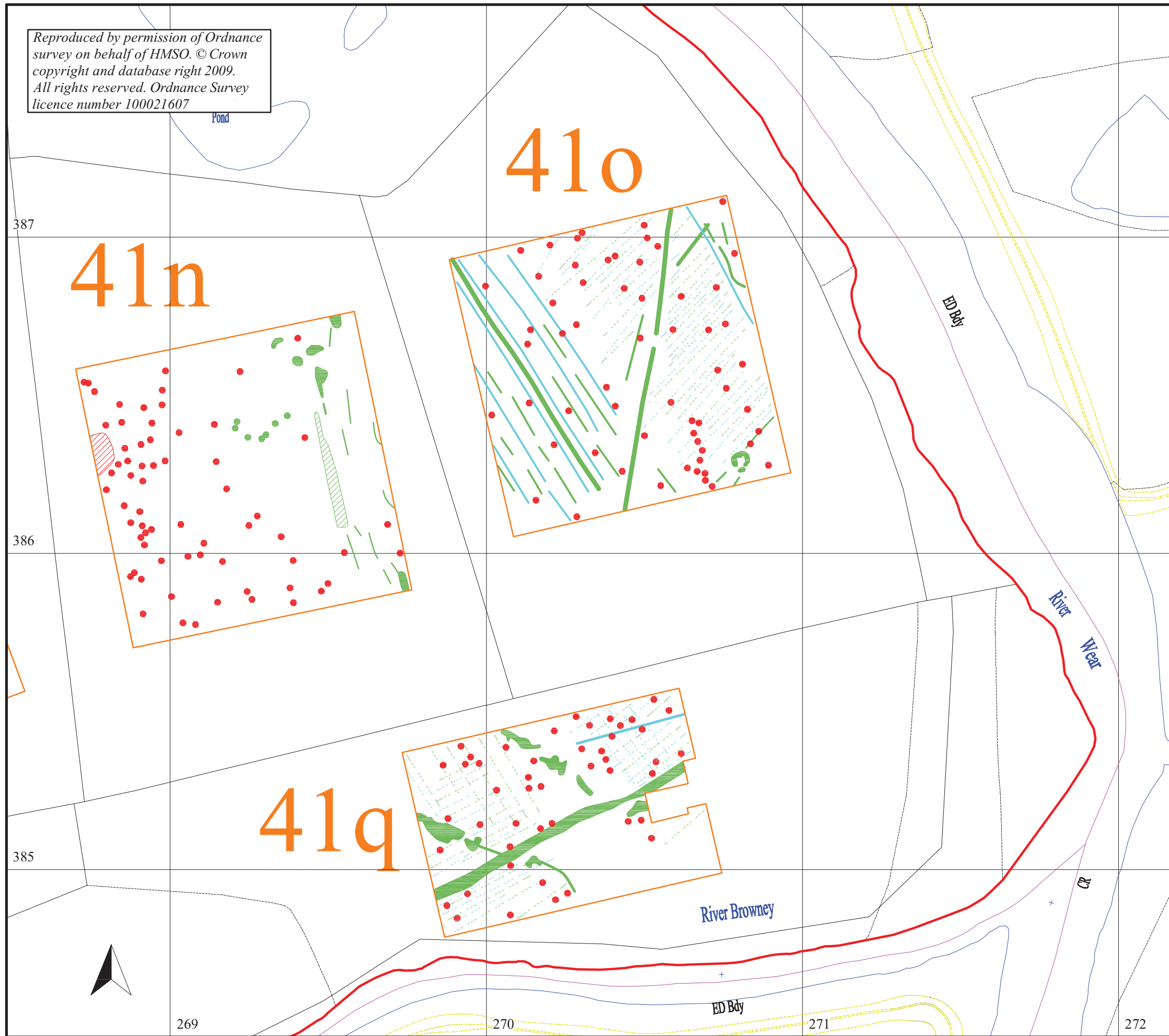
Area 41o and 41q, geophysical interpretation

on behalf of

The Woodland Trust

0 50m
scale 1:1250 - for A3 plot

-  survey areas
-  positive magnetic anomalies
-  negative magnetic anomalies
-  dipolar magnetic anomalies



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



Figure 24

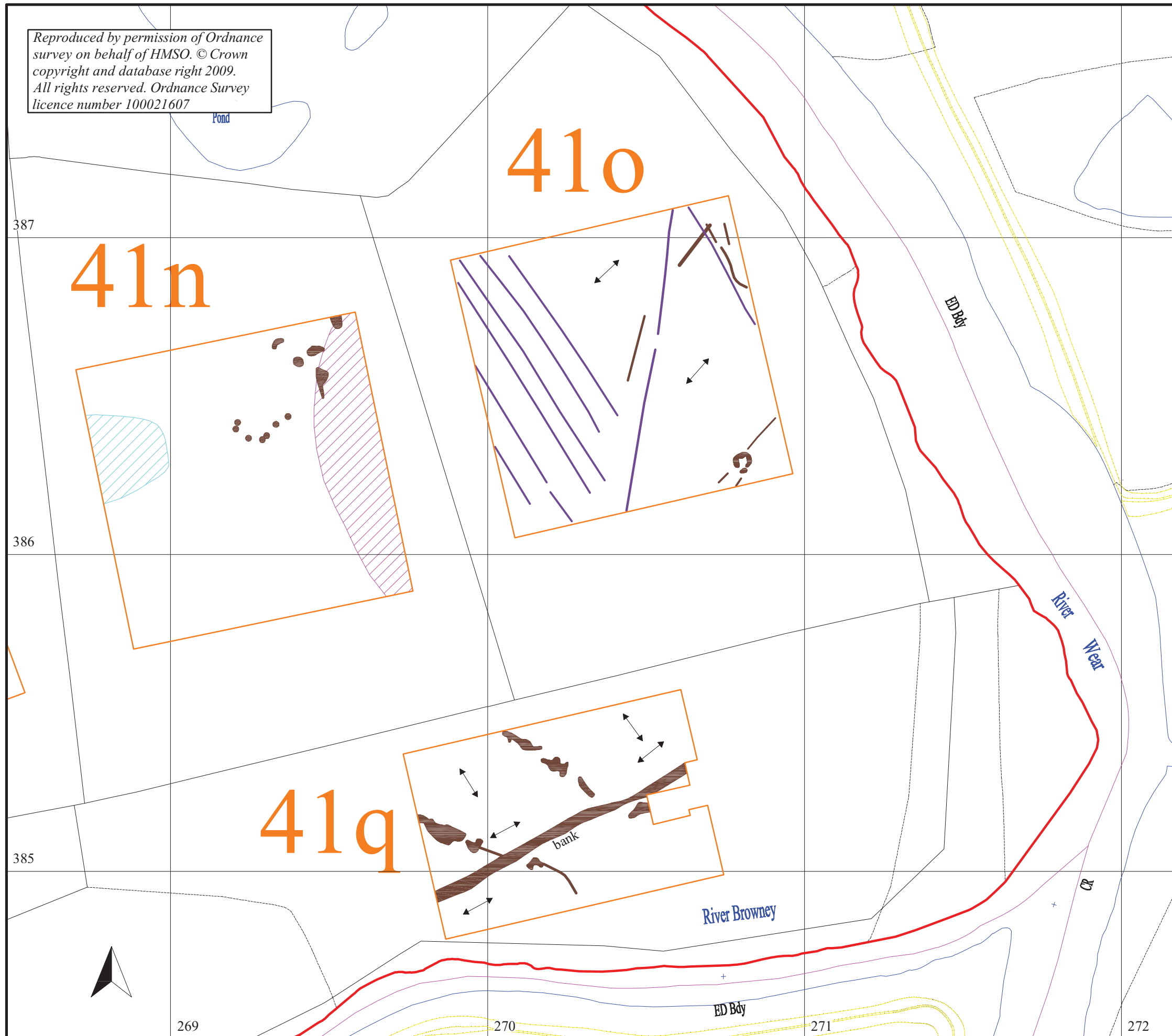
Area 41o and 41q, archaeological interpretation

on behalf of

The Woodland Trust

0 50m
scale 1:1250 - for A3 plot

-  survey areas
-  soil-filled features
-  orientation of ridge and furrow
-  land drains





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Figure 25

Area 41s, geophysical survey

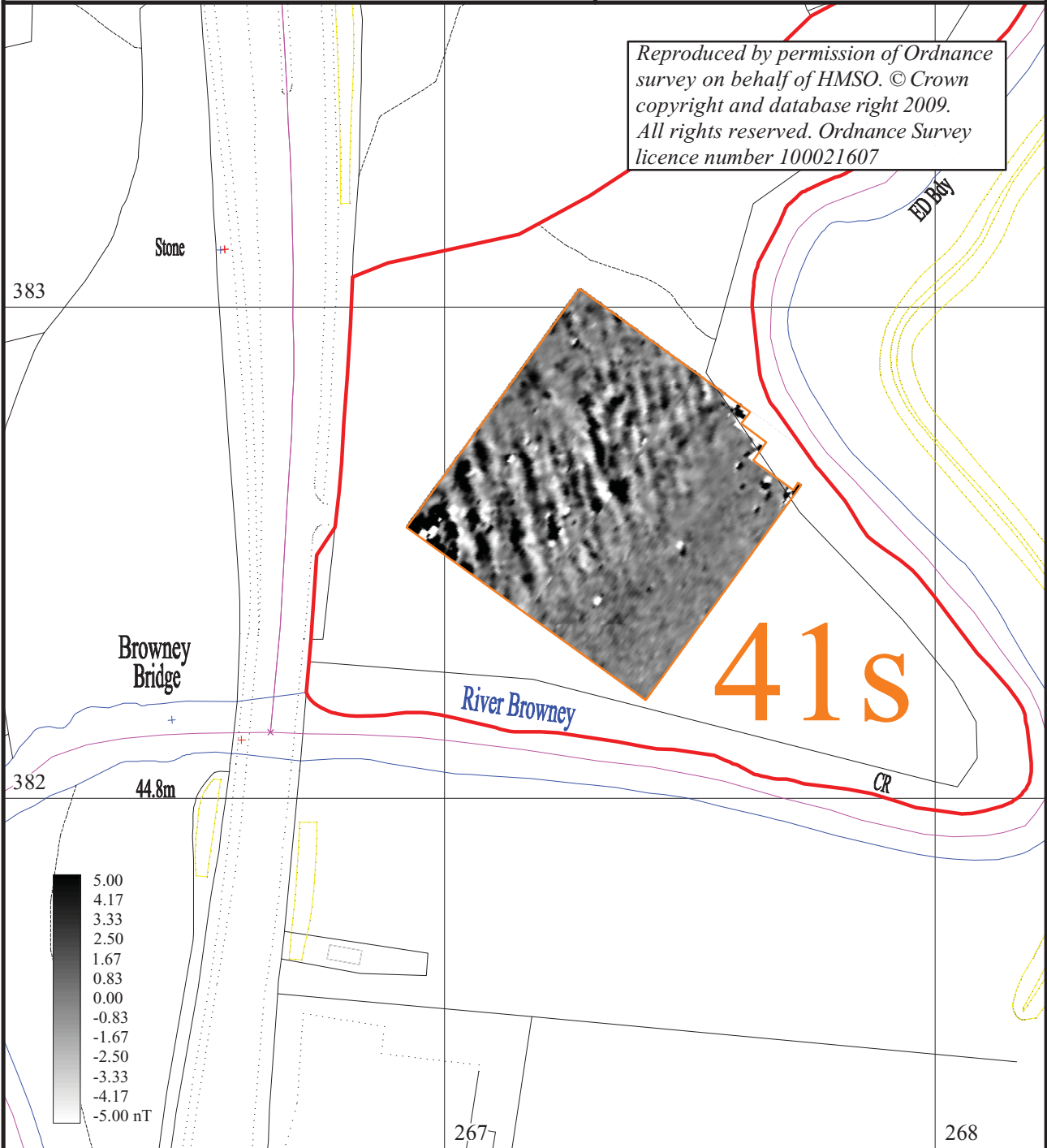
on behalf of

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scale 1:1250 - for A4 plot

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survey area





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Figure 26

Area 41s, geophysical interpretation

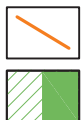
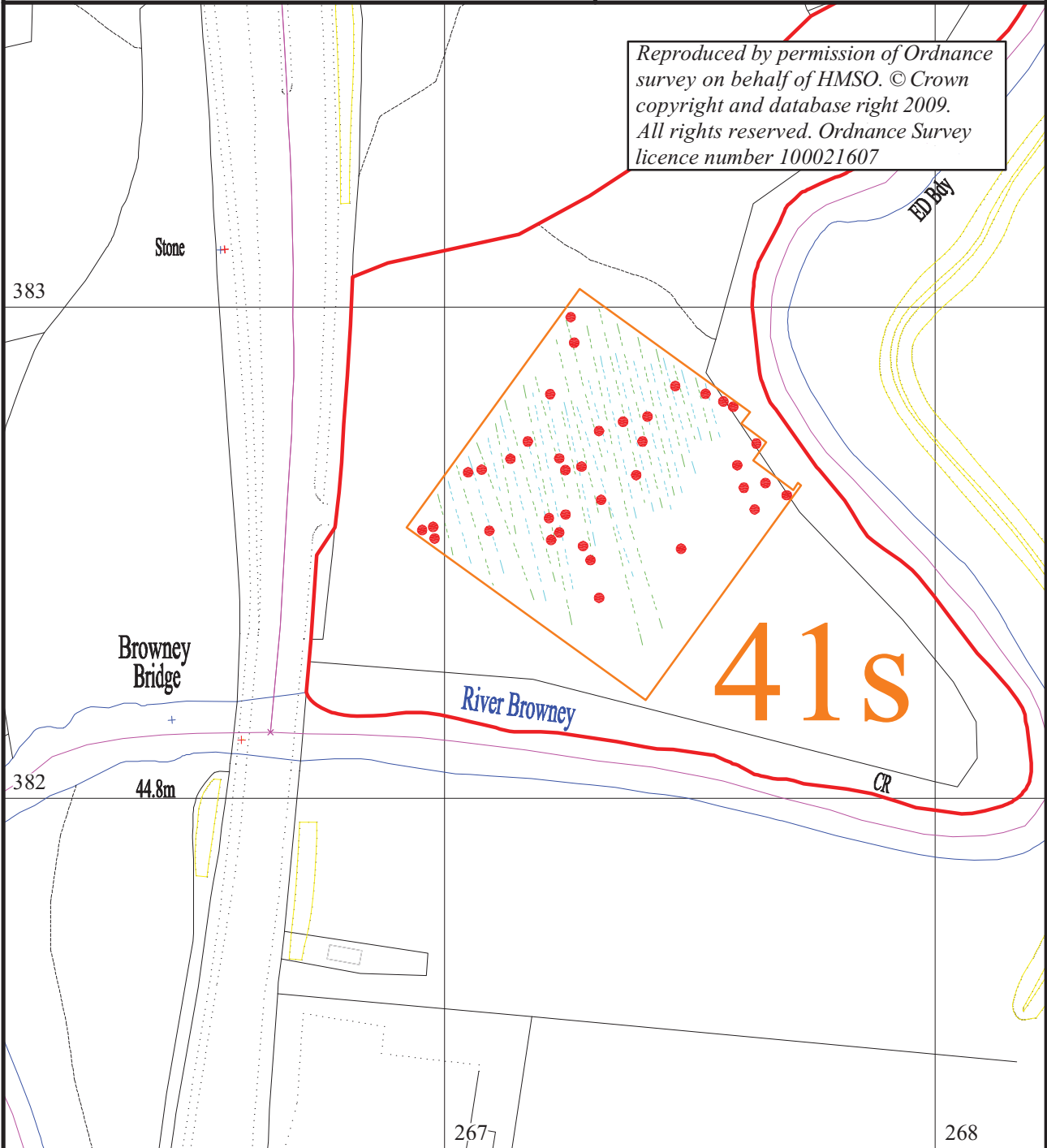
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scale 1:1250 - for A4 plot

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survey area



negative magnetic anomalies



positive magnetic anomalies



dipolar magnetic anomalies





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Figure 27

Area 41s, archaeological interpretation

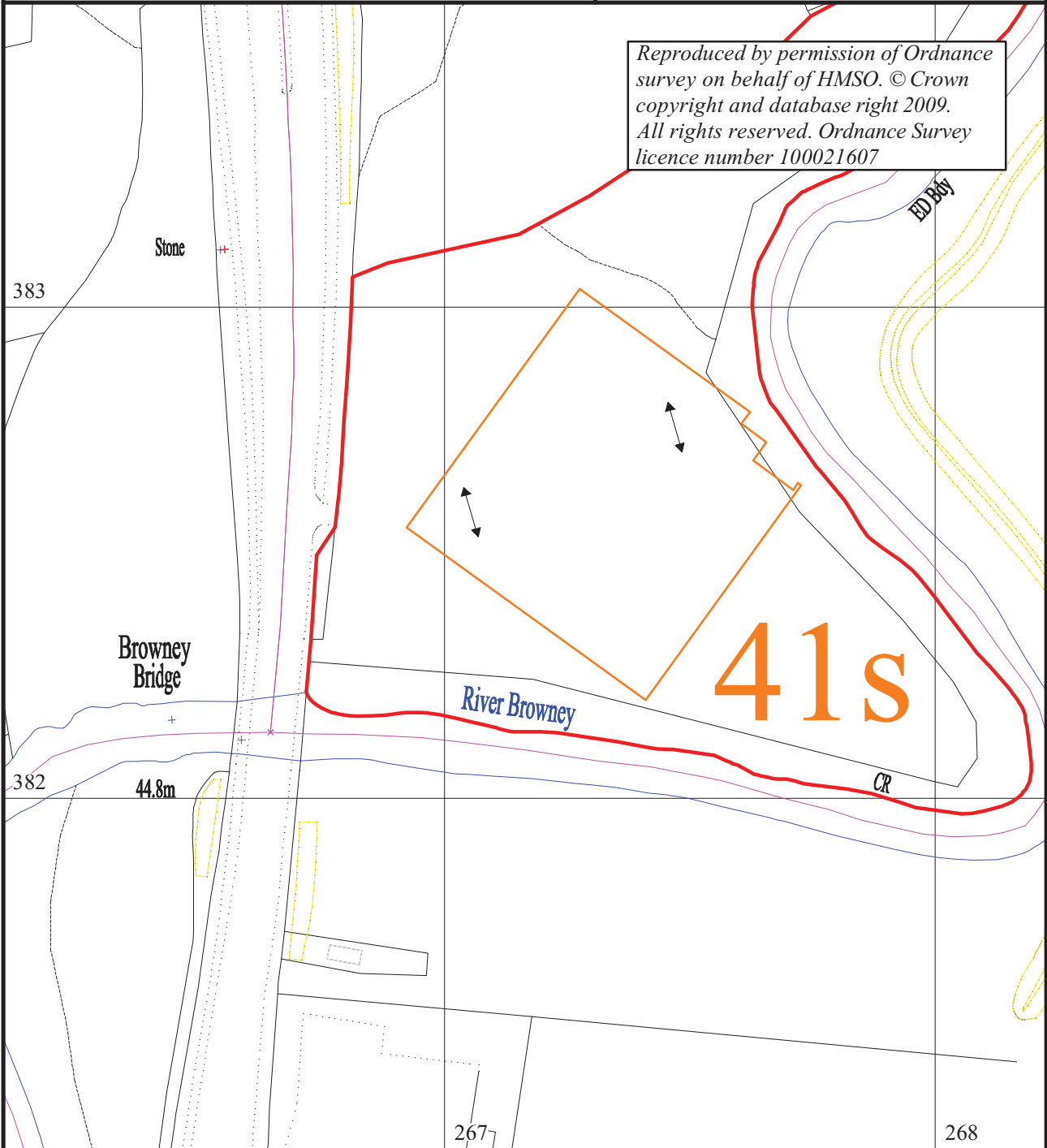
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scale 1:1250 - for A4 plot

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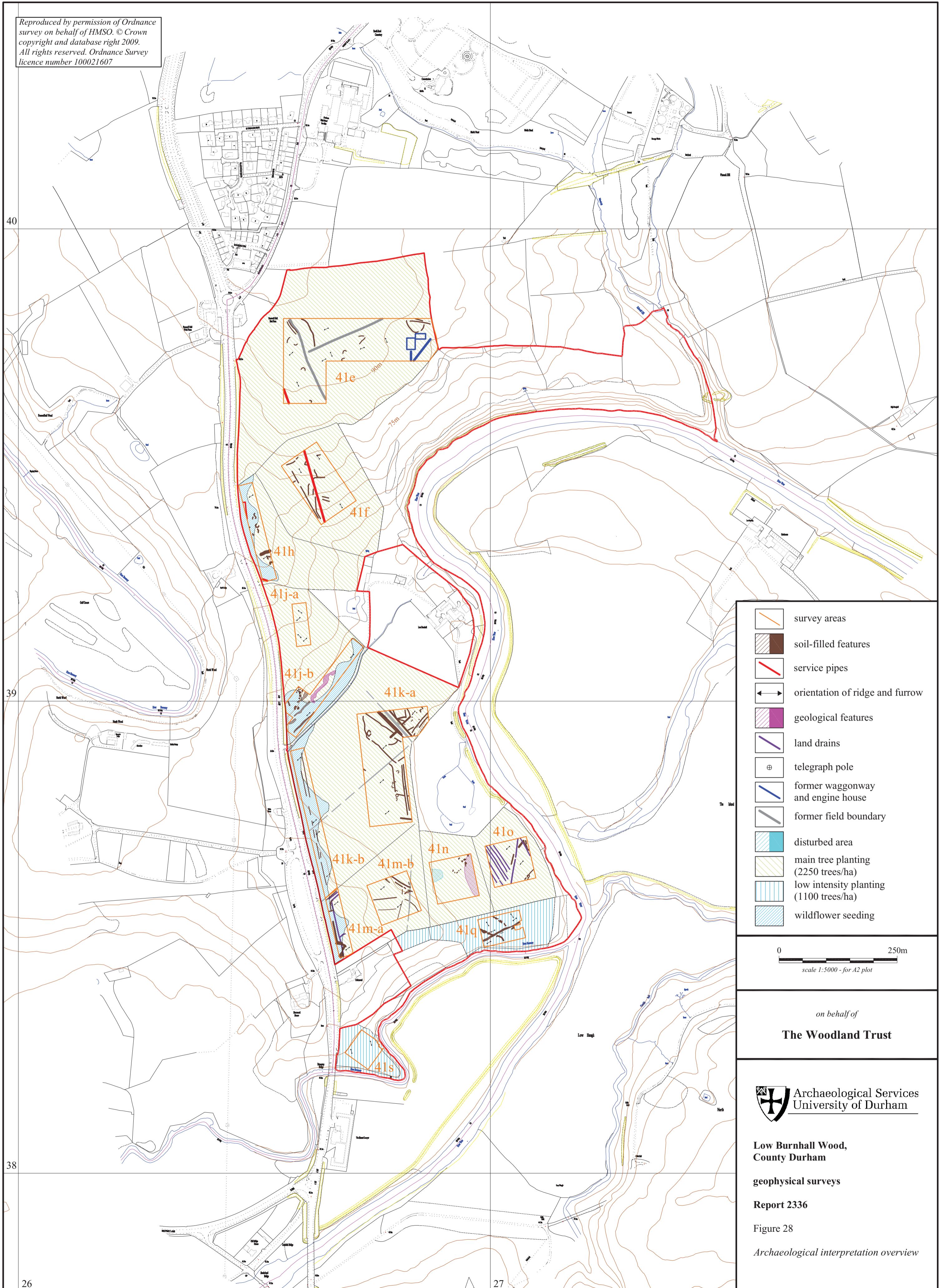
survey area
















orientation of ridge and furrow



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-  survey areas
-  soil-filled features
-  service pipes
-  orientation of ridge and furrow
-  geological features
-  land drains
-  telegraph pole
-  former waggonway and engine house
-  former field boundary
-  disturbed area
-  main tree planting (2250 trees/ha)
-  low intensity planting (1100 trees/ha)
-  wildflower seeding

0 250m
scale 1:5000 - for A2 plot

on behalf of
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University of Durham

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Figure 28
Archaeological interpretation overview

40

39

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26

27

Figure 29: Trace plots of geomagnetic data

Area 41e

