Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer and earth-resistance survey

Land adjacent to Boswell's Lane North Tawton, Devon

Centred on NGR (E/N): 267500, 101800 (point)

Report: 1506BOS-R-2

Ross Dean BSc MSc MA MCIfA

30 November 2015

Substrata
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Client:
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Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type:	magnetometer (twin-sensor fluxgate gradiometer) twin probe earth resistance
Date:	gradiometer: 15 July 2015 earth resistance: unknown (completed by ACE Archaeology)
Area:	gradiometer survey 0.72ha earth resistance survey 1.5ha
Author:	Ross Dean BSc MSc MA MCIfA
Lead surveyor:	gradiometer: Mark Edwards BA, Substrata earth resistance: ACE Archaeology

1.2 Client

Devon County Council Environment Group, Lucombe House, County Hall, Exeter, Devon EX2 4QD

1.3 Location

Site:	Land adjacent to Boswell's Lane
Civil Parish:	North Tawton
District:	West Devon
County:	Devon
NGR:	SS 675 018 (point)
NGR E/N:	267500,101800 (point)
Nearest post code:	EX20 2BY

1.4 Archive

OASIS entry: 230681

At the time of writing, the archive of this survey will be held by Substrata and will be deposited with the ADS in due course.

1.5 Introduction

Sherds of a handle and rim or base rim of a military type Roman (43 AD to 410 AD) patera were recovered during a metal detector survey at the above site. The finds were recovered from topsoil, close to a spring point and slightly above a marshy area. The area may have been disturbed by relatively recent, possibly Victorian, drain digging (see Section 5 for further details). An archaeological earth resistance survey was undertaken by ACE Archaeology to provide an archaeological context for the metal detecting finds. The results of the survey indicated the potential for a large, sub-rectangular platform that was either an archaeological structure or a natural feature with possible ditches along the eastern and southern edges.

This work was commissioned by the Devon County Council Environment Group to complement the earth resistance survey with a magnetometer survey and to combine both surveys into a broader geophysical assessment of the site.

1.7 Summary

Both the magnetic and earth resistance responses were sufficient to be able to differentiate anomalies representing possible archaeological features.

Four magnetic anomaly groups and five earth resistance anomaly groups were identified as possibly representing archaeological deposits or features. There is a distinct west-east trend in both data sets that is most likely to reflect former ploughing, some of which may have been ridge-and-furrow. The large sub-rectangular pattern in the resistance data is likely to reflect near-surface geology enhanced by a drainage ditch to the south and a former holloway, drainage channel or earthen bank to the east. A west-east orientated linear magnetic anomaly at the northern edge of the site may represent a substantial ditch. A group of north-south and east-west linear resistance anomalies forming an apparent sub-rectangular pattern is most likely to reflect

data collection and processing combined with the west-east ploughing trends discussed above but an archaeological origin for these right-angled trends cannot be entirely ruled out.

2 Survey aims and objectives

2.1 Aims

1. Define and characterise any detectable archaeological remains on the site using the magnetometer data collected by Substrata and the earth resistance data collected by ACE Archaeology.
2. Inform any future heritage management and archaeological investigation of the area.

2.2 Survey objectives

1. Complete a gradiometer survey across agreed parts of the site.
2. Process and analyse the gradiometer data collected by Substrata.
3. Process and analyse the earth resistance data collected by ACE Archaeology.
4. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
5. Within the limits of the techniques and datasets, archaeologically characterise any such anomalies or patterns of anomalies.
6. Accurately record the location of the identified anomalies.
7. Produce a report based on the survey that is sufficiently detailed to inform any subsequent heritage management of the site about the location and possible archaeological character of the recorded anomalies.

3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and English Heritage (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service/Digital Antiquity Guides (undated). The document text was written using the house style of the Chartered Institute for Archaeologists (Chartered Institute for Archaeologists, undated).

4 Site description

4.1 Landscape and land use

The survey area lies within a single field lying between 175m and 185m AOD to the east of the town of North Tawton as shown in Figure 1. A stream runs north to south on the eastern boundary of the field. Two springs were located within the field; one recorded as 'Issues' and the other coinciding with anomaly group g105 in Figure 2. The former is close to the location of the metal detection find noted in section 5 below.

At the time of the survey the land was under pasture.

4.2 Geology

Rocks of the Permian Bow Breccia Formation underlie the area. They comprise reddish-brown, silty and sandy breccia with pebbles of sandstone, slate, shale, hornfels, acid lava, vein-quartz and quartz porphyry. Lamprophyres and basalts are present near North Tawton. The superficial geology is not recorded in the source used (British Geological Society undated).

5 Archaeological background

5.1 Historic landscape characterisation

Medieval enclosures based on strip fields.

This area was probably first enclosed with hedge-banks during the later Middle ages. The curving form of the hedge-banks suggests that earlier it may have been farmed as open strip-fields (Devon County Council, undated)

5.2 Known Heritage Assets

The following is a short summary of information obtained from the Devon Historic Environment Record (DHER) within approximately 1000m of the survey area and relevant to the understanding of the geophysical survey. Except where specifically cited, this information was obtained using the Heritage Gateway (Historic England, undated).

5.2.1 Heritage Assets within the survey area

Sherds of a handle and rim or base rim of a military type Roman (43 AD to 410 AD) patera were recovered during a metal detector survey within the survey area. The finds were recovered from topsoil, close to a spring point (marked 'Issues' in Figure 2) and slightly above a marshy area. The area may have been disturbed by relatively recent, possibly Victorian, drain digging (DHER entry MDV109919, NGR SS 675 018).

5.3.2 Heritage Assets within 1000m of the Application Area

A Neolithic (4000 BC to 2201 BC) complex, multi-ditched enclosure lies at Stone, approximately 900m east-south-east of the site. It has a maximum of four enclosing ditches (maximum dimensions 100m by 110m) and is visible as cropmark. Internal features are visible including a possible north-south road running through centre of the enclosure (MDV41114, SS 684 016).

A Prehistoric (before 43 AD) ring ditch or small circular enclosure is located approximately 250m southeast of the site. Prior to the use of the field as a formal football pitch, it was visible as cropmark with a gap in the eastern side (MDV17628, SS 678 016).

An extant Prehistoric barrow (MDV12416, SS 682 010) with an undated granite window mullion set upright in the centre as a rubbing stone (MDV62042) is recorded near Crooke Farm approximately 900m south-east-south of the site. There are two ring ditches in an adjacent field.

A cluster of Prehistoric ring ditches are located between 800m and 900m south of the site. A 20m segment of a curving ditch excavated in advance of a residential development in 2004 is thought to be part of a ring ditch approximately 12 to 15m in diameter (MDV41111, SS 683 014). Two adjacent annular marks, with a diameter of approximately 30m and 20m, were recorded as a cropmark as was a previously unrecorded barrow in the adjacent field (MDV62043, SS 681 010). A possible ring ditch, approximately 10m diameter, within a larger ring ditch of approximately 30m diameter, both assessed as Bronze Age (2200 BC to 701 BC), were recorded by aerial reconnaissance in 1988 (MDV41118, SS 675 010). A possibly Neolithic ring ditch (20m diameter) with possible second ring ditch (approximately 20m in diameter) to the east were also recorded by aerial reconnaissance in the same year (MDV41113, SS 678 009).

A Bronze Age palstave with damaged blade, flanges and loop and a faint ridge on both faces was recovered to the north of the site (MDV3017, NGR SS 67 02).

The Ordnance Survey surveyor's drawing of 1806-7 and the 1847 North Tawton Tithe Map shows the area to the south of the town, approximately 900m west-south-west of the site, to be occupied by large regular fields. These may represent an early Post-medieval (1540 AD to 1900 AD) enclosure of a Medieval (1066 AD to 1539 AD) field system (MDV36427, SS 667 014).

6 Results, discussion and conclusions

This survey was designed to record magnetic and resistance anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits and structures.

The terms 'archaeological features' and 'archaeological deposits' refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity and not undertaken as recent land maintenance or farming.

The reader is referred to section 7.

6.1 Results

Figure 2 shows the interpretation of the gradiometer and earth resistance survey data. It includes the anomaly groups identified as relating to archaeological deposits along with their numbers. Figures 3 and 4 show the interpretations for the gradiometer and earth resistance surveys separately. Table 1 is an extract of the detailed analysis of the survey data which is provided in the attribute tables of the GIS project on the accompanying CD-ROM and in the project archive.

Figures 2 to 4 and Table 1 comprise the analysis of the survey data.

Various plots of the processed data used during the analysis are provided in Figures 5 to 10.

6.2 Discussion

6.2.1 General points

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project on the accompanying CD-ROM.

Anomalies thought to relate to natural features were not mapped except where they had a significant impact on the data that required further analysis.

There are numerous magnetic anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

6.2.2 Data relating to historical maps and other records

No magnetic or resistance anomalies coincided with previously mapped or otherwise recorded features.

6.2.3 Data with no previous archaeological provenance

Magnetic anomaly group **g1** has a similar orientation to magnetic anomaly groups **g**2 and **g3** as well as to resistance anomaly groups **r1** and **r4**. While g1, g3, r1 and r4 are most likely to represent near-surface disturbance by ploughing, quite possibly ridge-and-furrow ploughing which is Post-medieval, Medieval or occasionally Early-medieval in date, group g1 has a clearer magnetic response (Figures 5 and 6) and may represent an archaeological deposit such as a ditch. A linear earthwork was noted by the surveyors at g1 and fainter earthworks were also noted close to the other anomaly groups mentioned above.

Magnetic anomaly group **r2** has no magnetic equivalent (Figures 5 and 6) but is relatively clear in the resistance data (Figures 8 and 10). The anomaly group is most likely to represent a sub-soil filled linear structure such as a former holloway or drainage channel of natural or constructed origin. There is a possibility that it represents relatively recent material cleared from the adjacent stream.

Magnetic anomaly group **g4** and resistance anomaly group **r4** coincide with a visible linear earthwork and are most likely to represent a natural drainage channel from a spring at its western end that has been enhanced to create a drainage ditch at some time in the past.

The large sub-rectangular pattern in the resistance data of northern half of the survey area is likely to reflect near-surface geology enhanced by anomalies g4 and r4 to the south and r2 to the east.

Resistance group **r5** is difficult to characterise. It comprises linears on north-south and west-east orientations apparently forming sub-rectangular patterns best seen in Figure 10. The faint north-south trends seen in the magnetic data are derived from quite usual minor data collection errors and not related to these resistance anomalies Some of the west-east linears have the same trend as other anomalies characterised as possible sub-soil disturbance from ridge-and-furrow ploughing while some have a true west-east orientation. The true north-south and west-east trends are on or are at right-angles to the earth resistance survey traverse lines and so must be treated with caution as potentially derived from the survey process combined with post-survey data processing enhancement undertaken by Substrata to form ‘false anomalies’ rather than representing actual archaeological or natural deposits. Alternatively this group may represent combined former ploughing disturbance, for example ridge-and-furrow with overlying later north-south cultivation traces and, possibly, ‘false anomalies’. While these scenarios are more likely, an archaeological origin cannot be entirely ruled out and only further archaeological investigations will decide the origins of group r5.

6.3 Conclusions

Both the magnetic and earth resistance responses were sufficient to be able to differentiate anomalies representing possible archaeological features.

Four magnetic anomaly groups and five earth resistance anomaly groups were identified as possibly representing archaeological deposits or features. There is a distinct west-east trend in both data sets that is most likely to reflect former ploughing, some of which may have been ridge-and-furrow. The large sub-rectangular pattern in the resistance data is likely to reflect near-surface geology enhanced by a drainage ditch to the south and a former holloway, drainage channel or earthen bank to the east. A west-east orientated linear magnetic anomaly at the northern edge of the site may represent a substantial ditch. A group of north-south and east-west linear resistance anomalies forming an apparent sub-rectangular pattern is most likely to reflect data collection and processing combined with the west-east ploughing trends discussed above but an archaeological origin for these right-angled trends cannot be entirely ruled out.

7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79). This report contains material that is non-Substrata copyright or the intellectual property of third parties. Such material is labelled with the appropriate copyright and is non-transferrable by Substrata.

8 Acknowledgements

Substrata would like to thank Bill Horner of the Devon County Council Environment Group for commissioning us to complete this survey.

We would also like to acknowledge the professionalism and enthusiasm of the members of ACE Archaeology who undertook the earth resistance survey and gave us access to the data. These include Janet Daynes, Wendy Howard, Malcolm Howard, Gordon Fisher and Andy Parish. ACE members also organised access to the field and attended on the day. We are extremely grateful to Andy Parish who fed us at lunchtime and provided the comfort of his house to download the data.

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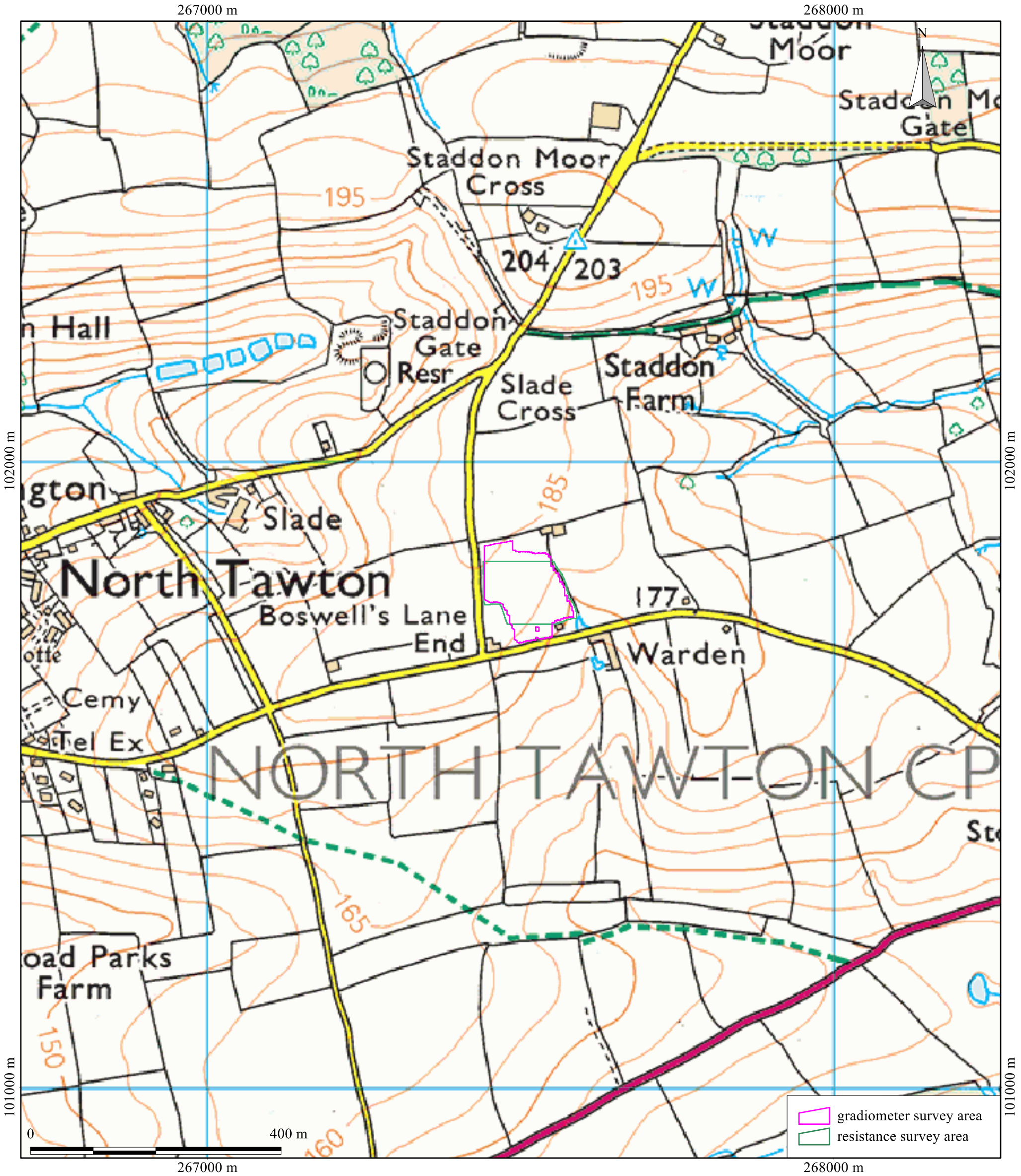
Appendix 1 Analysis table and supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.

A rough rule for interpreting resistance anomalies is that if an x-y trace is drawn of the resistance over an anomaly, then the width of an anomaly at half its maximum height is equal to the width of the buried feature. Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies and it should be noted that the relationship between change in resistance response and depth is not linear (Gaffney and Gater, 2003: 112).



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An archaeological gradiometer and earth resistance survey
Land adjacent to Boswell's Lane, North Tawton, Devon
Centred on NGR (E/N): 267500, 101800 (point)
Report: 1506BOS-R-1

Figure 1: location map

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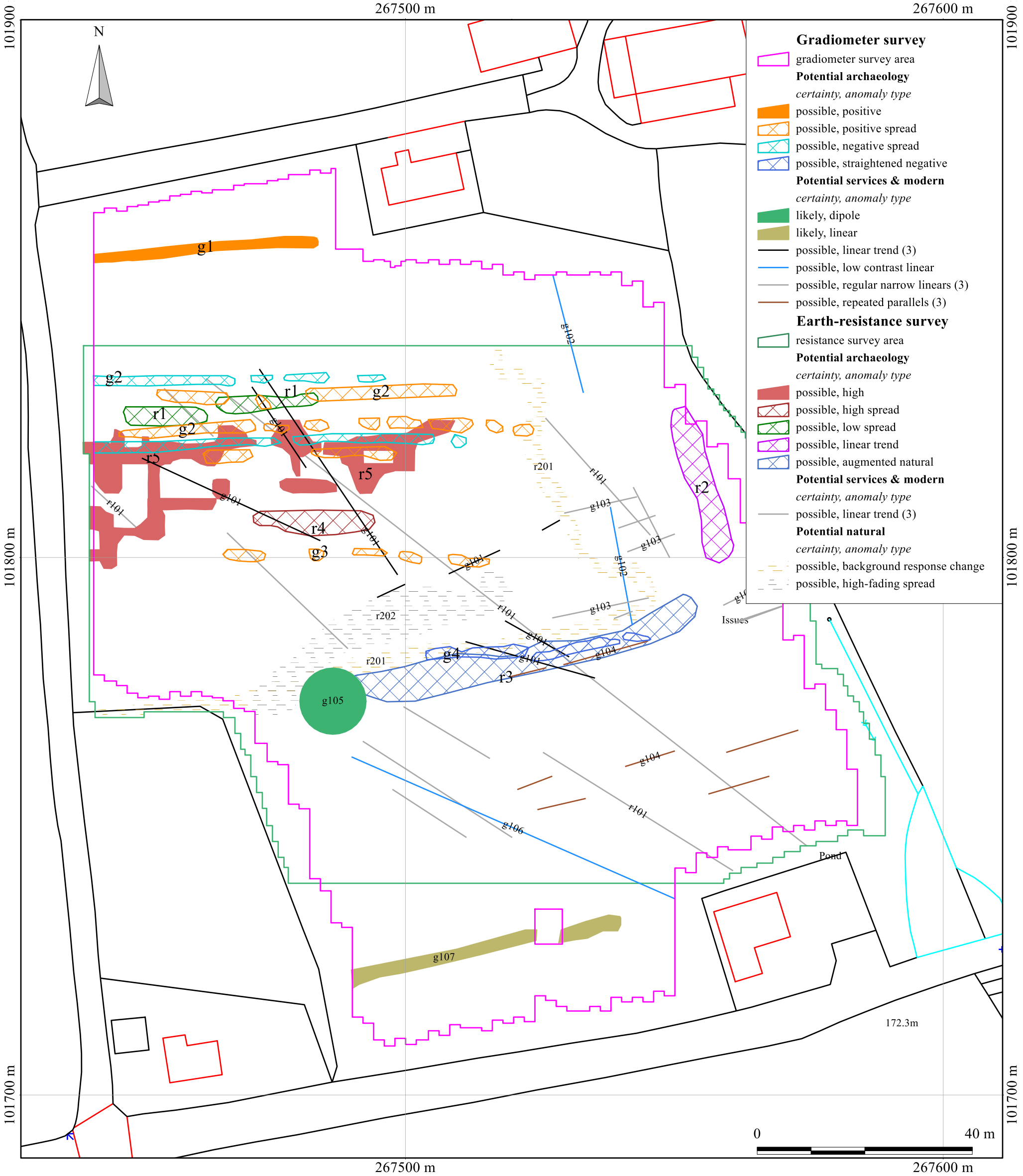

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Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
3. Representative; not all instances are mapped.
4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 2: combined survey interpretation gradiometer and earth-resistance surveys

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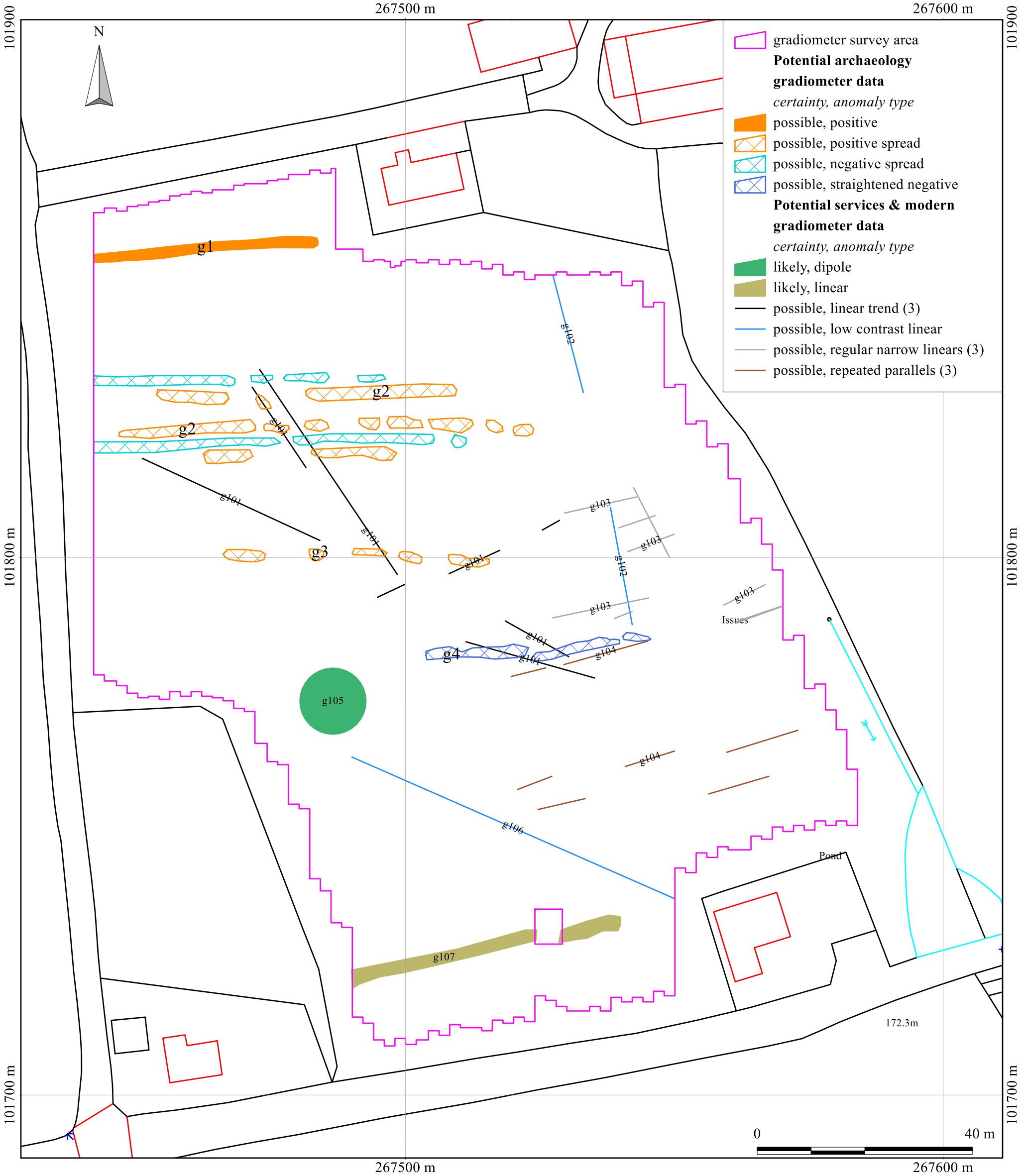

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Figure 3: gradiometer survey interpretation

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Figure 4: earth-resistance survey interpretation

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anomaly group	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
g1	possible, positive		ditch or possible furrow	anomaly group may represent either a ditch or, less likely, former ridge-and-furrow cultivation	low-lying earthworks in the vicinity
g2	possible, positive & negative spreads	disrupted linear	ploughing - possibly ridge-and-furrow		low-lying earthworks in the vicinity
g3	possible, positive spread	disrupted linear	ploughing - possibly ridge-and-furrow		
g4	possible, straightened negative	disrupted linear	enhanced drainage channel	anomaly represents either an enhanced natural drainage channel or a man-made ditch channelling water from a capped spring at the western end of this group	visible earthworks
g101	possible, linear trend		relatively recent ground disturbance	anomaly group represents recent ground disturbance of uncertain origin but likely to be field drains or service trenches	
g102	possible, low contrast linear		service trench		
g103	possible, regular narrow linears		field drains		
g104	possible, repeated parallels		relatively recent ploughing		
g105	likely, dipole		ferrous response	anomaly group represents the iron or steel use to cap and control a spring	visible to surveyors
g106	possible, low contrast linear		service trench		
g107	likely, linear		fence line (temporary fence removed)		visible to surveyors
r1	possible, low	disrupted linear	ploughing - possibly ridge-and-furrow		low-lying earthworks in the vicinity
r2	possible, linear trend	linear	filled holloway, earthen bank or enhanced drainage		
r3	possible, augmented natural	linear	enhanced drainage channel	anomaly represents either an enhanced natural drainage channel or a man-made ditch channelling water from a capped spring at the western end of this group	
r4	possible, high	linear	ploughing - possibly ridge-and-furrow		
r5	possible, high	multilinear	ploughing disruption, data recording and processing derived 'false anomalies' or archaeological deposits		
r101	possible, linear trend		relatively recent ground disturbance	anomaly group represents recent ground disturbance of uncertain origin but likely to be field drains or service trenches	
r201	possible, background response change		change in the underlying geology or deeper natural deposits		
r202	possible, high-fading spread		near surface bedrock - possible altered by human activities		

Table 1: data analysis

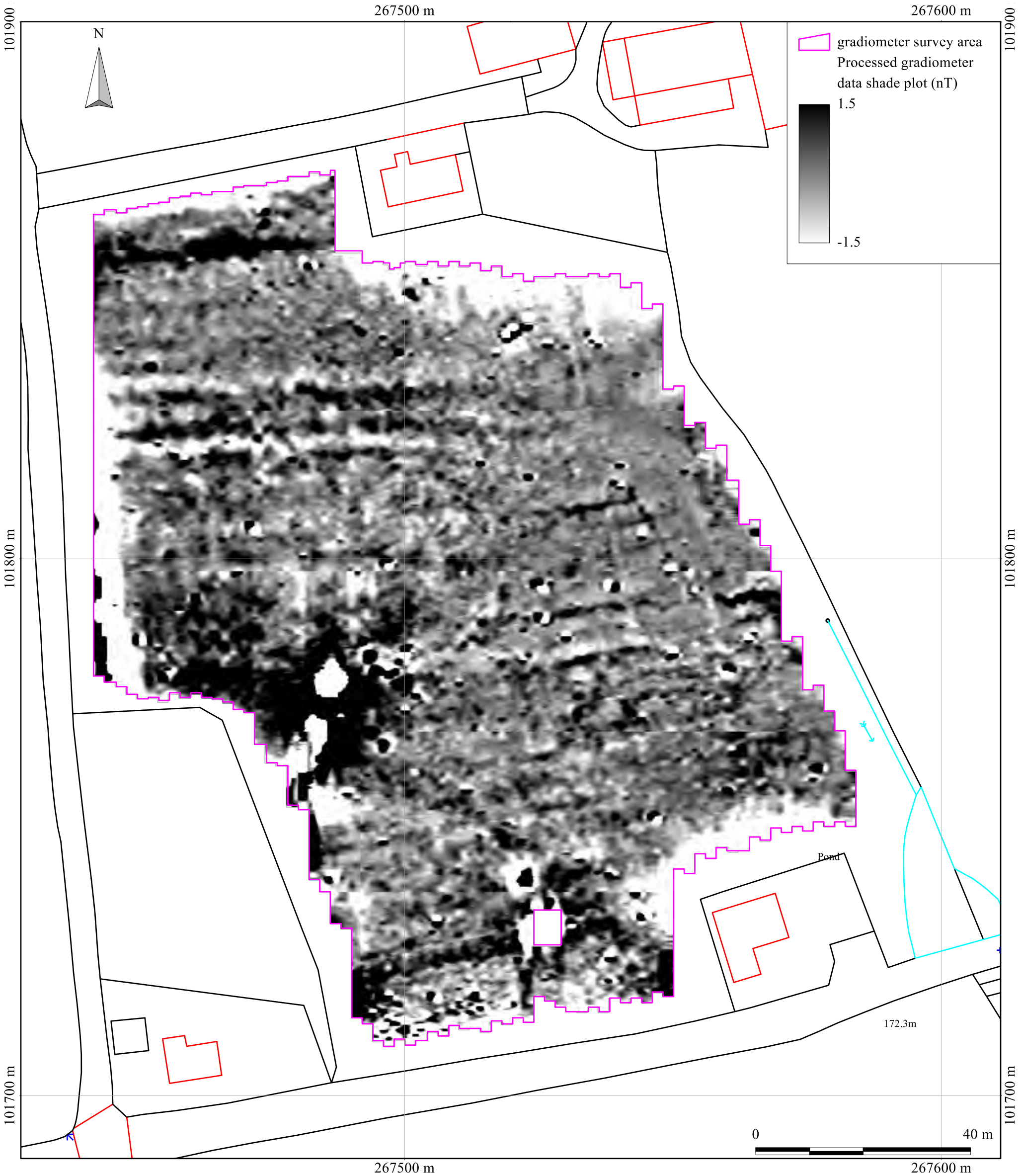

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Figure 5: shade plot of processed gradiometer data

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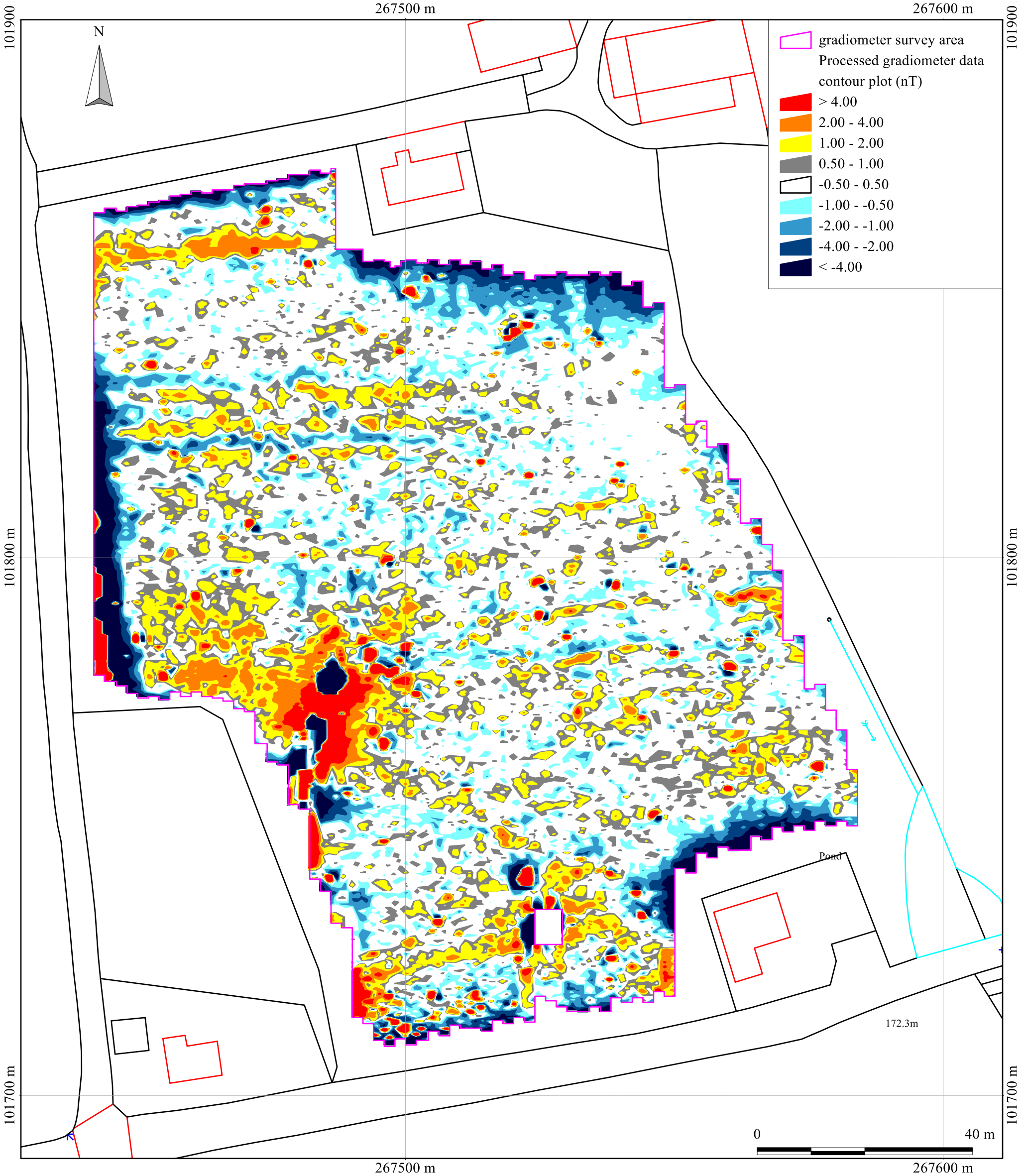

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Figure 6: contour plot of processed gradiometer data

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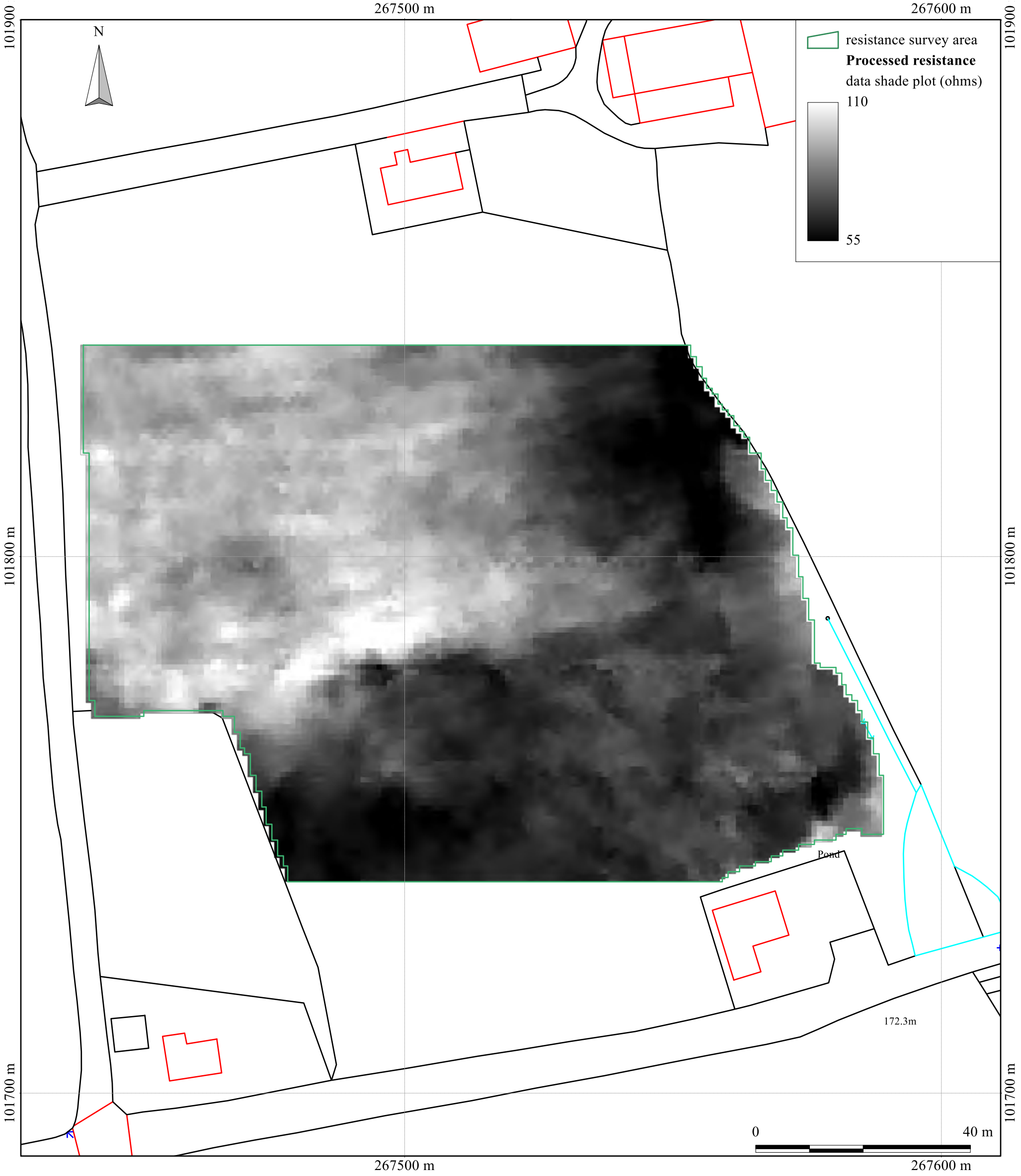

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Figure 7: shade plot of processed earth-resistance data

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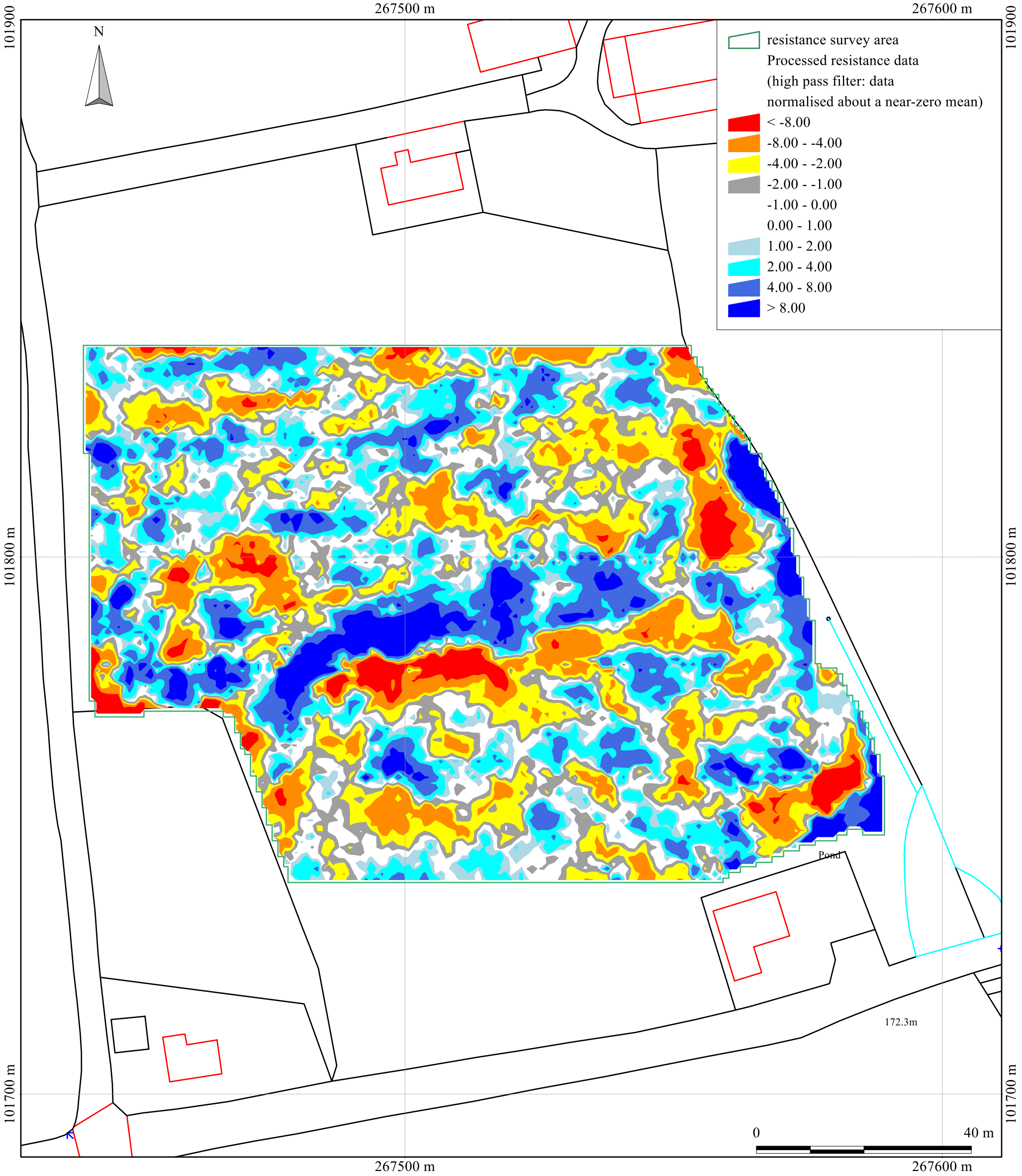

British Grid
centre X: 267519.76 m, centre Y: 101794.17 m

Geophysical survey: Copyright Substrata 2015.
Earth-resistance survey data: Copyright ACE Archaeology Club 2015.
Base map: Ordnance Survey (c) Crown Copyright 2015,
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Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer and earth resistance survey
Land adjacent to Boswell's Lane, North Tawton, Devon
Centred on NGR (E/N): 267500, 101800 (point)
Report: 1506BOS-R-1

Figure 8: contour plot of processed earth-resistance data (high pass filter)

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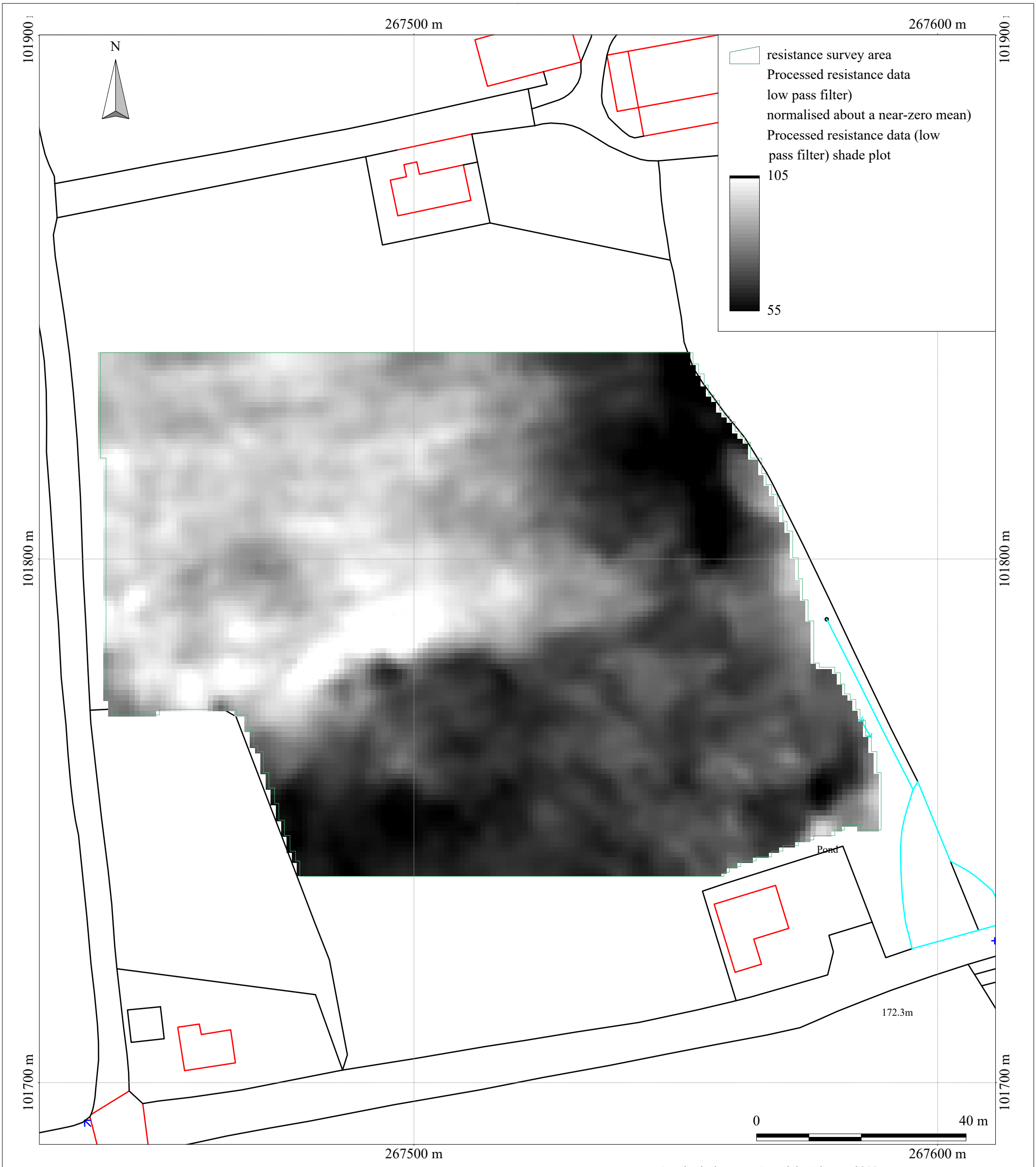

British Grid
centre X: 267519.76 m, centre Y: 101794.17 m

Geophysical survey: Copyright Substrata 2015.
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Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer and earth resistance survey
Land adjacent to Boswell's Lane, North Tawton, Devon
Centred on NGR (E/N): 267500, 101800 (point)
Report: 1506BOS-R-1

Figure 9: shade plot of processed earth-resistance data (low pass filter)

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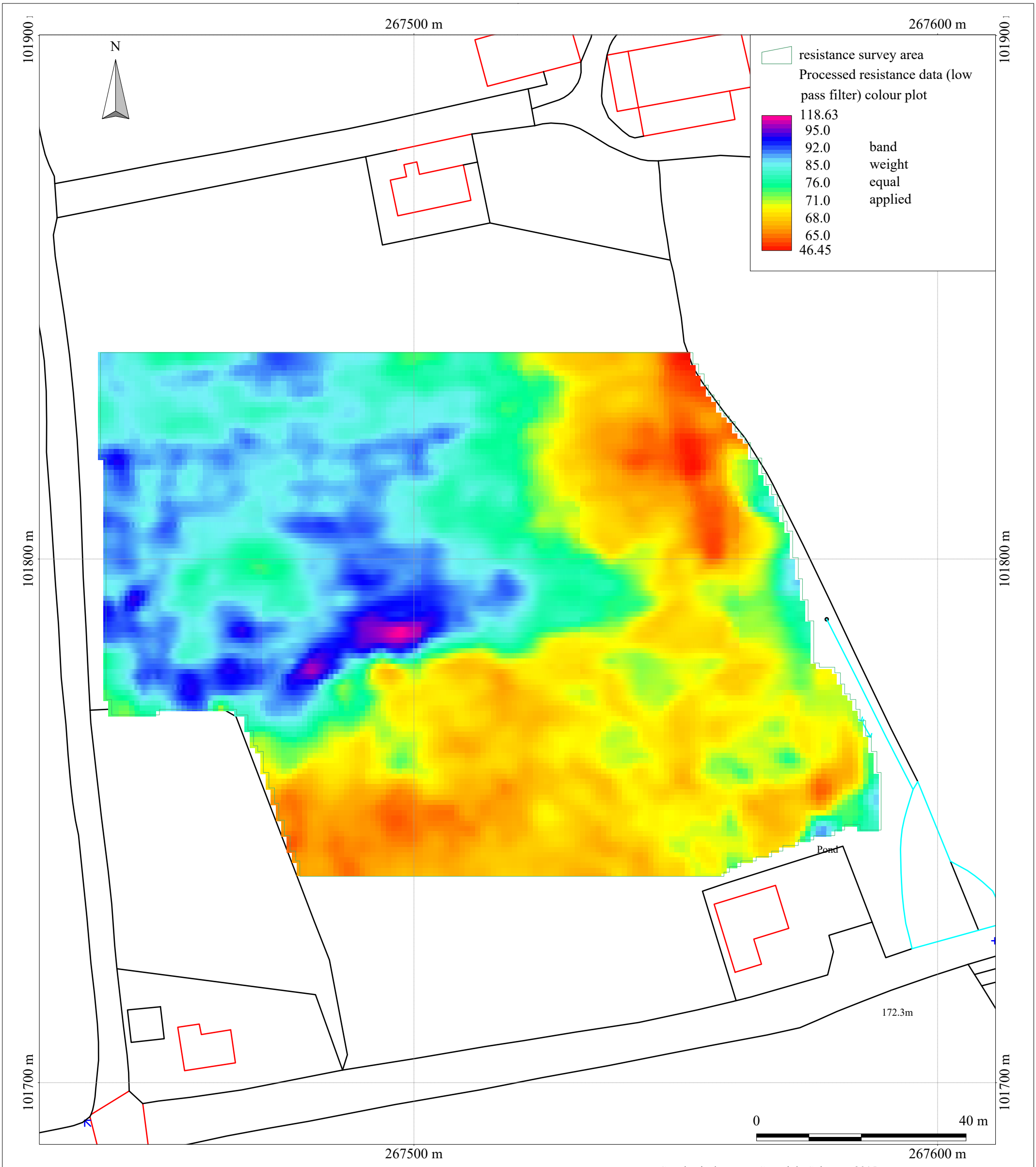

British Grid
centre X: 267519.76 m, centre Y: 101794.17 m

Geophysical survey: Copyright Substrata 2015.
Earth-resistance survey data: Copyright ACE Archaeology Club 2015.
Base map: Ordnance Survey (c) Crown Copyright 2015,
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Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer and earth resistance survey
Land adjacent to Boswell's Lane, North Tawton, Devon
Centred on NGR (E/N): 267500, 101800 (point)
Report: 1506BOS-R-1

Figure 10: colour plot of processed earth-resistance data (low pass filter)

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Appendix 2 Methodology Summary

<table>
<tr><th colspan="2">Table 2: methodology summary</th></tr>
<tr><td colspan="2">Documents
Survey method statement: Dean (2015)</td></tr>
<tr><td colspan="2">Methodology
1. The work was undertaken in accordance with the survey methodology statement. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service/ Digital Antiquity Guides (undated).
2. The earth resistance survey was undertaken by ACE Archaeology.
3. The gradiometer survey grid location information and grid plan was recorded as part of the project in a suitable GIS system.
4. The earth resistance survey grid location information and grid plan was provided by ACE Archaeology and recorded as part of the project in a suitable GIS system.
5. All data processing presented in this report was undertaken by Substrata using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology.</td></tr>
<tr><td colspan="2">Grid
Method of Fixing: DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates.
Composition: 30m by 30m grids
Recording: Geo-referenced and recorded using digital map tiles.
DGPS used: Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</td></tr>
<tr><td>Magnetometer Equipment
Instrument: Bartington Instruments grad601-2
Firmware: version 6.1</td><td>Magnetometer Data Capture
Sample Interval: 0.25-metres
Traverse Interval: 1 metre
Data capture: automated
Traverse Method: zigzag
Traverse Orientation: GN</td></tr>
<tr><td>Earth Resistance Equipment
Not known.</td><td>Earth Resistance Data Capture
Not known.</td></tr>
<tr><td colspan="2">Data Processing, Analysis and Presentation Software
IntelliCAD Technology Consortium IntelliCAD 8
DW Consulting TerraSurveyor3
Manifold System 8 GIS
Microsoft Corp. Office Excel 2013
Microsoft Corp. Office Publisher 2013
Adobe Systems Inc Adobe Acrobat 9 Pro Extended</td></tr>
</table>

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata

SITE
Instrument Type: Bartington Grad 610
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

PROGRAM
Name: TerraSurveyor
Version: 3.0.25.0

Stats
Max: 15.70
Min: -19.75
Std Dev: 2.12
Mean: -0.09
Median: 0.00

Processes: 21
1 Base Layer
2 Clip at 1.00 SD
3 Clip at 1.00 SD
4 De Stagger: Grids: All Mode: Both By: -7 intervals
5 De Stagger: Grids: bfa1.xgd bfb9.xgd Mode: Both By: 1 intervals
6 De Stagger: Grids: bfa4.xgd bfa5.xgd Mode: Both By: 1 intervals
7 De Stagger: Grids: bfa6.xgd Mode: Both By: 5 intervals
8 De Stagger: Grids: bfa10.xgd bfa9.xgd Mode: Both By: 2 intervals
9 De Stagger: Grids: bfa12.xgd bfa13.xgd Mode: Both By: 2 intervals
10 Move (Area: Top 49, Left 969, Bottom 56, Right 1203) to X -8, Y 0
11 Move (Area: Top 55, Left 971, Bottom 57, Right 1192) to X -8, Y 0
12 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 82, Left 159, Bottom 86, Right 212)
13 DeStripe Median Traverse: Grids: bfa11.xgd bfa12.xgd bfb5.xgd bfa10.xgd bfa13.xgd bfb4.xgd bfb6.xgd bfa9.xgd bfa14.xgd bfb3.xgd bfb7.xgd bfa8.xgd bfa15.xgd bfb2.xgd bfb8.xgd bfa6.xgd bfa16.xgd bfb1.xgd bfa5.xgd
14 DeStripe Median Traverse: Grids: bfb10.xgd bfa4.xgd
15 DeStripe Median Sensors: bfa1.xgd bfb9.xgd
16 Edge Match (Area: Top 30, Left 480, Bottom 59, Right 719) to Right edge
17 Edge Match (Area: Top 0, Left 720, Bottom 59, Right 959) to Bottom edge
18 Range Match (Area: Top 60, Left 960, Bottom 119, Right 1199) to Left edge
19 Edge Match (Area: Top 0, Left 480, Bottom 29, Right 719) to Right edge
20 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 45, Left 1222, Bottom 50, Right 1257)
21 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 45, Left 1196, Bottom 50, Right 1328)

Note: exporting from TerraSurveyor into Manifold GIS imposes an x=y interpolation across the dataset

Table 4: earth resistance survey - processed data metadata	
SITE Instrument Type: Earth resistance meter Units: ohms Direction of 1st Traverse: not recorded Collection Method: not recorded Sensors: not recorded Dummy Value: 32702 (after import into TerraSurveyor by Substrata) PROGRAM Name: TerraSurveyor Version: 3.0.25.0	
Figure 7, Appendix 1 Stats Max: 123.79 Min: 45.58 Std Dev: 15.38 Mean: 79.25 Median: 76.53	Processes: 5 1 Base Layer 2 Search & Replace From: 45 To: 130 With: Dummy (Area: Top 19, Left 128, Bottom 21, Right 130) 3 Despike Threshold: 1 Window size: 3x3 4 Despike Threshold: 1 Window size: 3x3 5 Periphery Match ALL grids in the survey
Figure 8, Appendix 1 Stats Max: 33.86 Min: -34.13 Std Dev: 5.20 Mean: 0.06 Median: -0.10	Processes: 6 1 Base Layer 2 Search & Replace From: 45 To: 130 With: Dummy (Area: Top 19, Left 128, Bottom 21, Right 130) 3 Despike Threshold: 1 Window size: 3x3 4 Despike Threshold: 1 Window size: 3x3 5 Periphery Match ALL grids in the survey 6 High pass Uniform (mean) filter: Window: 21 x 21
Figures 9 and 10, Appendix 1 Stats Max: 118.63 Min: 46.45 Std Dev: 15.18 Mean: 79.25 Median: 76.23	Processes: 6 1 Base Layer 2 Search & Replace From: 45 To: 130 With: Dummy (Area: Top 19, Left 128, Bottom 21, Right 130) 3 Despike Threshold: 1 Window size: 3x3 4 Despike Threshold: 1 Window size: 3x3 5 Periphery Match ALL grids in the survey. 6 Low pass Uniform (mean) filter: Window: 3 x 3