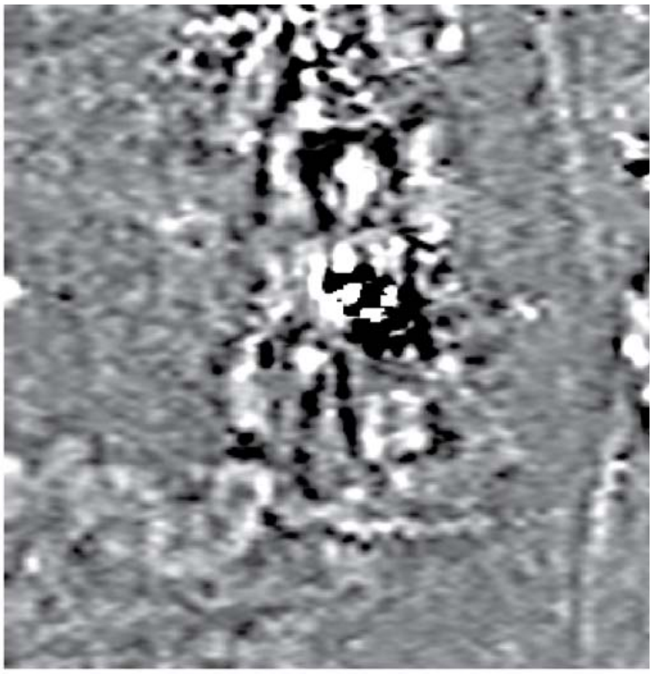
RESEARCH REPORT SERIES no. 37-2012

CROUGHTON, NORTHAMPTONSHIRE
FINAL REPORT ON GEOPHYSICAL SURVEYS, OCTOBER 1992, JANUARY 1993 AND SEPTEMBER 1994

Andrew Payne



REMOTE
SENSING

ENGLISH HERITAGE

This report has been prepared for use on the internet and the images within it have been down-sampled to optimise downloading and printing speeds.

Please note that as a result of this down-sampling the images are not of the highest quality and some of the fine detail may be lost. Any person wishing to obtain a high resolution copy of this report should refer to the ordering information on the following page.

CROUGHTON, NORTHAMPTONSHIRE

FINAL REPORT ON GEOPHYSICAL SURVEYS OCTOBER 1992, JANUARY 1993 AND SEPTEMBER 1994

Andrew Payne

NGR: SP 550 354

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)

The Research Report Series incorporates reports by the expert teams within the Investigation & Analysis Division of the Heritage Protection Department of English Heritage, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

Many of the Research Reports are of an interim nature and serve to make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers must consult the author before citing these reports in any publication. Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of English Heritage.

Requests for further hard copies, after the initial print run, can be made by emailing:
Res.reports@english-heritage.org.uk
or by writing to:
English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD
Please note that a charge will be made to cover printing and postage.

SUMMARY

A series of geophysical surveys were conducted between 1992 and 1994 to investigate the context of a Roman mosaic partially uncovered following metal detecting prompted by the construction of a gas pipeline through an arable field at Rowler Manor, Croughton, Northamptonshire. Magnetometer, magnetic susceptibility and earth resistance surveys were undertaken to help further define the extent and character of the Roman activity and to inform the on-going management of the site in response to the potential threat from plough damage and un-supervised treasure hunting. The geophysical surveys revealed the presence of a rectangular hall-type Roman building housing the mosaic set within a more extensive system of ditched enclosures, trackways and linear boundaries with evidence of further associated or pre-villa settlement activity distributed over some 15 hectares in total.

CONTRIBUTORS

Survey personnel: M Cole, A David, S Fear, A Gillbert, N Linford, A Payne

ACKNOWLEDGEMENTS

English Heritage is grateful to Mr Harris of Rowler Farm, and his staff, for allowing access to the site and for their help and cooperation with the survey. The Newbottle and Charlton Estate, and the farm manager at Forceleap Farm, Mr Locke, allowed access to the north-western part of the site.

ARCHIVE LOCATION

Fort Cumberland, Portsmouth.

DATE OF SURVEY

The geophysical fieldwork was undertaken in three stages during the 5-9th October 1992, 11-15th January 1993 and 26-30th September 1994. The report was completed on 8th October 2012. The cover shows: [left main image] the partially exposed 4th century AD mosaic floor depicting Bellerophon slaying the mythical beast Chimera; greyscale images of extracts from the magnetometer [top right] and earth resistance surveys [bottom right] showing the geophysical response to the building housing the mosaic.

CONTACT DETAILS

Andrew Payne, Geophysics Team (Remote Sensing), English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD.
Tel: 02392 856750. Email: andy.payne@english-heritage.org.uk

CONTENTS

INTRODUCTION

The Roman settlement on the Rowler Manor Estate in the parishes of Croughton and Newbottle, Northamptonshire, was first recognised in 1991 during a watching brief for the construction of a gas pipeline which ran through an area of Roman archaeology identified at NGR SP 550355 (now designated as SAM No. 22703; Nhants SMR No. 5717). Subsequent metal detector survey by amateur archaeologists south of the pipeline led to the discovery of a 4th century AD mosaic floor and a small area of structural stonework. The mosaic showed the Greek hero Bellerophon slaying the mythical beast Chimaera, set within a frame of geometric design and lay within a stone building of unknown extent and plan situated above a shallow valley of a tributary stream of the Cherwell, which although culverted and dry today, was once an open watercourse. Following this discovery a programme of geophysical survey was undertaken by English Heritage between 1992 and 1994 (David and Payne 1993; Dawson 2008). The objective was to determine the extent and nature of the remains in the environs of the mosaic find to inform the designation and protection of the site.

Ceramic evidence from field-walking and evaluation trenching suggests the most intense period of occupation of the Roman site was from the 2nd to 4th centuries AD, although a spearhead find from the primary fill of an enclosure ditch on the northern periphery of the site indicates earlier occupation from the late Iron Age (Northamptonshire Archaeology 1995; Blore 1996; Wilmott 2001).

The solid geology of the area comprises Middle Jurassic mudstones and limestones (primarily Rutland and Taynton formations) of the Great Oolite Group with underlying strata of Northamptonshire sands (British Geological Survey 2002). Soils developed over the site are calcareous loams of the Aberford Association (Soil Survey of England and Wales 1983).

METHOD

Initial magnetometer survey in October 1992 was focused on the mosaic find-spot and the field immediately to the north (Figure 1, Area A and Area B respectively). A second phase of survey took place in January 1993 to investigate the possible continuation of significant activity to the west (Areas C and D), followed by extended coverage of Area B in September 1994 to delimit the eastern extent of the site. More selective earth resistance survey was conducted where buried stone building remains were expected to be present together with soil magnetic susceptibility measurements to assist the interpretation of the magnetometer data.

i) Magnetometer survey

Geoscan FM36 fluxgate gradiometers were employed to collect readings at the 0.1 nanotesla (nT) resolution setting following the standard methodology in Note 2 of Annex

1. Subsequent processing of the data involved initial truncation to exclude extreme readings (values above and below 50 nT) caused by ferrous disturbance. Errors due to the directional sensitivity of the sensors and drift effects were then reduced by setting each instrument traverse to a zero median value.

A linear greyscale image of the combined magnetic survey is displayed at a scale of 1:2500 superimposed over the base Ordnance Survey (OS) mapping in Figure 2, together with greyscale images and traceplots at 1:1750 scale in Figures 3 and 4.

ii) Earth resistance survey

Standard twin electrode earth resistance survey following Note 1 of Annex 1 was initially carried out in the field containing the mosaic discovery (Figure 1, Area A), followed by more detailed investigation of the central building using an MPX15 multiplexer and an adjustable PA20 electrode frame to collect readings simultaneously at both a standard 0.5m mobile probe separation together with progressively deeper penetrating 0.75m and 1.0m mobile electrode spacings. A final standard earth resistance survey covered a limited 60m x 60m area of potential building remains to the north of the mosaic find (part of Area B).

Post-acquisition processing of the twin electrode data included the application of a 2m x 2m thresholding median filter to remove isolated high readings caused by poor contact (Scollar *et al.* 1990, 492). Further data processing to enhance linear anomalies from the background variation involved the application of a high-pass Gaussian filter, with a radius of 4m for the standard twin electrode survey data from Area A (Scollar *et al.* 1990, 506-12).

The minimally processed twin electrode results from Areas A and B are presented as greyscale images superimposed over the OS mapping on Figure 5. Additional minimally processed and enhanced versions of the data are shown as greyscale images and traceplots on Figures 6 and 7. Linear greyscale images of the earth resistance data collected over the remains of the Roman masonry building in Area A with multiple mobile probe separations of 0.5m, 0.75m and 1.0m are presented in Figure 8, together with an extract from the fluxgate gradiometer data for comparison.

iii) Magnetic susceptibility (MS) survey

During the initial survey in 1992 soil samples were recovered every 10m from orthogonal transects across the site intersecting over the location of the mosaic (Figure 1). Measurements of mass specific magnetic susceptibility were then made in the laboratory at low frequency (430Hz) with a Bartington MS2 susceptibility meter and MS2-B sensor. The dry mass of each sample was determined after air-drying at room temperature. A subsequent area survey of in situ volume specific magnetic susceptibility was conducted with a Bartington MS2-D field sensor at a 10m sample interval (Mullins 1977; Cole *et al.* 1995).

The results from the laboratory measured transects are shown on Figure 12 and the un-interpolated area MS survey as a linear greyscale image in Figure 10 superimposed on the Ordnance Survey base mapping. Figure 11 shows an interpolated, greyscale image of the MS area survey data following the application of low-pass median filter using a window size of 3 readings (30m).

RESULTS

i) Magnetometer survey

Specific responses referred to below by an [m] prefix are indicated on the graphical summary of significant magnetic anomalies presented in Figure 9.

Due to the favourable geological conditions the site has produced a good magnetic response. The outline of the building associated with the mosaic is indistinct, but appears to primarily consist of a negative magnetic anomaly [m1], with dimensions of approximately 8m x 30m, aligned nearly north-south. A strong ferrous response [m2] indicates the location of a metal grill installed in 1991 to protect the mosaic. An area of raised positive magnetic response [m3] running along the western edge of [m1] may be indicative of the projecting room found through excavation in 2002, although this appears to be poorly defined despite the presence of a hypocaust structure (Dawson 2008). Further discrete magnetic anomalies within [m1] may, possibly, also be indicative of heated structures. A less distinct pattern of mixed positive and negative magnetic response [m4] may indicate an extension of the building to the north, possibly in the form of a wing or short range of rooms perpendicular to the main structure.

The extensive areas of weak magnetic disturbance [m5] to the south and west of [m1] may relate to geological variation or quarrying disturbance either contemporary with the Roman settlement or, perhaps, related to later stone robbing. Other anomalies directly to the south and east possibly represent trackways [m6] and more intense responses due, perhaps, to semi-industrial activity [m7-8].

The building at [m1] is situated near the southern margin of a very widespread complex of buried archaeological features largely concentrated in the two fields to the north (Areas B and C) and primarily consisting of ditches defined by positive anomalies in the magnetic coverage.

Several linear positive anomalies [m9-12] appear to indicate a series of long straight ditches, perhaps defining a system of enclosures and boundaries sub-divided by trackways. Within this area a complex of inter-cut ditches and gullies defining small square and sub-rectangular enclosures [m13-14], larger ditched enclosures [m15-17], possible hut emplacements [m18-23], clusters of pits [m24 for example] and some possible industrial activity are found.

Further negative magnetic anomalies around [m25] suggests the presence of additional buildings amongst the wider complex of enclosures in the field to the north, in accordance with observations made during the unauthorised excavation of a pipe trench in August 2000 (Wilmott 2001).

A series of positive linear magnetic anomalies [m26-27] indicate the presence of a ladder type pattern of rectilinear enclosures to the east of the course of the stream (now culverted in a ferrous pipe [m31]). Magnetic activity is more limited within these enclosures compared to those to the west of the stream, suggesting they probably represent fields and paddocks or stock enclosures. Settlement activity appears to fall off as the ground rises to the east of enclosures [m26-27], although [m28] may indicate a trackway running in this direction together with further field boundaries [m29-30] possibly associated with the Roman settlement. Occupation activity also appears less intense in Area D and the ditch-type anomalies mapped here are more characteristic of outlying paddocks and small field enclosures which gradually fade away towards the northern limit of the survey coverage.

A magnetic response to extant plough furrows is visible in the 1994 coverage in a strip to the east and north of Area D, although this response is absent in the central area surveyed in 1992 when the field was still in set-a-side.

ii) Earth resistance

Significant earth resistance anomalies referred to in the text below with an [r] prefix are indicated on the greyscale images supplied in Figures 6 and 7.

The rectangular outline of the building around the mosaic is apparent as a series of high resistance anomalies. While not adding much further detail to the magnetometer survey, the resistance data does suggest structures to the east and the west of the long axis of the building [r1], a possible apsidal or curving end wall to the building on the south [r2] and a northerly extension shown as a solid area of high resistance [r3]. The broad linear band of lower resistance [r4] may be a trackway with a further tentative building in the south-east corner of the survey defined by a high resistance response at [r5]. A possible wall has also been detected at [r6] within an area of enclosure ditches defined by low resistance anomalies in the filtered data (Figure 6(B)) corresponding with the magnetic response [Figure 9, m16]. A possible road surface may also be visible in the filtered data (Figure 6(B)) in the form of a higher resistance linear anomaly [r7] within the broader linear band of generally low resistance response at [r4]. A discrete low resistance anomaly [r8], corresponding with a positive magnetic response, to the west of the mosaic building may represent a large pit or, possibly a well.

Considerable variation in background resistance occurs throughout the remainder of Area A, but the archaeological significance of this is uncertain. The mixed response to the south west of [r1] (for example at [r9] and [r10]) is suggestive of either local variation in the type or depth of soils, but may also possibly represent quarrying activity. However, there are occasional indications of more distinct wall type anomalies that might support an archaeological explanation for some of the resistance response. A number of weakly defined low resistance linear anomalies cross through the area of disturbed background on various alignments and probably represent drainage features. (for example [r11] and [12]). Evidence of modern ploughing is also present and is particularly apparent in the resistance data around [r13] where it may have cut into and disturbed the underlying deposits.

In Area B, two rectilinear clusters of moderately high resistance at [r14] and [r15] (Figure 7(B)) may indicate evidence of further masonry building remains on a perpendicular axis to [r1/m1] and coincide with an area of raised magnetic susceptibility, linear negative magnetic anomalies and a disturbed magnetic background supporting this interpretation. A high resistance response [r16], incompletely mapped due to the limited survey coverage, occurs within a ditched enclosure defined by low resistance and positive magnetic linear anomalies [m17/r17] and may represent a cobbled or paved yard surface as the magnetic data does not suggest disturbance associated with a building. Very low background resistance to the east of Area B corresponds to the water retentive deposits of the former stream bed but in the high-pass filtered data (Figure 7(B)) further high resistance anomalies [r18] and [19] become apparent.

In the repeat surveys conducted at varying probe separations (Figure 8) it is noteworthy that the response to the central area of the rectangular building containing the mosaic reverses from a low resistance anomaly in October 1992 to a high resistance anomaly in September 1994 but otherwise the shape and extent of the anomaly is consistent in all the data-sets. The variation of the response probably reflects the excavation of a trench in 1993 to re-expose and monitor the condition of the mosaic. The resistance data from the area of the building does not alter significantly with the varying probe-separations and current penetration depth but the response to the building appears fainter with the widest and most deeply penetrating 1.0m probe separation indicating the walls of the building lie close to the surface as observed by excavation.

iii) Magnetic susceptibility (MS)

The results of the initial transects of laboratory MS measurements indicate raised values in the region over the central building and in the vicinity of ditched enclosures, particularly at [m16] (Figure 12). Lower values occur over the area of the former tributary stream valley running through the centre of Area B. In general, the topsoil susceptibility measurements reflect the concentration of settlement activity defined by the magnetometer survey and the enhanced values ($>40 \times 10^{-8}$ m^3/kg) support the favourable magnetic response over the site.

The wider area MS survey shows values that also reflect the settlement activity, suggesting this diminishes rapidly to the south and west of the mosaic building with a concentration to the north around the course of the tributary stream, in agreement with the other geophysical techniques (Figures 10 and 11). Care must be taken in the interpretation of the MS data as correlation between concentrations of localised enhancement possibly related to settlement activity, for example in the vicinity of [m32], are not necessarily consistent as shown by the large area of raised values to the north east of Area B seemingly devoid of significant anomalies within the magnetometer data.

CONCLUSIONS

The geophysical survey has demonstrated that the Roman settlement on the Rowler Manor Estate consisted of a stone built house in a prominent position overlooking the spring fed brook that emerges in the field containing an extensive system of associated settlement activity to the north and west. Much of this initial geophysical interpretation was verified and refined by subsequent evaluation trenching (Blore 1996). Further, more extensive intrusive examination of the Roman building by Northamptonshire Archaeology in 2002 confirmed the geophysical evidence and also provided additional details of the ground-plan not previously apparent in the survey data.

The wider magnetometer coverage reveals a substantial area of settlement activity, represented by ditched enclosures on the higher ground to the north focused around the headwaters of the local tributary stream, extending over an area of at least 10 hectares beyond the site of the Roman buildings. The density and superimposition of many of the anomalies in these areas suggests development of the settlement over several phases indicative of prolonged activity in accordance with the wide date range of finds recorded by field-walking and subsequent excavation evidence (Northamptonshire Archaeology 1995; Dawson 2008). Rectangular areas enclosed by ditches may indicate smaller fields and paddocks and occur on both banks of the former stream.

The combined geophysical evidence suggested that the building containing the mosaic was part of a complex at the centre of a Roman country estate and this subsequently helped inform the designation of the site as a Scheduled Ancient Monument in 1995.

LIST OF ENCLOSED FIGURES

Figure 12 Laboratory measured topsoil magnetic susceptibility data from soil samples collected across orthogonal transects intersecting over the mosaic find area.

REFERENCES

Blore, F 1996 Croughton Evaluation report. A report on the archaeological evaluation undertaken at Croughton Roman Settlement, Northamptonshire, CAS Project 492. English Heritage, unpublished report.

British Geological Survey 2002 Buckingham, England and Wales Sheet 219, Solid and Drift Geology. 1:50,000 geology map series. British Geological Survey, Keyworth, Nottingham.

Cole, M A, Linford , N T, Payne, A W and Linford , P K 1995 'Soil Magnetic Susceptibility Measurements and their Application to Archaeological Site Investigation' *in* Beavis, J and Barker, K (ed), *Science and Site: Evaluation and Conservation. Proceedings of The Archaeological Sciences Conference 1993*. Bournemouth University, School of Conservation Sciences, Occasional Paper 1. Poole, Dorset, 144-162.

David, A and Payne, A 1993 Croughton, near Brackley, Northants - Site of Roman Mosaic Find. Interim report on geophysical surveys, 1992-93. *Ancient Monuments Laboratory Reports Series*, 15/93. English Heritage, unpublished report.

Dawson, M 2008 'Excavation of the Roman Villa and Mosaic at Rowler Manor, Croughton, Northamptonshire'. *Northamptonshire Archaeology*, 35, 45-93.

Mullins, C E 1977 'Magnetic susceptibility of the soil and its significance in soil science - a review.'. *Journal of Soil Science*, 28, 223-246.

Northamptonshire Archaeology 1995 Roman settlement at Rowler Farm, Croughton, Northamptonshire. Stages 1 & 2 Fieldwork and Desk Based Study. Unpublished report.

Scollar, I, Tabbagh, A, Hesse, A and Herzog, I, Eds. 1990. *Archaeological Prospecting and Remote Sensing*. Cambridge.

Soil Survey of England and Wales 1983 Soils of England and Wales: Sheet 6 - South East England, 1:250,000 soil map. Lawes Agricultural Trust, Harpenden.

Wilmott, T 2001 Croughton Roman Settlement, Northamptonshire. An Evaluation Report on Unauthorised Works. English Heritage Project 662. English Heritage unpublished archive report.

ANNEX 1: NOTES ON STANDARD PROCEDURES

1) Earth Resistance Survey

Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all aligned parallel to one pair of the grid square's edges, and each separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metres from the nearest parallel grid square edge. Readings are taken along each traverse at 1 metre intervals, the first and last readings being 0.5 metres from the nearest grid square edge.

Unless otherwise stated the measurements are made with a Geoscan RM15 earth resistance meter incorporating a built-in data logger, using the twin electrode configuration with a 0.5 metre mobile electrode separation. As it is usually only relative changes in earth resistance that are of interest in archaeological prospecting, no attempt is made to correct these measurements for the geometry of the twin electrode array to produce an estimate of the true apparent resistivity. Thus, the readings presented in plots will be the actual values of earth resistance recorded by the meter, measured in Ohms (Ω). Where correction to apparent resistivity has been made, for comparison with other electrical prospecting techniques, the results are quoted in the units of apparent resistivity, Ohm-m (Ωm).

Measurements are recorded digitally by the RM15 meter and subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to Fort Cumberland using desktop workstations.

2) Magnetometer Survey

Each 30 metre grid square is surveyed by making repeated parallel traverses across it, all parallel to that pair of grid square edges most closely aligned with the direction of magnetic N. Each traverse is separated by a distance of 1 metre from the last; the first and last traverses being 0.5 metre from the nearest parallel grid square edge. Readings are taken along each traverse at 0.25 metre intervals, the first and last readings being 0.125 metre from the nearest grid square edge.

These traverses are walked in so called 'zig-zag' fashion, in which the direction of travel alternates between adjacent traverses to maximise survey speed. Where possible, the magnetometer is always kept facing in the same direction, regardless of the direction of travel, to minimise heading error. However, this may be dependent on the instrument design in use.

Unless otherwise stated the measurements are made with either a Bartington Grad601 or a Geoscan FM36 fluxgate gradiometer which incorporate two vertically aligned fluxgates, one situated either 1.0m or 0.5 metres above the other; the bottom fluxgate is carried at a height of approximately 0.2 metres above the ground surface. Both instruments incorporate a built-in data logger that records measurements digitally; these are subsequently transferred to a portable laptop computer for permanent storage and preliminary processing. Additional processing is performed on return to Fort Cumberland using desktop workstations.

It is the opinion of the manufacturer of the Geoscan instrument that two sensors placed 0.5 metres apart cannot produce a true estimate of vertical magnetic gradient unless the bottom sensor is far removed from the ground surface. Hence, when results are presented, the difference between the field intensity measured by the top and bottom sensors is quoted in units of nano-Tesla (nT) rather than in the units of magnetic gradient, nano-Tesla per metre (nT/m).

3) Resistivity Profiling

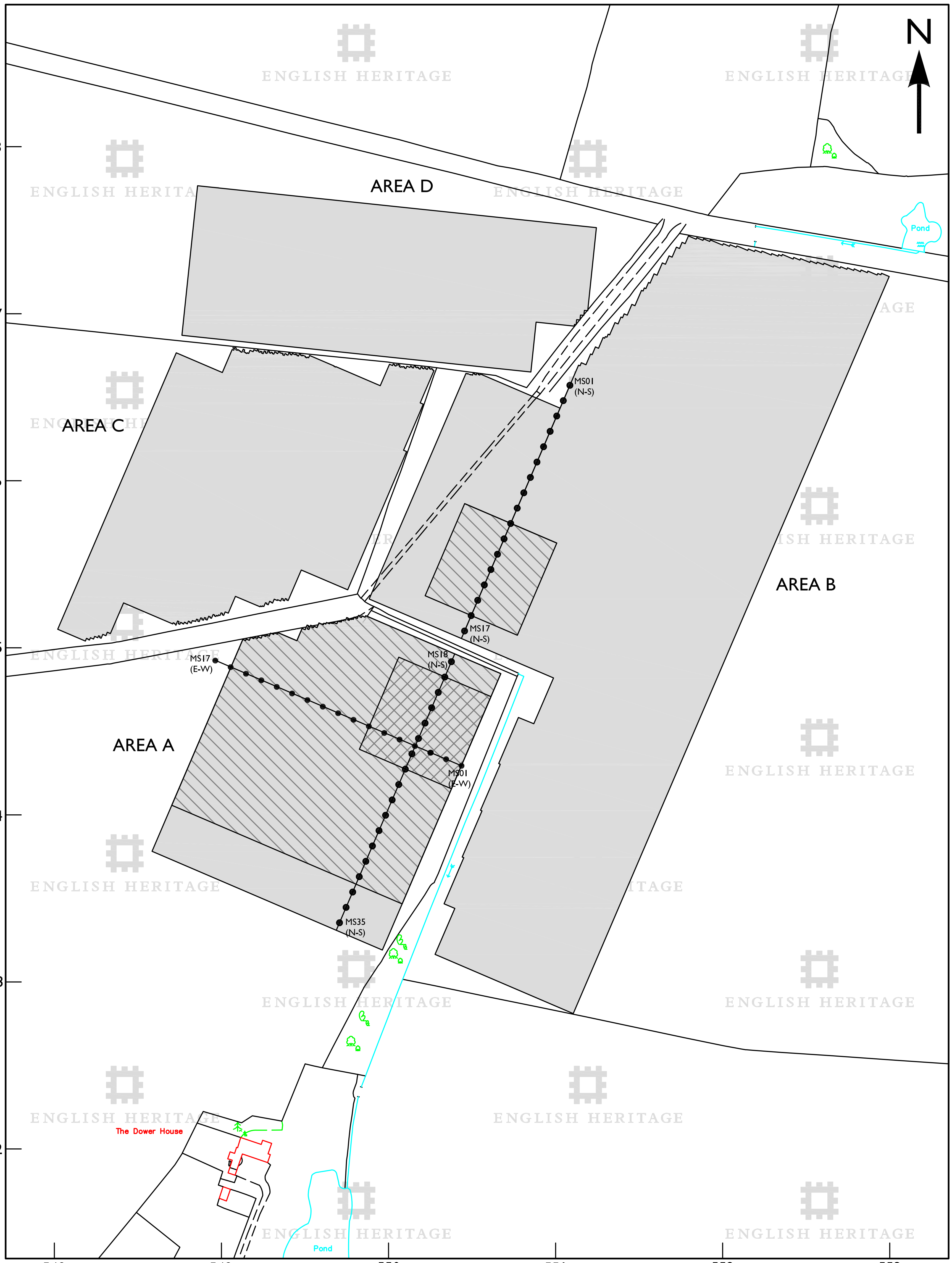
This technique measures the electrical resistivity of the subsurface in a similar manner to the standard resistivity mapping method outlined in note 1. However, instead of mapping changes in the near surface resistivity over an area, it produces a vertical section, illustrating how resistivity varies with increasing depth. This is possible because the resistivity meter becomes sensitive to more deeply buried anomalies as the separation between the measurement electrodes is increased. Hence, instead of using a single, fixed electrode separation as in resistivity mapping, readings are repeated over the same point with increasing separations to investigate the resistivity at greater depths. It should be noted that the relationship between electrode separation and depth sensitivity is complex so the vertical scale quoted for the section is only approximate. Furthermore, as depth of investigation increases the size of the smallest anomaly that can be resolved also increases.

Typically a line of 25 electrodes is laid out separated by 1 or 0.5 metre intervals. The resistivity of a vertical section is measured by selecting successive four electrode subsets at increasing separations and making a resistivity measurement with each. Several different schemes may be employed to determine which electrode subsets to use, of which the Wenner and Dipole-Dipole are typical examples. A Campus Geopulse earth resistance meter, with built in multiplexer, is used to make the measurements and the Campus Imager software is used to automate reading collection and construct a resistivity section from the results.

Figure 1

CROUGHTON, NORTHAMPTONSHIRE

Location of geophysical surveys, October 1992, January 1993 and September 1994



0 150m
1:2500

Fluxgate magnetometer survey

Standard earth resistance survey

Multiplexed earth resistance survey

Magnetic susceptibility soil sample points

Geophysics Team 2012

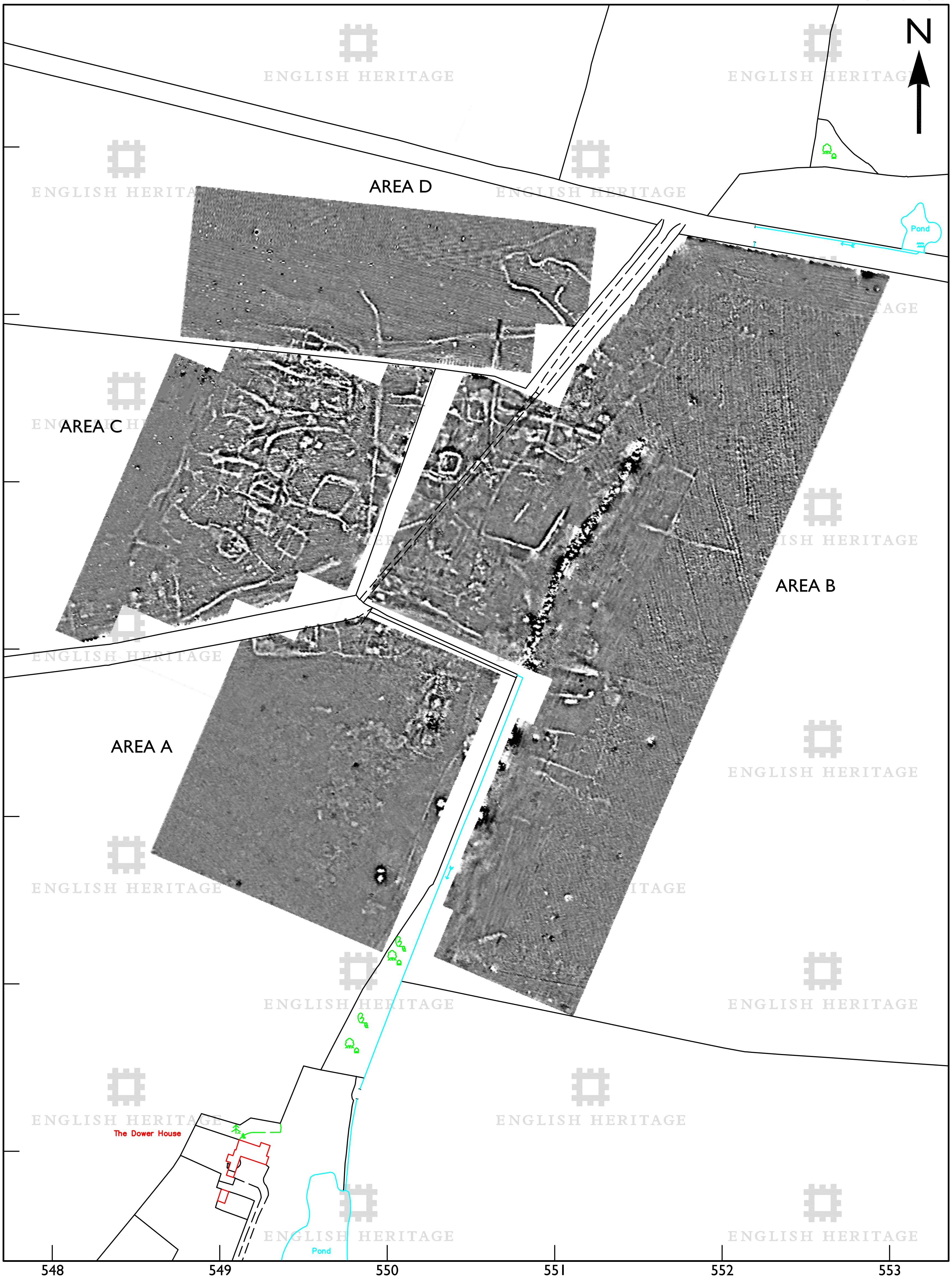
ENGLISH HERITAGE

Figure 2

CROUGHTON, NORTHAMPTONSHIRE

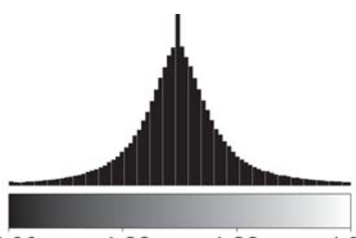
Location of magnetometer surveys, October 1992, January 1993 and September 1994

SP 5435



0 150m

1:2500



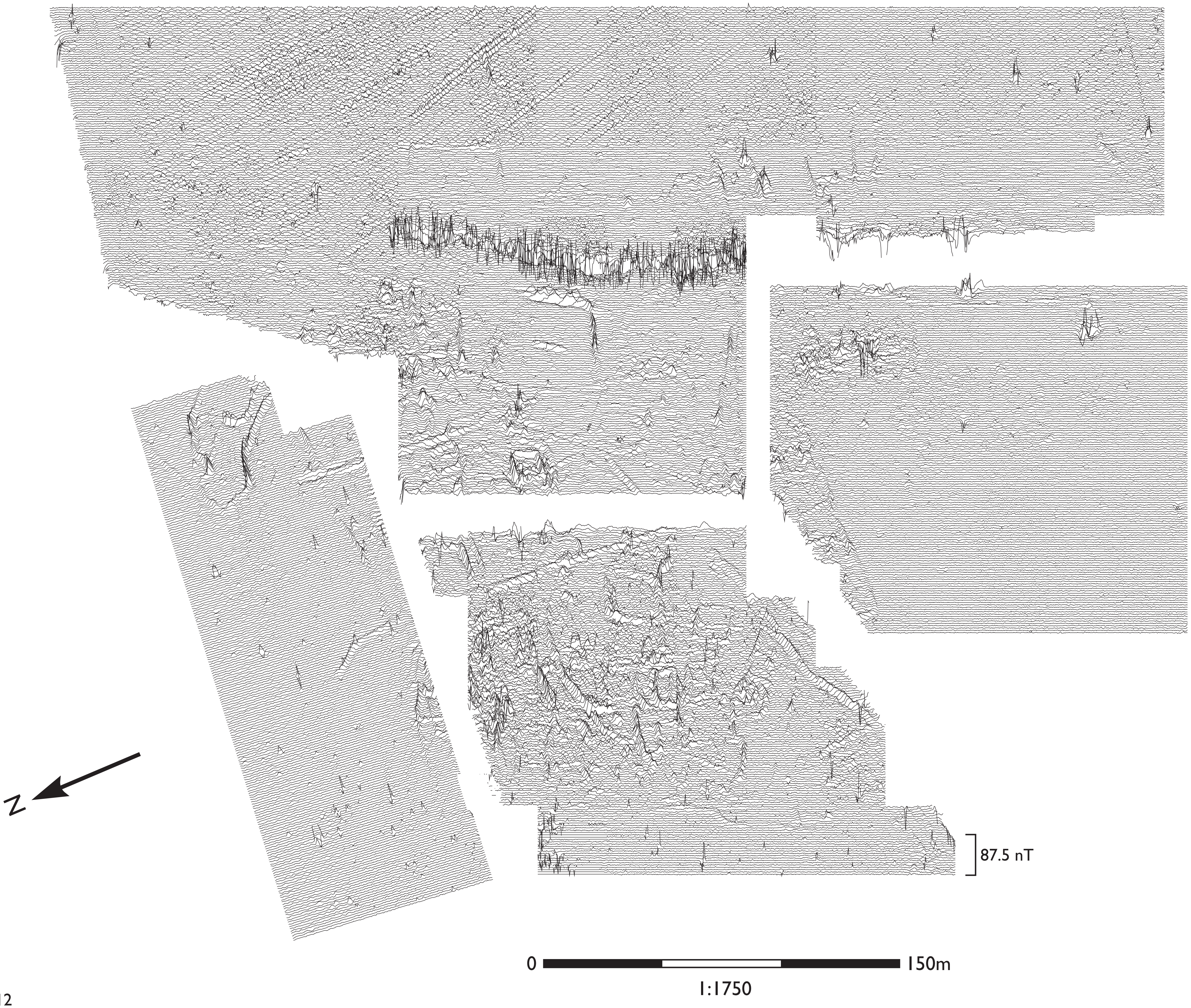
Geophysics Team 2012

ENGLISH HERITAGE

Figure 3

CROUGHTON, NORTHAMPTONSHIRE

Traceplot of the combined fluxgate magnetometer data, October 1992, January 1993 and September 1994



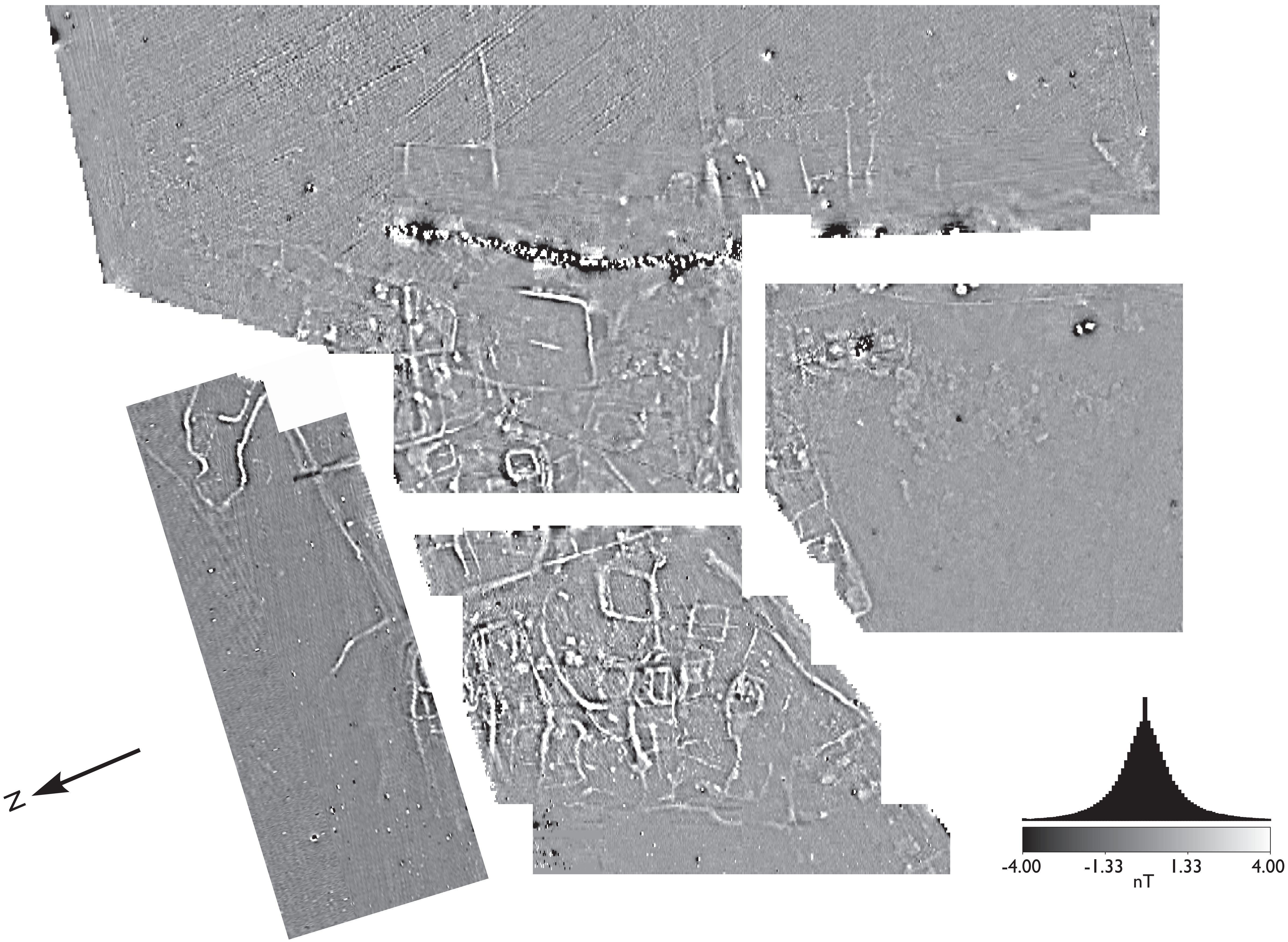
Geophysics Team 2012

ENGLISH HERITAGE

Figure 4

CROUGHTON, NORTHAMPTONSHIRE

Greyscale image of the combined fluxgate magnetometer data, October 1992, January 1993 and September 1994



Geophysics Team 2012

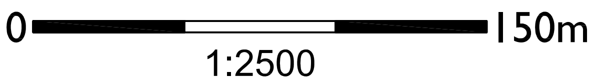
ENGLISH HERITAGE

Figure 5

CROUGHTON, NORTHAMPTONSHIRE

Location of earth resistance surveys, October 1992 and September 1994

SP 5435



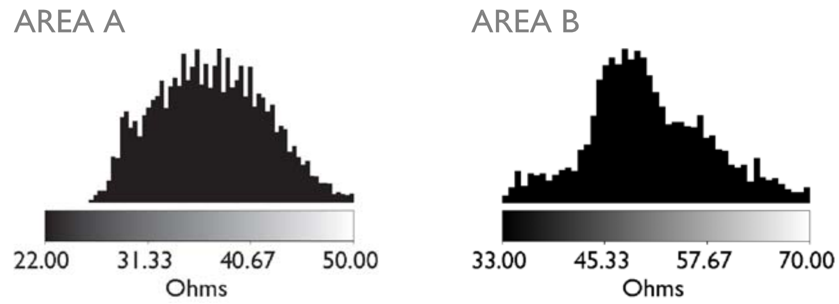
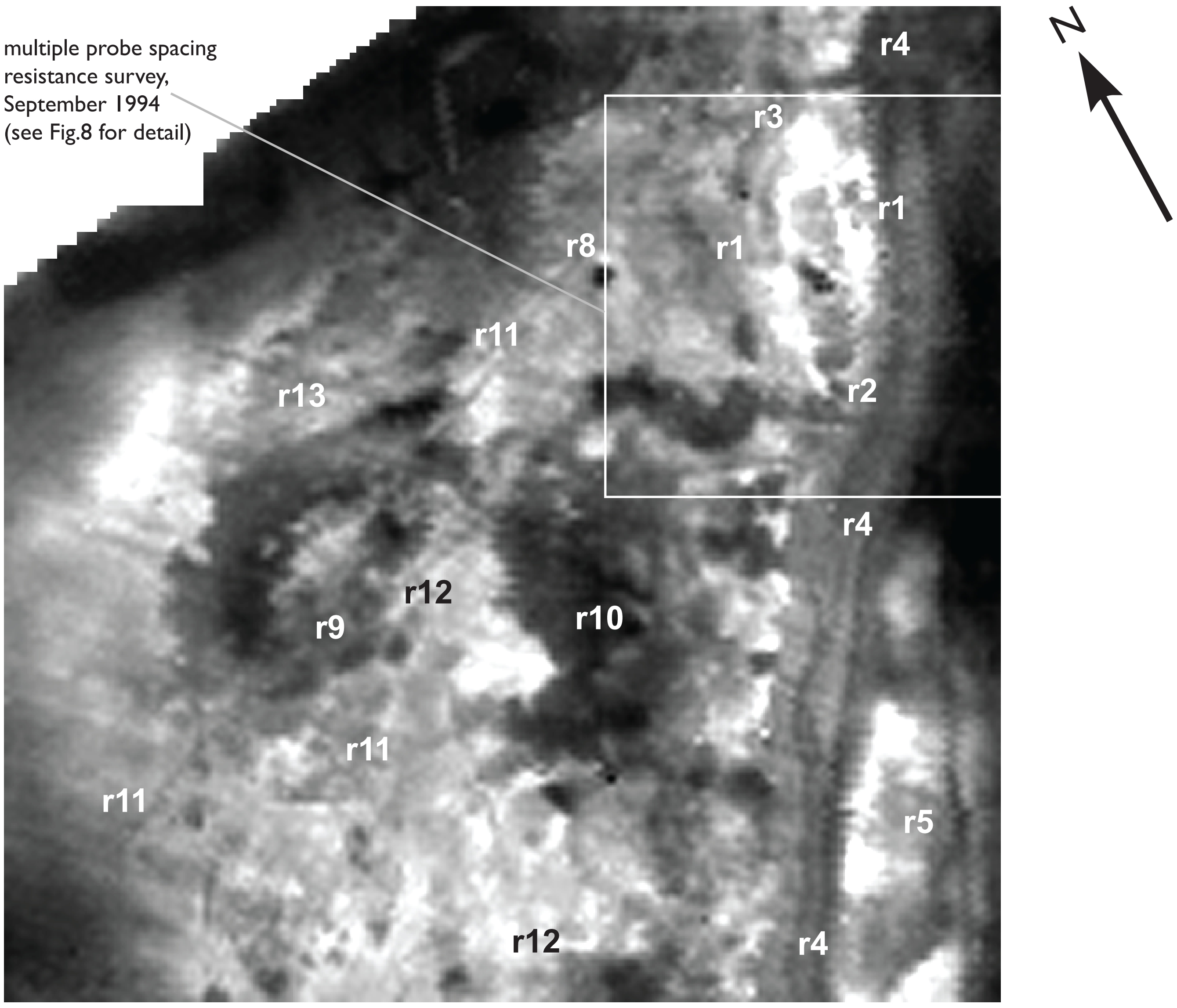


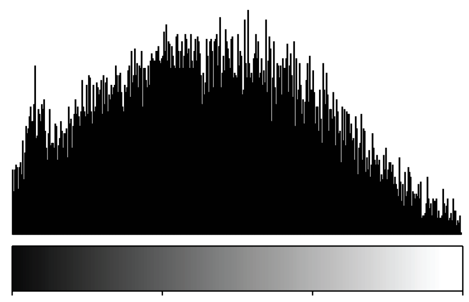
Figure 6

CROUGHTON, NORTHAMPTONSHIRE

Earth resistance survey of Area A, October 1992

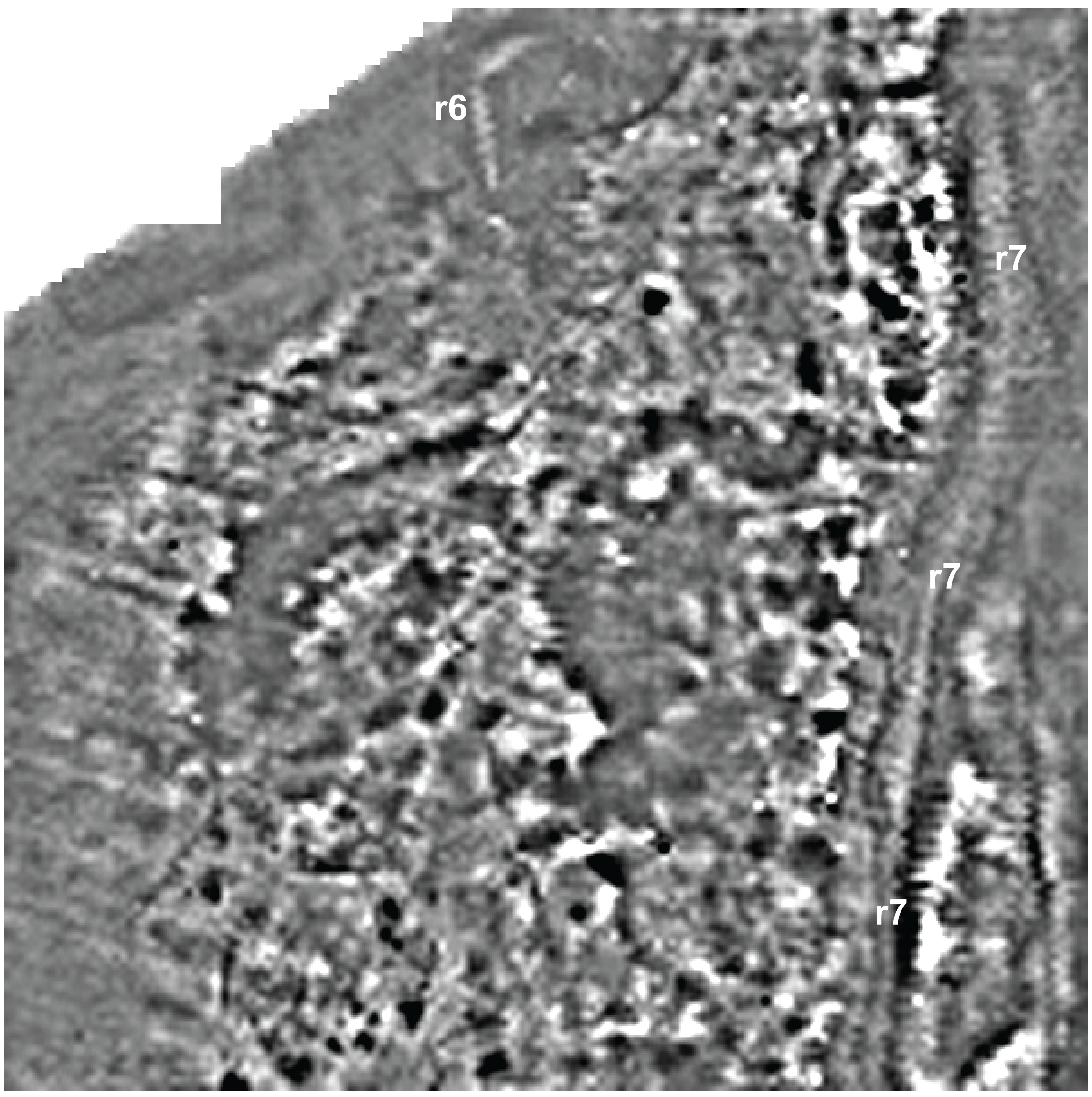
(A) Greyscale image of raw data

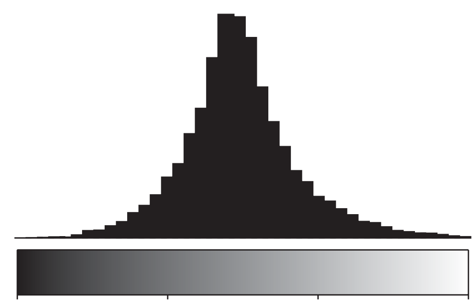




r1-8, r15-17 : earth resistance anomalies referred to in the report text

(B) Greyscale plot of enhanced data
(Gaussian high-pass filter, 4m radius)





0 60m
1:1000

Geophysics Team 2012

ENGLISH HERITAGE

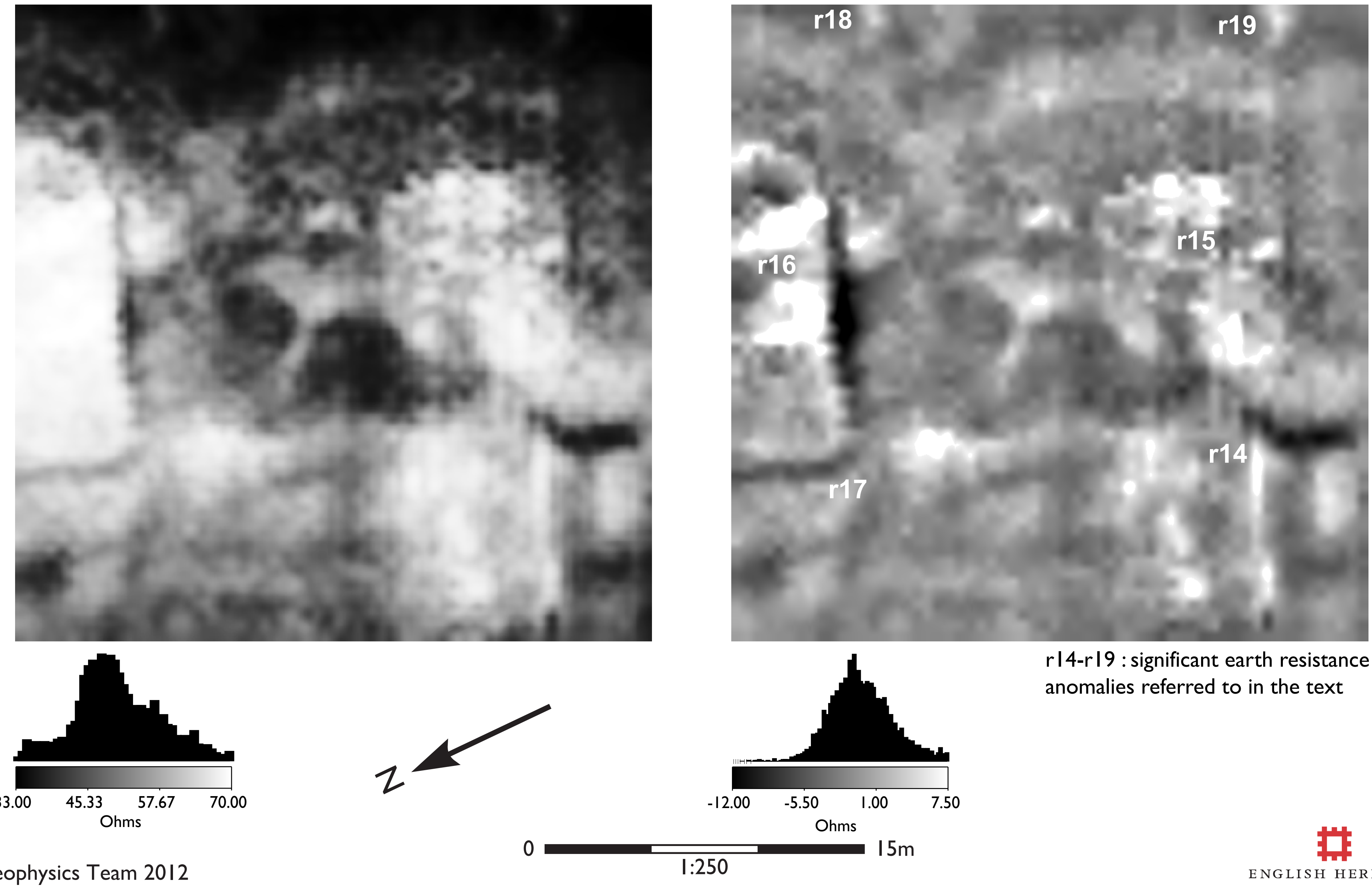
Figure 7

CROUGHTON, NORTHAMPTONSHIRE

Earth resistance survey of Area B, September 1994

(A) Linear greyscale image of raw data

(B) Greyscale plot of high-pass filtered data

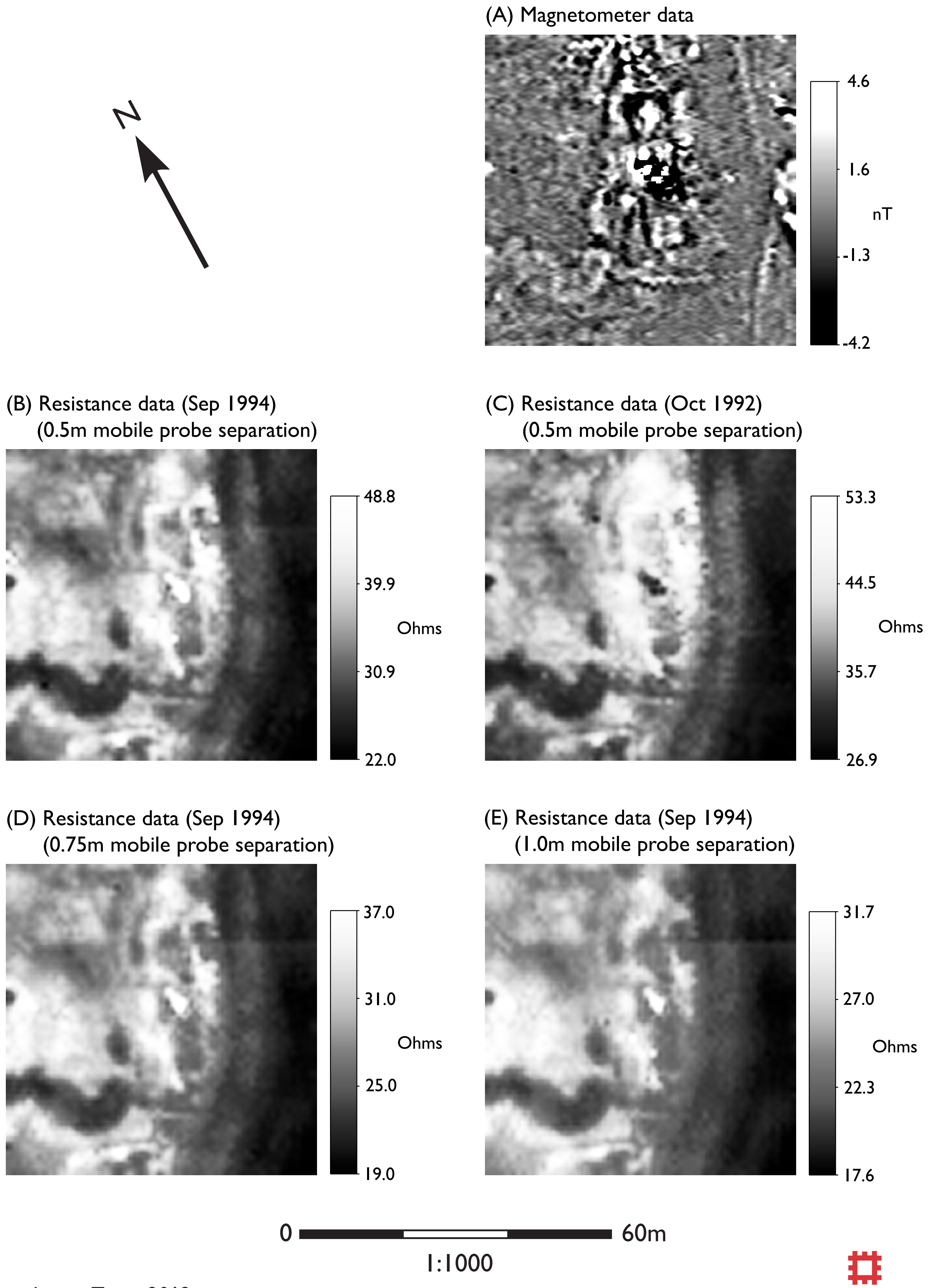


Geophysics Team 2012

ENGLISH HERITAGE

Figure 8

CROUGHTON, NORTHAMPTONSHIRE
Geophysical surveys over Roman building



Geophysics Team 2012

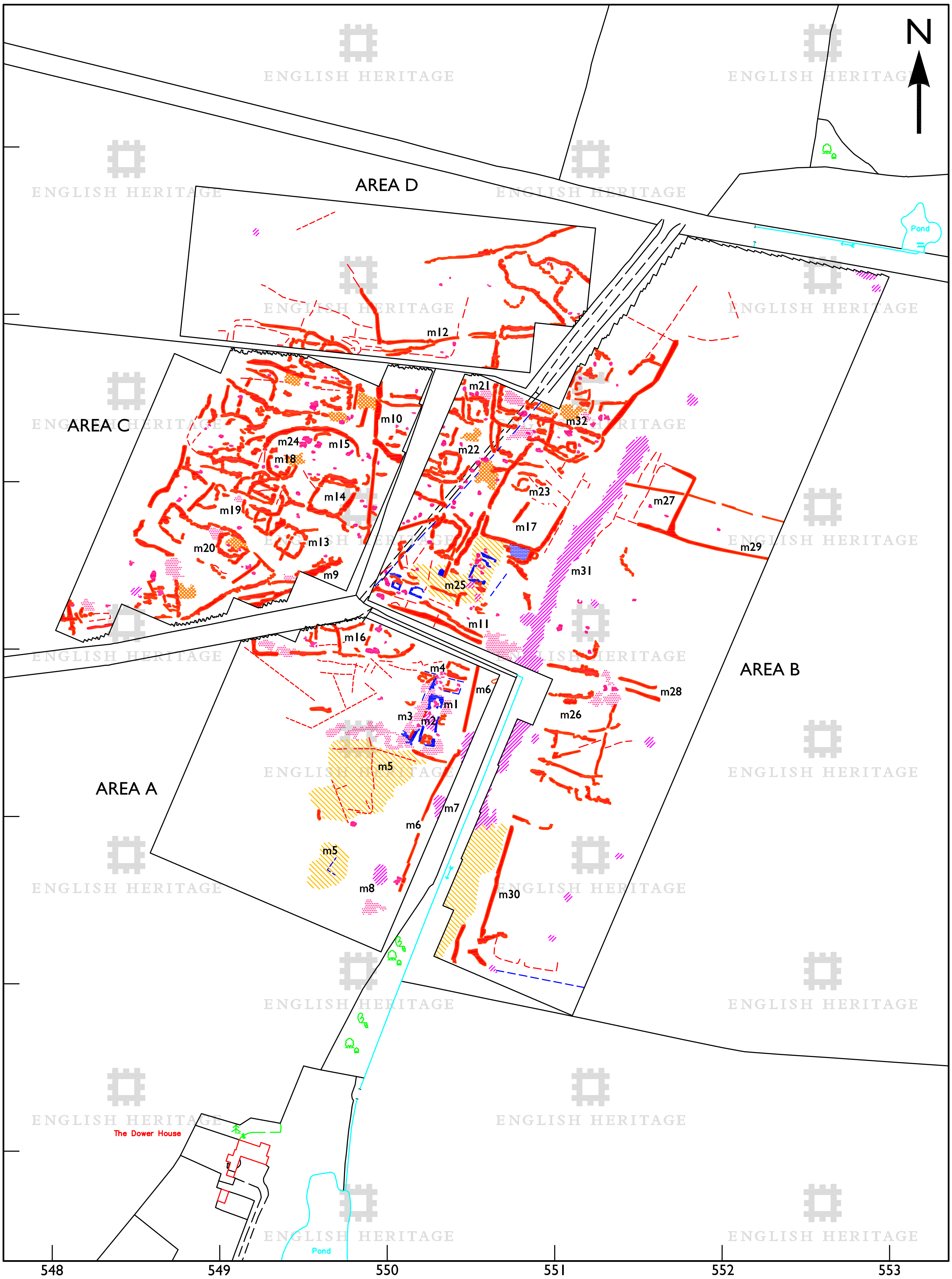
ENGLISH HERITAGE

Figure 9

CROUGHTON, NORTHAMPTONSHIRE

Graphical summary of significant magnetic anomalies, 1992 to 1994

SP 5435



linear positive magnetic anomaly

linear negative magnetic anomaly

weak linear magnetic anomalies

area with disturbed magnetic background

area of intense localised magnetic disturbance

area of raised magnetic response

area of ferrous magnetic disturbance

0 150m

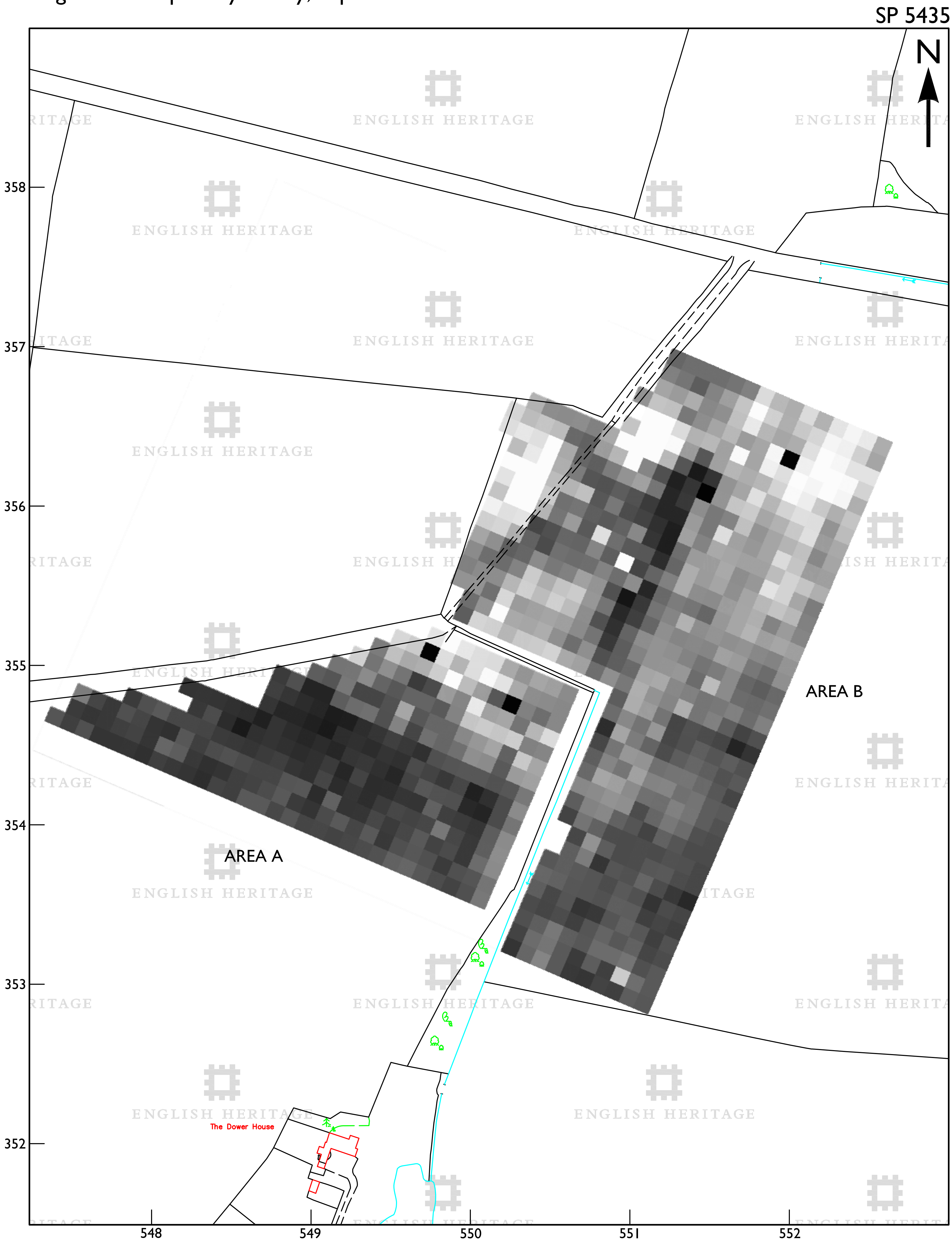
1:2500

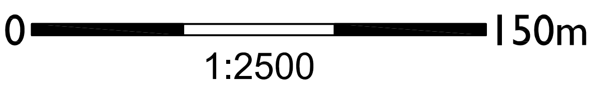
Geophysics Team 2012

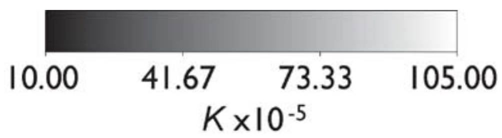
ENGLISH HERITAGE

Figure 10

CROUGHTON, NORTHAMPTONSHIRE
Magnetic susceptibility survey, September 1994







Geophysics Team 2012

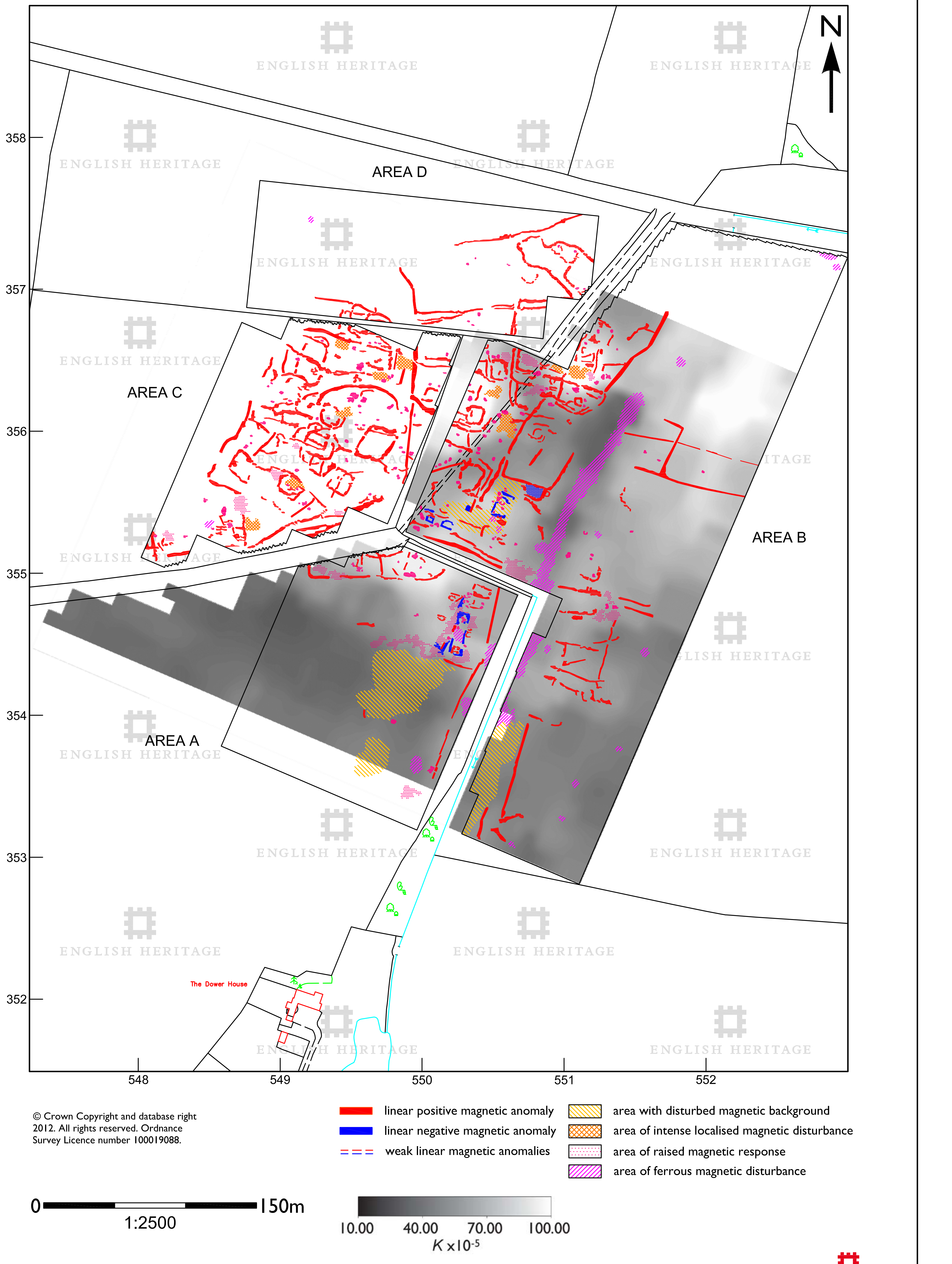
ENGLISH HERITAGE

Figure 11

CROUGHTON, NORTHAMPTONSHIRE

Interpolated magnetic susceptibility survey, September 1994

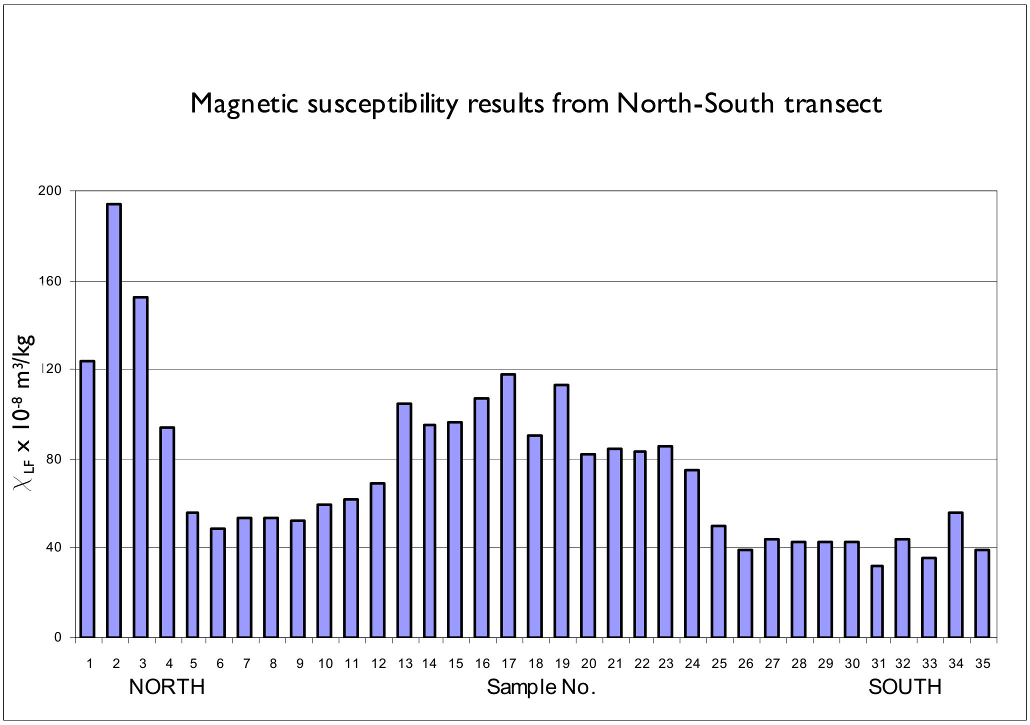
SP 5435

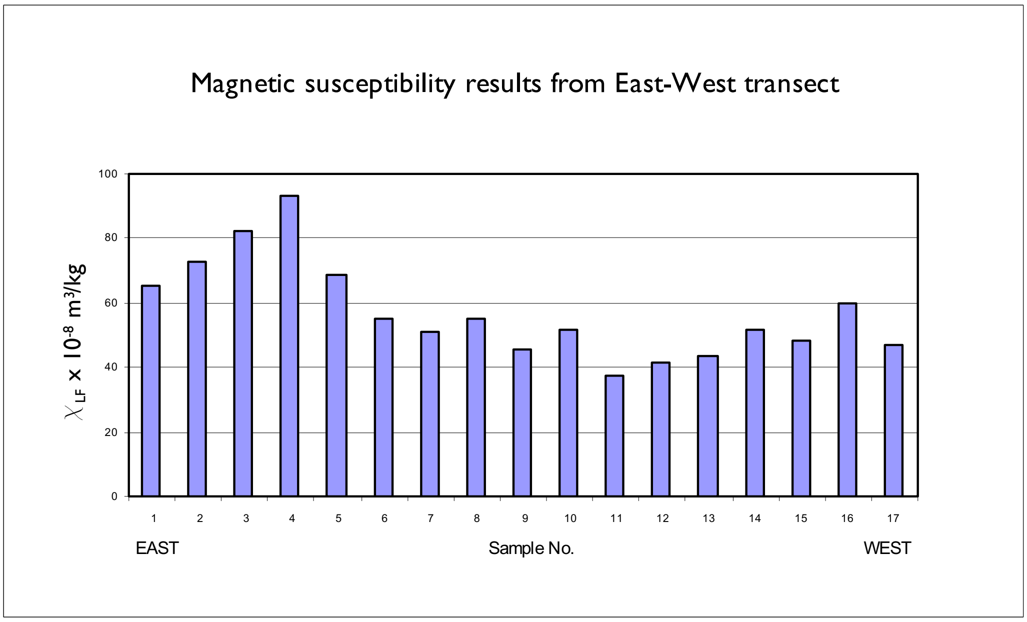


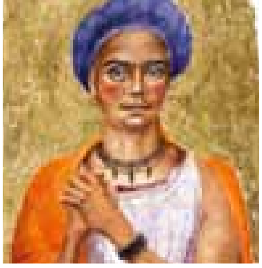
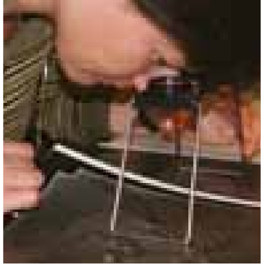
Geophysics Team 2012

CROUGHTON, NORTHAMPTONSHIRE

Magnetic susceptibility measurement transects







ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

ENGLISH HERITAGE

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)