Archaeological Services
University of Durham

Land at Harperley Hall, Crook, Weardale, Co Durham

geophysical surveys

on behalf of
Casella Stanger

ASUD Report 1310
July 2005

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Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at Harperley Hall, Crook, Weardale, Co Durham.

1.2 The works were commissioned by Casella Stanger and conducted by Archaeological Services University of Durham in accordance with instructions provided by Casella.

Results

1.3 Geomagnetic and electrical resistance surveys were conducted over a lawned area immediately north-east of the existing hall.

1.4 No features of likely archaeological significance were detected by either technique.

2. Project background

Location (Figure 1)

2.1 The study area was located on land immediately north-east of Harperley Hall near Crook in Co Durham (NGR centre: NZ 1275 3457).

Development proposal

2.2 The surveys were undertaken prior to proposed re-development of the Police National Training Centre (NTC Consolidation Project).

Brief

2.3 The surveys have been undertaken in accordance with instructions provided by Casella Stanger.

Objective

2.4 The principal aim of the surveys was to determine the extent and nature of any sub-surface features of likely archaeological or historical interest, including cut, built and fired features, which would assist the client and the planning authority in determining appropriate mitigation strategies should archaeological deposits be found to survive within the study area. In this instance it was thought that the remains of formal gardens might be detectable beneath the lawn.

Dates

2.5 Fieldwork was undertaken on 22nd July 2005. This report was prepared between 25th and 27th July 2005.

Personnel

2.6 Fieldwork was conducted by Lorne Elliott (Supervisor) and Jill Inglis. This report was prepared by Duncan Hale, with illustrations by Martin Railton/Janine Fisher. The Project Manager was Richard Annis.

Archive/OASIS

2.7 The paper and data archive is currently held at Archaeological Services, University of Durham. It is anticipated that the data archive will be transferred to the Archaeology Data Service in due course. Archaeological Services University of Durham is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is archaeol3-9437.

3. Archaeological and historical background

3.1 A historical and landscape study of the grounds around the Hall has been undertaken by Casella. The study identified possible evidence for formal gardens on the north-east side of the house (the current survey area), now an open lawn.

3.2 The survey area is depicted as being wooded on all Ordnance Survey map editions from 1856 –1950. Any formal gardens dating from before the OS will have been badly damaged both by tree roots and by subsequent clearance of the trees.

4. Landuse, topography and geology

4.1 At the time of survey the study area comprised a predominantly level lawned area at a mean elevation of *c*.155m AOD.

4.2 The local solid geology comprises Namurian series Millstone Grits, with Westphalian Coal Measures outcropping in places before commencing to the east. These are overlain by glacial and alluvial deposits.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*; the Institute of Field Archaeologists (2002) Paper No.6, *The use of geophysical techniques in archaeological evaluations*; and the Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*.

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of 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 a previous landscape study, it was suggested that formal gardens had been laid out in the survey area. Given the anticipated shallowness of the targets and the non-igneous geological environment of the study area both fluxgate gradiometry and earth electrical resistance survey techniques were considered appropriate. Both techniques have previously been shown to be effective in the general area.

5.4 Gradiometry involves the use of hand-held magnetometers to detect and record minute perturbations, or ‘anomalies’, in the vertical component (i.e. gradient) of the Earth’s magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect the presence of archaeological and garden features.

5.5 Electrical resistance survey measures the resistance to an electrical current when passed through the ground; this principally maps contrasts in soil moisture content.

Field methods

5.6 A 20m grid was established across the survey area, which was then tied-in to known, mapped Ordnance Survey points.

5.7 Measurements of vertical geomagnetic field gradient were determined using Geoscan FM36 and FM256 fluxgate gradiometers with automatic datalogging facilities. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 1600 sample measurements per 20m grid unit.

5.8 Measurements of electrical resistance were determined using a Geoscan RM15A resistance meter with automatic logging of the data. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1 ohms, the sample interval to 0.5m and the traverse interval to 1.0m, thus providing 800 sample measurements per 20m grid unit.

5.9 Data were downloaded on-site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.10 Geoplot v3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Appendix I. In the greyscale images, positive magnetic and high resistance anomalies are displayed as dark grey and negative magnetic and low resistance anomalies as light grey. A palette bar relates each greyscale intensity to anomaly values in nanoTesla or ohms.

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

Clip – clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.

Despike – locates and suppresses localised spikes in gradiometer data caused by near-surface ferrous litter and poor contact resistance in resistance data.

Interpolate – increases the number of data points in a survey; to match sample and traverse intervals and so create a smoother appearance to the data. In this instance both datasets have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.12 Colour-coded geophysical interpretation plans are provided in Figure 3. One type of geomagnetic anomaly has been distinguished in the data:

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.

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

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

Interpretation: features

5.13 Colour-coded archaeological interpretation plans are provided in Figure 4.

5.14 The gradiometer survey over this area did not detect any anomalies likely to reflect former garden or archaeological features. The western part of the survey has been adversely affected by the presence of the existing, adjacent building.

5.15 The resistance technique was not affected by the adjacent building and variations in electrical resistance were recorded, however, the anomalies do not appear to reflect coherent features. The resistance anomalies almost certainly reflect the ground disturbance that occurred during the clearing of trees from this area.

6. Conclusions

6.1 Geophysical surveys have been carried out on a lawn to the north-east of Harperley Hall near Crook in Co Durham.

6.2 Neither geomagnetic nor electrical resistance techniques detected anomalies of likely archaeological or historic garden interest.

7. References

Archaeology Data Service (2001) *Geophysical Data in Archaeology: A Guide to Good Practice*. Arts and Humanities Data Service.

English Heritage (1995) Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation*. London.

Institute of Field Archaeologists (1991) Technical Paper No.9, *The use of geophysical techniques in archaeological evaluations*. Birmingham.

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Figure 1
Location map showing the study area in orange

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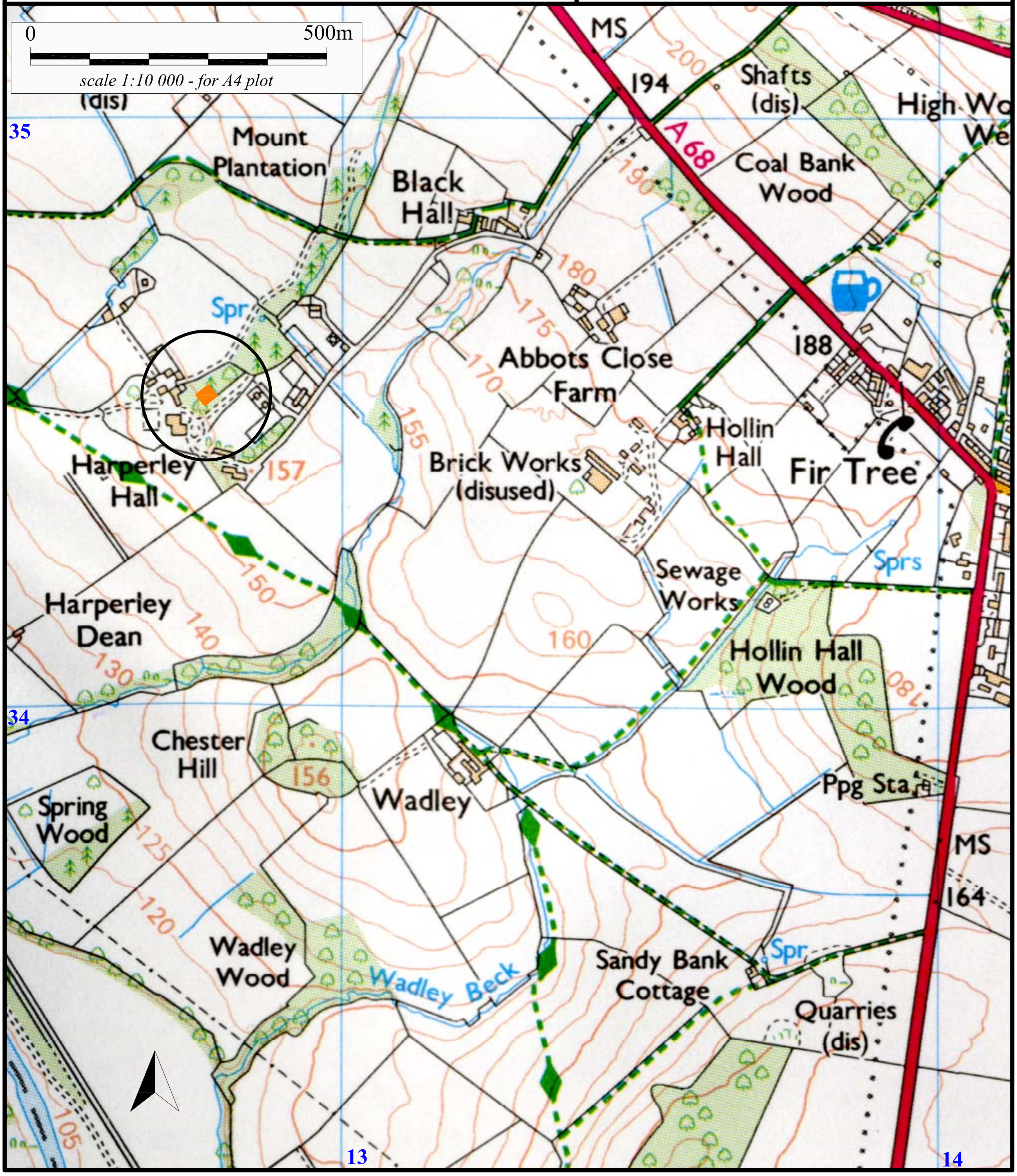

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0 25m
scale 1:500 - for A3 plot

outline of survey area

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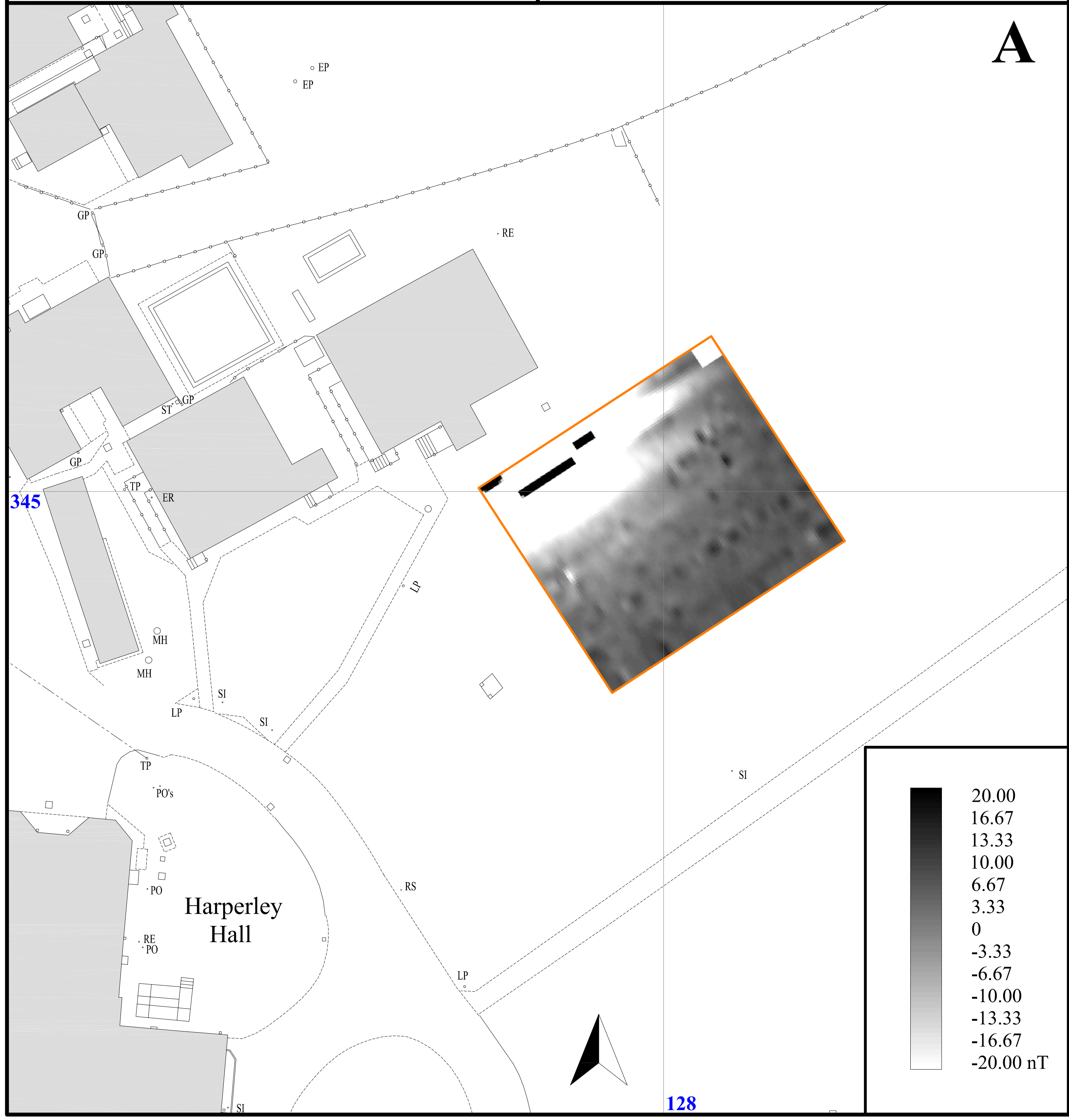
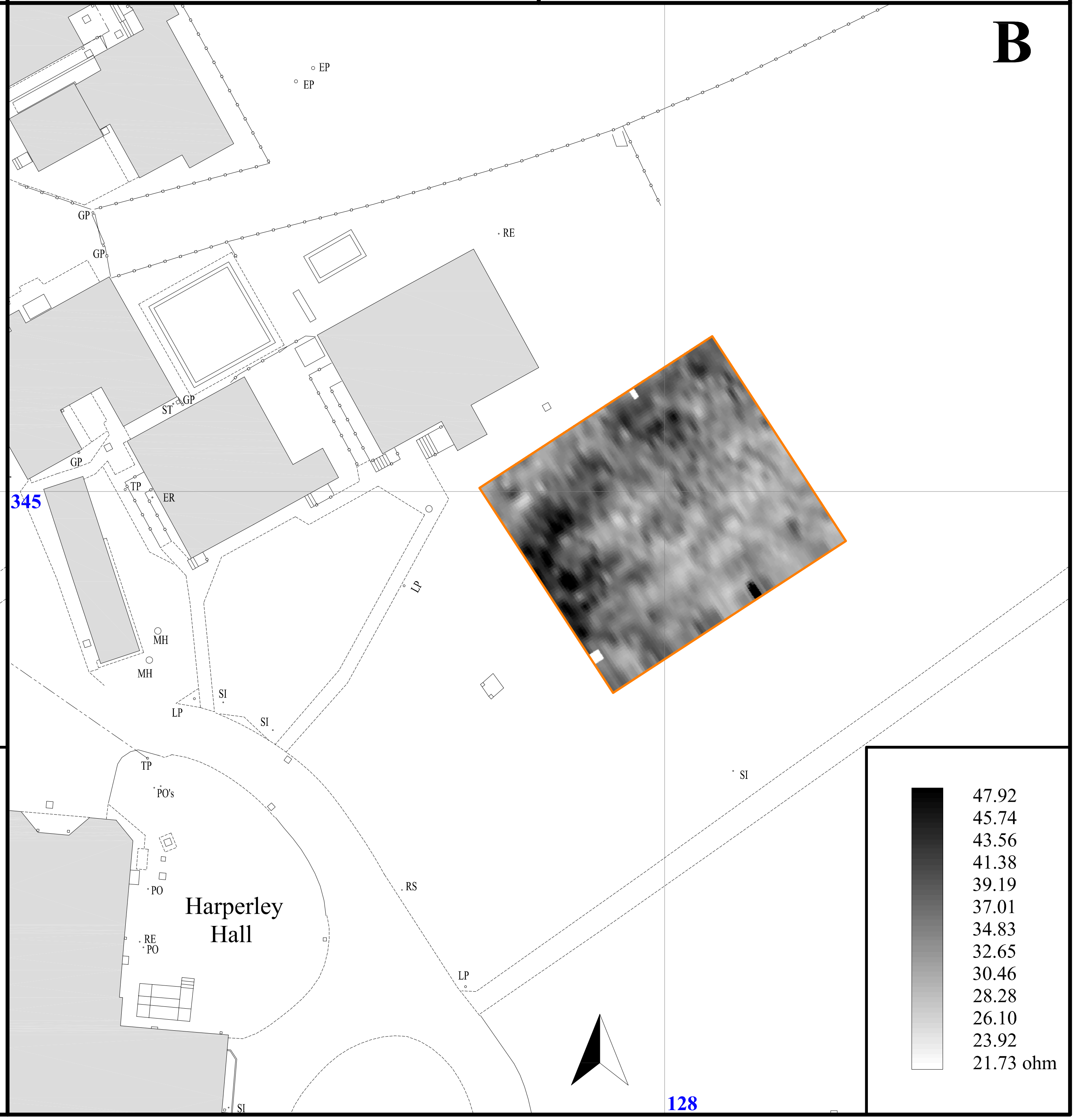
Figure 2

Geomagnetic (A) and electrical resistance (B) surveys





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0 25m
scale 1:500 - for A3 plot

outline of survey area
low electrical resistance
high electrical resistance
dipolar magnetic anomalies

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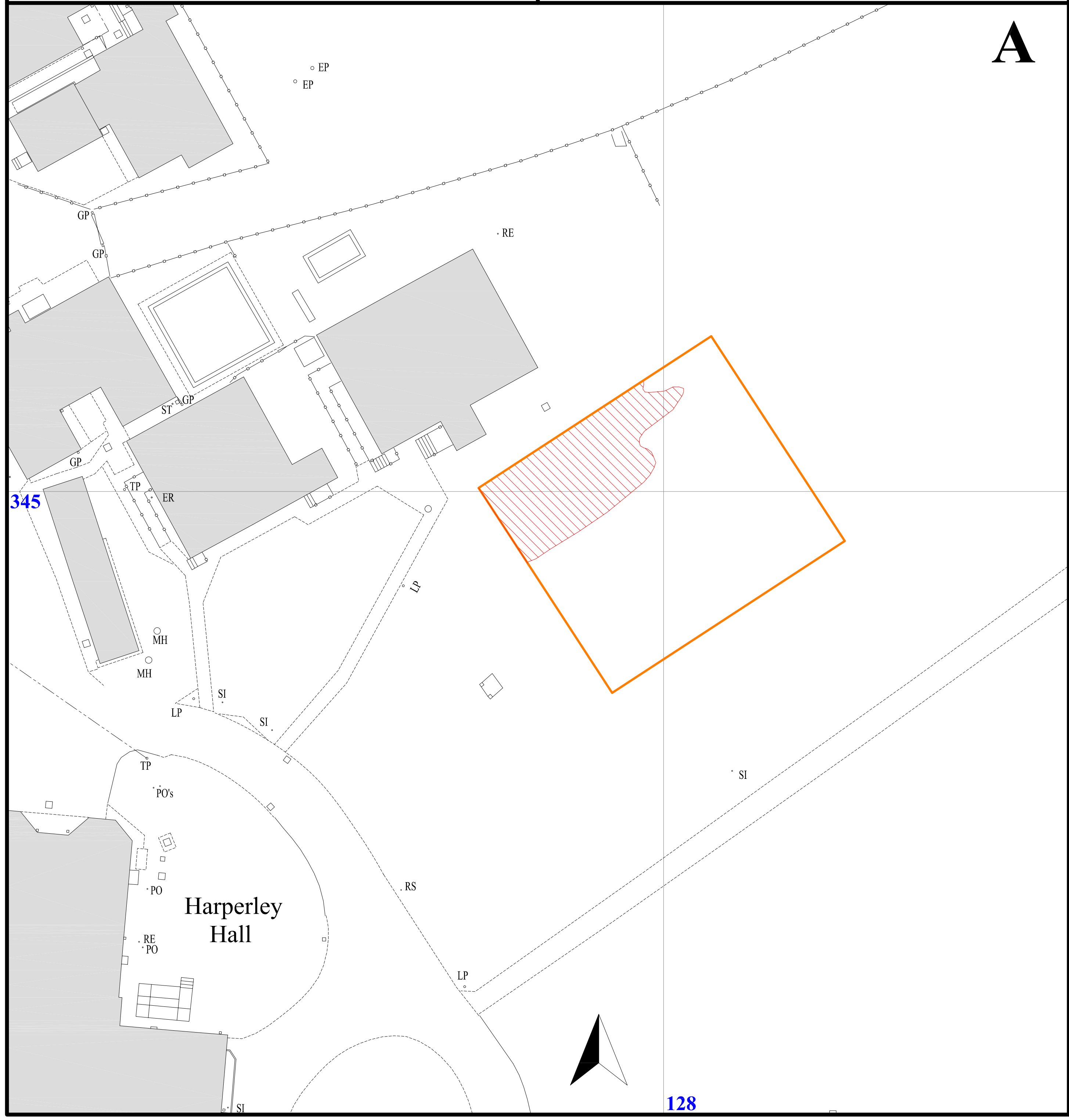
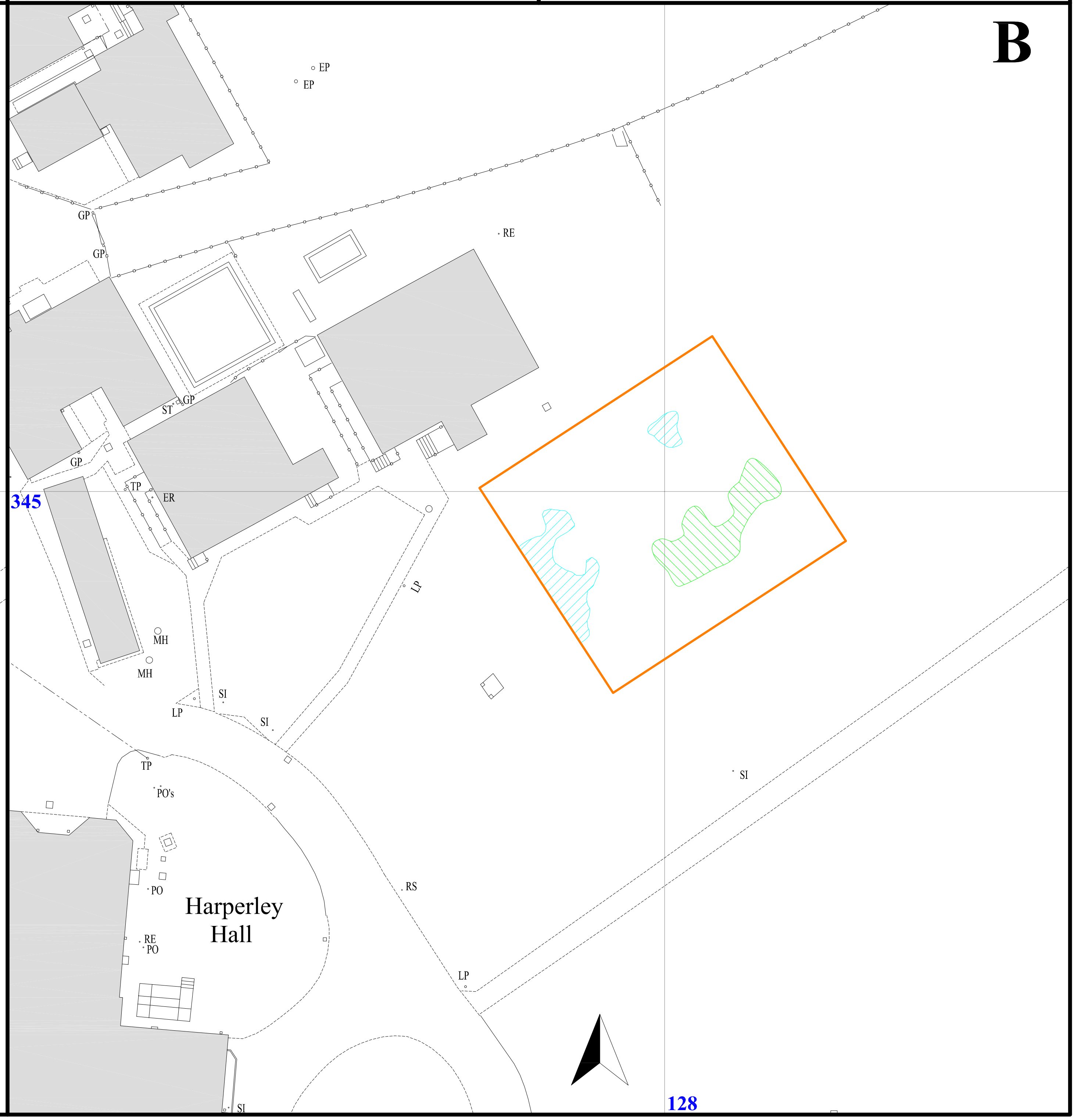
Figure 3

Geophysical interpretation of geomagnetic (A) and electrical resistance (B) surveys





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0 25m
scale 1:500 - for A3 plot

outline of survey area

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Figure 4

Archaeological interpretation