Archaeological Services
University of Durham

Bramham Park, Wetherby, West Yorkshire

geophysical surveys

on behalf of

The Bramham Park Estate

Report 1951
June 2008

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Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed restoration works at the Bramham Park Estate in West Yorkshire. The works comprised electrical resistance surveys which aimed to establish the presence or absence of former drains and ditch revetments.

1.2 The works were commissioned by The Bramham Park Estate and conducted by Archaeological Services.

Results

1.3 A perfectly regular feature has been recorded in Area 1, associated with the former ornamental pond.

1.4 An existing ditch with remains of a possible revetment was recorded in Area 2b, with an additional possible ditch also detected.

1.5 Probable concentrations of stone were detected in both surveys of Area 3.

2. Project background

Location (Figures 1-2)

2.1 The study area comprised parts of the Bramham Park Estate near Wetherby in West Yorkshire (NGR: SE 4078 4167). Five surveys were undertaken in three parts of the estate including a formal garden and the Southern Parkland.

2.2 Area 1 is the site of a former ornamental pond in the parterre in front of the house. It is bounded to the south-west by the wall of the parterre and the formal waterfall. The Area 2 surveys were located at the southern end of the 'Broad Walk' avenue where it emerges into the Southern Parkland. The Area 3a and 3b surveys were at the northern ends of the deodar cedar and maritime pine avenues respectively on the southern side of the Southern Parkland.

Restoration proposal

2.3 The Bramham Park Estate is continuing a programme of restoration of its historic landscape. At each survey site there is the possibility of stonework and drainage systems from the first half of the 18th century, although in most cases no evidence remains on the ground or in contemporary plans, with the exception of the former pond in the parterre whose former location is evident.

2.4 The landscape contains many avenues, each of which is lined by a different species of tree. Where these avenues emerge into the Southern Parkland there is some evidence for ditches to either side of the avenue entrances but not across the actual avenues. One current proposal is to set a wire fence into new ditches across the ends of key avenues, though these areas require investigation prior to excavation of the proposed ditches.

Objective

2.5 The principal aim of these surveys was therefore to assess the nature and extent of any sub-surface features of potential historic and horticultural interest and so inform formal garden and landscape restoration. Specific targets for the surveys included a former ornamental pond in the parterre in front of the house and possible former drainage systems and ha-ha revetments where avenues emerge into the Southern Parkland.

Methods statement

2.6 The surveys were undertaken in accordance with a specification prepared by the Bramham Park Estate's owner, Nicholas Lane Fox.

Dates

2.7 Fieldwork was undertaken on 6th May 2008. This report was prepared between 7th May and 19th June 2008.

Personnel

2.8 Fieldwork was conducted by Graeme Attwood and Duncan Hale. This report was prepared by Duncan Hale (the Project Manager) with illustrations by Janine Wilson.

Archive/OASIS

2.9 The site code is **WBP08**, for **W**etherby **B**ramham **P**ark 20**08**. The survey archive will be supplied on CD to the West Yorkshire Archaeology Service. Archaeological Services 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 **archaeol3-44131**.

Acknowledgements

2.10 Archaeological Services is grateful for the assistance of Nick Lane Fox of Bramham Park and the Estate's Resident Agent, Nicholas Pritchard, in facilitating this scheme of works.

3. Landuse, topography and geology

3.1 Area 1 - this formal garden is level with the exception of a shallow depression where the pond used to be; mean elevation 70m OD.

3.2 Areas 2a and 2b – this part of the grassed avenue is on generally level ground with the exception of shallow former ditches to either side and a centrally-placed, very low sub-circular mound; mean elevation 65m OD.

3.3 Area 3a and 3b – these surveys were at the northern ends of the deodar cedar and maritime pine avenues; the land was generally level at 75m OD.

3.4 The underlying solid geology comprises Late Permian dolostone of the Cadeby Formation.

4. Geophysical surveys

Standards

4.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation 2nd edition* (David forthcoming); the Institute of Field 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 2001).

Technique selection

4.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a variety of complementary techniques such as magnetometry, earth 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.

4.3 In this instance an electrical resistance survey had been specified due to the stoney nature of the targets.

4.4 When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone features will typically give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values.

Field methods

4.5 A 20m 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 (GPS) with real-time correction providing sub-metre accuracy.

4.6 Measurements of earth electrical resistance were determined using a Geoscan RM15D resistance meter. A mobile twin probe separation of 0.5m was used to log data at a theoretical depth of 0.75m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1ohm, the sample interval to 1m and the traverse interval to 1m, thus providing 400 sample measurements per 20m grid unit.

4.7 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.

5. Data processing and interpretation

5.1 Geoplot v.3 software was used to process the electrical resistance data and to produce continuous tone greyscale images of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figure 3. In the greyscale images, high resistance anomalies are displayed as dark grey and low resistance anomalies as light grey. Palette bars relates the greyscale intensities to anomaly values in ohm.

5.2 The following processing function has been applied to the resistance 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

5.3 Colour-coded geophysical interpretation plans are provided in Figure 3. 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

5.4 A colour-coded archaeological interpretation plan is provided in Figure 3.

Area 1

5.5 Blank areas at the eastern side correspond to existing flower beds which were not surveyed. A blank area at the western side, with adjacent high resistance values, corresponds to a waterfall feature and its footings. To the east of the waterfall is a well-defined, rectilinear low resistance anomaly with a semi-circular feature midway along its eastern side. This anomaly appears to define the edges of the former pond; however, the low resistance is not typical of a stone surround, and may reflect a trench or pipe around the pond. The former pond is evident on the ground as a hollow with slopes leading down into it; the anomaly is located halfway down the slope on each side.

Areas 2a and 2b

5.6 A low mound in the central part of the avenue, 2a, corresponds to an area of mixed high and low resistance values, probably indicating a mixed deposit of earth and rocks. No ditch features are evident in the survey.

5.7 Two linear low resistance anomalies were detected in 2b. The more southerly of the two starts to turn to the south-east at its eastern end, and almost certainly corresponds to a partially filled ditch evident on the ground. There are a number of high resistance anomalies to both sides of the low resistance anomaly; these almost certainly reflect stones, some of which were visible in the sides of the ditch, and could reflect the remains of stone revetment.

5.8 To the immediate north of the known ditch is another probable soil-filled ditch, no longer apparent on the ground, indicated by another low resistance anomaly, this time curving to the north at its eastern end.

Areas 3a and 3b

5.9 The only anomaly detected in 3a is an area of high resistance in the southern corner, possibly reflecting a concentration of stone.

5.10 Small arcuate anomalies of high resistance have been detected at each end of the Area 3b survey. These are not particularly regular in form but could possibly reflect the remains of stone features at either side of the avenue.

6. Conclusions

6.1 Earth electrical resistance surveys have been undertaken at specified locations on the Bramham Park Estate prior to proposed restoration works.

6.2 A perfectly regular feature has been recorded in Area 1, associated with the former ornamental pond.

6.3 An existing ditch with remains of possible revetment was recorded in Area 2b, with an additional possible ditch also detected.

6.4 Probable concentrations of stone were detected in both surveys of Area 3.

7. Sources

David, A, forthcoming *Geophysical survey in archaeological field evaluation, 2nd edition,* Research and Professional Services Guideline **1**, English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

Appendix: Specification

Specification of Work to Help Determine the Archaeological Sensitivity of Three Areas of Proposed Restoration in the Historic Landscape at Bramham Park

1. Summary

1.1 A limited amount of archaeological work consisting of a geophysical survey is to be carried out to establish the archaeological significance of the above site as part of the Bramham Park Estate's ongoing restoration programme.

1.2 This specification has been written by the Bramham Park Estate's owner.

1.3 Depending upon the results obtained, additional archaeological work may need to be carried out. This additional work would be governed by separate specifications.

2. Site Location & Description (Grid reference and attached map, with boundaries clearly shown)

2.1 Site 1 (Grid reference SE40774167) is the site of an ornamental pond in the parterre in front of the House. The area is approximately 17m x 13.4m and is bounded to the south west by the wall of the parterre and the formal waterfall. The outline shape of the dry pond is obvious on the ground. The ground is level. See attachment *Bramham Park Geophys Site 1*.

2.2 Site 2 (Grid reference SE41114127), marks the edge of the formal gardens, where the 'Broad Walk' avenue emerges into the Southern Parkland. The area is approximately 65m x 10m. It is bounded to south west and north east by the avenue trees. See attachment *Bramham Park Geophys Site 2*.

2.4 Site 3a (SE41234078), marks the edge of the Black Fen Pleasure Grounds, where the deodar cedar avenue emerges into the Southern Parkland. The area is approximately 25m x 10m. It is bounded to south west and north east by the avenue trees. See attachment *Bramham Park Geophys Site 3a*

2.3 Site 3b (SE41164072), picture below, marks the edge of the Black Fen Pleasure Grounds, where the maritime pine avenue emerges into the Southern Parkland. The area is approximately 28m x 13m. It is bounded to south west and north east by the avenue trees. See attachment *Bramham Park Geophys Site 3b*.

3. Background

3.1 Prior to restoration of the water system to Site 1, it is necessary to investigate the archaeology of the site.

3.2 In the fencing scheme for the Southern Parkland, where the 4-strand, high-tensile wire fence crosses the key avenue views, it is planned to sink it into ditches (Sites 2, 3a & 3b). Before the excavation of these, it is necessary to investigate the archaeology of these sites.

4. Archaeological Interest

At all four sites there is the possibility of stonework and drainage systems from the first half of the C18th although no evidence remains on the ground or in contemporary plans.

5. Aim of the Survey

The aim of this project is to establish the presence / absence, extent, character, relationships and date (as far as circumstances and the inherent limitations of the technique permit) of archaeological features within the proposed restoration areas.

6. Evaluation Methodology

6.1 General Instructions

6.1.1 Health and Safety

The archaeologists on site will naturally operate with due regard for Health and Safety regulations, and the contractor must ensure that all relevant requirements are met with regard both to site personnel and to members of the public. This work may require the preparation of a Risk Assessment of the site, in accordance with the Health and Safety at Work Regulations prior to submission of the tender. Neither the Trustees of the Bramham Park Estate, nor its agents can be held responsible for any accidents or injuries that may occur to outside contractors engaged to undertake this work while attempting to conform to this specification.

6.1.2 Confirmation of Adherence to Specification

Prior to the commencement of *any work,* the archaeological contractor must confirm adherence to this specification in writing to the Bramham Park Estate's Resident Agent, or state (with reasons) any proposals to vary the specification. Should the contractor wish to vary the specification, then written confirmation of the agreement of the Bramham Park Estate's Resident Agent to any variations is required prior to work commencing. Unauthorised variations are made at the sole risk of the contractor (see para. 11.2, below).

6.1.3 Confirmation of Timetable and Contractors' Qualifications

Prior to the commencement of *any work*, the archaeological contractor should provide the Bramham Park Estate's Resident Agent in writing with a projected timetable for the site work, and with details regarding staff structure and numbers. *Curriculum vitae* of key project members (the project manager, site supervisor, any proposed specialists *etc.*), along with details of any specialist

sub-contractors, should also be supplied to the Resident Agent (if *C.V.s* have not previously been supplied). All project staff provided by the archaeological contractor must be suitably qualified and experienced for their roles. The timetable should be adequate to allow an appropriate professional job to be undertaken subject to the judgement of the Resident Agent.

7. Survey Methodology

Geophysical survey contractors are expected to adhere to the English Heritage *Research & Professional Services Guideline No.1: Geophysical survey in archaeological field evaluation* (1995), but also see para. 7.2, below.

7.1 Data Collection

The resistivity survey should be carried out in the area marked green on the attached plan, recording data at 1.0m. stations on 1.0m spaced traverses. It is expected that the Twin Probe (or Twin Electrode) configuration will be used. If during the survey, it appears that useful results might only be obtained by higher resolution measurements, and if this would add significantly to the survey time, then the client and the WYAAS should be contacted and the matter discussed and agreed before implementation.

7.2 Data Presentation

The resistivity data is to be presented in grey-scale or dot-density format. There must also be an accompanying interpretation drawing at an appropriate scale.

8. Unexpectedly Significant or Complex Discoveries

Should there be unexpectedly significant or complex discoveries made that warrant, in the professional judgement of the archaeologist on site, more detailed recording than is appropriate within the terms of this specification, then the archaeological contractor should urgently contact the Bramham Park Estate's Resident Agent with the relevant information to enable him to resolve the matter.

9. Post Completion of Fieldwork

9.1 Report Production: Format and Content

A report should be produced, which should include background information on the need for the project, a description of the methodology employed, and a full description and interpretation of results produced. It is not envisaged that the report is likely to be published, but it should be produced with sufficient care and attention to detail to be of academic use to future researchers. Location plans should be produced at a scale which enables easy site identification and which depicts the full extent of the site investigated. Details of the style and format of the report are to be determined by the archaeological contractor, but should include survey details sufficient to allow accurate re-location of the survey grids on the ground, a full bibliography of sourced used, a quantified index to the site archive, and as an appendix, a copy of this specification.

9.2 Publicity
If the project is to be publicised in any way (including media releases, publications etc.), it will be at the discretion of the Bramham Park Estate, and if so, the form of words used will be subject to the Estate's approval.

9.3 Consideration of Appropriate Mitigation Strategy
The report should not give a judgement on whether preservation or further investigation is considered appropriate, but should provide an interpretation of results, placing them in a local and regional, and if appropriate, national context. However, a client may wish to separately commission the contractor's view as to an appropriate treatment of the resource identified.

10. General considerations

10.1 Authorised alterations to specification by contractor
Any technical queries arising from this specification should be addressed to the Bramham Park Estate's Resident Agent without delay.

10.2 Unauthorised Alterations to Specification by Contractor
It should be noted that this specification is based upon records available to the Bramham Park Estate. Archaeological contractors submitting tenders are strongly advised to carry out an inspection of the site prior to submission. If, on first visiting the site or at any time during the course of the recording exercise, it appears in the archaeologist's professional judgement that:

a part or the whole of the site is not amenable to treatment as detailed above, and/or
an alternative approach may be more appropriate or likely to produce more informative results, and/or
any features that have a bearing on the interpretation of the site, have been omitted from the specification,
then it is expected that the archaeologist will contact the Bramham Park Estate's Resident Agent, urgently, who will resolve the matter. If contractors have not yet been appointed, any variations that the Bramham Park Estate considers to be justifiable on archaeological grounds will be incorporated into a revised specification, which will then be re-issued to the tendering contractors. If an appointment has already been made and site work is ongoing, the Bramham Park Estate will resolve the matter in liaison with the contractor.

10.3 Technical Queries
It is the archaeological contractor's responsibility to ensure that they have obtained the Bramham Park Estate's Resident Agent's consent in writing to any variation of the specification prior to the commencement of on-site work or (where applicable) prior to the finalisation of the tender. Unauthorised variations are made at the sole risk of the contractor.

10.4 Valid period of specification
This specification is valid for a period of one year from date of issue. After that time it may need to be revised to take into account new discoveries, changes in policy or the introduction of new working practices or techniques.

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Archaeological Services
University of Durham

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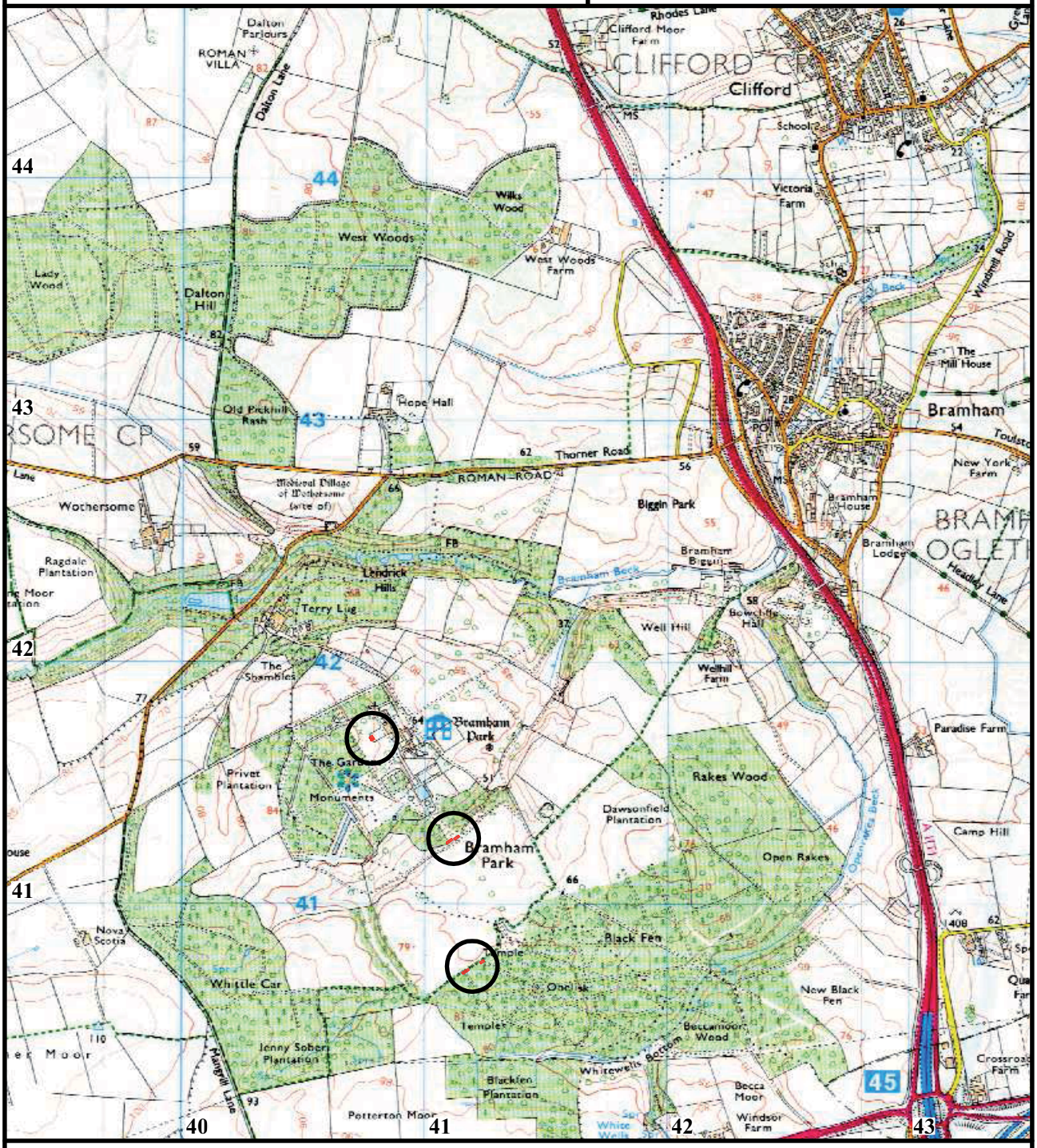
Figure 1
Location map

on behalf of
The Bramham Park Estate



location of geophysical surveys

0 1km

scale 1:25 000 - for A4 plot

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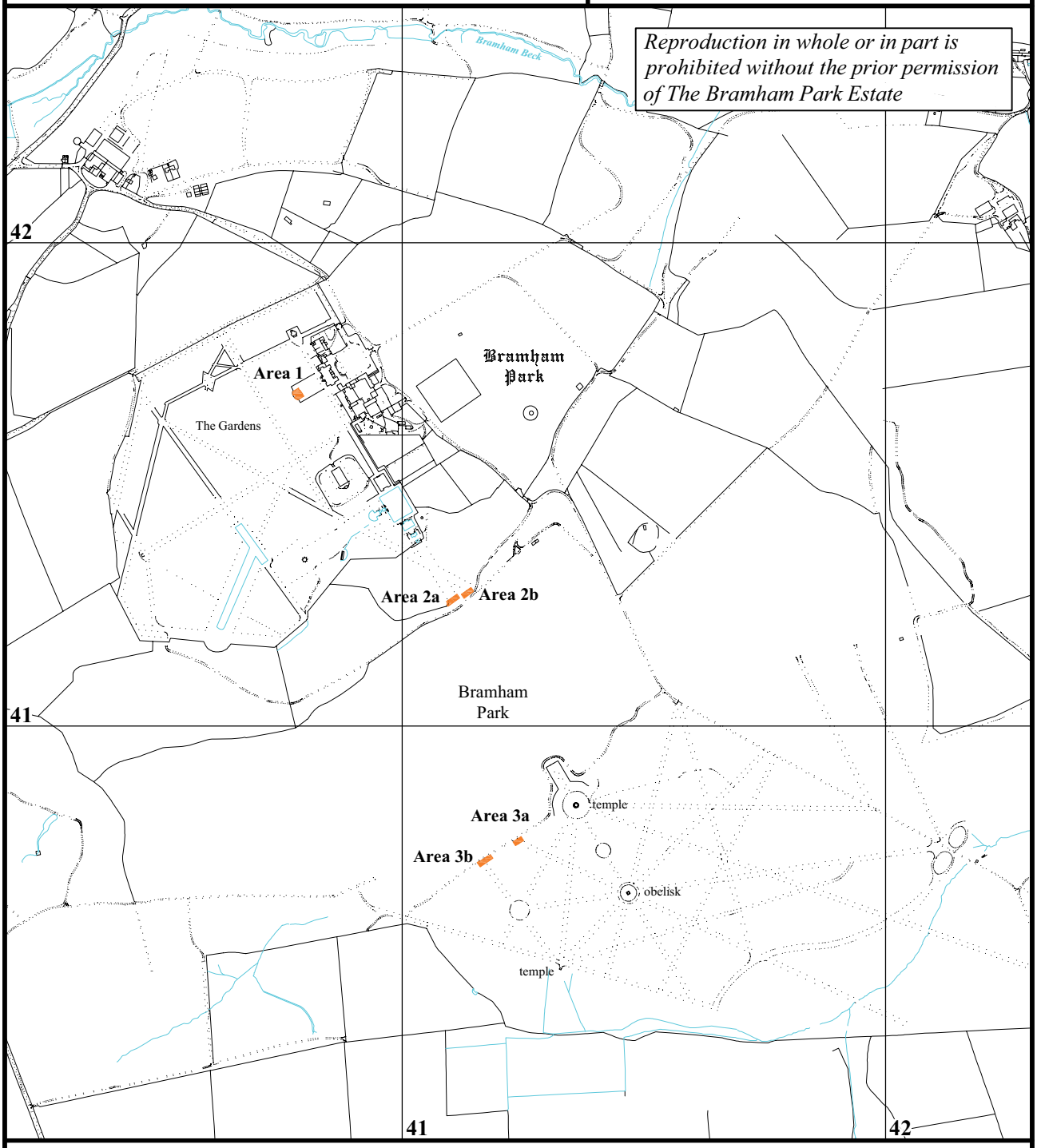
Figure 2
Location of geophysical survey areas

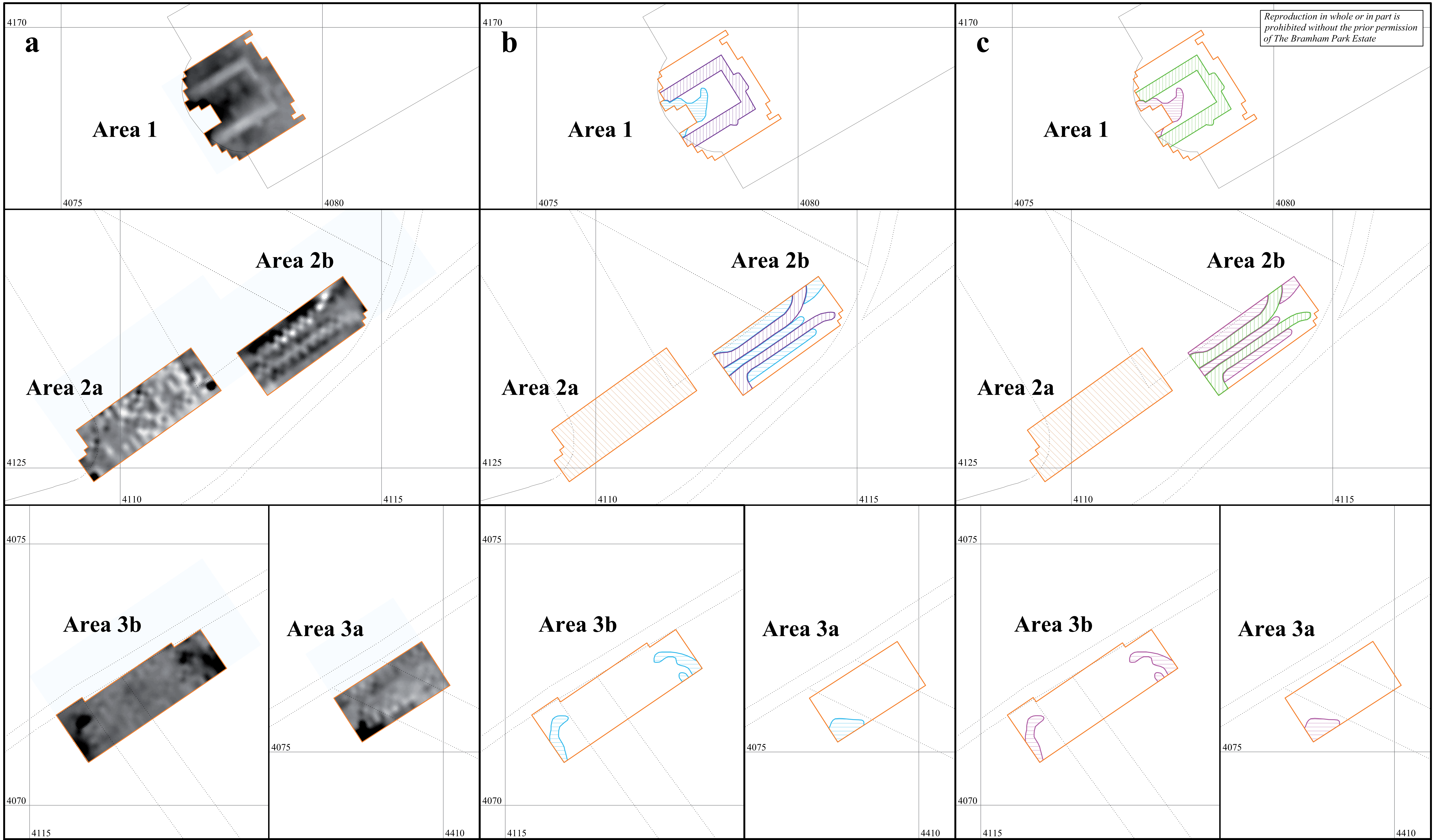
on behalf of
The Bramham Park Estate

0 300m

scale 1:6000 - for A4 plot



geophysical surveys



a) Geophysical surveys

Area 1	Area 2a	Area 2b	Area 3a	Area 3b
32.00	100.00	50.00	15.00	15.00
31.00	154.17	54.17	16.25	16.67
30.00	208.33	58.33	17.50	18.33
29.00	262.50	62.50	18.75	20.00
28.00	316.67	66.67	20.00	21.67
27.00	370.83	70.83	21.25	23.33
26.00	425.00	75.00	22.50	25.00
25.00	479.17	79.17	23.75	26.67
24.00	533.33	83.33	25.00	28.33
23.00	587.50	87.50	26.25	30.00
22.00	641.67	91.67	27.50	31.67
21.00	695.83	95.83	28.75	33.33
20.00 ohm	750.00 ohm	100.00 ohm	30.00 ohm	35.00 ohm

b) Geophysical interpretation

- outline of survey area
- high resistance anomalies
- low resistance anomalies
- mixed high and low resistance anomalies

c) Archaeological interpretation

- outline of survey area
- possible stone features
- possible soil-filled feature
- mixed deposit of earth and rocks

on behalf of
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0 25m
scale 1:500 - for A2 plot

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Figure 3

Geophysical surveys and interpretations