

**SURVEY RESULTS****2006 / 66 Buckingham Palace****1. Survey Areas**

- 1.1 Five areas (see Figure 1) within the grounds of Buckingham Palace were selected for geophysical investigation using a combination of geophysical techniques: gradiometer survey was carried out using a Bartington Grad 601-2 instrument and a Geoscan FM256; resistance survey employed a wheeled square array, incorporating a Geoscan RM15 meter; and Ground Penetrating Radar (GPR) survey used a Sensors & Software Noggin<sup>plus</sup> system.
- 1.2 The survey grid was set out by *GSB Prospection Ltd.* and tied in to the Ordnance Survey (OS) grid by *Dr Henry Chapman* using a Trimble Differential GPS system. The location of the survey areas is shown in Figure 1 at a scale of 1:2500.

**2. Data Processing and Display**

- 2.1 The magnetic data have been pre-processed by removing baseline shifts due to zig-zag data collection. Where appropriate, traverses have been corrected for minor misalignments; these are due to variations in walking speed, which are usually a result of ground conditions or topography. No filtering has been undertaken on the magnetic datasets collected in this project. The data have been interpolated to improve the quality of the greyscale images.
- 2.2 Where necessary the resistance data have been pre-processed to correct for grid-mismatch errors resulting from survey on different days. De-spiking has been undertaken, to reduce minor errors from contact with the ground surface. For presentation purposes, the data have been interpolated to reduce pixilation in greyscale images. Filtering is commonly used on resistance data to suppress, for example, a geological background and where used this will be noted on the relevant diagrams.
- 2.3 The GPR data traverses (*radargrams*) from each area have been reconstructed to form a 3-dimensional block of data which has been 'sliced' horizontally to produce plan maps (*time-slices*) of responses at increasing depths. In general, processing of the GPR data is kept to a minimum unless the outcome of applying some form of filtering is deemed to be specifically effective in refining the individual plots. If a filter has been used, it will be noted on the relevant diagrams. Further details of the display formats and possible processing routines are discussed in the technical information section at the end of the report.
- 2.4 Figures 2-11 show summary greyscale/colour images and interpretations of the data, superimposed on the OS mapping, at a scale of 1:1000 or 1:2000.
- 2.5 The magnetic results are displayed as XY traces and greyscale images and the resistance as greyscale images. All techniques are accompanied by an interpretation. These display formats and the interpretation categories used are discussed in the *Technical Information* section at the end of the text.

### 3. General Considerations and Complicating Factors

- 3.1 Conditions for survey were good, as the main survey areas consisted of flat, short grassed lawns. An area of GPR survey was conducted in the Quadrangle which had a tarmac surface covered with gravel.
- 3.2 Small scale ferrous anomalies within the gradiometer data are likely to be caused by modern debris containing iron and are therefore not of archaeological interest. Although highlighted on the interpretations they are not discussed in the text unless thought relevant.
- 3.3 Depths have been indicated on the GPR diagrams, but these have to be viewed with caution. The conversion from time to depth depends on the velocity of the electromagnetic signal through the ground. This velocity may vary markedly over relatively small distances (both laterally and vertically) and, as a result, any depth conversion *is only an approximation*. An average velocity of 0.09m/ns has been used for the time to depth conversions following velocity analysis using graphical methods, which involve the fitting of curves to point source reflections.
- 3.4 Where there is a strong electromagnetic contrast, the GPR signal can be inter-reflected or reverberated, producing a delay in the reflection of the signal. This is termed 'ringing'. This happens, to some extent, with all reflections and results in a greater apparent depth than actually exists. As a result, it is often not possible to detect the base of features; only the tops of buried deposits are detected with certainty [Annan 1996].

### 4. Results of Gradiometer Survey

#### Area 1

- 4.1 This block was placed over one location thought to possibly contain remnants of the Civil War defences. However, the magnetic data are magnetically noisy which has made interpretation difficult. While linear anomalies (A) have an archaeological form and could be associated with the defences, such an interpretation is, at best, tentative.
- 4.2 A pipe can be seen bisecting the south western section of the grid and metal fencing around the tennis court has added further magnetic disturbance.

#### Area 2

- 4.3 This area also contained possible Civil War defences as well as the projected course of the Goring Great Garden wall. Two services can be seen in the dataset; also present are areas of magnetic disturbance which may be associated with the landscaping of the area. All these responses have made identification of archaeological anomalies very difficult.
- 4.4 Archaeological type responses (B) might indicate the line of the defences and/or Goring wall although they are on a slightly different alignment to the postulated course; as such any archaeological interpretation must be viewed with care. Responses (C) also have an archaeological form but it is impossible to place an interpretation other than ditch-like features.
- 4.5 Throughout the data, linear anomalies (D) can be seen. It is thought that these could reflect drains.

**Area 3**

- 4.6 The main target of archaeological interest in this area was a large ornamental canal, centrally positioned with respect to the palace. However, no magnetic responses were found that were indicative of such a feature which might have been infilled with bricks or rubbish. Although archaeological type responses have been recorded at (E) that coincide with the suspected end of the canal, the responses would not normally have been singled out as being of particular interest.
- 4.7 Elsewhere, a handful of pit type responses can be seen within the data, but given the nature of the site, the responses could equally have a modern origin, such as more deeply buried ferrous debris.
- 4.8 A pair of linear trends (F) is visible on an east – west orientation; these may be of an archaeological origin but could just as equally be of a more modern nature, such as drains. They parallel a large area of magnetic disturbance that is known to contain numerous service pipes and this would enforce a modern origin for the trends.
- 4.9 Ferrous responses (G) are manhole covers marking the line of a buried (presumably plastic or non-ferrous) service.

**Area 4**

- 4.10 The Goring wall is meant to cross this area but the results are magnetically very disturbed; a number of services can be seen within the data along with linear responses (H) which are likely to be drains. Due to the disturbed nature of the area, no archaeology has been detected.

**5. Results of Resistance Survey****Area 1**

- 5.1 A rectangular area of high resistance (1) corresponds with the magnetic data (see paragraph 4.1) and may therefore represent structural or rubble remains but the results are equally likely to be the effect of landscaping.
- 5.2 Other responses within the data are likely to be natural or topographical in origin.

**Area 2**

- 5.3 A number of large trees were present within this area and have resulted in spurious zones of high resistance.
- 5.4 Bands of low resistance can be seen bisecting the data; these responses are caused by pipes and match up with the gradiometer results (see paragraph 4.6).

**Area 3**

- 5.5 High resistance responses (2) are associated with the steps as mentioned in paragraph 4.7. Other responses (3) may also have an archaeological origin and may be associated with the canal.
- 5.6 A small square of high resistance (4) coincides with a helipad.
- 5.7 Other areas of high resistance are likely to be due to landscaping of the gardens. These responses will have masked any archaeological features.
- 5.8 At the southeastern edge of the data an area of low resistance (5) may have been caused by the

large number of manhole/drainage covers present.

#### Area 4

- 5.9 A curving high resistance trend (6) may have an archaeological origin, although, a more modern intervention such as a former path may be equally as likely.
- 5.10 High resistance anomalies are likely to have been caused by the trees that were present whilst the low resistance responses may be indicative of services

## 6. Results of GPR Survey

#### Area 3

- 6.1 Although the shallow slices (Figures 6 & 7) show some correlation with the magnetic and resistance data, the radar results were generally disappointing over this area of the lawn. A high amplitude response (i) relates to trends in both the resistance and magnetic data, which is thought to be the footings of the former garden terrace. This extends through the intermediate time-slices but disappears at depth. A band of increased response (ii) running perpendicular to this is from the backfill where steps were believed to descend toward the ornamental canal. The response has a poor depth extent and only just shows up within the intermediate slices.
- 6.2 Other noise within these slices is thought to be merely the effects of landscaping, perhaps related to the magnetic spreads of material seen in the gradiometer data. There is little form to its distribution that would suggest that it is archaeological. A small number of trends may be related to drainage features.
- 6.3 At depth the responses in Area 3A are thought to be natural, perhaps the effects of geological features, again, they show little form to suggest an archaeological origin. The effects of the garden terrace and steps have gone from Area 3B leaving a simple trend and isolated zone of high amplitude response (iii). These are unlikely to be of archaeological significance given the depth relative to the garden features.

#### Area 5

- 6.4 The data from within the central quadrangle of the palace are very complex, with numerous services and disturbance potentially brought about through successive phases of surfacing. It would seem that the vast majority of linear anomalies within the central area are likely to be historic relics as very few contemporary pipes or cables actually cross the quadrangle (Palace engineer, *pers comm.*).
- 6.5 In the shallow time-slices (top 0.25m) there is a distinct, almost circular, spread of increased response (iv) in the centre of the quadrangle with a quieter zone around it. It is thought that this may be a former turning circle, or at least relate to some other former feature of the surfacing within this area.
- 6.6 With depth, this feature quickly fades and the concentration of reflections shifts to the northwest corner of the quad (v). The zone of increased response has a rectilinear distribution and correlates well with the only recorded archaeological investigation within this area. This amounts to a drawing of wall remains uncovered during works in 1744 by Flitcroft (see Figure 12 for comparison). They show these walls in relation to Buckingham House and a central fountain, the foundations of which (vi) are just about discernable in the slightly deeper slices. This zone of response and recorded walls are believed to be one wing of the 'H'-shaped Arlington House which

stood on the site prior to Buckingham House.

## **7. Conclusions**

- 7.1 The Civil War defences and the Goring Great Garden Wall have remained largely elusive apart from a few responses of archaeological potential in Areas 1 and 2 that might be associated with these features. Area 3 has produced a handful of archaeological anomalies, some of which could be associated with the ornamental canal. The majority of all the areas were magnetically disturbed due to services, drains and landscaping; these responses will have therefore masked any detectable archaeological features.
- 7.2 Results from the resistance results were more promising, particularly in Area 3, where anomalies associated with steps down to the ornamental canal were located. However, landscaping of the grounds and modern services have had a detrimental effect on the results...
- 7.3 The GPR survey results within Area 3 correspond to both the magnetic and resistance as having areas of high amplitude which correlate to the ornamental canal. Natural responses have also been noted in this area and may be a result of landscaping or geological features. Area 5 revealed a complex of features and was highly disturbed by modern and historic services. At depth features which correspond to Flitcrofts excavations, including a central fountain and remains of Arlington House were located.

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## SITE SUMMARY SHEET

2006 / 66 Buckingham Palace

NGR: TQ 290 795

### Location and topography

The areas under investigation are located within the grounds of Buckingham Palace, in the Westminster district of London. Survey areas consisted of generally level, mown lawns to the south and west of the Palace and a gravelled area within the Quadrangle. The soils are unclassified.

### Archaeology

The site of Buckingham Palace formed part of the Manor of Ebury in the Middle Ages; the ground would have been marshy due to the River Tyburn which today still flows under the courtyard and south wing of the palace. The first house to be erected on the site was around 1624 by Sir William Blake. In 1633 Lord Goring extended the house and developed the 'Goring Great Garden'. In 1703 the house which forms the core of the present palace was built for the first Duke of Buckingham. The house was converted into a palace in 1826 by George IV. Buckingham Palace became the principal Royal residence in 1837 on the accession of Queen Victoria.

### Aims of Survey

The aims of the survey were manifold: to locate any features associated with Civil War works on the outskirts of the grounds; to investigate the line of Goring's Great Garden Wall; to try to pinpoint a large ornamental canal associated with earlier phases of the Palace and to survey the Quadrangle in an attempt to locate early building foundations and other features of potential archaeological interest. This work formed part of a wider investigation being carried out by Channel 4's *Time Team* as part of the *Big Royal Dig* programme.

### Summary of Results \*

Gradiometer results have produced anomalies that may potentially be associated with the Civil War defences and the Goring Great Garden Wall, within Areas 1 and 2 respectively. However, the majority of all the areas were magnetically disturbed due to service, drains and landscaping; these responses will have masked many features of archaeological interest, if present.

The resistance results were slightly more informative, especially in Area 3, where a block of high resistance proved to be the base of steps associated with the ornamental canal. However, landscaping of the gardens and the services have had a detrimental effect on the survey results.

GPR survey within the Quadrangle (Area 5) showed a complex of both modern and historic services. Within the deeper time-slices high amplitude responses correspond to excavations in 1744 and include walls of Arlington House and a central fountain. Survey within Area 3 correlates to the magnetic and resistance surveys as it shows features associated with the canal. Natural responses were also located which may suggest geological or landscaping features.

**\* It is essential that this summary is read in conjunction with the detailed results of the survey.**

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**Archive CD**

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