REPORT ON GEOPHYSICAL SURVEY

CHARLTON VILLA

Report Number 92/108

Work commissioned by :

ROYAL COMMISSION ON THE HISTORICAL MONUMENTS OF ENGLAND

GEOPHYSICAL SURVEYS of Bradford

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SITE SUMMARY SHEET

92 / 108 Charlton Villa, Wiltshire

NGR: SU 108 567

Location, topography and geology

The area under investigation lies within the parish of Charlton St Peter, approximately 9 kilometres south-east of Devizes, Wiltshire. The field was under a young crop at the time of the survey and ground conditions were very wet following a period of heavy rainfall and flooding. The topography of the area is generally level, but the field slopes downhill towards the River Avon in the north. Lying on a low river terrace, the geology consists of gravels.

Archaeology

Quantities of pennant sandstone, box flue tiles and 3rd to 4th century pottery have been recovered from the field (SMR No. SU15NW302). Aerial photographs (APs) suggest the existence of a series of circular ditched features in the norh-west corner of the field under investigation (M. Corney *pers comm.*).

Aims of Survey

It was hoped that geophysical survey techniques would help ascertain whether there is any evidence for:-
1. buildings associated with the artefactual evidence.
2. the ring ditch features.

Summary of Results *

Both magnetic and resistance anomalies have been found which indicate the presence of three probable buildings and their presumed associated field systems. The resistance readings are slightly confusing in that ditch features are being detected as high resistance anomalies. This is as a consequence of differential drying following flooding of the ground: surface layers of the ditches have dried out more compared to their waterlogged lower fills. In addition to the probable Roman remains, ring ditch features have been located to the south of those visible on aerial photographs. The magnetic strength of the latter is weak, partly a reflection of their original function (presumed non-habitation) and also due to the postulated greater depth of alluvium closer to the River Avon.

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

SURVEY RESULTS

92 / 108 Charlton Villa, Wiltshire

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1. Survey Areas (Figure 1)

1.1 An area measuring 120m x 180m was investigated using fluxgate gradiometry, and a slightly smaller area, 120m x 120m, using resistivity. In addition, magnetic susceptibility field coil measurements were taken every 20m over an area of approximately 6 hectares. The detailed survey areas and sampling points are shown in Figure 1 at a scale of 1:2500.

1.3 The survey grids were established by **Geophysical Surveys of Bradford** (GSB) and tied-in by personnel from the **Royal Commission on Historic Monuments for England** (RCHME).

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2. Display (Figures 2 to 13)

2.1 The results are displayed at 1:625 in a variety of formats:- X-Y trace, dot density plot and grey scale image. These display options are discussed in the *Technical Information* section at the end of the text. Resistance results in Figure 8 are at a scale indicated in the diagram.

2.2 Magnetic susceptibility coil measurements are displayed as proportional circles on an outline of the field at 1:2500.

2.3 Interpretation diagrams are also produced at a scale of 1:625, together with a summary of the magnetic and resistance results (Figure 13).

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3. General Considerations - Complicating factors

3.1 In general, ground conditions were suitable for survey, the field being generally level and free of obstructions, apart from an electricity pole in the N-W corner of the detailed survey area.

3.2 The field was very wet at the time of the survey and this has made interpretation of the resistivity results confusing. Some of the near surface layers of the ditches are drier than the lower waterlogged fills, and this has the effect of high resistance anomalies being associated with the ditches when normally the opposite would be expected. This is mainly due to recent flooding of the field; the surface layers have dried out more quickly than the lower layers leaving a band of high resistance material.

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4. Magnetic Results (Figures 2 to 5)

4.1 The background magnetic data are generally low, apart from a few scattered ferrous peaks and a small area of disturbance associated with the electricity pole (Section 3.1).

4.2 Magnetic areas of interest divide into three broad categories: ditch-type anomalies, pit-type anomalies and discrete areas of high readings.

4.3 Most of the linear anomalies are associated with a complex of small fields, presumably associated with the postulated buildings (Section 5.3).

4.4 There are several pit-type anomalies scattered throughout the survey area, some being particularly well defined. It is possible that some of the anomalies are the result pockets of different magnetic gravels, but given the archaeological context, an anthropogenic explanation is more likely.

4.5 Three areas of discrete noise are apparent on the X-Y traces (Figure 2). The responses are typical of those normally associated with scatters of brick, tile and other building debris. Although it is not possible to identify individual walls as such, this is not unusual; the resistivity survey is more suited to this task.

4.6 In the northern half of the survey area there are two weak anomalies suggestive of ring ditches approximately 20m to 25m in diameter. These are similar in size and morphology to those visible on aerial photographs. However, the anomalies are located approximately 50m south-west of the AP transcriptions, and if this archaeological interpretation of the geophysical data is correct, then the evidence points towards a complex of ring ditches. Unfortunately, the area north of the present survey is closer to the course of the River Avon, and as such is likely to be under a greater depth of alluvium. This already appears to be masking features in the present survey. It is likely that further north the contrast between feature fill and subsoil is too small to be detected with the gradiometer.

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5. Resistivity Survey (Figures 6 to 11)

5.1 At the outset is must be re-emphasised that ground conditions at the site were particularly wet and this has resulted in some spurious readings. As already explained, high resistance anomalies have been recorded over some of the positive magnetic anomalies which have been interpreted as ditches. As a consequence, detailed interpretation of the results is in places difficult.

5.2 Broad variations in the readings across the site are due to underlying changes in the compositions of the gravels. For example, in the N-W corner of the survey there is a low resistance band which is interpreted as being associated with a former bed of the River Avon; see the meanders in Figure 1. The postulated former river bed follows an interesting course when compared to the line of a ditch identified in the magnetic survey which might be interpreted as respecting this line. Elsewhere, some of the high resistance areas could be due to different thicknesses of gravel deposits. Anomalies of archaeological interest are superimposed on these broad background changes.

5.3 Of particular interest are three 'blocks' (A, B and C - see Figure 9) of high resistance readings which coincide with areas of disturbed magnetic responses. The latter adds support to the interpretation that these resistance readings are most likely to be associated with former buildings.

5.4 Some wall lines are clearly visible in the western block (A), though the general spread of the results suggests that there are substantial quantities of building material / rubble masking any walls. The core of high readings covers a maximum area approximately 20m by 15m.

5.5 The central block (B) is the most clearly defined, due to the apparent lack of building rubble obscuring the walls. The building appears to consist of one main cell, approximately 6m wide by 13m long, with a sub-dividing wall in the western half. The eastern wall appears to overlie, or is possibly associated with a ditch.

5.6 The eastern block (C) appears to consist of a complex of walls, the predicted components being tentatively interpreted in Figures 9 and 11. The building lies within a small enclosure, formed by the ditches visible in the magnetic survey.

5.7 The ring ditches located in the magnetic survey also appear as high resistance anomalies, though the responses are poorly defined.

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6. Magnetic Susceptibility Sampling

6.1 As part of an on-going research project carried out by GSB, field coil measurements of the topsoil magnetic susceptibility were taken at 20m across the western half of the field. It was hoped that measurement of this phenomenon would help act as an indicator of areas of potential archaeological interest, by identifying areas of enhanced magnetic susceptibility.

6.2 The results are displayed as proportional circles in Figure 13 with larger circles representing higher readings.

6.3 The use of a field coil was only possible at Charlton Villa because the ground cover was bare soil. This is necessary in order to get a good contact.

6.4 The results clearly indicate an increase in the background magnetic susceptibility in the S-W corner of the field, suggesting perhaps that activity may continue in the next field. The highest readings coincide with the building complexes.

6.5 However, use of such a coarse sampling interval inevitably means that some elements of archaeological interest will have been missed. In addition, features such as the ring ditches are unlikely to have been located using this method and sampling interval.

6.6 The work demonstrates that further coarse sampling would be an appropriate methodology for identifying areas of concentrated activity.

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7. Conclusions

7.1 The geophysical survey work has successfully identified a complex of features of archaeological interest of a multi-phased nature. The resistivity survey has located three postulated building complexes, which appear to be situated within a system of small fields or enclosures; the latter being visible in the magnetic data. The results demonstrate admirably how the two geophysical data sets compliment each other.

7.2 Similar geophysical results have been identified on other sites, for example at Ham Hill (GSB 1993), Bancombe Hill (GSB forthcoming), and Wharram Percy (Rahtz *et al*, 1986). At Wharram a magnetic survey carried out by the Ancient Monuments Laboratory (English Heritage) identified a series of field systems very similar to those at Ham Hill, but unfortunately there was no supporting resistivity work. As a consequence an area of magnetic noise, thought to be associated with a villa building, was not proven. At Charlton, however, it has been possible to confirm that specific areas of magnetic noise do coincide with buildings visible on the resistivity survey.

7.3 There is one major difference between the results from Charlton and elsewhere, in that *three* discrete postulated buildings have been identified. If the buildings are contemporary, perhaps as suggested by their positions in relation to the field systems, then the results are particularly interesting.

7.4 A further difference between the results from Charlton and other sites is the apparent low density of pit and industrial type responses. It is possible that the current survey has only identified part of a larger site, as suggested by the magnetic susceptibility sampling (Section 6.4), which extends into the adjacent field(s).

7.5 The geophysical work has also confirmed the presence of ring ditch features in the northern half of the survey area. The western-most ditch, which runs close to Building A, and parallel to the postulated former river channel, also appears to respect the larger ring ditch visible in the geophysical data. Clearly it would be of interest to establish whether this ditch is contemporary with the buildings or the ring ditch.

7.6 The strength of the magnetic anomalies associated with the ring ditches is quite weak. This is either due to the presumed alluvial deposits masking the features, or due to a lack of magnetically enhanced ditch fills, which may be indicative of a 'ritual' function.

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Project Assistants: Dr C Gaffney, S Gaffney, N Nemcek, D Redhouse, D Shiel, A Shields and C Stephens

3rd March 1993
Geophysical Surveys of Bradford

References:

GSB 1992 — *Report on Geophysical Survey at Ham Hill, Somerset*, **Geophysical Surveys of Bradford**, Report 92 / 101, unpublished.

GSB forthcoming — *Report on Geophysical Survey at Bancombe Hill, Somerset*, **Geophysical Surveys of Bradford**, Report 93 / 21, forthcoming.

Rahtz, P., Hayfield, C., and Bateman, J., 1986 — *Two Roman Villas at Wharram Le Street*, **York University Archaeological Publications**, 2.

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GEOPHYSICAL SURVEYS OF BRADFORD.**

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs. Field plots are produced on a portable Hewlett Packard Thinkjet. Further processing is carried out back at base on computers linked to appropriate printers and plotters.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method.

(b) Resistance Meter - Geoscan RM4 or RM15

This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections".

(c) Magnetic Susceptibility

Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

Display Options

The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.

(a) X-Y Plot

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the indiviual anomalies. Results are produced on a flatbed plotter.

(b) Dot-Density

In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.

(c) Contour

This display joins data points of an equal value by a contour line. Displays are generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.

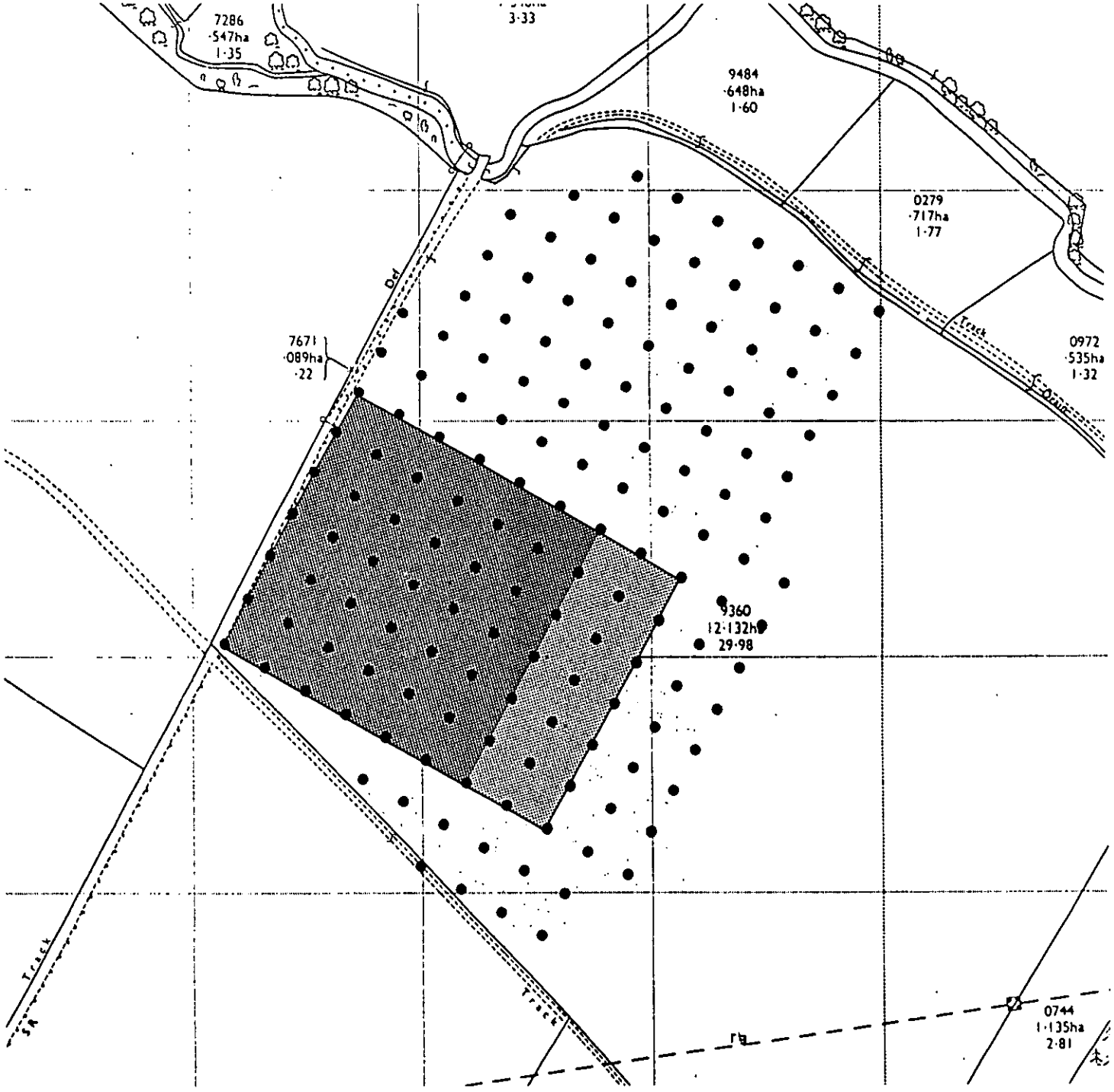
(d) 3-D Mesh

This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (a) above).

(e) Grey-Scale

This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. While colour plots can look impressive and can be used to highlight certain anomalies, grey-scales tend to be more informative.



Charlton Villa

Wiltshire

Location Diagram

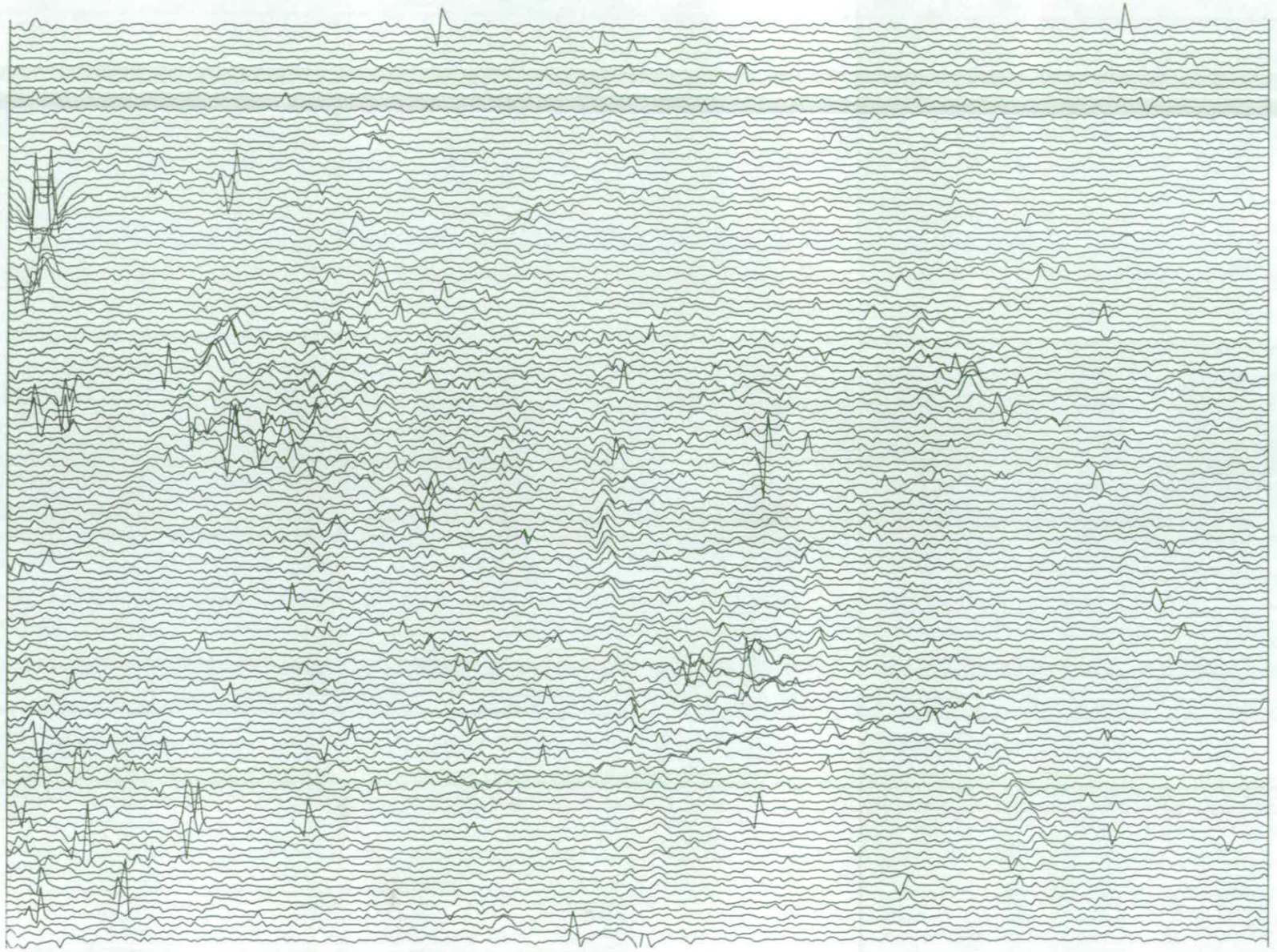
Magnetometry + Resistance

Magnetometry only

Mag. Susc. sampling points

1:2500

Figure 1



Charlton Villa

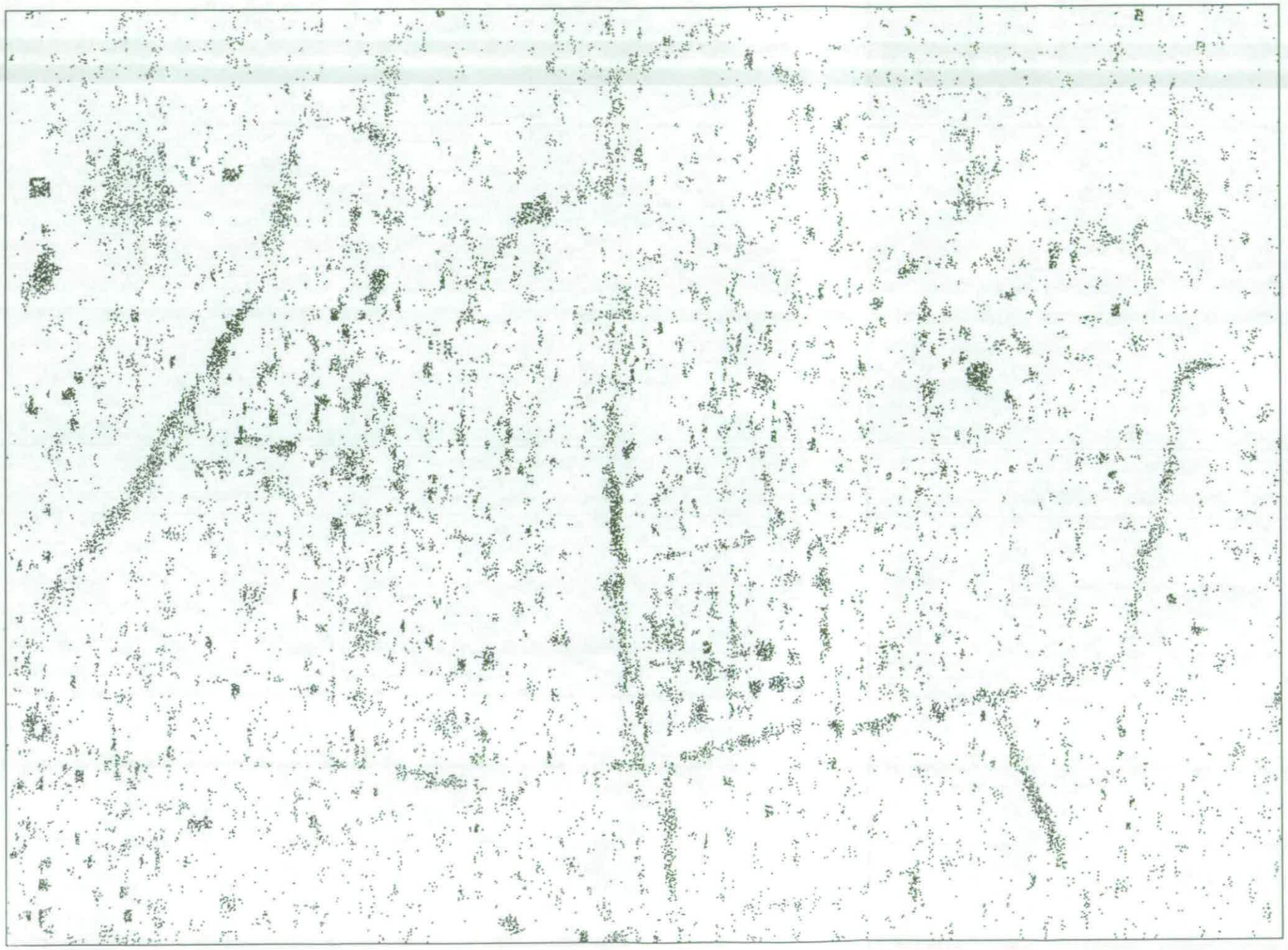
Wiltshire

Magnetic Data

0 m 20

15nT

Figure 2



Charlton Villa

Wiltshire

Magnetic Data

0 m 20

3
nT
0

Figure 3

Charlton Villa

Wiltshire

Magnetic Data

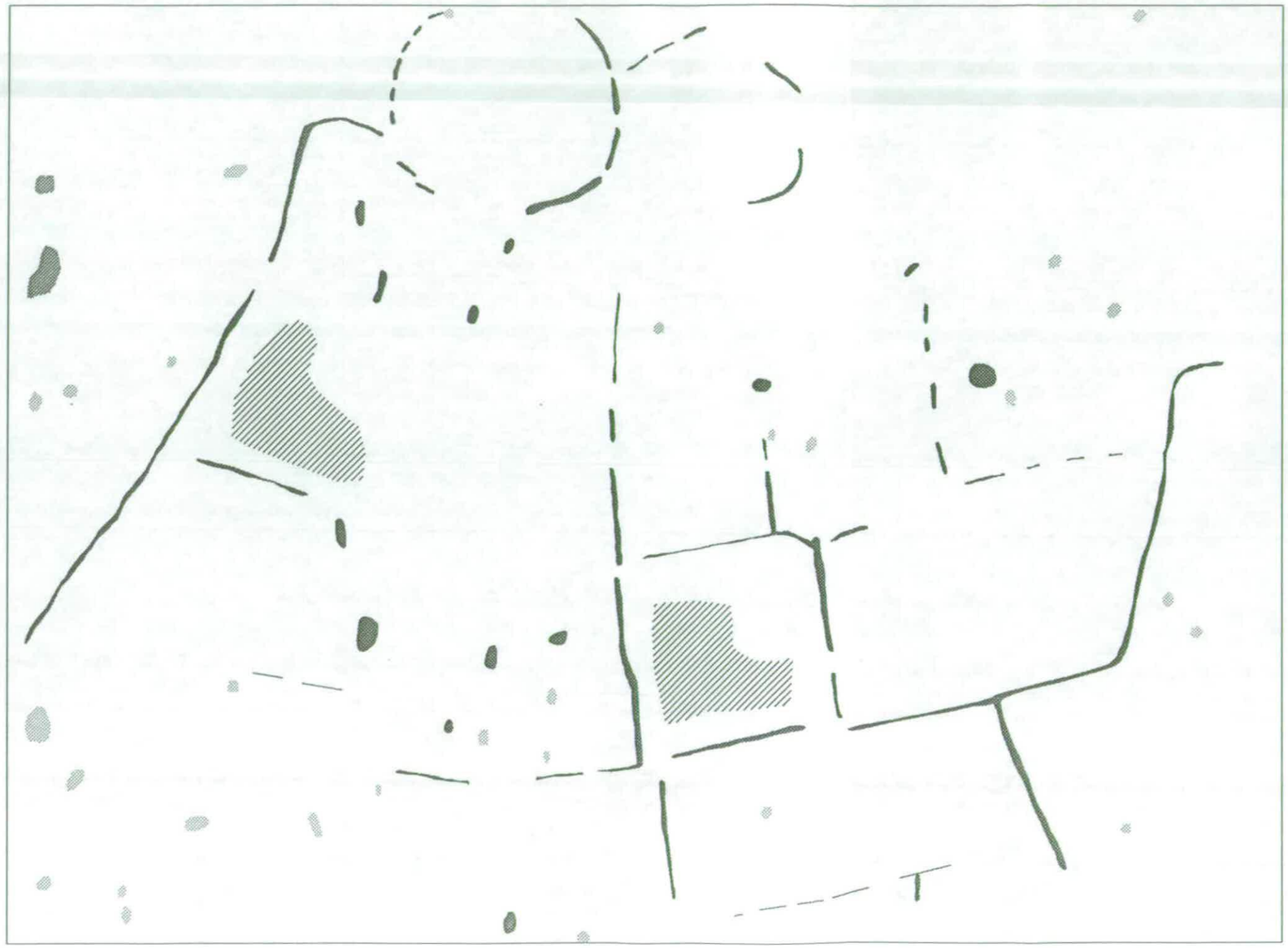
0 m 20

2.5

nT

-1

Figure 4



Charlton Villa

Wiltshire

Simplified Interpretation of Magnetic Data

Ditches/Pits

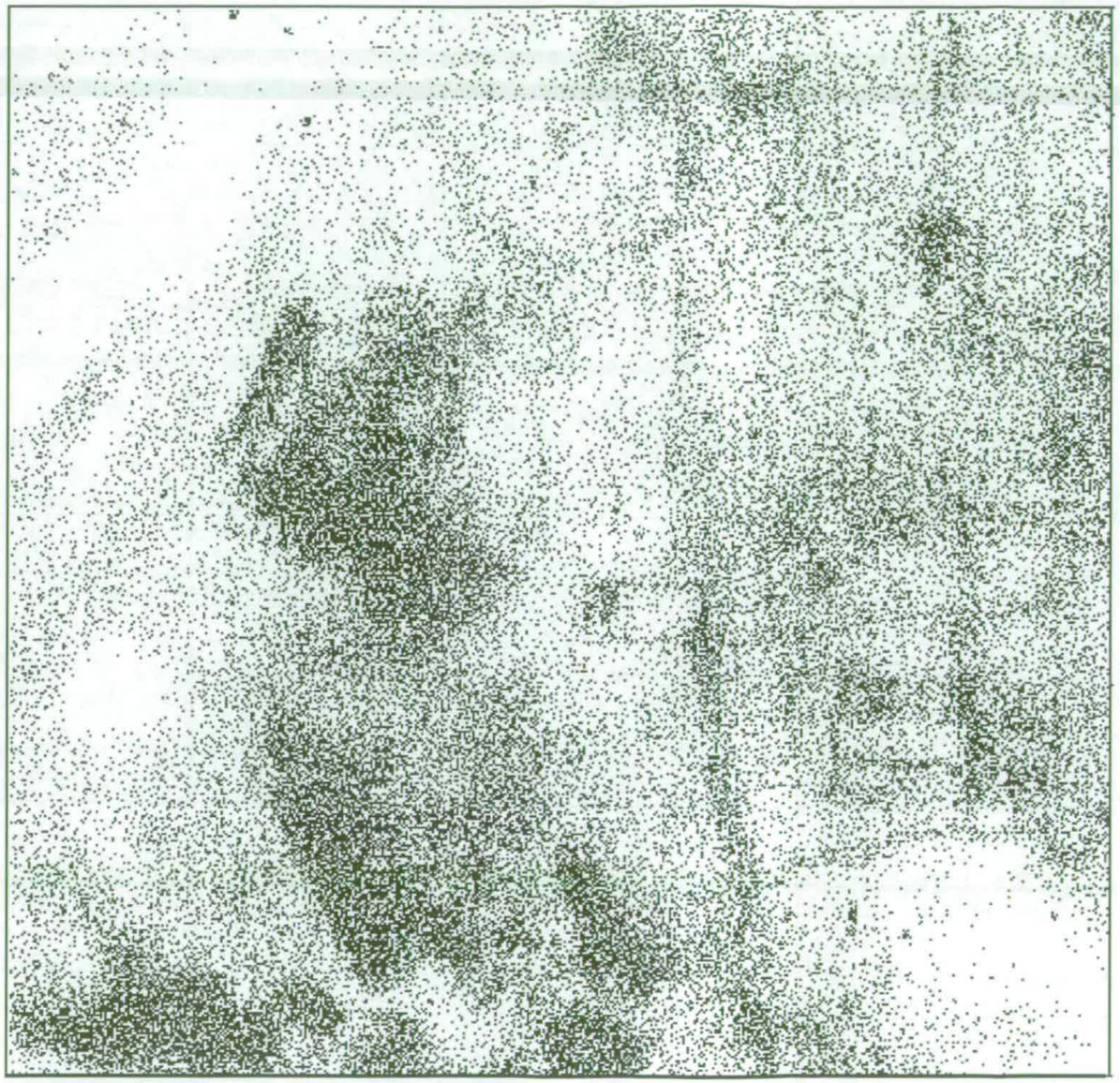
Ferrous

Enhanced Magnetic Readings

Electricity Pole Disturbance

0 m 20

Figure 5



Charlton Villa

Wiltshire

Resistivity Data

Figure 6

Charlton Villa

Wiltshire

Resistivity Data

0 m 20

12
ohms
9

Figure 7

Charlton Villa

Wiltshire

Resistance Data

A

B

C

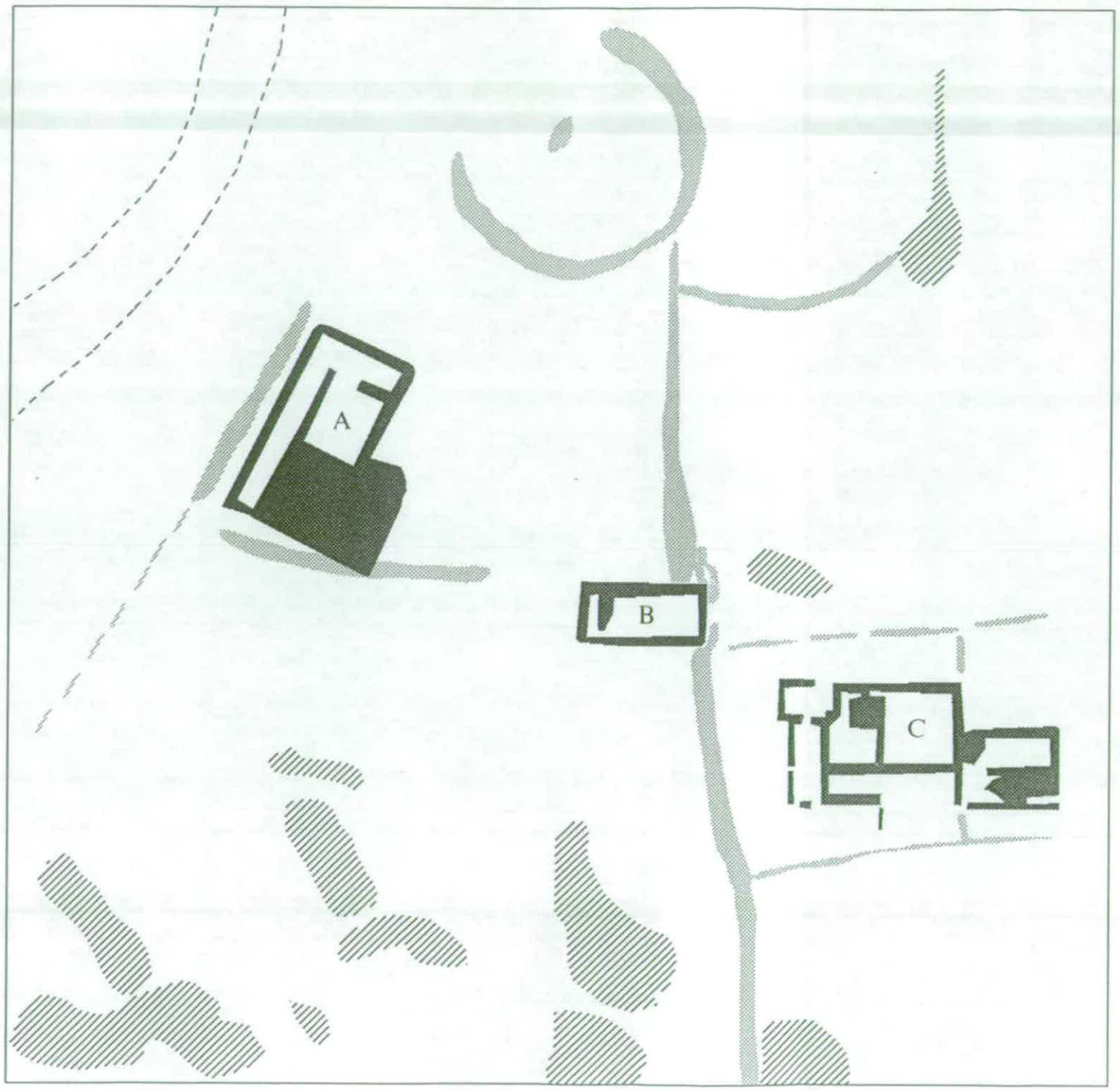
A High pass filter

B High pass filter, light source is at top left of picture

C High pass filter, light source is at bottom left of picture

Survey area 120m x 120m

Figure 8



Charlton Villa

Wiltshire

Simplified Interpretation of Resistance Data

Buildings/Walls

Ditches

Other Areas of Higher Resistance

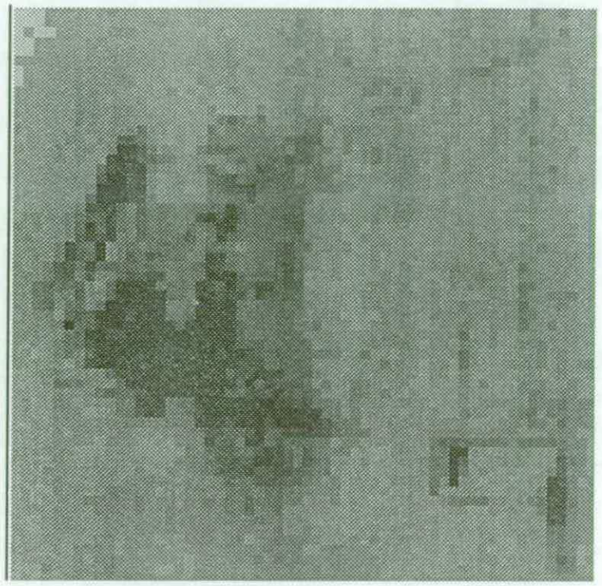
Old River Channel?

0 m 20

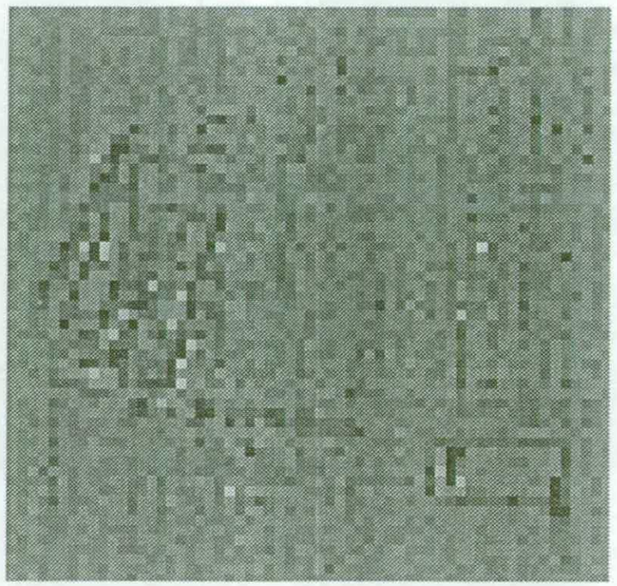
Figure 9

Charlton Villa

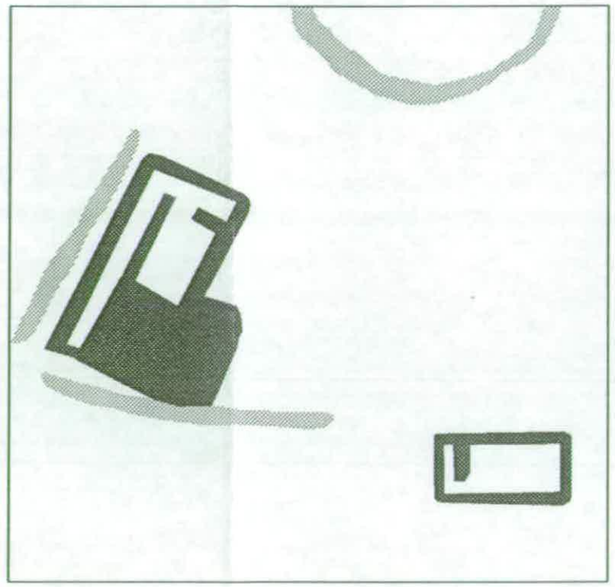
Wiltshire



9 to 12 ohms



9 to 12 ohms
High pass filter



Walls ?

Ditches

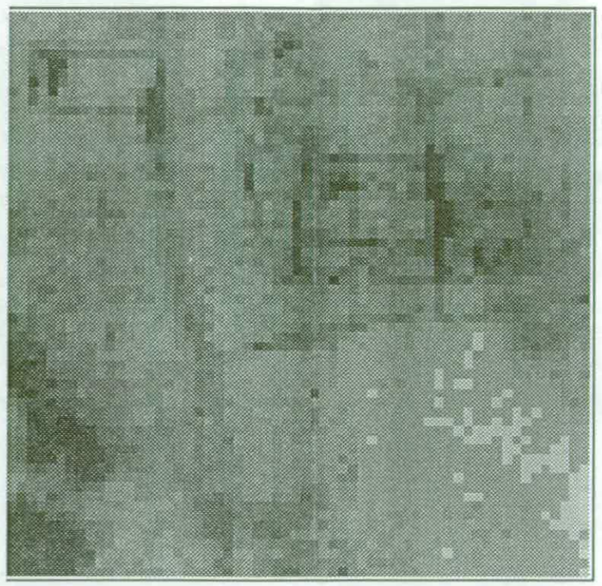
0 m 20

Figure 10

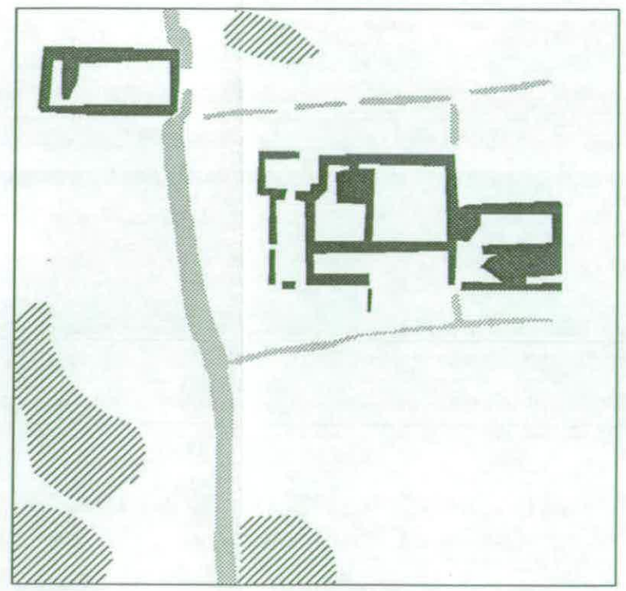
Charlton Villa

Wiltshire

9 to 12 ohms



9 to 12 ohms



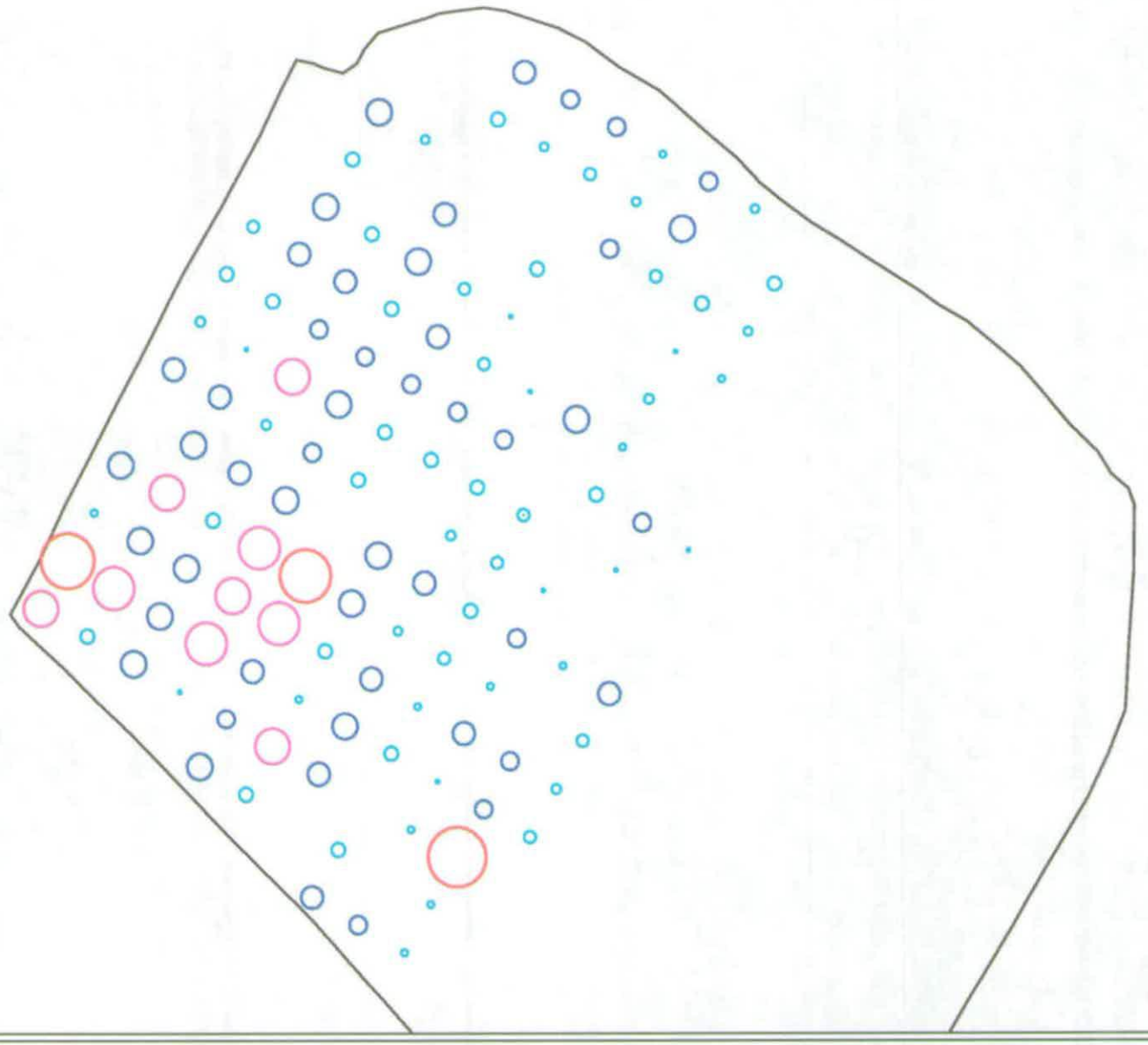
Walls ?

Ditches

Other High Resistance Readings

0 m 20

Figure 11



Charlton Villa
Wiltshire

Magnetic Susceptibility
Bartington Coil Measurements
(SI Units)

23 – 25

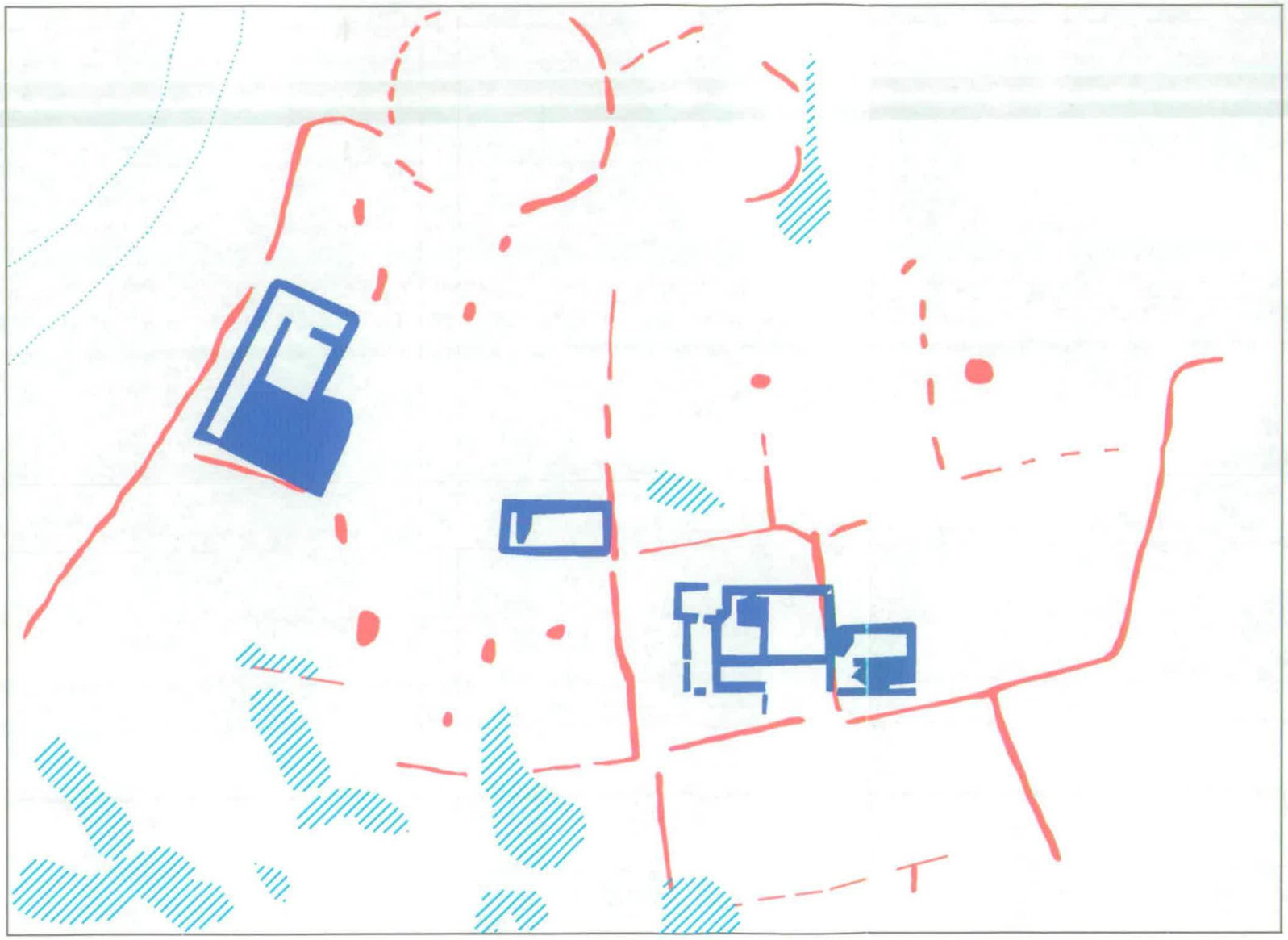
20 – 22

17 – 19

14 – 16

1:2500

Figure 12



Charlton Villa

Wiltshire

Simplified Interpretation

- **Buildings/Walls**
- **Areas of High Resistance**
- **? River Channel**
- **Ditch**

0 m 20

Figure 13

GEOPHYSICAL SURVEYS of Bradford

Specialising in Archaeological Prospecting