Historic England

Remote Sensing

Warblington Roman Villa, Havant, Hampshire
Report on Geophysical Surveys, February 2015

Neil Linford

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WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE

REPORT ON GEOPHYSICAL SURVEY, FEBRUARY 2015

Neil Linford

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SUMMARY
A Ground Penetrating Radar (GPR) survey was conducted over the Warblington Roman Villa, Havant, Hampshire, to provide a field test for a recently upgraded ground-coupled antenna array. The survey covered an area of 2.4ha and successfully identified building remains that correspond well with the earth resistance coverage of the site undertaken by volunteers from the Chichester and District Archaeology Society. In addition, the GPR survey has revealed some further structural detail in areas of the site where building rubble appears to obscure the earth resistance results. It is hoped that these results will contribute to the ongoing management of the site and help identify appropriate locations for further trial excavation trenches.

CONTRIBUTORS
The field work was conducted by Neil Linford of the Historic England Remote Sensing Geophysics Team and Emmanuel Thibaut (3d-radar).

ACKNOWLEDGEMENTS
The author wishes to express his thanks to Dr David Rudkin for suggesting the suitability of the site, and to Trevor Davies who arranged access for the survey to take place through both the landowner, Havant Borough Council and their tenant, Henry Young.

ARCHIVE LOCATION
Fort Cumberland

DATE OF SURVEY
The fieldwork was conducted on the 18th February 2015 and the report was completed on 20th May 2015. The cover photograph, courtesy of Trevor Davies, shows the survey in progress.

CONTACT DETAILS
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INTRODUCTION

Roman remains at Warblington were first reported in the 1920s and, although not currently designated, they have been subject to more recent research through both targeted excavation and geophysical survey (Taylor and Collingwood 1927 ; Taylor 1924). Chichester and District Archaeology Society (CDAS) has been monitoring this site since 2006, as part of the Chichester Harbour Area of Outstanding Natural Beauty Condition Assessment Project, and has undertaken both earth resistance and magnetic surveys over the site to inform an ongoing programme of excavation (Davies *et al.* 2008 ; Dicks and Haskins 2009 ; Haskins 2009 ; Dicks 2010 ; Davies 2011, 2012).

The aim of the current geophysical survey, prompted by a suggestion from Dr David Rudkin, was to test an upgraded version of the 3d-Radar ground coupled antenna array over a site with potentially challenging, waterlogged soil conditions. If successful, it was hoped that the results would also complement existing geophysical data from the site and inform further invasive investigations planned by CDAS. This work was undertaken as part of the National Heritage Protection Programme (NHPP) where it is categorised under Activity 8A5 Offsetting loss through knowledge dividend; Protection Result 8A5.2 Emergency investigation assistance for threatened heritage outside the planning process.

The site centred on SU 734 059 is currently down to grass where silty soils affectd by groundwater of the Park Gate association have developed over superficial river terrace deposits of clay, silt, sand and gravel Head capping Lambeth Group clay, silt and sand (Soil Survey of England and Wales 1983 ; British Geological Survey 1998). Weather conditions were generally fine and dry on the day of the field work.

METHOD

Ground Penetrating Radar survey

A 3d-Radar MkIV GeoScope Continuous Wave Stepped-Frequency (CWSF) Ground Penetrating Radar (GPR) system was used to conduct the survey collecting data with a multi-element GX1820 vehicle towed, ground coupled antenna array (Linford *et al.* 2010). A roving Trimble R8 Global Navigation Satellite System (GNSS) receiver was mounted on the GPR antenna array to provide continuous positional control for the survey collected along the instrument swaths shown on Figure 1. Data were acquired at a 0.075m x 0.075m sample interval across a continuous wave stepped frequency range from 60MHz to 2.99GHz in 10MHz increments using a dwell time of 5ms. A single antenna element was monitored continuously to ensure data quality during

acquisition together with automated processing software to produce real time amplitude time slice representations of the data as each successive instrument swath was recorded (Linford 2014).

Post acquisition processing involved conversion of the raw data to time-domain profiles (through a time window of 0 to 50ns), adjustment of time-zero to coincide with the true ground surface, background and noise removal, and the application of a suitable gain function to enhance late arrivals. Representative profiles from the GPR survey are shown on Figure 3. To aid visualisation amplitude time slices were created from the entire data set by averaging data within successive 2ns (two-way travel time) windows (e.g. Linford 2004). An average sub-surface velocity of 0.094m/ns was assumed following constant velocity tests on the data, and was used as the velocity field for the time to estimated depth conversion. Each of the resulting time slices, shown as individual greyscale images in Figures 2, 4 and 5 therefore represents the variation of reflection strength through successive ~0.09m intervals from the ground surface. Further details of both the frequency and time domain algorithms developed for processing this data can be found in Sala and Linford (2010).

RESULTS

A graphical summary of the significant GPR anomalies, [**gpr1-23**] discussed in the following text, superimposed on the base OS map data, is provided in Figure 6.

Significant reflections from the Roman buildings are separable from background noise to approximately 40ns (1.98m), and beyond this the signal is attenuated, possibly due to the clay head drift geology present. The near-surface data shows evidence for some vehicle rutting [**gpr1**] and a predominant pattern of linear N-S plough furrows that, due to the decoupling of the antenna, are evident throughout the entire time window.

The main winged corridor villa is replicated in the GPR data as a series of high amplitude reflectors [**gpr2**] between 8 and 24ns (0.38 to 1.22m) that correlate well with the earth resistance data. The southern wing of the building appears to continue to a greater depth, extending to approximately 40ns (1.88m), perhaps indicating either deeper foundations to support an upper storey, or even a small tower [**gpr3**] facing the approach from the sea. A partially described rectilinear anomaly [**gpr4**] offers some symmetry to [**gpr3**], with similar dimensions and depth range throughout the data, although [**gpr4**] is too isolated from the main structural remains of villa [**gpr2**] to confidently suggest this forms part of the same building. There is also some suggestion of a phased construction to the villa in the slight realignment of the W face at [**gpr5**]. Some internal details are also revealed within the southern wing, perhaps elements of a partially surviving

hypocaust [**gpr6**] and damaged floor layer [**gpr7**], although these responses are difficult to fully interpret and might also be associated with an accumulation of collapsed building rubble here too.

The rectangular building identified by the earth resistance survey is also partially described in the GPR data [**gpr8**] and appears to extend to a similar depth as the southern elevation of corridor villa. These two structures appear to share an orthogonal, courtyard style alignment respecting a common boundary wall or trackway [**gpr9**] that extends W to where it may meet with a tentative NS anomaly [**gpr10**]. A third building, potentially a large aisled barn following identification in the earth resistance survey and subsequent excavation, also shares the courtyard alignment, but is identified mainly through the discrete, high amplitude reflectors [**gpr11**], perhaps the post pads for upright timbers, rather than the walls. Some evidence for the eastern wall is evident and, in this regard, the GPR survey shares the slight ambiguity suggested by the earlier investigations.

Unfortunately, due to waterlogged ground conditions, it was not possible to extend the GPR coverage over the area immediately to the E of [**gpr11**]. However, to the N a series of small, rectilinear structures have been resolved [**gpr12**], although these appear to be constructed with comparatively shallow foundations extending to approximately 22ns (1.03m), perhaps representing more ephemeral agricultural buildings. This area is bounded by a double-linear trackway [**gpr13**] to the N that heads W towards a large rectilinear area of high amplitude response [**gpr14**] immediately N of the corridor villa [**gpr2**].

It is possible that [**gpr14**] represents an area of hardstanding, or even a natural outcrop of sand and gravel, bisected by two linear low amplitude responses, perhaps trackways, together with some fragmented structural remains including two polygonal / circular anomalies [**gpr15**]. The circular anomalies [**gpr15**] have a similar diameter of 7m and may, possibly represent either small Roman shrines or, perhaps, IA hut circles (T Davies, *pers com*). Parallel linear anomalies [**gpr16**] appear to bound [**gpr14**] to the W, and run N out of the survey area. To the N of the villa, a complex series of linear high amplitude anomalies [**gpr17**] are more difficult to interpret. Whilst elements of [**gpr17**] share the general alignment of the corridor villa they do not, necessarily, appear to represent structural remains as they are found through a limited depth range between 20 and 22ns (0.94 to 1.03m). These may represent more field boundaries or other ditches filled with some high amplitude reflective material, perhaps sand or gravel washed into the original cut features.

A series of discrete post-pit type anomalies are found across the survey area and possibly represent linear fence lines [**gpr18-22**], and both rectilinear [**gpr21**] and circular [**gpr22**] arrangements, possibly indicating buildings, enclosures or livestock corrals. In places the post-pit anomalies [**gpr19**] appear to cut

through the structural remains, perhaps further supporting the multi-phase development of the site (Linford 2007).

The deepest anomalies [**gpr23**] in the data set occur between 26 and 48ns (1.22 to 2.35m) and would appear to represent geomorphological responses to the underlying sand or gravel deposits.

CONCLUSION

Despite the waterlogged soil conditions at the site during the field work the GPR has successfully recorded significant anomalies to an approximate depth of 2m. The new data set complements the existing earth resistance survey, slightly extending both the area of coverage and providing some useful information regarding the depth of the surviving structural remains. This suggests the main villa building has developed through a series of phases that may, in part, be identified through the realignment of the walls. Some evidence for differing construction methods is also found through the variable depth of the wall footings. These results demonstrate the effectiveness of the new DX1820 ground coupled antenna array, although the influence of the recent ploughing emphasises the importance of maintaining good contact with the surface for the best results.

LIST OF ENCLOSED FIGURES

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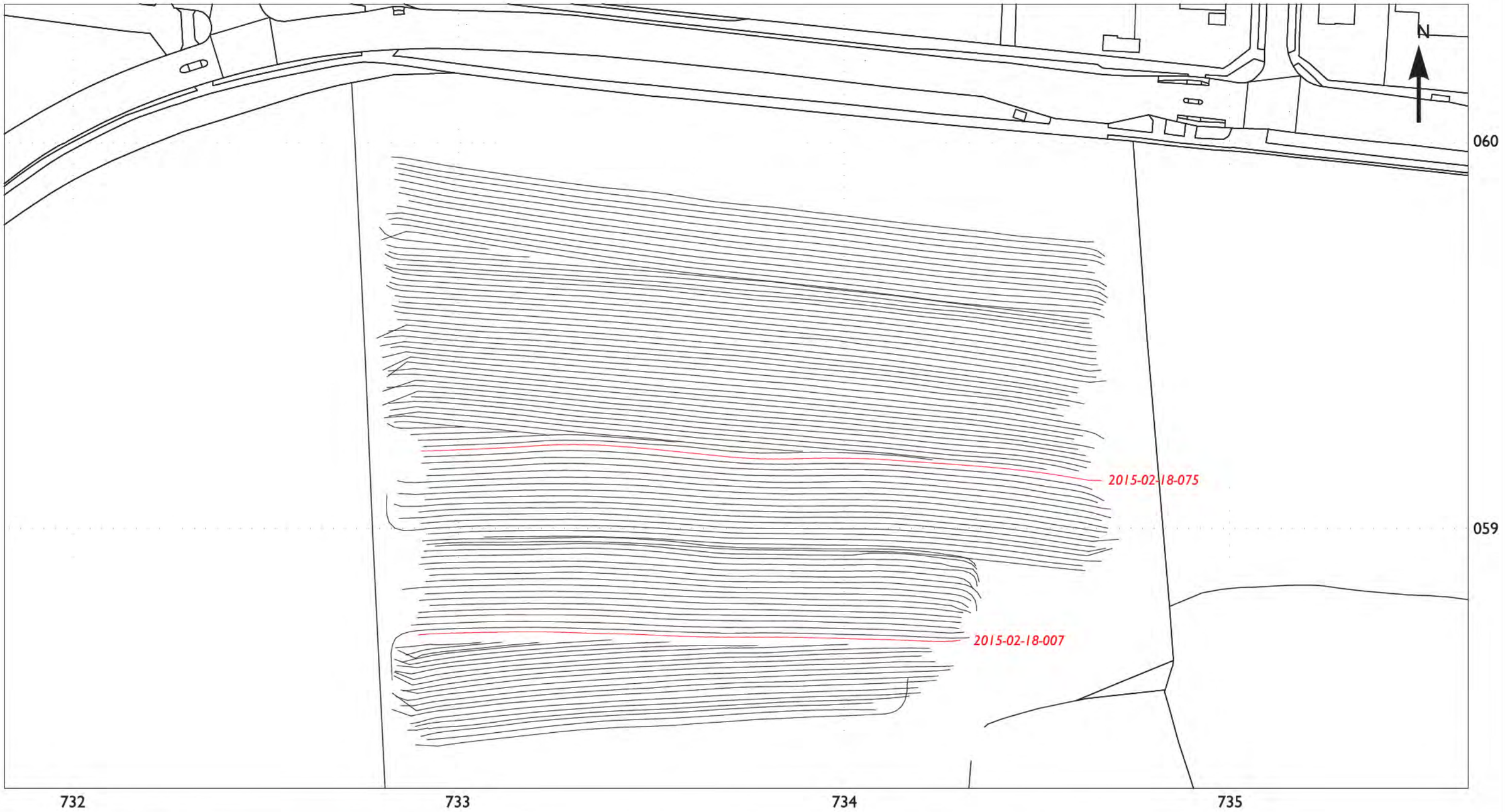
Figure 1

WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE

Location of GPR survey, February 2015



2015-02-18-007 Location of selected GPR profile shown on Figure 3

Ground Penetrating Radar survey swaths

0 60m

1:1000

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Figure 2

WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE

GPR amplitude time slice between 14 and 16ns (0.46 to 0.53m), February 2015

SU7305

2015-02-18-007 Location of selected GPR profile shown on Figure 6

Low *High*
relative reflector strength

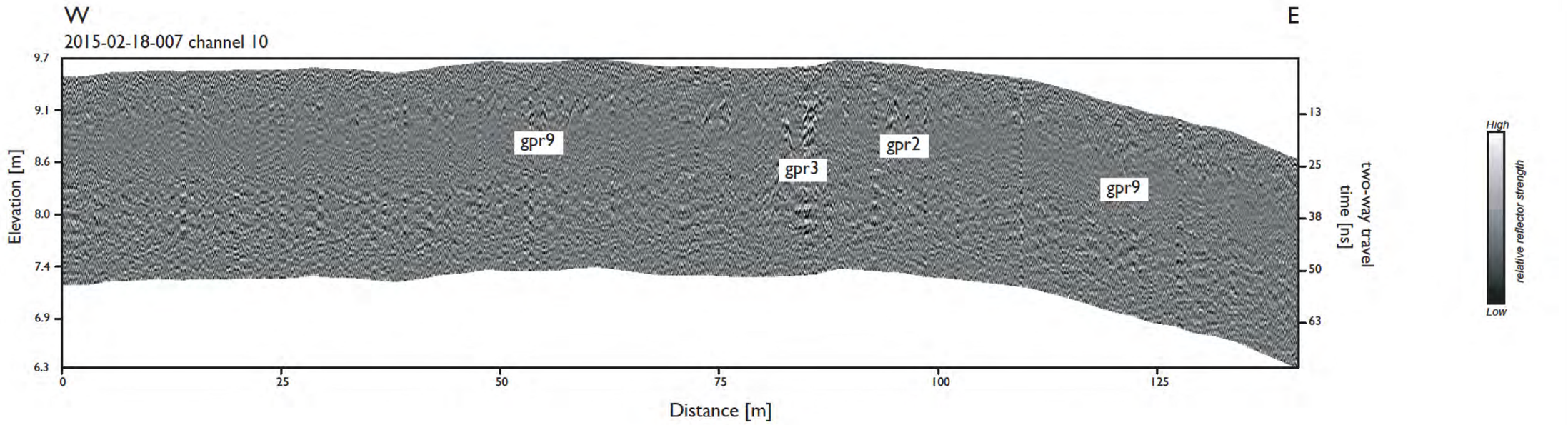
0 60m
1:1000

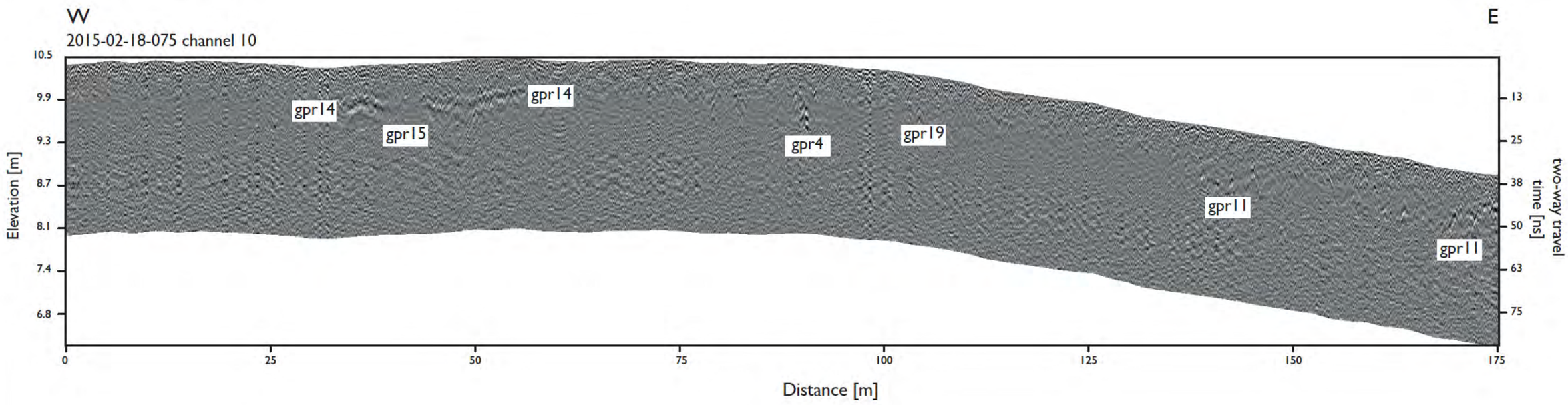
Geophysics Team 2015

Historic England

Figure 3

WARBLINGTON ROMAN VILLA, HAMPSHIRE
Selected GPR profiles, February 2015





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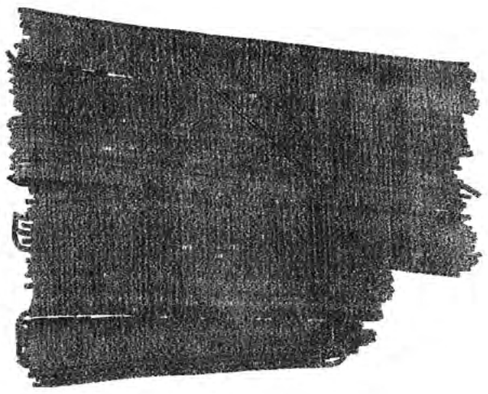
WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE

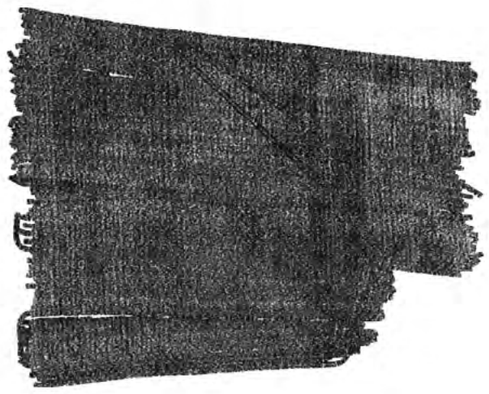
GPR amplitude time slices between 0.0 and 24.0ns (0.0 - 1.13m), February 2015

Figure 4

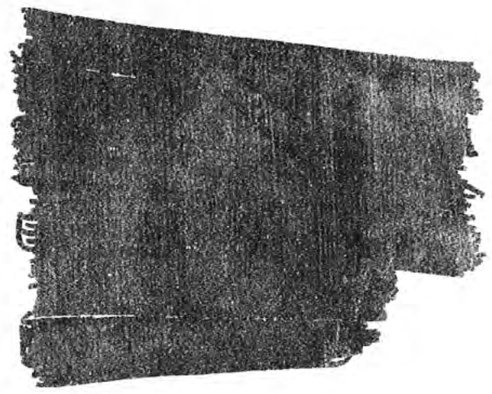
0 - 2ns (0.0 - 0.09m)



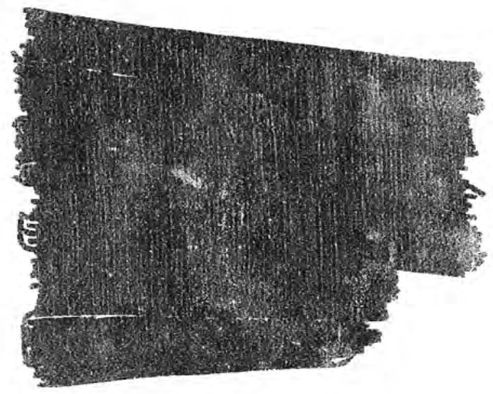
2 - 4ns (0.09 - 0.19m)



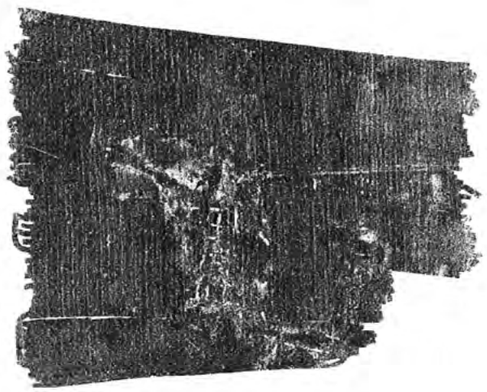
4 - 6ns (0.19 - 0.28m)



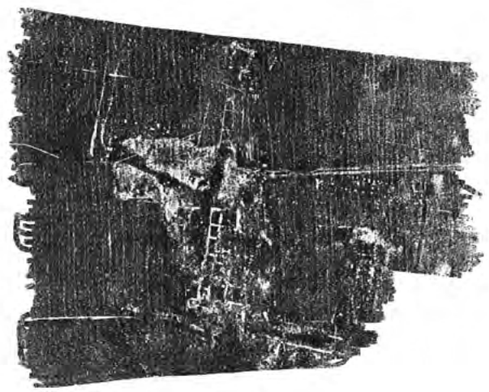
6 - 8ns (0.28 - 0.38m)



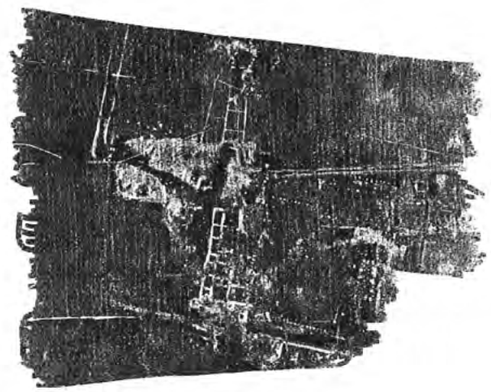
8 - 10ns (0.38 - 0.47m)



10 - 12ns (0.47 - 0.56m)



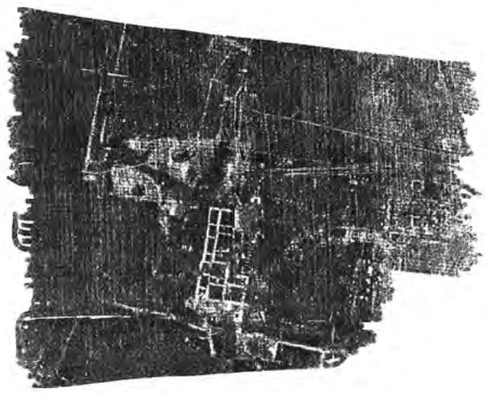
12 - 14ns (0.56 - 0.66m)



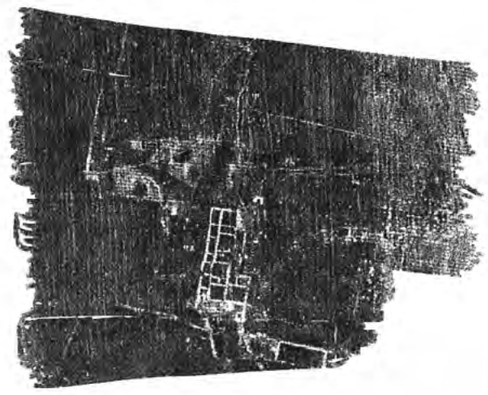
14 - 16ns (0.66 - 0.75m)

N

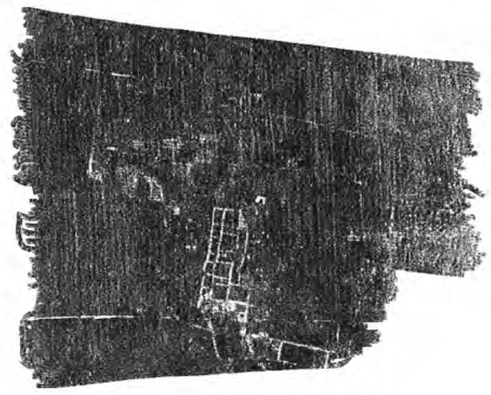
16 - 18ns (0.75 - 0.85m)



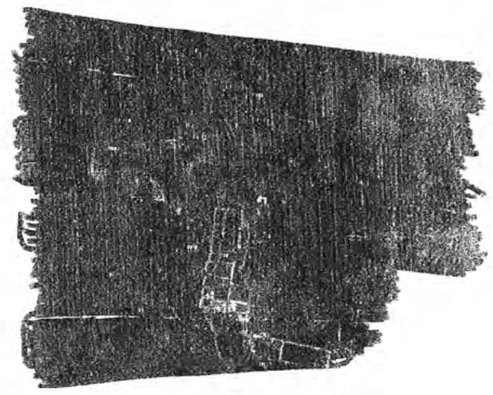
18 - 20ns (0.85 - 0.94m)



20 - 22ns (0.94 - 1.03m)



22 - 24ns (1.03 - 1.13m)



Low *High*

relative reflector strength

0 90m

1:2500

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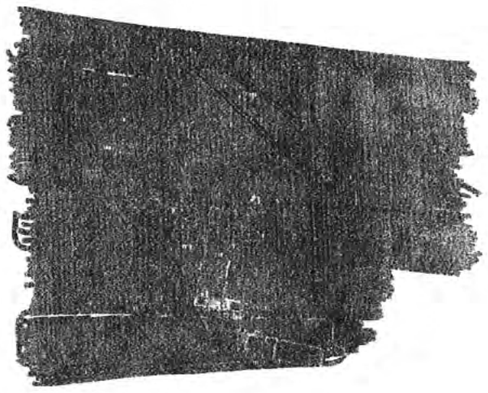
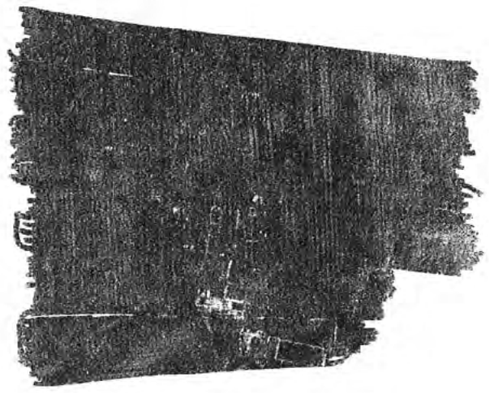
WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE
GPR amplitude time slices between 24.0 and 48.0ns (1.13 - 2.35m), February 2015

Figure 5

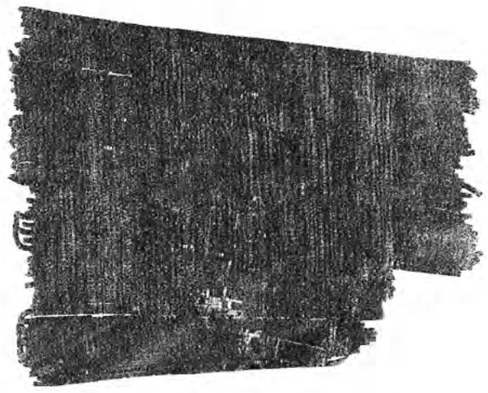
24 - 26ns (1.13 - 1.22m)



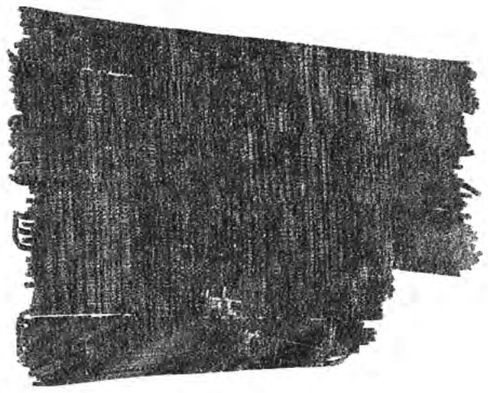
26 - 28ns (1.22 - 1.32m)



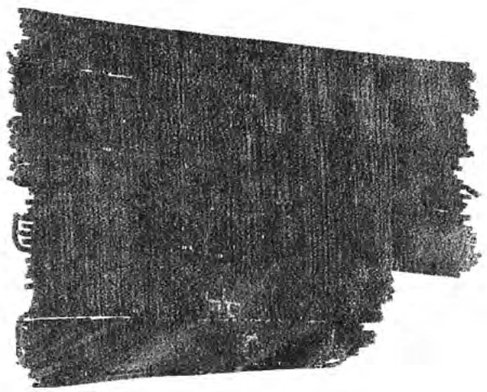
28 - 30ns (1.32 - 1.41m)



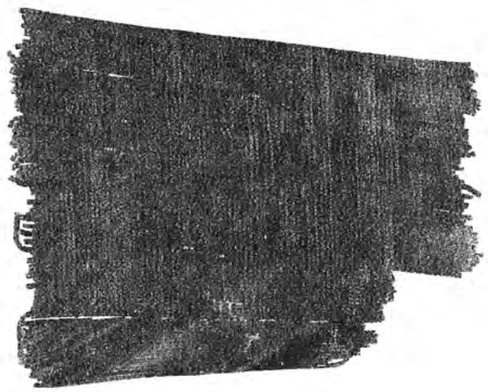
30 - 32ns (1.51 - 1.6m)



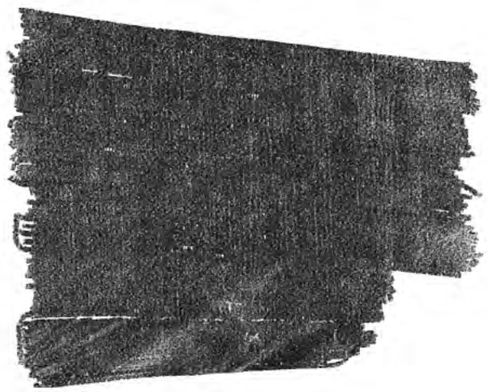
32 - 34ns (1.6 - 1.69m)



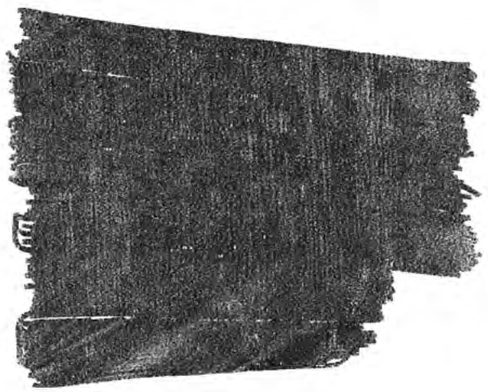
34 - 36ns (1.69 - 1.79m)



36 - 38ns (1.79 - 1.88m)

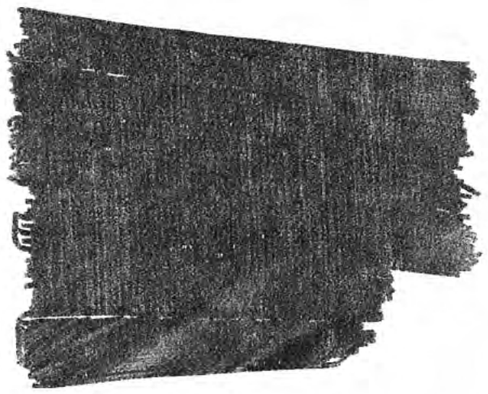


38 - 40ns (1.88 - 1.98m)

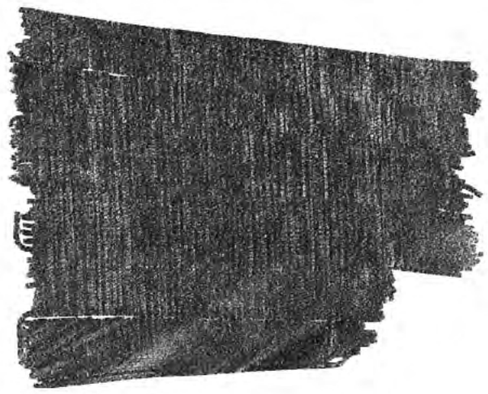


N

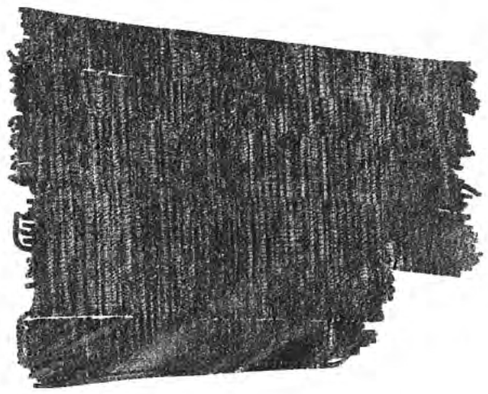
40 - 42ns (1.98 - 2.07m)



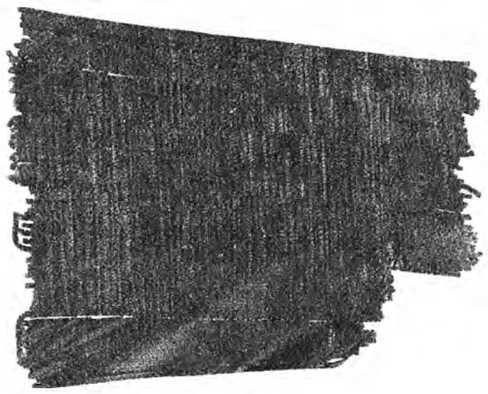
42 - 44ns (2.07 - 2.16m)



44 - 46ns (2.16 - 2.26m)



46 - 48ns (2.26 - 2.35m)



Low *High*
relative reflector strength

0 90m

1:2500

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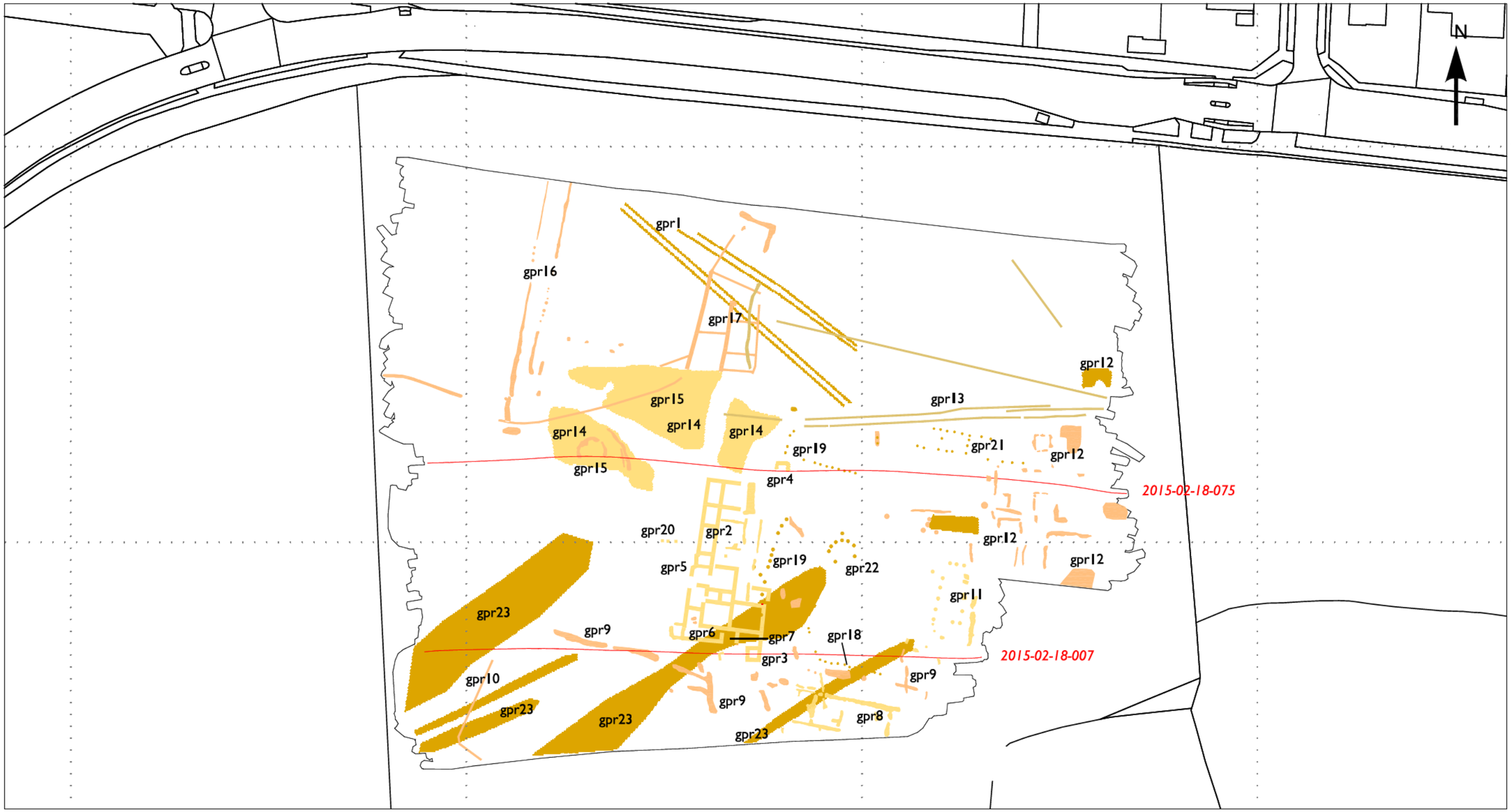
Figure 6

WARBLINGTON ROMAN VILLA, HAVANT, HAMPSHIRE
Graphical summary of significant GPR anomalies, February 2015



low amplitude reflectors

high amplitude reflectors

anomalies of known or recent origin

2015-02-18-007 Location of selected GPR profile shown on Figure 3

0 60m

1:1000

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Historic England

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