

Geophysical Survey Report

of

Wadeford Farm

Combe St Nicholas, Somerset

For Cotswold Archaeology

On Behalf Of Moore.freeston-architects ltd

Magnitude Surveys Ref: MSTA435

**HER Event Number: PRN 39455** 

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#### Abstract

Magnitude Surveys was commissioned to assess c.0.25ha of land adjacent to subsurface remains of an Roman Villa at the Wadeford Farm, Combe St Nicholas. A ground penetrating radar survey was successfully completed in 4 areas. Results showed a good signal penetration and response with a 450mHz antenna showing a range of anomalies. Evidence of structural remains were detected across the site in the form of rubble and walls. Two phases of activity were identified. The deeper responses at c.1m of depth are more likely to be associated with the Roman villa, in particular the cluster of anomalies to the north-west of the site. Shallower archaeological responses at a depth of c.0.50m highlight a square structure with a possible well adjacent to the eastern wall. Data also reflected modern activity associated with services, manhole covers, rubble, surface concrete material and effect from the adjacent buildings. Some of the responses, such as those associated with rubble, may have masked anomalies of different origins, though anomalies could still be detected against other anomalies of modern origins such as those associated with the concrete surface.

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#### 1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Cotswold Archaeology on behalf of Moore.freeston-architects ltd to undertake a geophysical survey on c. 0.25ha area of land at the Wadeford Farm, Combe St Nicholas, South Somerset, Somerset (ST 309 104).
- 1.2. The geophysical survey comprised hand-pushed, cart-mounted ground penetrating radar (GPR) survey. MS' Ofcom Ground Probing Radar licence number is L1078291/1.
- 1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al.*, 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt *et al.*, 2015).
- 1.4. The survey was conducted in line with WSI.
- 1.5. The survey commenced on 28/01/2019 and took two days to complete.

## 2. Quality Assurance

- 2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.2. Director Dr. Chrys Harris is a Member of ClfA, has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of ISAP. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the ClfA Geophysics Special Interest Group. Reporting Analyst Dr. Kayt Armstrong is a Member of ClfA, has a PhD in archaeological geophysics from Bournemouth University, is the Vice Conference Secretary and Editor of ISAP News for ISAP, and is the UK Management Committee representative for the COST Action SAGA.
- 2.3. All MS managers have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

## 3. Objectives

3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area and to identify any potential remains of a Roman Villa located north west of the site.

## 4. Geographic Background

- 4.1. The site is located to the east of Scrapton Lane, approximately 1.4km away from Combe St Nicholas village centre (Figure 1). Survey was undertaken across a series of areas bounded by fields to the north and west, an unnamed road and buildings to the east and Scrapton Lane to the south (Figure 2).
- 4.2. The underlying geology comprises sedimentary bedrock of sandstone of the Upper Greensand Formation. The superficial deposits consist of diamicton colluvium across much of the survey area, with no superficial deposits recorded to the north east of Area 2 (British Geological Survey, 2019).
- 4.3. The soils consist of freely draining slightly acid loamy soils (Soilscapes, 2019).

#### 4.4. Survey considerations:

ſ	Survey	Ground Conditions	Further notes:	
	Area			
	1	Flat concrete floor to the south,	Bound by wooden and metal fences to the north	
		and flat grassland to the north.	and west, a hedge to the north east, farm buildings	
		_	to the southwest and east, and a gate to the south.	
	-		Manholes are located to the south of the area,	
			with areas of mud and debris to the northeast.	
			Debris extant on the grassland at the time of	
Į			survey.	
	2	Flat concrete floor.	Bound by wooden and metal fences to the north	
			and west, and farm buildings to the south and	
L			east.	
	3	Flat concrete floor.	Boun by a gate to the northwest, with farm	
			buildings to the north, east and south. A manhole	
			is present in the north corner.	
ſ	4	Flat concrete floor to the south	Bound by a gate to the south, metal fences and	
h		of the survey area and grassland	trees to the southwest and northwest, and an area	
		to the north.	of debris and wooden fence posts to the north. An	
	V		area of mud is located to the northeast, with	
	7		metallic objects to the south.	

## 5. Archaeological Background

- 5.1. The following section summarises a desk-based assessment for the site and a 1km radius search area prepared by Cotswold Archaeology (Dowding 2018).
- 5.2. Most of the survey area lies within the scheduled area of a Roman villa, designated as a Scheduled Monument in 1954 (NHLE: 1006187).
- 5.3. Evidence for prehistoric activity includes a Bronze Age spearhead (HER: 53187) that was recovered during excavations of the Roman villa in the field immediately north-west of the survey area. A mid to late Iron Age enclosure (HER: 38867) has also been recorded c. 500m to the south-east of the survey area.
- 5.4. Evidence for Roman activity mainly relates to the Roman villa (HER: 53187) recorded in the field to the north-west of the survey area. Excavations in 1865-6 revealed a series of rooms arranged around a courtyard, including nine mosaics. An ancillary building was also recorded to the southeast of the villa. Hypocaust tiles are recorded to the immediate north-east of the survey area. Other finds recorded by the 1865-6 excavations include large quantities of pottery and Roman Coins (Claudius I). Two banks within the field with the villa, are related to the 19th century excavations. Other Roman archaeology within the environs of the survey areas comprises two findspots; a Roman fibula (HEA: 191811) c.380m to the east and Roman coins (HER: 53180) c.680m south-east of the survey area.
- 5.5. Evidence of Post-medieval activity includes a cloth drying site (HER: 55734) immediately to the south of the survey area and the remains of a mill (HER: 53196) in the adjacent field to northwest of the survey areas.

# 6. Methodology6.1.Data Collection

- 6.1.1. Geophysical prospection comprised GPR as described in the following table.
- 6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Ground Penetrating Radar	MALÅ GX450 ground penetrating radar	0.5 m	0.05 m
Ground Penetrating Radar	MALÅ GX160 ground penetrating radar	0.5 m	0.05 m

- 6.1.3. GPR data were collected along lines, using the system's odometer wheel to position sampling points. The lines were set out within a grid established using a Hemisphere S321 GNSS Smart Antenna RTK GPS which is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.
- 6.1.4. A 450MHz and a 160MHz antenna were tested on site. The 450MHz antenna is habitually more appropriate for detecting archaeological features. However, a concrete floor was present on the survey areas which may have caused problem for the 450MHz antenna to penetrate through the layer of concrete material. The 160MHz antenna has a better depth of penetration and is more likely to have a good amplitude of response going through a concrete floor; however, responses for the antenna responses will be less detailed at shallower depths. Both the 160MHz and 450MHz antennas were tested on site to determine which best suits the ground conditions; the 450MHz antenna appeared not to be impacted by the concrete material and thus was identified as the most suitable antenna for the survey.

#### 6.2. Data Processing

6.2.1. GPR data were processed in the standard commercial software package ReflexW 3D. GPR Processing steps were limited to:

<u>DC Shift</u> – The waveform response for each traverse was centred to correct for striping effects caused by small variations in sensor electronics and orientation.

<u>Bandpass Filter</u> – Frequencies outside the normal range of the measuring antennae were filtered out to remove errors from external sources.

<u>Gain Adjust</u> – A gain curve was manually calculated to account for signal attenuation with depth. The gain adjust allows features at depth with a weaker signal to be resolved at the same plotting scale as near surface features.

<u>Hyperbola fitting</u> – Manual fitting of hyperbola curves was conducted to calculate the velocity of the wave. This allows the calculation of response depth from response time.

## 6.3. Data Visualisation and Interpretation

6.3.1. The individual GPR radargrams have been stacked to form a three-dimensional cube of measurements. Greyscales have been created by horizontally slicing the cube to produce plan-view time-slices. These "timeslices" were initially considered in an animated GIF form to analyse the three-dimensional extent of anomalies. For print purposes, three gross soil volumes are considered: shallow, middle, and deep. The mean of the timeslices within each gross soil volume was taken and used as a representative time slice for the interpretation figures. Timeslices were interpreted in a layered environment, overlaid against open street mapping, satellite imagery, historic mapping, LiDAR data, and soil and geology mapping. The timeslices were also interpreted in consideration with the radargrams, which visualise the form of the geophysical response, aiding in anomaly interpretation.

#### 7. Results

### 7.1.Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports as well as reports of further work in order to constantly improve our knowledge and service.

#### 7.2.Discussion

- 7.2.1. The GPR survey has responded well to the survey environment with results demonstrating a good signal penetration at depth. The survey has detected several types of responses corresponding to building remains. It is difficult to assess with certainty the time periods of the remains, however, some of them located in the north east of the survey area are possibly linked with the Roman Villa, while others located in Area 3 are likely to be more recent in date. The results also show modern activity across the data due to the survey area being located on an active Farmyard. Evidence of its activity have been recorded since at least 1839 (tithe map of Combe St Nicholas). Additional anomalies could not be classified due to their ambiguous responses.
- 7.2.2. Remains identified as possible and probable archaeology in Area 1 are located at a depth of c.1 m deep and mostly represent rubble with a few possibly highlighting partial wall foundations. The depth and orientation of the responses are coherent with the known Roman Villa located northwest of the site. The responses are not clearly identifiable in the timeslices making assessment of the precise origins of the anomalies difficult. The anomalies though are clearly identifiable as rubble in the radargrams.

Some of the rubble is constrained by anomalies with a wall type of responses, these have been characterised as probable archaeology. The rubble anomalies without wall context have been classified as possible archaeology.

- 7.2.3. Structural responses have been detected in Area 3 at around 0.5m depth. In contrast to the responses in Area 1, the anomalies exhibit a more coherent response, more likely to result from reflections off a wall than rubble. Additionally, two walls and a clear void in between have been detected on the eastern edge of the structural anomalies. No man hole cover is located there and at a width of 1.2m the responses could be caused by a well. Due to the level of preservation and the fact that they are shallower than the anomalies detected in Area 1, they are likely to be of more recent origin.
- 7.2.4. Additional anomalies of interest have been detected in Area 3 matching the depth of the anomalies observed in Area 1, they have been classified as "Possible Archaeology".

  They are too isolated from the cluster of anomalies at the western end of Area 1 to confidently say they are associated with the anomalies of Area 1 and the Roman villa.

#### 7.3.Interpretation

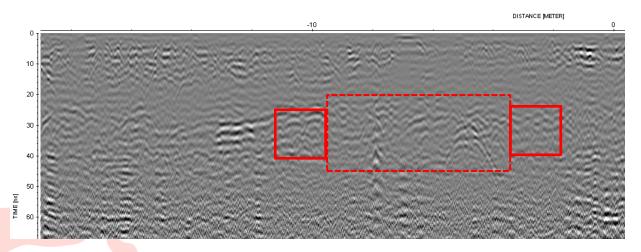
#### 7.3.1. General Statements

- 7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.
- 7.3.1.2. **Undetermined** Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes--although an archaeological origin cannot be entirely ruled out.

#### 7.3.2. Specific Anomalies

#### Area 1 and 2

7.3.2.1. Archaeology Possible-Probable (Wall/Rubble) — Several anomalies highlighting possible rubble or walls have been detected in Area 1 [1a]. They are mostly located in the western part of Area 1 but some similar features are also visible in the rest of Area 1 and in Area 2 (Figures 4 and 5 [1a]). The anomalies have been detected at a depth of c.1m and appear for the most part to represent rubble rather than walling. When interpreting the results, the classification of "Probable Archaeology" was attributed to rubble when walls or edges were detected around them (Radargram 1), if not the anomalies were categorised as "Possible Archaeology". The group of features identified in the west of Area 1 (Figure 4 and 5) has a general orientation similar to the main structure of the known Roman Villa (Figure 7 below), the depth is also coherent with archaeological remains which would indicate they are associated with the Roman Villa. The lack of extensive walls responses prevented the identification of a clear outline of the villa or its associated structures.



Radargram 1: In solid red are the two detected walls framing the area of rubble (dashed red).

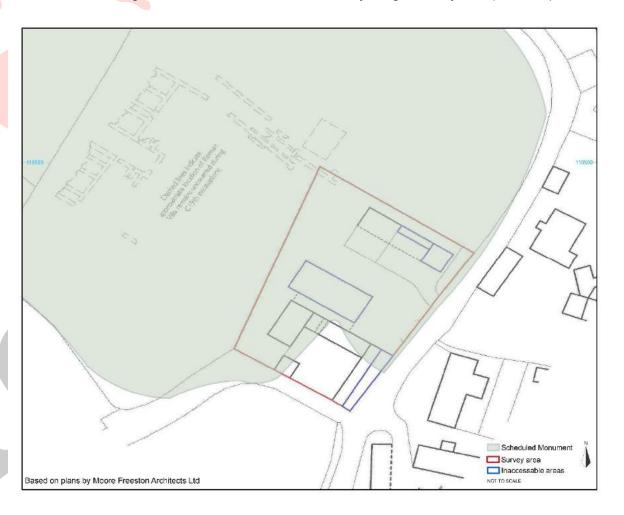
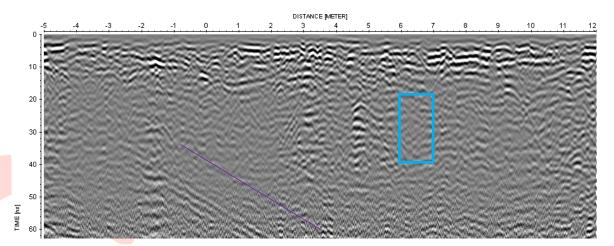


Figure 7: Location of the survey area in regard of the known remains of the Roman Villa (map provided by client based on plans by Moor Freeston Architects Ltd).

7.3.2.2. **Undetermined** — Additional linear anomalies located in Area 1 could not be classified due to their ambiguity [1b]. In the timeslices the anomalies look like services but in the radargram the responses are less clear and not typical for services (see Radargram 2). The anomalies occur at a depth of c.1m, which is similar

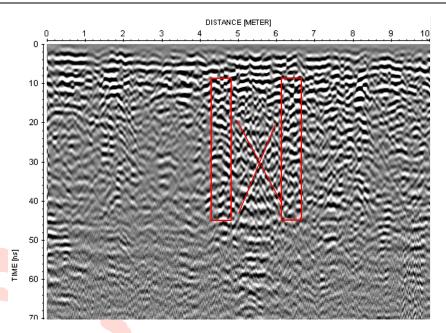
to many of the archaeological anomalies; however, the shape and context of these anomalies is too ambiguous for such an interpretation to be made.



Radargram 2: Framed in blue is the undetermined anomaly [1b], with a service shape in the Timslices but not in the radargram. In purple is an effect associated with reflections off a building wall of a located at the edge of this traverse. Many of these responses were more or less visible in the data.

#### Area 3

7.3.2.3. Archaeology Probable-Possible (Walls/Well) – Clear linear wall features forming a square structure have been detected in the timeslices of Area 4 (Figure 4 and 5). Their responses are shallower (around 0.5 m) than the structural anomalies visible in Area 1 which indicates a more recent origin. Another interesting set of anomalies have been identified on the eastern edge of the structure showing two walls responses and a void in between [2a]. The absence of a manhole cover at this location and the 1-1.2m wide void could indicate the presence of a potential well. On the radargram below (Radargram 3) the two walls are visible framing the void visible as "crossed" responses. A couple of similar anomalies of the wall and rubble have been detected in the north of Area 3 [2b], the anomalies have been classified as "Possible Archaeology" due to their isolated location in contrast with the rest of the structure.



Radargram 3: The crossed responses visible above are typical of void responses with the waves reflecting off the walls. The two external frames are showing the walls which are going from shallow to deep. The absence of a manhole cover response at this location and the dimensions of the response would indicate a possible former well.

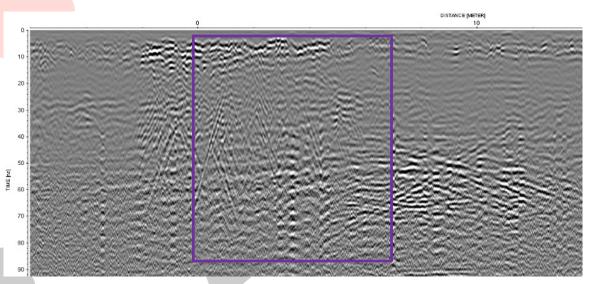
- 7.3.2.4. Archaeology Possible Anomalies of interest in Area 3 were detected at depth of c.1m [2c]. Though the anomalies do not form clear pattern like the other archaeological anomalies of Area 3, the responses are of possible archaeological origin as they are at a similar depth to the anomalies detected in Area 1. It is difficult to determine though whether the anomalies are related to the anomalies of Area 1.
- 7.3.2.5. **Modern** Two types of modern rubble have been observed in Area 3. To the west they are present in the shallow depth above anomalies discussed above in 7.3.2.4. In the east the rubble seems to continue further down, however a singular anomaly could still be detected just under the rubble, which has been classified as undetermined.

#### Area 4

- 7.3.2.6. **Modern** Area 4 is composed of a large area of grassland to the west and a small area of concrete floor to the east. A disturbed surface is causing attenuation to the deeper layers. Only the strongest responses associated with the disturbed layer were digitised in the shallow timeslices. The only other anomalies that could be detected were a man hole cover, services and reflections from adjacent standing buildings identifiable in the deeper layers (see Radargram 2 for the buildings reflections and Figure 4, 5 and 6 for the interpretation).
- 7.3.2.7. **Undetermined** Area 4's eastern part is a thin strip with a surface of concrete, it does not offer a lot of context and the anomalies seem to be mostly of modern origin. However, in the middle depths an archaeological origin could not be ruled out and the anomalies were classified as undetermined.

#### **All Areas**

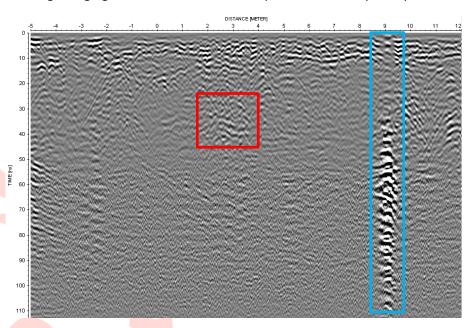
7.3.2.8. Modern – Modern anomalies of different origins have been detected across the site with varying effects upon the data. The concrete material used on the farmyard has a strong response in the shallow layers and have caused variable levels of signal attenuation at the near surface even though anomalies of different origins are still detectable. An area of debris on the grass land in Area 1 at the time of the survey (see section 4.4) had a strong response at or near the ground surface, possibly masking potential anomalies from layers below (Radargram 4). No debris was visible on Area 4. However, similar responses were visible in the radargrams indicating a possible layer of debris in the very near surface. A third type of anomaly of modern origins detectable at deeper layers results from the reflections of waves against the walls of adjacent buildings, creating a slope in the results (Radargram 2). Potentially these anomalies mask reflections from deeper layers, the anomalies of interest though are mostly located above this effect.



Radargram 4: In the shallow layer many source reflectors are visible. Their tails propagating through the layers concealing any potential anomalies of different origin.

- 7.3.2.9. **Services** Several services were detected across the site with responses in the radargrams dependant upon the orientation of the traverses to the services . One traverse ran perfectly in line with a service in the east of Area 1, creating a strong response in the timeslices.
- 7.3.2.10. Processing Artefact A couple of artefacts were detected in the results, one affecting the timeslices and the other affecting the radargrams. A response two traverses wide located in Area 1 has a strong amplitude response in the timeslice [1c] but no clear origin when looking at the corresponding radargram. This may be explained by the data of the two radargram having a higher averaged amplitude than the surrounding radargrams creating this effect. The second artefact is visible

on the radargram below (Radargram 5) caused by the gain applied to the data. The origin of the response is likely to be a modern anomaly in the shallow layer, creating a ringing effect which has been amplified in the deeper depth.



Radargram 5: In blue is a processing artefact that may have a real origin in the shallow layer (of modern origin) creating the deep high amplitude after applying a gain to the data. In red is an example of rubble.

#### 8. Conclusions

- 8.1. A ground penetrating radar survey has been successfully completed over 0.25ha of land at the Wadeford Farm, Combe St Nicholas. The GPR survey has responded well to the survey environment and conditions. The results present a good signal penetration with depth showing a range of anomalies from over 1m below the present ground surface. Evidence of structural remains were detected across the site under the form of rubble and walls. Two main depths were identified showing two phases of activity; around 0.5m and around 1m.
- 8.2. Possible element associated with the Roman Villa were detected in the north west of the site. They are composed of rubble and small portion of wall. The remains are too disturbed to form clear patterns in the timeslices. Across the rest of the site isolated responses reflecting possible rubble and small portions of wall have been identified; however, the isolated nature of the responses prevents a confident association with the Roman Villa. A few undetermined anomalies were too ambiguous to classify confidently as being of archaeological origins with a modern origin possible.
- 8.3. Wall responses forming a square structure are visible in Area 3, their shallower depth indicates a more recent origin than the anomalies from Area 1. A potential well was also detected directly adjacent to the east of the structure.
- 8.4. Responses relating to modern activity were also visible; services, manhole covers, rubble, surface concrete material and effect from the adjacent buildings. The rubble may have hidden anomalies of different origin, but anomalies could be distinguished within most of the other types of modern activity.

## 9. Archiving

- 9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and ungeoreferenced images, XY traces and a copy of the final report.
- 9.2. MS contributes all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.
- 9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

## 10. Copyright

10.1. Copyright and the intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd. is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

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