Land at Lydiard Park
Swindon, Wiltshire

Geophysical Survey Report

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April 2014

Report Ref. 103450.01

Quality Assurance

Project Code	103450	**Accession Code**		**Client Ref.**	103450.01
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	410400, 184625		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	*RDL*			
File:	X:\PROJECTS\103450\Geophysics\Report\103450_Geophysics_Report_RDL.Docx				
v02	E	*RDL*	*PAB*		02/04/14
File:	X:\PROJECTS\103450\Geophysics\Report\103450_Geophysics_Report_draft.Docx				
v02	F	*RDL*	*PAB*		07/04/14
File:	X:\PROJECTS\103450\Geophysics\Report\103450_Geophysics_Report_final.Docx				
File:					
File:					

* I = Internal Draft; E = External Draft; F = Final

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Summary

Wessex Archaeology was commissioned by English Heritage to undertake a geophysical survey of land around Lydiard House, near Swindon (centred on NGR 410400, 184625). The aim of the work was to establish the presence, or otherwise, and nature of detectable archaeological features on the site as part of a programme of archaeological works to enhance the archaeological record of the site as well as to inform on the presentation and development of the site.

The survey was undertaken between the 7th and 18th March 2014 with earth resistance and gradiometer survey carried out. The site is located approximately 5km west of the centre of Swindon. The site comprises an area of lawns located around Lydiard House inside Lydiard Park.

Detailed gradiometer survey was undertaken over all accessible parts of the site, a total of 4.8ha, and has demonstrated the presence of anomalies of probable and possible archaeological interest in addition to numerous features thought to relate to former garden features.

The archaeology detected includes pathways, walls, ditches and fences with many features thought to relate to the formal gardens laid out by the St John family in the 17th century. Other features were detected that seems to date to a different phase of land division.

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Acknowledgements

The detailed gradiometer survey was commissioned by English Heritage. The assistance of Neil Linford is gratefully acknowledged in this regard.

The fieldwork was carried out by Clara Dickinson, Alistair Salisbury, Laura Andrews and Jennifer Smith. The geophysical data was processed by Ross Lefort and Clara Dickinson and interpreted by Ross Lefort who also wrote this report. The geophysical work was quality controlled by Dr. Paul Baggaley and Ben Urmston. Illustrations were prepared by Ross Lefort and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Dr. Paul Baggaley.

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Geophysical Survey Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by English Heritage to carry out a programme of geophysical survey over land south of Lydiard House, Swindon, Wiltshire (centred on NGR 410400, 184625; **Figure 1**), hereafter "the Site". The survey is to be carried out in order to enhance the archaeological record and inform the presentation and development of the site.

1.1.2 An invitation to tender document was prepared by English Heritage that sets out the aim of the project which is to "*enhance the archaeological record of the site to inform the ongoing presentation and development of the site*" (EH 2014). The following objectives were set out to achieve this general aim:

- To survey a small rear garden between the house and the church that may cover medieval remains.
- To survey the area of the former formal 17th century gardens to the south of the house (EH 2014).

1.1.3 A method statement has been produced by Wessex Archaeology (2014) that sets out the methodology and strategy adopted for the survey.

1.1.4 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 Site Location and Topography

1.2.1 The Site is located around the grade I listed Lydiard House, approximately 5km west of the centre of Swindon. The Site comprises two survey areas including a small rear garden between Lydiard House and St Mary's church and a larger area of formal 17th century gardens to the south of Lydiard House (**Figure 1**). Most of the southern survey area was available for geophysical survey with the exception of a strip of woodland running along the southwest edge; the total area surveyed came to 4.8ha.

1.2.2 The Site is located on the east facing slope of a gently sloping stream valley. The land at the west side of the Site lies at an elevation of 115m above Ordnance Datum (aOD) and this drops to under 105m aOD at the eastern extents of the Site; the relief in the wider area gently undulates. A small unnamed stream runs along the eastern boundary and has been turned into a pond at the point where it passes the Site; this stream flows north into the River Ray. The Site is defined by the extent of the park and the courtyard.

1.3 Soils and Geology

1.3.1 The solid geology recorded across the Site is Stanford formation Limestone (Jurassic) with Ampthill clay formation and Kimmeridge clay formation (undifferentiated) and Ringsbury spiculite member sandstone close by (BGS). No superficial deposits are recorded within the Site although some alluvial deposits are recorded in the stream valley a short distance to the northeast (BGS).

1.3.2 The soils recorded across the Site are likely to be brown rendzinas of the 343d (Sherborne) association with pelo-stagnogley soils of the 712b (Denchworth) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

1.4 Archaeological and Historical Background

1.4.1 The following information is summarized from the Heritage Gateway website (www.heritagegateway.org.uk) and the online database for Wiltshire HER (http://www.wiltshire.gov.uk/artsheritageandlibraries/museumhistoryheritage/wiltshireandswindonhistoricenvironmentrecord.htm). A search was performed for all heritage assets within 500m of the Site.

1.4.2 There is very little prehistoric material recorded in the area. There are several records of Roman remains in the vicinity of the site including a building to the northeast (MWI16455). A single Saxon pottery sherd was recovered during excavation by Wessex Archaeology to the northwest of Lydiard House in 2004 (MWI16518).

1.4.3 A house has been recorded at this Site since before the Domesday Book and has been remodelled numerous times as well as changing ownership several times. The last major remodelling took place in the mid 18th century (EH222110). The church of St Mary is located behind the house and was constructed during the 13th century; like the house the church was subject to several alterations (EH222085). A medieval settlement is considered to exist in the vicinity of the house and the church of St Mary with medieval finds recovered although no clear picture of the layout and size of the settlement has emerged (MWI16521). Later in the medieval (by 1256) the area is recorded as a deer park (MWI16530). The small survey area within the courtyard aims to detect any medieval remains that may be present here.

1.4.4 The period and features of particular interest in the larger southern survey area date to the 17th century and comprise the gardens laid out to the south of the house by the St John family. The gardens are considered to have been laid out by Lady Johanna St John as a physic garden as her early work on botanicals is well known (EH2014). The gardens and canals built formed part of the wider redevelopment of the medieval house and grounds (NHL1001238). These gardens were largely removed by 1766 with the area recorded as an open lawn with a few trees in Willington's map of the park (Willington 1766). The garden features only survive as a series of low earthworks and parch marks visible on aerial photographs (EH1395197).

1.4.5 From the late 18th century onwards the estate was neglected and by the 1930s fell into decline. It was used as a military hospital by the American Forces from 1942 and was bought up by the Corporation of Swindon in 1943. The park and house have been subject to restoration and repair over the latter half of the 20th century with an extensive landscape restoration project completed in 2008 (NHL1001238).

1.4.6 Previous archaeological work undertaken on this site includes the investigation of Lydiard Park in 2004 by Wessex Archaeology with an evaluation carried out to inform on the restoration of features in the park. The features assessed in greatest detail included the walled garden to the northeast of Lydiard House, the ponds and associated structures, the medieval deer park pale, former routes through the park and the garden "temple" (Wessex Archaeology 2004).

1.4.7 Two trenches (Trenches 10 & 11) were opened within the area covered by this survey; both were targeted on earthworks observed during an English Heritage earthwork survey (Lord 2003). Trench 10 revealed a robbed out wall and a line of postholes with post-medieval finds recovered from the fill of the robber trench. Trench 11 contained a large quantity of rubble including 18th and 19th century brick and a mix of Roman, medieval and post-medieval finds. Under these rubble layers was a medieval soil horizon that was sealed by the rubble deposit. No intact brick structures were recorded in this trench (Wessex Archaeology 2004).

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using Bartington Grad601-2 dual fluxgate gradiometer systems and the earth resistance survey was carried out using a Geoscan Research RM15 instrument. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 7th and 18th March 2014. Field conditions at the time of the survey were good, with firm conditions under foot.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008). A Leica TPS 307 total station was used to survey the extents of the courtyard area for the purposes of accurately locating the geophysical data. Reference stations were established using the GNSS system.

2.2.2 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The deslope and multiply functions were used in certain instances to process out grid edge discontinuities and account for differences in sensor height between different operators. These four steps were applied to all survey areas, with no interpolation applied.

2.2.4 The earth resistance survey was undertaken using a Geoscan Research RM15 instrument in parallel twin (4 probe) configuration using the MPX15 multiplexer; each of the mobile

probes were spaced 0.5m apart, with the centres of the two twin probe arrays spaced 1m apart. Data were collected at 1m intervals along transects spaced 1m apart with an effective sensitivity of 0.1 ohms (Ω), in accordance with EH guidelines (2008). Data were collected in the zigzag method.

2.2.5 Data from the survey were subject to minimal data correction processes. These comprise despiking to remove erroneous readings resulting from poor contact resistance and grid matching to correct for systematic offsets resulting from sequential movements of the remote probes. This minimally processed dataset was then high-pass filtered (10x10 Gaussian) to emphasise smaller, more rapidly varying anomalies and to remove broad changes within the data typically associated with geological changes. A low-pass filter (2x2 Gaussian) was also applied to the minimally processed data to remove high frequency small scale data. Both filtered datasets were interpolated in X and Y directions to improve the appearance of the final images, although the original datasets and intermediate stages of processing can be made available.

2.2.6 Further details of the geophysical and survey equipment, methods and processing are described in **Appendices 1** and **2**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of probable and possible archaeological interest across the Site, along with modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (**Figures 2** to **8**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figures 4** and **8**). Full definitions of the interpretation terms used in this report are provided in **Appendix 3**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 A clear pattern of ditches is visible dividing a larger rectangular area into at least six small enclosed areas with the junctions of these enclosing ditches visible around **4000** and **4001**. These ditches are intermittent with very weak values in places and much stronger regions in others; the magnetic values range from less than +0.5nT to over +3nT. This variation in strength could be indicative of a variation of the magnetic properties of the ditch fill or could be a sign of variable preservation of ditches. The ditches are fairly narrow with a typical anomaly width of 1.5m so may not be very wide or deep.it is considered that these ditches flank and define pathways through the area. The ditches have been variously classed as archaeology, probable archaeology and possible archaeology depending on the strength of the anomaly.

3.2.2 These narrow ditches are contained within a larger northeast-southwest aligned rectangular enclosure that is defined on its southwest and southeast sides by linear anomalies with strong magnetic values at **4002** and **4003**. These linear anomalies consist

of numerous strong bipolar responses (black and white) that are consistent with ceramic material so it is considered that these features represent some kind of brick structure such as a brick wall or a ha-ha. These probable walls are classed as archaeology. The northwest side of this enclosure is defined by a line of ferrous responses at **4004** that are considered to represent a fence. The northeast side of this enclosure falls just outside of the survey area so it is not known if this end was open or closed.

3.2.3 The southern sub-division within the enclosure contains a number of parallel ditches around **4005** with some similar partial ditches observed in the neighbouring sub-divisions. These ditches have variable magnetic values along them ranging from +0.5nT to over +3nT. These internal ditches are not considered to define paths but may be related to bedding features. These ditches have been variously classed as archaeology, probable archaeology and possible archaeology depending on their magnetic values.

3.2.4 There are other ditches within the large rectangular enclosure that do not appear to follow the general layout created by other features within. The ditches at **4006** and **4007** appear to be cut by or cut the other features and **4007** is on an east-west alignment rather than following the northeast-southwest alignment of the enclosure. These features are thought to date to a different period but it is unclear whether they are earlier or later; both have been classed as archaeology and probable archaeology according to their magnetic values.

3.2.5 A clear L-shaped ditch is present further west at **4008** with magnetic values consistently over +3nT. This ditch may link up with a less clear ditch at **4009** to form a rectangular enclosure but large spreads of ferrous are located in this area that make full assessment of this as an enclosure difficult. A weaker internal ditch is visible inside the L-shape running parallel to it that is likely to be related. This possible enclosure is on a very slightly different alignment to the larger enclosure discussed above but could still be contemporary. The strong ditch sections are classed as archaeology and the weaker ones as either probable or possible archaeology.

3.2.6 There are two parallel ditch sections at **4010** that are parallel to **4007** further north. Like **4007** they have fairly weak magnetic values around +1nT and together these ditches may represent remnants of a different phase of land division. Both ditches have been interpreted as probable archaeology.

3.2.7 Two linear features are visible at **4011** and **4012** with the latter representing the continuation of **4002**. The strong magnetic values of both are likely to indicate a large proportion of ceramic material used in their construction. **4012** appears to represent an extensive boundary and could either represent a wall or the wall face of a ha-ha.

3.2.8 There are fence lines visible in the data as lines of regular ferrous responses at **4004**, **4013**, **4014** and **4015**; these anomalies do not look like services in spite of their regularity. Some of these fence lines correspond to mapped features and will be discussed in greater detail in the combined interpretation below.

3.2.9 There are some small and slightly irregular shaped positive anomalies visible in places across the data at **4016**, **4017** and **4018**. These features may represent cut features such as pits and ditches but their irregular forms also allow for a geological interpretation. As a result of this uncertainty all of these anomalies have been classed as possible archaeology.

3.2.10 Two clear services were observed at **4019** and **4020**; these will be discussed in more detail below.

3.2.11 As has been mentioned briefly above there is a heavy concentration of ferrous responses and spreads of increased magnetic response across the north of the main survey area. The courtyard survey area is completely dominated by ferrous responses. Where possible structural detail has been picked out but this spread of strong responses may have the effect of masking weaker ditch sections that may be present underneath. Much of this material may be relatively modern but some of it could relate to dismantled ceramic garden features that were built close to the house.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

3.3.1 Two services are visible running through the data at **4019** and **4020**; both appear to represent pipes. The possible pipe at **4019** runs from the house and through the entire survey area. The possible pipe at **4020** runs from the house and stops close to a large ferrous anomaly created by tree surrounded by railings; this pipe may represent an irrigation feature or may supply/have supplied a tap for use by ground staff. Consultation with staff at the estate may help to identify these pipes.

3.3.2 It is not clear from the geophysical data whether any of the services identified are in active use. It should also be noted that gradiometer survey may not detect all services present on Site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on Site.

3.4 Earth Resistance Survey Results and Interpretation

3.4.1 The clearest features detected consist of broad high resistance anomalies that look to correspond to the positions of paths. The largest complex of pathways is present around **5000** and forms a large rectangular area divided by paths into six sub-enclosures. The paths have variable resistance values with the highest areas around **5000** to the north with paths becoming intermittent further south around **5001**. All the paths detected are considered to be of archaeological interest.

3.4.2 The southwest and southeast sides of the area defined by the paths are enclosed by intermittent linear high resistance anomalies at **5002** and **5003**. The higher resistance values suggest a wall is possible but the intermittent values along their length may suggest variable preservation below ground. The possible wall sections have been defined as archaeology or probable archaeology depending on their resistance values.

3.4.3 There are a number of parallel low resistance anomalies in the southernmost sub-division around **5004** that are considered to be ditches with a lesser number of weaker ditches visible in the adjacent sub-divisions. These ditches may have been bedding features and are considered to be of archaeological interest.

3.4.4 Other internal features include a high resistance spread at **5005** that may relate to a path. It is much weaker that some other areas of path detected so it has been classed as probable archaeology rather than a path. A low resistance ditch is present at **5006** that is set on a different alignment to the other features within. This feature is not considered to be contemporary to the paths and has been classed as probable archaeology. The remaining features within are weak linear trends such as those around **5007**; these features may relate to bedding features or divisions.

3.4.5 Further west is another complex of paths around **5008**; these paths form a sub-rectangular area opposite Lydiard House that is divided into at least five areas by these paths. A low resistance ditch runs along the northwest side of this complex at **5009** although it is unclear whether this is directly related or cuts through this area. The only

features visible within are some weak trends that may relate to garden features. A squared high resistance region is present at **5010** that lies between the house and area of paths. This may be significant and has been interpreted as probable archaeology and the paths are considered to be of archaeological interest.

3.4.6 A low resistance ditched enclosure lies to the southwest at **5011** and **5012**; this enclosure shares a common alignment with the nearby paths and is likely to be related. These ditches are considered to be of archaeological significance.

3.4.7 A low resistance ditch is visible at **5013** that appears to link the two complexes of pathways on the east and west side. This ditch is considered to be of archaeological significance. Just south of this is another squared high resistance area similar to **5010** and this has been interpreted as probable archaeology.

3.4.8 Two high resistance anomalies are present at **5014** and **5015**; both are considered to represent walls with **5015** representing the continuation of **5003**. Another wall runs parallel to **5003** at **5016**. Like the other possible walls discussed these have varying values along their length which may indicate a variation in preservation. The walls have been interpreted either as archaeology or probable archaeology depending on their strength.

3.4.9 A ditch is visible at **5017** and **5018** on the same alignment as **5006** further north. The ditches here have much lower values than **5006** and have therefore been interpreted as archaeology although it is considered that all three ditch sections form part of the same wider scheme of land division. Another low resistance ditch is located further south at **5019** although this has an alignment similar to the paths further north.

3.4.10 There is a pair of linear high resistance anomalies located around **5020**; it is unclear what features these anomalies may relate to and both have been interpreted as possible archaeology. An area of high resistance values is present around **5021** and **5022**. They have an irregular shape in plan and it is therefore considered that they may represent a variation in the underlying geology.

3.4.11 The only anomaly detected within the courtyard area is a high resistance L-shaped anomaly at **5023**. It is unclear whether this corresponds to a wall or some form of drain associated with the house. The anomaly has been classed as possible archaeology to reflect the uncertainty over the interpretation.

3.4.12 The remaining anomalies are irregular shaped high resistance anomalies; some may correspond to archaeological features and others to geological features but there is no clear way of telling. All are therefore considered to be of uncertain origin.

3.5 Combined Interpretation

3.5.1 The two datasets complement each other with one survey revealing features the other hasn't and in cases where an anomaly has been detected in both has allowed a much firmer interpretation to be reached. A further interpretation has been produced (**Figure 9**) that aims to combine the results of the two surveys to produce a more complete plan of the more extensive features detected. Only a selection of the most significant small-scale anomalies has been included in this plan.

3.5.2 The large rectangular enclosure measures around 145m x 120m and contains a grid of pathways flanked by ditches around **2000** that divide the interior into at least six sub-enclosures. The paths appear to be surfaced with local stone rather than ceramic material as they are not detected at all in the gradiometer data. These sub enclosures contain

ditches across the south around **2001** that may have served as bedding trenches like those observed in the walled garden to the northwest of Lydiard House (Wessex Archaeology 2004). They are not visible further north but it is not clear if this is a bias in preservation or was simply not needed across the north. Two other ditches were detected at **2002** and **2003** but are considered to relate to a separate phase of use.

3.5.3 These paths are enclosed on two sides by brick walls at **2004** and **2005** and on the northwest side by a fence at **2006**. The two datasets shows the walls as high resistance anomalies with high magnetic values that both point to a ceramic brick wall as the most likely explanation. What is less clear is the form they took. It is possible an upstanding wall stood there or they took the form of ha-has or even marked terracing of the land here. The fence at **2003** is visible only in the gradiometer data suggesting a fence using a reasonable amount of iron stood here. A boundary is recorded in this position on the 1886 Ordnance Survey (OS) map but it is possible the fence has been replaced numerous times and the ferrous material is relatively recent.

3.5.4 Another complex of paths was observed around **2007** immediately opposite the house. There was little of this visible in the gradiometer data and no flanking ditches could be seen among the mass of ferrous/ceramic responses in this area. A ditch at **2008** may be related to this complex. The mass of ferrous/ceramic responses in the gradiometer data could be an indication that ceramic material was used more heavily here than was the case for the larger enclosure.

3.5.5 An enclosure is present further south that is defined by ditches; very little was detected in the interior and there is no clear indication as to its function although it shares a common alignment with **2007**.

3.5.6 Ditches were detected in both surveys at **2011** and **2012** that are on the same alignment as **2002**. These ditches do not appear to be contemporary to the paths and walls detected but seem to represent some form of land division.

3.5.7 More ditches were detected further south around **2013** and these ditches are on the same alignment with the wall at **2004**. Given their common alignment it is possible that these relate to the same period.

3.5.8 A wall is located at **2014** that is set on a different alignment to all others; it is unclear what this may relate to. The wall at **2015** is the southern extension to **2005** and this has a parallel wall at **2016** that only runs for part of the length. These walls seem to relate to the garden features detected and **2015** may represent a landscape boundary such as a ha-ha that could join up with the known example further south.

3.5.9 Some small features detected have very regular forms with two squared features observed in the earth resistance at **2017** and **2018**. These features coincide with high concentrations of ferrous/ceramic responses in the gradiometer data and this may suggest they are brick constructions although their identity is unclear.

3.5.10 The only anomaly of interest in the courtyard area is an L-shaped high resistance anomaly at **2019**. The gradiometer data added nothing to the understanding of this feature as this data was affected by the strong ferrous responses from the house. This anomaly could represent a wall but it is difficult to be certain of this as only a small area of data is available to interpret.

3.5.11 The remaining features at **2006**, **2020** and **2021** are considered to represent fences. As has been mentioned above **2006** is visible on OS maps as far back as 1886 and as

recently as 1981. The fence at **2020** is only visible on the 1924 OS map and the fence at **2021** was not observed on any of the maps consulted. It seems likely that **2021** is recent as it cuts through the enclosure at **2009** and **2010** and is made from ferrous material suggesting it is relatively recent.

4 CONCLUSION

4.1 Summary

4.1.1 The geophysical survey has been successful in detecting anomalies of likely, probable and possible archaeological interest within the Site, including features related to the former formal gardens. The two geophysical techniques used complimented one another allowing a fairly detailed map to be produced as well as informing on the likely construction materials used.

4.1.2 The gradiometer data revealed ditches and brick walls very well and the earth resistance data revealed walls ditches and stone features that do not typically show up that well in gradiometer data. The gardens seem to form two different complexes with a large one to the east (**2000**) and a smaller one to the west just opposite the house (**2007**). Paths run through these areas dividing them into smaller sub-divisions and these paths are considered to be surfaced using local stone rather than a crushed ceramic material. There are ditches within these sub-divisions that may mark out planting beds.

4.1.3 The brick wall at **2015** coincides with the line of rubble excavated by Wessex Archaeology in 2004. This trench was named trench 11 and recovered 18th and 19th century rubble but did not find an intact wall or foundations (Wessex Archaeology 2004). It is possible that the section of wall targeted in 2004 was particularly badly preserved and better preserved sections may exist further north. The date of the rubble found is troubling to an interpretation of this feature as part of the 17th century planned garden but it is possible that this feature was extended or remodelled from an earlier feature. There is a possibility that this feature formed part of a ha-ha.

4.1.4 A ditched enclosure was detected around **2009** and **2010** just behind **2007**; this enclosure is considered to possibly relate to this scheme of gardens although its exact function is unclear.

4.1.5 Only one feature was detected in the courtyard which was an L-shaped high resistance anomaly. This anomaly proved difficult to interpret given the small area surveyed and its proximity of the house but may be of archaeological interest.

4.1.6 Other features were found that were clearly not related to the former formal gardens including fences and ditches that appear to belong to different phases.

4.1.7 Overall the geophysical survey fulfilled its main aim and objectives by detecting features that can be further assessed through documentary research and excavation.

4.1.8 It is not possible to date features through geophysical survey and only basic and unreliable assertions of relative date can be made based on common alignments or areas where anomalies intersect to create unlikely contemporary arrangements. Some form of excavation will need to be carried out to see if any of the garden features detected relate to the 17th century formal garden. Linking the anomalies found to features present on 17th

century maps may be another way of assessing these features if detailed enough maps exist.

4.1.9 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; however, it is assumed that the centreline of services is coincident with the centreline of their anomalies. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.

4.1.10 It should be noted that small, weakly contrasting features may produce responses that are below the detection threshold of the equipment used. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.

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5.4 EH PastScape Records Consulted

EH1395197 – Monument No. 1395197, 17th century formal gardens, Lydiard Park

EH222085 – Church of St Mary

EH222110 – Lydiard House, Lydiard Park

5.5 National Heritage List for England

NHL1001238 – Lydiard Park

APPENDIX 1: GRADIOMETER SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data).

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies;
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: EARTH RESISTANCE SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The earth resistance data for this project was acquired using a Geoscan Research RM15 system in the twin probe configuration. Probes are arranged at fixed separations on a horizontal bar, with the RM15 controller and MPX15 multiplexer held on a frame above the bar. The multiplexer allows a range of different measurements to be taken at each survey station, depending on the requirements of the survey. Common configurations include arrays of expanding width and arrays arranged side-by-side. The twin probe array comprises a pair of remote probes set at a location outside the survey area, connected to the controller by electrical cable, and one or more pairs of mobile probes.

Readings are taken by injecting an electrical current into the ground and measuring the resistance of the ground within the path the current takes. The electrical resistance of the earth is dependent partly upon the chemical and geological composition of the soils but also largely upon the soil moisture content; for instance wet, briny environments will typically exhibit low electrical resistance, whereas dry sands will exhibit high resistance. Where ditches and pits are present, soil moisture content is likely to be higher within their fills, hence their appearance as low resistance anomalies. Walls, porous fills and voids are likely to be better drained than the surrounding material and are therefore generally high resistance anomalies.

The separation of the mobile probes is chosen depending upon the likely depth of investigation, with wider separations allowing the current to travel deeper into the ground at the expense of horizontal resolution. A separation of 0.5m is a common compromise, allowing good horizontal resolution whilst allowing depth penetration of approximately 0.7m, depending upon ground conditions.

Typical earth resistance surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 1m intervals along traverses spaced 1m apart. These strategies give 400 or 900 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.25m intervals along traverses spaced up to 0.25m apart, although the increase in sample density is directly proportional to the time taken to complete the survey.

Post-Processing

The earth resistance data collected during the detail survey are downloaded from the Geoscan Research RM15 system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- Grid Match – Each time the remote probes are moved, e.g. between grids or on different days, systematic offsets will be introduced through the change in resistance at the new location. Whilst efforts are made to minimise this in the field, small mismatches can be corrected by setting the statistical mean of any given grid to that of one of its neighbours.

Typical displays of the data used during processing and analysis:

- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 3: GEOPHYSICAL INTERPRETATION

The methodology used by Wessex Archaeology separates the anomalies into four main groups of interpretation categories: archaeological, modern, agricultural and uncertain origin/geological.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs and early mapping may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern;
- Probable archaeology – used for features which give a clear response but which form incomplete patterns;
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively recent in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin;
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is for clear features that are likely to relate to recent farming activity:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping;
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance;
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow;
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries;
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses. These drains can also be defined as ditches where a clear herringbone pattern can be discerned.

The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential;
- Trend – used for low amplitude or indistinct linear anomalies;
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of broad irregular shaped anomalies.

Apart from the categories particular to gradiometer data (Ferrous and Increased magnetic response) all categories listed above are utilised where relevant for the interpretation of earth resistance and Ground Penetrating Radar (GPR) data. Uncertain categories such as high or low amplitude response and high or low resistance anomaly may be added but these are purely geophysical interpretations describing the anomaly, they make no comment on their archaeological significance.