Ramsbury Manor Visitors Centre
Ramsbury, Wiltshire

Detailed Gradiometer and Ground Penetrating Radar Survey Report

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Summary

A detailed gradiometer survey was conducted over land north-east of Ramsbury Manor, Ramsbury, Wiltshire (centred on National Grid Reference (NGR) 426080 171360). The project was commissioned by Peregrine Bryant, on behalf of The Ramsbury Manor Foundation, with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the development of the site for a new visitor centre and associated infrastructure.

The site comprises two arable fields west of Ramsbury, covering an area of 10.7 ha. The geophysical survey was undertaken on 5 – 9 July 2019 and has demonstrated the presence of a number of anomalies thought to be archaeological in origin.

The surveys have confirmed the location and route of an 18th century road noted on historical mapping. Responses detected in the GPR results are thought to indicate wheel ruts and potential road surface compaction or metalling.

A former building noted on historical mapping has also been identified in both sets of results. This is seen as both foundations and an area of associated rubble. In addition, the GPR survey has indicated the potential for further features adjacent to the road that could indicate a small enclosure or building.

Furthermore, the gradiometer survey has highlighted the possible location of the Silchester to Bath roman road speculated to traverse the south of the site. However, there is no evidence for this in the GPR data and it is equally likely that the anomaly is caused by localised geological variation.

The gradiometer and GPR surveys have identified a large-pit like feature in the north of the site which could indicate a former extraction pit or pond associated with the significant landscaping surrounding Ramsbury Manor.

The gradiometer survey has also identified anomalies throughout the north of the site that are likely to indicate geological variation in the underlying deposits. However, it cannot be ruled out that these anomalies could indicate historic ploughing regimes as they correspond to the modern and historic pattern of land division noted on later historic maps.

The remaining anomalies identified in the gradiometer survey results are thought to indicate localised geological variation and modern services.

Acknowledgements

Wessex Archaeology would like to thank Peregrine Bryant for commissioning the geophysical survey. The assistance of Paul Chatham is gratefully acknowledged in this regard.

The fieldwork was undertaken by Rok Plesnicar, Jenna Jackson and Thomas King. Rok Plesnicar and Alexander Schmidt processed the geophysical data. Patricia Voke and Alexander Schmidt interpreted the data, wrote the report and prepared the illustrations. The geophysical work was quality controlled by Tom Richardson. The project was managed on behalf of Wessex Archaeology by Tom Richardson.

Ramsbury Manor Visitors Centre, Ramsbury, Wiltshire

Detailed Gradiometer and Ground Penetrating Radar Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Peregrine Bryant, on behalf of The Ramsbury Manor Foundation, to carry out a geophysical survey at Ramsbury Manor House, Ramsbury, Wiltshire (centred on NGR 426080 171360) (**Figure 1**). The survey comprises detailed gradiometer survey and ground penetrating radar (GPR) survey. The survey forms part of an ongoing programme of archaeological investigation being undertaken in support of a planning application for the development of the site for a new visitor centre and associated infrastructure.

1.2 Scope of document

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

1.3 The site

1.3.1 The site is located within the grounds of Ramsbury Manor, 2 km south-west of the village of Ramsbury. The site is 6 km north-east of the town of Marlborough and 17 km south-south-east of the city of Swindon, in the county of Wiltshire.

1.3.2 The survey comprises 10.4 ha of agricultural land, currently utilised for sheep pasture. The site is 400 m east of the Grade I listed Ramsbury Manor House and bounded by a line of trees and the River Kennet to the south. The site is located within the Grade II late 18th century parkland of Ramsbury Manor House and consists of two fields subdivided by a row of trees aligned east – west. To the north, east, and further south the site is surrounded by enclosed, mixed agricultural land.

1.3.3 The site is on a slight incline from 148 m above Ordnance Datum (aOD) at the northern edge to 116 m aOD at the southern edge towards the River Kennet.

1.3.4 The solid geology comprises Chalk of the Seaford Chalk Formation with no overlying superficial geological deposits recorded in the north of the site. However superficial sand and gravel deposits of the Beenham Grange Gravel Member are recorded in the south of the site. A north – south band of clay, silt, sand, and gravel Head deposits is also recorded in the south-east corner of the site (BGS 2019).

1.3.5 The soils underlying the northern half of the site are likely to consist of typical argillic brown earth soils of the 571m (Charity 2) association. The southern half of the site's underlying soils are likely to consist of calcareous alluvial gley soils of the 812a (Frome) 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 as well as providing favourable conditions for GPR survey.

2 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 An archaeological desk-based assessment (DBA) was prepared by Peregrine Bryant for Ramsbury Manor and its surrounding landscape, which examined the potential for the survival of buried archaeological remains within the development area (Peregrine Bryant 2018). The following background is not exhaustive but is summarised from aspects of the DBA that are considered relevant to the interpretation of the geophysical survey data.

2.2 Summary of the archaeological resource

2.2.1 The site is situated 500 m to the north-east of Ramsbury Manor House (National Heritage List for England (NHLE) 1184029), which is a 17th century Grade I listed Caroline double-pile building. The site is located within the Grade II listed late 18th century Registered Park and Garden (NHLE 1001242). The Registered Park and Garden area encapsulates several listed buildings, including two Grade II* listed gate piers and lodges (NHLE 1365500) 50 m south-east of the site and a Grade II listed 19th century farmhouse and barn (NHLE 1184047) 80 m north-east of the site.

2.2.2 There is limited evidence for prehistoric activity within the wider landscape surrounding the site. However, two parallel rows of pit alignments have been identified from aerial photographs 530 m east of the site. Whilst undated they have been recorded as possibly dating to the prehistoric period. Two possible Bronze Age barrows and an undated mound, possibly the site of a round barrow are recorded 1.9 km south-east of the site. An undated skeleton, possibly dating to between the Bronze Age and Iron Age, was excavated within the village of Ramsbury in 1985; however, the location for this site is unknown.

2.2.3 A section of the Roman road from Silchester to Bath is recorded on an NNE – SSW axis to the south of the site.

2.2.4 Evidence for Saxon activity has been identified during an archaeological excavation carried out in 1974, 1.2 km east of the site, where an iron-smelting industrial site sealed by a later Saxon occupation layer was found. The West Saxon bishoprics of Wells, Crediton and Ramsbury were all created in 909 AD. The Bishop of Ramsbury controlled both Wiltshire and Berkshire, and his residence was located within the centre of the village of Ramsbury.

2.2.5 Domesday records indicate that land surrounding what is now Ramsbury Manor was cultivated in 1086 AD and may have been reserved, both for sport and to keep animals for the Bishop's household. These likely holdings comprised principally the Old Park to the west of the village of Ramsbury, meadows along the River Kennet to the south of the site, and hunting grounds in the forests south of the river, fringing Savernake Forest.

2.2.6 By the early to mid-12th century Ramsbury Manor was still held by the Bishops of Salisbury and occupied the approximate site of the extant Restoration house. During the 13th century the Medieval Deer Park was created to surround Ramsbury Manor. From the 14th century onwards the imparked land was divided between the north and south parks with the River Kennet dividing it. The precise eastern edge of the deer park is unclear but is approximately located 150 m west of the site.

2.2.7 During the 16th century William Herbert, 1st Earl of Pembroke, rebuilt Ramsbury Manor and expanded the size of the estate. Further additions were made to the manor house until the late 18th century.

2.2.8 Possible remains of medieval and post-medieval boundaries visible as earthwork on aerial photographs have been recorded 600 m west of the site, aligned on an NNW – SSE axis. Possible remains of medieval and or post-medieval ridge and furrow have been identified on aerial photographs 750 m west of the site, aligned east – west. Extensive remains of

17th century earthworks and cropmarks, visible on aerial photographs are noted 300 m south of the site following the course of the River Kennet. These likely reflect agricultural activities for the creation of water meadows.

2.2.9 Historical mapping from the 18th century, including Andrews' and Dury's Map of Wiltshire (1773) and the Enclosure Award Map for Ramsbury (1778), depict the route of two post-medieval roads in the south of the site, aligned north – south. Both maps also depict a possible building where these two roads intersect. During the 18th century a bridge (NHLE 1184067), weir, and retaining lake for Ramsbury Manor were constructed 300 m south of the site.

2.2.10 A possible post-medieval tree ring and embankment, visible as cropmarks on aerial photographs are recorded 160 m west of the site.

3 METHODOLOGY

3.1 Introduction

3.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 5 and 9 July 2019. Field conditions at the time of the survey were fair throughout. An overall coverage of 7.7 ha of gradiometer survey and 0.3 ha of GPR survey was achieved. There were reductions in the gradiometer survey due to trees in the north and south of Area 3 and the north-west of Area 1.

3.1.2 The methods and standards employed throughout the geophysical survey conform to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2014) and European Archaeologiae Consilium (Schmidt *et al.* 2015).

3.2 Aims and objectives

3.2.1 The aims of the survey comprise the following:

- To determine, as far as is reasonably possible, the nature of the detectable archaeological resource within a specified area using appropriate methods and practices; and
- To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.2.2 In order to achieve the above aims, the objectives of the geophysical survey are:

- To conduct a geophysical survey covering as much of the specified area as possible, allowing for on-site obstructions;
- To clarify the presence/absence of anomalies of archaeological potential; and
- Where possible, to determine the general nature of any anomalies of archaeological potential.

3.3 Fieldwork methodology (Gradiometer)

Gradiometer Methodology

3.3.1 The cart-based gradiometer system used a Leica Captivate real-time kinematic (RTK) Global Navigation Satellite System (GNSS) instrument, which receives corrections from a network of reference stations operated by the Ordnance Survey (OS) and Leica Geosystems. Such instruments allow positions to be determined with a precision of 0.02 m in real-time and therefore exceeds European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

3.3.2 The detailed gradiometer survey was undertaken using four Bartington Grad-01-1000L gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart. Data were collected with an effective sensitivity of 0.03 nT at a rate of 10 Hz, producing intervals of 0.15 m along transects spaced 4 m apart.

3.4 Data processing (Gradiometer)

3.4.1 Data from the survey were subjected to minimal correction processes. These comprise a 'destripe' function (±5 nT thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together.

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

3.5 Fieldwork methodology (GPR)

3.5.1 Individual survey grid nodes were established using a Leica Captivate RTK GNSS instrument, which is precise to approximately 0.02 m and therefore exceeds European Archaeologiae Consilium recommendations (Schmidt et al. 2015).

3.5.2 The GPR survey was conducted using a Malå RAMAC/GPR XV11 monitor and control unit with a shielded antenna. This was mounted on a rough terrain cart fitted with an odometer to measure horizontal distance along the ground surface. This was deployed across all of the GPR areas with data collected along traverses spaced 0.5 m apart. Data with the 500 MHz antenna were collected every 0.03 m with an effective time window of 50 ns in the zigzag method, with the exception of a couple of lines where space restrictions required a parallel data collection method.

3.5.3 A field test of the antenna frequency was undertaken prior to the commencement of the survey using 500 and 250 MHz antennae. This established that the 500 MHz antenna was likely to provide the most information regarding the nature of archaeological remains within each area and therefore no further survey was undertaken using an alternative antenna.

3.5.4 The GPR survey was undertaken in accordance with European Archaeologiae Consilium recommendations (Schmidt *et al*. 2015).

3.6 Data processing (GPR)

3.6.1 Data from the survey were subjected to common radar signal correction processes. These comprise amplitude and wobble correction of the radar profile to correct for variance in temperature and soil moisture content, background and bandpass filtering to remove noise in the data from the surrounding area, and XYZ mean line to correct for mosaic effects from variance in the day-to-day conditions during the survey. These steps were applied to all datasets collected across the survey area.

3.6.2 The approximate depth conversion for the 500 MHz antenna is shown in **Table 1** below. These have been calculated on the assumption that the GPR pulse through the ground is 0.116 m/ns for the 500 MHz antenna. It is possible to determine more precisely the average velocity of the GPR pulse through the ground is excavated features at a known depth can be identified in the data. Radargrams were analysed for suitable hyperbolic reflections, which can be used to determine the velocity of the GPR pulse through the subsurface deposits.

3.6.3 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

Table 1 Relative velocity to depth conversion based on a dielectric constant of 6.36 for the 500 MHz antenna

Time Slice	Time (ns)	Depth (m)	Time Slice	Time (ns)	Depth (m)
1	0.00-3.55	0.00-0.21	**11**	29.25-32.80	1.7-1.9
2	2.93-6.48	0.17-0.38	**12**	32.18-35.73	1.87-2.07
3	5.85-9.40	0.34-0.55	**13**	35.10-38.65	2.04-2.24
4	8.78-12.33	0.51-0.71	**14**	38.03-41.58	2.21-2.41
5	11.7-15.25	0.68-0.88	**15**	40.95-44.50	2.38-2.58
6	14.63-18.18	0.85-1.05	**16**	43.88-47.43	2.54-2.75
7	17.55-21.10	1.02-1.22	**17**	46.80-50.35	2.71-2.92
8	20.48-24.03	1.19-1.39	**18**	49.73-53.28	2.88-3.09
9	23.40-26.95	1.36-1.56	**19**	52.65-56.20	3.05-3.26
10	26.33-29.88	1.53-1.73	**20**	55.58-58.50	3.22-3.39

4 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

4.1 Gradiometer survey introduction

4.1.1 The detailed gradiometer survey has identified magnetic anomalies across the site. Results are presented as a series of greyscale plots and archaeological interpretations at variable scales (**Figures 2** to **6**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale image.

4.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous responses, burnt or fired objects, and magnetic trends (**Figure 3**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

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

4.1.4 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.

4.1.5 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.

4.2 Gradiometer survey results and interpretation

4.2.1 The gradiometer survey has identified a number of magnetic anomalies and responses that are thought likely to be associated with archaeological remains. These are predominantly located in the centre of the site and are associated with linear and curvilinear features.

4.2.2 Two parallel fragmented negative linear anomalies have been identified in the centre of Area 3 (**4000** - **Figure 3**). The anomalies extend NNW – SSE for 168 m and are 2.2 m wide. At the southern end there is an 8.6 m wide gap between the anomalies, which widens to 37 m at the north. These anomalies are indicative of bank features and correspond with the location of two 18th century roads visible on Andrews' and Dury's Map of Wiltshire (1773) and the Enclosure Award Map for Ramsbury (1778). Historical mapping depicts the continuation of these roads to the north into Area 2, however such anomalies would not

have been detected in the gradiometer survey data in the southeast corner of Area 2 due to the strong magnetic disturbance there associated with a modern service (**4008**).

4.2.3 In the north-east of Area 3, located at the northern end of **4000**, an area of notably increased magnetic response has been detected at **4001**. The anomalies have little coherent shape and measure 24 m east – west by 17 m north – south. They correspond with the location of an 18th century building recorded on historical mapping (*ibid*.). The strong magnetic anomalies could represent demolition material from the building as there are no discernible wall footings or foundations detected in the gradiometer survey.

4.2.4 Surrounding **4001** on the south and west is a weak dipolar linear anomaly at **4002**. It is fragmented throughout and measures 53 m in an NNW – SSE alignment, parallel with the western edge of the road at **4000**. It continues on an east – west alignment for 18 m and is 2 m wide throughout. This anomaly likely represents a ditch feature backfilled with rubble from the nearby building at **4001**. It corresponds with an enclosure or boundary around the building identified on the Enclosure Award Map for Ramsbury (1778).

4.2.5 A positive linear anomaly (**4003**) has been identified directly east of the road at **4000** in the centre of Area 3. It is similarly aligned to the 18th century road on an NNW – SSE axis and is 27 m long by 2 m wide. This is indicative of a ditch feature, which may be associated with the construction of the road. However, it could equally relate to the variable geological deposits and soils in the area.

4.2.6 Several weaker anomalies have been identified in the north-east of Area 3 that are also thought to be associated with former tracks or roads. A weakly negative rectilinear anomaly has been identified at **4004**. The anomaly protrudes from the north-east corner for 20 m on a north – south alignment and turns to the west for 13.5 m. This corresponds to an additional portion of the 18th century trackway identified at **4000** – **4002**.

4.2.7 At **4005**, a weakly positive linear anomaly has been identified on an east – west alignment in the north-east corner of Area 3. The anomaly measures 26 m long and is 3.7 m wide. This corresponds to a 1776 trackway noted on the historical mapping.

4.2.8 To the south-west of Area 3, an area of weak magnetic enhancement has been identified on a broadly east – west alignment (**4006**). The anomaly spans the surveyed area for 115 m and is approximately 26 m wide north – south. This response broadly corresponds to the projected route of the Silchester to Bath roman road identified in the DBA, although further investigation would be required to confirm this as the anomaly could equally relate to localised geological variation.

4.2.9 A weakly positive, sub-circular anomaly has been identified at **4007**. It is located in the centre of Area 2 and measures 22 m in diameter. The response is indicative of a cut feature, with its size suggesting an extraction pit or pond. It could equally represent the removal of a tree-ring feature associated with the 18th century landscaping of the park and gardens of Ramsbury Manor, as there is such feature recorded 160 m to the west.

4.2.10 Numerous isolated circular and sub-circular positive anomalies have been identified across the site. They are 1 – 3 m in diameter and are indicative of pit-like features of unknown origin. It is possible that they represent refuse or boundary pits due to the recorded alignment of possible prehistoric pits 530 m east of the site. However, no clear alignment or pattern can be discerned and they could equally be caused by localised variation in the magnetic susceptibility of the underlying deposits.

4.2.11 Closely spaced negative and positive linear anomalies aligned on an NNE – SSW axis have been identified throughout most of Area 2 and extending into the north of Area 3. These anomalies are likely indicative of glacial sculpting of the site as the anomalies correspond to a significant slope from 152 m aOD in the north to 127m aOD in the south. However, it is possible that these anomalies are the result of ridge and furrow cultivation or extensive

ploughing in this area of the site. This interpretation is further strengthened by an area of ridge and furrow identified from aerial photography 750 m west of the site. Further archaeological investigation would be required to better understand these features.

4.2.12 Further evidence of geological variation has been identified throughout the site. In the north of Area 2 a broad, weakly positive anomaly at **4008** aligned east – west is visible. To the south and south-east of Area 3 a further amorphous weakly positive and negative anomaly has been identified at **4009**. The location of these anomalies corresponds with a band of Head deposits associated with the dry valley to the north of the survey area.

4.2.13 Three dipolar linear anomalies (**4010-4012**) are located in the south of Area 2 and the centre of Area 3. They are all aligned approximately east – west and reflect modern services.

4.2.14 The survey within Area 1 has only identified magnetically strong anomalies, consistent with ferrous object. These are not considered to be archaeological in origin, and likely relate to nearby fences or other modern features.

4.3 GPR survey introduction

4.3.1 The GPR survey was targeted over anomalies identified by the gradiometer survey and over features noted on historical mapping. The survey has been successful in identifying complex hyperbolic and planar responses across the nine targeted areas within the site (**Figure 1**).

4.3.2 The 500 MHz antenna used in this survey has the potential of detecting features to a depth of 2-3 m in optimal conditions, however the total depth reached varies depending on the specific conditions of each area.

4.3.3 For ease of interpretation, the most representative timeslices have been selected for presentation with the interpretation image detailing the salient results from each relevant approximately 0.20 m section. This is then followed by a graphical summary of all the timeslices to provide a summary and more complete understanding of how these features may relate to each other.

4.3.4 The GPR surveys have identified several point reflectors, planar returns, and linear responses, along with anomalous areas of high and low amplitude in each area. Results are presented as a series of greyscale timeslices, and archaeological interpretations at a scale of 1:1200 for Areas 4 - 12 (**Figures 4** – **5**). The greyscale plots display black representing high amplitude responses and white relating to low amplitude responses.

4.3.5 All features are described in terms of their geophysical character. It is important to stipulate that all the depths referred to in this report are approximate levels below the current ground surface. The interpretation of the GPR data highlights the presence of potential archaeological features, possible archaeological features and high amplitude responses alongside a series of linear trends (**Figures 6** - **8**).

4.3.6 It should be noted that small features and waterlogged features may produce responses that are below the detection threshold of the GPR antenna. Excessive disturbance can also impede the ability of geophysical techniques to detect archaeology. It may therefore be the case that more archaeological features are present than have been identified through the geophysical survey.

4.4 GPR survey results and interpretation

4.4.1 The GPR survey was targeted over the gradiometer anomalies thought to relate to the remains of an 18th century road and associated building, as well as the possible pond or extraction pit.

4.4.2 The negative responses noted in the gradiometer survey (**4000**) correspond to series of complex hyperbolic responses in the GPR survey results (See Example Radargram 1,

Figure 10). These are visible throughout Timeslices 1 – 12 (0.00 to 2.07 m deep) and are thought to be clear evidence of the 18th century road.

4.4.3 The responses at **5000** and **5001** (Area 8) are strong, hyperbolic responses suggesting a buried object (Timeslice 4 – 0.51 to 0.71 m deep) and when considered in plan present a clear linear alignment corresponding to the route of the road. It is thought likely these responses indicate kerb or stone edges to the road.

4.4.4 Between the two responses at **5000** and **5001**, several narrow linear anomalies (**5002**) are visible in the GPR data when viewed in plan. These anomalies are surrounded by notable amorphous responses. These are clear in Timeslice 1 – 10 (0.00 to 1.73 m deep) and are noted as a grouping of complex hyperbolic responses. It is thought these anomalies indicate smaller linear features, such as wheel ruts. The areas of more complex responses likely indicate a buried deposit or surface, probably relating to metalling of the road surface.

4.4.5 While the gradiometer data does not show the road extending into the northern field, Areas 6 and 7 in the GPR survey were located over the route indicated on historical mapping. Similar responses to those in Area 8 have been identified in the projected location of the road on a broadly north-east to south-west alignment. It is possible the feature continues further to the north (into Area 5) and south (into Areas 11 and 12), however the responses are not clear or consistent enough to apply a confident interpretation.

4.4.6 Within Area 8 complex hyperbolic responses have been detected that likely indicate buried debris or rubble (**5003**) at the same location as the building remains identified by the gradiometer survey (**4001**). Furthermore, when considered in plan, several planar responses identified in the timeslices (3 – 12 – 0.34 to 1.73 m deep) appear as fragmented linear responses. The response is broadly rectilinear in form and covers an area of approximately 16.5 m by 13.5 m. These responses are likely to indicate the building foundations.

4.4.7 Additional responses that could indicate further structures have been identified in the GPR survey. At **5004**, a broadly circular, high amplitude response has been identified that is clearly visible on Timeslice 7 (1.02 to 1.22 m deep). This response covers an area of 6 m north – south by 4 m east – west and possibly indicates a small roadside structure or feature, such as an enclosure.

4.4.8 Area 4 of the GPR survey was targeted over the possible pond or extraction pit feature identified in the gradiometer survey at **4004**. An area of higher amplitude responses has been identified in the GPR data at **5005**. The anomaly is noted across Timeslices 3 – 10 (0.34 to 1.73 m deep). When viewed in profile a cut feature can be seen in Example Radargram 2 (**Figure 10**). The response in plan is only visible to its full extent east – west and is 18 m wide. The larger anomaly in the gradiometer survey may indicate a spread of deposits around the pond or extraction pit related to its original excavation, while the anomaly in the GPR data is more likely to be representative of the cut feature.

5 DISCUSSION

5.1.1 The geophysical survey has been successful in detecting anomalies in both the gradiometer and GPR results that are thought to be archaeological in origin. The surveys have confirmed the location and route of an 18th century road noted on historical mapping. Responses detected in the GPR results are thought to indicate wheel ruts and potential road surface compaction or metalling.

5.1.2 A former building noted on historical mapping has also been identified in both sets of results. Notably increased magnetic response at the approximate location of the former building suggests the potential for building debris or rubble. This is corroborated by complex hyperbolic responses in the GPR survey results in the same location. Furthermore, the GPR

survey has identified discrete and planar responses that, when viewed in plan, detail a rectilinear structure that is likely to indicate the former building foundations.

5.1.3 In addition, the GPR survey has indicated the potential for further features adjacent to the road that could indicate a small enclosure or building. Further investigation would be required to determine exact origin of these anomalies.

5.1.4 Furthermore, the gradiometer survey has highlighted the possible location of the Silchester to Bath roman road speculated to traverse the south of the site. However, there is no evidence for this in the GPR data (Area 12) and it is equally likely that the anomaly is caused by localised geological variation.

5.1.5 The gradiometer and GPR surveys have identified a large-pit like feature in the north of the site which could indicate a former extraction pit or pond associated with the significant landscaping surrounding Ramsbury Manor.

5.1.6 Further isolated, smaller pit-like features have been identified throughout the site by the gradiometer survey. It is equally likely that these features could indicate refuse pits of unknown origin or natural pitting in the bedrock.

5.1.7 The gradiometer survey has also identified anomalies throughout the north of the site that are likely to indicate geological variation in the underlying deposits. However, it cannot be ruled out that these anomalies could indicate historic ploughing regimes as they correspond to the modern and historic pattern of land division noted on later historic maps.

5.1.8 The remaining anomalies identified in the gradiometer survey results are thought to indicate localised geological variation and modern services. Area 1 is only thought to contain modern ferrous features.

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APPENDICES

Appendix 1: Gradiometer Survey Equipment and Data Processing

Survey methods and equipment

The magnetic data for this project were acquired using a non-magnetic cart fitted with four Bartington Grad-01-1000L magnetic gradiometers. The instrument has four sensor assemblies fixed horizontally 1 m apart allowing four 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 0.03 nT over a ±100 nT range, and measurements from each sensor are logged at intervals of 0.25 m. All of the data are then relayed to a Leica Viva CS35 tablet, running the MLgrad601 program, which is used to record the survey data from the array of Grad601 probes at a rate of 10 Hz. The program also receives measurements from a GPS system, which is fixed to the cart at a measured distance from the sensors, providing real time locational data for each data point.

The cart-based system relies upon accurate GPS location data which is collected using a Leica Viva system with rover and base station. This 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 European Archaeologiae Consilium recommendations (Schmidt et al. 2015) for geophysical surveys.

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 0.125 m intervals along traverses spaced up to 0.25m apart.

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington cart 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.

The cart-based system generally requires a lesser amount of post-processing than the handheld Bartington Grad 601-2 fluxgate gradiometer instrument. This is largely because mounting the gradiometers on the cart reduces the occurrence of operator error; caused by inconsistent walking speeds and deviation in traverse position due to varying ground cover and topography.

Typical data and image processing steps may include:

- GPS Destripe – Determines the median of each transect and then subtracts that value from each datapoint in the transect. May be used to remove the striping effect seen within a survey caused by directional effects, drift, etc.
- GPS Base Interpolation – Sets the X & Y interval of the interpolated data and the track radius (area around each datapoint that is included in the interpolated result).
- Discard Overlaps - Intended to eliminate a track(s) that have been collected too close to one another. Without this, the results of the interpolation process can be distorted as it tries to accommodate very close points with potentially differing values.

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: Gradiometer Survey Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main 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 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.
- 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 modern 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 used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- 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.

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 positive, negative, or broad bipolar (positive and negative) anomalies.

Appendix 3: Ground Penetrating Radar Survey Equipment and Data Processing

Survey Methods and Equipment

The ground penetrating radar (GPR) data were collected using a cart mounted shielded antennae with central frequencies suitable for the types of target being investigated. Lower frequency antennae are able to acquire data from deeper below the surface, whereas higher frequencies allow high resolution imaging of near-surface targets at the expense of deep penetration. The exact make and model of equipment varies.

The depth of penetration of GPR systems is determined by the central frequency of the antenna and the relative dielectric permittivity (RDP) of the material through which the GPR signal passes. In general, soils in floodplain settings may have a wide range of RDPs, although around 8 may be considered average, resulting in a maximum depth of penetration c. 2.5m with the GPR signal having a velocity of approximately 0.1m/ns.

The GPR beam is conical in shape, however, and whilst most of the energy is concentrated in the centre of the cone, the GPR signal illuminates a horizontal footprint, which becomes wider with increasing depth. At the maximum depth of the antenna, it becomes impossible to resolve any feature smaller than the horizontal footprint for the corresponding depth. The size of the footprint is dependent upon central frequency, and its size increases as the central frequency decreases.

The vertical resolution is similarly dependent upon the central frequency; for the 500MHz antenna, features of the order of 0.05m may be resolved vertically. Antennae with lower frequencies can therefore penetrate more deeply but are less resolute in both horizontal and vertical directions. Choice of antenna frequency is guided largely by the anticipated depth to the target and the required resolution.

GPR data for detailed surveys are collected along traverses of varying length separated by 0.5m with cross lines collected running perpendicular to these traverses at wider separations. The data sampling resolution is governed by the data logger and a minimum separation of 0.05m between traces is collected for all surveys.

Post-Processing

The radar data collected during the detail survey are downloaded from the GPR system for processing and analysis using commercial software (GPR Slice). 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.

Typical data and image processing steps may include:

- Gain – Amplifies GPR data based upon its position in the profile, which boosts the contrast between anomalies and background. A wobble correction is also applied during this step;
- Background Filter - is used to remove banding noises that are seen across the radargrams
- Bandpass – Removes GPR data lying outside a specified range, which removes high- and low-frequency noise.

Typical displays of the data used during processing and analysis:

- Timeslice – Presents the data as a series of successive plan views of the variation of reflector energy from the surface to the deepest recorded response. The variation in amplitude is represented using a greyscale with black indicating high amplitude and white indicating low amplitude responses.
- Radargram – Presents each radar profile in a vertical view with distance along the profile expressed along the x axis and depth along the y axis. The amplitude variation is expressed using a greyscale.

Appendix 4: Ground Penetrating Radar Survey Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main 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 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.
- Possible archaeology – used for features which give a response, but which form no discernible pattern or trend.

For the interpretation of GPR datasets two additional categories are also employed:

- High Amplitude – used for features which give a notably high amplitude response but display no discernible pattern.
- Low Amplitude – used for features which give a notably low amplitude response but display no discernible pattern.

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

- Modern service – used for responses considered relating to cables and pipes. GPR is known to be very effective at locating buried utilities and they are often identifiable within the radargrams as strong hyperbolic reflectors.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- 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. These can sometimes repeat or ‘ring’ through GPR datasets, particularly if there are ploughing furrows on the surface.

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:

- 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 high and/or low amplitude response but are commonly amorphous in form.

Appendix 5: OASIS form

Project Details:

Project name		Ramsbury Manor Visitors Centre - TGS			
Type of project		Detailed gradiometer and ground penetrating radar survey			
Project description		The surveys have been successful in identifying the remains of an 18th century road noted on historical mapping. Internal responses detected in the GPR results are thought to indicate wheel ruts and potential road surface compaction or metalling. A former building also noted on historical mapping has also been identified in both sets of results. Notably increased magnetic response at the approximate location of the former building suggests the potential for building debris or rubble. This is corroborated by complex hyperbolic responses in the GPR survey results in the same location. Furthermore, the GPR survey has identified planar responses that detail a rectilinear arrangement of building foundations. In addition, the GPR survey has indicated the potential for further features adjacent to the road that could indicate a small enclosure or building. The surveys have also identified a large cut feature in the north of the site. This likely represents a former extraction pit or garden feature associated with the significant landscaping surrounding Ramsbury Manor. Further isolated, smaller pit-like features have been identified throughout the site by the gradiometer survey. These could indicate refuse pits of unknown origin or natural pitting in the bedrock. The gradiometer survey has also identified historic ploughing regimes. These correspond to the modern and historic pattern of land division noted on later historic maps. The remaining anomalies identified in the gradiometer survey results are thought to indicate localised geological variation and modern services			
Project dates		**Start:** 05-07-2019		**End:** 08-07-2019	
Previous work		Not known.			
Future work		Not known.			
Project Code:	209711	**HER event no.**	N/A	**OASIS form ID:**	wessexar1-362442
		NMR no.	N/A		
		SM no.	N/A		
Planning Application Ref.					
Site Status		Grade I Listed Building, Grade II Registered Park and Gardens			
Land use		Cultivated Land 2 – Operations to a depth of less than 0.25m			
Monument type		N/A	**Period**	N/A	

Project Location:

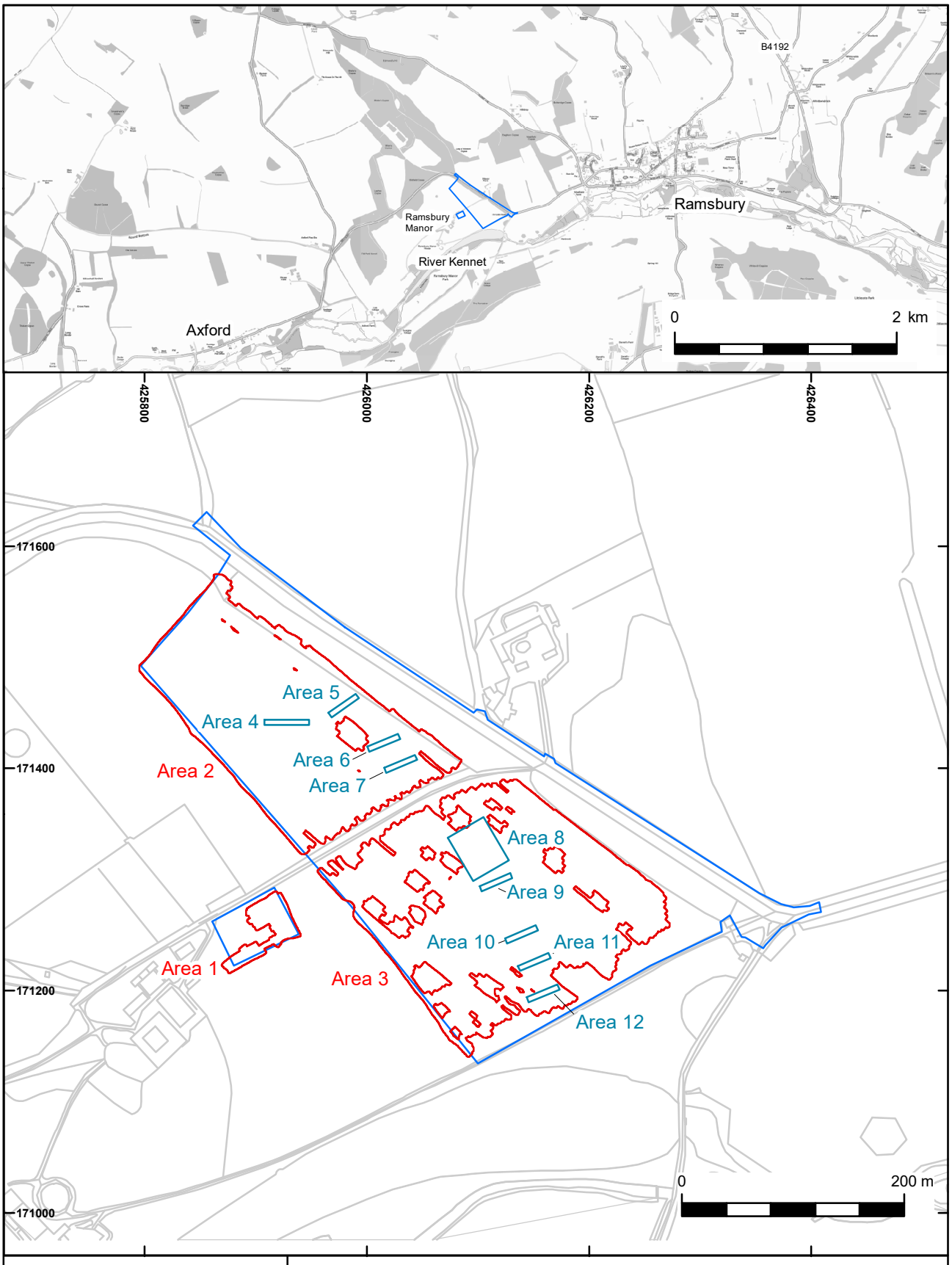
Site Address	Ramsbury Manor, Ramsbury, Wiltshire			**Postcode**	SN8 2HF
County	Wiltshire	**District**	Kennet	**Parish**	Ramsbury
Study Area	10.7 ha	**Height OD**	116 – 148 m aOD	**NGR**	426080 171360

Project Creators:

Name of Organisation	Wessex Archaeology		
Project brief originator	Peregrine Bryant	**Project design originator**	Wessex Archaeology
Project Manager	Tom Richardson	**Project Supervisor**	Jenna Jackson
Sponsor or funding body	Peregrine Bryant	**Type of Sponsor**	Client

Project Archive and Bibliography:

Physical archive	N/A	**Digital Archive**	Geophysical survey and report	**Paper Archive**	N/A
Report title	Ramsbury Manor, Ramsbury, Wiltshire Detailed Gradiometer and Ground Penetrating Radar Survey Report			**Date**	2019
Author	Wessex Archaeology	**Description**	Unpublished report	**Report ref.**	209711.03



Site Boundary
GPR Survey Extents
Gradiometer Survey Extents

Date:	23/07/2019	Revision Number:	0
Scale:	1:50,000 & 1:5,000 at A4	Illustrator:	PV/AJS
Path:	X:\PROJECTS\209711\GIS\FigsMXD\Report Figures 2019_07_18		

Geophysical survey results: site location

Figure 1

425800
426000
426200
426400
171400
171200
Area 1
Area 2
Area 3
0
100 m
Coordinate system:
OSGB36 (OSTN15/OSGM15)
Site Boundary
Detailed Survey Extents
- 2 nT
3 nT

Date:	18/07/2019	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	PV
Path:	X:\PROJECTS\209711\GIS\FigsMXD\Report Figures 2019_07_18		

Detailed gradiometer survey results: greyscale plot (area 1 - 3)

Figure 2

425800
426000
426200
171400
171200
Area 1
Area 2
Area 3
4000
4001
4002
4003
4004
4005
4006
4007
4008
4009
4010
4011
4012
0
100 m
Detailed survey extents
Site Boundary
Archaeology
Possible Archaeology
Trend
Geology
Superficial Geology
Modern Service
Ferrous
Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	18/07/2019	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	PV
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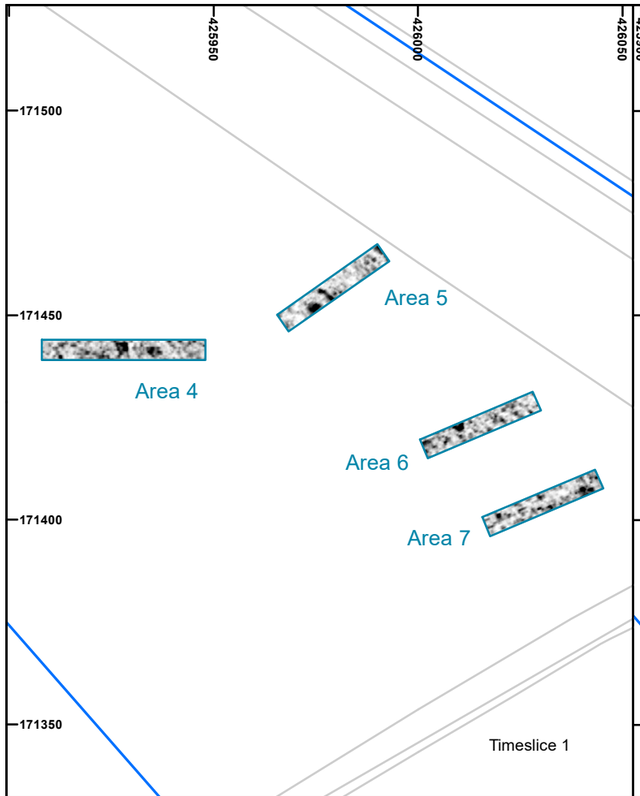
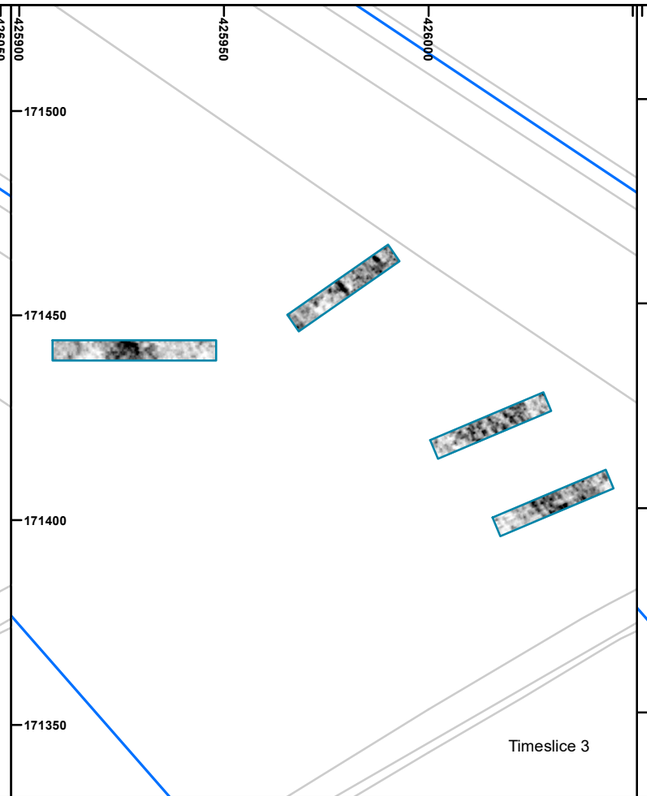
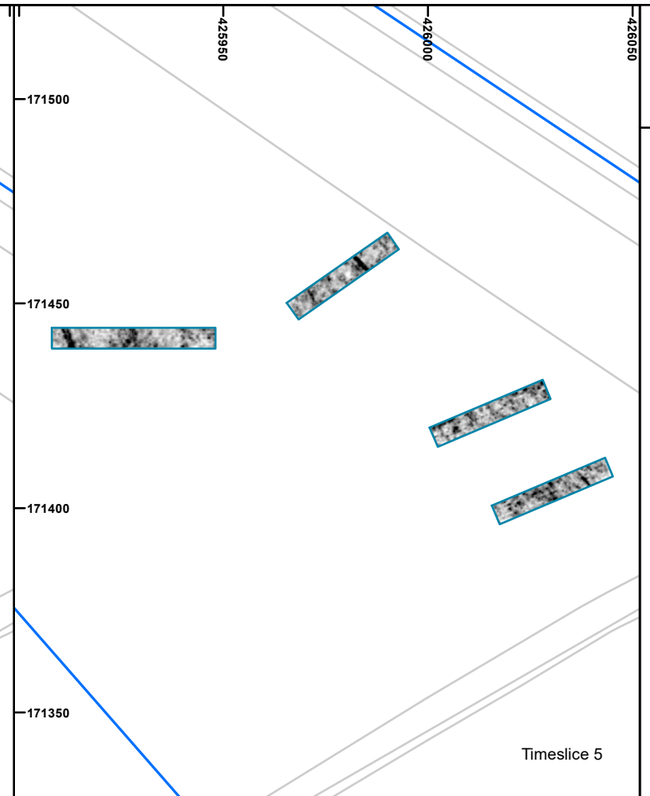
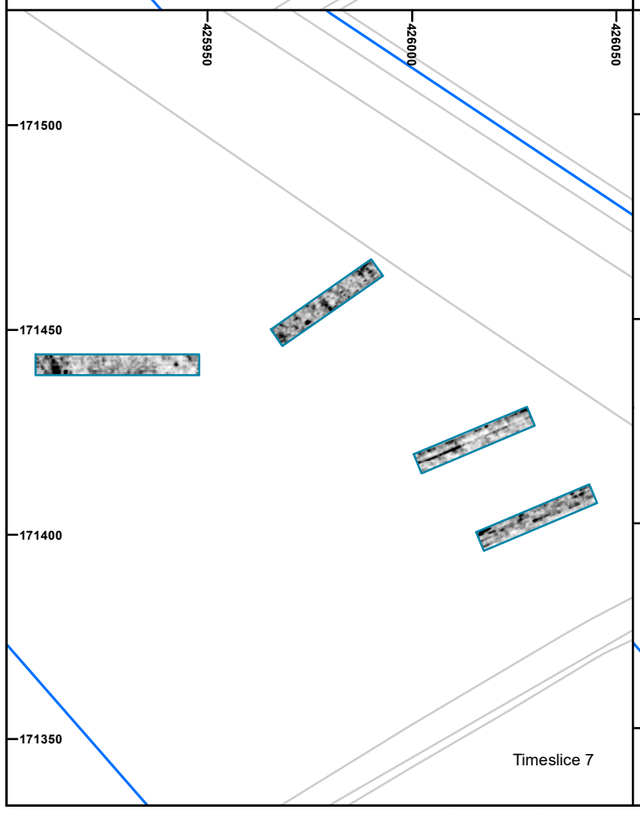
Detailed gradiometer survey results: interpretation (area 1 - 3)

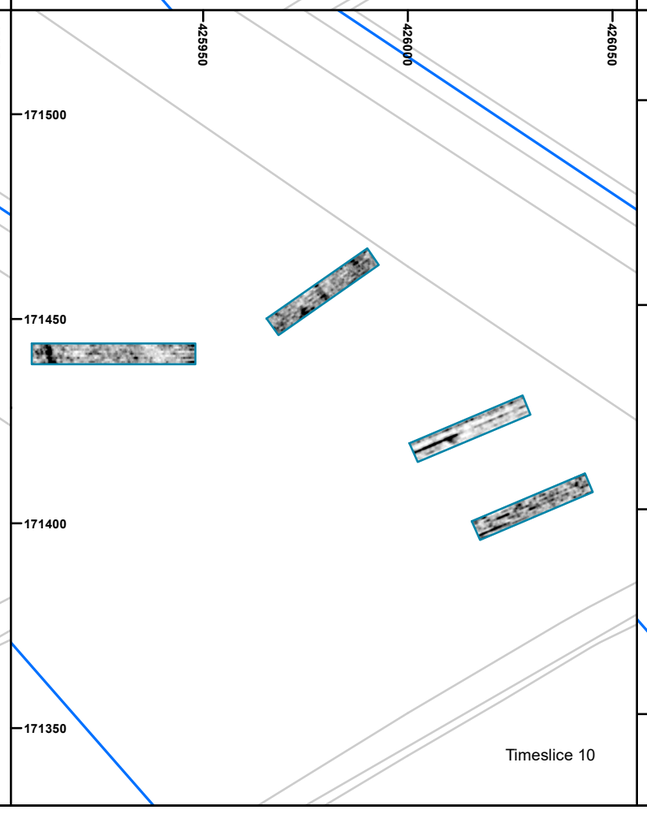
Figure 3

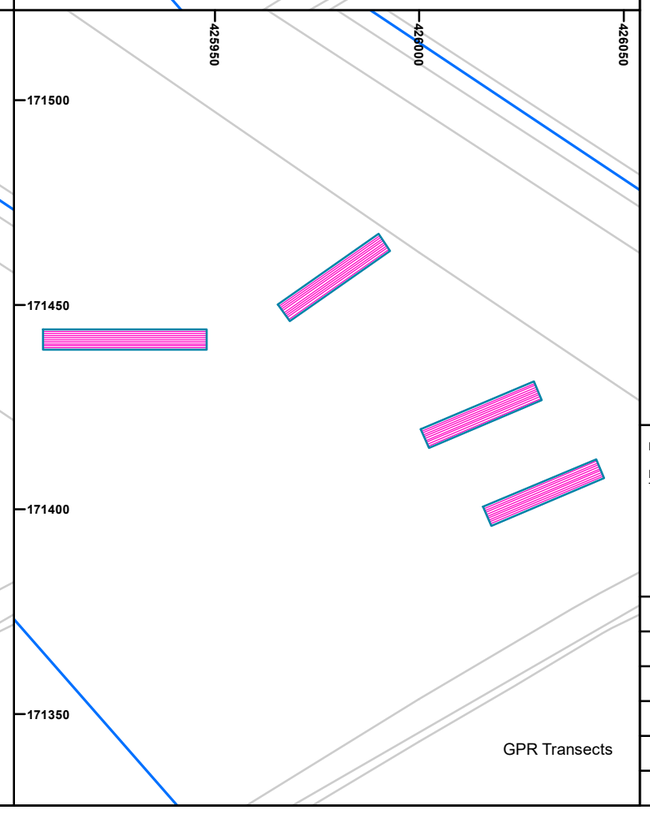












Site Boundary
GPR Survey Extents
GPR Transect

Low Amplitude
High Amplitude
0
50 m

Date:	23/07/2019
Revision Number:	0
Scale:	1:1500 at A3
Illustrator:	AJS
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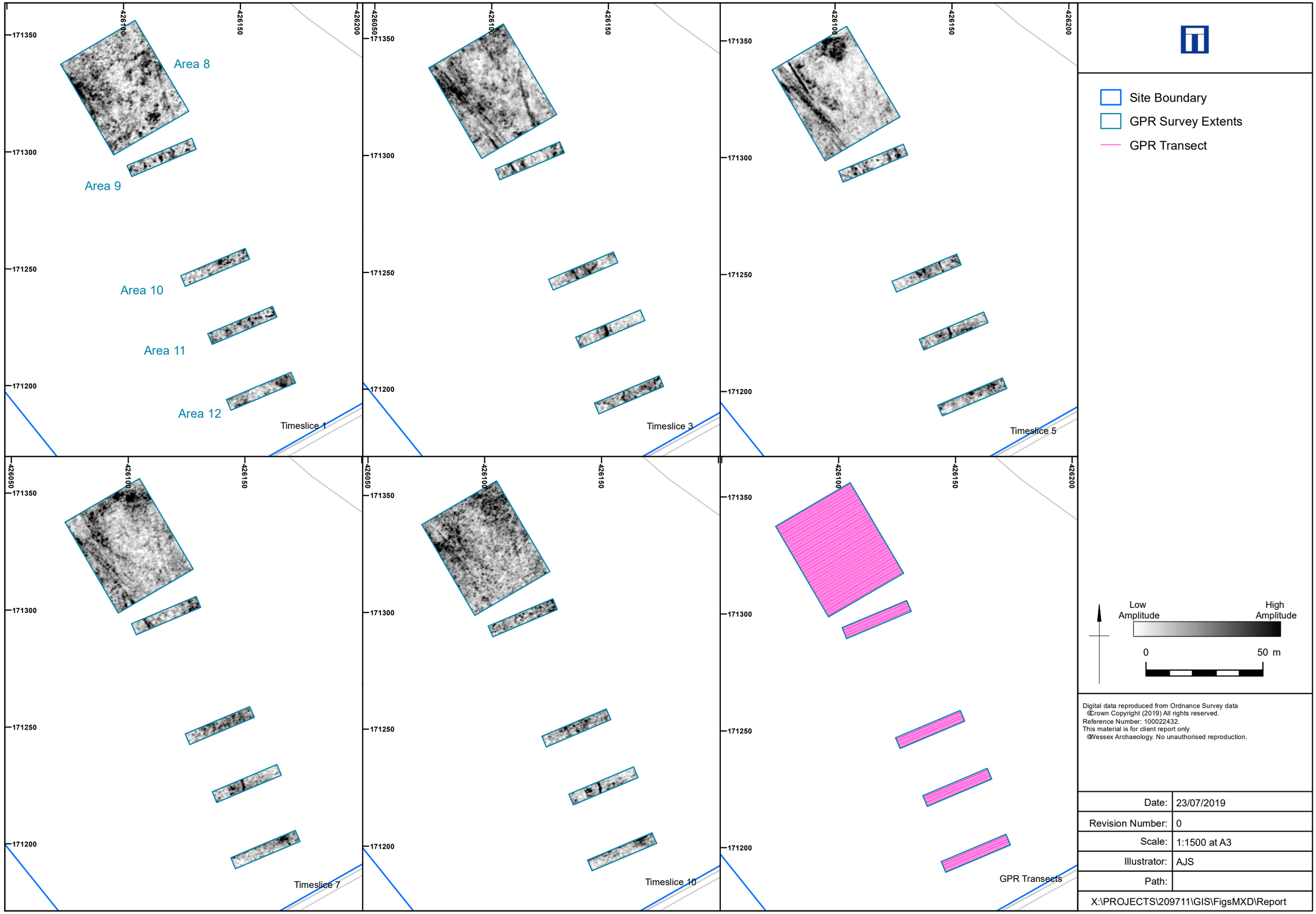
Ground penetrating radar survey results: greyscale (area 4 - 7)

Figure 4



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Revision Number:	0
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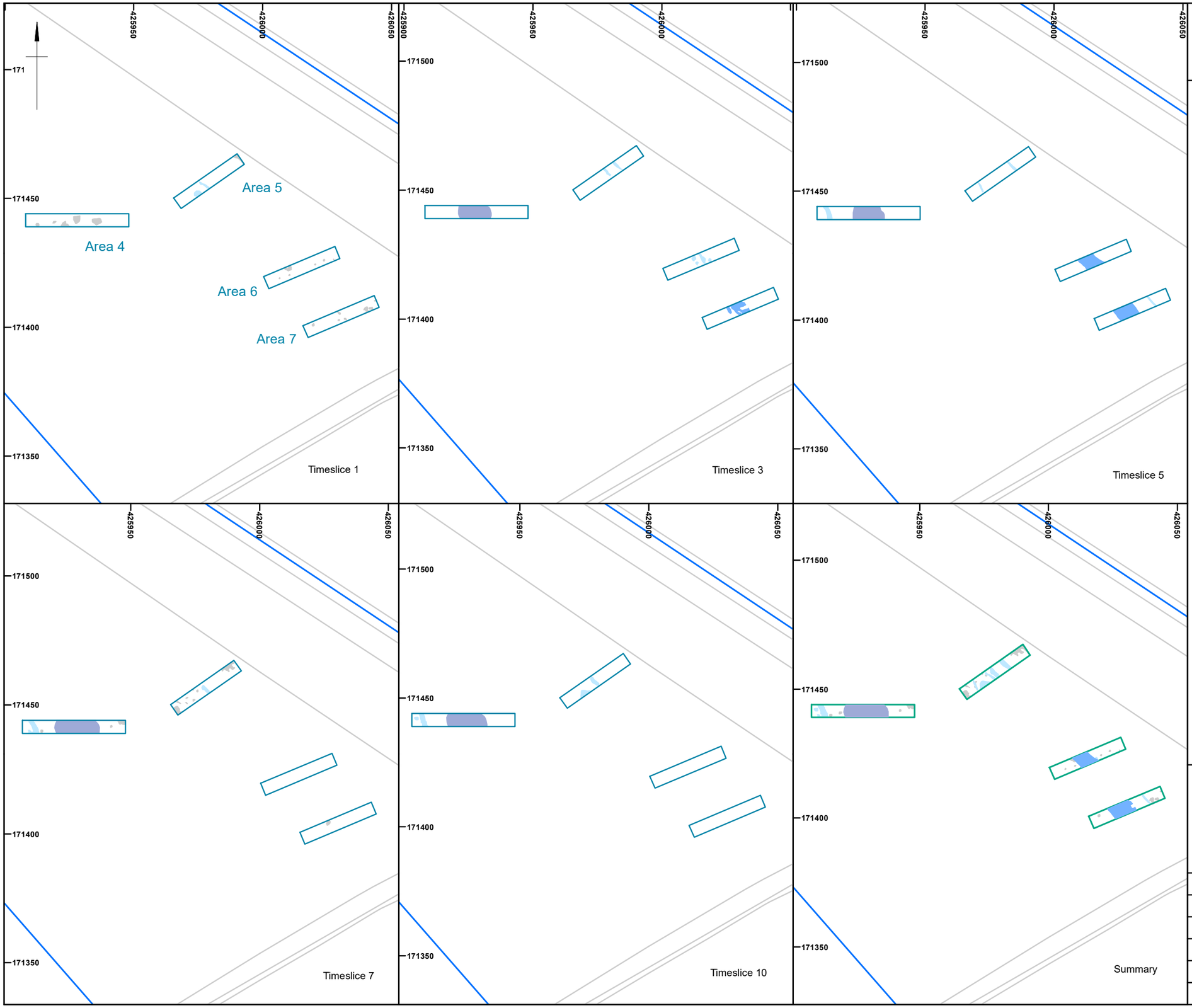
Ground penetrating radar survey results: greyscale (area 8 - 12)

Figure 5



Site Boundary
GPR Survey Extents
18th Century Road
Possible Road Continuation
Building or Wall Foundation
Possible Archaeology
Cut Feature
High Amplitude Response

0 50 m

Date:	23/07/2019
Revision Number:	0
Scale:	1:1500 at A3
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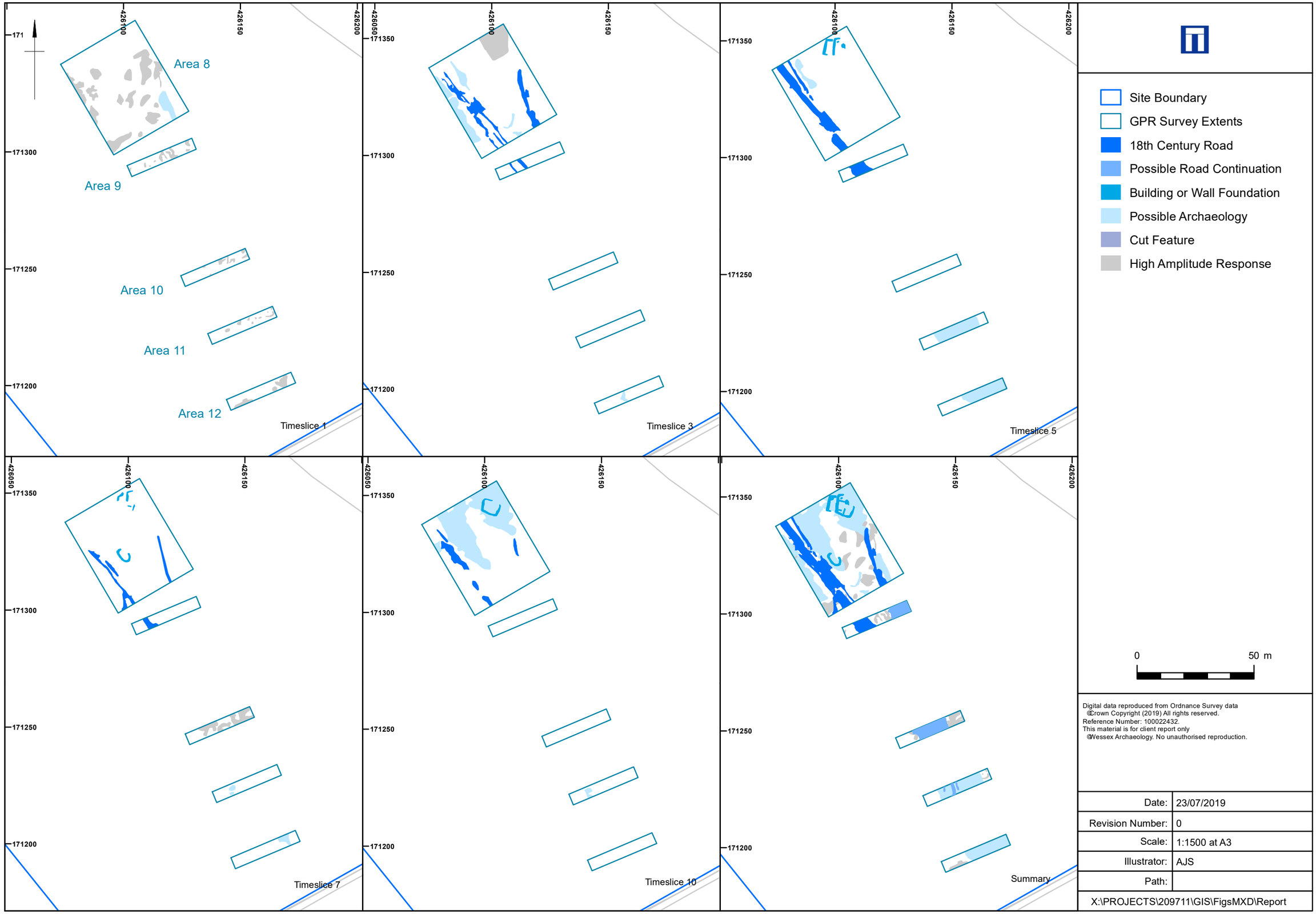
Ground penetrating radar survey results: interpretation (area 4 - 7)

Figure 6



Date:	23/07/2019
Revision Number:	0
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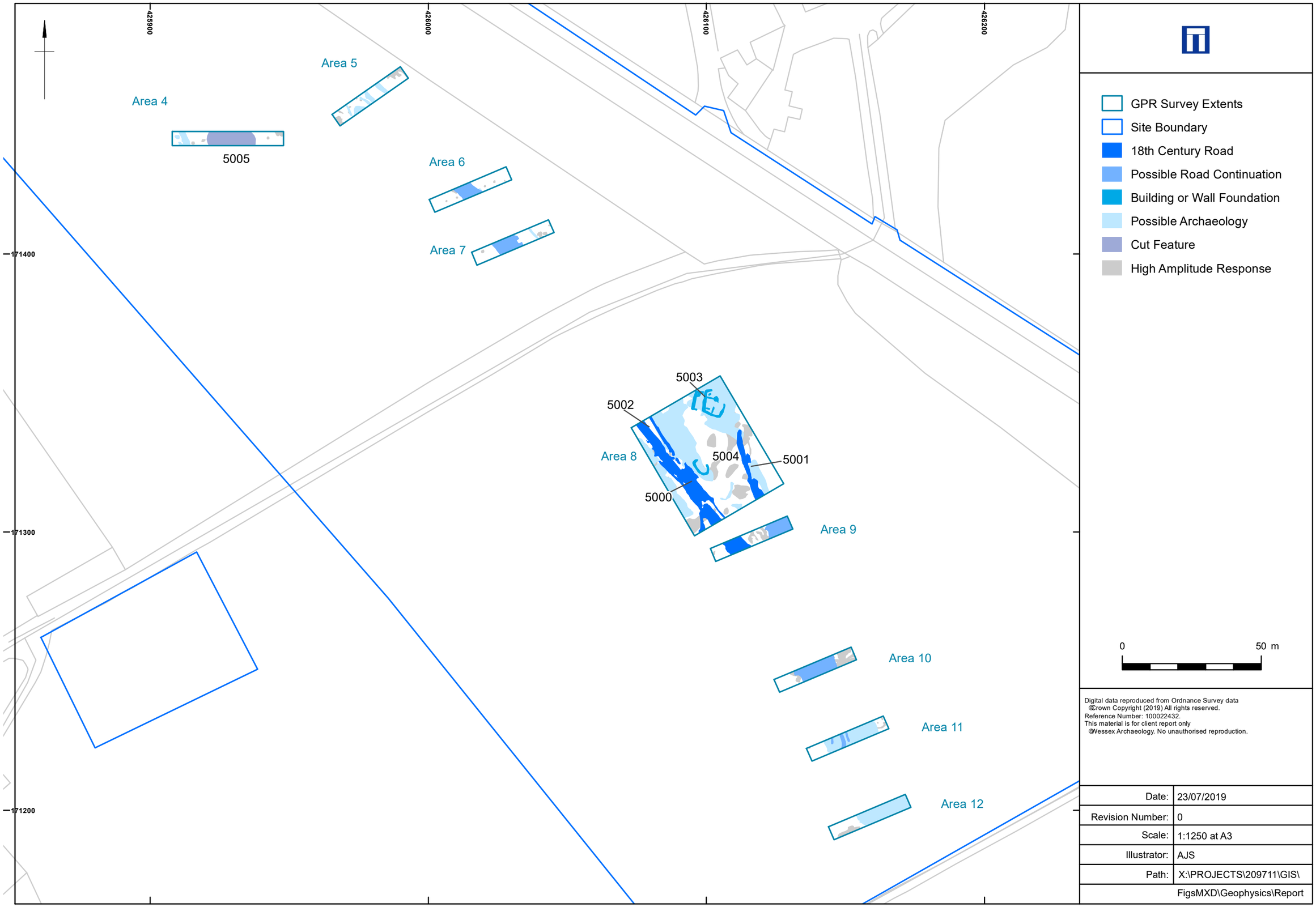
Ground penetrating radar survey results: interpretation (area 8 - 12)

Figure 7



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Revision Number:	0
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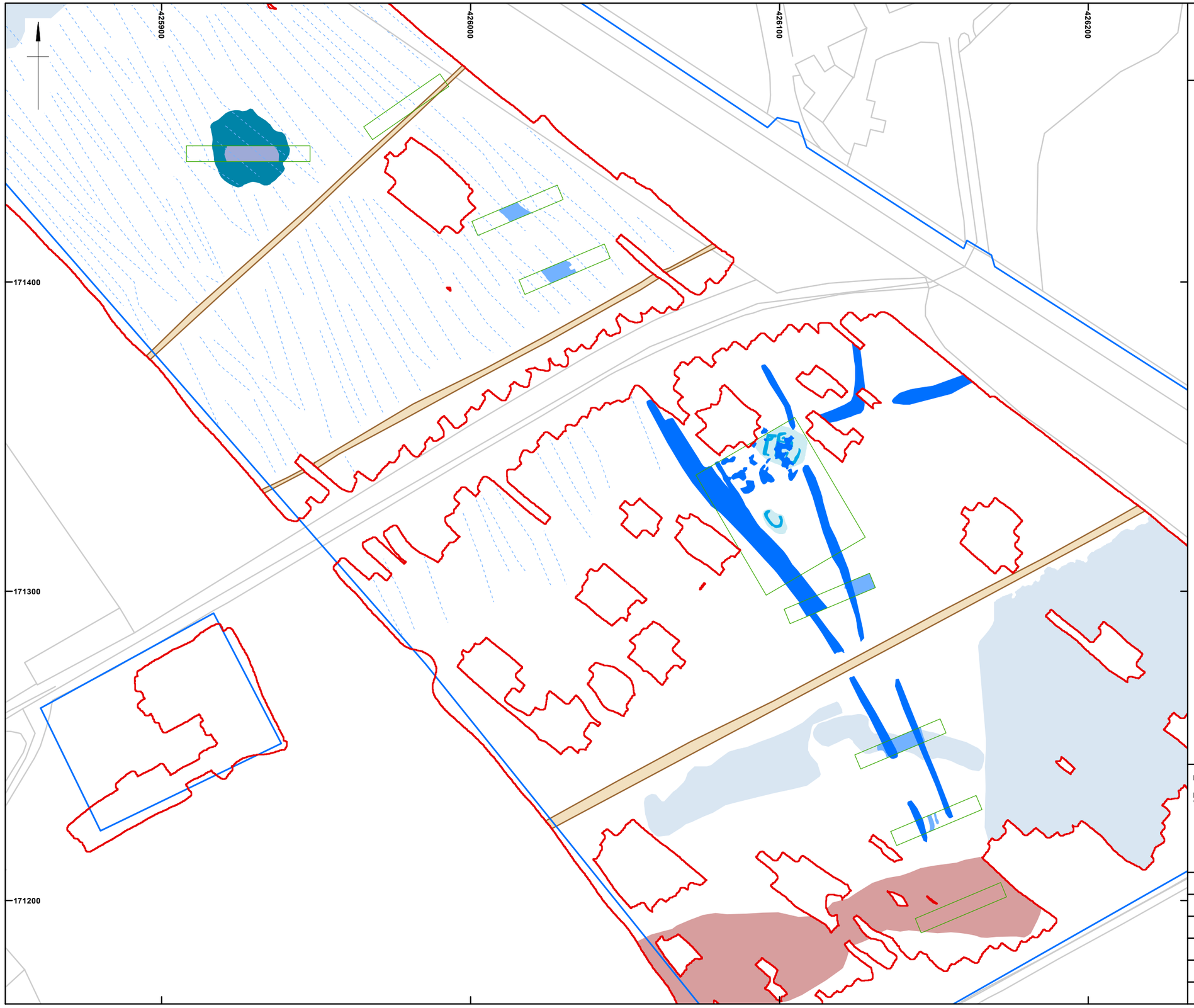
Ground penetrating radar survey results: graphical summary

Figure 8



Gradiometer Survey Extent
GPR Survey Extent
Site Boundary
18th Century Roads
Possible Roman Road
Geological Fissure
Possible Road Continuation
Building Rubble
Cut Feature
Infill/Extraction Deposits
Building or Wall Foundation
Superficial Geology
Modern Service

0 50 m

Date:	22/07/2019
Revision Number:	0
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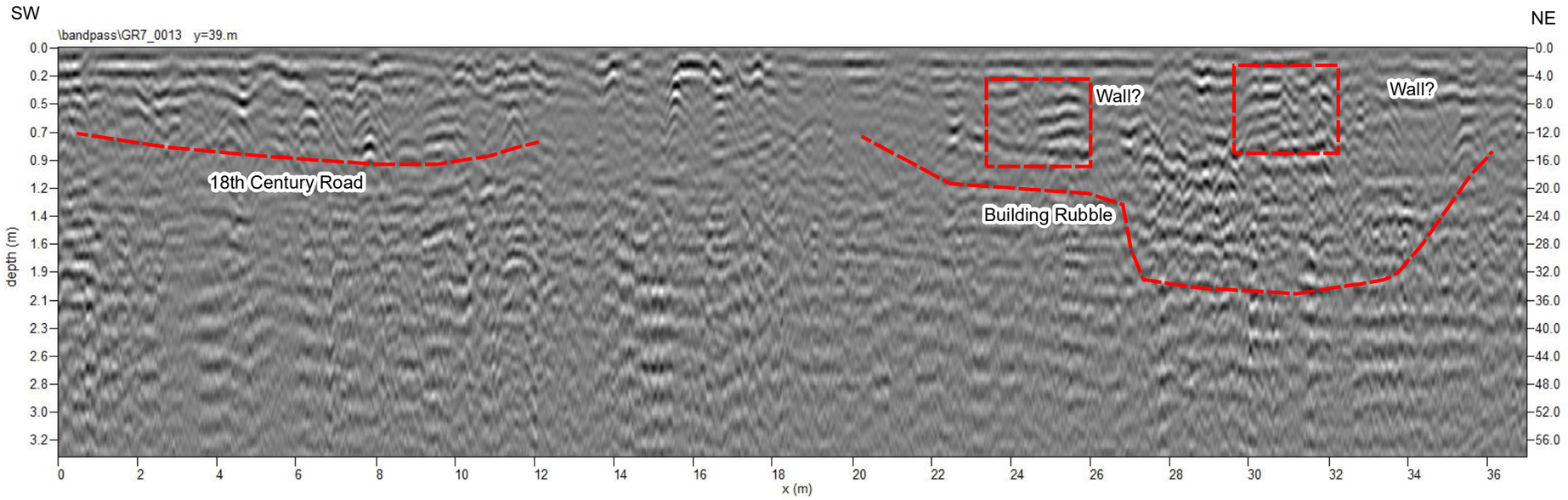
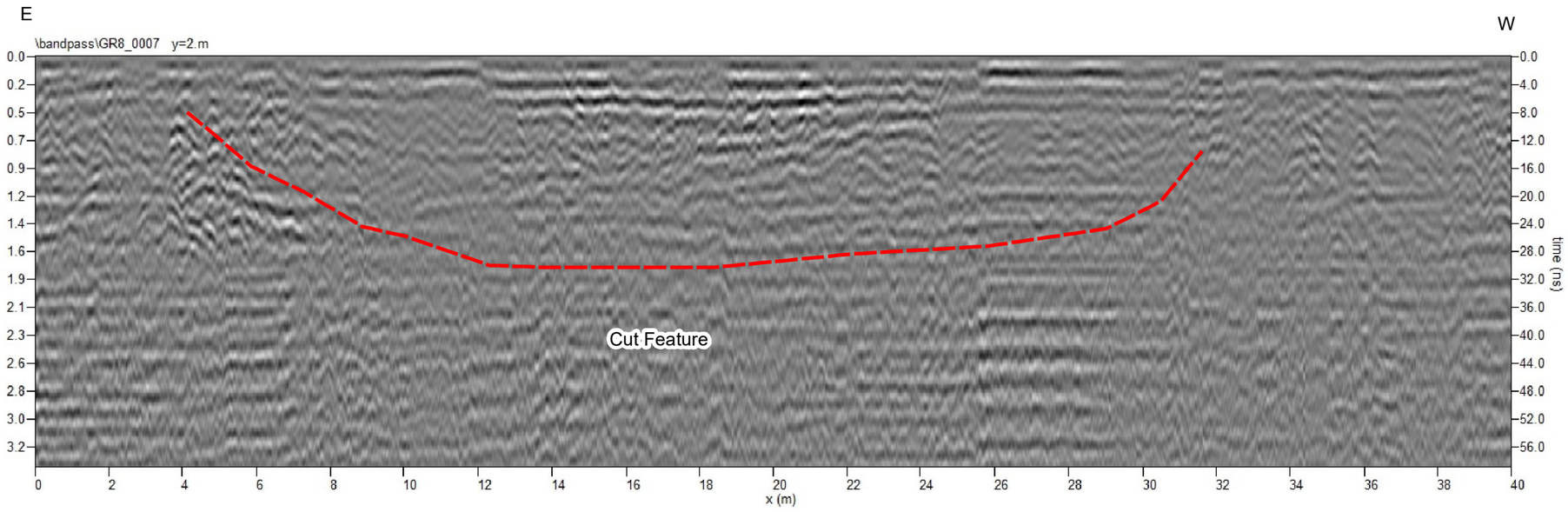
Geophysical survey results: summary

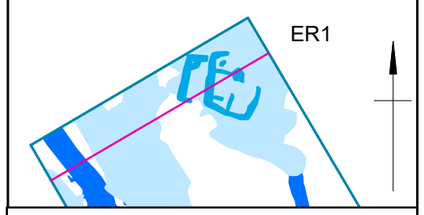
Figure 9



Example Radargram 1



Example Radargram 2



- Example Radargram
- GPR Survey Extents
- 18th Century Road
- Possible Road Continuation
- Possible Archaeology
- Cut Feature

0 35 m

Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	23/07/2019
Revision Number:	0
Scale:	N/A
Illustrator:	AJS
Path:	

X:\PROJECTS\115733\GIS\FigsMXD\Geophysics

GPR survey results: example radargrams

Figure 10

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FS 606559