

**22 Oxford Street  
Lambourn  
West Berkshire**

**A REPORT ON A GROUND PENETRATING RADAR SURVEY**

for

**Mr Bob Brewer**

David Sabin and Kerry Donaldson

March 2016

Ref. no. J650

ARCHAEOLOGICAL SURVEYS LTD

**22 Oxford Street  
Lambourn  
West Berkshire**

Ground Penetrating Radar Survey

for

**Mr Bob Brewer**

Fieldwork by David Sabin  
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey date - 15<sup>th</sup> February 2016  
Ordnance Survey Grid Reference -



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## SUMMARY

Archaeological Surveys Ltd carried out a ground penetrating radar (GPR) survey within the garden of 22 Oxford Street, Lambourn, West Berkshire. The work was carried out as part of research undertaken by the owner Mr Bob Brewer. Excavations within an adjacent site, carried out by Foundations Archaeology in 2007, revealed significant archaeological deposits of Roman and Saxon date and the potential for a villa somewhere in the vicinity. Test pits dug by Mr Brewer in his garden have revealed deposits and features of archaeological potential, but of uncertain extent.

The GPR survey located a number of anomalies that include linear and area features of archaeological potential. In the south eastern part of the garden an area of complex reflectors may indicate the presence of made ground and structural debris, possibly associated with a demolished building. Several linear anomalies were located in the northern part of the garden and these are likely to be associated with former paths and walls, but their full extent was not revealed. Deeper linear features (0.7 - 0.8m) were located at the far western end of the survey. Small areas of complex reflectors were recorded, and at the northern limit of the survey a zone of planar and complex reflectors may indicate structural remains.

## 1 INTRODUCTION

### 1.1 *Survey background*

- 1.1.1 Archaeological Surveys Ltd was commissioned by Mr Bob Brewer to undertake a ground penetrating radar (GPR) survey within the garden of his house at 22 Oxford Street, Lambourn, West Berkshire. The survey forms part of research by Mr Brewer at his property which may be located within an area of significant archaeological potential.
- 1.1.2 In 2007 Foundations Archaeology carried out archaeological investigations ahead of development on land immediately opposite Mr Brewer's property, and this revealed significant archaeological deposits. Roman features suggested the presence of a well-appointed household, possibly a villa, in the vicinity. In addition, several sunken featured buildings were discovered with evidence of Saxon settlement from the 5<sup>th</sup> - 8<sup>th</sup> or 9<sup>th</sup> centuries. Further finds and features of Medieval date were also revealed.

### 1.2 *Survey objectives and techniques*

- 1.2.1 The objective of the survey was to locate geophysical anomalies that may relate to features of archaeological potential within all accessible parts of the garden. In particular, the survey would support evidence of possible structural remains revealed within small test pits dug by Mr Brewer. It was hoped that the survey would provide additional information on the extent, depth, state of

preservation and function of buried features.

- 1.2.2 The methodology is considered an efficient and effective approach to archaeological prospection. The survey and report generally follow the recommendations set out by: English Heritage, 2008, *Geophysical survey in archaeological field evaluation*; Institute for Archaeologists, 2002, *The use of Geophysical Techniques in Archaeological Evaluations*.

### 1.3 Site location, description and survey conditions

- 1.3.1 The site is located within the garden of 22 Oxford Street, Lambourn, West Berkshire. Ordnance Survey National Grid Reference (OS NGR) SU 32821 79048, see Figures 01 and 02.
- 1.3.2 The geophysical survey covers approximately 350m<sup>2</sup> of lawn to the north and east of the property. The area is roughly L shaped, but has irregular boundaries due to vegetative cover, beds and other obstacles around the periphery of the garden. The irregular shape required survey based on three separate baselines in order to provide adequate coverage. A small open test pit to the north of the house was crossed using wooden boards.



*Plate 1: Survey area to the east of the house looking south towards Oxford Street*



*Plate 2: Survey area to the north of the house looking east*

- 1.3.3 The ground conditions across the site were considered to be mainly favourable for the collection of ground penetrating radar data, although some small zones around the periphery were uneven and antenna coupling was less than optimum. Weather conditions during the survey were fine.

#### **1.4 Site history and archaeological potential**

- 1.4.1 Within land on the opposite site of Oxford Street to the survey area excavations were carried out by Foundations Archaeology in advance of Development at Bourne House Stables. The investigations revealed moderate preservation of significant archaeological deposits that included Roman and Saxon material (King, 2009) .
- 1.4.2 Evidence of nearby occupation spanning much of the Roman period was located as well as Saxon settlement in the form of five sunken featured buildings, a possible workshop and an enclosure ditch. The nature of the Roman features and the character of the pottery assemblage may suggest the presence of a well-appointed household in the vicinity.
- 1.4.3 Several small test pits excavated by Mr Brewer have revealed material of Medieval and Roman date within the garden. In addition, evidence of potential structural remains has been located, but not dated. The GPR survey has the potential to locate further unknown features and to further define those already revealed.



## 1.5 *Geology and soils*

- 1.5.1 The underlying geology is from the New Pit Chalk Formation with overlying alluvial deposits from the River Lambourn (BGS, 2016).
- 1.5.2 The overlying soil across the site is from the Coombe 1 association and is a typical brown calcareous earth. It consists of a well drained, calcareous, fine, silty soil (Soil Survey of England and Wales, 1983).
- 1.5.3 GPR survey has proved useful on similar geological and pedological conditions elsewhere. Penetration appears to extend to 1 - 1.5m at 400MHz.

## 2 METHODOLOGY

### 2.1 *Technical synopsis*

- 2.1.1 Ground penetrating radar systems transmit an electromagnetic wave into the ground and record the time delay and amplitude of reflections from buried features. Reflections occur from changes in conductivity or dielectric permittivity.
- 2.1.2 Electromagnetic waves are increasingly attenuated as frequency increases and, therefore, lower frequencies provide greater penetration into the subsurface. However, the longer wavelengths associated with lower frequencies reduce the resolution of buried features. Typical frequencies chosen for archaeological prospection are around 500 and 200 MHz.

### 2.2 *Equipment configuration and data collection*

- 2.2.1 Ground penetrating radar data were acquired using an Utsi Electronics Groundvue 3A system running with a 400MHz shielded antenna. The system utilises a wheeled encoder on a small cart. A dielectric constant of 10 was used in the field to set up the instrument and view data. The value is for display purposes only and does not affect the recorded data. A value of 80ns (nanoseconds) was chosen for the time sweep (two way GPR signal travel time) in order to balance potential depth of penetration and resolution.
- 2.2.2 Data were collected from scans recorded at 0.0295m along traverses separated by 0.25m. The data captured along each traverse were logged to an internal disk drive to allow further processing and analysis.

### 2.3 *Survey grid and base mapping*

- 2.3.1 Ground penetrating radar data were collected along traverses originating from three separate baselines in order to avoid a number of obstacles within the garden, see Figures 03 - 05. A simple base map was surveyed using RTK GPS and this was used as the background for GPR time slices and abstraction with interpretation.



2.3.2 The survey baselines and background plan were surveyed to the Ordnance Survey OSGB36 datum using a Leica GS10 RTK GPS. The GPS is used in conjunction with Leica's Smartnet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

## 2.4 Data processing

2.4.1 Ground penetrating radar data were analysed using REFLEX v8 software. Each traverse was analysed as an individual profile or radargram to allow a manual assessment of anomalies. In addition, profiles across each survey area were combined and processed in order to create time slices showing the variation in reflector amplitude at various depths. The following processing has been carried out on GPR data captured during this survey:

- background removal - improves the appearance of the data by removal of strong horizontal bands,
- gain - increased with time in order to amplify weaker reflections from deeper features,
- bandpass filtering - lowers noise by the removal of energy below 200MHz and above 800MHz.

2.4.2 Time slices were analysed using both absolute and envelope reflectivity strengths. The latter use a square root function of the energy at an instant in time and is generally the preferred option; however, occasionally the absolute values provide more detailed anomalies.

## 2.5 Data presentation

2.5.1 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area. Approximate depths to anomalies are added to the abstraction and interpretation plot.

2.5.2 The main form of data display prepared for this report is a colour plot derived from Reflex as a TIF file. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.5.3 The raster images are combined with base mapping using ProgeCAD Professional 2016 creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. A digital archive, including raster images, is produced with this report, see Appendix D below.

## 3 RESULTS

### 3.1 General overview

- 3.1.1 The GPR survey located linear, discrete and complex anomalies within the survey area. Several were classified as having archaeological potential with others classified as of uncertain origin.
- 3.1.2 A velocity of 0.07m/ns was calculated using hyperbola matching. There were very few clear hyperbola that could be used for the analysis but the velocity would be consistent with the damp soil encountered across the site.

### 3.2 Statement of data quality

- 3.2.1 The GPR data were collected with due consideration given to surface conditions, obstructions and area constraints. GPR signals appear to have achieved moderate penetration with maximum depth likely to be approximately 1.3m.

### 3.3 Data interpretation

- 3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the radar anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics.







Report sub-heading CAD layer names and plot colour	Description and origin of anomalies
<p><b>Anomalies with archaeological potential</b></p> <p>AS-ABST GPR LINEAR ARCHAEOLOGY   AS-ABST GPR AREA ARCHAEOLOGY   AS-ABST GPR DEBRIS ARCHAEOLOGY </p>	<p>Anomalies have the characteristics of a range of archaeological features such as walls, structures, etc..</p>
<p><b>Anomalies with an uncertain origin</b></p> <p>AS-ABST GPR LINEAR UNCERTAIN   AS-ABST GPR DISCRETE UNCERTAIN   AS-ABST GPR AREA UNCERTAIN </p>	<p>The category applies to a range of anomalies where <u>there is not enough evidence to confidently suggest an origin</u>. Anomalies in this category <u>may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered</u>.</p>

Table 1: List and description of GPR interpretation categories

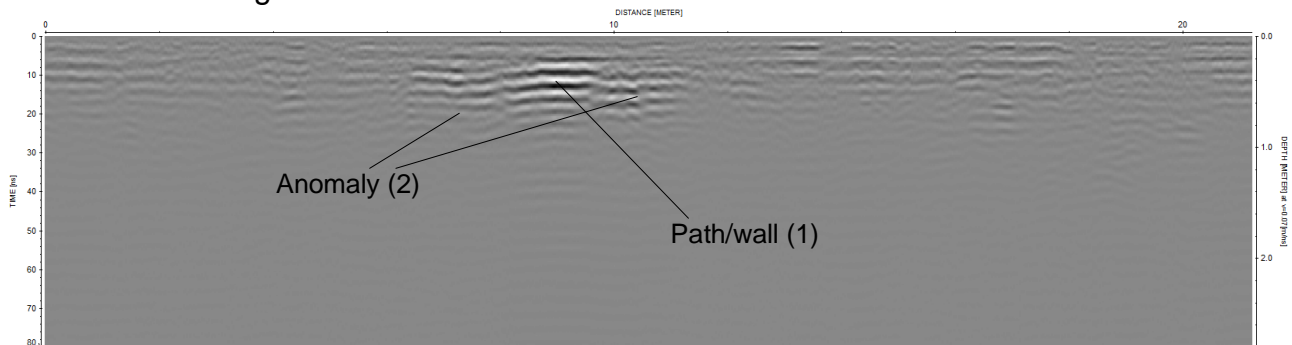
### 3.4 List of ground penetrating radar anomalies

Survey centred on OS NGR 432821 179048, see Figs ??.

#### *Anomalies with archaeological potential*

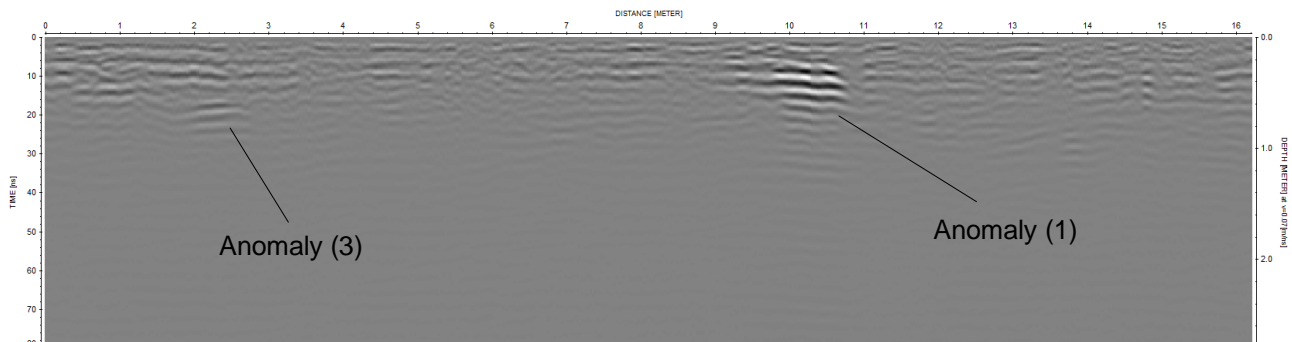
(1) - A broad linear response appears at approximately 0.15m depth. The feature has been partly excavated revealing a path-like structure constructed from brick, chalk, cinders, etc. but utilising the remains of a more substantial wall with a sarsen facing.

(2) - An area of strong reflections immediately north of the house and located either side of anomaly (1). The response is slightly deeper at approximately 0.25m. The area may represent ground make up and consolidation at the back of the house. See Radagram 1 below.



*Radagram 1: Traverse crossing anomalies (1) and (2) (File LB087)*

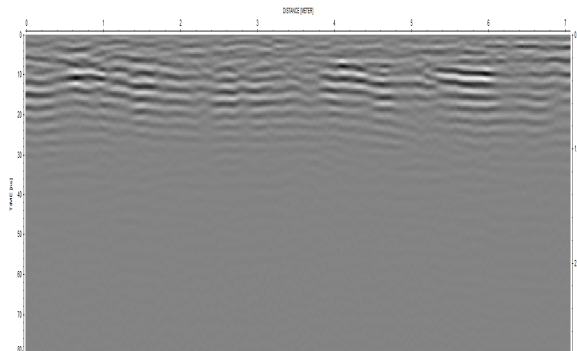
(3) - A linear response in two parts separated by the presence of a small tree. The feature appears at approximately 0.45m depth and cannot be resolved below about 1m, see Radagram 2. A small excavation trench targeted on the feature has revealed a potential wall.



*Radagram 2: Traverse showing possible wall anomaly (3) (File LB200)*

(4) - An area of complex reflectors close to the garden boundary with Oxford Street, see Radagram 3. A vague rectilinear outline highlights more intense response possibly relating to structural remains. The complex GPR reflectors relate to made ground and the presence of structural debris. The responses are very shallow and

start at the near surface extending to a depth of approximately 1m.



*Radargram 3: Traverse showing variable ground make up (File LB005)*

#### *Anomalies with an uncertain origin*

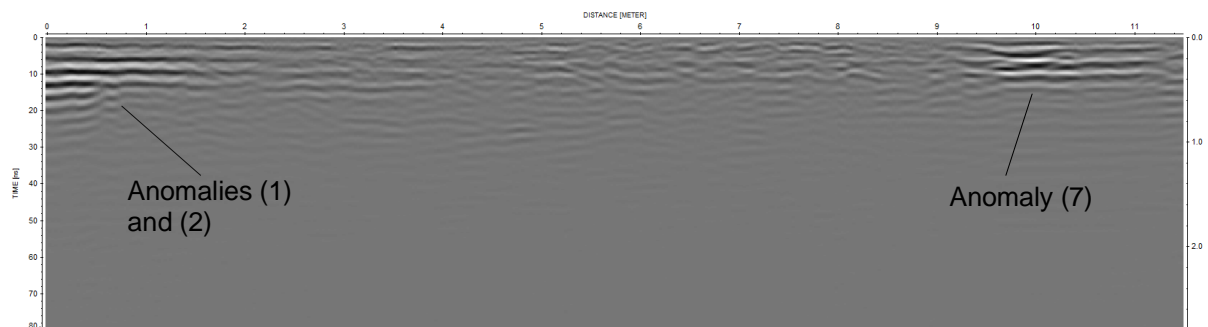
(5) - The south eastern part of the garden contains several near surface, narrow linear anomalies appear to rapidly fade with depth. It is possible that they may relate to former garden features of relatively modern origin.

(6) - At the south western corner of the site a linear feature crosses part of the survey area with a depth of approximately 0.8m. Towards its southern end is a small zone of complex reflectors the majority of which also appear strongly at a similar depth, although some are much shallower. The anomalies are located within the vicinity of a former well and may be associated.

(7) - Parallel with anomaly (3) are several short linear anomalies that appear at a greater depth but may be associated.

(8) - Several small zones of complex reflectors in the north eastern part of the garden. Surface conditions were variable and the responses occur at or near the surface suggesting some variable ground make-up and poor antenna coupling.

(9) - A zone of strong reflectors located at the northern tip of the survey. The responses appear near the ground surface but tend to resolve strongly at approximately 0.25m depth into a possible surface or structure extending beyond the limit of the survey. The reflectors fade rapidly beyond approximately 0.5m depth. See Radargram 4.



*Radargram 4: Strong reflectors relating to anomaly (7) (File LH180)*

(10) - Shallow layers of complex reflectors suggesting near surface ground make-up or former garden features.

(11) - A strong discrete anomaly within the central part of the surveyed area was investigated and proved to be associated with a Victorian drain.

## 4 CONCLUSION

- 4.1.1 The GPR survey located a number of anomalies across the site despite the limited area of survey. Several anomalies were classified as having archaeological potential as it appears likely that they are related to structural remains and debris. Several linear features could not be confidently interpreted; some may represent former garden features whilst others could be associated with structural remains or services.
- 4.1.2 To the east of the house, within the south eastern part of the survey area, a zone of complex responses relates to made ground that contains some structural debris. A vague rectilinear form was abstracted from time slices and this may represent part of the remains of an earlier building within this area.
- 4.1.3 To the north and north west of the house there are several linear anomalies the majority of which have an orientation similar to the existing buildings. A broad and very strong linear response had been located previously by a small excavation, and this appears to indicate a pathway possibly utilising the remains of a substantial wall. Close to the house it appears to be flanked by a made surface or consolidated ground. A strong response to a linear anomaly further to the west (3) may also indicate the location of a former wall. Parallel with this are several other linear responses of uncertain origin that are weak and/or fragmented and appear at greater depths (approximately 0.7m).
- 4.1.4 At the south western limit of the survey, a deep linear response and area of complexity was located. The features may be associated with a former well known to exist within the vicinity. A small area of strong reflectors at the northern limit of the survey may indicate a former surface. It is located in the vicinity of possible wall remains identified by excavation.

## 5 REFERENCES

British Geological Survey, 2016. *Geology of Britain viewer, 1:50 000 scale [online]* available from <http://maps.bgs.ac.uk/geologyviewer/> [accessed 16/03/2016].

Chartered Institute for Archaeologists, 2014. *Standard and Guidance for archaeological geophysical survey*. IfA, University of Reading.

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1*. 2<sup>nd</sup> ed. Swindon: English Heritage.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IfA Paper No. 6. IfA, University of Reading.

King, D., 2009. *Foundations Archaeology*. Summary notes in CBA Wessex News, p23.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 6 South East England*.

## Appendix A – digital archive

Archaeological Surveys Ltd hold the primary digital archive at offices in Wiltshire (see inside cover for address).

Surveys are reported on in hardcopy using A4 for text and A3 for plots (all plots are scaled for A3).

This report has been prepared using the following software on a Windows XP platform:

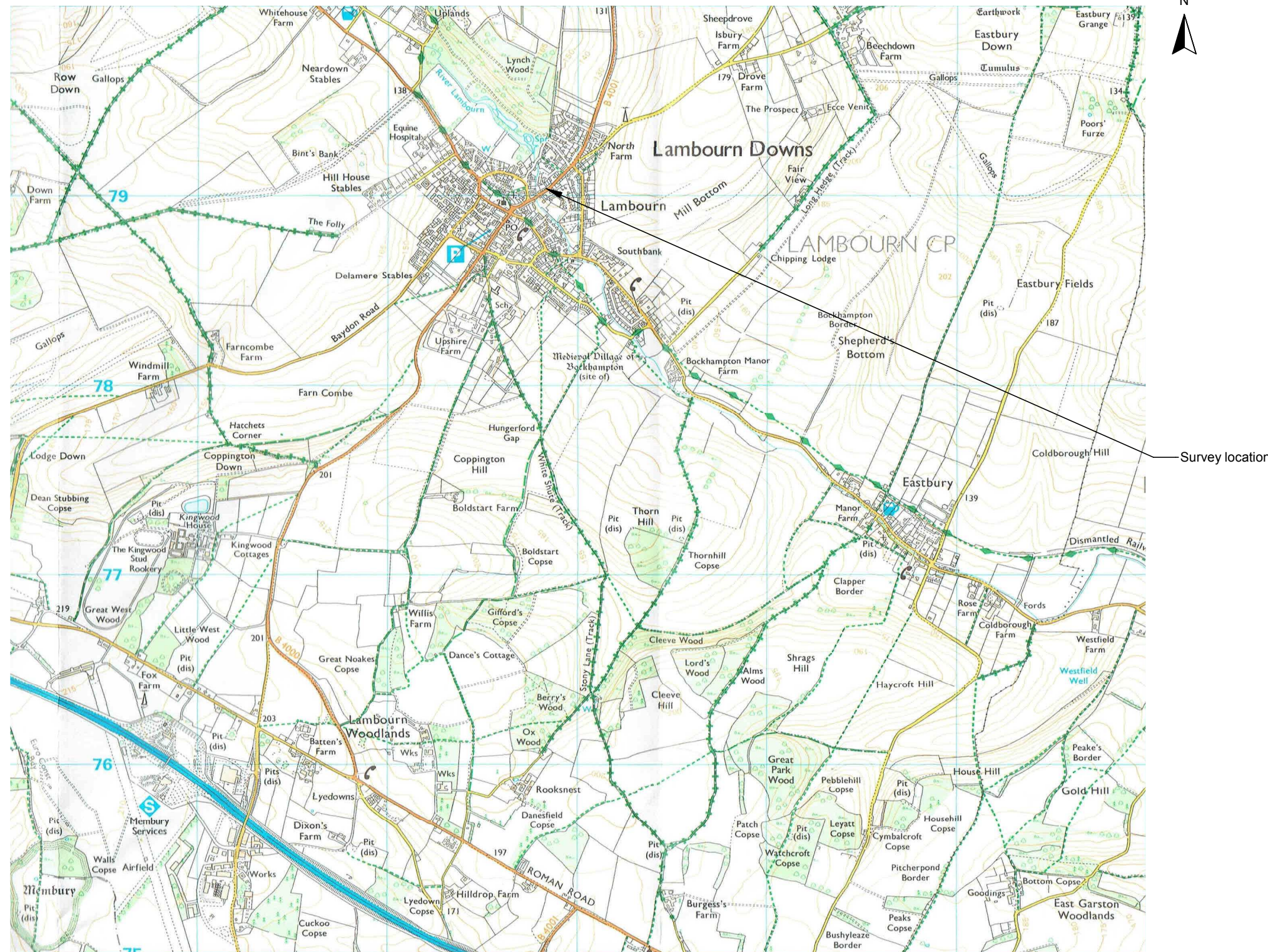
- Reflex v8 (GPR data analysis)
- ProgeCAD Professional 2016 (report plots),
- OpenOffice.org 4.1.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).



**Geophysical Survey  
22 Oxford Street  
Lambourn  
West Berkshire**

**Map of survey area**

Reproduced from OS Explorer map no.158 1:25 000  
by permission of Ordnance Survey on behalf of The  
Controller of Her Majesty's Stationery Office.  
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Licence number 100043739.



● Survey location

Site centred on OS NGR  
SU 32821 79048

SCALE 1:25 000



SCALE TRUE AT A3



**Geophysical Survey  
22 Oxford Street  
Lambourn  
West Berkshire**

**Location of survey area**



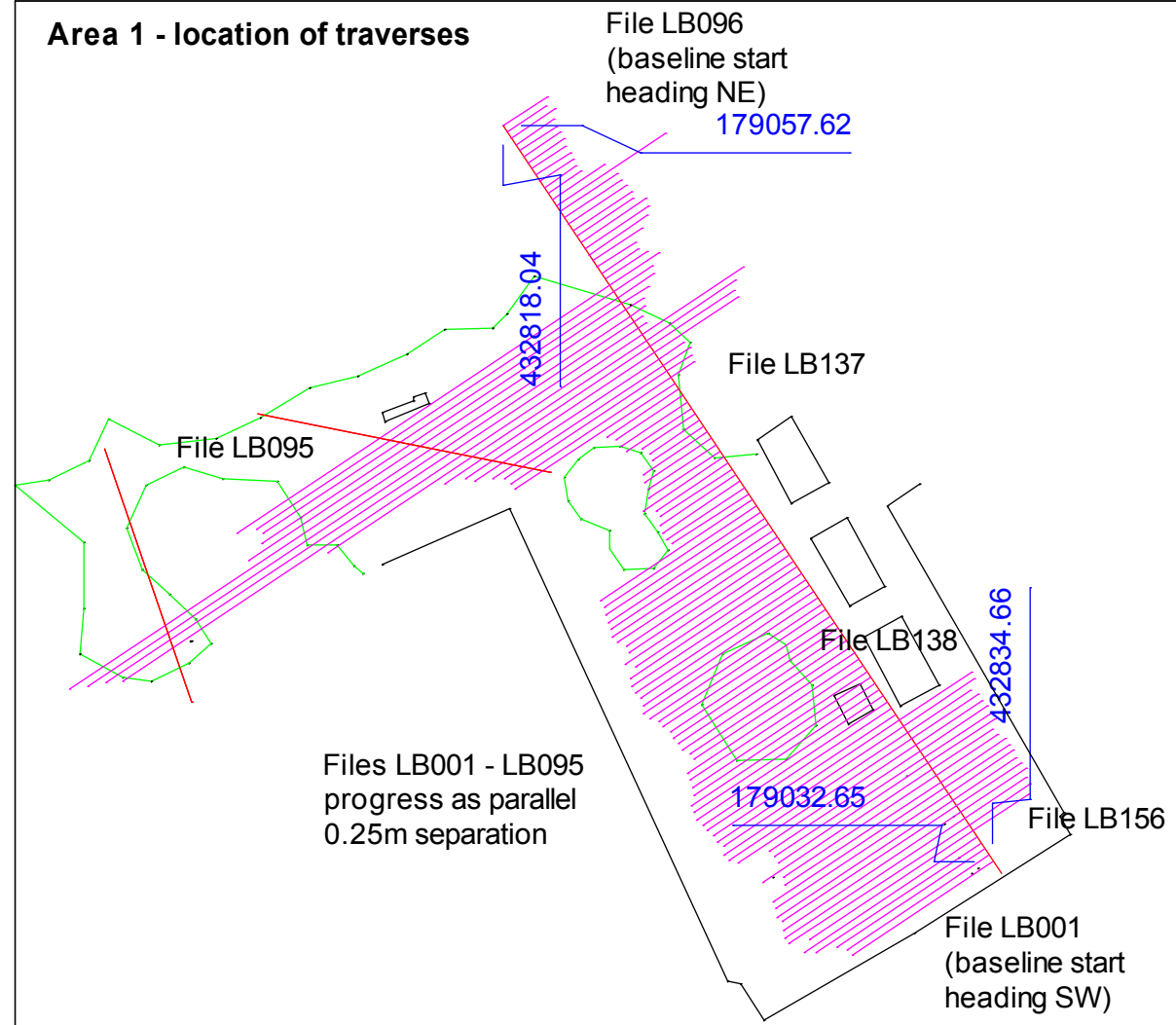
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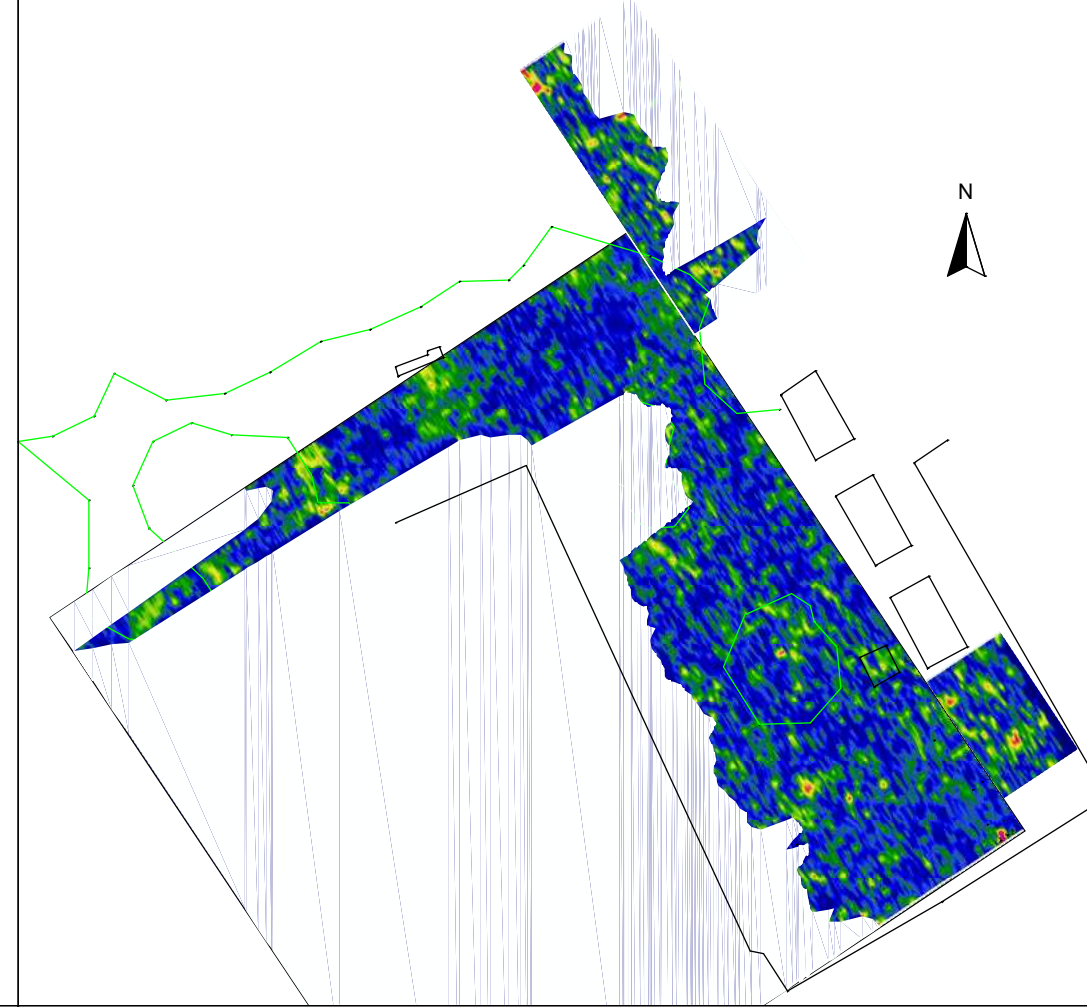
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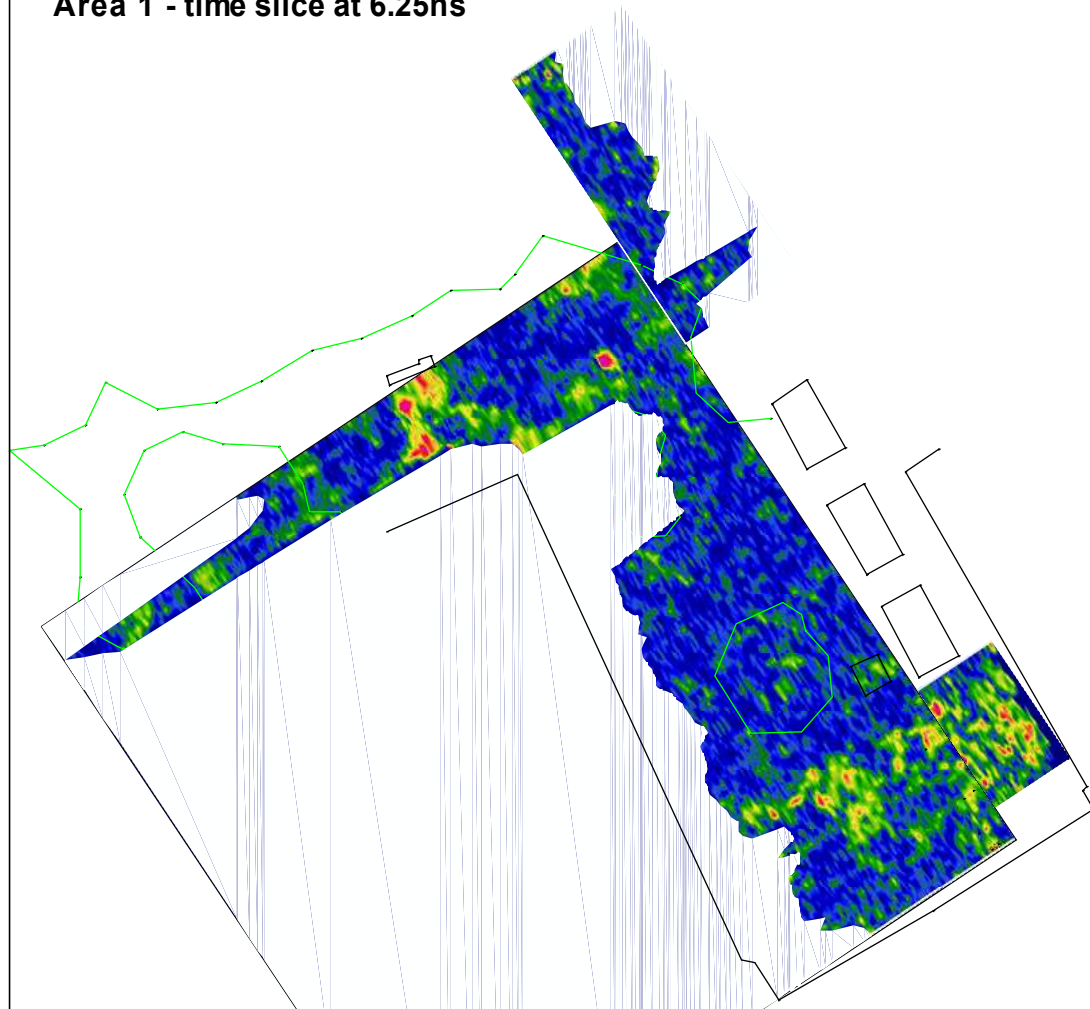
**Area 1 - location of traverses**



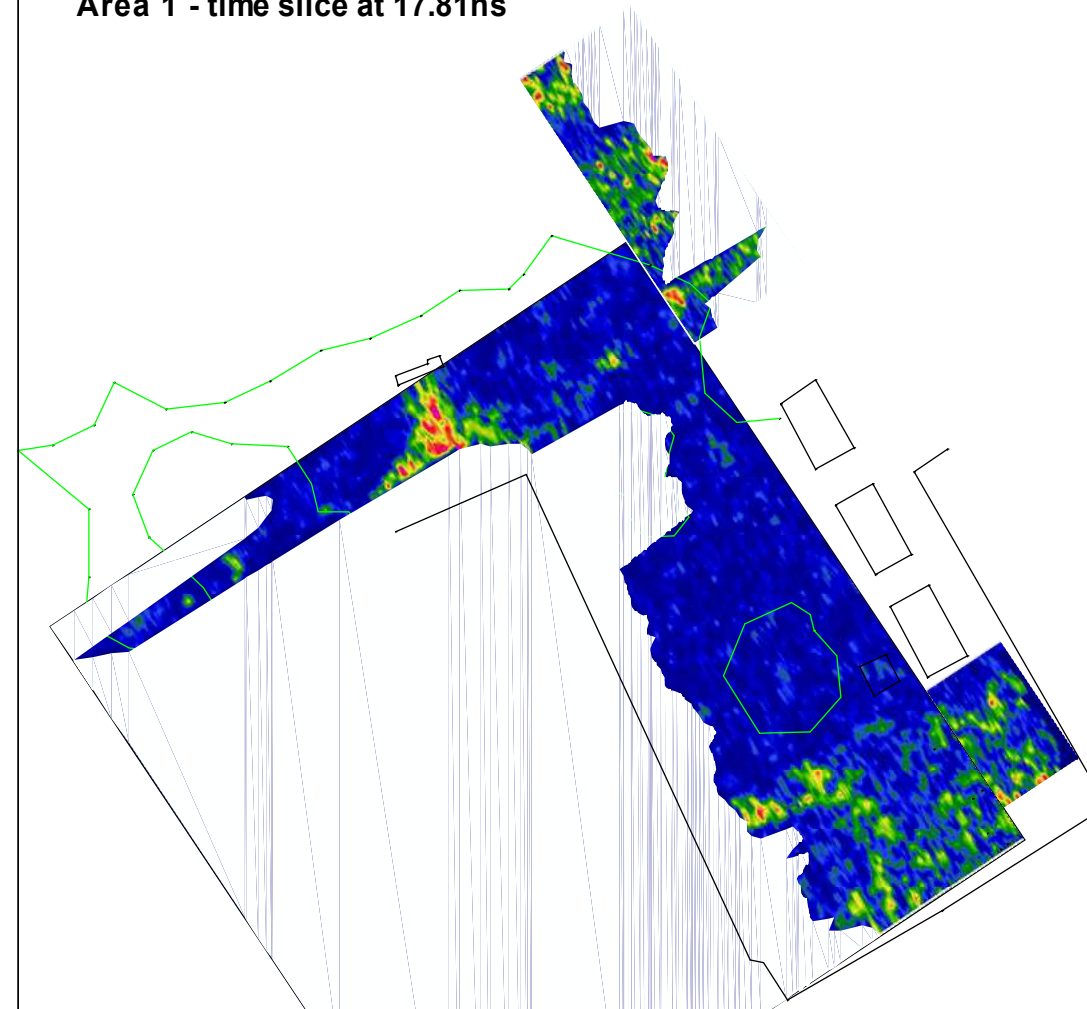
**Area 1 - time slice at 2.81ns**



**Area 1 - time slice at 6.25ns**



**Area 1 - time slice at 17.81ns**



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**Ground penetrating radar  
time slices - Area 1**

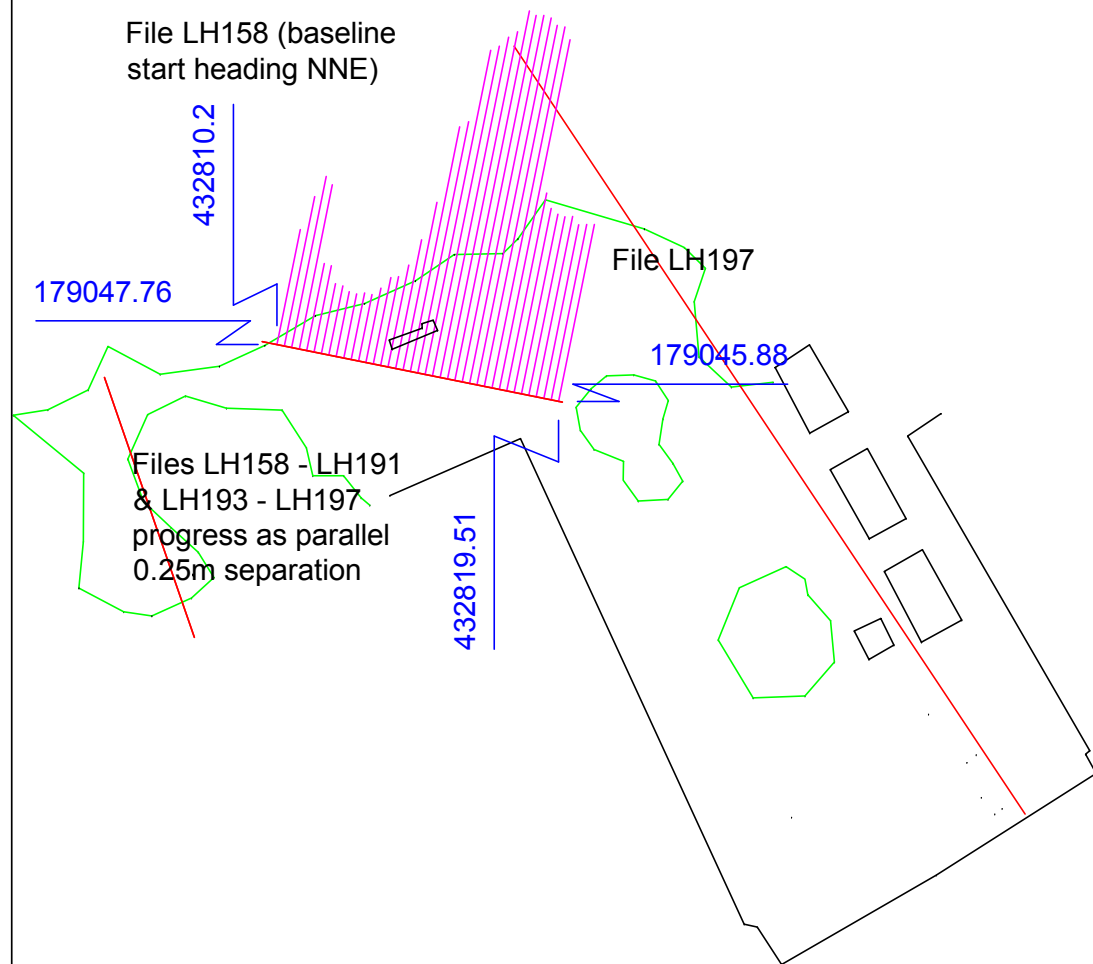


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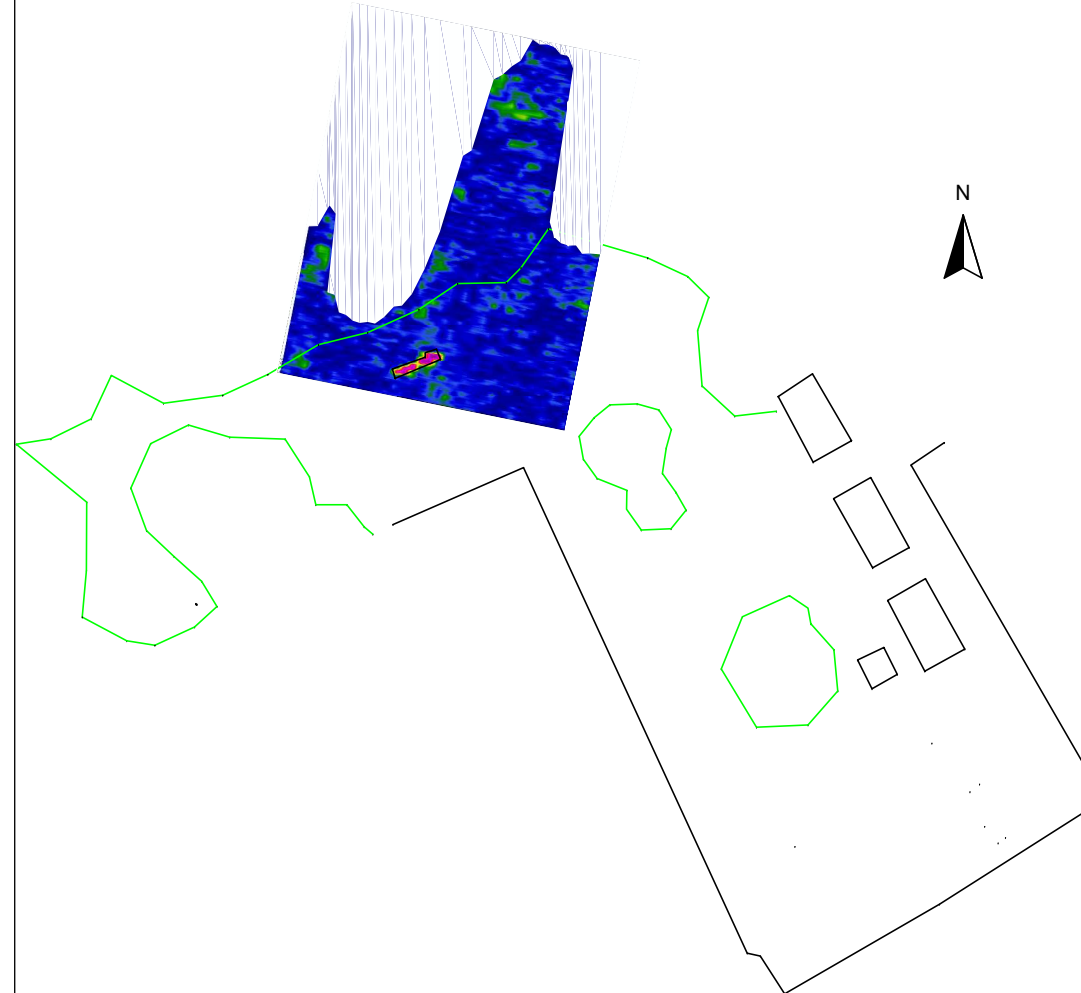


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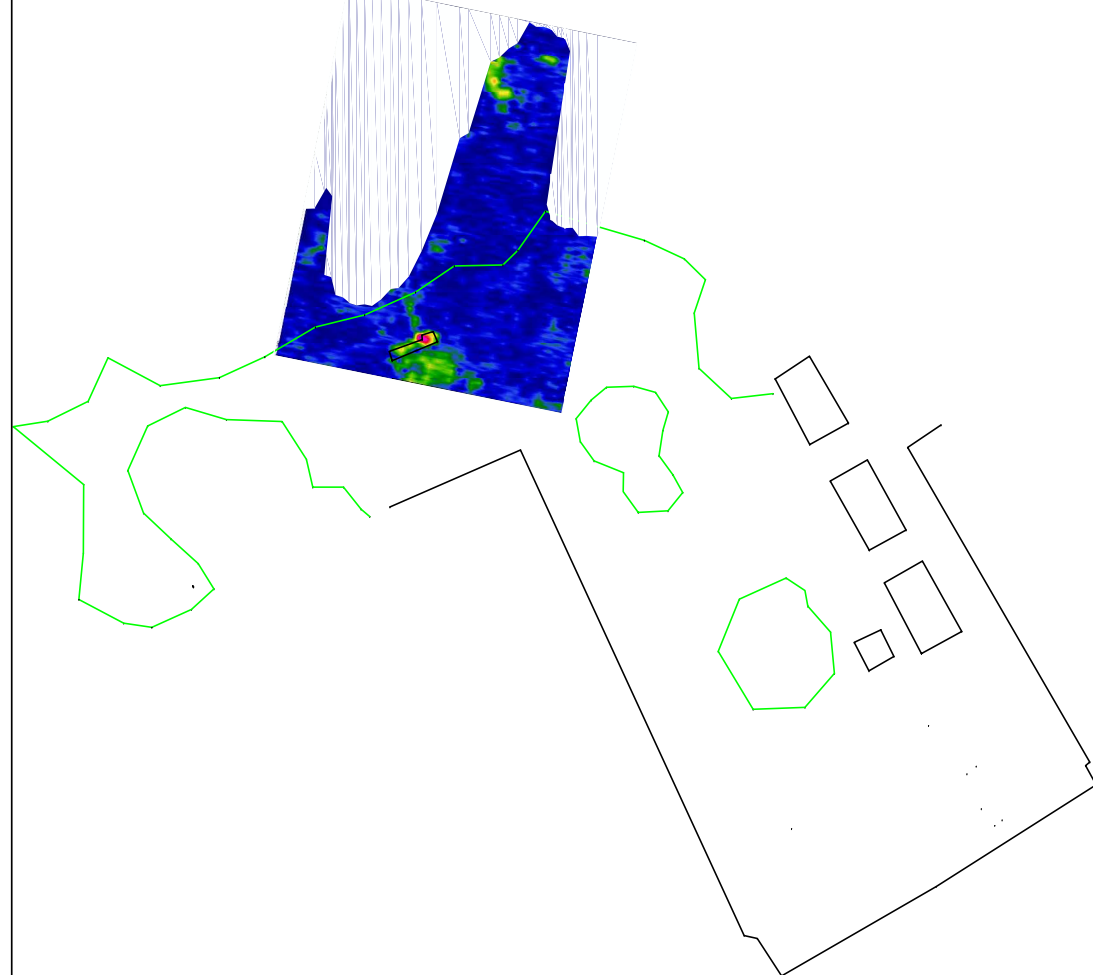
**Area 2 - location of traverses**



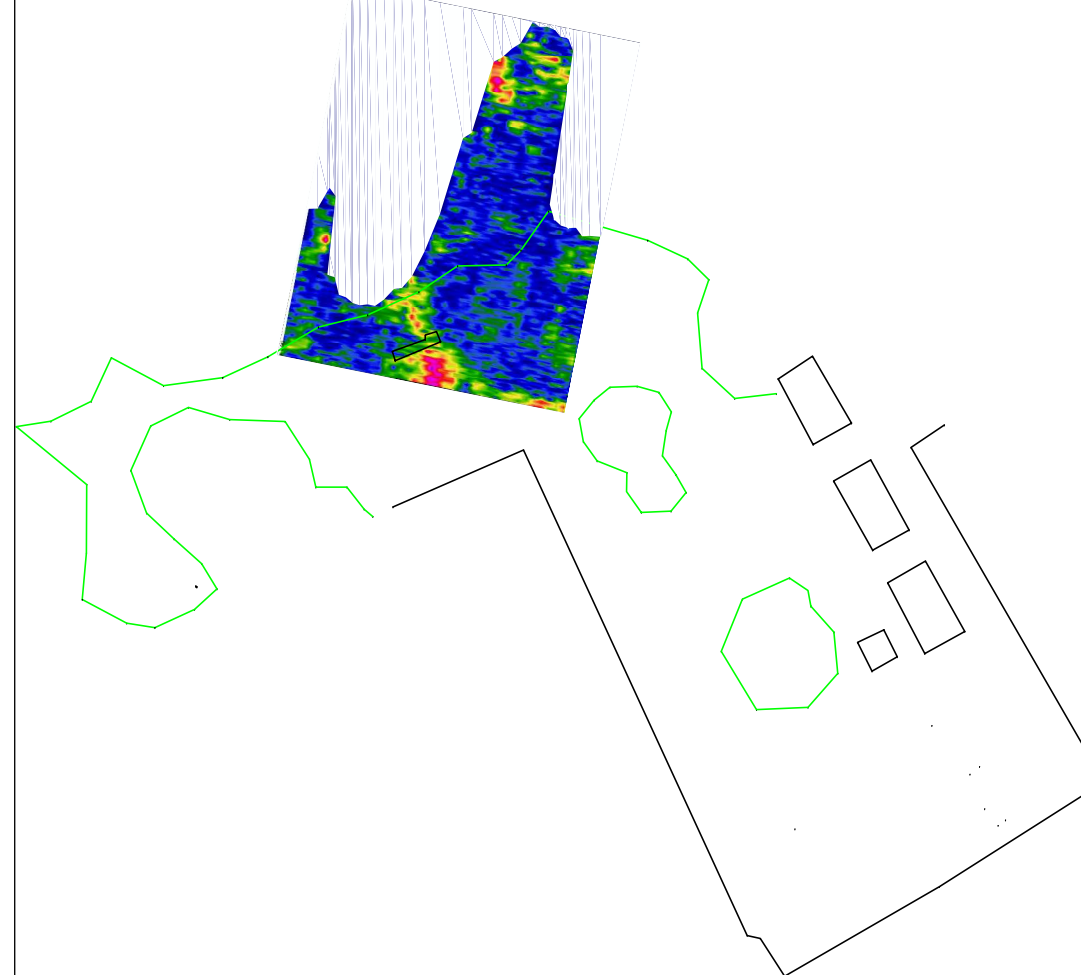
**Area 2 - time slice at 2.81ns**



**Area 2 - time slice at 6.25ns**



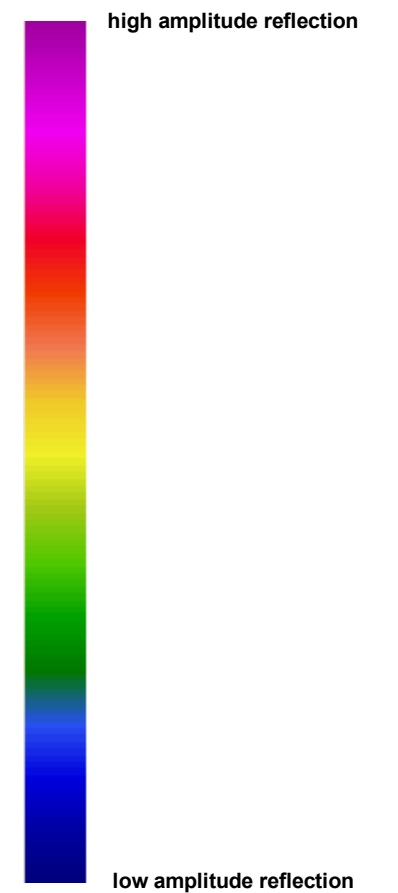
**Area 2 - time slice at 9.06ns**



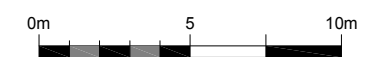
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**Ground penetrating radar  
time slices - Area 2**

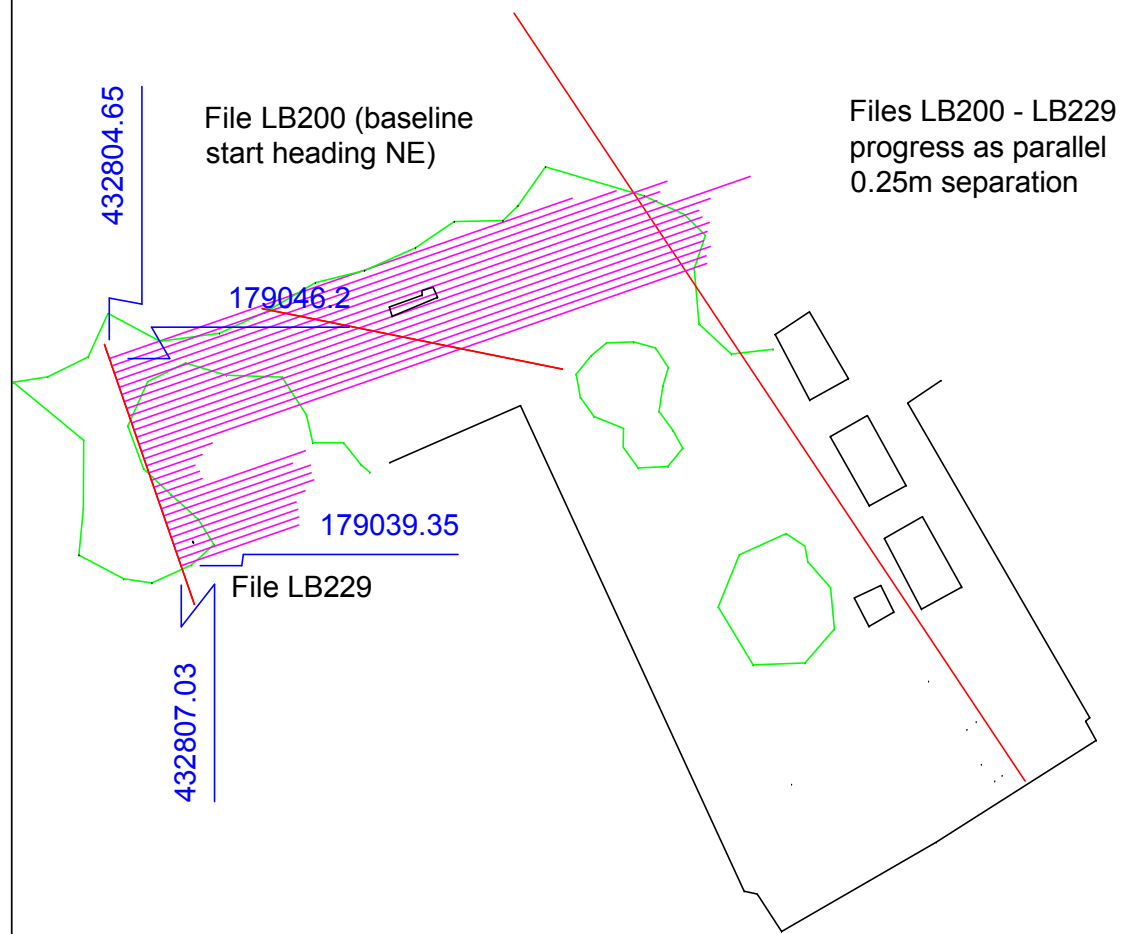


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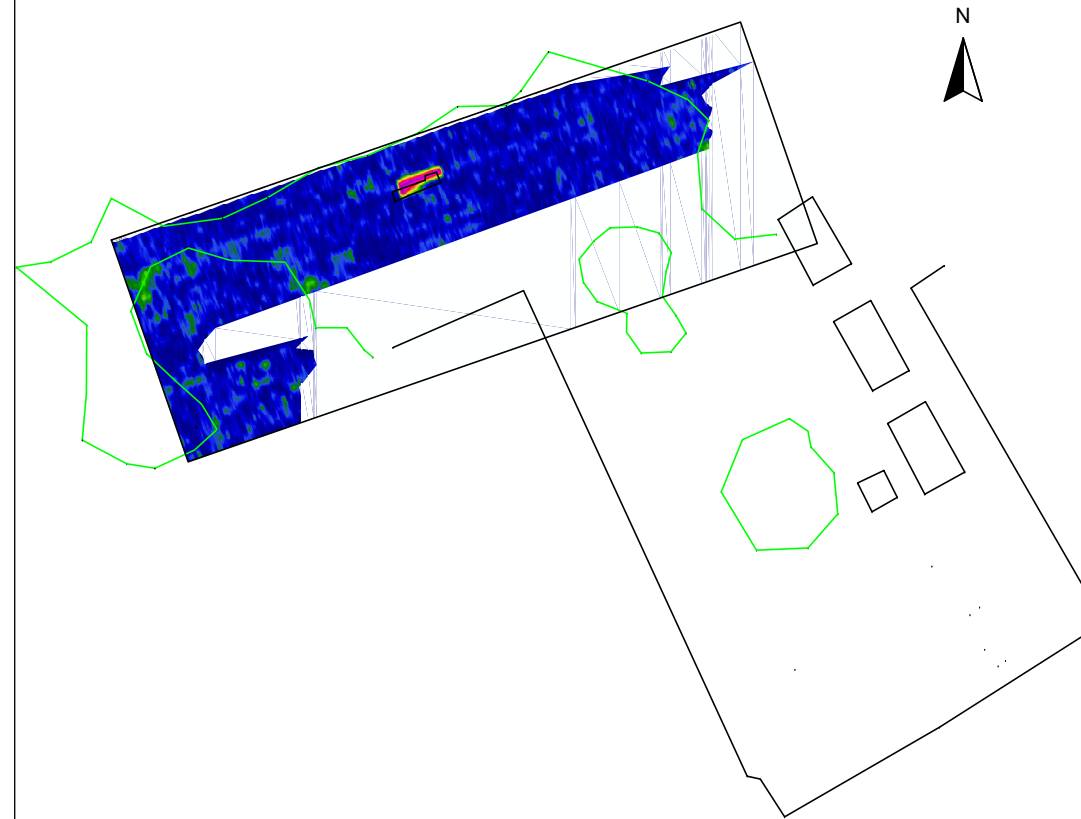


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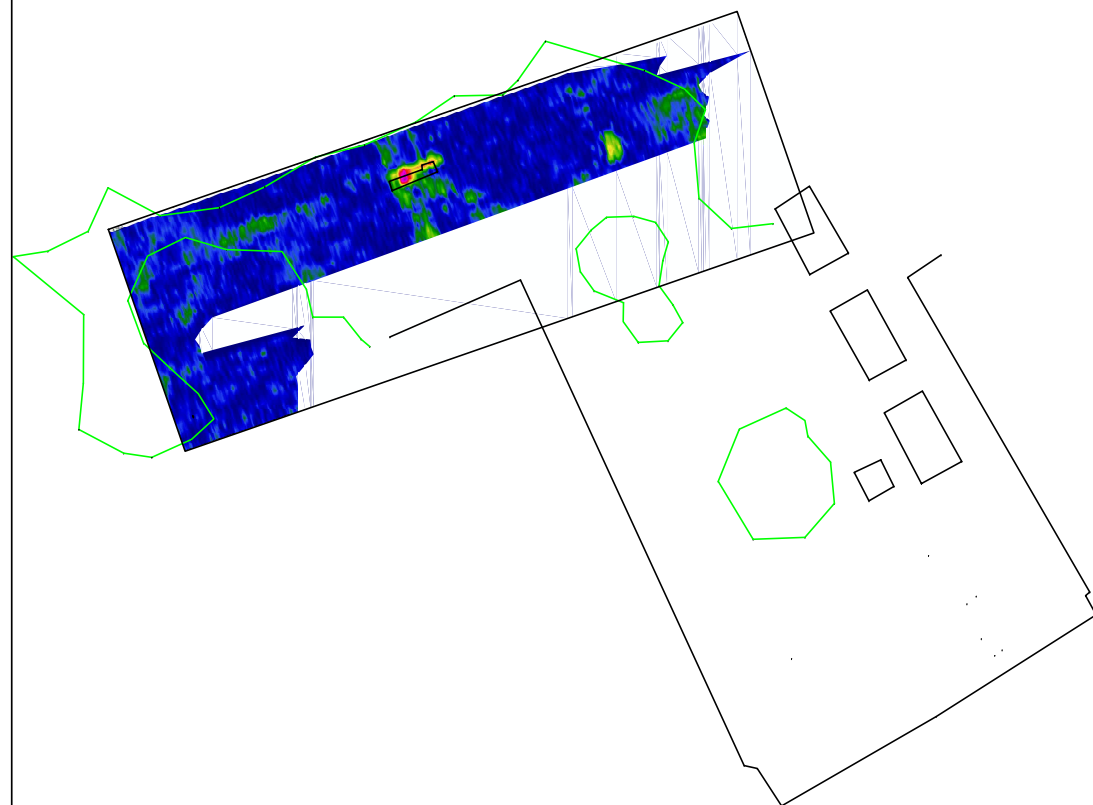
**Area 3 - location of traverses**



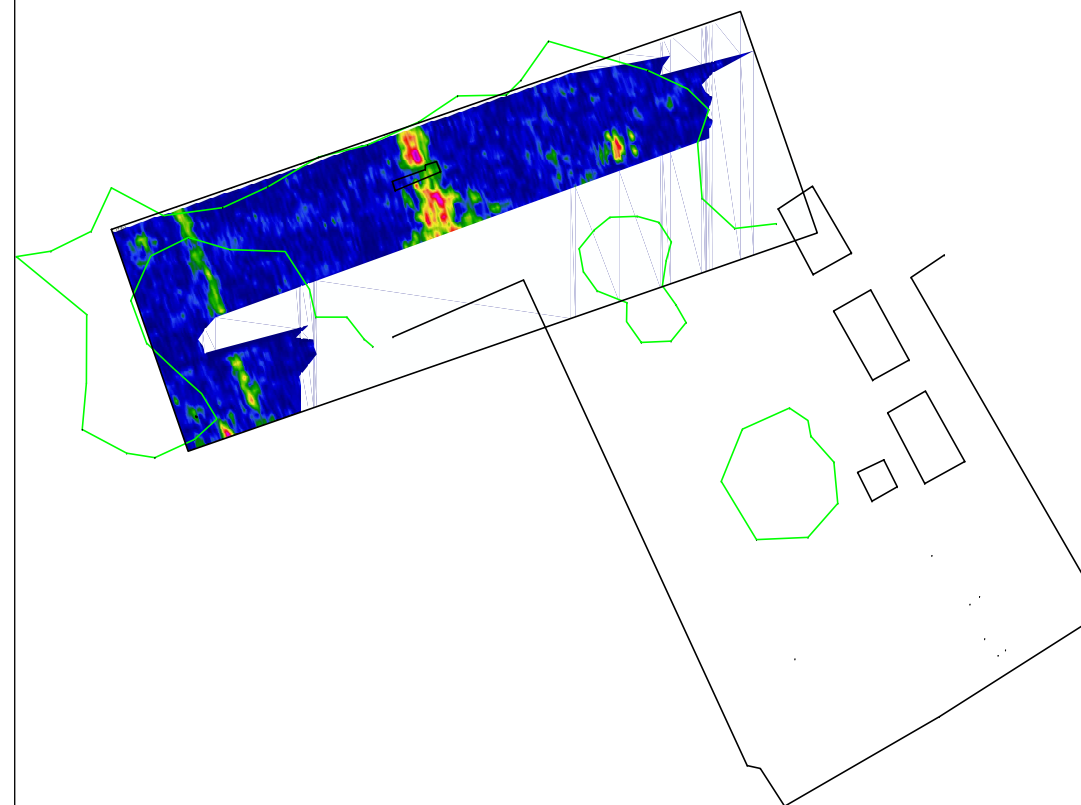
**Area 3 - time slice at 2.81ns**



**Area 3 - time slice at 6.25ns**



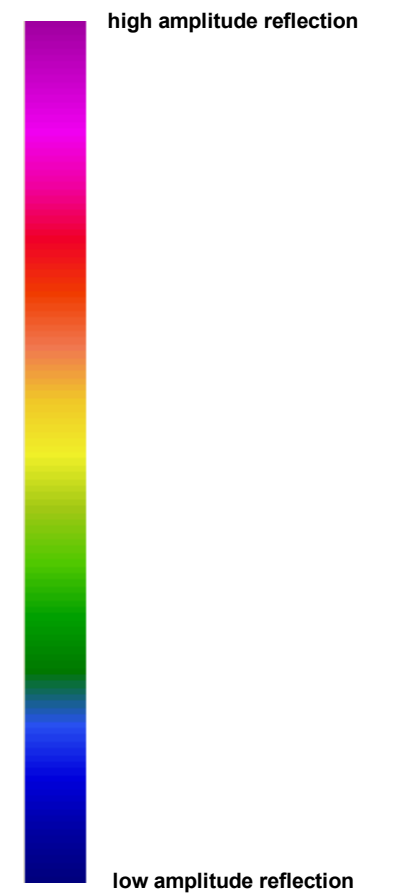
**Area 3 - time slice at 17.81ns**



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**Ground penetrating radar  
time slices - Area 3**



SCALE 1:250











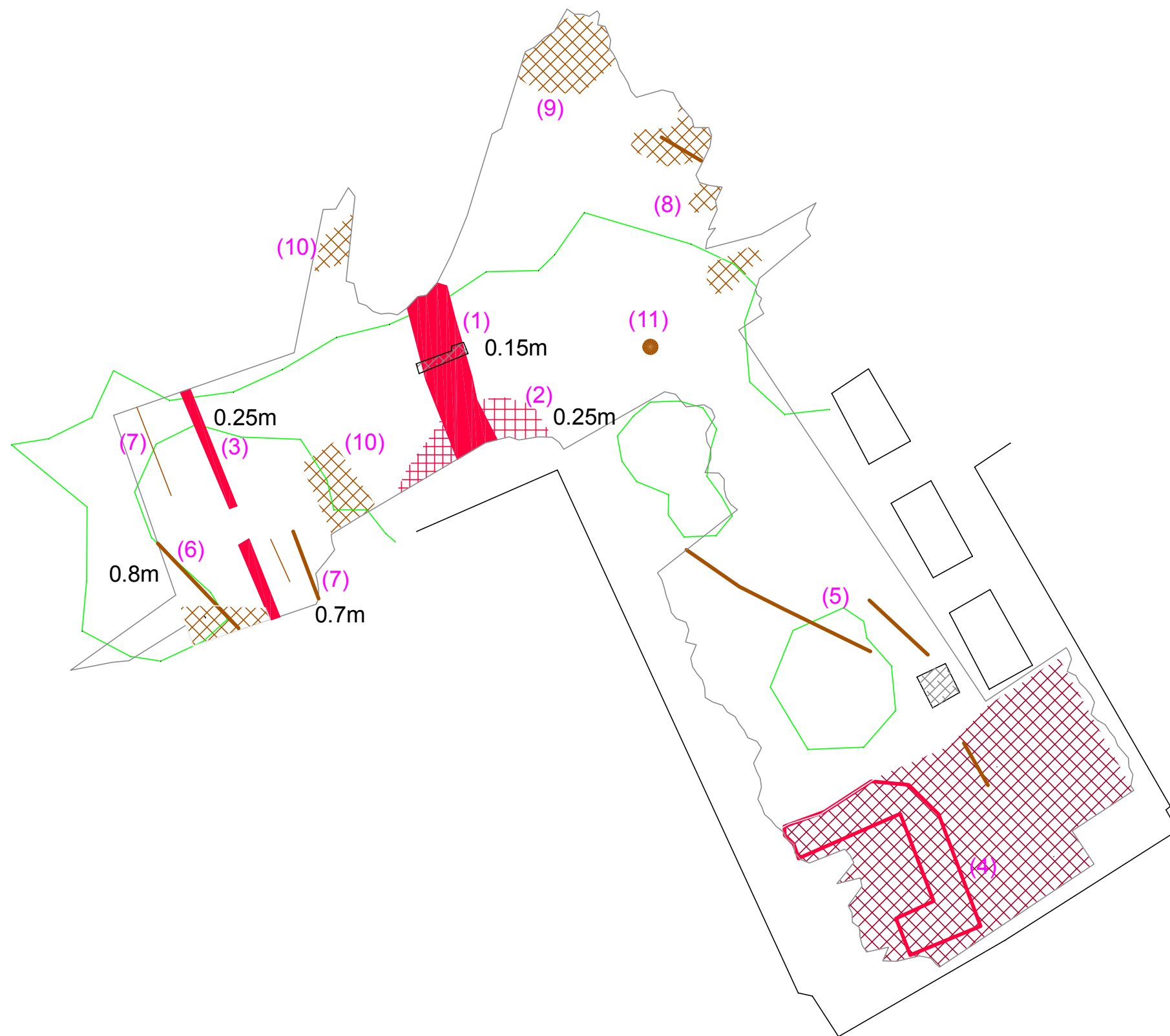
SCALE TRUE AT A3



**Geophysical Survey  
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West Berkshire**

**Abstraction and interpretation of  
ground penetrating radar  
anomalies**

-  Linear anomaly - feature of archaeological potential
-  Linear anomaly - uncertain origin
-  Discrete anomaly - uncertain origin
-  Area anomaly - surface of archaeological potential
-  Complex reflectors - made ground/debris of archaeological potential
-  Complex reflectors - made ground/debris of uncertain origin
-  Response to open and closed excavations
-  GPR survey boundary
- 0.1m Approximate depth of feature
- (1) GPR anomaly label



SCALE 1:150



SCALE TRUE AT A3