University of
HUDDERSFIELD
Inspiring global professionals
Centre of Archaeology

Ground Penetrating Radar Surveys at Tamworth Castle Lower Bailey, February 2024

Ground Penetrating Radar survey being undertaken at Tamworth Castle

Report authored by William Mitchell - September 2024

Figure List

(top right). Radargrams depicting profile line 5m (bottom left) and profile line 5m showing identified features (bottom right).

Figure S– 3D timeslices (birds-eye view) of GPR grid 6 south of Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m.

Figure T– GPR data for features identified in Grid 6. Timeslice from depth 0.4m (top left) and timeslice 0.4m showing the location of identified features (Highlighted in yellow and blue) (top right). Radargrams depicting profile line 10m (bottom left) and profile line 10m showing identified features (bottom right).

Figure U– 3D timeslice (birds-eye view) of GPR grid 6 at Tamworth Castle Lower Bailey, from 0.6m depth below current ground surface.

Figure V– 3D timeslices (birds-eye view) of GPR grid 7 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m.

Figure W– GPR data for features identified in Grid 6. Timeslice from depth 0.2m (top left) and timeslice 0.2m showing the location of identified features (Highlighted in yellow and blue) (top right). Radargrams depicting profile line 2.5m (bottom left) and profile line 2.5m showing identified features (bottom right).

Introduction

From the 5th to the 18th of February 2024, archaeologists from the Centre of Archaeology at Staffordshire University and members of the volunteer community completed a series of non-invasive investigations at sites at Tamworth Castle Lower Bailey. Seven Ground Penetrating Radar (GPR) grids and a Global Positioning System (GPS) were used to locate the GPR grids and to map the below-ground evidence (Figure A). The post-processing and reporting phase of the project has been completed by archaeologists from the Centre of Archaeology at the University of Huddersfield using data collected during primary fieldwork phase.
The purpose of this project was the identification of potential below ground remains, through non-invasive technology (GPR) to supplement the current historical and archaeological knowledge of the site.

Archaeological Monument Information

The late 11th century Tamworth Castle survives as an earthen mound (motte) upon which is constructed a stone keep (the inner bailey). The motte stands in the north-west corner of the former outer bailey. A large ditch, from which material was excavated during the construction of the motte, surrounded its base on the north and east sides, surviving as a buried feature. However, it is unclear whether the ditch continued around the south side of the motte, or whether the former course of the River Anker was utilised as a moat on this side. A late 12th century herringbone causeway and the foundations of a 13th century gatehouse survive in the immediate landscape.

The area of the lower bailey was largely stripped of its buildings when a pleasure garden was laid out in the late 18th century, although a number of buildings survived on the former bailey until the early 20th century. These buildings are present on the cartographic sources dating back to 1741 and include buildings and locations which have now been lost such as the castle stable and barns, castle court, gardens and barnyard (the locations of which hare illustrated on Figure B). It remains likely that earlier archaeological deposits associated with the medieval and later occupations survive as buried features across the landscape.

The GPR survey areas are located to gather information about any buried features located on the area of the lower castle bailey, in particular building and locations identified in the 1741, 1884 and 1902 maps which no longer survive within the landscape (Figures B and C).

Geology

The underlying geology consists of alluvium along the River Anker and Tame flood plain, with Mercia Mudstone to the north, and River Terrace deposits (sand and gravel) to the south (British Geological Survey 1:50,000). Tamworth Castle Shell Keep and curtain wall, which lies immediately north of the site, is constructed upon a large motte which is made up of excavated and piled up redeposited alluvial deposits, consisting of clay with inclusions of river cobbles.

Aims

The project was a continuation of a number of earlier community projects undertaken around Tamworth Castle and its immediate environs (October 2022, March 2023 and November 2023).
The archaeological aims are of this research project phase were to:

- Identify and assess the survival of potential below ground remains, through non-invasive technology (GPR).

- Provide information which may enhance historical and archaeological knowledge of the town of Tamworth, particularly its early Anglo-Saxon origins, Norman Castle and subsequent medieval town development.

- Contribute to any regionally or nationally important research questions whilst safeguarding the appearance and character of the Scheduled Ancient Monument.

Methodology

Ground Penetrating Radar

A Ground Penetrating Radar was used to undertake geophysical survey of the selected areas across the site. GPR is a well-established technique for the identification and investigation of buried remains. It functions by recording reflections or attenuations of electromagnetic (radar) signals that are continuously emitted from a roving antenna and receiver (Grasmueck et al., 2005, Conyers, 2013, Utsi 2017). The physical properties of the subsurface and any buried features within it, affect the reflections or attenuations presented in the data. The GPR principle is based on the phenomenon in which electromagnetic waves differently reflect when they interfere with materials

of different dielectric constants. The dielectric constant(s) and conductivity of the material(s) determines the strength of the reflected signal.

As the antenna moves over a buried object (or anomaly), the vertical distance (time of the reflected signal to arrive at the antenna) decreases until the antenna is above the object, and it increases as the antenna moves past the object; therefore, a single object will appear in the GPR output data as a hyperbola. The target is located at the peak of the hyperbola. Other targets such as negative archaeological features (pits ditches and post-holes) will be represented as areas of differing reflections within the radargram.

These reflections are then recorded and visualized in 2D radargrams (profiles) and 3D data plots (timeslices) that can be analysed to determine the presence, size, and nature of buried remains. An advantage of GPR is that the signal emitted can propagate through most materials (e.g. over concrete and in rural areas), providing the vegetation is not too high and there are not too many obstructions.

The GPR survey utilised a 350MhZ hyper-stacking antenna (in a three-wheeled survey cart configuration on each GPR grid. The antenna was used in conjunction with a SIR4000 computer to collect the most comprehensive dataset across multiple depths. The use of a 350MhZ antenna offered the opportunity to record subsurface remains from ground level up to a depth of around 3.5m. Digital data was collected with a 60-nS time window, 512 samples/scan, and with 60 scans/m. The gain settings were manually adjusted according to the ground conditions experienced on each gird location. The data was collected using parallel profile lines spaced at 0.5m traverse intervals, orientated to the landform. 1m intervals were used on sites where a larger area needed to be covered.

The GPR survey grids were positioned to: (1) include as much of the areas of interest as possible; (2) to account for obstacles within the survey area, such as vegetation and (3) to focus on potential areas identified in the cartographic sources. Following the surveys, the GPR data was processed using RADAN software. Various processing steps were undertaken to remove background noise and the air gap (time zero) between the GPR and the ground surface. Data interpretation was then undertaken using the individual 2D section profiles (generated from each individual line of data collected) and 3D depth timeslices (generated by combining all the individual profile lines into one 3D grid file).

Survey overview

Several GPR grids were undertaken across the location of the Lower Bailey (Figure A). The location of the grids was selected through a combination of the analysis of the visual and textual material and analysis of the site topography and taphonomy. The surveys were undertaken using the 350MhZ antenna (see above) to ensure the most comprehensive and accurate dataset.

Survey Grid	Survey dimensions	Collection system	Transect size
1	20m x 19m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m
2	21m x 11m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m
3	15m x 10m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m
4	10m x 8m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m
5	47m x 10m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m
6	77m x 21m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	1m
7	19m x 6m	350MhZ antenna, three-wheeled survey cart, parallel profile lines	0.5m

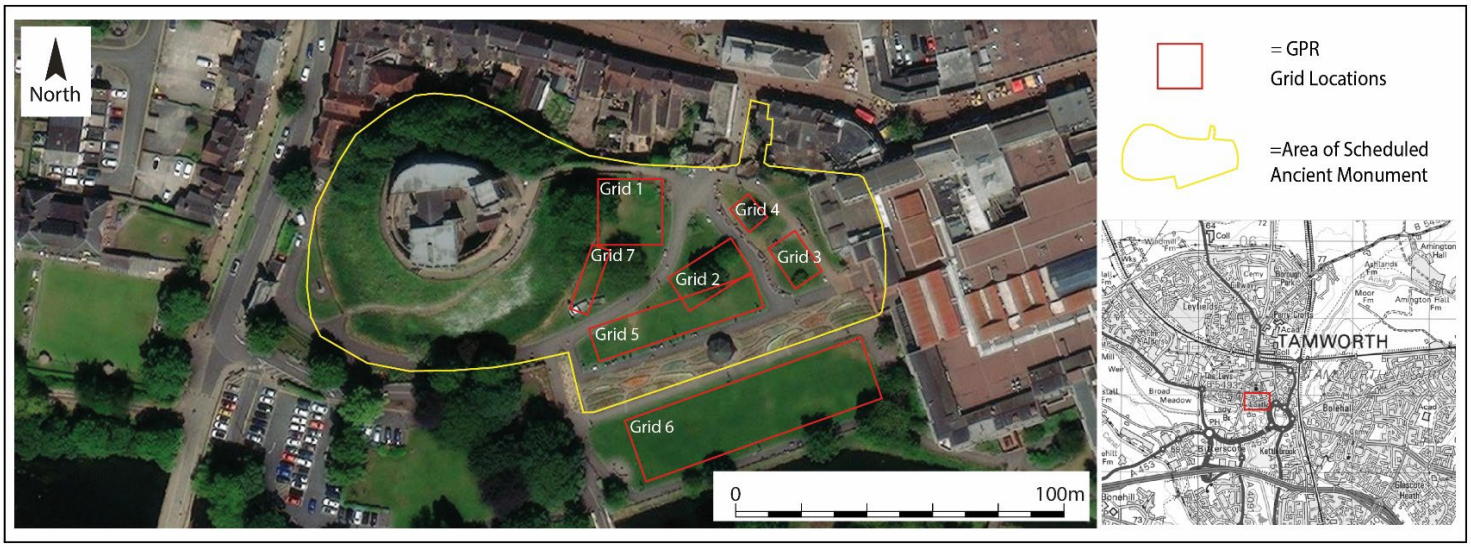


Figure A *– The location of the survey sites at Tamworth Castle Lower Bailey (Copyright: Centre of Archaeology and Google Earth 2021)*

Data processing and presentation

The results are presented in several ways. The data, where possible, is presented as both 2D radargram profiles (cross sections of the ground beneath the survey lines) and 3D timeslices (birds-eye view of the GPR data at different depths). On both the 2D and 3D data, strong reflections are present in white fading into light grey and weaker reflections are dark grey to black.

Results

Five survey areas (grids 1, 2, 3, 4, 5 & 7) were located within the Tamworth Castle Lower Bailey scheduled monument boundary (scheduled monument number 1002962). A further survey area was located to the south of the scheduled monument on terraced land adjacent to the River Anker (Grid 6).

No visible structural features of a historic nature were observed on the surface during the survey. Each of the grids was located on flat low-cut grass, currently used as public grounds. A number of established trees were located within the grid locations.

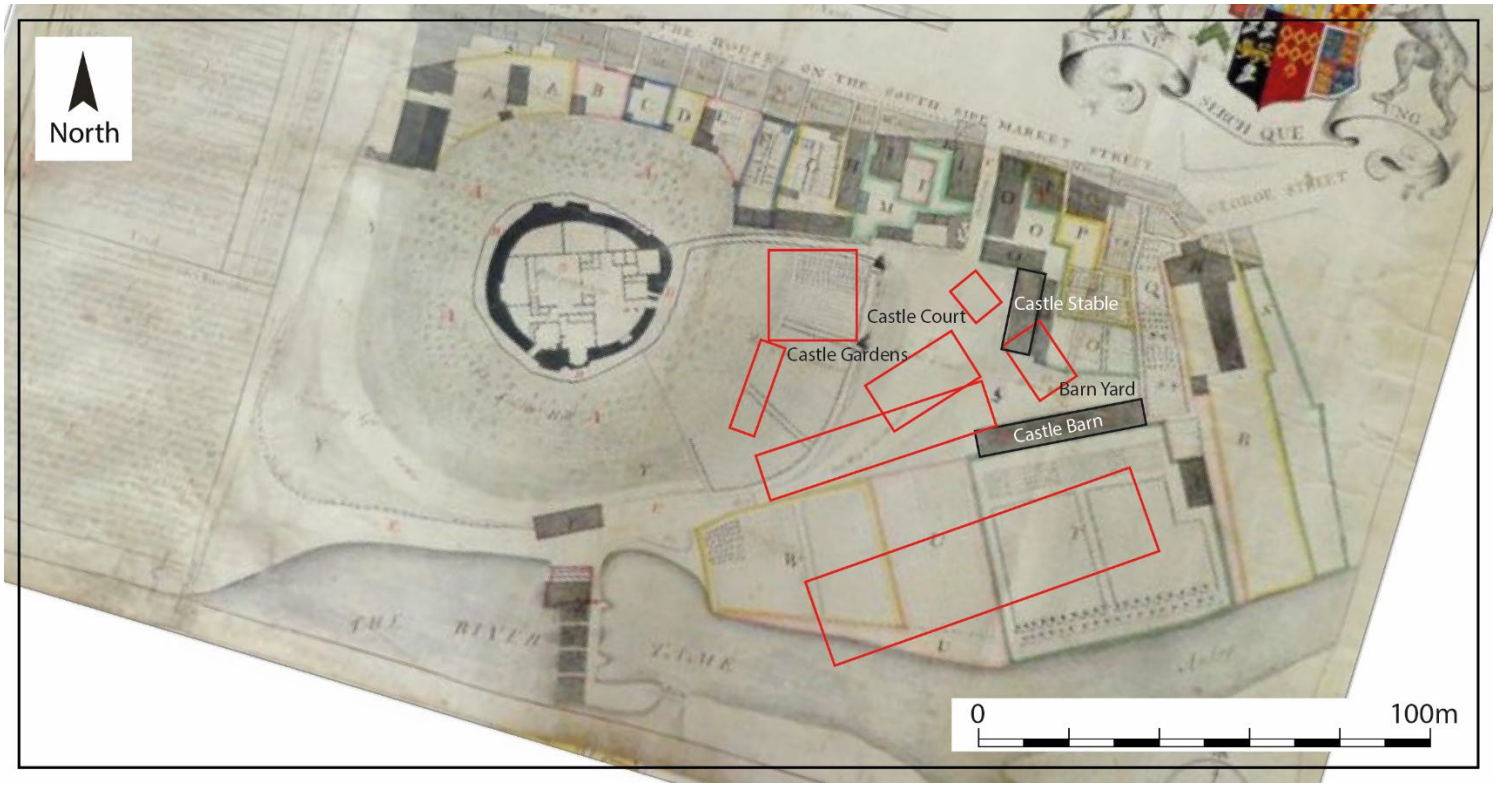


***Figure B**– The location of the survey sites at Tamworth Castle Lower Bailey on William Wyatt Map of 1741. The now demolished castle stables and barn are outlined in black. (Copyright: Centre of Archaeology and Stafford Record Office)*

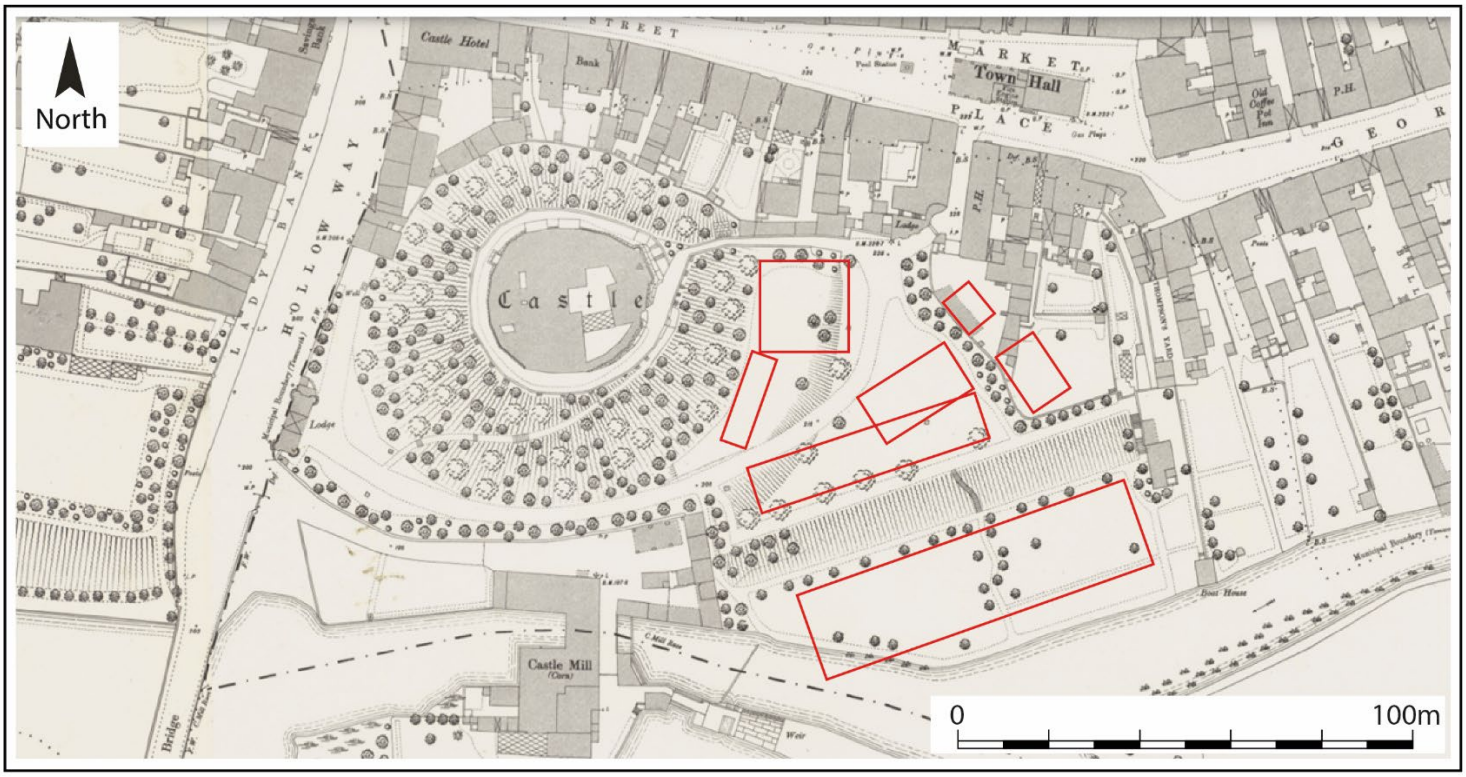


Figure C *– The location of the survey sites at Tamworth Castle Lower Bailey on OS map 1884 (Copyright: Centre of Archaeology and Ordnance Survey)*

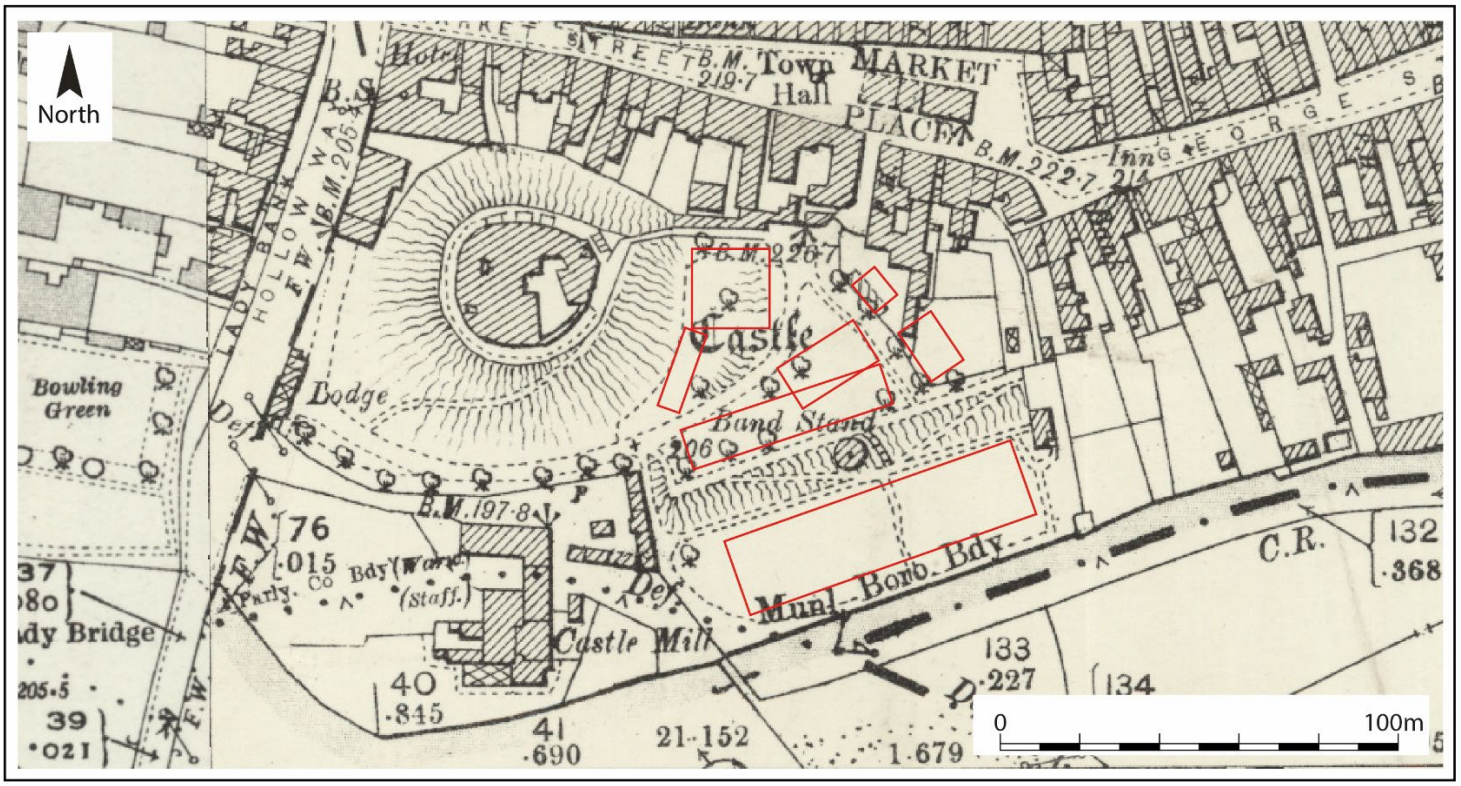


Figure D *– The location of the survey sites at Tamworth Castle Lower Bailey on OS map 1902 (Copyright: Centre of Archaeology and Ordnance Survey)*

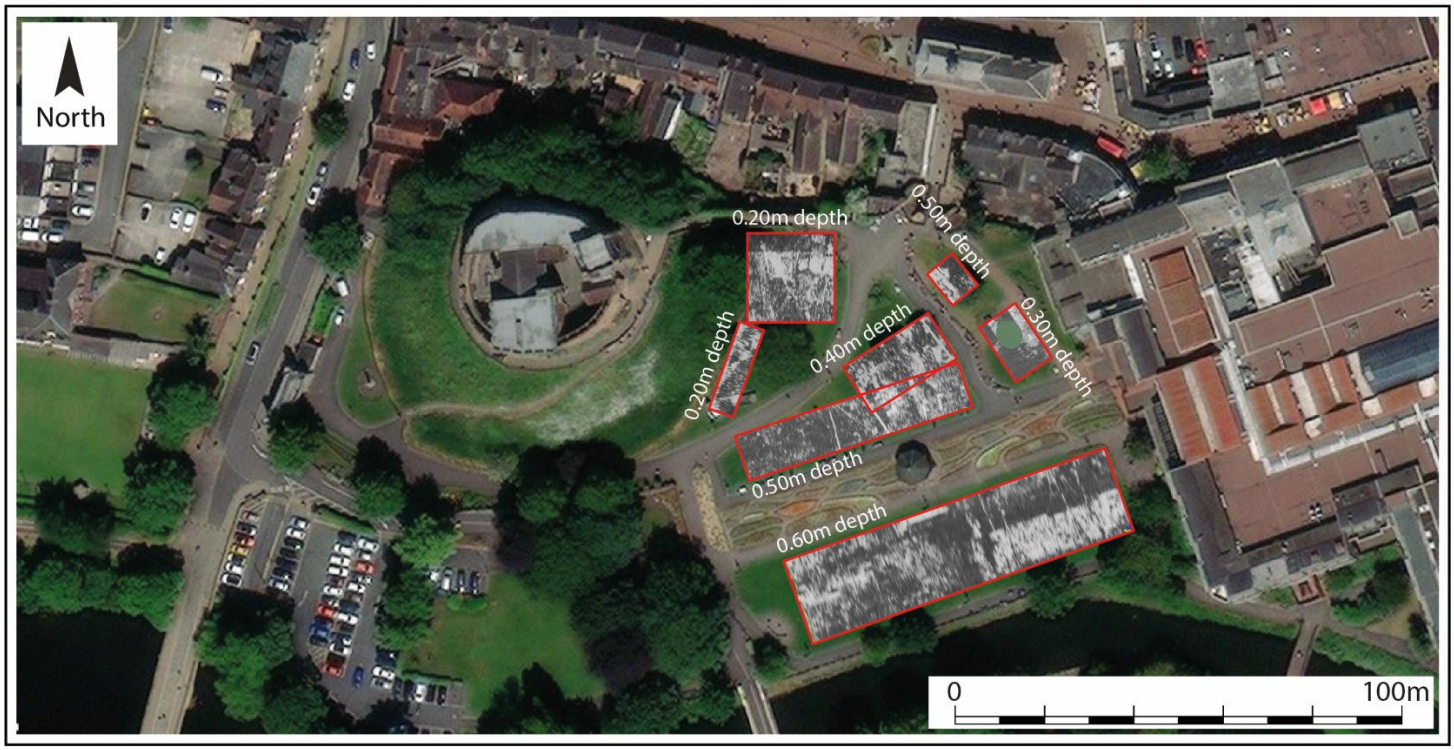


Figure E *– 3D timeslices (birds-eye view) of the GPR grids at Tamworth Castle Lower Bailey, from different depths ranging from 0.2m below the current ground surface to 0.6m. (Copyright: Centre of Archaeology and Google Earth)*

The combination of the public access, past site usage and active services resulted in a complex set of challenges for the GPR survey. Despite this, each site survey was successful in identifying several buried features and this data, taken alongside the cartographic evidence (Figures B, C & D), allows us to reach general conclusions about the nature of the buried remains at these locations.

Two maps in particular were influential in selecting potential areas of interest. The first was William Wyatts map of 1741. A number of locations are recorded which are no longer exist within the lower bailey including the castle stable, castle barn and barn-yard. The ordnance survey map of 1884 also shows a number of buildings which were constructed in the intervening period but have since disappeared from the landscape. Where possible, the locations of the grids were planned to target these lost buildings. To ensure that areas selected for survey were accurate, ArcGIS (Geographic Information System software) was used to locate the maps onto modern satellite imagery. Co-ordinates were then recorded and identified in the field using GPS.

Given the number of profile lines taken during each survey grid, only a selection of the key 2D radargram profiles and 3D timeslices will be discussed in detail here.

Grid 1

Specific Site Information:

- GPR Survey 1: Eastern base of mound (formerly castle gardens recorded in 1741)
- Terrain Type: Flat low-cut grass. Stone urn on plinth at south-east corner of grid.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 20m length x 19m width (maximum dimensions). The western end of the grid was limited due to the presence of iron fencing at the base of the mound.
- Parallel survey with 0.5m traverse intervals. Data collected East to West.

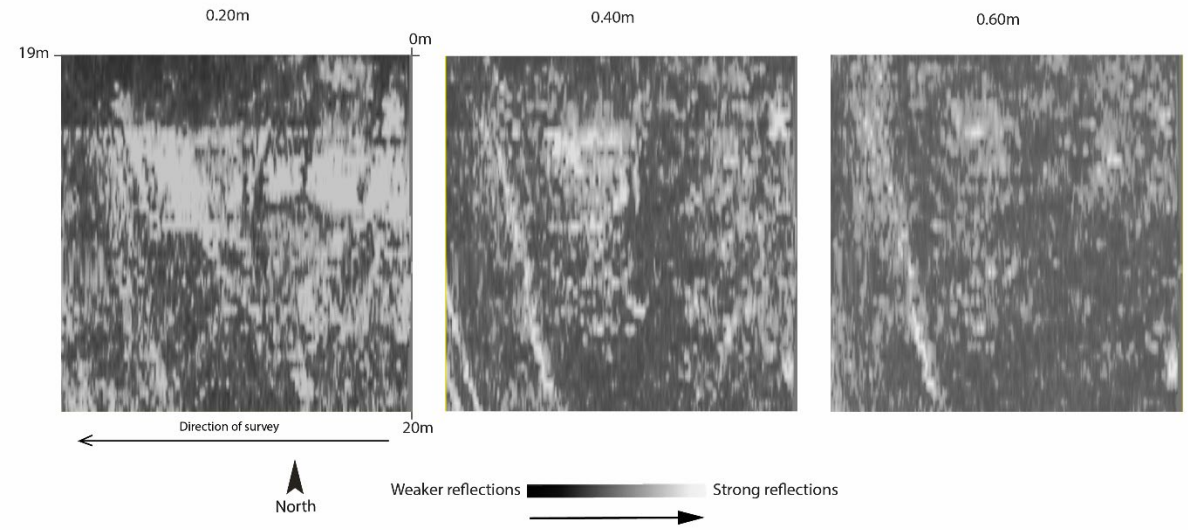


***Figure F**– 3D timeslices (birds-eye view) of GPR grid 1 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m (Copyright: Centre of Archaeology).*

Figure F shows 3D timeslices of the GPR data from three different depths ranging from 0.2m below the current ground surface to 0.6m. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent.

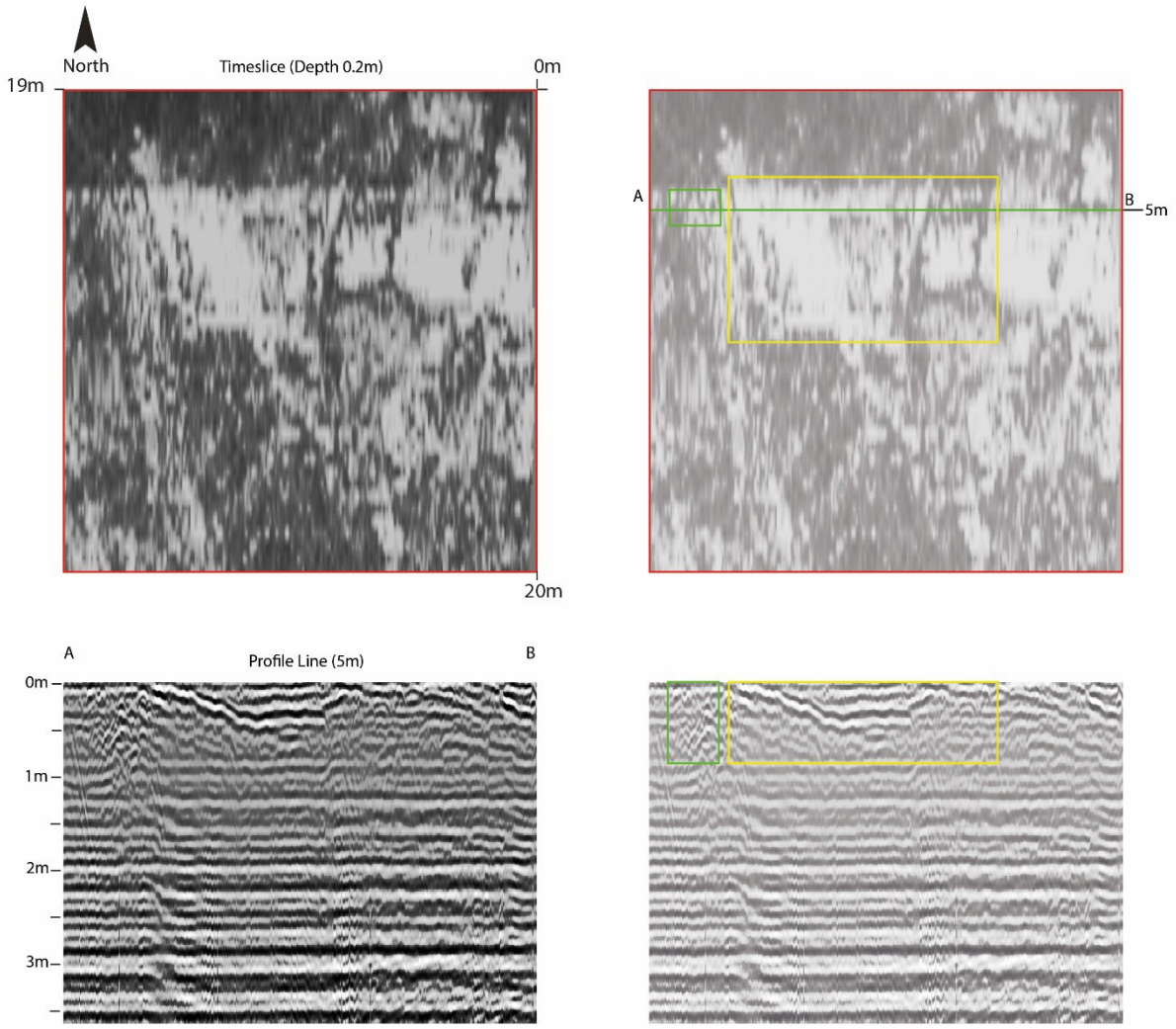


Figure G *– GPR data for features identified in Grid 1. Timeslice from depth 0.2m (top left) and timeslice 0.2m showing the location of identified features (Highlighted in green and red) (top right). Radargrams depicting profile line 5m (bottom left) and profile line 5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 1 (Figure G). Survey line 5m traversed across the northern part of the grid from east to west and it went down-slope towards the base of the motte.

A number of the anomalies present in the location of Grid 1 are likely the result of laying service trenches in the modern period. These are present to a depth of around 0.6m and are present running in a south-east to north-west direction. A trapezoidal shaped feature, adjacent to the herringbone causeway, is present in the northern half of the grid (highlighted in yellow- Figure G). This feature was present directly beneath the surface to a depth of around 0.5m and was around

10m in length x 6m in width. It may have continued further to the north, however, the data from the first 3m of the grid was inconsistent, due to radio interference or modern ground disturbance. A linear feature was present running approximately northwest to southeast across the entire grid (highlighted in green- Figure G). The data to the west of this represented disturbed material to a depth of around 0.7m.

The higher amplitude signals of the trapezoidal feature were likely to have been the hard edges, where the mixed signals within, were likely to be the backfill of the feature. The geophysical characteristics and the profile of the feature suggest the presence of foundations or rubble surrounding a pit like feature with a flattened base. The strong reflections and deliberate nature of the anomaly suggest this may be a demolished structure or substantial landscape feature.

The linear feature may represent the hard edge of the silted or disturbed shallow ditch which historically present at the base of the motte which has since naturally silted or has been deliberately filled. Analysis of the data from trench 7 confirms the continuation of this anomaly in an orientation which is consistent with the rounded base of the motte (highlighted in Figure H). It is unclear is this was a deliberate defensive ditch or simply an area which had become lowered as a result of the removal of material during the formation of the mound.

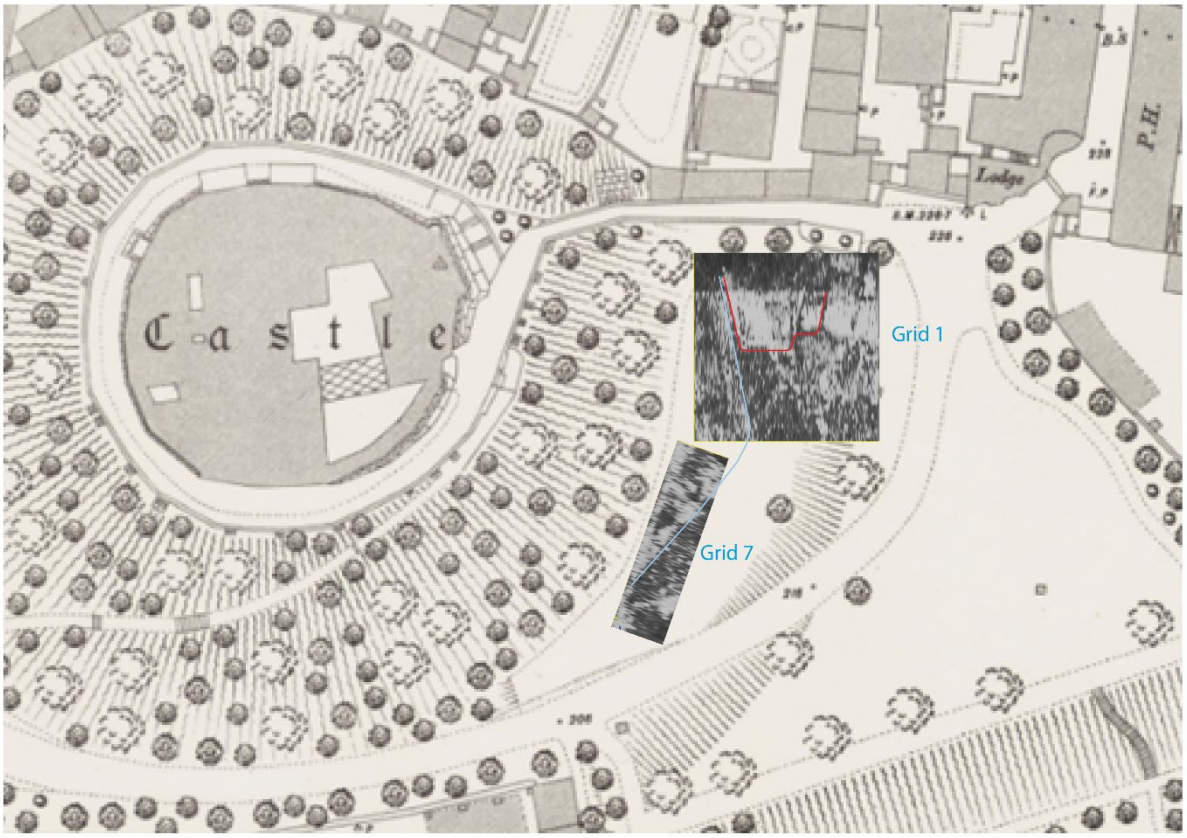


Figure H*– 3D timeslices (birds-eye view) of GPR grids 1 and 7 at Tamworth Castle Lower Bailey, from 0.2m depth below current ground surface. Features A and B highlighted (red and blue lines). (Copyright: Centre of Archaeology).*

Grid 2

Specific Site Information:

- GPR Survey 2: Within Tamworth Castle Lower Bailey
- Terrain Type: Flat low-cut grass. Two large established trees within grid.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 21m length x 11m width (maximum dimensions). The eastern and western ends of the grid ceased at the tarmac pathways..
- Parallel survey with 0.5m traverse intervals. Data collected East to West.

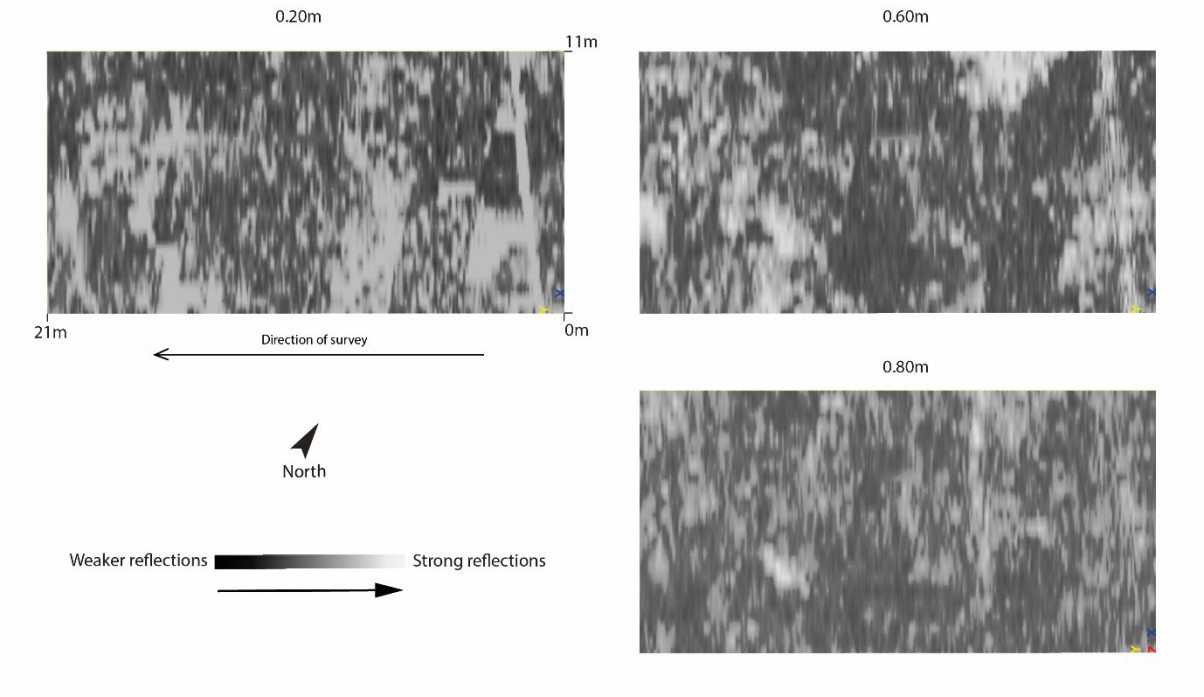


Figure I*– 3D timeslices (birds-eye view) of GPR grid 2 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.8m (Copyright: Centre of Archaeology).*

Figure I shows 3D timeslices of the GPR data from three different depths ranging from 0.2m below the current ground surface to 0.8m. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent.

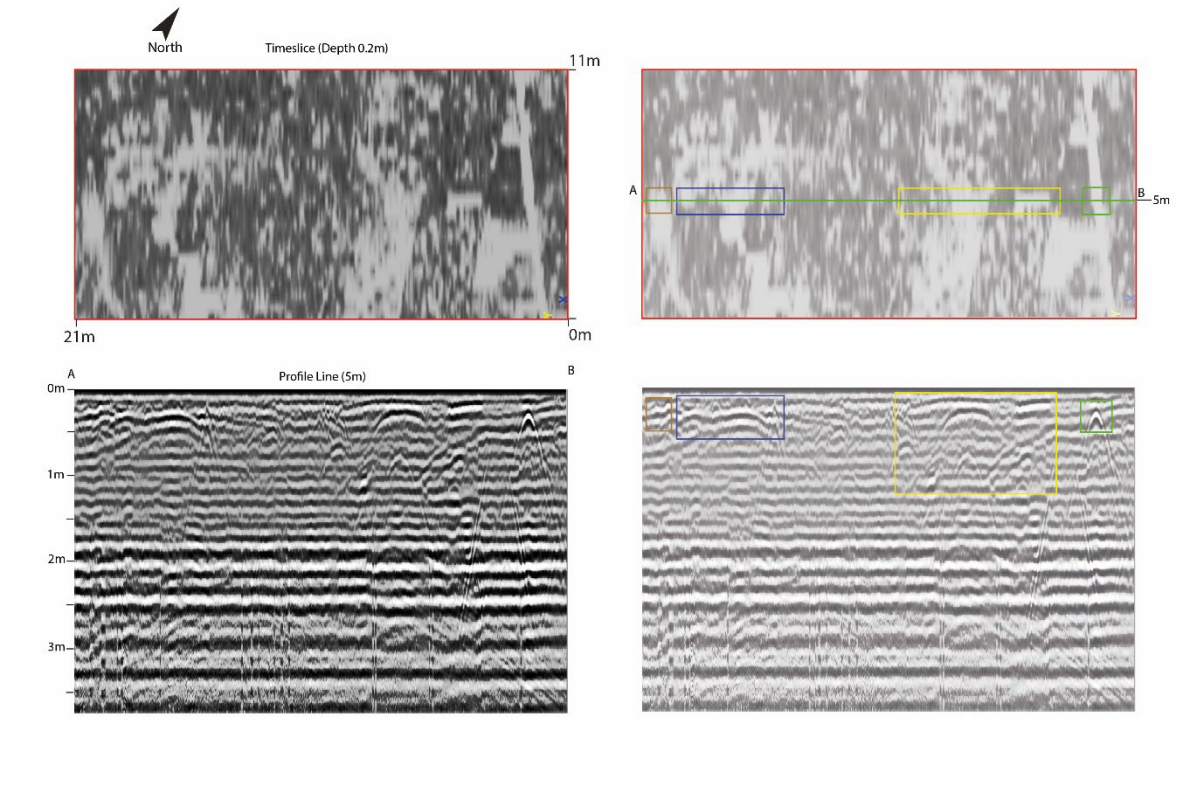


Figure J *– GPR data for features identified in Grid 2. Timeslice from depth 0.2m (top left) and timeslice 0.2m showing the location of identified features (Highlighted in green, yellow and blue) (top right). Radargrams depicting profile line 5m (bottom left) and profile line 5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 2 (Figure J). Survey line 5m traversed across the central part of the grid from east to west. This was across an area of open lawn in a central position within the former lower bailey.

There was a general absence of clear buried features within this grid (and associated grid 5- see figure K). A number of the linear anomalies present in grids 2 and 5 are service trenches and their associated services some of which are likely to be in use and some of which are likely non-operational. These are present to a depth of around 0.3-0.4m. Two examples of these are highlighted by the green and orange boxes. A wide linear anomaly running approximately north to south was present towards the eastern end of the trench (highlighted in the yellow box). Areas of disturbance are recorded at this location between 0.1m and 1m and the high amplitude signals is consistent with disturbed ground, this potentially represents buried structural material. This anomaly appears to terminate to the south of the grid and is not present in grid 5. An anomaly to

the western end of the trench present between 0.3m and 0.6m, represents an area of disturbance which may also represent structural remains. It is not clear from the data or map regression what this buried structural material may represent.

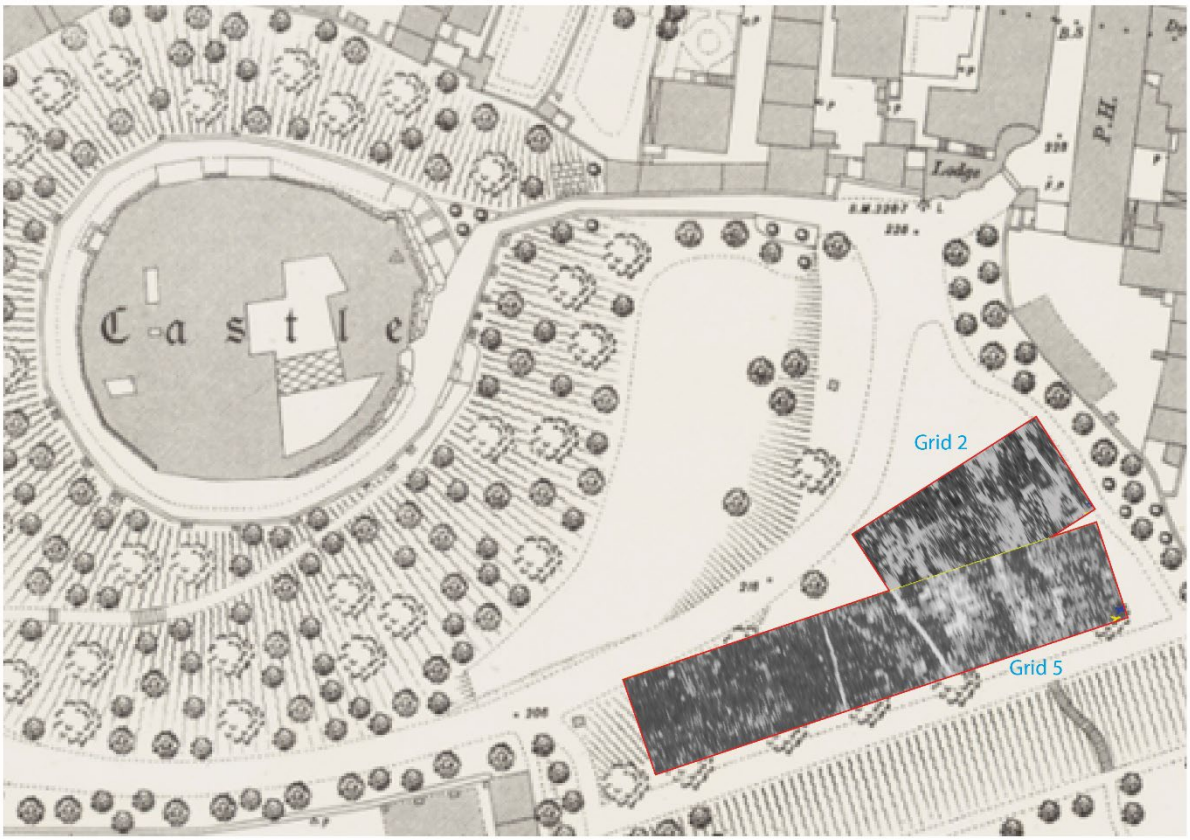


***Figure K**– 3D timeslices (birds-eye view) of GPR grids 2 and 5 at Tamworth Castle Lower Bailey, from 0.4m and 0.5m depth below current ground surface. (Copyright: Centre of Archaeology and Ordnance Survey).*

Grid 3

Specific Site Information:

- GPR Survey 3: Within eastern limits of Tamworth Castle Lower Bailey (in the location of the former castle stable and barnyard recorded in 1743)
- Terrain Type: Flat low-cut grass. Landscaping and flowerbed within grid.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 15m length x 10m width (maximum dimensions). The northern end of the grid contains a substantial area of void data due to an area of flowerbed which was not traversed.
- Parallel survey with 0.5m traverse intervals. Data collected South to North.

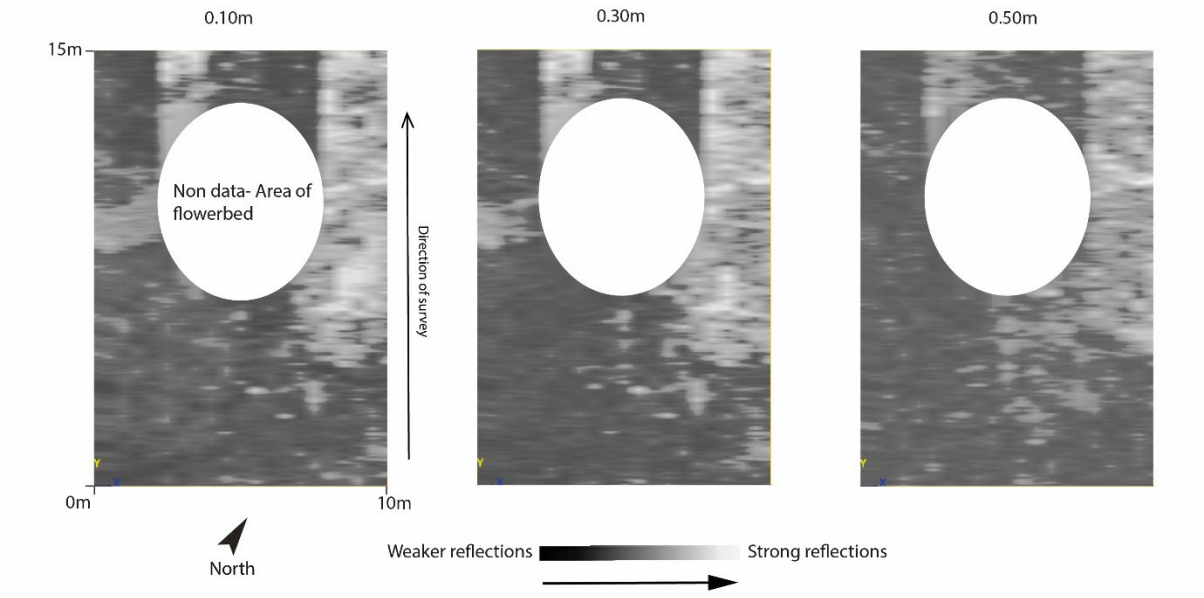


Figure L*– 3D timeslices (birds-eye view) of GPR grid 3 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.1m below current ground surface to 0.5m (Copyright: Centre of Archaeology).*

Figure L shows 3D timeslices of the GPR data from three different depths ranging from 0.1m below the current ground surface to 0.5m. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent.

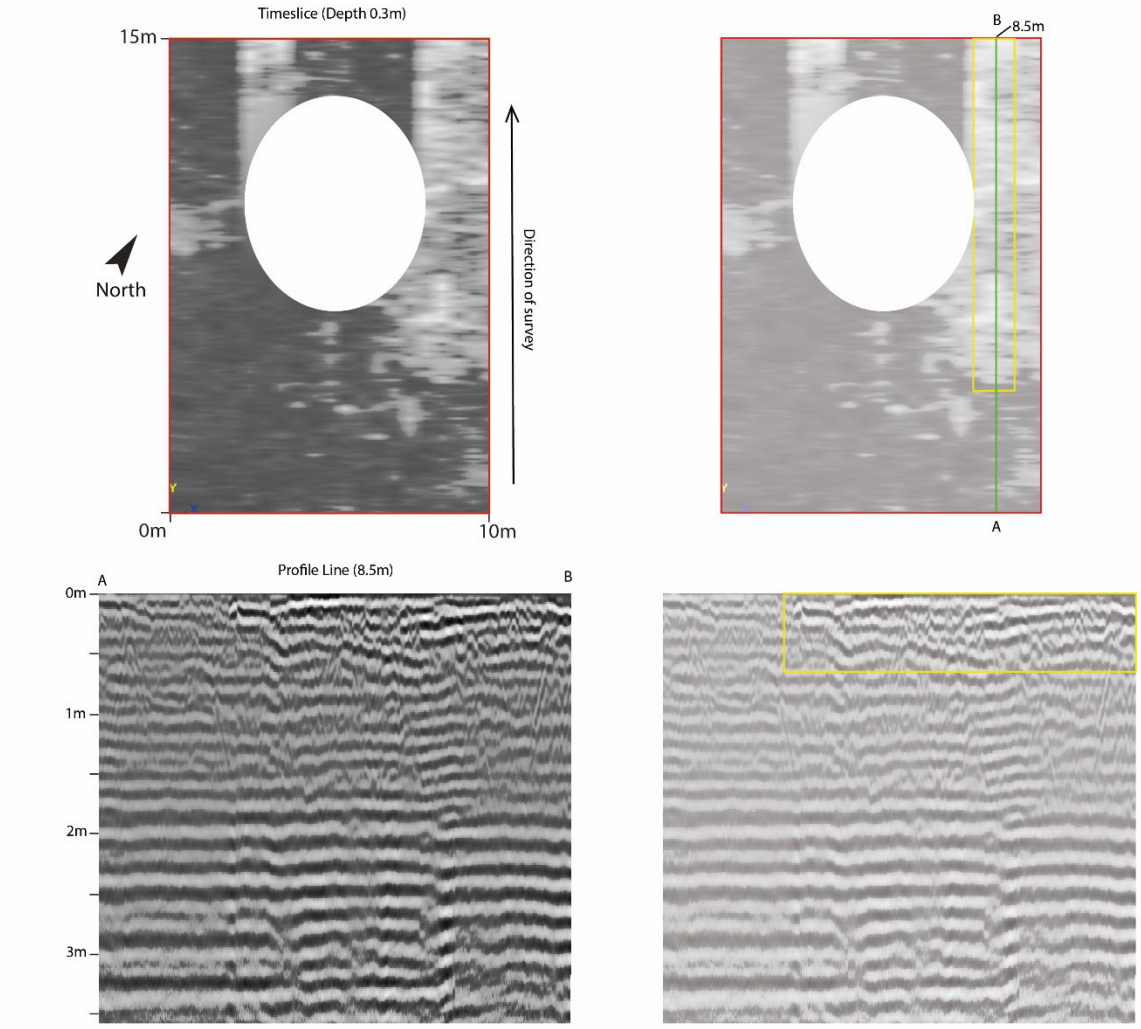


Figure M *– GPR data for features identified in Grid 3. Timeslice from depth 0.3m (top left) and timeslice 0.3m showing the location of identified features (Highlighted in yellow) (top right). Radargrams depicting profile line 8.5m (bottom left) and profile line 8.5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 8.5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 2 (Figure M). Survey line 8.5m traversed across the northern part of the grid from east to west. This was across an area of open lawn in a central position within the former lower bailey. This area was specifically recorded in 1741 as the castle stable and barnyard (Figure B).

An area of high resistance is identifiable in the north-eastern part of the grid (highlighted in yellow). The anomaly appears to be regular in form and is around 10m in length and 2.5m in width. The profile demonstrates that the feature survives to a depth of around 0.6m below ground level. The anomaly appears to continue outside of the northern and eastern extents of the grid and potentially

represents building remains/ foundations adjacent to the known location of the castle stables (as seen in figure N). Another feature in the north-west corner of the grid may represent the remains of the castle stables and buildings identified in the 1741 and 1884 maps. Interpretation is difficult due to the large area of non-data present as a result of the current raised flowerbed which could not be traversed.

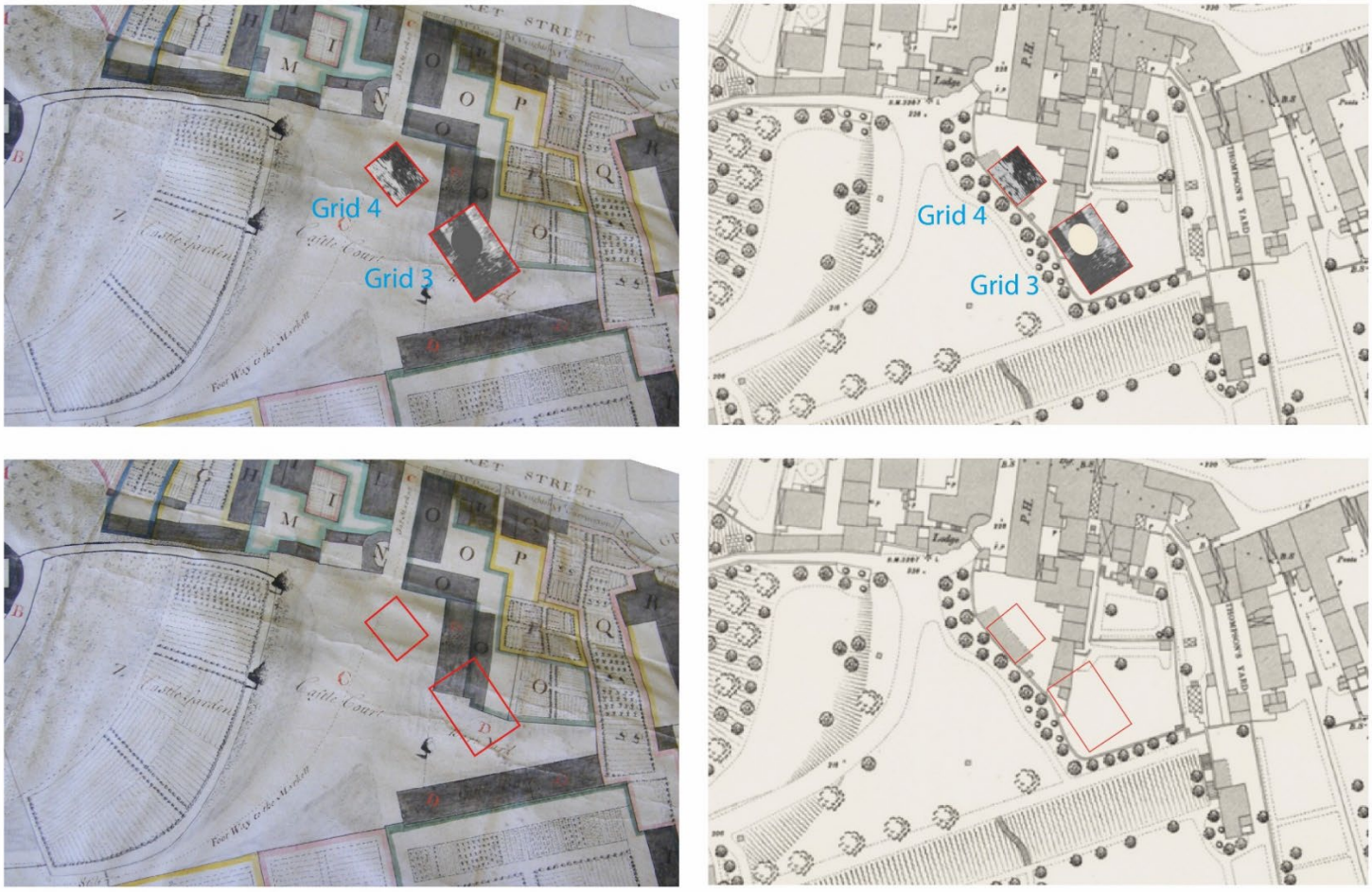


Figure N*– 3D timeslices (birds-eye view) of GPR grids 3 and 4 at Tamworth Castle Lower Bailey, from 0.3m and 0.5m depth below current ground surface. William Wyatt map 1741 (top and bottom left), Ordnance Survey map 1884 (top and bottom right). (Copyright: Centre of Archaeology and Ordnance Survey).*

Grid 4

Specific Site Information:

- GPR Survey 4: Within eastern limits of Tamworth Castle Lower Bailey (in the location of a former building recorded on the 1884 map)
- Terrain Type: Flat low-cut grass. Two semi-mature trees located within the grid)
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 10m length x 8m width (maximum dimensions).

- Parallel survey with 0.5m traverse intervals. Data collected West to East.

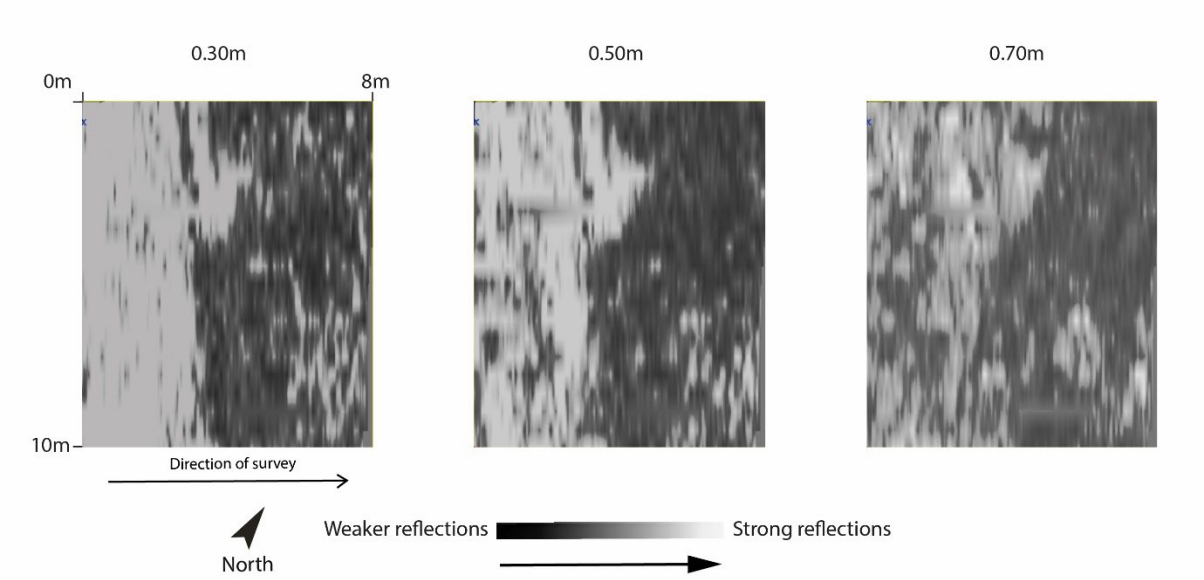


***Figure O**– 3D timeslices (birds-eye view) of GPR grid 4 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.3m below current ground surface to 0.7m (Copyright: Centre of Archaeology).*

Figure O shows 3D timeslices of the GPR data from three different depths ranging from 0.3m below the current ground surface to 0.7m. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent.

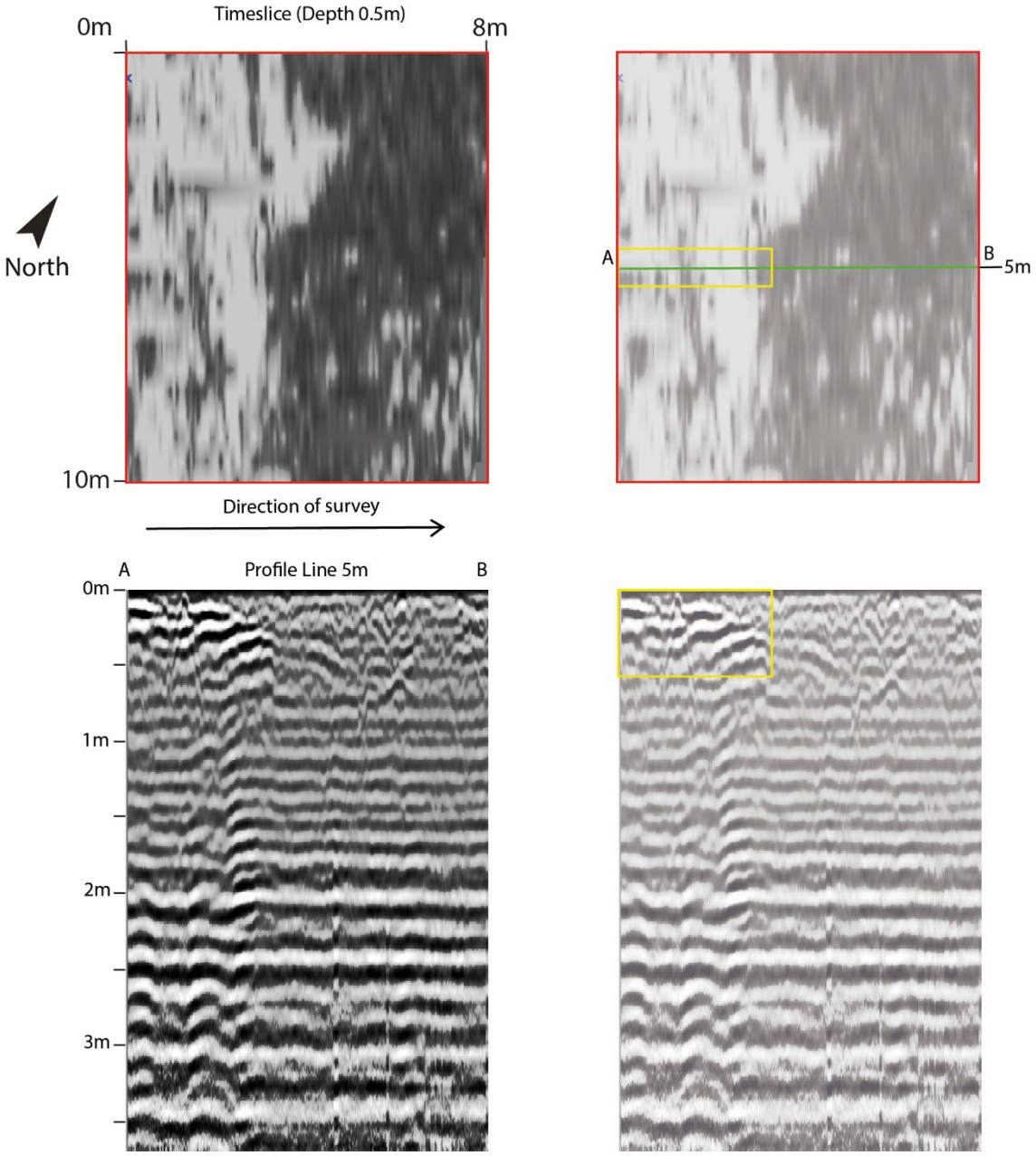


Figure P *– GPR data for features identified in Grid 4. Timeslice from depth 0.5m (top left) and timeslice 0.5m showing the location of identified features (Highlighted in yellow) (top right). Radargrams depicting profile line 5m (bottom left) and profile line 5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile line 5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 2 (Figure P). Survey line 8.5m traversed across the central part of the grid from east to west. This

was across an area of open lawn in a central position within the former lower bailey, in an area recorded in 1884 as being the location of a large rectangular building. This area in 1741 was formerly the castle court and the building is not present in the 1741 map confirming it was constructed between 1741 and 1884- this building was still present in 1902 (Figure D). An area of high resistance across the south-eastern half of the grid, present to a depth of 0.6m, directly correlated with the building present on the 1884 OS mapping. The data confirms the presence of buried building foundations or rubble at this location.

Grid 5

Specific Site Information:

- GPR Survey 5: Within Tamworth Castle Lower Bailey
- Terrain Type: Flat low-cut grass.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 47m length x 10m width (maximum dimensions). The eastern end of the grid ceased at the tarmac pathways.
- Parallel survey with 0.5m traverse intervals. Data collected East to West.

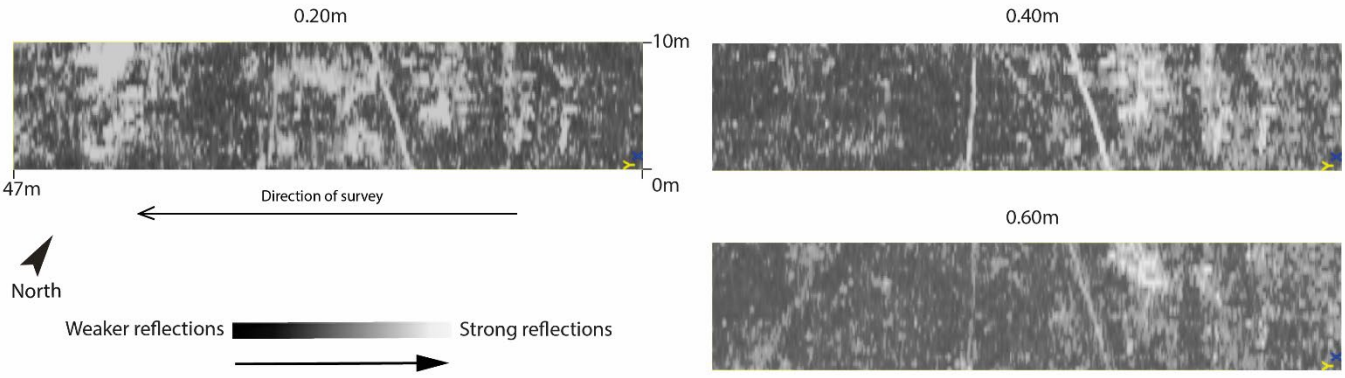


***Figure Q**– 3D timeslices (birds-eye view) of GPR grid 5 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m (Copyright: Centre of Archaeology).*

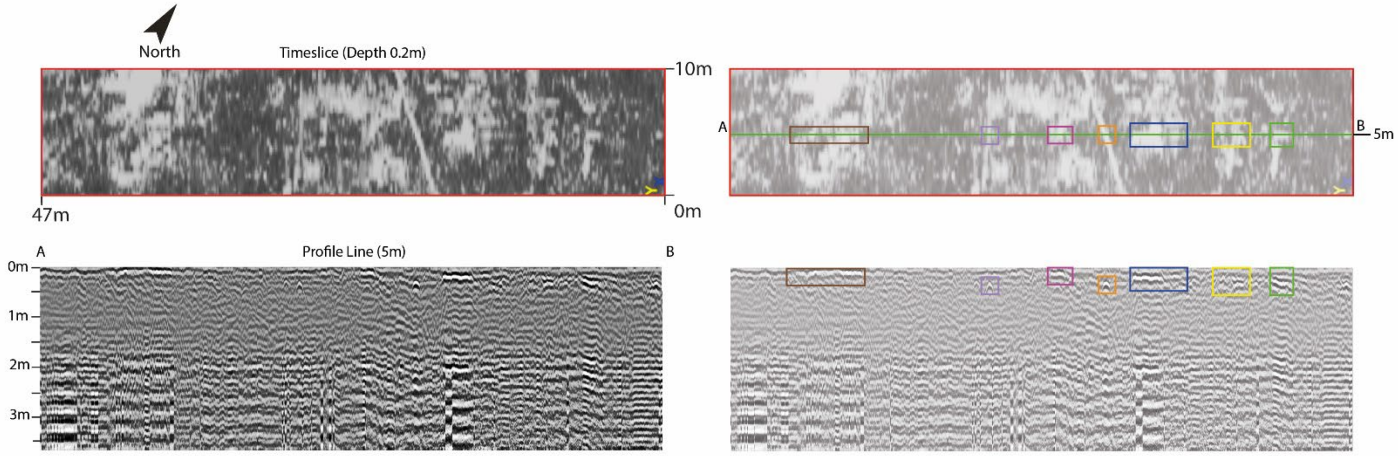


Figure R *– GPR data for features identified in Grid 5. Timeslice from depth 0.2m (top left) and timeslice 0.2m showing the location of identified features (Highlighted in green, yellow, blue, orange, pink, purple and brown) (top right). Radargrams depicting profile line 5m (bottom left) and profile line 5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 5 (Figure R). Survey line 5m traversed across the central part of the grid from east to west. This was across an area of open lawn in a central position within the former lower bailey.

Other than several linear anomalies likely to be service trenches and their associated services, there was a general absence of clear buried features within this grid (and associated grid 3). Each of the service trenches are present to a depth of around 0.3-0.4m. Examples of these are highlighted by the green, orange, pink and purple boxes. A wide linear anomaly running approximately north to south was present at the western end of the trench (highlighted in the brown box). Areas of disturbance are recorded at this location between 0.1m and 0.4m and the high amplitude signals is consistent with disturbed ground, potentially representing buried structural material. This anomaly appears to terminate to the south of the grid and is not present in grid 5. An anomaly to the eastern end of the trench present between 0.3m and 0.6m (highlighted in the blue box), represents an area of disturbance which may represent structural remains.

Grid 6

Specific Site Information:

- GPR Survey 6: South of Tamworth Castle Lower Bailey on terraced land adjacent to the River Anker. Likely to be reclaimed flood plain. In an area of formal gardens, the south west corner of the grid was once within the castle mill – mill race (as seen on the 1741 and 1884 maps)

- Terrain Type: Flat low-cut grass.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 77m length x 21m width (maximum dimensions). The eastern and western ends of the grid ceased at the tarmac pathways..
- Parallel survey with 1m traverse intervals. Data collected East to West.

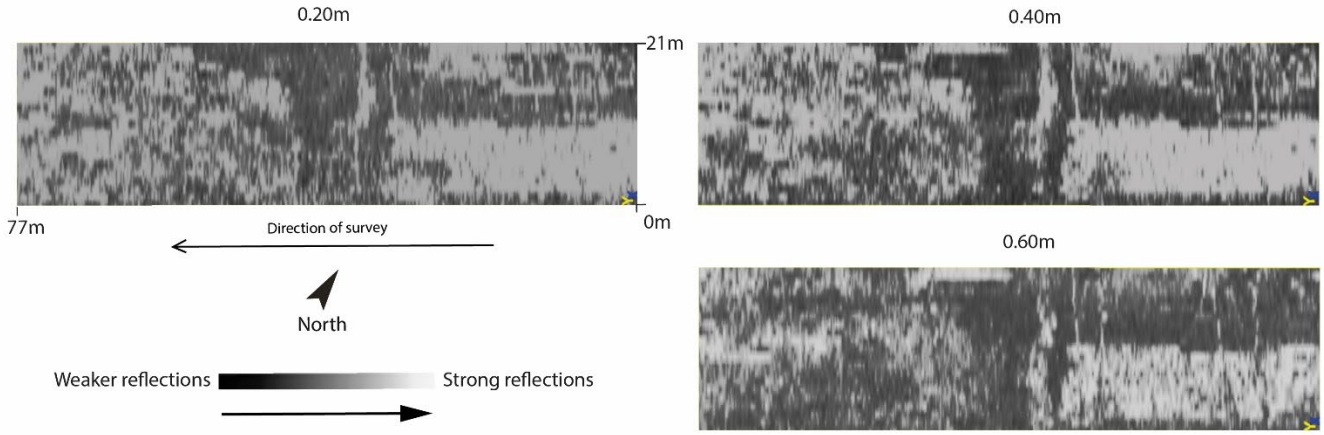


Figure S*– 3D timeslices (birds-eye view) of GPR grid 6 south of Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m (Copyright: Centre of Archaeology).*

Figure S shows 3D timeslices of the GPR data from three different depths ranging from 0.2m to 0.6m below the current ground surface. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent. This grid was likely to be in the area of a geological river terrace. It is also known to have been in an area known to have part of the river course, which has been diverted and changed a number of times in the past on account of castle mill – mill race and later landscaping developments. The underlying geology and later develops make definitive data interpretations more difficult.

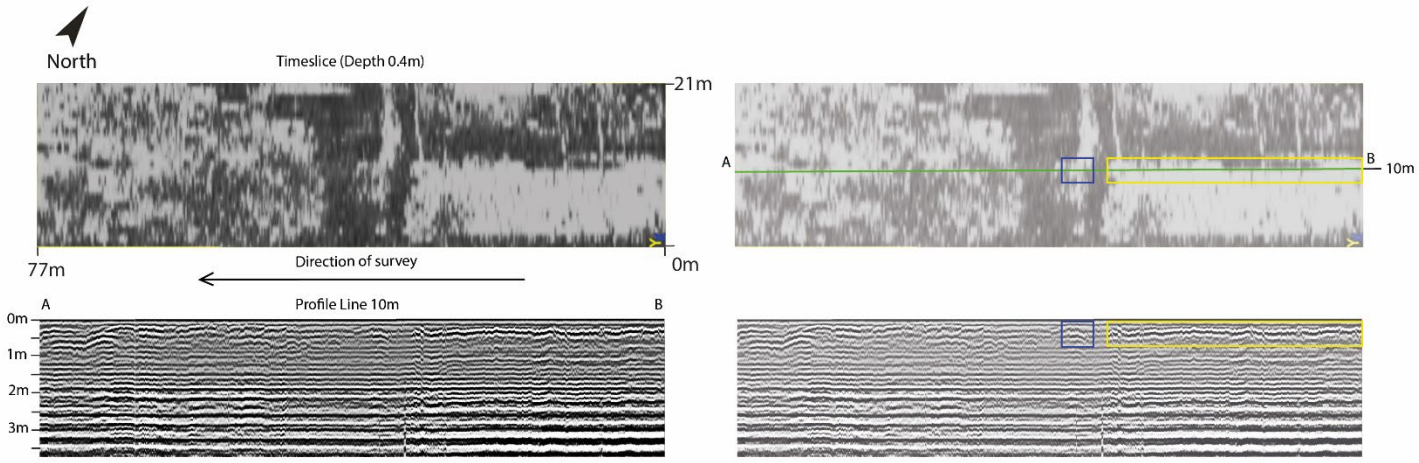


***Figure T**– GPR data for features identified in Grid 6. Timeslice from depth 0.4m (top left) and timeslice 0.4m showing the location of identified features (Highlighted in yellow and blue) (top right). Radargrams depicting profile line 10m (bottom left) and profile line 10m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 10m

A single profile line has been selected that best represents the results of this GPR survey from Grid 6 (Figure T). Survey line 10m traversed across the central part of the grid from east to west. This was across an area of open lawn in an area to located to the south-east of Tamworth Castle Lower Bailey on terraced land adjacent to the River Anker. This lower terrace was, in 1884, an area of formal gardens (Figure U). A single bending path present in the mapping was evidenced in the GPR data in the same location (highlighted in blue- figure T). A large rectangular area of high resistance in the eastern corner of the grid (approximately 35m x 10m- highlighted in yellow- figure T), potentially represents imported material used to fill in and level the former river terrace. This area was present to around 0.6m in depth.

Figure U*– 3D timeslice (birds-eye view) of GPR grid 6 at Tamworth Castle Lower Bailey, from 0.6m depth below current ground surface. (Copyright: Centre of Archaeology and Ordnance Survey).*

Grid 7

Specific Site Information:

- GPR Survey 7: Eastern base of mound (formerly castle gardens recorded in 1741)
- Terrain Type: Flat low-cut grass.
- Data collection: GSSI SIR4000 computer, 3 wheeled survey cart with a 350MhZ hyper stacking antenna.
- GPR Survey area and method: 19m length x 6m width (maximum dimensions).
- Parallel survey with 0.5m traverse intervals. Dara collected South to North

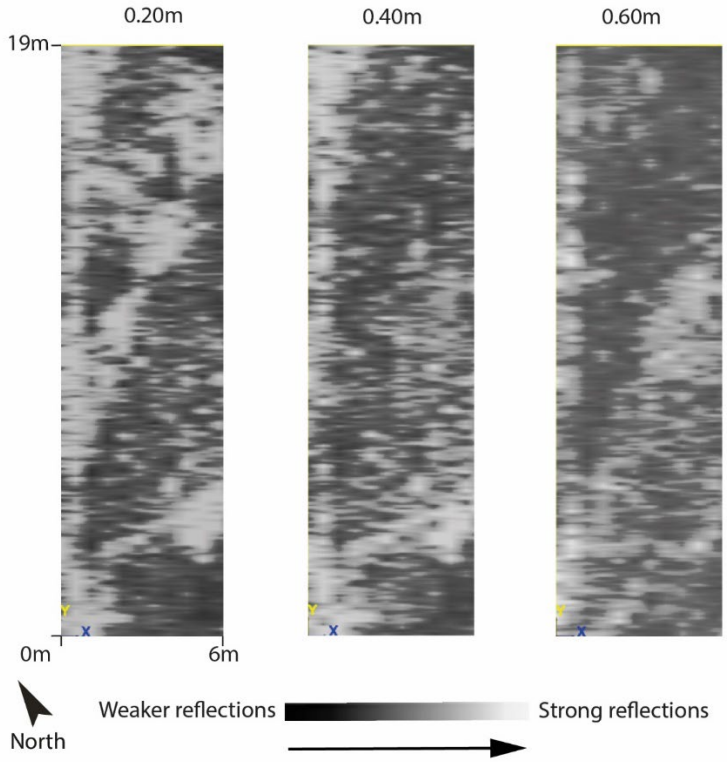


***Figure V**– 3D timeslices (birds-eye view) of GPR grid 7 at Tamworth Castle Lower Bailey, from three different depths ranging from 0.2m below current ground surface to 0.6m (Copyright: Centre of Archaeology).*

Figure V shows 3D timeslices of the GPR data from three different depths ranging from 0.2m below the current ground surface to 0.6m. Individual features from these timeslices will be discussed later. The geological layers across the site – clay and river cobbles – appear consistent.

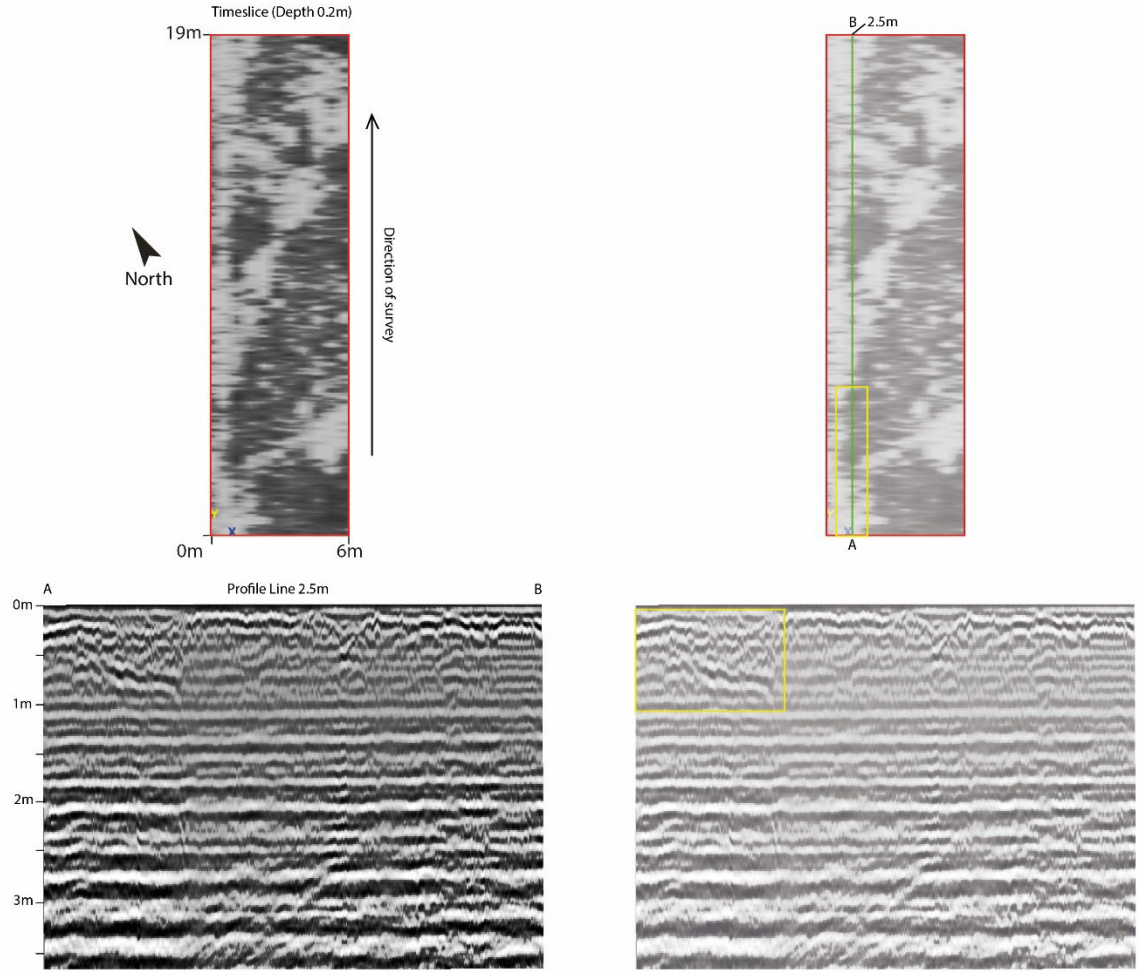


Figure W*– GPR data for features identified in Grid 6. Timeslice from depth 0.2m (top left) and timeslice 0.2m showing the location of identified features (Highlighted in yellow and blue) (top right). Radargrams depicting profile line 2.5m (bottom left) and profile line 2.5m showing identified features (bottom right). (Copyright: Centre of Archaeology).*

Profile Line 2.5m

A single profile line has been selected that best represents the results of this GPR survey from Grid 7 (Figure W). Survey line 2.5m traversed across the north-western part of the grid from south to north and it went along the base of the motte. A linear feature was present running approximately east to west across the entire grid. The data to the west of this represented disturbed material to a depth of around 0.7m.

The linear feature may represent the hard edge of the silted or disturbed shallow ditch which was present at the base of the motte and has since silted or has been deliberately filled. Analysis of the

data from trench 1 confirms the continuation of this anomaly in an orientation which is consistent with the rounded base of the motte (highlighted in Figure H).

Conclusions

The Ground Penetrating Radar survey has been successful in characterising the below ground remains across Tamworth Castle Lower Bailey. Interpretation of the data has confirmed the presence of anomalies (including negative features and remains of a structural nature), at various locations within the landscape.

It is likely that buried remains exist in the location of buildings previously present on the site. The origins of these buildings and anomalies, some of which can be seen in the mapping from 1741 onwards, are unknown. Future invasive investigations may be able to determine a more detailed phasing of these likely features. There is a high probability that remains relating to the early phases of the castle's construction remain buried, preserved beneath the topsoil, despite the numerous landscaping episodes which have occurred across the lower bailey.

Acknowledgements

This project was commissioned by Lara Rowe on behalf of Tamworth Castle. Thanks go to all the team at Tamworth Castle in particular Lara Rowe and Sarah Williams for their assistance and support throughout this project. Thanks also go to Joshua Wallace all the volunteers who supported the fieldwork throughout the project. The assessment was undertaken by William Mitchell who produced and illustrated the written report.

References

British Geological Survey https://geologyviewer.bgs.ac.uk/

Conyers, L.B., 2013. *Ground-Penetrating Radar for Archaeology*. Berkeley, AltaMira Press.

Grasmueck, M., Weger, R. and Horstmeyer, H., 2005. Full-resolution 3D GPR imaging. *GEOPHYSICS,* 70(1), pp. 12JF-Z26. Doi: https://doi.org/10.1190/1.1852780.

Utsi, E.C. 2017. *Ground Penetrating Radar: Theory and Practice*. Oxford: Butterworth-Heinemann.

Historic England

Historic England Geophysical Survey Summary Questionnaire

Survey Details and Location

Name of Site: Tamworth Castle, Lower Bailey

County: Staffordshire

NGR Grid Reference (SK 20613 0313)

Start Date: 15th February 2014 **End Date:** 19th February 2014
Post processing completed: 10th September 2014

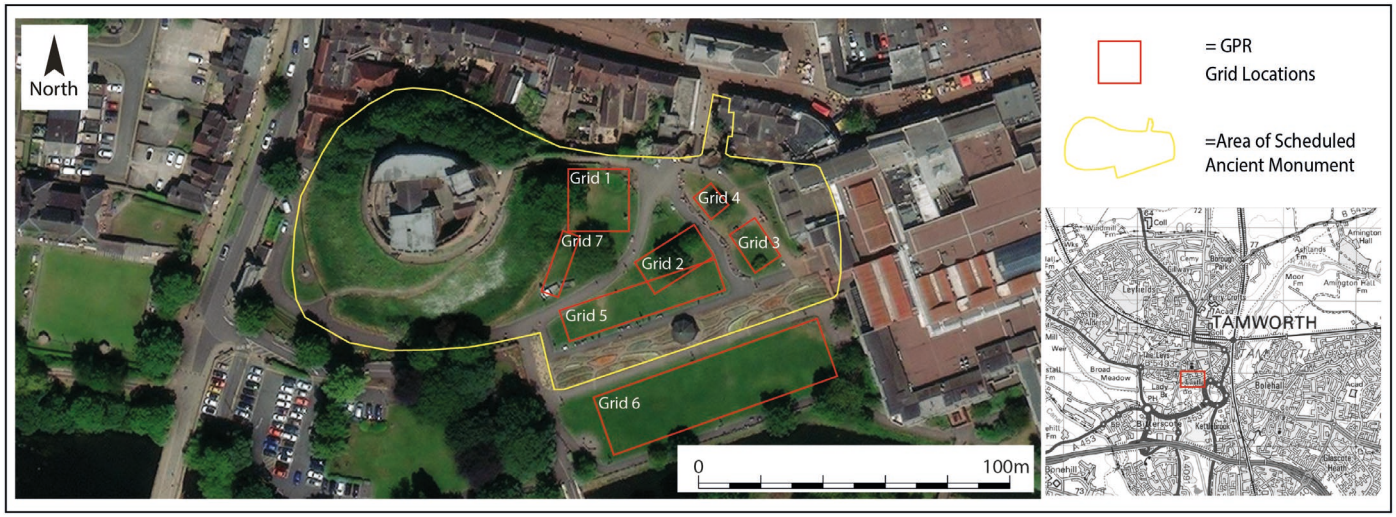
Geology at site (Drift and Solid):

The underlying geology consists of alluvium along the River Anker and Tame flood plain, with Mercia Mudstone to the north, and River Terrace deposits (sand and gravel) to the south (British Geological Survey 1:50,000). Tamworth Castle Shell Keep and curtain wall, which lies immediately north of the site, is constructed upon a large motte which is made up of excavated and piled up redeposited alluvial deposits, consisting of clay with inclusions of river cobbles.

Historic England

Known archaeological Sites/Monuments covered by the survey
(Scheduled Monument No. or National Archaeological Record No. if known)

Tamworth Castle- Area of the Lower Bailey- Scheduled monument number 1002962



Archaeological Sites/Monument Information

The late 11th century Tamworth Castle Motte survives as an earthen mound. The motte stands in the north-west corner of the former bailey. The ditch, from which material was excavated during the construction of the motte, surrounds its base on the north and east sides, surviving as a buried feature. However, it is unclear whether the ditch continued around the south side of the motte, or whether the former course of the River Anker was utilised as a moat on this side.

The area of the lower bailey was largely stripped of its buildings when the pleasure garden was laid out in the late 18th century, it is possible that earlier archaeological deposits associated with its medieval occupation survive as buried features.

The GPR survey areas were located to gather information about both the eastern ditch and any buried features located on the area of the lower castle bailey (See attached plan).

Archaeological Sites/ Monument types detected by the survey

The Ground Penetrating Radar survey has been successful in characterising the below ground remains across Tamworth Castle Lower Bailey. Interpretation of the data has confirmed the presence of anomalies (including negative features and remains of a structural nature), at various locations within the landscape.

It is likely that buried remains exist in the location of buildings previously present on the site. The origins of these buildings and anomalies, some of which can be seen in the mapping from 1741 onwards, are unknown. Future invasive investigations may be able to determine a more detailed phasing of these likely features. There is a high probability that remains relating to the early phases of the castle's construction remain

buried, preserved beneath the topsoil, despite the numerous landscaping episoes which have occurred across the lower bailey.

Surveyor

The Centre of Archaeology- (William Mitchell)- The University of Huddersfield (Formerly of Staffordshire University)

William Mitchell is a member of an interdisciplinary group of scholars spanning forensic investigation, archaeology, history, humanitarian studies, and digital humanities who have undertaken pioneering and impactful work in Holocaust and Genocide Studies and community archaeology projects. Many of these projects require non-invasive technologies and rely on the data collected through GPR investigations on contested and challenging sites.

We currently reside within the Centre of Archaeology at The University of Huffersfield where, over the last ten years, we have built an internationally recognised, world-leading centre of excellence that undertakes research, delivers innovative postgraduate programmes, and provides consultancy services.

Contact details:

William Mitchell BA (Hons), PGDipEd
Senior Lecturer in Archaeology
The Centre of Archaeology
The School of Arts and Humanities

University of Huddersfield | Queensgate | Huddersfield | HD1 3DH
www.hud.ac.uk

Email: W.L.Mitchell@hud.ac.uk

Name of Client
Tamworth Borough Council- Tamworth Castle

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:

The primary digital archive is stored within the University of Huddersfields' secure cloud storage and duplicated at Tamworth Castles' digital archives.

b) Full Report:

The report will details the archaeological background and will includes a discussion and interpretation of the GPR data, supported by annotated illustratrations. The written

report will be made publicly accessible, as part of the Staffordshire Historic Environment Record. Copies will also be submitted for inclusion in the Tamworth Borough Council and Historic England.

Methodology: Technical Details

Type of Survey: Ground Penetrating Radar

Area Surveyed, if applicable

Three Grids were undertaken across the area of the lower bailey.

Grid 1 = 20m x 19m (380m² or 0.038 hectares)
Grid 2 = 21m x 11m (231m² or 0.0231 hectares)
Grid 3 = 15m x 10m (150m² or 0.0150 hectares)
Grid 4 = 10m x 8m (80m² or 0.0088 hectares)
Grid 5 = 47m x 10m (470m² or 0.0470 hectares)
Grid 6 = 77m x 21m (1617m² or 0.1617 hectares)
Grid 7 = 19m x 6m (114m² or 0.0114 hectares)

Traverse Separation, if regular/ Reading/Sample Interval:

Digital data was collected with a 60-nS time window, 512 samples/scan, and with 60 scans/m. The gain settings were manually adjusted according to the geological conditions on site. The data was collected using parallel profile lines spaced at 0.5m traverse intervals, orientated to the landform.

Type, Make and model of Instrumentation:

The GPR survey utilised a 350MhZ hyper-stacking antenna (in a three-wheeled survey cart configuration) on each grid location. The antenna was used in conjunction with a SIR4000 computer to collect the most comprehensive dataset across multiple depths.

Land use at the time of the survey (Use term/terms from the attached list or specify other):

Grassland park / recreation ground.