magnitude surveys

Geophysical Survey Report

Of

Civil War defences in Bury Field

Monument No: 1021389

Newport Pagnell

Buckinghamshire

For

Milton Keynes Council

and

The Bury Field Commoners

Magnitude Surveys Ref: MSSP344

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Abstract

Magnitude Surveys was commissioned to assess the archaeological subsurface potential an area of c. 1.5 ha of land containing Scheduled Civil War defences (Monument No: 1021389) at Bury Field Common, in Newport Pagnell. The survey was specifically intended to identify the extent of any surviving sub-surface structural elements or features associated with the defences within and adjacent to the Scheduled area. A fluxgate magnetometer survey and subsequent targeted ground-penetrating radar (GPR) survey were both successfully completed, and a number of previously unrecorded features associated with the defences have been identified. Specifically, the use of GPR has helped to better characterise potential features relating to the construction and disuse or demolishing of the outer bank and ditch or *enceinte*. The magnetometer survey has identified no further anomalies of possible archaeological origin to the west of these earthworks. In the south of the site, part of a possible bastion feature, recorded as possible disturbed earthworks and visible in recent LiDAR data, were surveyed with both methods. Not all of this earthwork feature could be surveyed due to variations in ground conditions, limiting the available context for interpretation. Here, while multiple anomalies were identified, none could be confidently interpreted as potential features relating to the defences, as they may equally relate to subsequent extraction activity.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Milton Keynes Council on behalf of Milton Keynes Council and the Bury Field Commoners to undertake geophysical surveys on a c.1.5 ha area of land at Bury Field Common, in Newport Pagnell (SP 8747 4403).

1.2. The geophysical survey comprised hand-pulled, cart-mounted fluxgate magnetometer survey, and hand-pushed, cart-mounted ground penetrating radar (GPR) survey. MS' Ofcom Ground Probing Radar licence number is L1078291/1.

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David et al., 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt et al., 2015).

1.4. The survey was conducted in line with a Method Statement produced by Magnitude Surveys (Magnitude Surveys 2018), and in accordance with the conditions of an Ancient Monuments and Archaeological Areas Act 1979 section 42 licence, issued by Historic England (Case No: SL00193108).

1.5. The survey commenced on 14/08/2018 and took two days to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).

2.2. Director Graeme Attwood is a Member of CIfA, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford and is the Vice-Chair of the International Society for Archaeological Prospection.

2.3. All MS managers have relevant degree qualifications to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

3. Objectives

3.1. The specific objective of the survey was to provide information regarding the below ground extent of the Civil War defences and any surviving structural elements or related features within and adjacent to the scheduled area in accordance with objective 18.8.1 of the Solent-Thames Research Framework.

3.2. The fluxgate magnetometer survey was undertaken to identify the potential extent of subsurface archaeological features within and adjacent to the earthworks. This information was then used to inform the creation of smaller target areas to undertake ground-penetrating radar survey.

3.3. The ground-penetrating radar survey was carried out over specific target areas identified in the fluxgate magnetometer survey. The technique was selected to provide additional information regarding the below ground extent and character of target anomalies.

4. Geographic Background

4.1. The site is located at the south-east end of Bury Field Common, adjacently north of the town of Newport Pagnell (Figure 1). Survey was undertaken over two targeted areas of grass at the southeast edge of the Common. The site was bounded by housing to the north and east, Queens Avenue Car Park to the south, and housing and the remainder of Bury Field Common to the west. Area 1 contained the Scheduled area and linear earthwork, while Area 2 contained irregular, steep topographic variations outside of the Scheduled Area (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Short grass. A steep linear bank aligned SSW-NNE, topped with a crushed stone footpath, ran across the area, with a shallow ditch feature running parallel along its western flank.	Bounded by: hedgerows and brick walling to the north and east; trees and wooden fence associated with Queens Avenue Car Park to the south, and the remainder of Bury Field Common to the west. A shallow ditch-like feature was also noted at the northern end of the area.
2	Short grass. Irregular and steep topographic variations give way to a shallow ditch-like feature to the north of the area.	Bounded by: standalone trees to the north; trees and wooden fence associated with Queens Avenue Car Park to the south, and overgrown vegetation and the remainder of Bury Field Common to the west.

4.3. The underlying geology comprises sandstone, siltstone and mudstone of the Kellaways Formation. A single deposit of limestone of the Cornbrash Formation is also recorded in the centre of Area 1. No superficial geology is recorded across the site; the nearest recorded deposit is a band of alluvium c.85m north of Area 1 (British Geological Survey, 2018).

4.4. The soils consist of slightly acid loamy and clayey soils with impeded drainage (Soilscapes, 2018).

5. Archaeological Background

5.1. The following summarises selected records identified using a Heritage Gateway search of the site and the surrounding 1km, along with other sources. While this is not an exhaustive assessment of the full record, it will draw on elements relevant to the results obtained during survey.

5.2. Bury Field was likely used for agricultural purposes during the Medieval period, as is attested by extant ridge-and-furrow aligned sub west-east, visible at the ground surface and in LiDAR data to the west of Area 1 (Figure 8). History records that the ploughed land was turned to common pasture in the 12th Century, although parts of the field were again put under plough following WWII (Hancock, 2012).

5.3. The site contains a Scheduled Ancient Monument (Monument Number 1021389), the Civil War defences, which are the focus of the survey. These are recorded as earthwork features including a SW-NE aligned linear bank and ditch or 'enceinte', and two possible bulwarks at the northeast and southwest ends. Cornelius Vanden Broome produced a plan of the defences of Newport Pagnell in 1644 which shows a scale drawing of a continuous enceinte surrounding the town supported by eight bastions. The bulwark at the northeast end, 'Mill Hause Bulworcke', is now mostly overlain by housing, though a slight ditch-like feature may represent the southern edge of this feature. A similar ditch-like feature is recorded at the southern end of the enceinte and may represent the northern extent of the south-western bastion, 'Stone Bulworcke'. The defences were ordered to be slighted and demolished after August of 1646, though subsequent stone-quarrying activity is thought to have disturbed much of the bastion (Heritage Gateway 2018).

5.4. During the 1800s, the Town Land Feoffees record that stone was dug from small quarries and possibly from the Civil War defences to repair roads (Hancock, 2012). Quarrying activity is identifiable on LiDAR data as an extensive area of hollows to the west of Area 2 (Figure 8).

5.5. A former railway line (Monument Number 1507803) was planned to run through Bury Field, but was never completed. It is noted in the 1st Edition OS Map (1843-93) as a 'Projected railway'. The later edition (1904-39) OS map records the site as a dismantled railway. The former banks and cuts created for the railway are still extant as earthworks.

6. Methodology

6.1. Data Collection

6.1.1. Geophysical prospection comprised the magnetic and GPR methods as described in the following table.

6.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m
Ground Penetrating Radar	MALÅ GX450 ground penetrating radar	0.5m	0.05m

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.3.3. Rows of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. In quad-towed configuration, a navigation system was integrated with the RTK GPS was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.1.3.4. GPR data were collected along lines, using the system's odometer wheel to position sampling points. The lines were collected using a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.4. GPR data were collected along lines, using the system's odometer wheel to position sampling points. The lines were set out within a grid established using a Hemisphere S321 GNSS Smart Antenna RTK GPS which is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.

6.2.Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see sect 4.2 in David et al., 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen et al. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

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

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

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

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

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

6.3.Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the magnetometer's total field data as greyscale images, as well as the total field data from the upper and/or lower sensors. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 9). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

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

6.3.3. Geophysical results have been interpreted using greyscale images and magnetic XY traces in a layered environment, overlaid against open street maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth (2018) was consulted as well, to compare the results with recent land usages.

7. Results

7.1.Qualification

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

7.2.Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery (Figure 6), historic maps (Figure 7), and LiDAR data (Figure 8).

7.2.2. The cart-mounted fluxgate magnetometer survey and GPR survey have responded well to the survey area's environment. Thick vegetation west of Area 2 prevented survey into the quarried area west of the proposed 'Stone Bulworcke' bastion. Similarly, steep uneven terrain between Areas 1 and 2 also prevented survey with either system. This has resulted in a limited context, particularly in Area 2, which has made the interpretation of geophysical results somewhat challenging. Nevertheless, in the areas which were surveyed, anomalies have been successfully identified against their background, including weaker anomalies such as enhancements from extant ridge-and-furrow. This demonstrates the suitability of the methods used for detecting the extents of potential archaeological features.

7.2.3. In Area 1, the magnetometer survey has identified multiple potential features over the extent of the linear bank and ditch or *enceinte*, including a linear anomaly running atop the bank. The GPR data has shown that this anomaly likely results from a feature at a greater depth than what would be expected from the modern footpath which also follows the top of the bank. An additional linear anomaly has also been identified in both the magnetic and GPR results, aligned parallel with and c.10m east of the bank, which may represent a previously unrecorded feature related to the defences. A series of spreads c.5m west of the bank, located in a ditch-like feature, may represent accumulations of demolished material associated with the slighting of the defences. Within this spread, a short potential linear feature has been detected in the GPR data which was not identified in the magnetic survey, though it is unclear from the limited dataset whether this represents a potential archaeological feature. No anomalies of possible archaeological origin have been identified west of the ditch, and no anomalies have been identified which may relate to the 'Mill Hause Bulworcke' at the northern

end of Area 1. A series of weak, linear anomalies west of the *enceinte* align with extant ridge-and-furrow visible in LiDAR data.

7.2.4. In Area 2, variations in topography can be seen in the LiDAR data which take the approximate shape of the 'Stone Bulworcke' or bastion feature as drawn in the Vanden Broome map, including a possible westward extension of the *enceinte* ditch from Area 1, but these possible earthwork features appear more broken and varied than the more consistent ones to the north (Figure 8). This suggests that any features relating to the Civil War defences in Area 2 are more likely to have been disturbed by nearby quarrying activity. The magnetometer survey has identified two ferrous spreads, which are located within topographic depressions recorded in LiDAR data. These have also been detected as irregular spreads of material in the GPR data to a depth of c.60cm. From their shape and collocation with topographic depressions, it is likely that these collections of material are the result of either the demolition of the defences or of waste material from subsequent extraction activity, which may have included extraction of material from the defences themselves. Additionally, a short linear anomaly atop a bank-like feature has also been identified at the south-western extent of Area 2, though it is of limited length, was not surveyed with the GPR method, and has a modern footpath running along it; therefore, it cannot be confidently interpreted as being archaeological in origin. Additional survey to the north and west of Area 2 was prevented by thick vegetation to the west and steep irregular topography to the north.

7.3.Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

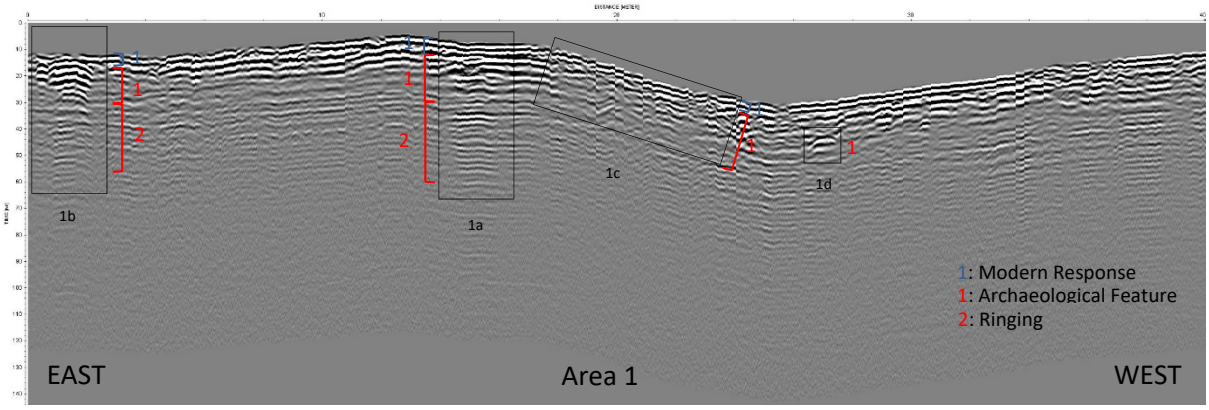
7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated deposition of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Geophysical Results - Specific Anomalies

Area 1

7.3.2.1. **Archaeology Possible (Strong) (Mag) –** A strong, slightly curving, linear anomaly, [**1a**], has been identified running c. SW-NE across the east of Area 1. This anomaly is located along the top of the banked earthwork and collocates with a crushed stone footpath which follows the top of the bank. Given the consistent, strong magnetic response of this anomaly, and its similarity to [**1b**], which does not correspond with any surface features, it is unlikely that [**1a**] results from magnetically enhanced material in the footpath. The GPR results complement this reasoning, showing reflections to a depth of c. 1.5m (see Radargram 1). Given its location along the top of the bank and its strong magnetic enhancement, it may represent a negative (cut) feature, such as a slot cut to support a wooden wall atop the bank. A shorter linear anomaly, [**1b**], has been identified in Area 1 c.15m east of [**1a**], which is similar in magnetic field strength and shape, though unlike [**1a**], there are no overlying surface features for this anomaly. Due to the similarity in geophysical responses with anomaly [**1a**], and their parallel alignment, it has been classified as possibly archaeological in origin, and is likely to represent a previously unrecorded feature associated with the Civil War defences.

7.3.2.2. **Archaeology Possible (Strong) (GPR) –** The anomalies [**1a & 1b**] have been clearly detected in the GPR results. They help to confirm the possible archaeological origin of the magnetic responses and they both present similar characteristics. In the very shallow layers they show a response associated with the actual surface. This response is stronger for the anomaly [**1a]** due to the presence of a crushed stones footpath; thus, in the shallow interpretation a modern origin has been associated with [**1a]** (Figure 10). As we go deeper, the response of possible archaeology becomes visible. In both case it consists of the possible archaeological anomaly followed by a ringing between 70cm and 150cm deep (see Radargram 1). The ringing associated with anomaly [**1a]** might also contain some ringing from the modern footpath. A short, linear high-amplitude anomaly [**1d**] has been identified which follows the base of a ditch-like earthwork feature west of the bank in Area 1. It has been identified at a depth of c.50-60cm and terminates just north of the southern extent of the radar target area (Radargram 1 and Figure 10). It is unclear whether this anomaly reflects a feature relating to the Civil War defences or a later accumulation of material in the bottom of the ditch, but the similar depth and orientation with the anomalies [**1a]** and [**1b]** allow the classification of possible archaeological origin.



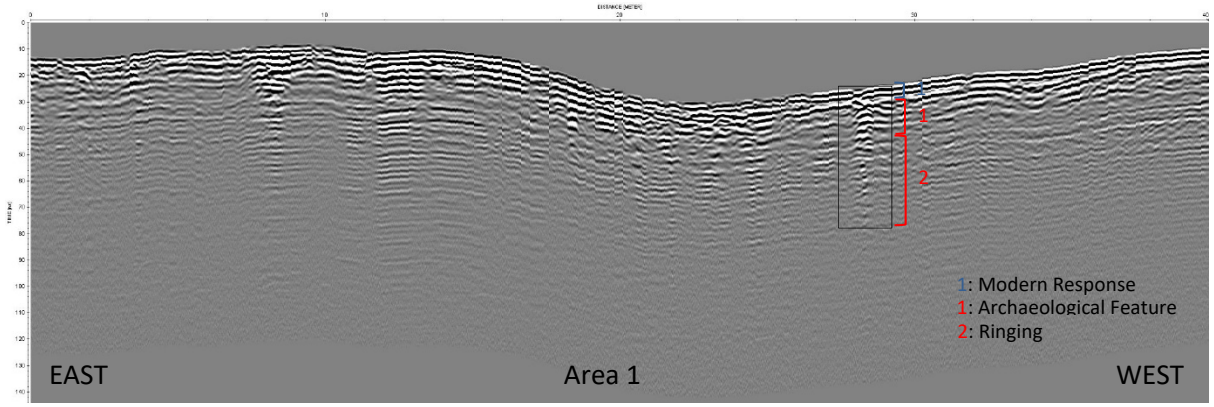
Radargram 1

7.3.2.3. **Archaeology Possible (Spread) (Mag)** – A series of spreads of magnetic enhancement, [**1c**], have been detected in Area 1 to the west of and parallel to [**1a**]. These are located along the western slopes of the bank earthwork and are identifiable in the radar results as irregular high-amplitude reflections (Figure 5). Their varying magnetic strength and inconsistent shape suggests that they are not the result of *in situ* features relating to the bank. Rather, they may instead represent the downslope accumulation of material, and may include dismantled or disturbed material from defences related to the bank.

7.3.2.4. **Archaeology Possible (Spread) (GPR)** – Within the GPR data the area of possible archaeology spread is visible below the surface response. It is fainter than the previous discussed anomalies but the disturbed layers with higher amplitude responses confirm the accumulation of material.

7.3.2.5. **Undetermined (Strong) (Mag) –** A linear alignment of strong magnetic responses, [**1f**], has been detected in the south-east corner of Area 1, aligned WNW-ESE and c.15m in length. Whilst it is partially located within the Civil War defences, it is unclear from its signal, form or alignment whether it is associated with these features.

7.3.2.6. **Undetermined (Strong) (GPR)** – Four anomalies have been detected in the north-west corner of the GPR data (Figure 10), 4m west of the linear anomaly associated with the Civil War Defences. Their responses (see Radargram 2) are similar to [**1a]** in Radargram 1, however, it is unclear if these are associated with the War Defences.



Radargram 2

7.3.2.7. **Agricultural (Weak) (Mag) –** A series of parallel weak linear anomalies, [**1g**], have been identified in the north-west of Area 1. These are aligned c. NW-SE, are spaced c.6-8m apart, and vary in width from 2-4m across. Their alignment, extent and spacing corresponds with extant ridge-and-furrow visible in LiDAR data (Figure 13), while their weak enhancement and shape is typical of enhanced plough furrows.

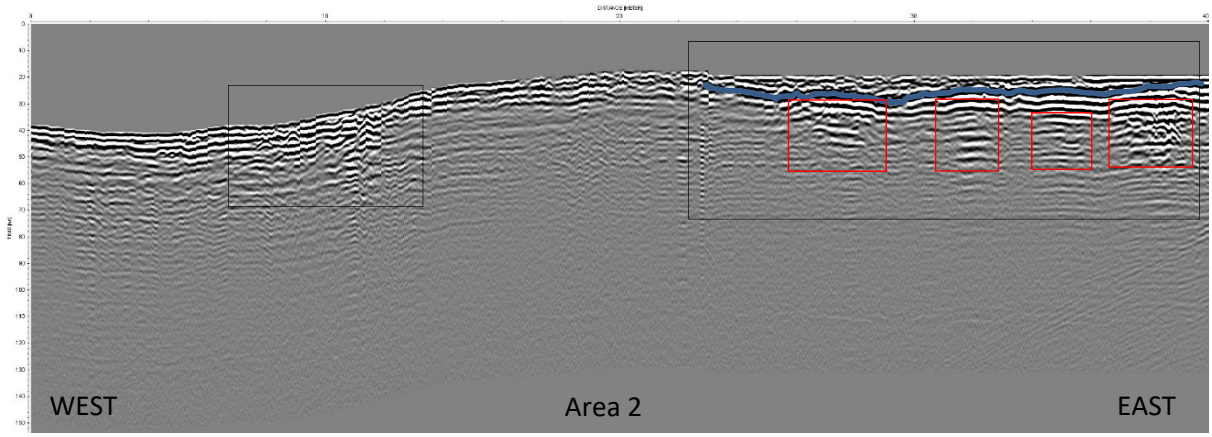
7.3.2.8. **Agricultural (Strong) (GPR)** – A linear feature [**1e**] has been identified crossing the area in the west - east direction, splitting and curving toward southeast and northeast corner (Figure 10, 11 & 12). It is aligned with a footpath visible on the satellite image (Figure 6); beyond the split, one part goes toward the stone footpath and the other part goes toward the southeast corner that is in the direction to the entrance of the field. These elements confirm the agricultural/land use origin.

7.3.2.9. **Collection Artefact (Trend) (Mag)** – A repeated line of weak negative anomalies, [**1h**], can be seen in the west of Area 1, running parallel with the direction of data collection. This portion of the survey was carried out by volunteers, and while great care was taken to remove magnetic objects and clothing, it is likely that a metallic object or clothing fixture belonging to a volunteer caused this slight interference.

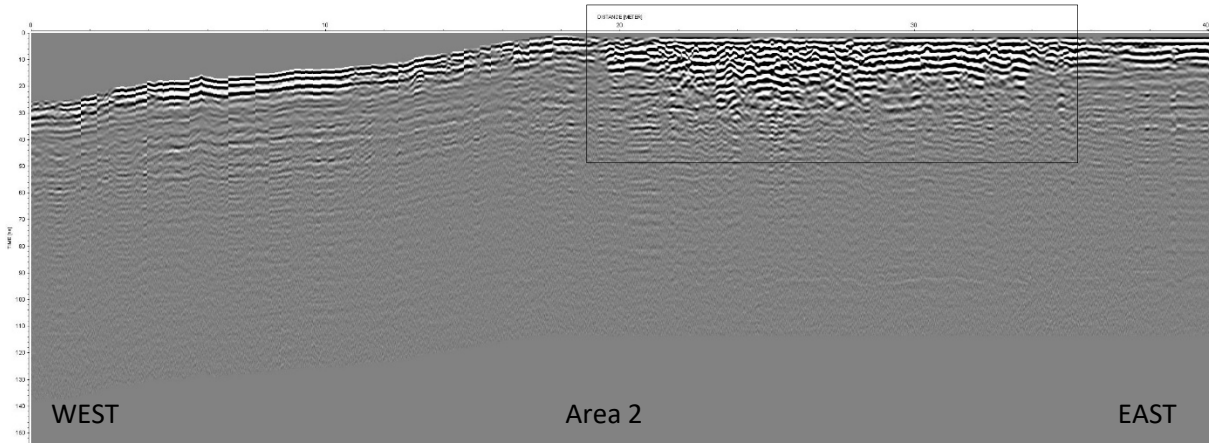
Area 2

7.3.2.10. **Ferrous (Strong, Spread) (Mag) –** A number of ferrous anomalies and spreads have been identified within Area 2, which appears to extend into the south-west corner of Area 1. Anomaly [**2a**] has also been detected in the GPR data, as a well-defined spread of high amplitude reflections, and sits in a topographic hollow visible on LiDAR (Figure 8). The shape and character of the magnetic responses are not indicative of *in situ* features, and instead may represent collections of material, either from the slighting of the defences or later extraction activity. Anomaly [**2b**] also lies within a slight topographic depression and has been detected as a similar geophysical response.

7.3.2.11. **Former Bastion / Quarrying (Strong Spread) (GPR)** – As in the magnetic results it is difficult to know if the anomalies detected in the GPR data originate in the Civil War Defences or the later quarrying. On Radargram 3 a ditch like feature is visible with disturbed material within and two strong anomalies under the ditch, which could be of archaeological origin. However, on Radargram 4 which is part of the same group of responses (Figure 16), only highly disturbed material is visible. It is possible that the results are a combined response from quarrying and remains of the Civil War Defences, however, the dissociation of the anomalies is unclear.



Radargram 3



Radargram 4

7.3.2.12. **Undetermined (Strong)** – A short linear magnetic anomaly has been identified running c. NW-SE in the south-west corner of Area 2. This collocates with a raised bank and footpath which continues to the north and west beyond the extent of the survey area. This raised area does approximately take the shape of the 'Stone Bulworcke' bastion as drawn in the Vanden Broome map (see Figure 8), though it is also sited within an area of extraction and is more broken in appearance than the earthworks in Area 1. It is possible that anomaly [**2c**] represents a similar feature to [**1a**], but without additional contextual information, and given its position within an area of subsequent extraction activity, the same interpretation cannot be justified. The survey area could not be extended further west due to thick vegetation, and this feature was not targeted for GPR survey due to its presumed function as a causeway through the quarried area and its current use as a footpath.

7.3.2.13. **Undetermined (Strong) (GPR)** – A couple of linear features have been detected in the middle layers in the north-west corner of the area. However, the response is faint and not clearly visible in the radargrams, which make its origin unclear. It could be of archaeological origin but natural or data artefact origins cannot be ruled out.

8. Conclusions

8.1. The techniques selected (cart-mounted fluxgate gradiometer survey and cart-mounted GPR survey) have responded relatively well to the survey area's environment. This combined survey has provided specific information regarding the below-ground extent of the Civil War defences, including potential surviving elements and previously unrecorded potential features, particularly around the bank-and-ditch or *enceinte* in the centre of the site. Specifically, the use of GPR has allowed the distinct interpretation of a possible linear feature along the centre of the bank, distinct and separate from a modern footpath at the ground surface. This feature may represent a foundation cut for a wooden perimeter wall atop the bank. Additional potential features have been identified using both methods, including a linear anomaly parallel to and east of the bank, and a series of accumulations of material within the outer ditch, which may relate to the demolition of the defences or the collection of material within the ditch during or after its use. No anomalies of possible archaeological origin have been identified west of this ditch, though a ridge-and-furrow ploughing regime has been identified as a series of weak, broad linear anomalies. No anomalies have been detected which may relate to a possible bastion at the north end of the site.

8.2. Due to the limitations of ground conditions, only limited portions of the potential bastion, 'Stone Bulworcke', at the south end of the site could be surveyed, and the interpreted results here are somewhat less conclusive as a result. Though some anomalies have been successfully identified which may relate to the Civil War defences, their potential origins are more difficult to determine, given their limited context and location within an area of subsequent extraction activity. A short linear magnetic anomaly along raised bank-like topography at the south-west end of the site may be analogous with the feature identified along the central *enceinte*, but without additional contextual information this interpretation cannot be put forward with confidence. It is clear from recent LiDAR data that the possible bastion is located within an area

of subsequent extraction and, if it remains, has been disturbed. Two spread anomalies within the possible extent of this bastion have been identified in both the magnetic and GPR data, and, given their situation within topographic depression, may reflect accumulations of material resulting from either the slighting of the Civil War defences or from subsequent extraction activity.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

10. Copyright

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

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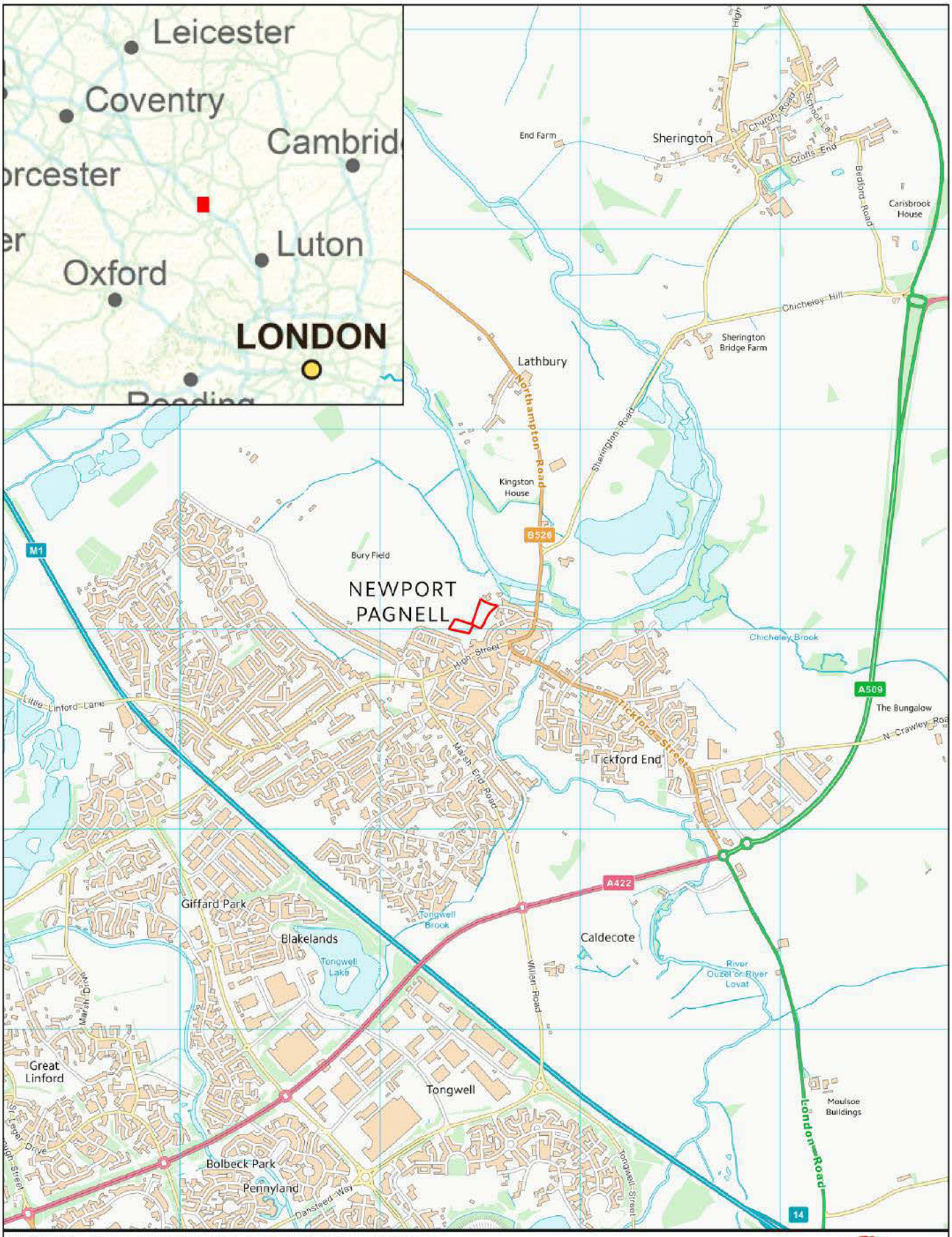


MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 2 - Location of Survey Areas
1:2,000 @ A3

Survey Extents
GPR Survey Extents

N

0 50 100 150 m

magnitude surveys

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,000 @ A3

48,990 nT 49,020

N

0 25 50 75 m

magnitude surveys

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 4 - Magnetic Gradient
1:1,000 @ A3

-3 nT 5

N

0 25 50 75 m

magnitude surveys

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 5 - Magnetic Interpretation
1:1,000 @ A3

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Ridge and Furrow (Trend)
- Ferrous (Dipolar)
- Ferrous (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Collection Artefact

N

0 25 50 75 m

magnitude surveys

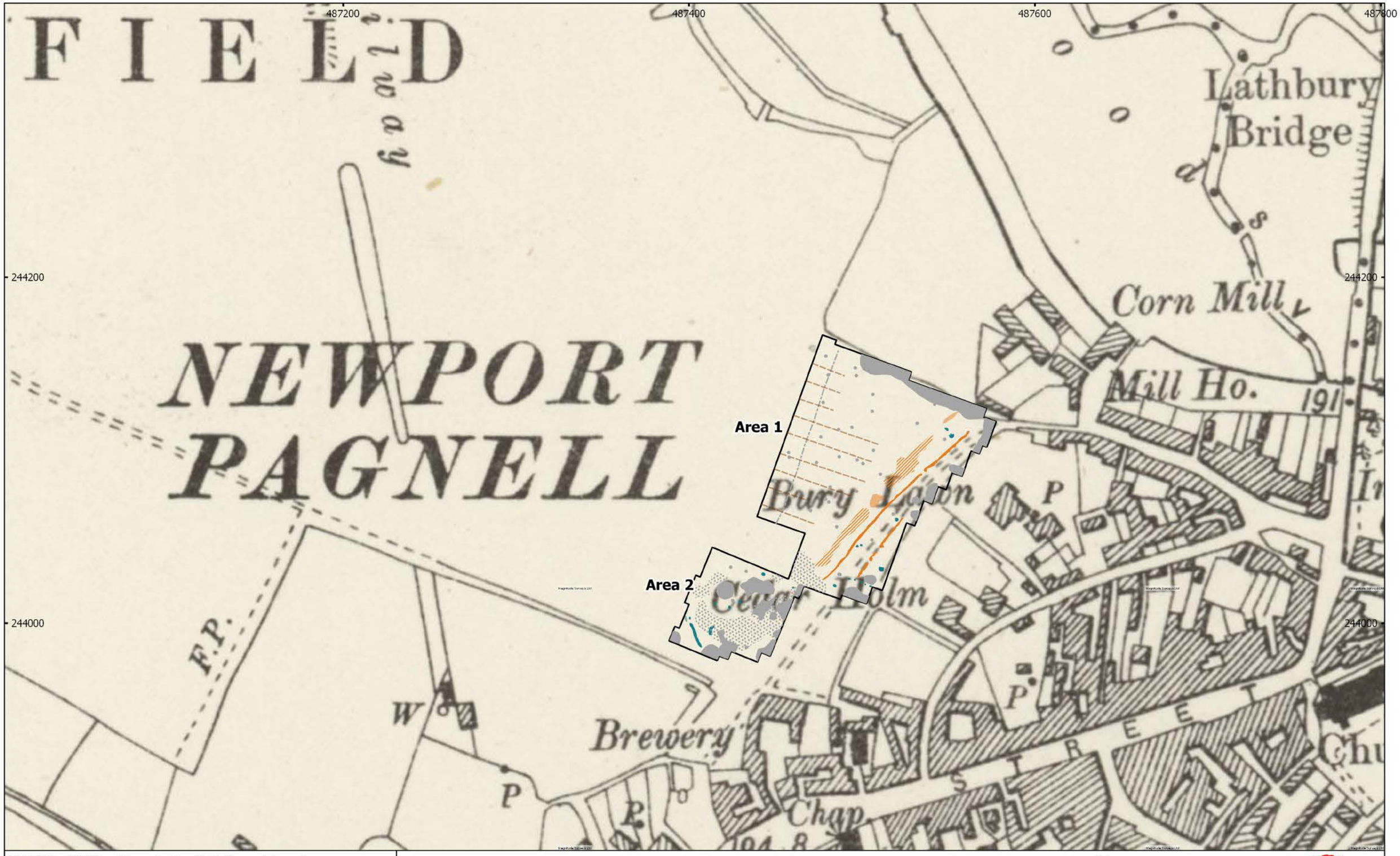
MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:1,000 @ A3

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Ridge and Furrow (Trend)
- Ferrous (Dipolar)
- Ferrous (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Collection Artefact

N

0 25 50 75 m

magnitude surveys



MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 7 - Magnetic Interpretation Over Historic Maps
1:2,000 @ A3

Contains historic maps: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Ridge and Furrow (Trend)
- Ferrous (Dipolar)
- Ferrous (Spread)
- Undetermined (Strong)
- Undetermined (Weak)
- Collection Artefact

N

0 50 100 150 m

magnitude surveys

487300
487400
487500
487600
244200
244100
244000

Area 1

Area 2

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 8 - Magnetic Interpretation Over LiDAR (Composite DSM)
1:1,000 @ A3

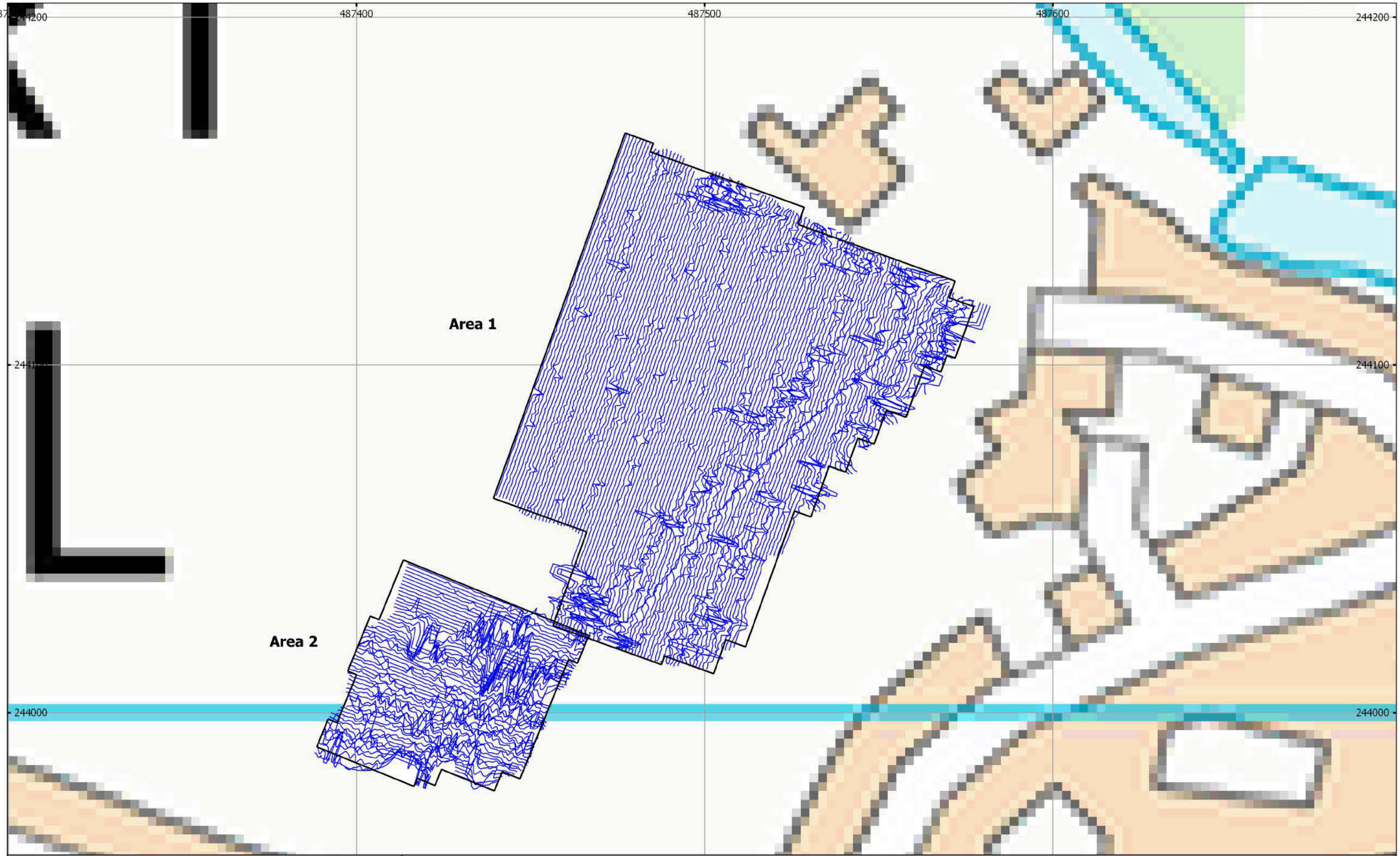
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Archaeology Possible (Spread)
Ridge and Furrow (Trend)
Ferrous (Dipolar)
Ferrous (Spread)
Undetermined (Strong)
Undetermined (Weak)
Collection Artefact

1m DTM over Hillshade
52 m 62

N

0 25 50 75 m

magnitude surveys



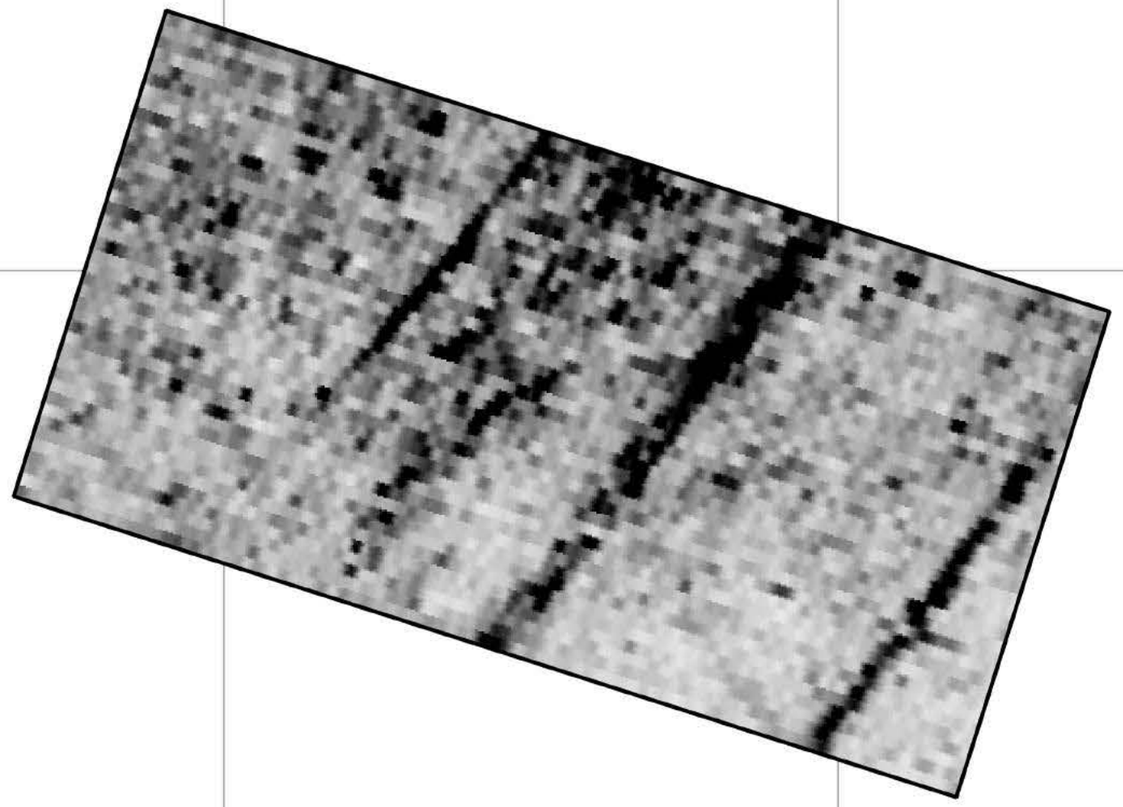
MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 9 - XY Trace Plot
100nT/cm at 1:1,000 @ A3

N

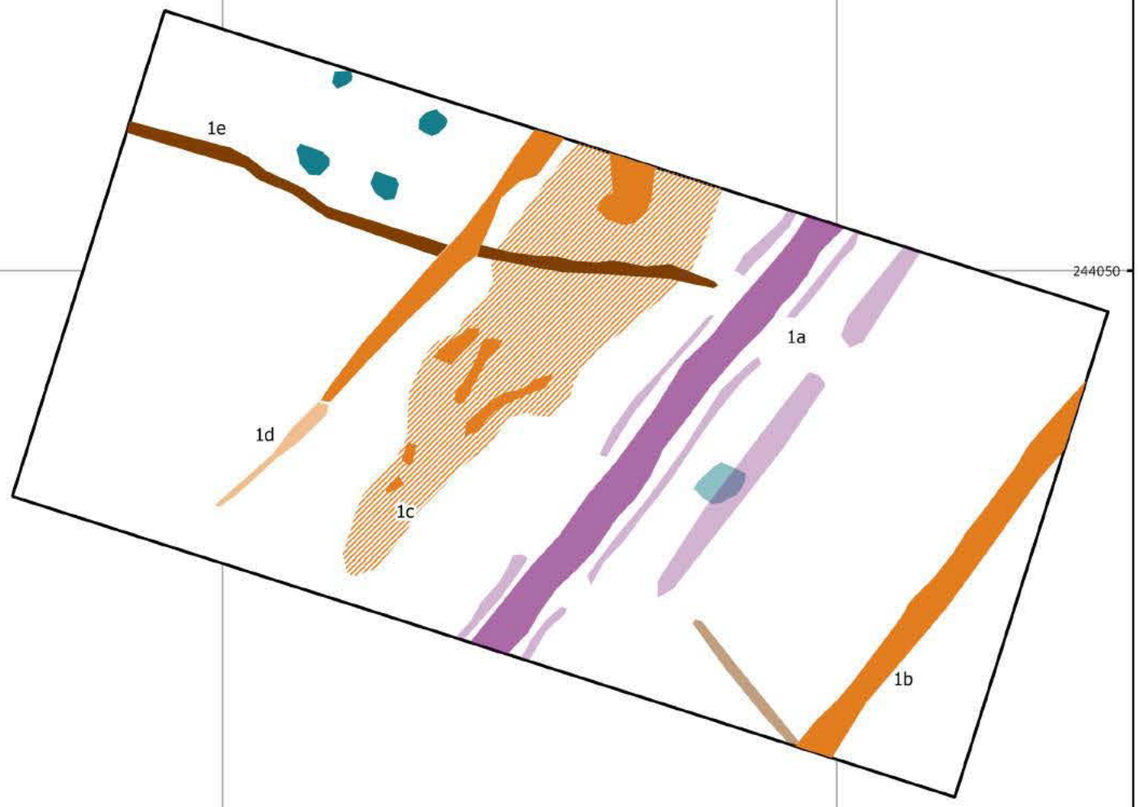
0 25 50 75 m

magnitude surveys

Timeslice depth: 50cm



AREA1 - SHALLOW



487475
487500
244050
244025

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 10 - GPR Area 1 Shallow Interpretation
1:250 @ A3

Low Amplitude High

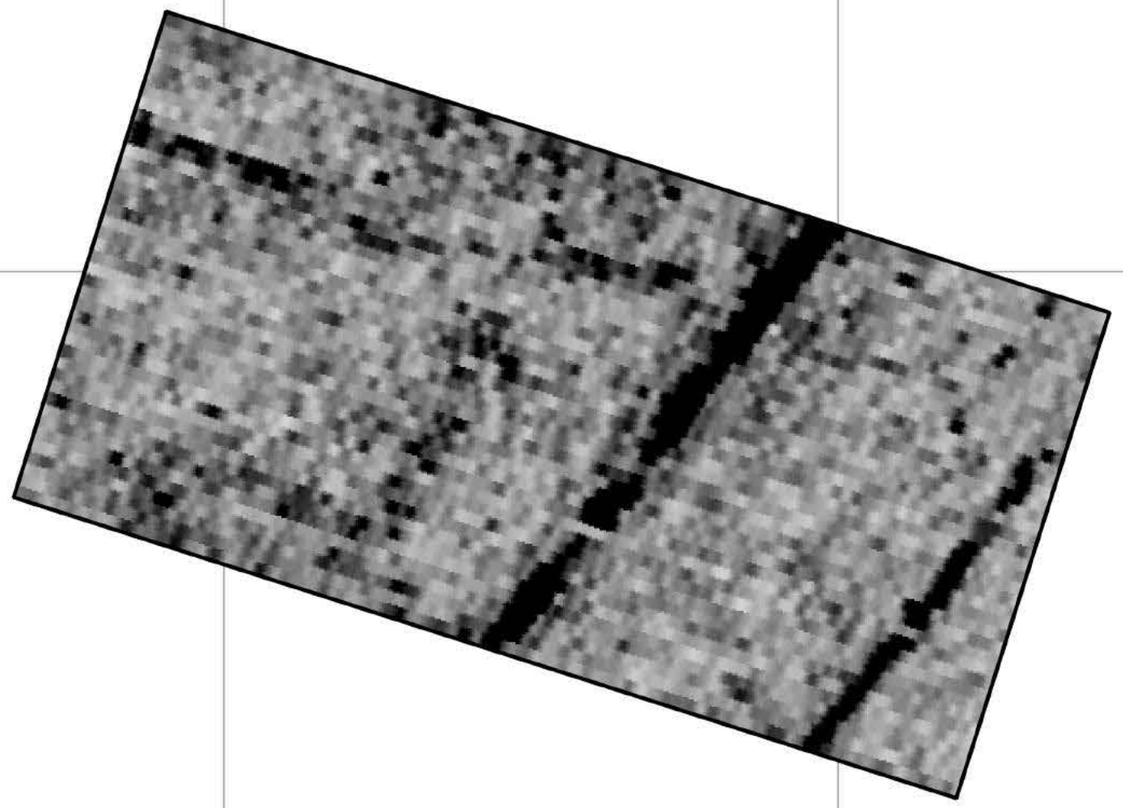
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Modern (Strong)
- Modern (Weak)
- Undetermined (Strong)
- Undetermined (Weak)

N

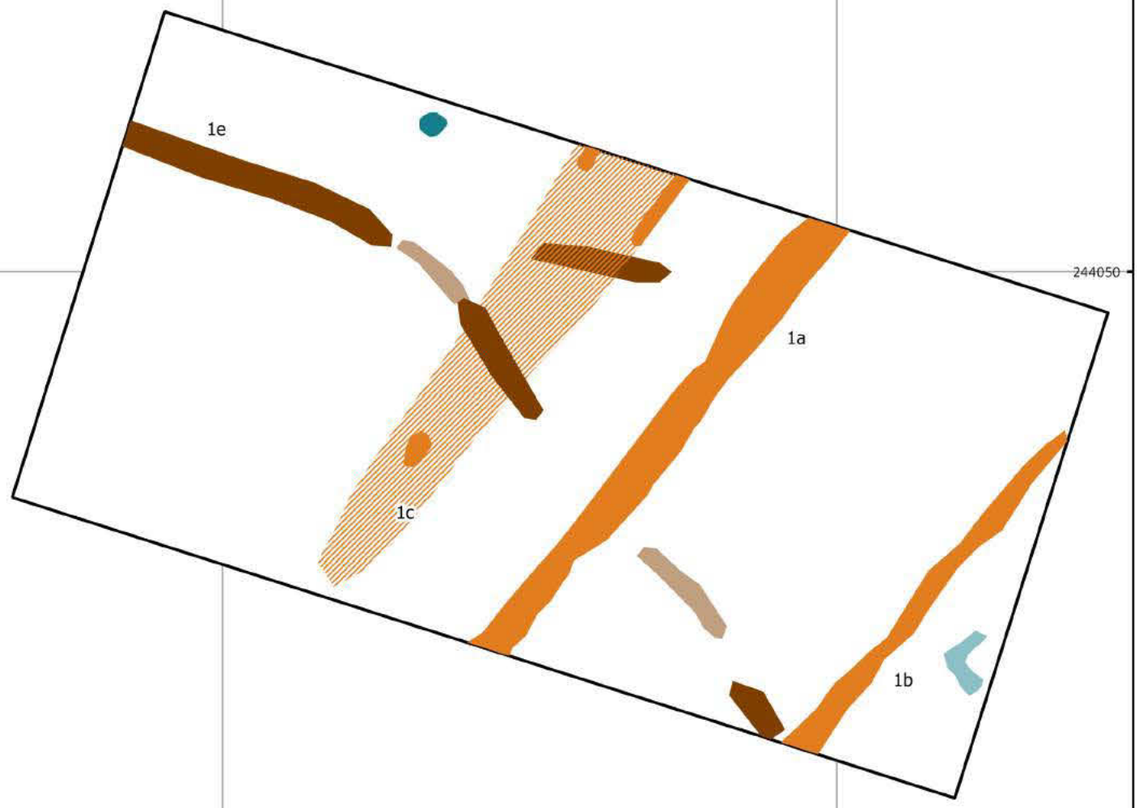
0 5 10 15 m

magnitude surveys

Timeslice depth: 100cm



AREA1 - MIDDLE



487475
487500
244050
244025

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 11 - Area 1 GPR Middle Interpretation
1:250 @ A3

Low Amplitude High

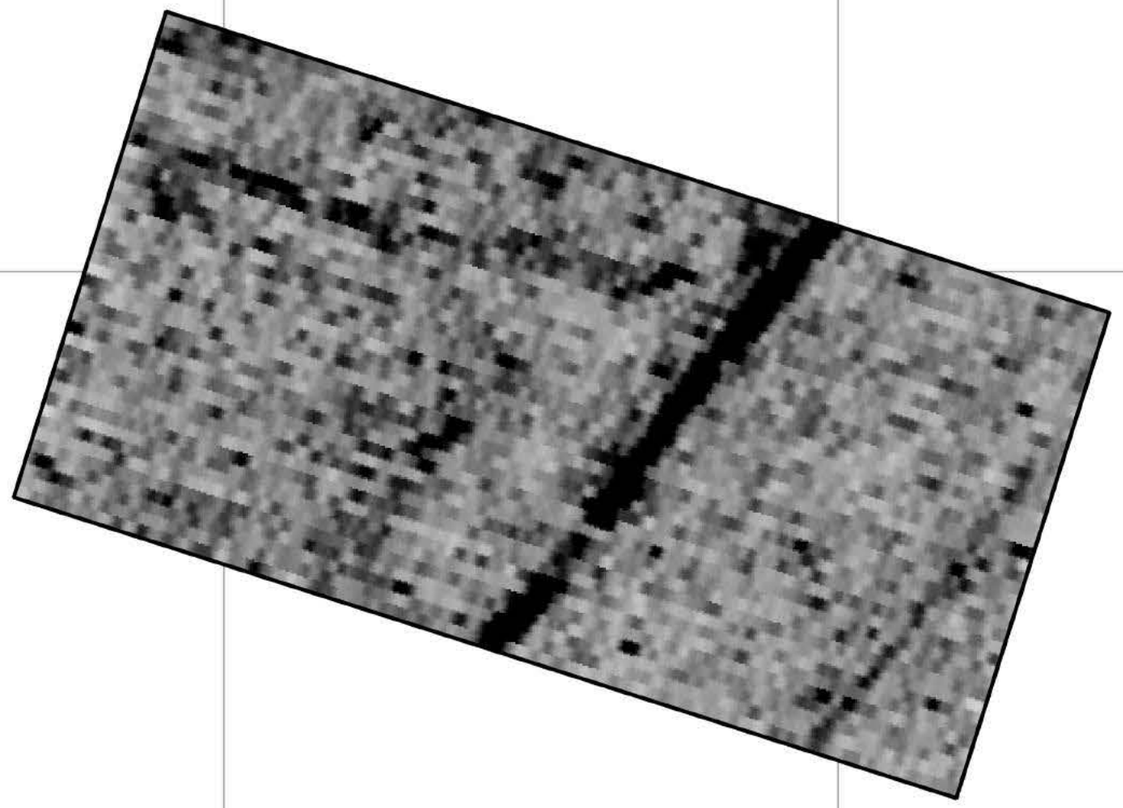
- Archaeology Possible (Strong)
- Archaeology Possible (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Undetermined (Strong)
- Undetermined (Weak)

N

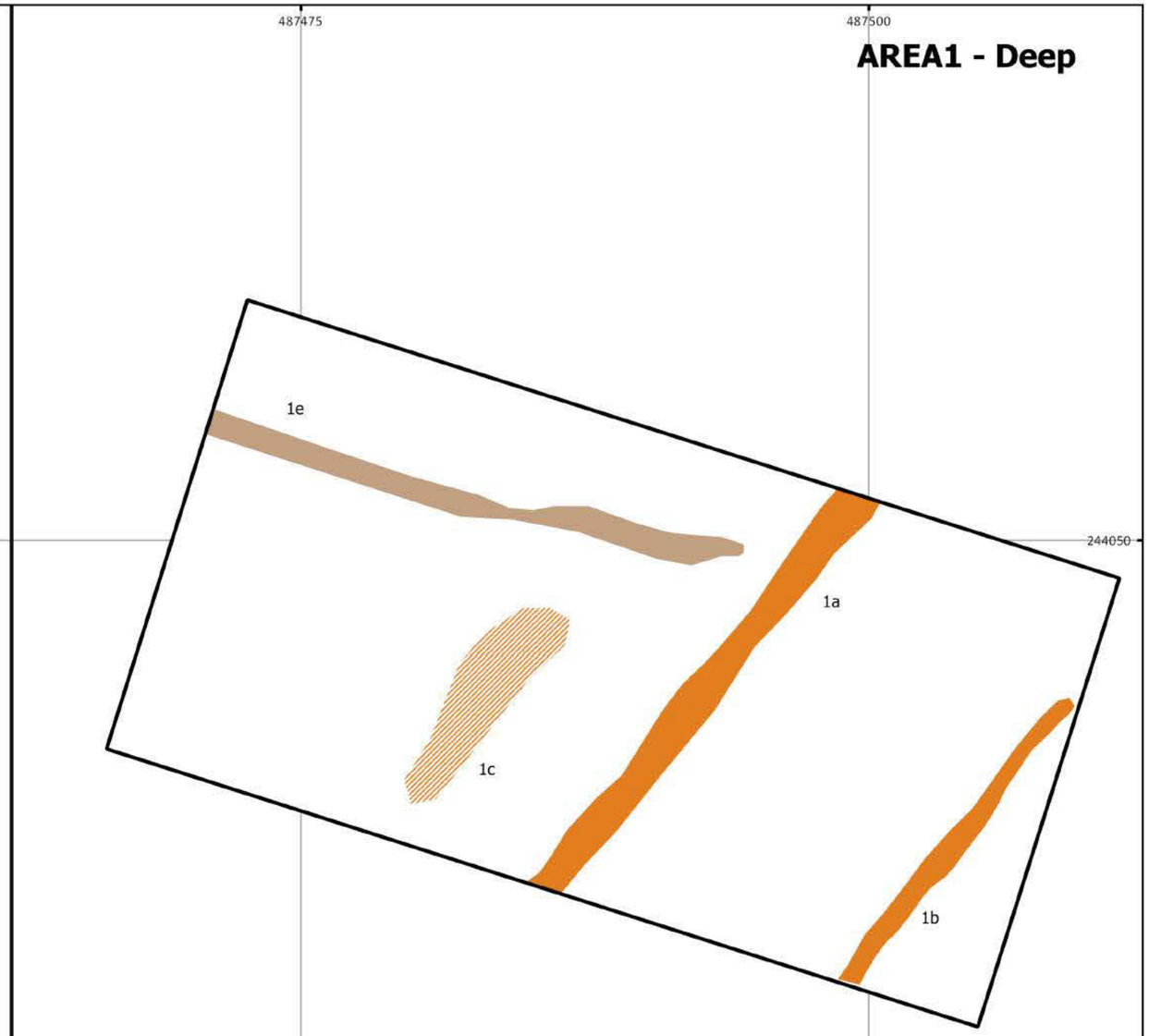
0 5 10 15 m

magnitude surveys

Timeslice depth: 150cm



AREA1 - Deep



MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 12 - Area 1 GPR Deep Interpretation
1:250 @ A3

Low Amplitude High

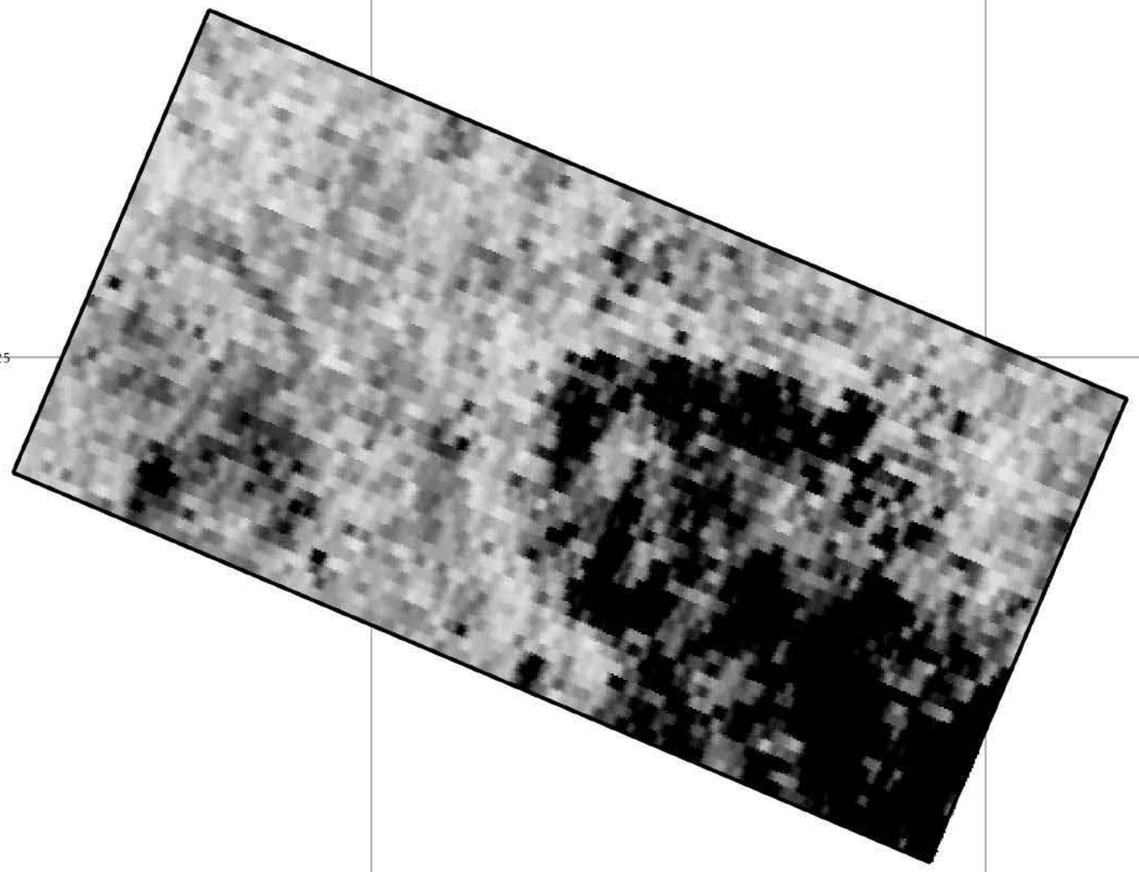
Archaeology Possible (Strong)
Archaeology Possible (Spread)
Agricultural (Weak)

N

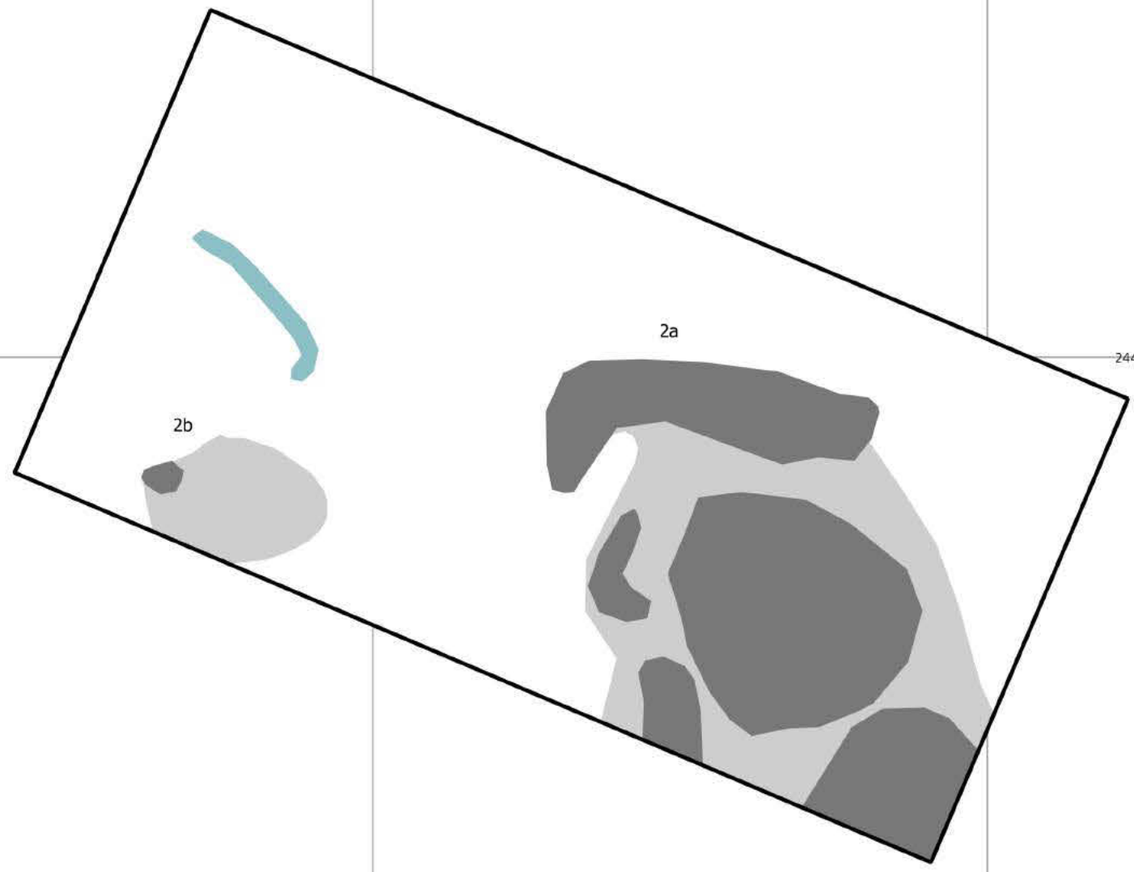
0 5 10 15 m

magnitude surveys

Timeslice depth: 20cm



AREA2 - SHALLOW



487425
487450
244050
244025
244000

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 13 - GPR Area 2 Shallow Interpretation
1:250 @ A3

Low Amplitude High

- Former Bastion/Quarrying
- Former Bastion/Quarrying (Spread)
- Undetermined (Weak)

N

0 5 10 15 m

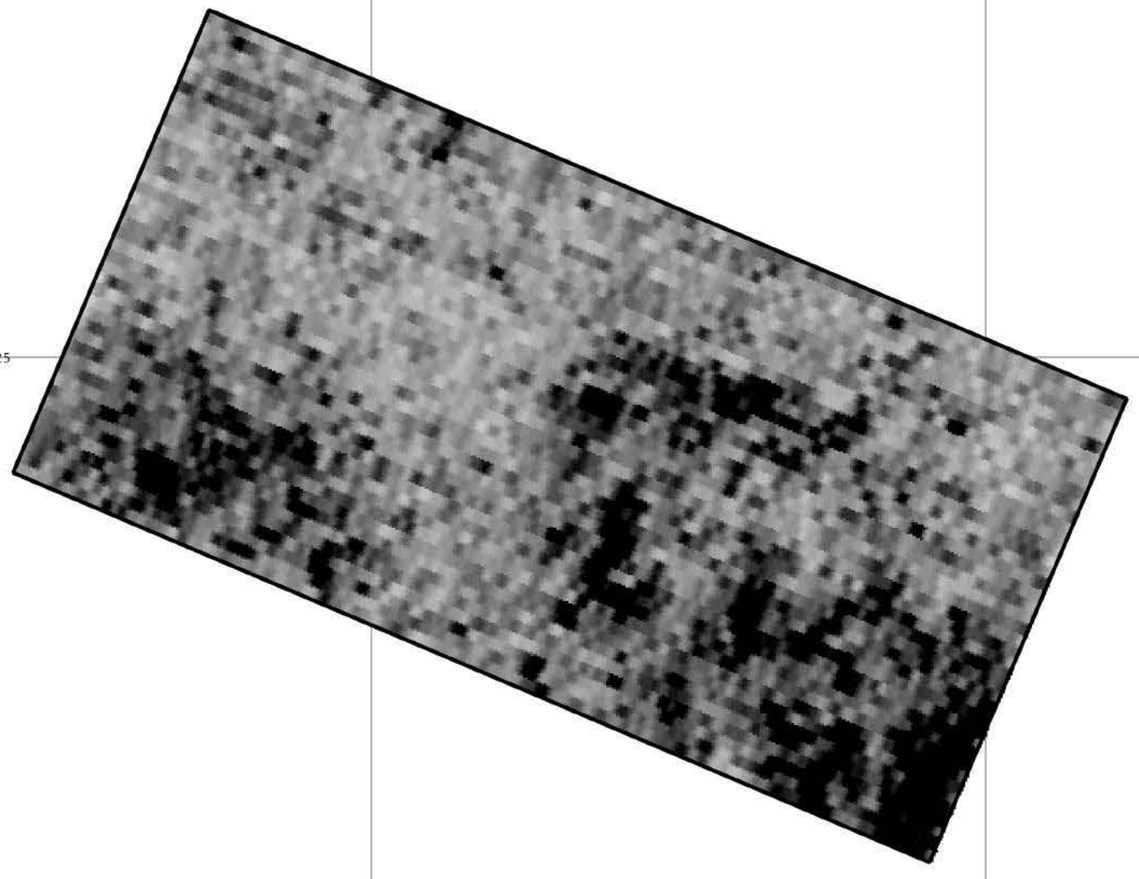
magnitude surveys

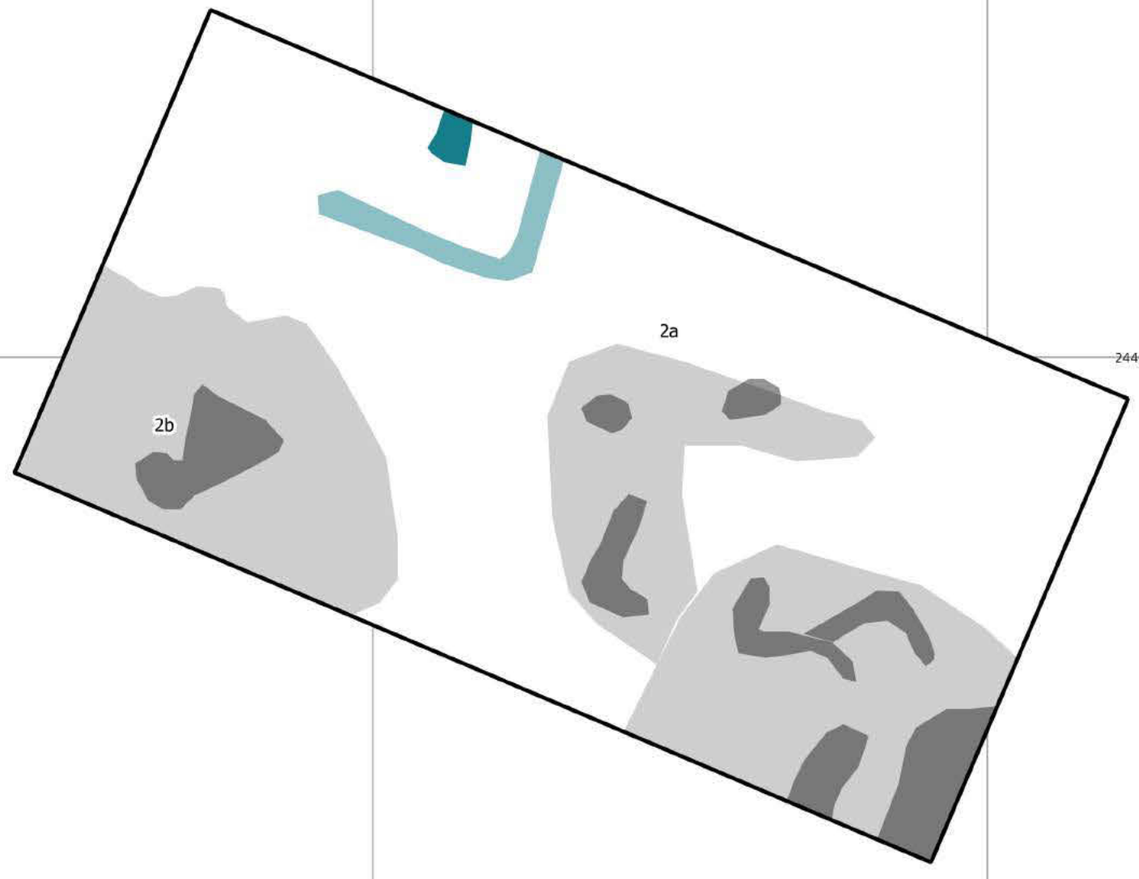
Timeslice depth: 100cm

AREA2 - MIDDLE

487425 487450

244050 244025 244000





MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 14 - GPR Area 2 Middle Interpretation
1:250 @ A3

Low Amplitude High

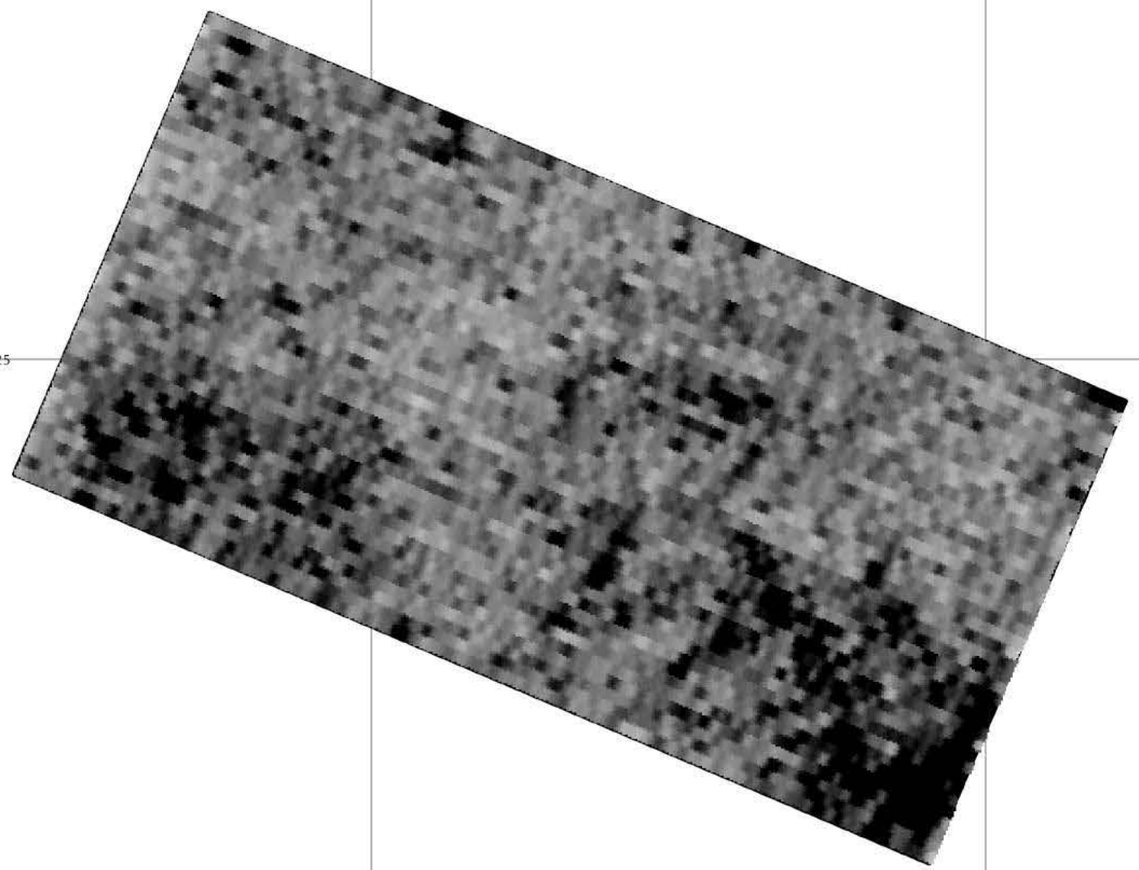
- Former Bastion/Quarrying
- Former Bastion/Quarrying (Spread)
- Undetermined (Strong)
- Undetermined (Weak)

N

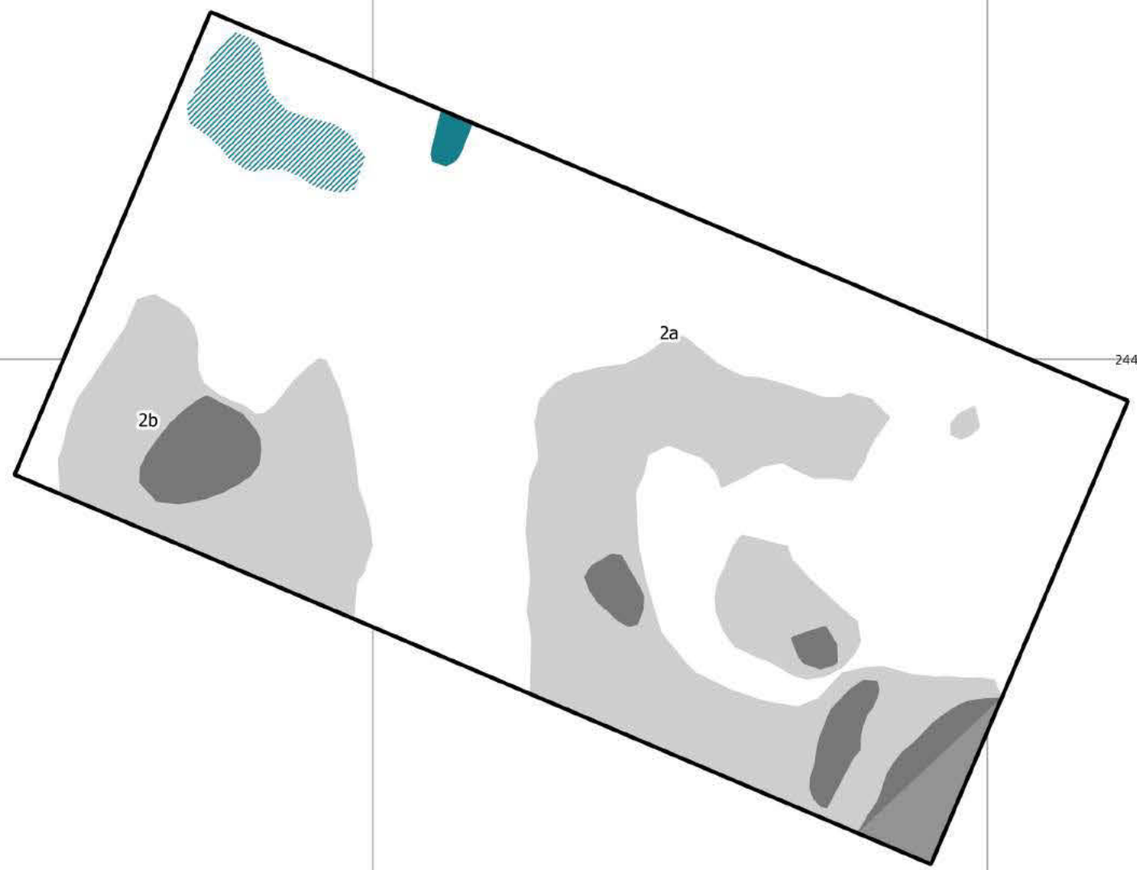
0 5 10 15 m

magnitude surveys

Timeslice depth: 150cm



AREA2 - DEEP



487425
487450
244050
244025
244000

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 15 - GPR Area 2 Deep Interpretation
1:250 @ A3

Low Amplitude High

- Former Bastion/Quarrying
- Former Bastion/Quarrying (Spread)
- Undetermined (Strong)
- Undetermined (Spread)

N

0 5 10 15 m

magnitude surveys

MSSP344 - Civil War defences in Bury Field, Newport Pagnell
Figure 16 - Radargrams Location
1:250 @ A3

Low Amplitude High

N

0 10 20 30 m

magnitude surveys

OASIS DATA COLLECTION FORM: England

OASIS ID: magnitud1-330599

Project details

Project name	Civil War defences in Bury Field
Short description of the project	Magnitude Surveys was commissioned to assess the archaeological subsurface potential an area of c. 1.5 ha of land containing Scheduled Civil War defences (Monument No: 1021389) at Bury Field Common, in Newport Pagnell. The survey was specifically intended to identify the extent of any surviving sub-surface structural elements or features associated with the defences within and adjacent to the Scheduled area. A fluxgate magnetometer survey and subsequent targeted ground-penetrating radar (GPR) survey were both successfully completed, and a number of previously unrecorded features associated with the defences have been identified. Specifically, the use of GPR has helped to better characterise potential features relating to the construction and disuse or demolishing of the outer bank and ditch or enceinte. The magnetometer survey has identified no further anomalies of possible archaeological origin to the west of these earthworks. In the south of the site, part of a possible bastion feature, recorded as possible disturbed earthworks and visible in recent LiDAR data, were surveyed with both methods. Not all of this earthwork feature could be surveyed due to variations in ground conditions, limiting the available context for interpretation. Here, while multiple anomalies were identified, none could be confidently interpreted as potential features relating to the defences, as they may equally relate to subsequent extraction activity.
Project dates	Start: 14-08-2018 End: 16-08-2018
Previous/future work	Not known / Not known
Any associated project reference codes	MSSP344 - Sitecode
Any associated project reference codes	EMK1359 - HER event no.
Type of project	Field evaluation
Site status	Scheduled Monument (SM)
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	DEFENCE WORK Post Medieval
Monument type	FIRING PLATFORM Post Medieval
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Development type	Community group survey
Prompt	Voluntary/self-interest
Position in the planning process	Not known / Not recorded

Solid geology (other)	Sandstone, siltstone and mudstone of the Kellaways Formation
Drift geology	Unknown
Techniques	Ground penetrating radar
Techniques	Magnetometry

Project location

Country	England
Site location	BUCKINGHAMSHIRE MILTON KEYNES NEWPORT PAGNELL Bury Field
Postcode	MK16 8AY
Study area	1.5 Hectares
Site coordinates	SP 8747 4403 52.087281840831 -0.723232843877 52 05 14 N 000 43 23 W Point

Project creators

Name of Organisation	Magnitude Surveys Ltd
Project brief originator	Milton Keynes Council
Project design originator	Magnitude Surveys Ltd
Project director/manager	Graeme Attwood
Project supervisor	Edward Burton
Type of sponsor/funding body	District Council

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Milton Keynes HER
Digital Archive ID	MSSP344
Digital Contents	"Survey"
Digital Media available	"GIS","Geophysics","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Geophysical Survey Report Of Civil War defences in Bury Field, Monument No: 1021389, Newport Pagnell, Buckinghamshire
Author(s)/Editor(s)	Burton, E.
Other bibliographic details	MSSP344
Date	2018
Issuer or	Magnitude Surveys

publisher	
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Entered on	10 October 2018

OASIS: