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LiDAR Analysis & Ground-truthing, Carburton Camp, Nottinghamshire. (SK 60199 73245).

LiDAR Survey Report

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Mercian Archaeological Services CIC

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Report MAS043



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Summary

As part of the Battle of Hatfield Investigate Society's "Warriors through the landscape" project, sponsored by the National Lottery Heritage Fund, a Light Detection and Ranging (LiDAR) Survey was undertaken by Bluesky. Using the data acquired by this survey, Mercian Archaeological Services CIC analysed the data. Then, following a series of community workshops to involve the community in identifying features and sites, Mercian undertook ground-truthing sessions in September 2018.

The project was also match-funded by Mercian Archaeological Services CIC who provided professional time to the project to investigate the LiDAR data as part of the Sherwood Forest LiDAR project, which forms a part of the larger Sherwood Forest Archaeology Project.

Mercian's Sherwood Forest LiDAR project has been under-way for a number of years. So far the project has created a comprehensive Geographic Information Systems (GIS) containing all the 2m, 1m, and 0.5m Digital Terrain Model (DTM) data, and 2m, 1m, and 0.5m Digital Surface Model (DSM) data, available for Historic Sherwood Forest landscape (as part of the Sherwood Forest Archaeology Project). The project has also demonstrated 'gaps' in LiDAR data coverage, and calculated percentages of coverage and highlighted areas requiring future surveys. This project aims to 'fill' one of those areas identified as a 'gap'.

The LiDAR acquired as part of the "*Warriors through the landscape*" project was gathered at a resolution of 0.25m. The LiDAR data set covered an area between Church Warsop in the south and Whitwell Woods in the north. The area stretched from the western boundary of Clumber Park in the east, to near Creswell in the west.

The data will be a 'fantastic' resource for years to come. Data gathered during a previous Heritage Lottery Fund Sponsored Project at Thynghowe in 2011 which collected data at 0.25m resolution has not only aided in the understanding of the Viking Meeting Site of Thynghowe, but has also been used by Mercian to identify features and enable ground-truthing in Birklands, Bilhaugh, and Budby South Forest, as part of the Sherwood Forest National Nature Reserve Archaeology Survey, as part of the Sherwood Forest Archaeology Project.

It is envisaged here that the data from Cuckney will be utilised in examining the

landscape in relation to the potential Battle of Hatfield site, as well as for re-examining sites such as Whitwell Woods, World War II features and much more.

The LiDAR was analysed as part of the archaeological investigation into Cuckney Castle and its landscape (Budge 2019). It was also used in the surveying and interpretation of the Cuckney water meadows system (Gaunt 2019). Images from these projects are included here, but the full analysis and results presented in the associated reports.

The LiDAR was also used to examine the site of Norton Prisoner of War Camp, results from this are shown here and are available in detail via the publication for that work "Warriors Through the Landscape - An Appreciation of Norton and Carburton POW Camps 1944-48" (Battle of Hatfield Investigation Society, Bob Ilet, and Mercian Archaeological Services CIC, 2019).

The above publication also investigated the Prisoner of War Camp at nearby Carburton. As part of this project the LiDAR data was analysed and a ground-truthing exercise was undertaken by Mercian with community volunteers as part of the project. The results of this preliminary prospection make up a large section of this report and include a photographic record, location data and description. Results show that Carburton Woods contains the remains of a former camp which included a large number of well-preserved building platforms, roadways, and trackways. This report demonstrates the potential of the site of Carburton Camp. It is only the results of a preliminary survey of the site and future work (proposed by Mercian) including full survey is required now that the potential has been revealed by this project.

The report also includes a number of 3-Dimensional models to demonstrate the possibilities of the LiDAR data set regarding future research into the landscape of Cuckney, and especially the battle of Hatfield.

1. Project location, topography and geology

1.1. Project Location

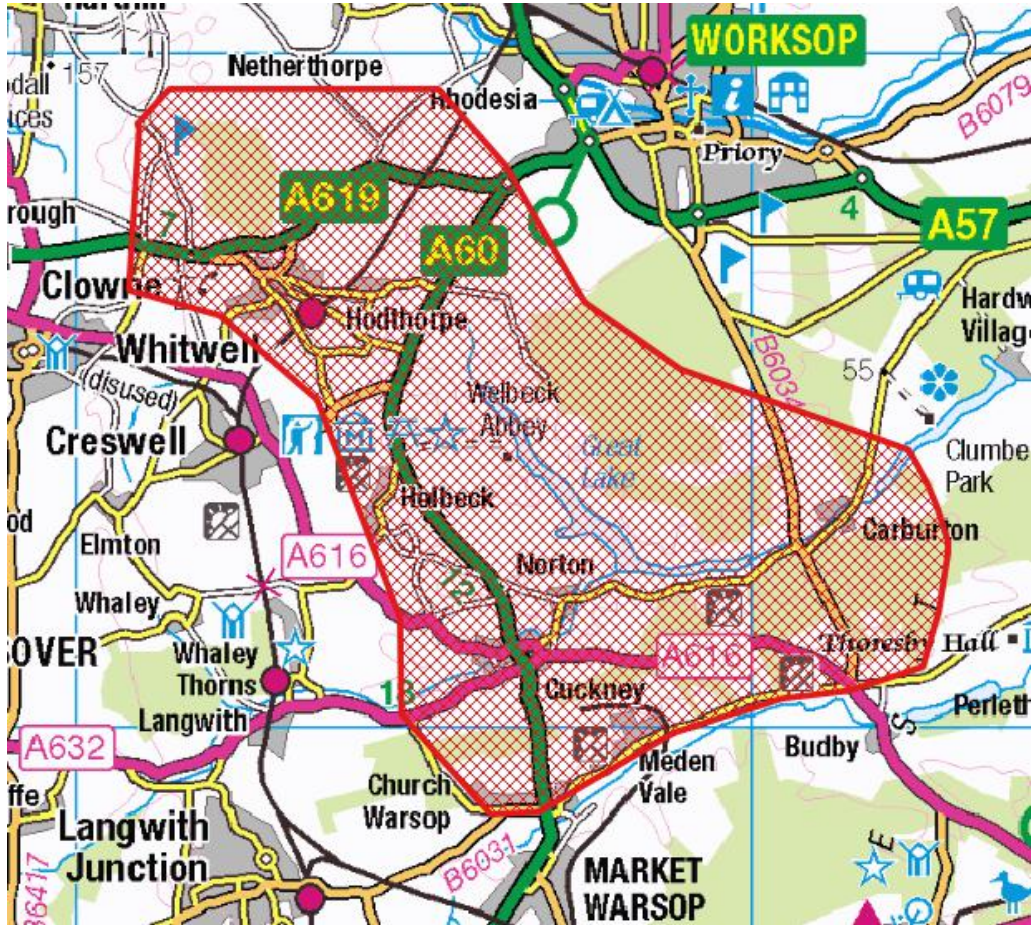


Figure 1: Site Location. Contains OS data © Crown copyright [and database right] 2018.

Carburton Woods is located to the west of the B6034, due west of St Giles Church, Carburton. The site lies 5 miles south of Worksop, and 2 miles north of Budby. The site is in the parish of Carburton, from which it takes its name, which lies in Bassetlaw, Nottinghamshire (SK 60199 73245).



Figure 2: Location of Carburton Woods. Contains OS data © Crown copyright [and database right] 2018.

The location of other sites discussed are shown alongside the results, in the appropriate section.

1.2 Geology

The British Geological Survey (BGS) lists the geology of the survey area in the following way (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html> - accessed 25/06/2019):

The geological bedrock formations run north to south with the oldest rocks at the western edge and the succession becoming progressively younger to the east.

The western part of the survey area as mapped at 1:50,000 scale identifies the bedrock geology as part of the Cadeby Formation. These Dolostones are sedimentary Bedrock formed approximately 252 to 272 million years ago in the Permian Period.

The local environment was previously dominated by shallow carbonate seas. These sedimentary rocks are biogenic and detrital, generally comprising carbonate material (coral, shell fragments), forming beds and locally reefs.

The 1:50 000 scale bedrock geology description from the BGS shows that to the east of the Cadeby formation (and north west of Cuckney) lies the Edlington Formation a Mudstone and Sandstone. These sedimentary bedrock deposits formed approximately 252 to 272 million years ago in the Permian Period. The local environment was previously dominated by lakes and lagoons. These sedimentary rocks are lacustrine or shallow-marine in origin. They are detrital, generally fine-grained (but can include layers of coarser material) and form beds of carbonate-rich deposits sometimes including precipitated beds of evaporites.

At the same scale the next formation to the east is the Lenton Sandstone Formation, a sedimentary bedrock formed approximately 247 to 272 million years ago in the Triassic and Permian Periods. The Local environment was previously dominated by rivers. This formation runs roughly northwards from Warsop through Cuckney. These sedimentary rocks are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting).

The eastern part of the survey area, including the site of Carbuton Woods is underlain by the Chester Formation, a Sandstone, Pebbly (gravelly). These sedimentary bedrocks formed approximately 247 to 250 million years ago in the Triassic Period. The local environment previously dominated by rivers. These sedimentary rocks are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting).

4. Research Aims and Objectives

The project ties in with Mercian Archaeological Services CIC's research questions into the landscape of Sherwood Forest.

The LIDAR data will be utilised to answer research questions relating to the

Battle of Hatfield Investigation Society's long term research aims regarding the 7th century battle.

The project was also designed to address the Updated Research Agenda and Strategy for the Historic Environment of the East Midlands.

7 HIGH MEDIEVAL (1066 – 1485): UPDATED RESEARCH AGENDA

7.2 Rural settlement

7.2.4. Can we clarify further the processes of settlement desertion and shrinkage, especially within zones of dispersed settlement?

7.4 Castles, military sites and country houses

7.4.2. What was the date and function of currently undated minor motte and bailey castles?

7.4.3. How many castle sites have been lost within the region?

7.4.5. What local resources were used for building and maintenance and what was the environmental context and economic impact of these buildings?

7.4.6. How should battlefield sites be further investigated?

9. MODERN (1750 TO PRESENT): RESEARCH AGENDA

9.8 Military sites

9.8.1. Can we establish a typology of surviving post-1750 military remains?

9.8.2. How are military sites distributed across the region?

9.8.3. What impacts have military developments had upon settlement development, landscapes, industry and transport?

5. Methodology

In very basic terms, airborne LiDAR *“consists of an active laser beam being transmitted in pulses from a fixed-wing or rotary aircraft and the returning reflection being measured. The precise location of the sensor array is known from the combination of global navigation satellite system (GNSS) data and the Inertial Measurement Unit (IMU) in the aircraft (Figure 2). By calculating the time taken for a pulse of light to reach the target and return, it is possible to record the location of points on the ground with a high degree of accuracy, typically 100-150mm in both plan and height”* (Historic England 2018, p3).

“Airborne lidar, therefore, facilitates the collection of very large quantities of high-precision 3D measurements in a short period of time. This enables very detailed analysis of a single site, or data capture of entire landscapes. It does not necessarily provide any information about the point being recorded in the way that multispectral data can, nor does it provide any inherent information about the nature of the feature being recorded (although see section 2.2.1 for full waveform lidar and section 2.2.2 for intensity data). What it does record is the 3D location of a point in space (together with some information on the intensity of the reflection)” (Historic England 2018, p3)

“There is a long tradition of archaeologists interpreting historic sites from ‘humps and bumps’, ie surface irregularities, visible on the ground or from the air”. However, it is necessary to be cautious, and it is essential that features detected in LiDAR are ground-truthed where possible to aid in interpretation, and to check whether they actually exist. This is because the height data recorded by LiDAR is not a straightforward record of the ground surface. “When the laser is fired from a sensor on a plane, the laser beam travels towards the ground and, if it strikes anything in passing, part of that beam is reflected back to the sensor and forms the first return; the rest of the beam continues towards the ground and may strike other features that produce further returns, until it finally strikes the ground or a surface that allows no further progression. The final reflection that reaches the sensor is known as the last return. In practice, built-up areas and open land act as solid surfaces and the first and last returns are often identical. Woodland, however, functions as a porous surface where the first return generally represents the top of the tree canopy and the last return may be a reflection from the ground surface but equally may be from the main trunks of the trees or areas of dense canopy or undergrowth” (Historic England 2018,

pp 6-7).

5.1. LiDAR processing, data preparation and analysis.

The data was received as .LAS files. This is a standard format for recording 3D point data created by the American Society for Photogrammetry and Remote Sensing (ASPRS) LAS. According to Historic England: *“The primary data are collected by the sensor simply as a series of points in space based on the calculated time taken for the beam to return to the sensor. It is only after these data have been registered (placed in a common coordinate system) and quality checked that they are readily usable. This procedure is carried out by the data provider. After the data have been registered, it is then necessary to align the grids of individual survey swathes to ensure that there are no discrepancies between scans that could lead to interference patterns. Again this procedure is best carried out by the data provider. Once these processes have been completed the first commonly available product can be generated: a fully georegistered point cloud. This is still just a collection of points floating in space, with no relationship between any given point and its neighbours. As such it is a relatively non-user-friendly product and is not generally of interest to archaeologists”*.

With the above in mind the data was also received from Bluesky in the form of a DSM (Digital Surface Model), and a DTM (Digital Terrain Model), using classification algorithms to identify and remove above-ground points. These files were then displayed and analysed in QGIS Geographic Information Systems (GIS) software.

All data was analysed in QGIS. For the requirements of this project, this was a suitable technology. The data was displayed as singleband grey, multiband colour, singleband pseudo colour, and hill shade models. Hillshade models were viewed with sun angles at different altitudes and azimuth, to better view different features.

In the future techniques examining reflection intensity and other properties can be employed, if required.

5.2. Ground-truthing Survey

Ground- truthing was undertaken on site using hill-shade models of LiDAR data as a guide. Walkover survey recorded features to include a photographic record with scale bars, ordnance survey grid reference location, and description. Grid-references were provided on site by hand-held GPS and then corrected using the LiDAR data.

5.3. Archiving and reporting:

5.3.1. OASIS

An OASIS entry pertaining to the work has been created. The OASIS identifier for the project is OASIS ID: merciana2-357419.

5.3.2. Historic Environment Record

A copy of the report has been logged with the Nottinghamshire Historic Environment Record (HER).

5.3.3. Public Dissemination on-line

Mercian Archaeological Services CIC also publish free downloadable versions of this report via our website.

6. Results & Discussion

The LiDAR survey covered an area of 25.580 square miles, from Whitwell Woods in the north, to Church Warsop in the South, and from Creswell in the west, to the edge of western edge of Clumber Park in the east.

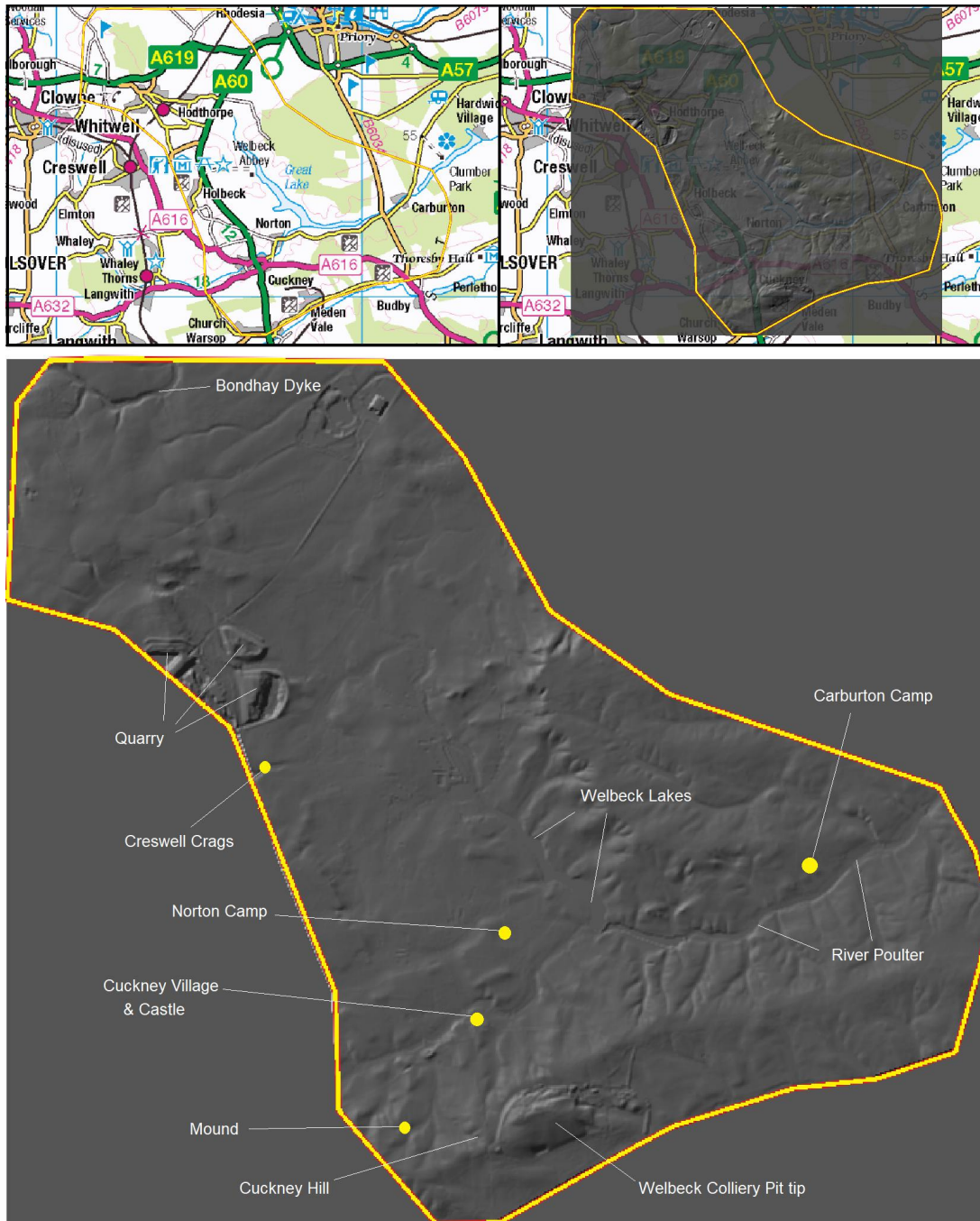


Figure 3: LiDAR survey area (outlined in yellow) and results. Sites in the report are marked with a yellow

dot. Images produced by Mercian from original data provided by Bluesky. Contains OS data © Crown copyright [and database right] 2018.

The results from a number of sites examined in detail are displayed below.

6.1. Mound at SK5561370058

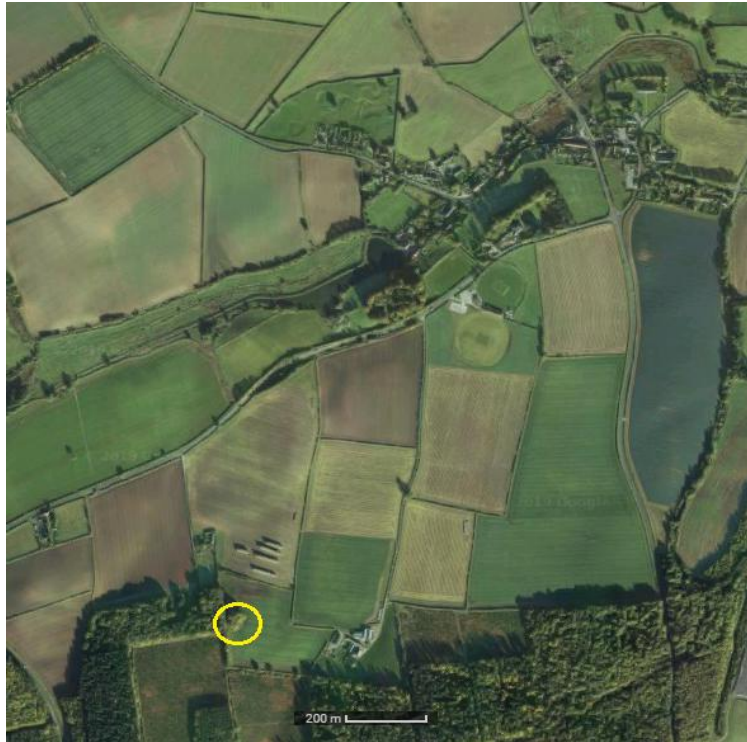


Figure 4: Location of mound in yellow circle. Cuckney Village top right of image. Imagery © 2019 Getmapping plc, Map Data © 2019. Google.



Figure 5: Location of mound in yellow circle. Cuckney Village top right of image. Imagery © 2019 Getmapping plc, Map Data © 2019. Google.



Figure 6: Digital Surface Model (DSM) of the mound south-west of Cuckney. Images produced by Mercian from original data provided by Bluesky.

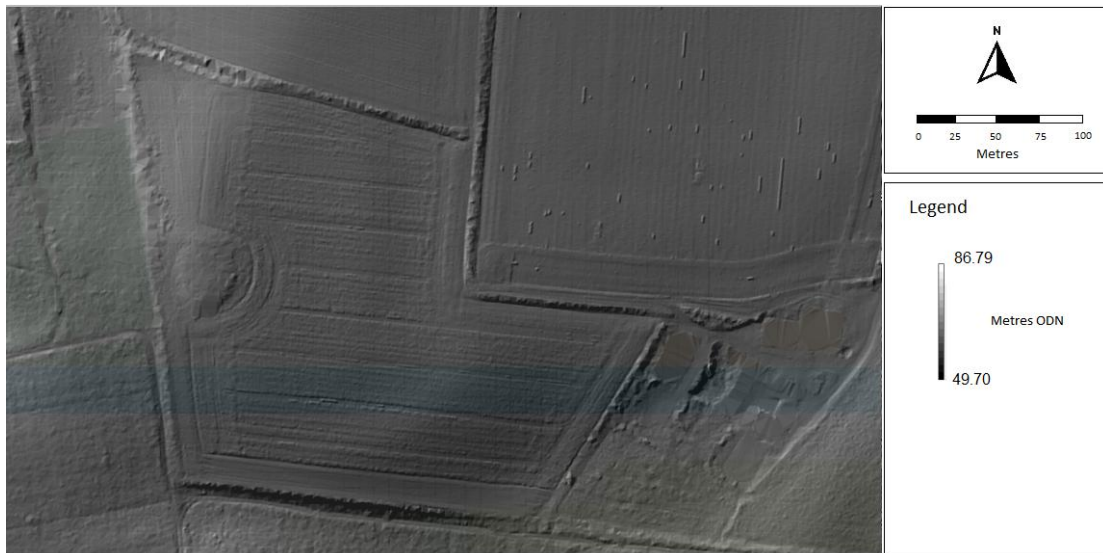


Figure 7: Digital Terrain Model (DTM) of the mound south-west of Cuckney. The last return data. Images produced by Mercian from original data provided by Bluesky.

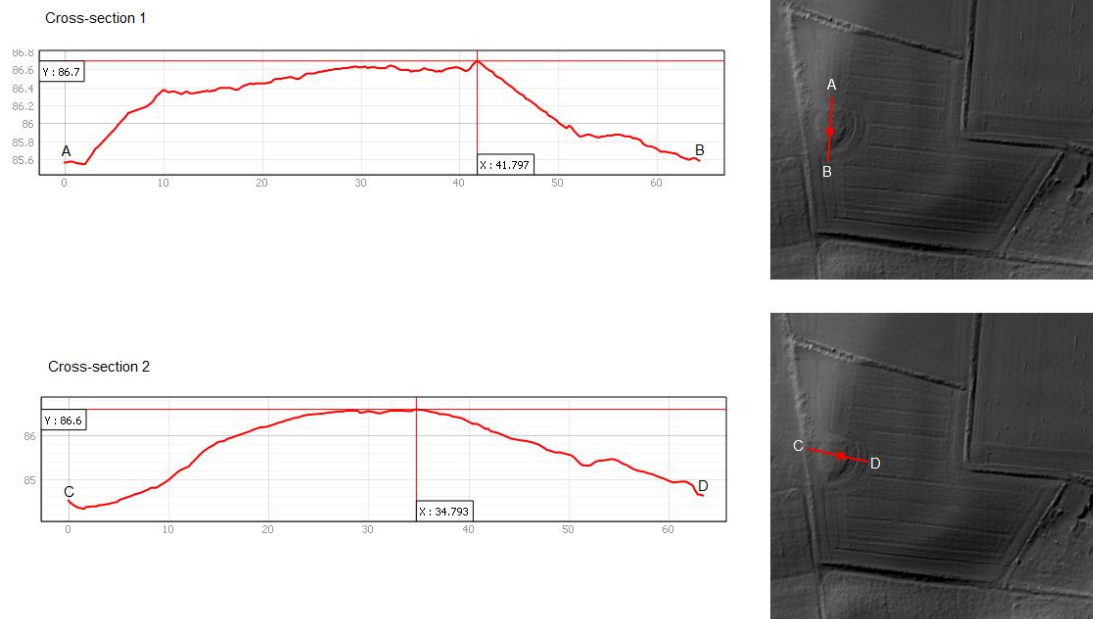


Figure 8: Cross-sections of mound. Images produced by Mercian from original data provided by Bluesky.

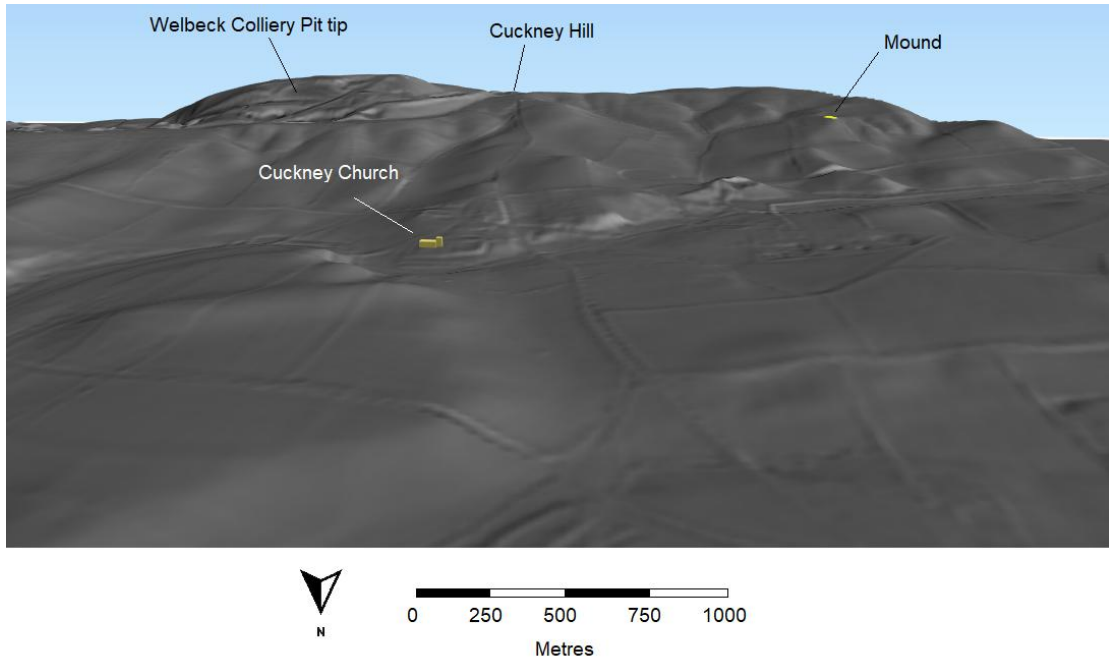


Figure 9: 3D model of the landscape surrounding the mound. Viewed from the north. Images produced by Mercian from original data provided by Bluesky.

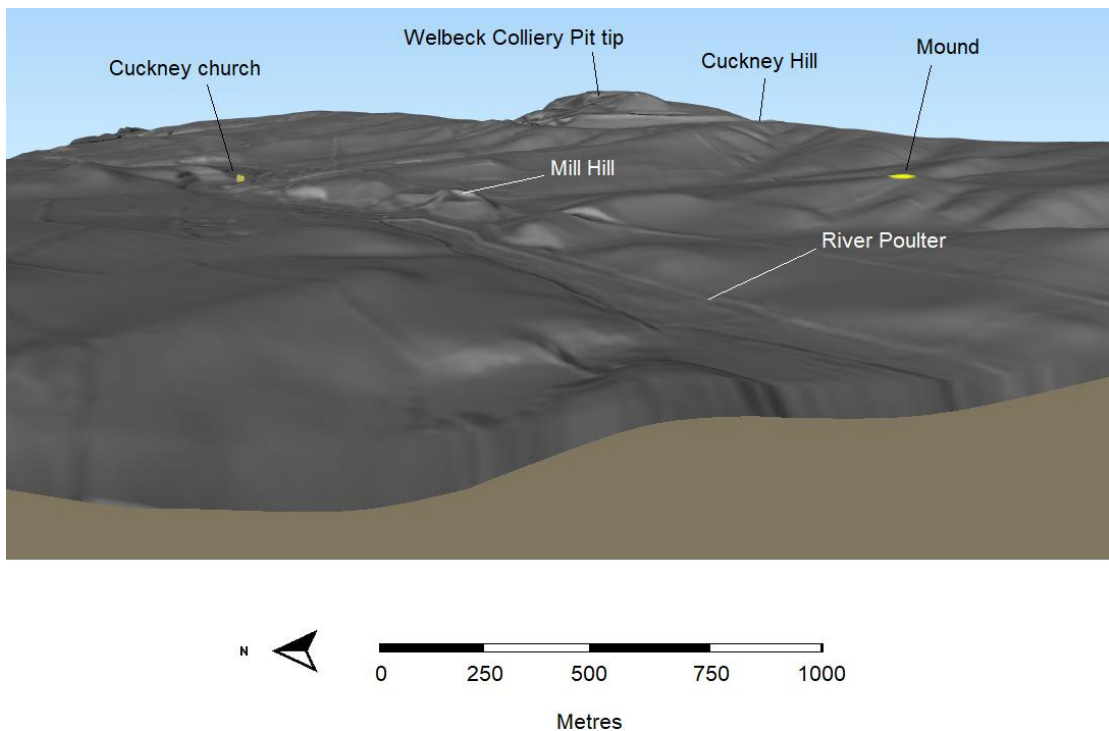


Figure 10: Figure 9: 3D model of the landscape surrounding the mound. Viewed from the north-west. Images produced by Mercian from original data provided by Bluesky.

The images shown in figures 7 to 10 show the mound identified in the LiDAR. The

3-Dimensional models show how the mound fits into the landscape. It clearly occupies a prominent position in the landscape when viewed from the north and the north-west.

The mound is depicted on Sanderson's 1835 Map of Twenty Miles Around Mansfield, as a circular area of trees. It may therefore be a plantation dating from the 18th or earlier 19th century's. However its shape, size, and location could suggest it may be a prehistoric mound, perhaps a Bronze Age burial mound. The site would benefit therefore, from a full archaeological investigation.

6.2. Cuckney Castle

Figure 11 below shows the location of Cuckney Castle and St Mary's church. LiDAR data was analysed for the landscape of Clipstone, with the aim of understanding more about the potential site of the castle.

3D modelling of the landscape, combined with the results of the topographic survey of the site by Mercian Archaeological Services CIC in 2015 (Gaunt & Crossley 2016), enabled a fresh examination of the castle site and its landscape setting.

The results from the topographic survey in 2015 had raised issues regarding the earthworks currently identified as the castle. LiDAR images in figures 12 to 14 show high ground to the west of the Scheduled area identified as Cuckney Castle. The earthwork high-lighted in figure 14, was the subsequent target identified for excavation by Mercian, as trench 2 in 2018 (Budge 2019).



Figure 11: Location of Cuckney Castle. Imagery © 2019 Getmapping plc, Map Data © 2019. Google.

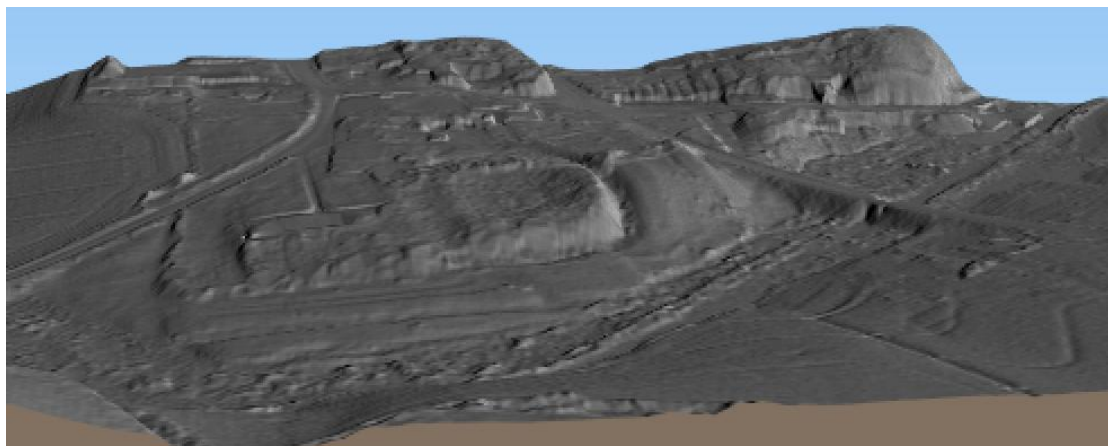


Figure 12: 3D model of the potential site of Cuckney Castle. 3x vertical exaggeration. Facing south-south-east. LiDAR, alongside topographic survey results (Gaunt & Crossley, 2016) enabled a re-assessment of the landscape, and helped in the choice of archaeological targets for excavation. Images produced by Mercian from original data provided by Bluesky.

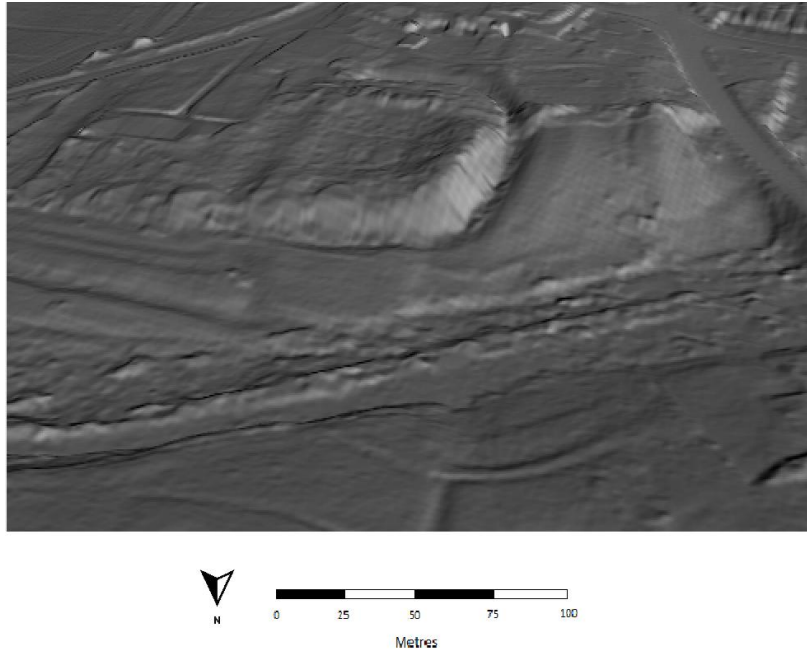


Figure 13: 3D model of the potential site of Cuckney Castle. 3x vertical exaggeration. Facing south. LiDAR, alongside topographic survey results (Gaunt & Crossley, 2016) enabled a re-assessment of the landscape, and helped in the choice of archaeological targets for excavation. Images produced by Mercian from original data provided by Bluesky.

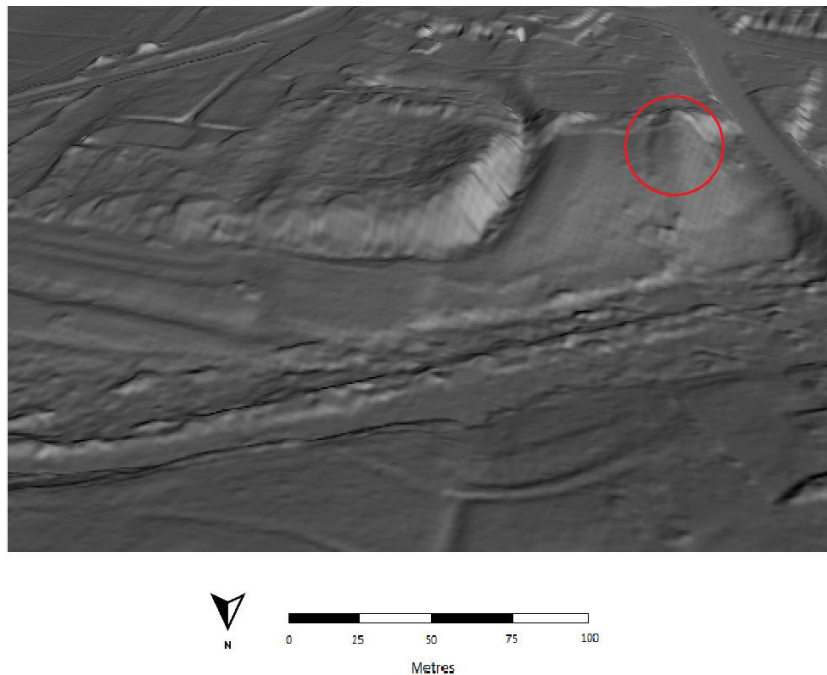


Figure 14: 3D model of the potential site of Cuckney Castle. 3x vertical exaggeration. Facing south. LiDAR, alongside topographic survey results (Gaunt & Crossley, 2016) enabled a re-assessment of the landscape, and helped in the choice of archaeological targets for excavation (area circled in red). The earthen bank on top of the mound to the west of the Scheduled Monument of Cuckney Castle, which was chosen as the location of trench 2 (Budge 2019). Images produced by Mercian from original data provided by Bluesky.

LiDAR analysis also formed an important part of the investigations of the castle for the 2018 excavations undertaken by Mercian. The following images in figures 15 to 19 shown how cross-section analysis of LiDAR data, was used to investigate the earthworks in the vicinity of the excavation to determine their likely form. A full discussion can be found in Budge 2019.

Budge also examined the landscape surrounding Cuckney 'castle' to determine why the site may have been important, using the single band pseudo colour image cropped between 53.5m OD and 56.5m OD, seen in figure 20.

Full results of the castle investigations are presented in the archaeological report Budge, D. 2019. *Archaeological Investigation at Cuckney, Nottinghamshire. Bassetlaw, Nottinghamshire. End of Project Report*. MAS049. Mercian Archaeological Services CIC (Budge 2019).

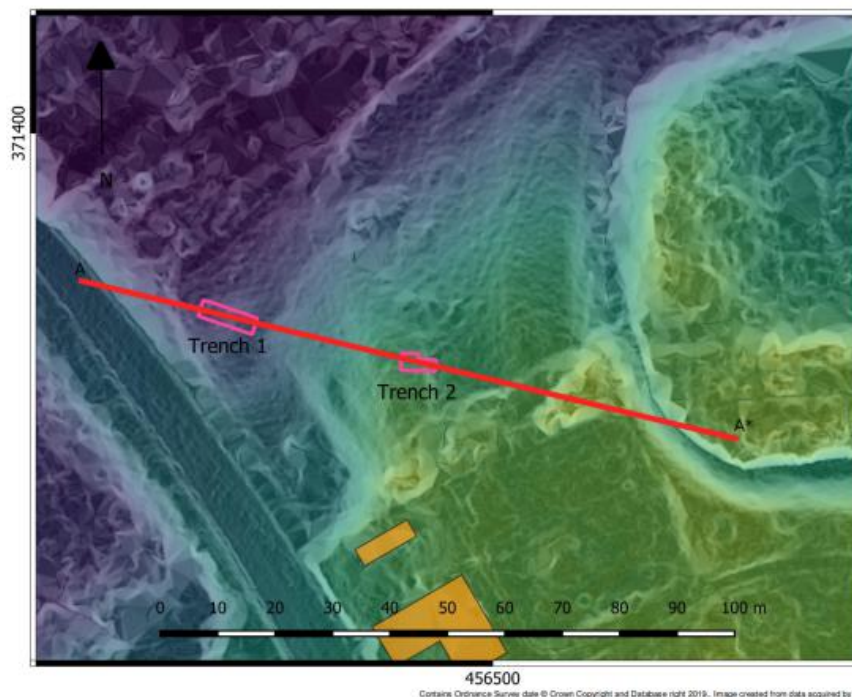


Figure 15: Location of profile (Figure 20) in relation to the topography and trenches at Cuckney. Digital hill slope model generated from LiDAR data captured by Bluesky. Figure 19 from Budge 2019, p46.

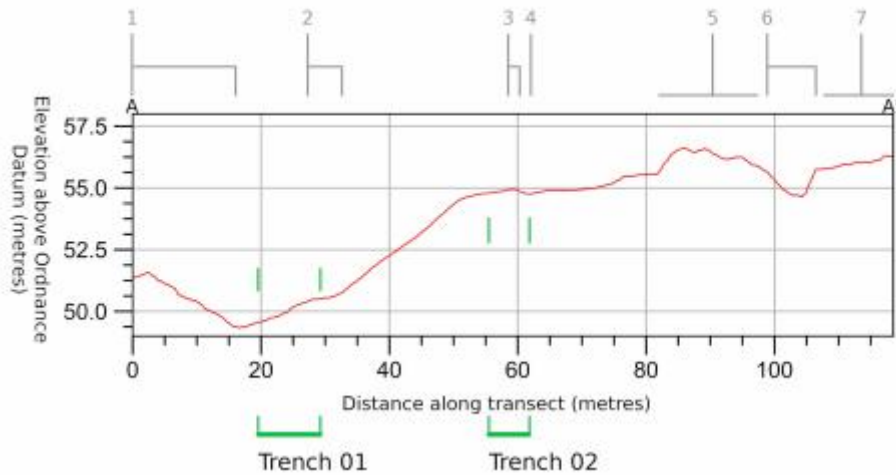


Figure 16: Profile of the present ground surface from LiDAR data captured by Bluesky displayed in relation to the excavated trenches and highlighting relevant features. Features as numbered are: 1 - A60 road embankment; 2 - terrace; 3 - bank; 4 - WWII trench; 5 - area of dense vegetation / brambles; 6 - ha-ha ditch around churchyard; 7 - interior of churchyard. Figure 20 from Budge 2019, p47.

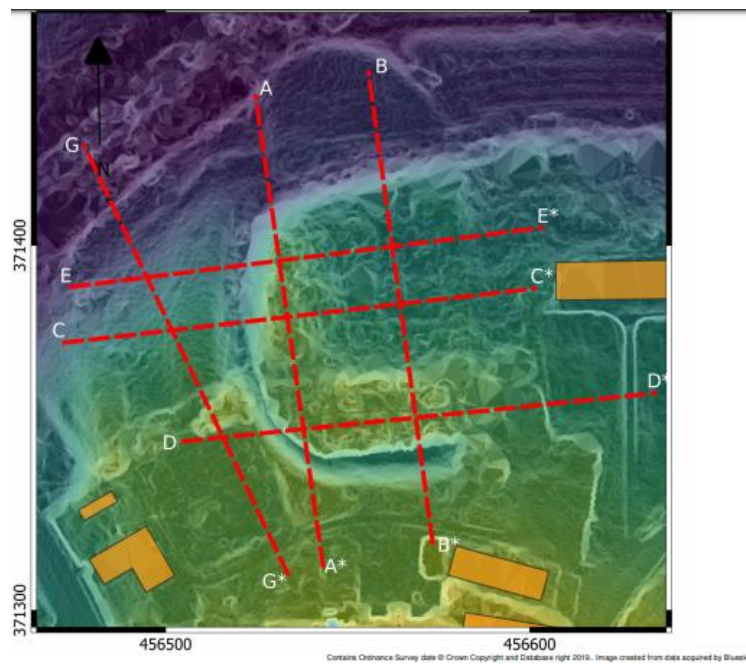


Figure 17: Location of cross sections of topographic features. Figure 21, from Budge 2019, p 57. Generated from LiDAR data acquired by Bluesky.

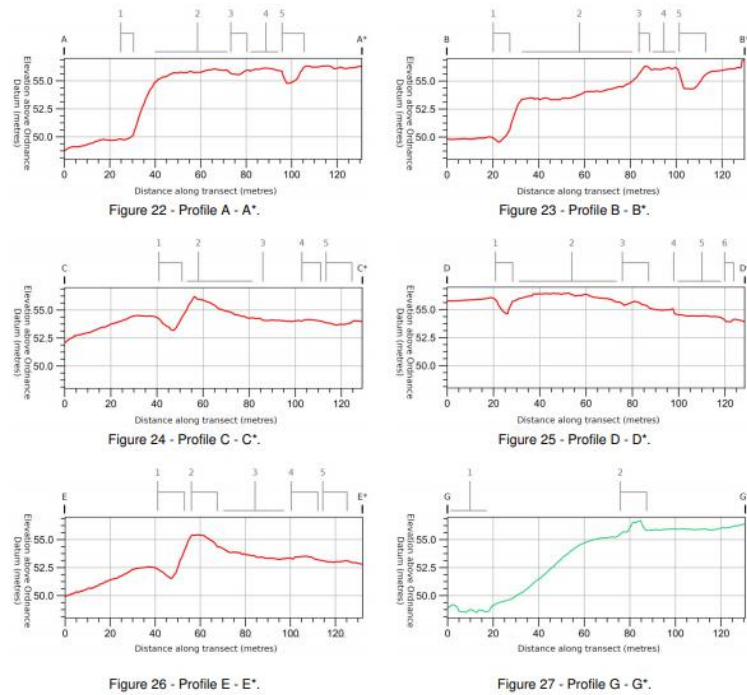


Figure 18: Profiles created from cross-sections of LiDAR in Figure 17 above. Figures 22-27 from Budge 2019, p 58.

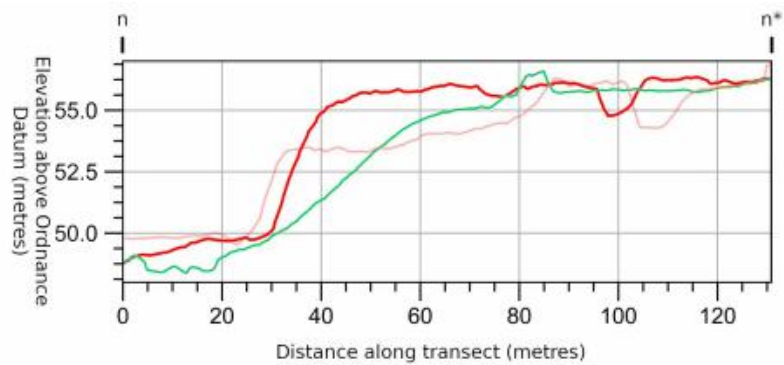


Figure 28 - Cross sections A-A* (red line); B-B* (light red line) and G-G* (green line) overlain.

Figure 19: Profiles from Figure 17 overlain to analyse the landscape. Figure 28, from Budge 2019, p 59.

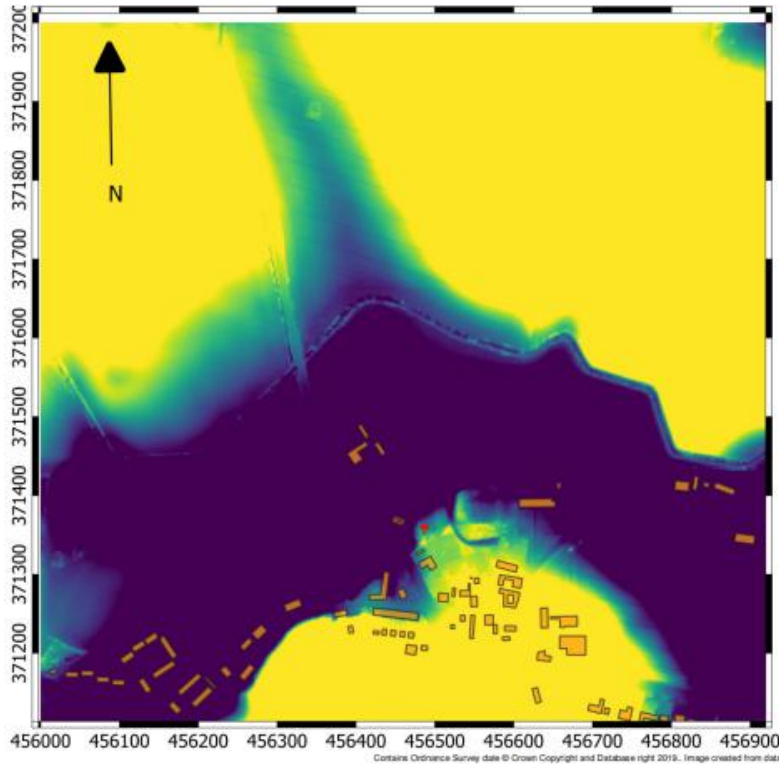


Figure 20: Topography in the vicinity of Cuckney. Single band pseudocolour cropped between 53.5m OD and 56.5m OD; land at elevations below 53.5m OD shown as purple; land over 56.5m OD as yellow; land between shown in intermediate shades. Figure 29, Budge 2019, p 60. Generated from LiDAR data acquired by Bluesky.

6.3. Cuckney Water Meadows

LiDAR data was analysed as part of the Cuckney water meadows survey (Gaunt 2019). Figure 21 shows the location of the survey. Figures 22 and 23 depict the water meadows in 3-dimensions. Figures 24 and 25 show the interpretation of the panes and channels and their relationship to the landscape. Full details of the research results are presented in the archaeological report for the surveys Gaunt, A. 2019. Archaeological Survey of Cuckney Water Meadow System, Cuckney, Nottinghamshire. Mercian Archaeological Services CIC. MAS043. Archaeological report (Gaunt 2019). The results shown here are presented to show some of the ways LiDAR was used in that project.



Figure 21: Location of Cuckney water meadows. Imagery © 2019 Getmapping plc, Map Data © 2019. Google.



Figure 22: LiDAR survey data results showing the water meadows system to the north of the canalised River Poulter. Images produced by Mercian from original data provided by Bluesky. Figure 12, Gaunt 2019, p 36.

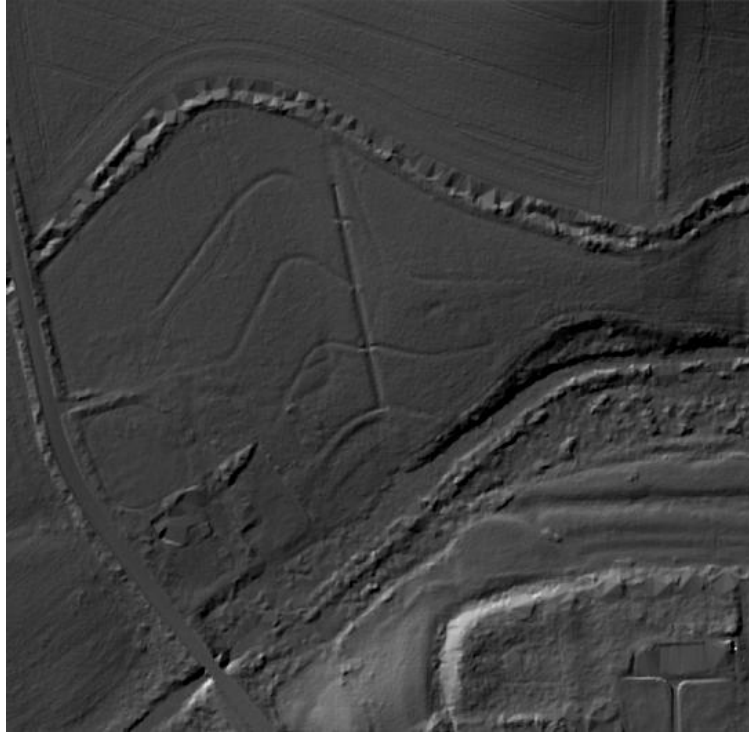


Figure 23: LiDAR survey data results showing the water meadows system to the north of the canalised River Poulter. Images produced by Mercian from original data provided by Bluesky. Figure 13, Gaunt 2019, p 37.

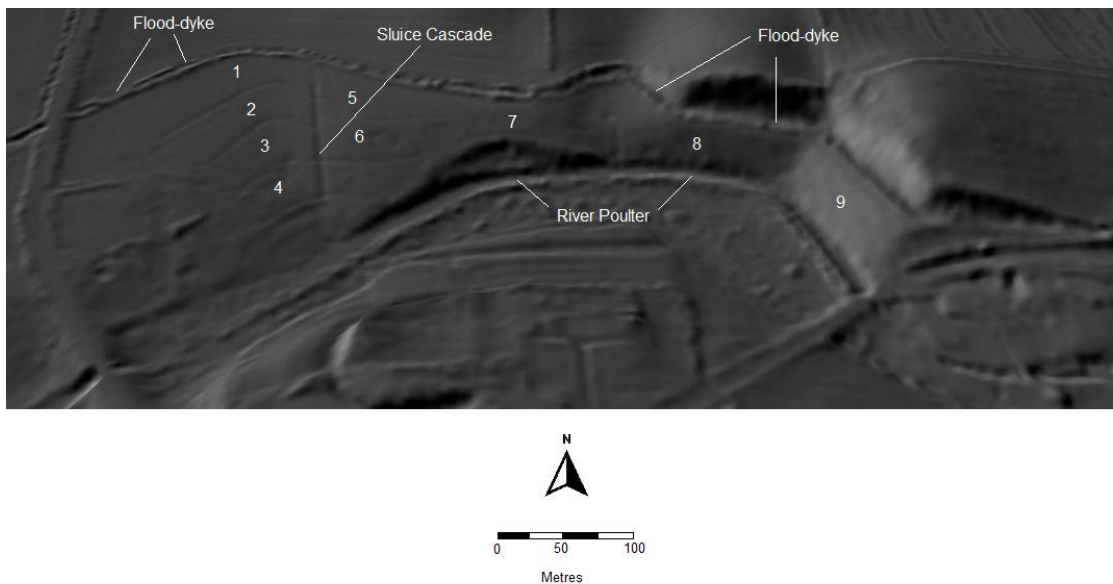


Figure 24: 3D LiDAR data model. 3x vertical exaggeration. Catchment Water meadow system looking North. The Panes are labelled by number. Panes 1 - 6 are aligned either side of the sluice cascade. Panes 8 and 9 can be seen to occupy very steep ground. The Flood-dykes sinuous shape can be seen following the contour of the hillside. Images produced by Mercian from original data provided by Bluesky. Figure 25, from Gaunt 2019, p 57.

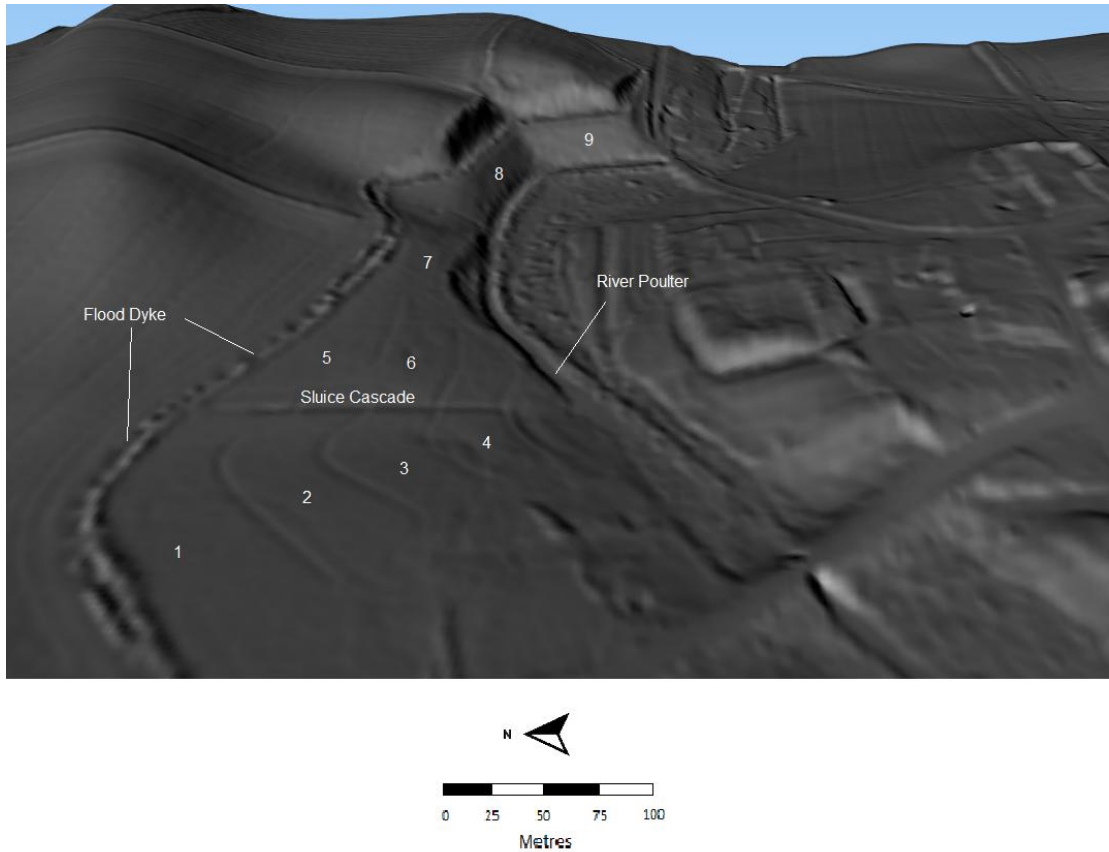


Figure 25: 3D LiDAR data model. 3x vertical exaggeration. Catchment Water meadow system from the Western end, looking East. The Panes are labelled by number. Panes 1 - 6 are aligned either side of the sluice cascade. Panes 8 and 9 can be seen to occupy very steep ground. The Flood-dykes sinuous shape can be seen following the contour of the hillside. Images produced by Mercian from original data provided by Bluesky. Figure 26, from Gaunt 2019, p 58.

6.4. Norton Camp

Norton Camp was a Second World camp which had a varied and interesting life during the war. The history of the camp has been written about as part of the same project which funded the LiDAR analysis undertaken, in the book *Warriors Through the Landscape - An Appreciation of Norton and Carburton POW Camps 1944-48*. (Battle of Hatfield Investigation Society, Bob Ilet, and Mercian Archaeological Services CIC, 2019).

The following are excerpts from that publication which gives an insight into the history of the camp:

“During 1940 the whole of North Nottinghamshire became a location for the training of troops and the storage of munitions. The estate adjacent to Welbeck, Clumber Park

the ancestral home of the Dukes of Newcastle, became 24 Ammunition Sub Depot of the Royal Army Ordnance Corps. On 1 January 1940 Norton Camp saw the arrival of the mounted regiment the Scottish Horse Yeomanry who were dehorsed, during the terrible winter and mainly quartered under canvas, to become the mechanised 79th (Scottish Horse) Medium Regiment RA on 15 February and the 80th (Scottish Horse) Medium Regiment RA on 15 April..." (p10).

Large numbers of Italian prisoners captured in North Africa were brought to the camp in 1940-41, and wooden huts were constructed for them:

"the same time the Ministry of Agriculture was pressing for the use of Italian prisoners of war as agricultural labourers and also to work on drainage and reclamation work. Non military work of this nature was permissible under the terms of the Geneva Conventions. By the end of 1941 over 9,000 Italians were so employed giving rise for the need for hutted camps, the construction of which was planned to be completed by October 1942 and it was during this phase of building that the hutted camp at Norton would have been constructed. There is local recollection of it being occupied by Italians..." (p11).

"The Welbeck Estate played host to many Army units between 1941 until after the end of the war but particularly in the build up to D-Day (6 June 1944). Canadian and American units, in addition to British Army units, were stationed there and indeed it was an American medical centre which provided health facilities to Norton Camp after the end of the war..." (p11).

After housing Germans captured following D-Day, including high-category prisoners:

"The purpose of the camp established at the instigation of the YMCA and Birger Forell was to provide education of carefully selected young Germans prisoners... and also included a faculty of theology for the training of both Protestant and Roman Catholic clergy. The International Red Cross acted as the supervising authority" (p12).

The camp was located on the southern edge of Welbeck Park, within its boundaries, approximately 300 metres north of the centre of the village of Norton.

An aerial photograph of the camp from the 1940s is published in *"Warriors Through the Landscape - An Appreciation of Norton and Carburton POW Camps 1944-48"* on page 9, and the results below reveal that elements of Norton Camp, seen on that 1940s image, survive in the landscape to this day.



Figure 26: Aerial photograph Norton Camp location. Imagery © 2019Getmapping plc, Map data © 2019. Google.

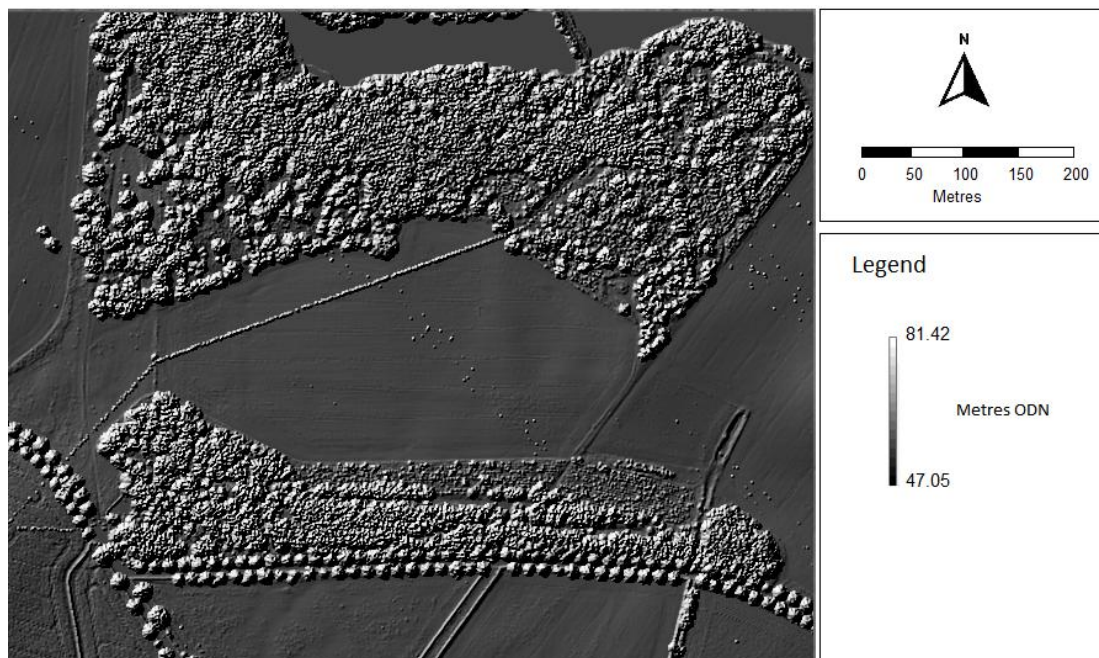


Figure 27: Digital Surface Model (DSM) of Norton Camp. Images produced by Mercian from original data provided by Bluesky.

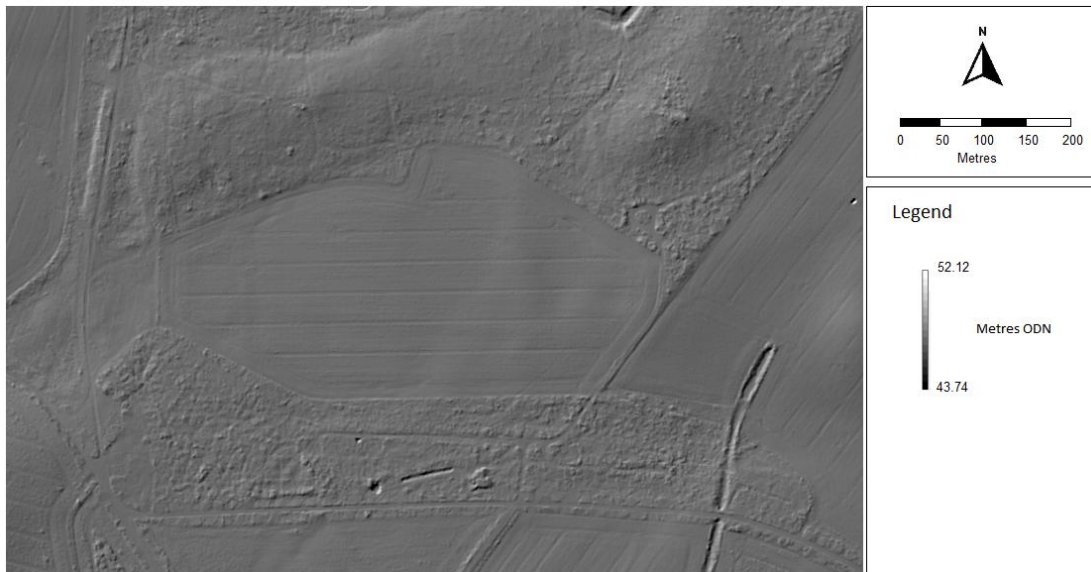


Figure 28: Digital Terrain Model (DTM) of Norton Camp. The last return data. Images produced by Mercian from original data provided by Bluesky.

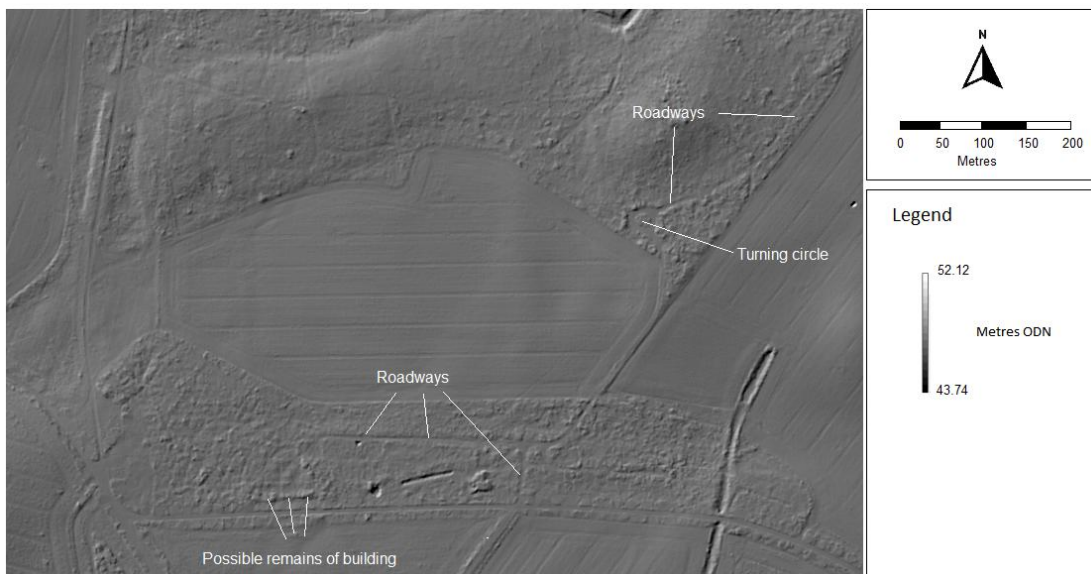


Figure 29: Digital Surface Model (DTM) of Norton Camp, interpretation. Images produced by Mercian from original data provided by Bluesky.

Features that are clearly visible include roadways, and a turning circle. These are shown in figure 29 above along with possible remains of buildings from the camp.

Ground-truthing would be required to confirm or deny the presence of buildings, but LiDAR has shown that the outline of the camp is still present on the ground in terms of roadways and elements of the infrastructure.

6.5. Carburton Woods and Camp

From 1943-44 the area which is now under Carburton Woods was used as a military camp for different troops including Canadians.

The history of the camp has been written about as part of the same project, which funded the LiDAR analysis undertaken, in the book *Warriors Through the Landscape - An Appreciation of Norton and Carburton POW Camps 1944-48*. (Battle of Hatfield Investigation Society, Bob Ilet, and Mercian Archaeological Services CIC, 2019).

The following are excerpts from that publication which give an insight into the history of the camp:

"In the Summer of 1944 the nature of military use of the area changed as men and supplies moved out following the D-Day invasions. Before then Britain held only a relatively small number of German Prisoners of War but this situation changed rapidly as the Allies advanced through France and Belgium. Carburton Camp became Prisoner of War Camp 181 initially holding mainly NCOs and other ranks..."

"...There were three categories of German prisoners:- Category A (Whites) - these were men who were decidedly not National Socialist, Category B (Greys) comprising the bulk of prisoners many of whom still had faith in Adolf Hitler appreciating what he had done for their country in the thirties but who were in the main ordinary men who had 'done their duty' and Category C (and C+) (Blacks) who were the committed National Socialists still with absolute faith in Hitler and even as prisoners ready to perform any task in fulfilment of the aims of the Third Reich. In 1945 a report further categorised the prisoners as :- group 1- those under 26 who had known no other system than National Socialism, Group 2- men between 26 and 35 who had helped to put National Socialism into powers making them fanatical with a determination to dominate and Group 3- the older men who knew life before Hitler came to power and were more likely to be anti Nazi.

The camp comprised a larger type of Nissen huts, probably Romney huts, set out in rows and capable of holding more than 1,400 men complete with a Medical centre, administrative buildings, cookhouse and dining area, separate latrines and shower blocks and meeting huts. The main entrance was off Piper Lane to the North of the

camp with an additional entrance to the South just North of Carburton Cross Roads. Each hut was capable of holding 50 men with beds at the far end and mess facilities with tables near to the door. Heat was provided by a cast iron pot bellied stove fired by solid fuel of one sort or another. Food was brought from the kitchen in dixies and eaten at the tables in the huts. There must have been at least 30 huts for the prisoners with other huts near the entrance to house the guards and other staff" ... (pp 22-23).

Analysis of LiDAR data suggested that there may have been remains of the camp still surviving under Carburton Woods. As part of this project a ground-truthing exercise was undertaken to determine if the LiDAR anomalies seen were archaeological remains, and if so what was the current level of preservation. Below are the results of the LiDAR survey and subsequent ground-truthing. Figure 30 shows Carburton Woods. Figures 31 and 32 show the LiDAR results.



Figure 30: Aerial photograph Norton Camp location. Imagery © 2019 Getmapping plc, Map data © 2019. Google.

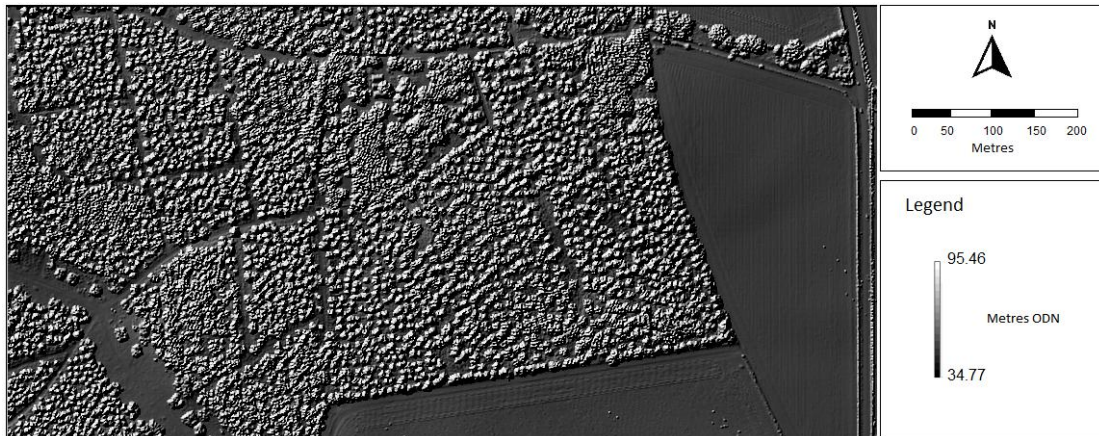


Figure 31: Digital Surface Model (DSM) of Carburton Woods. Images produced by Mercian from original data provided by Bluesky.

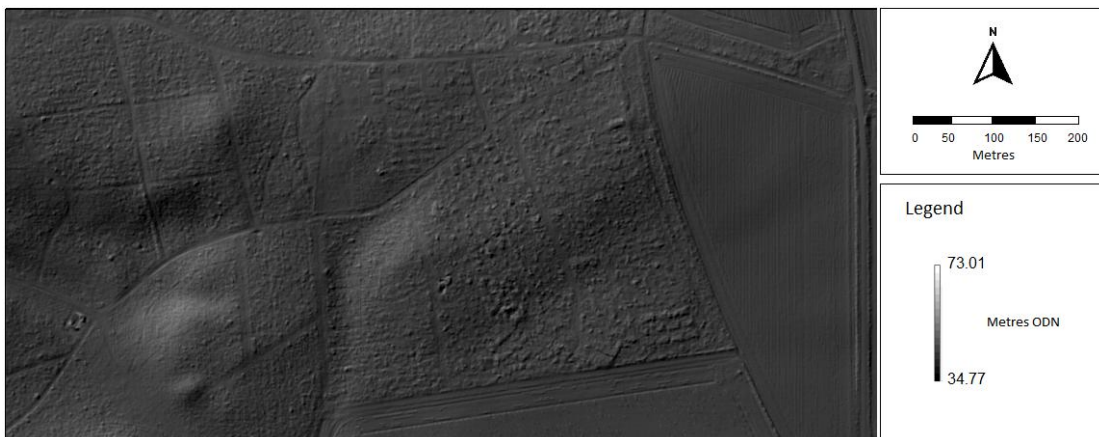


Figure 32: Digital Surface Model (DTM) of Carburton Woods. The last return data. Images produced by Mercian from original data provided by Bluesky.

6.5.1. Results of Ground-truthing in Carburton Woods

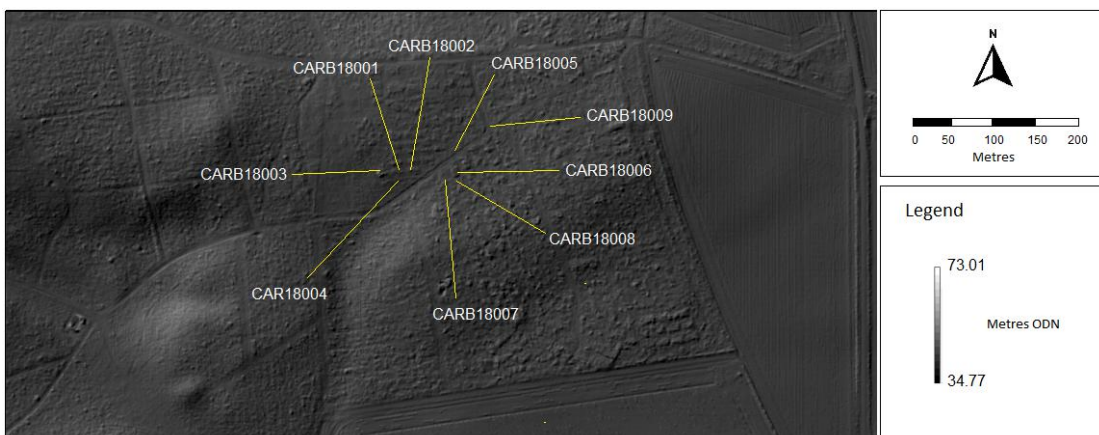


Figure 33: Results of ground-truthing of LiDAR. Images produced by Mercian from original data provided by Bluesky.

CARB18001 - Hut Platform, brick lined concrete base:



Photograph 01: CARB18001: Hut Platform, brick lined concrete base. Showing 'Welbeck' brick used in construction. Facing north.



Photograph 02: CARB18001: Hut Platform, brick lined concrete base. Showing 'Welbeck' brick used in construction. Facing west-north-west.

CARB18002 - Hut Platform, brick lined concrete base:



Photograph 03: CARB18002: Hut Platform, brick lined concrete base. Showing 'Welbeck' brick used in construction. Facing north.



Photograph 04: CARB18002: Hut Platform, brick lined concrete base. Showing proximity to tree on southern side. Track-way CARB18004 runs east to west at this location, parallel to the hut-base. The tree lies between the track and the hut-base.

CARB18003 - Hut Platform, brick lined concrete base, with projecting extension on western end:



Photograph 05: CARB18003: Hut Platform, brick lined concrete base, with projecting extension on western end. Facing north-east.



Photograph 06: CARB18003: Hut Platform, brick lined concrete base, with projecting extension on western end. Facing north-north-east.

CARB18004 - Concrete Trackway running east-west:



Photograph 07: Eastern end of concrete trackway CARB18004 at the point where it emerges from the woodland and merges with concrete roadway CARB18005. Facing north-west.



Photograph 08: Eastern end of concrete trackway CARB18004 at the point where it emerges from the woodland and merges with concrete roadway CARB18005. Facing west.

CARB18005 - Concrete Trackway running east-west:



Photograph 09: CARB18005 Concrete Roadway orientated north-east to south-west. Facing north-east. Volunteers Steve Horne and Nick Mason holding scale bars.



Photograph 10: CARB18005 Concrete Roadway orientated north-east to south-west. Facing north-north-west. Showing exposed surface.

CARB18006 - Hut Platform, brick lined concrete base:



Photograph 11: CARB18006: Hut Platform, brick lined concrete base. Facing north-east.



Photograph 12: CARB18006: Hut Platform, brick lined concrete base. Facing north.

CARB18007 - Concrete base of former gate post:



Photograph 13: CARB18007 Concrete Roadway orientated north-north-east to south-south-west. Facing north-north-east. Showing exposed surface.



Photograph 14: CARB18007 Concrete Roadway orientated north-north-east to south-south-west. Facing north-north-east. Showing exposed surface. Volunteer James Smalley and Nick Mason are standing on the trackway to show orientation.



Photograph 15: CARB18007 Concrete Roadway orientated north-north-east to south-south-west. Showing exposed surface. Facing north. Volunteer James Smalley and Nick Mason are standing on the trackway to show orientation.

CARB18008 - Concrete base of former gate post/ barrier post:



Photograph 16: CARB18008 Fragment of Sherwood Colliery Brick. Facing north-west.

CARB18009 - Concrete base of former gate post/ barrier post:



Photograph 17: CARB18009 Concrete base of former gate post/ barrier post. Facing north-north-west.



Photograph 18: CARB18009 Concrete base of former gate post/ barrier post. Facing north-west.



Figure 34: Digital Surface Model (DTM) of Carburton Camp showing the location of surviving building platforms. The last return data. Images produced by Mercian from original data provided by Bluesky.

The ground-truthing exercise undertaken by Mercian with community volunteers produced excellent results and confirmed that the anomalies seen on the LiDAR data were in fact archaeological remains of the former prisoner of war camp. Results show that Carburton Woods, contains the remains of a former camp which included a large number of well-preserved building platforms, roadways, and trackway. This report demonstrates the potential of the site of Carburton Camp. It is only the results of a preliminary survey of the site, and future work including full survey is required now that the potential has been revealed by this project.

6.5. Battle of Hatfield

The Battle of Hatfield Investigation Society and Mercian Archaeological Services CIC are researching the 7th century Battle of Hatfield and its connections to the Sherwood Forest area. King Edwin (later Saint) was killed at the Battle of Hatfield on the 12th October 633AD (Gaunt 2017) according to Bede.

Many elements link the Battle of Hatfield to the northern part of the later Sherwood Forest between Edwinstowe and Cuckney. These are discussed in detail in Gaunt's 2017 report.

In summary they include: the orientation of Edwinstowe church, on the Saint's

day sunrise of the feast day of St Edwin (12th October in the 12th century- now 19th October), and the presence of a medieval cult of St Edwin in the village of Edwinstowe, referenced in the 14th and 15th; the presence of a St Edwin's chapel in the neighbouring village of CLipstone; the place-name Edwinstowe meaning Edwin's Holy Place; the western half of Bassetlaw being called '*Hatfield District*' into the 18th century; the location of a 'Hatfield Grange and 'High Hatfield Farm' in the village of Cuckney (see Gaunt 2017 for a full referenced account). In 1951 builders discovered a large number of skeletons under the church at Cuckney, these skeletons were speculated to have come from the Battle of Hatfield (Revill, S. 1975).

Recently discovered by the author is an entry on the *Estate Map of Thoresby and Perlethorpe cum Budby* dated to 1738 (Ma 4 P 20- Manvers Collection), on the far western edge of the map, is an entry labelled 'Hatfield'. This entry is at the far eastern edge of Cuckney parish. It seems possible that this relates to the name of the eastern open field of Cuckney prior to enclosure. Further documentary research is planned by Mercian in the coming years.

Both Hatfield Grange and High Hatfield Farm stand in the eastern part of Cuckney, along with Hatfield Plantation.

The following images are two 3-Dimensional images which show how landscape modelling utilising LiDAR data from this project could be used to examine the landscape. The site of Hatfield on the two images (brown coloured area) is based on the map of 1738 which mentions Hatfield, in this location, and the presence of; Hatfield Farm, Hatfield Grange and Hatfield Plantation in this part of Cuckney.

Mercian are building a GIS-based map of the historic medieval landscape of Cuckney. Which alongside Mercian's ongoing research into the landscape of Sherwood Forest as part of the Sherwood Forest Archaeology Project, could enable a search for a potential battle site.

It is now fairly certain that the Battle of Hatfield was fought in the area surrounding the likely burial site of King Edwin at Edwinstowe (Gaunt 2017). Without archaeological excavation of the skeletons or bones from the sites highlighted as potentially containing the re-interments from the 1951 excavations, in the churchyard (anomalies discovered by RSK (Gaunt & Crossley 2016)), there is no definitive proof of Cuckney being the site of that battle.

However, without permission to excavate, non-invasive landscape analysis

techniques, such as using LiDAR modelling, alongside other fieldwork techniques including looking at settlement development (Budge 2019), and field-walking, could be a very useful tool.

Although, as stated, there is no definitive proof of the Battle of Hatfield occurring in Cuckney, beyond all the strong circumstantial evidence of place-names, alongside the potential burials under the church (Revill 295), it is still possible to speculate where a possible battle may have taken place. The images show Cuckney Hill in the back ground, with 'Hatfield' lying to the east. A small plateau to the east of the road has been circled on the image in figure 36 and labelled 'Hatfield?', suggested by the author as a potential site for an engagement taking place, following initial contact on Cuckney hill. The river crossing could easily have been a bottle-neck, or killing zone, which would explain a mass-burial under the subsequent church. Although this is pure speculation and conjecture, at this stage, it does show the potential for future interpretation, analysis and discussion using LiDAR data along side other evidence.

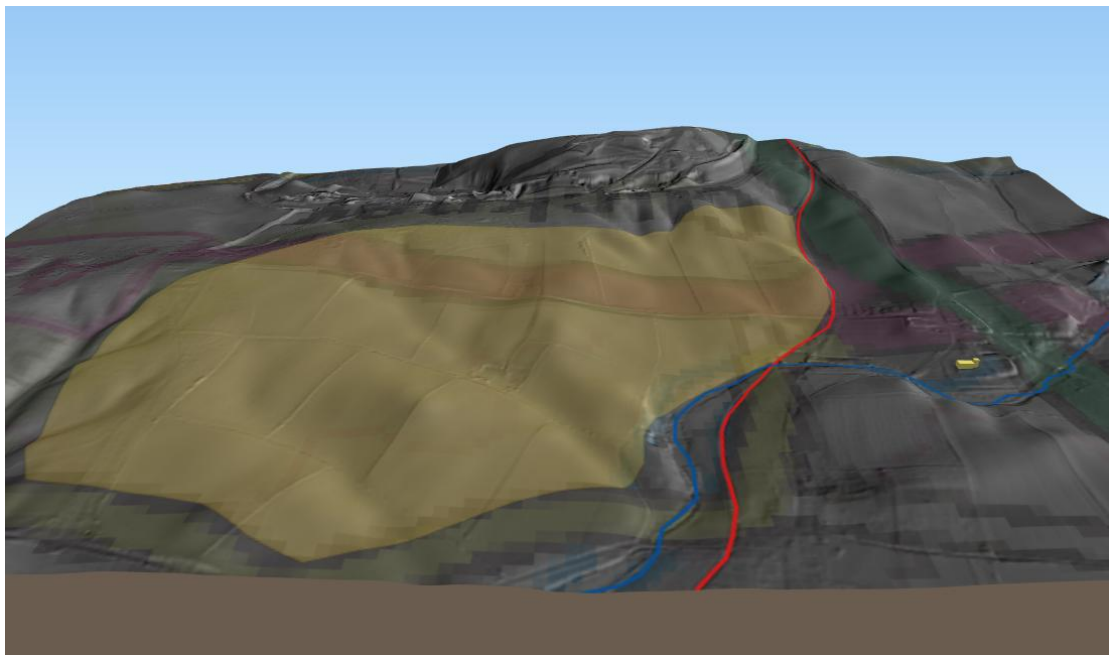


Figure 35: 3-Dimensional model of the landscape of Cuckney. The historic route of the roadway is marked in red, the River Poulter is marked as a blue line. Cuckney church is shown as an extruded polygon model in yellow. 'Hatfield' as suggested from 1738 map and the location of Hatfield Plantation, High Hatfield Farm, and Hatfield Grange is shown as a brown area. Images produced by Mercian from original data provided by Bluesky.

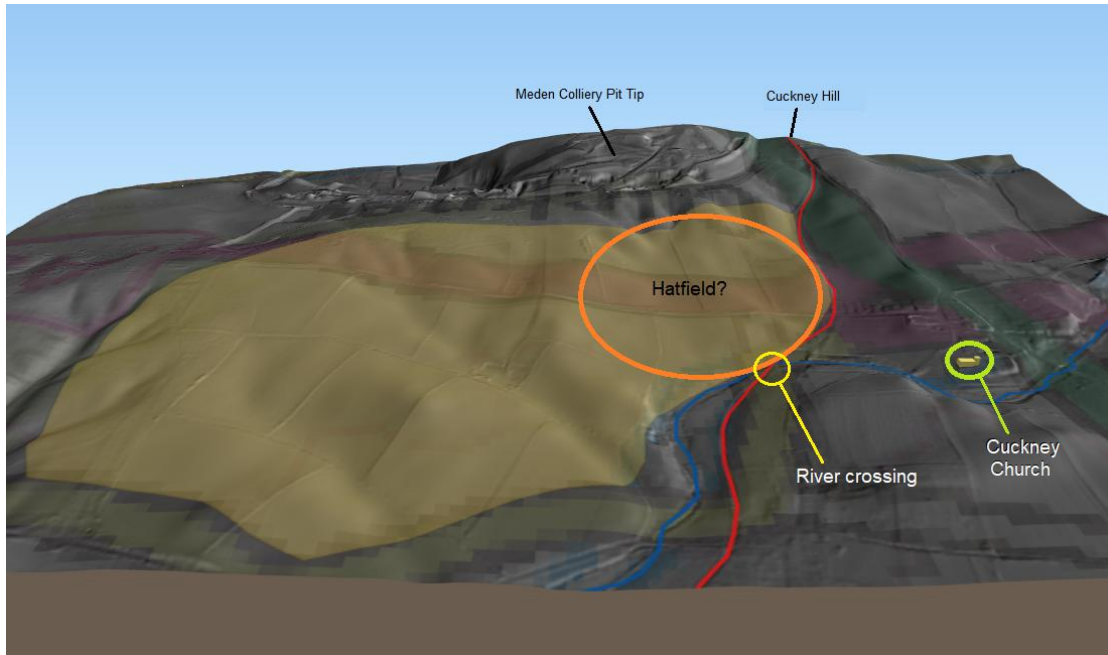


Figure 36: 3-Dimensional model of the landscape of Cuckney. The historic route of the roadway is marked in red, the River Poulter is marked as a blue line. Cuckney church is shown as an extruded polygon model in yellow. 'Hatfield' as suggested from 1738 map and the location of Hatfield Plantation, High Hatfield Farm, and Hatfield Grange is shown as a brown area. A possible location for the Battlefield is suggested in the orange circle marked 'Hatfield?', Cuckney church is also circled showing where the bodies may have been interred. The Images produced by Mercian from original data provided by Bluesky.

7. Future Work

It is recommended here that a full Level One, and Level Two Survey of Carburton Camp is undertaken.

Other military sites have also been detected through LiDAR analysis although they are not included here.

It is strongly recommended that a full analysis and recording of World War II remains be undertaken as part of a larger survey of World War II in Sherwood Forest. No such survey has been undertaken and would be a very important contribution especially if undertaken in the upcoming years following this survey.

The window for involving people with first hand experience is closing, and with this in mind, alongside the upcoming anniversaries, a full scale survey of World War II infrastructure in Sherwood Forest is imperative.

Further investigation is required into the Battle of Hatfield and its possible associations with Cuckney.

8. Disclaimer

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10. Bibliography

Accessing Environment Agency lidar tiles from the web

<https://historicengland.org.uk/content/docs/research/using-ea-lidar-data-pdf/>

A Short Guide to GPS. 2004. British Archaeological Jobs Resource.

Ainsworth, S., Bowden, M., McOmish, D. & Pearson, T. 2007. *Understanding the Archaeology of Landscape*. English Heritage.

Ainsworth, S. & Thomason, B. 2003. *Where on Earth are We? The Global Positioning System (GPS) in archaeological field survey*. English Heritage.

Bennett, R., Welham, K., Hill, R.A., and Ford, A. 2012: 'A comparison of visualization techniques for models created from airborne laser scanned data', *Archaeological Prospection* 19.1, 41–8

Bettess, F. 1990. *Surveying for Archaeologists*. Penshaw Press: University of Durham.

Bowden, M. 1999. *Unravelling the landscape. An inquisitive Approach to Archaeology*. Tempus, Stroud.

Budge, D. 2019. Archaeological Investigation at Cuckney, Nottinghamshire. Bassetlaw, Nottinghamshire. End of Project Report. MAS049. Mercian Archaeological Services CIC

Challis, K., Forlin, P., and Kincey, M. 2011: 'A generic toolkit for the visualisation of archaeological features on airborne LiDAR elevation data', *Archaeological Prospection* 18.4, 279–89

Chapman, H. 2006. *Landscape Archaeology and GIS*. Tempus.

ClfA, 2012, By-laws. *Code of Conduct*, Institute for Archaeologists, Reading.

Crutchley, S., and Crow, P. 2010: *The Light Fantastic: Using Airborne Laser Scanning in Archaeological Survey*, Historic England. Swindon.

Doneus, M. 2013: 'Openness as visualization technique for interpretative mapping of airborne LiDAR derived digital terrain models', *Remote Sensing* 5(12), 6427–42.

Gaunt, A. 2019. Archaeological Survey of Cuckney Water Meadow System, Cuckney, Nottinghamshire. Mercian Archaeological Services CIC. MAS043. Archaeological report

Gaunt, A. 2017. Archaeoastronomical and Topographic Survey at St Mary's Church, Edwinstowe in Sherwood Forest Nottinghamshire. Mercian Archaeological Services CIC. MAS030. Archaeological report.

Gaunt, A. & Crossley, S. 2016. *An Integrated Archaeological Survey of Cuckney Churchyard, Castle, and surroundings. Cuckney, Nottinghamshire*. Mercian Archaeological Services CIC, MAS021. Archaeological

Knight, D., Vyner, B. & Allen, C. 2012. *East Midlands Heritage- An Updated*

Research Agenda and Strategy for the Historic Environment of the East Midlands.
University of Nottingham and York Archaeological Trust.

Morris, J. 1977. Domesday Book. Nottinghamshire. Phillimore

Muir, R. 2004. *Landscape Encyclopaedia: A reference guide to the Historic Landscape* Windgather Press.

Revill, S. 1975. *King Edwin and the Battle of Hatfield*. Transactions of the Thoroton Society Volume 79.

Warriors Through the Landscape - An Appreciation of Norton and Carburton POW Camps 1944-48. (Battle of Hatfield Investigation Society, Bob Ilet, and Mercian Archaeological Services CIC, 2019).

Warriors Through the Landscape - Explain the Terrain. Battle of Hatfield Investigation Society and Mercian Archaeological Services CIC, 2019.