



Withington Villa Gloucestershire

UAV Surveys



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Summary

Wessex Archaeology was commissioned by Professor Richard Miles at The University of Sydney, on behalf of the Axel and Margaret Ax:son Johnson Foundation for Public Benefit, to undertake metric and visual Unmanned Aerial Vehicle (UAV) surveys of a 19 ha parcel of land at Manor Hall, Withington, Gloucestershire, GL54 4BN, centred on NGR 403245 215038. The surveyed area included part of the scheduled Withington Romano-British villa complex (NHLE 1003345). Prior to site attendance, permission was obtained from the neighbouring landowner to extend the survey to include an additional 7 ha area immediately to the south-west, centred on NGR 403152 214771, which incorporates the remainder of the scheduled area. The surveys were undertaken to create a visual record of the site, aid remote visualisation and improve understanding of the monument as it exists in the landscape.

The survey comprised a UAV photogrammetric and photographic survey, supported by ground-based photography. A photogrammetric orthomosaic and panoramic images were created from the photography to provide visual information on the site. A multispectral photographic survey was undertaken to see if any previously unknown archaeological features could be identified. The existing LiDAR dataset was re-examined, and additional visualisation methodologies employed, to determine whether additional hitherto unknown or unrecognised archaeological features could be identified, to better define known features, and to allow for the creation of topographic maps.

The metric and visual surveys have enhanced the understanding of the Withington Roman Villa site and surrounding landscape. The figures included in this report have drawn together previous knowledge of the site from the desk-based assessment, geophysical survey and archaeological evaluation and contributed to a greater understanding of how the identified archaeological features interact with the local topography. The LiDAR and multispectral assessments have depicted the known archaeology at the site and identified previously unrecorded archaeological features. This multifaceted approach can be used to inform future archaeological work at the site.

Acknowledgements

Wessex Archaeology is grateful to Professor Richard Miles for commissioning the project on behalf of the Axel and Margaret Ax:son Johnson Foundation for Public Benefit.

The metric and visual survey was completed by Anthony Russell with the assistance of Roberta Marziani and Sally Jones. The project was managed on behalf of Wessex Archaeology by Tori Wilkinson.



Withington villa site, Gloucestershire – UAV surveys

Archaeological Metric and Visual Survey

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology were commissioned by Professor Richard Miles at The University of Sydney, on behalf of the Axel and Margaret Ax:son Johnson Foundation for Public Benefit, to undertake metric and visual unmanned aerial vehicle (UAV) surveys at Manor Hall, Withington, Gloucestershire, GL54 4BN. The survey covered an area of 19 ha and an additional 7 ha to the south-west, centred on NGR 403245 215038 and NGR 403152 214771 respectively (Fig. 1).
- 1.1.2 The survey forms part of a staged archaeological investigation focused on a scheduled Romano-British villa site (NHLE 1003345) and has been undertaken in advance of proposed excavations in Manor Court Field, subject to Scheduled Monument Consent (S00242446). It follows previous excavations by Time Team in 2005, and LiDAR and geophysical surveys undertaken by Wessex Archaeology in 2018.
- 1.1.3 The survey, comprising UAV photogrammetric and photographic survey and ground-based photography, was undertaken over three days from 15 to 17 June 2022.

1.2 Scope of the report

- 1.2.1 The purpose of this report is to provide a detailed description of the results of the archaeological visual and metric survey, to interpret the results and assess whether the aims of the survey have been met.
- 1.2.2 The presented results will provide further information on the archaeological resource to help inform the scope and nature of any further archaeological work.

1.3 Location, topography and geology

- 1.3.1 The survey area is located to the south of the village of Withington, 11 km south of Cheltenham and 13 km north of Cirencester, in the county of Gloucestershire.
- 1.3.2 The survey covers the property extents of Manor Hall, centred on NGR 403245 215038, which incorporates Manor Court Field, and a field to the south-west. The area is bound to the east and north-east by the River Coln to the east and a tributary of it, and is given over to grazing.
- 1.3.3 The site lies within a valley, with the western side of the site being on an east-facing slope, dropping from 175 m OD to 155 m OD. The eastern side of the site becomes flatter as it approaches the River Coln. The valley bottom is on a south-facing slope.
- 1.3.4 The site falls within the ESA (Environmentally Sensitive Area) scheme managed by the Department for Environment, Food and Rural Affairs (DEFRA).



- 1.3.5 The geology for most of the site is mapped as Ooidal Limestone of the Birdlip Limestone Formation. In the south-east, areas of Crickley Member and Leckhampton Member Limestone are recorded, while the east of the site is covered by Mudstone of the Whitby Mudstone Formation. There are no superficial deposits recorded across the majority of the area; however, alluvial deposits of clay, silt, sand, and gravel are present along the banks of the River Coln (British Geological Survey online viewer).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

- 2.1.1 The archaeological and historical background has been fully assessed in a desk-based assessment (Wessex Archaeology 2018). The following is a brief summary of the historic records considered relevant to the site. Resources for this summary include the National Heritage List for England (NHLE) and Gloucestershire County Council Historic Environment Record (GHER).

2.2 Archaeological and historical context

- 2.2.1 The project area incorporates part of a scheduled Roman villa and associated features (NHLE 1003345 / HER 31), which was first excavated in by Samuel Lysons in 1811–12. Although the full plan of the villa was not exposed, the excavations uncovered 15 rooms and passages – eight of which contained tessellated floors – limestone walls, and a hypocaust system. The ‘Orpheus mosaic’, along with parts of others, was lifted and donated to the British Museum by the landowner Mr Henry C. Brook.
- 2.2.2 The site was revisited in August 2005, when an archaeological evaluation (HER 28529) and geophysical surveys (HER 28189) were undertaken by Channel 4’s ‘Time Team’. These investigations demonstrated that the villa site was considerably more complex than had initially been supposed and comprised not just the single building identified by Lysons, but was formed of ‘two substantial buildings set within a landscape of enclosures, boundaries and trackways, stretching from the upper slopes of the valley down to the River Coln’ (Thompson and Armour Chelu 2009, 200). The boundary of the scheduled monument was subsequently enlarged to the east.
- 2.2.3 Two other scheduled monuments are recorded in the surrounding area, both within Withington Woods. A 13 m diameter round barrow (NHLE 1017073) is located 450 m south-west of the site, surviving as a 1 m high mound. A probable Early Neolithic long barrow (NHLE 1017072) is recorded 600 m south of the site. This is visible as a 58 m long, 18 m wide, 2 m high mound.
- 2.2.4 There are 24 listed buildings recorded in the study area, including one Grade I and two Grade II* buildings. These are concentrated around the centre of Withington, mostly consisting of 17th- and 18th-century houses and cottages.
- 2.2.5 There are numerous non-designated heritage assets recorded within the surrounding area in the GHER. The most notable of these is a shrunken medieval village visible as earthworks to the west of Withington. This covers a 77 m by 55 m area, and is located 500 m north of the site.



3 AIMS AND METHODS

3.1 Project aims

3.1.1 As specified in the *Written Scheme of Investigation for an Archaeological Metric and Visual Survey* (Wessex Archaeology 2022) the general aims of the survey were:

- To create a visual record of the site, to aid remote visualisation and improve understanding of the monument as it exists in the landscape;
- To accurately map the site, in order to better understand the terrain and provide a basis for potential further 3D modelling;
- To re-examine the existing LiDAR dataset and employ additional visualisation methodologies, to determine whether additional hitherto unknown or unrecognised archaeological features can be identified;
- To help inform the scope and nature of any further archaeological work that may be required.

3.2 Project objectives

3.2.1 In order to achieve the above aims, the general objectives of the metric survey were:

- To establish, within the constraints of the metric and visual survey, the extent, character, condition and quality of any surviving archaeological remains within the specified area;
- To place any identified archaeological remains within a wider historical and archaeological context in order to assess their significance;
- To make available information about the archaeological resource within the site by reporting on the results of the metric and visual survey.

4 METHODS

Introduction

4.1.1 All works were undertaken in accordance with the detailed methodology set out within the WSI (Wessex Archaeology 2022) and in general compliance with the standards outlined in in Historic England guidance (Historic England 2015). The methods employed are summarised below.

UAV photogrammetric and photographic survey

4.1.2 The metric survey comprised a UAV photogrammetric and photographic survey, supported by ground-based photography, over an area of 19 ha.

4.1.3 The UAV survey was carried out in accordance with the standards established in *Metric Survey Specifications for Cultural Heritage* (Historic England 2015b) and *Photogrammetric Applications in Cultural Heritage* (Historic England 2017).

4.1.4 An aerial and ground-based photographic survey captured static oblique and 360° views across the landscape, at a number of key locations agreed in advance with the client and refined on site. UAV multispectral photographic data was also captured, and the UAV surveys were supported by ground-based photography.

- 4.1.5 A photogrammetric survey was carried out using a DJI Inspire 2 UAV with a Xenmuse X5S camera payload. Flights were carried out at a height of approximately 50m, with a minimum of 80% front and side overlap. A ground sampling distance (GSD) of 2cm/px was achieved in the recording of features within the survey area, which is described in Historic England guidance as suitable for a reproduction scale of 1:200 or larger.
- 4.1.6 A multispectral photographic survey was carried out using a Parrot Bluegrass UAV carrying a Parrot Sequoia multispectral sensor. Images were captured in four bands: Green, Red, Red-edge and Near Infrared (NIR). Flights were conducted at an approximate height of 70m, providing a GSD of 6cm/px, and with a minimum front and side overlap of 80%.
- 4.1.7 Ground control points (GCPs) were established to control the photogrammetric and multispectral photographic surveys. The location of the GCPs and of static photographic views was recorded using a Real Time Kinematic (RTK) Global Navigational Satellite System (GNSS) which provides an accuracy of +/-30mm in accordance with metric survey specifications laid down by Historic England (2015).

Data Processing

- 4.1.8 The photogrammetric data was processed using the latest version of Pix4D Mapper into a 3D point cloud (.las format), a 3D mesh model, and an orthomosaic (geotiff format).
- 4.1.9 The LiDAR assessment was undertaken using the Digital Terrain Model (DTM) tile data collected by Bluesky International Limited in 2018 as part of the previous phase of works. The data were acquired in ASCII raster and LAS (LiDAR point data) formats, with a 0.25 m horizontal resolution. The DTM dataset contained pre-filtered data, with vegetation and buildings removed, resulting in a 'bare earth' model of the terrain.
- 4.1.10 The DTM tiles were mosaiced prior to analysis using ArcPro 2.9 in order to create a single DTM for the site, from which a number of subsequent datasets were derived.
- 4.1.11 The ASCII files were processed in RVT (Relief Visualisation Toolbox) (Kokalj and Somrak, 2019; Zaksek *et al*, 2011), creating the following topographic visualisations:
- Shaded relief topographic visualisation (Hillshade).
 - 32 Multi-directional Hillshade, which produces multiple shaded reliefs, illuminating a surface from multiple directions to enhance slighter topographic features.
 - Slope Severity, producing a visualisation that conveys the maximum rate of change in height between neighbouring cells in the DTM.
 - Sky View Factor, producing a visualisation that identifies light on any upstanding topographic feature and depressions that receive less light.
 - Local Relief Model, producing a visualisation that enhances small scale topographic features and removes larger features such as valleys and landforms.
- 4.1.12 The intensity surface was created using ArcPro 2.9, from the point cloud LAS data, using the 'LAS to Raster' function on the last pulse intensity return. Intensity is collected using a near-infrared wavelength (c. 947nm), measuring the reflection to absorption ratio of a surface material (Challis *et al*. 2011).



- 4.1.13 ArcPro 2.9 was used to both display and analyse the topographic and intensity visualisations and to digitise features of archaeological interest. For digitisation, visualisations were routinely displayed to standard deviations of the display window enhancing the ability to detect subtle features.
- 4.1.14 The DTM was classified at 1 m height intervals using ArcPro 2.9 to produce a plan of the bare earth terrain of the site. A contour dataset was generated at 1 m intervals to create a topographic map of the site.
- 4.1.15 The multispectral sensor collected simultaneous imagery across four bands: Green (550 nm ± 40 nm), Red (660 nm ± 40 nm), Red edge (735 nm ± 10 nm) and Near infrared (790 nm ± 40 nm). Variations in the proportion of reflected, absorbed and transmitted energy within each band can be an indicator of plant health and growth, and therefore the presence of subsurface archaeological features.
- 4.1.16 The multispectral data was calibrated using Pix4D 4.6.4, from which the reflectance bands (Green, Red, Red edge and NIR) was produced. A Normalised Difference Vegetation Index was created, using the NIR and Red bands:

$$\text{NDVI} = (\text{NIR} - \text{RED}) / (\text{NIR} + \text{RED})$$

This index measures the contrast between NIR (which vegetation reflects) and Red (which vegetation absorbs), and therefore can differentiate areas of differential vegetation growth.

- 4.1.17 A Green Normalised Difference Vegetation Index was also calculated.

$$\text{GNDVI} = (\text{NIR} - \text{GREEN}) / (\text{NIR} + \text{Green})$$

This index uses the Green and NIR bands. Similar to NDVI, the GNDVI can differentiate areas of differential vegetation growth, however the GNDVI measures the contrast between NIR and Green.

- 4.1.18 The NDVI and GNDVI were interpreted to define areas of potential archaeology, through vegetation differentiation. Both indices were displayed in ArcPro v2.9.3. The NDVI's data range was clipped to 0.5 and 0.9, and the GNDVI's clipped to 0.4 and 0.8, in order to enhance the contrast of the data.
- 4.1.19 The aerial and ground-based photographs were processed using Adobe Lightroom and Photoshop to create panoramic images. A selection process identified a subset of those which best illustrated the landscape, which were cropped as appropriate for inclusion in this report (Figs 10–12). A full set of panoramas will be issued to the client.

5 ARCHAEOLOGICAL RESULTS

5.1 Introduction

- 5.1.1 The results presented below provide an assessment of how the archaeological visual and metric survey has enhanced knowledge of the site and wider landscape of Withington Roman Villa. (see Figs 2–9). The results have been cross-referenced with the archaeological desk-based assessment (Wessex Archaeology 2018a), the geophysical survey (Wessex Archaeology 2018b) and the results from the 2005 archaeological evaluation and geophysical survey (GSB 2005; Wessex Archaeology 2006).

5.2 Results

- 5.2.1 The 3D visualisation of the LiDAR Analytical Hillshade (Fig. 2) and the aerial panoramic photography (Figs 10–12) demonstrate that Withington Roman Villa occupied relatively low-lying ground compared to the surrounding terrain (the west-facing slope of the valley being steeper). This location would have afforded relative seclusion and shelter as well as access to the River Coln. The geophysical survey provided evidence of earlier activity at the site, including a possible Iron Age banjo enclosure and associated enclosures and field systems, suggesting the site was a favoured location for habitation before the construction of the villa (Wessex Archaeology 2018b).
- 5.2.2 The 2D orthographic image of the site was produced using the UAV metric survey data (Fig. 3). The image provides a textured, current plan-view of the landscape features visible at the site, and has been cross-referenced with the LiDAR and Multispectral imagery during analysis to identify and eliminate modern surface features. This orthomosaic has also been used to depict the locations of the UAV and ground-based photography (Fig. 9). View 2 was omitted from the survey due to plant movement in the vicinity.
- 5.2.3 Aerial views 1, 5, 6 and 7 have been included in the figures at the end of this report (Fig. 10–12) as they enhance the discussion of the results. The remaining panoramic views depicted on Figure 9, derived from aerial and ground-based photography, have been included as a digital deliverable alongside the report to help inform future archaeological work at the site.
- 5.2.4 The LiDAR DTM, filtered to remove vegetation and buildings and categorised at 1 m height intervals, has revealed the bare earth terrain of the site (Fig. 4). This has been enhanced by the 1 m contour dataset, which provides detail on the topology of the east-facing slope on which the villa and the surrounding trackways and field systems were constructed. The results of the geophysical survey (GSB 2005; Wessex Archaeology 2018b) have been overlain on this detailed topographical map and it is evident that the archaeological activity at the site occupies a plateau enclosed by a steep-sloping valley to the north, and a more gently sloping valley curving to the north-east at the southern extent of the site (see Fig. 5).
- 5.2.5 The main villa site is situated on the east-facing slope of the valley at a height of 167 m OD. The trackway identified on the geophysics, linking the Withington Roman Villa to the second building identified in Manor Court Field (Wessex Archaeology 2006; 2018b) can be seen following the gradient of the slope downhill to the head of the spring. The course of the stream associated with the spring described in the geophysical survey report can be identified from the group of peaked contours immediately south of the building (Wessex 2018b). The Manor Court Field building occupies a depression at 147 m OD which appears to have been deliberately terraced (Wessex Archaeology 2018b).
- 5.2.6 The 3D and topographic maps aided the transcription of archaeological features from the LiDAR visualisations. The 3D Analytical Hillshade (Fig. 2) could be rotated and examined to confirm if differences in height were indicative of archaeological activity or changes in topography. The re-examination of the LiDAR data corroborated with the previous report (Wessex Archaeology 2018c), although the full feature extents have been defined in greater detail as polygons.
- 5.2.7 In addition to the features identified on the previous LiDAR transcription, the following features were identified and are described by area below (see Fig. 7):

Manor Court Field

A stream fed by the spring curving north-west to north-east was identified at the southern extent of Manor Court Field. A Y-shaped ditch parallel to the stream can be seen to the south.

Withington Upon Wall-Well

A series of six banks and five ditches were identified extending north-east to south-west across the field. A fourth pit was noted as part of a cluster of similar features in the south-east corner of the field. Bank earthworks following the ridge at the eastern edge of the field have been further defined.

Additional survey area

Four banks relating to previously recorded prehistoric earthworks have been mapped and their extents defined, with the inclusion of an additional bank to the immediate south of these features. A curvilinear bank not previously recorded was identified in the south-east corner of the field.

- 5.2.8 The results of the multispectral survey corroborated the LiDAR interpretation, highlighting the location of the buildings at the main villa site in the additional survey area and Manor Court Field (Fig. 8). An area of possible archaeology was also identified in the vicinity of the pit cluster, enclosure and field systems identified in Withington Upon Wall-Well (see Figs 7 and 8).
- 5.2.9 Composite plans such as those in Figures 5–8 help inform the scope and nature of any further archaeological work at the site. In Figure 6, the locations of the previous evaluation trenches (Wessex Archaeology 2006) and the proposed evaluation trenches for the next season of fieldwork have been plotted against the results of the geophysical survey and the LiDAR topographic map.

6 CONCLUSIONS

6.1 Discussion

- 6.1.1 A comprehensive array of non-intrusive survey methods were utilised and compared to enhance the understanding of the Withington Roman Villa site. The detailed 3D visualisations and topographic maps show how the archaeological features exist in relation to the wider landscape. The orthographic and panoramic images have provided texture and context to these plans, to aid remote visualisation.
- 6.1.2 The results of the geophysical survey have been strengthened by the re-examination of the LiDAR data and the assessment of multispectral imagery, which has identified previously undetected discrete raised earthwork features. This combination of remote sensing techniques can be used to inform further archaeological investigation at the site.

7 ARCHIVE STORAGE AND CURATION

7.1 Repository

- 7.1.1 The archive resulting from the survey is currently held at the offices of Wessex Archaeology in Salisbury. It is recommended that the project archive resulting from the survey is deposited with a suitable local repository.



7.2 Preparation of the archive

- 7.2.1 The complete project archive, which includes paper records, graphics and digital data, will be prepared following the standard conditions for the acceptance of excavated archaeological material by the identified repository, and in general following nationally recommended guidelines (ADS 2013; Brown 2011; ClfA 2014b; SMA 1995). The archive will usually be deposited within one year of the completion of the project, with the agreement of the client.

7.3 Security copy

- 7.3.1 In line with current best practice (e.g., Brown 2011), on completion of the project a security copy of the written records will be prepared, in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

7.4 OASIS

- 7.4.1 An OASIS online record (<http://oasis.ac.uk/pages/wiki/Main>) has been initiated, and key fields completed on Details, Location and Creators Forms. All appropriate parts of the OASIS online form will be completed for submission, and will include an uploaded .pdf version of the final report. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service ArchSearch catalogue.

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8.1 Archive and report copyright

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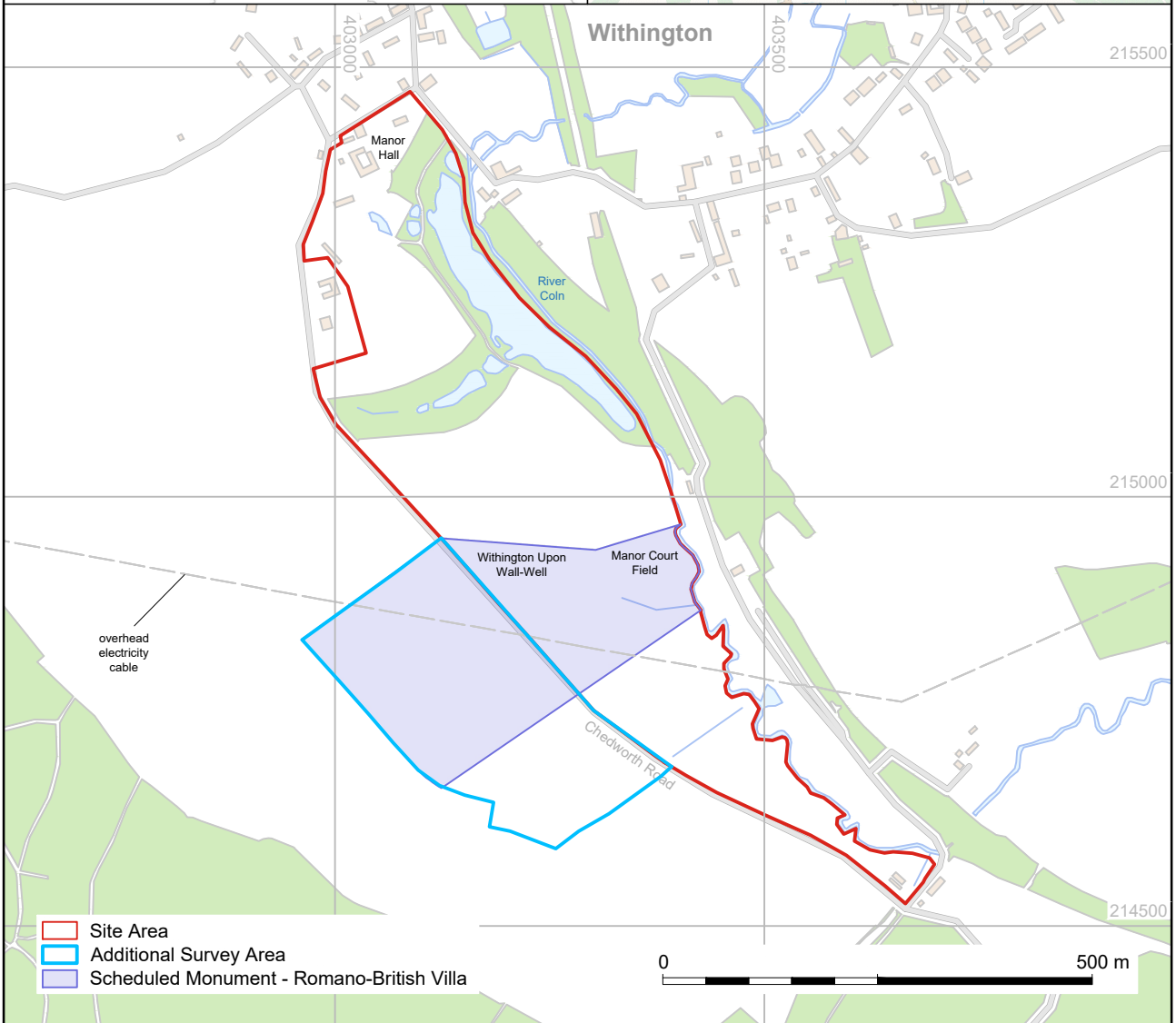
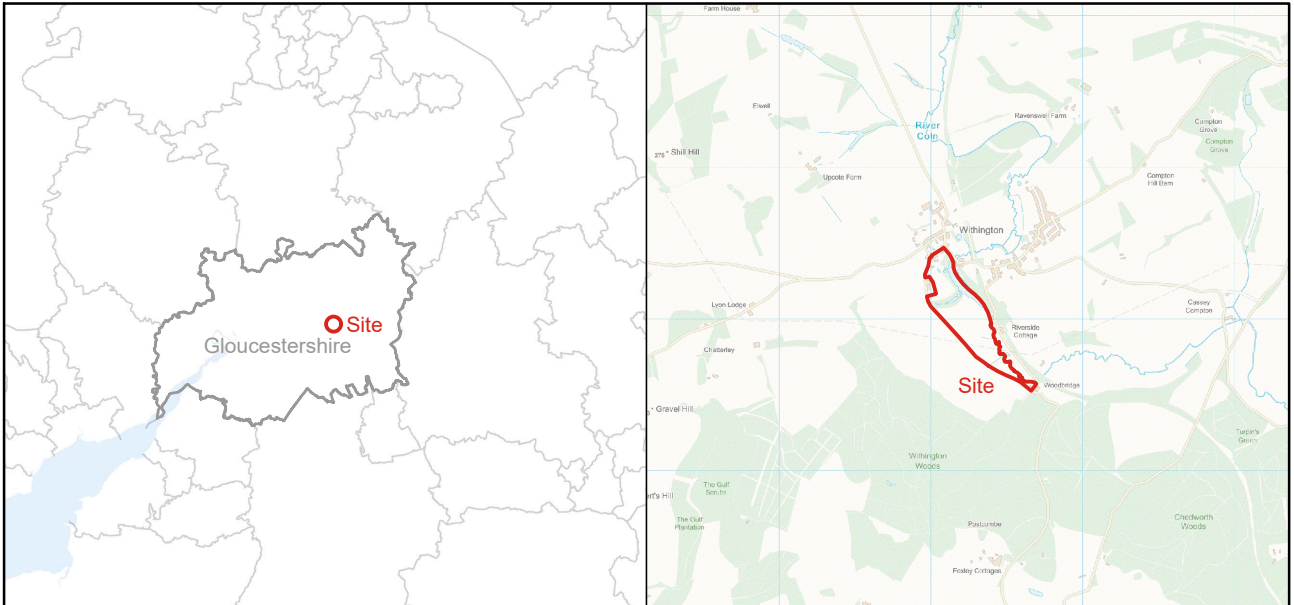
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REFERENCES

- ADS 2013. *Caring for Digital Data in Archaeology: a guide to good practice*. Archaeology Data Service and Digital Antiquity Guides to Good Practice
- British Geological Survey online viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (accessed March 2022)
- Brown, D. H. 2011. *Archaeological Archives: a guide to best practice in creation, compilation, transfer and curation* (revised edition). Archaeological Archives Forum
- Challis, K., Carey, C., Kinsey, M. and Howard, A. J. 2011. 'Assessing the preservation potential of temperate, lowland alluvial sediment using airborne lidar intensity', *Journal of Archaeological Science* 38: 301–11
- CIfA 2014a. *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives*. Reading, Chartered Institute for Archaeologists
- CIfA 2014b. *Code of Conduct*. Reading, CIfA
- CIfA 2014c. *Regulations for Professional Conduct*. Reading, CIfA
- Historic England 2015. *Metric Survey Specifications for Cultural Heritage*. Swindon: Historic England
- Historic England 2017. *Photogrammetric Applications in Cultural Heritage*. Swindon: Historic England
- Historic England 2018. *Using Airborne Lidar in Archaeological Survey: The Light Fantastic*. Swindon: Historic England
- Kokalj, Ž., Zakšek, K. and Oštir, K. 2011. 'Application of Sky-View Factor for the Visualization of Historic Landscape Features in Lidar-Derived Relief Models', *Antiquity* 85, 327: 263–73
- Wessex Archaeology 2006. *Withington, Gloucestershire. Archaeological Evaluation and Assessment of the Results*. Unpublished client report ref. 59468.01
- Wessex Archaeology 2018a. *Withington, Gloucestershire. Archaeological Desk-based Assessment*. Unpublished client report ref 202990.01
- Wessex Archaeology 2018b. *Withington, Gloucestershire. Detailed Gradiometer and Multichannel Radar Survey Report*. Unpublished client report ref 202990.04
- Wessex Archaeology 2018c. *Withington, Gloucestershire. LiDAR Assessment Report*. Unpublished client report ref 202990.05
- Wessex Archaeology 2022. *Written Scheme of Investigation for an Archaeological Metric and Visual Survey*. Unpublished client report ref 202992.1
- Zakšek, K., Oštir, K. and Kokalj, Ž. 2011. 'Sky-View Factor as a Relief Visualization Technique', *Remote Sensing* 3, 398–4



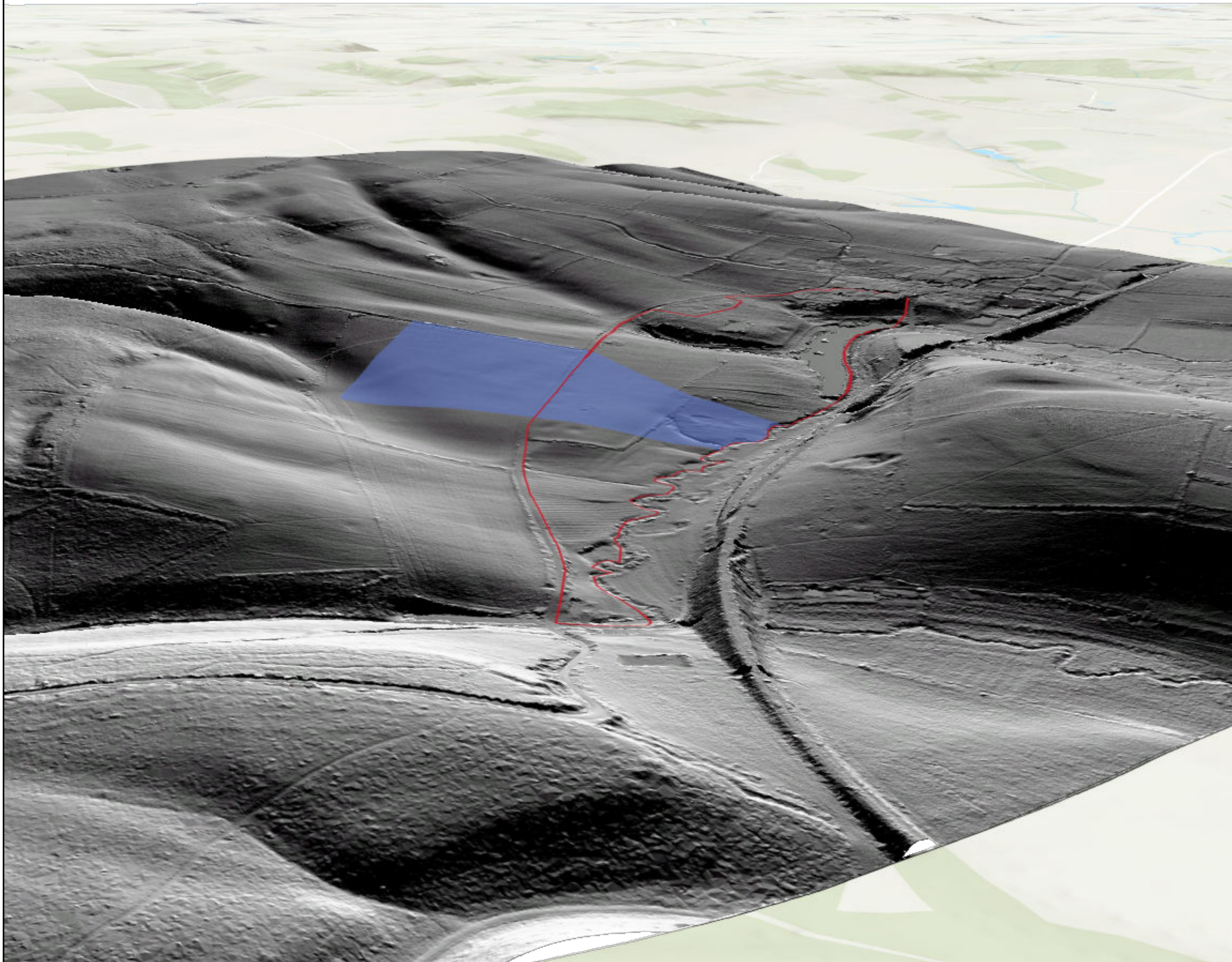
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	Scale:	1:8000 at A4	Created by:	OD/RJH
	Path:	X:\Projects\202992\GIS\MXD\CAD Fig1		

Site location and survey extents

Figure 1



- Site boundary
 - Scheduled monument
- Analytical hillshade (azimuth 315; height 35)
- Value
- 0.999989
- 0.755825



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Illustrator:	r.havard
Path:	X:\Projects\202992\GIS\MXD\

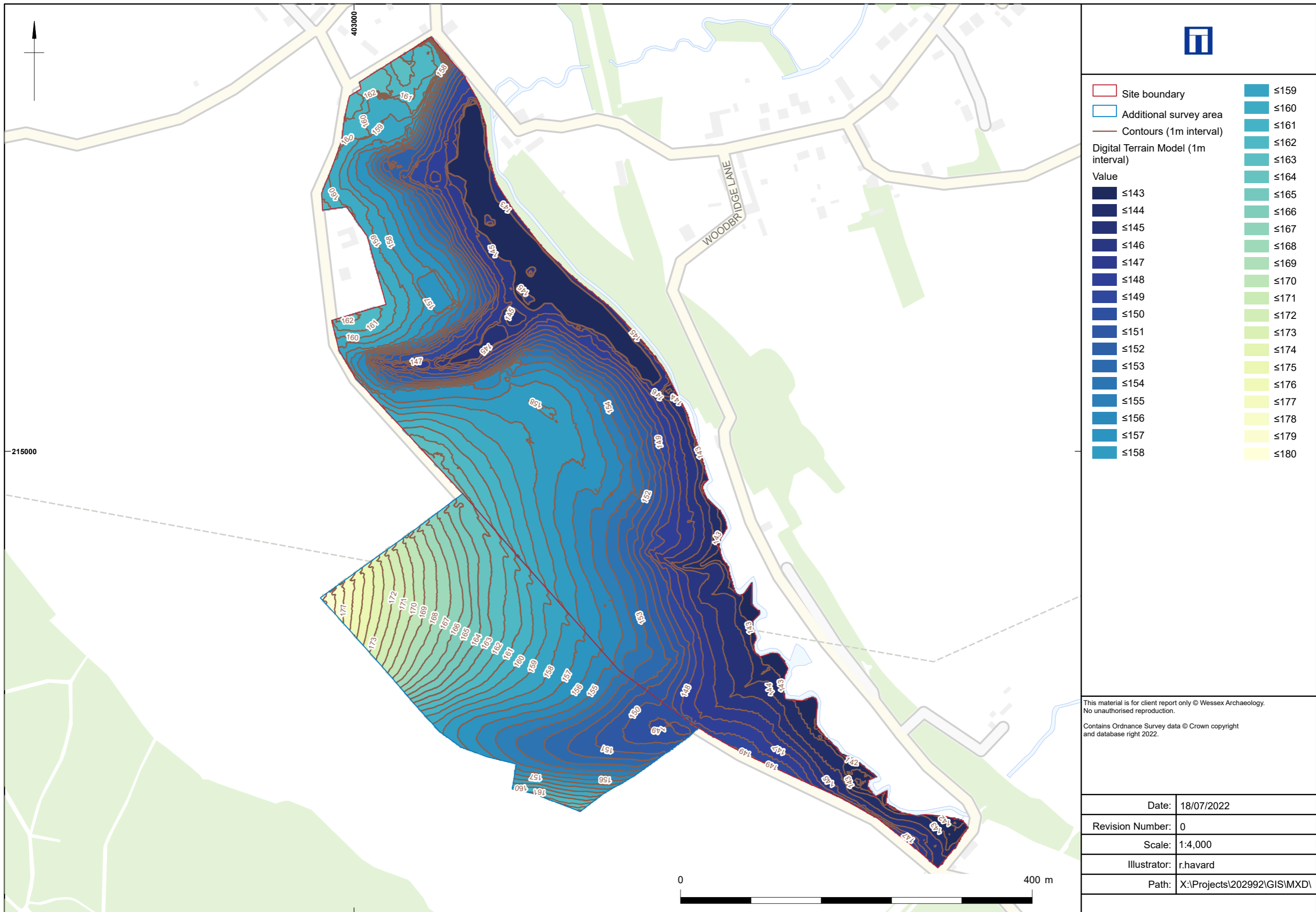
LiDAR Analytical Hillshade (exaggerated vertical height 2m) showing the topography of the landscape surrounding Withington Roman Villa.

Figure 2



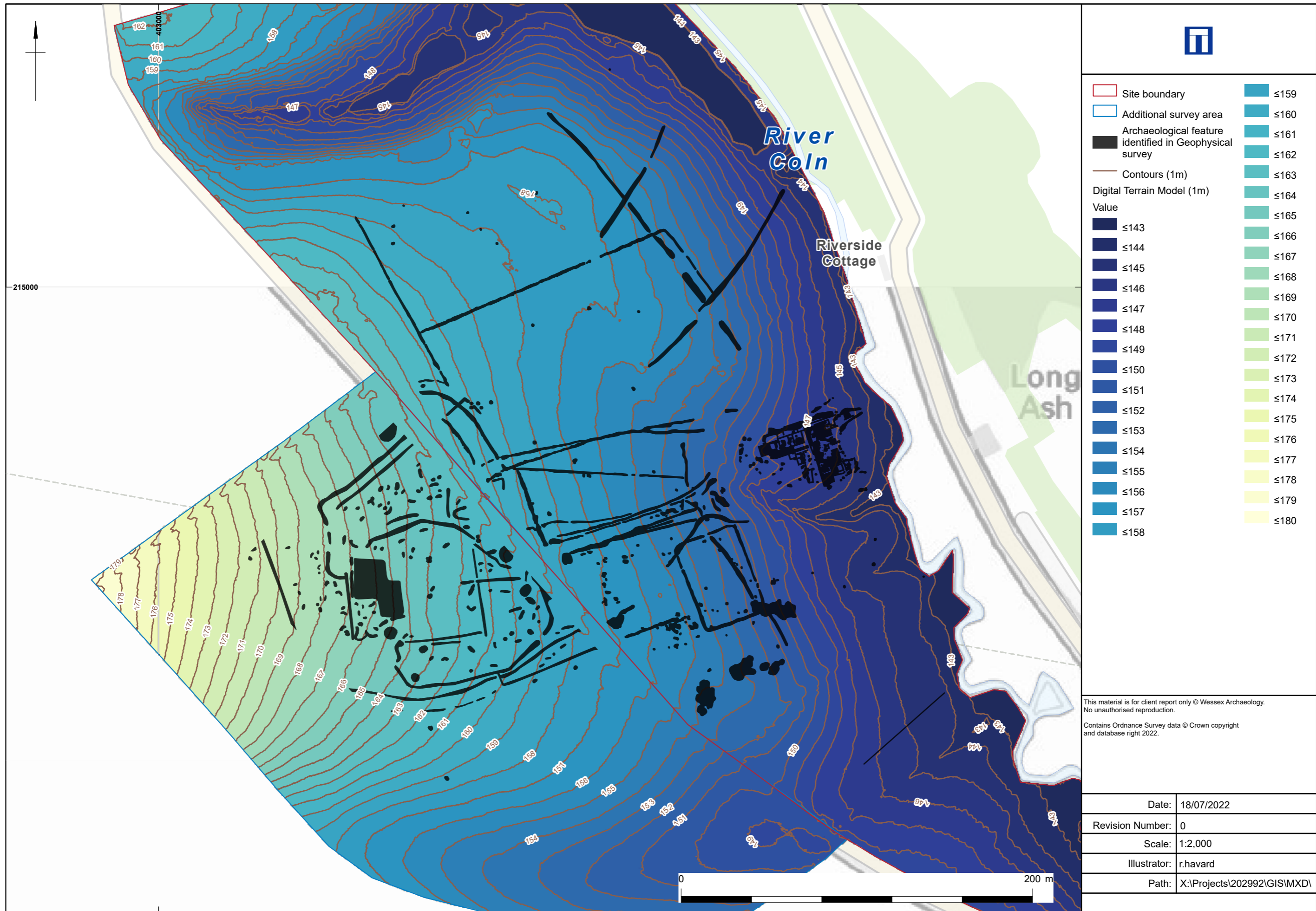
The site, showing additional survey area and orthomosaic

Figure 3



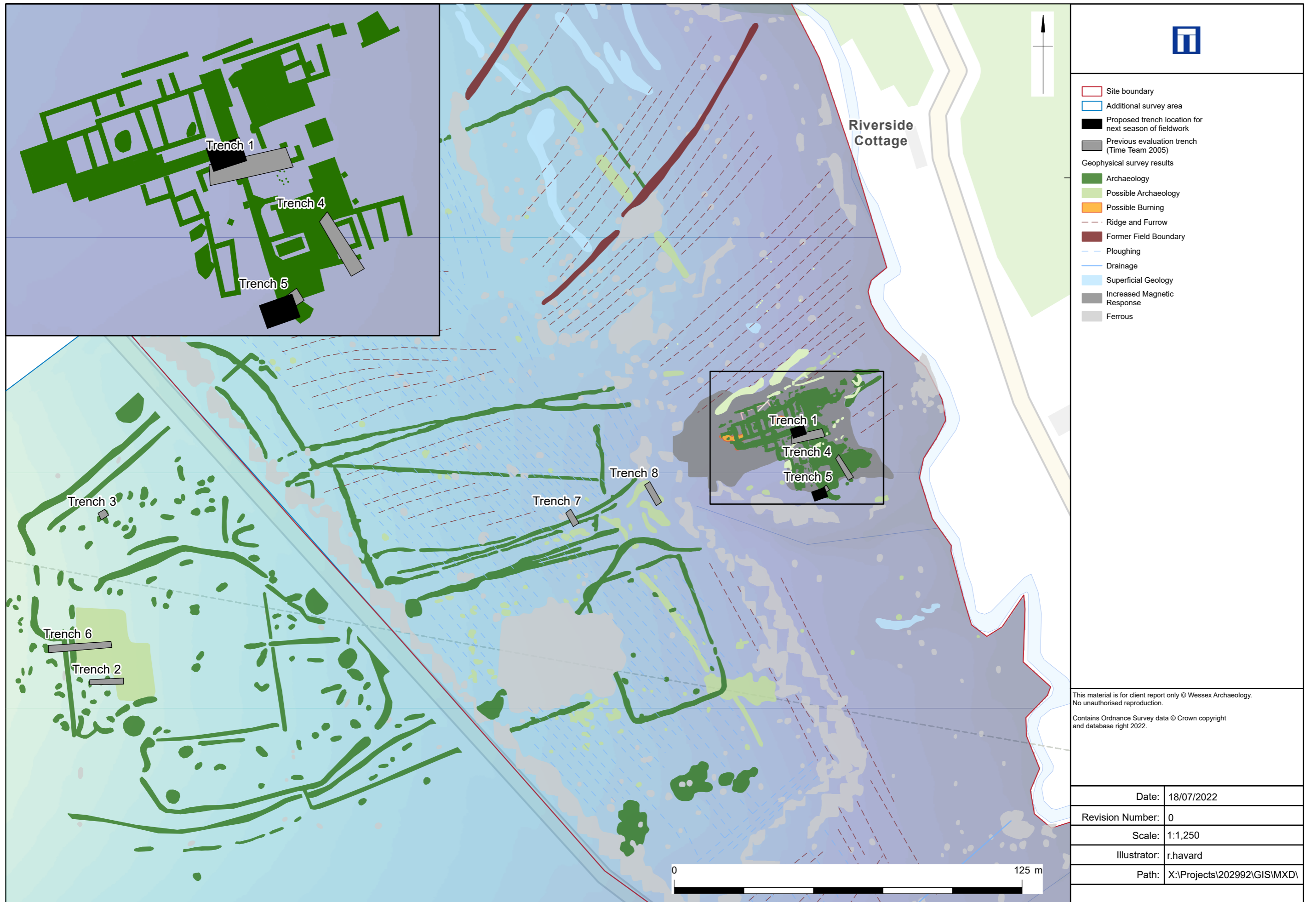
The site, showing additional survey area, contours and digital terrain model at 1m intervals

Figure 4



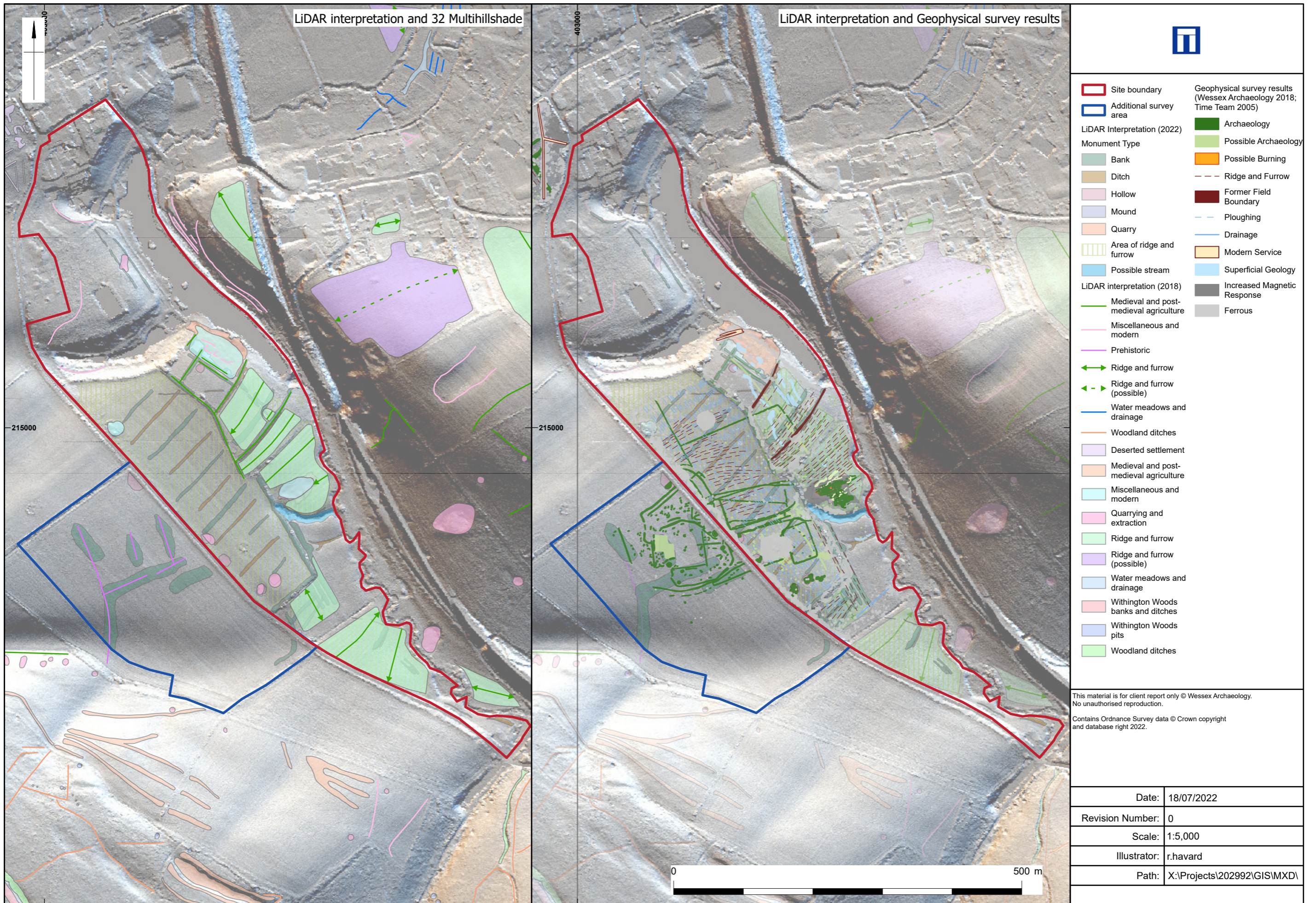
Plan showing archaeological features identified by geophysical survey, contours and digital terrain model at 1m intervals

Figure 5



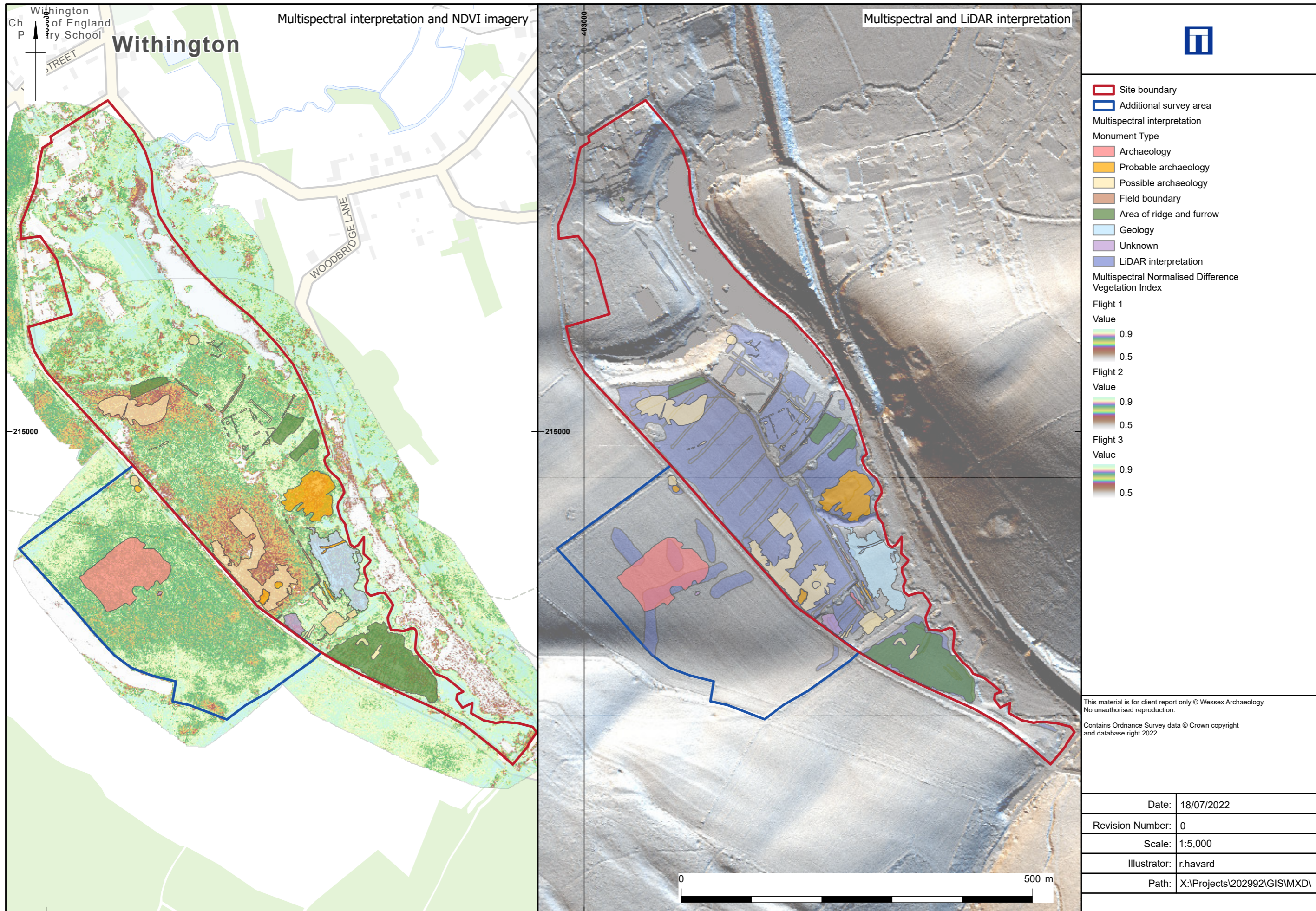
Plan showing location of proposed trenches, previous evaluation trenches and geophysical survey results

Figure 6



Plan showing re-examination of the existing LiDAR dataset and geophysical survey results

Figure 7



Plan showing multispectral and LiDAR interpretation

Figure 8




The site, showing location of aerial panoramic photographs

Figure 9



Panoramic View 1 looking south-east from Withington Manor

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Aerial panoramic view of the site and surrounding landscape


Figure 10



Panoramic View 4 looking south-west



Panoramic View 7 looking south-south-east


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Panoramic View 5 looking north-north-west



Panoramic View 6 looking north-west

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