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NAIS: UPLAND PILOT, BURTON-IN-KENDAL AND DALTON, CUMBRIA AND LANCASHIRE

AN ARCHAEOLOGICAL LANDSCAPE INVESTIGATION

Ian Hardwick

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AN ARCHAEOLOGICAL LANDSCAPE INVESTIGATION, JUNE 2013 - FEBRUARY 2014

Ian Hardwick

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SUMMARY

This report describes the results of a survey interpreting, mapping and recording archaeological features visible on aerial photographs and lidar, followed by ground-based reconnaissance, in a project area located to the east of the M6 motorway, centred around the town of Burton-in-Kendal and the site of the settlement of Dalton, providing a synthesis of the archaeology and analysing its character, diversity, distribution and associations in the landscape.

This study forms part of the National Archaeological Identification Survey (NAIS): Upland Pilot, carried out between February 2013 and September 2014, and covers a total area of 9sq km. Digital maps and supporting records were created by a HLF-funded Historic Environment Placement working within English Heritage's Aerial Investigation and Mapping Team and Assessment Team (North) based in York, as part of the placement's training in Non-Intrusive Survey Techniques.

The project identified and mapped sites ranging from later prehistory to the 20th century. New records were made for 68 sites and 14 existing records were enhanced during the aerial and ground-based elements of the project.

CONTRIBUTORS

Mapping and recording was carried out by Ian Hardwick, a Historic Environment Placement working within English Heritage's Aerial Investigation & Mapping team, with the work on Structure-from-Motion undertaken with the help of Sally Evans. The field reconnaissance was also conducted by Ian Hardwick, along with Dave Went of English Heritage's Assessment Team (North). The methodology section for the Structure-from-Motion technique was provided by Jon Bedford, Senior Technical Survey and Graphics Officer for English Heritage.

ACKNOWLEDGEMENTS

The author wishes to thank English Heritage's Aerial Investigation and Mapping Team: Sally Evans, David Knight, Dave MacLeod and Matthew Oakey; and Assessment Team (North): Dave Went, Becca Pullen, and Marcus Jecock, for their support during the project and advice on many aspects of the work, and also Petra Wade, Heritage Data Coordinator, for her advice on recording matters. Thanks also to Jon Bedford, for his guidance regarding Structure-from-Motion and the authoring of section 3.4 of this report, and Yvonne Boutwood, for her initial training of the author in mapping and recording for Aerial Survey. Additional thanks to Caron and Richard Newman for providing insight on the Dalton area, including their own as-yet unpublished report and guidance during the field reconnaissance, Jamie Quartermaine at Oxford Archaeology North for assisting in accessing their archaeological report on Lime Kiln Plantation, and also to the Dalton Hall estate for permission to access their land.

ARCHIVE LOCATION

English Heritage Archive, Swindon.

DATE OF SURVEY

The aerial survey and mapping component was conducted between 17th June and 20th August 2013, with ground-based reconnaissance undertaken on 13th and 14th January 2014. The report was completed on 21st March 2014.

CONTACT DETAILS

Aerial Investigation and Mapping Team, English Heritage, 37 Tanner Row, York, YO1 6WP.
Matthew Oakey; tel. 01904 601920; email matthew.oakey@english-heritage.org.uk

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1. INTRODUCTION

1.1 Background to Project

This study concerns a small area within the wider landscape chosen for the National Archaeological Survey (NAIS) Upland Pilot project (Oakey 2013a) with which it shares both standards and methodology. For the purpose of this report the term 'project' will be used to refer to this sub-project area, unless explicitly stated otherwise.

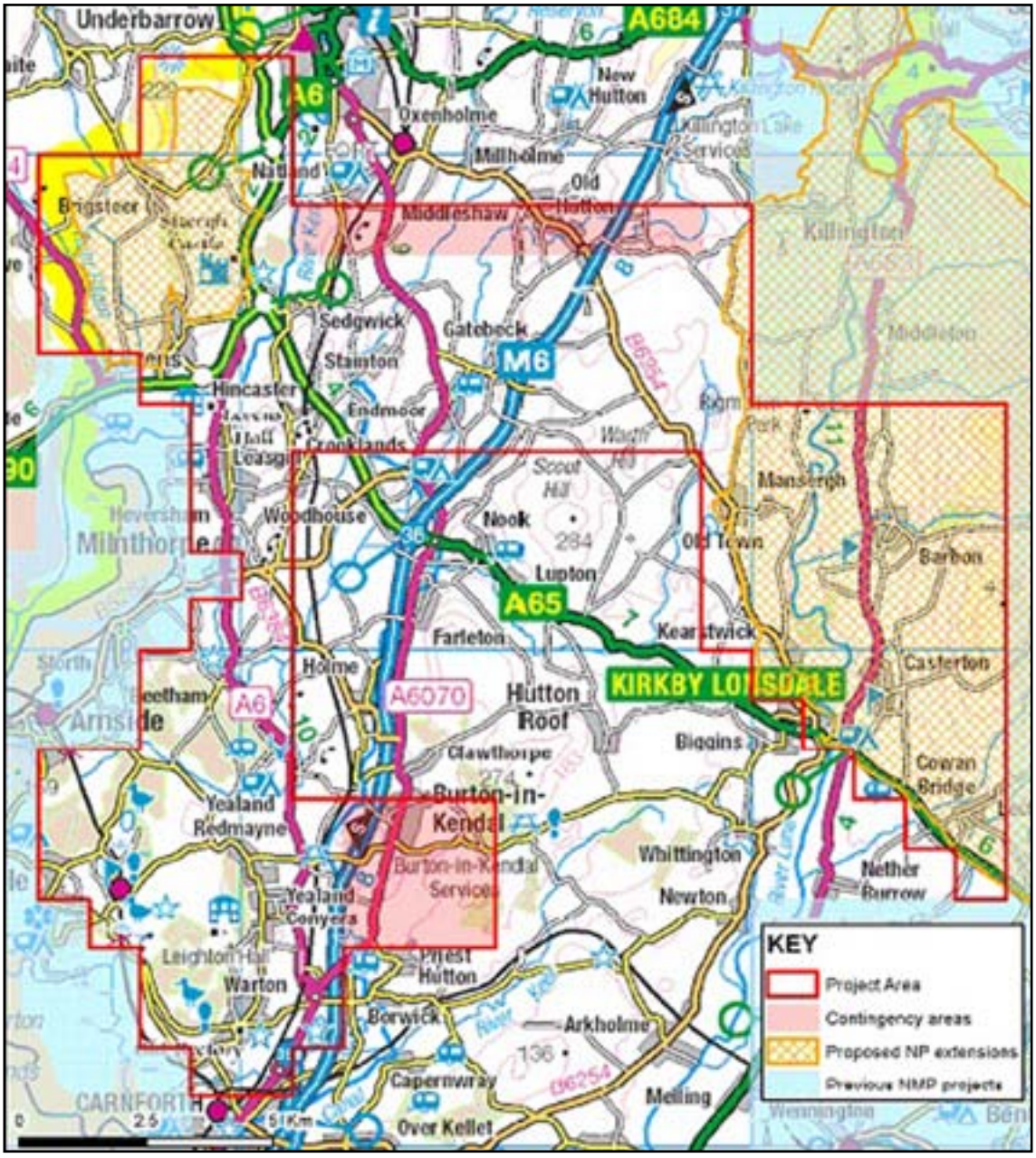

Fig 1: The NAIS Upland Pilot project area. © Crown Copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100019088.

This work was carried out by Ian Hardwick, a Historic Environment Placement funded by the Heritage Lottery Fund and run by the Institute for Archaeologists, working within the English Heritage Investigation and Analysis Division, namely the Aerial Investigation and Mapping (AIM) and Assessment (North) teams, based in York. Suggestions for further potential work by other English Heritage teams, such as the Geophysical Survey and Archaeological Projects teams, are also included.

The project uses as its basis information derived from air photo mapping and analysis, adopting the methods and standards developed for the National Mapping Programme (NMP), which was then used to inform ground-based analytical field survey, a reconnaissance on targeted sites being used to enhance and refine observations made from the aerial evidence.

The main project outcome has been to contribute to the results of the wider NAIS Upland Pilot project and its aims and objectives, which include providing enhanced protection for the historic environment through the recognition and definition of heritage assets and historic landscapes, and recommendations that certain sites, of particular significance, should be considered by the English Heritage Designation Team as potential candidates for statutory protection (Oakey 2013a). The project has also provided experience in working on aerial survey and field assessment for the aforementioned Historic Environment Placement, drawing upon other training received as part of the English Heritage / Institute for Archaeologists learning agreement. Furthermore, this summary project report of the archaeological resource for the selected area complements the archive of digital aerial photographic mapping, survey data and monument records deposited with the National Record of the Historic Environment database.

1.2 Project Area

The project covers an area of nine square kilometres (Fig 2), largely within the county of Cumbria, but with narrow strips on the southern and western edge of the project area within the borders of Lancashire. This area was designated in the NAIS Upland Pilot project design (Oakey 2013a) as Block 2f, a contingency area which was not covered within the wider NAIS project due to time constraints.

The project area defines a transect through the landscape which includes upland areas of rough pasture and woodland on limestone benches in the east, and more improved pasture and limited arable land to the west. The market town of Burton-in-Kendal occupies much of the north-western corner of the area, along with the M6 motorway and Lancaster Canal, which run close to and approximately parallel with the western edge of the project area (Fig 3).

1.3 Geology, Topography and Modern Land Use

The project area is located within Natural England's National Character Area (NCA) 20: Morecambe Bay Limestones, which lies to the west of the A65 road. It is predominantly a lowland landscape punctuated by limestone hills (Natural England 2012), including the

Fig 2: The NAIS Upland Pilot contingency area / 'Burton-in-Kendal and Dalton' project area. © Crown Copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100019088.

Fig 3: A landscape view of the western half of the project area, looking north. NMR 20152_009 24-SEP-2004 © English Heritage. NMR.

notable limestone escarpment of Dalton Crag, which is on the north-eastern corner of the project area, and is largely covered by woodland on its lower slopes, with bare limestone pavement revealed in places on its higher aspects.

Soils throughout much of the project area are mostly freely draining, lime-rich and loamy, with a small area of raised peat bog in the north-western corner, located on the western side of the M6 motorway. The limestone scarp of Dalton Crag, along with much of the north-eastern quarter of the project area, are dominated by freely-draining soils, but with limestone bedrock close to the surface (and outcropping in places), and woodland plantations dominating the western edge of the crag itself. The south-eastern corner of the project area, which is now largely covered in woodland plantations (including Dalton Park Wood, Con Hill and Hagg Wood), is described as having slowly permeable, wet and very acidic soils, with a peaty surface. Woodland is particularly extensive in these limestone areas, where there has been a traditional link with the production of lime. Most of the lowland agricultural land within the project area is designated as Grade 3 (good to moderate), with a mix of Grade 4 (poor) and 5 (very poor) on the eastern limestone escarpments (Natural England 2009). Between 93-95% of the National Character Area is given over to livestock farming, comprising a mix of largely managed pasture but also uncropped land. In lower-lying areas there are a relatively small number of often isolated arable fields (Natural England 2012).

The majority of drainage runs east to west, much of it flowing in the present day into the Lancaster Canal. This takes the form of small streams, particularly in the southern half of the project area, and modern agricultural drainage systems. At least two canalised leats were created to feed mills which are no longer present, but remain in use for drainage.

There is a general trend of historical and present-day communication running approximately north-south in the western half of the project area. These include the Lancaster Canal, the Lancaster-Carlisle Railway, the A6070 running through Burton-in-Kendal, and the more recent M6 motorway. The eastern half of the project area is generally given to smaller roads and trackways running perpendicular to these main lines of communication, and access routes.

The main urban area within the project area is the small market town of Burton-in-Kendal, in the north-western quadrant. Other settlement is restricted to isolated hamlets, as at Dalton Houses, and farms, including Coat Green, Home Farm and Henridding. In the centre of the project area is Dalton Hall, with an accompanying estate in the form of Dalton Park, while to the south-west is Buckstone House, a smaller country house.

In summary, the combination of soils, geology and agricultural regimes are not generally conducive to formation of cropmarks in any but the driest of years. It is therefore unsurprising that a high proportion of archaeological discoveries in this region were sites preserved as earthworks (Oakey 2013a). Due to the higher levels of infrastructure and urban development in the western half of the project area, along with the general trend of increasing improvement of agricultural land to the west, the best potential for archaeological preservation of earthworks is in the eastern half of the project area.

2. ARCHAEOLOGICAL BACKGROUND

2.1 Knowledge of the area prior to NAIS

The area covered by the project includes a range of archaeological features, largely confined to known sites in the eastern half of the project area, such as Dalton and Upp Hall, which are the subject of recent and ongoing research. Little has been done in the way of wider mapping or research until this project. Recent study (Newman and Newman 2009; Oxford Archaeology North 2010) has examined the well-preserved structural remains and earthworks around Dalton and Russell Farm in the east of the project area, based upon documentary evidence and backed up with field observation and archaeological landscape assessment. This work has reviewed the evidence for two of the three scheduled monuments within the project area – a 'Romano-British farmstead' at Russell Farm [list entry 1021250], and the 'deserted medieval village' at Dalton [1021249]. The third scheduled monument is a moated site and fishponds at Upp Hall [1012522].

There is little in the way of confirmed prehistoric remains, other than small finds. A possible cist burial (43017), excavated in the late 19th century, is recorded in the National Record of the Historic Environment (NRHE), sited within the parkland of Dalton Hall.

The Iron Age / Romano-British period had been thought to be better represented, with a settlement site surviving as ruined structures at Russell Farm in the north-east (Fig 4),

Fig 4: Enclosures surviving as stone walls at Russell Farm, scheduled as an Iron Age / Romano-British farmstead.
NMR 20775_008 13-MAY-2008 © English Heritage. NMR.

though this has recently been reinterpreted as being of medieval origin (Newman and Newman 2009, 7). A further conjectured cropmark site of prehistoric or Roman origin is located two kilometres to the south, while a projected Roman road runs north-south through the centre of the project area.

The medieval period was better represented in the existing record. The market town of Burton-in-Kendal originated in this period, and there was some evidence to suggest that Dalton Old Hall was built around a pele tower and surrounded by a large deer park of medieval origin (Newman and Newman 2009, 11). A possible medieval bloomery was thought to exist to the east of Dalton Old Hall, while Upp Hall, near the southern edge of the study area, appears to be the successor to a medieval moated site, the (scheduled) earthworks of which survive a short distance to the east [list entry 1012522].

The earthworks (part of which are scheduled) of a large deserted or shrunken settlement and associated open field system at Dalton dominate the central eastern edge of the project area. These remains have been identified as medieval in date, although recent research (ibid, 12) has indicated that the settlement's expansion and subsequent abandonment may have taken place largely in the post medieval period.

The research framework of the NAIS Upland Pilot highlights the need to examine such settlements in a broader landscape context and study the relationship between settlement and agriculture. Evidence for medieval cultivation in the form of lynchets and open field systems had already been recorded prior to the NAIS pilot, and it was considered highly likely that more would be identified.

The post medieval remains largely relate to the landscaping and building of the new estate of Dalton Hall, including structural features such as the icehouse and tithe barn. In terms of agriculture and industry, there is a watermill at Coat Green, in the south-western quarter of the project area, likely of post medieval date, and a wide spread of limestone quarries and lime kilns across the area recorded in the Historic Environment Record. The 18th-century Lancaster Canal runs parallel to the western edge of the area. There are multiple listed post medieval buildings and features within Burton-in-Kendal itself, comprising domestic buildings such as Burton House [1097316], 17th-century terraces including shops, such as The Bakery [1204426], and features such as an 18th-century market cross [1281114] and early lamp-post dating to 1863 [1335705].

There were no recorded military or industrial features from the 20th century, and it was not anticipated that many such features would be identified during the project.

2.2 Scope of the Project

The aerial investigation element of the project covers the whole of the project area as defined in this introduction, while the subsequent field-based research stage necessarily concentrated on smaller areas and individual sites, largely in the east of the project area, informed by queries raised by the results of the aerial mapping.

The scope of the aerial investigation element encompasses all archaeological features

ranging in date from the Neolithic to the 20th century. The distribution and type of archaeology recorded is defined by the nature of the archaeological evidence visible on aerial photographs and lidar. This usually includes surface features defined by ditches, banks or stonework and sub-surface remains visible as cropmarks, soilmarks or parchmarks. Features defined as structures in a military or industrial context are also routinely recorded. The project scope included those features that were extant on historic air photographs but have since been plough-levelled or removed.

Analytical study of standing buildings and structures, mapped by Ordnance Survey, lay outside the scope of the project, in line with the methodology of the NAIS Upland Pilot (Oakey 2013a), although historic buildings research in particular landscape contexts may be identified for subsequent study. In terms of visible field boundaries and systems, and features such as parkland tree ring enclosures, identified as being of post medieval date, only those which are not depicted on Ordnance Survey mapping have been recorded. The field reconnaissance focussed on earthwork and structural remains visible on the ground, and their relationship within a wider landscape context.

3. METHODOLOGY

3.1 Introduction

The project involved five main stages in the data gathering phase –

- Aerial photograph evaluation and rectification, and evaluation of lidar, orthophotography supplied through the Pan Government Agreement (PGA) and a digital elevation model produced by Structure from Motion technique.
- Mapping in AutoCAD of archaeological features visible on the above remote sensing sources.
- Recording of all identified and mapped features in the National Record of the Historic Environment (NRHE) database.
- Field visit to identify and further clarify particular features and targeted areas on the ground, answering specific questions raised by the aerial evidence.
- Writing up of field notes and photographs taken in the field and amending of NRHE database records.

The mapping and recording conventions broadly adhered to the methodology established for the National Mapping Programme (Winton 2012) and the National Archaeological Identification Survey (Oakey 2013a).

3.2 Evaluation of Sources

The project involved the systematic examination of all aerial photographs available from the English Heritage Archives, formerly the National Monuments Record (NMR), the Cambridge University Collection of Aerial Photography (CUCAP) and those held in the Lancashire and Cumbria Historic Environment Records. Orthorectified vertical photographs supplied by Next Perspectives™ through the Pan Government Agreement (PGA) as 1 square kilometre tiles in TIFF format were used in the project. For more detailed information on the various sources used in the NAIS Upland Pilot, see Oakey 2013b, 40-48.

The project also utilised 2D lidar tiles (in JPEG format) using the 16-direction hillshade image visualisation technique at 1m resolution, supplied by the Environment Agency as ASCII grid data and processed in-house. Unfortunately, due to a gap in the initial coverage, the large majority of the project area was not covered by the lidar data, and this source was not as useful as previously hoped.

Where possible, air photographs were viewed stereoscopically and under magnification. There were no prints of the PGA orthophotography, lidar, or DSM created by Structure-from-Motion so this was viewed digitally on screen. The interpreter could alter the colour balance of the PGA orthophotography in Adobe Photoshop to enhance the appearance of some archaeological features.

3.3 Rectification of Aerial Photographs

Oblique and vertical aerial photographs were scanned and then rectified using the

specialist AERIAL 5.29 software. Control was derived from 25cm resolution PGA orthophotography or Ordnance Survey 1:2,500 scale Mastermap® vector data.

Topographic information derived from the 5 metre interval contour data supplied to English Heritage by Next Perspectives™ through the PGA was used in AERIAL to improve the accuracy of rectification.

The accuracy of rectified images is normally to within ±2m of the source used for control but this error may be larger in areas with large topographic variation. The accuracy of the PGA orthophotography and Environment Agency lidar is within 10-15cm. Consequently the accuracy of mapped features, relative to their true ground position, will depend on the source used for mapping. This may be in the range of ±5-15m for images rectified using an OS base map but will be sub-metre accurate for those features mapped from orthophotography and lidar (Oakey 2014, 9).

3.4 Structure from Motion

Structure from Motion was used in this project as an additional source of data (see 3.5). This does not constitute a formal and complete trial of the technique for use on aerial photography. The ongoing development of the technique, and any findings and recommendations from the AIM team, will be reported upon in future publications.

Structure from Motion (SfM) is a computer vision technique which allows the use of uncalibrated imagery for the estimation of the projection geometries (both camera intrinsic and extrinsic calibration parameters) leading, in practical terms, to the generation of a sparse point cloud and a mapping of the relative positions of the cameras at the point of capture. Following on from this stage, multi-view stereo algorithms that operate on the pixel values can be implemented to compute a dense point cloud or a meshed representation expressed as a Triangulated Irregular Network (TIN), derived from an integration of the calculated depth maps for each image. This TIN is effectively a Digital Surface Model (DSM) and can be generated at resolutions that are typically much higher than those derived from Lidar data, although without the ability to filter for first/last returns. Being derived from photography, it is a first-return only technique. In addition, the DSM can be textured using the original input images to generate orthophotographs.

Broadly speaking, the process is implemented in Photoscan in three stages:

- Align Images. This is the SfM part of the process as outlined above. At this stage the data set can be filtered to remove points with large reprojection errors in an iterative fashion, and a bundle block adjustment applied to optimise the point cloud. At this stage the model is in an arbitrary local coordinate frame.
- Build Geometry. Depth maps are computed for each image using a pair-wise binocular stereo approach and these depth maps are integrated to produce a DSM. 3D control points are usually added at this stage to bring the model into a more useful coordinate frame (e.g. OSGB36).
- Build texture. Pixel values from the input images are mapped into position on the DSM generated above.

Typical outputs for aerial use:

- The DSM can be exported as-is and brought into a GIS for further analysis (e.g. 16 direction lighting etc) to aid interpretation.
- The textured model (once placed in correct coordinate frame) can be used to generate an orthorectified vertical photograph for downstream use in a variety of packages, in this case AutoCAD, and covering areas ranging from a single site to an entire valley if required.
- Resolution of all outputs is largely constrained only by the system resources available for processing.

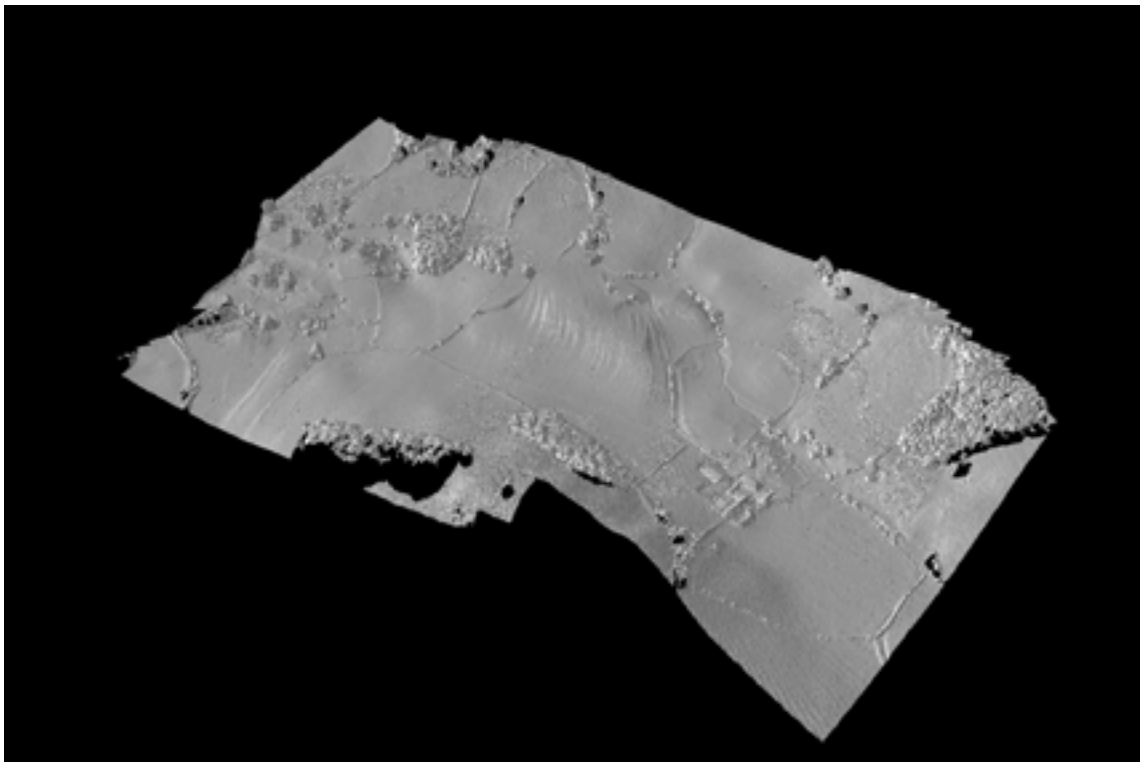

Fig 5: Digital Surface Model (DSM) created using Structure from Motion, and covering the area of the earthworks at Dalton settlement and Dalton Old Hall. © English Heritage.

3.5 Structure from Motion in this Project

For this project, Structure from Motion was used on the medieval / post medieval settlement site of Dalton and the possible defended enclosure at Dalton Old Hall, in the eastern part of the project area, utilising new oblique aerial photography taken by English Heritage. The technique was used to create a DSM (Fig 5; also Appendix 1) to aid in the understanding and mapping of the complex earthwork features of the settlement, its associated field system, and the site of Dalton Old Hall.

In the absence of lidar during the initial mapping phase, the DSM created from Structure from Motion produced an excellent tool for understanding the aforementioned sites, providing the ability to pick out finer variations in the topography than conventional aerial photography. The DSM was viewed in Quick Terrain Reader 8.0.1 software, allowing it to be manipulated to zoom into specific details from different angles, and also moving the

light source around to highlight specific features. This allowed the mapping of the sites in question to be better informed. In this regard, Structure from Motion was a success.

3.6 Mapping

Georeferenced orthophotography and rectified images were directly inserted into AutoCAD Map 3D, where archaeological features were mapped. The AutoCAD mapping conventions and layer structure are summarised in Appendix 2. Monument data were also recorded in an object data table (Fig 6).

3.7 Recording

All mapped features were recorded in the NRHE database (AMIE), where new records were created or existing records were amended, following NMR Heritage Datasets: Monument Recording Guidelines.

Where possible, concordance between data from the Cumbria and Lancashire Historic

Attribute	Description	Sample data
MONARCH*	NRHE Unique Identifier (UID)	79060
PERIOD	Date of feature (EH Thesaurus). Single or dual indexed terms	MEDIEVAL
NARROW_TYPE	Monument Type (EH Thesaurus). Specific monument type for individual features	FISHPOND
BROAD_TYPE	Monument Type (EH Thesaurus). Broader monument type to enable grouping of individual features	CISTERCIAN MONASTERY
EVIDENCE_1	Form of remains (EH Thesaurus) as seen on PHOTO_1	EARTHWORK
PHOTO_1	Source feature was mapped from (air photograph or lidar)	NMR RAF/3G/TUD/UK/3 PART 1 5097 14-DEC-1945
EVIDENCE_2	Form of remains (EH Thesaurus) as seen on PHOTO_2	LEVELLED EARTHWORK
PHOTO_2	Latest available source (air photograph or lidar) to give indication of current state of preservation. Not applicable for cropmark sites	NMR 28225/36 19-OCT-2011

**MONARCH is a former name of the National Monuments database re-named NRHE. The table retains the former name to facilitate download into the English Heritage Geographical Information System (GIS).*

Fig 6: AutoCAD map attached data table.

Environment Records and the NRHE records was achieved by noting the HER number in the NRHE entry's 'Other Identifiers' field. However, no comment was made on HER records which were not verified by the project.

Within the AutoCAD drawing file, monument data was also recorded in an object data table for every mapped archaeological feature. The object data were exported with the AutoCAD shapefile as attribute data. The content of these fields broadly duplicates those that are entered in the NRHE database (Fig 6).

Copies of the digital drawing file will be deposited with the English Heritage Archive in Swindon at the end of the wider NAIS project. NRHE monument data is available on the PastScape website (http://www.pastscape.org.uk).

3.8 Field Reconnaissance

The second phase of the project constituted a ground-based walkover of sites targeted for further work from the aerial mapping and recording stage, examining features of interest and attempting to answer queries raised by the aerial evidence. This assessment was undertaken to between Level 1 and Level 2 Survey recording guidelines, as laid out in Ainsworth et al 2007, 23: providing a more detailed visual record than Level 1 Survey, supplemented by description, but not constituting the metrically accurate level of analysis involved in Level 2.

The field reconnaissance included examination of areas unavailable for investigation via aerial sources, such as dense woodland persisting through all available aerial photographs, and close-up inspection of mapped features to clarify aspects such as function, potential date and relationships with other archaeological evidence. The survey was also assisted by the local knowledge of the area and its relationship to documentary sources, provided in the field to the Assessment Team by Caron and Richard Newman.

The ground-based element comprised a rapid walkover assessment of the earthwork and structural features, considering their relationship to the wider landscape, and compiling a record of photographs and field notes. A Trimble GeoXH handheld computer with mapping grade Global Positioning System (GPS) survey capability was used to mark the location of significant new features and amendments to aerial interpretation. With Virtual Reference Station (VRS) software enabled, the GeoXH was able to improve its accuracy to sub-10cm, using a differential correction to the national grid base stations via a modem link to the Ordnance Survey website. This provided a survey grade GPS position for each recorded point (Pearson 2014).

Upon return to the office, GPS survey details, field notes and photography were used to amend existing and create new NRHE records, and to supplement the archaeological analysis for this project.

4. SUMMARY OF RESULTS

4.1 Introduction

This report provides an overview of the archaeological features on a broad period-by-period basis. The changing landscape of the project area and survival of the evidence is discussed later in the report. The majority of archaeological remains seen from the air are earthworks (only a minority of which have been levelled since the first aerial photography for the region), and structures. There are very few cropmarks, even in the western half of the project area, where more intensive agricultural improvement has levelled most of the earthwork remains.

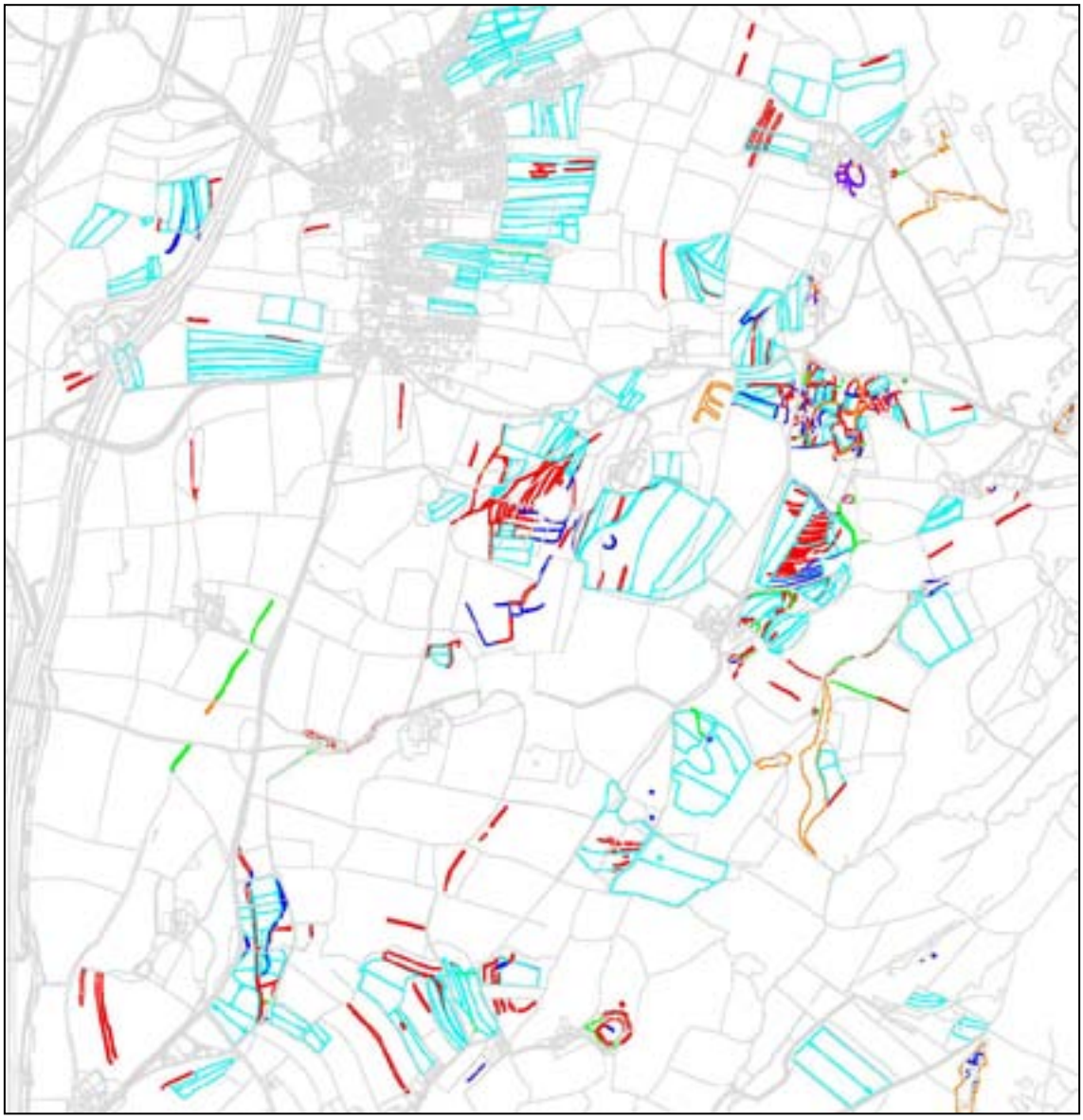

Fig 7: All archaeological features, levelled and extant, mapped by the project (see Appendix 2 for key to mapping conventions and Appendix 3 for site location reference numbers).

The archaeological features recorded range in date from later prehistory (probably Iron Age or Romano-British) to the 19th century. Figure 7 shows the complete mapping of features within the project area, while Figure 26 provides the locations for individual sites cited (using NRHE record numbers) in the text. There are no industrial or military structures from the 20th and 21st centuries visible in the project area. In total, 68 new records were created in the NRHE database, and 14 existing records were amended.

4.2 The Later Prehistoric / Romano-British Period

Within the area around Burton-in-Kendal and Dalton, little was previously known about the landscape of early prehistory. The only archaeological evidence relating to activity prior to the Iron Age were two chance discoveries: a Bronze Age stone axe-hammer (NRHE record 43013) found north of Burton, and a possible cist burial (43017), recorded in the NRHE as having been uncovered in the grounds of Dalton Hall in the late 19th century. Unfortunately, nothing was discovered by this project to add to this picture of earlier prehistory.

A little more was previously postulated for the Iron Age / Romano-British period landscape, with a potential cropmark settlement enclosure (43077) located to the south of Dalton Old Hall, related to a quernstone find of that date in the same field, along with the extensive stone remains at Russell Farm (43011), scheduled as an Iron Age / Romano-British settlement enclosure [list entry 1021250]. The aerial evidence examined in this survey revealed no trace of the former, the cropmarks suggested potentially being the result of modern agricultural activity, and analysis of the enclosure at Russell Farm, in terms of the form and survival of the remains, suggested a later, most likely medieval or post medieval date, which will be discussed later in this report.

A record for the projected course of a Roman road (43018), apparently substantiated by evidence from 20th century excavation, was similarly not supported by the evidence from aerial photography, a linear cropmark in the location instead being evidence of a recent pipeline.

The project did map two possible circular hut platforms (1577930), situated on, and terraced into, a west-facing slope located to the south-west of Dalton Old Hall, which were initially considered likely to be of later prehistoric or Romano-British date due to their form and location. However, upon closer examination during the field reconnaissance, the platforms proved to be less regular than previously supposed and were not easily distinguishable as either hut platforms or as serving any other, more recent function. Furthermore, the platforms were isolated from any associated features and located on a site with a steep topography and aspect possible but unlikely for settlement.

Consequently, on the whole, this project has found little evidence of late prehistoric or Romano-British settlement or the appearance of the landscape in these periods. Indeed, it has suggested that much of the previous evidence for Iron Age and Romano-British activity is not necessarily accurate. However, absence of evidence is not evidence of

absence, and it is likely that this area, situated adjacent to a main communication route used to the present, and with useful resources (including limestone and woodland), contained prehistoric and Romano-British archaeological sites. The reasons postulated for lack of survival of the evidence relating to this period will be described later in this report.

4.3 The Medieval Period

The project area was known to contain a relatively high proportion of medieval remains prior to the initiation of the project. These comprised extensive areas of well-preserved earthworks, as well as important landscape features suggested by historic documents.

The most noticeable increase in terms of the number of NRHE records and understanding of the landscape arose from the mapping of medieval field systems, which are visible as earthworks across much of the area, ranging in evidence from small groups of field boundaries to extensive areas of lynchets on steeper slopes.

The medieval field systems survive in larger patches in the easternmost part of the project area, as might be expected from the overall trend in landscape development mentioned in the introduction of this report. Examples of these more extensive medieval field systems include the series of lynchets (1578229) visible on a west-facing slope in parkland close to Dalton Hall, and the well-preserved earthwork open field system of lynchets (1578260 – Fig 8) located close to the south of, and probably associated with, the settlement of Dalton (43016). Evidence of medieval cultivation also survives further west, though in smaller, more dispersed patches, such as the lynchets (1577835) towards the south-east corner of the project area, and the medieval strip fields (1578011) and lynchets (1578026) to the west of Burton-in-Kendal.

Fig 8: The medieval lynchet field system (1578260) to the south of Dalton visible on oblique aerial photography (left) and visible from the ground (right).
NMR 20775_013 13-MAY-2008 © English Heritage. NMR. (Photograph: Dave Went).

Throughout the project area, lynchets appear interspersed with more conventional field boundaries, a mixture of earthwork and rubble linear banks of potential contemporary origin, with stone walls in places potentially indicating reuse. The forms of boundary appear dependent on the local topography. Lynchets dominate the steeper (particularly west-facing) slopes and valleys. If the other field boundaries are of medieval origin, they frequently continue in use as boundaries for areas of clearly post medieval ridge and

furrow and narrow ridge and furrow. Many also seem to be incorporated into later post medieval field systems, with additional definite post medieval field boundaries being inserted into the medieval system. During the ground-based survey, medieval land division in the Dalton area was revealed to have existed as a series of strip fields extending in a westwards direction from the line of the medieval settlement's main street, the boundaries now largely removed. These croft enclosures were directly related to the series of toft sites along the line of the village, which will be discussed later in this report.

In terms of evidence of plough cultivation, definite medieval broad ridge and furrow is only found in a few small patches in the east of the project area, within the fields of Dalton (43016) and in an area close to Dalton Old Hall (1577794). As with the field boundaries, this ridge and furrow appears to have continued in use into the post medieval period, much being transformed into split rig.

Other possible land-uses within the medieval landscape are hinted at by the

Fig 9: Aerial photograph (above) and project mapping (below) of stone-built enclosures and trackways at Russell Farm, possibly a medieval / post medieval site for stock management. [Purple represents ruined structures and orange represents features, such as cairns of limestone].

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archaeological remains, including limestone quarrying in an extensive area of small extractive quarries (1577963) on a large limestone outcrop in the south-east of the project area. These potentially have their origins in the medieval period, though become much more common in the post medieval landscape.

A further medieval land-use indicated by the archaeological remains is that of stock management, communal grazing and the seasonal movement of livestock. It has been argued (Newman and Newman 2009, 2) that the uncultivable land of Dalton Crag (in the north-east of the project area) was used by the medieval population as 'common waste', on which to graze their animals and therefore, that the substantial extant enclosures at Russell Farm (43011), identified prior to this project as a Romano-British settlement, are in fact a system of medieval enclosures and associated droveways for management of animals, brought in from the surrounding grazing land (Fig 9). This would seem a likely explanation, as the site appears to have operated as a functional part of the settlement as mapped in the 17th century (Newman and Newman 2009, 8) and fits well with the surrounding pattern of droveways and outgangs. It is also similar in construction to other surviving remains at Dalton (43016), Crow Trees (1578340) and Henridding (1578134). The enclosures (43011) were shown during the field reconnaissance to continue southwards for at least 20m into New Orchard Wood, surviving as stonefast walls constructed from material taken from the natural limestone pavement outcropping within the woodland.

In terms of lines of communication and routes through the medieval landscape, there is evidence of extensive braided trackways and hollow ways (1578296; 1577967) surviving in the east of the project area, running southwards from the settlement of Dalton, and then to and from Dalton Old Hall. There are also trackways running up onto the high ground, following the slope, from the aforementioned stock enclosures along the western edge of Dalton crag.

There is less evidence of local routeways for this period in the western half of the project area, as expected with the overall lesser degree of earthwork preservation. However, it is likely that the main north-south road in the region ran through this area, possibly under the modern A6070.

The main medieval settlement of the region was the market town of Burton-in-Kendal, recorded in Domesday (931865). The only remains of the medieval origins of the town however are the 12th-century church of St. James (43014), and also a possible manor house, under a more recent property of the same name. These, as standing mapped buildings, were not within the scope of this project. The overall linearity of the settlement and central market may reflect something of its medieval origins, though no archaeological features visible on modern or historical vertical photography support this.

The majority of medieval settlement in the project area may have been dispersed farmstead enclosures, of the type documented for the Dalton area (Newman and Newman 2009, 9). Only one of these sites (1578142) was visible from aerial sources, taking the form of a curvilinear banked enclosure about 15 metres in diameter, situated atop a low knoll to the south-west of Dalton Old Hall. Further examination on the

ground revealed that the curvilinear hollow was most probably a yard area associated with stone structures that survive beneath the adjacent woodland, taking the form of the footings of a single-celled building and associated pens. A second possible settlement of this type (1583317) was visible at a similar topographic position to the north-east, located at SD 545 751, though this only survives as an irregular earthwork platform and small patches of stone rubble, heavily damaged by a later tree which has since fallen and further uprooted the remains. This is therefore less clear as a convincing settlement site. These earlier medieval farmsteads in the Dalton area, along with two further possible candidates to the south-west of 1578142 (Newman pers comm), which are less well preserved, appear to have gone out of use with the establishment of the deer park (1578139) in the 14th century, as will be discussed later in this chapter.

Fig 10: Earthworks of the medieval / post medieval settlement site of Dalton. NMR 12455/22 02-FEB-1994 © Crown copyright. EH.

Of particular interest in terms of medieval settlement however, is the previously-mentioned site at Dalton (43016), scheduled as a deserted medieval village (DMV) and visible on aerial photography as an extensive pattern of yards, trackways, fields, cultivation earthworks and scattered stone structures (Fig 10). The medieval origins of the village of Dalton were re-examined in the field survey element of the project, in the light of recent findings from fieldwork, documentary and cartographic research previously carried out by Caron and Richard Newman (2009 and pers comm). The area

of earthworks visible on aerial photography (Fig 10), also forming the current extent of the scheduled monument, is largely the result of post medieval settlement expansion into the common land identified by Caron and Richard Newman (2009), located to the south of the village 'green'. The original medieval settlement is therefore partially masked by the later remains, which will be discussed in the following section. However, the overall extent and layout of the medieval settlement, as a 'loose nucleation along the edge of an area of common waste' (ibid, 12) is identifiable on the ground, running from the previously identified earthworks of 'Dalton' to the south (43016), northwards through Lime Kiln Plantation (1583309), the hamlet at Crow Trees (1578340) and New Orchard Wood (1583307), to the stock management site at Russell Farm (43011), located at the settlement's northernmost extent.

Given the tree cover (Lime Kiln plantation and New Orchard Wood in particular), the ground reconnaissance was able to identify the medieval period settlement remains much more clearly than the aerial evidence. The village of Dalton appears to have been sited along the line of two lanes, situated on either side of a 'green', visible on the 1694 estate map of Dalton (ibid, 8). Of these, the westernmost lane is better preserved, visible as an earthwork lined with low stone walls in the area of New Orchard Wood (1583307), between the hamlets of Dalton Houses and Crow Trees.

The ruined remains of stone walls (1583307) within the woodland on the western side of the aforementioned lane form rectilinear compartments which represent the extent of tofts that would initially have contained the medieval dwellings. These were linked to longer rectilinear enclosures, forming associated crofts, extending up the slope beyond the woodland to the west, now largely surviving only in the orientation of the modern field boundaries. Stone-built and earthwork enclosures at Crow Trees (1578340) are the only part of this line of medieval settlement visible in this area from aerial sources. Archaeological evidence for the lane and tofts to the immediate south of this no longer survive due to the present buildings at Crow Trees, though stonefast foundations and earthworks continue within the woodland to the east, postulated by Richard Newman (pers.comm) as the medieval and later post medieval pinfolds, again encroaching on the original village 'green'.

Further south, the western lane is preserved in the line of the modern trackway from Dalton Lane, running southwards to Dalton Old Hall, before deviating slightly into the southernmost earthworks of the scheduled monument of Dalton (43016), where it is visible as a slightly raised linear feature, cutting through the enclosure walls. Medieval tofts and their associated crofts are visible as terraced platforms and long strip fields lined by earthwork banks beyond, to the west of the modern lane. At least one of these tofts has been reoccupied by a post medieval building, visible as more sharply-defined earthworks atop the earlier platform.

One rather ambiguous feature, located directly south of the main settlement remains, was a small circular structure situated atop a mound (1578297), identified from historic aerial photographs and now under tree cover. The feature was postulated as a dovecote or similar structure on the strength of the aerial evidence, but field investigation proved it to be another collapsed multi-celled building or building with yard (Fig 11), situated atop

Fig 11: Ground photograph of the stone footings of the multi-celled building and associated yard (1578297), now under a small copse of woodland to the south of the settlement of Dalton. (Photograph: Dave Went).

a slight rise, suggested by Richard Newman (pers.comm) to be one of the southernmost tofts located on the eastern lane of the medieval village.

At the northern end of the medieval settlement, the remains of two further toft enclosures on the eastern of the two lanes are visible as stonefast foundations at NGR SD 544 765, just to the south of the present line of houses. The stock enclosures at Russell Farm (43011) located at this northern end of the medieval settlement, at the convergence of these two lanes, appear, as mentioned above, to be medieval in origin, linking the grazing land of the village green to the south with the common 'waste' of Dalton Crag to the north-east.

The final evidence relating to the medieval landscape within the project area concerns the higher status residences of this period. In the centre of the eastern part of the project area stands Dalton Old Hall (1390323) - the former manorial centre of the medieval settlement, later relegated to the status of a farm when the new hall was built to the north-west in the 18th century (Dalton Hall Estate nd). The 'Old Hall' at the centre of the farm is a building of the 17th century (Perriam and Robinson 1998, 339), yet immediately to the north lies a square stone structure, heavily augmented as a garden feature, which has previously been suggested as the base of a pele tower (ibid). A more likely explanation, based on closer examination, is that this structure originated as part of a solar tower, positioned at one end of a rectangular earthwork extending east, which may have been the central range of a medieval hall-house. The building is located within, and is probably contemporary with, a large irregular enclosure extending to the north and east, which has the characteristics of a defended site or 'barmkin' (Fig 12).

Fig 12: The site of Dalton Old Hall, and the defended enclosure to the north-east (contained within a later drystone wall). Earthworks suggesting the location of the original medieval manor house occupy the angle closest to the present farm buildings.
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This large, irregularly shaped defended enclosure dominates the bottom of the valley, the perimeter constituted of a bank and external hollow way, doubling as a ditch. The majority of the enclosure is contained within a later drystone wall, forming a large pen. The earthwork perimeter appears on the north-eastern, eastern and southern sides of the site, though the only evidence of it to the north-west is the steep drop-off from the current level of the field into the farmyard, possibly a result of the later farm activity in that area. The southern corner of the enclosure appears as a right-angled return in the earthwork bank, not visible on aerial evidence due to tree cover, broken by the stream and then disappearing under the modern farm buildings. At this corner there is also evidence of a braided hollow way descending from the hill slope to the south, as well as the corner of the deer park pale mentioned below, visible as an external bank and internal ditch on its approach from the south-west, and as a largely filled ditch depression on the turn. A second ditch below the proposed line of the pale is possibly another hollow way. Within the enclosure itself, an internal bank visible on the aerial evidence, running perpendicular to the defences in the north-eastern corner (SD 541 753), was resolved on the ground into the outline of a second multi-celled building and yard, located at the opposite end of the wider enclosure from the putative medieval hall. The enclosure's location provides a commanding view over the valley to the south, and beyond to Morecambe Bay.

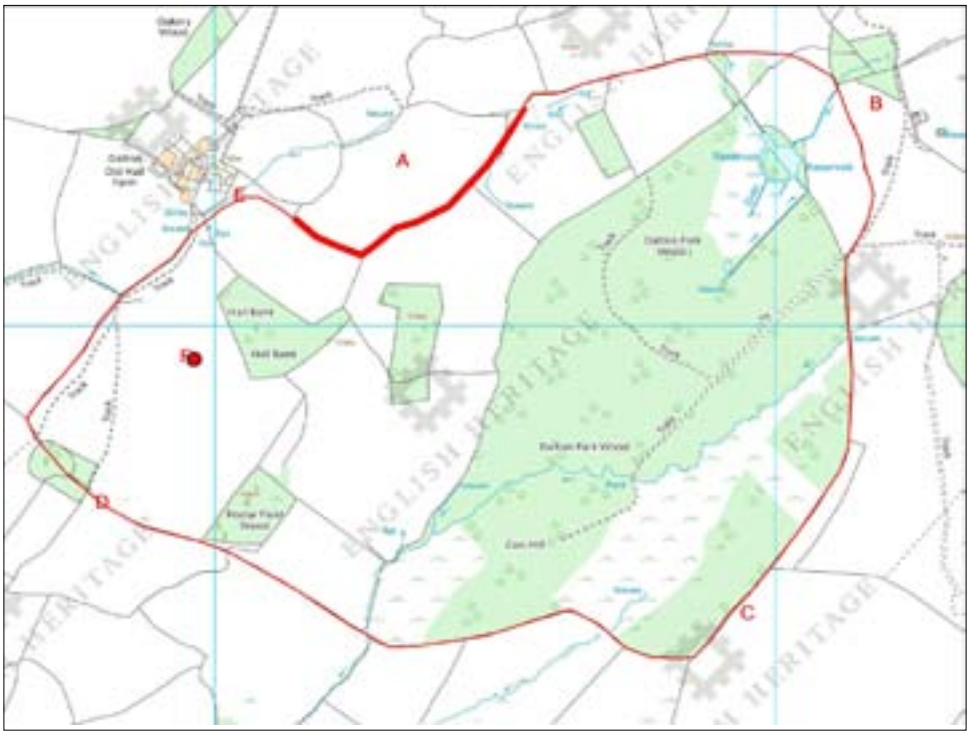

Fig 13: The line of the medieval deer park pale of Dalton Old Hall, as identified from documentary sources and confirmed by aerial and ground-based reconnaissance. The thicker line indicates the length of the boundary mapped from aerial evidence. © Crown Copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100019088.

Fig 14: Ground photograph of the deer park pale (1578139), close to Dalton Old Hall, visible as an earthwork exterior bank and interior ditch (on the right).
(Photograph: Dave Went).

Close to the south-east of the defended enclosure are the earthwork remains of a park pale (1578139) visible from the air and on the ground, associated with the documented 14th-century deer park of Dalton (Fig 13), initially identified by Newman and Newman (2009, 12). The length of pale visible and mapped from the air took the form of an external bank and internal ditch, broken in places but still visible along the modern field boundary (A on Fig 13; also Fig 14). The field survey revealed that the park pale is, in fact, still visible for much of its length, surviving in different forms along different sections. Its eastern and south-eastern perimeter (B and C on Fig 13) takes the form of a heavily filled earthwork ditch with a smoothed exterior bank between one and two metres in width, followed by a later field boundary and the edge of the current woodland respectively. On the south-western side of the park, the pale survives more clearly, in the form of a collapsed stone wall and earthen bank (D on Fig 13), while the earthwork inner ditch, surviving to a depth of at least 2 metres, and outer bank of the pale are visible in an area of trees directly south of Dalton Old Hall (E on Fig 13).

This park pale is clear evidence of a different, higher status use of the landscape during the medieval period, one which seems to have changed the agricultural use of the area enclosed within, as evidenced by the aforementioned abandoned settlement sites within the park pale (Dalton 2009, 11), but which respected the demesne arable land of the manor directly to the north. An oval enclosure (1583316) within the park to the south-west of Dalton Old Hall has been suggested as a possible 'hay' (F on Fig 13) - a feeding place used to monitor the number and condition of the deer (Newman and Newman 2009, 5). This was visible on aerial photographs but was depicted as a boundary surrounding woodland on the Ordnance Survey first edition mapping. For this reason it was considered likely to be a later tree enclosure and was therefore not recorded. Although there is no definitive evidence, the location of the enclosure in plain view from the site of the medieval manor does support its interpretation as a hay. The low, 1m-wide bank and a shallow internal ditch might be in part a medieval feature, therefore, rather than simply the boundary of a later copse planted over this area of rocky ground and springs. It is therefore possible that this site does represent an earlier feature potentially associated with the deer park, which was reused as a tree ring in the post medieval period.

The other possible location of a higher status medieval residence is the moated site (43060) located on the southern edge of the project area to the east of Upp Hall (perhaps its post medieval successor). The irregularly-shaped earthwork remains of a substantial moat, embanked on either side in places, are clearly visible (Fig 15). All that remains of internal features is a low earthwork bank across the middle of the site, its function uncertain. Widening of the moat on the north-western and south-western sides has been interpreted as conversion of the defences into fishponds, possibly during the late medieval period, or associated with the post medieval hall nearby, the building of which is recorded by Baines (1836, 582) as having replaced the 'manorial site'.

When examined as a whole, it is clear that evidence of much of the medieval landscape is preserved in the archaeological remains within the project area. The remains cover many uses of the landscape, including the remnants of arable field systems, including lynchets, along with the potential origins of stone extraction, both activities which were

Fig 15: Aerial photograph and project mapping of the moated site and fishponds to the east of Upp Hall.
Photograph - NMR 20767_019 07-MAY-2008 © English Heritage. NMR.
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further developed in the post medieval period. There are also the various routeways and settlements of differing size and status dating from this period. Though preservation of medieval earthworks and structures appears better in the eastern half of the project area, medieval remains do survive across the western part also. Consequently, it is probable that the highest gain in recorded archaeological knowledge within this project has been in the medieval period remains. Prior to the aerial investigation and mapping, though the main sites had been recorded on the NRHE database, little was recorded for the wider landscape context, except in the immediate area of the settlement of Dalton.

4.4 The Post Medieval Period

The Burton-in-Kendal / Dalton area appears to have undergone substantial change in the post medieval period, resulting in the landscape we see today. The evidence for these changes is seen not only in the development of the settlement pattern and road system, but also in the present pattern of fields, which largely exhibits post medieval enclosure of open fields and general replacement of the previous form of arable cultivation, with pasture. The period also seems to have seen intensification of alternative land uses possibly already present in the medieval period, such as limestone quarrying.

The most obvious development of the post medieval period in the project area is the change in agricultural practices. The majority of post medieval boundaries, including those introduced through the sub-division of former open fields, are recorded in Ordnance Survey and earlier mapping, as well as being fossilised in the present-day field system, none of which fell under the scope of this project. Thus, these field boundaries were not mapped.

Isolated field boundaries which are not standing structures or present on first edition Ordnance Survey mapping, but which were identified as post medieval based on form (straightness / narrowness of banks and ruined field walls) were mapped as part of the project. These largely seem to be contemporary with the earlier stages of the present field system. The enclosed field system broadly appears to have been established for pasture farming, much of it showing evidence of improvement for that purpose, and with very little evidence of post medieval arable farming. This shows the greatest change in land use in the area visible from aerial survey, from the arable lynchets and strip fields of the medieval landscape to the enclosed large-scale pasture fields of the post medieval, surviving through to today. An example of this is at New Orchard Wood (1583307), where the remains of the toft enclosures survive under the present woodland, but the accompanying croft strip-fields to the west are now enclosed and improved pasture, with only the occasional modern field boundary reflecting the orientation of the earlier arable field system.

One area of post medieval fields (1577816) located in the south-western corner of the project area, which appear different from the present-day field pattern (though also different from the longer medieval strip-fields), survives as earthworks that are now enclosed in a far larger field. The system consists of small fields, associated with a contemporary road (1577815) which is also no longer in use. A change in route might be the reason for this change in agricultural practice.

Fig 16: The medieval / post medieval stone-built stock enclosures at Russell Farm (above) and Crow Trees (below).
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In tandem with the changes in field systems, one of the most common archaeological features recorded in the project was post medieval ridge and furrow (divided into an NRHE record for each modern parish). Much of the narrowest ridge and furrow appears to have been created by steam-power, dating it to the 19th or 20th centuries. Post medieval ploughing may represent continued arable agriculture from the medieval period in places, though a large amount is probably land improvement for better pasture. The post medieval ridge and furrow is scattered quite evenly across the project area, but is noticeably absent on the limestone and forested areas (where deforested in historic vertical photography) in the east, probably due to poorer, thinner soils.

Stock management, previously mentioned with regard to the medieval period, and evidenced at Russell Farm (43011), Crow Trees (1578340) (Fig 16), Dalton (43016), and Henridding (1578134) on the margins of Dalton Crag, is extremely likely to have continued on a similar, if not larger scale. As explained earlier in this section, the post medieval period seems to have seen widespread conversion of arable into pasture, across the landscape, increasing a need for stock management sites. Indeed small post medieval enclosures, like those seen north of Upp Hall (1577939), may well have served to pen livestock, and appear throughout the region.

Other land-uses with potential medieval origins continue into the post medieval period, such as limestone quarrying. The majority of limestone quarries (largely in the eastern part of the project area) appear to have developed in the post medieval period, perhaps in part to meet the need for building stone and lime mortar, but more probably supply

Fig 17: Photographs of the two surviving lime kilns confirmed by field investigation (1578082 – above; 1578080 – below), located in woodland in the eastern part of the project area. (Photographs: Dave Went).

Fig 18: The hollow way located in Lime Kiln Plantation (1583309) in the eastern part of the project area, possibly created as access for limestone quarrying or grazing on the common waste of Dalton Crag. (Photograph: Dave Went).

Fig 19: One of the charcoal burning platforms (1577964) located on the southern slope of a small gill, in the south-eastern corner of the project area.
(Photograph: Dave Went).

agricultural lime for land improvement in the 18th and 19th centuries. The industry is present on Dalton Crag, where a quarry and associated kiln (1578082) and a second kiln (1578080) have been mapped as part of the project. These were both recorded during the field survey (Fig 17), the former standing to full height but missing its front face and the latter buried by later debris, but with the top of the drawing arch still visible. The latter appears to be situated close to an earlier trackway leading up the crag (1578080), possibly for access to higher limestone outcrops (not visited).

Further kilns in the vicinity of Dalton Crag are depicted on the first edition Ordnance Survey map but these were not visible on aerial photography due to thick tree cover, and walking through the area revealed no surviving kiln structures. However, large-scale limestone quarrying was evidenced in the woodland areas, particularly in the area named Lime Kiln Plantation (1583309) around SD 543 760, along with a hollow way running upslope to the east (Fig 18), potentially serving the quarries or common waste, varying in width between one and three metres.

A large hollow identified from aerial photography at approximately SD 543 758, within the post medieval settlement remains of Dalton (43016), proved in the field to be a collapsed kiln or clamp, most probably for lime production or potash processing, possibly using the abundant local sources of the former. Small areas of quarrying dotted the settlement area, possibly related to this activity.

A potential new post medieval industrial land-use in the Dalton area was that of managed woodland for charcoal production. Two charcoal burning platforms (1577964 – Fig 19) were mapped from aerial photographs, situated in a steep-sided valley in the south-east of the project area: an area known from Ordnance Survey mapping and historic aerial photography to have extensive woodland during at least the 19th and 20th centuries, probably originating earlier in the post medieval period. Ground-based techniques revealed a third potential platform between the initial two, partially truncated by a later field drain, thus placing the platforms about 15 to 20 metres apart. Field survey also revealed a further two platforms (1583313), similar in dimensions but better preserved, at the western end of the same field (SD 543 741), one surviving under the tree cover, and both in close proximity to an earthen dam (1583314) incorporating stonework. Other examples of such platforms are therefore potentially preserved under the modern woodland nearby, the two mapped features having been initially exposed by clearance visible on historical aerial photographs as only beginning in the 1960s.

There is more surviving evidence for water management from the post medieval landscape than from earlier periods. The remains of two mills at Coat Green (1577825) and a second complex located to the south, on the same leat system (1577823), both in the western half of the project area, appear to date to the post medieval period, though may have medieval origins. Coat Green is known from Ordnance Survey first edition (1891) mapping to have been used as a corn mill. These mills are linked to a network of races, connected to and possibly replacing, the natural water courses, which flow westwards from the higher landscapes in the east of the project area. More recent artificial drainage also flows into this overall network of leats and streams.

Fig 20: The large dam (1578137) constructed upstream of Dalton Old Hall, creating a reservoir that was potentially used to supply the 19th century farm.
(Photograph: Dave Went).

A large dam (1578137) to the east of Dalton Old Hall is more substantial, approximately 10m in width at its base, utilising a natural watercourse, but now dry. Examination during the field survey element of the project proposed a later post medieval origin due to the scale of the engineering and level of survival. and the dam is depicted as earthworks on the 1891 county series Ordnance Survey map. The construction of the dam (Fig 20) was possibly to supply a culvert visible as a stone-capped conduit directly downstream of the centre of the dam, which could have provided a constant water supply to Dalton Old Hall (1390323). Though the dam was mapped from the aerial evidence, field investigation was able to identify a slight overspill channel on the south-eastern end of the dam, as well as a quarry to the south-west which was possibly used for the building of the dam, and now acts as a sinkhole.

The first edition Ordnance Survey map depicts many post medieval wells and pump houses in the general area. Near to Dalton Old Hall, the collapsed stone superstructure of a well and associated water channel (1577938) was the only such feature recorded by this project.

The modern system of small roads and lanes which provides access to settlements and farms doubtless echoes much that was in use throughout the post medieval period. The only roads to survive as earthworks, having fallen out of common use, are that previously mentioned (1577815) in the south-west, and the driveways associated with higher status sites. At Buckstone House, also in the south-west of the project area, a road (1577827) is visible as one of the project's few cropmarks, north of the house. At the new site of Dalton Hall, a series of post medieval driveways (1578224), dating to no earlier than the hall's construction in the 19th century, survive in the parkland as earthworks, overlying a medieval lynchet system.

The greatest level of infrastructure development in the project area lies to the west, with the Lancaster Canal, Lancaster and Carlisle Railway, and A6070 road all running close to one another, in a north-south orientation, on flatter ground, and observable in the growth of the town of Burton-in-Kendal. However, much of the evidence for the early stages in this development has been hidden by subsequent and continuing expansion along these routes. The overall level of growth of infrastructure and urbanisation is, however, quite limited when compared to other locations in the region. Explanations for this include a lack of heavy industries or large-scale extraction in the immediate vicinity.

In terms of settlement, there appears to have been some continuity of occupation at Dalton (43016 – Fig 21), linked to a nucleation of dispersed medieval settlement, perhaps as one consequence of the emparkment of previously common-held land (Newman and Newman 2009, 5). This later, post medieval settlement appears to have encroached upon the medieval village green (Newman and Newman, pers.comm) and is evidenced by clear rectilinear stone-walled structures and earthworks of buildings, some with evidence of chimney stacks in their gable walls, and enclosures, built on platforms orientated around a series of hollow ways and tracks. Post medieval occupation extended across much of

Fig 21: Project mapping of the medieval / post medieval settlement of Dalton.
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Project mapping - © English Heritage.

Fig 22: The ruined building (1583311) to the south of scheduled area of Dalton village, of 18th or 19th century construction, and abandoned in the first half of the 20th century. (Photograph: Dave Went).

the settlement, with the footprint of a rectangular, multi-celled building occupying the site of an earlier toft to the west of the village's main western lane, and another located at SD 541 760, containing at least two rooms, with debris at one end suggesting a collapsed stack. This latter building, located in a triangular copse at the crossroads of the two modern lanes, was obscured by tree cover and was therefore not visible on aerial photographs.

Indeed, it appears that Dalton was only abandoned relatively recently – most likely in the 19th or early 20th century, having long outlasted its origins as a medieval settlement. A building (1583311), marked on the most recent Ordnance Survey maps as extant, located at SD 543 757, was examined during the ground-based survey (Fig 22) and proved to be of 18th or early 19th century date, the remaining fittings suggesting that it was abandoned during the first half of the 20th century. The building was located on the eastern lane of the medieval village and could be built upon an earlier toft. Other than the remains at Dalton, the pattern of post medieval rural settlement appears to survive in the present-day distribution of farms and hamlets.

The manorial centre at Dalton Old Hall (1390323) acquired a more comfortable and less defensive house in the 17th century (Perriam and Robinson 1998, 339), which remained in use as a farmhouse after the new Dalton Hall was built in the 18th century (Dalton Hall Estate nd), some distance to the north-west. The new hall, enlarged in the mid-19th century, and located at the centre of the Dalton Park estate (ibid), was set in landscaped grounds and park-like elements (tree rings and shelter belts) were created across a wider area, including the former deer park. A model home farm was established to the north of the new hall.

The Upp Hall site (43060) is also recorded as having been rebuilt to the west of, and replacing, the earlier manorial and moated sites (Baines 1836, 582). Both Dalton Old Hall and Upp Hall have subsequently become farmhouses. Buckstone House in the south-west of the project area appears to be a new country house built by the 19th century at the latest (it is depicted on the 1891 Ordnance Survey map), with no evidence of earlier origins visible on aerial photographs.

Therefore, much of the post medieval landscape remains legible within the project area, both in the archaeological record and in the present appearance of the landscape, with its enclosed field systems, extensive woodland in the east, and the main transport routes in the west. Some continuity from the medieval period is also apparent in terms of the main centres of occupation, the focus on pastoral farming and perhaps in other aspects such as milling and quarrying.

4.5 The 20th Century

Archaeological evidence from the 20th century, defined within the scope of the wider NAIS project (Oakey 2013a), was extremely limited within the study area. No evidence was found for military features from either of the two World Wars or the Cold War era. Neither was there evidence of extensive industrial activity. The most important change to the landscape lay to the west, where the building of the M6 motorway in the latter half of the century added a further layer to the routes of communication which are known to have followed this valley route linking Carlisle to Lancaster, since at least the Roman period. The eastern half of the project area, in comparison, has remained almost completely undeveloped.

5. LANDSCAPE DISCUSSION

This landscape project, part of the wider NAIS Upland Pilot, demonstrates quite well, in microcosm, the nature of this upland region of north-west England, situated between the edge of the Pennines and the Irish Sea. The landscape around Burton-in-Kendal is relatively marginal in terms of arable productivity but has proven to be a good resource for other land-uses since the medieval period, though probably extending back into the Roman period and prehistory.

Little new information has been garnered by these aerial and ground-based surveys regarding the prehistoric and Roman landscape, but this may be due to lack of preservation rather than definitive lack of activity, given that evidence for prehistoric and Romano-British settlement is frequently attested in adjacent landscape zones by the wider NAIS project. Roman communication routes linking the forts and settlements, such as Lancaster and Kendal, in the north of England would have passed close to, if not through, the project area, impacting upon the western half where more recent transport routes have also concentrated. The apparent absence of evidence from this period may therefore relate to the effects of more intensive arable farming in the area in the medieval and later periods.

A far larger body of archaeological evidence is available for the medieval and post medieval periods, showing a predominantly rural landscape of dispersed farming settlements, centred on the larger sites of Burton and Dalton, and the common land of the limestone escarpment, where other resources could be exploited, including timber and limestone. Amidst this pattern, and potentially in conflict with it, higher status manorial sites, replaced in the post medieval period by country houses, developed their surrounding parklands and estates.

Drainage does not seem to have been a great problem, most likely due to the underlying limestone, and natural streams being occasionally diverted or improved to supply water to farms and mills, at least during the post medieval period.

Though there seems to have been some continuity between patterns of medieval and post medieval settlement and agriculture, the latter period appears to have seen a general shift towards a pastoral economy, an increased exploitation of natural resources (limestone in particular) and the development of settlements which remain central to the character of the landscape seen today, causing the greatest change to the landscape visible from the results of this project.

Overall, the archaeological evidence revealed through this project reflects a persistent dichotomy in land use, in all periods, between the higher limestone-rich areas to the east and the lower-lying, more accessible areas to the west. This is largely a result of topography and land productivity but it is also affected by taphonomic processes, which may have a bearing on the differential survival of archaeological remains.

6. SURVIVAL OF THE EVIDENCE

As mentioned in the landscape discussion, survival of the archaeological remains within the project area has been a major factor determining the results of this project. The earthwork and structural remains, where surviving, are extensive and well-defined, but this survival is not equal across the project area. Much of the western half of the area has undergone substantial improvement of land and infrastructure in the more recent past, potentially removing or obscuring archaeological remains and establishing ground conditions (i.e. permanent pasture) which revealed neither cropmarks nor soilmarks. Indeed, cropmarks and parchmarks are very few in number for this project, as in the wider NAIS as a whole. The nature of the region's topography and climate are largely responsible for this lack of evidence, as the local conditions in the north-west of England are not generally conducive to cropmark formation (see Introduction) The small number of cropmarks within the project area is limited to the western, more improved half, where limited post medieval arable agriculture has taken place. This has led to an inevitable bias in the archaeological record developed through this project.

That said, though earthworks and standing structures are more extensive in the eastern half of the project area, they are not continuous. Survival depends very much on local land-use on a field-by-field basis. Gaps in the archaeological record visible from the air and on the ground have been produced by greater levels of land improvement in some areas, whereas rough, undeveloped pasture on steeper slopes has been shown to be most conducive to archaeological survival, along with the extensive areas of woodland around Dalton. Given the nature of this project, which was led by aerial imagery, but with lidar coverage absent, it has not been possible to produce archaeological mapping for areas that have been under continuous dense tree cover for the last half-century. Ground-focussed survey has assessed some remains under woodland, but without the ability to produce mapping to the same level as that achieved through aerial survey.

7. SUGGESTIONS FOR FUTURE WORK

Though aerial survey and ground-based follow-up have produced good archaeological results on the whole, creating 68 new records for the NRHE database, and amending 14 existing records, all for 9 square kilometres, this research has also identified a number of sites which, though more detailed investigation, could significantly improve knowledge of the area. The list below is for information only. It does not constitute a programme or imply English Heritage's intention to carry out or support this work.

7.1 Potential Targets for Earthwork Survey

- Dalton Old Hall, 'Pele tower' and defended enclosure (1390323) – a detailed Level 3 earthwork survey (as defined in Ainsworth et al 2007) would properly assess the evidence for a defended enclosure around the site, and examine postulated internal features in detail, in order to better determine potential date and precise function of the site and its relationship with the settlement and deer park of Dalton.
- Earthwork and structural remains between Russell Farm (43011) and Crow Trees (1578340) sites (Fig 23) – though examined and assessed on the ground, a detailed Level 3 earthwork survey would provide a more analytical understanding of the remains and assess levels of survival. This would allow better understanding of the nature of the Dalton medieval settlement and its development in the post medieval period.

7.2 Potential Target for Geophysical Survey

- Tithe Barn site, north of Dalton Hall – a tithe barn site is identified within a field close to the north of the Dalton Hall estate on the Cumbria HER and Ordnance Survey mapping but was not visible on any of the aerial photography as either earthworks or cropmarks. If confirmed, it would provide evidence of social and economic aspects of the landscape not previously identified.

7.3 Potential Targets for Excavation

- Sample excavation of the isolated medieval settlement site (1578142) and village of Dalton (43016) may obtain dating and other evidence related to the theory that dispersed farmsteads made up the majority of dwellings in the medieval period.
- Russell Farm stock management site (43011) – excavation of test pits in the enclosures at Russell Farm to attain the date of the site and confirm medieval / post medieval as opposed to Iron Age / Romano-British date.

7.4 Suggested Designation amendments

- The scheduled monument [1021250] at Russell farm (43011) is currently described as an Iron Age / Romano-British farmstead although it has been argued, and might be proven to be medieval / post-medieval in date, and rather more extensive within the woodland to the south.

- The scheduled monument [1021249] of Dalton (43011) is currently described as a deserted medieval village and open field system. However, it has proven to be both medieval and post-medieval in date, continuing in occupation until the 19th or early 20th century. The settlement has also been proven to continue northwards under the tree cover of Lime Kiln Plantation (1583309) and New Orchard Wood (1583307), connecting with the remains at Crow Trees (1578340) and Russell Farm (43011).

Fig 23: The medieval / post medieval stone-built enclosures at Russell Farm and Crow Trees, separated by woodland (left); and the structural remains beneath that woodland, not visible from the aerial imagery (above).
NMR 12455/33 02-FEB-1994 © Crown copyright. EH. (Photograph: Becca Pullen).

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APPENDIX 1 – DIGITAL SURFACE MODEL (STRUCTURE FROM MOTION)

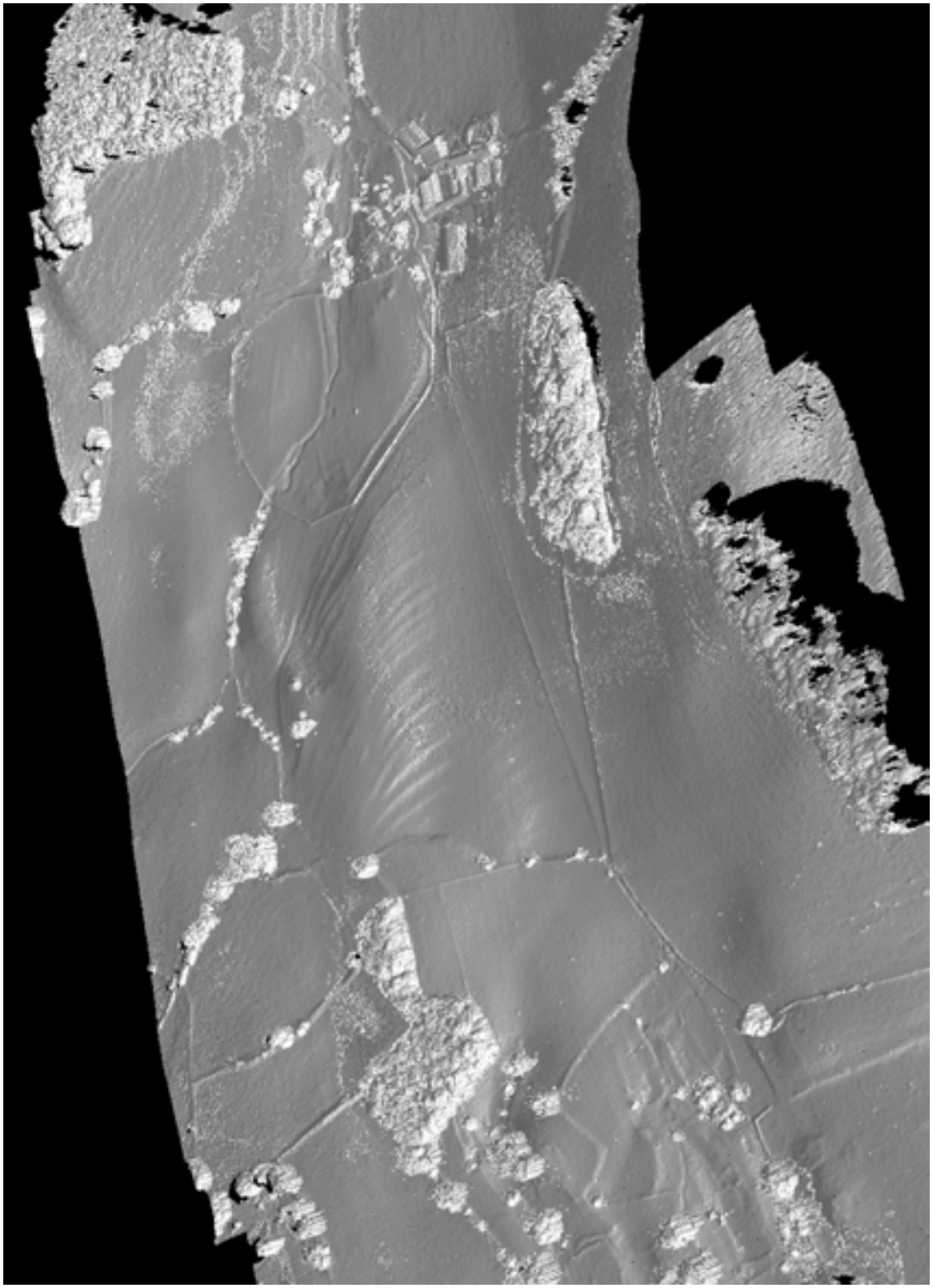

Fig 24: Dalton settlement site, lynchet field system and Dalton Old Hall, visible on a perspective view Digital Surface Model (DSM) created from oblique aerial photography using the Structure from Motion technique (north is to bottom of the page).

APPENDIX 2 – AUTOCAD MAP LAYER CONTENT AND DRAWING CONVENTIONS

Layer Name	Layer content	Attached data table	Layer colour	Linetype	
0	None	NONE	7 (white)	CONTINUOUS	
BANK	Closed polygons for features such as banks, platforms, mounds and spoil heaps	MONARCH	1 (red)	CONTINUOUS	
DITCH	Closed polygons for cut features such as ditches, ponds, pits or hollow ways	MONARCH	3 (green)	CONTINUOUS	
EXTENT_OF_FEATURE	Closed polygons outlining a feature or a group of features such as an industrial complex	MONARCH	30 (orange)	CONTINUOUS	
GRID	Grid lines at 1km intervals	NONE	7 (white)	CONTINUOUS	
MONUMENT _POLYGON	Closed polygon encompassing features recorded within a single NRHE record	MONARCH	7 (white)	CONTINUOUS	
RIG_AND_FURROW_ALIGNMENT	Polyline showing the direction of ploughing in areas of ridge and furrow	MONARCH	4 (cyan)	CONTINUOUS	
RIG_AND_FURROW_AREA	Closed polygon defining the extent of ridge and furrow	MONARCH	4 (cyan)	CONTINUOUS	
STRUCTURE	Closed polygon for built features including stone, concrete, metal and timber constructions	MONARCH	190 (purple)	CONTINUOUS	
THACHURE	Polyline t-hachure convention to schematise sloped features indicating the top of slope and direction of slope	MONARCH	5 (blue)	CONTINUOUS	

Fig 25: AutoCAD map layer content and drawing conventions. (refer to Fig 7 for project mapping).

APPENDIX 3 - LOCATION MAP FOR ARCHAEOLOGICAL REMAINS IDENTIFIED IN THE PROJECT AREA

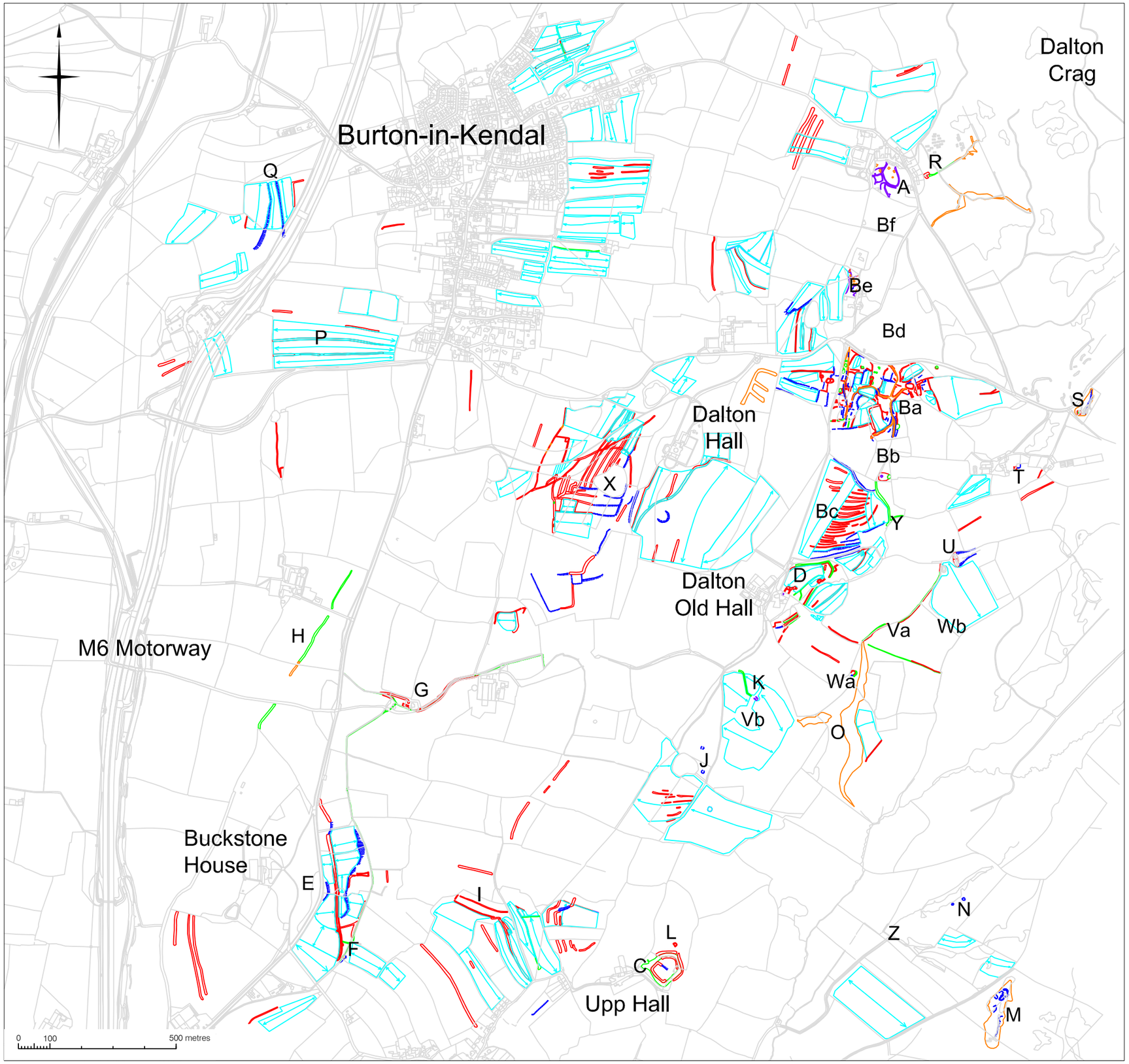

Fig 26 - Location map for archaeological sites identified or mapped through the course of the project.

Key to alphabetical labels on plan, for sites referred to in report text (using NRHE UID numbers):

43011 - A
43016 - Ba
43060 - C
1390323 - D
1577815; 1577816 - E
1577823 - F
1577825 - G
1577827 - H
1577835 - I
1577930 - J
1577938 - K
1577939 - L
1577963 - M
1577964 - N
1577967 - O
1578011 - P
1578026 - Q
1578080 - R
1578082 - S
1578134 - T
1578137 - U
1578139 - Va
1578142 - Wa
1578224; 1578229 - X
1578260 - Bc
1578296 - Y
1578297; 1583311 - Bb
1578340 - Be
1583307 - Bf
1583309 - Bd
1583313; 1583314 - Z
1583316 - Vb
1583317 - Wb

ENGLISH HERITAGE

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