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Archaeological Research Services Ltd

Staffordshire: Aerial Survey of Gnosall, Kidsgrove and Talke

A National Mapping Programme Project Report

Historic England Project Number 6613

Report by Samantha Bax

Archaeological Research Services Ltd

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1 SUMMARY

This report describes the methods and results of a survey, from aerial photographs and lidar, of the Gnosall, Kidsgrove and Talke areas of west Staffordshire. The project was completed to Historic England National Mapping Programme (NMP) standards and is the second phase of NMP work in Staffordshire funded by Historic England through the National Heritage Protection Commissions Programme (NHPCP).

The project was carried out by an Archaeological Research Services Ltd Investigator based with HE's Aerial Investigation and Mapping team in York.

The survey covered a total of 162 Ordnance Survey kilometre squares, in two blocks. These are the area between Gnosall and Eccleshall (75 km squares), and two closely situated areas to the north-east and south-west of Kidsgrove (total 87 km squares). The project area overlapped slightly with parts of east Cheshire. Combined with a previous NMP project (Bax 2014), about a quarter of Staffordshire has now been surveyed to NMP standards. The main products of the project were digital transcriptions of the form and extent of archaeological features seen on aerial photographs and lidar with supporting descriptions in the National Record of the Historic Environment (NRHE, available on the Pastscape website). The project was carried out between July 2014 and July 2015.

The project mapped and recorded a wide range of archaeological sites of varying nature dating from the Neolithic period to the twenty-first century, highlighted the extensive industrial heritage of north Staffordshire and identified a number of sites, including Ranton Abbey, where further investigation would be beneficial. A total number of 549 new records were created in the NRHE database and a further 21 existing records were enhanced.

2 ACKNOWLEDGEMENTS

The Staffordshire NMP was funded by Historic England through Heritage Protection Commissions. The project was undertaken by Archaeological Research Services Ltd in partnership with the Staffordshire County Council, who contributed through access to the Historic Environment Record (HER) data and air photograph collections.

Thanks are due to the Historic England Archive (formerly English Heritage Archive) for supply of aerial photographs, in particular Luke Griffin and the Archive Services Team.

Thanks are also due to the Cambridge University Collection of Aerial Photography (CUCAP) for the supply of the collection, particularly Alan Martin, photographic librarian.

Quality Assurance and continual guidance was supplied by members of Historic England's York-based Aerial Investigation and Mapping team: Dave MacLeod, Dave Knight, Matt Oakey and Sally Evans.

Elements of the survey extended beyond the Staffordshire county borders into Cheshire in order to allow the completion of whole kilometre squares, and this required the assistance of Cheshire County Council, specifically Rob Edwards, Historic Environment Records Officer.

3 INTRODUCTION

The Staffordshire NMP Phase 2 Western Areas is an air photo interpretation and mapping project designed to follow directly on from the Phase 1 Eastern River Confluences project. Both phases were designed to sample a variety of landscapes within Staffordshire. Prior to the Phase 1 project, Staffordshire had previously been subjected to very little large-scale systematic aerial survey. The results of the Phase 1 project were the subject of a separate summary report (Bax 2014).

The second survey phase, the Western Areas, comprised two blocks and the results are summarised in this report. The project areas (Fig. 1) were chosen to target identified priorities for research and potential risks to the archaeological landscape as defined in the Project Proposal (please see Waddington and Dean 2012 for further details) and chosen in accordance with the strategy for the NMP (Horne 2009).

● The northern block (block 4) is split into two areas, divided by the urban area of Kidsgrove. These areas are on the outskirts of the industrial area known as the Potteries and cover an area of uplands, on the north-west county border with Cheshire. Measuring a combined area of 87km², this region targeted the coal-producing areas of the North Staffordshire coal field, as well as an area where the existing archaeological record was deemed limited.

● Situated to the south of the block 4, block 3, is located on the western edge of the county. The rural nature of this region of west Staffordshire has provided little opportunity for archaeological intervention. The area covered 75km² and was targeted primarily to enhance the archaeological record of this poorly understood area.

The Historic England standard for air photograph mapping and recording is applied to projects under the banner of 'The National Mapping Programme' (NMP). NMP standards include the use of all available aerial photographs and lidar to map and record archaeological features, whether they are buried features revealed as cropmarks, soilmarks or parchmarks, or features visible at the surface, such as earthworks and structures. This includes sites with dates ranging from the Neolithic through to the near-present, including 20th-century military features. The standard products of NMP projects are a report and a digital archaeological map linked to monument records suitable for use by Historic Environment Records.

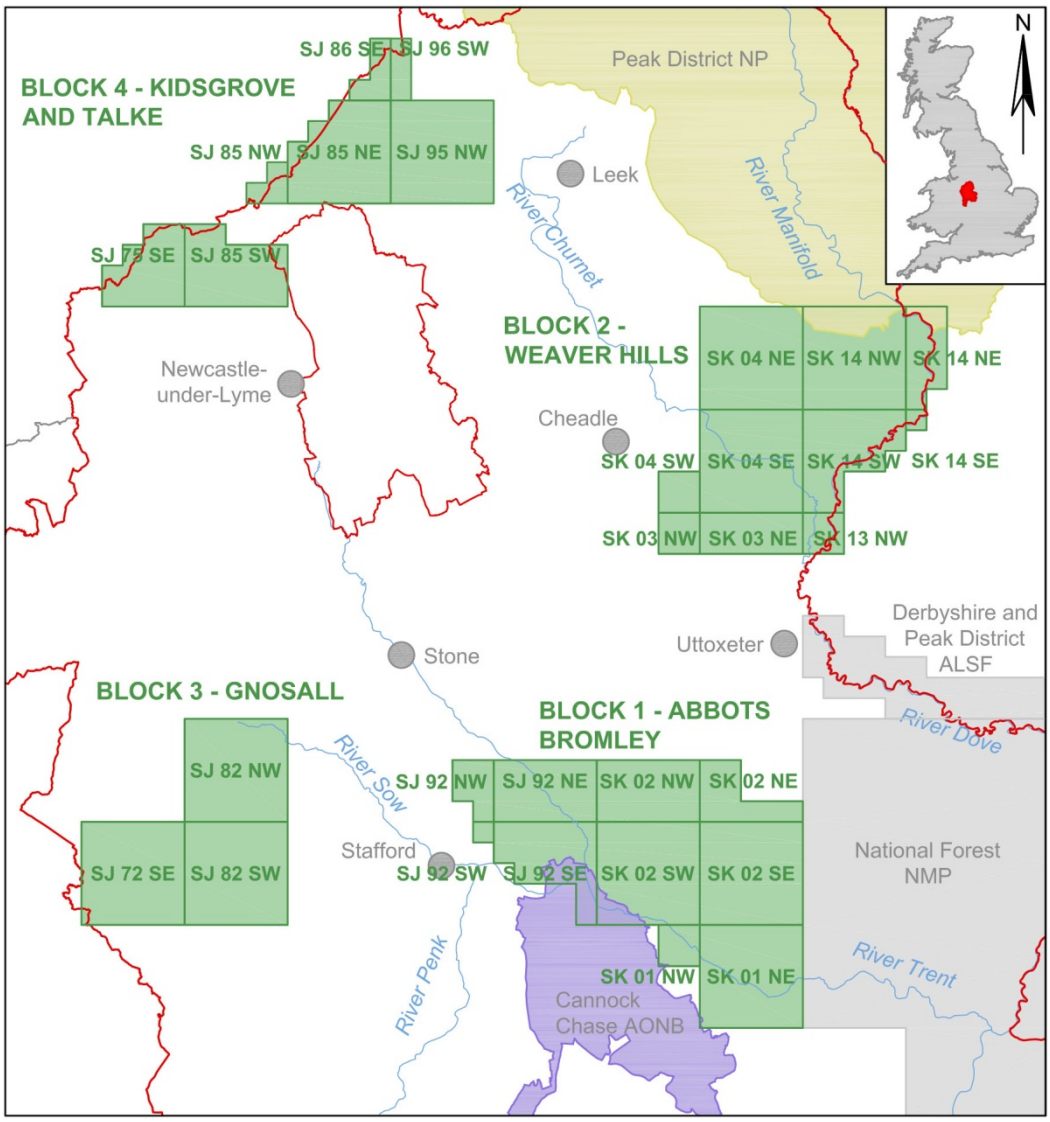

Figure 1. The Staffordshire National Mapping Programme project areas and previous NMP. Blocks 3 and 4 are the subject of this Phase 2 summary report.

4 PROJECT MANAGEMENT

The project was funded by Historic England (HE) and undertaken by Archaeological Research Services Ltd (ARS).

The Project Assurance Officer was Jonathan Last (HE NHPCP), working with Dave MacLeod as the HE Quality Assurance Officer (HE), and a Project Board comprising Stephen Dean (SCC), Suzy Blake (SCC), Ian George (HE Inspector of Ancient Monuments) and Deborah Williams and David Hilton (HE Designation Team). The Project Executive was Robin Holgate (ARS Ltd).

Samantha Bax (ARS Ltd) was the Project Officer who carried out the survey, recording and report production between July 2014 and July 2015.

The HE NMP Quality Assurance Officer for the air photo mapping was Dave MacLeod, and quality assurance was carried out on approximately 5% of the total mapped area. The HE team also provided advice, training and support where necessary and helped ensure the interpretation, mapping and recording were conducted according to NMP standards.

The project ran for 16 months beginning in July 2014, with mapping and recording completion in July 2015 and the report finalisation in October 2015.

5 SCOPE OF THE SURVEY

5.1 Geographical Scope

The project area comprises two blocks (see Chapter 3), designed to sample two different landscape regions of Staffordshire. The second phase of the Staffordshire NMP project has brought the total area of the county mapped to NMP standards to about a quarter. The survey was conducted over 4 full and 6 part 1:10,000 Ordnance Survey quarter sheets (Appendix 1), covering a total area of 162km^2 (Fig. 2 and 3).

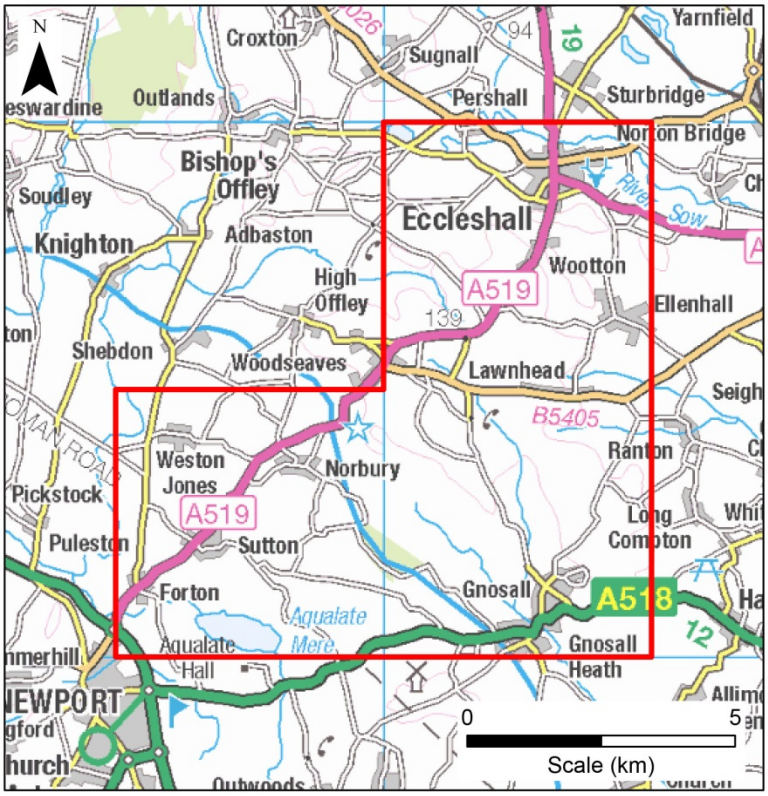

Figure 2. The Staffordshire NMP project areas: geographical scope of Block 3.

The following overview was composed using the National Character Area profiles, together with geology data obtained from the online Geology of Britain viewer, examined at a scale of 1:50,000 and soil data from the Cranfield Soil and Agrifood Institute (NRSI) Soilscapes Viewer accessed online, at a scale of 1:250,000.

The southern project area falls within the Shropshire, Cheshire and Staffordshire Plain National Character Area (NCA) 61 (Natural England 2014a). The area is a largely flat or undulating landscape dominated by mixed cultivation. This rural area of west Staffordshire is punctuated by small, dispersed settlements, the largest being Eccleshall towards the north, and Gnosall and the adjacent Gnosall Heath on the

southern edge of the project area. The River Sow meanders across the northern edge of the project area. Aqualate Mere, in the south-west corner of the project area, is the largest natural lake in West Midlands. The area is dominated by loamy soils of varying permeability, predominantly of slow-draining, seasonally wet character. The underlying bedrock geology is dominated by the Mercia Mudstone Group with an area of sandstones towards the west. The superficial geology consists of patchy, small-scale areas of sand and gravel, dispersed across the area, with scarcer peat deposits and alluvium.

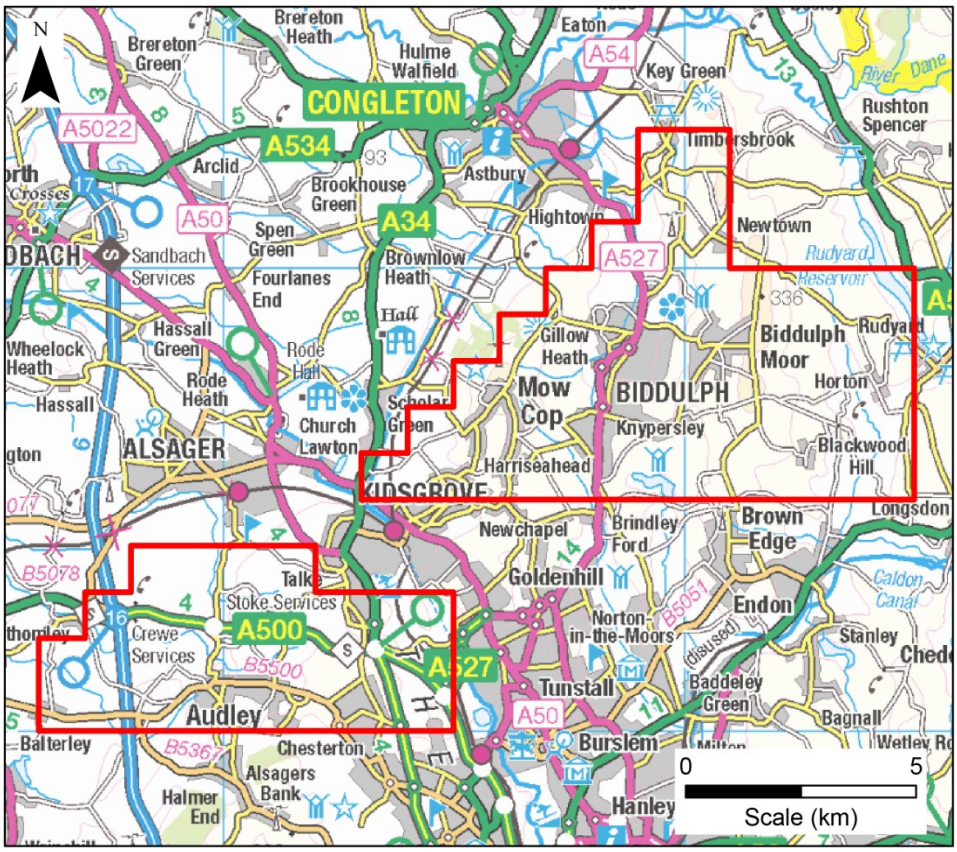

Figure 3. The Staffordshire NMP project areas: geographical scope of Block 4.

On the northern edge of the County, the final project area is located within the National Character Area (NCA) 64: Potteries and Churnet Valley (Natural England 2014b). The northern project area is split in two parts extending to the south-west and to the north-east of Kidsgrove.

North-east of Kidsgrove the landscape is predominantly of undulating uplands including areas of moorland, centred on Biddulph and Biddulph Moor. Biddulph itself sits within a valley bounded to the west by a ridge of Sandstone and Milstone Grit forming the Staffordshire-Cheshire county boundary and to the east by New Street leading to

Biddulph Moor. The project area follows the Staffordshire-Cheshire boundary north to Timbersbrook and extends east to the Rudyard Reservoir. The poorly-draining, low fertility soil is mostly made up of loamy and clayey soils with areas of peat, and is dominated by grassland used for pastoral farming.

The bedrock geology is dominated by Millstone Grit to the east. Biddulph sits at the tip of a triangle of Pennine Lower, Middle and Upper Coal Formations, which extend southwards forming the remainder of the bedrock geology. Much of the area is overlain with superficial deposits of Till. The Coal Formations extend south-east into the nearby southern area. Bands of Warwickshire Group Siltstone and Sandstone line the Coal Formations and are replaced by Triassic Rocks mostly composed of Mudstone, Siltstone and Sandstone across the western half of the area. No superficial geology covers some areas of the Coal Formation, whilst the remainder is Till.

The topography slopes westwards from Talk Pits across the moderately fertile western portion of the project area. Centred on Audley, the area extends west to Balterley and east to the North Staffordshire Railway. The base-rich loamy and clay soils support mixed agriculture and contrast with the highly-industrialised east, where there are large areas of restored soils from quarry and opencast spoil, and industrial and modern housing estates are numerous.

The underlying soil and geology, together with former and modern land-use, has impacted on the visibility of the archaeological features in a number of ways. The majority of the project area has been under arable cultivation at some point during the medieval and /or post-medieval periods. The extensive nature of the ridge and furrow, predominantly visible as earthworks on the air photographs, combined with the lack of later prehistoric and Roman monuments, indicates that masking or the destruction of these preceding features has occurred. Cropmarks, although relatively scarce, were for the most part associated with modern agricultural practices, such as networks of drains and post-medieval or 20th century field boundaries. The lack of identifiable archaeology does not necessarily mean earlier features are not present but that conditions are unfavourable to producing visible indicators, for example earlier features masked by topsoil.

The intensity of the post-medieval land-use will have influenced the survey's results. As previously mentioned, significant areas of restored soils and spoil are recorded in the northern area, indicating that any prior activity will have been destroyed and that post-medieval activities are also likely to have been removed, potentially reducing the usefulness of the aerial imagery available for recording.

5.2 Archaeological Scope

The aim of NMP is to increase our understanding of the historic environment. This is achieved by the mapping and recording of all possible and probable archaeological features identified on air photographs and (where available) lidar as earthworks, cropmarks, soilmarks, parchmarks and structures.

The sphere of interest for the project follows NMP guidance (Winton 2015) and is summarised below.

5.2.1 Earthwork archaeology

All earthworks identified as archaeological in origin were mapped, including those since levelled. Where the quality of the photography was insufficient to trace individual earthwork features with certainty, these were mapped as an extent of area. Complex braided trackways, thought to be primarily of post-medieval date, were not mapped unless they directly impacted upon other archaeological features.

5.2.2 Levelled archaeology

All cropmarks, soilmarks and parchmarks identified as archaeological in origin were mapped and recorded.

5.2.3 Post-medieval and modern field boundaries

Identified post-medieval and modern field boundaries (upstanding or levelled) that are depicted on first edition Ordnance Survey or later edition maps were generally not mapped, except to provide a wider context for field systems not mapped, or where found to truncate archaeological features.

5.2.4 Medieval and post-medieval ridge and furrow

All ridge and furrow was mapped: this was depicted as an outline of the extent of area and the direction of ploughing. Ridge and furrow of probable medieval date was indicated by wide, curving, usually s-shaped ridge and furrow earthworks, whilst post-medieval ridge and furrow is indicated by usually narrow, straight ridge and furrow earthworks. Where medieval ridge and furrow appeared to have been reused, as indicated by split ridges visible as narrower, curving ridge and furrow earthworks, or where the date of the earthworks was uncertain, these were dual indexed as medieval/post-medieval date.

5.2.5 Industrial features and extraction

Small-scale extractive pits of less than 0.5ha were not mapped unless the extraction impinged on existing archaeological features, or was visibly associated with other elements, such as limekilns. Quarries greater than 0.5ha were mapped and recorded usually as an extent of area, irrespective of if they were depicted on any Ordnance Survey map. Earthwork features within these complexes, such as spoil heaps, were generally mapped, though other elements such as tramways, trackways and extant buildings etc. were only mapped if considered to be of archaeological significance. Industrial sites such as brick and tile works were usually mapped as an extent of area. Urban industrial sites were not mapped.

5.2.6 Buildings

The foundations of buildings visible as cropmarks, soilmarks, parchmarks, earthworks or ruined stonework were mapped and recorded, except when they were depicted on first edition Ordnance Survey or later edition maps. Medieval ruined castles and monastic sites were also mapped if ruinous in form. Roofed or unroofed standing buildings or structures were generally not recorded unless they fell within the sphere of NMP interest, usually associated with industrial or military remains.

5.2.7 Parkland, landscaped parks, gardens and country houses

Post-medieval landscape and garden features visible as earthworks, cropmarks, parchmarks and structures were only mapped if previously unrecorded by first edition Ordnance Survey or later edition maps.

5.2.8 Geological features

In line with NMP practice, geological features were not mapped. These may be described within monument records, for example where close proximity potentially affects the accuracy of the interpretation.

5.3 Sources

All readily-available air photographs were consulted, together with 16-direction hillshaded lidar (where coverage was available) from the following collections.

● The HE Archive was the primary source of photography, with three loans consisting of a total of 2026 vertical and 85 oblique photographs. The vertical photography was made up from a number of sources, predominantly comprising RAF and Ordnance

Survey (OS) photography dating between 1941 and 2000. The oblique photography also came from a wide variety of sources and ranged in date from 1950 to 2010.

● A search of the Cambridge University Collection of Aerial Photography (CUCAP) online catalogue identified an additional 31 oblique photographs. This number excludes duplicate CUCAP photography held within the HE Archive. This specialist photography ranged in date from 1959 to 1984 and was largely focused on settlements and landscape parks.

● The Staffordshire County Council aerial photography collection was accessed. No oblique photographs were held for the Phase 2 project areas. The vertical photography held at the HER comprised a set dated to 1963, which were consulted although these did not add any additional detail.

● Orthophotography was supplied to HE by Next Perspectives™ through the Pan Government Agreement (PGA), ranging in date from 2007 to 2010, and was used not only for mapping, but also for the latest evidence statement for earthwork and structural sites.

● Google Earth™ imagery and where this was poor, Bing Map™ imagery was also consulted to provide additional data.

● 1 and 2 metre resolution lidar data was accessed from the Environment Agency through HE. This was supplied in the form of 1km² ASCII files which were processed to produce 16-direction hillshaded images. The lidar data did not cover the project area in full, but 26km² of Block 3 and 34 km² of Block 4 was available, equating to approximately 37% of the project area.

5.4 Monument Data and Other Sources

The National Record for the Historic Environment (NRHE, formerly the National Monuments Record or NMR) database, AMIE, together with HER monument records and Scheduled Monument data, were consulted regularly during the interpretation, mapping and recording programme. The data, supplied as shape files (.shp), were entered in AutoCAD to assist with mapping and interpretation.

Historic and modern Ordnance Survey mapping was also consulted to aid the interpretation and dating of features.

6 METHODOLOGY AND RECORDING

6.1 Mapping Methods

The mapping and recording methodology was carried out to NMP guidelines (Winton 2015). All hard-copy photography was analysed under magnification and stereoscopically, where possible. The photographs were scanned at a resolution of between 400-500dpi for rectification using AERIAL 5.29 and 5.35 software. Ordnance Survey MasterMap® 1:2,500 scale digital maps or 25cm resolution PGA orthophotography provided control for rectification. 5m interval contour data was used to improve the accuracy of the photo rectification; this was provided by HE (Licensed to HE for PGA through Next Perspectives™). Accuracy for the OS MasterMap® map is approximately ±2.5m or higher and rectification of photographs is normally within ±2m. The rectification accuracy will be lowered in areas of large topographical change and in areas where significant urbanisation has occurred.

The Environment Agency lidar ACSII data was supplied through HE and was processed to produce 16-direction hillshaded images. The processing for the southern project area was carried out using a toolbox extension in ArcGIS and the second area using the Relief Visualisation Toolbox (RVT), a stand-alone computer program. Both were written by Ziga Kokalj and colleagues at the Institute of Anthropological and Spatial Studies at the Research Centre of the Slovenian Academy of Sciences and Arts. The change in processing program came about due to the greater ease of use and accessibility of the RVT. Both programs produced georeferenced tiff files which were then imported into AutoCAD Map 3D in the same manner as the rectified air photographs.

The identified archaeological features were mapped from the rectified air photographs and lidar using AutoCAD Map 3D. The mapping conventions and layer structure used in the drawing files are summarised in Appendix 2. The attached data table for each feature recorded the corresponding NRHE record number and interpretation, along with other data within the drawing file (see Appendix 3 for an example attached data table).

In addition, the corresponding HER number (where existing) was included in the attached mapping data to aid concordance (see Appendix 3 for mapping data).

6.2 Recording Practice

The mapped archaeological features were recorded in the HE NRHE database. New records were created for previously unrecorded sites and those with existing records were updated. A list of the monument types used for this project is compiled in Appendix 4.

The PGA orthophotography was generally used to record the latest monument condition for earthworks and structural elements, unless more recent photography was available, for example from the HE Archive. No latest evidence source was recorded for cropmark sites.

Where possible, concordance between HER datasets and NRHE records was made through the mapping attached data table (see Appendix 3).

6.3 Data Archive and Dissemination

Copyright of the aerial survey mapping and associated NRHE records produced by the project resides with HE. Licence to use the data has been extended to ARS Ltd, Staffordshire County Council and Cheshire County Council.

6.4 Project Archive

The mapping has been deposited with the HE Archive in Swindon under a single parent collection number: EHC01/221, drawing number: MD002317.

The newly-created and enhanced monument records form part of the NRHE database, which are downloaded into the HE webGIS. The records are also available to view online through the PastScape website (www.pastscape.org.uk).

6.5 Project Dissemination

A copy of the AutoCAD Map drawing file has been supplied to ARS Ltd and shared with HE. Staffordshire County Council and Cheshire County Council received the mapping data in shape-file format for incorporation into their individual Geographical Information Systems.

All NRHE records have been supplied to ARS Ltd, and the relevant records to the Staffordshire County Council and Derbyshire County Council in Portable Document Format (.pdf). The project used Oracle Discoverer Plus Version 9.0.4.45.04 to output the NRHE record data in EXCEL spreadsheet format.

A copy of this aerial survey mapping report will be deposited with the HE Archive in Swindon, and will be available for download on the HE website.

7 SUMMARY OF PROJECT RESULTS

The following is a brief overview of the Phase 2 aerial survey mapping results, comprising approximately 6% of the county of Staffordshire. The results are discussed broadly by period and specific sites are referenced in brackets to the relevant NRHE database Unique Identifier Number (UID). Where HER records are specifically discussed, these are similarly referenced in brackets with the additional preface of MST.

The vertical and oblique photography offered a reasonably good coverage of the whole project area. The quality of the photography varied somewhat, particularly the RAF photography. In the northern area in particular some runs were of excellent quality and taken with low sunlight producing excellent shadow definition. The early 1940s and 1950s RAF photography was heavily relied upon in areas where urbanisation and industry had subsequently masked large areas of the land and the archaeological features contained within them. This was confined to the northern project area, for example the area surrounding Biddulph.

The greatest concentration of vertical photography occurred in the industrial area to the west of Stoke-on-Trent, where the later vertical photography documented urban expansion.

The oblique photography was sparse in both project areas. These targeted parklands, such as Biddulph Park, where they were of limited use, and Scheduled Monuments such as Ranton Abbey. The largely poor production of cropmarks in the project areas and relatively limited archaeological intervention will have affected the frequency of the area to be targeted for aerial reconnaissance; this in turn will have affected the opportunities for archaeological discoveries.

The aerial survey mapping for the Staffordshire NMP Phase 2 project amended 22 existing monument records and produced 549 new records. As a result 96% of the records produced comprised new monuments in the NRHE database. This summary provides an overview of the archaeology of the area as evidenced by the aerial survey record.

The monument evidence mapped was in the form of earthworks, structures, buildings and cropmarks. These were dated according to morphological characteristics, together with any available existing archaeological or documentary data. The double-indexing of periods was used to indicate where a feature is likely to have been in use across two periods, such as ‘medieval/post-medieval’.

7.1 Later Prehistoric and Roman periods

7.1.1 Neolithic period

The Neolithic period is represented by a single chambered long cairn known as The Bridestones (78118) (Fig. 4). The fragmentary tomb is a Scheduled Monument, known to have been partially excavated in the 1930s. This and subsequent investigation has identified evidence for an eastern forecourt surrounded by at least a partial stone circle and a possible second to the south (MST509) (Hollins 2012, 14, Fig. 8). The cairn is located on an area of upland at the northern extent of the project area on the Staffordshire-Cheshire county boundary.

Figure 4. The Bridestones (78118) Neolithic long cairn.

NMR 20940/52 09-SEP-09 © Historic England.

7.1.2 Bronze Age

The limited Bronze Age evidence identified from air photography consisted of three probable round barrows. The three monuments are located to the north-east of Norbury. One is an earthwork bowl barrow located on a prominent hill known as The Roundabout (74166) (Fig. 5) and the remaining two examples were recorded from faint cropmarks (74108) approximately 470 metres to the north-east.

Figure 5. Scheduled earthwork of the Bronze Age bowl barrow (74166) atop The Roundabout.

NMR 17487/20 17-JUL-00 © Historic England.

7.1.3 Iron Age

A single enclosure has potential Iron Age origins (1594964) (Fig. 6). Visible as cropmarks, the incomplete rectilinear enclosure is ditch-defined and has a smaller rectilinear annexe extending north from the main enclosure. The main enclosure measures approximately 60 metres in length and has a visible width varying between 37 and 55 metres.

A pit alignment of potential Iron Age/Roman date was recorded across a distance of approximately 100m, to the north-east of Ellenhall in the southern project area (1434411). It should be noted that additional pit alignments visible as cropmarks located towards the west of the project area have been recorded as medieval/post-medieval in date due to their association with a bank-defined field boundary (1590803) (see section 7.3.1 below).

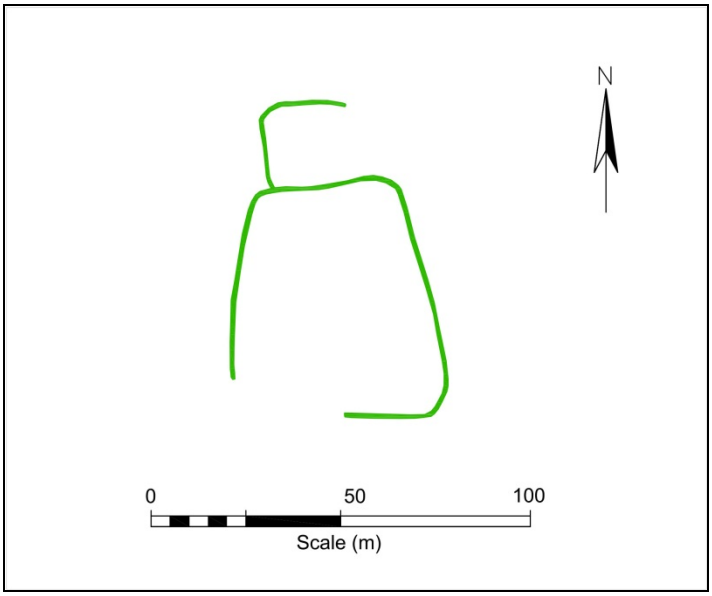

Figure 6. Mapping of a possible Iron Age rectilinear ditched enclosure (1594964).

7.1.4 Roman

The identified Roman evidence is as equally sparse as that of later prehistoric date. The only Roman monument identified was elements of the road (1590103) extending south-east on the suggested alignment of the road between Whitchurch and Stretton (1165867). The fragments were recorded to the east of Aqualate Mere in the southern project area. Further potential elements of the road could be found on the same alignment approximately 770 metres to the north-west in an area of medieval and post-medieval activity. These comprised a small hollow way on the south-east bank of Wood Brook (1590869) and a field boundary (1592775). The suspected path of the road continues on the same alignment as the modern road.

Two further Roman roads are thought to be located within or in the region of the northern project area. Neither was identified within the limit of the project area; however, a linear earthwork situated to the west of Dingle Lane was previously noted from the same photography run (Longley 1978/9, 6) (Fig. 7) and subsequently identified by field investigation (Wroe 1982, 30-3).

Figure 7. A Roman road visible as an earthwork linear (centre of frame) on historic vertical photography, immediately outside the northern project area.

RAF/CPE/UK/1935 FP 1101 17-JAN-1947 © Historic England RAF Photography.

7.1.5 *Discussion*

The identified evidence for activity from the Neolithic to the Roman period is especially sparse and largely representative of a funerary use during the Neolithic and Bronze Age periods, indicated by the scheduled chambered long cairn and bowl barrow. The location of several Roman roads extending through the project areas indicates a greater level of activity than the aerial survey has identified and this is also likely to be the case for the later prehistoric periods. This is corroborated by a rapid assessment of the limited find spot records for the project areas. Of particular note is the concentration of Roman finds recorded in the Forton and Eccleshall parishes in the southern project area. Whilst the northern blocks are generally unsuited to field walking and metal detecting, limited finds have been recorded for all periods.

The contrast in later prehistoric and Roman evidence between the areas mapped in the Phase 1 and Phase 2 projects is marked. The distribution of monuments recorded during the first phase was not extensive across the whole project area, but significant concentrations of monuments were recorded and distinct patterns of land-use were identifiable (Bax 2014, 46). The contrast is at least in part the result of post-medieval and modern land-use, particularly in the northern area of Phase 2, where post-medieval and 20th century industrial activities and settlement expansion mask areas. This is combined with the dominance of grassland for grazing as opposed to arable farming, reducing the opportunity for cropmark formation in an area of largely low soil permeability, and is thus less conducive for cropmark production.

7.2 Medieval

7.2.1 Land-use and Settlement

The remains of medieval activity are largely widespread across the project areas. Evidence for medieval land-use was most commonly recorded in the form of ridge and furrow. The medieval ridge and furrow is largely dispersed (Fig. 9). Significant concentrations of the earthworks were recorded in the area to the south-west of Biddulph Moor village (1592186) (Fig. 8), and elsewhere in the northern project area towards the west and south of Horton, along the Horton Brook (1592202) and in the area surrounding Balterley, to the west of the M6 (1594684, 1594372 and 1594663).

In the southern area, the archaeological evidence is dominated by ridge and furrow, particularly at Weston Jones (1590132) and stretches of the River Sow to the west of Eccleshall (1588568 and 1588490), and surrounding Pershall (1588570).

A noticeable gap in the distribution is present on the northern moorland to the east of Biddulph Moor village and the industrial area west of the city of Stoke-on-Trent. Woodland, the Aqualate Mere and surrounding wetland affect the otherwise dispersed distribution in the south. Approximately 39% of all ridge and furrow is recorded to be of medieval or medieval/post-medieval date, of which approximately 24% survives as extant earthworks. Figure 8 includes examples of the medieval ridge and furrow thought to have been reused in the post-medieval period, as indicated by split furrows, and earthworks with neither the well-defined wide s-shaped earthworks associated with medieval ridge and furrow nor the narrow straight earthworks associated with post medieval steam-ploughed farming.

Figure 8. Extensive predominantly medieval ridge and furrow to the south-west of Biddulph Moor (1592186), visible on historic vertical photography.

RAF/CPE/UK/1935 FS 2404 17-JAN-1947 © Historic England RAF Photography.

Dispersed field boundaries and former field systems of probable medieval origin were recorded where the earthworks are no longer in use. A field system of medieval origin with post-medieval reuse was recorded at Knightley Green (1589705) in association with a curvilinear earthwork enclosure (1378400) (Fig 10). The medieval origin of the field boundaries is suggested by the association of ridge and furrow of medieval origin, and further fields of post-medieval ridge and furrow indicate continued use of the field system.

Areas of field system such as to the south-west of Biddulph Moor village (1592186) (Fig. 8) where the field boundaries clearly respect the medieval ridge and furrow but were not mapped fell outside the remit of the mapping due to their continued use. In other areas the evidence of medieval field systems was too difficult to define due to the fragmentary and dispersed nature of the recorded field boundaries. This was the case at Western Jones where numerous field boundaries were recorded and presumably

formed a wider network of field boundaries and a field system, but this could not be determined from the available evidence.

Other evidence of cultivation was recorded in the form of several small groups of lynchets to the north and east of Old Biddulph House (1596018 and 1592382) and north-west of Gillow Heath (1592393).

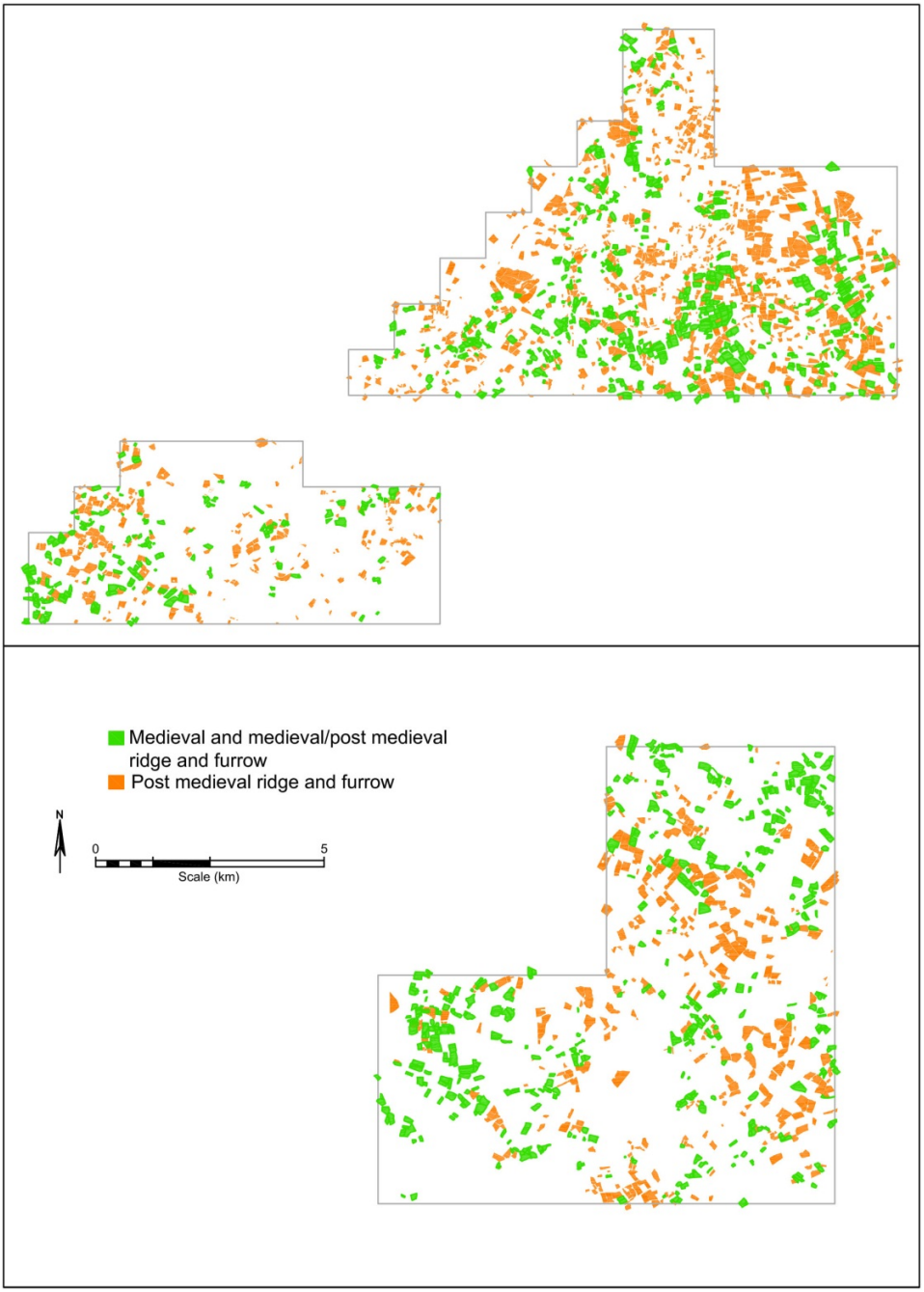

Figure 9. Distribution of medieval and/or post medieval ridge and furrow and the post-medieval ridge and furrow.

Figure 10. Knightley Green (1589705) field system and associated curvilinear earthwork enclosure (1378400)

RAF/CPE/UK/2492 RP 3369 11-MAR-1948 © Historic England RAF Photography.

7.2.2 Moats and Enclosures

The settlement evidence for the medieval period is largely confined to the moated and other recorded enclosures. Moats were most numerous in the southern project area, predominantly of rectilinear form and often associated with ridge and furrow, field boundaries and field systems.

Enclosures were fewer in the northern area. Of the total number of 14 recorded moats, one is located in the northern project area towards the south-east of Lask Edge (1592179). This is a newly-identified potential moat site, recorded in association with field boundaries and hollow ways. Another enclosure was recorded west of Crowborough Farm (1592035). This rectilinear enclosure is ditch defined and also associated with a number of field boundaries and ridge and furrow. A third, small enclosure of rectilinear form was recorded of potential medieval origin and is located under what is now housing in Biddulph (1592978). Two small, curvilinear bank-defined

enclosures may have been stock enclosures and could have either medieval or post-medieval origins (1593284).

The distribution of moated sites south of Ranton Abbey is relatively evenly-spaced across the landscape. Ranton Abbey itself is a moated site, discussed in greater detail with the monastic sites (7.2.4). Less than a kilometre to the east of Ranton Abbey, Ranton Hall is a well-preserved example (75644) (Fig. 11, B). The moat is one of the larger examples in the project area, measuring approximately 75m x 36m internally. Further south, smaller examples were recorded immediately east (75595) (Fig. 11, D) and towards the north (75634) (Fig. 11, E) of Gnosall, and north of The Hollies (75639) (Fig. 11, F). The example to the north of Gnosall appears to have a pond incorporated into the moat ditch which is implied by a widening of the north-east arm of the earthwork.

The survey provided further evidence of the Eyeswell Manor site which was excavated in the 1980s and subsequently built over (75506) (Fig. 11, G) (Hawke-Smith 1984). The excavation identified the moat to have been cut in the early 13th century and it appeared to overlie probable burgage plots extending from the Eccleshall High Street (Staffordshire County Council 2012, 14). Elements of the earthworks were mapped from the early RAF verticals; unfortunately vegetation cover prevented further earthwork identification.

Two potential adjacent moats were recorded to the north-east of Weston Jones (Fig. 11, A.). The more northerly of these surrounds a low oval mound previously recorded as a potential motte (74142). The mound appears to be natural in origin and sits in the bend of a stream to the south. Much of the moat ditch had been relatively recently re-cut on the 1940s RAF vertical photography used to map the site; it is this drain which surrounds much of the southern portion of the mound. A second previously unrecorded moat immediately to the south of the first is rectilinear in plan. A partial outer and inner bank lines the moat ditch. Although largely levelled the sites are in part extant on 2011 lidar.

At Knightley Green, the curvilinear enclosure associated with a previously described field system is located to the west of Hollies Brook (1378400). Within the enclosed area a pond appears to line the southern arm of the enclosure bank and a second potential pond is located outside the enclosure to the north. The regular form of the outer pond may indicate it is associated with a later, post-medieval phase of site use.

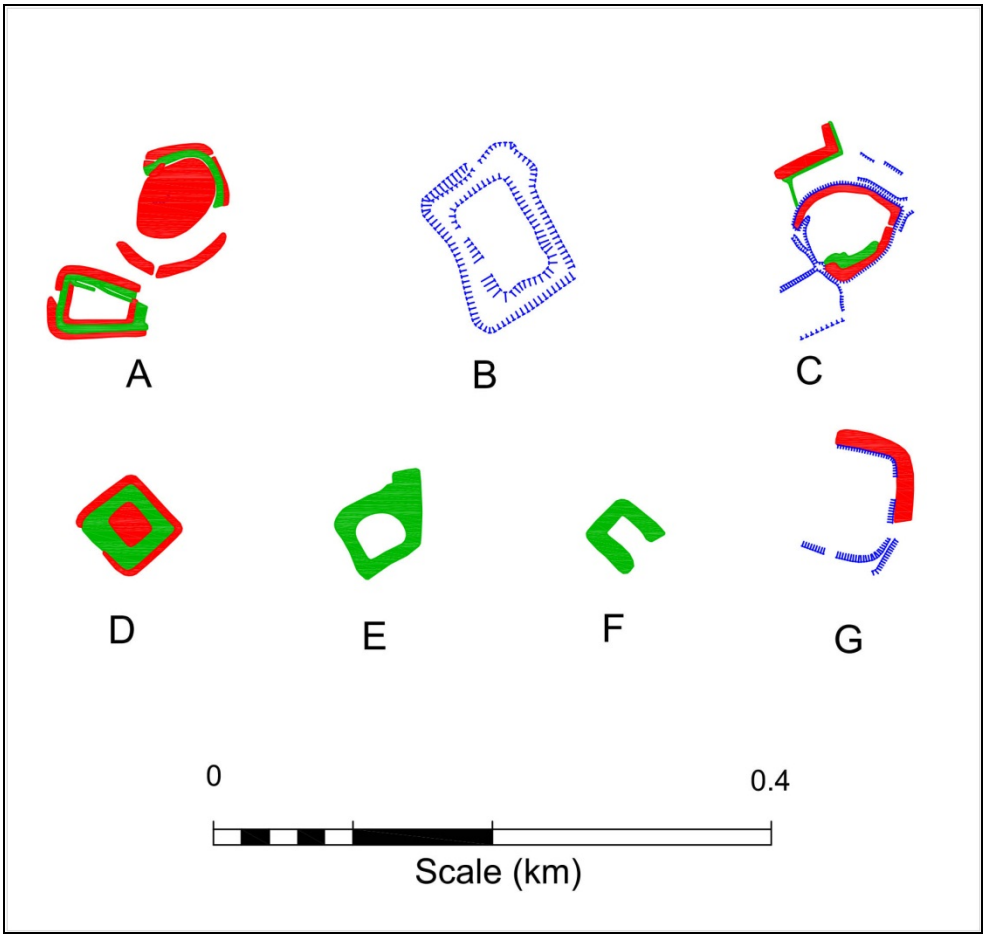

Figure 11. Moat and other enclosure transcriptions: A south 1590131 and A north 74142, B 75644, C 1378400, D 75595, E 75634, F 75639 and G 75506.

Further, more detailed examination of the variety and distribution of moated sites, including their dating and relationship with surrounding contemporary features, would therefore be useful to studies of medieval Staffordshire, particularly with regard to their wider regional context.

7.2.3 Fortified Sites

Fortified sites are not numerous but these are diverse. A D-shaped ringwork was recorded in Bailey's Wood, situated to the west of Biddulph Park (76072) (Fig. 12). The site is located in a prominent position in a curve of Biddulph Brook, which surrounds the site on all but the west side. The ringwork comprises a substantial bank up to approximately 12m wide, enclosing an area measuring 35.5m by up to 28m wide. A break in the south-west side of the enclosure may be an entrance. Surrounding the bank on all but the north-west corner is a relatively narrow ditch which is approximately 5m wide. Investigations in 1966 (Cantor 1966, 42) suggested the site was at least as early as 12th century in date. A wooden palisade, traces of wooden buildings and

subsequent 13th century building with stone foundations, along with 13th to 15th century artefacts, were recorded. Limited 16th century evidence suggested the site was abandoned at this time leading to the suggestion this may have been the former residence of the Biddulphs, prior to the construction of Biddulph Old Hall in the 16th century.

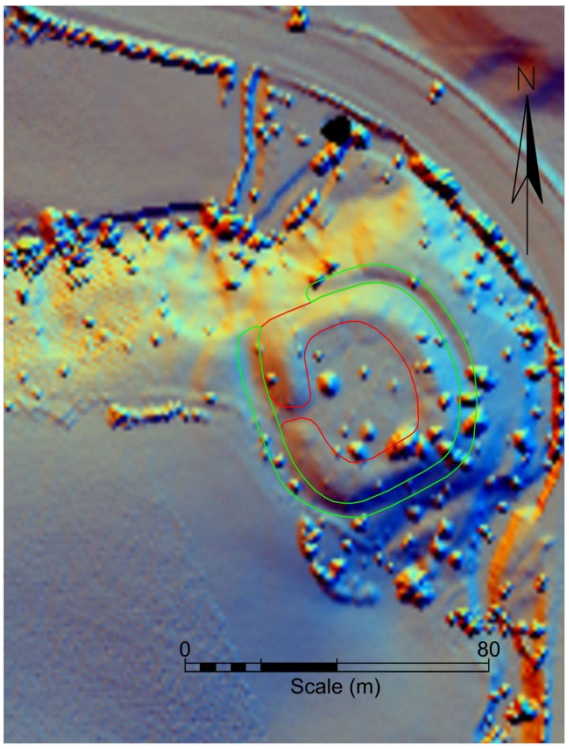

Figure 12. Transcription of Bailey's Wood ringwork (76072) on the 16 direction hillshaded lidar image from which it was mapped.

LIDAR SJ8859 Environment Agency DSM 6 April 2006 © Historic England, source Environment Agency.

A motte named Castle Hill is located at the northern edge of Audley (74623). The site consists of a raised curvilinear mound and partial surrounding ditch, and was difficult to define from the available air photographs due to vegetation cover. Excavation in 1914 recorded a wall, loose masonry and fragments of 15th, 17th and 18th century pottery (NRHE record).

Eccleshall Castle (75490), like the other fortified sites described, is protected as a Scheduled Monument, but also as a Listed Building. The castle is located to the north-west of Eccleshall village and was built in the 14th century; little remains of the castle itself, but a tower at the north-east corner of the site with connecting elements of the precinct wall and the wall-lined moat. Documentary evidence records the castle as an

episcopal residence, the property of the Bishops of Lichfield (Pevsner 1974, 126). The castle was destroyed during the Civil War and the present house built in 1695.

7.2.4 Monastic Sites

Evidence of monastic activity was identified at Ranton Abbey (75628), an Augustinian cell founded in approximately 1150. The upstanding building remains at the site are limited to the church west tower and a small section of adjoining wall, dated to the 15th century (Pevsner 1974, 224). The apparent main area of former buildings was surrounded by a moat, of which the north and eastern arms are extant. Outside of this area are extensive water channels, drains, boundaries, the potential southern precinct boundary and small areas of extraction, all previously unrecorded. The earthworks provide evidence for extensive water management and documentary evidence suggests this extended to a nearby mill (75536), comprising an extensive dam and rectilinear enclosure among other ditch and bank features. A second, less certain, mill site was recorded to the south of Ranton Hall and could be associated with it (1589659). No gardens or other features were identified that pertain to the 18th century ruined Georgian mansion which adjoins the monastic ruins.

Figure 13. The surviving earthworks at Ranton Abbey (75628), including the central moat.

NMR 14987/24 02-MAR-1994 © Crown copyright. Historic England.

7.2.5 Deer Parks

A potential deer park is located to the south-east of Ranton Abbey (1589646). Fragments of a boundary bank and ditch were identified following the path of the modern road adjacent to the place name 'Park Nook' as recorded by historic and modern mapping. The arrangement of the earthworks, with the ditch on the south-east side of the bank, indicates the park pale is likely to be associated with land to the south. Numerous other references to deer parks on Ordnance Survey mapping were observed but associated archaeological remains were not identified from the aerial survey.

7.2.6 Discussion

The medieval evidence shows greater variation and increased visibility than the preceding archaeological periods. Whilst settlement evidence associated with villages and hamlets is sparse, enclosures and particularly moated sites are common in the southern area. The ridge and furrow of medieval origin indicates land-use is much more extensive than the limited settlement evidence suggests, covering large areas of the northern project areas as well. The sparser evidence in the northern area may be due to the less favourable farmland across areas, with the general increase in post-medieval activity masking or having destroyed the medieval evidence. The variety of site types, including the defensive sites of the Audley motte and Bailey's Wood ringwork, along with the monastic site of Ranton Abbey suggest further archaeological investigations in both western and northern Staffordshire are needed to improve understanding of the development of settlement and land-use during the medieval period.

7.3 Post-Medieval and Twentieth Century

7.3.1 Post-Medieval Land-Use and Settlement

The post-medieval period proved to be the most extensively represented period within the two Phase 2 project areas that were surveyed. The evidence is both wide-ranging and widespread. Ridge and furrow is the most extensive evidence for post-medieval land-use (Fig. 9 above). The remains of arable cultivation are dispersed across much of the study area, although are most concentrated in the northern project area outside the industrialised south-east part. A rapid assessment of the earthwork survival found only 17% of the post-medieval ridge and furrow to be extant on the latest 2010 vertical photography. The change or reversion to predominantly pastoral farming in the northern project area will have contributed to the greater concentration of earthwork survival here. Elements of the narrow ridge and furrow could alternatively be associated with pasture improvement, rather than arable cultivation, but this cannot be distinguished from the air photography alone.

Only previously unmapped post-medieval field boundaries not depicted on historic Ordnance Survey mapping were digitised. A number of former field systems of probable post-medieval origin were recorded in the northern area. These were usually associated with ridge and furrow of the same date: for example, a field system in the area of Shirkley Wood (1592181) which was represented by numerous field boundaries and a number of tree enclosure rings (Fig. 14). The tree enclosures are L- or cross-shaped in plan and were drawn where they were associated with previously unrecorded field boundaries. Elements of these were cut by post-medieval ridge and furrow which may suggest the presence of a former park in this area. Another example was recorded in the area of Biddulph Park (1595998) where a number of hollow ways appeared to be associated with the field boundaries. A further example to the east of Biddulph (1592853) was constructed on a different alignment to the modern field boundaries clearly predating them. The field system is in association with post-medieval narrow ridge and furrow truncated by the current field boundaries; it appears that the field system was relatively short-lived.

An area of field boundaries defined by pit alignments were recorded on the western edge of the West Staffordshire project area (1590803). Elements of these had previously been recorded as pit alignments of later prehistoric or Roman date but they were shown to be in direct association with post medieval boundaries of possible medieval origin. One of the main alignments was located on top of a broad bank identified from lidar, indicating the presence of a fence- or hedge-line overlying the bank. This association suggests that this, and the nearby pit alignments, are of a similar post-medieval, rather than Iron Age/Roman, date, associated with the wider, banked field system.

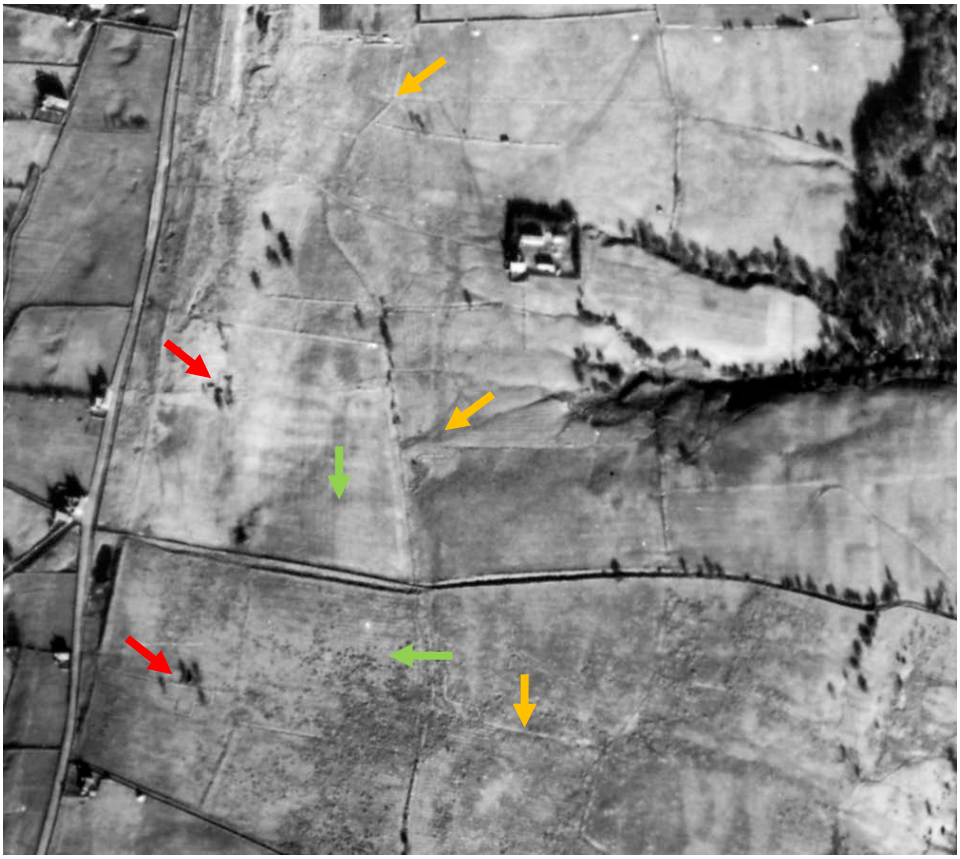

Figure 14. Shirkley Wood field system (1592181), visible as numerous field boundaries (examples highlighted by yellow arrows), tree enclosures (red arrows) and areas of ridge and furrow ploughing (green arrows).

RAF/CPE/UK/1935 RS 4403 17-JAN-1947 © Historic England RAF Photography.

Water meadows are another feature of the post-medieval landscape, which are mostly recorded along the River Sow in the southern project area of the common bedwork type. The earthworks comprised a network of drains constructed to improve hay yields and grazing lands (Smith and Stamper 2013, 2) on the banks of the River Sow (1588538, 1588541, 1588536 and 1588492). Elements of the earthworks may simply be drainage features that are undifferentiated from the water meadows due to the poor survival of the earthworks. A single area of water meadows was recorded in the northern project area, located at the convergence of the Horton Brook and another unnamed watercourse to the south of Horton (1592040). The meadows have an irregular layout, following the contours of the undulating landscape (Fig. 15). Elements of these water meadows appear to be in the form of catchworks, which utilise the natural contours to flood the fields (Smith and Stamper 2013, 2), an apparently less common form found in Staffordshire, as indicated by the Phase 1 results (Bax 2014, 37).

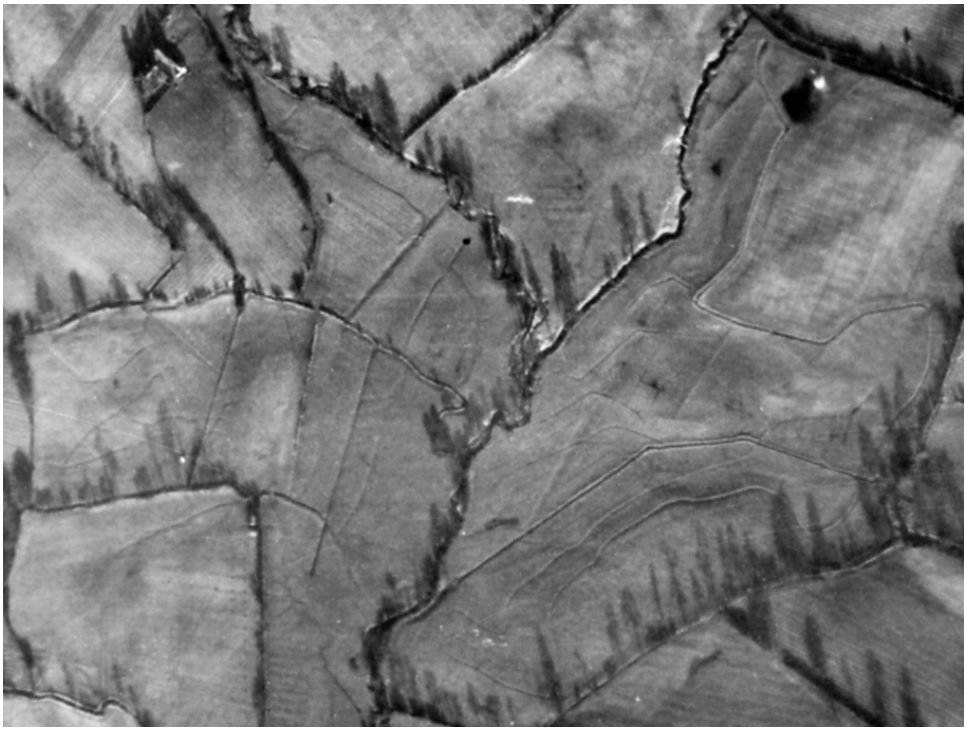

Figure 15. An area of water meadows to the south of Horton (1592040).

RAF/CPE/UK/1935 RP 3399 17-JAN-1947 © Historic England RAF Photography.

Other features in the landscape included enclosures. These were recorded in a variety of situations, for example a rectilinear enclosure located adjacent to an area of probable water meadow to the south-west of Gnosall Heath (1589758). The enclosure is ditch defined and drains into a water channel marking the edge of the water meadows. A field boundary of medieval origin forms the south-west side of the enclosure which is approximately 33 x 50 metres in size. There is no clear association to suggest a use for the feature. At least one enclosure is thought to be associated with the mining activities in the north of the project area. The enclosure is rectilinear in shape, defined by a bank and outer ditch, and is visible as cropmarks on air photographs and earthworks on lidar (1595717). The enclosure is adjacent to an area of small-scale coal mining and it is this close association which has led to the suggestion it is likely to be related to this activity, the function is unclear. Elsewhere, a small curvilinear enclosure and adjacent bank-lined hollows (1594920) measuring approximately 8 metres in length are located immediately west of a post-medieval ridge and furrow, and are probably associated with agricultural activities.

7.3.2 Industrial Activity

Post-medieval and 20th century coal mining is extensive across a wide band of the northern project area, the area of coal mining extending north-east to south-west from Biddulph Grange Country Park. The northern project area is located at the northern extent of the larger of the two main north Staffordshire coalfields. Centred on the Potteries, the area of coal mining forms a triangular area extending from Biddulph to Silverdale and Longton (Sherlock 1976, 86).

Documentary evidence records coal mining in the region during the medieval period at Tunstall, on the east edge of the northern project area, in 1282 and of Kingswinford, South Staffordshire in 1291 (Sherlock 1976, 91 and 86). Whilst elements of the recorded earthworks could have medieval origins, without identifiable variations from the features of the post-medieval and later sites, the earlier activity cannot be distinguished by aerial survey alone.

The sites vary in scale from small individual shafts and associated shaft mounds, to networks of collieries and their transport links and open-cast mining. The smallest scale activity, represented by individual or small groups of shafts, was found across much of the mining area. Small dispersed groups were mapped near Biddulph Park (1596336), to the south of Audley (1596374) and on Bignall Hill (1596372). Others are located adjacent to larger sites: for example, a number of shafts near Springwood (1596309) are adjacent to the colliery and iron stone mine named Glasshouse Colliery (1595663).

Figure 16. Peacock Hay colliery (1596341).

RAF/CPE/UK/1935 FP 1420 17-JAN-1947 © Historic England RAF Photography.

Whilst many of the sites are well-documented by historic Ordnance Survey mapping, some significant areas are either not recorded or do not display any obvious indication of the extent of the mining, such as at Peacock Hay (1596341) (Fig. 16 above), for which the historic mapping indicates the presence of only two shafts and where a much larger area of spoil heaps and probable shafts are present. The lack of detail in places may indicate that the features are earlier in date than the recorded elements. Potentially, these were no longer in use or were not deemed significant enough to be recorded. The earthworks may not have been easily recognisable due to erosion, partial destruction, or masking by vegetation at the time of surveying. These sites could be prioritised to further investigate into the origins and evolving methods of mining in north Staffordshire.

The shafts often formed a linear arrangement, following the seam of the coal. An extensive group, comprising six linear features, were recorded to the east of Towerhill Farm (1592964) on a north-east to south-west alignment (Fig. 17). The earthworks, consisting of shafts and several lines with associated shaft mounds, were already heavily eroded at the time of the 1947 RAF photography from which the features were mapped and half the earthworks were overlain by post-medieval narrow ridge and furrow. Smaller examples can be found west of Biddulph (1592986), near Stone Trough (1592669) and amongst the earthworks near Ravencliffe (1596336).

Figure 17. Linear arrangements of coal mining shafts (shown by red arrows) at Towerhill Farm (1592964).

RAF/CPE/UK/1935 FS 2413 17-JAN-1947 © Historic England RAF Photography.

Larger sites of post-medieval and/or 20th century date consist of networks of collieries linked by tramways and mineral railways. Several post-medieval collieries were linked to the Macclesfield Canal, which opened in 1831, by an extensive tramway (1592665) which is approximately 4km in length (Fig. 18). Extending east from the canal, the tramway passes through The Bank and a tunnel under Mow Cop to Towerhill Colliery (1481524), Stone Trough Colliery (1592668) and a third unnamed colliery (1592852), which are recorded as already disused on the first edition Ordnance Survey map. These collieries, consisting of large spoil heaps, reservoirs and shafts, are typical examples. The engine house at Towerhill Colliery survives as a ruined building; other structures were mapped at Stone Trough Colliery and are no longer extant. A number of associated drains and water channels were also mapped at Stone Trough Colliery. The tramway itself was no longer in use by the second edition Ordnance Survey map published in 1899.

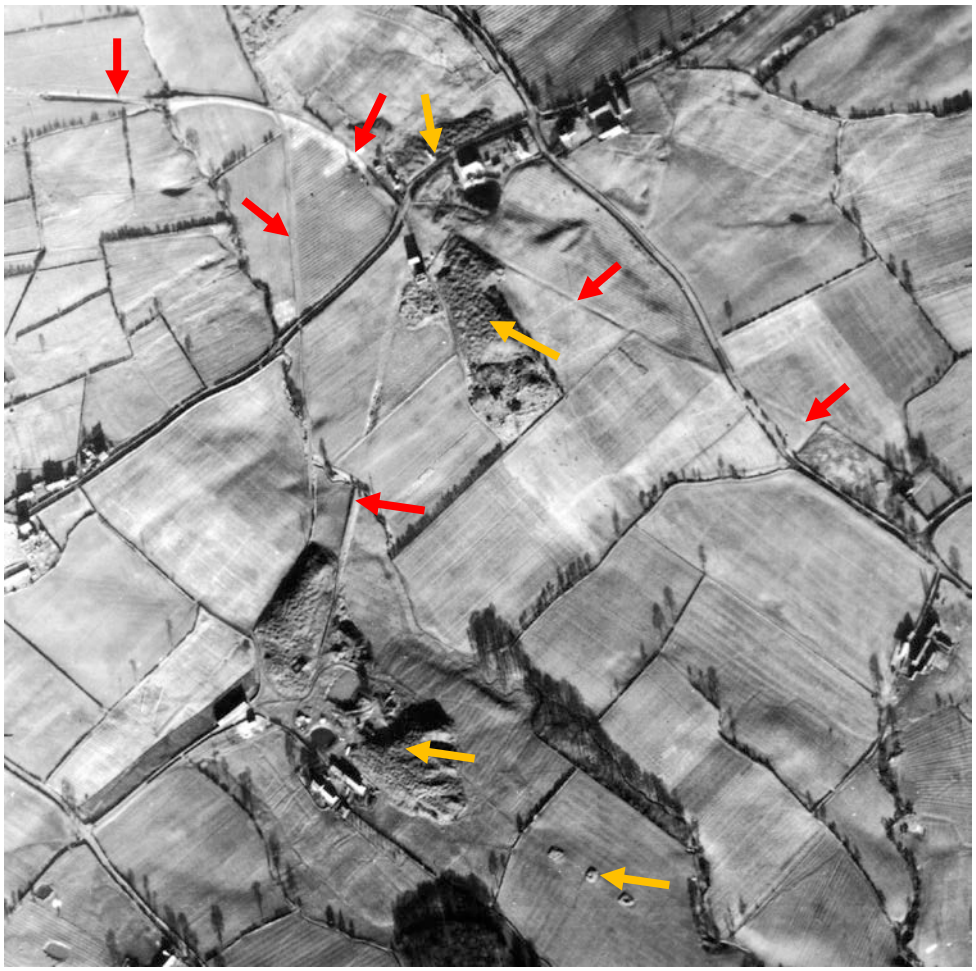

Figure 18. Coal mining (highlighted by yellow arrows) near Biddulph and Harriseahead, linked by an extensive tramway (1592665, red arrows).

RAF/CPE/UK/1935 FS 2413 17-JAN-1947 © Historic England RAF Photography.

Other examples of tramways were recorded which were used to transport the coal to the North Staffordshire Railway and/or other industrial sites. At Tubshore, post-medieval collieries (1592683) are linked by a tramway to Clough Hall Coal and Iron Works. West of the southern entrance to the Harcastle Tunnels are multiple phases of coal and ironstone mining, producing a complex string of post-medieval and 20th century mines and their associated tramways and mineral railways (1596339). The tramways and mineral railways link the mines to one another, and, in places, to the North Staffordshire Railway. The 20th century coal mining activities are largely confined to the southern part of the northern project area. Those sites which continued in use or were 20th century in date are often larger in scale than the post-medieval sites, as exemplified by the Talk O' Th' Hill Colliery (1596492) and Bignall Hill Colliery/Jamage Colliery (1596492), which were both served by the Audley Branch of the North Staffordshire Railway. The largest of the mining sites is an open-cast coal mine (1592700). The site was initially two complex and rapidly-changing post-medieval and 20th century collieries: Biddulph Valley Coal and Iron Works and the Brown Lees Colliery. In the late 20th century the adjacent land become a single large open-cast mine, engulfing much of the earlier collieries.

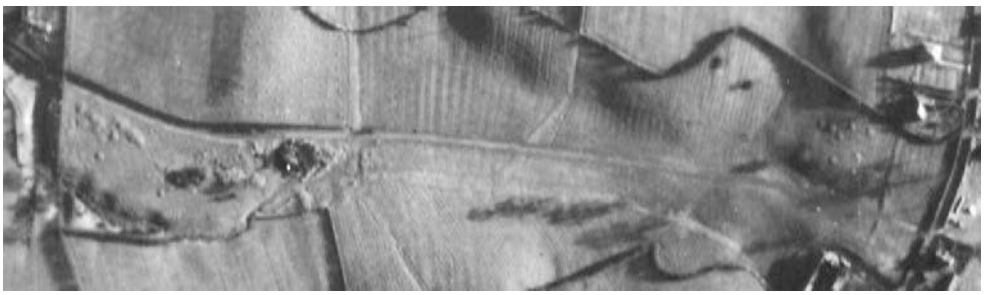

Figure 19. Two groups of mounds (1592962) and a trackway leading to the main road in Biddulph, thought to be associated with mining.

RAF/CPE/UK/1935 FS 2408 17-JAN-1947 © Historic England RAF Photography.

A number of small groups of mounds which appear to be spoil heaps or small shaft mounds were also recorded and are considered to be associated with the mining activity in the north the project area. At the southern extent of what is now Biddulph are two groups of mounds (1592962), between which a path extends to the road (Fig. 19). Another example was recorded immediately to the south of Biddulph Park (1592377), and further examples were found continuing southwards (1592469 and 1592980). It is unclear whether these are associated with some form of processing activity or simply small-scale mining.

Ironstone mines were recorded with a number of collieries. These are morphologically indistinguishable from the coal mines, known only by the mine description on historic

Ordnance Survey mapping. Ironstone and coal are frequently extracted from the same mine due to the proximity of ironstone layers alongside coal seams. The ironstone mines were recorded in the south-eastern area of the northern project area. The ironstone mines extend as far west as the Talk O' Th' Hill mine (1595702). Others were recorded at Parkhouse Colliery (1595754), New Hem Colliery (1595761) and Glasshouse colliery (1595663). The direct relationship of ironstone with the coal deposits may indicate ironstone was more widely mined in this area than indicated by the historic Ordnance Survey mapping records.

Chatterley Coal and Iron Works (1596296) is one of a number of iron works and forges in the wider area. All but the Chatterley site are located outside the limits of the survey area, to the east of the Trent and Mersey Canal.

The sites of 21 brick and/or tile works were recorded, almost entirely in the northern project area. The largest concentration is centred on the area of Bradwell Wood, where 11 sites were mapped. These are mostly of 20th century date, although some have post-medieval origins as exemplified by the post-medieval and 20th century brick and tile-making site later known as High Carr Tileries (1596305) (Fig. 20). The site comprises a large clay pit and main L-shaped building, and is surrounded by numerous kilns. This site is also connected to the Talk O' Th' Hill branch of the North Staffordshire Railway. A smaller concentration of sites was recorded in the Mow Cop area; others are more dispersed.

Figure 20. High Carr Tileries (1596305).

RAF/CPE/UK/2010 FS 2006 16-APR-1947 © Historic England RAF Photography.

A number of mostly small-scale sand pits and workings were mapped: the largest of these is Hurst Quarry (1592184). Small-scale sandstone extraction was recorded along the Staffordshire-Cheshire boundary ridge extending north-east from Mow Cop (1592410, 1592369, 1592794 and 1592655). These pits/workings were of post-medieval origin and continued in use into the 20th century. A further five records were created under the generic term of quarry where the specific type was not known or recorded on historic Ordnance Survey mapping. Marl pits were a frequent feature, particularly in the southern project area, but were rarely recorded due to their small scale, usually covering an area under 0.5ha. Only examples at Rue Barn Farm (1588518) and near Hilcote Hall (1588489) were of a large enough size to warrant mapping.

7.3.3 *Second World War Military Features*

The military evidence for the Phase 2 project area comprised several air raid shelter sites identified from the 1940s and 1950s RAF photography. The air raid shelters were all of a similar form, consisting of earthwork mounds and their associated entrances. In each case the air raid shelters are located adjacent to a school recorded on historic Ordnance Survey mapping. The largest was Kingsfield First School in the centre of Biddulph (1592845) (Fig. 21), and the remaining two sites were located at Knypersley First School (1592851) and a primary school (now the church hall) adjacent to St. Lawrence's Church in Biddulph Grange (1592379).

Figure 21. Air raid shelters (1592845) near Kingsfield First School in Biddulph, comprising earthwork mounds and with visible entrances.

RAF/106G/UK/645 RP 3338 11-AUG-1945 © Historic England RAF Photography.

7.3.4 *Discussion*

The post-medieval period is the best represented period for the Phase 2 project. An expansion of land-use, including agricultural activity, onto the moorland is visible as narrow ridge and furrow recorded on areas of moorland to the east of Biddulph and mining activity of varying scale. The northern area is shaped by industry with late post-medieval settlement expansion occurring at Biddulph and Biddulph Moor in association with the growth of the coal and iron working industries in the wider area (Staffordshire Moorlands HEA, 2010, Appendix 2, 1).

A large number of coal and ironstone mines and potteries increase in scale and number during the 19th and early 20th centuries. These were linked by transportation networks, initially in the form of the Trent and Mersey Canal built between 1766-77 along with further work on the Harcastle Tunnels in 1824-7, and the Macclesfield Canal, which was opened in 1831. These were followed by the construction of the railways in the late 19th century, such as the Audley Branch Railway which opened in 1870 with branches to the Jamage, Chesterton and Bignall Hill collieries.

Deep mining developed in the 19th century with technological innovations to deal with the ground water. In some places drains were cut into the sides of mines, for example the Harcastle Tunnel carrying the railway line is reported to have drained the nearby mine. Elsewhere engines were frequently used to pump the water out (Sherlock 1976, 91).

The mining sites vary in scale and form. The most northerly of the sites are predominantly post-medieval in date and generally tend to be of a smaller scale than those towards the south of Kidsgrove. The variability of the coal seams in terms of accessibility is one explanation for variations in the size and form of the mining sites. For example, surface mining has led to the extensive areas of small extractive pits, shafts and their associated shaft mounds, also known as bell pits. It should be noted that elements of the mines could have earlier medieval origins, but this cannot be distinguished by aerial survey.

The 20th century features comprise the previously discussed mining activities and the several Second World War air raid shelter sites. The extraction of coal, iron and clay and their associated works became more extensive in northern Staffordshire during the first half of the 20th century. The current study area is located on the west edge of the Potteries, and highlights the extensiveness of the industrialisation of north Staffordshire.

7.4 Features of unknown date

Features of unknown date usually consist of isolated features, lacking definitive features for dating purposes and frequently of potential natural origin; within the project area a single record for fragments of a number of ditches was recorded as such at Norbury (1590129).

8 OUTCOMES AND SIGNIFICANCE

8.1 Assessment of Significance: Phase 1 and 2

A rapid assessment of the archaeological significance of the monuments identified in both phases 1 and 2 highlighted two sites for further investigation and suggested scheduling reassessment. The most significant site is the Neolithic causewayed enclosure at Mavesyn Ridware. This is one of only two known examples in the County and resembles the example found at Alrewas. The site is visible as well-defined cropmarks, mapped from air photography taken over many years. Geophysical survey and trial trenching undertaken by Henry Chapman and Paul Garwood at the University of Birmingham (Ian George pers.comm.) have confirmed that the monument survives below ground. The other site is the Augustinian Cell of Ranton Abbey. The moated area of the site, containing the church (the only upstanding building remaining on the site), is an existing Scheduled Monument. The additional evidence produced by the detailed aerial survey provides evidence for a much more extensive complex, and potential evidence for an associated mill. The extensive earthworks recorded surrounding the moat enclosure, including field boundaries, water channels and the potential monastic precinct's southern boundary, need further investigation to assess the significance of the associated archaeological remains and whether the scheduled area should be increased.

8.2 Project Outcomes

Whilst the variety of the recorded monuments is more limited than was identified during the Phase 1 project, the number of new records per km² is similar, recording a significant number of new monuments across the project areas. This has considerably improved archaeological knowledge, particularly for the medieval and post-medieval periods in terms of the extent and type of land-use. The project has highlighted the significant industrial heritage in this area on the periphery of the Potteries, which appears to have been little investigated in comparison to the coalfields of southern Staffordshire, including Cannock Chase (for example Sherlock 1976). Further detailed research is needed to investigate the early origins of coal and ironstone mining and its link to the other industries in the region. Desk-based research should include the use of historic Ordnance Survey maps, which were found to be a particularly useful resource for the late post-medieval and 20th century mining sites. In conjunction with this, the surviving evidence for medieval and post-medieval field systems (including ridge and furrow ploughing) and their relationship with industrial sites and activities in the landscape, is another area in which further examination would add greatly to archaeological knowledge for the region.

The poor visibility of sites of later prehistoric and Roman date is noticeable. The evidence does not imply the area was devoid of activity during these periods, simply that the local soil and geology conditions together with the subsequent and current land-use are not conducive for their detection by aerial survey. Geophysical survey has already proved to be of use in the investigation of The Bridestones and should be considered as a technique for further investigations. Find spots recorded by the HER and Portable Antiquities Scheme suggest organised field walking and metal detecting in the areas of arable cultivation could improve the definition of areas of activity, for example targeting the suggested earthworks of the Roman road.

Overall, the Phase 2 project has not produced the breadth of archaeological sites mapped and recorded during the first Phase but has improved significantly the archaeological record and understanding of these additional sample areas. This new evidence will guide the management of future developments within these areas and help inform future archaeological investigations, including further aerial survey in Staffordshire.

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APPENDIX 1 1:10,000 MAP SHEETS

MAP	BLOCK	AUTHOR	Km Squares	Collection Numbers:
SJ 72 SE	3	SB	25	NRHE Parent Collection: EHC01/221
SJ 82 SW	3	SB	25	
SJ 82 NW	3	SB	25	NRHE Event: 1587560
SJ 75 SE	4	SB	13	
SJ 85 SW	4	SB	17	AF00376
SJ 85 NW	4	SB	3	
SJ 85 NE	4	SB	22	MD002317
SJ 86 SE	4	SB	4	
SJ 95 NW	4	SB	25	
SJ 96 SW	4	SB	3	

APPENDIX 2 AUTODESK MAP LAYERS AND DRAWING CONVENTIONS

Layer Name	Layer content	Attached data tables	Layer colour	Line type
0	None (AutoCAD Map 3D 2008 requirement)	none	7 (white)	CONTINUOUS
BANK	Closed polygons for features such as banks, platforms, mounds and spoil heaps	MONUMENT	1 (red)	CONTINUOUS
DITCH	Closed polygons for cut features such as ditches, ponds, pits or hollow-ways	MONUMENT	3 (green)	CONTINUOUS
EXTENT_OF_FEATURE	Closed polygons outlining complex or extensive remains such as mining or military installations	MONUMENT	30 (orange)	CONTINUOUS
MONUMENT_ POLYGON	Closed polygons encircling all the features recorded within a single NRHE record	MONUMENT	7 (white)	CONTINUOUS
RIDGE_AND_FURROW_ALIGNMENT	Polyline showing the direction of ploughing of ridge and furrow	MONUMENT	4 (cyan)	CONTINUOUS
RIDGE_AND_FURROW_AREA	Closed polygon defining the furlongs or extent of area of ridge and furrow	MONUMENT	4 (cyan)	CONTINUOUS
STRUCTURE	Closed polygons for built features including concrete, metal and timber constructions such as military installations	MONUMENT	190 (purple)	CONTINUOUS
THACHURE	Polyline T-hachure convention to schematize sloped features indicating the top of slope and direction of slope	MONUMENT	5 (blue)	CONTINUOUS

APPENDIX 3 AUTODESK MAP DATA TABLES

MONUMENT DATA TABLE

The Monument Data table consists of nine fields that were input directly through AutoCAD Map 3D 2008. The content of these fields follows those that are entered in the NRHE database.

FIELD NAME	FIELD CONTENT	Sample data
MONARCH	NRHE Unique Identifier (UID)	1592849
PERIOD	Date of features (HE Thesaurus)	POST-MEDIEVAL
NARROW_TYPE	Monument type (HE Thesaurus)	SHAFT
BROAD_TYPE	Monument type (HE Thesaurus)	COLLIERY
EVIDENCE_1	Form of remains (HE Thesaurus) as mapped	EARTHWORK
PHOTO_1	Reference for the photograph from which the feature was mapped and the date of photography	RAF/CPE/UK/1935 RS 4412 17-JAN-1947
EVIDENCE_2	Form of latest evidence (HE Thesaurus) as mapped	LEVELLED EARTHWORK
PHOTO_2	Reference for the photograph from which the latest evidence was taken	PGA Imagery SJ8757 27-AUG-2010
HER_NO	Staffordshire HER record number where applicable.	MST13126

APPENDIX 4 MONUMENT TYPES USED IN THE PROJECT

ADIT
AIR RAID SHELTER
ANGLE TOWER
AUGUSTINIAN CELL
BANK (EARTHWORK)
BOUNDARY BANK
BOUNDARY DITCH
BOWL BARROW
BRICK AND TILEMAKING SITE
BRICKFIELD
BRICKFIELD/SANDSTONE QUARRY
BRICKWORKS
BUILDING
CARRIAGEWAY
CHAMBERED LONG CAIRN
CHIMNEY
CHURCH
CLAY PIT
CLAY PIT/RESERVOIR
COAL MINING SITE
COLLIERY
COLLIERY/BRICK AND TILEMAKING SITE
COLLIERY/BRICKWORKS
COLLIERY/CHEMICAL WORKS
COLLIERY/IRON WORKS
COLLIERY/IRONSTONE MINE
COLLIERY/OPEN CAST MINE
COLLIERY/TRAMWAY
COOLING POND
CURVILINEAR ENCLOSURE
DAM
DITCH
DRAIN
EARTHWORK (BANK)
ENGINE HOUSE
EXTRACTIVE PIT
FIELD BOUNDARY
FIELD BOUNDARY/DRAIN
FIELD BOUNDARY/HOLLOW WAY
FIELD BOUNDARY/PLATFORM
FIELD BOUNDARY/TRACKWAY
FIELD SYSTEM
GARDEN FEATURE
HOLLOW
HOLLOW WAY
HOLLOW WAY/FIELD BOUNDARY
LEAT
LYNCHET
MARL PIT
MILL
MINE
MINERAL RAILWAY
MOAT
MONASTIC PRECINCT
MOTTE
MOUND
NARROW RIDGE AND FURROW
PARK PALE
PIT
PIT ALIGNMENT
PIT ALIGNMENT/FIELD BOUNDARY
PLATFORM
PLOUGH HEADLAND
POND
POND/EXTRACTIVE PIT
QUARRY
RAILWAY EMBANKMENT
RAKE
RECTILINEAR ENCLOSURE
RESERVOIR
RIDGE AND FURROW
RINGWORK
ROAD
ROUND BARROW
SAND PIT
SAND PIT/CLAY PIT
SAND WORKINGS
SANDSTONE QUARRY
SETTLEMENT
SHAFT
SHAFT MOUND
SPOIL HEAP
SPOIL HEAP/TRAMWAY
TILE WORKS

TRACKWAY
TRACKWAY/ROAD
TRAMWAY
WATER CHANNEL
WATER MEADOW