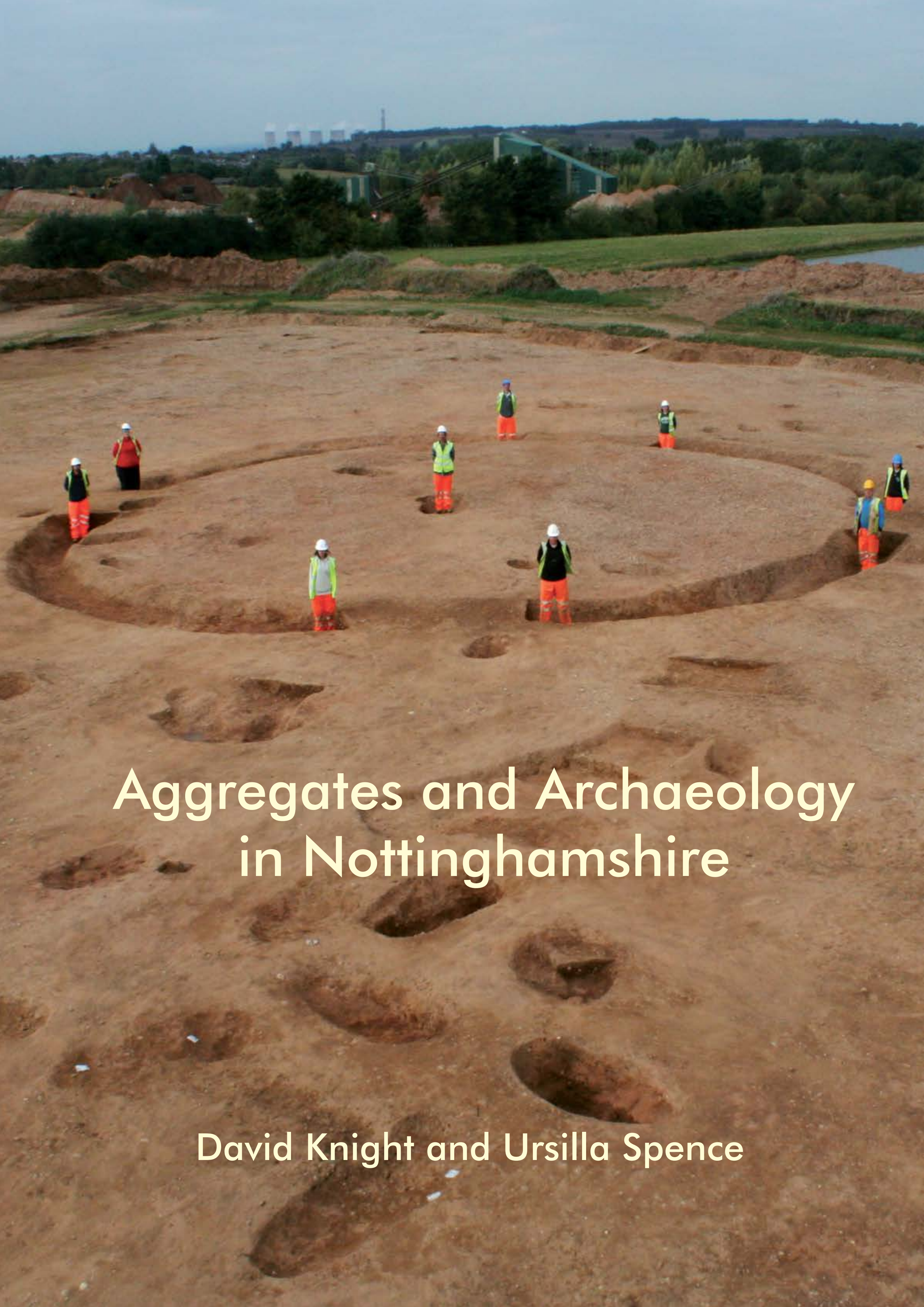

Aggregates and Archaeology in Nottinghamshire

David Knight and Ursilla Spence

This guidance document provides a concise summary of the Nottinghamshire Aggregates Resource Assessment, which was undertaken jointly by staff of Nottinghamshire County Council and Trent & Peak Archaeology from 2009 to 2012. This project was conducted with funding from the Aggregates Levy Sustainability Fund, distributed by English Heritage on behalf of the Department of Environment, Food and Rural Affairs (Defra), and has been guided by a Steering Group including representatives of the aggregates industry, English Heritage, British Geological Survey and the planning, contracting and academic sectors (Section 10). For clarity, aggregates are defined in this guidance document as fine to coarse particulate inclusions used in construction, and in the context of Nottinghamshire's raw material resource comprise sand, gravel and crushed limestone (Harrison *et al.* 2002).

This booklet has been written by David Knight (TPA) and Ursilla Spence (NCC), with important contributions from Virginia Baddeley (NCC), David Budge and Andy Gaunt (both formerly of NCC). It focuses upon the assessment, evaluation and mitigation techniques that should be employed during the development of archaeological schemes of treatment in advance of aggregates extraction and the research priorities that should inform these, and draws upon an on-line report incorporating detailed assessments by period of the archaeological remains that have been recorded in the aggregates-producing areas of Nottinghamshire. This information is presented in the full report in a tabular format for ease of reference, with details for each class of site of appropriate assessment, evaluation and mitigation strategies.

It is expected that this document, together with the on-line report and the GIS that underpins it, will be consulted prior to the development of archaeological schemes of treatment in the aggregates-producing areas of the County. A copy of this booklet and the full project report may be downloaded from the websites of Nottinghamshire County Council (www.nottinghamshire.gov.uk/learning/history/archaeology), Trent & Peak Archaeology (www.tparchaeology.co.uk/notts-aggregates-resource-assessment) and the Archaeology Data Service (http://dx.doi.org/10.5284/1018086). The GIS may be consulted by application to the Nottinghamshire Historic Environment Team (www.nottinghamshire.gov.uk/learning/history/historicbuildings/historicenvironmentrecord) and should be consulted at the earliest opportunity to identify the landforms in proposed development areas.

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Front cover: Early Bronze Age ring-ditch, excavated in advance of quarrying at East Leake. The ring-ditch demarcated a funerary barrow, which served later as the focus of an Anglo-Saxon inhumation and cremation cemetery. © Trent and Peak Archaeology, on behalf of Cemex Ltd

Facing page: Iron Age boundary ditch preserved beneath alluvial deposits masking river terrace gravels of the Trent at Hoveringham Quarry. The ditch is flanked by the remains of a sandy clay and gravel bank sealing a buried soil of dark brown silty clay loam above a clayey peat. © Trent & Peak Archaeology, on behalf of Lafarge Tarmac Ltd

Back cover: excavations in progress adjacent to the River Idle at Tiln, showing a complex network of ditched enclosures and other features associated with Iron Age and Roman settlement of the river terraces and floodplain. Photograph by Skycam Aerial Photography (Negative CCN) on behalf of Trent & Peak Archaeology and Lafarge Tarmac Ltd

1. INTRODUCTION

1.1 BACKGROUND

The research that underpins this guidance document was conducted between 2009 and 2012 with funding from the Aggregates Levy Sustainability Fund, distributed by English Heritage on behalf of the Department of Environment, Food and Rural Affairs (Defra). The full report (Knight and Spence 2012) can be downloaded from the websites of Nottinghamshire County Council[1], Trent & Peak Archaeology[2] and the Archaeology Data Service[3]. It is supported by a GIS that is curated by Nottinghamshire County Council and may be consulted by application to the Nottinghamshire Historic Environment Team[4].

From the national perspective, the project forms part of a package of Aggregates Resource Assessments that together provide a valuable resource for assessing the archaeological potential of the aggregates-producing areas of England. In the West and East Midlands, Resource Assessments have been completed for Derbyshire and the Peak District (Brightman and Waddington 2011), Leicestershire (Robinson and Clark 2012), Lincolnshire (Groundwork Archaeology 2006), Warwickshire (Alexander 2008) and Worcestershire (Jackson and Dalwood 2007), and aggregates or minerals assessments are currently in preparation for Herefordshire, Northamptonshire, Shropshire and Staffordshire. We have liaised closely with colleagues working in neighbouring areas of the Midlands with the aim of achieving compatible end products, and with this in mind have employed the landform element methodology that was pioneered in the Till-Tweed catchment (Passmore and Waddington 2009) and extended subsequently to Derbyshire and the Peak District (Brightman and Waddington 2010; 2011).

The research agenda and strategy proposed in this document builds upon the research framework published in *East Midlands Heritage* (Knight, Vyner and Allen 2012)[5] and the Research Strategy developed by Trent Valley GeoArchaeology.[6] The latter is a co-operative of stakeholders, including researchers, heritage managers and representatives of the quarry industry. It provides a mutually supportive framework for multidisciplinary research in the West and East Midlands, with a firm focus upon the Trent catchment, and has supported a wide variety of research projects in Nottinghamshire and adjoining Counties. The most relevant of these in the present context are *Trent Valley Landscapes* (Knight and Howard 2004) and *Making Archaeology Matter* (Knight and Vyner 2006). Together with the Quaternary Research Association's field guide to the Trent Valley and adjoining regions (White *et al* eds 2007) and a recent assessment of Pleistocene archaeological resources preserved in quarries along the Trent and beyond (Buteux ed, 2009), these provide valuable foundations for assessment of the County's archaeological resource and for the development of appropriate and cost-effective assessment, evaluation and mitigation strategies.

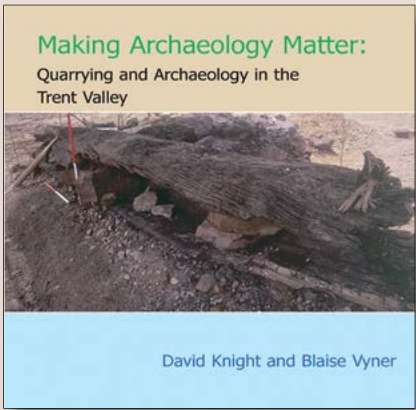

Fig. 1.1. A useful summary of assessment, evaluation and mitigation techniques of direct relevance to aggregates extraction in Nottinghamshire may be found in the above document. © York Archaeological Trust

Efforts have been made to ensure compatibility with current national guidelines for archaeological investigations in advance of mineral extraction. These are expounded in a suite of guidance booklets[7], including, most importantly, the Practice Guide for mineral extraction and archaeology (MHEF 2008)[8]. Readers are referred to the latter document for a valuable summary of appropriate assessment, evaluation and mitigation techniques and to the Sustainable Aggregates website[9] for an up-to-date and concise summary of the planning background, good practice and other operational considerations.

1 www.nottinghamshire.gov.uk/learning/history/archaeology

2 www.tparchaeology.co.uk/notts-aggregates-resource-assessment

3 http://dx.doi.org/10.5284/1018086

4 www.nottinghamshire.gov.uk/learning/history/historicbuildings/historicenvironmentrecord/

5 www.tparchaeology.co.uk/east-midlands-research-strategy

6 www.tvg.bham.ac.uk

7 See www.sustainableaggregates.com/sourcesofaggregates/landbased/historic_environment_introduction.htm for useful compendium of guidance documents

8 www.helm.org.uk/guidance-library/mineral-extraction-and-archaeology

9 See footnote 7

1.2 AIMS AND OBJECTIVES

The principal aims of the Aggregates Resource Assessment were to assess the archaeological resource of those parts of Nottinghamshire that are potentially available for aggregates extraction, provide guidelines for assessment, evaluation and mitigation in advance of mineral extraction and define the key priorities for research. Nottingham City, which incorporates no areas that are likely to be targeted for aggregates extraction in the foreseeable future, was excluded from consideration, although archaeological sites within the City boundary are shown in the maps that accompany this report. The built environment resource was also excluded, although full consideration was given to earthworks and other archaeological remains indicative of standing buildings, and it is hoped that opportunities will arise in the future to integrate more effectively the archaeological and built environment heritage.

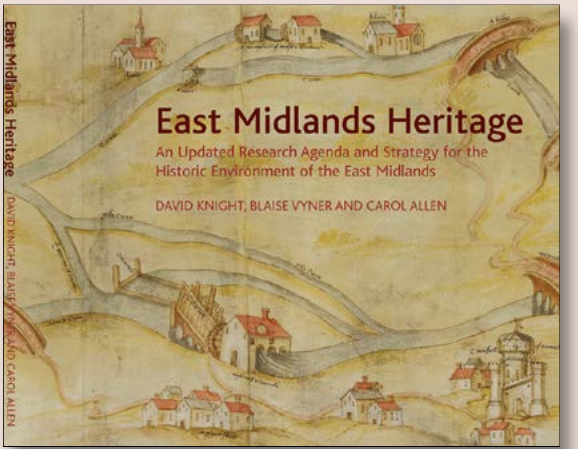

Fig. 1.2. The potential of the County's aggregates-producing areas for addressing the research priorities identified in the *Updated Research Agenda and Strategy for the Historic Environment of the East Midlands* is outlined in Section 8.
© English Heritage

It is hoped that this document will provide a useful synthesis of the archaeological resource for the aggregates industry, planners, curators, consultants, contracting units and other historic environment stakeholders, facilitate decisions on strategic planning, management and the preservation of archaeological remains and historic landscapes, and increase general awareness of Nottinghamshire's archaeological resource. For this purpose, we have compiled tabular summaries of the archaeological evidence by period, with the aim of creating a user-friendly resource that may be easily updated as new discoveries emerge. These tables may be viewed in the on-line archive report, together with all of the distribution maps generated from the project GIS, and in this document we include a concise summary by period of the data contained in these tables and a selection of the maps compiled during the project. The resource assessment tables provide the springboard for tabular summaries of assessment, evaluation and mitigation techniques that should be considered when developing archaeological schemes of investigation (Tables 7.1–7.8) and a research agenda and strategy for each archaeological period (Tables 8.1–8.8). These tables should be viewed as works in progress, to be revised on a regular basis as new information emerges, investigative strategies develop and research priorities change.

Attention is focused upon areas where British Geological Survey data indicate bedrock or superficial deposits suitable for use as aggregates, (Harrison *et al* 2002). This has restricted the survey to assessments of the archaeological resource of the Triassic Sherwood Sandstone Group, the Permian Magnesian Limestone escarpment and the Superficial Sands and Gravels (principally of the Trent and its tributaries). Within these zones, we have focused upon areas beyond established settlements that are potentially available for mineral exploitation. References to sites outside the aggregates-producing areas have been made where appropriate, but a systematic survey of the archaeological resource of Nottinghamshire beyond the areas potentially available for aggregates extraction has not been attempted.

The key objectives of the project underpinning this document were to:

1. Define the total aggregates resource of Nottinghamshire and identify, from data held by Nottinghamshire County Council as the County Minerals Planning Authority (MPA), areas of past, present and potential extraction. This embraces all sources of fine to coarse rock particles used in construction, which for the Nottinghamshire minerals industry comprises sand, gravel and crushed limestone (Harrison *et al* 2002).

2. Define a series of **Aggregate Character Areas** (Section 4.2) by reference to variations in the character of the superficial and bedrock deposits that may be utilised for aggregates production, bearing in mind that superficial aggregates deposits may sometimes overlie bedrock resources. These areas, of Magnesian Limestone, Sherwood Sandstone and Superficial Sands and Gravels, form the foundation of this assessment, and it is hoped will provide a clear framework for decision-making by mineral planners, developers, heritage professionals and other stakeholders.

3. Assess from Historic Environment Record (HER) data and other sources the archaeological resource of each Aggregate Character Area (ACA) and of the landform elements within these. As noted above, full details are provided in the on-line archive report, and here we provide a concise synthesis for each period (Section 6) and tabulated summaries of the archaeological resource of each landform (Section 7). The Nottinghamshire HER was enhanced for this purpose, and all available data were incorporated into a Geographical Information System (GIS) tailored to the needs of this assessment. Interpretation of the GIS data has been facilitated by the sub-division of each ACA into **Landform Elements**, following the terminology proposed by Passmore and Waddington (2009, 5-7; Chapter 2.3). Landform elements may be defined simply as geomorphologically and topographically distinct landform units, and as demonstrated by Passmore and Waddington in the Till-Tweed basin provide a valuable framework for assessing spatial variability in the archaeological and environmental resource and for identifying appropriate assessment, evaluation and mitigation techniques. The landform element approach forms the foundation of the Derbyshire and Peak District Resource Assessment (Brightman and Waddington 2011), and was employed in this study with the aim of ensuring compatibility between the Derbyshire and Nottinghamshire assessments.

4. Develop recommendations for the most appropriate assessment, evaluation and mitigation techniques to be adopted for the identification and study of particular categories of site within each landform element (Section 7).

5. Develop a period-based archaeological research agenda and strategy tailored to the needs of each Character Area (Section 8), taking into account the research priorities identified in *East Midlands Heritage* (Knight, Vyner and Allen 2012).

6. Increase the awareness of the minerals industry, planners and other historic environment stakeholders of the archaeological resource preserved within the aggregates-producing areas of Nottinghamshire.

It is anticipated that assessment, evaluation and mitigation strategies will evolve as knowledge accumulates and techniques of investigation develop. This assessment should be seen, therefore, as a living document requiring periodic updating as our understanding of the archaeology of aggregates-producing areas in Nottinghamshire grows and the effectiveness of particular investigative strategies develops.

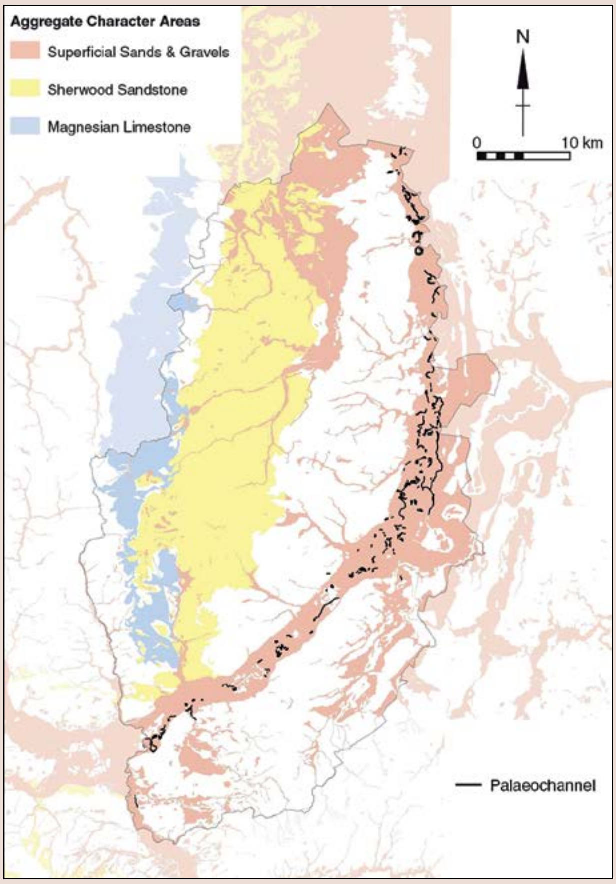

Fig.1.3. Map of Aggregate Character Areas, showing the close association between palaeochannel landforms plotted along the Nottinghamshire Trent Valley and the Superficial Sands and Gravels (source: Notts. HER)

Fig.1.4. Palaeochannel landforms adjacent to the River Trent near North Muskham, showing clearly from the air as dark bands of moisture-retentive alluvium. The sands and gravels into which the channels were cut preserve extensive cropmarks, including a cluster of subsquare ditched enclosures that on the basis of parallels with similar features in eastern Yorkshire may have demarcated Iron Age funerary barrows. © English Heritage (Derrick Riley Collection: DNR 427/31)

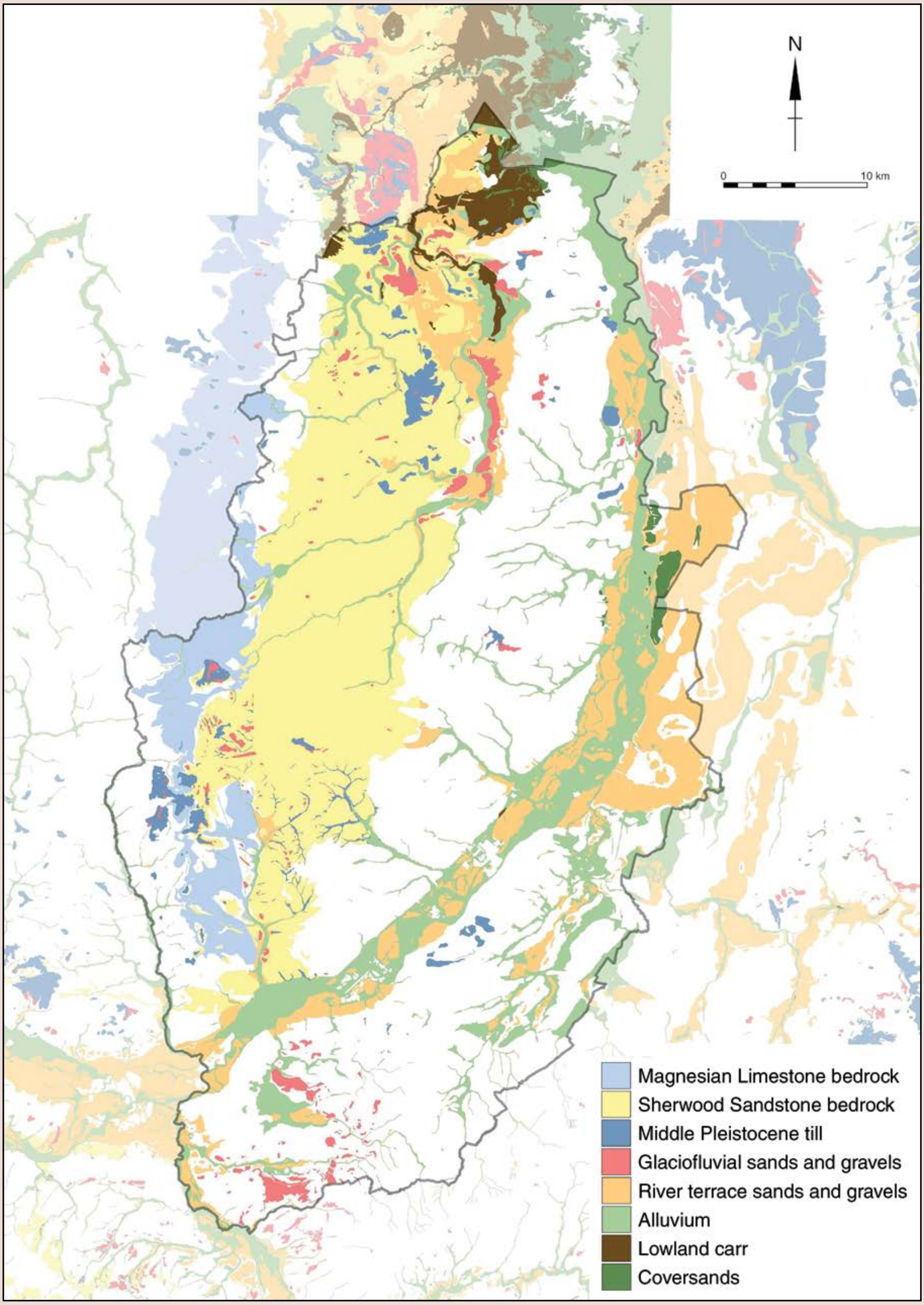

Fig. 1.5. The distribution of landform elements identified in the Aggregate Character Areas of Nottinghamshire and adjacent areas (excluding palaeochannels: see Fig. 1.3). This shows clearly the sub-division of the Superficial Sands and Gravels into glaciofluvial, river terrace and coversand deposits, the masking effect of till, alluvium and lowland carr, and the veneer of glaciofluvial sands and gravels that masks parts of the Sherwood Sandstone and Magnesian Limestone outcrops (source: Notts. HER)

2. THE NOTTINGHAMSHIRE AGGREGATES RESOURCE

The history of aggregates extraction in Nottinghamshire may be traced back at least to the Roman period, when sand and gravel was excavated from quarry pits or roadside ditches to provide metalled road surfaces – as demonstrated, for example, by archaeological excavations along the Fosse Way near the Roman small towns of *Ad Pontem (*Thorpe), *Crococolana* (Brough) and *Margidunum* (East Bridgford). Documentary and cartographic sources provide clear evidence for the use of aggregates from the medieval period for purposes such as land improvement and road construction, but the large-scale mechanical extraction of aggregates dates only from the mid-20th century (Cooper 2008).

The extent of past quarrying and its impact upon the landscape can be judged from the map below, which shows past as well as current aggregates extraction areas. This demonstrates a strong focus upon the Superficial Sands and Gravels of the Trent and Idle Valleys, but also the significant impact of quarrying upon the historic environment of the Sherwood Sandstone and Magnesian Limestone.

Nottinghamshire is currently one of the leading UK producers of sand and gravel, for use principally in concrete, mortar and asphalt production. By far the greatest volume of material derives from the **Superficial Sands and Gravels**, and in particular the river terrace and sub-alluvial sands and gravels of the Rivers Trent and Idle. Key quarries, each encompassing a variety of landforms with rich archaeological resources, include Besthorpe and Langford Lowfields along the Trent to the north of Newark and Finningley in the extreme north of the County. Glaciofluvial deposits are worked at East Leake in south Nottinghamshire and around Retford in the north-west of the County, but in terms of volume are comparatively minor sources of aggregates. Coversands, which occur intermittently as dunes or as sheets of sand in the Idle and lower Trent Valleys, are also exploited (notably at Besthorpe and Girton). Again, however, they provide a small volume of material by comparison with the river terrace and sub-alluvial sands and gravels.

The bedrock sandstones and conglomerates of the Triassic **Sherwood Sandstone Group**, especially those of the Nottingham Castle Formation, are quarried for aggregates at quarries from Scrooby and Bawtry in the north of the County to just north of Nottingham. This geological formation is largely composed of fine sand, and is generally more suitable for uses such as building sand and asphalting. The landform is also notable for its importance as a source of silica sand, especially from weakly cemented parts of the sequence, and fine-grained and weakly cemented Sherwood Sandstone is worked for silica sand near Mansfield at Ratcher Hill and Oakfield Lane. This provides a source of fine aggregates, which are employed for specialist uses such as foundry sands and as sands for shotblasting, block paving and asphalt.

Nottinghamshire is also a minor supplier of crushed rock for purposes such as sub-base roadstone, drainage media and constructional fill. This is derived from the Cadeby Formation of the Permian **Magnesian Limestone** escarpment that extends northwards from Nottingham into Derbyshire and Yorkshire. Large-scale production of crushed aggregates ceased in the early 1990s, but significant extraction continues at Linby, between Nottingham and Mansfield, and has recently started again at Steetley, near Worksop.

Attention should be drawn finally to a scatter of historic quarries along the **Jurassic Limestone** escarpment of SE Nottinghamshire. This landform is no longer exploited for crushed rock aggregates, and hence was excluded from this assessment.

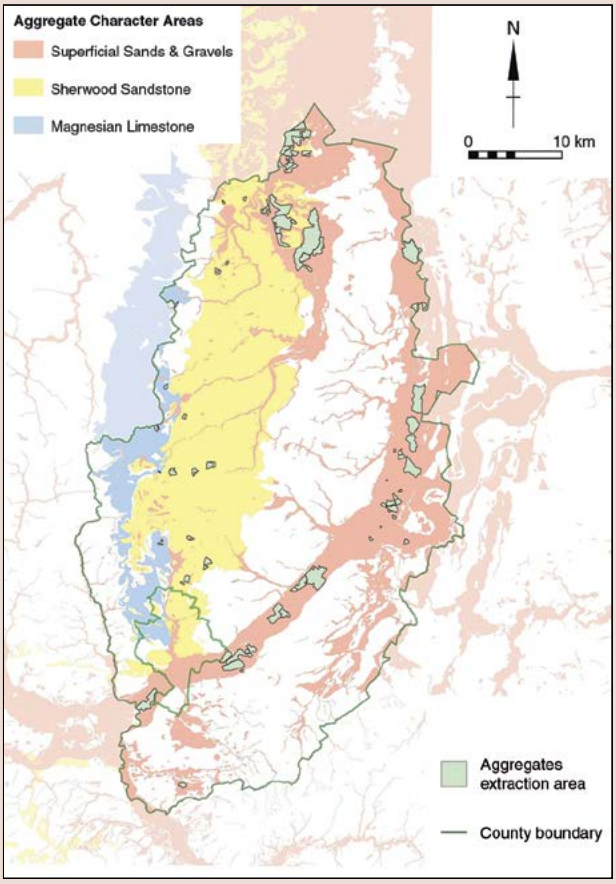

Fig. 2.1. Past and current aggregates extraction areas in Nottinghamshire, showing the boundaries of Nottinghamshire and the City of Nottingham (source: Notts HER)

3. THE PLANNING FRAMEWORK

3.1 THE NATIONAL CONTEXT

Planning policy and practice in England have undergone some major changes during the life of this project[10]. In March 2012, the *National Planning Policy Framework* was published by the Department for Communities and Local Government (DCLG 2012). This replaced most of the existing Minerals Planning Guidance and Minerals Planning Statements, with the exceptions of documents listed on the DCLG website[11]. The latter include the guidance documents accompanying *Minerals Policy Statement 1: Planning and Minerals* (DCLG 2006), *Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England* (ODPM 2005) and *Planning Policy Statement 5: Planning for the Historic Environment* (DCLG 2010).

Fig. 3.1. *Planning Policy Statement 5* (PPS5) and its successor, the *National Planning Policy Framework* (DCLG 2012. © Crown Copyright)

Although the documents that they were intended to support have been replaced, the guidance documents accompanying MPS1, MPS2 and PPS5 remain valid pending completion of a review of the guidance underpinning national planning policy. Thus, in a revision note introducing the *PPS 5 Practice Guide* in June 2012, English Heritage noted that 'the references to PPS5 policies in this document are obviously now redundant, but the policies in the NPPF are very similar and the intent is the same, so the Practice Guide remains almost entirely relevant and useful in the application of the NPPF.'

The correspondence between the NPPF and PPS5 derives from the direction of travel provided in 2010 by *The Government's Statement on the Historic Environment for England* (DCMS 2010)[12]. As with PPS5, which was also published in 2010, this document emphasised the importance of informed decision-making on the basis of proportionality, and made explicit the need for high-quality information and advice to be made available to decision-makers.

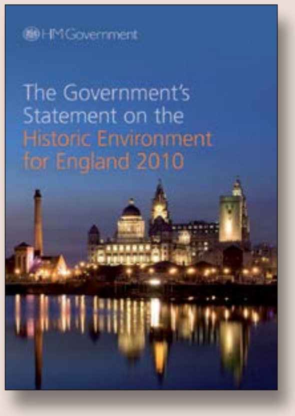

Fig.3.2. *The Government's Statement on the Historic Environment for England* (DCMS 2010; © Crown Copyright)

In its 2010 Statement, the Government outlined its strategic aims for the historic environment under the headings of 1. strategic leadership, 2. protective framework, 3. local capacity, 4. public involvement, 5. direct ownership and 6. sustainable future. Strategic Aims 2, 3 and 6 are particularly relevant in the context of this Resource Assessment, and are summarised below:

Strategic Aim 2 (protective framework): ensure that all heritage assets are afforded an appropriate and effective level of protection, while allowing, where appropriate, for well-managed and intelligent change.

Strategic Aim 3 (local capacity): encourage at a local level structures, skills and systems which:
1. promote early consideration of the historic environment.
2. ensure that local decision-makers have access to the expertise they need.

10 See www.sustainableaggregates.com/sourcesofaggregates/landbased/historic_environment_introduction.htm for an up to date summary of legislation and planning policy

11 www.gov.uk/government/organisations/department-for-communities-and-local-government

12 http://webarchive.nationalarchives.gov.uk/ + http:// www.culture.gov.uk/reference_library/publications/6763.aspx

3. provide sufficiently skilled people to execute proposed changes to heritage assets sensitively and sympathetically.

Strategic Aim 6 (sustainable future): seek to promote the role of the historic environment within the Government's response to climate change and as part of its sustainable development agenda.

The strategic aims are presented in the Government's Statement in the context of caring for the historic environment. They are restated and consolidated across all aspects of planning in the NPPF, demonstrating thereby the Government's direction of travel and the continuing validity of the Statement.

Sections 12 and 13 of the NPPF deal respectively with 'conserving and enhancing the historic environment' and 'facilitating the sustainable use of minerals', effectively covering the two subjects in a total of 24 paragraphs over seven pages.

Section 12 stresses proportionality, information and expert advice as the keys to good planning policies and decisions on the historic environment. In particular, great emphasis is placed upon the need to balance the conservation of heritage assets with information about their significance. It is noted that 'a balanced judgement will be required, having regard to the scale of any harm or loss and the significance of the heritage asset[13] [while] substantial harm to or loss of designated heritage assets of the highest significance, notably scheduled monuments, should be wholly exceptional.'[14]

Appropriate consideration of the settings of heritage assets is also covered. However, where the loss of assets is acceptable, it is stated that local planning authorities 'should also require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence publicly accessible.'[15]

Section 13 restates the axiom that minerals are finite natural resources, which can only be worked where they are found, before setting out the sustainability principles that should be adhered to during the preparation of strategic plans by local authorities. This includes the specification of environmental criteria against which planning applications will be assessed. These should ensure that there are no 'unacceptable adverse affects on the natural and historic environment' arising from either the direct or indirect impacts of minerals extraction in terms, for example, of increasing surface water flow and flood risks (paragraph 143). In addition, it is argued that policies should ensure that high-quality restoration takes place for 'agriculture (safeguarding the potential of the best and most versatile agricultural land and conserving soil resources), geodiversity, biodiversity, native woodland, the historic environment and recreation' (paragraph 143).

Although not specifically relevant to aggregates extraction, paragraph 144 of Section 13 includes consideration of the need to meet demands for small-scale extraction of building stone for the repair of heritage assets. This demonstrates that, while a very concise document, care has been taken in its preparation to highlight a wide range of issues.

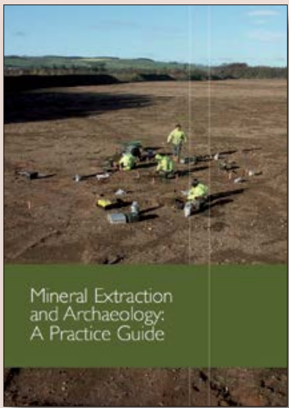

Fig.3.3. *Mineral Extraction and Archaeology: A Practice Guide* (MHEF 2008; © English Heritage)

For minerals planning, the advice of PPS 5, which is reiterated in the NPPF and the Government's Statement, had been anticipated by *Mineral Extraction and Archaeology: A Practice Guide* (MHEF 2008). The Minerals and Historic Environment Forum (MHEF) represents the full range of stakeholders in the minerals planning process, and is an essential discussion forum for all involved in that process. The stated purpose of the MHEF *Practice Guide* is 'to provide clear and practical guidance on the archaeological evaluation of mineral development sites [and to] ensure that adequate information is acquired in a cost-effective way so that an informed planning decision can be made'.[16]

The MHEF *Practice Guide* is a practical document, which helps explain the vision, aims and practice of

13 *NPPF*, paragraph 135

14 *NPPF*, paragraph 132

15 *NPPF*, paragraph 141

16 *MHEF* 2008,1

the suite of policy and guidance documents referred to above. Its strength is that it is a consensual document, endorsed by the Forum membership, and given that it is referred to in paragraph 101 of the PPS5 *Practice Guide* is thus a material consideration in the planning process. This Resource Assessment is intended to complement the MHEF *Practice Guide* by detailing the known archaeological resource of Nottinghamshire's aggregates-producing areas and by recommending the most appropriate assessment, evaluation and mitigation techniques to be conducted in advance of and during extraction in particular landforms.

3.2 THE NOTTINGHAMSHIRE CONTEXT

Nottinghamshire County Council acts as the Minerals Planning Authority (MPA) for the whole of the County. The **Nottinghamshire Minerals Local Plan** (NMLP), published by the County Council in 2005, provides the current policy document and will remain in place until adoption of the **Minerals Core Strategy**.

Most of the policies in the NMLP were saved by the Secretary of State in December 2008, but the following policies, which repeat national guidance or relate to used mineral allocations, were deleted from the document:

M3.2: Planning obligations
M3.21: Protected Sites
M6.5: Hoveringham (Bleasby) Allocation
M6.9: Lound Allocation
M6.10: Misson (Finningley) Allocation
M7.4: Scrooby Top Allocation
M11.1: Kirton Allocation.

The NMLP will be replaced in due course by the **Minerals Core Strategy**. This will provide guidance on how much mineral will be needed over the next ten to twenty years and in broad terms the preferred areas for extraction. It will also provide an indication of the potential impact of quarrying upon the archaeological resource of the aggregates-producing areas of the County. Adoption is scheduled for 2013, at which point it will replace the NMLP.

Work is currently being undertaken on a **Site-Specific Document**, aimed at identifying sites with the potential to be allocated for mineral extraction, but this document cannot progress far until the Minerals Core Strategy has been adopted. The results of this Aggregates Resource Assessment have clear potential, therefore, to feed directly into the on-going assessment of potential mineral allocations.

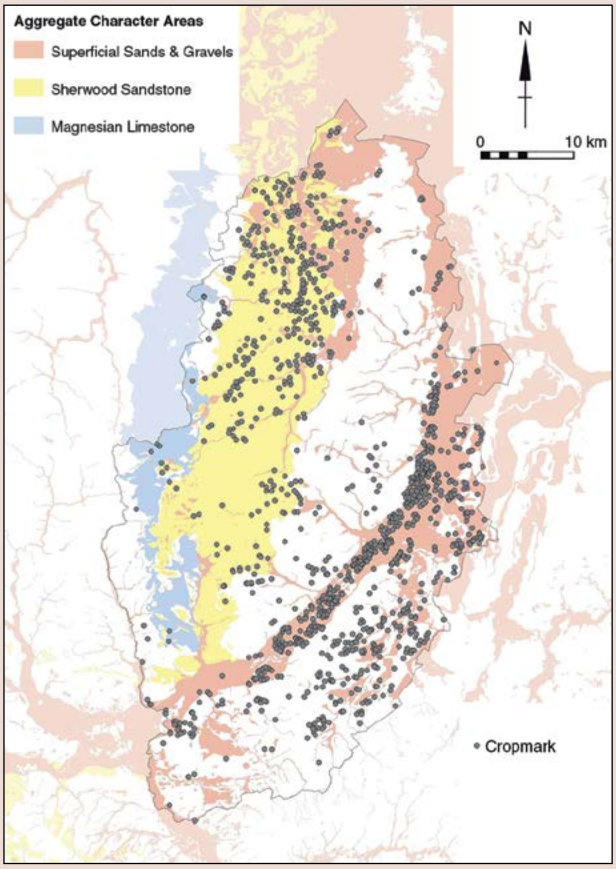

Fig. 3.4. Distribution of recorded cropmarks, showing the particular effectiveness of air photographic survey on the Superficial Sands and Gravels and Sherwood Sandstone (source: Notts HER)

The MPA is currently defining **Minerals Safeguarding Areas**. These represent areas with proven mineral resources, within which districts and developers must pay due attention to the potential of alternative developments to sterilise the mineral resource. A draft consultation document has been considered by districts and developers. However, until the Minerals Core Strategy and allocation documents are completed, it is not possible to elaborate further on the potential scale of future aggregates extraction or, therefore, the impact of future quarrying upon the archaeological and built environment resource.

This Resource Assessment provides a valuable addition to each of the above documents. It provides a strategic overview of aggregates deposits and their archaeological resource, which will assist future decision-making on the protection, management and investigation of archaeological sites and historic landscapes through the planning process. It is hoped that resources will be made available for periodic updating of this document, bearing in mind the steady accumulation of new data as a result principally of developer-funded archaeological investigations, advances in prospection techniques and changing research priorities.

4. METHODOLOGY

4.1 DEFINING THE AGGREGATES RESOURCE

A valuable overview of the County's mineral resources is provided in a report prepared for the Department of Transport, Local Government and the Regions' research project Mineral Resource Information in Support of National, Regional and Local Planning (Harrison *et al.* 2002). The map accompanying this report distinguished all mineral resources that at the time were viewed as potentially of economic interest, sites of active and past mineral extraction that had been the subject of planning permissions and locations where aggregates were extracted without permission (either illegally or from historic quarries). It was derived from British Geological Survey geological data, with refinements to take account of the potential depth of overburden and the possible quantity of the mineral resource, and was added as a layer to the project GIS.

Although a useful guide to the County's mineral resources, it became apparent from discussions with Steering Group members (Section 10) that some areas that would now be considered as commercially viable for extraction had been excluded from consideration. In view of this, it was decided to broaden the current assessment to include the full extent of each of the aggregates-producing geologies, regardless of current economic viability. This has ensured that the study area will not need to be extended in the future. BGS map data were employed for this purpose, and are available as a layer on the project GIS.

BGS base map data also provide a more precise record of the spatial extent of each Aggregate Character Area and landform element than the report published in 2002. Use of BGS data has assisted studies of associations between monument types and landform elements, although the boundaries between landforms are often difficult to locate precisely on the basis of existing information. Locational analyses are also complicated by the exclusion from the BGS database of information on the spatial distribution of important masking deposits such as talus and colluvium, and thus many subtleties in the spatial distribution of archaeological sites may elude analyses based solely upon current GIS data.

4.2 AGGREGATE CHARACTER AREAS

The minerals information derived from BGS sources has permitted definition of three Aggregate Character Areas, differentiated on the basis of variations in bedrock and superficial geology and the character of the derived aggregates resource. This simple division stems from Steering Group recommendations that the Character Areas should be readily recognisable by minerals industry planners and by other historic environment stakeholders, and was devised in consultation with colleagues in the British Geological Survey, Nottinghamshire County Council and the minerals industry. It is hoped that this will provide a useful framework for assessing spatial variability in the archaeological resource between aggregates-producing areas, and hence will contribute towards the development of assessment, evaluation and mitigation strategies tailored specifically to the requirements of particular aggregates environments.

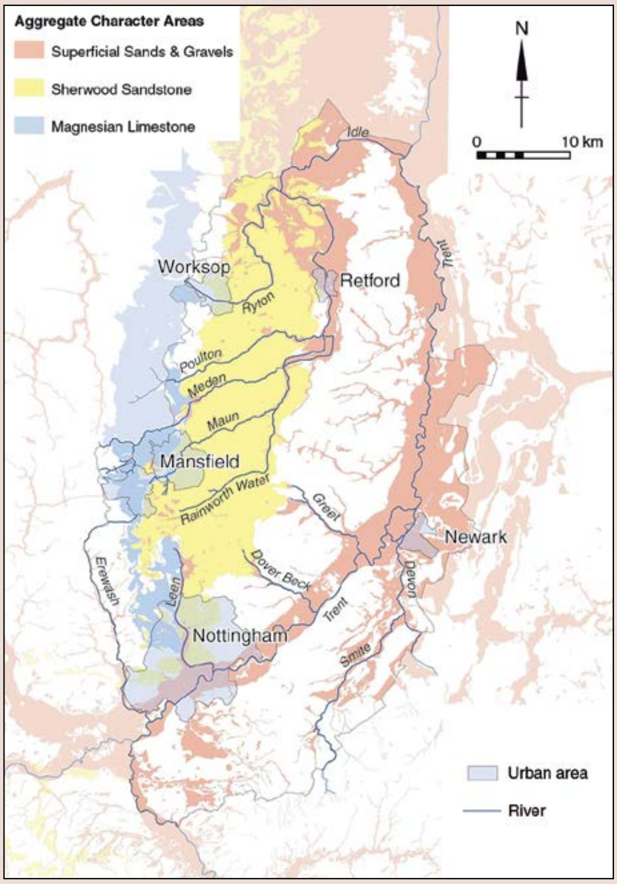

Fig. 4.1. Aggregate Character Areas in relation to main urban centres and modern rivers (source: Notts HER)

Nottinghamshire is a major producer of sands and gravels, which are derived principally from river terrace deposits and to a significantly lesser extent from glaciofluvial sands and gravels, coversands and Sherwood Sandstone Group bedrock. The County is also a minor supplier of crushed rock derived from bedrock sources on the Cadeby Formation of the Magnesian Limestone escarpment. These drift and bedrock sources have been grouped for the purposes of this study into three Aggregate Character Areas, which are defined below.

Superficial (Quaternary) Sands and Gravels

British Geological Survey base mapping permits a basic distinction between a) river terrace sands and gravels, particularly of the Idle Valley, Middle and Lower Trent Valleys, Soar Valley and Vale of Belvoir, b) glaciofluvial deposits formed in close association with Pleistocene glaciers, and (c) the Lateglacial and Early Holocene coversands that are distributed intermittently along the eastern edge of the lower Trent Valley.

Feedback from the Steering Group made it clear that these divisions of the Superficial Sands and Gravels were not necessarily recognised by the industry, which would tend to differentiate aggregates by their commercial end-use rather than geomorphological processes. It was agreed, however, that significant archaeological differences could emerge from assessments of coversands, river terraces and glaciofluvial deposits, which might require the use of different techniques for assessment and evaluation of their archaeological resource. This basic threefold distinction was therefore retained, and forms a key element of the analyses presented below.

Triassic Sherwood Sandstone Group

The Nottingham Castle Sandstone Formation provides aggregates that are mainly friable, loosely consolidated and easily worked. It is extracted at several sites from Nottingham northwards to Scrooby and Serlby in the extreme north of the County. It is predominantly a fine sand with sparse (<2%) gravel and is particularly useful for building sand and asphalting.

Permian Magnesian Limestone

Dolomites and dolomitic limestones of Lower Magnesian Limestone (Cadeby Formation) crop out on the western edge of the County. A small outcrop of the Upper Magnesian Limestone (Brotherton Formation) also exists to the north of Worksop, but has not been exploited commercially in Nottinghamshire due to it being very thin. These limestones are mostly porous, weak and friable, but, although of insufficient strength to yield good quality crushed rock aggregates, are generally suitable for sub-base roadstone, drainage media and fill. Large-scale production of crushed aggregates ceased in the early 1990s, following the exhaustion of reserves at a quarry near Mansfield Woodhouse. Since 2000, production of crushed stone has occurred intermittently at a quarry near Nether Langwith, which serves as a satellite to a quarry at Whitwell in Derbyshire. Small-scale extraction of building stone occurs near Linby, where aggregates can be produced from reject stone.

4.3 LANDFORM ELEMENTS

Landform elements have been differentiated within each Aggregate Character Area on the basis of their age and geomorphology (*cf.* Passmore and Waddington 2009, 5-7; Brightman and Waddington 2010, 4), and provide a useful framework for assessing spatial variability in the archaeological and environmental resource and for understanding processes of landscape evolution. The range of landforms that may be recognised within each Aggregate Character Area was determined in consultation with colleagues working on the Derbyshire and Peak District Aggregates Resource Assessment. Many landform elements occur in both areas, with the notable exception of the coversands of eastern Nottinghamshire, and use of this common methodology aids archaeological comparisons between Counties and the development of a consistent approach to assessment, evaluation and mitigation.

Fig. 4.2. Late prehistoric palaeochannel at Girton: one of many landform elements that contribute to the topographic diversity of the Superficial Sands and Gravels. © Trent & Peak Archaeology, on behalf of Lafarge Tarmac Ltd

A full list of Nottinghamshire landform elements is provided in Table 4.1 below. Correlations are noted in this table with landforms identified in Derbyshire and the Peak District (Brightman and Waddington 2011) and with the Aggregate Character Areas of Nottinghamshire. The mode of formation of each landform, their physical characteristics and the geomorphological processes that may have impacted upon the archaeological resource of each are summarised in the tables that form the core of Section 7. The impact of colluviation and other slope processes upon site visibility and preservation is also considered, but assessment of the full impact of these processes is limited by the paucity of detailed information on the spatial distribution of colluvial and other deposits that might mask archaeological features and deposits.

Geological period	Nottinghamshire Landform Element	ACA	Derbys Landform
Permian *c.*299–251 mya (million years ago)	**Magnesian Limestone bedrock.** This landform element corresponds to areas of the Magnesian Limestone escarpment that are not cloaked by superficial drift deposits, although determination of the actual extent of this landform element is complicated by the existence of colluvium, talus (scree) and other masking deposits that have yet to be mapped systematically. In addition, some thin till deposits may not have been recognised in the field, and the extent of till may be significantly underestimated.	ML	**1c**
Triassic *c.*251–200 mya	**Sherwood Sandstone bedrock.** This landform element corresponds to areas of the Sherwood Sandstone exposure that are not buried beneath superficial drift deposits, although determination of the actual extent of this landform element is complicated by the existence of colluvium and other slope deposits that have yet to be mapped systematically. In addition, some thin till deposits may not have been recognised in the field, and as with the Magnesian Limestone the extent of glacial till across this landform may be significantly underestimated.	SS	**1e**
Pleistocene *c.*1.8mya–*c.* 9500 cal BC	**Middle Pleistocene Tills**, deposited by Anglian (MIS 12) glaciers *c.*425,000 years ago, occur as eroded deposits on higher ground, and may mask Magnesian Limestone or Sherwood Sandstone. The region that is now Nottinghamshire lay beyond the limit of the Late Devensian glaciation of *c.* 20,000 years ago (MIS 2), but it remains uncertain whether the County was affected by the recently identified MIS 8 glacial incursion of *c.*245,000 years ago (Carney 2007; White *et al* 2007, 13).	ML SS	**2a**
	Undifferentiated deposits (including head and talus, formed by freeze-thaw of rocky outcrops in periglacial conditions, colluvium and alluvial fans). These deposits are shown on BGS maps and are indicated on the base map utilised for the project. Deposits may vary significantly in character, however, as also may their archaeological associations. As in Derbyshire and the Peak District, such deposits are excluded from the tables of archaeological associations.	ML SS SSG	**2b**
	Glaciofluvial sands and gravels, formed in close association with Pleistocene glaciers (*e.g.* sub-glacial stream deposits). These superficial deposits may mask Magnesian Limestone and Sherwood Sandstone aggregates resources.	SSG ML SS	**2c**
	River terrace sands and gravels, formed by the downcutting of floodplain surfaces by meltwater-enriched streams during glacial-interglacial transitions. The Holme Pierrepont Terrace, formed by downcutting of the floodplain during late MIS 2, has been vigorously reworked by **Holocene fluvial activity**, creating scroll bars, levees and a variety of other features that may stand above the general level of the modern floodplain (Howard 2007, 46; White et al 2007, 20). These reworked sands and gravels may incorporate a rich range of redeposited and *in situ* cultural remains.	SSG	**2d**
	Coversands. Wind erosion of exposed surfaces across the sparsely vegetated landscapes that prevailed during cold periglacial stages of the Devensian Glaciation caused the deposition of extensive coversands along the eastern edge of the lower Trent Valley and in the Idle Valley (Knight and Howard 2004, 22). These blown sands may seal or be interleaved with significant Palaeolithic archaeological remains. Recent discoveries, notably at Farndon Fields near Newark, indicate that coversands are more widely distributed along the Trent Valley than may be deduced from current BGS records.	SSG	Absent
Holocene *c.*9500 cal BC to present	**Alluvium**: modern floodplain deposits and alluvial veneers spilling from the modern floodplain across late Pleistocene terraces or other geological deposits. Alluvium may cover *in situ* Pleistocene deposits or fluvially redeposited sands and gravels, and may be interstratified with or underlie **peat**. Alluvial deposits overlying the MIS2 Holme Pierrepont Terrace at Farndon Fields have been dated by OSL techniques and associated artefacts to the late Pleistocene, indicating an earlier genesis for some deposits (Table 7.5), but this is principally a Holocene deposit.	ML SS SSG	**3a**
	Palaeochannels and carrs. Old river channels are often incised into Holme Pierrepont (MIS2) Sands and Gravels, and may underlie alluvial deposits. They may also preserve rich organic deposits, artefacts and associated structural remains such as fishweirs. The Lower Trent in particular preserves extensive Holocene peat deposits, stratified above alluvium and associated with pollen and other organic remains. This distinctive **carrland** environment forms part of the Humberhead Levels (Van de Noort and Ellis eds 1997), and in recent times has been modified significantly by extensive peat cutting.	SSG	**3b**
	Alluvial fans and colluvial spreads. Some deposits have been mapped by the BGS and during individual site investigations, but further field survey is needed to map comprehensively these and other slope deposits that might seal archaeological remains. As in Derbyshire and the Peak, such deposits are excluded from the tables of archaeological associations.	ML SS SSG	**3d**
	Coversands may have been reworked at various stages of the Holocene in response to human interference with vegetation and/or climatic change (*e.g.* at Tiln and Girton in the lower Trent and Idle Valleys in the Mesolithic, Roman and Early Medieval periods: Fig.5.1; Howard 2007, 44; Knight and Howard 2004, 32-33, 120). There is significant potential, therefore, for the burial of Holocene as well as earlier sites.	SSG	Absent

Table 4.1. Landform Elements of the aggregates-producing areas of Nottinghamshire, showing correlations with Aggregate Character Areas and Derbyshire/Peak District Landform Elements (ML: Magnesian Limestone; SS: Sherwood Sandstone Group; SSG: Superficial Sands and Gravels. MIS: Marine Isotope Stage; see Table 5.1)

Fig. 4.3. Girton Quarry: quarry section, showing the complex stratigraphy of the Holocene Coversands that extend along the eastern side of the Lower Trent Valley. This shows a pair of dunes cross-cutting horizontally bedded sands. The dunes display steeply dipping slipfaces (down which sand grains would have tumbled) and gentle dip slopes formed by the lateral creep of sand grains blown by the prevailing wind. © Trent & Peak Archaeology, on behalf of Lafarge Tarmac Ltd

4.4 THE PROJECT GIS

The Geographical Information System was created in MapInfo in a format that permitted a simple transfer to ArcGIS. This enabled translation of most data from the Nottinghamshire County Council Historic Environment Record GIS to the ArcView 9.3 software used by Trent and Peak Archaeology.

The GIS comprises the following base data layers:

- Ordnance Survey Mastermap (2009) and OS 1:25000 map.
- Old Ordnance Survey base maps, including the 1st edition 25 inches to 1 mile (1881).
- Chapman's 1774 map of Nottinghamshire and Sanderson's 1835 map Twenty Miles around Mansfield. Both maps were digitised and georeferenced. The Sanderson map was translated to ArcView 9.3 and included in the ArcGIS, but the Chapman map could not be translated to ArcView software.
- Vertical aerial photography (copyright Bluesky 2007). This was compiled within the MapInfo GIS for analysis but was not transferred to ArcView due to file size.
- Solid and drift geological data (copyright of British Geological Survey).

The project also utilised several datasets derived from the Nottinghamshire HER. These are based upon interpretations of information derived from a range of sources, and include the following four categories of evidence:

National Mapping Programme Data

NMP data comprise a digitised version of hand-drawn transcriptions of crop-and soil-marks interpreted as archaeological in origin, and have been fully integrated into the HER. These features were identified on vertical and oblique aerial photographs taken over a range of years. More information on the methodology employed during mapping of the Nottinghamshire aerial photographic data may be obtained from the project report compiled by Deegan (1999).

There has been no systematic programme of interpretation since the MORPH2 database was compiled as part of the NMP project in the early 1990s. Since then, fieldwork has served to answer questions of function and date on a number of important cropmark sites, allowing the possibility that sites of analogous form might now be more confidently interpreted and dated. Existing cropmarks within the Aggregate Character Areas that were recorded as of unknown date were re-examined as part of this project, permitting assignation of a tentative date to many of these on the basis of their morphology. The revised provisional dating was added to the GIS layer.

Historic Landscape Characterisation data

HLC data derive from an English Heritage and Nottinghamshire County Council partnership project begun in 1998. It was one of the first such projects to be undertaken, predating development of the methodology that is now consistently employed for HLC surveys. It has limited value, therefore, for some phases of landscape development, but is a particularly valuable tool for understanding medieval and later agrarian landscapes. Most of the HLC data have been added to the project GIS, but particular use has been made of the categories associated with Medieval open field systems and Parliamentary enclosures.

Holocene Palaeochannels

Plots of Holocene palaeochannels, generated from a survey of Nottinghamshire air photographic sources conducted in 1994, have been incorporated into the GIS. This information could usefully be enhanced by the addition of lidar data and further targeted documentary, cartographic and field research, but provides a valuable foundation for studies of the County's palaeochannel resource.

Archaeological Sites and Finds

Data layers for each archaeological period were created by querying the HER database and extracting layers of information as MapInfo table files. These were converted to ESRI shapefiles for use in ArcGIS. The ArcGIS layers were separated by period, and for each period maps are provided of Elements and Monuments.

Elements represent the physical components of Monuments, which cannot on their own describe the form or function of the site of which they formed part, and include individual features such as pits, findspots (single finds) and finds scatters. Element records have been subject to minimal interpretation, describing only the information as found, observed and recorded, and depending upon the extent of work may or may not be linked to Monuments. Some Elements may form parts of two or more Monument records, either because they have been re-used (for example, an Iron Age linear bank that was followed subsequently by a parish boundary) or because they may be interpreted in a variety of ways (for example, a ditch that may form part of either an Iron Age or a Romano-British settlement or field system).

Fig.4.4. This stone-lined Roman well forms one element of a Romano-British settlement excavated in the Trent Valley at Langford, near Newark. It preserved a humic silty fill with associated animal bone and leather. The cut for the well through terrace sands is visible either side of the stone lining. © Trent & Peak Archaeology, on behalf of Lafarge Tarmac Ltd

Monuments represent sites that can be defined in terms of their function or form, and records of these represent interpretations based on the physical evidence of Elements. In the Nottinghamshire HER, a Monument record must have at least one associated Element record. Monument records may be linked to Scheduled Ancient Monument records and/or to one or more Building records.

For the Neolithic and later periods, monument types were grouped in the GIS into functional classes, employing the hierarchical classification devised for English Heritage's *Thesaurus of Monument Types*[17]. This provided an effective method for examining the distribution of the increasingly diverse range of archaeological sites and expedited assessment of the archaeological resource.

Digital maps have been compiled on the basis of this information, including distributions of sites by period and by type. These maps are included as an appendix in the on-line archive report, and are illustrated in this section by two maps compiled for the Neolithic and Bronze Ages. The first of these shows the distribution of all known Monuments (each of which will include at least one Element record) and Elements, such as pits, finds scatters and single finds, that cannot be linked to a Monument type. This indicates a predictable bias towards more intensively investigated areas, with particularly high concentrations of sites along the Trent Valley and in intensively fieldwalked areas of the Magnesian Limestone. The distribution is thus severely distorted by variations in the level of archaeological activity, but although flawed in this respect it provides nonetheless a valuable statement of current knowledge. The second map shows the distribution of Monuments that may be grouped under the Thesaurus heading of 'religious, ritual and funerary' sites. Most of these have been investigated in advance

17 http://thesaurus.english-heritage.org.uk

of aggregates extraction, particularly at quarries extracting sands and gravels from sites located on the Trent river terraces and floodplain, and not surprisingly reveal a distribution that is skewed seriously towards this major river valley.

4.5 HER ENHANCEMENT

The Nottinghamshire Historic Environment Record was enhanced for this project by the incorporation of new data from the HER Documents Register and by consideration of hitherto unrecorded data derived from backlog projects conducted in advance of aggregates extraction.

Maps showing the distribution of archaeological investigations in the County were updated by a search of the Documents Register, which is a list of all archaeological reports received by the Nottinghamshire HER. This assisted the creation for each of the Aggregate Character Areas of an up to date map of archaeological interventions, and provided a useful indication of variations in the level of archaeological knowledge between the intensively studied river valleys of the Trent, Soar and Idle and the comparatively poorly researched Sherwood Sandstone and Magnesian Limestone outcrops.

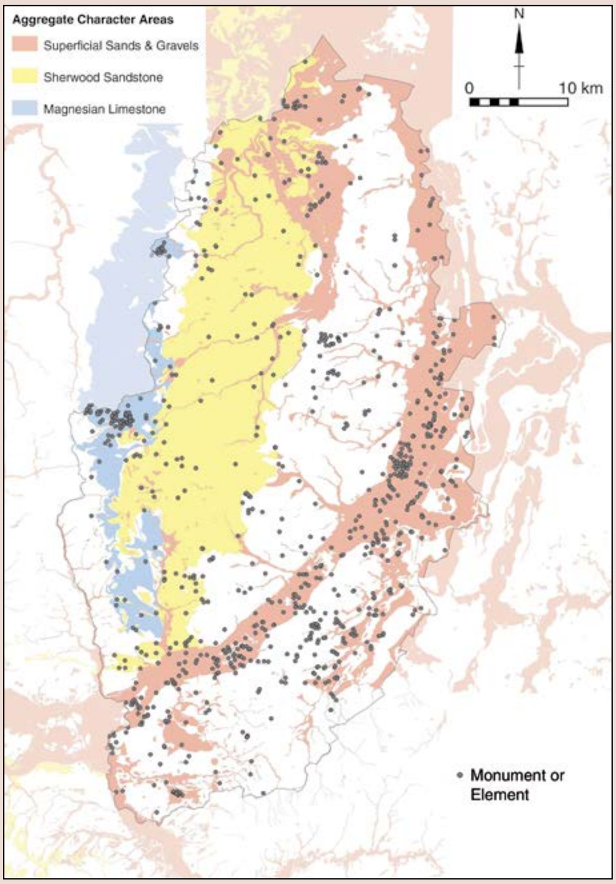

Fig.4.5. Neolithic and Bronze Age Monuments and Elements (source: Notts. HER)

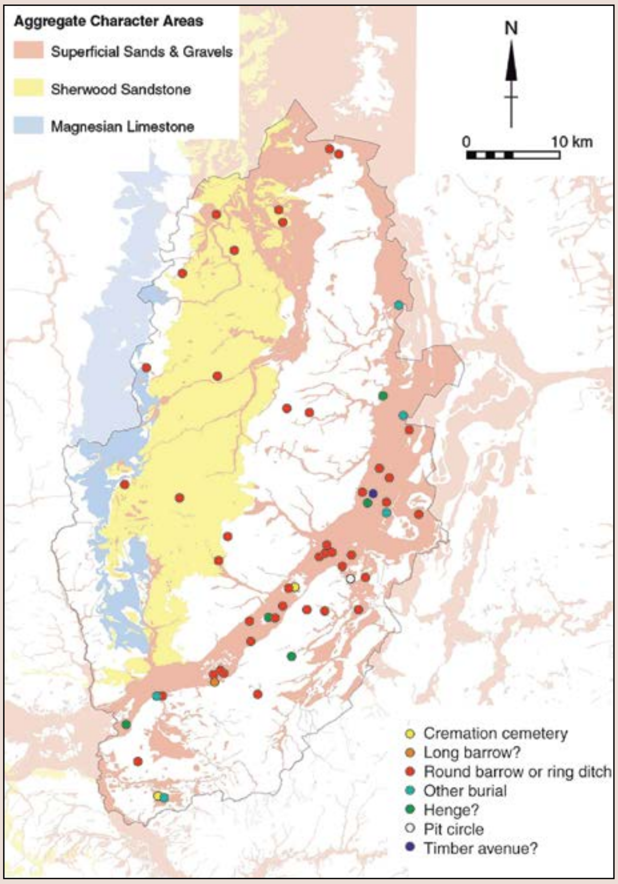

Fig.4.6. Neolithic and Bronze Age religious, ritual and funerary sites (source: Nottinghamshire HER)

A study was also conducted of archaeological investigations undertaken as a result of aggregates extraction but not yet available as archive or published reports. This work made use of the guidance and task-specific database developed by ARCUS[18] (2007) on behalf of English Heritage. All relevant archaeological contracting organisations were contacted and were requested to supply copies of reports that had not yet been deposited in the HER. Information contained in newly submitted reports was incorporated into the HER, further enhancing this record, and the list of archaeological investigations conducted in advance of and during aggregates extraction that have yet to be reported and disseminated was augmented.

In total, nearly 100 documents were added to the HER as a result of these tasks, which in turn resulted in the generation of 99 Event records, 206 Element records and 25 Monument records. The list of HER entries that were created or modified is included in the full archive report.

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4.6 ARCHAEOLOGICAL RESOURCE ASSESSMENT

A tabular summary of the archaeological resource of each Aggregate Character Area was compiled from information contained in published syntheses and site reports, unpublished archive reports and HER data, and may be viewed in the on-line archive report. Separate tables were prepared for each period, and for the Neolithic and later periods information on the archaeological resource was grouped under headings correlating with the functional class categories defined in the English Heritage *Thesaurus of Monument Types*.This provides a valuable link with the HER database, which utilises these monument types, and with the site distribution maps contained in the archive report. The archaeological resource for each Aggregate Character Area is presented side by side in each table, permitting easy comparison of the data available for each area.

Details are also provided in these tables of assessment, evaluation and mitigation techniques that should be considered for each of the monument classes occurring within Aggregate Character Areas. These recommendations, alongside those proposed for particular landforms (Section 7), have been developed with the aim of refining further the schemes of investigation developed in support of extraction proposals.

Computer-generated maps have been prepared for each period, showing the total distribution of Monuments (which may comprise many Elements) and of Elements that cannot be linked to a Monument type (*e.g.* single pits and finds scatters). Together, these provide a picture of the distribution of known sites for each period. Additional maps, each showing the distribution of particular Monument or Element types, have also been prepared. Several examples are included in this document, and provide useful summaries of the distributions of sites associated with occupation, burial and other activities.

4.7 ASSOCIATIONS WITH LANDFORMS

A tabular summary is provided in the archive report and in this booklet of the geomorphological processes operating within each landform, observed archaeological associations and landform-specific assessment, evaluation and mitigation techniques (Section 7). This has been developed with reference to the tabular format devised for the Derbyshire and Peak District Aggregates Resource Assessment, with the aims of ensuring compatible end products and of summarising succinctly the key conclusions of this project.

4.8 RESEARCH AGENDA AND STRATEGY

A Research Agenda and Strategy has been developed for each archaeological period, employing an innovative tabular format permitting easy comparison between each of the Aggregate Character Areas (Section 8). Agenda priorities have been defined by reference to the research priorities outlined in *East Midlands Heritage* (Knight, Vyner and Allen 2012)[19], but with due regard to research questions that are of particular relevance to Nottinghamshire. As an example, attention has been drawn to the pressing need for further work on the origins of the brickwork-plan field systems of the Sherwood Sandstone. This is particularly critical for understanding changes in the agrarian economy of Late Iron Age and Roman Nottinghamshire and the impact of these changes upon settlement patterns and the wider landscape.

Correlations have been noted between each Agenda Topic and the Agenda priorities identified in *East Midlands Heritage*, with the aim of permitting easy identification of correlations between regional research priorities and the topics identified in other period- and subject-based research frameworks. Agenda and Strategy priorities for each archaeological period have been summarised in a single table, expediting correlation between Agenda Topics and proposed Strategies. In addition, a distinction has been drawn between Strategies that may be applied broadly and those that are specific to particular Aggregate Character Areas. From the Palaeolithic perspective, for example, prospection for caves sealed by talus deposits is clearly only relevant in the context of the Magnesian Limestone, while prospection for pre-Anglian river deposits must necessarily be restricted to the Superficial Sands and Gravels. Searches for Upper Palaeolithic open-air sites, by contrast, are prioritised for each of the Aggregate Character Areas. It was judged appropriate, given the significant overlap of research priorities between the Post-Medieval and Modern periods, to combine these periods in a single table, but otherwise the period divisions in these tables echo those of the East Midlands regional research framework.

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19 www.tparchaeology.co.uk/east-midlands-research-strategy

5. CHRONOLOGICAL FRAMEWORK

The chronological framework employed here follows the period divisions of *East Midlands Heritage* (Knight, Vyner and Allen 2012) in order to ensure compatibility between the research frameworks proposed for the aggregates-producing areas of Nottinghamshire and the wider East Midlands region. Details of the nine periods that form the framework of this document are provided in the table below.

PERIOD NAME	**DATE RANGE** kya: thousand years ago (period beyond the limits of radiocarbon calibration)[20] cal BC: calibrated years BC (for periods where radiocarbon dates may be calibrated to an acceptable level of accuracy)[21]	**COMMENTS**
	PLEISTOCENE	
Palaeolithic (Old Stone Age)	Archaeological Period 1 (Cromerian and early Intra-Anglian): *c.*950/850 – *c.*450kya (MIS 25/21 - MIS12)	Pleistocene hunter-gatherer communities: intermittent occupation, correlating with periods of warmer climate. Periods 1 to 5 follow the scheme of archaeological periods outlined by McNabb[22] and are dated broadly by correlations with Marine Isotope Stages (MIS)[23]. In Britain, the earliest cultural remains of Period 1 may be correlated currently with either Marine Isotope Stage 25 (970-936kya) or 21 (866-814kya)[24]. Period 1 activity is known in the East Midlands, but cannot yet be closely dated. The Nottinghamshire HER distinguishes Lower, Middle and Upper Palaeolithic periods, which correlate respectively with Archaeological Periods 1–2, 3–4 and 5.
	Archaeological Period 2 (Pre-Levallois Lower Palaeolithic): *c.*450 – *c.*250kya (MIS12 - Early MIS8)	
	Archaeological Period 3 (Levallois Lower Palaeolithic): *c.*250 – *c.*150kya (Late MIS8 - Early MIS6)	
	Archaeological Period 4 (Mousterian): *c.*60 – *c.*40kya (MIS3)	
	Archaeological Period 5a (Early Upper Palaeolithic): *c.*40 – *c.*27 kya (Late MIS3 - Early MIS2)	
	Archaeological Period 5b (Late Upper Palaeolithic): *c.*13,000 – *c.*9,500 cal BC (Late MIS 2)	
	HOLOCENE	
Mesolithic (Middle Stone Age)	*c.*9500 – *c.*4000cal BC.	Post-glacial (Early Holocene) hunter-gatherer communities, characterised archaeologically by distinctive lithic artefact kits. Typological developments in lithic tool technology permit a distinction between an Earlier and Later Mesolithic, divided at c.8000 cal BC[25].
Neolithic (New Stone Age) to Middle Bronze Age	Neolithic: *c.*4000 – *c.*2200 cal BC.	Further changes in lithic artefact technology, coinciding with a gradual shift from a hunter-gatherer to an agricultural subsistence base and other key changes such as the development of pottery and the development of copper metallurgy in the later Neolithic (*c.*2400 – *c.*2200 cal BC).
	Early Bronze Age: *c.*2200 – *c.*1500 cal BC	Expansion of bronze-working technology; technological and typological developments evident in bronze artefact assemblages distinguish the Early from the Middle Bronze Age.
	Middle Bronze Age: *c.*1500 – *c.*1150 cal BC	
Late Bronze Age and Iron Age	Late Bronze Age: *c.*1150 – *c.*800 cal BC	Further developments of bronze-working technology and artefact typology.
	Iron Age: *c.*800 cal BC – AD 43	Replacement of bronze by iron as the principal metal for tools and weapons (developing from LBA roots).
Romano-British	AD 43 – c.410	From the Claudian conquest to the collapse of Roman administration and the withdrawal of Roman political and financial support in the early 5th century. The conventional date of *c.*AD 410 is employed here, but the chronology of the ending of Roman Britain remains a subject of debate.[26]
Early Medieval	*c.*410 – 1066	From the withdrawal of Rome to the defeat of King Harold by William I. This embraces a 'sub-Roman' period of uncertain duration, preceding settlement from the 5th century of Germanic migrants, Viking raids culminating in establishment of the Danelaw in eastern and northern England (793-1042) and the reinstatement of the Anglo-Saxon monarchy after Cnut's defeat in 1042.
High Medieval	1066 – 1485	From the Norman Conquest to the Battle of Bosworth. This crucial East Midlands battle saw the defeat of Richard III by Henry Tudor (crowned Henry VII) and the beginning of the Tudor dynasty.
Post-Medieval	1485 – 1750	From the Battle of Bosworth to the beginning of the Industrial Revolution.
Modern	1750 to present	The Industrial Revolution, driven by developments from the mid-18th century along the Derwent Valley, Ironbridge Gorge and elsewhere, heralds the beginning of the Modern period.

20 As employed by McNabb, J. 2006. The Palaeolithic, in N.J Cooper (ed.) *The Archaeology of the East Midlands*, Leicester Archaeological Monographs No. 13, University of Leicester, 13.

21 For radiocarbon conventions, especially where applied to the Pleistocene, see *e.g.* Buteux, S. (ed.) 2009. *Digging Up the Ice Age*. Oxford: Archaeopress, 107–108.

22 McNabb 2006, 13–15.

23 McNabb 2006, 12–17; see also Buteux, S. (ed.) 2009. *Digging Up the Ice Age*. Oxford: Archaeopress, 9–11, fig.11.

24 Parfitt, S.A. *et al.* 2010. Early Pleistocene human occupation at the edge of the boreal zone in northwest Eu*rope, Nature* 466, 229-233; Parfitt, S., Ashton, N. and Lewis, S. 2010. Happisburgh, *British Archaeology* 114, 15–23.

25 Myers, A.M. 2006. The Mesolithic, in N. J. Cooper (ed.) *The Archaeology of the East Midlands: An Archaeological Resource Assessment and Research Agenda.* Leicester: University of Leicester Archaeology Monographs 13, 53.

26 Moorhead, S. 2010. 410–2010: Rome and Britain, *British Archaeology* 111, 17–21.

Fig.5.1. View towards the Nottinghamshire side of the Magnesian Limestone gorge at Creswell Crags, showing the mouth of Church Hole cave. Caves and rock shelters preserving important evidence for Palaeolithic and later activity have been recorded in many of the limestone gorges that dissect the Magnesian Limestone escarpment. Subterranean features may be clearly visible, as here, but caves or rock shelters preserving significant cultural and environmental remains are often buried beneath thick slope deposits. Photograph ©Trent & Peak Archaeology, December 2012

Fig.5.2. Laser technology provides a highly accurate and cost-effective tool for the surveying of subterranean features, as demonstrated by this unprocessed point cloud image of the interior of Church Hole cave. Photograph © Trent & Peak Archaeology

6. THE ARCHAEOLOGICAL RESOURCE

6.1 INTRODUCTION

In common with the rest of the County, the aggregates-producing areas of Nottinghamshire have enjoyed a long history of antiquarian attention. This growing interest in the past may be traced to the seventeenth and eighteenth centuries with the investigations of prominent antiquarians such as Robert Thoroton, Hayman Rooke and William Stukeley, and into the Victorian period and beyond with scholars such as William Boyd Dawkins. The last of these was drawn to the archaeologically and environmentally rich caves at Creswell Crags, which along with other caves and rock shelters across the Magnesian Limestone escarpment harbour a Palaeolithic resource of international importance.

The history of aggregates-related archaeology, however, is rather shorter, and may be traced to the late nineteenth and early twentieth centuries with discoveries during quarrying of the river gravels around Nottingham by investigators such as Fred Davey and Albert Armstrong (Cooper 2008). Manual excavation in those periods of aggregates derived from river terrace quarries such as Stoney Street and Tottle Brook in Beeston uncovered Palaeolithic handaxes, flake tools and waste cores or flakes which, although small in quantity by comparison with those recovered from the Thames Valley or East Anglia, permitted new insights into the early prehistoric settlement of Nottinghamshire (Knight and Howard 2004, 17–19). Since then, the pace of archaeological discovery during aggregates extraction has greatly accelerated, particularly since publication of the seminal volume *A Matter of Time* (RCHME 1960).

From the 1980s onwards, planning legislation and government guidance placed increasing emphasis on the need to consider archaeological issues in the planning process, and in Nottinghamshire significant programmes of archaeological work, particularly on sand and gravel sites, were secured as a matter of course even before the publication of *Planning Policy Guide Note 16* (Dept of the Environment 1990). The increasingly close liaison between archaeological curators and aggregates planners has revolutionised our understanding of the archaeology of the aggregates-producing areas of Nottinghamshire, and as shown in the following tables and diagrams has made a dramatic impact upon the Historic Environment Record. These provide a succinct summary of the HER records for each Aggregate Character Area and the County, together

	Hectares	Km²	% of Notts area	Total sites	% of Notts sites	Sites per ha	Sites per km²
County	215,500	2155.0		15812		0.07	7.34
Sands and Gravels	68,310	683.10	31.7	5122	32.4	0.07	7.50
Magnesian Limestone	9453	94.53	4.4	805	5.1	0.08	8.51
Sherwood Sandstone	58,940	589.4	27.3	2471	15.6	0.04	4.19
All ACAs	136,703	1367.03	63.4	8398	53.1	0.06	6.14
Other areas of Notts	78,797	787.97	36.6	7414	46.9	0.09	9.41

Table 6.1. Frequency of archaeological sites in each ACA, non-aggregates-producing areas and Nottinghamshire generally

	Sands and Gravels		Mag. Limestone		Sherwood Sandstone		All ACAs		County	
Period	Sites recorded in HER									
	Total	Per km²	Total	Per km²	Total	Per km²	Total	Per km²	Total	Per km²
Palaeolithic	22	0.03	14	0.15	3	0.01	39	0.02	48	0.02
Mesolithic	27	0.04	8	0.08	12	0.02	47	0.03	50	0.02
Neolithic	55	0.08	6	0.06	10	0.01	71	0.05	229	0.11
Bronze Age	333	0.49	87	0.92	107	0.18	527	0.38	699	0.32
Iron Age	81	0.12	2	0.02	19	0.03	102	0.07	132	0.06
Roman	219	0.32	29	0.31	75	0.13	323	0.23	1204	0.56
Early Med	102	0.15	0	0	12	0.02	114	0.08	174	0.08
High Med	672	0.98	90	0.95	325	0.55	1087	0.79	1764	0.82
Post-Med	538	0.79	80	0.85	260	0.44	878	0.64	1227	0.57
Modern	1337	1.96	244	2.58	658	1.12	2239	1.63	5776	2.68
Undated	1736	2.54	245	2.59	990	1.68	2971	2.17	4509	2.09
Total	5122	7.50	805	8.51	2471	4.19	8398	6.14	15812	7.34

Table 6.2. Frequency of archaeological sites in each ACA and in Nottinghamshire by period

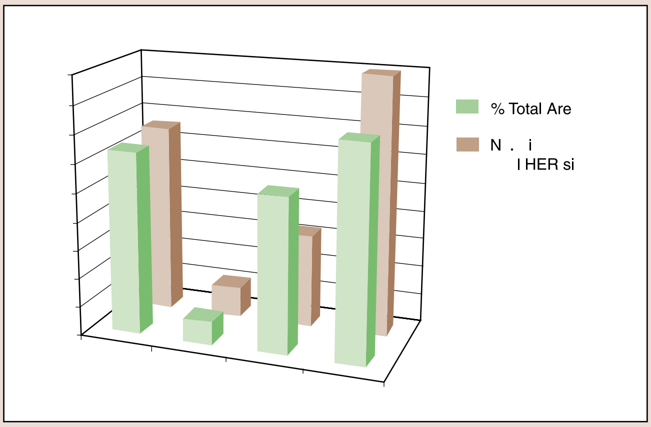

Fig.6.1. Comparison of the frequencies of sites inside and outside Aggregate Character Areas, showing the proportion of the County occupied by each ACA and the percentage of total HER sites recorded in each ACA

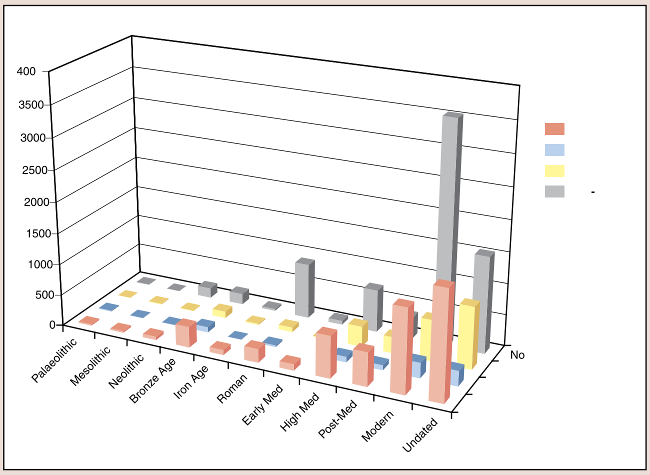

Fig.6.2. Comparison of variations in site frequencies by period in each Aggregate Character Area and in the non-aggregates-producing areas of Nottinghamshire

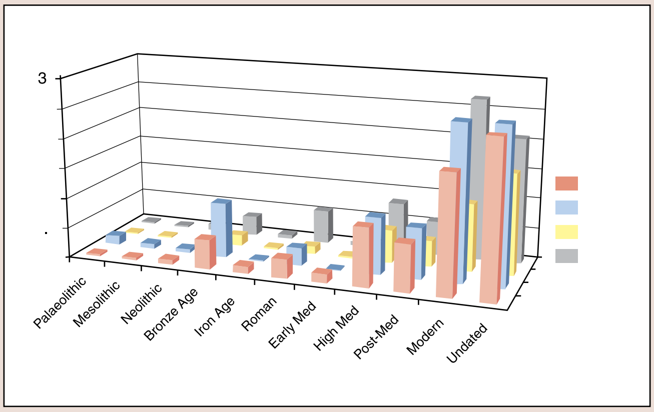

Fig.6.3. Comparison of variations in site densities (per km^2) in each Aggregate Character Area and in Nottinghamshire generally

with a breakdown by period. The period divisions employed by the HER do not correlate precisely with the chronological scheme employed in this guidance booklet (Section 5), but the benefits of synchronising the chronological frameworks of this study and the regional research framework were thought to outweigh the benefits of adhering strictly to the HER scheme.

6.2 PERIOD SYNTHESES

A detailed assessment of the archaeological resource of each of the County's aggregates-producing areas, together with supporting references, is provided in the full project report (Knight and Spence 2012).[27] In this section, we provide a concise summary of this resource, from quartzite artefacts that could indicate hunter-gatherer activity prior to the Anglian Glaciation of around 425,000 years ago to military and industrial monuments of the 20th century, and highlight the principal interest of areas accessible for aggregates extraction as sources for studies of Nottinghamshire's past.

Variations in site frequencies and densities between each Aggregate Character Area are summarised in Figs 6.1 to 6.3, employing the definition of 'site' as either (a) a Monument or (b) an Element that cannot be linked to a Monument type (Section 4.6). Many Monuments and Elements occur in close proximity to one another, and hence not all sites may be distinguished individually in the computer-generated maps that are included in this document.

Within each Aggregate Character Area, attention has been focused firmly upon the archaeological resource of areas that are potentially available for aggregates extraction. This tight focus has required consideration of the full range of known monument types for the prehistoric and Roman periods, as examples of each occur in areas that are potentially available for quarrying. For the Early Medieval to Modern periods, attention has been focused upon a more restricted range of evidence, excluding from analysis monument types that occur exclusively outside potential aggregates extraction areas (for example, in established urban areas). This approach is reflected in the discussion below, which comprises concise syntheses of the prehistoric and Roman periods and for the Early Medieval to Modern periods summaries of the key monument types that may reasonably be investigated by reference to the archaeological remains surviving in areas suitable for aggregates extraction.

27 http://dx.doi.org/10.5284/1018086

6.2.1 PALAEOLITHIC: *c*.950/850,000 years ago to *c*.9500 cal BC

Recent discoveries in East Anglia have provided convincing evidence for hominin activity from perhaps as early as *c*.950,000 years ago, but in Nottinghamshire hunter-gatherer settlement cannot yet be traced to such an ancient period. Discoveries of heavily rolled and hence probably redeposited quartzite artefacts in sands and gravels at East Leake have been interpreted as possibly evidence for activity in a warm phase preceding the Anglian glaciation of *c*.425,000 years ago, but further investigations are required to clarify the origin of these deposits and the circumstances of deposition of the associated artefacts. These and other finds of Lower Palaeolithic stone artefacts in the river terraces of Nottinghamshire, even though heavily rolled and redeposited, are nonetheless of outstanding importance for unravelling the history of early hominin activity in the County. The terrace gravels are also notable for the preservation on the Late Devensian Holme Pierrepont Terrace at Farndon Fields near Newark of at least one nationally important *in situ* Late Upper Palaeolithic campsite. Analysis of the lithic artefacts from this site, which was discovered during fieldwalking prior to dualling of the Fosse Way to the south-west of Newark, suggests that hunter-gatherers may have migrated between the Trent Valley and cave sites in the Magnesian Limestone, notably those at Creswell Crags. These groups may be assumed to have ranged over the intervening Sherwood Sandstone, and hence the discovery provides rare evidence not only for *in situ* activity foci but also for the possible routes of movement of hunter-gatherer communities. Other surface finds of Upper Palaeolithic lithic artefacts were recorded during the same fieldwalking campaign, and indicate dispersed activity across the river terraces and beyond. The key role of fieldwalking as a prospection technique for Palaeolithic material is illustrated by the map below, which shows clearly the linear pattern of Palaeolithic finds recorded to the southwest of Newark during fieldwalking prior to dualling of the A46 (Fosse Way).

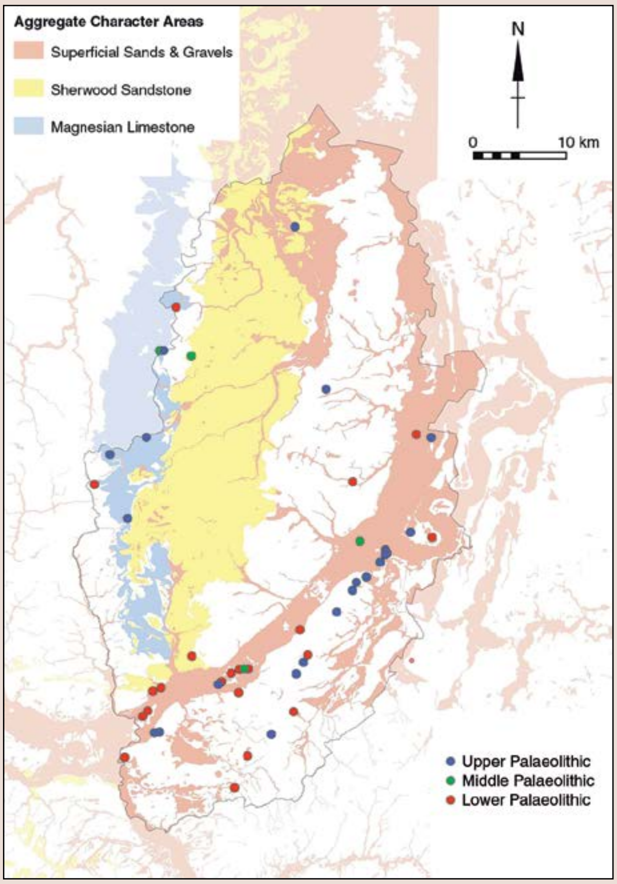

Fig. 6.4. Distribution of Palaeolithic sites, showing linear distribution of finds in the south-east of the County along the A46 fieldwalking corridor (source: Notts HER)

The evidence from the Sands and Gravels is complemented by discoveries in the caves and rock shelters of the Magnesian Limestone escarpment of lithic, faunal and other remains that may be dated as far back as the Mousterian period (from as early perhaps as *c*.50,000 years ago). Particularly extensive evidence for Late Upper Palaeolithic activity has been obtained from Creswell Crags, including lithic artefacts, extensive faunal remains and the only known parietal cave art in Britain. The discoveries at Creswell are of international importance, and along with finds from other limestone caves and rare surface finds of Late Upper Palaeolithic lithic artefacts emphasise the particular significance of this landform for studies of early hominin activity. Further examples of caves may survive beneath talus or other slope deposits, as demonstrated by discoveries at Creswell Crags outside Church Hole, and identification of these should be regarded as a high priority.

The Sherwood Sandstone, by contrast, has so far yielded little evidence that might indicate Palaeolithic activity. Rare references to Palaeolithic finds are contained in the HER, but re-examination of these by a Palaeolithic finds specialist is recommended to check this attribution and to refine the dating. It seems likely, despite the current paucity of data, that the Sherwood Sandstone would have been traversed by Palaeolithic hunter-gatherers moving between the Magnesian Limestone escarpment and the Trent, possibly along the main river valleys. To test this hypothesis, we would recommend re-examination during assessment of lithic artefact collections, followed by the targeting of colluvial and other masking deposits in valley bottoms to establish whether traces of early activity might be preserved beneath or interstratified with these.

6.2.2 MESOLITHIC: *c*.9500–*c*.4000 cal BC

Mesolithic sites, which have been distinguished principally on the basis of typologically diagnostic lithic artefacts, are thinly scattered over Nottinghamshire (0.02 sites per km²), but by comparison with the Palaeolithic are more evenly distributed across the Aggregate Character Areas. A particularly sparse scatter of diagnostic lithic artefacts is indicated across the Sherwood Sandstone, which in an area focused upon the catchments of the Rivers Meden, Ryton and Idle was shown by fieldwalking to preserve virtually no evidence of Mesolithic activity. This is in sharp contrast to areas walked by the same methods in the Sands and Gravels and across the Magnesian Limestone escarpment. Further fieldwalking to investigate these intra-regional contrasts is recommended, but on current evidence there is a suggestion of a genuinely lower density of Mesolithic activity across at least parts of the Sherwood Sandstone. The distribution of lithic artefacts across the other Character Areas is distorted by variations in the intensity of fieldwalking, but significantly higher densities of material may be discerned in the few areas that have been systematically fieldwalked (notably in the Trent Valley around South Muskham and on the Magnesian Limestone at Elmton in neighbouring Derbyshire). The current distribution

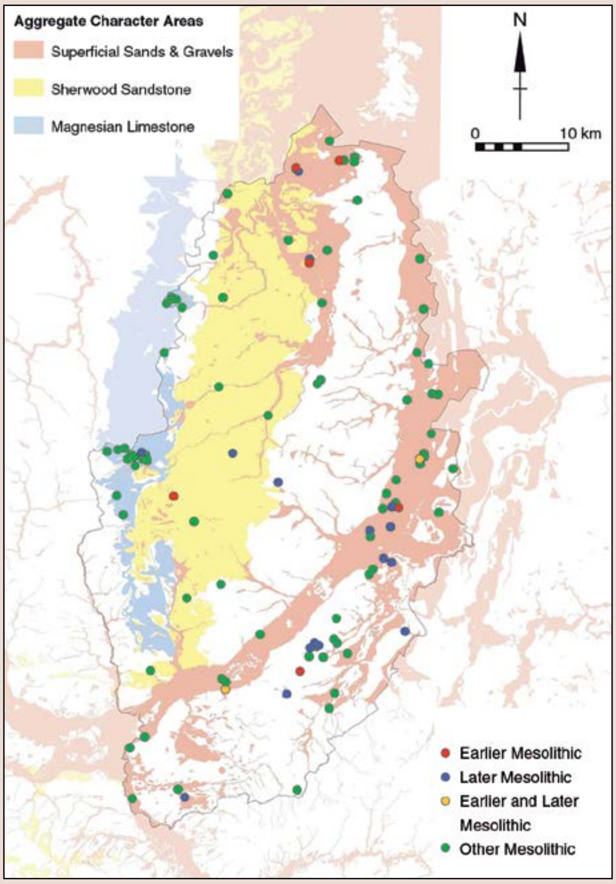

Fig. 6.5. Distribution of Mesolithic sites (source: Notts HER)

pattern must be interpreted cautiously, but at the very least it provides evidence for the utilisation of resources across a wide range of environmental zones. There is for the County as a whole a higher representation of sites attributed to the Later Mesolithic, although many of the sites recorded in the HER have not been differentiated by period. This contrast might relate in part to rising population levels, but interpretation is frustrated by the significantly greater duration of the Later Mesolithic, observed trends towards greater group mobility (and hence site density) and of course the problem of dating sites closely on the basis of artefact typology.

Sites of both the Earlier and Later Mesolithic are represented principally by surface lithic scatters indicating open-air activity foci, but as in Derbyshire caves and rock shelters along the Magnesian Limestone escarpment appear to have remained favoured locations for some communities. Further examples of caves may survive beneath talus and other slope deposits, and identification of buried sites should be regarded as a priority. In addition, rare evidence from the Sands and Gravels for pits yielding Mesolithic material emphasises the need to search for structures associated with open-air sites. Finds of Mesolithic organic material in palaeochannels, including the discovery in the Trent Valley at Staythorpe of a human female femur, cut antler and animal bone, stress the potential of these landforms for the survival of remains that may elucidate the Mesolithic economy and society and the changing environment. Discoveries of sites in wetland environments and on terrace-edge sites dipping beneath floodplain alluvium, including Misterton in the north Nottinghamshire carrs and Collingham in the Trent Valley, emphasise the potential of other landforms for the preservation of organic remains complementing those surviving in caves and beneath slope deposits. There is also significant potential for the preservation of sites beneath reworked coversands, notably around Girton and Tiln in the lower Trent Valley, and the location and investigation of these may be flagged as another key priority.

Fig. 6.6. Female femur from Staythorpe, dated to 5740–5620 cal BC (Beta-14401; 95% probability). Stable isotope analysis revealed a reliance upon animal protein and no influence of coastal food resources. © University of Sheffield

6.2.3 NEOLITHIC TO MIDDLE BRONZE AGE (*c.*4000 cal BC to *c.*1150 cal BC)

HER data indicate only a modest increase in site densities in the three Aggregate Character Areas between the Mesolithic (47 sites; 0.03 per km²) and Neolithic (71 sites; 0.05 per km²), with seemingly no significant differentiation between the Character Areas, but an extraordinary jump from the Neolithic to the Bronze Age (527 sites; 0.38 per km²; Table 6.2; Fig.6.2), especially on the Magnesian Limestone. The evidence is dominated by lithic scatters and single finds, including polished stone axes and axe-hammers. Few of these finds have been examined by lithic artefact specialists, and further study is recommended to test the validity of these distributions and to tease out subtler patterning between, for example, the earlier and later Neolithic. There is also the difficult problem of determining how many lithic finds scatters or findspots might derive in part or wholly from post-Bronze Age activity. These problems cannot be resolved on the basis of current evidence, and for the purpose of this study we have grouped 'Neolithic' and 'Bronze Age' collections together. In the longer term, we recommend the systematic re-examination of extant collections by appropriately trained lithic artefact specialists and, from the perspective of this document, specialist examination of extant lithic finds during assessment to establish their character and potential date range.

Fig. 6.7. Cleaning of this quarry section at Tiln revealed basal Late Devensian organic sediments, overlain by a buried soil sealed by coversand deposits yielding a dense Mesolithic stone artefact assemblage. Thermoluminescence (TL) dating demonstrated reworking of the coversands in the later Mesolithic (*c.*6500 cal BC), possibly due to human impact upon the vegetation (*e.g.* selective woodland clearance to encourage browse resource for large herbivores). Scientific dating techniques such as TL, optically stimulated luminescence and radiocarbon commonly provide crucial evidence for the date of archaeological features and deposits, and schemes of treatment must include adequate provision for scientific dating of appropriate samples. Photograph © A.J.Howard; on behalf of Lafarge Tarmac Ltd.

Taking HER data for the Neolithic and Bronze Age together, the record of lithic surface finds shows a pronounced but predictable bias towards intensively fieldwalked areas, including the Magnesian Limestone around Mansfield and Shireoaks and the Sands and Gravels of the Trent Valley to the north of Newark. As in the Mesolithic, the Sherwood Sandstone emerges as an island of comparatively sparse finds, represented in the HER principally by widely scattered findspots. Systematic walking of the brickwork-plan field systems of the Sherwood Sandstone by Daryl Garton revealed a similar pattern of sparse single finds and no finds clusters, which might indicate that activity foci of these periods were genuinely less dense across at least some parts of this landform. Notable contrasts in the densities of lithic finds may also be discerned between areas on the Magnesian Limestone and Sands and Gravels, with significantly higher densities of Neolithic or Bronze Age lithic artefacts recorded on the Limestone. This contrast may reflect in part variations in the intensity of fieldwalking. However, comparison of the results of systematic fieldwalking employing comparable methodologies on the Magnesian Limestone around Elmton in Derbyshire and on the Sands and Gravels near Newark (around South Muskham and along the Fosse Way) suggests that these patterns might reflect real variations in the density of activity. Interpretation is problematic, not least because of uncertainties regarding dating, but the possibility of real differences in land-use and settlement patterns between landforms should be tested by further fieldwork.

No obvious temporal increases in the density of activity may be discerned from consideration of the lithic artefact distributions generated from HER records, but analysis of the results of several systematic surveys of the Aggregate Character Areas suggests that this may have increased quite significantly from the earlier Neolithic. This may be postulated on the river terraces of South Muskham in the lower Trent Valley and along the Fosse Way where it traverses the Trent terraces to the south-west of Newark. Away from the river valleys, a similar trend towards higher levels of activity has been suggested on the Magnesian Limestone escarpment during fieldwalking in Elmton parish. Fieldwalking by Daryl Garton on the Sherwood Sandstone has also revealed a preponderance of Late Neolithic and Early Bronze Age artefacts, although the quantities of artefacts recovered are too small for firm conclusions on variations in settlement density to be drawn.

The lithic record for this period is augmented by rare discoveries of Bronze Age metalwork hoards and by scattered finds of Early and Middle Bronze Age metalwork. Single finds of metalwork have been obtained mainly from riverine and other watery contexts, most notably along the Trent. However, although especially common across the Sands and Gravels, scattered metalwork finds in river valley and other locations across the other Character Areas suggest that structured deposition of metalwork was a common theme across the County.

Further contrasts between the Character Areas are indicated by the greater range and variety of monuments across the Sands and Gravels. This is particularly noticeable in the Trent Valley, which has yielded evidence for a thin scatter of settlements preserving structural remains, together with early burnt mounds and a broad range of ritual and funerary monuments (including round and possibly long barrows, flat-grave cremation cemeteries, henges, pit circles and timber avenues). Ring-ditches, many of which may signify denuded barrows or have defined open arenas for burial and ceremonial activities, are particularly well represented on the Sands and Gravels, including a nationally rare early Neolithic example at Great Briggs, near Holme Pierrepont. Further funerary or ceremonial locations may be indicated by the aforementioned discoveries of Bronze Age weaponry and other artefacts in watery contexts, particularly along the Trent, and at Langford by a remarkable deposit of human skulls and animal bones in a palaeochannel. With the exception of a thin scatter of possible barrows and other burials, such monuments are conspicuous by their absence from the other Character Areas, even though the sandstone and limestone geologies are eminently suitable for cropmark formation. Discoveries on the Derbyshire Magnesian Limestone, notably of an Early Neolithic long cairn during quarrying at Whitwell, suggest that a broader range of monuments may await discovery across this landform. However, there is currently a suggestion of real differences in the Neolithic and Bronze Age record of Nottinghamshire between the Sands and Gravels and the other Character Areas.

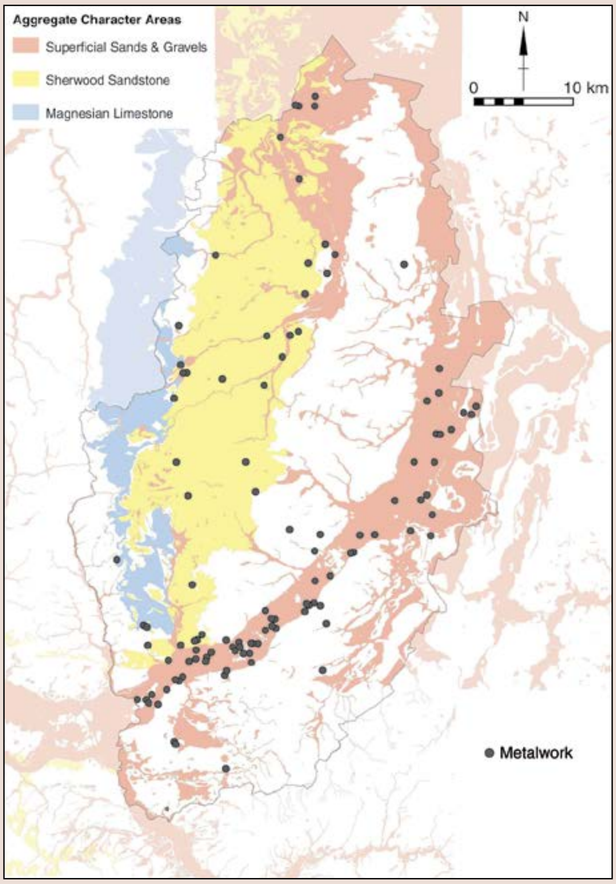

Fig. 6.8. Distribution of Bronze Age metalwork (source: Notts. HER)

6.2.4 LATE BRONZE AGE AND IRON AGE (*c.*1150 cal BC to AD 43)

HER data suggest a significant decrease in the density of sites in all Character Areas during the first millennium BC, from 527 (0.38 per km²) in the Bronze Age to a mere 102 (0.07 per km²) in the Iron Age. This is particularly at odds with the evidence of excavation on the river terraces, which has demonstrated a high density of Iron Age settlements at extensively excavated quarries such as Hoveringham. It may, however, owe much to the poor representation of pottery and other artefacts that may be dated securely to the first millennium BC in fieldwalking collections and the emphasis in the Neolithic and Bronze Age record upon highly durable lithic scatters and single finds (an unknown proportion of which could in fact relate to Iron Age activity). This contrast in site densities should not be seen, therefore, as necessarily an indicator of reduced activity, but rather as testimony to the limitations of the available archaeological data.

By contrast with the Neolithic and earlier Bronze Age, the emphasis in the archaeological record of the Late Bronze Age and Iron Age lies firmly upon domestic rather than funerary and ceremonial sites. Burial monuments that may be dated with confidence to the first millennium BC are currently conspicuous by their absence, with the possible exception of rare groups of square-ditched enclosures that may be related to the funerary enclosures that in Yorkshire demarcate barrows of the Arras tradition (Fig. 1.4). Discoveries of human bones and articulated or disarticulated animal skeletons may be expected in pits or in liminal features such as enclosure ditches, by analogy with other East Midlands sites, but currently the only securely dated examples from Nottinghamshire may be attributed to the Roman period. Evidence for burials may also be provided by some of the Late Bronze Age and Iron Age bronze weapons and other artefacts that have been retrieved from riverine and other watery contexts, notably along the Trent, but unequivocal evidence for an association between metalwork and burial has yet to be recovered.

Evidence for first millennium BC settlement is far more extensive, and is particularly focused upon the river terraces of the Trent and its major tributaries. Much of this evidence derives from large-scale excavations conducted in advance of quarrying, and in essence demonstrates a transition during the course of the first millennium BC from a landscape of open to enclosed settlements. The former are characterised by wide and seemingly random scatters of pits, post-holes and occasionally roundhouses, as demonstrated at Hoveringham Quarry. There is no observable typological differentiation between these settlements, but the discovery during quarrying at Girton of an Early Iron Age midden stratified beneath blown sand and of burnt mounds that might have continued in use into the early first millennium BC hints at greater complexity. As far as can be established, these unenclosed settlements were not linked to systems of fields or linear boundaries, suggesting perhaps that during this period there was comparatively little pressure upon land resources. From the mid-first millennium BC, however, we see the beginnings of significant changes in the organisation of settlements and the wider landscape. Habitation areas were increasingly enclosed, generally by a rectilinear ditched enclosure with flanking banks, and may have incorporated other enclosures that could have performed specialised roles associated with activities such as the corralling of stock.

No examples of hillforts or analogous defended enclosures have been recorded on the Sands and Gravels, with the possible exception of a site at Aslockton in the Vale of Belvoir that could represent a large defended enclosure associated with a population group beyond the level of an extended family unit. There are hints also that some Late Iron Age enclosures may

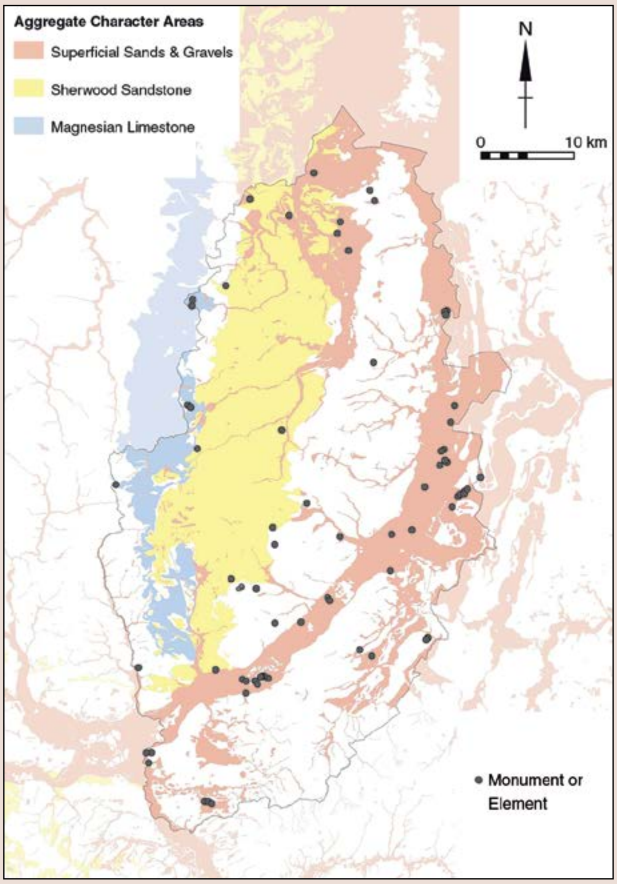

Fig. 6.9. Distribution of Iron Age Monuments and Elements (source: Notts. HER)

have formed parts of larger agglomerated settlements, as perhaps at Brough and Rampton. These could signify the growth in the Late Iron Age of sizeable communities, and may anticipate the nucleated rural settlements that developed during the Roman period.

The development of enclosures across the Sands and Gravels appears to have been linked in some areas to the growth of linear ditched boundaries and pit alignments, which may have divided blocks of land farmed by individual communities, and of field systems. The mechanisms underlying this process remain unclear, but links have been suggested with increasing pressure upon land resources, possibly in the face of rising population levels, and the need to maximise use of the available resources. Fields would have increased the stocking capacity of the available land, and along with other changes of the period such as the development of crops that could be sown in both the autumn and spring, the construction of ponds and wells, and an expansion of salt production, would have permitted a more intensive farming regime. These developments may have culminated in parts of the Trent Valley with the development of extensive coaxial field systems, comprising blocks of rectilinear fields linked to trackways and pit alignments. These systems are principally a feature of the Roman landscape, but their origins may lie in the Late Iron Age.

Considerably less is known about the development of Late Bronze Age and Iron Age settlement on the Magnesian Limestone and Sherwood Sandstone, and the location and characterisation of settlements in these areas remains a key priority. A stone-built enclosure at Scratta Wood currently provides a valuable insight into Iron Age settlement on the Magnesian Limestone, but otherwise we can point only to rare earthworks or cropmarks that might signify settlement of this period, including most notably a possible hillfort at Strawberry Bank to the west of Mansfield. Hillforts might also have been constructed on the Sherwood Sandstone, notably at Crow Wood near Styrrup in the extreme north of the County. Otherwise, however, undoubted evidence for Iron Age settlement in this Character Area is restricted at present to a small number of Roman ditched enclosures such as Dunston's Clump that on the basis of associated finds may be argued to have originated in the Late Iron Age. The brickwork-plan field systems that characterise the Roman period across the Sherwood Sandstone might also have pre-Conquest origins, in common with the coaxial field systems of the Lower Trent Valley, and determination of the chronology of these field systems must be regarded as key priority for future research in Nottinghamshire.

6.2.5 THE ROMAN PERIOD (AD43–*c*.410)

The Roman period saw a significant increase in the density and variety of known sites in each of the Character Areas, with an increase for all areas from 102 (0.07 per km²) in the Iron Age to 323 (0.23 per km²) in the Roman period. Similar densities of sites have been recorded on the Sands and Gravels (0.32 per km²) and the Magnesian Limestone (0.31 per km²), but the density of recorded sites on the Sherwood Sandstone (0.13 per km²) is surprisingly low given that large tracts of the sandstones preserve relics of extensive systems of brickwork-plan fields and enclosures that seem to have developed principally in the Roman period. The density figures may reflect in large part variations in the intensity of fieldwalking and the uneven spread of sites investigated intensively in advance of quarrying, and it is anticipated that the contrast between the Sherwood Sandstone and the other Character Areas will be reduced when the results of recent fieldwalking of the brickwork-plan fields in an area focused upon the catchments of the Rivers Meden, Ryton and Idle are fully integrated into the HER.

The Roman Conquest spurred the development of an elaborate road network, indicated in this region by several major roads such as the Fosse Way and by a number of lesser roads. These provided the framework for a system of early forts extending along the south-eastern edge of the Trent Valley, including several examples constructed on the Trent river terraces, and north-westwards into Brigantia. Some of these Trent Valley forts, such as *Ad Pontem* near Thorpe, provided the impetus for the development of small towns, while others, such as a marching camp at Holme on a raised 'island' in the Trent floodplain downstream of Newark, were occupied temporarily prior to abandonment. North-west of the Trent, examples have been recorded from air photographic and other evidence on both the Sherwood Sandstone, at Farnsfield, Calverton and Warsop, and the Magnesian Limestone, at Broxtowe. It is conceivable too that some earlier hillforts and analogous defended sites might have continued in use alongside these Roman forts, although currently only the enigmatic site at Aslockton in the Vale of Belvoir has yielded conclusive evidence for Roman as well as Iron Age activity.

The Roman period also saw significant developments in the pattern of rural settlement and the organisation of the agrarian landscape, both of which seem to have varied quite significantly between Character Areas.

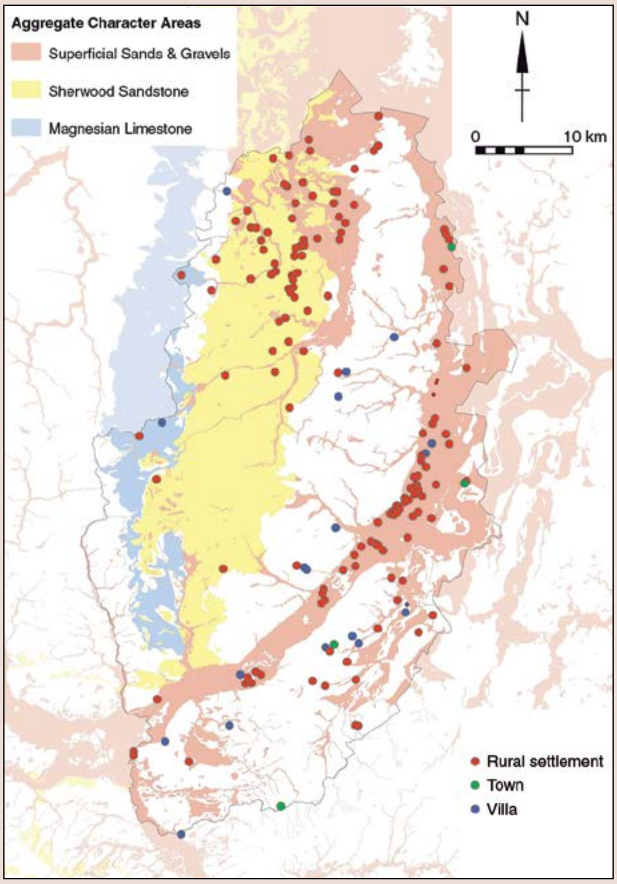

Fig. 6.10. Distribution of Roman rural settlements, towns and villas (source: Notts. HER)

Compelling evidence is available for the development on the Sands and Gravels of a hierarchy of small rural settlements (mainly enclosed farmsteads), larger nucleated villages, villas and towns, but the settlement patterns on the Sherwood Sandstone and Magnesian Limestone suggest a very different social and economic framework. Towns are absent from both of these areas, while only the Limestone has yielded evidence for villas (at Mansfield Woodhouse and, conceivably, at the site of a hypocaust near Broxtowe in Nottingham). In both of these Character Areas, the emphasis lies firmly upon small, generally rectilinear enclosures demarcated by ditches or, on the Magnesian Limestone, sometimes by stone walls (as at Scratta Wood near Worksop). Such sites recall strongly their Iron Age antecedents, and in view of the limited material evidence for social or economic differentiation between settlements may signal fundamental social and economic contrasts between settlements located in these areas and the more Romanised Trent Valley.

Further evidence for spatial variability is provided by studies of the organisation of the agrarian landscape. Both the Sherwood Sandstone and parts of the Trent Valley see the development of coaxial field systems, possibly developing from Iron Age roots. These comprise groups of rectilinear fields, integrated with ditched trackways and predominantly rectilinear ditched enclosures for habitation, stock, intensive horticulture or other purposes. There are some significant morphological differences between the field systems recorded in these Character Areas. For example, pit alignments, which are common in the Trent Valley, are seemingly absent from the Sherwood Sandstone, while none of the Trent Valley fields exhibit the classic elongated 'brickwork' plans of their Sherwood Sandstone counterparts. We may also postulate significant functional variations, with perhaps a higher emphasis upon arable in the Trent Valley and a greater focus upon pasture, particularly for sheep, on the Sherwood Sandstone. Comparable systems appear to be absent from the Magnesian Limestone, despite the suitability of this geology for cropmark formation, and there is a real possibility, therefore, of significant variations in land-use patterns between the Aggregate Character Areas that merit further investigation.

6.2.6 EARLY MEDIEVAL (*c*.410 to 1066)

The Early Medieval period is poorly represented in the HER by comparison with the more prolific Roman and High Medieval periods (Figs 6.2-3), with only 114 sites (0.08 per km²) for all of the Character Areas. This may reflect in part demographic changes following the ending of Roman administration, but other factors such as the end of mass pottery production, possibly with a more prominent role for organic and other perishable goods, and the poor archaeological visibility of settlements, may have led us to underestimate the extent of activity in this period. There is also a strong likelihood that many sites lie beneath established villages or towns such as Nottingham and Newark, both of which are known to have originated as Anglo-Saxon burhs. Neither towns nor villages of course can fall within the remit of aggregates archaeology, and we focus in this and subsequent sections upon those categories of site that may reasonably be investigated during aggregates extraction.

Fields and field systems

The fate of the coaxial field systems of the late Roman period is unclear, but there are indications that some of the rectilinear field systems of the river terraces had continued in use, albeit in modified form, into the sub-Roman and Anglo-Saxon periods (notably at Brough, on the outskirts of the Roman town of *Crococalana*). Some components of the Roman brickwork-plan field systems of the Sherwood Sandstone, which on current evidence may have been abandoned progressively after the 3rd century AD, may also have continued in use beyond the Roman period,

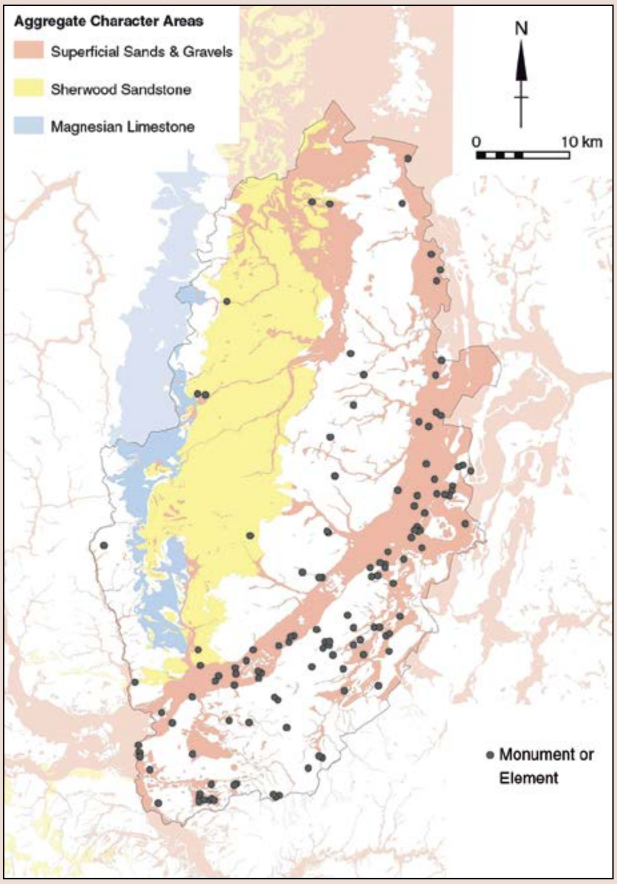

Fig. 6.11. Distribution of Early Medieval Monuments and Elements (source: Notts. HER)

but further work is required to test this hypothesis. How long such long-established field systems might have persisted is difficult to establish, but there are indications that they may have continued long enough on some sites to have influenced the development of the medieval open fields. The evidence is tenuous, but there are suggestions at Brough and at sites such as Willington in the Derbyshire Trent Valley that Roman ditch alignments had sometimes influenced the layout of the medieval open fields and the positioning of the ridge and furrow that is integral to the open field system. Such work provides a valuable pointer to further research, which it is recommended should include the retrieval of pottery and other datable finds from furrow fills to investigate their date range and their relationship to earlier boundary systems.

Fishweirs and other riverine structures

Extraction of sands and gravels along the river valleys of Nottinghamshire regularly exposes palaeochannels and redeposited terrace sands and gravels, and in the process has exposed fishweirs and other riverine structures that provide important insights into Early Medieval usage of riverine resources. The retrieval during quarrying near Colwick of an Anglo-Saxon timber fishweir provides an outstanding example of the preservation of structures that can contribute to studies of subsistence and related issues such as woodland management. Other important finds include a remarkable 8th century cal AD timber bridge at Cromwell, which provides proxy evidence for an associated road or trackway across the floodplain, and the rare evidence for riverine transport that is provided by the discovery in the Idle Valley near Mattersey of a logboat dated by radiocarbon to the 5th century cal AD.

Rural settlements

Archaeological traces of rural settlements remain elusive across each of the Character Areas, due in large part to the difficulty of identifying the structural elements of Anglo-Saxon settlements and concealment beneath later medieval villages. However, the potential of large-scale aggregates extraction for identifying hitherto unknown sites and for elucidating settlement morphology, social and economic variability, and environmental conditions are emphasised by the few examples of Anglo-Saxon settlements that have been recorded by excavation (notably on the river terrace sands and gravels of the Trent Valley at Brough, Girton, Langford and Holme Pierrepont, and on glaciofluvial sands and gravels near East Leake). The archaeological footprint of such sites comprises variable combinations of rectilinear post-pit buildings, sunken-floored buildings (grubenhäuser) and scatters of pits and post-holes that are difficult to spot unless large areas are investigated in advance of extraction. This emphasises the desirability of large-scale targeted excavations of suspected sites, together with the routine application of strip, map and sample procedures (Table 7.8). The preservation of structural remains at Girton by blown sand deposits provides an additional explanation for the rarity of recorded Anglo-Saxon settlements in areas of redeposited coversands, and further justification for monitoring closely the excavation of coversands and other masking deposits.

Burials

Inhumation, cremation and mixed-rite cemeteries, dating mainly from the 5th to early 7th centuries, are widely distributed across the river terraces and glaciofluvial sands and gravels, notably at Newark and Holme Pierrepont, together with rare single inhumations. The latter class of monument includes a remarkable burial at Winthorpe near Newark, which revealed a female inhumation associated with a rich range of grave goods. These burials provide an important insight into religious and ritual practices as well as ideal opportunities for isotope, DNA and other scientific analyses aimed at determining genetic relationships, diet and other demographic characteristics. No examples of burials have been recorded on the

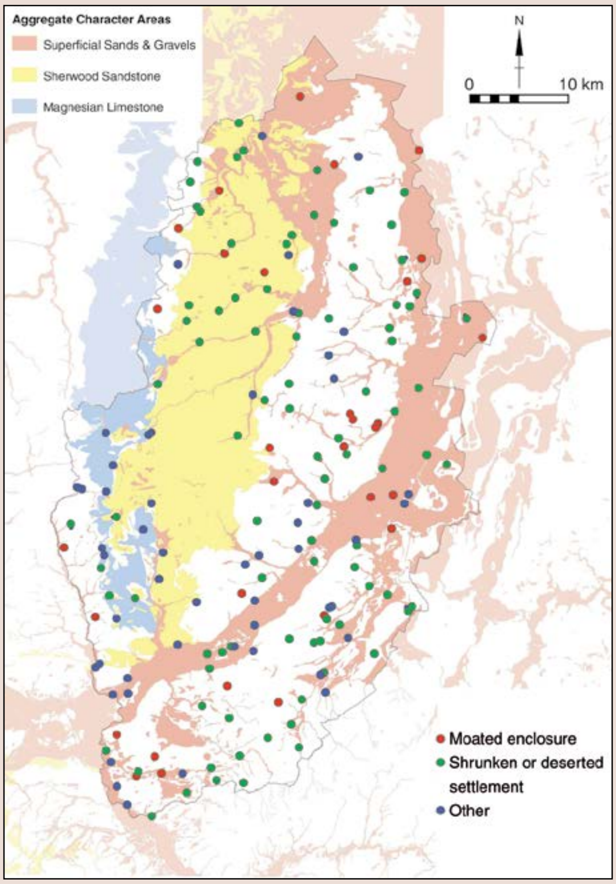

Fig. 6.12. Distribution of High Medieval domestic monuments (source: Notts. HER)

Magnesian Limestone, while investigations on the Sherwood Sandstone have revealed so far only a rich barrow burial at Oxton, perhaps signalling differences in burial traditions between the Character Areas.

Territorial boundaries and moot sites
Attention should be drawn also to the discovery in all Character Areas of linear earthworks that might mark Early Medieval territorial boundaries, and hence may contribute usefully to studies of early parochial organisation. Dating for all is problematic, but examples merit excavation, wherever threatened, to investigate their character and date. A small number of potential moot sites, which would have served as meeting and assembly places, have also been recorded on the Sands and Gravels and Sherwood Sandstone, and investigation of monuments at risk should be encouraged in view of the light they could shed upon early systems of administration.

6.2.7 HIGH MEDIEVAL (1066–1485)

After sites of the Modern period, the 1087 High Medieval sites recorded in the HER are the most densely distributed across the three Character Areas (0.79 per km²), occurring in approximately equal densities across the Sands and Gravels (0.98 per km²) and Magnesian Limestone (0.95 per km²) but in significantly lower densities across the Sherwood Sandstone (0.55 per km²). These variations may in this instance reflect actual differences in land-use, given that large areas of the Sherwood Sandstone are known from documentary sources to have comprised woodland and heathland during the High Medieval period.

A significant proportion of the High Medieval archaeological resource falls in urban and other areas beyond the scope of this study, but a broad range of monument types has been identified in rural areas with potential for aggregates extraction. These are described fully in the archive report, and as in the previous section we focus here upon those categories of site that may reasonably be investigated during extraction.

The agrarian landscape
Vestiges of ridge and furrow, headlands and other earthworks associated with open field agriculture, together with field shapes reflecting open fields, are distributed unevenly across the Character Areas (with particularly poor representation across the Magnesian Limestone and the northern part of the Sherwood Sandstone). There is significant potential for investigating the growth of the open field system,

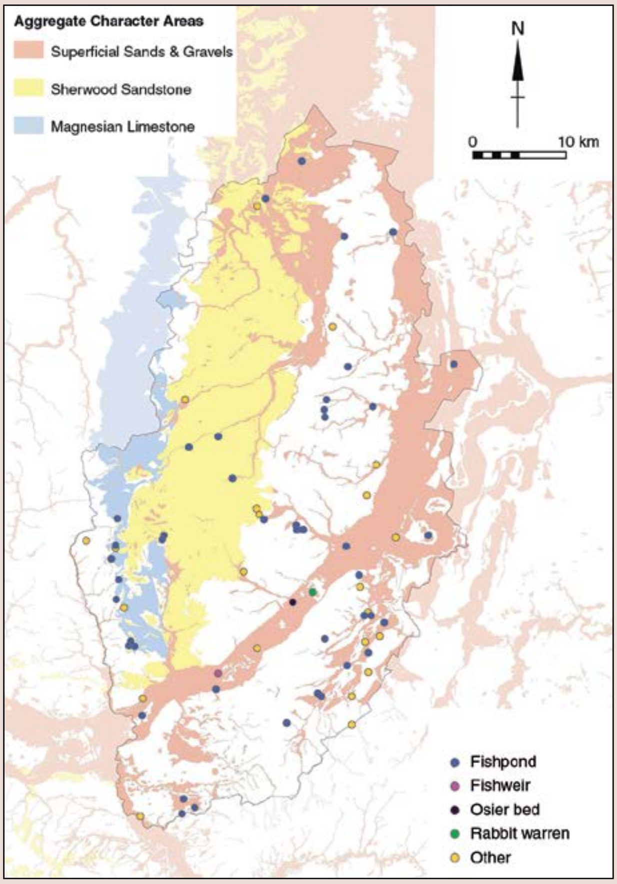

Fig. 6.13. Distribution of High Medieval monuments relating to agriculture and subsistence (source: Notts. HER)

the process of early enclosure and variability between and within the Character Areas. On the Sherwood Sandstone, for example, archaeological and historical data suggest that pasture, principally for sheep, may have prevailed over much of the area, as part of a complex patchwork including woodland, wood pasture, sheepwalk, warrens and temporary arable enclosures (brecks) supplementing arable infields. There is also significant scope for elucidating the character, distribution and development of specialised land–use regimes, such as water meadows and osier beds, and for examining the specialised means of food production that are indicated archaeologically by rabbit warrens and fishponds. Other features of the agrarian landscape that merit consideration include isolated moated enclosures; these are sometimes associated with archaeological remains of buildings, but could occasionally have been used for purposes such as orchards.

Deer parks, monastic estates and granges
Deer parks have been identified in each of the Character Areas, although not surprisingly they are particularly densely distributed across the woodlands and heathlands of the Sherwood Sandstone, and may yield archaeological remains of associated structures

such as park pales and hunting lodges. Opportunities may also arise in areas designated for aggregates extraction for the investigation of fishponds, relict ridge and furrow and other landscape features associated with monastic foundations and granges.

Fishweirs and other riverine structures

As discussed for the Early Medieval period, aggregates extraction may expose fishweirs and other riverine structures with major potential for elucidating the use of riverine resources. An 11th-12th century cal AD V-shaped timber fishweir recorded at Colwick emphasises the potential of the Trent Valley and other riverine environments for the preservation of structural remains of major regional importance, and other remains such as mills, mill dams, bridges and bankside revetments should be anticipated during extraction.

Rural settlement

There is restricted scope for the study of later medieval settlement, as most archaeological remains will be associated with modern villages lying outside areas appropriate for aggregates extraction. Structural remains of deserted or shrunken villages in rural settings could, however, require investigation in advance of quarrying, and if not preserved *in situ* should form elements of schemes of treatment aimed at elucidating the morphology and functions of settlement and the processes of shrinkage and desertion. Isolated moated enclosures may also lie within areas selected for aggregates extraction, and if not preserved *in situ* could yield valuable evidence of the date, character and function of this heterogeneous monument class.

Territorial boundaries and moot sites

As in the Early Medieval period, attention should be drawn to survivals in each of the Character Areas of linear earthworks that may contribute to studies of parochial organisation. Dating is problematic, but examples merit excavation wherever threatened to investigate their character and date. A small number of potential but as yet undated moot sites have also been recorded on the Sands and Gravels, notably at Aslockton in the Vale of Belvoir, and at Blyth Law and Thynghowe on the Sherwood Sandstone. Investigation of the late medieval use of possible moot sites revealed during the assessment of potential aggregates extraction areas could shed useful light upon developing systems of administration.

6.2.8 POST-MEDIEVAL AND MODERN (1485 to present)

The Post-Medieval and Modern periods are represented respectively by 878 and 2239 sites,

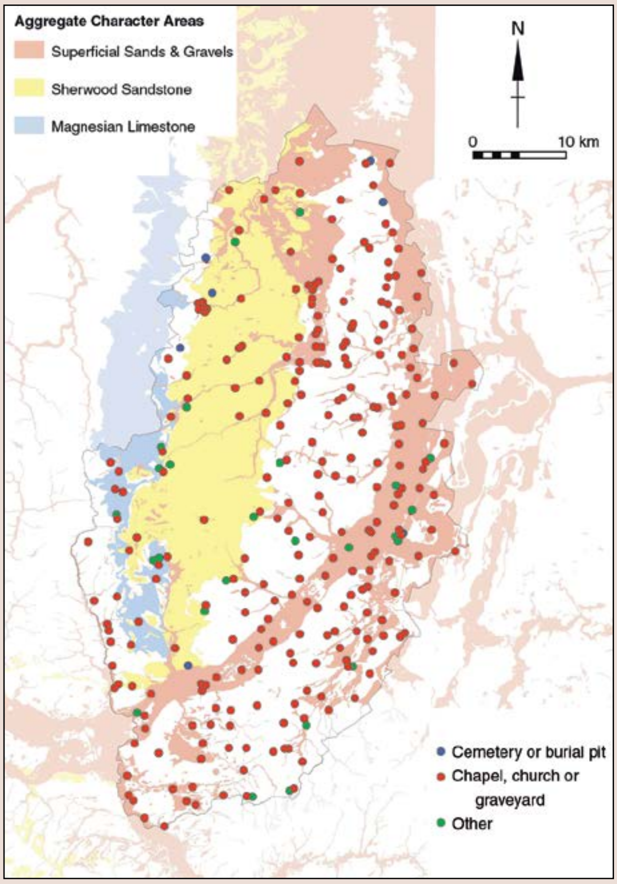

Fig. 6.14. Distribution of Post-Medieval and Modern religious, ritual and funerary monuments (source: Notts. HER)

yielding average densities of 0.64 and 1.63 sites per km². The Magnesian Limestone dominates in terms of the density of remains, as might be expected in view of the disproportionate impact of industrialisation upon this Character Area. An even greater proportion of the archaeological resource falls in areas outside the scope of this study than in earlier periods, but nonetheless a broad range of monument types that might potentially be affected by aggregates extraction has been identified. Details are provided in the tables accompanying the full archive report, and we focus in this concluding section upon the key categories of site that have been identified for these periods.

The agrarian landscape

The rural zones of each Character Area preserve archaeological remains that are fundamental to understanding the evolution of the agrarian landscape and variations between landforms, and aggregates extraction may be expected to impact significantly upon this resource. These periods saw the progressive enclosure of the open fields, culminating with the geometric field patterns that characterised the 18th and 19th centuries and the modified field patterns of the 20th and 21st centuries. Plentiful landscape evidence survives that may elucidate these developments and the application of industrial practices to farming (indicated, for example, by the straight ridge and furrow created by steam ploughing). Other key developments include the expansion of water meadows and osier beds and, particularly in the lower Trent and Idle Valleys, the development from the 17th century of major drainage schemes designed to improve the agricultural potential of wetlands. Fishponds and rabbit warrens add to the diversity of the landscape, together with isolated moated enclosures that in common with their medieval predecessors might sometimes have defined areas used for purposes such as orchards.

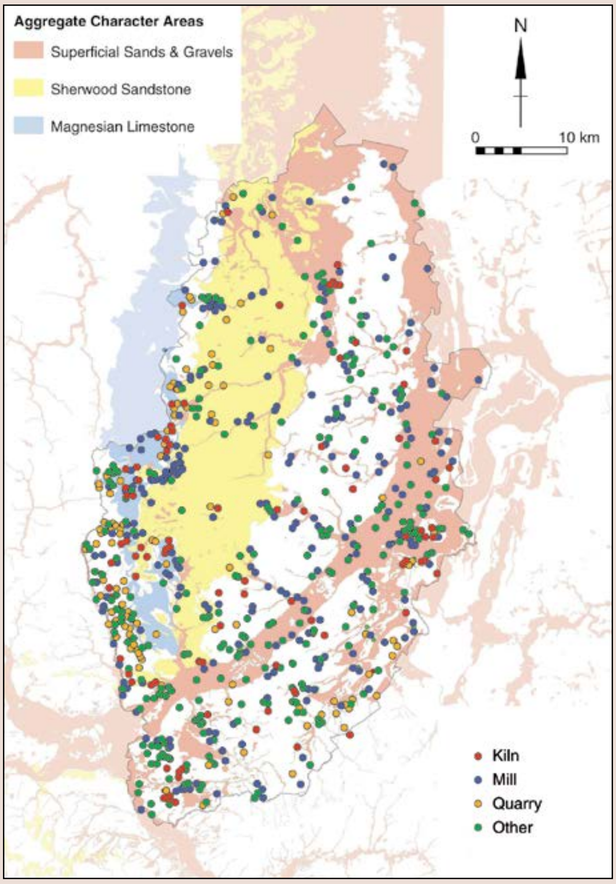

Fig. 6.15. Distribution of Post-Medieval and Modern industrial monuments (source: Notts. HER)

Rural settlements

As in the High Medieval period, there is limited scope for the study of rural settlement, as most archaeological remains will be associated with modern villages lying outside areas appropriate for aggregates extraction. Again, if preservation *in situ* is not recommended, remains associated with deserted or shrunken villages could yield significant information on settlement morphology and functions and the processes of abandonment. Investigations in rural areas designated for aggregates extraction may also permit study of activity beyond the village, as reflected, for example, in the isolated non-conformist chapels and burial grounds that are particularly characteristic of the Sherwood Sandstone.

Relics of rural industrialisation

The agrarian changes of the period were accompanied, as the Industrial Revolution gained momentum, by progressive industrialisation of the countryside. Many relics of this process remain, and merit recording and analysis in advance of development. Particular attention should be drawn to the impact of coal mining and quarrying, together with the landscape impact of kilns, textile mills, railways, canals and other industrial and transport installations. Woodlands merit special scrutiny, as they would have provided raw materials for a wide range of activities, and may preserve saw pits, charcoal burners' hearths and other remains indicative of woodland industries.

Gardens and parklands

One of the hallmarks of the Nottinghamshire landscape is the transformation of established monastic estates, following the Dissolution of 1536-40, into gardens and parklands for the aristocracy and gentry, particularly across the Sherwood Sandstone and Magnesian Limestone. These preserve a wide variety of recreational, ornamental and other features, often some distance from the grand house that sits at the centre of the estate, and hence may fall within areas designated for extraction. Monuments that might be affected by development include recreational structures such as fox coverts or duck decoys, major landscape features such as tree avenues or ornamental ponds, and fishponds.

Battlefields and fortifications

A final theme emerges from consideration of the extensive remains that have survived across each Character Area of battlefields, skirmish sites and defensive works. Together, these provide a substantial body of evidence for the landscape impact of warfare, while the Civil War fortifications around Newark form a monument complex of national importance. Monuments encompass the last battle of the War of the Roses at Stoke Fields (1487), an unparalleled concentration of Civil War defensive and offensive sites around Newark (many, as at Hawton, surviving as earthworks), three Civil War battlefields and skirmish sites, and a varied collection of World War I/II and Cold War remains focused particularly upon Sherwood Forest (including airfields, pillboxes, anti-aircraft and searchlight batteries, communal bunkers and training trenches). All have the potential to contribute significantly to studies of the landscape impact of conflict between the late 15th and 20th centuries, while some, such as the Civil War earthworks around Newark, may be of such significance that preservation *in situ* will be recommended.

7. LANDFORMS AND ARCHAEOLOGY:

GEOMORPHOLOGICAL PROCESSES, ARCHAEOLOGICAL ASSOCIATIONS AND ASSESSMENT, EVALUATION AND MITIGATION STRATEGIES

INTRODUCTION

Detailed analyses of the distributions of archaeological sites and finds within each of the Aggregate Character Areas have emphasised the close correlations between certain archaeological and environmental remains and particular landform elements (Knight and Spence 2012). Holocene palaeochannels, for example, may be expected to yield waterlogged palaeobotanical and other organic remains that may elucidate landscape change and developing subsistence economies, while organic material deriving from pre-Holocene interglacial and interstadial environments may be preserved within and beneath cold stage gravels deposited in the major river valleys. The river terrace sands and gravels are also renowned for their complex cropmark palimpsests, and in particular for the wealth of prehistoric and Roman sites that was first noted in *A Matter of Time* (RCHME 1960; see also Whimster 1989). Some landforms may be restricted to particular Character Areas – such as coversands, which are limited to the Superficial Sands and Gravels of the Lower Trent. Alternatively, other landforms may occur across a variety of Character Areas – such as glacial till (boulder clay), remnants of which overlie Sherwood Sandstone and Magnesian Limestone bedrock. To clarify these relationships, correlations between landform elements and Aggregate Character Areas have been summarised in Table 4.1 above.

In this chapter, tabular summaries are presented of the observed archaeological associations for each of the landform elements defined in this document. Undifferentiated deposits, which can include head, talus and alluvial fan accumulations of highly variable origin and character, are not included because of the difficulty of generalising on the subject of archaeological associations or recommended assessment, evaluation and mitigation strategies. The key geomorphological processes operating within each landform element are also noted, together with the variety of assessment, evaluation and mitigation techniques that should be considered during the compilation of archaeological schemes of treatment in advance of aggregates extraction. It is hoped that this will provide a succinct guide to current practice that will be of value to aggregates companies, consultants and contractors working in Nottinghamshire.

Helpful summaries of the techniques referred to in the following tables are provided in *Mineral Extraction and Archaeology: A Practice Guide* (MHEF 2008, 17-29), the guidance booklet published as a component of the Derbyshire and Peak District Aggregates Resource Assessment (Brightman and Waddington 2010) and the ALSF-funded publication *Making Archaeology Matter* (Knight and Vyner 2007). The last of these was prepared with the aggregates industry of the Trent Valley firmly in mind, but many of the techniques it describes are as applicable to the Magnesian Limestone and Sherwood Sandstone as the Sands and Gravels.

Fig.7.1. The value of aerial survey as a prospection technique on the Superficial Sands and Gravels is emphasised by the remarkable clarity of the cropmarks revealed in this view of the Trent Valley near North Muskham. The photograph shows a complex of rectilinear ditched enclosures and trackways dating probably from the late prehistoric and Roman periods, including a double pit alignment leading westwards from the River Trent (bottom) to beyond the A1 dual carriageway. © English Heritage (Derrick Riley Collection: DNR 847/24)

A summary of recommended assessment, evaluation and mitigation techniques is provided at the end of this section under the following four headings (Table 7.8):

1. Pre-Determination desk-based assessment: desk-based study, aimed at providing a synthesis of current knowledge of the archaeological resource, combined with a walkover survey of the proposed extraction area[28]. This provides the crucial foundation for the development of an appropriate evaluation strategy aimed at 'determining as far as is reasonably possible, the nature of the archaeological resource within a specified area using appropriate methods and practices'.[29]

2. Pre-Determination evaluation: programme of investigative work employing various combinations of the intrusive and non-intrusive fieldwork techniques that are listed in Table 7.8. The combination of techniques will be agreed with the archaeological curator, taking into account variations in the effectiveness of these between landform elements.

3. Post-Determination mitigation: programme of archaeological observation and investigation conducted in advance of and/or during ground disturbance, combined in certain circumstances with preservation *in situ*. The range of fieldwork methodologies to be employed will be agreed with the archaeological curator, who may recommend different approaches across the quarry depending upon the nature of the archaeological resource and the diversity of landform elements. All ground disturbances will require archaeological control and supervision ('watching brief'[30]), with adequate resources for the use where appropriate of strip, map and sample techniques and for 100% excavation of features or deposits where this is deemed essential for a satisfactory understanding of the archaeological remains[31]. Appropriate contingency funds must be made available to cover the risk of unexpected discoveries - such as logboats, timber bridges and fishweirs in alluvial zones (Table 7.5).

4. Post-fieldwork tasks: analysis, archiving, report preparation and dissemination, including full publication where recommended by the curator.

It should be emphasised that although some fieldwork techniques are restricted to Post-Determination mitigation (*e.g.* strip, map and sample), many others (such as sediment coring) may be recommended during evaluation or mitigation, or possibly both. Similarly, preservation *in situ* may be recommended at any stage of the development process, and for sites of national importance may be recommended without a requirement for assessment. In addition, depending upon their character, post-fieldwork tasks may be conducted at a variety of stages in the development process.

There can in fact be no hard and fast rules on when to use particular archaeological techniques, as the choice of these and the decision at which stage to employ them will depend upon the character of the site, its environmental setting and details of the development proposal. We have, therefore, eschewed a simple staged approach, but hope that the tables below will provide clear definitions of the techniques to be considered at all stages of the development process and hence expedite the formulation of archaeological schemes of treatment.

To assist further the choice of technique, we have indicated in Table 7.8 variability in the effectiveness of evaluation techniques between landforms. We have followed in principle the scheme devised for Derbyshire and the Peak District (Brightman and Waddington 2010, Table 15), but have modified the tabular format to show both the impact of landform upon the efficacy of evaluation techniques and curatorial requirements for the assessment, mitigation and post-fieldwork stages. The suitability of field methods as evaluation techniques for particular landforms is indicated by a gradation from darker to lighter shades of blue, with dark blue indicating circumstances where particular techniques have proved to be especially effective. Most of the mitigation strategies are standard requirements (and are shaded dark red), but targeted excavation, 100% excavation of features/ deposits and preservation *in situ* are options to be decided in liaison with the archaeological curator (and are shaded light red). In addition, while it is recommended that quarry conveyor belts should always be fitted with metal detectors during the quarrying of alluvial and other landforms likely to yield metalwork that was deposited in watery contexts (Tables 7.4–7.7), their use during the excavation of sandstone or limestone bedrock and of till deposits is a matter of curatorial judgement.

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28 *Institute for Archaeologists 2001a. Standard and Guidance for Archaeological Desk-Based Assessment.*

29 *IfA 2001b. Standard and Guidance for Archaeological Field Evaluation.*

30 *IfA 2001c. Standard and Guidance for an Archaeological Watching Brief.*

31 *IfA 2001d. Standard and Guidance for Archaeological Excavation.*

TABLE 7.1: MAGNESIAN LIMESTONE BEDROCK

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
● Thin and intermittent deposits of Middle Pleistocene till, deposited by the Anglian glaciers that would have scoured Nottinghamshire *c.*425,000 years ago, are recorded on BGS maps, and may fall within proposed extraction areas. It is likely that thin, unmapped deposits of till are spread more widely across this landform. ● Coversands and loessic sediments were deposited extensively over this area in the late Pleistocene and were reactivated during the Holocene. These deposits form the parent materials for the light and fertile loamy soils that have developed over much of the gently undulating terrain of the limestone escarpment. Pockets of loess with preserved palaeosols may survive in caves, fissures, natural hollows, *etc.* ● The escarpment is dissected by steep-sided gorges, cut by meltwater-enriched Pleistocene rivers. Caves and rock-shelters flanking these gorges may preserve multiperiod archaeological remains, which may have been buried or reworked by fluvial, aeolian, slope and rock failure processes, human or animal activity and chemical processes such as calcification. ● Palaeolithic materials deposited in plateau or hillslope settings may have been reworked or buried by periglacial, hillslope and mass-movement processes. ● Hillslope and plateau settings have generally been stable during the Holocene, but there is potential for significant localised colluviation and mass-movement activity. ● Holocene alluvial accumulations are comparatively restricted, given the prevalence of narrow, steep-sided gorges, but more extensive alluvial spreads with potential for preserving archaeological and environmental remains have been mapped in some of the broader river valleys.	● **Palaeolithic.** Caves and rock shelters, some yielding evidence for Palaeolithic activity, are distributed widely across the limestone, and have major potential for elucidating Pleistocene settlement. Church Hole cave is of outstanding importance in view of its internationally important parietal cave art, artefacts and environmental remains. Undisturbed sites may be preserved below talus accumulations, while significant cultural and environmental remains may be preserved in caves beneath layers of flowstone. Pockets of loess within caves may preserve significant environmental remains. Any work on the escarpment may reveal hitherto unknown fissures and other features with undisturbed environmental or cultural remains. Rare Late Upper Palaeolithic lithic artefacts found during fieldwalking may signify open-air sites, but more work is required to demonstrate the character of the sites from which they derive. ● **Mesolithic.** Activity may have continued in and around some caves and rock shelters, which should be investigated if threatened for undisturbed cultural and environmental remains (*e.g.* beneath talus). Significant numbers of sites have been recorded in extensively fieldwalked areas, and more may lie beneath alluvium or colluvium. ● **Neolithic to MBA.** Lithic artefact scatters recovered during fieldwalking or test-pitting and rare surface finds of stone axes and metalwork provide the only evidence for potential activity foci. Ceremonial and funerary sites are conspicuous by their absence, in sharp contrast to Derbyshire. ● **LBA and Iron Age.** A stone-walled enclosure at Scratta Wood provides the only definite structural evidence of settlement in this period. Earthworks at Strawberry Bank may represent a promontory fort comparable to the Iron Age/Roman site at Markland Grips, Derbyshire, while rare cropmark enclosures or trackways might indicate IA activity. Some lithic scatters could date from this period, complementing rare surface finds of pot and metalwork. ● **Roman.** Rare cropmark enclosures or trackways might signify Roman activity, but there is currently no evidence to rival the brickwork-plan field systems of the Sherwood Sandstone landform. Activity is otherwise indicated by rare rural settlements, villas and forts, some with associated cemeteries, rare discoveries of kilns and iron-smelting furnaces, and two potential roads. ● **Medieval.** Very sparse evidence is available for Early Medieval activity, although some villages and open field systems may originate in that period. Landscape evidence for the High Medieval period includes ridge and furrow, field boundaries reflecting open field cultivation and a limited range of other earthworks (particularly fishponds and shrunken/ deserted villages), some relating to monastic estates. This landform is characterised by more isolated hamlets/farms than the remainder of the County, and some significant contrasts may be discerned with the processes of village nucleation observed elsewhere in the County. In common with the Sherwood Sandstone landform, some significant forest-edge/secondary settlements may also be identified. ● **Post-Medieval and Modern.** Field boundaries indicating the progression from open field to enclosed landscapes provide a key archaeological resource, investigation of which should form a key element of schemes of treatment. Many traces also survive of rural industrialisation, including quarries, limekilns, features associated with coal mining, mills and straight ridge and furrow formed by steam ploughing. Significant garden and parkland features associated, for example, with water management and gentry leisure pursuits, should also be anticipated in this landform's extensive parklands (*e.g.* Newstead Abbey).	● **Desk-based assessments**, including **walkover surveys** to locate earthworks, slope deposits potentially sealing caves, *etc.*, should precede all other work. ● **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). ● **Aerial photography**. Few crop- and soilmarks are known by comparison with Derbyshire, despite the suitability of the limestone for their formation and the presence of extensive arable land. All available vertical and oblique air photographs should be inspected, followed by transcription of cropmarks, *etc.* ● **Lidar surveys** may assist earthwork identification, particularly in woodlands impervious to air photography, and all available lidar and other remote sensing records should be examined during assessment. ● **Geophysical surveys**, including magnetometry and earth resistance, can be effective on this landform. These should be considered as potential evaluation techniques, together with ground-penetrating radar for the location of fissures and airborne techniques such as multispectral remote sensing. ● **Earthwork surveys** have highlighted the potential of this landform for the preservation of Iron Age/ Roman enclosures, ridge and furrow, traces of woodland industries, *etc.*, in woodland and other environments little damaged by ploughing, and such remains should be sought and surveyed where required. ● **Fieldwalking** is crucial for locating sites where surfaces little modified by Holocene geomorphological processes have been ploughed and should be conducted routinely. Identifications of lithic concentrations are especially important, as these may provide vital evidence for prehistoric sites represented by scant (if any) structural remains. **Test-pitting** can elucidate further the character of finds scatters and the site stratigraphy, and may identify remains preserved beneath alluvium, *etc.* ● **Sediment coring** may be recommended to investigate sub-surface stratigraphy (*e.g.* colluvial accumulations along valley sides/bottoms). ● **Evaluation trenches** are useful for establishing the character of known sites and their archaeological and environmental potential (*e.g.* location of features beneath ridges of ridge and furrow). Large-scale trenching may not always be routinely recommended, as sites with dispersed structural remains may elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements). ● **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* regionally important cropmark sites). ● **Strip, map and sample techniques** provide the most effective method for locating dispersed structural remains such as characterise Neolithic to EIA and Early Medieval settlements, and will be applied routinely to ensure that sites of particular periods and types are not missed during excavation. Mitigation strategies will require contingency provisions, which will be targeted by reference to this document upon the most significant remains. ● **Palaeoenvironmental sampling and analysis** should be carried out routinely during evaluation and mitigation. The alkaline bias of soils on limestone bedrock provides excellent potential for organic preservation, and provision should be made for environmental sampling and analysis, including scientific dating. ● **Caves, rock shelters and fissures** provide a resource of national significance for studies of early prehistory, and some will be of such significance that preservation *in situ* is recommended. Any disturbances will require tailored evaluation/mitigation strategies devised with appropriate specialist input.

TABLE 7.2: SHERWOOD SANDSTONE BEDROCK

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Sporadic deposits of Middle Pleistocene Till, deposited by the Anglian glaciers that would have extended across Nottinghamshire *c*.425,000 years ago, are recorded on BGS maps of the Sherwood Sandstone, and may fall within proposed extraction areas. It is likely that thin, unmapped deposits of till extend more widely across elevated areas of the gently undulating terrain that characterises this landform. • The Sherwood Sandstone is characterised by light and dry soils, particularly susceptible to wind erosion, and depending upon the agricultural regime the more moisture-retentive tills may in certain periods have been particularly favoured by agricultural communities. More detailed mapping of till deposits is required to investigate the potential impact of variations in soil character upon settlement patterns and agricultural practice, and every opportunity should be taken to plot and to characterise more precisely these veneers of glacial drift. • Palaeolithic materials deposited in plateau or hillslope settings may have been reworked or buried by Quaternary periglacial, hillslope and mass-movement processes. • Hillslope and plateau settings have generally been stable during the Holocene, but there is potential for significant localised colluviation and mass-movement activity. • Extensive Holocene alluvial accumulations characterise the broad and open river valleys that traverse the Sherwood Sandstone, and may seal well-preserved archaeological and environmental remains.	• **Palaeolithic.** Very few sites have currently been recorded, but particularly in the Upper Palaeolithic period we should anticipate evidence of encampments of hunter-gatherers migrating between the Trent Valley and limestone uplands. Some sites may lie concealed beneath alluvium or colluvium. • **Mesolithic.** Sparse scatters of lithic artefacts have been recorded in intensively fieldwalked areas, but more may be sealed beneath alluvium or colluvium in valley bottoms. • **Neolithic to MBA.** The archaeological record is dominated by lithic artefact scatters, although even in intensively walked areas surface densities are generally low. Occasional finds of stone axes and metalwork have also been made. Rare discoveries have been made of possible Beaker burials, undated ring-ditch cropmarks and circular mounds interpreted as possibly Neolithic or Bronze Age barrows, but no funerary or ceremonial monuments definitely of this period have been recorded. • **LBA and Iron Age.** The Roman brickwork-plan field systems may originate in the Late Iron Age, together with some of the associated enclosed settlements (*e.g.* Dunston's Clump). Marsh forts or promontory forts should also be anticipated, although positive evidence for these has yet to be recovered. Some lithic scatters might relate to activity in this period, which is represented also by rare pottery scatters and occasional discoveries of metalwork and coins. • **Roman.** The rural landscape is characterised by brickwork-plan fields, integrated with trackways and domestic or specialised enclosures. These field systems may imply colonisation of hitherto marginal areas in response to increasing pressures on land resources, and may be linked to the development of a more intensive agrarian economy with an emphasis upon pasture. Some Roman roads traversed this landform, linking a number of early forts. Villas and towns are conspicuous by their absence. • **Early Medieval.** Some brickwork-plan field systems may have continued in use, while some later medieval villages and open field systems may have pre-Conquest origins. The area preserves several linear earthworks that might represent territorial boundaries originating in this period, plus a rich barrow burial at Oxton. • **High Medieval.** Ridge and furrow and field shapes suggesting open fields survive in some areas, and provide a key resource for assessing the extent of open field agriculture. A rich variety of other earthworks is preserved, many surviving in woodland or parkland and some relating to monastic estates; these include fishponds, moated enclosures, deserted or shrunken villages, and deer park and other boundary features. Some significant forest-edge/ secondary settlements may also be identified. • **Post-Medieval and Modern.** Field boundaries provide a key resource for rural landscape studies, along with water meadows, osier beds and traces of rural industrialisation (including quarries, limekilns, vestiges of coal mining, mills and straight ridge and furrow formed by steam ploughing). This landform is renowned for its country parks and gardens, which preserve crucial evidence for park and garden design and gentry leisure pursuits (including fox coverts, duck decoys, tree avenues and ornamental ponds); many other monuments are preserved in heath, woodland etc (*e.g.* 20th century military remains).	• **Desk-based assessments,** including **walkover surveys**, to precede all other work. • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photography.** Crop and soil-marks show clearly on the well-drained sandstones, which in Nottinghamshire are renowned for the brickwork-plan field systems dating principally from the Roman period. All available air photographs should be inspected, followed by transcription of cropmarks, soilmarks, *etc.* • **Lidar surveys** may assist earthwork identification, particularly in woodlands impervious to air photography, and all available lidar and **other remote sensing records** should be examined during assessment. • **Geophysical surveys**, including magnetometry and earth resistance, can be very effective on this landform, and together with **airborne techniques** such as multispectral remote sensing should be included in the evaluation toolkit. • **Earthworks** are particularly well preserved in the extensive woodlands and parklands of this landform, and have major potential for enhancing studies of garden and park design and for preserving earlier features such as fishponds, deserted or shrunken villages and 20th century military remains. Walkover surveys should be conducted during assessment to ensure the identification and subsequent evaluation of extant remains. • **Fieldwalking** is crucial for locating sites where surfaces little modified by Holocene geomorphological processes have been ploughed, and should be employed routinely. Identifications of lithic concentrations are especially important, as these may provide vital evidence for prehistoric sites represented by few if any structural remains, while fieldwalking of the brickwork-plan fields has demonstrated the enormous potential of this technique for elucidating the date and possible functions of these fields. **Test-pitting** can elucidate further the character of finds scatters and the site stratigraphy, and in particular may identify remains preserved beneath alluvium, colluvium, *etc.* • **Sediment coring** may be recommended to investigate sub-surface stratigraphy (*e.g.* colluvial accumulations along valley sides/bottoms). • **Evaluation trenches** provide useful means of establishing the character of known sites and their archaeological and environmental potential. However, large-scale evaluation trenching may not always be recommended as many key sites are likely to elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements). Important archaeological deposits and features may survive beneath the ridges of ridge and furrow, and the potential for preserved remains should be determined during evaluation. • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* regionally important cropmark sites). • **Strip, map and sample techniques** provide the most effective method for locating dispersed structural remains, such as characterise settlements of the Neolithic to EIA and Early Medieval periods, and will be applied routinely to ensure that sites of particular periods and types are not missed during excavation. Such mitigation strategies will require contingency provisions, which will be targeted by reference to this document upon the most significant archaeological remains. • **Palaeoenvironmental sampling and analysis** should be carried out routinely during evaluation and mitigation, including provision for scientific dating.

TABLE 7.3: MIDDLE PLEISTOCENE TILL

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Thin and intermittent deposits of Middle Pleistocene till, deposited by the Anglian glaciers that would have spread southwards across Nottinghamshire *c.*425,000 years ago, have been recorded on BGS maps of the Magnesian Limestone and the Sherwood Sandstone. Glaciofluvial deposits of sand and gravel form discontinuous layers and lenses throughout these till deposits. It is likely that thin deposits of till, not recorded on BGS maps, extend more widely across the Aggregate Character Areas, and more extensive deposits than may be deduced from current records should be anticipated during extraction. • These tills, historically known as boulder clay, form a moisture-retentive, clay-rich landform that can vary from waterlogged to indurated (hardened) depending upon conditions, and their distribution may have impacted significantly upon settlement and agricultural practices. Detailed mapping of till deposits should be viewed as a priority for investigating the potential impact of variations in soil characteristics upon settlement patterns, and every opportunity should be taken to plot and to characterise more precisely these veneers of glacial drift. • Localised colluviation and mass-movement activity may have impacted upon this landform during the Holocene, and in turn may have distorted the archaeological record through the burial of preserved remains.	• **Palaeolithic and Mesolithic.** The HER records no sites on these landforms, but it would be surprising if the wide-ranging hunter-gatherer groups that are implied by lithic artefact distributions in adjoining areas of the Sherwood Sandstone and Magnesian Limestone had not traversed the scattered patches of glacial till that comprise this landform. • **Neolithic to MBA.** Very rare lithic scatters and single finds (*e.g.* axe-hammers) have been recovered from till overlying Sandstone and Limestone. Heavier clay soils may have proved unattractive to early agriculturalists in comparison to the light, easily cultivated soils of the river terraces and other landforms, and hence this comparative paucity of evidence might reflect in part real differences in the distribution of activity at this time. • **Iron Age and Roman.** Cropmarks and soilmarks indicating landscapes of brickwork-plan fields, trackways and enclosures extend beyond the Sherwood Sandstone to superficial till deposits, notably in the vicinity of the excavated LIA to Roman enclosure at Dunston's Clump, emphasising that till deposits are capable of generating useful cropmark data. There is some evidence that Roman enclosures may have been preferentially sited on the more moisture-retentive and richer agricultural soils that developed on till deposits, and for an emphasis in the brickwork-plan fields upon pasture (illustrated by the clustering of pottery and other finds inside enclosures, rather than scattered widely as would be expected if they had formed components of manure scatters on arable fields). In addition, extrapolations of known Roman roads suggest that some are likely to have traversed tills overlying sandstone and limestone. • **Early Medieval.** No sites have currently been recorded, but as elsewhere in the County this may reflect in large part merely the difficulty of locating sites of this period. Some of the recorded brickwork-plan field systems may have continued in use into the sub-Roman period and beyond. In addition, as in other Character Areas, some later medieval villages and open field systems may have pre-Conquest origins. • **High Medieval.** Ridge and furrow and field shapes suggesting open fields extend across some areas of till, and provide an important landscape resource for studies of agrarian change. Traces also survive of deserted or shrunken villages and, particularly in woodland and parkland, a variety of other earthwork remains echoing those found across the Sherwood Sandstone and Magnesian Limestone (some relating to monastic estates). • **Post-medieval and Modern.** As in the other Character Areas, field boundaries provide important evidence for the developing agrarian landscape. Remains indicative of rural industrialisation are also widespread, particularly in the south-west of the County on till deposits mantling Magnesian Limestone (including quarries, limekilns, mills and features relating to coal mining). Other key resources include deserted or shrunken villages, features elucidating developments in park and garden design and military remains (particularly of the First and Second World Wars on tills overlying Sherwood Sandstone), recalling in terms of their density and variety the archaeological resource of the neighbouring Sherwood Sandstone and Magnesian Limestone.	• **Desk-based assessments**, including **walkover surveys**, to precede all other work. • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photography.** Heavier clay soils are more moisture-retentive than those of the limestone or sandstone and hence are less suitable for cropmark formation, but nonetheless till deposits above Sherwood Sandstone have yielded quite extensive cropmarks. This emphasises the importance of examining during assessment all available oblique and vertical air photographs, followed by transcription of cropmarks, soilmarks, *etc.* • **Lidar surveys** may assist earthwork identification, particularly in woodlands, and all available lidar and **other remote sensing records** should be examined during assessment. • **Geophysical surveys** should be considered at the evaluation stage, including ground-based techniques such as magnetometry and **airborne techniques** such as multispectral remote sensing, but with due regard to the need to focus upon ground-based or airborne remote sensing techniques more suitable for heavier and more moisture-retentive clay soils. • **Earthwork surveys** have highlighted the potential for the preservation of a wide variety of prehistoric and later earthworks in woodland, parkland and other environments not seriously denuded by ploughing, especially in areas with heavier clay soils. Walkover surveys should be conducted to ensure the identification and subsequent evaluation of extant remains. • **Fieldwalking** is crucial for locating sites where surfaces little modified by Holocene geomorphological processes have been ploughed and should be employed routinely. Identifications of lithic concentrations are especially important, as these may provide vital evidence for prehistoric sites represented by scant (if any) structural remains, and fieldwalking should precede and inform mitigation strategies. **Test-pitting** can elucidate further the character of finds scatters and the site stratigraphy, and in particular may identify remains preserved beneath alluvium, colluvium, *etc.* • **Sediment coring** may be recommended to investigate sub-surface stratigraphy (*e.g.* to determine the character and thickness of drift deposits). • **Evaluation trenches** are useful for establishing the character of known sites and their archaeological and environmental potential (*e.g.* identification of features beneath ridges of ridge and furrow). Large-scale trenching will not always be recommended, as sites with dispersed structural remains may elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements). • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* regionally important cropmark sites). • **Strip, map and sample techniques** provide the most effective method for locating dispersed structural remains, such as are especially characteristic of Neolithic to EIA and Early Medieval settlements, and will be applied routinely to ensure that sites of particular periods and types are not missed during excavation. Such mitigation strategies will require contingency provisions, which will be targeted by reference to this document upon the most significant archaeological remains. • **Palaeoenvironmental sampling and analysis** should be carried out routinely during evaluation and mitigation, including provision for scientific dating.

TABLE 7.4: RIVER TERRACE AND GLACIOFLUVIAL SANDS AND GRAVELS

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Glaciofluvial sands and gravels, formed during the Middle Pleistocene in close association with glaciers, mask some areas of limestone and sandstone bedrock and may seal pre-Anglian Sands and Gravels. Glaciofluvial sands and gravels also form discontinuous layers and lenses throughout Middle Pleistocene till deposits. • Organic material deriving from pre-Holocene interglacial and interstadial environments may be preserved within and beneath cold stage gravels. • River gravels, deposited by meltwater-rich rivers, preserve a complex sequence of Pleistocene terraces, formed in response to downcutting by fluvial erosion of river floodplains. The chronology of the river terraces remains a matter of debate, but current views are summarised concisely in the Quaternary Research Association's Field Guide to the Trent Valley and adjoining regions (White *et al* eds 2007). • Pre-Holocene fluvial terrace surfaces were largely stable during the Holocene, but surfaces may have been modified along the valley margins as a result of localised colluviation and alluviation. • Palaeolithic materials may have been reworked or buried by fluvial, periglacial, hillslope and mass-movement processes. • Fluvially deposited sands and gravels of the valley bottom are buried beneath variable depths of alluvium (principally of Holocene date, but some of late Pleistocene origin). Alluvium is sometimes interstratified with peat, and in the lower Trent is sealed by very extensive deposits of Holocene peat. Alluvium also cloaks parts of the late Devensian Holme Pierrepont Terrace, particularly along the terrace edges. In all these areas, there is significant potential for the preservation of buried archaeological structures and finds and the identification of palaeochannels and buried land surfaces.	• **Palaeolithic.** Sands and gravels at East Leake, interpreted as either MIS 12 terrace or glaciofluvial deposits, yielded quartzite artefacts that may indicate activity during warmer phases of the Anglian glaciation or earlier. MIS 4 (Beeston) terraces have yielded significant numbers of redeposited flint and quartzite artefacts. Some surface finds of LUP lithic artefacts are known, while fieldwalking, test-pitting and excavation at Farndon Fields revealed *in situ* activity foci, including finds stratified in late Pleistocene alluvium. • **Mesolithic.** Fieldwalking and test-pitting have revealed thin scatters of lithic artefacts, especially of the Later Mesolithic, with some notable concentrations at sites such as Collingham. Some scatters may be sealed by alluvium or colluvium, and hence may extend more widely than can be demonstrated from surface evidence. Rare pits may also relate to Mesolithic activity. • **Neolithic to MBA.** A wide variety of funerary and ceremonial monuments is known, including henges, pit circles, timber avenues, ring-ditches and cremation cemeteries, plus burnt mounds. Settlements are less well known, and where excavated comprise dispersed scatters of pits, post-holes and gullies. Extensive lithic scatters have been recorded during fieldwalking. Activity is also indicated by finds of polished stone axes and Bronze Age metalwork, the latter often from watery contexts. • **LBA and Iron Age.** Some earlier monuments may continue in use, notably burnt mounds, but this period sees some major changes. These include the earliest known pit alignments and fields, a shift from open to enclosed settlement, and new monument types such as middens, defended enclosures and possibly square-ditched barrows. Metalwork deposition continues, often in watery places, while some lithic scatters might also signal activity of this date. • **Roman.** Evidence survives of a dense spread of settlements and rectilinear field systems integrated with trackways and pit alignments, especially on the terraces downstream of Newark (where fieldwalking has revealed extensive artefact spreads interpreted as evidence for manuring of arable fields). There is compelling evidence for a developing settlement hierarchy of small towns, villas, villages and enclosed farms. Several major roads linked early forts, towns and roadside settlements. Temples and shrines should be expected, along with inhumation and cremation cemeteries. • **Early Medieval.** Significant remains have been recovered of Anglo-Saxon inhumation/cremation cemeteries and rare princely burials, together with groups of timber buildings, pits and sunken-floored structures indicative of settlement. Some Roman fields may have continued, and may have influenced medieval open field layouts. Some roads/trackways may also have persisted, while some linear earthworks/cropmarks may mark early territorial boundaries. • **High Medieval.** Ridge and furrow and field shapes suggesting open fields provide a key resource for studies of agrarian change. A wide variety of other archaeological remains may survive in rural areas, including traces of fishponds, moated enclosures, deserted or shrunken villages, field chapels, post-mills, warrens and deer park boundaries. • **Post-medieval and Modern periods.** Field boundaries provide important evidence for the developing agrarian landscape and rural industrialisation (including quarries, limekilns, mills and straight ridge and furrow indicating steam ploughing). Other key resources include fishponds, deserted or shrunken villages, field chapels, moated enclosures, warrens, features illuminating changes in park and garden design and gentry leisure pursuits, and military remains (notably of the Civil War and World Wars I and II).	• **Desk-based assessments,** including **walkover surveys**, to precede all other work. • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photography.** Crop- and soilmarks show well on well-drained gravel terraces lacking significant alluvial veneers or slope deposits, and the major river valleys preserve remarkable cropmark palimpsests. All available air photographs should be inspected, followed by transcription of cropmarks, earthworks, *etc.* • **Lidar surveys** may assist earthwork identification, particularly in woodlands, and are particularly useful for palaeochannel mapping. All available lidar and other **airborne remote sensing data** should be examined during assessment. • **Geophysical surveys**, including magnetometry and earth resistance, have been applied effectively on this landform, both for targeting particular sites and for examining rapidly large application areas, and should be considered at the evaluation stage, together with **airborne techniques** such as multispectral remote sensing. • **Earthwork surveys** have highlighted the potential for the preservation of a wide variety of prehistoric and later earthworks in woodland and other environments not seriously denuded by ploughing, and of palaeochannels surviving as ground features. Walkover surveys should be conducted to ensure the identification and subsequent evaluation of extant remains. • **Fieldwalking** is crucial for locating sites where surfaces little modified by Holocene geomorphological processes have been ploughed, and has proved particularly effective in studies of the cropmark palimpsests of the Trent Valley around South Muskham. Identifications of lithic concentrations are especially important, as these may provide vital evidence for prehistoric sites represented by scant (if any) structural remains, and fieldwalking should precede and inform mitigation strategies. **Test-pitting** can elucidate further the character of finds scatters and the site stratigraphy, and in particular may identify remains preserved beneath alluvium, colluvium, *etc.* • **Sediment coring** may be recommended to investigate the sub-surface stratigraphy and topography and to map palaeochannels. • **Evaluation trenches** are useful for establishing the character of known sites and their archaeological and environmental potential (*e.g.* identification of features beneath ridges of ridge and furrow). Large-scale trenching may not always be recommended as many key sites are likely to elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements). • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* regionally important cropmark sites). • **Strip, map and sample techniques** tend to provide the most effective method for locating dispersed structural remains, such as characterise settlements of the Neolithic to EIA and Early Medieval periods, and will be applied routinely to ensure that sites of particular periods and types are not missed during excavation. Such mitigation strategies will require contingency provisions, which will be targeted by reference to this document upon the most significant archaeological remains. • **Palaeoenvironmental sampling and analysis** should be carried out routinely, including provision for scientific dating. On these landforms, sites with well preserved faunal assemblages will be of particular significance. • **Application of a metal detector** to the conveyor belt is particularly recommended for this landform (see Table 7.6)

TABLE 7.5: ALLUVIUM

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Thick alluvial deposits accumulated in valley bottom locations during the Holocene, principally in response to soil erosion and increases in sediment loads arising from woodland clearance and ploughing. These deposits extend across the modern floodplain and partially cloak the late Devensian Holme Pierrepont Terrace sands and gravels. • Late Pleistocene alluvium, dated securely by OSL dating and associated with Late Upper Palaeolithic stone artefacts, has been identified on the edge of the Holme Pierrepont Terrace at Farndon Fields, suggesting a more extended chronology for some of the alluvium in valley-bottom locations. • Alluvium is sometimes interstratified with peat, and in the carrlands of the lower Trent is buried beneath extensive deposits of Holocene peat. • In all of the above areas, there is significant potential for the preservation beneath alluvium of structural remains and organic artefacts, and of palaeochannels and buried land surfaces with associated organic remains capable of elucidating the changing Holocene environment. • Lateral movement of the river across the modern floodplain and sudden shifts in course after flood (avulsions) have created a very distinctive floodplain topography of silted palaeochannels, oxbows, point bars, levees and other fluvial features. This channel mobility has also caused significant reworking of the Pleistocene sands and gravels and hence destruction of some archaeological structures and deposits. Assessment and evaluation should seek to identify areas where sands and gravels have been extensively reworked by fluvial erosion, as this will impact upon the range of archaeological remains that may be expected to survive.	• **Palaeolithic.** Dense scatters of Late Upper Palaeolithic artefacts were recovered during fieldwalking of the Holme Pierrepont Terrace at Farndon Fields. In addition, test-pitting and trenching revealed significant quantities of LUP finds stratified in late Pleistocene alluvium, interpreted as backswamp at the time of their deposition. The discovery at Farndon emphasises that some areas of alluvium might preserve artefact concentrations indicative of nationally important LUP open-air sites. • **Mesolithic.** Wetland resources are likely to have attracted Mesolithic hunter-gatherers, and activity foci in valley bottom locations may be sealed beneath or interstratified with alluvium. Some artefact scatters may be observed to continue beneath alluvium, but such remains may only be detected by test-pitting or other intrusive work. • **Neolithic to MBA.** Burnt mounds were located near watercourses and may be preserved beneath alluvium, together possibly with timber or brushwood trackways and logboats. Lithic scatters may continue beneath alluvium at terrace-edge sites. Floodplain locations may also be expected to preserve evidence for riverside activities associated with funerary and other ceremonial practices, including the deposition of metalwork and human remains. • **LBA and Iron Age.** Some terrace-edge settlements and field systems continued into alluvial zones, which may also preserve the remains of seasonally occupied sites and specialised structures such as wooden causeways, trackways and late examples of burnt mounds. Logboats should also be anticipated, together with ceremonially deposited metalwork and other material. • **Roman.** Significant numbers of enclosures, field systems, *etc*, may be seen to overlie alluvium, which might have been favoured in certain circumstances on account of its moisture-retentive and more productive soils. In other areas, alluvium may seal and hence preserve remains of this period, and on sites prone to periodic flooding may be interstratified with Roman structural remains/deposits. As in other periods, floodplain environments may be expected to preserve a rich range of evidence, including timber trackways, bridges, fords and logboats. • **Early Medieval.** There is evidence to suggest that settlement along the Trent and other major river valleys may have retreated to the more elevated locations favoured by later medieval villages in the face of increases in the frequency and magnitude of flooding and a rising water table. Remains should be anticipated on the floodplain of sub-alluvial fishweirs, timber bridges (and associated trackways) and logboats. • **High Medieval.** Ridge and furrow survives on some areas of the floodplain and provides important evidence for arable expansion into these flood-prone environments. Water meadows and osier beds have also been recorded, together with a wide range of structural remains (including relics of bridges, ferries, fords, fishweirs and mills preserved beneath alluvium). • **Post-Medieval and Modern.** Remains have survived beneath alluvium of a wide range of water-powered industrial and mill sites, plus bridges, ferries, fords, dams, weirs, bankside revetments, flood banks and wharves. Water meadows and osier beds may also survive as visible features on the floodplain.	• **Desk-based assessments**, including **walkover surveys**, to precede all other work. • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photography** is not an effective technique on areas of deep alluvium, but crop- or soil-marks are often visible in areas of thin alluvial cover or on low islands within the floodplain (including significant numbers of undated sites that might date from the late prehistoric or later periods). Air photographs may also reveal palaeo-channels, ridge and furrow and other earthworks. All available photographs should be inspected, followed by transcription of cropmarks, earthworks, *etc.* • **Lidar surveys** may assist earthwork identification, and are particularly valuable for mapping palaeochannels, ridge and swale, *etc.* All available lidar and **other remote sensing data** should be examined during assessment. • **Geophysical surveys** capable of identifying sub-alluvial channels and enabling reconstruction of the sub-alluvial topography should be considered during evaluation (*e.g.* electrical resistance tomography; ground-penetrating radar), and may be combined with sediment coring (below). • **Earthwork surveys**. Any earthworks located within the application area should be identified and surveyed prior to further investigation. • **Fieldwalking** is not appropriate on floodplains or terraces masked by deep alluvium, but may assist where earlier landforms protrude as 'islands' in the floodplain, on old (higher) alluvial terraces that have not experienced alluviation since early/mid-Holocene times, and terrace-edge locations where it may be possible to identify alluvial deposits that potentially seal well-preserved structural remains or deposits. **Test-pits** may aid characterisation of known finds scatters, especially where terrace-edge scatters continue beneath alluvium, reveal sub-alluvial finds in blank areas and assist studies of site stratigraphy. • **Sediment coring** should be conducted to establish the sub-surface stratigraphy and topography of the floodplain, and in particular to identify palaeochannels and other organically rich deposits. • **Evaluation trenches** provide a useful means of establishing the character of sites and their archaeological/environmental potential (*e.g.* identification of features beneath ridges of ridge and furrow). Large-scale trenching may not always be routinely recommended, as many key sites are likely to elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements), • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* palaeochannels yielding significant structural remains). • **Strip, map and sample techniques** will provide effective methods for locating sub-alluvial structural remains, and will be applied routinely. Stripping should be monitored closely to locate palaeochannels, buried soils, structures such as bridges, fishweirs and burnt mounds, boats, metalwork and other prehistoric to modern finds. Contingency provisions should be made for the recording of structural remains and finds and for the recording, sampling, dating and analysis of organic samples. • **Palaeoenvironmental sampling and analysis** should be carried out routinely, including provision for scientific dating. Associated organic remains have major potential for elucidating changes in landscape, agrarian economy and local climate • **Application of a metal detector** to the conveyor belt is particularly recommended for this landform (see Table 7.6).

TABLE 7.6: PALAEOCHANNELS AND CARRLANDS

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Abandoned channels, active during the Holocene, may survive as visible linear depressions on the floodplain or Holme Pierrepont Terrace, or may lie sealed beneath alluvium and/or peat. Many channels incorporate pollen, waterlogged plants, insects and other organic remains that together can shed significant light upon the changing environment of the river valleys and adjoining areas. Radiocarbon dating of these deposits can provide a tight chronological framework for study of changes in vegetation, local climate and fluvial geomorphology. • Woodland clearance, which appears to have accelerated significantly during the Neolithic and Bronze Ages, impacted progressively upon surface run-off levels, river discharge and the fluvial geomorphology of the major river valleys. Quarrying of fluvially redeposited sands and gravels along some stretches of the Trent Valley has revealed large numbers of uprooted Neolithic and Bronze Age tree trunks, aligned parallel to the direction of flow of ancient rivers. These appear to have been uprooted by fluvial erosion, and provide crucial evidence not only for early palaeochannels but also provide important testimony of the potential impact of woodland clearance upon river discharge, erosion and hence alluviation. • Evidence for the dynamic fluvial regime that prevailed in the Trent Valley prior to the navigational and other improvements of the Post-Medieval and Modern periods is provided by structural remains and artefacts indicative of former river courses in redeposited sands and gravels (*e.g.* anchor stones for fishing and bridge foundations). • Extensive peat deposits developed in the carrlands of the lower Trent and Idle, where they form significant thicknesses of material above alluvium. These may seal earlier archaeological sites as well as yielding datable organic deposits with high environment potential.	• **Palaeolithic.** The potential for campsites, knapping foci, *etc,* in late Pleistocene waterside or marshland environments is demonstrated most eloquently by the LUP finds retrieved from Farndon Fields (Section 6.2.1), and palaeochannel, backswamp and other wetland zones should be scrutinised closely for evidence of early open-air sites. • **Mesolithic.** The rich ecological resources of lowland riverine and marshy environments are likely to have attracted Mesolithic hunter-gatherers, as demonstrated by the extensive Mesolithic site at Misterton Carr, and activity foci in valley bottom locations may be sealed beneath later alluvium and sometimes peat. Artefact scatters may continue beneath alluvium or peat into valley bottoms, as at terrace-edge sites such as Collingham. Palaeochannels may yield important evidence of nearby activity, as shown by a female human femur, cut antler and animal bones found in a Mesolithic channel at Staythorpe. • **Neolithic to MBA.** Burnt mounds were located near watercourses and may be preserved on the edges of palaeochannels or incorporated into their fill as a result of later fluvial erosion, as at Girton. Other structures that might survive in close association with palaeochannels or marshland environments include timber or brushwood causeways and riverside structures such as wharves. Palaeochannels may also be expected to yield evidence for riverside activities associated with funerary and other ceremonial practices, including the deposition of metalwork and human remains, together with logboats. Trackways in neighbouring counties are well known for the ceremonial deposition of Bronze Age metalwork and other finds (*e.g.* Fiskerton, in the Witham Valley near Lincoln). • **LBA and Iron Age.** Burnt mounds may have continued in use into this period, although unequivocal evidence for continuity into the first millennium BC has yet to be demonstrated. Specialised riverside structures such as wharves, wooden causeways and logboats should also be anticipated, together with ceremonially deposited metalwork, other finds and possibly human remains. • **Roman.** A rich variety of evidence should be expected from palaeochannels and other wetland locations, including logboats, timber or brushwood trackways, remains of bridges and fords, and other riverside structures. In addition, the discovery at Holme Pierrepont of a virtually complete Roman spoked wooden wheel emphasises the potential of these landforms for the preservation of some remarkable artefacts. • **Medieval to Modern.** A wide range of archaeological remains, including Anglo-Saxon and High Medieval fishweirs at Colwick, a remarkable Early Medieval bridge at Cromwell and ferries, fords, bankside revetments, fishweirs, dams, floodbanks, wharves and mills, may survive in association with palaeochannels or in other waterlogged environments. Investigations of visible palaeochannels and valley-bottom sands and gravels redeposited by fluvial erosion should also anticipate discoveries of logboats and other river craft, plus a variety of specialised artefact types associated with fishing and other river-based activities (such as anchor stones and wicker fishing baskets).	• **Desk-based assessments**, including w**alkover surveys** to locate and record old river channels, ridge and swale *etc.* should be conducted first. Documentary and cartographic research may provide clues to the position of former river channels (*e.g.* spatial configuration of parish boundaries following former river channels). • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photographs** may reveal traces of old river channels and other fluvial features. All available vertical and oblique air photographs should be inspected during assessment, and potential channels and other fluvial features (*e.g.* ridge and swale) should be plotted. • **Lidar surveys** are particularly valuable for mapping palaeochannels, and all available records should be examined. The results of multi-spectral and other remote sensing techniques should also be collated and assessed. • **Geophysical surveys** capable of identifying sub-alluvial channels and of reconstructing the sub-alluvial topography, such as electrical resistance tomography and ground-penetrating radar, should be applied in appropriate circumstances. These may usefully be combined with sediment coring (below). • **Sediment coring** should be conducted to establish the sub-surface stratigraphy and topography of alluvial zones, and in particular to identify palaeochannels and buried land surfaces indicating former areas of carrland and areas with well-preserved organic remains. • **Evaluation trenches** are particularly useful for assessing palaeochannels and for investigating the sub-surface stratigraphy of former wetlands. Provision must be made for appropriate recording of structural remains and finds, and for the recording, sampling, dating and analysis of organic samples. • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation (*e.g.* palaeochannels yielding significant structural remains). • **Strip, map and sample techniques** provide a cost-effective mitigation strategy in view of the high likelihood of preserved palaeochannels with associated organic remains, buried land surfaces, structures such as bridges, fishweirs, wooden trackways and riverside burnt mounds, boats, metalwork and a host of other finds of prehistoric to modern date. Provision must be made for appropriate recording of structural remains and finds, and for the recording, sampling, dating and analysis of organic samples. This may require the use of contingencies for unexpected discoveries, while multiple discoveries will require careful prioritisation of resources. • **Palaeoenvironmental sampling and analysis** should be carried out routinely, including provision for scientific dating. Palaeochannels have a high potential for the preservation of pollen, plant macrofossils, insects and other organic remains, and hence for study of changes in the vegetation, agrarian economy and local climate. • **Application of a metal detector** to the conveyor belt is particularly recommended for this landform to ensure that metalwork deposited in riverine and other watery or damp locations does not elude discovery. Material recorded by this method cannot be tightly provenanced, but prompt retrieval may permit attribution of an approximate location. This is especially important in river valley environments in view of the wealth of metalwork that was deposited in wet or damp locations from the Early Bronze Age, especially along the Trent Valley.

TABLE 7.7: COVERSANDS

Geomorphological Processes	Archaeological Associations	Assessment, Evaluation and Mitigation Techniques
• Within the sparsely vegetated landscape of the Dimlington Stadial and the subsequent Lateglacial period, fine-grained glaciofluvial deposits were subject to processes of wind erosion. Extensive sheets of coversand were deposited across eastern England. Sand sheets blanket the Holme Pierrepont Sand and Gravel terraces on the eastern side of the valley floor In the Lower Trent Valley and in the Idle Valley around Tiln, and may extend over wider areas than is currently indicated in BGS records. • Palaeolithic land surfaces would have been buried by coversand deposition, and hence areas of coversand provide key opportunities for the discovery of *in situ* Palaeolithic remains. • The coversands may have been reworked at several periods subsequent to their deposition, notably around 8200BP (due to climatic change and/or human activity; Table 4.1) and possibly in the Roman and High Medieval period (in response perhaps to agrarian expansion and clearance). These deposits may potentially seal, therefore, finds and structural remains dating from a wide range of periods (including, at Girton, a rare Nottinghamshire example of a LBA-EIA midden).	• **Palaeolithic.** No definite finds of Palaeolithic lithic artefacts have yet been recorded in association with coversands, but there is significant potential for burial of *in situ* Upper Palaeolithic remains beneath these deposits. • **Mesolithic.** Lithic concentrations indicative of Mesolithic activity are particularly common on the coversands, which may have provided attractive environments for hunter-gatherer communities exploiting a wide range of ecological zones - most notably in the vicinity of the important Idle Valley site at Misterton Carr and around North Clifton, Spalford and Besthorpe in the Lower Trent downstream of Newark. • **Neolithic to MBA.** Extensive lithic scatters have been recorded during fieldwalking and excavations, notably at Misterton Carr and along the eastern side of the Trent Valley from Newton Cliffs to Besthorpe. Rare structural remains have been noted in association with occupation, including pits that may relate to Neolithic or Mesolithic activity at Newton Cliffs, while some of several ring-ditch cropmarks might signal funerary monuments of this period. Many more sites might lie below coversands or, on valley-edge sites such as Girton, beneath complex sequences of fluvial and wind-blown deposits. • **LBA and Iron Age.** Important sites of this period might lie preserved beneath coversands, as demonstrated by the discovery at Girton of an Early Iron Age midden and possible cultivation traces of this period. Other evidence for Iron Age settlement has been recovered from sites such as Besthorpe, suggesting that the light, easily cultivated and well-drained (but easily eroded) soils might have proved attractive to early farming communities. • **Roman.** Evidence for extensive Roman settlement and associated field systems has been recorded during excavations at Besthorpe, and is supplemented by discoveries of surface scatters of pottery and other material (*e.g.* coins). • **Early Medieval.** Finds scatters of this period, plus discoveries of several sunken-floored structures and timber buildings on coversand deposits at Girton, provide important evidence for settlement in this period. As in earlier periods, there is significant potential for the preservation of additional structural remains beneath coversands, which may have been extensively reworked subsequent to their deposition. • **High Medieval to Modern.** Relics of ridge and furrow, field shapes suggesting open fields and field boundaries providing evidence for the process of enclosure are among the key archaeological resources of this landform, and together provide an important source of evidence for the evolving agrarian landscape. Scatters of medieval and later finds retrieved during fieldwalking have the potential for elucidating further changes in land-use, while scattered sand pits and documentary references to windmills, brick kilns and other structures emphasise the potential for the preservation of remains related to rural industrialisation.	• **Desk-based assessments**, including **walkover surveys**, to precede all other work. • **Geomorphological mapping** should be conducted of landform elements identified during assessment. Further fieldwork may be required to clarify surface landforms and sub-surface stratigraphy (see below). • **Aerial photographs** may reveal significant archaeological features and should be inspected routinely, followed by transcription of cropmarks, earthworks, *etc*. Many sites may lie beneath reworked coversands, but occasional discoveries of ring-ditches and other sites (*e.g.* Roman marching camp at Misterton) emphasise the importance of systematic searches of air photographs during assessment. • **Lidar surveys** may assist earthwork identification, particularly in woodlands impenetrable to air photography, and all available lidar and other remote sensing records should be examined during assessment. • **Geophysical surveys**: the effectiveness of ground-based geophysical and **airborne remote sensing techniques** is likely to be impaired by the masking effect of coversands. These techniques should be carefully targeted, taking account of the extent and depth of masking deposits, and it would be prudent to trial a range of techniques before committing resources to a large area. • **Earthworks** recorded during assessment should be surveyed prior to further investigations. • **Fieldwalking**. The potential of fieldwalking as a means of locating early archaeological sites is limited by the burial of Palaeolithic land surfaces under wind-blown sand and by the burial of Holocene sites under reworked coversands, but important evidence for activity may still survive (*e.g.* of Anglo-Saxon finds on sand dunes at Girton). **Test-pitting** may provide a more effective prospection method for early sites in which finds scatters are interstratified with coversands, and should also assist understanding of the site stratigraphy and site formation processes. • **Sediment coring** should be considered as an effective means for establishing the depth of coversand deposits, which in turn will influence decisions on evaluation and mitigation strategies. • **Evaluation trenches** are useful for establishing the character of known sites and their archaeological and environmental potential, but large-scale evaluation trenching is not always recommended as many key sites may elude discovery by this method (*e.g.* Neolithic to Early Iron Age and Anglo-Saxon settlements). • **Targeted excavation** may be recommended during mitigation, depending upon the results of evaluation. • **Strip, map and sample techniques** provide the most effective method for locating dispersed structural remains (notably of Neolithic to EIA and Early Medieval settlements), and should be applied routinely to ensure that sites of particular types and periods are not missed during excavation. Such techniques are especially crucial on coversands, where the effectiveness of many prospection techniques is impaired by the depths of masking deposits • **Palaeoenvironmental sampling and analysis** should be carried out routinely during evaluation and mitigation, including provision for scientific dating. • **Application of a metal detector** to the conveyor belt is particularly recommended for this landform, which might seal palaeochannels, *etc.*, with a high probability of associated metalwork (see Table 7.6).

Landforms (see key below and Tables 7.1-7.7)	**ML**	**SS**	**Till**	**S&G**	**Alluv**	**PC**	**CS**
1. PRE-DETERMINATION DESK-BASED ASSESSMENT: CURATORIAL REQUIREMENTS							
Documentary and cartographic searches							
1. Search and collate Notts HER (Historic Environment Record) and HLC (Historic Landscape Characterisation) data	red	red	red	red	red	red	red
2. Search and collate all relevant documentary sources	red	red	red	red	red	red	red
3. Search and collate all relevant cartographic records (including historic and geological mapping)	red	red	red	red	red	red	red
4. Research and assess place name evidence	red	red	red	red	red	red	red
5. Search and collate Portable Antiquities Scheme data	red	red	red	red	red	red	red
Other tasks							
6. Aerial photograph coversearch: plot archaeological sites from cropmarks, soilmarks, earthworks *etc.*	red	red	red	red	red	red	red
7. Collate ground-based geophysics, lidar and other airborne remote sensing data	red	red	red	red	red	red	red
8. Compile geomorphological maps from historic borehole data *etc.*	red	red	red	red	red	red	red
9. Plot palaeochannels and record known data on chronology, associated organics, artefacts, *etc.*						red	
10. Conduct walkover survey and plot archaeological sites, palaeochannels, *etc.* on base map	red	red	red	red	red	red	red
2. PRE-DETERMINATION EVALUATION TECHNIQUES: SUITABILITY FOR EACH LANDFORM							
Non-intrusive techniques							
1. Commission aerial photographic, lidar, multi-spectral and other airborne remote sensing surveys	dark blue	dark blue	mid blue	dark blue	mid blue	mid blue	mid blue
2. Undertake ground-based geophysical survey (magnetometry, earth resistance, ground-penetrating radar *etc.*, as appropriate)	dark blue	dark blue	mid blue	dark blue	mid blue	mid blue	mid blue
3. Conduct surveys of extant archaeological earthworks (including plotting of ridge and furrow)	mid blue	mid blue	mid blue	mid blue	light blue	light blue	mid blue
Intrusive techniques							
1. Fieldwalking	dark blue	dark blue	mid blue	dark blue	light blue	light blue	mid blue
2. Sediment coring and analysis	light blue	light blue	mid blue	mid blue	dark blue	dark blue	mid blue
3. Test-pitting	dark blue	dark blue	dark blue	dark blue	mid blue	mid blue	dark blue
4. Evaluation trenching	dark blue	dark blue	dark blue	dark blue	dark blue	dark blue	dark blue
5. Palaeoenvironmental sampling and analysis	mid blue	mid blue	mid blue	mid blue	dark blue	dark blue	mid blue
3. POST-DETERMINATION MITIGATION: CURATORIAL REQUIREMENTS							
1. Archaeological control and supervision ('watching brief')	red	red	red	red	red	red	red
2. Targeted excavation	light red	light red	light red	light red	light red	light red	light red
3. Strip, map and sample	red	red	red	red	red	red	red
4. 100% excavation of features and deposits	light red	light red	light red	light red	light red	light red	light red
5 Metal detector attached to quarry conveyor belt	light red	light red	light red	red	red	red	red
6. Preservation *in situ* of structural remains, deposits, *etc.*	light red	light red	light red	light red	light red	light red	light red
4. POST-FIELDWORK TASKS: CURATORIAL REQUIREMENTS							
1. Assessment of finds, environmental remains, *etc.*	red	red	red	red	red	red	red
2. Updated Project Design	red	red	red	red	red	red	red
3. Analysis of artefacts and ecofacts	red	red	red	red	red	red	red
4. Preparation and dissemination of synthetic report	red	red	red	red	red	red	red
5. Preparation of journal summary	red	red	red	red	red	red	red
7. Preparation of full publication	light red	light red	light red	light red	light red	light red	light red
8. Archive preparation and deposition	red	red	red	red	red	red	red

Table 7.8. Summary of standard curatorial requirements for assessment, evaluation and mitigation (red: always required; light red: required in certain circumstances) and of the suitability of evaluation techniques between landform elements. The suitability of evaluation techniques for each landform is indicated by a gradation from darker to lighter shades of blue, with dark blue indicating landforms where particular techniques have proved to be especially effective (ML: Magnesian Limestone bedrock; SS: Sherwood Sandstone bedrock; Till: Middle Pleistocene till; S&G: River Terrace and glaciofluvial sands and gravels; Alluv: alluvium; PC: palaeochannels and carrlands; CS: coversands)

8. ARCHAEOLOGICAL RESEARCH AGENDA AND STRATEGY

INTRODUCTION

A Research Agenda and Strategy has been compiled for each archaeological period, employing an innovative tabular format permitting direct comparison between each Aggregate Character Area and easy correlation between Agenda Topics and Research Objectives. It was judged appropriate, in view of the significant overlap of research priorities between the Post-Medieval and Modern periods, to combine these in a single table, but otherwise each period has been allocated a separate table.

Agenda Topics have been defined by reference to the regional research priorities defined in *East Midlands Heritage* (abbreviated EMH; Knight, Vyner and Allen 2012), and are restricted to topics that may reasonably be pursued during archaeological work in advance of and during developer-funded aggregates extraction. Correlations are noted with the numbered Agenda Topics identified in *East Midlands Heritage*, thereby permitting easy correlation with the research priorities identified in that document.

For ease of reference, Agenda Topics have been numbered consecutively by period (1.1, 1.2, *etc.*), while Research Objectives have been allocated a unique alphanumeric code, incorporating the relevant period number (1A, 1B, *etc.*). Correlations between Agenda Topics and Research Objectives are indicated by filled circle symbols. A distinction has been drawn between Research Objectives that may be applied across all of the aggregates-producing areas and those that are specific to particular Aggregate Character Areas. From the Palaeolithic perspective, for example, prospection for natural caves sealed by talus or other slope deposits is only relevant in the context of the Magnesian Limestone, while prospection for pre-Anglian river deposits is confined to the Superficial Sands and Gravels. By contrast, the location and investigation of open-air sites, typological and trace element analyses of lithic artefacts and routine scientific dating are prioritised for each Character Area.

Fig.8.1. Aerial view of the Sherwood Sandstone outcrop in the vicinity of Hodsock, near Blyth, showing cropmarks of the brickwork-plan field system and associated rectilinear enclosures. Determination of the origins, development and functions of these field systems remains a key priority for research in Nottinghamshire, and should be prioritised during the development of archaeological schemes of treatment in advance of aggregates extraction. © English Heritage (Derrick Riley Collection: DNR 751/19; see also Riley 1980, 30)

TABLE 8.1. PALAEOLITHIC: *c*.950/850, 000 YEARS AGO TO *c*.9,500 cal BC

AGENDA TOPICS / RESEARCH OBJECTIVES	**1.1**. Can we elucidate the colonisation of Nottinghamshire by the earliest (pre-Anglian and early Intra-Anglian) hunter-gatherers and the environments over which they ranged?	**1.2**. What was the relationship between cave and open-air hunter-gatherer sites and how might this have changed over time?	**1.3**. Can we shed further light upon the patterns of movement of Upper Palaeolithic hunter-gatherers?
	EMH: 1.1.1–1.1.5, 1.5.1, 1.5.3	EMH: 1.3.1, 1.3.2, 1.4.3	EMH: 1.4.2–1.4.5
ALL AGGREGATE CHARACTER AREAS			
1A. Clarify typology/chronology of known Palaeolithic artefacts recorded in application area during assessment	●	●	●
1B. Prospect for open-air sites by conducting fieldwalking and test-pitting to locate lithic artefact scatters		●	●
1C. Conduct detailed archaeological investigations of open-air sites within potential extraction areas		●	●
1D. Conduct typological and trace element analyses of lithic artefacts to investigate raw material sources and mobility patterns	●	●	●
1E. Promote routine scientific dating to clarify the poorly understood chronology of hominin activity			
SUPERFICIAL SANDS AND GRAVELS			
1F. Locate pre-Anglian and early intra-Anglian river deposits with the potential for preserving traces of early hominin activity	●		
1G. Study the typology, raw materials and contexts of lithic artefacts contained in pre-Anglian and early intra-Anglian deposits and analyse associated organic remains	●		
MAGNESIAN LIMESTONE			
1H. Prospect for caves, rock shelters and fissures sealed by talus, colluvium *etc.* and potentially preserving Pleistocene cultural/ environmental remains.		●	●
1I. Conduct excavations to clarify character and date of activity in subterranean features threatened by aggregates extraction and ensure appropriate environmental analysis		●	●
SHERWOOD SANDSTONE			
1J. Locate and investigate sites sealed by colluvium or alluvium in valley bottoms, with the aim of locating routes of movement of hunter-gatherers between Magnesian Limestone and Trent Valley		●	●

TABLE 8.2. MESOLITHIC: *c*.9500 – *c*.4000 cal BC

AGENDA TOPICS / RESEARCH OBJECTIVES	**2.1.** How were caves and rock-shelters utilised during this period, what was their relationship to open-air settlements or specialised activity foci, and how might this have changed over time?	**2.2.** Can we elucidate further the character of open-air sites, and in particular establish changes in their morphology, functions, density and topographic locations over time?	**2.3**. How far can analyses of lithic collections and human bone enhance our understanding of mobility patterns (especially between the Trent and Pennines and in intervening areas)?	**2.4.** What may analyses of organic remains in caves, palaeochannels, *etc.*, contribute to studies of landscape change and developing Mesolithic subsistence strategies?
	EMH: 2.2.1, 2.3.1, 2.6.1	EMH: 2.2.1, 2.2.2, 2.3.1–2.3.5	EMH: 2.5.1, 2.5.2, 2.6.3	EMH: 2.6.1–2.6.3
ALL AGGREGATE CHARACTER AREAS				
2A. Clarify typology/chronology of Mesolithic artefacts during assessment and enhance knowledge of distribution of Mesolithic sites by further fieldwalking and test-pitting	●	●	●	
2B. Use strip, map and sample techniques to identify Mesolithic pits and other features		●		
2C. Promote routine scientific dating of contexts yielding Mesolithic cultural and/or environmental remains	●	●	●	●
2D. Building upon work at Staythorpe (Section 6.2.2), prioritise isotope analyses of human bones dated securely to this period			●	●
SUPERFICIAL SANDS AND GRAVELS				
2E. Locate and analyse organic deposits associated with Mesolithic activity, including targeting of known Mesolithic palaeochannels		●	●	●
2F. Prioritise fieldwalking, test-pitting and strip, map and sample to locate sites beneath coversands or alluvium, and thus with high potential for preservation of features/organics		●	●	●
MAGNESIAN LIMESTONE				
2G. Prospect for further caves and rock shelters that may be buried below talus, colluvium, *etc.*	●			
2H. Conduct excavations to establish character and date of activity in caves/rock shelters in areas approved for extraction; conduct environmental sampling and analysis	●		●	●
2I. Prioritise fieldwalking and test-pitting of areas in vicinity of Mesolithic caves/rock shelters to investigate relationship of open-air sites to caves and rock shelters	●	●	●	
SHERWOOD SANDSTONE				
2J. Test hypothesis of comparative paucity of activity in this ACA by encouraging fieldwalking, test-pitting and strip, map and sample to locate and characterise Mesolithic sites		●	●	
2K. Prioritise location and analysis of Mesolithic organic remains to enhance poor environmental record of this ACA, especially in Meden, Maun and Poulter valleys				●

TABLE 8. 3. NEOLITHIC TO MIDDLE BRONZE AGE: *c.*4000 – *c.*1150 cal BC

AGENDA TOPICS / RESEARCH OBJECTIVES	**3.1**. How far may the use of caves and rock–shelters have continued into this period, and what functions may they have performed?	**3.2**. Can we enhance the poor record of domestic sites, clarify their morphology, socio-economic status and interrelationships, and identify field/boundary systems?	**3.3**. Can we shed further light upon the development of monumental landscapes and ceremonial/ funerary traditions, and can we discern significant variations between landforms?	**3.4**. Can we refine our understanding of the processes of environmental change, the development of agriculture/ diet and the variability of these between landforms?
	EMH: 3.2.1, 3.4.3, 3.5.3	EMH: 3.2.2, 3.3.4, 3.5.1–3.5.4, 3.7.1, 3.8.1, 3.8.2, 3.9.1, 3.9.2	EMH: 3.1.4, 3.4.3, 3.6.1–3.6.4, 3.7.2, 3.7.3, 3.8.2, 3.9.3	EMH: 3.2.1–3.2.4, 3.3.1–3 3.4, 3.4.1–3.4.3
ALL AGGREGATE CHARACTER AREAS				
3A. Assess fieldwalking, air photo and lidar resource to enhance distribution of known/potential sites (including examination of recorded lithic artefacts to check typology)		●	●	
3B. Prioritise strip, map and sample in order to identify and record settlements, monuments and field boundaries, particularly those with well-preserved organic remains		●	●	●
3C. Conduct fieldwalking and test-pitting across different ecological zones to test for variations in density/character of sites; excavate lithic scatters to clarify date and character		●		
3D. Undertake isotope analyses of human bone uncovered during excavation				●
3E. Prioritise scientific dating to refine chronology of monuments, progress of woodland clearance, *etc.* (especially Bayesian analysis of radiocarbon dates)	●	●	●	●
3F. Maximise metalwork retrieval by ensuring that metal detectors are applied to conveyor belts in suitable landforms (especially riverine environments: Table 7.6)			●	
SUPERFICIAL SANDS AND GRAVELS				
3G. Prioritise location, sampling and dating of palaeochannels and sub-alluvial land surfaces yielding environmental data; monitor extraction in riverine areas			●	●
3H. Prioritise fieldwalking, test-pitting and strip, map and sample to locate sites below coversands/alluvium, and thus with high potential for preservation of features/organics		●		●
MAGNESIAN LIMESTONE				
3I. Prospect for caves/rock-shelters buried below talus and other slope deposits	●			
3J. Investigate use of caves/rock shelters, clarify character and date of activity, and investigate relationship to open-air sites	●	●	●	
3K. Prioritise location and analysis of palaeoenvironmental remains from caves, rock shelters and other locations	●			●
SHERWOOD SANDSTONE				
3L. Test by further fieldwork the hypothesis that Neolithic and Bronze Age sites may have been sparsely distributed across this area		●		
3M. Prioritise location and analysis of palaeoenvironmental remains, especially in the Meden, Maun and Poulter valleys				●

TABLE 8. 4. LATE BRONZE AGE AND IRON AGE: *c.*1150 cal BC – AD43

AGENDA TOPICS / RESEARCH OBJECTIVES	**4.1**. Can we elucidate further the morphology, functions and spatial distribution of settlements, their interrelationships and the processes of enclosure and nucleation?	**4.2**. When, where and why did the earliest field and linear boundaries develop, how did these change over time, and what purposes may fields, pit alignments and other boundaries have performed?	**4.3**. What may analyses of environmental remains contribute to studies of the developing agrarian economy and its landscape impact?	**4.4**. Can we shed further light upon developing funerary and ritual traditions, including the structured deposition of metalwork and other artefacts in watery and other contexts?
	EMH: 4.2.1, 4.2.2, 4.3.1–4.3.3, 4.4.1–4.4.3, 4.5.1–4.5.3, 4.10.1	EMH: 4.6.1–4.6.3	EMH: 4.8.1–4.8.4	EMH: 4.7.1–4.7.3
ALL AGGREGATE CHARACTER AREAS				
4A. Identify, date and characterise fields and linear boundaries (*e.g.* by strip, map and sample)	●	●	●	
4B. Maximise opportunities for location and analysis of organic deposits	●	●	●	●
4C. Promote routine scientific dating, especially Bayesian modelling of radiocarbon dates	●	●	●	●
4D. Ensure effective characterisation of the LBA-EIA settlement resource by routine use of strip, map and sample	●	●	●	
4E. Promote study of artefact production and distribution	●			●
SUPERFICIAL SANDS AND GRAVELS				
4F. Prioritise location, sampling and dating of palaeochannels and sub-alluvial land surfaces yielding environmental data; monitor extraction in riverine areas			●	●
4G. Prioritise investigation of placed deposits in riverine and other contexts				●
4H. Conduct large-scale excavations of Late Iron Age nucleated settlements and field systems of the river terraces and floodplain	●	●		
MAGNESIAN LIMESTONE				
4I Promote fieldwalking, test-pitting, *etc.* to enhance comparatively poor knowledge of settlement distribution and prioritise area excavations to establish character	●	●	●	
4J. Prioritise investigations of locations with the potential for the preservation of ecofacts, artefacts or structural remains in caves, fissures and below talus/colluvium.	●		●	●
SHERWOOD SANDSTONE				
4K. Prioritise large-scale stripping of brickwork-plan fields and settlements, focusing upon relationship of fields to settlements, dating of field ditches and environmental analyses to test hypothesis of pastoral emphasis	●	●	●	
4L. Focus investigations on valley bottom locations that may preserve artefacts, ecofacts or structural remains below colluvium/alluvium (*e.g.* Meden Valley)	●		●	

TABLE 8. 5. ROMANO-BRITISH: AD43–*c*.410

AGENDA TOPICS / RESEARCH OBJECTIVES	**5.1**. Can we enhance our understanding of the developing settlement hierarchy, and in particular the relationship between farmsteads, nucleated villages, villas, estates and towns?	**5.2**. Can we shed further light upon the development of field and boundary systems, their relationship to Iron Age and post-Roman systems of land allotment, and their articulation with settlements?	**5.3**. What may analyses of organically rich deposits in palaeochannels, settlement contexts, field ditches, *etc.* contribute to studies of landscape change and the developing agricultural economy?	**5.4**. Can we shed further light upon the developing industrial economy, and how might the character and pace of change have varied between the Aggregate Character Areas?
	EMH: 5.3.1–5.3.5, 5.4.1, 5.4.3, 5.4.5, 5.4.6	EMH: 5.4.1, 5.4.4, 5.4.5, 5.5.4	EMH: 5.5.1–5.5.5	EMH: 5.6.1–5.6.5
ALL AGGREGATE CHARACTER AREAS				
5A. Focus resources upon the identification of Roman field systems and their relationship to settlements; encourage excavations to establish their character and development	●	●	●	
5B. Prioritise the location of structural remains and finds that may elucidate industrial developments, and undertake appropriate specialist analyses	●			●
5C. Promote routine scientific dating, especially Bayesian modelling of radiocarbon dates	●	●	●	●
5D. Prioritise collection and analysis of organic samples, especially from waterlogged environments and in contexts preserved beneath alluvium, colluvium and coversands			●	
SUPERFICIAL SANDS AND GRAVELS				
5E. Prioritise identification, sampling and dating of palaeochannels in the Trent, Idle and other major river valleys; monitor extraction in riverine areas			●	
5F. Promote investigation of areas in close proximity to secondary urban centres to investigate the impact of towns upon their immediate hinterland	●	●	●	●
5G. Prioritise excavation of the nucleated settlements of the river terraces and floodplain and of the coaxial field systems of the Trent downstream of Newark	●	●	●	●
MAGNESIAN LIMESTONE				
5H. Prioritise area excavations of rural settlements to enhance comparatively poor knowledge of Roman settlement morphology and functions	●	●	●	●
SHERWOOD SANDSTONE				
5I. Prioritise excavation of brickwork-plan fields and enclosures, focusing upon interrelationships of fields and settlements, dating of field ditches and environmental analyses to investigate the agricultural economy	●	●	●	●

TABLE 8.6. EARLY MEDIEVAL: *c*.410 – 1066

AGENDA TOPICS / RESEARCH OBJECTIVES	**6.1**. Can we elucidate the development and territorial organisation of rural settlement, hierarchies of settlement, and the shift in some areas from dispersed to nucleated settlement?	**6.2**. Can we enhance our understanding of developing burial traditions, the changing demography of this period and pagan and Christian rituals and beliefs?	**6.3**. Can we trace the later history of Roman rectilinear field systems and the growth of the open field system, and how may agricultural practices have changed over time and across the County?	**6.4**. Can we provide further information on the development of trade and industry, and in particular the role of the Trent as a communications route and socio-economic divide?
	EMH: 6.4.1–6.4.5	EMH: 6.1.1–6.1.6, 6.2.1–6.2.6	EMH: 6.7.1–6.7.5	EMH: 6.3.3, 6.3.4, 6.6.1–6.6.6
ALL AGGREGATE CHARACTER AREAS				
6A. Undertake systematic fieldwalking, metal-detecting and test-pitting to locate settlements and other activity foci,	●			
6B. Prioritise strip, map and sample to locate and investigate settlements, fields and funerary sites, with focus upon study of shift from dispersed to nucleated settlement	●	●	●	●
6C. Survey ridge and furrow prior to extraction and ensure retrieval of finds from furrow fill during excavation			●	
6D. Focus upon the identification and analysis of structural remains and finds that may elucidate cultural links, industrial developments and trading networks	●			●
6E. Ensure routine scientific dating, particularly of excavated material spanning the poorly understood sub-Roman period	●	●	●	●
6F. Collect organic material from appropriate contexts; ensure systematic sampling, dating and analysis			●	
6G. Ensure the excavation of linear earthworks that might date from this period, particularly where they mark parish boundaries	●		●	
SUPERFICIAL SANDS AND GRAVELS				
6H. Monitor extraction of alluvium and terrace deposits to locate and investigate buried fishweirs, bridges, *etc.*, and identify, sample and date palaeochannels	●		●	●
6I. Prioritise excavation of the coaxial field systems that developed in the Trent Valley downstream of Newark to investigate the possibility of post-Roman use			●	
MAGNESIAN LIMESTONE				
6J. Search for Early Medieval settlement, which is currently especially poorly represented in this ACA; locate associated fields and prioritise excavation	●		●	●
SHERWOOD SANDSTONE				
6K. Prioritise the investigation of brickwork-plan fields to investigate the possibility of post-Roman continuity and the relationship of brickwork-plan fields to medieval open fields			●	

TABLE 8. 7. HIGH MEDIEVAL: 1066–1485				
AGENDA TOPICS / RESEARCH OBJECTIVES	**7.1**. Can we elucidate the growth of nucleated villages and parishes, moated and other manorial sites, dispersed hamlets and farms, the form, evolution and functions of associated buildings, and the processes of desertion and shrinkage?	**7.2**. Can we shed further light upon the development of the open field system, changes in the agricultural economy and diet, and woodland management practices, and how may these have varied within the County?	**7.3**. What can we learn from investigations of monastic estates of the growth of monastic settlement, its social, economic and landscape impact, and variability between the monastic orders?	**7.4**. Can we advance our understanding of the production and distribution of pottery and other industrial or agricultural products and of the developing commu-nications network?
	EMH: 7.2.1–7.2.4; 7.3.1–7.3.5	EMH: 7.7.1–7.7.6	EMH: 7.5.1, 7.5.2, 7.5.6	EMH: 7.6.1–7.6.4
ALL AGGREGATE CHARACTER AREAS				
7A. Identify ridge and furrow and review documentary and map data that may elucidate developing settlement patterns and field systems	●	●	●	
7B. Conduct systematic surveys of ridge and furrow and ensure retrieval of finds from furrow fills during excavation to clarify dating		●	●	
7C. Undertake systematic fieldwalking to refine understanding of spatial variations in settlement patterns and land-use	●	●	●	
7D. Prioritise identification and analysis of structural remains and finds elucidating industry and trade	●		●	●
7E. Ensure routine environmental sampling/analysis and scientific dating	●	●	●	
7F. Conduct targeted excavations of linear earthworks and cropmarks marking parish, county or other medieval boundaries (*e.g.* wapentakes)	●			
SANDS AND GRAVELS				
7G. Monitor extraction of alluvium and terrace deposits to locate and investigate fishweirs, bridges, mill structures, *etc.* and identify, sample and date palaeochannels		●		●
MAGNESIAN LIMESTONE				
7H. Prioritise the location and investigation of deserted/shrunken villages and relics of associated fields, which currently especially poorly represented in this ACA	●	●	●	●
SHERWOOD SANDSTONE				
7I. Prioritise earthwork searches and surveys in areas of Sherwood Forest that have escaped modern ploughing and have, therefore, an especially high potential for earthwork preservation (*e.g.* ridge and furrow)	●	●	●	

TABLE 8. 8. POST-MEDIEVAL AND MODERN: 1485 TO PRESENT

AGENDA TOPICS / RESEARCH OBJECTIVES	**8.1**. Can we elucidate the development of early enclosures, drainage schemes and other landscape changes linked to agrarian improvements?	**8.2**. Can we clarify the development of rural settlement, including the construction of flimsy structures that may be associated with the landless rural poor?	**8.3**. Can we shed light on developments in estate and garden design, including the landscape legacy of gentry leisure pursuits (*e.g.* fox coverts and fowling decoys)?	**8.4**. How did industrialisation and transport developments impact upon the rural landscape (*e.g.*coal-mining; lime-burning; quarrying; railways/canals)?	**8.5**. What traces have the military campaigns of the Tudor and later periods left in the rural landscape?	**8.6**. Can we enhance our understanding of the archaeology of outlying chapels and burial grounds in rural areas available for extraction?
	EMH: 8.3.1, 8.3.2, 9.6.1, 9.6.2	EMH: 8.4.1–8.4.5; 9.1.1, 9.6.3	EMH: 8.2.1–8.2.5; 9.5.1–9.5.6	EMH: 8.4.4; 8.5.4, 9.1.1; 9.4.1–9.4.5;9.7.1–9.7.5	EMH: 8.7.1, 8.7.2, 9.8.1–9.8.3	EMH: 8.6.2, 8.6.3; 9.3.2–9.3.4
ALL AGGREGATE CHARACTER AREAS						
8A. Ensure survey and excavation of deserted or shrunken villages and identification of physical remains relating to outlying settlement structures, chapels, burial sites, *etc.*		●				●
8B. Identify structural remains associated with the landless rural poor (*e.g.* in small, irregular enclosures on edges of pasture, roads, *etc.*).		●				
8C. Identify landscape features and structures associated with parkland landscapes and gentry leisure pursuits			●			
8D. Record archaeological evidence of military activities in rural areas (battlefields, World War I/II batteries, *etc.*)					●	
8E. Identify narrow ridge and furrow formed by steam ploughing and other traces of industrialisation of agriculture	●			●		
8F. Record archaeological evidence of industrial activities in rural areas (*e.g.* old quarries; coal mining remains in Sherwood Sandstone and Magnesian Limestone)				●		
8G. Prioritise systematic fieldwalking in order to elucidate spatial and temporal variations in field use and to identify ploughed-out industrial sites, battlefields *etc.*	●	●		●	●	
SUPERFICIAL SANDS AND GRAVELS						
8H. Prioritise recording of Civil War earthworks and associated features in areas designated for aggregates extraction around Newark					●	
8I. Monitor extraction of alluvium and terrace deposits to locate and investigate wharves, weirs, mills, bridges and other river-related transport and industrial features				●		
MAGNESIAN LIMESTONE						
8J. Prioritise surveys to locate and record the industrial archaeological remains that characterise rural areas of this ACA (notably limekilns and limestone quarries).				●		
SHERWOOD SANDSTONE						
8K. Prioritise recording of archaeological remains associated with this ACA's exceptional resource of outlying non-conformist chapels and burial grounds						●
8L. Promote surveys of the woods and parklands that characterise this ACA to locate traces of ridge and furrow, park and garden structures, rural industry, *etc.*	●	●	●	●	●	●

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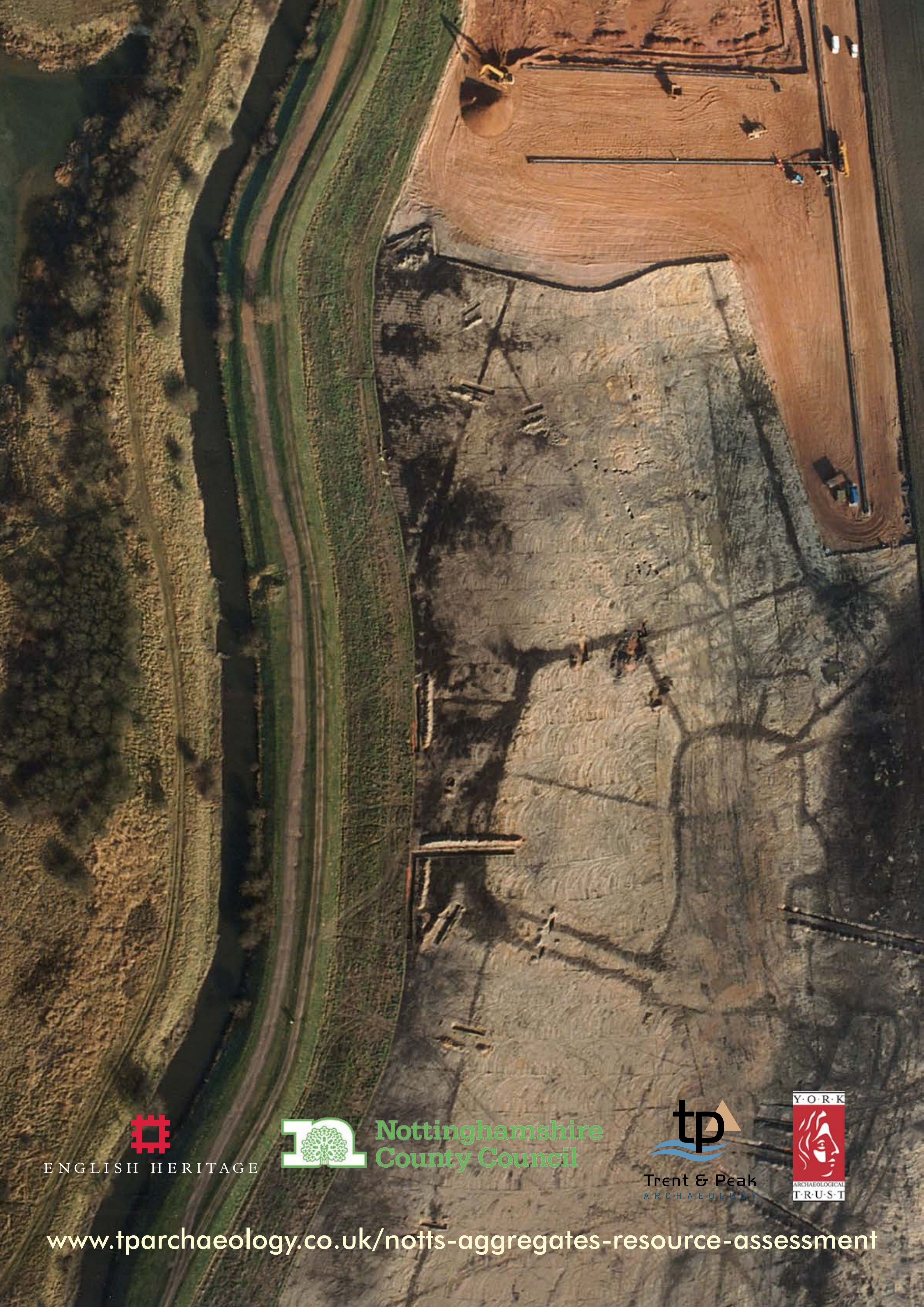
Palaeochannels incorporating organic deposits, exposed within the late Devensian braided river sands and gravels at Holme Pierrepont Quarry, demonstrate the potential of watching briefs for elucidating landscape change at all stages of the quarrying process - in this case, well below the level into which features indicative of prehistoric or later activity would have been cut. © A.J.Howard; on behalf of Lafarge Tarmac Ltd.



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