The Archaeology of Norfolk's Broads Zone

Results of the National Mapping Programme

English Heritage Project No: 2913

James Albone and Sarah Massey, with Sophie Tremlett

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A report for English Heritage

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Acknowledgements

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The project was carried out in collaboration with Cambridge University's Unit for Landscape Modelling (ULM), their contribution being the loan of material from their Air Photo Library.

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Summary

The National Mapping Programme (NMP) project covering Norfolk's Broads Zone has made an extremely significant contribution to the previously under-studied historic environment of this dynamic and varied landscape. It has led to the creation of 945 new sites on the Norfolk Historic Environment Record (NHER) database, representing a 31% increase in sites within the study area and a 2.17% increase to the NHER as a whole. A further 380 existing NHER records have been amended. The project has also created an archaeological map covering 543 sq km.

The NMP of the Broads Zone was carried out between 2006 and 2007, and sought to map, interpret and record all archaeological features visible on the consulted aerial photographs, whether earthworks, cropmarks or structures. The project was undertaken by Norfolk Landscape Archaeology (NLA), part of Norfolk County Council's Museums and Archaeology Service, and was funded by English Heritage under the Archaeology Commissions Programme (now the Historic Environment Enabling Programme).

The results of the project have significantly transformed our knowledge of the historic environment of the Broads, the lowland areas of which have a designated status equivalent to a National Park. The project has identified, and enhanced our knowledge of, a wide variety of sites ranging in date from the Neolithic to World War Two. Highlights include the mapping of numerous prehistoric ceremonial and funerary sites, including Neolithic mortuary enclosures, Bronze Age barrow cemeteries, and possible Iron Age square barrows. For the Iron Age and Roman period extensive swathes of field systems, trackways and enclosures have been mapped across vast areas of the uplands. Several possible Roman villas or large farmsteads were newly identified in the central area of the Broads, making a significant addition to the countywide distribution of this site-type. A considerable amount of new evidence for medieval and post medieval peat extraction was identified. Significant numbers of World War One to World War Two military sites were also recorded. Two main areas of research particularly stand out: the Iron Age to Roman field systems and settlement, and medieval to post medieval peat extraction. These research themes are discussed in some detail in this report.

It is hoped that in the future the NMP data will be utilised in more detailed studies of specific geographic areas, site-types or periods, where it can be integrated further with existing datasets, or can inform new investigations using other methods of inquiry. Future resources might also be invested in the dissemination of the Broads NMP data, both via traditional means or digitally. Notwithstanding this need for further work, already many of the NMP's records can be accessed via the online version of the NHER 'Norfolk Heritage Explorer', at <www.heritage.norfolk.gov.uk>.

1 Introduction

1.1 Project Background

The Norfolk National Mapping Programme (NMP) Broads Zone mapping forms the second phase of what had originally been conceived of as a larger countywide NMP project (Allen 2000). The work followed on from the mapping of the Coastal Zone, undertaken from 2001–2006, with a report submitted in 2007 (Albone et al. forthcoming, throughout this report). The Broads Zone was selected as the next priority area after the coast. This was in part based on the fact that this effectively man-made landscape is under threat from a number of pressures, and decisions need to be made regarding the management of any potential changes. For example, the Broads are now severely silted and require dredging before the problem becomes potentially irreversible. In addition, as much of the land constitutes low-lying coastal marsh, the effects of threatened sea-level changes are that much greater, including the possible breaching of the Broads in some areas and the reversion to saltmarsh of currently freshwater environments (Massey et al. 2006). These processes are likely to have a significant impact upon the historic environment.

The phase of mapping reported on here marks the end of the countywide NMP project originally planned for Norfolk (Allen 2000). This intended to divide the whole county into several broad landscape zones. Due to the various issues encountered by the project (detailed in Massey et al. 2006) only the Coastal and Broads Zones were completed, together representing approximately 25% of the county. Future Norfolk NMP projects will target particular research themes or threats, such as aggregate extraction, for which an assessment project, incorporating a significant NMP component, is currently being carried out (English Heritage Project No. 5241MAIN).

1.2 Study Area

The Norfolk NMP Broads Zone comprises twenty-four Ordnance Survey 1:10,000 quarter sheets (Fig. 1.1), approximately 543 sq km of which were mapped. Six of these map sheets cover the Norfolk/Suffolk county border. Here, only the land within Norfolk was mapped, due to logistical concerns, such as potential digital data exchange problems between the Norfolk and Suffolk HERs (Massey et al. 2006). Additionally, a Suffolk County Council ALSF project, which included an NMP element, has been undertaken on much of the Suffolk side of the Waveney Valley (English Heritage Project No. 3987MAIN).

The Norfolk NMP Broads Zone encompasses large areas of drained marsh, freshwater fen and carr woodland and upland areas of arable and settlement (see Section 2.4). This inclusion of the surrounding upland areas ensured that the fens and marshes were not

studied in isolation and were interpreted in the context of the surrounding landscape. The upland areas of the Broads have been comparatively neglected in the past, with attention focussed mainly on the Broads and river valleys. The landscape history of the Broads published by Williamson (1997) has gone a long way to redressing this balance, with the upland, river valley and marshland zones discussed in equal detail. The relationship and interplay between all of these environments is an important factor when considering the archaeology and landscape history of any period. The eastern part of the Broads landscape, in particular the upper Thurne Valley and the Halvergate Marshes, fell within the previously mapped Coastal Zone. The archaeological sites in this area that were of particular relevance to the Broads landscape, such as peat extraction sites, have been dealt with in this report and were not included in the main Coastal Report (Albone et al. forthcoming). The low-lying areas, typically marshes and fens, are administered by the Broads Authority, with a designated status equivalent to a National Park.

1.3 Summary of Norfolk NMP Methodology

The Norfolk Broads mapping was undertaken using the existing methodology of the NMP, a national initiative funded and run by English Heritage. The aims of the NMP are to 'enhance our understanding about human settlement, by providing primary information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from Neolithic period to the twentieth century' (Bewley 2001, 78). Ultimately, the Norfolk NMP aims to map, record and collate information for all archaeological sites in the county visible on the available aerial photographs, at a nominal scale of 1:10,000. The resulting maps and records will be stored in, and accessed via, the ExeGesIS HBSMR database and archive of the Norfolk Historic Environment Record (NHER; formerly Norfolk Sites and Monuments Record). The NHER is now accessible online, by means of the Norfolk Heritage Explorer website (at <www.heritage.norfolk.gov.uk>). Data will also be supplied to the National Monuments Record (NMR). Full details of the aims and archaeological scope of the project, of the mapping conventions used and the photographic sources consulted for the Broads Zone are given in Appendix 1. A management report, providing a critical overview of the overall project methodology and results, has also been submitted to English Heritage (Massey & Tremlett forthcoming).

2 The Character of the Broads Zone

2.1 Introduction

The landscape of the Norfolk Broads comprises three separate zones: marshland, the river valleys and Broads, and the uplands. The low-lying river valleys, Broads and marshland define the character of the region, and to some extent, as a result of 20th-century tourism, the popular perception of the quintessential Norfolk landscape.

In many respects the most important of the Broads environments is the marshland which lies at its heart, the greater part of which is known as Halvergate Marshes (Fig. 2.1). This area of low-lying marshland is fundamental to the landscape history of the Norfolk Broads and has its origins in a former estuary, known as the Great Estuary, that was present in the Roman period (see below). The estuary entered the North Sea to the south of Caister-on-Sea, at the point on the coast where Great Yarmouth is now situated. It once separated the Isle of Flegg and the Lothingland peninsula, but silted-up in the post-Roman period leaving Breydon Water as its sole remnant. The marshland environment present today, which is a product of medieval and later drainage and reclamation, all lies at around sea-level.

The tributaries of the Great Estuary form the modern rivers of the Broads, principally the Rivers Yare, Bure and Waveney. These three rivers, along with the smaller Rivers Ant, Thurne and Chet, comprise the river valley zone of the Broads (Fig. 2.1). Within these valleys are areas of relatively recently drained marshland, much of which has been converted to arable. Significant areas of undrained fen still survive, however, often colonised by alder and willow carr. It is within this landscape that the freshwater lakes, the 'Broads' by which the whole area has become known, are situated. The Broads are often seen as the defining characteristic of the area, despite only being present in a relatively restricted part of the region and also representing quite a late and relatively short phase of its history. The actual Broads themselves were created by medieval peat extraction, with the disused workings having since become water-filled and/or encroached by vegetation (see Chapter 6 for a more detailed discussion). The Broads have had a defining role in the development and study of this area since their recognition as man-made features (Lambert et al. 1960). The majority of the river valleys in the Broads Zone lie below 5m OD and, like the marshland into which they drain, many parts of the valley floors are close to sea-level. Several areas of valley floor are up to a metre below sea-level, most notably around St Benet's Abbey at Horning, at the confluence of the Rivers Ant, Bure and Thurne, and in the Yare Valley at Langley with Hardley. The River Waveney has a longer course within the Broads Zone than the other Broads rivers and its valley floor rises to a height of 10m OD to the southwest of Earsham.

The rivers of the Broads divide the landscape into a series of interfluves or peninsulas which fan out from the western edge of the marshland. Each of these peninsulas is referred to below by the pair of rivers that defines it (e.g. the Yare-Bure peninsula). These areas, along with the western part of the Isle of Flegg, form the upland landscape of the Broads Zone. The upland areas have a varied topography which to some extent reflects the differences in geology between the northern and southern parts of the Broads Zone (see below). The northern uplands, between the Rivers Bure and Ant, have a subtle topography which mainly lies at just over 10m OD. Only in the northwest of this area, near Worstead, does this block of land rise up to over 30m OD. Lying mostly below 10m OD, and reaching a maximum height of only 13m OD, the Ant-Thurne peninsula is the lowest lying of the upland areas in the Broads Zone. The western edge of the Isle of Flegg has a similarly muted topography which rises to just over 20m OD. The Yare-Bure peninsula and the claylands to the south of the River Yare have a gently rolling topography of plateaux and small valleys. These areas lie mainly between 10m and 30m OD, with occasional high points such as Strumpshaw Hill and Hedenham and Thwaite St Mary reaching up to 40m OD.

2.2 Geology and Soils

In common with most of the county of Norfolk, the Broads Zone is underlain by chalk deposits of Cretaceous date. These strata, however, are deeply buried by the later drift deposits that cover most of east Norfolk and are only exposed in small areas along the edges of the Yare and Bure Valleys in the extreme west of the Broads Zone. The drift geology of the Broads Zone can be divided into two categories: that restricted to the upland peninsulas and interfluves, and the younger deposits present in the river valleys and marshland. The earliest of these deposits in the upland areas consists of shelly sands and gravels of the Norwich Crag formation. These were deposited in a precursor of the modern North Sea during the Pliocene and early Pleistocene periods, between 3.5 and 1.6 million years ago (Chatwin 1961, 41; Williamson 2006, 12). They are mainly exposed in the northern part of the Broads Zone, in wide sinuous strips along the edges of the Bure and Ant Valleys and forming much of the low-lying Ant-Thurne peninsula. Narrower exposures are present along the edges of the Yare and Waveney Valleys. Overlying the Norwich Crag is the brown sandy clay of the Norwich Brickearth which was deposited during the Anglian Glaciation (c. 480,000–430,000 BP). This deposit is also predominantly present in the northern part of the Broads Zone where it is exposed over large areas of the uplands. Isolated deposits of sands and gravels laid down in glacial meltwater channels are present, particularly on the higher parts of the northern uplands and along the edges of the Yare and Waveney Valleys. The geology of the southern part of the Broads Zone is dominated by the Lowestoft Till, a chalky boulder clay that forms a vast swathe across central and south Norfolk. Significant deposits of this boulder clay are also present on the central and eastern parts of the Yare-Bure peninsula, with smaller areas on the western side of the Isle of Flegg. The river valleys of the Broads Zone

cut through these glacial drift deposits and their geology, along with that of the marshland, is determined by their post-glacial landscape history (see Section 2.3 below).

The soils of the Broads Zone are influenced by the nature of the drift geology. The most fertile soils in the region are the rich loams derived from loess deposits which are present across much of the northern uplands. The southern upland areas have poor-draining stagnogley soils derived from the underlying boulder clay. However, the small valleys in this area contain a mixture of fertile loamier sandy soils and poor gravel soils. The marshland soils comprise alluvial silts and clays deposited in the former estuary, whereas peaty soils are dominant in the river valleys (Williamson 2005, 8).

2.3 Landscape History

The sedimentary sequence that created the landscape that is today known as the Broads is extremely complex and almost certainly unique, involving several major periods of marine transgression. In early post-glacial times the rivers of the Broads Zone discharged into an open estuary occupying much of what is now called the Halvergate 'Triangle'. A subsidiary estuary, separated from this larger body of inter-tidal water by the higher ground of Flegg, occupied what are now the headwaters of the River Thurne, in the low-lying land between Winterton and Waxham (Williamson 1997, 11) (Fig. 2.1).

Rising sea-levels during the Mesolithic period meant that these previously fast moving rivers gradually slowed down, and freshwater and fen conditions started to develop on the valley floors, gradually forming the brushwood peat deposits of the 'Lower Peat' (ibid., 12). Environmental data indicates that throughout the late Mesolithic period and into the Neolithic, conditions were becoming more brackish and areas of saltmarsh developed along the coast (Coles & Funnel 1981, 126). A further rise in sea-level meant that estuarine conditions then developed in the middle reaches of the valley bottoms. The clays and silts laid down indicate that estuarine conditions extended up to 20km inland (ibid., 123). Large areas of mudflats and, later, saltmarsh developed, although around 2500 BC freshwater conditions and reed beds started to develop. The peat laid down within the modern Halvergate Marsh area indicates that large, open, freshwater lagoons had formed near the coast. These changes are attributed to the build up of a substantial sandspit blocking the mouth of the estuary and diverting the course of the River Yare southwards (ibid., 126-7; Williamson 1997, 12). These conditions allowed further peat formation in the middle reaches of the valleys, known as the Middle Peat. Throughout the Bronze Age, conditions in the inland valleys gradually became wetter, with evidence of pools forming along the Yare Valley and the river channels widening (Lambert et al. 1960, 21; Coles & Funnel 1981, 127). The sandspit across the embayment eventually breached and estuarine conditions penetrated into the lower valleys (Coles & Funnel 1981, 127; Williamson 1997, 12).

By the Iron Age the spit had disintegrated completely, creating an open estuary once more. In the Roman period this consisted of a vast area of open water, inter-tidal mudflats and saltmarsh – the 'Great Estuary' – with more brackish water conditions along the inland valley limits (Coles & Funnel 1981, 127). The 'Upper Clay' deposit relating to this phase of marine transgression indicates that these estuarine conditions reached 23km inland, within 7km of Norwich (ibid.). The Thurne channel also experienced tidal conditions, but it is not clear if it was connected to the sea at its eastern end as well as to the Great Estuary to its southwest (Horton et al. 2004). It has been suggested that the Thurne channel was separated from the sea by a natural barrier during this period (Lambert et al. 1960, 46). The final silting of the Great Estuary occurred during the Anglo-Saxon period, an event largely attributed to rising sea-levels and the re-blocking of the estuary mouth by the shingle spit upon which Great Yarmouth started to develop as a town in the Late Saxon period. The sedimentary sequence suggests that this marine regression happened relatively rapidly, with estuarine conditions remaining only in Breydon Water by about 500 AD (Coles & Funnel 1981, 128). The silting of the estuary and lower valleys formed the large areas of wetlands, fen and grazing marsh, criss-crossed with meandering saltmarsh creeks, which survive in part today. Fieldwalking within the Broads indicates that the reclaimed marshland was already being used during the Saxon period.

2.4 Land Use

The Broads Zone encompasses several different land use types. The large triangular area of drained marshland to the west of Great Yarmouth, usually referred to as the Halvergate Marshes, is predominantly used for pastoral agriculture. Within that area of marshland, aerial photographs reveal that the extent of the pasture has diminished significantly during the second half of the 20th century, as fields have been converted to arable. The river valleys also contain areas of drained marshland, although less extensive, and often represent much later improvements and enclosure dating to the 17th to 19th centuries. The upper reaches of the valleys contain areas of undrained freshwater fens with reed and sedge beds and areas of wet woodland, alder and willow carr. A significant amount of this carr woodland, in particular in the Bure Valley, has regenerated since the 1950s from areas of freshwater fen (Collins 2005). The uplands surrounding these low-lying marshes and fens are largely used for arable cultivation. Mapping by the Norfolk Historic Landscape Characterisation Project has revealed that most of this is represented by modern fields, created through late 20th-century agricultural improvement, although some pockets of 18th and 19th-century enclosure survive, in particular to the west of the project area (Paul Thorogood, NLA, pers. comm.). The Broads Zone does not contain any significant urban centres. The settlement pattern consists of villages and small towns, such as Acle and Stalham, which are located along the edges of the main river valleys and their tributaries. Some of these villages, in particular Wroxham beside the River Bure, have experienced enormous growth in the last century thanks to the tourist industry (Collins 2005).

3 Factors Affecting the Results of the Survey

As would be the case with any archaeological survey, the results of the Norfolk Broads Zone NMP project have been influenced by a number of different factors. Some of these factors are inherent in the NMP methodology, or in the nature of aerial photographic evidence and its interpretation. Others relate to archaeological work undertaken both before and during the project's lifespan. The effects are evident in both the number and nature of the sites recorded in different environments and under different conditions. While overall the project can be regarded as a success, these factors need to be kept in mind in the interpretation of its results.

3.1 NMP Methodology

The comprehensive analytical and interpretative aerial photographic survey provided by the NMP has made a vital contribution to our understanding of the historic environment of Norfolk's Broads Zone. The project has created 945 new sites in the NHER and amended 380 existing records. In addition to the identification and interpretation of sites visible on aerial photographs, the project has provided accurate locational data for each site recorded. The NMP mapping has also allowed the morphology of 482 of the larger and more complete sites to be characterised. Although some aerial photographic transcription of certain sites had been undertaken prior to the start of the project, and some has been done (and will continue to be done) under the auspices of PPG16 or as part of separate research projects, only the uniform and wide-ranging approach of the NMP can provide a standardised dataset and near-unbroken coverage at this level of detail.

The NMP to date has proved to be of particular value in Norfolk, where the industrial-scale agriculture that covers most of the county has left few surviving earthworks but there are extensive areas of cropmark-productive soils (Albone at al. forthcoming). Norfolk benefits from its own collection of aerial photographs — the Norfolk Air Photo Library (NAPL) — a large component of which is made up of specialist oblique photographs taken by Derek Edwards, formerly of Norfolk Landscape Archaeology (NLA), over the course of approximately twenty-five years. In those areas already completed, the NMP has maximized the potential of this important resource, identifying new sites either on photographs where a more dominant feature had been recorded, or on those which had not been studied previously. The use of historic photography, dating back to the 1940s (and sometimes earlier), has allowed the recognition of former earthwork sites which have since been levelled, and of all types of sites in areas that are now obscured by post-war development. The use of a wide range of photographs, from several collections, has included some which have proved to be particularly productive. Vertical photographs taken by Meridian Airmaps Ltd in the summer of 1976 have recorded numerous cropmarks visible only on these photographs.

3.2 Photo Coverage, Aerial Reconnaissance and Previous Air Photo Interpretation

A total of 14,420 aerial photographs were either consulted at or loaned from three major aerial photographic collections. The prime sources were the National Monuments Record (NMR; 9,373 verticals and 333 obliques) and the Norfolk Air Photo Library (2,288 specialist obliques and an unquantified amount of vertical photography). A significant proportion of the 1,158 obliques and 958 verticals for the area were also loaned from the Cambridge University Unit for Landscape Modelling (formerly CUCAP). Approximately 300 ADAS vertical aerial photographs were loaned from the Broads Authority and a comparable number of BKS verticals from NCC's Planning and Transportation department.

Variations in aerial photographic coverage had a significant impact on the mapping of cropmark sites. Large numbers of photographs, taken in a variety of different years, not only provide more opportunities for capturing the formation of cropmarks, but can also help confirm, or refute, the archaeological origin of a particular site. As has already been described, the availability of exceptionally productive photographs, such as the Meridian Airmaps Ltd runs from the summer of 1976, can also have a very significant impact on the number of sites recorded. Ordnance Survey verticals from 31 July 1990 also had a dramatic impact on the results from the areas they covered, with large cropmark complexes being recorded that were not visible on any other vertical or oblique aerial photographs. The availability of late summer photographs taken by BKS in August 1998, shortly before the sugar-beet harvest, was another significant factor for cropmark distributions, in particular for the southern part of the Broads Zone. Sugarbeet has a later growing season than cereal crops and therefore cropmarks may be visible on photographs taken in late summer, after cereal crops have already been harvested. The heavier, more water-retentive soils of this part of the Broads Zone may correspond with a preference for sugar beet cultivation in the area.

The existence of specialist oblique aerial photographs for some areas dramatically affected the NMP mapping, most notably in the parishes of Beighton and Cantley (see Chapter 5 and Figs 5.2–5.4 for the exceptional cropmarks recorded within this area). The complex and extensive cropmarks visible on the oblique aerial photographs were almost entirely absent from vertical photographs spanning the period from the 1940s to the 1990s. This highlights the vital importance of specialist collections. However, amongst the oblique photography, much of which was taken years and often decades before the start of the project, there is a notable tendency for certain areas to have become 'honey pots', with certain sites, or even parishes, being repeatedly photographed. In other areas the specialist coverage is poor, although the NMP mapping has now demonstrated, often through the consultation of vertical photography, that they are far from empty in terms of cropmark sites.

Since the work of Derek Edwards as Air Photographer for NLA ceased in 2000, aerial reconnaissance within the county has been limited. A number of local fliers, in particular Mike Page, have continued to contribute new photographs (sometimes of new sites) to the NAPL. The Broads mapping has hopefully signalled the start of a new and fruitful relationship between the Norfolk NMP and Mike Page who, at the request of the team, undertook some reconnaissance of a previously unrecorded possible Roman villa at Ashby with Oby (NHER 45060).

The Broads Zone had few pre-1945 aerial photographs when compared to the Coastal Zone, and it is probable that many temporary World War Two military sites had been removed without trace by the time of the first available aerial photographs. The Coastal Zone NMP work has previously indicated that where the only 'wartime' coverage is a single set of photographs taken in 1945–7 by the RAF for the National Air Survey, then the NMP mapping and recording will be limited (Albone et al. forthcoming). The majority of the military sites mapped by the project consequently consisted of fixed defences and those that left a recognisable footprint, such as searchlight batteries.

Prior to the NMP starting in Norfolk, there were a number of more limited attempts to transcribe and record archaeological sites visible on photographs held by NAPL and, to a lesser extent, in other collections. Basic sketches of cropmarks and other features (mainly those visible on Derek Edwards' specialist obliques) had been added to the county's paper 1:10,000 Sites and Monuments Record (SMR) maps, while more detailed manual transcriptions existed for some sites on an accompanying overlay. The Norfolk Earthworks Project (published in Cushion & Davison 2003) was preceded by a survey of aerial photographs, by Myk Flitcroft (formerly of NLA) among others, including Norfolk County Council's BKS colour vertical survey from 1987–8. In the mid-1990s, Danny Voisey (also formerly of NLA) undertook the survey of a large proportion of NAPL's collection of 1970s Ordnance Survey vertical photography. Brief descriptive records were added to the NHER (then Norfolk SMR) and some manual transcription was undertaken. Where available, the results of these various efforts were incorporated into the work of the NMP. One of the main benefits of the more recent project has been to provide transcriptions of previously recorded sites that are both more accurate and more detailed, through the use of digital rectification and by mapping within a digital environment.

3.3 NMP and Field Survey

The Broads landscape as a whole has seen a relatively small amount of systematic archaeological research. While extensive fieldwalking surveys have taken place, most notably in Hales, Loddon and Heckingham (Davison 1990), these have tended to be focussed upon relatively limited areas. Some parts of the project area have been subject to extensive metal detecting surveys, in particular the upland between the Bure and Yare Valleys. This work

provided valuable dating material for some of the cropmark complexes. Large-scale excavation work has been relatively limited within the Broads Zone. Notable exceptions are the prehistoric complex at Broome Heath (NHER 10602, SM 282), excavated by Wainwright between 1966 and 1971 (Wainwright 1972) and an adjacent site excavated more recently by NAU Archaeology (Robertson 2003). Burgh Castle, which has been subject to excavation (Johnson 1983), was mapped by the NMP as part of the Coastal Zone (Albone et al. forthcoming).

The Broads NMP mapping has incorporated the results of earlier, ground-based surveys, where these were available. The NMP's use of historic as well as modern aerial photography means that it has frequently been able to record earthwork sites which are now ploughed flat, as well as identifying new earthwork sites that for various reasons have previously been overlooked. At sites surveyed before the NMP started, such as those investigated by Brian Cushion as part of the Norfolk Earthworks Project (Cushion & Davison 2003), it has often been possible to add new information, either details of the site itself or of associated features in the vicinity. These may be apparent as earthworks that were levelled prior to the field survey taking place, or as cropmarks or soilmarks within or surrounding the surviving earthwork site.

At Repps with Bastwick, in the northeastern corner of the Broads Zone, it was possible to integrate the results of the NMP with ongoing analysis of recent excavations by NAU Archaeology along the Bacton to Great Yarmouth gas pipeline (Bates & Crowson 2004; Bates in prep.). This followed on from collaboration in the interpretation of several sites in the Coastal Zone, within which the majority of the pipeline fell. The benefits of a two-way flow of information, to the analysis of both the cropmarks and the excavated sites, are discussed in more detail in the Coastal Zone report (Albone et al. forthcoming). Suffice to say, that it proved as useful for the Broads Zone sites as it had for those in more coastal areas.

3.4 Topography and Soils

The sedimentary sequence and subsequent land use of the Broads landscape (see Chapter 2) means that the scope for using aerial photographs to identify archaeological sites could have potentially been quite limited. The build-up of alluvial, colluvial and marine deposits in river valleys, estuaries and other areas of low-lying land, particularly around the edges of the Broads themselves, is likely to have masked much of the evidence for early activity in these areas. Such deposits will potentially cover any earlier earthworks and, where substantial, will inhibit the production of cropmarks in all but exceptional circumstances. The contrasting deposits of alluvium seawards and peat inland, typical of most coastal alluvial lowlands, e.g. the Somerset Levels, has an obvious impact on the potential for identifying archaeological sites from aerial photographs. This is particularly the case for pre-transgression prehistoric

landscapes, which are largely masked, with only later medieval and post medieval features which postdate the alluvial deposits, being easily detected from the air.

It is not just aerial archaeology, however, that is affected by this masking of archaeological deposits. The pre-NMP distribution of monuments also reflected the changing nature of the estuary and the masking of pre-transgression sites. The distribution of prehistoric monuments recorded on the NHER database prior to the NMP within the lowland Broads Zone was sparse, and this is likely to have been in part a result of the masking of earlier sites that may have existed in the valley bottoms. A similar pattern was evident amongst the recorded Roman sites, which were clustered around what was the Great Estuary. The Saxon distribution again revealed a similar pattern, although sites of this period started to encroach upon the inner reaches of the former estuary, reflecting the drying out and increased use of previously inter-tidal areas. It is in the medieval and post medieval period, after the last marine transgression, that monument density really alters, with sites being spread across the reclaimed marsh (Massey 2005).

Outside of the low-lying marsh and fen environments, much of the archaeology mapped in the Broads Zone has been visible as cropmarks. The processes and conditions which lead to the formation of cropmarks, and the different geologies and soils on which they can be seen, are described elsewhere (e.g. Wilson 2000, 67-86). In general this is dictated by a crop's response to the relative lightness and drainage capacity of different soils, usually activated by soil moisture deficit, in particular in times of drought. The relatively varied topography, geology and soil background encountered within the Broads Zone means that there are inevitably biases in the evidence.

As discussed in Section 2.2, significant parts of the uplands of the southern Broads Zone are covered by deposits of boulder clay. Unsurprisingly, there is a noticeable reduction in the density of cropmarks recorded in these areas, which largely comprise poorly draining soils. However, the edges of the main river valleys and the minor valleys of the southern Broads, where glacial sands and gravels are present, provide pockets of good cropmark response. This is particularly evident at the extreme eastern end of the Waveney-Chet peninsula around Burgh St Peter. The uplands of the central and northern parts of the Broads consist mainly of a mixture of sands and gravels of the Norwich Crag and the sandy clay of the Norwich Brickearth (see Section 2.2). Both of these deposits were generally covered by light loamy soils and therefore produced some exceptional areas of cropmarks. However, areas of boulder clay deposits were present in the northern Broads Zone across the Yare-Bure peninsula and the western edge of the Isle of Flegg, resulting in areas of poorer cropmark response.

3.5 Land Use

As outlined in Section 2.4, the land use of the Broads Zone is varied, ranging from freshwater fen, carr woodland and grazing marsh to arable cultivation; all of these land uses had an obvious impact on the types of archaeology recorded. Unsurprisingly, the majority of earthwork sites were recorded within the drained grazing marshes and, as discussed above (Section 3.4), these were predominantly medieval to post medieval in date, overlying the main Iron Age to Roman date marine transgression deposit. Small portions of these marshes have been converted to arable relatively recently. On the drained marshland extensive soil-, vegetation and cropmarks of former drainage systems are visible. These often encompassed sinuous channels, the remnants of the natural drainage system, as well as straighter, man-made elements. Most of these drainage patterns probably developed from the medieval period onwards, and elements of them are often depicted on 19th-century maps. It is partly for this reason that these types of features were not mapped by the project (see Appendix 1). The only archaeological features recorded within areas of fen and alder carr margins were those relating to former peat and clay extraction and associated drainage schemes. These were visible as earthworks, vegetation marks and soilmarks. In common with other predominantly arable areas of Norfolk, the uplands revealed few traces of earthworks and the vast majority of sites in these areas were visible only as cropmarks and/or soilmarks. It is in these upland and predominantly arable locations that sites dating to the prehistoric period (and later) were identified. Conversely, earthworks dating to the pre-medieval period were rare in these areas, other than on surviving portions of heathland, such as Broome Heath (see Section 4.2).

4 Summary of Archaeological Results

4.1 Overall Results

The project has created 945 new sites in the NHER and amended 380 existing records. Although the 'new' records include previously recorded sites that have been split into separate elements, this still represents a substantial proportion of previously unrecorded archaeology. Prior to the NMP mapping the NHER database held 448 records relating to either cropmarks or earthworks within the project area. The NMP results therefore represent a doubling of the number of recorded earthwork and cropmark sites. The project area contained a total of 3081 sites, the remainder of which represent finds, listed buildings and other structural remains. The NMP mapping therefore also represents a 30.67% increase to the number of NHER sites for the project area and a 2.17 % increase to the NHER as a whole.

4.2 Neolithic Sites (4000–2351 BC)

A total of fifty-five sites of Neolithic or possible Neolithic date were recorded in the Broads Zone. A variety of site-types is represented, but as is typical of the aerial photographic evidence for this period, including that from Norfolk's Coastal Zone, the assemblage is overwhelmingly dominated by 'monuments', i.e. funerary and/or ceremonial sites. The Broads mapping did, however, include the remarkable enclosure at Broome Heath (NHER 10602, SM 282), excavated by Wainwright between 1966 and 1971 (Wainwright 1972). The pits of the earlier Neolithic settlement underlying it were not evident on the consulted aerial photographs, unsurprisingly given that the site is covered by rough heathland vegetation. Although unenclosed settlement sites can be identified from aerial photographs (Helen Winton, English Heritage, pers. comm.), the tendency in many areas of Norfolk for the background geology to produce pit-like cropmarks means that such sites will always be difficult to identify in the county, even under arable cultivation.

When compared with the results from the Coastal Zone (Albone et al. forthcoming), there is a notable absence of any good examples of the larger classes of monument – causewayed enclosures and cursus monuments. A number of large, curvilinear enclosures were mapped, together with several causewayed ring ditches. While a Neolithic date is possible for these sites, none could be confidently suggested as representing a causewayed enclosure. Postulated cursus monuments at Rollesby (NHER 44900) and Langley with Hardley (NHER 17584) were dismissed, a more recent, and more mundane, origin being suggested for the features. Possible hengiform monuments or enclosures were more common, although, as was discussed in more detail in the Coastal Report, the identification of such sites, and their interpretation, is problematic. Long barrows or putative mortuary enclosures are also relatively well represented, with fifteen possible examples recorded. These include the surviving long

barrow on Broome Heath (NHER 10597, SM 152), where the earthworks of a second possible small long or oval barrow were identified 42m to its northeast (NHER 43777). The latter was destroyed by quarrying by 1967 and was previously unrecorded. Conversely, the Neolithic enclosure excavated at Yarmouth Road, Broome (NHER 36289; Robertson 2003), less than 1km to the northeast, was not identified on the consulted aerial photographs, any potential cropmarks being masked by a palaeochannel.

The Neolithic sites mapped within the Broads Zone were widely distributed across the project area, with notable clusters at Broome Heath, around Ashby on the edge of the Isle of Flegg, and in the Waveney Valley, around Aldeby, Wheatacre and Burgh St Peter, for example.

4.3 Bronze Age Sites (2350–701 BC)

A total of 216 ring ditches were recorded and it was felt that the majority of these were the remains of plough-levelled Bronze Age round barrows. Of the 216, eighty-five were previously known sites, leaving 131 new possible ring ditches. (Some of the 'new' sites may be the product of splitting previously recorded multi-period cropmark sites.) Actual evidence of an earthwork mound was only recorded at seven sites. Most of these are now plough-levelled, the exceptions being two surviving earthwork sites at Broome Heath (NHER 10611 & 10624). The size of the ring ditches recorded varied tremendously, although the majority were between 10m and 30m in diameter. This is consistent with the size range of ring ditches recorded within the Coastal Zone (Albone et al. forthcoming). A number of larger ring ditches were also recorded: seventeen measured between 35m and 65m in diameter. It seems likely that the majority of these represented large and elaborate barrow sites and may represent funerary sites that were added to over time. As referred to earlier (Section 4.2), some may have late Neolithic origins, although this is not certain. Some of the larger sites may belong to a poorly understood class of monuments comprising large ring ditches and circular to sub-circular enclosures that may be of Neolithic to Bronze Age date (Wilson 2000, 110; Albone et al. forthcoming). The landscape setting of the ring ditches is relatively varied, but there was a definite preference for a slight or moderate slope and for sites to be positioned on valley sides. A number of barrows were positioned near or just below the 5m contour overlooking the broad valley floors of the Waveney, Yare and Bure (NHER 49308–9 & 49317–9, for example).

A total of sixteen barrow cemeteries was recorded within the Broads Zone. For the purposes of the project, barrow cemeteries are broadly defined as being groups of three or more barrows or ring ditches with an obvious spatial relationship or clustering, such as a nucleated group or linear arrangement. The cemeteries recorded in the Broads Zone contained between three and sixteen individual barrows. Some may have developed around earlier monuments (NHER 15805, 49686 & 49687), with some of the larger and more elaborate ring ditches possibly dating to the late Neolithic. These perhaps began as more isolated monuments,

which subsequently became a focus for later funerary activity, although, as has been outlined elsewhere (Albone et al. forthcoming), it is at present uncertain how many of these large barrow sites in Norfolk (or elsewhere in the region) are pre-Bronze Age in date. The largest barrow cemetery recorded in the Broads Zone (NHER 44844 at Broome), which encompasses up to sixteen possible components, is situated within a large and complex group of prehistoric monuments, some of which may also have Neolithic origins (e.g. NHER 44843). The landscape setting of the barrow cemeteries is reasonably varied and broadly reflects that of the more isolated barrows. The preferred landscape positioning appears to have been on a valley side, often on a slope of a minor tributary valley, as is the case with NHER 49686-7 at Strumpshaw and Lingwood with Burlingham. One of the barrow groups (NHER 43612) is located on the terrace of the River Waveney. This cluster of four barrows forms part of a wider dispersed barrow landscape, with other ring ditch cropmarks present to the east (NHER 43610-1) and northeast (NHER 43538-40).

No non-funerary enclosures within the Broads Zone were confidently attributed to the Bronze Age. A total of thirteen irregular and curvilinear enclosures of probable late prehistoric date were identified, such as those at South Walsham (NHER 49500), Thurton (NHER 23743), and Belaugh (NHER 49177), and the two identified at Burgh St Peter (NHER 44876 & 44885). The remainder of the possible late prehistoric enclosures, in particular the more rectilinear examples, are discussed below in the Iron Age summary (Section 4.4). A number of field systems were also tentatively attributed to the late prehistoric period and these too are discussed below. The possibility of a Bronze Age origin for some areas of coaxial fields within the Coastal Zone, to the north and east of the Broads Zone, has been highlighted elsewhere (Albone et al. forthcoming).

Cropmarks of a triple-ditched linear boundary were recorded at Earsham in the Waveney Valley (NHER 11676) (Fig. 4.1). Three parallel ditches were present on a sinuous intermittent alignment for up to 305m, between the River Waveney and a possible natural pond called The Lay. The boundary was not seen to continue to the south of the river (Hegarty 2006) and it is possible that it only existed for the short distance between The Lay and the Waveney. It divides a dispersed barrow cemetery comprising four small groups of ring ditches of probable Bronze Age date (NHER 43610-2 & 43540) but the relationship between these monuments is not clear. Multiple ditched boundaries of this type are relatively rare in East Anglia and are best known from Yorkshire and Lincolnshire where they are considered to be of late Bronze Age to Iron Age date (Stoertz 1997; Boutwood 1998). At least three other examples are known from aerial photographs within Norfolk, including a quadruple-ditched boundary at Hedenham (NHER 21077) and two sites consisting of five parallel ditches, at Lexham (NHER 17588) and Scottow (NHER 36729). The Scottow example has been proven by excavation (in 2004) to be cut by the ditch of a Roman Road (NHER 2796). Early Bronze Age pottery was

collected from the general vicinity of the cropmarks (Sims 2005), potentially indicating a date broadly contemporary with the Bronze Age to Iron Age examples known from elsewhere.

4.4 Iron Age Sites (800 BC–AD 42)

The problems of distinguishing between later prehistoric, Iron Age and Roman domestic enclosures and agricultural landscapes has been discussed in detail elsewhere (Albone et al. forthcoming). Other than the rare instances where the presence of Iron Age artefacts can indicate a specific date, as with the trapezoidal enclosure recorded at South Walsham (NHER 18330), enclosures with a broadly rectilinear or trapezoidal plan were generally interpreted as being Iron Age to Roman in date.

A total of fifty-seven rectilinear, rectangular or trapezoidal enclosures of possible Iron Age date were identified, although many of these were recorded as dating more broadly to the late prehistoric and/or Roman period. However, due to the presence of quite extensive areas of seemingly Roman, planned agricultural landscapes and settlements in some parts of the Broads Zone (see Chapter 5), there were opportunities to distinguish between a Roman phase and earlier enclosures and fields. In the parishes of Beighton and Cantley, a number of small sub-rectangular and trapezoidal enclosures were recorded that were clearly overlain by late Iron Age to Roman enclosures, fields and, in one case, a possible villa or temple complex. Boundaries associated with a rectangular enclosure with rounded corners (NHER 49615) appear to be overlain by part of the extensive system of fields and trackways in Beighton (NHER 6096), which is thought to be of late Iron Age to Roman date (see Chapter 5). To the north, a slightly trapezoidal enclosure of similar size, again with rounded corners (NHER 49645), is seemingly overlain by a large double-ditched square enclosure of possible late Roman date, which has been interpreted as a Roman villa or temple complex (NHER 21762). In both cases, a pre-Roman date for the enclosures seems probable, although another enclosure of comparable proportions and alignment at Strumpshaw (NHER 11865) would appear to be associated with Roman material. This again highlights the problems of distinguishing early Iron Age sites from those of the late Iron Age to Roman periods, and the likelihood of sites spanning both periods.

A total of fifty field systems were identified as being late prehistoric or Iron Age in date. Many of these were roughly coaxial in form and were associated with trackways and rectilinear enclosures. Although many were quite fragmentary, they were assigned this date on the basis of comparison with the more complete cropmark complexes. Some of the field systems appeared to be associated with clusters of conjoined and subdivided rectilinear and rectangular enclosures with a probable domestic function, as at South Walsham where extensive areas of fields appear to be associated with possible farmsteads or small settlements (NHER 49428 & 49431). Nevertheless, it needs to be borne in mind that, as with

the enclosures, it is impossible from the cropmark evidence alone to confidently distinguish late prehistoric or Iron Age field systems from those dating to the Roman period.

There appears to be a general clustering of these enclosures and fields around the margins of the broad river valleys and wet fenland — what would become the Great Estuary during the later Iron Age and Roman period. It is likely that Iron Age communities were exploiting both the uplands and the lowland fens and river valleys, perhaps with summer grazing of the wetlands and winter grazing and small-scale agriculture taking place within a more enclosed landscape located on the slightly higher ground.

A total of six small square ditched enclosures, ranging in size from 7m to 14m across, were recorded as being possible Iron Age to Roman square barrows or square-ditched funerary enclosures. Three of these sites (NHER 25647, 44854 & 44980) have already been discussed in detail within the NMP report on the Coastal Zone (Albone et al. forthcoming). The identification of three additional possible sites within the Broads Zone has unfortunately done little to improve our understanding of these sites. One at Haddiscoe (NHER 49666) appears to be associated with a Bronze Age barrow cemetery (NHER 49629), continuing a trend evident amongst the previously studied examples (Albone et al. forthcoming). Only one of the sites, that at Wheatacre (NHER 44980), appears to be located within a series of enclosures of possible Roman date (NHER 44984), but the chronology of the two sets of cropmarks is not known. It is interesting to note that three (NHER 17228, 44854 & 25647) of the six square enclosures mapped are aligned on the cardinal points, a characteristic shared with the excavated examples at Harford and Trowse (Ashwin & Bates 2000; also discussed in Albone et al. forthcoming).

4.5 Roman Period Sites (AD 43–409)

A total of 221 sites was recorded within the Broads Zone as being of Roman or possibly Roman date. However, only eighty-eight of these were recorded as being of solely Roman date, rather than late prehistoric to Roman or Iron Age to Roman.

The Broads Zone lacks the substantial military sites represented by the shore forts in the Coastal Zone. No evidence of a suggested Roman military site at Reedham (NHER 10418) was visible on aerial photographs. However, a number of possible small military camps were mapped in the Broads Zone, the most convincing of which lay at East Ruston. Here a square enclosure was visible as a cropmark, with external dimensions of 87m by 81m (NHER 45242). This enclosure had a broad outer ditch with an inner palisade trench and is similar to small camps recorded elsewhere. An adjacent incomplete enclosure, which also had ‘playing card’ corners (NHER 45243), may represent part of an associated temporary or practice camp. A small quantity of Roman pottery was recovered from the field surface in the area of these cropmarks during a recent investigation. A further palisaded rectangular enclosure

recorded along with field system cropmarks on the edge of the former Great Estuary at Reedham (NHER 21271), could also possibly be interpreted as a military site. However it is more likely to have had a domestic function.

The vast majority of sites (184 out of 221) that were recorded as being of definite or possible Roman date are cropmarks of enclosures, possible farmsteads and field systems. As previously discussed (Section 4.4), distinguishing between Iron Age and Roman sites of this type is problematic, and many sites could have been in continuous use across both periods. The sites consist mainly of rectilinear, rectangular and trapezoidal enclosures, and in most cases they could not positively be assigned a solely Roman date. Twenty-eight Roman period sites were recorded as possible farmsteads or settlements, widely distributed across the project area. Planned coaxial field systems of Iron Age to Roman date are discussed in greater detail in Chapter 5.

Other classes of specifically Roman site types were represented by only a small number of examples. A total of five possible villa sites were recorded in the Broads Zone. The difficulty of distinguishing villas from large farmsteads and temple complexes is well documented (Wilson 1974, 251; Albone et al. forthcoming) and the interpretation of the sites recorded by the NMP is not definite. Their identification is not helped by only limited quantities of finds, if any, having been recorded at most sites. The strongest candidate for classification as a villa is represented by a square double-ditched enclosure at Beighton (NHER 21762) (Fig. 4.2) comparable to a site mapped in the Coastal Zone at Fring (NHER 1659; Albone et al. forthcoming). The Beighton enclosure, which measures 123m by 133m, overlies a rectilinear enclosure of possible Iron Age date. However, the site could equally be interpreted as a temple complex. A further possible villa was located at Carleton St Peter (NHER 49533) where a group of rectilinear enclosures (Fig. 4.2) were located between the findspots of two 4th-century coin hoards. These two sites, and a third at Cantley (NHER 10270) (Fig. 4.2), were located within an area of extensive coaxial field system cropmarks of probable late Iron Age to Roman date. A further two groups of rectilinear enclosures, that could be interpreted as possible villas, were located on the western edge of the Isle of Flegg at Ashby with Oby (NHER 45060) and Thurne (NHER 21838). The presence of these possible villa sites in the Broads Zone is significant as they are sparsely distributed in Norfolk as a whole, with previously recorded examples lying mainly in the west and south of the county (Gurney 2005, 29).

In addition to the double-ditched enclosure at Beighton, five other possible temple sites were recorded in the Broads Zone. The clearest of these was a Romano-Celtic temple site at Aldeby (NHER 45036) where a circular structure (cella) was located within a rectangular enclosure (temenos). Other possible religious sites include small square enclosures at Honing

(NHER 45249) and Kirby Cane (NHER 25647), and a ring ditch with a small square annexe at Woodbastwick (NHER 29574).

Sections of road, recorded from cropmarks at a number of locations within the Broads Zone, were suggested as being of possible Roman origin. Only one section of definite Roman road was recorded. This was at Ditchingham (NHER 44820), where the modern road deviates from the original straight course of Stone Street (NHER 10636) as it crosses a small valley.

4.6 Anglo-Saxon Sites (AD 410–1065)

Cropmarks and earthworks dating to the Anglo-Saxon period are notoriously hard to identify from aerial photographic evidence alone (Albone et al. forthcoming). A total of twenty-three sites of possible Anglo-Saxon date were identified, thirteen of which had not been recorded previously.

A possible early Anglo-Saxon linear earthwork, comprising a double ditch and bank arrangement and interpreted as a defensive dyke, was mapped at Horning (NHER 14099). The mapping suggests that the earthworks would have created a barrier almost 40m across. This dyke extended across a peninsula of land between the River Bure to the south and the Ant to the north. The marshland associated with these rivers would have meant that the banks and ditches formed a defensive barrier across the peninsula, effectively cutting it off. The medieval abbey of Holm St Benet's (NHER 5199) is located further along the peninsula. The bank and ditch were first recorded as an earthwork in the 18th century but had been levelled by 1831. The early Anglo-Saxon date for this defensive earthwork is suggested by its similarity to other linear earthworks in the county (Rose 1982, 38). There is no artefactual evidence to support this date, but middle Anglo-Saxon pottery has been found immediately to its east (NHER 8446).

Twelve sites of possible grubenhauser, or sunken featured buildings, were identified, nine of which were new sites. These sites consisted of groups of sub-rectangular and oblong pit-like features, generally measuring between 1.5m and 3m in width and from 2m to 7m in length. The risk that these types of feature are instead small-scale extraction pits has been outlined elsewhere (Albone et al. forthcoming), and it remains a possibility that many of these cropmarks do not in fact relate to Anglo-Saxon settlement remains. Two of the cropmark sites, however, were located within areas of Anglo-Saxon finds (recovered through metal detecting, NHER 49581 & 41979). Another group was located approximately 300m to the south of the site of excavated grubenhauser (NHER 44948). The spatial relationships identified between oblong sunken feature cropmarks and Saxon date finds are potentially very significant additions to the debate concerning our ability to recognise such features on aerial photographs. It must also be noted that at one site where grubenhauser have recently been

excavated — Yarmouth Road, Broome (NHER 36289; Robertson 2003) — no corresponding features were visible on the aerial photographs.

4.7 Medieval Sites (AD 1066–1539)

A total of 351 sites were recorded as containing components that were of possible medieval date. Sixteen of these sites relate to peat extraction and are be discussed in more detail in Chapter 6. A further nineteen relate to the medieval to post medieval drainage of the marshes. On the whole, features relating to drainage were not mapped, as they fall outside the normal archaeological scope for NMP projects. The fens and former estuaries of the Broads were subject to a complex series of drainage, improvement and enclosure schemes from the Anglo-Saxon period to the modern day, with much of this dating to the medieval to post medieval periods. The possible benefits of mapping this evidence from aerial photographs in the future, given its significance to the landscape history of the Broads, is discussed in Section 7.5.

A total of thirty-two possible moats or moated enclosures were identified, eleven of which represent potential new discoveries. Five of these new discoveries were recorded as earthworks visible on historic aerial photographs; all but two, Hedenham (NHER 43730) and Reedham (NHER 49353), have since been plough-levelled. A significant number of the moats are associated with manors, and with medieval to post medieval halls and great houses. The NMP mapping frequently recorded associated enclosures, drainage ditches and ponds located in close vicinity or conjoined to the main moated enclosure, as at the medieval manor of the Bishop of Norwich at Blofield (NHER 12445). The mapping of the earthworks of Claxton Castle and the later Claxton Manor (NHER 10304), visible on 1946 RAF aerial photographs and no longer surviving on the ground, has added to the known extent and detail of the site. The presence of a curving outer moat earthwork, closely following the course proposed by Liddiard (2000, 116), was confirmed. In addition previously unrecorded earthworks of enclosures and platforms were mapped both within and outside of the moated area. Twenty-seven of the thirty-two moats were located on the boulder clay plateau or on the margins of the alluvial clays of the former estuary (Fig. 4.3). This preference for the heavier clays is consistent with that identified for the whole of Norfolk (Rogerson 2005).

From the early Anglo-Saxon period onwards the marshes and fens of the Broads Zone became a focus for the establishment of monastic communities. The NMP project mapped the remains of earthworks associated with Langley Abbey (NHER 10344), St Benet's Abbey (NHER 5199), Aldeby Priory (NHER 10725) and St Mary's Priory cell at Weybridge (NHER 8601). The sites of many of these religious houses have previously been recorded through field and building surveys. Only the NMP mapping of St Benet's Abbey significantly added to our existing knowledge of the site, with two ranges of previously unrecorded buildings visible as parchmarks on the aerial photographs. One of the building ranges was likely to have

formed part of the domestic or ancillary buildings of the abbey. Another building range, that fronts onto the River Bure, would appear to be associated with the Chequers Inn and may well have been outbuildings and stables, although it is possible that they were originally constructed as buildings associated with the Abbey. Additional enclosures and boundaries associated with the Benedictine Priory at Aldeby were also identified (NHER 15127 & 44954).

The sites of three destroyed medieval churches and chapels were recorded in the Broads Zone. The clearest cropmarks were of St Mary's Church at Holverston (NHER 10331). This church had a simple plan with a round tower, rectangular nave and chancel, and a south porch. It is similar in plan to cropmarks of St Peter's Church at Ormesby St Margaret (NHER 8248) in the Coastal Zone (Albone et. al. forthcoming). The plans of both of these churches are comparable to the surviving St Margaret's Church at Hales (NHER 10523) and are presumably also of early 12th-century origin (Batcock 1991, 158-61).

A total of eighty-six enclosures of possible medieval date were recorded, a proportion being associated with larger medieval complexes such as the moated, manorial and monastic sites referred to above. It is likely that many were associated with stock management, such as the large trapezoidal enclosure at Catfield (NHER 49325) that is associated with an area of medieval to post medieval finds (NHER 8330). A series of conjoined enclosures and fields at Wickhampton (NHER 30300 & 49402) appears to represent an area of medieval settlement consisting of tofts, crofts and fields. Twenty-four field systems of probable medieval date were also mapped, although many of these were dated more broadly to the medieval to post medieval period. These sites can be characterised as enclosed fields, paddocks and stock enclosures, as opposed to open field systems operating areas of ridge and furrow. The fields were commonly associated with enclosures and/or extant medieval to post medieval settlement features. A total of twenty sites with possible traces of ridge and furrow were identified. Ridge and furrow is not a common feature of the Norfolk landscape, or of East Anglia as a whole (Liddiard 1999, 1). It is particularly rare on the lighter soils. All of the sites identified in the Broads Zone were located on the boulder clay plateau or on the margins of the alluvial clays (Fig. 4.3), mirroring the locational pattern exhibited by the moats. It is probable that the heavier, poorly draining clay soils necessitated the use of ridge and furrow to assist drainage in these areas, or that the practice was more widespread but the physical traces are now only visible where the heavier soils produced more solid and substantial features. Some of the sites recorded may not in fact represent ridge and furrow at all, but rather other forms of land drainage.

Nine probable saltern mounds were recorded within the easternmost parts of the Broads Zone. These were located around the margins of the former estuary, now grazing marsh alongside the Rivers Yare and Waveney. These features have been discussed in more detail elsewhere (Albone et al. forthcoming).

4.8 Post Medieval Sites (AD 1540–1900)

Two hundred and seventeen of the NMP sites were felt to be of post medieval date or had significant components dating to this period. An additional 234 sites possessed possible post medieval features, although these were generally minor and often intrusive elements recorded within more complex, and for the most part earlier, cropmark sites, such as field boundaries or drainage ditches.

Peat and turf extraction of post medieval date is discussed separately in Chapter 6. The NMP contributed significantly to the mapping of seven probable brickworks, but existing historic map evidence proved a superior source of information for the remainder of the brickworks in the project area. While many of the NMP sites exhibited recognisable clay extraction pits, which tend to be large and overlapping, several revealed extensive areas of closely spaced, small, discrete, square or oblong cuts. The latter are all located next to the major Broadland rivers, the Waveney (NHER 32268, 43697 & 44848) and the Yare (NHER 10423), suggesting that water is essential to the sites. Whether the water was used in an extraction or manufacturing process, or whether the rivers were used for transporting either materials or a finished product, is not clear. The pits have previously been interpreted as brine pits, retting pits and clay pits for brickworks. It had been suggested that the cutting of small individual pits would be unusual for a brickworks (Edwin Rose, NLA, pers. comm.). However the finding of crude brick fragments, and the field name ‘brick field’ or ‘brick marsh’ at the site alongside the Yare, would appear to support their interpretation as clay pits and suggests that brick-making took place at the site. The identification of similar small oblong cuts visible as cropmarks at Sutton Mill (NHER 8334), a site where a post medieval brickworks is known to have existed, would also indicate that these pits are indeed associated with brick production. It may be that the wet environment of these riverside locations necessitated digging small individual clay pits, leaving baulks in between, rather than larger and more amorphous extraction pits. It remains a possibility that these distinctive areas of small clay pits are associated with relatively early clamp-brick production, which would have entailed the extraction of one clamp at time. This might have led to the distinctively small, discrete pits visible at these sites, but the pits may be too small and shallow to represent a full clamp of bricks (Edwin Rose, NLA, pers. comm.).

A total of twenty-two windmills and post mills were recorded, eight of which were new discoveries. These sites are likely to be broadly medieval to post medieval in date. The majority were visible as ring ditches with an internal cross-shaped pit, as is characteristic of post mills (Wilson 2000, 108). Eleven possible stack stands, or similar agricultural features, were recorded. These sites are characteristically circular enclosures, ranging in size from 4m to 17m in diameter, and situated in low-lying positions. They are comparable to those previously mapped in The Wash and on the coastal margins of the Broads (Wilson 1978, 45; Albone et al. forthcoming). Despite the vast numbers of drainage mills within the Broads

landscape, only three such possible structures were recorded specifically from the aerial photographs. This is almost entirely a reflection of the fact that many drainage mills still survive as standing structures, or are adequately recorded on historic maps, and consequently lay outside the scope of this project.

Only one artificial duck decoy pond was recorded within the Broads Zone (NHER 49340). This was located within Middle Marsh, to the east of Barton Broad. Six arms are clearly visible, radiating from a central pool. The relative scarcity of these features within the Broads area, which has many large areas of alder carr and fen suitable for wildfowling, is due to the use of the water-filled peat cuttings as large-scale decoy ponds, as has been recorded at Fritton Lake (NHER 13527) and Crostwight Water (NHER 22943). The use of the Broads as decoys and fisheries is discussed further in Chapter 6.

Ten sites containing post medieval garden or landscape features were recorded. The only site of particular note is the cropmarks of former formal gardens within Beeston Park (NHER 28356), which are possibly associated with the medieval to post medieval Old Hall that stood nearby. While the possibility remains that the cropmarks relate to the site of the Old Hall itself, this seems a less plausible interpretation, given the layout of the site and its resemblance to a formal planting scheme.

In general, post medieval field systems and boundaries were not mapped, in particular when historic map evidence provided comparable or superior information. Agricultural features dating to this period were usually only plotted when they formed part of a complex multi-period site, where it was hard to confidently distinguish them from earlier components or where the mapping and recording of these boundaries made the site more comprehensible and facilitated the identification of earlier cropmarks. In total, eighty-four sites were recorded as having post medieval field systems or boundaries.

4.9 Twentieth-Century Military Sites (AD 1914-45)

Nine World War One sites were recorded, four of which were pillboxes. Several of these sites, such as Reedham searchlight battery (NHER 10425), were reused during World War Two and therefore little evidence of World War One activity could be identified. A World War One munitions factory and site of three Belfast Hangars were recorded at Catfield (NHER 33293), although again the reuse of this site during World War Two makes any discussion of the World War One components problematic. Two areas of World War One trenches were mapped, one at Brundall (NHER 49565) and another at Broome Heath (NHER 43776), a site that was also used as a training area during World War Two.

The character and density of World War Two sites identified within the Broads Zone is in stark contrast to the complex and almost continuous ‘Coastal Crust’ defences encountered in the

Coastal Zone (Albone et al. forthcoming). Other than the stop line defences described below, military sites within the Broads Zone were much less common and more discrete in nature.

A total of 152 World War Two sites were recorded and these included fifty-three known or possible pillboxes, just over half of which appeared to be relatively isolated defences on the outskirts of villages and at the side of main roads. The remainder generally formed part of the perimeter defences for military installations, such as the twelve searchlight batteries located within the study area. In addition to the site at Broome Heath (NHER 43776), mentioned above, a further nine military training areas were mapped. One particular characteristic of the Broadland military landscape was the heavy defence and fortification of the river and canal crossings and bridges. These would often incorporate anti-tank cubes, barbed wire obstructions, trenches, and both fixed and temporary gun emplacements. The defences on the road and rail crossings of the River Waveney to the south of St Olaves are an excellent example (NHER 43670-1). The rivers were clearly being utilised as natural stop lines, and in some cases were deliberately strengthened. The North Walsham and Dilham canal (NHER 13534), improving the course of the River Ant, was deepened, and banks of the resulting spoil are visible on 1940s aerial photographs. The village of Acle, located to the west of the River Bure, at the point where many of the main roads and the railway from the east coast cross the Broads, was defined as a Category 'A' Nodal Point and as such was identified as a point of high invasion danger (Foot 2004). The defensive landscape surrounding the village (Defence Area 15) has been identified as being of national interest by a recent survey (ibid.). Several of the World War Two structures still survive, but it is interesting to note that the NMP mapping provided little additional information, other than to record the former presence of barbed wire obstructions at a number of locations. This is likely to reflect the paucity of early 1940s aerial photographs for the area, and particularly the non-existence (or at least unavailability) of low-level photography from this period.

Six sites relating to radar and radio were recorded, the radar station at Neatishead being the most noteworthy (NHER 31218). The earliest phase of the site comprised only a few wooden buildings and caravans, but the site developed throughout World War Two and the Cold War period. During the former it was used as a Ground Control Intercept (GCI) Station, tracking enemy aircraft once they were inland and past the circuit of coastal Chain Home (CH) radar stations (English Heritage 2001). Two additional radio or radar related sites were mapped approximately 1.5km from Neatishead (NHER 49479-80) and it is possible that these acted as outlier detectors or beacons or perhaps as navigation aids for Coltishall airfield approximately 6.5km to the northwest. A previously unrecorded High Frequency Direction Finding (HF/DF) Station was also mapped at South Walsham (NHER 49451). HF/DF sites formed a network of direction finding stations that helped lost aircraft return to base and plotted the location of mayday signals. A previously unrecorded wireless or radio mast was also identified 540m to the southwest of the HF/DF site (NHER 49452) and may represent a wireless telegraphy

(W/T) or radio telephony (R/T) station. (A more detailed discussion of these types of sites is given in Albone et al. forthcoming.)

The Broads Zone contained two World War Two airfields. Ludham (NHER 8456) opened in September 1941 as a satellite of Coltishall, and was used as a forward base for squadrons of fighter aircraft from its parent airfield. Seething Airfield (NHER 10466) was used by the USAAF 448th Bomb Group, flying B24 Liberators, from 1943 to 1945. Both are still in use today as private airfields, albeit in a much contracted form. Earthworks and associated structures were also mapped at four bombing decoys within the Broads Zone, and it is possible that Ludham airfield too was used temporarily as a decoy (NHER 8456). Two of the sites acted as daytime or 'K' type decoy airfields (NHER 13608 & 13610); all four acted as night-time or 'Q' sites, with the Surlingham/Bramerton site imitating Thorpe Railway (NHER 13608), and the Burgh St Peter site mimicking Lowestoft Port (NHER 13610).

Extensive remains relating to a dispersed USAAF bomb storage facility were mapped around Earsham in the south of the Broads Zone (Fig. 4.4). This was USAAF Station No. 545 which had its headquarters at a camp in the grounds of Earsham Hall (NHER 41375). It was home to the 1916th Ordnance Ammunition Co. (Aviation) and the 2217th Quartermasters Truck Co. (Aviation) (Anderson 1985, 49). Bombs were unloaded at a specially constructed railway siding on the Waveney Line, 2km to the south, and stored at this facility prior to distribution to USAAF airfields across this part of East Anglia (NASAM 1973, 18). The main bomb stores were located in nearby areas of woodland. (The name America Wood dates from at least the late 19th century and does not relate to the use of the site by the USAAF, as might be assumed.) Additional storage areas were located on concrete hardstandings along roadsides to the south, west and north of the camp. The perimeter of the facility was protected by sentry posts located on the roads leading into the area. Hardstandings and access roads survive in the woods and along the roadsides but few of the buildings associated with the facility survive. A bomb store associated with the USAAF airfield at Seething (NHER 10466), consisting of embanked pens and structures, was also visible on aerial photographs; camouflage netting covering the store is clearly visible on photographs taken in 1945.

Another World War Two logistics site was recorded at Ellingham, further along the Waveney Valley from Earsham. Here a previously unrecorded military fuel depot (NHER 44956), with its own railway siding, was located alongside the Waveney Line. Four circular fuel tanks were present along with various buildings. Information about the use of the site is limited but it seems likely that it was used for the storage of petrol and aviation fuel prior to its distribution by road to airfields in the vicinity. The site survived intact until the 1980s when the fuel tanks were replaced with grain silos and the site became a grain store. Two prefabricated huts, a possible vehicle shed and an air raid shelter all still survive at the site.

5 Research Theme: Iron Age to Roman Coaxial Field Systems

Cropmarks of extensive coaxial field systems have been recorded across large areas of the Broads Zone (Fig. 5.1). These are present on four of the Broadland peninsulas or interfluves described above (Section 2.1). Only the Ant-Thurne peninsula and the Isle of Flegg did not reveal any cropmarks that obviously related to coaxial field systems of the type discussed below. The Broads Zone field systems are located on a mixture of boulder clay and loam soils.

The greatest concentration of coaxial field system cropmarks is located on the Yare-Bure peninsula and will form the main focus for the discussion below. It largely consists of three groups of cropmarks which span the parishes of Cantley, Beighton, Halvergate, Freethorpe and Reedham (NHER 6096, 21271 & 49400) in the southern part of the peninsula (Figs 5.2–5.4). Numerous other fragmentary areas of cropmarks continuing the same pattern were also recorded. Together the three main groups of cropmarks cover an area of approximately 13 sq km. Although it is not possible to be certain that they were continuous across the whole of this area, the presence of small groups of similar cropmarks elsewhere on the peninsula makes this seem likely.

The field system is characterised by a series of roughly parallel linear features on a generally northwest to southeast alignment. These ‘long boundaries’ (an appropriate term coined by Riley [1980, 12], which will be adopted here) divide the field system into a series of parallel strips that measure between 50m and 220m in width. The majority of these fall within a narrower range of between 80m and 120m wide. Some of the long boundaries consist of a single linear field boundary ditch, but many comprise two parallel ditches spaced between 4m and 14m apart. These double-ditched long boundaries define individual strips or pairs of strips and are likely to be trackways providing access to, and through, the field system. In the largest of the areas of cropmarks at Cantley and Beighton, sixteen parallel trackways are present (Fig. 5.3). These cropmarks have strong similarities to some of the ‘brickwork pattern’ coaxial field systems recorded in North Nottinghamshire/South Yorkshire, particularly those at Barnby Moor (Riley 1980, 12-18), where similar double-ditched long boundaries were recorded. However, it was doubted that they were trackways as they were considered to be too narrow to be practical in the sandy soils of the area. Instead it was thought that they might represent double-ditched boundary banks (ibid., 23-24). The appearance of the Broads Zone field systems is more favourable to the interpretation of the double-ditched long boundaries as trackways, particularly at Beighton where one appears to lead directly into a field (NHER 6096). The strips created by the long boundaries are divided into fields by a series of ‘short boundaries’ that generally cross only one or two of the strips. These fields are generally

rectangular in plan ranging in length from 50m to 180m with varying widths governed by the spacing of the long boundaries.

A further characteristic of these coaxial field systems is the presence of small enclosures attached to the trackways and field boundaries. These rectilinear enclosures are frequently trapezoidal in plan with dimensions in the range of 20m to 50m. Similar enclosures were identified within the North Nottinghamshire/South Yorkshire field systems where they were interpreted as relating to settlement or other specialised activities (ibid., 27-35). It is likely that the enclosures in the Broads field systems had a comparable function. Cropmarks of other rectilinear enclosures, which were not directly connected to the field boundaries and trackways and in some cases lay on different alignments to them, were also present within the area of the field systems. It is likely that these also relate to settlement sites, but it is possible that they belong to different phases of Iron Age or Roman activity (e.g. NHER 49468 & 49615).

Along the northern edge of the Yare-Bure peninsula at South Walsham, small areas of reasonably complete coaxial field system cropmarks are present lying on northwest to southeast and north northwest to south southeast axes (NHER 49468–9). In the central area of the peninsula, to the west of Acle, only short sections of linear ditch cropmarks were visible (Fig. 5.1). Many of these appear to follow the general northwest to southeast alignment of the field systems on the peninsula, but the paucity of the cropmark evidence makes it impossible to be certain if the field systems originally extended continuously across the whole of the Yare-Bure peninsula.

To the north of the River Bure, on the interfluve between it and the River Ant (the 'Bure-Ant peninsula'), cropmarks of further coaxial fields were recorded. These are present in small groups along the western edge of the Broads Zone to the north of Hoveton. They exhibit a generally west to east alignment, rather than the northwest to southeast trend of those present on the Yare-Bure peninsula. Long boundaries formed by parallel trackways, here spaced between 120m and 250m apart, were present in parts of these field systems. The cropmarks are restricted to smaller groups than those present on the Yare-Bure peninsula but appear to show a slightly less regular, but nevertheless still coaxial, brickwork pattern. The axis of these fields rotates anti-clockwise the further north from Hoveton they extend. The trackways in the field system cropmarks at Hoveton (NHER 49180) lie on a roughly west northwest to east southeast axis whilst those 3km to the north at Tunstead have a more southwest to northeast alignment. The alignment of the cropmarks in the north of the group differs from that of a west to east aligned Roman road (NHER 2796) located immediately to its north. Unfortunately there is no direct relationship between the road and the field system cropmarks to allow the horizontal stratigraphy of these two features to be examined.

A small area of coaxial field system cropmarks was also recorded to the southwest of the River Yare on the Chet-Yare peninsula at Langley with Hardley and Carleton St Peter (NHER 17291 & 49534). This field system is more fragmentary than the main areas present on the Yare-Bure peninsula but has a similar northwest to southeast alignment. It too is based on a series of parallel trackways but also includes rectilinear fields which disrupt the overall coaxial pattern. The area of land between the Rivers Waveney and Chet (Waveney-Chet peninsula), forming the southern part of the Broads Zone, did not reveal extensive coaxial field system cropmarks, perhaps because of its predominantly boulder clay geology. A small fragment of a possible coaxial field system that was visible as cropmarks at Broome has been excavated and proven to be of Roman date (NHER 36363 & 36289; Robertson 2003, 229-31). These fields lay on a southwest to northeast axis, parallel to the River Waveney and the suggested course of other possible Roman roads or boundaries (NHER 48885).

No excavations have taken place in the more central areas of the Broads Zone coaxial field systems to provide firm evidence of their date. Consequently their dating relies on a combination of surface finds, comparison with dated examples recorded elsewhere, and their apparent spatial and chronological relationships with other landscape features. The clear similarity between some sections of the cropmark field systems mapped in the Norfolk Broads and those recorded in North Nottinghamshire/South Yorkshire strongly suggests a comparable date of origin. Excavations of those field systems have produced both Iron Age and Roman dating evidence, including pottery of approximately 3rd-century AD date (Riley 1980, 25-6); more recent fieldwork supports a predominantly Roman date (Knight et al. 2004, 140-1). In one case the field system cropmarks were cut by an extant Roman road suggesting that they were of Iron Age or early Roman origin (Riley 1980, pl. 2).

Surface finds from most of the areas of the Broads Zone coaxial field system cropmarks are sparse, apparently as a result of limited previous investigations. Finds of coins and pottery appear to span the whole of the Roman period, with only isolated sherds of Iron Age pottery having been recorded. However, there are exceptions to this sparse pattern of finds. Roman and Anglo-Saxon artefacts have been found in the vicinity of field system and enclosure cropmarks at South Walsham (NHER 49468-9). Roman finds have also been recorded in association with probable settlement sites on the edges of the Yare-Bure field systems at Cantley (NHER 10270) and Strumpshaw (NHER 11865). In several places in the most extensive cropmark areas, the field systems appear to discordantly overlie cropmarks of enclosures that might be interpreted as being of Iron Age or Roman date (e.g. NHER 49382 & 49615). The relationship between the enclosures and the field system emphasises the complexity of the landscape history in this area. It is possible that the enclosures are of Iron Age date and that they were overlain by the coaxial field system in the late Iron Age or early Roman period. The finds and cropmark evidence suggests that at least some parts of the field system remained in use and continued to evolve during the Roman period. A possible

villa/farmstead site comprising a group of rectangular enclosures and field boundaries was recorded at Carleton St Peter (NHER 49533) on the Chet-Yare peninsula. Two coin hoards of 4th-century date have been found within 200m of the site (NHER 10319 & 35090) providing a possible indication of the date of the villa/farmstead. The villa/farmstead cropmarks overlie part of a northwest to southeast coaxial field system (NHER 49534) and may indicate that this section of field system was out of use by the late Roman period. The complexity of some of the settlement sites associated with the field systems, such as the possible villa at Cantley (NHER 10270), also highlights the many phases in the development of this agricultural landscape. Elsewhere, as at South Walsham (NHER 49468-9), finds of Anglo-Saxon date indicate later activity and it is feasible that some of the cropmarks relate to that period or even that parts of the coaxial field systems persisted into the post-Roman period.

The function of the Broads Zone coaxial field systems is difficult to establish in the absence of supporting excavated evidence. It is possible that they relate to arable, pastoral or mixed agricultural regimes. Field systems including trackways are often seen as relating to the movement of livestock, but these could equally provide access to arable fields. However, a group of converging trackways at the eastern end of the Beighton and Cantley area of coaxial field system cropmarks, to the northeast of Southwood Hall (NHER 6096; Fig. 5.3), may be interpreted as part of a livestock management system.

The relationship of the Yare-Bure coaxial field system to the post medieval landscape also invites comment. The general northwest to southeast alignment of the field system on the Yare-Bure peninsula is partly reflected by the alignment of some roads in the modern landscape, particularly in the Cantley and Beighton area (NHER 6096). However, in most places the alignment is not identical and it is possible that the modern roads follow the axis of the peninsula rather than that of the field system. Post-Roman discontinuity is further supported by the lack of correlation between the field system cropmarks and parish boundaries; the parish boundaries and post medieval fields cut across and generally disregard the field system. This can be contrasted with the extensive Scole-Dickleburgh coaxial field system in the Waveney Valley, the general alignment of which survives in the modern landscape (Williamson 1987). The abandonment of the Broads Zone coaxial systems suggests that these two areas had different post-Roman landscape histories. However, it should be noted that the Scole-Dickleburgh coaxial field system is also overlain discordantly by the pattern of parish boundaries (Williamson 1987, 421).

Ring ditch cropmarks of probable Bronze Age round barrows are located on or adjacent to a number of the trackways and field boundaries in the Broads coaxial field systems. It appears that these pre-existing landscape features were incorporated into the field systems. This could be a result of the field systems being laid out along existing boundaries which already incorporated the round barrow earthworks. Alternatively the barrow mounds may have been

used as markers in laying out the new field systems, with the field boundaries being aligned on or adjacent to the earthworks.

An apparent difference between the Broads Zone coaxial field system cropmarks and both the North Nottinghamshire/South Yorkshire and East Anglian coaxial systems such as Scole-Dickleburgh, is their arrangement in relation to the river valleys. In most cases coaxial systems elsewhere have their long boundaries and trackways positioned perpendicular to the main river valleys (Williamson 2006, 50). This has been interpreted as a result of transhumance, with the division of land into strips which had access to both upland and lowland grazing areas. Such patterns were originally interpreted as planned systems but have more recently been seen as having a partially organic development, with the parallel trackways that define them representing the most direct and convenient link between the upland and lowland resources (Williamson 1998, 26). The Broads Zone field systems do not initially appear to conform to this pattern, with the trackways, particularly between the Yare and Bure, arranged along the peninsulas and interfluves parallel to the river valleys, rather than lying perpendicular to them. If these coaxial systems were solely the result of transhumance, it might be expected that the trackways would have radiated out along the peninsula to provide the most direct access to multiple points along the edge of the river valleys and the estuary to the east, rather than continuing straight along its length. Suggestions of a slightly radial pattern can be seen at the end of the Yare-Bure peninsula in the field system cropmarks adjacent to the edge of the former estuary between Reedham and Halvergate (NHER 49400 & 21271; Fig. 5.4), but this appears to be a localised exception. The apparently consistent coaxial pattern along the Yare-Bure peninsula supports a mainly planned origin for these coaxial field systems. It is possible that the peninsulas and interfluves in the Broads Zone formed part of an area of transhumance extending west from the edge of the former Great Estuary.

The coaxial field system cropmarks recorded within the Broads Zone have great potential for further research beyond the scope of this report. However, it is essential that fieldwork is undertaken to provide dating and phasing evidence for key elements of the field systems. They have the potential to provide significant new information about Iron Age and Roman land use and post-Roman landscape history in the Broads Zone. The relationship of the field systems to the earlier landscape, particularly to Bronze Age ring ditch cropmarks, could also be examined in more detail. Further analysis of the form and history of these field systems will be able to make a contribution to the ongoing debate surrounding the origin of coaxial field systems in East Anglia (see Hinton 1997 and Williamson 1998).

6 Research Theme: Medieval and Post Medieval Peat Extraction

6.1 Introduction

The Broads are a series of freshwater lakes located in the upper reaches of the river valleys of east Norfolk, in particular those of the Ant, Bure and Thurne (Fig. 6.1). They are often taken to typify the Broads landscape and have been an object of study and discussion from the 17th century onwards. Until relatively recently it was thought that the lakes were a natural phenomenon. As late as the early 1950s, analysis of cores was used in the interpretation of the Broads as a series of discontinuous natural lakes (Lambert et al. 1960, 1-2). However further work undertaken by Lambert and Jennings later in the 1950s indicated that these 'lakes' were actually man-made (ibid.). More intensive and closely spaced boring in the vicinity of the Broads themselves revealed that they had near vertical sides of truncated peat and clay. Also, within the Broads themselves, were islands and strips of undisturbed brushwood peat, surrounded by unconsolidated silty material, with occasional redeposited chunks of estuarine clay (ibid., 6). The sediment analysis from the Yare Valley provided additional proof that the Broads were distinct from, and fundamentally different to, the natural pools which are known to have formed shortly before and during the Iron Age and Roman period marine trangression. All of these findings proved that the Broads were not naturally formed, and suggested that these basins were the product of peat extraction, often to a depth of up to 3–4m, with baulks surviving between the workings (ibid., 22-3). The side-valley Broads and lakes, which follow the contours of valleys, such as the Ormesby-Rollesby-Filby complex, were also proved to be created through extraction and to represent extremely extensive and almost complete removal of peat from the valley floor, down to the underlying clay (ibid. 41-2). It was clear that this extraction post-dated the Roman period estuarine deposits considerably and a medieval origin for the features seemed likely.

6.2 Medieval Extraction

The existence of turbaries in the Broads Zone is not mentioned in Domesday records, although it is likely that by this time the easily accessible surface phragmites peat would have been exploited considerably for fuel. A rising population and use of peat in the salt industry would probably have increased the demand for peat and therefore necessitated exploratory diggings in search of deeper peat by the 12th century (Lambert et al. 1960, 76). The earliest record of turbaries is in the register of St Benet's Abbey, dating to 1141–9. The majority of the turbary records, however, range from the 1150s to the 1350s (ibid., 73-6). Almost every place in Broadland has evidence for the existence of turbaries, from account rolls, deeds and leases. The scale and extent of the industry was immense and it was estimated in 1960 that roughly 900 million cubic feet of peat had been removed. However, this figure was calculated

using the known extent of the Broads from map evidence, which were understood to have covered 2611 acres (ibid., 63). It is clear from the NMP mapping, as shall be outlined below, that a number of broads existed additional to those indicated by the historic map evidence, and therefore the level of extraction is likely to have been even greater. The location of extremely large and deep peat excavations, such as the Ormesby-Rollesby-Filby complex mentioned above, would appear to coincide with areas of relatively high population and wealth in the early 14th century, the higher population density presumably resulting in a higher demand for fuel (ibid. 82).

Monastic records appear to indicate a decline in turbaries from the 15th century onwards and this may in part be due to changes in land rental and leases (ibid., 77-82). It is likely that there were many contributing factors and they may have varied at different workings. However it is clear that many workings were being abandoned at this period due to a rise in sea-level, which caused the cuttings between the baulks to flood. The late 14th-century account rolls of St Benet's Abbey frequently mention flooded marshes and drainage works undertaken on peat doles (ibid., 89). The increased labour needed to keep workings in action may have coincided not only with a general decrease in population, and therefore a decreased demand for fuel, but also a shortage in labour characteristic of the mid to late 14th century (Williamson 1997, 86). It may have taken some time for the pits to become either completely unworkable or uneconomical, or both, but gradually the workings became flooded. The second half of the 13th century and the 14th century are known from historical documents to have been a period of severe storms and flooding in the North Sea basin, with frequent records of flooding in Eastern England and Holland (Lambert et al. 1960, 99-100). For example, in 1287 the sea broke through between Palling and Horsey on the northeast coast and also in the Yarmouth area, and inundated the marshes and villages, with floods reaching beyond St Benet's Abbey (ibid.). It is therefore likely that the peat extraction areas were periodically inundated by flood water during this period.

Once water-filled, the former workings or 'broads' were almost immediately used as fisheries and large-scale duck ponds. The term 'broad' is not used frequently as a land assessment term until the later 14th century and into the 15th century (ibid., 68, 78). As references to turbaries decline in the records, mentions of broads and 'pieces of water and marsh' become more common (ibid., 77). From the 16th century onwards 'fisheries' are increasingly recorded in areas previously described as turbary. These broads were also utilised as decoys for catching wildfowl, with pipes being added to the main broad. Many of the Broads, e.g. Hickling, now have placenames associated with decoys around their margins. The decoys constructed within the Broads were quite vast by contemporary artificial decoy standards. There are many European parallels for the development of turbaries into lakes, as was happening in Norfolk. In the Netherlands, Northern France and Denmark, the outlines of lakes

derived from peat cutting are characteristically irregular in detail, with projections following the orientation of the strips into which the turbary had been divided (ibid., 106).

As was outlined in Section 3.4, there is relatively limited potential for identifying archaeological sites within the valley bottoms of the Broads Zone due to the sedimentary sequence and landscape history of the area. Despite this, the NMP mapping proved particularly useful in recording the location of lost broads and turf ponds. The turbaries, once abandoned and water-filled, became colonised with vegetation, such as reed and sedge, and upper peat formation occurred. Through this encroachment, the more shallow broads often shrank, and in extreme cases completely disappeared. Comparison with early maps and later estate maps for some areas suggests that the size of the Broads was fairly stable from the 17th century until the end of the 19th century, when they started to contract in size rapidly (ibid., 65; Lambert & Jennings 1965, 274-311). Analysis of Tithe Maps would suggest that in 1840 there was approximately 1,227 hectares of open water in the Broads, only 826 of which remain today (Moss 2001, 15). It is possible that this reflects changes in management and use, such as the decline in turf cutting, and this has possibly been exacerbated by later drainage schemes in the surrounding fens and valley bottoms. The rapid shrinkage is clearly evident on the aerial photographs, where former broads visible in the 1940s and early 1950s have vanished from later aerial photographs.

In the former Thurne estuary, a number of broads no longer in existence on the ground are marked on historic maps. This allowed for an assessment of whether aerial photographs offered an opportunity to recognise these former cuttings. The site of Wiggs Broad (NHER 35363) on Long Gore Marsh, Hickling, is clearly marked on Faden's map of 1797 as a crescent-shaped body of water. The remains of this cutting could clearly be seen on aerial photographs from January 1943, where the saturated ground and vegetation revealed a similarly shaped feature (Fig. 6.2). The aerial photographs also revealed extensive traces of other known former broads, in particular Gage's Broad and Hare's Broad (NHER 32157-8) from the surrounding marshes at Hickling. The extent of the features as visible on the aerial photographs (Fig. 6.3) clearly extends what is marked on the 1842 Hickling Tithe Map (Fig. 6.4). These former broads can generally be identified on the aerial photographs as amorphous, darker, wetter and slightly sunken areas (Fig. 6.3). Many appear to be linked by channels. Also visible within these larger shallow and silted areas are noticeably deeper, angular and oblong cuts, the edges of which probably represent the old baulks within the cuttings, or perhaps different phases of extraction.

Analysis of the aerial photographic evidence of these known sites allows their distinguishing characteristics to be identified, after which it is then possible to tentatively identify further examples in the surrounding marshes, for example on the land surrounding Hickling Broad (Fig. 6.4). The aerial photographs clearly revealed more extensive evidence of former

extraction areas than the historic maps had previously indicated. Similar evidence of former extraction was then also identified outside of the Thurne Valley, in particular in the marshes surrounding Barton, Sutton and Catfield Broads (NHER 49206, 49339), Ranworth and Malthouse Broad (NHER 49684) and Upton Broad (NHER 49682-3).

The NMP mapping provided new information on nine of the known Broads. An additional thirty-nine previously unknown sites were also identified, many within the marshes surrounding the larger surviving broads. The NMP mapping of newly identified extraction sites is heavily clustered in the north of the Broads Zone, in particular in the upper reaches of the valleys. The distribution of existing broads does show this patterning to an extent, but it is much less severe and it is clear that the southern river valleys were also subject to peat extraction (Fig. 6.1). The clustering of sites within the upper valleys reflects the fact that the middle peat in these areas would have been less likely to be blanketed by the clay deposits laid down during the last marine transgression and therefore would have been preferred for extraction.

It is clear from the distribution of these NMP sites that the Thurne Valley, and to a lesser extent the Ant Valley, produced a significantly higher number of new sites (Fig. 6.5). The relative lack of sites identified in the upper reaches of the Bure and the Yare is likely to reflect the landscape history and current land use of these valleys. The HLC mapping for the Broads indicates a higher proportion of carr woodland within these valleys, in particular the Bure. The known medieval (and indeed surviving) broads in these areas are surrounded by carr woodland. The identification of medieval peat extraction sites from aerial photographs within these areas is consequently problematic due to the presence of tree cover. The distribution map indicates that evidence for post medieval extraction could be identified within these areas (see Section 6.3 for discussion). The majority of the newly identified medieval peat extraction sites were located in areas defined by HLC as ‘Inland – managed wetland’ and ‘Inland – drained enclosure’, with the drained enclosure land providing the best results.

The Hickling and Potter Heigham areas of the Thurne Valley produced the most spectacular results for the recording of former broads from aerial photographs, when compared with the rest of the Broads landscape. There are several important factors that may have resulted in this distributional bias. When compared with the other valleys the Thurne area is predominantly drained and enclosed pasture and, as stated above, these conditions tend to show extraction sites more clearly than the wetter and wooded environments, due to the absence of tree cover and the appearance of these features as soil and vegetation marks within the drained areas. The coring undertaken by Lambert and Jennings in the Thurne Valley indicated that the broads located in the base of the valley, such as Horsey Mere and Martham Broad, were largely the product of clay extraction (Lambert et al. 1960, 45-6) and it is possible that this has affected the visibility of the cuttings on aerial photographs. The

workings were all quite shallow and a mixture of clay and peat had been removed. As stated in Section 2.3, the Thurne Valley does not seem to have acted as an estuary during the Roman period and therefore only a thin layer of alluvium covers the peat. It is therefore likely that some of the former workings identified on the aerial photographs also relate to the digging of clay. However the largest existing broad, Hickling, whilst being extremely shallow, appears to have been entirely dug for peat (ibid.). Hickling Broad is located in a wide embayment of the upland, which drains down, through Heigham Sound to the main alluvial valley area. This would therefore suggest that the main areas of extraction identified from the aerial photographs to the north of Hickling Broad (see discussion of Wiggs Broad, NHER 35363, Gage's Broad and Hare's Broad, NHER 32157-8, above) are also likely to have been cuttings for peat and not clay. This indicates that it is not the removal of clay rather than peat that is making the extraction sites in this area more easily identifiable from the air.

It is therefore possible that it is the history of drainage and enclosure within the Thurne Valley that has meant that these features are more readily discernable on the aerial photographs. The HLC mapping within the main alluvial area of the Thurne identified a number of curvilinear drainage channels and this evidence was greatly added to by the NMP mapping, which increased the known extent of these features (Massey 2005). Within the wider Broads landscape, curvilinear drainage channels often represent the earliest phases of enclosure. On the Halvergate Marshes the earliest drains are irregular and curvilinear dykes, adapted from the natural drainage pattern in the 11th to 12th centuries (Williamson 1997, 42-3; Collins 2005). Although these sorts of features are uncommon in the landscape of the upper valleys, it is possible that the curvilinear boundaries identified in the Thurne Valley also originate from the adaptation of natural creeks formed during the drying out of the valley during the medieval period. It has been suggested that the silt soils in the lower reaches of the principal valleys, which represented a more valuable asset than the peaty soils, were enclosed much earlier than the remainder of the valleys. They were to a degree an extension of the Halvergate Marshes (Williamson 1997, 92) and as such were also enclosed at an early date.

Away from the main alluvial area, the process of drainage and enclosure appears to have occurred later. It has been suggested that the Thurne and the Ant Valleys in particular were subject to less early enclosure, and were as a consequence greatly affected by Parliamentary Enclosure (ibid., 92). The area around Hickling and the upper reaches of the Thurne Valley, prior to Parliamentary Enclosure, appear to have been relatively open (ibid., 94), bisected only by a number of natural drainage channels. These are visible on the aerial photographs, running between the numerous areas of former peat extraction (Fig. 6.3). The Parliamentary Enclosure of this land in 1808 resulted in a 'Commissioners Drain' and a rectilinear enclosure pattern being imposed on this former common fen (ibid., 96-7). It is therefore probable that it is this relatively late enclosure and more comprehensive drainage of the upper reaches of the Thurne Valley, and to a lesser extent the Ant, that has resulted in the greatest removal of

these features from the landscape and has therefore provided the greatest opportunity to record lost broads from aerial photographs.

6.3 Post Medieval Extraction

Peat extraction continued into the 18th and 19th centuries across much of the Broads, in particular on the Poor Allotments. The Poor Allotments were often created through Parliamentary Enclosure Acts and acted as specified areas of common land available to the poor for grazing and for cutting fuel and fodder (Williamson 1997, 98-9). Peat extraction and cutting of reeds and fodder continued at some of the Poor Allotments, such as East Ruston (NHER 22943), into the 20th century (ibid., 99). The late 18th and 19th centuries saw an increase in the scale of peat extraction, after the long period of relatively small-scale extraction that followed the decline of the medieval industry in the 15th century (ibid., 100). During this later phase of extraction, vast swathes of the fen surface were removed for fuel; it has been estimated that between half and three quarters of the surviving areas of open fen in the Broads have been stripped of their surface peat (ibid.). As mentioned earlier, large areas of post medieval extraction were identified, in particular within the Bure and Yare Valleys (Fig. 6.1), and these were generally located in the areas of managed wetland and regenerated carr woodland mapped by HLC. This is in stark contrast to the paucity of earlier extraction sites identified in these environments (see Section 6.2 above). The HLC mapping within the Broads Zone indicates that some areas of carr woodland regenerated in the relatively recent past, in particular in the Bure Valley, where large areas of freshwater fen survived into the 1950s and subsequently developed into carr woodland (Collins 2005; see Section 2.4). The use of historic aerial photographs by the NMP allowed evidence of this post medieval extraction to be recorded from aerial photographs dating from the 1940s and 1950s, traces of elongated cuts and baulks being detected amongst the fen and developing carr.

This later and shallower extraction was often undertaken along the lines of doles. Doles were a method of ensuring access to shared resources, such as peat, on common land and in particular Poor Allotments, where particular strips of land were allotted to individuals (Williamson 1997, 83). The practice is known from the 13th century onwards. Historic maps often reveal evidence for the division of the commons and fens into doles; a particularly good example is Upton Tithe Map of 1839, where land to the north of Upton Broad, now known as The Doles, is divided into narrow strips (ibid.) and a series of closely spaced ridges and drainage ditches are visible on aerial photographs. In some locations, such as Surlingham Broad (NHER 13522), the encroachment of fen vegetation and continuing wet conditions made it hard to accurately identify the extent of former extraction. However, consultation of the 1822 Enclosure Map, the 1839 Tithe Map and Ordnance Survey first edition 6 inch map (1879 and 1886) revealed a complex system of doles and turf ponds that are not evident on the aerial photographs (Lambert & Jennings 1965, 288-9). Nevertheless, several large areas of extraction doles were visible on the aerial photographs as earthworks and vegetation

marks within the Broads, the largest probably being that recorded at East Ruston Common (NHER 22943). This site covers approximately 0.6 sq km, much of which was formerly Poor Allotment. A fire on part of this site in 1990 revealed the baulks that separated the extraction strips still surviving on the ground (Williamson 1997, 82-3).

This extraction along the lines of doles can also be detected in the rectangular and oblong cuts that are clearly visible on the 19th century maps collated by Lambert and Jennings for Decoy Broad and Woodbastwisk Fen (1965, 282), Ranworth and Malthouse Broads (ibid., 284), Buckenham and Hassingham Broads (ibid., 294), Surlingham Broad (ibid., 288), and Strumpshaw and Carleton Broads (ibid., 290). The earthworks of comparable features were identifiable on the aerial photographs. Twenty-two groups of elongated rectangular and shallow cuts were identified around the margins of the larger surviving Broads. These rectangular cuttings were generally 5m to 20m wide and were of varying lengths, depending on the size of the common land or allotment. The variation in the width of these cuttings is likely to reflect the consolidation of strips by particular individuals, and possibly also the decline in usage of the common land for grazing and for supplying fodder and similar resources. The former restrictions on the extent of any extraction may have been relinquished (Williamson 1997, 103). One of the most impressive sites showing the earthwork remains of these extraction areas or doles was located on Horning Poor Allotment (NHER 49270; Fig. 6.6).

It must be noted that not all of this later, shallower extraction took place along the lines of doles, and it is thought that some of the workings would have created large open areas of water, similar in plan to those created during the medieval period (Williamson 1997, 100). The division of some of the Broads, such as Surlingham, on historic maps, would appear to indicate that the Broad itself was being actively extracted during the post medieval period (Tom Williamson, UEA, pers comm.). As a consequence, this type of extraction is potentially quite hard to distinguish from the evidence of earlier medieval extraction. It is only really the neater sub-rectangular cuts that can be securely dated to this later period. There is also evidence that some of the post medieval cuttings were occasionally extracted to a depth comparable with medieval workings, as at Catfield Fen, where brushwood peat was extracted to a depth of 2m (Williamson 1997, 101).

These shallow post medieval workings were often very temporary components of the landscape. The area of Heigham Holmes, at Potter Heigham, is shown as enclosed land on Faden's Map of 1797. By the time of Bryant's Map of 1826, the area is shown as open water. It is subsequently depicted as dry land on Potter Heigham Tithe Map of 1840, possibly indicating a rapidly created area of extraction that became water-filled and then colonised by vegetation during a time-span of forty years. The NMP mapping in this area revealed a series of amorphous extraction areas, surrounding the lake or turf pond depicted in 1826. As

discussed in the medieval section, since they are located on the main valley floor these cuttings may have been for clay, as well as or instead of peat (ibid., 86-7). To the south of Heigham Holmes, a series of extraction areas were identified on the aerial photographs, which, whilst overall having a relatively irregular appearance, possess some edges which are clearly linear. Comparison with the 1801 Potter Heigham Enclosure Map would indicate that these edges are consistent with dole allotments (Fig. 6.7a). By contrast, additional extraction areas to the east of Heigham Holmes were assumed to be medieval in date due to the shape of the cuttings and the fact that they appeared to be cut by a series of drainage ditches and allotment boundaries marked on the 1801 Enclosure Map (Fig. 6.7b). The NMP mapping revealed additional curvilinear boundaries which were no longer in use by the early 19th century or were made obsolete by the Enclosure Act. These were clearly cut through by later, more regular drains. Their date is not known, although, as referred to above, curvilinear boundaries are likely to represent relatively early enclosure on the silt soils of the lower valleys. The range of extraction features at this site highlights some of the problems inherent in the interpretation and dating of peat workings, and it is likely that further historic map and documentary research is required to fully assess and analyse the new body of data created by the NMP mapping.

7 Conclusions and Recommendations for Further Work

7.1 Project Results

With the creation of 945 new sites (a substantial proportion of which were new discoveries), the amendment of 380 existing NHER records, and the formation of an archaeological map covering 543 sq km, the NMP Broads mapping represents a significant contribution to the NHER and to our knowledge of Norfolk's historic environment. The increase by 31% to the number of known sites within the Broads Zone — a hitherto relatively understudied area — represents a significant move forward in our understanding of the Broads archaeological landscape. The National Park-equivalent status of the lowland areas of the Broads means that this increase in knowledge of the historic environment of the area will undoubtedly benefit the way in which the landscape is managed and promoted, through the work of the Broads Authority.

7.2 The Contribution of the NMP

In addition to highlighting two significant research themes, this report has provided a brief chronological overview of the entire NMP mapping results for the study area. The Broads mapping revealed numerous prehistoric sites and highlighted potentially significant relationships between the former lowland fens and estuaries, and the positioning of monuments such as Bronze Age round barrows. The mapping identified several new possible Iron Age to Roman date square barrows or square-ditched enclosures. In common with other areas mapped as part of the Norfolk NMP, it also revealed extensive areas of field systems and enclosures of probable late prehistoric to Roman date. Additional fieldwork and excavation is required to shed light on the dating and development of such landscapes (see below), but while the problems inherent in distinguishing later prehistoric sites from those dating to the Roman period were again an issue, the mapping of such extensive sites has dramatically altered our perception of the area in this broader period. As was outlined in Section 4.5, it is likely that many sites remained in use across the transition period. The recognition of a possible new villa site, and the reinterpretation of a previously recorded enclosure as another possible villa, represent significant additions to the known distribution of high-status Roman period settlement sites in Norfolk. Several possible farmsteads and small settlement sites probably dating to this period were also recorded. These were frequently located on the margins of the river valleys, providing access to both upland and lowland resources. The mapping also identified several new possible examples of Anglo-Saxon grubenhauser. Significantly, some of these sites were located within areas of finds of this date, a context that has been lacking for many of the previously identified cropmark sites (Albone et. al. forthcoming).

The project identified a number of new medieval sites, including eleven moats and nine saltern mounds. The mapping also added valuable new data to the a number of important known sites, including St Benet's Abbey and Claxton Castle. This highlights the benefits of the systematic assessment of historic aerial photographs for sites that have already received extensive ground-based fieldwork. The NMP mapping of the area's post medieval industrial sites has added to the body of data relating to brick-making in the area. The recording of 20th-century military remains has greatly improved our knowledge of this area during the two World Wars. The identification of two previously unrecorded World War One trench systems represents a significant discovery; sites of this date are relatively rare within the study area. The mapping of World War Two sites revealed a complex system of defences focussed on the main river crossings and bridges. A significant number of new sites relating to radar and/or radio were also recorded, increasing the number of sites from two to six within the project area. Another significant aspect was the identification of numerous sites relating to bomb storage and fuel depots, in particular in the area of the USAAF camp at Earsham. A number of these sites were newly recorded and structures still survive at at least one (the fuel depot at Ellingham).

7.3 Coaxial Field systems

Extensive areas of coaxial field system cropmarks of Iron Age to Roman date were mapped in the Broads Zone. These were predominantly mapped solely from oblique aerial photographs held in the Norfolk Air Photo Library and Cambridge University collection, many of which were taken over twenty years ago. Relevant cropmarks were only occasionally visible on the available vertical aerial photographs. Although most of the sites had previously been recorded as field system cropmarks, it was not until they had been accurately mapped by the NMP that their full extent, form and significance was realised. The presence of coaxial field systems of this type on the upland areas of the Broads Zone was unexpected and has added greatly to our knowledge of the Iron Age to Roman landscape of east Norfolk.

The significance of the Broads Zone coaxial field system cropmarks lies as much as in their potential for further research as it does in their current mapped extent. They raise many research questions about the agricultural land use of the period, the political structure behind their establishment, the associated pattern of settlements and, most fundamentally, their date of construction and use. Their relationship to both the prehistoric and post-Roman landscape of the Broads Zone also warrants further investigation. The majority of these questions can only be answered by a programme of targeted fieldwork. However, even without this fieldwork, the field systems have the potential to make a major contribution to the ongoing debate about the origin of other East Anglian coaxial systems that survive in the modern landscape, most notably those at Scole/Dickleburgh and elsewhere along the Waveney Valley. The very fact that the Broads Zone coaxial field systems are defunct and present as

cropmarks, and that they have not been fossilised in the later landscape, means that they can be usefully contrasted with the other East Anglian coaxial systems.

7.4 Medieval and Post Medieval Peat Extraction

The mapping of features relating to the medieval and post medieval peat extraction industry within the Broads has added significantly to the large body of existing data concerning this aspect of the historic environment of the area. The use of aerial photographs has greatly increased the extent of the known areas of extraction, particularly those of the medieval period. The identification of these peat workings on the aerial photographs was relatively easy, once their distinctive characteristics had been recognized. Analysis of the distribution of the sites would suggest that they are more evident in areas of enclosed land that has been drained in the last 200 years. The confident identification of medieval extraction sites within managed wetland and carr woodland was relatively rare, whereas post medieval extraction evidence was more observable within these types of environments. The analysis of the medieval to post medieval extraction evidence in relation to the Historic Landscape Characterisation (HLC) mapping proved particularly fruitful within this environment, and it is likely that this approach would also be beneficial for other aspects of the historic environment of the lowland and wetland areas of the Broads Zone, such as drainage and enclosure of the lowland fens and marshes (see below).

7.5 Recommendations for Further Work

As is outlined in Appendix 1, it was decided that the mapping of drainage ditches on the reclaimed marshes and wetlands was not an appropriate use of NMP resources. It was also felt that the mapping and interpretation of the process of drainage and enclosure within the Broads should be done in conjunction with a detailed assessment of a wider range of historic maps than is normally consulted for the NMP. A substantial portion of Halvergate Marshes fell within the NMP Coastal Zone, and the drainage ditches in this area were mapped in detail to provide a sample of the potential results and usefulness of using aerial photographs for this type of feature and environment. Along the River Thurne, the mapping of drainage ditches within the coastal marshes and lower reaches of the valleys — which again fell within the Coastal Zone — proved particularly productive, and the results worked well when analysed in conjunction with the HLC data and the historic maps available (Massey 2005). It is therefore felt that a project covering the whole of the marshes and lower valleys of the Broads, incorporating work with aerial photographs, historic maps, HLC data, and potentially also LiDAR (see below), would be a beneficial future project.

The coaxial field system cropmarks have significant research potential and can make a major contribution to our understanding of both the Iron Age to Roman and post-Roman landscape of the Broads Zone. However, much of this relies on fieldwork to establish the dating and

phasing of the field system cropmarks, which could include both non-invasive (e.g. fieldwalking and geophysical survey) and invasive (e.g. trial trenching) techniques.

7.6 The Future of the NMP in Norfolk

It is an English Heritage priority for the NMP to be undertaken across the entire country; at present c. 36% has been mapped. The completion of the Broads Zone, in addition to the Coastal Zone mapping undertaken from 2001-2006, means that over 25% of Norfolk will have been mapped. Given the overall success of the NMP methodology for discovering new sites, and for providing new information about those that are already known, there is a clear need for the NMP to continue to be rolled out across other parts of the county. Work has already started on an assessment of the county's aggregate landscapes (English Heritage Project No. 5241MAIN; Massey 2007) and this project will conclude in March 2008. A Project Design (English Heritage Project No. 5313PD) for a further block of work, driven by the need to address development pressures and covering Norwich, Thetford and the A11 corridor, has been submitted to HEEP (Tremlett 2007).

7.7 Aerial Reconnaissance

Since 2000, when the work of Derek Edwards as Air Photographer for NLA came to an end, aerial reconnaissance within the county has been extremely limited. While new photography by local fliers, such as Mike Page, continues to be submitted to the NAPL, and although new sites continue to be discovered, there is little targeted survey of specific areas or types of site.

A considerable body of lidar data exists for the Broads environment, held by the Broads Authority and the Environment Agency. It is currently used for site investigation purposes, creating hydrological models and assessing indicative floodplains. There is huge potential for this existing data to be analysed with a view to recording archaeological sites, and improving our understanding of their landscape setting. The majority of the data that currently exists consists of narrow corridor surveys. At present, as these have been undertaken predominantly on lowland and wetland environments, they may only be able to provide information on the medieval to post medieval aspects of the landscape, such as peat extraction, drainage and enclosure. However, it is possible that data covering the margins of this area could provide information on archaeological sites of Roman date located on the edges of the Great Estuary. These might include sites relating to salt production, for example, and possible quayside structures that may once have existed at locations such as Burgh Castle shore fort.

7.8 Synthesis and Dissemination of NMP Results

This report represents only a first attempt to draw together the results of the Broads Zone NMP into a brief chronological synthesis. Two research themes of particular significance have been identified, but it is felt that other aspects of the data also warrant further and more

detailed study. It is hoped that in the future the NMP data will be utilised in more intensive studies of specific geographic areas, site-types or periods, where it can be integrated further with existing datasets, or can inform new investigations using alternative methods of inquiry. These might be small-scale in nature, with the NMP mapping providing the context for a detailed study of a specific site, or at the sub-regional, regional or national scale, the NMP sites forming a corpus amongst which distinctive characteristics and traits might be identified. As stated above, the Iron Age to Roman landscape of the Broads would benefit from additional time and resources, and would definitely merit further research, analysis and publication. Future resources might also be invested in the dissemination of the existing NMP data, both via traditional means – journals, leaflets, etc. – or digitally. Having been produced in a digital environment, much of the basic NMP mapping and recording is ideal for dissemination via the World Wide Web; for example, it could perhaps be added to future versions of the Norfolk Heritage Explorer website, the online version of NHER database, or to the E-map Explorer website (at <www.historic-maps.norfolk.gov.uk>), by which historic maps and aerial photographs of the county can be viewed and overlain on each other.

It is hoped that the NMP data produced for the Broads Zone will be incorporated into the Broads Local Development Framework (LDF), which has replaced the Broads Local Plan. The Broads LDF sets out spatial policies and proposals for development and land use in the Broads, and consists of a series of Local Development Documents that are prepared on a rolling three-year programme. It is therefore hoped that NMP data provided to the Broads Authority will be integrated into the historic environment sections of the LDF, and feed into future Broads Core Strategy Development Plan Documents, which set out the environmental, social and economic objectives for this unique landscape.

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8.1 Websites

Norfolk E-Map Explorer: http://www.historic-maps.norfolk.gov.uk/
Norfolk Heritage Explorer: http://www.heritage.norfolk.gov.uk/

Appendix 1: Methodology

A1.1. Archaeological Scope of the Survey

All archaeological monuments visible on the consulted aerial photographs, both plough-levelled and upstanding, dating from the Neolithic period to the 20th century, including industrial and military remains up to 1945, have been recorded, except those sites (particularly of late post medieval and modern date) that are adequately recorded by readily accessible historic maps or existing surveys.

Plough-Levelled Features

All cropmarks and soilmarks representing features of archaeological origin have been recorded.

Earthworks

All earthwork sites visible on aerial photographs have been recorded, except where the aerial photographic evidence could add no new details to existing plans of the site, whether on historic maps or existing surveys, such as those reproduced in Earthworks of Norfolk (Cushion & Davison 2003). This information was augmented and complemented where necessary by the aerial evidence. The earthworks were recorded whether or not they were still extant on the latest aerial photographs. The accompanying ExeGesIS database records specified which elements of earthwork groups were surviving or plough-levelled.

Buildings

As a rule the survey did not record buildings other than those visible as earthworks, masonry foundations, cropmarks or soilmarks. Standing buildings of archaeological significance, visible on the earliest photographs but since destroyed, were recorded when there was no other adequate record: a map record existed in most (possibly all) cases. For any that were transcribed, the date and cause of their destruction, where known, was recorded.

Industrial Archaeology

The survey recorded evidence of industrial activity, such as salt-making, lime-burning and brick-making, where it could be recognised as pre-dating 1945 and only when the sites were not recorded adequately by historic maps. Small-scale extraction sites were only recorded where they were thought to be archaeologically significant or had a bearing on the surrounding archaeology.

Military Archaeology

All former military sites and installations up to 1945 visible on aerial photographs were recorded, in particular those World War Two sites visible on photographs taken by the RAF during the 1940s. Twentieth-century military remains, such as airfields and camps, were mapped at an appropriate level of detail, ranging from a dotted outline defining their extent to the recording of the main structural components. Isolated military sites, such as pillboxes and searchlight batteries, were mapped and recorded, again at an appropriate level of detail.

Inter-Tidal Archaeology

Although the Broads Zone included no coastal environments, there was potential for inter-tidal (and formerly inter-tidal) sites to be encountered within the marshland and river valleys. These were mapped to normal NMP standards.

Field Boundaries

Where recently removed field boundaries were visible as cropmarks on aerial photographs, they were not plotted or recorded, particularly if they were depicted on readily accessible historic maps (such as the Ordnance Survey 1st edition 6 inch). If they were extensive, and could be confused with the remains of earlier field systems, their presence and extent was in some cases mapped and recorded, or otherwise noted and/or sketched on a separate layer in the AutoCAD drawing.

Ridge and Furrow and Water Meadows

Remains of ridge and furrow were recorded using standard NMP conventions to indicate the extent and direction of the furrows. Areas of water meadows were mapped and transcribed in detail, using the bank and ditch layers.

Drainage Features

The mapping of drainage features is not normally included within the standard NMP specification and it was not undertaken within the Broads Zone. The mapping of large-scale drainage features in the Coastal Zone, particularly of those features not depicted on readily accessible historic maps, demonstrated the suitability of aerial photographs for recording and reconstructing former alluvial landscapes. Drainage features form an integral part of the development of the Broads landscape and are clearly an area of research potential. However, much of the data collated in the Coastal Zone might equally have been derived from a detailed historic map-based search, and many of the features mapped by the NMP were in part depicted on Tithe and Enclosure maps. Consequently, such features were largely ignored within the Broads Zone, but would clearly reward further detailed mapping and research.

Parks and Gardens

Earthworks and levelled landscape features associated with historic parks and gardens were recorded, including those listed in English Heritage's Historic Parks and Gardens Register and Norfolk County Council's Inventory of Parks, which are recognised as being of local or regional importance.

Geological and Geomorphological Features

Geological features were not plotted unless their presence helped to define the limits of an archaeological site. Geological and geomorphological features may have been noted in site records, as their presence in some instances assisted with an assessment of the archaeological potential of an area.

Areas of Destruction/Extraction

Areas of former quarrying thought to be of archaeological or historical significance have been mapped. More recent, large-scale quarrying, which is likely to have destroyed archaeological deposits, may have been noted on a separate AutoCAD layer when considered relevant to the understanding of a particular area.

A1.2 Sources

Aerial Photographs

Due to a misconception concerning the range of the NAPL collection, the original Project Design specified that only NAPL photography would be consulted (as detailed in Allen 2000, section 5.1). Use of the NMR collection is a now a requirement of the NMP nationally. This contains 108,682 aerial photographs of Norfolk, of which it is estimated that the NAPL holds approximately 55,000. Therefore, the inclusion of the NMR collection doubled the number of photographs consulted by the project.

The main photographic sources consulted were:

- Norfolk Air Photo Library (NAPL)

A collection of approximately 86,000 aerial photographs held by Norfolk Landscape Archaeology. It includes specialist oblique photography, as well as vertical photography by the RAF and Ordnance Survey, among others.

- National Monuments Record (NMR)

In summary, the NMR photographs included: RAF vertical and M-series oblique aerial photographs, Ordnance Survey vertical photography, and other commercial vertical photography. The project also borrowed specialist oblique aerial photographs, where a copy did not exist in the NAPL.

- Cambridge University Committee for Air Photography (CUCAP), Unit for Landscape Modelling

The project consulted all available vertical and oblique aerial photographic prints and film listed in the online catalogue (http://venus.uflm.cam.ac.uk/).

Other photographs utilised by the Norfolk NMP in the Broads Zone included:

- 1:10,000 scale countywide coverage taken by BKS in 1987-8 and held by the Planning and Transportation Department of Norfolk County Council.
- ADAS reconnaissance of the Norfolk Broads taken in 1995, loaned from the Broads Authority.

Documentary and Historic Map Sources

NHER maps and records were the primary archival sources for the project. NMR records, the Excavation Index and Ordnance Survey 1st edition 6 inch maps were also consulted for each area.

In addition to historic Ordnance Survey maps, Enclosure and Tithe maps were consulted where available via the E-map Explorer website (www.historic-maps.norfolk.gov.uk). This allows maps from across the whole county to be viewed, and also allows them to be overlain on a rectified mosaic of aerial photographs from 1946 (RAF) and 1988 (BKS). This product is extremely useful for NMP mapping and interpretation.

A1.3. Methodology

Digital Transcription

Separate AutoCAD drawings were produced for each 1:10,000 Ordnance Survey quarter sheet.

Except in exceptional circumstances where control was entirely lacking, photographs were rectified using AERIAL software. Control was provided by digital Ordnance Survey 1:10,000 base maps. A level of accuracy of 1–3m to the map and of 5–15m to true ground position could therefore be expected. Where necessary, the digital terrain model function in AERIAL was used to compensate for distortion due to slope and terrain.

Rectified images were imported into an AutoCAD drawing. Archaeological features were transcribed onto the relevant AutoCAD layer using the appropriate line and colour conventions, and the original image was then discarded (except in the case of complete scans of CUCAP photographs, which will be forwarded to the ULM for their future use). Where necessary, small amounts of additional detail were added to the AutoCAD plot by eye.

A digital export of the AutoCAD map was subsequently transferred to a MapInfo layer on the HBSMR. This layer now exists as a raster layer in the MapInfo environment set up for the NHER. In order to make the mapping clearer, the colour of some features was altered for the MapInfo export; all AutoCAD layers have been returned to the standard NMP conventions for archiving by the NMR and NHER.

Database Records

AutoCAD

Object Data tables were created and incorporated into each AutoCAD drawing. An object data table called 'NORFOLK' was created to include basic information, including NHER number, monument type, period and photographic references, plus any pertinent notes on the site. The NORFOLK table was transferred with the NMP mapping to the MapInfo layer linked to the NHER database. The object data was attached to both the monument polygon and the mapped features.

NHER (ExeGesIS HBSMR)

For each monument or group of monuments (new and existing) a site record was created on the county's ExeGesIS database. This is currently publicly accessible on the NHER database, and available on the World Wide Web via the Norfolk Heritage Explorer website (www.heritage.norfolk.gov.uk). The NMP records will be exported to the NMR database when the necessary software is in place.

MORPH Records

Where it was felt to be appropriate or necessary, with reference to the MORPH guidelines provided by English Heritage, morphological recording was undertaken for individual sites or elements of sites. This information was recorded directly within the NHER MORPH module.

Event Records

An event record was created for each Ordnance Survey quarter sheet, providing information on the compiler, dates of work, associated events and any additional information that would have previously been included on a Map Note Sheet. These event records have been linked to all the monument records for that sheet. The sites have also been linked to a parent event record for the whole project.

Sources and Progress Sheet

A brief record was kept of the progress of each quarter sheet, particularly of time taken for each task and the numbers of records created and amended. Progress sheets also included a brief summary of the aerial photographs and other sources used.

A1.4. Storage and Exchange of Data and Archiving

All photographic material on loan from the NMR and CUCAP collections was stored in locked cupboards within the NAPL office.

All digital mapping and recording data has been stored on the Norfolk County Council NLA shared drive for the duration of the project, as this has a daily back-up. The maps, in their original AutoCAD and exported MapInfo formats, are also stored on CD. The exported data is stored as a MapInfo layer on the NHER database. This database is on the NLA shared drive and weekly CD back-ups are created and stored off-site.

Copies of the digital maps and records will be archived within the NMR, according to current guidelines for NMP projects.

A mechanism is still to be devised for the eventual digital transfer of the NMP records created on the NHER to the NMR database AMIE, which is a requirement for all externally contracted NMP projects. It is intended to export the data in landscape zone blocks (i.e. the Coastal Zone, the Broads Zone). Some time has been spent attempting to standardise the fields and terminology used in the NHER records with regards to NMR conventions. It is therefore anticipated that the data transfer will be relatively straightforward. At present the Norfolk NMP has implemented the use of chronological periods, such as 'World War One' and 'World War Two', which are not standard terms within the NMR database. It is therefore anticipated that such terms will have to be globally changed to the NMR equivalent, i.e. 'Modern', before any data transfer takes place.

Other NMP projects, both past and present (such as the Suffolk Coastal NMP), are currently negotiating the transfer mechanism needed to copy HBSMR records to the NMR, and it is hoped that the same transfer process can be used for the Norfolk data.

The copyright for all transcriptions, digital files and accompanying records (paper and digital) is jointly held by English Heritage and Norfolk County Council.

A1.5. Project Staff

Helen Winton (EH)	Project Officer
David Gurney (NLA)	Project Executive
Jan Allen (NLA)	Project Manager
Alice Cattermole (NLA)	Project Manager & Historic Environment Record Officer (GIS)
Sarah Massey (NLA)	Senior Air Photo Interpretation Officer/Air Photo Interpretation Officer
James Albone (NLA)	Air Photo Interpretation Officer
Sophie Tremlett (NLA)	Air Photo Interpretation Officer/Senior Air Photo Interpretation Officer

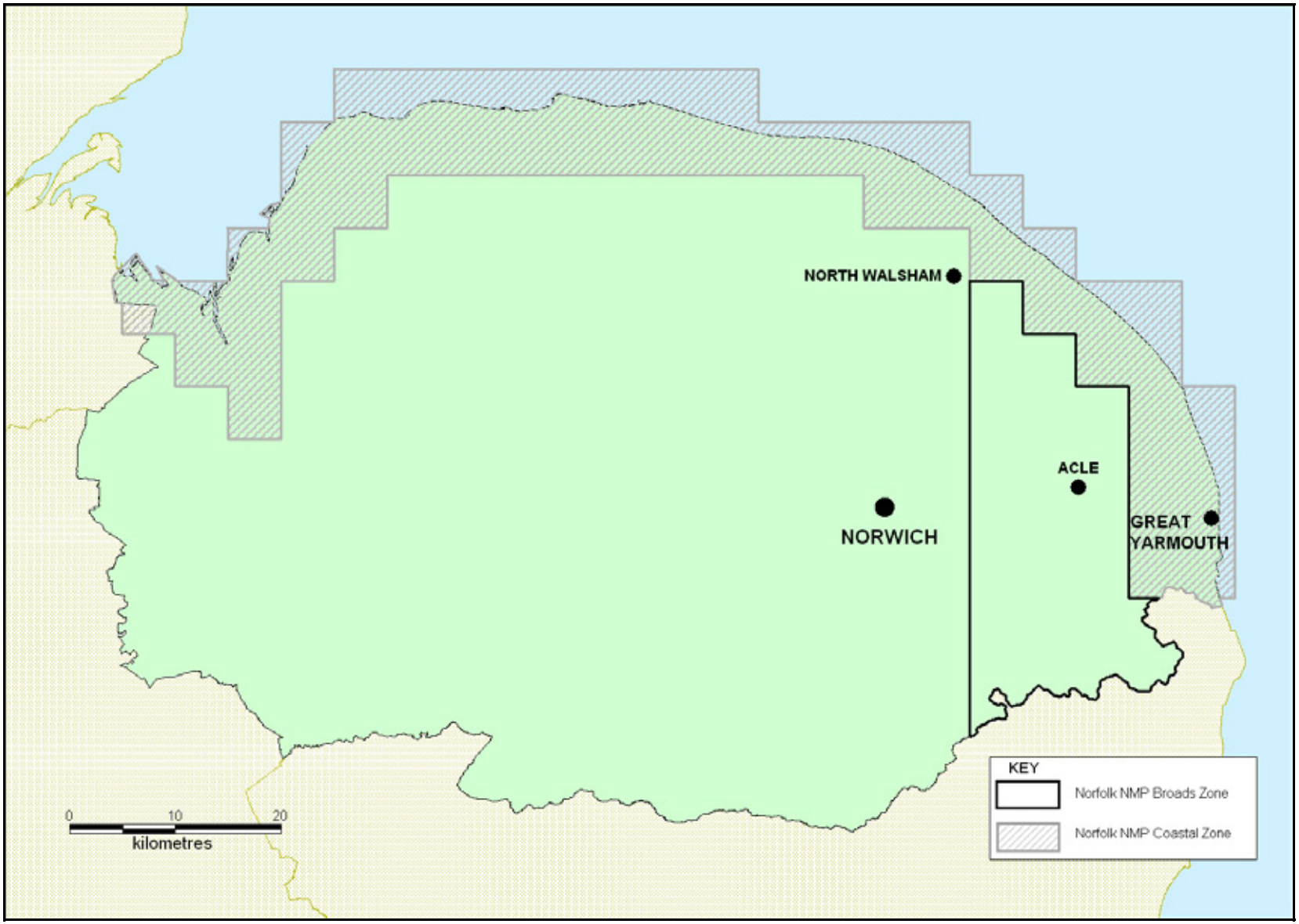

Figure 1.1. The Norfolk NMP Broads Zone

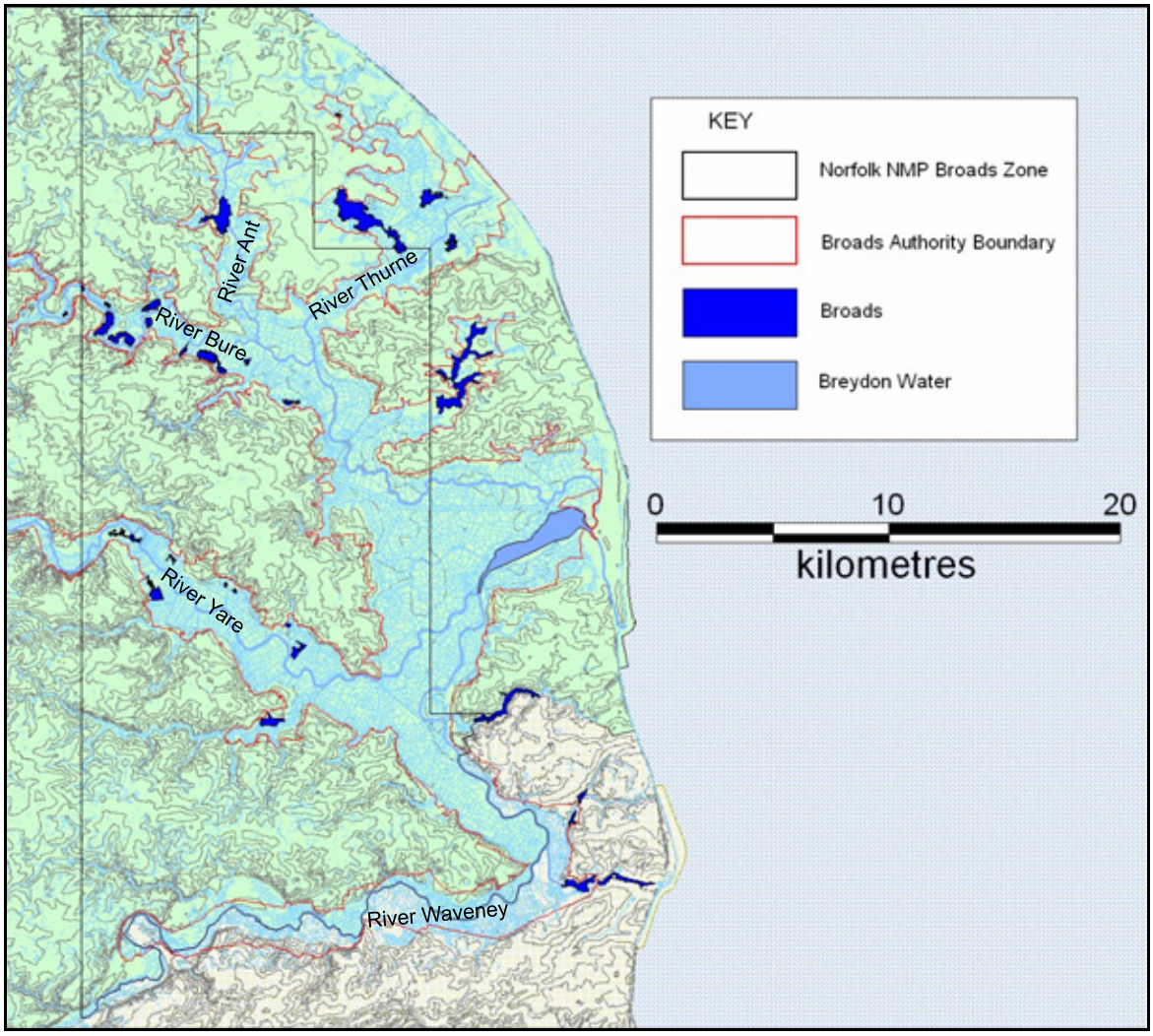

Figure 2.1. The topography and hydrology of the Broads Zone. The location of surviving Broads is also shown.

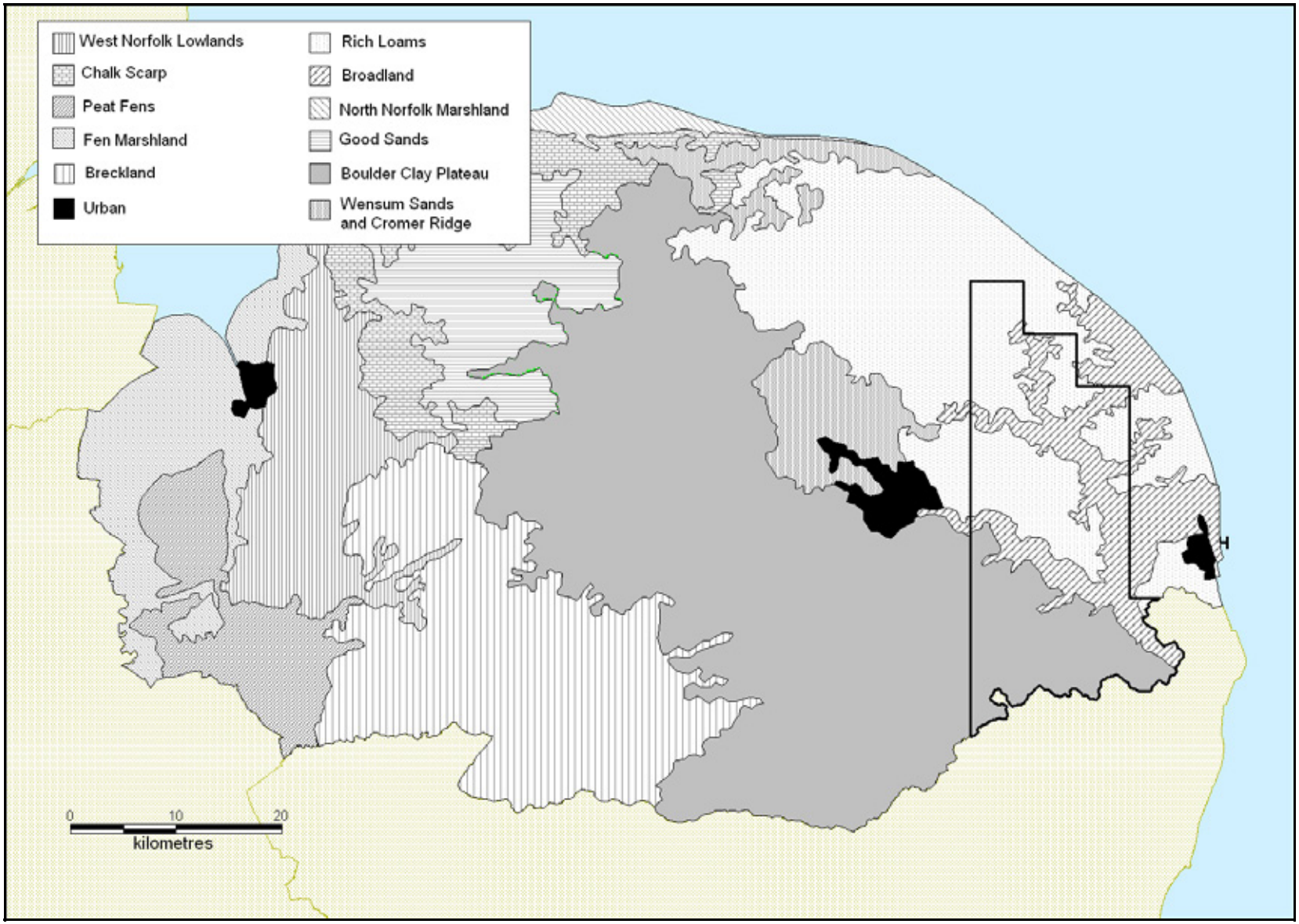

Figure 2.2. The soil landscapes of Norfolk showing the area of the Broads Zone

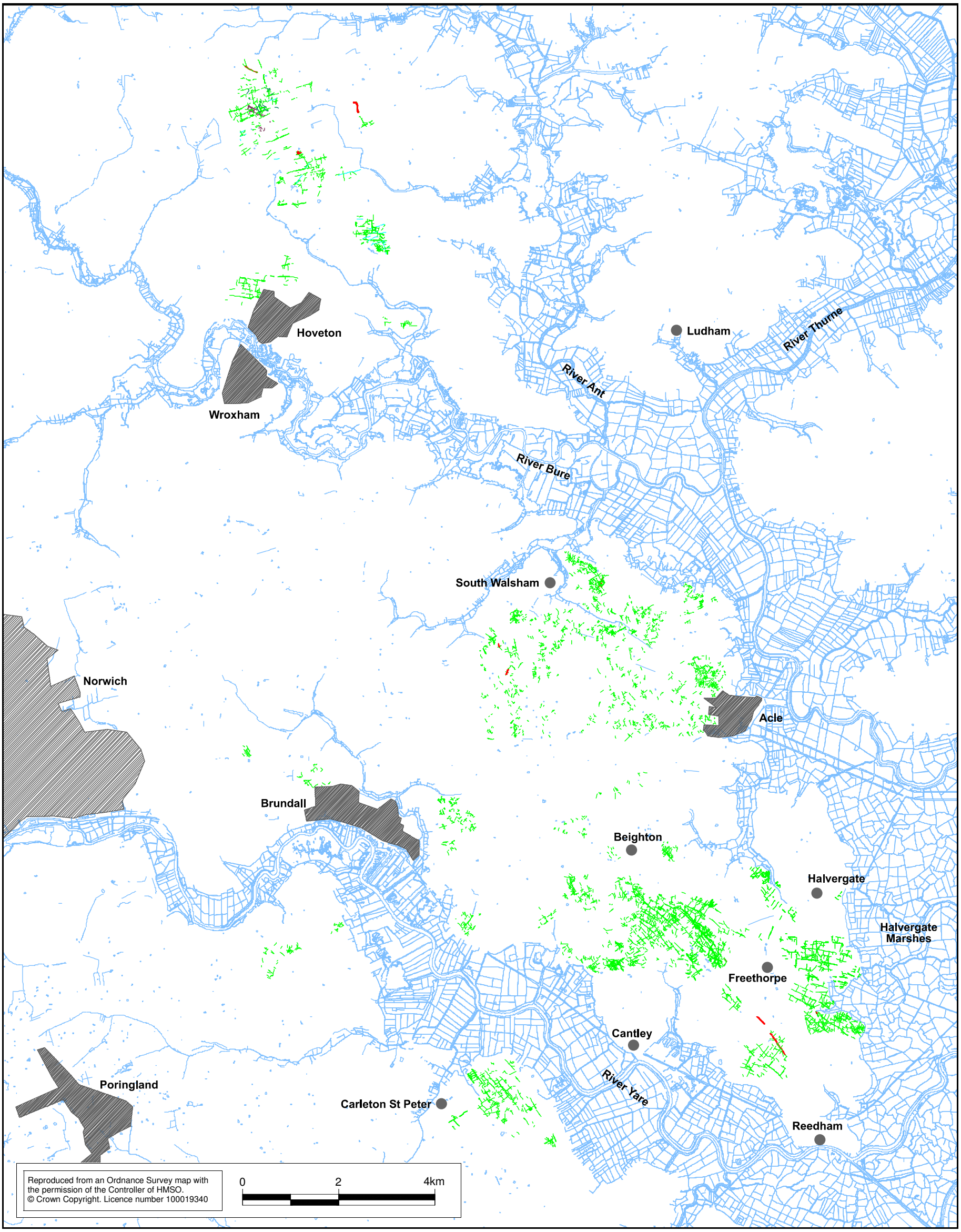

Figure 5.1. The distribution of the main areas of coaxial fields system cropmarks in the Broads Zone. The modern drainage pattern is shown to highlight the river valleys and former estuary area.

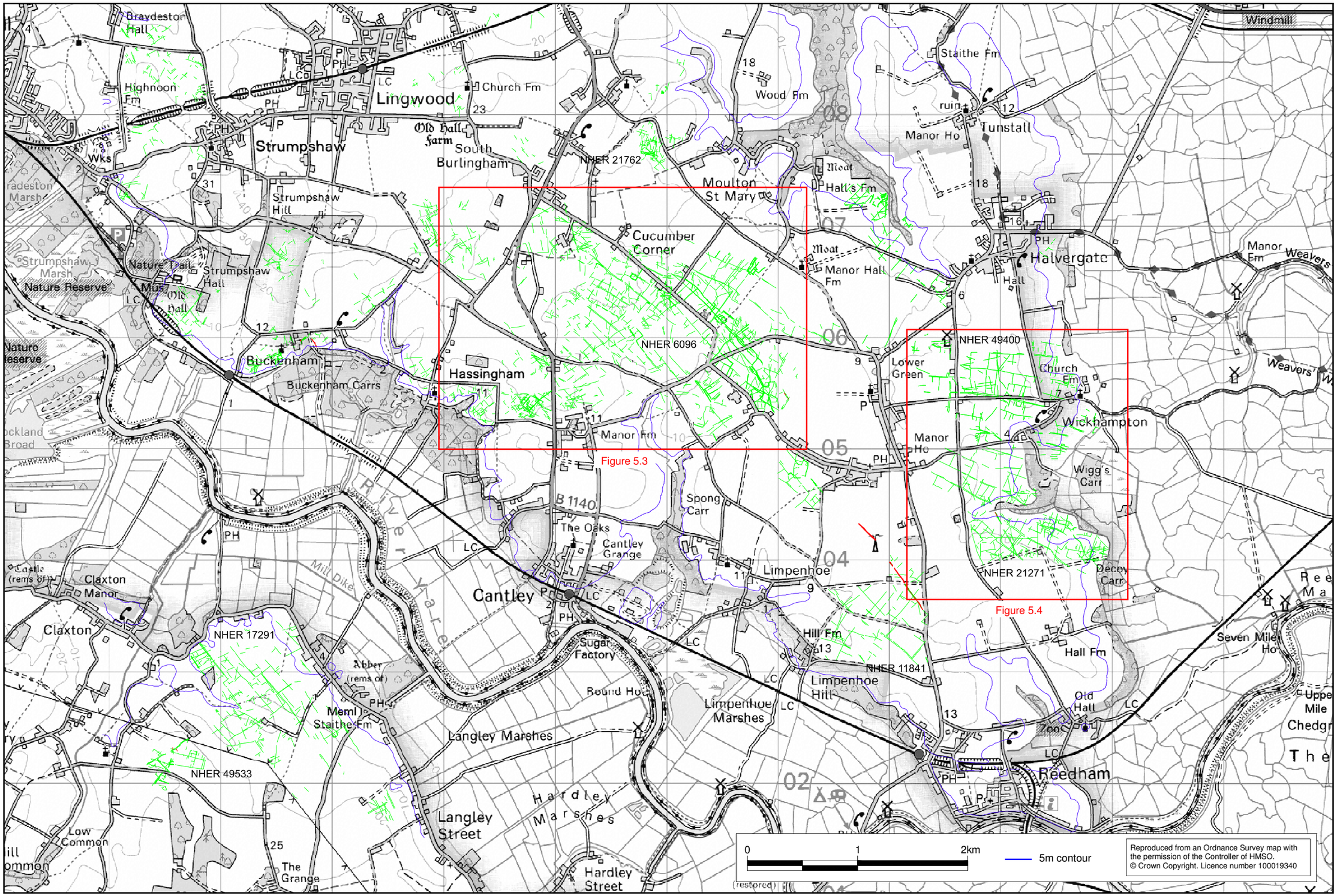

Figure 5.2. Cropmarks of coaxial field systems and other sites of Iron Age and Roman date on the southern part of the Yare-Bure peninsula.

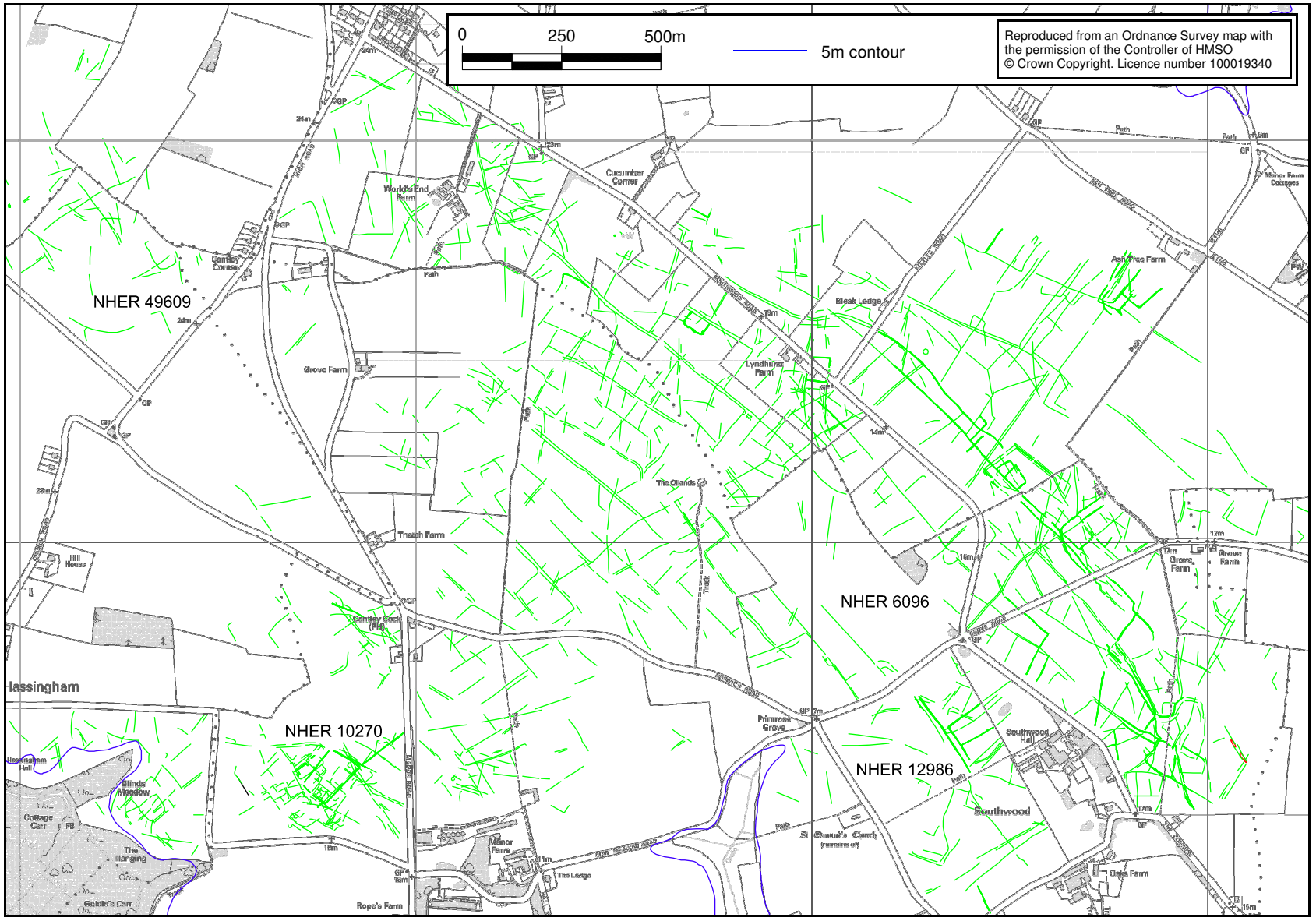

Figure 5.3. Coaxial field system cropmarks between Beighton and Cantley on the southern part of the Yare-Bure peninsula.

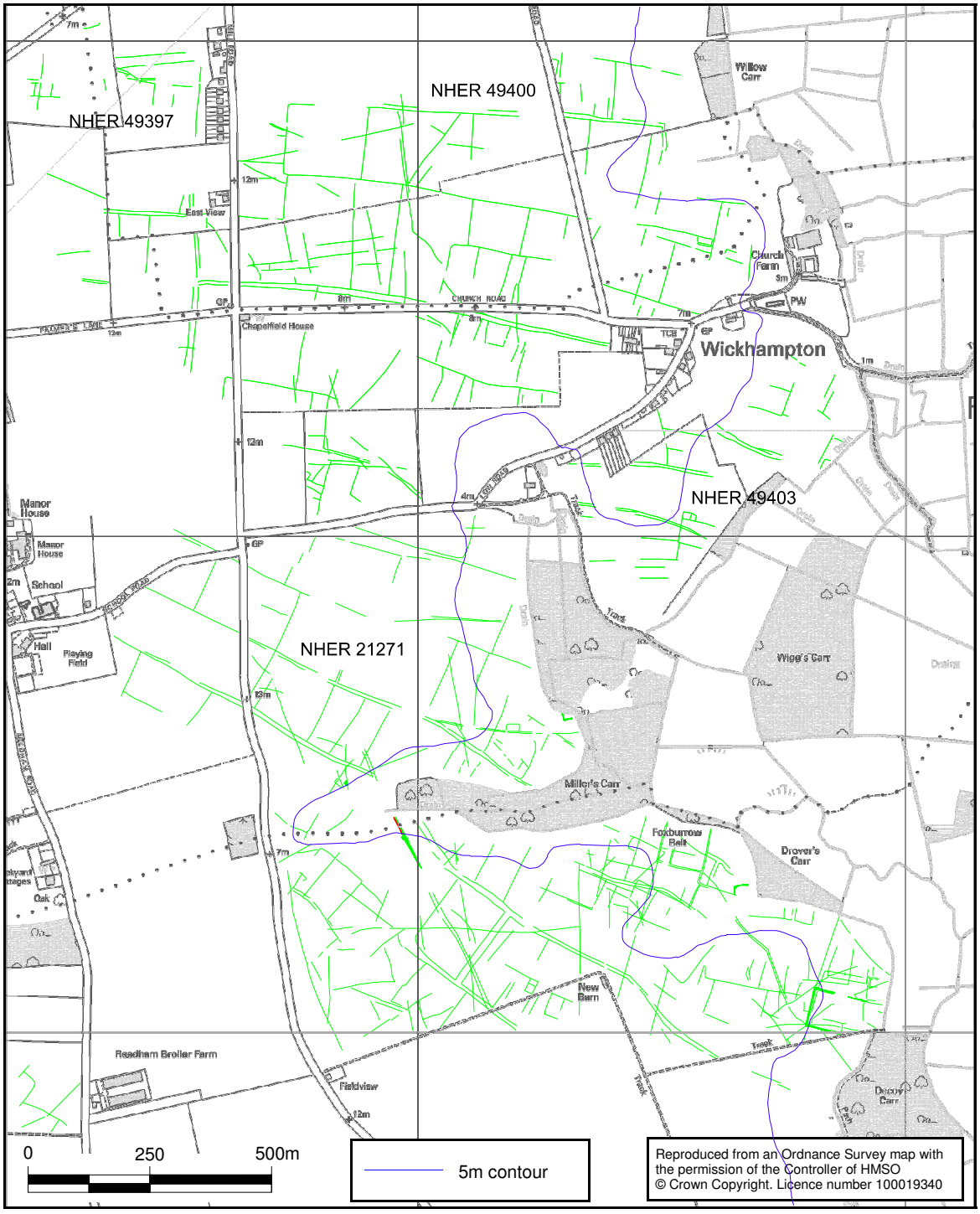

Figure 5.4 Coaxial field system cropmarks in the parishes of Reedham, Freethorpe and Halvergate.

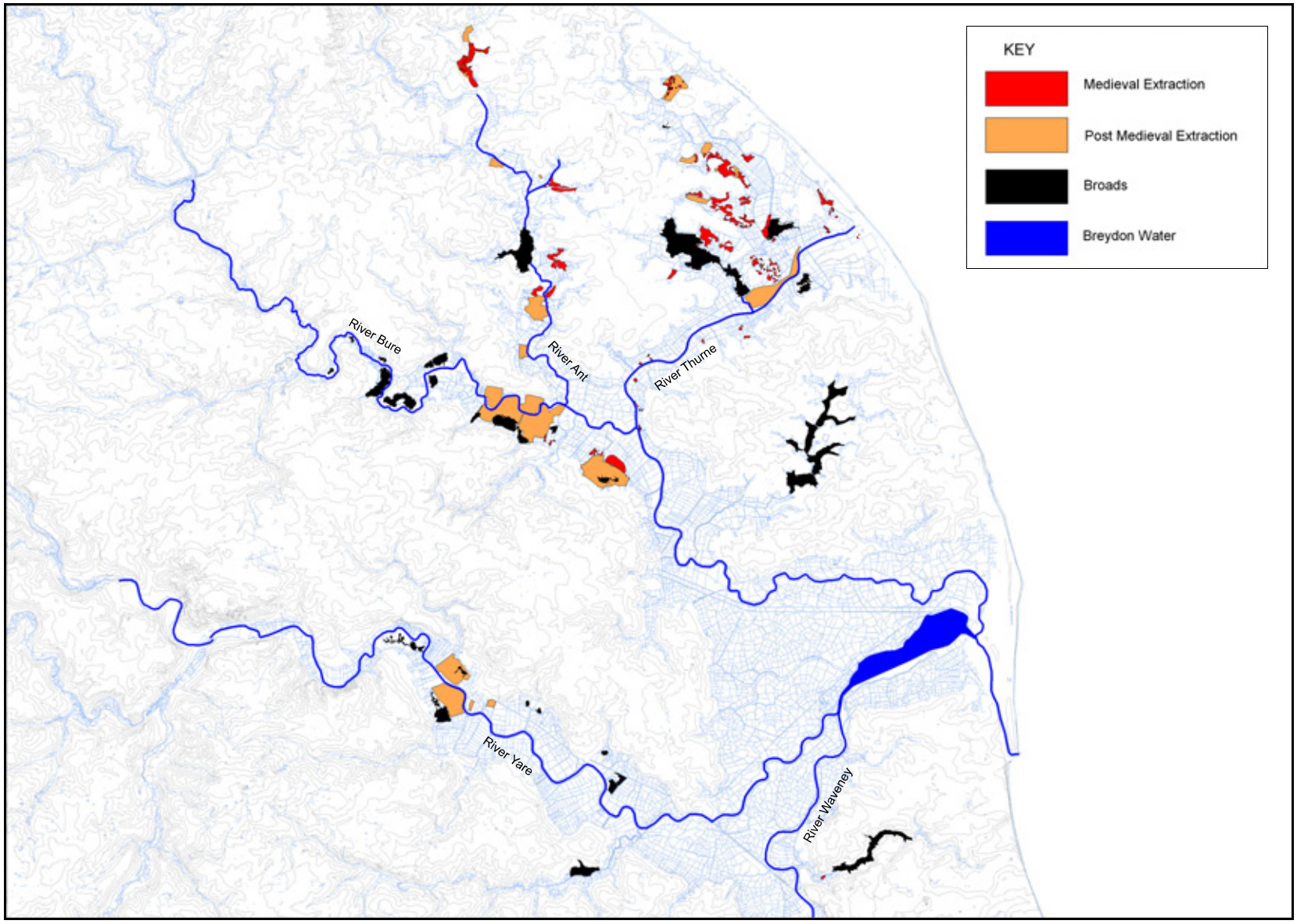

Figure 6.1. Distribution of peat extraction areas mapped from aerial photographs

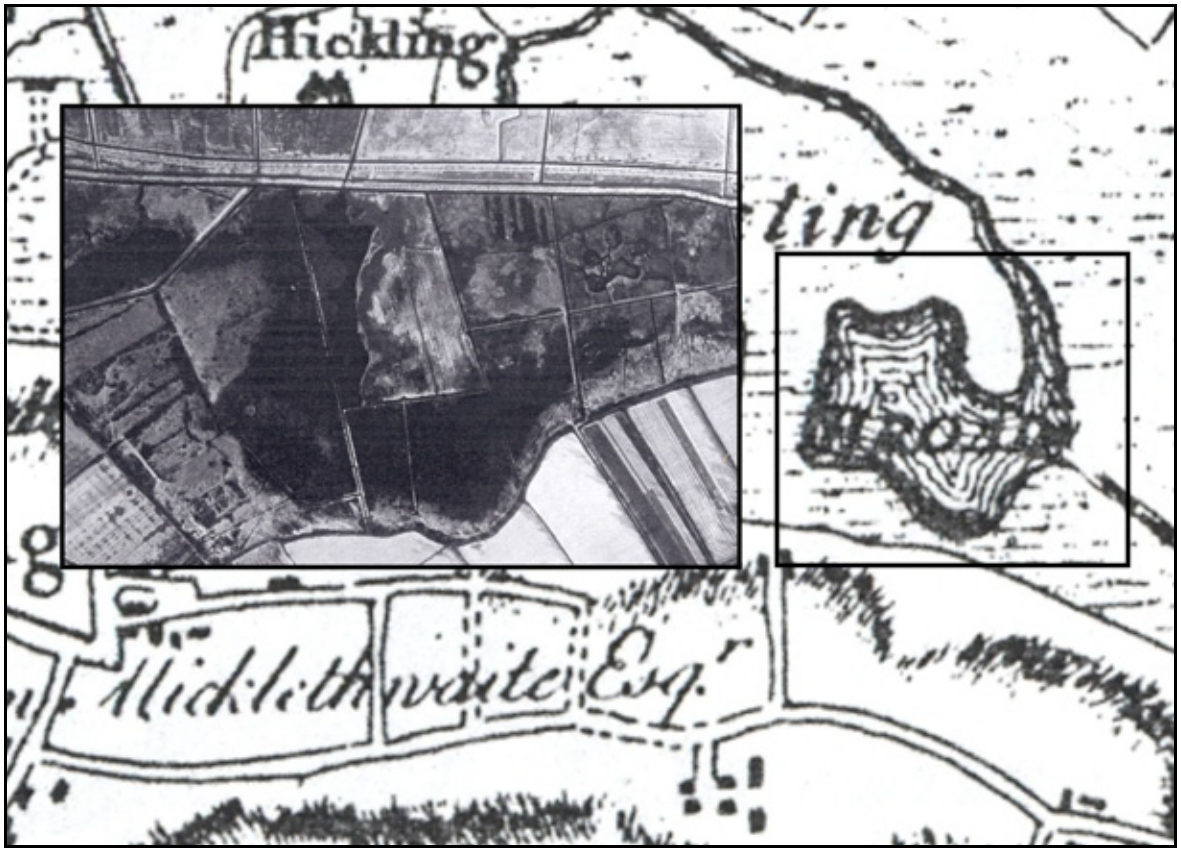

Figure 6.2. Composite illustration showing the depiction of Wiggs Broad (NHER 35363) on Long Gore Marsh, Hickling, on Faden's 1797 *Map of Norfolk* and, inset, the remains of the same peat cutting visible on a RAF photograph from 1943. (RAF AC/161 5144 04-JAN-1943. English Heritage (NMR) RAF Photography)

Figure 6.3. A RAF aerial photograph from 1946 showing the remains of Gage's Broad (NHER 32157) and other peat cuttings on the Hickling Poor Allotment. The NMP mapping for this area and its depiction on the 1842 Hickling Tithe map can be seen in Figure 6.4. (RAF 106G/UK/1634 4102-3 09-JUL-1946 (Norfolk HER TG 4322A)

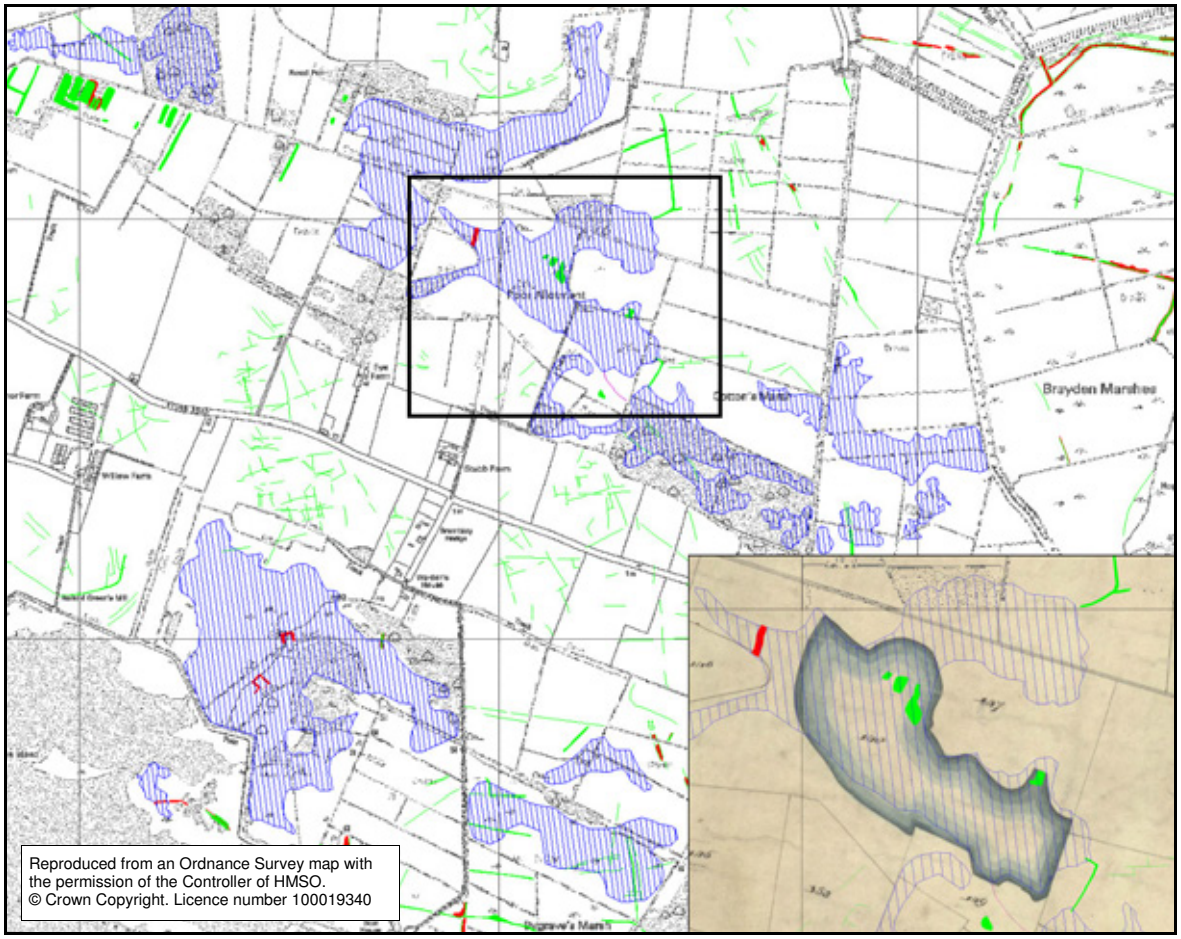

Figure 6.4. The NMP mapping of former peat extraction areas to the north of Hickling Broad (shaded in blue). The inset illustration shows the depiction of the main cutting, Gage's Broad (NHER 32157) on the 1842 Hickling Tithe map (NRO DN/TA 748).

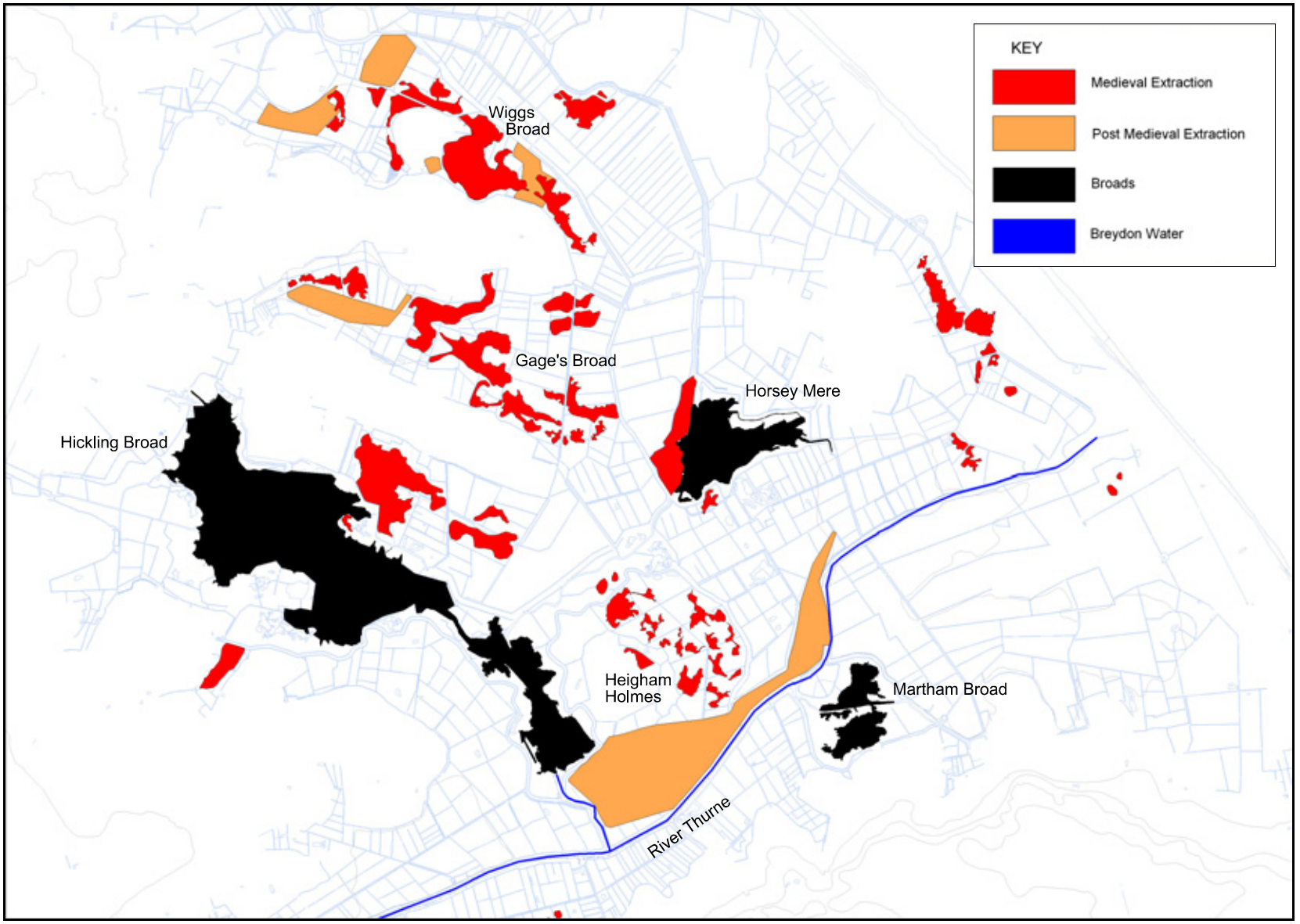

Figure 6.5. Map showing extraction sites mapped from aerial photographs within the Thurne Valley in the vicinity of Hickling Broad

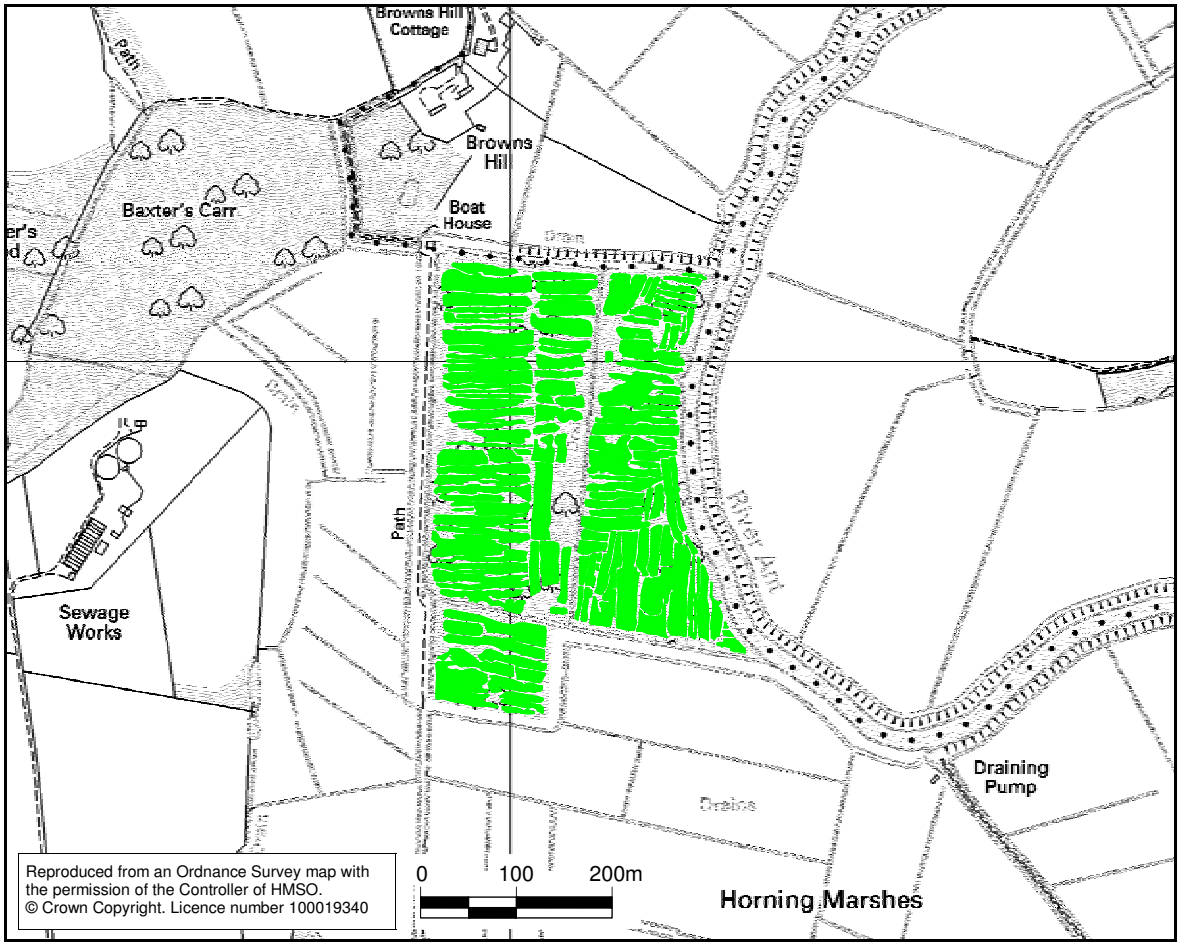

Figure 6.6. NMP mapping of an area of post medieval peat extraction on Horning Poor Allotment (NHER 49270).

A

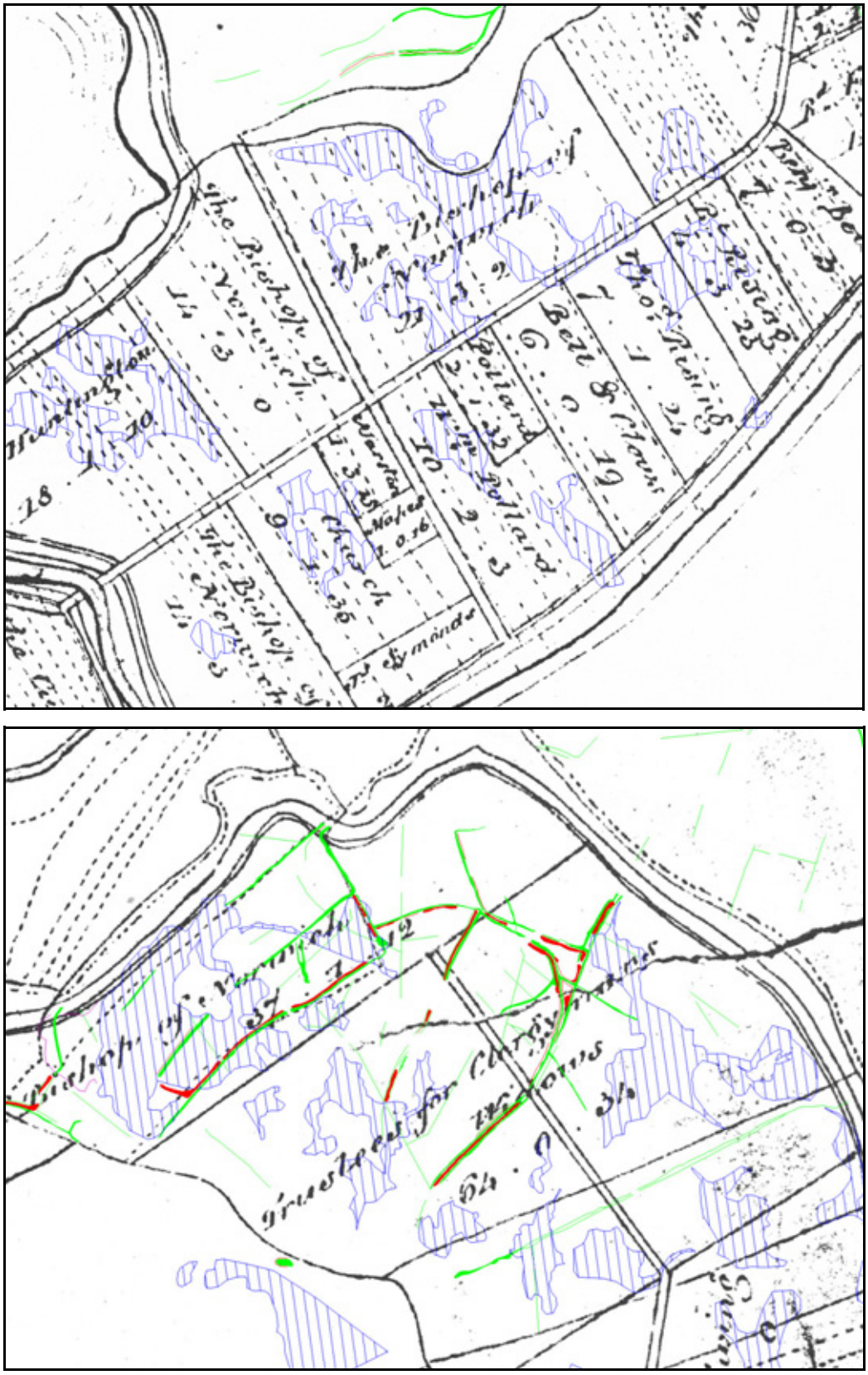

Figure 6.7. NMP mapping of peat and clay extraction areas and drainage ditches at Heigham Holmes, Potter Heigham, overlain over the 1801 Potter Heigham Enclosure map. (A) shows extraction of probable post medieval date that corresponds in part to the dole allotments marked on the map. (B) shows extraction of probable medieval date overlain by a series of curvilinear and rectilinear boundaries and drains of medieval to post medieval date.

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