

Climatic Fluctuations and Settlement in Medieval Norfolk, c. 500 – 1500 CE

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Thesis submitted to the University of East Anglia for the degree of Doctor of Philosophy

School of History

Submitted May 2025

Acknowledgements

To my wife, Hannah, whose unwavering support and many cups of tea carried me through countless late nights, and to my feline companions, Betty and Ziggy, for their constant company along the way.

I would also like to extend my warmest gratitude to CHASE and the AHRC, without whose support this thesis would not have been possible.

Abstract

This thesis utilises archaeological, geological, and palaeoclimatic data to determine whether changes in climate had an impact upon the macro-spatial development of settlement in Norfolk between c. 500 and c. 1500 CE. The study focuses on four of Norfolk's most distinct, climatically-sensitive environments: the south-central claylands, Breckland, and the west Norfolk Marshland and Peat Fen. Settlement in these marginal environments have the highest likelihood of exhibiting responses at a macro-spatial scale to changes in climatic inputs. Spatial analyses performed within GIS are the principal modes of investigation, with the distribution of potsherds mapped against surface geological and hydrological data to build an image of historic settlement and environment over the course of ten centuries in targeted study areas within each of the marginal environments. These analyses are subsequently compared against a climatic narrative built from an extensive review of modern palaeoclimatic reconstructions to ascertain the degree to which climatic fluctuations have influenced the development of settlement. The results of these analyses reveal that whilst climatic fluctuations may have had some limited impact upon a handful of individual sites, static environmental and anthropogenic factors such as surface geology, topography, advances in agricultural technology, and changes in modes of exploitation were far more significant drivers of settlement change at the macro-spatial level.

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Introduction

This thesis seeks to determine whether macro-spatial changes in settlement¹ in rural medieval Norfolk can be linked to historic fluctuations in climate between c. 500 CE and c. 1500 CE. This will be achieved by thoroughly reviewing modern palaeoclimatic literature to construct an up-to-date chronology of climatic change in Norfolk, after which the geological character of Norfolk's landscape will be investigated and any climatic vulnerabilities established. Data produced by large-scale archaeological fieldwalking surveys will be digitised and mapped in GIS alongside modern archaeological datasets such as the Portable Antiquities Scheme (PAS) and the Norfolk Historic Environment Record (NHER). These data – and the wider historical context – will be interrogated against the geological environment and the climatic narrative to determine whether shifts in settlement were being driven by changing climatic conditions. It is hoped that this thesis will further our understanding of the relationship between fluctuations in climatic conditions and medieval settlement. The devastating consequences of anthropogenic climate change are only now dawning on modern society, and there can be little doubt that studies investigating the link between climatic change and its impact upon the anthropogenic landscape have never been more relevant.

The core research question

The majority of landscape historical and archaeological scholarship presents rural medieval settlement in England as being driven primarily by human agency. Since the mid-twentieth century, however, a more environmental interpretation has been developed, promoting factors of the environment – most notably geology, pedology, and topography – as vital drivers of change in the medieval English landscape, although it is important to note that these environmental factors are commonly presented as being secondary drivers against the more influential anthropogenic drivers such as advancements in agricultural technology, changing modes of exploitation, and societal and cultural shifts. Everitt, Homans, Thirsk, and Kerridge were instrumental in developing this more environmental reading of the landscape, but it has only been in the past three decades that the foundations laid down by these scholars has been developed into a 'true' environmental interpretation of the English landscape, one where environmental drivers are held as the primary drivers of landscape development (Hoffman 2014; Homans 1960; Thirsk 1957, 1987, 2000; Williamson 1993, 2012; Williamson *et al.* 2013). Williamson, the leading figure in this 'true' environmental interpretation has, for the past three decades, advocated that factors of the natural environment – geology, pedology, topography, and hydrology – played the leading role in shaping the English medieval landscape, although this is not to

¹ The term 'settlement' is used in its broadest sense to describe the entirety of the anthropogenic landscape, from places of occupation to areas used for agriculture, industry, religion, and transport.

say that this more 'enviro-centric' interpretation dismisses anthropogenic factors as a driving force; as will be discussed in Chapter One, this is clearly not the case.

Williamson's interpretation does, however, contain a notably underdeveloped point. Whilst his work has linked the development of the English medieval landscape to factors such as geology, pedology, topography, and hydrology – factors which can best be described as *static* – very little attention has been paid to environmental factors which can be described as *dynamic*, with the primary dynamic influence being climate. The unwillingness of English landscape historians and archaeologists to interact with climate is perhaps due to a widespread aversion to interacting with primary climatic literature and data (Ljungqvist 2020: 1-3). Whilst terms such as the 'Medieval Warm Period' and the 'Little Ice Age' frequent the *corpus*, historians and archaeologists seem to be too willing to source their climatic information from outdated texts which usually – although not always – appear to regurgitate Professor Lamb's climatic narrative, a narrative which has long been proven as inaccurate (Dark 2000: 27; Lamb 1965: 13-37; Williamson 2012: 44-6). The emergence of a more environmental narrative should have prompted a greater exploration of palaeoclimatology by archaeologists and historians, but as will be discussed in Chapter One only a handful of landscape historical and archaeological works have engaged with modern palaeoclimatological literature, with the vast majority of these belonging to the international – rather than the specifically English - *corpus*. By engaging with palaeoclimatic literature from the outset and ensuring that both palaeoclimatological literature and historical and archaeological literature receives equal attention, it is hoped that the shortcomings of previous investigations will not be repeated in this thesis.

As we are all too aware of in the present day, climate change can alter the state of the physical landscape – particularly soils – in potentially dramatic ways; heavy clays can become waterlogged for months on end in periods of extreme rainfall, whilst lighter soils can be baked dry in times of elevated temperatures and reduced precipitation. Fluctuations in climate and variations in the physical landscape (and how they interact with each other) will form the independent or explanatory variables, whilst the archaeological and historical evidence will form the dependent or response variables. Framing the investigation in this way is necessitated by two salient facts: the unknown and largely uninvestigated interaction between climatic fluctuations and English medieval settlement, and the 'known' interaction between climatic variables and the physical landscape. 'Known' is used here cautiously. The way in which climatic variables – such as temperature and precipitation – interact with the pedological environment is 'known' at a basic level; heavy precipitation on clays will cause waterlogging, whilst increased temperature will increase rates of evapotranspiration on sandy soils. How specific landscapes within Norfolk react to changing climatic variables requires detailed analysis to understand (and is thus arguably not 'known'), but ultimately the basic principles are already

established to allow for this analysis. Conversely, how medieval settlement at a macro-spatial scale in medieval Norfolk is influenced by changes in climatic variables is not understood even at a basic level. This ensures that the independent or explanatory variable must be climatic fluctuations and prevents alternate framings of the core research question, which must ultimately be this: did climatic fluctuations influence the development of settlement at a macro-spatial scale in medieval Norfolk?

Settlement, occupation, and activity

The terms 'settlement', 'occupation(al)', and 'activity' feature prominently in this thesis; a brief explanation of these terms is required. The term 'activity' is used in this thesis to refer to any area of the physical landscape where evidence of historic anthropogenic presence has been detected that has *not* been interpreted as a place of occupation or industry. Thus, 'activity' is most commonly used to refer to physical locations where, for example, light scatters of sherds indicative of arable cultivation have been identified – the so-called 'manuring scatters' which will be discussed in Chapter One – rather than to locations with denser, more concentrated scatters which are likely indicative of habitation or industrial activity. 'Occupation', 'occupational', and 'occupational complex' is used to describe areas of the landscape where the evidence has been interpreted to indicate a place of sustained human presence, such as places of habitation, industry, or agricultural infrastructure such as farmsteads; these are often analogous with the term 'site' which will be discussed in detail in Chapter Three. Finally, the term 'settlement' is used in its broadest sense to describe the entirety of the anthropogenic landscape, from places where 'activity' has been identified to sites where 'occupation' is heavily implied.

Introducing the study area

The environment is not a homogenous entity. For example, environmental and climatic conditions in Cumbria, whether that be rates of precipitation, temperature, or its geological or pedological composition will invariably differ from the environmental conditions present in Norfolk; indeed, even at a county scale environmental conditions can vary dramatically. The same is true for medieval settlement, and thus in order to maximise the potential returns of this investigation the study area must be of limited size. Given the range of landscape types found within Norfolk and its excellent archaeological and historical record, it is the ideal county in which to undertake an investigation such as this. The county's importance in the medieval period is also a considerable advantage, for the landscape was densely settled even in the most marginal environments. This latter quality is of particular significance.

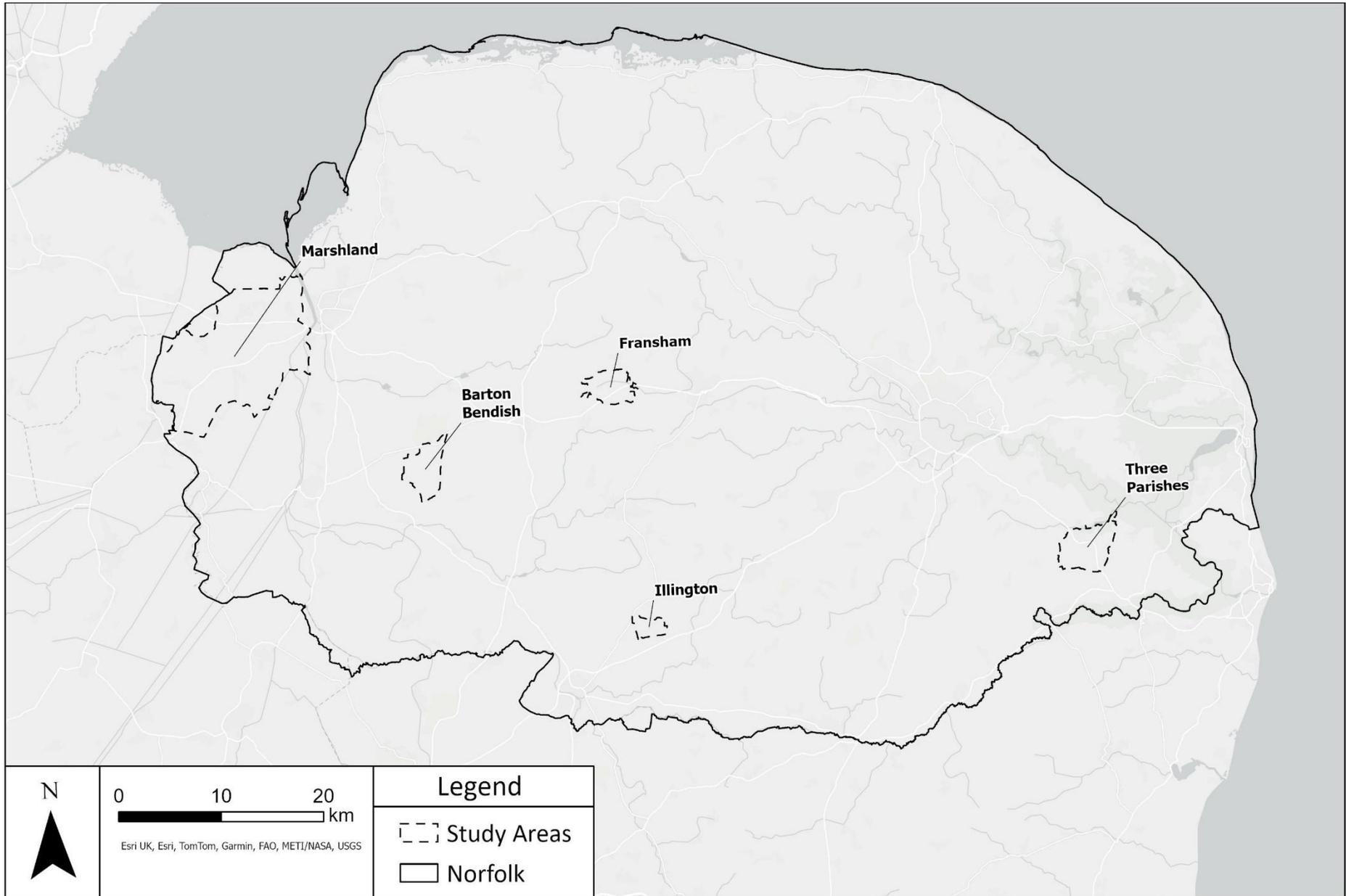


Figure 1: Study areas.

As mentioned above, both environmental and anthropogenic variables vary significantly even at a county scale; analysing Norfolk as a single entity would result in generalised conclusions and a considerable loss of accuracy at a more localised scale. In order for any correlation between climatic fluctuations and shifts in medieval settlement to be easily identifiable, it is necessary to focus on the physical landscapes within Norfolk which will logically produce the most 'extreme' reactions to climatic fluctuations.

Focusing on marginal landscapes is critical. For example, the loams of north-east Norfolk are relatively capable at handling both increased and decreased precipitation; their response to climatic fluctuations would therefore be less severe than a more marginal environment such as the parched sands of the Brecks. This thesis will therefore focus on four of Norfolk's most distinctive marginal environments: the south-central Claylands; Breckland; and the west Norfolk Marshland and Peat Fen. The principal characteristics of these distinctive marginal landscapes are briefly introduced below to allow the review of the archaeological fieldwalking surveys to reference these environments. A far more detailed analysis of these landscapes will be undertaken in Chapter Four, with the methodological processes utilised in defining their spatial extent discussed in Chapter Three.

The south-central claylands

The south-central claylands is the largest of Norfolk's four marginal environments investigated in this thesis, covering large tracts of land in south- and central-Norfolk. As its name suggests, this landscape possesses particularly heavy, clayey soils, with clayey loams dominating the landscape. It struggles with drainage, for the tight clays are particularly susceptible to waterlogging; any periods of increased precipitation would make these soils particularly difficult to work. It is largely synonymous with the extensive boulder clay plateau that occupies this part of the county.

Breckland

Breckland is perhaps Norfolk's most distinctive geological environment, with this region characterised by light, sandy soils of variable depth. Unlike other parts of the county, where the solid geology often lies at some depth from the surface, the chalky underlying geology of Breckland can lie just centimetres from the surface, whilst in other places the chalk can lie at considerable depth. These unique characteristics are a direct result of past glaciations, with the landscape of Breckland being one defined by its periglacial heritage. The sandy soils of this landscape ensures that it is a lack of water which is the most pressing issue, with any hydrological input quickly drained through the coarse, sandy soil, which has the unfortunate consequence of washing out precious minerals. This environment is notably hostile, with the soils frequently being dry and infertile.

Marshland

The west Norfolk Marshland (referred to as 'Marshland') is one of Norfolk's wettest environments and is one of two landscapes occupying west Norfolk's fenland. This low-lying landscape is characterised by its silty and clayey wetland soils, with this region being heavily influenced by its proximity to the sea. Saltwater and freshwater incursions and regressions have been a common fixture in this landscape for thousands of years, and it has only been with extensive drainage efforts that this landscape has been rendered habitable. Even then some parts of Marshland, especially in the wetter and more low-lying south were simply too wet and too low-lying to have been settled in the Middle Ages.

Peat Fen

The west Norfolk Peat Fen (referred to as 'the Peat Fen') is, along with Marshland, one of Norfolk's wettest environments and constitutes the second landscape within Norfolk's western fenland. Whilst Marshland is predominantly silty and clayey, the Peat Fen is characterised by peaty and clayey soils; this, combined with the fact that it is more low-lying than Marshland ensures that for much of the year this landscape would have been underwater, with saltwater incursions potentially flooding this area for extended periods of time. It is therefore unsurprising that this landscape was rarely 'settled' in the Middle Ages, instead being utilised as an extensive area of grazing.

Thesis structure

Following the introduction this thesis is composed of eight chapters. Chapter One is a literature review of medieval settlement scholarship – both in an English and an international context – and of the various archaeological fieldwalking surveys utilised in this thesis. Chapter Two begins with an overview of differing forms of palaeoclimatological data before moving onto a literature review of modern palaeoclimatic literature, which to this author's knowledge is the first time such a review has been conducted in English landscape archaeological literature. This review will focus on sixteen individual temperature or precipitation reconstructions, with the advantages and disadvantages of their varying methods of reconstruction being discussed; the conclusions reached by this review will determine which reconstructions will form the climatic narrative against which the environmental and archaeological data will later be compared. Following this, Chapter Three will present and discuss the methodological framework and data sources utilised by the analyses in Chapters Four, Five, Six, and Seven. The first of these analyses in Chapter Four will investigate the pedological, topographical, and hydrological characteristics of the four marginal landscapes mentioned previously, with this analysis discussing in detail the profiles, capabilities, and textural composition of their various soils before

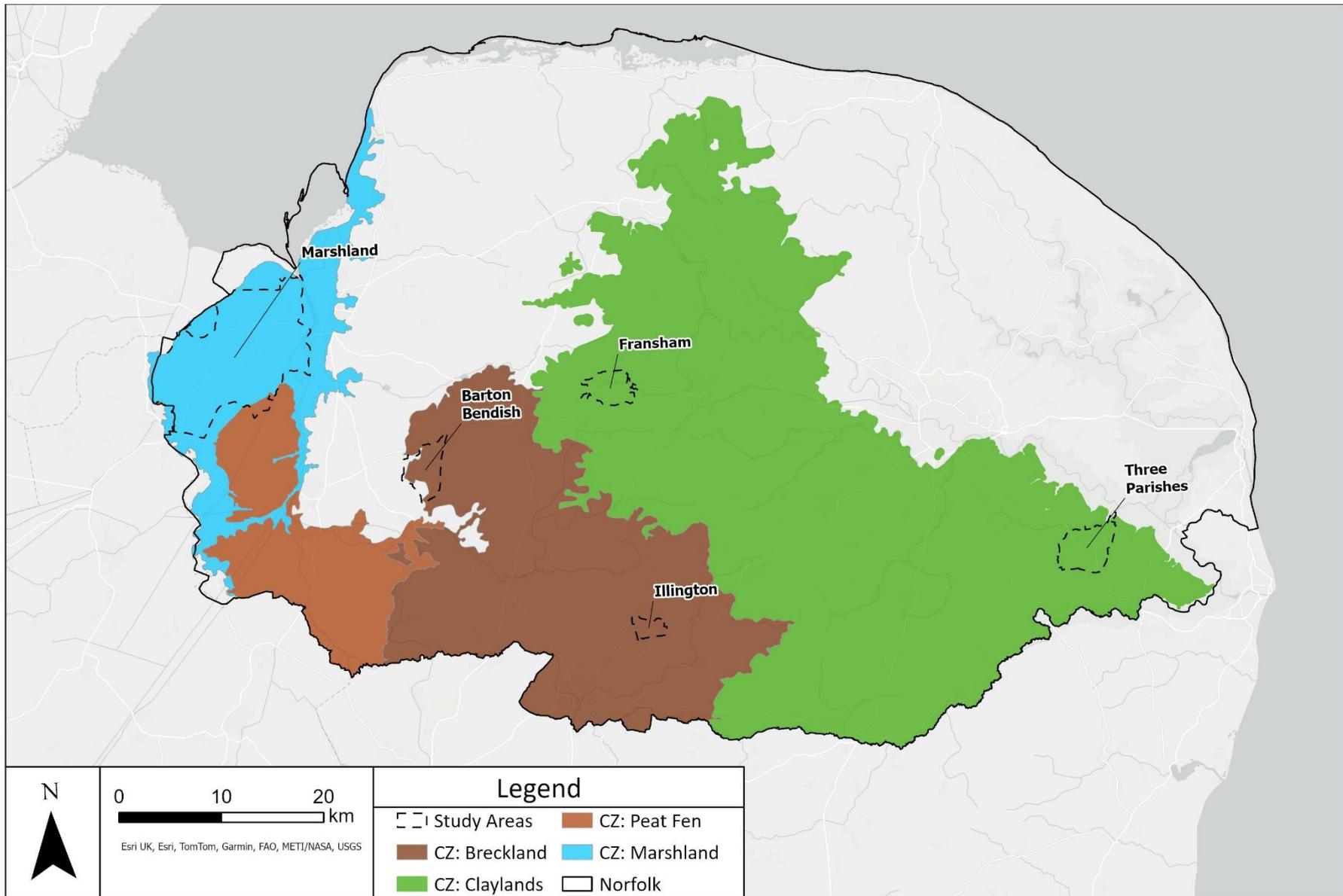


Figure 2: Study areas shown against identified 'Character Zones' (CZs) composed of soils that share similar characteristics. Chapter Three and Four discusses the formulation and qualities of these CZs in detail.

assessing how they respond to climatic variables. With the environmental character established, Chapters Five, Six, and Seven (which focus on the south-central claylands, Breckland, and the Marshland and Peat Fen respectively) will undertake spatial analyses investigating the relationship between environmental characteristics and the archaeological evidence over the *long durée*, with this then compared to the climatic narrative established in Chapter Two to determine whether there is any correlation between these variables. Finally, Chapter Eight will present the conclusions reached by this thesis.

Temporal conventions

This section details the conventions used in this thesis and provides a glossary of abbreviations. This thesis covers a one-thousand-year interval between c. 500 CE and c. 1500 CE, encompassing the beginnings of Anglo-Saxon England through to the termination of the medieval period c. 1500. Due to the temporal characteristics of the climatic reconstructions utilised in later analyses, a start date of c. 500 was more appropriate than the ‘traditional’ c. 410 date for the initiation of the early Saxon period. Whilst strictly laying outside of the temporal span of this thesis (c. 500 – c. 1500), a definition for the Romano-British period is provided as this period provides greater context to the early Saxon period. In order to improve readability and make comparisons more clearcut, this thesis will refer to specific named ‘periods’ rather than providing a range of centuries. These periods are:

| Period Name | Temporal Range (CE) |
|----------------|---------------------|
| Romano-British | c. 43 to c. 500 |
| Early Saxon | c.500 to c.720 |
| Middle Saxon | c.720 to c.850 |
| Saxo-Norman | c.850 to c.1150 |
| Medieval | c.1150 to c.1350 |
| Late medieval | c.1350 to c.1500 |

Table 1: Temporal span of named periods.

These periods are based primarily upon material culture. Whilst Rippon has highlighted how such an association between material culture and the traditional ‘periods’ often used in historical and archaeological literature can be problematic, this critique is far more appropriately applied to those regions outside of eastern and south-eastern England which lack diagnostic ceramic evidence (Rippon 2008: 8). For example, the middle Saxon period (c. 720 to c. 850) is analogous in Norfolk with Ipswich Ware, a type of pottery produced and used in East Anglia which has been dated by Blinkhorn to the c. 720 to c. 850 period (Blinkhorn 1999; 2012). Applying the term ‘middle Saxon’ to an East Anglian location in this period is thus accurate, for the period is synonymous with pottery produced and used in this specific region.

The usage of the term 'Saxo-Norman' is potentially the most problematic of these periods. As mentioned above, the need for concisely named periods is critical in improving the overall readability of subsequent analyses. Thus, the period running from c. 850 to c. 1150 which has Thetford Ware, St. Neots Ware, and Stamford Ware as its primary diagnostic ceramic is labelled as Saxo-Norman, even though it encompasses the traditional Saxo-Norman period (c. 850 to c. 1066) and the traditional Norman period (c. 1066 to c. 1150). Rather than using the rather clunky 'late Saxon and Norman' term to describe this period – with the inclusion of 'and' often making later comparisons difficult to follow – the term 'Saxo-Norman' has been chosen, even though it is usually applied to the c. 1060 to c. 1100 period. This is due to both its concise nature and the simple fact that it references both the late Anglo-Saxon period – which is applicable to the first half of the c. 850 to c. 1150 period – and the subsequent Norman period – which is applicable to the second half of the c. 850 to c. 1150 period.

Chapter One: Narratives of Landscape Development and Archaeological Fieldwalking Surveys

Narratives of landscape development

Introduction

The origin of England's medieval landscape has long been a source of debate amongst historians and archaeologists. Early interpretations tended to frame this development through a perceived dichotomy between the anthropogenic and the environmental. For many, explanations were rooted in human agency — emphasising technological, societal, and cultural change as the principal forces shaping the development of medieval settlement. Others, however, have argued that the primary drivers of settlement development are environmental, championing factors such as geology, pedology, hydrology, and topography.

In recent years, this long-standing binary has been increasingly challenged by both English and international scholarship. Interdisciplinary and climatically-aware research has demonstrated that neither cultural nor environmental factors operated in isolation, and that the medieval landscape should instead be understood as a product of reciprocal feedback between human agency, physical geography, and the dynamic forces of climate (Ljungqvist *et al.* 2020; Büntgen *et al.* 2021; Costello 2021; Lasher and Axford 2019; Xoplaki *et al.* 2016; Raposeiro *et al.* 2021). This recognition of interdependence has shown that climatic fluctuations produced regionally varied but socially significant pressures on settlement and agriculture (Lasher and Axford 2019; Xoplaki *et al.* 2016; Raposeiro *et al.* 2021). Furthermore, rather than replacing the traditional focus on social agency, these studies consider how this fits within a broader environmental framework, moving past traditional dichotomies (Costello 2021; Rippon 2001b). This chapter will trace how this interpretive evolution unfolded within the historiography of medieval settlement.

Environmental determinism

A key theme throughout this chapter is that of environmental determinism, which holds that the physical environment is the primary determinant of anthropogenic development (Plunkett *et al.* 2013: 17-31). This principle is not a twentieth- or even nineteenth-century construct, with the first examples of environmentally deterministic thought emerging in the ancient world. The ancient Chinese philosopher Guan Zhong wrote that the characteristics of major rivers determined the temperament of those peoples residing in their vicinity, whilst the medieval Arab polymath Ibn Khaldun suggested that physical factors of the environment – namely soils, climate, and food – determined whether a

society was nomadic or sedentary (El Hamel 2002: 29-52; Gates 1967: 415-22). In the nineteenth and twentieth centuries environmental determinism was widely adopted by European and North American writers as justifications for colonialism, imperialism, and racism in African, South American, Asian, and Oceanic countries (Gates *et al.* 2011: 17-24; Gallaher *et al.* 2009: 115-23, 127; Warde *et al.*, 2018: pp.33-4). For example, Thomas Jefferson suggested that the warm, tropical climates inherent to these places promoted degenerative societies, whilst Adolf Hitler utilised the concept to promote the primacy of the Nordic race over what Nazism perceived as those of 'subhuman' ancestry (Gates *et al.* 2011: 17-24; Gallaher *et al.* 2009: 115-23, 127). By linking indigenous populations with the environment in which they lived allowed western writers to 'render the subordinate group incapable of reflection and progress, legitimizing rule...' (Warde *et al.*, 2016: pp.33-4).

It is possible that the links of environmental determinism to the horrors of Empire and the Second World War made it a somewhat 'dirty' topic for historians in the difficult post-war period, a period that is defined by decolonisation and a growing sense of hostility towards past and present imperialism. Frenkel has discussed the concept of environmental determinism being a 'dirty' topic through investigating American actions in the Panama Canal Zone, demonstrating how environmental determinism contains a pervasive undercurrent of imperialism and racial prejudice (Frenkel 1992: 143-153). This can, perhaps, offer an explanation as to why the majority of landscape historical literature tended to focus on the anthropogenic in the post-war period.

However, this is not to say that the environmental narrative was entirely absent during this period, for interestingly this was precisely the time when the environmental narrative was being developed and slowly expanded upon, albeit by only a handful of English landscape and agricultural historians. One explanation for this dichotomy between mainstream disdain and the growing enthusiasm for a more environmentally deterministic reading of the landscape amongst English landscape and agricultural historians is perhaps explained by the difference in scope and geography between these two groups. Mainstream commentators were viewing environmental determinism on a global scale, attributing it to the forces of global imperialism and institutional racism within sovereign nations. Conversely, landscape and agricultural historians were viewing it at a maximum scale of England alone and were specifically relating it to the development of the English landscape at a village and field scale rather than through a global lens.

Environmental determinism was once more revived in the late-twentieth century in what has been termed 'neo-environmental determinism' (Sluyter 2003: 813-7). Diamond, a prominent proponent of this 'new' iteration of environmental determinism has argued that physical geography was a primary determinant of state formation in the pre-early modern period, with this theory being continued by

the economists Acemoglu, Johnson, and Robinson (Acemoglu *et al.* 2012; Diamond 1997). It is perhaps telling that a truly 'environmental' take on the development of the historic landscape only emerged in the late 1990s and 2000s, a time when the detrimental effects of human actions upon global environmental systems was beginning to be widely reported upon. This is conceivably one of the reasons why the wider concept of environmental determinism was experiencing a revival and had perhaps shed some of its more negative connotations, although this should not be taken to suggest that it had shed all of its perceived toxicity, for this was clearly not the case.

Ultimately, it is unsurprising that landscape historians began to weave environmental determinism into the study of the English landscape – an entity which is synonymous with the environment which surrounds us – as it is inextricably linked with factors of physical geography, regardless of whether one ascribes to an anthropocentric or environmental narrative of English landscape development.

The anthropogenic and the environmental

Whilst works investigating the origin and development of the English medieval landscape in the early- and mid-twentieth century tended to lean towards a more anthropocentric narrative with regards to change in medieval settlement morphology and changes in modes of exploitation – with these being most commonly attributed to cultural, societal, or technological developments – the beginnings of a more 'environmental' narrative were nevertheless beginning to emerge in the works of landscape and agricultural historians. The works of Everitt, Homans, Hoskins, Kerridge, and Thirsk were all critical in developing this burgeoning environmental narrative. (Everitt 1977; Homans 1960; Hoskins 1985; Kerridge 1973; Thirsk 1963). For example, in Kerridge's 1973 *The Farmers of Old England*, he comments that 'in the rural life of old England, what each man could best turn his hand to depended largely on the environment into which he was born... [and] it depended on whether the climate were wet or dry, the soil light or heavy, the roads good or bad, the market places near or far' (Kerridge 1973: 70). In 1967, Thirsk wrote that 'the geography of England imposed strict limitations... beneath the manmade landscape, and underlying all the institutions of society which differentiated neighbouring communities and united widely separated ones, nature had laid a foundation which men were forced to accept', with a similar quasi-environmentally determinist narrative being voiced in 1987, where she claimed that 'an exceptional region in the south east was the Weald of Kent where the heavy clay soils imposed pasture farming' (Thirsk 1967: 2; Thirsk 1987: 14). Everitt's classic 'river and wold' model is also a product of this time, with this model being arguably one of the most lasting and impactful products of these early pioneers of an environmental take on English rural landscape development (Everitt 1977). Even the twentieth-century American sociologist G. C. Homans, wrote in 1960 that 'an important part of the environment of a village is the soil...' (Homans 1960: 407).

There is thus an undercurrent of environmental determinism present in some twentieth-century English landscape historical works, where factors of the environment are seen to be partially determining the pattern of settlement and modes of exploitation, although as Homans makes clear, these environmental factors ran concurrent with anthropogenic factors: 'the study of landscapes... is more than the study of geography and geology; it is more than the study of techniques of farming and forestry; it is the study of societies as wholes, in so far as their form is determined by or determines their use of the land' (Homans 1960: 12). This is a critical point to note, for at no point was the anthropogenic narrative dismissed or thrown by the wayside, for it was clear that it should run alongside anthropogenic factors. The strong rebuke and subsequent vilification of the environmental narrative is thus difficult to understand when this point is considered.

Perhaps the most notable challenge to this early environmental narrative was provided in 1983 by Taylor, who argued that 'while there are clearly certain general physical determinants which cannot be ignored... most of the specific determinants of settlement location are probably not concerned with the physical nature of the site at all... the physical nature of the site is of far less importance in the decision to settle there than the human factor' (Taylor 1983: 12). Taylor's rejection of what he termed 'geographical determinism', which he claimed has 'dogged all studies of settlement' is, as evidenced above, a half-accurate observation – after all, the environmental narrative was being developed over the course of the twentieth century and it did use factors of the environment to partly explain landscape development – but his and others' strong rejection of this narrative was an overreaction, one which can perhaps be explained, at least in part, by the 'dirty' connotations that still clung to the concept of environmental determinism in the post-war period. Nevertheless, at no point was there a push by those developing the environmental narrative to disregard the anthropogenic, and thus it is strange that this narrative faced such a backlash (Taylor 1983: 12).

Whilst few modern landscape historians and archaeologists would take such a hard-line stance as that taken by Taylor in 1983, it serves to highlight the disdain which environmental interpretations of landscape development have often received. Even as recently as the 2010s a particularly strong response to a narrative which places the natural environment either ahead or on an equal footing with anthropogenic factors is evident; Draper, for example, criticised Williamson's 2012 *Environment, Society and Landscape in Early Medieval England*, suggesting that it 'should be regarded as representing a view that is deliberately provocative in downplaying cultural factors in favour of environmental ones. Readers are best advised to consider it alongside other literature in the field before forming their own opinions' (Draper 2013: 592). It seems unlikely that a piece of literature which placed the anthropogenic over the environmental would receive such a seemingly ideologically driven critique, with Draper's comments appearing to be rooted in an almost Taylor-esque refutation

of any non-anthropocentric narrative. Indeed, Rippon has highlighted that the term 'social agency' – which for all intents and purposes is a veiled way of saying 'anthropogenic determinism' – is widely used in modern literature, and there can be little denying that this term does not provoke the same kind of knee-jerk reaction that 'environmental determinism' often does (Rippon 2012: 2-4). Whilst Draper's criticism falls short in using the phrase 'environmentally deterministic' – a phrase which Rippon has observed is now used as a 'damning criticism' – the implication is nevertheless evident (Rippon 2012: 3).

It is thus unsurprising that English landscape historical and landscape archaeological literature has tended to emphasise the anthropocentric narrative over the environmental, for the somewhat 'dirty' label of 'environmental determinism' can very easily be hung over any work which champions factors of the environment.

The terrestrial and the climatic

Environmental interpretations of the development of the historic rural landscape have thus had a long presence – if not long acceptance – in English landscape archaeological and historical literature, yet the forms of evidence emphasised have remained largely terrestrial – soils, geology, hydrology, and topography. Even studies that place environmental factors at the centre of interpretation tend to treat climate as a largely static backdrop, with temperature and precipitation acknowledged as influencing soil conditions, cultivation windows, and growing seasons, but their temporal variability rarely forms part of the analytical framework (Williamson 2012). For example, in Williamson's *Environment, Society and Landscape in Early Medieval England*, explicit engagement with climate is confined to a short section drawing primarily on pre-2000 palaeoclimatology, leaving little scope for considering how multi-decadal or centennial shifts may have influenced the development of medieval settlement. This reflects a broader trend within English landscape scholarship: while terrestrial parameters have been richly theorised, the temporally dynamic nature of climate remains comparatively underdeveloped. The following chapter attempts to address this imbalance.

Over the past two decades, however, a more dynamic climatic narrative has appeared within international landscape literature. Macro-spatial analyses of anthropogenic settlement outside of an English context have utilised modern, high resolution palaeoclimatic reconstructions to show that climatic fluctuations – particularly changes in precipitation and temperature – interacted with environmental structures and anthropogenic systems in ways that produced highly variable, localised responses (Casely 2006: 55–7, 199–205, 227–30; Büntgen *et al.* 2011: 579–81; Xoplaki *et al.* 2016: 246–9; Lasher and Axford 2019: 267–9; Büntgen *et al.* 2021: 190–6). These studies all emphasise that settlement responses to climatic fluctuations were highly dependent upon local environmental and

anthropogenic variables, and that simple causal explanations cannot adequately reflect the ways in which climate interacted with local conditions to influence the development of medieval settlement (Casely 2006: 55–7, 199–205, 227–30; Büntgen *et al.* 2011: 579–81; Xoplaki *et al.* 2016: 246–9; Lasher and Axford 2019: 267–9; Büntgen *et al.* 2021: 190–6).

Modern palaeoclimatological research has enabled variations in temperature and precipitation to be reconstructed for the last two millennia, providing empirical climatic baselines for linking fluctuations to anthropogenic variables (Büntgen *et al.* 2011: 579–81). Macro-spatial analyses of settlement, demography, and economic change have shown that the high medieval centuries were characterised by generally favourable but spatially varied climatic conditions (Xoplaki *et al.* 2016: 246–9). Fluctuations in climatic conditions enabled intensification in some regions while constraining it in others; establishing firm causal links over broad geographical areas thus remains difficult due to the complexity and regional heterogeneity of climatic processes (Xoplaki *et al.* 2016: 248). In the North Atlantic, Casely's study of medieval settlement in Greenland shows that Norse occupation coincided with a period of relative warmth, although the study is keen to emphasise that climatic amelioration merely created opportunity; social organisation, agricultural strategies, and resource stress ultimately shaped the distribution, sustainability, and ultimately the decline of settlement (Lasher and Axford 2019: 267–9).

This interplay between the climatic, the environmental, and the anthropogenic has been built upon by more recent studies which have increasingly conceptualised climatic pressures as operating through complex anthropogenic and environmental feedback systems (Büntgen *et al.* 2021: 190–6). For example, a case study of maritime communities in the Azores demonstrated how shifts in winds and oceanic conditions during the high medieval centuries created windows of opportunity for settlement expansion, although these opportunities materialised only where they were supported by political power and maritime expertise, demonstrating the breadth of variables within these feedback systems (Raposeiro *et al.* 2021: 6). Recent research of medieval settlement in Ireland similarly views settlement as existing in a complex web of environmental and anthropogenic feedbacks, in which climatic variability intersects with adaptation strategies, social structures, and pedological and geological structures, with communities ultimately integrating environmental change into decision-making processes (Coyle 2023: 24).

In a British (rather a strictly English) context, relatively few studies integrate palaeoclimatic evidence directly into settlement analysis, although there are a handful of notable exceptions. For example, a macro-spatial analysis of lowland Britain that linked climatic variability to changes in wetland exploitation, coastal occupation, and agrarian expansion demonstrated that climatic shifts influenced

the feasibility, timing, and sustainability of pre-medieval and medieval settlement (Rippon and Fyfe 2019: 135–54, 148–51). Similarly, an analysis of the British uplands demonstrates that there was broad alignment between favourable climatic conditions and episodes of agricultural expansion, which subsequently retreated in cooler, wetter centuries, with these movements mediated by local environmental and anthropogenic variables (Costello 2021: 172–3). Beyond settlement studies, historical scholarship has also highlighted the influence of climate on England’s medieval economy and demography, linking short-term shocks and longer-term climatic shifts to fluctuations in health, grain production, and population (Campbell 2000; 2006; 2010; 2016).

These studies collectively demonstrate that climatic fluctuations did not occur uniformly across Europe. Rather, conditions varied markedly from region to region, with this climatic heterogeneity creating highly uneven opportunities for medieval communities. A solid understanding of a region’s palaeoclimate is thus a necessity, and the proliferation of palaeoclimatic reconstructions over the past three decades provides the researcher with all the data necessary to build such an understanding. In addition to this, the impacts of climatic fluctuations have been repeatedly shown to be filtered through local environmental and anthropogenic variables, creating a complex system of feedbacks that must be understood to accurately discern the relationship between climatic fluctuations and settlement.

Investigating the climatic

Recent international scholarship has thus established a strong foundation for understanding how climatic variability interacted with the anthropogenic and environmental systems that underpinned medieval settlement. Large-scale syntheses have demonstrated how palaeoclimatological reconstructions can be used to link fluctuations to demographic change, agricultural expansion and contraction, and shifts in settlement morphology (Casely 2006; Büntgen *et al.* 2011; Xoplaki *et al.* 2016; Lasher and Axford 2019; Ljungqvist *et al.* 2020; Büntgen *et al.* 2021). This thesis seeks to build upon these recent interpretations of landscape development by advancing a macro-spatial, climate-aware analysis of medieval Norfolk. It will bring together state-of-the-art palaeoclimatological reconstructions – as suggested by Ljungqvist *et al.* (2020: 16) – and soil, archaeological, and historical data specific to Norfolk to test whether shifts in precipitation and temperatures align with changes in settlement across the county's most marginal environments. Through systematic comparison of four contrasting marginal zones — the south-central claylands, Breckland, the west Norfolk Marshland, and the Peat Fen — this thesis will evaluate the relative influence of climatic variability, static environmental structures, and anthropogenic factors in shaping settlement across these zones.

Archaeological fieldwalking surveys

Introduction

Norfolk possesses one of the most extensive bodies of fieldwalking-derived data in England, owing largely to its predominantly arable landscape. For the purposes of this thesis, all discussion of fieldwalking refers specifically to its application to the study period (c. 500 to c. 1500 CE) unless otherwise stated. Fieldwalking is particularly well suited to reconstructing long-term settlement histories as where ceramic traditions are continuous, the distribution of surface artefacts can trace the evolution of settlement over the *longue durée*. In practical terms, fieldwalking surveys involve either an individual or a team of individuals physically walking across the landscape in a systematic manner with the objective of collecting archaeological material lying on the surface. Each individual is responsible for visually scanning a certain amount of ground around them as they walk across the landscape, with find spots and finds either bagged and plotted immediately or flagged for closer investigation later. Finds are catalogued producing datasets that can be mapped and interrogated within a GIS environment. Norfolk's agricultural regime provides favourable conditions for surface collection, with regular ploughing bringing artefacts into view, creating extensive areas that can be surveyed with relative ease. While this does not resolve all visibility issues — pasture, woodland, and urban environments remain problematic — it does enhance the likelihood that the macro-spatial distribution of medieval settlement can be detected at the resolution required for this thesis.

For the study period, the most frequently recovered material by fieldwalking surveys is ceramic potsherds, although building materials and industrial waste is also frequently recovered in varying quantities. Potsherds are particularly informative because they can often be dated with reasonable precision and many fabrics survive comparatively well in the plough soil, although it is important to note that their preservation is far from uniform. For example, Romano-British and later medieval wares are robust and often preserved intact, whilst early Saxon wares are particularly vulnerable to fragmentation and weathering. Identification difficulties can also increase where soils are acidic or heavily disturbed.

Whilst fieldwalking is well suited to macro-spatial analyses, it must be recognised that it is not without limitation. A growing body of development-led excavation demonstrates that some medieval settlements had minimal material culture assemblages, including very limited ceramic use (Lovell *et al.* 2007; Fletcher 2010; Brown and Bashford 2017). For example, short-lived farmsteads, sites under permanent pasture, and places where post-depositional processes have accelerated ceramic degradation all risk being underrepresented in fieldwalking datasets. For these reasons, an absence of ceramics cannot be equated with an absence of settlement. Fieldwalking ultimately identifies those

sites that generated, deposited, and preserved enough material culture to be archaeologically visible on the surface; it cannot capture those that fall outside this behavioural and taphonomic window.

The present study therefore adopts a multi-evidential approach to mitigate against this shortcoming. Fieldwalking remains the core datasets utilised for macro-spatial analyses, but it is supplemented by information from the Portable Antiquities Scheme (PAS), the Norfolk Historic Environment Record (NHER), and historical documentation and cartographic sources. Although PAS data are unsystematic and biased toward metalwork deposition, they can highlight areas of activity where ceramic use was low but where metal objects were lost or discarded. The NHER provides a further counterbalance, incorporating cropmark evidence, spatially referenced grey-literature excavation reports, and earthwork surveys that can reveal sites with little or no surface ceramic signature. Historical and cartographic sources offer additional lines of evidence, especially with regard to administrative records. It is hoped that by utilising a range of datasets that their individual limitations are mitigated against, ultimately providing a more nuanced evidential basis for discerning settlement patterns rather than relying solely upon fieldwalking data. The sources of data utilised in this thesis are explored more thoroughly in Chapter Three.

Due to the scope of the present investigation being limited to four marginal environments to maximise the likelihood of detecting macro-spatial settlement responses to climatic fluctuations, the number of surveys that can be included in the evidential base is necessarily restricted. Similarly, some surveys that intersect the study areas only marginally — such as Wade-Martins' *Village Sites in Launditch Hundred* — have been excluded because they do not supply findspot-level data or because the bulk of their coverage lies outside the relevant marginal zones. It is also necessary to note that this thesis has time constraints associated with CHASE funding, ensuring that the analytical focus must remain on those datasets that are most capable of addressing the core research question.

The following section introduces the selected investigations and outlines their differing methodological approaches, grouped according to the marginal landscapes they cover. It is also the first time that this data has been interrogated against modern soil GIS datasets. The detailed analysis of soils in Chapter Four will allow a far more detailed picture of the survey area's pedological characteristics to be constructed than was available to the authors of these datasets in the 1980s and 1990s.

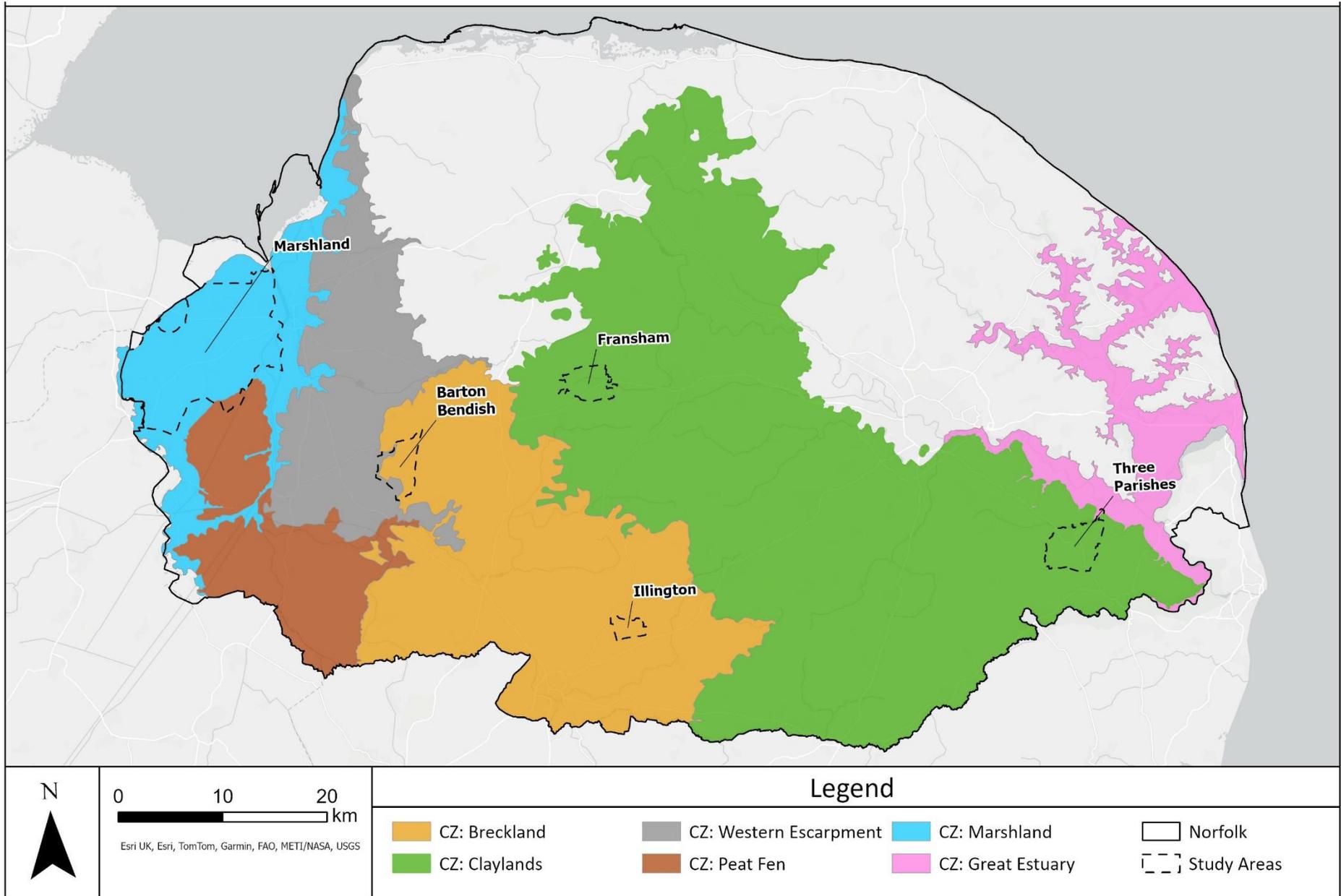


Figure 3: Study areas and Character Zones.

South-central claylands: The Three Parishes and Fransham Parish

The Norfolk claylands is one of the most heavily surveyed regions of the county, with numerous large-scale investigations being undertaken in an effort to understand the nature of settlement in the region. Alan Davison's *The Evolution of Settlement in Three Parishes in South-East Norfolk* (Davison 1990; shortened hereafter to the *Three Parishes* when referring to the survey and to the Three Parishes when referring to the geographical area) and Andrew Rogerson's *Fransham: An Archaeological and Historical Study of a Parish on the Norfolk Boulder Clay* (Rogerson 1995; shortened hereafter to *Fransham Parish* when referring to the survey and to Fransham when referring to the geographical area) are the most temporally and spatially relevant surveys and will therefore form the evidential basis for much of this landscape. Davison's *Three Parishes* focuses on the parishes of Loddon, Hales, and Heckingham whilst Rogerson's *Fransham Parish* focuses on the parish of Fransham.

In the *Three Parishes* Davison kept the method of survey relatively coherent across the survey area. The interval between walked strips was 5m, although on sites where initial investigation produced little surface evidence this interval was increased to 10m (Davison 1990: 10). None of the sites surveyed were gridded (Davison 1990: 10). Davison's explanation of why sites were not gridded – which would likely have resulted in more material being recovered – rests on the extensive area that the study was attempting to survey; ultimately, in the context of the investigation gridding was not a pragmatic option. By comparison, Rogerson employed grid-squares of 50m by 50m, with this grid reduced to 25m by 25m when it was clear that multiple concentrations were present, with these grids uniformly walked at intervals of 8m (Rogerson 1995: 15). Whilst this is a slightly larger interval than that routinely employed by Davison, it must be remembered that in some instances Davison increased his interval to 10m when low volumes of material were being recovered. Thus, the uniformity of Rogerson's 8m intervals, regardless of the assumed archaeology present in the field, must serve to increase the consistency of Rogerson's survey.

It is also possible that the greater consistency of Rogerson's survey reflects not only his experience but also the contrasting scale and duration of the two projects. Davison's survey covered a much larger area within a shorter period, necessitating the involvement of multiple fieldwalkers of varying experience levels. Consequently, differing levels of competency likely led to inconsistencies in the quantity and type of material recovered: while novice fieldwalkers may have overlooked less visible artefacts, more experienced individuals were less likely to do so. By contrast, Rogerson's survey of Fransham was conducted single-handedly over a much longer period, allowing for greater methodological consistency. Davison himself acknowledged that maintaining consistent standards was difficult, noting that the expertise of the two principal investigators improved as the survey

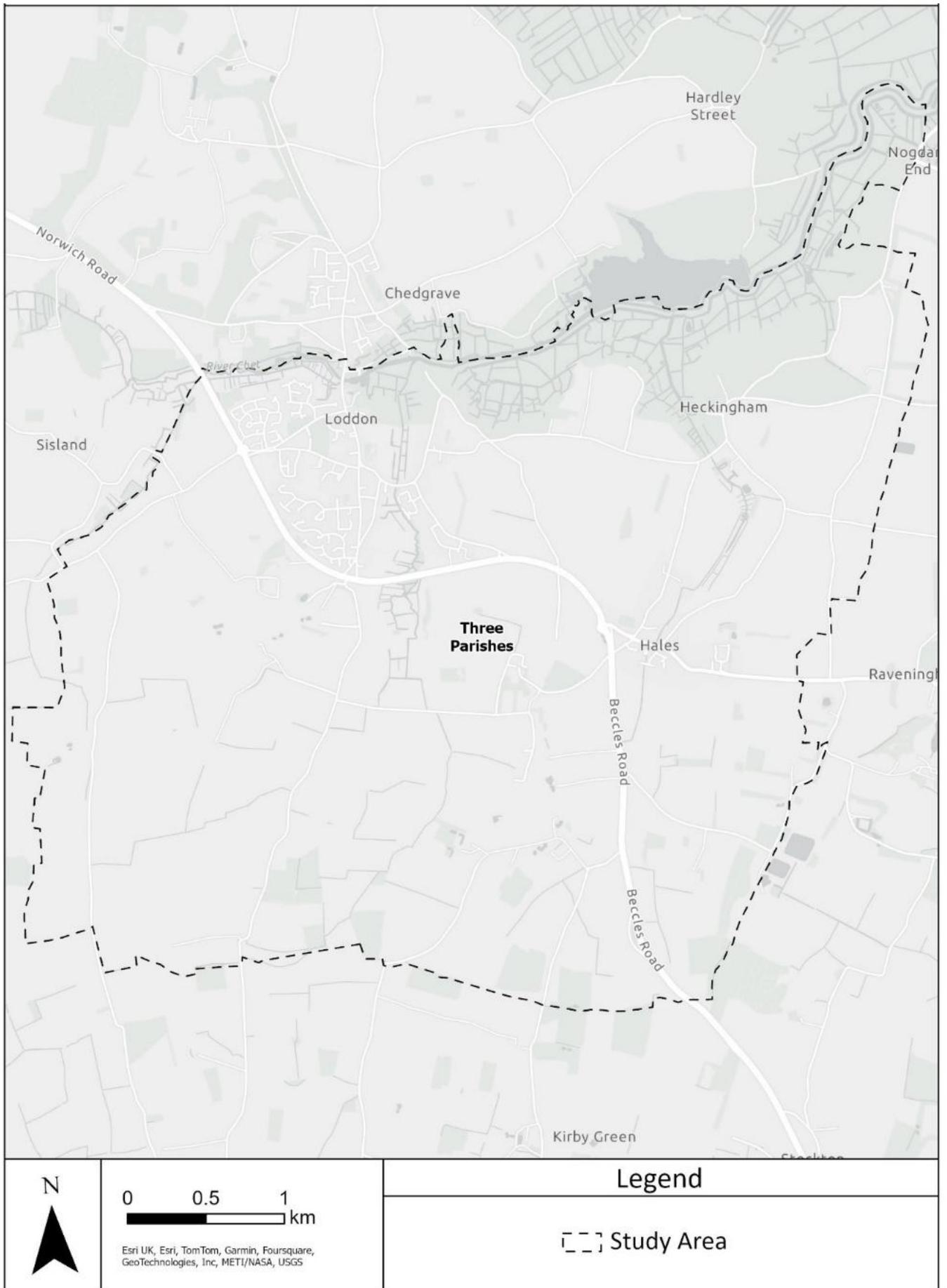


Figure 4: Three Parishes study area.

progressed, ‘thus underlining the inherent problem in maintaining the same standard throughout a survey’ (Davison 1990: 10). It is therefore possible that the survey of Heckingham parish, completed in a single season in 1985–6, was more thorough than the preceding investigations, reflecting the experience gained by the team during the earlier, multi-season surveys of Loddon and Hales (Davison 1990: 11).



Figure 5: Typical landscape of the south-central claylands. Large arable fields and discrete blocks of woodland dominate the modern landscape (photograph by the author, 2024).

Whilst it is ever the desire of large-scale fieldwalking surveys to investigate every square centimetre of land within the bounds of their proposed survey area, this is rarely, if ever, achievable. In Fransham, Rogerson managed to survey over 85% of the parish’s land area, including back gardens of residential properties and areas of pasture and woodland (Rogerson 1995: 14). While there are gaps in the survey area, the extent of accessible land was adequate to generate meaningful results. It is these gaps that the suite of supporting data sources can potentially fill. A similar percentage of land was surveyed in Davison’s *Three Parishes*, although there are significant areas of permanent pasture – particularly in the shallow valleys and on the medieval greens – which prevented investigation. Further extensive tracts where investigation was not possible tend to cluster in the south-east and north-east of the survey area. Loddon parish is the best represented of the three parishes surveyed with over two-thirds of the land area available for investigation. Conversely, the proportion of land available for investigation in Hales and Heckingham is no more than half, and of the two Heckingham is the least well represented.

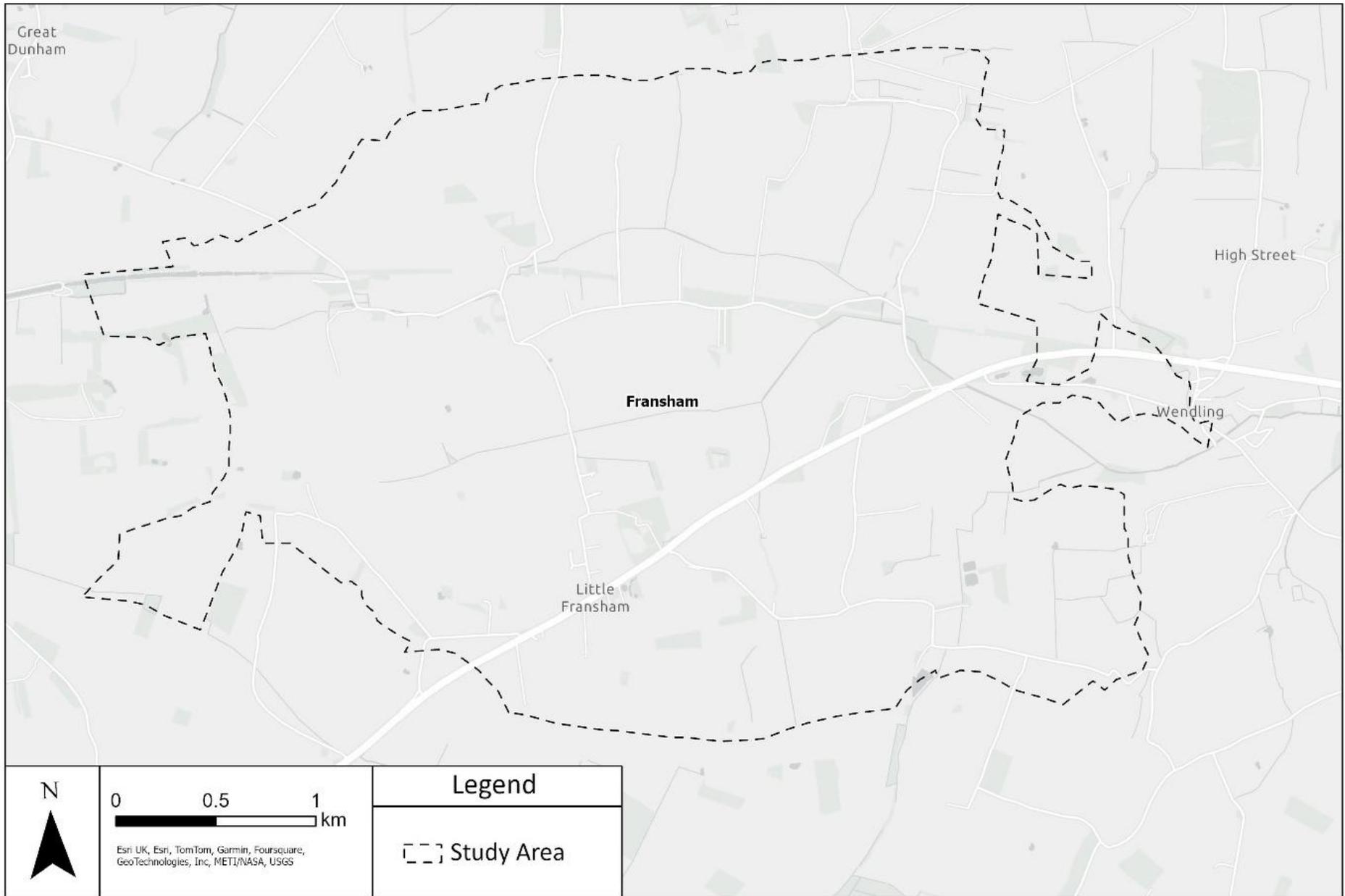


Figure 6: Fransham study area.

Both surveys take a similar approach to defining a 'site', with concentrations of material being considered indicative of occupation. This rather loose methodology is best summarised by Rogerson, who states that 'the majority of artefact concentrations designated below as 'sites' were indeed places of settlement, rather than off-site dumps of cultural material' (Davison 1990; Rogerson 1995: 19). Manuring scatters – light scatters of material deposited via manuring practices – are more common in the *Three Parishes*, which is potentially a result of Rogerson's stated aversion to speculating as to the function or even the nature of a 'site', an aversion which Davison does not possess; it could also be due to the nature of manuring scatters, which could include less ceramic material due to direct dunging, especially in later periods (Jones 2004: 159-88).

The principal divergence between the two studies is their respective recording and presentation methodologies, specifically that relating to their visualisations which are fundamental to interrogating their data. For example, Davison suggests that for sites where multi-period finds were recovered but which exhibited no great concentration – such as Site 81 in the *Three Parishes* – most likely represent a manuring scatter (Davison 1990: 12). These are marked as a dot in the centre of the relevant field in his visualisations (Davison 1990: 12). The issue with this methodology is plain, for the spatial extent and morphology of the modern field is unlikely to correlate to that of the field which was in use at the time the recovered material was deposited. Rogerson chooses a more sensible approach by either representing finds individually or marking loose concentrations as irregular polygons based on their physical extent in a similar fashion to Davison's concentrations. Rogerson's GIS visualisations are thus more spatially accurate than Davison's.

Davison also establishes a hierarchy of finds, with fewer examples of ceramic evidence from the early and middle Saxon periods being required for a 'site' to be defined (Davison 1990: 12). This rationale, whilst not accepted by all, appears to be entirely logical; objectively, early and middle Saxon pottery is far less common than pottery from later periods, and it is thus entirely within reason to place more emphasis on fewer finds (Rogerson 1997: 21; Godfrey 2007: 147). Rogerson does not comment on any hierarchy of finds, although a close look at his site gazetteer reveals that his methodology must have been similar to that of Davison due to the inclusion of early and middle Saxon 'sites' which produced very few sherds.

Breckland: Barton Bendish and Illington Parish

Breckland is well represented in archaeological literature. Alan Davison's *Illington: A Study of a Breckland Parish and its Anglo-Saxon Cemetery* (Davison 1993; shortened hereafter to *Illington Parish* when referring to the survey and Illington when referring to the geographical area) and Andrew



Figure 7: Barton Bendish study area.

Rogerson's *Barton Bendish and Caldecote: fieldwork in south-west Norfolk* (Rogerson 1997; shortened hereafter to *Barton Bendish* when referring to the survey and Barton Bendish when referring to the geographical area) will serve as the principal sources of data for the analyses of Chapter Six. Davison's *Barton Bendish* contains two fieldwalking surveys, one focused on the landscape of Barton Bendish and another focused on a single field in Caldecote. This latter study is far too localised to be of any use to this investigation, and thus only the larger survey of Barton Bendish will be utilised.

Rogerson's *Barton Bendish* is one of the few surveys discussed in this thesis to which access was granted to nearly every arable field within the survey area (Rogerson 1997: 2). However, a reasonable percentage of the survey area was inaccessible due to the presence of modern dwellings, permanent tracts of grassland, or MOD property. The largest tracts of unsurveyed land are in the south of *Barton Bendish*, especially on the boundaries formed by small streams, whilst in the north of the parish the largest unsurveyed area is that occupied by RAF Marham. On the other hand, any note of what land was or was not surveyed is entirely absent in Davison's *Illington Parish*. The only comment Davison provides that even vaguely relates to this topic is that 'the survey was carried out by fieldwalking the arable land as opportunities arose over three winter seasons' (Davison 1993: 1). Whether this rather ambiguous comment is intended to imply that all arable fields in the parish were investigated is unclear. It is also assumed that those tracts marked as woodland were inaccessible.

Davison's methodology is without a doubt the shortest and most incomplete of any of the surveys discussed in this chapter, with the only remaining information provided in his 90-word methodology briefly discussing the varying transect distances commonly walked during the survey (Davison 1993: 1). Intervals were not consistent throughout the survey, with transects at intervals of 10m or 20m common on the lower slopes of the valley whilst transect intervals of 30m were sometimes walked elsewhere (Davison 1993: 1). Around St. Andrews Church gridding by 50m by 50m squares was employed; this could, in part, explain the increased quantities of material recovered from around the church, although it is entirely plausible – and indeed likely – that this intensity is reflective of an actual increase in activity around the site of the church, a trend which is observable throughout Norfolk (see Davison 1990; 1993; Rogerson 1995; 1997; Williamson 1993; 2012). When a concentration of sherds was identified, intervals were reduced to 3m (Davison 1993: 1). There are thus some issues with Davison's methodology. The variations in transect intervals could arguably reduce the spatial accuracy of this survey, for it is unavoidable that transects of 30m will lead to material being missed, material which if walked at 10m is likely to have been recovered, especially in the often-flinty soil of the Brecks. It is also unclear as to how many people were involved in the fieldwalking, although the overall impression is that Davison was undertaking the survey alone. The raft of methodological omissions

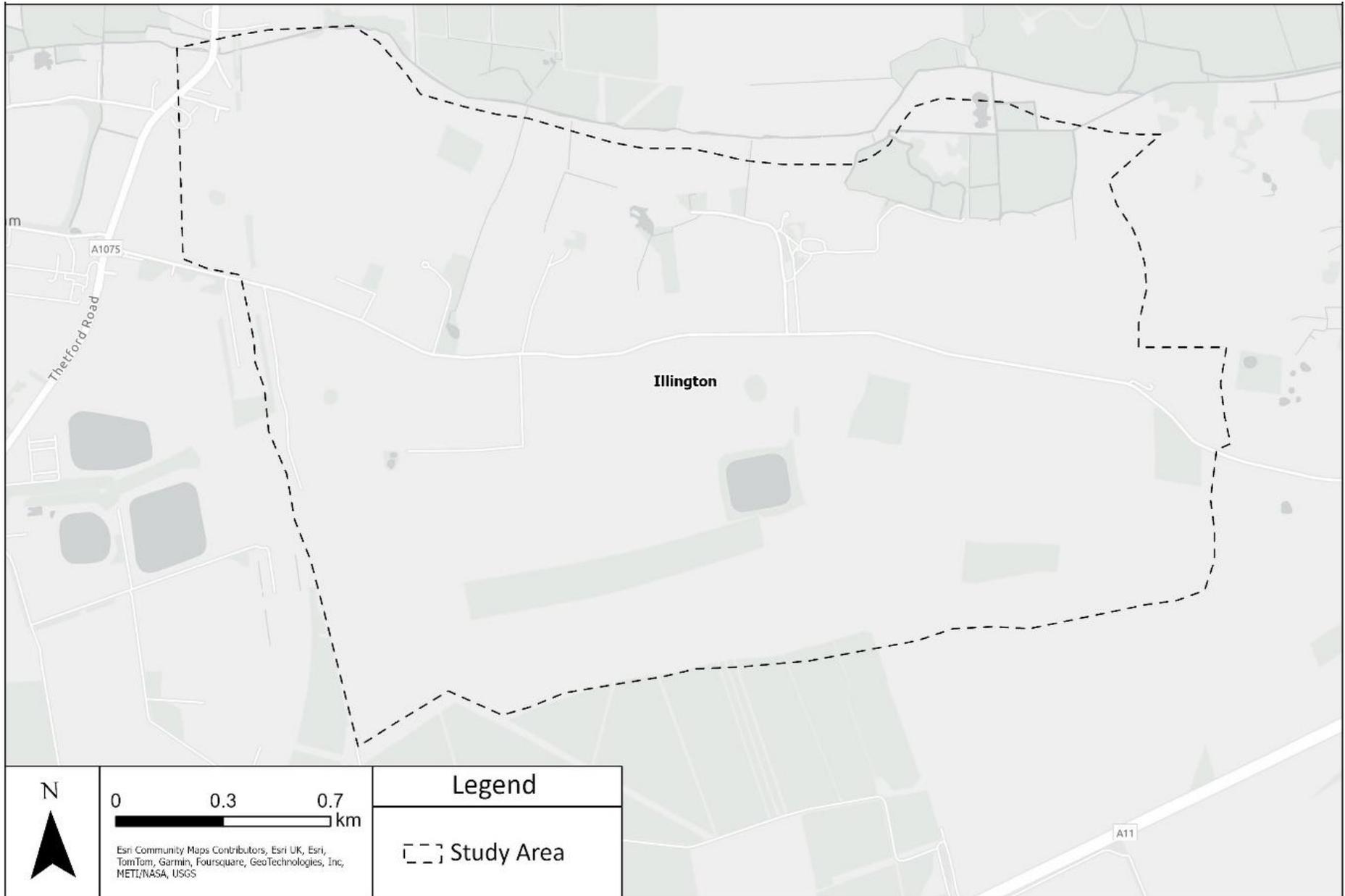


Figure 8: Illington study area.

damages the accuracy and reliability of *Illington Parish*, although not to such a degree as to make it unusable; rather, the conclusions reached from analysis of Davison's data need to be taken with a healthy degree of caution.



Figure 9: Typical landscape of Breckland. Large open fields of sandy soil dominate the landscape. Note the distinctive form of the Scots Pine shelterbelts centre-right (photograph by the author, 2024).

The variations in methodological rigorousness and reliability between different surveys is perhaps nowhere better demonstrated than that between Davison's *Illington Parish* and Rogerson's *Barton Bendish*. Rogerson's methodology is far superior to Davison's, containing an explanation of all of the methodological decisions and processes which had a bearing on the results on the survey. Fieldwalking was carried out by Rogerson alone, which as mentioned previously only serves to increase consistency. However, the consistency of the survey is slightly reduced as it was carried out over the course of some seven years (Rogerson 1997: 2). This extended temporal length reduces the consistency of the survey as surface conditions brought about by both climatic conditions and agricultural regimes would have made some areas more archaeologically productive than others, although Rogerson does state that 'every effort was made to select the optimum available degree of surface weathering, so that the majority of fields were examined in good, or reasonable conditions' (Rogerson 1997: 2). This criticism can also be levelled at Rogerson's *Fransham Parish*, which was carried out over an even greater timescale (Rogerson 1995: 1-2). While the protracted timespan of the *Fransham Parish* and *Barton Bendish* surveys may have introduced a degree of inconsistency, this is a minor disadvantage and the impact of this fact should not be over-emphasised.

The reliability of *Barton Bendish* is also very slightly reduced due to the varying levels of survey intensity over the 17.5km² of the survey area (Rogerson 1997: 2-3). Rogerson categorised each field walked as either 'Intense', which were walked in 2500m² blocks at intervals of 10m; 'Good', which were walked in one-hectare blocks at intervals of 15m; 'Adequate', which were walked in one-hectare blocks at either 15m or 20m; and finally, 'Inadequate', which were walked in areas greater than one hectare at intervals of 20m (Rogerson 1997: 2-3). Most fields were surveyed at 'Adequate' level or above, with the majority of the land around Barton itself being surveyed at 'Intense' level. Whilst it is ever the hope that surveys such as this will conduct an equally thorough search throughout the entire survey area, *Barton Bendish* is fairly consistent throughout.

The definition and extent of a 'site' has also been commented on by Rogerson (with Davison unsurprisingly providing no such insight). Whilst no objective, replicable methodology was employed to determine what concentration of finds constituted a 'site', a 'site' in Rogerson's *Barton Bendish* appears to be any dense concentration of finds, with the dimensions of these concentrations assessed and determined in the field (Rogerson 1997: 3). Where looser, more spatially extensive groupings of material have been recovered – groupings which cannot be considered true concentrations due to their reduced density – it is likely that these represent manuring scatters indicative of historic arable exploitation. Rogerson provides no methodological context for identifying manuring scatters but makes mention of them throughout *Barton Bendish*. There is thus a large degree of subjectivity in the definition of a 'site' and a 'manuring scatter' (Rogerson 1997: 3). However, whilst objectivity is arguably the pinnacle of modern scholarship and is frequently considered superior to subjectivity, there is no reason to discount subjective assertions based solely on the fact that they are subjective.

Whilst *Barton Bendish* is generally superior to *Illington Parish*, there is one aspect where this generalisation does not hold true. Rogerson chose to abandon the collection of post-medieval finds at an early stage in the survey, which he himself states was an 'unwise decision' (Rogerson 1997: 3). Furthermore, unlike in other surveys where recovered material was split into 'medieval' and 'late medieval', Rogerson's *Barton Bendish* sorted finds into just a single 'medieval' category, encompassing the entire c. 1150 to c. 1500 period. This provides a slight inconvenience to the researcher, for each site listed on his distribution maps requires manual filtration in order to elucidate the state of the medieval and late medieval landscape. Thankfully, a gazetteer of sites is included in Rogerson's survey, and thus manual filtration is possible. It should be noted that this gazetteer does not contain a record of each individual find; 'sites', which are often indicative of habitation or industry, are thus relatively straightforward to filter out, whilst individual finds, which perhaps constitute a part of manuring scatter, are impossible to filter out. Given that manuring scatters are arguably the more important of

the two to the analyses of this thesis, it is regrettable that Rogerson chose to employ such a temporally extensive categorisation of finds.

Marshland: The Fenland Project

The archaeological data utilised in analyses of the Norfolk Marshland (located in the northern half of the Fens in west Norfolk) will be drawn from Silvester's 1988 *The Fenland Project, Number 3: Norfolk Survey, Marshland and Nar Valley* report (henceforth referred to as the *Fenland Project* when referring to the survey and as Marshland when referring to the geographical area), which details and discusses the data gathered by the comprehensive fieldwalking and historical surveys undertaken over the course of four seasons between 1982 and 1986 in the Fens (Silvester 1988). Whilst the Fens is an extensive landscape covering some 3367km², only 16% of it – approximately 535km² – is located within Norfolk, which is just over 10% of the total land area of the county (Skertchly 1877: 1; Silvester 1988: 1). However, the considerable variation in both pedological conditions and the archaeological and historical heritage of the Norfolk fenland led Silvester to state, and quite rightly, that this small landscape is 'a microcosm of the Fenland as a whole' (Silvester 1988: 1). Unlike the other surveys discussed in this thesis, which investigate just one, two, or three parishes, the *Fenland Project* investigates fifteen; it will be impossible to cover every parish in detail, so the later analyses of Marshland In Chapter Seven will be ordered thematically rather than chronologically (Davison 1989; Davison 1993; Rogerson 1995; Rogerson 1997; Silvester 1988).

One of the most significant methodological divergences present in the *Fenland Project* is the distance between transect intervals. Every field in the *Fenland Project* was walked, wherever possible, at transect intervals of 30m, which is far wider than those walked in the *Three Parishes, Fransham Parish, Illington Parish, and Barton Bendish*. However, these surveys were investigating landscapes where stony inclusions in the soil are commonplace, and thus archaeological remains are intermixed – and vastly outnumbered – by natural geological material. This makes identifying archaeological remains far more difficult in these locations than in the stoneless silts, peats, and clays of Marshland, where the lack of stony inclusions makes archaeological remains lying in the soil particularly noticeable. Furthermore, when a 'site' – the definition of which will be discussed shortly – was identified, the transect interval was reduced to between two and five metres; these are far tighter intervals than that walked in the other surveys and could only have served to increase the consistency of the survey. The increased transect intervals are thus not as problematic as they first appear.

However, the scale of the *Fenland Project* is, as has been previously mentioned, far greater than other surveys, and it is therefore unsurprising that the coverage of fieldwork is far less consistent, with some

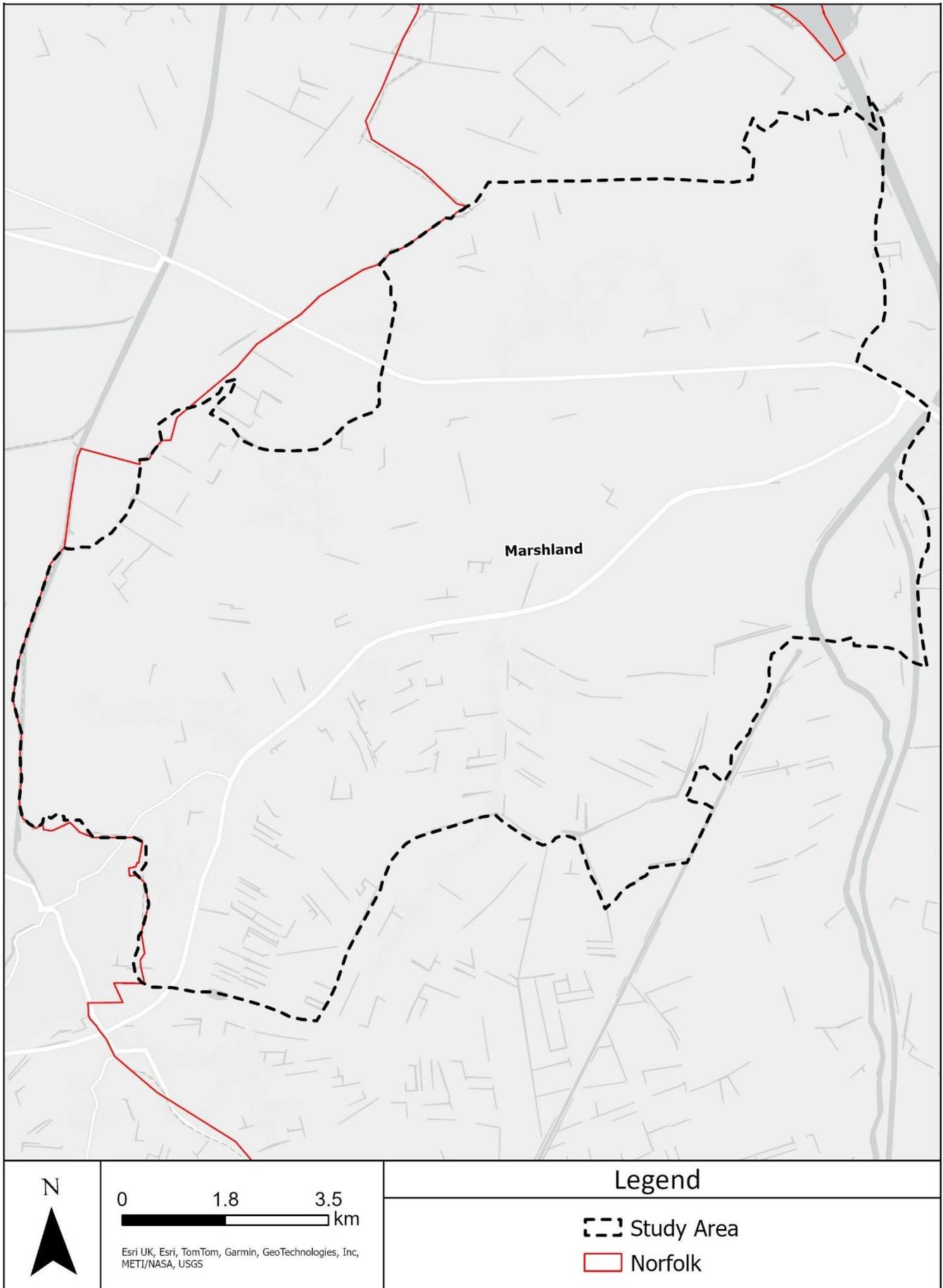


Figure 10: Marshland study area.

parishes more thoroughly investigated than others. Parishes such as Tilney All Saints and Walpole St. Peter saw nearly every part of the parish subjected to investigation; the parish of West Lynn, on the other hand, contains sizeable areas where fieldwalking was not possible due to modern developments. As mentioned earlier, the inclusion of the suite of supporting data sources is intended to mitigate against these limitations in the fieldwalking data. It must be said, however, that for the most part the parishes surveyed achieved a decent degree of coverage, and although it is likely that some sites were missed by the *Fenland Project* these are unlikely to overly impact the general trends identifiable within the data.



Figure 11: Typical landscape of Marshland. Note the darkness of the earth and the system of ditches and dykes visible centre-left (photograph by the author, 2024).

Whilst the spatial coverage of these parish surveys is, on occasion, slightly less than ideal, the intensity of the fieldwork is relatively consistent throughout the survey area. Silvester assigned every area covered by the *Fenland Project* one of three grades: ‘Good’, which signifies that the surface conditions at the time of surveying were good or optimum, and that fieldwalking was carried out at the desired transect interval of 30m; ‘Satisfactory’, which signifies that either the field was peat, fen clay, or permanent pasture where walking at 30m intervals was not appropriate, or that the arable field was in reasonable condition but the surveyors were satisfied that no sites had been missed; or ‘Poor’, which signifies that surface conditions were at their worst for fieldwalking, whether this be climatically induced or perhaps due to a crop being too advanced, ultimately leading to a poor chance of artefact recovery and a high likelihood of sites being missed (Silvester 1988: 12). Ultimately, the vast majority of the area surveyed was graded as ‘Good’, with only the parishes of Walsoken and Clenchwarton containing any moderate percentage of land graded as ‘Satisfactory’ (Silvester 1988: 12, 17-23, 71-

82). There is thus little reason to doubt the reliability of the survey's data at a macro-scale, especially when combined with supporting data sources.

The problem of the 'site' is also discussed by Silvester. He states that the term 'site' is used to cover a range of possibilities, with it being used to describe an area with the dense, concentrated pottery scatter indicative of habitation whilst also being used to describe areas of industrial, agricultural, or cultural activity, although like the other surveys discussed in this chapter Silvester similarly provides no empirical, objective definition of what volume of sherds constitutes a 'site' (Silvester 1988: 13). The definition of the term, as understood and utilised in the *Fenland Project*, is best summarised by Silvester himself, who comments that 'in this survey, 'site' is used in its broadest sense as a general term without the restricted connotation of 'settlement'' (Silvester 1988: 13). Silvester also establishes a hierarchy of finds, with early and middle Saxon sherds deemed to be more substantive than the more plentiful later medieval material, with the middle Saxon site WW 29 containing just two sherds of Ipswich Ware (Silvester 1988: 12; 1988b: F.10). There are thus few issues present within Silvester's methodology, and there is certainly a case for considering the *Fenland Project* to be the most methodologically rigorous survey discussed in this thesis.

Methodological and historical dissimilarities and their implications

There are thus a number of divergences within the methodologies of the five fieldwalking surveys. Whilst, in an ideal world, the transect intervals would be homogenous, the necessities of the surveys themselves – such as the availability of human resources and the nature of the soil – often dictate the methods employed. For example, it was not temporally viable to walk the entirety of the *Fenland Project* at 5m intervals, for given the spatial extent of the survey and the limited manpower available such a decision would have ensured that the objectives of the survey were unlikely to have been met in the desired timeframe. Furthermore, the intensity of fieldwork is very much influenced by factors that lie outside of the investigator's control, with modern developments, denial of access by landowners, or manpower issues all impacting the degree to which the landscape in question can be comprehensively surveyed. Inconsistencies in these areas are thus unavoidable in fieldwalking surveys; given the temporal and spatial disconnect between these various investigations it is surprising how well documented the methods and approaches utilised are, with the only exception being Davison's underexplained methodology in *Illington Parish*.

Perhaps the most pressing concern identified by the review of these fieldwalking surveys is the loose definition of the 'site'. This is not, however, an issue particular to these five surveys, for the definition of a 'site' has long been a point of contention within archaeological theory. Over the past four decades numerous archaeologists have attempted to quantify and define the 'site': in the 1980s it was

Haselgrove, Foley, Dunnell, and Hall; in the 1990s it was Binford and Dunnell; in the 2000s it was Anschuetz, Wilshusen, and Scheick, whilst more recently it was McCoy, who has attempted to place and reconcile the 'site' with the increasingly digital character of modern archaeology (Foley 1981; Hall 1981; Haselgrove 1985; Binford 1992; Dunnell 1983, 1992; Anschuetz *et al.* 2001; McCoy 2020). This difficulty in defining the 'site' is perhaps best reflected in the inability of the surveys discussed above to provide an empirical definition of the 'site', with the most substantive definition being Silvester's undeniably qualitative interpretation that 'site' is 'used in its broadest sense' to denote areas of habitation and areas of industrial and agricultural activity (Silvester 1988: 13). A further qualitative approach to site definition is provided by Rogerson, who concluded that 'the majority of artefact concentrations designated below as 'sites' were indeed places of [occupation], rather than off-site dumps of cultural material' (Rogerson 1995: 19). Ultimately, all the surveys discussed in this thesis opt to use a qualitative approach.

There are also issues with taking a quantitative approach to site definition. For example, Hall's 1981 methodological approach for identifying sites in the plough soil – as set out in his survey of the Cambridgeshire fens in the late 1970s – holds that a plough soil site must contain at least fifteen individual artefacts collected in under 10 minutes from an area greater than 10m by 10m (Hall 1981: 53). However, this rather stringent methodological approach has numerous flaws, with the most significant being an inherent assumption that all archaeological material is of equal value. This assumption does not reflect reality, for sherds of early and middle Saxon pottery are rarer due to both a poor survival rate and the simple fact that the use of pottery may have been less in these earlier periods than it was in later periods; there is thus a 'hierarchy of finds' which holds that the scarcer early and middle Saxon pottery is of more 'weight' than, for example, later medieval pottery (Coutts 1991). This is aptly summarised by Davison, who states that 'a scatter of twenty-to-thirty thirteenth/fourteenth-century pieces derived from the surface of a large field indicates no more than manuring distribution; if twenty-five of those sherds came from a small area, say 100 square metres in one corner of that field, then it might be considered a small site. Seven pieces of Ipswich-type Ware found in close proximity could be deemed, with justification, to indicate an undoubted site of that period, [whilst] seven pieces of medieval pottery would not. The survival rate of earlier pottery... must mean that finds from those periods have a greater significance even if they are small in quantity (Davison 1990: 12). Had Hall's quantitative methodology been utilised in the *Three Parishes, Fransham Parish, Illington Parish, Barton Bendish*, and the *Fenland Project*, the vast majority of early or middle Saxon sites would not have passed Hall's test, for it does not take into consideration the different weighting of certain types of material evidence (Hall 1981: 53; Davison 1990; 1993; Rogerson 1995; 1997; Silvester 1988: 12-3).

Defining the 'site' via both qualitative and quantitative means is thus fraught with issues. However, given that all the surveys discussed in this thesis opted for a qualitative approach, there is a modicum of homogeneity between them. This is further increased by the inclusion of a hierarchy of finds in all investigations, whether explicitly stated or implied within the gazetteer. There seems very little cause to retrospectively alter – perhaps using an objective, quantitative methodology such as that proposed by Hall in 1981 – what concentration of material is to be defined as a 'site' (Hall 1981). There is also little cause to disagree with the proposed function of these sites unless new evidence has suggested an alternative function.

There is also the distinction, frequently alluded to in these surveys, between the 'site' and the 'manuring scatter' (Davison 1990; 1993; Rogerson 1995; 1997; Silvester 1988). There is a consensus that low-density but extensive scatters of potsherds indicates historic arable cultivation; conversely, the absence of such scatters indicates that historic arable cultivation in that locale was unlikely (Jones 2004: 163-4). In 1978 Foard suggested that whilst manuring scatters are a helpful tool in elucidating the extent of medieval arable, they can only indicate the *minimum* acreage under cultivation, for 'invisible' manuring – such as direct dunging – will not show up in the archaeological record as they are essentially aceramic (Foard 1978; Jones 2004). The most significant work in this rather niche, but critically important field of study came in 2004, with Jones' *Signatures in the Soil: The Use of Pottery in Manure Scatters in the Identification of Medieval Arable Farming Regimes* (Jones 2004: 159-88). Here, Jones discusses how the material evidence from the Whittlewood Project indicates that developments and changes in arable regimes and systems are identifiable through the changing nature of manuring scatters, with these scatters able to capture the emergence of infield/outfield cultivation, open-field farming, demesne blocks, and assarts (Jones 2004: 159-88). Based on this evidence, Jones proposed a model for tracing these developments through the spatial characteristics and densities of manuring scatters (Jones 2004: 159).

In his model, Jones suggests that between c. 400 and c. 850 manure taken from a domestic setting – including pottery – was scattered over a limited area directly around the farmstead, with this scatter likely representative of the infield of an infield/outfield system, with the areas devoid of pottery likely utilised as woodland or pasture (Jones 2004: 184). This pattern shifted c. 850, when for the first time 'farming blocks became spatially divorced from domestic manure sources', for with more land being put under the plough the need for intensive manuring of the emerging open fields was reduced, for the careful use of rotations and direct dunging negated the need for manure from domestic sources (Jones 2004: 184). Instead, manure from domestic sources was likely spread on the crofts in the c. 850 to c. 1100 period (Jones 2004: 184). The pattern shifted again c. 1100, with domestic manure once again being spread on the fields (Jones 2004: 184). This was likely the result of the gradual, but

nevertheless inexorable decline in soil fertility levels experienced by arable fields after decades, if not centuries of continuous use; increases in yields, which were vital due to the expanding population and the increasing monetary rents, could thus only be achieved by putting more land under the plough and reducing the length of fallowing (Jones 2004: 184). Every available source of fertility-replenishing material – such as domestic manure – was thus needed to maintain soil fertility (Jones 2004: 184). This domestic manure was later intermixed with more resilient forms of pottery, which combined with the increased usage of ceramics ensured that scatters of pottery began to proliferate c. 1100 in all parts of the landscape under cultivation (Jones 2004: 184).

The model of Jones is, however, based on observations and evidence gathered from a ‘champion’ landscape in Northamptonshire. Its applicability to Norfolk is thus up for debate. Whilst this thesis is not primarily concerned with validating or refuting Jones’ model – with no attempt being made to calculate the densities outlined in his model – it will nevertheless be interesting to test whether the evidence from Norfolk exhibits any of these identified spatial patterns. It is accepted that manuring scatters are not perfect diagnostic tools, but the dominance of ceramic evidence and its undeniable association with medieval manuring practices ensures that it remains a vital tool in elucidating developments in the medieval settlement.

It must also be acknowledged that within the four marginal landscapes investigated in this thesis there exist geographical and historical dissimilarities between the individual study areas which are likely to have impacted the development of medieval settlement. In the south-central claylands the Three Parishes (which encompasses the parishes of Loddon, Hales, and Heckingham) occupies a peripheral position that is adjacent to the Broads, and has thus been shaped, at least in part, by its association with this unique wetland landscape. This differs from the far more ‘central’ positioning of Fransham. Barton Bendish similarly occupies a peripheral position within Breckland, where it occupies a fen-edge location that distinguishes it from the more central position of Illington. There is thus a distinction to be made between the study areas that lie within the core of the marginal landscape and those that lie in a more transitional context, for in the latter the development of the medieval rural landscape will have been influenced, in part, by neighbouring landscapes. Whilst it is important to acknowledge this difference, it is also important to not over-emphasise this dissimilarity. As will be discussed in Chapter Four, both the Three Parishes and Fransham in the south-central claylands, and Barton Bendish and Illington Parish in Breckland, are extremely similar in environmental characteristics. To ensure that the historical context of each study area is commented on individually, a dedicated subsection called ‘Spatial and historical context’ is included at the start of each of the analyses chapters to briefly discuss the spatial and historical characteristics of the individual study areas. This context will provide valuable

information on the similarities and dissimilarities between the study areas within each of the investigated marginal landscapes.

There is also a strong case to be made that the inclusion of both core and transitional study areas within the wider marginal landscapes is a methodological strength rather than a limitation. By comparing study areas that are geographically 'distant' (at least on a county-scale) but within the same broad landscape 'type', it becomes possible to assess whether observed patterns of settlement development are consistent across the landscape as a whole or are instead driven by highly localised conditions. If both core and transitional study areas exhibit similar responses to climatic and environmental variables, this provides robust evidence that the findings are representative of the broader marginal landscape. Conversely, if they diverge, this reveals important nuances about how location-specific factors interact with the broader environmental character, similar to the complex web of environmental and anthropogenic feedbacks discussed in the international medieval settlement *corpus* (Casely 2006; Büntgen *et al.* 2011; Xoplaki *et al.* 2016; Lasher and Axford 2019; Ljungqvist *et al.* 2020; Büntgen *et al.* 2021).

Chapter Two: Investigating the Climatic

Introduction

Understanding the climatic conditions that prevailed in Norfolk between c. 500 and c. 1500 is critical to the objectives of this thesis. It is perhaps telling that to this author's knowledge no piece of English landscape historical or archaeological literature has thoroughly reviewed developments in palaeoclimatology, despite a deepening overlap of the disciplines in recent years; a thorough review is thus long overdue. This lack of engagement cannot be attributed to a stagnation in palaeoclimatology, for over the past thirty years the discipline has flourished, with a multitude of hemispheric, continental, and regional temperature and precipitation reconstructions available to the researcher. It is freely admitted that the spatial scale of many of the reconstructions discussed in this chapter is far from ideal; however, considering that this thesis is concerned not with the short-term effects of climatic fluctuations but rather with its effect over the *long durée*, temporally extensive macro-scale multiproxy reconstructions will capture long-term trends in climate. Whilst a smaller geographical scale – county level, for example – would be preferable, multiproxy reconstructions at this scale are rare, although not entirely absent.

This chapter will investigate sixteen individual climatic reconstructions. Twelve of these are temperature reconstructions, with this selection composed of eleven temporally extensive hemispheric-scale reconstructions and one temporally limited county-level reconstruction. The remaining four reconstructions are concerned with historic rates of precipitation, with this selection composed of one temporally extensive continental scale reconstruction, two temporally limited regional-scale reconstructions, and one temporally limited county-level reconstruction. This is not to be considered an exhaustive list and any absence is not reflective of reliability or merit; rather, it is a sample of past and present research which has been chosen to show both the development of the discipline over the past three decades and the shift in palaeoclimatology's perception of historic climatic trends. Furthermore, the precise fluctuation in temperature or precipitation is of less importance – although it is critical to note that this is not stating that it is of *no* importance – to this study than the morphology of the 'curve', for whilst the magnitude of fluctuation is often different between reconstructions, the morphology often appears similar in form. However, before the reconstructions themselves can be reviewed, it is first necessary to explore the advantages and disadvantages of the data which is used to create these reconstructions.

Proxy data

The reconstructions discussed in this chapter are all based on data extracted from climatic ‘proxies’. These proxies capture within them a reflection of past climatic conditions and vary considerably in type, although the vast majority can be split into two main groups; proxies which are derived from the natural world, and proxies which are derived from the anthropogenic world (Jones, Osborn, and Briffa 2001). The former is, theoretically, less subjective than the latter, although the varying statistical and constructional techniques used to build climatic reconstructions – which is very much a subjective decision taken by the authors – leads to all reconstructions, even those based solely on scientific proxy data, containing within them an element of subjectivity. An understanding of the strengths and limitations of this data is thus critical to assessing the palaeoclimatological literature. This section will not investigate every type of proxy, for this would be vastly impractical; rather, the most commonly used proxy sources will be discussed, with dendroclimatic, ice core, coral, speleothem, and documentary data featuring in this section’s analysis.

Tree-Ring Width (TRW) and Maximum Latewood Density (MXD)

TRW is perhaps the most widely used type of proxy, with Briffa *et al.* (1996) commenting that tree-rings have ‘some claim to “special” status among so-called high-resolution proxy climate sources’ (Briffa *et al.* 1996: 10), not least because of their widespread availability (Briffa *et al.* 1996). By measuring the width of individual rings, important implications regarding the prevailing climatic conditions of the local area throughout the tree’s life can be obtained. In general, thinner rings indicate less favourable conditions, such as extremes in temperatures and rates of precipitation, with thicker rings indicating favourable growing conditions. This is, of course, a heavily simplified summary of dendroclimatic science, but serves to highlight its key principals.

In the following section all dendroclimatic proxies have been analysed to extract data pertaining to temperature; temperature is not, however, the only factor that causes variations in TRW. Precipitation, wind speed, and levels of sunlight also effect tree growth, as does atmospheric composition and competition with neighbouring trees ('Tree Rings' 2021). Whilst dendroclimatology has developed methods of limiting the impact of other climatic influences – such as through the careful selection of sample sites, often at high latitudes and altitudes – it is impossible to entirely eliminate the impact of other influences (Bradley 2015: 453-97). Indeed, research conducted by Toledo *et al.* (2011) and Żywiec *et al.* (2017) suggest that precipitation, not temperature, is the principal driver of radial growth. Temperature reconstructions that make use of dendroclimatic data must, therefore, take into consideration the likely presence of interference from other climatic influences – which shows up as ‘noise’ within the dataset – which could potentially lead to inaccurate

conclusions. Thus, any reconstruction containing dendroclimatic proxies needs a robust methodology to reduce the impact of noise arising from other climatic influences.

In addition to TRW, Maximum Latewood Density (MXD) is also used to reveal past climatic trends. Each annual growth ring of a tree is composed of two different densities of tracheid cells which form two types of wood: earlywood and latewood. Earlywood is the paler wood sandwiched between darker latewood 'rings', and is composed of thin-walled, loosely packed (and thus low-density) tracheids, whilst latewood is composed of thick-walled, tightly-packed (and thus high-density) tracheids. Schweingruber, Braker, and Schar (1979) have shown how variations in the density of tracheids contains a strong climatic signal relative to April-August mean temperature with analysis of maximum density – and therefore the density of latewood, not earlywood – being preferred over minimum density as it appears to be a better climatic indicator (Bradley 2015: 455). Densitometric dendroclimatology's foremost advantage over TRW is that density variations have a very simple growth function – namely that density is nearly linear with age – which allows for the preservation of low-frequency (long-term) climatic signals which TRW is unable to preserve (Bradley 2015: 455). However, whilst MXD is generally more accurate in determining local temperature than TRW, the usage of both ring-width data and densitometric data is recommended in order to achieve 'the optimum climatic [reconstruction]' (D'Arrigo, Jacoby, and Free 1992; Bradley 2015: 455).

Ice cores

Whilst dendroclimatological data is perhaps the most popular proxy used to piece together past climatic trends, data gleaned from ice cores comes a close second. As snow falls in polar or high-altitude locations, their cold climate and relatively short intervals of summer warming prevents precipitation from completely melting away. This allows for a repeating annual sequence of ablation and accumulation to take place, whereby snow from the previous accumulation season which survives the following ablation season is subsequently covered with snow from the next accumulation season, with this cycle repeating over the course of millions of years in the dry snow zone of polar ice sheets (Bradley 2015). Through the processes of mechanical packing the underlying snow is turned first into firn and then into ice, with the formation of the latter occurring at depths of at least 77 metres; the term ice core is thus a misnomer, for as Bradley (2015) points out, they are more accurately firn cores, although for the present analysis the term ice core will continue to be used (Herron and Langway 1980; Bradley 2015).

Ice cores are, at their most basic, a collection of frozen water deposited in a single location over the course of thousands or millions of years. Whilst they are constructed from precipitation, and indeed can be used to measure rates of precipitation, the chemical composition of the water can yield

valuable data which can be used to recreate historic summer or annual temperatures, wind speed, and levels of solar irradiance (Bradley 2015: 139). Recreating historic temperatures and precipitation is achieved by analysing of the ratio of the water molecules and stable oxygen isotopes ^{16}O and ^{18}O (termed $\delta^{18}\text{O}$ or Delta-O-18) within an ice sample. The heavier (by some 12.5%) ^{18}O isotope condenses more easily than the lighter ^{16}O , and thus precipitates more readily (Bradley 2015: 139). The presence of heavier concentrations of ^{18}O in an ice core thus indicates a warmer climate; similarly, high concentrations of ^{16}O – and by extension a reduced ^{18}O count – indicates a colder climate, for ^{16}O precipitates primarily in colder conditions. Whilst this is, admittedly, a heavily simplified explanation of $\delta^{18}\text{O}$, it nevertheless sets out the basic principles of $\delta^{18}\text{O}$ and how it is used in the context of ice core analysis.

There are, of course, limitations to ice core proxies. Ice cores are inherently dependent upon precipitation, and as summarised by Dark (2000), ice core samples rely upon ‘a sufficiently reliable and high rate of deposition to allow identification of seasonal features, and on maximum temperatures being too low to permit melting’ (Dark 2000: 20). There are a myriad of further variables that can render ice core samples unreliable, such as aeolian action wiping away a layer or human error mistaking a particularly strong weather event as its own annual layer (Dark 2000). There are also geographical limitations to ice cores, with the most obvious being that they can only be taken from extremely cold regions, and thus using ice core samples to recreate temperature at non-freezing locations is arguably more problematic than say, analysis of TRW from a location nearer to the study area. Ice cores from Greenland (such as Dye3, GISP2, GRIP, NGRIP, and NEEM) have also been found to be susceptible to fluctuations in both local ice sheet changes and North Atlantic temperatures (Bradley 2015: 150-1). Ice cores from Antarctica (such as SAE, ANARE, EPICA, and IPY LARISSA), however, have been shown to be less susceptible to external influences than those from Greenland, although they tend to be of lower resolution than cores taken from Greenland (Davies 2020). Each location therefore has its own set of limitations and strengths, and the choice of data is largely dependent upon the specific aims and needs of individual palaeoclimatic reconstructions.

Coral

Formed of the massed skeletal remains of coral polyps, corals capture within them a snapshot of oceanic conditions over the course of hundreds of years. Large, reef-building hermatypic corals of the order Scleractinia are the principle type used in palaeoclimatic research (Bradley 2015: 500-1). These are limited in geographical distribution to areas which have a mean annual sea-surface temperature of 18°C , which limits their range to the area between 30°N and 30°S (Bradley 2015: 500). Gathering coral palaeoclimatic data outside of this region is possible, and has been achieved by extracting deep-

sea corals, although this clearly presents more challenges than corals harvested from shallower waters (Copard *et al.* 2012; Robinson and Flierdt 2009).

Palaeoclimatic analysis of corals relies on techniques already discussed in this chapter, such as $\delta^{18}\text{O}$ and a modified – but nonetheless recognisable – variation of TRW. The latter is achieved by analysing coral ‘bands’, with these acting much like tree-rings, with thicker bands representing years when conditions were more favourable for growth (NASA 2021; Bradley 2015). Corals are, however, oceanic organisms which are influenced by other factors such as water salinity; they are also living organisms, and much like dendroclimatic data a large sample pool is required in order to use them as long-term proxies (NASA 2021).

Speleothems

Speleothems are a common feature in many limestone caves across the world; formed predominantly by dripping or flowing water, these mineral deposits contain valuable palaeoclimatic data (Bradley 2015; Sundqvist 2007). The most well-known types of speleothem are stalagmites (ground-up) and stalactites (ceiling-down), with the former being most commonly utilised for palaeoclimatic purposes. Investigations of speleothems commonly focuses on $\delta^{18}\text{O}$ and growth rates, with the former primarily related to temperature and the latter primarily related to precipitation (Bradley 2015: 293).

Speleothem analysis is increasing in popularity and given the widespread distribution of speleothems and the potential data they can yield the expansion of the field could be of considerable aid to palaeoclimatological science. Analysis must, however, be undertaken with due caution, as there are a myriad of environmental variables – hydrological, geological, and climatological – that can impact the growth and development of individual specimens, with Sundqvist (2007) urging the need for caution, stating that ‘speleothems are individuals [and] each... is unique with its own response to external processes’ (Sundqvist 2007: 2). Considering that speleothems are the product of water which has percolated through the aquifer over time, there may be a significant lag between changes in climatic conditions in the outside world and a change to speleothem growth in the cave environment (Bradley 2015: 294). This can limit the extent to which speleothems can be used to date shifts in climatic conditions, and whilst Bradley (2015) suggests that this characteristic ‘acts as a low-pass filter on the environmental record in speleothems’, he believes that in most instances ‘flow rates are high enough that annual (or even subannual) variations may be resolved in some situations’ (Bradley 2015: 293-4).

Documentary sources

The final proxy type discussed here is documentary data. Unlike those proxies discussed above, documentary data is anthropogenic in origin, and thus reflects a subjective interpretation of historic climatic trends and events. Documentary-based reconstructions, which do not themselves contain a

physical record of historic climate, cannot provide an anomaly value in the same way that scientific proxies can. Whilst a tree-ring can allow the researcher to extrapolate the value of the climatic anomaly – such as temperature – in degrees centigrade, documentary sources only allow the researcher to assign certain years or months a score to create a climatic index, although this is not to say that documentary data is *inherently* inferior. Categories of historical material, such as manorial rolls and weather diaries, have been shown to be more or less in agreement with scientific data. Indeed, the first attempts at palaeoclimatic reconstructions by Professor Lamb were based on documentary data, and over the years numerous other academics have compiled documentary sources in the hopes of creating increasingly more accurate palaeoclimatic reconstructions (Lamb 1965, 1963; Pribyl 2012; Pribyl, Cornes, and Pfister 2012). Perhaps the most successful of these attempts are those produced by Pribyl, who over the past decade has combined a vast array of historical documentary sources – primarily relating to grain harvests – with scientifically-based temperature and precipitation studies to create a series of late medieval palaeoclimatic reconstructions which often focus on East Anglia, and Norfolk in particular (Pribyl 2020; Pribyl and Cornes 2020; Pribyl and Cornes 2019; Pribyl 2017a; Pribyl 2017b, 2014, 2012; Pribyl, Cornes, and Pfister 2012). Pribyl’s reconstructions will be considered in greater detail in Chapter Two.

Whilst documentary data – with its unique ability to provide the researcher with a first-hand description of climatic events – can be of significant aid to palaeoclimatological studies, there are a number of limitations to historic documents. The most pressing issues are their subjectivity and their often limited temporal range, with the majority of relevant written documents post-dating c. 1200 (Ogilvie and Farmer 1997: 113; Bell and Ogilvie 1978). This has, unfortunately, led to there being an issue – although it is critical to state that this is an issue relative to this study only – with the work of Pribyl; due to the lack of documentary sources available from the pre-1200 period, majority of her work is confined to the post-1200 period. A further temporal limitation of documentary sources is that unlike many sources of scientific proxy data, historical documentary data is discontinuous and disjointed, and is reliant upon human perception; trees, corals, ice, and speleothems all outlive humans by tens, hundreds, thousands, or even millions of years, and even in times of completely unremarkable climatic conditions they continue recording the state of earth’s climate.

Humans, on the other hand, are far ‘pickier’ with recording climate; famine years, for example, are well documented – and for obvious reason – as the weather during these periods was often at the extremes and was thus worthy of recording. Average years, or slightly below or above average years, however, were not as readily recorded, for they were unremarkable and there was no reason for chroniclers to record periods of climatic normality. Documentary sources are thus useful for

highlighting extraordinary climatic intervals but often fail in recording the far more prevalent – and equally important – intervals of ordinary climatic conditions.

Multiproxy reconstructions

It should be clear that each type of proxy has its own strengths and limitations. Whilst each proxy can be used individually, doing so only magnifies its limitations, lessening the extent to which the resultant reconstruction can be considered reliable. Of course, there are exceptions to this rule that will be discussed in the following sections, but in general a multiproxy reconstruction – that is, one based on numerous types of proxy data – will often be preferable to mono-proxy reconstructions, as the incorporation of a range of proxy types allows the reconstruction to have the best chance at capturing the true climatic conditions prevalent at any given time.

Seasonality

Whilst the type of proxy data employed by the various reconstructions discussed in this chapter is highly influential in determining their results, another factor – the seasonality of the proxies themselves – is critical in determining their relevance to later analyses. In broad terms, temperature reconstructions tend to fall into one – or in some rare cases two – of the following categories: reconstructions that recreate winter temperatures; reconstructions that recreate summer temperatures; reconstructions that recreate annual mean temperatures. Similarly, precipitation reconstructions can either recreate winter precipitation, summer precipitation, or annual mean precipitation. The seasonality of these studies is determined by the type of proxy data being utilised, as differing types of input data reflects differing climatic conditions at the time that that particular proxy source was ‘recording’.

By far the most heavily represented months are the late-spring and summer months. For example, TRW is a reflection of climatic conditions during the growing season, which generally runs from April to late-September – a period which can also be expressed as AMJJAS – whilst MXD is generally reflective of the late-spring and summer months (Juckes *et al.* 2007: 4). Ice core melt layers are also dependent upon the warmer months, and medieval documentation, which is often concerned with recording the details of the harvest, is also biased towards representing the spring and summer months (Juckes *et al.* 2007: 4; Pribyl 2017). The dominance of the warmer months in the palaeoclimatological proxy record is mirrored in the seasonality of various reconstructions, although there is an important note to be made regarding this fact. Of the twelve temperature reconstructions that are investigated in this chapter, only two – BOS2001 and P2017(T) – consider themselves to be purely ‘summer’ reconstructions, whilst ten consider themselves to be reconstructions of mean ‘annual’ temperatures (see table below). However, upon closer examination many of these ‘annual’

reconstructions are based on proxy data which is weighted towards the summer months, with JBB1998, MBH1998, ECS2002, and L2010 each containing something of a disclaimer within the text that acknowledges that the reconstructed ‘annual’ temperatures are, as L2010 states, ‘biased towards the warmer seasons of the year’ (Ljungqvist 2010: 340). Even those which do not contain such a disclaimer could arguably be seen to be weighted, at least in part, to the summer months. This warm-season bias is also present in the four precipitation reconstructions discussed in this chapter, with all four either recreating summer precipitation – BTN2011(P) and P2017(P) – or recreating spring-summer precipitation – WML2013 and CMT2013.

The spring-summer bias prevalent in palaeoclimatological reconstructions is not necessarily a limitation, at least in the context of this thesis. Medieval life was centred on agriculture, whether arable or pastoral, and the intrinsic link between agriculture and climate ensures that it is the spring and summer months – the months that can make or break the year’s harvest and hay crop – that were most critical to success. With settlement and land-use so entwined with the fortunes of agriculture there is certainly an argument to be made that reconstructions of spring-summer temperatures and precipitation are of equal use to those which recreate mean annual values due to the importance of the spring-summer months. The dominance of spring-summer proxies has ultimately led to winter conditions being under-represented in the palaeoclimatological record, with none of the reconstructions discussed in this chapter being either solely dedicated to the colder months or weighted towards the colder months. However, whilst many annual mean temperature reconstructions are, as has been discussed above, weighted towards the warmer months, there is no reason to discount their applicability as ‘annual’ reconstructions, for as L2010 states, ‘the high correlation between seasons on decadal and longer timescales in the period covered by instrumental measurements [ensures that] it is justifiable to use [warm weighted proxies] as annual proxies, as has been done by [ECS2002] and [MSH2005]’ (Ljungqvist 2010: 340).

Temperature reconstructions

Introduction

This section will review the twelve temperature reconstructions (eleven hemispheric and one county-level) which have been produced over the past three decades. The table below contains basic information regarding these twelve reconstructions. In an effort to aid readability, these reconstructions have been assigned an abbreviation that follows a formula similar to that used by Juckes *et al.* (2007). Up to three letters form the first half of the abbreviation, with these letters referring to the first initial of the surname of the first three authors as listed on the original work, followed by the year the work was first published in. For hemispheric scale reconstructions up to 2007,

the excellent summary of palaeoclimatology's past achievements by Brázdil *et al.* (2005) and Juckes *et al.* (2007) will be indispensable in building a solid understanding of the state of palaeoclimatic research.

| Abbreviation | Author(s) | Year | Title | Period Covered | Seasonality |
|---------------------|---|-------------|---|-----------------------|-------------------------|
| JBB1998 | Jones, Briffa, Barnet, and Tett | 1998 | <i>High-resolution palaeoclimatic records for the last millennium: interpretation, integration and comparison with General Circulation Model control-run temperatures</i> | 1000-2000 | Annual, summer weighted |
| MBH1998 | Mann, Bradley, and Hughs | 1998 | <i>Global-scale temperature patterns and climate forcing over the past six centuries</i> | 1400-2000 | Annual, summer weighted |
| MBH1999 | Mann, Bradley, and Hughes | 1999 | <i>Northern Hemisphere Temperature During the Past Millennium: Inferences, Uncertainties, and Limitations</i> | 1000-2000 | Annual |
| CL2000 | Crowley and Lowery | 2000 | <i>How warm was the Medieval Warm Period?</i> | 1000-2000 | Annual |
| BOS2001 | Briffa, Osborn, Schweingruber, Harris, Jones, Shiyatov, and Vaganov | 2001 | <i>Low-frequency temperature variations from a northern tree ring density network</i> | 1400-2000 | Summer |
| ECS2002 | Esper, Cook, and Schweingruber | 2002 | <i>Low-Frequency Signals in Long Tree-Ring Chronologies for Reconstructing Past Temperature Variability</i> | 1400-2000 | Annual, summer weighted |
| MJ2003 | Mann and Jones | 2003 | <i>Global Surface Temperatures over the Past Two Millennia</i> | 200-2000 | Annual |
| MSH2005 | Moberg, Sonechkin, Holmgren, Datsenko, and Karlen | 2005 | <i>Highly variable Northern Hemisphere temperatures reconstructed from low- and high-resolution proxy data</i> | 0-2000 | Annual |
| HCA2007 | Hegerl, Crowley, Allen, Hyde, Pollace, Smerdon, and Zorita | 2007 | <i>Detection of Human Influence on a New, Validated 1500-Year Temperature Reconstruction</i> | 500-2000 | Annual |
| L2010 | Ljungqvist | 2010 | <i>A New Reconstruction of Temperature Variability in the Extra-Tropical Northern Hemisphere During the Last Two Millennia</i> | 0-2000 | Annual, summer weighted |
| XCL2016 | Xing, Chen, Luo, Nie, Zhao, and Huang | 2016 | <i>The Extratropical Northern Hemisphere Temperature Reconstruction during the Last Millennium Based on a Novel Method</i> | 850-2000 | Annual |
| P2017(T) | Pribyl | 2017 | <i>Farming, Famine, and Plague: The impact of climate in late medieval England</i> | 1256-1431 | Summer |

Table 2: Temperature reconstructions discussed in this chapter.

JBB1998, MBH1998, and MBH1999

The first three reconstructions to be investigated – JBB1998, MBH1998, and MBH1999 – will be grouped together and discussed in a single section. As some of the first hemispheric-scale temperature reconstructions all three have similar strengths and weaknesses, and whilst they are important pieces of palaeoclimatic literature and have had, as will be discussed later in this chapter, a not-insignificant influence upon landscape archaeological research, their age and their relative methodological simplicity limit both their usefulness to the present analysis and the amount of time which should be dedicated to investigating them.

JBB1998 is the first annually resolved northern hemispheric temperature reconstruction that covers the entirety of the second millennium (Jukes *et al.* 2007; Jones *et al.* 1998). MBH1998 shares the same resolution but is limited to the post-1400 period, a shortcoming which was rectified by its direct successor, MBH1999, which like JBB1998 begins at 1000 CE. These reconstructions utilise a range of proxies, with ice core, TRW, MXD, coral, and historical and instrumental data all present within the overall datasets. JBB1998 is the most limited in terms of quantity and geographical distribution, with only ten proxy datasets contributing to the reconstruction, six of which come from Europe and four from North America, although of this total only three proxies (two of which are sourced from Europe) date back to 1000. MBH1998 improves upon this by using twenty-three individual proxy records with 415 indicators, but although MBH1999 extends the temporal range, only twelve of the indicators date back to the reconstruction's start date of 1000 (Mann, Bradley, and Hughes 1998). As expected the accuracy of these pre-1400 indicators is considerably less than those of the post-1400 period, which were themselves only accurate to forty to fifty per cent back to 1400 (Mann, Bradley, and Hughes 1998; Jukes *et al.* 2007). This is a limitation of many reconstructions and one which can perhaps be best be described as 'regressive proxy thinning', in that as the reconstruction goes back in time so too does the quality and quantity of the available proxy data, although in recent years this has become less of an issue as more high-resolution, long-term annually-resolved proxy records have become available. The extent to which these reconstructions can be considered reliable – especially in the pre-1400 period – is therefore severely limited.

The morphology of these three examples also differs considerably from more recent reconstructions. Of particular note is their stunted variability, especially over the long-term. All three demonstrate a variability of no more than +/-0.4°C over the course of the study period, a fact which makes discerning any of the well-known climatic 'periods' difficult. For example, the 'Medieval Warm Period' (MWP) is essentially absent from JBB1998 – as is a defined 'Little Ice Age' (LIA) – although the authors do suggest that the lack of pre-fifteenth century proxies should warn the reader 'against dismissing the feature'

outright (Jones *et al.* 1998: 464). A well defined MWP is similarly absent from MBH1999, although in this case the authors make no mention of the MWP at all. MBH1998 and MBH1999 do, however, show a marked decline in temperatures c. 1450 – an event which is commonly thought to herald the initiation of the LIA – and which is the most pronounced climatic event described in these reconstructions.

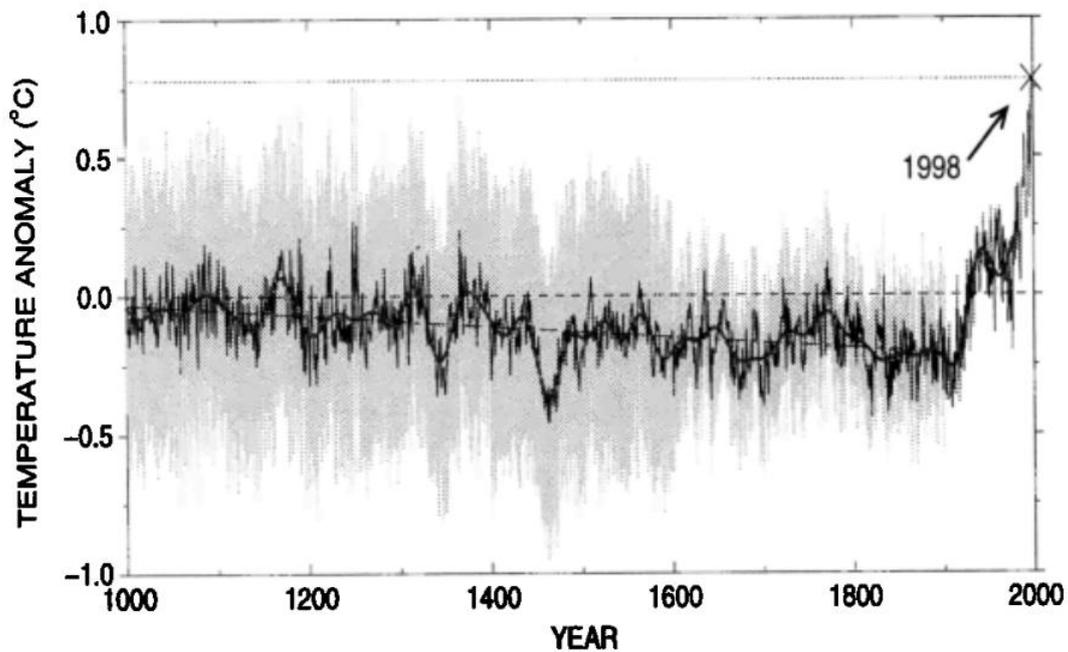


Figure 12: MHB1999 temperature reconstruction. Reproduced from Mann, Bradley, and Hughes 1999.

The techniques used to create these reconstructions are also of considerable importance to their reliability. The techniques used by MBH1998 and MBH1999 are more advanced than those used by JBB1998, with the principal differences being the former's creation of a multiproxy network of high-quality, annually-resolved proxies in lieu of the latter's simpler method of combining regional reconstructions to create a single large-scale reconstruction (Juckes *et al.* 2007; Mann and Jones 2003; Mann, Bradley, and Hughes 1998). This, combined with the MBH series' use of the climatic-anomaly-exploiting method of utilising spatial patterns of temperature variability over that of a mean hemispheric temperature time series places MBH1998 in a position above that of JBB1998 in terms of reliability (Juckes *et al.* 2007; Mann and Jones 2003; Mann, Bradley, and Hughes 1998). However, all three of these examples are undeniably primitive in their approach when compared to the techniques utilised in modern palaeoclimatological studies. Despite this, of all the hemispheric reconstructions discussed in this chapter, MBH1999 is perhaps the most widely known. This is largely due to its inclusion in the 2001 IPCC Third Assessment Report and is the original 'hockey stick graph' as first labelled by Mahlman, and has ultimately gone on to become a benchmark against which many palaeoclimatological reconstructions are measured (Wahl and Ammann 2007).

Overall, these three reconstructions are plagued by a combination of relatively simplistic techniques, insufficient numbers of proxies, and a lack of long-term data. They do, however, provide a starting point from which to analyse and critique subsequent palaeoclimatic reconstructions, which were built on the foundations laid down by these early examples.

CL2000

CL2000 did not attempt to override the previous reconstructions (JBB1998, MBH1998, MBH1999); rather, it attempted to present new and unused evidence using a differing methodology to dispel notions that twentieth century warming is not unusual (Crowley and Lowery 2000: 51-4). Whilst the target of this reconstruction was not to present a comprehensive hemispheric-scale reconstruction, the differing data sources used by CL2000 highlights some important facts regarding the possible timings of early-second millennium warmth.

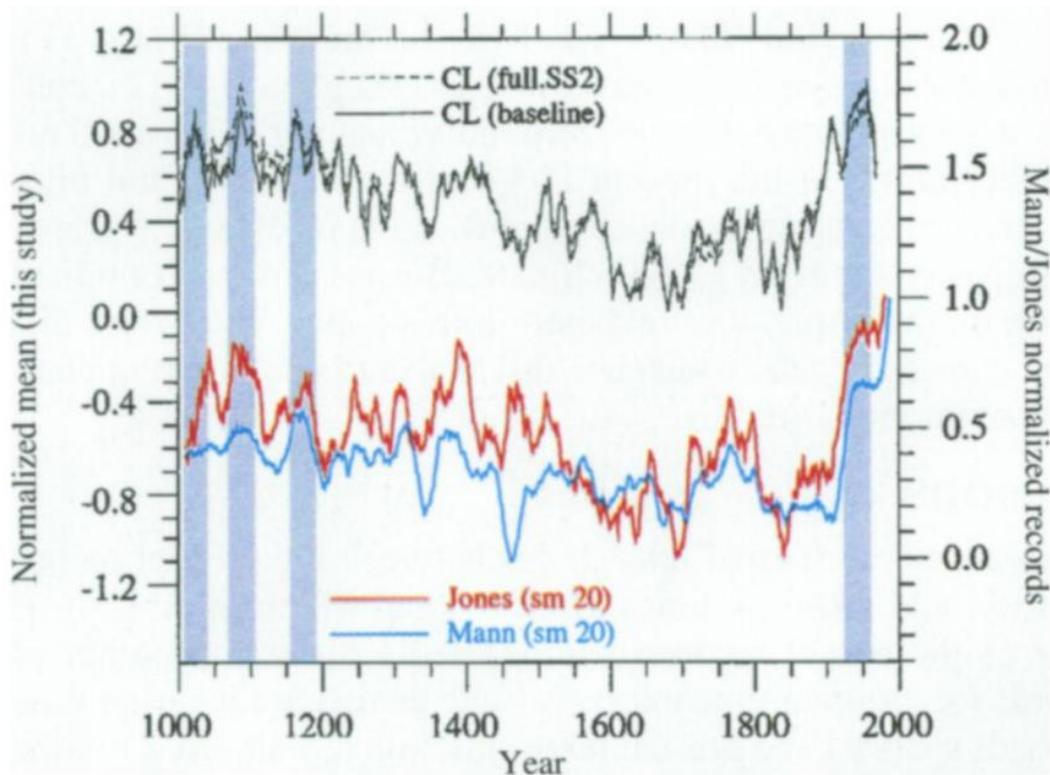


Figure 13: CL2000 temperature reconstruction, shown against JBB1998 (red line) and MBH1999 (blue line). Reproduced from Crowley and Lowery 2000.

The authors argue that JBB1998, MBH1998, and MBH1999 used more 'modern' proxy datasets than 'ancient' datasets and also noted that earlier reconstructions utilise a patchwork of different proxies all spanning different temporal periods, with the resultant reconstruction being the product of proxies that have essentially been stitched together. They therefore made use of fifteen carefully selected, millennial-long, relatively unused proxy datasets from across the Northern Hemisphere, with seven of

these proxies being sourced from Europe and Greenland (Crowley and Lowery 2000: 51-4). These proxies include tree-ring, ice core, marine, palynological, phenological, and historic documentary data, and are, in general, considerably lower in resolution than many of the proxies used in previous reconstructions. Only seven are annually resolved, and of the remaining eight proxies only five are decadal resolved, with three resolved to just fifty-years. Interestingly, the authors deem this a positive aspect, suggesting that 'in a sense, these inhomogeneities can be considered in a positive light as a sensitivity test to the robustness of the conclusion of Medieval warmth, with the repeat analysis justified based on the sheer frequency with which such records are used to make broad-scale generalisations about the relative magnitude of warmth in the Middle Ages' (Crowley and Lowery 2000: 52).

Unlike its predecessors, CL2000 suggests that there is clear evidence of an MWP, albeit in a form that differs from Lamb's original concept. They find three peaks in temperature, the first between c. 1010 and c. 1040, the second between c. 1070 and c.1105 (the warmest peak), and the third between c. 1155 and c. 1190, which CL2000 argues constitutes the MWP. Interestingly, the warmest peak c. 1070-1105 peak deviates by just a single year from JBB1998's warmest pre-1990 summer, which they consider having occurred in 1106. Following these peaks temperatures decline, with the most significant drop in temperature within the study period occurring during the fifteenth century, concurring with the conclusions reached by MBH1999. The magnitude of variation between the 'warm' conditions of the MWP and the 'cool' conditions of the LIA (which CL2000 considers to begin c. 1580) is, however, somewhat underwhelming, with CL2000 finding that the *mean* temperatures experienced between 1000-1200 were just +/-0.2°C warmer than those experienced during the LIA, a conclusion which finds little support in later reconstructions (Crowley and Lowery 2000: 52).

BOS2001

So far, only multiproxy reconstructions have been discussed in this section. BOS2001 differs in that it only utilises high-latitude and high-altitudinal dendroclimatic proxy datasets, extracted from nine geographical regions (Briffa *et al.* 2001). In addition to only using dendroclimatic datasets, the application of age band decomposition (ABD) – a technique that allows for long-term variability to be better preserved within the dataset, thereby giving more accurate results – gives BOS2001 an edge over previous reconstructions (such as MBH1999 and CL2000) that have made use of dendroclimatic proxies but which likely lost a large degree of variability due to variability-reducing techniques (Jukes *et al.* 2007). The result is noteworthy for its divergence from previous reconstructions with regards to the fifteenth century, with the final hemispheric graph in BOS2001 describing no sharp decline in temperature, instead describing an oscillating sequence of peaks and troughs. However, in previous

attempts earlier in the paper the decline is clearly represented; why this temperature decline does not feature in their final reconstruction is briefly discussed by BOS2001 and serves to highlight a salient point that must be considered when analysing any piece of palaeoclimatological research.

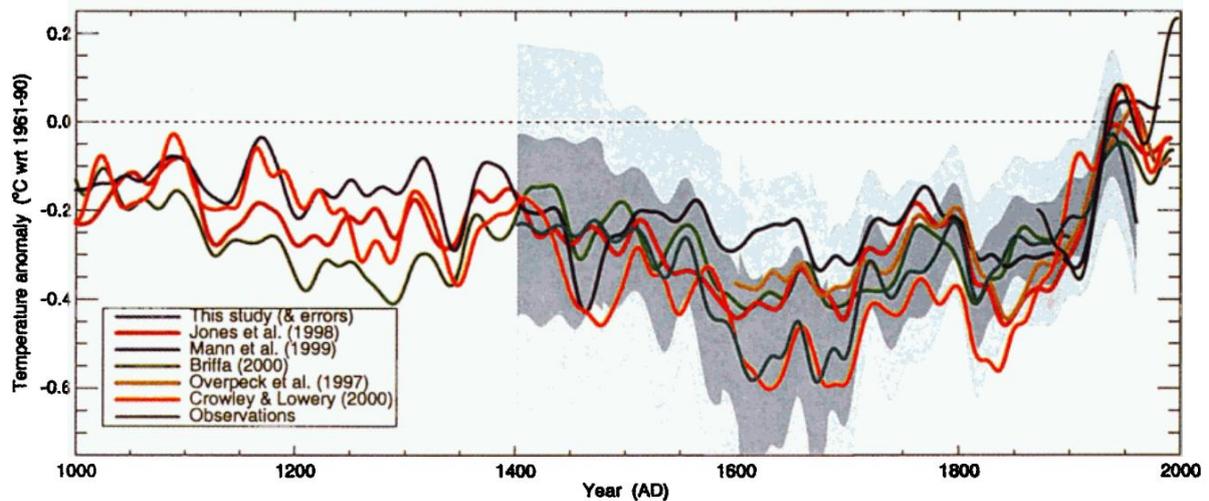


Figure 14: BOS2001 temperature reconstruction, shown against JBB1998, MBH1999, CL2000 and others. Reproduced from Briffa *et al.* 2001.

The final reconstruction was created using principal components regression (PCR), a statistical technique based on principal component analysis (PCA). The advantages of PCA, which are better described elsewhere (see Bro and Smilde 2014), essentially lie in its ability to reduce the dimensionality of large, cumbersome datasets into more compact, more workable datasets without incurring a heavy loss of accuracy (Briffa *et al.* 2001). PCA (and by extension PCR) demands from the outset as complete a dataset with as many principal components as is feasibly possible; thus, the more of the nine regions within BOS2001 that contain data for a specific time period, the more accurate the reconstruction. Given that only two of the nine regions have data for the 1402-1479 time period, the absence of a sharp decline in temperatures *c.* 1450 in the PCA/PCR reconstruction is more a product of the techniques used than it is representative of an absence of decline. This highlights a point of critical importance that holds true for all of the reconstructions discussed in this chapter; each curve has been created using a myriad of similar or differing statistical techniques, and as BOS2001 demonstrates, these techniques can significantly alter the morphology of the curve and thus the conclusions extracted from them.

BOS2001 also makes an interesting point regarding hemispheric scale temperature reconstructions. Due to the scarcity of long-term, high-resolution proxies previous reconstructions (JBB1998, MBH1998, and MBH1999) reuse the same datasets, which BOS2001 argues has led to ‘a strong element of overlap’ which has reduced the extent to which these reconstructions can be considered independent, which is further exacerbated if the piece of work is part of a uniformly-authored

sequence (Briffa *et al.* 2001: 2937). This rings particularly true of MBH1998 and MBH1999, and whilst this is by no means necessitates the automatic disqualification of reconstructions that are either re-using previously utilised proxy data or are the results of uniformly-authored sequences, it is critical that the reader keep in mind that whilst raw data is without agenda, the choice of data is very much a subjective decision, and individual personalities inherently inject a certain amount of subjectivity into their research.

ECS2002

Following BOS2001 is another tree-ring-based reconstruction, ECS2002. ECS2002 uses regional curve standardisation (RCS) in place of ABD, which allows for greater preservation of growth-trends that diverge from the regional curve, which in turn 'may reflect a low-frequency change in climate forcing on growth' (Esper, Cook, and Schweingruber 2002: 2251). The preservation of low-frequency climatic signals is critical in maintaining a true reflection of multi-centennial variability.

The differing processes applied by ECS2002 are reflected in the differing conclusions reached by the study to its predecessors. ECS2002 begins at c. 850 with a temperature of approximately -0.9°C against the 1900-77 baseline period, which is perhaps the final expression of so-called 'Dark Age Cold Period' (DACP), a period of significant cold which preceded the MWP. Following this, ECS2002 presents a series of temperature peaks c. 900, c. 1000, c. 1040, and c. 1090, peaks which they theorise are the principal expressions of the MWP but which never breach the $+0.1^{\circ}\text{C}$ mark. After c. 1100 temperatures enter a period of prolonged decline, and by c. 1460 temperatures have dropped back to c.850 levels, with temperatures at the end of the study period sitting at approximately -0.5°C .

ECS2002 suggests that the lack of an overtly distinguishable MWP in MBH1999 is perhaps due to the 'reduced expression of the LIA compared with [ECS2002]' precipitated by ECS2002's increased sensitivity to low-frequency signals (Esper, Cook, and Schweingruber 2002: 2252). ECS2002 firmly supports the notion of a MWP, stating that 'evidence for a large-scale MWP (*sensu lato*) has been reconstructed...' and is the first reconstruction to propose pushing the initiation of the MWP to before the beginning of the second millennium (Esper, Cook, and Schweingruber 2002: 2251). The timings of ECS2002's MWP (900-1300) and LIA (1200-1850) are, however, somewhat confusing.

Their MWP begins at c. 900 when temperatures were approximately -0.1°C against the 1900-77 baseline period, but ends in 1300 when temperatures were approximately -1°C . Why then, does -0.1°C constitute the beginning of a warm period but not the end of a warm period? Even stranger is that ECS2002's MWP includes the period of the most sustained cold (as shown in Figure 3 of ECS2002), which spans over a century from c. 1200 to c. 1300, a period which is both in their MWP and their LIA.

This leads to a dichotomy which dictates that an individual living in the thirteenth century was existing in a period that was marked by both above average warmth and abnormal cold when compared against the long-term average. When the morphology of this overlapping period is taken into consideration, it is difficult to understand why the authors considered this period as belonging to the MWP, for at the start of their LIA temperatures actually increase significantly from the levels present during the overlapping thirteenth century. This issue of determining when named climatic periods begin and end is not limited to ECS2002, and without a set, universally applied methodology the use of such names is more a hindrance than a help. Furthermore, given the extent to which archaeological and historical literature leans on such names, the need for clarity in this area has never been greater.

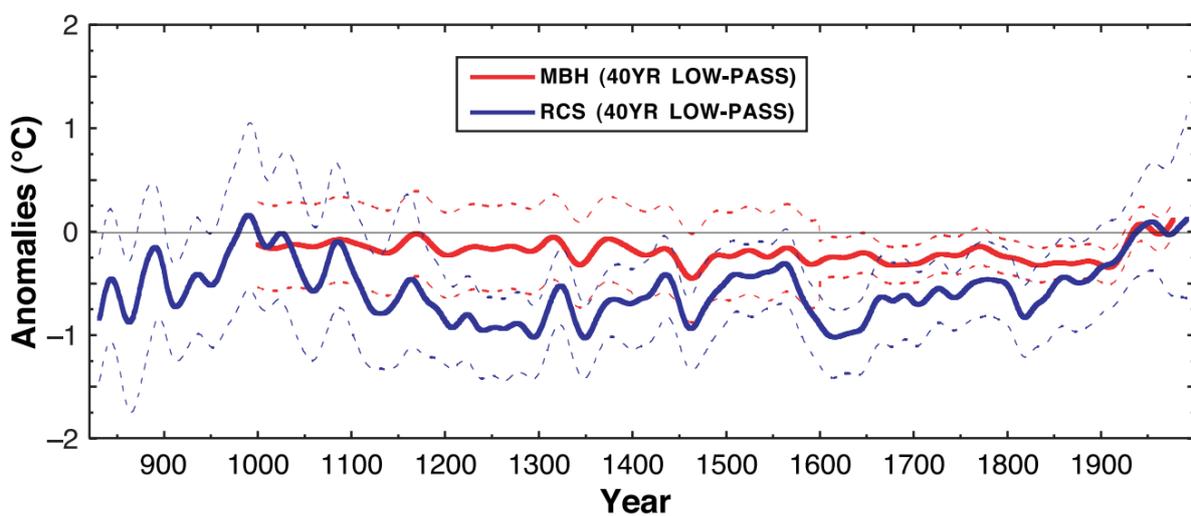


Figure 15: ECS2002 temperature reconstruction, shown against MBH1999. Reproduced from Esper, Cook, and Schweingruber 2002.

ECS2002 has, unsurprisingly, faced considerable criticism (Jukes *et al.* 2007; Cook, Esper, and D'Arrigo 2004). It is abundantly clear that in an effort to preserve and detect low frequency signals the magnitude of the fluctuation has been considerably deformed, to the extent that ECS2002 is largely dissimilar to any other reconstruction presented in this chapter. ECS2002 does, however, appear to capture a sequence of peaks between the late tenth century and the early twelfth century, peaks which are present in later reconstructions. This suggests that whilst the magnitude of temperature variation described by ECS2002 is largely unreliable, the timing of temperature fluctuations may, in some instances, be somewhat reliable. This bolsters the suggestion made earlier in this chapter that the morphology of the curve is of more use to this study than the magnitude of fluctuation.

MJ2003

MJ2003 presents an annual hemispheric temperature reconstruction based on high-resolution proxy data gathered from twenty-three individual proxy records which span the last 1800 years (Mann and

Jones 2003: 1). The proxy records used are of varying type, with ice cores, tree-rings, lacustrine sediments, macrofossils, and borehole datasets all contributing to MJ2003, with datasets coming from locations scattered across the Northern Hemisphere. Unfortunately, only six proxies go back to MJ2003's start date of 200 CE, increasing to just eight by 553; the extent to which earlier periods can be considered reliable is thus, once again, limited.

MJ2003 describes a cool start to the study period, with a nadir of -0.35°C occurring c. 536 against the 1901-80 baseline period, which gradually rises and culminates in a millennial apogee of -0.15°C c. 850. This is then followed by a short, somewhat anomalous cool period which sees temperatures plummet and then swiftly recover. After this cold spell came a significant recovery, with temperatures reaching a pre-twentieth century high of -0.15°C c. 1100, after which temperatures entered a prolonged, gradual decline marked by roughly 50-year oscillations between warm peaks and cold troughs. This period comes to an abrupt end c. 1450, when temperatures plummet to their lowest value (-0.4°C) seen in both the first and second millennium (Mann and Jones 2003: 10).

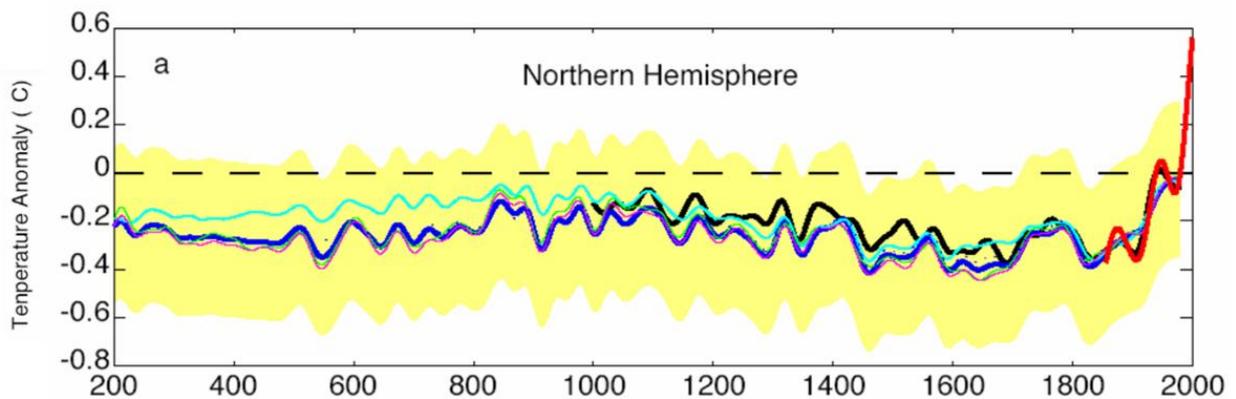


Figure 16: MJ2003 temperature reconstruction (blue line). Reproduced from Mann and Jones 2003.

MJ2003 states that in general, the six-hundred-year period between 800 and 1400 is warmer than the multi-century periods framing it, but it is careful not to use the problematic term 'warm period'. Whilst this period was undoubtedly warmer than the preceding or succeeding periods, it nonetheless contains significant periods when the climate was anything but warm (e.g., the cold period in the late ninth and early tenth centuries). In terms of similarity with other reconstructions, MJ2003 somewhat concurs with the general timings established by previously discussed reconstructions, namely an apogee of second century warmth c. 1100 which was followed by a prolonged and gradual cooling that culminated with a sharp plunge in temperatures c. 1450. In regard to magnitude MJ2003 is muted. It suggests a historic climate with limited multi-centennial variability, with nearly all of the reconstructed temperatures lying between -0.1°C and -0.4°C ; it is more in the vein of JBB1998 than

the more experimental reconstructions which were appearing in the early years of the twenty-first century.

Alongside the reconstruction, MJ2003 briefly discusses the issue of proxy weighting, with the authors noting that while the results of their reconstruction largely complies with the results and general morphology established by previous Northern Hemispheric reconstructions (JBB1998, MBH1998, and MBH1999), if weighting is removed certain proxies tend to dominate and the reconstruction is subsequently skewed, which again highlights the central role played by statistical techniques in determining the morphology of the reconstruction (Mann and Jones 2003: 1).

MSH2005

The reconstructions discussed so far all contain the basic assumption that high-resolution proxies – which are typically annually resolved – are superior to low-resolution proxies – which are typically decadal or centennially resolved. MSH2005 chooses to buck this trend, arguing that low-resolution proxies – in this case ocean and lacustrine sediments - can cede climatic information on a multi-centennial scale that would otherwise be missed by higher resolution proxies (e.g., annually resolved trees and ice cores). By combining these low-resolution proxies that are typically centennially resolved with a wavelet transformation technique in place of Climate Field Reconstruction (CFR), MSH2005 hoped to circumvent von Storch's critique that CFR was unable 'to yield realistic estimates of past variation in Northern Hemisphere temperature' (Wahl, Ritson, and Ammann 2006: 1; von Storch *et al.* 2004). However, as Wahl, Ritson, and Ammann (2006) subsequently proved, the von Storch *et al.* (2004) criticism was itself flawed, placing MSH2005 on considerably shaky ground from the outset. Combined with the use of variance scaling over that of the regression techniques used in previous studies (PCA and PCR), it is no surprise that the results of MSH2005 vary considerably from those already presented in this chapter, although, as will be discussed, MSH2005 is not as flawed as might first appear.

Between 500 and 600 MSH2005 describes, in their calibrated reconstruction, a climate similar to that described in MJ2003, although this is where similarities abruptly terminate. MSH2005 shows a nadir of -0.4°C occurring c. 530 which is then followed by gradual rise in temperatures after c. 600, ultimately peaking c. 700 at -0.2°C against the 1961-1990 calibration period. Jukes *et al.* (2007) criticises MSH2005 on this short calibration period, arguing that this calibration period is far too short to independently calibrate the low frequency components of MSH2005, although this is a criticism that can be levelled against many of the reconstructions discussed in this chapter (Jukes *et al.* 2007: 595). Post-700 MSH2005 shows a rapidly warming climate, one that peaks c. 990 and c. 1100 at +/-0°C. Whilst this latter peak is shown in other millennium-long reconstructions (albeit with a slightly less

pronounced magnitude), the former is a new addition to the climate record and one that features in all of the subsequent reconstructions (HCA2007, L2010, and XCL2016). Post-1100 temperatures enter a two-century long decline that culminates in a nadir of approximately -0.4°C c. 1300, followed by a brief rise and then by a severe decline that culminates in the latter half of the sixteenth century at approximately -0.7°C . With regards to named climatic periods, MSH2005 chooses not to label any period with the appellation DACP, MWP, or LIA.

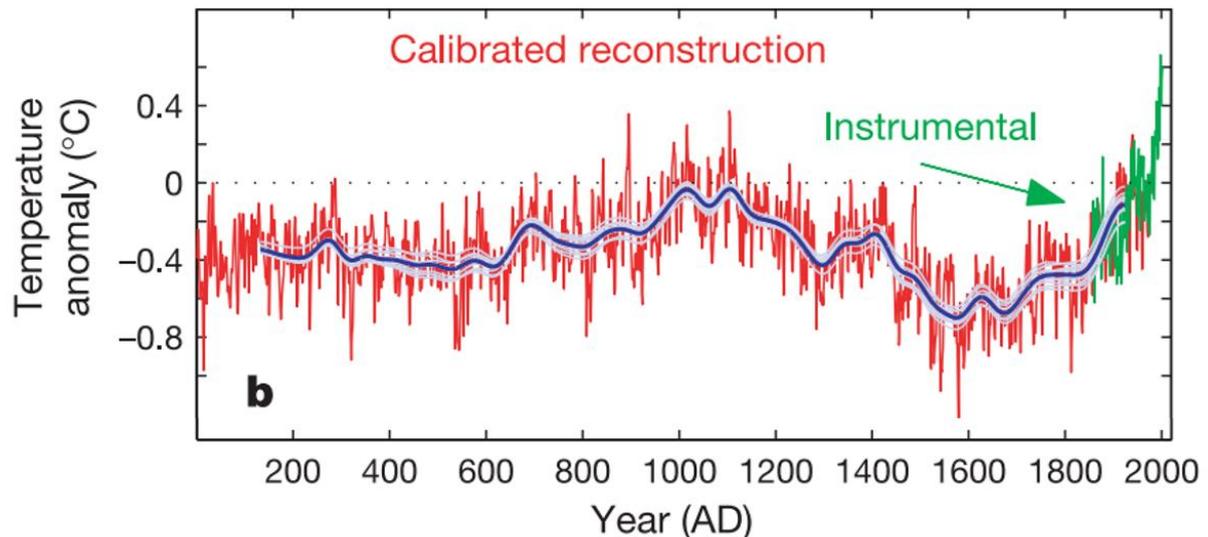


Figure 17: MSH2005 temperature reconstruction. Adapted from Moberg *et al.* 2005.

Whilst Mann *et al.* (2005) has criticised the methods used by MSH2005, it is perhaps significant that in an exercise undertaken in Juckes *et al.* (2007), where a 'union' curve was constructed from thirteen individual proxies, it was found that it shares considerable resemblance with MSH2005. In light of MSH2005's resemblance to later temperature reconstructions (L2010 and XCL2016) and to Juckes *et al.*'s 'union' curve, there is a strong case to consider MSH2005 as a significant piece of palaeoclimatological research that perhaps marks the escape of Northern Hemispherical reconstructions from the vast shadow cast by MBH1999. It is clear that the preservation of low-frequency signals is a fundamental necessity required of reconstructions if they are to accurately portray past temperatures, although it is vital to note that high-frequency signals are just as important; reconstructions should thus strive to preserve both low- and high-frequency signals, for they each have their benefits and appear to produce the most satisfactory results when used in tandem with each other.

HCA2007

Much like MSH2005, HCA2007 chooses to focus on low-resolution proxies, and proposes a new type of calibration that attempts to reduce the loss of low-frequency variance. HCA2007 utilises much of

the data – albeit in an updated form – as that used by CL2000, although the reconstructive methods used in HCA2007 differs considerably from CL2000 (Hegerl *et al.* 2007: 651)

It has already been discussed in BOS2001 how dendroclimatically-based reconstructions can fail to preserve low-frequency multi-centennial variation (Hegerl *et al.* 2007: 651). Frequency is not, however, the only factor which is critical in creating an accurate temperature reconstruction. All proxies invariably contain within them a certain amount of ‘noise’ from both climatic and non-climatic influences, with little attempt in prior reconstructions to filter out such noise. A noisy dataset can potentially lead to false conclusions, and so in an effort to combat the issue of noise HCA2007 advocates the use of a reconstructive method based on total least squares, a variant form of regression analysis which they claim can allow for ‘proper accounting of noise in both proxy and instrumental data during calibration, yielding a reconstruction with realistic amplitude and uncertainty’ (Hegerl *et al.* 2007: 651). Jukes *et al.* (2007: 596) notes that such a technique deals with proxy and instrumental noise in a different manner than previous reconstructions; whilst the inverse regression analysis used by MBH1999 deals with the issue of noise by effectively ignoring it, the total least squares regression used by HCA2007 attempts to take into consideration instrumental and proxy noise (Jukes *et al.* 2007: 596). It should be of little surprise, then, that HCA2007 demonstrates far greater variability and presents a reconstruction that is more akin to MSH2005 than MBH1999.

In an effort to avoid data inhomogeneity HCA2007 splits its reconstructions into three distinct, individual segments based on equally long proxies (which has the added bonus of eliminating the issue of regressive proxy thinning), of which only one, *CH-blend (Dark Ages)* – which covers the period 558-1950 CE and is based on five proxy records – is discussed here, as this segment is the longest of the reconstructions and as a homogenous record it is more accurate on an extended timescale than a combination of segments (Hegerl *et al.* 2007: 651). Calibration also differs from many of the previously discussed reconstructions, with HCA2007 choosing to use a calibration period of 1880-1960, a marked departure from the usual calibration period of 1961-1990. The authors argue that the 1961-1990 calibration period often leads to an overestimation of variance, and while they acknowledge that the 1880-1960 calibration period often leads to an underestimation of variance, the active attempt to reduce noise and boost the preservation of low-frequency signals makes the utilisation of a calibration period prone to underestimation the logical choice (Hegerl *et al.* 2007: 654-5).

HCA2007 begins at 558 with a temperature of -0.1°C against the 1880-1960 calibration period (Hegerl *et al.* 2007: 564). This drops to nearly -0.4°C in the late sixth century, before recovering substantially to $+0.2^{\circ}\text{C}$ c. 600. Following this considerable high, temperatures drop once again, so that by the closing

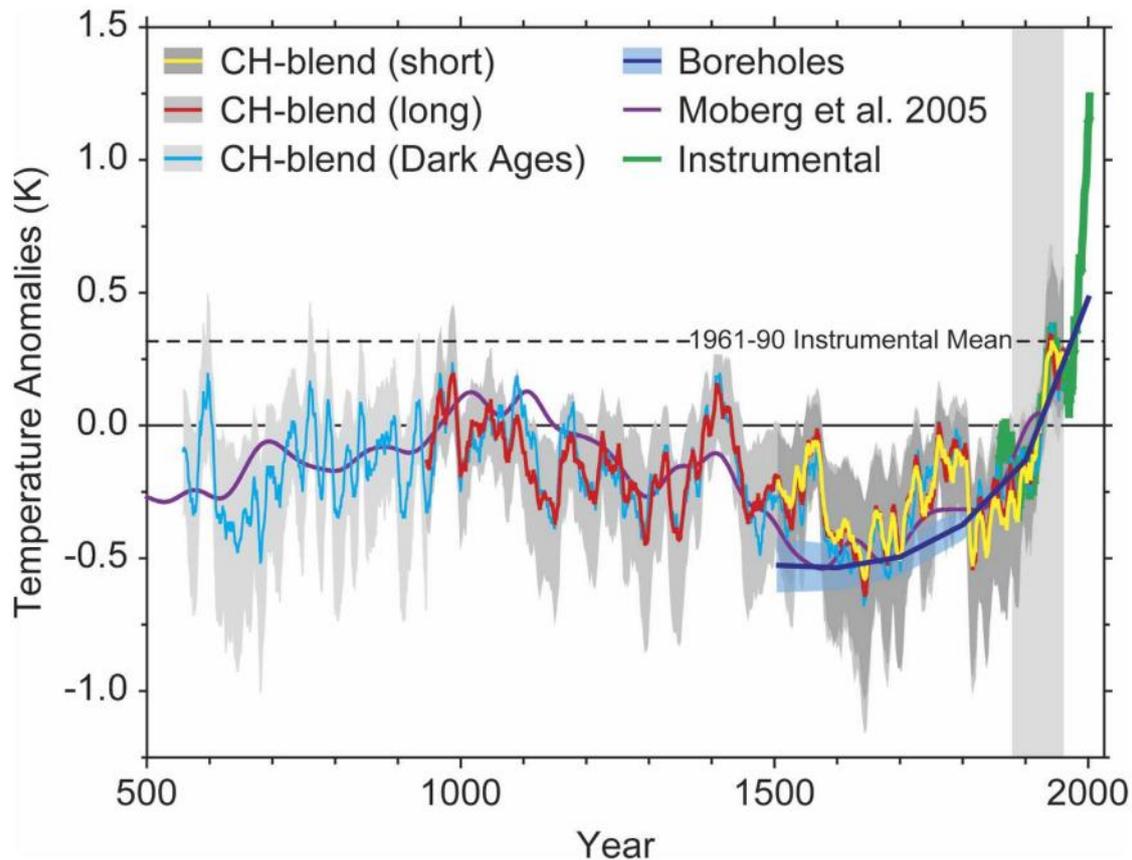


Figure 18: HCA2007 temperature reconstruction. The blue line (CH-blend (Dark Ages)) is the reconstruction discussed in this thesis. Reproduced from Hegerl et al. 2007.

decades of the seventh century temperatures are at -0.5°C , the coldest in the pre-seventeenth century period. Temperatures begin a gradual climb post-700, rising to roughly the same temperature that experienced c. 600 by c. 750. Temperatures briefly declined c. 800, but the general trend is one of gradual warming, culminating in the closing years of the tenth century with an apogee of approximately $+0.25^{\circ}\text{C}$, a morphology similar to MSH2005. Temperatures fluctuated only marginally during the eleventh century, perhaps by just $\pm 0.1^{\circ}\text{C}$, so that by 1100 temperatures were at the same level as they were in 1000. Following 1100, temperatures dropped by a considerable margin, and by the late twelfth century temperatures were approximately -0.4°C . This was immediately followed by a dramatic warming, so that by c. 1200 temperatures were reaching upwards of $+0.15^{\circ}\text{C}$, a remarkable recovery over such a short period of time. The period after 1200 varies rather dramatically from other reconstructions; the general downwards trend described by HCA2007 continues until c. 1300 with temperature lying at approximately -0.4°C . HCA2007 then describes a significant recovery peaking at c. 1400; such a considerable recovery at the turn of the fifteenth century is not described by any other reconstruction. Following this unprecedented high, temperatures rapidly plunge, so that by 1500 temperatures are lying at approximately the same levels as that experienced in the late sixth century.

HCA2007 thus appears to capture more variability than MSH2005, and whilst it contains some fundamental divergences, most notably with the positive spike c. 1400, it continues to elaborate on the image painted by MSH2005 of a climate that is far more variable than the more muted, 'traditional' reconstructions. It is in many places coherent with later reconstructions such as L2010 and XCL2016 and is part of a growing body of evidence that suggests climate was far more variable over the *long durée* than was previously thought.

L2010

A recurrent theme throughout this section has been the significant impact that differing methodologies and reconstructive techniques can have on the conclusions reached by palaeoclimatic studies; for example, compare MBH1999 with MSH2005 and it is immediately apparent that the varying statistical techniques, whilst both being derivative forms of regression analysis, have led to dramatically differing outputs. Furthermore, it has also been discussed how the type and temporal range of proxies can dramatically alter a reconstruction. L2010 echoes these concerns, and makes the convincing argument that previous reconstructions – and especially those that rely on dendroclimatic data – have been over-reliant on proxy data originating at high latitudes, a shortfall which L2010 attempts to rectify (Ljungqvist 2010: 340). L2010 also notes that the termination point of many proxy records precedes the final decades of the twentieth century, which Ljungqvist suggests has led to a possible underestimation of temperature in historic warm periods, which may account for the muted morphology of JBB1998 and MBH1999, theorised as they were when data from the last decade of the twentieth century was incomplete (Ljungqvist 2010: 340).

In order to build the reconstruction L2010 utilised thirty proxy records, the highest amount of the reconstructions presented in this chapter. They are also considerably varied in type, with documentary data, marine sediments, lacustrine sediments, speleothem $\delta^{18}\text{O}$, ice core $\delta^{18}\text{O}$, varved thickness sediments, TRW, MXD, and $\delta^{13}\text{C}$ tree-ring records all present in the dataset (Ljungqvist 2010: 340). So extensive is the reconstruction that Ljungqvist confidently states that 'virtually all available high-quality palaeotemperature proxies with a reasonably high temporal resolution have been used' (Ljungqvist 2010: 340). When compared to the proxies used in previous studies, L2010 is far superior in terms of both type and temporal and spatial distribution, and throws the conclusions reached by these earlier reconstructions into further doubt.

The results of L2010's reconstruction tells both a familiar and a slightly differing story to its predecessors. A considerable cold period spanning some five-hundred years from c. 300 to c. 800 is identifiable, which was followed by warmer period also spanning some five-hundred years from c. 800

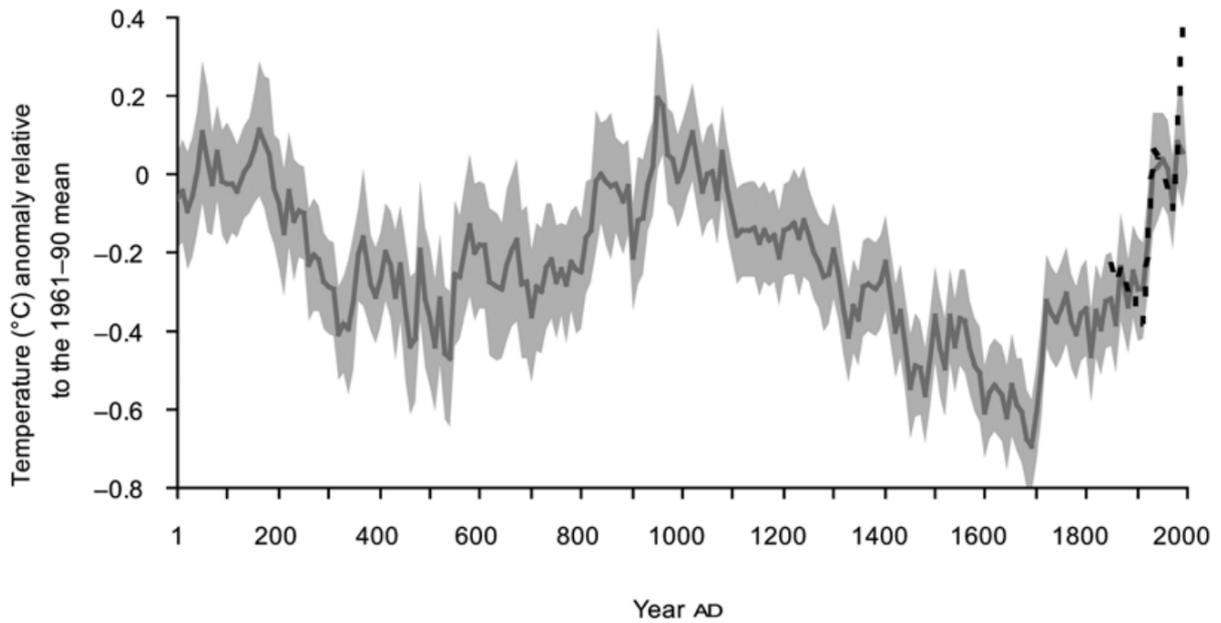


Figure 19: L2010 temperature reconstruction. Reproduced from Ljungqvist 2010.

to c. 1300. Conditions then begin to cool c. 1300, with this downwards trend persevering until the turn of the twentieth century. More importantly, the temperature anomaly compared to the 1961-1990 calibration mean is more akin to MSH2005 and HCA2007 than it is to JBB1998, MBH1999, and MJ2003. L2010 also displays far more multi-centennial variability than that shown in other reconstructions, with L2010 varying by some $\pm 0.6^{\circ}\text{C}$ between the warmest and coldest century (excluding the twentieth) compared to just $\pm 0.22^{\circ}\text{C}$ in MJ2003, and it should come as no surprise that MSH2005 provides an extremely similar variability of $\pm 0.58^{\circ}\text{C}$; L2010 does, however, warn caution in this value as MSH2005 was scaled against the full range of the Northern Hemisphere ($90-0^{\circ}\text{N}$), whereas L2010 is only scaled against the extra-tropical ($90-30^{\circ}\text{N}$) Northern Hemisphere (Ljungqvist 2010: 343). This is of particular use to this study, for the more spatially restricted latitudinal emphasis of L2010 make its applicability to Norfolk – which lies at approximately 53°N – greater than other reconstructions.

L2010 records a temperature of approximately -0.4°C against the 1961-1990 calibration mean at c. 500. In the first half of the sixth century the temperature drops even further, likely as a direct consequence of a massive volcanic eruption that occurred c. 536. Following this disastrous event temperatures began to slowly improve, with a gradual but inexorable upwards trend visible in the reconstruction from this point. By c. 800 the cold of previous centuries had given way to warmth, with the early years of the ninth century reaching $\pm 0^{\circ}\text{C}$. This marks the beginning of a period of warmth which peaks, much like in MSH2005 and HCA2007, in the final decades of the tenth century with an apogee of $+0.2^{\circ}\text{C}$, a high which is not equalled until the closing decades of the twentieth century. L2010 found that it was in the tenth century's sixth decade that the warmest temperatures were

experienced. Following this maximum, temperatures begin a slow downwards trend, with a slightly reduced maximum to that experienced in the 950s occurring in the 1030s with a pre-twentieth century millennial high of +0.1°C. Following this, temperatures continued on their downwards trajectory, although the period between c. 1100 and c. 1250 appears to have been noticeably stable, with temperatures fluctuating by less than +/-0.1°C. This period of stability was, however, brought to an abrupt end in the late thirteenth century when temperatures plunged to -0.4°C. Following this decline temperatures briefly rose c. 1400, before dropping to approximately -0.5°C in the closing decades of the fifteenth century, with this marking the lowest temperature of the c. 500 to c. 1500 period in L2010. This is far more consistent with the overall morphology of previous reconstructions than the anomalous mid-fifteenth century temperature stated in HCA2007, which paradoxically considered the mid-fifteenth century one of the warmest periods in the second millennia.

Overall, L2010 is a solid attempt at a two-thousand year-long Northern Hemispheric temperature reconstruction. It demonstrates significant variability without over-relying on low-resolution proxy data, and it is refreshing in that it is both a demonstration of a newly developed methodology and a serious attempt at an accurate, hemispheric-scale temperature reconstruction of the past two-thousand years. L2010 refines the morphology and magnitude set out in MSH2005 and HCA2007, and suggests a variability of approximately +/-0.89°C between the warmest and coldest climatic episodes (Ljungqvist 2010: 347).

XCL2016

The final Northern Hemispheric reconstruction presented here continues to strive towards the common goal of preserving low-frequency variability through the adaptation of new methodologies. XCL2016 utilises MDVM, a hybrid of ensemble empirical mode decomposition (EEMD) and variance matching (VM) (Xing *et al.* 2016: 1). The benefits of adopting components of EEMD into XCL2016's 'novel approach' are numerous; not only can EEMD stabilise and clarify results, it can also allow for complex datasets to be broken down into a number of intrinsic mode functions (IMFs). After the addition of noise introduced through repeated trials, the remaining IMFs can be extracted which theoretically contain within them enhanced results (Xing *et al.* 2016: 4). The primary function of VM in XCL2016 is to 'avoid the problem with underestimation of low-frequency variability associated with direct-regression-based calibration methods' (Xing *et al.* 2016: 4). In theory, XCL2016's novel approach should not only provide accurate and meaningful results but also preserve significant low-frequency variability. With regard to the input data, when compared to L2010, XCL2016 appears to be significantly lacking in diverse proxy data, for it relies wholly on tree-ring data. This lack of diversity is not, however, necessarily a limitation, with the authors stating that their MDVM technique was

developed to be ‘applicable to pure tree-ring data [and] was developed in order to fully make use of the tree-ring records and better capture low-frequency variability’ (Xing *et al.* 2016: 2). Thus, the exclusion of other types of proxy data is by no means to be considered a limitation of XCL2016, for instead of adopting a pre-existing technique they chose instead to create a bespoke methodology that is purposefully designed to maximise the potential of the input data.

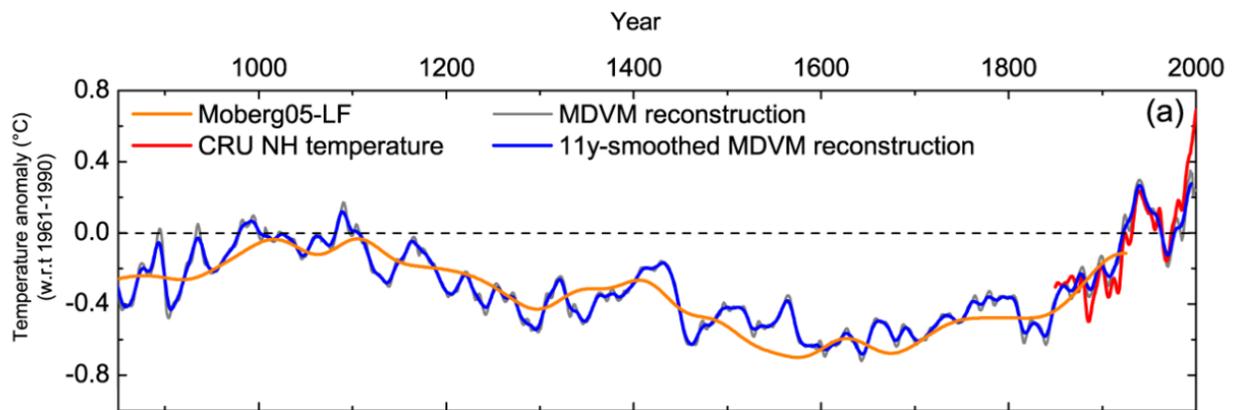


Figure 20: XCL2016 temperature reconstruction. The blue line (11y-smoothed MDVM reconstruction) is the reconstruction discussed in this thesis. Adapted from Xing *et al.* 2016.

Using XCL2016’s 11y-smoothed MDVM reconstruction, the general morphology is one that is largely coherent with its low-frequency preserving predecessors. With all fluctuations measured against the 1961-1990 calibration mean, the reconstruction begins at 850 at approximately -0.3°C , a value that is far lower than that shown in L2010 at this date. Following this cool start XCL2016 shows a general upwards trend that culminates in an apogee of $+0.1^{\circ}\text{C}$ in the 990’s. Temperatures then entered a period of relative stability for almost a century, with temperatures reaching a pre-twentieth century millennial high of $+0.2^{\circ}\text{C}$ in the 1090s. This is slightly different from MSH2005, HCA2007, and L2010, which all find the first peak c. 1000 to register the highest temperature. From c. 1100 onwards temperatures entered a steady but inexorable period of gradual decline, with the final noticeable expression of warmth occurring c. 1150 when temperatures peaked at $+/-0^{\circ}\text{C}$. Between the apogee of warmth c. 1100 and the first nadir of cool temperatures c. 1300, temperatures dropped by as much as 0.8°C , with temperatures c. 1300 sitting at -0.6°C whilst by c. 1450 temperatures had plunged to approximately -0.7°C .

The conclusions one can draw from XCL2016 are largely consistent with the overall trends marked by other reconstructions. XCL2016 picks up the tail-end of late first millennium cold and captures its transition into comparative warmth c. 950. This warmth lasts until c. 1150 where it begins to transition once again to cool conditions. The remainder of the study period is marked by a downwards trend in temperatures, with marked lows occurring c. 1300 and c. 1450. XCL2016 is in the minority of recent reconstructions that chooses to give both defined dates for the onset and termination of named

climatic periods and chooses to impose 'neutral' periods in between which, presumably, the authors deem to belong to neither the preceding climatic period nor the subsequent climatic period. This approach partly negates the criticism made earlier in this chapter that named climatic periods morph into one another and thus contain periods when temperatures cannot feasibly be considered overly warm or overly cold. Nevertheless, the usage of named periods, while useful for quick reference to long-term climatic trends, hide a considerable degree of variation and thus risks generalising periods marked by constant fluctuations.

P2017(T)

P2017(T) is an updated version of Pribyl *et al.*'s 2012 East Anglian temperature series and features alongside her precipitation reconstruction – P2017(P) – in her 2017 *Farming, Famine, and Plague: The impact of climate in late medieval England*. Much like P2017(P) – which will be discussed later in this chapter – P2017(T) is based primarily on documentary data detailing the beginning of the medieval grain harvest at 50 manors across East Anglia. All but five manors are located in Norfolk, a quality which ensures that P2017(T) is the most spatially applicable temperature reconstruction available for use by this study. Whilst P2017(T) is undeniably spatially ideal, its temporal applicability is significantly less than the other reconstructions discussed in this chapter, for it only spans a 175-year period between 1256 and 1431, a meagre 17.5% of this thesis' 1000-year study period. Whilst this is evidently a significant drawback, P2017(T) remains a significant piece of research due to its ideal spatial relevance, and closer analysis is therefore warranted.

As mentioned above, P2017(T) is principally based upon a composite dataset constructed from harvest start dates which have been extracted from medieval manorial accounts from 50 manors across East Anglia. These dates were subsequently calibrated against a further dataset of harvest dates from a comparison series based on data from Langham manor and Manley's Central England Temperature series (Manley 1973: 389-405). However, there exists a number of caveats in using this data as a climatic proxy. Perhaps the most significant amongst these is that harvest length is not just reliant on climatic factors; the supply of adequate amounts of labour, the method of harvesting (predominantly reaping versus mowing), and the total acreage of the crop under harvest all contributed to the length of the harvest (Pribyl 2017: 145-6). Major socio-economic upheaval would thus lengthen the duration of the harvest, a phenomenon easily observable in P2017(P) during the middle and later decades of the fourteenth century, when the human and institutional casualties of the Black Death were wreaking havoc on the agricultural sector (Pribyl 2017: 151). However, this is not to say that anthropogenic factors are more important than climatic ones in determining harvest length, for abnormal levels of precipitation or extreme temperatures could significantly impact the harvest. Rather, it was the

interplay between anthropogenic and environmental factors that ultimately determined the length of the harvest.

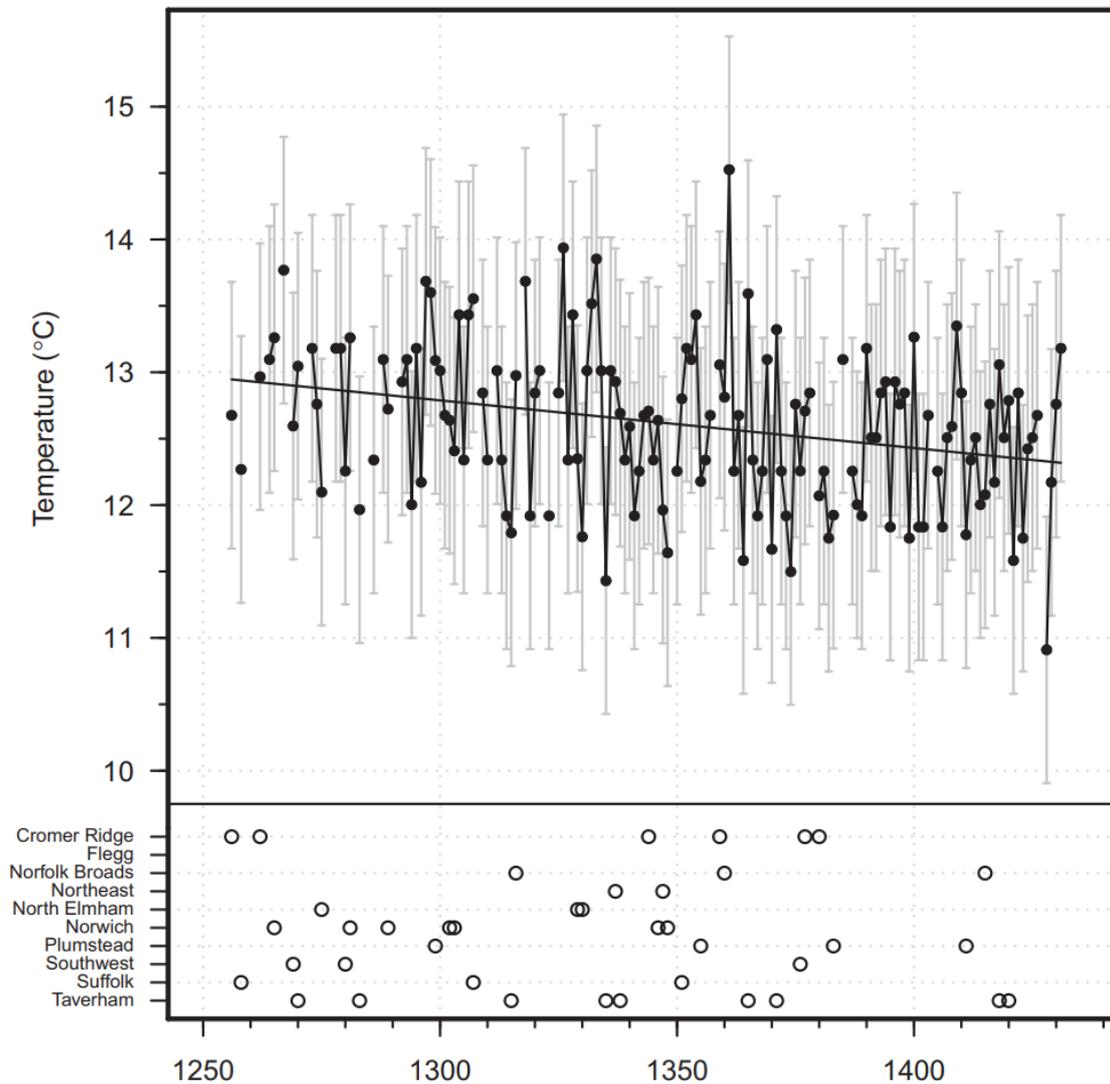


Figure 21: P2017(T) temperature reconstruction. Note that the circles in the lower panel indicate values that have been filled with data from other regional groups regressed to the Northwest series. Reproduced from Pribyl 2017.

P2017(T) is also dissimilar to other reconstructions discussed in this chapter in that it chooses to create a composite series not of mean annual values, which P2017(T) argues would ‘suppress the interannual variability’ of the data, but one based on regressed data which maintains interannual variability (Pribyl 2017: 79). The importance of retaining interannual variability is briefly touched upon, with P2017(T) stating that it was this variability that would have been ‘most keenly felt by the medieval people and that [it was this] that impacted directly on agricultural success’ (Pribyl 2017: 79). Whilst it is beyond the scope of this thesis to produce a directly comparable version of P2017(T) to the other reconstructions discussed in this chapter, the overall morphology of P2017(T)’s temperature curve can be compared to the larger hemispheric scale temperature reconstructions in order to assess any

similarities or differences. The overall applicability of P2017(T) is, from a spatial point of view, unparalleled, but as has been discussed this spatial applicability is offset by its limited temporal range. A similar argument, but this time in reverse, can also be made for the hemispheric and continental scale reconstructions; whilst many have good temporal coverage, the spatial extent is sometimes overly broad.

P2017(T) shows an overall trend of temperature decline between 1256 and 1450, with notable depressions occurring c. 1335 and c. 1430, whilst notable peaks occur c. 1325 and c. 1362. However, these do little to detract from the general trend of cooling.

Conclusion

It is clear that in the context of this study – which is seeking to construct a climatic narrative for the 500 – 1500 CE period – that the older the reconstruction the less reliable it is. JBB1998, which is chronically lacking in proxies, describes a palaeoclimate dominated by low-variability and stunted magnitudinal values, qualities which seem to be the complete antithesis of modern palaeoclimatic theory. MBH1998 and MBH1999 are also significantly flawed, and whilst they are a step up from JBB1998, they are plagued by similar limitations. BOS2001 and MJ2003 were also found to be largely dissimilar to later reconstructions, with the former seeming more a demonstration of technique and the latter appearing to rehash, albeit on a longer timescale, JBB1998. Whilst these shortcomings would make it unwise to allow these examples to overly influence the conclusions reached in this chapter, this is not reason to disqualify older reconstructions from appearing in contemporary analyses, for they provide an excellent baseline against which to measure and determine advances in palaeoclimatic science.

A step up from these three aging reconstructions are CL2000 and ECS2002. These paint a largely similar picture of the palaeoclimate, albeit one possessing slightly enhanced levels of variability compared to JBB1998, but they still fall short of the more recent reconstructions discussed in this chapter, especially in terms of variability. There are, however, elements of later reconstructions lying within these two reconstructions, most notably the series of warm peaks which occur between 1000 and 1200, and the sharp depression c. 1450, although other periods are less consistent with later reconstructions. They also utilised different proxies to previous attempts, and whilst the magnitudinal values are seemingly dissimilar to subsequent research, the timings of peaks and troughs seems to be largely similar. It is thus unnecessary to entirely exclude these examples from influencing the conclusions reached in this chapter. A similar conclusion can be reached for MSH2005, for whilst it is a step up from the reconstructions already discussed in this section, with the similarities between MSH2005 and the ‘union’ curve created by Juckes *et al.* (2007) being particularly striking, the

magnitude of temperature variation is once again stunted compared to HCA2007, L2010, and XCL2016. The limitations of MSH2005 are almost certainly due to the low-frequency nature of the input data and the lack of a bespoke methodology to combat the inherent underestimation of variance that plagues low-frequency reconstructions, as achieved by HCA2007 or XCL2016. Thus, the most useful application of these three examples is in determining the validity of subsequent reconstructions.

This leaves only the four most recent reconstructions undiscussed: HCA2007, L2010, XCL2016, and P2017(T). These reconstructions are undoubtedly the most reliable of the reconstructions presented here. Whilst HCA2007 is, like MSH2005, based upon low-frequency proxy data, the adoption of total least squares has enabled the authors to circumnavigate issues of noise and thus produce a reconstruction with more accurate levels of magnitude. XCL2016 also chose to focus on one type of data (dendroclimatic) and, much like HCA2007, developed a bespoke methodology to fully exploit their dataset, in this case through developing a hybrid technique termed MDVM. However, whilst these two reconstructions are undoubtedly of considerable quality, it is L2010 and P2017(T) which this chapter finds the most persuasive. L2010 utilises a vast array of proxies, with documentary data, marine sediments, lacustrine sediments, speleothem $\delta^{18}\text{O}$, ice core $\delta^{18}\text{O}$, TRW, and MXD records all contributing to the input dataset (Ljungqvist 2010: 340). It also displays considerable long-term variability and captures all the significant climatic fluctuations described in other reconstructions, such as the nadir in the mid-sixth century, the three peaks of late tenth and early eleventh century warmth, and the severe depression in temperature that occurred c. 1450.

Furthermore, when L2010 is compared to the much more spatially relevant P2017(T), there emerges a significant degree of similarity, with both P2017(T) and L2010 describing, over the long-term, a general trend of decline towards cooler temperatures over the 1256 to 1431 period; indeed, even at an increased temporal resolution similarities between L2010 and P2017(T) emerge. For example, between c.1270 and c. 1300 L2010 describes a depression in temperatures bracketed by warmer conditions, which is mirrored in P2017(T) which shows that warmer absolute temperatures were both less common during this period and that this period is bracketed by warmer temperatures much like in L2010. Following this bracketed interval L2010 displays a significant drop in temperatures which culminates c. 1330 with the reconstruction's lowest temperature preceding the mid-fifteenth century. The coolest pre-fifteenth century temperature also occurs during the third decade of the fourteenth century in P2017(T). This cool period is followed by a moderately swift recovery, with P2017(T)'s highest single temperature occurring c. 1362, which is once again mirrored in L2010 which shows a peak in temperatures as occurring c. 1360. Following this c. 1360 peak in P2017(T) temperatures enter a period of decline, an occurrence that is reflected in L2010. This decline appears to terminate c. 1380

in L2010, which also appears to be the point at which cooler temperatures prevail in P2017(T), with this cool interval once again bracketed by slightly warmer conditions.

This is not to say that these two reconstructions are in universal agreement. For example, L2010 shows elevated temperatures occurring c. 1400, and whilst similarly elevated temperatures are also suggested by P2017(T) the magnitude described by L2010 is far greater than that suggested by P2017(T). Indeed, the spike in temperatures suggested by L2010 c. 1400 is far more congruous with P2017(T)'s c. 1330 spike than its relatively muted c. 1400 spike. This would suggest that East Anglia's climatic experience at the beginning of the fifteenth century differed from the hemispheric average; this is, ultimately, unsurprising given the multitude of northern hemispheric locations represented within L2010's proxy. It would be unrealistic to expect that a single location's climatic experience would match the hemispheric at all points throughout history, as each location has a unique combination of geographical, geological, topographical, and atmospheric conditions which influence its local climate. A hemispheric scale reconstruction is unlikely to capture every instance of these localised nuances, but as the similarities between P2017(T) and L2010 show, hemispheric scale reconstructions do succeed in capturing the macro-trends of temperature in the locales. As will become clear in following chapters, it is the trends that exist over the *long durée* that are most likely to influence the macro-spatial characteristics of settlement. Given the similarities between L2010 and P2017(T), the argument for utilising the former as an accurate representation of Norfolk's palaeotemperature is strengthened. P2017(T) thus acts as something of a validating agent for L2010.

The temporal characteristics of the archaeological data must also be considered, for fieldwalking surveys can only suggest a temporal range for identified sites based upon the temporal range of the ceramic evidence, and it is thus impossible to pinpoint the exact date a site emerged and declined. The slight disconnect between trends at hemispheric and local level are rendered essentially obsolete by this fact, for the temporal characteristics of the archaeological fieldwalking data utilised will never match the temporal accuracy of climatic data. Given the degree of similarity between P2017(T) and L2010, there is therefore little to be gained from utilising P2017(T) for the 1256-1431 period, for all the major trends are captured within L2010, and it is thus the view of this chapter that L2010 is the most reliable of the temperature reconstructions presented here, with this reconstruction going on to form the foundation of the temperature narrative utilised in later chapters.

Precipitation reconstructions

Introduction

The impact that fluctuations in precipitation totals can have on anthropogenic activity is significant, with Wilson *et al.* (2013) going so far as to suggest that ‘precipitation probably has a greater influence on economic and agricultural stability than temperature’ (Wilson *et al.* 2013: 997). Despite this, palaeoclimatology has focused the vast majority of its attention to reconstructing historic temperature trends, with comparatively little research being directed towards hydroclimatic reconstructions (Wilson *et al.* 2013: 997). This section will investigate the four temporally and spatially relevant hydroclimatic reconstructions, with the table below detailing their basic information.

| <u>Abbreviation</u> | <u>Author(s)</u> | <u>Year</u> | <u>Title</u> | <u>Period Covered</u> | <u>Seasonality</u> |
|---------------------|---|-------------|--|-----------------------|----------------------|
| BTN2011(P) | Büntgen, Tegel, Nicolussi, McCormick, Frank, Trouet, Kaplan, Herzig, Heussner, Wanner, Luterbacher, and Esper | 2011 | <i>2500 Years of European Climate Variability and Human Susceptibility</i> | 500 BCE – 2000 CE | Summer, AMJ |
| WML2013 | Wilson, Miles, Loader, Melvin, Cunningham, Cooper, and Briffa | 2013 | <i>A millennial long March–July precipitation reconstruction for southern-central England</i> | 980 – 2009 CE | Spring-summer, MAMJJ |
| CMT2013 | Cooper, Melvin, Tyers, Wilson, Briffa | 2013 | <i>A tree-ring reconstruction of East Anglian (UK) hydroclimate variability over the last millennium</i> | 900 – 2009 CE | Spring-summer, MAMJJ |
| P2017(P) | Pribyl | 2017 | <i>Farming, Famine, and Plague: The Impact of Climate in Late Medieval England</i> | 1250-1450 | Summer, JAS |

Table 3: Precipitation reconstructions discussed in this chapter.

BTN2011(P)

BTN2011(P) is a combined temperature and summer (AMJ) precipitation reconstruction of Europe over the past 2500 years (Büntgen *et al.* 2011: 579). The input data is purely dendroclimatic, with 7284 oak ring-width series forming the dataset (Büntgen *et al.* 2011: 579). Eighty-seven different medieval documentary sources were used to corroborate their reconstruction, and of the thirty-two extreme climatic events described over the 1013-1504 CE period, thirty of these documentary sources corroborated their conclusions, whilst sixteen were found to contradict their conclusions.

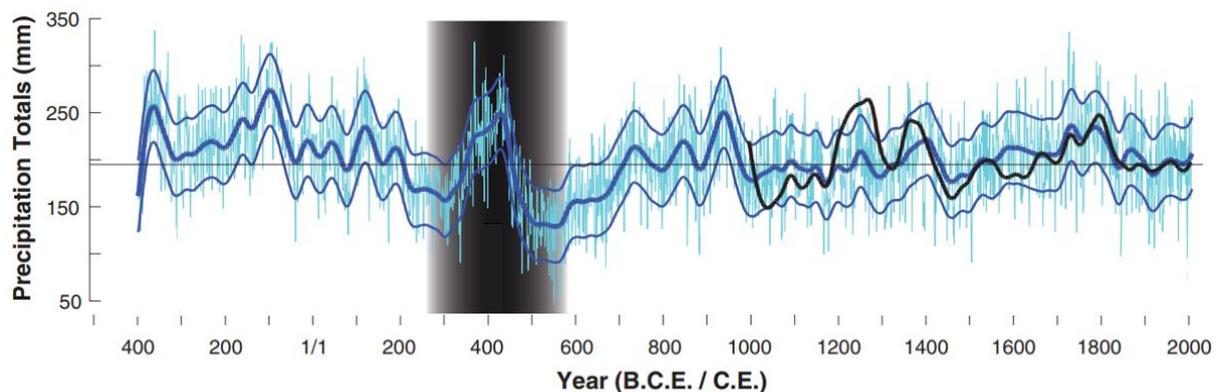


Figure 22: BTN2011(P) precipitation reconstruction. Adapted from Büntgen *et al.* 2011.

The usage of dendroclimatic proxies to elucidate historic precipitation has proven to be a contentious and relatively under-researched topic within palaeoclimatology. In 1978 Hughes *et al.* observed that numerous British oak trees appeared to contain a climate signal that could, potentially, act as a proxy for climatic fluctuations (Hughes *et al.* 1978; Wilson *et al.* 2013). The veracity of this claim was thrown into doubt with Pilcher and Baillie's subsequent 1980 investigation of eight British oak ring-width chronologies, an investigation which failed to show any significant climatic influence upon growth (Pilcher and Baillie 1980). However, over the next thirty years Hughes *et al.*'s original suggestion was ultimately shown to be accurate, with Jones *et al.* (1985), Briffa *et al.* (1985), and Kelly *et al.* (2002) demonstrating that ring-width did in fact capture within it a strong climatic signal. Thin rings in British oak generally indicate increased anticyclonic activity and colder winter conditions, which leads to reduced soil-moisture being present during the growing season thus stunting growth (Kelly *et al.* 2002; Cooper *et al.* 2013; Wilson *et al.* 2013). Wide rings, on the other hand, generally indicate increased levels of westerly airflow over the North Atlantic during winter, which coupled with increased cyclonic activity over northern Europe leads to favourable growing conditions due to increased levels of soil-moisture being present in the all-important growing season (Kelly *et al.* 2002; Cooper *et al.* 2013; Wilson *et al.* 2013). This is not to say that the use of dendroclimatic proxies is without flaws. As WML2013 points out, ideal dendroclimatic data is procured from locations where growth is limited by

a single dominant climatic factor; for temperature-orientated investigations samples are chosen from the upper tree-line, whilst precipitation-orientated investigations take their samples from the lower tree-line (Wilson *et al.* 2013; Fritts 1976). It is thus difficult for BTN2011(P) to use British data whilst maintaining their desired methodology, for there are no adequate sites where the necessary data could be retrieved from; the lack of British proxies in BTN2011(P) is thus unfortunate but not without cause, with British data only entering the fray with the publication of WML2013 two years later.

BTN2011(P)'s reconstruction of AMJ precipitation begins with totals lying at approximately 150mm c. 500, dropping to 120mm c. 536, the lowest precipitation total estimated by the study over the past 2500 years (Büntgen *et al.* 2011: 581). Following this nadir was a steady climb towards wetter conditions, so that by the mid-eighth century precipitation totals were higher than those experienced today, with levels fluctuating between 180mm and 220mm over the course of the eighth and ninth centuries. In the mid-tenth century this trend of gradually increasing precipitation totals reached its apogee, with this period being the wettest in the c. 500 to c. 1500 period. After this multi-century period marked by wetter than average conditions and considerable fluctuations came a period of extensive stability, with precipitation totals hovering around 180mm in the eleventh, twelfth, and early thirteenth centuries, with any fluctuations largely remaining within 10mm of this estimate. This period of relative stability persisted until c. 1250, after which precipitation briefly declined, so that by c. 1300 levels were sitting at approximately 175mm. After this precipitation entered a century long period of steady increase, culminating in the late fourteenth century with a high of approximately 225mm. This is followed by an equally marked decline, with totals dropping from 225mm in c. 1410 to 175mm by c. 1450, where levels remain for the rest of the study period.

WML2013

WML2013 is a one-thousand-year long reconstruction of MAMJJ precipitation totals in south-central England (Wilson *et al.* 2013: 997). Like BTN2011(P), it is based on dendroclimatic proxies, with 1892 series contributing to the input dataset, with a minimum of 50 trees present for each year between 980 and 2009 (Wilson *et al.* 2013: 997). Creating a long-term British hydroclimatic reconstruction of the past millennium has been made difficult by the scarcity of annually resolved dendroclimatic records that originate from within the British Isles, with WML2013 – and its independent companion paper authored by Cooper *et al.* (2013) – being the first attempts ‘to [composite] both living and historical tree ring data to derive [a] millennial length precipitation reconstruction for southern England’ (Wilson *et al.* 2013: 998).

As previously discussed in BTN2011(P), entirely ‘natural’ dendroclimatic data is difficult to come by in the British Isles, for anthropogenic management has ensured that every piece of woodland has, at

some point in history, been touched by human intervention (Wilson *et al.* 2013: 999). There are, unfortunately, no techniques that can adequately provide mitigation to this issue, and so WML2013 adopted the simple but ultimately effective policy of incorporating every available piece of oak ring-width data from central-southern England into their dataset, including archaeologically retrieved samples the provenance of which can be difficult to determine (Wilson *et al.* 2013: 999).

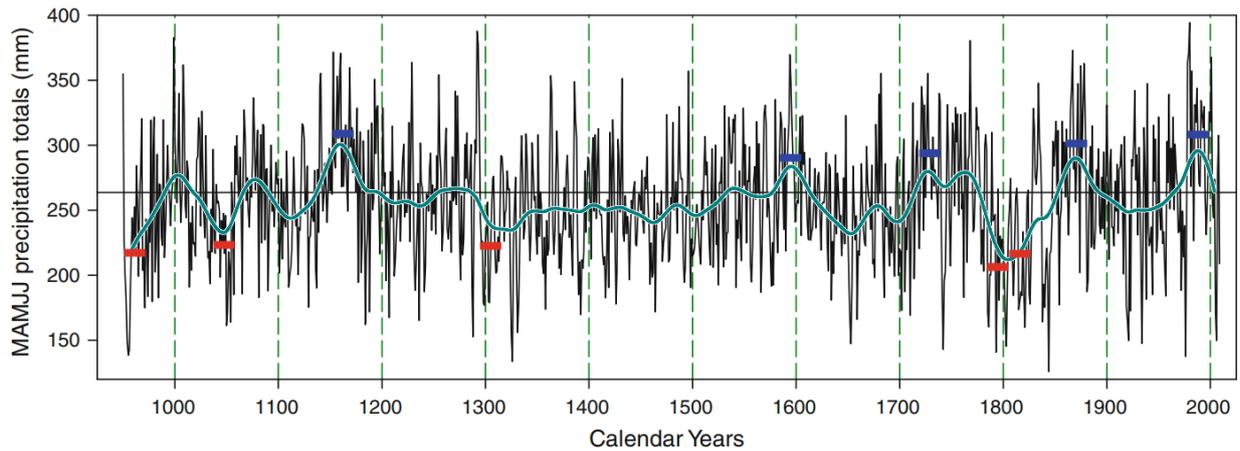


Figure 23: WML2013 precipitation reconstruction. Reproduced from Wilson *et al.* 2013.

WML2013 proposes an entirely dissimilar narrative to the historic hydroclimate than that proposed by BTN2011(P). Beginning at 950, WML2013 shows that c. 952 was the driest interval within the study period, with only 217mm of precipitation estimated to have fallen during the MAMJJ season. The years after c. 952 saw a steady increase in precipitation, so much so that by c. 1000 south-central England is experiencing the second wettest period on record with totals reaching 275mm. After this totals then dropped to 223mm c. 1050, before climbing once again so that by c. 1075 totals were reaching nearly 270mm. At the turn of the twelfth century precipitation had tailed off from the c. 1075 apogee, with the early twelfth century defined by relatively average conditions which were, however, gradually becoming wetter as the decades passed. This upward trajectory culminated in c. 1150 which received a staggering 308mm of precipitation over the MAMJJ season. After this extremely wet period totals once again reduced, dropping to approximately 255mm by the end of the twelfth century. This pattern of oscillating sequences of wet and dry intervals appears to terminate at this point, with the thirteenth century being marked by a considerable degree of stability. Totals remained between 250mm and 270mm until the last decade of the century, when totals dropped to approximately 220mm by c. 1300, a level at which it would remain until the mid-1320s when totals recovered slightly to 250mm. For the remainder of the study period precipitation totals fluctuate only slightly from this point, with the only noteworthy deviations being a slight depression c. 1460.

The general trends outlined by WML2013 is thus very much a tale of two halves. On one hand there is the highly variable pre-1200 period, where precipitation seems to oscillate between extremely dry conditions (c. 952, c. 1050, and c. 1110) and relatively wet conditions (c. 1000 and c. 1075), before entering the wettest phase of the reconstruction c. 1130 which culminated c. 1050 with the wettest year on record. The post-1200 period, on the other hand, is marked by considerably stunted variability. Apart from a relatively pronounced depression c. 1300, and another less pronounced depression c. 1460, precipitation totals, especially from the 1330s onwards, remained remarkably stable until the end of the study period.

CMT2013

CMT2013 is the companion paper to WML2013 and presents a 1100-year-long MAMJJ precipitation reconstruction of East Anglia (Cooper *et al.* 2013: 1019). This is once again a dendroclimatic study based on living and historic oak ring-width data, with 723 individual trees contributing to the dataset; whilst this is a lower total than WML2013, the largely complementary results produced by CMT2013 indicates that this smaller pool was in no way detrimental to the reliability of the overall reconstruction (Cooper *et al.* 2013: 1019; Wilson *et al.* 2013). Furthermore, as the majority of oak samples were taken from sites within Norfolk, the reconstruction is inherently skewed towards this county, a fact that only increases the applicability of CMT2013 to this thesis (Cooper *et al.* 2013: 1020).

Like many of the modern dendroclimatic investigations discussed in this thesis, CMT2013 uses RCS (see ECS2002) to preserve low-frequency signals (Cooper *et al.* 2013: 1019). However, as mentioned in WML2013, anthropogenic interference has led to no woodland existing within the British Isles which has not, at some point, been subject to anthropogenic management (Wilson *et al.* 2013). The vast majority of trees will also have experienced abiotic interference (such as extreme temperatures) at some point during their lifetime, and the combination of biotic and abiotic influences ultimately leads to a degree of noise existing within the signal (Cooper *et al.* 2013: 1023). In order to combat this, CMT2013 ensured that their reconstruction maintained as high a degree of sample replication through time as was possible with the available data, with an accepted measure of replication being Expressed Population Signal (EPS), which produces a result between zero (the lowest score possible) and one (the highest score possible) (Briffa and Jones 1990; Cooper *et al.* 2013). Wigley, Briffa, and Jones (1984) consider an EPS score of 0.85 to be 'acceptable', and is generally the threshold which climatic reconstructions attempt, at the very least, to equal (Wigley, Briffa, and Jones 1984: 207). For the majority of CMT2013 EPS remains above 0.85, although there is a slight, short-lived drop below 0.85 c. 1215, but for the large part this is not particularly detrimental to the reliability of the reconstruction given the limited temporal span of this episode. Unfortunately, whilst the data used by CMT2013 did

in fact pre-date their c. 900 start date, due to a considerable drop in EPS c. 900 (which falls to <0.10 c. 880), CMT2013 can only reliably reconstruct post 900 precipitation totals (Cooper *et al.* 2013: 1023-4).

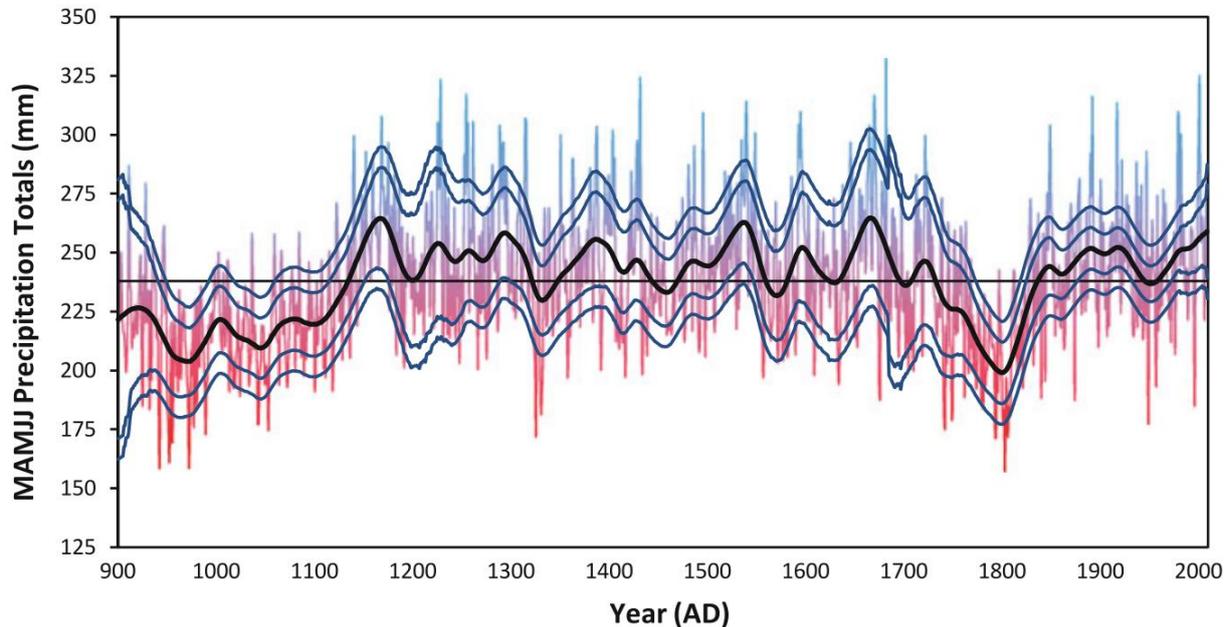


Figure 24: CMT2013 precipitation reconstruction. Reproduced from Cooper *et al.* 2013.

Like WML2013, CMT2013 found that precipitation totals often fluctuate on a multidecadal scale between periods of wet and dry conditions (Cooper *et al.* 2013: 1019). The reconstruction begins at c. 900 with precipitation totals sitting at 225mm, which then proceeds to drop to a nadir of 200mm by c. 950, with this latter period the driest episode of the entire study period. Relatively average conditions continued in the decades following this nadir, with notably dry phases occurring c. 1050 and c. 1100, although the general trend is one of gradually increasing wetness during the eleventh and twelfth centuries. This upwards trend culminates c. 1170 with the wettest phase of the reconstruction, with totals reaching approximately 265mm. Following this apogee was a decline towards more average conditions, so that by c. 1200 totals were sitting at 240mm, close to the long-term mean of 238mm but still above it. Precipitation then abruptly increases c. 1220 to approximately 250mm, with the rest of the thirteenth century marked by a degree of stability – albeit one that describes a trend towards increasing wetness as the century progresses – with totals remaining within 10mm of 250mm. This stability was, however, limited to the thirteenth century, with the early years of the fourteenth century seeing totals slide from a high of 255mm c. 1300 – the joint-second wettest period of the reconstruction – to just below average c. 1330. This decline was, however, short-lived, with totals recovering to above average by c. 1360, with this upwards trend continuing over the course of the fourteenth century ultimately reaching 255mm by c. 1390. The fifteenth century displays a largely

similar morphology to that of the fourteenth; totals c. 1400 lie slightly above average at 250mm, which proceeds to drop slightly c. 1460 before entering a sustained wet period which only ends in the mid-sixteenth century when totals are pushing upwards of 265mm. However, at the end of the study period c. 1500 totals are sitting at approximately 250mm.

It is, however, important to note that CMT2013 states that their reconstruction appears to underestimate extreme years, and particularly extremely wet years (Cooper *et al.* 2013: 1034). The cause of this underestimation is briefly discussed by CMT2013, who suggests that as the potential annual growth of oak is physiologically limited, once soil moisture (moisture which is largely the result of precipitation) surpasses a certain level, it ceases to drive growth; thus, extreme, anomalously wet conditions are not necessarily distinguishable from less extreme periods of wet conditions as oak growth is not unlimited. It is thus possible that the wettest phase of the reconstruction – the post-twelfth century period – may have been wetter than CMT2013 suggests. The overall picture painted by CMT2013 thus describes a climate which is relatively dry for much of the pre-c. 1150 period, after which totals increase significantly peaking c. 1170 and thereafter rarely drop below the long-term average, with the only exceptions to this rule being brief periods bracketing c. 1330 and c. 1460.

P2017(P)

P2017(P) presents a two-hundred-year precipitation index for late medieval Norfolk based on the observed relationship between harvest length and precipitation sensitive oak chronologies (specifically those presented by WML2013 and CMT2013). Unlike the vast majority of the reconstructions discussed in this thesis, P2017(P) relates specifically to Norfolk, and whilst it is of an extremely limited temporal range – recreating only the period between 1256 and 1450 – it is nevertheless able to provide both a detailed and ultimately accurate precipitation index whilst also serving to validate the more temporally extensive WML2013 and CMT2013.

The principal divergence of P2017(P) from the other reconstructions discussed in this thesis is the nature of the input data, with the one exception being the accompanying temperature reconstruction P2017(T) which uses a largely similar methodology to P2017(P). There is thus no need to investigate P2017(P)'s methodology in any detail, as the main points were previously discussed earlier in this chapter. Furthermore, there is little need to discuss the trends shown in P2017(P), with this reconstruction instead being used to corroborate the results of WML2013 and CMT2013.

Whilst P2017(P) and WML2013/CMT2013 are not identical, both appear to display, albeit at slightly different magnitudes and at slightly different times, a heavily similar morphological structure. Where

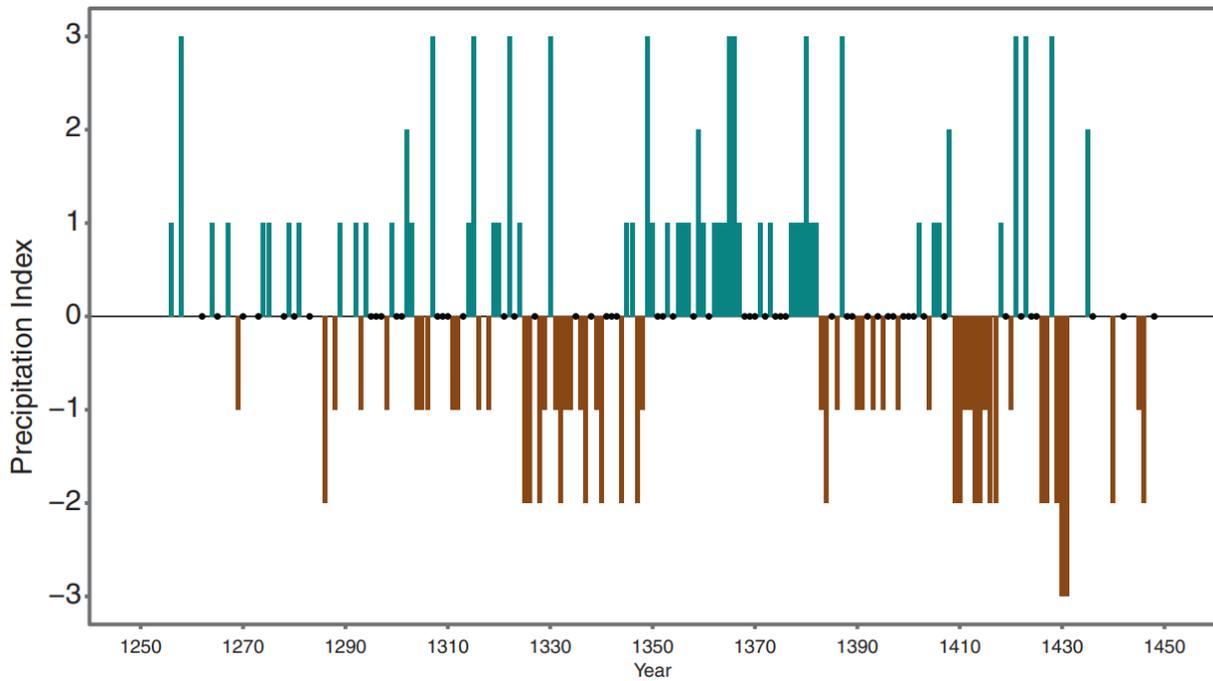


Figure 25: P2017(P) precipitation reconstruction. Reproduced from Pribyl 2017.

they do significantly differ – principally between the late 1340s and the end of the 1350s – this dissimilarity can be attributed to the devastating effect of the Black Death upon the agricultural workforce, which invariably drove up the duration of the harvest. The similarity between the methodologically dissimilar WML2012 and P2017(P) – and thus by extension WML2012’s companion paper CMT2013 – provides a rare and ultimately simple means of validating the general trends set out in these three reconstructions. There is also perhaps no better piece of evidence than this similarity to attest to the quality of P2017(P), and it proves that whilst environmental and biological proxies are by far the dominant form employed by palaeoclimatological researchers, anthropogenically derived proxies can without doubt provide equally valid results.

Conclusion

It is thus clear that there is something of a consensus regarding levels of precipitation in England over the past one thousand years. WML2012, CMT2013, and P2017(P) all describe a similar pattern of historic summer precipitation, and their similarity – especially given their differing input data and methodology – serves to reinforce the accuracy and veracity of these three studies over the course of the 500 – 1500 CE study period. This enables a relatively complete image of past precipitation to be constructed for Norfolk over the past one thousand years, and it is an unusual occurrence that a single English county should be so well represented in palaeoclimatological literature. Given both the mutually complementary results obtained by WML2012, CMT2013, and P2017(P), and the anthropogenic influences at play in P2017(P), this study will utilise CMT2013 as the basis for building

an understanding of historic precipitation patterns in Norfolk over the c. 910 – 1500 period, whilst for the c. 500 to c. 910 period BTN2011(P) will be utilised. The degree of continuity between c. 910 in CMT2013 and c. 910 is notable, with both reconstructions suggesting that totals around this time were in the vicinity of 220mm. Whilst it is admitted that the spatial suitability of BTN2011(P) is less than that of CMT2013, the absence of any targeted East Anglian or British precipitation reconstruction for this earlier period necessitates the use of a broader European reconstruction.

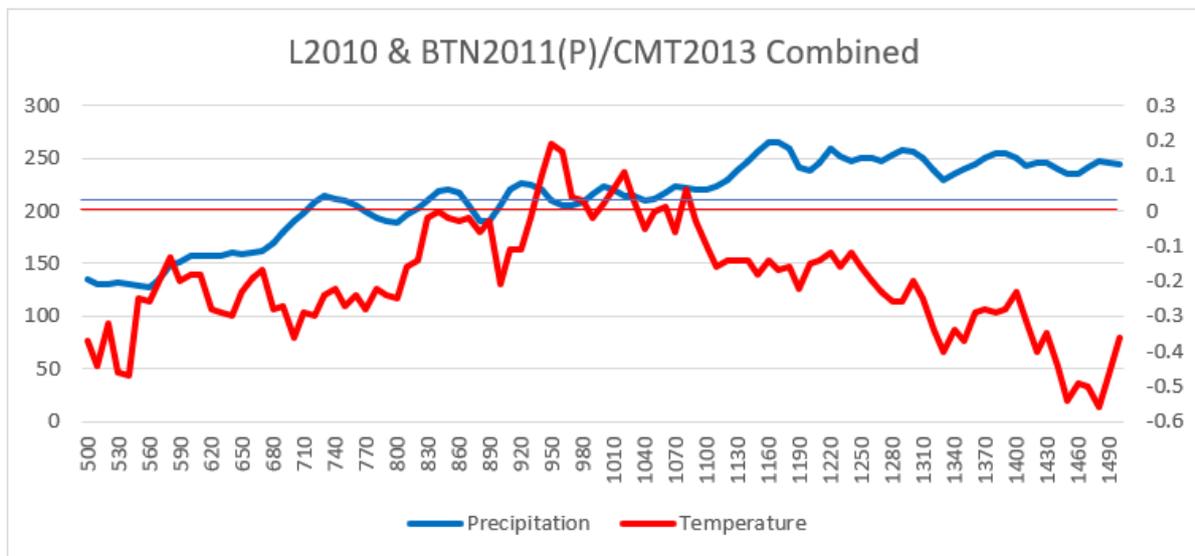


Figure 26: Composite graph of the temperature and precipitation reconstructions utilised in this thesis. Anomalies in temperature, given against the red long-term average line, are presented in 0.1 increments on the right side of the graph. Anomalies in precipitation totals, given against the blue long-term average line, are presented in 50ml increments on the left side of the graph.

A composite graph of the three reconstructions utilised in this thesis – L2010, BTN2011(P), and CMT2013 – is shown in Figure 15. No data has been altered in the creation of this graph, with the average lines representing the long-term mean of all decadal values. This graph is wholly original to this thesis and represents the climatic narrative adhered to throughout later analyses. It is based solely on the palaeoclimatic reconstruction discussed above, namely L2010, BTN2011(P), and CMT2013. By utilising these modern palaeoclimatic reconstructions an accurate understanding of the palaeoclimate of medieval Norfolk can be constructed, one that does not rely on undefined terms such as ‘Medieval Warm Period’ or ‘Little Ice Age’, terms that ultimately obscure a highly variable palaeoclimate.

Chapter Three: Methodological Framework, Data Sources, and Ceramic Wares

Introduction

This chapter sets out the evidential and analytical foundations upon which the subsequent macro-spatial analyses are built. It provides a detailed examination of the principal source materials employed in this thesis and outlines how these datasets can be used to investigate the development of medieval settlement in Norfolk. The chapter begins with an overview of GIS spatial analysis, explaining its value and its limitations within macro-spatial landscape studies. The focus then shifts to the core datasets that underpin the analysis: the quantitative archaeological data derived from the five systematic fieldwalking surveys, and the pedological data produced by the Soil Survey of England and Wales. As previously mentioned, the evidential base for English medieval settlement is broader than the fieldwalking data alone. The chapter therefore evaluates the suite of supplementary datasets that have been used to both enrich the evidential basis of this thesis and mitigate against the limitations of the fieldwalking datasets. This supplementary data includes the Portable Antiquities Scheme (PAS), the Norfolk Historic Environment Record (NHER), Lidar, and historic documents. The following sections establish the strengths, biases, and constraints of the data, providing the necessary context for understanding the macro-spatial analyses undertaken in Chapters Five, Six, and Seven.

The macro-spatial

The analyses undertaken in Chapters Five, Six, and Seven are all undertaken at the same spatial resolution; namely, at a 'macro-spatial' scale. In this thesis, the term macro-spatial is used to describe a resolution that encompasses a large spatial area, one that can perhaps best be described as being on a 'landscape' scale. As will be discussed in the following section, each site, potsherd, or concentration of potsherds will be represented as either a point or a polygon. It is the spatial location of these points and polygons which inform analyses of any potential climatic driver in the development of settlement; a single map may have upwards of one-hundred points spread over multiple square kilometres. Only by investigating the landscape at a 'macro' resolution can *widespread* trends be observed; after all, this is an investigation of settlement in its broadest sense, not a detailed investigation of a handful of sites (the 'micro-spatial').

This thesis will therefore not devote any significant portion of its length to investigations at a micro-spatial scale. Here, micro-spatial refers to detailed investigations of individual sites, investigating elements such as the positioning of walls and the archaeological context of artefacts uncovered as part of excavations. Whilst, of course, each site is investigated in the macro-spatial analyses, it is the

larger-scale (the 'macro') context, not the smaller-scale (or 'micro') context which is the focus of this thesis.

Attempting to include both macro- and micro-spatial analyses is not feasible from both a practicality point of view and a methodological point of view. For the former, the collation of macro-spatial data itself is a considerable task; introducing additional micro-spatial data would be an additional task that simply is not feasible within the limited funding period. There is also a methodological argument for focussing on only the macro-spatial, for the response to fluctuations in historic climate is likely very different at macro- and micro-spatial resolutions.

At a macro-spatial resolution, a macro-scale response to climate change – such as relocation to more favourable geological environments or a shift in focus to sites with more favourable topography – indicates that many or most of those living and working in these landscapes were being affected by the changing climatic conditions. This would suggest a deeply rooted link between settlement development and climate, for conditions were clearly having severe enough implications to illicit changes to the fabric of the anthropogenic landscape far beyond the specifics of an individual site.

This contrasts with the micro-spatial considerably. At a micro-spatial resolution, it may be that there is a slight slope that is causing runoff to accumulate against a building. The response to this could be to relocate the building slightly, perhaps a dozen metres upslope where the runoff is less; alternatively, the slight slope could be regraded, which is detectable only through excavation. This response to climatic fluctuations, perhaps affecting just a single toft, is clearly far more localised than a response detectable at a macro-spatial resolution, suggesting that climatic conditions were only severe enough to cause detectable changes in a few highly localised places rather than precipitating widespread change. These micro-spatial changes require far more detailed data to identify, which in itself presents a fundamental issue; without the knowledge of knowing whether macro-spatial changes are occurring, and if so *where* these changes are occurring, finding adequate, thoroughly investigated individual sites that may possibly demonstrate a response to fluctuations in climate is highly unlikely.

Data and methods of analysis

GIS and spatial analysis

GIS has become an invaluable tool in landscape archaeological research, with the vast majority of modern studies employing this powerful analytical tool (see Fleming 2013; Wright 2015; Rippon 2012; 2018; Williamson 2013). The primary form of analysis used in landscape archaeological research is that of spatial analysis, which involves the processing and examination of spatial data using various analytical functions within GIS, with the most common form of interrogation involving the use of

overlays and proximity analysis (Chapman 2006; Fotheringham and Rogerson 2005: 47-101; Lock 2003; Xu and Zhang 2022).

Whilst GIS is invaluable to the researcher, Fleming has noted that 'its pragmatic approach towards inductive forms of predictive modelling and spatial analysis must be acknowledged as being necessarily simplistic', for many forms of spatial analyses are essentially comparing quantitative geospatial data with other quantitative geospatial data, with the relationship between them then being used to formalise theories and draw conclusions (Fleming 2013: 73). This is a criticism which could be levelled at the analyses undertaken in this thesis, for quantitative geological data in the form of polygonal soil layers, quantitative topographical data in the form of Lidar derived raster elevation layers, and archaeological data in the form of point-layers and limited polygonal layers form the three principal types of comparable visualisation layers. This naturally injects a degree of environmental determinism to GIS-based studies, for anthropogenic data can only ever be mapped within a geographical context, with numerous scholars arguing that the reduction of anthropogenic interaction with the physical landscape 'to one of mere statistics outside of any given theoretical paradigm invites cries of environmental determinism' (Fleming 2013: 73; Gaffney and Van Leusen 1995; Lock 2003; Van Leusen 2002; Wheatley and Gillings 2002).

It is freely admitted that spatial analyses conducted within GIS are naturally weighted towards an environmental conclusion; indeed, with the primary mode of analysis in later chapters directly comparing the geospatial properties of data it is unavoidable that a degree of environmental bias will exist within the methodology itself. Whilst the elimination of this bias is impossible within the parameters of the analysis, this thesis will attempt to discuss the conclusions of the spatial analyses in both anthropocentric and environmental contexts.

Geospatial archaeological data: Fieldwalking

The majority of the quantitative archaeological data utilised in this thesis originates from the five fieldwalking surveys discussed in Chapter One, with this data containing both the type and number of sherds found and their spatial position within the landscape. This data has been inputted into GIS to create an interrogable vector dataset of spatial information that can be layered against geological, pedological, and topographical vector data to understand its environmental contexts, with the results of these analyses presented as GIS visualisations. Each dataset is derived from the site gazetteer or accompanying microfiche; the datasets used are thus digitisations of these documents, with none of the spatial or archaeological data being manipulated or altered from its original form. Each 'site' listed in these documents has been replicated precisely in GIS as a single point. The exception to this rule is where a concentration has been drawn by the author on accompanying distribution maps. In these

cases, the concentration has been traced in GIS as a single polygon from digitized, georeferenced versions of the original distribution maps. As has been previously mentioned, no retrospective methodology for classifying 'sites' has been implemented, as both quantitative and qualitative classification methods are plagued by issues; there was thus little to be gained from any alterations to the source material.

The rationale behind the creation of digitised GIS visualisations of this data when the original surveys include distribution maps is twofold. Firstly, as previously mentioned the archaeological data will need to be directly comparable against the geological data in the geospatial analyses of Chapters Five, Six, and Seven; GIS is thus the most appropriate tool with which to conduct this investigation, with manual comparisons vastly inferior to the precision allowed by GIS. Secondly, whilst all of the surveys include distribution maps of recovered material, a combination of subsequent re-dating of ceramic fabrics – such as Blinkhorn's re-dating of Ipswich Ware – and non-standard temporal categorisations which rarely agree between the surveys have rendered some of these maps problematic. This has, in turn, created issues with the temporal data contained within the original datasets. A re-evaluation of some of the temporal characteristics of the raw data is thus necessary. This re-evaluation is based on the discussion of Norfolk's primary diagnostic pottery types discussed below. Whilst this discussion is not intended to be an exhaustive account of Norfolk's ceramic history, the principal types of ceramic material found in Norfolk will be discussed.

Geospatial archaeological data: PAS and NHER

Two sources of data that will supplement the systematic fieldwalking surveys in this thesis are data from the Portable Antiquities Scheme (PAS) and the Norfolk Historic Environment Record (NHER). Both datasets provide valuable additional perspectives on settlement across the study areas, although each carries methodological considerations that inform how they are deployed in this investigation.

The PAS is a national recording scheme established in 1997 to encourage the voluntary recording of archaeological finds discovered by members of the public, particularly through metal detecting. The scheme has amassed a substantial database of findspots across England and Wales, with Norfolk representing one of the most intensively recorded counties due to its active metal detecting community and productive agricultural soils. PAS data is especially valuable for tracking distributions of metalwork – including coins, brooches, dress accessories, and other portable artefacts – which can illuminate patterns of exchange, deposition, and activity that complement the ceramic evidence recovered through fieldwalking. However, PAS data is by its nature non-systematic. The distribution of finds reflects not only past patterns of activity but also modern patterns of metal detecting, land access, and individual reporting behaviour. There is also a question as to the representativeness of

metalwork for tracking macro-spatial changes in settlement: whilst ceramic sherds entered the plough soil largely through household waste disposal and manuring practices, metalwork likely entered the archaeological record through more diverse means, with accidental loss a significant mode of deposition. Despite these caveats, PAS data can provide useful supplementary information on the character and intensity of activity within the study areas, particularly for periods where metalwork assemblages are chronologically diagnostic.

Alongside the PAS, the NHER will also form part of the evidential basis of later analyses. The NHER is the county's comprehensive database of archaeological sites, monuments, and findspots, integrating data from diverse sources including but not limited to chance finds, aerial photography, the National Mapping Programme (NMP), and excavation reports and associated grey literature, creating a broad repository of information on Norfolk's archaeological heritage. For clarity, this thesis refers to relevant NHER data by their discrete NHER entry number. For example, NHER 68279 relates to finds generated by a programme of trial trenching that produced a set of associated grey literature reports; throughout this thesis, such evidence is discussed using the NHER entry number rather than the titles of individual reports in the main body of the text to improve readability and to facilitate easy cross-referencing with labelled GIS visualisations. NHER data is particularly valuable for contextualising the fieldwalking results within the wider landscape, providing information on cropmarks, excavated sites, relevant grey literature, and known monuments that can help interpret patterns observed in the systematic survey data. To maintain However, temporal accuracy presents a limitation. Unlike fieldwalking surveys, which recover pottery sherds that are reliably datable — Ipswich Ware, for example, can confidently be attributed to the c. 720 to c. 850 period — the dating of many NHER entries, particularly cropmarks identified through aerial photography, is often necessarily broad. More precise dating of such features typically relies upon coincident finds or archaeological excavation. For the purposes of this investigation, where precise temporal resolution is essential for tracking settlement change across defined periods, this represents a constraint. Nevertheless, NHER data remains an extremely useful tool for understanding the broader archaeological context of the study areas and for identifying patterns that may not be visible through fieldwalking alone.

It is for these reasons that PAS and NHER data serve a supplementary role in this thesis, providing additional layers of information that enrich and contextualise the more comprehensive, uniform, and temporally-specific fieldwalking data.

Geospatial and textual pedological data and Character Zones (CZs)

The analyses of Norfolk's soil characteristics in Chapter Four are based primarily upon two data sources: a large GIS vector dataset containing the spatial extent of soil associations and the Soil Survey

of England and Wales' East Anglian volume (Hodge *et al.* 1984). The first source of data to be discussed is the GIS vector dataset. This dataset is composed of a multitude of polygons which corresponds to the spatial extent of various soil 'associations', which are themselves composed of numerous 'series'. A series is the basic unit of soil identification in England and Wales and describes a group of soils with similar profiles that were developed from similar parent materials. An association is thus a grouping of soil series which are commonly found together in the landscape.

However, mapping the landscape of Norfolk at association scale creates a crowded and essentially meaningless visualisation, the complexity of which ultimately hinders later macro-analyses. A unit larger than the association is thus required for the dataset to be interrogable. Thus, this thesis will establish a number of 'Character Zones' (CZs) that each represents a distinct, unique soil landscape constructed from geologically similar associations as identified by the Soil Survey of England and Wales (Hodge *et al.* 1984). The benefits of this approach over other methods – such as mapping by single association – lie primarily in its increased simplicity and its more meaningful symbology. For example, mapping by association would require fifty separate entities – many of which are only subtly different. When presented in GIS this would create a crowded map that would hinder later macro-analyses. Conversely, mapping by CZ allows for the creation of a sparser and more interrogable output, with this analysis identifying twelve independent CZs, with only three of these requiring further subdivision. This far more streamlined approach allows for the creation of a more meaningful, interrogable, and visually simplistic symbology.

It is necessary to note that there exists a certain degree of subjectivity in the drawing of CZs. In many instances, where two or more bordering soil landscapes are evidently of completely different character the drawing of a border based upon those associations is simple. However, when two bordering landscapes are clearly different and so constitute two different CZs – which for the purposes of this explanation are primarily composed of association X on one hand and association Y on the other – but both contain isolated outcrops of association Z, association Z will not be wholly assigned to either. Rather, the dominant association will be used to define the border and smaller, less spatially dominant associations – such as association Z – will fall within one CZ or the other, leaving association Z in both CZs. This compromise is the best way of producing meaningful visualisations whilst also retaining the overall character of the landscape, although it is freely admitted that this is at the cost of some degree of local accuracy.

This study is not the first to attempt a division of the county based upon the characteristics of the soil, with at least three versions featuring in published material since the mid-1990s. Of these, the most persuasive is that of Corbett and Dent (Corbett and Dent 1994: 18). The rationale behind this assertion

lies in Corbett and Dent's aversion to amalgamating their divisions into homogenous units as Williamson and Wright have preferred to do. As a result, Corbett and Dent's division model is more complex – regional units are, for example, frequently discontinuous – but due to the disjointed nature of this version it is ultimately more accurate and also more useful to the present study, as its spatial extent is dictated by the geology and not hampered by generalisations brought about by the desire to have continuous, easily defined and homogenous entities (Corbett and Dent 1994: 18). There are, however, a number of pitfalls present in Corbett and Dent's model, such as the splitting of Arthur Young's 'Good Sands' into two independent entities, the presentation of a rather confusing, poorly executed series of division around the Cromer Ridge, and the amalgamation of the medium and heavy clays of south-central Norfolk into a single entity devoid of any sub-groupings. Thus, whilst Corbett and Dent's divisions will form the foundation for this study's CZs, a large number of amendments and wholesale changes will be implemented.

In some instances it will be necessary to subdivide CZs into smaller 'subzones' where the overall character of the soils is the same – clayey, for example – but there exist notable differences amongst the constituent associations. The spatial extent of these subzones will be similarly determined at association level using the same dataset as that used for determining the CZs. The application of subzones is the most appropriate method of allowing both the similarity and the differences of a region's soils to be represented, and better reflects the differing, yet still suitably similar surface environment than the inherent homogeneity implied by a single block. It is conceded that this argument – which ultimately boils down to the simple fact that smaller divisions are inherently more detailed than larger divisions – could be similarly applied to the subdivisions proposed here. However, the resolution and objectives of the present study necessitates that divisions and subdivisions are manageable in quantity whilst also containing enough detail to allow meaningful analysis and clear GIS symbolization. Dividing a CZ into two or more subzones is therefore the most effective way to represent a region's closely related yet distinct soil landscapes.

The four aforementioned marginal CZs – the Claylands CZ, the Breckland CZ, the Marshland CZ, and the Peat Fen CZ– will be subjected to an in-depth analysis of their constituent associations and series, with their hydrological capabilities, workability, and topographical contexts discussed. This level of detail will allow for a rigorous analysis to be undertaken when assessing how changing climatic conditions may have affected different parts of the county. This level of detail will only be achievable by utilising the wealth of geological information contained within the Soil Survey of England and Wales' East Anglian volume. It is freely admitted that this book is a modern work and thus reflects the modern soil landscape. Numerous assumptions are made by the *Survey* which are unhelpful to the present investigation. Modern field drainage, soil maintenance regimes, fertilisation, and access to heavy,

modern farming equipment are all taken as standard within the text. Medieval farmers evidently had access to none of these things. However, it is possible, through analysing each association and its numerous component series, often using the soil profile itself, to regress the survey to the soil's possible state before modern practices began to influence the soil. For example, if a soil is gleyed – to be discussed at length in the following chapter – but rates as well-drained in the *Survey*, we can make the broad assumption that without modern field drainage that particular soil is unlikely to be well-drained. Furthermore, if a soil presents mottling but there is no mention of waterlogging, we can similarly make the assumption that at some point in its history cyclical saturation was occurring, likely in the pre-modern period before complex infrastructural and chemical improvements had been started. Williamson has, however, urged caution when applying the results of modern field surveys to the medieval period, arguing that in some places farming itself has altered the characteristics of the soil (Williamson 2013: 45-6). For example, in Norfolk and much of southern and central England, loess, a silty aeolian or periglacial material, was widespread; however, in many places it is now completely eroded away due to centuries of agricultural use (Williamson 2013: 46). These deposits, which once made these regions especially fertile, thus no longer benefit from their fertility-enhancing qualities and therefore do not rank as particularly fertile in modern soil surveys. Considerations such as this will be taken into account in the following chapter.

Additional data

The geospatial and textual data sources discussed above are supplemented by a range of additional datasets and textual sources that have each contributed to later analyses. These are listed below:

- Geospatial datasets
 - LIDAR Composite Digital Terrain Model (DTM) 1m and LIDAR Composite Digital Terrain Model (DTM) 2m, published by the Environment Agency, were used to create the lidar-derived topographical visualisations.
 - OS Open Rivers was utilised in visualisations depicting watercourses.
 - 1851 England and Wales census parishes, townships and places, provided by UK Data Service was utilised in visualisations depicting parishes. This dataset is the most accurate recreation of the possible spatial properties of England's pre-twentieth century parochial structure.
- Online resources
 - Edina Digimap's collections of OS historic maps were regularly consulted for contextual geospatial information.
 - Norfolk County Council's Norfolk Heritage Explorer was regularly consulted to identify relevant records held by the NHER.
 - Met Office data for Norfolk, average temperatures from the 1961-1990 period

- Published Sources
 - The Domesday Book: The Phillimore edition for Norfolk (Morris 1984) and Alecto Historical Editions (Williams 2002) were the versions used for analysis of the original text. All references within the text relate to the Phillimore editions. Darby's *The Domesday Geography of Eastern England* (Darby 1972) was consulted in conjunction with the primary text.

Ceramic evidence

This section outlines the principle types of ceramic wares found in Norfolk, with the discussion focusing on their diagnostic characteristics, their temporal span, and other pertinent information with regards to their suitability for tracking medieval settlement in Norfolk

Early Saxon

Pottery constitutes one of the principal sources of archaeological evidence for early Saxon settlement, with Wickham suggesting that most early Saxon pottery was intended for 'household' use and was largely undecorated – the quality and the longevity of the ceramic material was inferior to that of subsequent periods; it is no surprise that early Saxon material is far less common a find than ceramics of later periods, although as stated by Lawson pottery scatters of early Saxon material, whilst rare, do often correlate to buried settlements (Lawson 1983; Wickham 2005: 806-7). Early Saxon wares were often handmade rather than wheel-turned and were fired at comparatively low temperatures, resulting in ceramics that appear more primitive than the more advanced and refined pottery of later periods. The low firing temperatures and coarser production methods also made these vessels far less durable, meaning they lack the long-term survivability of later wares and are consequently less likely to be recovered archaeologically as they degrade more rapidly. Identifying early Saxon pottery is likewise not as straightforward as distinguishing sherds from Roman or later Saxon contexts; in particular, undecorated early Saxon wares are almost indistinguishable from Iron Age ceramics, and where the fabric has been weathered by, for example, acidic soils, early Saxon material can be difficult to differentiate from fragments of sedimentary rock (Davison 1990: 11).

Early Saxon ceramic evidence is thus far less widespread than later material for a number of reasons, from the weakness of the fabric to the difficulty in identifying it from earlier wares (Rogerson 1997: 1). This scarcity could perhaps also be attributed to the lower population during this time, with Wade suggesting that the early Saxon landscape was less intensively exploited than the later landscape (Wade 1983: 74-5). Furthermore, the more mobile character of settlement in the early Saxon period could very easily have negated the emergence of concentrated pottery scatters; the methodology of 'site' identification, based as it is on concentrations of pottery, may thus be more to blame for the scarcity of 'sites' than the pottery itself. However, it is equally likely that early Saxon settlement was

simply far scarcer than it was in later periods, for a more sparsely populated settlement moving around the landscape would naturally leave behind a reduced volume of ceramic evidence, thus reducing the likelihood of fieldwalking surveys identifying concentrations of early Saxon material. Add to this suggestion the friability and difficulty in identifying early Saxon pottery and the poor representation of early Saxon ceramic evidence in the archaeological record becomes more understandable. Ultimately, the lack of widespread, easily identifiable early Saxon pottery ensures that for the most part its temporal range covers some 320 years between c. 400 and the introduction of Ipswich Ware in c. 720 (Blinkhorn 1997: 113; 1999)

Middle Saxon: Ipswich Ware

Unlike the early Saxon period, middle Saxon pottery is both more easily identifiable and more widespread than its earlier counterparts. As mentioned earlier, East Anglia is one of the few parts of England which possesses an extensive middle Saxon ceramic record due to the introduction of Ipswich Ware in the early eighth century. Whereas early Saxon pottery was handmade and fired in bonfires whose temperatures were low and whose airflow was essentially uncontrollable, Ipswich Ware was thrown on a slow hand-turned wheel and fired in kilns which allowed for controllable airflow and thus higher temperatures (Blinkhorn 1989; 2000; 2012; Godfrey 2007: 148-9).



Figure 27: Typical Ipswich Ware. Licensed under CC-BY-SA 2.0 via Wikimedia Commons, The Portable Antiquities Scheme/ The Trustees of the British Museum.

Ipswich Ware is a hard, sandy grey ware, frequently undecorated, which was first identified in the Ipswich area (Hurst 1976: 299-301; Godfrey 2007: 148-9). Whilst our understanding of the chronology and development of this ware is still patchy, it is widely accepted that this ware was in use for the two centuries between c. 720 and c. 850 (Blinkhorn 1989: 12-16; 2000: 9; 2012; 2009: 356). Thus, the presence of Ipswich Ware can potentially indicate the presence of middle Saxon activity in a given area, with concentrations of this ware possibly indicating the presence of a nearby middle Saxon settlement, although the limitations of fieldwalking surveys noted in previous sections should be considered before any conclusions are drawn. It is important to note that other types of pottery were in use during the middle Saxon period, such as Shelly Wares, but these types were often in use for far longer periods of time and are thus of less diagnostic use than the more temporally limited Ipswich Ware.

Saxo-Norman: Thetford Ware

At some point around the mid-ninth century East Anglia transitioned from Ipswich Ware to Thetford Ware (Hurst 1976: 314). Unlike its predecessor, Thetford Ware was manufactured on a fast wheel and fired in more advanced kilns capable of reaching higher temperatures (Hurst 1976: 314). The principal characteristics of Thetford Ware are in some ways similar to Ipswich Ware, with the fabric being hard and often sandy with a greyish colour; unlike Ipswich Ware however, Thetford Ware exhibits thinner walls and taller forms – made possible in part by the introduction of fast wheels and improved kilns (Hurst 1976: 314-5). Unfortunately, our understanding of the developmental chronology of Thetford Ware is still incomplete. Whilst the broad history of this type is largely understood – we know, for example, that it was manufactured between c. 850 and c. 1150 in sites across Norfolk, with some manufacturing also likely occurring in Suffolk – the temporal aspects of its development are still uncertain (Rogerson and Dallas 1984: 126). Thus, whilst we know that stylistic changes to this ware did take place over the three centuries of production, the uncertainty of exactly *when* these stylistic changes occurred means that we cannot precisely date sherds beyond the rather extensive window between c. 850 and c. 1150 (Rogerson and Dallas 1984: 126).

Saxo-Norman: St. Neots Ware and Stamford Ware

Of a similar age to Thetford Ware, St. Neots Ware is believed to date from between c. 875 and c. 1100 (Hurst 1956; Spoerry 2016: 103). This ware typically exhibits a light brown, black, or purple-pink surface with a grey to black core, with the fabric of this ware typically fine with finely crushed fossil shells giving this ware its characteristic white speckled look (Spoerry 2016: 103). Similar to Ipswich and Thetford Wares St. Neots is wheel-thrown but Spoerry notes that this ware can also be coil-built, especially when the vessel is larger than average (Spoerry 2016: 103). The final Saxo-Norman ceramic type is Stamford Ware. This hard, often light-coloured ware is believed to have emerged c. 850 and

lasted until c. 1150 and is amongst the first examples of glazed pottery in England (Simpson 1982). The many variables relating to the glazing process means that the colour of this glaze can vary significantly between sherds, with some exhibiting a pale-green glaze whilst others exhibit pale yellow or even blue glazes (Simpson 1982). In addition to these glazes, Stamford Ware vessels are also identifiable by their often thin-walled, smooth fabric.

Medieval

Following the Anglo-Saxon period came a curious period of regression in ceramic manufacturing techniques. Whilst the middle Saxon and Saxo-Norman periods are dominated in East Anglia by entirely wheel-thrown pottery, by the mid-eleventh century manufacture had once again reverted to predominantly hand-made, rather than wheel-thrown, manufacture; it is, however, important to note that although vessels are predominantly handmade, they do appear to have been finished on a slow wheel. There are also some examples of wheel-made pottery produced in this period. A possible cause of this is the potential collapse of urban potteries during this period, after which potteries may have relocated to more rural areas (Spoerry 2016: 34-48; Leah 1994).

Regardless of this change in manufacturing technique the efficiency of medieval ceramic production after the Anglo-Saxon period is evidenced by the widespread distribution of medieval material across the county, and indeed the entire country. Whilst there are too many types of pottery produced and found in Norfolk between the mid-eleventh century and the turn of the sixteenth century to discuss individually, this section will detail some of the most common types found in archaeological investigations throughout the county.

Early Medieval Ware is predominantly handmade ware but was wheel-made in some instances (Rogerson 1997: 59; Rogerson 1995: 124). This dark brown, coarse hard ware has been found throughout the county as places such as Norwich, Barton-Bendish, and North Elmham, and is believed to date from between c. 1050 to c. 1150 (Rogerson 1997: 59; Wade 1980: 443; Jennings 1981: 41). According to Rogerson, Early Medieval Ware 'should thus be expected on sites occupied in the pre-Conquest period' (Rogerson 1995: 122). It presents difficulties, however, due to its very gentle merging into unglazed medieval ware, one of the most common medieval wares (Rogerson 1995: 124). Excavations at Blackborough End by Rogerson and Ashley in 1985, and fieldwalking undertaken by Rogerson in 1997 at Barton-Bendish have produced large numbers of sherds belonging to a development of Early Medieval Ware called Blackborough End Ware, a dark grey, hard, coarse ceramic with frequent sand inclusions named after the place of its initial discovery (Rogerson 1997: 59). This material is thought to date from the late-twelfth century and endure to at least the thirteenth century (Rogerson 1997: 60).

Grimston Ware, a sandy grey ware that has been found both glazed and unglazed – with glazed examples more common in later centuries – constitutes one of the most significant types of ceramic material recovered during Rogerson’s Barton Bendish fieldwalking survey, with over forty percent of the total sherds recovered belonging to this type (Rogerson 1997: 60). This often wheel-made pottery is believed to date from a multi-century period between c. 1200 and c. 1500 and is thus representative of the entire High to Late Medieval period.

Another common ware is Barton-Bendish Ware. It is unsurprising, given its name, that this type is believed to have been produced at a site near to Barton-Bendish (Rogerson 1987), with this wheel-made ceramic being grey with buffed surfaces (Rogerson 1997: 61). This type is believed to date from the fourteenth century, although Rogerson does suggest that production may have continued into the fifteenth century.

Other types of ware common to the post-Saxon period include local unglazed wares of uncertain origin, with Jennings suggesting that these may have been produced at Woodbastwick and Potter Heigham between the thirteenth and fifteenth centuries (Jennings 1981: 41), along with wares produced further afield, such as the thirteenth and fourteenth century Lyveden Ware that was produced in Northamptonshire and the thirteenth to late-fourteenth century Scarborough Ware that was produced, unsurprisingly, at Scarborough (Gryspeerd 1978: 61; Hayfield 1984: 17). In addition to these regional ceramics more generalised wares are found within the county, such as the Early Medieval Sandy Ware (produced between c. 1100 and c. 1400) and the Early Medieval Shelly Ware (produced between c. 1100 and c. 1400). In the later centuries of the study period wares such as the Late Medieval Oxidised Ware and the Late Medieval and Transitional Ware begin to appear, with these ceramics being produced from the mid-fifteenth century and from the late fourteenth century respectively. Imported ceramics such as German Stoneware – produced from the mid-fifteenth century – also become increasingly common as the centuries progress (Rogerson 1997; Jennings 1981).

Chapter Four: Geology and Soils

Introduction

This chapter will investigate the geology and soils of Norfolk and establish and discuss the four CZs using the methodology discussed in Chapter Three; the Claylands CZ, the Breckland CZ, the Marshland CZ, and the Peat Fen CZ. This will be followed by a detailed discussion of the implications of varying climatic conditions upon the soils of the four aforementioned CZs. In order to build a comprehensive understanding of the CZs mentioned above, it is necessary to undertake a finely detailed analysis of the soils, with this thesis making no apology for describing, in depth, the nature of each CZs soil characteristics. This detail is warranted as the generalisation of many previous attempts to explain Norfolk's geology and soils has obscured what is actually a more nuanced reality; for example, whilst it is clear that the Claylands CZ is predominantly clayey, what is obscured by this broad characterisation is that these clays can also include pockets of sandy Newport series soils which are potentially far more attractive to early colonisers than the far heavier soils surrounding this lighter pocket. Only by undertaking a finely detailed analysis can these nuances be identified. It is hoped that this detailed analysis will enable the soil character of Norfolk to be accurately reflected and the impact of climatic fluctuations assessed.

Solid geology

The solid geology of Norfolk is such that solid geological structures are rarely close enough to the surface for soils to form directly in them. Instead, soils are largely formed in the sediments that overlie these solid structures, and are often deep and largely fertile (Avery 1980: 5-10; Avery 1990; Funnell 1994c: 12; Hodge *et al.* 1984: 2). This is not, however, to say that the solid geology of Norfolk has little impact upon its environment, for as Hodge has highlighted, Norfolk's solid geology influences subsoil formation and determines the hydrological characteristics of the area (Hodge *et al.* 1984). A brief overview of the geology is therefore necessary before any discussion regarding the soils can begin. It is important to note that this analysis will not include the basement formations, for these lie too far from the surface to have any influence upon the analyses undertaken in this thesis.

In the west of the county it is primarily formations dating to the Jurassic which have the greatest impact on the surface environment. Here, the Lias Group of mudstones, siltstones, limestones, and sandstones creates a horizontal base upon which large clay formations have developed, with the youngest of these groups being the mudstones and siltstones of the Kimmeridge Clays; it is this formation which constitutes the principal solid geology of the area. These Jurassic formations are the oldest of the topmost solid geological formations in the county, but due to the canted stratigraphy of

the solid geology the Kimmeridge Clays continue north-eastwards under younger, more extensive formations.

Lying adjacent to the Kimmeridge Clays, and separating them from the later Cretaceous chalks, is a thin band of Cretaceous mudstones, siltstones, and limestones of the Lower Greensand Group and the Carstone and Gault Formations. This band runs in an approximately north to south-west direction from Hunstanton, through the town of Downham Market, and south-westwards to Soham and Cambridge. To the east of this thin band lies the far more extensive chalks which constitute the dominant Cretaceous formations within Norfolk. Occupying much of the county and following a similar trajectory to the Gault Formations, the chalk dominates much of north, central, and southern Norfolk. It is particularly influential in the south-west, north-west, and west of the county where the chalk lies nearer to the surface. This contrasts with the central and southern regions of the county where the chalk geology is buried by substantial drift deposits which limits its influence on the surface geology and soils. However, whilst the chalk is often covered by deep deposits of uncemented clays and gravels, it nonetheless serves as a major aquifer, providing the region with substantial amounts of groundwater. It also provides a substantial amount of high-quality flint from its contained nodules, a quality which has greatly influenced Norfolk's architectural character (Avery 1980: 5-10; Avery 1990; Chatwin 1961: 56-70; Funnel 1994c: 12).

The final and youngest solid geological structures within Norfolk lies in the east of the county. Formed predominantly during the Pleistocene and the Neogene, the Crag Group is composed of both estuarine and marine clays, silts, gravels, and sands, which originate from a time when the North Sea occupied much of what is now east Norfolk. This group extends southwards into Suffolk and Essex where the oldest formations of the group – the Coralline Crag and the Red Crag formations – predominate, particularly in coastal areas. Norfolk, however, only contains the two youngest formations, the Norwich Crag and Wroxham Crag, and it is these formations which dominate the eastern regions of the county. The group extends from just west of Cromer, and once again follows a similar curve to that displayed by the Chalk Group and the Gault Formations in the west and centre of the county. The border between the Chalk Group and the Crag Group is less well defined than that between the Gault and Chalks, with isolated outcrops of the Chalk Group being present south-east of Aylsham and a number of isolated Crag deposits existing within the Chalk Group around Norwich. Alongside the Crag in the south-east of the county, a small patch of Palaeocene London Clays can be found, but these are spatially limited to this extreme corner of south-east Norfolk.

The glaciers and the drift geology of Norfolk

Norfolk's soils are overwhelmingly formed in the mass of glacial deposits scattered over the county by the glaciations of the Quaternary period. Before the initiation of the Anglian Stage, late Cenozoic glaciers repeatedly penetrated the county, depositing large quantities of various materials as they advanced and receded, with later glaciers 'ploughing up' earlier deposits laid down by preceding glaciations (Chatwin 1961: 10; Funnel 1994: 14; Lewis *et al.* 2000). As a result of this destructive pattern of repeated deposition and removal, the glacial history of Norfolk during this period remains relatively uncertain, with Funnel commenting that the only certainty that can be drawn from this shadowy period is that there was a 'broad outline of repeated glacial interference' (Funnel 1994: 14). Meltwater flowing out from glacial ablation zones in the Midlands deposited large volumes of gravels onto the Crag formations in east Norfolk (Funnel 1994: 14; Lewis *et al.* 2000).



Figure 28: Many soils in Norfolk still carry the legacy of the county's glacial past, with stoney soils common throughout the county. Licenced under CC BY-SA 2.0, Keith Evans / Soil and sky.

However, by far the most influential glacial episode occurred during the Anglian Stage, when glaciers approached the county from numerous directions. Of particular importance were the clay and chalk laden glaciers advancing from the west, which deposited an extensive sheet of chalky, clayey till; this chalky formation is notorious for its high levels of carbonate, particularly towards the north Norfolk

coast (Arthurton *et al.*1994: 66; Funnel 1994: 14). However, as the formation tracks southwards its character becomes increasingly more clayey, with this expanse of clay – often termed boulder clay – still dominating central Norfolk’s surface environment (Gallois *et al.*1994: 26-8; Funnel 1994: 14; Lewis *et al.*2000). By the close of the Anglian Stage, the broad pattern of Norfolk’s geology and soils had been established, with boulder clays dominating the central and southeastern areas, while lighter, sandier deposits prevailed in the north and southwest.

After the Anglian Stage came the Hoxnian and finally the Devensian Glaciations, during which outwash gravels and sands accumulated at the north Norfolk coast. Glaciofluvial deposits are also common between the northern coastline and the area surrounding Norwich, with these gravelly deposits becoming more stony as they progress towards the Cromer Ridge (Funnel 1994: 16; Gallois *et al.*1994: 26-8). Freshwater peat began to form in the valleys where drainage was impeded by recent deposits, and as sea-levels rose, seawater flooded these peatlands, covering them with marine silts and clays. This sequence of events occurred all around Norfolk; the Fens and the marshy environments of the north and east Norfolk coast are all products of this process of peat formation and marine inundation (Arthurton *et al.*1994: 66; Gallois *et al.*1994: 26-8; Funnel 1994: 16).

With the termination of glacial conditions at the end of the last Ice Age, Norfolk’s surface geological character had largely been determined. Large tracts of boulder clays, becoming heavier as they progress southward towards the Suffolk border, dominate central and southeast Norfolk. Chalky, flinty sands and gravels, the results of glacial outwash from numerous glaciations, covers the south-west of the county. The repeated glacial advances and retreats invading the county from the west and north-west has left the north-western corner of the county largely stripped of drift deposits, making this far corner one of the only places in the county where the solid geological base – which in this instance are the formations laid down during the Cretaceous – is visible at ground level, either completely exposed or covered only by thin aeolian drift. In the east and north-east of the county silty aeolian drift and reddish till occupy the riverine, marshy landscapes typical of the area. Both of these deposits date predominantly to the last glacial stage, the Devensian, which terminated c. 10,000 BCE.

Character Zones

The general outline of soil types in Norfolk is thus broadly determined by the type of drift geology covering the landscape. We can, however, be more precise in describing the characteristics and spatial extent of soils than we can the underlying drift as the experience garnered by generations of agriculturalists and the execution of repeated surveys in the twentieth and twenty-first centuries has produced a wealth of data which allows a detailed, comprehensive analysis of the county’s many soil landscapes to be carried out. The following analysis will thus present and discuss in detail the four

marginal 'Character Zones' – the Claylands CZ, the Breckland CZ, the Marshland CZ, and the Peat Fen CZ – with this carried out utilising the methodology and datasets presented in Chapter Three.

The Claylands CZ

The Claylands CZ occupies a vast swathe of land in southern, south-eastern, central, and northern Norfolk. The largest CZ in the county – covering some 1675km² – the spatial extent of the Claylands is largely synonymous with the broad, slightly canted upland of Norfolk's boulder clay plateau, with the soils of this region being heavily influenced by the presence of this often flinty, chalky, clayey till.

The similarity of this region's soils – they are, for the most part, clayey loams – make dividing this region into separate CZs unnecessary, and thus the spatial extent of this region is similar to that of Williamson's 'Claylands', Wrights 'Central-southern Claylands', and Corbett and Dent's 'Boulder Clay Plateau' (Williamson 1993; Wright 2015; Corbett and Dent 1994). This is not, however, to say that improvements to this worn-in framework are not possible. When the associations of the CZ are analysed and their hydrological and chemical composition considered, there emerges enough evidence to support the creation and imposition of two subzones – the Heavy Claylands and the Medium Claylands – within the framework of the overarching CZ.

For example, on the relatively level areas of the boulder clay plateau, which can be found between the many gentle river valleys that cross the region, the soils, developed in the boulder clay, are often heavy, thick, and often intractable, characteristics that become even more extreme when these soils have experienced any sort of precipitation (Williamson 1993: 7). On the slopes of the river valleys, and on the slopes of the plateau itself, the boulder clay has sometimes produced soils which, whilst still being reasonably clayey, are less intractable than their heavier neighbours. On these slopes the soil is often more permeable and is loamier than the soils of the level plateau, with the superior drainage qualities of these valley and fringe soils – which stem in large part from the far more forgiving sloping topography of the plateau fringes and shallow valleys – ensuring increased tractability.

Williamson's own evaluation of the macro-spatial qualities of these two dominant types of boulder clay soils provides the best summary of this division, with Williamson observing that 'in general terms, the degree of dissection is greatest in the north-west: the least dissected areas are in the south-east, especially between the valleys of the Tas and the Waveney, where wide flat interfluves carry particularly heavy soils' (Williamson 1993: 8). This is not, however, a distinction which warrants a wholesale, homogenised division based on this north-west south-east variation, as any such division would lose a great deal of detail and variation in those locations possessing less extensive tracts of

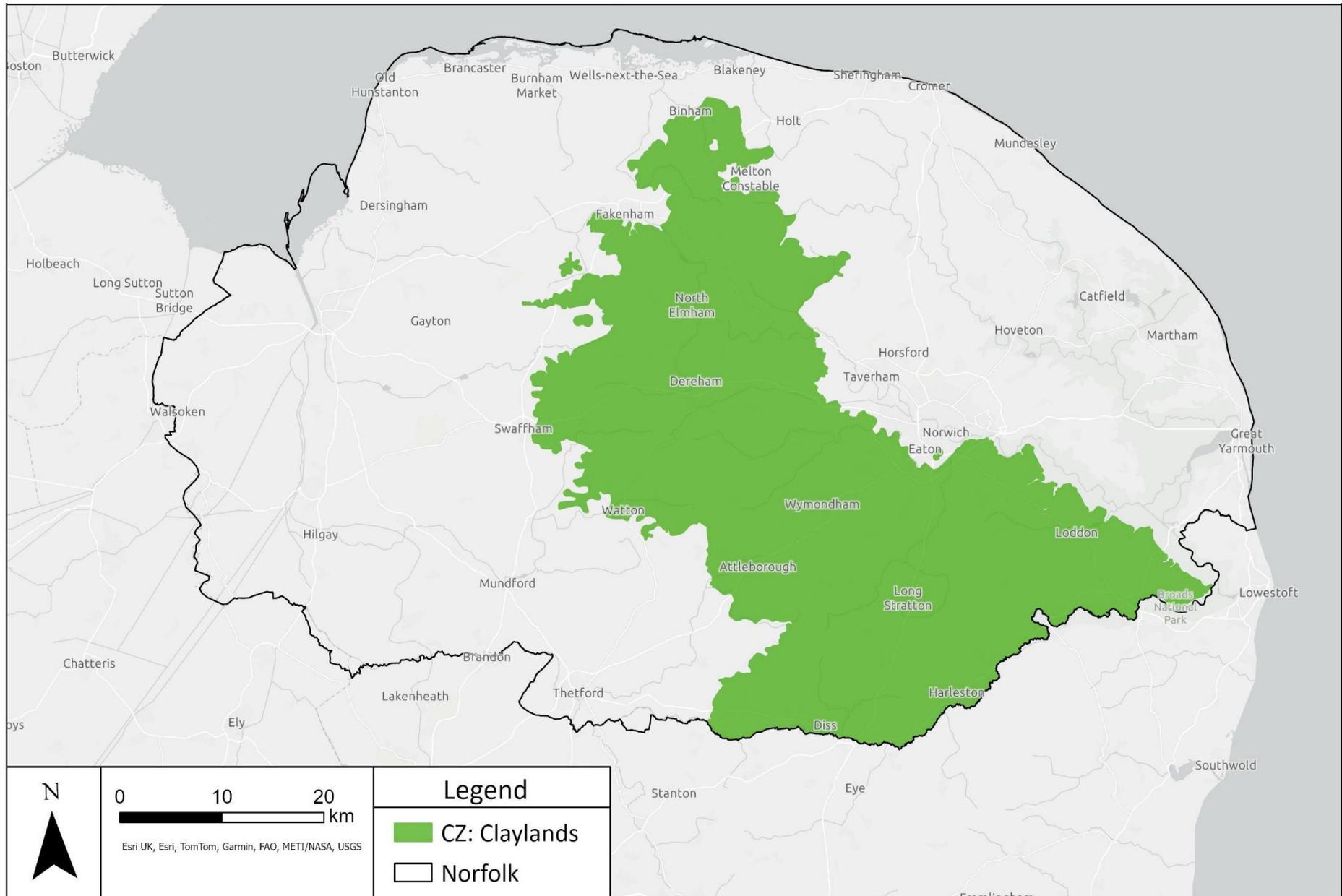


Figure 29: Claylands Character Zone.

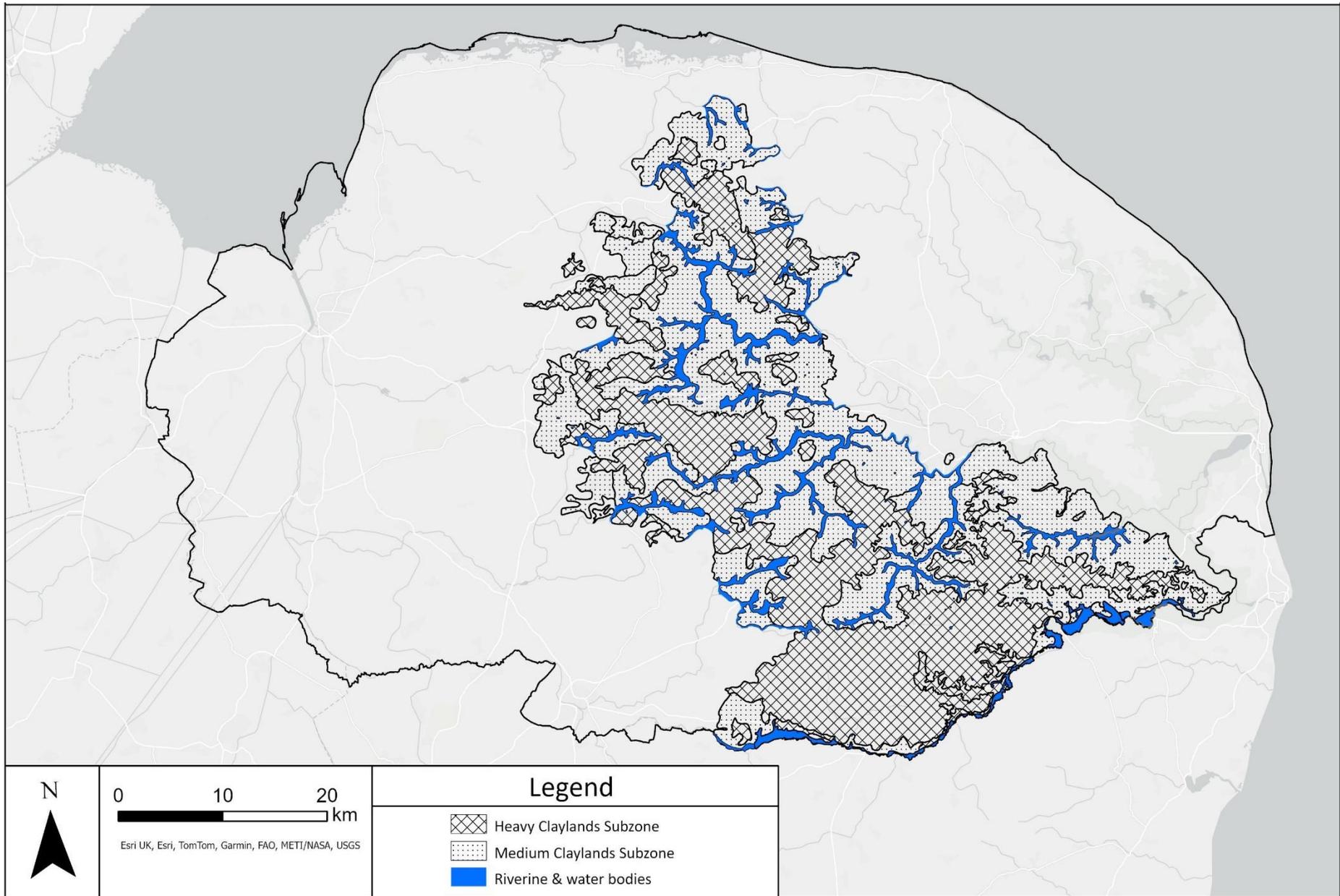


Figure 30: Heavy Claylands and Medium Claylands Subzones. A third category – riverine and water bodies – represents the alluvial soils.

both soil types; by implementing subzones mapped at association scale the variation in character is thus retained whilst also preserving local detail.

The Heavy Claylands Subzone

The first subzone to be investigated is the “Heavy Claylands”. This large subzone, composed primarily of the 711r Beccles 1 association, dominates vast swathes of land in north, central, and southern Norfolk, with the main body of this subzone occupying a large, continuous tract between the Waveney and the Tas, with tendrils of this expanse extending as far east as Toft Monks and as far north as Wrampingham. Progressing northward this subzone becomes increasingly discontinuous in its spatial coverage, with the largest of these disconnected tracts occupying the western and northern fringes of the boulder clay plateau. Like the large southern tract of the Heavy Claylands these fringe tracts are predominantly Beccles 1, although there is a relatively large tract of 711s Beccles 2 east of Fakenham, and barring two very small parcels east of Swaffham, these are the only examples of Beccles 2 within Norfolk. The subzone is at its most fragmented on its eastern flank and directly south of Norwich, where small enclaves of Beccles 1 exist within the main body of the Medium Claylands Subzone. Similar enclaves of Beccles 1 can be also found on the extreme western and northern flanks of the boulder clay plateau, although these are less numerous than those previously described.

As previously mentioned, the vast majority of the Heavy Claylands Subzone is dominated by the 711r Beccles 1 association. The primary component series in this association are the Beccles and Ragdale series soils, which occupy over three-quarters of the land, although there are some instances of Aldeby and Hanslope series in some locations (Avery 1980: 115; Corbett and Tatler 1970; Hodge *et al.* 1984: 118). The fine loamy over clayey Beccles series are typical stagnogley type soils, a type renowned for their relative impermeability and poor drainage capabilities. Typical stagnogleys such as the Beccles series belong to the surface-water gleys, a category of seasonally waterlogged, slowly permeable soils which exhibit prominently mottled subsoils, indicating that water percolating downwards is impeded and is ultimately forced to flow laterally along the soil. This mottled zone unsurprisingly becomes heavily saturated with water in the winter months when environmental conditions are frequently wet and cold, keeping the soil in a state of prolonged saturation. It is only when winter departs and spring begins to bring warmer, drier weather that the saturation level decreases, and it is this cyclical process of saturation and subsequent drainage that gives stagnogleys their distinct mottled horizons, with this cyclical process of winter saturation and spring drainage known as seasonal waterlogging (Avery 1980: 115; Corbett and Tatler 1970; Eldridge 1980; Hodge *et al.* 1984: 118). This saturation has the added effect of turning the soil increasingly grey, which is indicative of a general lack of oxygen caused, in this instance, by the presence of significant amounts of water (Avery 1980: 115; Corbett and Tatler 1970; Hodge *et al.* 1984: 118). This also causes a reduction in iron and manganese content in

waterlogged horizons, and a soil such as this, which has undergone significant, prolonged waterlogging is considered a gley. Gleyed soils are thus highly indicative of impeded drainage, and even in soils which have benefitted from increasingly elaborate and complex drainage schemes over the past few centuries will still exhibit mottling and gleying in their profile. Evidence of mottling and gleying is particularly useful to this investigation, as these relic features of modern soils provide hints as to how these soils likely behaved in the medieval period.

Frequently appearing alongside the Beccles series is the typical pelostagnogley Ragdale series, which exhibits mottling in all horizons below the Ap (ploughed) horizon. Pelostagnogleys are generally more clayey than typical stagnogleys – making them heavier – and like their loamier counterpart they similarly struggle with drainage, especially over winter (Avery 1980: 190; Corbett and Tatler 1970; Hodge *et al.* 1984: 293). Also occurring within the association – albeit in smaller areas – are the typical stagnogley Aldeby series, a series largely similar to the Beccles series in both composition and water regime, and the typical calcareous pelosol Hanslope series. Pelosols, whilst still being decidedly clayey, they do not suffer from gleying as do other clayey soils such as the stagnogleys and the pelostagnogleys, but despite this they are still considered slowly permeable.

The primacy of the Beccles and Ragdale series within the association ensures that overall, the slowly permeable Beccles 1 association suffers from impeded drainage, especially on level or concave ground where drainage is not aided by favourable topography. However, it is not just too much water that can negatively impact these stagnogley and pelostagnogley soils. These soils – and in particular the heavier Ragdale series – are prone to cracking when overly dry, largely due to the high clay content within these soils. Baked, dry soil is as problematic as waterlogged soil, just at the opposite end of the scale; water will find it difficult to percolate through the profile and significant runoff is possible, causing potentially severe erosion. This is a common issue of pelostagnogley soils and one which is virtually impossible to avoid without extensive irrigation networks.

The topographic arrangement of component series is not random, instead following a broad outline that whilst fallible, provides a reliable estimate of the likely topographic contexts of each component series. Beccles series commonly occupies the level or gently sloping plateaus of the Heavy Claylands, with Aldeby found on the muted crests of these plateaus. Ragdale and Hanslope soils are common on the sloping flanks of the plateaus themselves, with this topography serving to slightly increase these slope-dwelling series' drainage capabilities.

Nevertheless, due to the overall poor drainage capabilities of this association there are few opportunities for spring landwork even in years where precipitation levels are normal (Avery 1980: 90-102; Corbett and Tatler 1970; Hazelden 1989; Hodge *et al.* 1984: 119). Attempting to work Beccles

1 in wet conditions is potentially disastrous; the damage done to the structure of the soil would lead invariably to compaction, reducing the already low porosity of the soil even further (Avery 1980: 90-102; Corbett and Tatler 1970; Hazelden 1989; Hodge *et al.* 1984: 294). In wet years there are virtually no opportunities for Spring landwork, especially on areas where the heavier Ragdale series predominates. There are, however, more opportunities for landwork in the Autumn, as the soil will have experienced warmer, drier weather during the summer months, reducing the water content and making the soil more tractable. In years where precipitation is normal Beccles 1 is often workable in September and for much of October – and in some instances even into early November – although once again if the year is unusually wet opportunity for landwork is greatly reduced, perhaps to just September (Avery 1980: 190; Corbett and Tatler 1970; Hodge *et al.* 1984: 119). These estimates do come with a degree of caution; these are the approximate timescales for modern agriculturalists, who have the benefit of heavy machinery and practice fully mechanised farming on fields installed with modern drainage networks. We can, therefore, safely assume that the experience of medieval agriculturalists would almost certainly be far more difficult than their modern counterparts. Enclosed, heated tractors, able to pull heavy farming machinery of significant complexity in all-weather are replaced by teams of oxen pulling, by modern standards, simplistic pieces of equipment, which provided no safe harbour from the elements. The medieval experience would thus have been far more brutal than that of their modern descendants, and in the worst of conditions the Heavy Claylands would have been one of the most challenging areas of the county to farm. This experience would, however, have been more forgiving in drier years. The retention capabilities exhibited by clay soils would have provided a degree of protection from draught, which coupled with their high nutrient load made these heavy soils notably fertile when conditions were favourable. Consequently, such soils represent a ‘high-risk, high-reward’ environment — highly fertile when conditions were favourable, yet challenging and unproductive in adverse years.

711s Beccles 2 is similar to 711r Beccles 1, with the principal series remaining the stagnogley Beccles series. However, in place of the pelostagnogley Ragdale soils Beccles 2 has as its secondary component series the typical stagnogley Aldeby series. On the muted crests limited instances of the lighter sandy gley Blackwood series can sometimes be found, a soil which exhibits mottled subsoils and which is highly sensitive to fluctuations in the ground-water table, although this latter point is more relevant to low-lying instances of Blackwood. The topographic arrangement of these component series is largely similar to that of Beccles 1, with Blackwood replacing the Aldeby series on the muted crests and tracts of Beccles and Aldeby series occupying the more level or gently sloping ground around these shallow rises (Avery 1980: 190; Corbett 1979; Corbett and Tatler 1970; Hodge *et al.* 1984: 118-9).

| Heavy Claylands Subzone | | |
|-------------------------|--|--|
| Soil association | Constituent series | General character of association |
| 711r – Beccles 1 | Beccles – fine loamy over clayey stagnogley (surface-water gley); Ragdale – heavier pelostagnogley, mottled below Ap horizon; Aldeby – typical stagnogley, similar to Beccles; Hanslope – calcareous pelosol, heavy clay, slowly permeable, non-gleyed | Heavy clayey, slowly permeable stagnogley/pelostagnogley soils; very poor drainage; prone to winter waterlogging and summer cracking; typically on level or gently sloping plateau surfaces. |
| 711s – Beccles 2 | Beccles – typical stagnogley; Aldeby – stagnogley; Blackwood – sandy gley, mottled, sensitive to groundwater fluctuations (on muted crests) | Moderately to heavily clayey stagnogleys with occasional lighter sandy gleys; slowly permeable; poor drainage; similar to Beccles 1 but with lighter crest soils. |

Table 4: Heavy Claylands soil chart.

The Medium Claylands Subzone

The Medium Claylands dominates much of the territory west and south-east of Norwich in a large sweeping arc that runs from Burgh St. Peter in the south-east of the county to Saxlingham in the north. Whereas areas of the Heavy Claylands frequently appear within Medium Claylands as isolated outcrops, the Medium Claylands, barring one example near Great Palgrave, do not outcrop within the Heavy Claylands. 572n Burlingham 1 is the dominant association within the subzone and is somewhat more complex than Beccles 1 and 2, having a varied assortment of series that largely conform to distinct topographical contexts which will be outlined below (Hodge *et al.* 1984: 132). The Burlingham series is dominant within the association and is often accompanied by the similar Ashely and Hanslope series. Also present in the association are the Wighill series, the Wick series, and finally the Newport series (Avery 1980: 202; Corbett 1979; Corbett and Tatler 1970; Hodge *et al.* 1984: 132).

The primary component series is the fine loamy Burlingham series, stagnogleyic argillic brown earths which present little mottling and gleying in the Ap and Eb (eluvial) horizons. Being stagnogleyic, the Burlingham series is slowly permeable and exhibits mottled subsoils, although the absence of greyish horizons indicates that some drainage is occurring. The Burlingham series is, on the whole, slightly more well drained than, for example, the mottled gleyic Beccles series. Burlingham tends to be sandier and thus loamier than the heavier series which further improves its drainage capabilities. This is not to suggest that Burlingham does not struggle with drainage, as it is frequently seasonally waterlogged, although on sloping ground where this series is overlying well-drained glaciofluvial deposits its drainage capabilities are improved (Avery 1980: 202; Hodge *et al.* 1984: 133).

Occurring alongside the Burlingham series is the fine loamy over clayey Ashley series. This series, like the Burlingham series, is a stagnogleyic argillic brown earth and is largely similar to the primary

component series (Avery 1980: 202; Corbett and Tatler 1970; Hodge *et al.* 1984: 133). The clayey, typical calcareous pelosol Hanslope series is also common within the association. These three soils – Burlingham, Ashley, and Hanslope – are frequently found together on the highest areas within the subzone and are frequently constricted to this topographical context.

Moving downslope, the Burlingham 1 association transitions to the coarse loamy Wighill series. These stagnogleyic argillic brown earths are faintly mottled, slowly permeable, and are naturally waterlogged in the wetter winter months (Avery 1980: 202; Corbett and Tatler 1970; Hodge *et al.* 1984: 133-4). Continuing downslope is the typical brown earth Wick series. This non-alluvial loamy soil is non-calcareous and, unlike the Burlingham, Ashley, Hanslope, or Wighill series contains no significant clay enrichment in any part of its profile (Avery 1980: 202; Corbett and Tatler 1970; Hodge *et al.* 1984: 133). Wick is therefore permeable and is unmottled throughout. Given the spatial context of Wick soils within the Burlingham 1 association, these soils are both well-drained due to their physical and chemical composition and occupy sloping ground which inherently aids drainage. The final series completing this downwards progression of the Burlingham 1 association is the Newport series. This series continues the general trend of Burlingham 1 becoming more well-drained as it progresses downslope. A typical brown sand, Newport is non-calcareous and decidedly sandy; below the Ap horizon the B horizons are all stony sandy loams with no mottling or gleying present (Hodge *et al.* 1984: 133). This series is most common on the glaciofluvial deposits besides the region's main rivers, with further areas of Newport occurring on the steeper slopes where rivers and streams have sliced through the chalky till into the underlying glaciofluvial drift (Avery 1980: 202-5; Corbett and Tatler 1970; Hodge *et al.* 1984: 132). However, in the shallower valleys of the Medium Claylands there are few instances of Newport soils; instead, in these shallow valleys dominated by the heavier Burlingham, Ashley, and Hanslope series, the fine loamy Hopsford and medium loamy Wigton Moor series predominate (Avery 1980: 203; Corbett and Tatler 1970; Hazelden 1989; Hodge *et al.* 1984: 132). Hopsford series soils are gleyic brown earths with slight mottling and increasingly grey colouration down the profile, although the subsoil is permeable (Avery 1980: 203; Corbett and Tatler 1970; Hazelden 1989; Hodge *et al.* 1984: 132). Wigton Moor, typical cambic gley sandy soils, belong to the groundwater gleys. These soils developed over or within permeable deposits are prominent mottled and heavily gleyed. Unlike the stagnogleyic surface-water gleys which are seasonally waterlogged – due to the seasonal, cyclical rates of precipitation – groundwater gleys suffer periodic waterlogging due to fluctuations of a shallow water table. These soils – Hopsford and Wigton Moor – primarily occupy the floors of the smaller valleys whilst the Burlingham-Ashely-Hanslope grouping occupies the higher ground of these smaller valleys.

Appearing in smaller quantities but still extensive within the subzone is the 572p Burlingham 3 association. Found in the north, west, and south-east on elevated plateaus or their gentle slopes, Burlingham 3 contains similar component series to Burlingham 1, with the exception of the Wick series which does not feature in Burlingham 3. Burlingham 3 also contains additional component series not found in Burlingham 1. These additional series are the typical paleo-argillic brown earth Maxted and Barrow series, to be discussed in more detail in later sections, the unmottled typical argillic brown earth Weasenham series, and the stagnogleyic argillic brown earth Ashley series. On the upper slopes the mottled and slowly permeable Burlingham and Ashley series predominate, with the more well-drained Weasenham and Maxted series occupying a mid-slope position. There are also limited instances of the typical paleo-argillic brown earth Barrow series and the typical brown sand Newport series – both of which are to be discussed in greater detail in later sections – on the extreme flanks and foot slopes of this subzone (Avery 1980: 206; Corbett and Tatler 1970; Hazelden 1989; Hodge *et al.* 1984: 136). Many of these slopes lead down into shallow river valleys, with the principal riverine soil within the CZ being the sandy, peaty Isleham 2, a soil which will be discussed in more detail in later sections.

Burlingham 3 thus has similar drainage characteristics to Burlingham 1. Seasonal waterlogging is probable on the heavier series, although this can be somewhat alleviated by favourable topography. The lighter soils of the association are usually well-drained and have the potential to be moderately droughty in dry conditions (Avery 1980: 206; Hodge *et al.* 1984: 137). Opportunities for landwork the diverse soils of both Burlingham 1 and Burlingham 3 are more locally determined than on other associations. On areas of the lightest soils – for example the Wick and Newport soils – which are commonly well-drained, landwork opportunities are extensive in both autumn and spring; on areas of the heavier soils – such as the Burlingham, Ashley, and Hanslope soils – landwork is more restricted, with particularly heavy precipitation having the potential to cause moderate delays, although in general Burlingham 1 and 3 are more forgiving and ultimately lighter than Beccles 1 and 2.

The Claylands CZ is thus very much a two-part entity, but one that can be defined as whole by its clayey, loamy soils and broad, muted plateaus and shallow slopes. The Heavy Claylands are particularly intractable and provide a distinct challenge to agriculturalists who have to make the most of favourable weather, as the soils of this subzone are particularly sensitive to fluctuations in climatic conditions; too much rain, too little rain, too much sun, and too little sun can all have a profound effect on the condition of the soil, making this region particularly unforgiving. The Medium Claylands, whilst still able to pose a distinct challenge to agriculturalists in particularly inclement conditions, are, on the whole, more forgiving and tractable than the soils of the Heavy Claylands. These lighter soils are better drained and frequently occupy positions where topography can aid drainage. The importance of

topography in this heavy, intractable landscape cannot be understated, for working clayey soils on the slopes is a very different experience to working clayey soils on the flatter plateaus where waterlogging is a constant threat. The additional drainage provided by sloping topography is thus critical, and although this will in itself cause some nutrient loss via runoff, this would have been a small price to pay for improving the drainage capabilities of these easily waterlogged soils.

| Medium Claylands Subzone | | |
|--------------------------|---|---|
| Soil association | Constituent series | General character of association |
| 572n – Burlingham 1 | Burlingham – fine loamy stagnogleyic argillic brown earth; mottled subsoils; slowly permeable; Ashley – fine loamy over clayey stagnogleyic argillic brown earth; similar to Burlingham; Hanslope – typical calcareous pelosol; heavy clay; slowly permeable; Wighill – coarse loamy stagnogleyic argillic brown earth; faint mottling; slowly permeable; Wick – non-calcareous typical brown earth; loamy, freely drained, unmottled; Newport – typical brown sand; stony sandy loams; freely drained, unmottled; Hopsford – fine loamy gleyic brown earth; slight mottling; permeable subsoil; Wigton Moor – medium loamy typical cambic gley; groundwater gley; mottled and gleyed | Mixed clayey–loamy stagnogleyic association with strong topographic structuring; drainage improves downslope from heavier stagnogleys to freely drained sands; upper slopes slowly permeable, lower slopes variable; valley floors prone to groundwater gleying. |
| 572p – Burlingham 3 | Burlingham – stagnogleyic argillic brown earth; slowly permeable; Ashley – stagnogleyic argillic brown earth Weasenham – typical argillic brown earth; unmottled; moderately well drained; Maxted – typical paleo-argillic brown earth; well drained; Barrow – typical paleo-argillic brown earth; well drained; Newport – typical brown sand; freely drained; Isleham 2 – sandy/peaty gley | Similar to Burlingham 1 but with more mid-slope well-drained paleo-argillic brown earths; upper-slope stagnogleys remain slowly permeable; lighter soils moderately droughty in dry years; seasonally waterlogged on heavier series but generally more workable than the Heavy Claylands. |

Table 5: Medium Claylands soil chart.

The Breckland CZ

The Breckland CZ is perhaps the most distinctive and unique geological environment in the county. This region is composed of a low-lying plateau with very limited topographical variation; where there is a change in elevation it is typically achieved with gentle, drawn-out slopes rather than sharper, more defined slopes such as found in the north-west of the county.

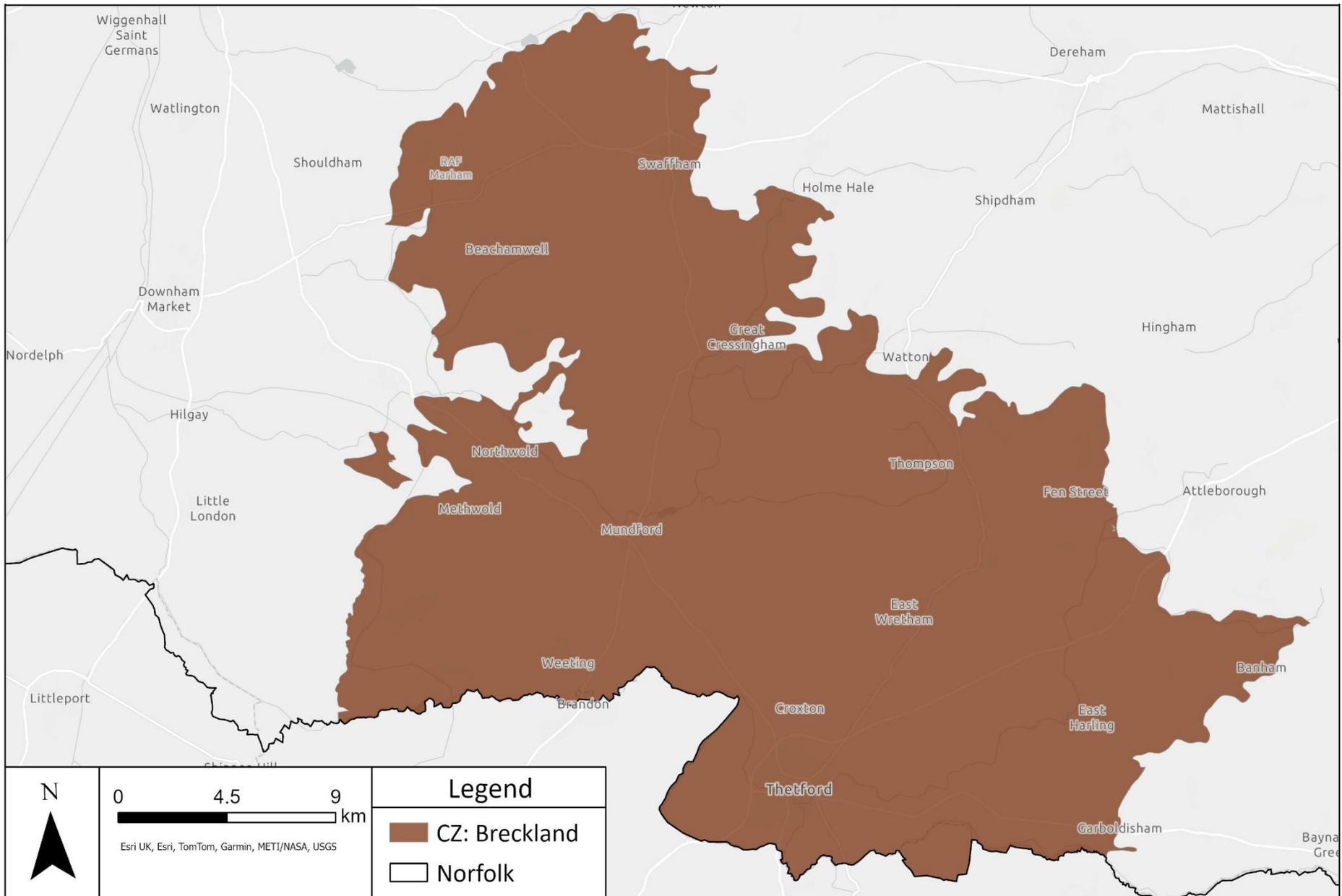


Figure 31: Breckland Character Zone.

Two of the most influential associations in the Breckland CZ are 554b Worlington and 521 Methwold. Of the two, Worlington is the most spatially expansive association and is widespread in the south-central and north-central areas of the CZ, and is, along with 343f Newmarket 1, the most spatially dominant association within the CZ. Worlington occurs primarily on the flat level ground of the Breckland plateau, with a small number of additional occurrences of the association on the gentle slopes which lead down from the limited instances of higher ground found in this largely topographically muted landscape. It is one of the deeper Breckland soils, and comprises the non-calcareous, acidic element to the patterned ground phenomena. The principal component series of the Worlington association is the arenosolic Worlington series, an unmottled argillic brown sand that is typically 120cm from the Ap to 2Cu horizon. This series is non-calcareous in its upper horizons transitioning to calcareous in its lowest (2Cu) horizon (Avery 1980: 135; Eldridge 1980). The calcareous character of this lower horizon is a product of the underlying geology; in this case, the depth of the Worlington series promotes upper horizons to be acidic – even though these upper horizons are originally derived from the chalky drift that has since decalcified – in accordance with the inherent acidity of many arenosols when not influenced by directly adjacent calcareous material. Due to the sandy character of the series, Worlington is highly permeable and, as such, drought, nutrient loss, and erosion present persistent challenges to cultivation and long-term soil stability.

Whilst the Worlington series is dominant within the association – accounting for, on average, forty percent of the soils – four other series are also found within the association. Each accounting for twenty percent of the total are the Euston series and the previously discussed Newport series. The Euston series is, like the Worlington series, an argillic brown sand, although unlike the Worlington series Euston has a far more clayey subsoil and is thus slightly less permeable than the Worlington series, although it still remains permeable and is non-calcareous. Spatially, Euston predominantly occurs in the east of the CZ, with only limited instances elsewhere in the region. Newport, a typical brown sand, is also permeable and non-calcareous due to its sandy nature, but unlike Worlington and Euston contains little argillic material, even in its lowest horizons. The final two series present in the Worlington association are two humo-ferric podzols: the limited Santon series and the more extensive Redlodge. Redlodge, a humo-ferric podzol, is a typically well-drained sandy soil with an iron-rich subsoil and an unincorporated acidic organic layer at the surface. Podzolization occurs when water, percolating through the loamy, sandy horizons in the upper profile, transports and deposits minerals – particularly iron and aluminium – into lower horizons from upper horizons. This creates an eluvial zone in the upper horizons, a term used to describe the process through which soluble minerals and material are removed from upper horizons and deposited into lower horizons. This in turn leads to the creation of an illuvial zone in the lower horizons, a zone where the soluble minerals and material

leached from above are deposited. This leaching of minerals leaves the uppermost horizons particularly acidic, whilst the lower horizons, enriched with the soluble minerals leached from above, are more alkaline and generally more fertile. In some cases, although not in the case of the Redlodge series, podzols develop a thin iron pan layer between the E horizon (the eluvial horizon) and the B horizons (Avery 1980: 135; Corbett 1987; Eldridge 1980; Hodge *et al.* 1984: 368). Leaching of the upper horizon gives podzolic soils a characteristic greyish colour in their eluviated zones, and it is this characteristic which gave rise to their name. *Pod*, derived from the Russian term for 'under', and *zol*, derived from the Russian word *zola*, meaning 'ash', thus describes these soils as 'under-ash', referring to the ash-grey E horizon and the darker soils beneath it. The process of leaching and subsequent deposition leaves leached horizons particularly infertile and acidic, although podzolic soils often become more alkaline towards the lower horizons, aided in this region by the underlying chalk geology.

Unusually, the podzolic Redlodge and Santon series are without the thin iron pan that is often characteristic of podzolic soils, but like the vast majority of podzols they are generally infertile and typically acidic. Occurrence of Redlodge is most common on glaciofluvial sands and gravels and is frequently observed to be near to, or adjacent to, occurrences of the typical brown sand Newport series, with Redlodge and Newport being most common in the north-east of the CZ on the upper reaches of the muted slopes present in the region (Avery 1980: 135; Corbett 1987; Eldridge 1980; Hodge *et al.* 1984: 368). Santon, on the other hand, has been observed to most likely occur where decalcified drift is thickest, such as in and around the vicinity of Santon Downham in the south of the CZ (Avery 1980: 135; Corbett 1987; Eldridge 1980; Hodge *et al.* 1984: 368).

Overall, the Worlington association is thus particularly well-drained. The sandy character of the association's five component series ensures that water can percolate freely down the profile, as the coarse particulates that compose the bulk of these series' material inherently creates larger pore spaces than, for example, the fine particulates found in argillic soils. Opportunities for landwork are suitably extensive, with only the coldest and wettest winter months regularly providing little opportunity for work. In wet years this unworkable period can be more extensive, but even in wet periods the soils can be worked soon after rainfall, although compaction is a threat on these soils and they readily slake, making spring ploughing more feasible than autumn ploughing in particularly wet seasons (Avery 1980: 139; Hodge *et al.* 1984: 266, 370). Due to the poor water retention capabilities of Worlington soils, wind erosion, particularly in warm dry spells, is a substantial threat to the health of these soils and to those working the land, with the effects of aeolian action and its potentially devastating consequences well documented in the region (De Keyzer *et al.* 2018: 123-34).

Occurring alongside the Worlington association and comprising the shallow calcareous element of Breckland's patterned ground is the 521 Methwold association. This association tends to occupy small tracts on both the flat level plateau of the CZ and the gently sloping locales in the few shallow valleys found in the CZ. The principal component series is the typical brown calcareous sand Methwold series, a slightly stony sand that contains both sands and chalk stones and flour from the underlying chalky rubble. Unlike the Worlington series, Methwold has little depth, with its lowest horizon lying just 50cm from the surface. The proximity to the chalky, calcareous material has a significant effect on the Ap and Bw horizons; where leaching and greater profile depth leads to the Worlington series being stripped of calcium carbonate, the proximity to such material leaves the entire profile with varying degrees of alkalinity. The combination of shallow depth and calcareous material near to the surface makes Methwold soils some of the most agriculturally productive in the CZ. Whilst the Ap and Bw horizons are, like the Worlington series, sandy and thus possessive of little capability for any degree of meaningful water retention, the proximity to the chalky rubble – which acts as a localised aquifer – allows more water to be retained closer to the surface. This, combined with the beneficial effects of a nearby source of calcium carbonate, ensures that whilst Methwold soils are permeable and well-drained, they are more agriculturally useful than their close counterparts.

The other primary component series in the association is the Worlington series, an argillic brown sand that has already been discussed. Other series which are known to occur within the association are primarily limited by topographical constraints, with the calcareous brown rendzinas of the Newmarket and Elveden series occurring on convex slopes, with these series being discussed in greater detail in the next section (Avery 1980: 139; Eldridge 1980; Hodge *et al.* 1984: 250). Opportunities for landwork are, like Worlington, typically expansive due to the poor water retention of the soils and thus their ability to transport even heavy rainfall away from the surface, with soils workable just days after winter rainfall. Furthermore, due to the previously discussed proximity to the underlying chalk, Methwold soils are able to provide crops with more water than Worlington soils, ensuring that Methwold series soils are regarded as some of Breckland's most productive soils.

The 343f Newmarket 1 association is, along with the Worlington association, the most spatially extensive association within the CZ. The bulk of the association occupies large swathes of ground in the west of CZ, although there are smaller, more discontinuous tracts present in the south and south-east of the region. In these two latter areas Newmarket 1 is most often associated with the gentle slopes of Breckland's dry, shallow valleys, whilst in the former Newmarket 1 tends to occupy the gently sloping ground that leads down to the fenland that lies to the west of the CZ. Like the Worlington and Methwold associations, Newmarket 1 also typically forms patterned ground in Breckland, with the three-component series alternating downslope over similar intervals of between six to ten metres,

whilst on level ground the association typically forms 'polygonal networks five to seven metres across around a core of shallower soils' (Avery 1980: 160; Hodge *et al.* 1984: 265). The primary component soil series is the lithomorphic Newmarket series. Lithomorphic soils are characteristically shallow, with few pedogenic processes having taking place creating a thin soil with only an organic-enriched mineral surface horizon over an unconsolidated C horizon, which in this instance is the mass of chalky rubble that underlies this region of Norfolk (Avery 1980: 160; Hodge *et al.* 1984: 269). Given the chalky nature of these lithomorphic soils, the Newmarket series is a brown rendzina; such a soil is moderately calcareous in its Ap horizon but escapes the overwhelming calcareousness that plagues many rendzinas. It is, however, typically shallow, with a profile that rarely exceeds 50cm, with the Ap horizon accounting for some 60% of the profile (Avery 1980: 160; Hodge *et al.* 1984: 269). The 2Cu horizon, which directly overlies the chalky rubble, is extremely calcareous and is very stony. Given the coarse loamy texture of the Newmarket series, the shallowness of its profile, and the unconsolidated chalky rubble which this series lies directly over, it is very capable when it comes to drainage; even during winter these soils are able to absorb the vast majority of precipitation with very little run-off (Avery 1980: 139; Eldridge 1980; Hodge *et al.* 1984: 269).

Also occurring within the association is the previously discussed typical brown calcareous sand Methwold series, and the lithomorphic Elveden series. The Elveden series, a shallow brown rendzina similar to the Newmarket series completes the association. This final series, much like the Newmarket series, tends to be calcareous without falling into extreme calcareousness, and is similarly shallow. In some limited areas the argillic brown sand Worlington series can be found within the association, although this is not a widespread component series.

Newmarket 1 soils are not the exception when it comes to their hydrological capabilities. They are permeable and well-drained, and similar to the Methwold association crops planted on Newmarket 1 benefit from its shallow profile as the underlying chalk and chalky rubble acts as an aquifer, storing more water than the deeper, acidic Worlington association. Opportunities for landwork are similarly extensive, with the soil workable just days after rainfall even in winter.

Also occurring in the Breckland CZ is the 343g Newmarket 2 association (Avery 1980: 160; Hodge *et al.* 1984: 269). This shallow, lime-rich, coarse loamy soil has as its primary component soil the previously discussed lithomorphic Newmarket series. Occurring alongside the Newmarket series are a number of lesser component series, namely the Rudham, Swaffham Prior, and Soham series, which together with the Newmarket series accounts for approximately two-thirds of the association. The Rudham series is similarly a calcareous brown rendzina but is fine loamy as opposed to coarse loamy and is moderately stony. Rudham is also even shallower than the Newmarket series, with an Ap

horizon just 25cm thick overlying a 5cm Cr or Cu horizon of unconsolidated chalky rubble. The fine loamy Soham series is also defined for its shallow depth, with few instances exceeding 55cm. Like the majority of Newmarket 2's soils, Soham is calcareous and increasingly so as the profile descends towards the underlying chalk. Whilst Newmarket and Rudham series soils – and to some extent the Soham series – are particularly shallow, not every series in the association conforms to this characteristic. The Swaffham Prior series is a coarse loamy typical brown calcareous earth, with a slightly stony loamy Ap horizon transitioning to moderately stony loam in the Bw horizon. Both of these horizons are calcareous and overlie a Cr or Cu horizon of chalky rubble which is, similar to the rendzinas, very calcareous (Avery 1980: 160; Hodge *et al.* 1984: 269). In a small handful of locations Newmarket 2 contains the deeper, typical argillic brown earth Moulton series. This coarse loamy series contains, as suggested by its subgroup, illuvial clay in its lower horizons. Due to this transmission of soluble material, upper horizons are often leached of calcium carbonate and thus broadly non-calcareous, although lower horizons remain calcareous to extremely calcareous due to the underlying chalky geology (Avery 1980: 160; Hodge *et al.* 1984: 269). Finally, some limited examples of the typical brown sand Newport series exist within Newmarket 2.

Overall, Newmarket 2 is best described as a predominantly calcareous coarse to fine loamy association with limited instances of non-calcareous soils in a handful of locales. Its coarse loamy texture and its frequently unconsolidated underlying chalk geology all combine to ensure that these soils are very well-drained; this can pose a drought risk, as even winter precipitation is readily absorbed, particularly by the sandy Newport series (Avery 1980: 160; Hodge *et al.* 1984: 269). This can lead to some issues with the soils' lime content, even on the most calcareous of this association's soils. With regard to tractability, given the loose structure of these soils there is little risk of compaction, with most soils able to be worked just two or three days after rainfall (Avery 1980: 160; Hodge *et al.* 1984: 269). Opportunities for landwork are thus readily available throughout much of the year, and even during wet years it is only the coldest and wettest winter months which offer little opportunities, which in dry years can be reduced by up to a month in both the autumn and spring (Avery 1980: 160; Hodge *et al.* 1984: 269).

The final association that covers a moderate portion of the Breckland CZ's surface area is 552b Ollerton. This association – which occupies the gentle slopes that lead to the Claylands CZ in the central and northern reaches of the Breckland CZ – is frequently intermixed with the Worlington association. Ollerton, a permeable sandy and coarse loamy association, is one of the few Breckland soils that suffers from moderate seasonal waterlogging and is heavily influenced by groundwater. As such, this association has been allocated to a subzone with the Breckland CZ; this subzone, the Breckland Transition Subzone, is composed of the Ollerton and 346 Reach associations, and is named to reflect

the fact that these two associations lie on the transition point between the light soils of Breckland and the heavier soils of the Claylands CZ and the fenlands to the west. The rationale behind allocating these two associations to a subzone within the main CZ is simple. These soils are both sandy and moderately shallow, much like other Breckland soils; however, unlike their counterparts they are not naturally well-drained, instead both suffering from seasonal waterlogging and fluctuations in groundwater. Whilst they are today considered well-drained due to the centuries worth of successful drainage contingencies introduced to improve these soils, in the medieval period these soils' drainage capabilities would not benefit from such efforts and would instead be nearer to these soils 'natural' state. The usage of the term 'natural' is to be interpreted with care; millennia of human interference after the final retreat of the glaciers has drastically altered Breckland's landscape and therefore its surface environment, not least through the destruction of tree cover and through the introduction of grazing livestock which has profoundly affected the type and distribution of flora in the region. 'Natural' is thus somewhat of a misnomer, but in lieu of a more appropriate term – especially one which is not obscenely long – the term natural must suffice. In the Middle Ages Ollerton would have suffered from seasonal waterlogging, a characteristic which is a direct contradiction to the permeable, year-round well-drained soils which compose the rest of the CZ. However, the aforementioned similarities, notably these soils' sandy and loamy character and their relationship with the underlying chalk and chalky rubble, makes splitting these soils into a separate CZ as problematic as keeping them in the same category as the well-drained sandy associations.

The principal component series of the Ollerton association is the gleyic brown sand Ollerton series. This series presents mottled subsoils and has a moderately deep profile (approximately 90cm) that is non-calcareous and without argillic enrichment. This is contrasted by second component series, the stagnogleyic argillic brown earth Honingham series. This series, which has similarly mottled subsoils presents a similar profile depth – in this instance one metre – and is calcareous in its lower horizons. The final component series is the gleyic argillic brown sand Hockham series. Like its counterparts this series is mottled in its B horizons, although its E horizon is unmottled. It is also deeper, with the entire profile having a standard depth of 120cm (Avery 1980: 249-6; Corbet 1987; Hodge *et al.* 1984: 284-5). These series are, at least in the upper horizons, all non-calcareous, although the Honingham and Hockham series transition to calcareous at depth, being influenced by the underlying calcareous geology.

The presence of mottling in all but the Ap horizon of Ollerton and Honingham series and the Ap and Eb horizons of the Hockham series demonstrates the different hydrological properties of this association compared to naturally well-drained soils. This is not to say that Ollerton is susceptible to waterlogging year-round; in the summer months these soils prove droughty due to the capable

drainage qualities of the sandy, loamy upper horizons. The more clayey, moderate deep Honingham series is the most drought resistant, holding more water thanks to its argillic content and its shallower profile, allowing the underlying chalky rubble to act as an aquifer. Opportunities for landwork are thus scarcer on soils belonging to the Ollerton association – in general, these soils lie in the middle ground between the lightest of the Breckland soils and the heavier soils of the neighbouring Claylands, with the Honingham series being the most difficult soil to work in the CZ after any amount of prolonged rainfall.

The final association found within the Breckland CZ, and the second association of the Breckland Transition Soils subgroup, is the 346 Reach association. This association is by far the most spatially limited in the CZ, and so only a cursory overview is required. The principal component series are the humic gleyic rendzina Reach series, the gleyic rendzina Burwell series, and the calcareous humic gley soil Blackdyke series. These series all display mottled horizons and are shallow to moderately deep, and all contain significant levels of calcium carbonate, making them extremely calcareous. Without modern drainage networks these sandy, loamy, and sometimes sandy clayey soils would suffer from waterlogging, evidenced by their mottled horizons, a situation that would likely be exacerbated by the common positioning of Reach association soils at the base of the gentle slopes that lead from the Breckland plateau down into the bordering fenland.

Other soils typical in the Breckland CZ but which are too spatially limited to warrant in depth discussion include the 551f Newport 3, a deep well-drained sandy and coarse loamy soil found in the extreme east of the CZ on the sloping higher ground that leads up to the Claylands, and the 551g Newport 4 association, a deep well-drained sandy soil which can be found occupying the dry shallow valleys between the few areas of increased elevation found within the CZ, with the distribution of this association's small parcels being relatively even across the entirety of the CZ. In the riverine environments found within the CZ the dominant soil is Isleham 2. Due to the shallow river valleys of this part of the county the area covered by Isleham 2 is more extensive than in other regions – where it is typically more sinuous – with this association covering over 93km² in the CZ.

| Breckland CZ | | |
|-----------------------|---|---|
| Soil association | Constituent series | General character of association |
| 554b – Worlington | Worlington – deep argillic brown sand; non-calcareous upper horizons; calcareous at depth; highly permeable; Euston – argillic brown sand; slightly more clayey subsoil; permeable; Newport – typical brown sand; non-calcareous; freely drained; Redlodge – humo-ferric podzol; well-drained; strong eluvial/illuvial horizons; acidic upper profile; Santon – humo-ferric podzol; shallow; acidic; associated with thick decalcified drift | Deep, drought-prone sandy soils; highly permeable; acidic in upper horizons; prone to nutrient loss and wind erosion; extensive landwork opportunities except in cold/wet mid-winter. |
| 521 – Methwold | Methwold – shallow brown calcareous sand; stony; over chalk rubble; permeable but retains moisture via chalk aquifer; Worlington – argillic brown sand (minor component); Newmarket – brown rendzina; shallow; calcareous; Elveden – brown rendzina; shallow; calcareous | Shallow, calcareous, permeable soils; productive due to chalk aquifer; rapidly workable; low compaction risk; drought-prone in dry years. |
| 343f – Newmarket 1 | Newmarket – shallow lithomorph brown rendzina; coarse loamy; highly permeable; Methwold – brown calcareous sand; Elveden – shallow brown rendzina; Worlington – argillic brown sand (localised) | Shallow, calcareous, coarse-loamy patterned-ground soils; very well-drained; extensive landwork opportunities; chalk rubble enhances moisture retention. |
| 343g – Newmarket 2 | Newmarket – lithomorph brown rendzina; shallow; coarse loamy; Rudham – fine-loamy brown rendzina; very shallow; Soham – fine-loamy brown calcareous earth; shallow; Swaffham Prior – coarse-loamy typical brown calcareous earth; stony; calcareous; Moulton – typical argillic brown earth; deeper; illuvial clay; non-calcareous upper horizons; Newport – brown sand (minor component) | Predominantly shallow, calcareous, coarse- to fine-loamy soils; very well-drained; low compaction risk; droughty on sands but chalk rubble increases moisture availability. |
| 552b – Ollerton | Ollerton – gleyic brown sand; mottled subsoils; moderately deep; non-calcareous upper horizons; Honingham – stagnogleyic argillic brown earth; mottled; calcareous at depth; Hockham – gleyic argillic brown sand; mottled B horizons; deeper profile | Sandy to coarse-loamy soils with seasonal waterlogging; influenced by groundwater; intermediate between well-drained Breckland soils and heavier Claylands; droughty in summer, waterlogged in wet winters. |
| 346 – Reach | Reach – humic gleyic rendzina; shallow; calcareous; mottled; Burwell – gleyic rendzina; shallow; calcareous; Blackdyke – calcareous humic gley soil; mottled; Associated valley-floor soils – shallow, sandy/loamy, waterlogged without drainage | Extremely calcareous sandy-loamy soils with frequent mottling; naturally waterlogged on valley floors and lower slopes; more poorly drained than main Breckland soils; shallow profiles over chalk rubble. |
| Isleham 2 | Isleham 2 – sandy/peaty gley; shallow; groundwater-influenced | Poorly drained, gleyed riverine soils; waterlogged in winter; more extensive in Breckland due to shallow valleys. |

Table 6: Breckland Character Zone soil chart.

The Marshland CZ

The Marshland CZ comprises one of two distinct landscapes investigated by this thesis that occupies part of Norfolk's fenland, a large region which was once a broad estuary for rivers such as the Ouse, the Witham, the Nene, and a number of smaller creeks and streams (Williamson 1993: 14). Extending from Hunstanton in the north and reaching as far south as Ten Mile Bank and Lakes End, this relatively large CZ is somewhat unique given that it entirely encircles a large part of the Peat Fen CZ in a rough circle between Downham Market, Wiggshall St. Mary Magdalen, and Emneth Hungate. Whilst, at least on the surface, the Peat fen CZ appears to be similar to the Marshland CZ, on closer inspection both the geological character and the region's history are notably different.

The silty and silty clay soils which dominates the Marshland CZ are the product of repeated prehistoric marine incursions, during which layers of silt were deposited over earlier depositions of clay and peat (Williamson 1993: 14). After this deposition sea-levels dropped, leaving behind a habitable landscape that has been home to often thriving human communities for over two-thousand years (Williamson 1993: 14). Conversely, the soils of the Peat Fen CZ are more peaty and clayey rather than silty and clayey, and due to the Peat Fen CZ's exceptionally low-lying topography, the marine incursions – which in the slightly more elevated Marshland CZ were less of an issue, especially after centuries of anthropogenic drainage efforts – continued well into the Medieval period leaving large areas of the CZ seasonally flooded (Williamson 1993: 14). Thus, whilst both the Peat Fen and the Marshland CZs are, at first glance, apparently a single landscape, they are in fact two distinct landscapes each with their own unique soil environment and history.

The most extensive association within the Marshland CZ is the clayey Wallasea 2 association, which occupies a large swathe of low-lying land north of Emneth Hungate in the centre of the CZ along with smaller tracts to the north-east, with these tracts typically occupying land that lies between two and three metres O.D. In the northern spur of this CZ long, somewhat sinuous, more elevated tracts of Wallasea 2 border the Western Escarpment CZ (see Figure 34), with further examples of this association occupying small parcels that protrude into the Western Escarpment between the slightly elevated outcrops common to that CZ. The primary component series is the mottled, greyish brown pelo-alluvial gley Wallasea series, which is seasonally waterlogged and extremely susceptible to fluctuations in the groundwater-table (Avery 1980: 388; Hazelden 1989; Hodge *et al.* 1984: 338; Seale 1975). Occurring alongside this component series – which accounts for more than half of the ground covered by the association – are the pelo-calcareous alluvial gley Newchurch series, the calcareous alluvial gley Wisbech series, and the gleyic brown calcareous alluvial Blacktoft series. Without significant drainage infrastructure these series, all marine alluvial soils, are waterlogged for extensive periods especially during the winter months (Avery 1980: 388; Hazelden 1989; Hodge *et al.* 1984: 339;

Seale 1975). The spatial context of these four-component series can be rather complex, especially where these soils occupy slightly elevated terrain, but in general the further inland and the higher the elevation the more likely it is for the clayey Wallasea and Newchurch series to predominate (Avery 1980: 388; Hazelden 1989; Hodge *et al.* 1984: 339). Conversely, the closer to the coast the more likely instances of Blacktoft and Wisbech become (Avery 1980: 388; Hazelden 1989; Hodge *et al.* 1984: 339; Robson and George 1978; Seale 1975).

Also spatially significant in this CZ is 812b Wisbech. This association is commonly found bordering the coastline in the north of the CZ on slightly elevated ground and also borders the majority of the encircled portion of the Peat Fen CZ. It also tends to occur alongside the Wallasea 2 and 812c Agney associations in a repeating sequence, with Agney often found between instances of Wallasea 2 and Wisbech (Avery 1980: 391; Hodge *et al.* 1984: 362; Robson and George 1978; Seale 1975). This deep, stoneless, calcareous, coarse, and silty soil has as its primary component series the mottled calcareous alluvial gley Wisbech series, and frequently occurs alongside the gleyic brown calcareous alluvial Romney series. Due to their silty, and in the case of the Wisbech series clayey character, these soils suffer from significant waterlogging if no drainage infrastructure is present (Avery 1980: 391; Hodge *et al.* 1984: 362; Robson and George 1978; Seale 1975).

The deep stoneless calcareous fine and coarse silty Agney association soils are, as has already been mentioned, commonly found between tracts of Wisbech and Wallasea 2. Whilst this is most readily observable around the encircled portion of the Peat Fen CZ, it is almost observable, albeit in a less impressive fashion, on the eastern flank of the CZ. The principal component series of the Agney association is the Agney series, calcareous alluvial gley soils that are a silty clayey loam. Also occurring within the association is the calcareous alluvial gley Wisbech series. Like their counterparts these soils are well-drained if suitable drainage infrastructure is place, but without suitable drainage they would likely suffer from waterlogging, as suggested by their relic mottling (Avery 1980: 381; Hodge *et al.* 1984: 339; Robson and George 1978; Seale 1975).

Occurring in two moderately sizeable tracts between Wisbech, Agney, and Wallasea 2 association soils is the deep stoneless fine and coarse silty and clayey 811e Tanvats association. The main component series is the typical alluvial gley Tanvats series, which exhibits mottling in every horizon within its profile, evidence of its frequent waterlogging. Indeed, in places with no drainage or unhelpful topography the medium silty Tanvats series is severely waterlogged, a product of both this series' subsoils being relatively limited with regard to permeability and the inherent hydrological characteristics of this part of the county (Hodge *et al.* 1984: 319; Robson and George 1978; Seale 1975).

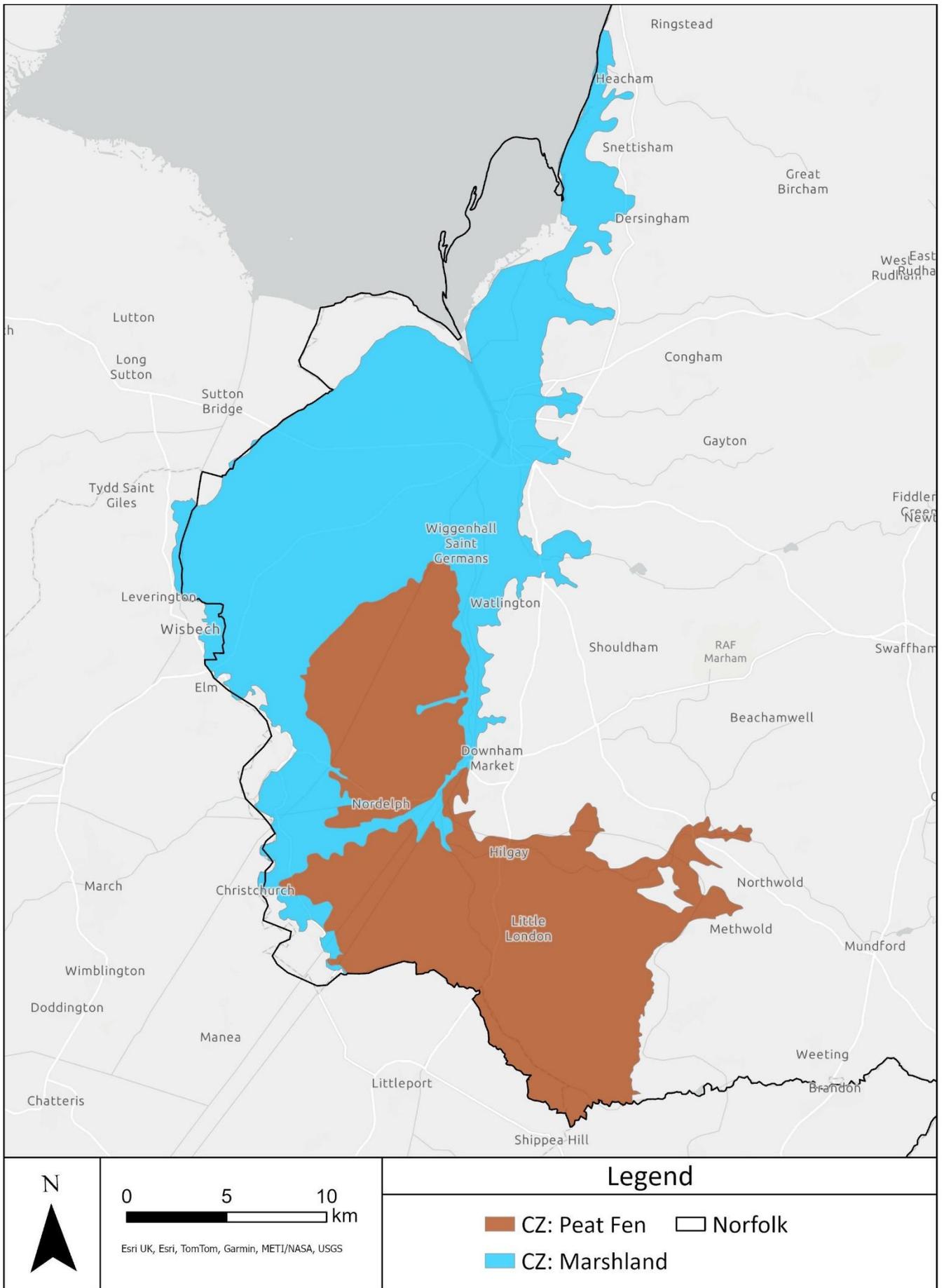


Figure 32: Marshland Character Zone and Peat Fen Character Zone.

Opportunities for landwork are thus most widespread in autumn, before the wet winter weather has a chance to inundate the soil, although wet cool summers can pose an issue for autumn landwork (Hodge *et al.* 1984: 319-21; Robson and George 1978; Seale 1975). Other series occurring alongside Tanvats is the pelo-alluvial gley Wallasea series and the Pepperthorpe and Rockcliffe series, with these latter two being closely related to Tanvats as they are similarly typical alluvial gley soils. These two similar soils also exhibit mottling throughout their profile, although Pepperthorpe is unmottled in its Ap horizon.

| Marshland CZ | | |
|----------------------|--|---|
| Soil | Constituent series | General character of association |
| 812a – Wallasea 2 | Wallasea – mottled greyish brown pelo-alluvial gley; clayey; seasonally waterlogged; highly sensitive to groundwater; Newchurch – pelo-calcareous alluvial gley; clayey; calcareous; waterlogged without drainage; Wisbech – calcareous alluvial gley; silty/clayey; strongly calcareous; waterlogged in winter without drainage; Blacktoft – gleyic brown calcareous alluvial soil; alluvial; calcareous; mottled | Deep marine alluvial clays and silty clays; strongly influenced by groundwater; naturally very poorly drained and seasonally waterlogged; inland tracts more clayey, coastal tracts more silty; intensive drainage required for reliable cultivation. |
| 812b – Wisbech | Wisbech – mottled calcareous alluvial gley; deep, stoneless; coarse to fine silty; often clayey; Romney – gleyic brown calcareous alluvial soil; silty; mottled | Deep, stoneless, calcareous silty and silty clay alluvium; naturally prone to prolonged waterlogging; improved drainage gives good agricultural land but with narrow workability windows in wet seasons. |
| 812c – Agney | Agney – calcareous alluvial gley; silty clayey loam; mottled; deep and stoneless; Wisbech – calcareous alluvial gley (as above) | Deep, calcareous fine and coarse silty alluvium; relic mottling indicates former prolonged waterlogging; now well-drained where infrastructure exists, but inherently wet and slow to drain without it. |
| 811e – Tanvats | Tanvats – typical alluvial gley; medium silty; mottled throughout; severely waterlogged in undrained or poorly drained contexts; Wallasea – pelo-alluvial gley (as above); Pepperthorpe – typical alluvial gley; silty; mottled throughout; Rockcliffe – typical alluvial gley; silty/clayey; mottled throughout | Deep, stoneless fine and coarse silty and clayey alluvial gleys; inherently poorly drained; severe winter waterlogging; autumn offers the best landwork window but can be curtailed by cool, wet summers. |
| 811d – Rockcliffe | Rockcliffe – typical alluvial gley; light silty loam; mottled throughout; groundwater-influenced; seasonally waterlogged; Tanvats – typical alluvial gley; slightly heavier than Rockcliffe; Snargate – gleyic brown alluvial soil; lightest within the association; mottled subsoils but relatively permeable compared to other series | Deep, stoneless silty and fine sandy alluvial gleys on low-lying ground; strongly controlled by shallow groundwater; naturally seasonally waterlogged and vulnerable to poaching; difficult to work outside short periods of favourable weather even where drained. |

Table 7: Marshland Character Zone soil chart.

Tucked between moderately sized tracts of Tanvats, Agney, and Wallasea 2 is a small parcel of the deep stoneless silty and fine sandy 811d Rockcliffe association. The primary component series is the typical alluvial gley Rockcliffe series, which are heavily influenced by fluctuations in the groundwater.

This light silty loam exhibits mottling throughout its profile and is thus seasonally waterlogged. Alongside the Rockcliffe series the similar Tanvats series is common within the association, although this series tends to be slightly heavier than the lighter Rockcliffe series. Also occurring in the Rockcliffe association, albeit in smaller quantities, is the gleyic brown alluvial Snargate series. This series is the lightest within the association and exhibits mottled subsoils and substratum, although the former is relatively permeable thus ensuring that in comparison to many of the soils within both the association and in the wider CZ Snargate has fairly capable natural drainage (Avery 1980: 22, 360; Hodge *et al.* 1984: 302). However, despite this the association is generally difficult to work in all but ideal weather, with poaching and seasonal waterlogging a very real threat in both drained and undrained landscapes (Avery 1980: 22, 360; Hodge *et al.* 1984: 302).

The Peat Fen CZ

The Peat Fens CZ occupies the southern half and part of the central areas of Norfolk's fenland. The majority of the associations in this CZ are clayey and peaty, which combined with their low-lying location – which rarely exceeds mean sea-level – makes these soils particularly susceptible to flooding and waterlogging. Whilst this area was exploited throughout the prehistoric period, for most of the Medieval period this area of unremitting peat marshland was subjected to extensive seasonal flooding. This lack of dry, workable land is reflected in the archaeological record of the CZ, which is noticeably bereft of any meaningful quantities of Medieval finds that would indicate arable activity, with this CZ most likely serving as seasonal grazing for livestock. There is thus little need for an in-depth analysis of the soils of this region, with only a brief overview of the constituent associations necessary.

The most spatially extensive association is the humose clayey 851a Downholland 1, which covers large swathes of ground in the south and east of this CZ, along with the majority of ground in the disconnected enclave within the Marshland CZ (Avery 1980: 358; Hodge *et al.* 1984: 166, 170; Robson and George 1978; Seale 1975). The deep peat 1022a Altcar 1 association is common in the east, with the extremely calcareous clayey and silty 373 Willingham and the clayey 813h Dowels associations prevalent in the west (Avery 1980: 167, 358, 360-4; Hodge *et al.* 1984: 89-90, 162, 355-8; Robson and George 1978; Seale 1975). In the south of the CZ Wallasea 2, Isleham 2, and the deep peat 1024a Adventurers' 1 associations are common in smaller, often intermixed tracts. In the centre of the CZ small parcels of Blackwood and the deep humose clayey and fine loamy 872a Peacock surround two small, elevated outcrops that rise between ten and twenty metres above the surrounding fenland, which themselves carry small parcels of Newport 2 and the deep loam 572q Ashley association, the most tractable soils in the CZ (Avery 1980: 277; Hodge *et al.* 1984: 83-5, 96-8, 290-3; Robson and George 1978; Seale 1975). On the fringes of the CZ, bordering the comparatively elevated lands which

lie to the north and east of the Peat Fen CZ are moderately sized tracts of the peat 1024b Adventurers' 2 association (Avery 1980: 401; Hodge *et al.* 1984: 85-7; Robson and George 1978; Seale 1975).

| Peat Fen CZ | |
|---------------------------|---|
| Soil association | General character of association |
| 851a – Downholland 1 | Deep humose clayey fen soils; naturally waterlogged; extremely poor drainage; dependent on engineered drainage for use. |
| 1022a – Altcar 1 | Deep peat; highly organic; very low bulk density; saturated most of the year; minimal natural tractability; prone to subsidence when drained. |
| 373 – Willingham | Extremely calcareous clayey/silty alluvium; slow-draining; seasonally waterlogged; heavy soils with narrow workable windows. |
| 813h – Dowels | Heavy clayey fen alluvium; very poorly drained; prolonged winter waterlogging; difficult soils to work. |
| Wallasea 2 | Marine-derived clayey alluvium; inherently waterlogged; strong gleying; reliant on artificial drainage. |
| Isleham 2 | Sandy-peaty gley influenced by shallow groundwater; naturally waterlogged; minimal medieval agricultural potential. |
| 1024a – Adventurers' 1 | Deep organic peat; extremely wet; little structural integrity; severe waterlogging. |
| Blackwood | Sandy gley; groundwater-influenced; naturally wet. |
| 872a – Peacock | Deep humose clayey and fine-loamy gley; poorly drained; often saturated. |
| Newport 2 | Deep freely drained brown sands; drought-prone; the most tractable soils in the CZ. |
| 572q – Ashley | Fine-loamy over clayey stagnogleyic soil; moderately heavy but workable on elevated ground. |
| 1024b – Adventurers' 2 | Shallow to moderately deep peat; waterlogged; limited cultivation potential. |

Table 8: Peat Fen Character Zone soil chart.

Plant Available Water (PAW) and temperature

One of the most critical aspects of agriculture is the availability of water. The analyses of the soils of the four CZs undertaken above makes repeated reference to how the soils cope with climatic variables; for example, on the clays of south and central Norfolk, any peak in precipitation would invariably lead to a wetter surface environment due to their impeded drainage. Mixed with a reduction in temperature – and thus a reduction in evapotranspiration – the experience of those working or living on heavier land during such an episode would likely be far harsher than, for example, those living on lighter land during the same period, land which is ultimately far less sensitive to

increased precipitation and lower temperatures. The availability of water to crops will thus differ in different soil environments, with this effect known as 'plant available water' (PAW). This concept is best described using a case study, with the Claylands CZ perfectly suited to this endeavour.

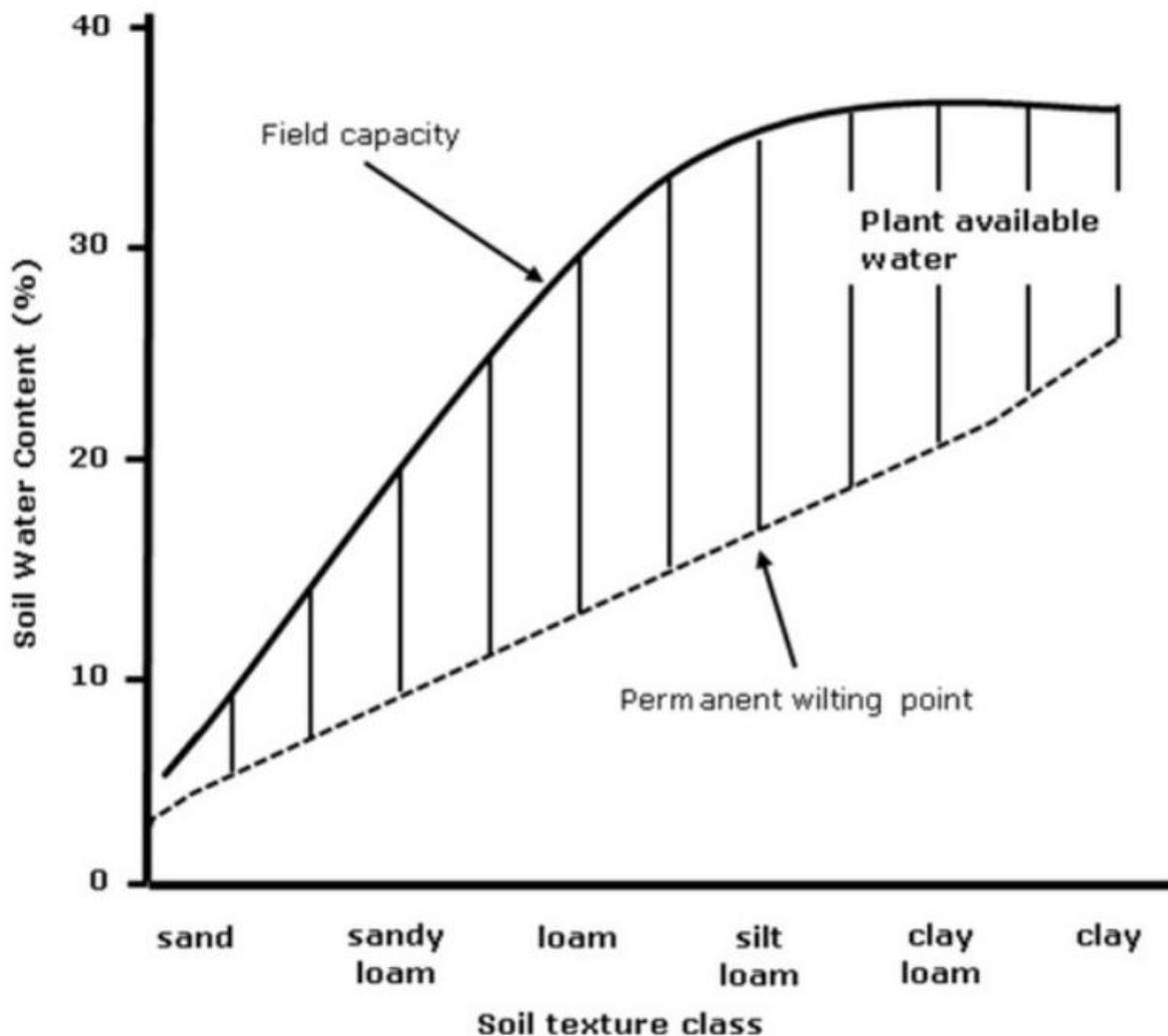


Figure 33: Plant Available Water (PAW) and soil texture. Image licensed under CC BY-SA 4.0.

The Claylands CZ is, unsurprisingly, characterised by its clayey composition. This type of soil is perhaps one of the most dualistic types of soil found in England. On the one hand, clay soil is rich in nutrients, as the tight, slowly permeable structure limits the percolation of water both laterally and vertically. It thus has the capability to be incredibly fertile as nutrients are not being leached from the soil, with clay soils able to produce strong, high quality, and often plentiful harvests. This tight structure is able to retain a large amount of water within the soil, with the small space in between the fine grains inherent to clay soils trapping a larger amount of water than other larger grained soils. This may seem counterintuitive at first glance; the pore-space in clay soils are defined as micro-pores due to their small size, whilst macro-pores, like those found in sandy soil, are much larger, and thus hold more water. However, due to the larger granules in coarser soils, there are far fewer macro-pores than there

are micro-pores; thus, whilst micro-pores hold less water when directly compared to macro-pores, it is the sheer number of micro-pores within a soil which allows fine grained soils to retain large volumes of water within the soil.

This is not to say that fine grained soils – such as clays – provide arable crops and grasses with the most water. Total water holding capacity may be highest in fine grained soils like clays, but it is not total water holding capacity which determines how much water is available to plants, with this being determined by potential energy, with water moving from areas of high-potential energy to areas of low-potential energy (Hillel 1982). There are three states which a soil can experience when changes in potential energy occur: saturation, which forces the potential energy gradient downwards and which allows drainage by gravitational forces (a common drainage mechanism in macro-pore soils) with this water unavailable to flora and termed drainable porosity; field capacity, which is reached when drainage of macro-pores via gravitational forces is complete, represents the water held in the soil by matric forces against the pull of gravitational forces and which represents a further reduction in potential energy; and finally the permanent wilting point, which occurs when matric forces hold water too tightly for extraction by flora. It is thus only water which is held between the permanent wilting point and field capacity that is available to plants for extraction, with this ‘sweet spot’ lying between the points at which water is being held by capillary forces against gravity but not so tightly as to be held against particulates by negative potential (below the permanent wilting point). This point, between field capacity and the permanent wilting point, is termed plant available water or PAW, with water held here available to plants for extraction. Micro-pores and the slightly larger meso-pores are the most useful type of pore-space in which most of PAW is stored.

Texture also plays a large role in determining the PAW within any given soil. As previously discussed, purely fine-grained soils, such as clays, store water in micro-pores, but this is often held too tightly for extraction by plants, thus slightly reducing the PAW when compared to more variable soils such as clayey loams. These soils benefit from the presence of larger pore-spaces – meso- and macro-pores – alongside micro-pores; this creates a soil with both plentiful water storage capacity and water which is held at the ideal tension, escaping the strong capillary forces which makes purely fine-grained soils so water retentive.

Thus, the Claylands CZ, which is composed not of pure clays but of loamy clays, is, at least from a PAW point of view, the most hospitable CZ in the county, with the soils of this region allowing crops access to easily extractable water reserves, which coupled with the region’s often elevated topography – thus replenishing these reserves through increased precipitation – make, at least from a water storage point of view, ideal agricultural land. However, there are several caveats which make this region far

less hospitable than PAW alone implies. Strongly structured soils, such as granular, fine and medium angular blocky, and subangular blocky soils allow water to rapidly drain through the soil. These soils, composed of very fine or fine aggregates, allow water to drain through the soil by increasing the soils macroporosity. At the opposite end of the scale are those soils which possess either a weak structure or coarse structural elements (prismatic or blocky), or a platy structure. These types of soil severely limit the degree to which water can percolate through the soil. With regards to the Claylands CZ – and in particular the Heavy Claylands Subzone – these structural factors ensure that Beccles soils, with their weakly structured, often prismatic or massive structure severely impedes drainage, as do the Ragdale, Aldeby, and Hanslope series soils.

It is thus of little surprise that clayey soils are particularly susceptible to waterlogging, especially in the winter months when rainfall increases and potential evapotranspiration – that is the evaporation of water from the soil due to the warming effects of solar radiation – decreases due to the cooler winter temperatures. In the Claylands CZ any notable peak in precipitation averages indicates a period during which environmental conditions on the heavy soils endemic to this CZ were likely more extreme and inhospitable. Furthermore, fluctuations in temperature could also impact PAW, for a generally warmer climate will increase evapotranspiration; thus, for soils with poor PAW such as the sandy loams of the Breckland, decreased precipitation coupled with an increase in temperature could be particularly problematic, for less water will be contained within the soil whilst more water will be being lost through an increase evapotranspiration due to the warmer climate.

With the primary interactions between soil and climatic fluctuations established, the climatic vulnerabilities of the Claylands CZ, the Breckland CZ, the Marshland CZ, and the Peat Fen can now be established.

Climate and soils

The Claylands CZ

The Heavy Claylands Subzone is home to the heaviest non-alluvial soils in the county. The heavy, clayey series which dominate this region – the stagnogley Beccles and Aldeby series, the pelostagnogley Ragdale series, and the pelosol Aldeby series – are mottled and gleyed (with the exception of the Aldeby series), testament to their poor drainage capabilities. This subzone is therefore extremely vulnerable to above average precipitation; without adequate drainage this subzone is waterlogged for much of winter, and in particularly wet winters this can last well into the spring months, and there is a very short window of opportunity for landwork. This is further compounded if temperatures are elevated, for the combination of warmer temperatures and increased rainfall is particularly problematic on clay soils. Warmer annual temperatures generally signal warmer winters, and with

warmer winters comes a reduction in the occurrence of frost. Clay soils benefit greatly from winter frosts to break down the soil; in wetter years, when the soil has been heavily saturated and potentially compacted by agricultural use, the occurrence of frost is critical to bringing the land back to a workable state. Thus, without the ameliorating effects of frosts the productivity and tractability of heavy clay soils is lessened.

The Medium Claylands Subzone is similar to the Heavy Claylands Subzone but is generally loamier in character and has slightly increased drainage capabilities. The primary soils of this region are the fine loamy stagnogleyic argillic brown earth Burlingham, Ashley, and Wighill series, the typical brown sand Newport series, and some instance of the pelosol Hanslope series. The inclusion of lighter soils in this region, which often occur downslope, make this region slightly more resilient to above average precipitation and slightly more vulnerable to below average precipitation, with some of these soils vulnerable to drought; this subzone has the highest PAW in the county. Whilst the overall character of this subzone is still predominantly loamy and clayey, this subzone has a heavier emphasis on the loamier qualities of the component soils. This means that they are slightly better equipped to deal with wetter conditions, whilst slightly more susceptible to drier conditions, although it is worth reiterating that these loamy, clayey soils have the greatest PAW in the county.

Breckland CZ

The Breckland CZ is home to the lightest and most marginal soils in the county. The principal associations are the deep sandy Worlington, the shallow sandy Methwold, the shallow sandy and coarse loamy Newmarket 1, and the sandy and coarse loamy Newmarket 2. These soils are all unmottled, un-gleyed, and are thus permeable and well-drained. On these soils lower or even average precipitation levels are extremely problematic, with these soils having very limited PAW. Furthermore, due to the sandy and coarse texture of these soils, average or increased levels of precipitation, whilst providing crops and livestock with more water, would lead to increased leaching of lime and a reduction in soil nutrients. Furthermore, the thermal properties of the soil are such that they heat up extremely quickly, increasing local temperatures and creating a micro-climate which has set nationwide daytime summer temperature records. However, whilst daytime temperatures are often intense, the structure of the soil ensures that very little heat is retained within the soil once the sun sets. Whilst this is not particularly problematic in summer, in winter the poor thermal properties of the soil can lead to lower-than-average temperatures (Met Office 2022), with the minimum temperatures at Marham (1961-1990) in January, February, and March being 0.15°C, 0.38°C, and 1.69°C respectively. By comparison, the same months at Coltishall, where January, February, and March record minimum temperatures of 0.74°C, 0.72°C, and 2.02°C respectively, whilst minimum winter temperatures in Hemsby for the same months stand at 1.24°C, 1.35°C, and 2.37°C respectively.

In years which are particularly cold this internal variability must have reduced the productivity of arable enterprises and only exacerbated the marginality of the CZ.

The Marshland CZ and the Peat Fen CZ

These two wetland environments occupy the low-lying landscape in the far west of the county. The associations which comprise this fenland landscape are the silty and clayey Wallasea 2, Wisbech, Agney, Tanvats, and Rockcliffe associations. The mottled, gleyed, and often alluvial soils found in this region are thus extremely vulnerable to hydrological input, whether this be fluctuations in groundwater or variations in precipitation. There are no stages when the climatic conditions could have provided 'good' conditions on these soils; this landscape is simply too wet, although this is not to say that exploitation was not taking place. Rather, exploitation was unlikely to been significantly aided by positive macro-climatic conditions.

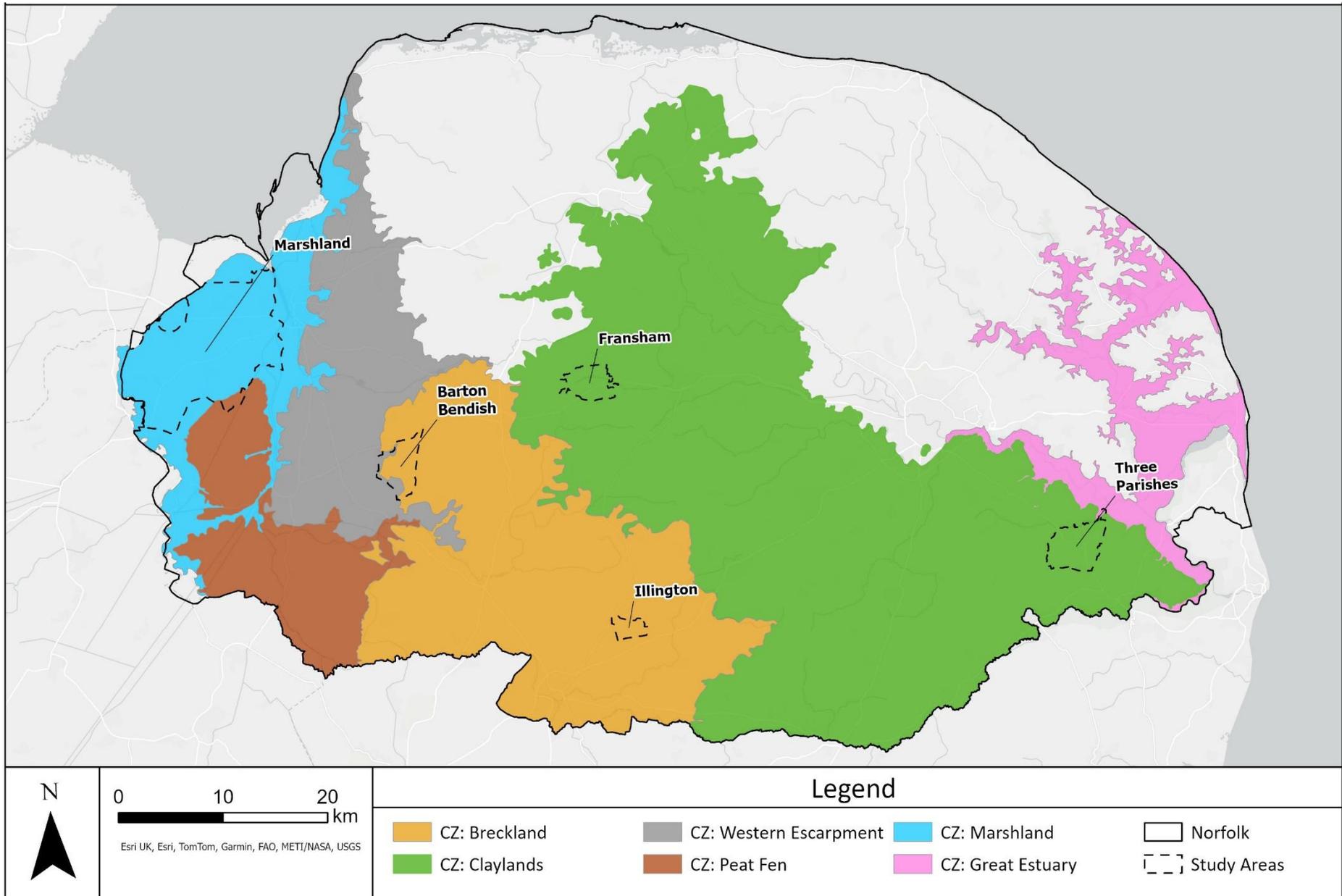


Figure 34: Character Zones in Norfolk. Note that the Great Estuary and Western Escarpment Character Zones are not discussed at length in this chapter due to the limited spatial coverage of these Character Zones within study areas.

Chapter Five: The Claylands

Introduction

This chapter will analyse the archaeological, historical, and geological evidence from the Claylands CZ and discuss the relationship between this evidence and fluctuations in historic climatic conditions.

Spatial, geological, and historical contexts

Davison's *Three Parishes* survey encompasses 20.7km² in the extreme south-eastern arm of the Claylands CZ and spans all three subzones identified within the Claylands CZ. In the north lies the shallow valley of the Chet, the principal river in the region, along with two small becks – the Loddon Beck and the Heckingham Beck – which extend southwards from the Chet valley (see Figure 36). These wet, low-lying environments lie between 0m OD and 5m OD. In the central parts of the survey area tracts of loamy clays belonging to the Medium Claylands predominate. These areas, composed of Burlingham 1, occupy the level areas between the shallow valleys and generally lie between 5m and 30m OD, whilst in the south of the survey area and on the gently sloping ground leading up to the slightly elevated plateau – with the most elevated parts of this plateau lying at 42m OD – is a relatively thin expanse of the Heavy Claylands Subzone, composed in this region of by the clayey loamy Beccles 1 association.

Romano-British settlement was well established across the Three Parishes study area, with a notable distribution of sites favouring the Medium Claylands – and particularly the pockets of sandier soils that constitute part of this subzone – and valley slopes near watercourses. The largest cluster of Romano-British sites occurs approximately 1km south of the modern town of Loddon, where sites occupy the shallow slopes that lead down to two extant watercourses within the Medium Claylands. This conglomeration of sites – evidenced by pottery scatters, structural remains, and metalwork finds – offered easy access to both a source of running water and the productive soils of the Medium Claylands (Davison 1990: 15-7, 66). A similar clustering is observed around St Mary's Church in Heckingham, where Romano-British activity is focused along the junction between the Isleham 2 soils and Medium Claylands, with a particular focus on the gentle valley slopes that descend toward the River Chet. This once again suggests a preference for fertile, slightly sloping, and well-drained locations close to sources of water. In Hales, Romano-British settlement appears more dispersed and exhibits less intensity than that evident in Loddon and Heckingham. There is, however, evidence of Romano-British settlement on the Heavy Claylands, indicating that some exploitation of this far more intractable and hydrologically sensitive ground was occurring in the Romano-British period. In the south of Loddon there is also evidence of expansion onto the Heavy Claylands, with two sites

occupying the crest of the low plateau that leads up to the comparatively higher ground south of the study area. Romano-British settlement in the Three Parishes was thus broadly following topographical and pedological characteristics, with a clear tendency to favour locations combining sloping topography, the fertile but more workable soils of the Medium Claylands, and a close proximity to source of running water.

South-east Norfolk was one of the most populated regions of the country in the early medieval period, only slipping into a slow decline from the thirteenth century (Davison 1990: 3; Williamson 1993: 112). For much of the post-Roman period this part of the county was heavily influenced by the two nearby Domesday boroughs of Yarmouth and Norwich, although this influence faded slightly in the medieval period as many of the smaller population centres in this region appear to have developed markets, reflecting the prosperity that this densely settled part of the county enjoyed (Davison 1990: 3). Whilst this regional context is important, two wider historical processes – the middle-Saxon shift and common-edge drift – are particularly significant in understanding the evolution of settlement within the Claylands CZ, and it is thus necessary to briefly discuss these before the evidence from the Claylands CZ is considered.

One of the most striking aspects of Anglo-Saxon settlement in Norfolk is the shift in settlement which likely occurred at some point in the seventh or eighth century. This shift, usually termed the ‘middle Saxon shift’ or the ‘middle Saxon shuffle’, is used to describe the shift in settlement which saw a relocation from sites of light, freely draining soil to areas of richer, comparatively heavier soil with a degree of nucleation frequently apparent in the morphology of these new sites of settlement (Arnold and Wardle 1981; Williamson 1993, 2012; Wright 2015). In the early 1990s and again in the early 2000s Hamerow criticised this theory, suggesting that many examples of the so-called ‘middle Saxon shift’ have only been partly investigated and that the shift is possibly an artefact of an incomplete archaeological record rather than an actual relocation of settlement (Hamerow 1991; 2012: 121-4). More recent scholarship has, however, shown that in many parts of England such a shift did occur (Rippon 2008: 171; Williamson 2012; Wright 2015). This is not to suggest that this shift was a planned, direct order from a lord or community leader that resulted in the appearance of fully formed nucleated villages; rather, as Williamson suggests, it was process of gradual settlement stabilisation, where the early Saxon tendency for mobile, comparatively short-term occupational sites was replaced by one which ‘began to grow *in situ*’ (Williamson 2012; 164).

The relevance of this shift to the arguments put forward later in this chapter lie primarily in the relationship between middle Saxon sites and parish churches. In Norfolk, and especially on the boulder clay plateau which constitutes the Claylands CZ, the largest – and in many cases the only –

concentrations of middle Saxon material are frequently found in the vicinity of parish churches: at Longham, the only evidence of middle Saxon activity was recovered in fields adjacent to the church (Wade-Martins 1980: 37); at Horningtoft, a two hectare scatter of Ipswich Ware was discovered just east of the church (Wade-Martins 1980: 25); at Mileham, 120 sherds of Ipswich Ware was recovered from within the immediate vicinity of the church (Wade-Martins 1980: 41). Blinkhorn's recent re-evaluation of the likely date of Ipswich Ware – which is the primary diagnostic material for middle Saxon sites – to no earlier than c. 720 suggests that this process was unlikely to have been fully underway before c. 720, providing a *terminus post quem* for the middle Saxon shift in Norfolk (Blinkhorn 2012). The parish church can arguably be used as an indicator for middle Saxon settlement in those locations where no archaeological investigations have been undertaken, and whilst there are, of course, exceptions to this rule, this generalisation holds true in most cases. That middle Saxon material is commonly found within the context of a parish church has important implications for the applicability of this chapter's conclusions to the Claylands as a whole, which will be discussed later in this chapter.

Following the gradual relocation of settlement during the middle Saxon shift came a period of piecemeal expansion, with Saxo-Norman occupation continuing and enlarging many of the middle Saxon sites whilst also establishing new settlements on the heavier soils. By the medieval period, however, the focus of settlement had shifted away from these earlier foci – and thus, by extension, away from the parish churches – towards green- and common-edge locations. This had the effect of often leaving the parish church in a peripheral position or, in some cases, entirely isolated within the landscape. This phenomena is known as common-edge or green-edge drift. These closely related processes describe how settlement gradually gravitated towards the edges of common pastures or the peripheries of greens in the medieval period, a process which ultimately produced the dispersed settlement patterns characteristic of many parishes on the East Anglian boulder-clays (Wegman 2013; Martin 2012; Williamson 2014). The Claylands CZ provides multiple clear examples of this transition; at Kempstone, for example, settlement was already gravitating towards the green by the twelfth century, with parallel patterns evident in Weasenham St Peter and across the Launditch Hundred (Wade-Martins: 86). NHER records similarly capture this medieval and late medieval transition, with large quantities of medieval material having been recorded around the edge of the green at Fritton.² As will be discussed later in this chapter, green-edge drift is also apparent in the Three Parishes, where the focus of settlement at both Heckingham and Hales drifted towards the green-edge in the medieval and late medieval periods (Davison 1990; Rogerson 1995). Whilst this is not an exhaustive list, these

² NHER 14319, 14865, 16774, 16775, 32922

examples serve to highlight the breadth of the medieval preference for green-edge locations throughout the Claylands CZ.

By comparison, Rogerson's *Fransham Parish* covers a smaller area of 12km² in west Norfolk, some 30km west of Norwich and lying roughly equidistant between the market towns of Dereham and Swaffham. Fransham occupies a part of Norfolk which exhibits more topographic variation than the flatter environments of the east, with the survey area lying at an elevation that varies between 50m OD in the shallow valleys and 98m OD on the elevated interfluves, making this the most elevated survey discussed in this chapter. Whilst lidar imagery (see Figure 40) reveals the presence of numerous palaeochannels throughout the survey area, the only extant watercourse is a small channel that carves east to west through the northern third of the parish. Both subzones which constitute the Claylands CZ are present in the survey area. The Heavy Claylands Subzone is the most extensive subzone in the region, occupying a horseshoe-shaped area which covers the highest elevations in the parish; these upland, interfluvial areas mark the boundary between Fransham and its neighbouring parishes. The open side of this horseshoe of the Heavy Claylands Subzone lies in the east of the parish where the small stream enters the survey area. The interior of this horseshoe is occupied by the soils of the Medium Claylands. Unlike the *Three Parishes*, Fransham appears to have been of moderate prosperity during the medieval period, for whilst there is no indication that it was overly wealthy, there is equally no evidence to suggest that it was objectively poor.

Romano-British settlement in Fransham was extensive, with evidence of occupation found across the study area, with a clear preference for the more workable soils of the Medium Claylands and the sloping topography of the shallow valleys. RB 5, the most significant Romano-British site in the study area lies in the centre of the parish within the heart of the Medium Claylands, positioned just south of an extant watercourse (Rogerson 1995: 58; Dunnett 1996: 42–4). Other concentrations of material recovered to the east of RB 5 similarly demonstrate these topographical and pedological preferences (Rogerson 1995: 58). There is also clear evidence for Romano-British exploitation of the Heavy Claylands. In the south of the parish, multiple Romano-British sites are distributed across these heavier soils, with many occupying the same sloping topography preferred by those sites within the Medium Claylands. Although no extant watercourses are present in the south of the parish, lidar suggests the potential presence of palaeochannels, indicating that these sites may have had access to either seasonal or permanent water sources (Rogerson 1995: 58; Dunnett 1996: 45). In the north of the parish, Romano-British sites are similarly present within the Heavy Claylands and again occupy positions near to extant watercourses on the sloping topography. Romano-British settlement in Fransham thus follows the broad outline described in the *Three Parishes*, with a clear preference for sloping topography near to sources of water. However, unlike in the *Three Parishes* there is a more

extensive Romano-British presence in the Heavy Claylands, with a multitude of sites occupying these heavier, more intractable soils (Rogerson 1995: 58).

| Heavy Claylands Subzone | | |
|-------------------------|--|--|
| Soil association | Constituent series | General character of association |
| 711r – Beccles 1 | Beccles – fine loamy over clayey stagnogley (surface-water gley); Ragdale – heavier pelostagnogley, mottled below Ap horizon; Aldeby – typical stagnogley, similar to Beccles; Hanslope – calcareous pelosol, heavy clay, slowly permeable, non-gleyed | Heavy clayey, slowly permeable stagnogley/pelostagnogley soils; very poor drainage; prone to winter waterlogging and summer cracking; typically on level or gently sloping plateau surfaces. |
| 711s – Beccles 2 | Beccles – typical stagnogley; Aldeby – stagnogley; Blackwood – sandy gley, mottled, sensitive to groundwater fluctuations (on muted crests) | Moderately to heavily clayey stagnogleys with occasional lighter sandy gleys; slowly permeable; poor drainage; similar to Beccles 1 but with lighter crest soils. |

Table 9: Heavy Claylands Subzone soil chart.

| Medium Claylands Subzone | | |
|----------------------------|---|---|
| Soil association | Constituent series | General character of association |
| 572n – Burlingham 1 | Burlingham – fine loamy stagnogleyic argillic brown earth; mottled subsoils; slowly permeable; Ashley – fine loamy over clayey stagnogleyic argillic brown earth; similar to Burlingham; Hanslope – typical calcareous pelosol; heavy clay; slowly permeable; Wighill – coarse loamy stagnogleyic argillic brown earth; faint mottling; slowly permeable; Wick – non-calcareous typical brown earth; loamy, freely drained, unmottled; Newport – typical brown sand; stony sandy loams; freely drained, unmottled; Hopsford – fine loamy gleyic brown earth; slight mottling; permeable subsoil; Wigton Moor – medium loamy typical cambic gley; groundwater gley; mottled and gleyed | Mixed clayey-loamy stagnogleyic association with strong topographic structuring; drainage improves downslope from heavier stagnogleys to freely drained sands; upper slopes slowly permeable, lower slopes variable; valley floors prone to groundwater gleying. |
| 572p – Burlingham 3 | Burlingham – stagnogleyic argillic brown earth; slowly permeable; Ashley – stagnogleyic argillic brown earth Weasenham – typical argillic brown earth; unmottled; moderately well drained; Maxted – typical paleo-argillic brown earth; well drained; Barrow – typical paleo-argillic brown earth; well drained; Newport – typical brown sand; freely drained; Isleham 2 – sandy/peaty gley | Similar to Burlingham 1 but with more mid-slope well-drained paleo-argillic brown earths; upper-slope stagnogleys remain slowly permeable; lighter soils moderately droughty in dry years; seasonally waterlogged on heavier series but generally more workable than the Heavy Claylands. |

Table 10: Medium Claylands soil chart.

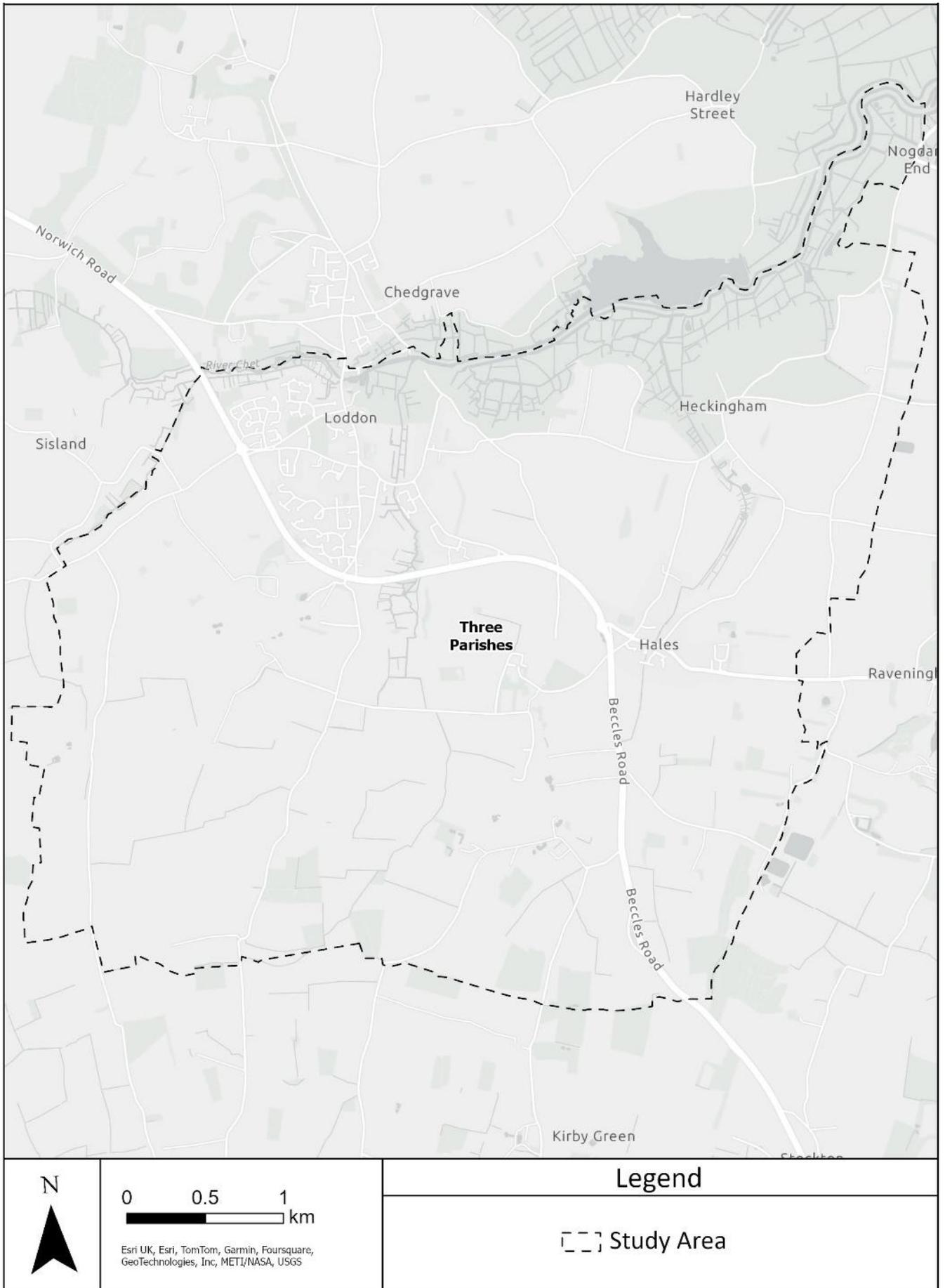


Figure 35: Three Parishes study area.

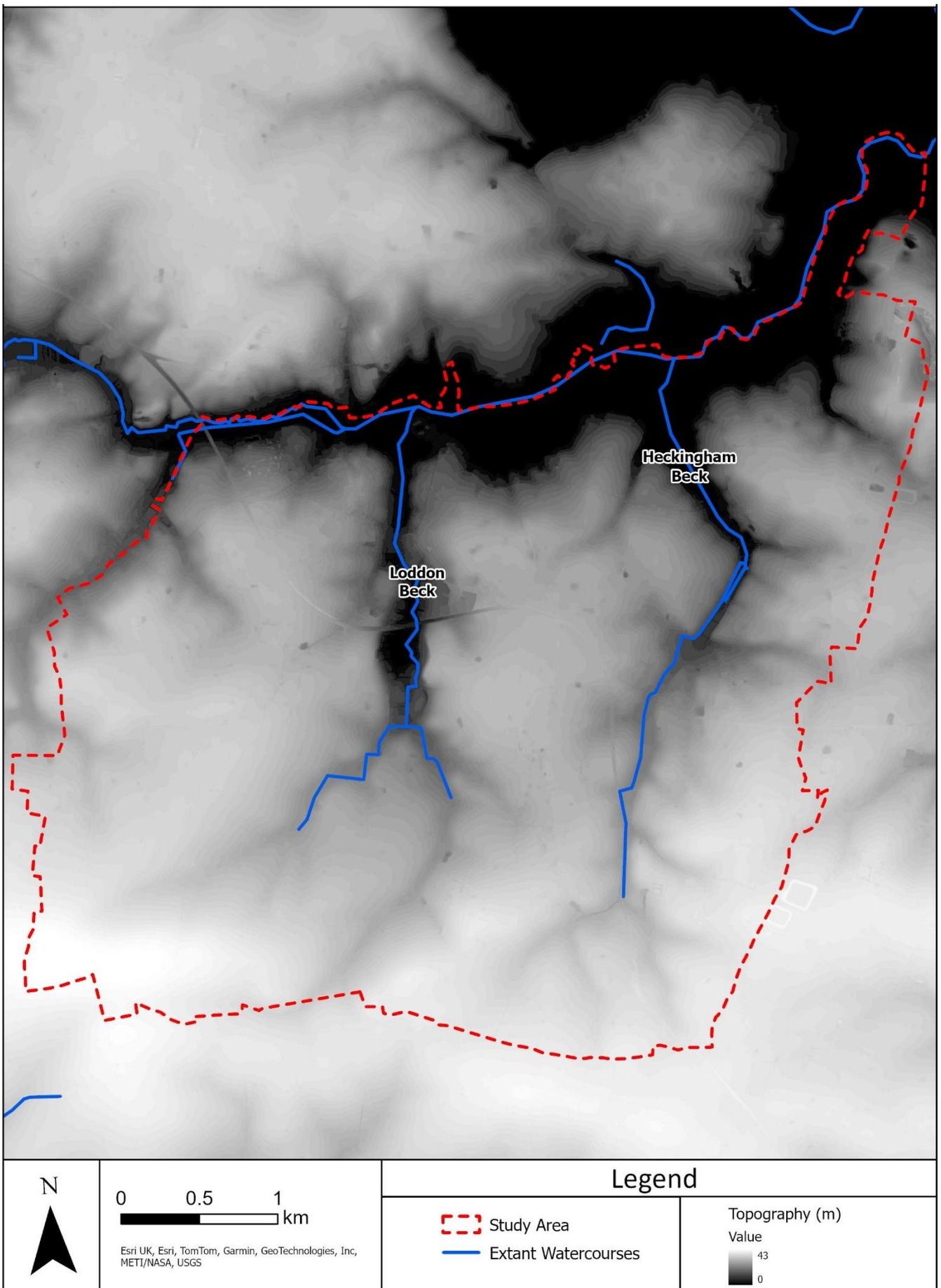


Figure 36: Three Parishes and their topography.

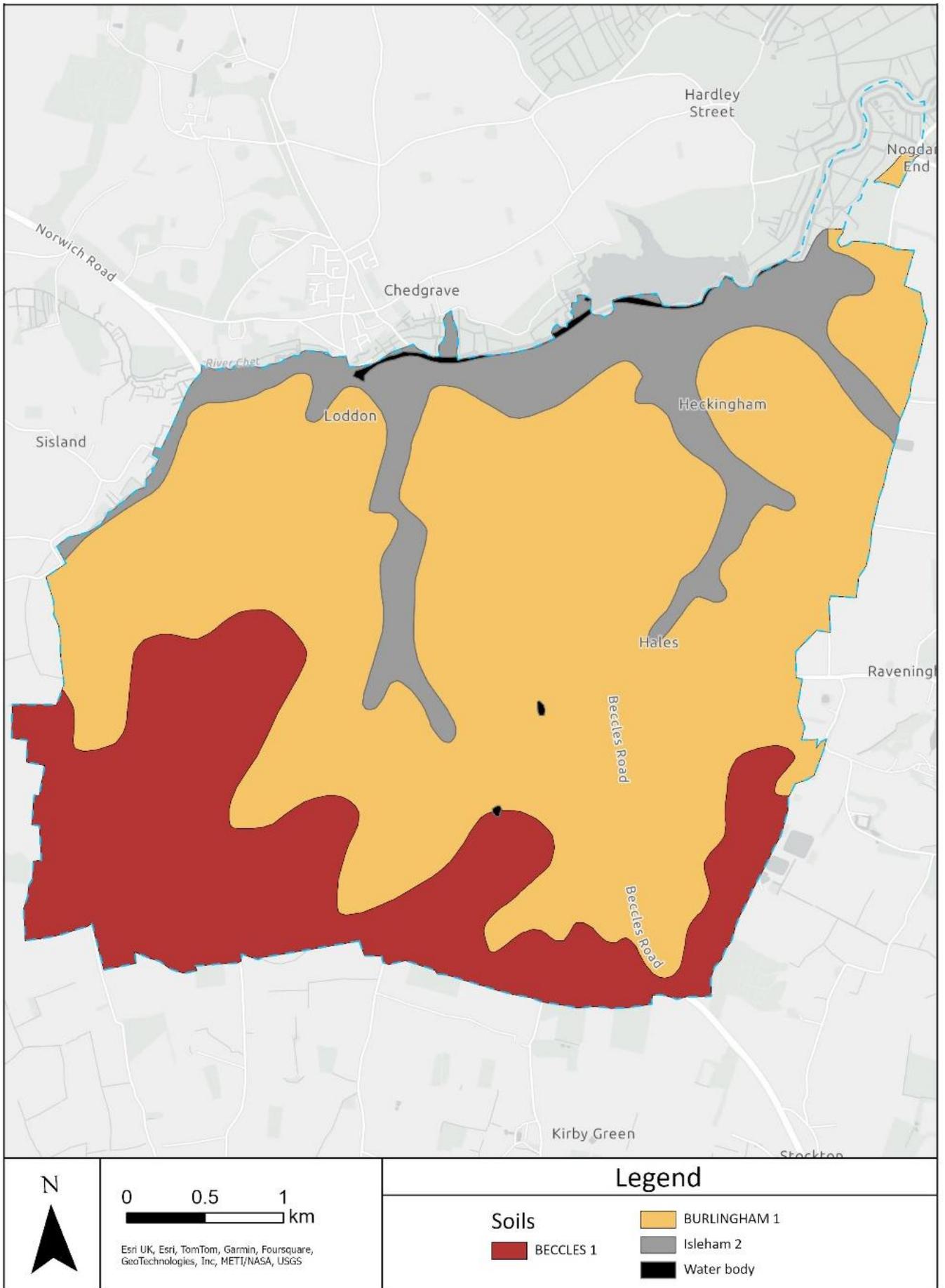


Figure 37: Three Parishes and their soils.

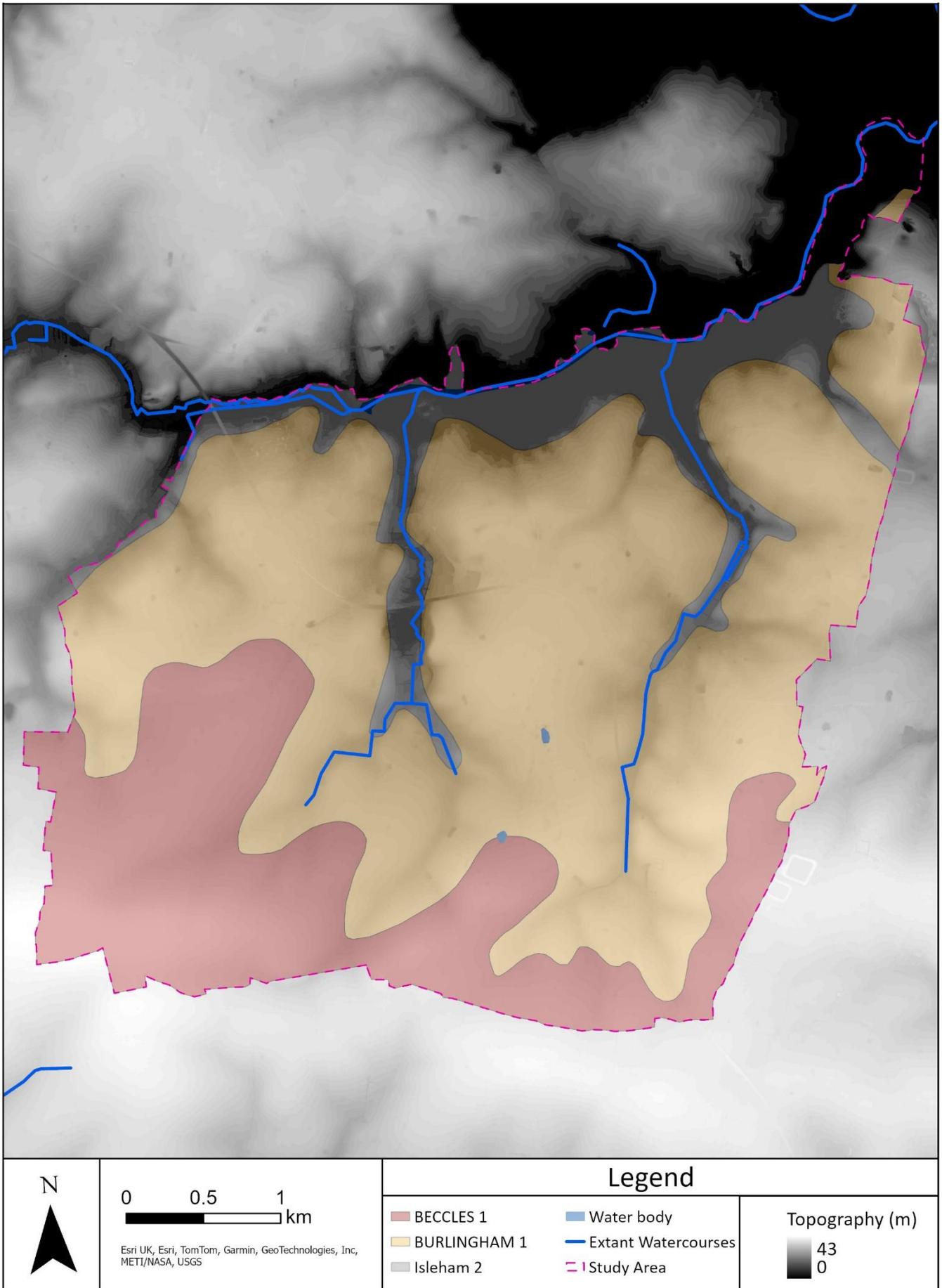


Figure 38: Composite showing the relationship between the Three Parishes' topography and soils.

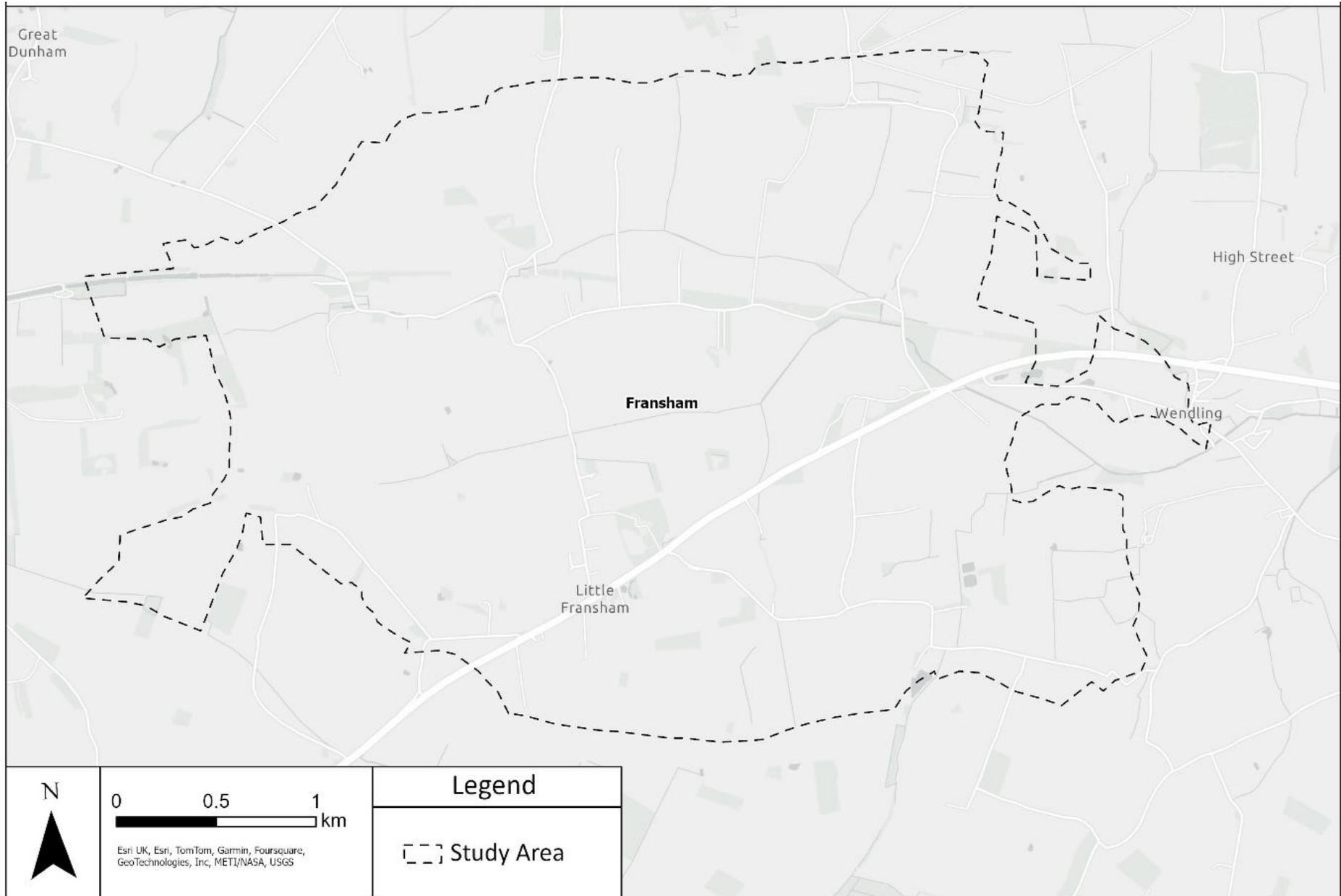


Figure 39: Fransham study area.

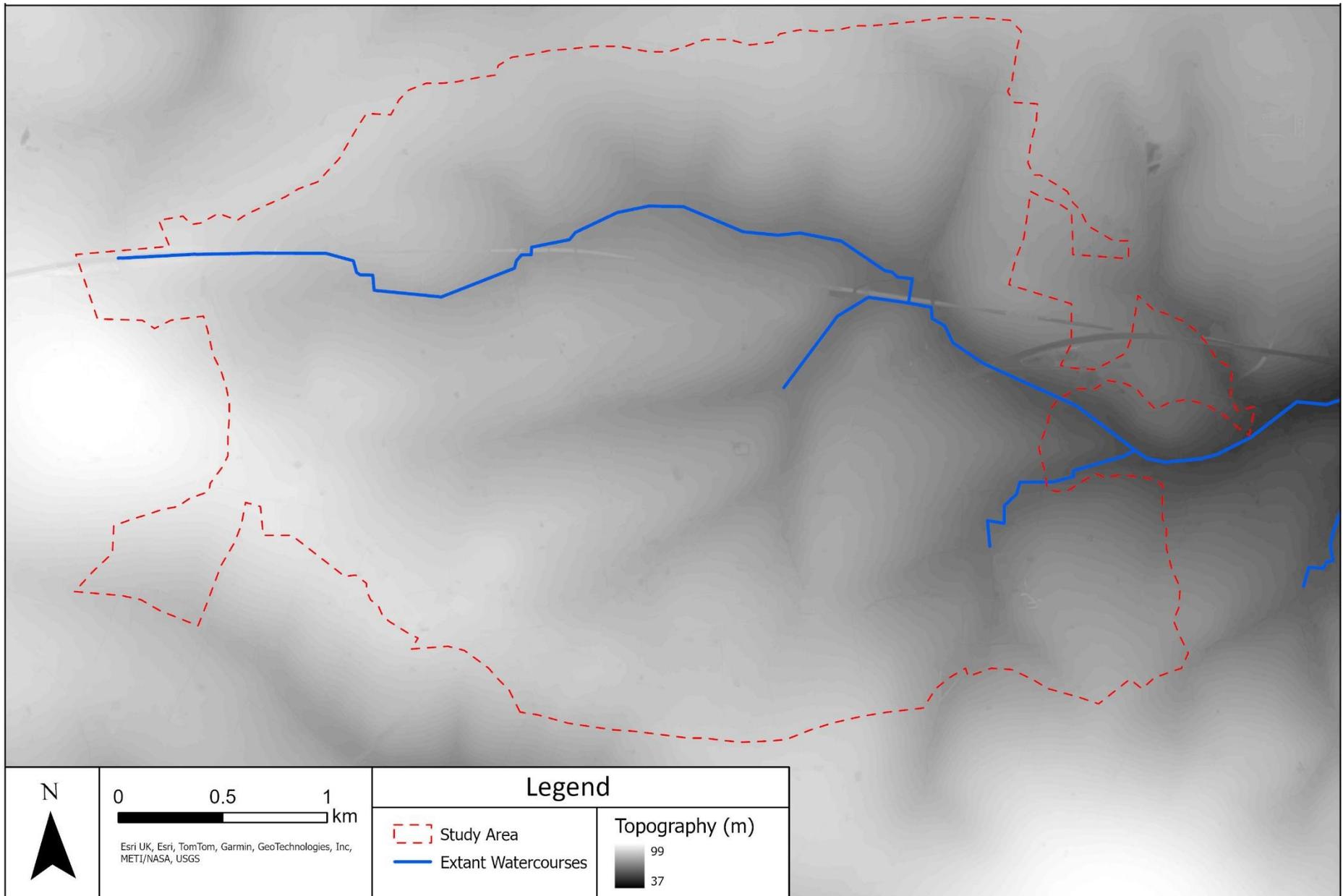


Figure 40: Fransham and its topography.

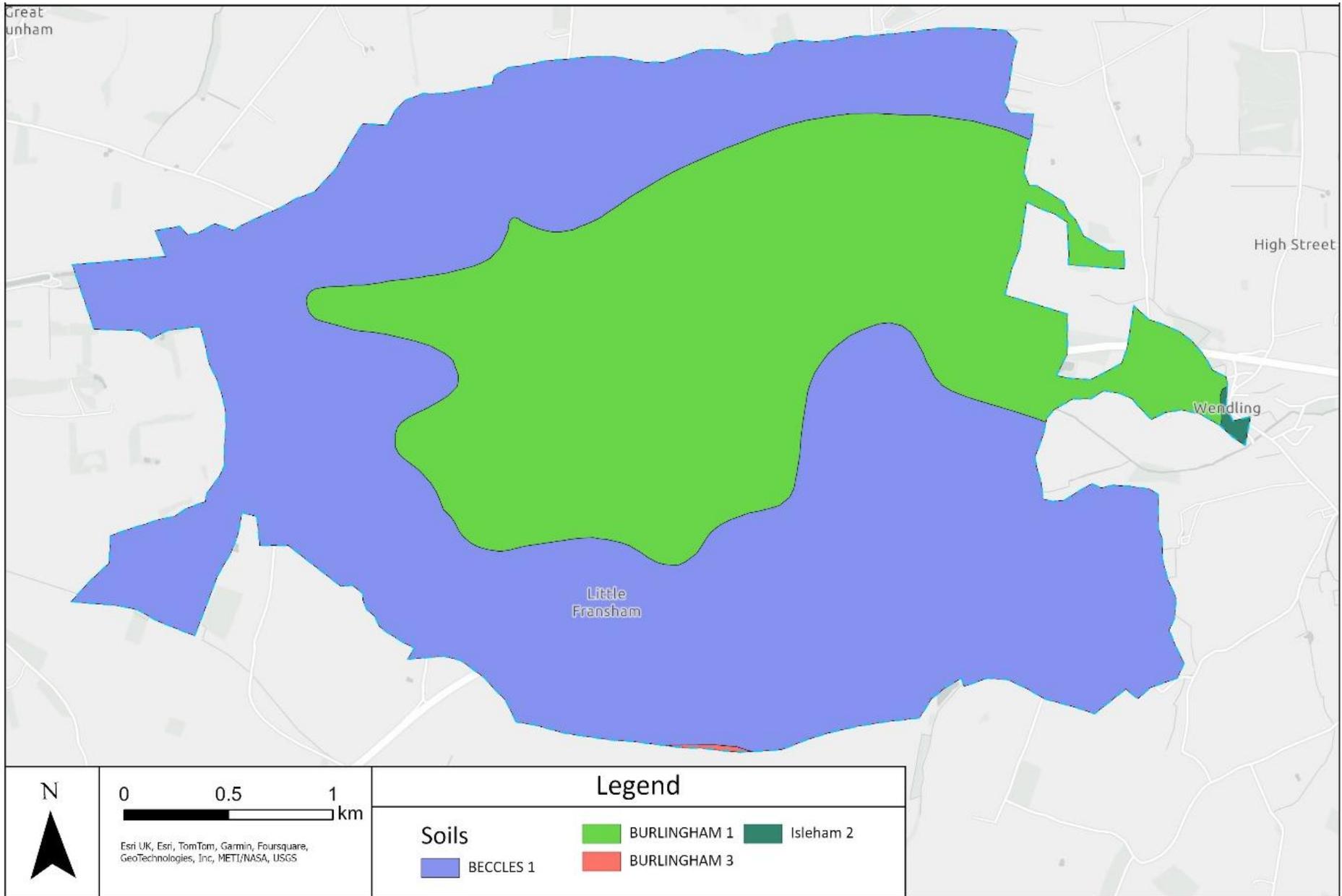


Figure 41: Fransham and its soils.

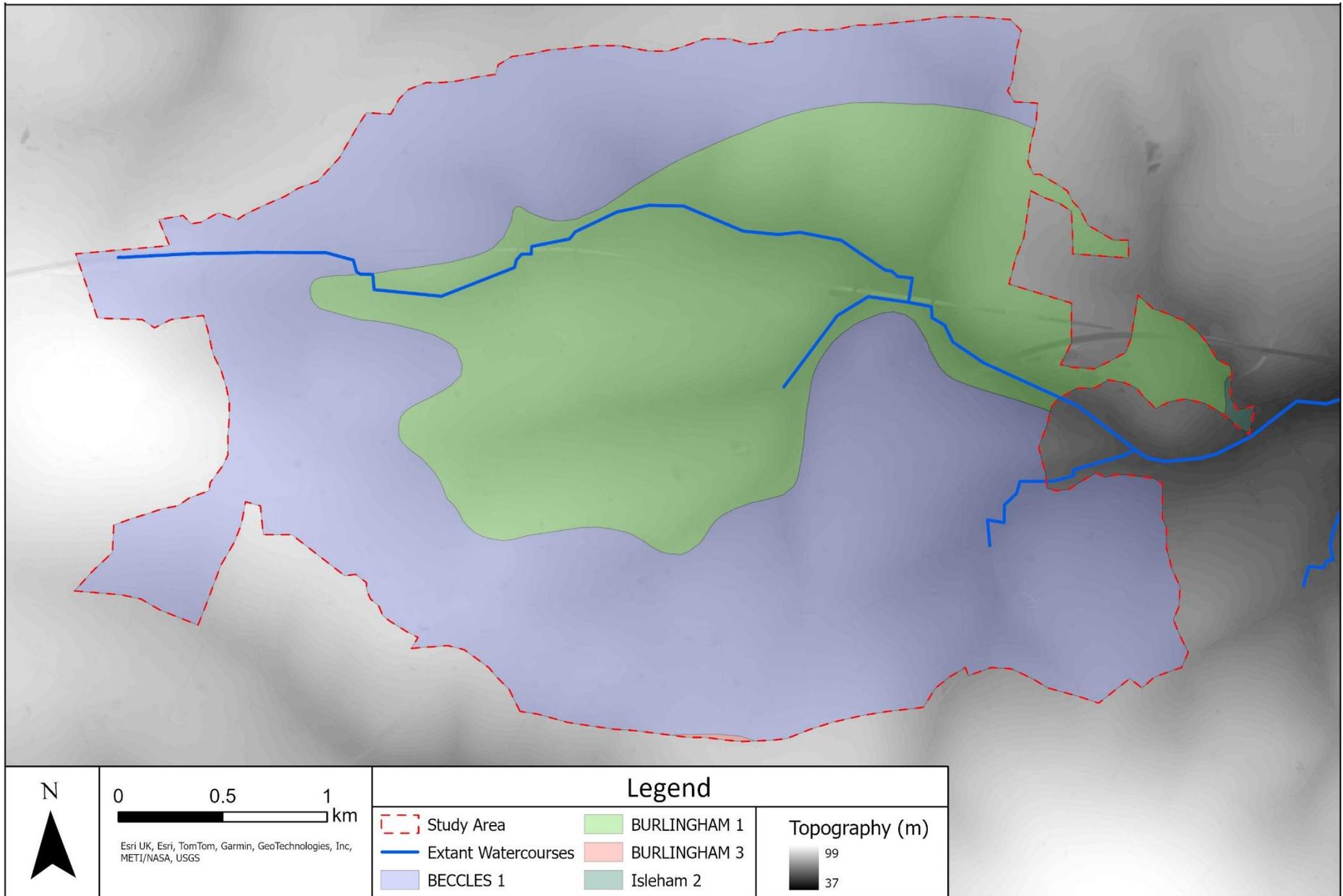


Figure 42: Composite showing the relationship between Fransham's topography and soils.

Fieldwalking evidence

Early Saxon: c. 500 – c. 650

Early Saxon settlement is extremely limited in both the Three Parishes and Fransham, representing a significant reduction in extent and intensity compared with the Romano-British landscape. Romano-British sites and scatters occurred across all soil types in these areas, with a clear preference for sloping terrain close to running water. This reduction in intensity is likely reflective of the lower population following the collapse of Romano-Britain in the early fifth century. In the Three Parishes four sites of early Saxon date were identified – Sites 14, 42, H25, and H44/1 – which are all closely associated with gently sloping topography, nearby watercourses – in this instance the two becks which extend southwards – and the lightest soils of the Medium Claylands Subzone (Davison 1990: 70). Of these Site 42 appears to be the primary occupational site in Loddon, with Site 14 likely an outlier of this more substantial site (Davison 1990: 70). A similar pattern is observable in Fransham, where the primary occupational site – Site ES 1 – occupies one of the lightest patches of soil in the survey area on gently sloping ground. Outlying sites in Fransham – such as ES 2, 3, 4, and 5 – also occupy areas of loamy soil, although the increased ‘heaviness’ of the Fransham area, which unlike the Three Parishes is dominated by the Heavy Claylands and not the Medium Claylands Subzone, ensures that exploitation was occurring on slightly more challenging soils when directly compared to the Three Parishes. The soils of these sites supports the relationship previously outlined in earlier chapters between topography and soils. This alignment between large scale generalisations and real-world, local geological characteristics therefore supports the use of these generalisations where high resolution local data is not available.

Of the four early Saxon sites in the Three Parishes Sites 42 and 14 are the most interesting. The former saw the recovery of the greatest volume of early Saxon material – some 525 sherds – and is it is closely associated with the nearby Site 14, where similar early Saxon evidence was recovered, albeit in smaller quantities (Davison 1990: 16). Early Saxon occupation in the Three Parishes was thus likely centred on Site 42, with Site 14 likely an outlier site (Davison 1990: 26). Davison notes that the light soils of these sites were highly attractive to early settlers, with considerable prehistoric, Romano-British, and early Saxon evidence recovered from these sites (Davison 1990: 66). The early Saxon preference towards lighter soils is likely due to the advantageous drainage characteristics of such sites, which would drain adequately even in the winter months (Davison 1990: 66). The nearby watercourses would provide occupational sites with adequate water supply, especially if these watercourses were once more substantial than they are today (Davison 1990: 12, 25-6, 66). The more evidentially scarce Sites H25 and H44/1 mirror Sites 42 and 14, being similarly located next to a beck on well-drained, sloping ground. This similarity could potentially indicate that although limited evidence was recovered from

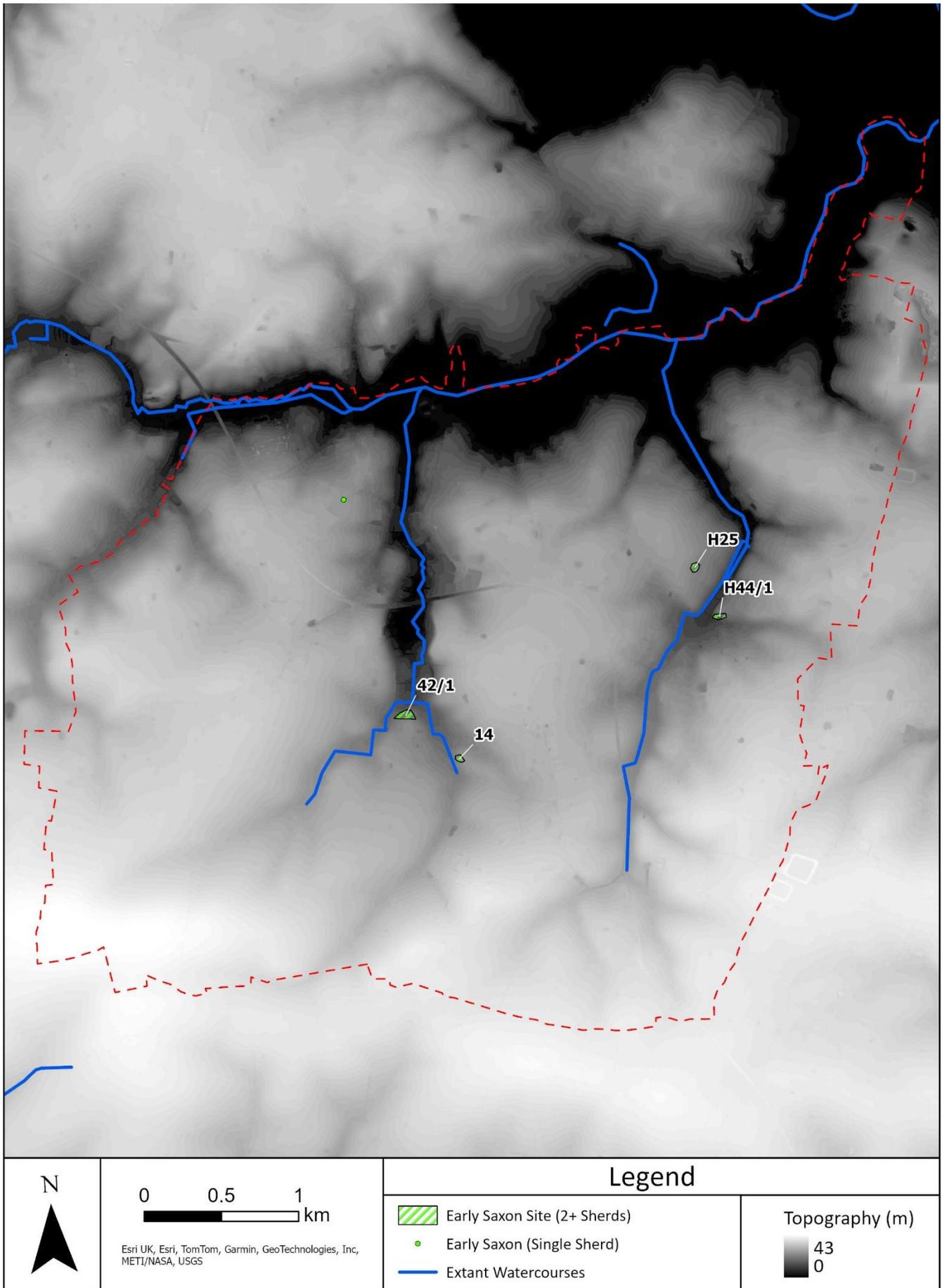


Figure 43: Early Saxon settlement in the Three Parishes shown against topography.

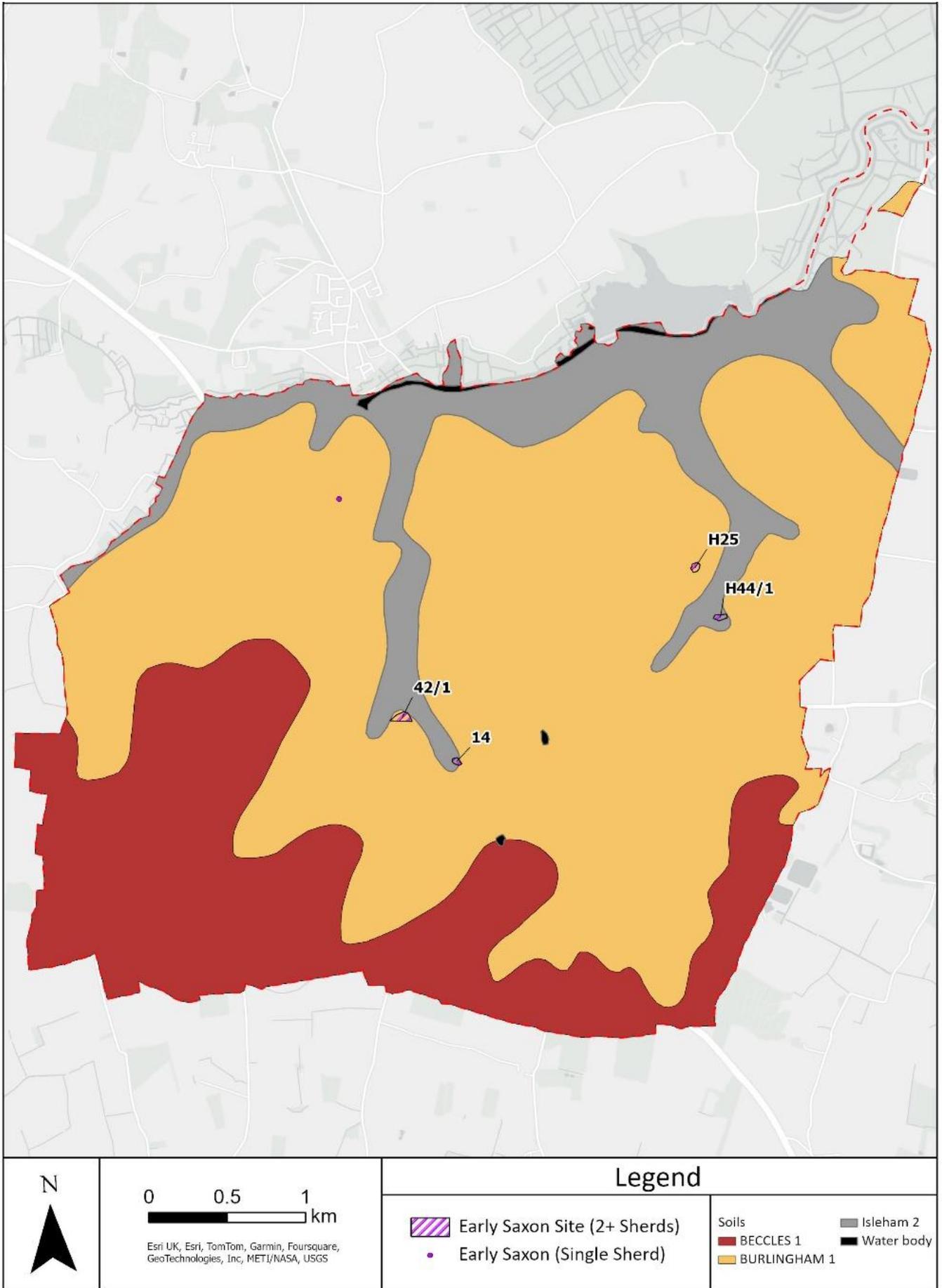


Figure 44: Early Saxon settlement in the Three Parishes shown against soils.

Site H25, this could potentially have been a satellite site similar to that of Site 14, although without further investigations on site this hypothesis remains conjecture.

In Fransham the primary early Saxon occupational site was undoubtedly ES 1, where 240 sherds were recovered (Rogerson 1995: 93). This site is 250m from the main Romano-British site in the parish and occupies a location at which a thin scatter of Romano-British sherds was recovered (Rogerson 1995: 58). The recovered sherds which have been ascribed to the early Saxon period are predominantly sandy, gritty, and organic tempered wares that are heavily abraded, with Rogerson noting that the temporal origin of these sherds could be anywhere between the fifth and seventh centuries, although he favours a seventh century date (Rogerson 1995: 93). The confines of this site are particularly well-defined and given the volume of sherds and their spatial distribution, it is no stretch to theorise that this was almost certainly a site of early Saxon occupation. Whilst the nature of early Saxon agriculture is still shrouded in considerable uncertainty, it is not unreasonable to surmise that any arable ventures undertaken by early Saxon communities – which Banham and Faith suggest would have been limited and very much secondary to animal husbandry – was likely to have occurred close to areas of habitation (Banham and Faith; 156-7; 73). It is thus telling that other fieldwalking evidence for early Saxon activity in the parish was found in three concentrations just to the west of the ES 1, with the most significant of these, ES 2, just 180m from ES 1. Here, a loose scatter of 33 sherds of probable early Saxon date were found, with this site occupying a south-facing slope again in the Medium Claylands (Rogerson 1995: 95).

The proximity of ES 2 to ES 1, the relative lightness of the soil compared to the heavier loams of the surrounding area, and the fact that this site occupies a south-facing slope could all be used as circumstantial evidence to suggest that ES 2 may have been exploited as arable by early Saxon communities, a notion strengthened if we interpret the loose scatter of sherds around ES 1 and ES 2 as possible manuring scatters.

Further to the west of ES 2 are two further suspected early Saxon sites. The first, Site ES 3, contained just seven sherds, whilst Site ES 4, the westernmost of the suspected early Saxon sites, contained ten sherds of probable early Saxon date (Rogerson 1995: 96). Rogerson suggests that ES 2, 3, and 4, which all lie in a roughly straight line no more than 1.3km away from ES 1, may have been sited so as to exploit the pre-existing road known in the fifteenth century as the Whiteway, a road which may have been in existence in the Roman period and which runs next to ES 1 (Rogerson 1995: 96).

Whilst the difficulty in identifying early Saxon ceramics, and their similarity to Iron Age material ensures that a healthy degree of caution should be exercised when assessing the extent of early Saxon settlement based upon recovered potsherds, there is enough evidence to support the assertion that

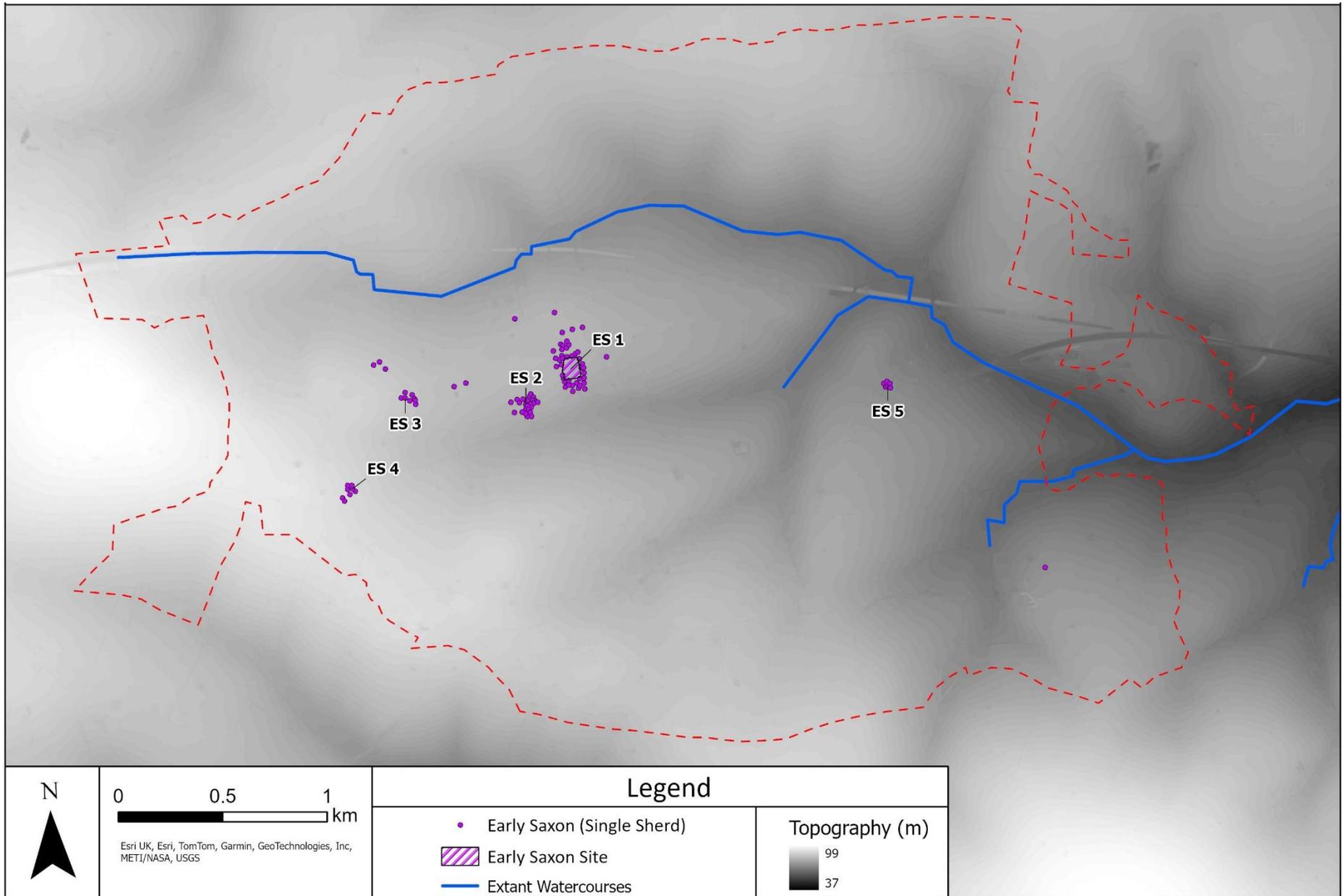


Figure 45: Early Saxon settlement in Fransham shown against soils.

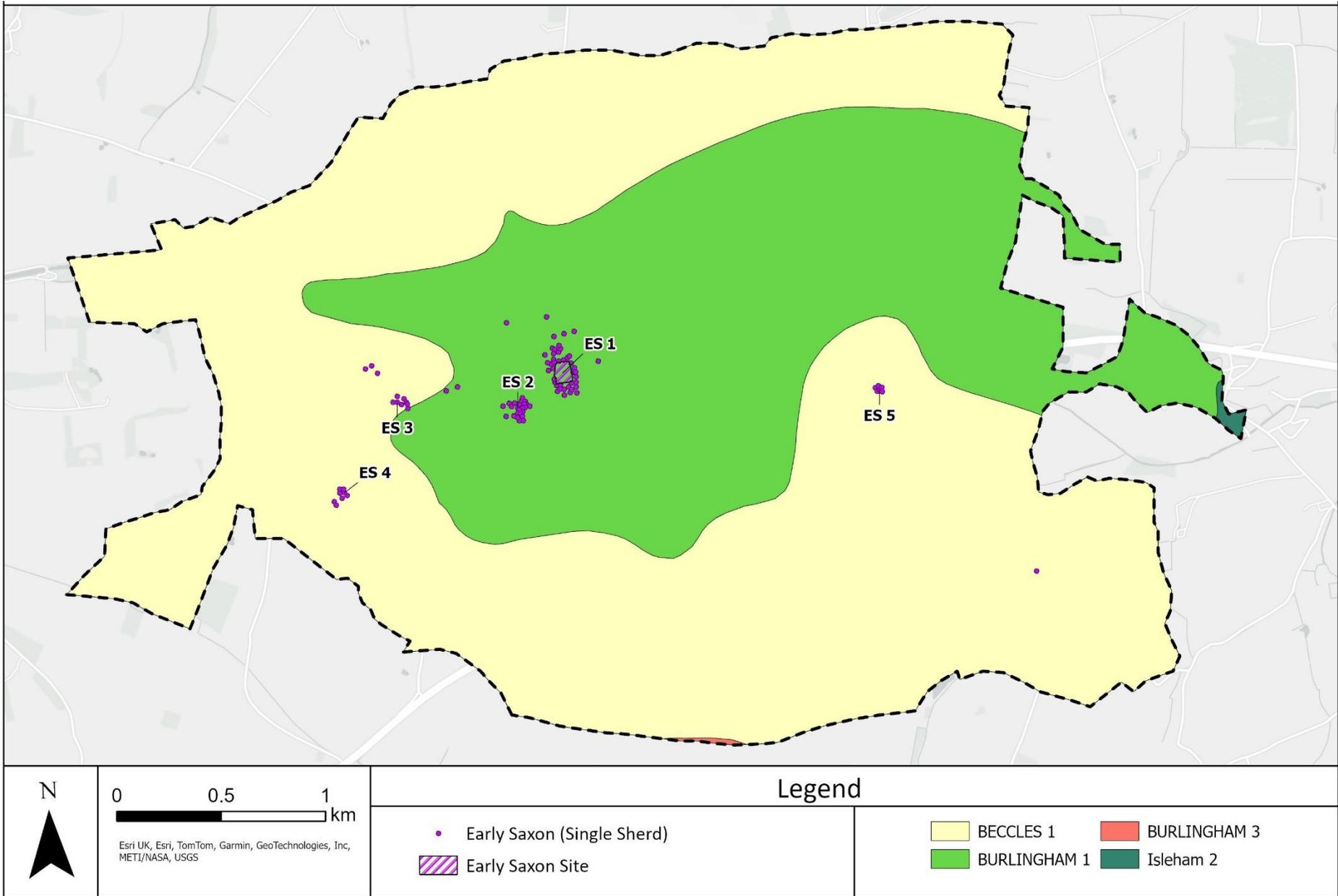


Figure 46: Early Saxon settlement in Fransham shown against soils.

Site 42 in the Three Parishes and Site ES 1 in Fransham were likely the foci of settlement. However, it is worth noting that early Saxon settlement was highly mobile, and it is not implausible that one of the aforementioned outlying sites was once the principal occupational site before it relocated to its eventual location. Neither is it certain that all of the sites previously discussed were occupied simultaneously throughout the period, which seems unlikely given the mobile character of early Saxon settlement. However, without a more accurate typology of early Saxon ceramics the exact sequence of occupation is impossible to discern.

Middle Saxon: c. 650 – c. 850

The onset of the middle Saxon period marked a clear shift in both the spatial distribution and morphology of settlement within the Three Parishes and Fransham survey areas. In Fransham, evidence points to a degree of nucleation during this period that is largely absent in later centuries. Only one site, MS 1, has yielded material attributable to middle Saxon occupation, which Rogerson suggests may have been in use from the seventh to the eleventh century (Rogerson 1995: 110-1). However, owing to the wide diagnostic range of Ipswich Ware and non-Ipswich fabrics, a more precise site chronology cannot be established without invasive investigation.

MS 1 lies on gently sloping loams within the Medium Claylands Subzone and is surrounded by a thin scatter of sherds indicative of manuring, suggesting that it formed the nucleus of middle Saxon activity in the parish. Material recovered from MS 1 includes 353 sherds of Ipswich Ware, 265 sherds of non-Ipswich fabrics, and a substantial assemblage of animal bone, the latter typical of middle Saxon sites (Wade-Martins 1980: 41). It is also typical of middle Saxon sites in that there is a clear 'shift' of focus away from occupational sites active during the early Saxon period. ES 1 – the principal early Saxon site in Fransham – is some 700m to the west and was likely abandoned in the seventh century (Rogerson 1995: 112). Sparse middle Saxon material extends westward along the central interfluvium from MS 1, overlapping with ES 2 and ES 3. Rogerson interprets this as a manuring scatter associated with middle Saxon arable exploitation, implying that cultivation continued along this lighter interfluvium throughout both the early and middle Saxon periods (Rogerson 1995: 110–111).

In the Three Parishes middle Saxon evidence is more spatially extensive than in Fransham, although similar to Fransham a degree of nucleation is apparent and the middle Saxon shift is equally evident. The focus of settlement in the area appears to have relocated to the northern regions adjacent to the low-lying valley of the Chet. Much of the recovered middle Saxon finds were found in concentrations on land directly adjacent to St. Gregory's Church in Heckingham, a trend noted elsewhere in the country which has led some to suggest that many of England's parish churches, particularly those that now sit relatively isolated in the modern landscape, likely date from the middle Saxon period.

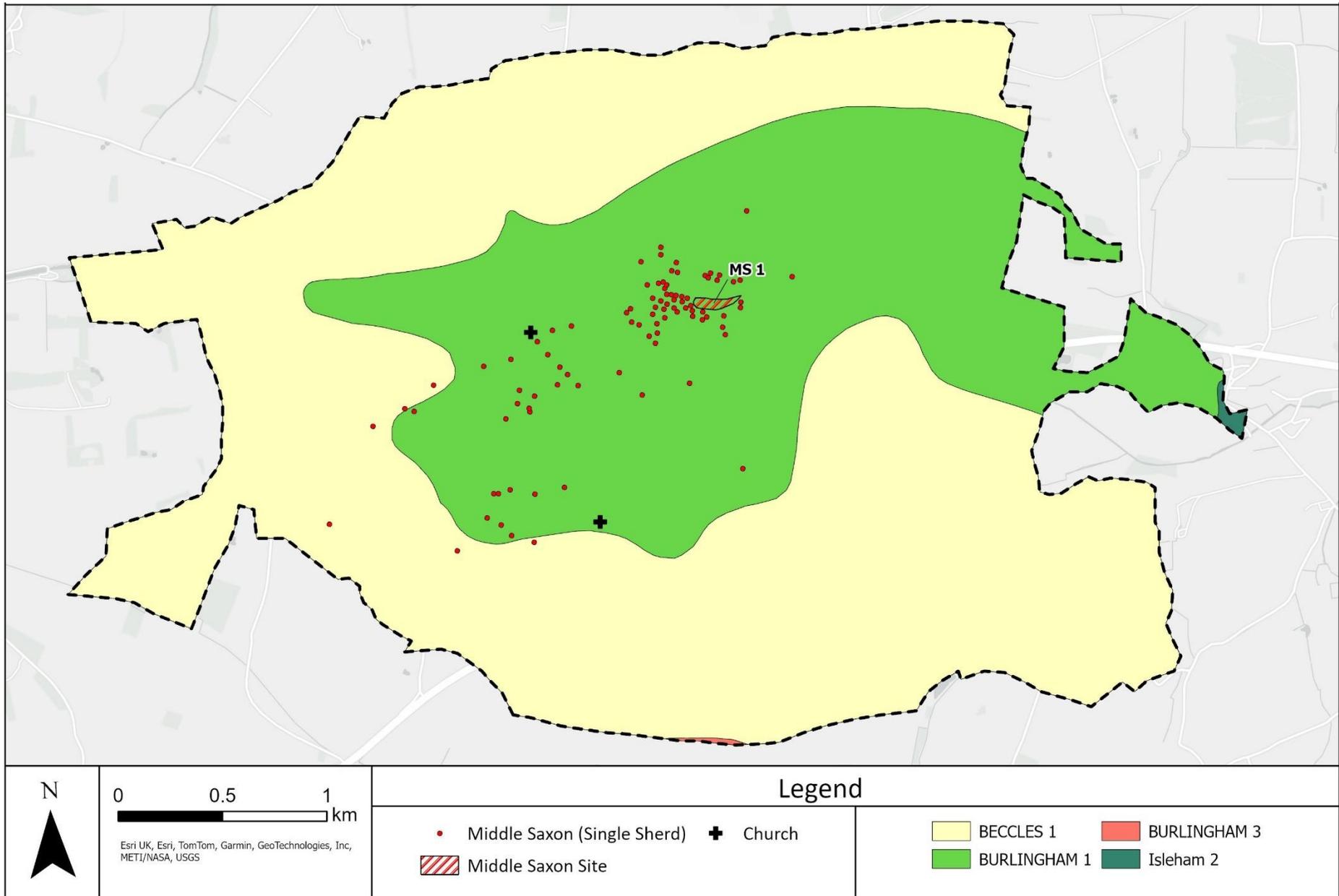


Figure 47: Middle Saxon settlement in Fransham shown against soils.

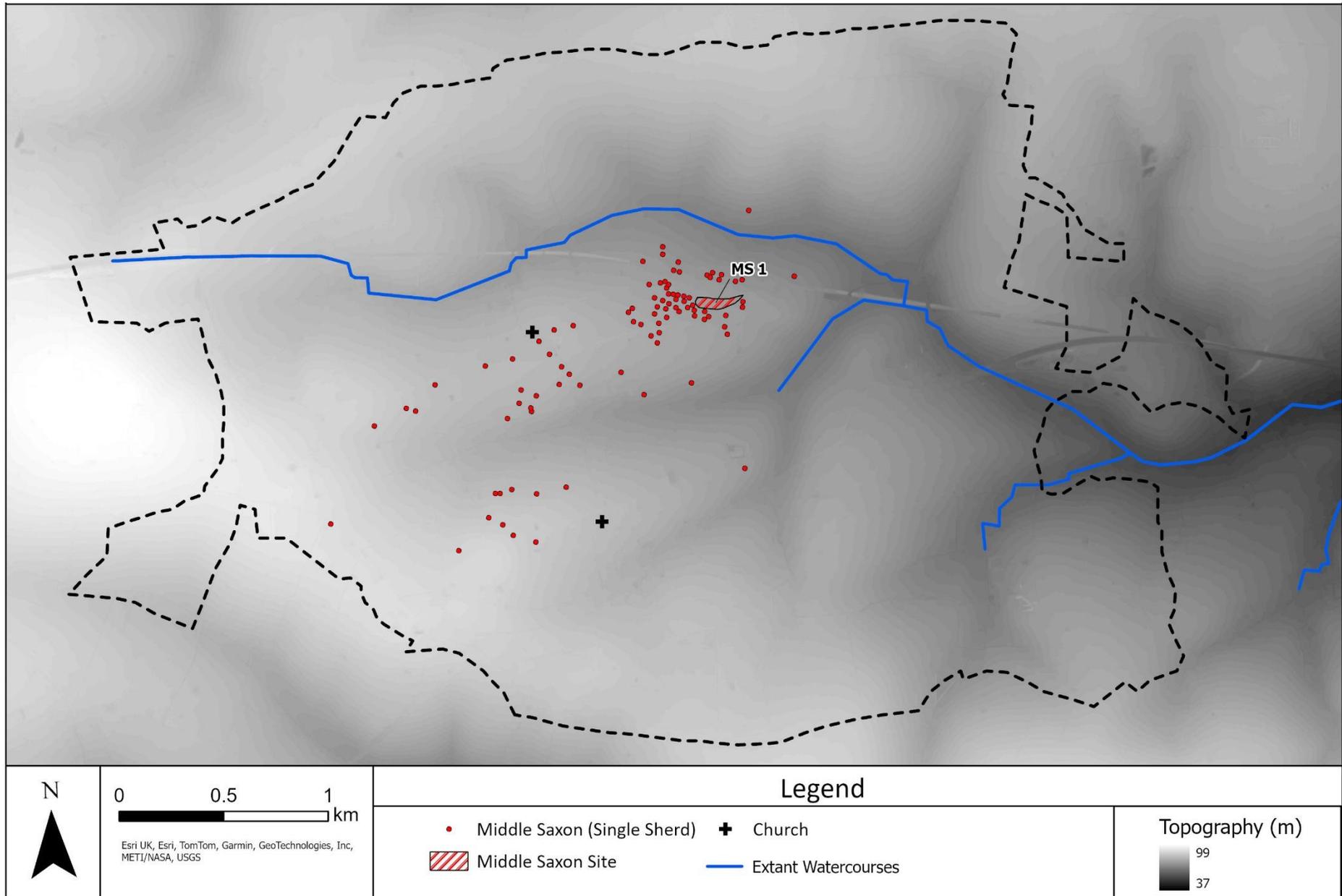


Figure 48: Middle Saxon settlement in Fransham shown against topography.

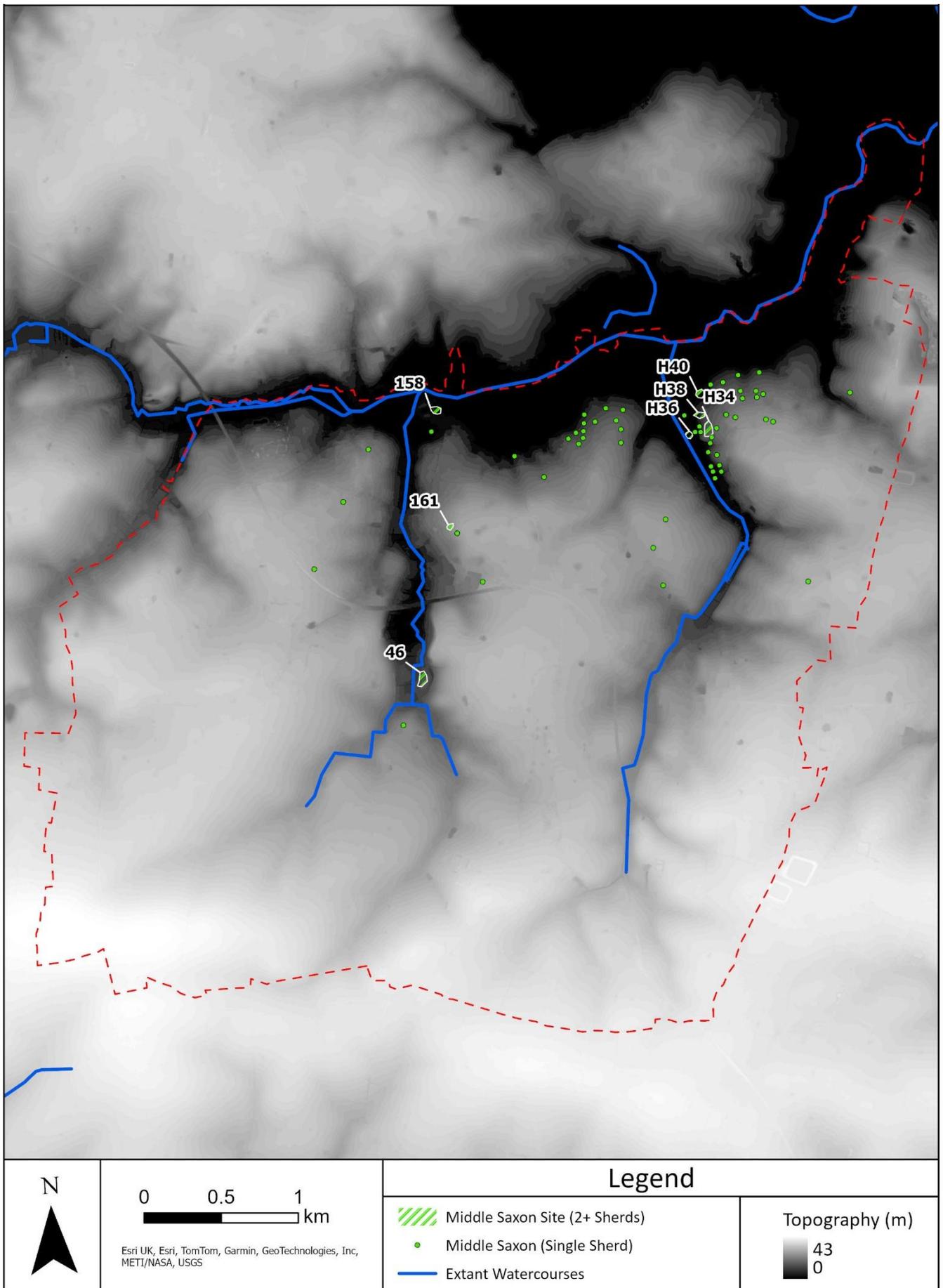


Figure 49: Middle Saxon settlement in the Three Parishes shown against topography.

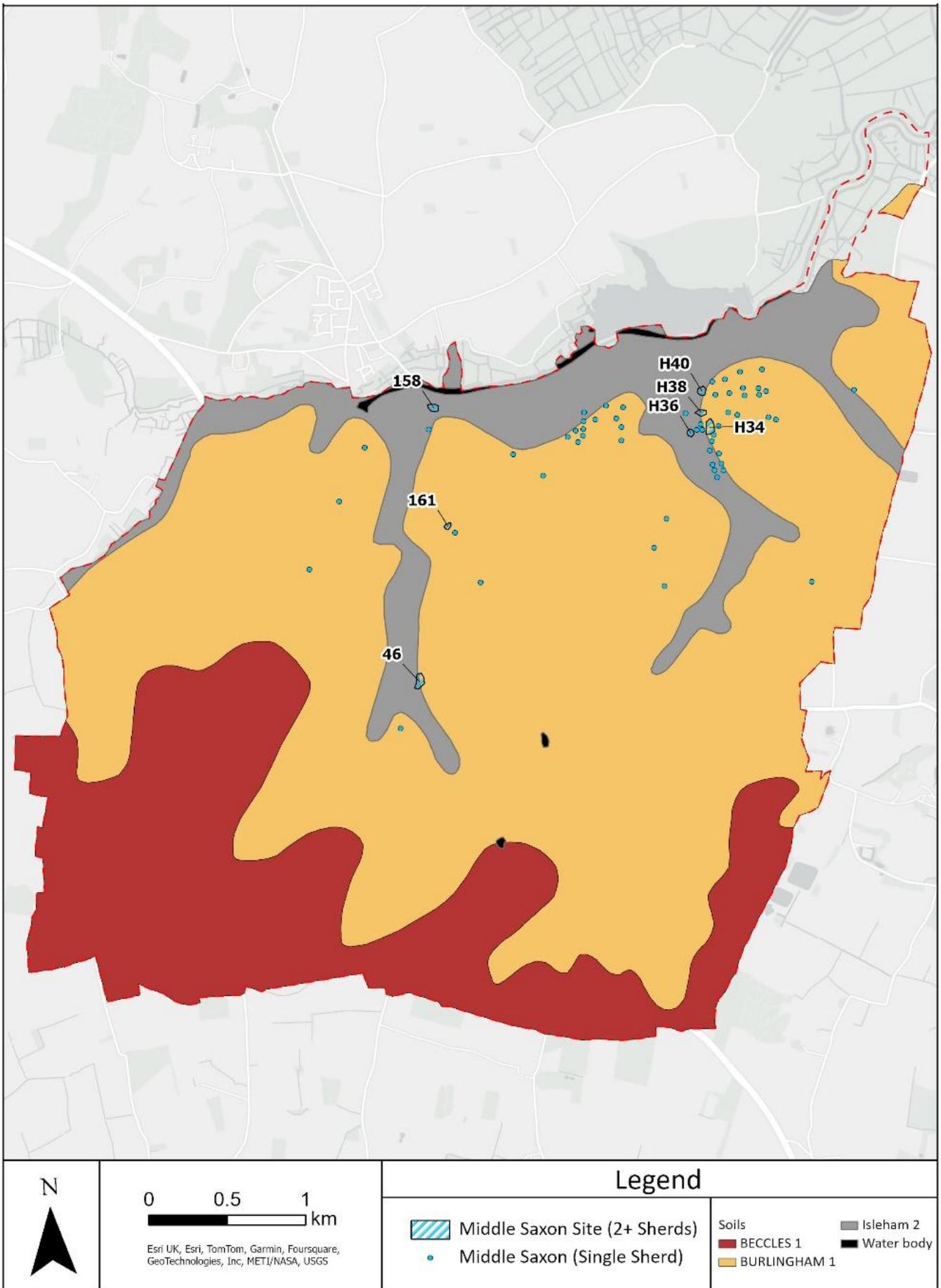


Figure 50: Middle Saxon settlement in the Three Parishes shown against soils.

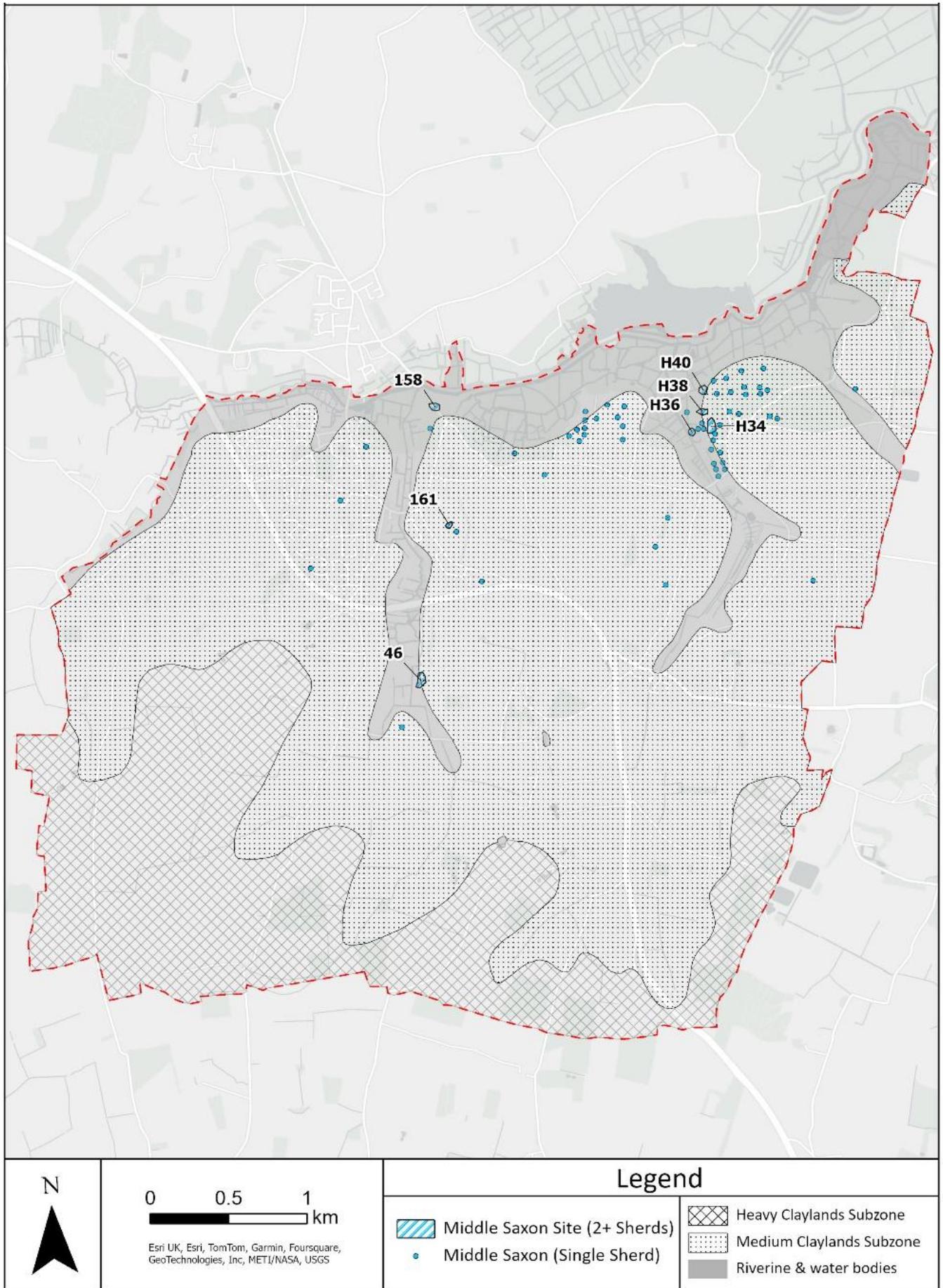


Figure 51: Middle Saxon settlement in the Three Parishes shown against the two subzones – the Heavy and Medium Claylands – of the Claylands Character Zone.

Unfortunately, none of the land surrounding Holy Trinity in Loddon was accessible by Davison's study, although it is likely no coincidence that the only middle Saxon find from the developed area of Loddon came just 50m from this church. The principal middle Saxon sites around St. Gregory's are Sites H34, H36, and H38, with a not insignificant number of individual middle Saxon finds recovered from fields north-east of these concentrations near Sites H16 and H20. Other locations where numerous individual finds were recovered include the fields to the east of St. Gregory's across the parish boundary and into Loddon, where numerous sherds of Ipswich Ware were recovered near Sites 154 and 157. It is possible that the area of middle Saxon occupation in these northern parts of Hales and Loddon parishes is more extensive than Davison's data would suggest, due to the considerable amount of land that is either developed, under permanent pasture, or was inaccessible to the surveyors.

Whilst middle Saxon settlement clearly shifted away from those sites favoured in the early Saxon period, the environmental context of these new sites retains a large degree of similarity with their predecessors. For the most part middle Saxon sites still tend to favour a downslope position occupying the junction between the heavier alluvial soils and the lightest soils of the Medium Claylands. These sites are thus relatively well-drained, although soil erosion and runoff from the heavier upslope soils could potentially cause issues during particularly wet phases (Davison 1990: 38). The middle Saxon is, however, the first period where material was recovered from the heavier soils of the low plateaus, suggesting that the area of exploitation was slowly expanding onto heavier, more intractable soils which were almost entirely devoid of early Saxon material.

Saxo-Norman: c. 850 – c. 1150

Saxo-Norman evidence is far more widespread than both early and middle Saxon material in both the Three Parishes and Fransham. However, within the *Three Parishes* survey there is a clear bias in the recovered material, with far more Saxo-Norman evidence being recovered from Heckingham than in Hales and Loddon. The dearth of Saxo-Norman evidence in these parishes is, in all likelihood, not necessarily representative of an absence of settlement. Rather, it may be a symptom of the inaccessibility of the landscape in and around these places. That being said, Loddon and Hales are not entirely devoid of material (Davison 1990: 15-7).

The most interesting development the material recovered from Loddon and Hales implies is that of the colonisation of the heavier soils found in the south of these parishes. For the first time in the study period, evidence suggests an expansion into the Heavy Claylands Subzone of the Three Parishes. Sites 104 and 141 in Loddon contain material dating to the Saxo-Norman period, which Davison interprets as indicative of 'very slight activity' rather than occupation (1990: 22, 83–84). Similar, but more extensive concentrations were identified at Sites 56, 57, and 58 in Hales on land which would later

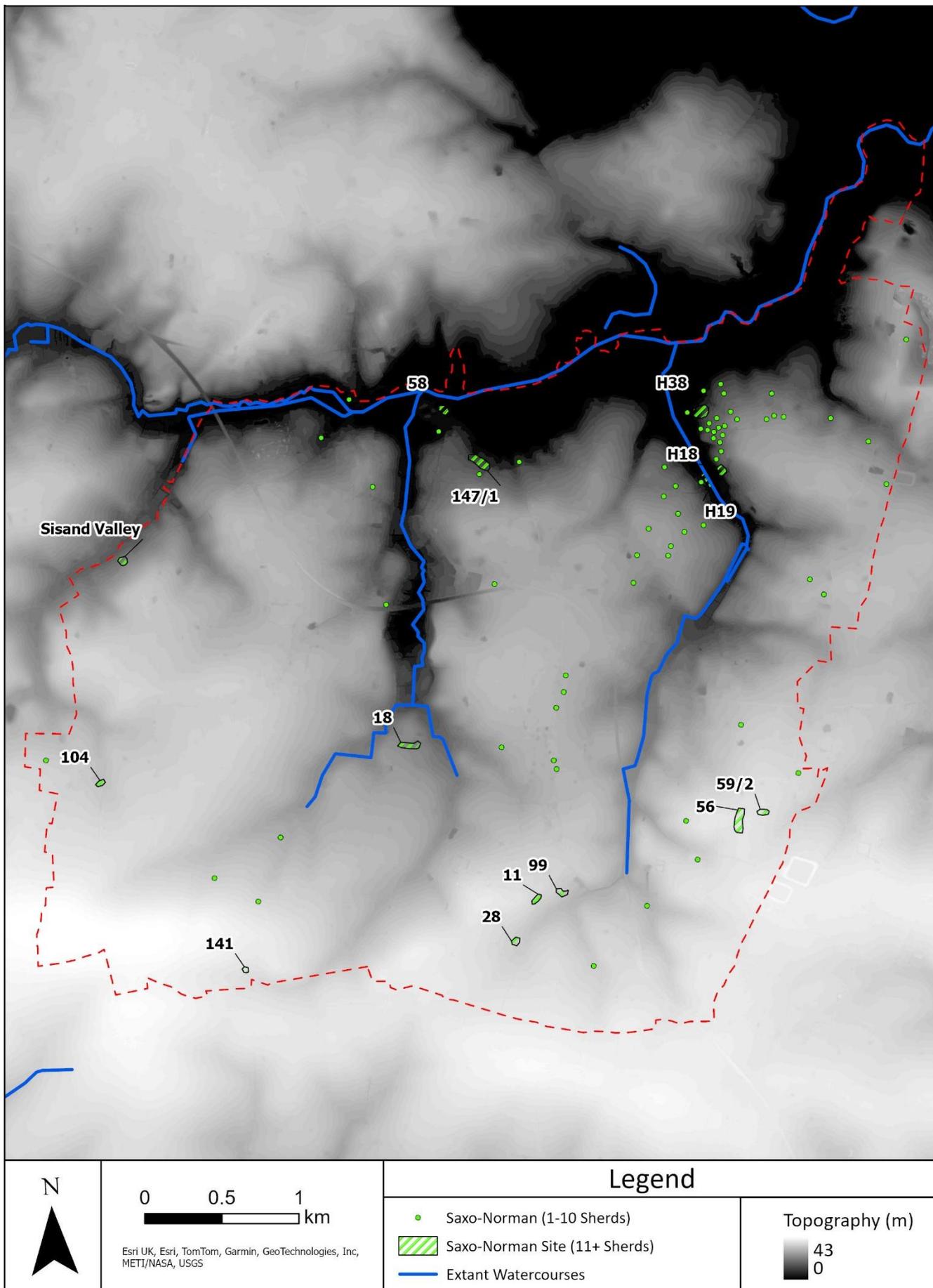


Figure 52: Saxo-Norman settlement in the Three Parishes shown against topography.

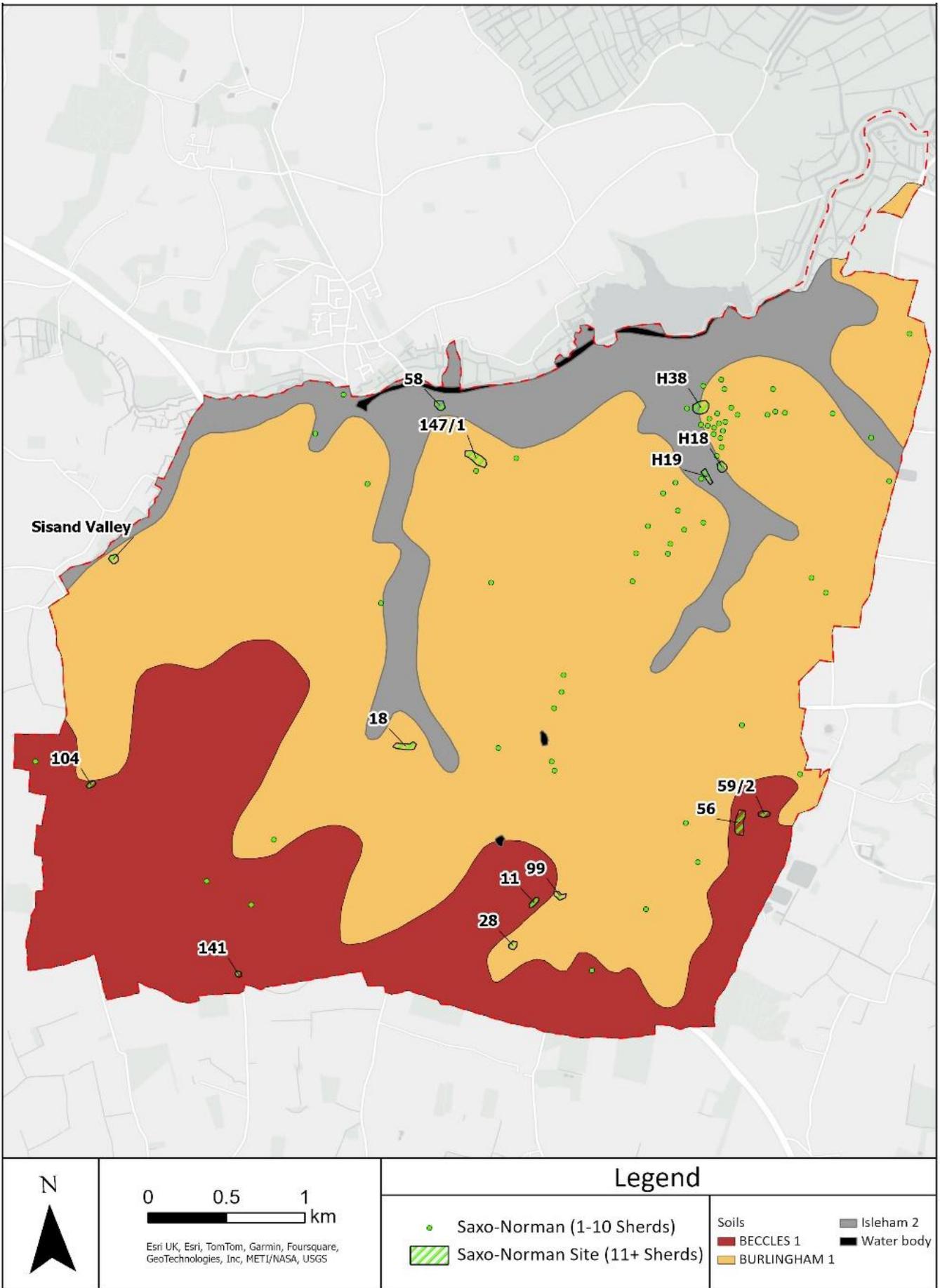


Figure 53: Saxo-Norman settlement in the Three Parishes shown against soils.

become the edge of Spot Common (Davison 1990: 22). Whether these sites represent occupation or manuring scatters is unclear, although the former seems more feasible given that settlement was already gravitating towards the edges of commons and greens (Mustchin *et al.* 2019: 22-3; Williamson 2014: 167-177). Thus, whilst activity does seem to have expanded onto heavier, more intractable soils, the overall picture of the development of settlement in Loddon and Hales is underwhelming; whilst it did not contract, neither did it expand with the same vigour as it did in the medieval period (Davison 1990: 16-21).

In Heckingham, however, Saxo-Norman activity appears to have continued at much the same pace as in the middle Saxon period; indeed, Davison comments that the ‘field scatters suggest exploitation of the land comparable with that of Middle Saxon times’ (Davison 1990: 21). To the west of Heckingham Beck there is evidence of Saxo-Norman exploitation of the sloping loams of the Medium Claylands Subzone, with the single finds recovered here likely part of a manuring scatter. Similarly, the lands immediately adjacent to St. Gregory’s – such as Sites H38/1 and H43 – witnessed an increase in activity (Davison 1990: 21). Indeed, some fifty-two sherds of Thetford Ware were recovered from Site H38/1, the same area from which twenty-one sherds of Ipswich Ware were recovered (Davison 1990: 16, 21). Later medieval pottery was also recovered from this site, although in significantly smaller volumes than the Saxo-Norman Thetford Ware, potentially suggesting that activity at this site was scaled back after peaking during the Saxo-Norman period. To the east of the church are a number of fields from which Saxo-Norman material was recovered, with many of these fields containing no early or middle Saxon material evidence, suggesting that expansion onto these sloping areas of the Medium Claylands Subzone only began in either the Saxo-Norman period or the subsequent Norman period. There is certainly an argument to be made that these finds could potentially be subjected to creep – with this north-facing slope being one of the area’s steeper inclines – whilst also being a potential false negative caused by the greater survivability of Saxo-Norman ceramics, although on balance the relative uniformity of finds over this rather extensive area is likely reflective of an expansion of activity rather than the result of artefact survivability or creep.

Settlement in Fransham largely mirrors the trends found in the *Three Parishes*. The principal Saxo-Norman site in the former parish of Great Fransham is LS 1, a continuation of MS 1 (Rogerson 1995: 124). The majority of the ceramic material recovered was Thetford Ware, although small quantities of Early Medieval Ware were also found at LS 1, with Rogerson stating that whilst ‘the bulk of this material would sit quite happily in the tenth century’, activity must have continued into the eleventh century, with this site being abandoned c. 1100 (Rogerson 1995: 124-5). The inclusion of small quantities of Grimston-Thetford Ware, which was being produced before c. 1085, suggests post-abandonment manuring of LS 1 (Rogerson 1995: 125). To the west of LS 1, along the central interfluvium,

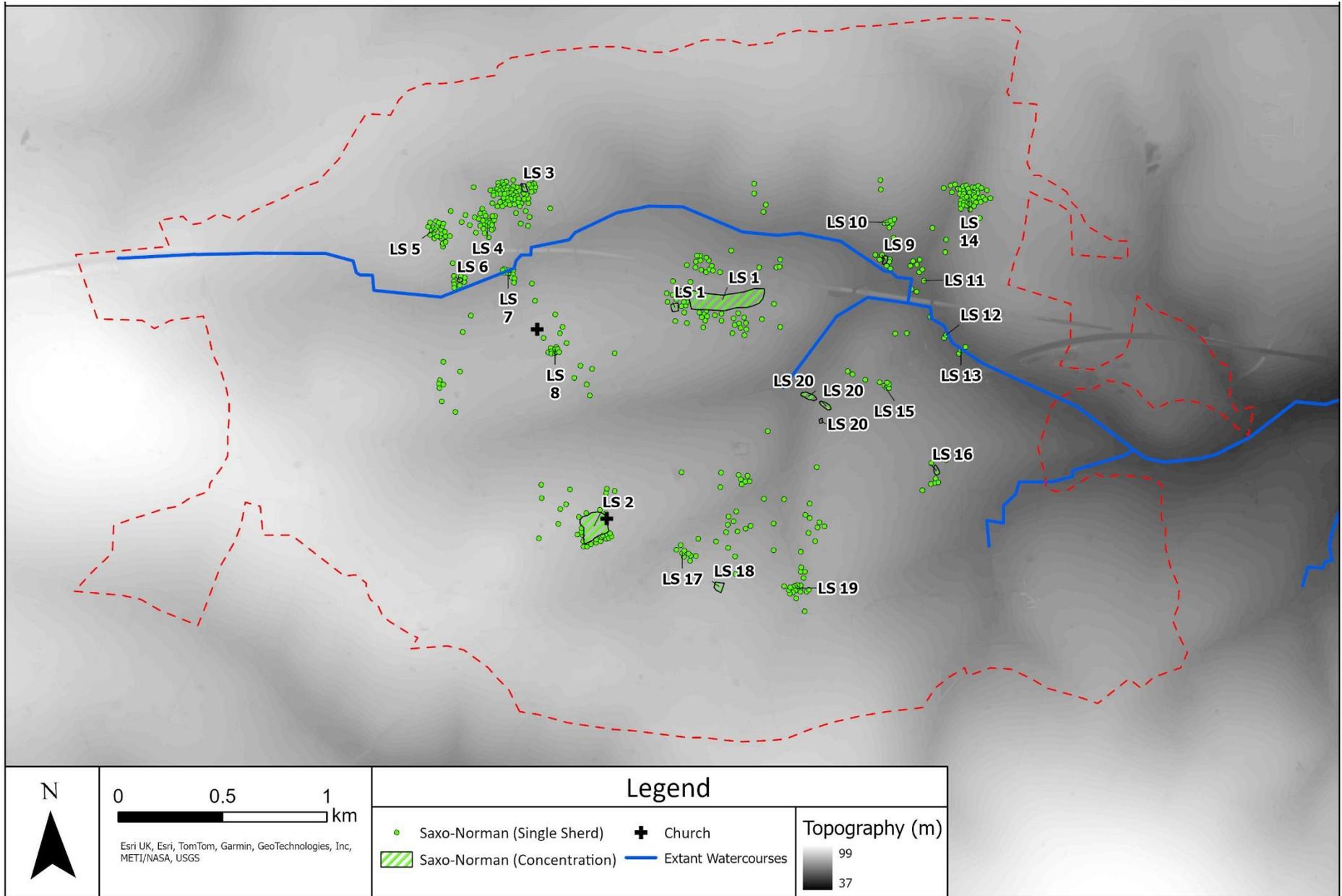


Figure 54: Saxo-Norman settlement in Fransham shown against topography.

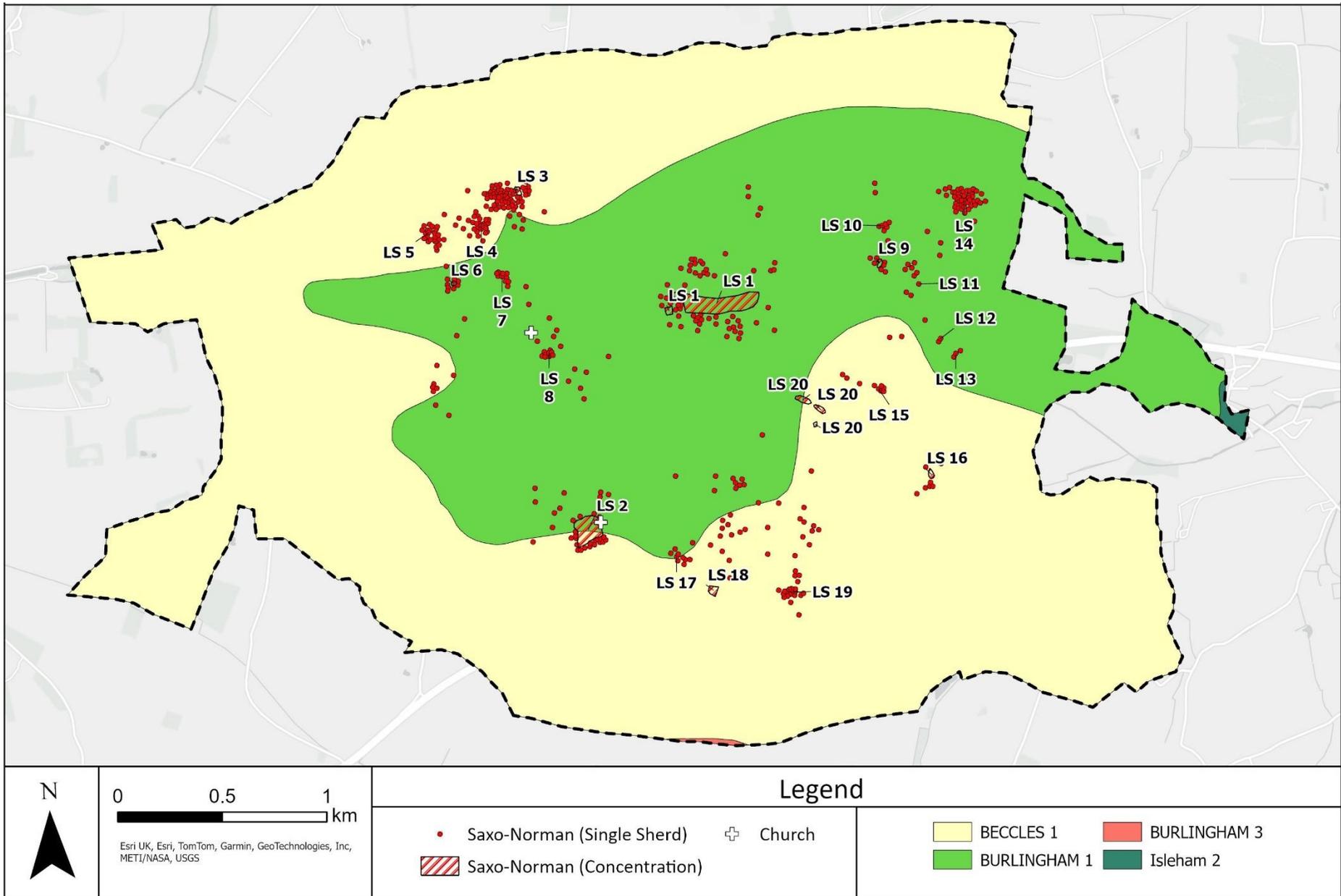


Figure 55: Saxo-Norman settlement in Fransham shown against soils.

Rogerson notes an absence of Thetford Ware in this area of lighter soils where small quantities of Ipswich Ware had been recovered associated with MS 1 (Rogerson 1995: 126).

LS 1, occupying the loams of the Medium Claylands, is larger than its middle Saxon predecessor and similarly expanded along the edge of the Whiteway, with Rogerson suggesting that this was a small nucleated settlement (Rogerson 1995: 127). Interestingly, the nucleation which is so apparent in Fransham is far less so in the Three Parishes. One speculative hypothesis as to why the pattern is different in the two surveys is the increased dominance of either the Heavy Claylands Subzone or the Medium Claylands Subzone, for it is possible that in an area where the heavier environments prevail nucleation was more pragmatic, allowing agriculturalists to properly exploit the thin windows of opportunity presented by the notoriously changeable English climate.

Throughout the Medium Claylands Saxo-Norman occupation and exploitation is evidenced by sherd concentrations and scatters, although Rogerson notes that scatters indicative of arable 'are disappointingly few and small in the study area' and states that the archaeological evidence does not correlate to the number of Domesday plough-teams recorded in the parish (Rogerson 1995: 157). He suggests that a method of direct dunging may have been employed, which would account for the lack of Saxo-Norman manuring scatters (Rogerson 1995: 157). Elsewhere in the parish, colonisation is expanding onto the heavier soils of the Heavy Claylands Subzone, although these are predominantly small sites, perhaps representative of a single farmstead. These sites, such as LS 16, 18, and 19, are all positioned in such a way as to exploit the natural landform. Eleventh-century material was recovered from Sites Med 15A, Med 19, and Med 22, with each of these sites lying on the edge or slightly inland in the Heavy Claylands Subzone on sloping ground where previous Saxo-Norman material had been recovered (Rogerson 1995: 432-5). The Aldeby, Hanslope, and Beccles series soils which are commonly found in the Heavy Claylands are particularly troublesome to work without some form of assisted drainage such as that provided by sloping topography. It is apparent that where the soil is at its heaviest, as mapped by Rogerson, Saxo-Norman exploitation is entirely absent. These areas were most likely exploited as pasture or carried woodland and were only gradually converted to arable after the beginning of the twelfth century (Rogerson 1995: 158).

Medieval: c. 1150 – c. 1350

Evidence from the medieval period indicates a marked expansion of settlement across the landscape. Nearly all fields surveyed in the *Three Parishes* produced scatters or concentrations of medieval sherds, with a particular focus on heavier soils and green-edge sites in all three parishes. These trends are largely mirrored in Fransham, albeit to a less intensive extent, with settlement gravitating towards heavy soils and the edges of greens. The twelfth and thirteenth centuries appeared to be particularly

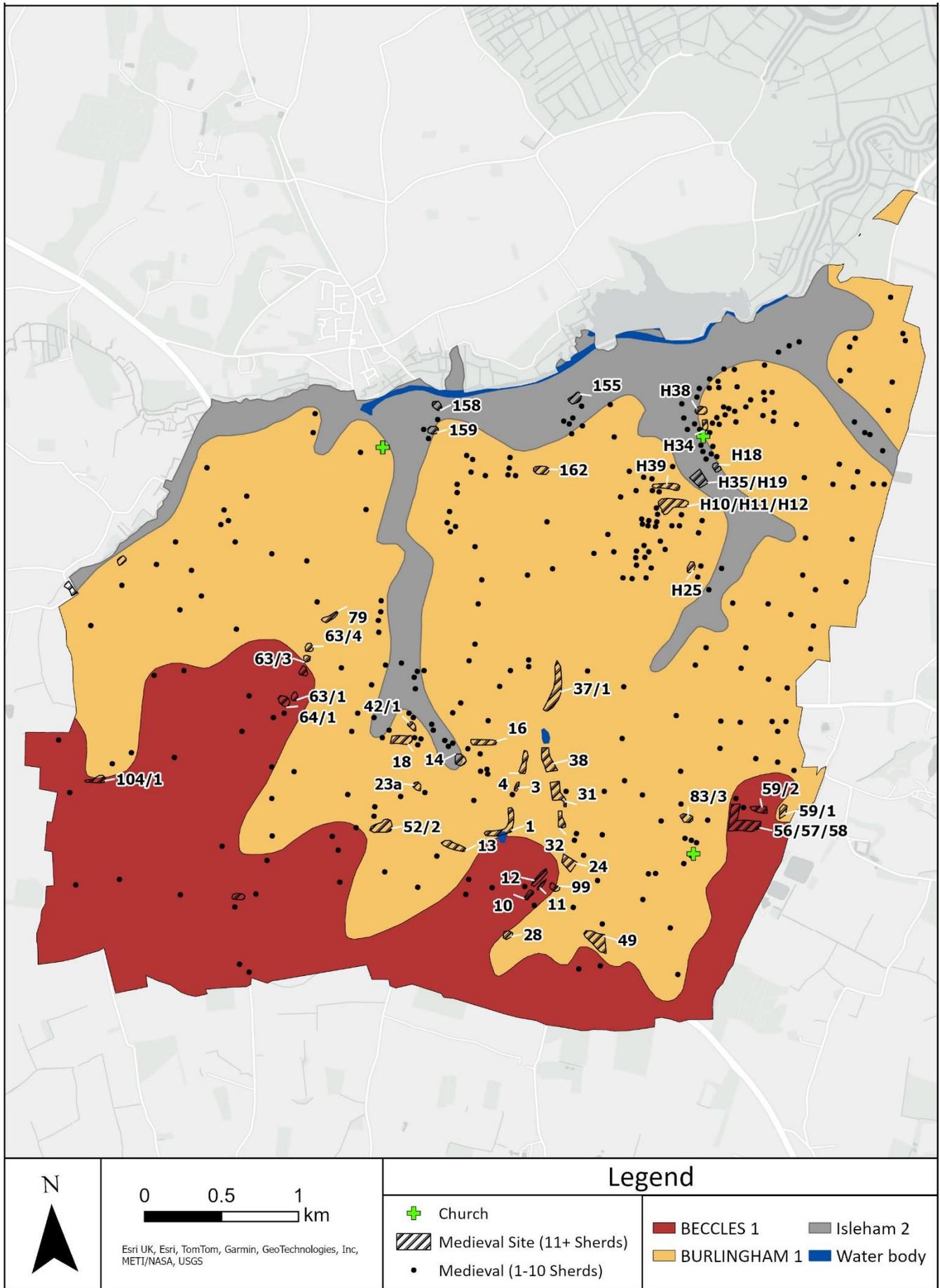


Figure 57: Medieval settlement in the Three Parishes shown against soils.

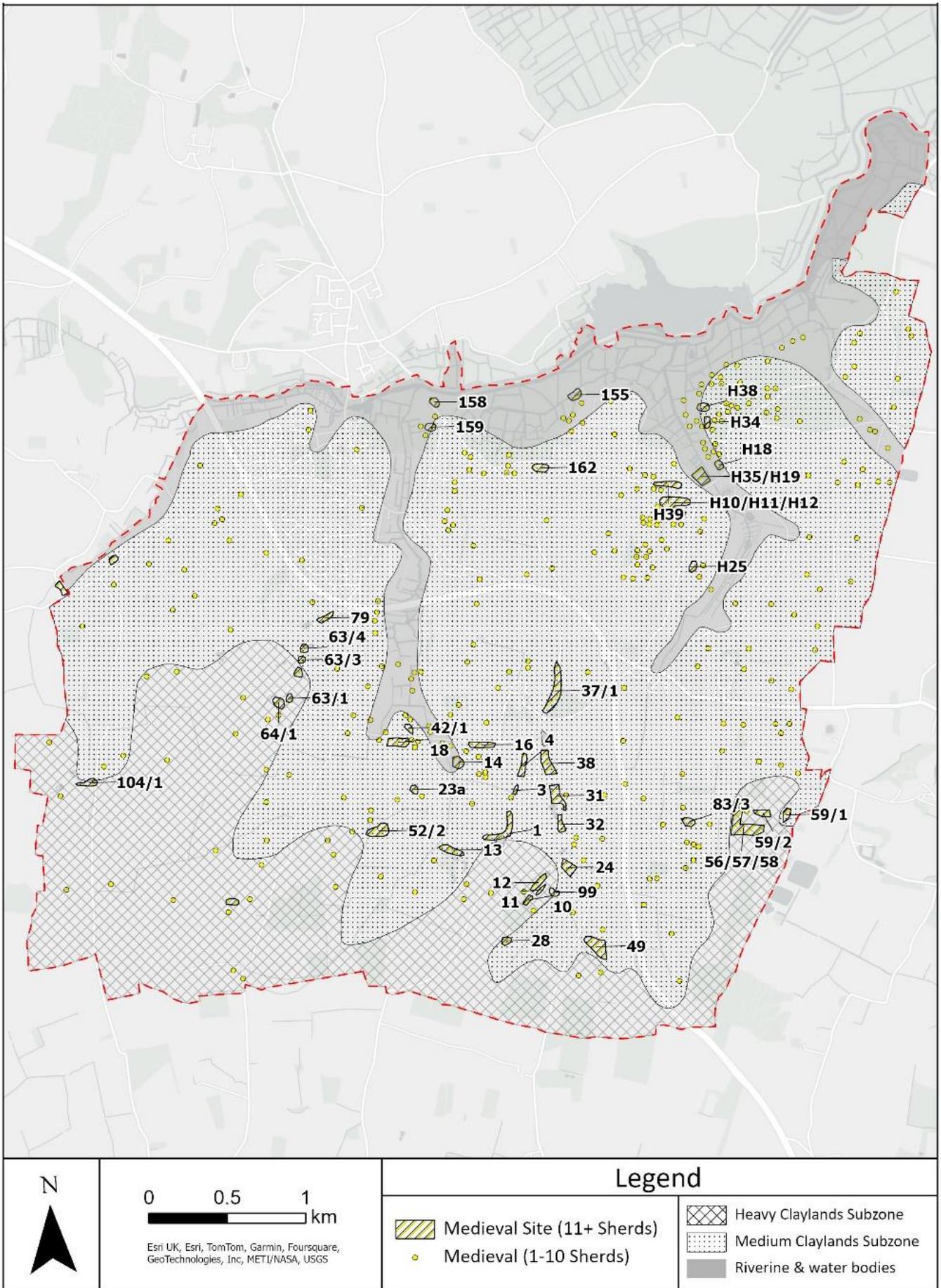


Figure 58: Medieval settlement in the Three Parishes shown against the Heavy and Medium Claylands Subzones.

intense periods of expansion, with thirty-eight sites commencing in the twelfth century and fifty-three sites commencing in the thirteenth century in Fransham (Rogerson 1995: 262). This increase is likely a reflection not only of the significant expansion of activity but also of the dispersed character of settlement that defines both the Three Parishes and Fransham in this period. Given their sheer number, a detailed discussion of every medieval site is not possible; instead, the overall pattern sketched by these sites will be commented on, with a select number of sites being discussed in greater detail when necessary.

In the Three Parishes Hales Green was a particular focus of medieval settlement, with a considerable number of manuring scatters found in fields surrounding these green-side occupational sites. The southern third of Hales Green occupies the crest of a forward thrust spur protruding from the main body of the Heavy Claylands, whilst the central and northern two-thirds of the Green extend into the Medium Claylands Subzone. Two-hundred and thirty-eight sherds of medieval unglazed pottery was recovered from Site 1 on the western flank of the green alone (Davison 1990: 77). This part of the Green possesses particularly sticky, loamy clayey soil and is difficult to work when wet, although the very gentle slope which these sites occupy would likely aid drainage, although to what extent such a shallow dip would counter the hydrologically challenged soils is questionable. The soils of the eastern flank of the Green is similar, although on this side the topography is level, making it more susceptible to hydrological input. That the eastern flank of the common saw more intensive activity in the medieval period than the western flank is curious (Davison 1990: 77). This apparent preference for the more intractable, more inhospitable flank of Hales Green is geologically and climatically illogical if those factors are to be considered the primary drivers of settlement evolution. This is only compounded when it is considered that the southern third of the Green, where it extends onto the Heavy Claylands, also appears to have been intensively utilised, with 994 sherds being recovered from Sites 5 to 12 (Davison 1990: 77). The volume of finds suggests intensive activity was occurring on the Heavy Claylands Subzone in this locale, albeit near to these junctions with the Medium Claylands Subzone. Davison suggest that the volume of thirteenth- and fourteenth-century ceramic material recovered from these sites, and in particular from Sites 5 to 9c, suggests that it was this cluster of sites which formed the medieval focus (Davison 1990: 77). The other greens and commons, such as Stubb's Green, Church Green, Spot Common, and Southwood Green all, with the exception of the latter, straddle the Medium Claylands and the Heavy Claylands Subzone in a similar fashion to Hales Green, with each of these examples exhibiting concentrations of medieval material around their perimeter.

In Fransham a similar pattern is observable. The sherds recovered which have been dated to the twelfth century indicate a significant shift in settlement. By the twelfth century the nucleation hinted at by the middle Saxon and Saxo-Norman evidence is entirely gone, replaced by a pattern of dispersed

farmsteads frequently occupying a green-edge, or near green-edge position (Rogerson 1995: 116-7). These sites are far more prevalent in the Heavy Claylands, a substantial shift in geological preference compared to previous periods. Just six of the 34 twelfth century sites lie in the Medium Claylands, with the remaining 28 sites all falling within the Heavy Claylands Subzone; this clearly shows a preference for sites with heavy soils. Nine of these Heavy Claylands sites occupy locations where the heaviest soils of this subzone predominate, with the remaining nineteen sites occupying soils which while still being loamy and clayey in character have more emphasis of the loamy aspect of their composition. Sites occupying the heaviest soils, such as Med 1, Med 31, and Med 32 are located so as to exploit the morphology of local topography. Never do these sites occupy level ground, with each example preferring instead to favour sloping topography in much the same way as did Saxo-Norman sites on these heavier soils. This observation is also true of those sites which occupy loamier soils in the Medium Claylands.

These trends continued into the thirteenth century in Fransham, with the material recovered from this period following the broad outline described above. More sites appear to have been abandoned in the thirteenth century than the twelfth, with some nineteen failing (Rogerson 1995: 162). There was an increasing emphasis on colonising areas home to the heaviest, most intractable soils within Fransham in the thirteenth century. For example, sites Med 76 to Med 82 occupy locations well within the bounds of the Heavy Claylands Subzone in the south of the parish, and in general the topography of these sites is also flatter than the often sloping topography exhibited by the majority of twelfth-century sites. Similar examples are also found in the north of the parish, where sites Med 33 to Med 35 occupy a tract of heavy soil on a broad plateau. Many of the twelfth and thirteenth century sites identified by Rogerson endured into the fourteenth century, and in many cases well into the nineteenth century (Rogerson 1995: 433-40).

Expansion into the interior of the Heavy Claylands is less dramatic in the Three Parishes but is nevertheless observable. Approximately one to ten sherds were found in half of the fields surveyed in the heavier environments in the south of the parishes. These finds likely represent manuring scatters from areas of medieval arable, with little evidence of any concentrations indicative of occupation. However, whilst evidence of occupation is scarce within the main body of the Heavy Claylands, concentrations of medieval material indicative of occupation are common on the junction between the Heavy and Medium Claylands, such as at Sites 49, 52, and 104 (Davison 1990: 77-80). A potential explanation as to why occupational sites may have preferred these junction zones is that communities exploiting these heavier lands needed to be physically closer to these more hydrologically sensitive soils in order to make the best use of favourable climatic conditions. For example, the manure scatters present on the heavier lands implies some form of medieval exploitation, likely arable;

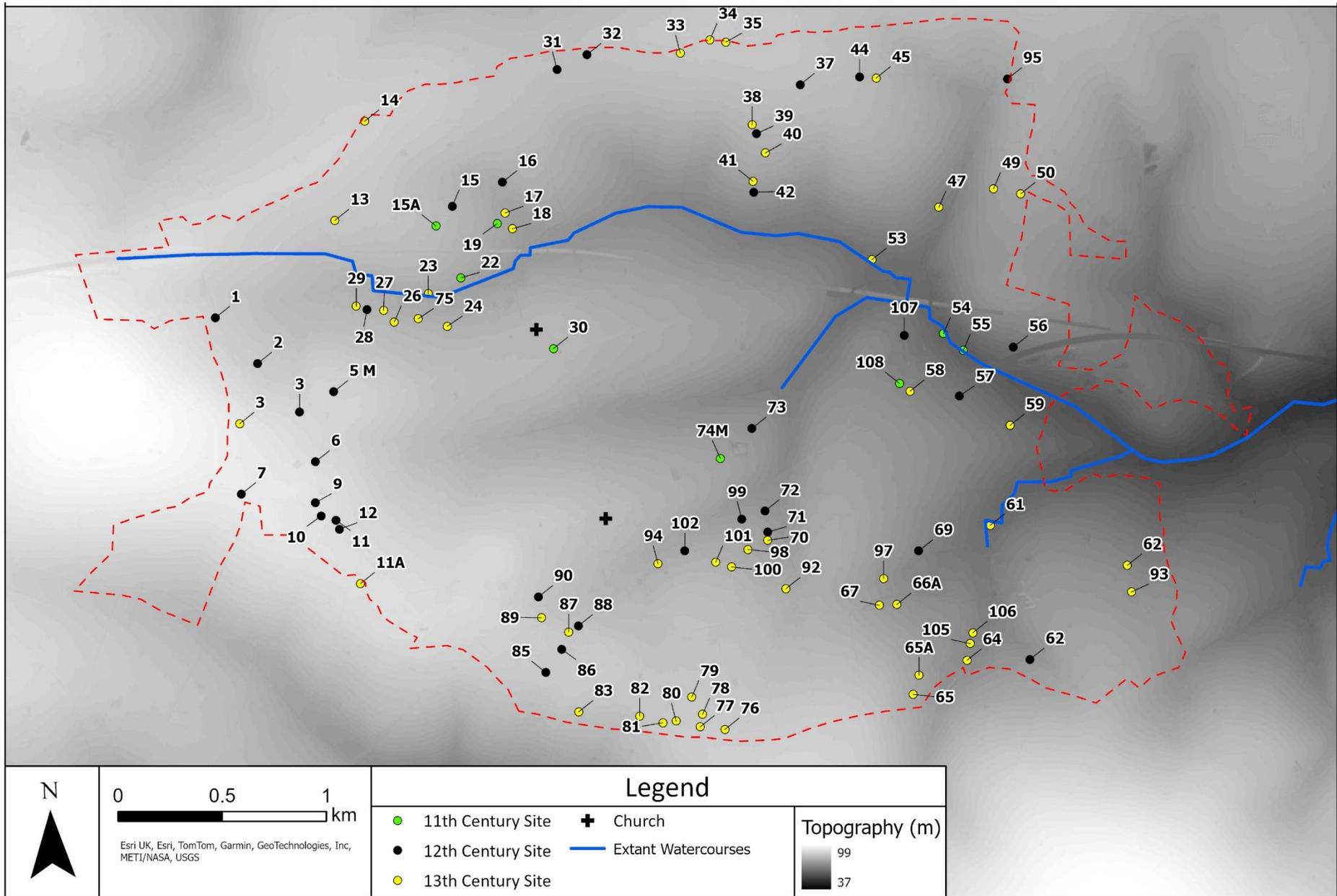


Figure 59: Medieval settlement in Fransham shown against topography.

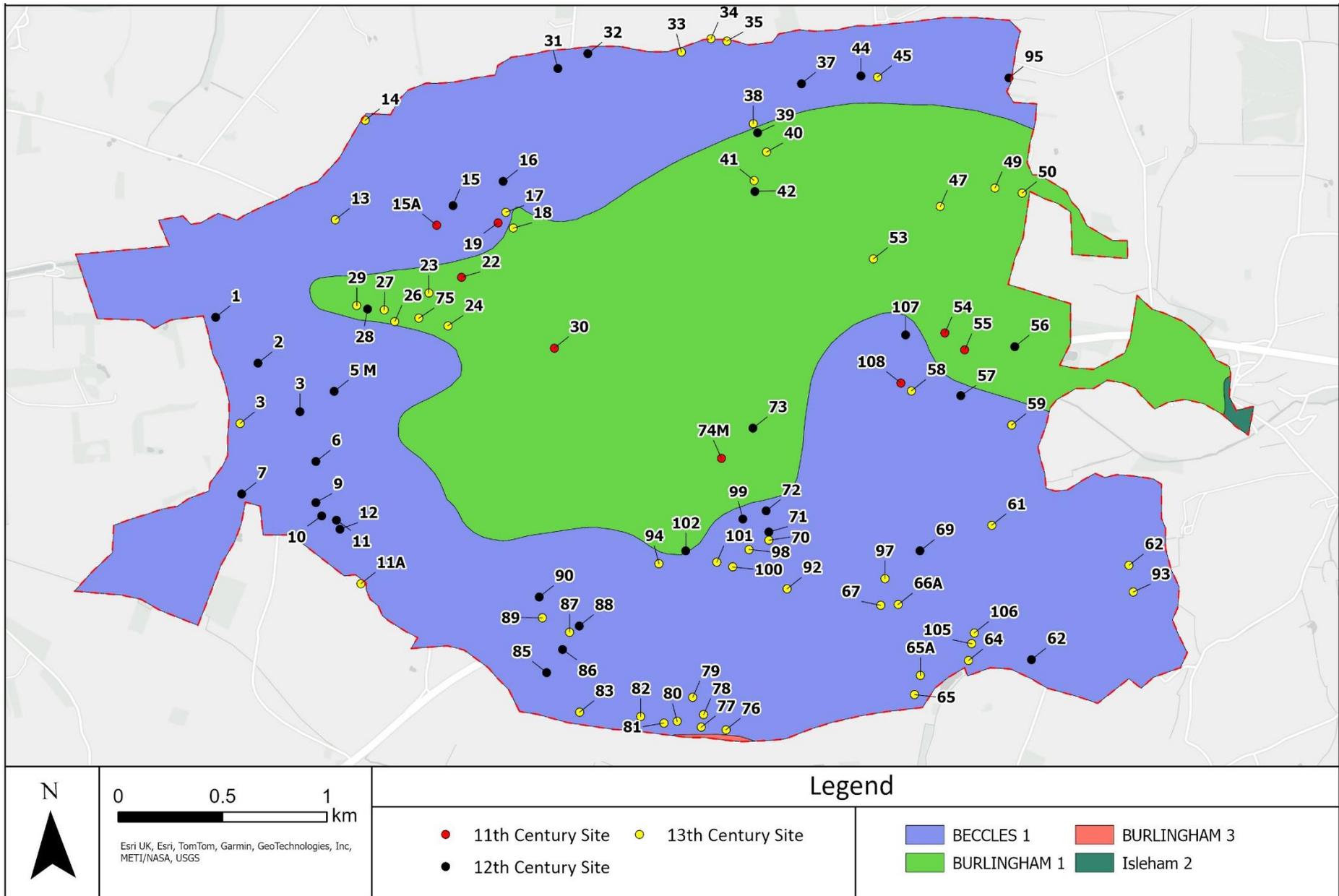


Figure 60: Medieval settlement in Fransham shown against soils.

farmers would thus need to plough or work the land at a time when the stagnogleyic soils would not compact, with this narrow window of opportunity being even harder to exploit if the farm was located far from the fields.

Elsewhere in the Three Parishes exploitation is similarly being expanded; medieval material was recovered from nearly every field that is part of the Medium Claylands Subzone, with the vast majority of these being interpreted by Davison as likely manuring scatters (Davison 1990: 16, 22, 77). Furthermore, whereas middle Saxon and Saxo-Norman exploitation tended to hug the slopes and generally avoided the thicker soils of the low plateaus, in the medieval period this aversion appears to have been overcome.

The valley floors in the north of the Three Parishes also saw an increase in activity, especially Sites 155, 158, 159, and 162 in Loddon and Site H24 in Heckingham (Davison 1990: 77). These areas were likely positioned to exploit the valuable pastures in this low-lying valley whilst also being in close proximity to the arable to the south, which was generally lighter in these downslope environments than the heavier soils found upslope (Davison 1990: 38, 77). A similar movement is also detectable in Fransham. For example, in the west of the parish sites Med 23 to Med 19 all occupy low-lying ground next to the principal watercourse which flows through the parish. Similarly, in the centre of the parish Med 53 occupies a waterside location, as does Med 61 in the south-east. Most of these water-side sites endured into the fourteenth century (Rogerson 1995: 433-40).

One of the most interesting valley floor sites, and which is of particular interest is Site H19 in the Three Parishes. This site, occupying the floor of the Beck, produced 78 sherds of Early Medieval Ware and medieval unglazed pottery, with Davison suggesting that this site was likely in use for a very limited time between the late twelfth century and early thirteenth century (Davison 1990: 41, 77-85). This heightened temporal accuracy of a site on alluvial – and thus climatically sensitive – soils is particularly useful to this study, with the potential implications of this site's colonisation and subsequent abandonment discussed in greater detail in later sections.

Late Medieval: c. 1350 – c. 1500

Following the apogee of the medieval period, the late medieval period is characterised by a distinct downturn and considerable contraction of settlement. This contraction is evident in both the Three Parishes and Fransham, with both occupational sites and wider activity experiencing a marked decline.

In the Three Parishes the most striking contraction of activity occurs on the Heavy Claylands Subzone. Whilst the preceding medieval period witnessed a considerable colonisation of these heavier, more

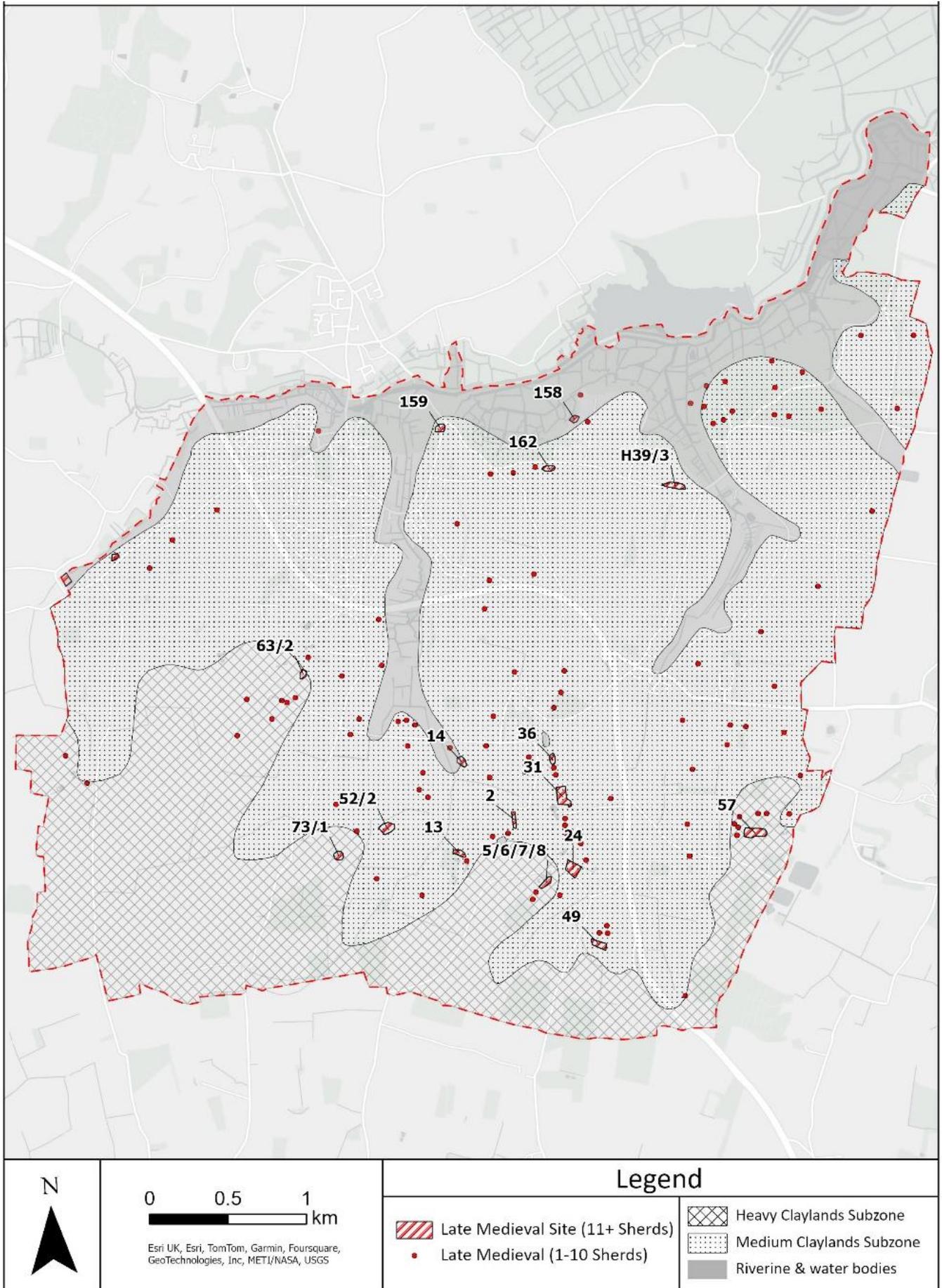


Figure 61: Late Medieval settlement in the Three Parishes shown against the Heavy and Medium Claylands Subzones.

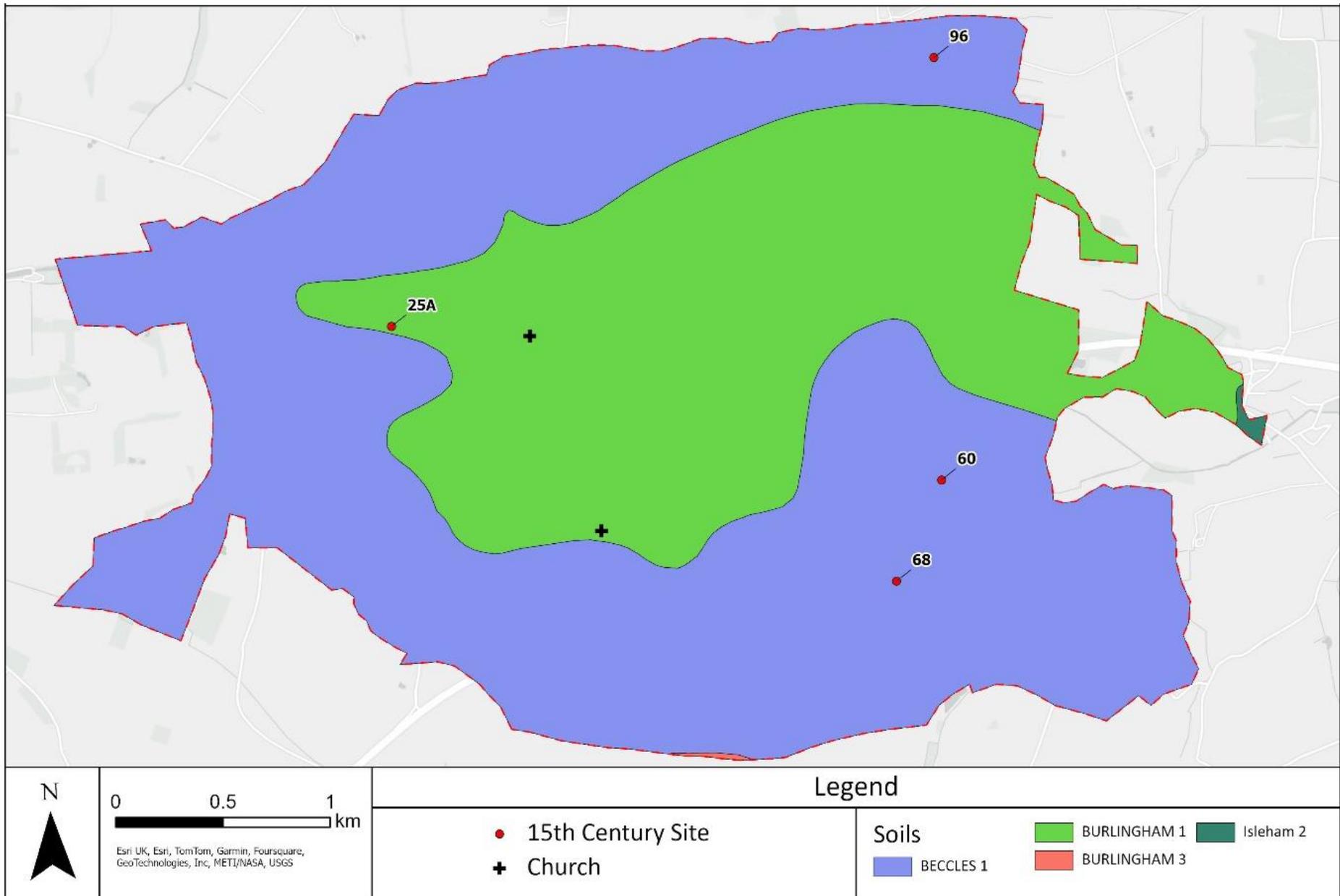


Figure 62: Late Medieval sites in Fransham shown against soils.

labour intensive soils, the late medieval period sees these locations return to a state more akin to the Saxo-Norman period than the medieval period. Manuring scatters are far scarcer on the heaviest soils, with only a few fields in the Stubb's Green vicinity containing late Medieval ceramic evidence. Elsewhere in the Heavy Claylands late-medieval material is entirely absent. The only concentrations of late medieval sherds are found in the context of the greens and commons which reach back onto these heavy soils, such as Sites 1, 2, 3, and 4 (Davison 1990: 77). The only sites in the vicinity of Hales Green which exhibit any significant evidence of continuation are Sites 24 and 31, with Davison noting that Site 24 was particularly active (Davison 1990: 22). Even then this site appears to have experienced a marked slowdown, with 640 medieval glazed and unglazed sherds recovered to just 131 late medieval and early post medieval sherds (Davison 1990: 77). The medieval concentrations at H38 and H43, which occupied land directly adjacent to the church, contained just one sherd each of late medieval date, whilst the manuring scatters north-east of the church near to Sites H16, H20a, and H20b similarly contain just a single sherd (Davison 1990: 86-7). These sites are predominantly on the lighter soils and occupy a downslope position; it is strange that these geologically and topographically forgiving sites were either entirely abandoned or greatly reduced in importance at a time when climatic conditions would have been making heavier sites even more unforgiving. In other parts of the survey area this decline – and in some instances wholesale abandonment – is similarly widespread.

Late medieval settlement in Fransham experiences the same decline as that experienced in the Three Parishes. From the high-water mark of the twelfth and thirteenth centuries forty-four sites went on to be abandoned in the second half of the fourteenth century, with no new sites established during this period (Rogerson 1995: 284-5). Only four new sites appeared in the fifteenth century – Med 25A, Med 60, Med 68, and Med 96 – which all conform to a general pattern of sloping topography, close proximity to greens, and heavy, hydrologically sensitive soils. The pattern of settlement in the late medieval period is the same as that in the twelfth, thirteenth, and fourteenth centuries, and is characterised by dispersed farmsteads and stretched out, green- or common-edge occupational sites.

Portable Antiquities Scheme and Norfolk Historic Environment Record evidence

The PAS and NHER evidence corroborate the patterns identified by the fieldwalking data while adding useful refinements. In Fransham, PAS data shows a dense cluster of early Saxon finds around the only early Saxon site identified in the fieldwalking data. These artefacts all lie within the Medium Claylands Subzone on a very gentle slope falling away from the central plateau. The assemblage includes cruciform and florid cruciform brooches, girdle-hanger fragments, strap-ends, buckle-set mounts, personal grooming items, and a detached gilded silver knob from a Lombardic radiate-headed brooch. This concentration of dress fittings and associated material, in the immediate vicinity of the ceramic scatter, strongly indicates an occupational focus rather than accidental loss, and underscores the

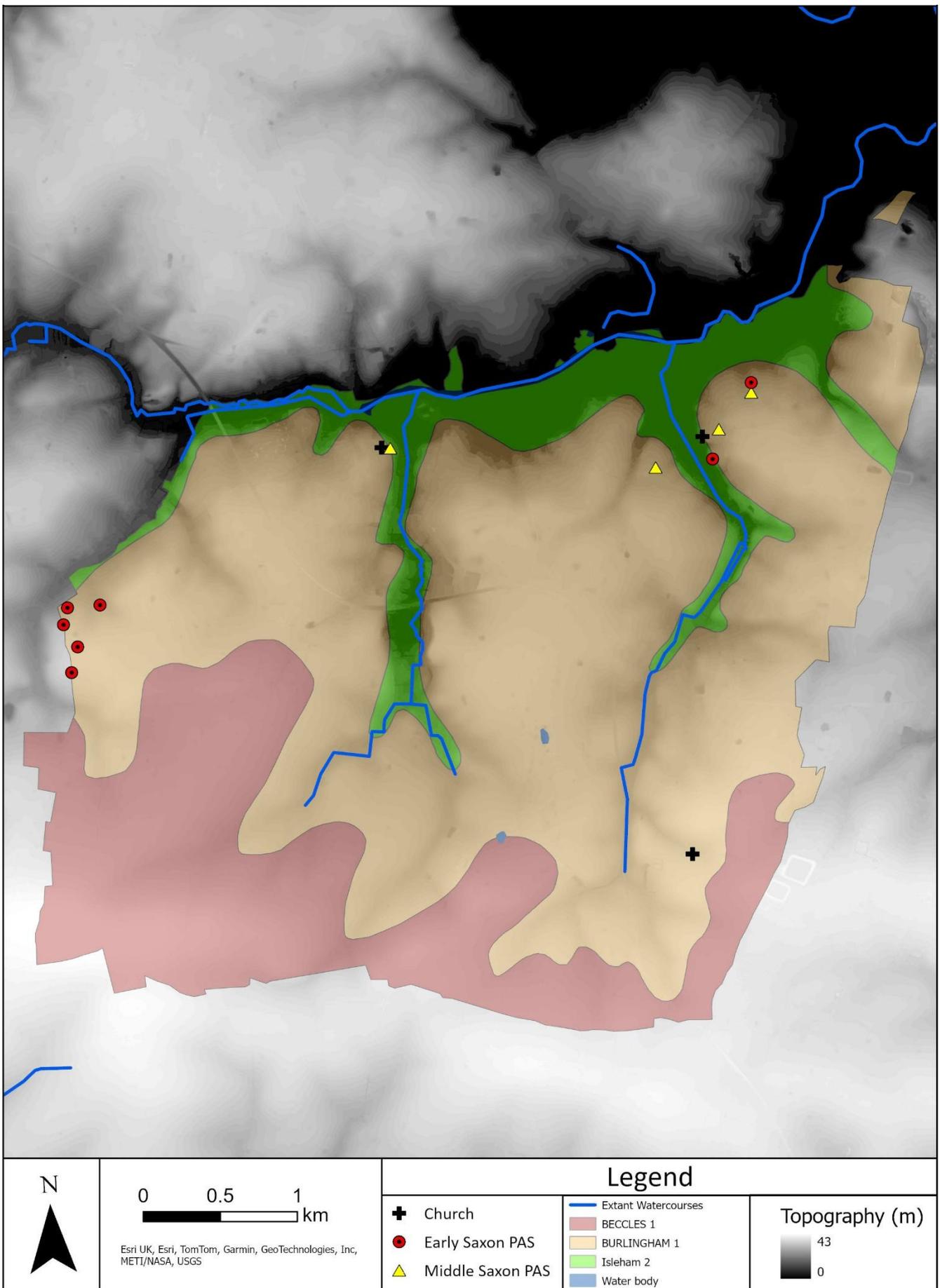


Figure 63: Early and middle Saxon PAS in the Three Parishes. Note the palaeochannel adjacent to the western set of early Saxon PAS artefacts.

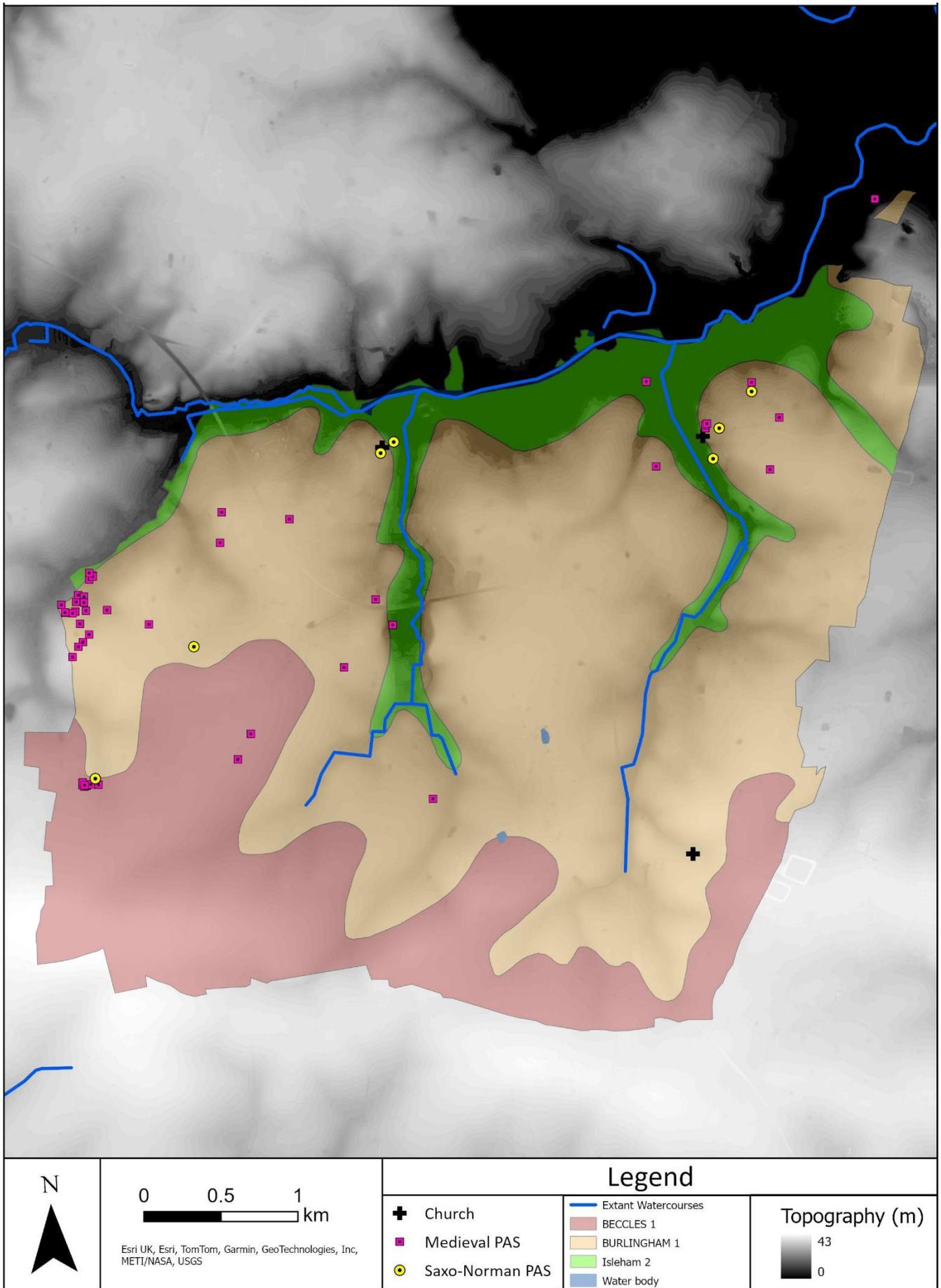


Figure 64: Saxo-Norman and medieval PAS in the Three Parishes.

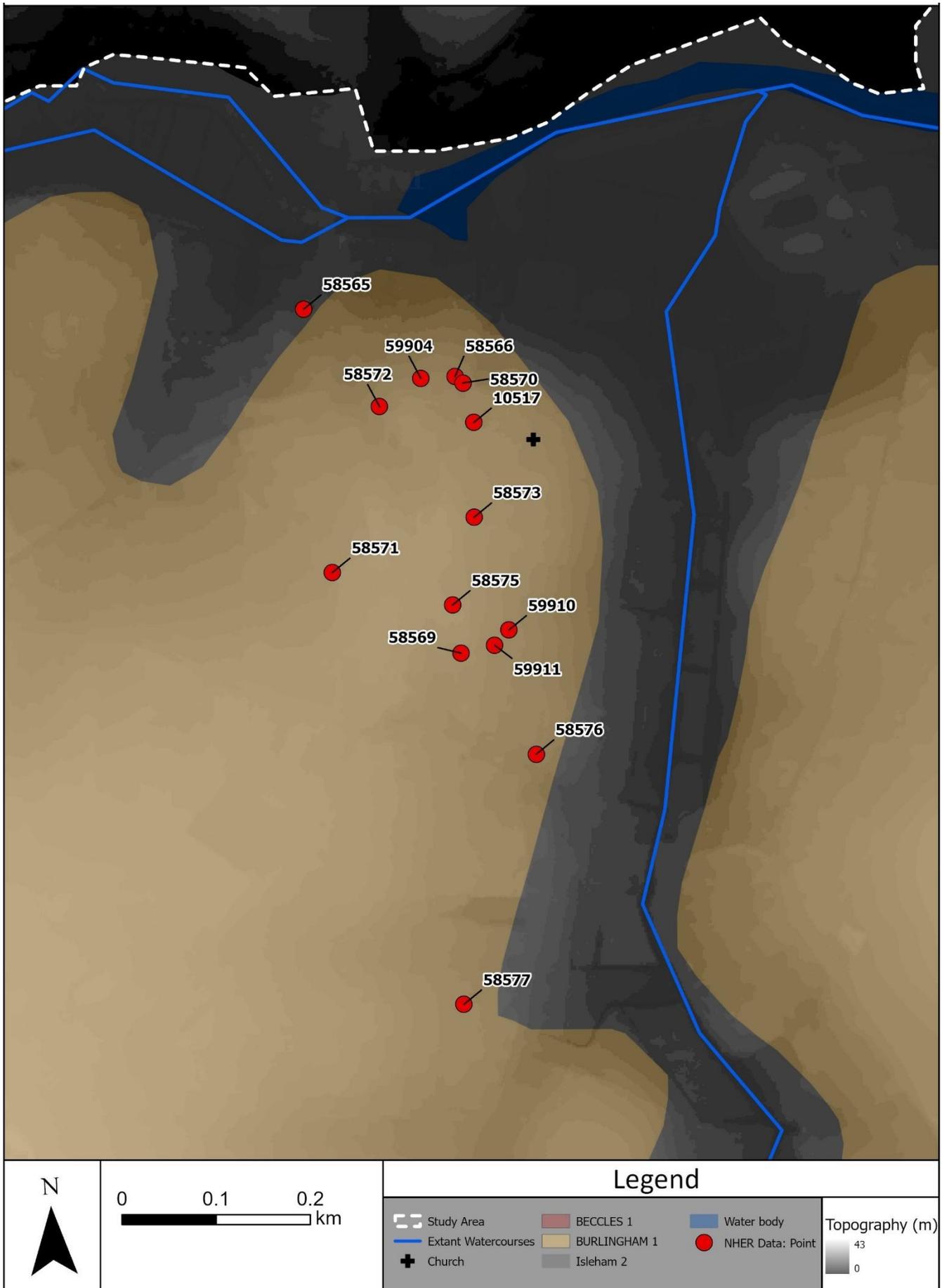


Figure 65: NHER data from the Three Parishes. Shown here is the modern town centre of Loddon that remains focused on Holy Trinity Church.

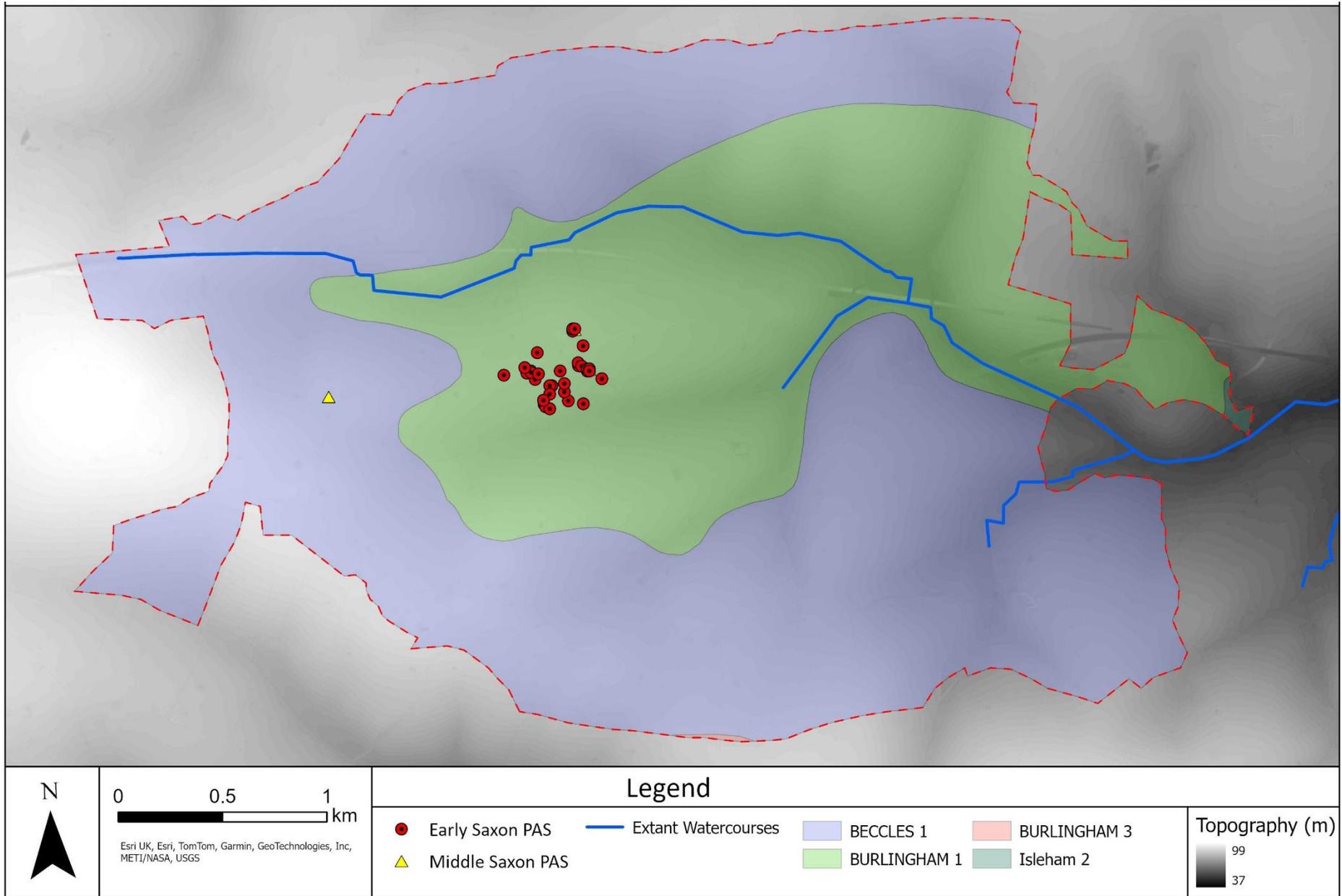


Figure 66: Early and middle Saxon PAS in Fransham.

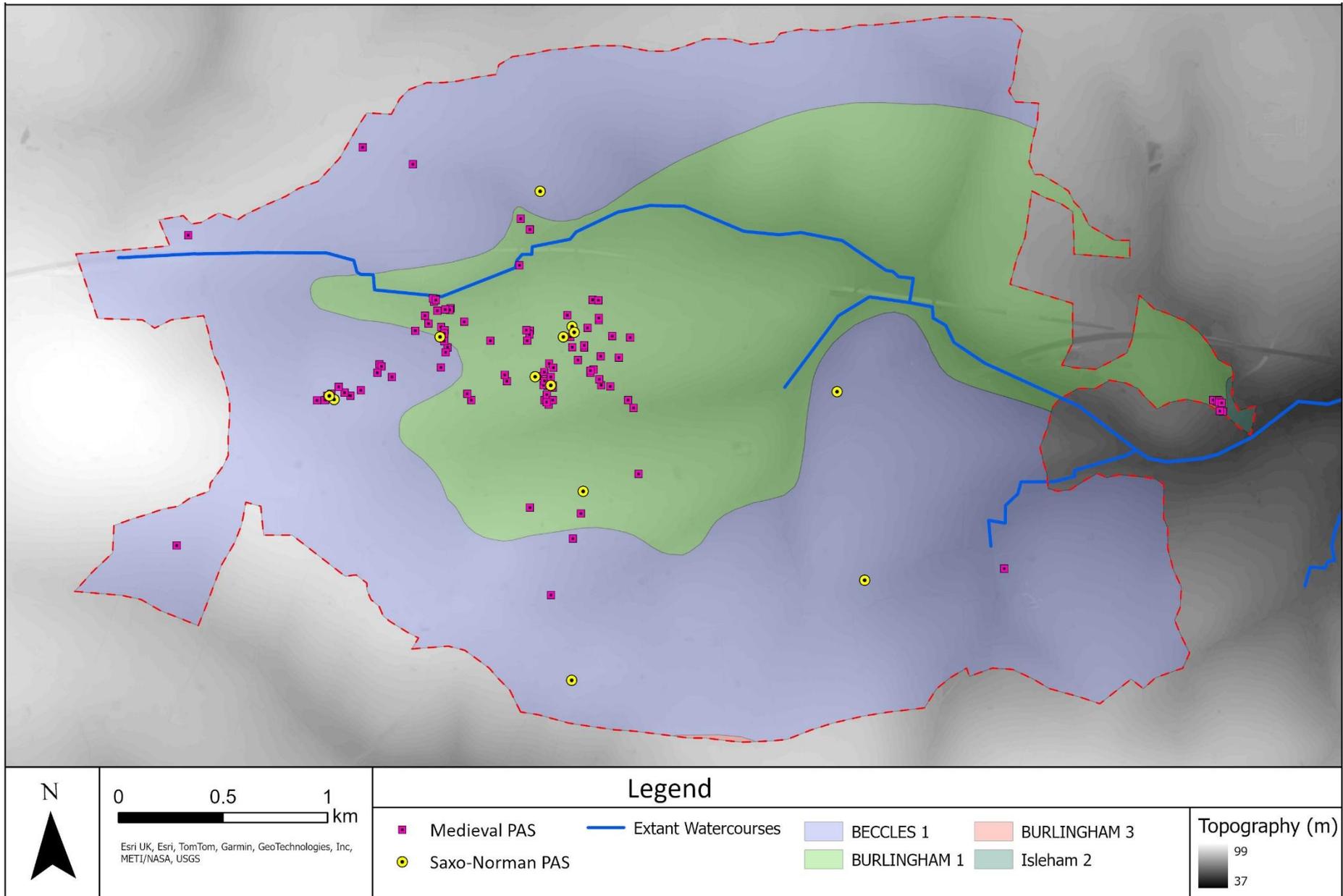


Figure 67: Saxo-Norman and medieval PAS in Fransham.

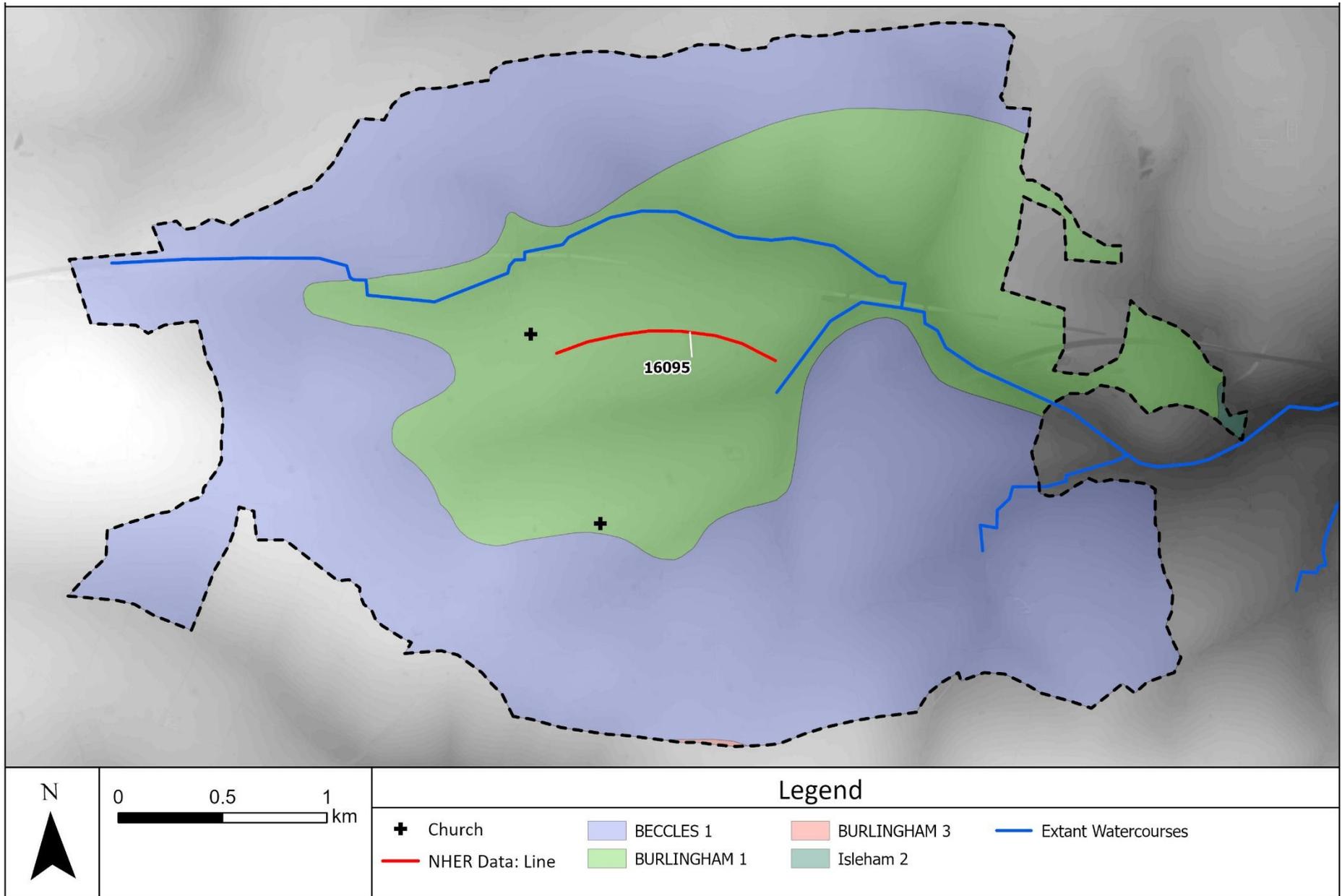


Figure 68: NHER data from Fransham.

preference of early Saxon communities for slightly inclined, well-drained ground at the lip of the plateau within the Medium Claylands Subzone.

In the Three Parishes the pattern described by the PAS data mirrors the environmental preferences exhibited by the fieldwalking data. A small but significant group of early Saxon artefacts — including a gilded silver radiate-headed brooch knob, a swastika plate brooch, cruciform brooch components, and sleeve-clasp fragments — has been recovered in the extreme west of the study area, where no early Saxon ceramics were recorded despite systematic fieldwalking. These finds occupy the slopes of a shallow valley at the junction between the Medium Claylands and the riverine Isleham 2 soils. Lidar strongly suggest the presence of a palaeochannel in this shallow valley (see Figure 63). A second early Saxon buckle frame, approximately 700m north-east of H25, sits on a comparable slope at the same soil junction above an extant watercourse. Together these finds not only indicate an additional early Saxon occupational foci (and one that is essentially invisible in the ceramic record) but also confirms the same topographical and pedological preferences noted at the other early Saxon sites in the Three Parishes, namely a focus on gently sloping ground overlooking active or former watercourses along the junction between the Medium Claylands and Isleham 2 soils.

Whilst no middle Saxon PAS artefacts have been recovered in Fransham, this absence is not replicated in the Three Parishes. Near Sites 158 and 161, a single Ipswich ware sherd recorded via PAS lies at the junction between the Medium Claylands and Isleham 2, reinforcing the presence of middle Saxon settlement in this location. Further east, near to the modern village of Heckingham and adjacent to Sites H34, H36, H38 and H40, two middle Saxon artefacts — a pin and a strap-end — have been recovered from the Medium Claylands on the gentle slopes leading down towards the River Chet. These finds mirror the distribution of the ceramic evidence recovered by the fieldwalking survey. Whilst the NHER record from the Three Parishes is dominated by entries derived from Rogerson's fieldwalking survey, it does provide some useful additional data, especially for areas in Loddon that were inaccessible to the fieldwalking survey due to urban developments. This data is of particular importance for understanding the extent of middle Saxon settlement around Holy Trinity Church, for as noted earlier in this chapter a middle Saxon presence is often detected around parish churches. This data indicates a very limited middle Saxon presence in Loddon and stands in stark contrast to the extensive middle Saxon presence detected around St Gregory's Church in neighbouring Heckingham. Test pits within 300m of the church (NHER 58565, 58566, 58570, 58572, 58573, 58575, 58576, 59904, 59910, 59911, and 10517) have consistently produced assemblages dominated by Saxo-Norman Thetford Ware and later medieval pottery, with only two of these — NHER 58573 and 10517 — recording middle Saxon material. Importantly, both of these sites lie on the junction between the Medium Claylands and the Isleham 2 soils, replicating the topographical and pedological preferences

exhibited by middle Saxon sites detected by the fieldwalking data. Ipswich Ware is recorded at NHER 58573, where a single test pit behind Church Plain – 100m from the Church itself – recovered a small quantity of middle Saxon pottery alongside prehistoric flints and a substantial medieval and post-medieval assemblage. At NHER 10517 a middle Saxon pin and a later medieval inhumation was found within 90m of the church. Further south at NHER 58577 – some 600m from Holy Trinity Church – a small number of Ipswich Ware sherds were recovered along with medieval material. Taken together, these records indicate that although the area around the church did serve as a focus of middle Saxon activity in Loddon, its archaeological signature is remarkably slight, with the test pits revealing only a sparse middle Saxon presence set against a far more substantial pattern of later Saxo-Norman and medieval occupation. That being said, there is certainly an argument to be made that the picture provided by test pitting and chance finds is too limited to state with confidence that the middle Saxon presence in Loddon was as slight as the current evidence implies, since it remains entirely possible that significant deposits are concealed beneath later urban development. Only further, more extensive excavation would be able to reliably prove either of these hypotheses, and there thus remains a question over the true extent of middle Saxon settlement in Loddon.

Saxo-Norman PAS material in both the Three Parishes and Fransham shows close correspondence with the fieldwalking data and illustrates the first significant, if still cautious, expansion onto the Heavy Claylands Subzone. In Fransham, artefacts around LS 8 and LS 2 form a coherent grouping within the Medium Claylands Subzone, comprising late Saxon stirrup-strap mounts, strap-ends, hooked tags and small quantities of Thetford-type pottery. In the Heavy Claylands Subzone near LS 3, LS 20 and LS 15, further harness components and substantial groupings of Thetford-type ware capture the Saxo-Norman expansion onto the heavier clays. Additional stirrup-strap mounts and strap-ends recorded wholly within the Heavy Claylands Subzone at the peripheries of the survey area – including examples near LS 19 – show that this extension was not confined to the junction zone. The PAS data from Fransham thus reinforces the broad pattern described by the fieldwalking data, namely that Saxo-Norman settlement was focused on the Medium Claylands Subzone but was gradually expanding into the Heavy Claylands Subzone.

In the Three Parishes the distribution of Saxo-Norman PAS finds and NHER records similarly mirrors the fieldwalking data. In the west of the study area, a socketed hook strap fitting in Ringerike style was recovered directly adjacent to Site 104 on the boundary between the Medium and Heavy Claylands. A kilometre to the north-east, a rare late Saxon lead plate brooch provides further evidence of activity in this western plateau margin. In the far north of the study area, Thetford-type sherds have been recovered near Sites 58 and 147/1, which occupies the sloping junction soils between the Medium Claylands and Isleham 2. Similarly, Thetford Ware and other Saxo-Norman pottery is well represented

in the NHER records for the current urban centre of Loddon, with NHER 58565, 58566, 58569, 58570, 58571, 58572, 58573, 58575, 58576, 59904, 59910, and 59911 all recovering Saxo-Norman and later medieval material. Moving east to Heckingham, PAS data from around St Gregory's Church shows that polyhedral weights and stirrup mounts have been found on the lower slopes of the Medium Claylands that leads down to the River Chet. The pattern of Saxo-Norman settlement suggested by both PAS and NHER data thus concurs with that described by the fieldwalking data.

The medieval PAS and NHER data from both Fransham and Loddon demonstrates how these Saxo-Norman patterns were consolidated and extended. In Fransham, medieval PAS finds cluster most densely around Site 30 in the Medium Claylands Subzone, where a varied assemblage of Limoges-type crucifix fittings, coins, lead and copper-alloy weights, book fittings, seal matrices, casket keys and pottery has been recovered, much of it from in and around the churchyard of All Saints Church. This material attests to a long-lived focus of settlement around the Church. A second grouping of artefacts around Sites 23, 24, 26, and 75 comprises strap-ends, buckles, pot mends and further coinage from the thirteenth and fourteenth centuries, with this assemblage occupying the junction of the Medium Claylands and Heavy Claylands Subzones. Just west of this grouping – and wholly within the Heavy Claylands Subzone – is a relatively compact cluster of medieval and late medieval artefacts including harness swivels, rings, buttons and other fittings, with these lying directly adjacent to Sites 3 and 5M. Further south near to Sites 85, 86, 87, 88, 89 and 90, buckle plates and a spur rowel have been recovered from within the main body of the Heavy Claylands Subzone. In the south-east, an incomplete buckle plate adjacent to Sites 66A, 67, 69 and 97 lies at the head of a shallow valley.

NHER records add a further dimension to this picture. In Fransham, NHER 16095 documents a substantial earthwork bank visible as soilmarks and low earthworks on aerial photographs and lidar. Lying in the centre of the parish and entirely within the Medium Claylands, this feature has been interpreted as a long boundary bank associated with medieval land division, with the western end corresponding with concentrations of medieval PAS records around Site 30 and All Saints Church. This feature continues for a kilometre east, tracking down into the shallow valley that leads to the extant watercourse near to Site 107. For the last 500m of its length it crosses land where no occupational sites have been identified by the fieldwalking data and where no PAS artefacts have been recovered, with only medieval manuring scatters found in this location. This lack of occupational sites strongly suggests that this was a part of the landscape that was devoted to agricultural exploitation rather than occupation, and the dearth of fieldwalking or PAS data from this location – bar medieval manuring scatters – supports this notion. There is thus no divergence from the broad pattern outlined by the fieldwalking data in the PAS or NHER record for Fransham.

In Loddon the same agreement between the medieval PAS and NHER record and the fieldwalking data is equally apparent. As previously mentioned, test pitting from within the modern town of Loddon have recovered large quantities of medieval material, with its ubiquity demonstrating a significant medieval presence in the town (see NHER 23809, 58565, 58566, 58571, 58572, 58573, 58575, 58576, 59904, 59905, 59909, 59910, 59985, 59911, and 10517). Around St Gregory's Church in Heckingham, adjacent to Sites H18, H34 and H38, a collection of devotional and personal items – including a lead ampulla, annular brooches, decorated buckles and composite buckle plates – are recorded by PAS from within the Medium Claylands Subzone on gentle slopes leading down to the River Chet. Additional artefacts – jettons, buckles, belt-plates, and seal matrices – recovered from around St Gregory's Church emphasise this location as a focus of medieval activity. Near to Site 104/1 on the elevated plateau that marks the Heavy Claylands Subzone in the Three Parishes, a group of medieval PAS artefacts – including coins of John and Edward I, buckles, harness pendants and a stirrup-shaped ring – evidence medieval colonisation of the Heavy Claylands in the same location as that suggested by the fieldwalking data. Similarly, in the extreme west of the Three Parishes and occupying the sides of the shallow valley that leads down to the palaeochannel associated with the early Saxon PAS cluster is another grouping of medieval PAS finds. Here silver dress accessories, seal matrices, buckle plates, mounts and armorial harness pendants have been recovered in a position near to the junction between the Medium Claylands and the Isleham 2 soils. The picture of medieval settlement in the Three Parishes outlined by the PAS data thus mirrors that of the fieldwalking data with considerable accuracy.

Supplementary evidence: Valuations and wider landscape applicability

As is often the case, the medieval period is relatively underrepresented in the documentary record, at least when compared to later periods. There is also a large disparity between the Loddon, Hales, and Heckingham and Fransham, with the latter having no spatially or temporally relevant documentary sources. The former, however, does possess a modest documentary record, with particularly helpful sources being the valuation of 1334 and the valuation of 1449. These documents clearly show that Loddon, Hales, and Heckingham were in marked decline by the time of the latter valuation (Hudson 1895: 269-70). Using statistics published by Davison, Loddon suffered a 28.6% decline, Hales a 20% decline, and Heckingham an 18.2% decline (Davison 1990: 58). This decline can be largely attributed to the devastating effects of the Black Death and the recurrent waves of plague which hammered Europe throughout the second half of the fourteenth and fifteenth centuries.

Other documentary sources for Loddon, Hales, and Heckingham shed light on the type of agricultural regime practiced in this region, a nuance which fieldwalking data can often struggle to reflect (Davison 1990: 52). Overall, it would appear that a mixed farming regime was practiced in this region, although

the lack of pre-eleventh century documentary evidence restricts this suggestion to the post eleventh century period. Evidence of open fields is relatively scant over the medieval period, although Fenner and Davison are confident that much of the landscape was operating under this system (Davison 1990: 52-3). There also seems to have been a large amount of pastureland in this region, with closes, greens, patches of marshland, and water meadows indicated in numerous documents (NRO BL 38/8; NRO BL 14/38; NRO BL 37; NRO BL 6/18; NRO BL X25; NRO BL 14/75; NRO BL 143; NRO BL 38/2; NRO 116; NRO E31). Both cattle and sheep are recorded in this region, but it is likely that sheep formed the dominant type of stock over the course of the study period, with early wills such as that of Aelfric Modercope in 1043 and Domesday recording high numbers of sheep in the region (Douglas 1955/1959 11, 836; Davison 1990: 53). It is likely that cattle numbers only became significant in the post-medieval period (Davison 1990: 53).

At the start of this chapter, both the middle Saxon shift and green- or common-edge drift – and how they are common phenomena in the Claylands CZ – were discussed. It should be apparent from the evidence presented in this chapter that both of these phenomena were occurring in the Three Parishes and at Fransham to varying degrees. There is thus a strong argument to be made for the conclusions reached by this chapter to be reasonably applied not just to these specific locations but rather to the Claylands CZ as a whole. The relationship between parish churches and the sites which emerged during the middle Saxon shift – coupled with the movement towards green-edge sites in the medieval period – are clearly captured in the Three Parishes, Fransham, and at the other examples discussed in this chapter. A parish church is indicative of nearby middle Saxon occupation, and by extension it can be assumed that early Saxon occupation is unlikely to be in the immediate vicinity of the parish church. The evidence discussed in this chapter suggest that just like the parish church, which acts as an indicator of middle Saxon occupation, so too can a geological map showing the lightest soils in a region be used to identify sites of possible early Saxon occupation. Similarly, a green or common is indicative of later medieval settlement, with occupation likely clustered around the green or common edge. That the majority of parish churches are found in the Medium Claylands (when this subzone is locally available) and that the majority of greens and commons occupy problematic, frequently heavy soils further increases the validity of applying this chapter's findings to the wider CZ.

Climate and settlement

Early Saxon: c. 500 – c. 720

In the early Saxon period precipitation and temperature levels were significantly reduced, with this period being one of the coldest and driest on record. In the Three Parishes, early Saxon settlement was extremely sparse and was restricted to the lightest of the Medium Claylands' soils. All four sites

are found on gently sloping land in a riverine context, with the Loddon and Heckingham Beck being the primary focus of settlement in the region, with this topographical and pedological arrangement largely mirroring the pattern of earlier Romano-British settlement. Site 42 is almost certainly the principal early Saxon occupational site in the Three Parishes. There is the possibility that the capable drainage qualities of these sites may have proved attractive locations for early Saxon dwellings, for well-drained sites would lessen the possibility of flooding. This preference of light soils for occupational sites is similarly apparent in Fransham, where early Saxon settlement is clearly focused upon ES 1. This site, cultivated by Romano-British agriculturalists prior to the Early Saxon period, was occupied by the latter between the fifth and early seventh centuries, and is situated on slightly sloping ground within a very limited patch of lighter soils in the Medium Claylands. This combination of light soil and slightly sloping topography – which is similarly exhibited around the set of early Saxon PAS artefacts – makes this particular location one of the most hydrologically tolerant within the parish, which is otherwise characterised by rather clayey, loamy, heavy soils. The decision to site what is likely the primary occupational site on this extremely limited patch of light soil is likely driven by pragmatism, for regardless of macro-climatic fluctuations and the reduced levels of precipitation being experienced during this time, precipitation would still have been the primary climatic variable which had the most impact upon the area. Extreme weather events would still have occurred – even though average levels were much reduced – which makes siting the primary occupational site on hydrologically tolerant ground the most prudent course of action. It is thus difficult to identify any climatic driver in the siting of early Saxon occupational sites; if climatic conditions were influential in their siting, then why is there such a clear preference for locations possessing the lightest, most well-draining soils in a period when climatic conditions would have made those sites with heavier soils far more hospitable, especially when compared to later periods? It seems far more likely that local soil conditions and slightly sloping topography were the primary drivers of early Saxon occupation site positioning, for regardless of climatic conditions well-draining sites – such as Site 42 – are inherently more tolerant of hydrological input than heavier soils.

The primacy of terrestrial variables – such as soils and topography – is also apparent at those sites interpreted to be some form of outlying farmstead as opposed to an occupational site. Sites 14 and H44/1 – which are possibly outlying farmsteads serving the principal occupational site at Site 42 – similarly occupy slightly sloping terrain and lighter soils (Davison 1990: 16). Whilst the precise nature of exploitation occurring at these sites is impossible to discern given the limited evidence, this is not particularly problematic, for regardless of the mode of exploitation the location of these sites on the lightest tracts of soil – combined with the dry climatic conditions prevailing at the time – once again makes a climatic driver unlikely. For example, if we assume these concentrations represent limited

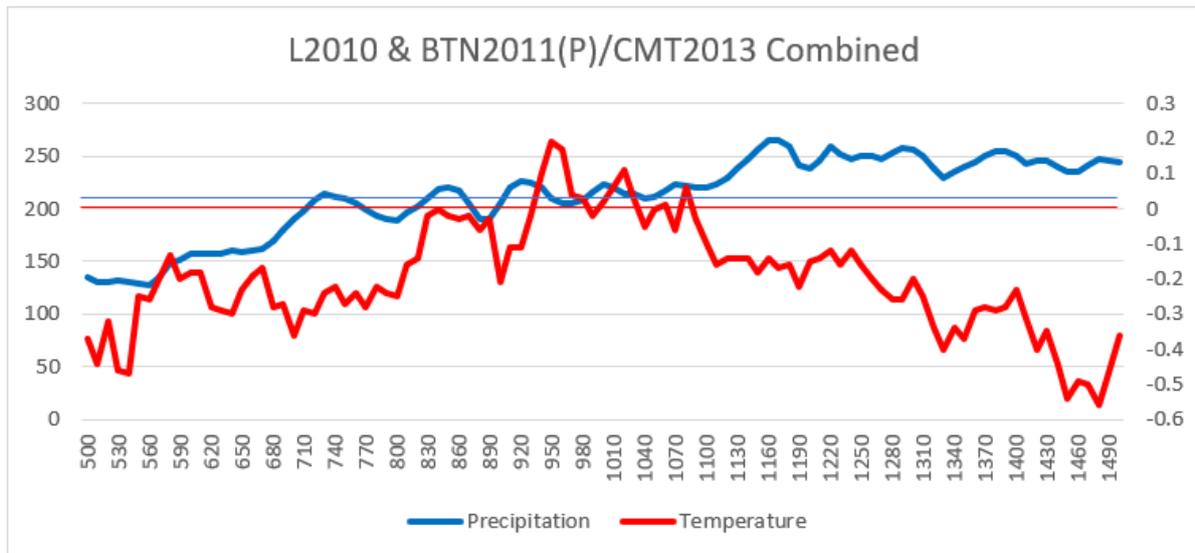


Figure 69: Temperature and precipitation over the course of the medieval period, based on L2010, BTN2011(P), and CMT2013.

areas of arable, then these tracts of light soils – which early Saxon settlers appeared to have overwhelming favoured – would have been made less hospitable during the period in question, for the lower rainfall on Newport soils would make them more susceptible to drought due to reduced PAW, which combined with the low temperatures experienced during this time would only have exacerbated the poor thermal properties of the soils, ultimately stunting crop growth. The only way climatic conditions at this time could have had a positive impact upon the soils is through the reduction of mineral and nutrient loss due to reduced precipitation totals, but even then the droughtiness of these soils is a far more difficult issue to overcome than low fertility; after all, infertile soil will still produce a stunted crop, whereas completely moisture deficient soil will not produce a crop at all. However, it must be remembered that whilst light soils would, in the early Saxon period, have been made less hospitable by climatic conditions, they remain far more forgiving to agriculturalists, providing them with a more extensive window of opportunity for landwork, thereby lessening the chance of climatic conditions causing significant issues with ploughing and harvesting.

A more plausible explanation as to why early Saxon arable farmers may have preferred the areas of the lightest soil is purely anthropogenic in nature, for the agricultural equipment which these early Saxon agriculturalists possessed was simply not advanced enough to cultivate the heavier soils found in the centre and southern portions of the Three Parishes study area. Andersen *et al.*, Fowler, Hill, Hamerow, Langdon, McKerracher, Payne, and Williamson have all discussed the impact which the heavy mouldboard plough has had on agriculture in the British Isles and across Europe, and it is the general consensus that a version of a heavy mouldboard plough was operated in Roman Britain, but subsequently disappeared after the collapse of Imperial administration and only saw *widespread* reintroduction in the tenth and early eleventh centuries (Andersen *et al.* 2014: 1-18; Fowler 2002:

203; Hamerow and McKerracher 2022; Hill 2000: 7-19; McKerracher 2018: 7-22; Langdon 1986: 27, 72; Williamson 2012: 16-7). However, whilst this chronology is likely accurate *sensu lato*, the discovery of an iron plough coulter at a late seventh-century monastic site in Lyminge in Kent suggests that the reintroduction of the mouldboard plough was likely more gradual, occurring over several centuries and likely progressing at differing rates in differing contexts; given the wealth of monastic institutions it is no great surprise that new technology appears to have first emerged in a monastic context (British Archaeology 2011: 200-1; Fowler 2002: 203-5; McDonnell *et al.* 2016: 742-758; Williamson 2012: 18-9). There is thus little cause to suggest that the reintroduction of the mouldboard plough reached every locale in the seventh century, for it is likely that only the richest farming communities could afford this emerging technology. The previously stated chronology that posits that *widespread* reintroduction was only achieved in the tenth and eleventh centuries appears to hold true. Anthropogenic factors therefore seem to be the driving force behind the early Saxon predilection towards sites which possess lighter soils, with little indication that climatic fluctuations were playing any meaningful role.

Even switching the lens to pastoral agriculture reveals no indication that climatic fluctuations were influencing the development of settlement at a macro-scale. The scarcity of occupational sites indicated by the archaeological evidence would provide ample space for grazing flocks, and thus competition for suitable pastureland would have been substantially less than that experienced during later periods, both in the valleys of the Chet and the local becks and up on the heavier soils in the south of the region. Once again, there is little evidence to suggest that climatic fluctuations were playing any meaningful role in the development of settlement.

However, whilst the data from Loddon, Hales, and Heckingham shows no correlation between climatic fluctuations and early Saxon settlement, the narrative is slightly different in Fransham. Sites ES 2, ES 3, and ES 4, which Rogerson considers to be outlying farmsteads rather than 'tiny and far-flung patches of manured arable' occupy the fringes of the medium loamy and heavy loamy soils of both the Medium Claylands and the Heavy Claylands Subzones. Whilst we do not know the mode of landscape exploitation being practiced from these outlying sites – and indeed if they were even contemporaneous with the primary occupational site at ES 1 – both arable and pastoral exploitation could potentially have been aided by the reduced precipitation levels being experienced at the time, for both modes of exploitation on these loamy, clayey soils would have found this period more climatically hospitable than later periods. For pre-eighteenth century arable, the high PAW content of these soils offsets the negative effects which reduced precipitation levels can bring. Furthermore, the low temperatures experienced during this multi-century period would have increased the chances for winter frosts which were so vital in breaking down the soils, with lower temperatures also reducing

the chance of particularly warm summers which could bake the soil dry. There is thus the potential for early Saxon expansion onto heavier soils in this region to be, at least in part, attributed to climatic fluctuations. However, when the developments in agricultural technology – or lack thereof – are taken into consideration, it seems unlikely that the positioning of these sites on the fringes of the Medium Claylands can be attributed to climatic factors. Rather, they were positioned so as to take advantage of the lighter ‘inland’ soils of the Medium Claylands Subzone whilst also providing easy access to what was likely extensive areas of grazing on the heavier, wetter soils of the Heavy Claylands Subzone. That the most extensive tracts of the heaviest soils in the parish are entirely devoid of ceramic evidence is perhaps evidence that early Saxon agriculturalists lacked the necessary technology – namely the heavy mouldboard plough discussed earlier – required to cultivate the heavy, intractable soils, with the extent of arable exploitation and habitation confined to the lightest soils of the Medium Claylands, which in this heavy landscape were the ‘lightest’ soils in the area. This is a critical point, for it demonstrates the primacy of anthropogenic developments and terrestrial environmental factors over that of climatic variables. Even if climatic conditions were ideal, human exploitation can only occur if the necessary developments in technology have been achieved, which coupled with the simple fact that fluctuations in climatic conditions were never severe enough to override the basic characteristics of the soils ensures that finding any climatic influence on the development of settlement at a macro-scale is unlikely even in this marginal landscape.

There is thus no persuasive evidence from either the Three Parishes or Fransham that indicates that climatic fluctuations were playing even a minor role in the development of early Saxon settlement. It seems far more likely that anthropogenic and terrestrial environmental drivers were the most influential variables, for there is clearly a desire for dry, hydrologically capable sites for dwellings and light, easily workable soils for arable; where this latter desire is not immediately available – such as in the rather heavy landscape of Fransham – early Saxon sites appear to have gravitated towards the lightest of the heavy soils, positing themselves in such a way as to allow easy access to the extensive areas of grazing that must have been in operation on the Heavy Claylands Subzone.

Middle Saxon: c. 720 – c. 850

The middle Saxon period saw both an increase in activity and a shift away from those places occupied during the early Saxon period. In the Three Parishes the new focus of settlement appears to have shifted to the northern valleys, with considerable evidence of middle Saxon occupation on the loamy lower slopes adjacent to the Chet and Heckingham Beck in the north-east, often on the transition between the wetland river soils – in this case Isleham 2 – and the Medium Claylands Subzone. There also appears to have been some exploitation of the heavier upslope soils to the west and east of Heckingham Beck, although this is limited to a handful of probable manuring scatters. Whilst

Heckingham is best represented by the data, the decline of this parish in the centuries after the middle Saxon period have ensured that much of the land is undeveloped and dominated by arable fields; Loddon, on the other hand, was much more successful and remains the focus of settlement today, with the modern town of Loddon being heavily developed. As discussed earlier in this chapter, it is possible that middle Saxon occupation of Loddon was greater than the fieldwalking, PAS, and NHER data would suggest, and it is thus difficult to *definitely* state that the middle Saxon focus was indeed at Heckingham, for it may be the case that modern developments are obscuring much of Loddon's middle Saxon heritage. However, that the handful of middle Saxon sherds and other small finds recovered from Loddon mirror the topographical and pedological contexts of middle Saxon settlement elsewhere in the Three Parishes do nothing do later the overall picture of settlement in the study area.

This is not to say that the possibility of a climatic driver is *entirely* out of the question. In the Three Parishes, and indeed in Fransham, expansion onto the heavier soils could be aided by the prevailing climatic conditions experienced throughout the period, for whilst conditions were undeniably wetter – and getting wetter throughout the period – during this time the soils of the Medium and Heavy Claylands would still have been more workable than in later periods, especially on the slopes where many of the manuring scatters of middle Saxon date were primarily found. This still does not explain, however, why the early Saxon inhabitants did not exploit these soils if climatic fluctuations were amongst the principal drivers, for these soils would have been even more receptive during this earlier period. Furthermore, why is exploitation of the Claylands still largely confined to the peripheries of heavier environments where the lightest soils of the Claylands are primarily found, with only minimal expansion onto the heaviest soils? It is possible that the middle Saxon population was simply not high enough to warrant further expansion onto the heavier soils, with the limited examples of middle Saxon material found on these heavier soils being a simple result of pragmatism; after all, why cultivate extensive tracts of land when all the community needs to survive and thrive is a fraction of the total land area? Nevertheless, the rate of expansion on the lighter peripheral soils and the relative dearth of expansion onto heaviest soils seems to damage the notion that a climatic driver was amongst the principal agents of settlement development in the middle Saxon period.

There is also the possibility that the nucleation of middle Saxon settlement was driven, at least in part, by the increasingly wet conditions. Wetter conditions would have made timely ploughing critical; dispersed settlement does not lend itself to swift exploitation of favourable climatic conditions, which in England can turn from ideal to terrible in a matter of hours. However, this once again does not explain why settlement shifted to far more climatically vulnerable locations as conditions were becoming more problematic. The middle Saxon evidence thus contradicts, for the most part, a narrative which exalts climatic fluctuations as the primary driver of settlement development.

| Heavy Claylands Subzone | | |
|-------------------------|--|--|
| Soil association | Constituent series | General character of association |
| 711r – Beccles 1 | Beccles – fine loamy over clayey stagnogley (surface-water gley); Ragdale – heavier pelostagnogley, mottled below Ap horizon; Aldeby – typical stagnogley, similar to Beccles; Hanslope – calcareous pelosol, heavy clay, slowly permeable, non-gleyed | Heavy clayey, slowly permeable stagnogley/pelostagnogley soils; very poor drainage; prone to winter waterlogging and summer cracking; typically on level or gently sloping plateau surfaces. |
| 711s – Beccles 2 | Beccles – typical stagnogley; Aldeby – stagnogley; Blackwood – sandy gley, mottled, sensitive to groundwater fluctuations (on muted crests) | Moderately to heavily clayey stagnogleys with occasional lighter sandy gleys; slowly permeable; poor drainage; similar to Beccles 1 but with lighter crest soils. |

Table 11: Heavy Claylands soil chart.

| Medium Claylands Subzone | | |
|--------------------------|---|---|
| Soil association | Constituent series | General character of association |
| 572n – Burlingham 1 | Burlingham – fine loamy stagnogleyic argillic brown earth; mottled subsoils; slowly permeable; Ashley – fine loamy over clayey stagnogleyic argillic brown earth; similar to Burlingham; Hanslope – typical calcareous pelosol; heavy clay; slowly permeable; Wighill – coarse loamy stagnogleyic argillic brown earth; faint mottling; slowly permeable; Wick – non-calcareous typical brown earth; loamy, freely drained, unmottled; Newport – typical brown sand; stony sandy loams; freely drained, unmottled; Hopsford – fine loamy gleyic brown earth; slight mottling; permeable subsoil; Wigton Moor – medium loamy typical cambic gley; groundwater gley; mottled and gleyed | Mixed clayey–loamy stagnogleyic association with strong topographic structuring; drainage improves downslope from heavier stagnogleys to freely drained sands; upper slopes slowly permeable, lower slopes variable; valley floors prone to groundwater gleying. |
| 572p – Burlingham 3 | Burlingham – stagnogleyic argillic brown earth; slowly permeable; Ashley – stagnogleyic argillic brown earth Weasenham – typical argillic brown earth; unmottled; moderately well drained; Maxted – typical paleo-argillic brown earth; well drained; Barrow – typical paleo-argillic brown earth; well drained; Newport – typical brown sand; freely drained; Isleham 2 – sandy/peaty gley | Similar to Burlingham 1 but with more mid-slope well-drained paleo-argillic brown earths; upper-slope stagnogleys remain slowly permeable; lighter soils moderately droughty in dry years; seasonally waterlogged on heavier series but generally more workable than the Heavy Claylands. |

Table 12: Medium Claylands soil chart.

Saxon-Norman: c. 850 – c. 1150

The Saxo-Norman period witnessed the beginnings of a period of expansion that would persist through the medieval period (c. 1150 – c. 1400). Whilst the intensity of expansion in the Saxo-Norman period in both the Three Parishes and Fransham pales in comparison to that which followed, the beginnings of the trends which define the medieval period are clearly observable. In Heckingham in the Three Parishes, the focus of settlement appears to have shifted away from the riverside locations favoured in the middle Saxon period, especially west of Heckingham Beck and in north-east of St. Gregory's Church. This potentially has a climatic and environmental explanation. The overall morphology of precipitation rates between c. 850 and c. 1150 is one of a gradual but defined increase, with the multidecadal period between c. 910 and c. 940 being particularly wet and warm, a dangerous combination on heavier soils. It is possible that low-lying or flat sites became less hospitable during this period of above average precipitation rates, for some mitigating action – which could potentially be interpreted as a response to wetter conditions – does seem to have been taken, as almost all of the Thetford Ware and Early Medieval Ware that was recovered from the main body of the Medium Claylands in the Three Parishes was recovered from sloping terrain which would have aided drainage to some extent, with a similar pattern emerging from the data gathered in Fransham. Similarly, those sites which fall within the Heavy Claylands Subzone are also regularly located on gently sloping ground. A number of riverside sites were also abandoned during this period, especially along the Chet; it is possible that using these riverside locations as grazing would have been difficult in a wetter climate, as the mechanical damage inflicted upon the wet, waterlogged grass by the feet of livestock would essentially ruin the turf, preventing any further use of the land as pasture.

However, it is clear from the evidence gathered by Davison and that recorded by the PAS that for the first time in the study period settlement in the Three Parishes was beginning to expand onto the Heavy Claylands Subzone, with a further expansion of activity also occurring on the Medium Claylands Subzone. Whilst this expansion is limited – and as previously mentioned pales in comparison to later medieval expansion – it nevertheless signals the initiation of anthropogenic colonisation of heavier, far more intractable land, a colonisation likely necessitated by an increasing population and made possible by technological advancements in agricultural implements. A similar colonisation of heavy land is occurring in Fransham, with LS 1 – the primary Saxo-Norman site which is itself a continuation of MS 1 – being much extended throughout this period, an expansion which is also indicative of an increasing population. Demographic growth is also evidenced by the number of sites and manuring scatters established further afield from LS 1, which often occupy the heaviest soils within both the Medium Claylands and the Heavy Claylands Subzones. That expansion onto loamy clayey soils was occurring at a time when precipitation totals were rising – thus making the land more difficult to work

– and which contained a multi-decadal period where temperatures were high and precipitation was slightly reduced – thereby making warm, drier winters more likely – ultimately ensures that it is difficult to ascribe developments to climatic fluctuations, for during this period the soil would have been particularly sensitive to compaction and waterlogging. That expansion was so widespread during this period is highly suggestive that any fluctuation in climatic variables was not severe enough to cause any notable shift in settlement trends; that this appears to be the case here, in one of the most marginal geological landscapes during a time of considerably elevated precipitation totals suggests that climatic fluctuations are unlikely to have played a role in the development of settlement at a macro-level even in similarly marginal landscapes.

The Saxo-Norman evidence is thus dualistic; on the one hand the abandonment of low-lying sites and the preference for sloping terrain could potentially be attributed to climatic fluctuations, whilst on the other hand the expansion onto areas of heavier soils is entirely at odds with the prevailing surface conditions caused by fluctuations in climate. The most likely conclusion to this dualistic character is that once again terrestrial environmental variables and anthropogenic developments were the driving force behind the pattern of settlement, with climatic variables being either entirely redundant or playing a role that is not detectable at a macro-scale. It is probable that the heavier soils brought into cultivation during this period were only able to be put to the plough due to agricultural technology becoming more advanced; this expansion of cultivation was being driven by the need to feed the ever-growing populace, and the most pragmatic choice of site for the new arable fields and their associated farmsteads was sloping terrain which naturally aids drainage. It is thus possible to explain the pattern of settlement without the need to introduce climatic variables, strongly suggesting that fluctuations in climate were likely playing little role in the development of settlement at a macro-scale.

Medieval: c. 1150 – c. 1350

The evidence from the medieval period describes an unprecedented level of expansion in both the Three Parishes and Fransham. In Fransham, the medieval period saw settlement flourish, with particularly intense periods of expansion occurring during the twelfth and thirteenth centuries. Whilst pre-medieval settlement is largely centred on the Medium Claylands with some limited expansion creeping onto the Heavy Claylands, by the twelfth century this pattern is entirely reversed. The bulk of twelfth-century material was recovered from the Heavy Claylands, with many sites – such as Med 31, Med 32, Med 63, and Med 95 – occupying areas possessing the heaviest, most intractable soils. A similar pattern is found in the distribution of thirteenth century material, which also gravitates towards the heaviest soils. In the Three Parishes, those places occupied in the Saxo-Norman period appear to persist into the medieval period, with a whole host of additional manuring scatters populating the landscape of the Medium Claylands to such a degree that few fields are without

evidence of medieval activity. Green-edge occupational sites have appeared in all three parishes, with these greens often occupying the crests of the low plateaus. Expansion onto the Heavy Claylands Subzone has continued, albeit to a lesser degree than that witnessed in the Medium Claylands. There is thus a considerable degree of activity occurring within the medieval landscape in both surveys, with this activity often occurring on the heaviest ground, especially in Fransham where the local landscape is dominated by the Heavy Claylands.

There is perhaps no better period than the medieval to highlight the disconnect between climatic fluctuations and human expansion. This entire period is one in which climatic conditions were consistently worsening, with the entire c. 1150 to c. 1400 period one of considerable vulnerability in both the Medium Claylands and the Heavy Claylands Subzones. The loamy clays of the Medium Claylands would be suffering from excesses of water which would have been even more pronounced than those experienced during the Saxo-Norman period. These loamy clay soils can cope well in droughts, but like the heavier clay loams it struggles to cope with increased precipitation, with seasonal waterlogging a particular issue on concave or even level ground. That the Medium Claylands witnessed such widespread colonisation over the course of the medieval period in the Three Parishes is further evidence that climatic fluctuations were either not severe enough over the long term to cause changes in settlement or that communities were adept at dealing with unfavourable climatic conditions, with the former being the most persuasive suggestion.

Whilst the Medium Claylands would have been wet, the Heavy Claylands would have been even wetter and more inhospitable to those wishing to exploit the land as arable, with the only mitigating climatic factor being that this was accompanied by dramatically reduced temperatures, thereby allowing frost to break down the soils over the winter months. If climatic conditions were the principal driving force behind this expansion onto heavier soils, this period should be one marked by an increase in activity on well-drained sites and a reduction in activity on poorly drained sites, but this simply is not the case in either the Three Parishes or Fransham. As well as arable exploitation, which is indicated by extensive medieval manuring scatters that mimic Jones' model, there also appears to have been a large amount of heavier land utilised as areas of woodland or pasture early on in the medieval period, with this especially true in the Three Parishes (Davison 1990; Jones 2004: 159). The usage of heavy land as grazing grounds for livestock is one way of turning problematic land into productive land, with the need to bring every inch of the landscape into a state of productiveness perhaps reflecting the pressure a growing population exerted on the landscape; Loddon alone is estimated to have doubled in population over the course of the medieval period (Davison 1990). However, the extent of manuring scatters suggests that as the medieval period progressed more and more land was being put under the plough to cope with the increasing pressure caused by an expanding population, with the most

likely victim of arable expansion being the heavier grazing grounds. It would thus appear that population pressure, which was almost certainly an issue in the pre-1348 period, outweighed the negative surface effects caused by the climatic deterioration which so defined the medieval period.

The reappearance of low-lying sites along the Chet in the north of the Three Parishes, which seemingly disappeared in the Saxo-Norman period, also indicates that climatic conditions were playing little role in the development of settlement. That these sites were evidently in use during one of the wettest and coldest periods in the second millennium is entirely contradictory to the notion that climatic fluctuations were driving changes in settlement, for during this period climatic conditions would have been making low-lying sites particularly wet and inhospitable. This pattern is also observable in Fransham – albeit to a lesser extent due to the lack of riverine environments – with several medieval sites emerging in the east of the parish near to the small stream, which similarly carries wetter soils.

However, there is a limited body of archaeological evidence which potentially indicates that in some instances changes in settlement morphology in the medieval period may have been influenced by climatic fluctuations. Significant concentrations of finds were made on the junction between the Medium Claylands and the Heavy Claylands Subzones in both the Three Parishes and Fransham. These farmsteads, located close to the fertile but hydrologically sensitive Heavy Claylands and Medium Claylands Subzones, would need to work the field when climatic conditions were perfect; too wet and the soil would compact, and too dry and the soil would be impenetrable to even the heavy mouldboard plough. Thus, in order to make the most of a short window of opportunity – a window which would be even shorter in periods of increased precipitation – a site nearer to the fields on which they worked was the most pragmatic solution. Whilst the settlement pattern hinted at by the medieval evidence does not suggest nucleation on a similar scale to that found in the Midlands, there is nevertheless a degree of clustering on the margins of the heaviest soils which only emerged once climatic conditions had become extremely wet and cold.

Also hinting at the possibility of a climatic influence is Site H19 in the Three Parishes. Whilst the majority of sites identified by Davison produce material dating to a rather extensive temporal window, one site, Site H19, appears to have been established and abandoned within the span of just a handful of decades in the late twelfth and early thirteenth centuries, and this low-lying, alluvial site produces some interesting correlations with climatic conditions. The period in question – the late twelfth and early thirteenth century – is one of only two periods which sees temporally limited reductions in precipitation levels. It is thus possible that the reduction in precipitation levels c. 1180 prompted an entrepreneurial agriculturalist to expand onto this hydrologically sensitive site. However, the



Figure 70: The predilection of medieval sites to occupy the edge of greens is clear in Hales in the Three Parishes. Here the fossilised green is clearly surrounded by medieval sites.

subsequent rise in precipitation levels which began c. 1210 and which had recovered to pre-c. 1180 levels by c. 1220 made continued cultivation of this particular plot of land untenable, leading to its abandonment. It is freely admitted that this theory has notable issues, not least the fact that even in this lull precipitation was still above average; however, to the individual or group of individuals who were responsible for expanding onto this site this period of reduced precipitation may have been particularly notable, and it must have seemed, especially to the older generation, that the rain which so defined their early years was beginning to ease. Nevertheless, it remains an interesting potential correlation between climatic fluctuations and settlement, although this one site is evidently far too evidentially limited to overly influence any conclusions.

There is thus a considerable amount of evidence from the medieval period which appears to further the assertion that settlement was not particularly affected by long-term climatic fluctuations. Whilst there is an extremely limited body of evidence which suggests that climatic fluctuations do, in some rare cases, correlate to shifts in settlement, the evidence is too scarce and circumstantial to be considered reliable. Furthermore, given the volume of evidence it is almost a certainty that at some point a correlation would occur, and it is thus entirely within reason to suggest that these correlations could be labelled false positives.

Late medieval: c. 1350 – c. 1500

Climatic conditions from c. 1350 onwards were similar to the conditions experienced in the medieval period, and although temperatures were still declining precipitation levels were slightly reduced from those experienced throughout much of the preceding period. Nevertheless, this is still a period characterised by wet weather and significantly reduced temperatures, conditions which would have made working the soils of the Claylands CZ difficult.

Whilst there is little evidence for changes in settlement correlating to fluctuations in climate in the medieval period, taken in isolation the late medieval period appears to buck this trend, with settlement contracting significantly in both the Three Parishes and Fransham. However, this contraction is far more likely to have been caused by the Black Death than by climatic factors. The devastation caused by the Black Death cannot be understated; Carenza Lewis, who has attempted to estimate the death toll via ceramic evidence, suggests that there was a forty-five percent decline in ceramic production in England, with Norfolk witnessing a particularly severe drop of sixty-five percent (Lewis 2016: 77-97). This largely aligns with the general consensus that the Black Death killed between a third and just over a half of England's population (DeWitte 2014; Glatter 2021; Lawton 2022; Benedictow 2021; Snowden 2019). Given that the large-scale reduction in late medieval finds mirrors this drop in population, it is not unreasonable to consider the Black Death, not the deteriorating

climatic situation, as being the primary driver of settlement contraction that is so well depicted in the archaeological record.

It is also possible that the sparser concentrations of late medieval finds and the apparent reduction of manuring scatters is reflective of a change in agricultural practices. Williamson and Bellamy have theorised that the adoption of convertible husbandry occurred in the late-medieval and early post-medieval period, with this practice bringing with it a different method of landscape exploitation. Whereas arable was periodically laid to fallow in the medieval period, Williamson and Bellamy suggest that under a convertible husbandry regime arable land was periodically laid to grass for numerous years instead of being fallowed in the traditional sense (Williamson and Bellamy 1987: 86). This would naturally lead to a reduction in manuring scatters as arable exploitation would not have been as extensive as it perhaps once was.

The spatial context of the archaeological evidence recovered from both the Three Parishes and Fransham Parish also suggests that climatic fluctuations were unlikely to be exerting any meaningful degree of influence on settlement. In Fransham, the collapse of occupational sites in the mid-fourteenth century and the relative dearth of new sites appearing in the fifteenth century cannot reasonably be attributed to climatic factors, for if this was the case settlement should have refocused on lighter land. That the first signs of recovery following the Black Death occurred on heavy land further evidences the fact that it must have been other forces, not climatic ones, which were the primary drivers of settlement change. In the *Three Parishes* a similar trend is emerging, with only a handful of new sites appearing in the fifteenth century which are nearly all on heavy land. There is also no realignment of activity onto lighter soils, with green-edge sites still the major foci in the region, especially in Hales and Heckingham. There is thus very little evidence suggesting that climatic fluctuations were the principal driving force behind the evolution of settlement in both the Three Parishes and Fransham in the late medieval period.

The point raised above, namely that there is little evidence of any realignment to the lighter soils in a period when climatic conditions were particularly unfavourable to the exploitation of heavier soils – with the lack of evidence for such a realignment suggesting, by extension, that climatic conditions were not severe enough to warrant a shift in focus – is also supported by a detail discussed by Pribyl in her excellent precipitation and temperature indexes (Pribyl 2017). In these indexes, which were discussed in *Chapter Two: Investigating the climatic*, it is clear that fluctuations in climate were playing a pivotal role in determining the date of, and the duration of, the harvest (it is critical to note that this thesis is, in no way, disputing that the role of climate in contexts such as these). Pribyl's research demonstrates the impact that an increase or decrease in rain days from July onwards can have on the

harvest, with an increase in rainfall during the harvest period ensuring that the harvest process was more labour-intensive, lengthening the harvest (Pribyl 2017: 143-159). Conversely, reduced levels of precipitation were likely to shorten the harvest period, as the grain could both dry quicker and be harvested with reduced labour input (Pribyl 2017: 143-159).

One of the most interesting details within Pribyl's research is the widespread evidence for an early example of a climate adaptation measure adopted by many of the manors, many of which are situated within the Claylands CZ. By switching to mowing – a method of collecting the harvest which was both quicker and less labour intensive than reaping – the harvest length could be shortened, reducing the risk of precipitation negatively impacting the grain harvest. In wet years, when extra steps were necessary to dry out the grain, the extra time gained by mowing would have been particularly vital (Pribyl 2017: 147). Beginning in the mid-fourteenth century, mowing had become a common practice by the 1410s and was particularly important in the post-Black Death period when labour shortages were rife (Pribyl 2017: 147-8).

This adaptation measure is a particularly telling aspect of the medieval response to climate change. Rather than realign exploitation onto lighter soils – an extreme adaptation measure but one that was entirely possible in the post-Black Death period – medieval agriculturalists instead chose a far less extreme adaptation method; namely, change the method of harvesting. That this 'lesser' adaptation method is evidenced across a multitude of manors at a time when precipitation levels were above average and temperatures were in a prolonged trend of decline is notable, for it suggests that even during these climatically-challenging times the climatic conditions were simply not extreme enough to warrant extreme adaptation measures; instead, lesser measures – such as switching to mowing – were adequate to adapt to the changing climate. It is thus unsurprising that the archaeological evidence reveals little correlation between climatic fluctuations and changes in settlement at a macro-spatial resolution, for mitigating against the unfavourable climatic conditions could clearly be achieved by changing something as relatively simplistic – when compared to a complete realignment of exploitation – as the method of harvesting.

Conclusion

Taken as a whole, the archaeological evidence from the Three Parishes and Fransham contains very little evidence that macro-scale changes in settlement were being driven by climatic fluctuations. Climatic conditions in the early and middle Saxon periods were ideal for expansion onto the heavy soils of the Claylands CZ, but no such colonisation occurred. Instead, settlement was limited to the lightest of soils, with only minimal colonisation of heavier land. Clearly other factors were playing a far greater role in determining settlement siting than factors of climate. The increased rainfall and

plummeting temperatures that began to set in c. 1070 coincided with a period of unprecedented expansion of settlement that is entirely contradictory to a climatically deterministic narrative. Whilst the decline of occupational sites and settlement more generally in the late medieval period does, at first glance, appear to correlate with climatic conditions, the Black Death is the principal agent of this collapse; furthermore, there is no realignment to the lighter soils despite the Black Death providing the reduction in demand and the space to realign. It is thus clear that in the Claylands CZ climatic fluctuations were playing little role in the development of settlement; instead, anthropogenic and terrestrial environmental variables were the real drivers of settlement change, whether this be in the form of technological advancement, macro-scale mortality events such as the Black Death, the evolution of different modes of landscape exploitation and harvesting methods, or differing types of soils.

Chapter Six: Breckland

Introduction

This chapter will analyse the archaeological, historical, and geological evidence from the Breckland CZ and discuss the relationship between this evidence and fluctuations in historic climatic conditions.

Spatial, geological, and historical contexts

Illington, which lies approximately 11km north-east of Thetford, covers 5.2km² in the south-east of the Breckland CZ and is the smallest survey discussed in this thesis. This survey is bounded to the north by a narrow stream which drains eastwards into the Thet, with this stream the only substantial body of water present in Illington (Davison 1993: 1-6). Topographically, Illington is relatively unremarkable. In the northern portions of the survey area, where the small stream flows through the parish elevation lies between 24m and 26m OD and marks the lowest part of the survey area. In the south-west the ground rises to 46m OD, the highest part of the parish. This highest part is on a small rise which dominates the south-western and western portions of the parish. In the south-east and east the ground is relatively level at 32m OD.

Illington lies within the Breckland CZ, and due to the relatively limited extent of the survey area only a single association – namely the Worlington association – is present in the non-alluvial parts of the parish. These sandy, non-calcareous, slightly acidic soils are amongst the deeper soils of the Breckland CZ, with this depth ensuring that Breckland's calcareous solid geology is further from the upper horizons ensuring that these will be more acidic than calcareous. Due to their sandy character these soils are extremely well drained, and it is thus a lack of water rather than an excess of water which is the primary threat, although it is important to note that increased rainfall is likely to wash out lime and nutrients from the soil, reducing its fertility. These soils are, however, easy to work, and are far more forgiving than the heavier soils which dominate much of southern and central Norfolk. In the north of Illington, along the course of the small stream, is a large tract of the deep sandy and peaty Isleham 2, with a small parcel of the peaty Adventurers' 2 in the east. Davison observes that there are a number of small pockets of sandy gravels on the low mounds in this marshy, wetland environment (Davison 1993: 1). There are also similar pockets of differing material within the main body of the Worlington soils. Pockets of gravel and clays are noted by Davison to occur throughout the parish, although these are extremely limited in their spatial extent (Davison 1993: 1). Whilst no geological map is provided by Davison, fieldnames such as 'Clay Pit Piece' and 'Sand Hill Close' as recorded on the Tithe Map allow the approximate location of some of these gravelly and clayey inclusions to be identified (Davison 1993: 1).



Figure 71: Illington study area.

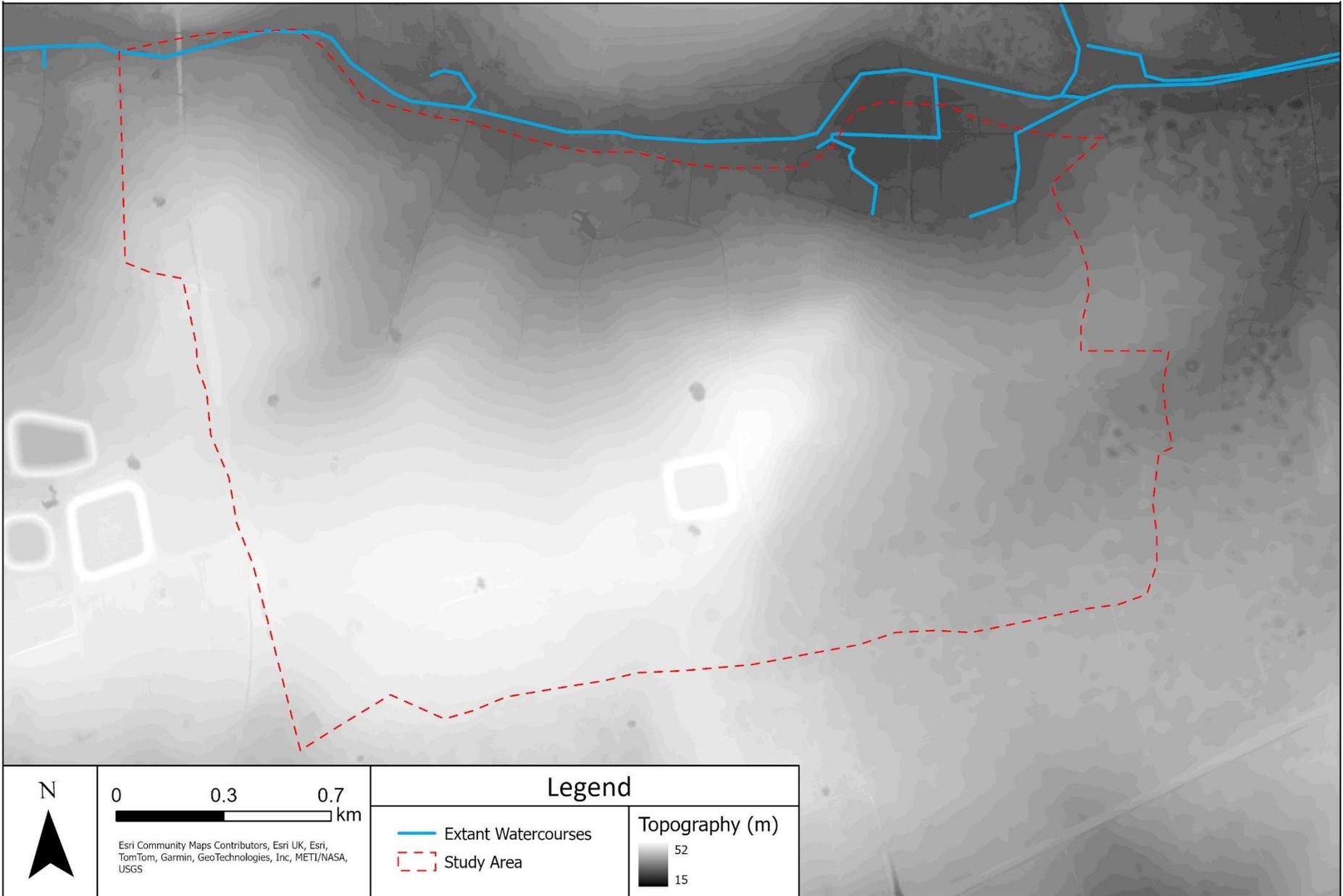


Figure 72: Illington and its topography. Note the four modern irrigation reservoirs.

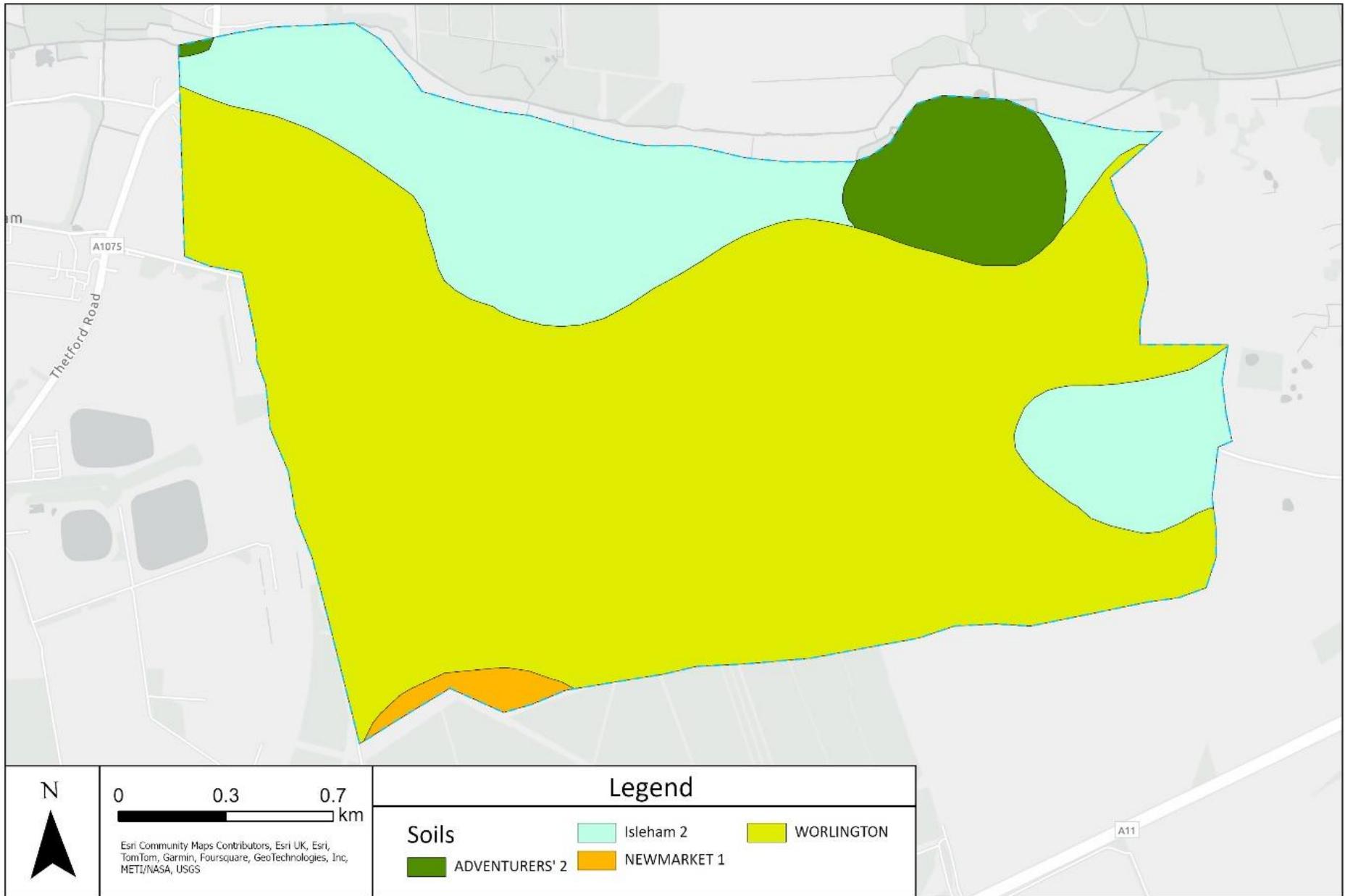


Figure 73: Illington and its soils.

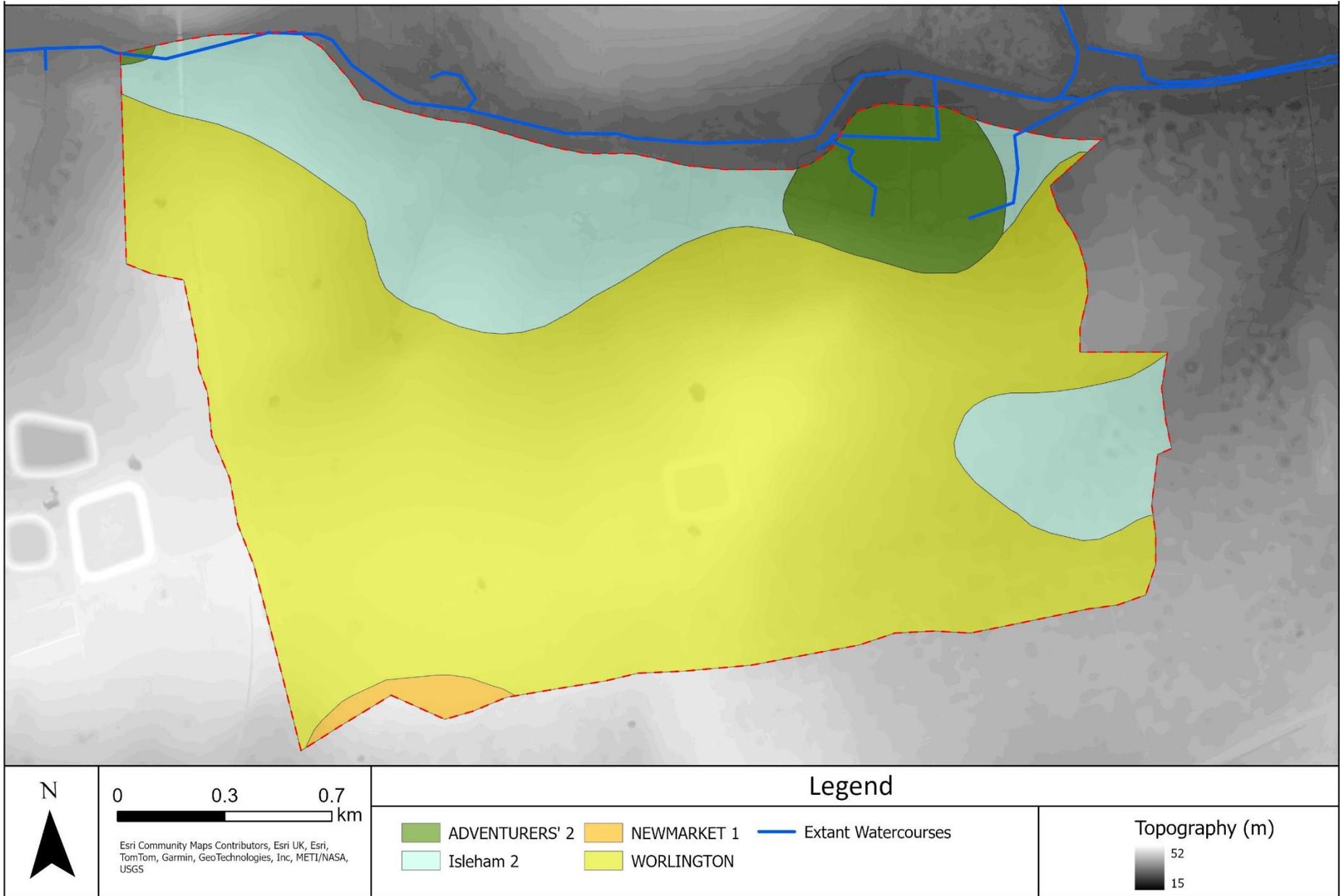


Figure 74: Composite showing Illington's topography and soils.

Romano-British settlement in Illington appears comparatively limited in both intensity and extent when measured against other areas investigated in this thesis. Two concentrations of Romano-British material were identified by the fieldwalking, both of which are situated in the northern part of the parish. One of these is located on the sloping ground near to the junction between the wetter, heavier Isleham 2 soils and the lighter, freely draining soils of the Worlington association, whilst the other is wholly within the Isleham 2 soils, once again on sloping terrain (Davison 1993: 2-4). These sites – which are located upslope of the extant watercourse – yielded modest quantities of pottery and building material and are thus likely to represent small-scale occupational sites surrounded by thin manuring scatters (Davison 1993: 2-4). In the southern half of the parish only a light, dispersed scatter of Romano-British pottery was recovered from the main body of the sandy Worlington soils, likely the result of manuring rather than occupation (Davison 1993: 2-4). The overall distribution of Romano-British material suggests a marginal presence in the Illington landscape, with settlement confined to the well-drained slopes near to small watercourses.

Compared to Davison's *Illington Parish*, which covers just 5.2km², Rogerson's *Barton Bendish* covers some 17.5km² in the extreme north-west of the Breckland CZ, 10km west of Swaffham. Whilst the majority of this survey lies in this CZ, parts of its western flank lies in the Western Escarpment CZ. Much of the north-eastern and eastern boundary of the *Barton Bendish* survey is formed by the Devil's Dyke, whilst a number of streams form much of the remaining boundary on all sides.

Barton Bendish is one of the most topographically diverse landscapes discussed in detail in this thesis. In the southern-most half of the survey area much of the southern, western, and eastern boundaries lie at just 4m to 7m OD, whilst in the northern half the boundaries are slightly more elevated, lying at between 10m and 20m OD. The interior of the southern two-thirds of Barton Bendish is dominated by a handful of small, but locally significant hills which typically lie between 12m and 26m OD, with the largest of these occupying a central position within the survey area. The northernmost third of the survey area is also characterised by gently undulating terrain and is dominated by Narborough Hill, which is the most elevated locale in the survey area lying at approximately 30m OD. This hill is, however, limited in its spatial extent, with much of this hill's landmass lying outside of the survey area. The far north of the survey area is much altered due to the upgrading of RAF Marham's infrastructure to concrete in 1944.

Romano-British settlement in Barton Bendish was extensive, with no corner of the parish recording an absence of material. A cluster of Romano-British sites – Sites 2, 3, 4, 5, 6, 8, and 9 – are located to the east of St Mary's Church along the sloping junction zone between the lighter Newmarket 1 soils



Figure 75: Barton Bendish study area.

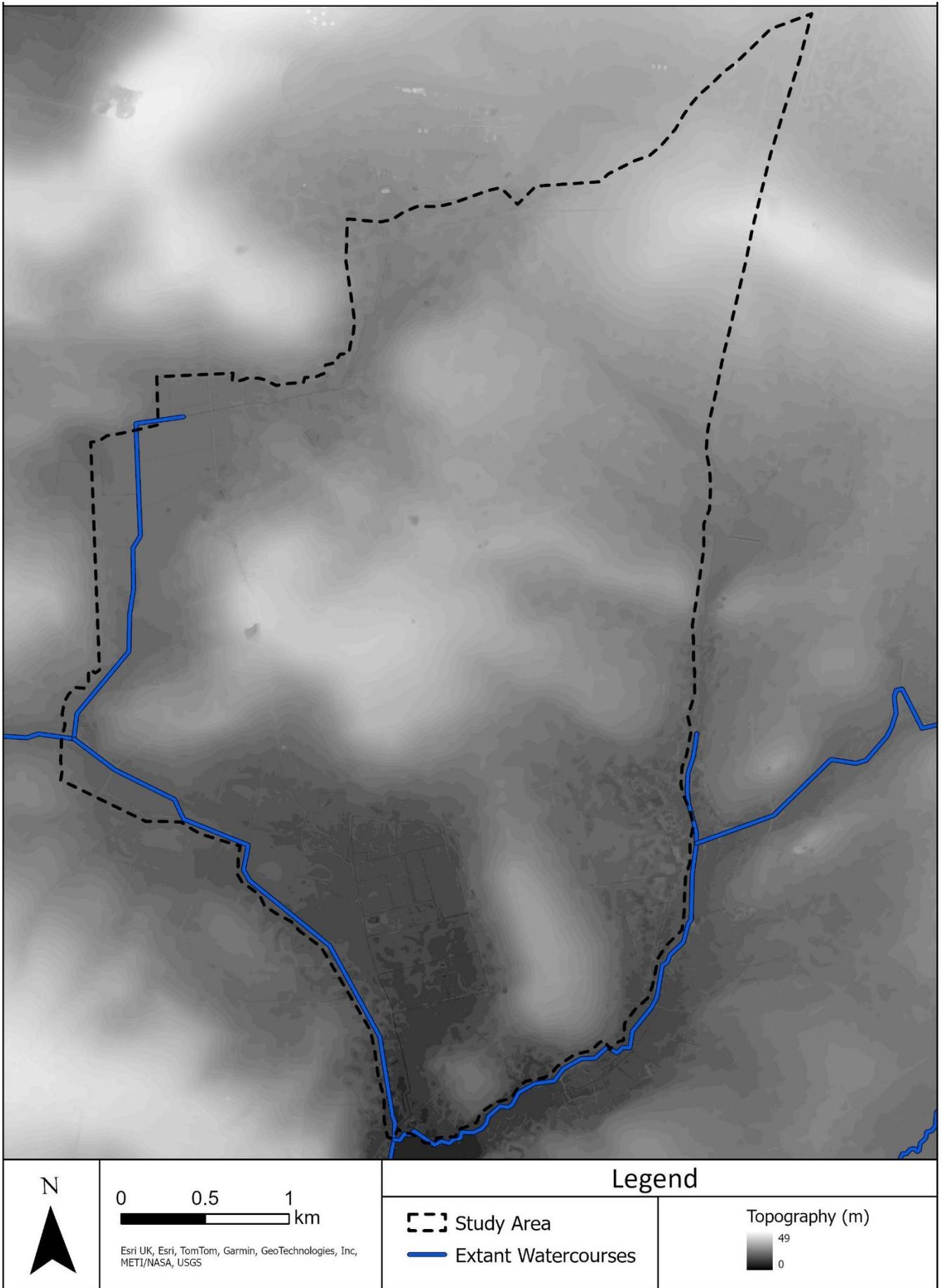


Figure 76: Barton Bendish and its topography.

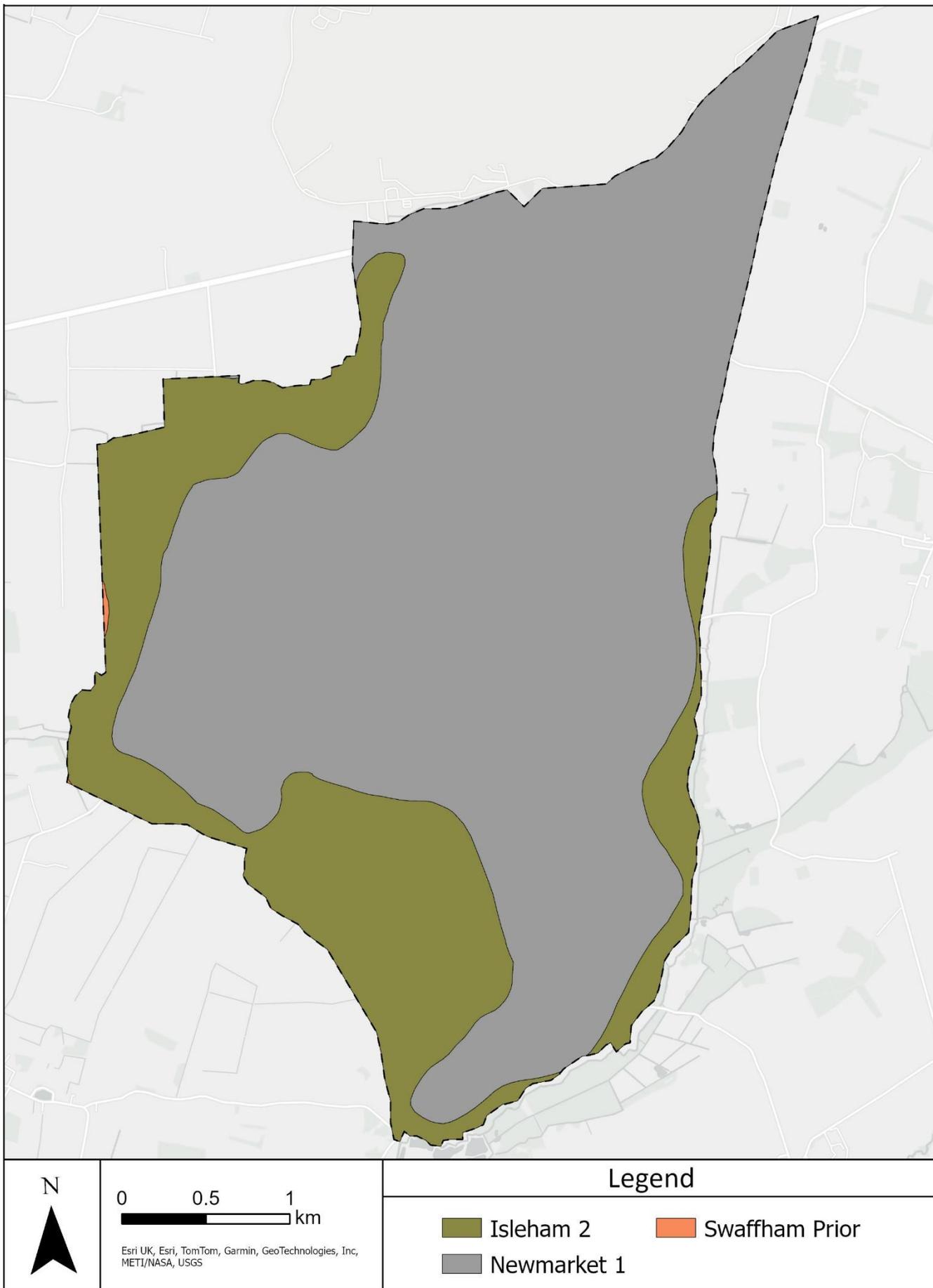


Figure 77: Barton Bendish and its soils.

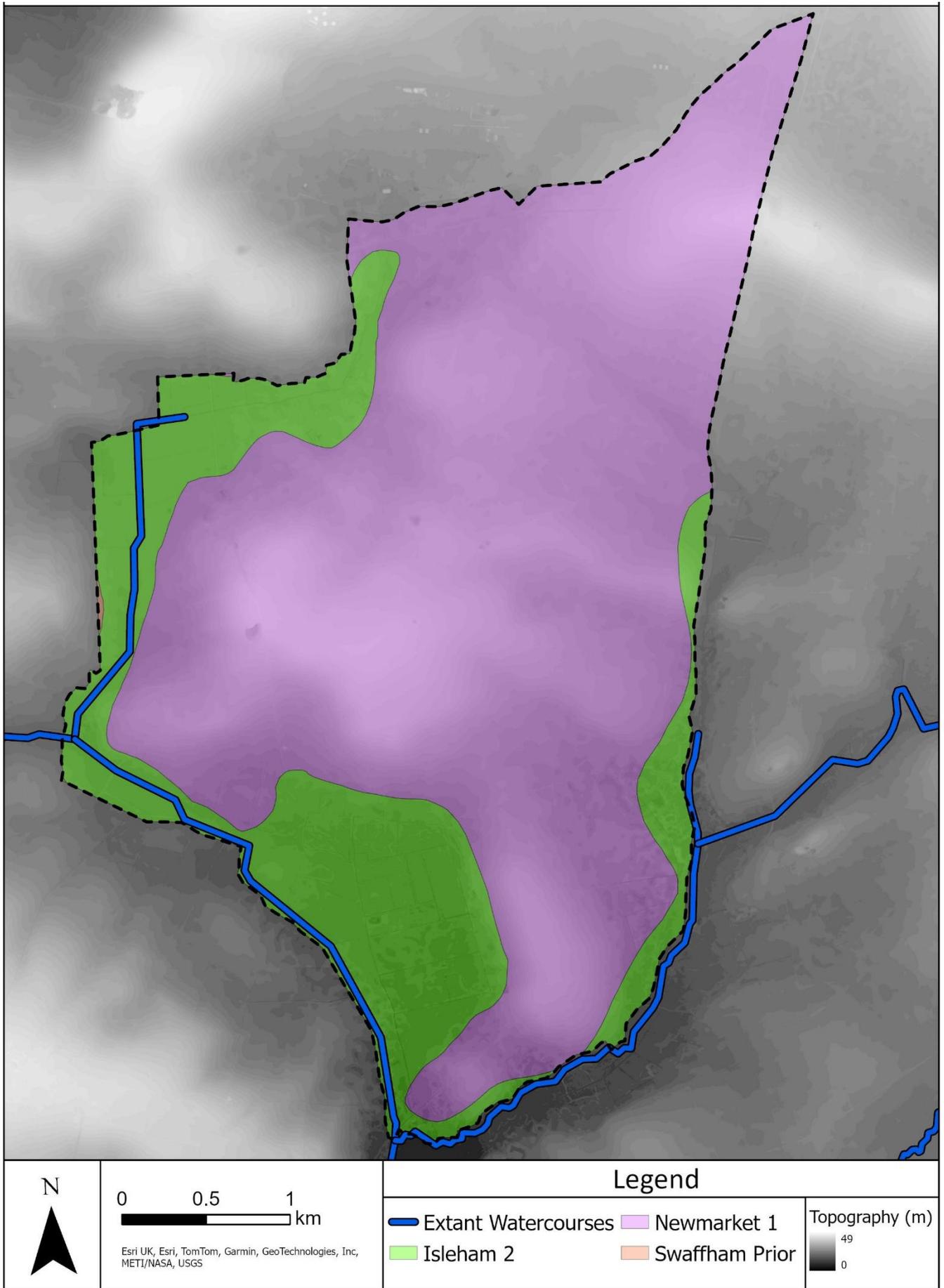


Figure 78: Composite of Barton Bendish's topography and soils.

| Breckland CZ | | |
|-----------------------|---|---|
| Soil association | Constituent series | General character of association |
| 554b – Worlington | Worlington – deep argillic brown sand; non-calcareous upper horizons; calcareous at depth; highly permeable; Euston – argillic brown sand; slightly more clayey subsoil; permeable; Newport – typical brown sand; non-calcareous; freely drained; Redlodge – humo-ferric podzol; well-drained; strong eluvial/illuvial horizons; acidic upper profile; Santon – humo-ferric podzol; shallow; acidic; associated with thick decalcified drift | Deep, drought-prone sandy soils; highly permeable; acidic in upper horizons; prone to nutrient loss and wind erosion; extensive landwork opportunities except in cold/wet mid-winter. |
| 521 – Methwold | Methwold – shallow brown calcareous sand; stony; over chalk rubble; permeable but retains moisture via chalk aquifer; Worlington – argillic brown sand (minor component); Newmarket – brown rendzina; shallow; calcareous; Elveden – brown rendzina; shallow; calcareous | Shallow, calcareous, permeable soils; productive due to chalk aquifer; rapidly workable; low compaction risk; drought-prone in dry years. |
| 343f – Newmarket 1 | Newmarket – shallow lithomorphic brown rendzina; coarse loamy; highly permeable; Methwold – brown calcareous sand; Elveden – shallow brown rendzina; Worlington – argillic brown sand (localised) | Shallow, calcareous, coarse-loamy patterned-ground soils; very well-drained; extensive landwork opportunities; chalk rubble enhances moisture retention. |
| 343g – Newmarket 2 | Newmarket – lithomorphic brown rendzina; shallow; coarse loamy; Rudham – fine-loamy brown rendzina; very shallow; Soham – fine-loamy brown calcareous earth; shallow; Swaffham Prior – coarse-loamy typical brown calcareous earth; stony; calcareous; Moulton – typical argillic brown earth; deeper; illuvial clay; non-calcareous upper horizons; Newport – brown sand (minor component) | Predominantly shallow, calcareous, coarse- to fine-loamy soils; very well-drained; low compaction risk; droughty on sands but chalk rubble increases moisture availability. |
| 552b – Ollerton | Ollerton – gleyic brown sand; mottled subsoils; moderately deep; non-calcareous upper horizons; Honingham – stagnogleyic argillic brown earth; mottled; calcareous at depth; Hockham – gleyic argillic brown sand; mottled B horizons; deeper profile | Sandy to coarse-loamy soils with seasonal waterlogging; influenced by groundwater; intermediate between well-drained Breckland soils and heavier Claylands; droughty in summer, waterlogged in wet winters. |
| 346 – Reach | Reach – humic gleyic rendzina; shallow; calcareous; mottled; Burwell – gleyic rendzina; shallow; calcareous; Blackdyke – calcareous humic gley soil; mottled; Associated valley-floor soils – shallow, sandy/loamy, waterlogged without drainage | Extremely calcareous sandy-loamy soils with frequent mottling; naturally waterlogged on valley floors and lower slopes; more poorly drained than main Breckland soils; shallow profiles over chalk rubble. |
| Isleham 2 | Isleham 2 – sandy/peaty gley; shallow; groundwater-influenced | Poorly drained, gleyed riverine soils; waterlogged in winter; more extensive in Breckland due to shallow valleys. |

Table 13: Breckland soil chart.

and the wetter, alluvial soils of the Isleham 2 association, with some sites located wholly within the expanse of Isleham 2 just east of the extant watercourse. This appears to have been the occupational focus of Romano-British settlement within Barton Bendish, with these sites turning up a significant volume of pottery and building materials (Rogerson 1997: 13-4). Adjacent to these occupational sites – and indeed throughout the parish as a whole – are thin scatters of sherds interpreted as manuring scatters, with these indicating extensive arable exploitation (Rogerson 1997: 13-4). Further occupational sites – Sites 12, 13, and 15 – and their associated manuring scatters have been identified on the low plateau in the centre of the parish, with these occupying the slopes of the light, freely draining Newmarket 1 soils (Rogerson 1997: 13-7). A broad pattern is thus discernible in Barton Bendish, whereby Romano-British settlement concentrated on the sloping junction zones between the lighter soils common in the centre of the parish and the heavier soils common in the shallow valleys. This pattern is replicated across the parish and suggests an intensively worked rural landscape in the Romano-British period.

Barton Bendish itself appears to have been relatively prosperous at the time of Domesday, with five manors and two churches, and Barton itself being the second largest population centre in Clackclose Hundred after Fincham (Rogerson 1997: 22). This relative prosperity was continued into the medieval and late medieval period, despite the economic downturn during the mid-fourteenth century (Rogerson 1997: 27-8). By comparison, the parish of Illington was not particularly prosperous, and out of the nineteen places in Shropham Hundred for which valuations were given in Domesday, Illington ranked fifteenth (Davison 1993: 6). It also had the tenth lowest population in the hundred (Davison 1993: 6). The differing levels of prosperity between Illington and Barton Bendish thus provide an interesting juxtaposition of two pedologically and topographically similar locations but which have had differing levels of economic success.

Fieldwalking evidence

Early Saxon: c. 500 – c. 650

Early Saxon evidence in Barton Bendish and Illington is typically scant. This is especially true in Illington, which unlike Barton Bendish witnessed relatively little Romano-British settlement. Early Saxon material recovered from the survey area was limited to the immediate vicinity of the Anglo-Saxon cemetery – some 400m from the principal Romano-British occupational site – which was first excavated by G. Knocker in 1949 (Clark 1957: 406; Davison 1993: 3). This cemetery occupies a well-drained, north-facing slope, and is believed to have been in use during the sixth and seventh centuries, although it is possible that it was in use before the turn of the sixth century (Davison 1993: 17). The

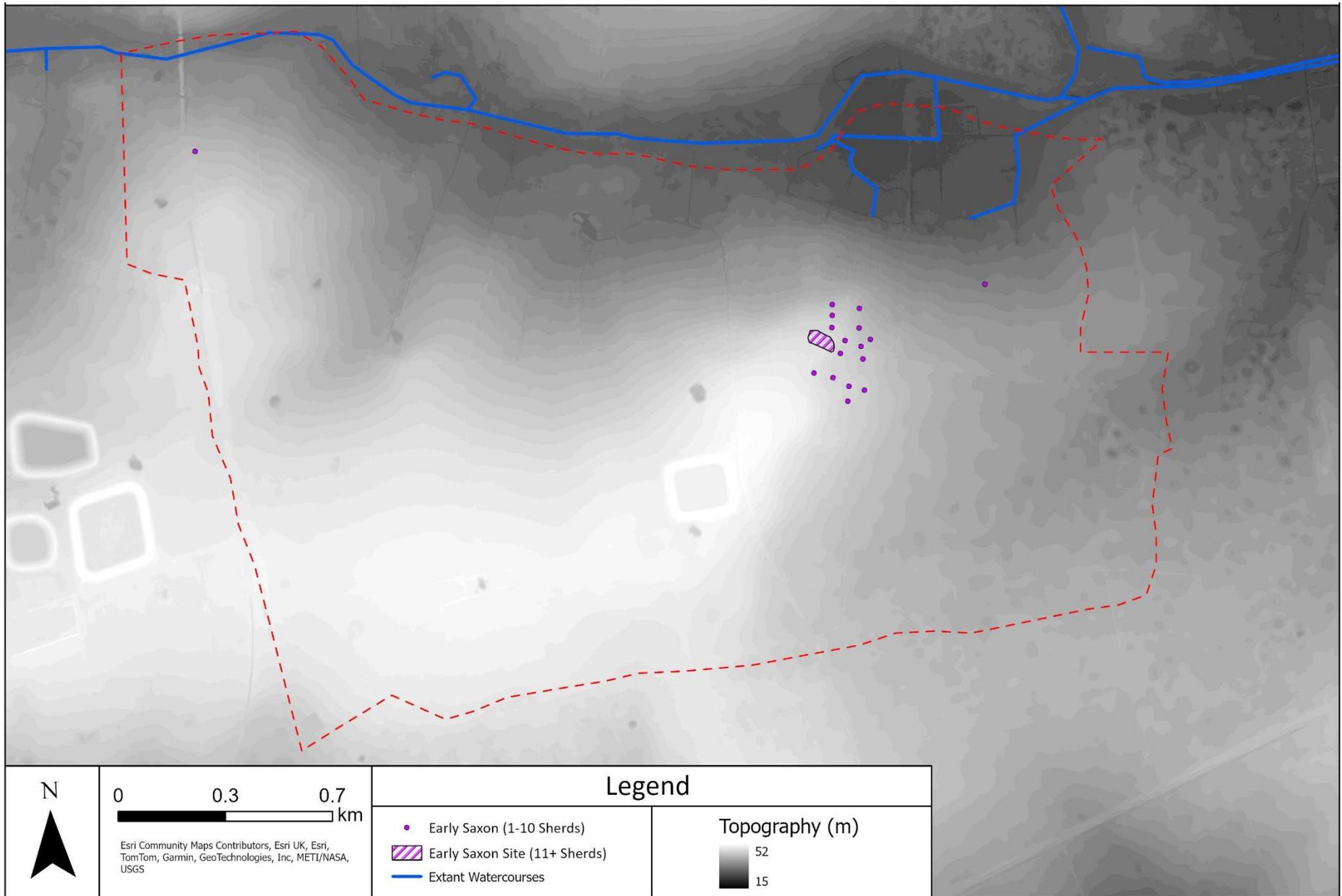


Figure 79: Early Saxon settlement in Illington against topography.

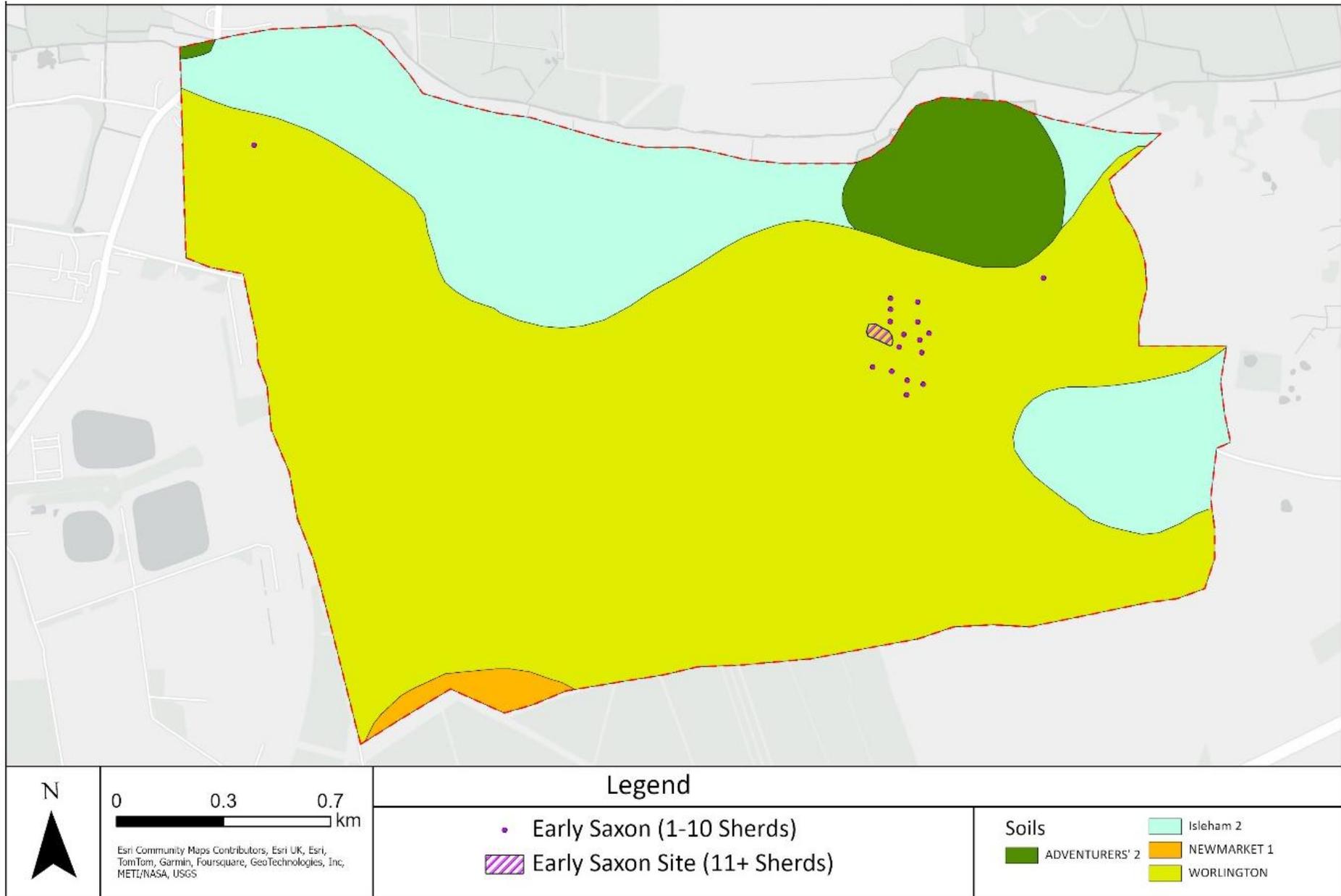


Figure 80: Early Saxon settlement in Illington against soils.

Early Saxon material recovered from around this site – which contains the only Early Saxon fabric found in the survey area – is believed by Davison to be directly associated with the cemetery, rather than evidence of occupation or agricultural activity (Davison 1993: 3-17). Davison further hypothesises that the complete lack of Early Saxon material recovered from the rest of the parish, combined with the presence of an Early Saxon cemetery, potentially indicates that Illington was part of a larger territorial unit (Davison 1993: 3, 9). He suggests that the presence of surrounding ‘hams’, such as the Hockhams, the Wrethams, Shropham, and Roudham is further evidence that Illington may have been just one part of a larger unit, with the occupational and agricultural sites being located outside of the parish, in an arrangement likely akin to Jones’ multiple estate theory (Davison 1993: 3, 9; Jones 1971; 1976; 1985).

Early Saxon evidence from Barton Bendish, whilst limited, is far more plentiful than in Illington and appears to follow the same pattern as that exhibited by Romano-British settlement, which demonstrated a clear preference for sloping topography near to sources of water. At Site 1, 80 sherds of sandy fabric were recovered in an oval concentration surrounded by a limited scatter of sherds (Rogerson 1997: 18) Whilst these sherds could potentially represent a manuring scatter it seems more likely that this small concentration is indicative of a small occupational site. The soils of this site matches up to the trends outlined in the previous chapter, with this site possessing light, well-draining soil (Rogerson 1997: 18). Elsewhere in the parish Early Saxon material was principally recovered from slightly wetter environments. ES 2, which is adjacent to one of the main Romano-British occupational sites in the parish, is located on the junction between the Newmarket 1 soils and the Isleham 2 soils, with this site producing 30 sherds of sandy fabric similar to that recovered from Site 1 (Rogerson 1997: 16-8). This is further surrounded by a broad scatter of early Saxon metalwork recorded by PAS. This site, which was perhaps an early Saxon occupational site, is located close to the current extent of Barton Bendish village and is in the vicinity of a group of Romano-British sites. RB 5, 6, 8, and 9 all contained Early Saxon material, with Rogerson noting that the thick scatter of Romano-British material may have inhibited the identification of the more difficult to spot Early Saxon material (Rogerson 1997: 17). Of these sites RB 9 is perhaps the most interesting, as the Early Saxon material is likely part of a manuring scatter (Rogerson 1997: 17-8). This site, like ES 2, is located on the junction between the Newmarket 1 association soils and the wetter alluvial soils associated with the extant watercourse. It is also positioned on the lower slope of one of the small hills discussed earlier in the chapter. The topographical positioning of ES 2 and its proximity to a source of water make it likely that ES 2 was the primary site of early Saxon occupation; as will be discussed in later sections, the positioning of ES 2 is far more in keeping with that of other sites of early Saxon occupation in Breckland.

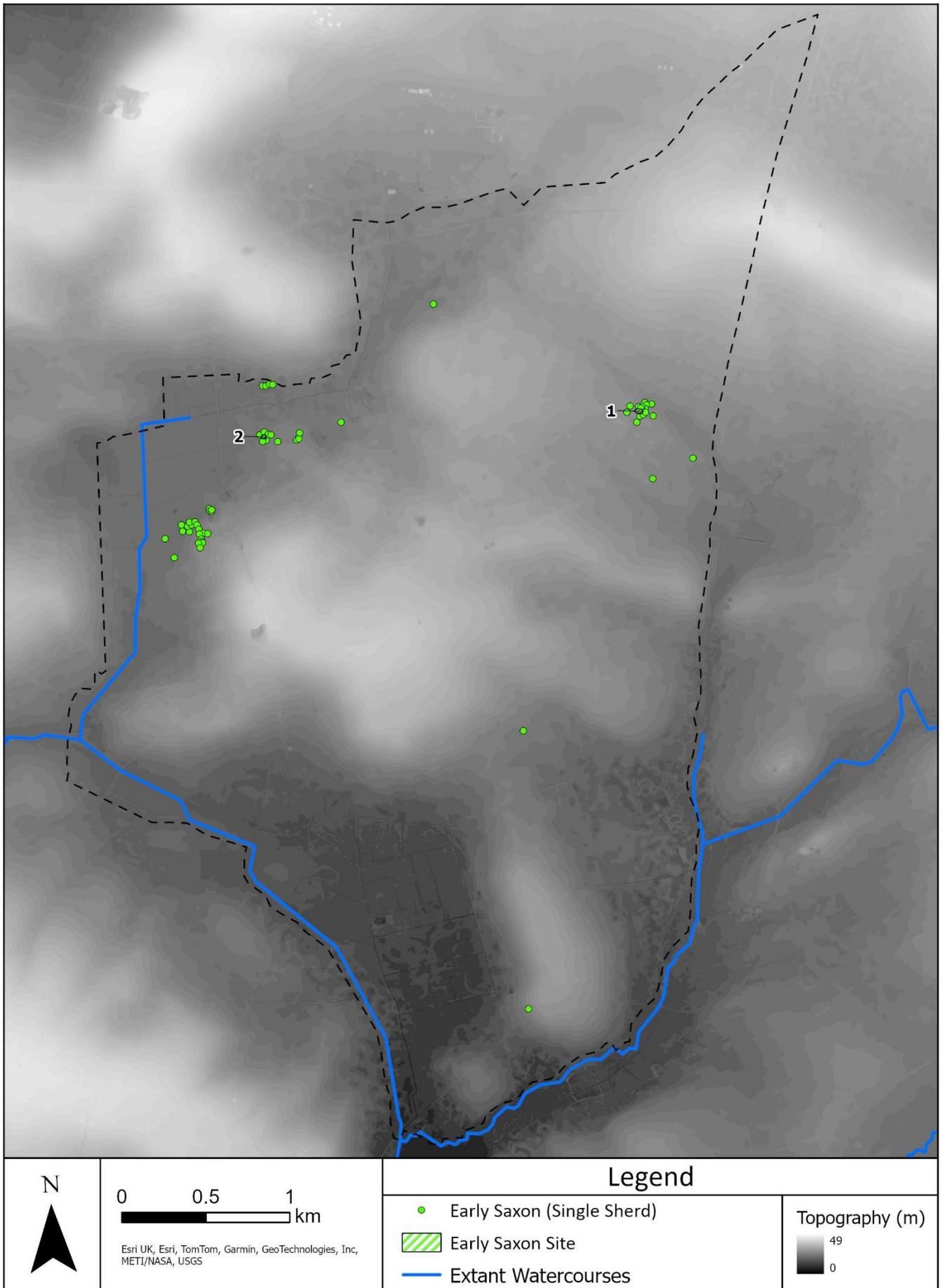


Figure 81: Early Saxon settlement in Barton Bendish against topography.

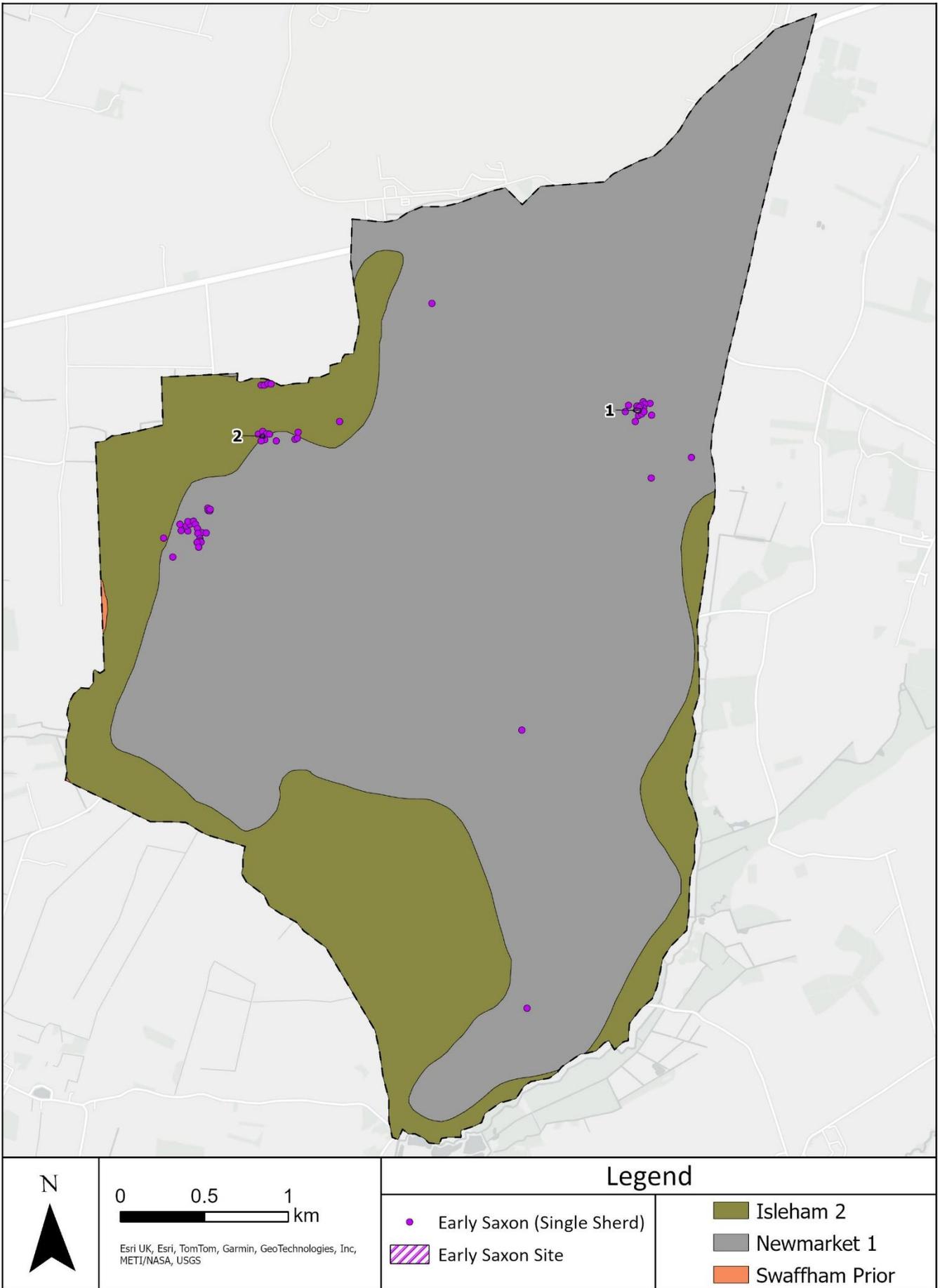


Figure 82: Early Saxon settlement in Barton Bendish against soils.

Rogerson notes that Early Saxon material is, in general, scarcer in Barton Bendish than it is in other surveys such as Davison's *Three Parishes* (Rogerson 1997: 17). He suggests that this could potentially be a result of Barton Bendish being an eastern part of the province of the *Wissa*, thus making the area of the survey the 'frontier between Celt and Saxon' (Rogerson 1997: 17). Another possible explanation as to the relatively limited Early Saxon evidence is that arable exploitation of the extremely light soils of the Breckland CZ, which covers the majority of Barton Bendish, would soon deplete the nutrients of the soil, especially if the same tract of land was repeatedly cropped. The mobile nature of Early Saxon settlement may have been exacerbated on these quick to deplete soils, and given that the available evidence suggests a landscape that was far more sparsely populated than it was in both Roman and later medieval times, it is conceivable that arable exploitation moved around the landscape far more readily due to the plentiful amount of unsettled and possibly unexploited land. Ceramic evidence would thus be more widespread but critically less concentrated than it would in more nutrient rich environments – such as the Three Parishes – which possibly accounts, at least in part, for the lack of Early Saxon material found in Barton Bendish.

Middle Saxon: c. 650 – c. 850

Middle Saxon evidence is even scarcer in Illington than Early Saxon evidence, although it appears to conform to the trends typical of the Middle Saxon period. Only four sherds of Ipswich Ware were recovered, with all of these sherds being recovered from fields immediately west of St. Andrews Church near to the junction of Worlington and Isleham 2 soils. It is possible that more middle Saxon material is hidden beneath the farm buildings and woodland nearby, but without more evidence it is impossible to determine if these sherds are representative of occupation or manuring scatters (Davison 1993: 4). However, given that the spatial context of these finds correlates to the general trends exhibited by Middle Saxon evidence elsewhere in Norfolk – such as a tendency to cluster near to the site of a parish church and to be spatially removed from sites where Early Saxon material has been recovered – it is not unreasonable to hypothesise that some form of Middle Saxon activity, whether that be occupational or agricultural, was taking place near to where these sherds were recovered.

Middle Saxon evidence is, however, far more widespread in Barton Bendish. Unsurprisingly, the majority of sherds recovered – which amounts to a total of 133 sherds of Ipswich Ware – are found within 200m of St. Mary's Church, near to the junction of the sandy, dry Newmarket 1 soils and the wetter, alluvial Isleham 2 soils (Rogerson 1997: 21). Whilst Rogerson has not been able to determine any definable concentration, stating that 'it has not been possible to isolate with confidence any areas that can be graced with the title of *site*', it is clear that some form of Middle Saxon activity was

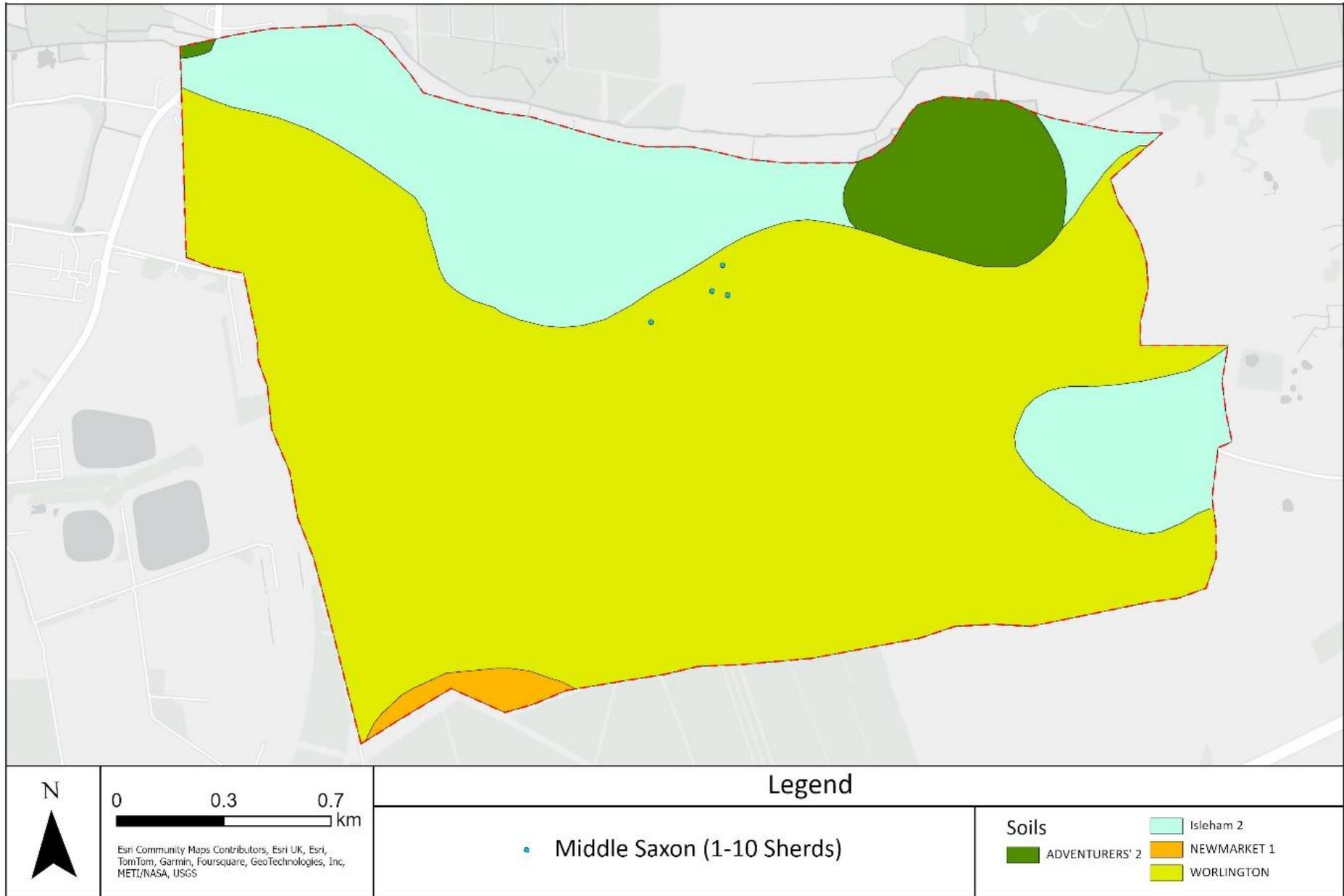


Figure 83: Middle Saxon settlement in Illington shown against soils.

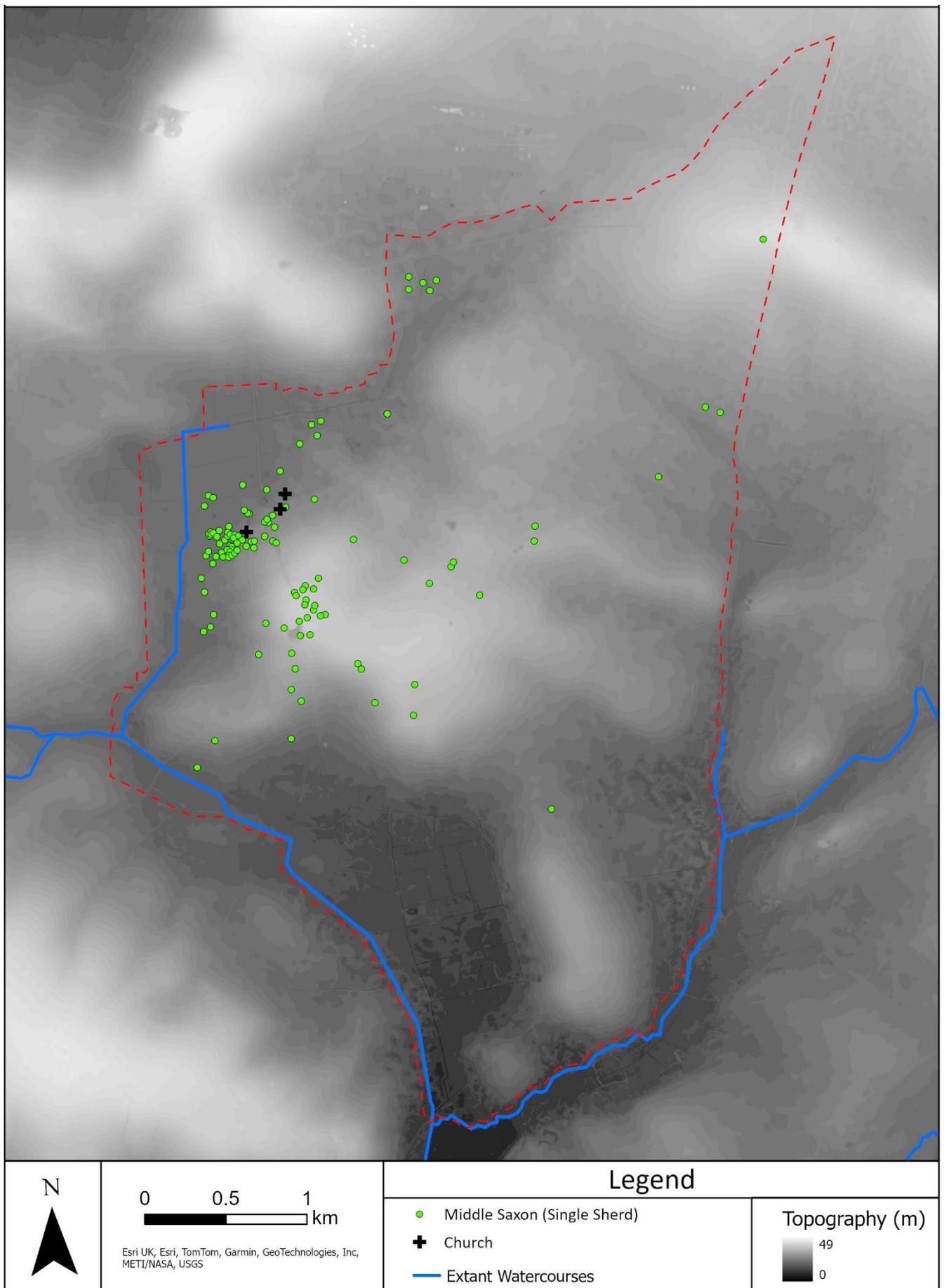


Figure 84: Middle Saxon settlement in Barton Bendish shown against topography.

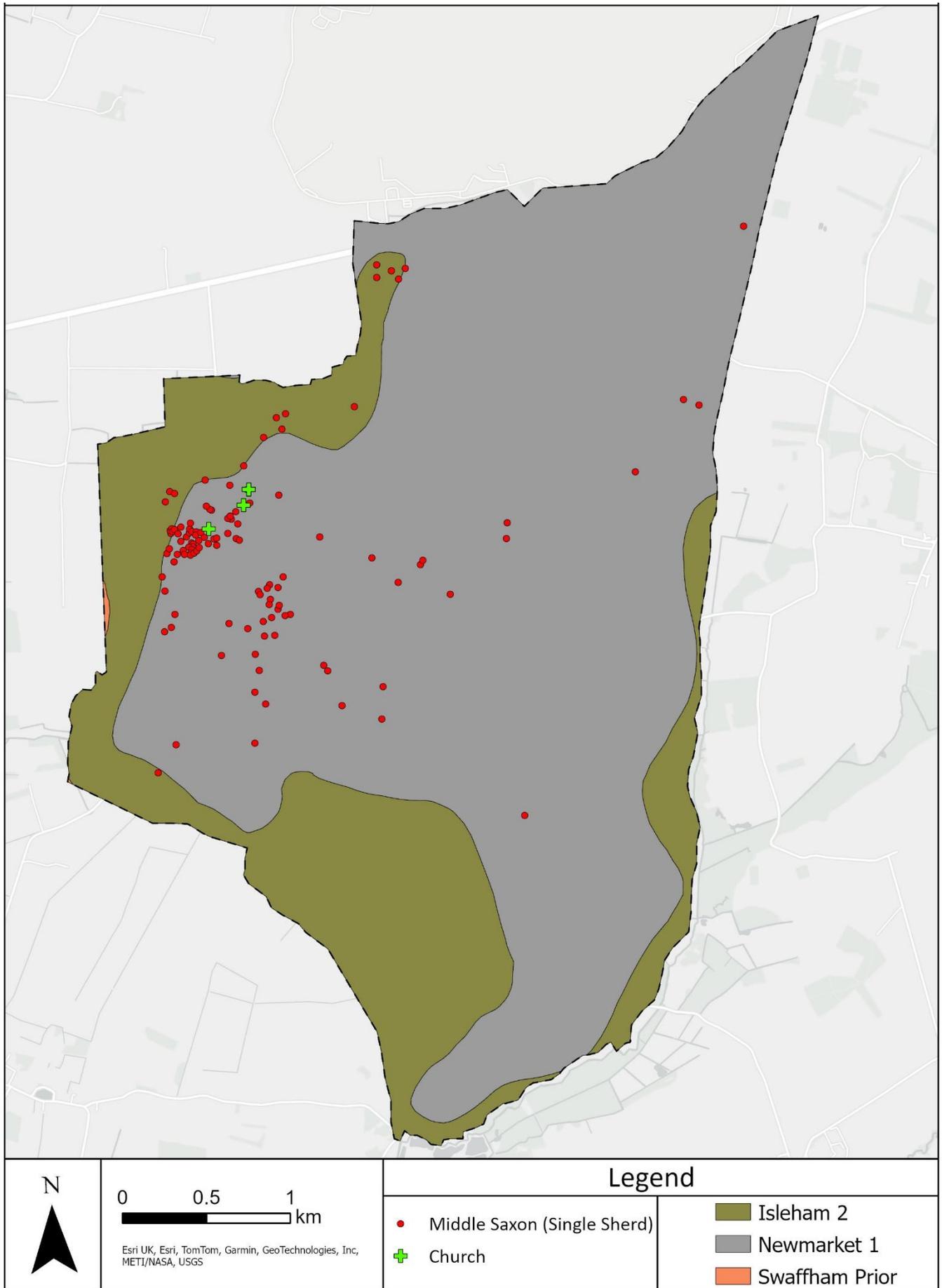


Figure 85: Middle Saxon settlement in Barton Bendish shown against soils.

occurring around St. Mary's Church. Rogerson suggests that this spread of sherds is more likely to be indicative of the manuring of arable rather than occupation, which is perhaps concealed beneath the permanent grass lying to the north-east which Davison's documentary research suggests is the location of two medieval manor houses (Rogerson 1997: 21). Rogerson notes that the sherd density decreases with distance from this north-eastern focus, further supporting the notion that the Ipswich Ware recovered from the survey area was likely deposited by Middle Saxon manuring practices rather than being occupational sites (Rogerson 1997: 21). This general pattern holds true albeit with one exception: some 500m south of St. Mary's Church, on the slopes of one of the three shallow hills, 22 sherds of Ipswich Ware were recovered, with this comparatively dense scatter likely indicative of intense Middle Saxon arable (Rogerson 1997: 21).

To the north and north-west of the primary scatter are heavier, wetter alluvial soils. It is clear that Middle Saxon exploitation avoided these wetter soils, for if a boundary was drawn between the outermost sherds this line would almost perfectly capture the transition from the sandy Newmarket 1 soils to the wet alluvial Isleham 2 soils. Alongside this geological preference there is also a topographical preference, with Middle Saxon exploitation appearing to favour, in almost every instance, the slopes of the shallow hills rather than the crests. This strategy was perhaps employed in order to exploit the advantageous drainage capabilities of sloping ground; alternatively, it is possible that the crests of these shallow hills would have been more exposed to the elements, especially winds whipping down the North Sea coast or from the low-lying Fenland which lies to the west and north-west of Barton Bendish.

Saxo-Norman: c. 850 – c. 1150

The Saxo-Norman evidence recovered from Barton Bendish and Illington tells a significantly contrasting story of settlement. In Barton Bendish, the Saxo-Norman period is characterised by an expansion of both occupational sites and arable exploitation across the parish, with the village itself split into two foci, with one in the west and another in the east (Rogerson 1997: 25). The western focus appears to be dominant, with particularly intense activity, likely representative of occupation, occurring around St. Mary's Church (Rogerson 1997: 25). In this western focus some 70 sherds were recovered from LS 3, a concentration which extends for 180m along what the main street of Barton Bendish, with further concentrations at LS 4, LS 5, LS 6 producing over 220 sherds (Rogerson 1997: 25). These concentrations – which likely indicate Saxo-Norman habitation – are accompanied by nearby clusters of sherds which Rogerson believes to be manuring scatters produced by the intense manuring of crofts (Rogerson 1997: 25).

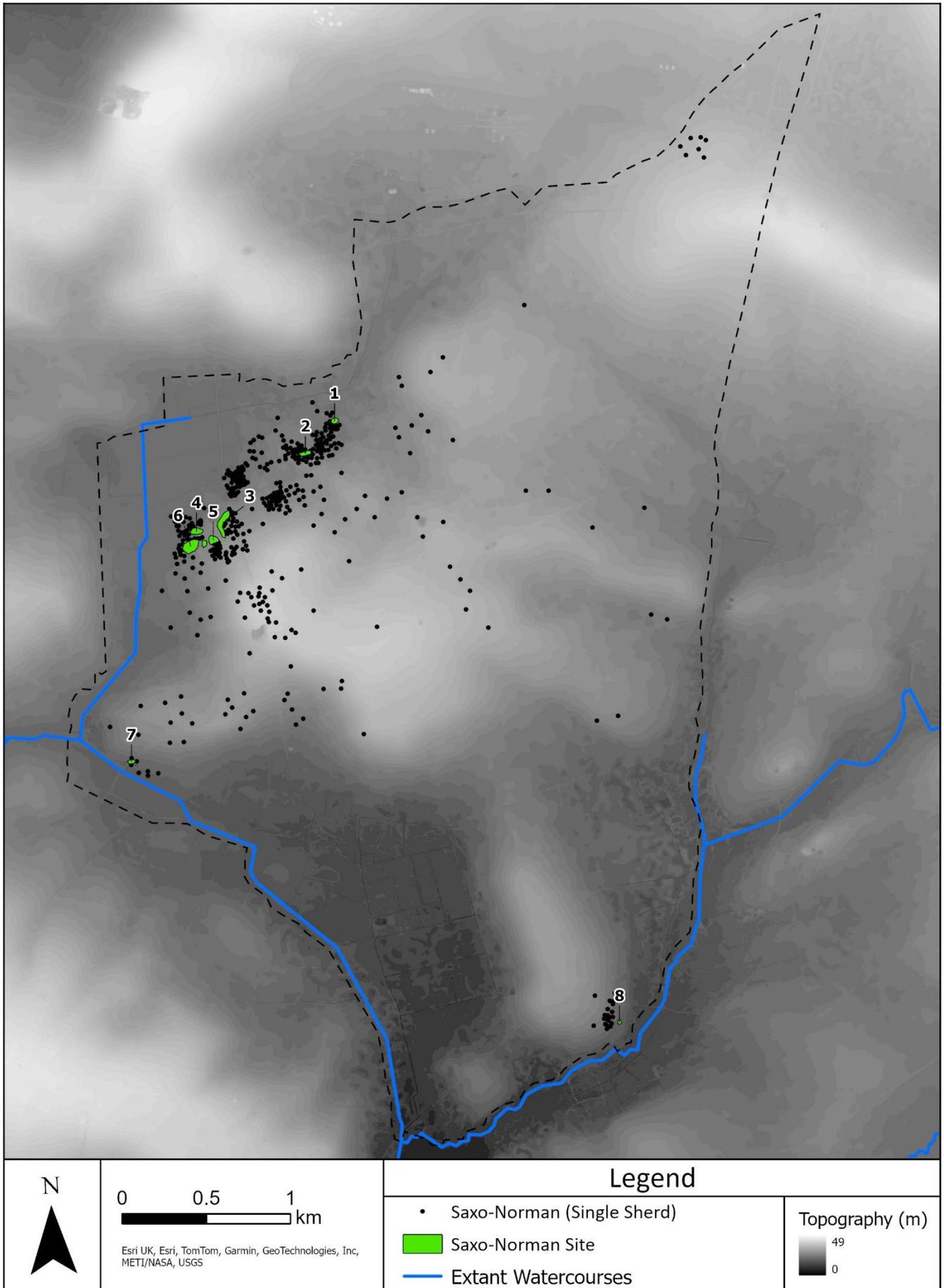


Figure 86: Saxo-Norman settlement in Barton Bendish shown against topography.

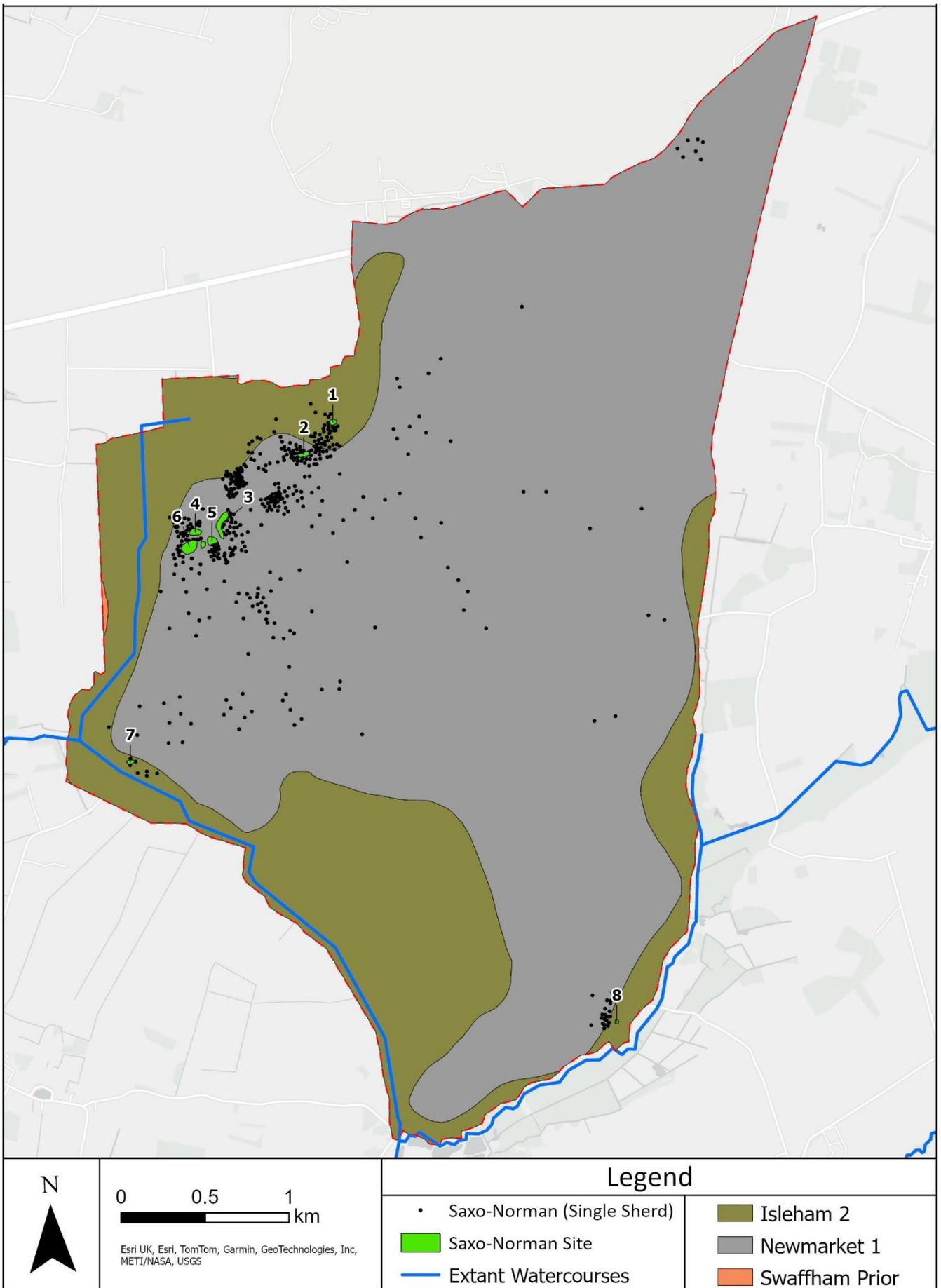


Figure 87: Saxo-Norman settlement in Barton Bendish shown against soils.

Whilst the western focus was the most significant area of Saxo-Norman activity in Barton Bendish, the eastern focus was nevertheless an important area of habitation and exploitation. The primary sites at this end of Barton Bendish village are LS 1 and LS 2, with 30 sherds and 20 sherds recovered from these locations respectively (Rogerson 1997: 22). As is the case in the western focus these sites are accompanied by clusters of sherds representative of intense manuring of crofts (Rogerson 1997: 25). The eastern focus also has a slightly differing geological character than the western focus. In the west, the concentrations and manuring scatters perfectly skirt the alluvial soils to the north and west in a similar fashion to their middle Saxon counterparts. Whilst LS 2 conforms to this trend, LS 1 and its associated scatter is located within the heavier alluvial Isleham 2 soils, some 150m downslope from the Newmarket 1 soils. Nevertheless, it is clear that the Saxo-Norman preference for occupational sites and their associated crofts was the light Newmarket 1 soils.

The only concentration of Saxo-Norman material – both Thetford Ware and St. Neots Ware – in Illington occurs north and west of St. Andrews Church, with the church forming the south-eastern corner of this concentration (Davison 1993: 4). This concentration is 140m south of the main body of the Isleham 2 soils, which here is comprised of Isleham 2 and also a decent-sized parcel of the peaty Adventurers' 2 associations. This nucleated concentration is surrounded by a sprinkling of sherds which may be manuring scatters, with the majority of these scatters occurring south of the primary concentration on lighter, better draining soils (Davison 1993: 4). Limited sherds were found throughout Illington, with the area to the west of the primary concentration producing the most Saxo-Norman material. However, the limited amount of material recovered makes it difficult to suggest what these sherds represent, although manuring seems far more likely than habitation given the scarcity of finds.

Whilst Illington contains little to no evidence of smaller, subsidiary sites elsewhere in the landscape, Barton Bendish contains a possible outlier at LS 7 and 8. At LS 7, a small concentration exists some 1.5km south-west of the main village site on wet alluvial soils, whilst at LS 8, some 4km south-east of the main village site, a small scatter was identified on a low hillock, possibly evidence of manuring. (Rogerson 1997: 22, 25). At the latter, an occupational site associated with this scatter may lie to the east, but permanent grassland on this parcel of land prohibited investigation. Even in this corner of the landscape, some 4km south-east of the principal population centre at Barton Bendish, the same pattern emerges, namely an almost uniform desire to be close to the junction of wetter and drier soils, with no concentrations or dense scatters identified in the central portions of the survey area.

So far the sites discussed have been representative of habitation or, in the case of the probable croft

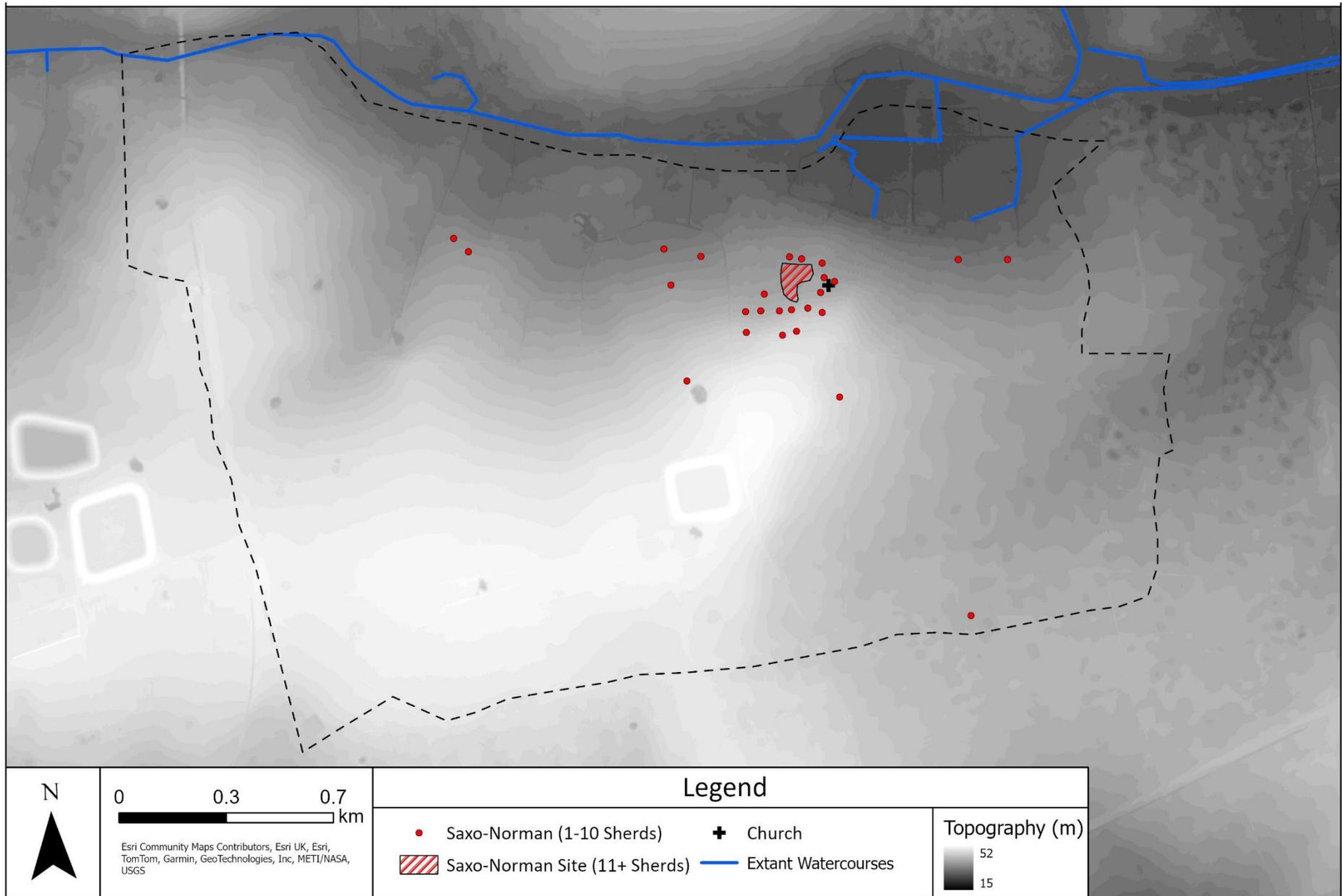


Figure 88: Saxo-Norman settlement in Illington shown against topography.

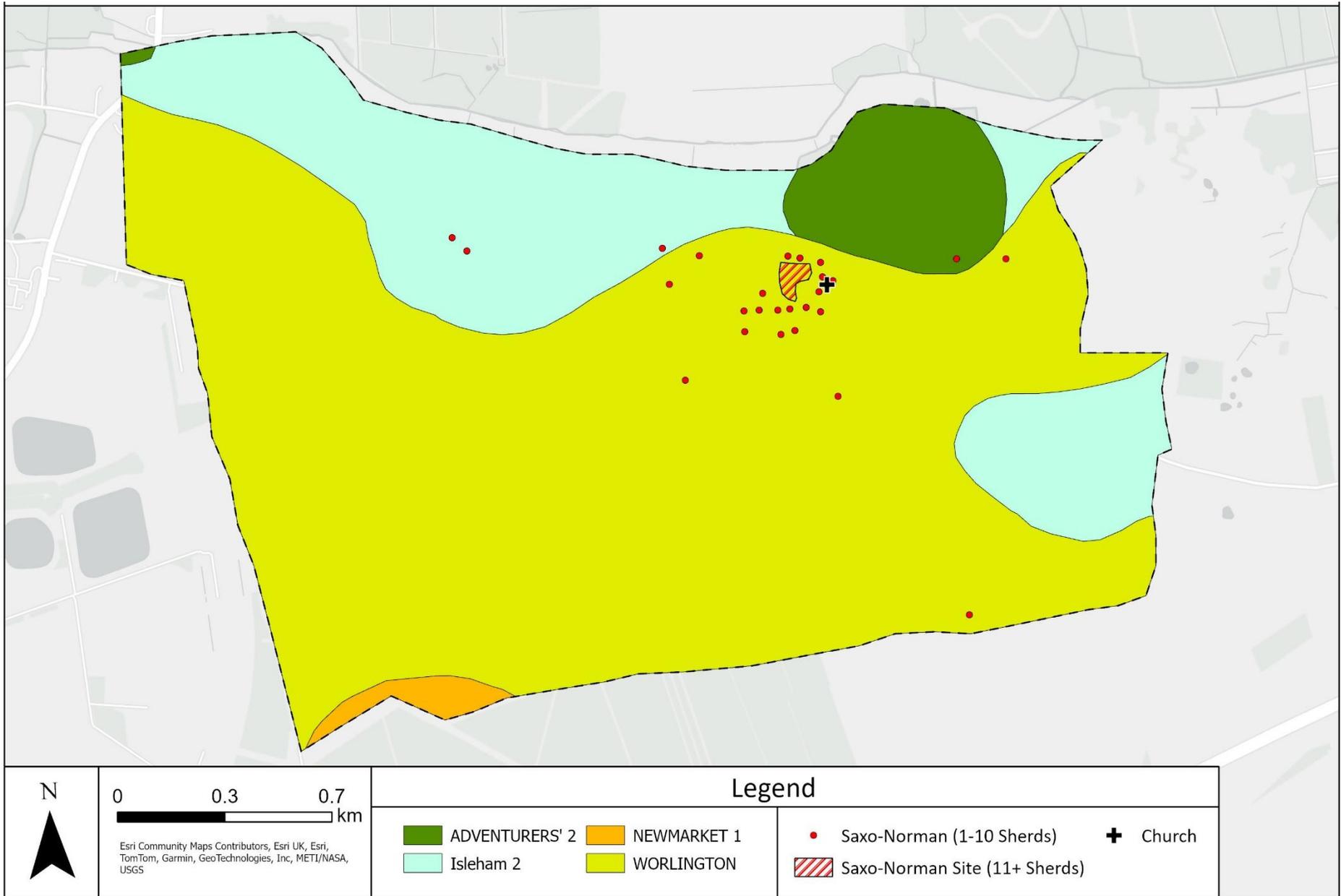


Figure 89: Saxo-Norman settlement in Illington shown against soils.

manuring scatters, representative of small-scale agricultural activities directly associated with occupational sites. However, in Barton Bendish there is clear evidence of large-scale Saxo-Norman agricultural exploitation of the light Newmarket 1 soils which dominate the interior of the survey area. Rogerson notes that the area within 2km of Barton Bendish village produced a 'fine sprinkling' of sherds that is likely indicative of open field agriculture, with these scatters largely occupying the slopes of the shallow central hill (Rogerson 1997: 25). Outside of this 2km inland zone evidence of Saxo-Norman arable exploitation is limited to a possible manuring scatter in the north of the survey area next to RAF Marham, which Rogerson hypothesises may be evidence of a breck in an area of 'upland' pasture (Rogerson 1997: 25). Elsewhere in Barton Bendish, especially in the southern upland, the lack of agricultural exploitation is notable, for this area of light, sloping ground is so heavily exploited as arable in the medieval period. However, whilst evidence for arable exploitation is entirely absent, this is not to say that this area was unproductive, with Rogerson proposing that this area may have served as a large area of wood-pasture (Rogerson 1997: 25). Given that Domesday suggests a population of some 400 or more individuals, with five manors and at least two churches present in the parish in the eleventh century, it is likely that every part of the landscape was subjected to some form of exploitation in order to maintain such a comparatively high population (Rogerson 1997: 25).

Medieval: c. 1150 – c. 1350

Similar to the Claylands CZ, the medieval evidence recovered from both Illington and Barton Bendish is far more plentiful than in previous periods. As discussed in previous sections, Rogerson's *Barton Bendish* treats the entire c. 1150 to c. 1500 period as one, and whilst it has been possible to separate *sites* into two periods – namely the medieval and late medieval – separating individual finds which are part of manuring scatters has been impossible. Thus, it is feasible that the extent of 'medieval' manuring scatters has been amplified by the inclusion of late medieval material, although it is the view of this thesis that any such amplification will not overly skew, or indeed change, the conclusions reached through analysis of Rogerson's data.

Both Illington and Barton Bendish contain a moderately sized body of evidence suggesting that expansion of both occupational and arable sites onto wetter, heavier soils was occurring in the Breckland CZ during the medieval period. In Illington, St. Andrew's Church, which formed the south-eastern corner of the Saxo-Norman nucleus retains its peripheral position into the medieval period, with the majority of expansion at this small 'core' occurring to the north and west of the church. However, it is not the expansion of this central 'nucleus' which is the defining feature of Illington's medieval development; rather, it is the establishment of a number of small to moderately sized linear

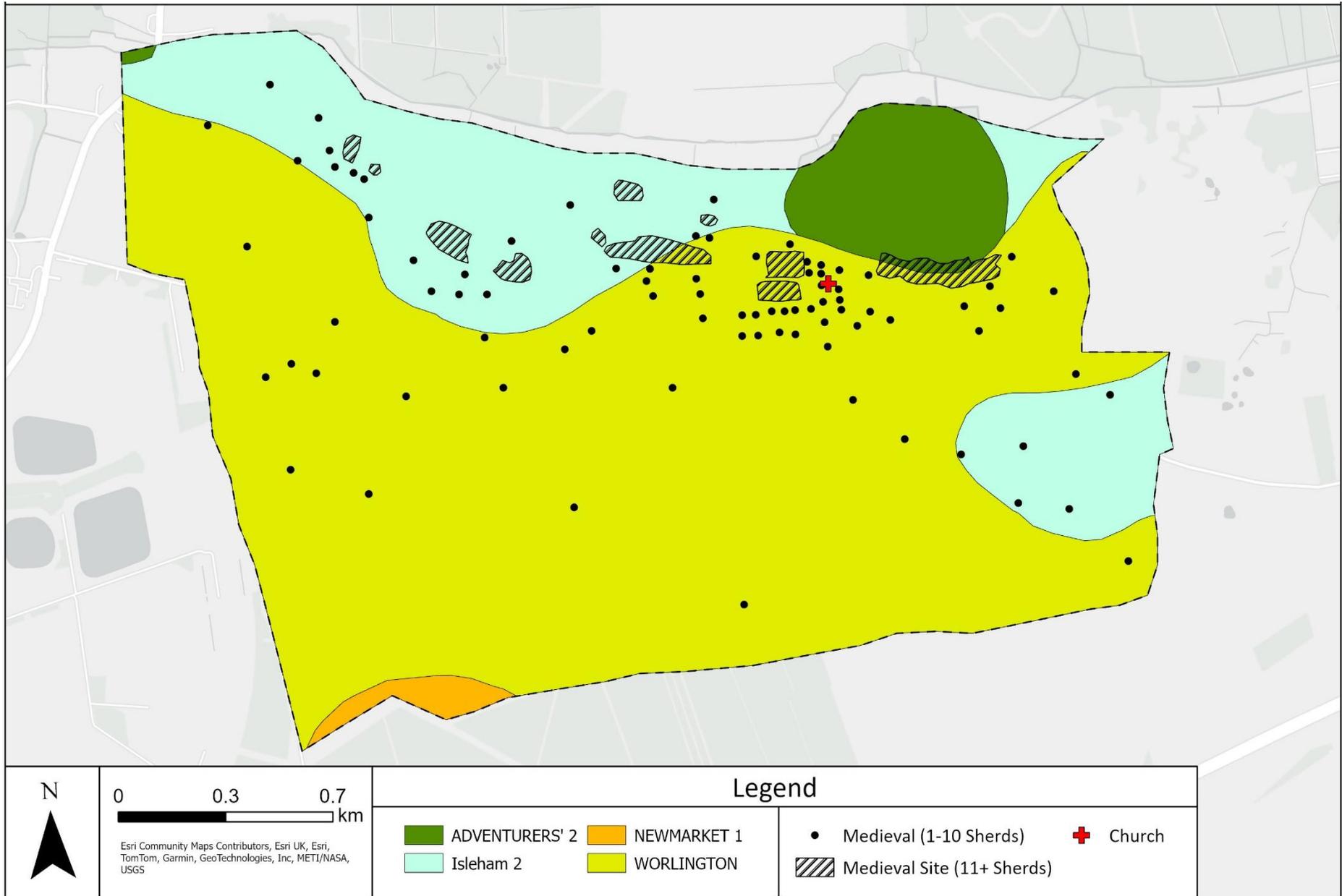


Figure 90: Medieval settlement in Illington shown against soils.

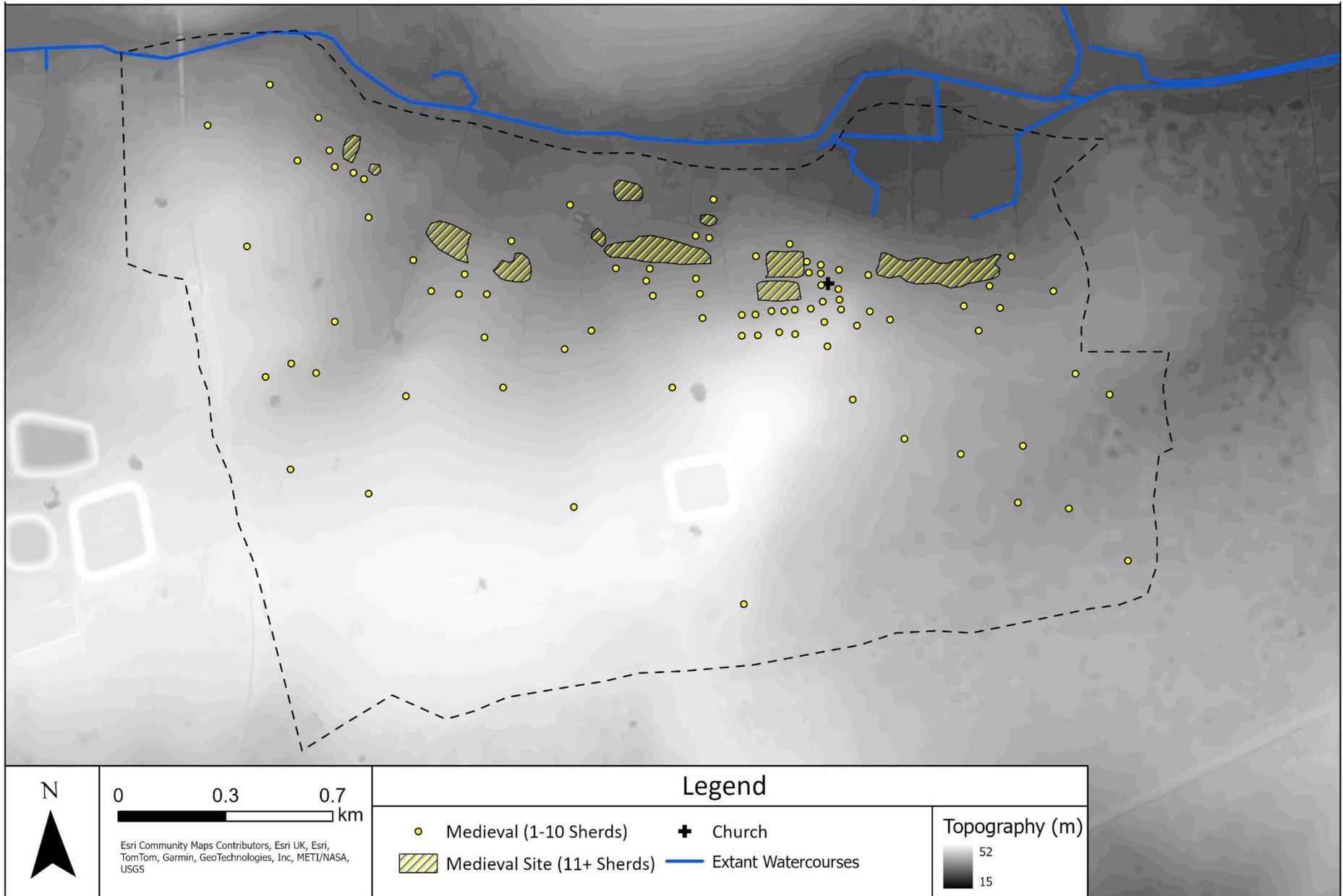


Figure 91: Medieval settlement in Illington shown against topography.

occupational complexes east and west of the old Saxo-Norman nucleus, complexes which commonly occupy locations either possessing alluvial soils or which lie at the junction between alluvial and lighter soils.

To the west and north-west of St. Andrews Church three sizeable concentrations of medieval material were identified. The largest concentration, which lies to the northwest of St. Andrew's Church is some 310m long and straddles the junction between the alluvial and non-alluvial soils. However, the northernmost concentration, which is associated with a moated site and which produced 59 sherds of unglazed medieval pottery and a considerable quantity of oyster shells, lies wholly within the alluvial Isleham 2 soils, being some 170m from the main body of the Worlington association soils (Davison 1993: 5). This site is also located less than 100m from the small northern stream, as is the smaller concentration to the east which similarly lies within the Isleham 2 soils.

To the west of these sites lies another large concentration centred on Old Farm. Here, 190 sherds of unglazed and 39 sherds of glazed medieval pottery, mostly Grimston Ware, were recovered from fields directly west of the current site of the farmyard, with a further 40 sherds being recovered from fields lying to the east (Davison 1993: 5). Given that the spread of sherds gives the impression of running under the present farmyard, Davison hypothesises that the site of the current farm is likely concealing the primary site of medieval occupation (Davison 1993: 5). A thin scatter of isolated finds to the south of this concentration is likely indicative of the manuring of arable, and it is interesting that no such scatter was recovered from the fields north of Old Farm. This suggests that arable exploitation was only occurring south of the farmstead, and thus towards the main body of the lighter Breckland soils rather than towards the increasingly wetter soils which lie to the north. Continuing westwards from Old Farm is a further small concentration on the southern edge of a plantation, from where 69 sherds, again of Grimston Ware, were recovered (Davison 1993: 5-6). This site is again well within the heavier, wetter soils of the Isleham 2 association.

It is not just in Illington that occupational sites appear to have been established on the wetter alluvial soils associated with watercourses. In the eastern reaches of Barton Bendish village three moderately sized sites occur either wholly within or partially within the Isleham 2 soils (Rogerson 1997: 29-30). Med 1, from which 30 sherds were recovered, occupies peat-stained soil and was likely occupied from the thirteenth to the fourteenth century, whilst Med 2 had a slightly longer history of occupation with the evidence suggesting that it was occupied from the twelfth to the sixteenth century (Rogerson 1997: 29-30). The final site, Med 5, is one of two moated sites in the village, with the 40 sherds

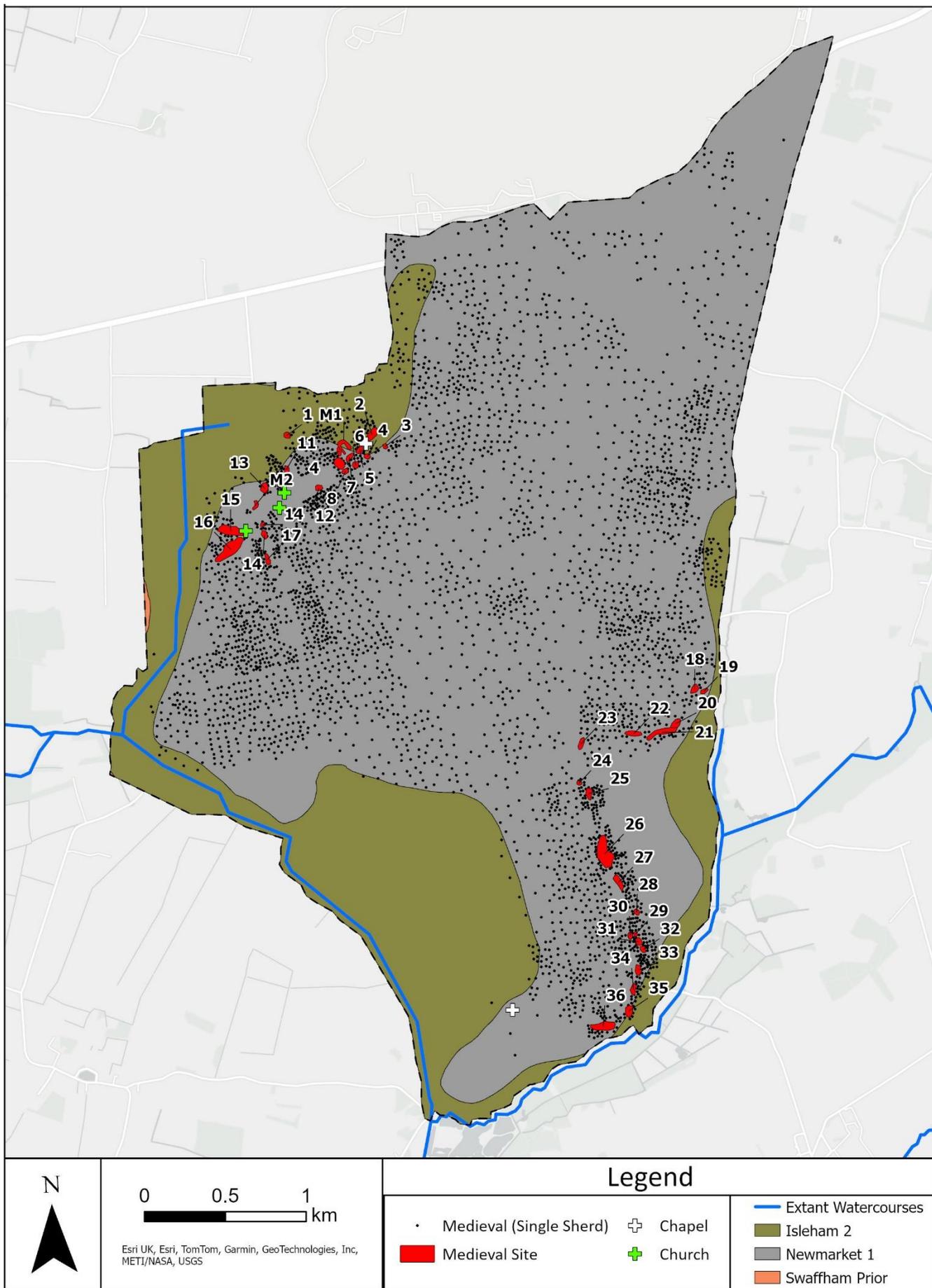


Figure 92: Medieval settlement in Barton Bendish shown against soils.

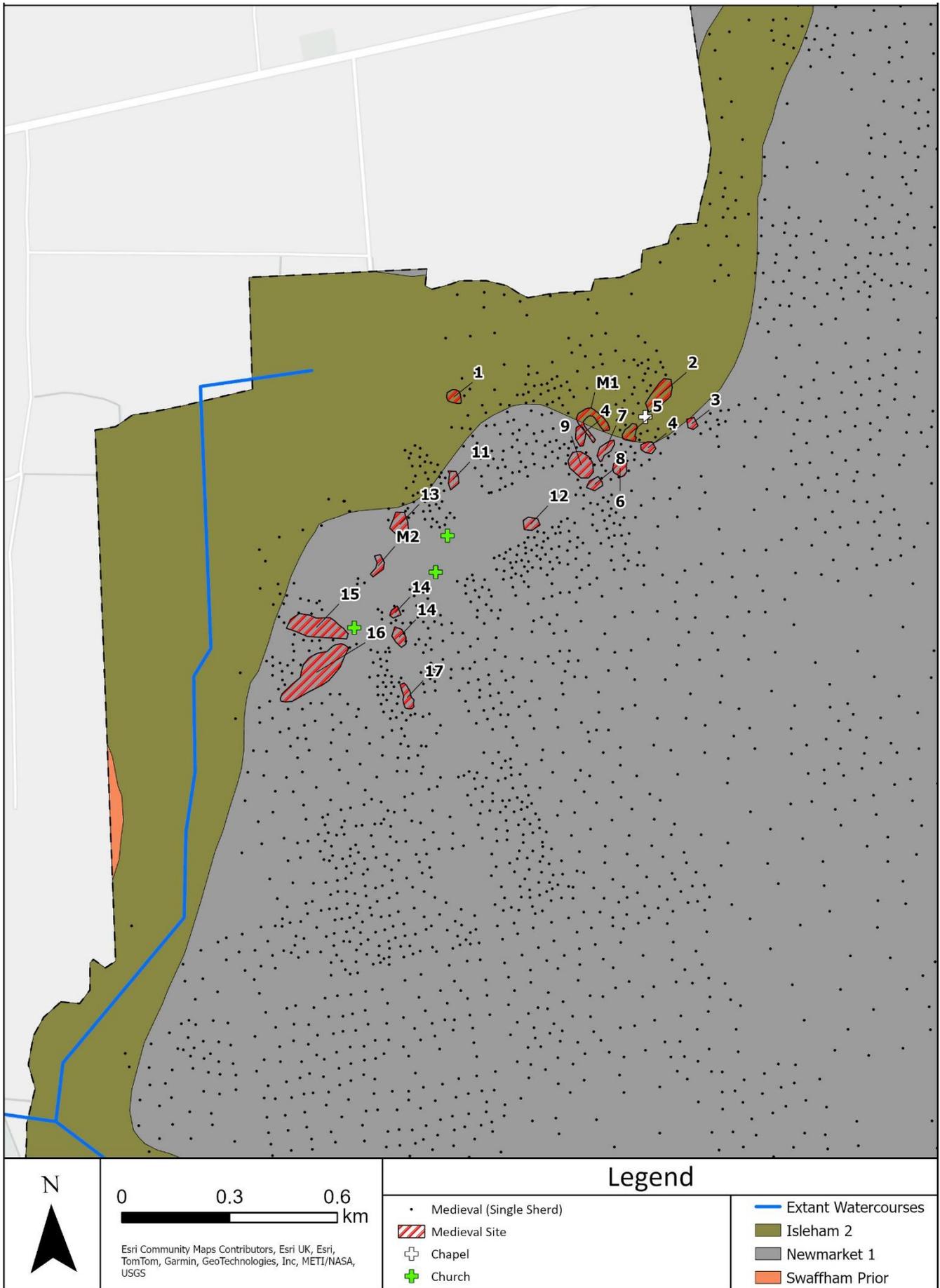


Figure 93: Medieval settlement in Barton Bendish focused on the village and shown against soils.

recovered suggesting that it was occupied from the thirteenth to the fifteenth century (Rogerson 1997: 29). This latter site, unlike the former two sites, straddles the boundary between the Newmarket 1 and the Isleham 2 associations.

This boundary is sometimes less of a hard border than the GIS would appear to suggest; whilst there are many instances where the soil does abruptly change, in some instances it is best to visualise the junction of soil types as a brief transitional zone where one type melds into the other, with first hand observations of this particular tract revealing that this transitional or 'junction' zone can extend for up to 25m. In the case of Barton Bendish and Illington, the junction zone of light and alluvial soils will nearly always be marked by simultaneously heavier or lighter soils depending upon which type – heavy or light – is the object of comparison. For example, if we are comparing the junction zone to the light Newmarket 1 soils then this zone is heavier, whilst if the comparison is being made with regards to the heavier Isleham 2 soils this zone will be lighter. These junction zones also possessed a rather useful hydrological quality in this arid landscape, for the transition between more permeable and more impermeable soils frequently created spring lines, creating naturally water-retentive conditions that provided reliable water access for both agricultural and domestic needs without the need for deep wells (Avery 1980: 160; Hodge *et al.* 1984: 265).

It is apparent that a minority of occupational sites throughout both Rogerson's and Davison's surveys colonised areas of heavier, wetter soils that were largely unsettled in preceding periods. However, by far the most significant trend throughout both surveys is the clear preference of medieval sites to occupy the lighter edge of the junction between the light, sandy soils and the wetter alluvial soils. In Illington, north-east of Saxo-Norman nucleus, is a linear concentration of over 160 sherds, mostly unglazed wares, that perfectly borders the inner edge of the Worlington soils where it transitions into the heavy, peaty Adventurers' 2 association. Evidence of this peripheral preference in Barton Bendish is far more widespread. The largest concentrations occur around St. Mary's Church, with Med 15 and 16 producing over 400 sherds of twelfth to fourteenth century material, with these sites possessing medium to heavy soils due to their peripheral position near to the junction of light and heavy soils. It is also apparent that in Barton Bendish occupational sites preferred to be located on the northern and western side of the main 1.5km street, that is on the same side as the small stream and thus closer to the wetter valley soils. In addition to Med 15 and 16, Med 7, 10, and 13, which were occupied between the twelfth and fifteenth, thirteenth and fifteenth, and twelfth to early thirteenth centuries respectively produced over 290 sherds (Rogerson 1997: 29-30). The 1.5km long street also mirrors the boundary between the Newmarket 1 soils and the Isleham 2 soils, and similar to earlier periods the manuring scatters are often densest towards the interior of the survey area, although this is less true

in the northern part of the village site where dense scatters are found facing the interior of the Isleham 2 soils.

Whilst occupational sites thus appear to have favoured the northern and western sides of the main street, this is not to say that occupation of the southern side of the road was entirely absent. However, whilst the concentrations on the southern side of the road produced a respectable 225 sherds (with every concentration on this side of the road containing an unknown volume of late medieval material due to Rogerson's questionable methodological decisions) this total pales in comparison to the 690 sherds of medieval material (with Med 7 and 10 also containing an unknown volume of late medieval material) that was recovered from sites on the northern side of the street (Rogerson 1997: 1-31).

It is not just Barton Bendish village which exhibits these preferences. In the south-east of Barton Bendish lies the hamlet of Eastmoor, a linear occupational complex strung out along a 2.5km street on low-lying ground adjacent to the locally prominent southern 'upland', which lies directly west of the main street. East of this street the ground slopes down to a small stream with ample, peat-stained meadowland which unsurprisingly carries Isleham 2 soils (Rogerson 1997: 31). This hamlet is thus in close proximity to the junction between the Newmarket 1 and Isleham 2 soils, mirroring the spatial arrangement of Barton Bendish in the north-west. Furthermore, the concentrations of medieval material are, without exception, found on the eastern and southern side of the road, the same side which leads down to the small stream and its associated wet, alluvial soils. Nineteen concentrations associated with Eastmoor were identified by Rogerson in this south-eastern corner of Barton Bendish, with numerous examples, such as Med 21, 26, and 36 likely indicative of multiple dwellings, whilst the smaller concentrations at Med 20, 25, and 28 are, for example, likely indicative of single dwellings (Rogerson 1997: 31).

Furthermore, the small, less intensive scatters which lie between the principal street and the numerous concentrations suggest that this intermediate area was likely a thin band of intensely manured arable directly abutting the dwellings (Rogerson 1997: 31). It is interesting that manuring scatters become entirely absent within 60 to 70m of these concentrations on the slope leading down to the rich low-lying alluvial meadows. One possible explanation is that this relatively large sloping expanse – which was intensely investigated by Rogerson – was used as pasture, which given the extent of manuring scatters elsewhere in the survey area – which will be discussed shortly – would likely have been in short supply. Thus it was only the crofts directly associated with the tofts which were being utilised as arable on this side of Eastmoor. This slope, which leads down to low-lying meadowland,

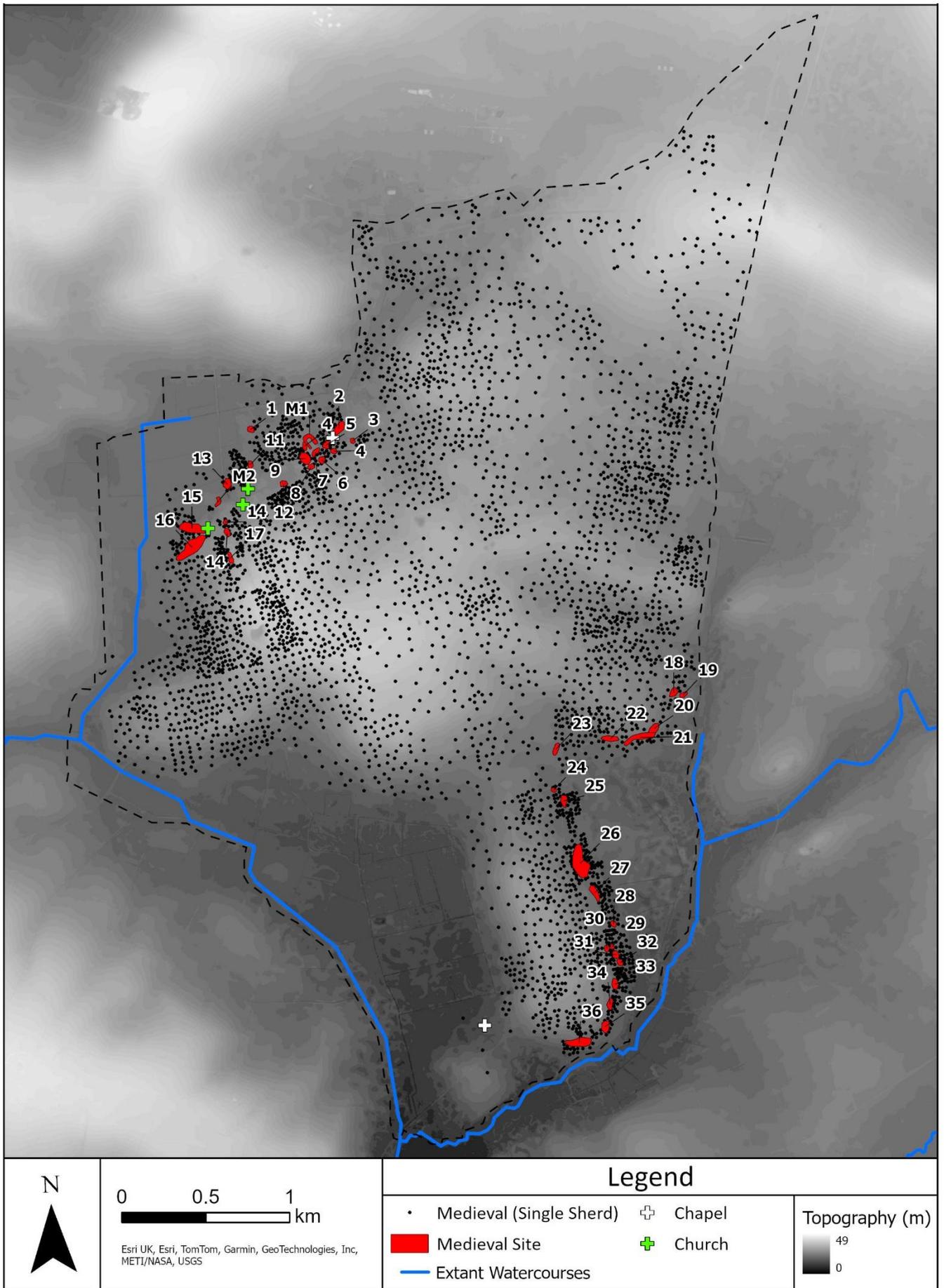


Figure 94: Medieval settlement in Barton Bendish shown against topography.

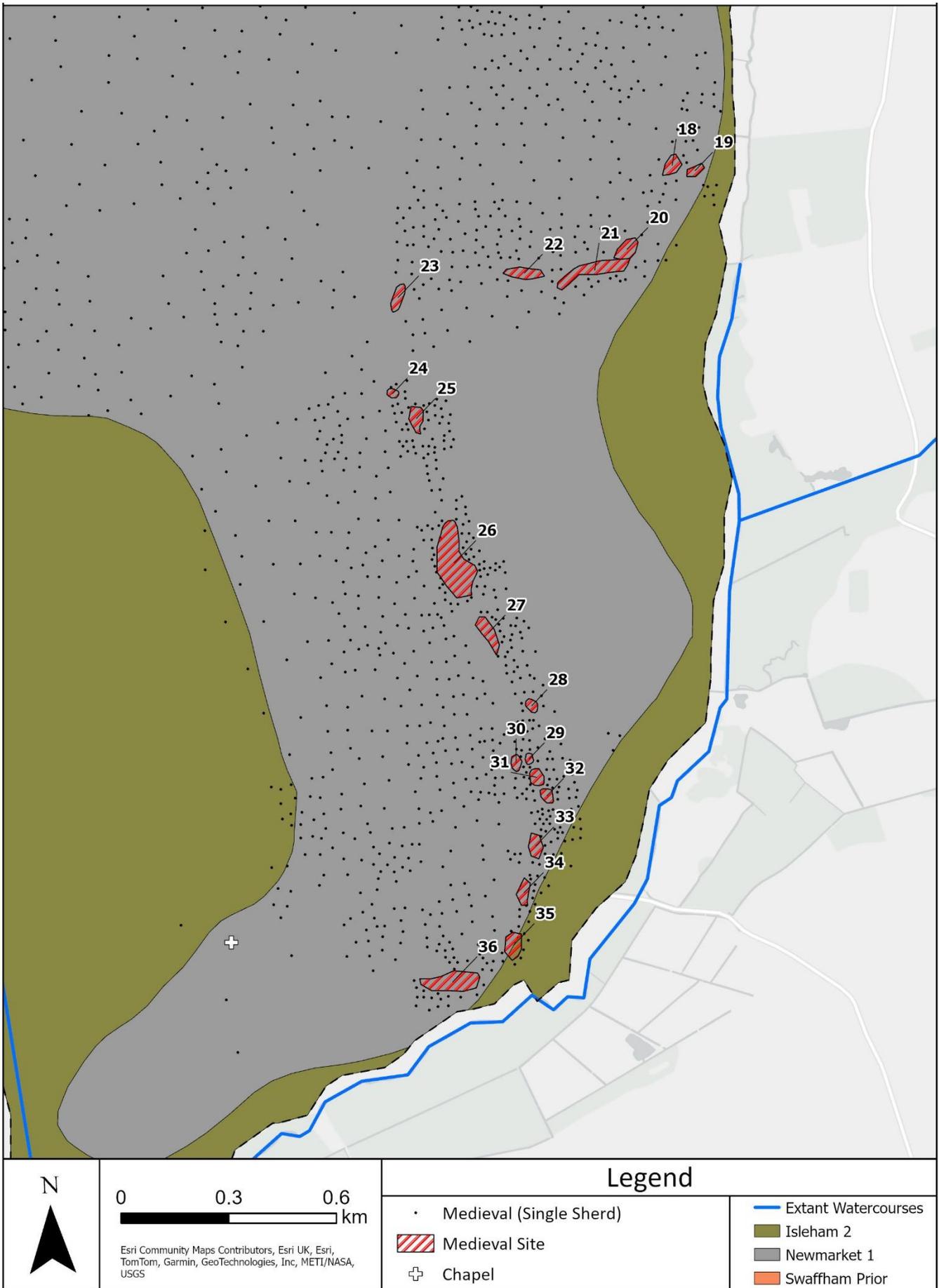


Figure 95: Medieval settlement in the south of Barton Bendish around the hamlet of Eastmoor shown against soils.

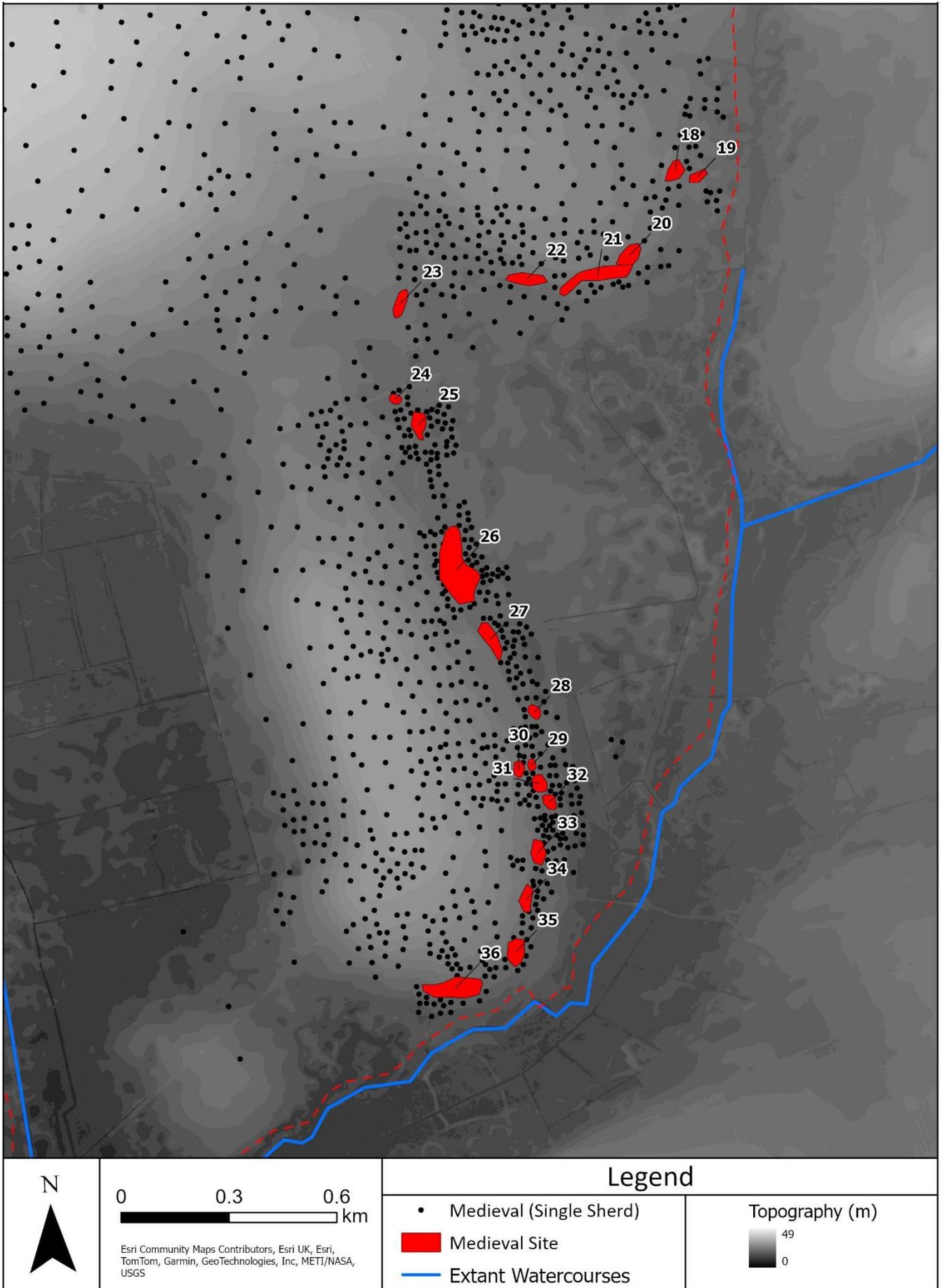


Figure 96: Medieval settlement in Barton Bendish around the hamlet of Eastmoor shown against topography.

would be ideal pastureland for the sheep which were so ubiquitous to this region. In such a dry environment a reliable source of water was fundamental to maintaining a healthy flock, and it is perhaps telling that the same relationship between manuring scatters and alluvial environments is often observable at Barton Bendish village in the north-west, with scatters often disappearing or significantly decreasing in density as the distance to the nearby stream decreased.

However, whilst Barton Bendish village was in occupation from the middle Saxon period, Eastmoor did not appear as a major focus of settlement until the eleventh century, and it was not until the twelfth and thirteenth centuries that the most intense periods of colonisation occurred (Rogerson 1997: 31). It is important to note, however, that PAS evidence – which will be discussed later in this chapter – indicates the presence of a short-lived early Saxon settlement that was subsequently abandoned by the start of middle Saxon period. This swift decline in the early Saxon period appears to have been replicated in the later fourteenth century, for following a burst of activity in the thirteenth century over 37% of sites were abandoned by the second half the fourteenth century (Rogerson 1997: 31). Only six sites, with Rogerson considering three of these sites doubtful, continued into the fifteenth century (Rogerson 1997: 31). Eastmoor clearly had none of the longevity which Barton Bendish possessed, declining as quickly as it rose.

So far, the sites discussed have been concentrations indicative of occupation. However, spreading across the vast majority of the survey area is a fine sprinkling of medieval and late medieval sherds highly indicative of the manuring of arable land. Whilst the densest manuring scatters are found in those places which are adjacent to areas of medieval occupation, with these perhaps indicative of intensely manured crofts, the spread of sherds across the region suggests a landscape that was under intense cultivation. When the intensity of Rogerson's survey is factored in, the spread of sherds is actually rather similar in all regions barring the south-west and the extreme north, for those areas intensely surveyed nearly always produced more sherds than those surveyed less intensively; it is thus reasonable to assume that had the survey been more consistent the spread of sherds across the landscape would likely have been relatively uniform. This explosion of activity during the medieval period brought areas into cultivation which had not been put to the plough since the Roman period and mirrors the trends observable in both the Claylands CZ and the Marshland CZ.

Whilst manuring scatters are, without a doubt, spread across the landscape, there are a few instances where these scatters are either absent or substantially reduced. As previously mentioned, in the north of the survey area the scatters are far sparser, with little material along the course of the White Road and near to RAF Marham, despite these areas being repeatedly surveyed. There is also a slight reduction in the intensity on the crest of the small hill in the centre of the survey area, which also

produced little Saxo-Norman evidence despite relatively significant scatters being identified in its immediate surroundings. It is possible that the reduction in medieval activity supports the previously forwarded theory that this slight, but regionally significant hill is too exposed to the elements to have been cultivated on a regular basis.

Late Medieval: c. 1350 – c. 1500

It is not surprising that the late Medieval evidence recovered from both Barton Bendish and Illington conforms to the general trends noted elsewhere in the county. In Illington, the focus of late medieval occupation appears to have shifted to the western half of the small linear occupational complex north-east of St. Andrew's Church which lies on the junction between the Worlington and Adventurers' 2 soils (Davison 1993: 6).

Around the church itself a few sherds of late medieval wares were recovered, although Davison states that this was 'hardly sufficient to suggest dwellings' (Davison 1993: 6). A limited concentration was identified between Old Farm and the eastern moated site, with Davison noting that this produced a sizeable volume of late medieval building material (Davison 1993: 6). This site is also near to the junction of soil types, although it is some 100m into the Isleham 2 soils. Elsewhere in Illington late medieval material was notably absent, with manuring scatters absent throughout much of the parish, barring a few possible instances in the west and centre of the parish.

Unfortunately, it is not possible to compare the state of manuring scatters in Barton Bendish to those in Illington due to Rogerson's previously discussed methodological decisions. However, the image garnered from the site gazetteer is one of decline and is largely congruous with the trends noted elsewhere in the county. The only new sites established in Barton Bendish during the late medieval period are Med 17 and Med 37. At Med 17, which is the southernmost concentration within Barton Bendish village, some sixty sherds of late medieval and post-medieval material were recovered, with Rogerson noting that this site occupies heavy soil on a north-facing slope which leads down to the small western stream (Rogerson 1997: 30). Med 37 is also located on wetter soil, being similarly positioned at the southernmost tip of Eastmoor, with this site believed by Davison to be the site of St. Mary's Chapel (Rogerson 1997: 30; Davison 1987: 50). Considering that only two virgin sites came into existence during the late medieval period is emblematic of the decline which so defines this period, with the expansion witnessed during the medieval period having come to an abrupt end during the fourteenth century.

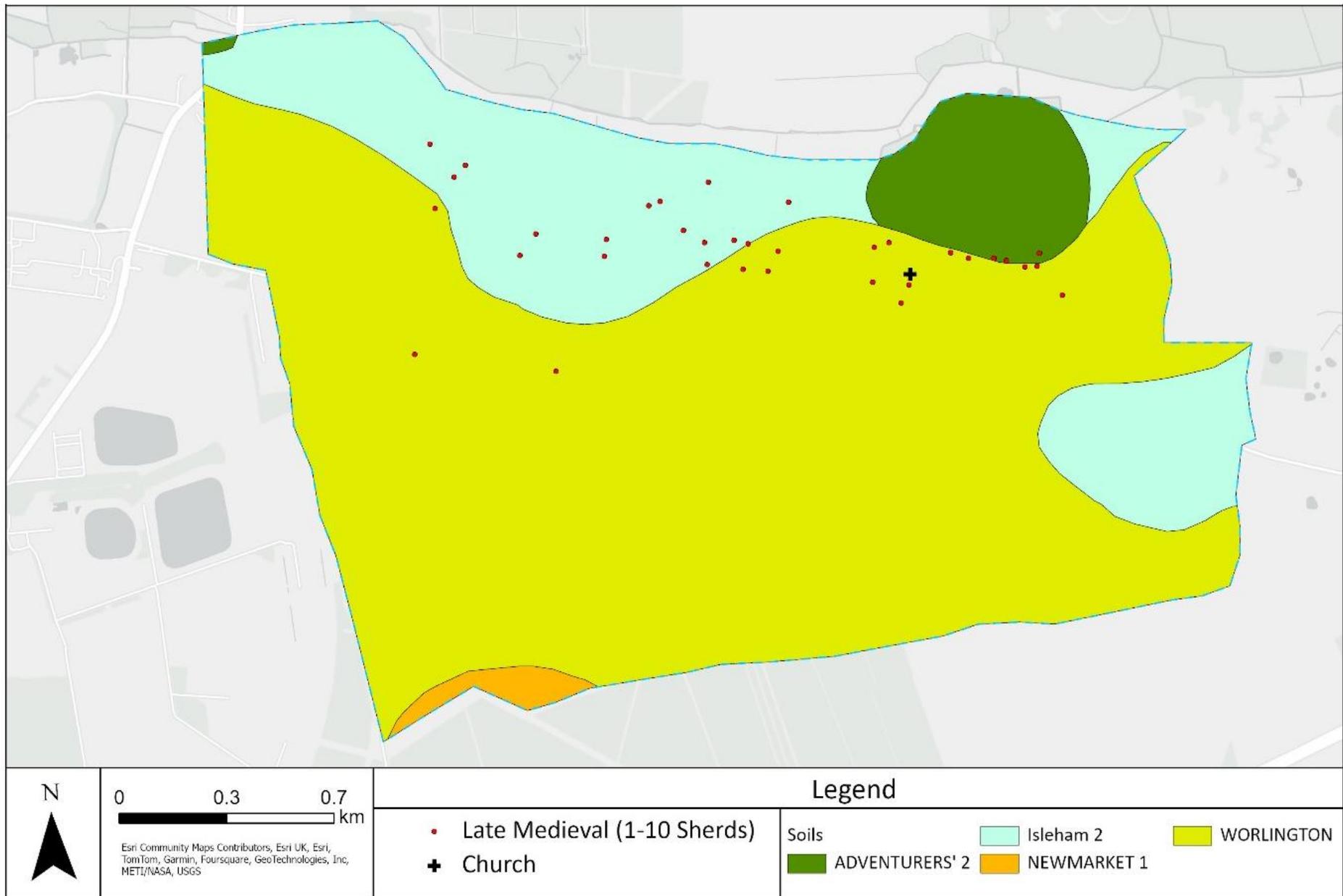


Figure 97: Late medieval settlement in Illington shown against soils.

This decline is also reflected in the number of medieval sites which continued to be occupied into the late medieval period. Of the 35 sites in existence during the medieval period, just 15 – or 43% of the total – survived into the late medieval period, with these predominantly located on the main street of the village. This considerable abandonment saw the almost complete desertion of Eastmoor and the shrinkage of Barton Bendish to a form far more in keeping with its current extent. The documentary evidence, such that it is, shows that between the Lay Subsidies of 1334 and 1449 the valuation of Barton Bendish dropped 9.7% (Rogerson 1997: 28). This drop is actually one of the least severe in Clackclose Hundred, with only five locations exhibiting a lower percentage decline, although the fact that even a century after the onset of the Black Death the valuation was still 9.7% lower than that before the pandemic is testament to the devastation that it must have wrought on the populace in the mid-fourteenth century (Rogerson 1997: 28). It thus seems a safe assumption, given the notable decline of occupational sites captured in the archaeological record, that the extent of arable land must have similarly reduced, although without more temporally accurate data determining exactly *where* this decline occurred is impossible to determine.

Portable Antiquities Scheme and Norfolk Historic Environment Record evidence

The PAS and NHER evidence support the broad pattern outlined by the fieldwalking data at both Barton Bendish and Illington. Whilst PAS reports no early Saxon finds in the Illington study area, this dearth of evidence is not exhibited at Barton Bendish. Here, early Saxon PAS records form three principal groupings which largely mirror the location of the early Saxon pottery scatters, with one notable exception. The most substantial cluster occupies a position that is concurrent with modern village centre, just east of St. Mary's Church in the vicinity of ES 2. Here, brooches, wrist-clasps, and other dress fittings have been recovered from the slopes within the Newmarket 1 soils on the immediate junction with Isleham 2. A second group is identifiable directly adjacent to St Mary's Church in precisely the same location where large scatters of early Saxon sherds were identified by fieldwalking. This second group occupies a position on the upper slopes of the shallow valley on the lighter side of the junction zone between the sandy Newmarket 1 soils and the heavier, riverine Isleham 2 soils. A third, smaller grouping lies on the parish boundary in the north-west of the study area, where brooch fragments and fittings have been found on the valley floor and lower slopes within the Isleham 2 association. Taken together, these assemblages corroborate the fieldwalking evidence and shows that early Saxon settlement focused on the well-drained, shallow slopes of Newmarket 1, while also indicating some use of the valley floor in the more moisture-retentive Isleham 2.

Interestingly, PAS data indicates a more substantial early Saxon presence in the hamlet of Eastmoor in the south-east of the parish than the fieldwalking data suggests. Here, a collection of early Saxon artefacts – including fragments of cruciform brooches, a nail-cleaner, a wrist-clasp plate, a decorated

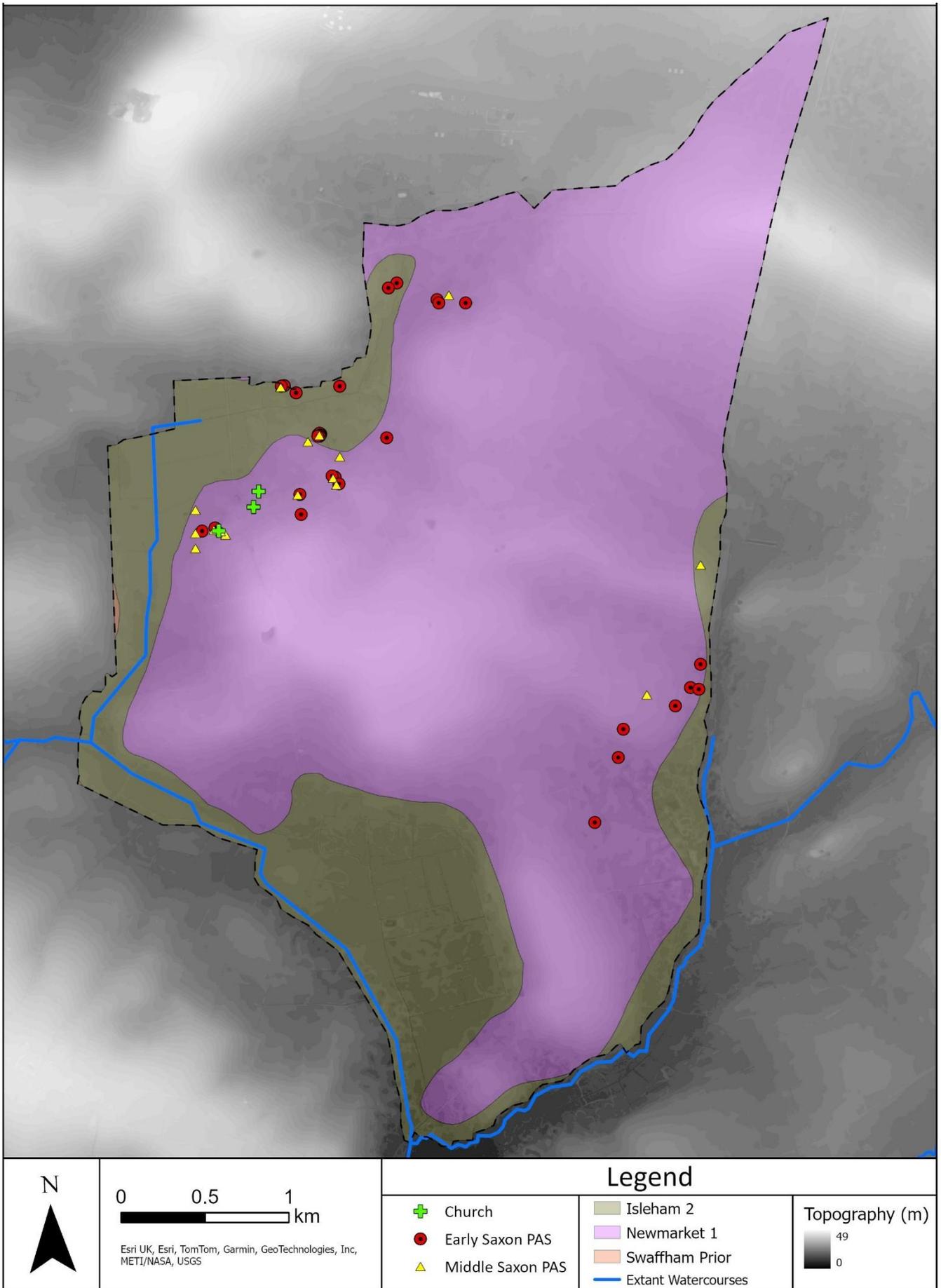


Figure 98: Early Saxon and middle Saxon PAS in Barton Bendish.

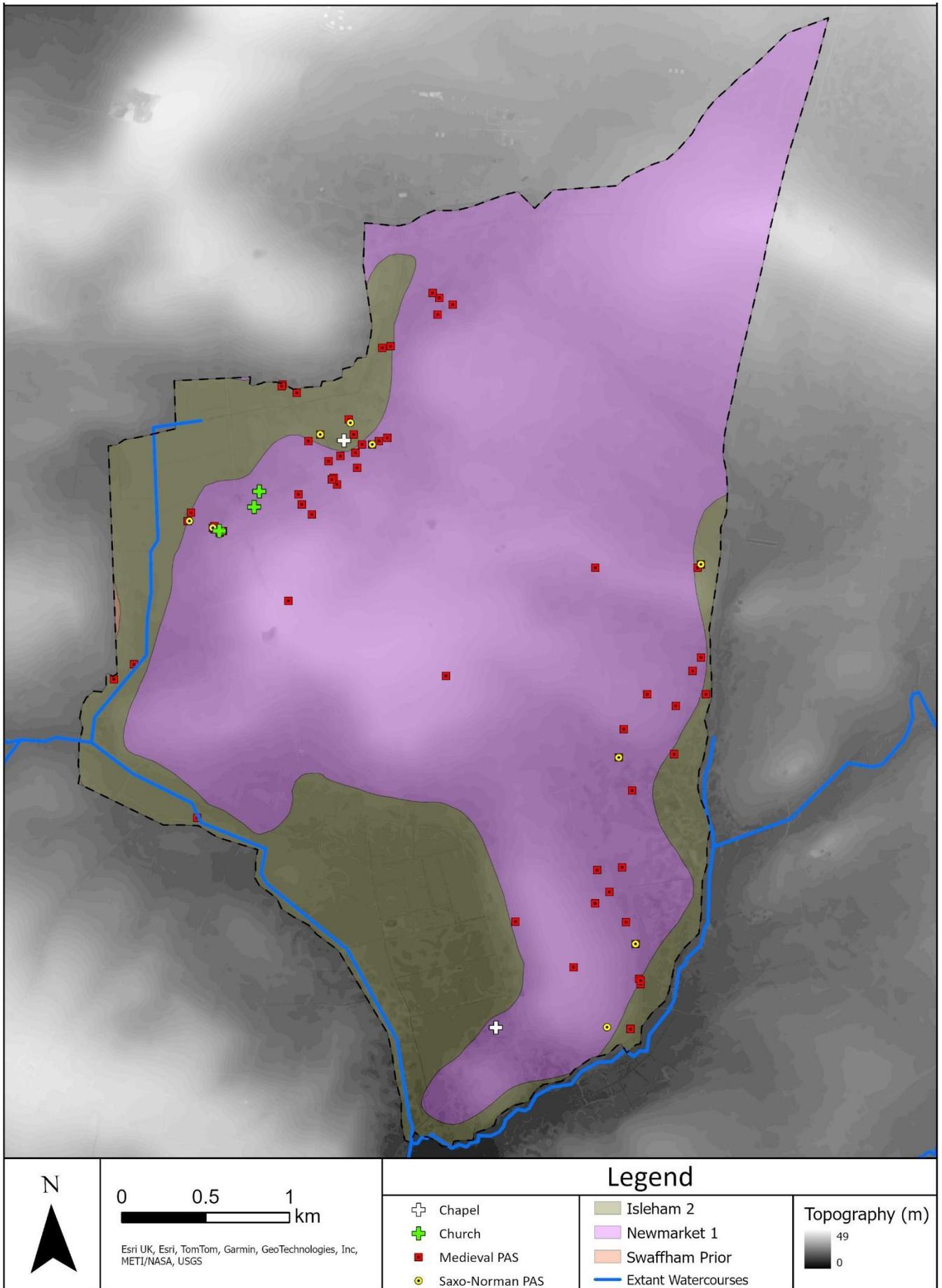


Figure 99: Saxo-Norman and medieval PAS in Barton Bendish.

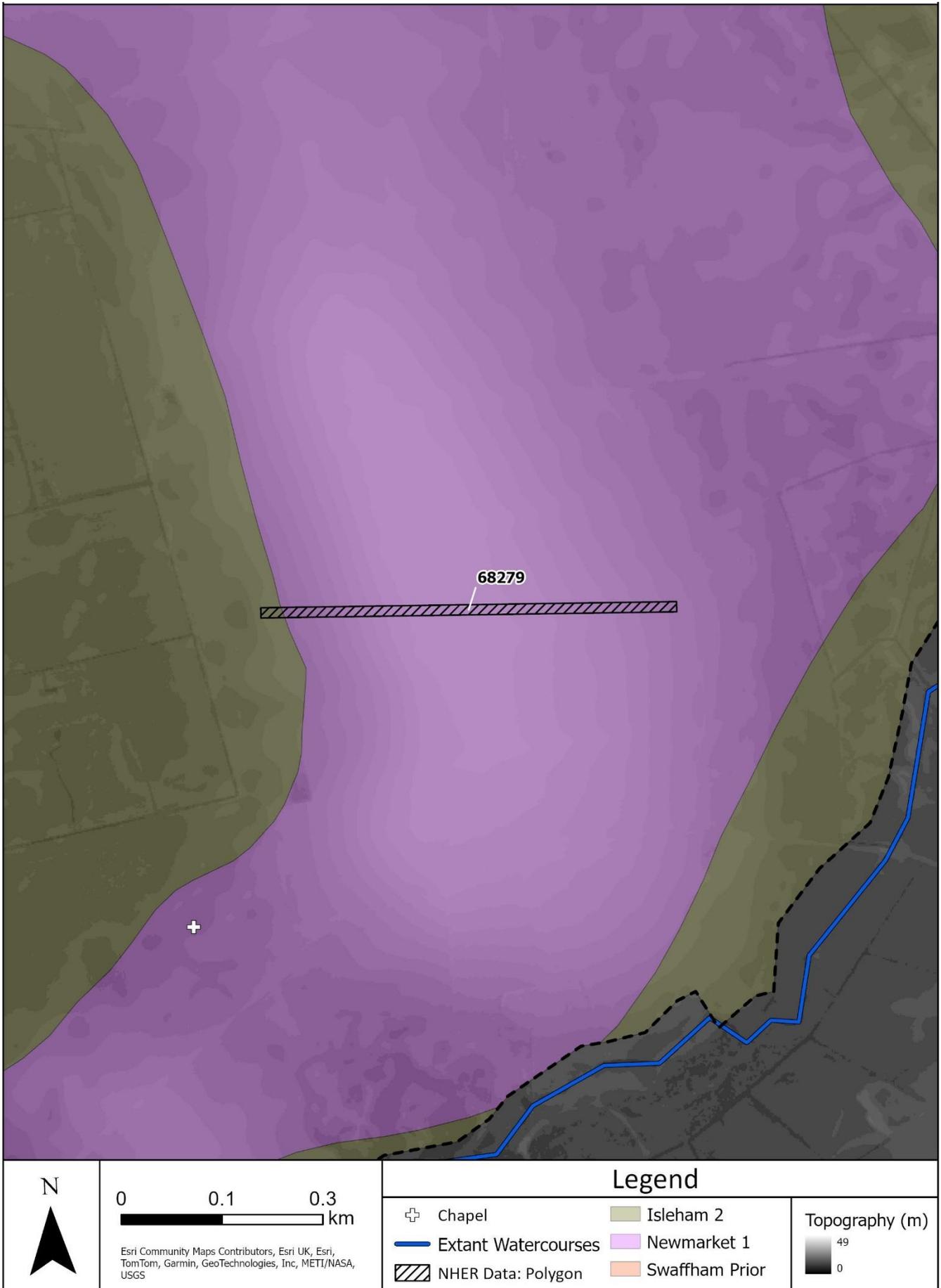


Figure 100: NHER data from Barton Bendish focused on the hamlet of Eastmoor.

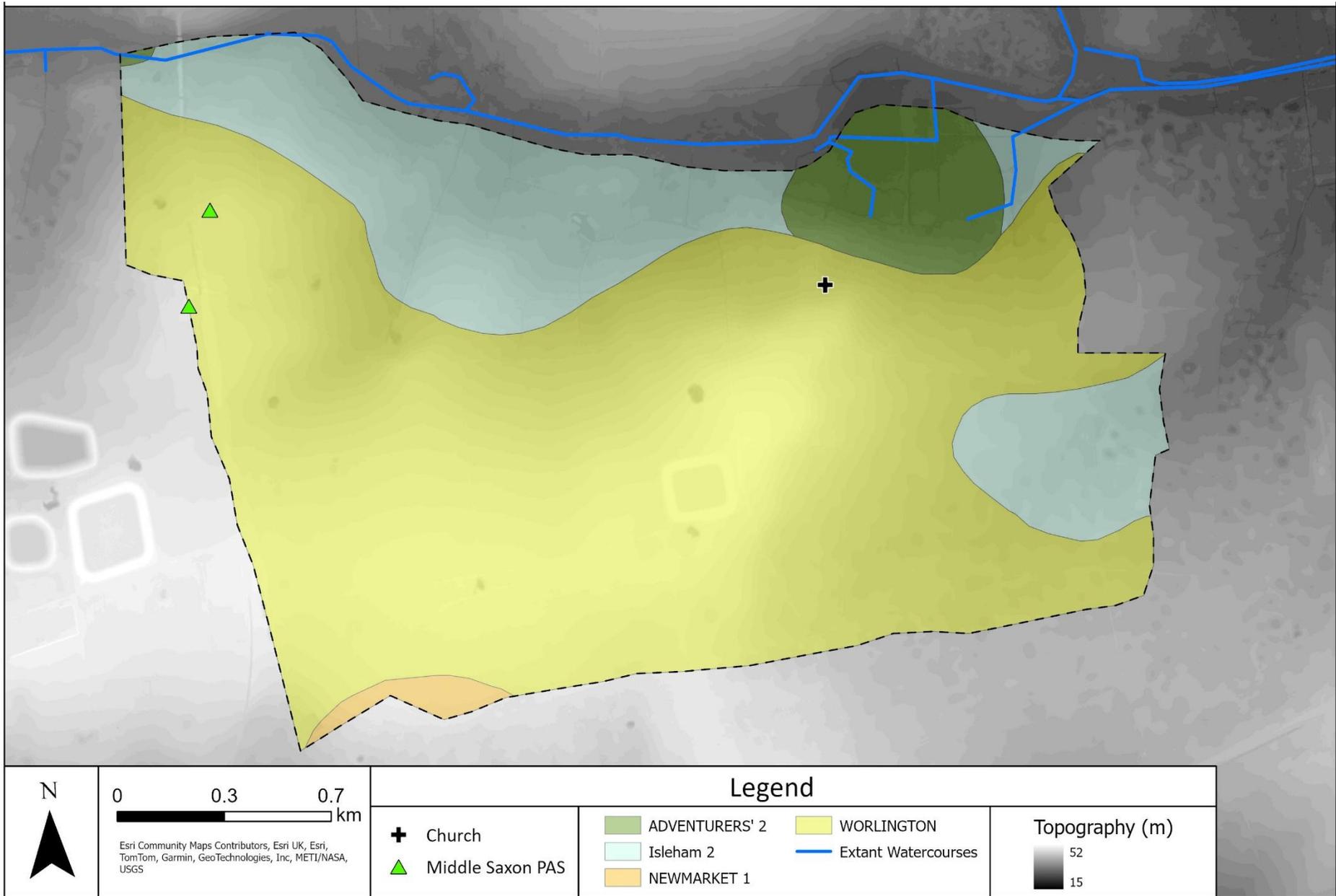


Figure 101: Middle Saxon PAS in Illington.

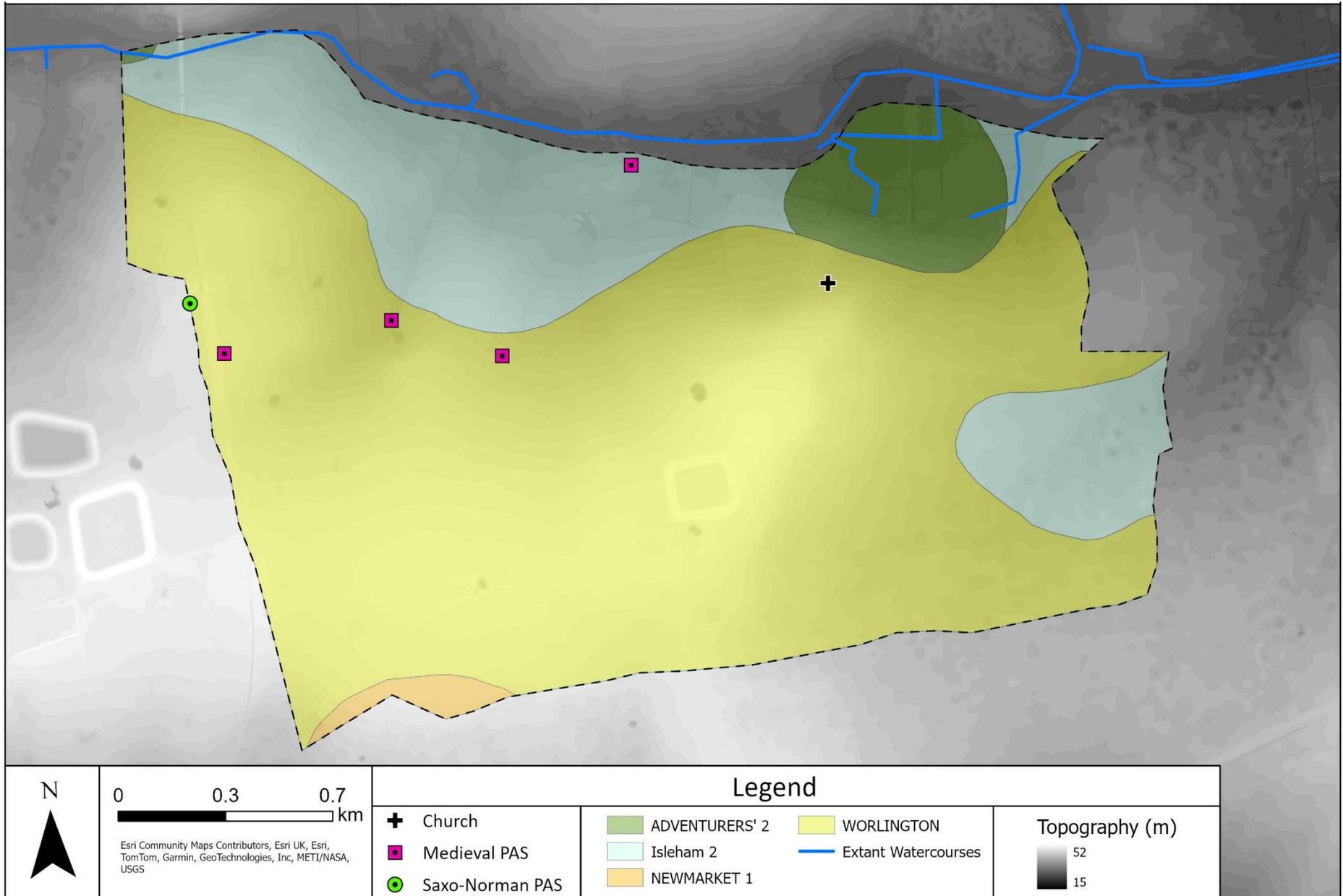


Figure 102: Saxo-Norman and medieval PAS in Illington.

gold sheet, an annular brooch fragment, and a Kentish-style strap fitting – have been recovered from the slopes of the Newmarket 1 soils that lead down to the extant watercourse. Despite investigation, the fieldwalking data recovered no early Saxon ceramic material from this location. The number of PAS artefacts recovered from Eastmoor is significant, with seven artefacts recovered. Whilst this is less than the number recovered from the early Saxon foci in the north-west of the parish – with thirteen artefacts recovered here – it nevertheless suggests that there was likely an early Saxon occupational complex in Eastmoor that has not been captured by the fieldwalking data. This does not, however, mark a break from the established pattern of early Saxon settlement in the study area, for it mirrors the pedological and topographical preferences demonstrated at the north-west foci. Early Saxon PAS artefacts in Eastmoor are limited to the slopes leading down from the elevated plateau in the centre of the parish near to the junction of the light Newmarket 1 soils and the heavier, riverine soils of Isleham 2 which hosts an extant watercourse. This is the same arrangement as that exhibited at the north-western foci. When the later PAS data for Eastmoor is considered it is clear the middle Saxon shift is particularly evident, for only a single middle Saxon and a single Saxo-Norman artefact have been recovered here, with the fieldwalking data for these periods exhibiting a similar dearth of evidence.

Middle Saxon PAS finds at Barton Bendish display an even closer correspondence with the patterns suggested by the fieldwalking data. Within the middle Saxon focus identified by the fieldwalking data around St Mary's Church, metalwork is tightly clustered along the Newmarket 1 slopes overlooking the shallow valley carrying the wetter Isleham 2 soils. The recovered artefacts – including ansate brooches, strap-ends, pins and hooked tags – are consistent with occupation and are intermingled with the ceramic material recovered by the fieldwalking survey. A smaller number of middle Saxon finds also lie on the slopes north-east of St. Mary's Church and are similarly associated with modest scatters of middle Saxon pottery identified by the fieldwalking data.

In Illington, the middle Saxon PAS evidence is confined to a single elaborate silver strap-end of Trehiddle style, securely dated to the later eighth or ninth century. This artefact was recovered from within the light Worlington association in close proximity to the junction where this lighter soil meets the heavier Isleham 2 soils that leads down to an extant watercourse. This location follows the pedological and topographical preferences exhibited by the limited scatter of middle Saxon sherds recovered by the fieldwalking survey that lies over a kilometre to the east, and reinforces the notion that Illington likely carried a very limited early and middle Saxon presence.

Saxo-Norman material recorded by PAS at Barton Bendish mirrors by the fieldwalking data. Around St Mary's Church and sites 3, 4, 5, and 6, strap-ends, disc brooches, balance fittings, and other personal

items are concentrated along the top of the shallow valley slopes within the Newmarket 1 soils. Further north-east, a smaller group of strap-fittings, buckles and Scandinavian-influenced brooches coincides with the chapel site and sites 1 and 2, again located on sloping topography but straddling the junction of the Newmarket 1 and Isleham 2 soils. To the south-east, around Eastmoor and site 8, a Saxo-Norman brooch and three finger-rings have been recovered from the sloping Newmarket 1 soils, marking the re-emergence of these locations after all but disappearing in the middle Saxon period. The PAS data thus confirms that Saxo-Norman settlement remained strongly focused on the sloping junction between the Newmarket 1 and Isleham 2 soils in the north-west of the study area whilst also capturing the re-emergence of settlement in the south-east of the study area that is similarly captured in the fieldwalking data.

Medieval and late medieval PAS finds are more dispersed across Barton Bendish but nevertheless remain heavily clustered around the same foci identified by the fieldwalking data. Around St. Mary's Church – corresponding broadly with Sites 1, 2, 3, 4, 5 and 6 – a diverse assemblage of strap-fittings, buckles, harness mounts, keys, spindle whorls and decorative mounts has been recovered, almost all from the slopes of the junction between the Newmarket 1 and Isleham 2 soils (with a clear focus on the lighter Newmarket 1 side of this junction zone). Additional PAS finds occupy floors of the shallow valley just north of sites 1 and 2, and once again mirrors the fieldwalking evidence.

The PAS assemblage around Eastmoor also demonstrates particular coincidence with the fieldwalking data. Here, the fieldwalking survey identified a well-defined medieval occupational complex focused on the slopes above the extent watercourse. The PAS finds coincident with the occupational complex that comprises sites 24 to 36 – which includes medieval and late medieval harness pendants, strap fittings, buckles, keys and a spindle whorl – are constrained to the same sloping topography within the Newmarket 1 soils, with only two PAS artefacts found to the east of this main complex, once again conforming to the pattern described by the fieldwalking data.

In Illington, medieval and late medieval PAS finds are more numerous than those dating from preceding periods but these ultimately remain modest in quantity, and their distribution once again concurs with the fieldwalking evidence. Two PAS finds date to the medieval period, with these positioned within the medieval sites and scatters identified by the fieldwalking data. Two finds – a decorative hooked mount and a silver penny of Edward III – date to the late medieval period and occupy the shallow slopes of the Worlington association. These are positioned at the junction between the Worlington and Isleham 2 associations, with this distribution mirroring the late medieval fieldwalking data.

NHER data provide an additional layer of context for Barton Bendish, particularly around Eastmoor. To the west of the hamlet, NHER 68279 coincides with the western side of the Eastmoor complex, where the fieldwalking survey recovered a substantial group of medieval and late medieval sherds. Trial trenching undertaken in 2023 revealed a small number of poorly dated ditches and possible pits, producing isolated sherds of late Neolithic, early Bronze Age, and Roman ceramics alongside medieval and late medieval sherds and fragments of lava quern and small pieces of post-medieval and modern glass (Griffith 2023; Serrano and Griffith 2023). This evidence fits with the fieldwalking data, where notable concentrations of Saxo-Norman and medieval material were identified along with a conspicuous absence of early Saxon potsherds. That the PAS data suggests an early Saxon presence in Eastmoor does not, however, clash with the negative result of this trial trenching, for this investigation was limited to a single site a kilometre south of the scatter of early Saxon PAS finds. It is thus likely that the early Saxon focus at Eastmoor was limited to its northern end, rather than being coincident with the full length (some 2.5km) of this extensive medieval occupational complex.

NHER entries for Illington add little in the way of additional information but do help to reinforce the distribution described by the fieldwalking and PAS data. NHER 54511 records a series of linear earthwork ditches and banks in the junction zone between Worlington and Isleham 2, south and east of Old Farm, interpreted as medieval to post-medieval drainage features. That these are coincident with the thin scatter of manuring sherds identified by the fieldwalking reinforces the notion that these features were potentially part of the medieval agricultural landscape. That they have been interpreted as drainage features is unsurprising given that they are coincident with the main body of the water-retentive Isleham 2 soils and lie downslope of the freely-draining Worlington soils. That they do not extend further south into the Worlington soils is equally as unsurprising, for these soils are particularly well-drained and extensive drainage networks was likely unnecessary.

Supplementary evidence: West Stow, Domesday, and wider landscape applicability

The archaeological surveys discussed above provide a snapshot of historic settlement in two Breckland landscapes. However, when other Breckland sites are considered, as well as the general trends in settlement and agricultural practices employed in the region throughout the Middle Ages, the similarity between these two localised surveys to that of the wider Breckland landscape is clear. Whilst this thesis is focused upon the county of Norfolk, the natural environment of Breckland is not limited to just a single county, with a sizeable portion of this distinctive geological environment located across the border in Suffolk. This southern part of the Brecks shares the same geological and topographical character as its northern counterpart and thus requires no further environmental discussion. This brief analysis, which will seek to demonstrate that Illington and Barton Bendish are typical of the wider

Breckland landscape, will investigate the site of West Stow and its surrounding landscape as well as the agricultural practices employed in the Brecks during the Middle Ages.

Located in the south of the Suffolk Brecks is one of Breckland's most famous medieval sites, the Anglo-Saxon settlement at West Stow, with this intensively excavated site being one of the finest examples of an early Saxon occupational site in the UK (West 1985: 1; Parry 2017: 1; Hoggett 2023: 20). The principal area of early Saxon occupation at West Stow occurs on an approximately 1.8 hectare sandy knoll standing 4.5m above the floodplain of the river Lark, slightly set back from the river itself (West 1985: 9). The majority of early Saxon activity occurred on the central crest of this knoll as well as on its southern edge adjacent to the Lark's floodplain, although a less intensive area of occupation was detected in the north-east corner of the site (West 1985: 10). The most striking archaeological feature of West Stow was the quantity of sunken-featured buildings (SFB), with at least 67 probable early Saxon SFB's being identified on the knoll itself (West 1985: 10). Also detected were a number of post-hole buildings, interpreted by West as the remnants of central 'halls' around which the SFB's were arranged (West 1985: 10-25). The 67 SFB's and numerous 'halls' identified were not, however, all occupied at the same time; rather, the site, which West considers to have been an averagely sized early Saxon village typical of the Brecks, was occupied from the fifth to the seventh centuries, at which point family groups appear to have relocated away from the sandy knoll towards the existing parish church, with this new site then continuing into the medieval period (West 1985: 162-170).

From a geological, geographical, and topographical point of view West Stow is largely congruous with the other early Saxon sites discussed in this chapter. The soils and topography ensure that it is particularly well-draining, whilst its proximity to the river provides a reliable source of water for both livestock and humans. These traits are typical of early Saxon sites, both in the Breckland CZ and elsewhere, with access to water being vital to occupation, industrial activity, and agricultural success, particularly in such a dry environment. Alongside the excavations of the West Stow site itself, a survey of the wider Lark Valley area was also undertaken, and it is clear from the data that there was a definite correlation between slightly set back waterside locations and early Saxon activity, such as in the parishes of Cavenham and Tuddenham where cemeteries indicate occupational sites lying slightly back from the tributaries of the Lark (West 1985: 155-161). That early Saxon sites in both Illington and Barton Bendish share these locational preferences suggests that they are typical of the wider landscape.

The excavations at West Stow produced large quantities of plant remains, with evidence of rye, barley, and bread wheat found throughout the site, indicating that the occupants of the village were engaged in arable agriculture (West 1985; Parry 2017: 8). It is also clear that arable exploitation was practiced

alongside pastoral farming, for over two tonnes of animal bones were recovered from across the site (West 1985; Parry 2017: 8). Although a relatively large portion of these bones came from cattle and pigs, a far larger portion – approximately 50% of the total – came from sheep or goats (West 1985; Parry 2017: 8). The importance of sheep will be discussed in greater detail later in this section, but for now it suffices to say that it is unsurprising that sheep were likely the dominant type of livestock at West Stow, for in later centuries the Breck's, with its dry grasses and extensive heathlands, were synonymous with sheep farming. The combination of plant remains associated with arable agriculture and faunal remains associated with animal husbandry thus indicates that during the early Saxon period a mixed farming regime was being practiced at West Stow, a regime which by necessity required suitable habitats for the various modes of exploitation; arable farming required light, easily ploughable soils whilst pastoral farming required suitable grazing and watering grounds.

Such environments were in plentiful supply at West Stow. To the south of the occupational core of the village is the Lark and its floodplain, with this environment providing rich meadowland eminently suitable for the grazing and watering of livestock, with further areas of rough, drier grazing to the north on the upland heaths which formed ideal sheepwalks (West 1985: 170; Parry 2017: 8-15). Between the floodplain of the Lark and the upland sheepwalks are large expanses of light, dry, gently sloping soils ideal for early Saxon cultivation. The presence of rye in the assemblage is unsurprising, for this crop possesses an extensive root system that is far more resistant to drought than many cereal crops and is thus able to thrive even in the low-moisture environment of Breckland. The landscape surrounding West Stow thus provided the inhabitants with a range of habitats allowing for multiple modes of exploitation to be practiced, and upon comparison the wider landscape of both Barton Bendish and Illington appear to contain similar compositional elements. The site of ES 2, which is likely the primary site of early Saxon occupation in Barton Bendish, shares many similarities with West Stow. It is located adjacent to a reliable source of water and thus also to its associated meadowland, as well as being on the edge of a large expanse of light, dry soil that leads to an area of rough, 'upland' pasture. This topographical arrangement is also observable in the data from *Illington Parish*, and although no occupational site was identified by Davison, West theorised during his survey of West Stow's wider landscape that an early Saxon cemetery must be associated with a nearby occupational site (West 1985: 155; Davison 1993: 1-5). Thus, whilst no such site was identified in Illington, there was likely a site of early Saxon occupation nearby due to the presence of an early Saxon cemetery. This occupational site was perhaps located in neighbouring parishes, which due to the small size of Illington lie no more than 2km away from the site of the cemetery, with Davison sharing this view that an early Saxon occupational site was likely near-by (Davison 1993: 1-10). The topographical and geological landscapes surrounding West Stow are thus mirrored in both Barton Bendish and Illington, and appear

to conform, to a remarkable degree, to Everitt's 'river and wold' model (Everitt 1977). Were ES 2 to be excavated, it is likely that a site similar to West Stow would be uncovered, for whilst these sites lie over 38km apart, their shared environmental characteristics ensures that they have developed along much the same lines.

As mentioned above, a large proportion of the faunal remains recovered from West Stow belong to sheep or goats (West 1985; Parry 2017: 8). The kill pattern suggests that sheep were not being raised for any one purpose; rather, they were being raised in order to exploit all three economic products that sheep can provide, namely meat, wool, and milk. Those slaughtered for meat at West Stow were no older than two or three years old, at which point they had reached maturity and were unlikely to grow any further, whilst those kept for wool and milk were generally older, with older males being prized for their wool-growing capabilities and older females being retained to provide the community with milk (West 1985; Parry 2017: 9). Whilst these economic products were undoubtedly critical to those communities tending to the flocks, it was another ability of the sheep which was arguably the most important to those farming the light, infertile soils of the Breck's, and which was critical to the development and evolution of the foldcourse system, the region's principal system of farming in the medieval to post-medieval period (Belcher 2020). Under this system crops could be grown in discrete blocks on the marginal, easily exhausted soils before being fallowed after harvest, whereby flocks of sheep, which had been grazing by day on the lowland meadows, upland pastures, and stubble were folded overnight on the fallows, where their dung and urine would fall to the ground and be treaded into the soil, thus rejuvenating it with the nutrients consumed by the sheep on the grazing grounds (Parry 2017: 13). Without this replenishment the soil would become exhausted, and crop failure would almost be a certainty.

An ample supply of manure was thus vital to arable success, and sheep, unlike cattle and pigs, are excellent organic manuring machines. Whilst cattle provide ten times the amount of protein per animal and pigs mature rapidly, their usage as producers of manure is limited. Cows produce a large volume of dung, but they often defecate in one place and so their manure requires manual spreading on the fields. Sheep, on the other hand, defecate often and in small volumes, and are excellent at treading in their urine and manure, working it into the soil and thus replenishing the vital nutrients that readily wash out of Breckland's light soils, in a practiced known as 'tathyng' (Parry 2017: 13). Simply spreading the manure over the land without working it into the soil would be far less effective (Bailey 1989: 65-6). The importance of sheep can be seen in contemporary documents, where in one example the Prior of Bury St. Edmunds Abbey leased valuable pastureland to a farmer from the village of Kilverstone, on the condition that he provide the hurdles for folding the sheep on the fallows and employ a shepherd, whilst in return he was granted the tathe of the flock (Parry 2017: 13).

That such a high proportion of faunal remains recovered at West Stow have been identified as those of slaughtered sheep is unsurprising given the dominance of sheep in Breckland's agricultural regime throughout the entirety of the study period (Campbell and Overton 1992: 377-396; Campbell and Overton 1993: 38-105). An early reflection of their importance is captured in Domesday. Whilst the Domesday entries for West Stow and Illington do not record the quantities of livestock, the Domesday entries for the five manors at Barton Bendish do, as do the entries for Culford, Ingham, and Great Hockham, with the two former settlements lying just east of West Stow and the latter lying just north of Illington. In 1066 a total of 5 cattle, 76 pigs, and 230 sheep were recorded at Barton Bendish, with this falling slightly in 1086 to a total of 3 cattle, 52 pigs, and 221 sheep (Phillimore Norfolk: 13, 3; 21, 2; 31, 21; 66, 2; 66, 36). At Culford, 1 cattle, 2 pigs, and 85 sheep were recorded in 1086, whilst at Ingham 4 cobs, 19 cattle, 30 pigs, and 520 sheep were recorded in 1086 (Phillimore Suffolk: 14, 70; 8, 32; 14, 69). At Great Hockham 2 cobs, 2 cattle, 8 pigs, and 220 sheep were recorded (Phillimore Norfolk: 9, 71; 9, 72). Elsewhere in Norfolk Domesday paints a picture of a far less sheep-oriented system. In the Claylands CZ, Hales records just 1 cob, 1 cattle, 14 pigs, and 10 sheep in 1066 (Phillimore Norfolk: 12, 43; 14, 42; 14, 43; 31, 16). In neighbouring Heckingham 2 cobs, 4 cattle, and 20 pigs are recorded in 1086, whilst 2 cobs, 40 pigs, and 40 sheep are recorded in Elsing in 1066 (Phillimore Norfolk: 9, 106; 9, 111; 9, 229; 12, 42; 14, 43; 8, 6). These latter totals pale in comparison to the 230 sheep kept at Barton Bendish, the 520 kept at Culford, and the 220 kept at Great Hockham.

The landscapes in and around Barton Bendish and Illington are thus typical foldcourse landscapes, with extended areas of rough upland pasture for the large flocks of sheep, extensive tracts of light soils suitable for arable cultivation, and limited, but invaluable lowland meadows associated with a river or a minor stream which provided hydration to humans and animals alike. That such a landscape is replicated 38km south at West Stow strengthens the case for utilising Barton Bendish and Illington as samples representative of the wider Breckland landscape, for the similarity in landscape composition, in the Domesday evidence, and in the farming regime being practiced is striking. The morphology of settlement is also similar in Barton Bendish and Illington to the wider Breckland landscape, where nucleated, coalesced occupational complexes and compact linear occupational complexes are typical; such a morphology is quite clearly exhibited in Barton Bendish and Illington, with this being particularly notable at the village of Barton Bendish and the hamlet of Eastmoor (Wright 2015: 140; Williamson 1993: 11). The suggestion that Barton Bendish and Illington be used as representative samples of the wider Breckland landscape should not be taken to imply that all Breckland landscapes are the same, for there are evidently examples which do not comply with this generalised outline. Nevertheless, Barton Bendish and Illington together embody the wider Breckland landscape, despite their geographical differences discussed in Chapter Two. Their contrasting

positions — Barton Bendish on the fen-edge and Illington in a more central, inland setting — help ensure that the analysis and resulting conclusions are not biased towards either environment but instead reflect the wider landscape of the Norfolk and Suffolk Brecks.

Climate and settlement

Early Saxon: c. 500 – c. 720

In the early Saxon period precipitation and temperature levels are significantly reduced compared to later periods. In the dry, sandy environment of Breckland this combination is particularly problematic, for the coarse soils allow significant volumes of water to percolate through the profile and are ultimately poor at retaining both moisture and heat. Whilst the early Saxon evidence from Illington is primarily associated with the cemetery site rather than an occupational or agricultural site, the evidence recovered at Barton Bendish and West Stow is far more useful in gauging the degree to which fluctuations in climate drove changes in settlement.

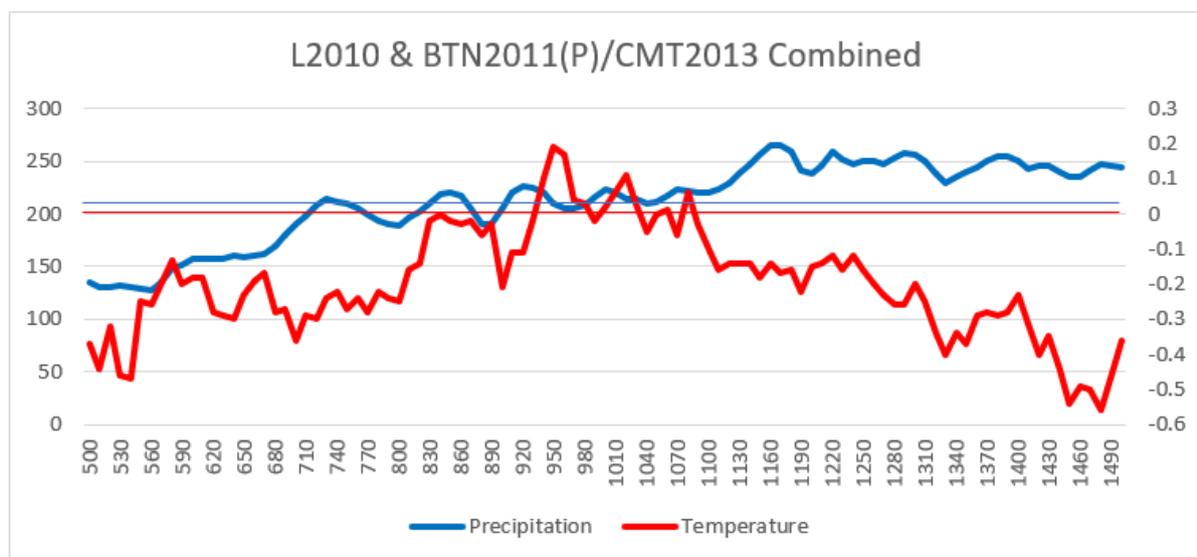


Figure 103: Temperature and precipitation over the course of the medieval period, based on L210, BTN2011(P), and CMT2013.

When the early Saxon evidence from Barton Bendish, West Stow, and the wider landscape is analysed, a clear preference towards riverine environments is observable. The primary early Saxon occupational site at Barton Bendish is likely ES 2, with this site – which is surrounded by earlier Romano-British occupational sites – just north-east of a probable early Saxon manuring scatter. These are located along the north-western edge of the survey area in close proximity to a watercourse, with these sites occupying the junction between the lighter Newmarket 1 soils and the heavier Isleham 2 soils. Even the possible early Saxon occupational site indicated by the PAS data in the north of the later medieval hamlet of Eastmoor adheres to this pedological and topographical framework. Similarly, West Stow is

| Breckland CZ | | |
|--------------------|---|---|
| Soil association | Constituent series | General character of association |
| 554b – Worlington | Worlington – deep argillic brown sand; non-calcareous upper horizons; calcareous at depth; highly permeable; Euston – argillic brown sand; slightly more clayey subsoil; permeable; Newport – typical brown sand; non-calcareous; freely drained; Redlodge – humo-ferric podzol; well-drained; strong eluvial/illuvial horizons; acidic upper profile; Santon – humo-ferric podzol; shallow; acidic; associated with thick decalcified drift | Deep, drought-prone sandy soils; highly permeable; acidic in upper horizons; prone to nutrient loss and wind erosion; extensive landwork opportunities except in cold/wet mid-winter. |
| 521 – Methwold | Methwold – shallow brown calcareous sand; stony; over chalk rubble; permeable but retains moisture via chalk aquifer; Worlington – argillic brown sand (minor component); Newmarket – brown rendzina; shallow; calcareous; Elveden – brown rendzina; shallow; calcareous | Shallow, calcareous, permeable soils; productive due to chalk aquifer; rapidly workable; low compaction risk; drought-prone in dry years. |
| 343f – Newmarket 1 | Newmarket – shallow lithomorphic brown rendzina; coarse loamy; highly permeable; Methwold – brown calcareous sand; Elveden – shallow brown rendzina; Worlington – argillic brown sand (localised) | Shallow, calcareous, coarse-loamy patterned-ground soils; very well-drained; extensive landwork opportunities; chalk rubble enhances moisture retention. |
| 343g – Newmarket 2 | Newmarket – lithomorphic brown rendzina; shallow; coarse loamy; Rudham – fine-loamy brown rendzina; very shallow; Soham – fine-loamy brown calcareous earth; shallow; Swaffham Prior – coarse-loamy typical brown calcareous earth; stony; calcareous; Moulton – typical argillic brown earth; deeper; illuvial clay; non-calcareous upper horizons; Newport – brown sand (minor component) | Predominantly shallow, calcareous, coarse- to fine-loamy soils; very well-drained; low compaction risk; droughty on sands but chalk rubble increases moisture availability. |
| 552b – Ollerton | Ollerton – gleyic brown sand; mottled subsoils; moderately deep; non-calcareous upper horizons; Honingham – stagnogleyic argillic brown earth; mottled; calcareous at depth; Hockham – gleyic argillic brown sand; mottled B horizons; deeper profile | Sandy to coarse-loamy soils with seasonal waterlogging; influenced by groundwater; intermediate between well-drained Breckland soils and heavier Claylands; droughty in summer, waterlogged in wet winters. |
| 346 – Reach | Reach – humic gleyic rendzina; shallow; calcareous; mottled; Burwell – gleyic rendzina; shallow; calcareous; Blackdyke – calcareous humic gley soil; mottled; Associated valley-floor soils – shallow, sandy/loamy, waterlogged without drainage | Extremely calcareous sandy-loamy soils with frequent mottling; naturally waterlogged on valley floors and lower slopes; more poorly drained than main Breckland soils; shallow profiles over chalk rubble. |
| Isleham 2 | Isleham 2 – sandy/peaty gley; shallow; groundwater-influenced | Poorly drained, gleyed riverine soils; waterlogged in winter; more extensive in Breckland due to shallow valleys. |

Table 14: Breckland soil chart.

also located adjacent to a natural source of water, which in this instance is the Lark; even the cemetery at Illington is located within 100m of the only stream. It is thus clear that early Saxon settlement gravitated towards these waterside, riverine locations, which is unsurprising given the dryness which characterises the interfluvial zones lying between Breckland's shallow streams and rivers, a dryness which would only have been exacerbated by the dry, cold climatic conditions prevailing at the time. However, whether this preference for water-side locations for both occupational and agricultural sites – such as West Stow, ES 2, the possible early Saxon site identifiable in the PAS data at Eastmoor, and the manuring scatter at RB 9 – was driven primarily by climatic fluctuations is questionable, for even in wetter periods water would still be in short supply in the inherently dry environment of Breckland. It thus seems more likely that it was static geographical structures – namely streams and rivers – which were determining the siting of early Saxon settlement, rather than the more dynamic forces of climate.

There is, however, the possibility that the dry conditions which defined the early Saxon period allowed the comparatively 'heavier' junction sites to be colonised, although it is important to note that this descriptor ('heavier') is intended to be read in comparative terms, for even these 'heavier' soils are still notably sandy. However, if climatic conditions were influencing settlement, it is curious that early Saxon sites at Barton Bendish – such as the manuring scatter at RB 9, the probable occupational site at ES 2, and the potential occupational site in the north of Eastmoor – often occupy the lighter side of the junction zone between the dry Newmarket 1 soils and the wetter alluvial soils of the Isleham 2 association, for in such a dry climate as that prevailing in the early Saxon period the richer downslope soils would have been far more workable and receptive than they were in later periods. The most likely explanation as to why these soils were not brought into cultivation during a period when they would have been at their most workable is likely rooted in anthropogenic factors, for it is probable that these early Saxon agriculturalists simply lacked the necessary agricultural implements to cultivate these heavier soils and were thus limited in what land they could put to the plough. There is thus the possibility that factors of climate were, to a limited extent, playing a role in determining the positioning of early Saxon settlement, although it is imperative to note that it was, first and foremost, the static geographical structures, such as the rivers and small streams and their associated 'junction zones' which were the principal 'draw' to early Saxon settlers. The influence of climatic forces are thus potentially more micro than macro, influencing settlement at a hyper-local scale. Interestingly, this is not the only occasion that such a trend has been observed, with site H19 in the *Three Parishes* also intimating that climatic forces are potentially more likely to influence settlement siting at a hyper-local scale rather than at a macro-scale. In order for this hypothesis to be tested a far more localised analysis than that presented in this thesis would need to be performed, with fully excavated sites in climatically vulnerable locations being individually analysed to determine whether, on a hyper-local

scale, climatic fluctuations were influencing the positioning of settlement. Only site H19 in the *Three Parishes* has been identified as a potential site for such an investigation.

Whilst the junction sites potentially indicate that climatic fluctuations were playing a role in determining early Saxon settlement, Site 1 appears to suggest otherwise. This site is located squarely in the centre of the Newmarket 1 soils on gently sloping ground. This site's soils would allow copious amounts of water to percolate through the soil, with the gently sloping topography of the site only serving to increase its drainage capabilities and further wash out precious nutrients. Whilst there are no modern water courses close to Site 1, lidar does suggest the existence of palaeochannels to the east and northeast of Site 1, which could have provided hydration for both man and beast or potentially provided a suitable location for a well (see Figure 81). Even with this potential source of hydration this would have remained an exceptionally dry location for an occupational site, which would only have been made more inhospitable by the dry climatic conditions of the period. Occupation thus seems an unlikely function for Site 1, especially when there was plenty of other, more hospitable locations to exploit nearby. A more feasible suggestion as to what function this site performed is hinted at by its proximity to the central upland, which suggests that it was possibly involved in the exploitation of this area of rough grazing. Given that the evidence from West Stow suggests that a mixed farming regime was being practiced by its early Saxon inhabitants, with the dominance of sheep indicated in both the bone assemblage and in the documentary record of later centuries, the suggestion that Site 1 was involved in pastoral exploitation is not unfeasible. Livestock were potentially driven down to water in the wetter lowland environments to the west or perhaps even to the palaeochannels near to Site 1. This suggests that exploitation of the landscape was paramount in determining where the site was located. There is thus little evidence that the siting of Site 1 was, in any way, driven by climatic forces, which at this time would only have exacerbated the inherent aridity of the landscape. Again, it appears that static pedological and environmental factors are far more influential in determining early Saxon settlement than the more dynamic forces of climate.

There is thus only limited evidence of climatic fluctuations driving changes in early Saxon settlement and land use in Breckland. If climate was the principal driver, we would expect the wetter locations – which during this period would have been at their most workable – to be particularly attractive to early Saxon settlers and subsequently exhibit signs of exploitation. As it is, the early Saxon sites in Barton Bendish, Illington, and West Stow avoid the heavier soils with a striking degree of uniformity, with even those sites occupying the junction zones loth to stray into the increasingly heavier downslope soils, preferring instead to stick to the lighter upslope soils. Indeed, the locational data of early Saxon sites on the north-western edge of Barton Bendish follows the inside edge of the

Newmarket 1 soils to such a degree that it could be used in lieu of the soil map produced by the Soil Survey of England and Wales, with such precision demonstrating just how conscious these early Saxon agriculturalists were of the environment in which they farmed and lived. We also see, from the evidence recovered at West Stow and the sites identified at Barton Bendish, a community which is able to adapt to their local environment, cultivating hardy, drought resistant crops such as rye and potentially exploiting the extensive heathlands which dominate the region as rough grazing for livestock. This ability to adapt to the local environment – and thus to *static*, rather than *dynamic* environmental conditions – appears to have shaped settlement to a far greater degree than fluctuations in climate.

Middle Saxon: c. 720 – c. 850

Precipitation totals and average temperatures were on the rise throughout the middle Saxon period, although totals only reached near to the long-term averages at the very end of the period. Nevertheless, given the marginal character of Breckland's soils and their tendency towards drought, this period, whilst wetter than that directly preceding it, would still have provided less than ideal conditions for those working the land.

The evidence from Illington is, once again, scarcer than that recovered from Barton Bendish. However, the fact that the excavations of the cemetery produced no material which has been dated to the middle and later decades of the seventh century suggests that by the middle Saxon period the site was no longer in use (Davison 1993: 17). It is thus unlikely that the middle Saxon sherds which were recovered from Illington are, unlike the early Saxon sherds, associated with the cemetery, with a much more plausible explanation being that they are associated with either an occupational site or the manuring of arable. The latter explanation seems more likely, for the sherds are scattered across the field directly adjacent to the church rather than occurring in a noticeable concentration, with this church-side location congruous with the general character of middle Saxon activity in other parts of Norfolk. The scatter of Ipswich Ware is, like the early Saxon sites at Barton Bendish, located on the lighter edge of the junction between the light, sandy soils of the Worlington association and the heavier alluvial soils of the Isleham 2 association. It is ultimately difficult to identify any climatic driver in this arrangement. As previously discussed, the draw of these junction zones is four-fold: they are wetter and more fertile than the more inland light soils, they commonly provide access to spring-lines, they are easier to cultivate than the heavier and wetter downslope soils, and they are closer to sources of surface water. Nor is this pattern limited to Illington, for this church-side, junction location is also exhibited at Barton Bendish. The largest scatter of Ipswich Ware was identified in the fields to the west of St. Mary's Church, with 133 sherds recovered from this area alone. Rogerson interprets this scatter as an intensely manured tract of middle Saxon arable, adding that it is likely that the current

extent of the nearby roads, dwellings, and grassland is concealing the main occupational site (Rogerson 1997: 31-36). The suggestion that it was static factors of geography and soils which was the primary determinant of settlement in the region, rather than the more dynamic and changing forces of climate, is perhaps evidenced by the fact that this scatter is located on the same tract of land as the early Saxon scatter detected at RB 9, which itself is a Romano-British scatter associated with the manuring of Romano-British arable land. This continuity of land use over the course of multiple centuries, centuries during which climatic conditions underwent considerable change, does little to advance the case for a climatic narrative. The only variables which remained constant throughout these centuries are those associated with the natural landscape: soils, topography, and geography.

The scatter of Ipswich Ware some 500m south of St. Mary's also suggests that climatic change is unlikely to have driven changes in land use. This scatter, located well into the main body of the extremely well-drained Newmarket 1 soils on gently sloping ground occupies one of the driest positions in the entire county, with both soils and topography ensuring that any hydrological input is soon drained away. Given that precipitation was still at reduced levels until the very last decades of the middle Saxon period, and that there was plenty of room left on the junction sites, why, if climate was the primary, or even secondary driver, would middle Saxon agriculturalists choose such a climatically vulnerable site when other more suitable sites were apparently available? There are two equally valid answers to this question; firstly, climatic fluctuations were not severe enough to be driving changes in settlement, or secondly, that anthropogenic forces beyond that captured in the archaeological record were dictating what land could be used and what land could not. Neither of these answers are mutually exclusive; indeed, it is likely that both are simultaneously correct. Various scholars have all commented on how the middle Saxon period saw elites become increasingly powerful, polities become more distinct and sophisticated, and the economy expand as more specialised productive sites appeared and coinage began to circulate (Hamerow 2002; Hamerow and McKerracher 2022; McKerracher 2018; Rippon 2007a: 105-21; Hansen and Wickham 2000; West 1985; Wright 2015: 175). That better land was available at Barton Bendish, but arable exploitation was instead directed to a tract that was geologically more marginal is perhaps evidence that anthropogenic forces were as influential as static geological and geographical forces in determining settlement. It could have been that some local lord dictated, for reasons unknown, that this virgin site be utilised as arable; perhaps the more fertile junction and alluvial soils were being utilised for pasture, which would leave very little archaeological evidence. It is also possible that simple pragmatism dictated that arable efforts would be focused on this sandy, dry hill, for it lies on the course of the main street along which the village of Barton Bendish would grow, with the potential middle Saxon occupational site just 500m north, along this same street, from this tract of arable. Close proximity to the fields in which the

inhabitants of a settlement worked allowed for a short transit time; after all, why site fields kilometres away when you could just as easily site them closer to home? Siting a field further away from the settlement in order to exploit slightly less marginal soils was thus a delicate balancing act; does the increase in yield which better soils bring, which in this almost uniformly marginal landscape would likely be negligible at best, warrant the extra distance? There is also the basic fact, highlighted excellently by Hoffman, that humans require energy, energy which ultimately came from the crops and livestock which these people were rearing (Hoffman 2014). Siting arable land closer to home is thus more efficient from an energy standpoint, for the more energy that was consumed getting to the fields, energy which these arable fields were themselves producing, was energy lost.

There is thus very little evidence that middle Saxon settlement was being driven by climatic fluctuations in the middle Saxon period. Again, it would appear that static factors of soils and geography, alongside anthropogenic forces, were the primary drivers.

Saxo-Norman: c. 850 – c. 1150

The Saxo-Norman period is marked by its significantly differing climatic experience. Whilst previous periods are defined primarily by cool, dry conditions, the Saxo-Norman period is marked by fluctuating precipitation totals which range from below average to slightly above average, with these totals becoming more stable towards the latter third of the period. Temperatures are also significantly different from preceding – and later – periods, with significantly elevated temperatures in the tenth century, although these are bracketed by cooler conditions.

In Barton Bendish, expansion of settlement occurred along much the same lines as it did in the middle Saxon period, with significant evidence of occupation extending along the main street of Barton Bendish village. There appears to be two foci of occupation in the village itself; the western focus is undoubtedly dominant, with plentiful evidence suggesting Saxo-Norman occupation along the main street and around St. Mary's Church, whilst another focus appears to be forming at the eastern end of the village. The western focus, from which 290 sherds were recovered from sites LS 3, 4, 5, and 6, along with a large number of individual sherds likely indicative of the manuring of crofts, occupies the lighter edge of the junction between the lighter Newmarket 1 soils and the heavier, wetter alluvial soils of the Isleham 2 association; the accuracy to which the recovered sherds mimic the junction of these soils, as indicated by the Soil Survey of England and Wales, is incredible, with just a small handful of sherds crossing the boundary into the Isleham 2 soils. This pattern is largely identical to that observed in middle Saxon Barton Bendish and suggests a large degree of settlement continuity. At the eastern focus, however, this pattern is slightly different, for although LS 2 conforms to the pattern already set out, LS 1 does not. This site instead occupies a position some 150m into the main body of

the alluvial soils, although it is interesting that the scatter of sherds associated with this site is primarily focused to the south and west of the concentration, i.e. towards the junction and thus towards the lighter soils, with far fewer sherds recovered from the area north of the concentration where the soils are far heavier and far wetter. These patterns suggest that arable cultivation was only occurring on the lighter soils, with very little evidence that the wetter alluvial soils were being utilised for arable cultivation. In Illington the evidence is much the same, with the primary site located around St. Andrew's Church with a light scattering of sherds, likely deposited through manuring practices, occurring south and east of this site, with only a handful of sherds being recovered from the fields north of this concentration. Once again, the preference for lighter locations adjacent to wetter soils emerges, in a pattern heavily reminiscent of that observable in Barton Bendish. Furthermore, the evidence for arable cultivation, which predominantly occurs south of the main Saxo-Norman site, mimics the pattern observable at LS 1, namely that arable cultivation was occurring towards the lighter soils rather than towards the heavier soils further into the wetter, heavier valleys. This concurs with the evidence from the wider landscape of Barton Bendish, where scattered finds across the survey area seem to show that some form of activity, potentially arable, was occurring on the light interior soils, with the density of sherds decreasing as the distance from the main village increases.

There is little to suggest that any of these patterns, in both Barton Bendish and Illington, were being driven by climatic forces; instead, they often appear to be related to previous anthropogenic settlement, for a large degree of continuity with middle Saxon settlement patterns is observable at Barton Bendish, although no such continuity is observable at Illington, where the probable middle Saxon site is some 360m to the west. It also appears that static geological factors were more influential than climatic factors, for arable cultivation is limited to the lighter soils of both the junction zones and the interior of the survey areas, with no evidence of arable activity on the heavier alluvial soils. Whilst the light soils of Breckland may have been more receptive in this period of increased – that is when compared to previous periods – precipitation, conditions were still too dry to be considered optimal, for these soils are dry even in 'normal' conditions. It is also possible that the increased temperatures would lead to increased rates of evapotranspiration, potentially negating any positive effects brought about by increased precipitation. The evidence from both Illington and Barton Bendish thus indicates that climatic forces were exerting very little influence upon Saxo-Norman settlement in Breckland, with past anthropogenic activity and static geological factors far more influential in determining the nature of settlement.

Medieval: c. 1150 – c. 1350

Climatic conditions during the medieval period were substantially wetter and cooler than in preceding periods. Precipitation was significantly above average, which was sustained for much of the period

barring the last half century; temperatures, on the other hand, were plummeting, a marked departure from the highs of the so-called 'medieval warm period' which preceded it. The combination of cooler temperatures and plentiful precipitation makes this period the only one in which climatic conditions could feasibly be considered favourable, for the lightness of the soil ensures that this environment remains dry and parched, even after significant volumes of precipitation. However, labelling this period as one in which favourable conditions prevailed needs to be taken with caution, for even in this climatically favourable period Breckland would have remained a particularly inhospitable environment. It is only with the introduction of large, modern irrigation systems that arable farming in the Brecks has become more stable, but even then, particularly dry conditions have the potential to play havoc with arable production. Thus, whilst conditions were at their most favourable during this period, the experience of agriculturalists would have remained one defined by marginality.

A trend which is immediately observable in both the data from Illington and Barton Bendish is that expansion of both occupational and arable sites in the medieval period was, in a handful of locations, occurring on the heavier, wetter alluvial soils which had, until now, either been largely avoided or more likely utilised as pasture. At Illington this trend is particularly clear, and whilst the lighter Saxo-Norman nucleus around St. Andrews Church continued to be occupied throughout the medieval period, just under half of the concentrations of medieval material were found either entirely or partially within the heavier, wetter Isleham 2 soils. These concentrations, north-east and east of the church, commonly take the form of 100m to 400m long linear sites stretched along an east to west axis, possibly along the course of a now segmented street that once ran across the survey area parallel to the river. It is, however, important to note that even when concentrations occur entirely within the Isleham 2 soils that these are always within 200m of the junction, and thus even though they are entirely within these wetter soils they are still occupying a peripheral position. Such sites are also in existence in Barton Bendish, with Med 1, 2, and 5 all lying partially or wholly within the Isleham 2 soils, although these are similarly all located within 200m of the junction and do not possess the linearity which so defines the sites at Illington.

That these concentrations, which are indicative of occupation, appear at a time when climatic conditions would have been making these sites more problematic is, from a climatic point of view, entirely illogical. The significantly increased average precipitation levels, combined with the significantly lower temperatures experienced during this period would make these damp, alluvial soils particularly wet and susceptible to waterlogging. It is interesting that once again the light scatter of sherds surrounding these concentrations, which are likely the product of manuring practices, are often far denser on that side which faces the lighter soils, with the side leading to the wetter valley soils often possessing far thinner scatters. One interpretation of this trend is that arable cultivation was

purposefully directed towards the lighter 'inland' soils, whilst the richer ground further towards the stream was reserved for grazing the sheep flocks which we know dominated the region. Indeed, in a wet climate such as the one prevailing during the medieval period the light soils of Breckland would have been particularly susceptible to nutrient leaching, for water percolating through the profile would wash out these vital nutrients. Given that the soils were inherently infertile, manuring practices were vital to the success of the region. As previously discussed, the foldcourse system operated in the Brecks allowed for large-scale nutrient transfers between the grazing grounds and the infertile arable fields to take place, with sheep the primary mode of nutrient transportation. Thus, given the known importance of sheep to arable exploitation it is reasonable to assume that the valuable lowland meadows would be reserved for grazing rather than utilised for arable; after all, whilst these lowland meadows were, by this time, cultivatable from a technological point of view, utilising these areas as arable would potentially doom far more extensive areas of less fertile, more marginal soils which relied upon the *tathe* of the sheep to keep them fertile and ultimately productive. The elevated levels of precipitation could thus have exacerbated the leaching of nutrients, increasing the local community's reliance upon their sheep flocks, which in turn would necessitate the allocation of extensive tracts of land as pasture, with the fertile valley soils providing the richest pastures in the CZ and a reliable source of water to boot. There is thus the possibility of a climatic driver being behind this pattern.

It nevertheless remains incredibly difficult to gauge to what extent climatic fluctuations can be reasonably said to have been driving this pattern, for whilst the tendency for manuring scatters in heavier locations to face towards the lightest soils and avoid the majority of the richest soils may, in part, be driven by climatic fluctuations, the siting of occupational sites on these wetter locations is entirely illogical if climate was a principal driver, for these sites would flood far more readily than sites just 50m further upslope. There is also the fact that whilst this period was undoubtedly wetter than preceding periods, the leaching of nutrients (and also of lime, which was replenished via marling) would occur even in drier periods, for the coarse sandy soils of the Brecks will, by their very nature, leach nutrients whenever it rains. It is thus equally plausible that it was this same mechanism – namely that low lying, alluvial sites were reserved for the grazing of the sheep – which was behind the avoidance of lowland sites in both Illington and Barton Bendish in earlier periods. If this is the case, then climatic fluctuations cannot be driving this trend, for climatic conditions were not consistent and were very different in c. 900 than they were in c.1200. Indeed, the only conditions which were continuous were static geological conditions, with these seeming far more influential in determining this pattern of settlement.

Further evidence that climate was unlikely to have been a primary driver in the development of settlement in Breckland can be found in the earthwork and cropmark record for the region's deserted

medieval villages (DMVs). A curious characteristic of some of Breckland's DMVs is that they were often situated in remarkably low-lying positions. At Roudham, the DMV occupies the southern and western flanks of a poorly drained basin of Isleham 2 soils, adjacent to its junction with the lighter Newmarket 1 soils, in an arrangement that mirrors that at Illington (Davison and Cushion 2003: 76). The remains of crofts and roads clustered north of the ruined church suggest phased shrinkage, with a notable decline observable between the Lay Subsidies of 1334 and 1449 (Cushion and Davison 2003: 62; Cushion *et al.* 1982: 54–59). Nevertheless, the settlement persisted until the mid-eighteenth century, when it was finally abandoned following purchasing-in by the landlord (Cushion and Davison 2003: 9, 62). The timing of the decline observable in the Lay Subsidies could, at least in part, be attributed to environmental stress, as this was a period when precipitation totals were increasing and temperatures were dropping. The threat of waterlogging and flooding would thus have been exacerbated by the settlement's low-lying topography and pedological characteristics. It is, however, perplexing that the community at Roudham did not relocate to the lighter soils upslope, which lay within 100 metres of the village nucleus. That this relocation did not occur suggests that climate was not the principal driver of shrinkage, for surely a community that was economically healthy (if not overly prosperous) in 1334 – as demonstrated by the Lay Subsidy – would have shifted focus rather than persisted in an increasingly hostile environment. A more feasible explanation is that the process of decline and desertion unfolded gradually over the course of the fourteenth to eighteenth centuries due to socio-economic and tenurial changes rather than climate-driven environmental stress. This is best surmised by Cushion and Davison, who note that the purchasing-in by the landlord in the mid-eighteenth century was 'the ultimate event in a long process of decay, often inexplicable, since the Middle Ages' (Cushion and Davison 2003: 9–10).

At West Tofts, the DMV lies within a small tributary valley draining westwards to the Wissey, with the DMV clustered along the lower valley floor – again on Isleham 2 soils – rather than on the adjacent higher ground, where the far lighter Methwold and Newport 4 associations dominate (Davison and Cushion 2003: 97). In the case of West Tofts, stability appears to have been maintained throughout the medieval and late medieval periods and well into the post-medieval period, with documentary evidence suggesting that this settlement was flourishing in comparison with its neighbours (Cushion and Davison 2003: 82; Whiteman 1986: 209–10). The settlement's contraction and abandonment can be traced to its partial embankment in the eighteenth century, with complete abandonment occurring in 1942 following the creation of the Stanford Training Area (Cushion and Davison 2003: 9–10, 82). That this settlement was flourishing throughout the medieval and late medieval period, despite occupying a low-lying, hydrologically sensitive location, is difficult to reconcile with a climatic

narrative, as this period is marked by increasingly wet and cold climatic conditions that would have exacerbated these characteristics.

This is not to say that the occupational focus of settlements in Breckland was confined purely to the alluvial soils, for the evidence from both Illington and Barton Bendish shows that the lighter soils were often preferred. At Illington, just under half of the medieval occupational sites were located either entirely or partially within the wetter, alluvial Isleham 2 soils, while the other half – and the majority of the manuring scatters – were located on the lighter edge of the junction zone or entirely within the main body of the Worlington soils. For example, north-east of the principal Saxo-Norman nucleus around St. Andrew's Church is a linear site some 400m long and containing 160 sherds, making this not only the largest concentration in terms of length but also in terms of the amount of material recovered. In Barton Bendish the vast majority of occupational sites also prefer the lighter edge of the junction zone. With the exception of sites Med 1, 2, and 5, the remaining concentrations identified at the main village site either lie on the lighter side of the junction zone or within 200m of the junction zone further into the main body of the Newmarket 1 association. Elsewhere in the survey area this pattern is replicated, with every occupational site in Eastmoor also occupying either the lighter edge of the junction zone or a position well within the Newmarket 1 soils. However, whilst the occupational sites share similar spatial contexts to those exhibited by earlier sites, the manuring scatters surrounding some of these sites show slightly different trends to those observed in preceding periods. In the southern arm of the village the scatter of sherds surrounding these concentrations are far less dense on the side facing the Isleham 2 soils, in a pattern consistent with that observed in earlier periods, whilst in the northern part of the village and at the small hamlet of Eastmoor the manuring scatters appear to buck this long-established trend. At these locations, significant volumes of material were recovered from the slopes leading down to the small streams, in quantities little different from those facing towards the interior of the survey area, although in all cases as the distance from the occupational site increased so too did the density of the manuring scatters decrease. Nevertheless, this would appear to suggest that arable cultivation was being practiced in some locations on these heavier, more fertile soils in the medieval period.

Again, it is difficult to associate this trend with climatic fluctuations, for these soils would be more sensitive and prone to waterlogging during the medieval period than they were in the drier and warmer Saxo-Norman period. It seems far more probable that anthropogenic factors – such as the reintroduction of the heavy mouldboard plough and demographic expansion – were again driving these changes. For example, the comparatively lower population in the Saxo-Norman period only required a few of these richer, but more labour-intensive soils to be put under the plough – such as the site at LS 1 – for at this time England's population is estimated to have ranged between two and

two and a half million (Roffe 2000). Compare this figure to the estimated five or six million believed to have populated England's landscape by 1348 and it becomes clear that population levels had exploded during the medieval period, and it is probable that the booming population would have been exerting considerable pressure upon existing productive structures throughout the medieval period. This demographic explosion would have necessitated the conversion of areas of once permanent pasture to arable, for whilst the sheep flocks were still enormously important to the agrarian system and would still have required areas of grazing in order to survive, the need for arable production, which ultimately provided the populace with the bulk of its food, would likely have trumped the needs of the livestock, which could ultimately be fed on the aftermath. This need for arable land is reflected at Barton Bendish and Illington by the sheer volume of medieval material recovered across the survey areas and is further evidenced by the fact that an entire secondary settlement at Eastmoor emerged during the twelfth and thirteenth centuries, which strongly implies that the landscape was far more populated in the medieval period than it was in previous periods. It is thus unlikely that climatic forces were driving the expansion of cultivation onto heavier, wetter land, with demographic pressure a far more likely driver.

This significant increase in population is also captured across the wider landscape of Barton Bendish, for nearly every corner of the survey area produced a fine scatter of medieval sherds deposited via manuring practices. The densest scatters are primarily located within 500m of occupational sites, with the large expanse of light soil in the centre of the survey area home to slightly thinner scatters, although this is relative to the often extremely dense scatters nearer to occupational sites. That, as stated above, nearly every corner of the landscape has evidence of arable cultivation is unlikely to be reflective of a positive response to the wetter conditions; rather, it is likely the product of sheep-corn husbandry and Breckland's rather unique 'shifts' – temporary blocks of discontinuous or continuous land that was uniformly cropped in a given year – that ensured that the area under cultivation in one year was unlikely to be the same as that under cultivation in the following year (Bailey 1989: 57). This rather roving character of agricultural exploitation, based not on the field but on the shift, allowed the all-important sheep flocks to rejuvenate the recently cropped land and allowed Breckland's agriculturalists to respond to changes in demand for grain far more freely than if the landscape was cultivated in fields (Bailey 1989: 57). Ultimately, why cultivate an entire field of grain if the economic return was not worth the cost of raising the crop, a crop which would only deplete the land of its precious nutrients that could be better spent raising a crop in a more economically profitable year? Thus, the ubiquitous scatter of sherds present in Barton Bendish is more reflective of anthropogenic responses to economic demand rather than being a positive response to the wetter, and thus more

hospitable conditions, conditions which as discussed earlier would lead to increased leaching of nutrients and lime.

There is thus little evidence to suggest that climatic fluctuations were driving the development of settlement in the medieval period, with anthropogenic factors and static environmental structures once again far more likely to have been driving macro-changes in the landscape.

Late Medieval: c. 1350 – c. 1500

The late medieval period shares many climatic similarities to the preceding period, although there are some slight divergences. This later period experienced slightly less wet and slightly cooler conditions than those experienced in the preceding medieval period, although these changes are slight and do not overly detract from the suggestion that there is a large degree of climatic continuity between the medieval and late medieval period. However, before the analysis of the late medieval evidence begins, it is imperative to note that Rogerson's *Barton Bendish* does not differentiate between the medieval and late medieval period, instead considering all finds between c. 1150 and c. 1500 as part of a single medieval period. Rogerson also does not provide a full gazetteer of recovered material, although he does provide approximate date ranges for identified 'sites' (with Rogerson appearing to consider dense concentrations of material as 'sites', although as discussed earlier Rogerson's methodology is relatively loose and subjective). Whilst this obviously limits the use of the data, enough evidence is available for meaningful conclusions to be drawn.

The data from both Illington and Barton Bendish suggests that the trends observed elsewhere in the county are also present in Breckland, with the shrinkage of settlement caused by the devastating effects of the Black Death apparent in both surveys. In Illington, the long-established central focus around St. Andrew's Church appears to have been abandoned, with little late medieval material being recovered from this area. The north-western site around Old Farm, which saw intensive activity in the medieval period, appears to have shrunk from its medieval apogee, with the north-eastern linear site also showing evidence of shrinkage. This latter site does, however, appear to have been the primary focus of late medieval settlement in the area. That the site around St. Andrew's Church appears to have been abandoned in favour of the north-eastern linear site does not comply with a climatically driven narrative. The site of the church is drier than the north-eastern site, which directly abuts the large parcel of Adventurers' 2; that a lighter environment was abandoned and a wetter environment subsequently became the focus of settlement at a time when precipitation was still above average does not align to a climatically-driven narrative for settlement development, for the lighter site would be less prone to waterlogging.

The overall image sketched in Illington by the late medieval data suggests that by this period settlement in the area had shrunk to a pattern largely similar to that observable today, with a handful of dwellings and small farmsteads dispersed across the northern part of the parish close to the junction between the lighter and heavier soils. There are very few late medieval manuring scatters, with only a handful of possible scatters located primarily towards the junction zone. This suggests that late medieval arable cultivation was significantly less than that which was occurring in the medieval period, with an obvious culprit for both the shrinkage of occupational sites and agricultural activity being the Black Death. With fewer mouths to feed, and indeed fewer hands to work the fields, the intensity of agricultural exploitation would invariably have lessened, leading to an inevitable reduction in archaeological material.

The late medieval evidence from Barton Bendish describes an incredibly similar pattern of shrinkage and decline. Of the 35 sites which were in use during the medieval period, only 43% remained in use by the late medieval period, with these sites spread along the main road through the village. Whilst Barton Bendish itself thus suffered a profound decline from the mid-fourteenth century onwards, this pales in comparison to the decline suffered by the secondary settlement of Eastmoor, which all but disappeared in the late medieval period. This significant desertion in the late medieval period saw the settlement pattern in Eastmoor transform into one which resembles the modern landscape, with a small number of farmsteads strung along the main street which forms the western edge of what in 1612 is shown to be Hall Fen Common (Rogerson 1997: 32). There is very little evidence to suggest that climatic conditions were forcing this desertion; if this was the case, then we would expect a large number of virgin sites to be established on the lighter soils.

However, across the entire survey area only two virgin sites were established – Med 17 and 37 – with both of these sites occupying tracts of heavier, wetter soils rather than lighter, more freely draining soils. Med 17 is likely an occupational site, whilst Med 37 is believed to be the site of St. Mary's Chapel; the former site is located at the extreme southern end of Barton Bendish village on the main street, whilst the latter is similarly positioned at the extreme southern end of Eastmoor, again in close proximity to the main street which runs through the hamlet. That virgin sites were established on these wetter soils rather than on lighter soils suggests two things; firstly, that the severity of climatic fluctuations was potentially not enough to influence the siting of dwellings and other structures, and secondly that it was perhaps pragmatic anthropogenic considerations which were determining siting, for it is possible that these virgin sites were established where they were in order to make use of the main roads which ran through both settlements. It stands to reason that a roadside location would be preferable for a new dwelling rather than one isolated and away from transport links, for the inhabitants would have to travel to and fro from the dwelling to their place of work, whether this be

a local productive site or the fields spread across the parish. Similarly, the positioning of St. Mary's Chapel on the main road at Eastmoor also concurs with this hypothesis, for worshippers would need to be able to attend the chapel regularly; siting such a place away from transport links makes very little sense. The siting of these virgin sites thus appears to be more a product of anthropogenic considerations than any climatic forcing.

The decline which set in in the mid-fourteenth century thus cannot, from the evidence gathered from both Illington and Barton Bendish, be attributed to climatic forces. It seems far more likely that anthropogenic factors were determining changes in settlement, with the severe decline in population precipitated by the Black Death causing significant abandonment throughout the region.

Conclusion

There is thus a body of evidence from the Breckland CZ which appears, at first glance, to suggest that climatic fluctuations may have been the primary driver of changes in settlement throughout the study period. However, whilst the evidence does suggest a degree of correlation between climatic fluctuations and changes in settlement, with the gradually increasing volumes of pre-1348 archaeological material recovered by Rogerson, combined with the increasing levels of precipitation experienced throughout this period producing the very pattern which we would expect to find were climatic forces driving these changes, there is a strong argument to consider climatic fluctuations as a secondary, rather than a primary, driver of change in the region. As discussed above it was likely anthropogenic factors – such as the development of specialised forms of agricultural exploitation and the continued utilisation of long-established sites – along with static factors of soils and geography – such as differing, largely tractable soil types and nearby watercourses – which were the primary drivers of settlement development. It is imperative to note that this is not suggesting that climatic fluctuations played no role in the development of settlement in the Breckland CZ; such a wholesale refutation of a climatic influence would simply not align with the evidence presented in this chapter, for as discussed above climatic fluctuations did invariably increase the viability of certain areas within the CZ. Rather, climatic fluctuations should be viewed as a secondary, supporting driver of change rather than a primary driver of change.

Chapter Seven: Marshland and the Peat Fen

Introduction

This chapter will analyse the archaeological, historical, and geological evidence from the Marshland CZ and the disconnected northern tract of the Peat Fen CZ – which is wholly surrounded by the Marshland CZ – and discuss the relationship between this evidence and fluctuations in historic climatic conditions.

Spatial, geological, and historical contexts

The *Fenland Project* surveyed over 190km² of land in west Norfolk, both in the siltlands and the Nar Valley (Silvester 1988: 1). Given that such a large area of land was subjected to intensive surveying, it is no surprise that the coverage of the *Fenland Project* dwarfs that of the other surveys discussed in this thesis, both in terms of absolute coverage and the coverage proportional to the area of the CZ in question. For example, Davison's *Three Parishes* and Rogerson's *Fransham Parish* covered 33km² in the 1675km² Claylands CZ, which equates to just under 2% of the total land area of the CZ; similarly, Davison's *Illington Parish* and Rogerson's *Barton Bendish* covered 24km² in the 681km² Breckland CZ, which equates to a similar percentage of just over 3.5% of the total land area of the CZ (Davison 1993; Davison 1989; Rogerson 1995; Rogerson 1997). Conversely, the *Fenland Project* investigates approximately 130km² in the 301km² Marshland CZ, which results in a significantly elevated proportional coverage nearing 44%, which is the result of both the vastly increased survey area and the comparatively small land area of the Marshland CZ. Even with the addition of the 25km² of Marshland St. Mary – and thus of part of the Peat Fen CZ – the proportional coverage sits just under 40%, still markedly more than the statistics from the Claylands and the Breckland CZ. Whilst it has been demonstrated that the conclusions drawn for both the Claylands CZ and the Breckland CZ are applicable to the wider landscape due to their shared geological, historical, and archaeological heritage – an argument which, as will be demonstrated, can also be made for the Marshland CZ – there can be little doubt as to the applicability of the results of the present analysis, for the sheer scale of the *Fenland Project* has provided a uniquely comprehensive insight into a particularly marginal environment.

The defining characteristics of the survey area itself are threefold, with topography, soils, and proximity to the sea all greatly influencing the Marshland CZ. The topography of the region is perhaps its most striking feature, for at first glance the entire area appears to be uniformly low-lying. Whilst there are obviously no areas which can be considered true 'uplands' in this flat environment, there

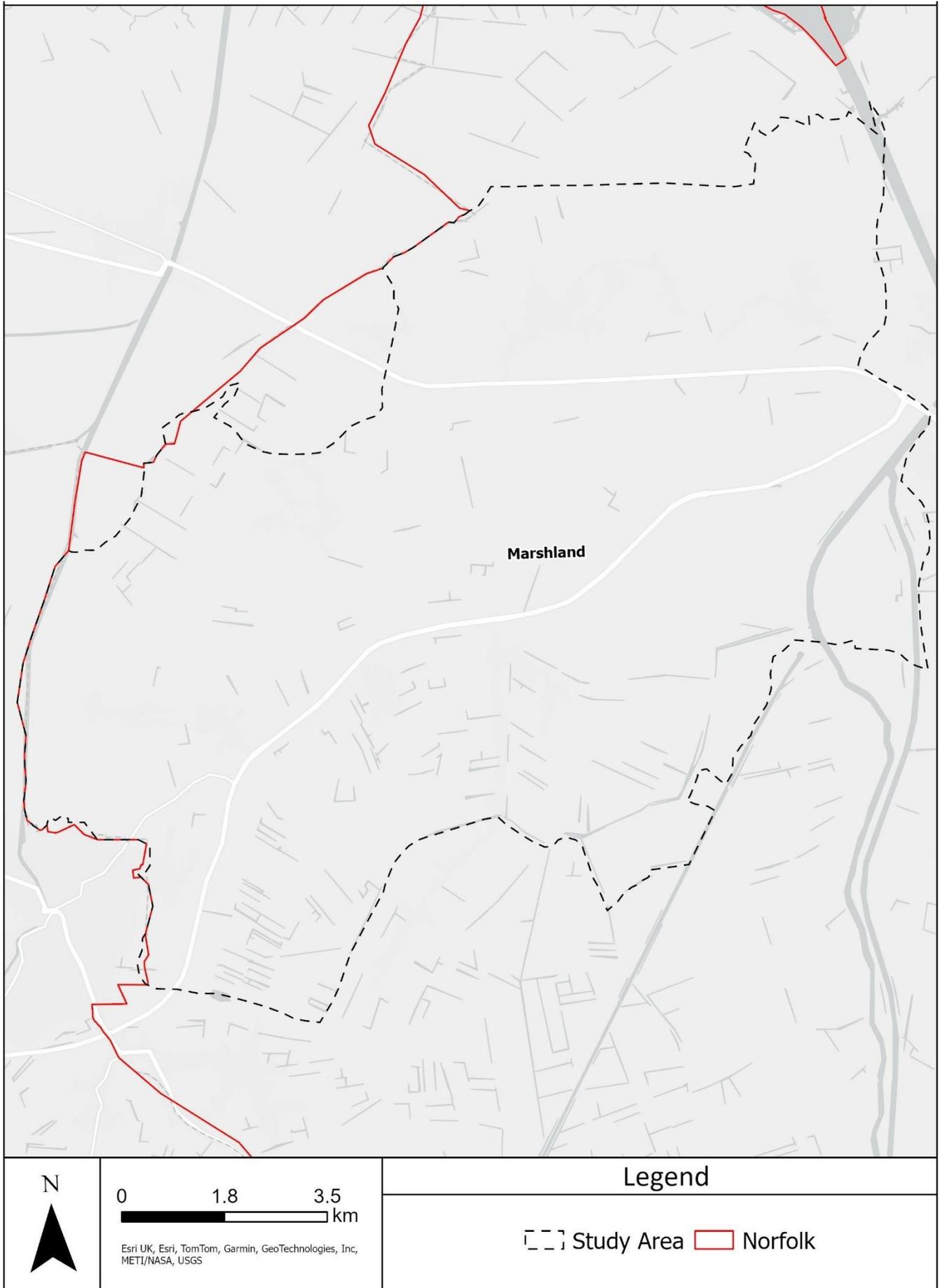


Figure 104: Marshland study area.

| Marshland CZ | | |
|----------------------|--|---|
| Soil | Constituent series | General character of association |
| 812a – Wallasea 2 | Wallasea – mottled greyish brown pelo-alluvial gley; clayey; seasonally waterlogged; highly sensitive to groundwater; Newchurch – pelo-calcareous alluvial gley; clayey; calcareous; waterlogged without drainage; Wisbech – calcareous alluvial gley; silty/clayey; strongly calcareous; waterlogged in winter without drainage; Blacktoft – gleyic brown calcareous alluvial soil; alluvial; calcareous; mottled | Deep marine alluvial clays and silty clays; strongly influenced by groundwater; naturally very poorly drained and seasonally waterlogged; inland tracts more clayey, coastal tracts more silty; intensive drainage required for reliable cultivation. |
| 812b – Wisbech | Wisbech – mottled calcareous alluvial gley; deep, stoneless; coarse to fine silty; often clayey; Romney – gleyic brown calcareous alluvial soil; silty; mottled | Deep, stoneless, calcareous silty and silty clay alluvium; naturally prone to prolonged waterlogging; improved drainage gives good agricultural land but with narrow workability windows in wet seasons. |
| 812c – Agney | Agney – calcareous alluvial gley; silty clayey loam; mottled; deep and stoneless; Wisbech – calcareous alluvial gley (as above) | Deep, calcareous fine and coarse silty alluvium; relic mottling indicates former prolonged waterlogging; now well-drained where infrastructure exists, but inherently wet and slow to drain without it. |
| 811e – Tanvats | Tanvats – typical alluvial gley; medium silty; mottled throughout; severely waterlogged in undrained or poorly drained contexts; Wallasea – pelo-alluvial gley (as above); Pepperthorpe – typical alluvial gley; silty; mottled throughout; Rockcliffe – typical alluvial gley; silty/clayey; mottled throughout | Deep, stoneless fine and coarse silty and clayey alluvial gleys; inherently poorly drained; severe winter waterlogging; autumn offers the best landwork window but can be curtailed by cool, wet summers. |
| 811d – Rockcliffe | Rockcliffe – typical alluvial gley; light silty loam; mottled throughout; groundwater-influenced; seasonally waterlogged; Tanvats – typical alluvial gley; slightly heavier than Rockcliffe; Snargate – gleyic brown alluvial soil; lightest within the association; mottled subsoils but relatively permeable compared to other series | Deep, stoneless silty and fine sandy alluvial gleys on low-lying ground; strongly controlled by shallow groundwater; naturally seasonally waterlogged and vulnerable to poaching; difficult to work outside short periods of favourable weather even where drained. |

Table 15: Marshland soil chart.

| Peat Fen CZ | |
|-----------------------|---|
| Soil association | General character of association |
| Downholland 1 | Deep humose clayey fen soils; naturally waterlogged; extremely poor drainage; dependent on engineered drainage for use. |
| Altcar 1 | Deep peat; highly organic; very low bulk density; saturated most of the year; minimal natural tractability; prone to subsidence when drained. |
| Willingham | Extremely calcareous clayey/silty alluvium; slow-draining; seasonally waterlogged; heavy soils with narrow workable windows. |
| Dowels | Heavy clayey fen alluvium; very poorly drained; prolonged winter waterlogging; difficult soils to work. |
| Wallasea 2 | Marine-derived clayey alluvium; inherently waterlogged; strong gleying; reliant on artificial drainage. |
| Isleham 2 | Sandy-peaty gley influenced by shallow groundwater; naturally waterlogged; minimal medieval agricultural potential. |
| Adventurers' 1 | Deep organic peat; extremely wet; little structural integrity; severe waterlogging. |
| Blackwood | Sandy gley; groundwater-influenced; naturally wet. |
| Peacock | Deep humose clayey and fine-loamy gley; poorly drained; often saturated. |
| Newport 2 | Deep freely drained brown sands; drought-prone; the most tractable soils in the CZ. |
| Ashley | Fine-loamy over clayey stagnogleyic soil; moderately heavy but workable on elevated ground. |
| Adventurers' 2 | Shallow to moderately deep peat; waterlogged; limited cultivation potential. |

Table 16: Peat Fen soil chart.

are critically important variations within Marshland's topographical form. In the peripheral areas of the CZ, especially in the northern, north-western, and western parts of the CZ the land is slightly elevated compared to the more central, inland areas, with the peripheries often lying at around 4m OD. This elevation steadily but unerringly drops to 0m OD as one travels towards the completely encircled 77km² parcel of the Peat Fen CZ which occupies the centre of Marshland. Here, the topography is almost uniformly at or below sea level.

The geological composition of the Marshland CZ is, as discussed in Chapter Four, similar, but suitably different to that of the Peat Fens CZ, being predominantly silty and clayey rather than peaty and clayey. The relic mottling presented by many of Marshland's soils – and by many soils in the Peat Fen CZ – suggest that historic waterlogging was a common occurrence, which is unsurprising, for even with modern drainage solutions this landscape can become inundated with water, especially in the wetter winter months; indeed, the prevalence and dominance of alluvial gleys in the Fens all but ensures significant episodes of waterlogging. Light soils, such as those found throughout the Brecks or even in small parcels throughout the Claylands are particularly rare in the fenland landscape, with instances of comparatively 'lighter' soils largely limited to the vitally important 'roddons' which are found throughout the fens. These features are the fossilised remains of mid- to late-Holocene tidal creek systems, which over the course of several millennia scoured deep ruts into the clay deposits which underlie this part of Norfolk (Smith *et al.* 2010: 268). These ruts, which capture the course of long vanished waterways (palaeochannels) – or even historic anthropogenic constructs such as dykes and ditches – were subsequently infilled with sediment, with the major palaeochannels predominantly being filled with fine sands whilst the minor tributaries were filled with fine silts and clays (Smith *et al.* 2010: 260, 268). These infilled channels thus formed a vast network of often lighter soils, and as anthropogenic drainage efforts progressed, these one-time waterways became locally prominent ridges as the surrounding soils, being heavier and wetter, shrank or subsided as they dried out, although the extent to which these features would have been noticeable ridges in the medieval period is unclear (Smith *et al.* 2010: 268-9). These infilled channels, which by the end of the seventeenth century had almost certainly become locally prominent ridges, are the roddons which are so ubiquitous with the fenland landscape, and as this chapter will show, it was these features with their lighter, somewhat more hospitable soils – that is compared to the often spongy and subsidence prone marine alluvial soils – which proved such a draw to anthropogenic settlement throughout the region. The largest of these roddons is the Great Marshland Roddon, a fossilised watercourse which was likely one of the most significant rivers in the region, with its course mimicking the boundary between the Marshland and Peat Fen CZ north of Marshland St. James (Silvester 1988: 154). This watercourse ultimately silted up during the late Iron Age and the Roman period, for the Aylmer Hall canal appears

to bisect the river in Tilney, with Silvester suggesting that this is an indication that 'the river's drainage function has ceased' (Silvester 1988: 154; NHER 'Aylmer Canal 25333').

In addition to topographical and geological influences, the Marshland CZ has been heavily impacted by its proximity to the sea; indeed, much of Marshland's topographical and geological characteristics are direct consequences of marine activity. Over the course of the Holocene the landscape of the Marshland and Peat Fen CZs witnessed repeated marine transgressions and regressions, leading to the formation of large tracts of salt-marsh, and it is likely that the palaeochannels, which were fossilised as roddons, were the very same channels which drained these salt-marshes as eustatic sea levels dropped (Gallois 1979: 34; Shennan 1986: 121; Silvester 1988: 151; Smith *et al.* 2010: 256). These natural drainage systems proved unreliable, eventually silting up over time, so as the population expanded more reliable, targeted drainage measures became necessary; Roman canals, Saxo-Norman and medieval sea banks and ditches, and early modern cuts and dykes are common features throughout Marshland and were all intended to make this wetland landscape habitable and reliably exploitable. Agricultural exploitation of this landscape was undoubtedly far more difficult than in drier environments, but there is sufficient evidence to suggest that whilst early Saxon exploitation was likely weighted towards pastoral farming – with the extensive tracts of saltmarsh and fenland valuable grazing for livestock – arable exploitation of the lighter roddon soils and of tracts of reclaimed ground was commonly occurring from the Saxo-Norman period onwards, although stock-rearing was still a mainstay of the agrarian economy throughout the study period (Silvester 1988: 164-5). With adequate drainage the damp soils of Marshland and the extensive areas of saltmarsh can become valuable arable land, with Cook suggesting that areas of saltmarsh could be turned into productive arable within a few years of embankment (Cook 1982: 215). In addition to these more 'common' modes of exploitation the production of salt was a widespread industry in Marshland, which was well-established by the time of Domesday (Silvester 1988: 165). Saltern mounds are common features in the archaeological record of Marshland, and sizeable concentrations of briquetage are not uncommon throughout parishes surveyed.

The Romano-British landscape of the Marshland CZ reveals a settlement pattern overwhelmingly concentrated on the higher silt ridges and roddons, with occupation favouring the better-drained Iron Age and marine silts and avoiding the low-lying peats and clays of the Peat Fen CZ. Across the northern parishes of Clenchwarton, Walpole St Peter, Walpole St Andrew, Walsoken and West Walton, settlement is repeatedly associated with the prominent roddon networks that thread through this landscape. In Clenchwarton, fieldwalking recovered numerous Romano-British scatters along the roddons, where pottery spreads and occasional briquetage indicate a mixture of occupation and salt-

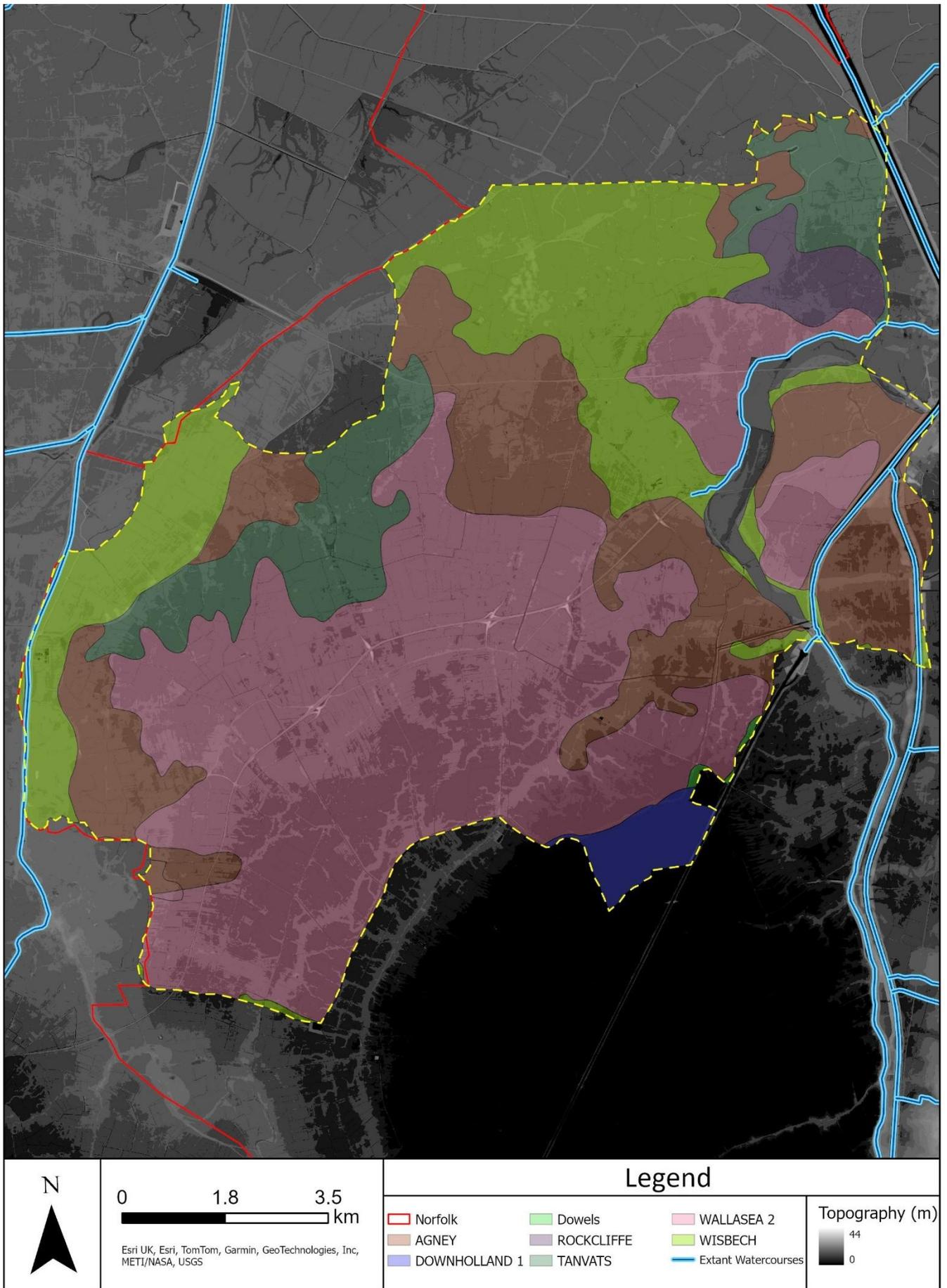


Figure 105: Composite of Marshland showing its soils and topography. Note how little topographic variation is present.

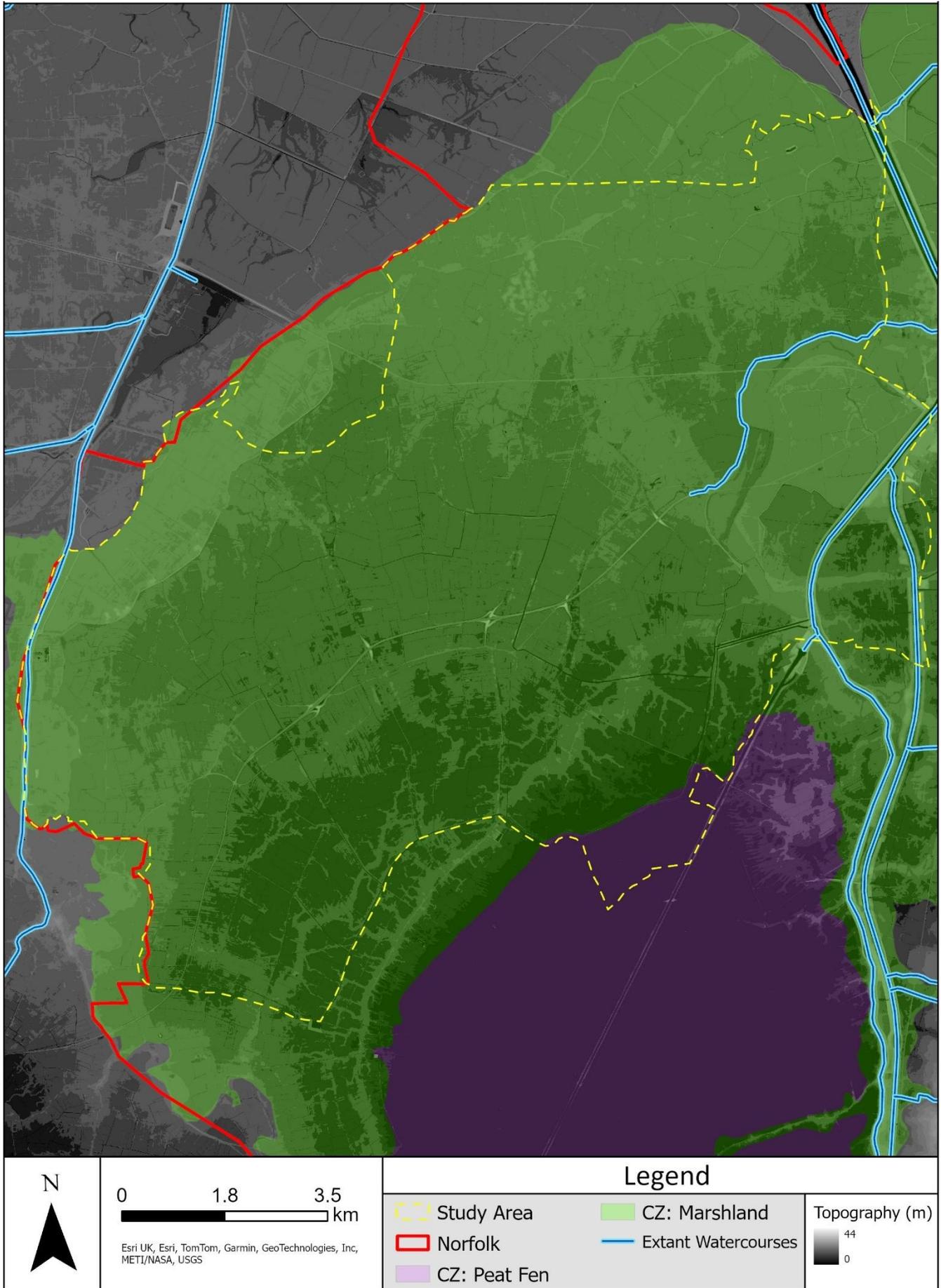


Figure 106: The study area's Character Zones; note how little of the Peat Fen Character Zone is within the study area.

working (Silvester 1988: 18–21). Further east, in the vicinity of King’s Lynn, settlement is much more limited and represented only by a small number of sites situated on the silts bordering the Great Ouse (Silvester 1988: 24–26). Marshland St James, lacking the raised silt ridges that elsewhere acted as foci for settlement, produced only sparse Romano-British material (Silvester 1988: 31–33).

Moving southwards, Terrington St Clement exhibits one of the densest clusters of Romano-British occupation, with large, well-defined sites and manuring scatters arranged along the roddon network (Silvester 1988: 35–36). Terrington St John shows the same pattern on a smaller scale, with pottery and briquetage marking a sequence of discrete settlements aligned along the central roddon (Silvester 1988: 42–45). In Tilney All Saints and Tilney St Lawrence, settlement again gravitated to the elevated roddons and Iron Age silt terraces, where multiple scatters of pottery indicate small clusters of occupation (Silvester 1988: 47–50). Further east, material from Walpole St Andrew demonstrates a continuation of this roddon-based pattern, with pottery distributions tracing a line of occupational sites along the main ridge, while Walpole St Peter preserves even more extensive concentrations of Romano-British material across multiple roddons (Silvester 1988: 66–69; 72–75). Walsoken and West Walton present similar configurations, with settlement confined to the roddon networks (Silvester 1988: 82–86; 88–91). The Wiggshall parishes diverge sharply from this pattern. Wiggshall St Mary Magdalen, Wiggshall St Mary the Virgin and Wiggshall St Germans all yielded almost no Romano-British material (Silvester 1988: 97–100; 98–101; 109–111), reflecting the markedly wetter, poorly drained claylands of the southern Marshland CZ where settlement appears to have been absent.

The Marshland CZ thus displays a coherent pattern of Romano-British occupation focused almost entirely on the elevated roddons, which offered essential dry ground within an otherwise inhospitable landscape.

Fieldwalking evidence

Early Saxon: c. 500 – c. 650

Early Saxon settlement in the Marshland and Peat Fen CZs is limited to just a single site – TYL 19 – in the parish of Tilney St. Lawrence, with this single site producing forty sherds of early Saxon ceramic material along with a sizeable quantity of later medieval pottery (Silvester 1988: 60). This represents a marked shift from the Romano-British period, when settlement was widely distributed across the network of roddons. The sheer number and density of Romano-British sites indicate not only occupation but also an intensively utilised working landscape; such cannot be said of the early Saxon landscape of Marshland. The function of TYL 19 is, like the vast majority of early Saxon sites, impossible to determine from the ceramic evidence alone, with only a comprehensive excavation of the site able to provide the data required to definitively determine the site’s function.

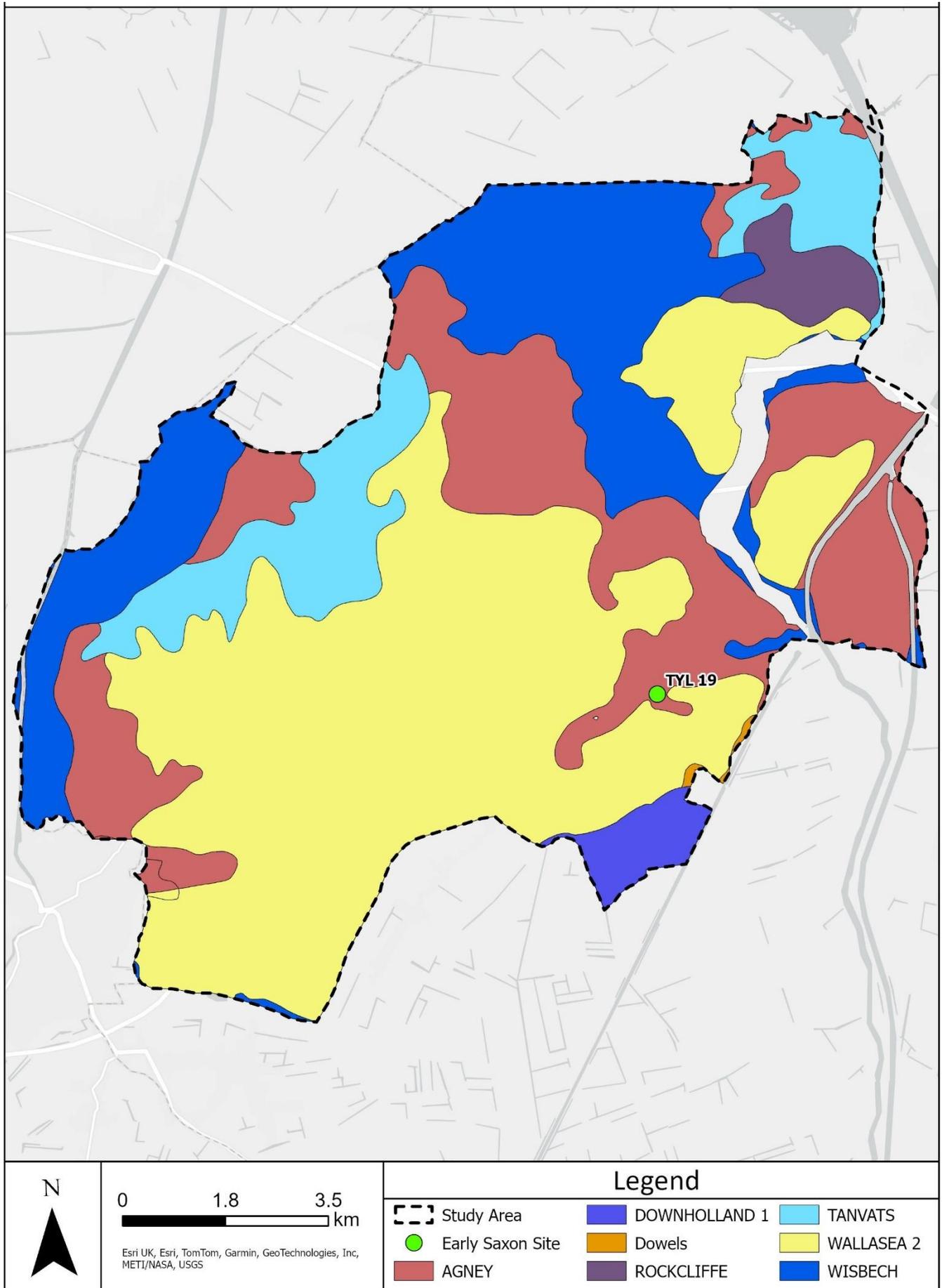


Figure 107: Early Saxon sites in Marshland shown against soils.

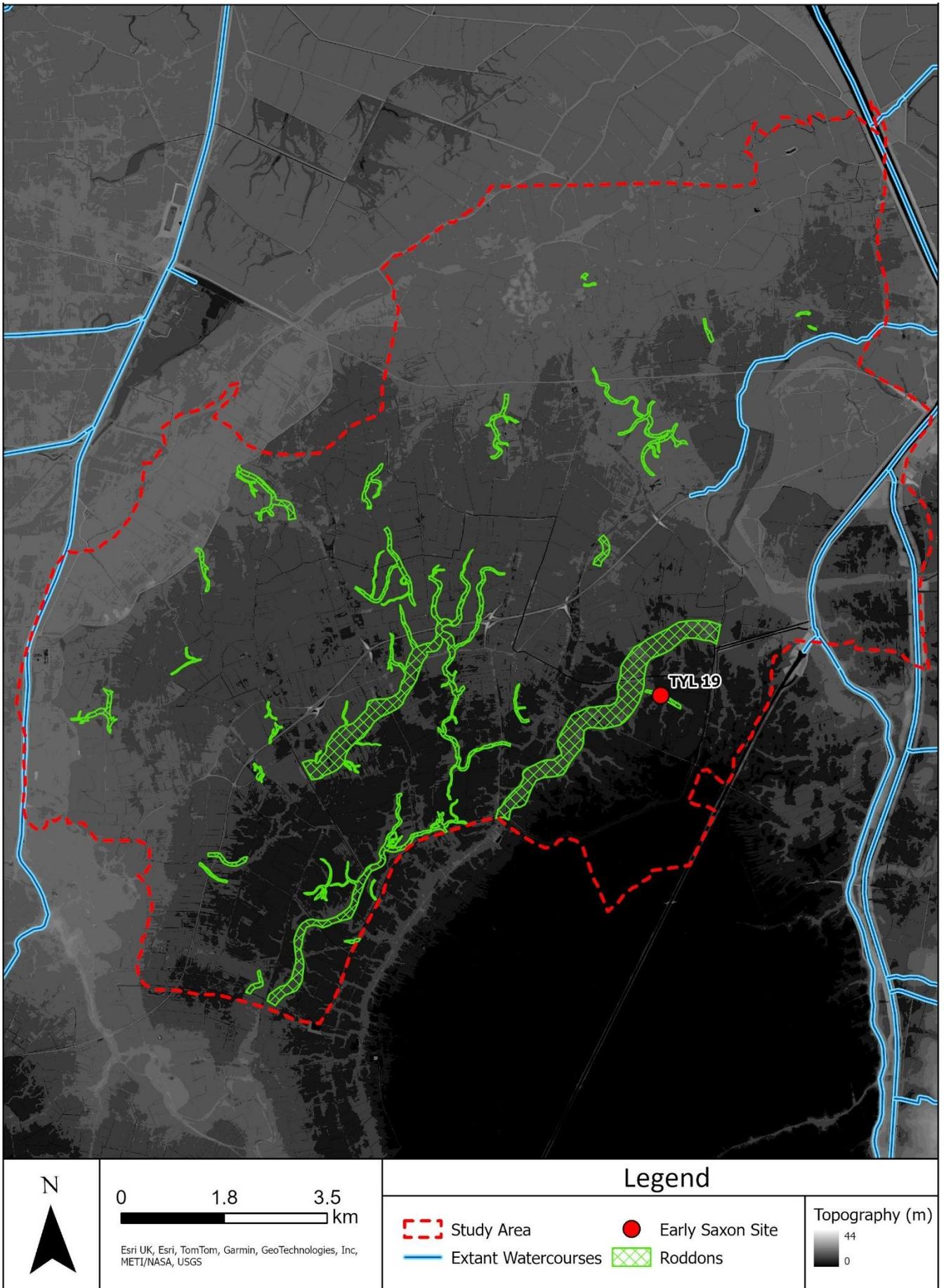


Figure 108: Early Saxon sites and roddons in Marshland shown against topography.

Nevertheless, both the general scarcity of early Saxon material and the comparatively plentiful assemblage recovered from TYL 19, coupled with the localised soils and topography of the site and its surrounds, gives credence to the speculative suggestion that this was perhaps an occupational site. The positioning of this site is similar to many other fenland sites discussed in this chapter, in that it is located on one of this region's many roddons, sinuous bands of often lighter silts and sands deposited in the carved-out hollows of extinct watercourses. Indeed, TYL 19 is located just 300m east of the Great Marshland Roddon and sits directly atop a small roddon formed by the silting up of the Roman Aylmer Canal which bisected this large feature.

Whilst the lack of other early Saxon sites within the *Fenland Project* could potentially be interpreted as both a symptom of the poor survival rate of early Saxon material and the difficulty in spotting such material in the plough-soil, given both the increased visibility of archaeological remains in the Marshland CZ and the largely consistent survey intensity throughout the entire region it is likely that the dearth of early Saxon material is reflective of an actual lack of activity. The implications of this lack of evidence are discussed in detail later in this chapter.

Middle Saxon: c. 650 – c. 850

Evidence of middle Saxon activity within Marshland is far more plentiful and far more widespread than the single instance of early Saxon activity in Tilney St. Lawrence. Running in a large sweeping arc from Wiggshall St. Mary The Virgin in the east to West Walton in the west are nine middle Saxon sites – seven definite and two probable – which together produced approximately 1220 sherds of middle Saxon date (Silvester 1988b: B.5 – G.7).

Starting in the eastern parish of Tilney St. Lawrence a clear preference for locations either directly on, or adjacent to this region's many roddons emerges amongst Marshland's middle Saxon sites. TYL 9 in Tilney St. Lawrence lies squarely on one of these roddons, although with only 13 sherds of Ipswich Ware it was unlikely to have been a large occupational site, perhaps being inhabited for only a short time or even as a seasonal occupational site for those working the nearby pastures (Silvester 1988: 60, 111). To the west of this site is the even smaller site at TYL U2 which also occupies a low roddon, and with only 6 sherds of Ipswich Ware must have been either short-lived or only seasonally occupied like TYL 9 (Silvester 1988b: D.4).

Moving westwards from Tilney St. Lawrence is the parish of Terrington St. Clement which contains the largest of Marshland's nine middle Saxon sites, TSC 23. This site is found in the southern half of Terrington St. Clement at Hay Green, with over one thousand sherds of middle Saxon pottery and vast quantities of animal bones – the significance of which will be discussed in greater detail later in this

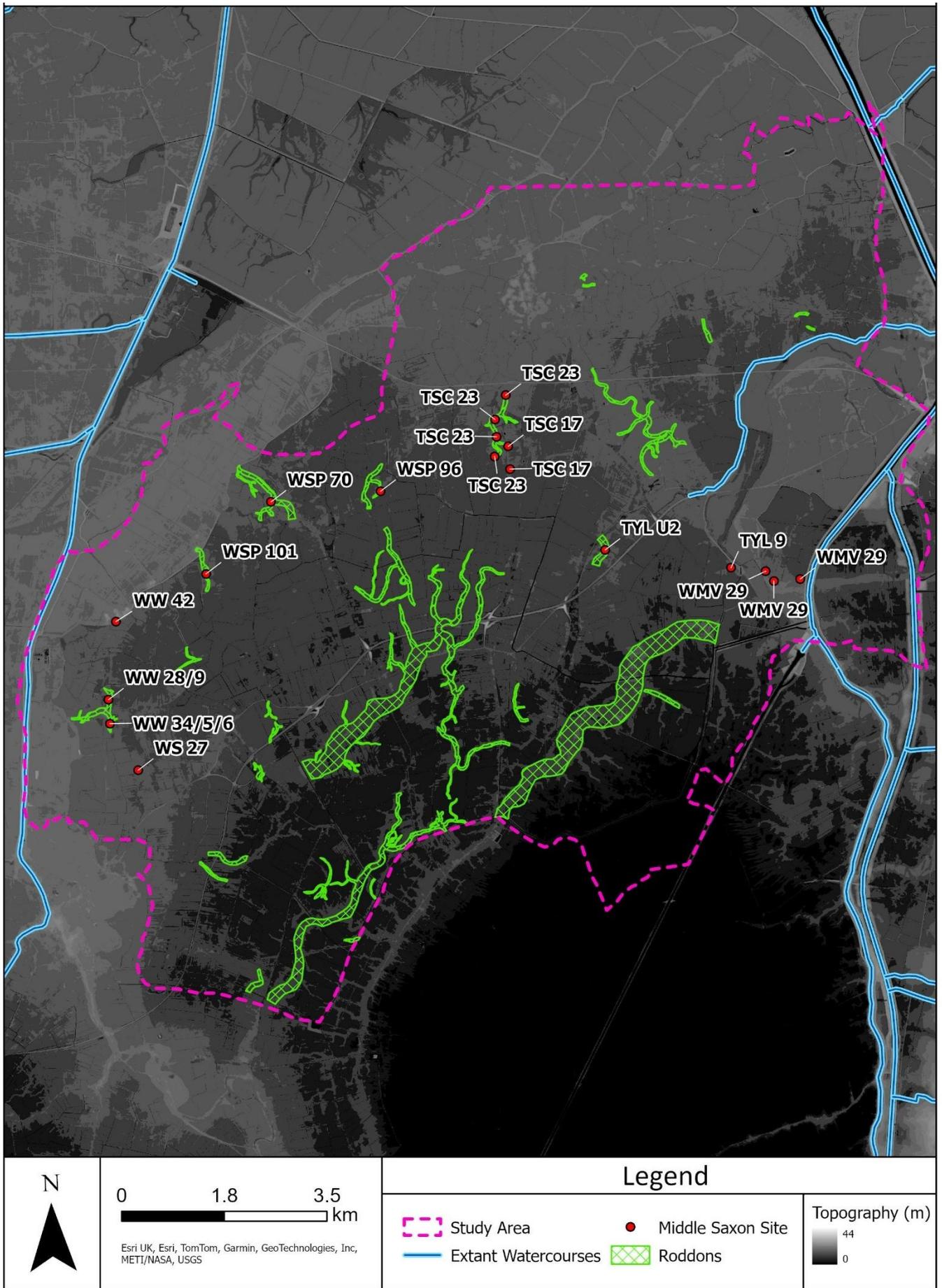


Figure 110: Middle Saxon sites and roddons in Marshland shown against topography.

chapter – being recovered from a single concentration some 1.5km long, making this site both the largest single middle Saxon site discussed in this thesis and one of the largest middle Saxon sites identified within the entire county (Silvester 1988: 37). The spread of sherds at TSC 23 follows the course of a large, sinuous roddon with remarkable accuracy, even tracing the form of one of its smaller offshoots. Given the aforementioned volume of animal bones found at this site – and at the majority of other middle Saxon sites – it is likely that both limited arable exploitation and pastoral husbandry was being practiced in middle Saxon marshland.

The largest roddon site after TSC 23 is found in Walpole St. Peter at WPP 96 (Silvester 1988b: E.10). 146 sherds of Ipswich Ware, along with a large assemblage of animal bones were recovered in a moderately dense concentration on and around a low, thin roddon some 1.6km east of the current village of Walpole St. Peter. It is possible that the increased volume of material recovered from this site was a product of the increased intensity of fieldwalking this particular site was subjected to by both Silvester and Rogerson, although for the purposes of this study this bias is of little consequence (Silvester 1988b: E.10). South-west of the main village centre and lying just inside the probable Saxo-Norman sea bank is a further middle Saxon site, WPP 101, from which 28 sherds of Ipswich Ware and moderate quantities of animal bone were recovered (Silvester 1988b: E. 10). This site also lies atop a low roddon system which continues northwards into Walpole St. Andrew and from there into the saltmarsh surrounding what was Walpole Island (Silvester 1988: 76; Silvester 1988b: E. 10).

Moving westward from the Walpoles is West Walton, the westernmost parish of the Marshland CZ where six middle Saxon sites were identified, one in the north of the parish and five in a cluster in the south of the parish (Silvester 1988: 92). This southern cluster appears to have been the primary middle Saxon focus, with sites WW 28, 29, 34, 35, and 36 producing both animal bones and a combined total of 26 sherds of Ipswich Ware, with these sherds recovered either on, or adjacent to, one of the most prominent roddons in the CZ, which rises some 2m above the current landscape (Silvester 1988b: F.10, F.11). Whilst it is impossible to know exactly how prominent this roddon was in the middle Saxon period, it would have remained a prominent landmark even if its height was half of what it is today, which after Roman drainage efforts is likely a conservative estimate. These middle Saxon sites are all located on or adjacent to a roddon, further solidifying these features as foci for settlement.

This is not to say that there is universal conformity to this rule in West Walton, with WW 42 lying on what is likely an artificial mound associated with the later sea bank rather than a roddon. Only 2 sherds of Ipswich Ware was recovered from this site, suggesting that whatever middle Saxon activity was occurring at this location was either extremely short-lived or extremely limited in scope (Silvester 1988b: F.12). Nevertheless, this site still conforms to the general pattern of middle Saxon sites

occupying locations that are raised from their surroundings and thus safer from the threat of inundation.

WW 42 is not the only site which does not conform to the general pattern suggested by the majority of Marshland's middle Saxon sites. In Wiggshall St. Mary The Virgin, WMV 29 hugs the northern bank of what is believed to be former course of the Great Ouse – which was almost certainly the course of the river in the middle Saxon period – with 26 sherds of Ipswich Ware recovered from this site (Silvester 1988: 111). Unlike the large, almost continuous site at TSC 23, WMV 29 appears to have been rather discontinuous, spread along the bank of the river for almost 1km and is not associated with any roddon. However, both WW 42 and WMV 29 are, without a doubt, in the minority when it comes to siting, for the vast majority of Marshland's middle Saxon sites are located on, or adjacent to, a roddon.

The nine middle Saxon sites in the Marshland CZ thus largely conform to factors of local topography and soils, for not only do the roddons provide elevated ground they also provide lighter, siltier soil that would have been more workable than the heavier, wetter soils of non-roddon sites. At a local scale there is thus a large degree of homogeneity between Marshland's middle Saxon sites. There is also a large degree of homogeneity at a regional scale, for every middle Saxon site avoids the deep clayey Wallasea 2 association, preferring instead to occupy either a central or peripheral site within either the Agney association or, more rarely, within the Tanvats or Wisbech associations. These three latter associations are more silty than they are clayey and tend to occur on higher ground than the Wallasea 2 association and are, in general, slightly more permeable than the Wallasea 2 soils which, due to their high clay content, struggle with drainage. Whilst the difference between these soils is slight, with Wallasea 2 only being slightly more impermeable than, for example, the Agney association, the avoidance of the wettest, most low-lying clays is notable.

Saxo-Norman: c. 850 – c. 1150

The trends established in the middle Saxon period, namely the preference of roddons and the avoidance of the low-lying clays, continue with much the same intensity into the Saxo-Norman period. In the north of Terrington St. Clement and located within the modern village of Terrington are two Saxo-Norman sites, TSC 25 and 43, with a further site, TSC 52, located slightly north of the modern village (Silvester 1988: 37). The latter site, which appears to occupy a small natural mound that is unlikely to be a roddon, is the smallest, with only 15 sherds of Saxo-Norman material being recovered (Silvester 1988b: B.9). However, the former sites are both larger – with TSC 25 and 52 producing 34

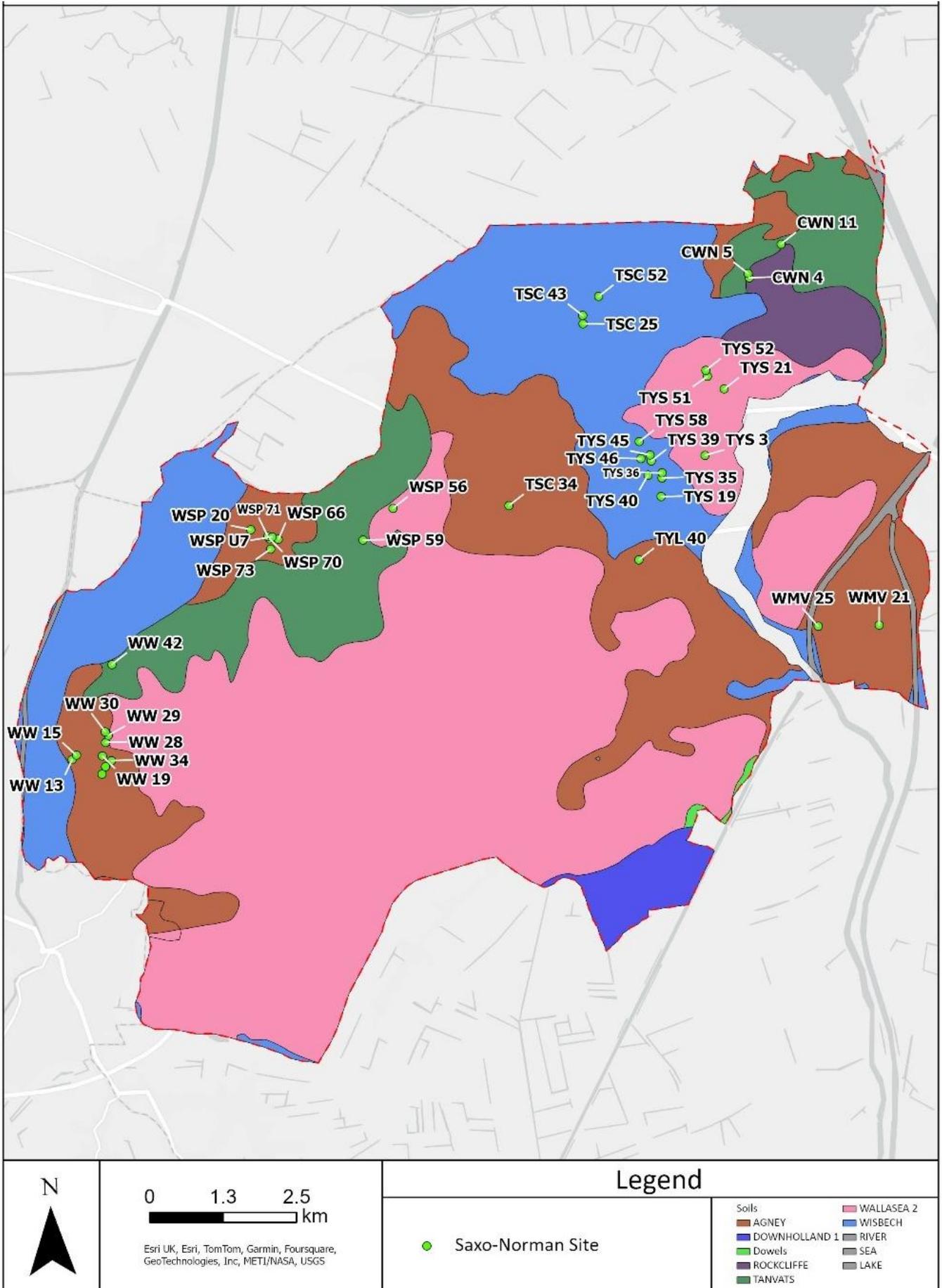


Figure 111: Saxo-Norman sites in Marshland shown against soils.

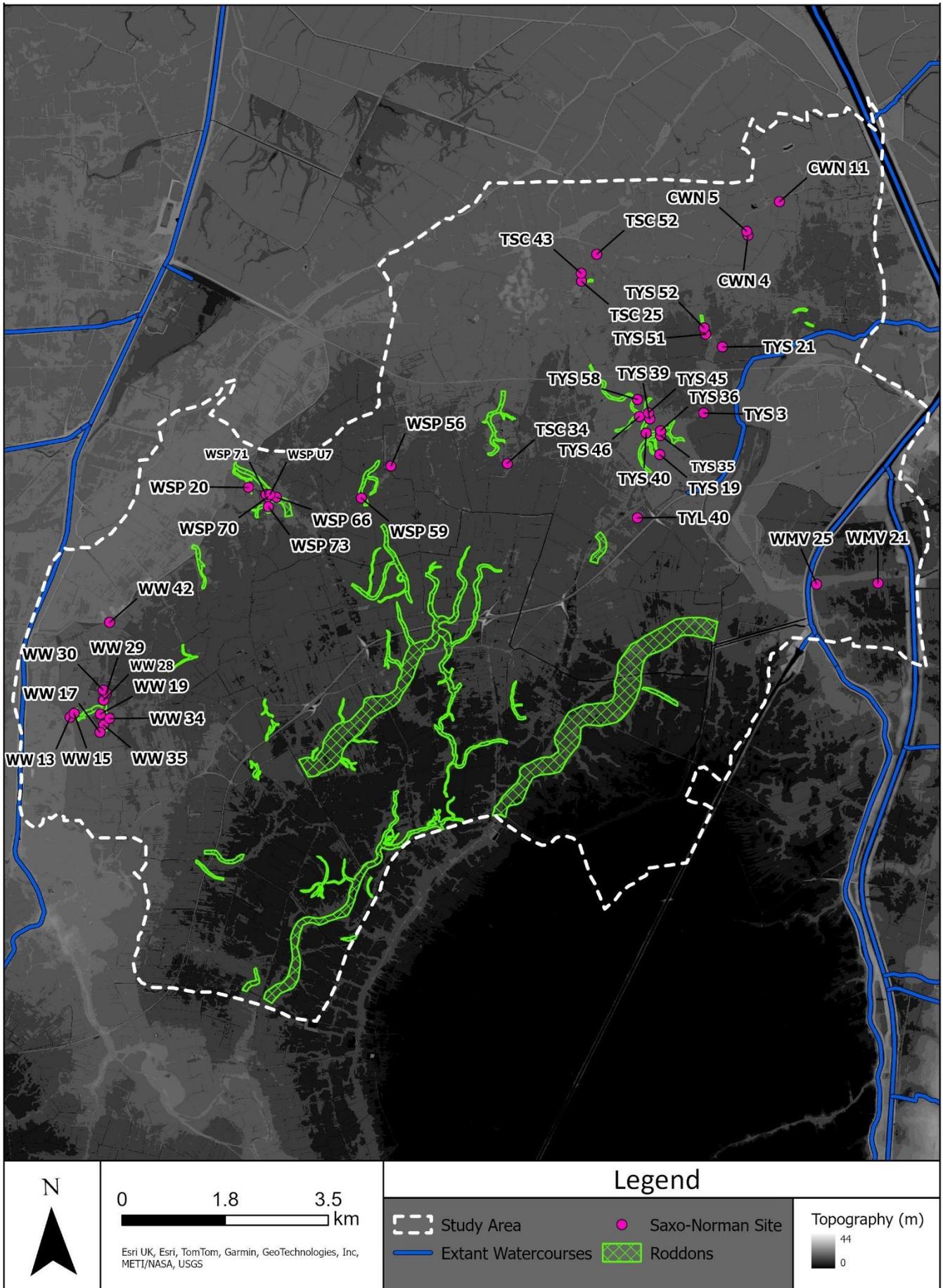


Figure 112: Saxo-Norman sites and roddons in Marshland shown against topography.

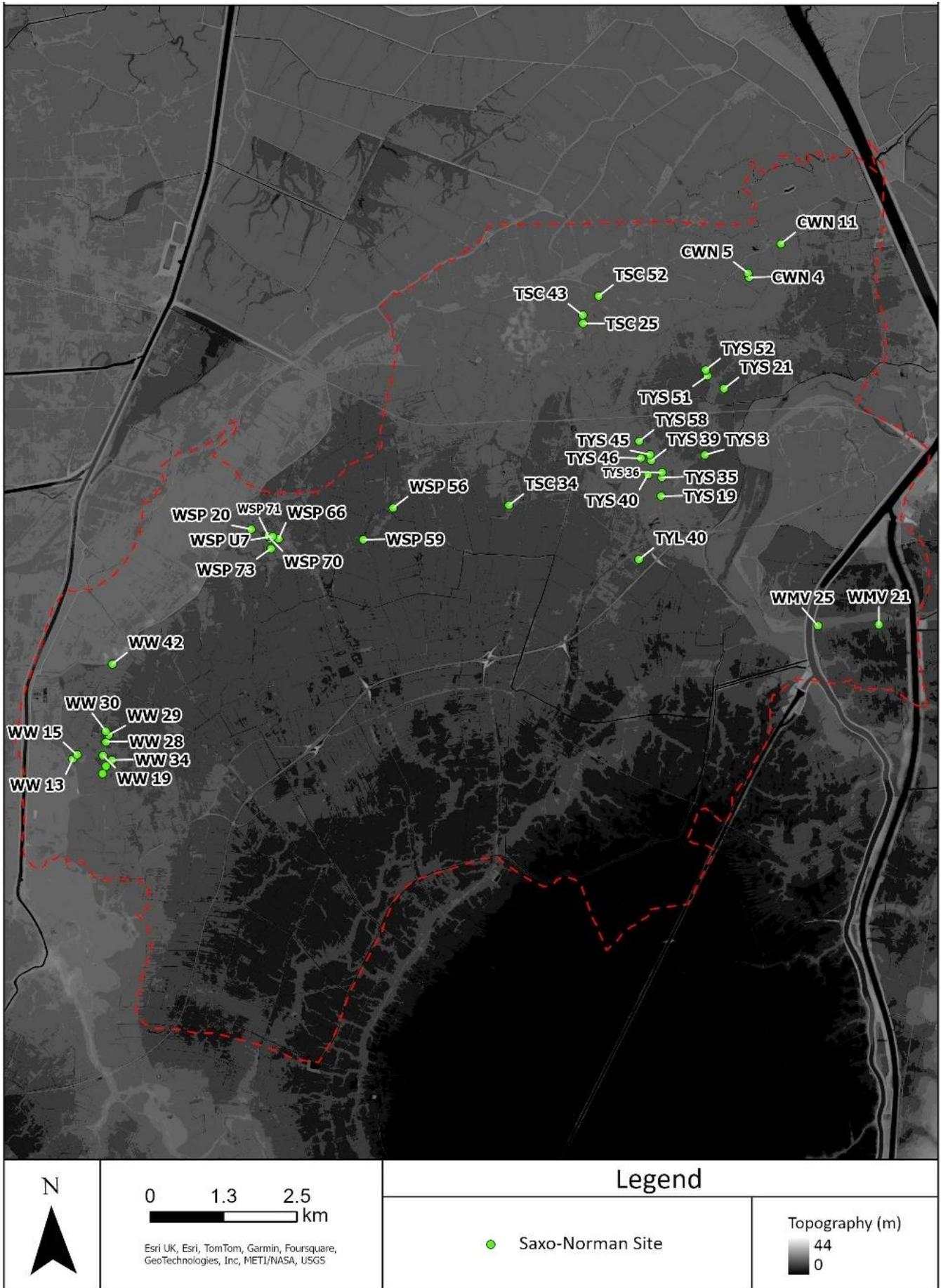


Figure 113: Saxo-Norman sites in Marshland shown against topography.

and 60 sherds respectively – and are located on a low roddon which likely extends under much of the village (Silvester 1988: 37; Silvester 1988b: B.8). Immediately west of Terrington St. Clement, in the parish of Tilney All Saints, Saxo-Norman potsherds are quite clearly following a sprawling, winding system of low levees that wend their way through the parish from north to south.

These features were unlikely to have been true roddons during the Saxo-Norman period as they most likely contained the shallow remains of the once larger watercourse which had made these features in the first place, thus making these raised banks levees rather than roddons (Silvester 1988: 49). However, much like the roddons which many of these features would eventually become, levees were both elevated from the surrounding landscape and were composed of sandy silts which were ultimately far lighter than the soils of the surrounding landscape. In the context of this investigation the distinction between roddon and levee is thus largely one of terminology, for the two types of feature share largely homogenous topographical and geological characteristics, with the only dissimilarity being that the levees were likely accompanied by a small, shallow stream (Smith *et al.* 2010: 256-269). TYS 19, 35, 39, 40, and 46 all occupy a position on this system of interconnected levees and which nearly all date to the tenth and eleventh century, with sites TYS 36, 45, and 58 also forming part of this complex but dating to the eleventh and twelfth centuries (Silvester 1988: 49).

The largest of these sites, TYS 40, produced 150 sherds of tenth- and eleventh-century pottery, mainly Thetford Ware, whilst the site at TYS 45 produced 63 sherds of Early Medieval Ware (Silvester 1988b: C.8; Silvester 1988: 49). To the north-east of these central sites are two Saxo-Norman sites – TYS 51 and 52 – which occupy a roddon near to the present hamlet of Kenwick and which date to the eleventh and twelfth centuries (Silvester 1988b: C.9). In the far north of the adjacent parish of Tilney St. Lawrence is TYL 40 – which is 1.1 km south of Tilney All Saint’s sprawling system of levees – from which 80 sherds of eleventh- and twelfth-century material were recovered, the only Saxo-Norman site identified within that parish (Silvester 1988b: D.2). This is a similar distance to that between the central sites and TYS 51 and 52 – which stands at 1.3km – and it is thus possible that these were once all outlying occupational sites established at a later date – namely the eleventh century – as the focal point centred on the levee system increased in size and, presumably, population. It should come as no shock that TYL 40 is located on the top of a rather sizeable roddon.

Moving westwards to the parish of Walpole St. Peter we find the same trends already established elsewhere in the Marshland CZ continuing with much the same intensity. At the present site of the village of Walpole St. Peter are five Saxo-Norman sites which all occupy a position on, or directly adjacent to, a roddon. Sites WSP 70, 71, and WPA 20 appeared in the tenth century whilst sites WSP

68 and 73 appeared in the eleventh century, with each of these sites likely indicative of occupation (Silvester 1988: 76; Silvester 1988b: E.5 – E.6).

Given the homogeneity of the Saxo-Norman evidence so far, it is no great surprise that the evidence from West Walton tells an almost identical story to those parishes already discussed. The main body of the present village of Walton lies on a large roddon system which has proven a significant draw to both Saxo-Norman and later medieval occupational sites. Indeed, this roddon system is the most prominent in the area, with Silvester suggesting that the combination of elevated terrain and the plentiful resources available from the adjacent estuary must have proven a significant draw to Saxon settlers. WW 13, 15, 19, 28, 29, 30, and 35 all occupy part of this prominent roddon system, with only WW 42, which lies to the north just inside the Saxo-Norman sea bank, located away from this evident focal point (Silvester 1988b: F.6-F.12). The main fabric recovered from these sites were Thetford and Stamford Wares and largely date from the tenth century onwards, although WW 42 appears to have been a later, eleventh century creation (Silvester 1988b: F.6-F.12).

Along with WW 42 are a small collection of Saxo-Norman sites which are not located on a roddon or levee. In Clenchwarton in eastern Marshland, sites CWN 4, 5, and 11 occupy artificial mounds of uncertain origin rather than roddons, with Saxo-Norman occupation of these mounds beginning in the eleventh century and lasting through to the mid-twelfth century (Silvester 1988b: A.9). This is similar to the previously discussed site at TSC 52, although here the mound on which Saxo-Norman material was recovered from was likely natural, rather than artificial, in origin (Silvester 1988: A.9-A.10, B.8). The final non-roddon site is found in the extreme east of the CZ in Wighenhall St. Mary The Virgin, where 16 sherds of Thetford Ware were recovered from WMV 25, a site which was likely on the banks of the Ouse in the Saxo-Norman period (Silvester 1988b: G.10).

There is thus a significant degree of similarity between Marshland's settlement pattern in the middle Saxon period and the settlement pattern in the Saxo-Norman period, with sites demonstrating an overwhelming preference for roddons, levees, and natural or artificial mounds. The similarities also persist into the macro-landscape, for once again the large central tract of Wallasea 2 is almost entirely avoided, with occupational sites either preferring a more central position within the siltier, slightly more permeable Agney, Tanvats, and Wisbech associations or favouring the edges of these associations where they border the clayier Wallasea 2 soils. Manuring scatters are largely limited to these siltier northern soils, with few Saxo-Norman scatters found on the clayier soils of the Wallasea 2 association (Silvester 1988: 164-9). Whilst the avoidance of Wallasea 2 is a widespread phenomenon throughout the Marshland CZ, two sites in the parish of Tilney All Saints – sites TYS 51 and 52 – buck this trend, and show that expansion onto these heavier, clayier soils was occurring during the Saxo-

Norman period, albeit to an incredibly limited degree. It should also be noted that TYS 51 and 52 are located on a roddon, which would almost certainly provide lighter soil and some degree of elevation compared to the surrounding landscape.

Medieval: c. 1150 – c. 1350

The start of the medieval period was a watershed moment in the Marshland CZ which sees the focus of settlement shift dramatically. Whereas before the focus of settlement was the region's many roddons and levees, the medieval period – and especially the post-twelfth century period – saw the focus switch to the extensive network of greens and droves which wound their way throughout many of Marshland's parishes, although it is critical to note that the roddons were still being utilised throughout this period. The often sinuous and irregularly shaped greens and droves are believed to date to the Saxo-Norman period and are critical to understanding the development of the Marshland CZ, with a more detailed discussion of the origin of these features being undertaken later in this chapter (Silvester 1988: 162-3). Due to the presence of so many medieval sites – over 240 in total – this discussion of the medieval evidence cannot feasibly include every site, or indeed every parish.³

Due to the volume of sites, the following section will focus on discussing those parishes which best reflect the character of the medieval landscape. The discussion will also centre primarily on identified 'sites' and large landscape features, with manuring scatters featuring less prominently in this chapter than in previous chapters. The reason for this is the near uniform scatter of medieval sherds present in nearly every field in the Marshland CZ, with only a few small fields in Clenchwarton bucking this trend (Silvester 1988: 163-9; Silvester 1988b: A.9-G.11). It is thus clear that medieval arable exploitation was occurring in every corner of the landscape; there is very little to be gleaned from this information, especially when attempting to discern whether climatic fluctuations were playing any role in the development of the landscape. For clarity, the term 'settlement' still refers to the entirety of the anthropogenic landscape, with 'occupation', 'occupational', or 'occupational complex' referring to places where the evidence has been interpreted to indicate a place of sustained human presence such as places of habitation, industry, or agricultural infrastructure such as farmsteads.

The proclivity towards green- and drove-edge sites is perhaps nowhere better demonstrated than in the parishes of West Walton, Terrington St. Clement, and Walpole St. Peter. There are three greens present in medieval West Walton; Brocks Green, Hall Green, and Place Green, which are all interconnected by an extensive system of tracks and droves and which is aptly referred to by Silvester

³ The maps presented in this section are not annotated with site numbers due to the sheer volume of sites. Two maps are provided for reference. The first is a map detailing the parish-based site codes (Figure 93), whilst the second (figure 94) provides an annotated view of Marshland's medieval sites.

as the 'Walton Highway' (Silvester 1988: 93, 95). Brocks Green appears to have been the primary focus of medieval settlement within the parish, with St. Mary's Church and at least twenty sites⁴ lying directly adjacent to the green (Silvester 1988: 95). The southern edge of the green seems to have witnessed the most intense medieval activity, with sites WW 16, 20, 21, 23, and 44 directly abutting this southern edge and sites WW 13, 14, 15, 17, and 22 lying within 200m (Silvester 1988: 93).

It is unlikely to be mere happenstance that the most intense medieval activity occurs in this southern locale, for this is where Brocks Green connects to Hall Green via a track which passes directly south of St. Mary's Church. On the south-western corner of Hall Green – directly adjacent to the south-eastern corner of Brocks Green – are sites WW 19, 34, 35, and 36 (Silvester 1988: 93). These latter three sites, along with WW 13, 14, 15, 17, 20, 21, 23, and 44 also lie on the roddon which underlies this southern half of the green, although most of these roddon sites are continuations of Saxo-Norman sites rather than virgin sites (Silvester 1988b: F.7-F.6). However, the majority of medieval sites around Brock Green – and indeed Hall Green and Place Green – are situated adjacent to, or near to (defined here as within 50m but most commonly within 20m) the edge of the green or track. Sites WW 28, 29, 30, 31, 33, 37, 38, 39, 40, and 61 all lie around the fringes of Brocks Green, with most of these sites either being virgin sites established in the twelfth or more likely the thirteenth century or sites that only produced a very light scatter of Saxo-Norman sherds which is indicative of the manuring of arable rather than a defined 'site' (Silvester 1988: 70).

Medieval settlement in other parts of West Walton follows much the same pattern as that described around Brocks Green, although the intensity diminishes as one progresses eastwards through the parish. The northern edge of Hall Green is undoubtedly the focal point of settlement in this more central part of the parish, with sites WW 32, 49, 57, and 63 all lying directly adjacent to the northern edge of the green along a 700m stretch starting at the green's north-western corner. With the exception of WW 34, 35, and 36 – which lie on the south-western corner of Hall Green and the south-eastern corner of Brocks Green – only WW 58 and 59 lie on the southern edge of Hall Green. These sites all appear to have emerged during the thirteenth century and lasted until the fourteenth century, at which point they were abruptly abandoned.

Compared to the relative intensity of settlement around Brocks Green – and to a lesser extent around Hall Green – Place Green, which lies in the east of the parish, is notably lacking in medieval sites. This is unlikely to be a product of the survey methods, for the eastern half of West Walton was surveyed

⁴ Sites adjacent to Brocks Green: WW 16, 18, 19, 20, 21, 23, 28 (moated), 29, 30, 31, 33, 37, 38, 39, 40, 41, 44, 61, U6 (Silvester 1988b: F.6-G.2).

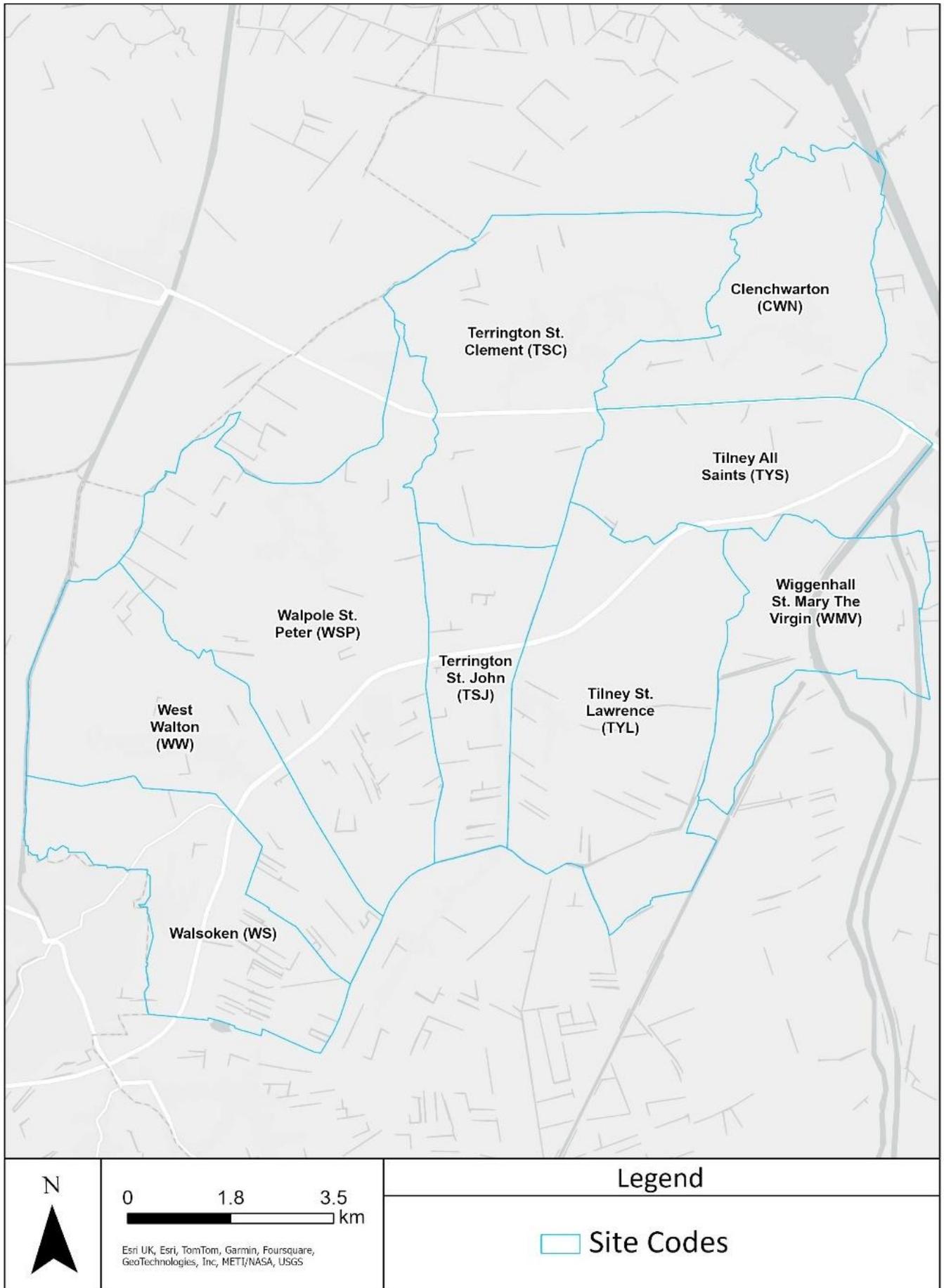


Figure 114: Marshland's parish-based site codes.

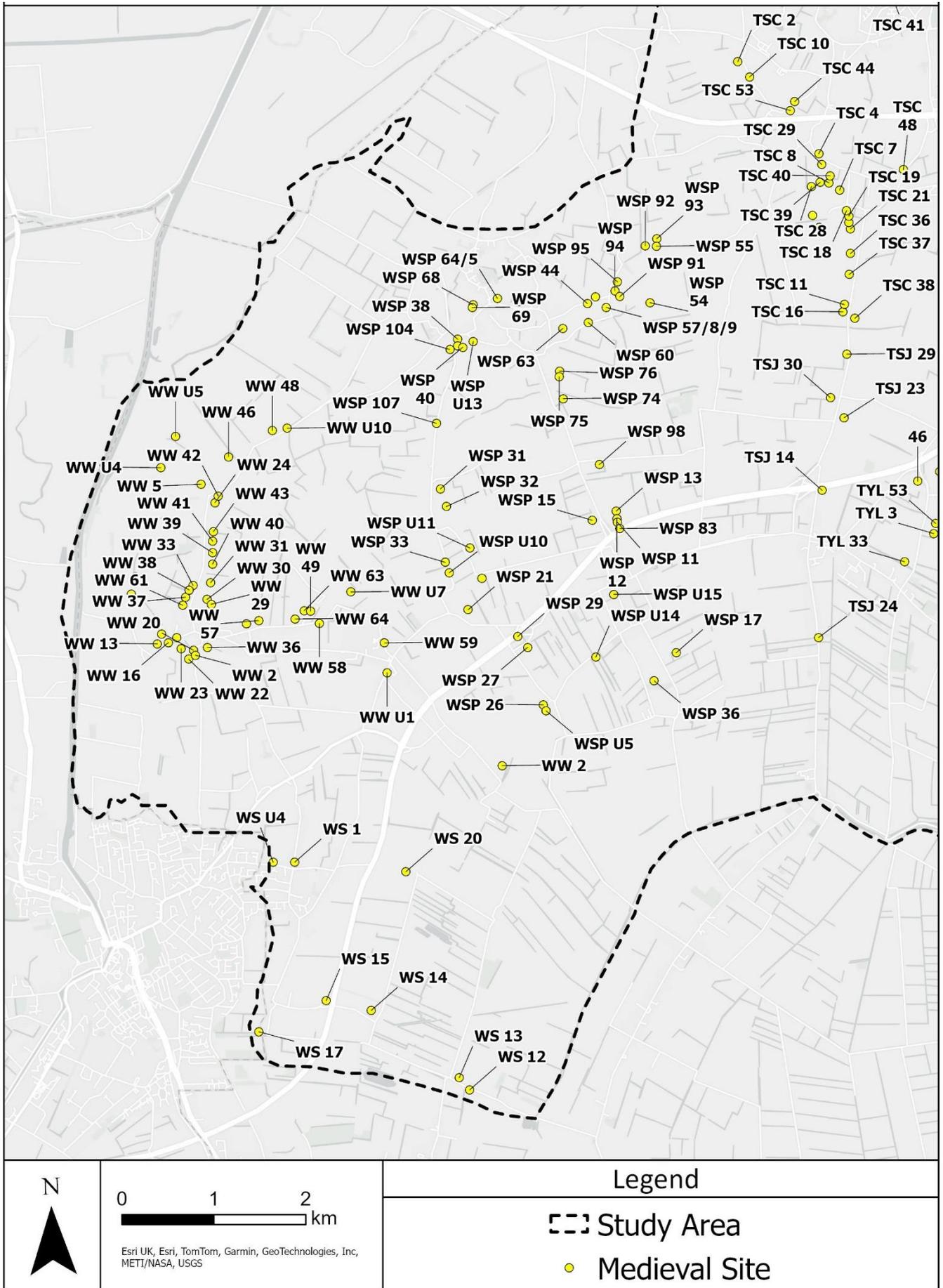


Figure 116: Marshland's medieval sites in the south-western half of the study area with site codes.

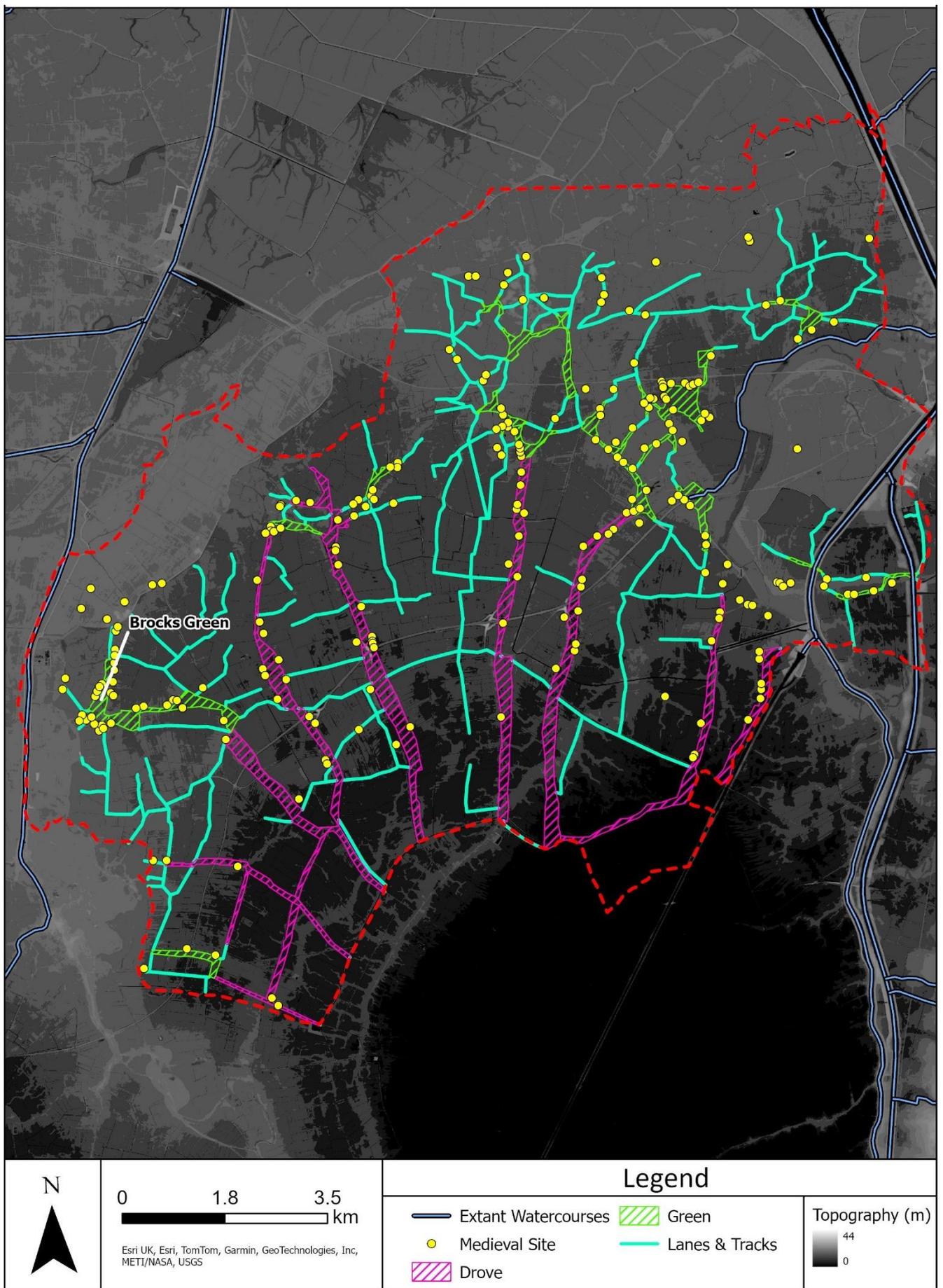


Figure 117: Medieval sites and droves, greens, and tracks in Marshland shown against topography.

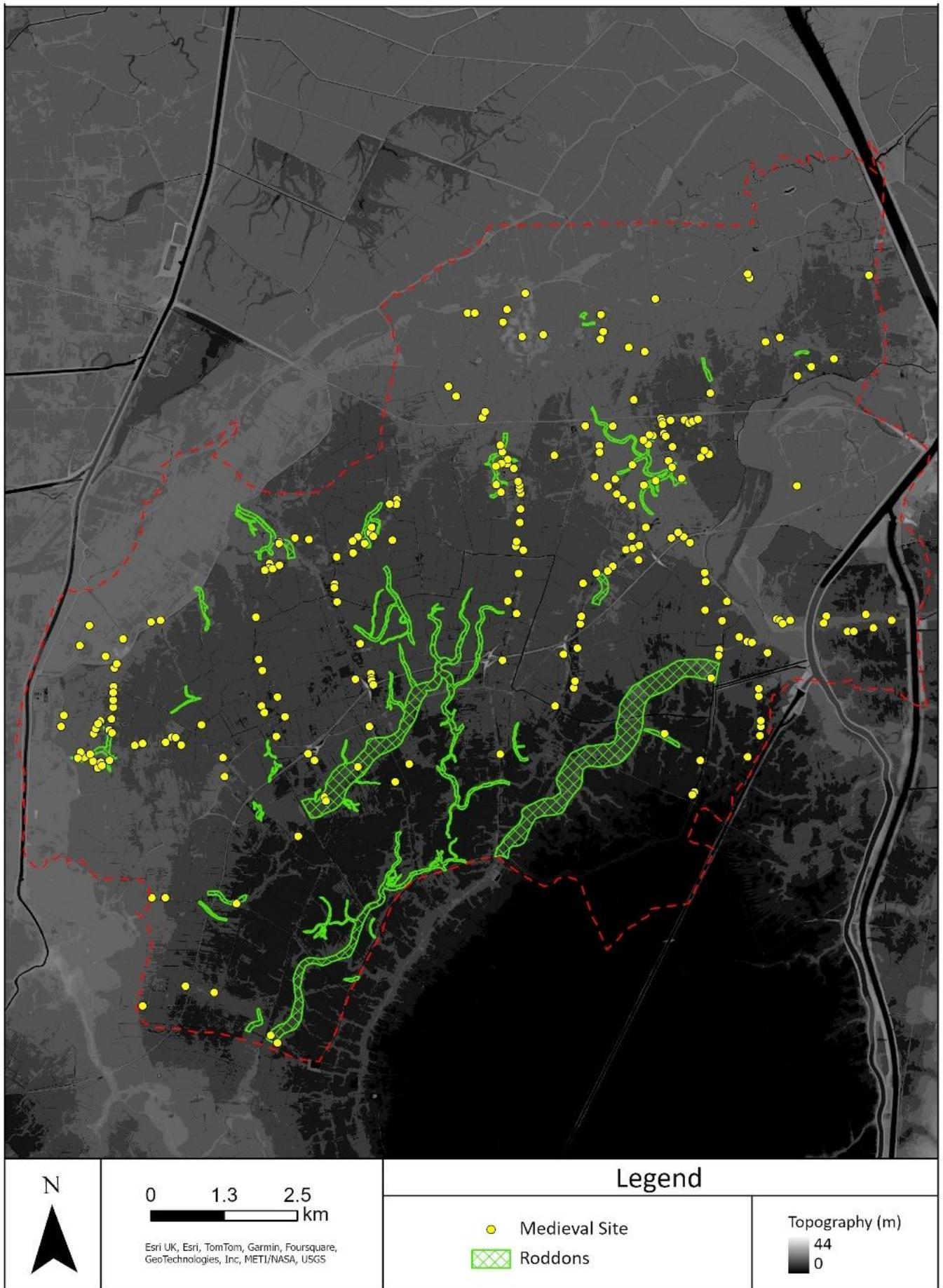


Figure 118: Medieval sites and roddons in Marshland shown against topography.

with no less vigour than the western half; this dearth of sites is thus likely representative of a true absence rather than one precipitated by shortcomings in the survey itself. The only medieval sites around this green are WW 2 and U1, with the former occupying a roddon on the flank of the green and the latter occupying the northern border and being composed of numerous gullies and low banks, of possible medieval origin, which were perhaps paddocks or crofts (Silvester 1988b: F.14). Unfortunately, neither of these sites produced fabrics which could be more precisely dated other than to the rather general 'medieval' period, which is regrettable as this eastern part of the parish lies within the Wallasea 2 association and could have provide valuable information as to the date this part of West Walton was reclaimed (Silvester 1988b: F.6-G.1). However, whilst a more precise temporal range for these sites would be preferable, the concentration of sites in the west of the parish and the thinning of sites as one draws ever closer to the parish's eastern boundary is significant, for the Agney association underlies the western focal point of Brocks Green whilst the Wallasea 2 association underlies the more sparsely populated Hall Green and Place Green, with this spatial variance discussed in more detail later in this chapter.

Elsewhere in the Marshland CZ this medieval predilection for green-edge and drove-edge sites is equally apparent. In Walpole St. Peter, 45 sites, mostly dating to the thirteenth and fourteenth century, are spread around the small northern greens and the long, sinuous droves which connect these northern greens to the seasonal grazing grounds of Marshland Smeeth in the south. Both East Drove and West Drove have approximately twelve sites strung along their length, although the patterns of settlement are largely dissimilar. West Drove appears to have been the site of a small, comparatively clustered drove-edge occupational complex containing what is potentially a moated site, again interpreted as a demesne farm, whilst the occupational sites spread along East Drove exhibits a more dispersed pattern, with its twelve sites sprawling along its 6km length (Silvester 1988: 77-81). The remaining 21 medieval sites are clustered around the two northern greens, Waterdin Green and Bristot Green, with the former being adjacent to the current village of Walpole where middle and Saxo-Norman occupation appears to have focused. Whilst some of these Saxo-Norman sites continued into the medieval period, only five virgin sites – WPP 64, 65, 66, 67, 68, and 69 – appeared in Walpole, although this is likely a product of the inherent inaccessibility for the survey of this more urban locale, and it is entirely plausible – and indeed likely – that a significant number of sites are obscured by modern dwellings. Just 200m east of the main village of Walpole is a not insignificantly sized green-edge occupational complex which emerged in the late twelfth and thirteenth centuries near the edges of the thin, sinuous Bristot Green, with 16 medieval sites identified along this 1.2km long green. This small complex does, however, lie atop a pronounced roddon which skirts the junction between the Tanvats and Wallasea 2 association, although elsewhere in the parish,

perhaps most notably at the small, clustered occupational complex on West Drove, the large roddon system which underlies much of the southern half of the parish is entirely ignored.

In Terrington St. Clement, the extent of the current village – which formed the focal point of medieval settlement – likely obscures a significant proportion of its medieval sites; only a handful have been identified within the village itself, with these sites – such as TSC 24, 26, 27, and 41 – usually restricted to the fringes of the village. However, whilst the primary focus is largely obscured, the rest of the parish has been comprehensively surveyed, and it is these virgin medieval sites which are of the most interest, particularly those in the south and centre of the parish at Hay Green. Settlement began in this part of the parish in the Saxo-Norman period at TSC 34, which contained evidence of occupation up until the eleventh and twelfth centuries (Silvester 1988: 38). This site was, however, set some 250m back from the green, and it was only at TSC 20 that potsherds dating to the twelfth century were recovered from a green-edge site (Silvester 1988: 38-9).

Hay Green's origins can thus be tenuously traced back to the eleventh century, although a more solid estimation would be the thirteenth century when thirteen green-edge sites appeared (Silvester 1988: 37-41). These are overwhelmingly clustered on the green's western flank, with only TSC 38 occurring on its eastern side. Why this western flank was clearly preferred is a mystery, although one possibility is that the more regular field boundaries present to the east of the green, which continue up to the western flanks of the greens and droves present in the neighbouring parishes of Tilney All Saints and Tilney St. Lawrence, perhaps indicate that the landscape was converted to arable in one intake from a large expanse of former common pasture (Silvester 1988: 38-9; Silvester 1988b: B.3-B.10). Nevertheless, the overall picture sketched by the Hay Green evidence largely concurs with the pattern noted elsewhere in the parish, with green-edge sites proliferating in the thirteenth century.

The settlement at Hay Green also demonstrates the twelfth-century preference for lanes and tracks. TSC 28, 34, 39, and 44, which account for nearly half of the non-salern twelfth-century sites, are all located adjacent to either a lane or a trackway (Silvester 1988b: B.3-B.7). Similarly, the twelfth-century sites WW 17 and 43 in West Walton, which again account for nearly half of the twelfth-century sites in the parish, lie adjacent to a trackway or lane (Silvester 1988b: F.3-G.2). This trend is repeated throughout the CZ, and of the approximate 54 sites established in the twelfth century, almost half are sited next to lanes or trackways.

So far, the medieval sites discussed have been representative of the majority of sites within the Marshland CZ, and have largely occupied a position adjacent to, or near to, one of the region's many greens, droves, or lanes. However, whilst such sites are undoubtedly representative of the majority,

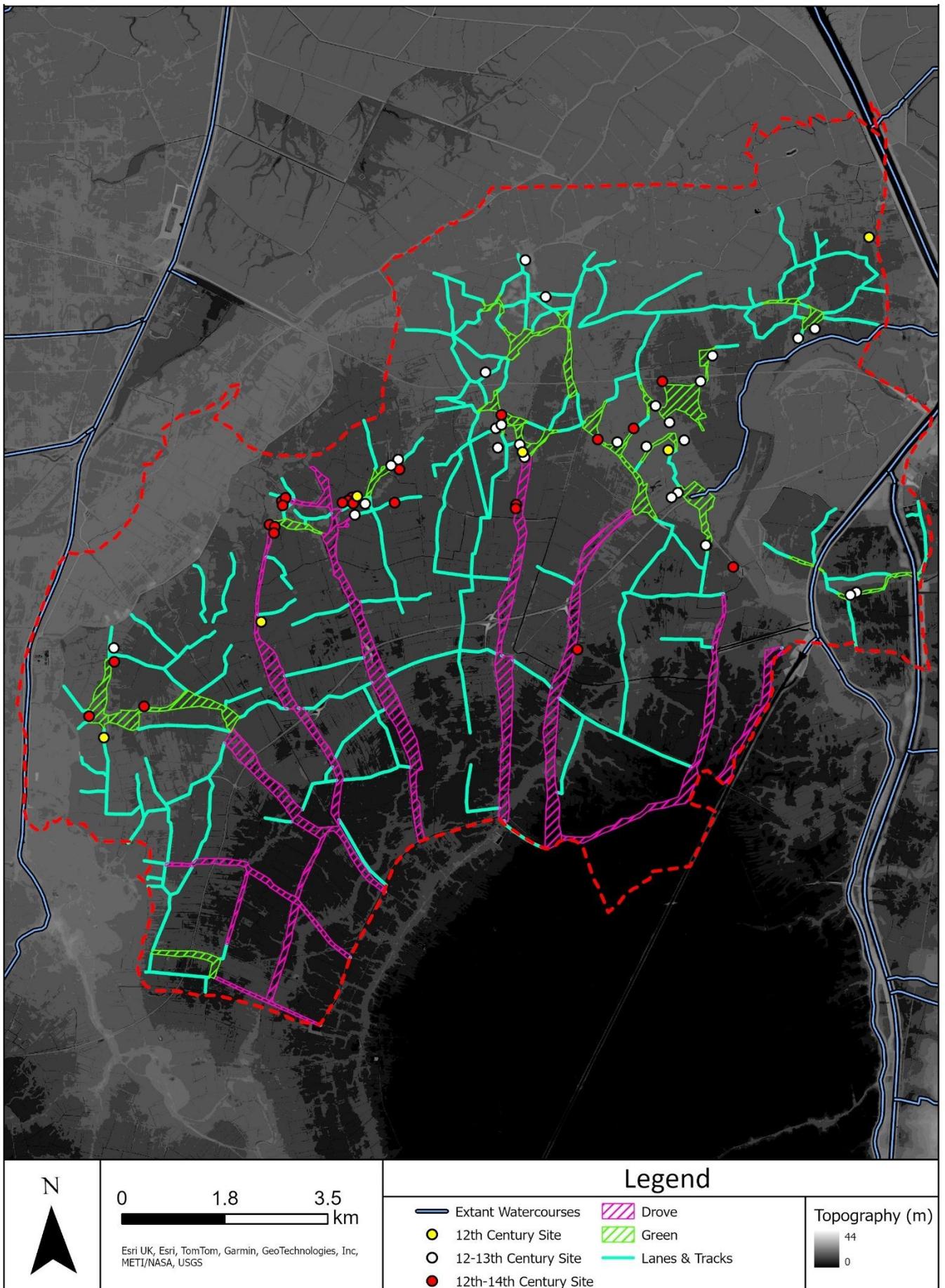


Figure 119: Medieval sites with temporally limited occupation (see legend for dates of occupation) shown against topography.

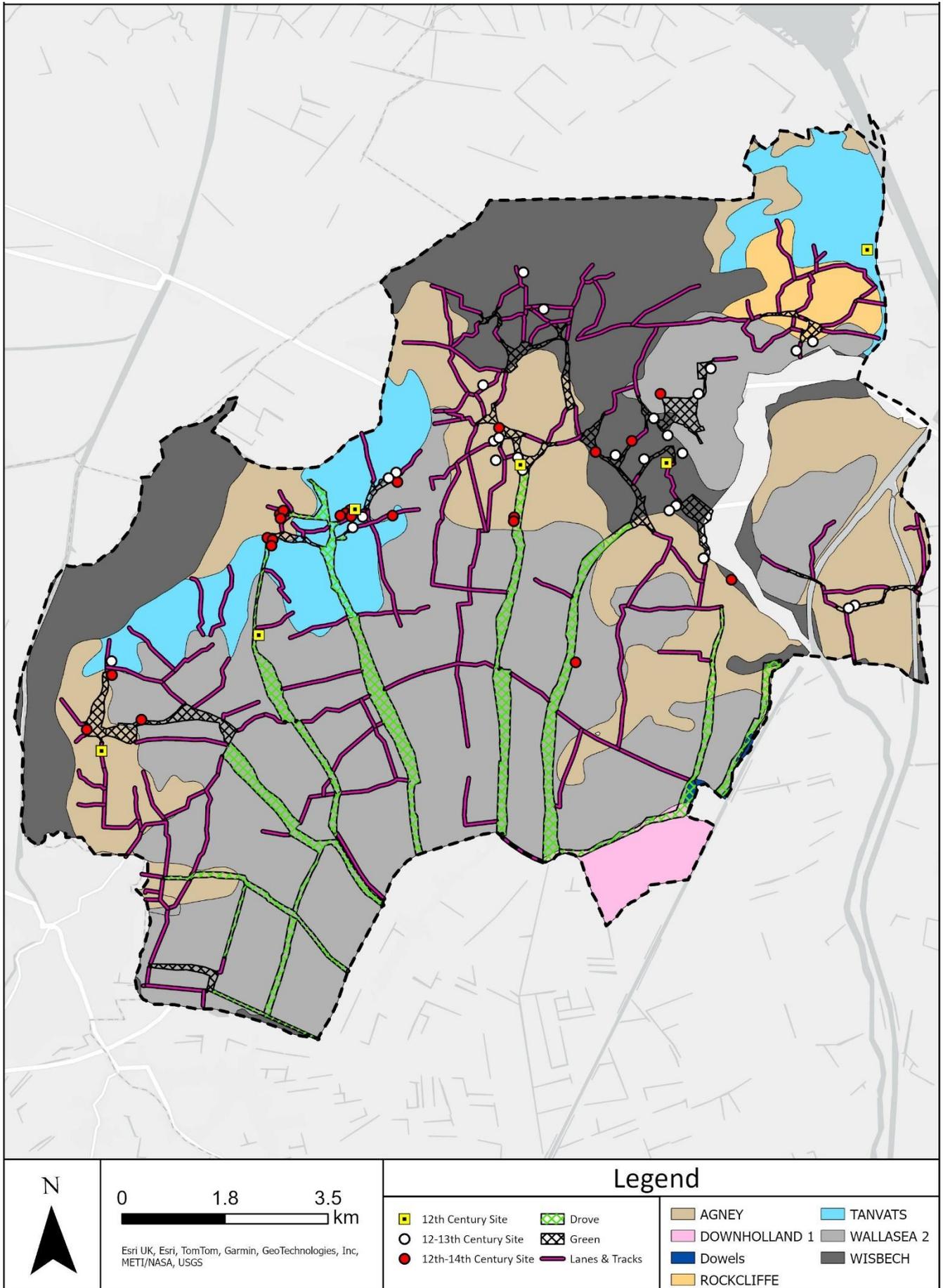


Figure 120: Medieval sites with temporally limited occupation (see legend for dates of occupation) and droves, greens, and tracks in Marshland shown against soils.

there is a small, but nevertheless critical collection of sites which are associated not with the greens, droves, and lanes but with the saltmarshes which often lie outside of the sea banks. These sites were part of Marshland's incredibly lucrative salt industry, with the parishes of West Walton, Walpole St. Peter, and Terrington St. Clement containing numerous sites associated with this industry. In West Walton, one of the most recognisable features in the landscape is the sea bank which protects much of the parish's northern and western flank. For the most part medieval sites are limited to the interior of this bank, with some sites – such as WW 13, 24, and 42 – being located directly adjacent to the interior edge of the bank itself (Silvester 1988: 93). However, there are a number of sites which lie outside of the sea bank and within the salt marshes, with sites WW U4, U5, U10, 5, 6, 46, and 48 the most interesting of these 'external' sites (Silvester 1988b: F.6-G.1). These sites have been interpreted by Silvester as saltern mounds, artificial mounds composed of the waste material deposited by the repeated filtration of the salt rich coastal muds in an effort to collect the concentrated brine that could then be boiled to produce salt, one of this region's most valuable exports (Silvester 1988: F.6-G.1; Kwiatkowska 2021: 1-18). Such sites are found all across the Marshland CZ. In Walpole St. Peter, WPP 18 and 19 are almost certainly medieval saltern mounds, as are TSC 45, 46, and 47 in Terrington St. Clement, with all of these sites lying beyond the sea bank in the coastal saltmarshes (Silvester 1988b: D.12). It is in West and South Lynn that the greatest number of medieval saltworks was identified, with KLY 2, 4, 11, 12, 14, 18, 19, 20 all being possible salterns (Blackbourn 2019; Clarke 2016a; 2016b; 2017a; 2017b; 2018a; 2018b; Cope-Faulkner 2014; Kwiatkowska 2020; Silvester 1988: 26-7; Silvester 1988b: A.12-B.1). West Lynn appears to have been particularly dependent upon its saltworks, with a permanent occupational complex emerging in this parish which has the unusual characteristic of lying beyond the sea bank (Blackbourn 2019; Clarke 2016; 2017; 2018a; 2018b; Cope-Faulkner 2014; Kwiatkowska 2020; Silvester 1988: 27). Owen has suggested that this complex may pre-date the Conquest, linking the salterns visible in the archaeological record to those held in Ralph Banyard's manor of Terrington in Domesday (Owen 1984: 8). The material evidence recovered from KLY 16, 19 and 18 appear to support this notion, with the former two salterns producing sherds dating to the twelfth- and thirteenth centuries whilst eleventh- and early twelfth-century material was recovered from the latter (Silvester 1988: 27; Silvester 1988b: A.12-B.1).

In previous periods settlement in the Marshland CZ exhibited a marked aversion to the deep clays of the Wallasea 2 association. This tendency was somewhat tempered in the medieval period; the greens and droves which are so ubiquitous of Marshland's medieval landscape – and which proved such a draw to settlement, especially from the thirteenth century onwards – often carved through the large central parcel of the Wallasea 2 association as they extended southwards through the CZ towards the seasonal pastures of the Smeeth and West Fen. The utilisation of this clayier soil was thus far more

prevalent in the medieval period than it was in preceding periods, which was both a product of the gradual reclamation of inundated land and the inescapable pressures caused by a booming population. However, even in the medieval period sites on the Wallasea 2 association constituted just 20% of all medieval sites in the CZ, with the remaining 80% situated on the Agney, Tanvats, or Wisbech associations. Thus, whilst expansion onto the Wallasea 2 soils was far more extensive than it was in preceding periods, the general trend of occupational sites preferring the siltier associations still largely holds true, with the focal point of medieval settlement in the vast majority of parishes tending to lie on these siltier soils whilst the lesser occupational complexes – such as the small hamlet on West Drove in Walpole St. Peter or the small greenside settlement at Jars Green in Walsoken – often emerging on the clayier Wallasea 2 soils.

Late Medieval: c. 1350 – c. 1500

Late medieval settlement in the Marshland CZ demonstrates the same trends noted elsewhere in Norfolk, with retraction rather than expansion defining this region in the later fourteenth and fifteenth centuries (see Figures 121 and 122 below). In Terrington St. Clement, the thirteenth- and fourteenth-century secondary occupational complex at Hay Green had almost entirely disappeared by the fifteenth century, with TSC 1 and 9 the only sites from which fifteenth-century material was recovered (Silvester 1988b: B.3). Similarly, the sites strung along West Drove in Walpole St. Peter had similarly contracted, with just three sites active in the fifteenth compared to twelve in preceding centuries. In West Walton the once extensive occupational sites surrounding Brocks Green and Place Green were dramatically reduced, with just eight sites active in the fifteenth century compared to the more than 28 sites which were active during the medieval period.

Portable Antiquities Scheme and Norfolk Historic Environment Record evidence

The PAS and NHER records add useful context to the fieldwalking evidence, particularly regarding the attraction of settlement to roddons, greens and droves, and the sustained avoidance of the Peat Fen CZ.

For the early Saxon period, only a single object is recorded by PAS: a circular gold-and-garnet mount or stud, likely from a scabbard or sword-belt, thought to date from between 580–650 CE. This artefact, recovered in the parish of Walsoken on the northern boundary with West Walton, lies directly on the line of a later medieval drove and is only 160m from a roddon. Its position thus somewhat parallels TYL 19 – the only early Saxon site identified by fieldwalking in Marshland – which is also associated with a roddon. However, far more interesting is this artefact's perfect coincidence with what would

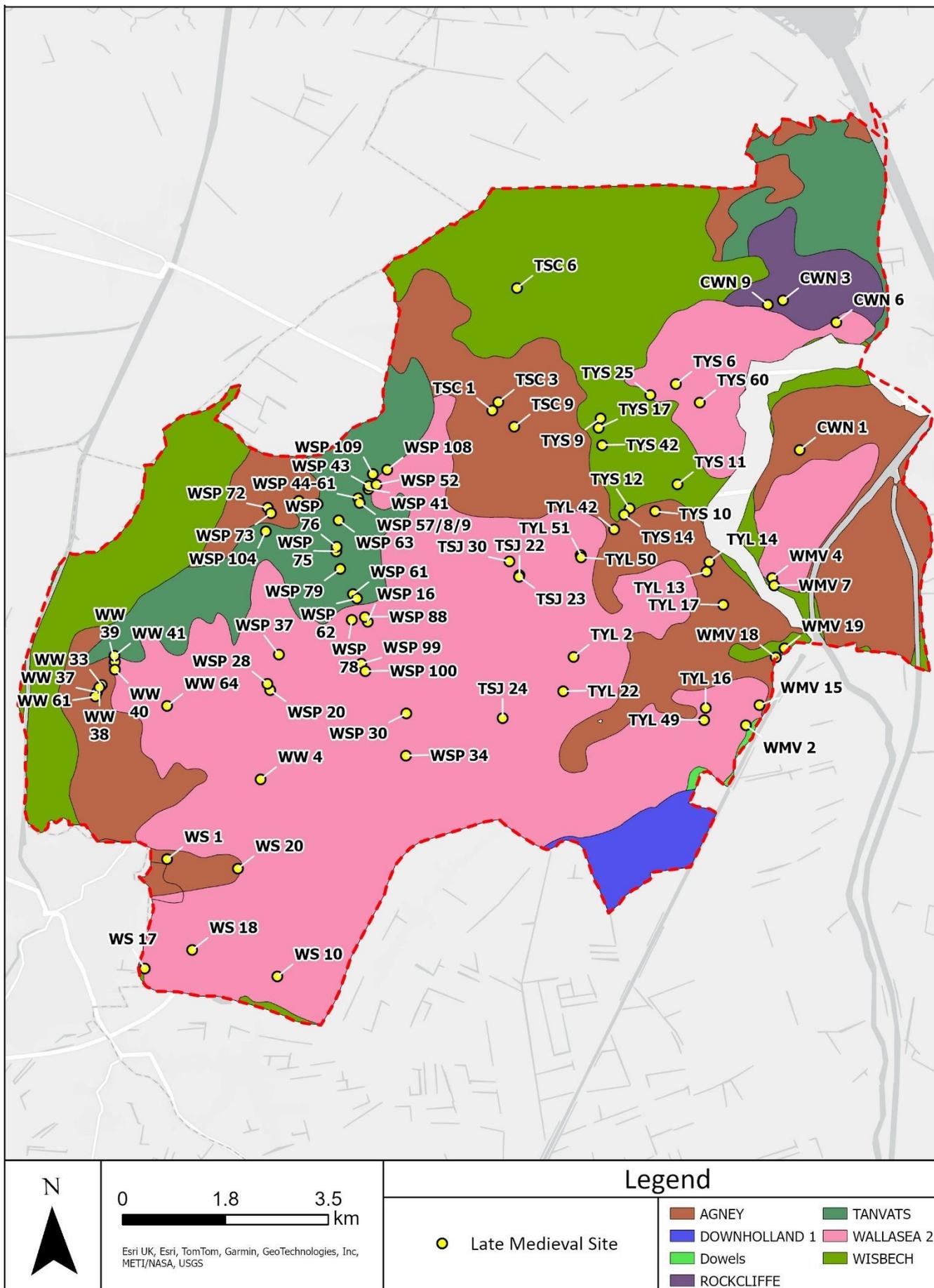


Figure 121: Late Medieval sites in Marshland shown against its soils.

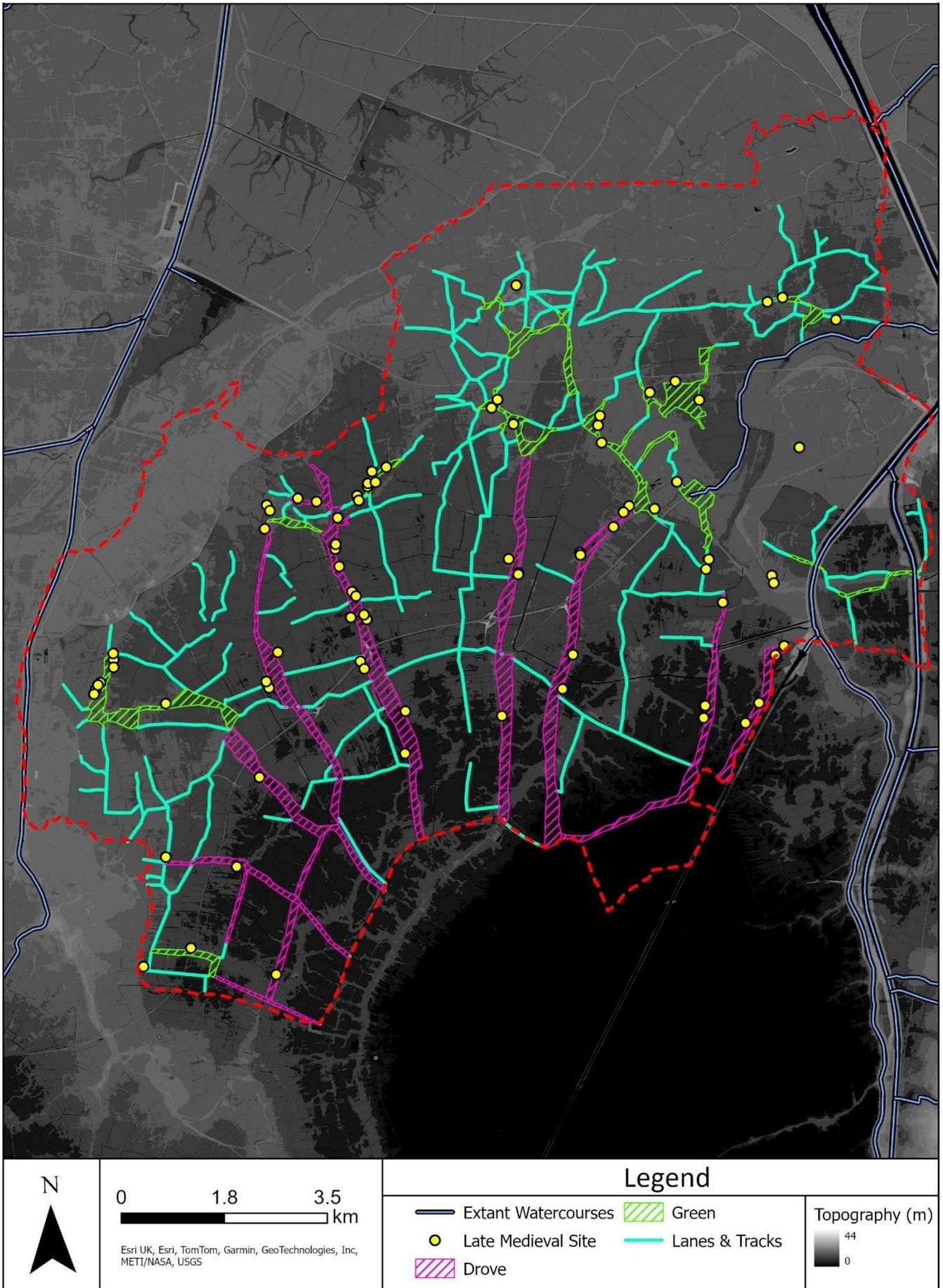


Figure 122: Late Medieval sites and droves, greens, and tracks in Marshland shown against topography.

later become a drove in the medieval period. This raises the possibility that this high-status object was lost in transit along this route, pointing to early movement along the same corridors that later structured medieval access to the wet pastures of the Peat Fen CZ.

Middle Saxon PAS records, though similarly sparse, conforms closely to the ceramic evidence recovered by Rogerson. In West Walton, a small group of copper-alloy pins was recovered directly atop a roddon just 20m south of WW 28/9. This is also only 390m north of the cluster of middle Saxon sites at WW 34, 35, and 36, sites which also occupy this roddon. In Tilney All Saints, an incomplete hooked tag was found approximately 350m south-east of the principal roddon system in this parish. In similar vein to the only early Saxon PAS artefact recovered in the study area, this later find lies on later medieval trackway, suggesting that these routes were potentially already navigable by the eighth and ninth centuries.

Saxo-Norman PAS material is more numerous and exhibits the same drove- and green-side focus as demonstrated by the fieldwalking data. A varied assemblage of artefacts — including harness links, bridle components, a sword pommel, a stirrup-strap mount, finger-rings and a gold ring interpreted as Scandinavian bullion — has been recovered almost exclusively from locations directly associated with droves or greens. The predominance of horse-gear and weapon fittings is consistent with contexts where mounted movement, stock-driving, and the transport of goods would be concentrated. The continued absence of Saxo-Norman PAS finds from the Peat Fen CZ reinforces the impression that this area was principally utilised as wet pasture and rough grazing, accessed via the sinuous network of droves rather than as a place of occupation.

Medieval and late medieval PAS material is more extensive and adheres to the same broad distribution pattern as revealed by fieldwalking. In Walsoken, a particularly dense cluster of artefacts has been recovered around the drove-side sites of WS 12, 13 and 14. These include twelfth- to fourteenth-century coins, copper-alloy harness pendants, buckles, strap-ends, and an incomplete late twelfth or early thirteenth century gilt copper-alloy appliqué figure of Christ. This distribution is entirely consistent with the ceramic evidence.

Comparable patterns recur in Tilney All Saints, where a substantial grouping of artefacts are clustered around the green near to TYS 8 and 9. These include coins from the twelfth to fourteenth centuries, buckles, strap-fittings, tweezers, a probable book clasp, and multiple brooches dating to the thirteenth or fourteenth century. A similar picture emerges at Tilney St Lawrence, where PAS has recorded coins, jettons, brooches and a high-quality gilded silver ring around the green near TYL 25, 26, 27, and 28. In the western part of the study area at Wiggenhall St Mary the Virgin, coins and a heraldic harness pendant have been recovered from around WMV 1, 13, 14 and 16, which once again occupy a drove-

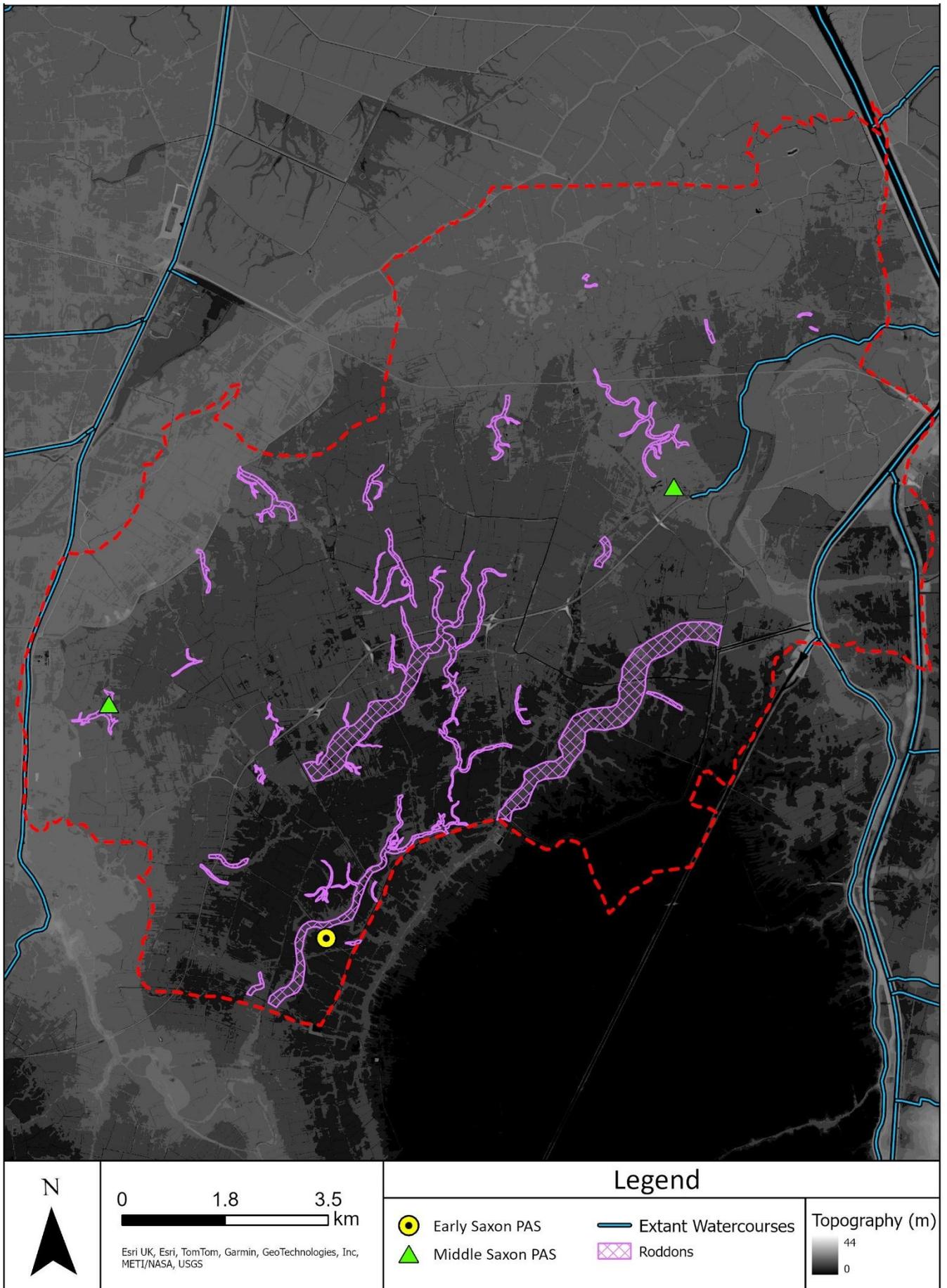


Figure 123: Early Saxon and middle Saxon PAS in Marshland.

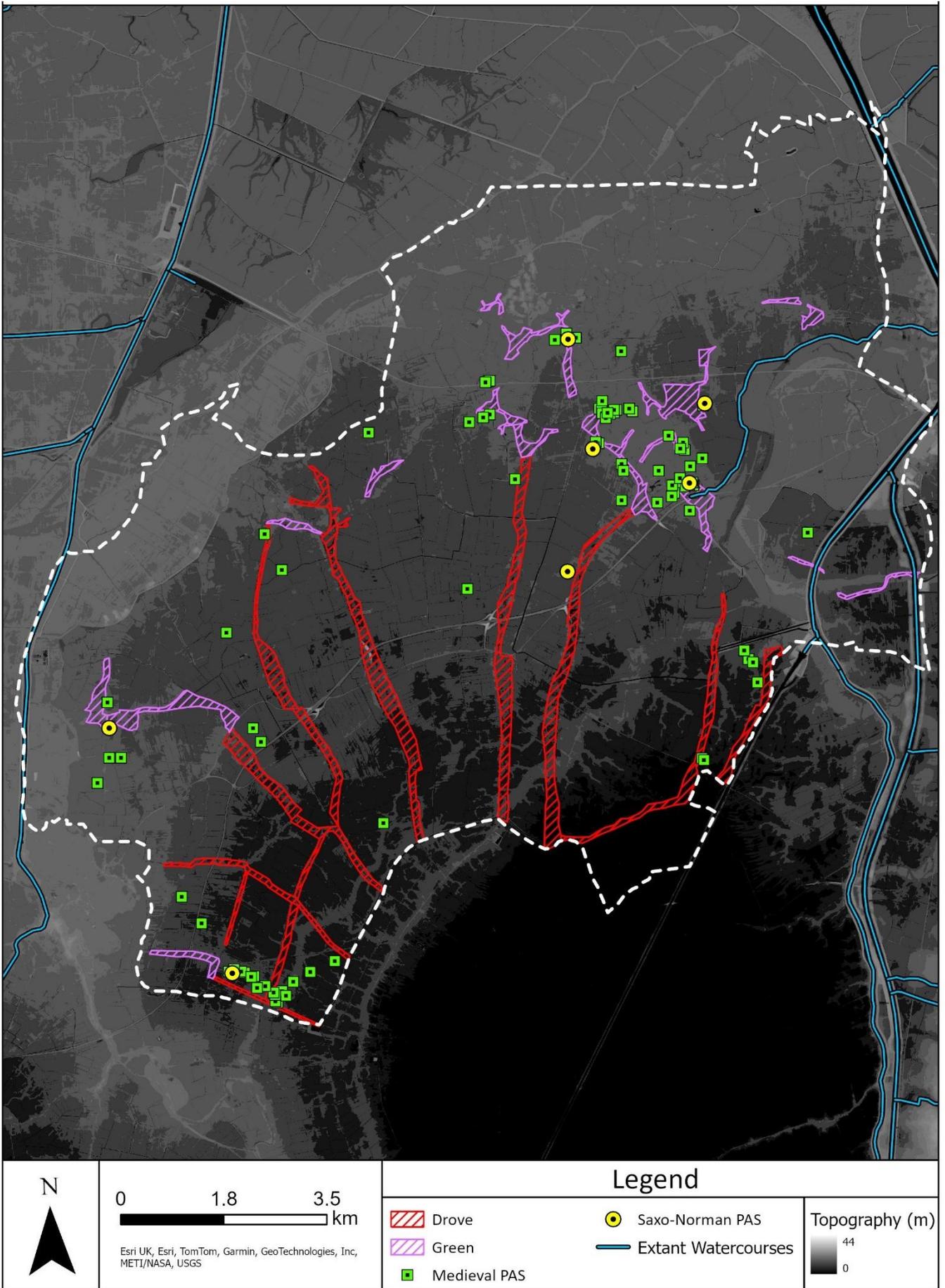


Figure 124: Saxo-Norman and medieval PAS in Marshland.

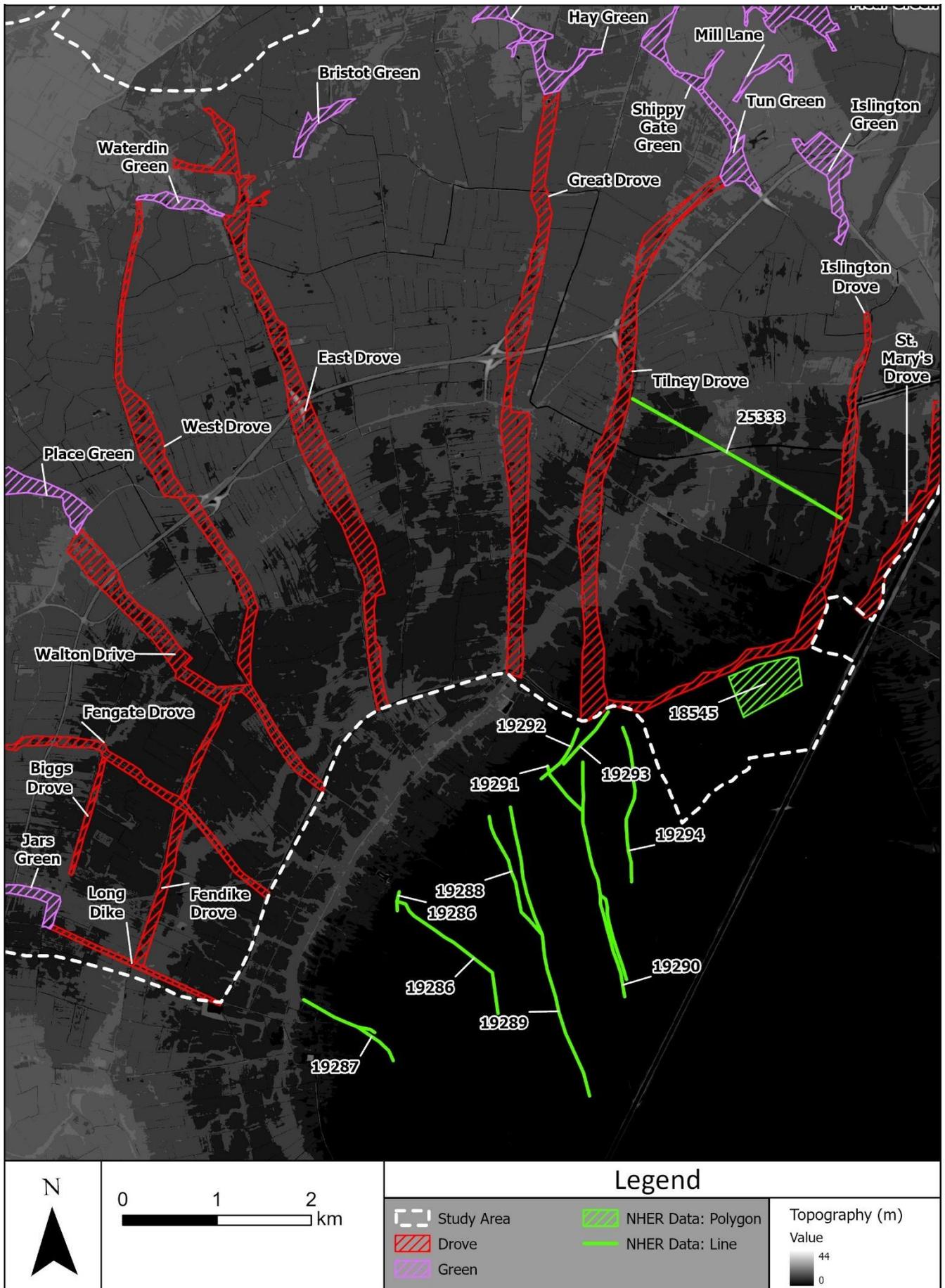


Figure 125: NHER data in Marshland and Peat Fen CZ. Note the alignment between the NHER ditches (green lines in the south) and the ditches in the main study area (red hatched polygons).

side location. In each case, the medieval PAS evidence highlights the same basic configuration: artefacts are focused on the greens, lanes and droves which acted not only as the focus of occupation but which also provided access to the wetland landscape of the Peat Fen CZ.

The NHER data for Marshland largely comprise results from the Fenland Survey and therefore replicate the patterns already evident in the ceramic record: a dense scatter of medieval material is spread across the Marshland CZ, with a particular focus on the lanes, droves, and a pronounced dearth of evidence within the Peat Fen CZ. There are, however, a number of records relating to the droves leading from the Marshland CZ into the heart of the Peat Fen pastures (NHER 19294, 19290, 19289, 19288, 19286, 19287). These records document the physical structure of the droves within the Peat Fen CZ to the south of the study area, and it is clear how they fitted in with the droves identified within the study area to the north. For example, NHER 19287 aligns well with Long Dike, whilst NHER 19290, 19292, 19293, and 19294 align well with Tilney Drove, highlighting how access to the wet pastures was channelled along a limited number of engineered routes (see Figure 125).

Also of interest are cropmarks recorded in 1982 as NHER 18545, interpreted as a possible failed medieval field system in the south of Tilney St Lawrence on the boundary between the Marshland and Peat Fen CZs. The complete absence of pottery from this system, despite the otherwise extensive medieval sherd scatter across the Marshland CZ, strongly suggest that attempts at cultivation in this marginal zone were particularly short-lived or simply wholly unsuccessful. This interpretation dovetails with the fieldwalking evidence that demonstrates a sharp decline in artefact densities at the edge of the Peat Fen CZ, underlining the challenging environmental conditions operating in this boundary zone.

Supplementary evidence: Reclamation and RSL fluctuations

Perhaps the most dramatic mode of landscape change was the gradual process of reclamation which began as early as the middle Saxon period and endured, with varying levels of intensity, throughout the remainder of the study period. Elucidating the precise stages of reclamation in specific locations is largely based on documentary material and circumstantial archaeological evidence, with Silvester noting that accuracy comparable to Hallam's intensive examination of the Lincolnshire fens is unlikely to be achieved in the *Fenland Project* given the reduced volume of documentary material available (Silvester 1988: 166). Nevertheless, Silvester is confident that all of Marshland as far south as the Smeeth had been enclosed – which by extension implies successful reclamation – by the mid-thirteenth century (Silvester 1988: 166). This concurs with Miller's 1951 conclusion that the late thirteenth century was marked by considerable landscape stability in the region, with little evidence of demesne expansion or indeed retraction (Miller 1951: 100). This conclusion is further supported by

the fine scatter of medieval sherds – indicative of medieval manuring practices and thus confirming both successful reclamation and arable cultivation – present in nearly every field surveyed as part of the *Fenland Project* (Silvester 1988: 70). Thus, whilst the precise stages of reclamation are largely impossible to conclusively determine, a mid-thirteenth century date for the final large scale medieval reclamations seems probable.

The final piece of supplementary evidence requiring discussion is historic fluctuations in sea levels. Unfortunately, this topic is severely under-researched, especially at a regional scale, with enthusiasm for this topic seemingly declining in the 2010s. Furthermore, those which have been conducted on a regional scale are rarely concerned with medieval East Anglia, with many of those pertaining to the North Sea relating to mainland Europe's northern coastline (Behre 2007). There are, however, a small number of temporally and spatially relevant investigations available to the researcher that can provide an insight into historic fluctuations of sea-level, although it is notable that there is little agreement between these studies. 'Holocene land- and sea-levels around level changes in Great Britain', which includes data gathered from the East Anglian coastline suggests that post-Roman flooding could have reached heights of 6.7m in the Lincolnshire fens (Shennan *et al.* 2002: 511-526). 'A new Holocene sea-level curve for the southern North Sea' presents a different narrative to that of Shennan (Behre 2007).

Whilst many of the sampled basal and intercalated peats were taken from Europe's north coast, data points far closer to East Anglia – such as those taken from Dogger Bank – also constitute part of this latter study's dataset, increasing its spatial relevance to East Anglia (Behre 2007: 87-9). Behre's curve shows that sea levels were at their highest c. 1460 after a multi-century period of sustained increase which set in after a nadir which occurred c. 950 (Behre 2007: 98). During this time sea levels rose by approximately 2m to levels largely similar to those present at the turn of the twenty-first century (Behre 2007: 98). By comparison, the period preceding c. 950 shows a more muted curve, with sea-levels at c. 500 being approximately 1m below the late fifteenth century apogee, rising slightly by c. 725 before dropping to the c. 950 nadir (Behre 2007: 98). However, this narrative has itself been criticised for not taking factors such as the size of embayments and the impact of anthropogenic intervention into account (Baeteman 2008: 51-61). Nevertheless, given the lack of interest in this field in recent years and the lack of additional temporally and spatially relevant investigations, Behre's narrative remains one of the most persuasive despite its shortcomings.

Climate and settlement

Unlike Chapters Five and Six where the discussion of climate and settlement is undertaken chronologically, the discussion in this chapter will be undertaken on a more thematic basis. This is due to the both the spatial extent of the *Fenland Project* and the unique character of the Marshland and

Peat Fen CZs, although it should be noted that every effort has been made to present the thematically ordered evidence chronologically.

Roddons and terrestrial environmental variables: c.500 – c. 1150

The desire to avoid locations which are vulnerable to the destructive capabilities of marine and freshwater inundation is repeatedly exhibited throughout the entire Anglo-Saxon period – and indeed in the preceding Romano-British period – with the overwhelming majority of Saxon sites occurring either on, or adjacent to, one of the many roddons which sprawl across the CZ. These features provided not only an elevated position but also lighter, more forgiving soils formed of sands and silts which would have provided a drier environment for structures and which would have been far easier to put to the plough than the wetter, heavier soils surrounding the roddons. The only early Saxon site identified within the Marshland CZ – TYL 19 in Tilney St. Lawrence – sits atop a roddon formed by the silting up of the Roman Aylmer Canal, with this site producing forty early Saxon sherds (Silvester 1988b: .13). This size of this site is considerably smaller in comparison to some of the other early Saxon sites discussed in this thesis – such as Site 42 in the *Three Parishes* from which 525 sherds were recovered – and thus it is likely that early Saxon occupation in this highly marginal landscape was extremely limited, with the small volume of recovered material perhaps suggesting that this was a seasonally or temporarily inhabited site.

The ease with which material can be identified within Marshland's plough-soil and the homogeneity of the survey's spatial coverage makes it unlikely that the dearth of early Saxon evidence is due to a poor rate of artefact recovery, and whilst there remains the possibility that some early Saxon ceramic evidence has either been lost due to subsequent soil disturbances or disintegrated due to soil conditions – with the slightly acidic roddon soils potentially damaging the weak fabric of early Saxon ceramics – we would expect some isolated sherds to survive. TYL 19 was thus likely to be the only substantial early Saxon site present within the Marshland CZ, perhaps acting as a seasonal base from which early Saxon agriculturalists could exploit the rich pastures present in this part of the county or even as a permanently occupied, but ultimately short-lived occupational site.

The positioning of TYL 19 in the context of the wider landscape also gives credence to the notion that this site existed in a widely deserted landscape. The parish of Tilney St. Lawrence occupies a relatively central position within the Marshland CZ – with TYL 19 in turn occupying a central position within Tilney St. Lawrence – and it is conceivable that the siting of TYL 19 was determined by its central location relative to the varying exploitable habitats found within the Marshland CZ. A community occupying TYL 19 had easy access to both the lighter soils of the roddons for small-scale arable

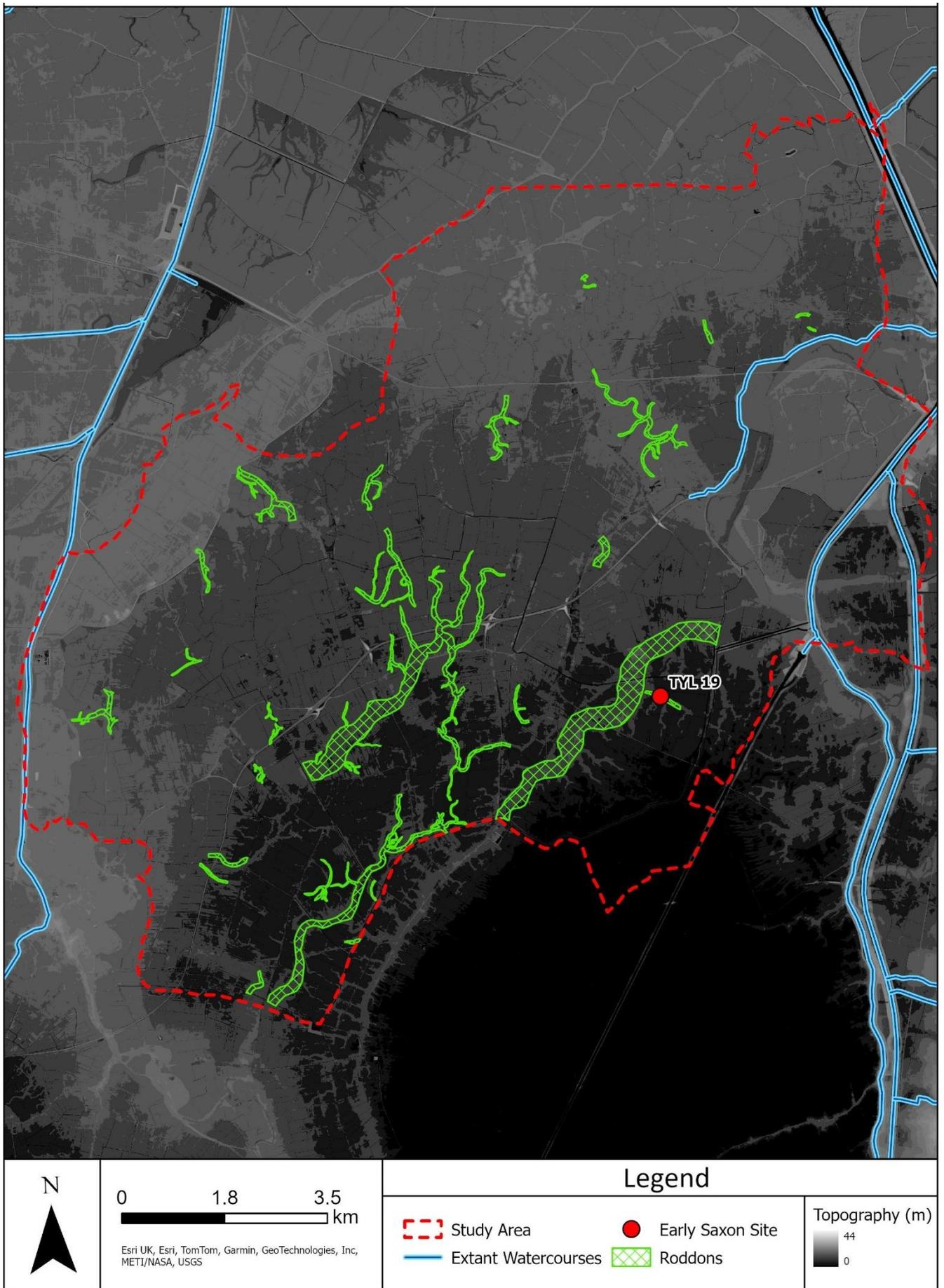


Figure 126: Early Saxon settlement and roddons in Marshland shown against topography.

exploitation and access to the rich seasonal pastures which lay 1.6km to the south for the grazing of livestock, with Silvester estimating that the fenland may have extended northwards to lie adjacent to the southern boundary of the site during the early Saxon period. Furthermore, in Stenton's seminal *Anglo-Saxon England*, he suggested – without a great deal of evidence to support it – that the complex webs of creeks and rivers which wove throughout this landscape perhaps served as a major route of ingress for Germanic settlers arriving on British shores in the sixth century, and whilst this theory is largely circumstantial, the lack of permanent early Saxon occupational sites in this region may indicate that this wetland environment was viewed as more of a transitory landscape than one in which to permanently settle (Stenton 1971: 26). It seems unlikely that Marshland's marginal landscape would have proved particularly attractive to early Saxon settlers, especially considering that the far more hospitable landscape of the Brecks, with its light, forgiving, and more easily workable soils lay just east of the potentially deadly landscape of the Marshland CZ. The lack of a substantial early Saxon presence in this extensive, but undeniably hostile landscape fits rather neatly into this theoretical – but admittedly rather circumstantial – narrative.

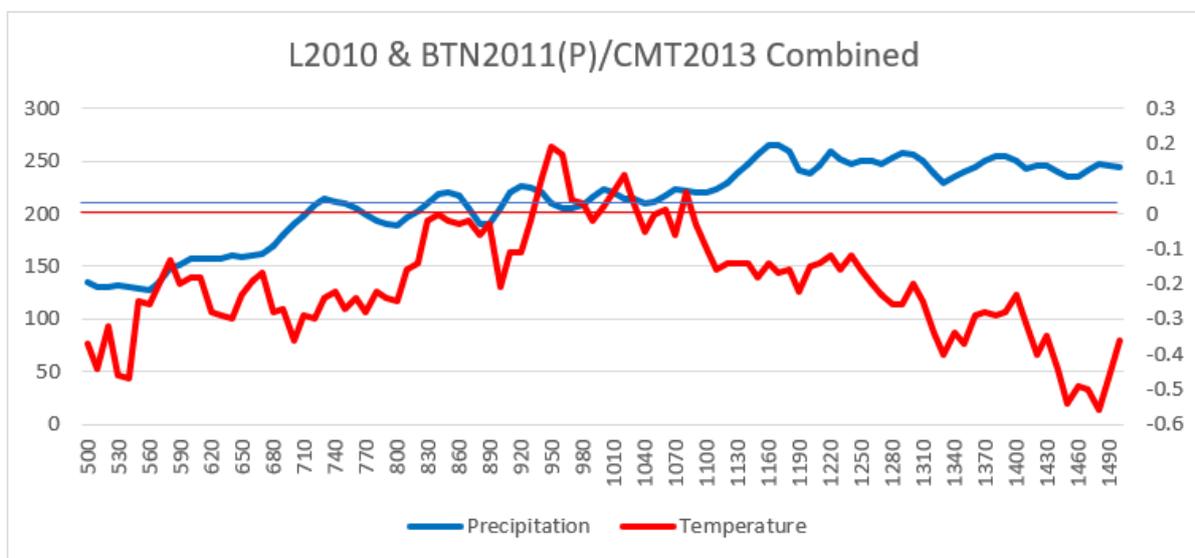


Figure 127: Temperature and precipitation over the course of the medieval period, based on L2010, BTN2011(P), and CMT2013.

Whilst the importance of roddons in the development of Marshland's settlement pattern is hinted at by the single early Saxon site at TYL 19, the middle Saxon period confirms their central role, with six of the nine suspected middle Saxon sites lying either on, or adjacent to, a roddon. By far the most impressive of these sites is TSC 23 in Terrington St. Clement, where over one thousand sherds of Ipswich ware were recovered over a 1.5km long concentration which followed the course of a large system of sinuous, winding roddons underlying the later medieval occupational complex at Hay Green (Silvester 1988b: B.6). In Walpole St. Peter, the two largest middle Saxon sites in the parish – WPP 96 and 101 – also occupy a position atop a low roddon, with much of the present village sprawling across

a roddon system which extends into the neighbouring parish of Walpole St. Andrew. In West Walton, the relatively minor middle Saxon sites at WW 28, 29, 34, 35, and 36 are stretched along one of the most prominent roddons in the CZ, elevating them some 2m above the surrounding landscape. The dominance of roddon sites continued into the Saxo-Norman period, with the tenth century sites at TSC 25 and 43 in Terrington St. Clement, TYS 51 and 52 in Tilney All Saints, TYL 40 in Tilney St. Lawrence, WW 13, 15, 19, 28, 29, 30, and 35 in West Walton, WSP 70 and 71 in Walpole St. Peter, and WPA 20 in Walpole St. Andrew all lying on a roddon, whilst the tenth century sites of TYS 19, 35, 39, 40, and 46 in Tilney All Saints lie not on roddons but on levees, features which would later become roddons (Silvester 1988b). There is thus a clear preference amongst both middle Saxon sites and Saxo-Norman sites for occupying roddons or roddon-type features.

The evident desire of Anglo-Saxon and Norman settlement to gravitate towards these features is almost certainly rooted in their advantageous topographical and environmental characteristics. In a landscape constantly under threat of marine incursions, a roddon or levee provided an invaluable safe space above the incoming floods which must have been a serious threat before the construction of the sea bank in the Saxo-Norman period. Such an elevated location was the pragmatic choice for occupational sites in such a marine susceptible region, for any structure or worked land lying at or below sea level – which in the Marshland CZ was true of nearly half of the landscape – was under the constant threat of inundation. As well as providing an elevated, and thereby comparatively safer location for dwellings and crofts, the soils of roddons were, as has been previously discussed, siltier and sandier than the almost uniformly heavy, wet soils of the lower-lying locales. The soils of the roddons were thus far easier to cultivate; indeed, before the widespread dissemination of the heavy plough in the Saxo-Norman period these lighter soils were the only workable arable soils in the CZ. In many ways the roddons were thus the only viable locations for early and middle Saxon settlement, for every other part of the CZ was either seasonally flooded due to pedological and topographical factors, at risk from flooding due to storms or tidal surges, or simply too heavy and intractable for arable cultivation to be viable.

This latter point is reflected in the almost complete absence of light scatters of pre-tenth century material across Marshland's lower-lying landscape. This absence suggests that arable cultivation was likely focused on the roddon sites. While later silt deposition may have masked some ceramic material in lower-lying areas, the widely-evidenced concentration of material on roddons implies that other tracts of arable cultivation away from these features were either too short-lived to have left behind ceramic indicators – with this suggestion potentially implying that a regional version of an infield-outfield system may have been in operation – or that they were directly dunged, thereby leaving little in the way of potsherd scatters. Of these two possibilities the former seems more likely, as fields would

invariably flood, whether due to seasonal rainfall or marine transgressions, at which point a new parcel of dry land could be put to the plough. Strip fields fossilised in parish boundaries suggest that arable agriculture on a larger scale was being practiced by the time parish boundaries were formalised, with this topic being discussed in more detail later in this chapter.

Thus, with arable farming far less widespread in pre-medieval Marshland than it was in other regions, other forms of agricultural production, namely pastoral husbandry, must have plugged the gap and been critical to the local agricultural economy. Unlike arable cultivation – which left behind a scatter of sherds associated with manuring practices – pastoralism left behind very little direct archaeological evidence, and so we must turn to more indirect forms of archaeological evidence gathered from across the CZ. The large quantities of animal bone recovered at many of the middle Saxon sites – and to a slightly lesser degree at many Saxo-Norman sites – suggests that meat formed a substantial part of the diet in this region, which in turn implies that stock rearing and pastoral husbandry must have formed a significant part of the rural economy (Silvester 1988: 158; Crabtree 2012: 57). This is in keeping with other East Anglian middle Saxon sites, with Crabtree's excellent investigation into middle Saxon animal husbandry clearly demonstrating that animal husbandry was an integral part of the middle Saxon economy, with sheep, cattle, and pigs dominating bone assemblages (Crabtree 2012: 25-40, 57-8). The proportions of these three dominant faunae in the bone assemblages were not, however, homogenous throughout East Anglia (Crabtree 2012: 25-40, 58). Sites at Brandon in the Brecks were clearly geared towards the exploitation of sheep, with the assemblages from Flixborough and Quarrington in Lincolnshire also suggesting that the local economy was practicing a sheep-focused pastoral regime (Rackham 2003; Crabtree 2012: 58). However, at Wicken Bonhunt in north-west Essex pigs dominated the assemblage, for this was a region where pannage was plentiful (Dobney *et al.* 2007: 223; Crabtree 2012: 58). Ultimately, the choice of which animal to rear was no real choice at all, for the local environment is often the primary determinant; the wetland pastures of the Marshland CZ are not, for example, well suited to large-scale exploitation of pigs, for the lack of large tracts of suitable pannage limits the quantity of livestock the landscape can realistically carry. On the other hand, sheep and cattle are more suited to the rich, wet pastures of the Marshland, for these hardy creatures will happily graze the grasses and wetland flora endemic to this region.

Unfortunately, the middle Saxon and Saxo-Norman bone assemblages from the *Fenland Project* were not analysed in any great detail, and thus definitive confirmation of what livestock were dominant in this region in these periods is absent. However, given the lack of pannage it is highly unlikely that pigs were dominant in this wetland environment, with sheep and cattle far more likely to have been the principal types of livestock kept by the inhabitants of Marshland. Furthermore, the dominance of sheep over cattle in later centuries potentially indicates that it was sheep, not cattle, which were the

main type of stock reared in many Marshland parishes, with Domesday recording significant flocks of sheep on many manors. West Walton, for example, had a flock of over 1300 animals, with Dymond suggesting that the statistics presented in Domesday, which are already impressive, likely underestimate the sheer quantity of sheep present in the region c. 1086, saying the 'had the Domesday scribes recorded pasture more systematically, particularly common marsh and fen, then the Marshland would undoubtedly have appeared richer' (Dymond 1990: 121). In 1637 William Camden commented that there was both 'an abundance of cattell' and that in 'a place called Tilneymeth there feed much about 30,000 sheepe...', which is almost certainly referring to the part of the Smeeth which lies in the Tilney parishes (Camden 1637: 481). Pastoralism thus has a long tradition in Marshland; the presence of so much heavy, seasonally flooded land must have forced local communities to rely less on arable cultivation and more on the rearing of livestock, for whilst the roddons provided invaluable patches of cultivatable land and a dry place for occupational sites, the vast majority of the landscape was far more suited to seasonal grazing than it was arable cultivation, although it is important to note that as the pace of land reclamation increased throughout the early, middle, and Saxo-Norman periods more land would have become available for arable cultivation, and thus its relative importance to the local economy would have increased, with this being discussed in greater detail later in this chapter. Nevertheless, the dearth of light scatters of pre-ninth and -tenth century potsherds indicative of manuring practices on the heavier, lower-lying soils of Marshland is entirely within keeping with the clear emphasis on pastoral agriculture that was present in this region before the medieval period (Silvester 1988: 37-8).

There is thus a significant body of evidence which suggests that a large proportion of pre-medieval settlement in Marshland was primarily determined by factors of the environment, much like they were in the Romano-British period. The roddons were the principal sites of occupation and activity, providing high and dry locations for dwellings and lighter soils for limited arable cultivation. Agriculture in the region was forced to adapt to the local environment, for the heavy and wet soils of the low-lying locales would have been unworkable for much of the pre-tenth century period; the emphasis on pastoral farming in the Anglo-Saxon period was therefore an organic response to environmental conditions. With this in mind, there is very little indication that settlement in the Marshland CZ was, in any way, influenced by climatic forces. In the early and middle Saxon periods climatic conditions were both drier and colder than they were in later periods, with identified sites almost always occupying a position on, or adjacent to, a roddon. In the wetland environment of Marshland, the reduced precipitation totals would have made the soils marginally more hospitable than they were in later, wetter times, yet even in the far wetter and warmer Saxo-Norman period anthropogenic settlement was still glued to the roddons.

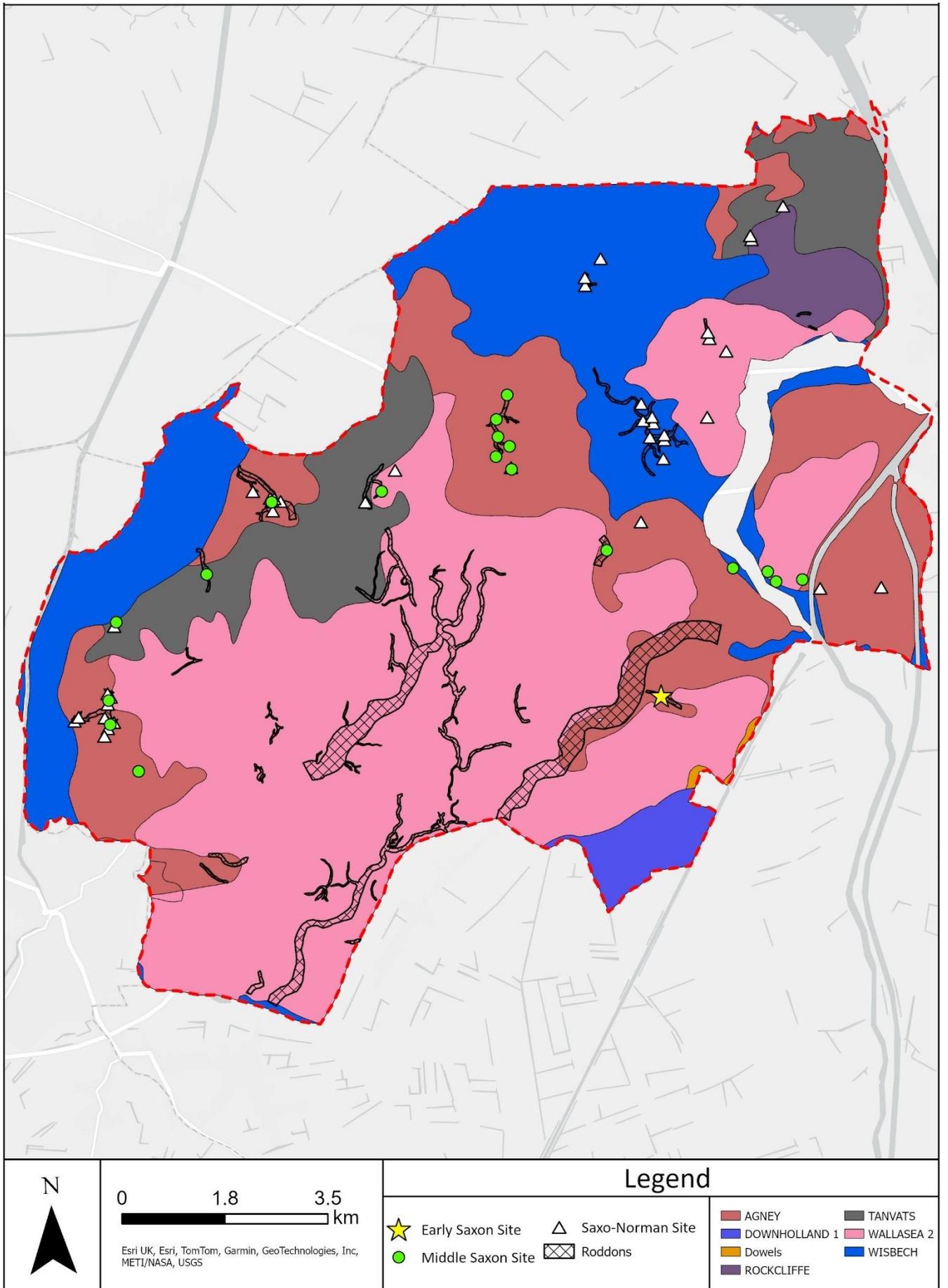


Figure 128: Pre-Conquest settlement and roddons in Marshland shown against soils.

This evident preference for these elevated features was a direct consequence of both the ever present possibility of marine flooding and the seasonal waterlogging which plagued the majority of this region's soils, with these factors being a far more pressing and immediate concern for this region's inhabitants than fluctuations in precipitation. The abandonment of Marshland in the post-Roman period would have made this landscape a formidable adversary in the early and middle Saxon periods, with the character of the landscape perhaps best summarised by the eight-century *Life of Guthlac*, which describes the fenland as: 'a very long tract, now consisting of marshes, now of bogs, sometimes of black waters overhung by fog, sometimes studded with wooded islands and traversed by the windings of tortuous streams ... [and] this remote desert had hitherto remained untilled and known to a very few. No settler had been able to dwell alone in this place before Guthlac...' (Colgrave 1956: 54). Whilst this is undoubtedly a highly fictionalised account of Marshland, it serves to highlight how in many ways pre-medieval Marshland was defined by the primacy of the environment, with human settlement adapting to the environment rather than humans adapting the environment to suit their own wants and needs. Fluctuations in precipitation or temperature would thus do very little to make this region more or less habitable, with only extensive reclamations and drainage efforts capable of making this a habitable landscape.

Antecedent territories and parochial structure: c. 500 – c. 1150

Before Marshland's medieval evidence and its relationship to climatic fluctuations can be fully explored, it is first necessary to discuss a topic which bridges the pre-medieval period and the medieval period: parochial morphology and the course of their boundaries. As has been alluded to elsewhere in this chapter, many of Marshland's parishes possess a distinctive shape characterised by a funnelled form, with one end of the parish often being far narrower than the opposite end. The narrow end of the parish frequently lies adjacent to the low-lying, roughly circular Peat Fen CZ which is home to the clayier seasonal pastures of the Smeeth and Marshland Fen, whilst the wider end often encompasses both the more elevated – and thus drier – terrain of the siltier northern soils as well as their low-lying, coastal saltmarshes which were vital to this region's profitable salt industry. This funnelled form is most readily apparent in the west and north-west of the CZ. The parish of West Walton stretches over 8.6km from the coast in the north-west to the fenland pastures of the Peat Fen CZ in the south-east, with the 9.2km long neighbouring parish of Walpole St. Peter similarly extending from the coast in the north to the Peat Fen CZ in the south. A similar arrangement is evident west of the Marshland CZ in neighbouring Lincolnshire, where long, sinuous parishes such as Holbeach, Fleet, and Whaplode reach south into the wetland peats and clays around Gedney Hill.

This neat arrangement does, however, become more muddled in the east of the Marshland CZ,

although even in this more complex parochial landscape the groupings of similarly named parishes preserve something of the neat arrangement observable in the more westerly parishes and across the border in Lincolnshire. For example, the two Terrington parishes – the smaller Terrington St. John and its larger, adjoining parish of Terrington St. Clement – share continuous eastern and western boundaries and appears to have been split in two, implying that this was once a single territory. The three Tilney parishes – Tilney St. Lawrence, Tilney cum Islington, and Tilney All Saints – also gives the impression of being the fragmented remains of a once larger territorial unit, as do the collection of Wiggshall parishes – Wiggshall St. Mary The Virgin, Wiggshall St. Peter, Wiggshall St. Mary Magdalen, and Wiggshall St. Germans. Even the relatively neat north-western Walpole parishes – the previously mentioned Walpole St. Peter and the smaller parish of Walpole St. Andrew – also appears to have once been a single unit. Each of these larger, etymologically linked units follows the general morphology observable in the larger, more continuous western parishes, namely a funnelled form with the narrower end terminating directly adjacent to the Peat Fen CZ and the wider end often occupying siltlands with its adjoining saltmarshes.

Penn has suggested that both the larger, unfragmented parishes of western Marshland and the more fragmented, but nevertheless etymologically linked parishes of eastern Marshland were likely self-sufficient, self-contained territories practicing a mixed, non-specialised farming regime during the middle Saxon period and possibly even during the early Saxon period (Penn 2005: 298-301). Crowson has similarly suggested that West Walton may have once included parts of Walsoken and Walpole, making this one large territorial unit likely centred on the middle Saxon sites at WW 28, 29, 34, 35, and 36 near to St. Mary's Church, which Hoggett has suggested likely emerged in the middle Saxon period (Crowson *et al.* 2005: 190; Hoggett 2007: 131). It is thus probable that the driving force behind the macro-morphology of Marshland's parochial structure – and by extension also that of the forerunner territories which parishes likely emerged from – was resource access, for their morphology granted each unit access to this region's three distinctive habitats: the coastal saltmarshes, the siltier, more elevated soils of the Agney, Tanvats, and Wisbech associations, and the low-lying seasonal pastures of the central fens, an arrangement which is reminiscent of Williamson's 'banded resources' (Williamson 2012: 99).

At a macro-scale environmental forces are thus the primary determinants of parochial morphology, which ties in well with both Williamson's emphasis on the importance of environmental factors when interpreting the development of historic settlement and the environmentally driven narrative of settlement development in the pre-medieval period being proposed for the Marshland CZ in this chapter (Williamson 2012). Faith's concept of 'small shires' also appears to be particularly well suited to explaining the development of Marshland's landscape, for this region was undoubtedly one of the

‘small shires which had deep roots and long lives’ and which were ‘the resource territory of a small people’ (Faith 2008: 9).

Whilst the composition of the wider environment determined the overall morphology of the parishes themselves, the precise course of their boundaries was determined by anthropogenic structures such as the greens, droves, and strip fields, features which show little correlation to both variations in the environment and to environmental features, which stands in stark contrast to the trends observable elsewhere in the county. For example, the boundaries of the previously discussed parishes of Loddon, Hales, Heckingham, Fransham, Barton Bendish, and Illington all routinely follow, for a significant proportion of their length, environmental features such as streams, rivers, and watersheds. However, with the one exception of the wetland landscape of the Peat Fen CZ, Marshland’s parish boundaries show little regard for environmental features, with Silvester noting that major environmental features in the region, such as the creek which ran through Terrington St. Clement and into Tilney All Saints, was not utilised as part of the parish boundary as we would typically expect (Silvester 1988: 166). Instead, parish boundaries in this part of the county appear to be directly related to anthropogenic structures. For example, the course of the western border of Tilney cum Islington is composed of the fossilised forms of a plethora of strip fields, whilst parts of the border between West Walton and Walpole St. Peter, Terrington St. John and Tilney All Saints, Tilney cum Islington and Wiggenhall St. Mary The Virgin, and Wiggenhall St. Mary The Virgin and Wiggenhall St. Germans are formed by the greens and droves which run throughout Marshland’s landscape.

Even those boundaries not directly formed by the greens and droves appear to have been influenced by them, with much of the border between Walsoken and West Walton, Walpole St. Peter and Terrington St. John, and Terrington St. Clement and Tilney All Saints lying equidistant between the droves, which themselves often mimic the course of the parish boundary. Such an arrangement ensured that regardless of location every part of the Marshland landscape was readily accessible; having the droves unevenly spread across the landscape would invariably make certain parts of the CZ more inaccessible than others, which given the marginality of the landscape could only serve to hinder the local economy. Ultimately, a spatially optimised landscape was beneficial to all involved, a fact which carries with it the implicit suggestion of some form of large-scale planning. This is not to suggest that the Marshland landscape was the product of some sort of directive leading to a ‘planned’ landscape. Rather, this landscape was most likely the product of ‘organic developments from below, rather than simply being artificial impositions from above’ (Williamson 2012: 82).

A spatially optimised landscape such as Marshland’s allowed a somewhat ‘fair’ division of resources between multiple communities, an arrangement which was in the interests of the wider community.

For example, if one community were to fail or fall into relative poverty, the maintenance of the network of ditches, dykes, and the all-important sea bank could falter, thus putting the entire region at risk. As discussed earlier in this chapter flooding – marine and freshwater – was a constant threat, with the only defence against these potentially devastating incursions being proper maintenance of the flood defences. In 1348 it is recorded that the landowners in West Walton were responsible for repairing six feet two inches of the sea bank for every acre they held, with Dymond also noting that in particularly severe floods taxes were often remitted for damaged townships (Dymond 1990: 122-3). Maintenance of critical infrastructure was thus clearly of paramount importance, and it is conceivable that if a parish was to fail then others would invariably have to pick up the slack, which in turn would cause an economic loss for the those residing in wealthier, more successful parishes. The ‘fair’ division of resources thus prevented, by proxy, these structures from falling into disrepair.

There was little altruism in such an arrangement, with the incentive likely being the preservation of both the self and of one’s property and way of life. The usage of the term ‘fair’ is perhaps misleading, with a more appropriate term likely being ‘unequal fairness’. This is nowhere better exemplified than in the Smeeth and Marshland Fen, where the entire landscape is divided into a myriad of discontinuous, unequal parcels assigned to each of Marshland’s many parishes, allowing even those parishes which do not back onto this landscape – such as Terrington St. Clement and Walpole St. Andrew – some degree of access to this crucial area of seasonal pasture. The size of these parcels were not, however, equal, with Clenchwarton only receiving an extremely small parcel of the Smeeth whilst West Walton received a large parcel in both the Marsh and the Smeeth, which Silvester attributes to the ‘pervasive influence and power of the Ely and Lewes manors centuries earlier when grazing rights were first established in West Fen’ (Silvester 1988: 34). Nevertheless, every parish was afforded some of this valuable land, and whilst the proportions were not particularly equal, there was clearly a desire to ensure that every local community had some degree of access.

Marshland’s parochial structure and the morphology of its boundaries is thus both environmentally and anthropogenically driven. On the one hand their macro-morphology is largely environmentally determined, encompassing varying habitats which each provided the community with a valuable resource: the marshes and fens provided rich seasonal pasture, the siltier soils provided workable arable land, and the coast and its saltmarshes provided a place for pastures, fisheries, and salterns. However, on the other hand it is the greens, droves, and strips which determined the exact course of the boundary, suggesting that at a local level boundaries were determined by pre-existing anthropogenic structures which often had little relationship to variations in the environment or environmental features. Considering that the archaeological evidence suggests that the greens and droves emerged in the Saxo-Norman period – ultimately becoming the primary focus of settlement by

the thirteenth century – the evidence from Marshland supports the notion that parish boundaries had become largely stable by the twelfth, and perhaps even eleventh, centuries, a date which concurs with the conclusions of Roffe, Pounds, and Godfrey (Roffe 1984: 116; Pounds 2000: 3-10; Godfrey 2007).

There is thus a relatively neat temporal divide between the two principal drivers of parochial development in Marshland which is mirrored, as will be discussed later in this chapter, by the archaeological evidence. In the early and middle Saxon periods macro-environmental forces were driving the emergence of large territories, with these being the ‘small shires’ of Faith and perhaps the ‘multiple estates’ of Jones (Jones 1985; Faith 2008: 9). However, during the Saxo-Norman period the focus began to shift away from environmental determinants, for as these later communities reclaimed more land and gradually expanded southwards towards the seasonal pastures they did so in an environment that was ‘as yet devoid of man's influence’ (Silvester 1988: 166). These routes to the seasonal pastures of the south ultimately emerged as the droves which are so ubiquitous of the medieval landscape, with these structures owing their spatial position not to environmental factors but to the practicalities of anthropogenic resource access. After all, in a landscape composed of reclaimed fenland there were very few relict anthropogenic structures and very few notable environmental features to influence the form of this ‘new’ landscape. It is thus unsurprising that parochial boundaries tend to follow anthropogenic structures, for these were likely the only notable features in an otherwise blank landscape. Furthermore, the significant degree of anthropogenic intervention in this landscape has made environmental factors far more unstable than they are in other parts of the country, with generation after generation attempting, with varying levels of success, to tame Marshland’s landscape. The Romans constructed canals, the Anglo-Saxons constructed large sea banks, Marshland’s medieval and late medieval inhabitants created extensive networks of ditches and dykes, whilst early modern engineers such as Vermuyden constructed great cuts that dramatically altered the form of the landscape. The lack of environmental stability makes it impractical for boundaries to follow the same type of features as those commonly followed in more environmentally stable regions. It is thus unsurprising that boundaries appear to follow anthropogenic structures, which in this ever-changing landscape could outlast the very environmental features that in other parts of the county would always almost outlast anthropogenic structures.

There is thus no evidence to suggest that the morphology of Marshland’s parishes and the course of their boundaries were influenced, in any way, by climatic fluctuations. Rather, differing habitats and the varying resources which they can provide appear to have defined the overall morphology of antecedent territories – which likely originated in the early and middle Saxon period – with their characteristic funnel-shape allowing these territories to encompass these differing habitats. However, the precise, formalised morphology of these boundaries appears to be determined not by

environmental factors but by anthropogenic entities such as the droves and greens, with this stratigraphy suggesting that the parish boundaries were, at the very least, formalised in the eleventh or twelfth centuries and thus after the emergence of the greens, droves, and strip fields.

Greens, droves, and tracks: c. 1150 – c. 1500

The medieval period marks a turning point in the narrative of settlement development in the Marshland CZ. As has been previously discussed, factors of the environment were the primary determinants of settlement in the early, middle, and Saxo-Norman periods, with the roddons and levees playing host to the vast majority of sites. However, over the course of the Saxo-Norman period the dominance of the roddons was eclipsed by the greens, droves, and tracks, with the majority of sites across the CZ being associated with these features. In West Walton, sites are almost entirely limited to a position either directly adjacent to, or within 50m of, one of the three greens – Brocks Green, Hall Green, or Place Green – with the vast majority of these green-side sites emerging in the twelfth, or more commonly the thirteenth century, with Brock's Green appearing to be the focus of medieval activity. This latter claim is further strengthened by the presence of WW 28, a moated site which lies on Brock Green's eastern flank and Hall Green's northern flank just north of St. Mary's Church. Silvester interprets this site as being the centre of one of the demesne farms which belonged to one of the two estates mentioned in contemporary medieval documents, with this assertion based on the presence of the moat itself and the curvilinear field boundaries which surround this site, boundaries which are markedly different to the typical rectilinear, sinuous field boundaries found elsewhere in the parish (Silvester 1988: 94). Silvester himself admits that this hypothesis is based on circumstantial evidence, but given the proximity to the church and the fact that this site has easy access to both Brocks Green and Hall Green only furthers the notion that it was this southern end of Brocks Green which was the focal point of the medieval landscape (Silvester 1988: 93). This southern end of the green also saw the most intense middle Saxon and Saxo-Norman activity, and it should come as no surprise that all of these earlier sites occupy a position on a roddon.

This highlights the complex interplay between medieval sites – which were most commonly positioned to make use of nearby anthropogenic structures such as greens and droves – and locations which have a long-established tradition of occupation which originated due to the proximity of favourable environmental features. For example, at West Walton the medieval sites clearly cluster around the greens and are particularly prevalent around the southern edge of Brock's Green, and are, for all intents and purposes, entirely ignoring the roddon. However, it was only because of the presence of the roddon that Romano-British, middle Saxon, and Saxo-Norman settlement was drawn to this specific part of the landscape in the first place; had this environmental feature not been present, occupation would likely not have occurred. It is thus critical to note whilst many medieval sites may

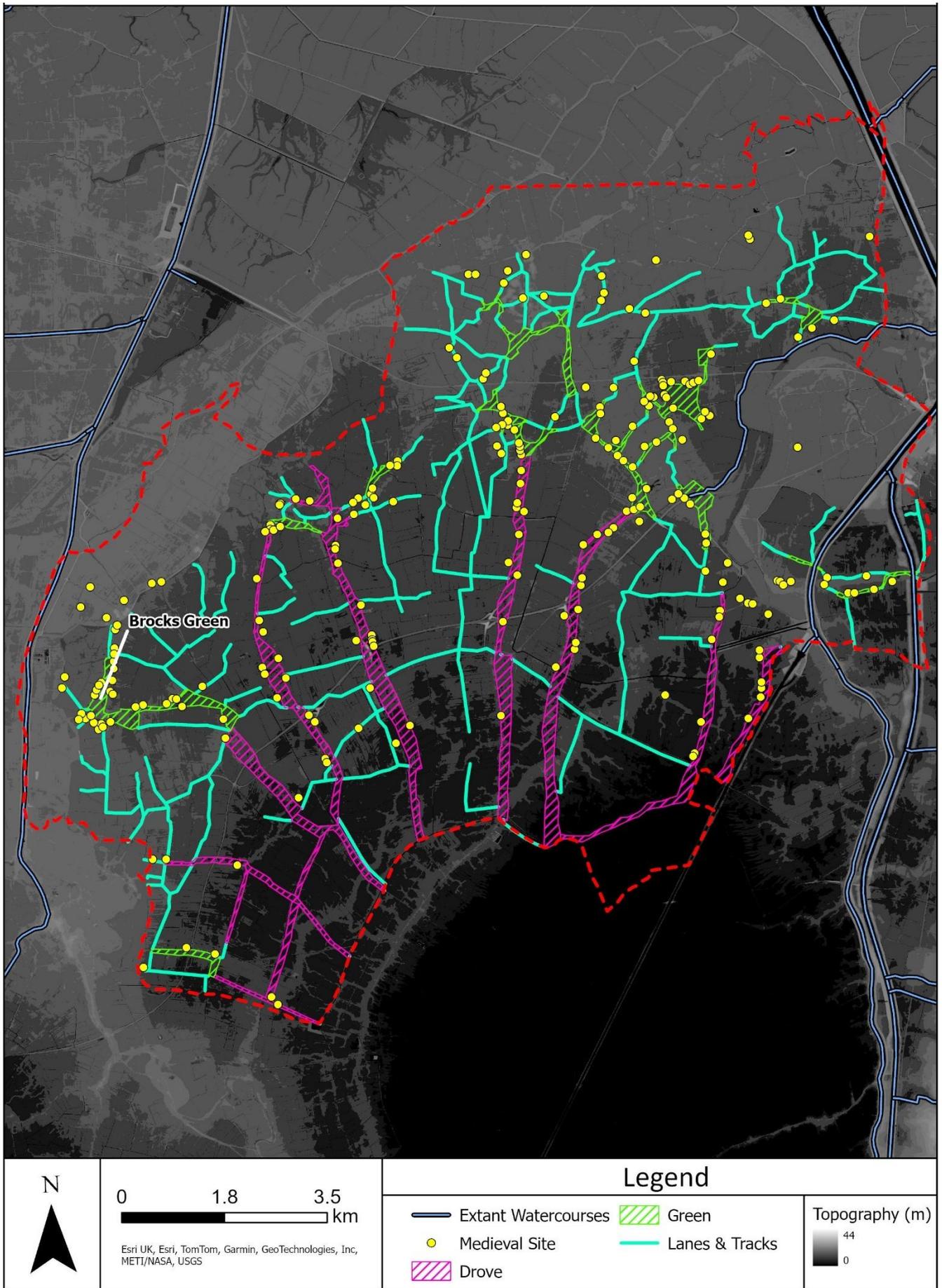


Figure 130: Medieval settlement and droves, greens, and tracks shown against topography.

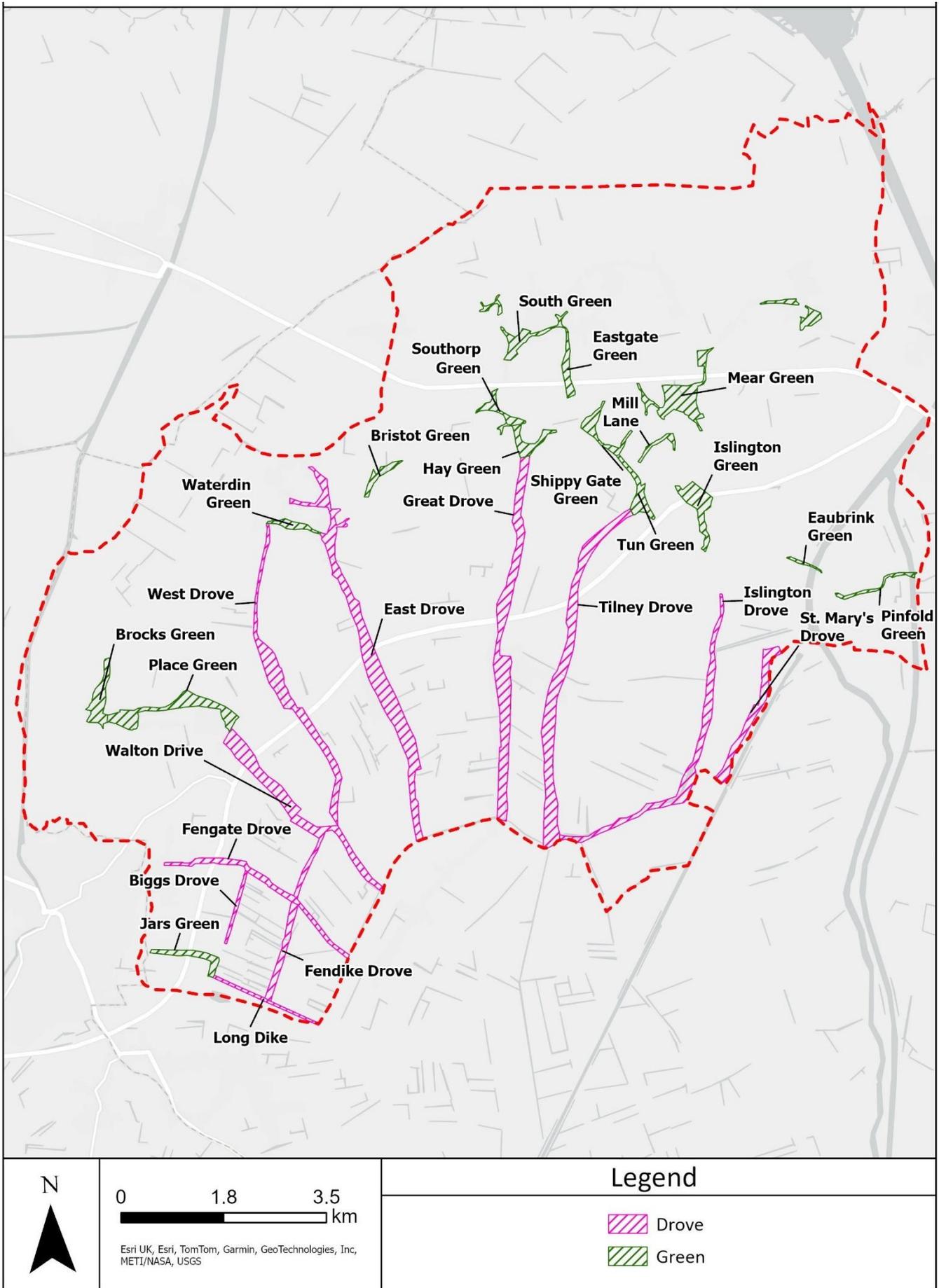


Figure 131: Greens and drives in Marshland.

appear around a roddon, this spatial proximity is not indicative of a medieval attraction to such features, instead being the result of a tradition of occupation that began in the Romano-British period.

The primacy of greens and droves is also apparent in Walpole St. Peter. Here, sites largely dating to the thirteenth and fourteenth century occupy positions spread along the course of the two sinuous droves which lead from Walpole village in the north-west to the Smeeth in the south-east, with further medieval sites lying in Walpole village around Waterdin Green and Bristot Green. These latter two locations possess, in a fashion similar to that at West Walton, a 'tradition of occupation' that dates back to the middle Saxon period and which can be directly attributed to the roddons which underlie this landscape.

Medieval settlement in both West Walton and Walpole St. Peter thus appears to have spread from these middle Saxon and Saxo-Norman nuclei to locations further south, a directional expansion which was almost certainly enabled by the successful reclamations of once inundated land. The greens are thus likely to have pre-dated the droves, for the vast majority of greens in Marshland's landscape occur in the northern siltlands and are strongly associated with sites dating to the middle Saxon and Saxo-Norman periods. On the other hand, pre-medieval sites only very rarely occupy a position associated with a drove suggesting that these sinuous features were yet to emerge. Within the entirety of the *Fenland Project*, only a single pre-medieval site lies adjacent to a drove, TYL U2 in Tilney St. Lawrence. This site, which characteristically occupies a roddon, may also have been sited so as to lie on the main track leading from the more substantial middle Saxon complex in the centre of Wiggshall St. Mary The Virgin to the seasonal pastures of the Smeeth and Marshland, a chronology which would suggest that the droves emerged from amongst the primary north/south trackways which facilitated access to the southern pastures from the siltlands of the north.

This is not to suggest that greens and droves were the sole determinants of medieval occupation, for whilst this is true of the thirteenth and fourteenth centuries – with the sites at West Walton, Walpole St. Peter, Tilney St. Lawrence, and Tilney All Saints all demonstrating this preference – tracks and lanes were as influential as the greens and droves in attracting twelfth century occupation. This preference is perhaps most apparent at Hay Green, where nearly half of all twelfth-century sites lie adjacent to trackways and lanes. This proportion is an accurate reflection of the other twelfth-century sites in the *Fenland Project*, for of the 54 sites which emerged during this period half are found in the context of lanes and trackways. Other sites in the twelfth century appear to favour greens over droves, which potentially suggests that the droves were not, in the twelfth century, fully developed. Indeed, it is possible that the droves which were so clearly in place by the thirteenth century originated as trackways, and it is perhaps significant that those sites associated with trackways and which *did not*

persist into later centuries often lie in more remote areas of the landscape away from the droves – with these sites having largely disappeared by the fourteenth century – whilst sites which emerged in the twelfth century but which *did* persist into the fourteenth century are frequently found to occupy a drove-side position. The abandonment of twelfth-century sites in later centuries is thus higher if the adjacent trackway failed to develop into a drove by the close of the thirteenth century.

It is, however, freely admitted that this narrative is not without fault, for it assumes that the presence of archaeological evidence beginning in the twelfth century in drove-side locations correlates to the emergence of ‘droves’ as a distinctive feature, essentially ascribing to the principle that an absence of evidence is evidence of absence. Considering that much of the southern landscape of Marshland must have been utilised as an extensive area of seasonal pasture, it is equally plausible that the droves are all that is left of these once extensive tracts after the reclaimed landscape was enclosed in the Saxo-Norman and medieval periods, with the enclosed fields essentially ‘eating away’ at the tracts of seasonal pasture until all that was left were the droves which survived into the medieval period (Silvester 1988: 163). In this scenario it seems likely that the droves fossilised the most prominent of the presumably myriad trackways which led from the northern siltlands to the Smeeth and Marshland in the south. The emergence of drove-side archaeological evidence is thus simply an indication that settlement had not previously expanded to drove-side locations, with this move perhaps precipitated in the twelfth and thirteenth centuries by the booming population. Thus, the first theory proposed for the emergence of droves postulates that the droves expanded *outwards* from trackways, whilst the second suggests that the droves emerged from the *inward* contraction of large expanses of seasonal pasture. However, neither of these possibilities are mutually exclusive, and it is likely that both are, to some degree, accurate, and as will be discussed shortly both of these theories concur with the narrative that climatic fluctuations played little role in the development of Marshland’s landscape.

Why some of Marshland’s trackways became droves whilst others did not is likely the result of the spatial composition of the wider landscape, and ties in well with the concept of ‘landscape optimisation’ discussed earlier in this chapter and is applicable to both of the narratives of drove-emergence discussed above. Multiple droves in close proximity to each other would serve a smaller proportion of the landscape than if they were equally spaced, which would ensure that many of Marshland’s fields were further from the droves. This would have a knock-on effect on the efficiency of agriculture, for the distance of strips and pastures from the main routes of travel (i.e. the droves) would be greater, thereby lessening efficiency as workers, livestock, and machinery would find it more difficult and time-consuming to reach their destination due to the lack of major thoroughfares; for example, driving a herd of several hundred head of sheep through narrow trackways winding throughout the dyked and ditched fields would have been a far more difficult undertaking than simply

driving the herd down a relatively straight, wide drove which could also provide the herd with energy. There is very little evidence to suggest that anything barring anthropogenic concerns were determining the location of droves, a suggestion which is given further credence by the fact that a large proportion of these features' length tends to lie within the Wallasea 2 association which is common to reclaimed land, with the relic mottling and significant gleying present in their profile, which was discussed in Chapter Four, belying their marine heritage. If soil conditions were homogenous, there was no environmental need to have the droves equally spaced; thus, the only logical conclusion is that this pattern emerged due to anthropogenic motives, and the simple need for efficiency seems the most persuasive explanation.

It was mentioned above how there is a correlation between droves and soil types, with the Wallasea 2 association often underlying these features. It was not, however, just the droves which occupied this clayier soil, for a large proportion of Marshland's enclosed fields are found on this association. As mentioned earlier in this chapter, scattered across almost every field in the CZ, with the exception of a few fields in Clenchwarton, is a thin scatter of medieval sherds indicative of the manuring of arable, with Saxo-Norman manuring scatters largely restricted to the areas around the primary occupation complexes in the northern siltlands (Silvester 1988: 164-5). This latter observation potentially correlates to climatic fluctuations, for the increasing wetness of this period would make the clayier soils harder to work even with a heavy plough; utilisation of the clayier soils as pasture was thus more pragmatic and may account for the lack of manuring scatters in the heavier locales. However, that medieval manuring scatters were present in nearly every corner of the landscape significantly damages any suggestion that the wetter conditions were prohibiting expansion onto heavier soils.

Furthermore, the drove-side occupational complexes which emerged in the twelfth and thirteenth centuries also goes entirely against a climatically driven narrative of settlement development. From c. 1100 precipitation totals skyrocketed, with the thirteenth century the wettest on record. If fluctuations in climate were playing any role in determining Marshland's pattern of settlement then this period should have been one defined by an aversion to the most hydrologically sensitive soils; instead, the Wallasea 2 association, composed primarily of reclaimed land, witnessed widespread colonisation at a time when climatic conditions would have been at their least hospitable. These soils were almost entirely avoided in the pre-medieval period, which at first appears to support a climatic narrative. However, as this chapter has shown, anthropogenic considerations appear to have been paramount, and it is entirely plausible – and indeed likely – that this correlation is a false positive. The inherent marginality of this region is thus unlikely to be dramatically altered by fluctuations in climatic conditions.

The late medieval period also provides little evidence of any climatic involvement in the development of Marshland's landscape. The contraction of settlement noted elsewhere in the county is equally apparent in Marshland, and this is nowhere better demonstrated than in the overall site statistics calculated from all of Marshland's identified sites as listed in the survey's companion microfiche (Silvester 1988b). It should be noted that the statistics for the fourteenth century are given as a whole in the *Fenland Project*, but given the death and the inevitable abandonment of sites wrought by the Black Death it is entirely reasonable to associate this statistic not with the century as a whole but rather the first half of the century, with the statistics for the fifteenth century likely far more representative of the later fourteenth century than that given for the entirety of the fourteenth. Over the course of the twelfth, thirteenth, and (early) fourteenth centuries approximately 240 sites were active at some point throughout Marshland's fourteen parishes, with approximately 90, 195, and 200 sites active during the twelfth, thirteenth, and early fourteenth centuries respectively. The number of sites emerging in each century was far from uniform, and it is abundantly clear that the most intensive phase of expansion occurred in the thirteenth century, when approximately 125 virgin sites emerged within Marshland's landscape. Compare this statistic to the approximately 52 sites which emerged in the twelfth century and the approximately 44 sites which emerged in the fourteenth century and the unmatched expansion experienced during the thirteenth century becomes apparent. The contrast between the thirteenth century and those centuries bracketing it is significant, although this contrast pales in comparison to that between the twelfth, thirteenth, and fourteenth centuries and that of the fifteenth century. Just seven sites were established in the fifteenth century across the entirety of Marshland, compared to the approximately 200 sites active during the fourteenth century just 105 were active during the fifteenth.

The medieval emphasis on greens, droves, and tracks also shifted in the late medieval period. Whilst sites were still active around greens, five of the seven virgin sites were adjacent to the sinuous droves which ran through the CZ from north to south. This archaeological evidence concurs with Haiwarde's 1591 map of Marshland, which clearly shows linear clusters of houses strung along the droves which would have been vital routes of communication, transport, and even pasture in this notoriously wet landscape. Whilst the droves carved through the large tract of Wallasea 2 leading down to the Smeeth and West Fen, the percentage of sites on Wallasea 2 soils and the percentage of sites on the siltier soils stayed largely the same in both the medieval and late medieval period, with just 20% of medieval sites and 22% of late medieval sites occupying the clayier soils. Considering the relative similarity of climatic conditions in the medieval and late medieval period, the similarity of these statistics is unsurprising.

RSL fluctuations: c. 500 – c. 1500

One final aspect which requires discussion is the correlation – or lack thereof – between fluctuations in RSL and developments in settlement. As has been discussed, Middle Saxon and Saxo-Norman settlement gravitated towards the roddons, with these features providing elevated, and thus drier locations for dwellings and crofts. It thus seems likely that even though sea levels were lower during this period than they were in later centuries, with the lowest sea levels likely occurring c. 950, flooding was evidently a concern for this region's early medieval inhabitants (Behre 2007: 98). It was probably only with the construction of the sea-bank in the Saxo-Norman period that some degree of reliable defence was achieved – barring the passive mitigating action of siting structures and crofts on elevated roddons – and it is unlikely to be coincidence that after the construction of the sea bank the dominance of the roddons as sites of occupation was significantly reduced. However, that the archaeological record so clearly captures the expansion of settlement to low-lying locations in the medieval period – a period when according to Behre sea-levels were potentially at their highest – strongly suggests that changes in sea levels were not a meaningful driver of settlement development once the sea bank had been constructed.

With the construction of this bank the threat and severity of marine incursions in subsequent periods was thus invariably reduced, although it is imperative to note that the sea bank was far from impenetrable. Documentary evidence from both England and the Low Countries suggests that the countries adjacent to the southern North Sea basin experienced surges in 1014, 1029, 1099, 1236, 1248, 1287, 1288, 1291 and 1334, whilst storms in 1277, 1282, 1285, 1286, 1287, 1288, 1308, 1316, 1318, 1321, 1322, 1325, 1334, 1335, 1337, 1339, and 1344 led to flooding in the fens (Bailey 1991; Hallam 1961). Storms in the fifteenth century were equally prevalent, with the first two decades and the final five decades witnessing particularly frequent storms (Simmons 2015: Appendix 2.1.A). Simmons aptly summarises this relentless sequence of storms, stating that: 'Such a chronology implies few long periods without a major flooding potential and hence any low-lying area adjacent to the east coast was under virtually constant and unpredictable threat of loss of human life, livestock and land; invasion of the East Fen by salt water also meant a menace to the many resources of the fen that depended upon fresh water, especially fishing and grazing' (Simmons 2015: 2.1.A). These storms were undoubtedly destructive and problematic in the short term, with the *Chronica Buriensis* recording how, in 1287, the 'part of England known as the Marshland... became a lake and innumerable people were cut off by the water and drowned', whilst other documentary sources record how, in 1338, flooding in Tilney drowned 160 sheep (Gransden 1964: 187; Dymond 1990: 123).

However, despite these destructive but ultimately short-term events the communities occupying this landscape were evidently flourishing, with the myriad of medieval sites and the high valuations

recorded for many of Marshland's population centres evidence of this success (Silvester 1988: 165). There was thus a high degree of long-term resilience to the frequent marine incursions and their resulting effects, with the local communities evidently well adapted to life in this dangerous environment. This brings to mind the 'deep roots' of Faith's 'small shires', for whilst the inhabitants lived under the constant shadow of the storms, surges, and the rising tides, this community was used to them, and had been successfully living in, and in many ways taming this hazardous landscape for generations (Faith 2008: 9). The flourishing population centres present in the Marshland CZ suggests that the fluctuations in sea-level discussed earlier in this chapter had little impact upon the long-term pattern of settlement in the region.

Conclusion

There is thus little indication, once again, that climatic fluctuations were driving changes in the pattern of settlement in the Marshland and Peat Fen CZs. The considerable decline in population precipitated by the Black Death appears to have been the primary drivers of settlement contraction in the two CZs, with the similarity of climatic conditions in both the medieval and late medieval period making any correlation to climatic fluctuations unlikely. Indeed, after the widespread expansion of settlement onto the heaviest soils in the medieval period, which occurred during a time of significantly elevated precipitation totals, the suggestion that climatic fluctuations were driving changes in Marshland's and Peat Fen's settlement pattern is rendered obsolete.

Chapter Eight: Conclusion

Climate, settlement, and the macro-spatial relationship

The principal research question posed by this thesis is, at its core, relatively simplistic: did climatic fluctuations influence the development of settlement at a macro-spatial scale in medieval Norfolk? To answer this question this thesis has investigated the interaction between atmospheric climatic conditions and surface geological structures – and the influence that this interface of the climatic and the geological had on those living and working the land – in four of Norfolk’s most marginal environments; the Claylands, Breckland, and the West Norfolk Marshland and Peat Fen. Archaeological data has been collated, with its spatial and temporal characteristics extracted and interrogated via geospatial analyses. Historical data has similarly formed part of the evidential basis of this thesis, albeit to a lesser extent than archaeological data. This thesis has also sought, by thoroughly investigating recent palaeoclimatological reconstructions of both historic temperature and historic precipitation, to update the palaeoclimatic narrative within a landscape historical and landscape archaeological setting.

Despite the sophistication of modern palaeoclimatological research, most environmental interpretations of English medieval settlement – with the notable exception of those of Campbell, Rippon, and Costello – have remained centred on the terrestrial, focusing on soils, geology, hydrology, and topography, with climate largely left as a stable contextual backdrop. This contrasts sharply with the small but increasingly influential international corpus, where high-resolution palaeoclimatic reconstructions have been integrated directly into analyses of medieval settlement in Iceland, the Byzantine world, Greenland, and the wider North Atlantic (Casely 2006; Xoplaki *et al.* 2016; Lasher and Axford 2019; Raposeiro *et al.* 2021). These studies demonstrate that climatic fluctuations produced regionally distinct outcomes, which are a product of both climatic heterogeneity and the complex system of environmental and anthropogenic feedbacks through which climatic fluctuations are filtered. These wider international studies illustrate the value of integrating palaeoclimatic reconstructions into medieval settlement studies.

The review of palaeoclimatic literature undertaken in Chapter Two demonstrates that the palaeoclimate was anything but static; to view it through a lens through which one can only see the simplistic outline of the Medieval Warm Period or the Little Ice Age obscures a highly variable chronology characterised by trends that play out over both decades and centuries. This duality of the *long durée*, which sees decadal-scale variation occurring within overarching, multi-century trends is common across the majority of reconstructions presented in this thesis. This thesis has demonstrated the value of engaging with modern palaeoclimatological literature; by identifying commonalities in

reconstructions produced throughout three decades of ever advancing technology and at varying temporal and spatial resolutions, the most suitable climatic narratives were able to be selected from the multitude of those available. L2010, BTN2011(P), and CMT2013 provide a continuous narrative of both temperature and precipitation for medieval Norfolk, and whilst it is freely admitted that each contains flaws – L2010, for example, contains proxies from across Europe – the overall agreement between many reconstructions – with the correlation between P2017(T) and L2010, and again the correlation between BTN2011(P) and CMT2013 of particular note – ensures that they are, on the balance of probability, as accurate a reconstruction of the palaeoclimate as modern science can currently produce. Whilst in an ideal world bespoke micro-scale, multiproxy climatic reconstructions of each Character Zone would have been preferable, these simply do not exist – and are unlikely to ever exist – simply due to the sheer volume of work which is necessary to produce just a single reconstruction.

This thesis has demonstrated – by comparing archaeological and historical data against modern palaeoclimatic reconstructions and pedological data – that fluctuations in climate conditions are unlikely to be the primary drivers of change in the macro-spatial characteristics of settlement in medieval Norfolk. Across all four Character Zones static factors of soils, topography, and hydrology, along with anthropogenic factors such as the advancement in agricultural technology, appear to be the primary drivers of changes in settlement, in much the same vein as that envisaged by Williamson (Williamson 2012). Indeed, there is little indication to suggest that the current narrative of rural medieval landscape development is inaccurate. This narrative holds that the early Saxon period was characterised by a dispersed pattern of settlement which focused on the lightest soils. The middle Saxon period saw a change in this pattern, with dispersed settlement coalescing into more nucleated forms often around the parish church and moving to comparatively heavier, more fertile soils. The Saxo-Norman period saw an expansion onto increasingly heavier soils, with almost complete colonisation of even the most intractable soils complete by the medieval period. Green-edge sites proliferated in this and the succeeding medieval period, with their characteristic ‘drift’ from their parish church focus to the edge of the sinuous network of interconnected green and commons a staple of the narrative of Norfolk’s medieval landscape. Finally, the current narrative suggests that there was a contraction of settlement caused by the Black Death all across the county in the late medieval period, with remaining sites clinging to the edges of greens or shrinking from their medieval apogee. When this narrative is plainly laid out, there is little reason to consider the findings of this thesis as contradictory in any way.

In the Claylands CZ, early Saxon settlement clearly favoured light, well-drained soils that were no great distance from watercourses, despite this period being both cold, which would have aided the breaking

up of the medium and heavy clays through frost action, and dry, which would have reduced incidents of waterlogging and made the soil easier to work. Middle Saxon and Saxo-Norman settlement began to expand onto heavier soils as the climate became warmer and wetter, reaching an apex in the medieval period which saw an unprecedented expansion onto the heaviest soils, despite climatic conditions being unfavourable for the cultivation of heavy soils compared to earlier periods. The contraction in the late medieval period is primarily associated with the Black Death, and the lack of realignment onto lighter soils – despite the Black Death providing the ability to achieve such a realignment – suggests that climatic fluctuations were not driving changes in the macro-spatial characteristics of settlement development. Furthermore, the adoption of a less extreme climate adaptation method – namely switching from reaping to mowing – as opposed to a wholesale realignment of arable exploitation strongly suggests that climatic conditions were not unfavourable enough to warrant a more extreme response.

In the Breckland CZ, early Saxon settlement appeared to have been similarly drawn to the few watercourses present in the region, which given the aridity of this environment is unsurprising. The early Saxon predilection for the occupation of sites sitting on the junction between lighter and comparatively ‘heavier’ soils, which would have been able to retain more moisture than the extremely light, freely draining soils dominating the Brecks, could potentially be interpreted as suggesting a climatic driver in the positioning of occupational sites. However, even where these ‘heavier’ junction zones were colonised in the early Saxon period, they nearly always tended to occupy the lighter side of the junction zone, despite climatic conditions being ideal for colonisation of the ‘heavier’ side. An explanation for this trend is that the ‘lighter’ side of these zones were selected as these were the limits to which the agricultural systems and implements available to these early Saxon colonisers could feasibly cultivate (with the assumption here being that colonisers would likely prefer the heaviest, most fertile land that was in their ability to cultivate), and that even though the ‘heavier’ soils would have been more receptive to cultivation during the early Saxon period, they simply lacked the necessary tools to do so. Moreover, the emphasis on pastoral farming in this period allowed for more climatic resilience than arable farming, which is intrinsically more sensitive to variations in climatic conditions. The expansion onto heavier soils – and the clear evidence of arable cultivation – in the middle Saxon, Saxo-Norman, and medieval periods came at a time when climatic conditions were far less favourable than they had been in the early Saxon period for arable cultivation. Once again it is difficult to ascribe changes to climatic fluctuations.

In the Marshland and Peat Fen Character Zones it was clearly static environmental features – namely the roddons – that were the principal determining factors for medieval settlement, with later developments likely a result of the need to maximise access and exploitation of resources. Throughout

the early Saxon, middle Saxon, and Saxo-Norman period the roddons were the clear focal points of settlement, with the occupation of these features being necessitated by the wetland character of this environment. In a place that was susceptible to marine inundation, it is entirely logical that occupational complexes gravitated towards those places which could provide refuge from the encroaching floodwaters. The expansion onto some of the heaviest soils in the medieval period, which was a time of significantly elevated precipitation totals, once again suggests that climatic fluctuations were not the primary driving force behind developments in the macro-spatial characteristics of settlement; rather, the ever growing population necessitated an increase in the productive capacity of the landscape, ensuring that every effort was made to bring as much of the landscape into productive use as possible. By extension this also suggests that climatic fluctuations were likely not severe enough to cause changes at a macro-spatial scale. Viewed in this way, this begs the question: did medieval agriculturalists even have a choice of what part of the landscape was exploited, or did population pressure simply necessitate exploitation of even the most intractable corners of the landscape?

Across all Character Zones the late medieval period saw a significant contraction of activity, almost certainly precipitated by the devastating effects of the Black Death in the mid-fourteenth century. This contraction was not, however, limited to specific geological environments in a similar way that expansion was; rather, it was a wholesale contraction across the landscape with little regard for the environmental characteristics. This contraction highlights that even with space to realign onto lighter soils due to the decimation of the population this simply did not occur, even when climatic conditions were getting more and more unfavourable to heavy soils in the second half of the fourteenth century and throughout the fifteenth century. Had climatic conditions been dire enough to make the cultivation of heavier soils untenable, it stands to reason that with space to realign onto lighter soils this opportunity would have been taken; that it was not taken suggests that even at a time that was, climatically-speaking, the worst time in one-thousand years to be an agriculturalist operating on heavier soils this climatic downturn was simply not severe enough to cause a change in the macro-spatial characteristics of settlement. The development of agricultural technology, and in particular the reemergence of the mouldboard plough in the tenth and eleventh centuries, had given agriculturalists the means to tame soils which were previously intractable in earlier periods. That it was the Saxo-Norman period that saw the most pronounced expansion onto heavy soils across all Character Zones discussed in this thesis, and that this period aligns extraordinarily well with the likely widespread reintroduction of the mouldboard plough, seems unlikely to be coincidence. Once these heavier soils were workable with the equipment available, there seems to be very little evidence that fluctuations in climatic conditions were ever severe enough to negate the capabilities of medieval agriculturalists.

Wider landscape applicability

This thesis makes no claim that the conclusions reached are representative of every landscape type within England. Indeed, this thesis has consciously attempted to focus solely on the geological and archaeological character of Norfolk alone. However, it stands to reason that those landscapes similar to that of Norfolk – the landscapes of Suffolk, Cambridgeshire, and parts of Lincolnshire for example – will likely display similar patterns to those described here. Whilst it is freely accepted that there may very well be variations in the conclusions – after all, every part of England possesses a unique environmental and historical character – it is this author’s belief that were this study to be replicated in such regions it is unlikely that the conclusions reached would differ from the conclusions reached by the present investigation in any significant way. It is, however, critical to note that the conclusions reached by this thesis are unlikely to be applicable to what can be described as the ‘Highland Zone’ of England, for the climatic conditions, soils, topography, hydrology, and historic character differ significantly from that of Norfolk to such a degree that only an investigation tailored to this region could reach reliable conclusions.

Magnitudes of climatic change

As was touched upon above, that there is little indication of historic fluctuations in climate being a driving force behind changes to settlement at a macro-spatial resolution is perhaps indicative that fluctuations in climatic conditions were simply not severe enough to cause noticeable change in the landscape. This difference in the magnitude of climatic change between what was experienced in the medieval period and what we are currently experiencing is significant. L2010 records its highest temperature anomaly against the 1961-1990 baseline of +0.2°C c. 990. Against the same 1961-1990 baseline period, 2024 recorded a +1.68°C global temperature anomaly according to Berkeley Earth’s annual global temperature report (Rohde 2025). This means that the current severity of temperature change is approximately 8.4 times greater than what were likely the warmest decades of the entire medieval period.

Accurately modelling future climate is vital if we are to successfully adapt to climate change and effectively mitigate its impact. To ensure that climate models are comparable with each other a common set of greenhouse gas and aerosol scenarios known as ‘Representative Concentration Pathways’ or RCP scenarios have been developed by the climate modelling community and formally adopted by the Fifth IPCC Assessment Report (AR5) in 2014 (van Vuuren *et al.* 2011; Pachauri and Meyer 2014). This set of four scenarios – RCP2.6, RCP4.5, RCP6.0 and RCP8.5 – are not projections of possible future emissions; rather, they describe a possible route (a ‘pathway’) to a certain degree of

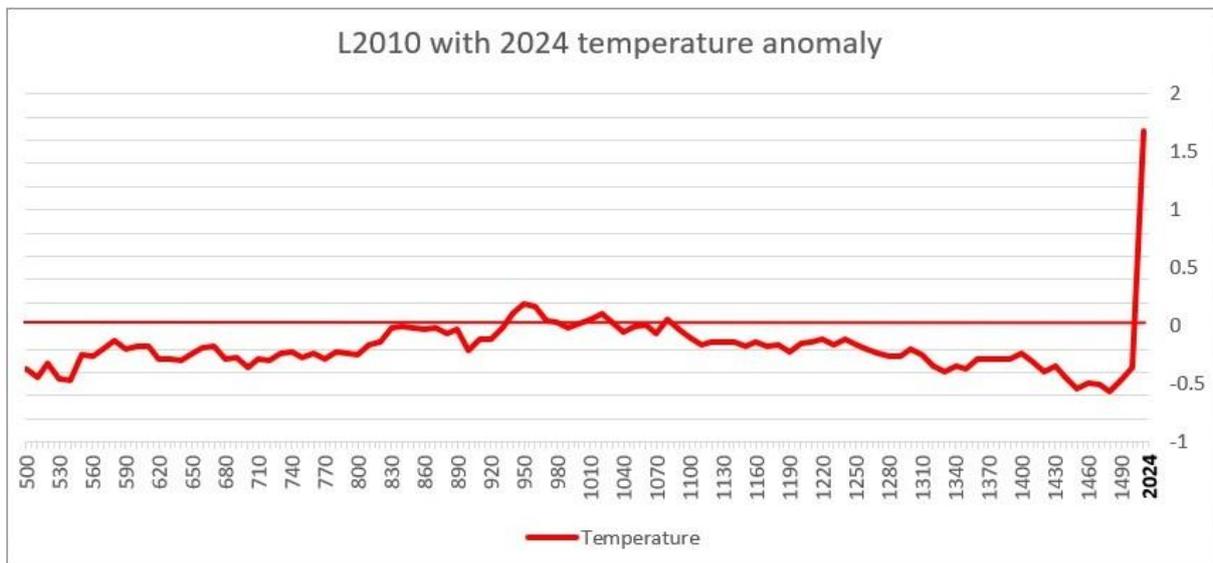


Figure 132: L2010 with the temperature anomaly for 2024. Note how significant the difference in the magnitude of warming is between the late tenth century and today.

atmospheric greenhouse gas concentration by the year 2100, based on what adaptation and mitigation actions humanity takes to tackle climate change (van Vuuren *et al.* 2011; Pachauri and Meyer 2014). Each scenario is known by a number; RCP2.6, RCP4.5, RCP6.0 and RCP8.5. This number is a reference to the value, given in Watts per square metre (W/m^2), of the level ‘radiative forcing’ that exists at the end of the century. Radiative forcing refers to the combined energy imbalance created by the various drivers of climate change, such as the concentration of warming greenhouse gases in the atmosphere which alters the Earth’s energy budget. RCP8.5 can therefore be understood as describing an end of century energy imbalance of $8.5\text{W}/\text{m}^2$, the highest and therefore the most severe RCP scenario, whilst RCP2.6 describes a less severe end of century energy imbalance of $2.6\text{W}/\text{m}^2$.

The more energy trapped in our atmosphere – an input which upsets the energy budget of the planet – the warmer the global climate becomes. This energy budget is the sum of the incoming longwave radiation predominantly originating from the sun (solar radiation), and the shortwave radiation (thermal infrared radiation which we feel as heat) that is emitted back after being absorbed by the earth as longwave solar radiation. In a balanced climate the incoming and outgoing radiation is in balance over the long-term, effectively equalling net zero. However, any imbalance in this budget leads to either global warming – induced by ‘positive’ radiative forcings like greenhouse gas accumulation which prevents shortwave infrared radiation from escaping our atmosphere – or global cooling – induced by ‘negative’ radiative forcings such as the aerosols emitted during volcanic eruptions.

The RCP scenarios all refer – unsurprisingly – to positive radiative forcings. Since the publication of AR5 in 2014, RCP8.5 has commonly been referred to as the ‘business as usual’ scenario, representing

a future where there is no policy-driven mitigation; it has become a widely acknowledged ‘worst-case scenario’ that is often presented as being the most likely no-policy outcome. Whilst this is not strictly the case – with RCP8.5 representing the most high-end scenario described in climatological literature rather than a ‘business as usual’ scenario – RCP8.5 does serve to highlight the upper limits of possible end of century warming (van Vuuren *et al.* 2011; Pachauri *et al.* 2014; Hausfather and Peters 2020).

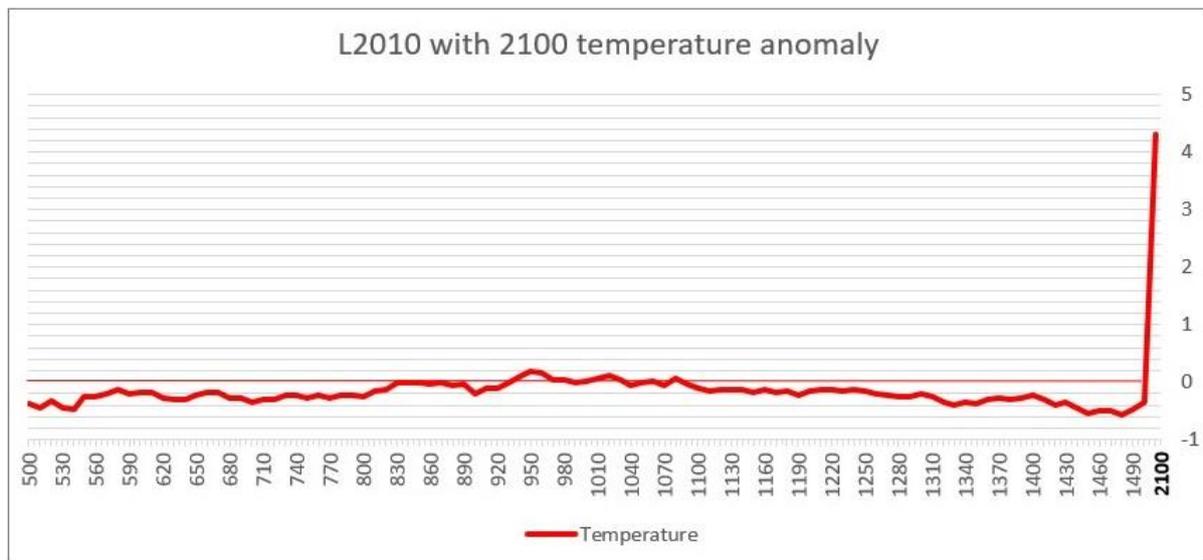


Figure 133: L2010 with the temperature anomaly suggested under RCP8.5. Note the sheer magnitude of potential warming at the end of the twenty-first century.

Under RCP8.5, radiative forcing will continue to increase over the course of the twenty-first century, surpassing 8.5W/m^2 by 2100. Temperature rise by 2100 is expected to be over $+4.3^\circ\text{C}$. Even under RCP4.5, in which scenario radiative forcing is stabilised before 2100 by employing a range of technologies and strategies for reducing greenhouse gas emissions, global temperature rise is still estimated to lie between $+2^\circ\text{C}$ and $+3^\circ\text{C}$. Viewed through this lens, the magnitude of medieval warming is 21.5 times smaller than what we could potentially be facing by the close of the twenty-first century under RCP8.5. Even if we do succeed in mitigating climate change and manage to achieve the pathway set out in RCP4.5, we will still be facing temperature anomalies that are between fifteen and twenty times bigger than the late tenth-century apogee of $+0.2^\circ\text{C}$. The last time our planet experienced equivalent levels of warming was likely in the mid-twentieth century, and whilst the effects of climate change were undoubtedly being felt even then – the warning given by Edward Teller in 1959 to the US government and oil industry warned of the rising threat of climate change – its effects were being felt far less keenly than they are now; there were certainly no large-scale changes in the macro-spatial distribution of mid-twentieth-century human settlement. Given the conclusions reached by this thesis – that there is no indication of the macro-spatial characteristics of medieval settlement changing due to fluctuations in climatic conditions – and the comparative mildness of

medieval warming, it is perhaps no surprise that there was little response at a landscape, macro-spatial scale to these fluctuations, for they simply were not severe enough to necessitate a response.

It is, however, critical to note that this thesis is not suggesting that the magnitude of climatic fluctuations was not severe enough to impact *anything*; rather, this thesis is suggesting that climatic fluctuations were not of sufficient magnitude to impact the macro-spatial characteristics of settlement in Norfolk. For example, it was discussed in Chapter One that Campbell has theorised that *Yersinia pestis* was able to spread from its central-Eurasian reservoir regions due to a climatic downturn in the early 1340s⁵ (Campbell 2016: 286-7). This thesis is by no means suggesting that such a suggestion is incorrect, for the conclusions reached here and the discussion of magnitude relate specifically to settlement development at the macro-spatial scale.

Beyond the macro-spatial

Whilst at a macro-spatial level (the 'landscape' scale) climatic fluctuations do not appear to have influenced the development of settlement, at a micro-spatial scale (the individual 'site') there is potentially more scope to ascribe changes to climatic fluctuations. Whilst this micro-spatial aspect has not been the primary focus of this investigation, perhaps the most persuasive piece of evidence in this thesis for climatic fluctuations influencing settlement is found at this micro-spatial level. Site H19 in Davison's *Three Parishes* appears to have been established and abandoned within the span of just a handful of decades in the late twelfth and early thirteenth centuries. This period is one of only two periods which sees temporally limited reductions in precipitation levels in these centuries. It is thus possible that the reduction in precipitation levels c. 1180 prompted an entrepreneurial agriculturalist to expand onto this hydrologically sensitive, but more fertile site before the subsequent rise in precipitation levels c. 1210 made continued cultivation untenable, leading to its abandonment. As discussed in Chapter Five, it is freely admitted that this theory has issues, but to the individual or group of individuals who were responsible for expanding onto this site this period of reduced precipitation may have been particularly notable, and it must have seemed, especially to the older generation, that the rain which defined their early years was beginning to ease, only to increase in intensity shortly after the site was established. The possibility of fluctuations in climatic conditions being a primary driver in individual site establishment and abandonment, rather than a primary driver of macro-spatial, landscape-level settlement development is potentially worth further investigation and begs a pertinent question: would an investigation of carefully selected, hydrologically sensitive individual sites like site H19 yield more evidence of climatic involvement in the development of settlement than there is at a macro-spatial scale? Whilst site H19 is one of the very few sites where there is a potential

⁵ This downturn is captured in L2010.

correlation between atmospheric climatic fluctuations and the archaeological evidence – making this site very much atypical – this avenue is potentially worth further investigation.

However, it is critical that any future investigations are undertaken with caution. At the start of this thesis attention was drawn to the comparative lack of climatically aware English landscape historical and archaeological literature. It is encouraging that in 2025, the Medieval Settlement Research Group's Spring Conference is titled 'Adaptations: Medieval Responses to Environmental Change'. The increasing interest in understanding medieval responses to climate change is undoubtedly a product of the ever-increasing visibility of our own worsening climate; wildfires have torn through cities, towns, and rural landscapes across the globe, properties and infrastructure is being routinely lost to coastal processes, and biodiversity is being pushed to the very limits of viability. Indeed, with the catastrophic future envisaged by RCP8.5 and even RCP4.5, it is no surprise that interest in past responses to climatic change is increasing. However, whilst this interest in the climatic is undeniably a positive step forwards for the discipline, this thesis urges caution to those linking together the study of the historic landscape and the historic climate. It is all too easy to repeat the perceived wisdom of previous scholars when discussing the palaeoclimate, slipping into familiar terms such as 'Medieval Warm Period' and 'Little Ice Age'. As has been previously discussed, whilst these periods are undeniably visible over the *long durée*, such generalisations serve to obscure a considerable degree of nuance. There is also the previously discussed question of the magnitude of change; even at the apogee of the 'Medieval Warm Period', temperatures peaked at +0.2°C against the baseline period. Current warming is some 8.4 times this late tenth century apogee. Any future studies must take this into consideration and must, above all, ensure that modern palaeoclimatological literature is the basis for all information relating to the palaeoclimate.

Climate and settlement

From the evidence presented in this thesis there is little indication that climatic fluctuations were influencing the development of settlement at a macro-spatial, landscape-scale resolution. Indeed, in the vast majority of examples the expansion and contraction of settlement appears to have occurred with an almost universal disregard for climatic fluctuations. Anthropocentric factors such as the advancement of agricultural technology, changing modes of land use and exploitation, demographic expansion, and large-scale mortality events such as the Black Death all appear to have had far more influence on the macro-spatial development of settlement than fluctuations in temperature and precipitation. Critically, the anthropogenic factors referenced above are underscored by the static environmental structures – soils, hydrology, and topography – championed within the enviro-centric narrative of rural landscape development. At the very start of this thesis Williamson's static

environmental interpretation of landscape development was critiqued for its lack of consideration to the dynamic forces of climate over the *long durée*. Whilst the omission of an investigation into the dynamic forces of climate remains an undeniable flaw within Williamson's work, from the geospatial and historical analyses undertaken in this thesis there can be little doubt that it is the *static* elements of the natural environment, not the *dynamic* forces of climate, which have exerted the most influence on the development of Norfolk's medieval rural landscape.

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GIS data

Norfolk Heritage Explorer, available at: <https://www.heritage.norfolk.gov.uk/map-search>

1851 England and Wales census parishes, townships and places, available at:

<https://reshare.ukdataservice.ac.uk/852232/>

OS Open Rivers, available at: <https://www.ordnancesurvey.co.uk/products/os-open-rivers>

LIDAR Composite Digital Terrain Model (DTM) - 1m, available at:

<https://environment.data.gov.uk/dataset/13787b9a-26a4-4775-8523-806d13af58fc>

LIDAR Composite Digital Terrain Model (DTM) – 2m, available at:

<https://environment.data.gov.uk/dataset/09ea3b37-df3a-4e8b-ac69-fb0842227b04>