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ELTON 2, WARMINGTON, NORTHAMPTONSHIRE

GEOARCHAEOLOGICAL WINDOW SAMPLING

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OASIS SUMMARY SHEET

Project details			
Project name	*Elton 2, Warmington, Northamptonshire: Geoarchaeological Window Sampling*		

Ten window sample cores were put down in June 2018, located to augment data from eleven geotechnical boreholes sunk in 2015. In May/ June 2021 a further six window sample cores were sunk to the east as land within the site boundary became accessible. The revealed lithostratigraphy was used to construct a series of deposit models to aid in the geoarchaeological interpretation of the site.

The investigation revealed a picture of mid-late Holocene floodplain development characterised by gradual channel abandonment and consolidation. Palaeotopography and drainage at the site is constrained by late Pleistocene sand and gravel deposits forming an elevated plateau or 'island' occupying a central position. Such islands are fairly common Nene Valley floodplain features and have been found to provide relatively stable land surfaces in the Early Holocene and a focus for Mesolithic activity.

Hydrological change was initiated during the late Neolithic period with the silting of a former channel crossing the SE corner of the site commencing 4,819 calBP. Recovered macrofossil remains indicate an open landscape and slow-moving water body, suggesting gradual channel demise. This fits the wider picture of floodplain evolution recorded in the Nene Valley, which tends to be characterised by channel simplification since the Mid-Holocene. A further sequence of organic-rich deposits recorded c. 20m to the west of the current river channel accumulated between 4,816 and 2,186 calBP and may indicate the lateral migration of the primary channel or simply its contraction and deepening as a result of accelerated bank aggradation. Palynological assessment of the channel deposits indicates a contemporary open pastoral landscape, with local arable cultivation also suggested. Palaeoenvironmental macrofossils from the channel suggest a slow-moving channel set within an open environment, which is consistent with gradual channel abandonment.

From the mid/late-Holocene and particularly from later historical periods, the sedimentary regime was dominated by overbank alluvial deposition, forming the main sedimentary unit of alluvial silts and clays that blanket the site. The close proximity of Neolithic and Bronze Age funerary remains suggests nearby settlement, most likely occupying elevated ground to the north and south, with the floodplain being utilised as seasonal pasture within a mixed agricultural regime.

Four archaeological test pits were excavated through the topsoil/ subsoil and upper alluvium for the purpose of artefact recovery. The result of this exercise was negative.

Project dates (fieldwork)	*12th June 2018; 24th May 2021; 8th June 2021; 19th August 2021*		
Previous work (Y/N/?)	*Y*	Future work	*TBC*
P. number	*BE10140 (6422)*	Site code	*AS1810*
Type of project	*Geoarchaeological window sampling and archaeological test pits*		
Site status	-		
Current land use	*Pasture and woodland*		
Planned development	*Extension to existing quarry/reservoir*		
Main features (+dates)	*Palaeochannel feature(s) containing organic-rich infill spanning 4,819-2,236 calBP with good preservation of organic remains.*		
Significant finds (+dates)	*N/A*		
Project location			
County/ District/ Parish	*Northamptonshire*	*North Northamptonshire*	*Warmington*
HER/ SMR for area	*Northamptonshire County Council Historic Environment Record (NCC HER)*		
Post code (if known)	-		
Area of site	*c.14.5ha*		
NGR	*TL 07096 91909*		
Height AOD (max/ min)	*15-20m AOD*		
Project creators			
Brief issued by	*Northamptonshire County Council*		
Project supervisor/s	*Tom McDonald; Gareth Barlow; Uinseann O'Manachain*		
Funded by	*Ingrebourne Valley Ltd*		
Full title	*Elton 2, Warmington, Northamptonshire: Geoarchaeological Window Sampling*		
Authors	*Bescoby, D.*		
Report no.	*5641*		
Date (of report)	*29th August 2018; revised 11th December 2018 & 16th March 2022*		

ELTON 2, WARMINGTON, NOTHAMPTONSHIRE

GEOARCHAEOLOGICAL WINDOW SAMPLING

SUMMARY

Ten window sample cores were put down in June 2018, located to augment data from eleven geotechnical boreholes sunk in 2015. In May/ June 2021 a further six window sample cores were sunk to the east as land within the site boundary became accessible. The revealed lithostratigraphy was used to construct a series of deposit models to aid in the geoarchaeological interpretation of the site.

The investigation revealed a picture of mid-late Holocene floodplain development characterised by gradual channel abandonment and consolidation. Palaeotopography and drainage at the site is constrained by late Pleistocene sand and gravel deposits forming an elevated plateau or 'island' occupying a central position. Such islands are fairly common Nene Valley floodplain features and have been found to provide relatively stable land surfaces in the Early Holocene and a focus for Mesolithic activity.

Hydrological change was initiated during the late Neolithic period with the silting of a former channel crossing the SE corner of the site commencing 4,819 calBP. Preliminary assessment of recovered macrofossil remains indicate an open landscape and slow-moving water body, suggesting gradual channel demise. This fits the wider picture of floodplain evolution recorded in the Nene Valley, which tends to be characterised by channel simplification since the Mid-Holocene. A further sequence of organic-rich deposits recorded c. 20m to the west of the current river channel accumulated between 4,816 and 2,186 calBP and may indicate the lateral migration of the primary channel or simply its contraction and deepening as a result of accelerated bank aggradation. Palynological assessment of the channel deposits indicates a contemporary open pastoral landscape, with local arable cultivation also suggested. Palaeoenvironmental macrofossils from the channel suggest a slow-moving channel set within an open environment, which is consistent with gradual channel abandonment.

From the mid/late-Holocene and particularly from later historical periods, the sedimentary regime was dominated by overbank alluvial deposition, forming the main sedimentary unit of alluvial silts and clays that blanket the site. The close proximity of Neolithic and Bronze Age funerary remains suggests nearby settlement, most likely occupying elevated ground to the north and south, with the floodplain being utilised as seasonal pasture within a mixed agricultural regime.

Four archaeological test pits were excavated through the topsoil/ subsoil and upper alluvium for the purpose of artefact recovery. The result of this exercise was negative.

1 INTRODUCTION

1.1 In June 2018, Archaeological Solutions Ltd put down ten window sample cores for the purpose geaorchaeological assessment at Elton 2, Warmington, Northamptonshire (NGR TL 07096 91909). The survey was commissioned to provide detailed information about the nature and formation of deposits on the site in relation to its environmental and archaeological history. The project was carried out based on a brief issued by the Northamptonshire County Council County Archaeological Advisor (NCC CAA) dated 17th May 2016.

1.2 By June 2021, plantation woodland occupying the eastern section of the site had been cleared, and a further six window sample cores were sunk to provide additional data from this area of the site.

1.3 The project was carried out in accordance with two specifications compiled by AS (dated 12th February 2018 and 19th March 2021), approved by the Northamptonshire County Council County Archaeological Advisor (NCC CAA). The geoarchaeological assessment was carried out in accordance with the Chartered Institute for Archaeologists' *Standard and Guidance for Archaeological Field Evaluation* (2014; updated 2020) and the Historic England (2015) geoarchaeology guidelines.

Objectives

1.3 The objectives of the geoarchaeological assessment were to establish the sub-surface stratigraphy of the site, and develop corresponding deposit models to be used in assessing surviving fluvial deposits and the development of floodplain at this location.

1.4 To present the results within the wider context of archaeological, geoarchaeological and palaeoenvironmental investigations in the Nene Valley.

1.5 The recovery of organic remains from suitable sediments encountered for palaeo-environmental assessment and radiocarbon dating, allowing a chronology for changing floodplain conditions to be established and set within a palaeo-environmental context.

1.6 Archaeological test pits were excavated for the recovery of artefactual remains from within the topsoil/ subsoil and upper layers of alluvium to assess finds distribution in these horizons.

Planning policy context

1.7 The National Planning Policy Framework (MHCLG 2021) states that those parts of the historic environment that have significance because of their historic, archaeological, architectural or artistic interest are heritage assets. The NPPF aims to deliver sustainable development by ensuring that policies and decisions that concern the historic environment recognise that heritage assets are a non-renewable resource, take account of the wider social, cultural, economic and environmental benefits of heritage conservation, and recognise that intelligently managed change may sometimes be necessary if heritage assets are to be maintained for the long term. The NPPF requires applications to describe the significance of any heritage asset, including its setting that may be affected in proportion to the asset's importance and the potential impact of the proposal.

1.8 The NPPF aims to conserve England's heritage assets in a manner appropriate to their significance, with substantial harm to designated heritage assets (i.e. listed buildings, scheduled monuments) only permitted in exceptional circumstances when the public benefit of a proposal outweighs the conservation of the asset. The effect of proposals on non-designated heritage assets must be balanced against the scale of loss and significance of the asset, but non-designated heritage assets of demonstrably equivalent significance may be considered subject to the same policies as those that are designated. The NPPF states that opportunities to capture evidence from the historic environment, to record and advance the understanding of heritage assets and to make this publicly available is a requirement of development management. This opportunity should be taken in a manner proportionate to the significance of a heritage asset and to impact of the proposal, particularly where a heritage asset is to be lost.

2 DESCRIPTION OF THE SITE

2.1 The village of Warmington lies *c.*8km south-west of Peterborough in the county of Northamptonshire (Fig.1). The hamlet of Eaglethorpe is located to the north-west, truncated by the A605. The site lies in agricultural land to the north-west of Eaglethorpe comprising mostly pasture but also some woodland.

2.2 The site is an irregular shape lying within the floodplain of the River Nene, as shown in Fig 2. Channels of the latter surround the site on all sides. Historically sections of the river have been engineered and managed at various times, such as canalisation in the vicinity of Elton mill for the creation of a mill leat and pond. A public footpath runs from south to north across the site giving access to nearby Fotheringhay.

2.3 Topographically the site lies on lower ground within the river valley floodplain at *c.*15m AOD. Upon the surrounding plateau, Jurassic strata of the Great Oolite series is overlain by deposits of pre-Devensian glacial material dominated by Boulder Clay. The Jurassic strata are often exposed on the valley sides, comprising of Upper Lias Clay; Northampton Sand and Ironstone; Sand with Ironstone; sands, clays and gravels of the Lower and Upper Estuarine Series, Great Oolite Limestone and Clay, Cornbrash Limestones, Kellaways Clay and Sand and Oxford Clay (Horton, 1989)

2.4 The overlying soil is recorded as loamy and clayey with naturally high groundwater (BGS 1978; SSEW 1983).

3 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 An archaeological desk-based assessment has previously been prepared for the site (Wilson & Henry 2015). In summary:

The site is located on the periphery of the historic Saxon villages of Warmington and Eaglethorpe within a landscape dominated by the River Nene. Bronze Age round barrows and ditches have been recorded in the field to the north-west of the site. Evidence for prehistoric activity, including Bronze Age burials and Iron Age field systems and droveways, has been identified to the east, and may be part of a wider prehistoric landscape. The evidence for later periods is focused within the village to the south-east, excepting a possible medieval trackway that may run along the route of the Nene Way from Fotheringhay to London. Based on the known archaeology the site has a low to moderate potential for archaeological remains.

3.2 A magnetic gradiometer survey over the larger extent of the site has also been completed (Summers *et al.* 2016), which identified channel features associated with past activity of the River Nene. These channels are likely to have ancient origins and, as such, may be contemporary with prehistoric human activity in the area. A number of discrete positive anomalies were interpreted as probable tree hollows, although an archaeological origin cannot be ruled out.

4 GEOARCHAEOLOGICAL BACKGROUND

4.1 The following section provides details of the wider geoarchaeological setting of the Nene valley, drawing on the findings of relevant studies at a number of locations within the valley. These are used as the basis of a summary of current knowledge in relation to the evolution of the River Nene, it's associated deposits and archaeological potential, providing context for the current investigation.

The Nene Catchment and fluvial deposits

4.2 The Nene valley consists of a low-energy floodplain within a large rural catchment occupying the eastern side of the Midland Plain, encompassing the western border of Northamptonshire. The River Nene leaves its valley at Peterborough, flowing eastwards through Cambridgeshire and the East Anglian Fens before draining into the North Sea via the Wash near Wisbech. The river has its headwaters on the Midlands Plateau and its course largely follows the edge of the Jurassic escarpment – section 2.3 above. The valley is one of the most quarried landscapes in the UK, with aggregate extraction focused between Northampton and Peterborough targeting both sub-alluvial and terrace gravels. The superficial floodplain and terrace deposits at the site are shown in Fig.3.

4.3 The orientation of the Nene Valley partly follows a pre-Devensian drift-filled buried channel (Horton,1970) and while the rockhead morphology beneath the floodplain is sub-planar between Northampton and Woodford, a deeply buried trench is encountered further downstream (Castleton, 1976). The current floodplain varies in width from 750m to 900m, with surviving terrace fragments sitting at 2m or so above the floodplain. The reach of the Nene Valley is overall of low slope and is today characterised by one or two channels of low sinuosity, often seen flowing at opposite edges of the floodplain (Brown et al., 1994). A blanket of alluvium obscures much of the former floodplain topography, concealing a surface of late Glacial sands and gravels dissected by palaeochannels and often forming small gravel 'islands'. Recent artificial channel works in the form of new, straight sections and the creation or conversion of small channels are commonplace within the valley.

4.4 The catchment retains substantial areas of glacial material, including till and outwash, deposited during pre-Devensian glaciations as well as younger drift (Boulder Clay) deposited by a post-Hoxnian, but likely pre-Ipswichian glacial (Jones & Keen, 1993). These deposits have subsequently experienced significant erosion as the Devensian glaciation initiated new drainage patterns that subsequently down cut to old levels (Brown et al., 1994).

4.5 The identification and characterisation of terraces within the catchment is somewhat underdeveloped and stages of development by downcutting channels during Devensian are as yet not well defined. At least three gravel terraces can be identified on the Nene (see Castleden 1980), although their spatially fragmented nature often makes correlation difficult, and Langford and Briant (2004) have questioned whether grouping them as fluvial terraces is really appropriate.

4.6 The oldest Third terrace, located at elevations of 10-17m above the floodplain is thought to be of late Middle Pleistocene date. A lower Second Terrace of deposits, found at elevations of 5-9m above the current floodplain, are attributed to the Late Pleistocene; both terraces were deposited prior to the Glacial maximum (OIS3) and the late glacial (OIS2) (Brown et al., 1994; Briant 2003; Langford & Briant, 2004).

4.7 The majority of the floodplain gravels are sub-alluvial, rising to form the First Terrace deposits along valley margins where they reach elevations of c.2m above the floodplain. It has been shown that the basal gravels of this sequence were laid down from c.28,000 BP onwards, with the uppermost layers being deposited as late as 9,000 BP (Brown et al., 1994; Langford & Briant, 2004).

Previous studies

4.8 Extensive gravel extraction within the catchment, both along river terraces and upon the floodplain over the past 70 years have provided a detailed picture of the fluvial sedimentary history of the valley, including palaeoenvironmental evaluation of organic remains and the radiocarbon dating of suitable deposits. In particular, large excavations at Stanwick, West Cotton, Raunds, Irchester, Ditchford and Wollaston have generated extensive palaeoenvironmental and archaeological data.

4.9 In 2009, an archaeological and environmental synthesis of the Nene Valley was undertaken by Northampton Archaeology and the University of Exeter, successfully drawing together data from many of these large extraction projects and numerous smaller operations to provide a detailed picture of the evolving valley landscape (Meadows et al., 2008; Brown & Allen, 2008).

Geoarchaeological Summary

4.10 The following section draws together data from a number of Nene Valley sites, summarised in Table 1, to provide geoarchaeological context to the current study.

Table 1: Sites for which palaeoenvironmental and archaeological data have been derived in the geoarchaeological summary.

Site	Type	Period	Notes
Ecton	First Terrace	OIS3	Organic clay deposit (Morgan 1969).
Ditchford	Sub-alluvial gravels	Younger Dryas (Loch Lomond Readvance) OIS2	Palaeochannel Scar. (Brown, 2004).
	Infilled channel beneath medieval trackway	Early medieval	740-880 calAD (Brown et al., 1994)
Stanwick (Irthlingborough)	First Terrace (Ecton Member). Prehistoric settlement	Cold stage gravels	Gravels contain extensive faunal remains (Briant et al., 2008; Harding & Healy, 2007)
Redlands Farm (West Cotton)	Palaeochannels	Roman – late Saxon	Abandonment of channel prior to Roman occupation. Accelerated alluviation from late Saxon period (Windell et al., 1990; Campbell, 1994)
Grendon	Flood bank	Late Saxon Medieval	Accelerated Alluviation possible abandonment of mill (Brown & Hatton, 2000,2001)
	Floodplain sites along 8km	Late-glacial, Mesolithic & Early Bronze Age	Late-glacial palaeochannel (Brown & Hatton, 2000,2001)
Wollaston	Paleochannel, Iron Age – Roman ditches.	Neolithic-Roman	Late Neolithic palaeochannel. Roman vineyard complex (Brown et al., 1994)
Raunds	Paleochannels. Prehistoric activity and settlement.	Late-glacial – Early - Mid Holocene	Late-glacial sequence of changing channel conditions (Brown et al., 1994; Brown, 2006; Harding & Frances, 2007)

Pleistocene deposits

4.11 The earlier Pleistocene fluvial deposits represented by the Second and Third terraces are not currently well understood, owing to their fragmented nature within the valley. The Second Terrace deposits equate locally to the Grendon Member and higher Third Terrace deposits to the Woodstone and Orton Longueville Members. Both these terraces are relatively late, post-dating the Anglia glaciation (Landford & Briant, 2004).

4.12 The late Pleistocene gravels forming the sub-alluvial flood plain gravels, those of the First Terrace, are found almost the entire length of the Nene and recent OSL dating has shown that the Nene was active throughout the Devensian (Briant, 2003). While the basal gravels of this sequence were laid down from c.28,000 BP onwards, as evidenced by extensive OIS 3 cold stage deposits in the Ecton Member at Stanwick, the uppermost layers were being deposited as late as 9,000 BP. A small palaeochannel lens in the very base of sub-alluvial gravels at Ditchford has been dated to 11,280-11,090 calBC (11220±45 BP; SRR-4644) and the base of an upper palaeochannel cut into the gravel to 10,390-9,880 calBC (10280±45 BP: SR-4642), (Brown, 2004). Pollen from Ditchford indicates an open grassland environment, with some birch along with several indicators of continental steppic conditions (Brown et al., 1994). Similarly dated channel fill deposits exist at Wollaston, Little Irchester and Grendon. The emerging picture is one of continued deposition and reworking of gravels into the late Devensian, followed by relative lack of deposition and channel change during the early Holocene.

Palaeolithic archaeology

4.13 The location of the valley in relation to earlier Mid-Pleistocene channels (inferred from deposits such as the Milton Member, indicating north-west to south-east drainage), highlights its potential importance during the Lower and Middle Palaeolithic. Individual lithic artefacts (hand axes) attributed to the Lower Palaeolithic have been found in much later, Late Pleistocene alluvial deposits, including the Second and First Terrace gravels at Elton, Fotheringhay, Henington and Oundle (Boismier, 2009). Similarly, Levellois finds attributed to the Early Middle Palaeolithic have been found in similar Late Pleistocene contexts. No *in situ* Palaeolithic sites have been identified in the valley with most, if not all of the artefacts representing materials redeposited within terrace or floodplain gravels (Boismier, 2009).

4.14 The characterisation of Middle Palaeolithic settlement in the valley is severely limited due to the problem of distinguishing the non-Levellois elements of the Middle Palaeolithic from the Lower Palaeolithic materials found together in the same terraces (Boismier, 2009). The same difficulties arise in distinguishing Mousterian artefacts from those of earlier non-levallois technologies also severely limits any characterisation of Mousterian occupation in the valley (Boismier, 2009).

4.15 The Nene valley has so far yielded very little evidence for activity during the Upper Palaeolithic and no securely dated floodplain sites are known. This is in sharp contrast to Leicester and Rutland.

Holocene deposits

4.16 As noted above, the general pattern seems to be one of continued deposition and reworking of gravels into the late Devensian, followed by a lack of deposition and channel change in the early Holocene, as anastomosing channel systems develop out of the earlier braided patterns. Early Holocene Palaeosols are often recorded sandwiched between the Devensian gravels and later alluvium, as previously dissected sections of the floodplain emerge as 'islands' of relative stability.

4.17 This pattern of floodplain channel evolution is reasonably common in lowland river systems with low regional slopes, non-flashy fluvial regimes and a system subject to a net input of fine sediment (Brown, 1997). The evolution of channels in this way has been described by Brown and Keough (1992) as the stable bed/aggrading banks model (SBAB) and involves the reduction of the number of small channels in order to offset the increase in channel size that occurs as flow is concentrated in the remaining channels and as the floodplain surface aggrades. The implication is the existence of more complex channel patterns in the early to mid-Holocene, followed by the abandonment of channels and overbank alluviation in the mid-late Holocene. The depth of recorded palaeochannels in the Nene Valley, combined with the general uniformity of underlying gravels and the lack of depth of finds on gravel islands also suggests minimal lateral migration of channels in the later Holocene (Brown et al., 1994). A period of greatly accelerated channel siltation and abandonment is often evident from the Saxon period onwards (Brown, 2004).

4.18 The published pollen evidence suggests a palaeoecological history not dissimilar from that of other Midland valleys, with alder migrating into a relatively open floodplain in the early Holocene and out-competing willow to form a dense alder woodland by the mid-Holocene, which was probably lost through human deforestation from the late Iron Age onwards (Brown, 1997).

Archaeological potential

4.19 Evidence for Mesolithic occupation in the valley is abundant and suggests a more-or-less continuous human presence from the onset of the Holocene. Artefact scatters and find spots for this period tend to occur on gravel islands within the floodplain and on overlooking valley slopes, conforming to the wider riverine pattern of Mesolithic settlement identified for other East Midland rivers (see Phillips, 2004)

4.20 The environmental record (derived from Grendon, Wollaston, Ditchford and Raunds) indicate an initially open environment and only small amounts of tree pollen. Pine becomes dominant c 7,500 calBC, probably colonising the valley sites and interfluves and by the onset of the Mesolithic Alder woodland becomes common in many floodplain settings, with dryer portions supporting oak and lime. At the late Mesolithic site on Irthlingborough island, tree-throw pits span over a millennium up to the Mesolithic/Neolithic transition. Clear evidence of disturbance by both natural and human activity suggests vegetation management and utilisation of the valley floor by late Mesolithic hunter-gatherers (Boismier, 2009).

4.21 At the start of the Neolithic local woodland was dominated by oak, hazel and alder, but with evidence also of extensive open areas of grasses, sedge and bracken – the presence of the latter at sites such as Grendon and Turnell’s Mill Lane suggesting low-intensity grazing and possibly another primary (funerary) function of these open spaces (Harding & Healy, 2007). At some locations, such as Turnell’s Mil Lane, significant slope deforestation is thought to have occurred by the mid-Neolithic. The earliest securely dated cereal pollen (*Avena/Triticum*) in the valley was recorded at Woolaston between 3,960-3,780 BC. By the end of the Neolithic more widespread clearance activity is evident, with dramatic clearances at Turnell’s Mill Lane dated to the Neolithic/Bronze Age transition and is probably typical of much of the valley floor at this time. Funerary monuments are constructed on the floodplain at West Cotton, Irthlingborough and Stanwick (Harding & Healy, 2007).

4.22 The late Bronze Age is not so well represented by valley sites, the most complete records being from Grendon (Brown & Hatton, 2000, 2001). Here a clear demise in local tree pollen signals the expansion of open grasslands, probably used for pasture. By the end of the Bronze Age the Nene Valley was largely an open landscape, with pasture, arable cultivation and hedges. By the onset of the Iron Age, nearly all pollen records indicate the valley floor landscape to be almost entirely open and managed, with the prevalence of annuals typical of cultivated and disturbed ground (Brown & Hatton, 2000, 2001). These changes are often mirrored in the fields, tracks and enclosures that appear at sites such as Wollaston and Grendon at this time, in a landscape of linear farmsteads aligned to the limit of seasonal flooding, indicative of an intensively managed floodplain for stock with arable cultivation on the terraces and fringes (Brown, 2004).

More recent periods

4.23 The area became highly Romanised with the development of a number of small towns and settlements, such as those at Higham Ferrers and Stanwick. One of the first large scale vineyards was discovered at Wollaston (Harding & Healy, 2007). Later periods are less well represented in the environmental records from the valley, partially as a result of low water levels and channel stability from the Saxon period. The most complete palaeobotanical sequences come from Raunds and West Cotton (Saxon), and Mallows Cotton (Medieval), (Campbell, 1994; Brown, 2006). From the Roman period onwards both cereal and buckwheat pollen are persistent features of pollen sequences. After a period of medieval cultivation, most of the floodplain seems to have been given over to pasture and/or hay meadow.

5 METHOD OF WORK

5.1 Ten window sample cores (WS1 to WS10) were recovered from boreholes put down at the site in May/ June 2018 with a further six cores sunk in June 2021 within the recently cleared eastern portion of the site. The spatial positioning of the cores takes into account the location of 11 geotechnical boreholes sunk in 2015, allowing the meaningful incorporation of geotechnical data into the current evaluation – see Fig. 4. The spatial position of each borehole was recorded in the field using RTK GPS. The sixteen window sample borehole locations are given in Table 2 below. The methodology and results of the test pitting exercise are presented in Appendix 3.

Table 2: Geoarchaeological window sample borehole locations

	Borehole number	Easting	Northing	Height at surface (m AOD)
2018 boreholes	**WS1**	506946.5	291876.2	15.395
	WS2	506966	291936	15.457
	WS3	507080.6	291841.6	15.184
	WS4	507184.1	291840.3	15.014
	WS5	507103.6	291906.8	15.145
	WS6	507052.8	291948.5	15.315
	WS7	506991.6	291998.6	15.614
	WS8	507124.9	291972.9	15.417
	WS9	507259	291862.7	14.93
	WS10	507284.3	291941.8	14.927
2021 boreholes	**WS12**	507424.4	292013.0	14.715
	WS16	507339.5	292061.4	15.142
	WS17	507363.9	292006.6	15.054
	WS18	507406.5	291911.4	15.045
	WS19	507444.1	291972.6	15.045
	WS20	507501.4	292090.4	15.063

5.2 Cores were recovered using a percussion sampling rig with samples recovered within sleeved 1m sections. Boreholes were discontinued on encountering sample recovery failure, which in all cases occurred within the upper surfaces of sand and gravel deposits.

5.3 Recovered core sections from seven locations were opened on site in 2018 and the revealed lithostratigraphy described using standard procedures for the recording of unconsolidated and organic sediments, noting physical properties, composition, consistency, sedimentary boundaries and inclusions. Sample sleeves were first split down their centreline, providing a section through each of the recovered cores. One half was then cleaned back with a spatula and sedimentary boundaries identified and measured. A photographic record was made of each section.

5.4 Core samples from three borehole locations (WS5, WS6 and WS9) in 2018 and from six locations in 2021 (WS12, WS16, WS17, WS18, WS19 and WS20) were retained unopened for more detailed recording and further analytical work, including sub-sampling for palaeo-environmental analysis and radiocarbon dating.

5.5 Five sub-samples from organic-rich deposits were submitted for AMS radiocarbon dating to the Scottish Universities Environmental Research Centre (SUERC) from which radiocarbon dates were successfully obtained, detailed in Table 3 below. Calibrated age ranges quoted were determined from the University of Oxford Radiocarbon Accelerator Unit calibration program OxCal4. The results from the radiocarbon dating are presented in Appendix 3. Calibrated date ranges quoted within the report are at 95.4% probability. Full details of the obtained dates are given in Appendix 2.

Table 3: Details of radiocarbon dates used within the current assessment.

Borehole	Sample depth (m) From	To	Laboratory code	Radiocarbon age	Calibrated date (95.4%)
WS9	2.92	2.97	SUERC-81035	3929 ± 27	2547-2307 calBC
WS12	3.9	3.96	SUERC-99016	4132 ± 21	2869-2585 calBC
WS12	2.9	2.95	SUERC-99020	3610 ± 19	2027-1900 calBC
WS20	3.88	3.88	SUERC-99021	4124 ± 24	2866-2580 calBC
WS20	2.35	2.4	SUERC-99022	2326 ± 24	416-236 calBC

5.6 A 2-D deposit model, based on the identification of correlating stratigraphic units from the lithostrategrahic data derived from both the geoarchaeological window sampled cores and from previous geotechnical borehole data was constructed using Golden Software's Strater program.

5.7 Seven vertical cross-sections were modelled at locations indicated in Fig. 5; five were orientated approximately NW-SE across the floodplain between extant channels of the River Nene and two were orientated approximately E-W along the approximate axis of the valley. While the geotechnical sediment logs give a reliable indication of the main sediment types encountered in the boreholes, they are less detailed in terms of sedimentological and pedological descriptions than the lithostratigraphical sequence recorded from the geoarchaeological cores.

5.8 A 3-D deposit model allowing the volumetric representation of key stratigraphic units was constructed using Golden Software's Voxler software. The results from the deposit model were displayed using ESRI's ArcMap GIS software.

6 RESULTS

Lithostratigraphic summary

6.1 The 16 geoarchaeological window sampled cores, along with the eleven geotechnical borehole logs, provide a reasonably detailed sedimentary history for the late Quaternary evolution of this portion of the floodplain. Core logs providing descriptions of the sedimentary sequence at a number of key locations (WS5, WS6, WS9, WS12 and WS20) are shown in Figs 6-10. The observed lithostratigraphy allowed the identification of seven main stratigraphic units, which are listed in Table 4 below.

Table 4: Classification of major sedimentary units encountered

Stratigraphic Unit		Lithology	Regional Stratigraphic unit
Unit 7		Topsoil.	Mid-Late Holocene alluvial deposits
Unit 6		Compact, silty clay sub-soil.	
Unit 5		Alluvial silts & clays, compact and homogenous over bank deposits.	
Unit 4	**c**	Dark fine-medium sand with shells. Can become gravelly.	
	b	Organic-rich alluvial silts & clays of somewhat variable composition with stem/wood/shell.	
	a	?Peat with wellpreserved woody fragments recorded in WS12 only.	
Unit 3		Dark greyish brown medium sand with shells. Ocassiaonally <20% small clasts.	Early Holocene?
Unit 2 undifferentiated	**b**	Dark medium sands with <50% poorly sorted quartzite clasts up to mid. pebble size.	
	a	Yellowy poorly sorted sand and gravel, ~70% large poorly sorted clasts, various lithologies.	Late Quaternary sub-alluvial/First Terrace sand and gravel.
Unit 1		Stiff, well compacted blue clay with cobbles.	Upper Lias clay of Jurassic age

6.2 Topsoil and sub-soil layers (Units 7 and 6) were fairly consistent across the 16 window sampled cores, as well as the earlier geotechnical cores; the two units reaching a depth of c.0.3m on average and typical of floodplain soils subject to frequent overbank flooding events.

6.3 Unit 5 is present in all of the window sampled cores, forming the main component of the upper sequence of floodplain sediments. These alluvial deposits of fine, unstructured silts and clays form compact, homogeneous deposits with very few inclusions. Typically, they take on a greenish grey hue at ~14m AOD, indicating their continued saturation below the water table. This unit is synonymous with sediments derived from episodes of overbank flooding, fining with distance from the primary channel flows. A possible palaeosol horizon was recorded in WS7 at 13.7mAOD.

6.4 Unit 4 represents a relatively complex suit of sediments rich in organic material deposited between 11.95-12.68mAOD, difficult to differentiate within core samples. The unit is predominantly characterised by a moderately compact silt (Unit 4b), often fining upwards and of a greenish black colour. The survival of discrete fragments of organic material within this unit is somewhat variable and, in most cases, subject to a degree of diagenetic degradation. In some instances, the deposit is succeeded by a layer of dark medium to fine sand containing small shell fragments (Unit 4c). In one instance (WS12) a thin layer of peat may have formed a basal deposit (Unit 4a) dating to 4132±21BP, although the window sample is dominated by a large fragment of Alnus sp. wood, making its depositional context difficult to define. Overall, the sediments making up Unit 2 are derived from former channel activity, their silting and in some cases brief reactivation, probably during flood events. Radiocarbon dates from suitable organic material show this phase of activity occurs between 2,869 – 236 calBC (see Table 3 above).

6.5 Unit 3 comprises typically a dark greyish brown medium to fine sand, often with an occasional clastic component. When interfacing with Unit 4, the boundary is usually abrupt. In WS8 this unit is interbedded with thin layers of silt and clay. It is taken to represent channel activity occurring during warming conditions at the Devensian/Holocene transition.

6.6 Unit 2 is comprised of poorly sorted and loosely compact sands and gravels of predominantly flint, quartzite and limestone lithologies forming the basal deposits recorded in all 16 window sampled cores. The overall depth of these deposits across the site is recorded by 11 geotechnical boreholes, reaching a thickness of 7.4m in the NW corner of the site. Within the geoarchaeological cores, only the uppermost portions of the deposit were sampled. The unit itself divides into an upper sub-unit (Unit 2b) comprised of a dark medium sand matrix with <50% flint and quartzite clasts up to mid-pebble size, typically 0.2m in thickness. It is likely this reflects conditions at the end of the Pleistocene/early Holocene and the development of a more stable surface over the gravels. The sandy, slightly silty, clayey composition may reflect the degraded remnants of an early soil.

6.7 The bulk of Unit 2 is recorded as a poorly sorted gravel comprising 60-70% sub-angular to sub-rounded clasts of predominantly quartzite, flint & occasionally sedimentary (shale/mudstone) reaching mid-pebble size within a yellowish-brown medium sand matrix. Clasts of a smaller size fraction are usually of angular to sub-angular forms of low sphericity. Weak horizontal bedding is occasionally observed. The unit represents late Pleistocene sub-alluvial gravels which also form the 1st Terrace sand and gravel deposits, and are more or less present throughout the Nene Valley.

6.8 Within the geotechnical boreholes, the sands and gravels of Unit 2 were found to give way to a compact deposit of blue clay (Unit 1) which often contained a significant quantity of cobbles. These deposits are ascribed to Upper Lias Clays laid down in the late Jurassic period.

2-D deposit models

5.8 The spatial distribution of the 17 boreholes used within the current investigation allowed seven vertical cross-sections to be reconstructed along a series of transects across the floodplain. The locations of the seven cross-sections are shown in Fig. 5 and the resulting sedimentary profiles depicted in Figs 11-17.

5.9 Cross-Section 01 (Fig. 11) crosses the westerly portion of the site. The surface ground level slopes to the NW from WS2 towards the extant channel bounding the site. Here Unit 5 overlies a wedge of organic-rich silts (Unit 4b), which may extend downslope to GT11 (as drawn). As these deposits commence at a relatively high elevation (c.13.76mOAD) reaching a height of c.14.11mAOD, this deposit might be considered to be chronologically later and probably relate to channel disturbance. Aerial images (for example Fig.5) appear to show the remnants of a waterlogged feature c.30m to the north of GT11, which would suggest relatively modern channel related activity at this location.

5.10 To the south of WS2, the surface of the sub-alluvial gravels (Unit 2) slops gently downwards before becoming relatively level. Beneath Unit 2, the depth of the Lias Clay (Unit 1) can be seen to be dipping to the north through the length of the profile, which probably reflects erosion of the clay surface by the high energy channels of the Late Pleistocene.

5.11 Towards the base of GT09 a layer of fine alluvial silts and clay can be seen at c.8.8mAOD, extending down to the upper surface of Unit 1. The deposition of finer material within the gravel sequence suggests warm stage channel activity and as such may date to the Late Glacial Interstadial c.14,670 to c.12,890 BP (see Pettitt & White, 2012).

5.12 Across the majority of the profile, fine alluvial silts Unit 5 seal the Pleistocene sands and gravels, reaching a maximum depth of 2.2m beneath GT08. This location is also at the highest elevation along this profile and its proximity to the extant channel flowing to the SW is likely responsible for the greater deposit depth of Unit 5 in terms of overbank sediment deposition.

5.13 Cross-Section 02 (Fig. 12) forms a parallel cross-section *c*.90m to the east. The surface of the sub-alluvial sand and gravels (Unit 2) dips sharply northward from WS5 before rising more gently towards WS7. The hollow is infilled with dark grey medium to coarse sand (Unit 3). Beneath WS6 the sands are intercalated with bands of greenish grey silty clay. The observed sequence is interpreted as a broad relic channel feature down cut into the basal gravels. The infilling sediments are very different from the organic-rich silts and clays of Unit 4 and it is suggested that the abandoned channel may date to the late Pleistocene/early Holocene boundary, as braided channel networks evolved towards more anastomosing planforms under changing climatic conditions. No fluvial structural elements were identifiable within the core sediments. By contrast, further channel activity with downcutting into the sub-alluvial gravels was recorded in WS4, although here the channel is infilled with organic-rich sediments (Unit 4) sitting on a thin lens of clay. The type of channel infilling is more typical of a low energy fluvial environment and likely to be of a later, Holocene date.

5.14 Cross-Section 03 (Fig. 13) represents a further NW-SE section through the floodplain. The NW section shows a downward sloping trend in the sub-alluvial gravels towards GT07, overlain by sand (Unit 3) and a thin layer of organic-rich silts (Unit 4). It is likely that this sequence represents a continuation of the northerly channel section hypothesised in section 5.3 above. As noted in Cross-Section 01, the Lias Clay (Unit 1) again seems to dip away to the north.

5.15 WS9 revealed a log sequence of organic-rich silts and clays consistent with channel infill deposits. Two sub-samples extracted from WS9 were subject to a preliminary assessment for macroscopic palaeoenvironmental remains and material suitable for radiocarbon dating – see Appendix 2. The lowermost sample contained a number of identifiable plant macrofossil remains and mollusc taxa, indicative of slow-moving water surrounded by a waste ground type habitat along the margins of the channel. A stem fragment sampled at 11.98m AOD yielded a C14 date of 4,497-4,257 calBP (95.4%) (SUERC-81035) - a sample submitted for dating from the top of the sequence failed due to insufficient carbon - see Appendix 2. This feature may be the continuation of the palaeochannel recorded in Cross-Section 02 (WS4).

5.16 Cross section 04 (Fig. 14) strikes a perpendicular path W-E through the centre of the site. The elevation of the sub-alluvial sands and gravels (Unit 2) reach their maximum elevation beneath WS5, sloping downwards towards GT06 before levelling out to the east some 0.5m lower. The elevation of the Lias Clay (Unit 1) is fairly constant within GT03 and GT06, falling beneath

GT09 at the location of Late Pleistocene channel activity discussed above.

5.17 There appears to be no evidence for down cutting from relic channels crossing the floodplain in a N-S direction, although core sample spacing is quite wide. At the western margin, a layer of organic-rich silts and clays (Unit 4) were recorded at WS1, indicative of former channel activity. As noted above (Section 5.9), the appearance of these sediments at this elevation is likely to represent channel/channel edge manipulation of a relatively recent date within the NW corner of the site. At the eastern extent of the cross-section, a sequence of sand, silts and organic-rich silts and clay cut into the sub-alluvial gravels of Unit 2 beneath WS19, suggesting the further intersection of a palaeochannel feature.

5.18 Cross-Section 05 (Fig.15) forms a N-S section through the eastern portion of the site. The current topography of the floodplain shows a slight rise in levels to the south, reflected in underlying sub-alluvial gravels (Unit 2), which then dip northwards from WS17. The underlying Lias Clay (Unit 1) also dips to the north, reaching its deepest point, suggesting erosion during the deposition of the late Devensian gravels.

5.19 Beneath WS18 dark medium sand is overlain with organic-rich sediments (Unit 4) and taken to represent an infilled channel feature. Sedimentary variations in late Pleistocene channel deposition are recorded beneath GT02 at the base of the sub-alluvial sands and gravels (Unit 2a), and within Unit 2a beneath WS17.

5.20 Cross-Section 06 (Fig.16) follows a similar orientation c.70m to the east. The extant topography of the floodplain slopes southward, largely reflecting the topography of the basal sub-alluvial gravels (Unit 2).

5.21 A thin layer of peaty material (Unit 2a) was recovered from the base of WS12 and a radiocarbon date from a large piece of wood of *Alnus* sp. dated to 4,819-4,535 calBC (SUERC-99016). The peat was overlain by dark grey medium sand and gravel. The basal portion of this deposit contained c.35% moderately sorted clasts of granule to small pebble size, while the upper portion became increasingly coarse, containing c.50% poorly sorted quartzite clasts. The sand and gravel deposits were in turn overlain with organic-rich silts and clays (Unit 2b). A second radiocarbon sample at the base of this unit returned a date of 3,977-3,850calBC (SUERC-99020). The sequence represents channel fill deposits which may indicate the reactivation of the channel sometime after its initial abandonment, a depositional phase spanning c.500 years if the peaty material at the base of the sequence represents in-situ deposition. No bed features were present within the sands and gravels deposited within the reactivated channel, although such features are generally not well preserved within window sampled sediments.

5.22 A sequence of channel infill deposits was also recorded beneath WS19 c.50m to the south. Here basal deposits of medium homogeneous sand are followed by silty clays becoming increasingly organic-rich (Unit2b). It is proposed that these channel infill deposits form a continuation of those recorded beneath WS12; the reconstructed cross-section intersecting the palaeochannel feature obliquely – this is how the sediments are represented in Fig. 16.

5.23 Finally, Cross-section 07 (Fig. 17) reconstructs a transect W-E through the NE corner of the site. While the surface of the extant floodplain is relatively flat through the section, there is a slight dip in the surface of the underlying sub-alluvial gravels beneath WS16. The basal deposits of Lias Clay (Unit 1) picked up by the geotechnical cores are also fairly level across the profile. An overlying layer of dark gravelly sand (Unit 3) may taper down from the west to WS16. Beneath GT05 it likely represents a continuation of the channel sands recorded to the west in GT07 and WS07, and the dip in the gravels beneath WS16 may further reflect the position of the late Pleistocene/early Holocene channel.

5.24 Beneath WS20 a thick sequence of organic-rich silt and clays (Unit 4b) are interpreted as the infill of a palaeochannel cut into the underlying gravels (Unit 2). A radiocarbon date from the base of this sequence indicates its inception from 4,816-4,530 calBP (SUERC-99021), while organic material from the top of the sequence returned a date of 2,366-2,186 calBP (SUERC-99022). The dates suggest channel siltation took place over an extended period of c.2,630 years. The deposits are interpreted as indicating either the lateral migration of the primary channel, presently located c.20m to the east, or simply its contraction and deepening as a result of accelerated bank aggradation.

5.25 Palynological assessment of Unit 4 in WS20 indicates an open contemporary landscape dominated by grassland, which was probably utilised as pasture (Langdon and Scaife, Appendix 1). Cereal cultivation was also probably important locally, although this may have a more complex taphonomy, such as fluvial transport from areas upstream. Assessment of macroscopic palaeoenvironmental remains (plant macrofossils and molluscs) suggests a slow-moving channel set within an open environment (Summers, Appendix 2), which is comparable to the data from WS9. Rough waste ground habitats may have predominated on the channel margins, while there was also evidence for grassland habitats, which supports the pollen data.

Topographic and volumetric deposit models

5.26 Three additional deposit models were constructed, modelling the underlying topography of Unit 2 beneath the extant floodplain and the volumetric distribution of coarser sand deposits (Unit 3), and organic-rich silts and clays (Unit 4).

5.27 The topographical model of the upper surface of Unit 2b is shown in Fig. 18. The sub-alluvial sand and gravel formations can be seen to form an irregular ‘V’ shaped ridge within the centre of the site, deepening towards the margins of the site in most cases. There are marked dips in the gravel surface in the vicinity of WS9, WS12 and WS20 as a result of down-cutting by a former channel. Similarly, Unit 2b deepens along the NW margins of the site, again as a result of down cutting by late Pleistocene/early Holocene channel activity. As noted above, in the early/mid-Holocene topographically elevated portions of the floodplain would have formed relatively stable ‘islands’ upon the floodplain, and within the Nene Valley similar settings have been found to be a focus for Mesolithic activity. The implication for the site at Warmington is discussed below.

5.28 A representation of the volumetric distribution of Unit 3, comprising of a greyish brown medium sand is shown in Fig. 19. The deposit is deepest along the northern margins of the site, where it is interpreted as the upper fill within an infilled channel forming part of a former braided network of channels at the end of the Pleistocene. A thin deposit of sandy material, classified as Unit 3 was also recorded at the base of the later (Holocene) palaeochannel recorded beneath WS18. Here this may well represent the remnants of channel bed deposits.

5.29 A representation of the volumetric distribution of Unit 4, comprising diverse deposits organic-rich sands, silts clays and possible peat horizon, is shown in Fig. 20. Deposits are predominantly associated with channel infill and the distribution of sediment volume is useful in reconstructing the likely position of former channels upon the floodplain.

5.30 A reconstruction of the location of the late Devensian channel along the northern boundary of the site and the Holocene channel crossing the SE corner of the site are shown in Fig. 21. The latter may have originally connected to the primary channel at a location that exists today as a cuff-off section, but which formed a tight meander in the river as late as the last century. This feature is clearly visible in aerial imagery and appears on recent maps.

6 CONCLUSIONS

6.1 The window sample cores, in conjunction with earlier geotechnical boreholes, have allowed an evaluation of the sedimentary history of the site from the late Pleistocene. A study of this type is necessarily limited in terms of spatial resolution, and the low volume and nature of sediment recovery. The detailed recording of intra-unit and inter-unit sedimentary features such as fluvial bed forms and palaeo land surfaces is therefore inferior to those obtained from exposed sections, such as might be encountered in worked quarry faces.

6.2 Along the northern portion of the site, sandy infill deposits (Unit 3) suggest deposition and the reworking of gravels at least around the margins of the site into the late Devensian/Early Holocene. Given the age of the sub-alluvial gavels, deposited between c.28,000 BP and the end of the Devensian, there is little chance of Upper Palaeolithic sites surviving undisturbed upon the floodplain, although redeposited material from this and earlier periods might be recovered. The full-thickness of these gravels is only revealed in the geotechnical boreholes, and while some morphological features relating to late Devensian channel activity were recorded, such as possible Late glacial (Windermere) interstadial deposits recorded in GT09, floodplain hydrology at this time is not well understood.

6.3 The Holocene seems to have initially ushered in a period of relative stability, with minimal fluvial activity and no clear evidence of deposition and channel change, and primary channels existing more or less in their current locations. In common with other reaches in the Nene Valley a more complex network of secondary channels is likely to have existed at this time and the investigation identified the existence of one such channel flowing across the SE corner of the site. While no conclusive sedimentary evidence was found to support the development of a stable land surface over the sub-alluvial gravel Unit, such as the presence of palaeosols, the increased organic input and sandy nature of the upper portions of this unit (Unit2b), are suggestive of the remnants of soil development subject to processes of pedogenic disturbance and bioturbation.

6.4 The main archaeological potential for the site is likely to rest on this period of relative fluvial stability during the early Holocene, allowing the development of stable land surfaces over the elevated gravel ‘island’ between channels in the centre of the site. Similar locations within the Nene Valley, such as sites along the reach from Raunds and Stanwick have revealed extensive Mesolithic activity during this period. Within the relatively stable fluvial regime, albeit comprising of a more complicated channel pattern, little or no seasonal flooding was likely to have taken place over these elevated areas. At Raunds the development of Alder woodland on the floodplain during the early Holocene is well attested from pollen records, with the drier islands possibly supporting oak, lime and hazel. A larger number of shallow channels would have provided more water edge habitat concentrated within a smaller area of the floodplain, likely to provide an important hunting and fishing resource.

6.5 By the late Neolithic the channel running through the SE portion of the site had begun to silt up, signalling hydrological changes that were at least in part likely to have been brought about by anthropogenic activity on the floodplain, such as woodland clearance. Wider changes in the catchment, including vegetation clearance and the expansion of cultivation would also have contributed to the initiation of overbank flooding and deposition. Pollen assessment indicates an open contemporary landscape dominated by grassland, likely representing pasture (Langdon and Scaife, Appendix 1). Cereal cultivation was also probably important locally, although this may have a more complex taphonomy. The apparent openness of the landscape is incongruous for the Neolithic when woodland was dominant over the region. However, multiple dates from the deposits indicate the same inception of siltation. Assessment of macroscopic palaeoenvironmental remains suggests a slow-moving channel set within an open environment (Summers, Appendix 2), consistent with gradual channel abandonment. By c.236 calBC, the channel was sealed with alluvial silt and clay.

6.6 Extensive late Neolithic/Bronze Age settlement activity is known in the Warmington area. Most is in the form of funerary evidence (Wilson, 2015), comprising of round barrows and pit alignments recorded in a field commencing *c.*100m to the north of the site (NHER 128556; 128557; 128558 and NHER 6750). These sites occupy the distal end of a narrow tongue of sand and gravel deposits forming the 1st Terrace, extending south-eastwards from Fotheringhay and broadly following the 20m contour. The location is likely to have represented an area of elevated ground in close proximity to the northerly channel, which may have precluded the construction of monuments on the gravel plateau. The location of funerary monuments close to channel junctions has been noted elsewhere on the Nene floodplain (Keevill, 1992), and may reflect the liminality of such locations in terms of access and proximity to the river. The southern and eastern borders of the site are similarly flanked by elevated sand and gravel deposits belonging to the 1st Terrace and further clusters of funerary sites are known. Approximately 540m to the east, cremations and a grave forming a probable late Neolithic or early Bronze Age cemetery (NHER 141156) and a crouched inhumation buried with a Beaker urn, flint knife, flakes, an arrowhead and jet buttons was excavated c.250m to the south of the site along the A605 (NHER 142611).

6.7 In the Raunds area, extensive Bronze Age monument creation does occur on elevated 'gravel island' floodplain locations, suggesting these areas were still upstanding. Here significant forest clearance seems to have been initiated sometime after 2,490 calBC. As noted above, palaeoenvironmental data from Warmington suggests that the landscape was also open at this time, although there is currently no evidence of Bronze Age funerary activity on the floodplain itself.

6.8 During later periods it appears that settlement continued to be concentrated upon elevated terraces to the north and south of the river exploiting the lighter, better drained soils, with the active floodplain likely being utilised as seasonal pasture within a mixed agricultural regime. Similar comparable settlement patterns have been identified at several locations in the Nene Valley, such as Grendon and Wollaston. Cropmarks and possible ring ditches *c.*600m to the south, towards Warmington village, may represent Iron Age occupation (NHER 128510) and there is further evidence of Iron Age activity from excavations on the Elton Estate (Barlow 2008). In a period of agricultural intensification, it is likely that the floodplain zone formed an important grazing resource.

6.9 Within the Nene Valley, increasing overbank alluviation is recorded and the data suggests greatly accelerated alluviation from the Saxon period onwards (Brown, 2004), as channels continued to deepen and contract due to bank aggradation. It seems reasonable to infer that a substantial proportion of the alluvial deposits that blanket the site are of medieval origin. The processes that generated the increased sediment supply must have taken place upstream in the wider catchment, probably relating to the expansion of intensive agricultural cultivation, although climatic factors might also have come into play. The test pit excavations in the Phase 1 area of the site did not provide any additional data to characterise or date these deposits (Appendix 3).

6.10 In summary, floodplain development along this reach of the Nene during the Holocene appears similar to other sites investigated in the valley. The underlying fluvial processes were driven by the development of anastomosing channel systems from an initial braided-river topography and subsequent simplification towards single or bi-channel systems as a result of floodplain and channel siltation (see Brown et al., 1994).

6.11 The test pitting and sieving exercise was found not to be successful on the types of deposit present at the site and no artefactual remains were recovered (Appendix 4).

7 DEPOSITION OF THE ARCHIVE

7.1 Archive records, with an inventory, will be deposited with any donated finds from the site at Northampton Museum. The archive will be quantified, ordered, indexed, cross-referenced and checked for internal consistency.

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APPENDIX 1
Elton, Northants: Pollen assessment analysis

Dr C. T. Langdon and Dr R.G. Scaife

Introduction

Samples for pollen analysis from this palaeo-channel of the Nene have been examined to ascertain if sub-fossil pollen and spores are preserved in this sediment and if so, to provide some preliminary information on the vegetation and environment at the time of deposition. Preservation was found to be generally poor due to the minerogenic and alluvial origin of the sediment. However, enough pollen has been obtained to produce a preliminary pollen diagram. The pollen assemblage obtained is dominated by herb pollen with negligible numbers of trees and shrubs demonstrating an open and agricultural landscape. Radiocarbon measurements/dates have been obtained from the upper and lower parts of the profile and are discussed and a preliminary interpretation of the pollen data is given.

Method

Standard techniques for pollen concentration of the sub-fossil pollen and spores were used on these (12) sub-samples of 1.5 ml. volume (Moore and Webb 1978; Moore *et al*. 1992). For this assessment, a sum of 200-250 pollen grains per level were identified and counted. This was total pollen and as such included wetland/marsh elements (largely Cyperaceae). Fern spores and other miscellaneous elements were, however, counted outside of this total pollen sum. A pollen diagram (Figure 1) was produced using Tilia and Tilia Graph with percentages calculated as follows.

Sum =	% total dry land pollen
Marsh/aquatic herbs =	% tdlp + sum of marsh/aquatics
Spores =	% tdlp + sum of spores
Misc. =	% tdlp + sum of misc. taxa.

Taxonomy in general follows that of Moore and Webb (1978) modified according to Bennett *et al.* (1994) for pollen types and Stace (1991) for plant descriptions. An extensive pollen comparative collection was available. These procedures were carried out in the Palaeoecology Laboratory of the School of Geography and Environment, University of Southampton.

The Pollen data

Pollen preservation was in general, poor which is not unusual for minerogenic, alluvial sediment. However, enough pollen was concentrated to allow the construction of a pollen diagram (figure 1) from which interpretations of the past vegetation and environment have been made. Overall, the pollen assemblages are dominated by herbs with few tree and shrub pollen. There is little stratigraphical variation in the pollen sequence other than an expansion of Lactucoideae (dandelion types) in the upper levels which is a function of differential preservation in favour of this robust taxon. This was likely due to degradation caused by a fluctuating water table in the upper profile. The palynological characteristics are given below

i.) Trees and shrubs: As noted, arboreal and shrub pollen is subordinate to that coming from herbs. These include consistent but low values of *Betula* (1-2%), *Pinus* (<1%), *Quercus* (to 5%), (*Alnus* 7%) and *Corylus avellana* type. The latter has higher values (to 10%) in the lower levels (2.85-2.95m). Other taxa which occur sporadically are *Ulmus, Populus, Tilia, Fraxinus, Fagus* and *Salix*.

ii.) Herbs: Herbs are dominated by Poaceae (to 65%) with important values of *Plantago lanceolata* (to 16%) and Lactucoideae. The latter becomes more important at the top of the profile (to 18% at 2.24m). Cereal type (to 15%), *Ranunculus* (7%), Chenopodiaceae (peak to 6%) and *Rumex* are of note. Overall, the herb assemblages are diverse and include a range of taxa occurring individually/sporadically.

iii.) Marsh: Alnus and *Salix* are noted above under trees and shrubs. Marsh/fen taxa are dominated by Cyperaceae (peak to 20% at 2.30m) with *Typha angustifolia/Sparganium* type (5-6%). There are occasional aquatic macrophyte pollen including *Nuphar, Myriophyllum spicatum* and *Potamogeton* type. Other marginal aquatic include *Sagittaria sagittifolia*, *Littorella uniflora* and *Caltha* type.

iv.) Ferns: There are limited numbers of spores of Pteridophytes. These include consistent but low values of *Pteridium aquilinum* (to 5%) and monolete form *Dryopteris* type (1-3%) and occasional *Polypodium.* There is a single record of *Botrychium lunaria.*

v.) Miscellaneous: These comprise algal *Pediastrum* (3% in upper sample), occasional liverwort spores and reworked pre-Quaternary palynomorphs.

Discussion

Two radiocarbon dates have been obtained which appear to show that the sediment sequence spans the period from the late Neolithic to the Iron Age. That is, a basal age of 4,124+/-24 BP (SUERC-99021) at 3.88m and 2,326 +/-24 BP (SUERC-99022) at 2.35-2.40m.

Overall, the pollen assemblages are consistent throughout and are dominated by herb pollen with substantially less representation of trees and shrubs. This implies a largely open landscape at least in proximity to this sample site. Grasses (Poaceae) are dominant and along with a range of other taxa, notably ribwort plantain (*Plantago lanceolata*), Lactucoideae (dandelion types) and buttercups (*Ranunculus* type) strongly demonstrate grassland, probably pasture. There is, however, also a strong representation of cereal pollen which, along with pollen of some typical segetal plants is indicative of arable agriculture. It can be noted that arable related pollen is less well represented in pollen spectra than are those of pastoral habitats. Because the pollen described here comes from the fills of a palaeochannel, it must be considered that there is a complex taphonomy with pollen having been fluvial as well as from normal airborne vectors. Thus, the regions of cereal cultivation or possible cereal processing activities releasing pollen may have lain further upstream. These data do suggest that a mixed agrarian economy existed during the time-span represented by the sediment archive.

As noted, this sequence has been dated to 4,124+/-24 BP (SUERC-99021) at 3.76m that is, the Neolithic at the base and to 2,326 +/- at 24BP (SUERC-99022) at the top of the sequence. This is a substantial time-span for a somewhat thin, and minerogenic accumulation. If these radiocarbon measurements are accepted, it appears that by the middle-Late Neolithic period, the environment at least locally, had been cleared of woodland and that subsequently until the early Iron Age, there were no changes in the local vegetation and environment. These data are somewhat incongruous compared with the known sequences from eastern and southern England where, during the late-prehistoric period until the middle Bronze Age (commonly) lime (*Tilia*) woodland was dominant on better drained soils with oak (*Quercus*) and hazel (*Corylus*) remaining important in edaphically suited conditions. That is, after the demise of elm (*Ulmus*) woodland during the early Neolithic through fungal pathogens transported by insect vectors. Overall, the pollen data here are more akin to the expected more open agricultural environment of the late-Bronze Age onwards. That is, being commensurate with the date for the upper levels of the profile.

The depositional environment: Throughout the profile, there is relatively strong evidence of a wetland, grass-sedge dominated environment. Other fen taxa recorded include *Typha angustifolia* and/or *Sparganium* (bulrush and/or bur-reed), *Sagittaria sagittifolia* (arrowhead) and *Osmunda regalis* (The Royal Fern). There is also evidence of standing water with aquatic macrophytes including *Nuphar luteum* (yellow water-lily), *Myriophyllum spicatum* (water milfoil), *Potamogeton* type (pond weed but may also include water arrow grass) and algal *Pediastrum*.

S*ummary and conclusions*

The following principal points have been made in this evaluation study.

This study sought to establish is sub-fossil pollen and spores are present in the sediment taken from the palaeochannel and if so potential for vegetation and environmental reconstruction.

The study successful with pollen recovery from all of the twelve samples analysed allowing identification, pollen counts and construction of a pollen diagram.

The pollen spectra are homogeneous throughout being dominated by herbs with lower numbers of trees and shrubs.

The depositional habitat of the sediment was on of wet herb fen (grasses, sedges and other marginal aquatic plants) with evidence of standing/slow flowing water with aquatic macrophytes.

The pollen spectra show a strong agricultural environment. Pasture from the high levels of grass pollen and other associated grassland herbs such as ribwort plantain, buttercup type and dandelion types. Cereal pollen and associated segetals are also present and as these are usually underrepresented in pollen spectra compared with pastoral indicators, it is suggested that arable activity was locally important. However, the taphonomy may also have played a role with pollen possible coming from secondary sources such as crop processing and/or fluvially transported from up stream.

Some questions are raised regarding the apparent Neolithic basal date for the base of the profile. The apparent openness of the landscape at this time is incongruous for a period when woodland was dominant over the region. Additional radiocarbon dating may elucidate this.

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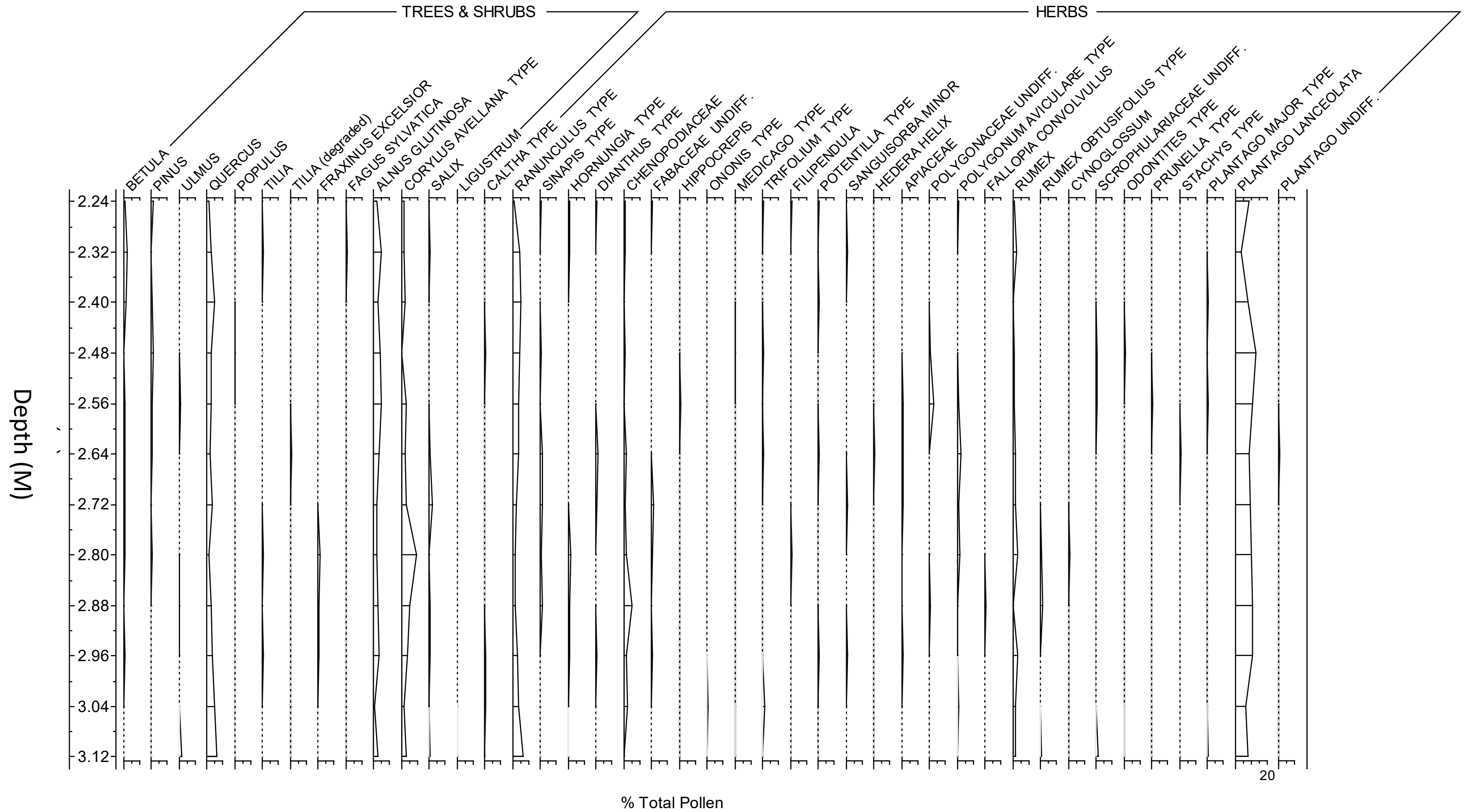
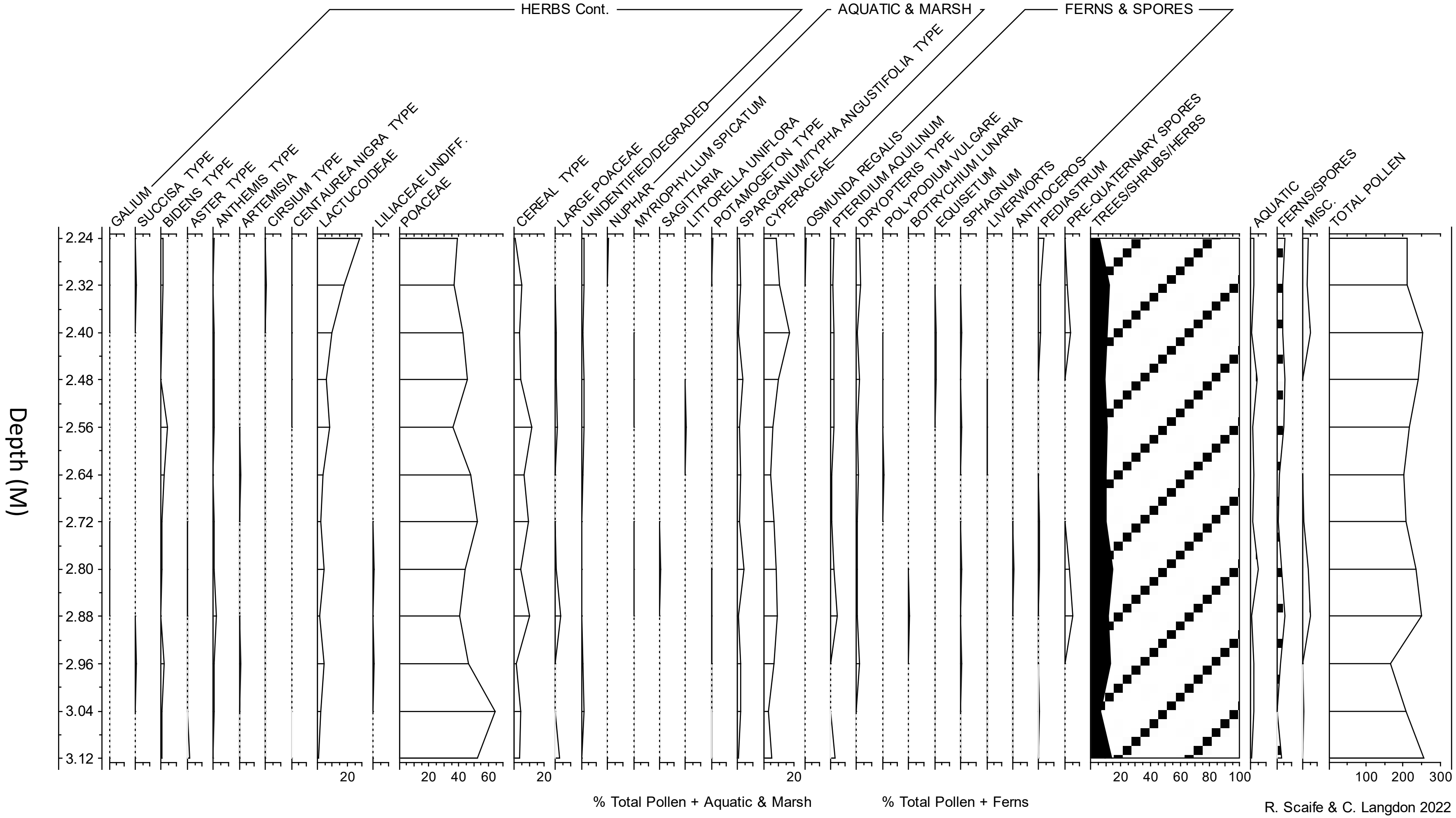


Elton, Northants Cont.



APPENDIX 2

Elton 2, Warmington (P6422)

Assessment of macroscopic palaeoenvironmental remains from the C14 sub-samples

Dr John Summers

Introduction

A sequence of bulk samples for environmental macrofossil assessment were taken from WS20 to complement the geoarchaeological and palynological investigations. The assessment was carried out using 5cm blocks of sediment spaced at 5cm intervals. The aim of the assessment was to determine the nature of preservation of ecofactual macrofossil remains within the sediments and to provide any additional palaeoenvironmental information.

In addition, two sub-samples of sediment were extracted from WS9 for the purpose of recovering material for AMS radiocarbon dating. During this process, the opportunity was taken to make a preliminary assessment of the material for plant macrofossil and mollusc remains in order to gain an understanding of organic preservation within the channel deposit.

Methods

Samples were processed at the Archaeological Solutions Ltd facilities in Bury St. Edmunds using the washover flotation method. The light fractions and heavy fractions were recovered using 500μm (micron) laboratory sieve. The resulting material was stored in clean water and examined under a low power stereomicroscope (x10 – x30 magnification) while wet. Identifications were made using reference literature (Cappers *et al.* 2006; Jacomet 2006; Kerney and Cameron 1979; Kerney 1999) and a reference collection of modern seeds was available as necessary.

Results

WS20

The data from the WS20 bulk samples are presented in Table 5. The basal sample from 3.75-3.88m was relatively small in volume and contained only a small number of identifiable remains. The sample also contained herbaceous stems/ roots, including mosses (Bryophyta). Molluscs included aquatic taxa

Pisidium sp. and *Planorbis* sp.

The samples from 2.55m to 3.00m were the richest for plant macrofossil remains. Two types of pondweed (*Groenlandia densa* and *Zannichellia palustris*) were identified, which occupy a range of aquatic habitats. A single seed of yellow water lily (*Nuphur lutea*) was recorded at 2.85-2.90m. Other plants which occupy the margins of ponds and rivers were probable water-plantain (*Alisma* cf. *plantago-aquatica*) and narrow-leaved water-plantain (*Alisma* cf. *lanceolatum*), and common club-rush (*Schoenoplectus lacustris*).

Taxa indicative of waste ground were also recorded, including common nettle (*Urtica dioica*), black bindweed (*Fallopia convolvulus*), dock (*Rumex* sp.), fat-hen (*Chenopodium album*) and other goosefoot (*Chenopodium* sp.) and oraches (*Atriplex* sp.), hemp nettle (*Galeopsis* sp.) and prickly sowthistle (*Sonchus asper*). A single seed of bramble (*Rubus* sp.) at 2.75-2.80m suggests scrub as well. These likely represent rough vegetation on the margins of the channel. In addition, grassland habitats were indicated by meadow/ bulbous buttercup (*Ranunculus acris/ bulbosus*), hairy buttercup (*Ranunculus sardous*), hawkbit (*Leontodon* sp.) and grasses (Poaceae).

Herbaceous stems/ roots were common throughout, along with small amounts of moss (Bryophyta). Pondweed (Potamogetonaceae) was present at 2.95-3.00m

A relatively small range of aquatic molluscs was present between 2.55m and 3.00m, in the form of *Pisidium* sp., *Valvata cristata* and *Valvata piscinalis*. The latter *Valvata* species are indicative of slow flowing or still water with rich vegetation and muddy substrates. These samples also contained detached opercula, which were generally more frequent than identifiable shells. Arthropod remains were present in the majority of samples between 2.55m and 3.00m, being recorded as common at 2.55-2.60m and 2.95-3.00m. These were not identified as part of the assessment. A single small mammal scapula at 2.75-2.80m is probably from the bankside fauna.

The upper samples between 2.25m and 2.50m suggest increasingly terrestrial conditions, with fewer marsh/ aquatic taxa, although the upper samples were less rich than those from lower in the profile, probably as a result of poorer preservation within a fluctuating water table. Samples between 2.35m and 2.50m contained meadow/ bulbous buttercup (*Ranunculus acris/ bulbosus*), thistles (*Carduus/ Cirsium* sp.) and grasses (Poaceae) indicative of grassland habitats. Individual specimens of common club rush (*Schoenoplectus lacustris*) and probable narrow-leaved water-plantain (*Alisma* cf. *lanceolatum*) were present at 2.45-2.50m. The upper sample (2.25-2.30m) contained only a single sedge (*Carex* sp.) nutlet, which can be part of rough wet grassland communities.

Mollusc shells were also infrequent between 2.25m and 2.50m, with a small number of *Planorbis planorbis* at 2.35-2.40m. This common aquatic species is also able to tolerate seasonal desiccation. Arthropod remains were present between 2.35m and 2.50m but were not identified.

<u>WS9</u>

The assessment data from the sub-samples from WS9 are presented in Table 6. Preservation in the two sub-samples was very different, with much fewer identifiable remains present in the upper portion of the deposit (Sample 1) than at the base (Sub-Sample 2).

Sub-Sample 1 from the uppermost channel deposits in WS9 (2.04-2.09m) contained only a small concentration of indeterminate stem/ root fragments. In addition were a small number of insect remains and fragments of mollusc shell.

Sub-Sample 2 from the base of the channel deposits in WS9 (2.92-2.97m) were richer and displayed better preservation. This is likely due to the greater depth into the water table, leading to more stable anaerobic conditions. Small stem/ root fragments were most common among the plant macrofossil remains. Most were indeterminate, although some could be identified as pondweed (Potamogetonaceae). Also present were small fragments of waterlogged wood and insect remains.

A number of identifiable seeds were present. These included aquatic plants, such as pondweed (*Potamogeton* sp.), wetland or wet ground taxa, such as wood dock (*Rumex* cf. *sanguineus*), common club-rush (*Schoenoplectus* cf. *lacustris*) and water plantain (cf. *Alisma* sp.), and plants of waste ground habitats, such as narrow-leaved pepperwort (cf. *Lepidium ruderale*). With the exception of pondweed, these are likely to represent plants growing on the margins of the channel. This is comparable to the pattern identified in WS20.

A range of mollusc taxa were present in Sub-Sample 2. These were all aquatic or semi-aquatic types. The majority (e.g. *Acroloxus lacustris, Blithynia tentaculata, Blithynia leachii, Gyraulus albus* and *Gyraulus crista*) have a preference for slow-moving well oxygenated water. This range of shells was larger than from WS20 but indicates similar conditions.

<u>WS12</u>

A sample for AMS radiocarbon dating was also processed from WS12 at 2.90-2.95m. Observations of the basal material from WS12 indicated good organic preservation, with wood fragments, herbaceous stems/ roots, seeds, molluscs, insects and ostracods noted.

In addition to the samples, a large piece of waterlogged wood was examined at the base of the channel deposits in WS12 (3.77-3.96m). The wood was identified as alder (*Alnus* sp.) and had been cut through by the window sample tube to produce a cylindrical plug of wood. It was not possible to examine the ring pattern in detail but it was possible to determine that the wood had been lying horizontally and that both sapwood and heartwood were present. The wood had a minimum diameter of 19cm but it is highly likely that this had been subject to compression, both from overlying deposits and as a result of the force from the percussion corer. The wood was probably a fallen tree, most likely from local alder carr woodland, which had been incorporated into the channel deposits during its silting.

<u>C14 samples</u>

Waterlogged herbaceous material was submitted to the Scottish Universities Environmental Research Centre (SUERC), Glasgow, for AMS radiocarbon dating from WS9 at 2.04-2.09m (Failed – Lab code GU48508) and 2.92-2.97m (SUERC-81035).

Unidentified wood fragments were also submitted from WS12 at 2.90-2.95m (SUERC-99020) and WS20 at 2.35-2.40m (SUERC-99022). Hand collected alder wood (*Alnus* sp.) was submitted from WS20 at 3.88m (SUERC-99021). Sapwood from Alder wood at the base of WS12 (3.96m) was also submitted to obtain the earliest possible date (SUERC-99016) from the channel fill.

Conclusions

The remains from WS20 demonstrate anaerobic preservation of organic remains throughout the channel fill in WS9, in addition to other palaeoenvironmental remains (arthropods and molluscs).

The remains from the basal portion of the deposit (2.55-3.00m) are consistent with an environment of slow-moving freshwater. Some of the plant macrofossils were derived from wet and waste ground habitats on the margin of the channel, with evidence for grassland also identified. This is also demonstrated by the basal sample from WS9 and is consistent with the results of the pollen assessment (Langdon and Scaife, Appendix 1). The upper portion of the deposit (2.25-2.50m) suggests a drier local environment, perhaps with grassland dominating, although the evidence was limited.

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Table 5: Palaeoenvironmental macrofossil remains from WS20

Sample depth	**2.25-2.30m**	**2.35-2.40m**	**2.45-2.50m**	**2.55-2.60m**	**2.65-2.70m**	**2.75-2.80m**	**2.85-2.90m**	**2.95-3.00m**	**3.75-3.80m**
Date	**-**	**2366-2186calBP (SUERC-99022)**	**-**	**-**	**-**	**-**	**-**	**-**	**~4816-4530calBP (SUERC-99021) @ 3.88m**
Sample weight (g)	**133**	**135**	**134**	**121**	**133**	**136**	**149**	**128**	**40**
Seeds/ fruit:									
Nuphar lutea (L.) Sm. - Yellow water-lily	-	-	-	-	-	-	1	-	-
Ranunculus acris/ bulbosus L. - Meadow/ bulbous buttercup	-	2	2	-	3	1	1	2	-
Ranunculus sardous Crantz - Hairy buttercup	-	-	-	-	-	1	-	-	-
Rubus sp. L. - Bramble	-	-	-	-	-	1	-	-	-
Urtica dioica L. - Common nettle	-	-	-	-	-	-	-	1	-
Fallopia convolvulus (L.) A.Love - Black-bindweed	-	-	-	-	1	-	-	-	-
Rumex sp. L. - Dock	-	-	-	-	1	-	1	-	-
Chenopodium album L. - Fat-hen	-	-	-	-	-	-	1	-	-
Chenopodium sp. L. - Goosefoot	-	-	-	-	4	-	2	-	-
Atriplex sp. L. - Oraches	-	-	-	-	1	-	-	1	-
Galeopsis sp. L. - Hemp-nettle	-	-	-	-	-	-	1	-	-
Lamiaceae - Dead nettle family	-	-	-	-	-	-	-	1	-
Carduus/ Cirsium sp. - Thistle	-	2	2	-	-	-	-	-	1
Leontodon sp. L. - Hawkbit	-	-	-	-	-	-	1	-	-
cf. *Scorzonera* sp. L. - Viper's grass	-	-	-	-	-	-	1	-	-
Sonchus asper (L.) Hill - Prickly sowthistle	-	-	-	-	-	-	1	-	3
Oenanthe cf. *aquatica* (L.) Poir. - Fine-leaved water-dropwort	-	-	-	-	-	-	2	-	-
Alisma cf. *plantago-aquatica* L. - Water-plantain	-	-	1	1	-	-	4	-	-
Alisma cf. *lanceolatum* With. - Narrow-leaved water-plantain	-	-	-	-	1	-	3	1	-
Groenlandia densa (L.) Fourr. - Opposite-leaved pondweed	-	-	-	-	1	1	-	1	2
Zannichellia palustris L. - Horned pondweed	-	-	-	-	-	-	1	-	1
Schoenoplectus lacustris (L.) Palla - Common club rush	-	-	1	5	9	8	5	2	-
cf. *Carex hirta* L. - Hairy sedge (urticle)	-	-	-	-	-	1	-	-	-

Carex sp. L. - Sedge	1	-	-	-	-	-	-	-	-
Poaceae indet. - Grass (large)	-	1	-	-	-	-	2	-	-
Poaceae indet. - Grass (medium)	-	1	1	1	2	1	-	-	-
Poaceae indet. - Grass (small)	-	-	-	-	-	-	1	-	-
Other remains:									
Herbaceous stems/ roots	XX	-	XX	XX	XX	XX	XX	XX	XX
Moss (Bryophyta)	-	-	X	X	X	X	X	X	X
Pondweed (Potamogetonaceae)	-	-	-	-	-	-	-	X	-
Wood	-	X	-	X	-	-	X	X	-
Arthropods	-	X	XX	XX	X	X	-	XX	-
Small mammal bone	-	-	-	-	-	1 (scapula)	-	-	-
Fish scale	-	-	-	-	-	X	-	-	-
Molluscs:									
Pisidium sp.	-	-	-	-	-	-	X	XX	X
Planorbis planorbis	-	X	-	-	-	-	-	-	-
Planorbis sp.	-	-	-	-	-	-	-	-	X
Valvata cristata	-	-	-	-	-	-	-	XX	-
Valvata piscinalis	-	-	-	-	X	X	X	XX	-
Detached opercula	-	-	-	X	X	XX	XX	XX	X

X = present
XX = common
XXX = abundant

Table 6: Results from the assessment of the sub-samples taken from WS9 for the recovery of material for AMS radiocarbon dating

Site code	**Sample number**	**Core**	**Depth**	**Waterlogged seeds**		**Molluscs**		**Other remains**
				Seeds	Notes	Molluscs	Notes	
P6422	1	WS9	2.04-2.09m	-	-	X	Fragments + detatched opercula	Indet. Stems/ roots (X), Insects (X)
P6422	2	WS9	2.92-2.97m	XX	*Rumex* cf. *sanguineas* (1), cf. *Alisma* sp. fruit (1), cf. *Lepidium ruderale* (1), *Potamogeton* cf. *angustifolius* (1), *Potamogeton* sp. (1), *Schoenoplectus* cf. *lacustris* (3)	XX	*Acroloxus lacustris* (3), *Blithynia leachii* (6), *Blithynia tentaculata* (3), *Gyraulus albus* (1), *Gyraulus crista* (2), *Pisidium* sp. (9), *Succinea/ Oxyloma* sp. (5)	Indet. Stems/ roots (XX), Pondweed (X), Insect (XX), Insect larva (X), Fish bone (1), Fish scales (2), Wood fragments (X)

APPENDIX 3

SUERC C14 results

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Director: Professor F M Stuart Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE
15 August 2018

Laboratory Code	GU48508
Submitter	Jennifer O'Toole Archaeological Solutions Ltd 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	P6422
Context Reference	WS9 2.04-2.09m
Sample Reference	1
Material	Waterlogged stems/ roots
Result	Failed due to insufficient carbon.

N.B. Any questions directed to the laboratory should quote the GU coding given above.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Checked and signed off by : P. Naysmith

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RADIOCARBON DATING CERTIFICATE
15 August 2018

Laboratory Code	SUERC-81035 (GU48509)
Submitter	Jennifer O'Toole Archaeological Solutions Ltd 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	P6422
Context Reference	WS9 2.92-2.97m
Sample Reference	2
Material	Waterlogged stems/ roots
$\delta^{13}C$ relative to VPDB	-28.0 ‰
Radiocarbon Age BP	3929 ± 27

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

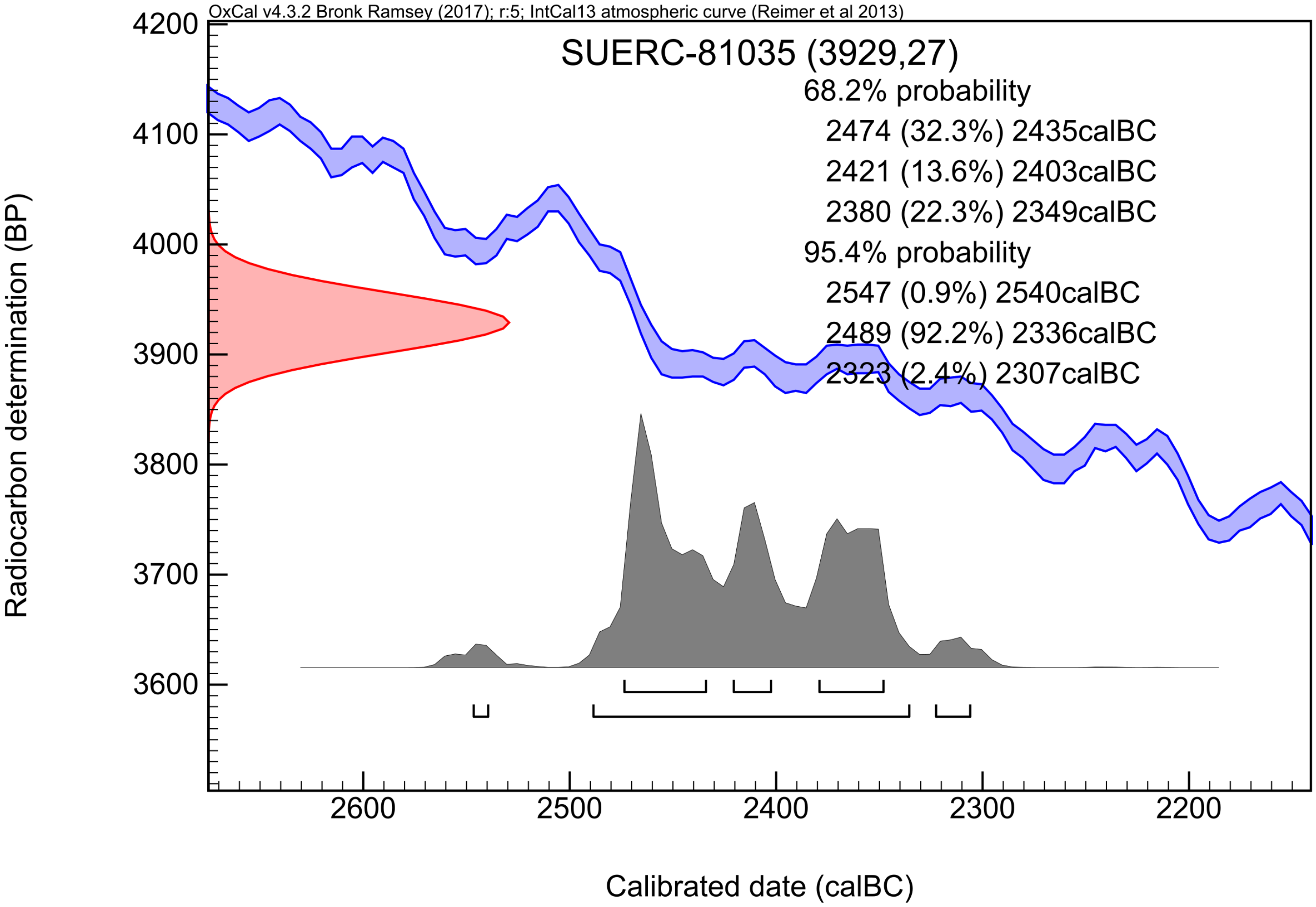
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal13 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2013) *Radiocarbon 55(4) pp.1869-87*

Scottish Universities Environmental Research Centre
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RADIOCARBON DATING CERTIFICATE
03 August 2021

Laboratory Code	SUERC-99016 (GU58435)
Submitter	Luke Harris Wardell Armstrong LLP 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	BE10140
Context Reference	WS12 - 3.96m
Sample Reference	1
Material	Wood : Alnus sp.
$\delta^{13}C$ relative to VPDB	-27.5 ‰
Radiocarbon Age BP	4132 ± 21

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

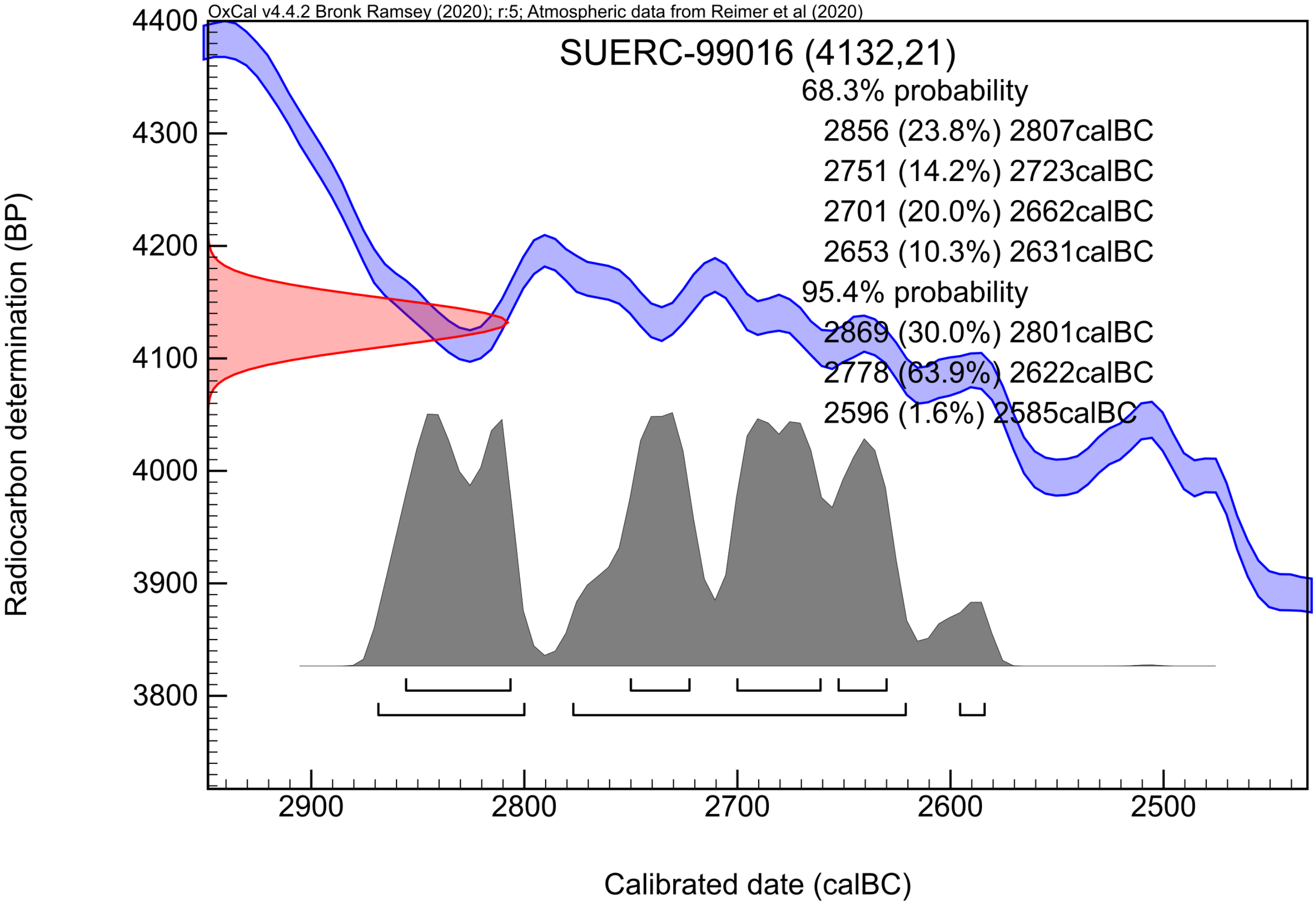
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal20 atmospheric calibration curve.†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*

† Reimer et al. (2020) *Radiocarbon 62(4) pp.725-57*

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RADIOCARBON DATING CERTIFICATE
03 August 2021

Laboratory Code	SUERC-99020 (GU58436)
Submitter	Luke Harris Wardell Armstrong LLP 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	BE10140
Context Reference	WS12 - 2.90-2.95m
Sample Reference	2
Material	Wood : Indet. Fragments
$\delta^{13}C$ relative to VPDB	-28.3 ‰
Radiocarbon Age BP	3610 ± 19

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

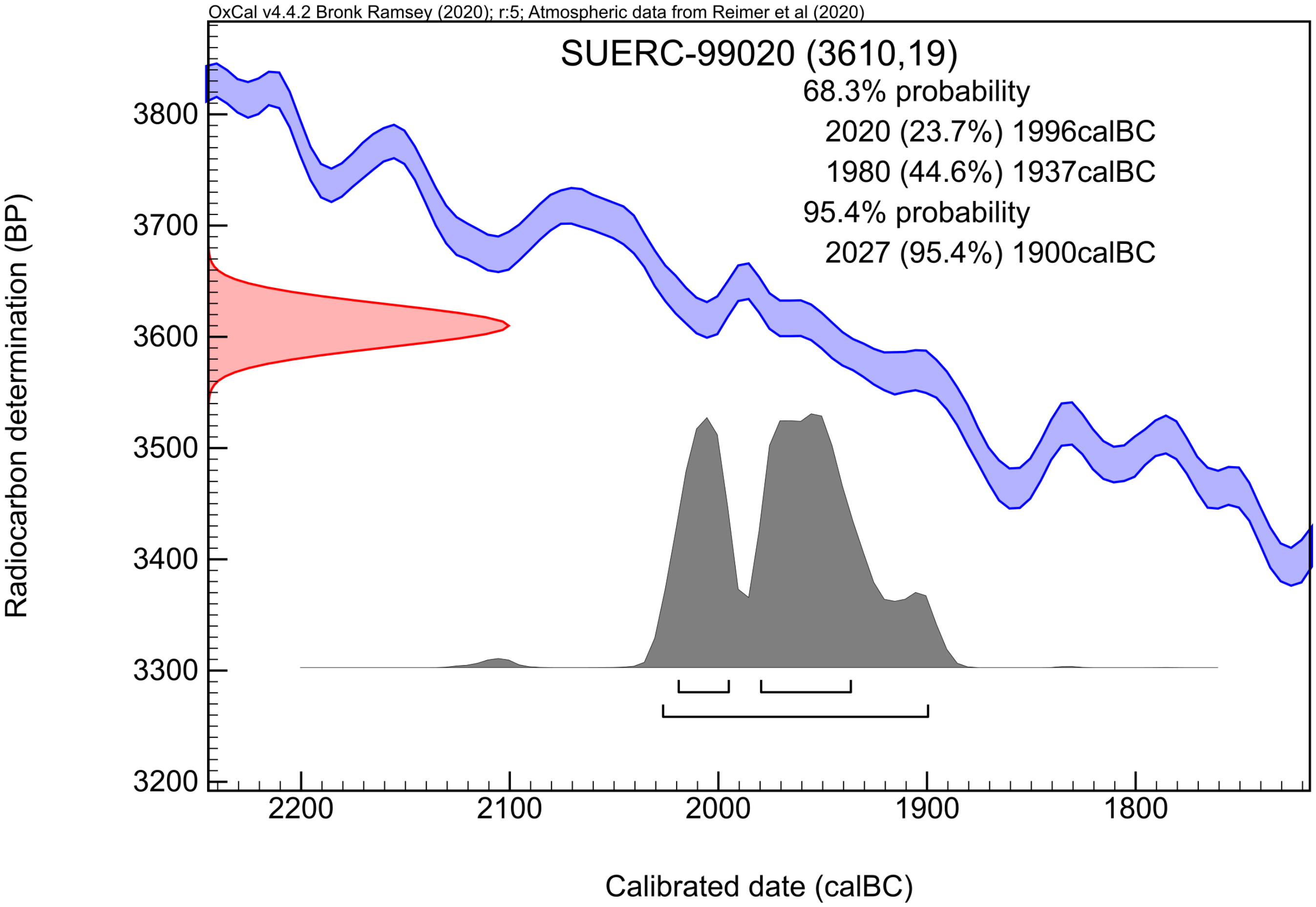
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal20 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2020) *Radiocarbon 62(4) pp.725-57*

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RADIOCARBON DATING CERTIFICATE
03 August 2021

Laboratory Code	SUERC-99021 (GU58437)
Submitter	Luke Harris Wardell Armstrong LLP 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	BE10140
Context Reference	WS20 - 3.88m
Sample Reference	3
Material	Wood : Alnus sp.
$\delta^{13}C$ relative to VPDB	-27.2 ‰
Radiocarbon Age BP	4124 ± 24

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

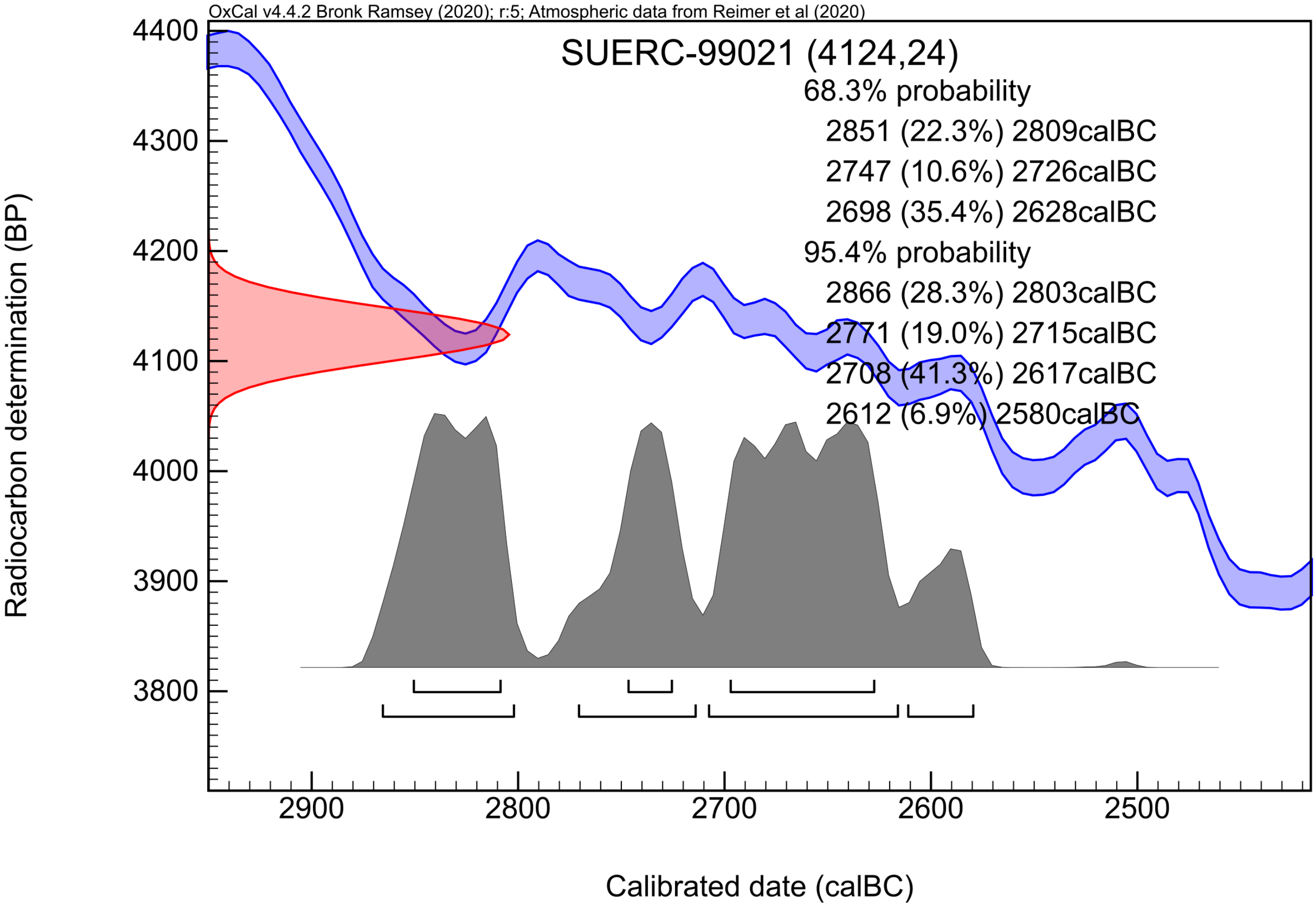
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal20 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2020) *Radiocarbon 62(4) pp.725-57*

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RADIOCARBON DATING CERTIFICATE
03 August 2021

Laboratory Code	SUERC-99022 (GU58438)
Submitter	Luke Harris Wardell Armstrong LLP 6 Brunel Business Court Eastern Way Bury St Edmunds IP32 7AJ
Site Reference	BE10140
Context Reference	WS20 - 2.35-2.40m
Sample Reference	4
Material	Wood : Indet. Fragments
$\delta^{13}C$ relative to VPDB	-25.0 ‰ assumed
Radiocarbon Age BP	2326 ± 24

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD) and requires calibration to the calendar timescale. The error, expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

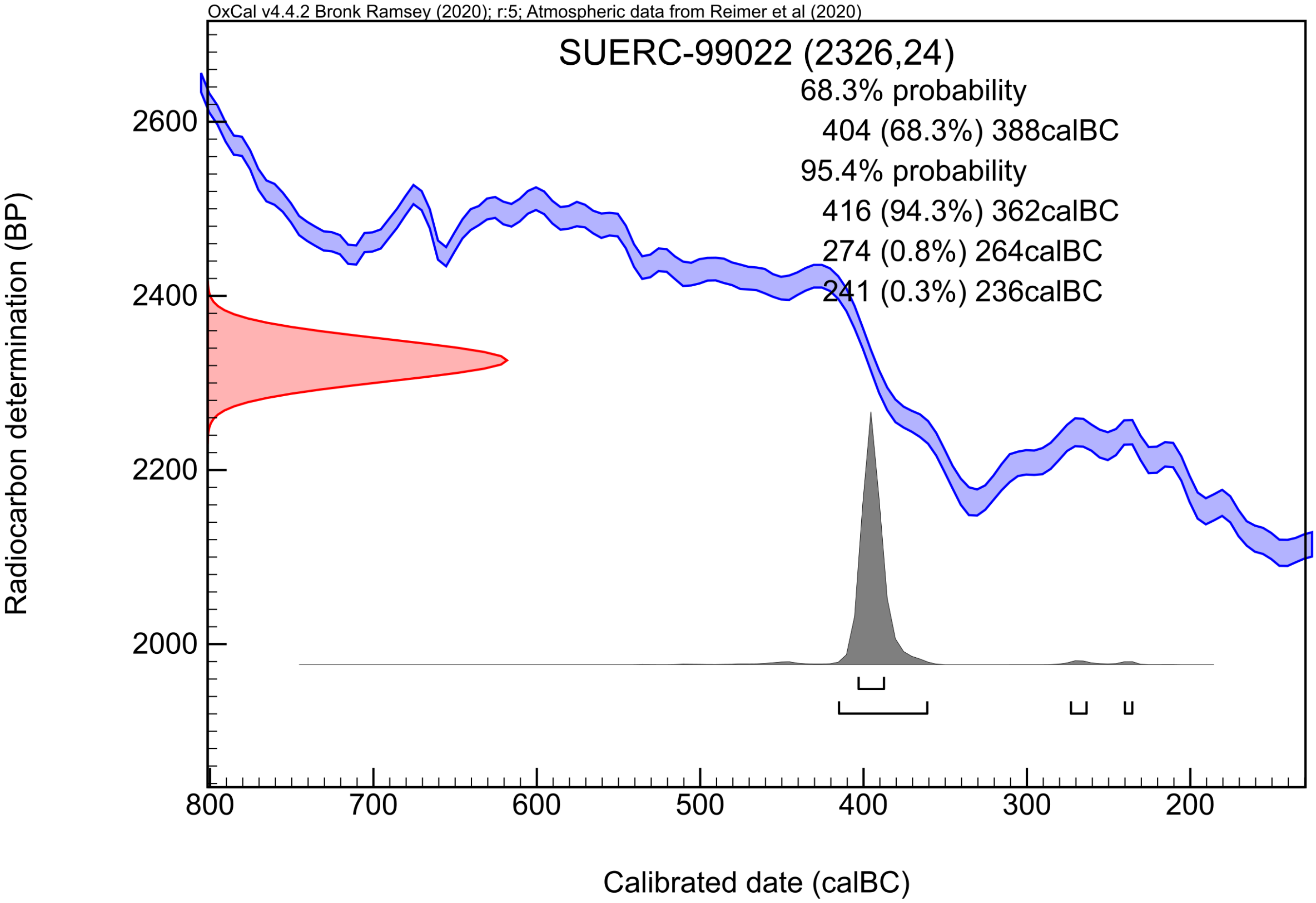
Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Laboratory and should be quoted as such in any reports within the scientific literature. The laboratory GU coding should also be given in parentheses after the SUERC code.

Detailed descriptions of the methods employed by the SUERC Radiocarbon Laboratory can be found in Dunbar et al. (2016) *Radiocarbon 58(1) pp.9-23.*

For any queries relating to this certificate, the laboratory can be contacted at suerc-c14lab@glasgow.ac.uk.

Conventional age and calibration age ranges calculated by : E. Dunbar

Checked and signed off by : P. Naysmith



The radiocarbon age given overleaf is calibrated to the calendar timescale using the Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.*

The above date ranges have been calibrated using the IntCal20 atmospheric calibration curve†

Please contact the laboratory if you wish to discuss this further.

* Bronk Ramsey (2009) *Radiocarbon 51(1) pp.337-60*
† Reimer et al. (2020) *Radiocarbon 62(4) pp.725-57*

APPENDIX 4

Archaeological test pits

1 Introduction

1.1 As part of the additional works at the site in 2021 (WSI dated 19th March 2021), four test pits were excavated within the Phase 1 area (Fig. 22). These form part of a wider gridded layout of test pits across the whole site area detailed within the specification.

1.2 The test pits were excavated on the 19th August 2021 and the objective of the exercise was to assess the sediments for artefactual remains, where possible through sieving, in order to gain an understanding of the distribution of artefactual remains within these horizons.

2 Methodology

2.1 The test pit locations were located using an RTK GPS and excavated using a mechanical 360º excavator with a toothless ditching bucket. Excavation extended to the point of water ingress (1.3-1.82m). Deposits were recorded using archaeological context sheets and the machined sections were photographed from the trench edge.

2.2 Sieving of the clay-rich sediments was not possible, so excavated spoil was spread out on the surface and searched for artefactual remains.

2.3 Following the excavation, the excavated test pits were re-surveyed using an RTK GPS and immediately back-filled.

3 Results

The recorded sections from the test pits are presented below:

Test Pit 1 0.00 = 14.97m AOD		
0.00 – 0.20m	1000	Topsoil: Firm dark grey brown organic clay silt
0.20 – 0.50m	1001	Alluvium: Firm mid yellow brown clay silt
0.50-1.30m+	1002	Alluvium: Firm dark/ mid blue grey clay silt

Test Pit 2

0.00 = 14.75m AOD		
0.00 – 0.20m	1000	Topsoil: Firm dark grey brown organic clay silt
0.20 – 0.55m	1001	Alluvium: Firm mid yellow brown clay silt
0.55-1.60m+	1002	Alluvium: Firm dark/ mid blue grey clay silt

Test Pit 3 0.00 = 14.98m AOD		
0.00 – 0.30m	1000	Topsoil: Firm dark grey brown organic clay silt
0.30 – 0.70m	1001	Alluvium: Firm mid yellow brown clay silt
0.70-1.40m+	1002	Alluvium: Firm dark/ mid blue grey clay silt

Test Pit 4 0.00 = 14.99m AOD		
0.00 – 0.30m	1000	Topsoil: Firm dark grey brown organic clay silt
0.30 – 0.68m	1001	Alluvium: Firm mid yellow brown clay silt
0.68-1.82m+	1002	Alluvium: Firm dark/ mid blue grey clay silt

No artefactual remains were recovered from the observation and sorting of the spoil.

4 Deposit Model

4.1 The stratigraphy of the test pits was consistent with the results of the geoarchaeological investigation. Topsoil layer (1000) corresponds with Units 6 and 7 (topsoil and subsoil), which overlay compact homogeneous alluvial silts and clays (1001 & 1002 = Unit 5). There was a colour change observed in the alluvial silts and clays to a darker blue grey hue, which rapidly oxidised on excavation. This is a result of greater water saturation a lower levels.

5 Conclusions

5.1 The test pitting exercise identified the same upper deposits of topsoil/ subsoil over alluvial silts and clays recorded by the geoarchaeological window sample investigation.

5.2 Water ingress and limits of safe working prevented excavation to the base of the alluvium and the interface with sub-alluvial gravel deposits, which regularly exceed a depth of 2m across the site.

5.3 No artefactual remains were recovered during the exercise which could be used to investigate finds distribution or provide a date for the deposits. The geoarchaeological investigation suggests a medieval date for much of the alluvial accumulation and it is likely that the site itself was not occupied during this time due to regular inundation. However, the limitations of recovery imposed by the clay-rich sediments on the site are also likely to have negatively affected finds retrieval.

Summary for wardella2-505695

OASIS ID (UID)	wardella2-505695
Project Name	Geotechnical Test Pit at Elton 2, Warmington, Northamptonshire
Sitename	
Activity type	Geotechnical Test Pit
Project Identifier(s)	AS1810, BE10140
Planning Id	
Reason For Investigation	Planning: Between application and determination
Organisation Responsible for work	Wardell Armstrong Archaeology
Project Dates	12-Jun-2018 - 19-Aug-2021
Location	Elton 2, Warmington, Northamptonshire NGR : TL 07096 91909 LL : 52.5145555516859, -0.423249805293711 12 Fig : 507096,291909
Administrative Areas	Country : England County : Northamptonshire District : East Northamptonshire Parish : Warmington
Project Methodology	The test pit locations were located using an RTK GPS and excavated using a mechanical 360º excavator with a toothless ditching bucket. Excavation extended to the point of water ingress (1.3-1.82m). Deposits were recorded using archaeological context sheets and the machined sections were photographed from the trench edge. Sieving of the clay-rich sediments was not possible, so excavated spoil was spread out on the surface and searched for artefactual remains. Following the excavation, the excavated test pits were re-surveyed using an RTK GPS and immediately back-filled.

Project Results	The investigation revealed a picture of mid-late Holocene floodplain development characterised by gradual channel abandonment and consolidation. Palaeotopography and drainage at the site is constrained by late Pleistocene sand and gravel deposits forming an elevated plateau or 'island' occupying a central position. Such islands are fairly common Nene Valley floodplain features and have been found to provide relatively stable land surfaces in the Early Holocene and a focus for Mesolithic activity. Hydrological change was initiated during the late Neolithic period with the silting of a former channel crossing the SE corner of the site commencing 4,819 calBP. Recovered macrofossil remains indicate an open landscape and slow-moving water body, suggesting gradual channel demise. This fits the wider picture of floodplain evolution recorded in the Nene Valley, which tends to be characterised by channel simplification since the Mid-Holocene. A further sequence of organic-rich deposits recorded c. 20m to the west of the current river channel accumulated between 4,816 and 2,186 calBP and may indicate the lateral migration of the primary channel or simply its contraction and deepening as a result of accelerated bank aggradation. Palynological assessment of the channel deposits indicates a contemporary open pastoral landscape, with local arable cultivation also suggested. Palaeoenvironmental macrofossils from the channel suggest a slow-moving channel set within an open environment, which is consistent with gradual channel abandonment. From the mid/late-Holocene and particularly from later historical periods, the sedimentary regime was dominated by overbank alluvial deposition, forming the main sedimentary unit of alluvial silts and clays that blanket the site. The close proximity of Neolithic and Bronze Age funerary remains suggests nearby settlement, most likely occupying elevated ground to the north and south, with the floodplain being utilised as seasonal pasture within a mixed agricultural regime. Four archaeological test pits were excavated through the topsoil/ subsoil and upper alluvium for the purpose of artefact recovery. The result of this exercise was negative.
Keywords	
Funder	
HER	Northamptonshire SMR - unRev - STANDARD
Person Responsible for work	David, Bescoby
HER Identifiers	
Archives	Digital Archive - to be deposited with Northamptonshire Archaeological Resource Centre

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Fig. 1 Site location plan

Scale 1:25,000 at A4

Warmington Quarry, Peterborough, Northants (PBE10140/6422)

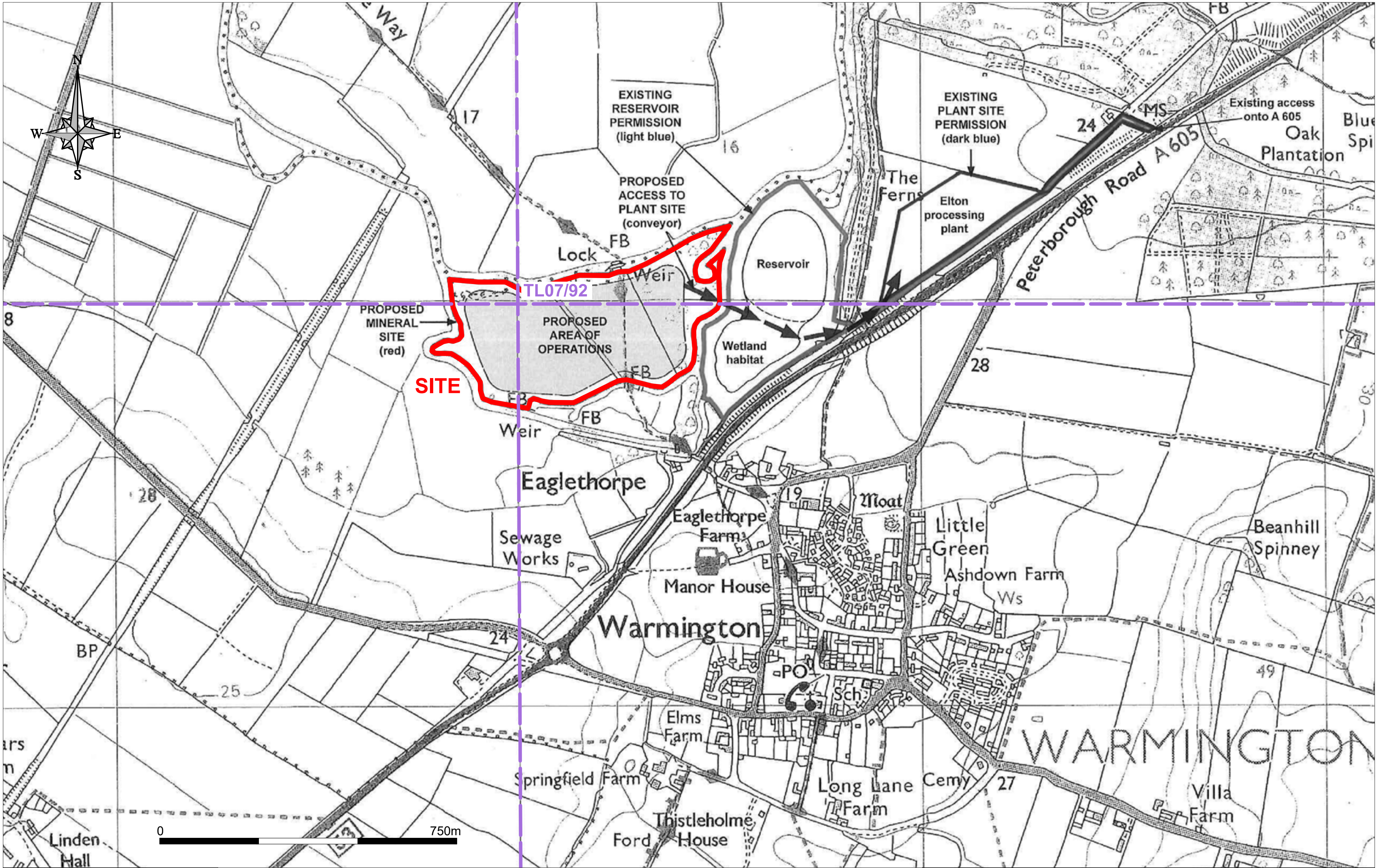

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Fig. 2 Detailed site location plan

Scale 1:12,500 at A4

Warmington Quarry, Peterborough, Northants (P6422)

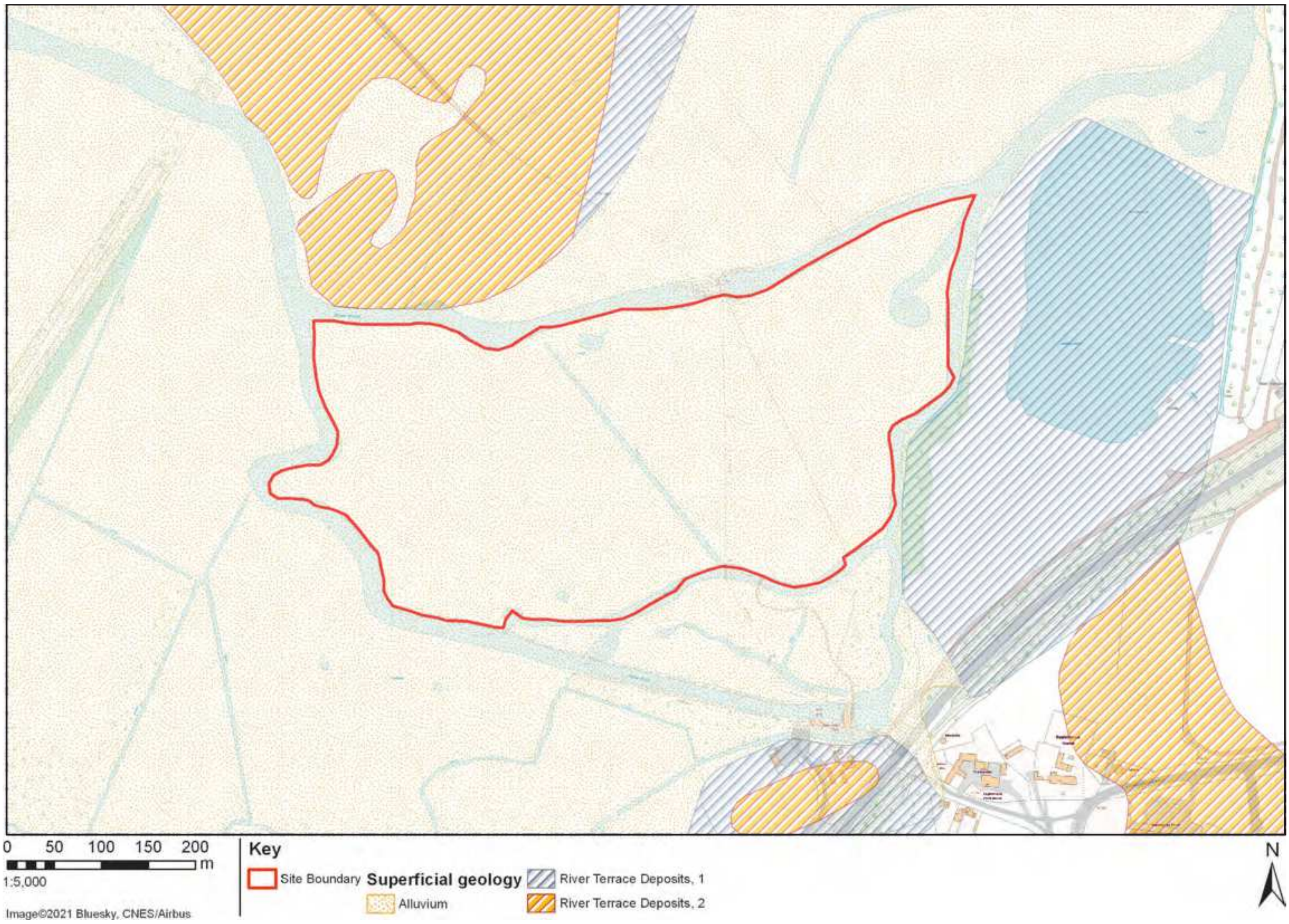

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Fig. 3 Mapped superficial geology at the site

As scale bar

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

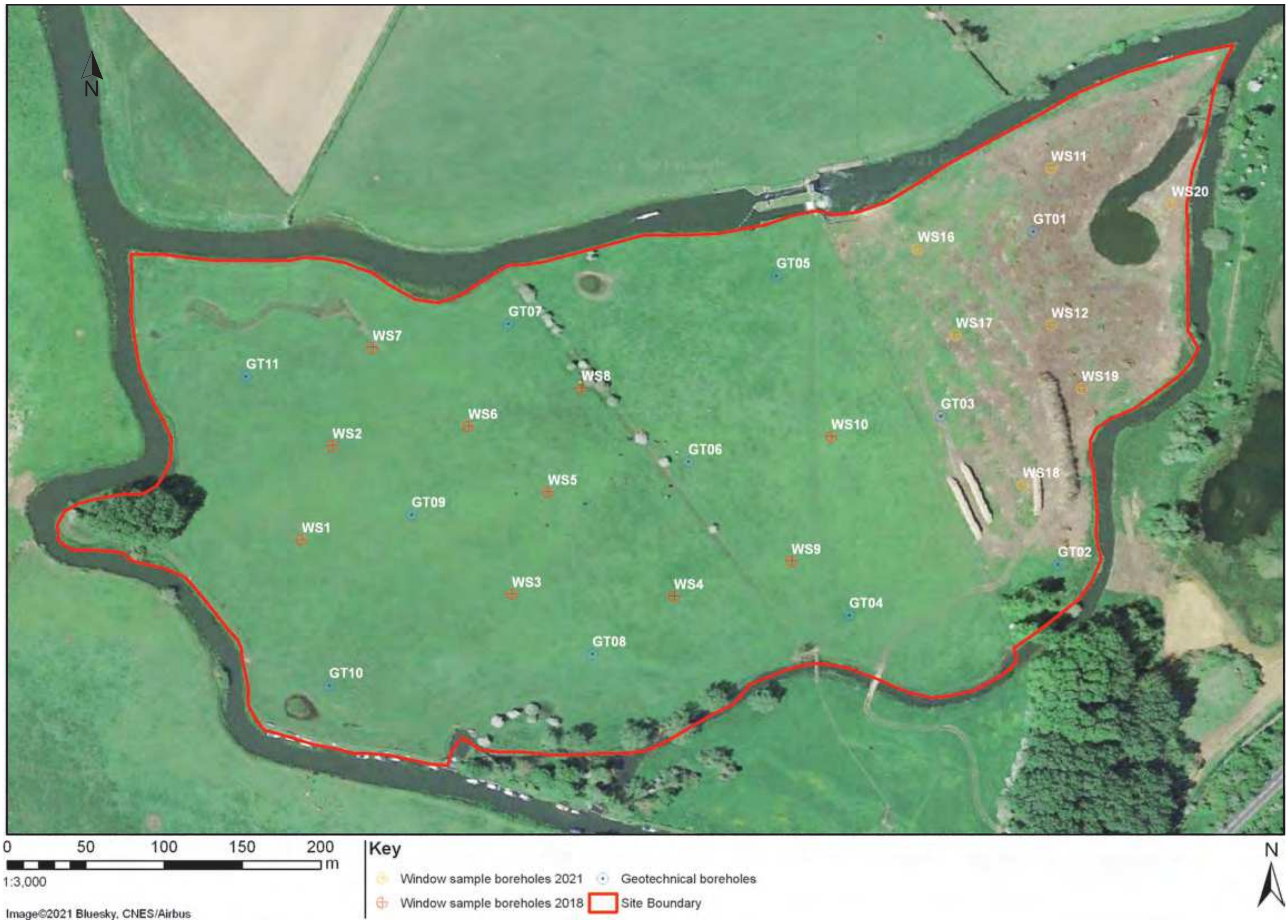

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Fig. 4 Location of boreholes across the site
As scale bar
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

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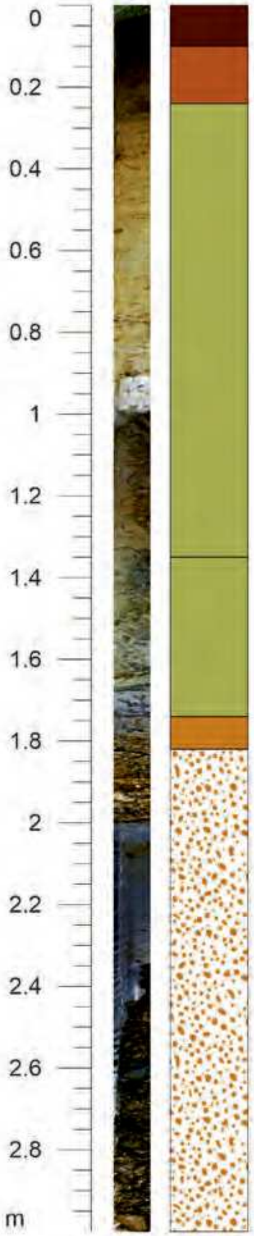
Fig. 5 Location of modelled sedimentary cross-sections

As scale bar

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

WS5

TL 07104 91907



Very dark greyish brown (10YR 3/2) silty loam. Heavily rooted with a clear, blocky structure. Very few (1%) granule sized mineral inclusions. Clear boundary.

Brown (10YR 4/3) silty clay. Well compact and homogenous with moderate rooting. Very few inclusions. Faint blocky texture towards top of unit, but otherwise little sign of structure. Abrupt boundary.

Light yellowish brown (2.5Y 6/3) fine silty clay. Well compact, homogenous and with few inclusions, which when present appear as diffuse bands of angular to sub-angular small quartz pebbles of low sphericity - e.g. band at 0.34 m. Deposit becomes more mottled from 0.70 m, displaying diffuse bands of orange staining from decomposing organic material, seen as dark brown granule sized fibrous material. Clear boundary with underlying layer.

Greenish grey (GLEY1 5/1) fine silty clay of similar consistency to the above and sitting below the mean water table. Loosely compact with very few (<1%) inclusions, which when present comprise of coarse sand sized particles of minerogenic origin. Reddened root casts containing some fibrous material towards base of deposit accompanied by darkening of sediment hue. Abrupt boundary.

Dark greenish grey (GLEY1 4/1) fine sand deposit, fining upwards. Gradual boundary with underlying layer 15% poorly sorted angular to sub-angular granular to small pebble sized clasts of quartzite along with granule sized platey clasts of sedimentary lithologies, ?chalk. Boundary zone also characterised by broad patches of orange mottling/iron staining.

Dark yellowish brown (10YR 4/4) medium sand matrix with extensive iron staining containing 70% poorly sorted clasts or varying shapes and lithologies. Larger, pebble sized clasts are predominantly rounded-sub to rounded and of a quartzite lithology, while clasts within the smaller size fraction are characterised by angular to sub-angular platey forms of low sphericity - c. 5% appear to be of a shale/mudstone lithology. A number of rounded, platy clasts appear bed horizontally, forming a distinct horizon at 1.90 m. A thin lens of dark silt was recorded at 2.74 m. With depth, the gravel fraction becomes coarser, containing up to 20% rounded quartzite pebbles of generally low sphericity from 2.8 m.

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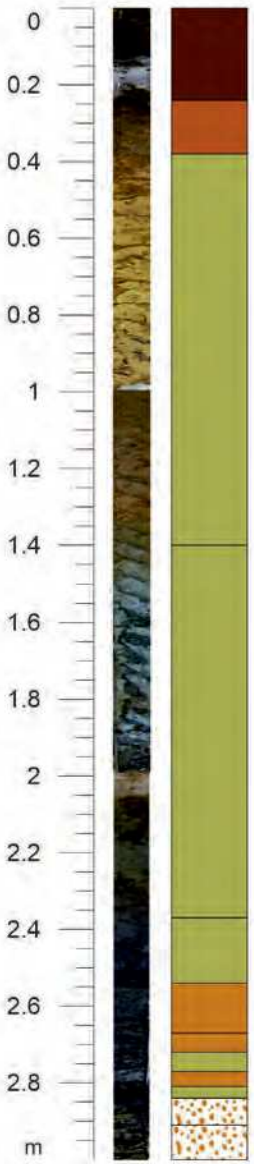
Fig. 6 WS5 core log
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

WS6

TL 07053 91948



Very dark greyish brown (10YR 3/2) silty loam. Heavily rooted with a clear, blocky structure. Very few (1%) granule sized mineral inclusions. Clear boundary.

Brown (10YR 4/3) silty clay. Well compact and homogenous with moderate rooting. Very few inclusions. Faint blocky texture towards top of unit, but otherwise little sign of structure. Abrupt boundary.

Light yellowish brown (2.5Y 6/3) fine silty clay. Well compact, homogenous and with few inclusions, which when present appear as diffuse bands of angular to sub-angular small quartz pebbles of low sphericity. A narrow band of medium sized shell fragments was recorded between 0.40 -0.43m. Deposit becomes more mottled from 0.70 m, displaying diffuse bands of orange staining from decomposing organic material, seen as dark brown granule sized fibrous material. Gradual boundary with underlying layer.

Greenish grey (GLEY1 5/1) fine silty clay of similar consistency to the above and sitting below the mean water table. Loosely compact with very few (<1%) inclusions, which when present comprise of coarse sand sized particles of minerogenic origin. Reddened root casts containing some fibrous material towards base of deposit accompanied by darkening of sediment hue and increased mottling from 1.80 m. Small calcite nodule recorded at 1.89 m and gastropod remain recorded at 1.92 m. Abrupt boundary.

Very dark greenish grey (GLEY1 3/1) silty clay. Moderately compact and homogenous containing 1% medium sand sized shell fragments. Deposit darkens sharply at interface forming a clear boundary with the underlying layer.

Very dark greenish grey (GLEY1 3/1) medium sand, homogenous and lose-moderately compact. Sharp boundary.

Very dark greenish grey (GLEY1 3/1) medium - coarse sandy band; coarse fraction makes up c. 25%. Sharp boundary.

Very dark greenish grey (GLEY1 3/1) silty clay band, homogenous with no visible inclusions. Sharp boundary.

Very dark greenish grey (GLEY1 3/1) coarse sand layer. Poorly sorted. <1% small pebble sized angular quartzite. Sharp boundary.

Dark greenish grey (GLEY1 4/1) silt. Homogenous and compact. Sharp boundary.

Greenish black (GLEY1 2.5/1) coarse sand matrix containing 25% small to mid. pebble sized quartzite clasts, predominantly sub-rounded and of low sphericity with a smaller fraction of a distinctly tabular form. C. 5% smaller angular to sub-angular quartzite clasts. Sharp boundary.

Light olive brown (2.5Y 5/3) sandy gravel with a marked silt fraction. 40% small to med. pebble sized sub-rounded to sub-angular quartzite clasts of low sphericity and of a characteristic platy form. Larger clasts are moderately sorted.

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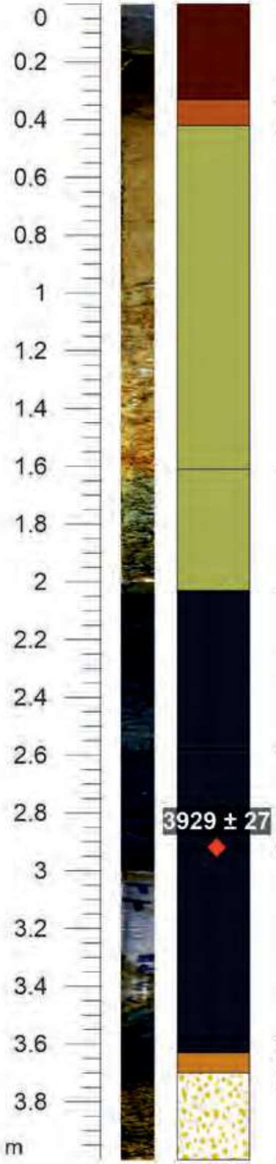
Fig. 7 WS6 core log

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

WS9

TL 072589 91866



Very dark greyish brown (10YR 3/2) silty loam. Heavily rooted with a clear, blocky structure. Very few (1%) granule sized mineral inclusions. Clear boundary.

Brown (10YR 4/3) silty clay. Well compact and homogenous with moderate rooting. Very few inclusions. Faint blocky texture towards top of unit, but otherwise little sign of structure. Abrupt boundary.

Brown (2.5Y 6/3) silty clay. Compact with few inclusions which where present occur in diffuse bands: 0.58 m - broad band of sub-angular granule sized clasts. Diffuse orange staining from 0.9m containing occasional granule sized spherical fibrous nodules and 2% granule sized black ?manganese nodules. Abrupt boundary.

Greenish grey (GLEY2) silty clay, similar in consistency with overlying layer. Only moderately compact. Very few inclusions: <1% very coarse sand minerogenic particles and small angular shell fragments. Fairly constant olive brown (2.5Y 4/4) mottling throughout and red rootlet casts crossing the upper boundary. Deposit darkens in tone with depth becoming a dark greenish grey (GLEY1 4/1).

Very dark greenish grey (GLEY2 3/1) silty clay. Moderately compact, less so at the top of the deposit. Very few inclusions: <1% small angular shell fragments with bands of coarser organic silt deposits occurring most notably at 2.03 - 2.08 m and 2.28 - 3.20 m, displaying abrupt boundaries. The latter band contains 10 - 15% very small shell fragments of fine sand size. Abrupt boundary.

Greenish black (GLEY2 2.5/1) silty clay. Moderately compact and very similar to above, but with greater organically derived content. 1% shell fragments from small sand to granule sized. Otherwise homogenous. Abrupt boundary.

Very dark greenish grey (GLEY2 3/1) silty clay, moderately compact and containing ~40% fine sand and 5% shell fragments of coarse sand grain size. Lamina of coarser material at 2.90 m. Sharp boundary with underlying layer.

Bluish black (GLEY2 2.5/1) organic rich silty clay. Moderately compact with 1% discrete fibrous organic inclusions. 1% shell fragments of mid sand grain size. Organic remains somewhat bioturbated. Abrupt boundary.

Bluish black (GLEY2 2.5/1) organic rich silt. Lightly compacted and homogenous, containing ~2% discrete fragments of highly decomposed woody material. Abrupt boundary.

Very dark greenish grey (GLEY1 3/1) medium sand. Homogenous and moderately compact containing <1% small shell fragments of similar grain size (mid. sand). Abrupt boundary.

Dark yellowish brown (10YR 4/6) gravel within a somewhat silty mid. sand matrix of a loosely compact nature. Poorly to moderately sorted clasts of granule to small pebble size and dominated by rounded/sub-rounded quartzite. The smaller size fraction is more angular and tabular in character. Unit possibly displays a degree of reworking.

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Fig. 8 WS9 core log
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

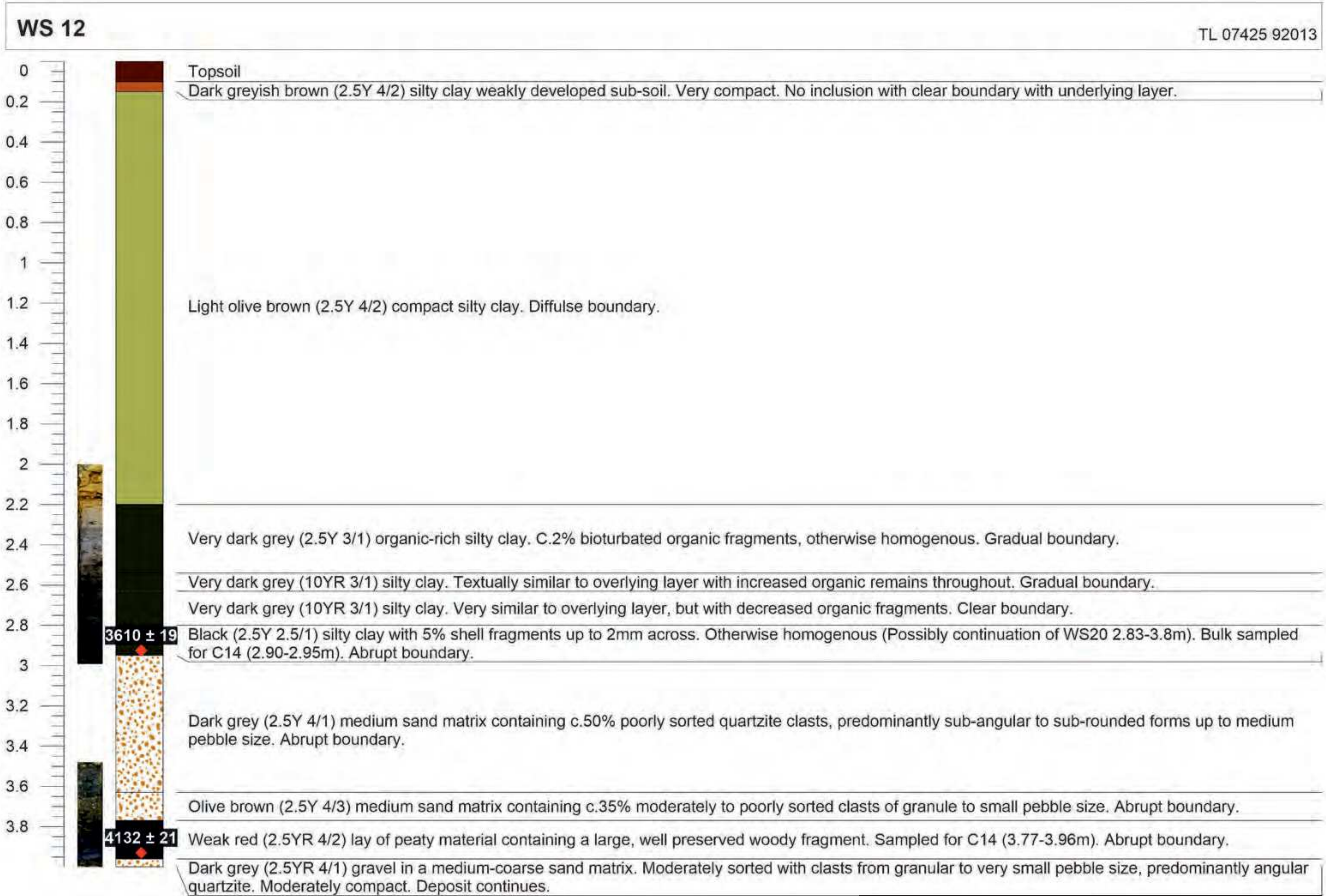

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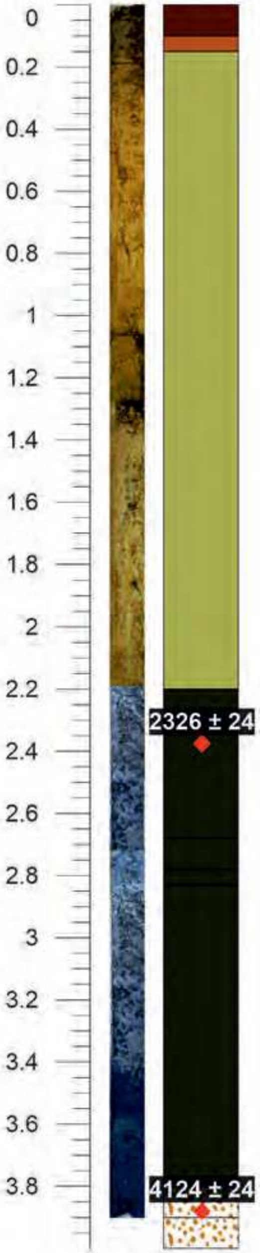
Fig. 9 WS12 core log

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

WS 20

TL 07501 92090



Topsoil

Dark greyish brown (2.5Y 4/2) silty clay weakly developed sub-soil. Very compact. No inclusion with clear boundary with underlying layer.

Light olive brown (2.5Y 5/4) compact silty clay. Very few inclusions. <1% shell fragments. Deposit takes on a grey hue (2.5Y 5/1) from c.0.85m. Rooting evident and mottled appearance from c.1.6m, but texturally homogenous. Clear boundary.

Very dark grey (10YR 3/1) silty clay, homogenous and compact. <1% 1-7mm sized shell fragments. Bulk sampled for C14 (2.25-2.30m & 2.35-2.40m). Abrupt boundary.

Black (10YR 2/1) silty clay. Identical textually to overlying layer. Abrupt boundary.

Very dark grey (10YR 3/1) silty clay textually similar to the overlying layer. <1% shell fragments. Gradual boundary.

Black (2.5Y 2.5/1) moderately compact silty clay. Textually identical to the overlying layers. C.1% shell fragments up to 3mm + one complete 6mm bivalve shell.

Very dark grey (2.5Y 3/1) medium sand with poorly sorted gravel. Wood fragment at boundary (3.87-3.89m) sampled for C14.

Light olive brown gravel in a medium sand matrix comprising 60-70% poorly sorted sub-angular to sub-rounded quartzite clasts. Deposit continues.

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Fig. 10 WS20 core log

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

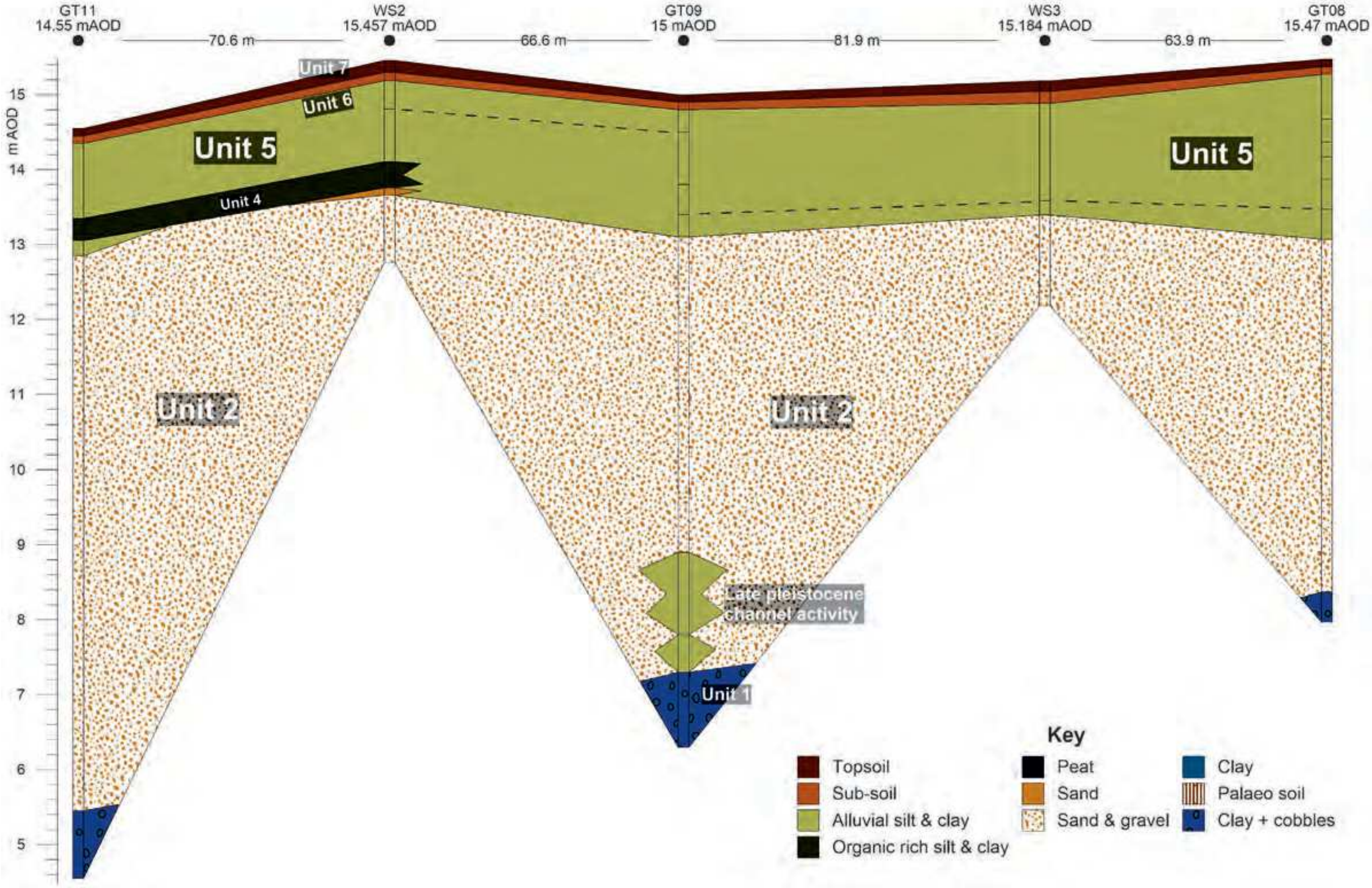

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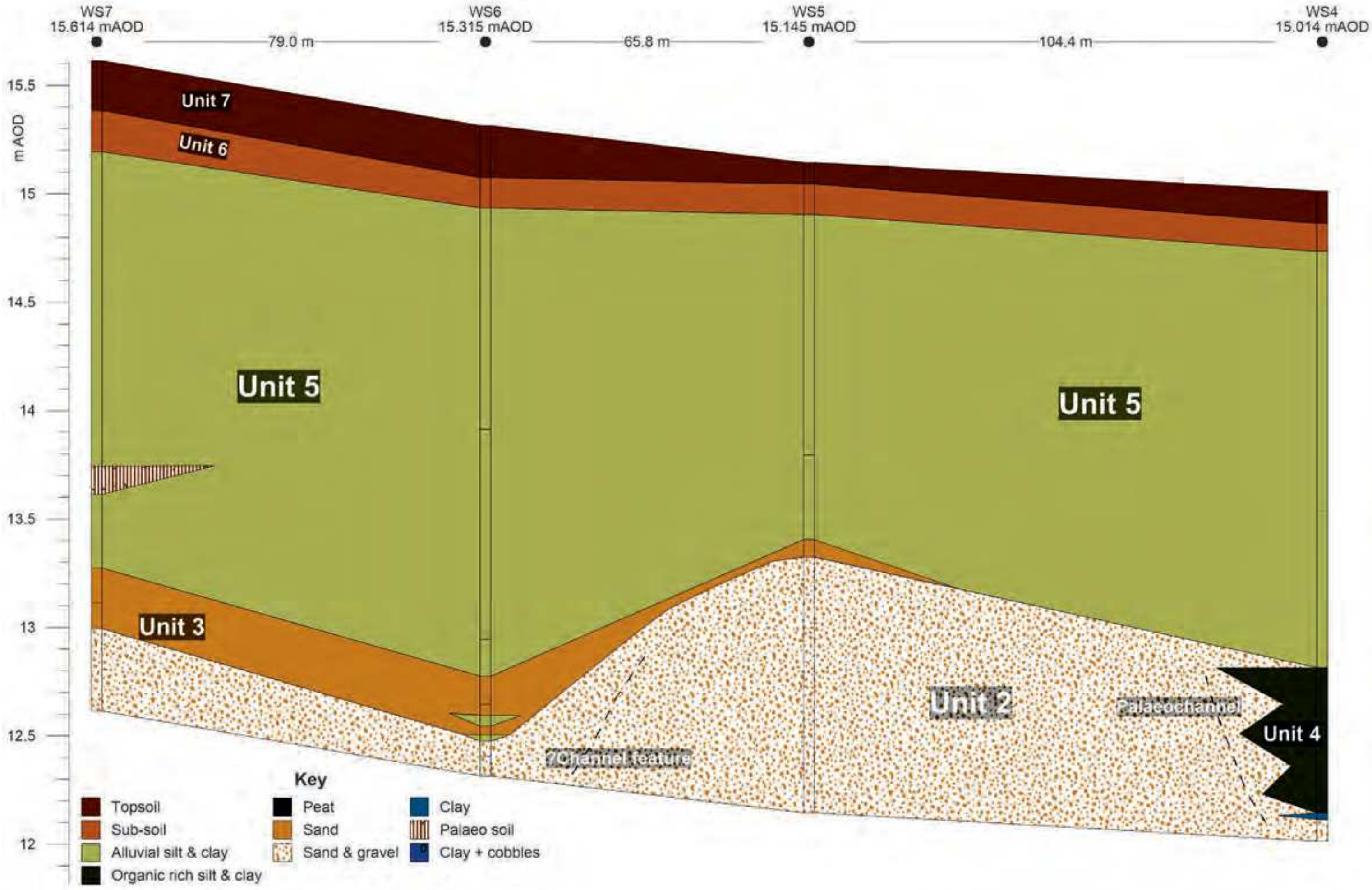
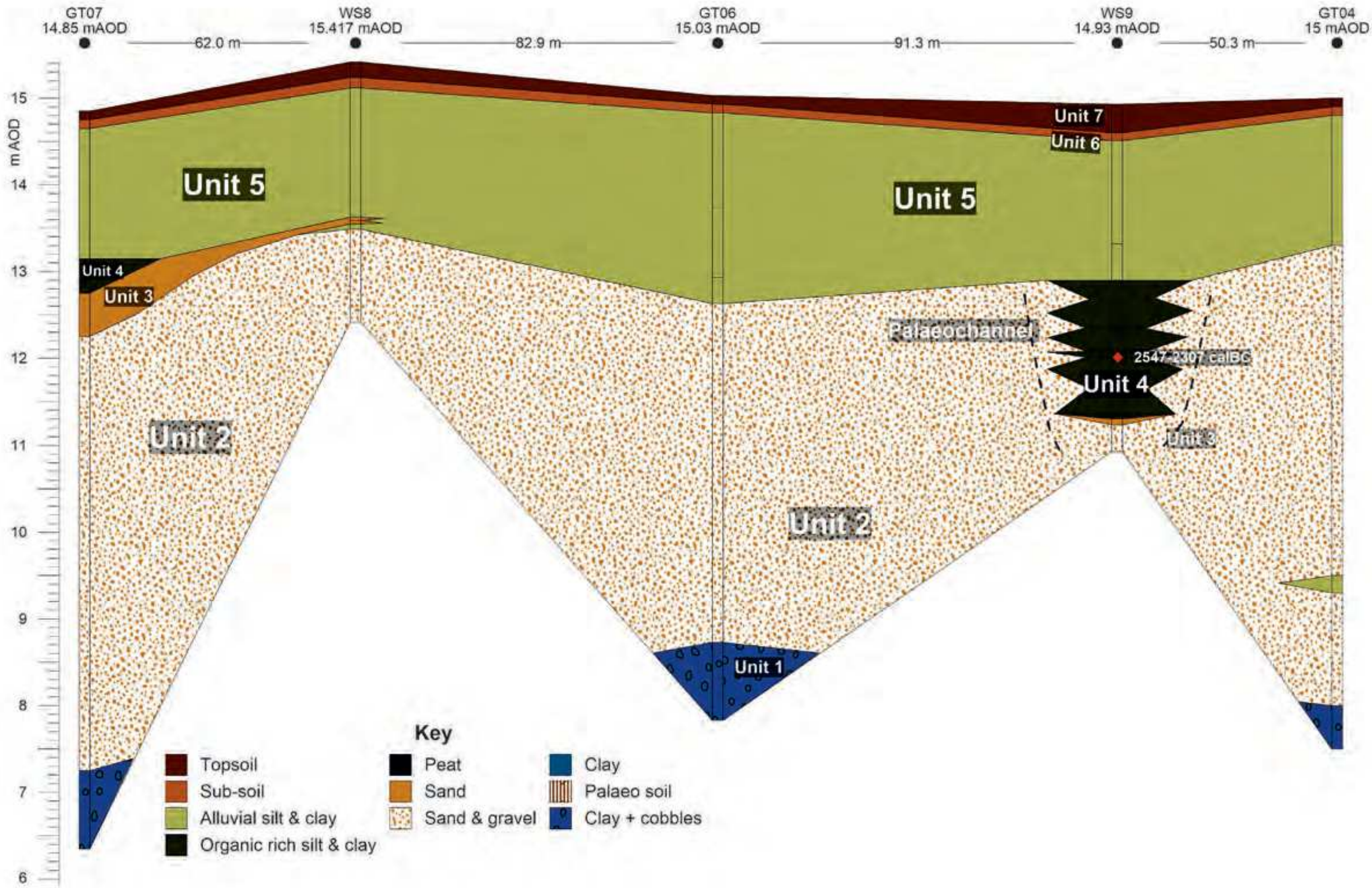
Fig. 11 Modelled cross-section 01

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)



Archaeological Solutions Ltd
Fig. 12 Modelled cross-section 02
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)



Archaeological Solutions Ltd
Fig. 13 Modelled cross-section 03
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

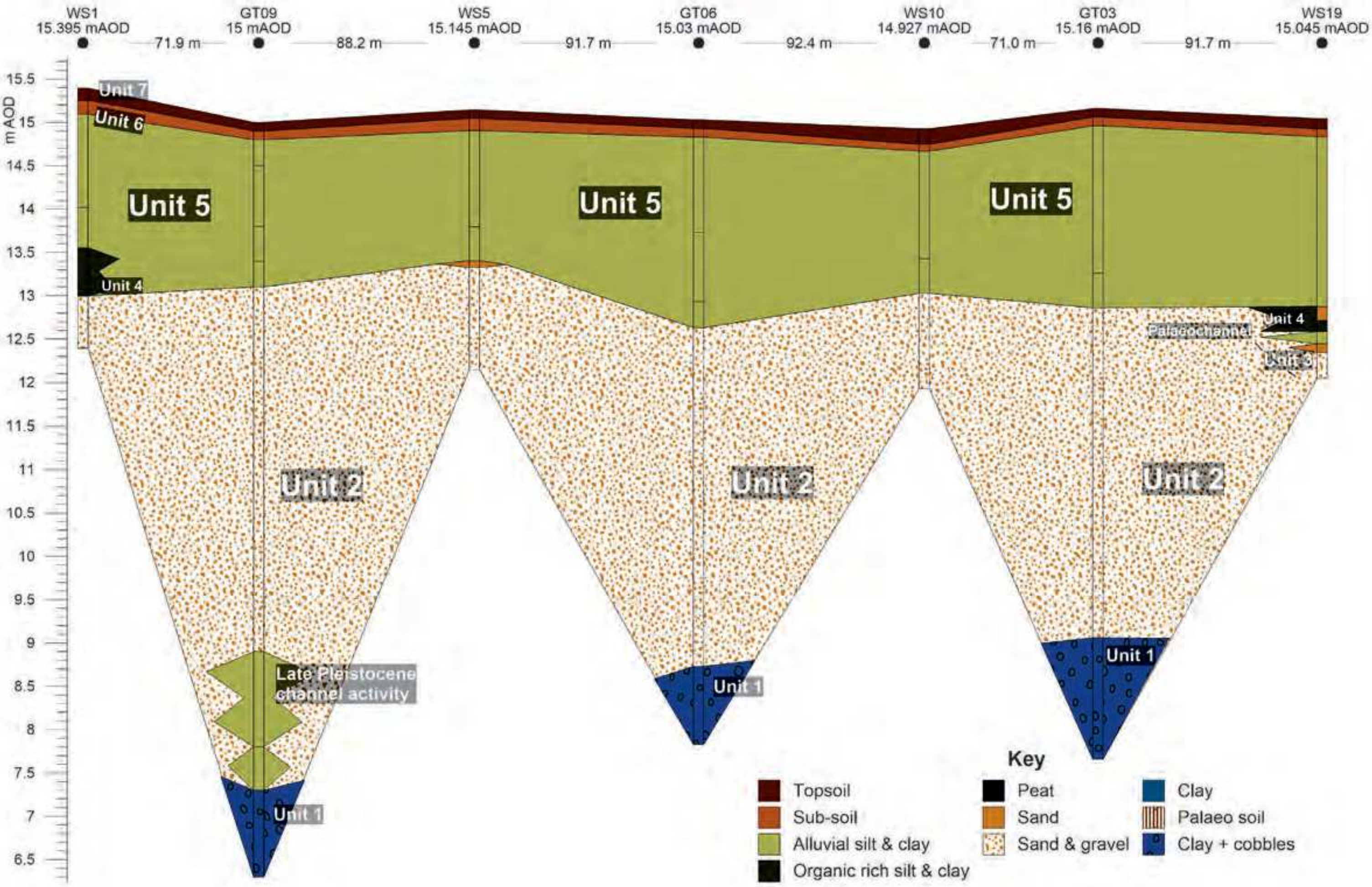


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Fig. 14 Modelled cross-section 04

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

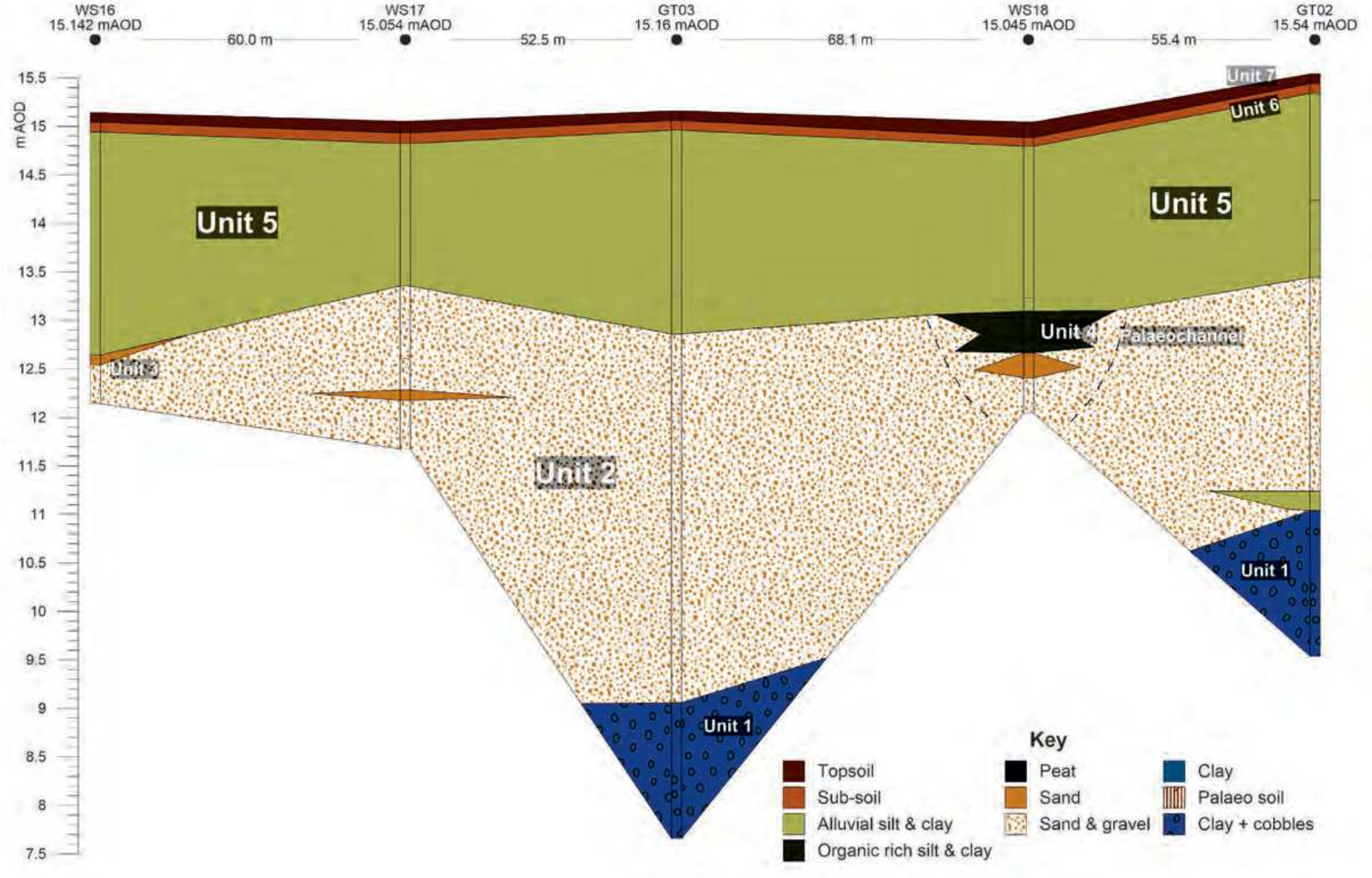

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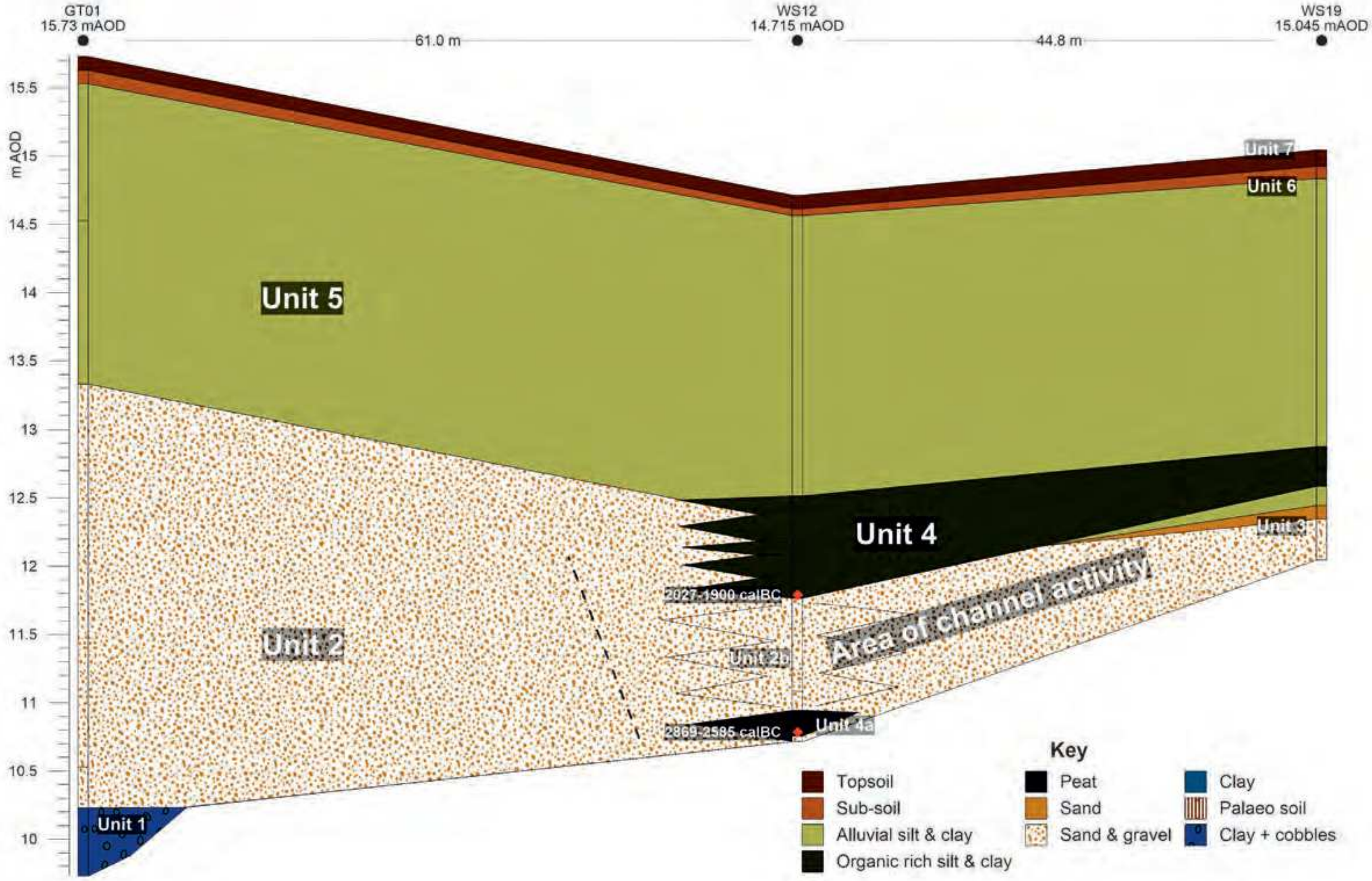
Fig. 15 Modelled cross-section 05
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)



Archaeological Solutions Ltd
Fig. 16 Modelled cross-section 06
Not to scale
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

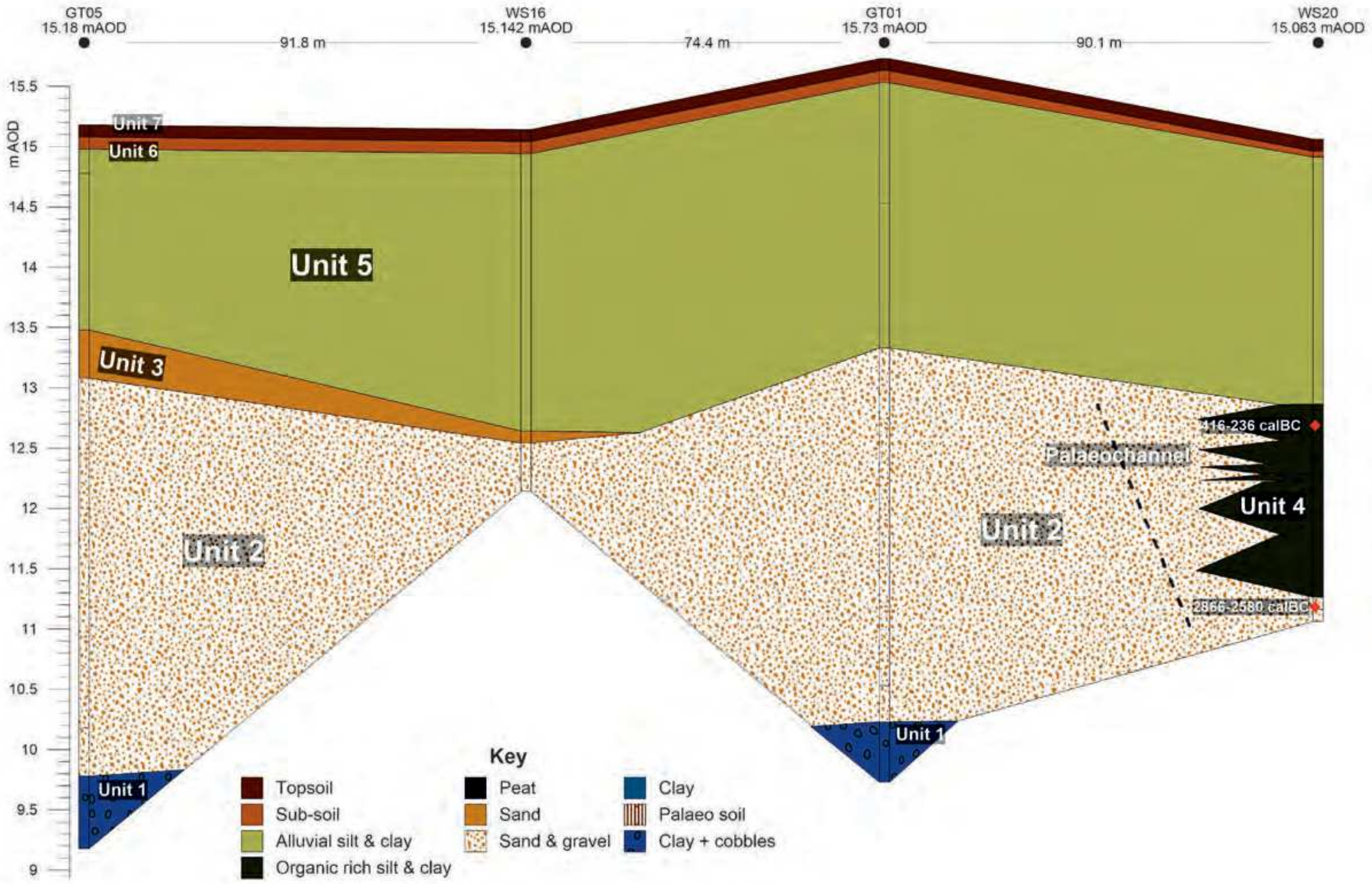


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Fig. 17 Modelled cross-section 07

Not to scale

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

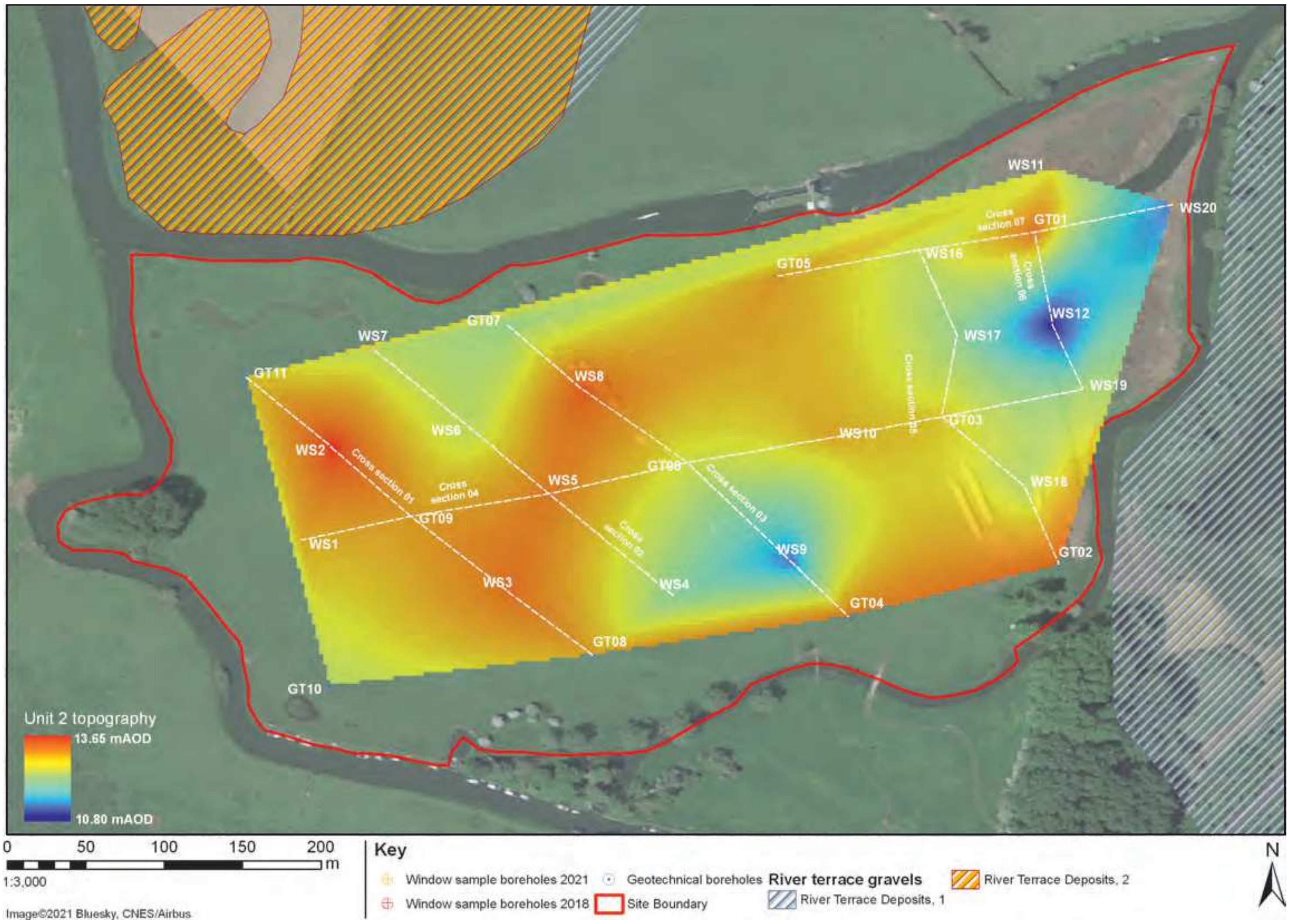

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Fig. 18 Modelled topography of Unit 2 sub-alluvial gravel surface

As scale bar

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

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Fig. 19 Volumetric model of Unit 3 deposits
As scale bar
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

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Fig. 20 Volumetric model of Unit 4 deposits

As scale bar

Warmington Quarry, Peterborough, Northants (BE10140/P6422)

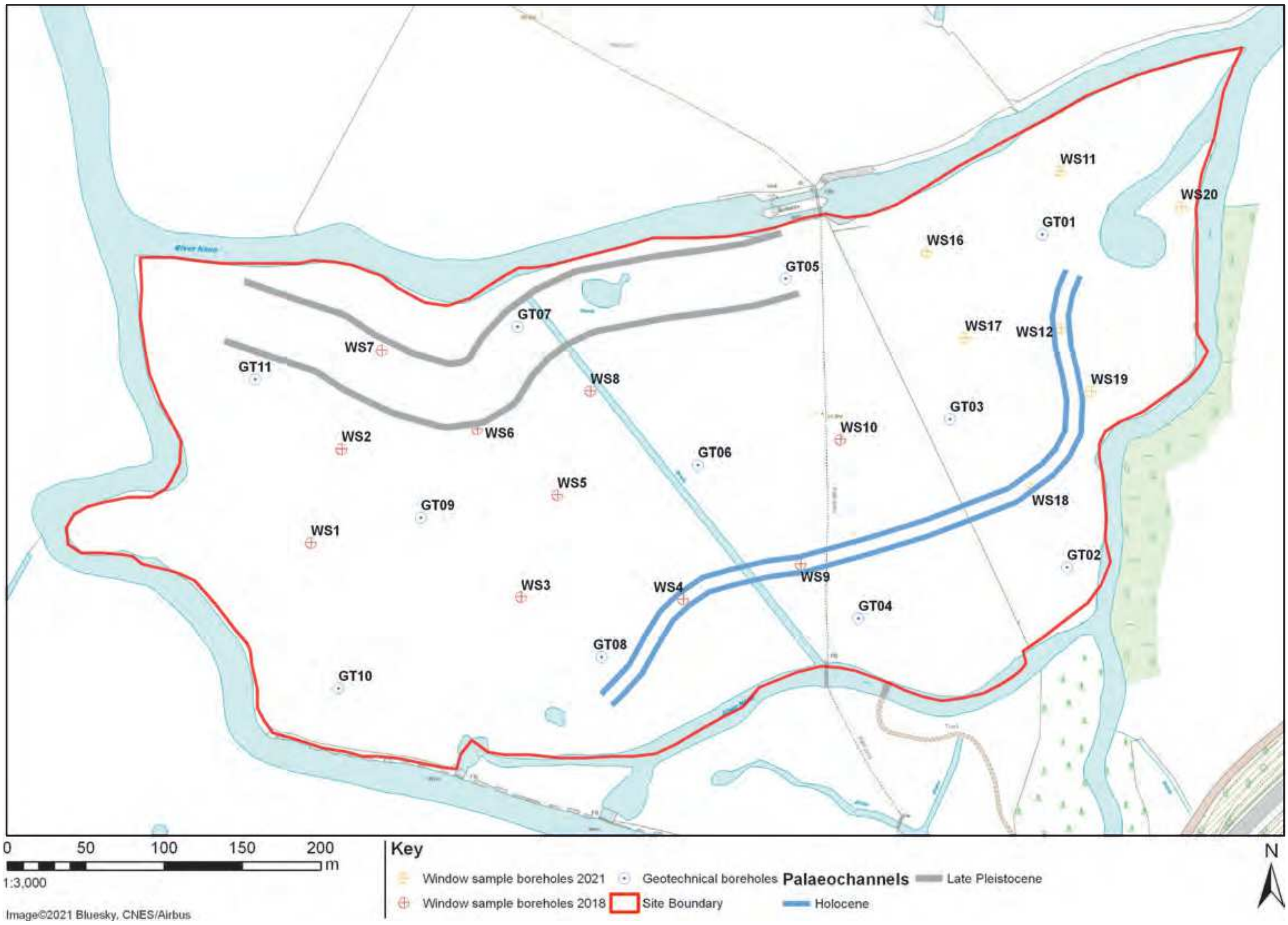

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Fig. 21 Predicted location of former channels
As scale bar
Warmington Quarry, Peterborough, Northants (BE10140/P6422)

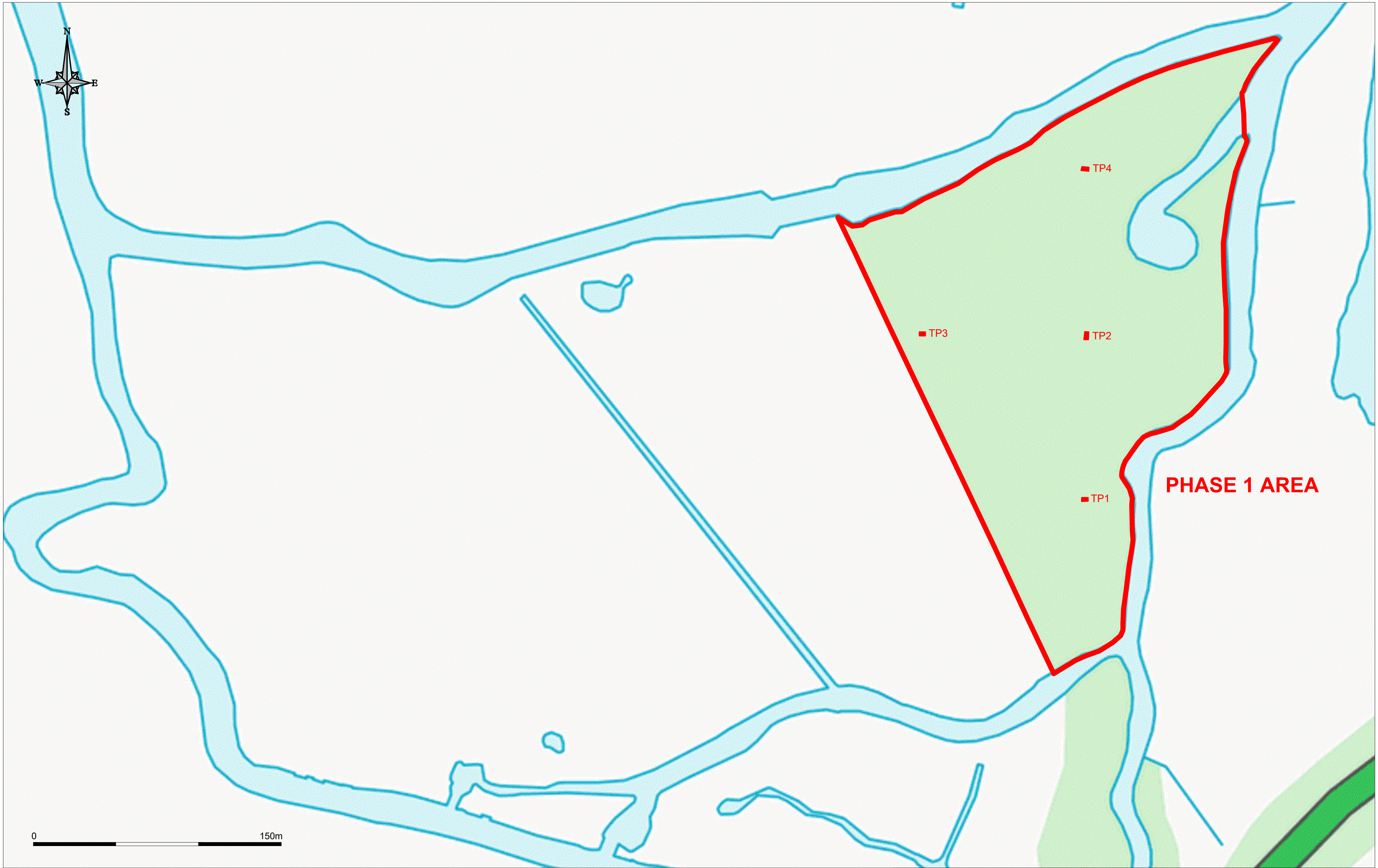

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Fig. 22 Phase 1 test pit locations

Scale 1:3,000 at A4

Warmington Quarry, Peterborough, Northants (BE10140/P6422)