SITE 25 (PHASE 1)
New Aquatics Centre
(Carpenter's Road)
Newham
E15

London Borough of Newham

An archaeological evaluation report

June 2005

MUSEUM OF LONDON Archaeology Service

PRE-CONSTRUCT ARCHAEOLOGY

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National Grid Reference: 537845 184470

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Summary (non-technical)

This report presents the results of an archaeological evaluation carried out by the Museum of London Archaeology Service and Pre-Construct Archaeology on the site of the proposed New Aquatics Centre, Carpenter's Road, Newham, London, N15. The report was commissioned from MoLAS/PCA by the London Development Agency.

Following the recommendations of GLAAS, ten evaluation trenches were excavated on the site and the results have helped to refine the initial assessment of its archaeological potential. A sequence of alluvial deposits (lying between 1-3m OD) was found that record the lateral migration of a tributary channel of the Lea during the prehistoric period, which has been dated by five radiocarbon samples.

The base of the alluvial sequence was not seen, but previous geotechnical boreholes suggest it lies between 0-0.5m OD, around a metre below the base of the trenches. The earliest deposits observed were tufa-rich sands accumulated in clear flowing water, when climate was warmer than today, probably during the Early Neolithic or before. Butchered bone was found in a peaty landsurface of Neolithic date and worked wood, dating to the Bronze Age, had been washed-up as driftwood at the margins of the later river. Environmental samples, comprising blocks of undisturbed sediment (monoliths) and adjacent bulk samples, for future off-site examination, were taken from marshy backwater areas where peaty sediments had accumulated behind successive sand banks during the prehistoric period. The characteristics of the clayey upper part of the alluvium indicate that the site was subject to seasonal flooding in historic times, when it lay on low-lying ground adjacent to the river. A buried soil and turf line, representing the landsurface existing prior to the 19th-20th century industrial development of the site was recorded at just below 3m OD. It was sealed by about 2m of modern made ground.

The evaluation has shown that the site lay within active river channels or in marshy areas adjacent to the channels for most of prehistory and on seasonally inundated meadowland during the historic period. Although cut features and structures have elsewhere been found in such environments, no evidence of such archaeology has been found on the site and it is considered that if any human activity took place here in the past it would have been at a very low-level and left few, if any, archaeological remains. In contrast, the samples taken from the site have good potential for reconstructing past environments.

Although the route of the Roman London to Colchester road has been projected across or close to the site area, the evaluation recovered no evidence for the presence of the road within the limits of the site.

No detailed plans for the construction of the Aquatics Centre are yet available, but any ground remediation and other works extending below 2m OD will encounter deposits of archaeo-environmental significance. Although it is considered that the characteristics of these deposits across most of the site have been adequately recorded and sampled during the evaluation, so that little additional information would be obtained by further fieldwork, no evaluation has yet been made of the lowest alluvial deposits (below c 1m OD), which might extend the site sequence back into the Mesolithic. It is therefore recommended that these deposits be examined during ground reduction or by geoarchaeological auger/boreholes.

It is also recommended that an assessment of the potential of the samples collected on the site for past landscape reconstruction is undertaken, which would contribute to

the development of an understanding of the archaeo-environmental potential of the Olympics / Lower Lea Regeneration area and help in targeting environmental work on future sites.

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Front cover: Taking monolith samples through the alluvial stratigraphy in Trench 8

(Top step, made ground; middle step thin made ground over buried turf line and soil formed in alluvial clay, accumulated during seasonal flooding of grassy meadowland; bottom step, predominantly organic deposits, representing permanently flooded marshy fen, with fluvial sands of an active river channel at the base of the sequence - dark line is where the fluvial sands fall away from the more cohesive organic clays above.)

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1 Introduction

1.1 Site background

The evaluation took place within Site 25 (part of Construction Zone 1) of the Olympic 2012 and Lower Lea Valley Regeneration Masterplan. The area evaluated comprises only a part of Site 25 and has been designated Site 25 (Phase 1), as the Tarmac works and other areas are not yet available for evaluation. The area of evaluation, hereafter called 'the site', is bounded by Carpenter's Road to the north-east, Marshgate Lane to the north-west, the Waterworks River to the south-west and the Tarmac works to the south-east (see Fig 1). The OS National Grid References for the centre of the site is 537845 184470.
The level of the ground slab on the site varied between 5.5m OD in the north and 3.4m in the south, corresponding with the current ground level along Carpenter's Road immediately east of the site, which slopes from 5.5m OD in the north to 3.7m OD in the south. The site code is OL-00105.

It is proposed to redevelop the site as an Aquatics Centre. A desk-based *Archaeological assessment* was previously prepared, which covers the whole area of Site 25 (Howell and Corcoran 2005). The *assessment* document should be referred to for information on the natural geology, archaeological and historical background of the site, and the initial interpretation of its archaeological potential. A *Method statement* was subsequently prepared (MoLAS-PCA 2005), which formed the project design for the evaluation. The evaluation comprised ten archaeological trenches excavated in February and March 2005.

1.2 Planning and legislative framework

The legislative and planning framework which framed the archaeological exercise was summarised in the *Archaeological assessment* (Howell and Corcoran 2005, Section 2). A general background to the planning and legislative framework covering all sites included in the Lower Lea Valley Olympic applications was included in the previous *Environmental statement* (Capita Symonds 2004).

1.3 Planning background

In accordance with local and national policies, archaeological evaluation of the site in advance of its redevelopment was required as part of the planning process. Evaluation is intended to define the archaeological potential and significance of any deposits present on the site, so that the local authority can formulate responses appropriate to any identified archaeological resource.

1.4 Origin and scope of the report

This report was commissioned from MoLAS/PCA by the London Development Agency (LDA). The report has been prepared within the terms of the relevant Standard specified by the Institute of Field Archaeologists (IFA 2001).

Field evaluation, and the *Evaluation report* which comments on the results of that exercise, are defined in the most recent English Heritage guidelines (English Heritage, 1998) as intended to provide information about the archaeological resource in order to contribute to the:

- formulation of a strategy for the preservation or management of those remains; and/or
- formulation of an appropriate response or mitigation strategy to planning applications or other proposals which may adversely affect such archaeological remains, or enhance them; and/or
- formulation of a proposal for further archaeological investigations within a programme of research

1.5 Archaeological background

(For words in **bold** see glossary)

1.5.1 Modern topography

The site is located on the floodplain (valley floor) of the River Lea, *c* 3.5km to the north of its confluence with the River Thames. The modern topography and drainage of the area has been much modified by man and bears little resemblance to the landscape of the site in historic and prehistoric times. Ground raising prior to industrial development has masked the natural landsurface by several metres of 'made ground'. Similarly, very little remains in the modern landscape of the natural course of the Lea, which today flows through a series of mostly man-made canalised and culverted channels, including the Waterworks River that is followed by the western boundary of the site.

1.5.2 Geology

The British Geological Survey Sheet 256, North London shows that the site lies on **alluvium**, which represents a range of different wetland and dryland environments that existed on the floodplain of the Lea from the Mesolithic period onwards. Although little archaeological work has previously been undertaken in the local area, excavation in the valley of the Thames and its tributaries suggests that archaeological remains of the prehistoric and earlier historic period are likely to lie within the alluvium.

Gravels, deposited following the scouring-out of the valley floor during the Palaeolithic period (the **Pleistocene**) underlie the alluvium. The base of the gravels, or surface of Tertiary bedrock (which in this area is variably London Clay and Woolwich and Reading Beds) acts as the bottom line for deposits of archaeological interest.

In contrast, archaeology from later periods is likely to lie at the surface of the natural alluvial deposits, or be cut into them.

1.5.3 Buried landscape and its archaeological significance

Recent research, based on geotechnical borehole data, has reconstructed the topography of the Lower Lea valley at the start of the **Holocene**, in the Early Mesolithic (Burton *et al* 2004; subsequently refined for the Olympics area in Corcoran and Swift 2004).
This topography (Fig 2) influenced the environments within the Lea Valley for much of the prehistoric and early historic period, until it became obscured by the build-up of alluvium.

The buried topography shows that the site, and especially its northern and western area, lies close to the deepest part of the floodplain, which may in the past have been followed by the main channel of the River Lea. As a result, activities and environments associated with the active river channel might be expected. In the south-east of the site the landsurface appears to have risen up onto a low terrace, where drier environments and a different range of activities may have existed and taken place.

1.5.3.1 Pleistocene

The higher topography in the south-east part of the site belongs to a low terrace that is thought to exist down the eastern side of the floodplain of the Lea in the Temple Mills to Stratford area (Fig 2). This area is considered to be an older part of the floodplain than further west, as here gravels that accumulated just prior to the **Last Glacial Maximum** (18,000 years ago) may exist, which are known to preserve organic material that has been eroded from the 'reworked' part of the floodplain. Organic deposits of this date are very rare and include the **Arctic Beds** previously recorded further upstream. They have good potential for reconstructing the environment of the Lower Lea prior to and during the last cold stage and for clarifying the impact of the climatic fluctuations of the last cold stage on the landforms and stratigraphy of the valley floor, which is poorly understood.
Towards the end of the Pleistocene (in the **Late Glacial** period) the ancient River Lea appears to have carved out a deep channel in the central part of the floodplain in this area, with its main axis to the west of the present Waterworks River. As it did so, the earlier gravels were reworked, but remained *in situ* further east (ie: forming the low terrace). Within the reworked gravel of the deep channel, fine-grained units have been found, which preserve palaeo-environmental information about the changing climate and environment between about 15,000 and 10,000 years ago.

Although Upper Palaeolithic people may have visited the area in the arctic environment of the Late Pleistocene, evidence for such activity is rarely found.

1.5.3.2 Holocene

The **ecotonal** location of the site, at the interface of the river and low terrace could have been attractive for human activity and resource exploitation at all times in the past. It is in such locations that prehistoric and historic structures associated with watersides (platforms, bridge piers, jetties, fish traps, boats etc) may have been constructed, although much of the activity that took place (fishing, fowling, river transport etc) would have been of an ephemeral nature and will have left little tangible evidence.
Previous geotechnical boreholes from the lower-lying area in the north and west of the site record thick alluvium (peat, clay and sand). Such deposits probably

accumulated in channels and abandoned channels since about 10,000 years ago, from the Mesolithic onwards, and generally preserve environmental remains suitable for past landscape reconstruction. Similar channel-marginal locations upstream have also produced rich evidence of Mesolithic activity (Bowsher and Sidell in prep) and recently a Romano-British timber structure (AoC pers comm.).

The low terrace is likely to have been dry land in the early prehistoric period, when lower-lying parts of the valley floor were probably marshy and crossed by a network of streams. As a consequence of relative sea level rise, the valley floor became progressively waterlogged and the wetland area is likely to have expanded across the drier land of the low river terrace during the prehistoric period. Little information is yet available about the nature and timing of this wetland expansion.

1.5.3.3 Prehistoric cultural activity

Ditches and pits recorded in archaeological evaluation trenches in the eastern part of the Stratford Box (an underground structure associated with the Channel Tunnel Rail Link scheme), to the north-east of the site (Fig 2) suggest local dryland occupation for much of the prehistoric period.

Tributary channels of the Lea are known to have drained across the low terrace and in the area of the present site former channels of the Channelsea River are likely to have existed. Prehistoric and activity associated with the channels of a tributary stream, was recently found during archaeological excavation in the western part of the Stratford Box (Fig 2). Driven stakes and wood off-cuts were dated to both the Bronze and Middle Iron Age (Wessex Archaeology 2003). These lay on the surface of the gravel at *c* 1.09m OD.

1.5.4 Roman

Areas both to the immediate west and east of the Lea Valley – above the valley floor – have archaeological evidence for Roman activity in the form of buildings and field patterns (see (Fig 2 for location). To the west of the valley the activity is associated with the alignment of the London to Colchester road, which left the City of London at Aldgate

Projection of the line of the Roman London to Colchester road, observed in previous excavations undertaken by PCA on the western side of the valley floor, in the Old Ford area, indicates it may cross the floodplain in or not far beyond the southern part Site 25. Earlier conjecture of the route of the Roman road (as mapped in MoLAS' London GIS) put it slightly further south. Both projections are shown of Fig 2 and are based on short lengths of excavated road, which it is assumed linked the concentrations of settlement in the Old Ford and Stratford Market areas. The uncertainty of the exact route of the road demonstrates that it was not absolutely straight, and no doubt was aligned to take advantage of the local topographic differences. However, despite this deviation it is clear that the projected road alignment passes close to the southern limit of the site.

Further evidence for Roman activity on the west side of the valley was provided during recent excavations by AoC in the Old Ford area (AoC 2004) which found timber piles, posts and base plates that are thought to have formed the footings for a bridge of jetty. These lie north of both projected road alignments (Fig 2).

Not enough is yet known about the nature of the river and valley floor in the Roman period to suggest whether a river crossing in this area was feasible and what form such a crossing may have taken. However, a longitudinal transect constructed for the Lea Valley Mapping Project assessment report (Burton *et al* 2004, 148) provided an initial reconstruction of the downstream gradient of the Lea in the past. It suggests that in the confluence area with the Thames the valley floor was relatively flat with a gravel surface around –2.5m OD. A step up to a general gravel surface level of around 0m OD (ie: a '**knickpoint**') occurs roughly where the railway line crosses the valley, just south of Mill Meads (Fig 2). This is also roughly where the multiple threaded modern river in the 'Bow Back Rivers' area converges into a single channel. It has been suggested that these back rivers represent mill leats, with the line of mills depicted on historic maps in the Mill Meads area built to exploit the drop in gradient at this point (Richard Malt pers comm.). A second knickpoint occurs at roughly the point where the Bow to Stratford railway line crosses the Northern Outfall Sewer, which coincides with a constriction in the extent of the deepest part of the valley floor (Fig 2). At this point the general gravel surface level steps up to around 1m OD and from here upstream as far as Tottenham the dip of the valley floor has a steeper gradient (*c* 1:1800).

These characteristics of the valley floor influenced the Holocene river regime and, as a result, may have also had a bearing on the sitting of a Roman (or later) river crossing. The river gradient and its knickpoints will have influenced the upstream migration of tidal water and it is possible that the location of the tidal head had a bearing on the position of a river crossing, as it appears to have done in the City of London. In addition, the location of the river crossing could well have changed through time as the characteristics of the river between Old Ford and Stratford itself evolved. It is likely that many of these issues can be addressed by palaeo-environmental evidence from the alluvium of the valley floor, which will supplement more tangible archaeological evidence from excavated roads, bridge piers and jetties.

1.5.5 Saxon

Evidence for Saxon activity close to the site is associated with the channels of a tributary stream of the Lea, and was recently uncovered during archaeological excavation in the western part of the Stratford Box, Leyton Road (Stratford Station), Stratford New Town, E15 (SBX00), where a Mid to Late Saxon stone and timber bridge abutment / jetty was recorded (Fig 2). This had been constructed from timber piles extending out into the tributaries' channel, which were enclosed by a masonry superstructure of flint and limestone. Two of the timber piles dated to the mid-Saxon period (AD 650-770 and AD 600-800). North of the bridge/jetty was a similarly-dated bundle of wound wattle rods covering part of the channel. In addition, a wattle hurdle panel was recovered within the channel itself, downstream from the bridge/jetty. (Wessex Archaeology 2003). Its location corresponded with the Bronze Age / Iron Age activity noted above (1.5.3.3).

Otherwise, the evidence for specific Saxon-period activity in the site area is limited, although the Lea Valley's watercourses certainly were in use during this period (e.g. substantial driven stakes or piles with leather waste and late-Saxon pottery have been found along the Channelsea (HW-GY94: Stratford Station (Jubilee Line), Gibbin's Yard, Stratford, E15, 600m east of the site).

1.5.5.1 Medieval

The major focus of medieval activity in the area was *c* 1000m to the south-east of the site, on the Stratford marshes where, in 1135, near modern Abbey Road, the Abbey of Stratford Langthorne was founded. The Cistercian Order was renowned for its feats of engineering, particularly of water channels and the exploitation of water power, so the presence of the braided Lea tributaries was exploited from an early phase. Industry was a significant part of the abbey's income, based on the abbey's possession of several water-mills on the rivers. The abbot of Stratford was charged with the repair of bridges including one over the Lea at Bow Bridge. There is no direct evidence for any medieval activity on, or immediately close to, the site.

1.5.6 Post-medieval

Documentary sources show that the site remained as open land until the late 19th century, when industrial development, mainly associated with the perfume industry, took place (including the setting out of Carpenter's Road) – mainly in the period between the 1882 and 1899 Ordnance Survey maps . From the 1960's most of the factories went out of use and the site became derelict and took on its present post-industrial wasteland characteristics.

1.6 Aims and objectives

The following research aims and objectives were established in the *Method Statement* for the evaluation (Section 2.2) and are intended to address the research priorities established in the Museum of London's *A research framework for London Archaeology* (2002):

- Are there any high gravel islands, which may have been exploited in the prehistoric or early historic eras? Or do the gravels shelve gently towards the river?
- Does the peat recorded in several boreholes have archaeological significance, either in terms of its palaeoenvironmental information or as an ancient landscape?
- Is there evidence for prehistoric human exploitation of the landscape? If so is it possible to characterise the status of occupation or land use exploitation?
- Is there evidence for the London-Colchester Roman road? Does it share similar characteristics to the fragments excavated to the west at Old Ford? What is the nature of the landscape that is adjacent to the road and some distance from it?
- What evidence is there for post-Roman exploitation, in particular is there evidence for water inundation and water management? If so how are these activities characterised?
- Are there any in situ deposits of archaeological significance within the made ground or is it all of $19^{th}/20^{th}$ century dump and make-up deposits?
- Is there evidence of pre-19^{th} century industrial features?
- What is the date and significance of the redeposited alluvium?

2 The evaluation

2.1 Methodology

All archaeological excavation and monitoring during the evaluation was carried out by a joint MoLAS/PCA team in accordance with the *Method statement* (MoLAS/PCA 2005).
Ten evaluation trenches, numbered 1 to 10, were excavated (see Fig 3). Trenches 1–5 measured *c* 12m x 12m and Trenches 6–10 *c* 25m x 8m at the top.

Towards the south of the site it was anticipated that the Roman London–Colchester road was close by, or possibly crossing the site. In this area (Trenches 6-9), longer and staggered north-south orientated trenches were excavated cover to intersect the line of the road if it was present.

The ground slab was broken out and cleared by contractors. A mechanical excavator, using a breaker and toothed bucket, reduced the modern overburden under archaeological supervision. Once archaeologically sensitive deposits were identified a toothless ditching bucket was employed.

The trenches were excavated in steps of 1.2m. Four steps were excavated in Trenches 1–5 and three in Trenches 6–10. The depth of the alluvium, unstable sides and water ingress meant that it was not possible in any trench to excavate to the bottom of the alluvial sequence (ie: the top of Pleistocene gravel).

The evaluation trenches were located by the main contractor's engineers and MoLAS surveyors. This information was electronically collated and plotted onto the OS grid. Levels were calculated from the engineer's spot-heights.

A written and drawn record of all archaeological deposits encountered was made in accordance with the principles set out in the MoLAS site recording manual (MoLAS, 1994). Photographic working shots were also taken of every trench.

The trench sections were examined by a geoarchaeologist who provided provisional interpretations of the alluvial deposits excavated and selected representative (ie: 'typical') profiles, for more detailed recording and sampling. Overlapping monolith tins and an adjacent column of bulk samples, together with spot samples for radiocarbon dating were taken for off-site examination from five geoarchaeological profiles. Additional samples for radiocarbon dating were taken from every trench and occasional bulk samples of interesting deposits were also collected.

Following excavation, five radiocarbon samples were selected for dating, to provide a chronological framework for the alluvial deposits recorded on the site, to help in assessing its archaeological and palaeo-environmental potential. The remaining samples collected have not been processed as part of the evaluation. Their locations are referred to in the trench discussions and a preliminary indication of their potential for reconstructing the past landscape of the Lower Lea, as covered by the Olympics / Regeneration scheme, is suggested in section 4, with a strategy for assessment recommended in section 5.

The stratigraphic data from the evaluation trenches and the previous geotechnical investigation has been input into the Lea Valley Mapping Project digital TerraStation II database, as updated for the Olympics / Lower Lea regeneration scheme, with the prefix 'OL25' (see Fig 4).

The site has produced: 1 trench location plan; 109 context records; 44 section drawings at 1:20 and 1:10; and digital photographs of every trench, together with standard 35mm slide and black and white print shots of the site in general. In addition 1 box of finds, 14 monoliths (forming 5 profiles), 39 bulk samples and 39 samples for radiocarbon dating (of which 5 have been processed) were recovered from the site. The site finds and records can be found under the site code OL-00105 in the MoL archive.

2.2 Results of the evaluation

A sequence of alluvial deposits, representing the evolving prehistoric and historic landscape was recorded in each trench. The potential and significance of these deposits for archaeology and past landscape reconstruction can best be understood at a site-wide scale. Thus the deposit sequence in each trench is illustrated on one of two transects (schematic cross sections) drawn across the site (Fig 5 and Fig 6), which relate the individual contexts recorded in each trench to site-wide deposits (facies). The overall characteristics of the site stratigraphy are summarised in section 2.3.
Trenches with alluvial sequences available for off-site analysis are also identified on the transects. Although individual sample locations are not shown, they can be located by reference to the context number and the trench discussions below. All levels have been rounded to the nearest 0.05m.

Note: context numbers are noted thus with square brackets [xx]; sample numbers noted thus with curly brackets {xx}

2.2.1 Trench sequences

2.2.1.1 Evaluation Trench 1

Table 1 Details of depositional sequence in Evaluation Trench 1

Location		North-west area	
Dimensions		12.5m by 12m and 4.30m deep	
Modern ground level		*c* 4.90m OD	
Base of modern fill		3.20m OD	
Top of alluvium observed		3.20m OD	
Level of base of deposits observed		0.65m OD	
Thickness of deposits of archaeological interest (ie: alluvium) observed		*c* 2.6m	
Context numbers		[1 to 12] and [100 to 108]	
Samples	Bulk	Sample {19}	Context [1]
	Radiocarbon	{17}	[4]
		{18}	**[12] (^{14}C dated)**
		{20}	[6]
		{21}	[11]

Evaluation Trench 1 was excavated to a maximum depth of 4.3m below ground level (0.63m OD), where an area 3.50m by 2.12m was exposed. The lower steps of the trench were constricted in area by a large structural base in the southern corner and concrete piles. Although no archaeological features were found about 2.6m of alluvium was recorded and its characteristics contribute to reconstructions of the past environment of the site.

The lowest deposits observed (contexts [1] to [4]) were predominantly sandy. They comprised dipping beds and lenses of interleaved humic (ie: brown, organic matrix) sands and clay silts, with moderate amounts of driftwood, which accumulated within or at the margins of an active channel, probably in an area of shallow water with intermittently fast and sluggish flow. Approximately 1.2m of these deposits were recorded, between *c* 0.65 to 1.8m OD. A sample suitable for radiocarbon dating was taken (sample {17}) from the base of the sequence and a sample ({19}) for plant remains and snails from a very shelly bed towards the top. The humic nature of the sands suggests that they are of Holocene and not Pleistocene date and a radiocarbon date from the overlying deposits indicates that they accumulated in the later prehistoric period.

A gradual interface existed between the humic sands and the overlying sandy humic clay deposits (contexts [11] and [12]), which contained reedy roots. This transition suggests the influence of active flowing water was decreasing and a sedge or reed-filled abandoned channel may have taken the place of the active channel in this part of the site. Samples for radiocarbon dating were taken from the base and top of the humic clays (samples {18} and {21}), but only {18}, from its base was dated as part of the evaluation. It produced a date of 180 BC to AD 120, indicating that in this part of the site a transition from an active channel to backwater took place at the Iron Age / Roman interface. The humic clay was about 0.20m thick, with a surface at about 2m OD. It became less sandy and less humic upwards, representing the transition from a backwater to an area subject to seasonal overbank flooding.

The upper part of the alluvium, between *c* 2m and 2.8m OD, consisted of a sequence of minerogenic clays (contexts [6] to [10]), which probably accumulated as a result of seasonal overbank flooding at some time during the historic period, when the site would have been wet meadowland. Episodic drying out and the effect of soil formation, both whilst the clays accumulated and post-depositionally led to the iron and manganese staining, carbonate precipitations and humic patches that characterise the different contexts.

A peaty clay soil (context [5]), about 0.25m thick with a surface at *c* 3m OD, was recorded at the top of the alluvial sequence and buried by modern made ground deposits. This soil is likely to represent the landsurface that existed in this part of the site prior to burial by ground-raising deposits. The alluvial deposits were sealed by *c* 1.60m of modern overburden (contexts [100]–[108]) and concrete slab.

2.2.1.2 Evaluation Trench 2

Table 2 Details of depositional sequence in Evaluation Trench 2

Location		North-west area	
Dimensions		12.5m by 12m and 4.00m deep	
Modern ground level		5m OD	
Base of modern fill		2.8m OD	
Top of alluvium observed		2.8m OD	
Level of base of deposits observed		1.05m OD	
Thickness of alluvium (ie: deposits of archaeological interest) observed		c. 1.75m	
Context numbers		[13] to [22]	
Samples	Monolith	Sample {9}	Context [13]
		{10}	[13] [17] [18]
		{11}	[13] [15] [16]
	Bulk	{2}{3}{4}	[16]
		{5}{6}	[15]
		{7}{11-12}	[13]
		{14}	[18]
		{15}	[17]
	Radiocarbon	{8}{16}	[13]

Evaluation Trench 2 was excavated to a maximum depth of 4m below ground level (1.05m OD), where an area 4m by 4.25m was exposed. Below 2.2m of made ground, 1.75m of alluvium was recorded. Overlapping monoliths with adjacent bulk and radiocarbon samples were taken through the entire alluvial sequence and these samples have potential for past landscape reconstruction. No archaeological features were found within the trench, although one piece of possible worked wood was found within active river channel deposits towards the base.

About 0.2 to 0.35m of loose coarse sandy gravel (context [16]) that became increasingly sandy upwards and contained thin lenses of soft grey clay was recorded at the base of Trench 2, with an irregular surface just below 1.20m OD. Fine roots were visible throughout the gravel and bulk samples {2}, {3} and {4} were taken from it. Above the gravel was soft grey sand with clayey and shell rich lenses (context [15]). The undulating surface of the sand was recorded between 1.20 and 1.35m OD. Bulk samples {5} and {6} were taken from it and a piece of possible worked wood was found, which had been incorporated as driftwood as the sand accumulated. The gravel and overlying sands represent episodes of active flowing water. The fining up sequence observed may represent a gradual drop in the flow rate from energetic to more tranquil river flow through time and the formation of an in-channel or point bar, suggesting migration of the active channel away from the trench location. The clayey lenses within the layers suggest periods of standing water, which may have resulted from seasonal fluctuations in water flow. The rooting observed also suggests periods of lower flow allowing vegetation to take hold.

Towards the southern part of the trench the sand was interleaved with bands of humic clay (context [14]), which represent the transition from an active channel to a slackwater area. Humic clay, containing plant, wood and shell fragments and sand lenses (context [13]) sealed these deposits and extended across the entire trench. The humic clay layer was about 0.85m thick and itself became less humic with less organic fragments upwards. It was sampled with bulk samples {7}, {11} and {12} and radiocarbon samples {8} and {16} were taken from its base and top respectively. Its surface lay at 2.05m OD. It represents deposition in fairly tranquil standing water conditions possibly at the edge of an active channel or in an abandoned channel, which would have existed as a marshy vegetated backwater. However, sand lenses, especially towards the southern part of the trench, suggest episodic fluvial influence was still taking place.

An alluvial clay sequence, about 0.75m thick (context [17] and [18]), with a surface at approximately 3m OD was recorded above the organic layers and was sampled with bulk samples {13} to {15}. The clays are likely to represent an accretionary soil developing in overbank flood deposits in a grass or hay meadow environment. The alluvial sequence was sealed by *c* 2.2m of modern overburden, redeposited clay and concrete slab.

2.2.1.3 Evaluation Trench 3

Table 3 Details of depositional sequence in Evaluation Trench 3

Location		North-west area	
Dimensions		11.25m by 11m by 4.9m deep	
Modern ground level/top of slab		5.2m to 5.5m OD	
Base of modern fill/slab		2.7m OD	
Top of alluvium observed		2.7m OD	
Level of base of deposits observed		0.6m OD	
Thickness of alluvium (ie: deposits of archaeological interest) observed		*c* 2m	
Context numbers		[39] to [46]	
Samples	Radiocarbon	Samples {22} {23}	Context [45]
		{24}	[44]

Evaluation Trench 3 was excavated to a maximum depth of 4.9m below ground level (0.6m OD), where an area 3m by 2.25m was exposed. The lower steps of the trench were obstructed by a deep concrete foundation in its north-eastern corner. Below about 2.8m of made ground, 2m of alluvium was recorded and its characteristics contribute to reconstructions of the past environment of the site. No archaeological features or finds were found.

At the base of the trench, 0.15m of sandy gravel with a humic matrix and some rooting (context [46]) was recorded, with a surface at 0.85m OD. The deposit was difficult to record accurately owing to water ingress, but is likely to represent in-channel deposition in fairly high-energy river conditions. The rooting observed may be the result of channel migration exposing the channel deposits and allowing plant colonisation, although the roots could be intrusive from the more organic deposit above.

A gradual transition from an active to peripheral channel environment is recorded in the overlying humic silt (context [45]), which contained frequent thin lenses of fine silty sand in its lower part but became gradually less silty and more clayey upwards.

Wood, plant and reed fragments were moderately abundant throughout the context, which was *c* 0.8m thick. Two radiocarbon samples, {22} and {23} were taken from the base and top of the humic silts. The overlying humic clay, context [44] was *c* 0.2m thick, with a surface at *c* 1.75m OD and probably represents a marshy backwater environment cut off from the direct influence of the river. Radiocarbon sample, {24} was taken from the top of this unit.

The overlying deposits (contexts [40] to [43]) consisted of grey/brown minerogenic clays, *c* 0.75m thick with a surface at 2.5m OD and represent an accretionary soil developing in overbank flood deposits, probably in wet meadowland. The uppermost 0.15m of the alluvial clay was darker and more humic (context [39]). This deposit (with a surface at 2.7m OD) may represent the buried soil of the landsurface existing prior to the industrial development of the site. The alluvial sequence was sealed by c. 2.7m of modern overburden and concrete slab.

2.2.1.4 Evaluation Trench 4

Table 4 Details of depositional sequence in Evaluation Trench 4

Location		Central area	
Dimensions		12m by 11.5m by 4.6m deep	
Modern ground level/top of slab		4.6 to 5.2m OD	
Base of modern fill/slab		2.75m OD	
Top of alluvium observed		2.5m OD	
Level of base of deposits observed		0.6m OD	
Thickness of alluvium (ie: deposits of archaeological interest) observed		*c* 2m	
Context numbers		[30] to [38]	
Samples	Monolith	Samples {30}	Contexts [37+38]
		{31}	[37]
		{32}	[34-36]
		{33}	[31-33]
	Bulk	{34}	[31]
		{35}	[32]
		{36}	[33]
		{37}	[34]
		{38}	[35]
		{39}	[36]
		{40-44}	[37]
	Radiocarbon	**{45}**	**[37] (^{14}C dated)**
		{46}	[36]

Evaluation Trench 4 was excavated to a maximum depth of 4.6m below ground level (0.6m OD), where an area 3m by 3.5m was exposed. No archaeological features or finds were found within the trench, but below about 2.3m of made ground *c* 2m of alluvium was recorded and sampled with overlapping monolith tins and adjacent bulks and these samples have potential for past landscape reconstruction.

At the base of the trench about 0.05m of loose sandy gravel with frequent small roots was observed (context [38]), with a surface at *c* 0.8m OD. It was not possible to accurately record the layer as a result of severe water ingress. The gravel represents active channel flow across this part of the site, and is likely to be Holocene in date. The rooting observed within it could represent vegetation colonising an exposed gravel bar, although the roots may be intrusive from the organic layer above.

Above the gravel a 1.15m thick unit of humic silt (context [37] and [36]), with roots, reeds, wood and shell fragments was recorded. The top of the unit was observed at *c* 2m OD. Its lowest part contained lenses of mid grey silty sand together with a proportion of sand in the matrix, which became progressively less sandy upwards. This fining up sequence suggests the lower part of the context represents reedbeds at the slackwater margins of a river channel that became progressively less influenced by channel flow through time. Two radiocarbon samples ({46} and {45}) were obtained from the top and base of the humic silts. Sample {45}, taken from the base of the deposit, has been dated to between 1730 and 1400 BC. This suggests that the transition from an active to abandoned channel in this part of the site took place during the Early to Middle Bronze Age. A continuous column of bulk sample slabs ({39} to {44}) was also taken from the humic silts.

A 0.5m thick unit of minerogenic alluvial clay (contexts [33] to [35]) was recorded above the humic silts, with a surface at *c* 2.4m OD. Its upper part contained occasional fragments of brick and clay pipe. These deposits are probably the result of seasonal overbank flooding with accretionary soils forming in a wet grassy environment. The alluvial clays were sampled with bulk samples {36} to {38}.

A buried subsoil and topsoil horizon had developed in the top of the alluvial clays and was recorded between about 2.4 and 2.7m OD (context [31] and [32]). At the interface of this soil and the overlying made ground was a 0.02m thick layer of matted roots and plant material, which probably indicates a buried turf line of the landsurface that existed on the site immediately prior to its industrial development. The buried soil was sampled with bulk samples {34} and {35}. The alluvial sequence was sealed by *c* 2.45m of redeposited clay (context [30]), modern overburden and concrete slab.

2.2.1.5 Evaluation Trench 5

Table 5 Details of depositional sequence in Evaluation Trench 5

Location	Central area		
Dimensions	11.5m by 11m by 3.7m deep		
Modern ground level/top of slab	5.1m OD		
Base of modern fill/slab	2.75m OD		
Top of alluvium observed	2.55m OD		
Level of base of deposits observed	1.4m OD		
Thickness of alluvium (ie: deposits of archaeological interest) observed	*c* 1.05m		
Context numbers	[47] to [56]		
Samples	Radiocarbon	Sample {47} **{48}** {49)	Context [54] base **[54] middle (^{14}C dated)** [54] top

Evaluation Trench 5 was excavated to a maximum depth of *c* 3.7m below ground level (*c* 1.35m OD), where an area 6m by 5.5m was exposed. Below 2.3m of made ground, *c* 1.4m of alluvium was recorded. No archaeological features were found, although four pieces of worked wood ([47] to [49], and [56]) were recovered from active channel deposits towards the base of the trench.

About 0.10m of coarse grey sand (context [55]) was recorded at the base of the trench, with a surface at about 1.5m OD. This deposit was difficult to record accurately, as a result of rapid water ingress, but is likely to represent active channel flow. A machine-dug slot was dug down from the base of the trench to find the depth of the sand and level of the underlying Pleistocene gravel surface. It was not possible to record these depths accurately, as access could not be gained close to the sondage owing to the instability of the sand, but it was estimated that the sand was about 2m thick and the gravel surface lay at around –0.5m OD.

Above the sand a 0.6m thick unit of brown humic silt (context [54]), with a surface at 2.1m OD, was recorded. Lenses of moderately coarse grey sands containing shell fragments were prevalent throughout the layer, but with a larger number of lenses towards its base. The humic silts contained reedy plant material and small fragments of wood throughout and represent a marshy slackwater area at the margin of a river channel. Four pieces of worked wood (context [47] to [49] and [56]) were recovered from the same location at the base of the humic silts, just above the interface with the underlying sands. The wood was probably washed-up onto the sandy margins of the channel and the fact that all four pieces (two planks and two others) were found together and that they were not with natural driftwood (eg: branches) suggests they had not travelled far. This was also suggested by the clarity of the toolmarks (D. Goodburn pers comm.). The humic silts became more clayey in their upper part, which suggests decreased influence from the active river and the development of a quieter backwater environment. Three radiocarbon samples (sample {47} to {49}) were taken from the humic silts and sample {48}, from roughly where the silts became more clay-rich, was dated as part of the evaluation. The date obtained, of 1600 to 1400 BC, puts the transition from the margin of an active river to a marshy backwater in the Early to Middle Bronze Age.

A gradual interface between the humic clay and overlying minerogenic clays (context [53], [52]) suggests a gradual transition from backwater to wet meadow subject to seasonal overbank flooding. The alluvial clays were 0.45m thick, with a surface at 2.55m OD. Above the alluvial clays a subsoil and topsoil horizon (context [51]) *c* 0.25m thick was identified and a turf-line was preserved at about 2.8m OD. The sequence was sealed by about 2.3m of redeposited clay (context [50]), modern overburden and concrete slab.

2.2.1.6 Evaluation Trench 6

Table 6 Details of depositional sequence in Evaluation Trench 6

<table>
<tr><td>Location</td><td colspan="3">Southern area</td></tr>
<tr><td>Dimensions</td><td colspan="3">8.5m by 25.75m and *c* 3m deep</td></tr>
<tr><td>Modern ground level/top of slab</td><td colspan="3">3.6 to 4.1m OD</td></tr>
<tr><td>Base of modern fill/slab</td><td colspan="3">*c* 2.8m OD</td></tr>
<tr><td>Top of alluvium observed</td><td colspan="3">*c* 2.8m OD</td></tr>
<tr><td>Level of base of deposits observed</td><td colspan="3">1.1 to 1.5m OD</td></tr>
<tr><td>Thickness of alluvium (ie: deposits of archaeological interest) observed</td><td colspan="3">*c* 1.7m</td></tr>
<tr><td>Context numbers</td><td colspan="3">[57 to 61]</td></tr>
<tr><td rowspan="3">Samples</td><td rowspan="3">Radiocarbon</td><td>Sample {50}</td><td>Context [58]</td></tr>
<tr><td>{51}</td><td>[60]</td></tr>
<tr><td>{52}</td><td>[61]</td></tr>
</table>

Evaluation Trench 6 was excavated to a maximum depth of 3m below ground level (1.1m OD), where an area about 1.4m by 15m was exposed. The trench was bisected by a concrete base about 3m wide and was excavated in two parts (north and south), both of which had the same deposit sequence. No archaeological finds or features were found, but about 2.6m of alluvium was recorded and its characteristics contribute to reconstructions of the past environment of the site.

The lowest deposits observed (contexts [61] to [60]) formed a fining-up sequence 0.6m thick, of humic sands to silts, with frequent snail shells and reed fragments and sand lenses in its lower part. It is likely to represent the reed and sedge-filled margins of an active river. Occasional driftwood fragments were found that had been washed-up along the edges of the river, but none appeared to be worked. Two samples suitable for radiocarbon dating were taken (samples {51 and 52}). The surface of the humic sands and silts lay at about 1.8m OD. A previous borehole drilled through the sediments excavated in Trench 6 suggests they become increasingly sandy below the base of the trench, where they probably represent a more active channel environment, and extend to an interface with floodplain gravel at just above 0m OD.

.A layer of whitish grey organic silt (context [59]) about 0.20m thick existed at the interface of the organic sands and silts and overlying minerogenic alluvial clay. Although the depositional environment of the organic silt is uncertain, it is likely to represent the transition from sedge-filled backwater to seasonally flooded meadowland and probably indicates greater oxidation of organics as a result of regular drying out and greater inputs of clayey sediment carried by the river.

The uppermost 0.8m of the alluvium, between about 2m and 2.8m OD was predominantly clayey (contexts [58] and [57]). A sample for radiocarbon dating was taken (sample {50}) from a more organic horizon towards the base of the clays, which probably accumulated as a result of seasonal overbank flooding. Episodic drying out and the effect of soil formation, both whilst the clays accumulated and post-depositionally led to the iron and manganese staining and humic patches that characterise the different contexts.

A peaty clay soil (base of +), about 0.25m thick with a surface at *c* 2.8m OD, was recorded at the top of the alluvial sequence and buried by modern made ground deposits. This soil is likely to represent the landsurface that existed in this part of the site prior to its industrial development. The alluvial deposits were sealed by *c* 1m of modern overburden.

2.2.1.7 Evaluation Trench 7

Table 7 Details of depositional sequence in Evaluation Trench 7

<table>
<tr><td>Location</td><td colspan="3">Southern area</td></tr>
<tr><td>Dimensions</td><td colspan="3">8m by 30.5m and c 3m deep</td></tr>
<tr><td>Modern ground level/top of slab</td><td colspan="3">3.7 to 4m OD</td></tr>
<tr><td>Base of modern fill/slab</td><td colspan="3">c 2.6m OD</td></tr>
<tr><td>Top of alluvium observed</td><td colspan="3">c 2.6m OD</td></tr>
<tr><td>Level of base of deposits observed</td><td colspan="3">c 0.4m OD</td></tr>
<tr><td>Thickness of alluvium (ie: deposits of archaeological interest) observed</td><td colspan="3">c 2m</td></tr>
<tr><td>Context numbers</td><td colspan="3">[62 to 75] and [109]</td></tr>
<tr><td rowspan="12">Samples</td><td>Bulk</td><td>Sample {59}</td><td>Context [69]</td></tr>
<tr><td rowspan="2">Pollen/diatom</td><td>{66}</td><td>[63-65]</td></tr>
<tr><td>{67}</td><td>[65+71-3]</td></tr>
<tr><td rowspan="9">Radiocarbon</td><td>{53}</td><td>[69]</td></tr>
<tr><td>{54}</td><td>[73]</td></tr>
<tr><td>{55}</td><td>[109]</td></tr>
<tr><td>{56}{61}{64}</td><td>[64]</td></tr>
<tr><td>{57}</td><td>[68]</td></tr>
<tr><td>{58}</td><td>[66]</td></tr>
<tr><td>{60}</td><td>[74]</td></tr>
<tr><td>{62}</td><td>[72]</td></tr>
<tr><td>{63}{65}</td><td>[71]</td></tr>
</table>

Evaluation Trench 7 was excavated to a maximum depth of 3.5m below ground level (0.4m OD), where an area about 2.5m by 22m was exposed. The trench was excavated in two parts (north and south) as a result of a concrete capping beam and piled foundations that crossed its central area. No archaeological finds or features were found, but about 2.6m of alluvium with potential for past landscape reconstruction was recorded. Very soft sediment at the base of the trench and oil contamination limited the opportunity for sampling.

The stratigraphy recorded in Trench 7 was interesting, as evidence for the migration of a river channel from east to west across the trench was clearly seen. The earliest deposit recorded was a bank of calcareous (possibly tufa-rich) sand (context [75]) in the south-east corner of the trench. This sand was well-concreted, suggesting it may be early in date and was possibly deposited at the edge of a Mesolithic / Early Holocene river channel. There was evidence for a soil, or at least vegetation growth, in its surface ([74]), which may have developed as the river migrated away from this part of the trench. The surface of the calcareous sand bank was at about 1.3m OD and its edge crossed the trench diagonally from north to south.

Sands ([73]) recorded intermittently across the base of the trench to the north and west of the sandy bank were probably deposited as the river subsequently migrated westwards. Although only the uppermost part of these sands was seen, they appeared to be loose and well-bedded and contained hair roots, some twiggy plant material and calcareous / tufa clasts, suggesting reworking of earlier channel deposits. Their surface undulated between about 1.6m OD and below the base of the trench. The series of ridges and hollows (swales) created by the undulating surface of the sands is characteristic of a point-bar, formed as a channel migrates away from a bend in the river. A sample suitable for radiocarbon dating ({54}) was taken from the top of the sand towards the north of the trench, but this is likely to post date the initial deposition of these sands, closer to the calcareous sandy bank in the south-east.

Organic clay deposits ([69], [72]) infilled the hollows in the surface of the sand, which may have formed shallow pools, cut off from the active channel. Layers of leaves and other organic debris lay within the clay and this material had probably been blown or washed into the pool and settled in the mud on its floor, becoming well-preserved and stratified. A bulk sample ({59}) was taken from [69]. Thin peat beds ([71], [66], [68]) with shrubby roots sealed the clays, suggesting that the pools eventually became vegetated marshy hollows. Samples suitable for radiocarbon dating were taken from the organic clays ({62}, {53}) and peat lenses ({63}, {57} and {58}), which would provide a timescale for the channel migration and evolving environment in this part of the site.

Evidence for rising river levels may be recorded in the clays ([65] and possibly [64]) that seal the peat developed across the earlier pools and sand banks. These clays might represent prolonged flooding. Such flooding could reflect ‘ponding-back’ associated with the progressive influence of estuarine conditions in this part of the Lea Valley. A series of samples for pollen and diatoms ({66} and {67}) was taken through the sequence in the southern part of the trench, to investigate whether changes exist in the salinity of the water through time in this area.

A layer of alluvial clay 0.30 to 0.40m thick ([63]), representing seasonal overbank flooding, sealed the earlier alluvial deposits (above about 2m OD). A soil ([62]) had developed in the surface of these clays, with the old turf-line still intact across most of the trench, suggesting that prior to the modern industrial build-up the grassy landsurface in this part of the site lay at *c* 2.6m OD.

2.2.1.8 Evaluation Trench 8

Table 8 Details of depositional sequence in Evaluation Trench 8

Location	Southern area		
Dimensions	27m by 9m and *c* 3.5m deep		
Modern ground level/top of slab	3.5 to 3.9m OD		
Base of modern fill/slab	*c* 2.9m OD		
Top of alluvium observed	*c* 2.9m OD		
Level of base of deposits observed	*c* 0.3m OD		
Thickness of alluvium (ie: deposits of archaeological interest) observed	*c* 2.5m		
Context numbers	[76 to 84]		
Samples	Radiocarbon	Sample {68}	Context [83]
		{69}	**[82] ^{14}C dated**
		{70}	[81]
		{71}	[79]
		{80}	[80]
	Bulk	{72}	[76]
		{73}	[77]
		{74}	[78]
		{75+76}	[79]
		{77}	[81]
		{78}	[82]
		{79}	[83]
	Monolith	{25}	[79][81][82]
		{26}	[82][83]
		{27}	[76][77][78]
		{28}	[[77][78][79]

Evaluation Trench 8 was excavated to a maximum depth of 3.5m below ground level (about 0.3m OD), where an area about 3m by 21.5m was exposed. No archaeological finds or features were found. About 2.5m of alluvium was recorded, which was sampled with overlapping monoliths and adjacent bulk and radiocarbon samples in the northern part of the trench (see front cover photo) and these samples have potential for past landscape reconstruction.

Well-bedded gravelly sand ([83], bulk sample {79}) containing shells, driftwood and occasional tufa clasts was intermittently recorded at the base of the trench and would have been deposited as bars (sandbanks) within an active river channel. Occasional humic silt lenses existed within the sand and one was sampled for radiocarbon ({68}), which would date the active phase of channel flow in this area. The surface of the sand dipped from about 1.2m OD in the north of the trench to about 0.8m OD in the south.

A gradual interface existed between the sand and overlying humic silt ([82], bulk sample {78}), which contained occasional sand lenses and reedy roots. This suggests gradual marginalisation of the area from active flowing water and the development of sedges in shallow, slack water at the edge of the river. A date of 2270-1910BC was obtained from radiocarbon sample {69}, taken from the base of the humic silts, indicating that the transition from active river to fringing sedge fen took place in the very late Neolithic or early Bronze Age. A layer of woody peat ([81], bulk sample {77}) 0.2 to 0.6m thick, had formed at the surface of the silts, suggesting that shrubby vegetation developed as the influence of the river decreased. Radiocarbon sample {70} was taken to date this development. The peaty surface lay at about 1.6m OD and was best-developed in the northern part of the trench. Towards the south it was barely perceptible, but could be identified as a slightly darker band, with more woody inclusions, at the top of the humic silts, at about 1.2m OD.

Humic clays with frequent reedy roots ([79], bulk samples {75} and {76}) overlay the peaty surface. They imply prolonged periods of standing water and might be associated with 'ponding back' of drainage as a result of rising river levels and the encroachment of estuarine conditions upstream. Radiocarbon sample {71} was taken from the upper surface of the humic clay (fairly consistent across the trench at about 2.3m OD) and could date the transition to the drier (ie only seasonally flooded) environment represented by the overlying minerogenic clays ([78] and [77], bulk samples {74} and {73}). A soil ([76], bulk sample {72}) had developed in the alluvial clay, which had been truncated at about 2.75m OD during modern ground-raising / industrial activities.

2.2.1.9 Evaluation Trench 9

Table 9 Details of depositional sequence in Evaluation Trench 9

Location	South-east of site		
Dimensions	22m by 7m and *c* 3m deep		
Modern ground level/top of slab	4.15 to 4.6m OD		
Base of modern fill/slab	*c* 2.8m OD		
Top of alluvium observed	*c* 2.8m OD		
Level of base of deposits observed	*c* 1m OD		
Thickness of alluvium (ie: deposits of archaeological interest) observed	*c* 1.8m		
Context numbers	[85 to 90] and [98]		
Samples	Bulk	Sample {83}	Context [87]
		{84}	[88]
		{85}	[89]
		{86}	[90]
		{87}	[98]
	Radiocarbon	{88}{89}	[88]
		{90}	**[90] (^{14}C dated)**
	Monoliths	{81}	[87][88]
		{82}	[88][89][90][98]

Evaluation Trench 9 was excavated to a maximum depth of 3.6m below ground level (about 1m OD), where an area about 2.5m by 12.5m was exposed. No archaeological finds or features were found. About 2.5m of alluvium was recorded and its lower, more organic, part sampled with overlapping monoliths and adjacent bulk and radiocarbon samples, which have potential for past landscape reconstruction.

A shallow geoarchaeological slot at the base of the trench recorded 0.20m of a silty sand deposit (context [98]), with abundant calcareous concretions (tufa) and snail shell fragments, which extended downwards to an unknown depth. It was sampled with bulk sample {87}. The silty sand is likely to have been deposited within an active river channel and its tufaceous characteristics suggest clear water and a warm climate. Such deposits are often found to be of Neolithic or earlier date. The fluvial sands were overlain by blackish brown gritty organic clay ([90]) that was observed intermittently along the base of the trench, with an irregular surface rising to about 1.5m OD. Bulk sample {86} was taken from the organic clay and a date of 2910-2490 BC was obtained from it (radiocarbon sample {90}), indicating it formed during the Neolithic, which is compatible with the date inferred for the underlying fluvial sands. Hollows in the surface of the sand and filled with the organic clay were suggestive of rooting and may represent shrubby vegetation development following a period of standing / stagnant water above the earlier fluvial sands.

The overlying gritty silty clay deposits contained frequent reed stems and humic, peaty lenses (contexts [88, 89]). These deposits may represent a mosaic of sedge-filled hollows and grassy hummocks within an area of permanently and seasonally flooded marshy ground. The overlying paler grey clay ([87]) with a surface at just below 2m OD, may indicate greater amounts of sediment transported in the floodwater influencing this part of the site, or more prolonged periods of drying out (ie: little organic preservation). It was sealed by *c* 0.7m of firm clay, likely to represent seasonal overbank flooding ([86] and [85]) and about 1.5m of modern made ground.

2.2.1.10 Evaluation Trench 10

Table 10 Details of depositional sequence in Evaluation Trench 10

<table>
<tr><td>Location</td><td colspan="3">South-east of site</td></tr>
<tr><td>Dimensions</td><td colspan="3">21m by 7.5m and c 3m deep</td></tr>
<tr><td>Modern ground level/top of slab</td><td colspan="3">4 to 4.5m OD</td></tr>
<tr><td>Base of modern fill/slab</td><td colspan="3">c 2.75m OD</td></tr>
<tr><td>Top of alluvium observed</td><td colspan="3">c 2.75m OD</td></tr>
<tr><td>Level of base of deposits observed</td><td colspan="3">c 1.25m OD</td></tr>
<tr><td>Thickness of alluvium (ie: deposits of archaeological interest) observed</td><td colspan="3">c 1.5m</td></tr>
<tr><td>Context numbers</td><td colspan="3">[91 to 95]</td></tr>
<tr><td rowspan="6">Samples</td><td rowspan="3">Bulk</td><td>Sample {92}</td><td>Context [93]</td></tr>
<tr><td>{93}</td><td>[94]</td></tr>
<tr><td>{94}</td><td>[95]</td></tr>
<tr><td rowspan="2">Radiocarbon</td><td>{95}</td><td>[94]</td></tr>
<tr><td>{96}</td><td>[99]</td></tr>
<tr><td>Monolith</td><td>{91}</td><td>[92][93][94][95]</td></tr>
</table>

Evaluation Trench 10 was excavated to a maximum depth of 3.2m below ground level (about 1.25m OD) in a slot at the southern end of the trench. The remaining trench was excavated to about 1.5m OD, where an area about 2.5m by 1m was exposed. No archaeological features were found, but a cut bone and some pieces of possibly worked wood were recovered from the interface of an active channel deposit and overlying peaty landsurface at the base of the alluvial sequence. About 1.5m of alluvium was recorded and its lower part was sampled with one monolith and adjacent bulk and radiocarbon samples, which have potential for past landscape reconstruction.

A bedded gravel deposit, with organic inclusions and becoming sandy in its upper part (context [95]) was recorded at the base of the trench. The gravels are likely to represent Holocene re-working of Pleistocene floodplain gravel and they were sampled with bulk sample {94}. The gravel surface sloped upwards from about 1.4m OD in the north of the trench to 1.55m OD in the south.

It was overlain by a layer of gritty peaty silt about 0.15m thick ([94]), which probably represents vegetation colonising the gravel surface and was sampled with radiocarbon sample {95} and bulk sample {93}.

A cut metatarsal (lower leg) bone from an adult horse (Kevin Rielly, pers comm) and fragments of possibly worked wood were found at the interface of the sandy gravel with the peaty surface. It is unclear whether they had washed-in with the sand or had been discarded on the peaty surface. Examination of the bone has identified shallow cuts and scrapes all down the anterior (front) surface, which suggest it had been skinned with a lithic blade (Alan Pipe, pers comm.).

The deposit overlying the peaty silt was a whitish grey silty clay ([93]) with an irregular surface between about 1.8m and 2m OD. Although its environment of deposition is uncertain, it is probably transitional between permanent wetland and seasonally flooded meadowland. It was sampled with bulk {92}. A tree throw (context [96]) was identified within this deposit in the northern part of the trench. Rooting, likely to be associated with the tree, extended into the underlying gravels and was sampled for species identification and radiocarbon dating (sample {96}). Firm iron-stained clays (context [91 and 92]) about 0.5m thick formed the upper part of the alluvial sequence. Although the clays represent the development of wet meadowland with seasonal overbank flooding, their brown and oxidised characteristics suggest frequent drying-out. Frequent pebbles may also suggest proximity to an area of higher gravel – perhaps beyond the south-east margin of the site. A soil and buried turf-line had developed in the surface of the alluvium and represent the landsurface prior to the industrial development of the site, which lay at about 2.75m OD in this area. The alluvial deposits were buried by about 1.5m of made ground.

2.2.2 Radiocarbon dating

A roughly similar stratigraphic sequence, with local variation, was recorded in each trench but, without dating the sequences, it is not possible to tell whether the succession of changing environments took place at the same time everywhere across the site, or whether the deposits were 'time transgressive' (ie: forming at different times in different places).

Although the alluvial deposits on the site contained little dateable archaeological material, such as pottery, organic remains were well preserved and such material can be radiocarbon dated to provide a chronology for the site sequence. Without such dating, in fact, the samples and records of the alluvial stratigraphy would be of relatively little value, as archaeo-environmental remains themselves are not inherently dateable.

During excavation samples for radiocarbon dating were collected in every trench from suitable organic deposits, focusing on levels where one depositional environment changed into another. This system ensured that samples were obtained from key deposits and levels that would have significance at a site-wide scale, even though exactly which deposits and levels these would be would not be known until preliminary stratigraphic assessment was undertaken. As a result, more samples (and this applied to all environmental samples, not just those taken for radiocarbon dating) were taken on site than would eventually be needed for assessment and analysis.

In order to provide a preliminary chronological framework for the alluvial sequence recorded on the site and, in particular, to establish whether the deposit sequence was synchronous across the site as a whole, five samples were selected from the 39 taken on the site and submitted for radiocarbon (^{14}C) age estimation. The results of this dating will provide a very basic framework in which to place the preliminary interpretations of the changing environments and landscape processes represented by the alluvium and provisionally assess its potential. Further dating, which will provide more detail, will be undertaken during later assessment and analysis.

The samples selected were widely spaced across the site and were all taken from locations that would date the transition from active channel to marshy backwater or abandoned channel environments. The sample locations and elevations are set out in the table below and illustrated in Fig 5 and Fig 6.

Table 11 The radiocarbon samples

Trench	context	Sample	m OD	Material	Co-ords	MoLAS ref.
1	[12]	{18}	1.8	Fibrous organics from organic sediment	537789/184445	OL1-TR1-1.8
4	[37]	{45}	0.7	Organic sediment	537936/184369	OL1-TR4-0.7
5	[54]	{48}	1.9	Organic sediment	537933/184337	OL1-TR5-1.9
8	[82]	{69}	1.1	Organic sediment	537995/184261	OL1-TR8-1.1
9	[90]	{90}	1.2	Organic sediment	538037/184253	OL1-TR9-1.2

All of the samples were analysed by the radiometric dating technique. The ^{14}C age estimates, made by Beta Analytic[1] are presented in the table below.

Table 12 Results of radiocarbon dating

context	sample	Lab no.	Uncalibrated date	calibrated date*
[12]	{18}	Beta-204033	2070+/-70 BP	190 BC to AD 120
[37]	{45}	Beta-204034	3370+/-60 BP	1730 to 1440 BC
[54]	{48}	Beta-204035	3270+/-50 BP	1600 to 1400 BC
[82]	{69}	Beta-204036	3750+/-60 BP	2270 to 2260 and 2220 to 1910 BC
[90]	{90}	Beta-204037	4180+/-80 BP	2910 to 2490 BC

The dates suggest that the alluvial deposits are 'time transgressive' and not contemporary across the site. This means that although the deposit sequence looks roughly the same in each trench, similar deposits (fluvial sands and gravels; humic silts accumulated at the margins of channels and humic clays in backwaters) were accumulating at different times in different places. The active river channel deposits are older in the south-east than in the central and north-west areas; and the marshy backwater deposits are correspondingly of different date in different locations.

[1] Calibration was provided by Beta Analytic, using the calibration data published in Stuiver, M. *et al* (1998) *Radiocarbon Vol.40 No.3* and is quoted to 98% confidence levels.

Significantly, there appears to be a trend in the date of the transition from active channel to backwater (ie: cut off from the active river) deposits, which suggests that the south-eastern corner of the site became abandoned by the river during the Neolithic, whereas a river channel continued to flow in the central area until the Early to Middle Bronze Age and across the north-western area until the Romano-British period. This would imply that a river channel was migrating from south-east to north-west across the site during the prehistoric and early historic period.

2.3 Stratigraphic discussion of the site

A similar sequence of deposits was recorded in each trench. The distribution of these deposits (facies) across the site as a whole is illustrated in Fig 5 and Fig 6.
In general, sands and/or gravels deposited within an active river channel (facies 1-3) were overlain by humic silts representing the slackwater fringes of the river (facies 5) and then by humic (and subsequently manganese stained) clays, accumulated in shallow standing or stagnant water (facies 6). Firmer clays with evidence of pedogenesis (soil formation) indicate that these permanent pools eventually dried out seasonally, when grassy meadowland subject to seasonal overbank flooding developed (facies 7). The turf line of the landsurface existing prior to the industrial development of the site (facies 8) was preserved in several trenches, with the soil and subsoil horizons of this landsurface surviving almost everywhere across the site. The alluvial stratigraphy was sealed by 1-2m of made ground (facies 9).

Although this sequence suggests decreasing influence from the river and increasingly dry environments developing through time, the results of radiocarbon dating suggest that the succession of changing environments did not take place at the same time everywhere across the site. Older deposits exist in the south-eastern area than further north and west and this suggests that a river channel may have been migrating progressively from south-east to north-west across the site during the prehistoric period.

2.3.1 Buried topography

The stratigraphy recorded in the evaluation trenches and previous geotechnical investigation has been added to the updated Olympics / Lower Lea Regeneration version of the Lea Valley Mapping Project database. A topographic plot of the Pleistocene gravel surface, based on preliminary examination of this data has been constructed (Fig 7), which shows that the surface of gravel is generally low (between Om and 1m OD) across the site. Beyond the western boundary of the site the gravel surface falls to nearly –2m OD and to –3.5m OD to the south-west of the Site 25 area. This location, close to the deepest part of the valley floor, implies that the site was likely to have always been at the margin of the main channel of the River Lea in the past. Furthermore, the gravel surface plot suggests a tributary channel may have flowed across the site towards the main channel of the Lea. It is quite likely that sandy bars accumulated at the confluence of this channel with the main channel of the Lea, building up as distributaries of the channel migrated across the site.
In the south-east and north-east of the site, however, the gravel surface rises up towards the 'low terrace' that exists down the eastern side of the valley floor in the Stratford area (Fig 7 and Fig 8). The gravel surface was high enough in the area of Trenches 2, 4 and 10 for it to have been recorded at the base of the trenches (facies 1),

where its organic content and bedding characteristics suggested its surface had been reworked by a Holocene river (Fig 5). No dates have (yet) been obtained for this channel activity, but the general trend of increasingly recent deposits from south-east to north-west across the site suggests the gravels seen in Trench 2 may have been deposited / reworked later than those in Trench 10.

2.3.2 Deposits accumulated within and at the fringes of active channels

During the prehistoric and possibly early historic period the site lay within an active river environment and in the Early Holocene its entire area was probably crossed by a network of shallow channels. Deposits from this period may be preserved at the base of the alluvium, which was not excavated in most of the trenches, owing to the unstable nature of the sediments and rapid water ingress. However, calcareous tufa-rich sands (facies 2) survive in the south-east part of the site (see Fig 5 and Fig 8) and these may relate to this period. Tufa forms in clear water and a warm climate and these sands are likely to have been deposited during the 'climatic optimum' of the later Mesolithic to early Neolithic.

Subsequently, the south-eastern area of the site became abandoned by the active river. This may have been as a result of falling river levels in general, or following channel 'avulsion' (when water flow switches from one channel to another), or owing to migration of the river towards the north-west. Cut off from the direct influence of the river, pools of water may have infilled depressions and vegetation developed in the surface of the tufa-rich sands and reworked gravels. The marshy landsurface (facies 4) that developed has been dated in Trench 9 to the Neolithic (2910-2490 BC). A horse bone with evidence of butchery and skinning and worked wood (stake-like) were found at the interface of gravels and the marshy landsurface in Trench 10. They may have been washed in with the sand or (more likely) discarded on the peaty surface, suggesting nearby human activity, probably upslope on the low terrace. The peaty surface in this trench was not dated but if it corresponds to the peaty surface in Trench 9 it suggests the activity took place in the Neolithic.

Progressive migration of the tributary channel from south-east to north-west across the site was particularly clear in Trench 7, where a series of ridges of sand and deeper troughs was recorded, providing evidence for channel migration away from an earlier bank of tufa-rich sand, perhaps following re-activation of the river in this area. As the channel migrated it deposited banks of bedded sand (facies 3) and in the swales (hollows) behind the banks, shallow pools and marsh developed (facies 5 and 6). This process took place at a range of scales, so that the pattern of sandy ridges and marshy swales seen in Trench 7 is also apparent across the site as a whole (Fig 8; and see the transects, Fig 5 and Fig 6).

A date of 2270 to 1910 BC has been obtained from humic silts (Facies 5) that accumulated at the fringes of the active Late Neolithic river in Trench 8, probably when this location was becoming marginalized from active river flow by a bank of sand deposited by the migrating channel (Fig 6). The practically indistinguishable dates obtained from the humic silts at the top of the sand bank in Trench 5 (1600 to 1400 BC) and those at base of the swale in the nearby Trench 4 (1730 to 1440 BC), as illustrated on Fig 6, suggests that an active channel existed in the central part of the site until the Early to Middle Bronze Age, when the area of Trenches 4 and 5 appears to have become abandoned by the river. Worked wood, washed up onto the sandbar as driftwood, was recovered from the interface of the sand and overlying humic silt in

Trench 5 and is likely to be of Early Bronze Age date. As four pieces of worked wood were found together and they were not with other driftwood they may not have travelled far, suggesting Bronze Age activity in the vicinity of the tributary channel. Occasional worked wood in other trenches, also typically at the interface of the sand and humic silts suggests prehistoric activity taking place close to the river further up the Lea or its tributary valley, as is known from the Stratford Box excavations (see section 1.5.3.2). Such wood may have travelled some distance, however.

No dates have yet been obtained from Trenches 2 and 3 and the lack of observations between Trenches 3 and 4 mean that it is not known whether the tributary channel became abandoned altogether in the Bronze Age or continued to exist through the later prehistoric period in the north-west part of the site (see Fig 8). Fluvial sands were certainly still being deposited by an active channel in the north-west corner of the site in the Romano-British period, as a date of 190BC to AD120 was obtained from humic lenses of the upper sand in Trench 1. However, the sand in this location may have been deposited by the Lea, rather than its tributary channel (see Fig 8).

2.3.3 Backwater deposits

A 'conformable' (ie: no breaks in the sequence) transition from humic silts (facies 5) representing slackwater areas at the fringes of a river channel to humic clays (facies 6), likely to represent shallow standing water in backwater areas, cut off from the river, was recorded in most of the trenches. No radiocarbon dates have been obtained from this part of the sequence, but it is expected that these deposits are also 'time transgressive' and will have accumulated earlier in the south-eastern parts of the site than towards the north-west, as areas of the site became increasingly more distant from the active river channel.

Such depositional environments provide ideal conditions for the preservation of biogenic remains suitable for past landscape reconstruction. Owing to the successive development of backwater areas from south-east to north-west across the site, samples taken from them might provide information about the nature of the site and its surroundings spanning a considerable part of the prehistoric and early historic period.

In the southern part of the site there is some indication that a period of prolonged flooding, depositing peaty clays took place after much of this area had already become relatively dry land (see Fig 5). The interpretation of these deposits, which have for convenience also been ascribed to facies 6, is not yet clear, but it is possible that they reflect a period of rising river levels resulting from ponding back of drainage down the Lea Valley, in response to relative sea level rise that caused estuarine environments to encroach upstream. No dating has yet been obtained from these deposits but their timing and characteristics could be compared to current understanding of relative sea level fluctuations recorded in the alluvial sequences of the Thames. They may also have a bearing on the use of the area in the past (eg: the nature and location of the river crossing).

2.3.4 Wet meadowland

The upper 0.5 to 1m of alluvial deposits on the site are predominantly greyish fairly stiff cohesive clays (facies 7). The alluvial clay sequence generally consisted of manganese staining at the base with an iron-stained layer above and a zone of carbonate precipitations spanning these two layers. Above these bands the clays

tended to be stiffer and the uppermost 0.20 to 0.30m was generally fairly humic and often contained fragments of clay pipe and other post-medieval inclusions. These deposits accumulated by clay settling out of standing water during periods of seasonal overbank flooding. During summer months the floodwater drained away, the landsurface dried out and soil processes took place, working the clay into the soil, which built up as an 'accretionary' soil profile.
The alluvial clays, therefore, are likely to represent wet meadowland, which could have been used for grazing. No dates have been obtained for this deposit, but is likely to have accumulated during the historic period across most of the site. It is thickest in Trenches 1-4, suggesting they lay closest to the source of the floodwater (the historic River Lea and perhaps its tributary).

A more gravelly, gritty clay was recorded in the central part of the alluvial sequence in the south-east area of the site. This deposit has also been interpreted as a variant of wet meadowland and thus ascribed to facies 7 for the purpose of the evaluation. It developed above the higher gravel surface and tufa-rich sands, in the south-east area of the site, which may have formed an area of slightly higher ground sufficiently far from active river channels for a wet meadowland environment as opposed to permanent wetland to exist, perhaps from the later Neolithic onwards. The oxidised characteristics of the alluvial clay in Trench 10, in particular, suggest this area (the extreme south-east corner of the site) was drier for much of the historic and possibly even prehistoric period than the rest of the site.

A more humic, crumbly (soil) layer in the uppermost 0.20 to 0.30m of the alluvium and a turf line of compressed organics, about 0.02m thick intermittently preserved at the surface of the soil represents the landsurface existing prior to the industrial development of the site. This pre-industrial landsurface lay at around 2.75m OD.

2.3.5 The Roman road

No evidence for the presence of the Roman London to Colchester road was uncovered during the evaluation.
As discussed above in 2.3.4, the uppermost deposits on the site are predominantly cohesive clays, often containing fragments of clay pipe and other post-medieval inclusions. These deposits accumulated by clay settling out of standing water during periods of seasonal overbank flooding and represent wet meadowland – a deposit likely to have accumulated during the historic period across most of the site. If the Roman road had traversed the site it would have been sealed by this meadow/clay deposit which accumulated during the post-Roman period.

Evaluation trench 1 showed that the level of the interface between Iron Age and Roman period deposition was at *c* 2m OD, in an area where current ground level was c 4.90m OD (see 2.2.1.1). Therefore any truncation from late-Victorian developments within the site would probably not have removed the road, were it present.

Furthermore, no Roman features were found, including those typically associated with Roman roads, such as roadside ditches.

Therefore, the Roman road was not present on the site, and if present in this area of the Lea Valley it probably passed on an east-west route to the south of the site.

2.4 Assessment of the evaluation

GLAAS guidelines (English Heritage, 1998) require an assessment of the success of the evaluation 'in order to illustrate what level of confidence can be placed on the information which will provide the basis of the mitigation strategy'.

In the case of this site, the good coverage of trenches suggests that the total lack of structural features (such as roads, bridges, crannogs, trackways and platforms) within the alluvium on the site is likely to be a reliable indicator. However, less intensive activity may have taken place, leaving evidence of a more ephemeral nature that may have been difficult to identify in the conditions of excavation.

The depositional sequence is compatible with natural landscape succession and with previous deposit models which provided preliminary predictions of the buried landscape. However, the depth of the alluvial sequence, together with rapid water ingress and unstable sediments in the lower part of the stratigraphy prevented the examination of deposits below about 1m OD.

This means that the characteristics of the lower part of the alluvial sequence is not known, but the results of previous geotechnical boreholes have been used to extend the stratigraphy down to the top of Pleistocene gravel.

On-site environmental sampling was intended to target typical depositional sequences, representative of and capable of reconstructing the range of environments that existed on the site through space and time. Preliminary off-site stratigraphic assessment, as summarised in this report, has shown that the samples taken should be able to fulfil this purpose, as a good range of samples both laterally across the site and chronologically are available. However, no assessment of the range and potential of the environmental remains preserved in the samples has yet been made.

3 Archaeological potential

3.1 Realisation of original research aims

The extent to which the evaluation has been able to address the research objectives established in the *Method Statement* for the evaluation is discussed below:

Are there any high gravel islands, which may have been exploited in the prehistoric or early historic eras? Or do the gravels shelve gently towards the river?

The gravel surface is generally low on the site (between 0m and 1m OD). A tributary of the Lea may have flowed across this low-lying area during the prehistoric period.

Beyond the western boundary of the site the gravel surface shelves quite sharply into the main channel of the Lea.

However, the gravel surface slopes up in the north-east and south of the site to over 1.5m OD, towards the low terrace that exists down the eastern side of the Lea floodplain in this area and a low promontory also appears to have existed in the south of the site. These areas of higher gravel may have had potential for exploitation, although they were essentially wetland areas in the past.

A butchered horse bone and several worked wood fragments in a peaty landsurface developed above the higher gravel in Trench 10 suggest that good preservation of any prehistoric (Neolithic date inferred) activity would be expected in this sequence. Such activity may have taken place on the promontory or on the low terrace to the east or south-east of the site rather than on the site itself.

Does the peat recorded in several boreholes have archaeological significance, either in terms of its palaeoenvironmental information or as an ancient landscape?

Although little true peat was recorded, organic deposits on the site include humic silts, humic clays and thin peaty lenses, which span the Neolithic to Romano-British period (at least).

These organic deposits, which are likely to have accumulated as vegetation developed above channel bars, in the slackwater fringes of a river channel and in shallow marshy pools infilling abandoned channels, have good potential for past landscape reconstruction, as they can be radiocarbon dated and are also likely to preserve good assemblages of environmental remains (although these have not yet been assessed). Unlike the well-known prehistoric woody peat from the floodplain of the Thames, the organic deposits on the site represent more open environments that might provide more diverse information about the surrounding landscape. They may also provide indirect evidence for nearby human activity.

Is there evidence for prehistoric human exploitation of the landscape? If so, is it possible to characterise the status of occupation or land use exploitation?

No structural archaeological features and very few finds were recovered from the site, which would have lain within active river channels or in marshy areas adjacent to channels for most of prehistory and on seasonally inundated meadowland during the historic period.

Very occasional pot, bone and worked wood indicate that a very low-level of ephemeral activity, exploiting the wetland environment may have taken place, but the worked wood in particular is likely to be driftwood, washed-up on the site from activity that took place upstream.

Is there evidence for the London-Colchester Roman road? Does it share similar characteristics to the fragments excavated to the west at Old Ford? What is the nature of the landscape that is adjacent to the road and some distance from it?

No evidence for the road was found and is unlikely that it crossed the site.

What evidence is there for post-Roman exploitation, in particular is there evidence for water inundation and water management? If so how are these activities characterised?

The upper alluvial clays represent seasonal flooding of wet meadowland. No evidence for water management was found.

Are there any in situ deposits of archaeological significance within the made ground or is it all of 19th/20th century dump and make-up deposits?

All the made ground observed consisted of 19th/20th century dump and make-up deposits.

Is there evidence of pre-19th century industrial features?

No pre-19th century industrial features were identified.

What is the date and significance of the redeposited alluvium?

Redeposited alluvium was recorded in several trenches. As it everywhere overlies the pre-industrial development landsurface, it probably represents the excavation of basements and foundations associated with the 19th/20th century industrial use of the site.

3.2 General discussion of potential

The evaluation has shown that the site lay within active river channels or in marshy areas adjacent to the channels for most of prehistory and on seasonally inundated meadowland during the historic period.
Although cut features and structures have elsewhere been found in such environments, no evidence of such archaeological remains has been found on the site and it is considered that any human activity that took place here in the past would have been at a very low-level and left few, if any, archaeological remains.

A small amount of worked wood, washed-up as driftwood on the sandy banks and fringing reedbeds of the prehistoric river has been found, indicating some potential for finds of an *ex-situ* nature. Such finds may be far-travelled, although concentrations of archaeological material – of which there none on this site – could imply a more local source.

In contrast, there is very good potential for past landscape reconstruction from the records and samples taken on site. The alluvial sequence sampled is 1.5 to 2m thick and covers the period from the Neolithic to just before the industrial development of the site in the 19th century. The upper alluvial clays and buried pre-industrial soil are fairly homogenous across the site, lying typically between 2 and 2.8m OD.

Environmental remains preserved within these clays should be able to characterise the historic environment of the site and its surroundings, although the evidence may be relatively difficult to date, as the clays contain little organic material suitable for radiocarbon dating and the range of environmental remains they preserve may be fairly low and have been subject to bioturbation in the past. The lower alluvial deposits have far greater potential. Below about 2m OD, the alluvium represents a range of channel and channel marginal environments and consists of deposits accumulated during the lateral migration of a tributary channel of the Lea across the site from at least the Neolithic to Romano-British period.

Good preservation of environmental remains is likely in organic silts, humic clays and peaty lenses that accumulated in marshy hollows behind a succession of sand bars, which developed progressively from south-east to north-west across the site. These organic deposits are also suitable for radiocarbon dating, which would provide a chronological framework for reconstructions of the evolving environment.

The period covered by the lower part of the alluvium has not yet been defined, however, as its upper levels have not yet been dated. In addition, the base of the alluvial sequence was not observed in most of the trenches, owing to unstable sediments and rapid water ingress. Thus, although the basic characteristics of the lowest part of the alluvial sequence (below about 1m OD to its interface with Pleistocene gravels) has been inferred from previous geotechnical borehole logs, it has not been sampled or examined geoarchaeologically. This part of the sequence is likely to relate to the Early Holocene (Mesolithic) period, but whether deposits of this date survive on the site is not yet known. Similarly, no refinement of the earlier assessment of the potential of the gravels that exist below the alluvium on the site for past landscape reconstruction and the survival of archaeology can be made, as these deposits were also not examined during the evaluation.

Samples taken from the alluvial deposits (and especially the humic silts, humic clays and peaty lenses in the lower part of the sequence) have potential to provide information about the past environment and indirect evidence for human activity that may have taken place on the site and on the low terrace to the east. Samples were taken through the entire alluvial sequence in Trenches 2, 4 and 8 and comprised:

- Undisturbed blocks of sediment (monoliths) suitable for sub-sampling for pollen, diatoms and other microfossils and for more detailed sedimentary analysis, such as loss-on-ignition, magnetic susceptibility and soil micromorphology;
- Bulk samples, taken adjacent to the monoliths and suitable for the recovery of plant remains, insects and snails;
- Radiocarbon samples, thin slices of organic sediment taken to date the transition from one deposit / depositional environment to another.

Trenches 9 and 10 were sampled in a similar way but here, as the upper alluvial clays were more oxidised and unlikely to preserve environmental remains, only the lower part of the sequence was sampled. The locations of the sampled profiles are illustrated on Fig 5 and Fig 6 and their distribution, which provides good lateral coverage, spanning the successive sandy ridges and marshy hollows from south-east to north-west across the site, can be seen in Fig 8.

Assessment of the samples taken during the evaluation is needed to confirm their potential for past environment reconstruction. In particular, assessment will suggest the range and diversity of environmental remains preserved and the research objectives that analysis of selected categories of environmental remains might address. In very general terms, it can preliminarily be suggested that research objectives would include gaining a better understanding of:

- the river regime;
- the on-site environment;
- local vegetation change and the surrounding environment;
- indirect evidence for human activity on the site and its surroundings;
- the impact of relative sea level fluctuations in this part of the Lea Valley;

for specified time-frames.

3.3 Significance

Very little is yet known about the evolving environment of the Lower Lea and its relationship to the changing landscape and river regime of the Thames and to the archaeology of the river terraces on either side of the valley floor.

The potential of the records and samples taken from the alluvial sequence surviving on the site to contribute to our current understanding of the past environment of the site and its surroundings is undoubtedly of local significance. However, there is nothing to suggest that it is of regional or national importance.

4 Proposed development impact and recommendations

It is proposed to build an Aquatics Centre on the site. No detailed plans for its construction are yet available but it will involve ground remediation to remove contaminated ground. Swimming pools are likely to require excavation to at least several metres depth, but whether basements, lift shafts or other deeply cut structures will also be built is not yet known. Pile probing, piling and pile caps and temporary works are also likely to involve deep excavation.

The evaluation has shown that alluvial deposits of archaeo-environmental interest lie below *c* 2.75m OD on the site (their surface varies between 1.5 and 2.25m below current ground level). The upper *c* 0.75m of the alluvium is fairly homogenous and has relatively low potential for past environmental reconstruction. However, alluvial deposits lying below *c* 2m OD (ie: lower than variably 2m to 3m below current ground level) preserve evidence for the river regime and landscape that existed on the site between the Neolithic and Romano-British period at least, which is of greater archaeo-environmental significance.

Any groundworks associated with the proposed development that extend to more than about 2-3m below current ground level (ie: below 2m OD) are likely to impact upon deposits of archaeo-environmental interest. However, it is considered that the characteristics of these deposits across most of the site (down to a level of just below 1m OD) have been adequately recorded and sampled during the evaluation and little additional information would be obtained by further fieldwork.

The lowest part of the alluvial sequence has not yet been examined however, and as a result the potential of the deposits on the site for preserving evidence of the Mesolithic period is not yet known. A limited amount of further fieldwork is therefore recommended, its form depending on the location and depth of the groundworks associated with the proposed development. It could be carried out either by sinking and examining cores from 2-3 auger or boreholes, or by the excavation of a trench following ground reduction (and de-watering) for construction works. The evaluation results suggest that the earliest deposits are likely to survive in the south-east of the site and it is suggested that the boreholes or trench are excavated in the vicinity of Trench 7 to Trench 9. It is likely that a maximum thickness of 2m (and possibly closer to 1m) of alluvium, between the base of the alluvial clay (about 2m OD) and the surface of floodplain gravel, will need to be examined, either in section or as continuous cores.

In addition to the fieldwork proposed above, it is recommended that the environmental samples collected from the site be assessed to provide a better idea of the range, diversity and potential for past environmental reconstruction of biogenic remains preserved in the samples.

Such assessment would reduce the number and size of environmental samples requiring storage (with its inherent risk of decay/deterioration), organisation and management, whilst providing a clearer idea of the potential of these samples for further work. In particular, it would establish achievable research aims for the records and material collected from the site, which could at a later stage of the project be integrated with those from other parts of the Olympics / Lower Lea Regeneration scheme to provide a sound basis for assessing the scope of further analysis and preparing a scheme-wide environmental assessment and UPD.

In addition, environmental assessment along with continually updating the TSII stratigraphic database for the Olympics / Lower Lea Regeneration area, as sites are evaluated / excavated, will contribute to a cumulative understanding of the evolving environment of the Lower Lea, which should feed back into the development of sampling strategies on subsequent sites.

Environmental assessment at this stage would make sense in terms of logistics, the development of a knowledge-base and of research priorities for the Olympics / Lower Lea Regeneration area and in focusing environmental work on future sites. It will also be cost-effective, as less time will be needed to organise the samples, also less time might need to be spent on the collection, processing and assessment of samples on future sites and in the preparation of a scheme-wide environmental assessment and UPD.

It is recommended that environmental assessment comprises:

- Further radiocarbon dating (7 samples) to establish a date for the upper part of the lower alluvium (ie: the alluvium that is considered to be of greatest archaeo-environmental potential) in the sampled profiles and to obtain a date for the Trench 2 and Trench 3 sequences, which might help determine whether the tributary channel continued to flow across the site in the later prehistoric / historic period. Further dating will also establish whether the time-frames of the sampled profiles overlap (which is likely) or are discrete and will help in recommending research objectives for analysis.
- Processing and assessment (ie: for plant remains, snails/ostracods and insects) of the bulk samples from the Trench 2, 4 and 8 profiles, excepting the samples from the upper alluvial clay in Trench 2 (26 bulk samples); these profiles should provide biogenic information from channel marginal and subsequently marshy areas cut off from the river through space and time; their assessment should establish the extent to which assemblages from marshy hollows in different parts of the site and from different periods differ and the potential for comparison through space and time;
- Processing and routine assessment of EITHER the bulk samples from Trench 9 OR of samples taken from the proposed further fieldwork (max 8 bulk samples); these profiles are intended to provide information from the area closest to the low terrace, as well as from the earliest (Neolithic and earlier) deposits on the site;
- Diatom assessment of *c* 16 sub-samples taken from the monoliths through the assessed profiles. The location of these sub-samples will depend on the additional dating results and will intend to provide an indication of the changing salinity / nutrient status of water influencing the site through time.

The methodology for bulk sample processing should be discussed with John Giorgi (MoLSS) who has suggested that wet sieving over a very fine mesh – in order to collect a greater range of seeds, smaller insects, ostracods and the smallest snails - might alleviate the usual requirement to keep back a proportion of selected samples for analysis of insect and other remains at a later stage. Paraffin flotation for insects would be undertaken on a sub-sample of the wet-sieved residue. If assessment shows that the difference between bulk samples from roughly similar landscape positions through space and time is negligible, then this will inform the level of sampling and assessment proposed on future sites and it will also reduce the level of analysis and range of research questions that can be posed.

No pollen assessment is recommended at this stage. Pollen is derived from a wider catchment than the site itself and, as a result, provides information about vegetation change from the local area. It is recommended that locations for pollen are selected and assessed during the preparation of the scheme-wide environmental assessment and UPD. By this stage of the project more information will be available about the range of depositional environments existing across the Olympics / Lower Lea Regeneration area as a whole. The distribution of archaeology within it will also be better understood and this will be significant in the selection of sampling locations, as pollen also provides indirect evidence about past human activity. The results of the further dating and environmental assessment proposed here (and as undertaken on future sites) will also help to target suitable profiles for pollen analysis.

If it is possible to process sufficient material for both assessment and analysis of plant, insect snail and ostracod remains at this stage, then all bulk samples not included in the list above and any unprocessed fractions of the samples would be discarded following assessment. Stored in glass jars, the processed flots will take up little space and will not be subject to deterioration. All monoliths and samples for radiocarbon will be retained and will be kept cool and dark for the duration of the project, until it is known which of them will be needed for analysis.

The decision on the appropriate archaeological response to the deposits existing on the site and samples taken from them rests with the Local Planning Authority and their designated archaeological advisor.

5 Acknowledgements

MoLAS and PCA would like to thank the London Development Agency for commissioning this report. Also, David Divers (GLAAS) the Archaeological Advisor to the London Borough of Newham and Dr Jane Sidell, EH Archaeological Science Advisor for Greater London for their advice during the project, which has been managed by Nick Bateman and Kieron Tyler (MoLAS) and Gary Brown (PCA). Erith Demolition, the main contractors on site are thanked for their co-operation during fieldwork, which was supervised by Isca Howell (MoLAS) assisted by Chris Reid and James Langthorne (PCA), with geoarchaeological input from Craig Halsey and Jane Corcoran (MoLAS).

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7 NMR OASIS archaeological report form

OASIS ID: molas1-9050

Project details

Project name	Site 25 (Phase I), New aquatics Centre, Carpenters Road, Newham, E15
Short description of the project	Ten evaluation trenches machine excavated through alluvial deposits (lying between 1-3m OD) recorded the lateral migration of a tributary channel of the Lea during the prehistoric period, which has been dated by five radiocarbon samples. The base of the alluvial sequence was not seen, but previous geotechnical boreholes suggest the surface of Pleistocene gravel lies between 0-1m OD. The earliest deposits observed were tufa-rich sands and date to the Early Neolithic or before. Butchered bone and worked wood was found in a peaty landsurface of Neolithic date developed at the surface of the sand and worked wood dating to the Bronze Age had been washed-up as driftwood at the margins of the later river. Environmental samples, comprising overlapping monoliths and adjacent bulks for future off-site examination were taken from five profiles, spanning the earliest to latest deposition on the site. The sampled profiles targeted hollows, infilled with humic silts and clays, which had developed behind successive sand banks and formed marshy backwater areas. The site would have lain within an active fluvial environment during the prehistoric period and a seasonally flooded meadowland in historic times. A buried soil and turfline, representing the landsurface existing prior to the 19th-20th century industrial development of the site was recorded at just below 3m OD. It was sealed by about 2m of modern made ground, with the modern groundsurface generally around 5m OD.
Project dates	Start: 01-02-2005 End: 24-03-2005
Previous/future work	No / Not known
Any associated project reference codes	OL-00105 - Sitecode
Type of project	Field evaluation
Site status	Local Authority Designated Archaeological Area
Current Land use	Vacant Land 1 - Vacant land previously developed
Monument type	WATERCOURSE Late Prehistoric
Significant Finds	CUT BONE Neolithic

Significant Finds	WORKED WOOD Bronze Age
Methods & techniques	'Environmental Sampling','Targeted Trenches'
Development type	Public building (e.g. school, church, hospital, medical centre, law courts etc.)
Development type	aquatic centre (swimming pool complex)
Prompt	Direction from Local Planning Authority - PPG15
Position in the planning process	After full determination (eg. As a condition)

Project location

Country	England
Site location	GREATER LONDON NEWHAM STRATFORD Site 25 (Phase 1) Carpenters Road E15
Postcode	E15
Study area	40000.00 Square metres
National grid reference	TQ 37845 84470 Point
Height OD	Min: 2.70m Max: 2.90m

Project creators

Name of Organisation	MoLAS/PCA
Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	MoLAS/PCA
Project director/manager	Nick Bateman
Project supervisor	Isca Howell
Sponsor or funding body	London Development Agency

Project archives

Physical Archive recipient	LAARC
Physical Archive ID	OL-00105
Physical Contents	'Animal Bones','Ceramics','Environmental','Wood'
Physical Archive Exists?	Yes
Digital Archive recipient	LAARC
Digital Archive ID	OL-00105
Digital Contents	'Stratigraphic','Survey','other'
Digital Media available	'Database','Survey','Text'
Digital Archive notes	Stratigraphic data temporarily stored on MoLAS' TSII database. Digital photographs stored on CD
Digital Archive Exists?	Yes
Paper Archive recipient	LAARC
Paper Archive ID	OL-00105
Paper Contents	'Environmental','Stratigraphic','Survey','other'
Paper Media available	'Context sheet','Correspondence','Matrices','Notebook - Excavation',' Research',' General Notes','Photograph','Plan','Report','Section','Survey ','Unpublished Text','Unspecified Archive'
Paper Archive notes	Geoarchaeological transects (ie: schematic cross sections drawn to scale) across the site. Geoarchaeology logs of representative profile in each trench with interpretation notes
Paper Archive Exists?	Yes

Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Site 25 (Phase 1) New Aquatics Centre Carpenter's Road Newham E15: an archaeological evaluation report

Author(s)/Editor(s)	Howell, I.
Author(s)/Editor(s)	Halsey, C.
Author(s)/Editor(s)	Corcoran, J.
Date	2005
Issuer or publisher	MoLAS
Place of issue or publication	London

Entered by	Jane Corcoran (janec@molas.org.uk)
Entered on	1 July 2005

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Appendix 1: Glossary

Alluvium. Sediment laid down by a river, and usually well-sorted. Can range from sands and gravels deposited by fast flowing water and clays that settle out of suspension during overbank flooding. Other deposits found on a valley floor are usually included in the term alluvium. Peat develops when there is little mineral sediment deposition and impeded drainage, which limits biological decay; and tufa accumulates when springs rich in calcium carbonate discharge in damp well-vegetated situations.

Arctic Beds. Cold climate deposits, pre-dating the Last Glacial Maximum and sometimes found within the gravels of the Lower Lea. They may survive within parts of the floodplain not reworked by the river during the Late Glacial.

Ecotone. A zone that lies between areas of contrasting environment, such as on the wetland/dryland margins.

Holocene. The most recent epoch (part) of the Quaternary, covering the past 10,000 years during which time a warm interglacial climate has existed. Also referred to as the 'Postglacial' and (in Britain) as the 'Flandrian'.

Knickpoint. A fall in base level (such as the low sea level at the end of the Pleistocene) gives rise to a discontinuity in the longitudinal profile of a river ie: steepening of the downstream channel gradient. The river tends to adjust to such a change by increased flow, which leads to increased erosion in the steepened section of the river and this results in the steepened section (knickpoint) cutting back in an upstream direction.

Last Glacial Maximum. The height of the glaciation that took place at the end of the last cold stage, around 18,000 years ago.

Late Glacial. The period following the Last Glacial Maximum and lasting until the climatic warming at the start of the Holocene. In Britain this period is subdivided into a warm 'interstadial' episode the Windermere Interstadial, followed by a renewed cold ('stadial') episode, in which local ice advances occurred (the Loch Lomond Stadial).

Pleistocene. Used in this report to refer to the earliest part of the Quaternary, the period of time until the start of the Holocene, about 10,000 years ago. However, since the present Holocene epoch is almost certainly only a warm interglacial episode within the oscillating climate of the Quaternary, it is often seen as being part of the Pleistocene epoch, in which case the terms Pleistocene and Quaternary are interchangeable. As it is necessary, in this report, to differentiate between the events that took place at various times during the last cold stage and earlier in the Quaternary and those that took place during the Holocene, the Pleistocene is used to refer to the parts of the Quaternary pre-dating the climatic amelioration that took place at the start of the Holocene.

Quaternary. The most recent major sub-division (period) of the geological record, extending from around 2 million years ago to the present day and characterised by climatic oscillations from full glacial to warm episodes, when the temperate was as warm as if not warmer than today. To a large extent human evolution has taken place within the Quaternary period.

Appendix 2: Environmental sample list

Sample ({})	Context ([])	Trench	status*
BULK samples			
2	16	2	A
3			A
4			A
5	15		A
6			A
7	13		A
11			A
12			A
13	17+18		A
14	18		A
15	17		A
19	1	1	D
34	37	4	A
35	38		A
36	39		A
37	40		A
38	35		A
39	36		A
40	37		A
41			A
42			A
43			A
44			A
59	69	7	D
72	76	8	A
73	77		A
74	78		A
75	79		A
76			A
77	81		A
78	82		A
79	83		A
83	87	9	(A)
84	88		(A)
85	89		(A)
86	90		(A)
87	98		(A)
92	93	10	(A)
93	94		(A)
94	95		(A)

MONOLITH samples			
1	13,15,16	2	R
9	13		R
10	17,18		R
25	79,81,82	8	R
26	81,82,83		R
27	76,77,78		R
28	77,78,79		R
30	37	4	R
31	37		R
32	33,34,35,36		R
33	30,31,32,33		R
81	87,88	9	R
82	88,89,90,98		R
91	92-95	10	R
RADIOCARBON samples			
8	13	2	R
16			R
17	4	1	R
18	12		Dated
20	6		R
21	11		R
22	45	3	R
23			R
24	44		R
45	37	4	Dated
46	36		R
47	54	5	R
48			Dated
49			R
50	58	6	R
51	60		R
52	61		R
53	69	7	R
54	73		R
55	109		R
56	66		R
57	68		R
58	66		R
60	74		R
61	65		R
62	72		R
63	71		R
64	64		R
65	71		R
68	83	8	R

69	82		Dated
70	81		R
71	78		R
80	80		R
88	88	9	R
89			R
90	90		Dated
95	93	10	R
96	95		R
97	96		R
OTHER (POLLEN/DIATOM) samples			
66	63,64,65	7	R
67	65,71,72,73		R

* Abbreviations in the status column:
Dated: these samples have already been radiocarbon dated
A: it is proposed to process and assess these samples, retain the residues for future analysis and discard any unprocessed material (see section 4);
(A): whether these samples are assessed or discarded will depend on whether any further work that involves the collection of bulk samples takes place on the site (see section 4);
D: it is proposed that these samples are discarded.
R: it is proposed that these samples are retained until a future stage of assessment and analysis (see section 4).

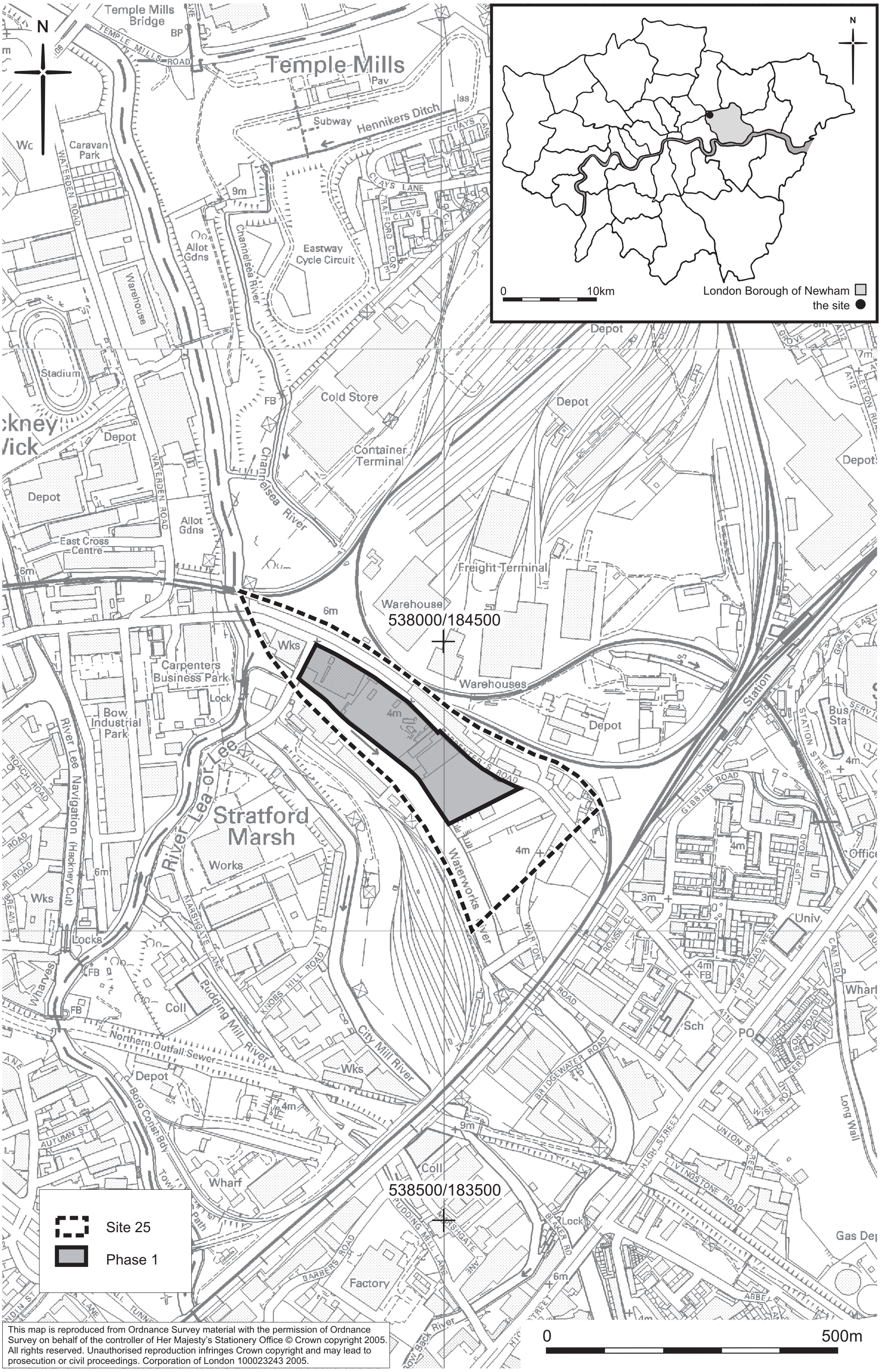

Fig 1 Site location

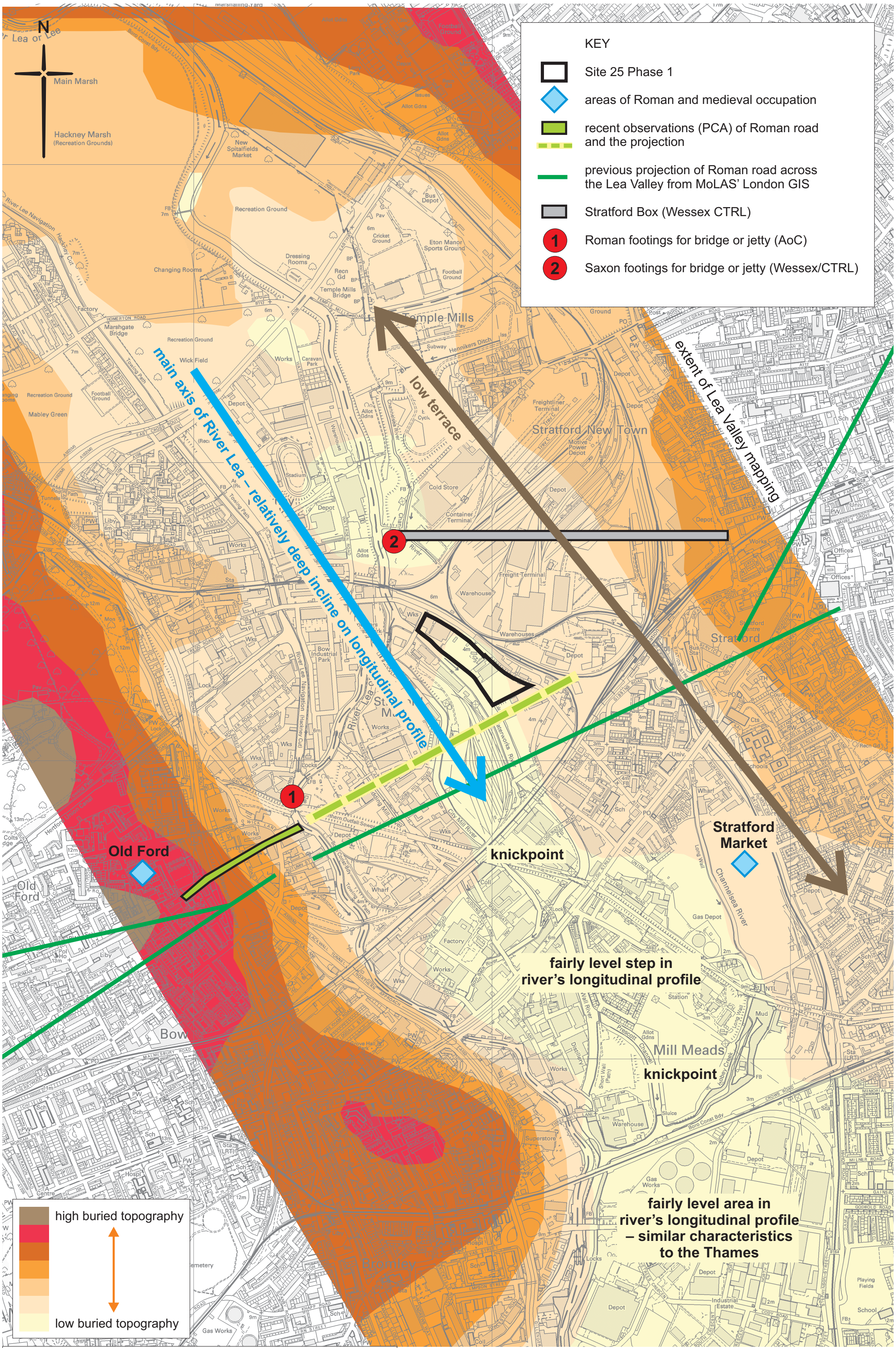

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Fig 2 Archaeological landscape setting

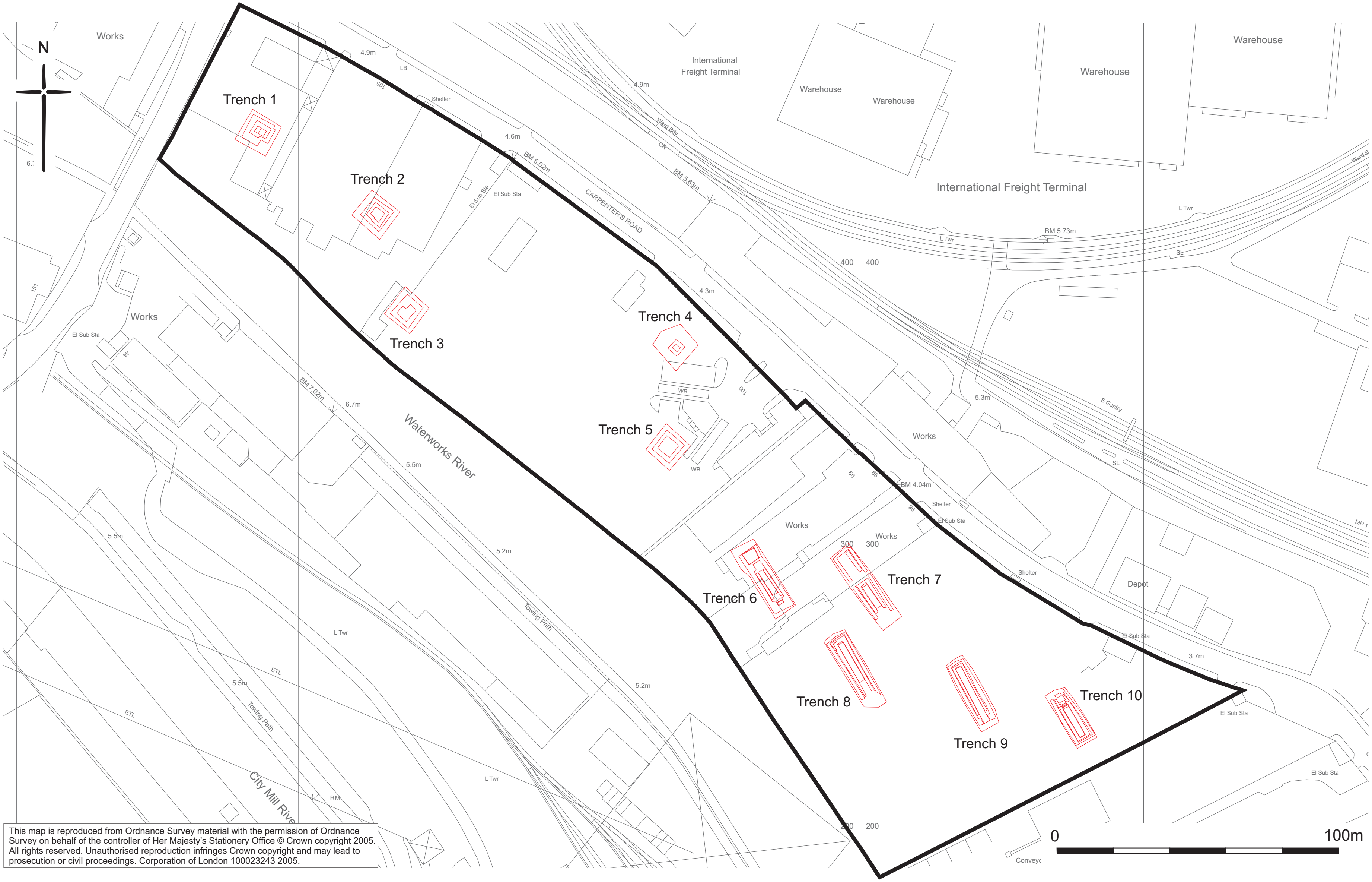

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Fig 3 Trench locations

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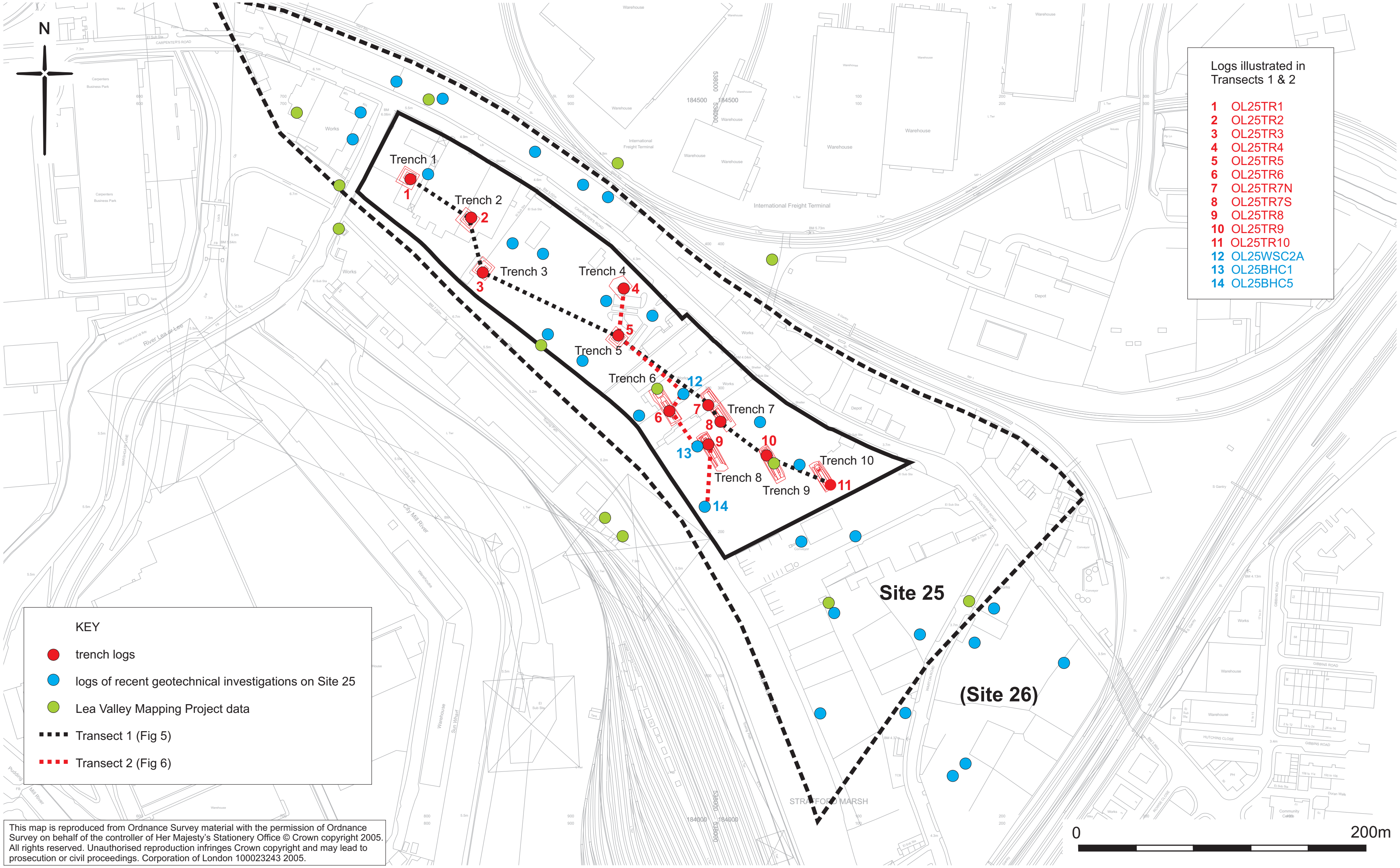

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Fig 4 Location of transects and distribution of stratigraphic data from Site 25

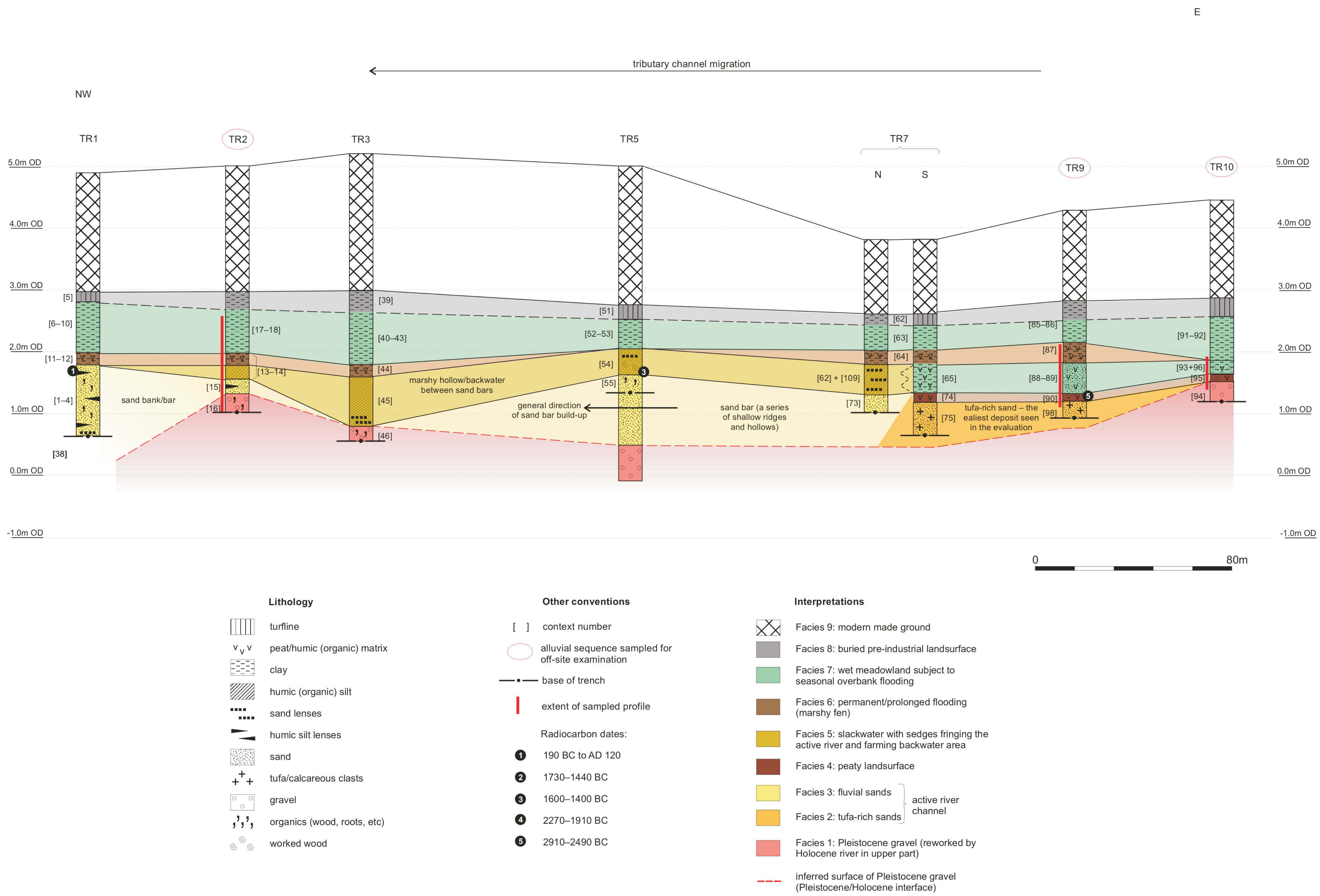

Fig 5 Transect 1: NW–SE section across the site

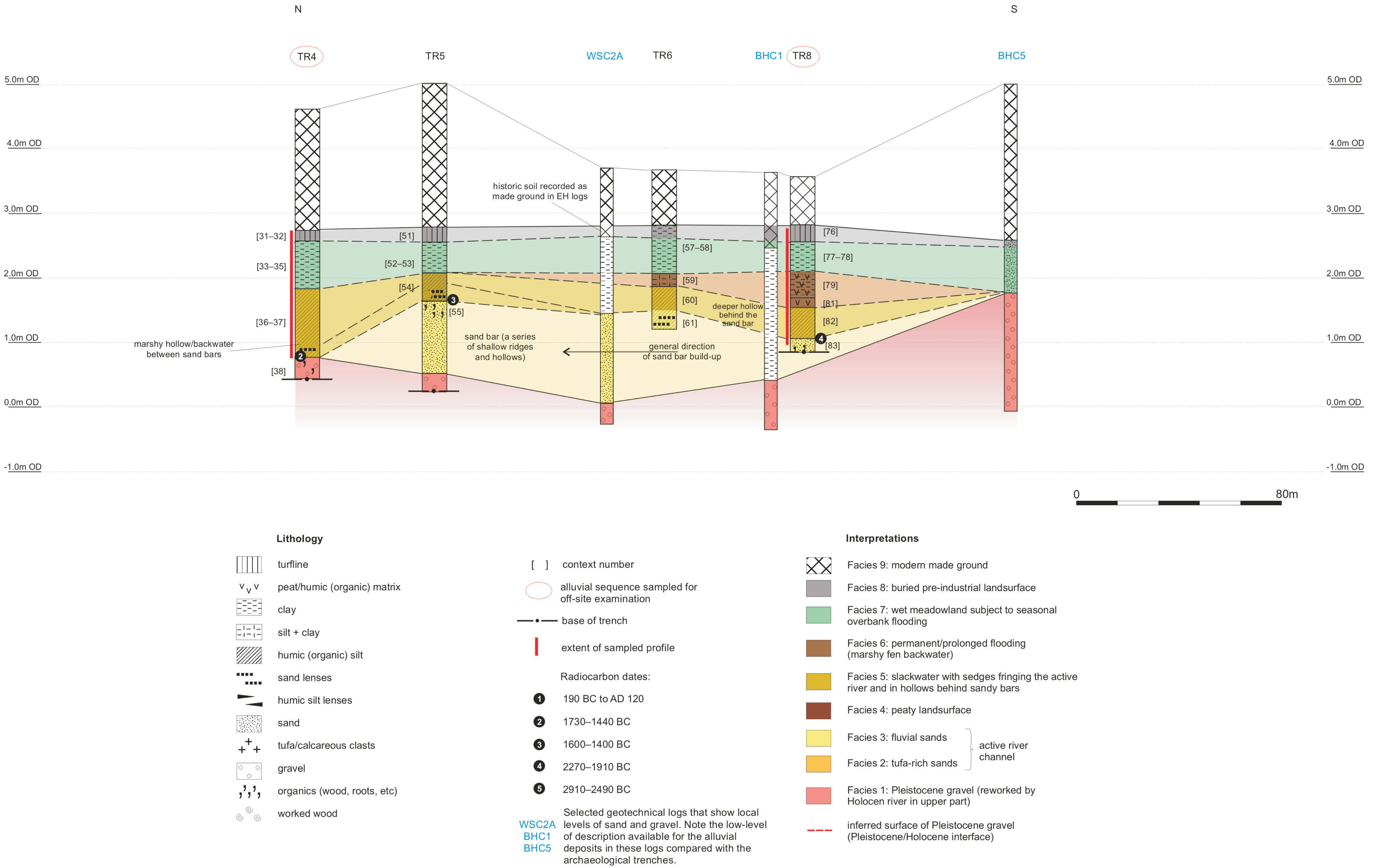

Fig 6 Transect 2: N–S section across the site

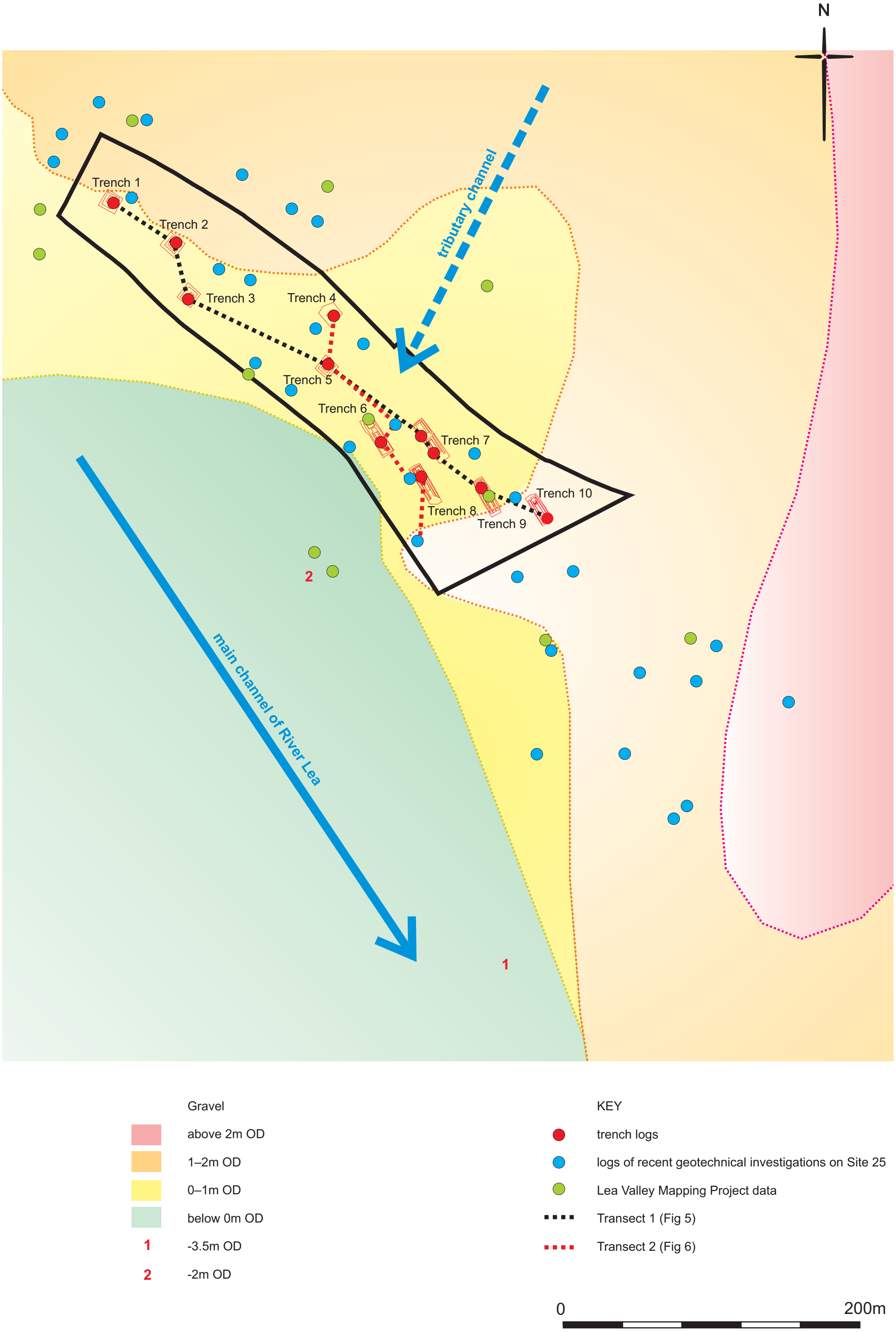

Fig 7 Gravel surface topography

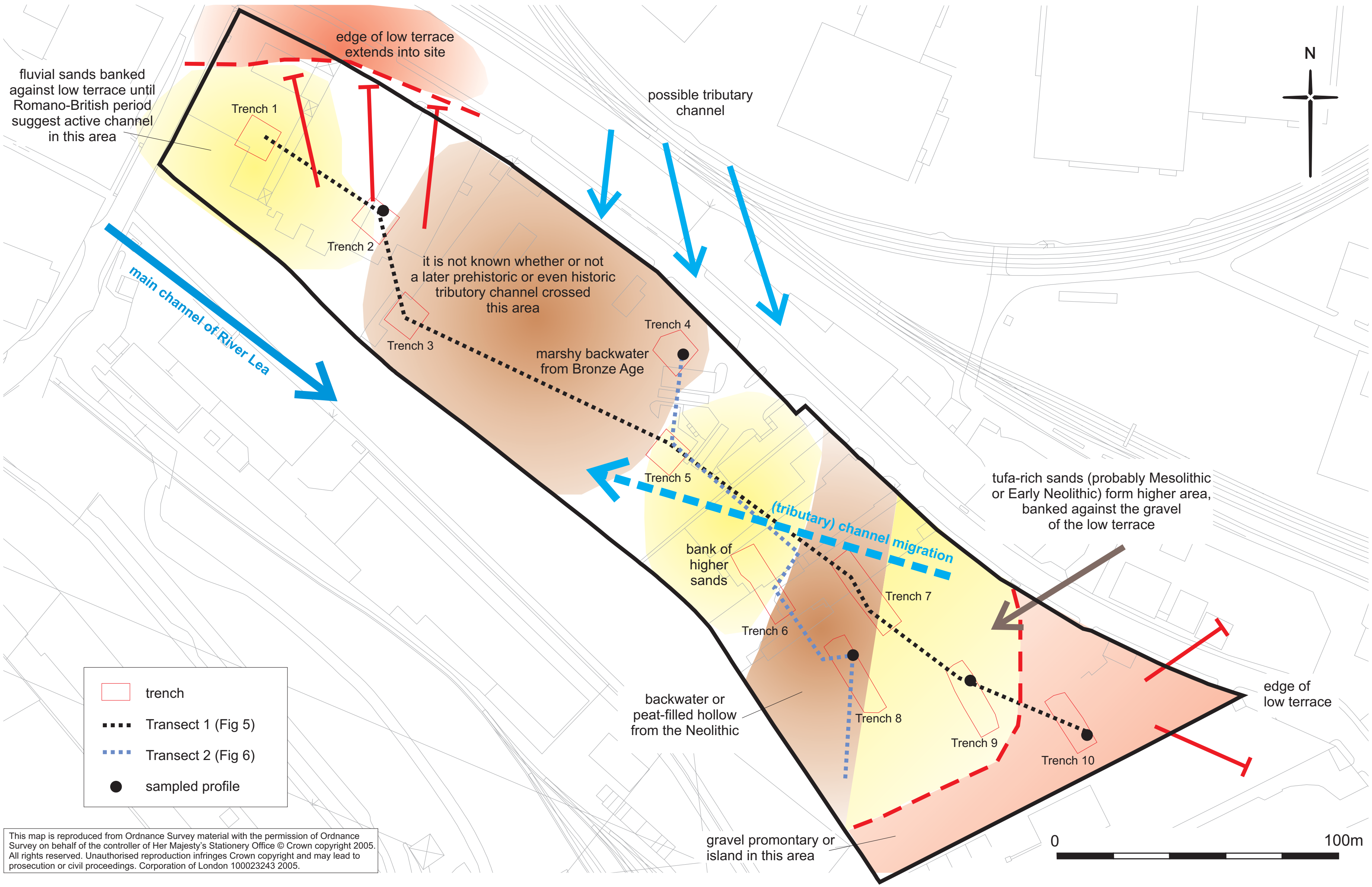

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Fig 8 Characteristics of the buried landscape

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