



PLANNING DELIVERY ZONE 3
Work Package 3
Trenches PDZ3.38
PDZ3.39

E15

London Borough of Newham

An archaeological evaluation report



MUSEUM OF LONDON

Archaeology
Service

PRE-CONSTRUCT ARCHAEOLOGY

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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 (MoLAS-PCA) within the Olympic, Paralympic and Legacy Transformations Planning Applications: Planning Delivery Zone 3 (Work Package 3, Trenches PDZ3.38 and PDZ3.39), London Borough of Newham, London E15. The report was commissioned from MoLAS-PCA by Capita Symonds Limited on behalf of the client the Olympic Delivery Authority (ODA).

Following the recommendations of the previous Detailed Desk-Based Assessment compiled for the overall Planning Delivery Zone, and subsequent consultation with the Greater London Archaeology Advisory Service, two evaluation trenches were excavated on the site and the results have helped to refine the initial assessment of its archaeological potential.

The trenches were excavated to the level of the natural gravels where possible. These deposits were overlain by alluvial sequences ranging from 0.16m to 1.66m in thickness. Much of the area was subject to episodic flooding, especially in the southern area. Deposits identified in the northern area indicated a slower moving, more backwater type of environment, indicative of the natural disuse of a former water channel. Furthermore, no gravel was observed within the southern trench, only sand, suggesting that a fast flowing, deeper channel lay in the vicinity, scouring the underlying gravels to a much greater depth. The higher land therefore lay to the north of the study area. Although finds have yielded some spot dates, the infilling of watercourse might be more closely dated as the alluvial sediments that accumulated across the area contain seeds and other plant remains suitable for close radiocarbon dating. The plant remains, together with insects and snails preserved within the samples taken from the flood and silting-up deposits have potential to reconstruct the characteristics of the river and the surrounding environment. Preliminary mollusc and plant macrofossil analysis indicate a slowly flowing freshwater environment typical of a floodplain prior to human modification. Further work including microfossils analysis (in particular diatoms and pollen) might provide information about the changing characteristics of the river, as well as vegetation and landuse in the surrounding area. In between the episodic flood events some dry land surfaces formed allowing soil development (palaeosoils) which, through soil micromorphological analysis, could reveal anthropogenic activity or land use not visible to the naked eye.

Other features of archaeological interest observed within or cutting these deposits included wooden revetments, palaeosols, a prehistoric ditch and evidence of either several channels or different phases of one main, meandering channel, the most likely source being the Pudding Mill River. The sequences of archaeological interest were sealed by thick deposits 19th–20th century made ground or landfill capped by a concrete surface.

The varying presence and preservation of archaeological horizons; features; organic remains and palaeoenvironmental evidence suggests that the site has a high archaeological significance and high geoarchaeological significance in understanding the natural and cultural formation and change of the lower Lea Valley.

Tying the stratigraphic information from PDZ3.38 and PDZ3.39 in to the information recovered from the surrounding area (by inputting the data into the MoLAS-PCA geoarchaeological database for the Olympics Project), when linked to historic map

evidence and dating will contribute to our understanding of the evolving river regime of the Lower Lea.

In the light of revised understanding of the archaeological potential of the site the report concludes that further fieldwork is necessary, especially on the in situ boat, revetments and prehistoric ditch and also archaeo-environmental work on the samples already taken from the site (as noted above), together with the collection and examination of further samples as appropriate to provide adequate mitigation of the archaeological resource.

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1 Introduction

1.1 Site background

The evaluation took place adjacent to the junction of the River Lea and north end of the Pudding Mill River in the north of Planning Delivery Zone 3 (PDZ3) of the Olympic, Paralympic and Legacy Transformations Planning Applications, in the London Borough of Newham, hereafter called ‘the site’.

The site occupies a triangular plot of land, bounded to the north by vacant land fronting onto the Marshgate Lane; by Marshgate Lane to the east and northeast; by the Pudding Mill River to the south and to the west by the River Lea. The OS National Grid Reference for the centre of the site is 537530 184070. Ground level across the site is fairly consistent, falling slightly from 6.92m OD in the north of the site to 6.83m OD in the south. The site code is OL-04407.

The footprint of Work Package 3 was defined by local property boundaries, and the limits of areas within which access was possible to excavate the three evaluation trenches. Effectively, the footprint of Work Package 3 was delimited as a tool for defining the location and potential maximum extent of the group of trenches (Fig 2).

Detailed architectural and engineering designs are not yet available, but current proposals for Planning Delivery Zone 3 (PDZ3) comprise construction of the Main Olympics Stadium and Warm-up Athletics Tracks. New bridges will be constructed. Parts of the site will be lowered, and others raised. New roads, services, water supply and drainage will be required.

A desk-based assessment was undertaken for the whole of PDZ3 (MoLAS-PCA 2007a), and 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 prepared for PDZ3 (MoLAS-PCA 2007b) which forms the project design for the evaluation.

1.2 Planning and legislative framework

The legislative and planning framework in which the archaeological exercise took place was summarised in the *Desk Based Assessment* and *Method Statement* which formed the project design for the evaluation (MoLAS-PCA 2007a and 2007b respectively).

1.3 Planning background

In accordance with local and national policies, archaeological evaluation of Morris Fields 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 Planning Authority can formulate responses appropriate to any identified archaeological resource.

The evaluation of the subject site, within PDZ3, was undertaken in support of a condition applied by the Olympic Delivery Agency Planning Decisions Team and attached to Planning Application Number 07/90011/FUMODA. The condition (SP.0.38) states:

The site Preparation Development shall not be commenced until a Written Scheme of Investigation for Archaeological Works has been submitted to and approved by the Local Planning Authority. This shall be in accordance with the Generic Written Statement for Archaeology, the Written Scheme of Investigation for Archaeological Field Evaluation and the relevant Detailed Desk-Based Assessment. The archaeological work shall be undertaken in accordance with the approved Written Scheme of Investigation. If significant archaeological finds are encountered, further archaeological works or design measures may be required to mitigate the impact of development on those remains. This condition may be discharged on a Planning Delivery Zone Basis.

Reason: To ensure that archaeological remains are properly investigated and recorded.

1.4 Origin and scope of the report

This report was commissioned by Capita Symonds Ltd on behalf of the Olympic Delivery Authority and produced by the Museum of London Archaeology Service and Pre-Construct Archaeology Ltd (MoLAS-PCA). 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 Aims and objectives

The following research aims and objectives for PDZ3 were established in the Method Statement for the evaluation (MoLAS-PCA 2007b) and are intended to address the research priorities established in the Museum of London's *A research framework for London Archaeology* (2002). See section 2.2 for further details on the Landscape Zones referred to below.

- To identify Late Pleistocene environmental evidence and late Upper Palaeolithic activity across the site.
- To identify evidence for settlement of prehistoric and historic date, particularly within zones of higher ground not already truncated by quarrying.
- To identify wetland and channel-margin activity of prehistoric date and riverside structures of historic date.
- To identify evidence for the nature and/or date of past land management and exploitation.
- To identify evidence relating to past landscape, river pattern and changing environment of the site from the Mesolithic onwards.
- To identify evidence for the Roman London to Colchester road and roadside margins.
- To identify evidence for the nature and/or date of past waterways management and exploitation.
- To identify evidence for the presence of the River Lea, Pudding Mill and City Mill Rivers in the past.
- When did the River Lea assume its current course along the southwest edge of the zone? Is this course the result of 'natural' channel migration or did it originate in past waterway/wetland management activity?
- What evidence is there for early or later medieval exploitation of the area; in particular is there evidence for water inundation (water levels continued to rise throughout these periods) and water management? If so how are these activities characterised? Are there any features or structures, particularly water mills, present within the subject site? Is it possible to determine whether the Pudding Mill River or City Mill River have their origins in the late Saxon era, possibly associated with Alfredian defences, or partial drainage of the increasingly flooded wetlands?
- 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?

2 Topographical and historical background

The following summary of the geological and archaeological background to the site is based upon the desk based assessment for PDZ3 (MoLAS-PCA 2007a).

2.1 Modern topography and drainage

The site is located on the western side of the floodplain (valley bottom) of the Lea Valley, to the east of the River Lea, which forms the western site boundary. The extent to which these rivers are natural or have been manipulated or even entirely created by people in the past is not yet known. The pattern of rivers flowing across the site in the past will, however, have influenced its use and hence its archaeological potential.

The landscape of the site in the past bears little relation to the visible landscape of today, with the deposition of made ground deposits completely obscuring the earlier topography. Modern ground level slopes slightly from 6.92m OD in the north to 6.83m OD in the south.

2.2 Natural topography and past landscape setting

The British Geological Survey (Sheet 256: North London) indicates that the site lies on alluvial sediments. These alluvial deposits would have supported a range of different environments from wetland through to dry land, which are likely to have existed within the Lea valley from the Mesolithic period onwards. These environments would have been constantly changing throughout the Holocene period. Gravels and associated deposits of Palaeolithic date underlie the alluvium. The higher ground of the gravel terrace, which forms the western side of the valley, lies a short distance west of the site, on the opposite side of the River Lea. Tertiary bedrock, which in this area is variably London Clay and Woolwich and Reading Beds, underlies the gravels. The surface of bedrock delineates the extent of archaeological deposits.

Boreholes undertaken at Site Investigations within PDZ3 were monitored and interpreted by MoLAS-PCA geoarchaeologists, and reported in the Detailed Desk-Based Assessment (MoLAS-PCA 2007a). This indicates that:

- The majority of the PDZ3 lies within a low-lying area of the Lea floodplain that was probably a wetland basin crossed by river channels, located immediately to the west of the main Lea channel (Landscape Zone 2).
- Areas of higher ground existed within the wetland basin, notably a region along the northwest side of the PDZ3 (Landscape Zone 1), which may have been dry land in the prehistoric period and thus has potential for evidence of prehistoric occupation activity.
- A river channel may have separated Landscape Zone 1 from the high ground of the valley side to the west, although whether this was a channel of the Lea

(as exists today), of the Hackney Brook or a local channel flowing off the river terrace is uncertain. Timber piles of Roman date, possibly part of a bridge or wharf structure were found to the west of this channel, just west of PDZ3 at Dace Road, Old Ford. Similar structures may be located close to the east bank of the channel within the zone.

- Two other high areas existed in the eastern central portion of PDZ3. These would have formed dry islands within the floodplain well into historic times, and thus have potential for historic occupation activity. Together with Landscape Zone 1, these high areas probably represent outcrops of earlier terrace deposits that were not scoured away by Late Glacial meltwater.
- Relatively thick alluvial deposits of archaeological interest are likely to exist in the low lying area (Landscape Zone 2), which will include sediments accumulated within the river channels (gravels, sands, silts and tufa) and in marshy areas associated with them (peat, organic sediment and clays).
- As this part of the floodplain lies close to the intensive prehistoric, Roman and medieval occupation known to have existed in the Old Ford area, there is a strong possibility that evidence of wetland exploitation, such as the bridge or jetty mentioned above, will be found in Landscape Zone 2.
- Evidence of Late Upper Palaeolithic and Early Mesolithic activity may be found at the base of the alluvial sequence, especially on the gravel bars and sandy islands that are likely to be associated with palaeochannels in this zone.
- Evidence relating to the Late Glacial period may be preserved within the gravels, which will be of significance in reconstructing the environment in this part of the Lower Lea in the Late Upper Palaeolithic period. Deposits of Late Glacial date have already been identified in previous boreholes drilled just beyond the north-east boundary of the site.

2.3 Prehistoric

Although no prehistoric find or deposits have been recorded within PDZ3 itself, antiquarian findspots show a low level of activity in the form of disassociated finds. However, recent archaeological fieldwork in the immediate vicinity increasingly indicates that the area was occupied and exploited. Neolithic land surfaces and Bronze Age worked wood have been identified in the north of PDZ 1, to the east of the site (site OL-001 05). Site OL-003 05 in the south of PDZ 1 revealed evidence for an area of slightly higher and therefore drier land which had Bronze Age – Iron Age features, such as post-holes, pits, a ditch and a possible ring gully, cutting through it. A small amount of struck and reworked flint and a large amount of burnt flint was also recovered from the site.

Wooden structures such as trackways and jetties may be present within PDZ3. A fragment of possible Iron Age trackway, the precursor to the later Roman road, was recorded in the centre of the zone (GLSMR ref 080875). It should also be noted that watery areas were often a focus for ritual activity, such as the deposition of votive objects, and it is possible that the Neolithic and Bronze Age axes recovered from the neighbouring PDZ 2 are examples (GLSMR 061746, 060258).

2.4 Roman

The Roman road that connected the main port at Londinium (London) with the early military base and Colony at Camulodunum (Colchester) is projected across PDZ3. There is also a moderate potential for evidence of the Roman crossing point across the Lea. This may have taken the form of a ford or via timber bridges or raised platforms, crossing the braided channels from island to island.

Associated with this road is fragmentary evidence for settlement activity in the near vicinity; either a nucleated settlement or several small farms or farmsteads dotting the landscape with associated field systems. A cemetery or cemeteries are also possible this area. Roman occupation within PDZ3, if present, is likely to be sited on the islands of higher ground.

2.5 Saxon

Evidence of Saxon activity in the area is limited to the River Lea and its channels (the Stratford Back Rivers). The river will have remained a useful resource and by the late Saxon period mills may have been located along the river. There is a moderate possibility that in situ remains associated with management of the streams and banks of this period survive within alluvial deposits.

2.6 Medieval

Although no archaeological evidence for medieval activity comes from within PDZ3, areas to the immediate west were occupied and exploited from at least the 13th century. The rivers within PDZ3 have a moderate potential for medieval deposits and features relating to the mill complexes known to have existed in the area. These features may include timber wharfing and leats set back from the waterfront themselves.

2.7 Post-medieval

During the 16th and 17th century the land in PDZ3 was, as earlier, characterised by marshes and remained undeveloped. Evidence of past land management and exploitation may survive in former stream channels. There is a possibility of evidence of post-medieval activity, particularly due to the proximity of the River Lea and the Pudding Mill River. There is potential for isolated structures relating to stream channels. Later, the area still remained largely open ground, with little development. The marsh no doubt hindered development but also attracted noxious industries, such as the 19th-century tar and turpentine distillery between the Pudding Mill and City Mill rivers. Other evidence is expected to relate to quarrying and subsequent ground consolidation. The archaeological deposits are likely to be sealed by a considerable thickness of Victorian and modern made ground. In some places the made ground may infill areas of historic excavation, such as gravel quarries, brick pits and diverted river channels.

3 The evaluation

3.1 Methodology

All archaeological excavation and monitoring during the evaluation was carried out by a joint MoLAS-PCA team in accordance with the preceding *Method Statement* (MoLAS-PCA 2007b) and the *MoLAS Archaeological Site Manual* (MoLAS, 1994).

Two evaluation trenches were excavated, PDZ3.38 and PDZ3.39, targeting locations likely to be impacted by the proposed development. Each trench was excavated to the top of the alluvially deposited materials, before machining a test slot to the natural gravels in order to ascertain the extent of any hydraulic pressure in the groundwater.

Excavation of PDZ3.38 began on 14 August 2007 and was completed on 7 September 2007. PDZ3.39 commenced on 12 October 2007 and was completed on 8 November 2007.

In PDZ3.39 the artesian pressure was considered, by Atkins' engineers, to be too great to render exposure of the gravels practicable. In this case, with the agreement of English Heritage, a 0.30m sealant layer of alluvium was left in place on top of the gravels to separate the uncontaminated pressurised groundwater from the contaminated perched water present in the made ground. Despite machining a test slot to a level of 0.14m OD, no gravels were visible, with ground water breaking through natural sands.

The remaining trench PDZ3.38 was excavated to the level of the natural gravels through a series of three slots, in order to effectively manage rising water.

A mechanical excavator initially using a breaker and toothed bucket removed the concrete slab from the trench areas. Grading off of the underlying deposits was undertaken by the mechanical excavator using a flat ditching bucket, monitored by an archaeologist and a banksman at all times. MoLAS/PCA geoarchaeologists visited the trench during excavation to examine and interpret the deposit in plan and section and to take samples as appropriate.

The locations of the evaluation trenches were recorded by the MoLAS-PCA surveyor using an EDM. This information was electronically collated and plotted onto the OS grid. Levels were calculated from benchmarks established by Atkins' engineers, established along Marshgate Lane and within the Galvanising area adjacent to the trenches, and imported onto the site.

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).

The site has produced: 1 electronically surveyed overall trench plan; 2 drawn detail trench plans at a scale of 1:20; four detailed structure/feature plans at 1:20 scale; 123 context records; 2 sections drawn at a scale of 1:10 and 6 at a scale of 1:20. The site finds and records can be found under the site code OL-04407 in the MoL archive.

3.2 Results of the evaluation

(See Fig 2 for trench locations).

3.2.1 Evaluation Trench PDZ3.38

Location	Northern part of work package 3
Dimensions	22.58m x 3.24m at base; c 5.6m deep
Modern ground level	6.92m OD
Base of modern fill	4.60m OD – 3.56m OD
Depth of archaeological deposits seen (alluvium)	0.9m
Level of base of deposits observed and/or base of trench	1.29m OD
Natural observed	2.31m OD

Table 1 Trench PDZ3.38 deposit summary

Gravel layer [29] was present at 2.31m OD at the trench base. This deposit contained medium sized rounded pebbles and probably represents natural gravel lying within the base of a former river channel. Comparable deposit [28] consisted of yellow-grey gravel containing small–medium rounded pebbles, present at a surface of 2.05m OD. This was interpreted as a gravel bar, also within the base of a former channel, and measured 0.56m thick, exceeding the limit of excavation. Layers [28] and [29] were confined to the northernmost section of the trench, within the machine excavated slot (Fig 5).

In the southern part of the trench, natural gravel layer [46] was encountered at 1.51m OD measuring 0.12m thick and extending beyond the limit of excavation. This comprised loose, brownish-yellow, coarse sandy gravel, and may represent a continuation of [29] from the north, suggesting an undulating nature to the underlying geology.

However, the precise relationship between contexts [29] and [46] is impossible to ascertain due to the nature of the investigations.

Loose, blue-grey coarse sandy gravel [45] measuring c 0.1m thick, sealed [46] from a height of 1.61m OD, this was similarly interpreted as a natural deposit of alluvial gravel (Fig 5).

Five timber posts, assigned the overall structure context [40], aligned north-east/south–west were cut into layer [45]. Each post survived to between 1.81m–1.87m OD and measured an average 100mm diameter. The posts were rounded to sub-square and were left in situ by the excavators. Consequently, further information regarding species identification or full dimensions was not possible. All the posts [40] were found in association with timber plank [41] and interpreted as supports for this context, being positioned both to the south-east and north-west. Plank [41] comprised a radially cleft oak board, laid horizontally on edge; measured 2.20m in length x 60mm thick x 300mm depth and was encountered at 1.88m OD. Features [40] and [41] were allocated structure context [42]. The structure is believed to represent a revetment, or an example of a localised strengthening of such a revetment (D Goodburn pers comm). Close dating of this feature from technological grounds is not possible, however the degree of preservation and level of construction might infer a

Saxon to mid- Medieval date range (D Goodburn pers comm). This structure therefore represents the earliest phase of water management within the trench (

Fig 3).

Deposits [44] and [39] overlay structure [42] to the east and west respectively. Layer [39] was observed from 2.04m OD, measured *c* 0.3m thick and comprised a light yellow-brown/blue-grey clayish gravel and contained frequent inclusions of small snail shells. Deposit [44] to the east of plank [41] consisted of mid blue-grey silty clay, approximately 0.30m thick from a surface of 2.86m OD and sloped down to 1.77m OD in the south of the trench. Both layers were interpreted as alluvial silting. Geoarchaeological sampling will define the depositional sequence more precisely (

Fig 3).

An 0.16m thick gravel deposit [38], sealed [44] and [39] at 2.02m OD. This layer consisted of grey/yellow-brown coarse sandy gravel and was overlain in turn by soft, blue-grey clayey silt [36], observed from 2.37m OD. A 0.5m thick layer of loose, yellowish-brown, sandy gravel [34] overlay [36] from 2.66m OD. Layers [34], [36], [38], [44] and [39] were believed to have been alluvially deposited and representative of a period of episodic flooding in the area (

Fig 4).

In the north of the trench, a firm, blue-grey silty clay [27], measuring 0.28m thick at 1.87m OD sealed layers [28] and [29]. The deposit formed around gravel bar [28], indicative of alluvially deposited silt accumulating at the base of an inactive channel. Further alluvial deposition was evidenced in layer [26], encountered at 2.59m OD and measuring between 0.60m and 0.28m thickness. The deposit was a dark brown, sandy silt containing frequent inclusions of snail shells and moderate degree of organic residue, including roots and plant fragments (Section 6, Fig 5). A light yellowish green silty sand [47] was recorded at 3.55m OD and measured 0.26m thick. This deposit extended 4.30m north–south along the western face of the trench. Layers [47], [26], and [27] were all interpreted as representative of a period of episodic alluvial silting.

A possible former east–west channel [430] truncated layer [34] at 2.67m OD. This measured 2m in width x 0.75m depth and extended beyond the limit of excavation to the north. The cut exhibited concave sides with an undulating base. This was filled by deposits [37] and [35]. Primary Fill [37] measured 0.25m thick and comprised a loose, mid yellow, coarse sand with blue clay lenses. Firm, yellowish brown clay [35], measuring 0.56m thick overlay fill [37]. Both fills appeared moderately well sorted and reflect natural silting (

Fig 4).

Stake [31] cut into alluvial deposit [26] at the north end of the trench. The oak stake was formed from a cleft quartered pole and was encountered at 2.55m OD. The pole measured 120mm diameter x 0.96m length up to the limit of excavation. Wattle rods were woven around both sides of [31], connecting further stakes in both directions in a northwest–southeast alignment. The rods appeared to have been worked in handfuls in a plain, slew weave, with each up to 35mm wide (D Goodburn pers comm). The rods and stakes were assigned the structure number [32] and have been interpreted as the remnants of a wattle revetment of a former river channel. The timber exhibited a considerable lean towards the south-west, suggesting that the former channel lay to this side although this was not possible to verify within the confines of the evaluation. The general character of the structure and level suggests a Saxon to early post-medieval date range (D Goodburn pers comm).

Firm, mid orange-brown sandy silt alluvial layer [30] sealed wattle revetment [32]. This contained occasional inclusions of charcoal flecks, snail shells and small animal bone fragments. The deposit was observed in section, measuring 2.85m north–south x 0.26m thick and was encountered at 2.42m OD. Preliminary interpretation indicates that the deposit formed as a result of drier environmental conditions, and therefore forming a land surface. Whilst fragments of animal bone and charcoal infer some element of human occupation or activity within the vicinity, no other cultural material, or indications of land-use, was identified within this area.

An extensive alluvial deposit [43] was identified in section sealing both the landsurface horizon [30] and channel fill [35]. The layer extended 19.2m north–south and varied in thickness between 0.35m and 1.47m from 2.46m OD. The layer comprised a firm, brownish-yellow silt containing frequent inclusions of molluscs and small sub-rounded pebbles.

Firm, mid greenish brown alluvial silty clay [24] sealed layer [47] at the south end of the trench. The layer contained frequent inclusions of flint flecks, occasional chalk fragments and moderate small sub-rounded pebbles. The deposit was observed in section at 3.72m OD and measured 8.8m north–south x 0.78m thickness. This was sealed by firm, mid yellow-greyish brown silty sand [14] at 4.60m OD. Layer [14] contained frequent inclusions of small rounded and sub-rounded pebbles; occasional small snail shells and occasional chalk flecks. The deposit measured 23.65m north–south x 1.66m thickness. Layers [14] and [43] were comparable in composition, inclusions and deposition and are considered to represent part of the same layer.

Firm, mid brown silty sand [33], containing occasional inclusions of small shells and organic debris overlay alluvial layer [14]. This was present in the section (Section 5, Fig 5) from 3.81m OD, measuring 7.2m north–south x 0.49m thick. The layer was interpreted as an ‘A horizon’ deposit, formed naturally as indicated by humic staining. It is probable that a fragment of clay tobacco pipe retrieved from this context was intrusive in nature (Appendix 2). The layer was sealed in turn by a palaeosoil of soft, brown, sandy silt [20], containing occasional inclusions of small pebbles, plus occasional fragments of preserved grasses. In section, the layer was recorded at 3.72m OD and measured 7.76m north–south 0.12m thick (Fig 5). Surface [20] was truncated to the south by cut [22]. This measured 1.61m north–south x 0.44m depth and was encountered at 3.68m OD. Yellow-brown silty sand [21] containing fragments of mortar, cbm and rounded pebbles filled the feature. It is unknown what the cut may represent although it is apparent that they date to the post-medieval period (Section 5, Fig 5).

A series of levelling dumps and made ground deposits sealed feature [22] and the underlying sequence. These comprise contexts [1]–[13], [15]–[19], [23] and [25]. These comprised layers of mixed debris including 20th-century tyres, redeposited sand and ceramic building material; overall 4.13m in depth from 7.18m OD. Fragments of pottery and glass recovered from these deposits were of 18th and 19th century date, suggesting that this phase of ground raising may have commenced at this time (see Appendix 2).

3.2.2 Evaluation Trench PDZ3.39

Location	Southern part of Work package 3
Dimensions	15.94m x 1.90m at base; 5.3m deep
Modern ground level	6.83m OD
Base of modern fill	3.18m OD
Depth of archaeological deposits seen (including alluvium)	1.7m
Level of base of deposits observed and/or base of trench	1.56m OD
Natural observed	NA

Table 2 Trench PDZ3.39 deposit summary

Soft, orange-yellow tufaceous sand [314], containing frequent inclusions of calcium carbonate, was observed in section at the trench base sloping from 1.46m OD in the south to 1.40m OD to the north (see Fig 7). Pottery recovered from the layer dating to the Late Iron Age – AD 70 period is likely to be intrusive, although it is possible that it indicates some reworking of the upper horizon of this deposit (see Appendix 2). A light orange-brown sandy clay alluvial layer [313], with frequent patches of iron staining, sealed the sandy tufa. This was observed at a height of 1.60m OD, with a maximum thickness of 0.16m.

Probable ditch cut [316] truncated the northern end of layer [313] extending east–west across the trench width. This measured 2.00m east–west x 1.54m north–south x 0.26m depth, exhibited a sharp break of slope at top with concave sides breaking sharply to a flat base. Deposit [395] comprised the primary fill, consisting of firm, dark brownish-blue grey silty clay with frequent inclusions of charcoal flecks, moderate quartz fragments and snail shells, and occasional fragments of burnt flint and small pottery sherds of Roman date (AD 50–400; Appendix 2). The fill was overlain by 0.20m thick fill of firm dark brownish-grey silty clay containing occasional shell fragments and manganese staining [315]. The latter fill appears to reflect disuse of the ditch, consistent with silts deposited by regular water ingress. Pottery fragments recovered from the primary fill indicate an Iron Age date, suggesting that the original function of ditch [316] may be a boundary feature (figure 5).

Firm, dark greyish brown, waterlain silty clay [312], measuring 0.44m in section (Fig 7), with frequent patches of manganese staining and containing occasional small snail shells, sealed ditch [315]. The layer contained pottery dating to the Late Iron Age and 70AD. Sediments within the layer suggest fluvial deposition by fast moving water.

Posthole [436] cut into alluvium [312] in south of the trench. This measured 80mm x 70mm x 130mm depth and was filled by timber post [335]. The top of post [335] was encountered at 2.33m OD and comprised a sub-circular conversion of uncertain wood

species. The post was left in situ, pending further investigation, and is believed to represent a fragment of a larger structure, probably reverting as part of water management.

Firm, dark brownish-black silty clay [311] sealed post [335]. This contained frequent inclusions of organic material indicative of seasonally decaying vegetation. As a whole the layer is interpreted as a former land surface, having formed under temporary drier environmental conditions. The layer was recorded at 2.00m OD with a maximum thickness of 0.20m. The relationship between this and revetment [334] to the north has been impossible to ascertain without further investigation.

A layer of firm, dark bluish grey, fluvial sandy silt with clay [310] measuring up to 1.26m thick, overlay land surface [311] between 3.18m OD and 2.76m. The deposit contained frequent lenses of snail shell fragments and manganese staining. The layer was likely to have been laid down during prolonged episodes of seasonal flooding.

Cut [319] truncated alluvial layer [310] to the north. This extended roughly north–east / south–west across the trench and measured 0.90m in length x 0.86m thick. Although the cut had steeply sloping sides, due to the limitations of the evaluation trench it was not possible to observe the full depth, width and characteristics of the base. Firm, dark brown, silty clay [318] filled cut [319] at 1.88m OD to a depth of 0.44m and abutted revetment [334] (see below). The fill contained moderate inclusions of small rounded pebbles, encountered. Cut [319] may have functioned as the construction cut for revetment [334], with [318] deposited as backfill. Further work is required to confirm the nature of this feature and its relation to both the revetment (below) and any potential underlying channel fills associated with the revetment.

Timbers [325] to [333] inclusive, formed a north-south timber revetment [334], lining the east side of a north-south channel aligned northeast–southwest. The east (landside) element comprised five vertical, sub-rectangular posts, [326], [327], [328], [329] and [333]. These survived to between 2.31m OD and 2.35m OD; the minimal evidence of damage may represent the original height of the structure. Details of the posts are given below

- Post [326] boxed halved measuring 110mm x 170mm x 160mm,
- Post [327] boxed heart measuring 180mm x 100mm x 160mm
- Post [328] boxed heart measuring 200mm x 90mm x 130mm
- Post [329] boxed halved measuring 210mm x 130mm x 170mm,
- Post [333] boxed halved measuring 200mm x 100mm x 200mm .

The posts were all oak in a state of good preservation, and lined the eastern side of a series of planks, laid horizontally on edge. The uppermost of these [330] survived to 2.29m OD, measured 2080mm x 130mm x 40mm and abutted plank [325] to the south. Plank [325] was recorded to a length of 210mm x 50mm x 60mm and extended beyond the limit of excavation to the west. Below [330], two further planks [331] and [332] survived to 2.16m OD and 1.89m OD and measured 2080mm x 280mm x 40mm and 2100mm x 250mm x 40mm respectively. All planks were tangentially faced and identified as oak and pine in an excellent state of preservation. The structure exhibited a slight batter towards the north, supporting the notion that the channel lay to this side (Fig 6).

Timber posts [306], [336] and [337] were located west of revetment [334] (Fig 6). The posts were assigned structure number [305]. Post [306] was survived to 2.20m OD, measured 80mm x 40mm x 280mm in length and extended beyond the limit of excavation. The post was sub-rectangular in appearance and no other associated features were noted. Post [306] was left in situ. Posts [336] and [337] were both sub-circular, measuring 100mm x 120mm x 100mm length and 60mm x 70mm x 290mm length respectively. These survived to 2.28m OD and 2.36m OD and followed a possible north–east / south–west alignment. The posts were interpreted as rubbing posts, associated with structure [334] discussed below, which would have prevented boats from damaging the face of the revetment.

Dark orange-brown silty clay with occasional small rounded pebbles [429] lay within the conjectured channel to the west of revetment [334]. The deposit was present from 1.38m OD, measuring 1.50m north–south in length and extended beyond the limit of excavation, and is interpreted as abandonment silting within the channel.

A clinker built boat [390], possibly a Thames skiff, lay on the surface of deposit [429]. Its full extent was beyond the limit of excavation. The dimensions were 1.74m width north–south by 1.30m length east–west. The key identified components were planking from the hull, ribs and floor planks. The hull comprised planks [355] – [365], [387] and [388]; each orientated north–south, with widths varying from 60mm–120mm. The uppermost plank [355] was encountered at 2.14m OD. Planks [387] and [388] represent the lower timbers encountered at a height of 1.75m OD in the north. All planks related to the hull utilised brass rivets and were preserved in relatively good condition. The planks were overlain by a series of ribs: [307]–[309]; [338]–[343]; [348]–[349]; [353] and [354], comprising 13 timbers in total. All ribs were positioned east–west horizontally, consistently measuring 20mm, 25mm or 30mm in width and were sub-rectangular in form with brass rivets. All ribs were encountered at an approximate height of 2.00m OD. Horizontally laid, sub-rectangular timbers for floor supports also overlay the hull planks. The floor timbers were recorded as [344]–[347]; [350] and [352], seven timbers in total. Each timber measured between 20mm and 35mm in thickness, with the exception of smaller piece [345], measuring 12mm width. The floor supports were encountered at 1.92m–2.07m OD. Timber of uncertain function [389] was located at the north-east of the main boat. This was an irregular shaped timber positioned northeast–southwest horizontally, measuring 310mm length x 130mm width x 20mm depth, at 1.98m OD. The piece may represent a damaged fragment of floor planking. This may have been damaged prior to the boat being covered by silting and made ground deposits rather than by modern truncations. All components of structure [390] were recorded and left in situ pending further investigation and trench extension.

Dark brown, silty clay [428] sealed and infilled boat [390]. This contained occasional small rounded and angular pebbles, and measured 3.10m north–south by 0.54m thick. The deposit sloped down from 2.26m OD in the south to 1.74m OD to the north. This lay only on the north side of revetment [334] and was interpreted as post abandonment silting of the former channel. Firm, mid brown, silty clay [427] overlay layer [428], fill [318] and revetment [334]. The deposit contained occasional small rounded stones, and measured 1.8m north–south by 0.46m thick, sloping from the south at 2.34m OD to 2.20m OD to the north. This deposit appears to correspond to cut [319], however, as it clearly seals the later boat [390] it cannot be related to the construction cut for [334]. Further investigation will resolve this relationship.

A grey-brown silty clay layer [299], containing red brick fragments and occasional slag flecks sealed the earlier alluvial horizons. This was truncated by a large modern feature [394] from 3.80m OD in the south of the trench, sloping down to 1.70m OD to the north. The cut extended 1.44m north–south beyond the limit of excavation to the north. The base of the cut was obscured by the trench limits. The cut had steeply sloping sides and contained fills of clayey silt deposits containing wood, shell, slag and cbm fragments [298] and [297] to a combined depth of 0.9m. The fills are characteristic of late 19th–early 20th century dumping.

Made ground/levelling deposits sealed the remainder of the trench. These consisted of deposits [320]–[323], [295] and [296]; with a combined depth of 2.65m from a ground level of 6.85m OD. The layers consisted of a variety of very mixed silty clays and sands, and contained fragments of cbm, mortar, coal and shell, all consistent with the character of late 19th and 20th century levelling layers.

3.3 Stratigraphic interpretation of the site

3.3.1 Phase 1: late Glacial/ early Holocene deposits forming the buried topography

<i>Trench</i>	<i>Contexts</i>	<i>Samples</i>
PDZ3.38	[28], [29]; [45], [46];	{40}, {44}

Table 3 Buried topography index

Gravels were only recorded at the base of Trench PDZ3.38. The gravels from the northern extent of the site were present at 2.31m OD and exhibited an undulating upper boundary, sloping to 0.93m OD at their lowest level. Gravels identified from the south of the area were identified at between 1.51m OD and 1.41m OD. This supports the proposed landscape model as described in the desk based assessment of an irregular topography of the Lea Valley Gravels. The observed levels also support the notion of drier, higher land formations to the north-west of the site, sloping down towards the south toward a deep channel (presumably the Pudding Mill River). It is possible that a considerable degree of scouring from the action of former water courses, took place towards the southern boundary of the site, to the north of PDZ3 Work Package 2 (site OL-04207).

3.3.2 Phase 2: alluvial deposits

<i>Trench</i>	<i>Contexts</i>	<i>Samples</i>
PDZ3.38	[26]–[28]	{8}, {16}, {44} {46}
PDZ3.39	[314]; [313]	{218}, {222}; {219}, {223};

Table 4 Index of alluvial deposits

The alluvial deposits cover a wide timespan from the Mesolithic to the post medieval period and further work on the samples, dating and stratigraphy is needed to place it within the archaeological sequence. The lower alluvium overlays gravels to the north and tufaceous sand to the south, indicating the influence of ground water and water channels in the area. Over time in the northern area, the disused channel silted up whilst in the southern area, flood deposits sealed the sands gradually turning the whole area into a backwater environment, which became subject to water

management techniques. A series of alluvial deposits overlay the gravels described above. Whilst these varied somewhat across the two trenches, they appeared to represent a continuous sequence of sediment accumulation through seasonal flooding and periods of waterlogging across a floodplain environment.

In PDZ3.39 early, probably mid-Holocene, tufaceous sand [314] developed – the tufa element probably formed by calcium carbonate rich fresh water springs percolating through the sandy floodplain – is the earliest indication of the floodplain environment to the south of the site overall. Interestingly, no gravel was observed within this trench, only sand, suggesting that a deeper channel lay in the vicinity scouring the underlying gravels to a much greater depth. Over [314] a silty clay [313] is deposited, initially sandy then fining upward, indicating a flood deposit of a less energised fluvial environment than that which deposited the sands (probably some considerable time before). Further alluvial deposits are seen to occur after the construction of a ditch of probable Iron Age date [316] (see 3.33 below). These silty clays tend to indicate a similar environment indicated by [313] although quieter still with [315] and [312] being organic in nature indicating vegetation colonising the area marginal to the floodplain. The sands and gravels probably existed for some period of time prior to their inundation by the later Holocene silty clay flood deposits.

In PDZ3.38 context [27], essentially a silty clay flood deposit, draped the gravel bar [28] but suffered erosion prior or due to the deposition of the more organic sandy silts of [26]. Context [27] also possibly indicated a period of quiescence across the floodplain area as root channels were present throughout this context indicating the possibility that a certain amount of river margin vegetation took hold during this period. All the alluvial deposits including and over [26] – [14], [43], and [33] continue the theme of probable episodic overbank flood events as the sand, small pebble and mollusc content frequently seen in these contexts indicate river bedload being deposited across the floodplain. The flooding episodes were punctuated with drier conditions allowing land formation sustaining plant growth. Of the deposits identified, clear indications of seasonally decaying vegetation were visible, as well as material suggesting human occupation and exploitation within the site vicinity. It is likely that the area probably suffered much anthropogenic influence such as water management periodically throughout the late prehistoric and historic periods. Certainly however the deposits generally indicate a gradual shift toward a dryer land environment across the area over time. This is corroborated by the presence of palaeosols such as [20] at the top of the profile in PDZ3.38 prior to levelling with dumped material of the nineteenth century .

3.3.3 Phase 3: prehistoric land use

<i>Trench</i>	<i>Contexts</i>	<i>Samples</i>
PDZ3.39	[316] [395] [315]; [312]	{217}; {221} {224} {226} {227}

Table 5 Index of site prehistoric land use

A ditch of possible Iron Age date [316] was recorded within PDZ3.39. Although only partially revealed, this may represent a field boundary or drainage ditch, which naturally silted up following disuse.

3.3.4 Phase 4: historic water management and channel usage

<i>Trench</i>	<i>Contexts</i>	<i>Samples</i>
PDZ3.38 PDZ3.39	[31] [32] [306] [307]–[309] [325] [326] [327] [328] [329] [330] [331] [332] [333]. [334] [336] [337] [338]–[343] [344]– [347] [348]–[349] [350] [352] [353] [354] [355] – [365] [387] [388] [389] [390] [427] [428] [429]	–

Table 6 Index of historic water management and channel usage contexts

At least two phases of timber reverting were recorded during the evaluation, with a further phase of wattle lined reverting recorded in the north of trench PDZ3.38. Preliminary dating based purely on typology infers a date range from Saxon as the earliest example, to medieval and late post medieval. Each phase of reverting was sealed by further alluvial deposits, demonstrating a continuity of human occupation and management of the environment that corresponds with changing waterways and environmental conditions.

3.3.5 Phase 5: 19th–20th Century Made Ground & Landfill

A considerable depth of made ground and modern levelling material was present across the site. No archaeological features of note were identified within this material. These made ground layers comprised very mixed deposits and indications of large modern truncations. It may therefore be interpreted that land reclamation and industrialisation of the area did not begin until the late 19th and early 20th centuries.

3.4 Evaluation of environmental evidence

3.4.1 Introduction

Several visits were made by a MoLAS-PCA geoarchaeologist to examine, record and sample the natural sequence exposed within the evaluation trenches. The geoarchaeologist's description and interpretation of the deposits form part of the trench results and stratigraphic interpretation in sections 3.2 and 3.3 above.

Furthermore, the stratigraphy recorded in a representative profile of the trench sequence, as drawn and described by the geoarchaeologist, should be entered into the MoLAS-PCA geoarchaeological stratigraphic database of the Lower Lea as part of the assessment. This database will be used in post excavation stages of the project, to reconstruct the evolving past environment of the Olympics site and to target samples and locations for analysis.

3.4.2 Sediment characteristics

In Trench PDZ3.39 a sequence of two monolith tins (sample {226}) was taken through the deposit sequence contexts [312] [315] [318] [395] and [427] at the north-western end of the trench, and a single monolith tin (sample {225}) through the natural deposit sequence (contexts [310] [311] [312] [313]) in the south eastern end of the trench. These tins provide undisturbed columns of sediment, as revealed in the trench sections, for off-site examination and they were accompanied by bulk samples

{215}, {217} to {224} and {227} of the contexts sampled in the tins. In trench PDZ3.38 a single sequence of 5 monolith tins were taken (comprising of samples {40},{41},{42},{43}and{45}) through the deposit sequence (contexts [14],[19],[20],[26],[27],[29],[30],[33] and [43]) in the northern half of the trench. The location selected for sampling was considered to be a representative profile of the deposits exposed in the trench. The monolith is suitable for sub-sampling for microfossils and sedimentary techniques, intended to gain a better understanding of the changing environments represented by the alluvial deposits across the site as a whole.

Sedimentary techniques such as loss on ignition, magnetic susceptibility and soil micromorphology might tell us more about the depositional and post depositional environment of the alluvial deposits. Microfossil examination might be able to provide information about the river characteristics and surrounding vegetation.

The monoliths will be retained until environmental assessment is undertaken, when sub-samples for pollen and diatoms will be examined to determine their potential for past environment reconstruction (see below). Further retention until the analysis stage of the project is likely to subsequently be required, as this is when more detailed sedimentary techniques will be carried out.

3.4.3 Microfossils

The alluvial deposits (accumulated as a result of episodic flooding) might preserve microfossils, such as pollen and diatoms, as well as cladocera, chironomids and other microscopic remains although preservation in the upper part of the alluvial silty clays (33) and the palaeosols (20) and possibly (30) may be poor, as a result of oxidation and weathering. Such evidence can provide valuable information about the evolving past environment. In particular information about the past vegetation, water characteristics, and indirect evidence for human activity, such as landscape clearance, cultivation and other disturbance might be gleaned. Such evidence is likely to be complimentary to the information obtained from macro-remains from the bulk samples. This is only a guide however, without assessment of the microfossil inclusions their survival and potential cannot be reliably evaluated. The preservation of microfossils in the deposits sampled by the monolith tins needs to be assessed as a further stage of work.

3.4.4 Bulk sample processing

Fourteen environmental bulk soil samples were collected for the potential recovery of plant remains, molluscs and insect remains with the expectation that they might provide information on the local environment and evidence of any human activity in the area. This work should stand alongside any environmental information produced from the monolith samples and should help to look at any environmental changes across the site. The aim of this evaluation was to establish whether a full assessment of any of the materials present in the samples should be carried out.

Five-litre sub-samples were processed for this evaluation by floating the soil into 250µm mesh and washing the residue over a 500µm mesh. The flots were stored wet

to help with the preservation of any organic material and the wet sieved fractions were dried. The remaining soil from each sample was retained for further work.

Small amounts of the flots were examined to show whether further assessment would be worthwhile. The flots were scanned rapidly under a low-power binocular microscope. As this was not an assessment, detailed comments of the contents can not be made.

3.4.5 Radiocarbon dating

In general, few artefacts suitable for spot dating were recovered from the alluvial sequence. However, the deposits excavated contained twigs and other plant remains, from which radiocarbon dates might be obtained. Although some samples specifically for radiocarbon dating were taken, the sequence of bulk samples (and the monoliths if necessary) should provide sufficient material for the extraction of single entity organic remains suitable for radiocarbon dating by AMS (Accelerator Mass Spectrometry) if deemed necessary from elsewhere across the site.

3.4.6 Molluscs and ostracods

Three contexts that preserved snails were [26], sample {8}, [27], sample {46} and [43], sample {16}. Freshwater taxa, particularly snails, but with a smaller number of bivalves, provide virtually all, more than 99%, of the shell count.

The fauna mainly included bithynia *Bithynia sp.*; pond snail *Lymnaea sp.* and ram's-horn snail Planorbidae with smaller numbers of river nerite *Theodoxus fluviatilis*, valve snail *Valvata sp.* and small bivalves, probably pea mussels *Pisidium sp.*. Although all these taxa are abundant in base-rich, still or slowly-flowing freshwaters in S E England, there are considerable *inter-specific* differences in habitat requirement shown by pea mussels, planorbids and within the genera *Lymnaea*, *Bithynia* and *Valvata*. Accurate identification of the represented species will allow specific comments on local freshwater habitat in terms of flow, seasonality, substrate and vegetation. From the preliminary identifications carried out so far, the molluscan faunal composition does not indicate significant effects due to periodic drying, organic pollution or elevated salinity.

3.4.7 Plant remains

Fourteen wet flots were examined in this evaluation. Of these, all produced organic waterlogged plant remains, including seeds, wood and rootlets. Charred plant remains were occasionally present in some of these samples. Clumps of waterlogged compacted straw were present in sample {215} from context [311]. Moderate quantities of charred wood were present in PDZ3.38 from sample {16} context [43], and in PDZ3.39 from sample {220} from [310] which also had charred grain, {222} from context [313], {224} from [315] and {227} from context [395]. Good waterlogged fruit seeds were present in sample {16} from context [43] from PDZ3.38. Good waterlogged wetland plant remains were also present in a number of samples, including {8} from [26] in PDZ3.38 and {220} from [310], {215} from [311], {224} from [315] and {227} from [395] in PDZ3.39.

Fruit remains present included grape (*Vitis vinifera*), fig (*Ficus carica*), raspberry (*Rubus cf. idaeus*) and blackberry/raspberry (*Rubus fruticosus/idaeus*). Wetland

plants included pondweed (*Potamogeton* spp.), sedges (*Carex* spp.), horned pondweed (*Zanichellia palustris*), water plantain (*Alisma* spp.), crowfoots (*Ranunculus* BATRACHIUM), watercress (*Rorippa* spp.), yellow rocket (*Barabarea* spp.), gipsywort (*Lycopus europaeus*), branched bur-reed (*Sparganium erectum*) and hemp agrimony (*Eupatorium cannabinum*). Remains from plants of waste or disturbed ground were also present, including seeds from thistle (*Carduus/Cirsium* spp.), buttercup (*Ranunculus* spp.), henbane (*Hyoscyamus niger*), dock (*Rumex* spp.) and stinging nettle (*Urtica dioica*).

3.4.8 Insect remains

Moderate beetle or other insect remains were present in seven flots, sample {8} from context [26] in PDZ3.38 contained possible invertebrate eggs in addition to beetle remains.

context	sample	taken	processed	wood	seeds/fruits	insects	molluscs
26	8	10	5	+++	+++	++	++
27	46	20	5				++
28	44	10	5	+++			
43	16	20	5	++chd	+++	++	++
310	220	20	5	+++ ++chd	+++	++	
311	215	20	5		+++	++	
312	221	20	5		++		
312	217	20	5		+++	++	
313	218	20	5		+		
313	222	20	5	++chd	+		
314	219	20	5		++	+	
314	223	20	5	++	++		
315	224	20	5	+++ ++chd	+++		
395	227	20	5	+++ ++chd	+++	++	

Table 7 Evaluation of environmental evidence

3.5 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’.

The evaluation trenches within Work Package 3 of PDZ3 exposed Pleistocene/early Holocene reworked gravels, overlain by alluvial sequences. Within the alluvium a series of archaeological structures relating to water management were identified ranging in date from Saxon to late post medieval, and overlain by a further sequence of alluvial deposition. In addition, a series of palaeosols was identified, including a band of palaeosoil, indicating several phases of land surfaces. A considerable depth of 19th–20th century made ground, dump deposits, and concrete surface extended across the site, sealing the archaeological deposits. The reworked gravels at the base of the sequence represent a horizon beneath which no deposits of archaeological

significance are likely to be found. Furthermore, where relevant, the areas exposed represented a minimum of 5% of the areas to be impacted upon by construction works. The trenches thus satisfy the original requirements of the evaluation as stated in the Written Scheme of Investigation (MoLAS-PCA 2007b).

4 Archaeological potential

4.1 Realisation of original research aims

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

To identify Late Pleistocene environmental evidence and Late Upper Palaeolithic activity across the site.

No evidence relating to the Upper Palaeolithic activity was identified in either trench. Deposits within the northern part of the site inferred a previous watercourse, orientated northwest–southeast, with gravel bars at the base although these maybe early Holocene in date. The underlying gravel appeared to undulate and was not observed within the southern area, despite machine testing to some depth. This implies the existence of a former, faster flowing channel, scouring the underlying gravels to a greater depth in this area.

To identify evidence for settlement of prehistoric and historic date, particularly within zones of higher ground not already truncated by quarrying.

There was no evidence of such settlement in Trench PDZ3.38. However, Trench PDZ3.39 in the south of the site identified an east–west ditch of possible Iron Age date containing moderate amounts of pottery. The ditch cut into a layer of alluvium and may represent a boundary or drainage function. Furthermore, the well-sorted nature of the upper fills suggests that the ditch naturally silted rather than being deliberately backfilled. Radiocarbon dating and microfossil analysis of the organic material infilling the ditch will help to identify a closer time frame for the silting up the ditch and an idea of the environment – both vegetational and fluvial – at this time.

To identify wetland and channel-margin activity of prehistoric date and riverside structures of historic date.

No riverside structures of prehistoric date were identified within the site. Those from the historic period are discussed separately in detail below. With few finds of anthropogenic material, nothing firmly dateable to the prehistoric period was identified denoting channel-margin activity although seeds or twigs found in samples from watercourse deposits could provide dates for channel migration or flooding. Channel margin activity is likely to leave quite ephemeral traces in the landscape, and therefore liable to be destroyed by the continual flooding and active water channels in the area. Whilst it is clear that the waterways in this area were an important resource and continually exploited, other forms of activity are impossible to ascertain at this stage.

To identify evidence for the nature and/or date of past land management and exploitation.

Very little evidence for past land management outside of the Iron Age ditch were identified within the site although two possible soil horizons or palaeosols could infer land surfaces existed upon which land management and exploitation could have taken place. Closer dating and microfossil analysis of the Iron Age ditch sediments along

with soil micromorphological analysis of the palaeosols could give some insight into the nature of the exploitation of the land at the time.

To identify evidence relating to the past landscape, river pattern and changing environment of the site from the Mesolithic onwards.

As mentioned above, the predominating environmental conditions of the site comprised a series of water channels, episodic flooding and continued attempts to manage the water through a number of wooden reveted structures. It is difficult, within the confines of the evaluation trenches to form broad assumptions about the past river pattern.

The majority of reverting, as well as indications of naturally re-cut channels, follow a rough north–south orientation. It may therefore be possible that these channels represent one continuously meandering, silting and re-cutting channel. Following a review of the historical sources, the most likely source is the Pudding Mill River, which appears to have gradually migrated southwards through time.

A further possibility is that these features indicate diversions from the River Lea, forming protected inlets, rather than lining a pre-existing river. Radiocarbon dating of organic materials from samples taken of the conjectured dryer periods or flood events would possibly provide a clearer chronostratigraphic structure for channel activity and abandonment.

To identify evidence for the Roman London to Colchester road and roadside margins.
The site yielded no evidence relating to the Roman road or any associated roadside margins.

To identify evidence for the nature and/or date of past waterways management and exploitation.

Both trenches revealed considerable evidence relating to the management of past waterways. A revetment of possible Saxon or later date was aligned north-east / south-west, and a wattle lined revetment aligned north-west / south-east, of early post medieval date were identified within Trench PDZ3.38, indicating the management of at least two different phases of watercourses in this area. It is as yet unknown where the channel relating to the former revetment lay in relation to this feature. The lean of posts associated with the wattle revetment however infer that a channel lay to the south-west although further work is required to verify this. The management of waterways over a relatively wide timescale in the vicinity clearly demonstrates that the waterways here were an important resource requiring continuous management.

Further evidence of reverting was found within Trench PDZ3.39 to the south of the study area. A north–south revetment demarcated the limits of a post medieval waterway. An early 19th-century boat was uncovered within the course of the channel, suggesting a mid to late 19th century date for the abandonment of this watercourse.

Without dating we cannot be certain whether the fluvial and alluvial deposits relate to prehistoric or historic watercourses. Obtaining dates should be a priority for further work.

To identify evidence for the presence of the River Lea, Pudding Mill and City Mill Rivers in the past.

The City Mill River lies some distance to the east of PDZ3 and therefore outside the confines of the work package being discussed. The River Lea and Pudding Mill rivers however lay in close proximity to the west and east of the site respectively. Historical sources suggest the River Lea maintained a relatively stable route, along the western edge of PDZ3 from at least 1746. Sources do however indicate a degree of deviation regarding the Pudding Mill River. Following a N–S orientation, the channel cut observed within Trench PDZ3.38 could feasibly represent one such course. The wattle lined revetment could either represent a former course of the Pudding Mill, or an inlet fed from the River Lea to the west. It is, as yet, unclear which watercourse the reverting found within Trench PDZ3.39 to the south of the area relates to.

The location of the study area close to the apex between two rivers could easily give rise to the area forming a natural floodplain. Flooding is well documented from the area, and the considerable amounts and depths of alluvial deposition found across the site appear to support this.

Without dating we cannot be certain whether the fluvial and alluvial deposits relate to prehistoric or historic watercourses. Obtaining dates should be a priority for further work.

When did the River Lea assume its current course along the southwest edge of the zone? Is this course the result of 'natural' channel migration or did it originate in past waterway/wetland management activity?

The study area was confined to the north-western part of PDZ3. Although the trenches lay adjacent to the current course of the River Lea, nothing conclusively associated with former courses of this river could be identified. The reverting within Trench PDZ3.38 could represent an inlet derived from the River Lea, as could the reverting from trench PDZ3.39. Similarly, the layers of alluvium may have resulted from the seasonal flooding of this river and these deposits may have potential in terms of indirect evidence of anthropogenic activity through macrofossil and microfossil analysis. However, these remain conjectural at present and more work is needed in order to address the above research aim. It is possible that the existing concrete river wall may have truncated evidence pertaining to the former course of the River Lea.

What evidence is there for early or later medieval exploitation of the area; in particular is there evidence for water inundation (water levels continued to rise throughout these periods) and water management? If so, how are these activities characterised? Are there any features or structures, particularly water mills present within the subject site? Is it possible to determine whether the Pudding Mill River or City Mill River have their origins in the late Saxon era, possibly associated with Alfredian defences, or partial drainage of the increasingly flooded wetlands.

As discussed above, extensive evidence relating to water management was identified within the study area. Two of the timber revetments recorded within PDZ3.38 may relate to the medieval period although this dating may be subject to change following further analysis. The earlier structure comprised a large oak plank set on edge, supported by a series of posts, inferring a number of phases of use and repair. This structure may represent either a localised strengthening of a channel, or a diversion from a main waterway. A later structure, in the north of the trench, comprised a wattle revetment on a differing alignment. Although only partially exposed, no evidence of repair or re-use was noticeable, suggesting a single phase of use. Furthermore, the

posts are set into alluvial silt, which may indicate the artificial narrowing and support of a channel already partially silted up to the north.

The structures were separated from one another by a series of alluvial deposits extending the length of the trench. The later wattle revetment was sealed by a further series of alluvial layers, suggesting continued inundation and flooding of the area. Therefore, the study area presents a great deal of evidence to support the notion of continually rising water levels and subsequently increased flooding. However, no dating material has, as yet, been recovered from within the alluvium from which to determine the precise period when these flooding episodes became increasingly prominent. Radiocarbon dating of the alluvial deposits would therefore prove useful here.

The former landscape of the study area comprised a waterlogged environment with frequent flooding and possible natural re-cutting of water channels. The attempts at water management represent the only evidence from this period denoting exploitation of the wider environment. No occupational features or material were recovered, reflecting to a certain extent the impracticability of settling adjacent to a frequently flooding river; alternatively later waterways may have subsequently destroyed all such evidence.

With regards to the origin and date of the Pudding Mill and City Mill Rivers, the present site only has the potential to address the former. The wattle revetment could derive from a former course of the Pudding Mill River, as could a channel re-cut identified also within trench PDZ3.38. Both features follow a NW–SE alignment, which fits with the historic projections of this river. Precise dating however is again difficult, and reliant upon further geoarchaeological data. No anthropogenic material was recovered from the fills of the channel cut, and further work is required to determine the exact location and therefore date of the channel lined by the wattle revetment.

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?

No archaeologically significant deposits were identified within the made ground. Extensive truncation was observed within the sections of both trenches, and all were filled by late 19th and 20th century material.

4.2 General discussion of potential

The evaluation has shown that undisturbed deposits, including the post medieval ground surface, survive intact beneath late 19th century made ground. These comprise a significant depth of alluvial deposition ranging from 0.16m to 1.66m in thickness, with various layers either truncated by or sealing archaeological features related to water management. The lower alluvium overlays gravels to the north and tufaceous sand to the south, indicating the influence of ground water and water channels in the area. Over time in the northern area, the disused channel silted up whilst in the southern area, flood deposits sealed the sands gradually turning the whole area into a backwater environment, which became subject to water management techniques. There were indications of prehistoric activity, notably an east-west ditch containing Iron Age pottery, possibly representing a boundary or drainage ditch. Preliminary dating of the wooden revetments suggest a date range of Saxon to late medieval, and

Saxon to early post medieval for those found within trench PDZ3.38, and a Post Medieval date for those seen in Trench PDZ3.39.

The site has demonstrated high archaeological potential. Other than the features described above, several possible palaeosols were also identified. It is therefore possible, that after extension of the areas examined in the evaluation, features associated with land-use of the wider area, and not just related to water management may be identified. The anticipated prehistoric evidence pertaining to the Upper Palaeolithic and Early Mesolithic along gravel bars however was not evident within the evaluation, and prehistoric remains may therefore be regarded to have a low potential.

The northern part of the site would have been the most likely place for occupational evidence as suggested by rising gravel levels, indicative of higher ground. However, these areas lay outside the confines of the northernmost trench, and also outside what is practicable to excavate. However, the presence of the Iron Age ditch indicates that the far south may also yield occupation evidence, with the remainder of the site likely to contain evidence of past watercourses, either uninhabitable or prone to destruction.

In geoarchaeological terms the evaluation was able to provide a notable amount of evidence and information. As mentioned above, the preliminary evaluation, through on site work and of the samples taken, has indicated that a channel (that consequently silted up over time) formerly crossed the northern area of the site through PDZ3.38 and that flood deposits, probably associated with a larger channel to the south, cover large areas in PDZ3.39. Although some archaeological materials have yielded some spot dates, the infilling of watercourse might be more closely dated as the alluvial sediments that accumulated across the area contain seeds and other plant remains suitable for close radiocarbon dating.

Furthermore the plant remains, together with insects and snails preserved within the samples taken from the flood and silting-up deposits have potential to reconstruct the characteristics of the river and the surrounding environment. Preliminary mollusc and plant macrofossil analysis indicate a slowly flowing freshwater environment typical of a floodplain. Further work including microfossils analysis (in particular diatoms and pollen) which could be preserved within these fine-grained sediments might provide information about the changing characteristics of the river, as well as vegetation and landuse in the surrounding area. In between the episodic flood events some dry land surfaces formed allowing soil development (palaeosols) which, through soil micromorphological analysis, could reveal anthropogenic activity or land use not visible to the naked eye.

When the stratigraphic information from PDZ3.38 and PDZ3.39 has been tied in to the information recovered from the surrounding area (by inputting the data into the MoLAS-PCA geoarchaeological database for the Olympics Project), linked to historic map evidence and dated it could have potential to contribute to our understanding of the evolving river regime of the Lower Lea.

Depending on the results of dating, it might also provide useful information about vegetation change and the changing environment of the Olympics Site during the historic period. Such information would be of real value, as environmental evidence is poorly preserved within the (typically weathered) alluvial clay that in general accumulated across the floodplain in historic time. It is only from the diminishing areas of continuing wetland, man made cut features and abandoned stream channels,

such as that recorded in the site area that evidence for the historic environment is likely to survive.

4.3 Significance

The geoarchaeological evidence from the site will be able to provide a significant amount of information which will aid in the understanding of the evolving environment of the Lea Valley. This information will contribute to our understanding of the past environment of the site and its environs and will assist in landscape reconstruction models being developed. This information is certainly of local significance.

Any evidence of prehistoric, Roman, Saxon and medieval activity would similarly aid in our understanding of the past land use of the site and of the area in general. Any such evidence would be of local significance, though any evidence relating to the Roman road and Saxon exploitation of the Lea Valley may be considered of regional significance.

The evaluation of PDZ3, Work Package 3, has highlighted a great deal of potential to aid in the archaeological understanding of the area. Both trenches have provided significant evidence indicative of continual water management, inferring numerous phases of use and activity. Furthermore, the waterlogged conditions have enabled the excellent preservation of organic remains. These remains comprise both wooden features as well as organic traces within the alluvium, both of significant importance to the understanding of prevailing environmental conditions and the exploitation of the area. This is likely to be of both local and regional significance.

5 Assessment by EH criteria

The recommendations of the GLAAS 1998 guidelines on *Evaluation reports* suggest that

‘Assessment of results against original expectations (using criteria for assessing national importance of period, relative completeness, condition, rarity and group value)’ (Guidance Paper V, 4 7)

A set of guide lines was published by the Department of the Environment with criteria by which to measure the importance of individual monuments for possible Scheduling. These criteria are as follows: *Period*; *Rarity*; *Documentation*; *Survival/Condition*; *Fragility/Vulnerability*; *Diversity*; and *Potential*. The guide lines stresses that ‘these criteria should not...be regarded as definitive; rather they are indicators which contribute to a wider judgement based on the individual circumstances of a case’.¹

In the following passages the potential archaeological survival described in the initial Assessment document and Section 3.2 above will be assessed against these criteria.

Criterion 1: period

Taken as a whole, archaeology of the site is not characteristic of any particular period. The Evaluation indicates a multi period site.

Criterion 2: rarity

Further analysis is needed to establish whether any of the archaeological finds are rare either in a national or regional context.

Criterion 3: documentation

Whilst there may be considerable contemporary documentation for the later medieval period from *c* 1300 onwards, it is unlikely that any of this will be specific enough to relate to individual features.

Criterion 4: group value

The landscape features relate to and are part of the wider pattern seen within the Olympic Park and elsewhere in the Lea Valley. Full interpretation is only possible in that context. The post-medieval survival is remnants of part of the spread eastwards from the City of London and the industrialisation of the site area, combined with the management of the water courses within the Lea Valley.

Criterion 5: survival/condition

The evaluation results have demonstrated that geoarchaeological and archaeological remains (including a timber structure) were preserved beneath several metres of modern made ground, although within areas of development will have been truncated to dramatically different levels.

Criterion 6: fragility

Experience from other sites has shown that isolated and exposed blocks of stratigraphy can be vulnerable to damage during construction work.

¹ Annex 4, DOE, Planning and Policy Guidance 16, (1990). For detailed definition of the criteria see that document. Reference has also been made to Darvill, Saunders & Startin, (1987); and McGill, (1995)

Criterion 7: diversity

Clearly, taken as a whole, the deposits at the site do not represent a diverse and heterogeneous group of archaeological remains of all types and periods. However, this diversity is in itself the product of a random process of vertical and horizontal truncation and separation. There is no reason to suggest that the diversity *per se* has any particular value which ought to be protected.

Criterion 8: potential

(the term Potential in this context appears to mean that though the nature of the site, usually below-ground resources, cannot be specified precisely, it is possible to document reasons predicting its existence and importance)

The evaluation has shown that variable depths of alluvium overlying late Pleistocene/early Holocene gravels are likely to exist elsewhere in the local vicinity. Further examination of samples already taken from the alluvial deposits on the site hold the potential to enhance current understanding of the natural and manmade environment of this part of the Lea Valley from the early prehistoric to modern periods.

The evaluation of PDZ3, Work Package 3, has highlighted a great deal of potential to aid in the archaeological understanding of the area. Both trenches have provided significant evidence indicative of continual water management, inferring numerous phases of use and activity. Prehistoric features and deposits have been identified across the site and add to a growing corpus of previously unseen areas of occupation across the Lea Valley at this time. Furthermore, the waterlogged conditions have enabled the excellent preservation of organic remains. These remains comprise both wooden features as well as organic traces within the alluvium, both of significant importance to the understanding of prevailing environmental conditions and the exploitation of the area. This is likely to be of both local and regional significance

6 Proposed development impact and recommendations

The entirety of Work Package 3 lies within the proposed footprint of the Main Olympics Stadium and concourse. The nature of the proposed foundations is not currently known (MoLAS-PCA, 2007a). Considering the nature of the geology, it is assumed that piled foundations will be used. Piling would remove any archaeology within the footprint of each pile down to the base of the alluvium and into the underlying gravels. The introduction of pathways to other deposits may also impact the geochemical stability of the buried remains. The severity of the impact would depend on the pile type, size and density.

Ground remediation may be required where there have previously been industrial processes which have contaminated the ground or where imported landfill material contains contamination. The depth of such remediation is currently not known and will depend on the extent of contamination (MoLAS-PCA, 2007a). Presently available ground investigation data indicate that contamination with heavy metals and volatile organic compounds is extensive. The impact is potentially down to a depth of several metres. Removal of contaminated ground would remove any archaeological remains present.

The depths and extents of the proposed re-profiling and realignment of the City Mill River have not yet been finalised (MoLAS-PCA, 2007a). However, any excavation into the current ground surface could potentially remove any archaeological features or deposits that may be present.

The evaluation has shown that earlier deposits of prehistoric to post-medieval date survive beneath late 19th century made ground. The majority of the archaeological deposits relate to management of the wetland environment and are therefore of moderate to major significance with regards to understanding former environmental conditions and the exploitation of these in the past. Further field work is therefore recommended in both the evaluated locations. There is the need to further investigate and date both reveted structures within Trench PDZ3.38, and determine the course of the water channels. Within Trench PDZ3.39, there is the need to further investigate the boat, to determine whether a complete vessel lies intact within the silt, and to further examine the Iron Age features to look for any continuation of the ditch identified.

The geoarchaeological significance and potential is high for this site, but further work is needed both on and off site to help build a complete sequence of alluvial deposition. In particular we need to take samples to date the different phases of river activity, examine the evidence for dry land surfaces and characterise the changing river regime.

In addition to the assessment of any new samples taken during any further excavation, it is recommended that assessment of the samples taken during the evaluation is undertaken, as initial evaluation of the samples collected suggests they have good palaeoenvironmental potential.

In order to clarify the potential of the samples taken during the evaluation and to refine the research aims they might be able to address, it is recommended that the

following work is undertaken during the post excavation assessment alongside the assessment of the any samples taken from the excavation:

- Five litres of each of the unprocessed samples be processed by paraffin flotation for the assessment of insect remains;
- Five litres of each of the unprocessed samples be wet sieved and together with the wet-sieved fractions of the parts of samples already processed, examined to assess the potential of the snail and ostracod assemblages preserved;
- Five litres of each of the unprocessed samples be floted and the flots (together with those already processed) assessed for plant remains (6 flots);
- Three radiocarbon dates are obtained by C14 or AMS (on identified twigs, seeds or other plant material) from the monolith sequence in PDZ3.38 and five from those PDZ3.39.
- Pollen and diatom assessment of the stratigraphic sequences is undertaken (8 sub-samples for each to be cut from the monolith tins)
- Soil micromorphological analysis of palaeosols (20) and possibly (30)
- The stratigraphic, dating and sample assessment data is entered into the MoLAS-PCA geoarchaeological stratigraphic database and used to update the current GIS models of the past topography and environment, to contribute to the environmental assessment of PDZ3.38 and PDZ3.39;
- Research aims that might realistically be addressed by the samples are identified and a report prepared by a geoarchaeologist or environmental archaeologist, summarising the environmental assessment results and the potential of the samples collected from the site.

The assessment above (Section 5) does not suggest that preservation *in situ* would be an appropriate mitigation strategy. MoLAS-PCA considers that earlier deposits of prehistoric to post-medieval date survive beneath late 19th century made ground. The majority of the deposits have local importance for archaeological finds and features and have good palaeoenvironmental potential.

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

7 Acknowledgements

MoLAS-PCA would like to thank Capita Symonds Ltd for commissioning this report on behalf of the Olympic Delivery Authority (ODA), and David Divers (English Heritage GLAAS) for monitoring the project on behalf of the London Borough of Newham.

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ODA, 2007d *Olympic, Paralympic and Legacy Transformation Planning Applications Annexure Code of Construction Practice, Vol 15 (OLY/GLB/ACC/DOC/CCP/01)*

9 Appendix 1: NMR OASIS archaeological report form

OASIS ID: preconst1-35532

Project details

Project name	Olympics - PDZ3, Work Package 3
Short description of the project	An evaluation of Work Package 3 within planning delivery zone 3. Two trenches were excavated to the depth of natural gravels where possible. The evaluation identified extensive evidence for past water management, with numerous phases of wooden reverting, overlaid by alluvial deposits and a substantial depth of made ground.
Project dates	Start: 04-09-2007 End: 13-09-2007
Previous/future work	No / Yes
Any associated project reference codes	OL-04407 - Sitecode
Type of project	Field evaluation
Current Land use	Industry and Commerce 1 - Industrial
Monument type	DITCH Iron Age
Monument type	WATERCRAFT Post Medieval
Monument type	WATERCHANNEL Uncertain
Monument type	FLOOD DEFENCES Medieval
Monument type	FLOOD DEFENCES Post Medieval
Monument type	FLOOD DEFENCES Post Medieval
Significant Finds	POT Iron Age
Methods & techniques	'Sample Trenches', 'Targeted Trenches'
Development type	Public building (e.g. school, church, hospital, medical centre, law courts etc.)
Development type	Extensive green field commercial development (e.g. shopping centre, business park, science park, etc.)
Prompt	Direction from Local Planning Authority - PPG16
Position in the planning process	Not known / Not recorded

Project location

Country	England
Site location	GREATER LONDON NEWHAM STRATFORD Olympics PDZ3, Work Package 3
Postcode	E15
Site coordinates	TQ 37530 84070 51.5382565645 -0.01672167220630 51 32 17 N 000 01 00 W Point
Height OD	Min: 0.93m Max: 2.31m

Project creators

Name of MoLAS/PCA Ltd
 Organisation
 Project supervisor Amelia Fairman
 Project supervisor Richard Archer
 Name of London Development Authority
 sponsor/funding
 body

Project bibliography 1

Publication type Grey literature (unpublished document/manuscript)
 Title Planning Zone 3, Work Package 3
 Author(s)/Editor(s) Fairman, A
 Date 2007
 Issuer or publisher MOLAS-PCA Ltd
 Place of issue or London
 publication
 Description A4 document

Entered by Amelia Fairman (afairman@pre-construct.com)

Entered on	11 December 2007

10 Appendix 2: 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.

11 Appendix 3: Site index

Context No.	Section / Elevation	Type	Description	Date	Phase
1	S.05	Layer	Made Ground	19th/20th Century	11
2	S.05	Layer	Made Ground	19th/20th Century	11
3	S.05	Layer	Redeposited sand with CBM	19th/20th Century	11
4	S.05	Layer	Made Ground: silty sand/glass/cbm	19th/20th Century	11
5	S.05	Layer	Made Ground: sand with cbm	19th/20th Century	11
6	S.05	Layer	Dump Layer; freq glass and cbm	19th/20th Century	11
7	S.05	Layer	Dump Layer: silty sand and cbm	19th/20th Century	11
8	S.05	Layer	Made Ground/Levelling	19th/20th Century	11
9	S.05	Layer	Made Ground: Redeposited sand	19th/20th Century	11
10	S.05	Layer	Made Ground: sand/charcoal/glass	19th/20th Century	11
11	S.05	Layer	Made Ground: sand/cbm/concrete	19th/20th Century	11
12	S.05	Layer	Made Ground: sand/glass/mortar	19th/20th Century	11
13	S.05	Layer	Made Ground: sand/pot/cbm	19th/20th Century	11
14	S.05	Layer	Alluvium: silt/sand with shells/chalk	Undated	9
15	S.05	Layer	Made Ground: redep sand/flint	19th/20th Century	11
16	S.05	Layer	Dump Material/ Landfill: silty sand	19th/20th Century	11
17	S.05	Fill	Fill of [18]: freq cbm	19th/20th Century	11
18	S.05	Cut	Modern Truncation	19th/20th Century	11
19	S.05	Layer	Levelling Layer: clay with flint	19th/20th Century	11
20	S.05	Layer	Land Surface/paleosoil	Undated	10
21	S.05	Fill	Fill of [22]	19th/20th Century	11
22	S.05	Cut	Modern Pit	19th/20th Century	11
23	S.05	Layer	Dump Material/Landfill	19th/20th Century	11
24	S.05	Layer	Alluvium: silty clay with flint/chalk	Undated	9
25	S.05	Layer	Dump Material/ Landfill with tyres	19th/20th Century	11
26	S.04, 06, 07	Layer	Shell-rich silt	Undated	4
27	S.06	Layer	Blue clay	Undated	4

28	S.06	Layer	Gravel bar within river channel	Late Pleistocene/Early Holocene	1
29	S.06	Layer	Gravel at base of river channel	Late Pleistocene/Early Holocene	1
30	S.06, 07, 14	Layer	Land Surface/palaeosoil: sandy silt	Undated	9
31	S.06	Timber	Post assoc with structure [32]	Early Post Medieval	6
32	S.06	Structure	Wattle revetment: [31]	Early Post Medieval	6
33	S.05	Layer	A' horizon palaeosoil:silt/sand with snails	Undated	10
34	S.01	Layer	Sandy gravel	Undated	5
35	S.01	Fill	Fill of channel cut [430]: yellow clay	Undated	5
36	S.01	Layer	Blue-grey clayey silt	Undated	4
37	S.01	Fill	Fill of channel cut [430]: coarse sand with clay lenses	Undated	5
38	S.01	Layer	Yellow sandy gravel	Undated	4
39	S.01	Layer	Clayey gravel	Undated	4
40	S.02	Timber	Posts assoc with [42] (Group number)	Late Saxon/Early Medieval	3
41	S.02	Timber	Cleft Oak board assoc with [42]	Late Saxon/Early Medieval	3
42	S.02, 03	Structure	Revetment	Late Saxon/Early Medieval	3
43	S.07	Layer	Alluvium: yellow clay/silt with molluscs	Undated	9
44	S.03	Layer	Blue-grey silty clay	Undated	4
45	S.02, 03	Layer	Blue gravelly sand	Late Pleistocene/Early Holocene	1
46	S.03	Layer	Yellow sandy gravel	Late Pleistocene/Early Holocene	1
47	S.05	Layer	Natural sand?	Undated	4
48	VOID				
295	S.15	Layer	Made ground	19th/20th Century	11
296	S.15	Layer	Made ground	19th/20th Century	11
297	S.15	Layer	Made ground	19th/20th Century	11
298	S.15	Layer	Made ground	19th/20th Century	11
299	S.15	Layer	Made ground	19th/20th Century	11
305	-	Structure	Rubbing Posts	Late Post Medieval	7
306	-	Timber	Stake/Pile	Late Post Medieval	7
307	-	Timber	Rib -part of boat [390]	Mid-Late 19th Century	8

308	-	Timber	Rib -part of boat [390]	Mid-Late 19th Century	8
309	-	Timber	Rib -part of boat [390]	Mid-Late 19th Century	8
310	S.15	Layer	Alluvium	Late Post Medieval	7
311	S.15	Layer	Organic layer/Land Surface	Late Post Medieval	7
312	S.15	Layer	Alluvium	Undated	4
313	S.15	Layer	Iron-stained deposit	Late Pleistocene/Early Holocene	1
314	S.15	Layer	Tufa sand	Late Pleistocene/Early Holocene	1
315	S.15	Fill	Fill of [316]	Iron Age	2
316	S.15	Cut	Ditch	Iron Age	2
317	VOID				
318	S.15	Fill	Backfill of revetment/fill of [319]	Late Post Medieval	7
319	S.15	Cut	Constr cut for revetment	Late Post Medieval	7
320	S.15	Layer	Made Ground/Levelling	19th/20th Century	11
321	S.15	Layer	Made Ground	19th/20th Century	11
322	S.15	Layer	Made Ground/Levelling	19th/20th Century	11
323	S.15	Fill	Fill of [324]	19th/20th Century	11
324	S.15	Cut	Modern Truncation	19th/20th Century	11
325	-	Timber	Plank assoc with [334]	Late Post Medieval	7
326	-	Timber	Post assoc with [334]	Late Post Medieval	7
327	-	Timber	Post assoc with [334]	Late Post Medieval	7
328	-	Timber	Post assoc with [334]	Late Post Medieval	7
329	-	Timber	Post assoc with [334]	Late Post Medieval	7
330	-	Timber	Plank assoc with [334]	Late Post Medieval	7
331	-	Timber	Plank assoc with [334]	Late Post Medieval	7
332	-	Timber	Plank assoc with [334]	Late Post Medieval	7
333	-	Timber	Post assoc with [334]	Late Post Medieval	7
334	-	Structure	Revetment	Late Post Medieval	7

335	-	Timber	Pile	Late Post Medieval	7
336	-	Timber	Post assoc with [305]	Late Post Medieval	7
337	-	Timber	Post assoc with [305]	Late Post Medieval	7
338	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
339	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
340	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
341	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
342	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
343	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
344	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
345	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
346	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
347	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
348	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
349	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
350	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
351	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
352	-	Timber	Floor - part of [390]	Mid-Late 19th Century	8
353	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
354	-	Timber	Rib - part of [390]	Mid-Late 19th Century	8
355	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
356	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
357	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
358	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
359	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
360	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8

361	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
362	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
363	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
364	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
365	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
387	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
388	-	Timber	Plank - part of [390]	Mid-Late 19th Century	8
389	-	Timber	Broken floor plank? assoc with [390]	Mid-Late 19th Century	8
390	-	Structure	Boat	Mid-Late 19th Century	8
391	VOID				
394	S.15	Cut	Modern Truncation	19th/20th Century	11
395	S.15	Fill	Primary fill of [316]	Iron Age	2
427	S.15	Fill	Fill of [319]	Mid-Late 19th Century	8
428	S.15	Fill	Fill of [319]	Mid-Late 19th Century	8
429	S.15	Fill	Fill of [319]	Mid-Late 19th Century	8
430	S.01	Cut	Channel cut	Undated	5
436	-	Cut	Cut for pile [335]	Late Post Medieval	7

12 Appendix 4: Finds assessment

12.1 The pottery

James Gerrard and Chris Jarrett

12.1.1 Introduction

There are a total of 34 sherds of pottery (and none are unstratified) recorded from site OL-04407 dating to the late Iron Age, Roman, medieval and late post-medieval periods. The pottery is generally in a good condition and indicates it was mostly deposited soon after breakage. The pottery was classified according to standard Museum of London pottery codes and was recorded in an Access database.

Table 8 shows the distribution of the pottery in the contexts it was recovered from, the number of sherds and a spot date for each deposit.

Context	Sherd count	Spot date
2	1	1800–1900
10	1	1805–1900
13	3	1830–1900
25	1	1780–1900
312	0	LIA – AD 70?
314	27	LIA – AD 70
395	1	50 – 400

Table 8 Site OL-04407: Pottery spot dating index

12.1.2 Significance, potential and recommendations for further work

The significance of the pottery is at a local level and demonstrates the archaeological periods represented on the site and what types of activity was occurring. The assemblage can be compared to other excavations in North East London. The potential of the assemblage is that the pottery can date the contexts it occurs and a number of vessels merit illustration. Recommendations for further work should include that the Prehistoric and Roman pottery is further researched by the appropriate specialists and a publication report is produced on this material. The medieval and particularly the late post-medieval pottery has very little merit but information on the types of pottery and reasons for their presence on the site may be useful for the final publication.

12.2 The Clay Tobacco Pipe

Chris Jarrett

12.2.1 Introduction

One clay tobacco pipe was recovered from site OL-04407. The clay tobacco pipe was in a good condition and was probably deposited soon after its final use. The information was entered onto an Access database.

12.2.2 Distribution

Context	Item count	Spot date	Description
33	1	1580–1900	Only a broadly dated stem was recorded for the context

Table 9 Site OL-04407 clay tobacco pipe spot dating index

12.2.3 Significance, potential and recommendations for further work

The clay tobacco pipe has some significance at a local level and demonstrates the local clay pipe making industry or what was being marketed to the area. The potential of the clay tobacco pipe is to date the context from which it was found. Recommendations for further work should be that a publication report of all the assemblages from the Olympic site excavations should be compiled in order to understand the local clay tobacco pipe industry.

12.3 The glass

Chris Jarrett

12.3.1 Introduction

A small assemblage of glass (thirteen fragments and none were unstratified) was recovered from the excavation. The assemblage is very fragmentary, but not abraded and therefore the material was probably discarded soon after breakage. The glass forms could be recognised and the information was entered on to an Access database.

12.3.2 Distribution

Table 10 shows the contexts the glass was found in, the number of fragments and a spot date for the deposit.

Context	Fragment count	Spot date
8	1	18th/19th century
6	1	18th/19th century
4	2	1850+
10	2	1850+
12	2	19th century
23	2	1850+
13	3	1845+

Table 10 OL-04407, glass spot dating index

12.3.3 Significance, potential and recommendations for further work

The glass has little significance at a local, regional or international level. Its main potential is to date the contexts it was found in. It is recommended that no further work is required and if the material needs to be referenced for a publication, then information should be sought from the database.

12.4 The timber

Damian Goodburn

12.4.1 Contextual background

Trench PDZ 3.39 revealed the remains of a pile and plank revetment running roughly N–S c 15m east of the current frontage of the Pudding Mill River. This structure was truncated at c. +2m OD (c 3m below the modern surface) and has had dumps of mid to late 19th century rubbish deposited over it. Commentary on this aspect of the timber remains is synthesised into the main body of the text on the trench.

One end of a small boat was found in the evaluation to the west of the revetment. The boat was clearly old when abandoned on the shore and was thought to be broadly Georgian in date from the associated pottery. Small planked boats dating to before the 1890s are extremely rare in museum or private care. There is very little hard evidence for small boats before c 1850 other than a handful of naval architect's idealised line drawings and some paintings and etchings, like the well known sequence of Thames panoramas. Very little detail is shown in these sources and its only when solid remains are found that methods of construction and materials used etc can be gleaned. This is shown by the recent discovery by archaeologists of a totally unknown system of barge building on the Thames and Lea which has echoes of ancient Roman practice.

Bearing these circumstances in mind, the evaluation trench was extended so that the remains of parts of the boat as exposed could be examined in detail. The vessel lies on a thin gritty layer over a clay-silt, probably estuarine foreshore or channel infill. The area lies well below the 19th-century tidal head of the river.

12.4.2 The boat

This small vessel survives relatively intact with c 70 % of the original hull, including much of the bow and stern but missing the upper most parts. The remains are c 5m long by c 1.10m wide and c 0.50m deep. Although the keel has been bent and probably broken towards the bow, and the hull distorted in some areas, we have to note that it is very well preserved due to deep burial, continual waterlogging and applications of (?coal tar) pitch and relatively recent date. The vessel shows at least four phases of repair which probably indicates construction in the first quarter of the 19th century or thereabouts.

The boat is clinker built (with a shell of partially over lapping boards) in a very refined lightweight style with hull boards less than 10mm thick and very light bent frames under 15mm thick. The board laps are fastened with very distinctive copper nails, comprising a nail and diamond shaped washer or rove inboard. This has not been recorded in a boat find before and appears to be a missing link between diamond-shaped iron roves of the 17th century and earlier and the factory made round

copper roves of recent times. The frames are fastened with turned copper nails. There appear to have been lifting eyes of iron fastened through the keel. The rounded base of the stem timber survives but the small, well tucked up transom stern was removed in the past.

It would appear that the original boat was a lightweight gig-type boat used on a large boat or small ship as a fast, elegant water taxi. Fittings in the bow hint at it being fitted with a light mast. The ultra light weight hull was repaired fairly early on by doubling up the bent frames in many cases. Later the craft was rebuilt in a rather crude style.

Two pairs of crudely fitted plank bulkheads were added and a thick layer of tar to the inside. The bulkheads seem to have formed lockers and although the planks were reused traces of hinges may indicate that the locker tops could have been opened and closed. At this stage further applications of tar were made to the inside and some further timber and metal patched repairs. Much of this repair work was situated in the bow (front) area. A handful of bird shot was found at the base of the first locker from the bow. This material and the strengthening of the bow area is strongly indicative of the use of the, now old and leaky, boat as a gun punt for wild fowling on the lower River Lea. Eventually she must have become just too leaky and was abandoned where the upper parts would have been accessible for most of the tidal cycle. These upper parts were probably cut away for kindling.

It was not possible to record the outside of the boat as it lay in the trench in a very wet area. Thus, it is essential to complete the record of the materials used the external finishing, shape of the keel etc with the hull moved out of the trench. Fortunately the very solid – still springy – timber, uncorroded copper nails and hard pitchy covering hold the very light hull together. Following the completion of in situ recording (*c* 2–3 days in fine weather), it should be possible to remove the alluvium and dump around the vessel (largely mechanically to just below the hull) and remove the vessel from the trench. The cleaning down of the outside and its recording could then follow. Importantly, it should then be possible to gently reform much of the distorted timber into close to its original shape and to carry out targeted additional recording so the boats true shape can be discerned. This approach has been taken with a number of boat finds. The condition of the vessel is such that controlled air drying in a suitable space would be a relatively cheap conservation option as has been successfully carried out with similar finds in the Netherlands and elsewhere. The further advice from a suitably qualified conservator should be sought to confirm this approach. The vessel and finds could form an evocative display of a relatively recent – but hidden – past of the lower Lea valley.

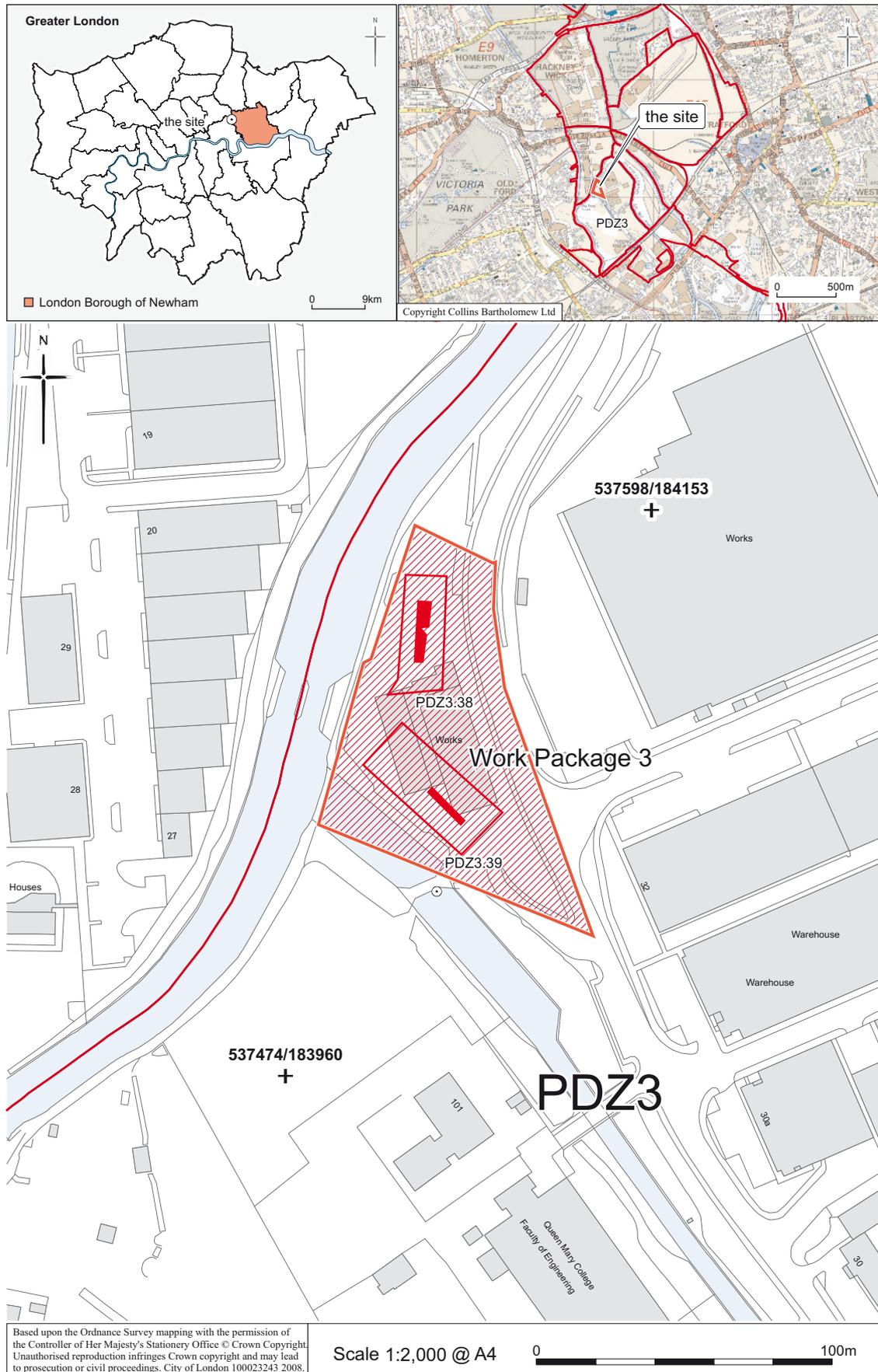


Fig 1 Location map

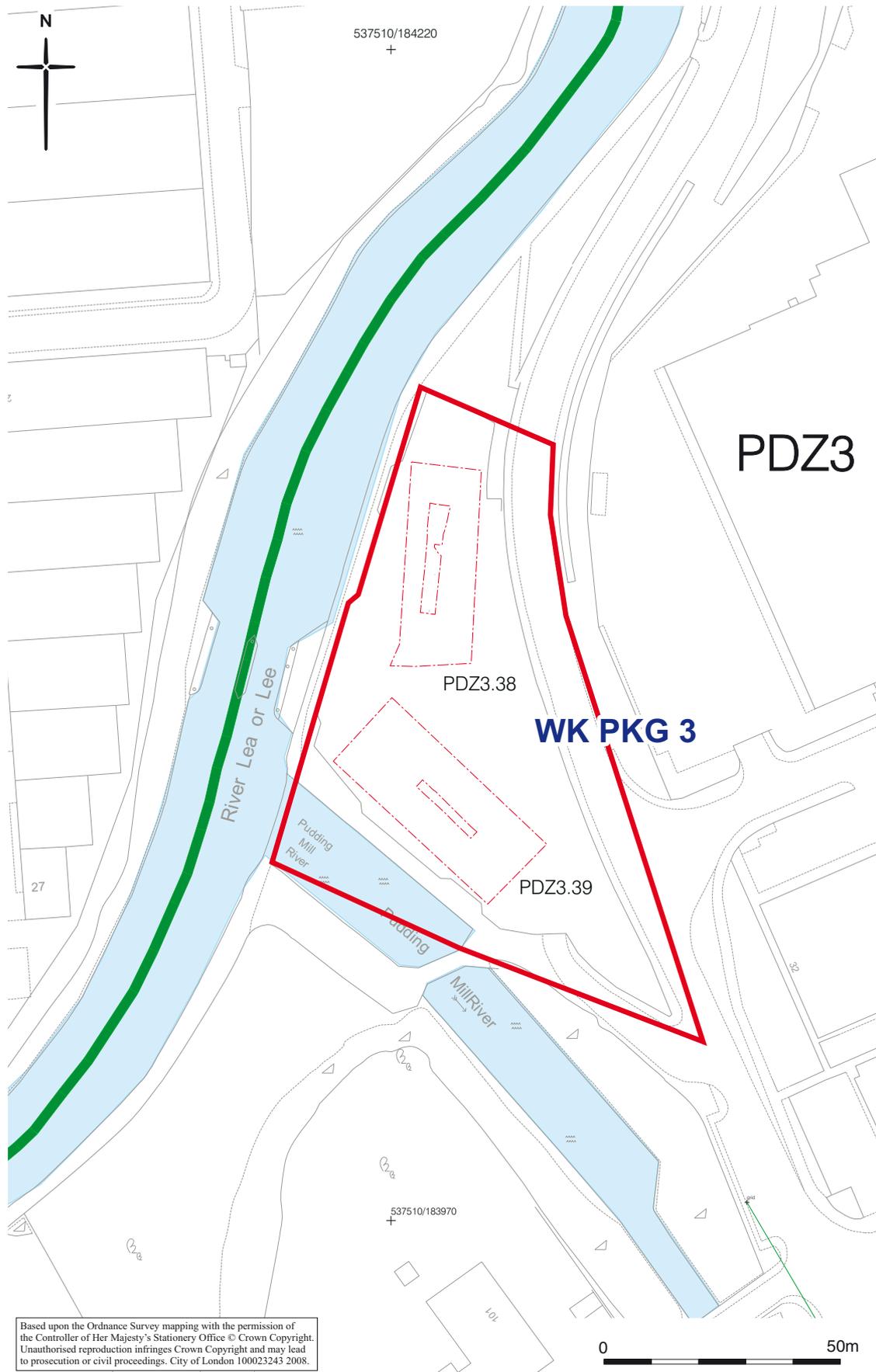


Fig 2 Trench location

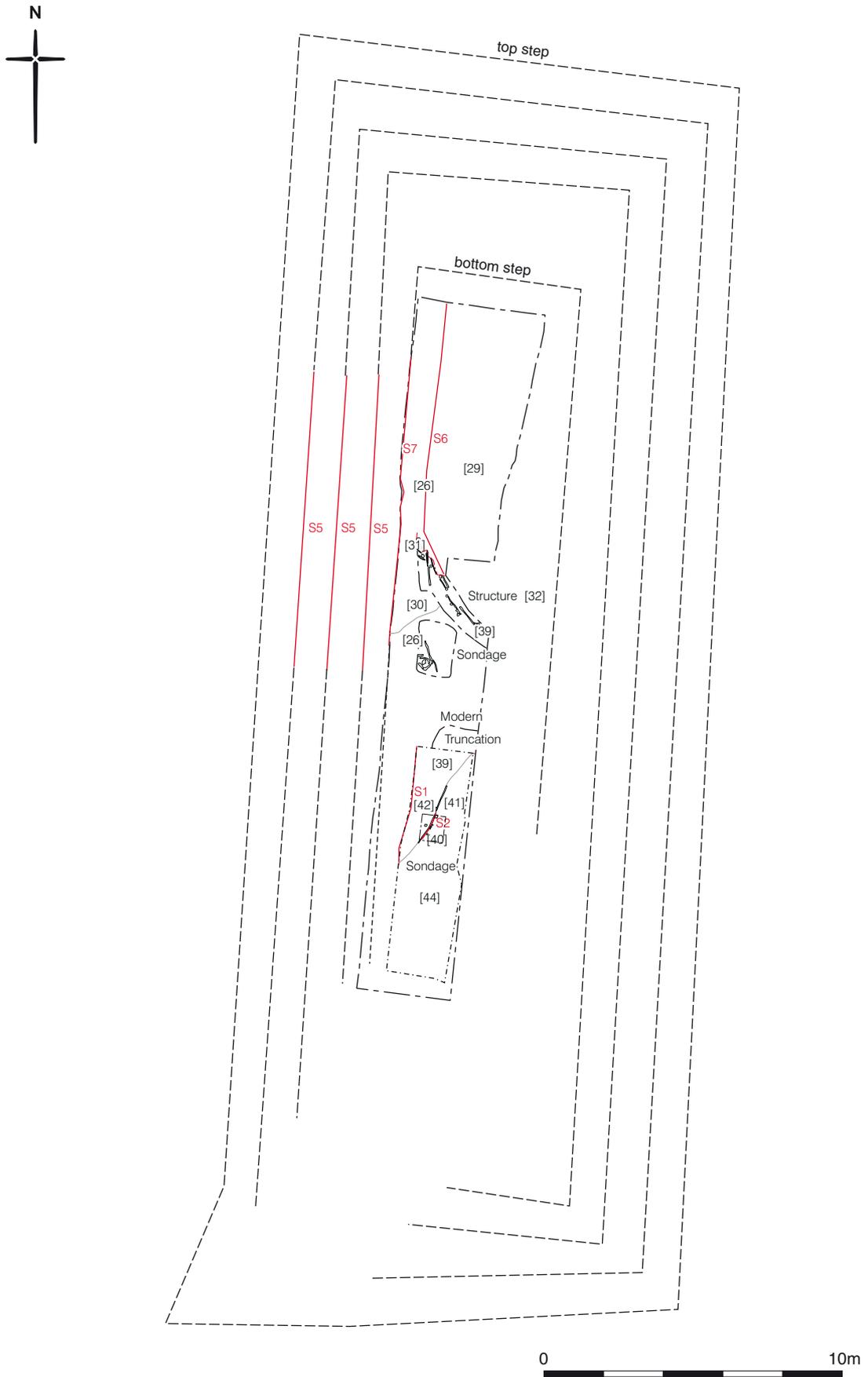


Fig 3 Plan of Trench PDZ3.38

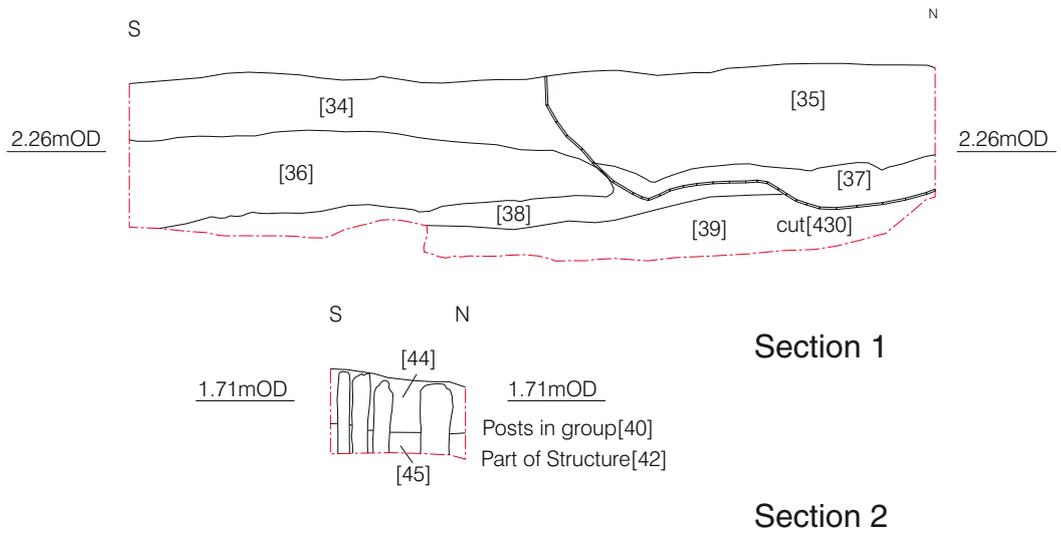
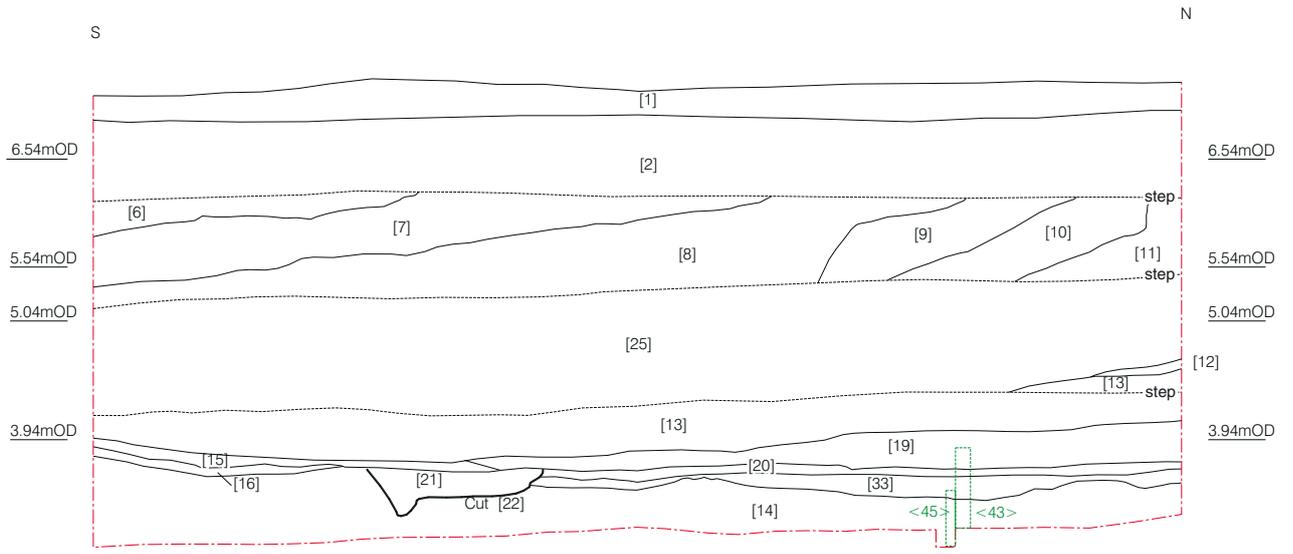
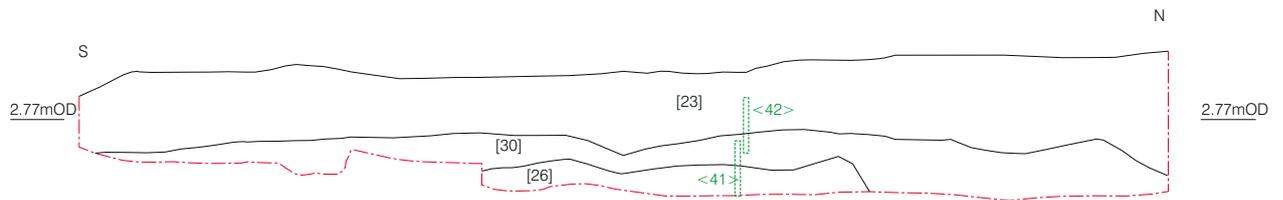


Fig 4 East facing sections 1 and 2 of Trench PDZ3.38



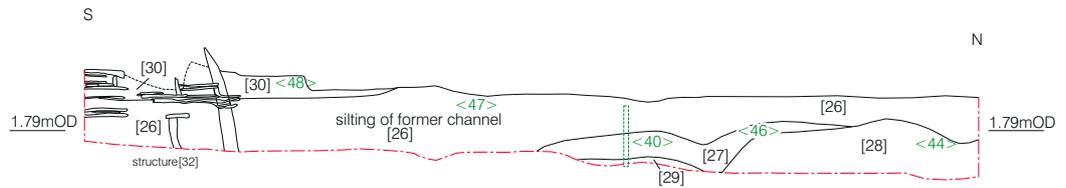
Section 5

Sample; 10-20metres



Section 7

Sample; 7.5-17.5metres



Section 6



Fig 5 East facing sections 5, 6 and 7 of Trench PDZ3.38

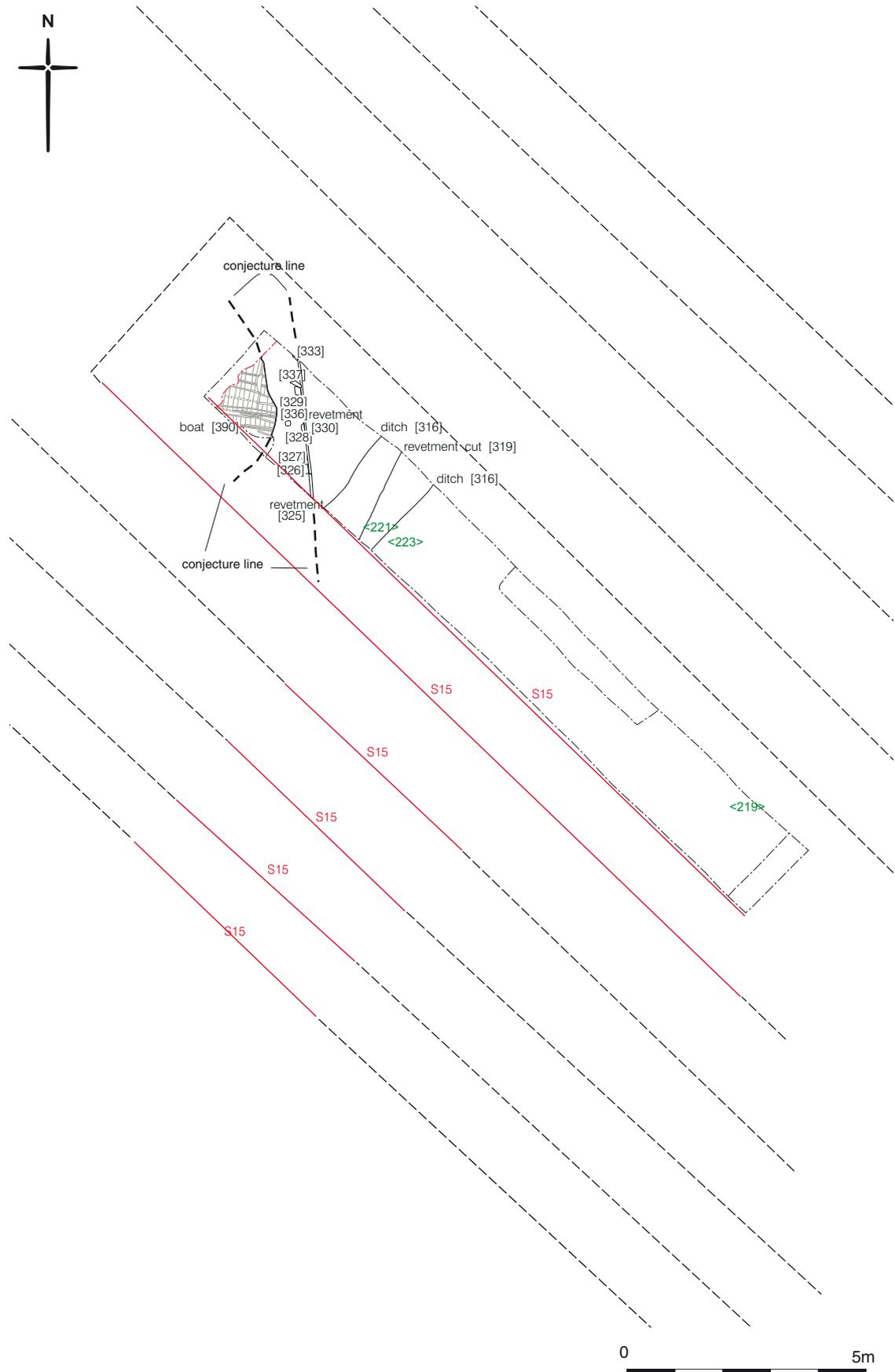


Fig 6 Plan of Trench PDZ3.39, trench base

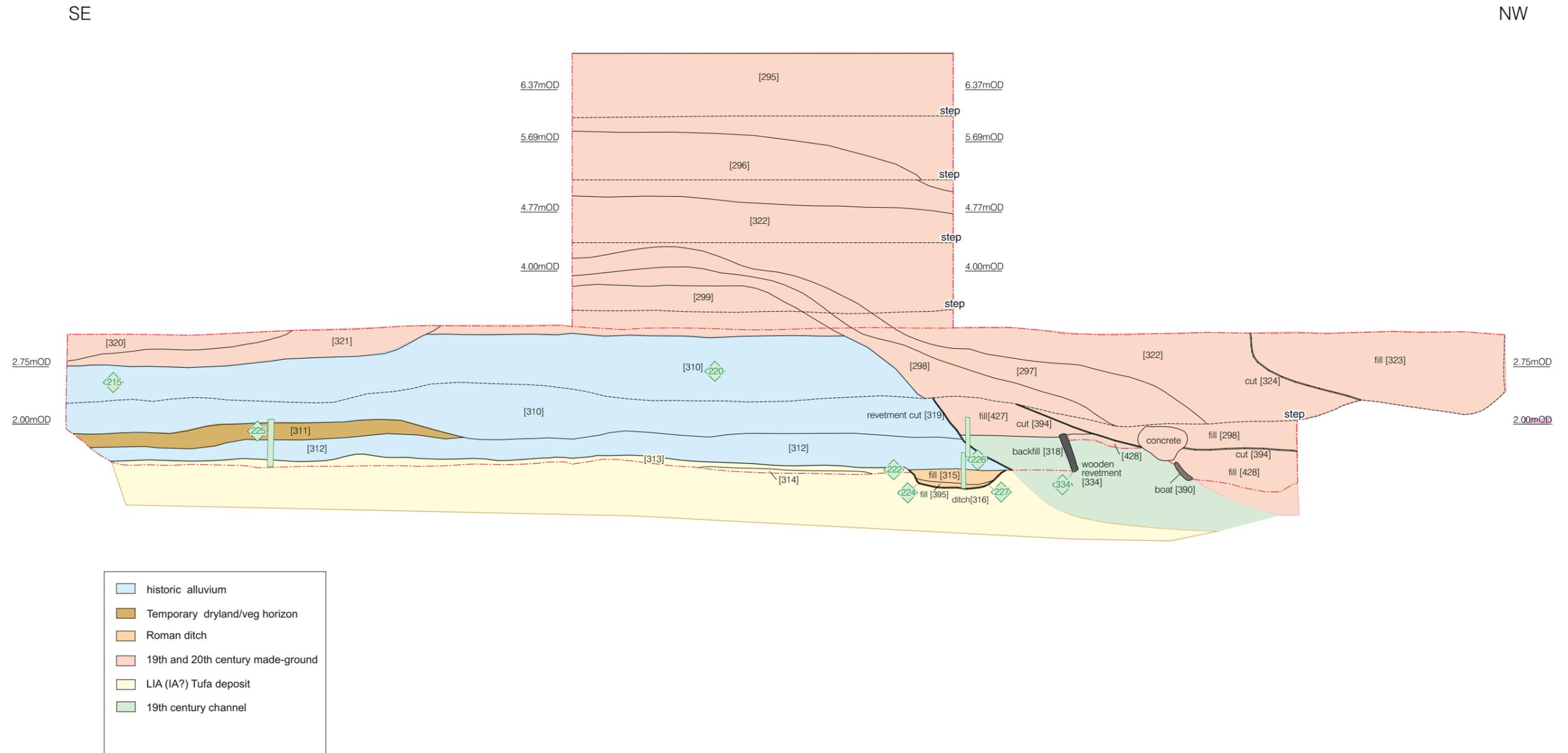


Fig 7 North-eastern facing section 15 of Trench PDZ3.39