Foreshore-based Archaeological Evaluation report

Site 15: Albert Embankment Foreshore (ALBEF)

TTI14

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

Thames Tideway Tunnel

Foreshore-based Archaeological Evaluation Report Albert Embankment Foreshore

Name	Data
Document no	2530-TDWAY-ALBEF-180-XZ-RG-000001 Revision P01
Environmental Significance	High
Document type	Draft Report for comment
WBS	
Authors	Gail Wakeham, Dave Norcott, Richard Payne, Dave Howell
Keywords	Archaeology, Evaluation, Albert Embankment Bridge Foreshore, Parametric Sonar, Targeted walkover, Hand augering, Mechanical coring, Geoarchaeological and Palaeoenvironmental assessment, Deposit model

Contents amendment record [INTERNAL]

This document has been issued and amended as follows:

Revision	Date	Issued for/Revision details	Revised by
V01	30.06.2015	Draft for Comment	D. Norcott / A. Holmes
V02	10.11.2015	Final	G.Wakeham / D. Norcott / A. Holmes

Contents amendment record [EXTERNAL]

This document has been issued and amended as follows:

Revision	Date	Issued for/Revision details	Revised by
V01	22/09/2015	Draft for Comment	B. Buss/K. Whittaker

Required approvals

Name – Title | Date

Name – Title | Date

Thames Tideway Tunnel

Foreshore-based Archaeological Evaluation Report
Albert Embankment Foreshore

List of contents

Page number

List of tables

Page number

List of figures

Plates

Executive summary

EX 1.1 This report was commissioned from Wessex Archaeology by Atkins on behalf of Thames Tideway Tunnel Ltd. It presents the results of a foreshore-based archaeological evaluation carried out by Wessex Archaeology at Albert Embankment Foreshore (ALBEF), a Thames Tideway Tunnel project Site.

EX 1.2 The evaluation included: parametric sonar (PS) survey, targeted walkover survey, hand augering, mechanical coring, geoarchaeological assessment of cores, as well as palaeoenvironmental assessment and radiocarbon dating of samples taken during the fieldwork, and the production of a foreshore deposit model. The report also takes account of data from previous investigations on the Site and its surroundings, including the results of gap analysis on bathymetric survey data (Wessex Archaeology 2013); geotechnical and historic borehole data (Appendix A.5); and information and drawings collated for the Environmental Statement (TTT 2013).

EX 1.3 The parametric sonar survey identified deposits (>0.5m) across the majority of the foreshore overlying the London Clay. Three sub-riverbed marine geophysical features were mapped. One feature is a coarse sediment layer and its depth correlates with river gravels identified in vibrocores, although this layer may be more extensive than PS data suggests. The second feature on the central foreshore was seen as a water-filled depression during the walkover and so could not be further examined and the third is a depression on the west of the Site under the riverbed. Two further small mounds are likely to be natural in origin.

EX 1.4 Numbers of timbers were known from the Site already, including a possible Late Mesolithic structure (c. 6000-4000 BC). The easternmost timber of this grouping - a roundwood oak upright probable pile - was recorded and lifted during the walkover survey. Radiocarbon dates obtained have confirmed that it is probably contemporary with the other previously dated timbers, significantly strengthening the case for these remains being structural. This structure, the oldest in London (Milne *et al* 2010) is highly significant. Two other older Mesolithic timbers were recorded and radiocarbon dated to the north, although it is presently inconclusive as to whether these represent posts or the eroded remains of natural wood.

EX 1.5 A nearby Late Mesolithic land surface (*c.*0.4m thick) was recorded, sampled and dated; this is likely an extension of a more extensive peat deposit recorded in 2010 that lies within the Site, although its full surviving extent was unable to be confirmed during this evaluation due to the level of the low tide.

EX 1.6 Another discrete area of probable land surface was newly discovered during the walkover and radiocarbon dated to the Middle Neolithic (*c.* 3500-2900 BC) and there remains the potential for further pockets of organic deposits, potentially containing archaeological and

palaeoenvironmental remains, to be buried below active beach deposits in the central foreshore of the Site.

EX 1.7 A short alignment of four stakes was newly recorded and one stake lifted for dating and assessment. It was shown to have been tapered by the use of tools, possibly including a bronze tool. This timber was radiocarbon dated to the Late Bronze Age (*c*. 1000-700 BC), and is clearly the remains of a structure, presently of uncertain type. This is highly significant given the known extensive remains upstream of Vauxhall Bridge of an earlier Bronze Age timber jetty or bridge and an Early Iron Age fish trap.

EX 1.8 Post-medieval structures of a barge bed, crane base and a possible mooring post (likely associated with each other) were surveyed in the north of the foreshore Site; these are considered of low significance. No remains were recorded during the walkover that might be related to the built heritage of Vauxhall Bridge or Lack's Dock, although such remains may potentially be buried within the active beach deposits.

EX 1.9 Five vibrocores, seven additional mechanical cores and twelve hand auger points taken from the Site foreshore were described and interpreted. Only the mechanical cores penetrated the London Clay bedrock; however, all the cores displayed the same deposit sequence. This consists of surface active beach deposit (up to 1.16m thick), underlying river gravels up to 2.56m deep, above London Clay. The hand augering was only physically possible in a *c.*65m long area on the lower foreshore where the active beach deposits were soft enough to allow penetration; these all recorded low energy clays up to *c.*0.4m deep, interpreted as active beach deposits. Using available borehole data, a geoarchaeological deposit model has been prepared for the Site.

EX 1.10 In contrast to the findings of the walkover survey, no organic deposits or landsurfaces were identified in any of the cores or auger points or in the deposit modelling transects. Of note was the modelled surface of the underlying river gravels, which indicated a broad shallow depression in the central foreshore (**Figure 10**). Although its origin is presently unclear it is most probably a relic feature from an earlier braided Pleistocene river system. Importantly, it was in this area that the prehistoric land surfaces and the timbers were located, and therefore where archaeological survival is likely to be best.

EX 1.11 Three landscape zones are predicted across the Site's foreshore (LZ1, LZ2 and LZ3, see **Table 5.4**). Surface active beach deposits are present across the foreshore (LZ1), with discrete pockets of organic peats, silts and clays of variable prehistoric date on the central foreshore (LZ2) and underlying river gravels (LZ3) mapped over much of the foreshore, except small areas of the lower foreshore where presumably scoured away to the underlying London Clay bedrock.

EX 1.12 The evaluation concludes that the Site has an overall **High** potential for the survival of archaeological remains, and that these are likely to be of **High** significance to the identified research aims (OAWSI section 4). This concurs with levels anticipated in the initial assessment of the

archaeological potential of the Site set out in the Environmental Statement.

EX 1.13 It is recommended that targeted archaeological survey, investigation and recording, including environmental sampling (advised by a geoarchaeologist), be undertaken within the area of the temporary cofferdam and foreshore ground works.

EX 1.14 This evaluation has shown the potential significance of the Site to contribute towards the Route-wide Heritage Themes (RWHTs); and the themes which this Site has the potential to augment have been revised in the light of this evaluation.

EX 1.15 Future interpretation is likely to focus on the theme of palaeoenvironment and prehistory. Wider interpretation, dependent on the results of future mitigation, could highlight the proximity of the proposed foreshore structures to the prehistoric structures on the foreshore, and to examine how past human populations utilised/occupied the landscape within the changing floodplain environment.

1 Introduction

1.1 Purpose of this report

1.1.1 The purpose of this evaluation report for the Albert Embankment Foreshore (ALBEF) Site is to:

a. Describe and assess the results of a foreshore-based evaluation, which included: parametric sonar survey, targeted walkover survey, hand augering, mechanical coring and geoarchaeological and palaeoenvironmental assessment of cores and bulk/ wood samples.

b. To provide information on the character, extent, quality, date, preservation and significance of archaeological deposits and/or palaeoenvironmental remains surviving at the Site likely to be affected by the TTT project through assessment of results of the above, and production of a foreshore deposit model.

c. To provide conclusions regarding predicted archaeological survival and significance across the Site.

d. To assess the significance of the evaluation results within the wider local and regional context and TTT Archaeological Research Framework.

e. To outline potentially suitable mitigation options.

1.1.2 The above is in accordance with the Site Specific Archaeological Written Scheme of Investigation (SSAWSI; 100-RG-ENV-00000-000161). This SSAWSI was approved by the Historic Buildings and Monuments Commission for England (HBMCE) advisor to the project prior to the start of work.

1.1.3 This document refers to archaeological approaches and definitions set out in the Overarching Archaeological Written Scheme of Investigation (OAWSI). The OAWSI forms part of the Application for Development Consent, and is appended to the Environmental Statement. It sets out the overall mitigation strategy, procedures, standards and techniques to be followed across the Thames Tideway Tunnel project (the 'project').

1.1.4 This report is produced for Thames Tideway Tunnel Ltd. and will be submitted to the London Borough of Lambeth. The results of this programme of evaluation works will inform the need for, design of, and programme of further mitigation to be undertaken by the Employer's Archaeological Contractor (EAC) during the Main Works phase of the project.

1.1.5 A field evaluation, and the reported results of that exercise, are defined in the most recent English Heritage guidelines (GLAAS April 2015 *Guidelines for Archaeological Projects in Greater London*) as:

a. To assess the presence or absence of archaeological remains; their extent, nature, quality, date and character in relation to the impact of the proposed development.

b. An exercise to enable the significance of the Site's archaeological potential to be understood. This understanding, in turn, will allow for appropriate decisions to be made regarding change to the archaeological assets.

c. To provide a sufficient sample of the area of impact to confidently assess the principle aims and objectives of the fieldwork, as articulated in the Written Scheme of Investigation.

1.2 Site location and topography

1.2.1 The Albert Embankment Foreshore Site, hereafter called 'the Site', is located south of the River Thames within the London Borough of Lambeth, forming part of the east bank as the river flows approximately north from Vauxhall Bridge towards Waterloo. The Site covers an area of 3.1 hectares centred on National Grid Reference (NGR) 530168 178218, and the majority of this is lies on the Thames foreshore and within the river channel (**Figure 1**).

1.2.2 The Site is bounded by the River Thames foreshore to the north and south, and the River Thames to the west. Vauxhall Cross and two high rise office buildings (Camelford House and Tintagel House), and the St George Wharf mixed use development (the closest building in the development being Bridge House), are located along the eastern boundary of the Site. The Grade II* listed Vauxhall Bridge crosses over the southern section of the Site.

1.2.3 Within the Site the foreshore at low water level is at 98.4m Above Tunnel Datum[i] (ATD) in the south-west, rising to 99.9m ATD to the north-east. The foreshore adjacent to the river wall is 99.9m ATD in the south-west rising to 101.4m to the north-east. Along the top of the embankment on the eastern boundary of the Site, the ground level lies between 105.0-106.3m ATD.

1.2.4 The foreshore has until recently been relatively stable; it has, however, become an extremely dynamic environment since the construction of a new pier upstream (ES Vol 16 section 7.4.6).

1.2.5 The Site is situated on alluvium overlying sand and gravel deposits associated with the floodplain of the River Thames. The Kempton Park river terrace is 25m to the east of the Site (British Geological Survey Solid and Drift Geology, Sheet 270). The former River Effra, a tributary of the Thames, flowed into the eastern side of the Thames in the vicinity of the Site. The BGS mapping shows that the Kempton Park river terrace in the vicinity of the Site has been eroded at the mouth of the River Effra, suggesting that in the past it was a significant river.

[i] ATD is equivalent to 100m above Ordnance Datum (aOD)

1.2.6 Further details concerning the topography and geology of the Site are found in the Environmental Statement (ES Vol 16, Section 7 and Appendix E).

1.3 Evaluation aims and objectives

1.3.1 All archaeological work on the project is considered within the context of the project specific Archaeological Research Framework, included in Appendix B of the OAWSI. The Framework groups together the potential types and classes of heritage assets that might be found at TTT Sites and draws on existing archaeological research frameworks and strategies for Greater London, e.g. *A Research Framework for London Archaeology* (MoLA & English Heritage, 2002) and *Greater Thames Estuary Historic Environment Research Framework* (Heppell 2010).

1.3.2 For evaluation at the Albert Embankment Foreshore Site, the following Route-wide Heritage Themes (RWHTs) within the Archaeological Research Framework are considered relevant:

a. Palaeoenvironment and prehistory

b. Settlement patterns and boundaries

c. London's water systems and public health

1.3.3 For the evaluation and watching brief the following questions were specified in the SSAWSI (Section 2.3):

a. What is the topography of the foreshore at present, and how does this change over time (scour, sedimentation etc.)?

b. What is the depositional sequence at the Site?

c. Is there any evidence for the survival of deposits of palaeoenvironmental significance?

d. What is the nature and context of the possible Mesolithic Structure?

e. Does evidence survive that may be associated with the construction of extant post-medieval heritage assets (Lack's Dock, Vauxhall Bridge etc.)?

f. Is there any evidence of prehistoric to post-medieval activity on the Site?

g. What is the character, date, condition and significance of deposits encountered?

h. What is the extent of archaeological survival across the Site?

i. *What is the (seasonal) influence of tidal patterns and storm events on the archaeology of the foreshore?*

1.4 Organisation of the report

1.4.1 The report is set out into the following sections:

Section 2: Historical and archaeological background; this provides a brief summary of the potential and significance of the archaeology likely to be encountered on the Site. This is summarised from Section 7, of Vol 16 of the Environmental Statement (ES).

Section 3: Methodology; this sets out the methods used in the evaluation (as defined in the SSAWSI), and quantifies the physical and drawn archive (i.e. numbers of plans and sections and boxes of finds).

Section 4: Fieldwork Results; this presents the results of the targeted walkover survey and parametric sonar survey undertaken as part of this evaluation.

Section 55.4.3: Geoarchaeological and Palaeoenvironmental Results; this describes the deposit sequence recorded in each core. Additional data is used to demonstrate the relationship between deposits located on the foreshore and those sequences landward of the river wall (i.e. a deposit model). Palaeoenvironmental assessment results and radiocarbon dating of samples taken during the evaluation fieldwork is also described. This section also assesses the reliability of the results, noting any constraints encountered.

Section 6: Archaeological potential and significance; this responds to each of the Site specific questions identified to guide the evaluation, and how the results contribute to the project wide research themes. This section also discusses the predicted archaeological survival across the Site, and how the results refine the understanding of the significance of the archaeology as previously defined in the ES.

Section 7: Predicted impacts and recommendations; this assesses the impact of the development on the archaeological resource and provides recommendations as to an appropriate mitigation strategy

2 Historical and archaeological background

2.1 Introduction

2.1.1 A desk-based assessment for this Site and its defined study area is reported within Volume 16 (Section 7, and detailed in Appendix E) of the Environmental Statement (ES). For detailed information on background and potential the ES should be referred to, however the relevant information is briefly summarised below.

2.1.2 Known historic environment assets (HEA references from the ES) are discussed where relevant in the text below; those indicated in bold (**HEA**) are shown on **Figure 3**.

2.2 Previous archaeological investigations

2.2.1 A number of foreshore surveys have been undertaken within the Site: the Thames Archaeological Survey (TAS) in the 1990s and the Thames Discovery Programme (TDP: site code FLM01) 2009–2012. The most significant asset recorded by these surveys is a roundwood, possibly piled structure of six timbers on the central foreshore of the Site at the mean low water mark (**HEA 1A**; ES Vol 16 Figure 7.4.3; **Figures 3-4**).

2.2.2 During a TDP/MoLA investigation in 2010 three timber samples were taken from the probable structure for radiocarbon dating and this confirmed its Late Mesolithic date, returning radiocarbon dates of 4790-4610 cal BC, 4690-4490 cal BC and 4720-4540 cal BC, making it the oldest known timber feature on the Thames foreshore (Milne *et al* 2010). It is suggested that the timbers may represent more than one phase of activity as the timbers do not form any obvious alignments (*ibid*).

2.2.3 The probable structure is associated with prehistoric peat deposits including at least one other horizon of this date. An assemblage of Mesolithic and Neolithic flint (including a tranchet adze) has been recorded eroding out of these deposits. Other artefacts found nearby include early Neolithic pottery and an antler pick (**HEA 1A**, ES Vol 16, 7.4.8). The assemblage of over 20 sherds of early Neolithic pottery was found at low water a few metres downstream of the Mesolithic timbers, these are somewhat later in date than the timbers and it is hypothesised that maybe this location was a memorable place in the landscape (Milne *et al* 2010).

2.2.4 A TDP investigation undertaken in 2012 within the Site mapped the extent of a peat deposit (A310 **Figure 4**) which contained Mesolithic and Neolithic lithic artefacts and a green sandy deposit, a possible land surface thought to overlie the peat (A311 **Figure 4**) which contained similar artefacts (E.Wragg January 2015 *pers comm*). In addition to the Late Mesolithic timbers, three timber posts were also identified (MOLA 13, 15 and 16 **Figure 4**). Timber 13 was a possible semi-circualr pile, 0.44m in diameter; timber 15 was a circular pile, 0.09m in diameter with evidence of tar or pitch and therefore not thought to be prehistoric; and timber 16 was a very degraded possibly circular pile with a diameter of 0.12m, it was

sampled by TDP although has presently yet to be processed *(ibid*) – these timbers all lay west of the area that was available during the walkover survey completed as part of this evaluation.

2.2.5 Upstream of Vauxhall Bridge near St George's Wharf pier, approximately 500m south-west of the Site, the TDP team surveyed and sampled further assets on the foreshore, consisting of prehistoric peat deposits which contained associated artefacts, and a newly identified line of timber stakes that may represent a fish trap (Wragg 2012). TDP are presently awaiting the results of samples taken for radiocarbon dating from this structure (E. Wragg January 2016 pers comm).

2.2.6 These previous foreshore surveys also noted several post-medieval timber assets, mainly situated in the southern part of the Site, these comprised: the leeboard of a vessel (**HEA 1C**); timbers with metal feet (**HEA 1D**) and timber mooring blocks and drains (**HEA 1F**). The surveys also recorded some degradation of the foreshore from its cutting away by the modern river (**HEA 1G**). A number of consolidation layers and dumps were recorded, ranging from modern concrete to undated deposits, which may be archaeological (**HEA 1B**; **HEA 1E** and **HEA 1H**). These consolidation attempts indicate past erosion of the Thames on the foreshore.

2.2.7 Three land-based archaeological investigations carried out within 100m east of the Site (**HEA 2**, **3** and **6**) have also provided information on the historic use of the area for pottery and glass manufacture. The closest investigation to the Site (**HEA 3**), undertaken in 1989, revealed substantial remains of a 17th century glasshouse with much of the kiln intact and large quantities of waste products. Stone foundations of a medieval or later building fronting the Albert Embankment and a waterfront complex with the remains of three brick boathouses (in use from the 17th to 19th century) were also uncovered. An inhumation burial of unknown date was found, cut into the natural gravels. Flood defences were also recorded.

2.3 Historical and archaeological context

Palaeotopographic considerations

2.3.1 At the start of the Holocene (by 9500BC) it is considered that the Thames had adopted a multi-channel form with the relict channels filling with peats, although these are largely dated from 4000 cal BC and later (Sidell *et al* 2002, 8). Topographic modelling undertaken suggests that by the late Mesolithic (6000–4000BC) the Thames was concentrating into a single channel, but running a course that was significantly to the south of its present course across Lambeth/Southwark (Sidell *et al* 2002 Fig 5). The subsequent northwards migration of the Thames (and the migration of the tidal head) and the effect on prehistoric communities is discussed further in Sidell *et al* 2002.

2.3.2 The Site is located near the confluence of the Thames with the former early Holocene River Effra. This confluence was historically altered until the tributary valley was completely infilled and the Thames narrowed during the 19th century.

2.3.3 To the south-west of the Site, and prior to later historic realignment and reclamation, the channel of the Effra was one of the larger 'lost rivers'. Although its upper course is somewhat disputed, it rose in Norwood and flowed into Dulwich, where it was joined by another tributary at Brockwell Park, before flowing into Brixham and round the south side of the Oval, receiving another small tributary, before flowing into the Thames just upstream of Vauxhall bridge. The lower part of the river was also referred to as Vauxhall Creek (Barton 1962, 51-52).

2.3.4 The lower Effra was used as an open sewer by the 17th century and is shown on early historic maps (e.g. Thomas Hill's Vauxhall Manors map of 1681; ES Vol 16 Plate E.1) to have a double mouth [with the northern open sewer flowing into the area of the Site]: in the later 19th century the lower section was partly filled in (Barton 1962, 51-52). The present sewer outfalls are now situated by the Grade II listed Vauxhall Bridge with associated timber dolphins and granite slipways (ES Vol 16 E.4.34; **HEA 1F**; ES Vol 16 Plate E.10).

Prehistoric (700,000 BC–AD 43)

2.3.1 The Site would have been within an area which comprised marsh, dry land and river channel at different times throughout the prehistoric period. As discussed above, the significant remains of a late Mesolithic timber probable structure in association with peat deposits and artefacts (**HEA1A**) have been previously recorded by TDP/MoLA foreshore investigations on the Site (section 2.2). Other finds from the immediate surroundings of the Site indicate slightly later prehistoric activity including a prehistoric axe, a Neolithic axe and two Bronze Age bronze swords found c. 40m south-west of the Site (**HEA 8**); a copper alloy tanged Bronze Age chisel recovered near the northern boundary of the Site (**HEA 35**); and a Neolithic implement and a Bronze Age flake from a previous land-based archaeological investigation (**HEA 2**).

2.3.2 Upstream of Vauxhall Bridge, *c.*600m south-west of the Site, is the remains of a substantial piled timber structure radiocarbon dated to the Bronze Age, comprised of over 20 piles set in two irregular rows extending riverwards down the intertidal zone for at least 15m. These remains were identified in 1993 and subsequently investigated by TAS/University College of London. At the same foreshore location two copper alloy spearheads had also been recovered. The structure is interpreted as the foundations of a causeway, jetty, platform structure or a bridge to a lost eyot (Sidell *et al* 2002, 29-30). This structure was radiocarbon dated to 1750–1285 cal BC (Milne *et al* 2010).

2.3.3 A second smaller timber structure is also known in this location at the same site (FLM01) and has been dated to the Early Iron Age (790–390 cal BC). This comprises two roughly parallel rows of stakes with wattle recorded between them, set at an angle to the foreshore (north-east to south-west orientated), and the structure seems to have been attached to two large timbers of the older Bronze Age structure (above). It may be the remains of a fish trap, and if so provides rare evidence of fishing in the Iron Age (Haughey 2003, 65). Further assets are also known in this

locality from TDP survey work undertaken in 2012 (paras 2.2.4-2.2.5 above).

Roman (AD 43–410)

2.3.4 No Roman buildings or roads are known within the immediate vicinity; the nearest major road called Stane Street followed the A3/Kennington Park Road over 0.5km south-east of the Site. Evidence of Roman activity is limited to the chance find of a late Roman pottery vessel (**HEA 1H**). During the Roman period the foreshore Site may have been prone to flooding due to rising sea levels from the late prehistoric period, and probably lay in open marshland or on the inter-tidal zone suggesting that it was unlikely to be suitable for settlement (ES Vol 16 Appendix E.4.8).

Early medieval (AD 410–1066)

2.3.1 The Site was located some distance from the nearest known settlements and would probably have been unsuitable for habitation due to marshy conditions. No evidence of early medieval activity has been recorded within the Site itself. Approximately 90m north-east of the Site a gully of possible early medieval date, underlying a sandy soil containing later medieval pottery was recorded (**HEA 2**). Two medieval swords were found in the Thames, approximately 40m and 70m west of the site (**HEA 8** and **HEA 9**).

Later medieval (AD 1066–1485)

2.3.1 Throughout this period the Site likely remained as marshland, which may have been drained for pasture, although was also likely to have been suitable for settlement. The Site was located within the manor (estate) of Lambeth, or South Lambeth, and was possibly the embarkation point for a horse ferry prior to bridge construction. The nearest medieval settlement was at the east end of Vauxhall Bridge, *c.*200m east of the Site, and a further small settlement existed along South Lambeth Road, *c.*770m to the south of the Site. However, there is evidence of some later medieval activity nearer the Site. Later medieval features and buildings were recorded at 34-46 Albert Embankment, *c.*90m north-east of the Site (**HEA 2**) and stone foundations of a possible later medieval building were recorded at Vauxhall Bridge Foot c. 60m east of the Site (**HEA 3**). A former bridge called Cox's bridge over the northern channel of the Effra is known from 1340 to the east of the Site. A later medieval wharf associated with the transporting stone for the construction of Westminster Abbey is recorded from documents *c.* 50m east of the Site (**HEA 17**); although its precise location is uncertain.

Post-medieval (AD 1485–present)

2.3.1 In the 17th century, a substantial waterfront complex was developed *c.*60m east of the Site (**HEA 3**, as discussed in section 2.2 above). From the 17th century onwards, the area surrounding the Site became increasing industrial as evidenced by: an armoury (**HEA 11**); a 17th century stone-working site (**HEA 34**); and a Soap Boiler's, distillery and pub founded in the 18th /early 19th century; and further to the east, a glasshouse was

constructed in 1615, which operated until1786 (**HEA18**). This glassworks occupied an extensive area and evidence was also recorded *c.*60m east of the Site (**HEA 3**). Vauxhall was also the location of an important pottery, with pottery manufacturing extending eastwards from the Site over an extensive area (**HEA 2, 6, 7, 21** and **28**).

2.3.2 Historic maps examined for the ES show the Site lay within the River Thames and on the foreshore in the 17th to 18th centuries. The earliest map of 1681 also shows an open channel labelled a sewer, a remnant canalised channel of the Effra discharging into the Thames. By the mid-18th century the eastern edge of the Site was reclaimed from the river and included some buildings, probably warehouses, constructed along the river front, several small docks or wharves and some small plots of land. The Site extends east along the southern side of a former road that led to Vauxhall Stairs (**HEA 5** which provided access to the river) and included a row of buildings fronting onto that road.

2.3.3 A map of 1813 (ES Vol 16 Plate E.3) shows the line of the first Vauxhall bridge (opened in 1816), this construction cut through the existing vinegar manufactory located within the south-eastern part of the Site. The north-eastern part of the Site includes Vauxhall Stairs, a built-up area of wharves and warehouses between what is now Albert Embankment and the Thames.

2.3.4 The first edition OS map of 1862 (Vol 16 Plate E.4) shows the completed bridge, a ‘coal store’ in the south-east of the Site, ‘a gin and vinegar distillery’ in the north-east and ‘Luck’s dock’ in the north-east (later ‘Lack’s dock, **HEA 1L**), with remaining undeveloped Thames foreshore.

2.3.5 In 1906, the original Vauxhall bridge was replaced by the current Grade II* listed structure (**HEA 1N**), which is flanked by two sewer outfalls (the Effra storm Relief CSO to the north, built in 1882 as part of the Effra Storm Relief scheme, and the Brixton Storm Relief CSO to the south, built in 1906 as part of the bridge scheme) with associated timber dolphins and granite cobbled slipways or aprons constructed (**HEA 1F**, ES Vol 16, 7.4.44). Joseph Bazalgette’s Grade II listed river wall along Albert Embankment immediately north of the Site, was built around the same time and was originally intended to extend beyond Vauxhall Bridge, but was abandoned due to high costs. A brick and stone river wall, partly dating to the 19th century with modern elements is located along the eastern side of the Site (**HEA 1M**, ES Vol 16, 7.4.43).

2.3.6 Buildings in the south-eastern and central eastern edges of the Site suffered some blast damage during the Second World War. The post-war OS map of 1947 (ES Vol 16 Plate E.7) shows the area of the former distillery is now labelled ‘oil works’. In the southern part of the Site, two ‘Dolphins’ and two sewer outfalls are labelled to the north of and beneath Vauxhall Bridge. Later 20th century development has since taken place including the construction of Camelford House and the Vauxhall Cross building (**HEA 39**), which bound the Site. Two modern outfall pipelines are also known to cross the foreshore (**HEA 1J** and **1K**).

2.4 Summary of potential and significance from ES

2.4.1 A summary of the Site's archaeological potential and significance by period is given in **Table 2.1**; as identified in the ES (Vol 16 Table 7.10.1).

Table 2.1: ALBEF archaeological potential and significance by period

Overall Site potential: **High potential** for prehistoric land surface with possible manmade timber structure dating to Mesolithic period. Site of overall **High significance** (OAWSI, para 8.4.3).
High potential for prehistoric remains, including radiocarbon-dated[ii] late Mesolithic timber possible structure and land surfaces including associated palaeoenvironmental remains (**High** significance)
Setting of Mesolithic and other prehistoric timber structures (**Medium** significance)
Low potential for isolated Roman artefacts (**Low** significance)
Low potential for isolated early medieval remains (**Low** significance)
Low potential for later medieval remains of a possible ferry or waterfront structures (**Low** significance)
High potential for post-medieval remains comprising industrial remains (**Low** significance)
Post-medieval river outflows, dolphins, storm flaps and brick slipways (**Medium** significance)
Existing unlisted river wall on the Site (**Medium** significance)
Lack's Dock (**Medium** significance, modern parapet wall of **negligible** significance)
Vauxhall Bridge (**High** significance)

[ii] Was 'possible Mesolithic' in ES Table 7.10.1, but the dating of the possible structure has been confirmed as Mesolithic through radiocarbon dating of timber samples by TDP (see section 2.2) and therefore this table has been adapted to reflect this recent discovery.

3 Methodology

3.1 Introduction

3.1.1 The methods applied to the evaluation of the Site included:

a. Condition Monitoring – based on comparison on bathymetry data collected at quarterly intervals to track changes in the topography of the foreshore and riverbed of the Site;

b. Marine Geophysics (Parametric Sonar);

c. Targeted walk over survey;

d. Geoarchaeological and palaeoenvironmental recording and assessment, and radiocarbon dating of samples taken during the evaluation fieldwork; and

e. Deposit Modelling.

3.1.2 The Condition Monitoring programme is undertaken using third party bathymetry data, collected by Port of London Authority (PLA) for TTT, and is reported on separately at roughly quarterly intervals. The first Condition Monitoring report has been issued (Wessex Archaeology 2014; TTT document reference forthcoming). More detailed methodologies for the other techniques are set out below.

3.1.3 All archaeological investigations were carried out in accordance with the SSAWSI (ref. 100-RG-ENV-00000-000161) for the evaluation works at this Site. All recording was carried out to the format and standards detailed with the *Archaeological Site Manual* (MOLAS 1994).

3.1.4 The site code, as allocated by the Museum of London Archaeological Archive and Research Centre (LAARC), is referenced: TTI 14. This Site code was used on all records, retained artefacts and samples that form part of the Site archive.

Data and samples acquired prior to Evaluation

3.1.5 The scope of evaluation works as set out in the SSAWSI required the utilisation of data and samples acquired prior to the start of the evaluation. In addition to large numbers of geotechnical borehole data used in deposit modelling, these include:

Geoarchaeological vibrocores

3.1.6 A series of vibrocores have been retrieved from within the Site specifically for the purposes of geoarchaeological study (PLA 2013, **Appendix A.5**) at locations previously agreed with Historic Buildings and Monuments Commission for England (HBMCE) for the TTT project (**Figure 1**). These core samples were delivered to Wessex Archaeology, and have been assessed as part of this evaluation.

Non-archaeological marine geophysical data

3.1.7 TTT has gathered non-archaeological marine geophysical data over the course of the pre-consent phase of the project for engineering purposes, to inform understanding of ground conditions on the Site.

3.1.8 The data acquired prior to September 2013 comprises processed sidescan sonar and multibeam bathymetry datasets from multiple surveys. This data has been subjected to gap analysis in order to assess its suitability for use in identifying any unusual seabed structures that could be shipwrecks or other anthropogenic debris (document ref. 1000-ENV-ZZZZZ-SGR-YE-RG-100001-P01).

3.1.9 The results of this gap analysis report show that the data were unsuitable for use in archaeological interpretation. Although not directly applicable to defining archaeological potential, this result has helped develop the methodology for this evaluation (SSAWSI; 100-RG-ENV-00000-000161).

3.2 Parametric sonar survey

3.2.1 The marine geophysical data were collected by Wessex Archaeology on board the Port of London Authority (PLA) vessel Galloper between the 9th and 14th June 2014. A gridded line system was set out for the survey in order to ensure maximum coverage of the Site (**Figure 1**). Due to the intertidal nature of the Site, the survey was planned around the tides in order to gain maximum information, with lines furthest out into the main Thames channel run at a lower tide and the closest lines (and cross lines) run around high tide.

3.2.2 The marine geophysical data used for this report were assessed for quality and their suitability for archaeological purposes, and rated using the Wessex Archaeology's in-house criteria defined below in **Table 3.1**.

Table 3.1: Criteria for assigning geophysical data quality rating

Data Quality	Description
Good	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris.
Average	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.
Variable	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.

3.2.3 The geophysical data have been rated as "**Average**" using the defined criteria. This is due to several survey limitations; i) equipment penetration was limited in places, likely due to the hard substrate (sands and gravels) identified during previous vibrocore surveys, and ii) the shallow depth of water meant data was obscured by seabed multiples. These represent Site environmental limitations, which affect the quality of data in the same way regardless of the equipment used.

3.2.4 PS data were acquired using an Innomar SES 2000 Compact Parametric Sub-bottom Profiler system, operated at a dual frequency of 10kHz/100kHz. Positioning data for the survey were provided by an Applanix PosMV Inertial navigation unit. The data were logged by the PLA during the survey using HyPack, and recorded directly along with the PS data (recorded as both *.raw* and *.ses* files) in Innomar's SESwin software.

3.2.5 The PS data were initially viewed and processed using Innomar's ISE post-processing software. This program, along with the accompanying SES Convert software, was mainly used to convert the positioning data to British National Grid and the file formats to *.sgy* and *.xtf*. Images of the data acquired along each survey line were also taken. The converted PS data were processed using Coda Seismic+ software. This software also allows the data to be visualised with user selected filters and gain settings in order to optimise the appearance of the data for interpretation. The shallow seismic data were interpreted with a two-way travel time (TWTT) along the z-axis. In order to convert from TWTT to depth, the velocity of the seismic waves was estimated to be 1,600ms-1. This is a standard estimate for the speed of sound through shallow unconsolidated sediments. The data were then interpreted using the lower frequency (10kHz) data within Seismic+, as this was found to produce better penetration, with comparisons back to the original dual frequency data set.

3.2.6 The PS data was interpreted and integrated with available archaeological and geotechnical borehole data across the Site (as detailed with the results). A discrimination flag was then added to all identified features in order to discriminate against those which are not thought to be of an archaeological interest. These flags are ascribed by type of non-archaeological and archaeological interest as shown below in **Table 3.2**.

3.2.7 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all identified features of potential archaeological interest to be highlighted, while retaining all the information produced during the course of the geophysical interpretation for further evaluation should more information become available.

Table 3.2: Types of identified palaeogeographic features within the Site

Non-Archaeological	U2	Feature of non-archaeological interest
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material

	P2	Feature of possible archaeological interest

3.2.8 Occasionally, small possible mounds were also observed on the riverbed and recorded. For anomalies on the riverbed, the discrimination flags are ascribed as shown below in **Table 3.3**.

Table 3.3: Types of identified riverbed anomalies within the Site

Non-Archaeological	U1	Not of anthropogenic origin
	U2	Known non-archaeological feature
	U3	Non-archaeological hazard
Archaeological	A1	Anthropogenic origin of archaeological interest
	A2	Uncertain origin of possible archaeological interest
	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly

3.3 Targeted walkover survey

3.3.1 Existing available survey data, aerial photography and Greater London Historic Environment Record (HER) data was examined and plotted within a CAD GIS system and was used to generate a Site briefing document in order to identify key features and survey data gaps and enable a degree of targeting for the walkover survey.

3.3.2 The walkover survey was undertaken on the 10th–11th September 2014. Works on Site consisted of the identification, examination and recording of features, layers and structures. Recording comprised allocation of a unique context-based record number to each feature, and a full written, drawn and photographic record was made, as appropriate, using the Wessex Archaeology *pro forma* recording system.

3.3.3 A survey-grade GPS was used on Site to accurately plot all *in situ* remains and this data was incorporated into the CAD GIS model.

3.3.4 Object numbers (ON) were allocated at the time of the survey to artefacts, only when an artefact's position was considered potentially significant and/or the artefact was of intrinsic value.

3.3.5 In the context of the foreshore environment, and the relatively constrained tidal window within which the targeted walkover survey was undertaken, archaeological remains were not 'excavated' per se. However, limited hand-investigation was employed as necessary, particularly to obtain artefactual and/or palaeoenvironmental evidence where observed. Care was taken to preserve the integrity of any archaeological features or complex deposits which may be better excavated under controlled archaeological mitigation.

3.3.6 The targeted walkover survey was not intended as a full condition survey of known assets (HEA) present on the foreshore. However, where further information could be gained to address the aims of the evaluation,

appropriate recording and sampling of known assets was undertaken. The walkover survey aimed also to identify and record any assets previously not known and surface collect any artefacts present on the safely accessible foreshore at the time of the survey (i.e. to record new assets).

3.3.7 Where exposed areas of deposits with palaeoenvironmental potential were observed on the foreshore, bulk samples were taken for palaeoenvironmental assessment. These were then labelled and returned to the Wessex Archaeology's laboratory for environmental processing and initial assessment.

3.3.8 Bulk samples were processed and assessed in accordance with the recommendations outlined in the HBCME *Guidelines for Environmental Archaeology and Geoarchaeology* (EH 2011).

3.3.9 Where bulk samples displayed good palaeoenvironmental potential, sub-sampling was undertaken in line with the procedures outlined in **Table 3.5** below. The methodology of processing these samples is presented in section 3.8 below.

3.3.10 The recovery of finds on site and retention of artefacts/ecofacts and the archive was carried out in accordance with the methodology set out in the SSAWSI.

3.3.11 Details concerning the assessment of waterlogged wood that was sampled/lifted from the Site to allow for examination and dating in order to inform the probable period and significance of the archaeological deposits/structures, is outlined below.

3.4 Waterlogged wood assessment

3.4.1 Waterlogged wood was lifted from the Site in order to inform the objectives of the evaluation and stored appropriately by Wessex Archaeology's conservator at the Salisbury office. It was subsequently recorded by a worked wood specialist who aimed to assess the potential of the waterlogged wood assemblage in terms of woodworking technology, woodland reconstruction, decay analysis, species identification, dendrochronology and conservation and retention. All in accordance with English Heritage guidelines for the treatment of waterlogged wood (Brunning and Watson 2010) and recommendations made by the Society of Museum Archaeologists (1993) for the retention of waterlogged wood.

3.4.2 Each discrete item was recorded individually using a pro forma 'wood recording sheet'. The system of categorisation and interrogation developed by Taylor (1998, 2001) has been adopted within this report. Joints and fixings are described in accordance with the Museum of London archaeological Site manual (Museum of London1994).

3.4.3 Where possible, waterlogged wood fragments were prepared for microscopic identification to taxa. Slides were made of the transverse, radial longitudinal and transverse longitudinal sections using techniques based on those given in Hather (2000: 12-19). These were examined using a compound microscope with magnification ranging from 4x to 100x.

Diagnostic features were noted and identifications were made using a wood atlas (Schoch et al. 2004 and Hather 2000). Identifications were made to species where diagnostic features were clear in all three sections and given possible identifications (e.g. cf. Quercus sp.) where diagnostic features were not clear. Nomenclature follows Stace (2010).

3.4.4 The condition scale developed by the Humber Wetlands Project (Van de Noort et al. 1995: Table 15.1) was used to assess the condition of the material (**Table 3.4** below). The condition scale is based primarily on the clarity of surface data. Material is allocated a score dependent on the types of analyses that can be carried out, given the state of preservation. The condition score reflects the possibility of a given type of analysis but does not take into account the suitability of the item for a given process.

Table 3.4: Waterlogged wood assessment: condition scale

Condition Score	Museum Conservation	Technology Analysis	Woodland Management	Dendro-chronology	Species identification
5 excellent	+	+	+	+	+
4 good	-	+	+	+	+
3 moderate	-	+/-	+	+	+
2 poor	-	+/-	+/-	+/-	+
1 very poor	-	-	-	-	+/-
0 non-viable	-	-	-	-	-

3.4.5 If preservation varies within a discrete item, the section that is best preserved is considered when assigning the item a condition score. Items that were set vertically in the ground often display relatively better preservation lower down and relatively poorer preservation higher up.

3.4.6 The waterlogged wood is temporarily stored at the offices of Wessex Archaeology in controlled conditions, as managed by Wessex's in-house conservator. The material will be retained until the reporting phase of the project is completed and then if no further work is recommended, it will be discarded.

3.5 Geoarchaeological mechanical coring

3.5.1 Mechanical coring was undertaken simultaneously with the targeted walkover survey on the 10th-11th September 2014. The mechanical coring locations (**WA11-14** and **WA101-103**) are shown in **Figure 1**.

3.5.2 All cores were drilled by a specialist geotechnical subcontractor, under the direct supervision of Wessex Archaeology's geoarchaeologist. Each core

was located/ levelled accurately using survey-grade GPS. Each core was continued downwards until underlying geology was reached, or until refusal.

3.5.3 Mechanical coring was carried out using pneumatic windowless sampling methods using a Terrier rig. The rig drove a c.10cm diameter 1m long sampling chamber down into the sediments, and extracted a sleeved core for either immediate opening and description, or labelling and storage for later assessment. An extension rod was added and the process repeated at an additional 1m depth, with the casing used to ensure the integrity of the samples where appropriate.

3.5.4 The cores were sealed, labelled and returned to the Wessex Archaeology's laboratory for description and assessment in accordance with procedures outlined in in Section 3.73.7 below.

3.6 Geoarchaeological hand augering

3.6.1 The purpose of the hand augering was primarily to provide supplementary records to augment the records from the mechanical coring and where necessary record and sample sequences of possible high palaeoenvironmental potential.

3.6.2 Augering was carried out at twelve locations within the Site's Foreshore on the 10th-11th September 2014 and recorded by Wessex Archaeology's geoarchaeologist on Site, following Hodgson (1997). The location of the auger holes (**HA1** to **HA12**) is illustrated in **Figure 1**.

3.6.3 A gouge augering system was utilised for rapidly recording strata; a 1m long, 3cm diameter open-sided sampling chamber, was pushed downwards through the strata manually using a T-bar handle. Extendible 1m rods were used where necessary. This system is not suitable for obtaining laboratory samples due to the open-sided chamber, but is ideal for recording and identifying strata prior to sampling via Russian auger if appropriate.

3.6.4 In this case no deposits suitable for Russian auger sampling were recorded.

3.6.5 The elevations and locations of the auger holes were surveyed in by GPS and recorded in line with the procedures outlined in Section 3.7 below.

3.7 Geoarchaeological and palaeoenvironmental assessment of cores

3.7.1 Five vibrocores have been previously retrieved within the Site for the TTT project (**Figure 1**). The following approach to the recording, assessment and analysis of the cores was employed, in accordance with the recommendations outlined in the HBCME *Guidelines for Environmental Archaeology and Geoarchaeology* (EH 2011).

3.7.2 A staged approach was utilised for the geoarchaeological and palaeoenvironmental investigations outlined in **Table 3.5** below.

Table 3.5: Staged approach to core assessment

Stage 1: Geoarchaeological assessment	The cores will be split and described by a geoarchaeologist, and interpretations made regarding formation processes and depositional environments, and their likely archaeological and palaeoenvironmental potential. This data will inform the development of a Site-specific deposit model, which will also incorporate any other available data. Following geoarchaeological description and interpretation Stage 2 palaeoenvironmental assessment work would be scoped to assess the potential of the deposits, and to further characterise and interpret them.
Stage 2: Palaeoenvironmental assessment	Sub-sampling and assessment of samples agreed in Stage 2 will be undertaken (for a range of micro-and macro-fossil palaeoenvironmental indicators such as pollen, diatoms, plant macrofossils, molluscs, ostracods and foraminifera as appropriate, together with suitable plant macrofossils for radiocarbon dating). The relevant ecofacts will be identified to at least main Taxon, with quality of preservation and approximate quantification. This will enable the value of the palaeoenvironmental material surviving within the samples to be assessed. The Stage 2 findings will form part of the Evaluation Report, and set out the results of laboratory assessment, and summarise the results and their potential in the archaeological and palaeoenvironmental context of the local area. The results of deposit modelling will also be presented. Recommendations will be made as to whether any further analysis would be required as part of mitigation.

3.7.1 At Stage 1, existing core samples were opened, described and interpreted, as were any supplementary samples from additional mechanical coring and auger sampling works.

3.7.2 The cores were split and described by a geoarchaeologist, following Hodgson (1997). A wide range of characteristics were recorded including (but not limited to) texture, colour, structure, inclusions, nature of boundaries and evidence for depositional and post-depositional soil and sediment processes.

3.7.3 The results were used by the geoarchaeologist to interpret the likely formation processes represented, and to make initial judgements regarding the probable archaeological and palaeoenvironmental potential of the deposits.

3.7.4 Based on the results of Stage 1, no deposits were identified as suitable for further work and Stage 2 laboratory assessment has not been required to meet the evaluation objectives.

Storage

3.7.5 The shelf life of the retained core samples is *c.* 3–4 years. The cores are retained at the Wessex Archaeology's geoarchaeology laboratory in controlled storage until such a time as they are no longer needed.

3.8 Palaeoenvironmental assessment and radiocarbon dating

3.8.1 Where exposed organic deposits were recorded on the foreshore during the targeted walkover survey, two bulk samples were taken to obtain material for radiocarbon dating and palaeoenvironmental assessment.

3.8.2 The following methods were used and the results are presented in section 5.2.

Macrofossils (plants, molluscs and insects)

3.8.3 Two one litre subsamples were processed in order to assess the presence/ absence and diversity of macrofossils, including molluscs, waterlogged plant material and insects.

3.8.4 Laboratory flotation was undertaken with the sample retained on a 0.25mm. The flot was visually inspected under a x10 to x40 stereo-binocular microscope to determine if waterlogged material occurred. Where waterlogged material was present, preliminary identifications of dominant taxa were recorded (see results section **Table 5.1**). Nomenclature follows Stace (1997).

Foraminifera

3.8.5 Two subsamples were assessed for the presence and environmental significance of foraminifera.

3.8.6 Sediment samples of *c.*25g were disaggregated in a weak solution of Hydrogen Peroxide and water, then wet sieved through a 63µm sieve. The sediment was dried and sieved through 500µm, 250µm, 125µm sieves. The presence of foraminifera was assessed under 10-60x magnification and transmitted and incident light using a Vickers binocular microscope using standard techniques (Murray 1979, 2000).

Ostracods

3.8.7 Two subsamples was assessed for the presence and environmental significance of ostracods.

3.8.8 Sediment samples of *c.*25g were disaggregated in a weak solution of Hydrogen Peroxide and water, then wet sieved through a 63µm sieve. The sediment was dried and sieved through 500µm, 250µm, 125µm sieves. Microfossils were assessed under 10-60x magnification and transmitted and incident light using a Vickers binocular microscope following methods detailed in Athersuch et al. (1989) and Meisch (2000).

Radiocarbon dating

3.8.9 Eight samples were submitted for radiocarbon dating to the Scottish Universities Environmental Research Centre (SUERC). Seven radiocarbon dates were obtained (one sample failed _– **Table 5.2**).

3.8.10 The radiocarbon dates have been calculated using the calibration curve of Reimer et al. (2013) and the computer program OxCal (v4.2.3) (Bronk Ramsey and Lee 2013) and cited in the text at 95% confidence and quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years. The range in plain type in the radiocarbon tables has been calculated according to the maximum intercept method (Stuiver and Reimer 1986). All other ranges are derived from the probability method (Stuiver and Reimer 1993). The results are presented in Section 5.2.

3.9 Deposit model construction

3.9.1 In order to create the deposit model, available data points from the Site and vicinity were entered into a digital database (Rockworks 15). For this Site these included: geoarchaeological vibrocores retrieved prior to the start of the evaluation (PLA 2013); and other borehole data (**Appendix A.5**); mechanical cores, hand auger and 'pseudopoints' based upon geophysical data (**Appendix A.5**).

3.9.2 At this Site, a total of 65 deposit records were entered. The distribution of selected data points most relevant to this analysis is illustrated in **Figure 4**.

3.9.3 During modelling, each identified lithological unit (gravel, sand, silt etc.) is given a unique colour and pattern allowing cross correlation of the different sediment and soil types across the Site. By examining the relationship of the lithological units (both horizontally and vertically) correlations can be made between soils and sediments, and associations grouped together on a Site-wide basis. The grouping of these deposits is based on the lithological descriptions, which define distinct depositional environments.

3.9.4 Thus, where suitable contexts are present, a sequence of stratigraphic units[iii] representing certain depositional environments and/or landforms can be reconstructed both laterally and through time for the Site. These can then be displayed in the form of Digital Elevation Models (DEMs) and thickness plots.

3.9.5 Geoarchaeological interpretation of the modelling results can be used to create a series of Landscape Zones (LZs) made up of characteristic deposit sequences containing one or more stratigraphic units, and defining landforms and depositional environments.

[iii] A geoarchaeological term defining a layer deposited under certain environmental conditions. For example, alluvial clays/silts deposited in intertidal salt marsh, or peats forming in wetland alder carr.

3.9.6 In practice, the sequences recorded on most of the foreshore sites are limited in variability and depositional environments represented, and the number of stratigraphic units are therefore similarly limited.

3.9.7 The system of landscape zones and stratigraphic units has been retained nonetheless, in order to allow uniform approach between the sites, and easier correlation with deposit modelling from evaluation of the land-based sites. These have been supplemented by transects across the Site to show the sequence of deposits and their relative levels.

3.10 Quantification of the archive

3.10.1 Four boxes of finds, four pieces/samples of waterlogged wood, and seven cores were recovered. The flots and residues from sub-samples taken from two bulk environmental samples were also retained.

3.10.2 The Site finds, samples and records can be found under the site code TTI14 at the offices of Wessex Archaeology, but will be deposited in the Museum of London Archaeological Archive and Research centre (LAARC) in due course, with the exception of artefacts/samples to be discarded as outlined within this report.

4 Fieldwork Results

4.1 Parametric sonar survey

Introduction

4.1.1 Any specific individual palaeogeographic features or riverbed features of possible archaeological interest have been mapped (**Figure 2**). These have been given individual ID numbers, which refer to the more detailed descriptions of individual features provided in **Appendix A.1**.

4.1.2 Additionally, the approximate extents of deposits (>0.5m thick) overlying the London Clay have been mapped (**Figure 2**). These cover the majority of the foreshore Site and the western extent of these deposits approximately correlates with the low water mark.

4.1.3 The Site was generally free of obstructions, with the exception of Vauxhall Bridge in the south-west; however, despite this full planned data coverage of the Site was obtained.

4.1.4 Five recent vibrocores (**VB7014**, **VB7014A**, **VB7015**, **VB7027** and **VB7028**, **Appendix A.3**) and four vibrocores acquired by MoLA (**MoLA-VC6392**, **MoLA-VC6393**, **MoLA-VC6393A** and **MoLA-VC6394**: **Appendix A.5**) are located within the Site and were used to aid in the PS data interpretation. Additionally, two cores previously acquired by MoLA (**MoLA-VC6033A** and **MoLA-VC6034**) located just outside to the west of the Site were also used. This interpretation has also taken into consideration bathymetry data from the Site (**Appendix A.5**).

Results

4.1.5 The upper surface of the London Clay horizon has been identified towards the main Thames channel on a number of survey lines.

4.1.6 The nature of the Pleistocene/Holocene sediments overlying London Clay is uncertain from the PS data itself. Irregular reflectors within the top 1m of the data potentially indicate a heterogeneous series of deposits, both vertically and laterally, very few layers within which can be traced with any confidence between survey lines.

4.1.7 Three geophysical features of possible archaeological potential have been identified within the Site, as well as two small mounds (**Figure 2**).

4.1.8 Feature **7500** is a sub-horizontal reflector within the Pleistocene/Holocene deposits identified on a number of survey lines though dipping beyond the limit of equipment penetration towards the shore. Vibrocore **VB7028** sampled river gravels and sands at the same depth of this feature (approximately 2m below river bed); therefore it is interpreted as a coarse sediment deposit. Vibrocore **VB7014A** also sampled the same unit at approximately 3m below river bed, indicating similar gravel deposits are present elsewhere within the Site that have not been imaged by the PS equipment.

4.1.9 Feature **7501** is interpreted as a complex cut and fill, and is characterised by a possible cut filled with two distinct phases of sediment (**Figure 2**). The upper sediment fill is potentially recent; however, the lower fill is uncertain in age and nature, and further sampling would need to be undertaken to fully interpret the feature, though this was not possible during the evaluation fieldwork.

4.1.10 Feature **7502** is a small infilled depression only identified along a single survey line on the riverbed on the western edge of the Site. It appears as a depression in the surface of the London Clay subsequently filled with sediment, the age of which is unknown.

4.1.11 Two small mounds (**7520** and **7521**) were also identified within the Site. Both potentially correlate with features visible in previous multibeam bathymetry data (**Appendix A.5**) and are likely to be natural features, though they could be anthropogenic in origin.

Summary

4.1.12 The results indicate that sediments (>0.5m thick) overlying London Clay cover the majority of the foreshore Site. Although the nature of these sediments has not been determined from the PS data alone, cores examined during this evaluation indicate up to 1.16m of active beach deposits over up to 1.84m of river gravels over London Clay, with the walkover survey suggesting the presence of isolated pockets of exposed organic deposits.

4.1.13 Three riverbed features were identified with possible archaeological potential. Feature **7500** is interpreted as a coarse sediment layers and its depth correlates with river gravels recorded in vibrocores: this layer may be more extensive than the PS data indicates. One feature (**7501**) is located on the central intertidal foreshore and at low tide remained a water filled depression throughout the evaluation fieldwork and could not be examined by other fieldwork techniques.

4.1.14 A depression (**7502**) within the London Clay on the western edge of the Site is possibly a natural erosional feature, although the date of deposits infilling it are uncertain as it was unable to be sampled during the hand augering survey.

4.1.15 Two mound features (**7520** and **7521**) also identified by the marine geophysics are likely to represent natural features.

4.2 Targeted walkover survey

Introduction

4.2.1 The walkover survey was undertaken on the 10th–11th September 2014. At the time of the walkover survey the TDP/ MoLA surveyed peat and the majority of the surveyed Late Mesolithic timber probable structure (**HEA 1A**), with the exception of one timber, lay east of the extent of the walkover, as defined by the tide on the day of the survey (**Figures 3-4**).

4.2.2 The walkover survey was successful in confirming the presence of new (previously unknown) *in situ* remains on the foreshore, as well as

recording a number of previously known assets. This included the recording and lifting of the easternmost timber of the previously known late Mesolithic probable structure, and establishing that associated peat deposits extended slightly further to the east than they had been previously been recorded. A new apparently localised area of peat was also discovered to the north at the low water mark, it was sampled and subsequent radiocarbon dating has shown it to be of Middle Neolithic date. Two groups of newly discovered timbers in the central lower foreshore were also recorded and sampled, subsequent radiocarbon dating has shown one of these (a pair of timbers) to also be of Late Mesolithic date and the other (an alignment of four upright timbers) to be part of a Late Bronze Age structure. Further post-medieval assets of a barge bed and crane/winch base with a possible mooring timber were also recorded to the north of the foreshore Site.

4.2.3 A relatively small quantity (62 in number) of unstratified finds were recovered from the exposed foreshore (unstratified context **6000**) during the walkover survey (**Appendix A.2.1**). The finds were recovered as a sample of the material present on, and presumably eroding from the Site in this active foreshore environment. The finds are quantified by material type in **Table 4.1**, and detailed below. All of the dateable finds recovered are of post-medieval date.

Table 4.1: All finds by material type (number/weight (g))

Material	Number	Weight (g)
Pottery	31	1022
Clay Pipe	1	5
Flint	3	118
Glass	2	43
Iron	7	1433
Animal Bone	8	336
Slag	2	86
Shell	3	82
Ceramic	1	95
Other Metal	1	29
Plastic	3	13

In situ remains

Late Mesolithic probable timber structure and peat deposits (HEA 1A)

4.2.4 Timber **6006**, an upright roundwood possible pile or post with a surface level of 97.92m ATD was briefly exposed at low tide and was rapidly surveyed and photographed (**Plate 1**). It measured *c*.0.09m in diameter and was eroded at its surface and was exposed to a height of approximately 0.2m above the surface of the present foreshore. Its location is entirely consistent with one of the timbers ('MoLA 1', **Figure 4**) of the probable structure of late Mesolithic date previously recorded by TDP/MoLA investigation in 2010 (**HEA 1A**).

4.2.5 During their investigation, TDP/MoLA recorded six timbers and took three timber samples for the purposes of radiocarbon dating from two of them.

Two samples taken from 'MoLA 2' during the MoLA/TDP investigation produced a radiocarbon date of 4790–4610 cal BC and 4690–4490 cal BC and a sample from another timber 'MoLA 4' produced a radiocarbon date of 4720–4540 cal BC (Milne *et al* 2010).

4.2.6 Timber **6006** equivalent to 'MoLA 1' was not sampled or radiocarbon dated during this previous investigation (**Figure 4**) and so (in consultation with TTT archaeological advisor to the project) timber **6006** was lifted for specialist wood assessment and radiocarbon dating (fully detailed in section 4.3 and section 5.2 respectively), in order to examine it for signs of working, and confirm whether it was contemporary with the other radiocarbon dated timbers of the Mesolithic probable structure. The base of **6006** was directly within London Clay (at *c.*97.64m ATD **Figure 4**) without any indication of a posthole cut; it is therefore assumed to be a driven pile.

4.2.7 Radiocarbon dates obtained from timber **6006** indicate it is indeed of late Mesolithic date (cal 4830-4710 BC) which is slightly earlier although comparable to the dates obtained by TDP/MoLA investigation (see 4.2.5 above) therefore the conclusion is that it is likely part of the same structure, although further statistical analysis is needed to confirm this (see 5.2.18 below).

4.2.8 One further timber was briefly observed in this locality just within the river at the time of the walkover survey (**Figure 4**). Due to inaccessibility it could not be fully recorded however a level was taken on it (97.72m ATD) and its location would appear to be approximately consistent with 'MoLA 2' (**Figure 4**) – the disparity in surveyed position can be attributed to the fact that the surveyor had to lean over the water to acquire a point for it (in accordance with health and safety requirements, work had to remain strictly 'dryside').

4.2.9 An area of organic peaty deposit **6005** measuring approximately 4m by 4m in area (**Figure 4**) was exposed very briefly at low tide *c.*7m to the north-east of the late Mesolithic timber structure (**HEA 1A**) at *c*97.7m ATD. It consisted of a mid-greyish brown clay with occasional small sub-angular and sub-rounded stones with evident organic remains (roots etc), interpreted as an organic stabilisation horizon or possible land surface. A bulk environmental sample (sample 7) was retrieved from deposit **6005** and during this process the depth of the deposit was recorded as 0.4m thick.

4.2.10 Organic peaty deposit **6005** lay immediately east of the area of a peat deposit (**HEA 1A**) that had previously been surveyed by TDP/MoLA in 2010 (**Figure 4**), suggesting that this could represent the eastern extension of this deposit. A hand augering survey was undertaken as part of this evaluation in this locality in order to try to establish the extent and depth of surviving peat, however no organic deposits were recorded within the accessible hand auger points (the results are detailed in Section 5.1). A sub-sample sent for radiocarbon dating returned a late Mesolithic date (5980-5750 cal. BC – fully detailed in section 5.2, with palaeoenvironmental assessment results).

4.2.11 A grid peg (**6007**, **Figure 4**), likely from the TDP/MoLA survey was also surveyed to the east of timber **6006**.

Other late Mesolithic timbers

4.2.12 Further to the north on the central lower foreshore of the Site, two further timbers were exposed. Timber **6012** was circular measuring 0.26m by 0.27m and stood upright to a height of 0.15m (98.16m ATD) above the present foreshore, it was eroded at its surface and the majority of the timber still had bark present and no toolmarks were visible (**Plate 2**). This bark was sub-sampled for radiocarbon dating, which revealed a Late Mesolithic date of cal 5280–5050 BC (detailed in section 5.2). The other timber (**6017**) was located *c.*1.2m north-east of timber **6012**, at the low water mark.

4.2.13 The second timber of the pair, **6017**, was larger in diameter, measuring 0.42m by 0.24m and was exposed to a maximum height of 0.14m (at 97.93m ATD) above the present foreshore surface (**Plate 3**). No tool marks were visible on its surface, though it was visibly eroded. Subsampling of the outer surface of this timber for radiocarbon dating was attempted on Site, at which point it became apparent that the timber was both shallow and loose; it was therefore decided to lift it for inclusion in the specialist wood assessment (detailed in section 4.3 below). Radiocarbon dating showed timber **6017** to be also of Late Mesolithic date, cal 6570–6440 BC (detailed in section 5.2).

4.2.14 The timbers **6012** and **6017** lay within shallow fine-grained alluvium, whilst their bases lay upon firmly packed gravel. It is considered possible that these are the eroded remains of natural *in situ* tree trunks, the lower portions of which have degraded away due to fluctuating conditions within the relatively free-draining gravel layer, whilst the portion preserved in finer-grained alluvium has remained waterlogged.

Middle Neolithic peat deposit

4.2.15 An exposed area of an organic peaty minerogenic deposit **6001** was visible at the time of the walkover survey near the low water mark in the central foreshore of the Site at 98.2 to 98.1m ATD (**Figure 5**). It consisted of a light greyish brown sandy clay with small (<0.02m) of sub-rounded and sub-angular stones and covered an approximate area of 1.7m by 2.5m (**Plate 4**). There was evidence of *Phragmites* type rooting, and occasional laminations within this deposit that had a clear undulating lower boundary.

4.2.16 A bulk environmental sample (sample 1) was taken from a cleaned section on the edge of deposit **6001** in order to assess for palaeoenvironmental remains. During this process it was seen that that deposit **6001** was approximately 0.25m thick and it was observed in section that it stratigraphically overlay a thin mid grey sandy clay alluvium (0.05m thick) deposit **6002**, which also contained organic rooting and occasional small (<0.01m) sub-angular and sub-rounded stone inclusions. Alluvium deposit **6002** was observed to stratigraphically overlie probable London Clay **6003**, which was exposed on the surface of the foreshore in a small area to the north and south of organic peaty deposit **6001** where

levels were taken on its surface at 98.11 to 98.18m ATD (**Figure 5**). The radiocarbon date obtained from waterlogged plant remains in sample 1 indicates that peat deposit **6001** is of Middle Neolithic date (cal 3340-3020 BC). Full details of the palaeoenvironmental assessment and radiocarbon dating can be found in section 5.2.

Late Bronze Age timber structure

4.2.17 A south-east to north-west alignment of four upright roundwood timbers was recorded just above the low water mark, to the south of the extant slipway in the centre of the foreshore Site (**Figure 5**). Timber **6014** was circular, measuring 0.08m in diameter and survived to a height of 0.04m (at98.2m ATD) above the foreshore surface. In order to inform the date and nature of the potential structure, timber **6014** was lifted (**Plate 5**) for specialist wood assessment and radiocarbon dating (the results of which are detailed below in section 4.3 and section 5.2 respectively). No cut was discernible in section either side of the timber and the base of the timber lay within fluvial gravels with a silty matrix.

4.2.18 The sample from timber **6014** returned a radiocarbon date of cal 910-810 BC (Late Bronze Age) and wood assessment has shown it is a stake with visible tool facets, probably from the use of a bronze tool. Timber **6013** was located 0.7m north-east of the **6014**, again was circular with a diameter of 0.07m and survived to a height of 0.05m (at 98.17,m ATD) above the foreshore surface and was eroded at its surface (**Plate 6**). Timber **6016** was located a further 0.8m to the north-east and was circular with a diameter of 0.05m and survived to a height of 0.04m (at98.14m ATD) above the foreshore surface (**Plate 7**). Timber **6015** was located 0.3m to the north-east and was sub-circular at its top, presumably due to erosion, measuring 0.42m by 0.24m and survived to a height of 0.04m (at 98.11m ATD) above the foreshore surface (**Plate 7**).

Post-medieval barge bed, timbers and deposits

4.2.19 A large area of hardstanding (**6009, Figure 3**) measuring approximately 55m by 20m was recorded in the north of the foreshore Site and is interpreted as the remains of a post-medieval barge bed (**Plate 8**). The surface (at 101.3m to 99.9m ATD) consisted of stone cobbles and brick fragments (<0.15m) set into a coarse concrete. From an exposed section on the southern edge of the barge bed, it is clearly composed of a number of underlying bedding layers and patches of chalk were also visible under the cobbled surface (**Plates 9** and **10**).

4.2.20 A square cut timber post or pile (**6010**) was located near the northern end of the barge bed. It measured *c.* 0.3m² and was exposed to a height of 0.2m above the present foreshore at 100.23m ATD (**Plate 11**). Its surface was extensively eroded and there was no evidence for toolmarks. It is probably associated and maybe contemporary with the barge bed, and is interpreted as a possible mooring timber.

4.2.21 Another feature likely associated with barge bed **6009** located to its immediate west was the base of a probable crane/winch (**6011**, **Figure 3**). It consisted of a circular concrete base (surface height 100.7m ATD) measuring 0.26m in diameter with a small part of a concrete side (0.15m

high), some of which had been eroded and lay detached to the side, with a central corroded metal upright fixing (**Plate 12**).

4.2.22 An irregular patch of dark grey black silty clay (layer **6004**, **Figure 3**) measuring *c.* 4.9m by 1.8m containing post-medieval CBM and pottery was investigated and interpreted as silting within a shallow depression in the surface of the active beach deposits (**6008**) at 98.41 to 98.62m ATD.

Pottery

4.2.23 Thirty-one sherds of pottery were recovered, all of which are post-medieval (see **Appendix A.2.1**). All sherds are at least lightly abraded, and some have suffered considerable abrasion in the riverine environment, removing any surface treatments.

4.2.24 Amongst the post-medieval wares are coarse redwares (PMR), including one sherd from a late white-slipped kitchenware bowl. Stonewares are represented by 19th/20th century English stonewares, some with feldspathic glazes (ENGS, ENGS BRST), all used for containers for beverages or household goods (jars, bottles, an inkwell). There is also one sherd from a German seltzer bottle (SELZ). The remaining sherds consist of refined wares, some transfer-printed, and occurring mainly as flatwares (REFW, REFR, TPW).

4.2.25 Overall the chronology of this small group focuses on the 19th and 20th centuries, although some of the coarse redwares could date earlier in the post-medieval period.

Clay Pipe

4.2.26 One unidentifiable piece of clay pipe stem was recovered.

Flint

4.2.27 Three fragments of flint were originally recovered from the Site, but after a visual assessment these fragments were discarded as unworked.

Glass

4.2.28 Two pieces of glass, weighing a total of 43g, were recovered. Both pieces are bottle stoppers of late 19th–20th century date.

Iron

4.2.29 Seven pieces of iron weighing a total of 1433g were recovered from the Site. The bulk of the assemblage is made up of nails with rectangular shafts and square heads.

4.2.30 The assemblage also includes a very worn axe head (**ON 8**), which is covered with corrosion products.

4.2.31 Other finds from the Site include a circular iron rod, one end bent over and ending in a ball-shaped terminal; and a thin flat strip of curved iron, which may possibly be part of a spur.

Animal Bone

4.2.32 Eight fragments of animal bone, weighing a total of 336g were recovered from the Site. The assemblage was rapidly scanned to ascertain species, skeletal element, butchery and gnawing marks. The assemblage is composed of butchery waste and domestic food refuse.

4.2.33 Four cattle bones were identified. This includes two very large ribs and a lumbar vertebra, all of which had been sawn. Saws were not normally used in butchery until the 19th century, when they became essential tools to deal with the task of butchering the larger breeds of 'improved' animals, which became prevalent at that time.

4.2.34 Three sheep bones were also recovered, including part of a radius with signs of gnawing, a rib and a scapula; and a humerus from a young chicken.

Other finds

4.2.35 Other finds recovered included two pieces of slag (one recorded as **ON 10**), two oyster shells, one of which had a circular perforation, a scallop shell and a fragment of ceramic drain pipe.

4.2.36 Modern finds from the Site include a bunch of keys; one of which is for a Chubb mortise lock, and the other from a Yale-type lock marked JMA Spain on one side and 1A SKS on the other. Both keys are held on a thin wire key ring with the remains of a thin green plastic tag. Also recovered were some modern plastic cards including a European Health Identity Card, an identity card and a laminated VIP Guest ticket for an event called 'Synergy at The Fridge', Brixton 2002.

4.3 Waterlogged wood assessment

6006

4.3.1 Upright timber **6006** was the easternmost of a group of six timbers previously surveyed by TDP/MoLA in 2010 (equivalent to 'MoLA 1' **Figure 4**). Two of these timbers have been previously sampled by TDP/MoLA and radiocarbon dated to the Late Mesolithic ('MoLA timbers 2 and 4' **Figure 4**).

4.3.2 Microscopic identification to taxa was possible and *Quercus* sp. (oak) was identified for **6006**.

4.3.3 This upright, oak timber, formed of slow grown heartwood only, is water worn along its length and the top has been truncated by this action. The bottom of the timber terminates in a fracture or break that has occurred whilst the timber was waterlogged (**Figure 6**).

4.3.4 The item is in moderate condition and scores a **3** (using the system out-lined in **Table 3.4**).

4.3.5 The item has a slightly twisted grain and off centre pith, suggesting it may be a limb or branch. The only possible evidence of woodworking is one somewhat angular face.

4.3.6 This item measures 315mm in length with a maximum diameter of 86 x 95mm.

6012

4.3.7 The context sheet records that this sub-sample was removed from a circular upright timber with a diameter of 260 x 270 mm, and that the timber may be associated with a closely located timber (**6017**).

4.3.8 The sub-sample submitted for recording consists of three fragments of bark, the thickness and curvature of which suggests they are derived from a relatively large timber. The largest fragment measures 119 x 48 x 15mm.

6014

4.3.9 This timber forms part of a group of four stakes possibly part of the same structure (with timbers **6013**, **6015** and **6016**).

4.3.10 Microscopic identification to taxa was possible and *Quercus* sp. (oak) was identified for **6014**.

4.3.11 The top of this oak roundwood stake is water worn and has been truncated by this action (**Figure 6**). The item scores a **3** for condition (using the system out-lined in **Table 3.4**).

4.3.12 The lower end has been trimmed from all directions to a tapered, or pencil point. The visible tool facets are somewhat small and slightly concave (maximum facet length 38mm, maximum facet width 32mm). A partial stop mark measuring 26:1mm is visible (**Figure 6**). Small, concave facets can be indicative of the use of a bronze tool.

4.3.13 This item measures 290mm in length with a maximum diameter of 81 x 90mm.

6017

4.3.14 This upright timber may be associated with adjacent timber **6012**.

4.3.15 Microscopic identification to taxa was possible and *Alnus glutinsa/incana* (alder) was identified for **6017**.

4.3.16 The item is water worn along its length and the top has been truncated by this action. The item broke into three large fragments during lifting. The bottom of the timber terminates in a pitted, flat surface at the transition between alluvium and gravel. The item scores a **3** for condition.

4.3.17 The item forms roughly a third of a tangentially aligned outer chord of a large, alder timber. The high levels of water wear raise the possibility that this could be caused by taphonomic processes. The flat base of the timber suggests that the item has been cross cut, although it is possible that this is a result of differential degradation. If the timber is cross cut, it is suggestive of a set post as opposed to a driven pile.

4.3.18 The item measures 160mm high, is 420mm wide and 300mm thick.

Statement of potential

4.3.19 The woodworking technology is very basic, being limited to tool facets and a single possible tangential split. There is no scope for further analysis of the woodworking technology.

4.3.20 The items have all been identified to taxa. The sample size was too small to allow any inferences regards woodland reconstruction to be made.

4.3.21 None of the oak items displays the minimum 50 years of growth rings required to be considered viable for dendrochronology dating. However, suitable sub-samples have been recovered to allow radiometric dating, should this be required.

4.3.22 None of the material is of sufficient interest to warrant conservation and retention. It is advised that the material is retained until the reporting phase of the project is completed, and then be discarded.

5 Geoarchaeological and Palaeoenvironmental Results

5.1 Vibrocores and hand augering

Introduction

5.1.1 Five vibrocore sequences from within the Site were described and interpreted. The location of the vibrocores is shown in **Figure 1**.

5.1.2 Additional mechanical coring (seven cores) and hand augering (twelve hand auger points) were carried out as part of this foreshore evaluation on 10th-11th September 2014. Due to the impenetrable stony ground over most of the Site hand augering was only possible over a 65 metre wide stretch of the foreshore at the low water extent at the time of the evaluation. The location of the cores and auger holes is illustrated in **Figure 1**.

Results

5.1.3 The detailed descriptions for the vibrocores, mechanical cores and hand auger points are tabulated in **Appendix A.3,** and the results summarised below.

Summary

5.1.4 The five vibrocore samples returned only deposits associated with the present depositional environment (active beach deposits over river gravels with high and low energy inputs).

5.1.5 **VB7014** penetrated to a depth of 1m with active beach deposits over river gravels at 0.68m depth99.88m ATD). **VB7014A** penetrated to a depth of 2.6m with 0.74m of active beach deposits over river gravels at 99.93m ATD.

5.1.6 **VB7015** recorded 0.75m of active beach deposits over river gravels with alternating high and low energy inputs at100.17m ATD. **VB7027** recorded 0.55m of active beach deposits over river gravels at 98.92m ATD and **VB7028** recorded 0.35m of active beach deposits over river gravels at 99.2m ATD.

5.1.7 All seven mechanical cores (**WA11** to **WA103**) recorded deposits that included active beach deposits over river gravels over London Clay. The upper surface of the river gravels ranged in height from 98.77m ATD in **WA 101** to 97.87m ATD in **WA11**. The upper surface of the London Clay ranged in height from 98.19m ATD in **WA12** to 97.36m ATD in **WA13**.

5.1.8 The twelve hand auger points (**HA1** – **HA12**) were taken in an area of approximately 65m in length on the lower foreshore where the active beach deposits were soft enough to allow penetration. The deposits recorded at each hand auger location consisted of low energy clays (up to

*c.*0.4m thick) likely representing active beach deposits because of their soft consistency that had accumulated in the upper surface of the shallow depression indicated by the modelling of the surface of the river gravels (**Figure 10**). It was within this depression that the organic deposits (**6005** and **6001**) with underlying thin alluvial clay were located during the walkover survey.

5.1.9 No alluvium was recorded within the cores and auger points though low energy deposits as well as high energy inputs were observed at the top and within the river gravel deposits such as: between 97.74 to 97.86m ATD in **VB7014A**; from 100.17 to 100.07m ATD and from 99.25 to 99.13m ATD and from 99.01 to 98.92m ATD in **VB7015**; and from 98.44 to 98.37m ATD in **WA12**.

5.2 Palaeoenvironmental assessment

Introduction

5.2.1 During the walkover survey two organic contexts (**6001** and **6005; Figures 3-5**) exposed on the lower foreshore were sampled (bulk samples <1> and <7> respectively). These contexts were provisionally interpreted as organic land surfaces.

5.2.2 Context **6005** (sample <7>) was recorded as a grey brown organic clay, measured approximately 4m by 4m where encountered and was located immediately to the east of the peat deposit previously recorded by TDP/MoLA and is probably an extension of that same deposit.

5.2.3 Context **6001** (sample <1>) was a smaller area of approximately 2m by 2m, recorded as a grey brown organic sandy clay and located approximately 25m to the north-east of **6005**.

5.2.4 Subsamples were taken from these bulk samples and assessed for a range of macrofossil remains and also were submitted for radiocarbon dating.

5.2.5 The methodology for the processing and assessment of macrofossils, foraminifera, ostracods and radiocarbon dating is outlined in section 3.8 above.

Macrofossils (plants, molluscs and insects)

5.2.6 Two one litre subsamples were taken from bulk samples <1> and <7> (from contexts **6001** and **6005** respectively) and processed in order to assess the presence/ absence and diversity of macrofossils, including molluscs, waterlogged plant material and insects, and to allow selection of suitable material for radiocarbon dating.

Results

5.2.7 Relatively large quantities of woody stem/twig/root fragments were recovered in both samples. There were also a few seeds of sedge (*Carex* sp.) in the sample from context **6005**.

5.2.8 There were no insect fragments observed in these samples.

5.2.9 Molluscan remains were rare. A single shell of *Radix balthica*, a species typical of still and slow flowing permanent water, was recovered from context **6005**.

5.2.10 The sample is not suitable for further analysis work.

Table 5.1: Macrofossil assessment results

Site	**Albert Embankment Foreshore**	
Context	6001	6005
Sample	1	7
Volume	1 l	1 l
Waterlogged material		
Carex sp. (Sedge)		+
woody stem/root frags > 2mm	++	++
woody stem/root frags < 2mm	+++	+++
Molluscs		
Radix balthica		+

Key: + = <50, ++ = 50-100, +++ = >100

Foraminifera

Introduction

5.2.11 Two sediment subsamples were assessed from bulk samples <1> and <7>, from probable land surfaces **6001** and **6005** for the presence and environmental significance of foraminifera.

Results

5.2.12 No foraminifera were present in the assessed sample.

5.2.13 A paucity of calcareous material was noted with this and other samples from similar contexts on other Thames Tideway sites, which is most likely due to acidification of organic sediments.

5.2.14 Most foraminifera have calcareous walls composed of calcium carbonate. Sediments with a low pH can cause the dissolution of foraminiferal tests, which may explain why these (and other) calcareous remains are largely absent from the assessed samples.

Ostracods

Introduction

5.2.15 Two sediment subsamples were assessed from bulk samples <1> and <7>, from probable land surfaces **6001** and **6005** for the presence and environmental significance of ostracods.

Results

5.2.16 No ostracods were present in the sample.

5.2.17 A paucity of calcareous material was noted within these samples. Most ostracods have calcareous valves composed low magnesium calcite, and, as noted above, this is most likely due to acidification of organic sediments.

Radiocarbon dating

Introduction

5.2.18 Eight samples were submitted to the Scottish Universities Environmental Research Centre (SUERC) (**Table 5.2** below). Seven radiocarbon dates were obtained and one sample failed.

Methods

5.2.19 The radiocarbon dates have been calculated using the calibration curve of Reimer et al. (2013) and the computer program OxCal (v4.2.3) (Bronk Ramsey and Lee 2013) and cited in the text at 95% confidence and quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years. The range in plain type in the radiocarbon tables has been calculated according to the maximum intercept method (Stuiver and Reimer 1986). All other ranges are derived from the probability method (Stuiver and Reimer 1993).

Results

5.2.20 The aim of the radiocarbon dating programme was to determine the age of two peat deposits (**6001** and **6005**) and four timbers (**6006**, **6012**, **6014** and **6017**). There is no direct stratigraphic relationship between any of these peat deposits and the timbers (see section 4.2 above). See **Table 5.2** below for summary of radiocarbon measurements and **Figure 12** (embedded in text below) for the calibration confidence of the measurements.

5.2.21 SUERC-59297 on waterlogged stems from peat deposit **6001** produced a Middle Neolithic date (3340-3010 cal. BC).

5.2.22 SUERC-59298 on waterlogged stems from peat deposit **6005** produced a Late Mesolithic date (5980-5750 cal. BC at 95% confidence), while SUERC-60044 on bulk sediment from the same deposit produced a significantly earlier Mesolithic date (9330-9260 cal. BC). It is possible that the latter included old material and, therefore, the former may be closer to the true age of the peat.SUERC-59299 is from a waterlogged hazelnut shell (Corylus avellana) and SUERC-59300 is on a waterlogged alder (Alnus glutinosa) cone, both from the same sample of this deposit (**Table 5.2**).

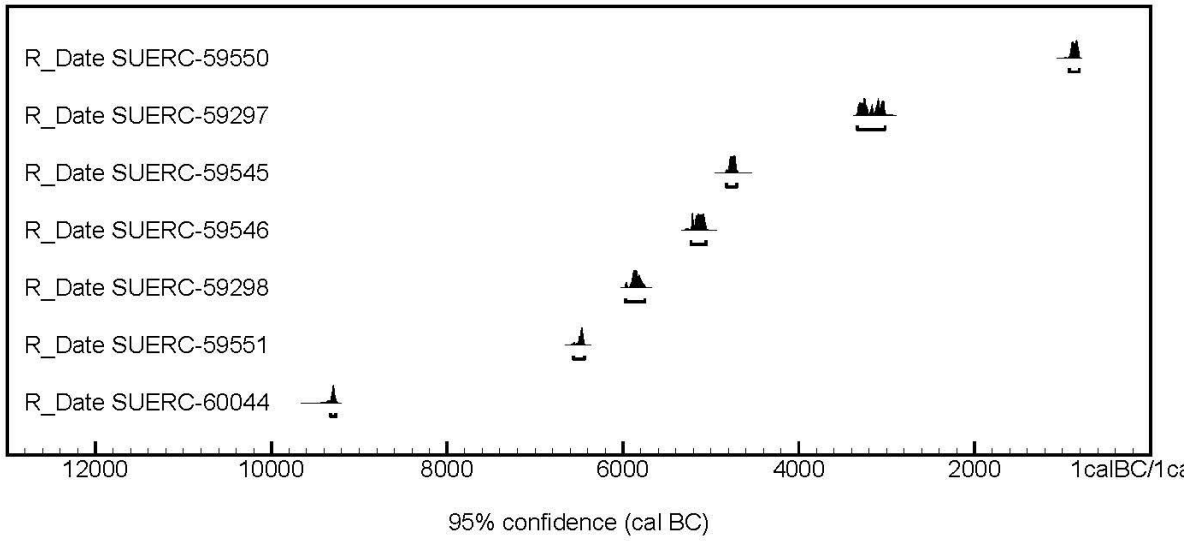
5.2.23 The timbers (**6006**, **6012** and **6017**) have been dated to the Late Mesolithic (SUERC-59545, SUERC-59546 and SUERC-59551), although they are all significantly different in age. The sample from timber **6006** was on heartwood and, therefore, the result (SUERC-59454: 4830-4700 cal. BC at 95% confidence) is likely to have a significant age off-set. This upright timber was identified as 'MoLA 1' and part of the identified structure from the TDP/MoLA investigation in 2010 that had returned similar early to mid-5th millennium cal BC Mesolithic dates ('MoLA 2 and 4', **Figure 4**). 'MoLA 2 and 4' are roundwood and their dates are slightly younger than the single result returned for **6006** ('MoLA 1'). Further analysis would be required to see if the results are statistically consistent and, therefore, of the same age. However, the probability that timber **6006** ('MoLA 1') is part of the same structure would appear to be quite likely.

Significantly, timbers **6012** and **6017** returned results indicating that older timbers belonging to the 6th and 7th millennium cal BC, respectively, were present in this area. Timber **6014** (roundwood) has been dated to the Late Bronze Age period (SUERC-59550: 920-800 cal. BC).

Table 5.2: Radiocarbon measurements on samples

Laboratory Code	Context & sample	Radiocarbon age BP	δ13C ‰	Calibrated date range (95% confidence)
SUERC-59297	Peat deposit **6001** <1> waterlogged stems	4455±29	-28.1‰	3340-3010 cal. BC
SUERC-59298	Peat deposit **6005** <7> A waterlogged stems	6968±29	-28.7‰	5980-5750 cal. BC
GU-37237	Peat deposit **6005** <7> B waterlogged Carex seeds	Failed sample		
SUERC-60044	Peat deposit **6005** <7> C bulk sediment	9856±29	-29.2	9330-9260 cal. BC
SUERC-59545	Timber **6006** Quercus sp. Heartwood (MoLA timber 1)	5883±26	-27.4‰	4830-4700 cal. BC
SUERC-59546	Timber **6012** bark	6197±27	-26.9‰	5230-5050 cal. BC
SUERC-59550	Timber **6014** Quercus sp. roundwood	2716±29	-28‰	920-800 cal. BC
SUERC-59551	Timber **6017** Alnus glutinosa/incana	7643±29	-27.9‰	6560-6440 cal. BC

Figure 12: Calibrated radiocarbon dates



Summary

5.2.24 All cores from the Site returned deposits associated with the present depositional environment; namely active beach deposits overlying river gravels with episodes of varying energy above London Clay.

5.2.25 We know however from previously recorded peats on the lower foreshore, together with results from context **6001** and **6005**, that there are at least some areas in which pockets of intact prehistoric land surfaces are preserved – in this case of confirmed Late Mesolithic (**6005**) and Late Neolithic (**6001**) date – with the potential to contain both archaeological and palaeoenvironmental evidence.

5.2.26 Results indicate that acidic conditions have probably been present in organic/ peaty landsurfaces **6001** and **6005**, as evidenced by the paucity of calcareous evidence (molluscs, foraminifera and ostracods), although plant macrofossils and rare molluscs were recovered.

5.3 Geoarchaeological deposit model

Introduction

5.3.1 The following sections present a sub-surface deposit model for the Site. This was constructed by extrapolating stratigraphic deposits identified within the data across the whole of the Site, including outlying points (**Appendix A.5**).

5.3.2 The results best suit examination in schematic cross section, and are displayed in the form of seven transects (A, B, C, D, E, F and G), located in **Figure 7** and shown in **Figure 8** - **9** and described in **Appendix A.4**.

5.3.3 One Digital Elevation Model (DEM) and one thickness model of the river gravels were also produced for the Site (**Figures 10** and **11**).

5.3.4 From the results of the deposit modelling, three Landscape Zones (LZs) were predicted (**Table 5.4**).

Stratigraphic Units

5.3.5 Although not all recorded directly within the Site, five major stratigraphic units are known to exist in the area of the Site. These units are summarised in **Table 5.3** below, and listed in stratigraphic order from the oldest to the most recent.

5.3.6 For deposit modelling purposes the gravel units are recorded – with the exception of active beach deposits where possible – under the collective term of ‘river gravels’. Where particular units are mapped locally this will be referred to; however, this evaluation is not designed to date or map gravel terrace deposits.

Table 5.3: Summary of stratigraphic units

Stratigraphic unit	Lithology/Description	Chronology	Environment of deposition
1. Lambeth Group	Clay, silt and sand.	Palaeogene, *c*. 56 to 66 million years ago	Swamps, estuaries and deltas
2. London Clay	Clay, silt and sand.	Palaeogene; 34 to 56 million years ago	Deep sea marine deposits
3. River gravels (including Terrace Gravels, e.g. Shepperton)	Coarse grained sands and gravels	Late Devensian, c 18–15,000 BP or Holocene	High energy river regime (e.g. cold climate braided if Kempton Park Gravels (Gibbard 1994 & Bridgland 1994))
4. Organic deposits	Organic silts, clays and peats	Holocene	Temperate climate Stabilisation/channel edge deposits
5. Alluvium	Minerogenic silts, sands and clays	Holocene – ranging from prehistoric to post-medieval	Temperate climate Channel/Channel edge/waterlogged environment
6. Active beach deposits	Sands, sandy gravels and soft muds	Broadly early medieval (Saxon) to post-medieval: probably mostly post-medieval	Tidal foreshore environment

Results

5.3.7 Schematic cross sections were produced in the form of seven transects (located in **Figure 7** and shown in **Figure 8** and **9**) which are fully described in **Appendix A.4**.

5.3.8 A river gravels DEM and thickness model (**Figures 10** and **11**) were also produced and are discussed below.

5.3.9 The interpretation of the data is also displayed as a plan-view of landscape zones (LZs) in **Figure 7** and summarised in **Table 5.4** below.

River gravels DEM (Figure 10)

5.3.1 The elevation model was constructed using all 65 deposit records. The resulting DEM indicates that across the foreshore Site the surface of the river gravels ranged from its highest at approximately 102m ATD at the top of the foreshore at the south-west end of the Site falling to its lowest at

approximately 96.27m ATD at the bottom of the foreshore in the centre of the Site.

5.3.2 In general the river gravels slope down from south-east to north-west forming the edge of the current river channel. At the north-west end of Transect A (in the river) the upper surface of the river gravels is modelled at approximately 99.4m ATD and slopes down to approximately 96.27m ATD in the vicinity of Transect C at the lower end of the foreshore before sloping up to 99.45m ATD at the north-west end of Transect G in the north-east end of the Site. This has resulted in a broad shallow sided depression within which all the organic deposits recorded during the evaluation along with the peat deposit recorded by TDP/MoLA were located. It was also within this area that the surface active beach deposits were able to be penetrated by hand auger.

5.3.3 The depression suggested by the model is unlikely to be the mouth of a former channel, but rather a small inlet or bay within the river gravels at the edge of the main river channel within which organic deposits have built up. Although its origin is presently unclear it is most probably a relic feature inherited from an earlier braided Pleistocene river system.

River gravels thickness model (Figure 11)

5.3.4 Not including the hand auger points, most of the 22 deposit records located on the foreshore reached the London Clay, though four did not. A thickness model was produced in order to display the thickness of the river gravels present between the foreshore active beach deposits and the underlying London Clay.

5.3.5 The river gravel thickness model was constructed using all 65 deposit records. From the resulting model the thickness of the river gravels was mapped as ranging from approximately 5m in thickness at the south-west corner of the Site where the upper surface was at approximately 102m ATD, to less than 100.5m ATD in the centre of the Site at the bottom of the foreshore.

Summary

5.3.6 London Clay was recorded along the foreshore in all transects except Transect E, with heights ranging from 98.28m ATD in Transect D (**WA12**) to 96.88m ATD in Transect G (**SR5007B**).

5.3.7 River gravels were recorded on the foreshore in all seven transects with heights that varied from 99.77m ATD in Transect F (**VB7014A**) to 97.87m ATD in Transect B (**WA11**) and recorded at their greatest thickness of 2.56m in Transect F (**VB7014A**). The general surface height of the river gravels reflected the course of the main river channel with the addition of a shallow depression within the centre of the lower foreshore; although its origin is presently unclear it is most probably a relic feature inherited from an earlier braided Pleistocene river system. The area of the depression encompasses the area within which organic deposits were recorded both by TDP/MoLA and Wessex Archaeology and where the active beach deposits were soft enough to allow hand augering, indicating the sheltered

nature of the depression, which has also helped preserve and protect the organic deposits recorded there.

5.3.8 No organic deposits were recorded on the foreshore in the deposit records from the transects or the cores/augerholes taken as part of this evaluation. On the landward side of the river wall in Transect A only one historic deposit record described possible organic deposits described as a 'stiff black silty clay with some organic material' 0.3m thick, at the base of the river gravels. The river gravels were described as containing some rounded brick fragments, although the depth was not stated. These rounded brick intrusions suggest the gravels may in part be post-medieval in date, and in the borehole log from 1968 the drillers had grouped everything above the 'stiff black silty clay with some organic material' as 'made ground'.

5.3.9 The deposit records on the foreshore indicate the river gravels were overlain by active beach deposits that ranged from 0.3m to 1.16m in thickness.

Landscape Zones (LZs)

5.3.1 Three major landscape zones were predicted across the Site (LZ1, LZ2 and LZ3), which are summarised in **Table 5.4** below and displayed as a plan-view in **Figure 7**.

Table 5.4: Summary of Landscape Zones

Landscape Zone	Description	Archaeological potential/ significance[iv]	Palaeoenvironmental potential/significance[v]
LZ1	Area characterised by the presence of sediments in the form of active beach deposits on the surface of the foreshore, comprised of silts, sands, and gravels, with some pockets of finer grained alluvium. Up to a maximum of 1.16m in thickness (at 98.46m ATD in Transect C).	Negligible potential for intact terrestrial strata. Probably mainly post-medieval/modern in date. High potential for evidence of post-medieval assets such as barge beds/crane base moorings and artefacts relating to industrial activity (low significance). Moderate potential for redeposited artefacts of other periods.	Moderate potential for remains of low significance within low-energy alluvial/ tidal muds

[iv] The significance level is determined using the criteria in Section 7 of ES Vol 2 Methodology

[v] Ibid.

Landscape Zone	Description	Archaeological potential/ significance[iv]	Palaeoenvironmental potential/significance[v]
LZ2	Area characterised by periods of stabilisation promoting peat formation after periods of marine inundation. Organic peats, silts, and clays, of variable prehistoric date, where recorded. Recorded to be up to maximum of 0.4m in thickness (**6001** C14 dated to middle Neolithic and **6005** C14 dated to later Mesolithic). Underlying LZ1, though exposed at time of walkover survey. Overlying thin alluvial deposit (**6002**), above London Clay	High potential for prehistoric terrestrial deposits that may contain evidence of occupation/ dry-land activity including late Mesolithic probable timber structure and any artefacts within such deposits (High significance).	High potential for remains of high significance
LZ3	Undifferentiated river gravel units (Kempton Park are mapped locally). This river gravel units may include low energy silts and sands as well as high energy gravel sediments. Where recorded, ranging from 0.27m to 2.56m in thickness (100.23m ATD in Transect B). Earlier phases of LZ3 can underlie LZ2, and in turn more recent deposits of LZ3 or reworked older LZ3 deposits can overlie LZ2.	Lower energy silts within Holocene river gravels could preserve Holocene waterlogged archaeological remains (such as the Bronze Age timber structure of high significance). Pleistocene river gravel likely to be present in lower river gravels, negligible potential for archaeological remains.	Low palaeoenvironmental potential

5.3.2 LZ1 is mapped over the entire area of the foreshore, to the north-west of the river wall (**Figure 7**). Comparison of the modern foreshore profile based on bathymetric data with borehole records located on the foreshore has shown that there has been no or little change in the level of the active beach deposits in the time since the boreholes were drilled and the bathymetric survey was undertaken (Wessex Archaeology 2014; TTT document reference forthcoming).

5.3.3 LZ2 was recorded in two small areas within the centre of the lower foreshore. One area recorded as a grey brown organic clay (**6005**) measured approximately 4m by 4m was located immediately to the east of a peat deposit recorded by TDP/MoLA and is probably an extension of that same deposit. A second smaller area recorded as a grey brown organic sandy clay (**6001**) approximately 2m by 2m was located approximately 25m to the north-east of **6005**.

5.3.4 LZ3 is mapped over the majority of the Site with the exception of areas of the lower foreshore, where the active beach deposits directly overlay the London Clay. Presumably as the river gravels in this area have been scoured away by fluvial action. The LZ3 deposits ranged in thickness from 0.27m to 2.56m.

5.4 Overall reliability of the results

5.4.1 The data quality of the parametric sonar survey was defined as **average**. Despite the presence of Vauxhall Bridge in the south-west of the Site, full planned data coverage was obtained.

5.4.2 The walkover survey at the Site was successfully completed although because of the limit of low tide at the time of the survey the majority of the peat and most of the timbers of the Late Mesolithic structure previously identified by TDP/MoLA in 2010 lay west of the surveyed walkover area.

5.4.3 The mechanical coring was completed with moderate success with seven out of the twelve boreholes (including vibrocores) penetrating through the river gravels to the London Clay below. The twelve hand auger points only penetrated the active beach deposits to a maximum depth of 0.43m and were only possible on a 65m stretch of the lower foreshore, due to impenetrable active beach deposits elsewhere.

5.4.4 The density of deposit records used in the deposit modelling varied with the majority of the records located around the centre of the foreshore. The accuracy of the predictive model is likely to be satisfactory regarding the distribution and thicknesses of the major units.

6 Archaeological potential and significance

6.1 Review of aims and objectives

Site specific questions

6.1.1 Drawing on the results presented in Section 4 and Section 5, the following is concluded in relation to each of the objectives detailed in para 1.3.3:

a. What is the topography of the foreshore at present, and how does this change over time (scour, sedimentation etc.)?

6.1.2 Bathymetry data has been assessed as part of the ongoing condition monitoring programme of the foreshore Sites. This programme compares foreshore topographical data to evaluate the rate and significance of sediment erosion and deposition at each Site (ongoing alluvial processes) to show the effects on any buried archaeology that may be present. The results of the first monitoring report (Wessex Archaeology 2014; TTT document reference forthcoming) conclude that between October 2013 and March 2014, a relatively large amount of sediment movement has occurred within the Site (*ibid.* section 3.7).

6.1.3 Up to+0.6m of sediment has accumulated against sections of the embankment wall, especially in the area around the extent slipway, in the centre of the foreshore Site. Two natural sedimentary features, ridges of sediment running approximately parallel with the embankment, have also increased in height by up to +0.6m during this time, and there has been a slight accumulation of sediment (up to +0.25m) around the pier bases of Vauxhall Bridge.

6.1.4 One area of erosion was identified, and is located approximately at the low water mark in the locality of PS feature 7502, where erosion of up to -0.4m has occurred (*ibid*) and may have affected the said feature. Although this small area of erosion is the only presently identified and it is located *c.*80m to the north of the Late Mesolithic probable structure and associated peat deposit, given the similar location i.e. near the low water mark, the erosion indicated is significant and suggests that these nationally significant Mesolithic remains, and other regionally significant prehistoric remains, may be at risk from future erosion within this dynamic riverine environment.

b. What is the depositional sequence at the Site?

6.1.5 Surface active beach deposits ranging in thickness up to 1.16m thick are present across the foreshore of the Site, and ranged in surface height from 100.67m ATD in Transect F in the north-east of the Site to 98.17m ATD in Transect B in the south-west of the Site.

6.1.6 Underlying the active beach deposits, river gravels (with evident low energy episodes as well as high) were identified across the Site up to 2.56m deep with an approximate surface height that ranged from 100.23m to 97.87m ATD. A broad shallow sided depression was identified from the

river gravels DEM in the central foreshore, although its origin is presently unclear it is most probably a relic feature inherited from an earlier braided Pleistocene river system. It was within this depression that localised pockets of organic deposits were recorded during the walkover and where the peat deposit recorded by TDP/MoLA was located. It was also within this area that the surface active beach deposits were able to be penetrated by hand auger, which recorded low energy clays considered to probably represent active beach deposits accumulation.

6.1.7 Organic deposits were only encountered in two small areas within the centre of the lower foreshore during the walkover survey, and underlie the active beach deposits (though exposed at the surface at the time of the survey). One area (**6005**) was located immediately to the east of more extensive peat deposits previously recorded by TDP/MoLA within the Site and is probably an extension of that same deposit. A second area (**6001**) was located *c.*25m to the north-east of **6005**. A thin deposit of sandy clay alluvium (**6002**) was also recorded beneath the localised patch of organic deposit (**6001**) above the London Clay.

6.1.8 The river gravels overlay London Clay which was recorded at an approximate height that ranged from 98.17 to 97.6m ATD.

c. Is there any evidence for the survival of deposits of palaeoenvironmental significance?

6.1.9 During the walkover two bulk samples were taken for palaeoenvironmental assessment from peaty deposits (**6001** and **6005**). Assessment of the samples has revealed some plant macrofossils, sub-sampled for obtaining radiocarbon dates, and rare molluscs but a paucity of other calcareous evidence (foraminifera and ostracods). However, the results indicate palaeoenvironmental potential in localised pockets of organic deposits and this is potentially regionally significant for the early Holocene.

d. What is the nature and context of the possible Mesolithic Structure?

6.1.10 Only the easternmost timber of six known timbers of the Late Mesolithic possible structure was within the extent of the walkover survey, due to the available foreshore revealed by the low tide at the time. This timber (**6006**) was an upright timber and is equivalent to that previously surveyed by MoLA/TDP investigation as 'MoLA1' (**Figure 4**), although they had previously obtained radiocarbon dates from two other timbers, this one had not been sampled.

6.1.11 The sample from timber **6006** was on heartwood and, therefore, the result (4830-4700 cal. BC at 95% confidence) is likely to have a significant age off-set. 'MoLA 2 and 4' are roundwood and their radiocarbon dates are slightly younger than the single result returned for **6006** ('MoLA 1'). Further analysis would be required to see if the results are statistically consistent and, therefore, of the same age. However, the probability that timber **6006** ('MoLA 1') is part of the same structure would appear to be likely.

6.1.12 Specialist wood assessment of the timber has determined that it is oak heartwood, and may originally have been a limb or branch. The timber is

in moderate condition and the only possible evidence of woodworking is one somewhat angular face. The upright position of the timber and finding that the base of **6006** was directly within London Clay (at *c*.97.64m ATD) without any indication of a posthole cut has led to the assumption that it is a driven pile and given its context with the surrounding approximately contemporary timbers, part of the same probable structure. This evaluation has not; however, been able to gain sufficient information to be able to determine the nature or purpose of this structure.

6.1.13 Organic deposit (**6005**) measuring approximately 4m by 4m in area and 0.4m in thickness was exposed very briefly at low tide c.7m to the north-east of the Mesolithic timber structure at *c*.97.7m ATD (**Figure 4**). It consisted of a mid-greyish brown clay with evident organic remains, interpreted as an organic stabilisation horizon or possible land surface that could be the eastern extension of that previously surveyed by TDP/MoLA (**Figure 4**). Two sub-samples on waterlogged plant remains from the same bulk sample taken from **6005** sent for radiocarbon dating returned Mesolithic dates of 5980-5750 cal. BC, and a significantly earlier 9330-9260 cal. BC, both at 95% confidence; it is possible that the latter included old material and, therefore, the former may be closer to the true age of the peat. Although there was no stratigraphic relationship between timber **6006** and this peat, the westernmost timbers of the structure may have a relationship with the more extensive area of peat surveyed by TDP/MoLA that lies wholly within the Site, although as this lay beyond the limit of the walkover survey at the time.

e. Does evidence survive that may be associated with the construction of extant post-medieval heritage assets (Lack's Dock, Vauxhall Bridge etc.)?

6.1.14 No new assets were revealed during the walkover survey that can be associated directly with either Lack's Dock or Vauxhall Bridge, though it remains possible that such assets could potentially be buried within the active beach deposits. However, assets of probable post-medieval date were surveyed on the surface of the foreshore such as the remains of an extensive barge bed in the north of the Site (**6009**) with a possibly associated crane base (**6011**) and mooring timber (**6010**).

f. Is there any evidence of prehistoric to post-medieval activity on the Site?

6.1.15 In addition to the Late Mesolithic timber probable structure and associated peat deposit discussed above, this evaluation has discovered other new significant prehistoric assets exposed on the surface of the foreshore at the time of the walkover survey, as detailed below, as well as known post-medieval assets.

6.1.16 Two additional Late Mesolithic upright timbers were newly recorded on the central lower foreshore (**6012** and **6017**, **Figure 5**). Radiocarbon dates obtained are 5230–5050 cal. BC and 6560–6440 cal. BC respectively, significantly suggesting that older Mesolithic timbers; in comparison to the previously discussed Late Mesolithic structure, are present within the Site. The specialist wood assessment of **6017** [note **6012** was only a sub-

sample of bark] has determined it to be roughly a third of a tangentially aligned outer chord of a large, alder timber, though the high levels of water wear raise the possibility that this could be caused by taphonomic processes. The flat base of the timber suggests that the item has been cross cut, although it is possible that this is a result of differential degradation. It is therefore presently inconclusive as to whether these Late Mesolithic timbers represent set posts or the eroded remains of natural *in situ* wood.

6.1.17 A small pocket of peat (**6001**, **Figure 5**) exposed on the lower central foreshore of the Site has been radiocarbon dated to the Middle Neolithic (3340–3010 cal. BC). Although no artefacts or timbers recovered during this evaluation were dated to the Neolithic, this would appear to be significant given the previous Neolithic pottery and other artefacts of this period recovered in the vicinity during previous foreshore surveys (2.2.3 above).

6.1.18 A north-west to south-east alignment of four upright timbers on the central lower foreshore representing a Late Bronze Age structure (**Figure 5**) is a new significant discovery given the known Bronze Age and Iron Age Vauxhall timber structures recorded just upstream of Vauxhall Bridge (2.3.2 above),; as well as the contemporary metalwork artefacts previously discovered in the locality. One of these timbers (**6014**) returned a radiocarbon date of 920–800 cal. BC (Late Bronze Age) and the specialist wood assessment identified this timber as an oak roundwood tapered stake with clearly visible small, concave tool facets that can be indicative of the use of a bronze tool. It is hypothesised that the new structure within the Site may have served a similar function to the known remains of an Early Iron Age fish trap upstream of Vauxhall Bridge, given the size of the stakes and their angled orientation to the foreshore.

6.1.19 The post-medieval assets recorded are discussed in question e above. All of the dateable artefacts recovered from the walkover survey were of post-medieval date.

g. What is the character, date, condition and significance of deposits encountered?

6.1.20 The deposits on the foreshore consist of surface active beach deposits up to 1.16m in thickness; these are mainly of post-medieval date (though may contain older artefacts that have been reworked by fluvial processes) and some low significance assets of this date are evident on the foreshore surface, e.g. barge bed, crane base and mooring block.

6.1.21 The deposits that are classed as river gravels not only cover a range of fluvial environments from high energy sands and gravels to low energy silts and clays, but can also span considerable lengths of time. This time span includes Pleistocene/early Holocene river terrace deposits such as the Kempton Park gravels all the way to post-medieval river gravels with a corresponding input of post-medieval debris, within which earlier artefacts may be reworked. The lower energy deposits within this category are significant as they have the potential to preserve waterlogged

archaeological and palaeoenvironmental remains, as indicated by the recorded Late Bronze Age structure.

6.1.22 Earlier river gravels of Pleistocene/early Holocene date have been identified on the Site from overlying discreet areas of organic deposits (**6001** and **6005**). Radiocarbon dates obtained from samples of these organic deposits has dated them as Middle Neolithic and late Mesolithic respectively.

6.1.23 The pockets of organic deposits surviving are of high significance as they have the potential to contain further early Holocene archaeological and palaeoenvironmental remains. This is particularly relevant for the late Mesolithic peat, which is a probable eastern extension of that previously investigated by TDP/MoLA and is likely associated with the probable timber structure also radiocarbon dated as Late Mesolithic, of which one timber was recorded and lifted during this evaluation.

h. What is the extent of archaeological survival across the Site?

6.1.24 Organic deposits (some with an underlying thin alluvium layer) were only recorded during this evaluation by the walkover survey in two discreet patches, although one is likely an extension of a peat deposit known to continue beyond the limits of the walkover survey (**Figure 4**). From the modelling of the river gravels surface these would seem to be located within and confined to a shallow depression, at the edge of the present channel within the central foreshore of the Site. There is therefore the potential for other localised area of organic deposits and further waterlogged archaeological remains to be buried below active beach deposits within this depression (**Figure 10**).

6.1.25 Archaeological survival is likely to be locally affected in the south-west of the Site by the construction of Vauxhall Bridge, which has likely removed any earlier buried archaeological remains within this locality. Similarly, the construction of the river wall and Lack's Dock may have locally impacted on earlier buried archaeological remains along a narrow corridor on the eastern side of the Site.

i. What is the (seasonal) influence of tidal patterns and storm events on the archaeology of the foreshore?

6.1.26 Ongoing conditioning monitoring of the Site will provide a detailed assessment of tidal and storm event influences on the archaeology in due course. Results are scheduled to be provided on a quarterly basis over the 2014/2015 assessment period, dependent on the rate of third-party resurvey.

6.2 Predicted archaeological survival

6.2.1 The results of this evaluation indicate the following predicted archaeological survival:

- Surviving Late Devensian and Holocene deposits sequences may provide a record of environmental change and local palaeotopography;

- Discrete pockets of organic probable land surfaces of at least two periods (individually radiocarbon dated to Late Mesolithic and Middle Neolithic) containing palaeoenvironmental remains and potentially archaeological remains (the former may have relationship with the known Late Mesolithic structure discussed below);

- Probable timber structure of Late Mesolithic date (confirmed by a further radiocarbon date as part of this evaluation), the known elements of which lie wholly within the Site (likely associated with one of the above mentioned peat deposits);

- Further older Mesolithic timbers (radiocarbon dated) evident on the lower foreshore, though inconclusive whether these are natural or anthropogenically formed;

- Linear timber structure confirmed by radiocarbon dating undertaken as part of this evaluation to be of Late Bronze Age;

- Post-medieval structures of barge bed, crane base and mooring timber (possibly with group value) and industrial waste from local glass/pottery industry; and

- Post-medieval remains associated with the construction of Vauxhall Bridge, river walls and Lack's Dock, although not evidenced during this evaluation, are possibly buried within active beach deposits.

6.2.2 In summary, predicted archaeological survival broadly reflects previous anticipated levels described in the OAWSI and ES (as summarised in Section 2 above). The overall potential for archaeological survival remains **High**.

6.3 Significance

OAWSI assessment of significance

6.3.1 Based on the results of the survey techniques employed to evaluate Albert Embankment Foreshore, the overall significance of the archaeological potential of the Site is deemed to be **High** in relation to the identified research aims (OAWSI).

6.3.2 The main areas of significance are:

- Probable timber structure of Late Mesolithic date, in association with Mesolithic land surface;

- Discrete areas of organic probable land surfaces, one identified as Mesolithic (above) and another dated to Middle Neolithic, may provide evidence of prehistoric occupation, as well as a record of environmental change; and

- Timber structure dating to the Late Bronze Age;

Significance of the Site

6.3.3 With regard to *Conservation Principles, Policies and Guidance* (Historic England 2015), the results of the evaluation have been considered against the key criteria of Evidential, Historical, Aesthetic and Communal Value, to identify the significance of the Site's archaeology and to determine whether as undesignated assets the remains might be deemed of equal significance to designated assets.

6.3.4 Evidential Value: The Site has demonstrable evidential value, in the form of a Late Mesolithic probable timber structure with possibly associated Mesolithic land surface. Remains of this date are rare within London, and given the evidence collected during this evaluation this strengthens the case for it potentially being London's oldest structure (Milne *et al* 2012). Indeed, timber structures of this period are rare across the country, and therefore this is nationally significant. A Late Bronze Age timber structure is also of high value given the previously investigated Bronze Age jetty or bridge downstream of the TTT Site south-east of Vauxhall Bridge. The finding of another probable land surface of Middle Neolithic date indicates the potential for further evidence of prehistoric activity/occupation. These prehistoric remains may provide evidence for the nature of communities, which exploited the river and floodplain, local patterns of movement, and the environment in which people lived. Other post-medieval remains on the foreshore surface relating to barge beds and cranes, although are of interest in providing evidence of industry and trade along the Thames are of low significance. However, overall evidential value is therefore considered to be of high significance.

6.3.5 Historical value, in the context of the Thames foreshore, the development of the nation's capital, and reliance on sea-faring trade throughout time should be considered of high value. Bazalgette's remodelling of Albert Embankment is of high value, but this does not extend as far south as the Site, reflected by the current embankment wall, which is of low value, and the sewer outflows on the foreshore are part of two different schemes, although of moderate value. Vauxhall Bridge itself is of national significance, yet there is presently no evidence of archaeological remains that relate to the construction of this bridge within the Site. Similarly no archaeological remains have been presently encountered on the foreshore that relate to the construction of the 19th century Lack's Dock or the earlier 18th Vauxhall Stairs themselves of local and regional significance respectively. Historical value overall is therefore considered to be of regional to national significance.

6.3.6 Although Londoners, and the many millions of visitors to the city each year, draw great comfort and inspiration from the River Thames, and the built heritage that defines its course, the archaeology of the Albert Embankment Foreshore might be considered of limited aesthetic value. As such, aesthetic value is deemed to be of local significance.

6.3.7 Communal value, and specifically social value, for the foreshore with those that relied on it, worked on it, interacted with it and lived alongside it (as with, for instance, the London docks) was formerly high. In more recent times, many factors (not least technology, trade, economics etc.) have

seen communities change, trades relocate, and traffic reduce, to a point that communal value must be considered relatively low (certainly by comparison). Communal value is therefore considered to be of local significance.

6.3.8 In conclusion, specific aspects of the Albert Embankment Foreshore heritage are certainly considered to be of equal significance to designated assets in relation to its historical and evidential value. However, when considering its overall collective value, the Site is deemed to be of regional significance only.

6.4 Discussion

6.4.1 This evaluation, whilst confirming the overall high potential and high significance of the ALBEF Site, in relation to its prehistoric timber structures and deposits, has also highlighted the likely nature of the deposit sequence: with up to *c.*1m of surface active beach deposit, pockets of prehistoric probable land surfaces up to 0.4m thick of variable dates (both Late Mesolithic and Middle Neolithic), river gravels 2.5m thick, above London Clay.

6.4.2 None of the cores, hand auger points or deposit modelling transects indicated the presence of organic deposits representing significant prehistoric land surfaces, this was only ascertained by exposed areas recorded during the walkover survey. This does suggest these peaty deposits are limited in extent, although there remains the potential for further such pockets to be buried below the active beach deposits within an identified depression noted in the modelled surface of the river gravel.

6.4.3 This broad shallow sided depression, though its origin is presently unclear, is most probably a relic feature inherited from an earlier braided Pleistocene river system. As a palaeotopographic feature, it could be important for understanding the context of identified and potentially buried prehistoric archaeological remains within the Site, as all the identified pockets of peat remains and timber structures lie within this area on the central foreshore of the Site.

6.4.4 There are assets recorded in other areas of the Site, mainly considered to be of post-medieval date. Structural post-medieval remains are recorded in the north-east of the foreshore, although these are of low significance. Other post-medieval assets of higher significance, relating to the construction of Vauxhall Bridge and Lack's Dock could potentially be buried within active beach deposits in the south-east and eastern extents of the Site.

6.4.5 This evaluation has shown the potential significance of the Site to contribute towards the Route-wide Heritage Themes (RWHTs). Dependent on the results of any proposed mitigation work, these Themes can now be revised in the light of the evaluation to include :

- Theme 1: Palaeoenvironment and prehistory;
- Theme 3: River management, transport, infrastructure and trade;
- Theme 4: London's water systems and public health.

6.4.6 Future interpretation is likely to focus on the first RWHT to highlight the proximity of the proposed foreshore structures to the prehistoric structures on the foreshore, and dependent on the results of future mitigation, to examine how past human populations utilised/occupied the landscape within the changing floodplain environment.

7 Predicted impacts and recommendations

7.1.1 The works at ALBEF are required to intercept the existing CSOs from the Clapham Storm Relief Sewer and Brixton Storm Relief Sewer. Two cofferdam areas would be constructed one either side of Lack's Dock: the one to the north to provide a construction platform to build a CSO drop shaft and an air treatment chamber; and the one to the south to construct a combined interception chamber and connection culverts to the Clapham and Brixton Storm Relief Sewers. The shaft would be connected to the main tunnel by a short connection tunnel under the river (SSAWSI).

7.1.2 The following predicted impacts of the proposed works have been identified:

- Deep excavations within and around the footprint of the two temporary and permanent cofferdams including access ramp; construction of a temporary campshed adjacent to the northern cofferdam; deep excavations associated with the construction of CSO shaft and associated chambers and connection culverts; and scour around temporary structures will have a direct impact on any surviving archaeological and palaeoenvironmental remains described in section 5.2 above.

7.1.3 The impact of localised works associated with site set-up (service diversions, the establishment of hoarding and welfare facilities) is not considered within the scope of this report as (following the SSAWSI) this evaluationwas focused on the inter-tidal zone west of the present river wall. Similarly, the impact of the demolition of above-ground standing structures including the existing sewer outflows (including dolphins, storm flaps, and granite cobbled slipways) and parts of the existing river wall in the south of the Site and part of the northern parapet wall of Lack's dock were also not considered.

7.1.4 It is recommended that targeted archaeological survey, investigation and recording, including geoarchaeological/ palaeoenvironmental sampling, be undertaken within the area of the temporary cofferdams and foreshore ground works to record *in situ* prehistoric (including the Mesolithic timber structure, Bronze Age timber structure and localised peat deposits) as well as post-medieval assets.

7.1.5 Monitoring of scour effects and implementation of scour protection measures should also be considered.

7.1.6 Further to the recommendations set out above, mitigation options will be reviewed and developed in detail with the main works contractor, during the detailed design phase. The proposed mitigation strategy will then be set out in a SSAWSI, to be submitted to and approved by the HMBCE Advisor prior to the commencement of any on-site enabling and construction work.

Appendix A: Specialist reports

A.1 Parametric sonar survey

Table A.1.1: Parametric sonar survey: features of archaeological potential

WA ID	Name / Classification	Archaeological Discrimination	Description
7500	Coarse Sediment Layer	P1	Distinct sub-horizontal reflector identified on a number of survey lines, though reduced penetration in the area close to shore means the layer cannot be traced far. Possible layer of Pleistocene gravel, as seen at similar depth in core VB7028. Depth Range: 1.4m - >2.0m below river bed.
7501	Complex Cut and Fill	P2	Possible very shallow cut and fill feature containing two phases of fill, though feature was only identified on two survey lines and is uncertain. Depth to base of feature correlates with thin alluvium deposit identified in core VB7028. Possible alluvium deposit layer within foreshore deposits, though age unknown. Depth Range: 0.2m - 1.2m below river bed.
7502	Infilled Depression	P2	Small, possible Infilled depression in top of London Clay. Poorly defined and only identified on one survey line. Filled with sediments of unknown age. Depth Range: 0.1m - 0.7m below river bed.
7520	Mound	A2	Large but poorly defined mound located on the riverbed. Possibly corresponds with a feature seen in the multibeam bathymetry data, though this is unclear. Likely to be a natural feature, though could be anthropogenic in origin.
7521	Mound	A2	Distinct mound located on the rverbed. Possibly corresponds with a feature seen in the multibeam bathymetry data, though this is unclear. Likely to be a natural feature, though could be anthropogenic in origin.

A.1 Finds

Table A.2.1: Targeted walkover survey: all finds

Site Code	Context	Object No	Material Type	Object Type	Number	Weight (g)	Comments	Pot Fabric Code	Pot Form Code
TTI 14	6000		Animal Bone	animal bone	2		very large cattle ribs, sawn		
TTI 14	6000		Animal Bone	animal bone	1		cattle lumbar vertebrae, sawn		
TTI 14	6000		Animal Bone	animal bone	1		cattle radius shaft		
TTI 14	6000		Animal Bone	animal bone	1		sheep rib		
TTI 14	6000		Animal Bone	animal bone	1		sheep radius, gnawed		
TTI 14	6000		Animal Bone	animal bone	1		sheep scapula		
TTI 14	6000		Animal Bone	animal bone	1		chicken humerus, from young chicken		
TTI 14	6000		CBM	drainpipe	1	95	Drain pipe end fragment with deep , moulded grooves and red-brown glaze		
TTI 14	6000		Clay Pipe	stem	1	5	Unidentifiable stem		
TTI 14	6000	6	Flint	VOID	1	35	Unworked - Discarded		
TTI 14	6000	9	Flint	VOID	1	77	Unworked - Discarded		
TTI 14	6000		Flint	VOID	1	6	Unworked - Discarded		

Site Code	Context	Object No	Material Type	Object Type	Number	Weight (g)	Comments	Pot Fabric Code	Pot Form Code
TTI 14	6000		Glass	bottle	2	43	2 x clear blue-green glass stoppers, one with cork surviving.		
TTI 14	6000		Iron	uncertain	1	38	Curved flat, thin strip, possibly from a spur		
TTI 14	6000		Iron	uncertain	1	131	Circular rod with bent end ,ending in a ball-shaped terminal		
TTI 14	6000		Iron	nail	1	46	Flat, rectangular nail with bulbous square head		
TTI 14	6000		Iron	nail	2	87	2 x flat-bodied nails with flat rectangular heads		
TTI 14	6000		Iron	nail	1	47	Probably a nail with square body and rectangular head. Top half obscured by corrosion products		
TTI 14	6000	8	Iron	axe	1	732	axe-head		

Site Code	Context	Object No	Material Type	Object Type	Number	Weight (g)	Comments	Pot Fabric Code	Pot Form Code
TTI 14	6000		Other Metal	keys	1	29	Bunch of keys. One key is from a Chubb mortice lock, the other is a Yale-type key marked JMA Spain on one side and 1A SKS on the other. Held on a thin wire key ring with the remains of a green plastic tag		
TTI 14	6000		Plastic	miscellaneous	3	13	1 x ID card, 1 x EHIC card, 1 x laminated VIP Guest ticket for Synergy at The Fridge, Brixton, 2002.		
TTI 14	6000		Pottery	base sherd	1	311	bunghole spout, just above base	ENGS	CIST,PPOT
TTI 14	6000		Pottery	base sherd	1	47		SELZ	BOT,PPOT
TTI 14	6000		Pottery	rim sherd	1	23		ENGS BRST	BOT,PPOT
TTI 14	6000		Pottery	body sherd	1	49		ENGS BRST	
TTI 14	6000		Pottery	body sherd	1	31	cylindrical bottle or jar	ENGS BRST	
TTI 14	6000		Pottery	base sherd	1	18		ENGS	
TTI 14	6000		Pottery	rim sherd	1	21	narrow-mouthed jar, ochre-dipped	ENGS BRST	JAR,PPOT
TTI 14	6000		Pottery	body sherd	1	27	ochre-dipped	ENGS BRST	

Site Code	Context	Object No	Material Type	Object Type	Number	Weight (g)	Comments	Pot Fabric Code	Pot Form Code
TTI 14	6000		Pottery	rim sherd	1	21	narrow-mouthed jar, ochre-dipped	ENGS BRST	JAR,PPOT
TTI 14	6000		Pottery	rim sherd	1	39	ink bottle with pourer	ENGS BRST	INK,PPOT
TTI 14	6000		Pottery	rim sherd	1	30	upright rim, unglazed	PMR	
TTI 14	6000		Pottery	body sherd	1	13	glazed int	PMR	
TTI 14	6000		Pottery	rim sherd	1	8		PMR	FLP,PPOT
TTI 14	6000		Pottery	base sherd	1	19		REFW	
TTI 14	6000		Pottery	rim sherd	1	32	Late white-slipped ware	PMR	BOWL,PPOT
TTI 14	6000		Pottery	handle	1	16		REFW	
TTI 14	6000		Pottery	base sherd	1	21		REFW	
TTI 14	6000		Pottery	body sherd	1	5		REFW	
TTI 14	6000		Pottery	body sherd	1	5	backstamp: Smith & Co Conduit St London; Simpsons / Strand / Divan	REFW	
TTI 14	6000		Pottery	base sherd	1	40	probably teapot	REFR	
TTI 14	6000		Pottery	body sherd	1	9	Greek key & ovolo print	TPW4	
TTI 14	6000		Pottery	rim sherd	1	8		TPW3	PLAT,PPOT
TTI 14	6000		Pottery	rim sherd	1	4		TPW	PLAT,PPOT
TTI 14	6000		Pottery	rim sherd	1	20	heavy rim	TPW	BOWL,PPOT
TTI 14	6000		Pottery	base sherd	1	3	flatware	TPW	
TTI 14	6000		Pottery	body sherd	1	5		TPW	
TTI 14	6000		Pottery	body sherd	1	9		TPW5	

Site Code	Context	Object No	Material Type	Object Type	Number	Weight (g)	Comments	Pot Fabric Code	Pot Form Code
TTI 14	6000		Pottery	base sherd	1	25		YELL	
TTI 14	6000		Pottery	rim sherd	1	8		PMR	
TTI 14	6000		Pottery	rim sherd	1	102	large, heavy-rimmed bowl/crock	PMR	BOWL,PPOT
TTI 14	6000	7	Pottery	rim sherd	1	53	unglazed	PMR	BOWL,PPOT
TTI 14	6000		Shell	shell	1	21	Oyster shell, left hand valve, unmeasureable		
TTI 14	6000		Shell	shell	1	32	Oyster shell, right hand valve, measureable. Deliberate circular hole cut into top half.		
TTI 14	6000		Shell	shell	1	28	Partial scallop shell.		
TTI 14	6000		Slag	slag	1	55			
TTI 14	6000	10	Slag	slag	1	31			

A.2 Geoarchaeological sediment descriptions

Table A.3.1: Vibrocore VB7014 sediment description table

Location:	530308.46 178258.22	**BH:**	VB7014	**Comments: TTT Albert Embankment Borehole 7014**		
Level (top):	0.56m OD					
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-0.28	0.56 – 0.28			GAP (compression)	GAP (compression)	
0.28-0.68	0.28 – -0.12			10YR 3/4 dark yellowish brown coarse sand with gravel and some brick. Poorly sorted. Sharp boundary.	Active beach deposits	Foreshore
0.68-0.83	-0.12 – - 0.27			10YR 2/1 black sand with gravel and some brick. Sand less coarse than above. Wet and slightly silty, poorly sorted. Abrupt boundary	River gravels	Fluvial sandy gravels
0.83-1.00	-0.27 – -0.44			5Y 3/1 very dark grey coarse sand with gravel and marine shell- mussel. Poorly sorted.	River gravels marine shell.	

Table A.3.2: Vibrocore VB7014A sediment description table

Location:	530309.81 178257.64	**BH:**	VB7014A	**Comments: TTT Albert Embankment** Borehole 7014A		
Level (top):	0.67m OD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-0.14	0.67 – 0.53			GAP (compression)	GAP (compression)	Fluvial sandy gravels and beach deposits, alternating high energy and low energy events with possible anaerobic conditions.
0.14-0.44	0.53 – 0.23			10YR 3/2 very dark greyish brown sandy gravel with brick/cbm. Poorly sorted, gravel <4cm. Sharp boundary.	Active beach deposit	
0.44-0.74	0.23 – -0.07			10YR 2/1 black stained sandy gravel. Moderately well sorted, gravel <4cm. The matrix, which is fairly wet, almost watery, is stained rather than the actual sand grains and gravel. Abrupt boundary.	River gravels Stained due to ?anaerobic conditions	
0.74-0.86	-0.07 – -0.19			5Y 4/3 olive sandy gravel. Poorly sorted with gravel size smaller than above <1.5cm. Sharp boundary.	River gravels	
0.86-1.00	-0.19 – -0.33			5Y 4/3 olive slightly silty sand (fine sand/coarse silt) much finer than above. Faint horizontal laminations towards the bottom. Stone free.	River gravels, low energy, with inwashes.	
1.00-1.15	-0.33 – -0.48			GAP (compression)	GAP (compression)	
1.15-2.60	-0.48 – -1.93			2.5Y 5/4 light olive brown sand with occasional patches of 5Y 2.5 black. Again, the matrix seems to be stained rather than the actual sand grains. Stains the fingers. There is a horizontal band of this staining at the bottom 2.58-2.60. Very sharp boundary.	River gravels Stained due to ?anaerobic conditions, with inwashes	

Location:	530309.81 178257.64	**BH:**	VB7014A	**Comments: TTT Albert Embankment** Borehole 7014A	
Level (top):	0.67m OD	**Drg:**			
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**
Mono	mOD				
2.60-2.73	-1.93 – -2.06			5Y 4/4 olive fine sand and coarse silt, laminated with the siltier element towards the top, becoming sandier down profile. Two 1mm wide bands of dark grey clay at 2.70 and 2.73, the sand in between these bands is darker, 5Y 3/1 very dark grey. Stone free. Very sharp boundary.	River gravels with low energy inwashes.
2.73-2.81	-2.06 – -2.14			10YR 3/1 very dark grey clay with small mottles of 5Y 4/3 olive towards the top. Massive, soft, stone free, no pores observed. Very sharp boundary.	Low energy alluvial deposit within river gravels.
2.81-2.94	-2.14 – -2.27			10YR 2/1 black stained sandy gravel. Slight metallic smell. Stains fingers. Again, it appears that the matrix is black rather than the sand grains or gravel. Poorly sorted. Sharp boundary.	River gravels
2.94-3.00	-2.27 – -2.33			2.5Y 4/3 olive brown sandy gravel. Poorly sorted.	River gravels

Table A.3.3: Vibrocore VB7015 sediment description table

Location:	530326.86 178287.29	**Mono:**	VB7015	**Comments: TTT Albert Embankment Borehole 7015**	
Level (top):	0.92m OD	**Drg:**			

Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-0.45	0.92 – 0.47			GAP (compression)	GAP (compression)	
0.45-0.75	0.47 – 0.17			Clast supported sandy gravel, poorly sorted, clast size <4cm. Becomes more mixed in with 10YR 3/1y dark grey silty clay with some fine sand towards the bottom. Clear boundary	Active beach deposit	Fluvial sandy gravels and beach deposits, alternating high energy and low energy events with possible anaerobic conditions.
0.75-0.85	0.17 – 0.07			7.5YR 2.5/1 black soft sticky silty clay with quartz sand grains. Faint horizontality, stone free. Abrupt boundary	Low energy alluvial deposit at top of river gravels	
0.85-1.00	0.07 – -0.08			10YR 2/1 black stained sandy gravel. Moderately well sorted, gravel <4cm. Stains fingers, slight metallic smell.	River gravels deposit Stained due to ?anaerobic conditions	
GAP				GAP (compression)	GAP (compression)	
1.34-1.67	-0.42 – -0.75			10YR 4/6 dark yellowish brown sandy gravel. Fairly well sorted, clast size <1cm. Inwashes of 10YR 3/1 very dark grey stone free sand at 1.52-1.57 and 1.65-1.67. Sharp boundary.	River gravels with low energy alluvial inwashes.	
1.67-1.79	-0.75 – -0.87			2.5Y 4/1 dark grey fine sand/coarse silt with a faint horizontality to it. Stone free. Sharp boundary.	Low energy river gravel/alluvial deposit.	
1.79-1.87	-0.87 – -0.95			2.5YR 2.5/1 black stained sandy gravel. Moderately well sorted, clast size <4cm. Stains fingers, metallic smell. Sharp boundary.	River gravels, Stained due to ?anaerobic conditions	

Location:		530326.86 178287.29	**Mono:**	VB7015	**Comments: TTT Albert Embankment Borehole 7015**	
Level (top):		0.92m OD	**Drg:**			
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
1.87-1.91	-0.95 – -0.99			2.5Y 5/2 greyish brown clay. Massive, slightly firm, stone free. Sharp boundary.	Very low energy river gravel/alluvial deposit.	
1.91-2.00	-0.99 – -1.08			2.5YR 2.5/1 black stained sandy gravel. Moderately well sorted, clast size <4cm. Stains fingers, metallic smell. Sharp boundary.	River gravels Stained due to ?anaerobic conditions	

Table A.3.4: Vibrocore VB7027 sediment description table

Location:		530241.24 178167.16	**BH:**	VB7027	**Comments: TTT Albert Embankment Borehole 7027**		
Level (top):		-0.53m OD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
0.00-0.35	-0.53 – -0.88			GAP (compression)	GAP (compression)		
0.35-0.55	-0.88 – -1.08			2.5Y 4/3 olive brown sandy gravel. Moderately well sorted gravel clast size <5cm with a decrease in size down profile to <3cm. Clear boundary.	Active beach deposit	Active beach deposits	
0.55-0.80	-1.08 – -1.88			10YR 2/1 black stained sandy gravel. Matrix very wet and it is this that is black rather than the sand grains. Poorly sorted with larger clast size than the bottom of above. Lump of chalk approx. 5cm at the bottom. Metallic smell. Clear boundary.	River gravels deposit ?anaerobic conditions	Fluvial sandy gravels and beach deposits, alternating high energy and low energy events with possible anaerobic conditions.	
0.80-1.00	-1.88 – -1.53			10YR 2/1 black sand with small gravel <2cm. More compact than above contexts. Again, the matrix is black rather than the sand/gravel. Becomes slightly clayey at the bottom 2cm. Metallic smell.	River gravels deposit, low energy. ?anaerobic conditions.		
1.00-1.60	-1.53 – -2.13			GAP (compression)	GAP (compression)		
1.60-1.86	-2.13 – -2.39			2.5Y 4/3 olive brown sandy gravel with occasional patches of 10YR 2/1 black. Clast size <4cm. Flecks of chalk and brick throughout. Lump of stone 6cm thick at the bottom ?sandstone. Abrupt boundary.	River gravels deposit		
1.86-2.02	-2.39 – -2.55			10YR 2/1 black fine sand/coarse silt with gravel <4cm. Again, matrix is stained black rather than sand grains. Diesel smell apparent.	River gravels deposit, low energy. ?anaerobic conditions.		

Table A.3.5: Vibrocore VB7028 sediment description table

Location:		530272.93 178217.23	**BH:**	VB7028	**Comments: TTT Albert Embankment Borehole 7028**		
Level (top):		-0.45m OD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
0.00-0.25	-0.45 – -0.70			GAP (compression)	GAP (compression)	Fluvial sandy gravels and beach deposits, alternating high energy and low energy events with possible anaerobic conditions.	
0.25-0.35	-0.70 – -0.80			10YR 4/3 brown sandy gravel. Matrix supported, poorly sorted. Clast size <4cm. Clear boundary.	Active beach deposits		
0.35-0.62	-0.80 – -1.07			10YR 2/1 black sandy gravel with occasional bits of brick. Matrix is very wet and is stained black rather than the sand grains. Fairly compact compared with above. Moderately well sorted, clast size smaller than above <3cm. Metallic smell. Abrupt boundary.	River gravels ?anaerobic conditions		
0.62-0.70	-1.07 – -1.15			10YR 4/3 brown sandy gravel. Matrix supported, poorly sorted. Clast size <4cm. Clear boundary.	River gravels		
0.70-0.78	-1.15 – -1.23			Gley 1 4/1 dark greenish grey sandy clay. Would probably be stone free but it appears a little mixed up with the above context. Clear boundary.	River gravels, low energy. ?anaerobic conditions		
0.78-1.02	-1.23 – -1.47			10YR 4/3 brown sandy gravel. Matrix supported, moderately well sorted. Clast size <2cm.	River gravels		
1.02-1.60	-1.47 – -2.05			GAP (compression)	GAP (compression)		
1.60-1.97	-2.05 – -2.42			10YR 4/3 brown sandy gravel with patches of 10YR 2/1 black stained matrix as before. Poorly sorted. Clast size <2cm. Clear boundary.	River gravels		

Location:		530272.93 178217.23	**BH:**	VB7028	**Comments: TTT Albert Embankment Borehole 7028**	
Level (top):		-0.45m OD	**Drg:**			
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
1.97-2.03	-2.42 – -2.48			Gley 1 4/1 dark greenish grey sandy clay with some small gravel <2cm mixed in.	River gravels low energy. ?anaerobic conditions	

Table A.3.6: Borehole WA11 sediment description table

Location:	530223.67 178165.23	**Mono:**	WA11	**Comments: TTT Albert Embankment Borehole WA11**		
Level (top):	-1.83mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0 – 0.30	-1.83--2.13			5YR 3/4 dark reddish brown gravel with coarse sand, black stained in places. Poorly sorted.	Active beach deposits	Foreshore
0.30-0.57	-2.13 --2.40			5YR 3/4 dark reddish brown gravel with coarse sand, black stained in places. Poorly sorted, clast size <6cm, becoming slightly sandier with smaller clast size <4cm down profile. Abrupt boundary.	River gravel deposits, high energy	Fluvial sandy gravels and beach deposits.
0.57-2.00	-2.40 – -3.83			2.5Y 3/2 very dark greyish brown slightly silty clay. Stiff, massive, homogenous, stone free. No obvious laminations.	London Clay	Geology

Table A.3.7: Borehole WA12 sediment description table

Location:	530248.25 178199.35	**Mono:**	WA12	**Comments: TTT Albert Embankment Borehole WA12**		
Level (top):	-0.995mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-0.57	-0.995--1.565			2.5Y 3/3 dark olive brown gravel with coarse sand and some brick/CBM. Clast size <6cm, poorly sorted, becoming slightly finer down profile, clast size <4cm. Abrupt boundary.	Active beach deposits.	Foreshore
0.57-0.64	-1.565--1.635			5Y 2.5/1 black medium to coarse silt with a layer of fine sand at the bottom. Relatively stone free with faint horizontal laminations. Abrupt boundary.	Low energy tidal silts/fluvial deposits.	Fluvial sandy gravels and beach deposits. Alternating high and low energy flowing water events.
0.64-0.82	-1.635--1.815			2.5Y 3/3 dark olive brown gravel with medium-coarse sand and some clay, very mixed up, poorly sorted, clast size <4cm. Clear boundary.	Lower energy river gravel deposit.	
0.82-2.00	-1.815--2.995			2.5Y 4/3 olive brown becoming 2.5Y 3/2 very dark greyish brown slightly silty clay. Stiff, massive, homogenous, stone free. No obvious laminations.	London Clay.	Geology

Table A.3.8: Borehole WA13 sediment description table

Location:		530248.38 178178.14	**Mono:**	WA13	**Comments: TTT Albert Embankment Borehole WA13**		
Level (top):		-0.389mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
0.00-1.16	-0.389--1.549			2.5Y 4/3 olive brown gravel with medium to coarse sand. Poorly sorted, clast size <12 cm. Clear boundary.	Active beach deposits.		Foreshore
1.16-1.47	-1.549--1.859			2.5Y 3/1 very dark grey silty clay with a layer of fine sand, and sparse brick with small gravel from 1.30-1.37. No obvious horizontal laminations. Some pottery and glass at the bottom. Abrupt boundary.	River gravel deposits, with lower energy tidal silts.		Fluvial sandy gravels and beach deposits. Alternating high and low energy flowing water events.
1.47-1.74	-1.859--2.129			10YR 2/1 black medium to fine sand with poorly sorted medium gravel <3cm and some pieces of slate. Slight decrease in gravel size down profile (<2cm). Sharp boundary.	River gravels		
1.74-2.25	-2.129--2.639			2.5Y 5/6 light olive brown coarse sand with gravel, poorly sorted, clast size <5cm. 2 bands of 2.5Y 3/2 very dark greyish brown stone free finer sand at 1.75-1.78 and 1.80-1.82. Clear boundary.	River gravels with tidal inwashes.		
2.25-3.00	-2.639--3.389			2.5Y 3/2 very dark greyish brown slightly silty clay. Stiff, massive, homogenous, stone free. No obvious laminations.	London Clay		Geology

Table A.3.9: Borehole WA14 sediment description table

Location:	530272.53 178210.70	**Mono:**	WA14	**Comments: TTT Albert Embankment Borehole WA14**		
Level (top):	-0.262mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-1.14	-0.262--1.402			5Y 4/2 olive grey gravel and coarse sand with patches of black and 10YR 4/6 dark yellowish brown sand. Poorly sorted, clast size <7cm. Sharp boundary.	Active beach deposits.	Foreshore
1.14-1.36	-1.402--1.622			Gley 1 4/1 dark greenish grey medium to coarse silt, relatively stone free, faintly horizontally laminated. Gradual boundary.	Tidal silts/low energy fluvial deposits. Anaerobic conditions.	Fluvial sandy gravels and beach deposits. Alternating high and low energy flowing water events.
1.36-1.42	-1.622--1.682			10YR 5/8 yellowish brown fine sand and large gravel with some black staining. Layer is essentially made up of one very large piece of gravel with some sand. Sharp boundary.	High energy river gravels deposit.	
1.42-1.53	-1.682--1.792			Gley 1 4/1 dark greenish grey fine sand mixed up with the same colour silty clay gradually becoming just soft sticky silty clay. Fairly stone free. Slightly horizontally laminated at the top where the profile is sandier. Sharp boundary.	Low energy river gravels deposits, anaerobic conditions.	
1.53-1.69	-1.792--1.952			2.5Y 5/4 light olive brown medium sand stained black underneath. Large piece of gravel at top boundary otherwise stone free. Sharp boundary.	Fairly low energy river gravels deposit.	
1.69-1.82	-1.952--2.082			2.5Y 5/6 light olive brown gravel with medium sand and some coarse silt. Stained black in places. Poorly sorted. Clast size <3cm. Abrupt boundary.	Higher energy river gravels deposit.	

Location:		530272.53 178210.70	**Mono:**	WA14	**Comments: TTT Albert Embankment Borehole WA14**		
Level (top):		-0.262mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
1.82-3.00	-2.082--3.262			2.5Y 3/2 very dark greyish brown slightly silty clay. Stiff, massive, homogenous, stone free. No obvious laminations	London Clay	Geology	

Table A.3.10: Borehole WA101 sediment description table

Location:	530271.48 178212.97	**Mono:**	WA101	**Comments: TTT Albert Embankment Borehole WA101**		
Level (top):	-0.315mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0.00-0.92	-0.315--1.235			10YR 3/3 dark brown gravel and coarse sand with slate, metal and some oyster shell. Poorly sorted, clast size <10cm. Abrupt boundary.	Active beach deposit	Foreshore
0.92-1.24	-1.235--1.555			2.5Y 4/3 olive brown medium to fine sand, becoming coarser and more gravelly towards the base. Poorly sorted, clast size <5cm. Sharp boundary.	River gravel deposit, high energy.	Fluvial sandy gravels and beach deposits. Alternating high and low energy flowing water events.
1.24-1.60	-1.555--1.915			2.5Y 5/4 light olive brown fine sand with fine horizontal laminations. Compact, with some horizontal iron staining near the bottom. Large pieces of flinty gravel <10cm toward the bottom. Abrupt boundary.	Low energy river gravel deposit with tidal inwashes.	
1.60-1.80	-1.915--2.115			2.5Y 4/3 olive brown fine to medium silt with some clay and small gravel. Almost pure silt at the bottom. Faint horizontal laminations. Abrupt boundary.	River gravels with tidal silts. Low energy deposit.	
1.80-2.00	-2.115--2.315			2.5Y 3/3 dark olive brown slightly silty clay. Stiff, massive, homogenous with some gravel at the top boundary.	London Clay.	Geology

Table A.3.11: Borehole WA102 sediment description table

Location:	530242.80 178180.06	**Mono:**	WA102	**Comments: TTT Albert Embankment Borehole WA102**		
Level (top):	-0.728	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0 – 0.5	-0.728 -– 1.28			2.5Y 4/3 olive brown medium to coarse gravel with medium to coarse sand. Poorly sorted, clast size <10cm.	Active beach deposits	Foreshore
0.5-1.90	-1.28 - -2.628			2.5Y 4/3 olive brown medium to coarse gravel with medium to coarse sand. Poorly sorted, clast size <10cm. Sand is black stained in places. Sand is finer at 1.00-1.18. Colour becomes 10YR 4/6 dark yellowish brown from 1.58-1.90. Clear boundary.	River gravels.	Fluvial sandy gravels and beach deposits. Alternating high and low energy flowing water events.
1.90-2.00	-2.628--2.728			10YR 5/6 yellowish brown slightly silty clay. Slightly mixed up with some sand and gravel at the boundary, otherwise Stiff, massive, homogenous, stone free. No obvious laminations.	London Clay	Geology

Table A.3.12: Borehole WA103 sediment description table

Location:	530246.25 178202.97	**Mono:**	WA103	**Comments: TTT Albert Embankment Borehole WA103**		
Level (top):	-1.464mOD	**Drg:**				
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**	
Mono	mOD					
0 – 0.30	-1.464 – --1.764			2.5Y 3/3 dark olive brown medium sand and coarse silt with medium to coarse gravel.	Active beach deposits	Foreshore
0.30-0.63	-1.764 – -2.094			2.5Y 3/3 dark olive brown medium sand and coarse silt with medium to coarse gravel. Gravel is poorly sorted, clast size <9cm, becomes smaller down profile <5cm. Sharp boundary.	River gravels	Fluvial sandy gravels and beach deposits.
0.63-1.00	-2.094 – -2.464			2.5Y 3/2 very dark greyish brown slightly silty clay. Stiff, massive, homogenous, stone free. No obvious laminations.	London Clay	Geology

Table A.3.13: Hand auger points sediment descriptions

ID	Descriptions & depths	Coordinates		
		X	Y	Z
HA01	0 – 0.2m Dark grey black sandy clay with faint laminations, becoming clay with depth, occasional sub-rounded stone inclusions <0.02m. Active beach deposits. 0.2 – 0.34m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530243.59	178198.77	-1.53
HA02	0 – 0.43m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530251.12	178212.03	-1.59
HA03	0 – 0.22m Medium brown clay with occasional fine black flecks, no visible laminations, top 0.10m dark yellow brown becoming grey with depth. Active beach deposits.	530238.29	178189.67	-1.58
HA04	0 – 0.4m Active beach deposit sands and gravels	530227.40	178166.22	-1.70
HA05	0 – 0.35m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530242.14	178202.40	-1.96
HA06	0 – 0.34m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530234.54	178188.12	-2.04
HA07	0 – 0.31m Medium brown clay with occasional fine black flecks, no visible laminations, top 0.10m dark yellow brown becoming grey with depth. Active beach deposits.	530224.75	178173.38	-2.00
HA08	0 – 0.23m Active beach deposit sands and gravels	530219.87	178167	-2.01
HA09	0 – 0.44m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530231.00	178183.76	-2.16
HA10	0 – 0.36m Medium brown clay with occasional fine black flecks, no visible laminations. Active beach deposits.	530235.02	178191.40	-2.13
HA11	0 – 0.36m Medium brown clay with occasional fine black flecks, no visible laminations, woody root at 0.23m. Active beach deposits.	530240.57	178204.55	-2.17
HA12	0 – 0.32m Organic, fibrous, woody deposit. Base of tree stump over London Clay.	530250.24	178223.35	-2.12

A.3 Deposit modelling: transect descriptions

The location of the transects is shown in **Figure 7** and the transects themselves are illustrated in **Figures 8 - 9.**

Transect A

Transect A ran north-west to south-east across the south-west end of the Site. The transect was approximately 140m long and included six deposit records. Five deposit records (TQ37NW1571, TQ37NW2411, TQ37NW2410, TQ37NW1570 and TQ37NW2418) were located on the landward side of the embankment and one (TQ37NW1593) was located on the foreshore.

The first deposit record (TQ37NW1571) was located at the south-east end of the transect where the deposits were recorded as 5.5m of made ground over 3.3m of river gravels over London Clay. From TQ37NW1571 moving north-west the second deposit record (TQ37NW2411) is located approximately 15m along the transect and the deposits were recorded as 5.3m of made ground over 4m of river gravels over London Clay. The third deposit record (TQ37NW2410) was located approximately 37m along the transect where the deposits were recorded as 4.6m of made ground over 5m of river gravels over London Clay. The fourth deposit record (TQ37NW1570) was located approximately 50m along the transect where the deposits were recorded as 5.5m of made ground over 3.3m of river gravels over 0.3m of stiff black silty clay with organic material over London Clay. The fifth deposit record (TQ37NW2418) was located approximately 67m along the transect where the deposits were recorded as 2.9m of made ground over 6.2m of river gravels over London Clay.

The sixth deposit record (TQ37NW1593) was located on the foreshore approximately 86m along the transect and 18m to the north-west of the embankment. The deposits were recorded as 0.3m of active beach deposits over 2.2m of river gravels over London Clay.

Although TQ37NW1593 was drilled in 1971 there is only approximately up to 0.5m difference between the plot of the profile of the present foreshore surface/river bed taken from bathymetric contour data (**Appendix A.5**) and the top of the borehole. London Clay was encountered on the foreshore in TQ37NW1593 at 2.5m depth (-2.54m OD).

Transect B

Transect B ran north-west to south-east across the south-west end of the Site to the north-west of Vauxhall Bridge. The transect was approximately 100m long and included seven deposit records. Two deposit records (TQ37NW2686 and TQ37NW2682) were located on the landward side and five deposit records (VB7027, SR5004, HA04, WA11 and HA08) were located on the foreshore.

The first deposit record (TQ37NW2686) was located at the south-east end of the transect where the deposits were recorded as 3.2m of made ground over river gravels. The second deposit record (TQ37NW2682) was located approximately 31m

along the transect adjacent to the embankment where the deposits were recorded as 2.9m of made ground over 5.2m of river gravels over London Clay.

The third deposit record (VB7027) was located on the foreshore approximately 51m along the transect and 15m from the embankment where the deposits were recorded as 0.55m of active beach deposits over 1.47m of river gravels. The fourth deposit record (SR5004) was located on the foreshore approximately 60m along the transect and 25m from the embankment, where the deposits were recorded as 0.4m of active beach deposits over 1m of river gravels over London Clay.

The fifth deposit record (HA04) was located on the foreshore approximately 66m along the transect and 30m from the embankment where the deposits were recorded as 0.35m of active beach deposits. The sixth deposit record (WA11) was located on the foreshore approximately 70m along the transect and 35m from the embankment where the deposits were recorded as 0.57m of active beach deposits over London Clay The seventh deposit record (HA08) was located on the foreshore approximately 74m along the transect and 39m from the embankment where the deposits were recorded as 0.23m of active beach deposits.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. The London Clay was encountered in SR5004 at 1.4m depth (-2.58m OD) and WA11 at 0.57m depth (-2.4m OD).

Transect C

Transect C ran north-west to south-east through the centre of the Site. The transect was approximately 84m long and included six deposit records, one (TQ37NW2680) on the landward side and five (WA13, WA102, HA03, HA10 and MoLA-VC6033A) on the foreshore.

The first deposit record (TQ37NW2680) was located at the south-east end of the transect where the deposits were recorded as 4m of made ground over 3.6m of river gravels over London Clay.

The second deposit record (WA13) was located on the foreshore approximately 28m along the transect and 13m from the embankment, where the deposits were recorded as 1.16m of active beach deposits over 1.09m of river gravels over London Clay. The third deposit record (WA102) was located on the foreshore approximately 34m along the transect and 19m from the embankment where the deposits were recorded as 1.9m of active beach deposits over London Clay.

The fourth deposit record (HA03) was located on the foreshore 44m along the transect and 30m from the embankment where the deposits were recorded as 0.22m of active beach deposits. The fifth deposit record (HA10) was located on the foreshore 49m along the transect and 33m from the embankment where the deposits were recorded as 0.36m of active beach deposits. HA10 was 6m to the north-west of the organic deposits (**6005**) recorded during the walkover survey and the peat deposit recorded by TDP/MoLA .

The sixth deposit record (MoLA-VC6033A) was located on the foreshore (though outside of the Site bounds) 84m along the transect and 69m from the embankment where the deposits were recorded as 0.15m of active beach deposits over London Clay.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. The London Clay was encountered in WA13 at 2.25m depth (-2.63m OD), in WA102 at 1.9m depth (-2.63m OD) and MoLA-VC6033A at 0.15m depth (-5.24m OD).

Transect D

Transect D ran north-west to south-east through the centre of the Site. The transect was approximately 105m long and included five deposit records, one (TQ37NW2687) on the landward side and four (WA12, WA103, HA11 and MoLAVC6034) located on the foreshore.

The first deposit record (TQ37NW2687) was located at the south-east end of the transect where the deposits were recorded as 3.1m of made ground over river gravels.

The second deposits record (WA12) was located on the foreshore 59m along the transect and 25m from the embankment where the deposits were recorded as 0.57m of active beach deposits over a thin (0.07m) layer of alluvial silt, over 0.18m of river gravels over London Clay.

The third deposit record (WA103) was located on the foreshore approximately 64m along the transect and 28m from the embankment where the deposits were recorded as 0.63m of active beach deposits over London Clay. The fourth deposit record (HA11) was located on the foreshore approximately 70m along the transect and 35m from the embankment where the deposits were recorded as 0.36m of active beach deposits.

The fifth deposit record (MoLA-VC6034) was located on the foreshore (though outside of the Site bounds) approximately 135m along the transect and 70m from the embankment where the deposits were recorded as 0.16m of active beach deposits over 0.14m of river gravels over London Clay.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. London Clay was encountered in WA12 at 0.82m depth (-1.81m OD), WA103 at 0.63m depth (-2.09m OD) and MoLA-VC6034 at 0.3m depth (-4.29m OD).

Transect E

Transect E ran north-west to south-east through the centre of the Site. The transect was approximately 106m long and included five deposit records, one (TQ37NW2684) was located on the landward side and four deposit records (WA14, WA101, SR5005 and HA12) were located on the foreshore.

The first deposit record (TQ37NW2684) was located at the south-east end of the transect where the deposits were recorded as 2.5m of made ground over 5.3m of river gravels over London Clay.

The second deposit record (WA14) was located on the foreshore 61m along the transect and 10m from the embankment where the deposits were recorded as 1.14m of active beach deposits over river gravels over London Clay.

The third deposit record (WA101) was located on the foreshore 64m along the transect and 13m from the embankment where the deposits were recorded as 0.92m of active beach deposits over 0.91m of river gravels over London Clay. The fourth deposit record (SR5005) was located on the foreshore 72m along the transect and 22m from the embankment where the deposits were recorded as 0.3m of active beach deposits over 1m of river gravels over London Clay. The fifth deposit record (HA12) was located on the foreshore 88m along the transect and 36m from the embankment where the deposits were recorded as 0.32m of active beach deposits.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. London Clay was encountered in WA14, WA101 and SR5005 at height of -2.08, -2.14 and -2.12 respectively.

Transect F

Transect F ran north-west to south-east across the north-east half of the Site. The transect measured approximately 104m and included three deposit records, one (TQ37NW1204) was located on the landward side and two (VB7014A) and (VB7014) were located on the foreshore.

The first deposit record (TQ37NW1204) was located at the south-east end of the transect where the deposit records were recorded as 0.6m of made ground over 4.68m of river gravels over London Clay.

The second deposit record (VB7014A) was located on the foreshore 51m along the transect and 30m from the embankment where the deposits were recorded as 0.44m of active beach deposits over 0.32m of river gravels. The third deposit record (VB7014) was located two metres to the north-west of VB7014A where the deposits were recorded as 0.68m of active beach deposits over river gravels.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. London Clay was not encountered.

Transect G

Transect F ran east to west across the north-east end of the Site. The transect measured approximately 96m and included three deposit records, one (TQ37NW173) on the landward side and two (SR5007B and SA5007) were located on the foreshore.

The first deposit record (TQ37NW173) was located at the east end of the transect where the deposits were recorded as 1.68m of made ground over 5.94m of river gravels over London Clay.

The second deposit record (SR5007B) was located on the foreshore approximately 62m along the transect and 16m from the embankment where the deposits were recorded as 0.3m of active beach deposits over 2m of river gravels over London Clay. The third deposit record (SA5007) was located on the foreshore approximately 62m along the transect and 17m from the embankment where the deposits were recorded as 0.3m of active beach deposits over 2.3m of river gravels over London Clay.

All the boreholes located on the foreshore were recently drilled and as such closely match the modern foreshore profile based on bathymetric contour data. London Clay was encountered in SR5007B at 2.3m depth (-3.12m OD) and in SA5007 at 2.6m depth (-3.37m OD

A.4 Data references

Borehole record	Source	Easting	Northing	Elevation m OD	Total depth metres
HA01	WA	530243.6	178198.8	-1.53	0.34
HA02	WA	530251	178212	-1.59	0.43
HA03	WA	530238.3	178189.7	-1.58	0.22
HA04	WA	530227.4	178166.2	-1.7	0.4
HA05	WA	530242.1	178202.4	-1.96	0.35
HA06	WA	530234.5	178188.1	-2.04	0.34
HA07	WA	530224.8	178173.4	-2	0.31
HA08	WA	530219.9	178167	-3.01	0.23
HA09	WA	530231	178183.8	-2.16	0.44
HA10	WA	530235	178191.4	-2.13	0.36
HA11	WA	530240.6	178204.6	-2.17	0.36
HA12	WA	530250.2	178223.4	-2.12	0.32
MoLA-VC6033A	MoLA	530205.8	178211.1	-5.09	1
MoLA-VC6034	MoLA	530223.1	178235.1	-3.99	0.6
SA5007	TTT	530338	178349	-0.77	4.5
SR2059	TTT	530120	178244	-5.55	3
SR2060	TTT	530007	178120	-3.5	5
SR2061	TTT	529955	178038	-3.99	5
SR2084	TTT	530255	178543	-5.31	9
SR2085	TTT	530185	178398	-3.9	5
SR5004	TTT	530232	178170	-1.18	6
SR5005	TTT	530264	178218	-0.82	6
SR5006	TTT	530311	178266	0.03	5
SR5007B	TTT	530338	178347	-0.82	5
TQ37NW108	BGS	530330	178160	4.26	12.19
TQ37NW1204	BGS	530360	178270	5.18	15
TQ37NW1570	BGS	530238	178076	5.9	13.4
TQ37NW1571	BGS	530274	178054	5.2	12.2
TQ37NW1575	BGS	530198	178048	1.73	5.57
TQ37NW1588	BGS	530199	178074	-0.55	34.75
TQ37NW1589	BGS	530161	178030	-0.6	8.2
TQ37NW1593	BGS	530215	178099	-0.4	7.6
TQ37NW1594	BGS	530169	178024	-0.3	8.5
TQ37NW173	BGS	530400	178340	4.83	9.14
TQ37NW174	BGS	530230	178130	1.31	10.46
TQ37NW175	BGS	530130	178180	-3.33	5.79
TQ37NW176	BGS	530130	178180	0.77	7.88
TQ37NW2388	BGS	530200	178070	-0.55	6.25
TQ37NW2392	BGS	530180	178050	0.1	8.3

TQ37NW2393	BGS	530220	178100	-0.4	7.6
TQ37NW2410	BGS	530250	178080	5.75	9.8
TQ37NW2411	BGS	530260	178060	5.45	9.5
TQ37NW2418	BGS	530230	178090	6.05	9.5
TQ37NW2680	BGS	530270	178160	5	10
TQ37NW2682	BGS	530250	178150	5	10
TQ37NW2683	BGS	530320	178100	5	10
TQ37NW2684	BGS	530330	178190	5	15
TQ37NW2685	BGS	530270	178110	5	3.2
TQ37NW2686	BGS	530280	178140	5	3.5
TQ37NW2687	BGS	530300	178170	5	3.3
TQ37NW2689	BGS	530310	178100	5	2.4
TQ37NW445	BGS	530203	178044	5.73	12.19
VB6038	TTT	530205	178211	-5.09	2.1
VB6039	TTT	530223	178235	-3.99	1.8
VB7014	WA	530308.5	178258.2	0.56	1
VB7014A	WA	530309.8	178257.6	0.67	3
VB7015	WA	530326.9	178287.3	0.92	2
VB7027	WA	530241.2	178167.2	-0.53	1.02
VB7028	WA	530272.9	178217.2	-0.45	2.03
WA101	WA	530271.5	178213	-0.32	2
WA102	WA	530242.8	178180.1	-0.73	2
WA103	WA	530246.3	178203	-1.464	1
WA11	WA	530223.7	178165.2	-1.83	2
WA12	WA	530248.3	178199.4	-0.995	2
WA13	WA	530248.4	178178.1	-0.389	3
WA14	WA	530272.5	178210.7	-0.262	3

Key to source

WA = Wessex Archaeology
MoLA = Museum of London Archaeology
BGS = British Geological Survey
PLA = Port of London Authority
TTT – Thames Tunnel Tideway

Data references

MoLA = 'MoLA monitored TTT core data supplied by client, ref. email from Suzanna Pembroke 31/3/14'

BGS = http://www.bgs.ac.uk/data/boreholescans/home.html

PLA vibrocores taken on behalf of TTT = 100-MD-GEO-00000-000091

DDS-000690-WXARC_Bathymetry (Transmittal: 100/WXARC/000009 Date: 13/8/14 Filename:100-MD-GIS-WXARC-000004)

Appendix B : NMR OASIS archaeological report form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: wessexar1-216055

Project details

Project name	Foreshore-based Archaeological Evaluation, Albert Embankment Foreshore
Short description of the project	Wessex Archaeology was commissioned to undertake a foreshore-based archaeological evaluation at Albert Embankment Foreshore, a Thames Tideway Tunnel project site. The evaluation included parametric sonar survey, geoarchaeological and palaeoenvironmental assessment of cores, a walkover survey and and the production of a foreshore deposit model.
Project dates	Start: 09-06-2014 End: 25-06-2015
Previous/future work	Yes / Yes
Any associated project reference codes	102510.37 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Coastland 1 - Marine
Current Land use	Coastland 2 - Inter-tidal
Monument type	STRUCTURE Late Mesolithic
Monument type	POST ALIGNMENT Bronze Age
Monument type	BARGE BED Post Medieval
Monument type	MOORING BOLLARD Post Medieval
Significant Finds	PEAT Middle Neolithic
Significant Finds	CERAMIC Post Medieval
Significant Finds	ANIMAL REMAINS Uncertain
Methods & techniques	"Augering","Fieldwalking","Geophysical Survey","Vibro-core"
Development type	Tunnel
Prompt	Planning condition
Position in the planning process	After full determination (eg. As a condition)
Solid geology	LONDON CLAY
Drift geology	ALLUVIUM
Techniques	Other

Project location

Country	England
Site location	GREATER LONDON LAMBETH LAMBETH Albert Embankment Foreshore
Study area	2.40 Hectares
Site coordinates	TQ 30397 78367 51.4886968502 -0.121633386495 51 29 19 N 000 07 17 W Polygon
Site coordinates	TQ 30397 78064 51.4859735844 -0.121745320075 51 29 09 N 000 07 18 W Polygon
Site coordinates	TQ 30156 78367 51.4887524929 -0.125102988653 51 29 19 N 000 07 30 W Polygon
Site coordinates	TQ 30156 78064 51.4860292218 -0.125214715772 51 29 09 N 000 07 30 W Polygon
Height OD / Depth	Min: -6.00m Max: 5.50m

Project creators

Name of Organisation	Wessex Archaeology
Project brief originator	Wessex Archaeology
Project design originator	Wessex Archaeology
Project director/manager	David Norcott
Project supervisor	David Howell
Project supervisor	Richard Payne
Project supervisor	Gail Wakeham
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Wessex Archaeology
Digital Contents	"none"
Digital Media available	"Database","GIS","Geophysics","Images raster / digital photography","Text"
Paper Archive recipient	Wessex Archaeology
Paper Contents	"none"
Paper Media available	"Report"

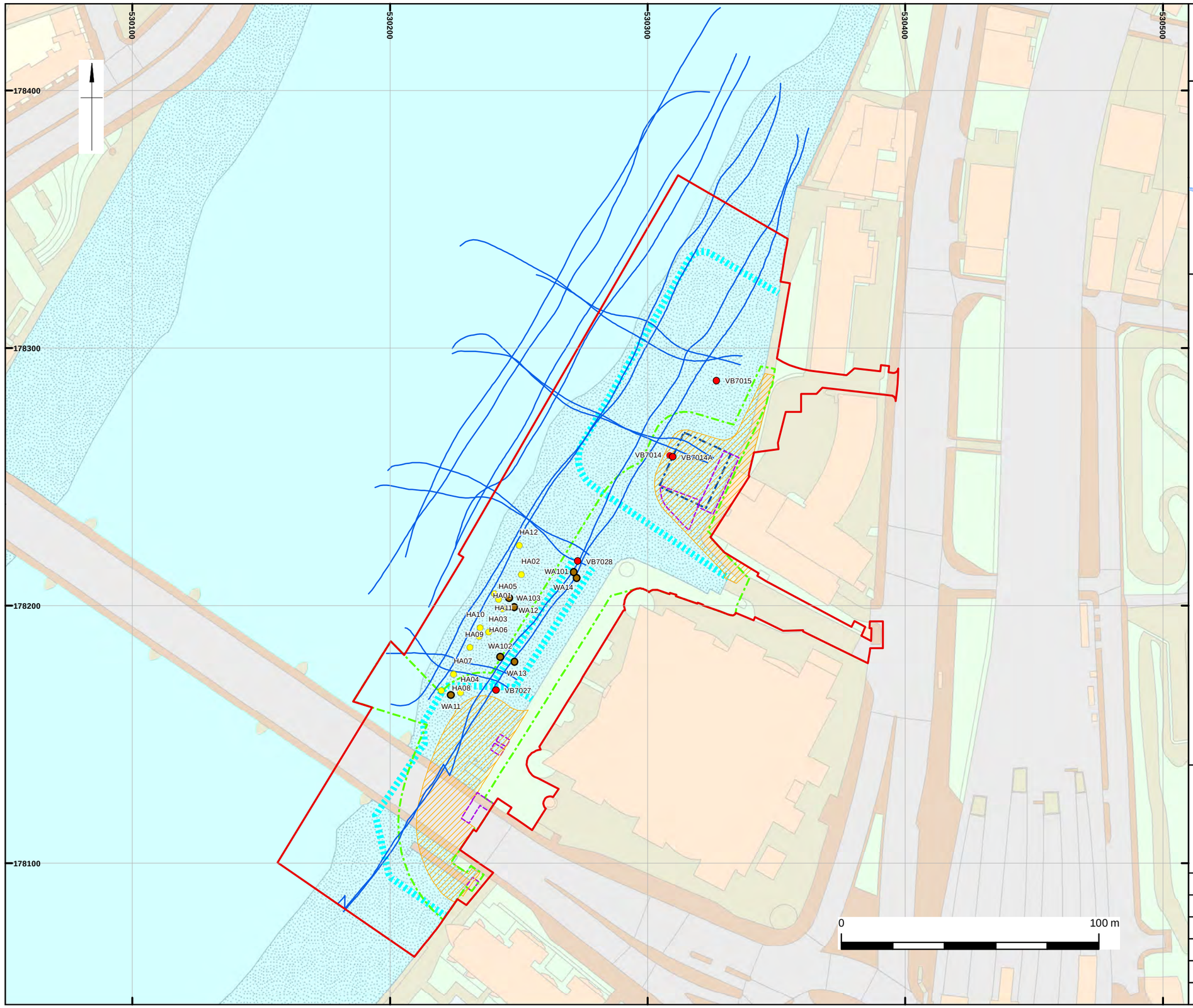
Project bibliography 1

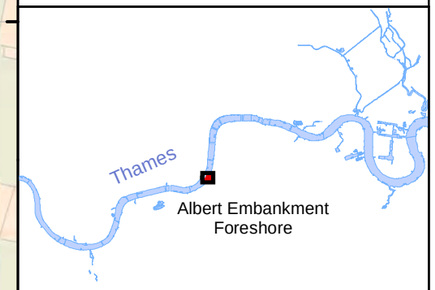
Publication type	Grey literature (unpublished document/manuscript)

Title	Foreshore-based Archaeological Evaluation Report Albert Embankment Foreshore
Author(s)/Editor(s)	Howell, D., Norcott, D., Payne, R. and Wakeham, G.
Other bibliographic details	102510.37
Date	2015
Issuer or publisher	Wessex Archaeology
Place of issue or publication	Salisbury
URL	http://oasis.ac.uk
Entered by	Richard Milwain (r.milwain@wessexarch.co.uk)
Entered on	29 June 2015

OASIS:

Figures





- Site
- Vibrocores
- Hand auger
- Mechanical cores/boreholes
- Parametric sonar survey lines
- Above-ground Structure Zone
- All Site Structure Zone
- Required Landscaping Area
- Shaft Zone
- Maximum extent of temporary works platform
- Intertidal Zone
- River Thames

Date:	23/06/2015
Revision Number:	0
Scale:	1:1500 at A3
Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS
	\FigsMXD\Evals_DO\KST\Fig01.mxd

Albert Embankment Foreshore evaluation location

Figure 1

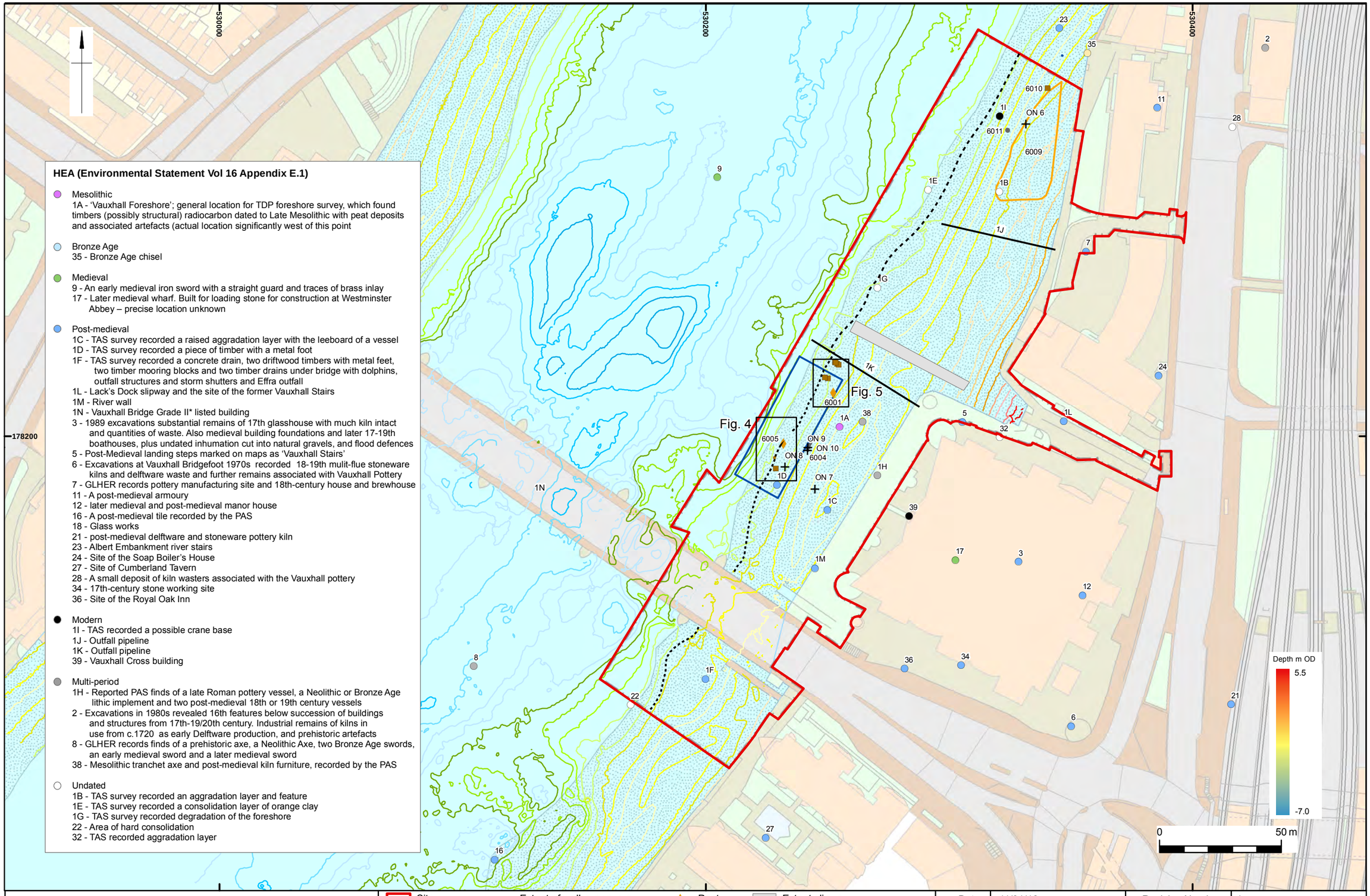
530000
530200
530400
530600
178400
178200
178000
7521
7502
7500
7501
7520
SW
NE
Approx. 1m
Riverbed
Feature 7501
Riverbed multiple
Parametric sonar data example transect
Depth m OD
5.5
-7.0
0
100 m

Site
Intertidal Zone
Transect
A2 riverbed feature
Complex cut and fill
Coarse sediement layer
Infilled depression
Area with Pleistocene/Holocene deposits

Date:	08/06/15	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\AEF\Fig02.mxd		

Albert Embankment Foreshore Parametric Sonar Results

Figure 2



HEA (Environmental Statement Vol 16 Appendix E.1)

Mesolithic
1A - 'Vauxhall Foreshore'; general location for TDP foreshore survey, which found timbers (possibly structural) radiocarbon dated to Late Mesolithic with peat deposits and associated artefacts (actual location significantly west of this point

Bronze Age
35 - Bronze Age chisel

Medieval
9 - An early medieval iron sword with a straight guard and traces of brass inlay
17 - Later medieval wharf. Built for loading stone for construction at Westminster Abbey – precise location unknown

Post-medieval
1C - TAS survey recorded a raised aggradation layer with the leeboard of a vessel
1D - TAS survey recorded a piece of timber with a metal foot
1F - TAS survey recorded a concrete drain, two driftwood timbers with metal feet, two timber mooring blocks and two timber drains under bridge with dolphins, outfall structures and storm shutters and Effra outfall
1L - Lack's Dock slipway and the site of the former Vauxhall Stairs
1M - River wall
1N - Vauxhall Bridge Grade II* listed building
3 - 1989 excavations substantial remains of 17th glasshouse with much kiln intact and quantities of waste. Also medieval building foundations and later 17-19th boathouses, plus undated inhumation cut into natural gravels, and flood defences
5 - Post-Medieval landing steps marked on maps as 'Vauxhall Stairs'
6 - Excavations at Vauxhall Bridgefoot 1970s recorded 18-19th mulit-flue stoneware kilns and delftware waste and further remains associated with Vauxhall Pottery
7 - GLHER records pottery manufacturing site and 18th-century house and brewhouse
11 - A post-medieval armoury
12 - later medieval and post-medieval manor house
16 - A post-medieval tile recorded by the PAS
18 - Glass works
21 - post-medieval delftware and stoneware pottery kiln
23 - Albert Embankment river stairs
24 - Site of the Soap Boiler's House
27 - Site of Cumberland Tavern
28 - A small deposit of kiln wasters associated with the Vauxhall pottery
34 - 17th-century stone working site
36 - Site of the Royal Oak Inn

Modern
1I - TAS recorded a possible crane base
1J - Outfall pipeline
1K - Outfall pipeline
39 - Vauxhall Cross building

Multi-period
1H - Reported PAS finds of a late Roman pottery vessel, a Neolithic or Bronze Age lithic implement and two post-medieval 18th or 19th century vessels
2 - Excavations in 1980s revealed 16th features below succession of buildings and structures from 17th-19/20th century. Industrial remains of kilns in use from c.1720 as early Delftware production, and prehistoric artefacts
8 - GLHER records finds of a prehistoric axe, a Neolithic Axe, two Bronze Age swords, an early medieval sword and a later medieval sword
38 - Mesolithic tranchet axe and post-medieval kiln furniture, recorded by the PAS

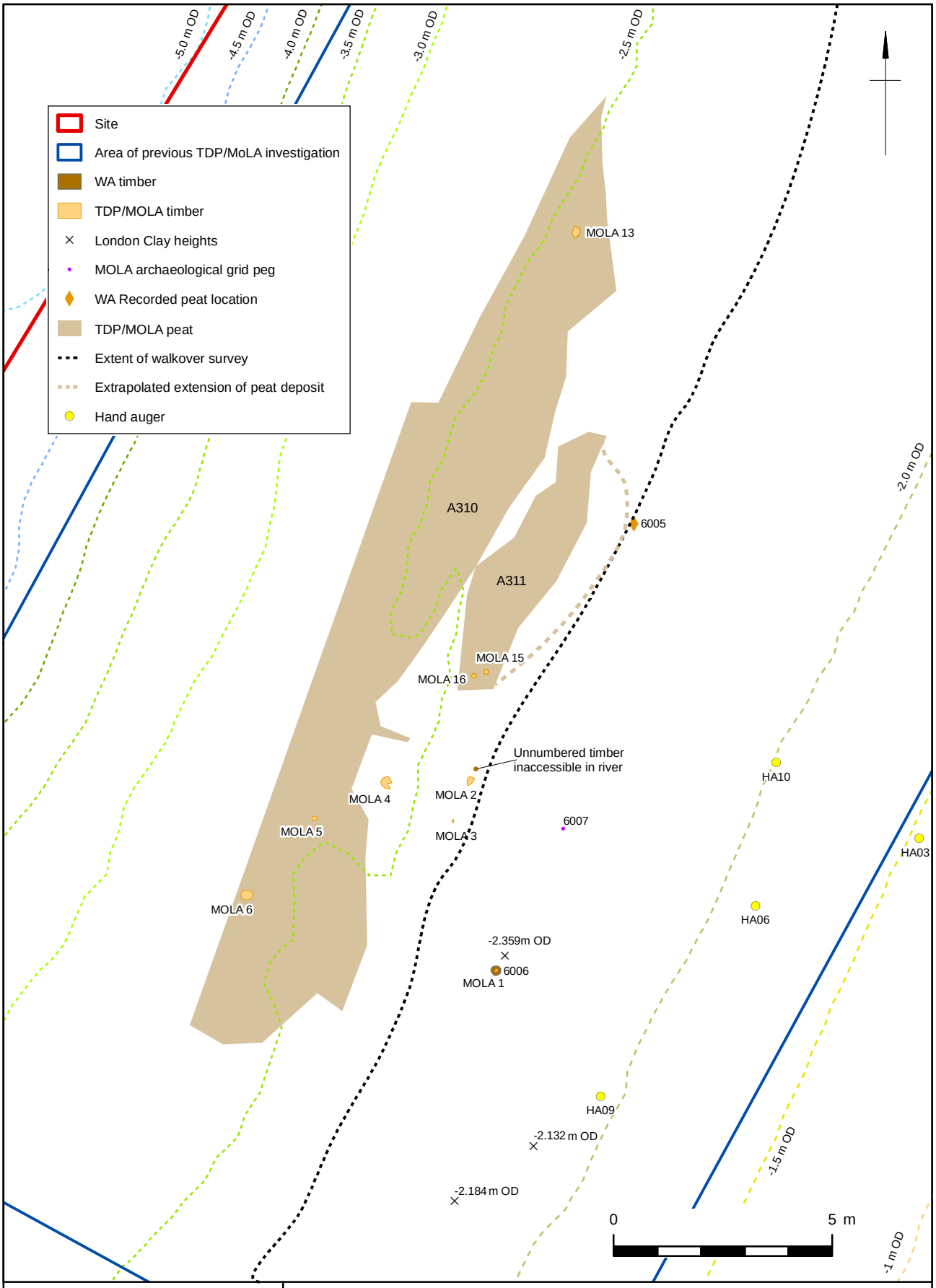
Undated
1B - TAS survey recorded an aggradation layer and feature
1E - TAS survey recorded a consolidation layer of orange clay
1G - TAS survey recorded degradation of the foreshore
22 - Area of hard consolidation
32 - TAS recorded aggradation layer

Site
Intertidal Zone
Find spot
Extent of walkover survey
Area of previous TDP/MoLA investigation
Peat
Timber
WA timber
Extant slipway
Other archaeology
Barge bed

Date:	11/01/16	Revision Number:	1
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\KST\Fig03_v2.mxd		

Albert Embankment Foreshore targeted walkover results with known Historic Environment Assets (HEA) within Site

Figure 3

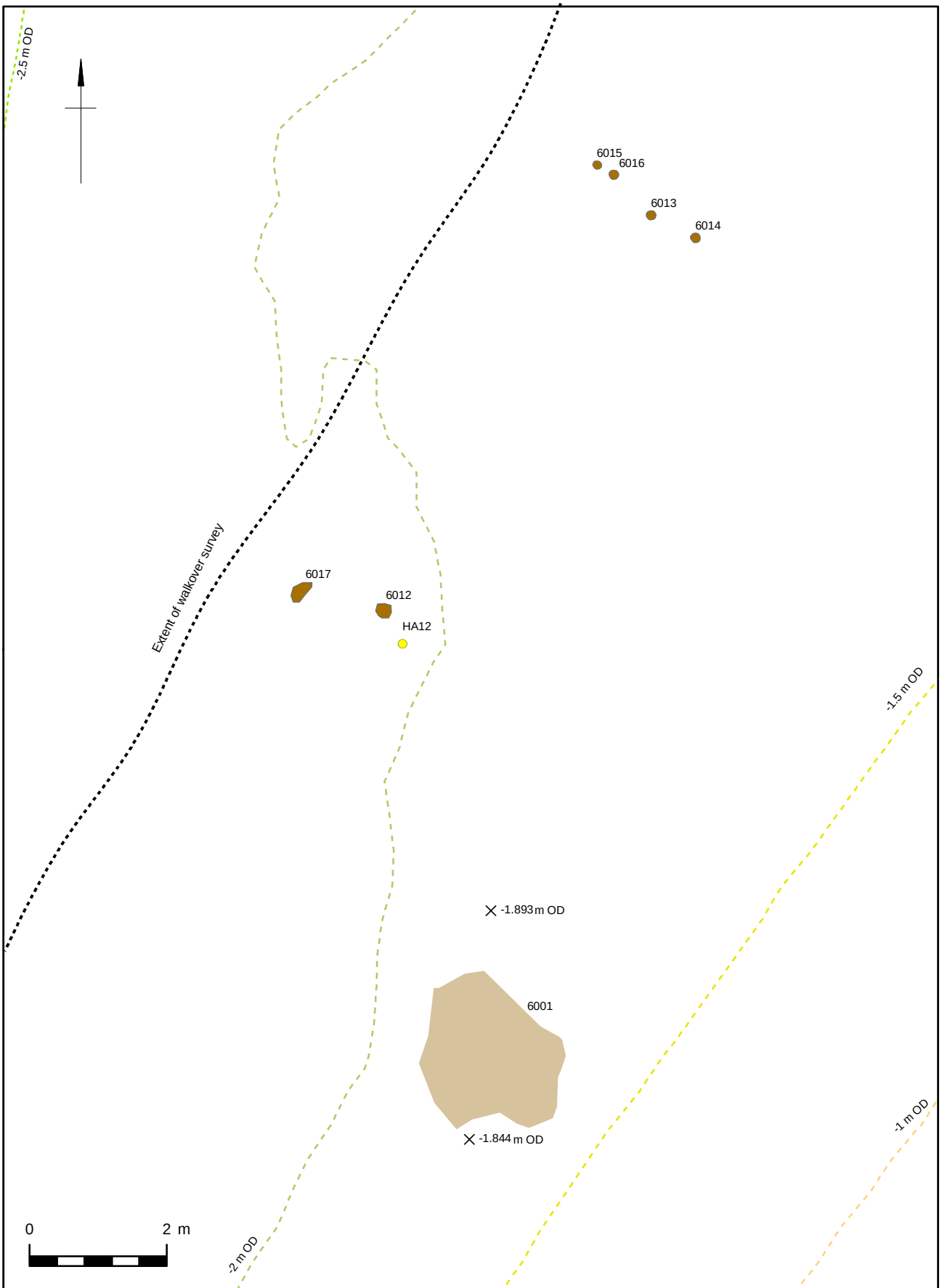


MoLA timber and peat data supplied by TDP/MoLA

Date:	11/01/2016	Revision Number:	1
Scale:	1:25 at A4	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\AEF\Fig04_v2.mxd		

Inset of Late Mesolithic probable structure and associated peat deposits overlain with previous TDP/MoLA investigation data

Figure 4



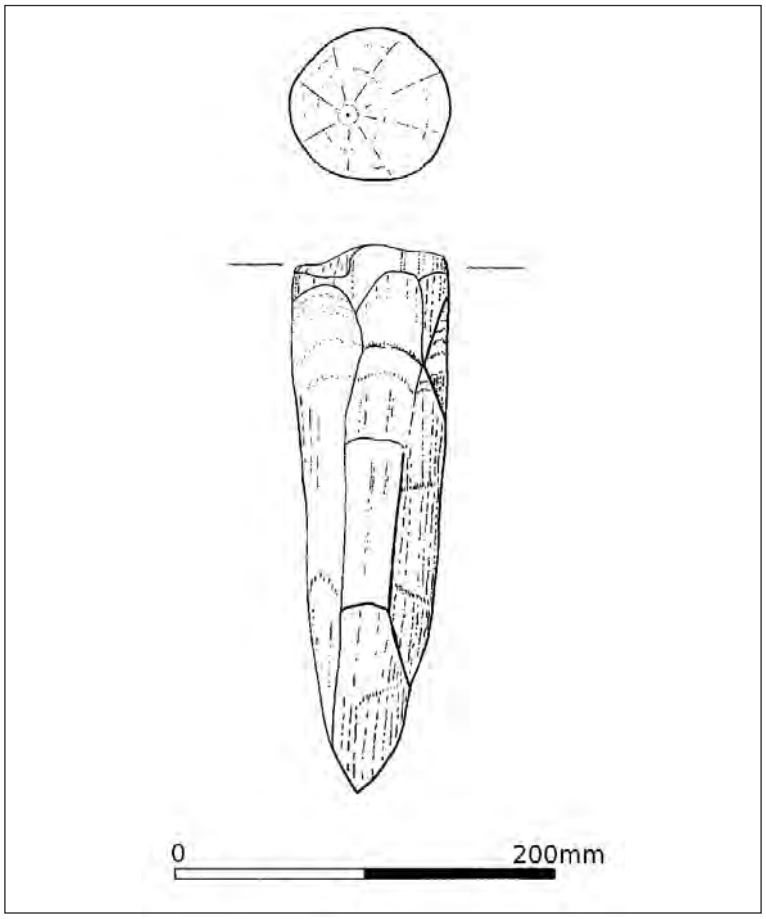
Peat
Timber
London Clay heights
Hand auger

Date:	17/06/2015	Revision Number:	0
Scale:	1:80 at A4	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\AEF\Fig05.mxd		

Inset of prehistoric timbers and deposits in central area of Site

Figure 5

Timber 6006

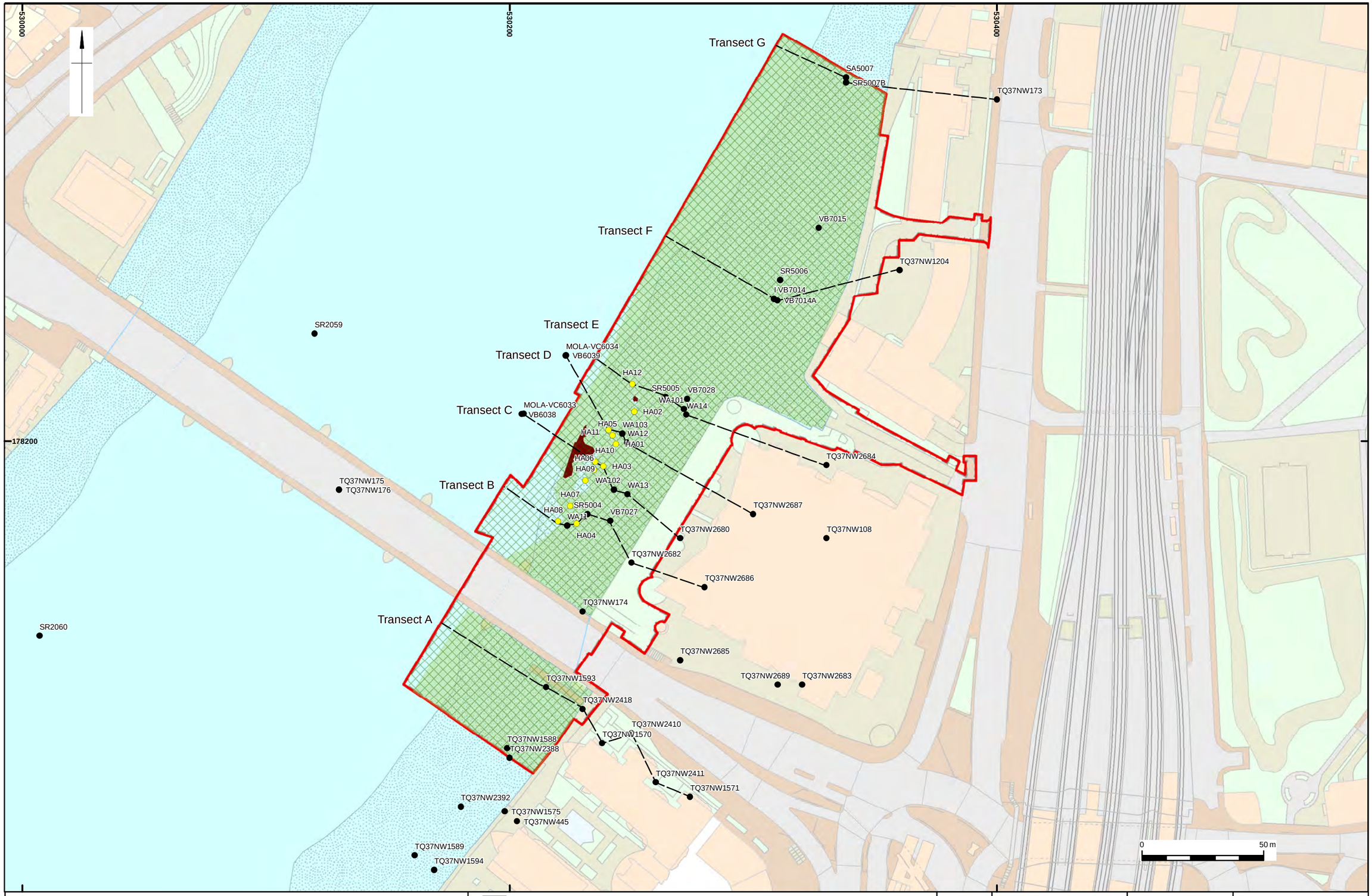


Worked wooden stake 6014

Date: 09/06/2015 Revision no.: 0 Scale: Measured dwg 1:4 at A4 Layout: KL

Path: X:\PROJECTS\102510\Drawing Office\Report figs\Evaluation\AEF\2015_05_21\Fig06.cdr

Albert Embankment Foreshore: timber 6006 and worked wooden stake 6014 Figure 6

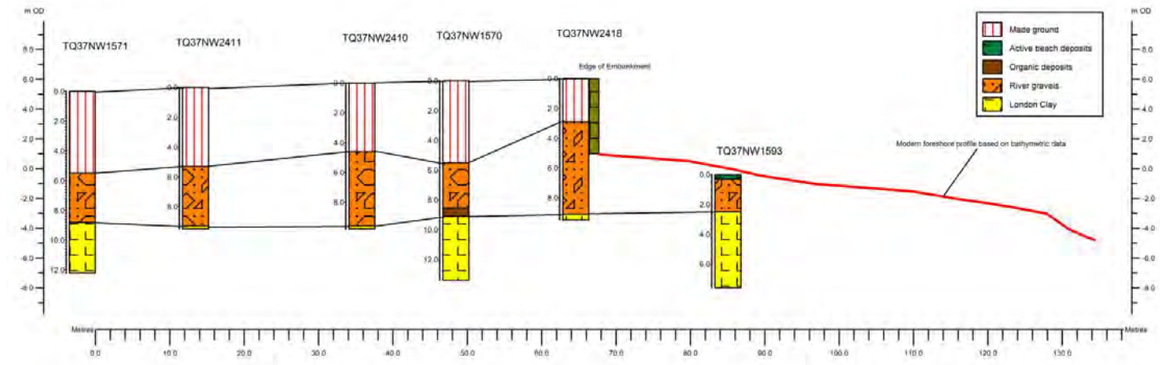


Site
Intertidal Zone
Hand auger
Bore hole
Transect
LZ1
LZ2
LZ3

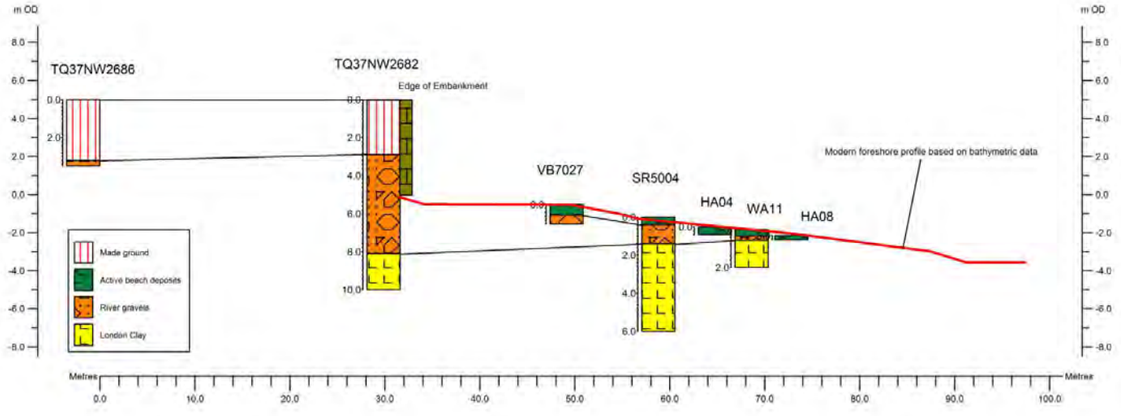
Date:	24/06/15	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\KST\Fig07.mxd		

Albert Embankment Foreshore Deposit Modelling: location of transects and predicted landscape zones

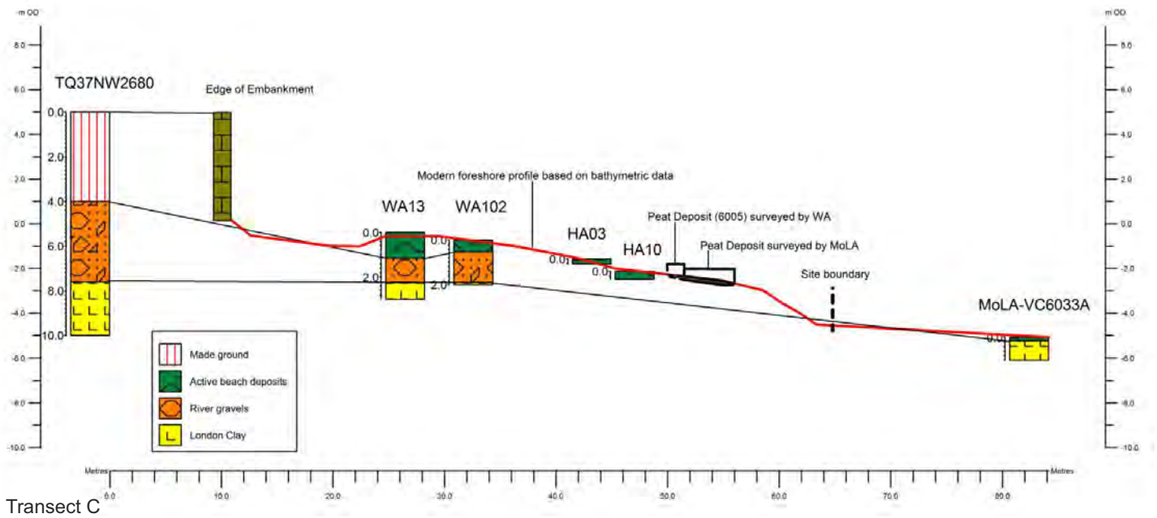
Figure 7



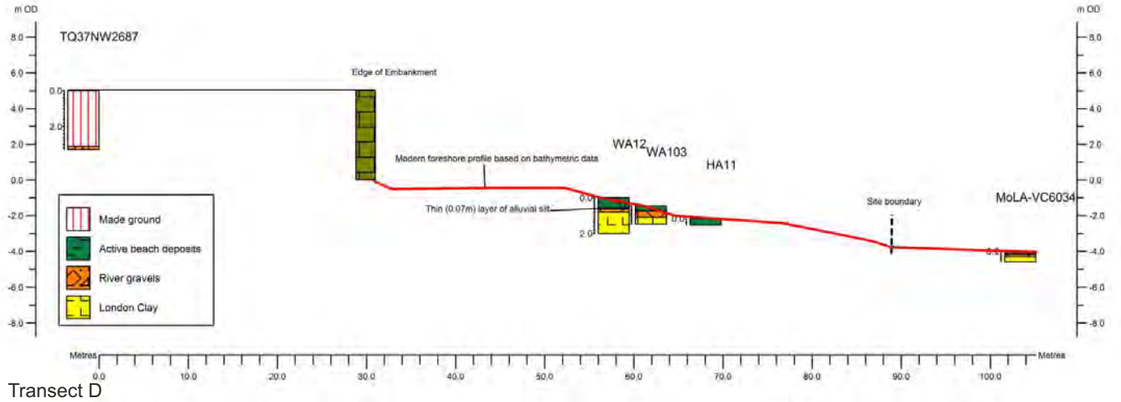
Transect A



Transect B



Transect C

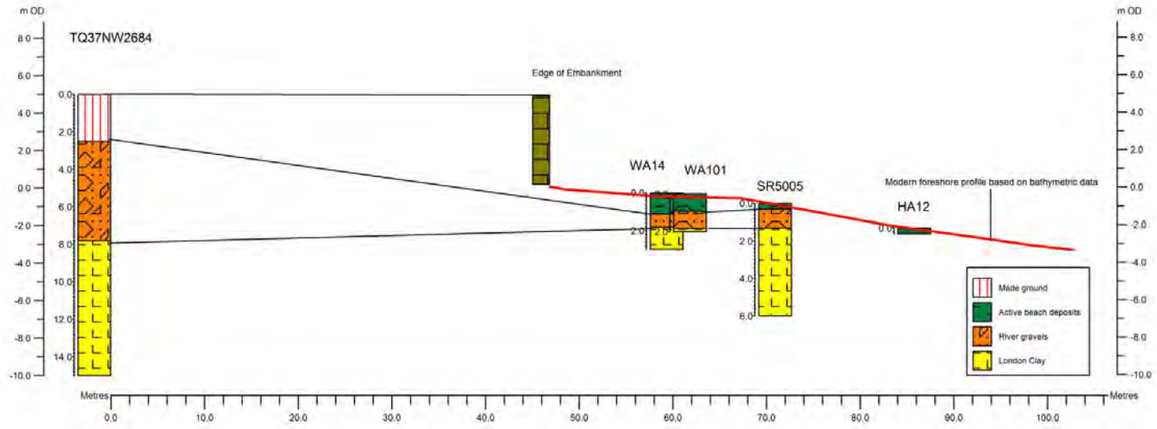


Transect D

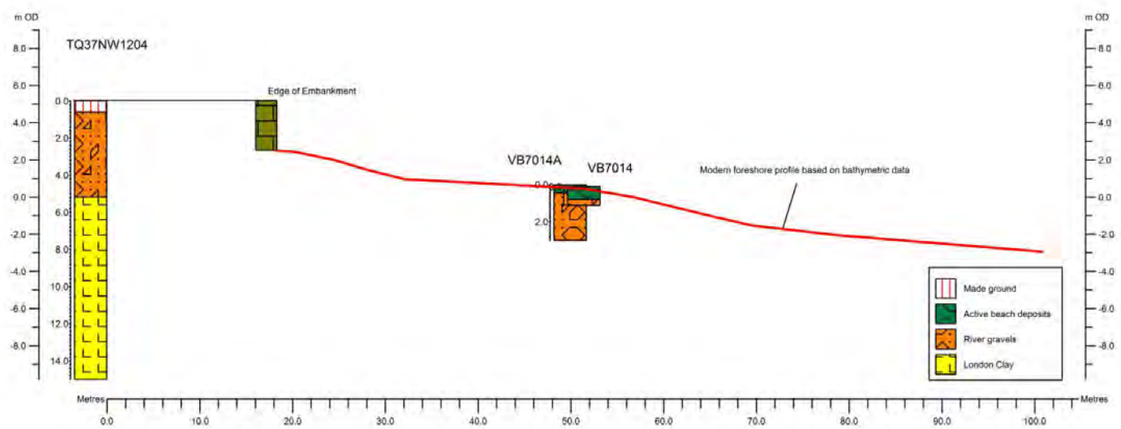
Date:	23/06/15	Revision Number:	0
Scale:	n/a	Illustrator:	KL
Path:	X:\PROJECTS\102510\Drawing Office\Report figs\Evaluation\AER\Fig08.cdr		

Albert Embankment Foreshore Deposit modelling results (transects A to D)

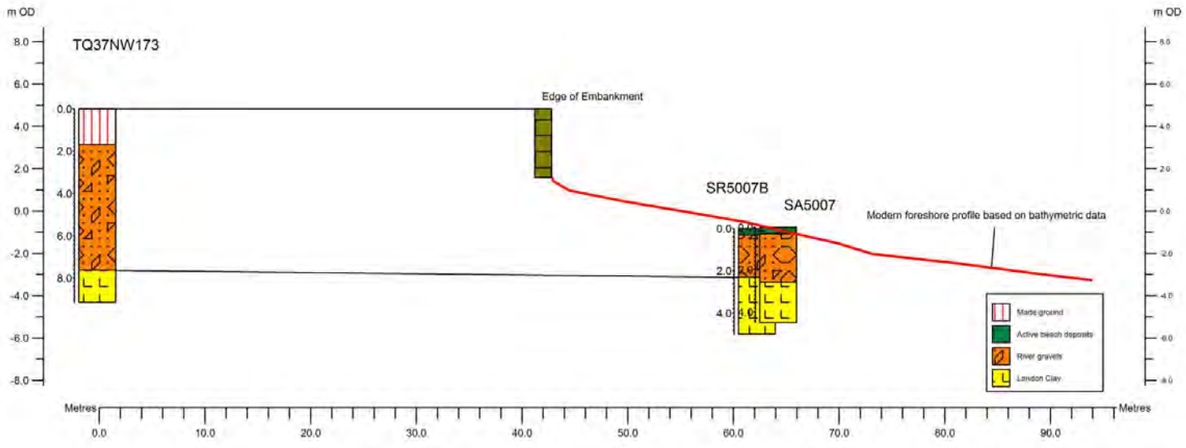
Figure 8



Transect E



Transect F



Transect G

Date:	11/06/15	Revision Number:	0
Scale:	n/a	Illustrator:	KL
Path:	X:\PROJECTS\102510\Drawing Office\Report figs\Evaluation\AER\Fig09.cdr		

Albert Embankment Foreshore Deposit modelling results (transects E to G)

Figure 9

530000
530200
530400
178200
Transect G
Transect F
Transect E
Transect D
Transect C
Transect B
Transect A
SA5007
SR5007B
TQ37NW173
VB7015
TQ37NW1204
SR5006
I VB7014
VB7014A
SR2059
MOLA-VC6034
VB6039
HA12
SR5005
VB7028
HA02
WA101
WA14
MOLA-VC6033
VB6038
HA05
WA103
HA11
WA12
HA01
HA01
TQ37NW2684
HA06
HA03
HA09
HA10
WA102
WA13
TQ37NW175
TQ37NW176
HA07
SR5004
TQ37NW2687
HA08
VB7027
WA11
HA04
TQ37NW2680
TQ37NW108
TQ37NW2682
TQ37NW2686
TQ37NW174
SR2060
TQ37NW2685
TQ37NW1593
TQ37NW2689
TQ37NW2683
TQ37NW2418
TQ37NW2410
TQ37NW1570
TQ37NW1588
TQ37NW2388
TQ37NW2411
TQ37NW1571
TQ37NW2392
TQ37NW1575
TQ37NW445
TQ37NW1589
TQ37NW1594

River gravels surface
m OD
High : 4.17327
Low : -5.06282

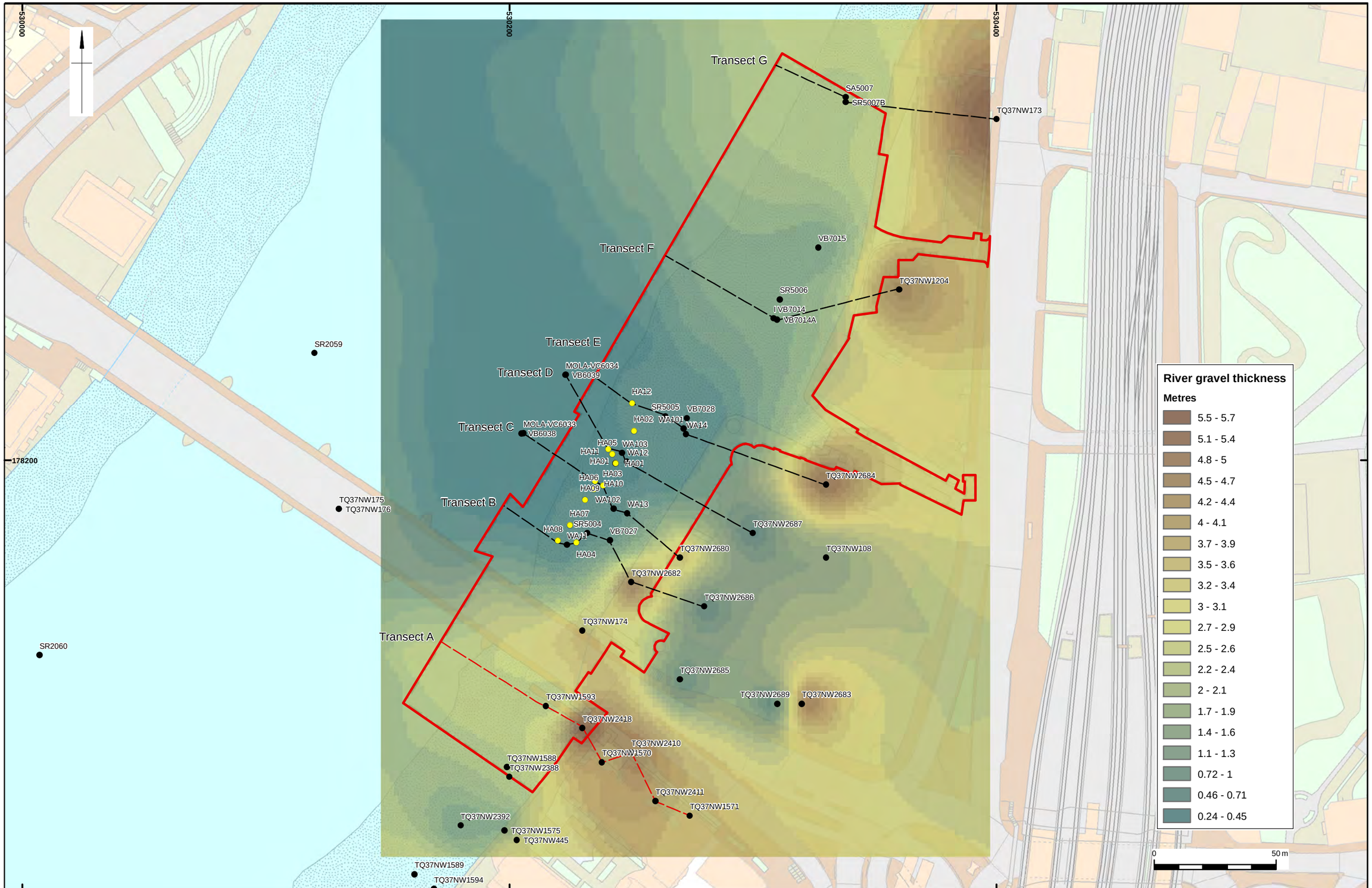
0
50 m

Site
Intertidal Zone
Transect
Hand auger
Bore hole

Date:	11/06/15	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\KST\Fig10.mxd		

Albert Embankment Foreshore river gravels DEM

Figure 10



Site
Intertidal Zone
Transect
Hand auger
Bore hole

Date:	11/06/15	Revision Number:	0
Scale:	1:1500 at A3	Illustrator:	KL
Path:	X:\PROJECTS\102510\GIS\FigsMXD\Evals_DO\KST\Fig11.mxd		

Albert Embankment Foreshore river gravels thickness model

Figure 11

Plate 1: View from south-east of late Mesolithic timber 6006

Plate 2: View from south of Late Meolithic timber 6012

Plate 3: View from south of Late Mesolithic timber 6017

Plate 4: View from north-east showing ‘island’ of peaty deposit 6001 surrounded by underlying London Clay

Plate 5: Late Bronze Age timber 6014 in section, prior to lifting

Plate 6: View from east of timber 6013

Date:	12/06/2015	Revision Number:	0
Scale:	n/a	Layout:	KL
Path:	X:\PROJECTS\102510\Drawing Office\Report figs\Evaluation\AEF\Plates.cdr		

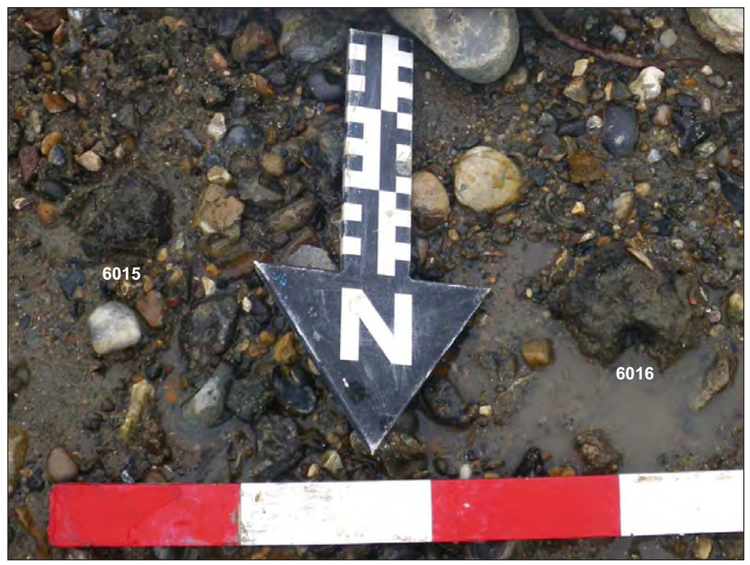


Plate 7: View from south of timbers 6015 and 6016

Plate 8: View from south-west of remains of barge bed 6009

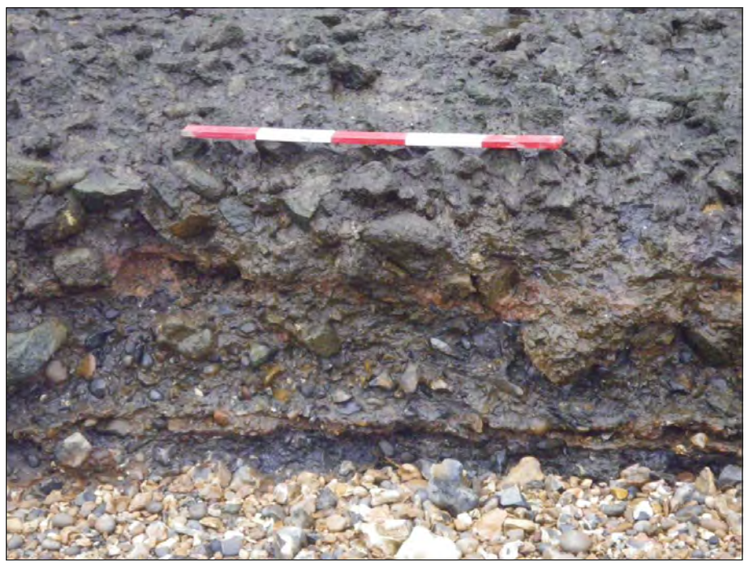


Plate 9: Exposed section of barge bed 6009 showing varying make up layers

Plate 10: Cobbled surface and underlying chalk of barge bed 6009

Plate 11: View from east of timber 6010

Plate 12: View from south of crane/winch base 6011

Date:	23/06/2015	Revision Number:	0
Scale:	n/a	Layout:	KL
Path:	X:\PROJECTS\102510\Drawing Office\Report figs\Evaluation\AEF\Plates.cdr		

References

Anderson, R., 2005, An annotated list of the non-marine Mollusca of Britain and Ireland, *Journal of Conchology* 38, 607-637

Barton, N., 1992, *The Lost Rivers of London*. Historical Publications, London

Bayliss, A, Bronk Ramsey, C, van der Plicht, J, and Whittle, A, 2007 Bradshaw and Bayes: towards a timetable for the Neolithic, *Cambridge Archaeological Journal* **17**, 1–28

Bridgland,D.R., 1994, *Quaternary of the Thames*, Chapman and Hall, London

Bronk Ramsey, C. and Lee, S., 2013, Recent and phased development of the Program OxCal, *Radiocarbon* **55**, (2-3), 720-730

Brunning, R. and Watson, J., 2010*, Waterlogged Wood: Guidelines on the recording, sampling, conservation and curation of waterlogged wood*. English Heritage, London

English Heritage 2011, *Guidelines for Environmental Archaeology and Geoarchaeology*

Gibbard, P.L., 1994, *Pleistocene History of the Lower Thames Valley*, Cambridge University Press

Hather, J. G., 2000, *The Identification of the Northern European Woods- A guide for archaeologists and conservators.* Archetype Publications, London

Haughey, F.M., 2003, From prediction to prospection: finding prehistory on London's River in Howard, A. J., Macklin, M. G. and Passmore, D.G. (eds.) 2003, *Alluvial Archaeology in Europe*. A.A. Balkema Publishers, Lisse, the Netherlands

Hodgson, J. M. 1997, Soil Survey Field Handbook, Harpenden, Soil Survey Technical Monograph No. 5.

Milne, G., Cohen N., and Cotton, J., 2010, London's Top Secret: London's oldest prehistoric structure, *London Archaeologist 12*

Mook, W. G., 1986, Business Meeting: recommendations/resolutions adopted by the twelfth international radiocarbon conference, *Radiocarbon* **28**, 799

Museum of London, 1994, *Archaeological Site Manual,* 3rd edition

Museum of London & English Heritage 2002, *A Research Framework for London Archaeology*

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Bronk Ramsey, C., Grootes, P.M., Guilderson, T.P., H., H., H., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughes, K.A., Kaiser, K.F.,Kromer, B., Manning, S.W., Nui, M., Reimer, R.W., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M., & van der Plicht, J., 2013, IntCal13 and Marine 13 Calibration Curve, 0–50,000 Years BP *Radiocarbon* 55 (4)

Sidell, J., Cotton, J., Rayner, L. and Wheeler, L., 2002, *The prehistory and topography of Southwark and Lambeth*. MoLAS Monogr Ser 14, London

Sidell, J., Wilkinson, K., Scaife, R. and Cameron, N., 2000, *The Holocene Evolution of the Thames, archaeological excavations (1991-1998) for the London Underground Limited Jubilee Line Extension Project* Museum of London Archaeological Services Monograph 5

Society of Museum Archaeologists, 1993, *Selection, Retention and Dispersal of Archaeological Collections: guidelines for use in England, Wales and Northern Ireland* (1st edition)

Schoch, W., Heller, I., Schweingruber, F. H. and Kienast, F., 2004, *Wood anatomy of central European Species* http://www.woodanatomy.ch

Stace, C., 2010, *New Flora of the British Isles – third edition.* Cambridge University Press, Cambridge

Stuiver, M., and Reimer, P. J., 1986, A computer program for radiocarbon age calculation, *Radiocarbon*, **28**, 1022–30

Stuiver, M, and Reimer, P J, 1993, Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program, *Radiocarbon*, **35**, 215–30

Taylor, M., 1998, Wood and bark from the enclosure ditch. In: F. M. M. Pryor (ed.) *Etton: excavations at a Neolithic causewayed enclosure near Maxey, Cambridgeshire, 1982-87.* English Heritage Archaeological Reports 18, London, pp. 115-59

Taylor, M., 2001, The Wood. In: F. M. M. Pryor (ed.) *The Flag Fen Basin: Archaeology and Environment of a Fenland Landscape.* English Heritage Archaeological Reports, London, pp. 167-228

Van de Noort, R., Ellis, S., Taylor, M. and Weir, D., 1995, Preservation of archaeological Sites. In: R. Van de Noort and S. Ellis (eds.) *Wetland Heritage of Holderness - an archaeological survey*. Humber Wetlands Project (1st Edition)

Wragg 2012, Report on emergency survey work undertaken by the Thames Discovery Programme team on the Vauxhall foreshore, Lambeth, 2012, unpublished report

TTT documents

Thames Tideway Tunnel 2013, Application for Development Consent (Application Reference Number: WWO10001) Overarching Archaeological Written Scheme of Investigation (OAWSI) Document ref. 7.13

Thames Tideway Tunnel 2013, Application for Development Consent (Application Reference Number: WWO10001), Environmental Statement (Section 7 Historic Environment and Appendix E Historic Environment of Vol 16)

Thames Tideway Tunnel 2014, Written Scheme of Investigation for a foreshore-based archaeological evaluation: Albert Embankment Foreshore. Document no. 100-RG-ENV-00000-000161 (SSAWSI)

Wessex Archaeology 2013, Thames Tideway Tunnel – Archaeological Gap Analysis of Marine Geophysical Data, Unpublished Report Ref: T17424.01

Wessex Archaeology 2014, Thames Tideway Tunnel – Multibeam Bathymetry Data Condition Monitoring, Unpublished Report Ref: 102510.26