



Multi-Disciplinary Consultant Package 4

PLANNING AND ENVIRONMENT

Package Specific WSI Deliverable
 DDBA North Woolwich Portal

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1 Executive Summary

This assessment represents a commitment to providing early advice to establish the cultural heritage resource of the site and surrounding sturdy area.

Multi Disciplinary Consultancy Package 4 (MDC4) has undertaken an archaeological Detailed Desk Based Assessment (DDBA) covering the proposed railway portal at North Woolwich, as part of the Crossrail development (NGR 542698 180003).

The portal is located between Factory Road and Alfred Road at the junctions of Winifred Road and Fernhill Street with Albert Road. The proposed portal works consist principally of the tunnel entrance (eye) and shaft, approached by an extensive length of cut-and-cover tunnel approach ramp. The shaft would be used for construction of the running tunnels and on completion would become an intervention and evacuation point. There would also be a construction compound (worksite), sewer and utility diversions and dewatering.

The North Woolwich Portal site lies within an Archaeological Priority Area. The Greater London Sites and Monuments Record (GLSMR) identifies 21 entries within the study area. There are however, no finds or monuments within the site footprint and no Scheduled Ancient Monuments in the study area at all. There is a Listed Building within the study area (North Woolwich Station, **MLO90707**) however designated buildings are beyond the remit of this report. There are several non-designated structures within the study area, including a pedestrian tunnel beneath the River Thames (GLSMR **2216330/00/00**); Woolwich Manorway Pumping Station and Sewage Works (GLSMR **800110/00/00**); Woolwich Manorway Engine House (GLSMR **800110/01/00**); Woolwich Manorway Boiler House (GLSMR **800110/02/00**); Woolwich Manorway Coal Shed (GLSMR **800110/03/00**); Woolwich Manorway Chimney (GLSMR **800110/04/00**); and a former Sewage Pumping Station (**MLO76401**).

Please refer to Appendix 1

The area has **high potential** for palaeo-environmental and topographic evidence within the alluvium. There is **moderate potential** for prehistoric activity at the wetland/dry land interface (particularly Mesolithic to Bronze Age); for Roman there is a **low potential** for finds, **increasing to moderate** in the vicinity of Roman roads and occupation sites; the archaeological potential for medieval and post medieval finds is **low increasing to moderate** in the vicinity of known settlements; and **moderate** for industrial and railway archaeology. Any prehistoric structures, such as timber trackways, would be of high importance. Other remains are of moderate importance (Assessment of Archaeology Impacts, part 4, 2005. p101).

The Geoarchaeological deposit model identifies reasonable potential for prehistoric to Roman archaeological remains in the form of boats, and subsistence equipment related to fishing and the exploitation of the Thames floodplain in landscape zone 1. Landscape Zone 2 has a good potential for evidence of dry-land prehistoric and later human activity. While Landscape Zone 3 has reasonable to good potential for the recovery of prehistoric wetland archaeological remains (such as Bronze Age timber trackways or platforms), and excellent potential for the recovery of organic remains with palaeoenvironmental significance. (Geoarchaeological Deposit Model: North Woolwich Portal. January 2008)

Where the potential geoarchaeological deposits are likely to be impacted upon by the scheme proposals an appropriate mitigation method statement will be developed.



Preservation by record would be the most appropriate form of mitigation for archaeological remains within this area. With this mitigation, no significant impacts will occur. Mitigation proposals will be detailed in the subsequent WSI.



2 Introduction

2.1 Project Background and Site Location

Crossrail is a new Cross-London Rail Link project which will provide a transport routes across the southeast of England and London. The line will provide a range of both new and improved rail journeys across London and its immediate surroundings. The proposed development will include the construction of seven stations within central London which will have interchange with other public transport modes including the London Underground, National Rail and the London Bus service; the development will also include the renewal and/or upgrade of existing stations outside central London. The route itself will link Maidenhead and Heathrow in the west with Shenfield in the north-east and Abbey Wood in the south-east. As part of these works a portal at North Woolwich will be required.

The North Woolwich portal will be located within the existing railway corridor of the North London Line between Factory Road and Albert Road, NGR 542698 180003 (see **Figure 1**). The tunnel portal itself will be located between the junctions of Winifred Road and Fernhill Street with Albert Road, from here the line will run in a cut and cover box to the tunnel eye. To the north of the portal lies a residential area, and to the south industrial buildings, beyond that is the River Thames (ES, Vol 1. p402).

2.2 Proposed Development Summary

The proposed development of the North Woolwich Portal will involve (ES, Vol3. p407):

- Ground treatment over the portal area and removal of the old 1600 mm sewer that will have been diverted (refer to SES2 Utilities Mapping SE4, part 1&2). Installation of walling to the perimeter of where the shaft and the deeper section of the tunnel approach ramp/portal structure will be constructed and then installation of piling to what will form the shallower retained cut section of the portal approach ramp;
- Construction of the rectangular concrete shaft roof below Albert Road from the top down, followed by excavation works. The shaft and the cut and cover and sections will be excavated and propped in stages after which concrete base slabs and central walls (cut and cover section) will be cast;
- Lining and fitting out, followed by construction and fitting out of the shaft surface structure housing;
- Installation of track slabs followed by track laying, installation of signalling systems and system testing. These works will commence in parallel with the internal fit-out of the shaft; and
- Some dewatering may be necessary during excavation and construction of the approach ramp and portal structures.



2.3 Reporting Limitations

- The report has been prepared under the express instructions and solely for the use of CLRL;
- All work carried out in preparing this report has utilised and is based upon MDC4 Archaeology Team's professional knowledge and understanding of current (2008) relevant United Kingdom standards and codes, technology, and legislation. Changes in these areas may occur in the future and cause any conclusions, advice, recommendations or designs contained in this report to become inappropriate or incorrect; and
- This report represents an early stage of a phased approach to assessing the archaeological and cultural heritage resource of the site and study to allow the development of an appropriate mitigation strategy, should this be required. It does not comprise mitigation of impacts in itself.



3 Aims and Objectives of Assessment

It is in the interest of the local community, the developer and the Local Authority that archaeological and cultural heritage issues are discussed, with an appropriately trained specialist, at an early stage in the planning process. This assessment represents a commitment to providing early advice to establish the Cultural Heritage Resource of the site and surrounding study area.

The aims of this Detailed Desk Based Assessment were therefore to:

- Identify archaeology and cultural heritage constraints (including planning constraints) within and in the immediate vicinity of the site;
- Assess the baseline conditions and offer an analysis of the extent, preservation, sensitivity, potential and importance of the recorded cultural heritage resource within the site;
- Assess the baseline information and offer an analysis for the potential that unrecorded archaeology/cultural heritage remains survive within the site;
- Assess the potential impacts upon the known and currently unknown archaeological resource, taking into account the severity of the impacts and the importance of the resource; and
- Propose a programme of further works and / or suitable mitigation measures to avoid, reduce or remedy any adverse impacts caused by development, if required.

The specific traits of a DDBA differentiating it from a standard DBA include:

- The use of extensive, new data from site specific surveys or additional documentary searches;
- Qualitative level of analysis, detailed by site; and
- Reporting with detailed factual statement and scope for WSI (Written Scheme of Investigation), with interpretative site deposit model and detailed plan and with outline costs and scope of mitigations.



4 Methodology & Sources

4.1 Methodology

This assessment was conducted with regard to standards set out by the Institute of Field Archaeologists (IFA).

Information was obtained for an irregular shaped study area extending 500 metres along the stretch of land between the Docks and the River Thames and 500 metres radius from Albert Road. The development is centred at OS grid-point 542698 180003 (**Figure 2**). The scope of resources examined included statutorily designated cultural heritage sites such as Scheduled Monuments and Conservation Areas (Listed Buildings are not covered under the scope of this report), above ground non-designated built heritage features, as well as features of the cultural heritage resource recorded on the Greater London Sites and Monuments Record (GLSMR).

The general approach and methodology has been to consider the effects on the cultural heritage resources including Archaeological Sites and Monuments (including palaeo-environmental deposits assessed by means of a deposit model) – potential destruction or damage to sites and monuments due to permanent or temporary landtake and / or physical intrusion and indirect effects, such as changes to the drainage pattern.

These resources may be nationally or locally designated (by Registration or Scheduling), may appear in the national or local archaeological record, or may be identified from specialist scrutiny of the landscape and historic records.

A gazetteer listing (**Appendix 1**) the known cultural heritage resource within the study area was compiled and is provided in **Appendix 1**. Each entry has been marked on a cultural heritage features map (**Figure 2**) and discussed in the text. In addition this report includes a map regression study.

In summary the work has involved:

- identifying the sources available for consultation;
- assembling, consulting and analysing the available resources;
- consulting specialists as appropriate; and
- preparing the written report.



4.2 Sources

Crossrail Environmental Statement. February 2005

Crossrail Archaeology Programming Assessment, November 2006.

Crossrail MDC4 Archaeology Updated Baseline Assessment, January 2008

Crossrail MDC4 Archaeology Overview of ground Levels and Land Raising around the Docks in the MDC4 area January 2008

Crossrail MDC4 Archaeology – Geoarchaeological Deposit Model: North Woolwich Portal. January 2008

Historic maps including Rocque, Chapman and Andre, and Ordnance Survey

Supplementary Environmental Statement 2 (SES2). January 2006

Technical Report – Assessment of Archaeology Impacts, Part 4 South-east Route Section. February 2005

MoLAS. The Holocene Evolution of the London Thames, Archaeological Excavations (1991-1998) for the London Underground Limited Jubilee Line Extension Project.

Victoria County History, Essex Vol 6

Other SES & APS:

- SES 1- No Relevant changes to North Woolwich;
- SES 3 & SES 3 Erratum - No Relevant changes to North Woolwich;
- SES 4 - No Relevant changes to North Woolwich;
- Amendment to Provision 1 -Jan 2006 - No Relevant changes to North Woolwich;
- Amendment to Provision 2- May 2006 - No Relevant changes to North Woolwich;
- Amendment to Provision 3 -Nov 2006 - No Relevant changes to North Woolwich;
and
- Amendment to Provision 4- May 2007 - No Relevant changes to North Woolwich.



5 Results

5.1 Statutory/Non statutory Protected Features

The North Woolwich Portal lies within an archaeological priority area as designated by London Borough of Newham.

There are no Scheduled Ancient Monuments within the search area around the North Woolwich Portal. (NB buildings of special architectural or historic interest – Listed Buildings – do not fall within the remit of this report). There are several non-designated structures within the study area, including a pedestrian tunnel beneath the River Thames (GLSMR **2216330/00/00**); Woolwich Manorway Pumping Station and Sewage Works (GLSMR **800110/00/00**); Woolwich Manorway Engine House (GLSMR **800110/01/00**); Woolwich Manorway Boiler House (GLSMR **800110/02/00**); Woolwich Manorway Coal Shed (GLSMR **800110/03/00**); Woolwich Manorway Chimney (GLSMR **800110/04/00**); and a former Sewage Pumping Station (**MLO76401**). These are discussed below.

5.2 Sites and Monuments Record (SMR)

The local SMR, held by the Greater London Sites and Monuments Record (GLSMR) was consulted to establish if any additional non-designated Archaeological Findspots and sites or cultural heritage remains were recorded in their database since the Environmental Statement was written. In total there were 21 entries identified by the GLSMR which are discussed below in the archaeological and historical background section. A gazetteer of these finds can be found in **Appendix 1**.

The report on the updated baseline (Crossrail MDC4 Archaeology – Updated Baseline, 2008. p24) states that there are new baseline data entries (not all of which are in the GLSMR and most of which fall outside the Land to be Acquired or Used and the Limits of Deviation). They are as follows:

- DLA03 – Watching brief and evaluation of bore holes. Negative evidence, sedimentary sequence giving environmental/topographical information. Outside LLAU/LOD (Land to be Acquired or Used/Limits of Deviation);
- DLR05 – Watching brief. environmental/topographical sequence of two brands of peat and silty clay (dating from the late Mesolithic period to the late Bronze Age) overlying natural gravels. Outside LLAU/LOD;
- ORI05 (MLO76391) - Auger holes. Sedimentary sequence giving environmental/topographical information including peat and possible timber structure. Outside LLAU/LOD;
- ORI05 (MLO9814) – Evaluation. Sedimentary sequence giving environmental/topographical information. Outside LLAU/LOD; and
- PIE07 – Evaluation. Deep alluvial sequence with extensive peat and wood peat deposits formed in the wooded backswamp of a meandering “inland river” Thames, prior to its flooding in the Late Bronze Age or Iron Age. Upper surface of the peat presented remains of palaeochannel. Outside LLAU/LOD.



Baseline data added to the SMR includes North Woolwich station (**MLO90707**) – which is beyond the remit of this report as it is a listed building; and Drew Road, (**GLSMR 062811/00/00**) Peat floodplain deposit. Geotechnical boreholes. Sedimentary sequence (etc) including peat and alluvium. Outside LLAU/LOD – which is mentioned below.

5.3 Geology, Topography and Palaeoenvironment

Average ground levels in the area surrounding the North Woolwich Portal site lie between c 1.5 and c 2.5m OD. Levels rise to the north and south of the site, approaching the King George V Dock and the Thames, respectively (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).

In an area extending c 80m to the south of the King George V Dock, ground level rises to c 4.5m OD. This appears to be the result of spoil (probably redeposited alluvium) dumped from excavation of the docks. Redeposited alluvium (over in situ alluvium) c 2 to 3m thick has been recorded on two archaeological sites in this area (site codes SVY02, TWF07), itself overlain by 'made ground' c 2 to 3m thick (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).

Similarly, in an area extending 70m north of the Thames, levels increase to c 5.0–5.5m OD, which may be the result of embankment construction.

In situ alluvium has been recorded at c –1.0 to c 1.0m OD with varying thicknesses in this area (ORIO05, DLR05, PIE07, AET01, etc). Peat was present beneath this alluvium on six of these sites, but possibly not in one of the boreholes (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).

The surface of the natural geology (Shepperton Gravels) has been recorded between c –6.0 and c –2.5m OD (ORIO05, BAJ00, DLA03, etc) (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).

Thus the site has high potential for palaeo-environmental and topographic evidence within the alluvium. The site is situated on floodplain of peat and alluvium (reclaimed marshland) 100m to the north of the River Thames. This area was dry land intersected by channels in the Mesolithic, becoming wetland during the Neolithic and former sand/gravel eyots exist in the area. The site may include a palaeochannel (the former Ham Creek). The 1869 Ordnance Survey shows a stream channel crossing the site and discharging into the creek south of Albert Road. An 1805 map shows this creek as having been larger and extending further inland, suggesting the presence of a palaeochannel from a minor tributary of the Thames (Assessment of Archaeology Impacts, part 4, 2005. p50).

5.4 Deposit Modelling

The Geoarchaeological deposit model identifies reasonable potential for prehistoric to Roman archaeological remains in the form of boats, and subsistence equipment related to fishing and the exploitation of the Thames floodplain in landscape zone 1. Landscape Zone 2 has a good potential for evidence of dry-land prehistoric and later human activity. While Landscape Zone 3 has reasonable to good potential for the recovery of prehistoric wetland archaeological remains (such as Bronze Age timber trackways or platforms), and excellent potential for the recovery of organic remains with



palaeoenvironmental significance. (Geoarchaeological Deposit Model: North Woolwich Portal. January 2008)

For the full Geoarchaeological Deposit Model text refer to Appendix 2. For the models refer to Appendix 3

5.5 Previous Excavation or Survey

The GLSMR identifies several previous geoarchaeological evaluations, excavations and Desk Based Assessments. These include:

- **MLO76394** – Geoarchaeological Evaluation undertaken as 145-155 Albert Road revealed late Mesolithic deposits;
- **MLO77217** - Geoarchaeological Evaluation undertaken as 145-155 Albert Road revealed Neolithic deposits;
- **MLO77218** - Geoarchaeological Evaluation undertaken as 145-155 Albert Road revealed Bronze Age deposits;
- **MLO77219** - Geoarchaeological Evaluation undertaken as 145-155 Albert Road revealed that the Bronze Age peat may have been truncated in the medieval period;
- **MLO77220** - Geoarchaeological Evaluation undertaken as 145-155 Albert Road revealed post-medieval deposits;
- **MLO70921** – Evaluation undertaken in 1996 at Milk Street revealed three postholes cut through a Roman dumped deposit;
- **GLSMR 062640/00/00** – evaluation undertaken in 1996 at Milk Street revealed a Roman Dump;
- **MLO76401** – Desk Based Assessment for the redevelopment of the former Sewage Pumping Station;
- **GLSMR 062486/00/00** – compilation of borehole reports as part of a desk based assessment revealed possible ancient water channels of unknown date; these may be associated with maritime features which potentially survive archaeologically; and
- **GLSMR 062294/00/00** – excavations at Albert Road and the North Woolwich Pumping Station revealed alluvial peat and silt deposits of unknown date.

5.6 Chronological Summary/Archaeological and Historical Background

This section provides a brief overview of the archaeological background of the study area which will aid understanding of the likelihood of encountering currently unrecorded resources within the application site and potentially determine their significance and likely condition.



5.6.1 Prehistoric Period (c 500,000BP – AD50)

It is not anticipated that any in situ Palaeolithic remains will be found within this area as they are likely to have been reworked by changes in the course and floodplain of the River Thames (Assessment of Archaeology Impacts, part 4, 2005. p2).

Following the end of the last glaciation, the Thames and the lower Lea followed a course of multiple braided channels, which would have accumulated organic sediments as they became disused, between c 11,000 and 9000 BC. The likely environment comprised marshes, shallow watercourses, sand banks and islands where hunting, fowling, fishing and plant resources would have attracted nomadic groups. Such landscapes may in part have been sealed and preserved by alluvium in subsequent transgression phases, but they would be characterised by transient activity rather than settlement. They are also likely to have been truncated by down-cutting and erosion from later channel formations. Rising sea levels and flooding of the Thames estuary would have led to the inundation and abandonment of these traditional hunting grounds, placing greater pressure on resources inland (Assessment of Archaeology Impacts, part 4, 2005. p3/ MoLAS, The Holocene Evolution of the London Thames).

There is a background potential for river use and flood defence features such as revetments, causeways, trackways, fish weirs, and boats in the prehistoric, Roman, Saxon and medieval periods (Assessment of Archaeology Impacts, part 4, 2005. p3). Any such prehistoric structures would be of high importance (ES Vol3, p412).

Despite this background potential, current findspot evidence for human intervention within the study area surrounding the North Woolwich Portal is restricted to one find of a hand axe and four Mousterian artefacts (**GLSRM 110072/00/000**).

Several previous excavations and surveys, mentioned above, also reveal evidence of undisturbed prehistoric deposits at 145-155 Albert Road. The SMR preferred references for these are - **MLO76394**, **MLO77217**, and **MLO77218**. The presence of such deposits highlights the potential for recovering other prehistoric finds or structures.

Overall Prehistoric archaeological potential: moderate for Mesolithic chance finds and moderate, increasing to high for associated palaeoenvironmental sequences.

5.6.2 Roman Period (AD50-450)

During the Roman period much of this area would still have been marshy open land, although occupation evidence suggests that sea levels were much lower than they are today and that the marshes were drier, and were probably drained and extensively used. Potential Roman roads and trackways lie outside of the study area highlighting Roman activity in proximity; these routes include a trackway at the alignment of Green Street and Boundary Lane and a possible Roman road, marked by East Ham High Street and East Ham Manor Way, leading from the higher ground to the north down towards the ferry crossing at North Woolwich.

Evaluations undertaken in 1996 at Milk Street (mentioned above) reveal the presence of Roman activity within the study area. **MLO70921** revealed three postholes cut through a Roman dumped deposit. **GLSMR 062640** revealed the Roman Dump. Two layers of the dump were dated to the Roman period – the first was an organic clay containing late 2nd-late 3rd century pottery including plain samian ware, possible mayen ware, mortaria, flagons, flasks, brick, bone, slag, charcoal, wood and burnt flint;



all potentially representing domestic refuse. A second, later layer, contained similar finds which appeared to be deposited as a result of flooding.

Overall Roman archaeological potential: low, increasing to moderate in the vicinity of possible Roman roads and occupation sites.

5.6.3 Medieval Period (450-1540)

By the Early Medieval period much of the floodplain of East London was once again marshland due to the rising levels of the Thames. To the north, on the higher and drier ground, were the manors of West Ham and East Ham.

The SMR identifies two sites which date from the medieval period – the settlement of North Woolwich (GLSMR **061818/00/00**) and Hammarsh Manor (GLSMR **061803/00/00**).

There is documentary evidence for a small settlement at North Woolwich by 1086 (GLSMR **061818/00/00**), which probably centred on Hammarsh Marsh, and was owned by Westminster Abbey. The settlement lay within the parishes of East Ham and Woolwich. Documentary evidence (Victoria County History, Essex Vol 6) refers to the destruction of the settlement by a 'great flood' in 1236, although the process was probably more gradual throughout the floods of the 14th-15th centuries.

The settlement at North Woolwich, the majority of which lay on the south bank of the Thames, formed an outpost of Kent on the northern (Essex) bank, an administrative anomaly which may reflect the strategic importance of the ferry crossing here, referred to as being under royal control in 1320 (Assessment of Archaeology Impacts, part 4, 2005. p50).

Hammarsh Manor (GLSMR **061803/00/00**) is also identified through documentary evidence. It was located in the 'Marshes of East Ham near the Thames'. From at least 1086 the manor, like the North Woolwich Settlement, belonged to Westminster Abbey. At this time it comprised two hides of land and by 1846 it was enlarged to 50 acres. Little is known of the site of the Manor – the area was described as a 'cottage and a marsh' in 1530 and it is likely that it was frequently flooded.

Overall Medieval archaeological potential: low, increasing to moderate in the vicinity of known settlements.

5.6.4 Post Medieval (1540-1900)

By the early 17th century much of the marsh had been drained and reclaimed although 1612 – 1613 severe flooding occurred in the area. The ditches that were dug to drain the levels developed into major drainage dykes, becoming open sewers feeding into the tributaries of the Thames. This process of land reclamation continued into the 19th century.

By the middle of the 19th century the area had changed significantly, as London became an increasingly important international port and the associated area of docks, warehouses and industry expanded eastwards. The North Woolwich Railway line opened in 1840s and accelerated the process with large factory complexes being built alongside it. The Royal Docks were also being developed in the mid 19th century, although King George V dock, which falls within the study area, was not built until 1921.



The majority of the structures registered in the Greater London Sites and Monuments record, within the study area, date from the post-medieval period. These include:

- a pedestrian tunnel beneath the River Thames (GLSMR 2216330/00/00);
- Woolwich Manorway Pumping Station and Sewage Works (GLSMR 800110/00/00);
- Woolwich Manorway Engine House (GLSMR **800110/01/00**);
- Woolwich Manorway Boiler House (GLSMR **800110/02/00**);
- Woolwich Manorway Coal Shed (GLSMR **800110/03/00**); and
- Woolwich Manorway Chimney (GLSMR **800110/04/00**).

There is also a post medieval to modern former Sewage Pumping Station (**MLO76401**).

There is a low potential for early post medieval remains, rising to **moderate potential** near settlements; and a **moderate potential** for industrial and railway archaeology.

Overall archaeological potential: high.

5.6.5 Modern (1900+)

The only Sites and Monuments record that dates from the modern period is the former Sewage Pumping Station (MLO76401) – for which a Desk Based Assessment was written as a prerequisite of its redevelopment.

5.6.6 Unknown

There are three GLSMR sites which are of unknown dates – two of which were archaeology surveys mentioned above. Undated entries include:

- The Royal Albert Dock Marsh, known as Trinity Marsh and New Marsh (GLSMR **062684/00/00**); which was reclaimed in the 16th century for pasture;
- A compilation of borehole reports which revealed possible ancient water channels of unknown date (GLSMR **062486/00/00**); these may be associated with maritime features which potentially survive archaeologically; and
- Excavations at Albert Road and the North Woolwich Pumping Station revealed alluvial peat and silt deposits of unknown date (GLSMR **062294/00/00**).



5.7 Map Regression

A search was undertaken of a range of Historic Survey Maps covering the study area. The progressive maps document the history and development of the site and its environs, as well as changes in settlement and land use within the wider study area. The Ordnance Survey (OS) Maps examined dated from 1799 to 1894, while the earliest non OS map of relevance to this assessment was the 1746 Rocque Map.

Please refer to Appendix 4 for the below mapping;

1746 Rocque Map, (north and south) shows that the site and study area are undeveloped.

1777 Chapman and Andre Map shows that the site and study area are rough grassland/marsh. There are tributaries coming off the Thames into the study area.

1799 Ordnance Survey Map shows that the site is still undeveloped.

1844 Ordnance Survey Map shows that the area is now lightly developed with Ferry House being marked and North Woolwich Station and railway line.

1867 Ordnance Survey Map shows partial coverage of the western end of the study area. The map shows that Silvertown Works (India Rubber Gutta Percha and Telegraph Works) is situated in the south-western section of the study area. There are also residential buildings on the western boundary and St Marks Church, the Parsonage and Silvertown Station lie between the Woolwich railway lines and sidings. The railway line cuts into the study area from the north-western corner. Residential buildings lie to the north of the railway line.

1869 Ordnance Survey Map shows partial coverage of the eastern end of the study area. This map identifies Albert Works situated in the west of the study area beneath the railway line. To the east, adjacent to Albert works, are the Victoria Docks Gas Works. An area of marshland and sand cuts inland to the east of the Gas Works. There is then an area of undeveloped land to the east and then the Electric telegraph works, some residential buildings and the Victoria Ale Stores. Central to the circular study area is North Woolwich Station with residential buildings to the north and gardens to the east. Much of the land to the north of the railway line is undeveloped with several drainage ditches. In the east of the circular study area lies residential buildings and the National Infant School.

1893 Ordnance Survey Map shows partial coverage of the western end of the study area. The map shows that the India Rubber Gutta Percha and Telegraph Works is still situated in the south-western section of the study area although it has expanded to the north and west. There are still some residential buildings on the north-western boundary and St Marks Church and the Parsonage remain between the Woolwich Branch railway and the sidings, as does Silvertown station. The railway line cuts into the study area from the north-western corner, residential buildings lie to the north of it.

1894 Ordnance Survey Map shows partial coverage of the eastern end of the study area. It identifies that the area previously occupied by the Albert Works, situated in the west of the study area beneath the railway line, is now an unlabelled works. Victoria Docks Gas Works still lies to the east. The area of marshland and sand to the east of the Gas Works is now occupied by a sewage works and the District Chemical Works. The Electric telegraph works has become the Electric Cable Works. The residential buildings remain, except those north of Victoria Street which have become the Telegraph and Electric Cable Works. The Victoria Ale Stores are still present. Central to the circular study area is North Woolwich Station with residential buildings to the north and gardens to the east. Much of the land to the north of the railway line is now



developed. In the east of the circular study area lies residential buildings and the National Infant School. The land above this remains undeveloped with ditches.

5.8 Evidence for recent or previous truncation/disturbance to archaeological horizons

Underlying deposits will have been partly truncated by the existing railway and, in the area of the proposed works sites, by 19th and 20th century industrial buildings, although some of these features may themselves constitute archaeological resources (Assessment of Archaeology Impacts, Part4, 2005. p51).

5.8.1 Industrial Buildings and Basements

A warehouse and a complex of industrial buildings, of 19th- and 20th-century date, are located within the LLAU/LOD. It is possible that some of these may have basements, despite their proximity to the river and the low ground levels (suggesting risk of flooding). If there are significant excavations works within the construction compounds, Crossrail or other basement/building surveys could be examined, focused on the areas of potential impact (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).

5.8.2 Railway

The existing railway is between c 0.4 and c 0.9m higher than the adjacent road- and ground levels, maintaining the differential as the latter slopes down to the east.

Assuming that the trackbed is c 0.5 to 0.6m deep, and that there is a minimum of c 0.1–0.2m of modern made ground beneath the original ground level, the railway should not have affected potential archaeological remains in this area (Crossrail Archaeology, MDC4: Levels Overview, 2008. p4).



6 Discussion

6.1 Baseline Data Summary and Research Agenda

There are 21 GLSMR entries within the study area for the North Woolwich portal. These include prehistoric deposits, Roman deposits and dump, settlement and manor dating from the medieval period and extant structures mainly dating from the post medieval period.

The map regression shows that the area remained largely undeveloped until the mid 1800s when the North Woolwich railway line and station were developed and industrial works started to flourish.

The archaeological potential of the area gives rise to several prospective research agendas. These have been generally identified in the technical note on the Assessment of Archaeological Impacts, 2005. Research areas considered specific to North Woolwich include:

- Identifying the industries that especially represented London;
- Understanding the relationship between landscape, river and settlement, and the influences of the Thames in particular on communication and social interaction;
- Understanding the relationship between the Bronze Age wooden trackways and the settlement to which they presumably led, and what the trackways represent in terms of woodcraft and woodland management; and
- Understanding the nature and meaning of the deposition of metalwork in the Thames and at the headwaters of river tributaries.

6.2 Impacts

The proposed portal works consist principally of the tunnel entrance (eye) and shaft, approached by an extensive length of cut-and-cover tunnel approach ramp. The shaft would be used for construction of the running tunnels and on completion would become an intervention and evacuation point. There would also be a construction compound (worksite). Moving eastwards, the impacts are:

- 713m-long tunnel approach ramp of four sections. It would be approximately 16m deep in the vicinity of the BT satellite station;
 - 101m-long retained cut with temporary sheet piles and permanent concrete U-section ground support.
 - 425m-long retained cut with diaphragm walls.
 - 127m-long cut-and-cover tunnel with diaphragm walls.
 - 60m-long cut-and-cover tunnel, with diaphragm walls.

The impact of construction of the first three sections of the approach ramp would be to completely remove all surviving archaeological remains (excluding the final section of graded ballast from ground to embankment level).



- Tunnel eye incorporating a shaft for construction, intervention and excavation. The shaft would measure c 21m by 30m (internally) and employ diaphragm walls descending c 31m.

The impact of the construction of the tunnel eye would be to remove completely all surviving archaeological remains.

- Major service diversions:
 - Reconstruction of sewer inlet to pumping station at Albert Road: open cut trench to a depth of 5m with sewer carried over the railway.
 - The diversion of the Royal Docks sewer under Factory Road to south of the road: tunnel with three shafts at a depth of 16m.
 - Diversion of the 1220mm sewer and 9" water main at Albert Road, along/parallel to the north side of the proposed line: open cut, to a depth of 5m.
- The diversions of electricity, telecoms, gas, sewer and water services have the potential to partially remove archaeological remains. The impact of the tunnel shafts and open cut trench diversions would be to remove completely potential archaeological remains. The tunnel itself would have no impact (SES2, 2006. P356);
- Diversion/protection of other services. The impact is likely to partially or completely remove archaeological remains;
- A construction compound, the North Woolwich Worksite, runs along the railway, Albert Road and Factory Road with one area east of Store Road and another west of Henley Road. The 1869 Ordnance Survey map shows the area partly as open ground, industrial buildings (stores) and residential buildings. The area of worksite located in an industrial estate on the west side of Henley Road would necessitate the demolition of existing buildings;
- Impacts at both work sites would result from general ground reduction (c 0.5m deep) and the footings for compound accommodation (c 0.4m to 0.8m deep), and at the Henley Road worksite from the footings of Bentonite plant (c 0.5m to 0.9m deep). These works have potential to partially remove potential archaeological remains;
- Changes in groundwater level have been predicted at this site. The potential impact, if any, cannot be adequately quantified due to a lack of detailed information; in particular on present groundwater regime and on the nature of any surviving archaeological remains. However, there are no known resources on the site of a type which might be adversely affected, although there is potential for waterlogged organic remains; and
- Removal of the existing North London Line track would probably have no or minimal archaeological impact, confined to the possibility of historic railway infrastructure being encountered. (Assessment of Archaeology Impacts, part 4, 2005. p51).



6.3 Mitigation and Residual Impacts

To mitigate such impacts, the incorporated mitigation measures will be implemented as set out in the main ES, Volume 1, Chapter 3 (paragraph 3.7.13) to produce preservation by record. The shaft and trench for twin foul rising mains are likely to require localised archaeological excavation and other works probably an archaeological watching brief. With this mitigation, there will be no significant residual impacts (SES 2, 2006. p356).

- Magnitude of impact before mitigation is considered high with potential for significant impact;
- Residual impact after incorporated mitigation is considered none, the incorporated mitigation measures would constitute preservation by record;
- Site specific mitigation for below ground remains – none. Possible standing industrial archaeological remains would require initial structural appraisal of the historic fabric in order to determine the appropriate level of recording from those specified by the RCHM(E) 1996, to constitute preservation by record;
- Residual impact after site specific mitigation – none; and
- Significance of residual impact – non-significant (Assessment of Archaeology Impacts, part 4, 2005. p53).

Where the potential geoarchaeological deposits are likely to be impacted upon by the scheme proposals an appropriate mitigation method statement will be developed.



7 Recommendations

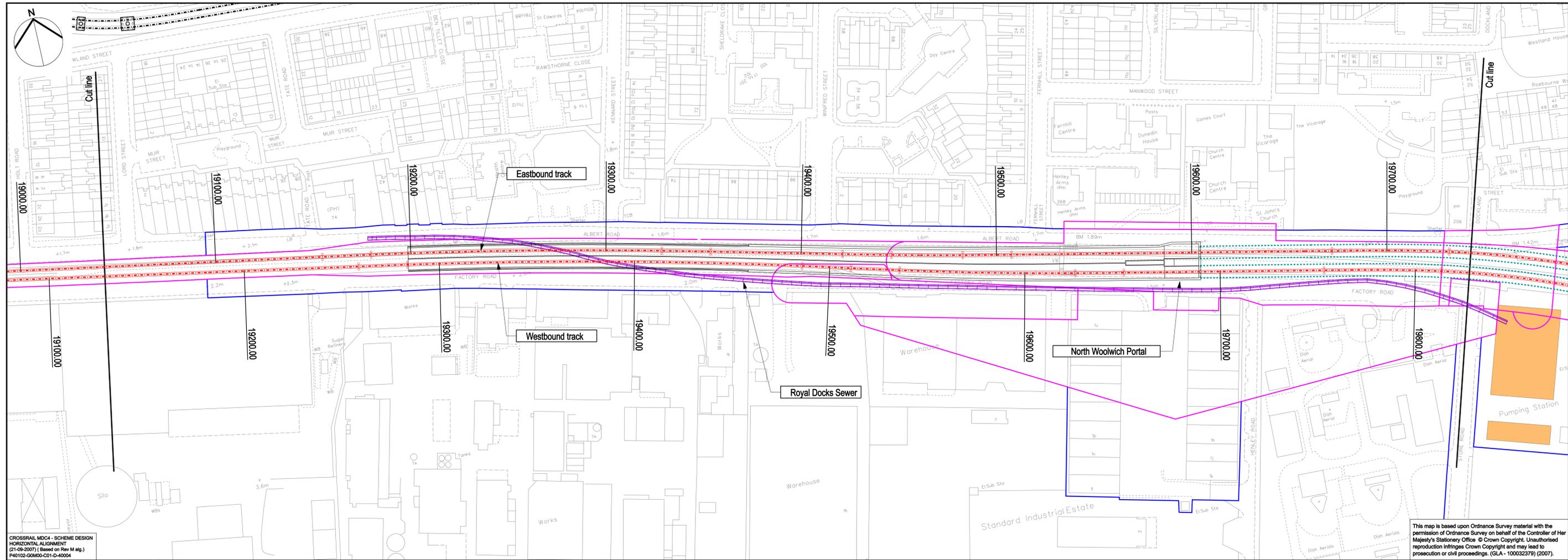
Preservation by record would be the most appropriate form of mitigation for archaeological remains within this area. With this mitigation, no significant impacts will occur. Mitigation proposals will be detailed in the subsequent WSI.



8 Figures

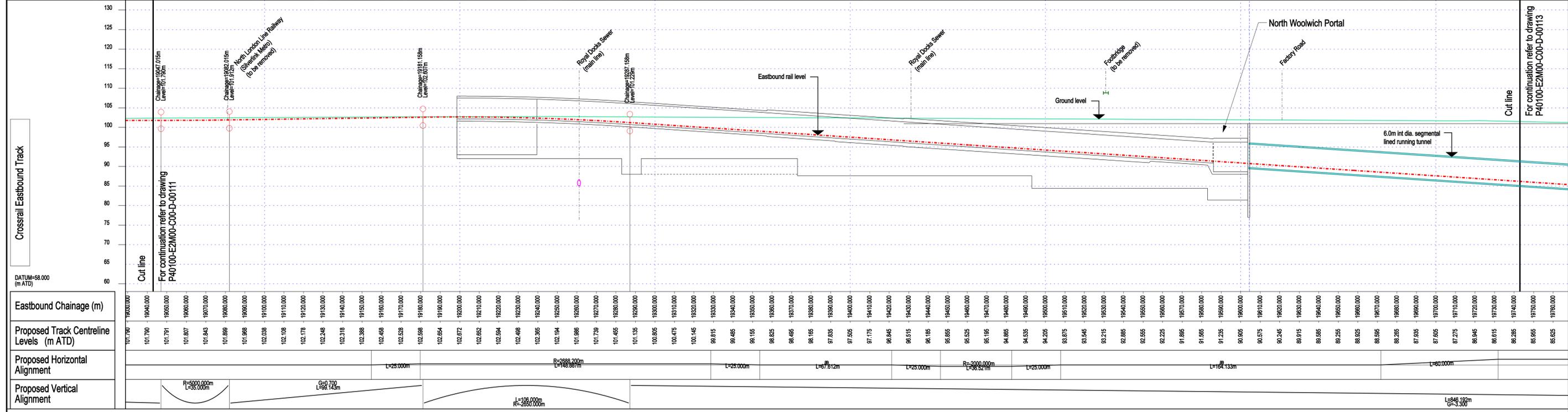
Figure 1 P40100-C1M00-C00-D-00108

Figure 2 NOR_GLSMR_211207_LOCATIONS.pdf



CROSSRAIL MDC4 - SCHEME DESIGN
HORIZONTAL ALIGNMENT
G1-03-2007 (Based on Rev M sig.)
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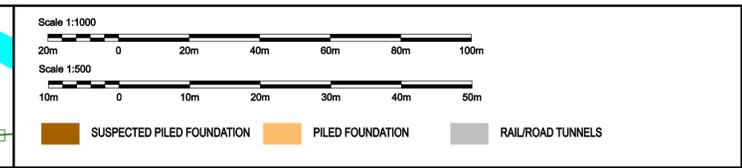
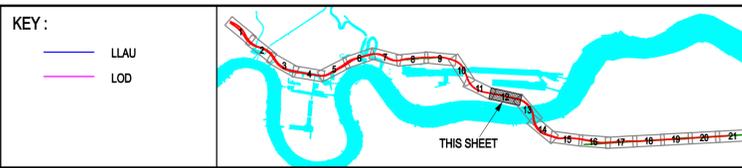
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REV	DATE	DESCRIPTION	BY	CHKD	APP	CAD	ACC
A	15/11/06	INITIAL REFERENCE DESIGN	ARN	MB	RPM		
B	30/11/06	INITIAL REFERENCE DESIGN UPDATED	ARN	MB	RPM		
C	20/11/07	SCHEME DESIGN ISSUE	ARN	MB	RPM		



CROSSRAIL MDC4 - SCHEME DESIGN
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CONTRACT No. / CONSULTANT:
 1200 / HALCROW

TITLE:
 PLAN AND PROFILE
 EASTBOUND
 SHEET 12 OF 21

SCALE:
 1:1000 @ A1

DRAWING AND CAD FILE No:
 P40100-E2M00-C00-D-00112

REV:
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NORTH WOOLWICH PORTAL_GLSMR_OS_211207

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Appendix 1 - Gazetteer

Pref Ref	Name	Mon Type	Date Range	Easting	Northing
061803/00/00	Albert Rd North Woolwich E16, documentary evidence of manor	Manor	Early Medieval/Dark Age to 16th C (900 AD to 1539 AD)	543565.0	179854.0
061818/00/00	North Woolwich E16, documentary evidence of settlement	Settlement	Early Medieval/Dark Age to 16th C (1000 AD to 1539 AD)	543255.0	179805.0
110072/00/00	Woolwich, hand axe and four Mousterian artefacts	findspot	Palaeolithic (500000 BC to 10001 BC)	543005.0	179505.0
062640/00/00	Milk St, Roman dump	Dump	Roman (43 AD to 409 AD)	543704.0	180054.0
MLO70921	Milk Street {Roman Postholes}, Pottery (Roman), Daub (Roman), Tile (Roman), Unidentified Object (Roman)	Post Hole	Roman (43 AD to 409 AD)	543704.0	180054.0
062684/00/00	Royal Albert Dock	Marsh	Unknown	543005.0	180005.0
MLO76394	Albert Road, deposit	Deposit	Late Mesolithic (7000 BC to 4001 BC)	543255.0	179905.0
MLO76401	Former Sewage Pumping Station, North Woolwich	Sewage Pumping Station	Post Medieval to Modern (1900 AD to 2000 AD)	543714.0	179905.0
MLO77217	Albert Road, evaluation	Peat	Neolithic (4000 BC to 2201 BC)	543255.0	179905.0
MLO77218	Albert Road, evaluation	Peat	Bronze Age (2200 BC to 701 BC)	543255.0	179905.0
MLO77219	Albert Road, evaluation	Deposit	Medieval (1066 AD to 1539 AD)	543255.0	179905.0
MLO77220	Albert Road, evaluation	Deposit	Post Medieval (1540 AD to 1900 AD)	543255.0	179905.0
062486/00/00	Royal Albert Dock, evaluation	Peat	Unknown	543700.0	180000.0
062294/00/00	Albert Rd, evaluation	Peat	Unknown	543304.0	179705.0



221633/00/00	Pier Rd pedestrian tunnel	Pedestrian Tunnel	Post Medieval (1540 AD to 1900 AD)	543263.0	179505.0
800110/00/00	Woolwich Manorway	Pumping Station, Sewage Works	Post Medieval (1540 AD to 1900 AD)	543704.0	179805.0
800110/01/00	Woolwich Manorway	Engine House	Post Medieval (1540 AD to 1900 AD)	543704.0	179805.0
800110/02/00	Woolwich Manorway	Boiler House	Post Medieval (1540 AD to 1900 AD)	543704.0	179805.0
800110/03/00	Woolwich Manorway	Coal Shed	Post Medieval (1540 AD to 1900 AD)	543704.0	179805.0
800110/04/00	Woolwich Manorway	Chimney	Post Medieval (1540 AD to 1900 AD)	543704.0	179805.0
062800/00/00	Drew Road	Flood deposit, peat	unknown	542184.0	180244.0



Appendix 2 - Geoarchaeological Deposit Model Report



CROSSRAIL
MDC4 ARCHAEOLOGY
GEOARCHAEOLOGICAL DEPOSIT MODEL:
NORTH WOOLWICH PORTAL
JANUARY 2008

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Archaeology Service

31/01/2008

1 Geoarchaeological deposit model: North Woolwich Portal

1.1 Introduction

1.1.1 Landscape Zones

In general terms, the sub-surface deposits underlying the North Woolwich Portal (NWP) study area comprise fine-grained alluvial sediments relating to deposition within, or adjacent to, a network of braided channels (braidplain). These channels flowed through low-elevation marshland situated directly to the north of the present day course of the River Thames. Overlying the Cretaceous chalk bedrock, sands and gravels of Pleistocene origin (*c* 2,000,000–10,000 BP) form the topographic template of the area. These sediments were deposited in a fast-flowing braided river environment towards the end of the last glaciation in basal sheets, and as point bars and in-channel bars. In the lowest elevation areas, channels flowing through this wetland environment would have existed throughout much of the prehistoric and historic periods, with silts and clays being laid down by slow moving and still water. Peat would have formed at the margins of the braidplain, and in areas where channels silted and became separated from the main fluvial system. Areas of relatively high-elevation sands and gravels would have existed as high and dry islands rising from the marshlands during periods of prehistory. These islands of high and dry ground (which may have remained above river levels for much of prehistory) would have been attractive to prehistoric people exploiting the Thames floodplain during the early to mid Holocene.

Through the study of the relationship (both horizontally and vertically) of the various sediment types, and the depositional environments which they represent, the area under assessment has been divided into landscape zones (LZs). These zones facilitate assessment of the potential of these areas for the preservation of archaeological and palaeoenvironmental material.

1.1.2 Reliability of the model

The surface model used to define the landscape zones has been derived from borehole data obtained from sites occupying a roughly linear east–west corridor through the central region of the study area (Fig 00: borehole and transect location). Because of the clustering of these data towards the central region of the study area (approximating to the area of the North Woolwich Portal), the model may become less reliable towards the northern and southern parts of the study area. Therefore, owing to the ability of the model to only accurately generate a picture of the sub-surface topography in the central region, only this east–west corridor has been used to define the landscape zones outlined below. Within this corridor, where borehole data is relatively abundant, the model is likely to be very reliable.

1.2 Deeper channel/braidplain areas (LZ1)

LZ1 comprises much of the modelled area, and is characterised by generally low-lying land, most likely associated with a network of braided channels flowing across this area of the Thames floodplain from the late Pleistocene/early Holocene to historic periods. There is **reasonable potential for prehistoric to Roman archaeological remains in the form of boats, and subsistence equipment related to fishing and the exploitation of the Thames floodplain** in this landscape zone. Furthermore, this area is important in our understanding of the changing behaviour of fluvial systems during marked changes in climate regime (ie glacial – interglacial transitional periods). Such an understanding is not only important in its own right, but if associated with evidence for human activity, allows for the elucidation of the interaction between past human populations and these landscape features.

At present, the River Thames is a single channel meandering river, situated directly to the east and south of the study area. However, in the past, following the last glaciation, the Thames was formed of a series of smaller interconnected channels surrounded by a wide expanse of marshland, and higher, drier sand and gravel bars. These channels migrated back and forth across the Thames floodplain, switching between active, flowing channels, and cut-off channels prone to sediment infilling. This landscape zone would not have been an accessible environment except by water craft and would have presented a formidable barrier against access further south into the floodplain.

Sediments associated with this landscape zone are dominated by fine-grained minerogenic sediments related to deposition in generally slow-moving braided channels. As can be seen in boreholes ARC4, ARC6 and BH410 (Fig 00: west to east transect), these channels were active at the beginning of the Holocene (early Mesolithic) and could have been easily exploited food resources. Later in the Holocene, probably from the later Neolithic up until historic times, these channels silted up, and peat formation was initiated. This peat formation would have been catalysed by slowly increasing river levels, causing this landscape zone to change to a predominantly marshland environment. At this time the Thames floodplain was now dominated by a single-thread meandering channel, not dissimilar to the one seen today.

The fine-grained humic muds and clay-rich peats infilling these relict channels are highly conducive to the preservation of organic material, and so these sediments have high potential for the preservation of palaeoenvironmental material, such as molluscs, insects and pollen, all of which can be examined in order to recreate the changing environment in which past human populations existed.

River valleys would have been targeted during prehistoric periods by hunter-gatherer-fisher groups in particular, as locations of water and diverse food resources and such activity was often focused in marginal areas adjacent to the stream channels themselves. Thus there is also potential for evidence of such wetland activity from the Mesolithic and onwards to be found in this landscape zone. Such evidence might include organic artefacts and structures associated with river crossings, fish traps and boats.

1.3 Sand and Gravel ‘Islands’ (LZ2)

Areas of higher, drier ground exist in the western, central and eastern areas of the study area. These ‘islands’ of sand and gravel are important in our understanding of the exploitation of the Thames floodplain during the prehistoric periods as they are likely to have remained higher and drier above the marshy environment of the channel marginal area (LZ3), and could therefore have **good potential for evidence of dry-land prehistoric and later human activity**.

The sub-surface stratigraphy of LZ2 comprises gravel and sand islands which have a surface elevation ranging from *c* 95 to 100m LUL. At the beginning of the Holocene (early Mesolithic) it is likely that the Thames river level was significantly lower than that of the present day, possibly up to 15m lower (Bates and Whittaker 2004). However, during the course of the early to mid Holocene, rapidly rising sea levels (related to the unlocking of polar ice) caused the Thames to rise to approximately 97m LUL by the Mesolithic/Neolithic transition (Bates and Whittaker 2004).

The high ground in the west of the study area (approximate area of the Connaught Road worksite) has a surface elevation of *c* 100m LUL and is therefore likely to have remained as high, dry ground throughout much of prehistory. This area would have been an attractive area of the Thames floodplain in which subsistence activities such as hunting and fishing could have been carried out. It is possible that makeshift camps would have been constructed on some of the larger islands, which might have served as a base from where such activities took place.

Towards the centre and east of the study area are three areas of high ground at a lower elevation (*c* 95m LUL) than that to the west, and estimates of rising river levels during the early part of the Holocene suggest that these sand and gravel highs would have probably been inundated by the end of the Mesolithic period (10,000–6,000 BP) (Bates and Whittaker 2004). The central area corresponds to the North Woolwich Portal and adjacent worksite. During the Mesolithic period, hunter-gatherer-fisher populations could have utilised such an area of dry ground to carry out subsistence activities such as hunting, stone tool manufacture and food processing. Soils may have developed on these surfaces, prior to peat formation related to rising sea/river levels, and these buried land-surfaces have potential for the accumulation and preservation of archaeological material, such as lithic scatters – the bi-product of the manufacture of stone tools. Mesolithic ephemeral soils have been observed in this area of the Thames floodplain and have been consistently dated to the Mesolithic (eg Lam and Corcoran 2002; Morley 2003).

Depending on the elevation and the position of these sand and gravel islands within the floodplain, there is also potential for these areas of high ground to have remained dry-land during the Neolithic and Bronze Age periods, such as the high elevations of sand and gravel seen in boreholes ETAP BH1, TW NW BH05, TW NW BH06 and NW15R (*c* 96–100m LUL). Approximately 1km to the west of the study area, a timber trackway of Neolithic age was found associated with a gravel island with an upper surface lying at approximately 99m LUL (Wessex Archaeology 2000). This trackway was thought to have been used to link areas of high ground which were separated by lower lying, wet and marshy areas not easily accessible to prehistoric people traversing the Thames floodplain.

1.4 Marginal semi-terrestrial marshlands (LZ3)

LZ3 is essentially the transitional environment between the higher ground of the sand and gravel islands, and the network of channels associated with the east-west aligned braidplain. This landscape zone is characterised by well-developed peats which testify to an increase in wetland vegetation at the margins of the main channel network. **LZ3 has reasonable to good potential for the recovery of prehistoric wetland archaeological remains (such as Bronze Age timber trackways or platforms), and excellent potential for the recovery of organic remains with palaeoenvironmental significance.**

Much of the peat found in this landscape zone is highly woody and fibrous and shows that moisture-tolerant vegetation existed at the margins of the Thames floodplain (and associated smaller marginal braidplains), primarily as alder-carr vegetation assemblages, most likely with a ground flora of sedges and ferns. Boreholes TW NW BH06 and NW15R contained woody and fibrous peat directly overlying sands and gravel, indicating that well-developed vegetation was growing in these marginal areas of the Thames floodplain. Oak, elm, ash and lime trees were probably also growing in these marginal areas (Morley 2003), but these may not have been strongly developed in more channel proximal locations.

The environment of LZ3 may have been partially accessible to prehistoric people hunting, fishing and foraging along the margins of the Thames floodplain, but there would have been issues with both the density of the vegetation, which may have proved impenetrable in places, and the boggy nature of the ground surface. Prehistoric people would have probably tried to utilise higher ground where available, but the dense tangle of vegetation most likely represented by the well-developed peat units, may also have served as useful cover whilst tracking and hunting animals.

Owing to the highly organic nature of the sediments in this landscape zone, there is very good potential for the preservation of palaeoenvironmental remains such as wood, nuts and pollen, as well as organic archaeological material such as wood and bone tools.

1.5 References

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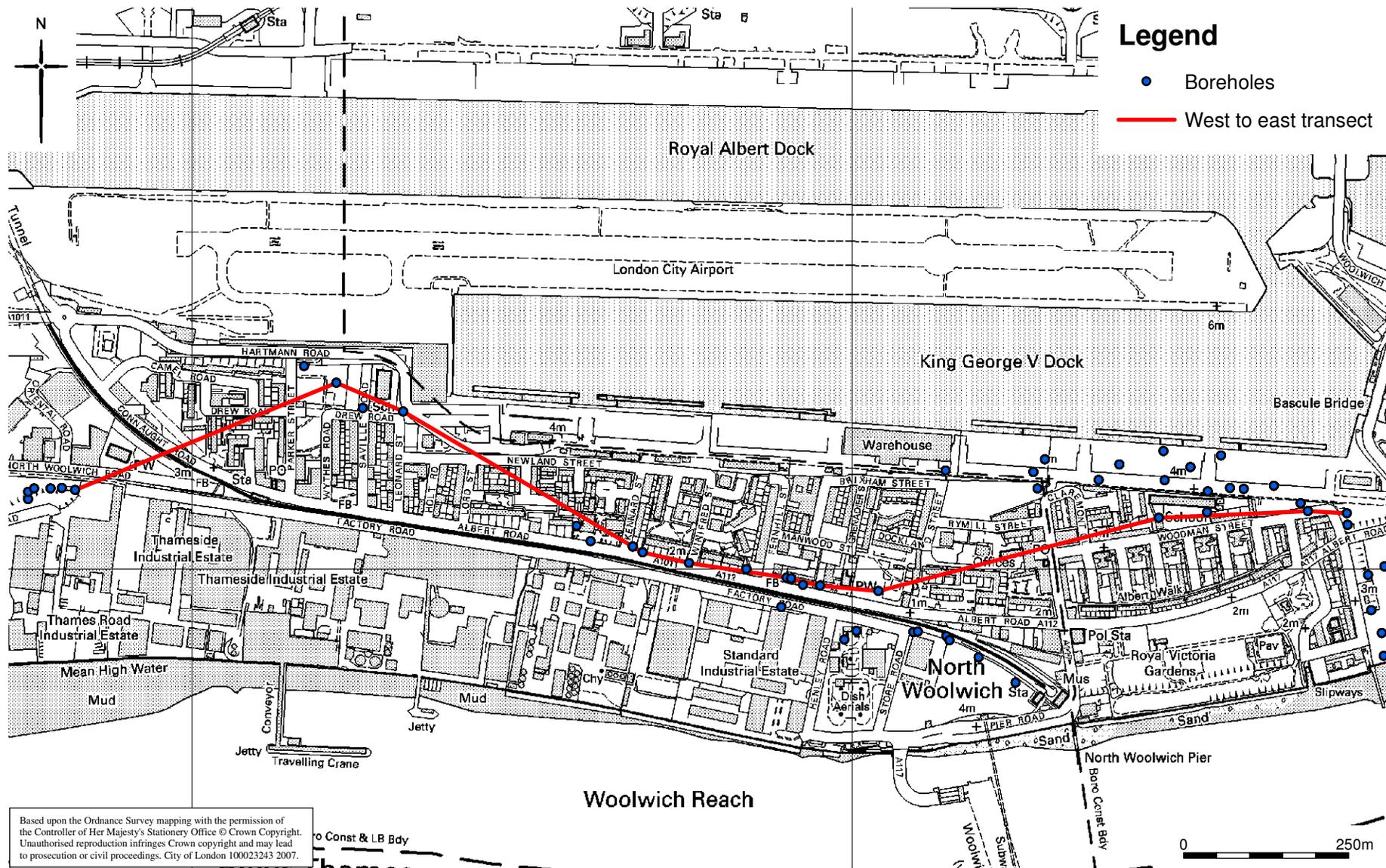
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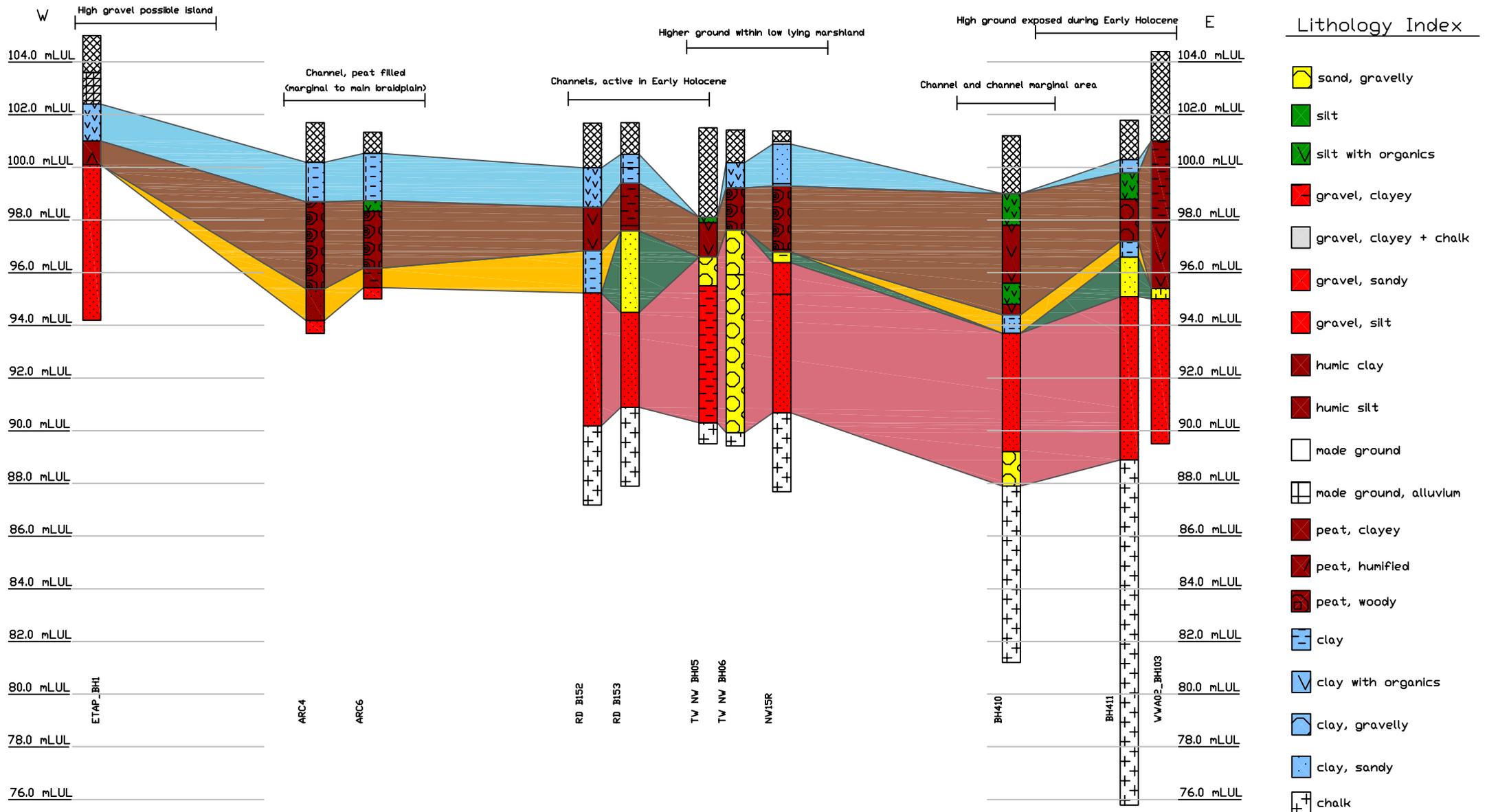


Appendix 3 - Geoarchaeological Deposit Models



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Borehole and transect locations



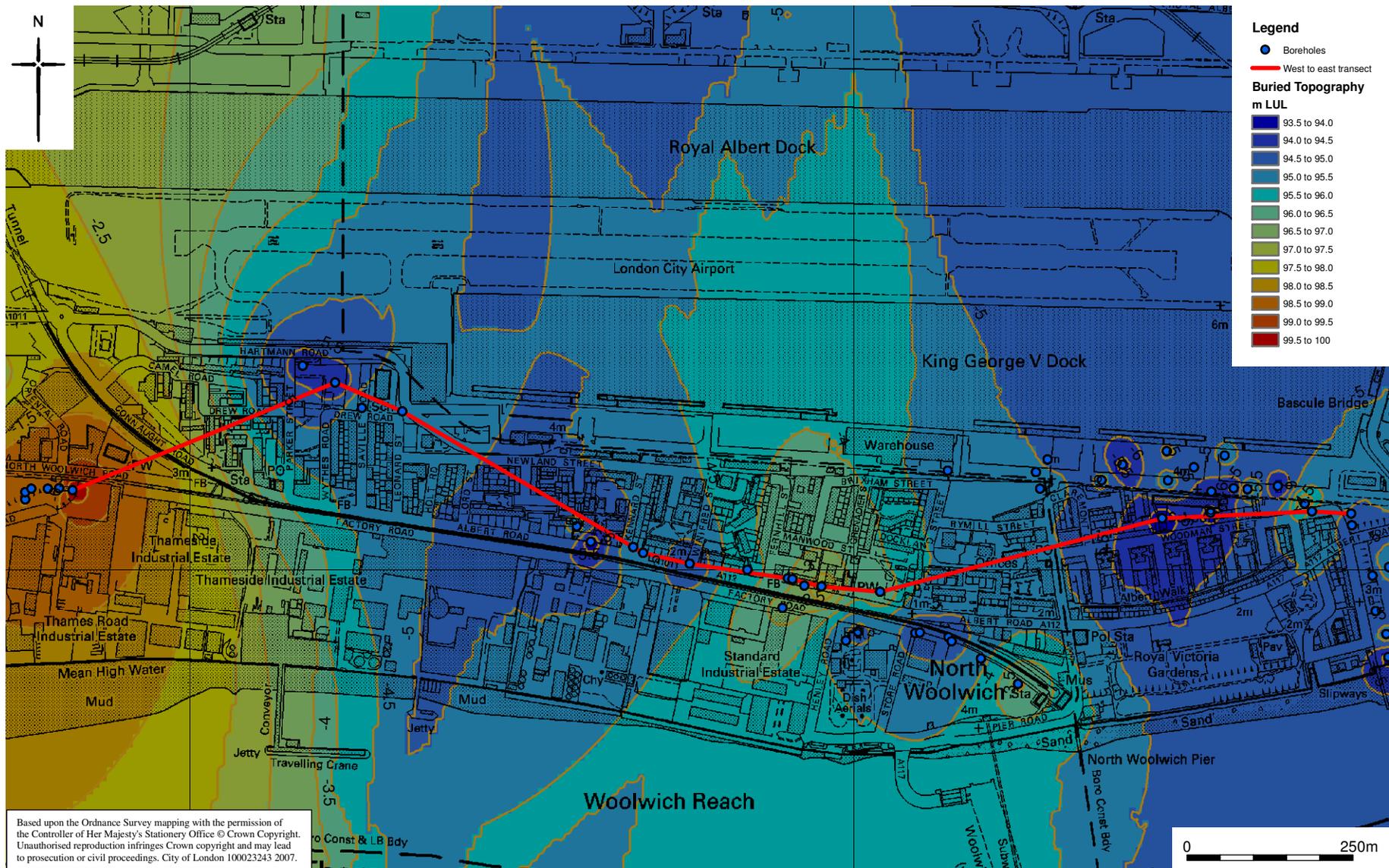
Lithology Index

- sand, gravelly
- silt
- silt with organics
- gravel, clayey
- gravel, clayey + chalk
- gravel, sandy
- gravel, silt
- humic clay
- humic silt
- made ground
- made ground, alluvium
- peat, clayey
- peat, humified
- peat, woody
- clay
- clay with organics
- clay, gravelly
- clay, sandy
- chalk

Stratigraphy Index

- Pleistocene Gravels
- Early Holocene Sand
- Early Holocene Channel Sediments
- Peats and Humic Muds
- Holocene Alluvium

North Woolwich Portal West to East Transect



File storage location path

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Buried topography



File storage location path

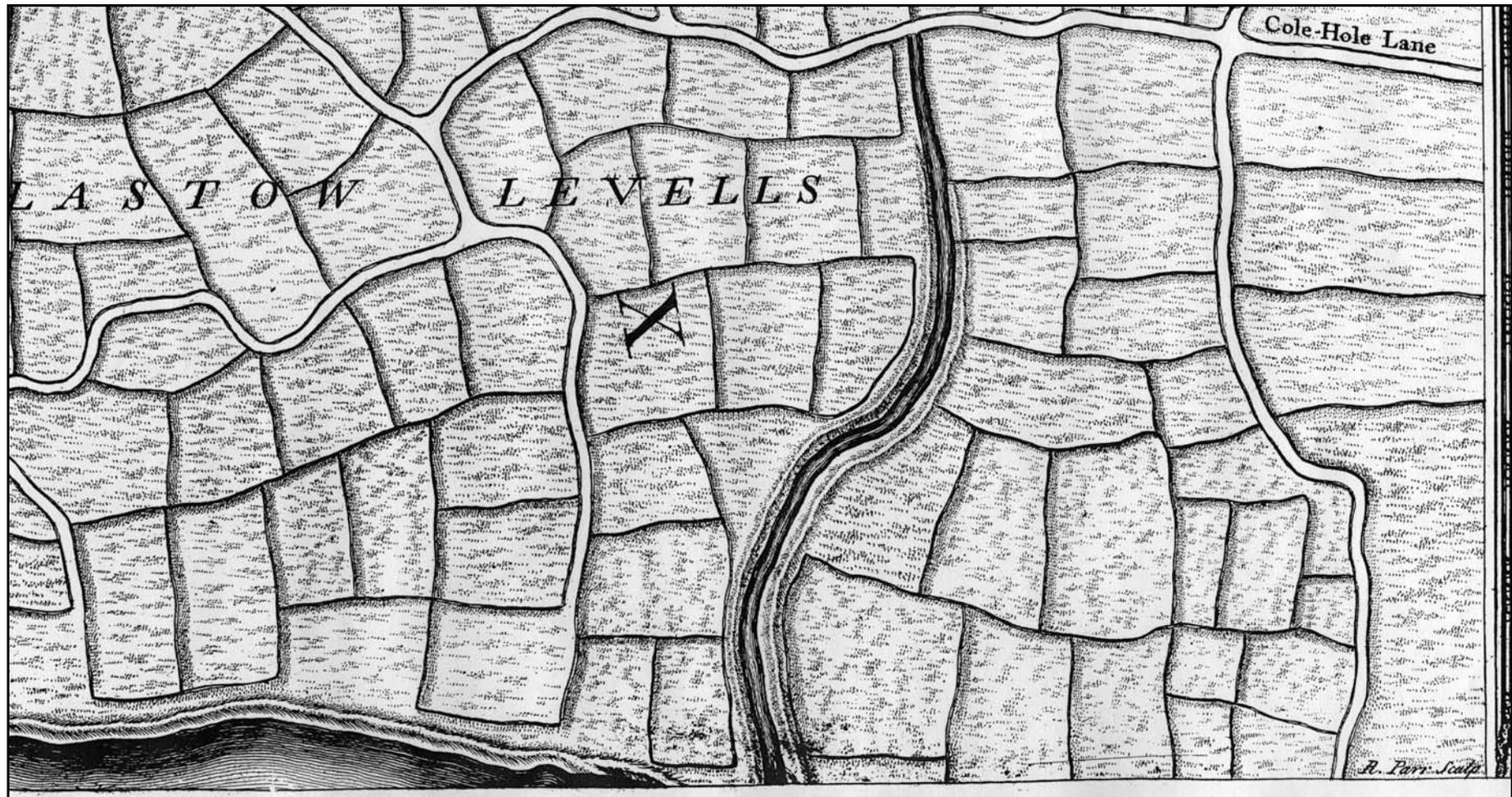
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Archaeological potential



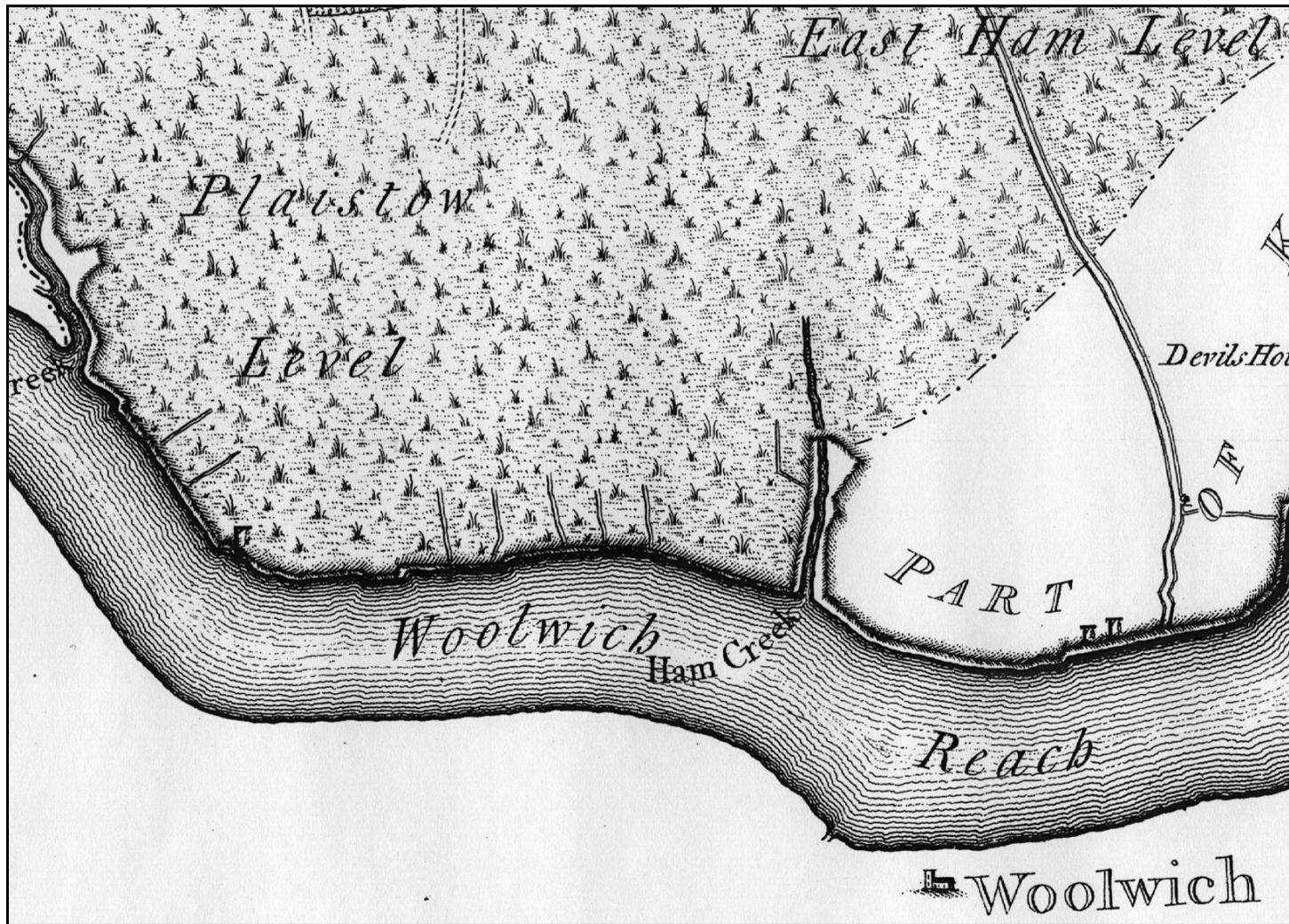
Appendix 4 – Historic Mapping for North Woolwich

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



1746 Rocque Map (north)

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



1777 Chapman and Andre Map

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



1799 Ordnance Survey Map

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



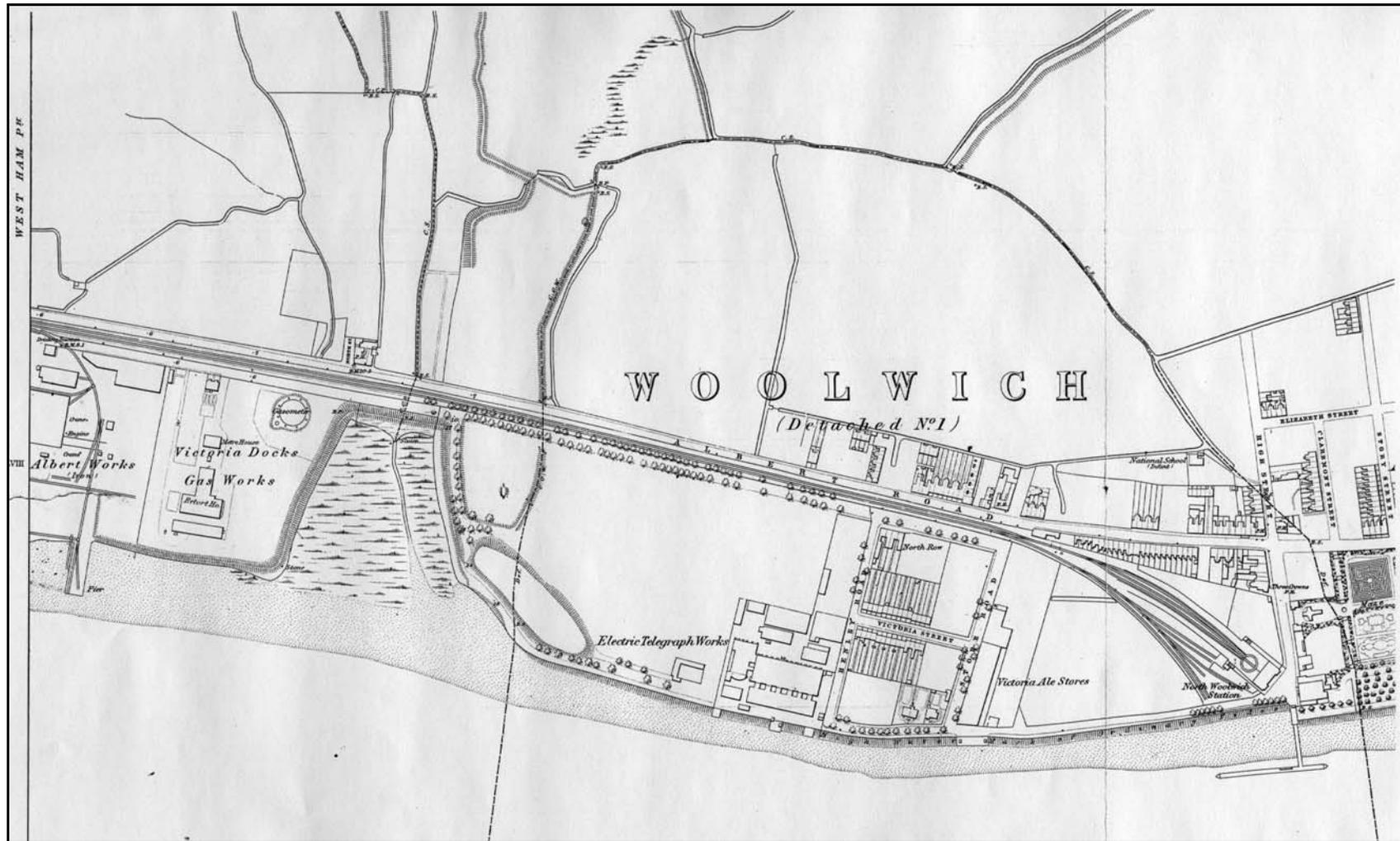
1844 Ordnance Survey Map

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



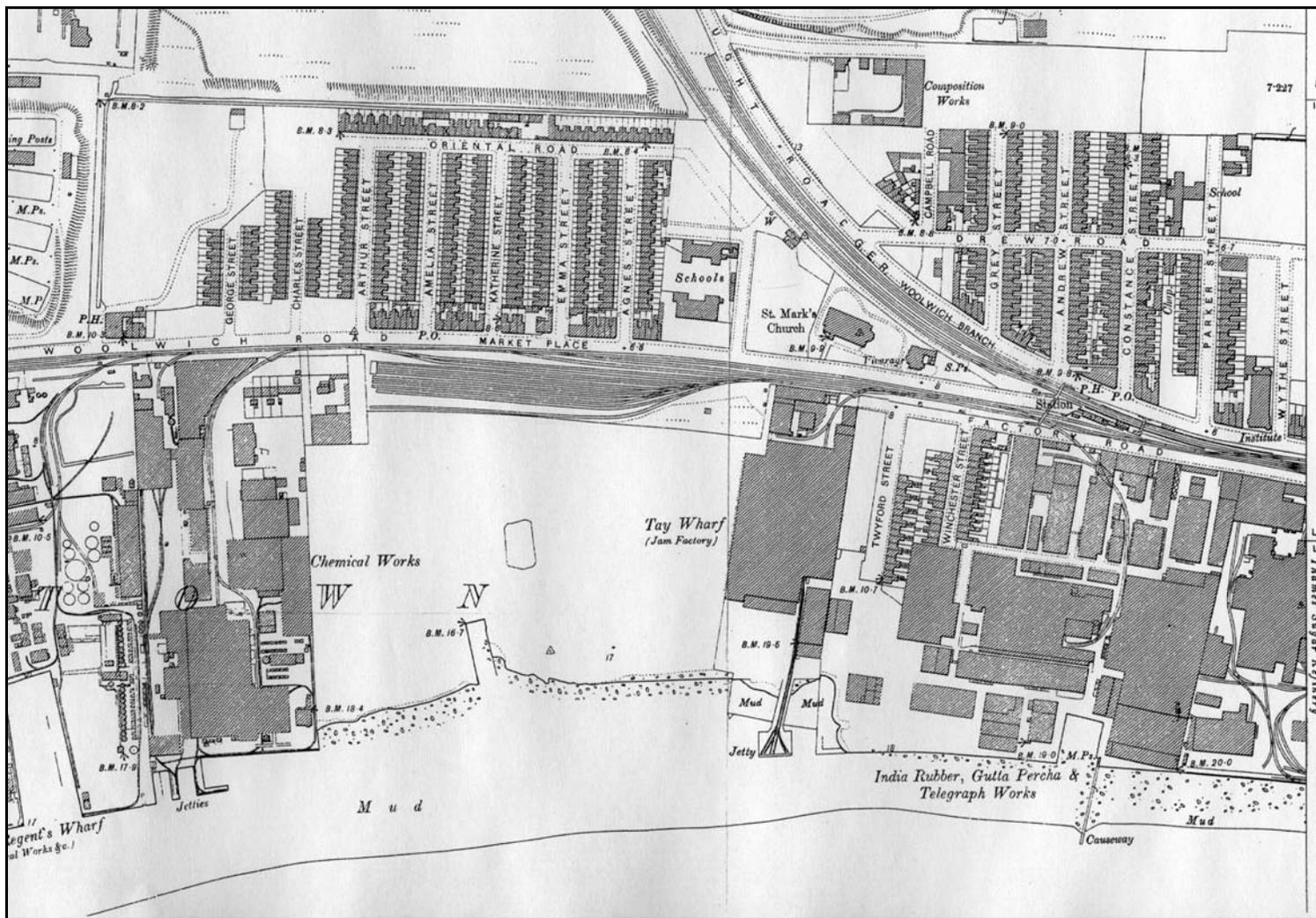
1867 Ordnance Survey Map

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



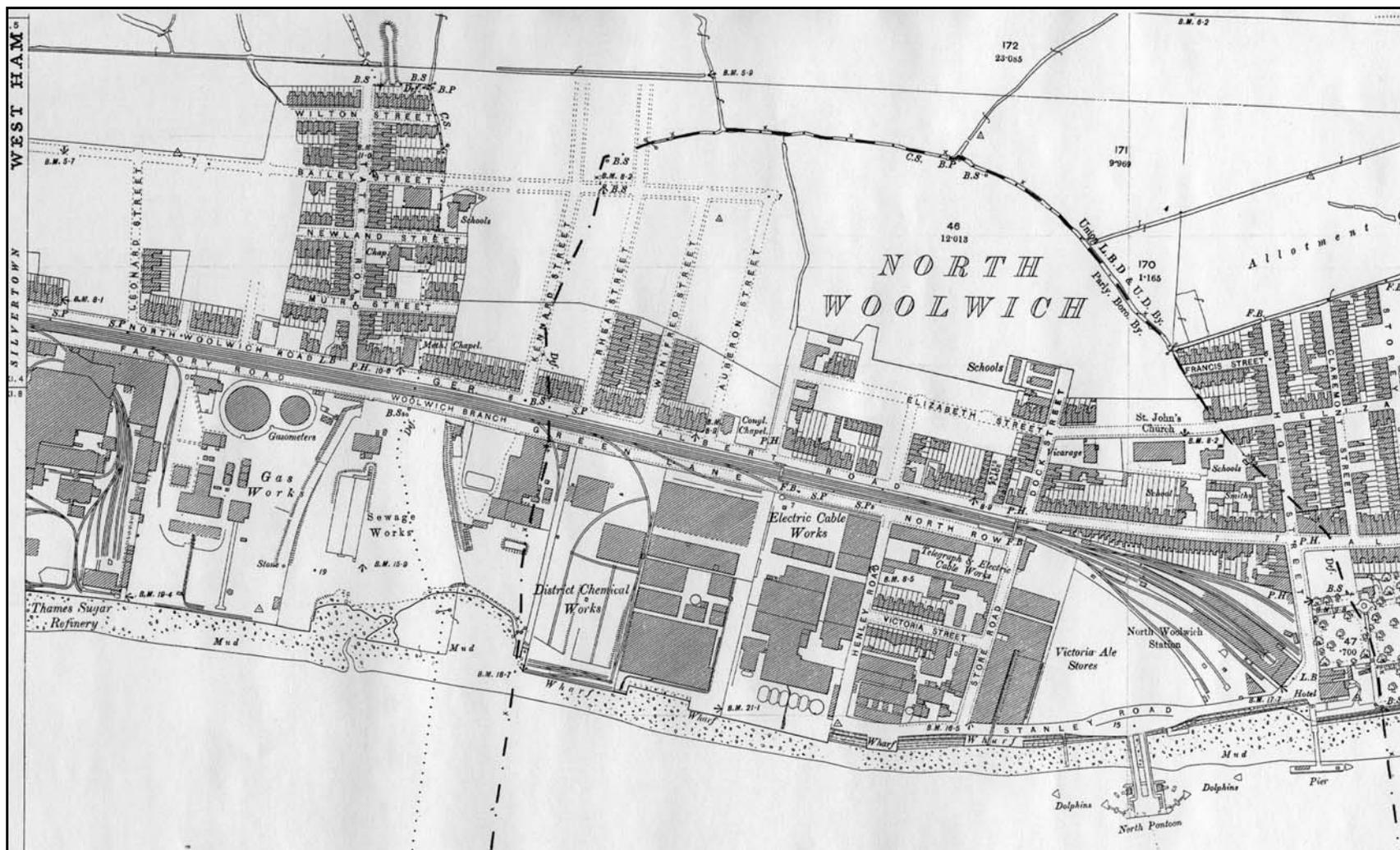
1869 Ordnance Survey Map

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



1893 Ordnance Survey

Appendix 4 - North Woolwich Historic Maps. Detailed Desk Based Assessment



1894 Ordnance Survey Map



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