

# **A REPORT ON THE GEOARCHAEOLOGICAL BOREHOLE INVESTIGATIONS: WEST HAM BUS GARAGE (THE FORMER PARCEL FORCE DEPOT), WEST OF STEPHENSON STREET, LONDON BOROUGH OF NEWHAM (SITE CODE: WHQ09)**

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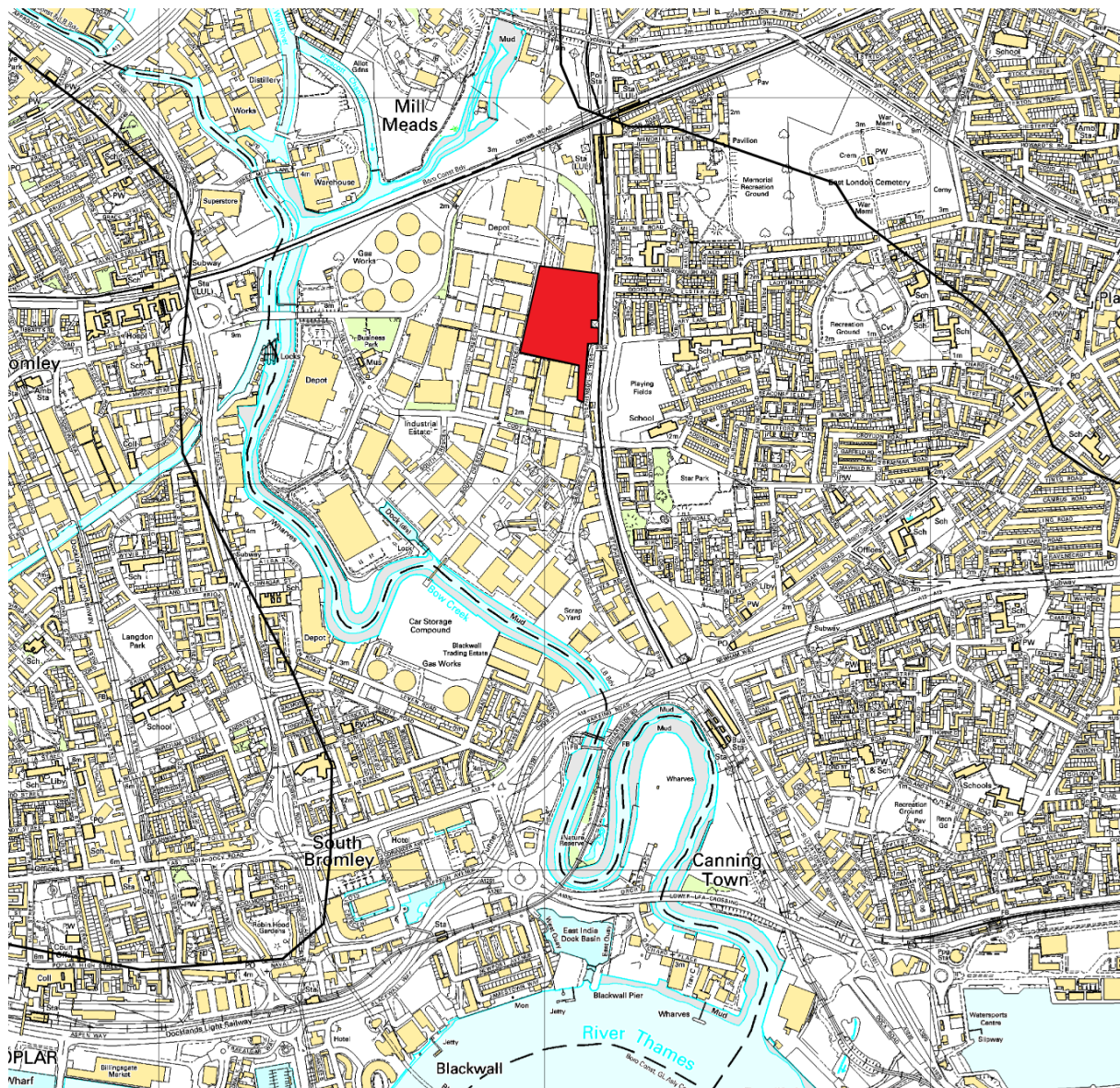
## **INTRODUCTION**

This report summarises the findings arising out of the geoarchaeological borehole investigations undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09; National Grid Reference: TQ 539050 182500; Figures 1 and 2). The results of a recent archaeological desk-based assessment conducted by Bull and Corcoran (2007), and the Lea Valley Mapping Project by Burton *et al.* (2004), suggest that the site has considerable potential for addressing a range of important research questions with respect to the environmental and cultural histories of the Lea Valley. Situated centrally within the modern floodplain of the Lea Valley, and only a short distance upstream from the confluence with the River Thames, Bull and Corcoran (2007) recorded a stratigraphic sequence comprising Holocene alluvium (floodplain deposits) overlying Pleistocene gravels. The thickness of the alluvium and height of the gravel surface deepened towards the eastern boundary of the site. This suggested that the former course of the River Lea may have occupied the eastern limits, with the remaining area comprising relatively dry ground (alluvium <1.5m in thickness), which was only subject to intermittent flooding. This alluvial sequence in the western part of the site probably represents a series of landsurfaces ("accretionary soils" see Bull and Corcoran, 2007, 15), located proximal to the river channel, and its tributary streams, which have progressively accumulated during prehistory and into the historic period. The margins of the former river channel have also been identified by the presence of peat, and it is these deposits and possible former channel fills that provide the potential for reconstructing the environmental history of the site and its environs, enabling records to be compiled of human impact on the wetland and adjacent dryland environment e.g. woodland clearance and farming (these comments are also supported by Bull and Corcoran, 2007). Bull and Corcoran also conclude that if the peat deposit is an extensive unit, it may be of a similar age to the Middle Holocene peat recorded extensively within the Lower Thames Valley. At several sites in the Lower Thames Valley, this peat unit has been linked to a period of marine regression, where the rate of Holocene sea level rise since the end of the last glaciation has slowed, resulting in the

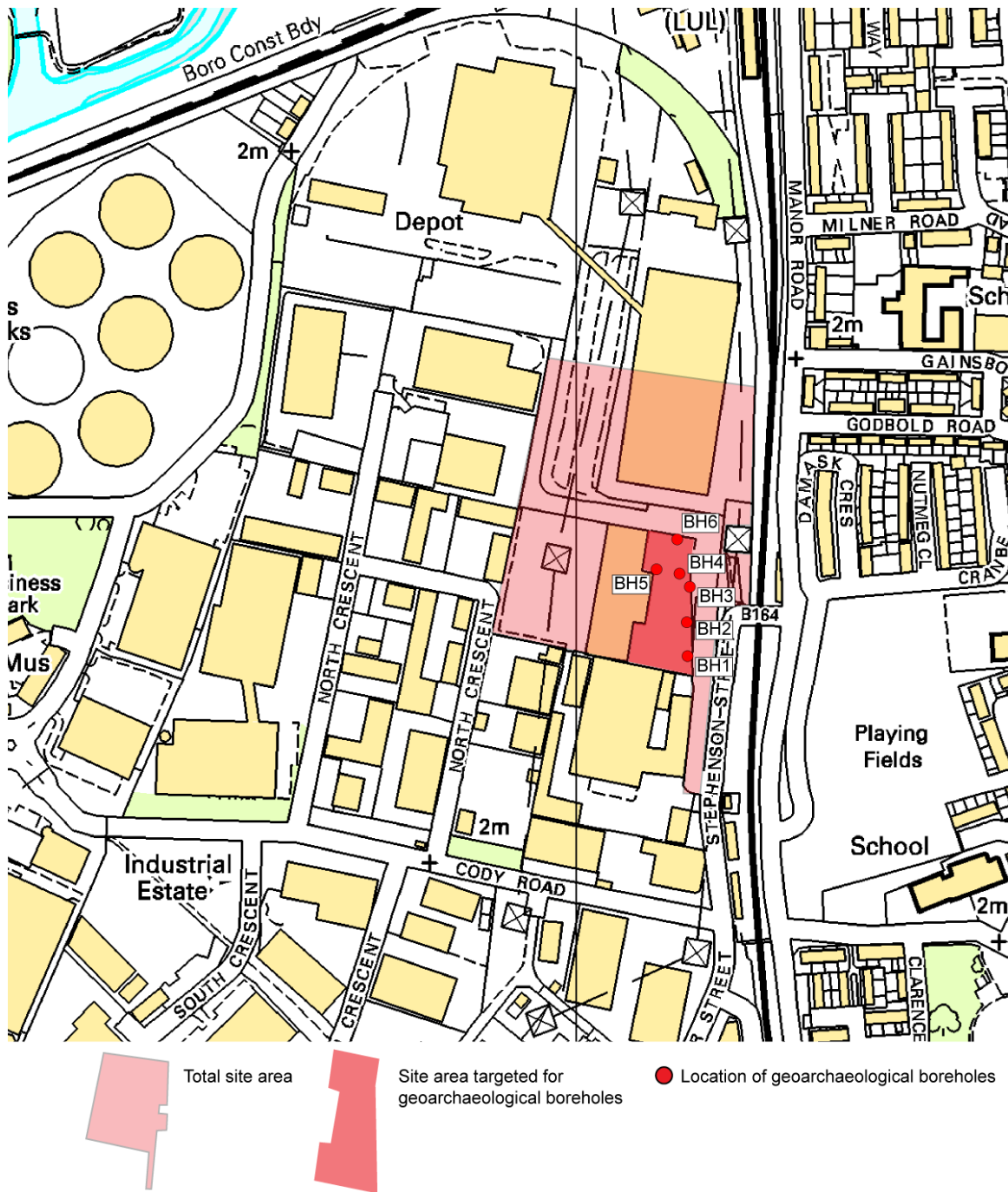
transition from estuarine sediment deposition (alluvium) to peat formation within a semi-terrestrial environment.

If a similar unit exists in the Lower Lea Valley, then there is potential to reconstruct the timing and duration of this event within a tributary valley of the Thames, and compare the influence of changes in sea level on the landscape and environment of both valleys. In addition, organic deposits dating to the end of the last glaciation have been recorded elsewhere in the Lea Valley (so called 'Lea Valley Arctic Beds'; also noted by Bull and Corcoran, 2007). These deposits are of considerable importance because they provide a record of rapidly changing environmental, especially climatic, conditions. The records suggest therefore that a complex topographic and sedimentary sequence exists at the site. Bull and Corcoran (2007) conclude however by stating that "...any information recovered from the site would contribute to a better understanding of the Quaternary stratigraphy and archaeological significance of this part of the Lea Valley, which is at present unknown" (Bull and Corcoran, 2007, 26).

The main aim of the current borehole investigations was to produce a model of the sub-surface stratigraphy in south-eastern area of the site (see Figure 2), where thick alluvial and peat deposits are indicated by previous investigations (Bull and Corcoran, 2007). The investigation consisted of recording the physical properties and composition of the sedimentary successions in each borehole and reconstructing a preliminary depositional history of the study area, incorporating previous research. The report also considers the potential of the borehole sequences for further environmental archaeological investigations (assessment and analysis).



**Figure 1: Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09) (reproduced from Ordnance Survey digital map data ©Crown copyright 2009. All rights reserved. License number 0100031673)**



**Figure 2: Location of Boreholes BH1 to BH6, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09) (reproduced from Ordnance Survey digital map data ©Crown copyright 2009. All rights reserved. License number 0100031673)**

## METHODS

### *Field Investigations*

Six boreholes (Boreholes <BH1> to <BH6>) were put down in the south-eastern area of the site (Phase 3 of the construction work; Figure 2). The ground surface (located at approximately 1.5m OD across the site) was initially cleared of all reinforced concrete and contaminated Made Ground by Mansell Construction Services Limited. As soon as natural uncontaminated sediments were recorded in the field by Quaternary Scientific, boreholes were then put down using an Eijkelkamp window sampler and gouge set driven by an Atlas Copco TT 2-stroke percussion engine. Each borehole was put down until coarse grained unconsolidated sediments had been recorded. The spatial attributes of each borehole was recorded from the ground surface by Mansell Construction Services Limited (Table 1 and Figure 2).

### *Lithostratigraphic descriptions*

All borehole core samples were retained and described in the laboratory using standard procedures for recording unconsolidated sediment and peat, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour; (3) recording the composition e.g. gravel, fine sand, silt and clay; (4) recording the degree of peat humification, and (5) recording the unit boundaries e.g. sharp or diffuse.

**Table 1: Location of Boreholes BH1 to BH6, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

<b>Borehole number</b>	<b>Easting</b>	<b>Northing</b>	<b>Depth at surface (m OD)</b>
<b>Site B</b>			
BH1	539088.853	182320.893	1.38
BH2	539088.278	182347.701	1.55
BH3	539090.695	182375.626	1.39
BH4	539082.465	182386.137	1.33
BH5	539063.815	182389.620	1.38
BH6	539080.647	182413.135	1.47



## PRELIMINARY RESULTS AND INTERPRETATION

The deepest sedimentary units recorded comprised dominantly coarse-grained mineral-rich sediments in boreholes <BH1>, <BH3>, <BH4> and <BH6> (Figure 3). These deposits were not recorded elsewhere; borehole <BH2> had to be abandoned due the presence of contaminated Made Ground, and the base of the sequence could not be reached in borehole BH5. There was some variation in the nature of the basal sediments, but they mainly consisted of gravels and sands, with some silt, clay and detrital wood. The upper surface of these deposits varies, between -2.86m in borehole <BH1> and -0.14m OD in borehole <BH6>, indicating a steep topographic rise in the gravel surface from south to north, in this area of the site. These records approximately reflect the findings of previous investigations (Bull and Corcoran, 2007), and represent the upper and/or reworked surface of the Pleistocene Gravel.

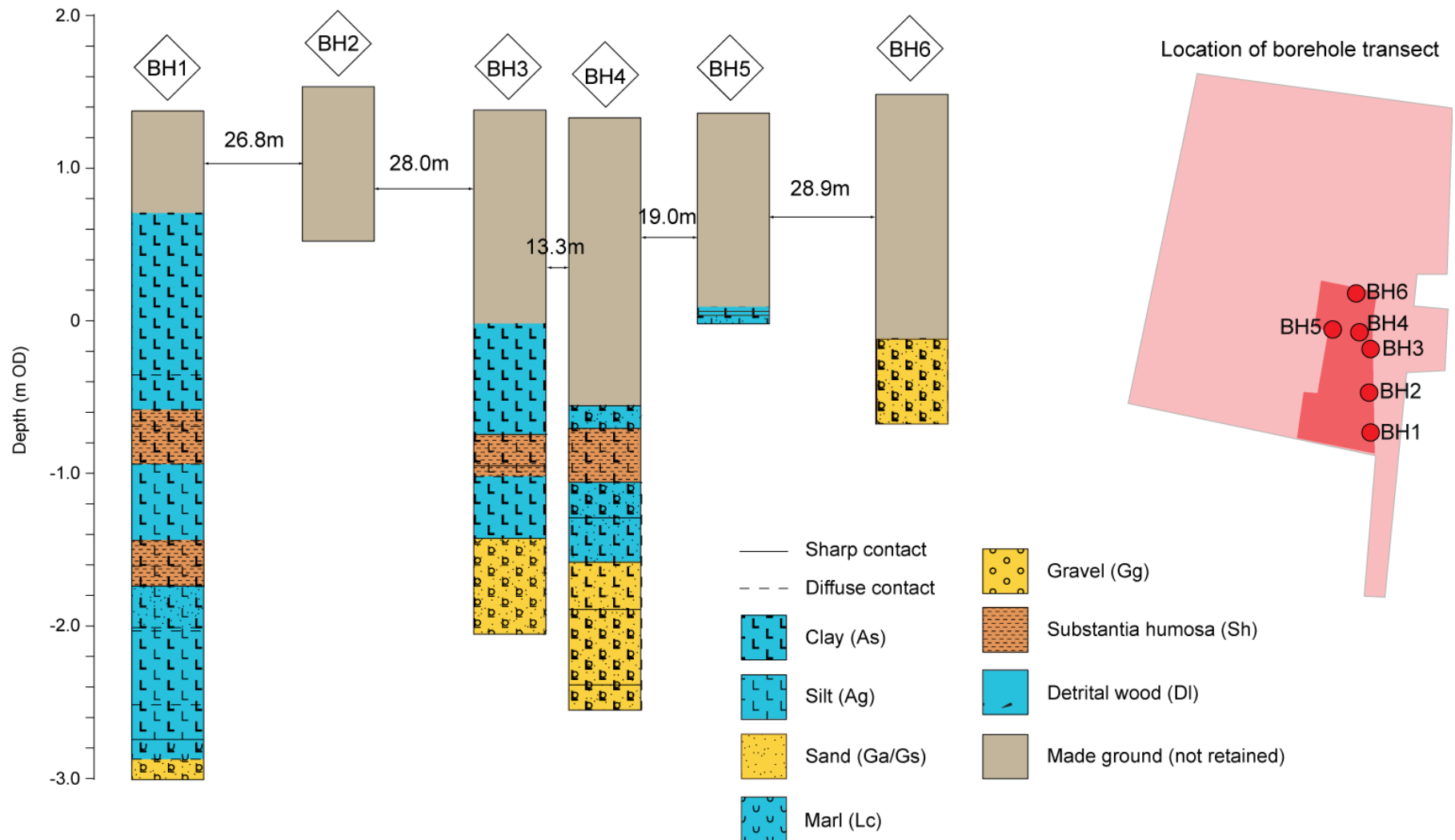
Overlying these coarse-grained sediments in boreholes <BH1>, <BH3>, <BH4>, <BH5>, and almost certainly <BH2>, was a varying thickness of fine-grained alluvial deposits, generally comprising silt and clay. A very thin layer of these deposits was also visually recorded in borehole <BH6> following clearance of the reinforced concrete and Made Ground. However, its absence within the borehole record would suggest that backfilling of the trench, (prior to drilling), removed what little material was originally present.

There is some variability in the nature of the alluvial deposits with three boreholes (<BH1>, <BH3> and <BH4>) containing highly organic-rich layers (*Substantia humosa*; Figure 3), which represent a transition towards semi-terrestrial conditions. In borehole <BH1> (Table 2), two of these horizons are recorded between -1.74m OD and -1.43m OD (Units 7 and 8), and -0.94 to -0.58m OD, the second of which is at approximately the same depth as the single horizon recorded in boreholes <BH3> (-1.01 to -0.76m OD; Units 3 and 4; Table 4) and <BH4> (-1.06 to -0.70; Unit 6; Table 5). These results therefore indicate at least one temporary shift towards semi-terrestrial conditions occurred contemporaneously across the site, between boreholes <BH1> and most likely <BH5>. The absence of these deposits towards the north of the site at borehole <BH6> is most likely the result of the rising topography of the underlying Gravel towards higher drier ground. Alternatively these deposits may have been subsequently truncated.

In addition, recorded at the transition between the Shepperton Gravel and alluvial deposits in borehole <BH1> only, were three Units spanning ca. 50cm containing significant quantities of calcareous material that may represent marl or tufa. Similar deposits have been recorded in

the Lea Valley approximately 2km north-west at the Olympic Park. Here, a sequence of calcareous sandy deposits developing into peaty silts and peats, suggested the infilling of initially active fluvial channels during the Middle Holocene (Green *et al.*, 2009). It is therefore suggested that the sequence (and therefore environmental history) recorded in the transect at West Ham Bus Garage, may have similar characteristics to those recorded at the Olympic Park.

In all boreholes, the fine grained alluvium was overlain by Made Ground that ranged in thickness, up to 2m. This variable thickness was similar to that recorded during previous investigations (Bull and Corcoran, 2007).



**Figure 3: Transect of lithostratigraphic sequences from Boreholes BH1 to BH6, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09). The borehole logs are accurately spaced representing their geographical location**



**Table 2: Lithostratigraphic descriptions of Borehole <BH1>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (m OD)	Unit number	Description
1.38 to 0.65	14	Made ground
0.65 to -0.35	13	5Y 3/2 with 10YR 2/1 and 2.5Y 7/2; As4 Gs+; Dark olive gray clay with small patches of black and occasional light gray sand. Diffuse contact into:
-0.35 to -0.58	12	5Y 3/2; As4 Sh+; Dark olive gray clay with organic matter. Diffuse contact into:
-0.58 to -0.69	11	10YR2/1; Sh2 As1 Ag1; Black organic rich silty clay. Diffuse contact into:
-0.69 to -0.94	10	10YR 2/1 to 5Y 3/2; As3 Sh1 DI+; Black to dark olive gray organic-rich clay with detrital wood. Diffuse contact into:
-0.94 to -1.43	9	5Y 3/2; As3 Ag1 Sh+ DI+; Dark olive gray silty clay with organic matter and detrital wood. Diffuse contact into:
-1.43 to -1.61	8	10YR2/1 to 5Y 3/2; As2 Sh1 DI1; Black to dark olive gray organic-rich clay with detrital wood. Diffuse contact into:
-1.61 to -1.74	7	10YR 2/1 to 5Y 3/2 with 2.5Y 6/2; As2 Ag1 Sh1 Gs+ DI+; Black to dark olive gray organic-rich silty clay with traces of light brownish gray sand and detrital wood. Sharp contact into:
-1.74 to -2.01	6	2.5Y 5/2 to 2.5Y 4/3; Ag2 As1 Ga1 Sh+ DI+ Humo 2; Grayish brown to olive brown clayey sandy silt with organic matter and detrital wood. Diffuse contact into:
-2.01 to -2.03	5	10YR 3/2; As3 Ag1; Very dark grayish brown silty clay.
-2.03 to -2.52	4	10YR 3/2; As2 Ag2 Ga+ DI+; Very dark grayish brown silty clay with traces of sand and detrital wood. Diffuse contact into:
-2.52 to -2.75	3	2.5Y 4/3; Ag3 As1 Lc+ Ga+ Sh+ DI+; Olive brown clayey silt with traces of sand, organic matter, marl and detrital wood. Sharp contact into:
-2.75 to -2.86	2	2.5Y 4/2 to 2.5Y 7/2; Lc2 As1 Ag1 Ga+; Layers of dark grayish brown to light gray marl with sand. Diffuse contact into:
-2.86 to -3.03	1	10YR 2/1 to 10YR 4/1; Gs2 Gg1 Ag1 As+ Sh+ Lc+; Black to dark gray silty gravelly sand with organic and calcareous material.

**Table 3: Lithostratigraphic descriptions of Borehole <BH2>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (m OD)	Unit number	Description
1.55 to 0.55	1	Made Ground – borehole abandoned

**Table 4: Lithostratigraphic descriptions of Borehole <BH3>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (m OD)	Unit number	Description
1.34 to -0	6	Made Ground
0 to -0.76	5	2.5Y 4/3 mottled with 10YR 2/1 and 10YR 5/6; As4; Olive brown mottled with black and yellowish brown clay. Diffuse contact into:
-0.76 to -0.95	4	2.5Y 4/3; As2 Ag1 Sh1 DI+; Olive brown silty organic-rich clay with detrital wood. Diffuse contact into:
-0.95 to -1.01	3	2.5Y 4/3 to 10YR 2/1; Sh2 As1 Ag1 DI+; Olive brown to black very organic-rich silty clay with detrital wood and Mollusca inclusions. Diffuse contact into:
-1.01 to -1.42	2	2.5Y 4/3; As4 Ga+ Sh+ DI+; Olive brown clay with sand organic matter and detrital wood inclusions. Sharp contact into:
-1.42 to -2.04	1	10YR 4/1; Gs2 As1 Gg1 DI+; Dark gray clayey sand with gravel and detrital wood inclusions.

**Table 5: Lithostratigraphic descriptions of Borehole <BH4>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (m OD)	Unit number	Description
1.34 to -0.57	8	Made Ground
-0.57 to -0.70	7	2.5Y 6/4; Gs2 Gg1 As1; Light yellowish brown clayey gravelly sand. Sharp contact into:
-0.70 to -1.06	6	2.5Y 4/3 to 2.5Y 2.5/1; Ag2 As1 Sh1; Olive brown to black organic-rich clayey silt. Sharp contact into:
-1.06 to -1.29	5	10YR 4/1; Gs2 Gg1 As1; Dark gray clayey gravelly sand. Sharp contact into:
-1.29 to -1.57	4	10YR 4/1 to 10YR 2/1; Gs2 As2 Sh+; Dark gray to black clayey sand with organic-rich inclusions. Diffuse contact into:
-1.57 to -1.90	3	10YR 4/1; Gs2 As2 Gg+; Dark gray clayey sand with gravel. Sharp contact into:
-1.90 to -2.39	2	10YR 3/1; Gs2 Gg1 As1; Very dark gray, clayey gravelly sand. Sharp contact into:

-2.39 to -2.87	1	10YR 3/1; Gg2 Gs1 As1; Very dark gray clayey sandy gravel.
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**Table 6: Lithostratigraphic descriptions of Borehole <BH5>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (cm)	Unit number	Description
1.38 to 0.18	6	Made Ground
0.18 to 0.08	5	2.5Y 3/1; As3 Ag1 Gs+ Sh+ Dh+ DI+; Very dark gray silty clay with sand, organic-rich and detrital wood and plant remains. Unknown contact into:
0.08 to 0.13	4	2.5Y 3/1; As3 Ag1 Gs+ Sh+ Dh+; Very dark gray silty clay with sand, organic-rich and detrital plant remains. Unknown contact into:
0.13 to 0.08	3	2.5Y 3/1; As3 Ag1 Sh+ Dh+; Very dark gray silty clay with organic-rich and detrital plant remains. Unknown contact into:
0.08 to 0.03	2	2.5Y 3/1; As3 Ag1 Gs+ Sh+ Dh+ DI+; Very dark gray silty clay with sand, organic-rich, detrital wood and plant remains. Unknown contact into:
0.03 to -0.02	1	2.5Y 3/1; As2 Ag1 Gs1 Gg+ Sh+ Dh+ DI+; Very dark gray silty sandy clay with gravel, organic-rich, detrital wood and plant remains

**Table 7: Lithostratigraphic descriptions of Borehole <BH6>, Location of West Ham Bus Garage (the former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)**

Depth (m OD)	Unit number	Description
1.47 to -0.14	2	Made Ground
-0.14 to -0.69	1	10YR 3/1; Gs2 Gg1 As1 DI+; Very dark gray clayey gravelly sand with detrital wood and Mollusca inclusions

## CONCLUSIONS AND RECOMMENDATIONS

The sediments at West Ham Bus Garage can be divided into five main stratigraphic units, in order of deposition:

1. Coarse grained mineral-rich sediments dominated by gravels and sands probably representative of the Pleistocene Shepperton Gravel were recorded at the base of the sequence. The surface elevation of these deposits indicates a steep rise towards the north of the site.
2. Calcareous-rich sediments were recorded above the Pleistocene Gravel to the south of the site, in the deepest borehole sequence (<BH1>), possibly representing either marl or tufa deposits at the base of a previously active channel
3. Alluvial fine grained mineral-rich deposits overlay the Pleistocene Gravel/calcareous deposits across the site. These deposits reflected the underlying topography, being thickest in the south of the site, and thinning towards the north, where the elevation of the Pleistocene Gravel indicates the presence of higher, drier ground.
4. Organic-rich deposits representative of shifts towards semi-terrestrial conditions were recorded in the alluvium. One of these layers was recorded at the same altitude in three boreholes indicating a site-wide environmental change. A second horizon was recorded at a lower elevation in borehole <BH1> only.
5. Made Ground of variable thickness truncated the natural deposits in all boreholes

The results of the geoarchaeological survey and preliminary deposit model enhance the findings of previous research (Burton *et al.*, 2004; Bull and Corcoran, 2007), indicating that the site has considerable potential for addressing a range of important research questions with respect to the environmental and cultural histories of the Lea and Lower Thames Valleys. It is therefore strongly recommended that an assessment of the recovered borehole records is carried out, incorporating organic matter determinations on boreholes <BH1>, <BH3>, and <BH4>, and a pollen and plant macrofossil assessment on the sediments from <BH1>. The results of these investigations will lead to an updated, detailed deposit model, some provisional indications of the vegetation and cultural history of the site, and the potential for further analysis (if necessary).

## REFERENCES

Bull, R. and Corcoran, J. (2007) *Parcel Force Depot, West of Stephenson Street, London, E16, London Borough of Newham, Archaeological Desk-based Assessment*. Museum of London Archaeological Service and PCA Ltd Unpublished Report.

*Quaternary Scientific (QUEST) Unpublished Report April 2009; Project Number 007/08*

Burton, E., Corcoran, J., Halsey, C., Jamieson, D., Malt, D. and Spurr, G. (2004) *The Lea Valley Mapping Project*. Museum of London Archaeological Service Unpublished Report.

Green, C.P., Batchelor, C.R., Young, D. And Branch, N.P. (2009) *Planning Delivery Zones 5 and 6 (PDZ5 and 6), Olympic Park: Rapid Environmental Archaeological assessment*. Quaternary Scientific (QUEST) Unpublished Report February 2009; Project Number 010/08

## APPENDIX A: OASIS

### OASIS ID: quaterna1-62216

#### Project details

Project name	Geoarchaeological borehole investigations at West Ham Bus Depot (site code: WHQ09)
Short description of the project	<p>A borehole survey was undertaken to provide a record of the Holocene sedimentary sequence at West Ham Bus Garage (the Former Pacel Force Depot), West of Stephenson Street, London Borough of Newham. A total of 6 boreholes were taken along a transect orientated approximately north south across the site. The recorded sediments were divided into five main stratigraphic units, in order of deposition: (1) Coarse grained mineral-rich sediments dominated by gravels and sands probably representative of the Pleistocene Shepperton Gravel were recorded at the base of the sequence. The surface elevation of these deposits indicates a steep rise towards the north of the site; (2) Calcareous-rich sediments were recorded above the Pleistocene Gravel to the south of the site, in the deepest borehole sequence (), representing tufa deposits at the base of a previously active channel; (3) Alluvial fine grained mineral-rich deposits overlay the Pleistocene Gravel/calcareous deposits across the site. These deposits reflected the underlying topography, being thickest in the south of the site, and thinning towards the north, where the elevation of the Pleistocene Gravel indicates the presence of higher, drier ground; (4) Organic-rich deposits representative of shifts towards semi-terrestrial conditions were recorded in the alluvium, and (5) Made Ground of variable thickness truncated the natural deposits in all boreholes. The sedimentary sequences of boreholes , and were recommended for laboratory assessment.</p>
Project dates	Start: 15-04-2009 End: 15-05-2009
Previous/future work	Yes / Yes
Type of project	Field evaluation
Site status	None
Current Land use	Community Service 1 - Community Buildings
Monument type	BUS STATION Uncertain
Significant Finds	ALLUVIUM Uncertain
Significant Finds	PEAT Uncertain
Methods & techniques	'Vibro-core'



Development type	Service infrastructure (e.g. sewage works, reservoir, pumping station, etc.)
Prompt	Direction from Local Planning Authority - PPG16
Position in the planning process	After full determination (eg. As a condition)

#### Project location

Country	England
Site location	GREATER LONDON NEWHAM WEST HAM West Ham Bus Garage
Postcode	E16
Study area	5.20 Hectares
Site coordinates	TQ 3902 8245 51.5233318654 0.00411148782910 51 31 23 N 000 00 14 E Point
Height OD / Depth	Min: -2.90m Max: 0.70m

#### Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	Quaternary Scientific (QUEST)
Project design originator	Dr N.P. Branch
Project director/manager	C.R. Batchelor
Project supervisor	C.R. Batchelor
Type of sponsor/funding body	Developer
Name of sponsor/funding body	Mansell Construction Services Limited

### Project archives

Physical Archive recipient LAARC

Physical Archive ID WHQ09

Physical Contents 'Environmental'

Digital Archive recipient LAARC

Digital Archive ID WHQ09

Digital Contents 'Environmental','Stratigraphic','Survey'

Digital Media available 'Images raster / digital photography','Images vector','Spreadsheets','Text'

Paper Archive recipient LAARC

Paper Archive ID WHQ09

Paper Contents 'Environmental','Stratigraphic','Survey'

Paper Media available 'Correspondence','Drawing','Map','Report','Survey '

### Project bibliography 1

Publication type Grey literature (unpublished document/manuscript)

Title A report on the geoarchaeological borehole investigations: West Ham Bus Garage (The former Parcel Force Depot), West of Stephenson Street, London Borough of Newham (site code: WHQ09)

Author(s)/Editor(s) Branch, N.P.

Author(s)/Editor(s) Batchelor, C.R.

Author(s)/Editor(s) Morgan, P.

Author(s)/Editor(s) Young, D.

Other bibliographic details Project Number 007/08

Date 2009

Issuer or publisher Quaternary Scientific (QUEST)

Place of issue or publication Unpublished report

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### **Project bibliography 2**

Publication type Grey literature (unpublished document/manuscript)

Title Parcel Force Depot, West of Stephenson Street, London, E16

Author(s)/Editor(s) Bull, R.

Author(s)/Editor(s) Corcoran, J.

Date 2007

Issuer or publisher MoLAS-Pre-Construct Archaeology Ltd

Place of issue or publication London

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### **Project bibliography 3**

Publication type Grey literature (unpublished document/manuscript)

Title Written Scheme of Investigation for the geoarchaeological investigation of The Parcel Force Depot, West of Stephenson Street, London, E16

Author(s)/Editor(s) Branch, N.P.

Date 2008

Issuer or publisher ArchaeoScape

Place of issue or publication Royal Holloway, University of London

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**Project bibliography 4**

Publication type Grey literature (unpublished document/manuscript)

Title Method Statement: the Parcel Force Depot, West of Stephenson Street

Author(s)/Editor(s) Batchelor, C.R.

Date 2009

Issuer or publisher Quaternary Scientific (QUEST)

Place of issue or publication University of Reading

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Entered by Rob Batchelor (c.r.batchelor@reading.ac.uk)

Entered on 31 July 2009

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