A REPORT ON THE GEOARCHAEOLOGICAL BOREHOLE INVESTIGATIONS AND DEPOSIT MODELLING ON LAND HERON QUAYS 1, 10 BANK STREET AND HERON QUAYS 2, 1 BANK STREET, ISLE OF DOGS, LONDON BOROUGH OF TOWER HAMLETS (SITE CODE: HRN14)

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INTRODUCTION

This report summarises the findings arising out of the geoarchaeological borehole investigations and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the Secant Piling Works at Heron Quays 1, 10 Bank Street (HQW1) and Heron Quays 2, 1 Bank street (HQW2), Isle of Dogs, London Borough of Tower Hamlets (site code: HRN14; National Grid Reference centred on TQ 3728 8013; Figures 1 & 2). The site lies towards the centre of the floodplain on the Isle of Dogs, an area bounded to the west, south and east by a large meander loop of the Thames. The site is located between the Heron Quays to the north and the West India Dock South to the south.

Recent geotechnical investigations carried out by Concept Site Investigations (2013) indicate a sequence of Pleistocene River Gravels (the late Devensian Shepperton Gravel), the surface of which lies at between -0.27m OD and -1.01m OD, overlain by a predominantly clayey (but in places sandy or peaty) Alluvium to a level of between +3.50 and -0.61m OD. The Alluvium is overlain by Made Ground to the present day surface (between 5 and 6m OD). Made Ground directly overlies the Gravel in one borehole (BH03), where the Made Ground/Gravel contact lies at -0.45m OD. At Canada Water, beyond the Isle of Dogs meander *ca*. 1km to the west (NGR TQ 355 795; Sidell *et al*., 2000), a thin peat unit was recorded within the Alluvium between -1.20m and -0.90m OD. Peat initiation at this site commenced around 4280-3690 cal BP (Late Neolithic/Bronze age). Adjacent to Canada Water at the Surrey Quays site (NGR TQ 355 796; Batchelor *et al*., 2010), Peat horizons were recorded between *ca*. -1.3 and -0.2m OD, and radiocarbon dated to the late Bronze Age/early Iron Age, with a later period of Peat formation occurring during the Roman to Early Medieval periods. Towards the northeast of the Isle of Dogs, Peat was recorded at Preston Road, Poplar (*ca*. 800m to the northeast; Branch *et al*., 2007) between -0.46 to -0.32m OD, accumulating from the late Neolithic (4260-3910 cal BP) to the Bronze Age (3650-3360 cal BP). At the Atlas Wharf site, *ca*. 500m to the south of Heron Quays (Lakin, 1998), Peat formation occurred from the early/middle Neolithic (*ca*. 5750 cal BP) through to the Bronze

Age (Lakin, 1998).

The different stratigraphic units recorded are significant as they represent different environmental conditions that would have existed in a given location. For example, soil and Peat represent former terrestrial or semi-terrestrial land-surfaces, whilst fine to medium-grained sediments such as sands, silts and clays represent periods of inundation/flooding by estuarine or fluvial waters. Thus by studying the sub-surface stratigraphy across a given area (i.e. the HQW1 and HQW2 sites), it is possible to build an understanding of the former landscapes and environmental changes that took place over space and time. Furthermore, the soils and Peats represent potential areas that might have been utilised or even occupied by prehistoric people. Similarly, high areas of Shepperton Gravel may also represent utilised surfaces as they remained elevated above the floodplain during periods of inundation. Evidence for such utilisation of the floodplain landscape has, for example, been recorded at the Atlas Wharf site, where a Bronze Age structure (possible platform) was recorded and radiocarbon dated to 3840-3550 cal BP (Lakin, 1998).

The aim of this report is to produce a model of the sub-surface stratigraphy of the site using a combination of new geoarchaeological boreholes put down and described by Quaternary Scientific, and existing Concept Site Investigations and BGS borehole records resulting from previous investigations both on and immediately adjacent to the site. This model will be used to provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential utilisation by prehistoric people. In addition, this report will provide recommendations on the suitability for further geoarchaeological investigations.

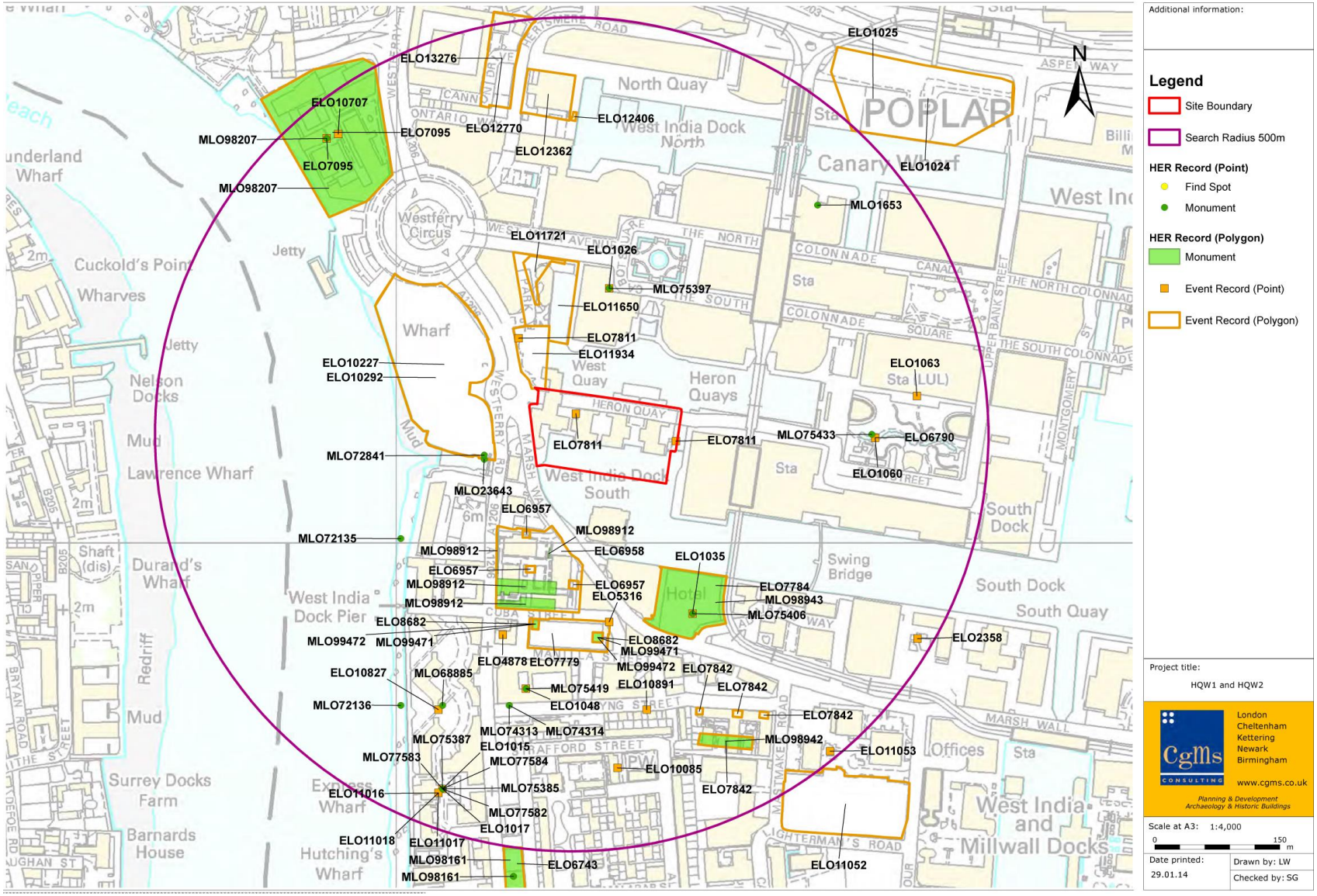

Figure 1: Site location, showing HER search data (provided by CgMs Consulting).

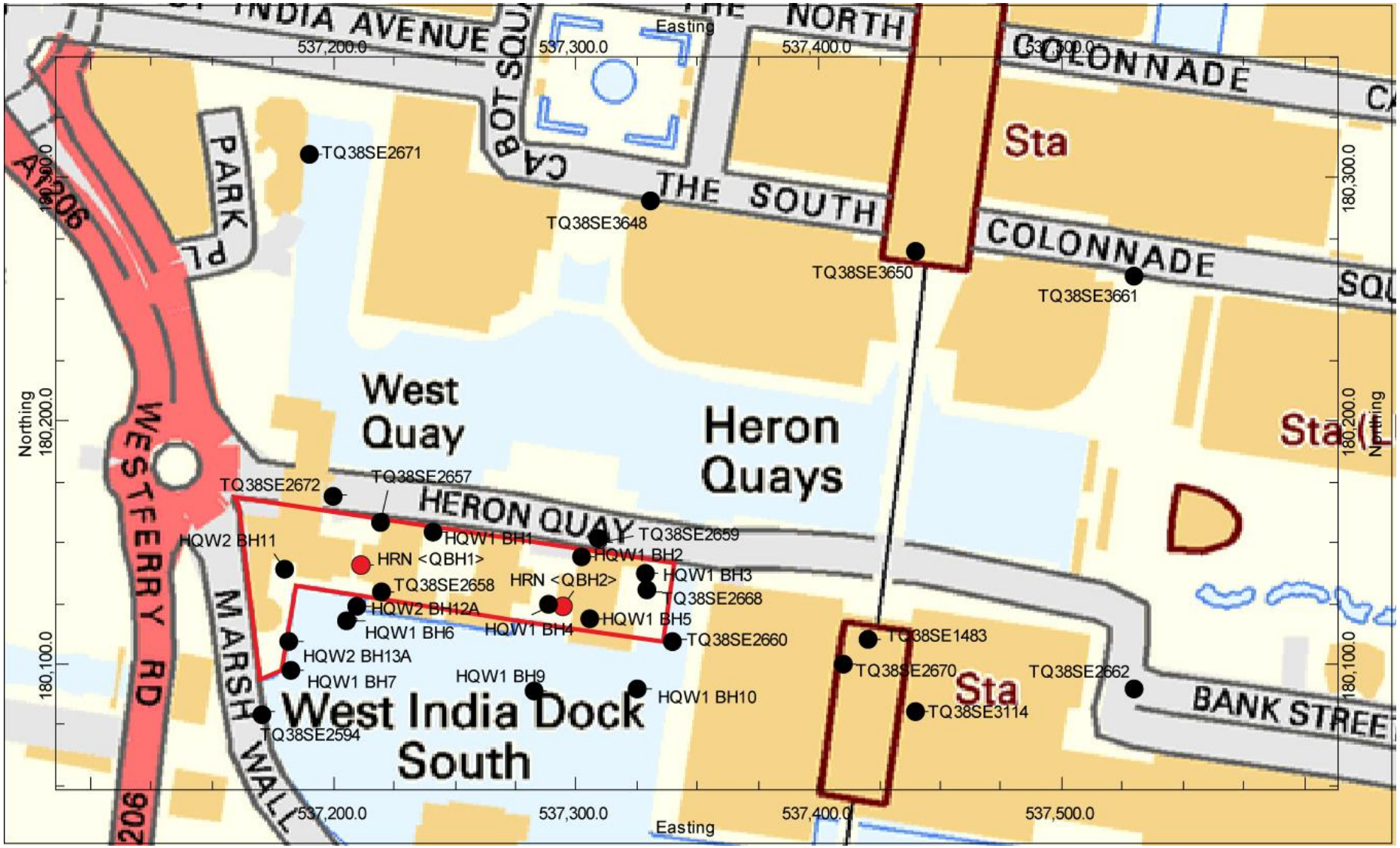

Figure 2: Location of boreholes HRN<QBH1> and HRN<QBH2> (in red), and previous borehole investigations put down on/nearby to the site. ***Contains Ordnance Survey data © Crown copyright and database right [2014]***

METHODS

Field investigations

Two boreholes (HRN<QBH1> and HRN<QBH2>) were put down at the site in March 2014. Core samples were recovered using an Eijkelkamp window sampler and gouge set using an Atlas Copco TT 2-stroke percussion engine. This coring technique is a suitable method for the recovery of continuous, undisturbed core samples and provides sub-samples suitable for not only sedimentary and microfossil assessment and analysis, but also macrofossil analysis. The recovered core samples were wrapped in clear plastic to prevent moisture loss, labelled with the depth (metres from ground surface) and orientation (top and base) and returned to Quaternary Scientific for storage in a purpose built facility at 2^{o}C. This temperature prevents fungal growth on the core surface, which may lead to anomalous radiocarbon dates, and moisture loss. The spatial attributes of each borehole were recorded (Figure 2).

Table 1: Spatial data for the new geoarchaeological boreholes attributes, Land at Heron Quays 1, 10 Bank Street (HQW1) and Heron Quays 2, 1 Bank street (HQW2), Isle of Dogs, London Borough of Tower Hamlets

Borehole number	Easting	Northing	Elevation (m OD)
HRN<QBH1>	537211	180141	5.53
HRN<QBH2>	537295	180124	5.30

Lithostratigraphic descriptions

The lithostratigraphy of boreholes <QBH1> and <QBH2> was described in the laboratory using standard procedures for recording unconsolidated sediment and organic sediments, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts) (Tröels-Smith, 1955). 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 using a Munsell Soil Colour Chart; (3) recording the composition; gravel (Grana glareosa; Gg), fine sand (Grana arenosa; Ga), silt (Argilla granosa; Ag) and clay (Argilla steatoides); (4) recording the degree of peat humification and (5) recording the unit boundaries e.g. sharp or diffuse. The results are displayed in Figure 3 to 5 and Tables 2 and 3.

Deposit modelling

The reconstruction of the sedimentary architecture beneath the site was undertaken using records from 21 geoarchaeological and geotechnical boreholes. An additional seven geotechnical boreholes displayed in Figure 2, were not included in the deposit modelling exercise as they lie within the confines of the West India Dock South (HQW1 BH6, BH7, BH9& BH10; TQ38SE1483, TQ38SE2594 & TQ38SE3114). Modelling was undertaken using

RockWorks v14 software. The term 'deposit modelling' describes any method used to depict the sub-surface arrangement of geological deposits, but particularly the use of computer programmes to create contoured maps or three dimensional representations of contacts between stratigraphic units. The first requirement is to classify the recorded borehole sequences into uniformly identifiable stratigraphic units. At the site three stratigraphic units were recognised: (1) Shepperton Gravel; (2) Alluvium, and (3) Made Ground.

How effectively Rockworks portrays the relief features of stratigraphic contacts or the thickness of sediment bodies depends on the number of data points (boreholes) per unit area and the extent to which these points are evenly distributed across the area of interest. The portrayal is also affected by the significance assigned to these data points, in terms of the extent of the area around the point to which the data are deemed to apply. This can be predetermined for each data set, and in the present case was restricted to a distance of 50m from each borehole. This is equivalent to an area of *ca*. 0.78 hectares.

Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models is variable. In general, reliability improves from the boundaries of the site, where edge effects adversely influence the reconstructions, towards the core area of the site where mutually supportive data are likely to be available from several adjacent boreholes

Reliability is also affected by the quality of the stratigraphic records which in turn are affected by the nature of the sediments and/or their post-depositional disturbance during previous stages of land-use on the site. Quality is also affected where boreholes have been put down at different times and recorded using different descriptive terms and subject to differing technical constraints in terms of recorded detail including the exact levels of the stratigraphic boundaries.

Finally, because of the 'smoothing' effect of the modelling procedure, the modelled levels of stratigraphic contacts may differ slightly from the levels recorded in borehole logs.

RESULTS, INTERPRETATION & DISCUSSION OF THE GEOARCHAEOLOGICAL BOREHOLE INVESTIGATIONS AND DEPOSIT MODELLING

The results of the geoarchaeological borehole investigations are displayed in Tables 1 and 2, and the results of the deposit modelling in Figures 3 to 5.

Three major stratigraphic units were recorded across the Heron Quay 1 and Heron Quay 2 sites. The lower most unit comprises coarse grained sands or coarse grained sands and gravels, representative of the upper surface of the Shepperton Gravel. This was deposited under high energy fluvial conditions during the Late Devensian. The results of the borehole investigations and deposit modelling indicate that the surface of the Shepperton Gravel lies between approximately -0.20 and -1.20m OD. This is mainly consistent with boreholes put down beyond the confines of the site to the east, and north of the Heron Quays dock. It is also comparable with the surface of the Shepperton Gravel as recorded on the western side of Greenwich Peninsula (-1.25m OD; e.g. Young & Batchelor, 2013). This surface is relatively high, but still lower than gravel islands to the west (e.g. *ca*. 1.0; the Horsleydown and Bermondsey Eyots) or north-east (e.g. 0.5m OD; beneath Royal Docks Community School; Holder, 1997) where unequivocal evidence for prehistoric activity has been recorded. However, the presence of wood and charcoal at the interface between the Shepperton Gravel and Alluvium in geoarchaeological borehole HRN<QBH1> is of note, possibly suggesting a period of stabilisation prior to the onset of alluvial sedimentation. Whether the remains are of natural or anthropogenic origin is impossible to determine.

Overlying the Shepperton Gravel is a complex sequence of Alluvial deposits overlain by Made Ground. The Alluvium is generally characterised by fine-grained inorganic sediments that become increasingly silty and sometimes sandy with depth; thin lenses of organic-rich material are recorded only intermittently. These Alluvial sediments are indicative of deposition within a low energy fluvial or estuarine environment, with the lenses of organic remains suggesting brief periods of stabilisation. The upper surface of the Alluvium represents the original natural topography of the historic floodplain of the Thames, which in this area of London would normally be anticipated to lie between approximately 0 and +1m OD. However, interrogation of the geoarchaeological and geotechnical boreholes suggests that the surface is highly variable, ranging between approximately 0 and >3m OD (e.g. HQW BH11; TQ38SE2660) (Figure 4). It is highly unlikely that natural processes specific to this area enabled accumulation to continue to such high elevations. It is far more probable that the surface has been artificially raised by material excavated from the adjacent docks.

Distinguishing the ‘naturally deposited’ alluvium from the excavated material is near

impossible in the geotechnical records, but laboratory-based detailed description of the geoarchaeological boreholes suggests the interface lies between 0.35 and 0.91m OD, which correlates with anticipated heights of the natural floodplain surface suggested above. It is also evident from some of the geotechnical boreholes (e.g. BH03) that no definitive 'natural' alluvial deposits remain between the Shepperton Gravel and Made Ground, suggesting truncation in certain areas of the site.

The combined results therefore indicate that the 'natural' alluvium is relatively thin (frequently <1m), and that that the model presented in Figure 4 is not a true representation of its surface. Unfortunately, due to the less detailed nature of the geotechnical logs it is not possible to produce such a model; it is also for this reason that a borehole transect has not been created as it could lead to over-interpretation of the data.

CONCLUSIONS & RECOMMENDATIONS

The aim of this report was to produce a model of the sub-surface stratigraphy of the site in order to: (1) provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential exploitation by prehistoric people; and (2) to provide recommendations on the suitability for further geoarchaeological investigations at the site.

The results of the investigation have revealed that the surface of the Late Devensian Shepperton Gravel lies between -0.2 and -1.2m at the site and within its immediate surroundings. This surface is relatively high, but not as high as known gravel eyots to the west and north-east of the Isle of Dogs containing archaeological remains. Despite this, a few fragments of wood and a large piece of charcoal (>4mm) were recorded at the very top of the Shepperton Gravel deposits in HRN<QBH1>. Whether these are of anthropogenic or natural origin is impossible to determine.

A relatively thin sequence of fine-grained dominantly inorganic alluvial deposits rests on the Shepperton Gravel. Traces of organic-rich remains were recorded, but nothing similar to the thick prehistoric peat deposits recorded at sites such as Canada Water (Sidell *et al*., 2000), Surrey Quays (Batchelor *et al*., 2010), Preston Road, Poplar (Branch *et al*., 2007) or Atlas Wharf (which also contained a Bronze Age structure) (Lakin, 1998). The 'natural' alluvial deposits are overlain by redeposited alluvium most likely originating from the adjacent excavated docks. Distinguishing the naturally deposited alluvium from the excavated material is near impossible in the geotechnical records, but detailed description of the geoarchaeological boreholes suggests it lies between 0.35 and 0.91m OD which correlates with anticipated surface heights. Due to the thin and mineral-rich nature of the alluvium, it is

considered to contain minimal geoarchaeological potential, and thus no further work is recommended.

REFERENCES

Batchelor, C.R., Young, D., Green, C.P., Allott, L., Cameron, N., Elias, S. and Brown, A. (2010) *Land at Site A1 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London SE16 (site Code: CQH10): Environmental Archaeological Analysis*. Quaternary Scientific Unpublished Report.

Branch, N.P., Batchelor, C.R., Elias, S. Green, C.P., and Swindle, G.E. (2007) *Preston Road, Poplar High Street, Poplar, London Borough of Tower Hamlets (site code: PPP06): environmental archaeological analysis*. ArchaeoScape Unpublished Report.

Holder, N. (1998) *An Archaeological Excavation Assessment and Updated Project Design for Royal Docks Community School Site, Prince Regent Lane, Newham.* MoLAS Unpublished Report.

Lakin, D. (1998) *Atlas Wharf, Westferry Road, Isle of Dogs*. MoLAS Unpublished Report.

Sidell, J., Wilkinson, K., Scaife, R. & Cameron, N. (2000) *The Holocene Evolution of the London Thames*: MoLAS Unpublished Report.

Tröels--Smith, J. (1955) Karakterisering af løse jordater (Characterisation of unconsolidated sediments), *Danm. Geol. Unders., **Ser IV*** **3**, 73.

Young, D.S. & Batchelor, C.R. (2013) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Plot MO115, Greenwich Peninsula, London Borough of Greenwich (site code: CHB13)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 224/12.

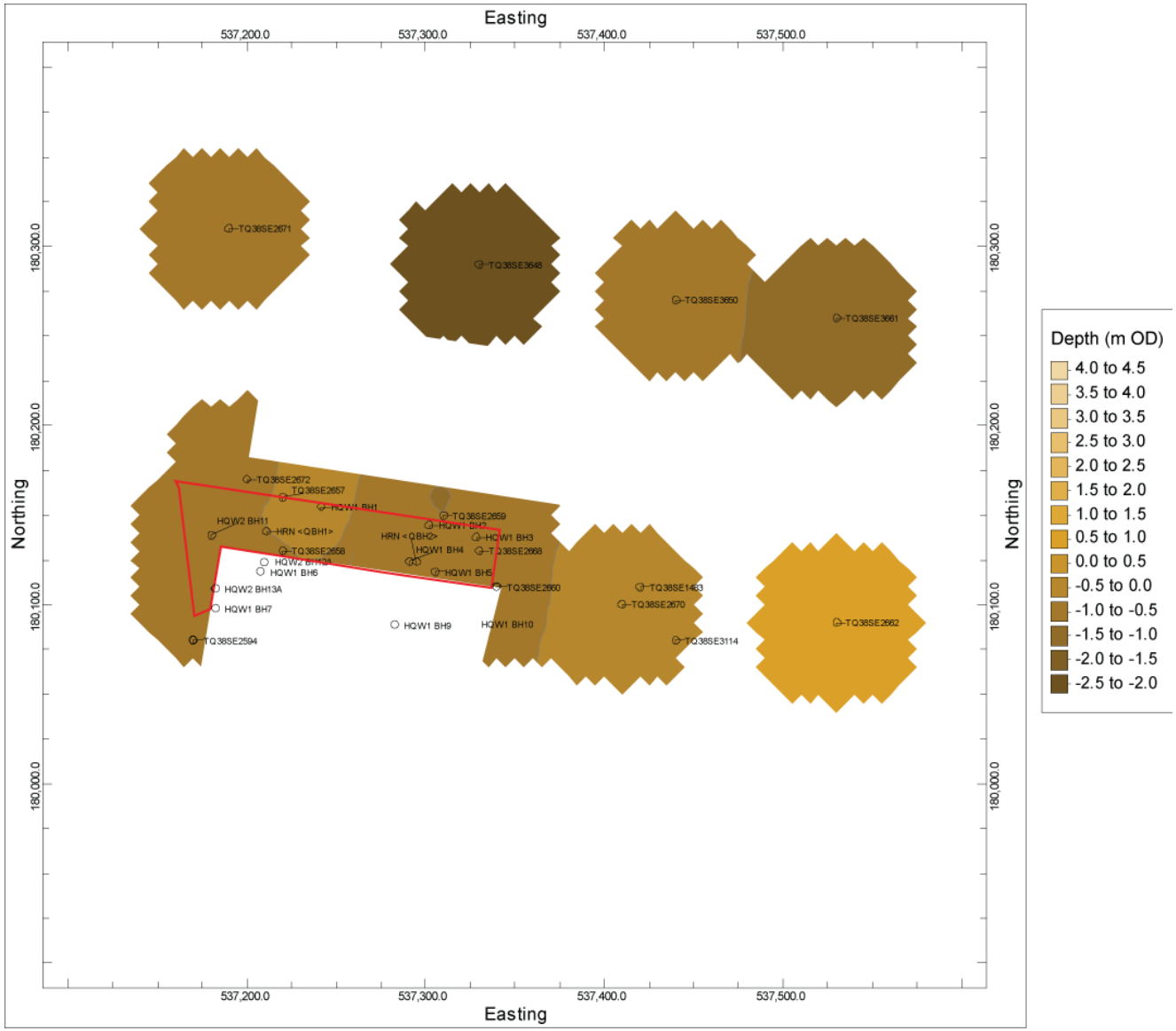

Figure 3: Modelled surface of the Shepperton Gravel (m OD).

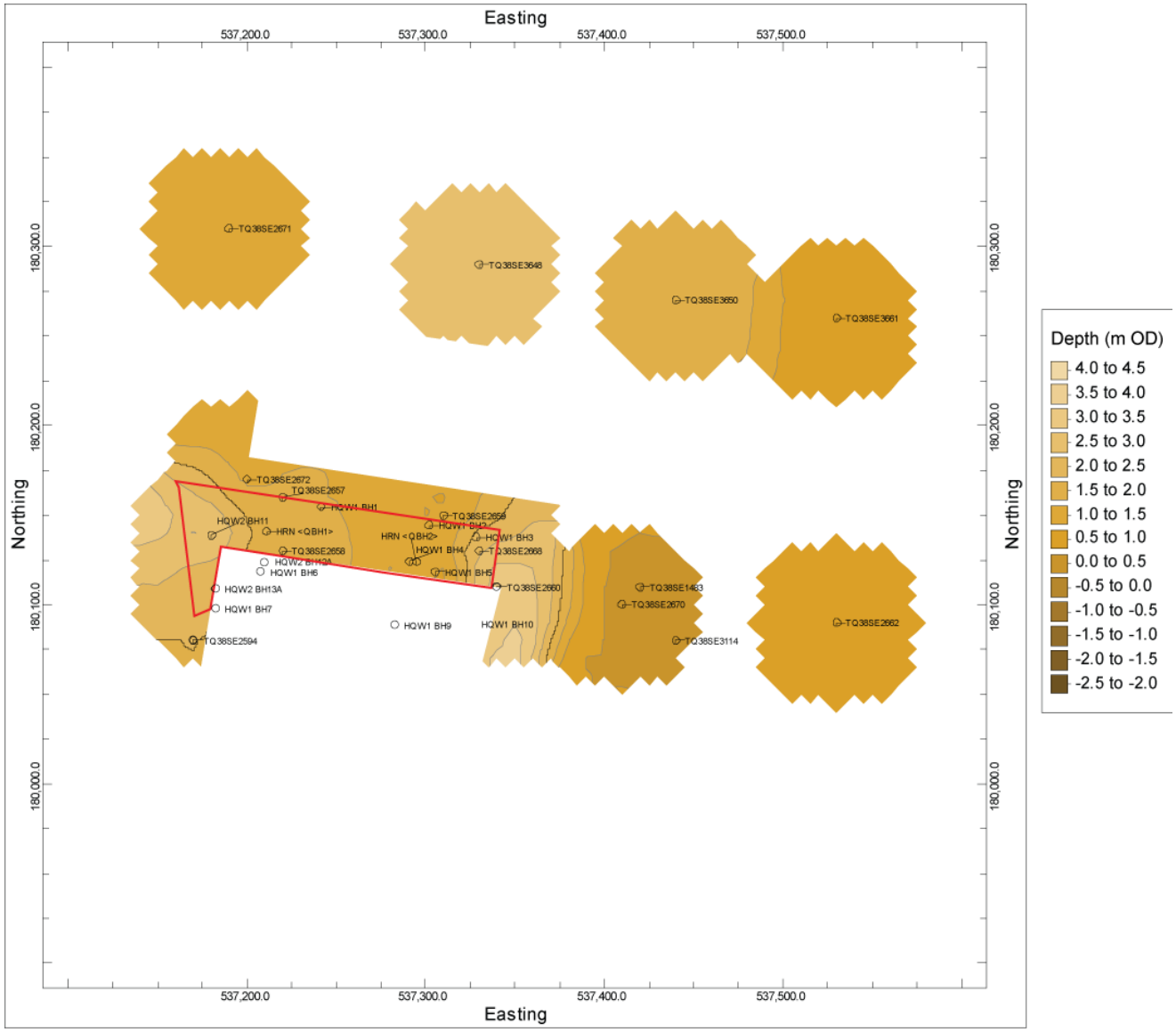

Figure 4: Modelled surface of the Alluvium (m OD)

Table 2: Lithostratigraphic description of Borehole HRN<QBH1>, Heron Quays 1, 10 Bank Street (HQW1) and Heron Quays 2, 1 Bank street (HQW2), Isle of Dogs, London Borough of Tower Hamlets

Depth (m OD)	Depth (m BGL)	Lithostratigraphic description	Geoarchaeological interpretation
5.53 to 1.98	0.00 to 3.55	Made Ground	Made Ground
1.98 to 1.73	3.55 to 3.80	10YR 4/1; As3 Ag1; Dark grey silty clay. Sharp contact into:	Ground raising associated with excavation of the adjacent docks
1.73 to 1.65	3.80 to 3.88	10YR 5/1; As2 Ga1 Ag1; Grey sandy silty clay. Sharp contact into:	
1.65 to 1.34	4.00 to 4.19	10YR 4/2 to 10YR 5/1; As3, Ag1; Mottled light grey to dark greyish brown silty clay with charcoal, sand and organic-rich inclusions; sharp contact into:	
1.34 to 1.21	4.19 to 4.32	10YR 3/1 to 10YR 5/1; Sh2, Ag1, As1; Mixed grey to very dark grey organic rich silty clay; sharp contact into:	
1.21 to 0.91	4.32 to 4.62	10YR 4/1; Ag2, As2; Dark grey silty clay with sand, organic-rich, and possibly very fine brick/tile fragments. The unit has a rough texture and becomes finer grained and lighter with depth; diffuse contact into:	
0.91 to -0.27	4.62 to 5.80	10YR 5/1; As4; Grey stiff clay with traces of silt; diffuse contact into:	Alluvium
-0.27 to -0.37	5.80 to 5.90	10YR 5/1 to 10YR 4/1; As3, Ag1; Grey to dark grey silty clay with traces of sand and charcoal fragments recorded at the sharp interface into:	
-0.37 to -0.47	5.90 to 6.00	10YR 4/1; Ga4; Grey to brownish yellow coarse sand with silt, clay and large wood fragments (roots?)	Shepperton Gravel

Table 3: Lithostratigraphic description of Borehole HRN<QBH2>, Heron Quays 1, 10 Bank Street (HQW1) and Heron Quays 2, 1 Bank street (HQW2), Isle of Dogs, London Borough of Tower Hamlets

Depth (m OD)	Depth (m BGL)	Lithostratigraphic description	Geoarchaeological interpretation
5.30 to 2.00	0.00 to 3.30	Made Ground	Made Ground
2.00 to 1.85	3.30 to 3.45	Made Ground/disturbed alluvium	Ground raising associated with excavation of the adjacent docks
1.85 to 1.63	3.45 to 3.67	10YR 4/1; As3 Ag1 Ga+; Dark grey silty clay with a trace of sand. Sharp contact into:	
1.63 to 1.30	3.67 to 4.00	10YR 5/1; As2 Ag2 Ga+; Grey silt and clay with a trace of sand. Some horizontal bedding with beds of sandier matrix.	
1.30 to 1.12	4.00 to 4.18	10YR 3/3; Ga3, Gg1; Brown sandy gravel; sharp contact into:	
1.12 to 0.62	4.18 to 4.68	10YR 5/1 to 10YR 2/1; As2, Ag2; Mottled grey and black silty clay and possibly organic-rich material. Rough texture; diffuse contact into:	
0.62 to 0.35	4.68 to 4.95	10YR 5/1 to 10YR 2/1; As2, Ag2; Mottled grey with some black silty clay and possibly organic-rich material with traces of gravel. Rough texture; diffuse contact into:	

0.35 to 0.30	4.95 to 5.00	10YR 5/1; As4; Grey stiff clay with traces of silt; unknown contact into:	Alluvium
0.30 to -0.47	5.00 to 5.77	10YR 4/2; Ag2, As1, Ga1; Greyish brown clayey sandy silt; diffuse contact into:	
-0.47 to -0.70	5.77 to 6.00	10YR 4/2; As2, Ag1, Ga1; Greyish brown silty sandy clay;	
-0.70 to -1.15	6.00 to 6.45	10YR 3/2; Ga3 Ag1; Dark brownish grey silty sand. Sharp contact in to:	
-1.15 to -1.70	6.45 to 7.00	10YR 3/1; Gg3 Ga1; Dark grey sandy gravel. Clasts are flint, 5-50mm in diameter, sub-rounded to sub-angular.	Shepperton Gravel

APPENDIX 1: OASIS

Project details

Project name	HERON QUAYS 1, 10 BANK STREET AND HERON QUAYS 2, 1 BANK STREET, LONDON BOROUGH OF TOWER HAMLETS: DEPOSIT MODEL
Short description of the project	Geoarchaeological boreholes and deposit modelling were undertaken in connection with the Secant Piling Works at Heron Quays 1, 10 Bank Street (HQW1) and Heron Quays 2, 1 Bank street (HQW2), London Borough of Tower Hamlets. The aim of this report was to produce a model of the sub-surface stratigraphy of the site in order to: (1) provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential exploitation by prehistoric people; and (2) to provide recommendations on the suitability for further geoarchaeological investigations at the site. The results of the investigation have revealed that the surface of the Late Devensian Shepperton Gravel lies between -0.2 and -1.2m at the site. This surface is relatively high, but not as high as known gravel eyots to the west and north-east of the Isle of Dogs containing archaeological remains. Despite this, a few fragments of wood and a large piece of charcoal (>4mm) were recorded at the very top of the Shepperton Gravel deposits in HRN<QBH1>. Whether these are of anthropogenic or natural origin is impossible to determine. A relatively thin sequence of fine-grained dominantly inorganic alluvial deposits rests on the Shepperton Gravel. The 'natural' alluvial deposits are overlain by redeposited alluvium most likely originating from the adjacent excavated docks. Distinguishing the naturally deposited alluvium from the excavated material is near impossible in the geotechnical records, but detailed description of the geoarchaeological boreholes suggests it lies between 0.35 and 0.91m OD which correlates with anticipated surface heights. Due to the thin and mineral-rich nature of the alluvium, it is considered to contain minimal geoarchaeological potential, no further work was recommended.
Project dates	Start: 01-03-2014 End: 27-03-2014
Previous/future work	Yes / Yes
Any associated project reference codes	HRN14 - Sitecode
Any associated project reference codes	HQD07 - Sitecode
Type of project	Environmental assessment
Site status	None
Current Land use	Vacant Land 1 - Vacant land previously developed
Monument type	ALLUVIUM Uncertain
Significant Finds	ALLUVIUM Uncertain

Project location

Country	England
Site location	GREATER LONDON TOWER HAMLETS TOWER HAMLETS HERON QUAYS 1,

	10 BANK STREET AND HERON QUAYS 2, 1 BANK STREET
Postcode	E14 5NY
Study area	0 Square metres
Site coordinates	TQ 3728 8013 51.5029084323 -0.0218597862543 51 30 10 N 000 01 18 W Point
Height OD / Depth	Min: -1.20m Max: 1.00m

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	CgMs Consulting
Project design originator	D.S. Young
Project director/manager	C.R. Batchelor
Project supervisor	D.S. Young
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
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Digital Archive recipient	Report
Paper Archive recipient	LAARC
Paper Media available	''Report''

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