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KENT WHARF DEPTFORD LONDON BOROUGH OF LEWISHAM

Environmental Archaeological Assessment Report

NGR: TQ 3760 7745

Site Code: KWF15

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1. INTRODUCTION

This report summarises the findings arising out of the environmental archaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at Kent Wharf, Deptford, London Borough of Lewisham (NGR centred on: TQ 3760 7745; site code: KWF15; Figures 1 & 2). Quaternary Scientific were commissioned by CgMs Consulting Ltd to undertake the investigations. The area of investigation at Kent Wharf (*centred* on NGR TQ 3760 7745; Figure 1) lies in the valley of the Ravensbourne, a minor right bank tributary of the River Thames that rises in Bromley (Barton, 1992). The site is within the tidal reach of the River, known here as Deptford Creek, around 500m upstream from its confluence with the Thames. British Geological Survey (BGS) mapping (1:50,000 Sheet 270 South London 1998) shows the valley of the Ravensbourne cutting down into the Upper Chalk and the floor of the valley occupied by Alluvium, with a narrow strip of terrace gravel (the Kempton Park Gravel) present on both sides of the valley.

The results of a previous site-based deposit modelling exercise integrating geoarchaeological and geotechnical records (Batchelor, 2015) demonstrated a Gravel surface resting between -1.64 and -2.23m OD across the majority of the site. This is overlain by 0.96-2.2m of Lower Alluvium, representing Holocene floodplain sedimentation in a moderate to low energy fluvial or estuarine environment. Towards the south of the site however, the Lower Alluvium appears to have been eroded by a former channel or tributary of the Deptford Creek. This channel was subsequently abandoned and infilled by a 2m thick horizon of Peat, which at the time of its accumulation would have supported the growth of wetland woodland. An alternative possibility to the infilling of a former channel, is that the Peat deposits represent the infilling of a tree-throw hollow. Both the Peat and Lower Alluvium were succeeded by the deposition of Upper Alluvium, representative of an overbank floodplain or estuarine environment. The Kent Wharf sequence was capped by *ca*. 3m of Made Ground deposits, which in places truncated the Upper Alluvium.

The presence of thick Peat deposits towards the south of the site was deemed of significance; on the basis of the thickness and location of the site, these deposits may have accumulated for a period of 2000 years, spanning multiple cultural periods during the prehistoric and/or historic period. Such

deposits have high potential to provide a detailed reconstruction of past environments through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating. Furthermore, such investigations have the potential of providing evidence of human activity; unequivocal evidence for which has been recorded at the nearby Old Seager Distillery site (Batchelor et al., 2014).

It was therefore strongly recommended that an environmental archaeological assessment was carried out on a sequence originating from the area of thick Peat deposits (Kent-QBH1). This assessment should consist of: (1) range-finder radiocarbon dating to ascertain the age of Peat accumulation and cessation; (2) organic matter determinations to aid identification of the sedimentary units; (3) assessment of the palaeobotanical remains (pollen, waterlogged wood and seeds) to provide a provisional reconstruction of the vegetation history and evidence of human activity; (4) assessment of the diatoms to provide an indication of the palaeohydrology (e.g. marine, brackish or freshwater), and (5) assessment of the zooarchaeological remains (insects and Mollusca) to provide information on the general environmental conditions, climatic change and hydrology of the site.

The following report details the results of the assessment exercise, which also contributes towards aims 2, 3 and 4 of the geoarchaeological Written Scheme of Investigation (WSI; Batchelor, 2015b) of the site as follows:

1. To clarify the nature of the sub-surface stratigraphy across the site;
2. To clarify the nature, depth, extent and date of any alluvium and peat deposits
3. To investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity
4. To investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland)
5. To integrate the new geoarchaeological record with other recent work in the local area for publication in an academic journal

Figure 1: Location of (1) Kent Wharf, Deptford, London Borough of Lewisham, and nearby sites discussed in the text: (2) Greenwich Creekside East (Batchelor, 2015c); (3) Faircharm Creative Quarter (FCM14; Young, 2014); (4) Old Seager Distillery (DEG00; Batchelor *et al.*, 2014) and (5) the DLR Lewisham Extension site (DXK96; Sidell et al., 1999). contains ordnance survey data © Crown copyright and database right [2015].

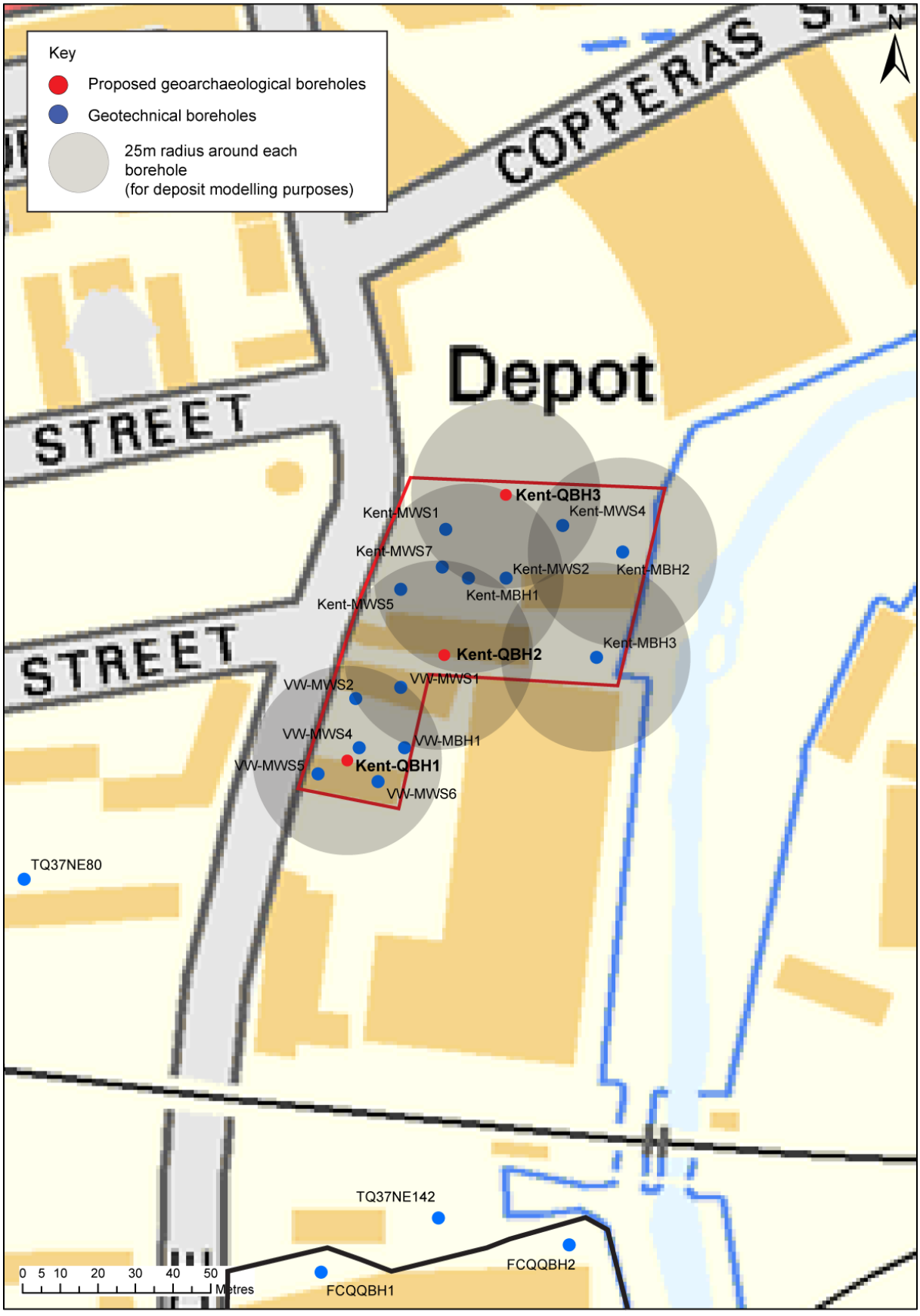

Figure 2: Locations of the geoarchaeological boreholes, and historic geotechnical records

2. METHODS

Geoarchaeological field investigations and deposit modelling

Three geoarchaeological boreholes (boreholes Kent-QBH1 to QBH3) were put down at the site in October 2015 (Figure 2) by Quaternary Scientific. Borehole 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 new and historic borehole locations were obtained with reference to site maps and recent topographic surveys (Table 1).

The lithostratigraphy of the retained core samples 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 sample using a scalpel; (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 Figures 3 (west-east transect) and 4 (north-south transect) and in Tables 2 to 4.

The deposit model was based on a review of 17 borehole records, incorporating the three new geoarchaeological boreholes, and historical records from within or around the site (Figure 2; Table 1). Sedimentary units from the boreholes were classified into three groupings: (1) Gravel, (2) Lower Alluvium; (3) Peat; (4) Upper Alluvium and (5) Made Ground. The classified data for groups 1-5 were then input into a database with the RockWorks 16 geological utilities software. Models of surface height (using a nearest neighbour routine) were generated for the Gravel, Lower Alluvium and Upper Alluvium Alluvium (Figures 5, 6 & 9). Thickness of the Lower Alluvium, Peat, Upper Alluvium and Made Ground (Figures 7, 8, 10 & 11) was also modelled (also using a nearest neighbour routine). Two-dimensional transects of selected boreholes are shown in Figures 3 & 4.

How effectively Rockworks portrays the relief features of stratigraphic contacts or the thickness of sediment bodies depends on the number of data points (boreholes/test pits) 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 the value chosen for each data point (borehole) is equivalent to an area of 25m radius for all models. The boreholes are relatively well distributed over the area of investigation. In general, reliability improves towards the core area of boreholes where mutually supportive data are likely to be available from several adjacent data points. 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. Of the records used in the deposit model, the cores from the geoarchaeological boreholes put down by Quaternary Scientific represent the most detailed record of the sediment sequences. 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.

Organic matter determinations

A total of 29 subsamples from borehole QBH1 were taken for determination of the organic matter content (Table 5; Figure 12). These records were important as they can identify increases in organic matter possibly associated with more terrestrial conditions. The organic matter content was determined by standard procedures involving: (1) drying the sub-sample at 110^0C for 12 hours to remove excess moisture; (2) placing the sub-sample in a muffle furnace at 550°C for 2 hours to remove organic matter (thermal oxidation), and (3) re-weighing the sub-sample obtain the 'loss-on-ignition' value. The samples were then re-weighed after 2 hours at 950°C for determination of the calcium carbonate content (see Bengtsson and Enell, 1986).

Radiocarbon dating

Two subsamples of unidentified twig wood (<2-3 years old) were extracted from the top and base of the Peat horizon in borehole QBH1 for radiocarbon dating. The samples were submitted for AMS radiocarbon dating to the BETA Analytic Radiocarbon Dating Facility, Miami, Florida. The results have been calibrated using OxCal v4.2 (Bronk Ramsey, 1995; 2001 and 2007) and the IntCal13 atmospheric curve (Reimer *et al.*, 2013). The results are displayed in Figure 12 and in Table 6.

Pollen assessment

12 subsamples from borehole QBH1 were extracted for an assessment of pollen content. The pollen was extracted as follows: (1) sampling a standard volume of sediment (1ml); (2) adding two tablets of the exotic clubmoss *Lycopodium clavatum* to provide a measure of pollen concentration in each sample; (3) deflocculation of the sample in 1% Sodium pyrophosphate; (4) sieving of the sample to remove coarse mineral and organic fractions (>125µ); (5) acetolysis; (6) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm^3); (7) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and followed by thorough sample cleaning in filtered distilled water. Quality control is maintained by periodic checking of residues, and assembling sample batches from various depths to test for systematic laboratory effects. Pollen grains and spores were identified using the University of Reading pollen type collection and the following sources of keys and photographs: Moore *et al* (1991); Reille (1992). The assessment procedure consisted of scanning the prepared slides, and recording the concentration and preservation of pollen grains and spores, and the principal taxa on four transects (10% of the slide) (Table 7).

Macrofossil assessment

A total of six small bulk samples from borehole QBH1 were extracted for the recovery of macrofossil remains including waterlogged plant macrofossils, wood, insects and Mollusca. The extraction process involved the following procedures: (1) removing a sample of either 5 or 10cm in thickness; (2) measuring the sample volume by water displacement, and (3) processing the sample by wet sieving using 300µm and 1mm mesh sizes. Each sample was scanned under a stereozoom microscope at x7-45 magnifications, and sorted into the different macrofossil classes. The concentration and preservation of remains was estimated for each class of macrofossil (Table 8). Preliminary identifications of the waterlogged seeds have been made using modern comparative material and reference atlases (Cappers *et al.* 2006). Nomenclature used follows Stace (2005) (Table 9).

Table 1: Borehole attributes for those records used in the deposit model, Kent Wharf, Deptford, London Borough of Lewisham

Borehole number	Easting	Northing	Height (m OD)	Borehole depth (m)	Top of Upper Alluvium (m bgl)	Top of Peat (m bgl)	Top of Lower Alluvium (m bgl)	Top of Gravel (m bgl)	Notes
Geoarchaeological borehole									
Kent-QBH1	537565	177421	4.2	7	2.60	4.30	-	6.21	UA organic-rich between 3.72 & 4.30m bgl
Kent-QBH2	537591	177449	4.3	6	2.60	-	5.00	5.96	Uncertainty distinguishing LA and UA; Gravel horizon towards the base of the LA
Kent-QBH3	537607	177256	4.8	7	2.60	-	4.61	6.90	
Geotechnical boreholes									
Kent-MBH1	537598	177470	4.8	10	3.1	-	5.40	7	Uncertainty distinguishing LA and UA; Gravel horizon towards the base of the LA
Kent-MBH2	537639	177477	4.72	10	-	-	5	6.95	
Kent-MBH3	537632	177449	4.56	10	-	-	4	6.2	
VW-MBH1	537581	177425	4.5	10	2.7	4.8	-	5.7	
Geotechnical window samples									
Kent-MWS1	537592	177483	4.9	5.45	2.8				
Kent-MWS2	537608	177470	4.8	5	2.5				
Kent-MWS4	537623	177484	4.75	5.45	2.9				
Kent-MWS5	537580	177467	5.44	5.45	2.8				
Kent-MWS7	537591	177473	4.8	4.45	1.9				
VW-MWS1	537580	177441	4.5	4	3				
VW-MWS2	537568	177438	4.5	4	3				
VW-MWS4	537569	177425	4.5	4	2.5				
VW-MWS5	537558	177418	4.5	4	2.5				
VW-MWS6	537574	177416	4.5	4	3				

3. RESULTS AND INTERPRETATION OF THE GEOARCHAEOLOGICAL BOREHOLE INVESTIGATIONS, DEPOSIT MODELLING & RADIOCARBON DATING

The geoarchaeological investigations (Tables 2 to 5) have permitted a programme of deposit modelling of the surface elevation and thickness of each major stratigraphic unit (Figures 3 to 11). The results of the organic matter content determinations and radiocarbon dating of Kent-QBH1 are displayed in Figure 12 and Tables 5 and 6.

The basal unit at the site is a horizon of sand and gravel, probably equivalent to the Shepperton Gravel that underlies the Holocene alluvium of the Thames (Gibbard, 1985), deposited during the Late Devensian (15,000 to 10,000 years before present) within a high energy braided river environment (Figures 3 to 5). This surface is reached by 7 of the 17 borehole records which are well distributed across the site. The surface of the Gravel was generally relatively even across the site, ranging between -2.23 (Kent-MBH2) and -1.64m OD (Kent-MBH3). Only in VW-MBH1 was the surface outside of this range, resting at -1.2m OD. These results thus indicate a fairly even valley floor across the site, with the possibility of a rising Gravel surface towards the south.

Three stratigraphic units were recognised above the Shepperton Gravel: the Lower Alluvium (Figures 6 & 7), Peat (Figure 8) and Upper Alluvium (Figures 9 & 10), which in turn were capped by a variable thickness of Made Ground (Figure 11). It is noted however that distinguishing between the Lower Alluvium and Upper Alluvium is difficult within the sedimentary sequences from Kent Wharf, due to the similarity of the material. This is particularly true of the geotechnical borehole records.

The Gravel surface is overlain by deposits of generally silty clay, with various inclusions (e.g. detrital plant remains and Mollusca). This horizon is indicative of deposition within a moderate-energy fluvial environment, and is considered to represent the Lower Alluvium recorded elsewhere in the Lower Thames Valley, most likely deposited during the Early Holocene, following a reduction in flow rate at the end of the Late Glacial period. This stratigraphic unit is recorded in all boreholes located towards the north of the site (Kent-QBH2 & QBH3, Kent-MBH1 to MBH3), and varies between 0.96 and 2.2m thick. During the accumulation of the Lower Alluvium, a high energy flood event(s) is indicated across at least part of the site, by the deposition of silty clay with sub-rounded gravel clasts up to 30mm in size in Kent-QBH2 and Kent-QBH3.

Towards the south of the site however, Lower Alluvium is absent and a 2m thick horizon of well-preserved moderately-humified wood Peat is recorded (VW-BH1 & Kent-QBH1). It is unlikely that this horizon accumulated at the same time as the Lower Alluvium. Instead, it is thought more likely that the Lower Alluvium was eroded in this area of the site, most likely by a former course or tributary of the Deptford Creek. This channel was subsequently abandoned, and became infilled by Peat deposits, supporting the growth of wetland woodland. On the basis of the available evidence, it is not possible to ascertain the dimensions or orientation of the former channel, but it must have exceeded 16m in size (the distance between VW-MBH1 & Kent-QBH1). An alternative possibility to

the infilling of a former channel, is that the Peat deposits recorded are representative of the infilling of a tree-throw hollow. Whatever the sequence of events, radiocarbon dating of the Peat sequence from Kent-QBH1 indicates that it accumulated between at least 6660-6490 and 3160-2960 cal BP (Figure 12; Table 5); a period of more than 3000 years spanning the late Mesolithic to late Bronze Age cultural periods. During this period, frequent inundation of the Peat surface is indicated by the moderate and variable organic matter values (35-80%; Figure 12, Table 6).

Both the Lower Alluvium and Peat deposits were overlain by silty clay. These sediments most likely represent deposition on the floodplain at a distance from any active channels and are analogous to the Upper Alluvium recorded elsewhere in the Lower Thames Valley and its tributaries. This horizon is likely to have accumulated from the late Neolithic period onwards, as a result of increased sediment supply resulting from woodland clearance and agricultural activity within the river catchment. The Upper Alluvium is recorded across the site and is fairly consistent in thickness (2-2.5m). However in certain locations the deposits have been truncated by Made Ground (Kent-MBH2 and Kent-MBH3).

The sequence across the site is capped by variable thicknesses of Made Ground, averaging between 2.5 and 3m.

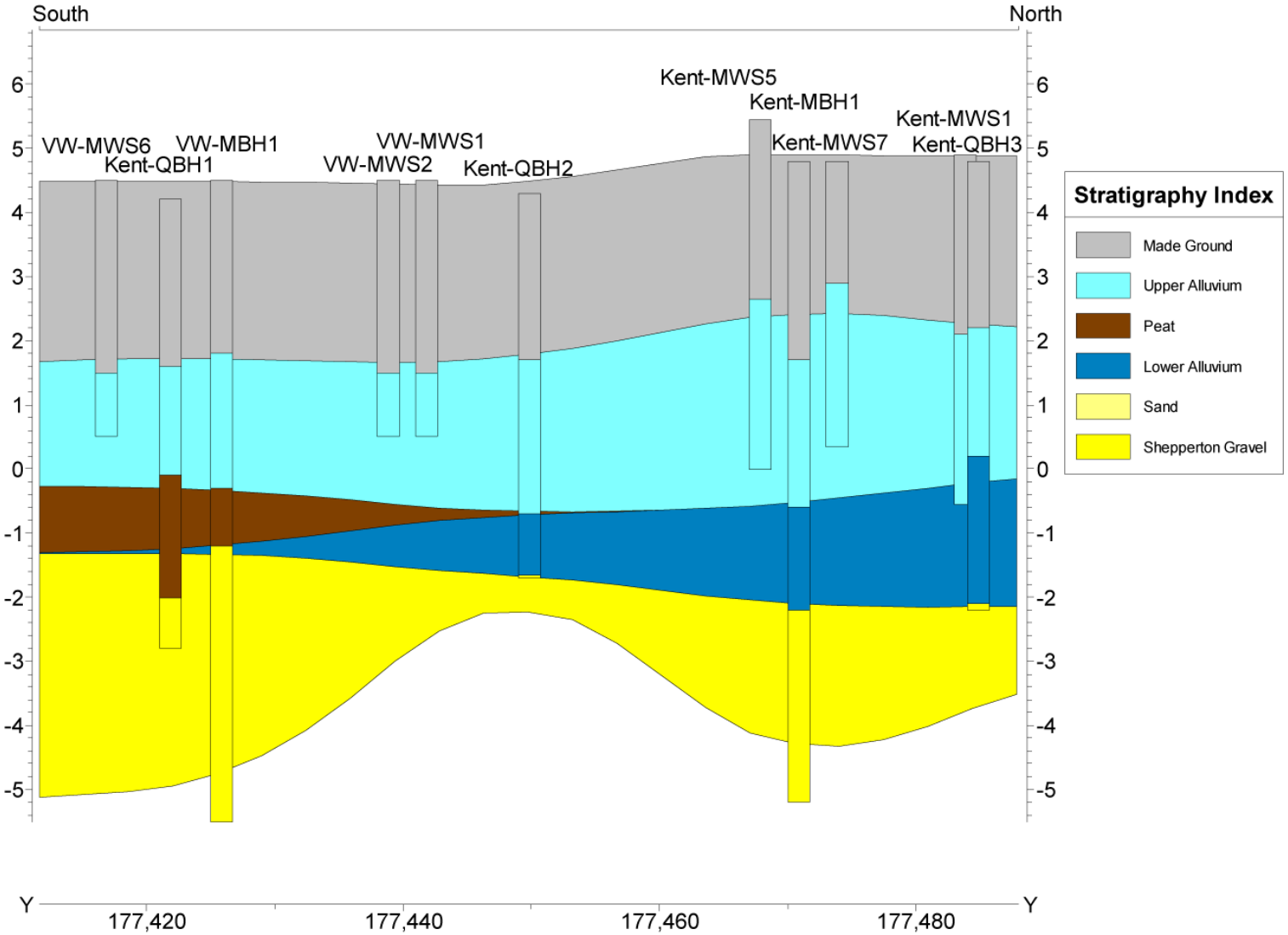

Figure 3: North-South transect of selected boreholes across Kent Wharf, Deptford, London Borough of Lewisham

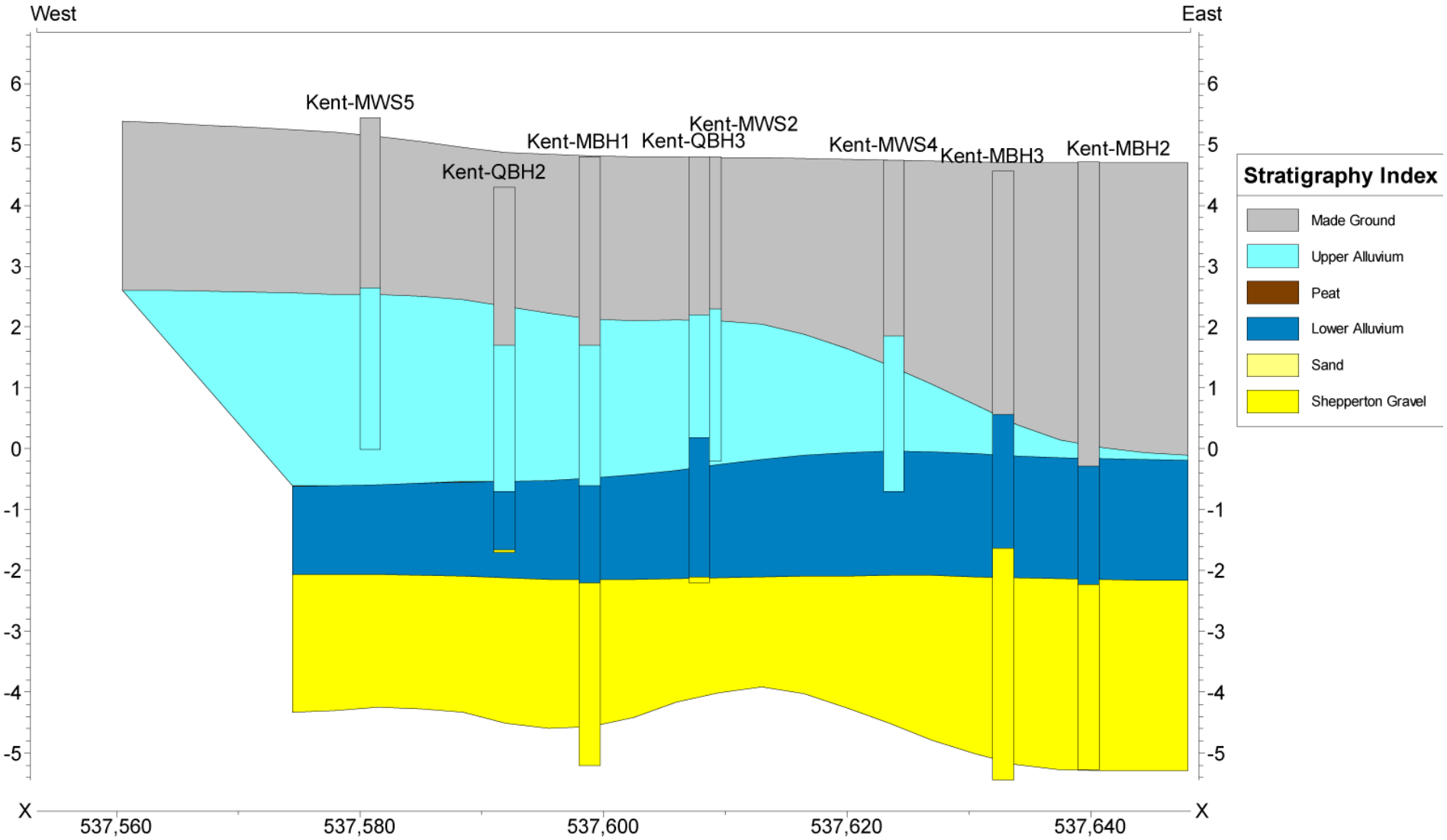

Figure 4: West-East transect of selected boreholes across Kent Wharf, Deptford, London Borough of Lewisham

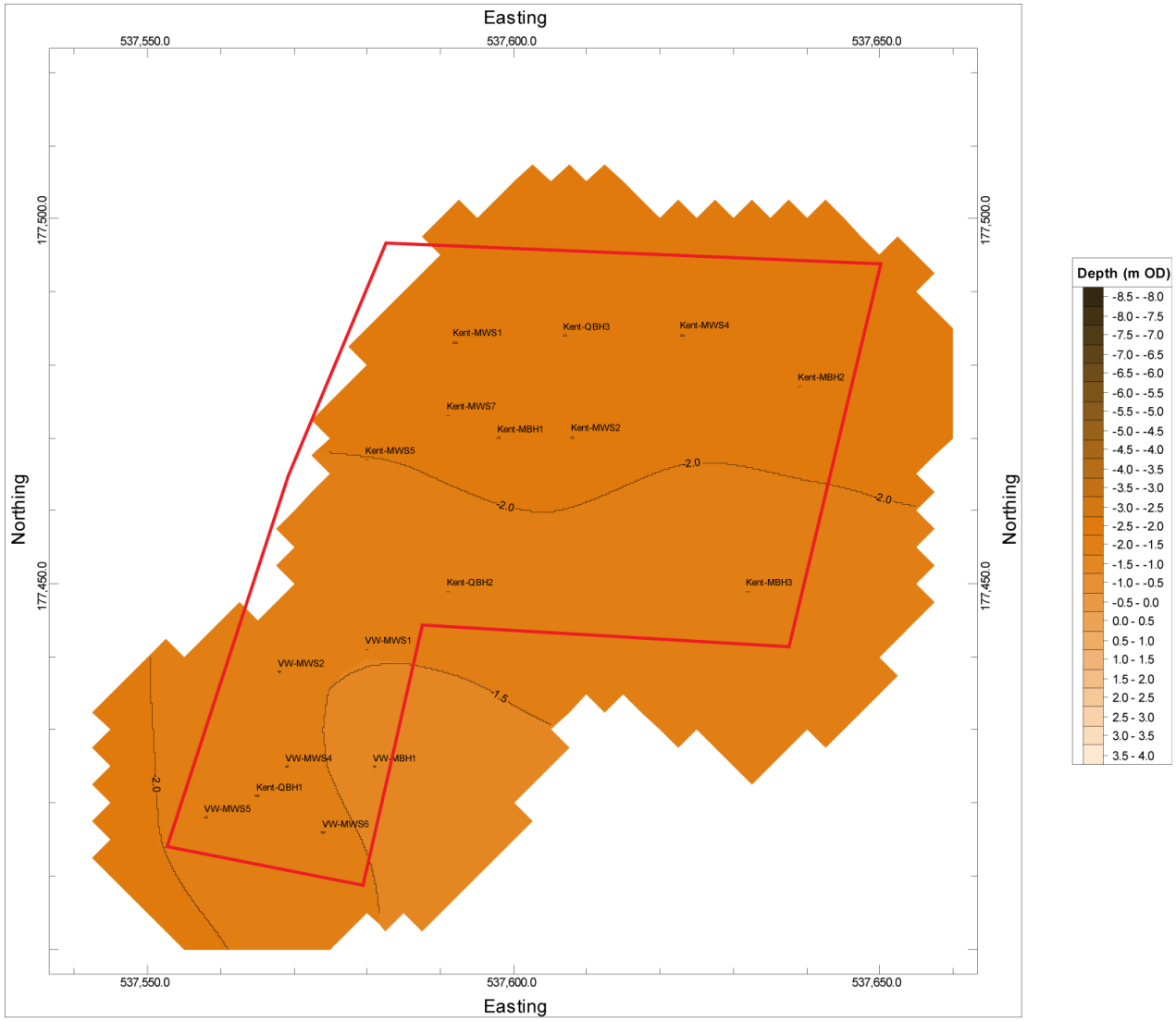

Figure 5: Top of the Shepperton Gravel (m OD) (site outline in red)

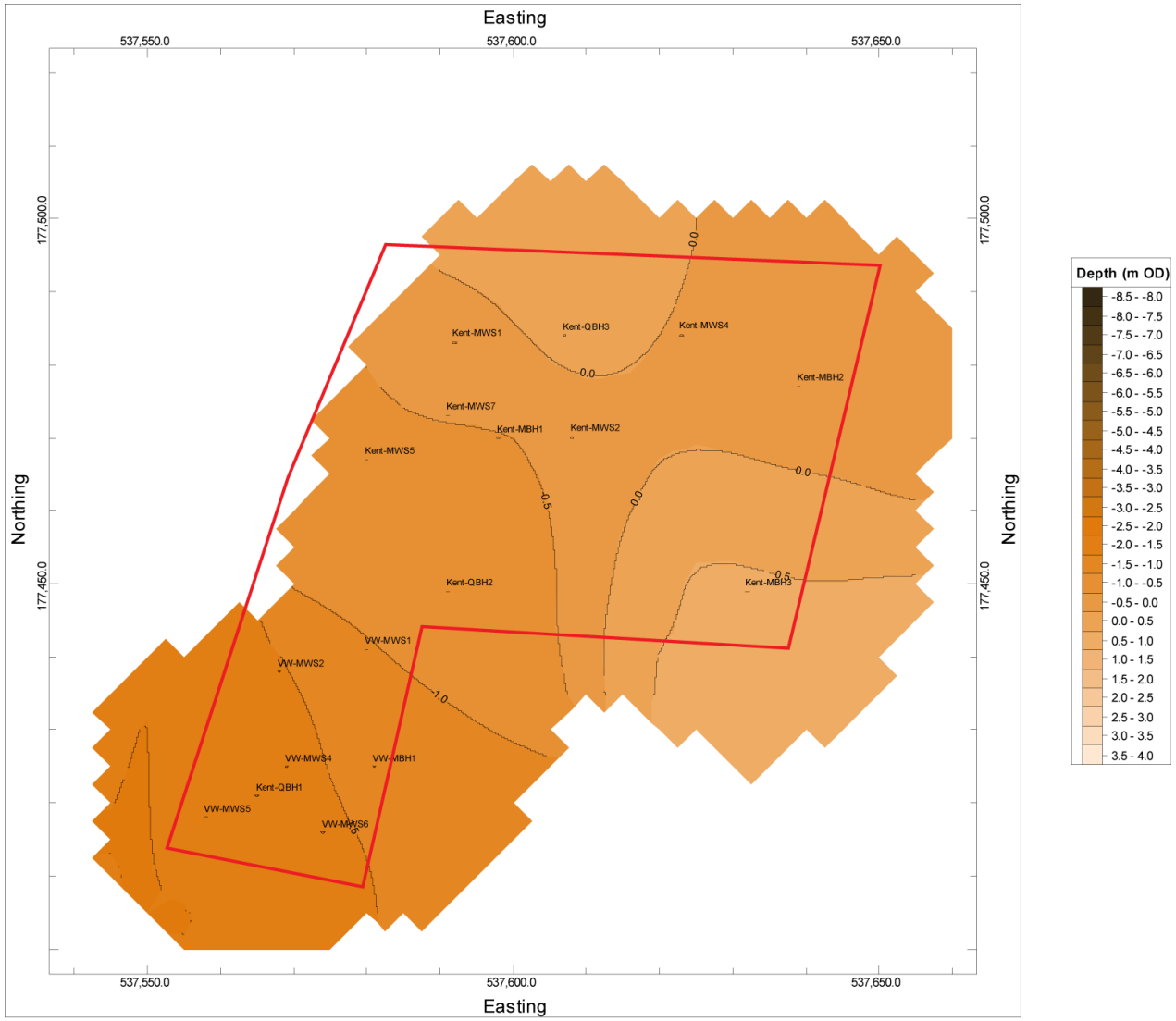

Figure 6: Top of the Lower Alluvium (m OD) (site outline in red)

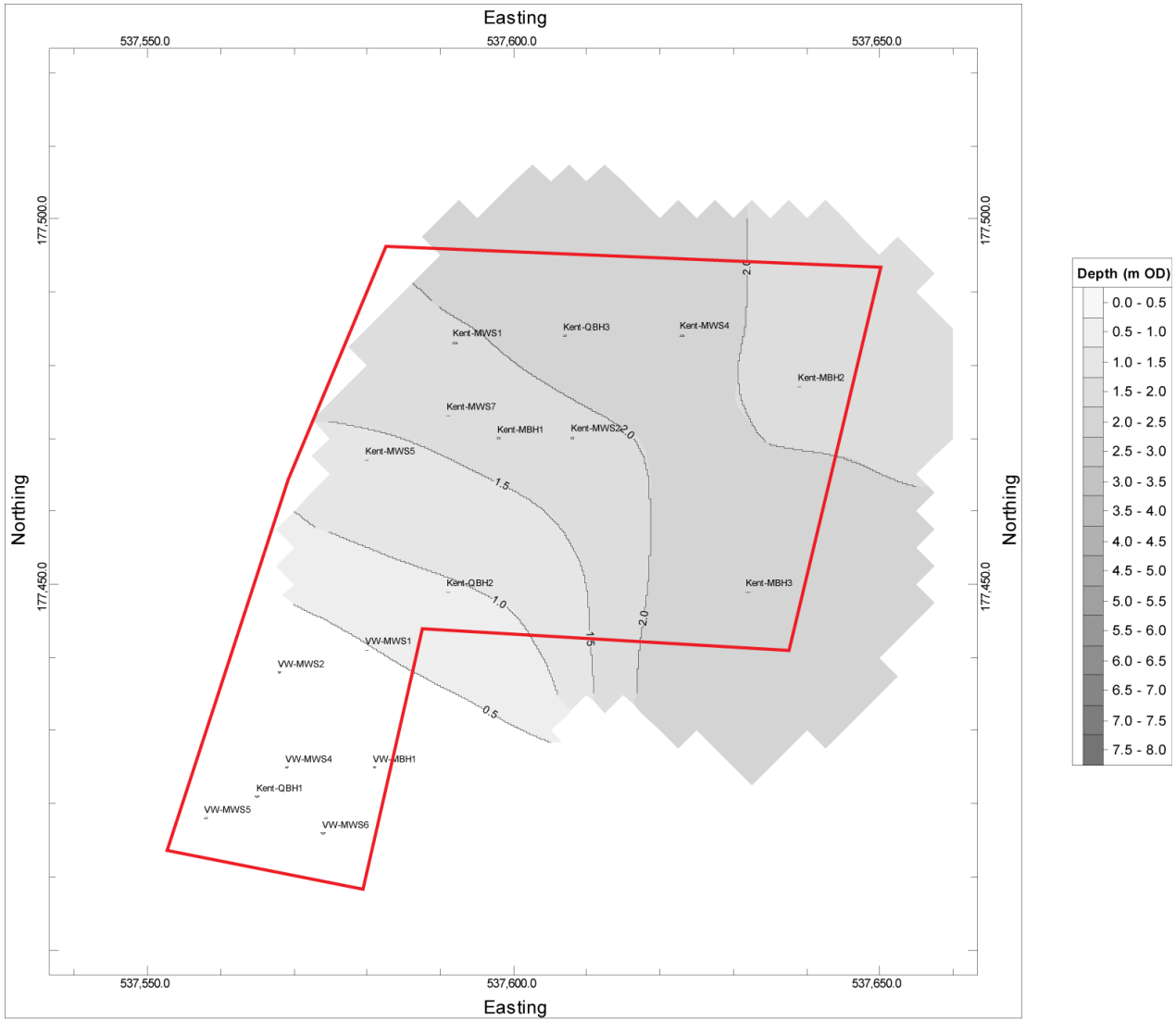

Figure 7: Thickness of the Lower Alluvium (m) (site outline in red)

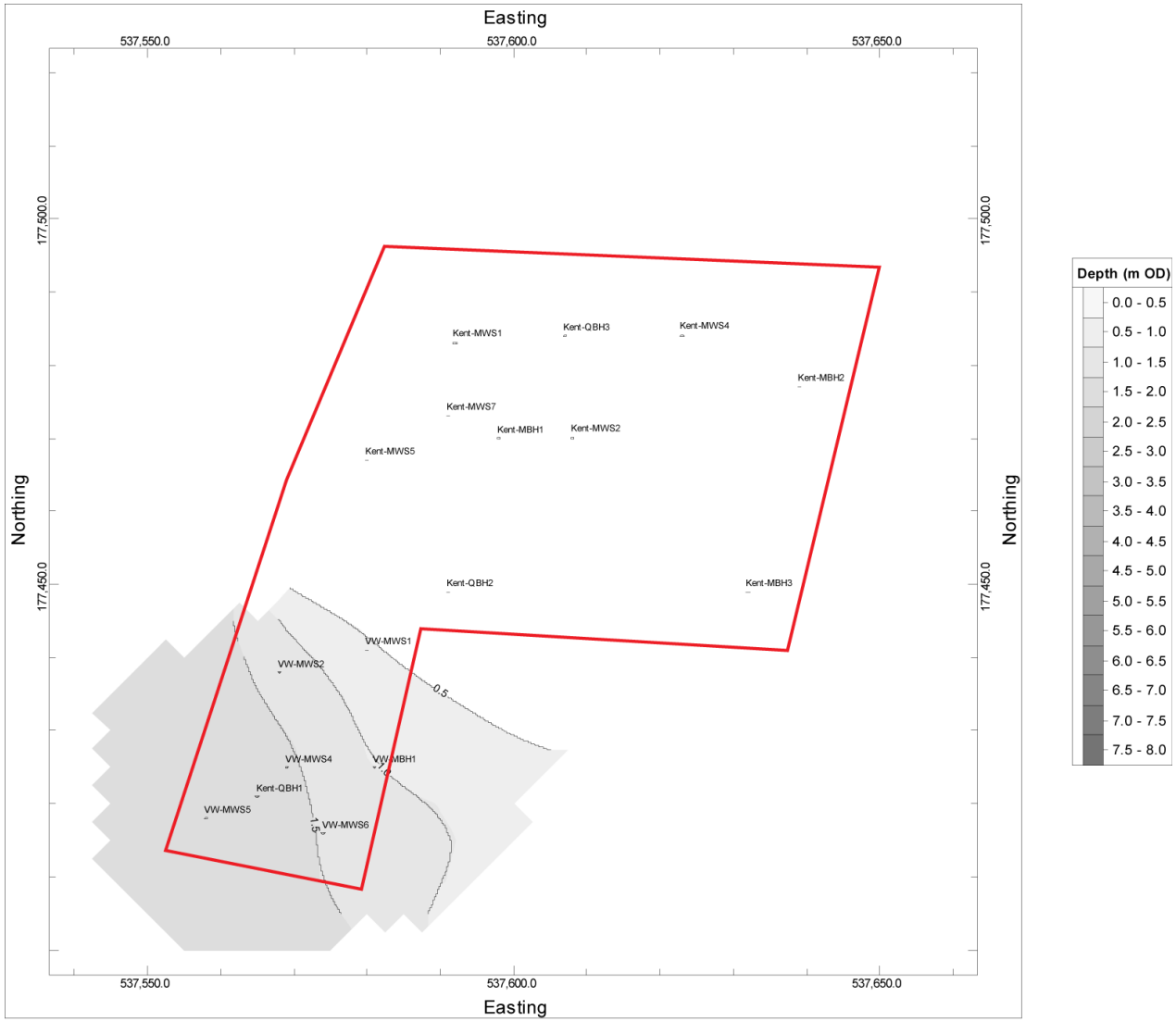

Figure 8: Thickness of Peat (m) (site outline in red)

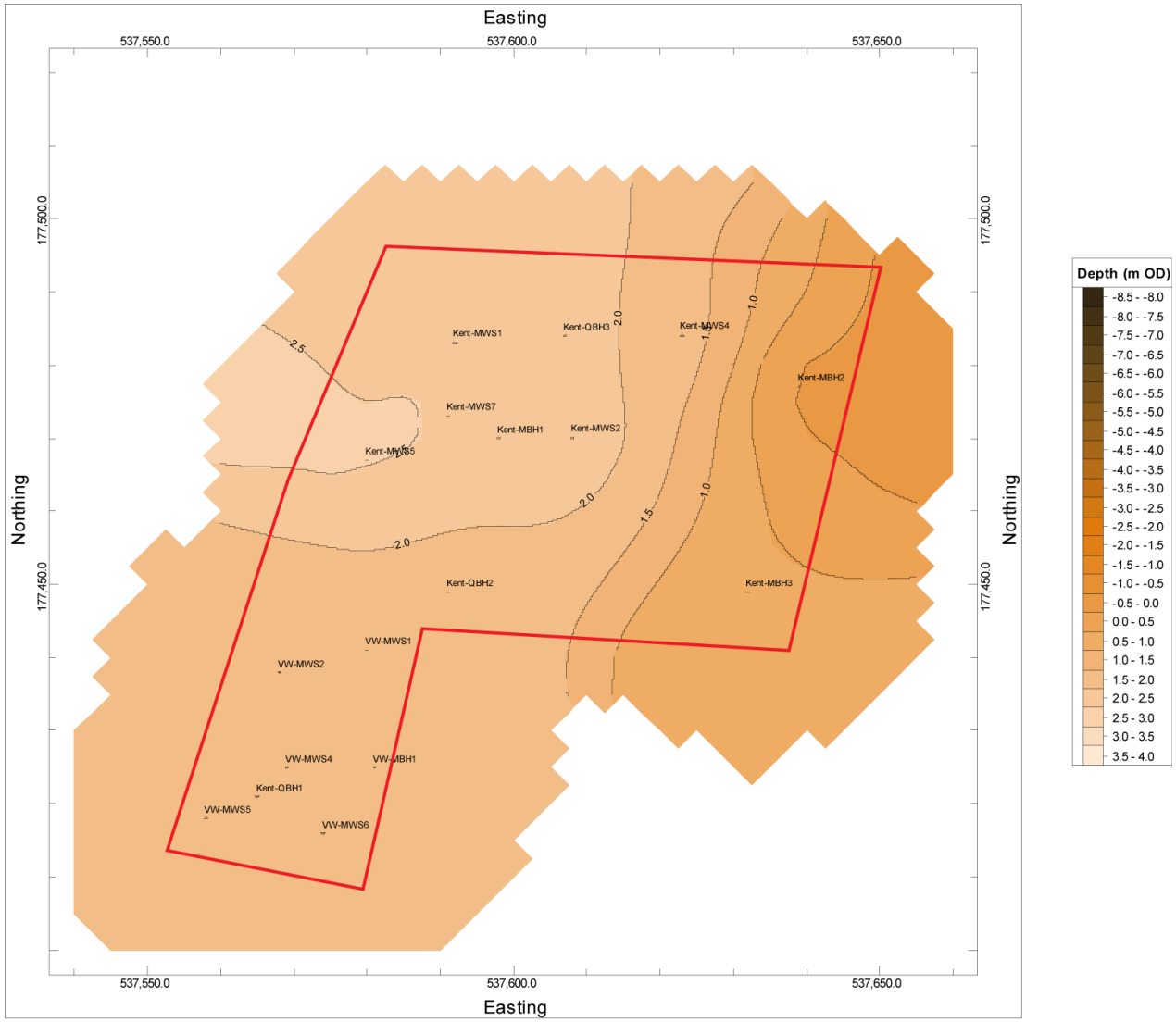

Figure 9: Top of the Upper Alluvium (m OD) (site outline in red)

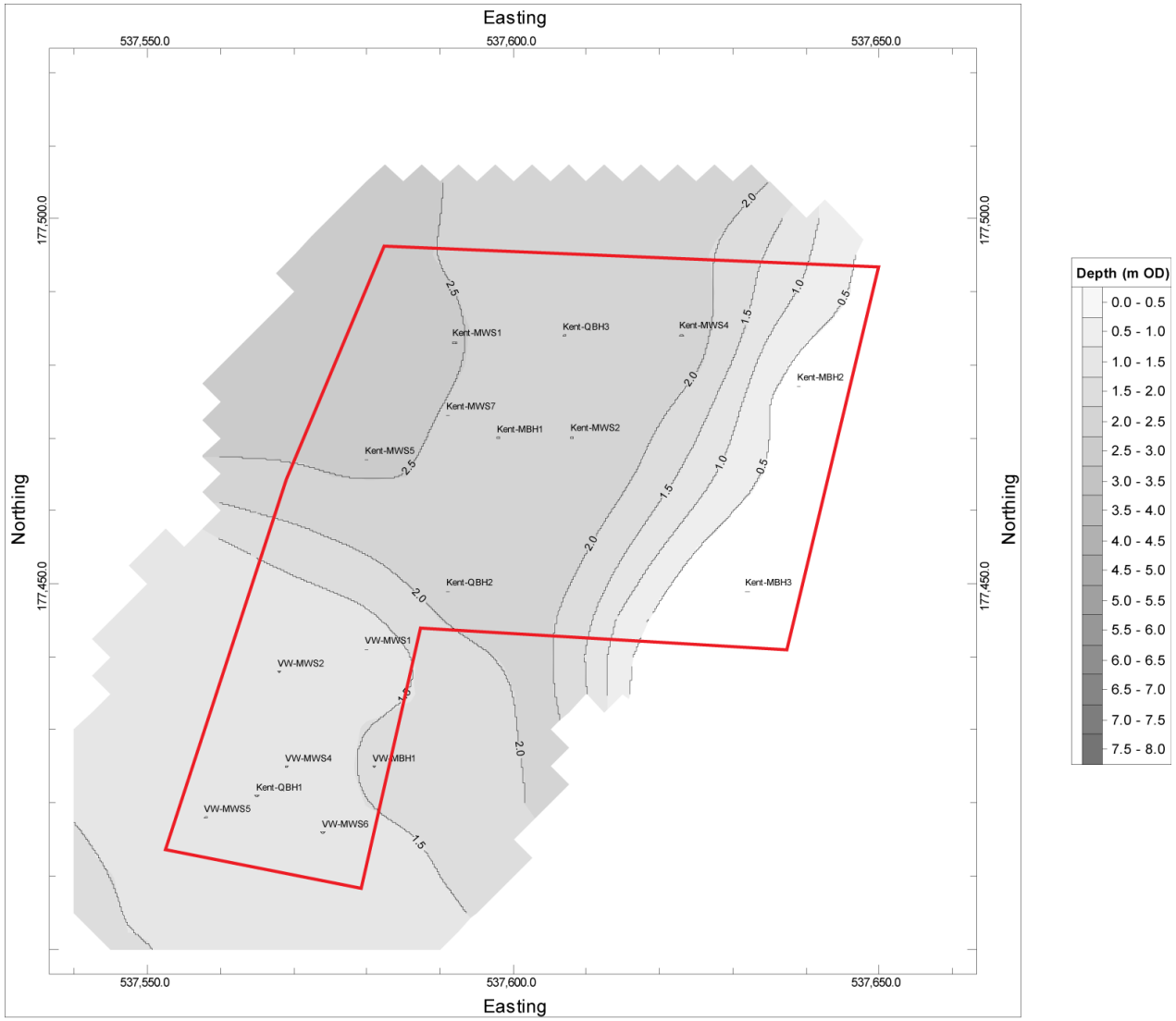

Figure 10: Thickness of the Upper Alluvium (m) (site outline in red)

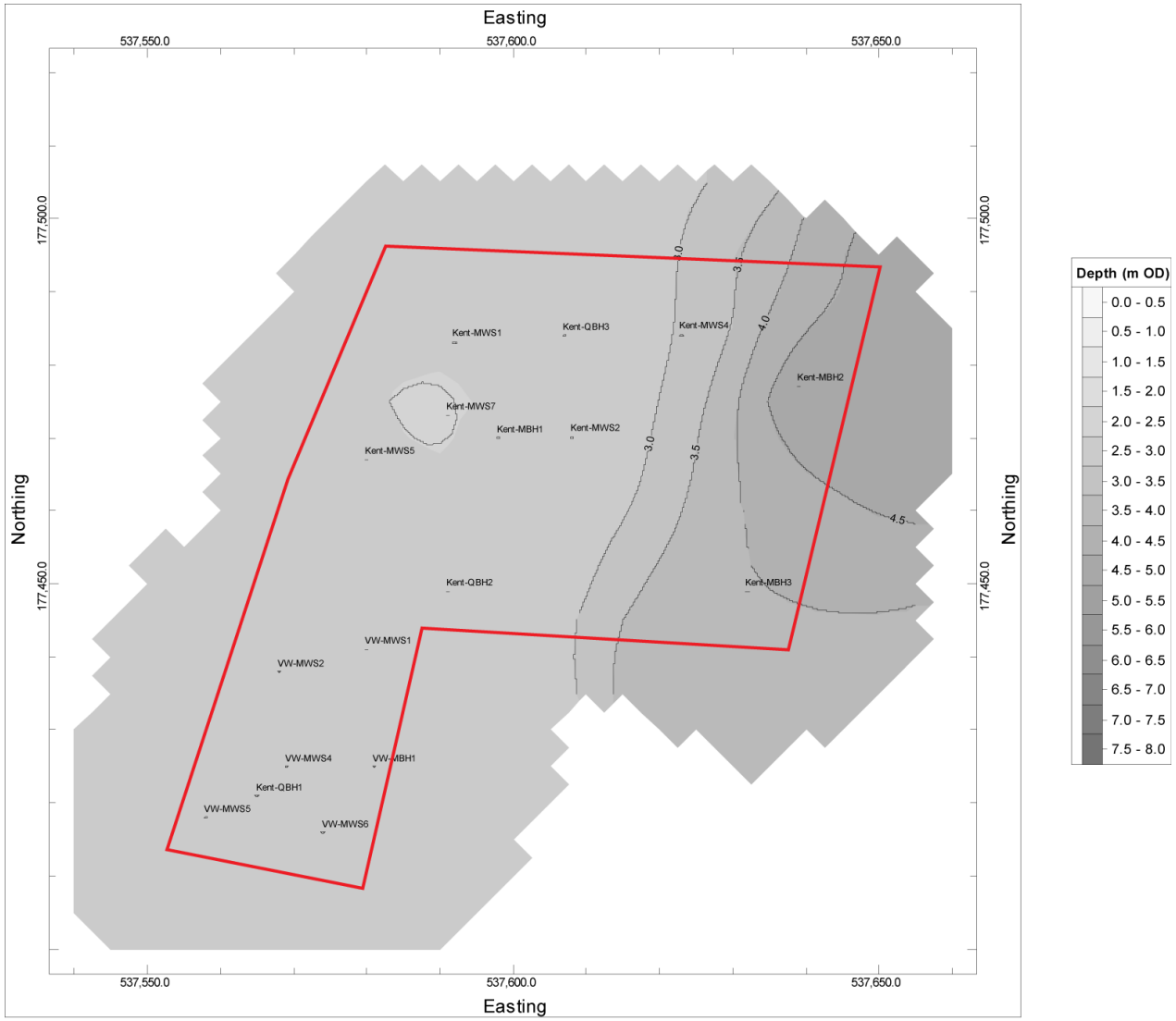

Figure 11: Thickness of Made Ground (m) (site outline in red)

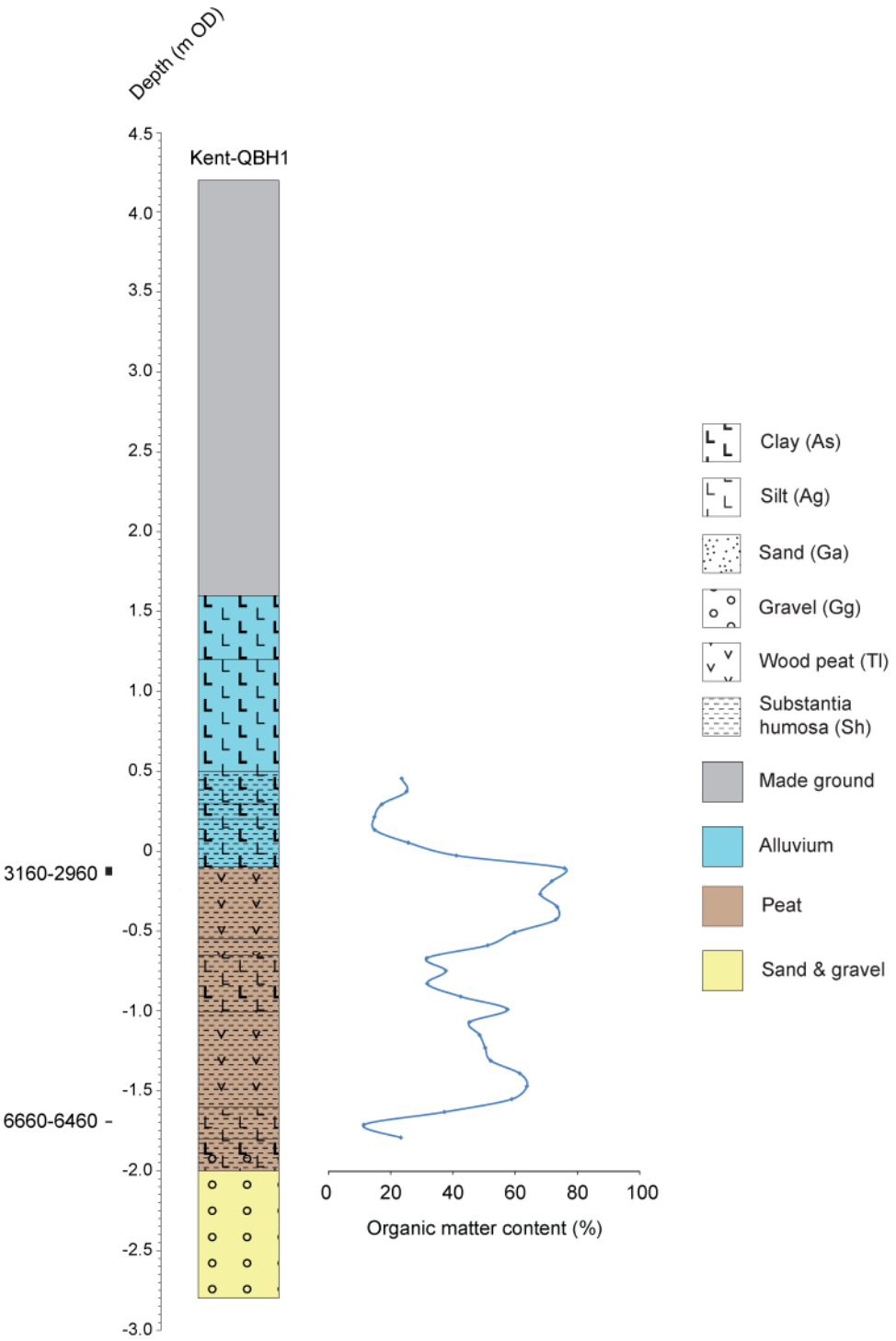

Figure 12: Detailed lithostratigraphy of Kent-QBH1, Kent Wharf, London Borough of Lewisham, incorporating organic-matter determinations and radiocarbon dating (ages are calibrated years before present).

Table 2: Lithostratigraphic description of borehole Kent-QBH1, Kent Wharf, Deptford, London Borough of Lewisham

Depth (m OD)	Depth (m bgs)	Description
4.20 to 1.60	0 to 2.60	Made Ground
1.60 to 1.20	2.60 to 3.00	Gley 2 4/1; As3, Ag1, Dh+; Dark bluish grey silty clay with detrital plant remains. Diffuse contact into:
1.20 to 0.48	3.00 to 3.72	Gley 1 6/1; As3, Ag1, Dl+; Greenish grey silty clay with detrital wood remains. Diffuse contact into:
0.48 to 0.29	3.72 to 3.91	10YR 4/1; As2, Sh1, Ag1, Dl+; Dark grey organic-rich silty clay with detrital wood remains. Diffuse contact into:
0.29 to 0.20	3.91 to 4.00	10YR 4/1; As2, Sh1, Ag1, Dl+; Dark grey organic-rich silty clay with detrital wood remains; Diffuse contact into:
0.20 to 0	4.00 to 4.20	10YR 4/1; As2, Sh1, Ag1, Dl+, Dh+; Dark grey organic-rich silty clay with detrital wood and plant remains (sedges/reeds). Diffuse contact into:
0 to -0.10	4.20 to 4.30	10YR 4/1; As2, Sh1, Ag1, Dh+; Dark grey organic-rich silty clay with detrital plant remains (sedges/reeds). Diffuse contact into:
-0.10 to -0.54	4.30 to 4.74	10YR 2/1; Tl^{2}2, Sh2; Humo 3; Black well-humified wood peat. Diffuse contact into:
-0.54 to -0.64	4.74 to 4.84	10YR 2/1; Tl^{2}2, Sh1, As1; Humo 2; Black moderately-humified wood peat with clay. Diffuse contact into:
-0.64 to -0.98	4.84 to 5.18	10YR 4/1; As2, Sh2, Tl+; Dark grey very organic-rich clay with wood remains. Diffuse contact into:
-0.98 to -1.60	5.18 to 5.80	10YR 2/1; Sh3, Tl^{3}1; Humo 3; Black well-humified wood peat. Diffuse contact into:
-1.60 to -1.80	5.80 to 6.00	10YR 3/1; Sh3, As1, Gg+, Dl/Tl+; Very dark grey very organic-rich clay with occasional gravel clasts. Diffuse contact into:
-1.80 to -2.01	6.00 to 6.21	10YR 4/3; Sh2, Ag1, Gg1, Dl+; Brown very organic-rich gravely silt with detrital wood remains; sharp contact into: UNIT NOT RETAINED
-2.01 to -2.80	6.21 to 7.00	10YR 4/1; Gg3, Ag1, As+, Ga+; Dark grey silty gravel with traces of clay and sand. Gravel clasts of flint up to 30mm, sub-angular to well-rounded. UNIT NOT RETAINED

Table 3: Lithostratigraphic description of borehole Kent-QBH2, Kent Wharf, Deptford, London Borough of Lewisham

Depth (m OD)	Depth (m bgs)	Description
4.30 to 1.70	0 to 2.60	Made Ground
1.70 to 1.30	2.60 to 3.00	10YR 4/1; As2, Ag1, Dl1, Gg+; Dark grey silty clay with detrital wood and traces of gravel.
1.30 to 0.99	3.00 to 3.31	10YR 4/1; As2, Ag1, Ga1, Dl+; Dark grey gravelly silty clay with traces of detrital wood and brick/tile fragments. Diffuse contact into:
0.99 to -0.70	3.31 to 5.00	10YR 5/1; As3, Ag1; Grey silty clay. Unknown contact into:
-0.70 to -1.04	5.00 to 5.34	10YR 4/1; As2, Gg2; Dark grey gravelly clay. Gravel clasts of flint up to 30mm, sub-angular to well-rounded. Sharp contact into:
-1.04 to -1.66	5.34 to 5.96	10YR 5/1; As3, Ag1, Dl+; Grey silty clay with detrital wood remains. Diffuse contact into:
-1.66 to -1.70	5.96 to 6.00	10YR 4/1; Gg3, As1, Ga+; Dark grey clayey gravel. Gravel clasts of flint up to 30mm, sub-angular to well-rounded.

Table 4: Lithostratigraphic description of borehole Kent-QBH3, Kent Wharf, Deptford, London Borough of Lewisham

Depth (m OD)	Depth (m bgs)	Description
4.80 to 2.80	0 to 2.00	Made Ground
2.80 to 2.30	2.00 to 2.50	Made Ground / Disturbed Alluvium
2.30 to 2.21	2.50 to 2.59	10YR 5/1; As3, Ag1; Grey silty clay; sharp contact into:
2.21 to 1.42	2.59 to 3.38	10YR 4/1; Ga2, Ag1, Gg1; Dark grey silty gravelly sand. Sharp contact into:
1.42 to 0.92	3.38 to 3.88	10YR 5/1; As3, Ag1; Grey silty clay. Diffuse contact into:
0.92 to 0.80	3.88 to 4.00	10YR 5/4; As3, Ag1, Dh+; Yellowish brown silty clay with traces of detrital plant remains. Diffuse contact into:
0.80 to 0.19	4.00 to 4.61	10YR 5/1; As3, Ag1, Dh+; Grey silty clay with traces of detrital plant remains. Diffuse contact into:
0.19 to -0.20	4.61 to 5.00	10YR 4/1; As2, Ag2, Dh+, Sh+; Grey silty clay with traces of detrital plant remains, organic material and Mollusca. Diffuse contact into:
-0.20 to -1.20	5.00 to 6.00	10YR 5/1; As2, Ag2, Dl+, Gg+, Sh+; Grey silty clay (sometimes appearing laminated) with traces of gravel, detrital wood, organic remains and Mollusca. Unknown contact into:
-1.20 to -1.95	6.00 to 6.75	10YR 5/1; Gg3, Ga1, Ag+; Grey sandy gravel with traces of silt. Gravel clasts of flint up to 30mm, sub-angular to well-rounded. Sharp contact into:
-1.95 to -2.10	6.75 to 6.90	10YR 5/1; As4, Ag+; Grey clay with traces of silt. Sharp contact into:
-2.10 to -2.20	6.90 to 7.00	10YR 5/1; Gg3, Ag1, Sh+, Dl+; Grey silty gravel with traces of organic remains and detrital wood. Gravel clasts of flint up to 30mm, sub-angular to well-rounded.

Table 5: Results of the borehole Kent-QBH1 organic matter determinations, Kent Wharf, Deptford, London Borough of Lewisham

Depth (m OD)		Organic matter content (%)
From	To	
0.45	0.46	23.56
0.37	0.38	25.14
0.29	0.30	17.16
0.21	0.22	14.77
0.13	0.14	14.88
0.05	0.06	25.69
-0.03	-0.02	41.17
-0.11	-0.10	75.93
-0.19	-0.18	71.84
-0.27	-0.26	68.10
-0.35	-0.34	73.52
-0.43	-0.42	73.14
-0.51	-0.50	59.86
-0.59	-0.58	51.20
-0.67	-0.66	31.64
-0.75	-0.74	37.78
-0.83	-0.82	31.76
-0.91	-0.90	42.56
-0.99	-0.98	57.55
-1.07	-1.06	45.36
-1.15	-1.14	48.58
-1.23	-1.22	50.37
-1.31	-1.30	52.20
-1.39	-1.38	61.53
-1.47	-1.46	63.80
-1.55	-1.54	58.94
-1.63	-1.62	37.32
-1.71	-1.70	11.40
-1.79	-1.78	23.28

Table 6: Results of the borehole Kent-QBH1 radiocarbon dating, Kent Wharf, Deptford, London Borough of Lewisham

Laboratory code / Method	Material and location	Depth (m OD)	Uncalibrated radiocarbon years before present (yr BP)	Calibrated age BC/AD (BP) (2-sigma, 95.4% probability)	δ13C (‰)
BETA-427665 AMS	Twig wood; top of Peat	-0.11 to -0.16	2910 ± 30 BP	1210-1010 cal BC (3160-2960 cal BP)	-28.0
BETA 427666 AMS	Twig wood; base of Peat	-1.69	5770 ± 30 BP	4710-4540 cal BC (6660-6490 cal BP)	-28.6

4. RESULTS OF THE POLLEN ASSESSMENT

Samples were prepared for pollen assessment through the Peat horizons of Kent-QBH1. The results of this assessment (Table 7) indicate a variable concentration and preservation of remains.

Two assemblages can be identified from the assessment data. Eight samples between -1.80 and -0.68m OD are dominated by Alnus (alder), Quercus (oak), Tilia (lime), Corylus type (e.g. hazel) and Filicales (ferns). Ulmus (elm) and Pinus (pine) are also occasionally recorded. Sporadic and minimal values of herb and spore taxa are also recorded including: Poaceae (grasses), Cyperaceae (sedges), Lactuceae (dandelions), Apiaceae (carrots), Ranunculus type (e.g. buttercup/water crowsfoot), Plantago lanceolata (ribwort plantain), Polypodium vulgare (polypody). A potential cereal grain is also recorded at -1.48m OD. Microcharcoal was recorded in negligible quantities throughout most of the samples, but was recorded in higher concentrations in the lowermost sample at -1.80m OD.

The three samples from the top of the Peat (-0.36 to -0.04m OD) contained a more diverse assemblage of tree, shrub, herb, aquatic and ferns including: Alnus, Quercus, Corylus type, Poaceae, Cyperaceae, Asteaceae (daisies), Lactuceae, Plantago lanceolata, Chenopodium type (goosefoot) and *Rumex acetosa/acetosella* (sorrel), with sporadic occurrences including: Caryophyllaceae (pinks), Apiaceae, Galium type (bedstraw), and Valerianna type (marsh valerian). Microcharcoal was either absent or recorded in negligible quantities throughout the three samples. Between the two distinct assemblages, the sample at -0.52m OD contained an absence of pollen, but an abundance of microcharcoal.

The lower assemblage (-1.80 to -0.68m OD) is indicative of a wetland environment dominated by alder carr with a ground flora of sedges, grasses and ferns. Other trees and shrubs such as elm and hazel may also have formed part of this woodland community, but are more likely to have grown on the dryland, forming mixed deciduous woodland with oak and lime. Of potential importance, is the decline in elm pollen values towards the base of the sequence. This is suggestive of environmental changes taking place towards the wetland-dryland interface (e.g. the loss of dryland habitat or anthropogenic impact). Significantly, a possible cereal pollen grain is also recorded at this point in the sequence, potentially indicating an anthropogenic influence.

Within the upper assemblage (-0.36 to -0.04 OD), the decline of tree taxa and increased amount and diversity of herbaceous pollen is suggestive of changes taking place on both the dryland and wetland surfaces. On the floodplain, a large increase in grasses, sedges, dandelions (Lactuceae), *Chenopodium* type and various herbs and aquatics is recorded. This assemblage is suggestive of a shift towards sedge fen, reed swamp and salt-marsh communities, potentially with an estuarine influence. On the dryland, the decline of lime is suggestive of a large reduction in mixed deciduous woodland. The increase of a large array of herbaceous taxa may suggest that this decline was a consequence of woodland clearance for settlement and agricultural purposes, which took place from the Bronze Age onwards.

Table 7: Results of the pollen assessment from Kent-QBH1, Kent Wharf, Deptford, London Borough of Lewisham

	Depth (m OD)	-0.04	-0.20	-0.36	-0.52	-0.68	-0.84	-1.00	-1.16	-1.32	-1.48	-1.64	-1.80
Latin name	Common name												
Trees													
Alnus	alder	1	21			2	9	4	43	10	5	4	6
Quercus	oak	4	3	1		2	3	2	6	6	1	3	9
Pinus	pine			1		1	2	1				5	
Ulmus	elm						1	1				4	4
Tilia	lime					2	7	1	2	1	5	5	
Shrubs													
Corylus type	e.g. hazel		1	1		1	1	1	4	2	7	3	3
Salix	willow												1
Herbs													
Cyperaceae	sedge family	61	2	5			1			2			3
Poaceae	grass family	14	7	4							1		1
cf *Cereale* type	e.g. barley										1		
Asteraceae	daisy family	2											
Lactuceae	dandelion family	3	1	1		1		1	1				
Plantago lanceolata	ribwort plantain						1						
Chenopodium type	goosefoot family	1		2									
Caryophyllaceae	pink family		1										
Rumex acetosa/acetosella	sorrel	3	1	1									
Apiaceae	carrot family		1										1
Ranunculus type	buttercup / water crowsfoot								1				
Galium type	bedstraw		1										
Valerianna type	marsh valerian		2										
Calystegia type	bindweed		1										
Aquatics													
Sparganium type	bur-reed	1		3									
Spores													
Pteridium aquilinum	bracken	1	4	1		2							
Filicales	ferns	2	15	1		6	2	6	6	3	1	9	2
Polypodium vulgare	polypody					1	2	2			2		
Unknown									2	3			
Total Land Pollen (grains counted)		90	42	16	0	9	25	11	57	21	20	24	28
Concentration*		5	5	3	0	2	4	2	5	3	3	4	4

	Depth (m OD)	-0.04	-0.20	-0.36	-0.52	-0.68	-0.84	-1.00	-1.16	-1.32	-1.48	-1.64	-1.80
Latin name	Common name												
Preservation**		4	4	3	0	2	4	3	4	3	3	3	3
Microcharcoal Concentration***		1	0	0	5	1	1	1	0	1	1	2	3
Suitable for further analysis		YES	YES	YES	NO	NO	YES	NO	NO	YES	YES	YES	YES

*Key: *Concentration: 0 = 0 grains; 1 =1-75 grains, 2 = 76-150 grains, 3 =151-225 grains, 4 = 226-300, 5 =300+ grains per slide; **Preservation: 0 = absent; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = excellent; ***Microcharcoal Concentration: 0 = none, 1= negligible, 2 = occasional, 3 = moderate, 4 = frequent, 5 = abundant*

5. RESULTS OF THE MACROFOSSIL ASSESSMENT

A total of six small bulk samples from borehole QBH1 were extracted for the recovery of macrofossil remains, including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca (Table 8). The samples were focussed on the Peat horizon in borehole QBH1. The results of the macrofossil rapid assessment indicate that waterlogged wood is present in moderate to high concentrations in four of the six samples assessed, between -0.20 and -0.80m OD and in the sample from -1.40 to -1.50m OD, and in low concentrations in the samples from -1.10 to -1.20 and -1.70 to -1.80m OD. Waterlogged seeds were recorded in low to moderate concentrations in three of the six samples (-0.20 to -0.30, -1.10 to -1.20 and -1.40 to -1.50m OD). No insects, charred plant remains, Mollusca, bone or artefacts were recorded during the assessment.

The three samples from borehole Kent-QBH1 in which waterlogged seeds were recorded underwent a more detailed assessment (Table 9). The seed assemblage included *Alnus glutinosa* (alder) catkins in all three samples, with *Rubus* cf. *fruticosus* (e.g. bramble) and *Chenopodium album* (fat hen) recorded in the sample from -0.20 to -0.30m OD. Although the assemblage recorded in these samples is too small to attempt a full environmental interpretation, the taxa recorded are typical of an alder carr wetland environment.

Table 8: Results of the macrofossil assessment of borehole Kent-QBH1, Kent Wharf, Deptford, London Borough of Lewisham

				Charred					Waterlogged		Mollusca		Bone				
Depth (m OD)	Volume sampled (ml)	Volume processed (ml)	Fraction	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Chaff	Wood	Seeds	Whole	Fragments	Large	Small	Fragments	Insects	Artefacts
-0.20 to -0.30	60	60	>300µm	-	-	-	-	-	3	2	-	-	-	-	-	-	-
-0.50 to -0.60	90	90	>300µm	-	-	-	-	-	4	-	-	-	-	-	-	-	-
-0.80 to -0.90	50	50	>300µm	-	-	-	-	-	2	-	-	-	-	-	-	-	-
-1.10 to -1.20	60	60	>300µm	-	-	-	-	-	1	1	-	-	-	-	-	-	-
-1.40 to -1.50	50	50	>300µm	-	-	-	-	-	3	1	-	-	-	-	-	-	-
-1.70 to -1.80	50	50	>300µm	-	-	-	-	-	1	-	-	-	-	-	-	-	-

Key: 0 = Estimated Minimum Number of Specimens (MNS) = 0; 1 = 1 to 25; 2 = 26 to 50; 3 = 51 to 75; 4 = 76 to 100; 5 = 101+

Table 9: Results of the waterlogged plant macrofossil (seeds) assessment of borehole Kent-QBH1, Kent Wharf, Deptford, London Borough of Lewisham

Depth (m OD)	Waterlogged seeds		
	Latin name	Common name	Number
-0.20 to -0.30	*Alnus glutinosa* (catkin) *Rubus* cf. *fruticosus* *Chenopodium album*	alder e.g. bramble fat hen	1 1 13
-0.50 to -0.60			1
-0.80 to -0.90	-	-	-
-1.10 to -1.20	*Alnus glutinosa* (catkin)	alder	1
-1.40 to -1.50	*Alnus glutinosa* (catkin)	alder	2
-1.70 to -1.80	-	-	-

6. DISCUSSION

The results of the geoarchaeological investigations have demonstrated a Shepperton Gravel surface resting between -1.64 and -2.23m OD across the majority of the site. This is overlain by 0.96-2.2m of Lower Alluvium, representing Holocene floodplain sedimentation in a moderate to low energy fluvial or estuarine environment. Towards the south of the site, the Lower Alluvium is not present, and appears either: (a) to have been eroded by a former channel or tributary of the Deptford Creek, which was subsequently abandoned and infilled by a 2m thick horizon of Peat; or (b) removed during the formation of a tree-throw hollow, which was subsequently infilled by Peat.. Both the Peat and Lower Alluvium were succeeded by the deposition of Upper Alluvium, representative of an overbank floodplain or estuarine environment. The Kent Wharf sequence was capped by *ca.* 3m of Made Ground deposits, which in places truncated the Upper Alluvium.

Radiocarbon dating of the Peat in Kent-QBH1 indicates that it accumulated between at least 6660-6490 and 3160-2960 cal BP; a period of more than 3000 years spanning the late Mesolithic to late Bronze Age cultural periods. Throughout this period, the Peat surface was initially colonised by alder-dominated carr woodland with an understorey of grasses, sedges and ferns. During the latter period of accumulation, the dominant growth of grasses and sedges, with a diverse range of herbs, aquatics and spores is suggestive of a more open and wet floodplain environment. However, organic matter determinations suggest the Peat surface was continually subjected to episodic flooding. Throughout the period of Peat accumulation, the surrounding dryland was occupied by mixed deciduous woodland dominated by oak and lime; the decline of these taxa and a more open environment is indicated during the latter period of Peat accumulation. Perhaps of greatest significance is an apparent reduction in elm pollen values towards the base of the sequence, potentially suggestive of the early Neolithic elm decline, which is recorded across the Lower Thames Valley and British Isles around this time (Batchelor *et al.*, 2014; Parker *et al.*, 2002). Furthermore, this decline coincides with the occurrence of a possible cereal grain, suggestive of an anthropogenic influence around the same time.

The potential decline of elm and near contemporaneous occurrence of possible cereal pollen at Kent Wharf has affinities with findings made further upstream at the Old Seager Distillery site (Batchelor *et al.*, 2009, 2014). Here, Peat (overlying gravel) was recorded within a tree-throw hollow between 0.44 and 1.80m OD, and radiocarbon dated between 7200-6440 and 5580-5320 cal BP (late Mesolithic to Neolithic). Significantly, this Peat contained a lithic assemblage dating to the Mesolithic or Early Neolithic. The condition of the Peat was relatively poor, limiting the palaeoenvironmental reconstruction of the site, but the growth of fen woodland on the wetland and mixed deciduous woodland on the dryland was indicated during this period, with a decline in elm woodland recorded after 6740-6540 cal BP potentially linked to human activity. Following a long hiatus, a second phase of Peat formation occurred between 1940-1810 and 1020-930 cal BP (Roman and Medieval periods). During this period, the wetland was dominated by aquatics and emergent plants, with a much reduced woodland cover, while the dryland was open and dominated by herbaceous communities (Batchelor *et al.*, 2009, 2014).

In addition, the DLR Lewisham Extension site (Sidell *et al*., 1999; Figure 1) indicated a similar sedimentary sequence to Old Seager Distillery; basal alluvial silt/clays were overlain by Peat from 7430-7030 cal BP (Late Mesolithic) that accumulated between *ca*. 0 and 0.5m OD. A hiatus in Peat formation of unknown duration also occurred here, represented by a weakly organic clay indicating deposition under aquatic conditions. No palaeoenvironmental work was undertaken at this site.

As outlined within the introduction, at both Greenwich Creekside East (250m to the north; Batchelor, 2015), and the Faircharm Creative Quarter site (175m to the south; Young, 2014), previous geoarchaeological investigations indicate a similar inorganic sedimentary sequence to that recorded across the majority of the Kent Wharf site.

7. CONCLUSIONS AND RECOMMENDATIONS

As a consequence of the findings made during the geoarchaeological deposit modelling exercise (Batchelor, 2015a), and the presence of a 2m thick Peat horizon, an assessment of Kent-QBH1 was undertaken. This assessment aimed to contribute towards aims 2 to 4 of the Kent Wharf geoarchaeological WSI (Batchelor, 2015b): (2) to clarify the nature, depth, extent and date of any alluvium and peat deposits; (3) to investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity, and (4) to investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland).

The results have confirmed the presence of thick Peat deposits towards the south of the site, infilling either a former channel or tree-throw hollow from at least the late Mesolithic to late Bronze Age. Assessment of the pollen and plant macrofossil remains has demonstrated that this Peat has the potential to provide a detailed reconstruction of past environments through further analysis and radiocarbon dating. Furthermore, the assessment results provide indications of human activity that might be correlated to previous archaeological and geoarchaeological evidence recorded at the nearby Old Seager Distillery site.

It is highlighted that detailed palaeoenvironmental reconstruction in the Ravensbourne tributary has previously been restricted by very poor preservation of palaeoecological remains (e.g. Batchelor *et al*., 2009, 2014). The preservation of remains at Kent Wharf is variable, but nevertheless represents a better opportunity to reconstruct the former environment than that recorded previously. It is therefore strongly recommended that environmental archaeological analysis of the Kent-QBH1 sequence is carried out.

8. REFERENCES

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9. APPENDIX 1: OASIS FORM

OASIS ID: quaterna1-228152

Project details

Project name	Kent Wharf, Deptford, London Borough of Lewisham
Short description of the project	Three geoarchaeological boreholes were put down across the site. The resultant sequences were combined with historical borehole records to produce a deposit model for the site. The deposit model revealed a sequence of Late Glacial Shepperton Gravel, overlain by early-middle Holocene Lower Alluvium. Towards the south of the site, the Lower Alluvium appears to have been truncated by either a palaeochannel or tree-throw hollow. This depression was infilled by wood Peat. Upper Alluvium covered both the Peat and Lower Alluvial deposits. Made Ground capped the sequence. The Peat was radiocarbon dated from the late Mesolithic to late Bronze Age period and contains sufficient pollen/plant macrofossil remains to undertake environmental archaeological analysis. Further work is recommended.
Project dates	Start: 12-10-2015 End: 25-01-2016
Previous/future work	No / Yes
Any associated project reference codes	KWF15 - Sitecode
Type of project	Environmental assessment
Monument type	PEAT Neolithic
Monument type	PEAT Mesolithic
Monument type	PEAT Bronze Age
Significant Finds	POLLEN Mesolithic
Significant Finds	POLLEN Neolithic
Significant Finds	POLLEN Bronze Age
Survey techniques	Landscape

Project location

Country	England
Site location	GREATER LONDON GREENWICH GREENWICH Kent Wharf
Postcode	SE8
Study area	5500 Square metres

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	Consultant
Project design originator	Dr C.R. Batchelor
Project director/manager	C.R. Batchelor
Project supervisor	C.R. Batchelor

Type of sponsor/funding body	Developer

Project archives

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

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Kent Wharf, Deptford, Royal Borough of Greenwich: Geoarchaeological Deposit Model
Author(s)/Editor(s)	Batchelor, C.R.
Other bibliographic details	Quaternary Scientific (QUEST) Unpublished Report September 2015; Project Number 004/15
Date	2015
Issuer or publisher	Quaternary Scientific
Place of issue or publication	University of Reading

Project bibliography 2

Publication type	Grey literature (unpublished document/manuscript)
Title	Kent Wharf, London Borough of Lewisham: Environmental Archaeological Assessment Report
Author(s)/Editor(s)	Batchelor, C.R.
Other bibliographic details	Quaternary Scientific (QUEST) Unpublished Report January 2016; Project Number 004/14
Date	2016
Issuer or publisher	Quaternary Scientific
Place of issue or publication	University of Reading

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