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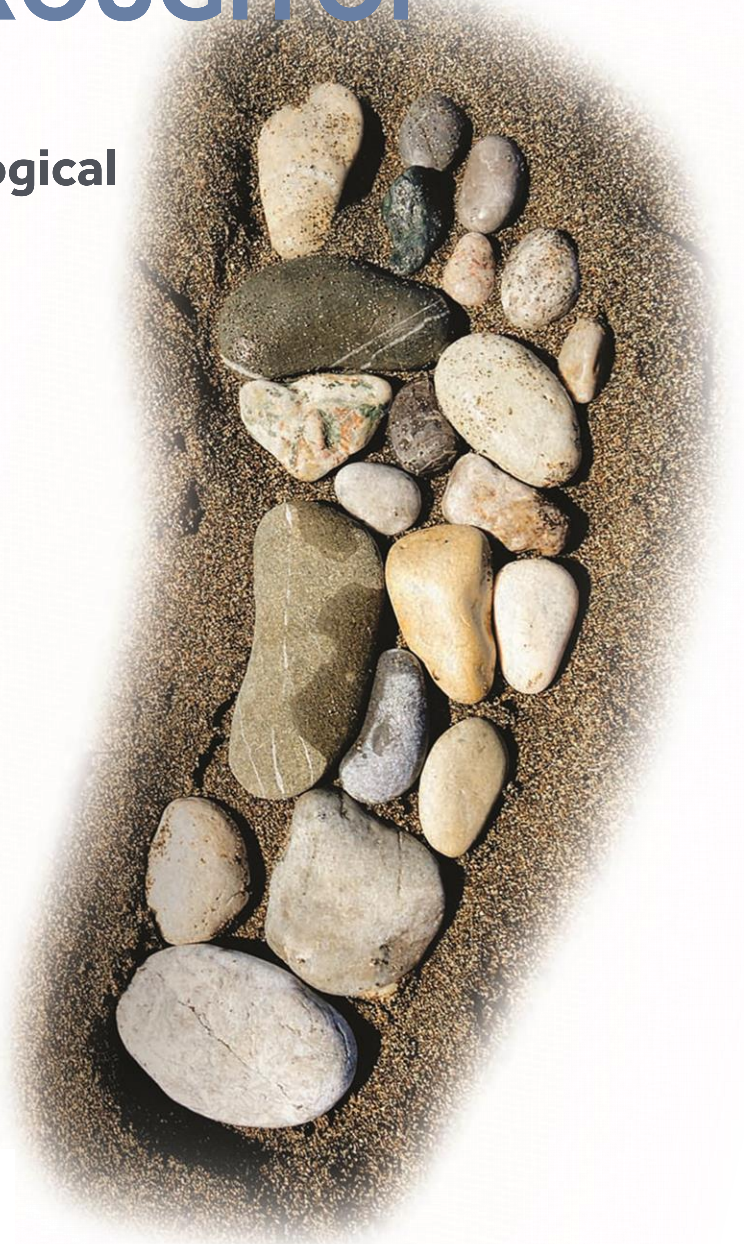
ALCATEL-LUCENT TELEGRAPH WORKS, LONDON BOROUGH OF GREENWICH

Environmental Archaeological Assessment Report



NGR: TQ 3841 7866

Site Code: BLW15

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Written by:

D.S. Young MSc & Dr C.R. Batchelor

QUEST, School of Archaeology, Geography and Environmental Science, Whiteknights, University of Reading, RG6 6AB

Tel: 0118 378 7978 / 8941
Email: d.s.young@reading.ac.uk
http://www.reading.ac.uk/quest

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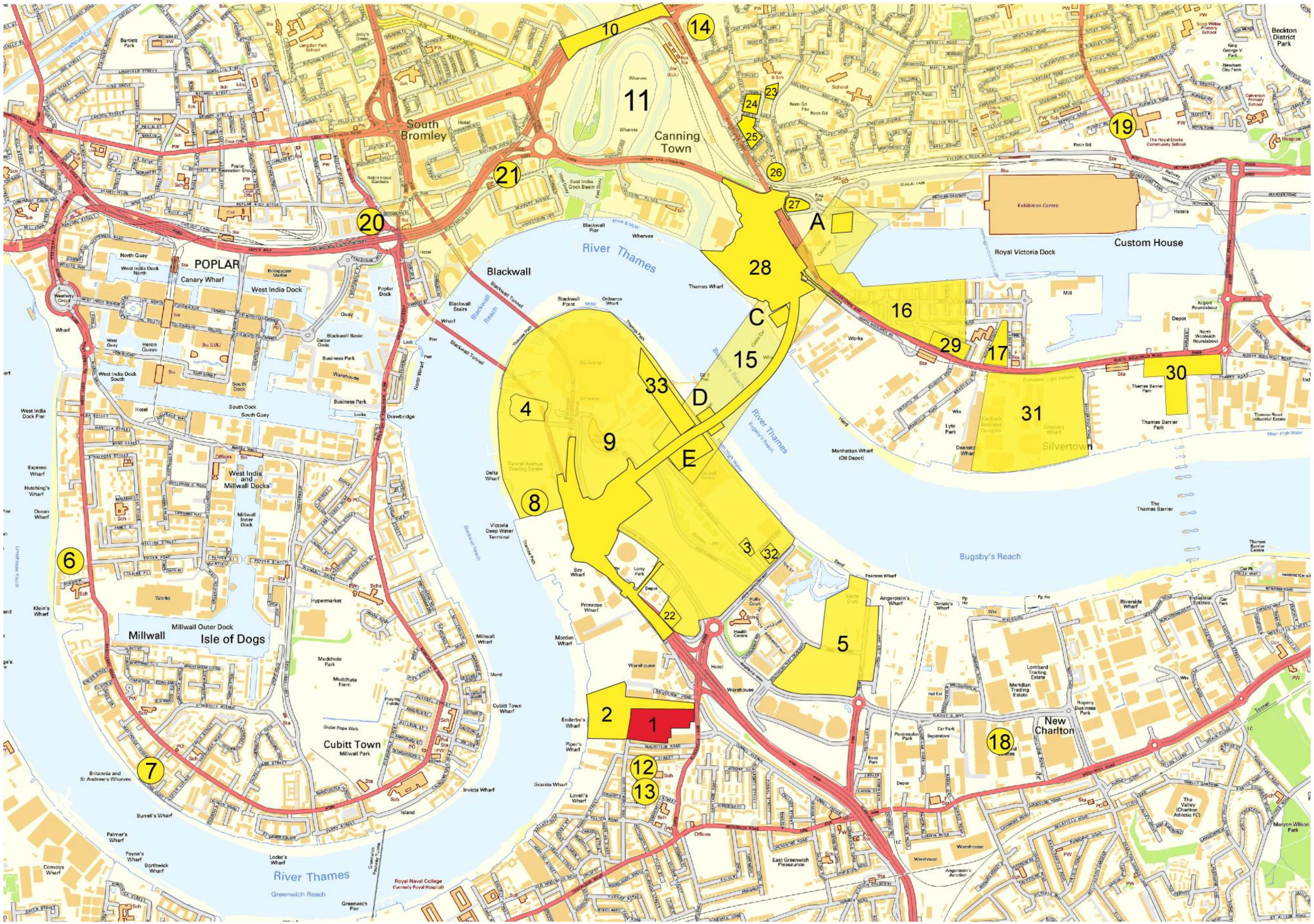
1. INTRODUCTION

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 the Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10 (National Grid Reference centred on: TQ 3841 7866; Figures 1 and 2). The site is located towards the south-western corner of Greenwich Peninsula, bounded to the west by the River Thames and to the east by Blackwall Lane (Figure 1). Greenwich Peninsula is formed and bounded by a meander of the Thames to the west, east and north of the site, and lies opposite the confluence of the River Lea. The ground across the area originally formed part of the natural floodplain of the Thames, and is underlain by river alluvium (British Geological Survey 1:50,000 sheets 256 North London 1993, 257 Romford 1996, 270 South London 1998, 271 Dartford 1998). This alluvium consists of fine-grained mineral-rich deposits and peat, and is mapped to the south to approximately the position of the A206 where it meets higher drier ground. Beneath the alluvium, sand and gravel is present and is assigned by Gibbard (1994) to the Late Devensian Shepperton Gravel. The bedrock beneath this is mapped as the Palaeogene Lambeth Group – Clay, Silt and Sand. Ground level at the site is recorded at between 1 and 2m OD (CgMs Consulting, 2014).

The results of previous geoarchaeological deposit modelling at the site (Young & Batchelor, 2015) revealed that the surface of the Late Devensian Shepperton Gravel at the site lies at between -3.54 and -4.93m OD, and that the site lies within a broad east-west aligned palaeochannel, in which Holocene alluvial deposits (including Peat) have accumulated. The Peat horizon was present in thicknesses of between 0.61 and 1.67m across the site, and represents a period of semi-terrestrial conditions supporting the growth of wetland vegetation. At the Enderby Wharf site immediately to the east and north (see Figure 1) the Gravel surface is recorded between approximately -2.75 and -

5.0m OD (Batchelor *et al*., 2015a). Here Peat thicknesses ranging from 0.5 to 3.0m have been recorded, and subsequent radiocarbon dating of the Peat in borehole QBH1 at Enderby Wharf indicates that it accumulated between 5450-5070 and 3390-3230 cal BP, equating to the Neolithic and Bronze Age cultural periods. This same record provides a record of the wetland and dryland vegetation history during this period (see Batchelor *et al*., 2015a). Other geoarchaeological investigations on Greenwich Peninsula (see Figure 1), including at the Millennium Festival Site (BWP97; Bowsher & Corcoran, unknown date), the Cable Car South Station (CAB11; Batchelor *et al*., 2012), Greenwich Millennium Village (Miller & Halsey, 2011), the Victoria Deep Water Terminal and across Greenwich Peninsula as a whole (TUA02; Corcoran, 2002) have revealed a sequence of Shepperton Gravel, overlain by Alluvium and Made Ground. At these sites, a horizon of Peat within the Alluvium has been radiocarbon dated as accumulating between approximately 6000 and 3000 cal BP, equating to the Neolithic and Bronze Age cultural periods. On the basis of the radiocarbon dates from Enderby Wharf and elsewhere on the Peninsula, it is therefore possible that Peat may have been accumulating on the present site at the same time as trackway construction occurred on the nearby 72-88 Bellot Street (Mclean, 1993; Philp, 1993) and the Garage Site, Bellot Street (Branch *et al*., 2005) sites (Bronze Age) approximately 100m to the south.

Significantly, the Peat horizons recorded at the Alcatel-Lucent site have the potential to provide suitable palaeobotanical and zooarchaeological remains for reconstructing the past environmental conditions (including evidence for human activity) of the site and its environs, which may enhance previous work conducted at the nearby Enderby Wharf and Bellot Street sites. A programme of environmental archaeological assessment was therefore carried out on borehole QBH2, the aims of which were (1) to establish the age of the Peat recorded in this borehole; (2) to assess the palaeoenvironmental potential of the sequence; (3) to highlight any indications of nearby human activity, and (4) to provide recommendations for further analysis (if necessary). Although the Peat horizon recorded in borehole QBH1 was thicker (see below), QBH2 was selected for the assessment since QBH1 was within 100m of the borehole at Enderby Wharf on which environmental archaeological analysis has already been conducted. Borehole QBH2 offered the opportunity to assess a sequence >100m from that previously analysed at Enderby Wharf; in addition, the base of the Peat within QBH2 was recorded at a lower elevation, and was potentially of an earlier date, than that in QBH1 (see Figure 11).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Royal Victoria Dock
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Millwall
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1
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Cubitt Town
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River Thames
Greenwich Reach

Figure 1: Location of (1) Alcatel-Lucent Telegraph Works, Blackwell Lane, London Borough of Greenwich and selected other geoarchaeological and archaeological sites nearby: (2) Enderby Wharf, Christchurch Way, London Borough of Greenwich (Batchelor *et al*., 2015a); (3) Plot MO117 (JHW13; Young & Batchelor, 2013a); (4) Plot MO115 (Young & Batchelor, 2013b); (5) Greenwich Millennium Village (Miller & Halsey, 2011); (6) Atlas Wharf (AWF98; Lakin, 1999); (7) Mast House Terrace (MHT95; Bowsher & Wilkinson, 1995); (8) Victoria Deep Water Terminal (TUA02; Corcoran, 2002); (9) Greenwich Peninsula (Corcoran, 2002); (10) Canning Town (Stafford, 2012); (11) Lower Lea Valley Mapping Project (Corcoran *et al*., 2011); (12) Bellot Street (GLB05; Branch *et al*., 2005); (13) 72-88 Bellot Street (BSG93; McLean, 1993; Philp, 1993); (14) Canning Town Regeneration Area 7 & 1C (CTR12; Green & Young, 2012); (15) the Cable Car route (CAB11; Batchelor *et al*., 2015b) (A) North Station; (B) North Intermediate Tower; (C) North Tower; (D) South Tower; (E) South Station); (16) Silvertown (BWC96; Wilkinson *et al*., 2000); (17) Fort Street (HW-FO94; Wessex Archaeology, 2000; Crockett et al., 2002); (18) Greenwich Industrial Estate (GIE02; Morley, 2003); (19) Royal Docks Community School (PRG97; Holder, 1998); (20) Preston Road (PPP06; Branch *et al*., 2007); (21) East India Docks (Pepys, 1665); (22) Plot MO401 (Batchelor, 2014). (23) 105-107 Tarling Road (Batchelor & Young, 2014); (24) St Luke's Square (LUC07; Wicks, 2008); (25) Caxton Works (Young, 2014); (26) 118 Victoria Dock Road (Barnett *et al*., 2010); (27) Tidal Basin Road (Young & Batchelor, 2013c); (28) Silvertown Tunnel (Young & Green, 2015); (29) Barnwood Court (HW-BC97; Farid, 1997); (30) Thames Barrier Park East (TBP06; Green *et al*., 2006); (31) Royal Wharf, Silvertown (Batchelor *et al*., 2014a); (32) Tunnel Avenue (GPF12; Batchelor, 2013) and (33) Greenwich Peninsula Central East (Young & Batchelor, 2015). *Contains Ordnance Survey data © Crown copyright and database right [2015]*

Figure 2: Location of the new geoarchaeological boreholes at the Alcatel Lucent Telegraph Works site (red outline) and existing geoarchaeological, geotechnical and BGS archive boreholes in the area of the deposit model, including those at Enderby Wharf (Batchelor *et al.*, 2015a; black outline). *Contains Ordnance Survey data © Crown copyright and database right [2012].*

2. METHODS

Previous investigations (field investigations, lithostratigraphic descriptions and deposit modelling)

Three geoarchaeological boreholes (boreholes QBH1, QBH2 and QBH4) were put down at the site in August 2015 by Quaternary Scientific. One of the boreholes proposed in the WSI for the site (QBH3; Batchelor, 2015) could not be put down since this area of the site was still in use at the time of the fieldwork. 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 borehole locations were recorded using a Leica GS09 Differential GPS (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 of the geoarchaeological descriptions of the boreholes are displayed in Tables 2 to 4. The spatial attributes of the boreholes are displayed in Table 1 and in Figure 2.

The deposit model was based on a review of 47 borehole records, including the three new geoarchaeological boreholes and seven existing geotechnical boreholes (Merebrook Consulting, 2012) for the site, three geoarchaeological and seven geotechnical boreholes from the Enderby Wharf site (Batchelor *et al*., 2015) and 27 BGS archive boreholes (www.bgs.ac.uk/opengeoscience) (Figure 2; Table 1). Modelling was undertaken using RockWorks 16 geological utilities software. The term 'deposit modelling' describes any method used to depict the sub-surface arrangement of geological deposits, but particularly the use of computer software 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 Alcatel-Lucent site, the sedimentary units were classified into six groupings: (1) Gravel, (2) Sand, (3) Lower Alluvium, (4) Peat, (5) Upper Alluvium and (6) Made Ground. Models of surface height (using a nearest neighbour routine) were generated for the Gravel, the Lower Alluvium, the Peat and the Upper Alluvium (Figures 3, 4, 5 and 7). Thickness of the Peat (Figure 6), combined Alluvial units (Sand, Lower Alluvium, Peat and Upper Alluvium) (Figure 8) and Made Ground (Figure 9) was also modelled (also using a nearest neighbour routine). A two-dimensional north-south transect of selected boreholes is shown in Figure 10.

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 100m radius for all models, except for the Peat, where a radius of 50m was used. 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.

Table 1: Borehole attributes for the records used in the deposit model, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Borehole	Easting	Northing	Elevation (m OD)
Geoarchaeological boreholes (present site)			
QBH1	539351	178714	1.80
QBH2	539417	178711	1.80
QBH4	539344	178651	2.02
Geoarchaeological boreholes from Enderby Wharf (Batchelor et al., 2015a)			
EWQBH1	539270.4	178740	1.84
EWQBH2	539216	178659.4	2.32
EWQBH3	539428.3	178765.3	1.59
Geotechnical boreholes (present site; Merebrook Consulting, 2012)			
MWS1	539292	178761	1.40
MWS2	539327	178757	1.50
MWS3	539320	178716	1.80
MWS4	539294	178701	2.00
MWS5	539346	178635	2.10
MWS6	539346	178669	1.90
MWS7	539314	178660	2.10
Geotechnical boreholes from Enderby Wharf (Batchelor et al., 2015a)			
EWBH1	539161	178803	2.25
EWBH2	539258	178827	1.90
EWBH3	539149	178692	2.77
EWBH4	539201	178717	2.16
EWBH5	539271	178740	2.05

Borehole	Easting	Northing	Elevation (m OD)
EWBH6	539261	178689	2.05
EWBH7	539215	178657	2.44
BGS archive boreholes			
TQ37NE1998	539140	178810	5.20
TQ37NE1756	539450	178580	1.33
TQ37NE1757	539420	178570	1.27
TQ37NE1946	539509	178860	3.05
TQ37NE1947	539495	178575	1.34
TQ37NE1948	539255	178525	1.19
TQ37NE2098	539170	178940	3.66
TQ37NE2099	539210	178990	3.87
TQ37NE2101	539100	179000	3.66
TQ37NE2157	539430	178630	1.57
TQ37NE2158	539530	178660	1.69
TQ37NE3948	539669	178727	2.01
TQ37NE602	539280	178985	4.27
TQ37NE603	539302	178980	4.27
TQ37NE623	539561	178577	1.86
TQ37NE631	539625	178642	1.92
TQ37NE698	539475	178969	2.29
TQ37NE721	539470	178990	2.31
TQ37NE722	539500	178980	1.41
TQ37NE724	539530	178920	1.05
TQ37NE725	539550	178940	3.30
TQ37NE730	539650	179000	1.09
TQ37NE731	539670	178960	0.87
TQ37NE735	539560	178830	2.42
TQ37NE737	539610	178820	1.21
TQ37NE739	539660	178770	1.35
TQ37NE779	539170	178930	2.74

Organic matter determinations

A total of 37 subsamples from borehole QBH2 were taken for determination of the organic matter content (Table 5; Figure 11). 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^{0}C 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 QBH2 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 v4.0.1 (Bronk Ramsey, 1995; 2001 and 2007) and the IntCal13 atmospheric curve (Reimer *et al*., 2013). The results are displayed in Figure 11 and in Table 6.

Pollen assessment

12 subsamples from borehole QBH2 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 QBH2 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).

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

The results of the deposit modelling for the site have been reported previously (Young & Batchelor, 2015). The results of these investigations are shown in Tables 2 to 5, with the resultant deposit models shown in Figures 3 to 10. The results of the lithostratigraphic descriptions, organic matter determinations and radiocarbon dating for boreholes QBH1, QBH2 and QBH4 are displayed in Figure 11.

The previous geoarchaeological investigations (Young & Batchelor, 2015) revealed that the basal unit at the site is a horizon of sand and gravel (the Shepperton Gravel). These sediments were deposited during the Late Devensian (Marine Isotope Stage 2, *ca*. 16,000-11,500 cal BP), within a high energy braided river system. The surface of this unit is recorded in the three geoarchaeological boreholes at -4.15 (QBH1), -3.54 (QBH2) and -3.91m OD (QBH4), similar to the levels recorded at the Enderby Wharf site immediately to the west (-3.5 to -4.0m OD; Batchelor *et al*., 2015a). The Gravel surface falls towards the southeast of the site to -4.93m OD in BGS borehole TQ37NE2157, -6.81m OD in TQ37NE2158 and -5.4m OD in TQ37NE631. To the south of the Alcatel-Lucent and Enderby Wharf sites the Gravel rises to -2.73m OD in TQ37NE1757, and -1.25m OD in TQ37NE1948, whilst to the northwest and northeast of these sites the Gravel surface generally lies above -3m OD (see Figure 3). A lower Gravel surface is also recorded in the area of boreholes TQ37NE2099, TQ37NE602, TQ37NE603 and TQ37NE698, where the Gravel generally lies below -4m OD. The Gravel topography in the modelled area is indicative of an east-west aligned depression, suggestive of a broad palaeochannel across the area of the Alcatel-Lucent and Enderby Wharf sites (see Figure 10). It is unclear from the present model whether the depression to the north of the modelled area is connected to this palaeochannel, or represents a separate topographic feature.

In several of the boreholes within the east-west aligned palaeochannel the Gravel surface is overlain by a horizon of sand (QBH4, EWQBH1, EWQBH2, EWBH7, TQ37NE2157, TQ37NE1756 and TQ37NE623), indicative of a gradual reduction in flow rate in this channel during the Early Holocene. Elsewhere, the Shepperton Gravel is overlain by sandy or clayey silt with frequent detrital organic inclusions of wood or herbaceous material, considered here to represent the Lower Alluvium and indicative of the former presence of low energy fluvial or estuarine conditions during the Early to Middle Holocene. In borehole QBH2 the organic content in this unit is recorded at between *ca*. 5 and 10% (Figure 11). The surface of this unit across the site lies at between *ca*. -3.5 and -2.0m OD (Figure 4), generally sloping downwards from west to east across the area of the site.

In boreholes QBH1 and QBH2 the Lower Alluvium is overlain by a horizon of woody Peat with occasional herbaceous remains, indicative of a transition to semi-terrestrial conditions supporting the growth of wetland vegetation in this area of the site. In borehole QBH2 the organic content within this horizon is consistently recorded at between 80 and 85%. In borehole QBH4 no Peat is recorded, but a horizon of organic-rich Alluvium is present at the same elevation as the Peat identified elsewhere. In QBH1 Peat is recorded at between -0.85 and -2.52m OD, separated by a horizon of organic Alluvium between -1.35 and -1.94m OD; in QBH2 the Peat is recorded at between -2.20 and -2.81m OD. Radiocarbon dating of the base (-2.76 to -2.81m OD) and top (-2.20 to -2.25m OD) of the Peat in borehole QBH2 has revealed an age-reversal, which may be due to an erroneous date on one of these samples, or may represent the reworking of older sediment (by fluvial activity) in the case of the upper date. The ages of both the base (4825 to 4570 cal BP) and top (5300 to 4980 cal BP) of the Peat do however fall within the range of the lower and middle Peat horizons at the Enderby Wharf site, recorded at a similar elevation to that in borehole QBH2 (see Figure 11) and indicative of Peat formation during the Neolithic period.

Towards the southeast of the site, Peat was also recorded in BGS borehole TQ37NE2157, between -0.38 and -3.68m OD. No Peat was recorded in the majority of the existing geotechnical boreholes from the site; however, none of these boreholes penetrated beyond 4m depth, and only in MWS5 was the surface of the Peat recorded (-0.7m OD). Notably, the horizon of organic Alluvium that separates the Peat in QBH1 was also identified within the Peat sequence at the Enderby Wharf site, here of variable thicknesses between *ca*. 0.5 and 1.0m and generally recorded between *ca*. -1.0 and -2.0m OD. Given the spatial extent of this horizon, it may represent a contemporaneous period of flood events and mineral-rich sedimentation that occurred across much of the Alcatel-Lucent site and the wider area.

The thickness of the Peat is variable across the site, recorded as 1.67m in QBH1 (inclusive of the intervening organic Alluvium), 0.61m in QBH2 and 3.3m in TQ37NE2157 (Figure 5). The wider deposit model suggests that Peat thickness is generally greatest within the east-west aligned palaeochannel identified above, with the greatest thicknesses to the southeast and east of the Alcatel-Lucent site. At the Enderby Wharf site to the west Peat was identified at elevations between 0.0 and -2.5m OD, and was generally between 0.5 and 2m thick (see Figure 5). The upper surface of the Peat is highly variable, lying at between -0.38 and -2.2m OD within the area of the site and at similar elevations elsewhere in the wider deposit model (Figure 6).

The Peat is overlain across the site by a horizon of silty clay, referred to here as the Upper Alluvium and representative of inundation of the Peat surface and sediment accumulation on the floodplain at a distance from any active channels. In borehole QBH2 this unit is generally between 5 and 15% organic, with peaks of 52% and between 20 and 35% recorded at -1.85 to -1.86 and -1.61 to -1.37m OD respectively. The latter horizon occurs at a similar elevation to the upper Peat/organic silty clay recorded in borehole QBH1, perhaps indicating more marginal organic accumulation in the area of borehole QBH2 at a similar time to that recorded in QBH1. The surface of the Upper Alluvium is relatively even across the site, generally lying at between 1.0 and 0.5m OD (Figure 7). The total thickness of the Holocene alluvial units at the site, incorporating the Sand, Lower Alluvium, Peat and Upper Alluvium is shown in Figure 8; total thickness of between 4.34 and 4.9m are recorded in the area of the site. The sequence at the site is capped by between 1.0 and 1.5m of Made Ground (Figure 9), so that the modern surface of the site lies at between *ca*. 1.5 and 2.0m OD.

Table 2: Lithostratigraphic description of borehole QBH1, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Depth (m OD)	Depth (m bgs)	Composition
1.80 to 0.80	0.00 to 1.00	Made Ground
0.80 to 0.30	1.00 to 1.50	As3 Ag1; brown silty clay with frequent iron staining particularly in worm and root hollows. Diffuse contact in to:
0.30 to -0.20	1.50 to 2.00	As3 Ag1; blue grey silty clay with some iron staining.
-0.20 to -0.44	2.00 to 2.24	Gley 1 4/10Y; Ag2 As2; dark greenish grey clay and silt with iron staining. Diffuse contact in to:
-0.44 to -0.61	2.24 to 2.41	Gley 1 5/N; Ag3 As1; grey clayey silt with less frequent iron staining. Diffuse contact in to:
-0.61 to -0.85	2.41 to 2.65	7.5YR 4/1; Ag2 As1 Sh1 Dl+ Dh+; dark grey organic clayey silt with traces of detrital wood and detrital herbaceous material. Diffuse contact in to:
-0.85 to -1.35	2.65 to 3.15	7.5YR 3/1; Sh3 Ag1 Th+ Tl+; humo. 2/3; very dark grey moderately to well humified silty peat with traces of wood and herbaceous material. Diffuse contact in to:
-1.35 to -1.94	3.15 to 3.74	10YR 4/1; Ag2 Ga1 Sh1 Dl+ Dh+; dark grey organic sandy silt with traces of detrital wood and detrital herbaceous material. Some more organic or sandy horizons within this unit. Diffuse contact in to:
-1.94 to -2.52	3.74 to 4.32	10YR 2/1; Sh3 Tl^{2}1 Ag+; humo. 2; black woody moderately humified peat with a trace of silt.
-2.52 to -3.20	4.32 to 5.00	Gley 1 5/10Y; Ag3 As1 Dl+; greenish grey clayey silt with a trace of detrital wood.
-3.20 to -3.82	5.00 to 5.62	Gley 1 6/10Y; Ag3 As1 Ga+ Dl+; greenish grey clayey silt with a trace of sand and detrital wood. Diffuse contact in to:
-3.82 to -4.07	5.62 to 5.87	Gley 1 5/10Y; Ga2 Ag2; greenish grey sand and silt. Sharp contact in to:
-4.07 to -4.09	5.87 to 5.89	Gg3 Ga1; sandy gravel. Clasts are flint, up to 20mm in diameter, sub-angular to sub-rounded. Sharp contact in to:
-4.09 to -4.15	5.89 to 5.95	Gley 1 5/10Y; Ga2 Ag2; greenish grey sand and silt. Sharp contact in to:
-4.15 to -4.20	5.95 to 6.00	Gg3 Ga1; sandy gravel. Clasts are flint, up to 30mm in diameter, sub-angular to sub-rounded.

Table 3: Lithostratigraphic description of borehole QBH2, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Depth (m OD)	Depth (m bgs)	Composition
1.80 to 0.80	0.00 to 1.00	Made Ground
0.80 to 0.30	1.00 to 1.50	As3 Ag1; brown silty clay with frequent iron staining particularly in worm and root hollows. Diffuse contact in to:
0.30 to -0.20	1.50 to 2.00	As3 Ag1; blue grey silty clay with some iron staining.
-0.20 to -0.92	2.00 to 2.72	10YR 5/2; As3 Ag1; greyish brown silty clay with some iron staining. Diffuse contact in to:
-0.92 to -1.20	2.72 to 3.00	10YR 4/2; Ag3 As1 Sh+ Dl+; dark greyish brown clayey silt with traces of organic matter and detrital wood.
-1.20 to -1.40	3.00 to 3.20	2.5Y 4/1; Ag3 As1 Dh+; dark grey clayey silt with a trace of detrital wood. Diffuse contact in to:
-1.40 to -1.59	3.20 to 3.39	2.5Y 3/1; Ag2 Sh1 Dl1 Ga+; very dark grey organic silt with detrital wood and a trace of sand. Diffuse contact in to:

Depth (m OD)	Depth (m bgs)	Composition
-1.59 to -2.20	3.39 to 4.00	Gley 1 4/10Y; Ag3 As1 Sh+ Dl+; dark grey clayey silt with traces of organic matter and detrital wood.
-2.20 to -2.81	4.00 to 4.61	10YR 2/1; Sh2 $Tl^2$2 Th+ Ag+; humo. 2; black moderately humified wood peat with traces of herbaceous material and silt. Sharp contact in to:
-2.81 to -3.20	4.61 to 5.00	Gley 1 4/10Y; Ag2 As2 Dh+ Ga+; dark greenish grey clay and silt with traces of detrital herbaceous material and sand.
-3.20 to -3.54	5.00 to 5.34	Gley 1 5/10Y; Ag2 As1 Ga1 Dh+; greenish grey sandy clayey silt with a trace of detrital herbaceous material. Some vertical sedge rooting. Sharp contact in to:
-3.54 to -4.20	5.34 to 6.00	Gg3 Ga1; sandy gravel. Clasts are flint, up to 40mm in diameter, sub-angular to well-rounded.

Table 4: Lithostratigraphic description of borehole QBH4, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Depth (m OD)	Depth (m bgs)	Composition
2.02 to 1.02	0.00 to 1.00	Made Ground
1.02 to 0.97	1.00 to 1.05	Disturbed Alluvium (Made Ground)
0.97 to 0.02	1.05 to 2.00	As3 Ag1; blue grey silty clay with some iron staining.
0.02 to -0.61	2.00 to 2.63	Gley 1 5/10Y; Ag2 As2; greenish grey clay and silt. Diffuse contact in to:
-0.61 to -0.98	2.63 to 3.00	10YR 3/1; Ag2 As1 Dl1 Dh+ Sh+; very dark grey clayey silt with detrital wood and traces of detrital herbaceous material and organic matter.
-0.98 to -1.98	3.00 to 4.00	10YR 4/1; Ag2 Sh1 Dl1 Dh+; dark grey organic silt with detrital wood and a trace of detrital herbaceous material.
-1.98 to -2.24	4.00 to 4.26	10YR 3/1; Ag2 As1 Dl1 Sh+ Ga+; very dark grey clayey silt with detrital wood and traces of organic matter and sand. Diffuse contact in to:
-2.24 to -2.84	4.26 to 4.86	10YR 2/1; Ag2 Sh1 Dl1 Ga+; black organic silt with detrital wood and a trace of sand. Some more sandy horizontal beds. Diffuse contact in to:
-2.84 to -2.98	4.86 to 5.00	Gley 1 5/10Y; Ag2 Ga1 Dl1; greenish grey sandy silt with detrital wood. Frequent Mollusca.
-2.98 to -3.80	5.00 to 5.82	Gley 1 5/10Y; Ag2 As1 Ga1 Gg+; greenish grey sandy clayey silt with occasional gravel clasts. Very sharp contact in to:
-3.80 to -3.91	5.82 to 5.93	Gley 1 4/10Y; Ga4 Ag+; dark greenish grey sand with a trace of silt. Sharp contact in to:
-3.91 to -3.98	5.93 to 6.00	Gg3 Ga1; sandy gravel. Clasts are flint, up to 40mm in diameter, sub-angular to well-rounded.

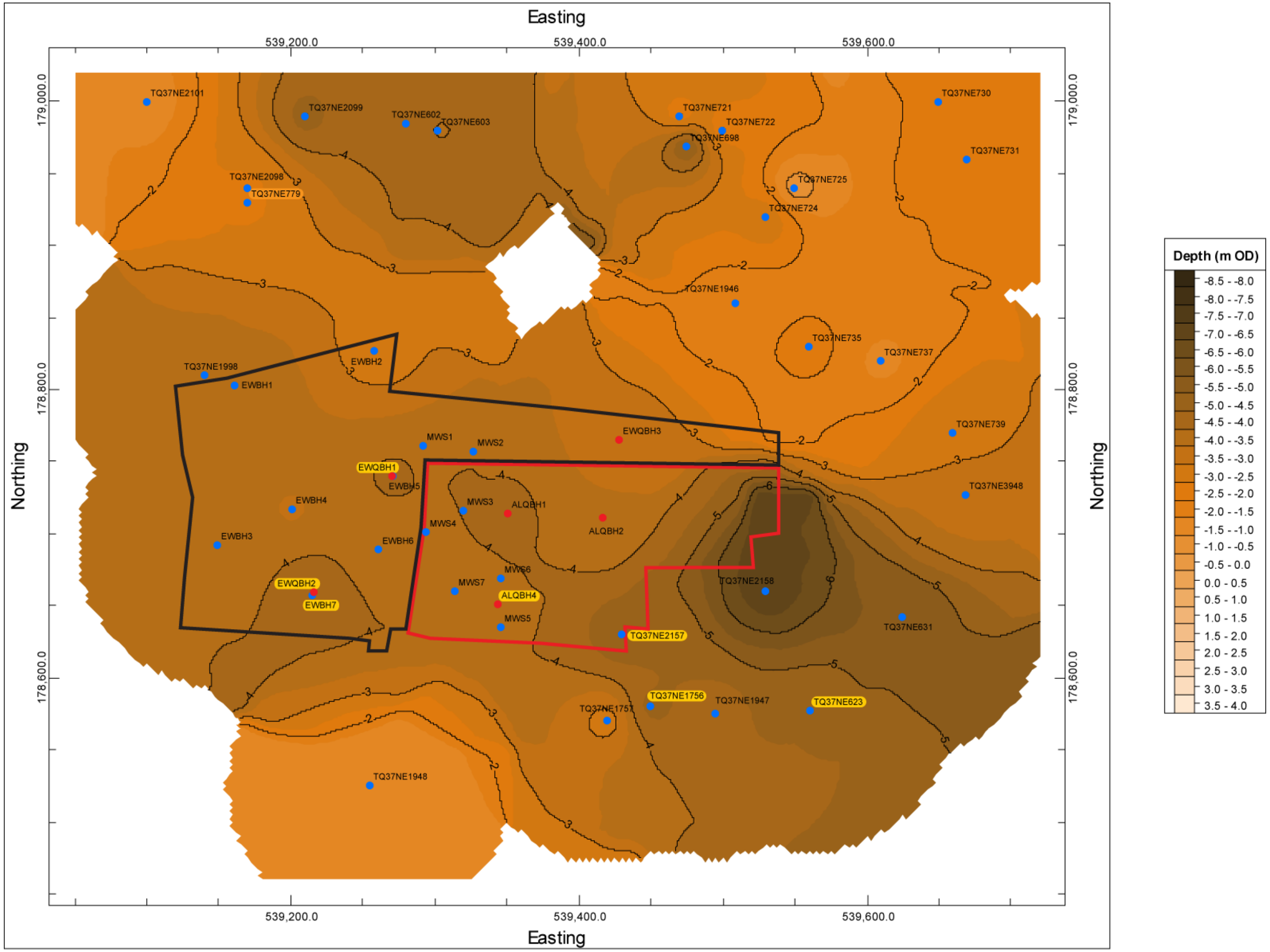

Figure 3: Modelled surface of the Shepperton Gravel (contour heights in metres OD). Boreholes with sand overlying the Shepperton Gravel are highlighted in yellow.

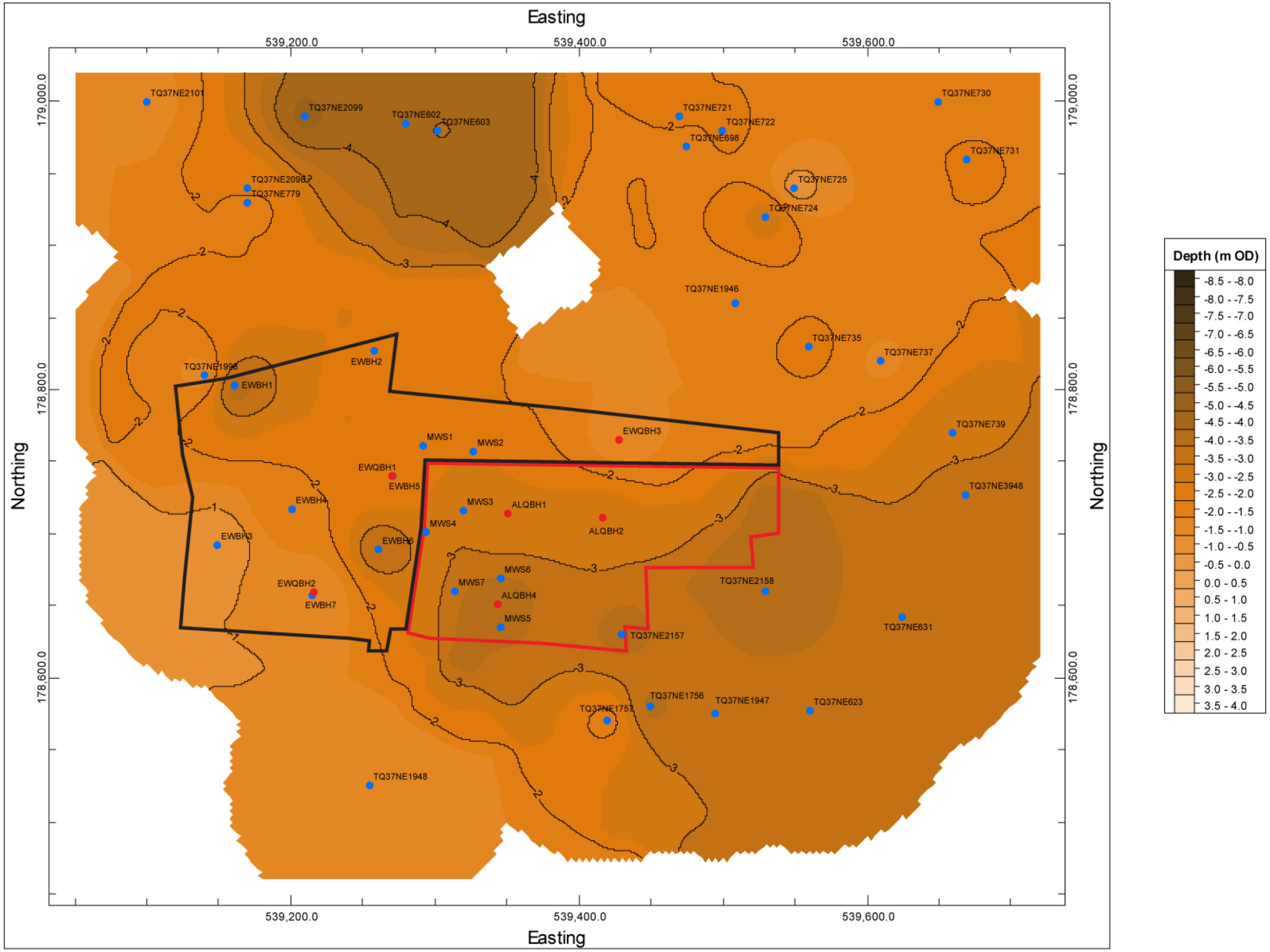

Figure 4: Modelled surface of the Lower Alluvium (contour heights in metres OD).

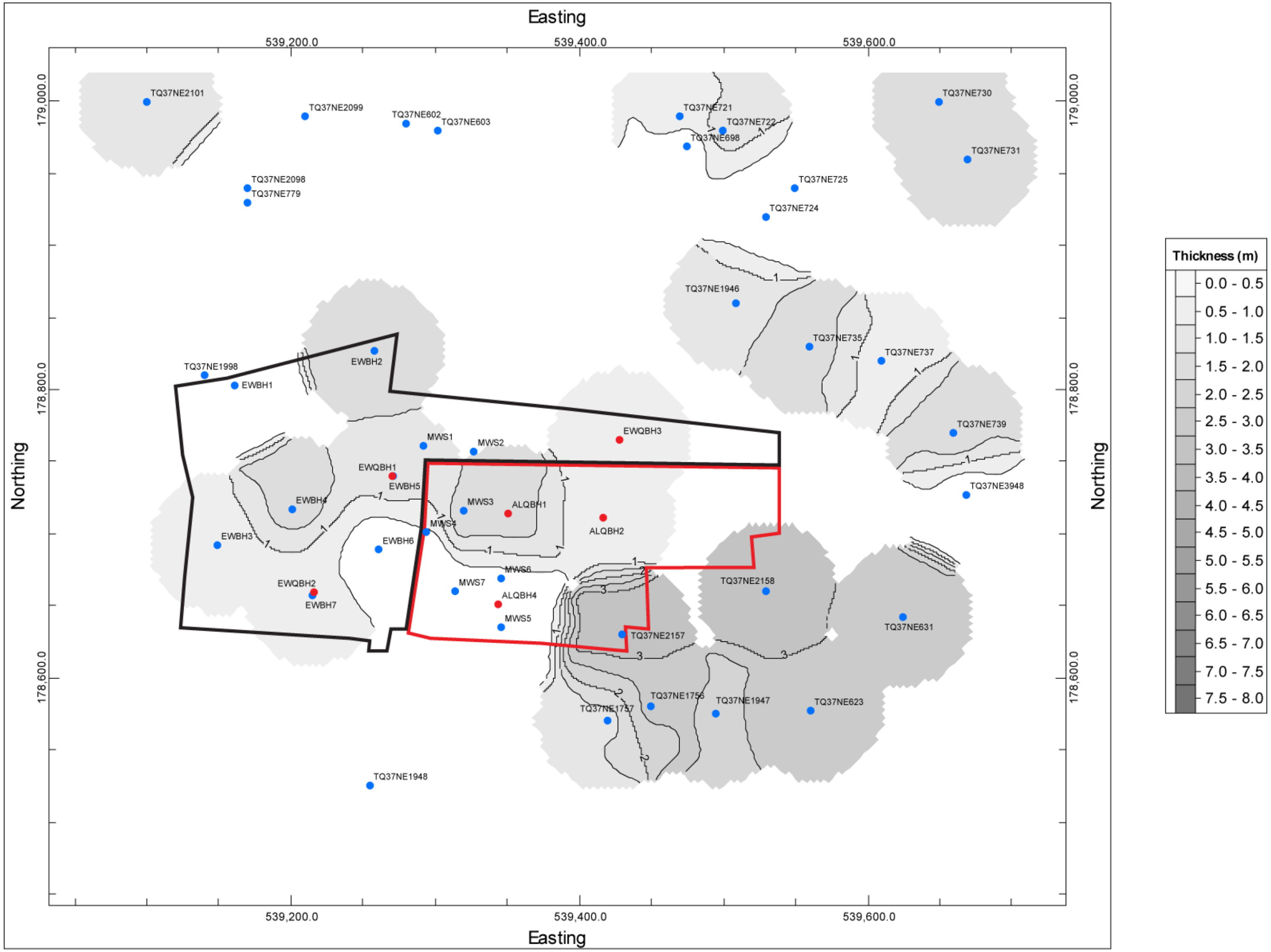

Figure 5: Modelled thickness of the Peat (metres).

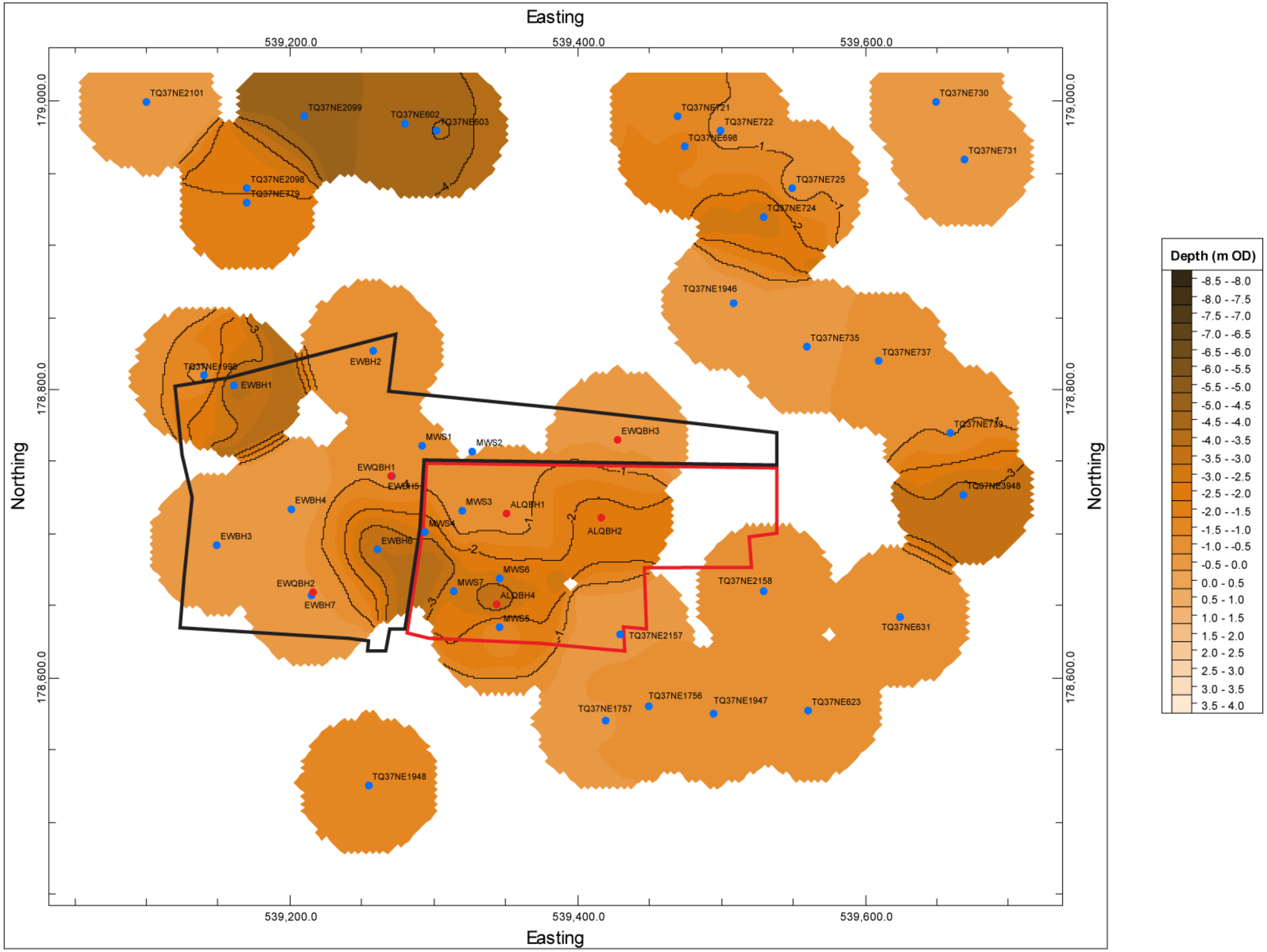

Figure 6: Modelled surface of the Peat (contour heights in metres OD).

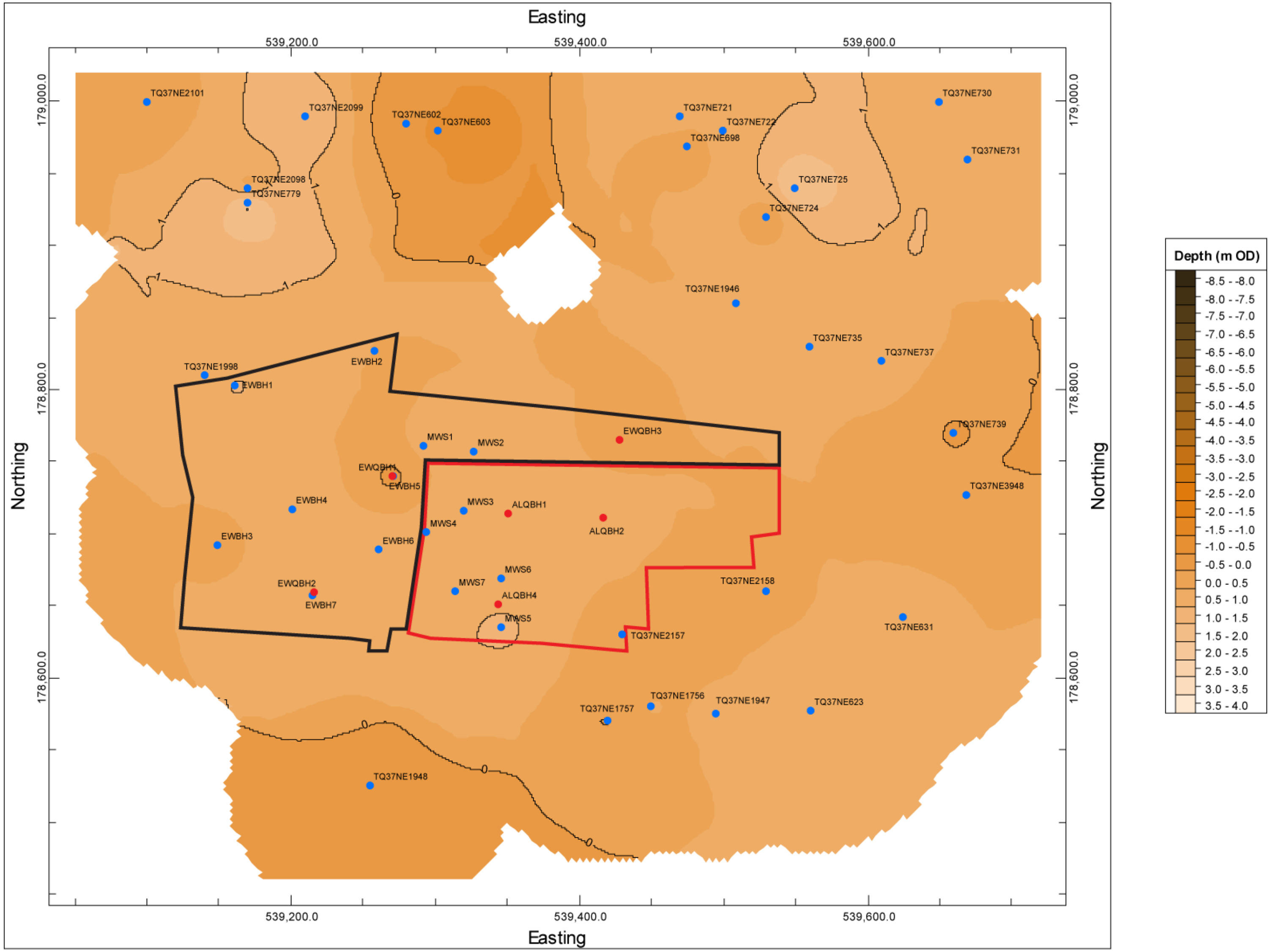

Figure 7: Modelled surface of the Upper Alluvium (contour heights in metres OD)

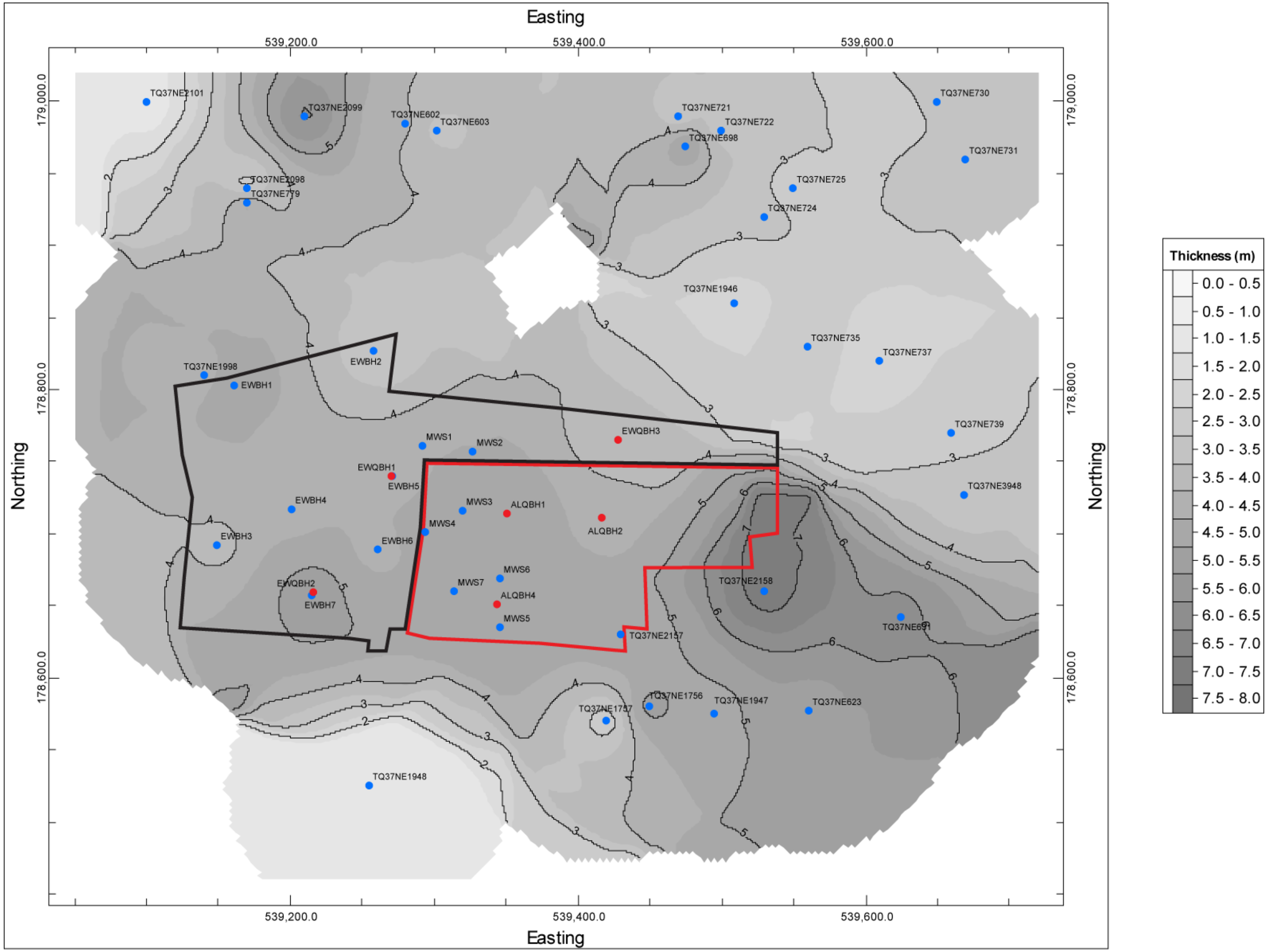

Figure 8: Modelled thickness of the combined Alluvium (incorporating the Sand, Lower Alluvium, Peat and Upper Alluvium) (metres)

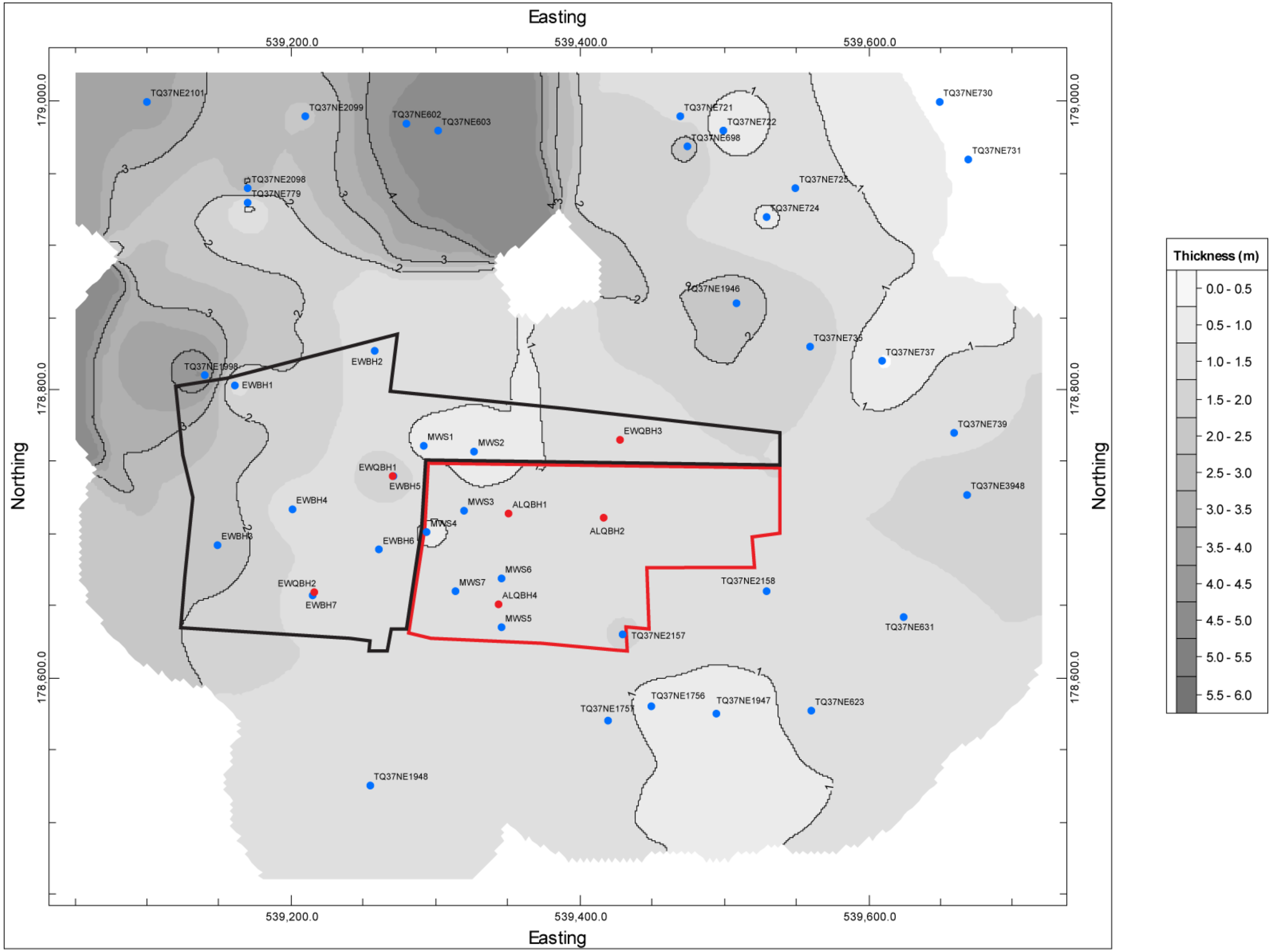

Figure 9: Modelled thickness of the Made Ground (metres).

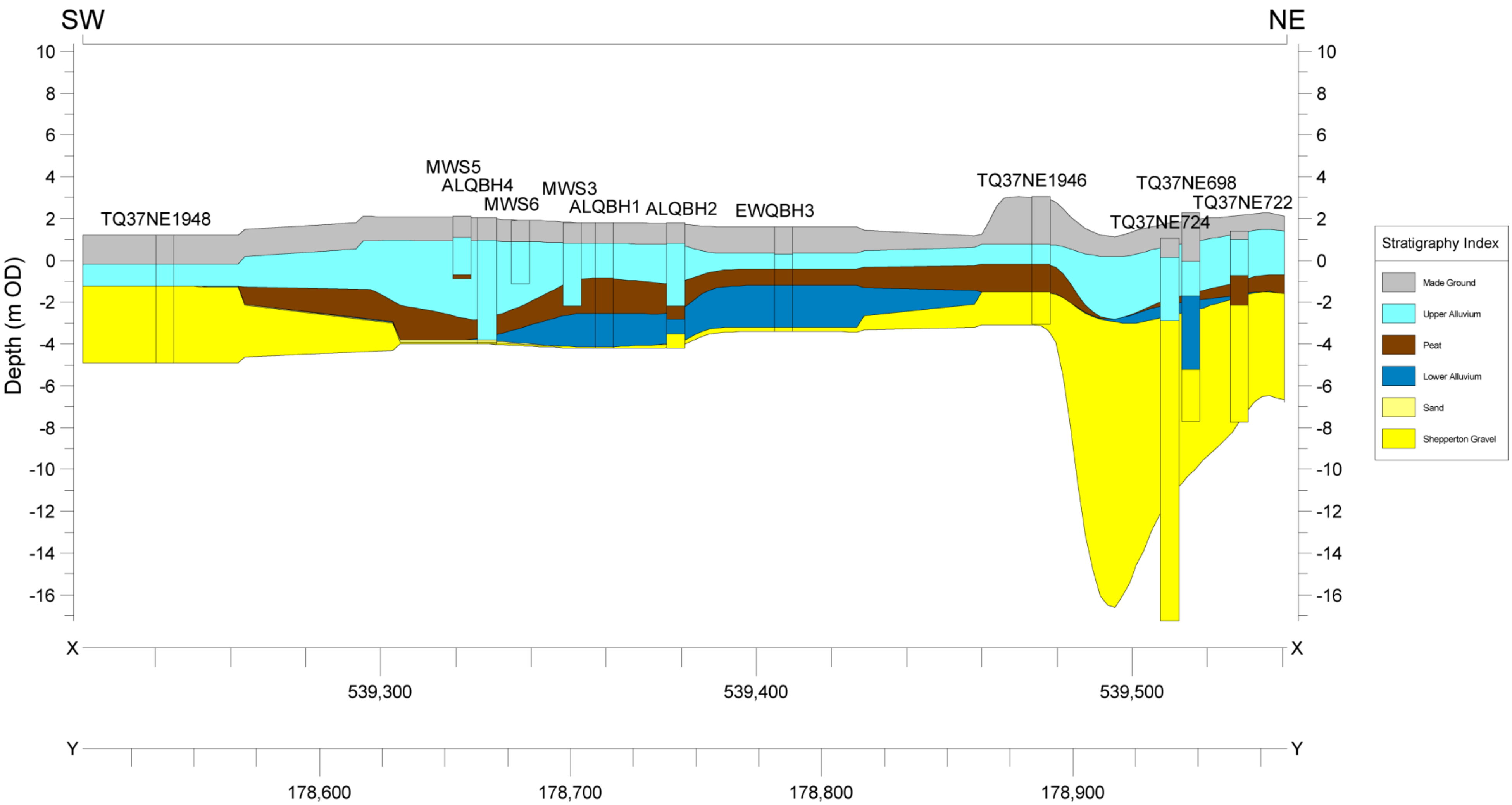

Figure 10: Northeast-Southwest stratigraphic profile of boreholes across the site and the wider area.

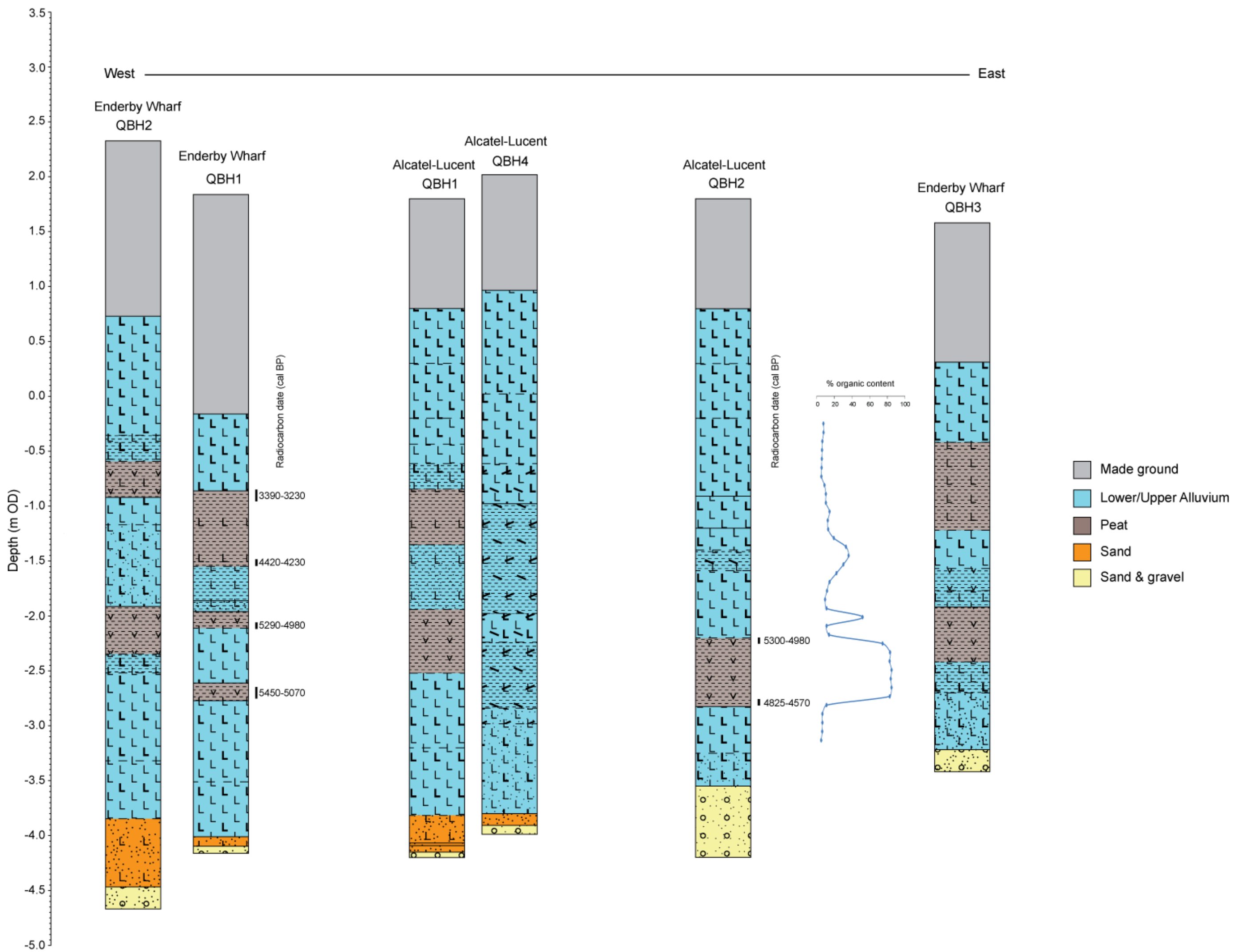

Figure 11: Results of the lithostratigraphic descriptions, radiocarbon dating and organic content analysis of boreholes at the Alcatel-Lucent Telegraph Works and Enderby Wharf (Batchelor *et al*., 2015a) sites.

Table 5: Results of the borehole QBH2 organic matter determinations, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Depth (m OD)		Organic matter content (%)
From	To	
-0.25	-0.26	7.67
-0.33	-0.34	7.81
-0.41	-0.42	6.46
-0.49	-0.50	6.07
-0.57	-0.58	5.86
-0.65	-0.66	5.58
-0.73	-0.74	5.33
-0.81	-0.82	8.84
-0.89	-0.90	10.44
-0.97	-0.98	10.45
-1.05	-1.06	14.55
-1.13	-1.14	12.57
-1.21	-1.22	12.96
-1.29	-1.30	19.41
-1.37	-1.38	33.20
-1.45	-1.46	36.19
-1.53	-1.54	30.30
-1.61	-1.62	22.38
-1.69	-1.70	14.55
-1.77	-1.78	11.73
-1.85	-1.86	9.54
-1.93	-1.94	11.19
-2.01	-2.02	51.98
-2.09	-2.10	11.25
-2.17	-2.18	13.95
-2.25	-2.26	74.62
-2.33	-2.34	83.09
-2.41	-2.42	82.59
-2.49	-2.50	84.80
-2.57	-2.58	83.86
-2.65	-2.66	84.76
-2.73	-2.74	82.75
-2.81	-2.82	11.14
-2.89	-2.90	6.51
-2.97	-2.98	6.47
-3.05	-3.06	6.28
-3.13	-3.14	5.14

Table 6: Results of the borehole QBH2 radiocarbon dating, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

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)	**δ**13C **(‰)**
BETA 423497	Twig wood; top of Peat	-2.20 to -2.25	4490 ± 30 BP	3350 to 3030 cal BC (5300 to 4980 cal BP)	-31.0
BETA 423496	Twig wood; base of Peat	-2.76 to -2.81	4150 ± 30 BP	2875 to 2620 cal BC (4825 to 4570 cal BP)	-26.1

4. RESULTS AND INTERPRETATION OF THE POLLEN ASSESSMENT

The results of the assessment (Table 7) indicate a high concentration and preservation of remains through the majority of the Peat sequence from borehole QBH2; only two samples (-1.46m and -0.26m OD) contained a notably low concentration of remains. Two distinct assemblages can be identified from the assessment data. Eight samples between -2.74 and -1.86m OD are dominated by *Quercus* (oak) and Cyperaceae (sedges) with *Alnus* (alder), *Corylus* type (e.g. hazel) and *Filicales* (ferns). *Tilia* (lime) and *Ulmus* (elm) are recorded in low numbers towards the very base of the sequence. Sporadic and minimal values of other tree, shrub, herb and aquatic taxa are recorded throughout the sequence. Microcharcoal values were very occasionally recorded in a few samples, but were frequent at -1.86m OD.

The four samples from the top of the sequence (-0.26 to -1.46m OD) contain a more diverse assemblage of tree, shrub and herb taxa including *Alnus*, *Quercus*, *Pinus*, *Calluna vulgaris* (heather), *Corylus* type, sedges, Poaceae, Lactuceae (dandelions), *Chenopodium* type (goosefoot), Caryophyllaceae (pinks) and *Rumex acetosa/acetosella* (sorrel) with sporadic occurrences of *Ulmus* and *Cereale* type (e.g. barley). Microcharcoal was more commonly recorded within these four samples.

The lower assemblage (-2.74 to -1.86m OD) is indicative of a relatively damp and open wetland environment dominated by sedges and ferns. Alder and willow carr also formed part of the wetland vegetation, but low to moderate pollen concentrations suggest the limited and/or distant growth of these trees; most likely on drier areas of the floodplain. Other trees and shrubs such as hazel, ash and birch may also have formed part of this wetland woodland community, but are more likely to have grown on the dryland, forming mixed deciduous woodland with oak, lime and elm. Indeed, the high proportion of oak pollen recorded in this part of the sequence is of note. It is possible that these high values are a function of the apparently open nature of the wetland vegetation at this point on the floodplain, enabling a greater influx of pollen from the dryland. Alternatively, it is possible that areas of dryland were located relatively close to the site during this period. Also of potential importance, is the decline in lime and elm pollen values towards the very 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). No definitive evidence of human activity is recorded through this part of the sequence; however, the occurrence of microcharcoal is suggestive of natural or anthropogenic burning in the nearby environment.

Within the upper assemblage (-0.26 to -1.46m OD), the decline of oak and increased diversity of 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 with an estuarine influence, most likely as a consequence of an increase in relative sea level rise (RSL). *Pinus* (pine) and *Pteridium aquilinum* (bracken) also increase during this period; these are taxa frequently over-represented in alluvial environments as a consequence of its morphology, which allows it to float long distances. On the dryland, the decline of oak is suggestive of a large reduction in mixed deciduous woodland. The increase of a large array of herbaceous taxa including cereal pollen suggests that this decline was a consequence of woodland clearance for settlement and agricultural purposes, which took place from the Bronze Age onwards. An increase of microcharcoal, suggestive of burning, is also recorded. Whether the decline of the floodplain and dryland woodland is linked is uncertain, but does seem to be a common feature of woodland within pollen-stratigraphic records from the Lower Thames Valley.

Table 7: Results of the pollen assessment from QBH2, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

	Depth (m OD)	-0.26	-0.66	-1.06	-1.46	-1.86	-2.26	-2.32	-2.42	-2.50	-2.58	-2.66	-2.74
Latin name	Common name												
Trees													
Alnus	alder		5	9	6	1	9	4	1	4	9	7	16
Quercus	oak		2	5	1	9	19	10	11	20	5	28	21
Pinus	pine	3	5	1		1	1						1
Ulmus	elm			1			1			1		1	2
Tilia	lime		1		4		6			2	2	6	2
Fraxinus	ash		1										1
Betula	birch					1		1					
Shrubs													
Calluna vulgaris	heather		2	1									
Corylus type	e.g. hazel		6	5		1	3	3	2	5		3	6
Salix	willow						1						
Vibernum	wayfaring tree			1									
Herbs													
Cyperaceae	sedge family	1	5	7		3	11	12	7	18	10	8	12
Poaceae	grass family	1	13	4									1
Cereale type	e.g. barley		2										
Asteraceae	daisy family			1									
Lactuceae	dandelion family	2	3	1		1							
Plantago lanceolata	ribwort plantain			1							1		
Chenopodium type	goosefoot family		1	1		2							
Caryophyllaceae	pink family	1	1										
Potentilla	cinquefoil									1			
Rumex acetosa/acetosella	sorrel	1		1									
Apiaceae	carrot family									5			1
Ranunculus type	buttercup / water crowsfoot			1									
Galium type	bedstraw									1			
Aquatics													
Sparganium type	bur-reed							1		1			
Spores													
Pteridium aquilinum	bracken		1	3									
Sphagnum	moss		2										
Filicales	ferns		2	4		1	161	245	9	53		3	4

	Depth (m OD)	-0.26	-0.66	-1.06	-1.46	-1.86	-2.26	-2.32	-2.42	-2.50	-2.58	-2.66	-2.74
Latin name	Common name												
Polypodium vulgare	polypody		1		1					1		5	
Unknown			1										
Total Land Pollen (grains counted)		9	47	40	11	19	51	30	21	58	27	54	63
Concentration*		2	5	5	2	3	5	4	3	5	4	5	5
Preservation**		3	3-4	4	3	3-4	3	4	4	4-5	4-5	4-5	4-5
Microcharcoal Concentration***		0	3	2	1	4	1	0	1	0	1	0	0
Suitable for further analysis		NO	YES	YES	NO	YES	YES	YES	YES	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 AND INTERPRETATION OF THE MACROFOSSIL ASSESSMENT

A total of six small bulk samples from borehole QBH2 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 QBH2. The results of the macrofossil rapid assessment indicate that waterlogged wood was present in moderate concentrations in all six samples from the Peat in borehole QBH2. Waterlogged seeds were present in low concentrations in two samples (-2.25 to -2.30 and -2.71 to -2.76m OD). Insects were recorded in low concentrations in one sample (-2.56 to -2.66m OD).

No charred plant remains, Mollusca, bone or artefacts were recorded during the assessment. The two samples from borehole QBH2 in which waterlogged seeds were recorded underwent a more detailed assessment (Table 9). The seed assemblage included only one specimen of *Alnus glutinosa* (alder) in each sample. Although too small an assemblage to attempt a full environmental interpretation, the presence of alder in these two samples is consistent with an alder-carr dominated wetland environment.

Table 8: Results of the macrofossil assessment of borehole QBH2, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

				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
-2.20 to -2.25	50	50	>300µm	-	-	-	-	-	2	-	-	-	-	-	-	-	-
-2.25 to -2.30	25	25	>300µm	-	-	-	-	-	2	1	-	-	-	-	-	-	-
-2.35 to -2.45	75	75	>300µm	-	-	-	-	-	3	-	-	-	-	-	-	-	-
-2.56 to -2.66	50	50	>300µm	-	-	-	-	-	3	-	-	-	-	-	-	1	-
-2.71 to -2.76	25	25	>300µm	-	-	-	-	-	3	1	-	-	-	-	-	-	-
-2.76 to -2.81	25	25	>300µm	-	-	-	-	-	2	-	-	-	-	-	-	-	-

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 QBH2, Alcatel-Lucent Telegraph Works, Blackwall Lane, London Borough of Greenwich SE10.

Depth (m OD)	Waterlogged seeds		
	Latin name	Common name	Number
-2.20 to -2.25	-	-	-
-2.25 to -2.30	*Alnus glutinosa* (catkin)	alder	1
-2.35 to -2.45	-	-	-
-2.56 to -2.66	-	-	-
-2.71 to -2.76	*Alnus glutinosa* (catkin)	alder	1
-2.76 to -2.81	-	-	-

6. DISCUSSION AND CONCLUSIONS

The aims of the environmental archaeological assessment at the Alcatel-Lucent site were (1) to establish the age of the Peat recorded at the site; (2) to assess the palaeoenvironmental potential of the sequence; (3) to highlight any indications of nearby human activity, and (4) to provide recommendations for further analysis (if necessary). In order to achieve this aim, an environmental archaeological assessment of one borehole (QBH2) was carried out. Although the Peat horizon recorded in borehole QBH1 was thicker (see above), QBH2 was selected for the assessment since QBH1 was within 100m of the borehole at Enderby Wharf on which environmental archaeological analysis has already been conducted. Borehole QBH2 thus offered the opportunity to assess a sequence >100m from that previously analysed at Enderby Wharf; in addition, the base of the Peat within QBH2 was recorded at a lower elevation, and was potentially of an earlier date, than that in QBH1 (see Figure 11).

The results of the previous geoarchaeological investigations (Young & Batchelor, 2015a) indicated that the sediments recorded at the Alcatel-Lucent site are analogous to those recorded elsewhere on Greenwich Peninsula and in the Lower Thames Valley, with a sequence of Shepperton Gravel overlain by Holocene Alluvium containing Peat, capped by Made Ground. The surface of the Late Devensian Shepperton Gravel at the site lies at between -3.54 and -4.93m OD, the results of the deposit modelling indicating that the site lies within a broad east-west aligned palaeochannel, in which Holocene alluvial deposits have accumulated (see Figures 10 and 11). The Enderby Wharf site (Batchelor *et al*., 2015a), immediately to the east and north, is thought to lie within the same palaeochannel, where the Gravel surface was recorded at between *ca*. -2.75 and -5.0m OD. Deposit modelling of the wider area of Greenwich Peninsula and north of the River Thames in Newham, and forming part of a forthcoming publication (Green *et al*., in prep), suggests that this channel was a significant feature of the Early Holocene landscape in this area of the Lower Thames Valley.

The site lies to the southwest of the area of Greenwich Peninsula investigated by Corcoran (2002), who defined landscape zones based on the geoarchaeological characteristics of those areas. In this investigation, four landscape zones were identified as follows: Landscape Zone A, representing an area of higher Gravel surface (higher than -2m OD); Landscape Zone B, where the Gravel surface lies at between -2 and -4m OD; and Landscape Zones C and D, where it lies below -4m OD. The Alcatel-Lucent site lies *ca*. 300m southwest of Corcoran's (2002) Landscape Zone B, where the Gravel surface is described as lying at between -4 and -2m OD, and 'probably not overlain by sand'. The deposit model for the site shows that the surface of the Shepperton Gravel lies within or below this range. However, a horizon of Sand considered to represent Early Holocene fluvial deposition overlies the Gravel surface within much of the aforementioned palaeochannel, analogous to that recorded elsewhere on the Peninsula (Corcoran, 2002).

As reported previously (Young & Batchelor, 2015a), at the Bellot Street site (Branch *et al*., 2005) *ca*. 100m to the south, the Shepperton Gravel surface rises to between -0.70 and -1.49m OD. Elsewhere on Greenwich Peninsula, relatively high Shepperton Gravel surfaces (between *ca*. -1 and

-1.7m OD) have been recorded at the Tunnel Avenue (Landscape Zone B; Batchelor, 2013) and Victoria Deep Water Terminal sites (Landscape Zone A; Corcoran, 2002). Towards the north-east of the Tunnel Avenue site however, the Shepperton Gravel surface drops to below -4m OD. It does the same towards the south-west and south-east of the MO115 (Landscape Zone B; Young & Batchelor, 2013a) and MO117 (Landscape Zones A and B; Young & Batchelor, 2013b) sites, in the far south-eastern corner of Greenwich Millennium Village (Miller & Halsey, 2011) and at the Greenwich Peninsula Central East site (Young & Batchelor, 2015b). In addition, smaller 'patches' of lower gravel surface >-4m OD were recorded towards the centre and south-western areas of the Millennium Festival Site (Landscape Zone D; Bowsher & Corcoran, unknown). These areas of lower Gravel surface have been interpreted as either localised hollows, or part of interconnected palaeochannels.

The Alluvium that accumulated at the site contains woody Peat, recorded in the geoarchaeological boreholes at elevations between -0.38 and -2.81m OD and in thicknesses of between 0.61 and 1.67m, similar to the sequence recorded at the Enderby Wharf site immediately to the west (Batchelor *et al*., 2015a; see Figure 11). At the Enderby Wharf site a lower, silty peat horizon was recorded within the Lower Alluvium (EWQBH1) between -2.61 and -2.77m OD. Subsequent radiocarbon dating indicated that peat accumulation commenced here around 5450-5070 cal BP (middle Neolithic). This horizon was considered to be distinct from a thicker complex of generally woody or herbaceous Peat and organic sediment, considered to be equivalent to that recorded at the Alcatel-Lucent site. Radiocarbon dating of the base of this horizon at Enderby Wharf demonstrated that the accumulation of this horizon began at around 5290-4980 cal BP (middle Neolithic). The results of the radiocarbon dating of the Peat in borehole QBH2 at the present site (-2.20 to -2.81m OD) revealed an age-reversal, which may be due to an erroneous date on one of these samples, or may represent the reworking of older sediment (by fluvial activity) in the case of the upper date. The ages of both the base (4825 to 4570 cal BP) and top (5300 to 4980 cal BP) of the Peat do however fall within the range of the lower and middle Peat horizons at Enderby Wharf, recorded at a similar elevation to that in borehole QBH2 (see Figure 11), and indicative of Peat formation during the Neolithic period.

The period of Peat formation at the Alcatel-Lucent site therefore appears to be contemporaneous with a widespread period of accumulation recorded elsewhere across the Lower Thames Valley, between *ca*. 6500-3000 cal BP, largely driven by variations in relative sea level rise (e.g. Devoy, 1979; Sidell, 2003). They are also consistent with those recorded elsewhere on the Greenwich Peninsula. At the Victoria Deep Water Terminal site, Peat accumulation was radiocarbon dated to 5280-4660 cal BP (Neolithic; Corcoran, 2002), whilst at the Cable Car South Station in SSBH1C , the base of the peat was recorded around 5580-5310/5890-5610 cal BP and continued until 3380-3210 cal BP (Neolithic through to Bronze Age; Batchelor *et al*., 2015a).

The results of the palaeobotanical assessment of the Peat in QBH2 has revealed two distinct assemblages. The lower assemblage, between -2.74 and -1.86m OD, is indicative of a relatively damp and open wetland environment, dominated by sedges and ferns but with alder and willow carr also forming part of the wetland vegetation, perhaps on drier areas of the floodplain. On the dryland a mixed deciduous woodland dominated by oak, lime and elm is recorded. Significantly, a decline in lime and elm pollen values towards the base of the sequence is recorded, suggestive of environmental changes taking place towards the wetland-dryland interface (e.g. the loss of dryland habitat or anthropogenic impact). No definitive evidence of human activity was recorded in this part of the sequence, but the occurrence of microcharcoal may be suggestive of either natural or anthropogenic burning in the nearby environment. Between -0.26 and -1.46m OD the assemblage is suggestive of a shift towards sedge fen, reed swamp and salt-marsh communities with an estuarine influence, most likely as a consequence of an increase in relative sea level rise (RSL). On the dryland, the decline of oak is suggestive of a large reduction in mixed deciduous woodland; the increase of a large array of herbaceous taxa including cereal pollen suggests that this decline was a consequence of woodland clearance for settlement and agricultural purposes, which took place from the Bronze Age onwards.

There are some significant differences between the relatively open environments indicated at the Alcatel-Lucent site, and those from Enderby Wharf, where a much stronger wetland woodland signal is recorded (Batchelor *et al.*, 2015a). These differences may reflect localised variations in environment and vegetation at the time the Peat was forming, or given the uncertainties regarding the chronology of the Alcatel-Lucent sequence, may indicated that the Peat is of a different age to that recorded at the Enderby Wharf site.

At the latter site, the analysis indicated that during the early stages of Peat formation (between 5450-5070 and 5290-4980 cal BP; middle Neolithic) the wetland environment was occupied by alder-carr swamp and sedge fen communities with areas of still or standing water, and potentially a limited tidal influence. Shortly after 5290-4980 to around 3390-3230 cal BP (middle Neolithic to Bronze Age) this vegetation community underwent a transition towards more mature and drier fen carr woodland dominated by alder, but may also have included hazel, ivy, elm, ash and yew. At this time the dryland environment was occupied by mixed deciduous woodland dominated by oak with lime, birch, hazel, elm and ash. Changes in the structure and composition of the dryland woodland are indicated from shortly after 5290-4980 to 3390-3230 cal BP as both lime and elm increased relative to oak. At the very top of the sequence around 3390-3320 cal BP, a reduction in fen woodland cover and an increase in herbaceous and aquatic taxa indicate a transition towards a wetter environment at the site. The timing of this event, in combination with elevated values of *Chenopodium* pollen, suggests this transition was caused by an increased saline influence which may correlate with that recorded in the upper part of the Alcatel-Lucent sequence.

Unlike the upper part of the Alcatel-Lucent sequence, no definitive indicators of human activity were recorded at Enderby Wharf, including around the time of trackway construction at 72-88 Bellot Street (Philp & Garrod, 1994; 3380 to 3500 cal BP) and the Garage Site, Bellot Street (Branch *et al.*, 2005; (3890-3680 to 3720-3570 cal BP). In addition, the near-contemporaneous Bronze Age decline of the wetland and dryland woodland (as recorded in sequences elsewhere in the Lower Thames Valley, including at Alcatel-Lucent) was not definitively recorded at Enderby Wharf.

Most likely this occurred just after 3390-3230 with the transition from Peat formation to the Upper Alluvium. This transition is considered largely to have been caused by estuarine inundation consequent of an increase in relative sea level rise (RSL); not only would this have caused flooding of the wetland woodland, but would also have caused the expansion of wetland onto areas of former dryland, and/or the saturation of dryland soils, thus leading the decline of dryland woodland. However, Bronze Age clearance taking place on the neighbouring dryland edge, is also likely increased both sediment and water runoff, contributing to flooding on the floodplain.

7. RECOMMENDATIONS

On the basis of the previous investigations conducted thus far, and the dissimilarities between the Alcatel-Lucent and Enderby Wharf sites, further environmental archaeological analysis of borehole QBH2 is recommended. This analysis should include (1) two additional radiocarbon dates, to resolve the age reversal recorded in the current radiocarbon dates and provide a more detailed chronological model for the environmental changes recorded; (2) analysis of up to 20 pollen samples to examine the changes in vegetation recorded at the site in more detail; (3) analysis of the waterlogged wood, to ascertain the composition of the wetland woodland; and (4) analysis of four diatom samples to examine the hydrological history of the site in more detail.

8. REFERENCES

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9. APPENDIX 1: OASIS