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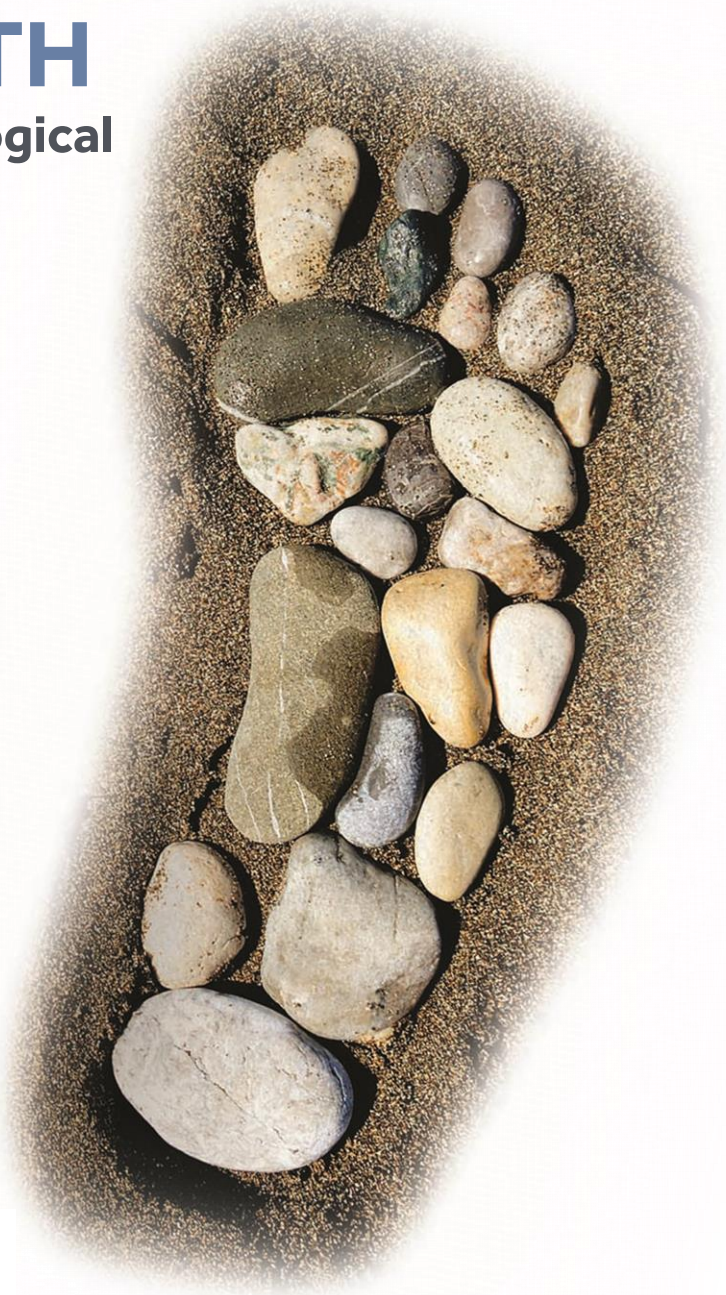
University of Reading

RAM BREWERY (PHASE 1), RAM STREET, LONDON BOROUGH OF WANDSWORTH

Environmental Archaeological Assessment Report



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1. INTRODUCTION

This report summarises the findings arising out of the geoarchaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth (National Grid Reference: TQ 256 747; Site Code: RBR14; Figure 1). This report refers to the work conducted in the area of the site outlined in Figure 2, referred to as Phase 1. Quaternary Scientific were commissioned by CgMs Consulting to undertake the geoarchaeological investigations. The site is located in the valley of the River Wandle, a right bank tributary of the tidal River Thames. It is about 600m upstream from the confluence with the Thames, the modern ground level lying at between *ca*. 5.5 and 4.5m OD. The British Geological Survey (BGS; 1:50,000 Sheet 270 South London 1998) shows the site as Made Ground overlying Alluvium, resting on London Clay bedrock.

The results of previous geoarchaeological deposit modelling at the site (Young, 2014) revealed a sequence of Wandle/Shepperton Gravel (deposited during the Late Devensian, 10-15,000 years before present), overlain by variable thicknesses (up to *ca*. 1.5m) of Holocene Alluvium within a possible palaeochannel associated with the River Wandle towards the middle and north of the site. Towards the east, west and south of the site, outside of the limits of the inferred palaeochannel, a sequence of Kempton Park Gravel (deposited during the Early to Middle Devensian (30-120,000 years before present) was overlain in places by thin horizons (generally less than 0.5m) of Holocene Alluvium. Within the palaeochannel the Gravel surface was recorded at between *ca*. 0.5 and 1.5m OD, whilst beyond the margins of the channel the Gravel rises to between 2.0 and 3.0m OD. This is consistent with the Gravel surfaces recorded *ca*. 250m to the south at the Garratt Lane site (Howe *et al*., 2002), where an undulating Gravel surface was recorded at *ca*. 3.6m OD in the centre and east of the site, falling to below 2.0m OD towards the west and indicative of a broadly north-south aligned palaeochannel. As might be expected, the Late Devensian Gravel surfaces recorded *ca*. 500m to the northwest at the Osiers Road (Green & Young, 2010) and Morganite sites (Branch *et*

al., 2007; see Figure 1) are lower (-0.40 and -0.81m OD respectively), but also demonstrate the presence of a north-south aligned channel cut down into the gravels of the Kempton Park Terrace.

Within the possible palaeochannel the Gravel is directly overlain in places by Peat or possible soil horizons, up to 0.7m thick and generally recorded at between 0.5 and 1.85m OD. The alluvial sequence at the Morganite site consisted of a sequence of silty sands overlying an upper Peat and slightly gravelly organic silts, which passed down into calcareous sands including remains of molluscs and ostracods, with a second, lower Peat horizon at the base of the sequence resting directly on the underlying Gravel. This sequence was dated from at least 4780-4420 to 1570-1410 cal BP, with age-depth modelling of the sequence suggesting that the Peat overlying the Gravel may be of Mesolithic date, whilst the upper Peat accumulated during the Bronze Age (Branch *et al*. 2007; Jarrett *et al*., 2010). In the deposit model report it was suggested that the Peat/soil horizons overlying the Gravel at the Ram Brewery site may be contemporaneous with the Mesolithic Peat at the Morganite site, or alternatively, on the basis of height OD, may be equivalent to the Bronze Age upper Peat recorded at the Morganite site between 0.84 and 0.19m OD.

Significantly, the peat and possible soil horizons recorded at the Ram Brewery 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. A programme of environmental archaeological assessment was therefore recommended, the aims of which were (1) to establish the age of the Peat recorded in borehole QBH3, and the possible soil in QBH4 (if possible); (2) to assess the palaeoenvironmental potential of the sequences; (3) to highlight any indications of nearby human activity, and (4) to provide recommendations for further analysis (if necessary).

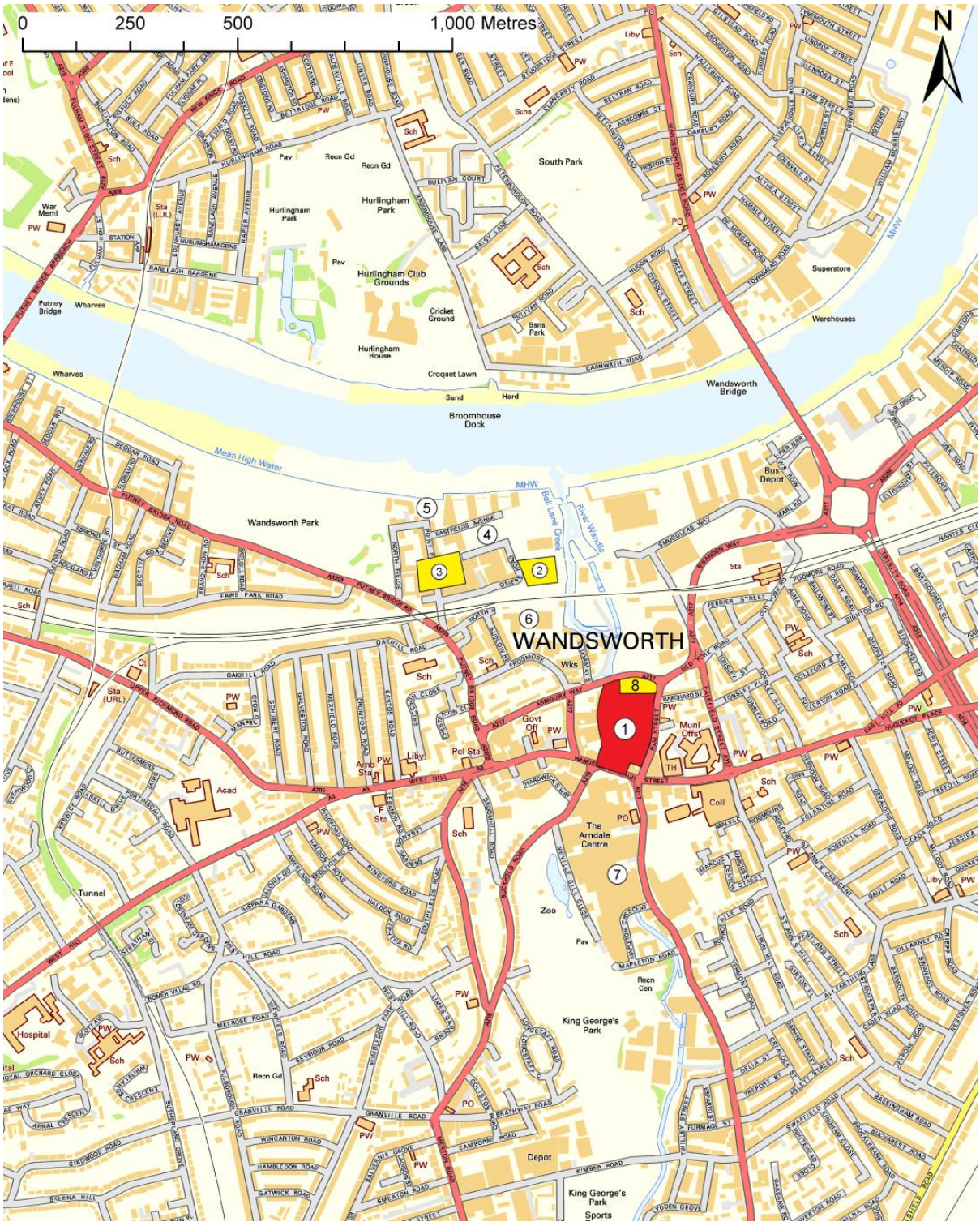

Figure 1: Location of the Ram Brewery (Phase 1) site, Ram Street, London Borough of Wandsworth (Site Code: RBR14) and other sites of geoarchaeological interest: (2) Osiers Estate (Green & Young, 2010); (3) Morganite Site (Branch *et al*., 2007); (4) Former Shell Oil Terminal (Perry & Skelton, 1995a); (5) Prospect Reach Foreshore (Perry & Skelton, 1995b); (6) Frogmore Depot (Spurr, 2004) (7) Garratt Lane (Howe *et al*., 2002) and (8) Ram Brewery – Phase 1 (MoLA, 2012). *Contains Ordnance Survey data © Crown copyright and database right [2012].*

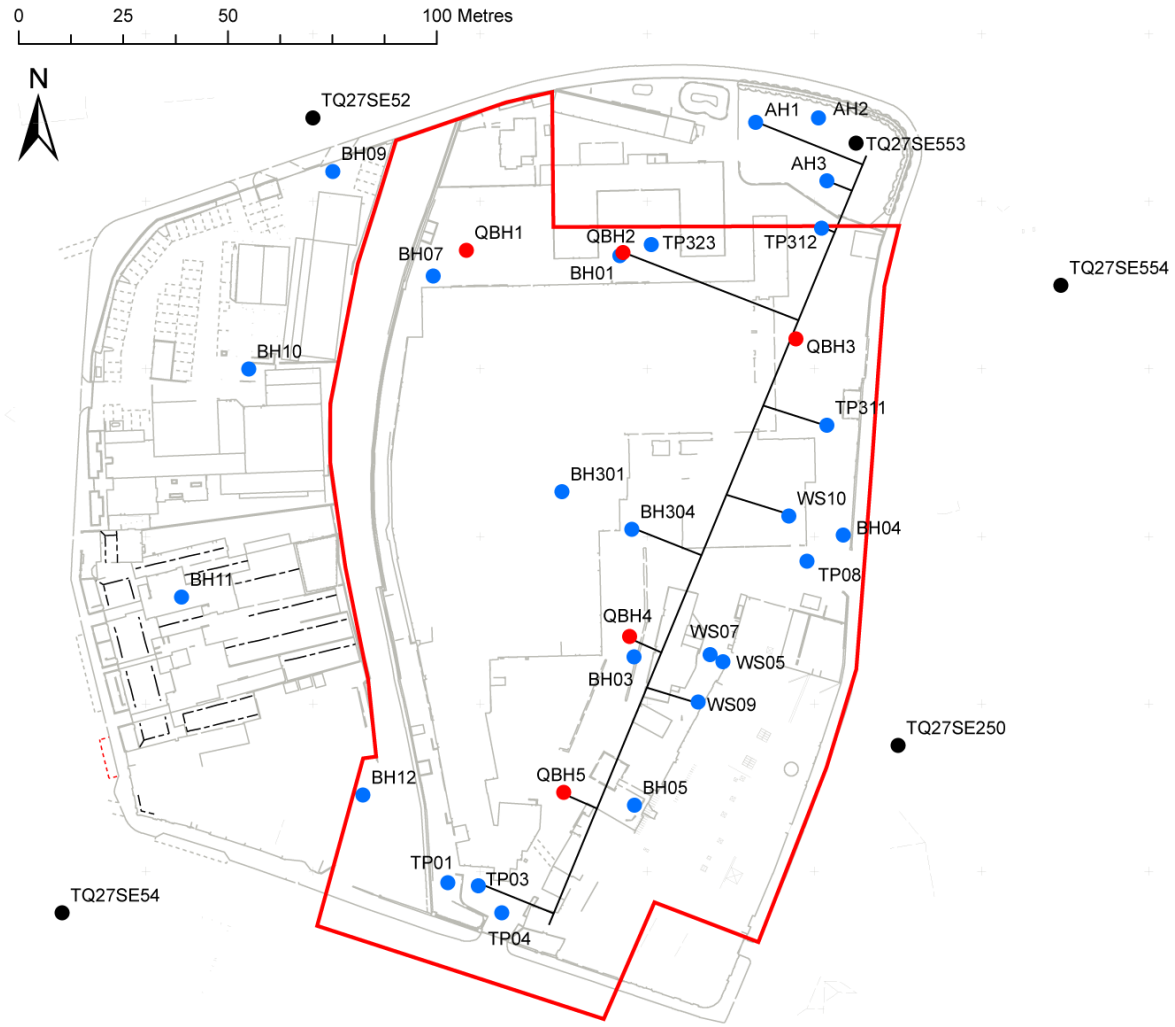

Figure 2: Location of the new Quest geoarchaeological boreholes (red) and existing geoarchaeological and geotechnical boreholes (blue), including existing BGS borehole records (black) at the Ram Brewery (Phase 1) site. *Contains Ordnance Survey data © Crown copyright and database right [2012].*

2. METHODS

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

Five geoarchaeological boreholes (boreholes QBH1 to QBH5) were put down at the site in August 2014 (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 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 6. The spatial attributes of the boreholes are displayed in Table 1 and in Figure 2.

The deposit model was based on a review of 35 borehole records, incorporating the five new Quest geoarchaeological boreholes, three Museum of London Archaeology Service (MoLA) geoarchaeological boreholes, 22 geotechnical boreholes or test pits (Concept/Peter Brett Associates) and five BGS borehole records (www.bgs.ac.uk/opengeoscience) within or around the site (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 Ram Brewery (Phase 1) site sedimentary units from the boreholes were classified into five groupings: (1) Gravel, (2) Lower Alluvium, (3) Peat, (4) Upper Alluvium and (5) Made Ground. Models of surface height (using a nearest neighbour routine) were generated for the Gravel, Peat and Upper Alluvium (Figures 5, 6 and 8). Thickness of the Peat (Figure 7), combined Alluvium (incorporating the Lower Alluvium, Peat and Upper Alluvium (Figure 9) and Made Ground (Figure 10) was also modelled (also using a nearest neighbour routine).

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 each data point (borehole) is equivalent to an area of 50m radius around each borehole. Although the boreholes are well distributed at the present site,

the boreholes are not uniformly distributed over the area of investigation and the reliability of the models is variable. This is particularly true of the western area of the site, where compared to the east relatively few borehole records are available. In general, reliability improves from the boundaries of the site, where edge effects adversely influence the reconstructions, towards the core area of the site where mutually supportive data are likely to be available from several adjacent boreholes.

Reliability is also affected by the quality of the stratigraphic records which in turn are affected by the nature of the sediments and/or their post-depositional disturbance during previous stages of land-use on the site. Quality is also affected where boreholes have been put down at different times and recorded using different descriptive terms and subject to differing technical constraints in terms of recorded detail including the exact levels of the stratigraphic boundaries. Of the records used in the deposit model, the cores from the geoarchaeological boreholes put down by Quaternary Scientific and MoLA 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 those records used in the deposit model, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth

Borehole	Easting	Northing	Elevation (m OD)
Quest geoarchaeological boreholes			
QBH1	525596.77	174828.41	4.50
QBH2	525634.00	174828.00	4.50
QBH3	525675.58	174807.17	4.30
QBH4	525635.76	174736.04	4.20
QBH5	525620.00	174698.82	4.50
Concept boreholes/test pits			
BH01	525633.90	174827.30	4.42
BH03	525636.80	174731.20	4.02
BH04	525686.90	174760.30	4.67
BH05	525636.90	174695.80	4.18
BH07	525588.80	174822.20	4.48
BH09	525564.80	174847.20	4.91
BH10	525544.60	174800.00	5.25
BH11	525528.60	174745.50	4.60
BH12	525572.00	174698.20	5.18
WS05	525658.10	174730.00	4.42
WS07	525655.00	174731.70	4.37
WS09	525652.20	174720.40	4.20
WS10	525673.90	174764.90	4.54
TP01	525592.30	174677.20	5.51
TP03	525599.60	174676.50	5.27
TP04	525605.20	174670.00	5.25
TP08	525678.20	174754.10	4.49
Peter Brett Associates test pits/boreholes			
TP311	525683.01	174786.58	4.37
TP312	525681.77	174833.65	4.35
TP323	525641.00	174829.71	4.46
BH301	525619.57	174770.72	4.53
BH304	525636.29	174761.70	4.38
BGS boreholes			
TQ27SE52	525560.00	174860.00	4.12
TQ27SE54	525500.00	174670.00	6.09
TQ27SE553	525690.00	174854.00	4.80
TQ27SE554	525739.00	174820.00	4.79
TQ27SE250	525700.00	174710.00	5.46
MoLA geoarchaeological boreholes			
AH1	525666.00	174859.00	5.04
AH2	525681.00	174860.00	4.95
AH3	525683.00	174845.00	4.84

Organic matter and calcium carbonate determinations

A total of 10 subsamples from borehole QBH3 and 11 from QBH4 were taken for determination of the organic matter and calcium carbonate ($CaCO_3$) content through these sequences (Tables 7 and 8; Figure 3). 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

One subsample of unidentified twig wood (<2-3 years old) was extracted from the base of the Peat horizon in borehole QBH3 for radiocarbon dating. The sample was 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 3 and in Table 9. Subsamples were extracted from the base of the soil horizon in borehole QBH4; however, in the absence of macrofossil remains suitable for dating, no samples were submitted to the radiocarbon dating facility.

Pollen assessment

Six subsamples from borehole QBH3 and six from QBH4 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) (Tables 10 and 11).

Diatom assessment

Four subsamples from borehole QBH3 were extracted for the assessment of diatoms. The diatom extraction involved the following procedures (Battarbee *et al.,* 2001): (1) treatment of the sub-sample (0.2g) with Hydrogen peroxide (30%) to remove organic material and Hydrochloric acid (50%) to remove remaining carbonates; (2) centrifuging the sub-sample at 1200 for 5 minutes and

washing with distilled water (4 washes); (3) removal of clay from the sub-samples in the last wash by adding a few drops of Ammonia (1%); (4) two slides prepared, each of a different concentration of the cleaned solution, were fixed in mounting medium of suitable refractive index for diatoms (Naphrax). Duplicate slides each having two coverslips were made from each sample and fixed in Naphrax for diatom microscopy. The coverslip with the most suitable concentration of the sample preparation was selected for diatom evaluation. A large area of this coverslip was scanned for diatoms at magnifications of x400 and x1000 under phase contrast illumination using a Leica microscope. The results are displayed in Table 12.

Macrofossil assessment

A total of seven small bulk samples, including three from borehole QBH3 and four from QBH4, 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 (Tables 13 and 14). 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 15).

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, 2014). The results of these investigations are shown in Tables 2 to 5, with the resultant deposit models shown in Figures 4 to 11. The results of the lithostratigraphic descriptions, organic matter determinations and radiocarbon dating for boreholes QBH3 and QBH4 are displayed in Figure 3.

The previous geoarchaeological investigations (Young, 2014) revealed that the basal unit at the site is a horizon of sand and gravel, which across the majority of the site lies at between *ca*. 0.5 and 3.0m OD. The surface of the sand and gravel is generally lower towards the middle of the site, where it is recorded below *ca*. 2.0m OD, and from where it rises to both the west and east (see Figures 4 and 6) to between *ca*. 2.0 and 3.0m OD. Towards the middle of the site the surface of the sand and gravel is recorded at 0.44 (AH1), 0.95 (AH2), 0.52 (BH01) and 1.32m OD (QBH4 and BH03); to the east it rises to 3.09m OD in BGS borehole TQ27SE554 and to the west to 2.75m OD in TQ27SE52. The depression in the Gravel surface appears to be broadly linear, aligned approximately northeast-southwest, and may be indicative of a former channel associated with the River Wandle. Where the sand and gravel surface lies below *ca*. 2.0m OD it is probably equivalent to the Wandle Gravel of Gibbard (1985) (equivalent to the Shepperton Gravel of the Thames valley), deposited during the Late Devensian (10-15,000 years before present) within a high energy braided river environment. Towards the western, eastern and southern extents of the site, where the gravel rises above *ca*. 2.0m OD, it is most likely equivalent to the Kempton Park Gravel, deposited during the Early to Middle Devensian (30-120,000 years before present).

Within the possible channel feature and towards the north of the site, the Gravel is overlain by very organic Alluvium or Peat in three boreholes, between 0.7 (AH1) and 0.25m thick (QBH3; see Figure 8) and generally lying at between 0.5 and 1.85m OD. In borehole QBH4, directly overlying the Gravel, an organic clayey silt with indications of soil formation is recorded between 1.51 and 1.32m OD; a similar possible soil horizon was recorded in borehole AH2 between 0.95 and 1.10m OD (MoLA, 2014). Peat was also recorded in borehole AH3 at a higher elevation of between 2.39 and 2.64m OD (MoLA, 2014). Significantly, the highly organic Alluvium and Peat horizons are indicative of a transition towards a semi-terrestrial environment, supporting the growth of wetland vegetation and which may have been utilised by prehistoric people. Radiocarbon dating of the base of the Peat in borehole QBH3 indicates that accumulation began during the Roman period (1860 to 1700 cal BP), whilst the results of the loss-on-ignition analysis (Figure 3 and Table 7) indicate that the Peat horizon is up to 20% organic, suggesting that frequent flood events brought mineral-rich material on to the Peat surface during its accumulation. Where possible soil horizons are identified, these are indicative of drier, more terrestrial environments which again may have been utilised by prehistoric people. The results of the loss-on-ignition analysis of the possible soil horizon in borehole QBH4 (Figure 3 and Table 8) indicate that it is between *ca*. 15 and 30% organic.

In boreholes QBH4, AH1, AH2 and AH3 (towards the north of the site) the organic horizons described above are overlain by tufa-rich deposits, up to 0.33m thick (QBH4) and recorded at between 1.10 and 1.84m OD. The tufa is of varying grain size (silt to gravel) and is indicative of the accumulation of calcareous sediment in a low energy and probably shallow aquatic environment. The results of the calcium carbonate content analysis (see Figure 3 and Tables 9 and 10) demonstrates that these horizons are moderately calcareous-rich (up to *ca.*15%) in borehole QBH4, whilst in borehole QBH3 the Alluvium (underlying the Peat in this borehole) is composed of up to *ca*. 20% calcium carbonate, whilst values are generally less than 5% overlying the Peat.

The organic horizons (Peat/possible soils) and tufa-rich deposits appear to be confined to the northern area of the site, within the possible channel feature. Where present, they are overlain by a horizon of silty and clayey Alluvium, which in places is sandy and contains detrital organic material (between *ca*. 3 and 18% organic; see Figure 3 and Tables 7 and 8). Elsewhere, this horizon directly overlies the Gravel in selected boreholes, but is more common within the area of the possible channel feature. This horizon is considered to represent the Upper Alluvium, indicative of sediment accumulation on the floodplain at a distance from any active channels but with occasional input of coarser material during higher-energy flood events. The surface of the Upper Alluvium generally lies at between *ca*. 2.0 and 3.0m OD (Figure 9). In general the total thickness of the Holocene Alluvium (incorporating the Peat/organic horizons and alluvial units) is greatest within the possible channel feature and towards the north of the site, where it is generally greater than 1.0m thick (Figure 10). In places, predominantly to the west of the possible channel feature and towards the south of the site Made Ground directly overlies the Gravel, and Holocene Alluvium is absent. In such instances the recorded depth of the Gravel can only be used as an indication of the minimum elevation of the Gravel surface due to possible truncation. In general, the Made Ground is thicker towards the west and south of the site (Figure 11), where it is recorded at up to 3.0m thick in BH301, 3.5m thick in BH12 and 2.9m thick in BH07. The modern surface elevation of the site is relatively even, generally lying at between 4.5 and 5.0m OD.

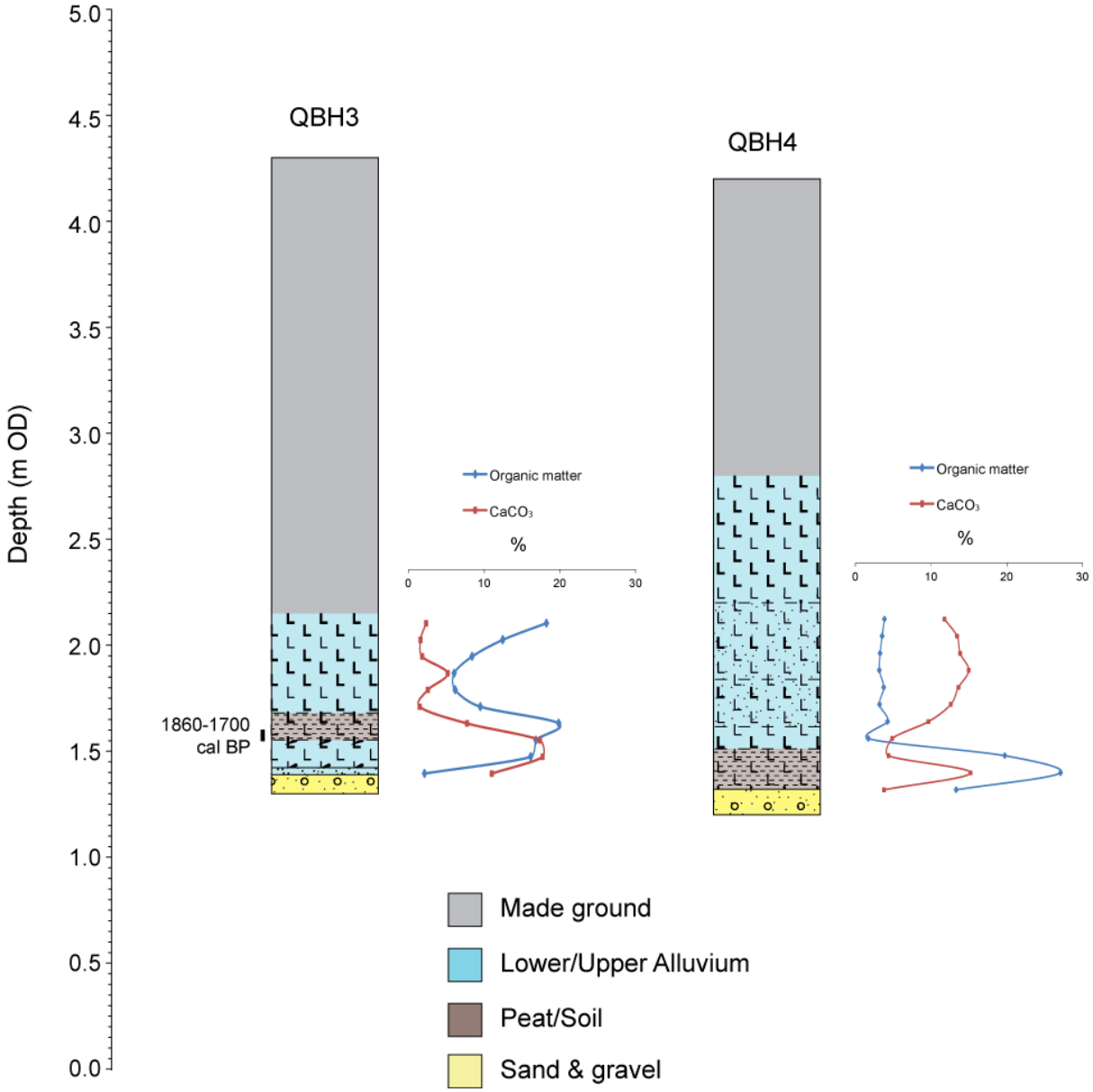

Figure 3: Results of the lithostratigraphic descriptions, radiocarbon dating, organic content and calcium carbonate determinations for boreholes QBH3 and QBH4 at Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

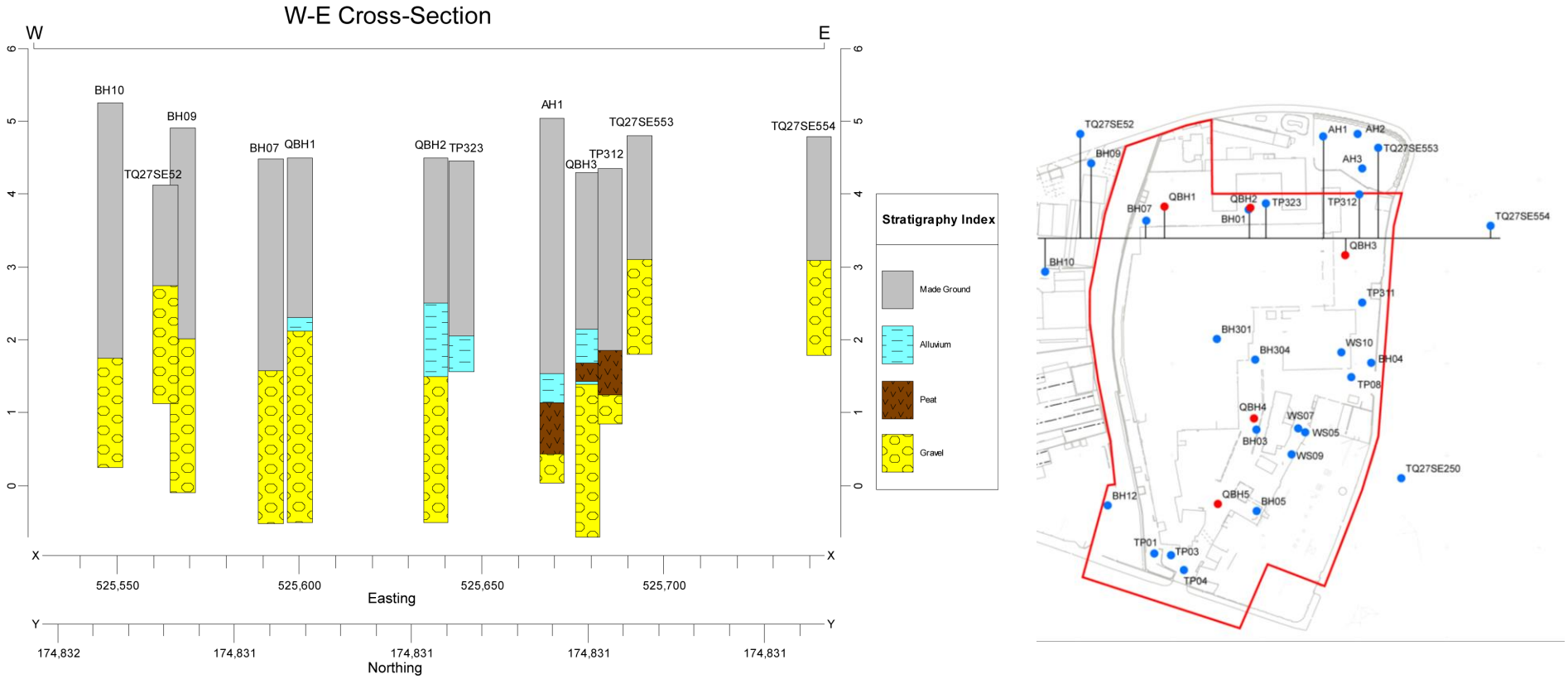

Figure 4: West-East transect of selected boreholes across the site at Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth

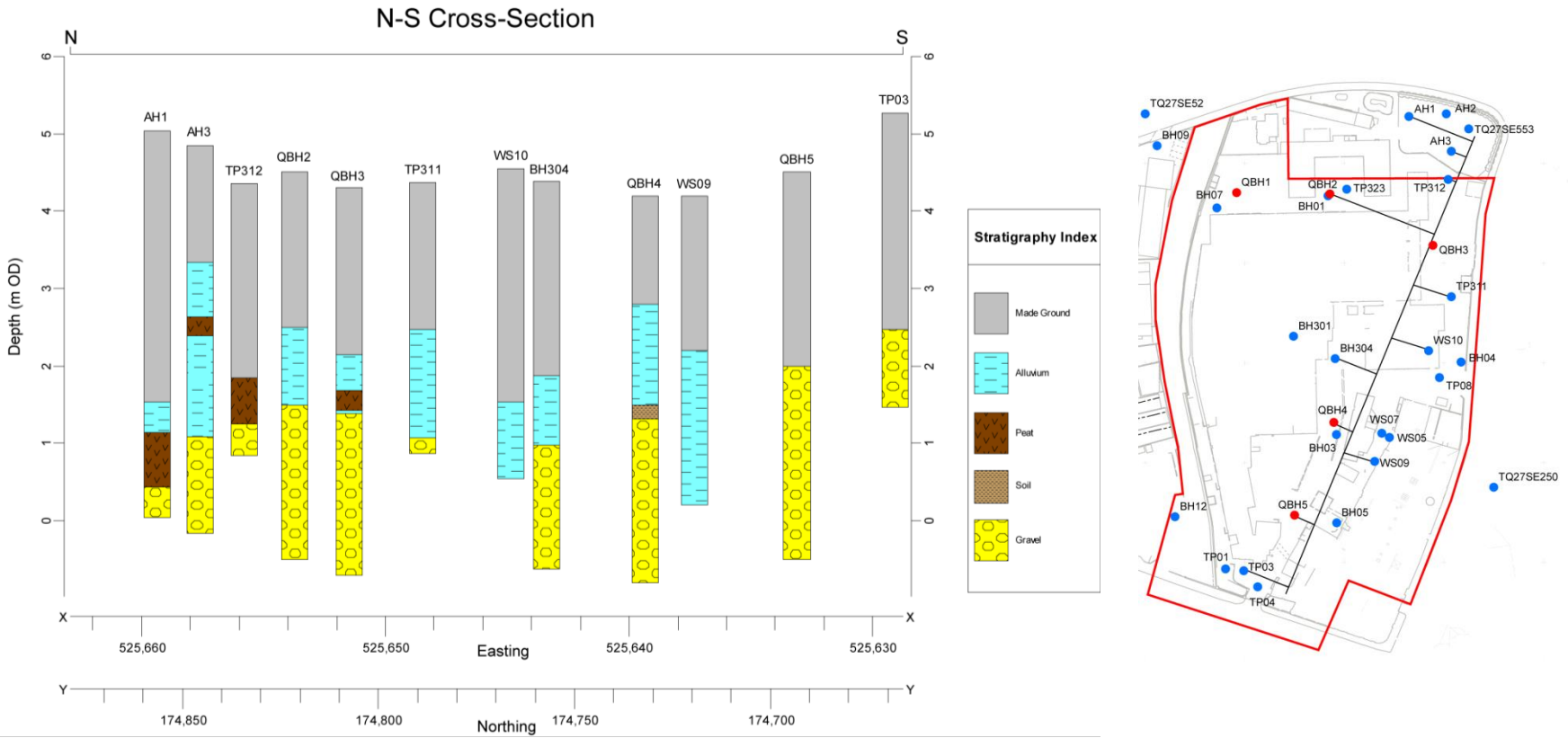

Figure 5: North-South transect of selected boreholes across the site at Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth

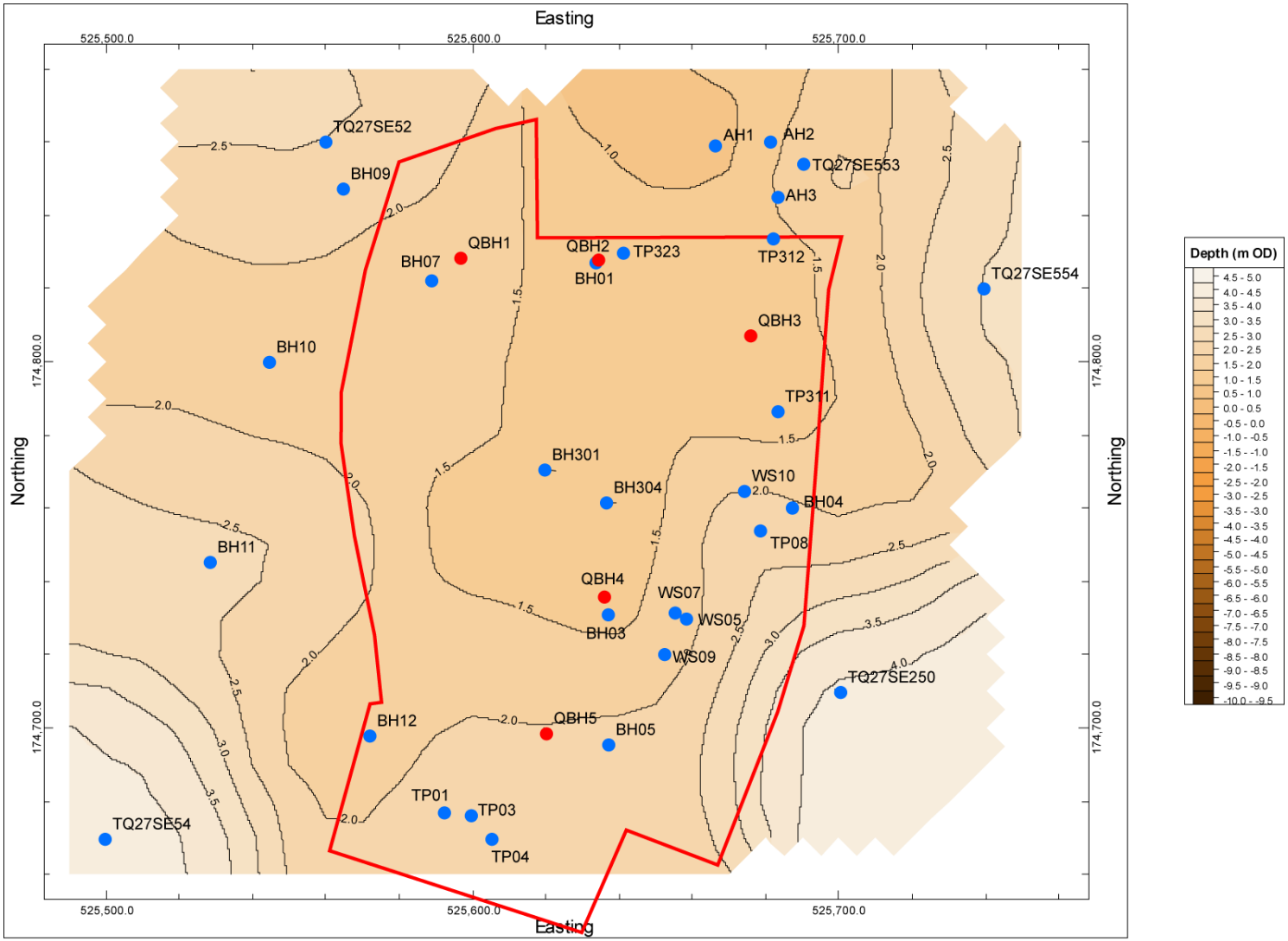

Figure 6: Top of the Gravel (m OD) (site outline in red)

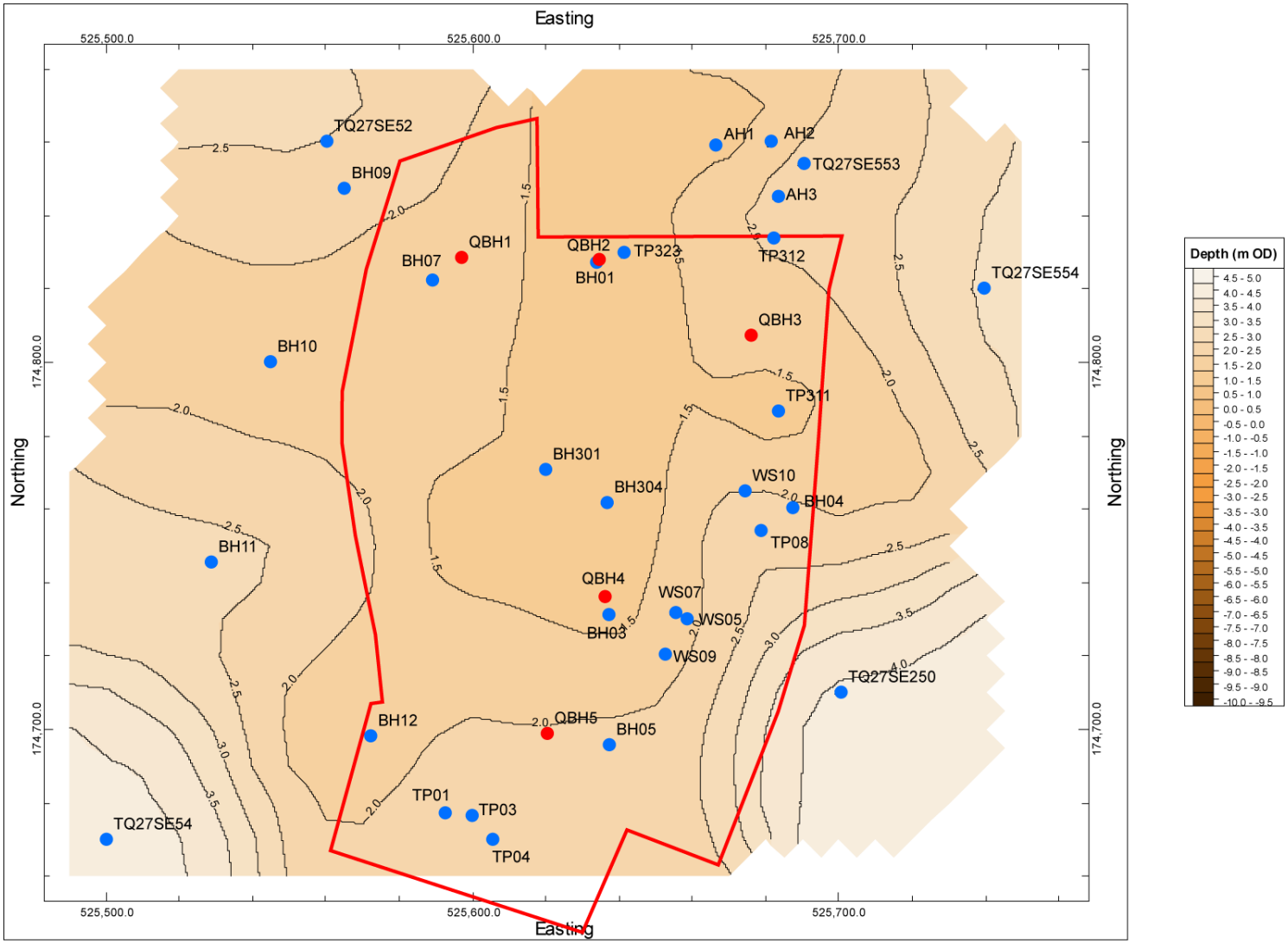

Figure 7: Top of the Peat (m) (site outline in red)

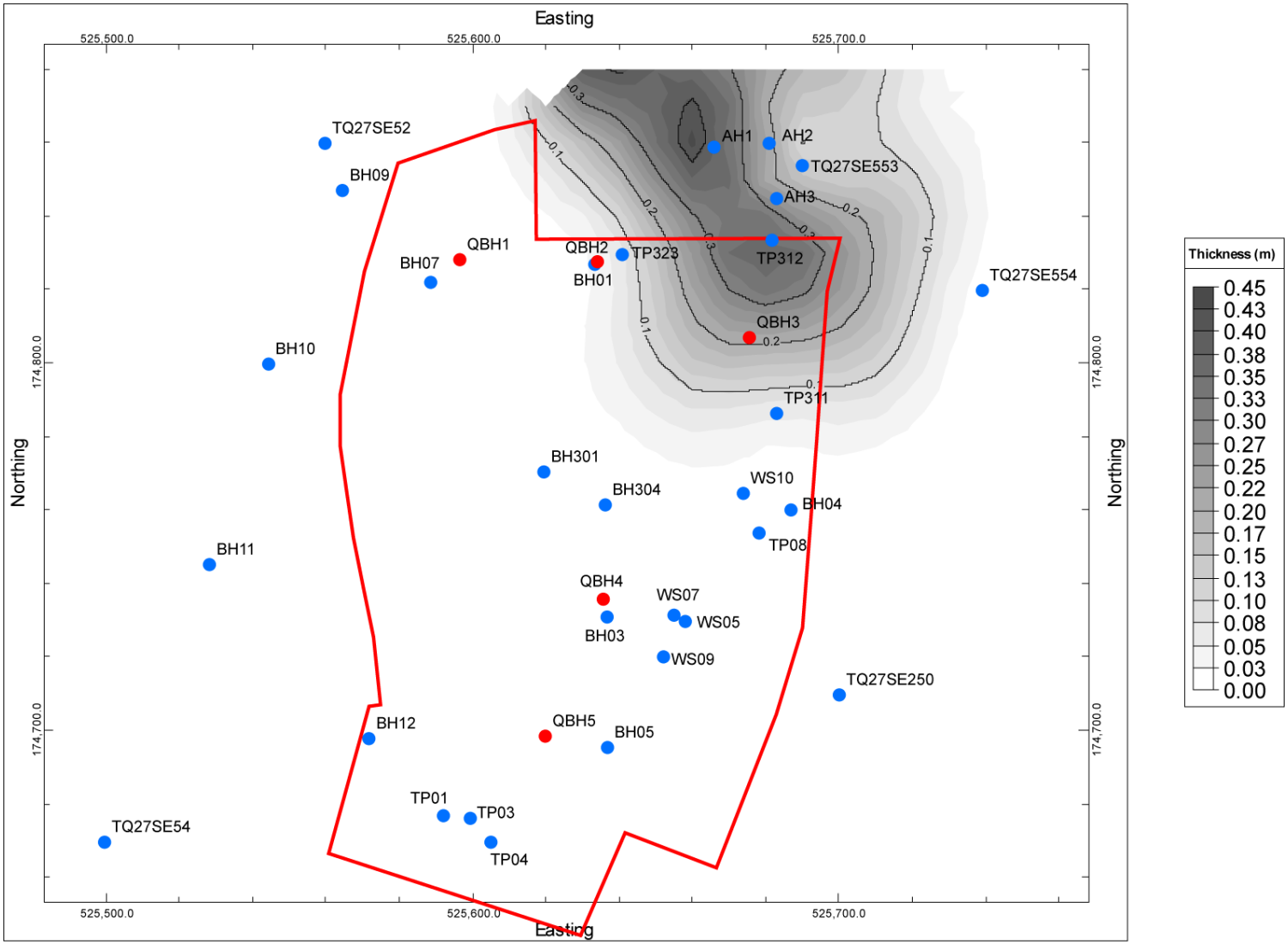

Figure 8: Thickness of the Peat (m) (site outline in red)

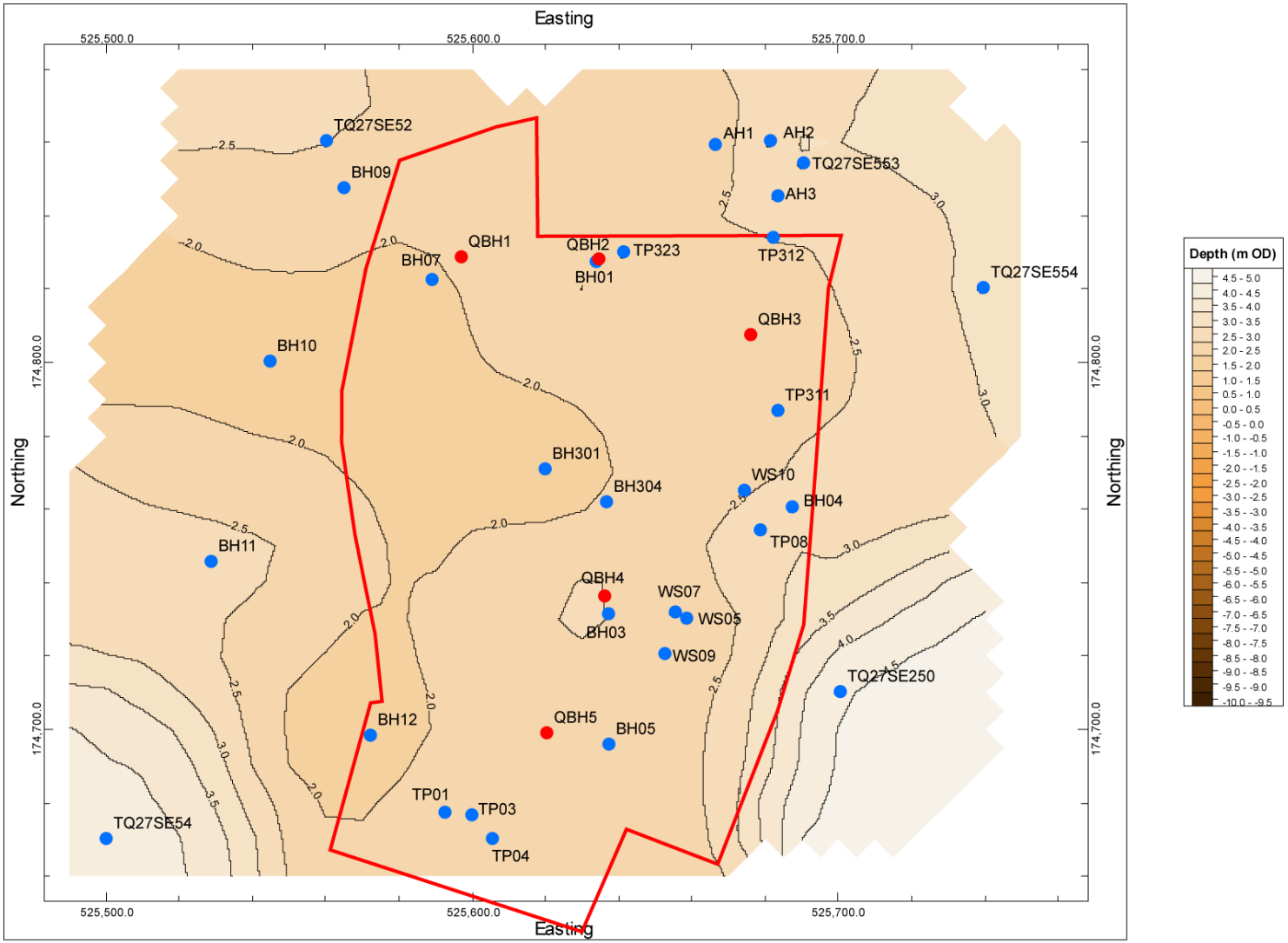

Figure 9: Top of the Upper Alluvium/base of the Made Ground (m OD) (site outline in red)

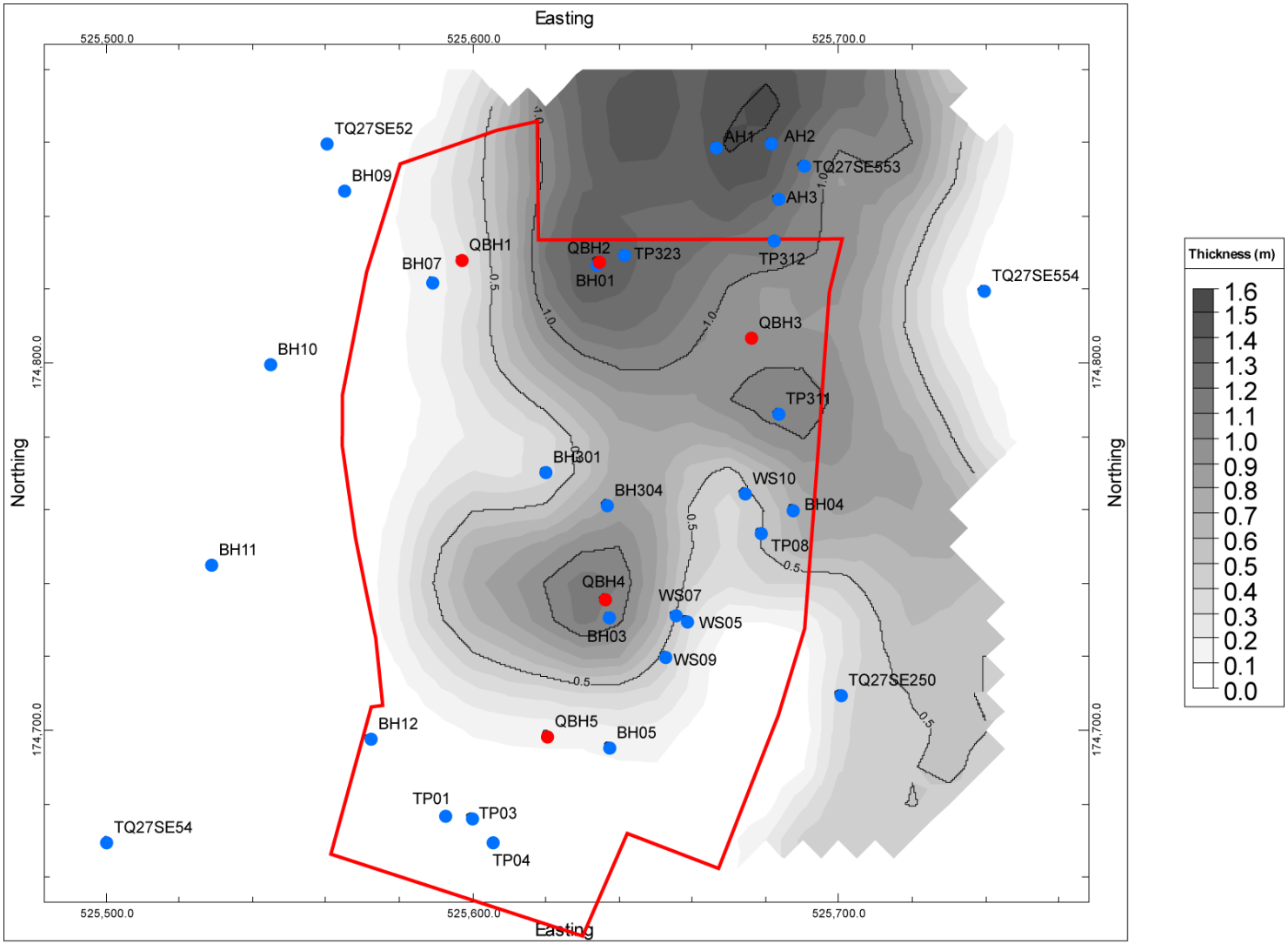

Figure 10: Thickness of the Holocene Alluvium (m) (site outline in red)

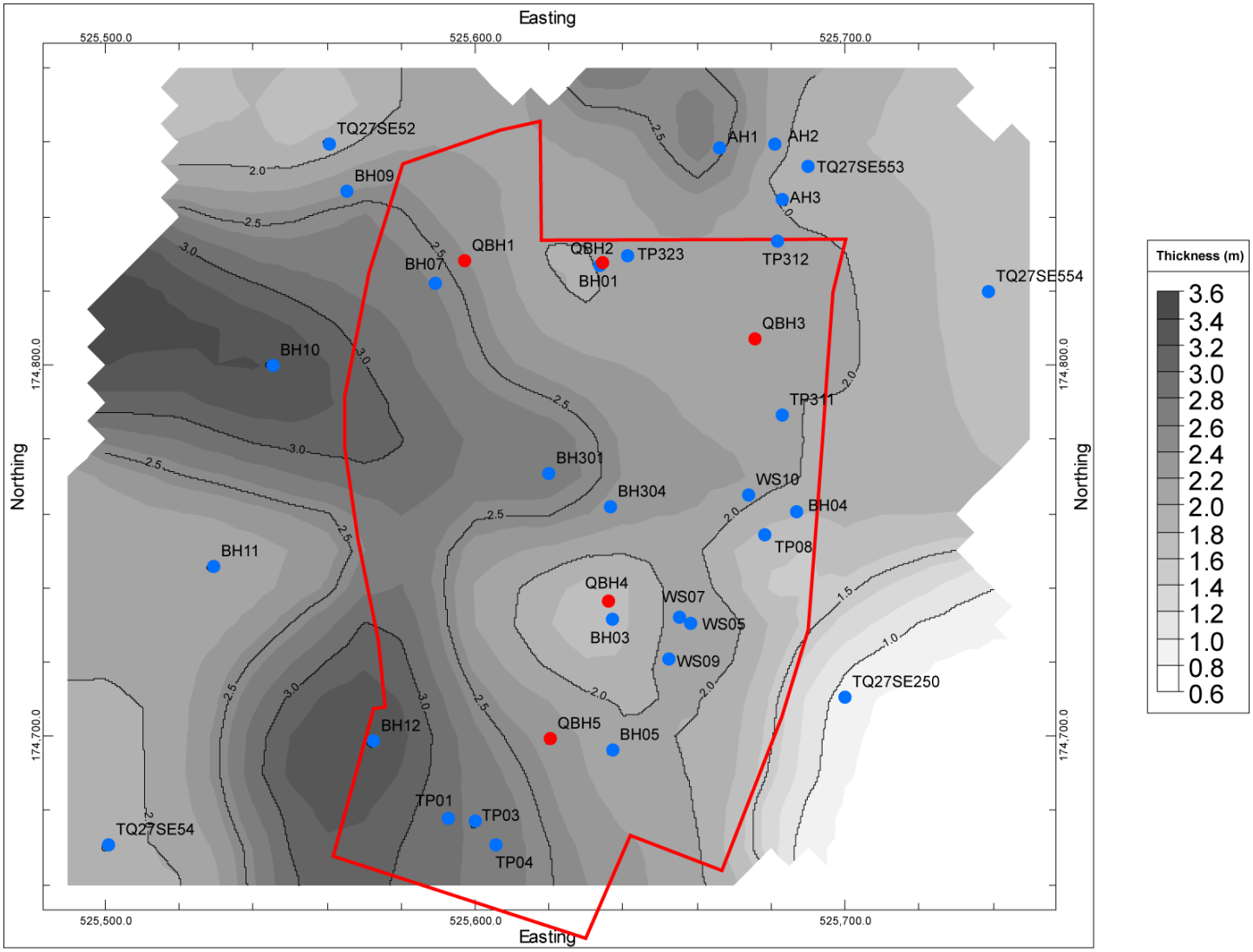

Figure 11: Thickness of the Made Ground (m) (site outline in red)

Table 2: Lithostratigraphic description of borehole QBH1, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Depth (m bgs)	Description
4.50 to 2.44	0.00 to 2.06	Made Ground
2.44 to 2.30	2.06 to 2.20	Made Ground/Redeposited Alluvium
2.30 to 2.12	2.20 to 2.38	7.5YR 3/2; As1 Ag1 Sh1 Ga1 Gg+; dark brown organic clay, silt and sand with occasional gravel clasts. Sharp contact in to:
2.12 to 1.95	2.38 to 2.55	2.5Y 3/2; Gg2 Ga1 Ag1; dark olive brown silty sandy gravel. Diffuse contact in to:
1.95 to 1.50	2.55 to 3.00	Gg3 Ga1; sandy gravel. Flint clasts sub-angular to sub-rounded, up to 30mm in diameter.

Table 3: Lithostratigraphic description of borehole QBH2, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Depth (m bgs)	Description
4.50 to 2.50	0.00 to 2.00	Made Ground
2.50 to 2.15	2.00 to 2.35	7.5YR 4/1; Ag2 As1 Ga1 Gg+; dark grey sandy clayey silt with occasional gravel clasts and Mollusca. Diffuse contact in to:
2.15 to 1.82	2.35 to 2.68	7.5YR 4/1; Ga2 Ag2 As+; dark grey sand and silt with a trace of clay. Frequent Mollusca. Diffuse contact in to:
1.82 to 1.50	2.68 to 3.00	7.5YR 3/2; Ga2 As1 Ag1; dark brown silty clayey sand with fine horizontal bedding. Occasional Mollusca.
1.50 to 0.50	3.00 to 4.00	Gg3 Ga1 Ag+; sandy gravel with a trace of silt. Flint clasts sub-angular to sub-rounded, up to 50mm in diameter.

Table 4: Lithostratigraphic description of borehole QBH3, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Depth (m bgs)	Description
4.30 to 2.90	0.00 to 1.40	Made Ground
2.90 to 2.15	1.40 to 2.15	Made Ground/redeposited Alluvium
2.15 to 1.68	2.15 to 2.62	2.5Y 3/1; Ag2 As2 Dh+; very dark grey silt and clay with a trace of detrital herbaceous material. Occasional Mollusca; frequent vertical roots. Diffuse contact in to:
1.68 to 1.55	2.62 to 2.75	7.5YR 3/2; Sh2 Ag1 As1 Ga+ Th+; humo. 2/3; dark brown humified very organic silt and clay with traces of sand and herbaceous material. Occasional Mollusca fragments. Diffuse contact in to:
1.55 to 1.43	2.75 to 2.87	7.5YR 4/2; Ag2 As1 Dh1 Ga+ Sh+; brown clayey silt with detrital herbaceous material and traces of sand and organic matter. Sharp contact in to:
1.43 to 1.39	2.87 to 2.91	2.5Y 3/2; Ga3 Ag1; very dark greyish brown silty sand. Sharp contact in to:
1.39 to 1.30	2.91 to 3.00	Gg3 Ga1; sandy gravel. Flint clasts sub-angular to well-rounded, up to 20mm in diameter.

Table 5: Lithostratigraphic description of borehole QBH4, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Depth (m bgs)	Description
4.20 to 2.80	0.00 to 1.40	Made Ground
2.80 to 2.20	1.40 to 2.00	7.5YR 4/1; As2 Ag2 Ga+; dark grey silt and clay with a trace of sand and frequent Mollusca.
2.20 to 1.84	2.00 to 2.36	7.5YR 4/1; Ag2 As1 Ga1; dark grey sandy clayey silt with occasional Mollusca fragments. Diffuse contact in to:
1.84 to 1.61	2.36 to 2.59	7.5YR 3/1; As2 Ag1 Ga1 Gg+; very dark grey sandy silty clay with occasional gravel clasts and tufa fragments. Diffuse contact in to:
1.61 to 1.51	2.59 to 2.69	7.5YR 2.5/1; As2 Ag1 Ga1 Gg+; black sandy silty clay with occasional gravel clasts. Frequent tufa fragments up to 20mm in diameter. Diffuse contact in to:

1.51 to 1.32	2.69 to 2.88	7.5YR 2.5/1; Ag2 As1 Sh1 Ga+ Dl+; black organic clayey silt with traces of sand and detrital wood. Possible soil horizonation. Sharp contact in to:
1.32 to 1.20	2.88 to 3.00	Gg3 Ga1; sandy gravel. Flint clasts sub-angular to well-rounded, up to 40mm in diameter.

Table 6: Lithostratigraphic description of borehole QBH5, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Depth (m bgs)	Description
4.50 to 2.90	0.00 to 1.60	Made Ground
2.90 to 1.99	1.60 to 2.51	Made Ground/redeposited Alluvium
1.99 to 1.90	2.51 to 2.60	Gg3 Ga1; sandy gravel. Flint clasts sub-angular to well-rounded, up to 30mm in diameter.

Table 7: Results of the borehole QBH3 organic matter determinations, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)		Organic matter content (%)
From	To	
2.11	2.12	18.06
2.03	2.04	12.31
1.95	1.96	8.28
1.87	1.88	5.91
1.79	1.8	6.05
1.71	1.72	9.36
1.63	1.64	19.69
1.55	1.56	16.68
1.47	1.48	15.98
1.39	1.4	2.00

Table 8: Results of the borehole QBH4 organic matter determinations, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)		Organic matter content (%)
From	To	
2.12	2.13	3.90
2.04	2.05	3.59
1.96	1.97	3.33
1.88	1.89	3.24
1.8	1.81	3.80
1.72	1.73	3.26
1.64	1.65	4.32
1.56	1.57	1.77
1.48	1.49	19.66
1.4	1.41	26.95
1.32	1.33	13.29

Table 9: Results of the borehole QBH3 calcium carbonate content determinations, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)		Organic matter content (%)
From	To	
2.11	2.12	2.21
2.03	2.04	1.47
1.95	1.96	1.70
1.87	1.88	5.04
1.79	1.8	2.43
1.71	1.72	1.36
1.63	1.64	7.60
1.55	1.56	17.18
1.47	1.48	17.55
1.39	1.4	10.85

Table 10: Results of the borehole QBH4 calcium carbonate content determinations, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)		$CaCO_3$ content (%)
From	To	
2.12	2.13	11.75
2.04	2.05	13.40
1.96	1.97	13.80
1.88	1.89	14.93
1.8	1.81	13.58
1.72	1.73	12.57
1.64	1.65	9.67
1.56	1.57	4.89
1.48	1.49	4.42
1.4	1.41	15.17
1.32	1.33	3.84

Table 11: Results of the borehole QBH3 radiocarbon dating, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

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 419479	Twig wood; base of Peat	1.60 to 1.55	1830±30 BP	90 to 250 cal AD (1860 to 1700 cal BP)	-26.7

4. RESULTS AND INTERPRETATION OF THE POLLEN ASSESSMENT

QBH3

The results of the assessment indicate a high concentration and preservation of remains in four of the samples from QBH3; the remaining two samples contain a low to moderate concentration and preservation of remains. All six samples contain a similar assemblage, characterised by high values of herbaceous taxa dominated by Cyperaceae (sedges), Lactuceae (dandelions) and Poaceae (grasses) with sporadic occurrences of *Plantago* type (plantain), Asteraceae (daisies), *Cirsium* type (thistles), *Centaurea nigra* (black knapweed), *Ranunculus* type (e.g. buttercup), Apiaceae (carrot family) and *Cereale* type (e.g. barley). Aquatics *Typha latifolia* (bulrush) and *Sparganium* type (bur-reed) were also commonly recorded towards the base of the sequence. Tree and shrub values were generally low including most commonly, *Quercus* (oak) and *Corylus* type (e.g. hazel). Spores were near absent.

This assemblage is indicative of an open environment. The presence of sedges, grasses, and aquatic taxa are suggestive of a damp environment, most likely growing in a wetland environment, possibly on the margins of a former channel. The combined presence of grasses, goosefoot, black knapweed, thistles and plantain, however, is indicative of an anthropogenically disturbed environment. Furthermore, the presence of cereal pollen may suggest nearby cultivation and/or crop processing. These results are consistent with a late prehistoric/historic age for the sequence.

QBH4

The results of the assessment indicate a poor to moderate concentration and preservation of remains in the majority of samples; only one sample (1.48m OD) contains a high concentration of remains. Those samples with a sufficiently high concentration of remains all indicate the dominance of *Pinus* (pine), with Cyperaceae (sedges). Sporadically recorded taxa include Poaceae (grasses), Asteraceae (daisies), Lactuceae (dandelions), *Quercus* (oak), *Filicales* (ferns) and aquatics. Whilst of limited diversity, this assemblage is indicative of the localised growth of pine woodland with a ground flora dominated by sedges. No definitive evidence of anthropogenic activity is recorded. This assemblage differs substantially from that recorded in QBH3, and is characteristic of the cold climatic conditions of the early Mesolithic (early Holocene).

Table 12: Results of the pollen assessment from QBH3, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

	Depth (m OD)	2.03	1.87	1.71	1.63	1.55	1.47
Latin name	Common name						
Trees							
Alnus	alder					3	
Quercus	oak			1	1	3	2
Pinus	pine				2		
Betula	birch				1		
Shrubs							
Corylus type	e.g. hazel			1	3	4	3
Herbs							
Cyperaceae	sedge family	6	6	15	8	8	6
Poaceae	grass family	1		5	14	10	16
Cereale type	e.g. barley				1	1	1
Lactuceae	dandelion family	4	13	11	7	5	4
Asteraceae	daisy family				1		2
Cirsium type	thistle					2	
Caryophyllaceae	pink family				1		
Chenopodium type	goosefoot family			1			
Centaurea nigra	black knapweed	1				2	1
Apiaceae	carrot family					1	1
Plantago lanceolata	ribwort plantain				2	2	7
Ranunculus type	e.g. buttercup				3	4	
Sinapis type	e.g. charlock					1	
Aquatics							
Typha latifolia	bulrush				4	6	3
Sparganium type	bur-reed					1	1
Spores							
Filicales	ferns				1		
Pteridium aquilinum	bracken				1		
Polypodium vulgare	polypody			1			
Unidentifiable							
Total Land Pollen (grains counted)		12	19	34	44	46	44
Concentration*		2	3	5	5	5	5
Preservation**		3	3	3	3-4	3-4	3-4
Microcharcoal Concentration***		2	2	2	2	1	1
Suitable for analysis		NO	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*

Table 13: Results of the pollen assessment from QBH4, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth

	Depth (m OD)	2.04	1.80	1.56	1.48	1.40	1.32
Latin name	Common name						
Trees							
Quercus	oak						1
Pinus	pine			16	23	11	5
Shrubs							
Corylus type	e.g. hazel				1	2	
Herbs							
Cyperaceae	sedge family	1	1	2	14	2	1
Poaceae	grass family			1	3		1
Asteraceae	daisy family			1	2		
Lactuceae	dandelion family		3	1			
Aquatics							
Typha latifolia	bur-reed				1		
Sparganium type	bur-reed				1		
Spores							
Filicales	ferns			4	5	2	
Polypodium vulgare	polypody						1
Unidentifiable							
Total Land Pollen (grains counted)		1	1	21	44	15	8
Concentration*		1	1	2	5	2-3	2
Preservation**		1	1	2-3	3	4	3
Microcharcoal Concentration***		2	1	2	2-3	2-3	1
Suitable for analysis		NO	NO	YES	YES	YES	NO

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 DIATOM ASSESSMENT

Four subsamples were extracted from borehole QBH3 for the assessment of diatoms (Table 14). Diatoms were only recorded in low concentrations in one sample from QBH3. A number of factors influence diatom preservation, and it is probable that in the sediments examined here diatom concentrations were always low and that post-depositional destruction of the frustules has occurred due to drying-out, abrasion and possibly unfavourable chemical conditions. Dissolution of the diatom silica, for example, can occur as a response to the ambient dissolved silica concentration, the pH in open water, and the interstitial water in sediments. Using both fossil and modern diatoms, these and other environmental factors have been shown to affect the quality of preservation of assemblages. On the basis of the results of this assessment no further analysis is recommended.

Table 14: Results of the diatom assessment from QBH3, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Diatom concentration	Quality of preservation	Diversity
1.72 to 1.71	0	-	-
1.68 to 1.67	0	-	-
1.56 to 1.55	1	3	-
1.52 to 1.51	0	-	-

Key:
**Concentration: 0 = 0, 1 =1-75, 2 = 76-150, 3 =151-225, 4 = 226-300, 5 =300+ frustules per slide*
***Preservation: 0 = absent; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = excellent*

6. RESULTS AND INTERPRETATION OF THE MACROFOSSIL ASSESSMENT

A total of three small bulk samples from borehole QBH3 and four from QBH4 were extracted for the recovery of macrofossil remains including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca (Tables 15 and 16). The samples were focussed on the Peat horizon in borehole QBH3 and the possible soil horizon in QBH4.

The results of the macrofossil rapid assessment indicate that waterlogged wood was present in low concentrations in one sample from borehole QBH3 (1.60 to 1.55m OD) and two samples from QBH4 (1.42 to 1.37 and 1.37 to 1.32m OD). Waterlogged seeds were present in low concentrations all three samples from borehole QBH3, but were absent in the four samples from QBH4. Insects were recorded in two samples from borehole QBH3 (1.65 to 1.60 and 1.60 to 1.55m OD), but were absent from 1.68 to 1.65m OD in QBH3 and in the four samples from QBH4. No charred plant remains, Mollusca or bone were recorded during the assessment. The three samples from borehole QBH3 in which waterlogged seeds were recorded underwent a more detailed assessment (Table 17). The seed assemblage included *Apium nodiflorum* (fool's water-cress), *Betula* sp. (birch), *Ranunculus repens* (creeping buttercup), cf. *Myosotis* sp. (forget-me-not), cf. *Eleocharis* sp. (spikerush) and cf. *Ranunculus fluitans* (river water crowfoot). Although limited, the range of taxa recorded is typical of a damp, generally open environment dominated by herbaceous taxa. The presence of the aquatic taxon river water crowfoot is indicative of flowing water nearby, whilst birch may have been growing nearby on the wetland or dryland.

Table 15: Results of the macrofossil assessment of borehole QBH3, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

				Charred					Waterlogged		Mollusca		Bone			
Depth (m OD)	Volume sampled (l)	Volume processed (l)	Fraction	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Chaff	Wood	Seeds	Whole	Fragments	Large	Small	Fragments	Insects
1.68 to 1.65	0.025	0.025	>300µm	-	-	-	-	-	-	1	-	-	-	-	-	-
1.65 to 1.60	0.025	0.025	>300µm	-	-	-	-	-	-	1	-	-	-	-	-	1
1.60 to 1.55	0.025	0.025	>300µm	-	-	-	-	-	1	1	-	-	-	-	-	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 16: Results of the macrofossil assessment of borehole QBH4, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

				Charred					Waterlogged		Mollusca		Bone			
Depth (m OD)	Volume sampled (l)	Volume processed (l)	Fraction	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Chaff	Wood	Seeds	Whole	Fragments	Large	Small	Fragments	Insects
1.51 to 1.47	0.025	0.025	>300µm	-	-	-	-	-	-	-	-	-	-	-	-	-
1.47 to 1.42	0.025	0.025	>300µm	-	-	-	-	-	-	-	-	-	-	-	-	-
1.42 to 1.37	0.025	0.025	>300µm	-	-	-	-	-	1	-	-	-	-	-	-	-
1.37 to 1.32	0.05	0.05	>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 17: Results of the waterlogged plant macrofossil (seeds) assessment of borehole QBH3, Ram Brewery (Phase 1), Ram Street, London Borough of Wandsworth.

Depth (m OD)	Waterlogged seeds		
	Latin name	Common name	Number
1.68 to 1.65	*Apium nodiflorum* *Betula* sp.	fool's water-cress birch	5 1
1.65 to 1.60	*Ranunculus repens* cf. *Myosotis* sp. cf. *Eleocharis* sp.	creeping buttercup forget-me-not spikerush	1 1 1
1.60 to 1.55	cf. *Ranunculus fluitans*	river water crowfoot	1

7. DISCUSSION AND CONCLUSIONS

The aims of the environmental archaeological assessment at the Ram Brewery (Phase 1) site were (1) to establish the age of the Peat recorded in borehole QBH3, and the possible soil in QBH4 (if possible); (2) to assess the palaeoenvironmental potential of the sequences; (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, environmental archaeological assessment of two sequences (boreholes QBH3 and QBH4) was carried out.

The results of the geoarchaeological investigations have contributed to our understanding of the Holocene stratigraphic sequence in this area of the Wandle valley. Towards the middle and north of the site a sequence of Wandle/Shepperton Gravel is recorded (deposited during the Late Devensian, 10-15,000 years before present), overlain by variable thicknesses (up to *ca*. 1.5m) of Holocene Alluvium within a possible palaeochannel. Towards the east, west and south of the site, outside of the limits of the inferred palaeochannel, a sequence of Kempton Park Gravel (deposited during the Early to Middle Devensian (30-120,000 years before present) is overlain in places by thin horizons (generally less than 0.5m) of Holocene Alluvium. Within the palaeochannel the Gravel surface lies at between *ca*. 0.5 and 1.5m OD, whilst beyond the inferred margins of the channel the Gravel rises to between 2.0 and 3.0m OD. This is consistent with the Gravel surfaces recorded *ca*. 250m to the south at the Garratt Lane site (Howe *et al*., 2002), where an undulating Gravel surface was recorded at *ca*. 3.6m OD in the centre and east of the site, falling to below 2.0m OD towards the west and indicative of a broadly north-south aligned palaeochannel. As might be expected, the Late Devensian Gravel surfaces recorded *ca*. 500m to the northwest at the Osiers Road (Green & Young, 2010) and Morganite sites (Branch *et al*., 2007; see Figure 1) are lower (-0.40 and -0.81m OD respectively), but also demonstrate the presence of a north-south aligned channel cut down into the gravels of the Kempton Park Terrace.

Within the possible palaeochannel at the present site the Wandle/Shepperton Gravel is directly overlain in places by Peat or possible soil horizons, up to 0.7m thick and generally recorded at between 0.5 and 1.85m OD. Although no material suitable for radiocarbon dating was identified within the possible soil horizon in borehole QBH4, the base of the Peat in QBH3 was radiocarbon dated to 1860-1700 cal BP (90-250 cal AD), indicating that accumulation of this horizon began during the Roman period.

The alluvial sequence at the Morganite site consisted of a sequence of silty sands overlying an upper Peat and slightly gravelly organic silts, which passed down into calcareous sands including remains of molluscs and ostracods, with a second, lower Peat horizon at the base of the sequence resting directly on the underlying Gravel. This sequence was dated from at least 4780-4420 to 1570-1410 cal BP, with age-depth modelling of the sequence suggesting that the Peat overlying the Gravel may be of Mesolithic date, whilst the upper Peat accumulated during the Bronze Age through to the Roman period (Branch *et al.* 2007; Jarrett *et al.*, 2010). Other investigations nearby confirm the presence of organic sediments associated with the prehistoric River Wandle close to its confluence with the Thames. At the Former Shell Oil Terminal, Point Pleasant (Perry & Skelton, 1995a), these have been radiocarbon dated to between 3640-3380 and 2920-2500 cal BP (Bronze Age; -1.2 to -0.7m OD). At the Prospect Reach Foreshore site, Point Pleasant (Perry & Skelton, 1995b), a radiocarbon-dated Peat and alluvial sequence is of Roman and post-Roman age. To the south of the Morganite site at the Frogmore Depot, Dormay Street site, an alluvial sequence including organic-rich sediments and Peat dated from at least 2460-2160 to 910-700 (Iron Age to post-Roman; Spurr, 2004), whilst at Garratt Lane (Howe *et al.*, 2002) organic sediments of post-Bronze Age date were identified, accumulation beginning at *ca*. 2780-2370 cal BP.

The Peat horizon identified in borehole QBH3 is thus later than that recorded at the Former Shell Oil Terminal site, but is contemporaneous with organic horizons recorded at the Prospect Reach Foreshore site (Perry & Skelton, 1995b) and the latter part of the alluvial/organic sequences at the Frogmore Depot (Spurr, 2004) and Morganite sites (Branch *et al.*, 2007). Although no age could be obtained for the possible soil horizon in QBH4, the combined results of the palaeobotanical assessments (pollen and seeds) are consistent with different ages for this horizon and the Peat in QBH3. The assemblage in the Peat in QBH3 is indicative of a damp, open environment, dominated by sedges, grasses, and aquatic taxa perhaps on the margins of a channel. The pollen assemblage is indicative of an anthropogenically disturbed environment, in which cereal cultivation and/or crop processing was being undertaken. In contrast, the pollen assemblage in the possible soil horizon in QBH4 is dominated by pine and sedges, with some oak, ferns, grasses and other herbaceous taxa. This assemblage is indicative of a damp, open environment on the wetland and the localised growth of pine woodland, characteristic of the cold climatic conditions of the early Mesolithic (early Holocene). As might be expected, no definitive evidence of anthropogenic activity was recorded in this part of the sequence.

The open fen and swamp environments identified at the Ram Brewery site are consistent with those of similar age identified elsewhere in the lower valley of the River Wandle. At the Morganite site (Branch *et al.,* 2007) the sequences were indicative of a period of Peat formation that was subject to intermittent flooding, with flora consisting of tall grasses, sedges, rushes and herbs, persisting from the Middle Bronze Age through to the late Roman period. At the Prospect Reach Foreshore site, Point Pleasant (Perry and Skelton, 1995b), the Peat (of Roman and post-Roman age) is characterised by open mixed deciduous woodland and herbaceous taxa on the nearby dryland, with wetland taxa including aquatic and marginal aquatic plants. At Garratt Lane (MoLAS,

2004) organic sediments of post-Bronze Age date were dominated by wet sedge fen, with shallow standing water, and evidence for the cultivation of cereals on the nearby dryland.

8. RECOMMENDATIONS

On the basis of the previous investigations conducted in this part of the valley of the River Wandle, where the analysis of sequences of similar age and character has been undertaken (see above), no further environmental archaeological analysis is recommended.

9. REFERENCES

Concept Site Investigations (2007) *Greenwich Peninsula GNP206 borehole logs*. Concept Site Investigations Unpublished Report December 2007.

Andersen, S.Th. (1979) Identification of wild grasses and cereal pollen. *Danmarks Geologiske Undersogelse,* 1978, 69-92.

Barnett, C., Allen, M.J., Evans, G., Grimm, J.M., Scaife, R., Stevens, C.J. & Wyles, S.F. (2010) A Submerged Forest with Evidence of Early Neolithic Burning Activity and the Tilbury Alluvial Sequence at Canning Town, East London. *Transactions of the London and Middlesex Archaeological Society*, 61, 1-15.

Battarbee, R.W., Jones, V.J., Flower, R.J., Cameron, N.G., Bennion, H.B., Carvalho, L. & Juggins, S. (2001) *Diatoms.* In (J.P. Smol and H.J.B. Birks eds.), *Tracking Environmental Change Using Lake Sediments Volume 3: Terrestrial, Algal, and Siliceous Indicators*, 155-202. Dordrecht: Kluwer Academic Publishers.

Batchelor, C.R., Branch, N.P., Elias, S., Young, D., Austin, P., Green, C.P., Morgan, P. and Williams, K. (2008a). *Former Borax works, Norman Road, Belvedere, London Borough of Bexley: rapid environmental archaeological assessment (site code: NNB07).* ArchaeoScape Unpublished Report.

Batchelor, C.R., Branch, N.P., Christie, R., Elias, S. Young, D.S., Austin, P., Williams, K., & Wilkinson, K. (2008b) *Imperial Gateway, Belvedere: environmental archaeological assessment report.* Quaternary Scientific (QUEST) Unpublished Report December 2008; Project Number 056/08.

Batchelor, C.R. (2013) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Greenwich Peninsula, Tunnel Avenue, London Borough of Greenwich (Site Code: GPF12)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 079/12.

Batchelor, C.R. (2014) *A report on the geoarchaeological deposit modelling on land at plot MO401, the Gateway Site, Greenwich Peninsula, London Borough of Greenwich*. Quaternary Scientific (QUEST) Unpublished Report November 2014; Project Number 178/14.

Batchelor, C.R., Young, D.S., Green, C.P., Austin, P., Cameron, N. & Elias, S. (2012). *A Report on the Environmental Archaeological Analysis of Boreholes collected from the London Cable Car Route, London Boroughs of Newham and Greenwich (site code: CAB11)*. Quaternary Scientific (QUEST) Unpublished Report January 2012; Project Number 140/10.

Bengtsson, L. & Enell, M. (1986) Chemical Analysis. In (Berglund, B.E. ed.) *Handbook of Holocene palaeoecology and palaeohydrology,* 423-451. Chichester: John Wiley and Sons.
Bronk Ramsey C. (1995) Radiocarbon Calibration and Analysis of Stratigraphy: The OxCal Program, *Radiocarbon* **37 (2)**, 425-430.

Branch, N.P., Green, C.P., Vaughan-Williams, A., Elias, S., Swindle, G., & Batchelor, C.R. (2005) *Bellot Street, Maze Hill, London Borough of Greenwich (site code: GBL05): environmental archaeological assessment*. ArchaeoScape Unpublished Report.

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

Bronk Ramsey C. (2001) Development of the Radiocarbon Program OxCal, *Radiocarbon* **43 (2a)**, 355-363.

Bronk Ramsey, C. (2007) Deposition models for chronological records. *Quaternary Science Reviews* (INTIMATE special issue; 27(1-2), 42-60.

Bowsher, J. (2002) *Gallions Reach Urban Village, Canal extension, Thamesmead: an archaeological watching brief*. MoLAS unpublished report.

Cappers, R.T.J., Bekker R.M. & Jans J.E.A. (2006) Digital Seed Atlas of the Netherlands. Groningen Archaeological Series 4. Barkhuis, Netherlands

Corcoran, J. (2002) *Greenwich Peninsula SE10: a geoarchaeological report*. MoLAS unpublished report.

Corcoran, J., Halsey, C., Spurr, G., Burton, E. and Jamieson, D. (2011) *Mapping past landscapes in the lower Lea valley: A geoarchaeological study of the Quaternary sequence*. Museum of London Archaeology, MOLA Monograph 55.

Flower, R.J. (1993) Diatom preservation: experiments and observations on dissolution and breakage in modern and fossil material. *Hydrobiologia 269/270*, 473-484.

Gibbard, P.L. (1994) *Pleistocene History of the Lower Thames Valley*. Cambridge University Press, Cambridge.

Green, C.P., Batchelor, C.R. & Young, D.S. (2011) *A Report on the Geoarchaeological Borehole Investigations and Deposit Modelling on the London Cable Car Route, London Boroughs of Newham and Greenwich (site code: CAB11).* Quaternary Scientific (QUEST) Unpublished Report May 2011; Project Number 140/10.

Green, C.P. & Young, D.S. (2012) *A Report on the Geoarchaeological Borehole Investigations and Deposit Modelling on Land at Canning Town Regeneration Area 7/1C, London Borough of Newham (NGR 539610 181443).* Quaternary Scientific (QUEST) Unpublished Report June 2012; Project Number 048/12

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

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

McLean. G. (1993) *An outline report on an archaeological evaluation at the land at the rear of 72-88 Bellot Street Greenwich London SE10*. SELAU Unpublished Report.

Miller, P. & Halsey, C. (2011) *Greenwich Millennium Village Phase 3-5, Greenwich SE10: A geoarchaeological and historic environment assessment*. Museum of London Archaeology Unpublished Report 2011.

Moore, P.D., Webb, J.A. and Collinson, M.E. (1991) *Pollen Analysis* (2nd Ed.). Oxford: Blackwell.

Morley, M. (2003) *Greenwich Industrial Estate, Bugsby's Way, Charlton, London SE7, a Geoarchaeological Investigation*. MoLAS Unpublished Report.

Reille, M. (1992) *Pollen et Spores d'Europe et d'Afrique du Nord*. Marseille : Laboratoire de Botanique Historique et Palynologie.

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Bronk Ramsey, C., Buck, C.E., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Turney, C.S.M., and van der Plicht, J., (2013) IntCal13 and Marine13 radiocarbon age calibration curves, 0-50,000 years cal BP. *Radiocarbon* **55**: 1869-1887.

Pepys, S. (1665). *Samuel Pepys Diary September 1665*. Available at http://www.pepysinfo/1665/1665sep.html accessed on 20th April 2007.

Philp, B. (1993) *An Outline Report on an Archaeological Evaluation Excavation at the Land at the Rear of 72-88 Bellot Street, Greenwich, London SE10*. SELAU Unpublished Report.

Ryves, D.B., Juggins, S., Fritz, S.C. & Battarbee, R.W. (2001) Experimental diatom dissolution and the quantification of microfossil preservation in sediments. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 172, 99-113.

Sidell, E.J. (2003) *Relative sea-level change and archaeology in the inner Thames estuary during the Holocene.* University College, London, Unpublished PhD Thesis.

Stace, C. (2005) *New Flora of the British Isles*. Cambridge: Cambridge University Press.

Stafford, E. (2012) *Landscape and Prehistory of the East London Wetlands*. Oxford Archaeology Monograph no. 17.

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

Waller, M.P. (1994) Paludification and pollen representation: the influence of wetland size on Tilia representation in pollen diagrams. *The Holocene,* **4**, 430-434.

Wessex Archaeology (2000) *Fort Street (West) Silvertown, London, E16, Archaeological excavation assessment report*. Wessex Archaeology: Unpublished Report.

Wilkinson, K.N., Scaife, R.J. & Sidell, E.J. (2000) Environmental and sea-level changes in London from 10,500 BP to the present: a case study from Silvertown. *Proceedings of the Geologists' Association,* **111**, 41-54.

Young, D.S. & Batchelor, C.R. (2013a) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Plot MO115, Greenwich Peninsula, London Borough of Greenwich (site code: CHB13)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 210/12.

Young, D.S. & Batchelor, C.R. (2013b) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Plot MO117, Greenwich Peninsula, London Borough of Greenwich (site code: JHW13)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 210/12.

Young, D.S. (2013c) A report on the geoarchaeological borehole investigations and deposit modelling on land at Enderby Wharf, Christchurch Way, London Borough of Greenwich SE10 0AG

(NGR: TQ 3925 7873). *Quaternary Scientific unpublished Report November 2013, Project Number 140/13.*

Young, D.S. (2015) Written Scheme of Investigation for the geoarchaeological investigation of land at Greenwich Peninsula Central East (Plots NO205, NO206, NO207). *Quaternary Scientific Written Scheme of Investigation, May 2015 (Project Number: 067/15).*

Young, D.S. & Green, C.P. (2015) *A report on the geoarchaeological deposit modelling on land associated with the Silvertown Tunnel, London Boroughs of Greenwich and Newham*. Quaternary Scientific (QUEST) Unpublished Report May 2015; Project Number 046/15.

10. APPENDIX 1: OASIS

OASIS ID: quaterna1-206122

Project details

Project name	RAM BREWERY (PHASE 1), RAM STREET
Short description of the project	Geoarchaeological investigations (including five new geoarchaeological boreholes) and a programme of deposit modelling was carried out in order to clarify the nature of the sub-surface stratigraphy, and to evaluate the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs. Towards the middle and north of the site a sequence of Wandle/Shepperton Gravel is recorded, overlain by variable thicknesses (up to ca. 1.5m) of Holocene Alluvium within a possible palaeochannel associated with the River Wandle. Towards the east, west and south of the site, outside of the limits of the inferred palaeochannel, a sequence of Kempton Park Gravel is overlain in places by thin horizons (generally less than 0.5m) of Holocene Alluvium. Within the possible palaeochannel the Wandle/Shepperton Gravel is directly overlain in places by Peat or possible soil horizons, up to 0.7m thick and generally recorded at between 0.5 and 1.85m OD. Subsequent assessment of the Peat and possible soil horizons found the Peat to be of Roman age with flora typical of damp, open environments and with evidence of human activity. No material suitable for dating was found in the possible soil horizon, but its pollen assemblage is indicative of an Early Holocene (Mesolithic) date. The results are consistent with other investigations in this area of the valley of the River Wandle.
Project dates	Start: 01-08-2014 End: 09-10-2015
Previous/future work	No / Not known
Type of project	Environmental assessment
Monument type	ALLUVIUM Uncertain
Monument type	PEAT Roman
Significant Finds	NONE None
Survey techniques	Landscape
Status	Incomplete

Project location

Site location	GREATER LONDON WANDSWORTH WANDSWORTH RAM BREWERY (PHASE 1), RAM STREET
Postcode	SW18 1TJ
Study area	0 Hectares
Site coordinates	NGR - TQ 256 747 LL - 51.4568257967 -0.192000147205 (decimal) LL - 51 27 24 N 000 11 31 W (degrees) Point
Status	Complete

Project creators

Name of	Quaternary Scientific (QUEST)

Organisation	
Project brief originator	CgMs Consulting
Project design originator	D.S. Young
Project director/manager	D.S. Young
Project supervisor	D.S. Young
Status	Complete

Project archives

Physical Archive Exists?	No
Digital Archive Exists?	No
Paper Archive recipient	LAARC
Paper Contents	"Environmental","Stratigraphic"
Paper Media available	"Report"
Status	Incomplete

Project bibliography 1

Title	RAM BREWERY (PHASE 1), RAM STREET, LONDON BOROUGH OF WANDSWORTH (SITE CODE: RBR14): GEOARCHAEOLOGICAL FIELDWORK AND DEPOSIT MODEL REPORT
Author(s)/Editor(s)	Young, D.S.
Other bibliographic details	Project Number 098/14
Date	2014
Issuer or publisher	Quaternary Scientific
Place of issue or publication	Reading
Status	Incomplete

Project bibliography 2

Title	RAM BREWERY (PHASE 1), RAM STREET, LONDON BOROUGH OF WANDSWORTH ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT REPORT
Author(s)/Editor(s)	Young, D.S.
Author(s)/Editor(s)	Batchelor, C.R.
Other bibliographic	Project Number 098/14

details	
Date	2015
Issuer or publisher	Quaternary Scientific (QUEST)
Place of issue or publication	Reading
Status	Incomplete