FORMER NUFARM UK SITE, CRABTREE MANORWAY NORTH, BELVEDERE (NGR: TQ 50117 80239): GEOARCHAEOLOGICAL FIELDWORK REPORT

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INTRODUCTION

This report summarises the findings arising out of the geoarchaeological fieldwork and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at the Former NuFarm UK site, Crabtree Manorway North, Belvedere (National Grid Reference: TQ 50117 80239; Figure 1). Quaternary Scientific were commissioned by CgMs Consulting to undertake the geoarchaeological investigations. The site is located on the floodplain of the Estuarine Thames, less than 300m from the modern waterfront, and ca. 1km north of the floodplain edge and the rising ground of the valley side (Figure 1).

Previous geotechnical investigations were carried out at the site by Geochem (1994) and Card Geotechnic (2010). Subsequent deposit modelling by the Museum of London Archaeological Service (MoLAS; Halsey, 2010) consisted of two borehole transects orientated north-south and east-west, and a deposit model across the site based on 52 data points. Site investigation works in 1994 (Geochem, 1994) all bottomed in made ground or upper alluvium at a maximum depth of 1.6m bgs, and were not used in the deposit model for the site. These investigations revealed a pre-Holocene gravel surface that was fairly uniform, around -9.0m OD across much of the site and rising slightly to ca. -7.5m OD towards the northern part of the site. However, the reconstructed gravel surface based on the current deposit model is limited, since relatively few (only 5 within the study area) of these geotechnical boreholes reached the surface of the sand and gravel. The landscape history of the site was subsequently divided by MoLAS (Halsey, 2010) in to three 'Landscape Zones', each containing distinct depositional sequences (Halsey, 2010): Zone 1 covered the majority of the site and consisted of a thick woody peat horizon of possible Late Mesolithic to Bronze Age date, sealed by clays and silts deposited as intertidal muds; Zone 2 covered a narrow strip from the northern to the central part of the site where thick peats were recorded, but were subsequently truncated by a possible tidal creek or inlet that deposited fine grained muds (Halsey, 2010); Zone 3 occurred in the south eastern corner of the site where thick peats were recorded within a possible palaeochannel that may be of Late Bronze Age date.

The Alluvial and Peat sediments at the Former NuFarm UK site thus have the potential to provide data contributing to the reconstruction of past environments on both the wetland and dryland, from the Mesolithic to Late Bronze Age cultural periods. In particular, there is the potential to increase knowledge and understanding of the interactions between relative sea level, human activity and vegetation succession in this area of the Lower Thames Valley. Significant vegetation changes include the Mesolithic/Neolithic decline of elm woodland, the Neolithic colonisation and decline of yew woodland; the Late Neolithic/Early Bronze Age growth of elm on peat, and the general decline of wetland and dryland woodland during the Bronze Age. It is also highlighted that significant evidence of prehistoric activity has been recorded locally to the Former NuFarm UK site, including a Mesolithic flint scatter at Erith Spine Road / Bronze Age Way (Sidell *et al.*, 1996) and Bronze Age trackeways at both Erith Spine Road / Bronze Age Way and on the Erith Foreshore (Sidell pers. comm.) (Figure 1).

Six significant research aims were outlined for geoarchaeological investigations at the Former NuFarm UK site during the generation of the Written Scheme of Investigation (Young, 2012). The geoarchaeological field investigations aimed to address the first of these research aims: 'To carry out geoarchaeological borehole investigations to clarify the nature of the sub-surface stratigraphy across the site'. The following objectives were proposed in order to achieve this aim:

1. To obtain 6 geoarchaeological boreholes from select locations across the site (Figure 2).
2. To use the stratigraphic data from the new locations, and existing records to produce a new deposit model of the major depositional units across the site.

In the first instance after the completion of these geoarchaeological investigations, the resultant deposit modelling report will be used in order to clarify the need for further environmental archaeological assessment and/or analysis (if necessary).

The six geoarchaeological borehole locations (<QBH1> to <QBH6>) were chosen for the following reasons: <*QBH1*> was located in order to duplicate the thick peat sequence recorded in the area of borehole <NFE07 BH37>; <*QBH3*> to duplicate the thick peat sequence recorded in the area of borehole <NFE09 WS205>; <*QBH5*> to duplicate the thick peat sequence recorded in the area of borehole <NFE09 TP312> and boreholes <*QBH2*>, <*QBH4*> and <*QBH6*> to confirm the expected sedimentary sequence in these areas of the site (in particular the surface of the Shepperton Gravel), and to fill spatial voids for the purposes of the 3D deposit model. In addition, the six borehole locations were chosen so that two boreholes were collected from each of the Landscape Zones defined by MoLAS (Halsey, 2010).

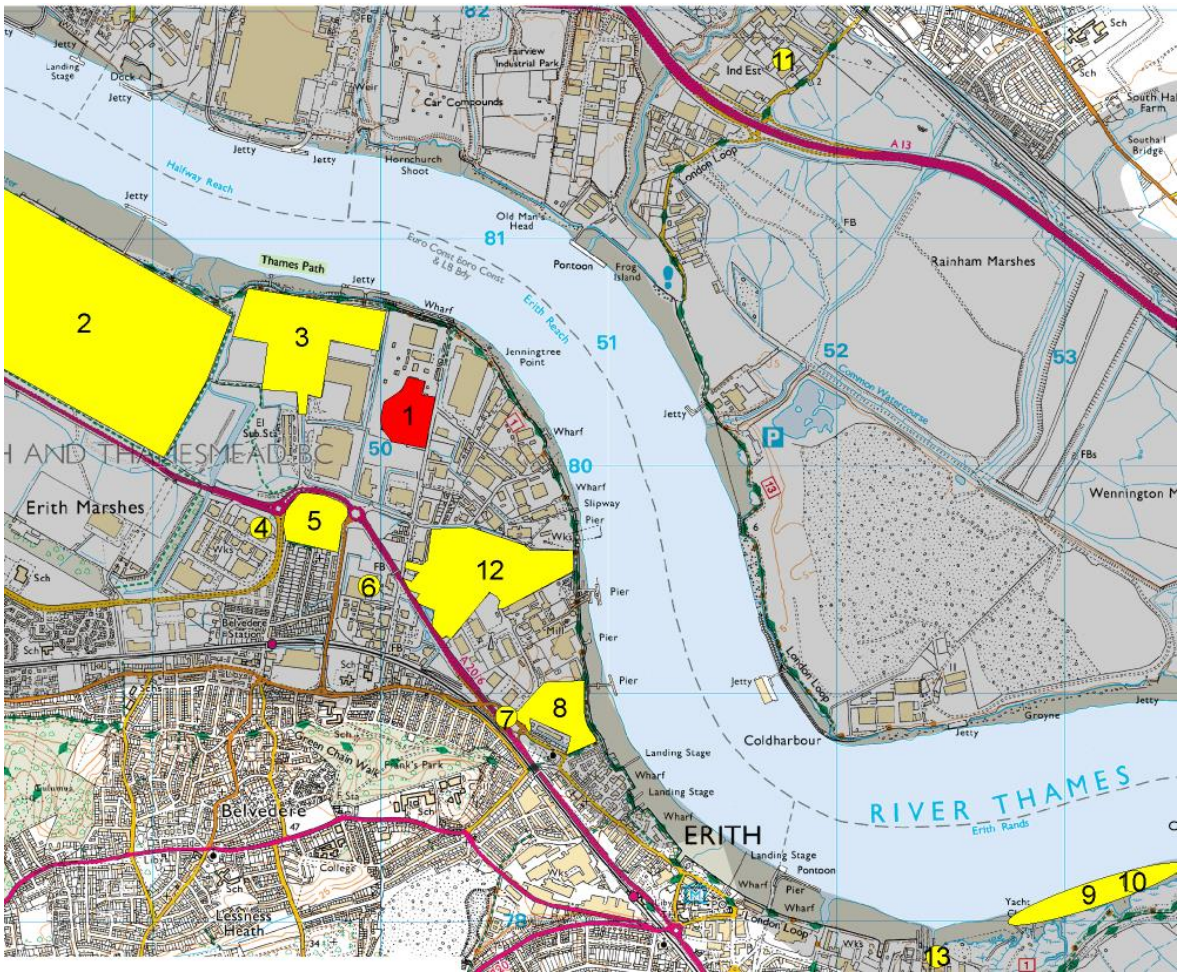

Figure 1: Location of the Former NuFarm UK site (1) and other selected local sites: (2) Crossness (Devoy, 1979) / Crossness Sewage Works (EAW06 - Batchelor et al., 2007a; CXS07 - Batchelor et al., 2007b; CRO11 - Green et al., 2011) (3) Norman Road (NNB06; Batchelor et al., 2008a; in prep) (4) North Bexley Drainage Improvements (EWY01; Branch et al., 2004) (5) Imperial Gateway (Batchelor et al., 2008b) (6) Crabtree Manorway South (CXN05; Askew and Spurr, 2006) (7) Erith Spine Road / Bronze Age Way (Sidell et al., 1996) (8) Corinthian Quay (Corcoran & Lam, 2002) (9) Erith Forest (Seel, 2001) (10) Erith Forest (Sidell, pers. comm.) (11) Frog Lane (Newham Museum Service, 1995); (12) Pirelli Works (Batchelor et al., in prep); (13) Erith Wind Turbine (Batchelor et al., in prep)

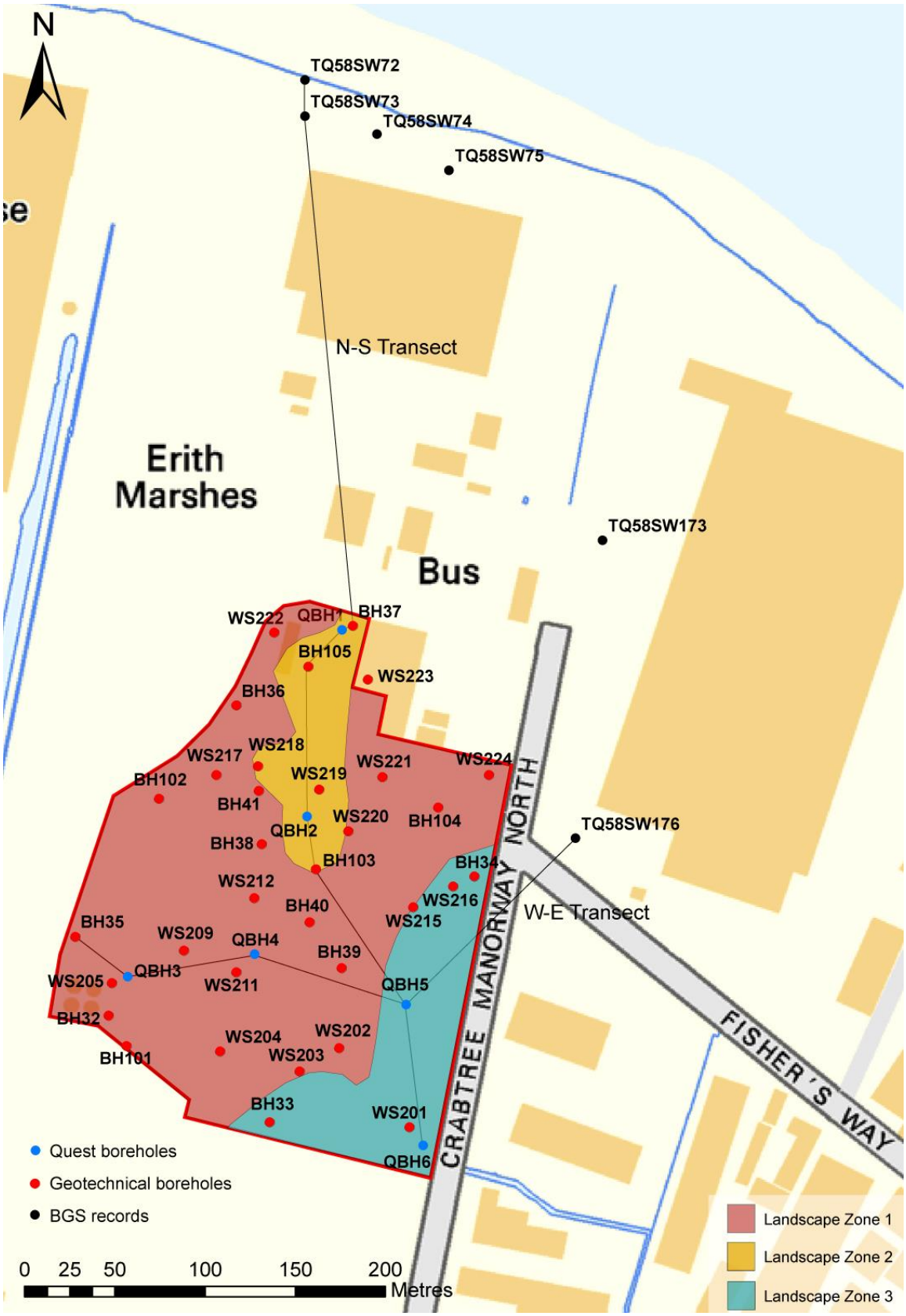

Figure 2: Detailed site map incorporating the location of the previous geotechnical boreholes, existing BGS borehole records, new Quest boreholes and Landscape Zones (Halsey, 2010) at the Former NuFarm UK site, Crabtree Manorway North, Belvedere. ***Contains Ordnance Survey data © Crown copyright and database right [2012]***

METHODS

Field investigations

Six boreholes (Boreholes <QBH1> to <QBH6>) were put down at the site in August 2012 (Figure 2). 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 recovered core samples were wrapped in clear plastic to prevent moisture loss, labelled with the depth (metres from ground surface) and orientation (top and base) and returned to Quaternary Scientific for storage in a purpose built facility at 2^{o}C. This temperature prevents fungal growth on the core surface, which may lead to anomalous radiocarbon dates, and moisture loss. The spatial attributes of each borehole were recorded using a Leica DGPS (Table 1 and Figure 2).

Table 1: Borehole attributes, the Former NuFarm UK site, Crabtree Manorway North, Belvedere.

Borehole number	Easting	Northing	Elevation (m OD)
Quest boreholes			
<QBH1>	550150.70	180375.50	1.00
<QBH2>	550131.19	180272.06	1.15
<QBH3>	550031.88	180183.39	1.45
<QBH4>	550102.22	180195.80	0.85
<QBH5>	550186.16	180168.02	0.90
<QBH6>	550195.62	180089.99	1.25
Geotechnical boreholes			
BH32	550021.14	180161.90	1.37
BH33	550110.40	180102.94	1.81
BH34	550212.17	180233.37	1.09
BH35	550002.69	180205.63	1.00
BH36	550092.02	180333.60	1.11
BH37	550156.52	180377.66	1.06
BH38	550106.16	180256.87	1.02
BH39	550150.33	180188.22	0.98
BH40	550132.63	180213.73	0.88
BH41	550104.48	180286.32	1.34
WS201	550188.00	180100.00	1.56
WS202	550149.00	180144.00	1.16
WS203	550127.00	180131.00	1.60
WS204	550083.00	180142.00	1.63
WS205	550023.00	180180.00	1.45
WS209	550063.00	180198.00	1.02
WS211	550092.00	180186.00	0.93
WS212	550102.00	180227.00	0.79
WS215	550190.00	180222.00	1.09
WS216	550224.00	180239.00	1.00
WS217	550081.00	180295.00	1.18

WS218	550104.00	180300.00	1.05
WS219	550138.00	180287.00	1.19
WS220	550154.00	180264.00	1.10
WS221	550173.00	180294.00	0.89
WS222	550113.00	180374.00	1.06
WS223	550165.00	180348.00	1.02
WS224	550232.00	180295.00	0.94
BH101	550031.00	180145.00	1.74
BH102	550049.00	180282.00	1.14
BH103	550136.00	180243.00	0.83
BH104	550204.00	180277.00	1.01
BH105	550132.00	180355.00	1.03
BGS borehole records			
TQ58SW176	550280.00	180260.00	0.88
TQ58SW173	550295.00	180425.00	0.53
TQ58SW75	550210.00	180630.00	1.00
TQ58SW74	550170.00	180650.00	1.20
TQ58SW73	550130.00	180660.00	1.20
TQ58SW72	550130.00	180680.00	4.00

Lithostratigraphic descriptions

The lithostratigraphy of boreholes <QBH1> to <QBH6> 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) (Troels-Smith, 1955). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour using a Munsell Soil Colour Chart; (3) recording the composition; gravel (Grana glareosa; Gg), fine sand (Grana arenosa; Ga), silt (Argilla granosa; Ag) and clay (Argilla steatoides); (4) recording the degree of peat humification and (5) recording the unit boundaries e.g. sharp or diffuse. The results are displayed in Figures 3 (north-south transect) and 4 (west-east transect) and in Tables 2 to 7. Due to contamination in the area of borehole <QBH4>, the borehole was not fully described, and the lithostratigraphic descriptions are limited to recording the depth of the Made Ground and the surface of the sand and gravel.

Deposit modelling

The deposit model was based on a review of 41 borehole records incorporating the six new Quaternary Scientific geoarchaeological boreholes, 33 existing geotechnical boreholes (Geochem, 1994; Card Geotechnic, 2010) and two BGS borehole records.

Sedimentary units from the boreholes were classified into five groupings: (1) Shepperton Gravel; (2) Lower Alluvium; (3) Peat; (4) Upper Alluvium, and (5) Made Ground. The

classified data for groups 1-5 were then input into a database with the RockWorks 2006 geological utilities software. Models of surface height (using a nearest neighbour routine) were generated for each of these stratigraphic groups (Figures 5 to 8). Thickness of the Peat (Figure 9) and combined alluvial units (Figure 10) were also modelled (also using a nearest neighbour routine). Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models generated using RockWorks is variable. In general, reliability improves from outlying areas where the models are largely supported by scattered archival records towards the core area of commissioned boreholes. 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 and section drawings.

In addition, the reliability of individual models is 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 development on the site. In particular, it is important to recognise that three sets of boreholes are represented, 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 six new boreholes (<QBH1> to <QBH6>) represent the most detailed record of the sediment sequences.

RESULTS, INTERPRETATION AND DISCUSSION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS AND DEPOSIT MODELLING

The combined results of the geoarchaeological borehole investigation (Tables 3 to 7; Figures 3 and 4) have enhanced the previous geotechnical investigations and permitted a programme of deposit modelling of the surface elevation and thickness of each major stratigraphic unit (Figures 5 to 10).

The basal unit at the site is a horizon of sand and gravel (the Shepperton Gravel) (Figure 5). These sediments were deposited during the Late Glacial within a high energy braided river system. The new geoarchaeological boreholes have improved the model for the surface of the Shepperton Gravel at the site, and indicate that the surface of the Shepperton Gravel is more variable than was indicated in the previous geotechnical investigations by Halsey (2010). Two gravel highs, in the areas of boreholes <QBH1> (-7.37m OD) and <QBH2> (-7.83m OD), may form part of a gravel ridge that is aligned roughly north-south. Elsewhere the gravel surface falls towards the west (to -8.91m OD in borehole BH102) and south-west (to -8.86m OD in borehole BH101) of the site, and to the east towards boreholes BH104 (-9.09m OD) and TQ58SW176 (-8.72m OD). The lowest gravel surface is recorded in the south-eastern part of the site, where it falls to -9.17m OD in borehole <QBH6>.

Succeeding the Shepperton Gravel was a unit of generally silty or occasionally sandy clay, between 3.0 and 5.0m thick and often containing wood macrofossils. This unit represents the Lower Alluvium, the sediments of which were deposited during the Early to Mid-Holocene, as the energy of flow decreased and the Thames probably became confined to a single meandering channel. Within this Lower Alluvium, at between *ca*. -6.8 and -8.0m OD, a lower organic horizon was often present, consisting of organic-rich clay and generally between 0.3 to 1.0m thick. This either rested directly on the Shepperton Gravel, or was separated from the sand and gravel by a sandy clay horizon. Significantly, this lower organic horizon would have represented a semi-terrestrial land surface that might have been utilised by prehistoric people.

The upper surface of the Lower Alluvium is generally recorded at *ca*. -4.0m OD in the Quest boreholes (boreholes <QBH1> to <QBH6>), but is either lower (between *ca*. -6.0 to -8.0m OD) or not recorded in the previous geotechnical boreholes (Figure 6). This is considered however to be a function of the different descriptive terms and differing technical constraints (in terms of recorded detail) of the geotechnical investigations, since the Peat and Lower Alluvium in these boreholes is often combined in to one continuous unit of ‘peat interbedded

with clay'. The records of the Lower Alluvium (including its depth and thickness) are thus considered to be more reliable in the new Quest boreholes. No specific (or significant) arrangement in the surface height of the Lower Alluvium is therefore noted.

Well-humified, often woody Peat overlay the Lower Alluvium in the majority of boreholes between *ca*. -2.0 and -4.0m OD. This main Peat horizon was not recorded however in the BGS boreholes north (boreholes TQ58SW72 and TQ58SW73) and east (borehole TQ58SW176) of the site. The Peat is indicative of a transition towards a semi-terrestrial environment supporting the growth of wetland woodland. The thickness of the Peat varies, but is generally between 1.0 and 2.0m thick (Figure 9). The Quest boreholes indicate that the Peat is thinner towards the north and centre of the site in the area of boreholes <QBH1> and <QBH2> (generally less than 1.0m thick) than it is to the south-west in the area of borehole <QBH3> (*ca*. 1.0m thick), and to the south-west in the area of boreholes <QBH5> and <QBH6> (*ca*. 1.5 to 2.0m thick). In all cases, the Peat is coarsely interbedded with mineral-rich horizons, indicating that periods of inundation of the Peat surface (which may have taken place over longer periods of time) were frequent across the site. Significantly, in boreholes <QBH1>, <QBH2> and <QBH6>, a *ca*. 0.3 to 0.8m thick horizon of mineral-rich sediment (consisting of silty clay or clayey silt, often with detrital wood material) is present within the Peat horizon at between *ca*. -3.6 and -2.2m OD, indicative of inundation of the wetland in this part of the site and possibly associated with a flooding event that occurred simultaneously across these areas of the site.

Elsewhere, the deposit model of the thickness of the Peat is constrained by the limited number of borehole records which record the full depth of Peat. These are limited to boreholes BH33, BH35, BH37, BH101, BH102, BH104, BH105, TQ58SW173 and TQ58SW176. As discussed previously, these records are in turn limited by the differing technical constraints of these geotechnical investigations, and are only considered reliable indicators of the Peat depth in the case of boreholes BH33, BH35, TQ58SW173 and TQ58SW176. These boreholes indicate that the Peat is thickest towards the south (up to *ca*. 2.5m thick in borehole BH33) and west of the site (possibly up to *ca*. 4.5m in borehole BH35).

The upper surface of the Peat lies at between -2.0 and -4.0m OD across much of the site (Figure 8). The deposit model indicates that the Peat surface is lower towards the north and centre of the site, at *ca*. -3.0 to -4.0m OD in the area of boreholes <QBH1>, BH37 and BH105, and between -2.0 and -3.0m OD in the area of boreholes <QBH2>, BH103 and

BH41. Halsey (2010) suggested that this lower Peat surface may be indicative of an episode of peat erosion that may be related to the formation of a tidal creek or inlet. The new deposit model is consistent with Halsey's (2010) proposal of a distinct landscape zone in this part of the site. However, given the nature of the contact between the Peat and the Upper Alluvium in this area (generally diffuse), it is not consistent with an erosion event, and it is unclear whether the silty clays of the Upper Alluvium in this area may be contemporaneous with or post-date the Peat.

The Upper Alluvium overlies the surface of the Peat, and is representative of inundation of the wetland environment. In many cases, including within the area of boreholes <QBH1> and <QBH2>, the contact between the Peat and Upper Alluvium is diffuse, suggesting a gradual transition. In borehole <QBH6> however the contact between the Peat and the Upper Alluvium is sharp, indicating that the transition was more abrupt and that some erosion took place during inundation. In addition, the sediment overlying the Peat in this borehole is sandy between -1.55 and -0.94m OD. Boreholes <QBH6> and <QBH5> are located within the south-eastern part of the site, an area defined by Halsey (2010) as Landscape Zone 3, where the sediment overlying the Peat was indicative of 'an active fluvial regime, markedly different to the finer grained silts and clays deposited within lower energy tidal environments'. The description of this part of the sequence in borehole <QBH6> is consistent with this interpretation. Whilst the contact between the Peat and Upper Alluvium is diffuse in borehole <QBH5>, the Upper Alluvium in this borehole is sandy between -1.10 and -1.32m OD, possibly indicating a more marginal influence of the channel in this area.

The surface of the Upper Alluvium generally lies between 1.0 and -1.0m OD (Figure 8). In the central part of the surface of the Upper Alluvium lies at between -1.0 and -1.5m OD in the area of boreholes <QBH2>, <QBH4> and <QBH5>, and is clearly truncated by Made Ground to a lower level than is recorded elsewhere. Between 1.0 and 3.0m of Made Ground caps the majority of boreholes across the site to a level of *ca*. 1.0m OD (Figures 3 and 4). The Made Ground is thickest in the central part of the site (*ca*. 2.0 to 3.0m) in the area of boreholes <QBH2>, <QBH4> and <QBH5>; in the northern (<QBH1>), western (<QBH3>) and south-eastern (<QBH6>) parts of the site the Made Ground is *ca*. 1.0m thick.

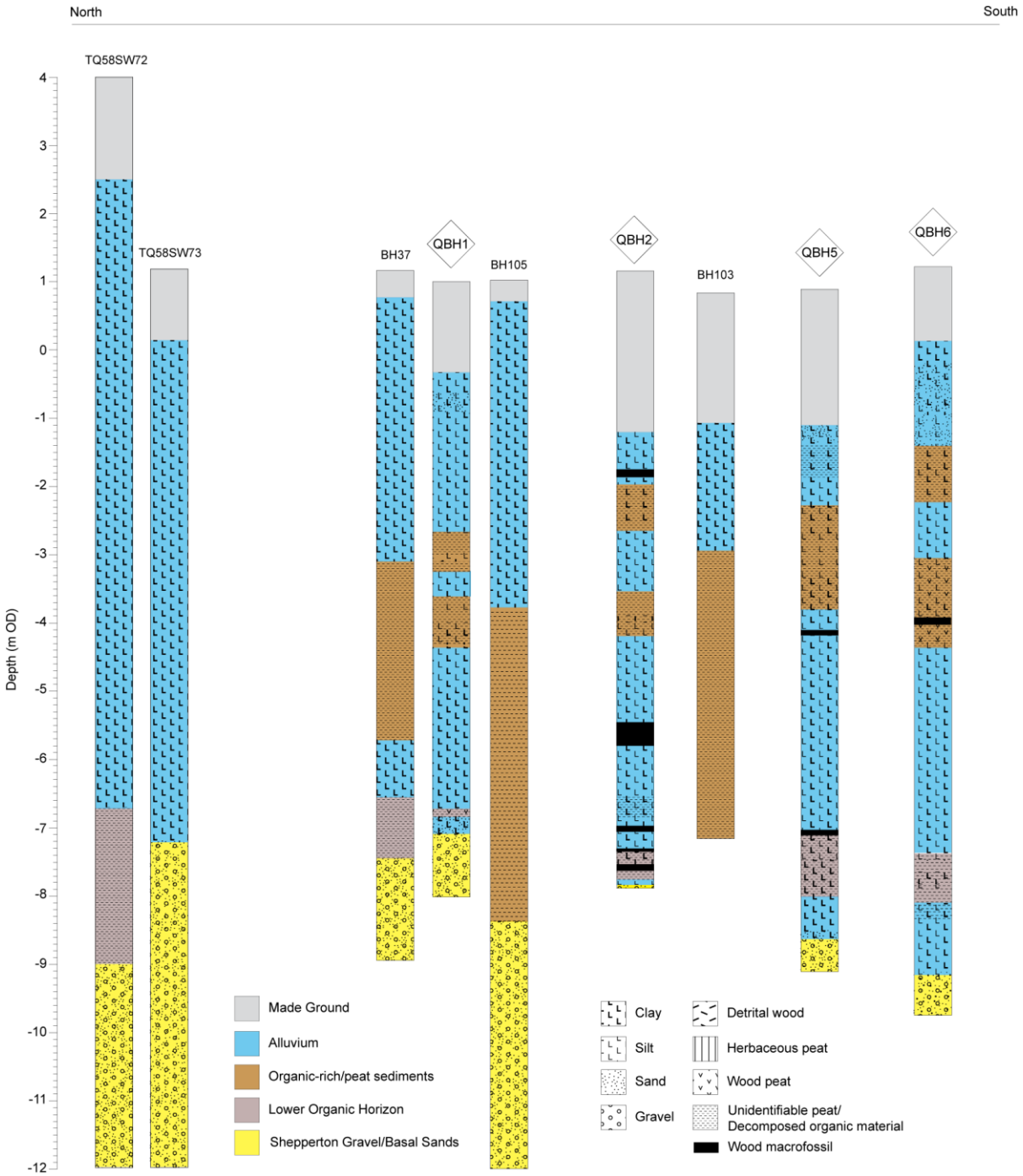

Figure 3: North-south transect of selected boreholes across the Former NuFarm UK site, Crabtree Manorway North, Belvedere (distance between boreholes is not to scale)

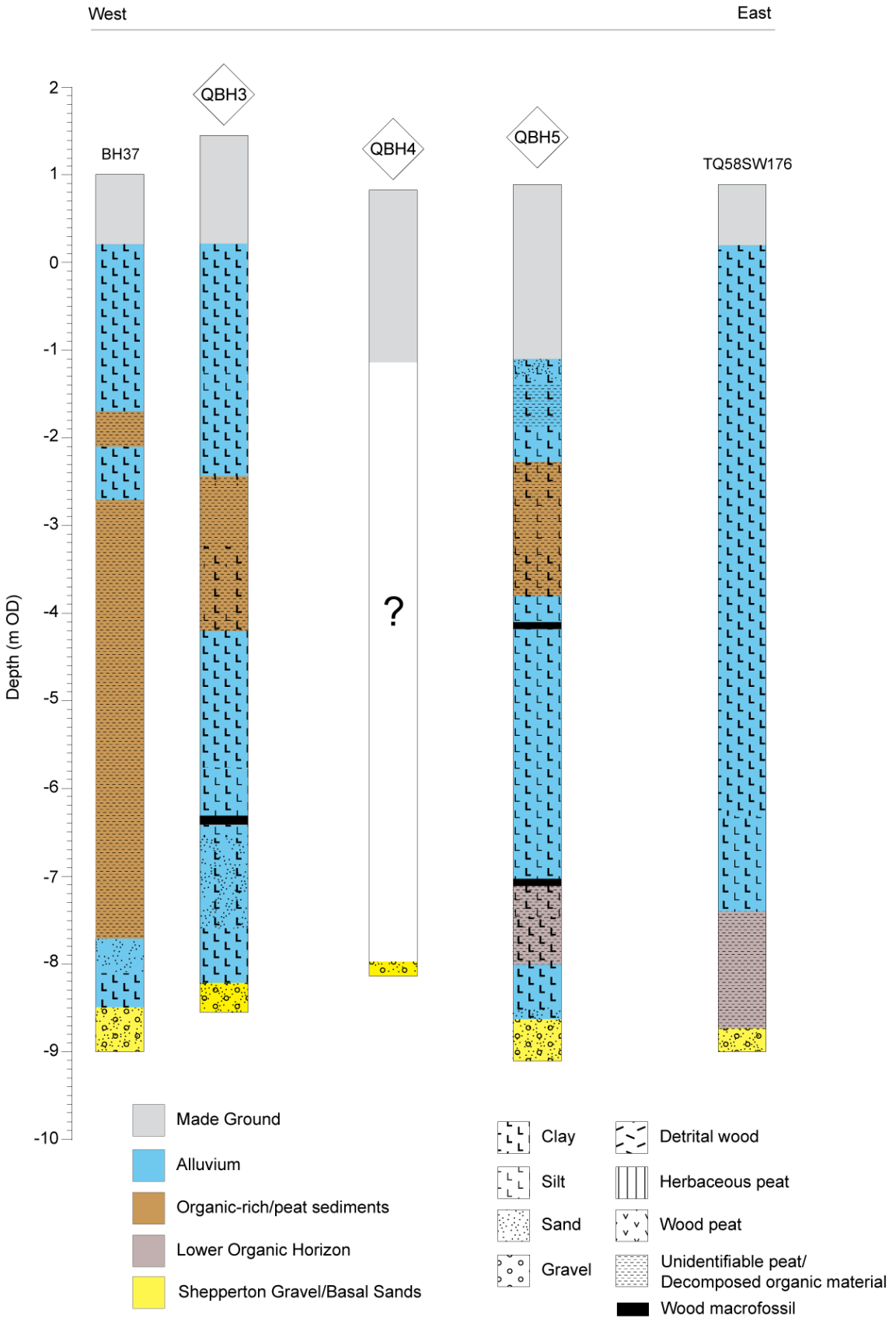

Figure 4: West-East transect of selected boreholes across the Former NuFarm UK site, Crabtree Manorway North, Belvedere (distance between boreholes is not to scale)

Table 2: Lithostratigraphic description of Borehole <QBH1>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
1.00 to 0.00	0.00 to 1.00	Made ground
0.00 to -0.33	1.00 to 1.33	10YR 5/3 / 10YR 3/1; As2 Ag2 Ga+ Sh+; mottled brown and very dark gray clay and silt with a trace of sand and organic matter; sharp boundary into:
-0.33 to -0.64	1.33 to 1.64	2.5Y 2.5/1; As3 Ag1; black silty clay; diffuse boundary into:
-0.64 to -0.96	1.64 to 1.96	10YR 5/6; Ag2 As1 Ga1; yellowish brown sandy clayey silt; diffuse boundary into:
-0.96 to -1.00	1.96 to 2.00	10YR 4/1; As4 Dl+; dark gray clay with a trace of detrital wood
-1.00 to -1.63	2.00 to 2.63	10YR 4/1; Ag3 As1; dark gray clayey silt becoming more organic between 2.54 and 2.58 (Sh+); sharp contact into:
-1.63 to -1.93	2.63 to 2.93	10YR 3/2; Ag3 As1 Dl+; very dark grayish brown clayey silt with a trace of detrital wood; diffuse contact into:
-1.93 to -2.00	2.93 to 3.00	7.5YR 4/1; As4 Sh+; dark gray clay with a trace of organic matter.
-2.00 to -2.69	3.00 to 3.69	10YR 3/1; As2 Ag2 Dl+; very dark gray clay and silt with a trace of detrital wood; wood macrofossil from 3.48 to 3.50; diffuse boundary into:
-2.69 to -3.00	3.69 to 4.00	10YR 2/2; Sh3 Ag1; Humo 3; very dark brown silty well humified peat; wood macrofossil from 3.97 to 4.00m
-3.00 to -3.10	4.00 to 4.10	10YR 4/1; Ag2 Dl/Tl^{3}2 Sh+; Humo 2; dark gray silt and detrital wood/wood peat with a trace of organic matter; diffuse boundary into:
-3.10 to -3.25	4.10 to 4.25	10YR 2/1; Sh2 Ag2; Humo 4; black organic matter and silt; sharp contact into:
-3.25 to -3.61	4.25 to 4.61	5YR 3/1; Ag3 As1 Sh+ Dl/Tl+; very dark gray clayey silt with a trace of organic matter and detrital wood/wood peat; diffuse contact into:
-3.61 to -4.00	4.61 to 5.00	10YR 2/1; Sh3 Ag1 As+ Tl+; Humo 4; black silty well humified peat with a trace of clay and wood peat.
-4.00 to -4.31	5.00 to 5.31	10YR 3/2; Ag2 As1 Sh1 Dl/Tl+; Humo 2; very dark grayish brown organic clayey silt with a trace of detrital wood/wood peat; wood macrofossils from 5.06 to 5.17m and 5.24 to 5.31m; sharp contact into:
-4.31 to -4.47	5.31 to 5.47	10YR 3/1; Ag2 As1 Dl1; very dark gray clayey silt with detrital wood; sharp contact into:
-4.47 to -5.00	5.47 to 6.00	7.5YR 4/1; As3 Ag1 Dl+; dark gray silty clay with a trace of detrital wood.
-5.00 to -6.74	6.00 to 7.74	10YR 3/1; As4 Ag+ Dl+; very dark gray clay with a trace of silt and detrital wood; wood macrofossils present from 6.27 to 6.33m, 6.78 to 6.82m, 6.85 to 6.86m and 7.64 to 7.66m; diffuse contact into:
-6.74 to -6.79	7.74 to 7.79	10YR 2/1; As2 Ag1 Sh1Tl/Dl+; Humo 4; black organic silty clay with a trace of wood peat/detrital wood; some mollusc inclusions throughout; sharp contact into:
-6.79 to -6.87	7.79 to 7.87	10YR 2/1; Sh2 Tl^{4}1 Ag1; Humo 4; black silty well humified wood peat; mollusc inclusions throughout; sharp contact into:

-6.87 to -7.10	7.87 to 8.10	10YR 4/1; As3 Ga1 Gg+; dark gray sandy clay; sharp contact into:
-7.10 to -7.37	8.10 to 8.37	10YR 4/1; Gg3 Ga1 As+; dark gray sandy gravel with a trace of clay; diffuse contact into:
-7.37 to -7.82	8.37 to 8.82	2.5Y 4/2; Ga3 Gg1; dark grayish brown gravelly sand; diffuse contact into:
-7.82 to -8.00	8.82 to 9.00	2.5Y 4/1; Gg3 Ga1; dark gray gravelly sand.

Table 3: Lithostratigraphic description of Borehole <QBH2>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
1.15 to -1.23	0.00 to 2.38	Made ground
-1.23 to -1.43	2.38 to 2.58	10YR 5/1 / 10YR 5/3; Ag4 As+; mottled gray and brown clay with a trace of silt; sharp boundary into:
-1.43 to -1.59	2.58 to 2.74	10YR 4/1; Ag3 As1 Dl+; dark gray clayey silt with a trace of detrital wood; sharp contact into:
-1.59 to -1.68	2.74 to 2.83	10YR 3/2; As2 Ag2 Dl+ Sh+; very dark grayish brown clay and silt with a trace of detrital wood and organic matter
-1.68 to -1.72	2.83 to 2.87	WOOD MACROFOSSIL
-1.72 to -1.77	2.87 to 2.92	10YR 3/2; Ag2 As1 Sh1 Dl+; Humo4; very dark grayish brown organic clayey silt with a trace of detrital wood.
-1.77 to -1.85	2.92 to 3.00	VOID
-1.85 to -1.94	3.00 to 3.09	10YR 4/1; As4 Ag+ Sh+; dark grayish brown clay with a trace of silt and organic matter; rooting inclusions throughout; diffuse contact into;
-1.94 to -2.03	3.09 to 3.18	10YR 2/2; As2 Sh2 Ag+; Humo 4; very dark brown clay and well humified peat with a trace of silt; diffuse contact into:
-2.03 to -2.55	3.18 to 3.70	10YR 2/1; Sh3 As1 Tl/Th^{3}1; Humo 3; black clayey well humified peat with a trace of wood peat/herbaceous peat; diffuse contact into:
-2.55 to -2.66	3.70 to 3.81	10YR 4/2; Sh2 Ag2 Th+; Humo 4; dark grayish brown well humified peat and silt with a trace of herbaceous peat; sharp contact into:
-2.66 to -3.59	3.81 to 4.74	10YR 4/1; As 2 Ag2 Dl+; dark gray clay and silt with a trace of detrital wood becoming more organic (Sh+) towards the base; diffuse contact into:
-3.59 to -3.85	4.74 to 5.00	10YR 2/1; Sh4 Ag+ As+;Humo 4; black well humified peat with a trace of silt and clay.
-3.85 to -3.93	5.00 to 5.08	10YR 2/2; As2 Sh2 Dl+; Humo 4; dark brown clay and well humified peat with a trace of detrital wood; diffuse contact into:
-3.93 to -4.10	5.08 to 5.25	10YR 2/2; Ag2 Sh2 As+ Th/Dh+;Humo 4; dark brown silt and well humified peat with a trace of clay and herbaceous peat/detrital herbaceous material; diffuse contact into:
-4.10 to -4.18	5.25 to 5.33	10YR 3/1; Ag2 Sh1 Dl/Dh1; Humo 4; very dark gray organic silt with detrital wood/detrital herbaceous material; diffuse boundary into:
-4.18 to -5.50	5.33 to 6.65	10YR 4/1; As2 Ag2 Dl+; dark gray clay and silt with a trace of detrital wood.
-5.50 to -5.80	6.65 to 6.95	WOOD MACROFOSSIL

-5.80 to -5.85	6.95 to 7.00	10YR 4/1; Ag3 As1 Dl+; dark gray clayey silt with a trace of detrital wood.
-5.85 to -6.48	7.00 to 7.63	10YR 3/1; As2 Ag2 Dl+; very dark gray clay and silt with a trace of detrital wood; mollusc inclusions throughout; diffuse contact into:
-6.48 to -6.56	7.63 to 7.71	10YR 2/1; Ag2 As1 Sh1; Humo4; black organic clayey silt; diffuse contact into:
-6.56 to -6.85	7.71 to 8.00	10YR 2/1; Sh2 Ag1 As1; Humo4; black silty clayey well humified peat.
-6.85 to -6.98	8.00 to 8.13	10YR 3/1; Ag3 As1 Dl+; very dark gray clayey silt with a trace of detrital wood.
-6.98 to -7.05	8.13 to 8.20	WOOD MACROFOSSIL
-7.05 to -7.30	8.20 to 8.45	10YR 3/1; Ag2 As2 Dl+ Sh+; very dark gray silt and clay with a trace of detrital wood and organic matter; mollusc inclusions throughout; diffuse boundary into:
-7.30 to -7.33	8.45 to 8.48	WOOD MACROFOSSIL
-7.33 to -7.44	8.48 to 8.59	10YR 2/2 As2 Sh2; Humo4; very dark brown clay and well humified peat; diffuse contact into:
-7.44 to -7.51	8.59 to 8.66	10YR 2/1; Sh3 As1; Humo4; black clayey well humified peat.
-7.51 to -7.61	8.66 to 8.76	WOOD MACROFOSSIL
-7.61 to -7.78	8.76 to 8.93	10YR 2/1; Sh4 Ag+ As+; Humo 4; black well humified peat with a trace of silt and clay; mollusc inclusions throughout; sharp contact into:
-7.78 to -7.83	8.93 to 8.98	2.5Y 3/1; As3 Ag1; very dark gray silty clay; sharp contact into:
-7.83 to -7.85	8.98 to 9.00	2.5Y 3/2; Ga2 Gg2 As+; very dark grayish brown sand and gravel with a trace of clay.

Table 4: Lithostratigraphic description of Borehole <QBH3>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
1.45 to 0.26	0.00 to 1.19	Made ground
0.26 to -0.85	1.19 to 2.30	2.5Y 4/1; As4; dark gray clay; diffuse contact into:
-0.85 to -1.26	2.30 to 2.71	2.5Y 5/2; As4; grayish brown clay; diffuse contact into:
-1.26 to -1.55	2.71 to 3.00	10YR 3/2; As2 Ag2 Sh+ Dl+; very dark grayish brown clay and silt with a trace of organic matter and detrital wood.
-1.55 to -1.78	3.00 to 3.23	10YR 3/1; As4 Ag+ Dl+; very dark gray clay with a trace of silt and detrital wood; diffuse contact into:
-1.78 to -2.43	3.23 to 3.88	10YR 3/2; As4 Dl+; very dark grayish brown clay with a trace of detrital wood becoming more organic between 3.72 and 3.77m (Sh+); diffuse contact into:
-2.43 to -2.46	3.88 to 3.91	10YR 2/1; As2 Sh1 Ag1; Humo 4; black organic silty clay; diffuse contact into:
-2.46 to -2.55	3.91 to 4.00	10YR 2/1; Sh3 Ag1 As+; Humo4; black silty well humified peat with a trace of clay.
-2.55 to -3.22	4.00 to 4.67	10YR 2/1; Sh4 Ag+ As+; Humo 3; black well humified peat with a trace of silt and clay; wood macrofossil inclusions from 4.50 to 4.67m; diffuse contact into:
-3.22 to -3.35	4.67 to 4.80	10YR 2/2; Sh2 As2; Humo 4; very dark brown well humified peat and clay; sharp contact into:
-3.35 to -3.47	4.80 to 4.92	10Yr 3/1; As2 Sh1 Ag1 Dl+; Humo 4; very dark gray

		organic silty clay with a trace of detrital wood; diffuse contact into:
-3.47 to -4.03	4.92 to 5.48	10YR 2/1; Sh3 As1 Ag+; Humo 4; black clayey well humified peat with a trace of silt; diffuse contact into:
-4.03 to -4.22	5.48 to 5.67	10YR 3/1; As2 Sh1 Ag1 Dl/Tl+; Humo 4; very dark gray organic silty clay with a trace of detrital wood/wood peat
-4.22 to -5.77	5.67 to 7.22	2.5Y 3/1; As4 Ag+ Dl+; very dark gray clay with a trace of silt and detrital wood; diffuse contact into:
-5.77 to -6.30	7.22 to 7.75	2.5Y 4/1; As3 Ag1 Dl+; dark gray silty clay with a trace of detrital wood becoming more organic towards the base; diffuse contact into:
-6.30 to -6.40	7.75 to 7.85	WOOD MACROFOSSIL
-6.40 to -6.55	7.85 to 8.00	10YR 3/2; As3 Ag1 Sh+; very dark grayish brown silty clay with a trace of organic matter.
-6.55 to -7.55	8.00 to 9.00	2.5Y 4/1; Ga2 As2 Ag+ Gg+; dark gray sand and clay with a trace of silt and gravel; mollusc inclusions throughout; core severely compressed due to presence of a large stone inclusion.
-7.55 to -7.62	9.00 to 9.07	10YR 6/2; As4 Ga+; light brown clay with a trace of sand; sharp contact into:
-7.62 to -8.23	9.07 to 9.68	10YR 3/1; As4 Sh+; very dark gray clay with a trace of organic matter; mollusc inclusions throughout; sharp contact into:
-8.23 to -8.55	9.68 to 10.00	10YR 5/4; Ga2 Gg2; yellowish brown sand and gravel.

Table 5: Lithostratigraphic description of Borehole <QBH4>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
0.85 to -1.15	0.00 to 2.00	Made ground
-7.99 to -8.15	8.84 to 9.00	2.5Y 4/2; Ga2 Gg2; dark grayish brown sand and gravel

Table 6: Lithostratigraphic description of Borehole <QBH5>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
0.90 to -1.10	0.00 to 2.00	Made ground
-1.10 to -1.32	2.00 to 2.22	2.5Y 5/2; Ag2 As1 Ga1; grayish brown clayey sandy silt; fine sand partings present; diffuse sharp boundary into:
-1.32 to -1.49	2.22 to 2.39	10Yr 3/2; As3 Sh1 Ag+ Dl+; Humo 4; very dark grayish brown organic clay with a trace of silt and detrital wood; fine sand partings present; diffuse contact into:
-1.49 to -1.84	2.39 to 2.74	10YR 3/2; Sh2 As1 Ag1 Tl+ Th+; Humo 4; very dark grayish brown clayey silty well humified peat with a trace of wood peat and herbaceous peat; diffuse contact into:
-1.84 to -2.10	2.74 to 3.00	10YR 3/1; Ag2 Dh1 As1 Sh+; very dark gray clayey silt with detrital wood and a trace of organic matter; wood macrofossil inclusions from 2.78 to 2.84m and 2.92 to 2.93m.
-2.10 to -2.29	3.00 to 3.19	10YR 3/2; As3 Ag1 Dl+ Sh+; very dark grayish brown silty clay with a trace of detrital wood and organic

		matter; diffuse contact into:
-2.29 to -2.49	3.19 to 3.39	10YR 3/2; As2 Ag1 Sh1 Dh+; Humo 4; very dark grayish brown organic silty clay with a trace of detrital herbaceous material; diffuse contact into:
-2.49 to -2.58	3.39 to 3.48	10YR 2/2; As2 Sh2 Dl+; Humo 4; very dark brown clay and well humified peat with a trace of detrital material.
-2.58 to -2.63	3.48 to 3.53	WOOD MACROFOSSIL.
-2.63 to -2.70	3.53 to 3.60	10YR 2/2; Sh3 As1 Ag+; Humo 4; very dark brown clayey well humified peat with a trace of silt; diffuse contact into:
-2.70 to -3.10	3.60 to 4.00	10YR 2/1; Sh3 Ag1; Humo4; black silty well humified peat.
-3.10 to -3.29	4.00 to 4.19	10YR 2/1; Sh3 Ag1 As+ Tl+; Humo 4; black silty well humified peat with a trace of clay and wood peat; wood macrofossil inclusion from 4.06 to 4.11m; diffuse contact into:
-3.29 to -3.56	4.19 to 4.46	10YR 3/2; As2 Ag1 Sh1 Dl+; Humo 4; very dark grayish brown organic silty clay with a trace of detrital wood; diffuse contact into:
-3.56 to -3.83	4.46 to 4.73	10YR 2/1; Sh2 As1 Ag1; Humo 4; black clayey silty well humified peat; sharp contact into:
-3.83 to -3.99	4.73 to 4.89	10YR 4/1; As3 Ag1 Dl+; dark gray silty clay with a trace of detrital wood; diffuse contact into:
-3.99 to -4.06	4.89 to 4.96	10YR 3/1; Ag2 Sh1 Dl1; Humo 4; very dark gray organic silt with detrital wood.
-4.06 to -4.10	4.96 to 5.00	VOID.
-4.10 to -4.17	5.00 to 5.07	WOOD MACROFOSSIL.
-4.17 to -4.33	5.07 to 5.23	10YR 2/1; As2 Ag1 Dl1 Sh+; black silty clay with detrital wood and a trace of organic matter; sharp contact into:
-4.33 to -4.50	5.23 to 5.40	10YR 3/1; Ag3 As1 Dl+; very dark gray clayey silt with a trace of detrital wood.
-4.50 to -4.74	5.40 to 5.64	WOOD MACROFOSSIL.
-4.74 to -6.10	5.64 to 7.00	10YR 4/1; Ag3 As1 Dl+; dark gray clayey silt with a trace of detrital wood; mollusc inclusions throughout.
-6.10 -7.03	7.00 to 7.93	10YR 4/1; Ag2 As2 Dl+; dark gray silt and clay with a trace of detrital wood; wood macrofossil inclusion from 7.24 to 7.34m.
-7.03 to -7.10	7.93 to 8.00	WOOD MACROFOSSIL.
-7.10 to -7.42	8.00 to 8.32	10YR 3/1; As2 Sh1 Ag1 Dl+; Humo 4; very dark gray organic silty clay with a trace of detrital wood; mollusc inclusions throughout; sharp contact into:
-7.42 to -7.91	8.32 to 8.81	10YR 2/1; Sh3 As1 Ag+ Tl+; Humo 4; black clayey well humified peat with a trace of silt and wood peat; diffuse contact into:
-7.91 to -7.99	8.81 to 8.89	10YR 2/2; Sh2 As2 Ag+; Humo 4; very dark brown clay and well humified peat with a trace of silt; sharp contact into:
-7.99 to -8.10	8.89 to 9.00	2.5Y 2.5/1; As4 Ga+; black clay with a trace of sand.
-8.10 to -8.48	9.00 to 9.38	2.5Y 3/1; As4 Ag+; very dark gray clay with a trace of silt; sharp contact into:
-8.48 to -8.75	9.38 to 9.65	2.5Y 4/1; As2 Ga2; dark gray clay and sand; sharp contact into:

-8.75 to -9.10	9.65 to 10.00	2.5Y 4/2; Ga2 Gg2 As+; dark grayish brown sand and gravel with a trace of clay.

Table 7: Lithostratigraphic description of Borehole <QBH6>, the Former NuFarm UK site, Crabtree Manorway North, Belvedere

Depth (m OD)	Depth (m BGS)	Composition
1.25 to 0.16	0.00 to 1.09	Made ground
0.16 to -0.14	1.09 to 1.39	10YR 5/1; As4; gray clay; diffuse contact into:
-0.14 to -0.27	1.39 to 1.52	2.5Y 3/1; As3 Ga1 Dl+; very dark gray sandy clay with a trace of detrital wood; diffuse contact into:
-0.27 to -0.42	1.52 to 1.67	2.5Y 4/1; Ag2 As1 Ga1; dark gray sandy clayey silt; diffuse contact into:
-0.42 to -0.78	1.67 to 2.03	2.5Y 2.5/1; Ag3 Ga1 As+ Dl+; black sandy silt with a trace of clay and detrital wood; sharp contact into:
-0.78 to -0.88	2.03 to 2.13	2.5y 4/1; Ag2 As1 Ga1; dark gray sandy clayey silt; sharp contact into:
-0.88 to -0.94	2.13 to 2.19	10YR 4/3; Ag2 As2 Ga+; brown silt and clay with a trace of sand; sharp contact into:
-0.94 to -1.21	2.19 to 2.46	10YR 4/1; Ag3 Ga1 As+ Dl+; dark gray sandy silt with a trace of clay and detrital wood; diffuse contact into:
-1.21 to -1.45	2.46 to 2.70	10YR 4/1; Ag2 Ga1 As1 Dl+; dark gray sandy clayey silt with a trace of detrital wood; diffuse contact into:
-1.45 to -1.55	2.70 to 2.80	2.5Y 3/1; Ag2 Ga2; very dark gray silt and sand; sharp contact into:
-1.55 to -1.56	2.80 to 2.81	10YR 5/1; As4 Ag+; gray clay with a trace of silt; sharp contact into:
-1.56 to -1.71	2.81 to 2.96	10YR 2/2; Sh3 As1 Ag+; Humo 4; very dark brown clayey well humified peat with a trace of silt; diffuse contact into:
-1.71 to -1.75	2.96 to 3.00	10YR 3/2; As2 Sh2 Ag+ Dl/Tl+; very dark grayish brown clay and well humified peat with a trace of silt and detrital wood/wood peat.
-1.75 to -1.87	3.00 to 3.12	10YR 3/3; Ag2 As1 Sh1 Dl/Tl+; Humo 4; dark brown organic clayey silt with a trace of detrital wood/wood peat; diffuse contact into:
-1.87 to -2.21	3.12 to 3.46	10YR 3/2; Sh2 As1 $Tl^4$1; Humo3; very dark brown clayey well humified wood peat; silt parting from 3.33 to 3.34m; diffuse contact into:
-2.21 to -3.02	3.46 to 4.27	10YR 4/1; Ag2 As2 Dl+; dark gray silt and clay with a trace of detrital wood becoming increasingly organic towards base (Sh+); diffuse contact into:
-3.02 to -3.14	4.27 to 4.39	10YR 2/2; Sh2 As1 Ag1 Dl/Tl+; very dark brown clayey silty well humified peat with a trace of detrital wood/wood peat; diffuse contact into:
-3.14 to -3.69	4.39 to 4.94	10YR 2/1; Sh2 $Tl^3$1 Ag1 Th+; Humo4; black silty well humified wood peat with a trace of herbaceous peat; wood macrofossil inclusion from 4.54 to 4.55m diffuse contact into:
-3.69 to -3.89	4.94 to 5.14	10YR 3/2; Ag2 As1 Sh1 Dl+; Humo 4; very dark grayish brown organic clayey silt with a trace of detrital wood; wood macrofossil inclusion from 5.00 to 5.03m.
-3.89 to -4.06	5.14 to 5.31	WOOD MACROFOSSIL.
-4.06 to -4.26	5.31 to 5.51	10YR 2/1; Sh2 $Tl^3$2 Ag+ As+; Humo 4; black well

		humified wood peat with a trace of silt and clay; sharp contact into:
-4.26 to -4.31	5.51 to 5.56	10YR 2/2; Sh2 Ag1 As1 Tl/Dl+; Humo 4; very dark brown silty clayey well humified peat with a trace of wood peat/detrital wood; sharp contact into:
-4.31 to -4.45	5.56 to 5.70	2.5Y 3/1; Ag3 Dl1 Sh+; very dark gray silt with detrital wood and a trace of organic matter; diffuse contact into:
-4.45 to -4.58	5.70 to 5.83	2.5Y 4/1; Ag2 As2 Dl+; dark gray silt and clay with a trace of detrital wood; diffuse contact into
-4.58 to -4.75	5.83 to 6.00	2.5Y 4/1; Ag2 As2 Ga+ Dl+; dark gray silt and clay with a trace of sand and detrital wood
-4.75 to -6.61	6.00 to 7.86	2.5Y 3/1; Ag2 As2 Dl+; very dark gray silt and clay with a trace of detrital wood; mollusc inclusions throughout diffuse contact into:
-6.61 to -7.48	7.86 to 8.73	2.5Y 2.5/1; As2 As2 Dl+; black silt and clay with a trace of detrital wood; mollusc inclusions throughout; diffuse contact into:
-7.48 to -7.63	8.73 to 8.88	10YR 3/1; As2 Ag1 Sh1 Dl+; very dark gray organic silty clay with a trace of detrital wood; mollusc inclusions throughout; diffuse contact into:
-7.63 to -7.80	8.88 to 9.05	10YR 2/2; Sh3 As1 Ag+; very dark brown clayey well humified peat with a trace of silt; mollusc inclusions throughout; sharp contact into:
-7.80 to -7.87	9.05 to 9.12	10YR 4/1; Ag2 Dl2; dark gray silt and detrital wood; sharp contact into:
-7.87 to -8.10	9.12 to 9.35	10YR 3/1; Sh2 $Tl^3$1 As1 Th+; Humo 4; very dark gray clayey well humified wood peat with a trace of herbaceous peat; diffuse contact into:
-8.10 to -8.35	9.35 to 9.60	10YR 3/2; Ag2 As1 Sh1 Dl/Tl+; Humo 4; very dark grayish brown organic clayey silt with a trace of detrital wood/wood peat; diffuse contact into:
-8.35 to -8.58	9.60 to 9.83	10YR 4/1; Ag2 As2 Dl+; dark gray silt and clay with a trace of detrital wood; diffuse contact into:
-8.58 to -8.85	9.83 to 10.10	Gley 1 5/1; Ag2 As2; gray silt and clay; diffuse contact into:
-8.85 to -8.93	10.10 to 10.18	Gley 1 2.5/1; As3 Ag1; black silty clay; diffuse contact into:
-8.93 to -9.12	10.18 to 10.37	Gley 1 3/3; As3 Ag1 Ga+; very dark gray silty clay with a trace of sand; diffuse contact into:
-9.12 to -9.17	10.37 to 10.42	2.5Y 4/1; Ga2 Ag1 As1; dark gray silty clayey sand; sharp contact into:
-9.17 to -9.75	10.42 to 11.00	2.5Y 5/3; Ga2 Gg2; light olive brown sand and gravel.

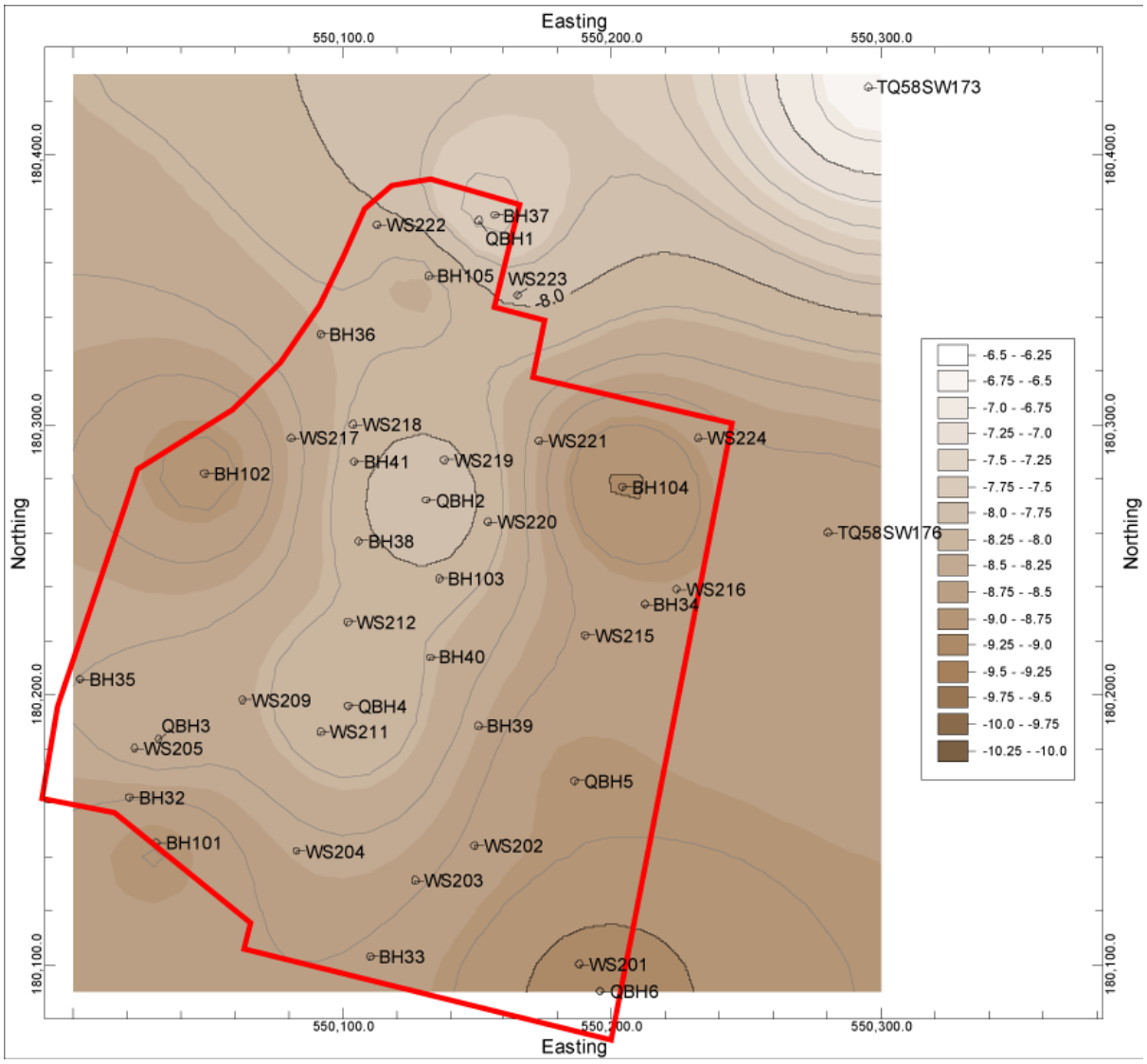

Figure 5: Top of the Shepperton Gravel / Base of the Lower Alluvium (m OD)

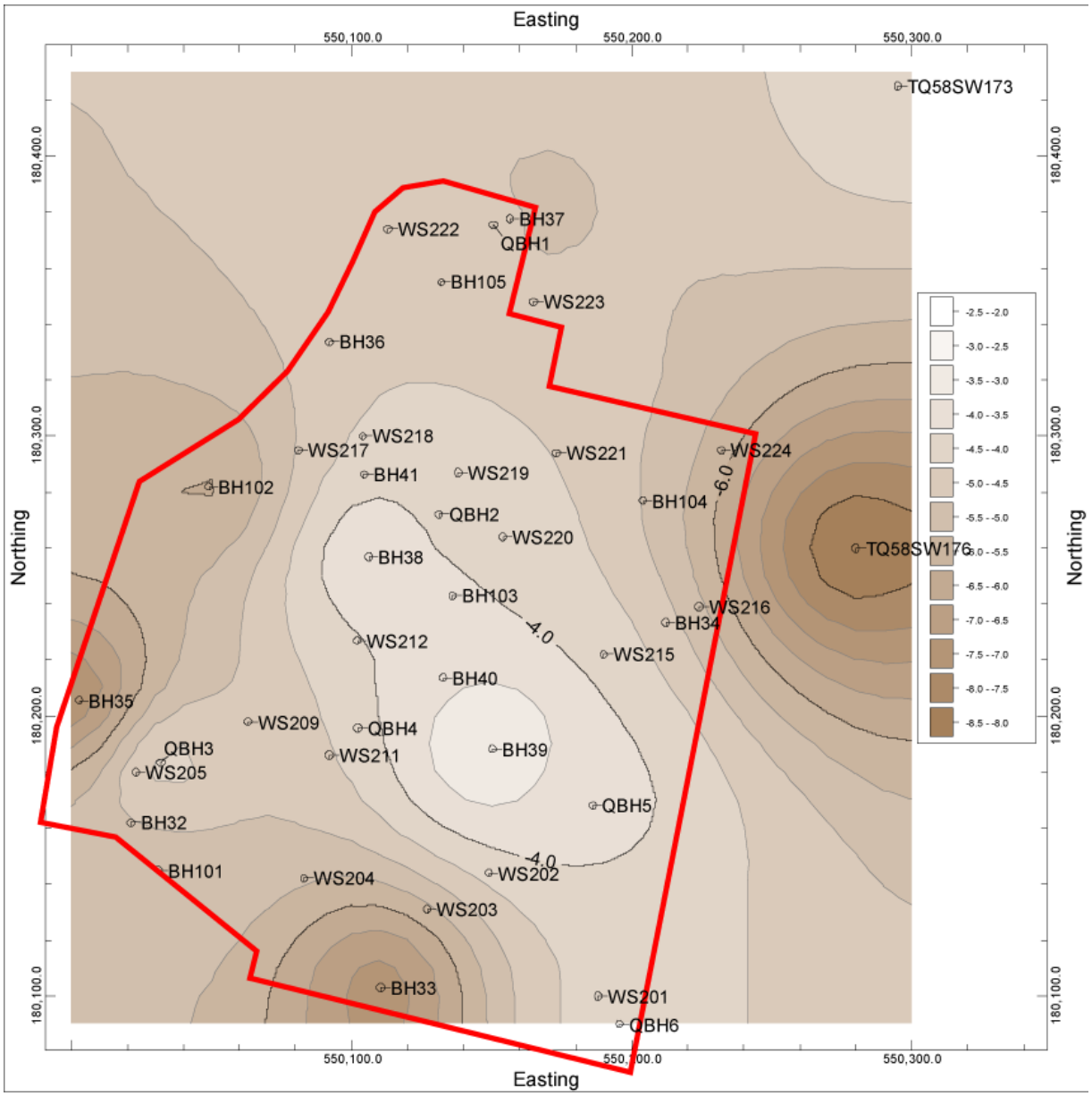

Figure 6: Top of Lower Alluvium / Base of the Peat (m OD)

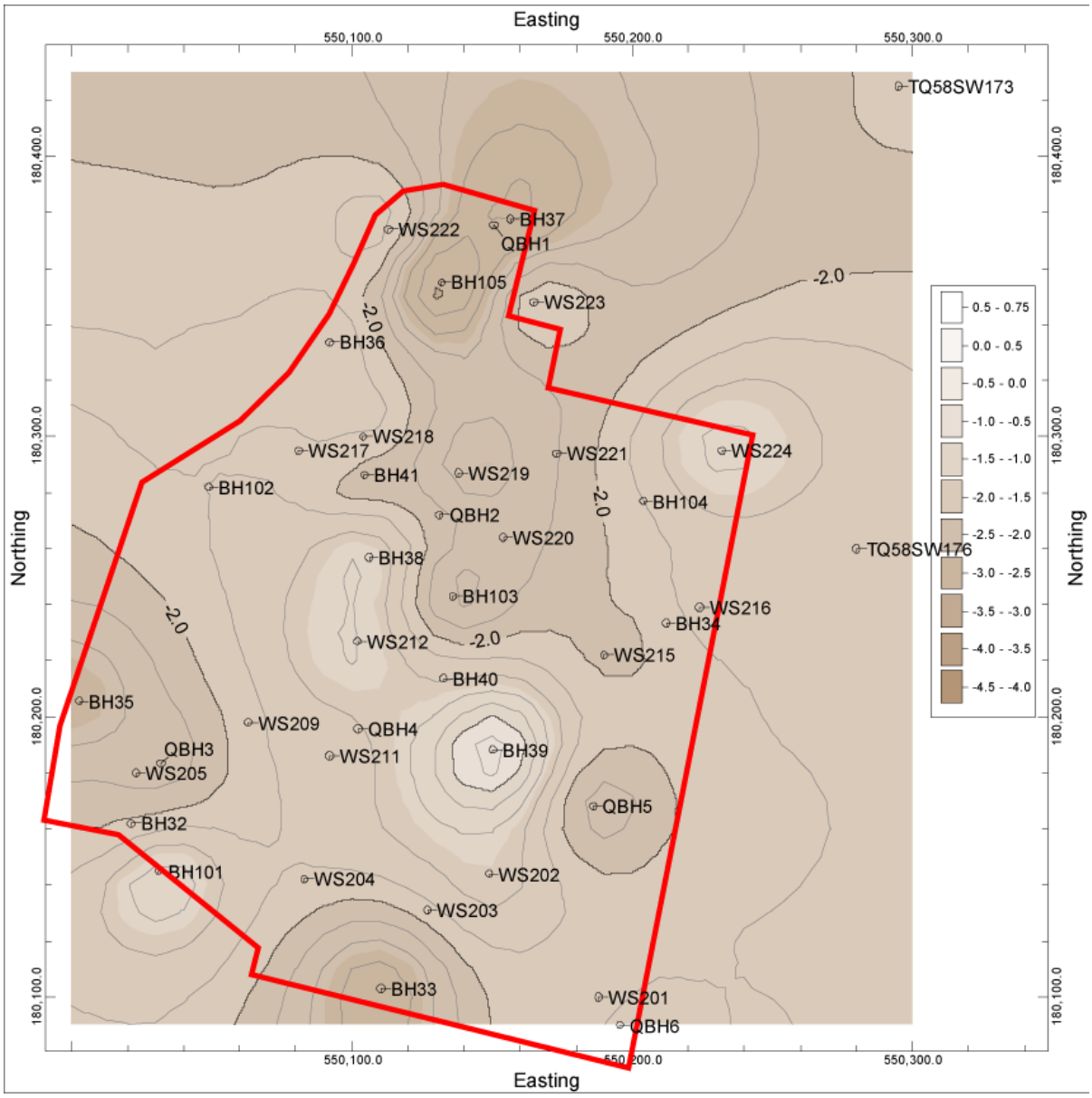

Figure 7: Top of Peat / Base of the Upper Alluvium (m OD)

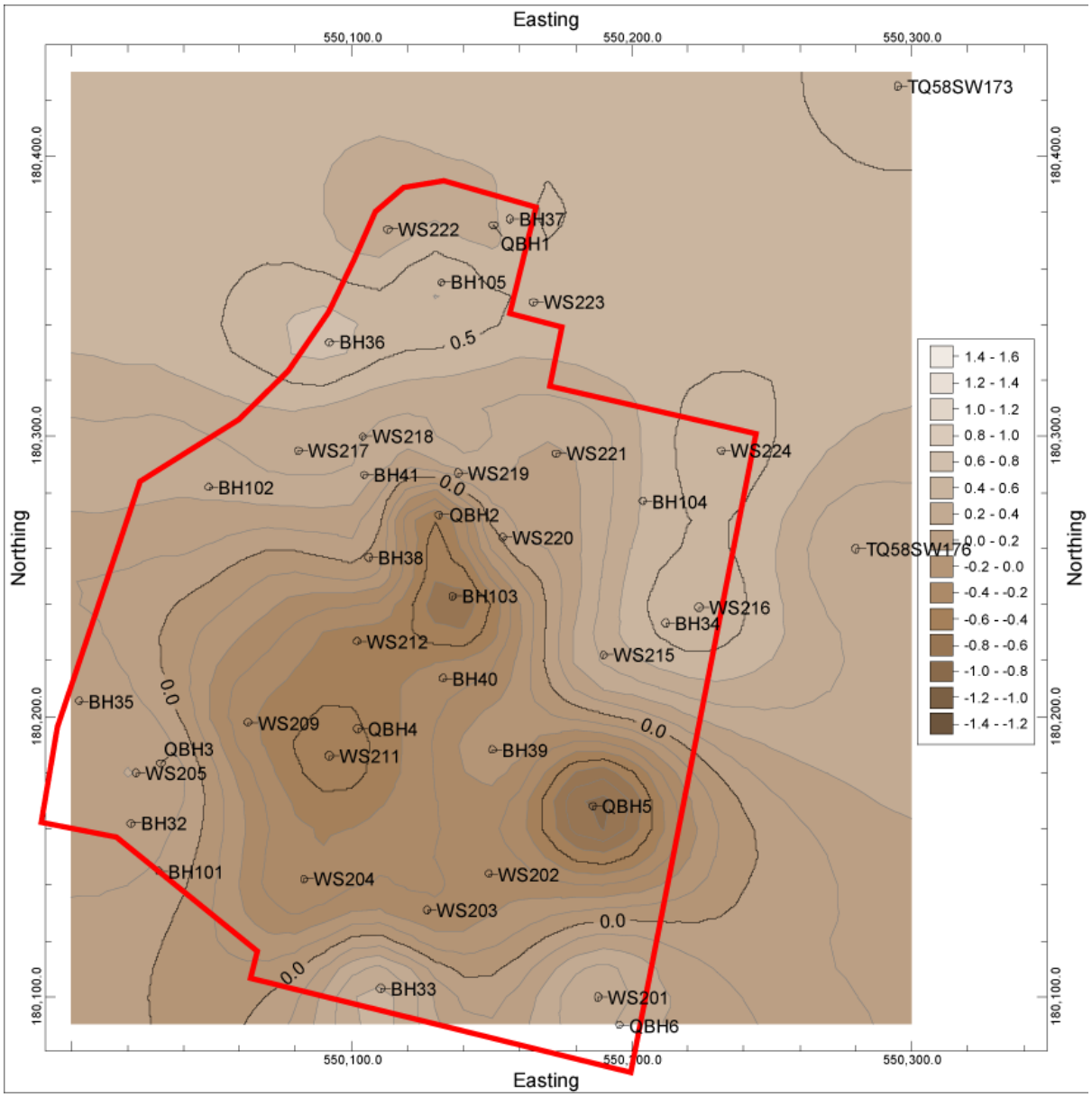

Figure 8: Top of Upper Alluvium / Base of Made Ground (m OD)

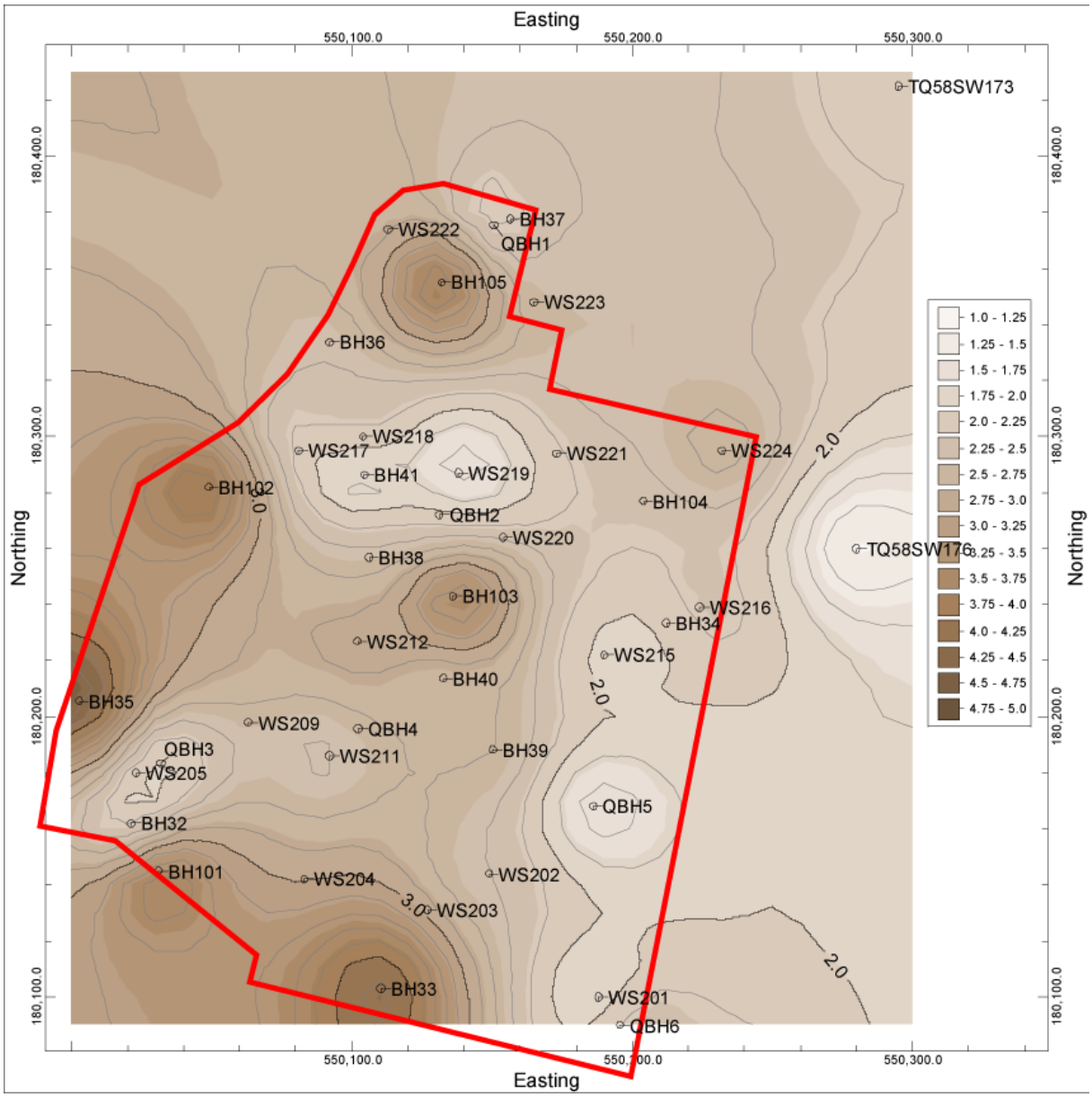

Figure 9: Thickness of the Peat (m)

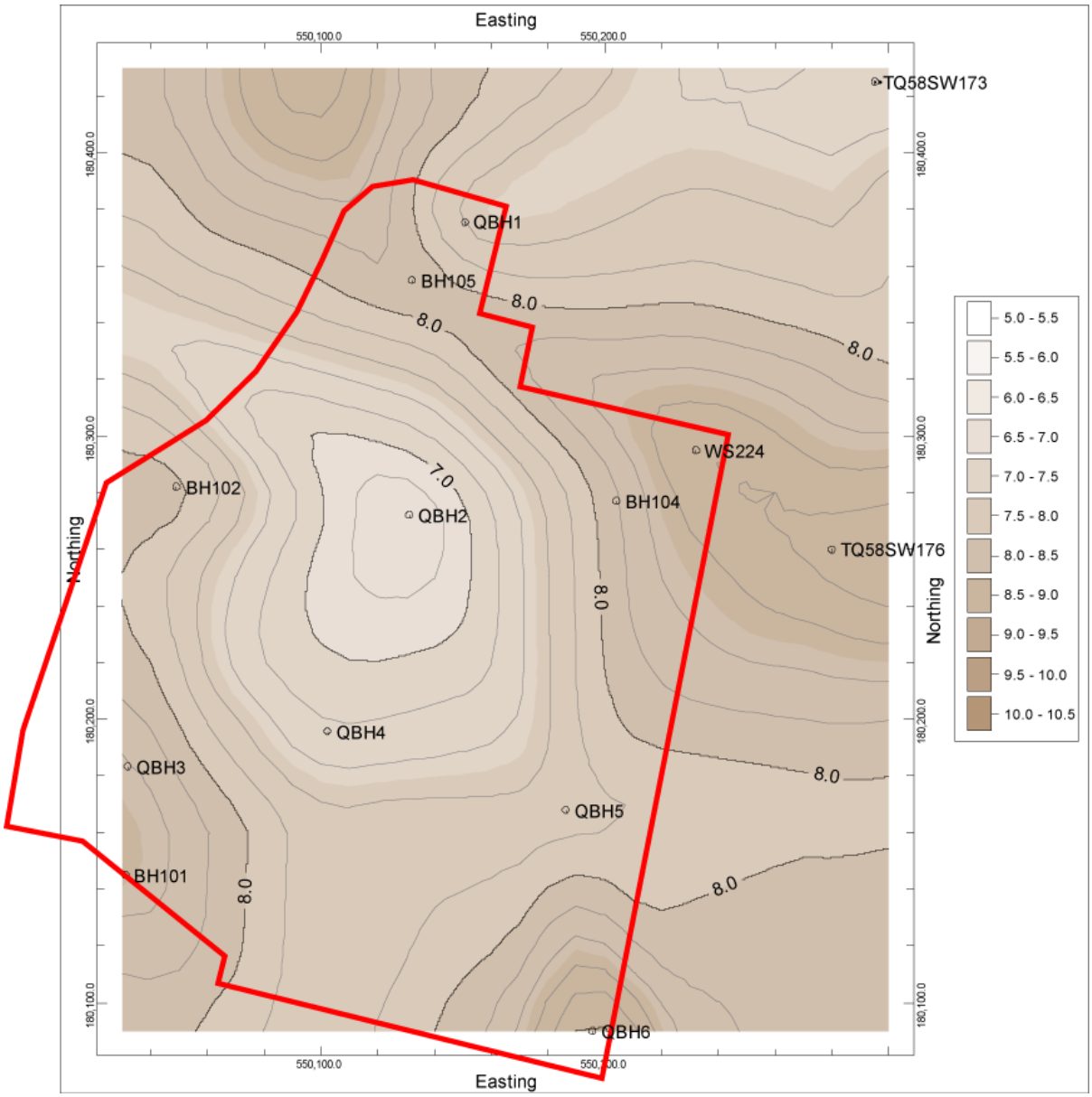

Figure 10: Thickness of Total Alluvium (m) (selected boreholes)

DISCUSSION AND CONCLUSIONS

The Former NuFarm UK site is close to the Pirelli Works site, which has been the subject of recent geoarchaeological investigation (Young *et al.*, 2012). In addition, the site is within an area in which several other geoarchaeological investigations have taken place (see Figure 1): Crossness (Devoy, 1979)/Crossness Sewage Works (Batchelor *et al.*, 2007a; Batchelor *et al.*, 2007b), Norman Road (Batchelor *et al.*, 2008a), Imperial Gateway (Batchelor *et al.*, 2008b), Crabtree Manorway South (Askew and Spurr, 2006) and Erith Spine Road/Bronze Age Way (Sidell *et al.*, 1996).

In all these areas a broadly similar sequence of sediments overlies the bedrock. Immediately overlying the bedrock are sands and gravels of Late Devensian late glacial age - the Shepperton Gravel of Gibbard (1985). At the Former NuFarm UK site the surface of the Shepperton Gravel is variable, and is characterised by gravel highs in the areas of boreholes <QBH1> (-7.37m OD) and <QBH2> (-7.83m OD), possibly forming part of a gravel ridge that is aligned roughly north-south. Elsewhere the gravel surface falls towards the west (to -8.91m OD in borehole BH102) and south-west (to -8.86m OD in borehole BH101) of the site, and to the east towards boreholes BH104 (-9.09m OD) and TQ58SW176 (-8.72m OD). The lowest gravel surface is recorded in the south-eastern part of the site, where it falls to -9.17m OD in borehole <QBH6>. This gravel surface is consistent with the broad view of the surface of the Shepperton Gravel in this area, where the principal relief features of the gravel surface are longitudinal bars separated by channels in which finer grained deposits are sometimes present; however, the orientation of the gravel ridge at the Former NuFarm UK site is inconsistent with the general alignment of gravel bars within river systems, most of which are aligned along the long axis of the valley or parallel to the modern course of the River Thames in this part of the Lower Thames Valley.

At the Pirelli Works site, *ca.* 500m to the south-east (Figure 1), a highly variable gravel surface representing two separate channels trending roughly north-north-west to south-south-east (approximately parallel to the Thames at this location) was recorded. Towards the base of these channels the gravel surface lies at maximum depths of -9.73m and -9.65m OD; away from the channels, the surface rose in the eastern part of the site to -6.41m OD, and to -7.2m OD towards the centre of the site. BGS borehole records to the east of the Former NuFarm UK site and towards the modern course of the River Thames indicate that the gravel surface falls in this direction, from -8.5m OD (borehole TQ57NW42) to -12.0m OD (TQ57NW27).

Ca. 400m to the south-west of the site at Imperial Gateway (Batchelor *et al.*, 2008b; Figure 1) the surface of the Shepperton Gravel was variable, generally between -5.0 and -9.0m OD. At Norman Road, *ca*. 300m to the north-west (Batchelor *et al.*, 2008a) the gravel surface was recorded at between -9.2m and -6.7m OD, with a higher gravel surface to the south of the site up to -2.8m OD. West of here, at the Crossness Sewage Treatment Works (Batchelor *et al.*, 2007a), *ca.* 500m west of the Former NuFarm UK site and bordering the southern bank of the Thames, the gravel surface is variable, recorded between *ca.* -5.0 and -11.0m OD.

Overlying the Shepperton Gravel across most of the Lower Thames Valley is a sequence of Holocene alluvial sediments, usually comprising a lower unit of sandy alluvium (Lower Alluvium) which often contains visible organic remains, which may include wood, other plant remains, and Mollusca. In many places the Lower Alluvium is overlain by a Peat bed, representing the development of a more stable terrestrial surface across the floor of the valley. The uppermost unit almost everywhere is a silty alluvium (Upper Alluvium) in which visible organic remains are uncommon. In the tidal reaches of the Thames, the Upper Alluvium represents evidence of the combined effects of rising sea level, leading to regular estuarine flooding, and an increase in sediment supply produced by soil erosion associated with the intensification of land-use from the Neolithic period onward. The overall effect of Holocene floodplain sedimentation has been to bury progressively the uneven surface of the Shepperton Gravel and to create in the tidal reaches of the Thames a very low relief floodplain close to OD.

The sequence of deposits recorded at the Former NuFarm UK site thus fits the model for the Lower Thames Valley. Within the Lower Alluvium at the Former NuFarm UK site a lower organic horizon was recorded in some boreholes at between *ca*. -6.8 and -8.0m OD, consisting of organic-rich clay and generally between 0.3 to 1.0m thick. This unit is generally thicker where the surface of the Shepperton Gravel is lower. Significantly, this horizon would have represented a semi-terrestrial land surface that might have been utilised by prehistoric people. At the Pirelli Works site, the accumulation of this horizon began at least during the late Mesolithic cultural period (6930 to 6750 cal BP, QBH5; 7160 to 6950 cal BP, <QBH6>). At Imperial Gateway this horizon was radiocarbon dated to 7160-6900 cal BP, whilst a slightly earlier date was established for the 'lower peat' recorded at *ca.* -8.0m OD at Corinthian Quay (*ca.* 500m to the south-east; Corcoran & Lam, 2002), dated to 7425-7240 cal BP. It is of note that a large Mesolithic flint scatter and possible hearth were found at the nearby Bronze Age Way site (Sidell, 1996), demonstrating nearby human activity that may

be contemporaneous with the lower organic horizon at the Former NuFarm UK site.

A well-humified, often woody Peat overlay the Lower Alluvium in the majority of boreholes, present between *ca*. -2.0 and -4.0m OD. This horizon is indicative of a transition towards a semi-terrestrial environment supporting the growth of wetland woodland. The Peat is generally thinner towards the north and centre of the site in the area of boreholes <QBH1> and <QBH2> (generally less than 1.0m thick) than it is to the south-west in the area of borehole <QBH3> (*ca*. 1.0m thick), and to the south-west in the area of boreholes <QBH5> and <QBH6> (*ca*. 1.5 to 2.0m thick). In all cases, the Peat is coarsely interbedded with mineral-rich horizons, indicating that periods of inundation of the Peat surface (which may have taken place over longer periods of time) were frequent across the site. Significantly, in boreholes <QBH1>, <QBH2> and <QBH6>, a *ca*. 0.3 to 0.8m thick horizon of mineral-rich sediment is present within the Peat horizon at between *ca*. -3.6 and -2.2m OD. This is indicative of inundation of the wetland in this part of the site and may be associated with a flooding event that occurred simultaneously across these areas of the site. The upper surface of the Peat is generally lower (*ca*. -3.0 to -4.0m OD) in the area of boreholes <QBH1>, BH37 and BH105, in the area of boreholes <QBH2>, BH103 and BH41 (-2.0 to -3.0m OD). The new deposit model is therefore consistent with Halsey's (2010) proposal of a distinct landscape zone in this part of the site. However, given the nature of the contact between the Peat and the Upper Alluvium in this area (generally diffuse), it is not consistent with an erosion event, and it is unclear whether the silty clays of the Upper Alluvium in this area may be contemporaneous with or post-date the Peat. Loss-on-ignition analysis of this part of the sequence may contribute to our understanding of the relationship between the Peat and the Upper Alluvium in this area.

At the Pirelli Works site the accumulation of the main Peat horizon began at least during the late Mesolithic/early Neolithic (6280 to 6030 cal BP, <QBH1>), and continued until the Middle to Late Bronze Age. The radiocarbon dates for this Peat horizon are consistent with Devoy's (1979) Tilbury III regressive event, and with those from peat horizons from sites nearby. At Imperial Gateway the base of the 'middle' peat was radiocarbon dated to 6290-6120 cal BP), and peat cessation took place at a similar time (3840-3640 cal BP, during the Early to Middle Bronze Age). At Corinthian Quay (Corcoran & Lam, 2002) the onset of accumulation of the peat horizon recorded at *ca.* -3.0 to -1.0m OD was dated to 6300-6000 cal BP; at Crossness Sewage Works (Batchelor *et al.*, 2007a) a slightly earlier date for peat initiation was returned, the base of the peat radiocarbon dated to 6010-5870 cal BP, and an Iron Age date was returned (2720-2350 cal BP) for peat cessation. At Norman Road

(Batchelor *et al.*, 2008a), *ca*. 300m to the north-west and where the base of the peat was recorded at -2.45m OD, the modelled date for peat initiation was later than those recorded at Pirelli Works and elsewhere, at *ca.* 5320-4860 cal BP. Bronze Age trackway structures at Erith Spine Road/Bronze Age Way (Sidell *et al*., 1996) and on the Erith foreshore (Sidell, pers. comm.) demonstrate that human activity was taking place nearby that may be contemporaneous with the Peat horizon at the Former NuFarm UK site.

RECOMMENDATIONS

As outlined above, the boreholes retained from the Former NuFarm UK 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. Given the probable chronology of the sequences, including the presence of Mesolithic and later Neolithic to Bronze Age semi-terrestrial land surfaces, the borehole sequences also have the potential provide on the past environmental conditions associated with archaeological sites nearby and contemporaneous with the organic horizons at the site.

It is therefore recommended that an assessment of three sequences is undertaken to evaluate this potential. Such an investigation is recommended on the following boreholes:

(1) Borehole <QBH1>, since it occupies an area of higher ground (within Halsey's (2010) Landscape Zone 2) that might have been utilised by prehistoric people, and radiocarbon dating of the top of the Peat in this borehole will contribute to our understanding of this part of the sequence in Landscape Zone 2;

(2) <QBH2> since it also occupies an area of higher ground, and radiocarbon dating of the top of the Peat in this borehole will contribute to our understanding of this part of the sequence in Landscape Zone 2; in addition, this borehole contains a comparatively thick lower organic horizon on the border of Halsey's (2010) Landscape Zones 1 and 2;

(3) <QBH6> since it is located within Halsey's (2010) Landscape Zone 3, an area in which a channel was present that may be contemporaneous with or post-date the Peat horizon, and radiocarbon dating of the top of the Peat horizon can provide a maximum age for this channel. In addition, this borehole contains comparatively thick organic horizons.

The assessment should incorporate: (1) rangefinder radiocarbon dating, to provide an age for the onset and cessation of peat formation and to contribute to our understanding of the

relationship between the Peat and Upper Alluvium in Landscape Zone 2; (2) organic matter determinations to aid identification of the sedimentary units and in particular to contribute to our understanding of the relationship between the Peat and Upper Alluvium in Landscape Zone 2; (3) assessment of the archaeobotanical remains (pollen, waterlogged wood and seeds) to provide a provisional reconstruction of the vegetation history; (4) assessment of the diatoms to provide an indication of the palaeohydrology (e.g. marine, brackish or freshwater), and (5) assessment of the zooarchaeological remains (insects and Mollusca) to provide information on the general environmental conditions, climatic change and hydrology of the site. The environmental assessment will also highlight any indications of nearby human activity, and provide recommendations for further analysis (if necessary).

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