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GORESBROOK PARK LONDON BOROUGH OF DAGENHAM

Geoarchaeological Deposit Model Report

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1. NON-TECHNICAL SUMMARY

Two geoarchaeological boreholes were put down at the Goresbrook Park site, both to ground-truth the existing geoarchaeological deposit model and to collect material suitable for palaeoenvironmental investigation. The results of the new geoarchaeological investigations and subsequent deposit modelling indicate that the sediments present beneath the site are similar to those recorded elsewhere in the Lower Thames Valley. The Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, including peat, buried beneath modern Made Ground. The surface of the Shepperton Gravel generally rests between -3 and -4.5m OD across the majority of the site, rising to 2m OD on the northern most part, representative of the Taplow Gravel terrace and the floodplain edge. The Peat recorded within the alluvium generally ranges between 1 and 2m in thickness. Significant prehistoric archaeological remains have been found towards the top of the Peat close to the floodplain/dryland edge immediately adjacent to the site; the potential of identifying such remains at Goresbrook site, particularly towards its northern edge, therefore exists. On the basis of the results of the geoarchaeological investigations at the site, and the possible archaeological remains identified in borehole QBH2, it is recommended that a full environmental archaeological assessment is undertaken on borehole QBH1, with a limited programme of assessment on the sequence from QBH2.

2. INTRODUCTION

2.1 Site context

This report summarises the findings arising out of the geoarchaeological field investigations and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at Goresbrook Park, London Borough of Dagenham (National Grid Reference: centred on TQ 48432 83233; Figures 1 & 2). Quaternary Scientific were commissioned by CgMs Consulting to undertake the investigations. The site lies on the floodplain of the Lower Thames Valley, to the west and north of the Gores Brook tributary; the northern boundary of the site borders the edge of the floodplain. The modern course of the River flows broadly north-west to south-east *ca*. 1km to the south of the site. The British Geological Survey (BGS) show the site underlain London Clay bedrock, with Lambeth Group deposits, described as 'clay, silt and sand' outcropping just beyond the southern border of the site. The bedrock is overlain by Holocene alluvium across the vast majority of the site (described as 'clay, peaty, silty, sandy'), with deposits of the Wolstonian (Marine Isotope Stages (MIS) 6-10) Taplow Gravel terrace towards its northern border. In fact, the alluvial deposits of the Lower Thames and its tributaries are almost everywhere underlain by Late Devensian (MIS 2) Late Glacial Gravels (in the Thames valley, the Shepperton Gravel of Gibbard, 1985, 1994), and this gravel is widely recorded in boreholes in the vicinity of the site.

The results of a recent desk-based deposit modelling exercise for the site (Batchelor, 2017), integrating the results of previous geotechnical investigations, confirmed that the sediments present beneath the site are similar to those recorded elsewhere in the Lower Thames Valley, with a sequence of Shepperton Gravel overlain by Holocene alluvial sediments, including peat, and buried beneath modern Made Ground. The surface of the Shepperton Gravel generally was recorded at between -3 and -4.5m OD across the majority of the site, rising to 2m OD in the northern most part of the site, representative of the Taplow Gravel terrace and floodplain edge. The Shepperton Gravel (and occasional sand) is overlain by a tripartite sequence of Lower Alluvium, Peat and Upper Alluvium; the Peat generally ranges between 1 and 2m in thickness (Batchelor, 2017).

2.3 Palaeoenvironmental and archaeological significance

The existing deposit model for the site, based on geotechnical borehole records, indicates considerable variation in the height of the Gravel surface, and the type, thickness and age of the subsequent Holocene deposits within the vicinity of the site. Such variations are significant as they represent different environmental conditions that would have existed in a given location. For example: (1) the varying surface of the Gravel may represent the location of pre-Holocene river terraces, former channels and bars; (2) the presence of peat represents former terrestrial or semi-terrestrial land-surfaces, and (3) the various alluvial units represent periods of changing hydrological conditions. Thus by studying the sub-surface stratigraphy across the site in greater detail, it will be possible to build an understanding of the former landscapes and environmental changes that took place across space and time.

Organic-rich sediments (in particular peat) also have high potential to provide a detailed reconstruction of past environments on both the wetland and dryland. In particular, they provide the potential to increase knowledge and understanding of the interactions between hydrology, human activity, vegetation succession and climate. 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. Such investigations are carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating. For example, at Hornchurch Marshes, <2km to the southeast (Batchelor, 2009; Branch *et al*., 2012) analysis of fine-grained mineral-rich sediments and peat revealed the presence of freshwater during the Late Mesolithic, at which point peat accumulation began, corresponding to a regional reduction in sea level. Significant changes in both the wetland and dryland environment were recorded here, including the establishment of alder carr woodland, yew; the decline of both elm during the Neolithic, and decline of lime during the Neolithic & Bronze Age. A subsequent transition to estuarine conditions was dated to *ca*. 3900 cal BP, coinciding with a decline in woodland cover and the expansion of plant communities typically found within reed swamp. Analysis of borehole sequences from Barking Riverside, *ca*. 2km to the southwest (see Figure 1), indicated that peat accumulation began at *ca*. 6000 cal BP (late Mesolithic), and continued until at least *ca*. 3500 cal BP (Bronze Age) (Green *et al*., 2014). The peat at Bridge Road meanwhile, >3km to the east, was found to be of Late Neolithic to Bronze Age date (Meddens & Beasley, 1990). Palaeoenvironmental analysis here revealed that during its accumulation, dense alder carr woodland dominated the wetland, with oak, lime and hazel on the surrounding dryland (Meddens & Beasley, 1990). Palaeoenvironmental assessment carried out immediately to the west of the site at New Road, Rainham revealed a thin sequence of peat and alluvial deposits dating to the Bronze Age. This indicated similar vegetation communities, but the local environment became more open in response to wetter conditions and clearance (Krawiec, 2014). Peat deposits have also been recorded accumulating from the Late Mesolithic to the Iron Age East of Ferry Lane on the High Speed 1 route (Bates & Stafford, 2013).

Finally, areas of high gravel topography, soils and peat represent potential areas that might have been utilised or even occupied by prehistoric people, evidence of which may be preserved in the archaeological (e.g. features and structures) and palaeoenvironmental record (e.g. changes in vegetation composition). This is of particular significance at the present site, as a 4m wide Bronze Age causeway, constructed of gravel and burnt flint (MLO59097, TQ 4850 8320 was identified at Hays Storage Dagenham immediately adjacent to the eastern part of the site (Divers, 1996; Figures 1 & 2), Radiocarbon dating of the causeway at Hays Storage Service Ltd. suggested that the causeway was in use for over 100 years between 1520 and 1400 BC (Divers, 1996). The trackway was orientated NNE/SSW and recorded at a depth of -1.70m OD, and traced for 23m within the upper level of a peat deposit also dated to the Bronze Age. The Dagenham Idol, a Neolithic wooden figurine, was also discovered during the installation of sewer pipes in 1922, approximately 200m to the east of the site. In addition, a series of prehistoric archaeological features were identified less *ca*. 3km to the east at Bridge Road (Meddens & Beasley, 1990; Beasley, 1991), whilst. The features recorded at Bridge Road included stake holes and spreads of fire-cracked pebbles associated with the foreshore of a former channel, and later, stakes, wattling and a brushwood trackway associated with peat formation (Meddens & Beasley, 1990; Beasley, 1991). Further important prehistoric and historic archaeological remains in the nearby area are highlighted in the Archaeological Desk-Based Assessment for the site (CgMs Consulting, 2016).

2.4 Aims and objectives

On the basis of the above, and following the desk-based deposit modelling exercise (Batchelor, 2017), it was recommended that a minimum of two geoarchaeological boreholes were put down on the site to ground-truth the existing model and collect material for palaeoenvironmental investigation. The boreholes have been selected to: (1) provide a good spatial distribution across the site; (2) target the areas of proposed development (see Figure 2); (3) target the sequences with the thickest Peat, and (4) avoid areas of contamination / greatest likely truncation. The results of these field investigations and lithostratigraphic descriptions are presented here, along with recommendations for further environmental archaeological assessment.

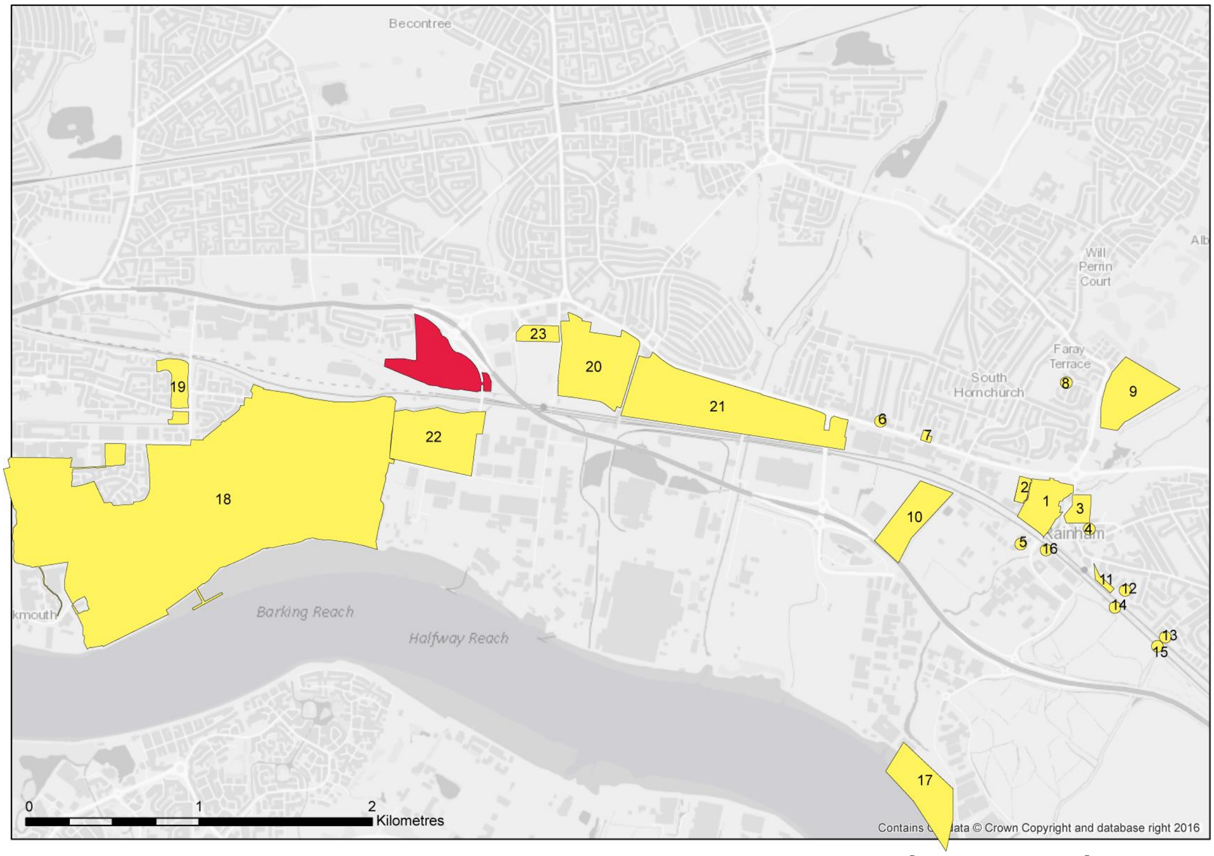

Figure 1: Location of Goresbrook Park / Hays Storage Dagenham (Divers, 1996), London Borough of Dagenham (highlighted in red) and selected other archaeological and palaeoenvironmental sites: (1) Dovers Corner (Batchelor & Young, 2016); (2) the Passivhaus Housing Development (NRD13; Dyson, 2013); (3) Bridge Road (RA-BR89; Meddens & Beasley, 1990; Beasley, 1991); (4) Viking Way (RA-VW 96; Beasley, 1996); (5) Union Railways (URA97; MoLAS, 1997); (6) the former Manser Works (MNM03; Potter, 2003); (7) 155-163 New Road (NRI07; Pre-Construct Archaeology, 2007); (8) the Lessa Sports Ground (LSA98; MoLAS, 1998, 2001); (9) Scott & Albyn's Farm, Rainham Road (RNH96; HO-CP95; Hertfordshire Archaeological Trust, 1995, 2000); (10) Hornchurch Marshes (MOY03; Branch et al., 2012; Batchelor 2009), (11) the former Rainham Squash and Snooker Club (RSQ04; Archaeological Solutions Ltd, 2005); (12) the former Rainham Football Club (RA-FG95; Thames Valley Archaeological Society, 1995); (13) Brookway Allotments (RA-BA92; Newham Museum Service, 1992); (14) 24.455, East of Ferry Lane, HS1 (Bates & Stafford 2013); (15) 24.755, East of Ferry Lane, HS1 (Bates & Stafford 2013); (16) Rainham Creek (Bates & Stafford 2013); (17) Frog Island (MER11; Batchelor *et al.*, 2011); (18) Barking Riverside (Green et al., 2012); (19) Renwick Road (Green et al., 2012); (20) Former Ford Stamping Factory Park (Young & Batchelor, 2017b); (21) Beam Park (Young & Batchelor, 2017a); (22) London Sustainable Industries Park (MoLA, 2010); (23) Merrielands Crescent (ARCA, in prep).

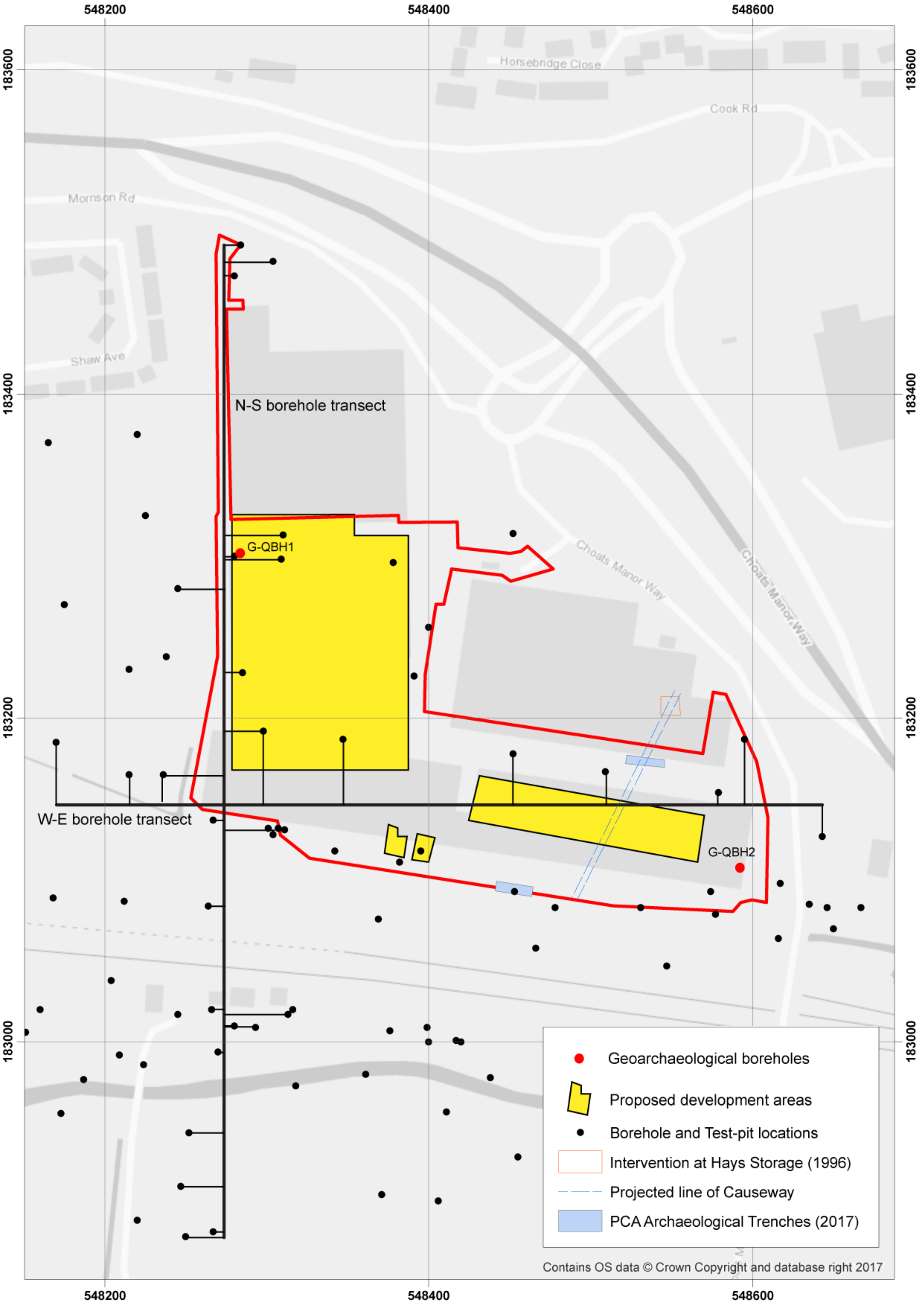

Figure 2: Location of the new geoarchaeological and existing geotechnical boreholes and test-pits across the Goresbrook Park site. Also displayed is the location of the causeway discovered at Hays Storage Dagenham and its projected orientation (Divers, 1996).

3. METHODS

3.1 Field investigations

Two geoarchaeological boreholes (boreholes QBH1 and QBH2) were put down at the site in July 2017 by Quaternary Scientific (Figure 2). The borehole core samples were recovered using an Eijkelkamp window sampler and gouge set using an Atlas Copco TT 2-stroke percussion engine. This coring techniques provide 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. Spatial co-ordinates for each borehole were obtained using a Leica Differential GPS (see Table 1). It was not possible to record the entire Holocene alluvial sequence in QBH2, due to the presence of a thick (≥0.66m) layer of wood at between 4.34 to 5.00m bgl which prevented drilling beyond this depth (see below).

3.2 Lithostratigraphic description

A combination of laboratory- and field-based lithostratigraphic descriptions of the new borehole samples was carried out using standard procedures for recording unconsolidated sediment and peat, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts). 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; (3) recording the composition e.g. gravel, fine sand, silt and clay; (4) recording the degree of peat humification, and (5) recording the unit boundaries e.g. sharp or diffuse. The results are displayed in Tables 2 and 3.

3.3 Deposit modelling

The deposit model for the site was based on a review of 143 borehole records, including the two new geoarchaeological records. Sedimentary units from the boreholes were classified into six groups: (1) Bedrock (London Clay / Lambeth Group), (2) Gravel, (3) Lower Alluvium. (4) Peat, (5) Upper Alluvium and (6) Made Ground. In addition, 743 geoarchaeological, archaeological and geotechnical records were collated to examine key deposits across the wider area. The classified data for groups 1-6 were then input into a database within the RockWorks 16 geological utilities software, the output from which was displayed using ArcMAP 10. Models of surface height were generated for the Gravel, Lower Alluvium, Peat and Upper Alluvium using an Inverse Distance Weighted algorithm (Figures 3-5, 7 and 9). Thickness of the Peat, total Holocene alluvium (incorporating the Lower Alluvium, Peat and Upper Alluvium) and Made Ground (Figures 6, 8 and 10) were also modelled (also using an Inverse Distance Weighted algorithm). Borehole transects are displayed in Figures 11 (north-south) & 12 (west-east).

In general, both the distribution and density of boreholes across the site is good; however, not all boreholes record the entire Holocene alluvial sequence, and thus for selected stratigraphic units the reliability is better in certain areas of the site. The reliability of the models generated using RockWorks is therefore variable. In general, reliability improves from outlying areas where the models are largely supported by scattered archival records towards the core area of 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. As a consequence of this the modelling procedure has been manually adjusted so that only those areas for which sufficient stratigraphic data is present will be modelled. In order to achieve this, a maximum distance cut-off filter equivalent to a 50m radius around each record is applied to all the site-wide deposit models, and 100m for the wider gravel surface model. In addition, it is important to recognise that multiple sets of boreholes are represented, put down at different times and recorded using different drilling/descriptive terms and subject to differing technical constraints in terms of recorded detail including the exact levels of the stratigraphic boundaries.

Table 1: Spatial attributes and lithostratigraphic data for the new geoarchaeological boreholes at Goresbrook Park, London Borough of Dagenham.

Borehole	Easting	Northing	Elevation (m OD)	Total Depth (m)	Upper Alluvium surface (m bgl)	Peat surface (m bgl)	Lower Alluvium surface (m bgl)	Sand surface (m bgl)	Gravel surface (m bgl)
QBH1	548282.99	183301.78	2.41	6.0	2.45	3.69	4.63	5.76	5.87
QBH2	548595.65	183105.09	1.18	5.0	2.75	3.00	Not reached	Not reached	Not reached

4. RESULTS, INTERPRETATION & DISCUSSION OF LITHOSTRATIGRAPHIC DESCRIPTIONS & DEPOSIT MODELLING

The results of the lithostratigraphic descriptions of the two new geoarchaeological boreholes are displayed in Tables 2 and 3, with the results of the deposit modelling displayed in Figures 3 to 13. Figures 3 to 11 are surface elevation and thickness models for each of the main stratigraphic units, whilst Figures 12 and 13 are two-dimensional transects across the site. The results of the deposit modelling indicate that the number and spread of the logs is sufficient to permit modelling with a high level of certainty across the vast majority of the site.

The full sequence of sediments recorded in the boreholes comprises:

Made Ground
Upper Alluvium – widely present
Peat – widely present
Lower Alluvium – widely present
Sand – present across the south-western part of the site
Gravel – widely present

4.1 Gravel

Gravel was present in all the boreholes that penetrated to the bottom of the Holocene sequence. The modelling exercise indicates that the surface of the Gravel falls from the northern most part of the site, where it is recorded at around 2m OD to between -3 and -4.5m OD across much of the rest of the site (Figures 3 & 12-13). The surface of the Gravel was reached in only one of the new geoarchaeological boreholes; in QBH1 it is recorded at -3.46m OD.

Across much of the site, this unit most likely represents the Shepperton Gravel deposited during the Devensian Late Glacial (MIS2; 15,000 to 10,000 BP) and comprises the sands and gravels of a high-energy braided river system which, while it was active would have been characterised by longitudinal gravel bars and intervening low-water channels in which finer-grained sediments might have been deposited. Such a relief pattern would have been present on the valley floor at the beginning of the Holocene when a lower-energy fluvial regime was being established. The rise in Gravel surface to 2m OD towards the northern most part of the site is consistent with the position of the site on the edge of the floodplain. Indeed, this elevation is indicative of the older Wolstonian Taplow Gravel terrace (MIS 6-10; 352,000 to 130,000 BP) which in this area forms the edge of the floodplain; Gibbard (1994) shows the surface of the Mucking (Taplow) Gravel falling to around 1m OD in the area of South Hornchurch (p 54). However, it is difficult to differentiate the deposits of the Taplow and Shepperton Gravel on the basis of elevation alone.

Beyond the margins of the site, the surface of the Taplow Gravel can also confidently recognised, where it reaches between *ca*. 1.5 and -1m OD on the northern part of the Beam Park site (Young & Batchelor, 2017a; Figure 4), and along Ripple Road where it reaches between 0 and 3m OD to the west and east. From the terrace edge, the Gravel surface generally falls to between -3 and -6m OD representative of the Shepperton Gravel. Particularly deep depressions are recognised however, towards the south-west of Beam Park where the Gravel surface is consistently recorded at between *ca*. -7.5 and -9.58m OD. Although the extent and orientation of this depression is not yet fully understood, due to the absence of data to the south, it is possible that this feature represents a former channel. In addition, towards the north-west of Beam Park, three borehole records indicate thick alluvial deposits resting directly on Bedrock at up to -14m OD. It is possible that these records are erroneous, but it is of note that similarly deep depressions are recorded adjacent to the terrace edge at Barking Riverside (Green *et al*., 2014). Higher gravel surfaces above -2m OD can also be recognised across the wider area, including on the southern part of Barking Riverside, and to the south of Choats Road.

4.2 Sand

A horizon of sand is the lowest unit in the Holocene alluvial sequence, and where present, it rests directly on the surface of the underlying Shepperton Gravel. Where it is identified, it can be interpreted as being deposited under low to moderate energy fluvial conditions, most likely within former channel features. On the present site, Sand is recognised in 23 sequences, varying in thickness between 0.2 and at least 2m (Figures 5 & 12-13). In borehole QBH1, it was recorded overlying the Gravel at between -3.35 to -3.46m OD. The Sand appears to be present mainly in the southwestern area of the site. However, its absence in the other sequences does not necessarily mean it is not present as an individual unit; it is rarely possible to confidently separate Sand from Shepperton Gravel or indeed the silty sandy deposits of the Lower Alluvium, due to the nature of the coring methods and less precise method of geotechnical description. In the case of the modelling exercise, differentiation between the Sand and Gravel is made based upon the presence of more than rare occurrences of Gravel within the sediment.

4.3 Lower Alluvium

The Lower Alluvium rests directly on either the Shepperton Gravel or Sand and was recorded in the majority of those records that penetrated sufficiently deeply across the site. The surface of the Lower Alluvium (Figures 6 & 12-13) is relatively even, ranging between -2 and -3.5m OD. It is however absent towards the very north of the site, probably as a consequence of its location above the floodplain edge.

The deposits of the Lower Alluvium are described as a predominantly silty or clayey, tending to become increasingly sandy downward in most sequences, and occasionally organic. The Lower Alluvium frequently contains detrital wood or plant remains, and in many cases is described as organic and with occasional Mollusca remains. In borehole QBH1 the Lower Alluvium was recorded between -2.22 and -3.35m OD, with a richly organic unit between -2.22 to -2.37m OD at the interface between this unit and the overlying Peat.

The sediments of the Lower Alluvium are indicative of deposition during the Early to Mid-Holocene, when the main course of the Thames was probably confined to a single meandering channel. During this period, the surface of the Shepperton Gravel was progressively buried beneath the sandy and silty flood deposits of the river. The richly-organic nature of the Lower Alluvium suggests that this was a period during which the valley floor was occupied by a network of actively shifting channels, with a drainage pattern on the floodplain that was still largely determined by the relief on the surface of the underlying Shepperton Gravel.

4.4 Peat

Overlying the Lower Alluvium / Sand or in some cases Shepperton Gravel in the vast majority of the boreholes is a unit of Peat. The peat is indicative of a transition towards semi-terrestrial (marshy) conditions, supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain. On the basis that 1m of peat represents up to 1000 years of peat accumulation (a figure typical of fen peat in alluvial floodplains), peat may have been accumulating in areas of the site for up to 2000 years. Nearby sites such as Hornchurch Marshes (Batchelor, 2009; Branch et al., 2012), Barking Riverside (Green et al., 2014) and Bridge Road (Meddens & Beasley, 1990; Beasley, 1991) have all recorded Peat accumulation from the late Mesolithic to Bronze Age.

The Peat generally varies in thickness between 1 and 2m in thickness across the vast majority of the site (Figure 7). In geoarchaeological borehole QBH1 it was recorded at between -1.28 and -2.22m OD, and below -1.82m OD in borehole QBH2 (the base of the Peat in this borehole was not reached). The Peat is absent on the northern most part of the site, and an isolated few other sequences (TQ48SE1238, 1363, 1237, 1242, 1162, 1092) all of which are beyond the margins of the site. Within these sequences, mineral-rich deposits were recorded ranging in size from clay to gravel sized clasts. The surface of the Peat is relatively even, generally lying between -1 and -2m OD (Figure 8 & 12-13).

The Peat has the potential to contain archaeological remains as demonstrated by significant trackway/causeway findings at both Hays Storage Dagenham (Divers, 1996) and Bridge Road, Rainham (Meddens & Beasley, 1990; Beasley, 1991). Generally, these remains have been recorded towards the top of the Peat, and relatively close the floodplain edge. In QBH2 a large, horizontal piece of wood was recorded between -3.16 and *at least* -3.82m OD. It is uncertain at this stage if this piece of wood represents a large branch or trunk of a fallen tree, or potentially a wooden structure. It is of note that a large charred wood fragment (20x20mm) was identified just above this wood, at between -2.86 to -2.88m OD.

4.5 Upper Alluvium

The Upper Alluvium generally rests directly Peat, and was recorded in all records across the site with the exception of those in the northern most part. The deposits of the Upper Alluvium are described as predominantly silty or clayey which are very occasionally organic-rich. The surface of the Upper Alluvium is relatively even, generally lying at between *ca*. -1.5 and 2m OD (Figure 9 & 12-13); in boreholes QBH1 and QBH2 it is recorded at -0.04 and -1.57m OD respectively. The sediments of the Upper Alluvium are indicative of deposition within low energy fluvial and/or semi-aquatic conditions during the Holocene. The high mineral content of the sediments may reflect increased sediment loads resulting from intensification of agricultural land use from the later prehistoric period onward, combined with the effects of rising sea level.

The combined Holocene alluvial sequence, incorporating the Sand, Lower Alluvium, Peat and Upper Alluvium ranges between 2 & 4m in thickness, and is generally thicker where the Shepperton Gravel surface is lower towards the south of the site (Figure 10). It is worth noting however, that the thickness of the Total Alluvium noted on the northern most part of the site, likely represents Pleistocene sands resting on the Taplow Terrace, rather than Holocene floodplain deposits.

4.6 Made Ground

Between 1 & 3m of Made Ground caps the Holocene alluvial sequence across the vast majority of the site.

Table 2: Lithostratigraphic description of borehole QBH1, Goresbrook Park, London Borough of Dagenham.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
2.41 to -0.04	0.00 to 2.45	Made Ground of concrete hardstanding over concrete and brick rubble in a matrix of brown silty clay.	MADE GROUND
-0.04 to -0.59	2.45 to 3.00	As3 Ag1; blue grey silty clay with frequent worm/root hollows. Diffuse contact in to:	UPPER ALLUVIUM
-0.59 to -0.82	3.00 to 3.23	As3 Ag1; dark olive grey silty clay with some vertical rooting. Rare iron staining Diffuse contact in to:	
-0.82 to -0.97	3.23 to 3.38	As3 Ag1 Sh+; dark greyish brown silty clay with a trace of organic matter. Some structure/colouration indicative of soil formation. Diffuse contact in to:	
-0.97 to -1.28	3.38 to 3.69	Ag3 As1; grey silty clay. Sharp contact in to:	
-1.28 to -1.59	3.69 to 4.00	Sh3 Th^{3}1; humo. 3; well humified dark reddish brown herbaceous peat. Diffuse contact in to:	PEAT
-1.59 to -2.22	4.00 to 4.63	Sh2 Tl^{2}1 Th^{2}1; humo. 2; moderately humified dark reddish brown herbaceous and wood peat. Diffuse contact in to:	
-2.22 to -2.37	4.63 to 4.78	Ag2 Sh2 Th+; dark greyish brown very organic silt with a trace of herbaceous material (in situ). Diffuse contact in to:	LOWER ALLUVIUM
-2.37 to -2.59	4.78 to 5.00	Ag2 As1 Ga1 Dh+; dark olive grey sandy clayey silt with a trace of detrital herbaceous material. Some vertical sedge rooting. Diffuse contact in to:	
-2.59 to -3.23	5.00 to 5,64	Ag2 Ga1 As1 Dl+; grey sandy clayey silt with a trace of detrital wood. Diffuse contact in to:	
-3.23 to -3.35	5.64 to 5.76	Ga3 Ag1 Gg+; grey silty sand with occasional gravel clasts (flint). Diffuse contact in to:	
-3.35 to -3.46	5.76 to 5.87	Ga3 Gg1; orange gravelly sand. Clasts are flint, sub-angular to rounded, up to 20mm in diameter. Diffuse contact in to:	SAND

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
-3.46 to -3.59	5.87 to 6.00	Gg3 Ga1; orange sandy gravel. Clasts are flint, sub-angular to well-rounded, up to 30mm in diameter.	GRAVEL

Table 3: Lithostratigraphic description of borehole QBH2, Goresbrook Park, London Borough of Dagenham.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.18 to -0.82	0.00 to 2.00	Made Ground of concrete hardstanding over concrete and brick rubble.	MADE GROUND
-0.82 to -1.40	2.00 to 2.58	Made Ground of concrete and brick rubble; frequent glass.	
-1.40 to -1.57	2.58 to 2.75	As3 Ag1; blue grey silty clay with frequent worm/root hollows. Possibly reworked. Diffuse contact in to:	
-1.57 to -1.82	2.75 to 3.00	As3 Ag1; greyish brown silty clay. Some structure/colouration indicative of soil formation. Diffuse contact in to:	UPPER ALLUVIUM
-1.82 to -3.16	3.00 to 4.34	Sh3 Th^{2}1 Tl+ Ag+; humo. 3; dark reddish brown well humified herbaceous peat with traces of woody material and silt. Charcoal fragment (20x20mm) at -2.86 to -2.88m OD. Sharp contact in to:	PEAT
-3.16 to -3.82	4.34 to 5.00	Large wood branch/timber. Not possible to core beyond 5.00m bgl.	WOOD

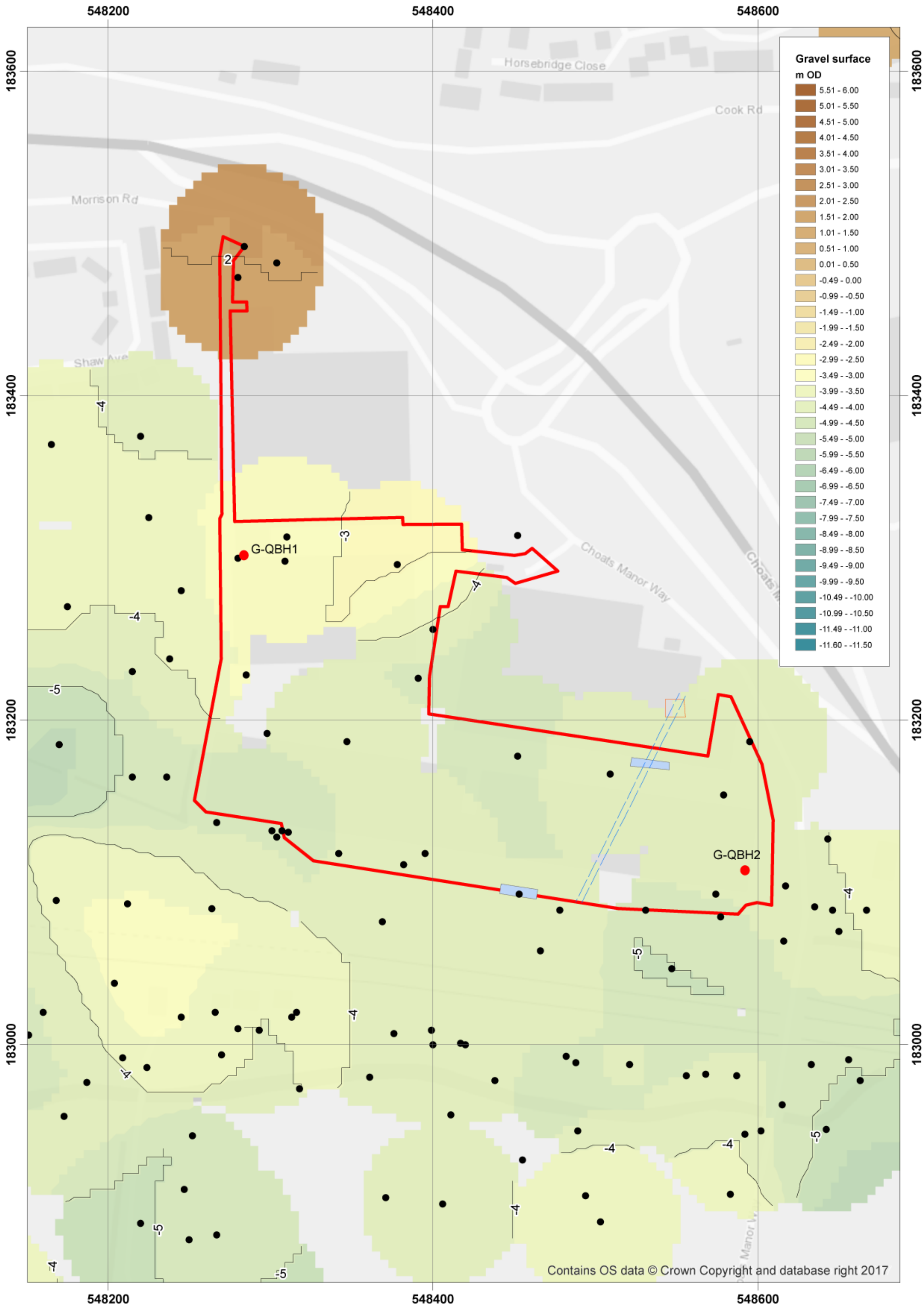

Figure 3: Top of the Gravel (m OD)

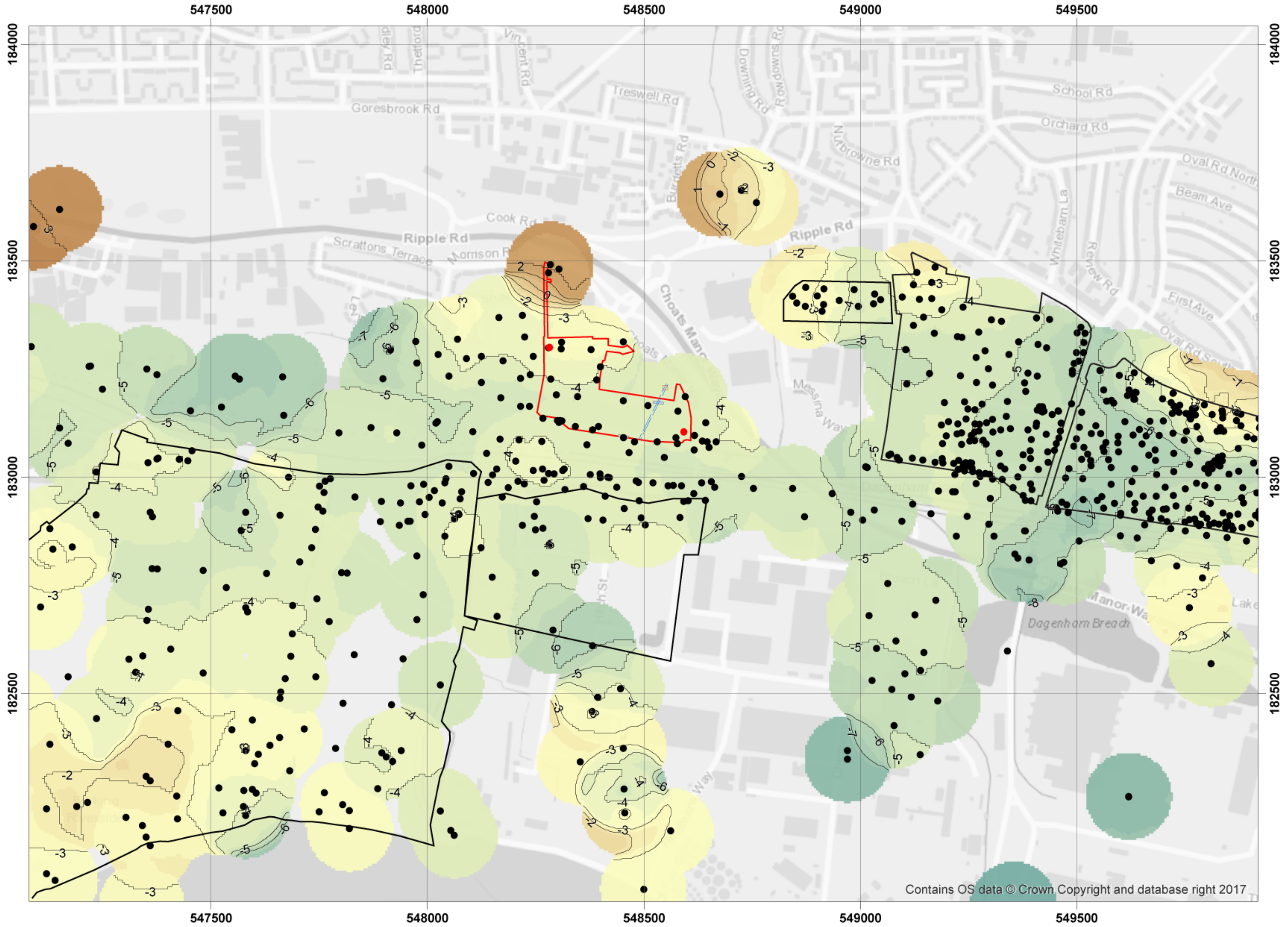

Figure 4: Top of the Gravel across the wider area (m OD) (site outline in red)

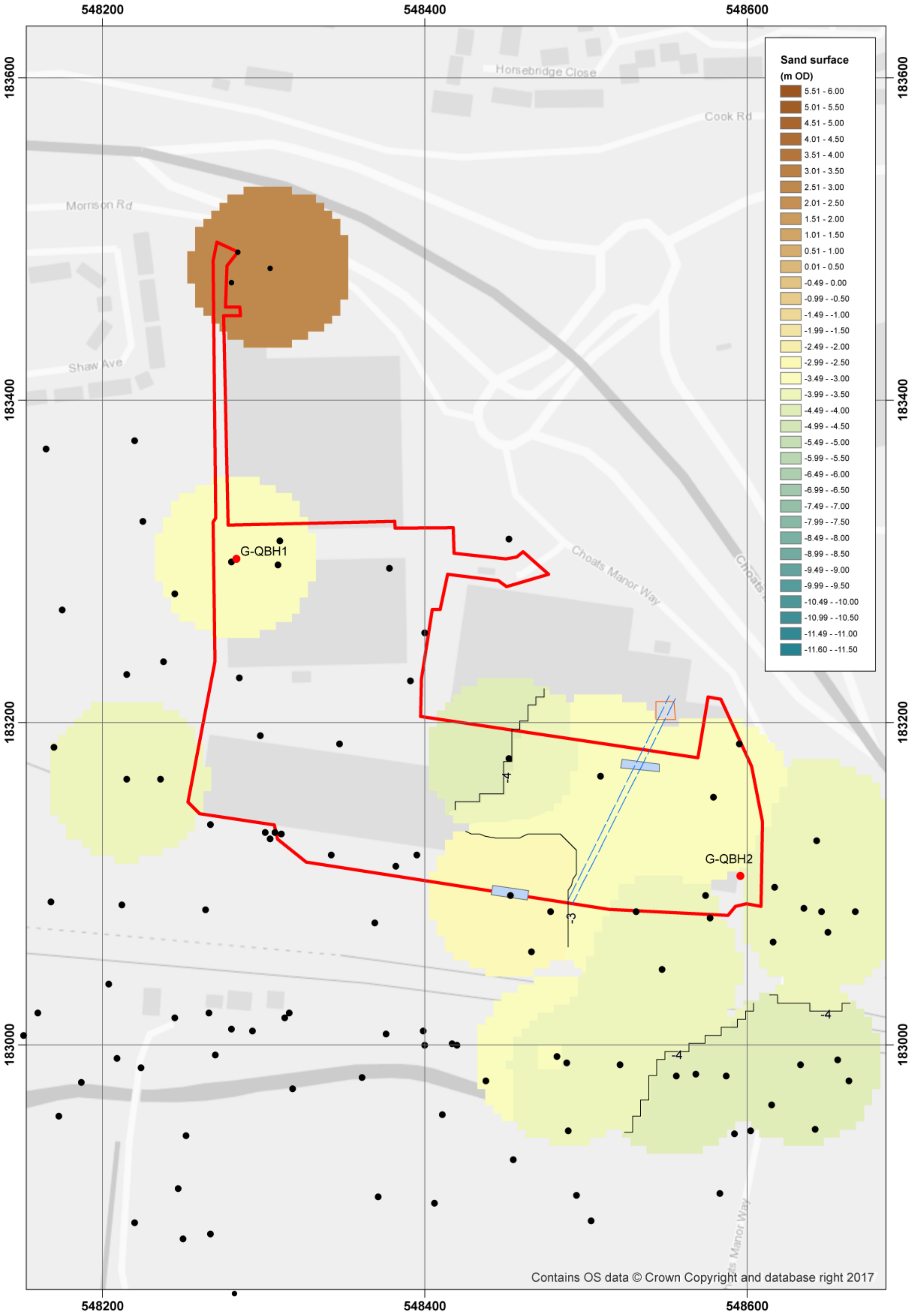

Figure 5: Top of the Sand (m OD)

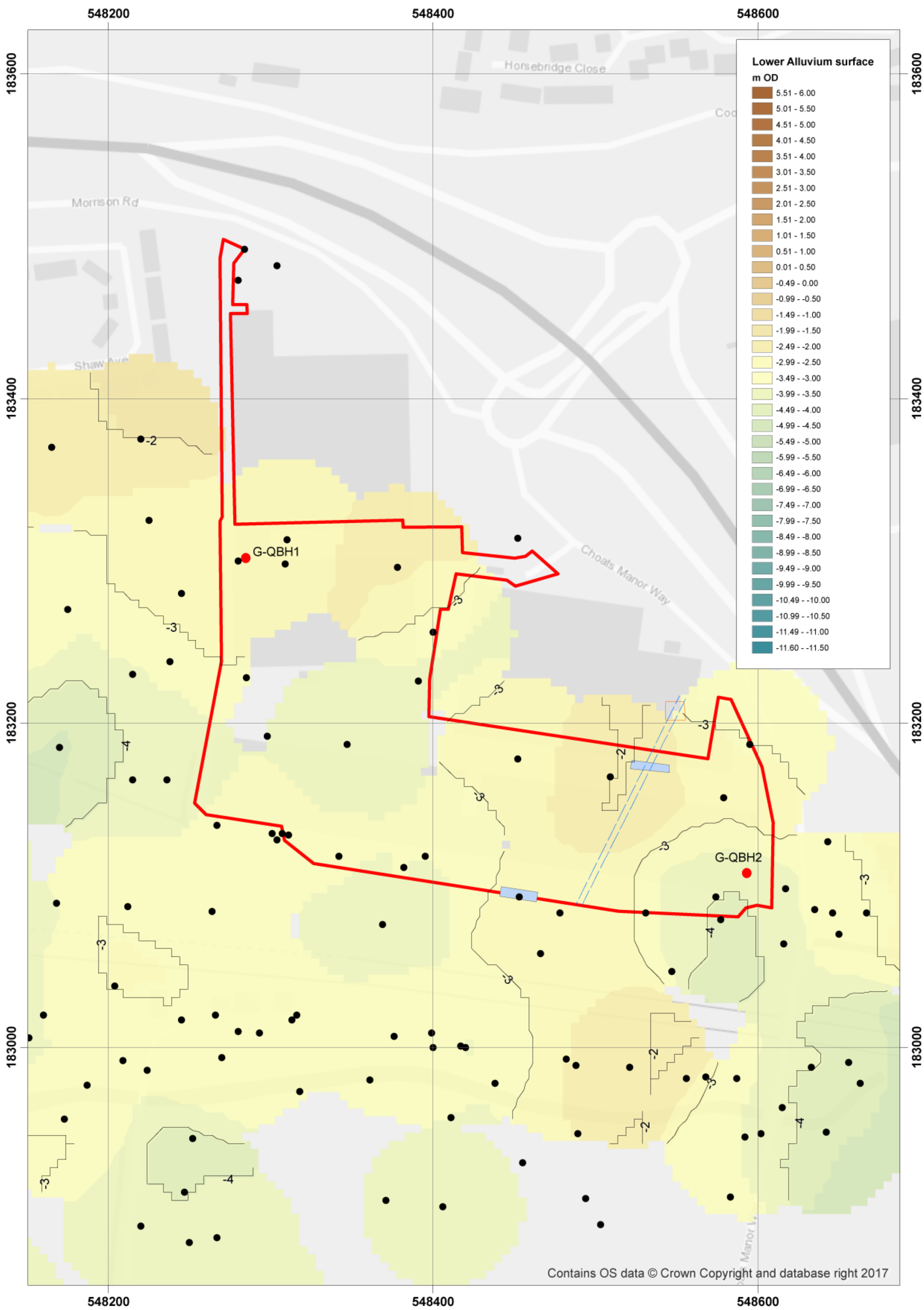

Figure 6: Top of the Lower Alluvium (m OD)

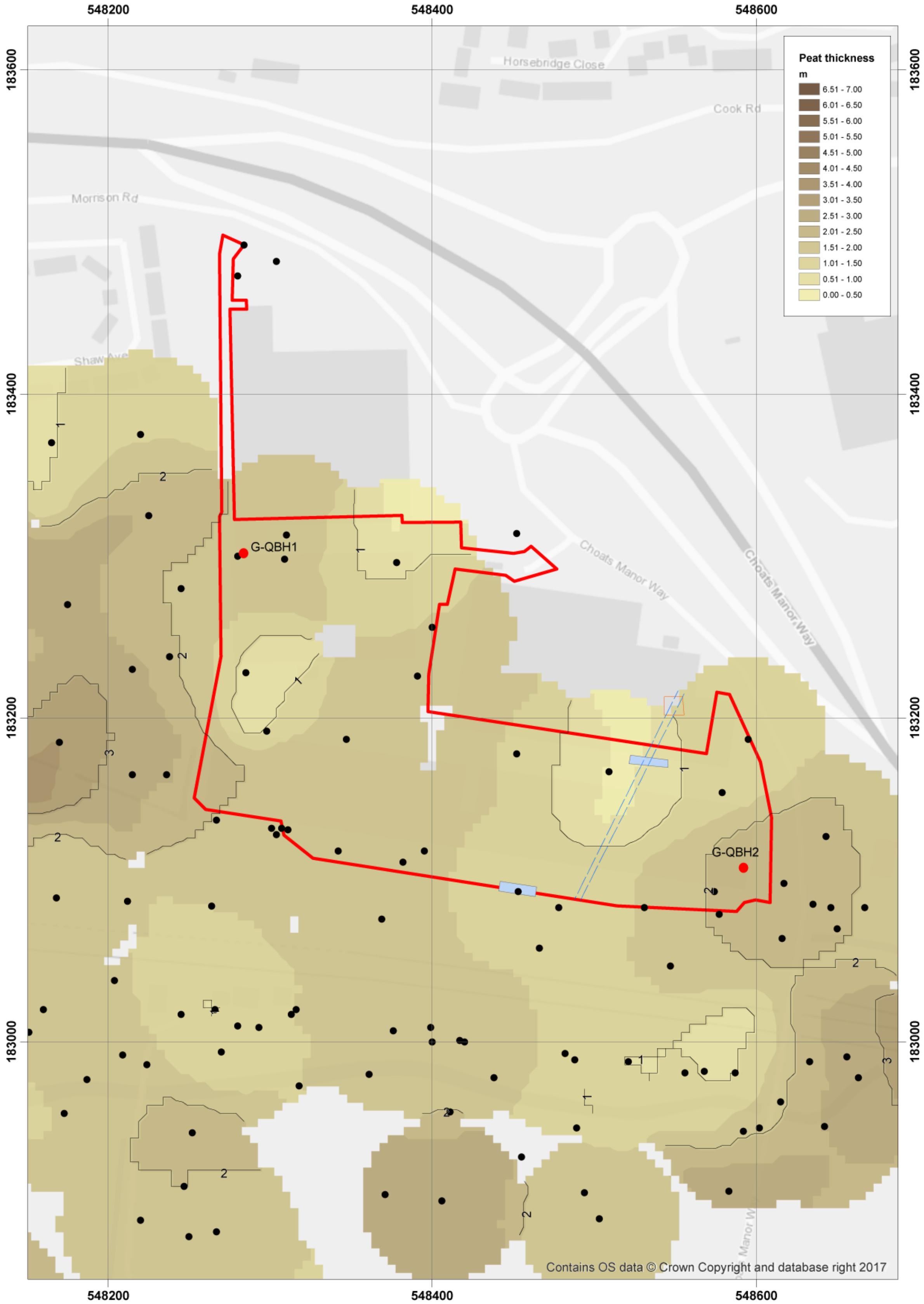

Figure 7: Thickness of the Peat (m)

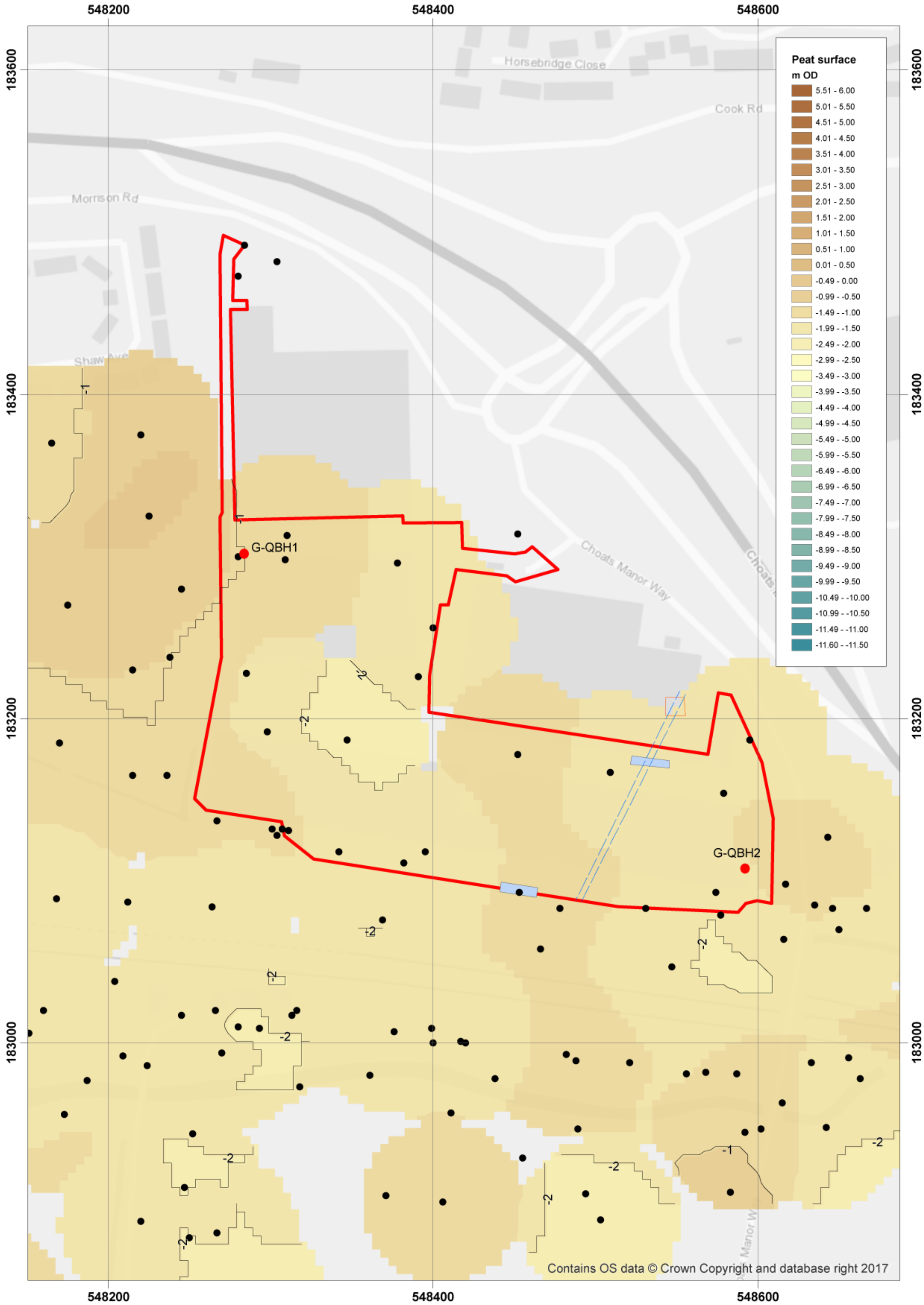

Figure 8: Top of the Peat (m OD)

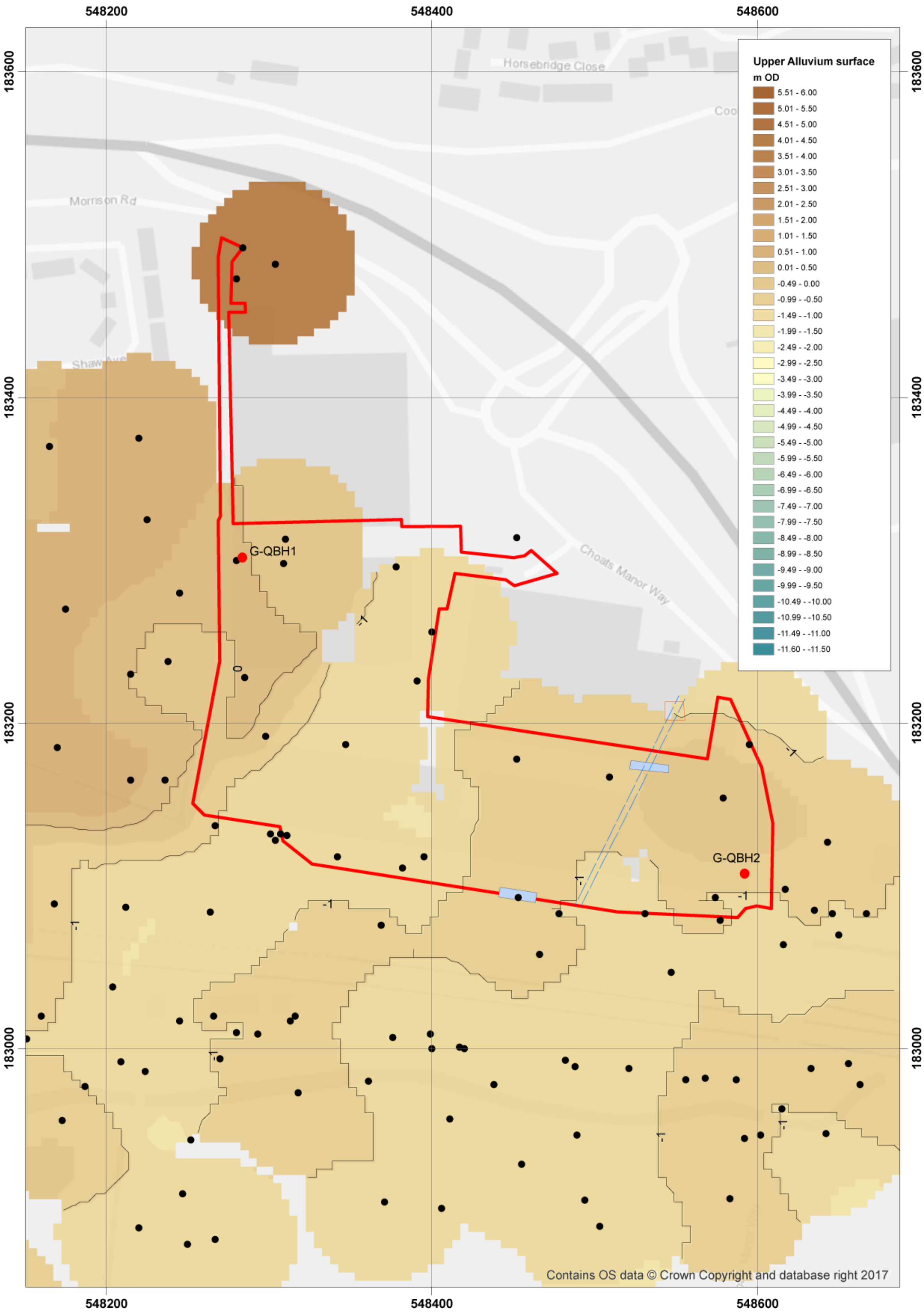

Figure 9: Top of the Upper Alluvium (m)

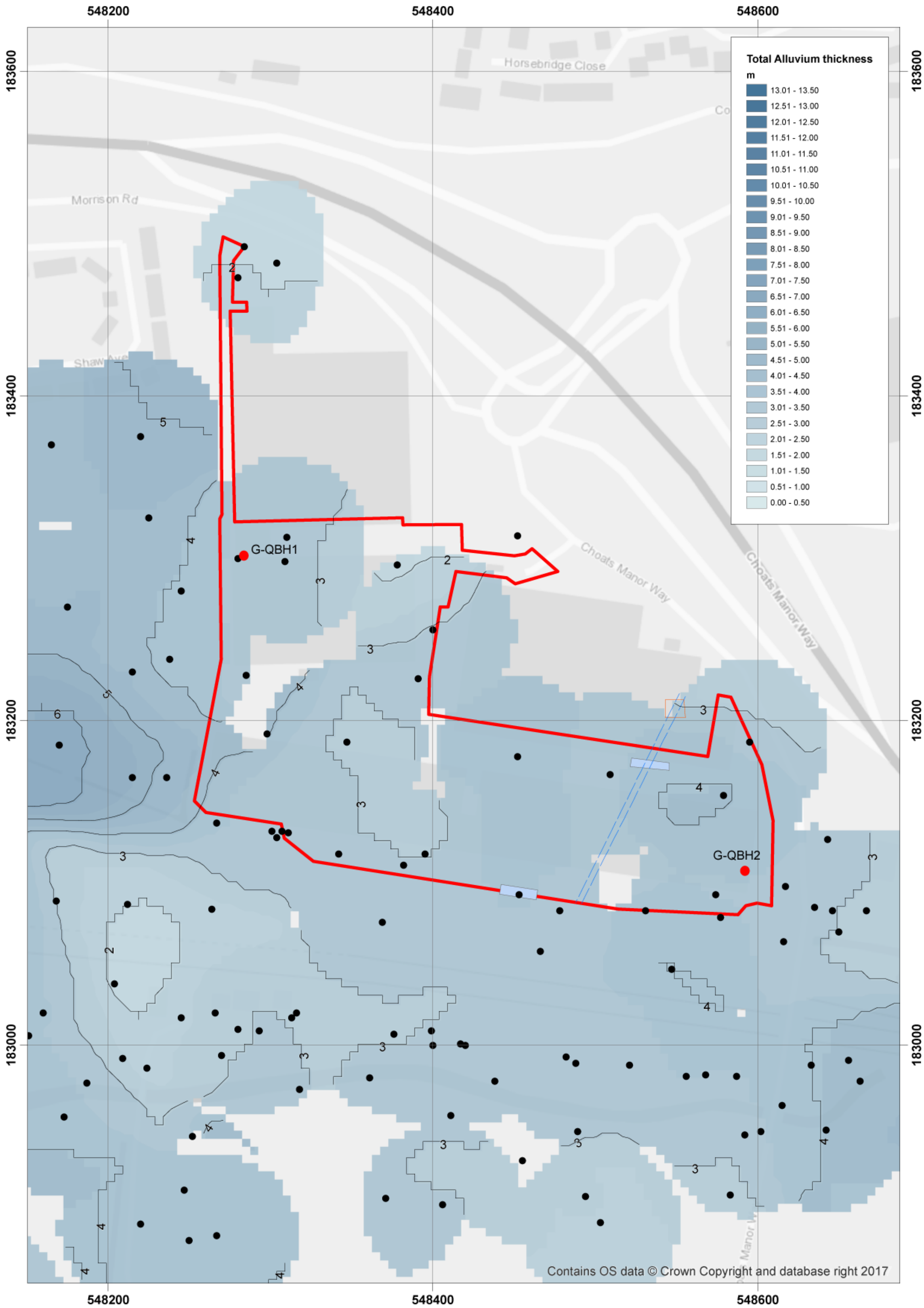

Figure 10: Thickness of the Total Alluvium (Lower Alluvium, Peat and Upper Alluvium) (m)

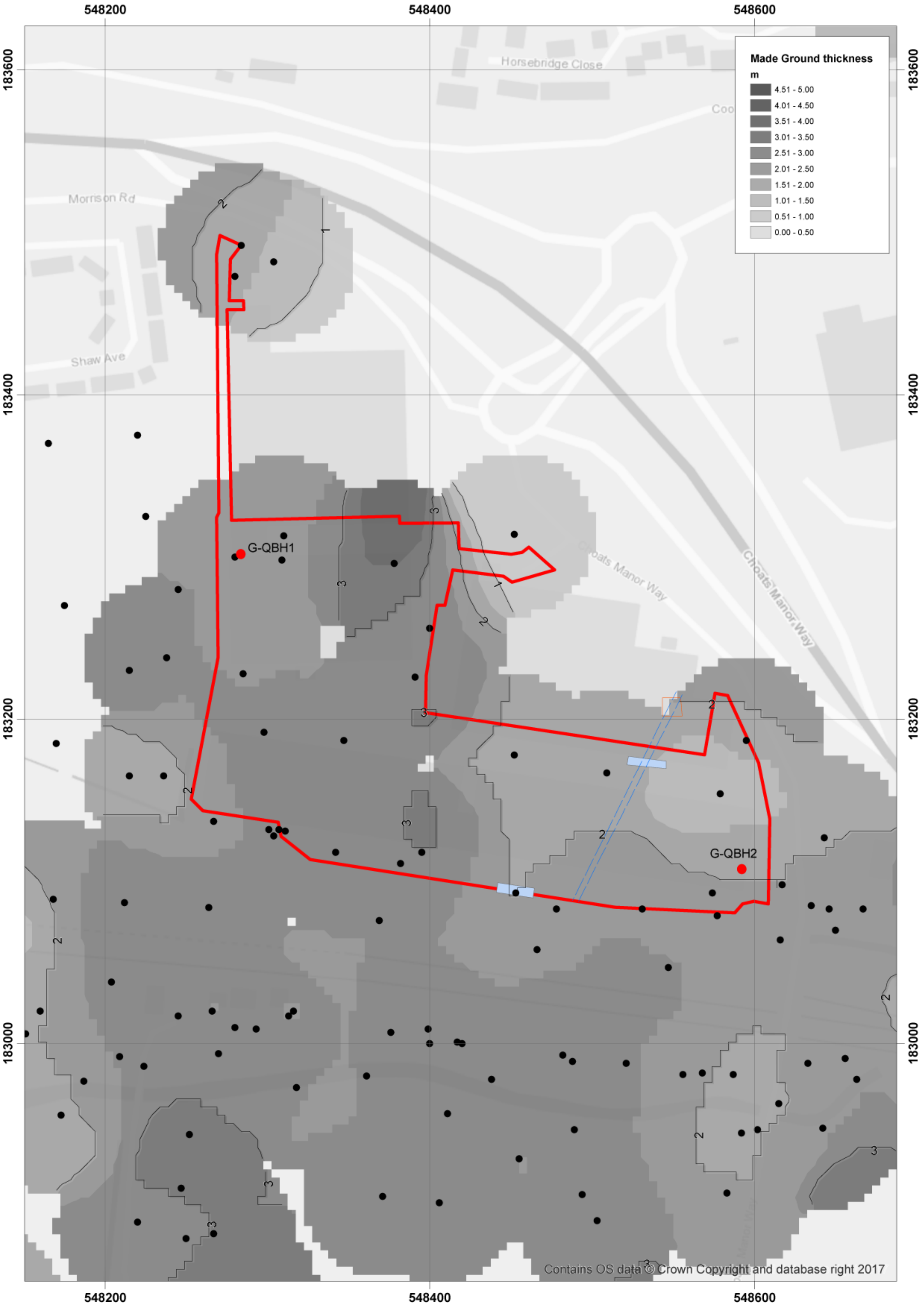

Figure 11: Thickness of Made Ground (m)

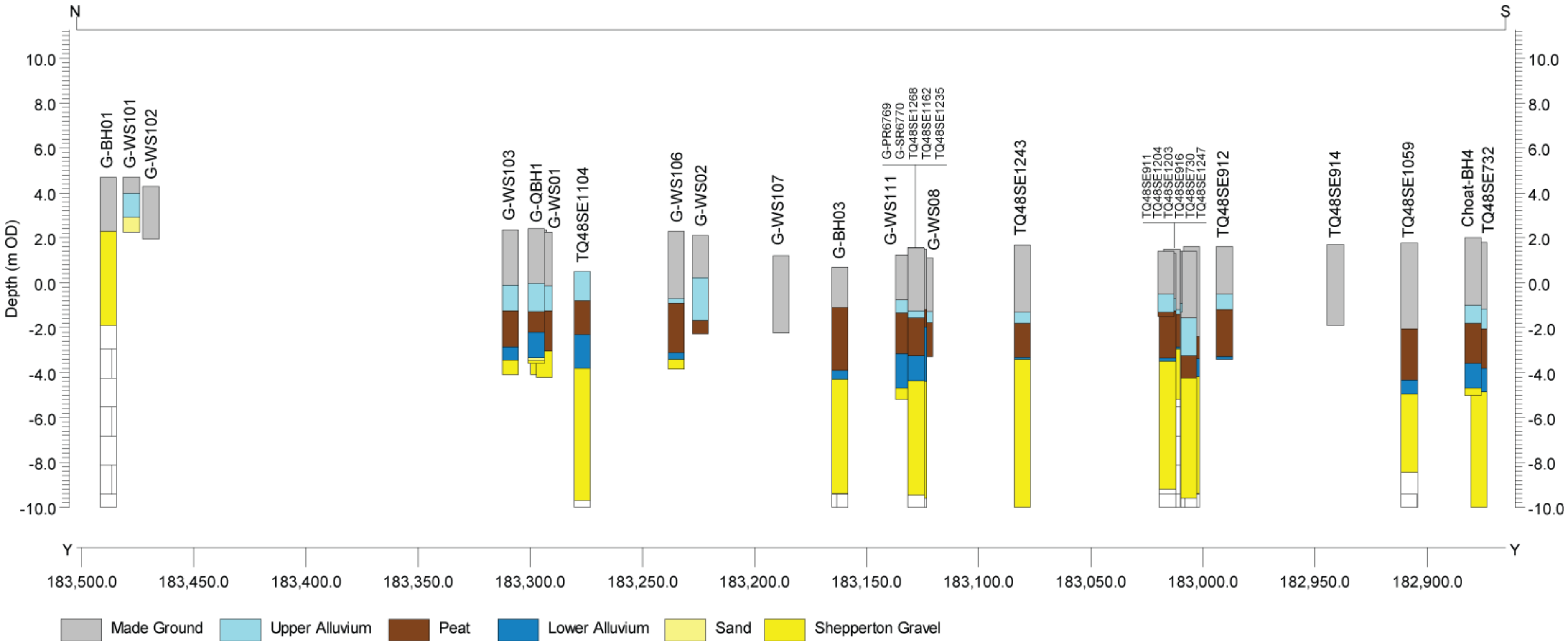

Figure 12: Site-wide north-south borehole transect

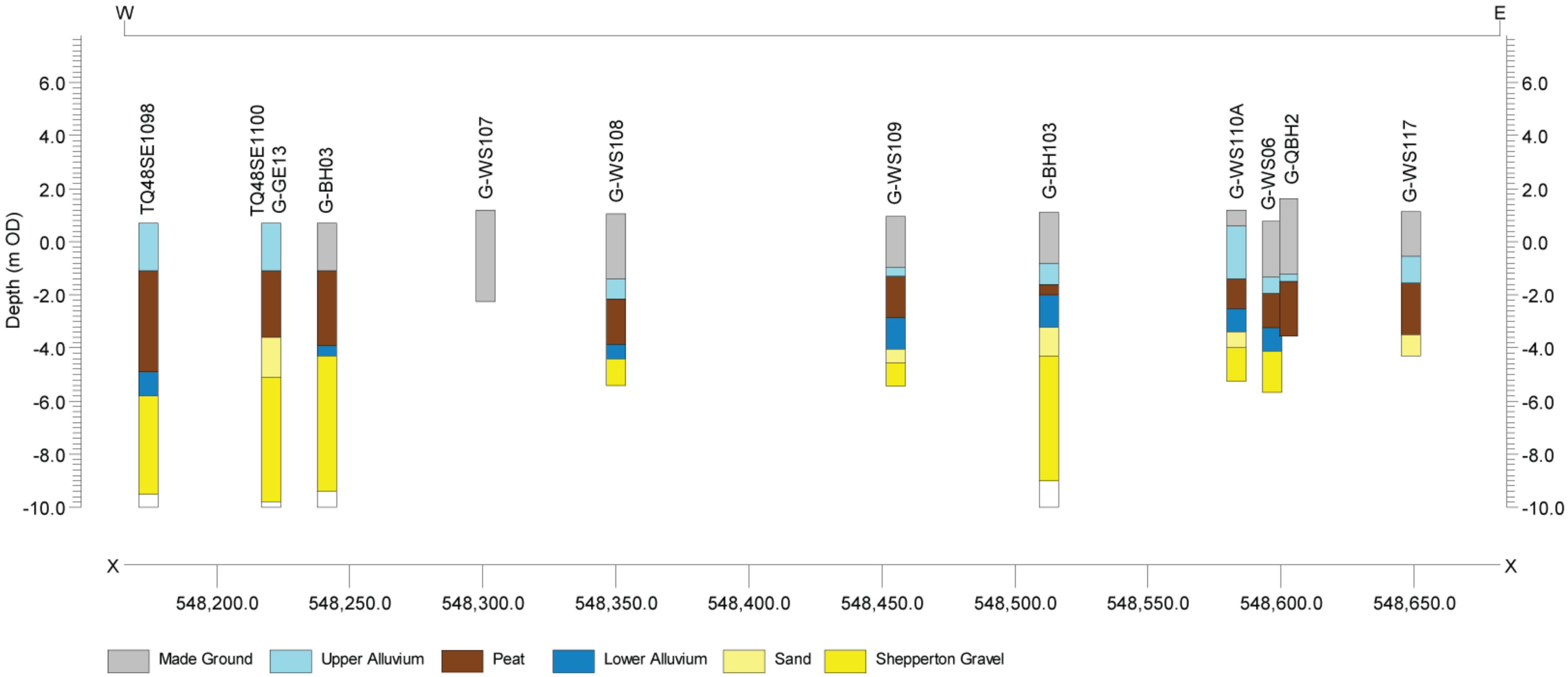

Figure 13: Site-wide west-east borehole transect

5. DISCUSSION & CONCLUSIONS

Following the results of a desk-based geoarchaeological deposit modelling exercise (Batchelor, 2017) two geoarchaeological boreholes were put down at the site both to ground-truth the existing model, and to collect material suitable for palaeoenvironmental investigation. These new boreholes have contributed to our understanding of (1) the sub-surface stratigraphy of the site, in particular the presence and thickness of alluvium and peat, (2) the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs, and (3) the archaeological potential of the site. The stratigraphic data from the new geoarchaeological boreholes was used to refine the existing deposit model of the major depositional units across the site.

The results of the new geoarchaeological investigations and subsequent deposit modelling indicate that the sediments present beneath the site are similar to those recorded elsewhere in the Lower Thames Valley. The Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, including peat, buried beneath modern Made Ground. The surface of the Shepperton Gravel generally rests between -3 and -4.5m OD across the majority of the site, rising to 2m OD on the northern most part of the site, representative of the Taplow Gravel terrace and floodplain edge. A similar sequence of deposits is recorded across the neighbouring Beam Park (Young & Batchelor, 2017a) and Former Ford Stamping Factory (Batchelor, 2017b) sites to the east. The Shepperton Gravel (and occasional sand) is overlain by a tripartite sequence of Lower Alluvium, Peat and Upper Alluvium. The Peat generally ranges between 1 and 2m in thickness.

Significant prehistoric archaeological remains have been found towards the top of the Peat (at *ca*. -1.6m OD) close to the floodplain/dryland edge at Hays Storage (Divers, 1996) immediately adjacent to the site. Further remains have been found at Bridge Road, Rainham (Meddens & Beasley, 1990; Beasley, 1991) and more recently within brickearth in the north-eastern corner of Beam Park (PCA, in press). At Bridge Road, these included a Bronze Age causeway, constructed of gravel and burnt flint, stakes, spreads of fire-cracked pebbles, wattling and a brushwood trackway. The potential of identifying such remains at the Goresbrook Park site, particularly towards the northern edge therefore exists, though it is highlighted that a recently completed archaeological evaluation (PCA, 2017) and ongoing watching brief (Mayo, pers. comm.) are yet to identify any prehistoric remains. It is of note that in borehole QBH2 a large, horizontal piece of wood was recorded between -3.16 and *at least* -3.82m OD; it is uncertain at this stage if this piece of wood represents a large branch or trunk of a fallen tree, or potentially a wooden structure. Interestingly, Divers (1996) noted that fallen yew and alder trees were recorded lower down in the peat sequence at the Hays Storage site, below the causeway identified there. Perhaps significantly, a large charred wood fragment (20x20mm) was identified just above this wood, at between -2.86 to -2.88m OD; again, it is unclear if this charcoal is a result of human activity or a natural fire event.

Even in the absence of archaeological remains at the site, the sediments have the potential to contain a wealth of further information on the past landscape, through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils and insects) and radiocarbon dating. So called environmental archaeological or palaeoenvironmental investigations can identify the nature and timing of changes in the landscape, and the interaction of different processes (e.g. vegetation change, human activity, climate change, hydrological change) thereby increasing our knowledge and understanding of the site and nearby area. In the case of human activity, palaeoenvironmental evidence can include: (1) decreases in tree and shrub pollen suggestive of woodland clearance; (2) the presence of herbs indicative of disturbed ground, pastoral and/or arable agriculture; (3) charcoal/microcharcoal suggestive of anthropogenic or natural burning, and (4) insect taxa indicative of domesticated animals. Such investigations are routinely carried out where required as part of planning conditions across the Lower Thames Valley and its tributaries, instructed by the LPA Archaeological Advisor.

6. RECOMMENDATIONS

On the basis of the results of the geoarchaeological investigations at the site, and the possible archaeological remains identified in borehole QBH2, it is recommended that a full environmental archaeological assessment is undertaken on borehole QBH1, with a limited programme of assessment on the sequence from borehole QBH2. For both boreholes, this assessment should consist of: (1) radiocarbon dating of the base and top of the Peat in order to ascertain the age of peat accumulation and cessation; (2) organic matter determinations to aid identification of the sedimentary units; (3) assessment of the palaeobotanical remains (pollen, waterlogged wood and seeds) to provide a provisional reconstruction of the vegetation history; (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 assessment will also highlight any indications of nearby human activity, and provide recommendations for further analysis (if necessary).

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8. APPENDIX 1: OASIS FORM

OASIS ID: quaterna1-295975

Project details

Project name	Goresbrook Park
Short description of the project	Two geoarchaeological boreholes were put down at the Goresbrook Park site, both to ground-truth the existing geoarchaeological deposit model and to collect material suitable for palaeoenvironmental investigation. The results of the new geoarchaeological investigations and subsequent deposit modelling indicate that the sediments present beneath the site are similar to those recorded elsewhere in the Lower Thames Valley. The Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, including peat, buried beneath modern Made Ground. The surface of the Shepperton Gravel generally rests between -3 and -4.5m OD across the majority of the site, rising to 2m OD on the northern most part, representative of the Taplow Gravel terrace and the floodplain edge. The Peat recorded within the alluvium generally ranges between 1 and 2m in thickness. Significant prehistoric archaeological remains have been found towards the top of the Peat close to the floodplain/dryland edge immediately adjacent to the site; the potential of identifying such remains at the Goresbrook Park site, particularly towards its northern edge, therefore exists. On the basis of the results of the geoarchaeological investigations at the site, and the possible archaeological remains identified in borehole QBH2, it is recommended that a full environmental archaeological assessment is undertaken on borehole QBH1, with a limited programme of assessment on the sequence from borehole QBH2.
Project dates	Start: 15-07-2017 End: 15-09-2017
Previous/future work	No / Yes
Type of project	Environmental assessment
Survey techniques	Landscape

Project location

Country	England
Site location	GREATER LONDON BARKING AND DAGENHAM DAGENHAM Goresbrook Park
Postcode	RM9 6RS
Site coordinates	TQ 48432 83233 51.527966794075 0.140026310543 51 31 40 N 000 08 24 E Point

Project creators

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

Project archives

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

Entered by	Daniel Young (d.s.young@reading.ac.uk)
Entered on	15 September 2017