ARCA Geoarchaeology

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# JUNCTION 28 IMPROVEMENTS, M25, HAVERING: GEOARCHAEOLOGICAL AUGER STUDY

Prepared for Cotswold Archaeology

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## SUMMARY

*A geoarchaeological auger survey was undertaken of land encompassed by a revised layout of Junction 28 of the M25 motorway in the London Borough of Havering. The particular focus of the study was the floodplain of Weald Brook and the surrounding valley sides. Fieldwork was carried out in November 2022, while the purpose of the work was to determine the depth, nature and archaeological/palaeoenvironment potential of strata subcropping on the site.*

*Thirty-four geoarchaeological auger holes were completed using manually operated Edelman augers. Strata in the auger heads were described in the field and lithostratigraphic data obtained from the auger holes was combined in a Rockworks database with those from 15 geotechnical boreholes and 3 geotechnical test pits. The database was then used to plot composite cross sections and deposit models.*

Technical summary of the stratigraphy

*Five stratigraphic units are present on the site. Strata of the Early Eocene age London Clay Formation form the bedrock basement and were found underlying superficial deposits across the entirety of the site. Matrix-supported flint gravels overlie London Clay Formation deposits on the western flanks of the Weald Brook valley and have an upper subcrop elevation of c. +35.5 to +31.5m OD. Further gravel with similar properties were found in the Weald Brook floodplain at +31.8 to +28.7m OD, while geotechnical boreholes demonstrated that these deposits were up to 2.5m thick. It is likely that the gravels are either remnants of a single unmapped Late Pleistocene fluvial terrace or of two such terraces, one Late Pleistocene and the other Late Pleistocene or Holocene. It is notable that one geotechnical borehole (GE ATK090) encountered deposits containing organic remains beneath the gravel. The archaeological potential of the gravel is dependent on age, which is presently unknown. However,* in situ *archaeological remains are unlikely. Organic preservation beneath the gravel in one floodplain location demonstrates localised moderate palaeoenvironmental potential.*

*Moderately sorted silt/clays with occasional to moderate gravel overlie strata of the London Clay Formation and the gravel to the west of the Weald Brook floodplain. These deposits are thickest in the west of the study area (up to 4m in one of the geotechnical boreholes [GE ATK058]), but they feather out on the floodplain edge. The strata are colluvial deposits (Head) and are most likely of Late Pleistocene and Holocene age. They have a low archaeological and palaeoenvironmental potential.*

*Moderately to well sorted brown and grey silt/clays form the surficial outcrop in the Weald Brook floodplain. Such deposits are up to 2.8m thick, and lack both organic remains and visible sedimentary structures. These strata are likely alluvium that has accreted by overbank flooding of the Weald Brook during the Holocene. The deposits have a low archaeological and palaeoenvironmental potential.*

*Poorly sorted gravels containing cultural material (brick, concrete etc) are found as localised subcrops to the east of the Weald Brook floodplain. These deposits are Made ground, most likely forming as a result of activities associated with industrial units attached to Grove Farm. The Made ground has no archaeological or palaeoenvironmental potential.*

Non-technical summary of the stratigraphy

*Flint gravels of probable Late Pleistocene age and of up to 2.5m thickness form the base of the Quaternary sequence across much of the site, while in one location on the present floodplain of the Weald Brook, they include organic sediments. These gravels probably formed in a river channel during the Late Pleistocene period, while they have an archaeological potential dependent on age (currently unknown) and a moderate palaeoenvironmental potential in the locus of the organic sediments.*

*Up to 4m of colluvial deposits ('Head') were encountered overlying the Pleistocene river gravels and London Clay bedrock on the western side of the Weald Brook valley. These colluvial deposits thin to the east and are of likely Holocene and Late Pleistocene age. They have a low archaeological and palaeoenvironmental potential.*

*Silt/clay alluvium of up to 2.8m thickness was found on the current Weald Brook floodplain. The deposits were homogenous and lacked organic remains, and their archaeological and palaeoenvironmental potential is low.*

*Made ground strata of 20$^{th}$ century date were found at the extreme east of the Weald Brook floodplain and on the slopes to the east. These deposits have a low archaeological and palaeoenvironmental potential.*

# 1. INTRODUCTION

1.1 This document reports the results of a geoarchaeological study undertaken of land that will be affected by the remodelling of Junction 28 (J28) of the M25 motorway in the London Borough of Havering (henceforth 'the site'). The work was carried out as set out in a task specific written scheme of investigation (Cotswold Archaeology 2022a, Wilkinson 2022), following the recording and reporting protocol of the Archaeological Management Plan (AMP) (Highways England 2021, section 10), and in accordance with Historic England's (2015) guidance on geoarchaeology and the Chartered Institute for Archaeologist's (CIfA) (2014) *Standards and guidance for archaeological field evaluation*. ARCA carried out the geoarchaeological study on behalf of Cotswold Archaeology and their client, Graham Group Ltd.

1.2 ARCA's fieldwork was carried out on 22–25 November 2022 at which time the surveyed area comprised the Graham Group Ltd and Cadent Gas Ltd construction site.

1.3 The site is centred on NGR TQ 56316 92439 and comprises the east and west slopes of a valley containing the Weald Brook (Figure 1C). Surface elevations in the area examined varied between +37.38 and + 31.32m OD. The Weald Brook has its headwaters 4.5 km north-north-west of the site on Navestock Common, and flows in a meandering form to the site, which it bisects on a north–south axis (Figure 1B and C). The Weald Brook is the main source of the Ingrebourne River, which in turn has a confluence with the Thames 14 km south of the site at Rainham.

1.4 The British Geological Survey (BGS) (2022a) map the bedrock geology of the study area as the London Clay Formation, deposits of which formed during the Ypresian stage of the Early Eocene, i.e. 56.0–47.8 million years ago (British Geological Survey 2022b). The BGS map Holocene[1] Alluvium overlying the London Clay Formation in the centre of valley of the Weald Brook Stream and Head on the slopes of that valley (British Geological Survey 2022a). 'Alluvium' and 'Head' are catch-all terms used by the BGS to describe deposits forming in flowing water and as a result of Newtonian flow (gravity, i.e. colluvium) respectively. Prior geotechnical studies of the study area suggest that the London Clay Formation subcrops at 0.25–4.00m below ground level (bgl) within the study area (Geotechnical Engineering Ltd 2020, Highways England 2020). The same geotechnical data have been interpreted to suggest that up to 7m of Alluvium form the Weald Brook floodplain below +34m OD, while c. 2m Alluvium outcrop at up to +36m OD on the western flanks of the Weald Brook valley (Highways England 2020, appendix J).

1.5 The Greater London Historic Environment Record has designated the floodplain of the Weald Brook and Ingrebourne River as an Archaeological Priority Zone (APZ) (DLO33196) because of the potential for prehistoric remains to lie within and beneath the Alluvium. The Head deposits are also designated as an APZ (DLO33197) for similar reasons. However, a watching brief carried out during the geotechnical works found no archaeological materials within or beneath the Alluvium and Head (Cotswold Archaeology 2019). An archaeological evaluation comprising 66 trenches, was carried out of the site by Cotswold Archaeology in August and September 2022, and finds were made of medieval, Mesolithic, Iron Age and Roman date (Cotswold Archaeology 2022b). Section 2 below provides a further summary of the archaeological background.

[1] The geological epoch from 11,700 years before present (BP) to the present day.

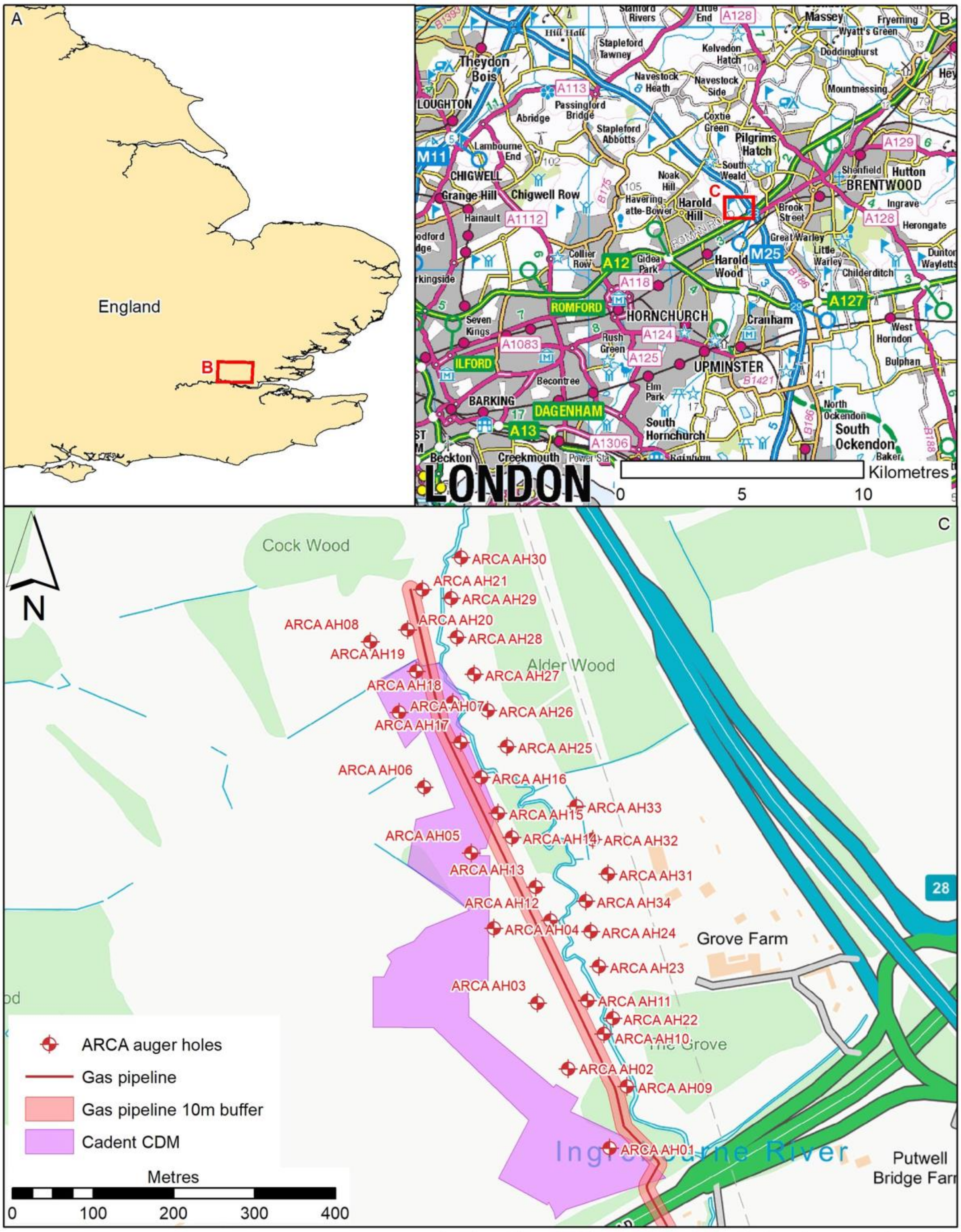




*Figure 1. Location of site within (A) southern England and (B) north-east London and western Essex, and (C) position of the ARCA geoarchaeological auger*

1.6 The aims of the present geoarchaeological study were set out in the task specific written scheme of investigation (Wilkinson 2022), which were in turn was informed by the archaeological research framework for the east of England (Medlycott 2011) and the overarching written scheme of investigation for the entirety of the J28 M25 archaeological works (Highways Agency 2021, section 6.3.2, 24–25). They were to:

1.6.1 To identify and record the extent and depth of Pleistocene[2] and Holocene superficial deposits within the site;

1.6.2 To assess the geoarchaeological and archaeological potential of superficial deposits within the site;

1.6.3 To develop updated deposit models illustrating key superficial deposits, including any buried land surfaces;

1.6.4 To retrieve undisturbed core samples and/ or subsamples to enable scientific laboratory works;

1.6.5 To make detailed appropriate recommendations for palaeoenvironmental assessment and dating at the reporting stage.

1.7 The remaining sections of this report first set out the methodologies by which the geoarchaeological study of the Weald Brook valley was carried out. The strata revealed in the auger holes are then described, while the Assessment section considers processes of landscape formation and archaeological/palaeoenvironmental potential of the strata. Collectively this latter text addresses Aims 1.6.1–1.6.2. The Results section contains the deposit models that satisfy Aim 1.6.3 and the Conclusion includes a consideration of Aim 1.6.5. Aim 1.6.4 was addressed throughout the fieldwork, but deposits suitable for the extraction of biological proxies were not encountered, i.e. meaningful palaeoenvironmental assessment was not possible.

[2] The geological epoch extending between 2.6 million and 11,700 BP.

## 2. ARCHAEOLOGICAL BACKGROUND

2.01 The text in the remaining part of Section 2 is taken in an (almost) unmodified form from the Cotswold Archaeology's (2022b) archaeological evaluation report.

2.0.2 The site and its environs have been the subject of a desk-based assessment (AOC Archaeology 2017), archaeological test pitting and an archaeological watching brief during ground investigation works (both Cotswold Archaeology 2019), an initial trial trench evaluation (Cotswold Archaeology 2021) and a second phase of trial trench evaluation (Cotswold Archaeology 2022b). The following text presents a synthesis of the known archaeology of the study area, while the cited texts should be consulted for a more complete background.

### 2.1 Prehistoric (pre-AD 43)

2.1.1 APZ DLO33196 (see Section 1.5) runs along the line of Weald Brook, reflecting the potential for prehistoric deposits to survive beneath alluvial layers associated with the brook.

2.1.2 Evidence for prehistoric activity is limited within the wider area, although South Weald Camp, a later prehistoric hillfort, is located within Weald Park (approximately 2km north-east of the evaluation site).

2.1.3 A Mesolithic tranchet axe was recovered from within Alluvium on the Weald Brook floodplain and Iron Age ceramics from colluvial deposits on the west side of the Weald Brook valley during Cotswold Archaeology's (2022b) August–September 2022 evaluation of the site.

### 2.2 Roman (AD 43-AD 410)

2.2.1 The A12 road (which runs along the southern boundary of the evaluation site) preserves the line of the former Roman road between London and Colchester. The line of the road is designated as APZ DLO33238.

2.2.2 Roman artefacts were found (together with those of Iron Age date) in colluvial deposits on the west side of the Weald Brook valley during Cotswold Archaeology's (2022b) 2022 evaluation.

### 2.3 Early Medieval (AD 410-1066)

2.3.1 Previous archaeological investigations at the Gardens of Peace (which lies on the east side of the A12) recorded Early Saxon activity, including drainage conduits and possible foundations for a light building. The unpublished report for this phase of works was supplied by GLAAS in draft form.

### 2.4 Medieval (1066–1539)

2.4.1 Known medieval activity in the area includes a medieval building at Harold Park (c. 350m south-west of the evaluation site), plus a hospital and a moated site off Brook Street, Brentwood (c. 1.2km north-east of the evaluation site).

2.4.2 Three (possible) medieval furrows (possibly remnants of a former rig and furrow field system) and a (possible) tree throw hollow containing burnt material and medieval pottery were found on the west flanks of the Weald Brook valley during Cotswold Archaeology's (2022b) 2022 evaluation.

### 2.5 Post-medieval (1540-1800) and modern (1800-present)

2.5.1 The map of the Liberty of Havering (c. 1618) shows the study area and the surrounding landscape as a series of enclosed fields. Ordnance Survey (OS) mapping from the 19th century shows the development of Grove Farm to the south- east of the site. The 1881 OS map shows a series of now-disappeared internal field boundaries throughout the site, and two ponds in the western side of the site.

2.5.2 The study area partially coincides with the former bounds of Maylands Aerodrome. The latter was established in 1929 and ceased functioning after 1940, when the airfield was hit by an incendiary bomb. Historic plans of the aerodrome show a road/trackway running through the evaluation site and a hanger with adjacent fuel stations in the south-central part of the site. A concrete base survives in the location of this hanger. Further structures, including a control tower, are shown to the immediate north of the A12.

## 3. METHODOLOGY

### 2.1 Fieldwork

3.1.1 The methodology employed in the field and subsequently was as described in outline in the task specific written scheme of investigation (Wilkinson 2022).

3.1.2 The locations of 34 auger holes were planned in an ArcGIS 10.7 project[3], these collectively forming three north–south transects parallel to the Weald Brook (Wilkinson 2022, figure 1). Coordinates for the auger holes were uploaded to a Leica GS16 RTK GPS and the latter device used to locate the drill positions in the field. However, in three instances (ARCA AH22, ARCA AH24 and ARCA AH26) the planned auger hole locations coincided with a BPA multipurpose pipeline. Further, the planned position of ARCA AH04 coincided with an area that had been machine excavated to the Pleistocene substrate in order to reveal the gas pipeline shown on Figure 1C. In all four cases therefore, auger hole locations were moved by 5–10m to avoid the hazard/prior works.

3.1.3 A CAT scanner was used to search for buried services at each auger hole location and within a 2m surrounding radius. Sub-surface anomalies were only found in the case of ARCA AH05 and that auger hole location was moved to a nearby position where there was no CAT scanner response. The final position of all boreholes was re-surveyed using the Leica GS16 GPS (Figure 1C, Appendix 1).

3.1.4 Holes were drilled using manually driven Edelman augers and were advanced to either the London Clay bedrock, impenetrable gravel strata or 3m bgl, whichever was encountered first. Sediment retained in the Edelman auger heads was described using standard geological criteria (Jones et al. 1999, Munsell 2000, Tucker 2011) and then used to backfill the auger hole void on completion. Lithological descriptions of the strata recovered in the Edelman auger holes are included in Appendix 2.

3.1.5 Upon completion of fieldwork, lithological (i.e. field descriptions of strata sampled in the Edelman auger heads) and positional data (downloaded from the Leica GS16 GPS) were transferred into a RockWorks 17 database.

### 3.2 RockWorks

3.2.1 Lithological and positional data from 15 geotechnical boreholes and 3 test pits drilled/dug by Geotechnical Engineering Ltd (2020)[4] were added to the RockWorks database containing the geoarchaeological auger data described in Section 2.1.5 above, resulting in a total of 52 stratigraphic records for the site (see Figure 2 for locations).

3.2.2 The RockWorks software was used to plot six composite cross sections through the site (Figure 3, Figure 4, Figure 5, Figure 8, Figure 9 and Figure 10) and four deposit models (Figure 6, Figure 7, Figure 11 and Figure 12). The latter accord with Historic England (2020) guidelines and were generated using a kriging interpolation algorithm

[3] Borehole positioning had to take account of a gas pipeline (and a 10m way leave either side) passing north–south along the western side and overhead power cables (also with a 10m way leave each side) on the eastern side of the Weald Brook (Figure 1C).
[4] All Geotechnical Engineering Ltd's boreholes located in the Weald Brook valley and those test pit records in the Weald Brook valley that penetrated the complete thickness of Head or Alluvium units were added to the RockWorks database.

to model the stratigraphy of uninvestigated areas on the basis of the nearest eight neighbours (i.e. borehole positions) and with a 50m cut off[5].

### 3.3 Archive

3.3.1 As noted in Section 2.1.3 above, sediment recovered in the Edelman auger heads was discarded in the field and then used to refill the void left by the borehole. There is consequently no material archive resulting from the geoarchaeological project.

3.3.2 The digital archive comprises a RockWorks 17 (SQLite) database housing the positional and lithostratigraphic data . These data will be held in perpetuity at the University of Winchester while exported versions of the data are included in this report as Appendices 1–2).

3.3.3 The digital archive conforms to the Archaeology Data Service (2022) Digital Antiquity: guides to good practice.

[5] Meaning locations greater than 50m from any stratigraphic record are not modelled. The distance represents 5.75% of the maximum (i.e. north–south) dimension of the site.

## 4. LITHOSTRATIGRAPHY

4.0.1 As previously noted, deposits revealed in the boreholes and in a prior geotechnical study are shown as six composite cross sections (Figure 3, Figure 4, Figure 5, Figure 8, Figure 9 and Figure 10 – composite cross location axes are shown in Figure 2), Detailed lithostratigraphic descriptions are provided in Appendix 2, while four deposit models map the surface of London Clay Formation bedrock (Figure 6) and Pleistocene gravel superficial geology (Figure 7Figure 4) and thickness of the Pleistocene/Holocene Head (Figure 11) and Holocene alluvium (Figure 12). The following text synthesises the depositional sequence in reverse stratigraphic order.

### 4.1 London Clay Formation

4.1.1 Firm grey (Munsell 5 Y 5/1) silt/clay, frequently mottled with strong brown (7.5 YR 5/8) iron stains was encountered in auger holes (ARCA AH11, ARCA AH22, ARCA AH24, ARCA AH26–27, ARCA AH29–30, ARCA AH34) in the Weald Brook floodplain where fluvial gravels did not subcrop (see Section 4.2) (Figure 4 and Figure 5). Similar deposits were also found in auger holes (ARCA AH02, ARCA AH05, ARCA AH07, ARCA AH09, on the western flanks of the Weald Brook valley, also in locations where there was no gravel subcrop (Figure 3). In the floodplain, the grey silt/clays subcropped below +33.83m OD in the north of the site (ARCA AH30 and ARCA AH29) and +29.09m OD in the south (ARCA AH22) (Figure 4, Figure 5 and Figure 6).

4.1.2 The firm grey silt/clay is the London Clay Formation bedrock geology mapped by the BGS, while the strong brown iron stains demonstrate weathering of that stratum rather than the operation of redox processes (as seen in the Alluvium – see Section 3.4 below). Indeed, strata sampled in the geotechnical boreholes has been interpreted to suggest that the top 2–10m of the London Clay Formation is weathered (i.e. it contains red/brown sediment) (Geotechnical Engineering Ltd 2020, Highways England 2020, appendix J). The London Clay Formation is most likely the source of particles forming both the Head (Section 4.3) and Alluvium (Section 4.4) deposits discussed below, and can only be separated from the latter on the basis of compaction and the nature of the weathering products.

4.1.3 Given variability of compaction and weathering features, and the method by which the Edelman auger head extracts a sample (i.e. disrupting sediment structures), it is possible that deposits categorised as Head or Alluvium in this report, are actually strata of the London Clay Formation. In other words, the sub-crop elevations shown in Figure 6 should be taken as a minimum. On the other hand, it is considered unlikely that deposits attributed to the London Clay Formation are either Head or Alluvium.

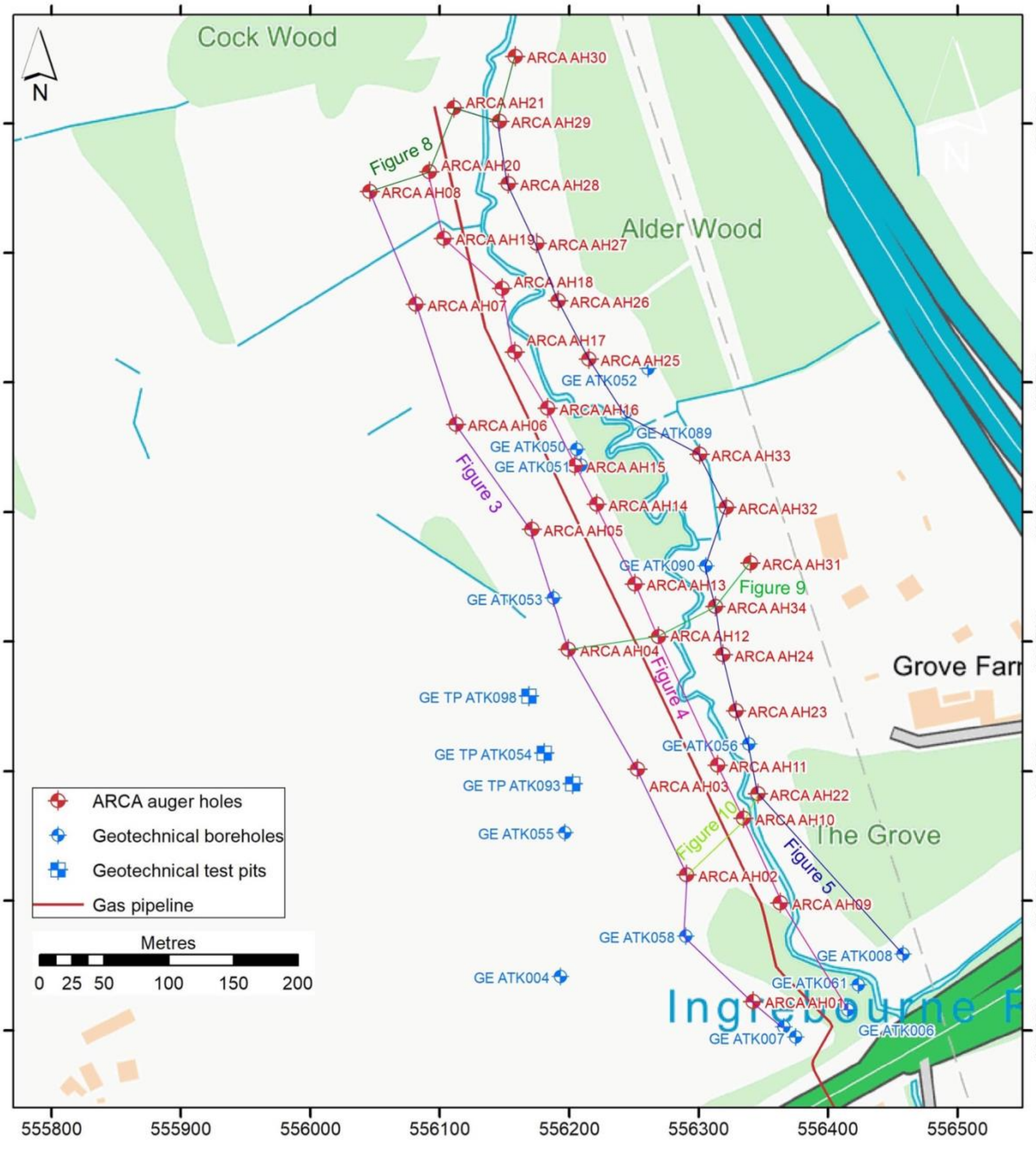


*Figure 2. Location of composite cross sections*

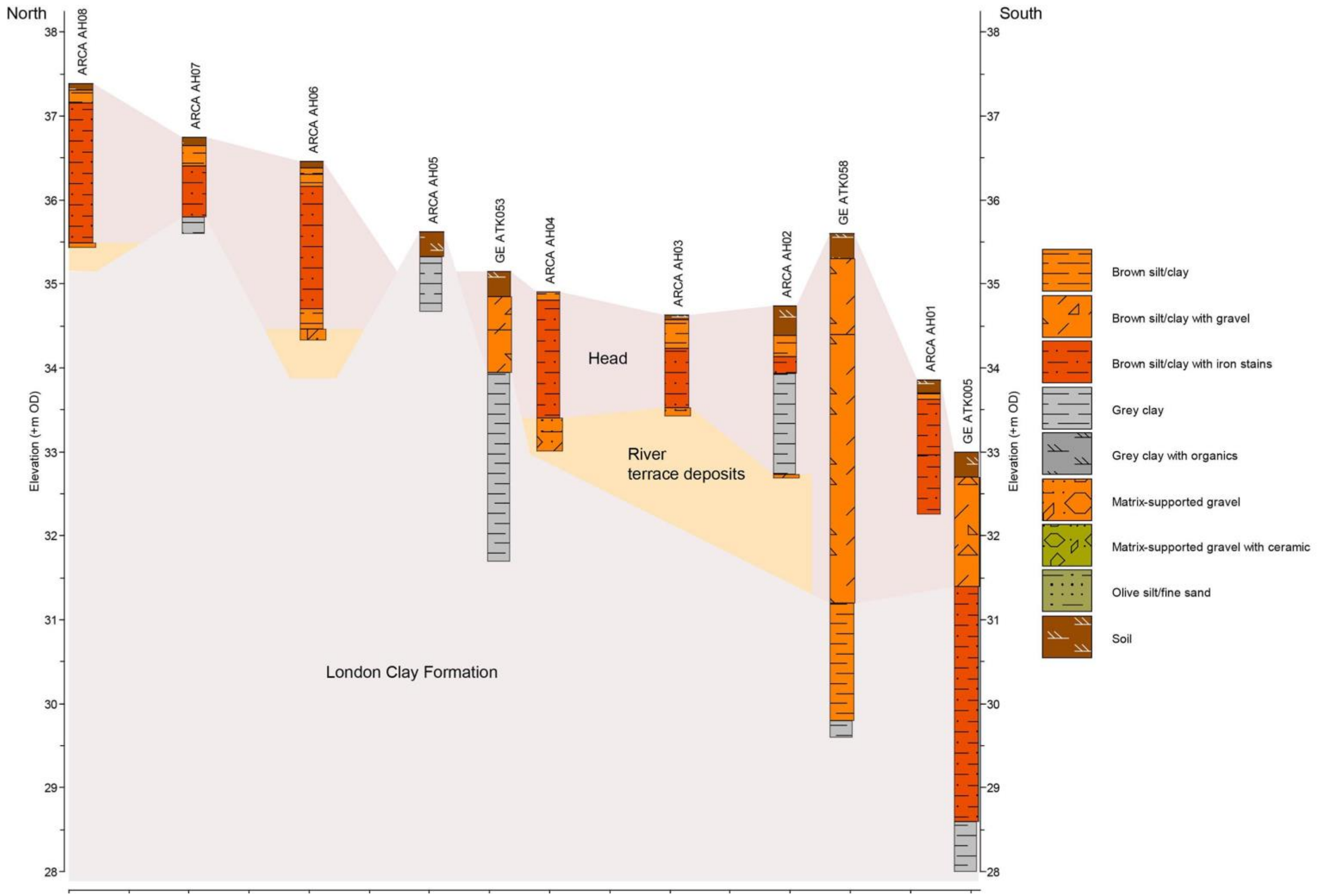


*Figure 3. North–south composite cross section through the western part of the site*

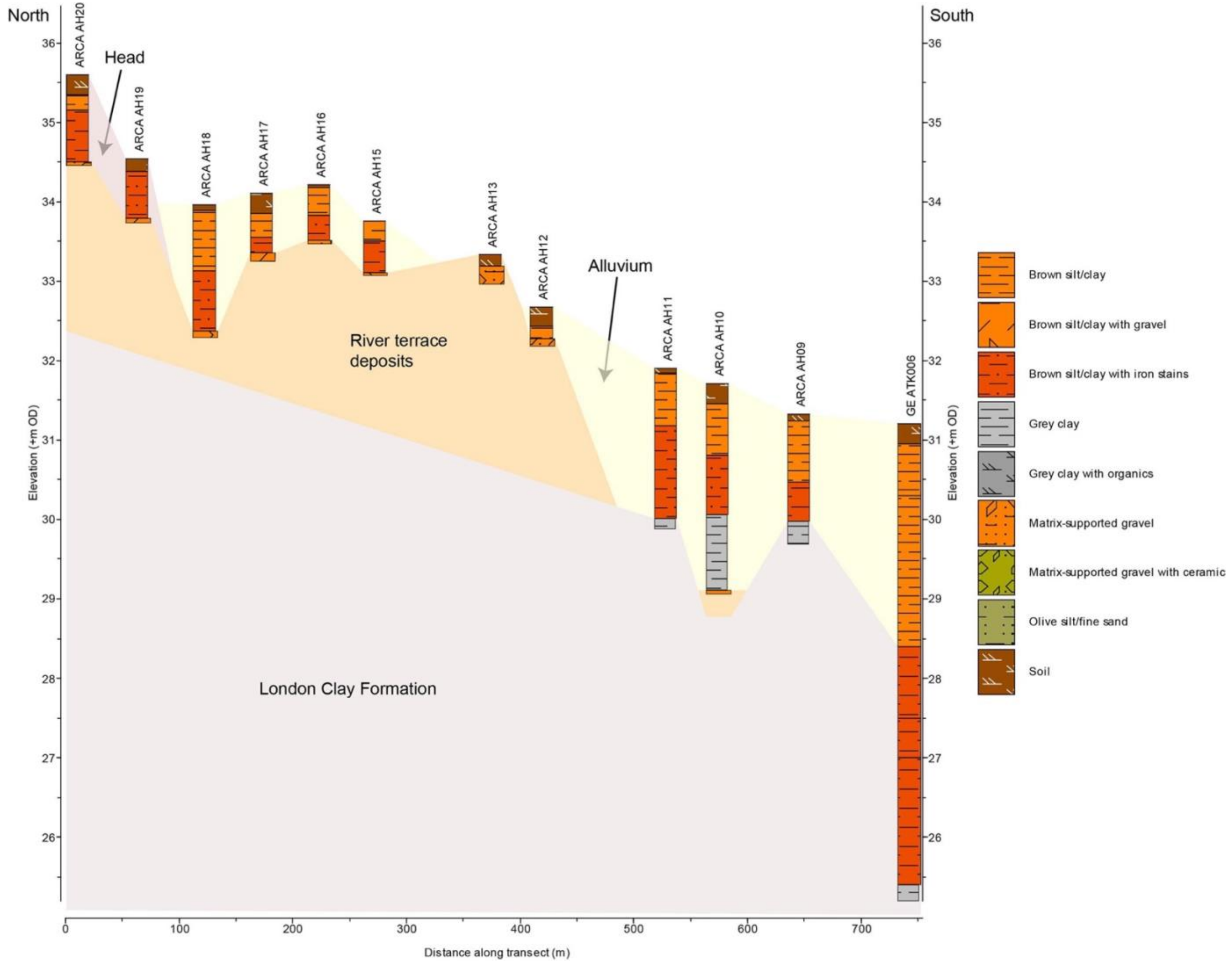


*Figure 4. North–south composite cross section through the west floodplain of the Weald Brook*

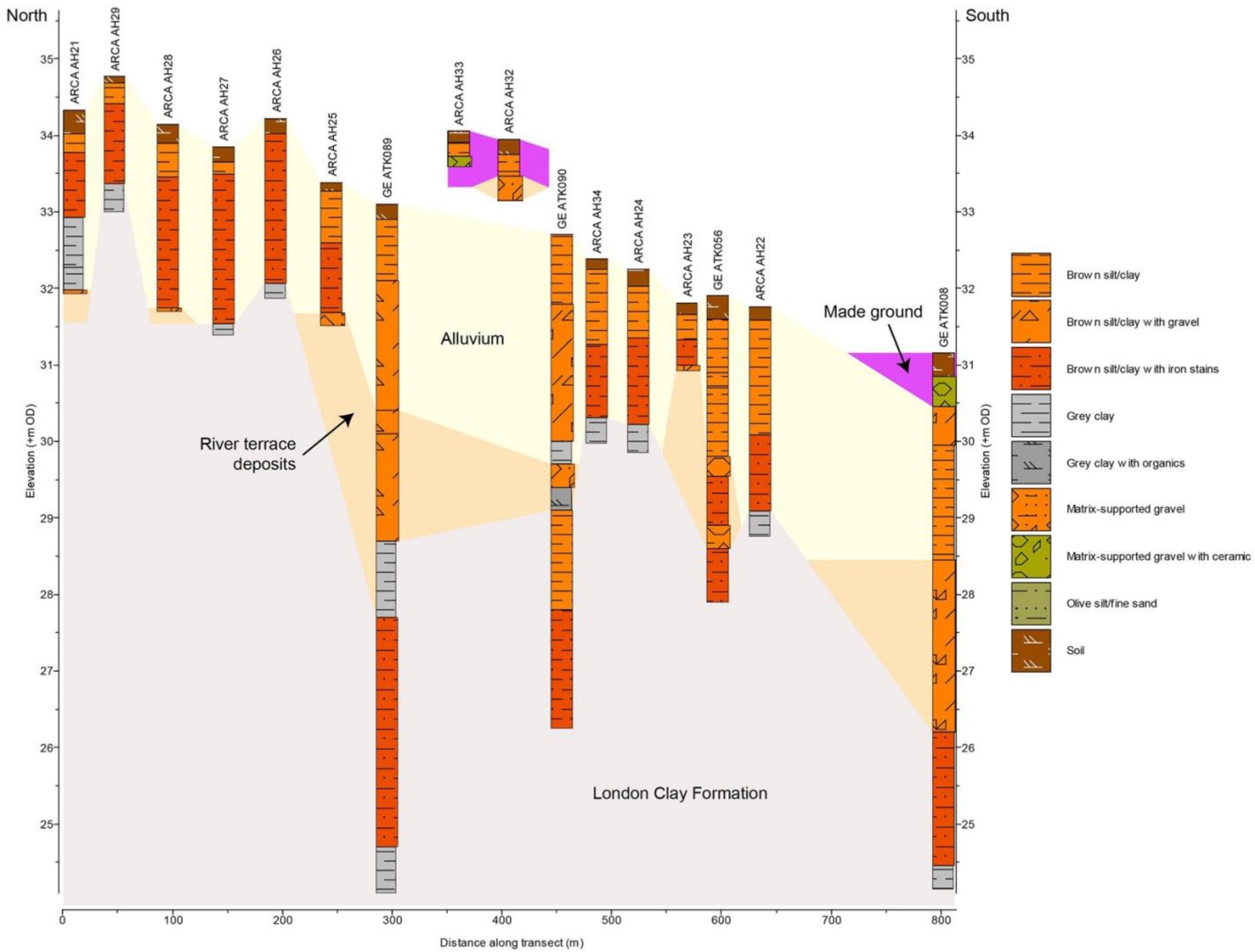


*Figure 5. North–south composite cross section through the east floodplain of the Weald Brook*

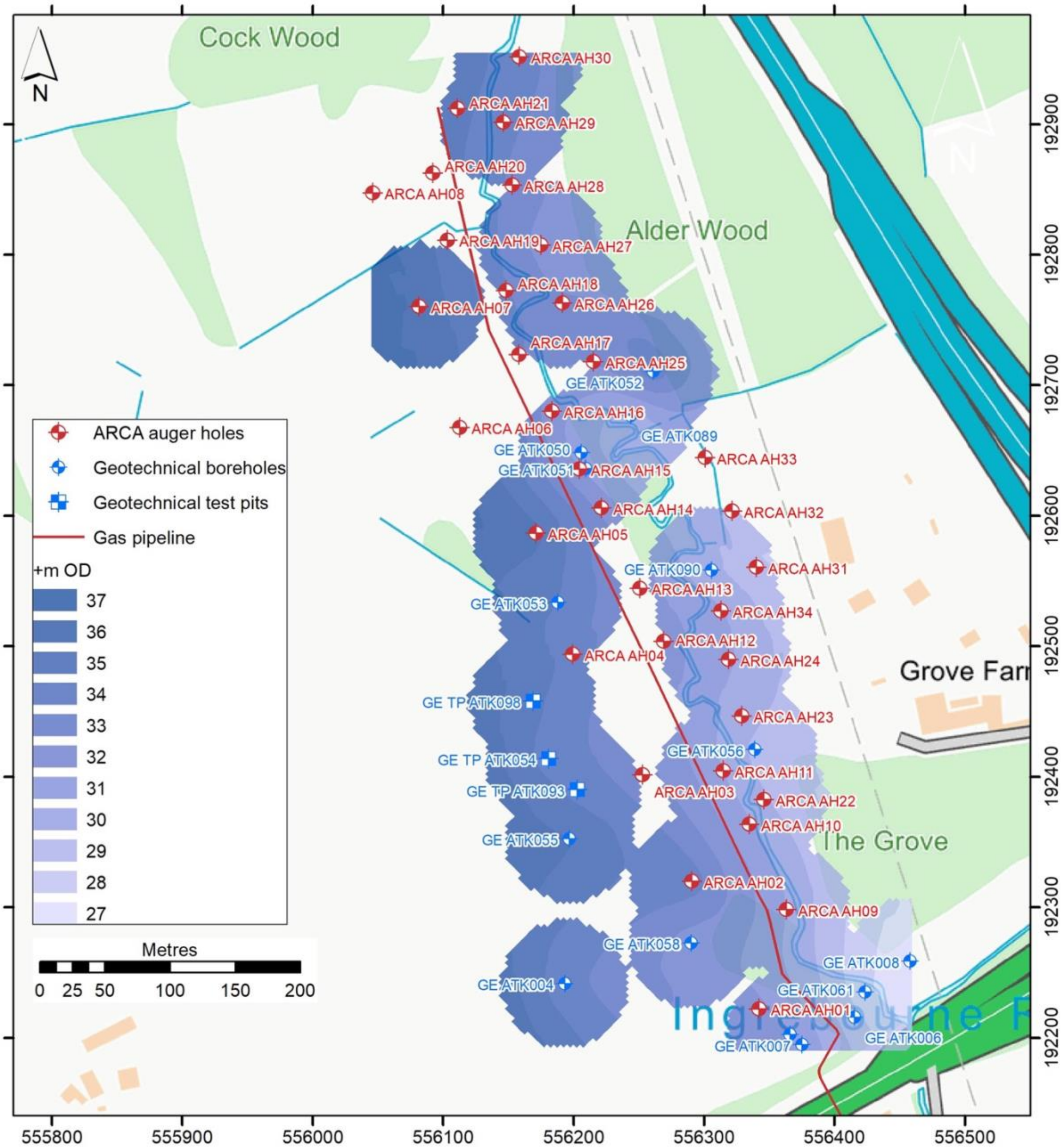


*Figure 6. Modelled surface of the London Clay Formation*

## 4.2 Pleistocene gravel

4.2.1 Brown (Munsell 7.5 YR 4/3, 10 YR 5/3) matrix-supported gravels of sub-angular to sub-rounded flint pebbles in a silt/clay matrix are present either beneath Head deposits (see Section 4.3) or as a surface outcrop (ARCA AH13 – see Figure 4) in the majority of auger holes on the western flank of the Weald Brook valley (Figure 3). Similar, but light yellowish brown (10 YR 6/4) and grey (5 Y 5/1) matrix-supported gravels also underlie Alluvium (Section 4.4) in the centre of the Weald Brook valley. In both instances the gravel strata were impenetrable by the Edelman auger and therefore neither gravel thickness, nor the relationship of the stratum with the London Clay Formation could be determined from the present field data. However, although not separately recorded on the western flanks of the Weald Brook valley[6], gravel deposits in the geotechnical boreholes in the Weald Brook floodplain are up to 2.5m thick (GE ATK008) and overlie deposits of the London Clay Formation (Figure 5). One of the five geotechnical boreholes (GE ATK090) drilled in the Weald Brook floodplain encountered 0.30m of 'soft bluish grey silty clay with frequent fragments (up to 20mm) of decomposed wood and frequent pockets (up to 10mm) of black fibrous peat' beneath gravel deposits at 3.00m bgl (Geotechnical Engineering Ltd 2020, appendix A). Otherwise, organic remains were not encountered in association with gravel strata.

4.2.2 The gravel surface subcrop on the west flank of the Weald Brook valley ranges from +35.48m OD (ARCA AH08) to +33.41 (ARCA AH04), i.e. 2.2m to 1.05m above the present channel of the stream (Figure 3 and Figure 7). However, gravel strata beneath the Alluvium lie at +31.75m OD in the northern (ARCA AH28) and +28.70 OD on the southern part (GE ATK008) of the site east of the stream (Figure 5), and between +33.35m OD (ARCA AH17) and +32.47m OD (ARCA AH12) on the west of the stream (Figure 4). The gravel outcrop is hence 1.0–0.2m below on the eastern floodplain of the Weald Brook and 1.3–1.2m above present channel elevation on the western side of the water course.

4.2.3 Although the BGS do not map a River Terrace Deposits on the site and the prior geotechnical surveys have followed the BGS mapping (Geotechnical Engineering Ltd 2020, Highways England 2020), the gravels described above are likely subcrops/outcrops of such strata. Indications of a fluvial origin are the mixed assemblage of sub-rounded and sub-angular flint clasts (flint is not present in the London Clay Formation), inclusion of sand in the matrix (sand is not found in strata of the London Clay Formation on the site) and the size sorting of gravel clasts. Unfortunately, the Edelman auger does not recover intact samples and so sedimentary structures could not be identified in the gravels, while the geotechnical borehole logs do not record structural features. However, a limited exposure had been excavated by contractors through the gravel on the western side of the Weald Brook valley to reveal the gas pipeline in the area be ARCA AH04 and ARCA AH05. Although battened and not directly accessible, the gravels appeared to be bedded and of at least 0.6m in thickness.

4.2.4 The gravels likely formed in the bed of a previous Weald Brook stream, following which downcutting has occurred. Either a single Quaternary fluvial terrace or possibly two fluvial terraces are represented, one on the western side of the valley extending 2.2–1.2m above the present channel and the other on the east sub-cropping 1.0–0.2m below the present channel. Whichever scenario is correct, the terrace(s) are likely to be of Late Pleistocene or possibly, in the case of the eastern sub-crop, Holocene age given the elevation difference with the present stream.

[6] Rather the presence of gravel particles is included in lithological descriptions, sometimes in relative terms, e.g. 'many', 'some' etc, but not always the depth at which they were encountered (Geotechnical Engineering Ltd 2020).

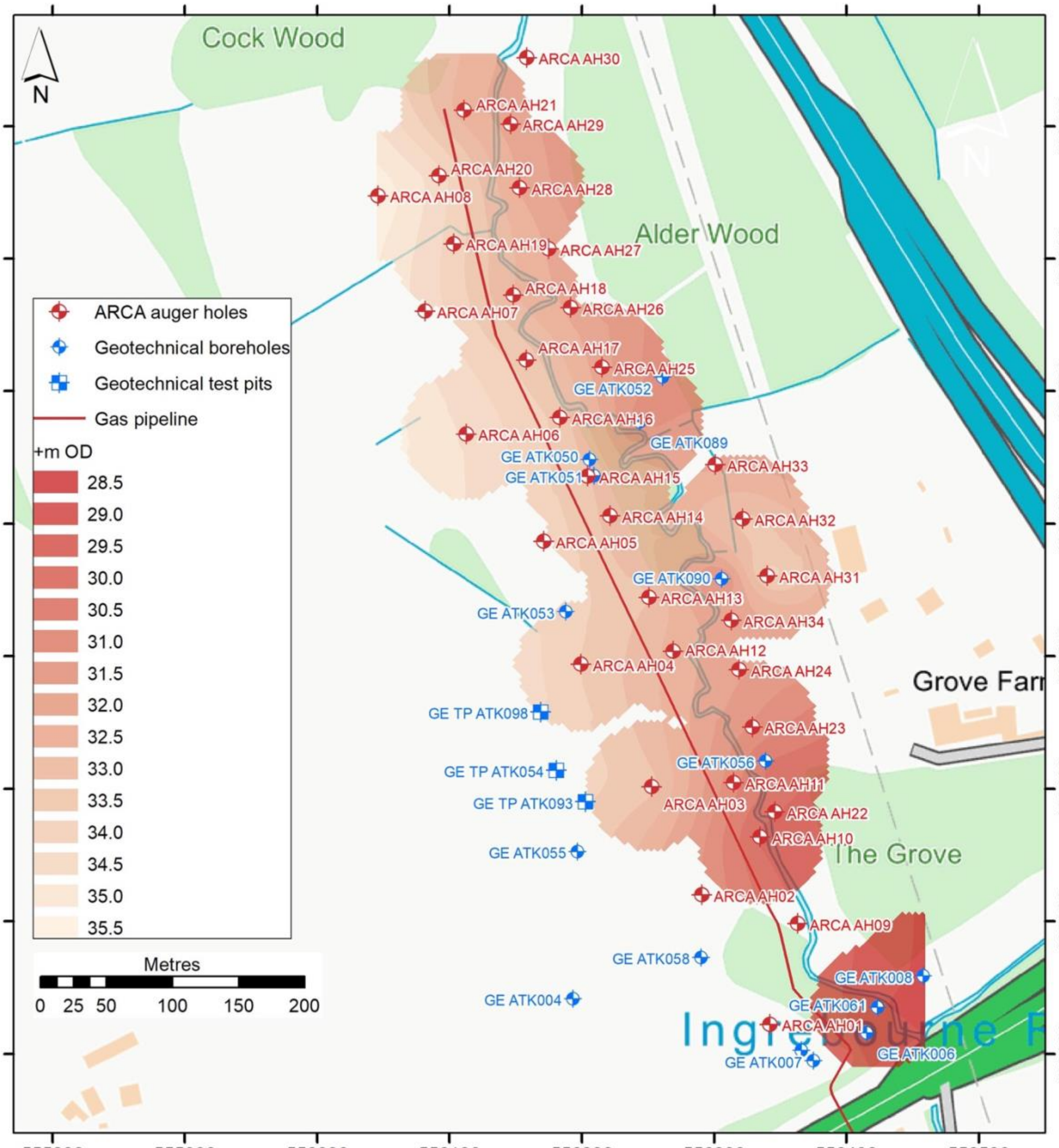


*Figure 7. Modelled surface of the fluvial gravel*

### 4.3 Pleistocene Head/Holocene colluvium

4.3.1 Brown (10 YR 5/3) and greyish brown (10 YR 5/2) silt/clay strata containing occasional to moderate sub-angular and sub-rounded flint pebbles are found outcropping in all auger holes (ARCA AH01–08, ARCA AH19–20) on the western flanks of the Weald Brook valley (Figure 3). These deposits are locally iron stained and extend from the gravel stratum (Section 4.2) to the present ground surface. The thickest of these brown/greyish brown silt/clay strata are in the west, and particularly south-west, of the site, i.e. at relatively high elevation, while the deposits thin to the east and disappear above the level of the Weald Brook floodplain (Figure 8, Figure 9, Figure 10 and Figure 11). For example, 2.00m of brown/greyish brown silt/clay subcrops in ARCA AH06 and

1.90m in ARCA AH08 in the western part of the site, while lesser thicknesses are found downslope and to the east, e.g. 0.75m in ARCA AH19 and 1.1m in ARCA AH03.

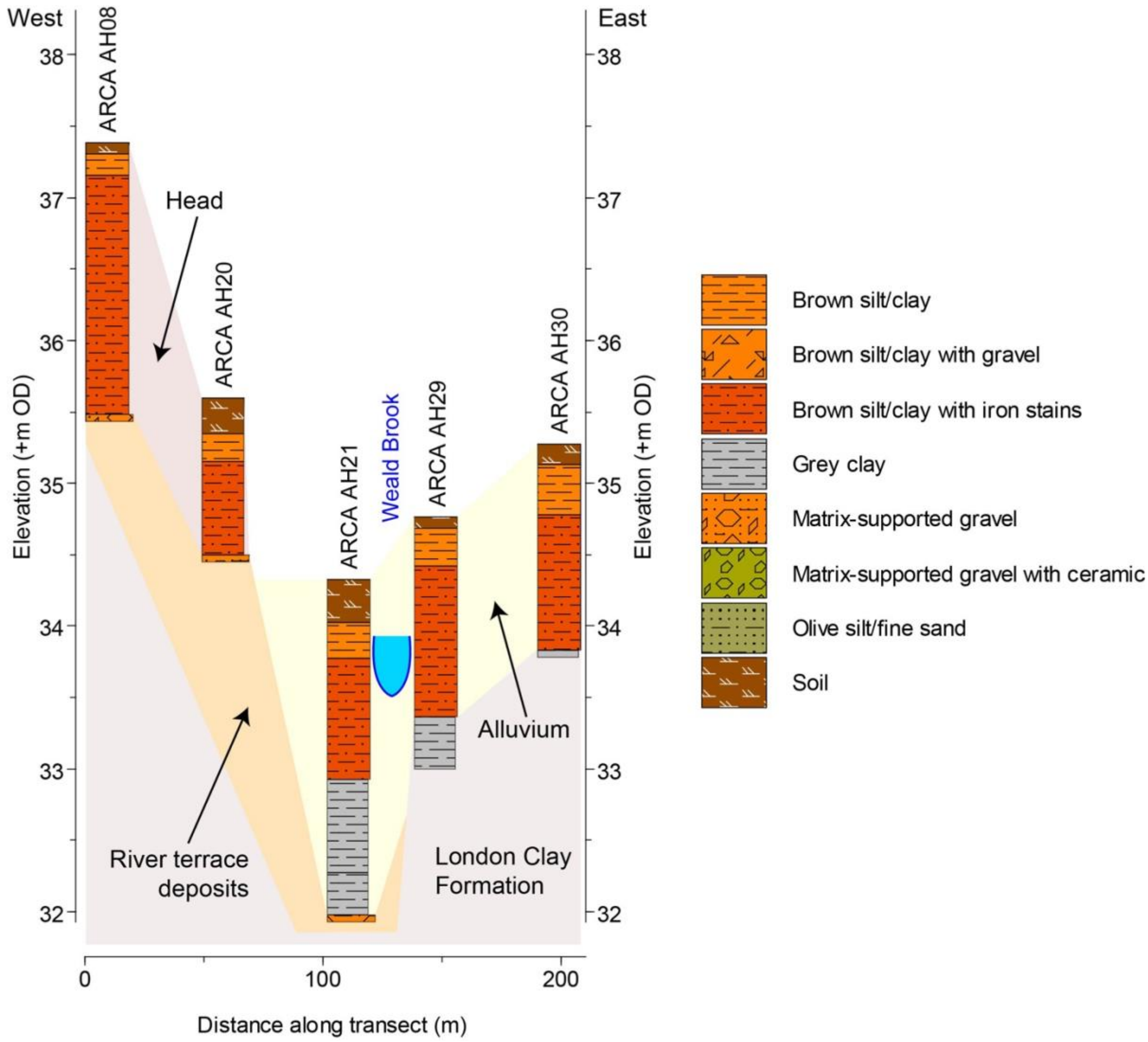


*Figure 8. West–east composite cross section through the northern part of the site*

4.3.2 As has been discussed in Section 4.1.2, the brown/greyish brown silt/clays are derived from the London Clay Formation. However, the weathering properties of the latter are different from the former, i.e. having a colour that indicates surface exposure (brown rather than grey) and containing generalised iron stains rather than as discrete patches. Further, unlike strata of the London Clay Formation (Section 4.1) and the Alluvium (Section 4.4), the brown and greyish brown silt/clays have a moderate gravel component. The latter are of lithologies and sizes characteristic of the fluvial gravel (Section 4.2), from which the particles must have been derived.

4.3.3 The brown and greyish brown silt/clays are interpreted as colluvial deposits or Head in BGS terminology (British Geological Survey 2022b). Such strata form as a result of Newtonian movement and as a product of either overland flow or mass movement (see review by Wilkinson [2009]). It is likely that the colluvial deposits have infilled rills and gullies formed in the western slope of the Weald Brook valley, but feather out at the break of slope that contains the present floodplain. The deposits overlie the fluvial gravels and are therefore likely to be of Late Pleistocene age or later, and indeed they are probably a mixture of Late Glacial solifluction and Holocene colluvium.

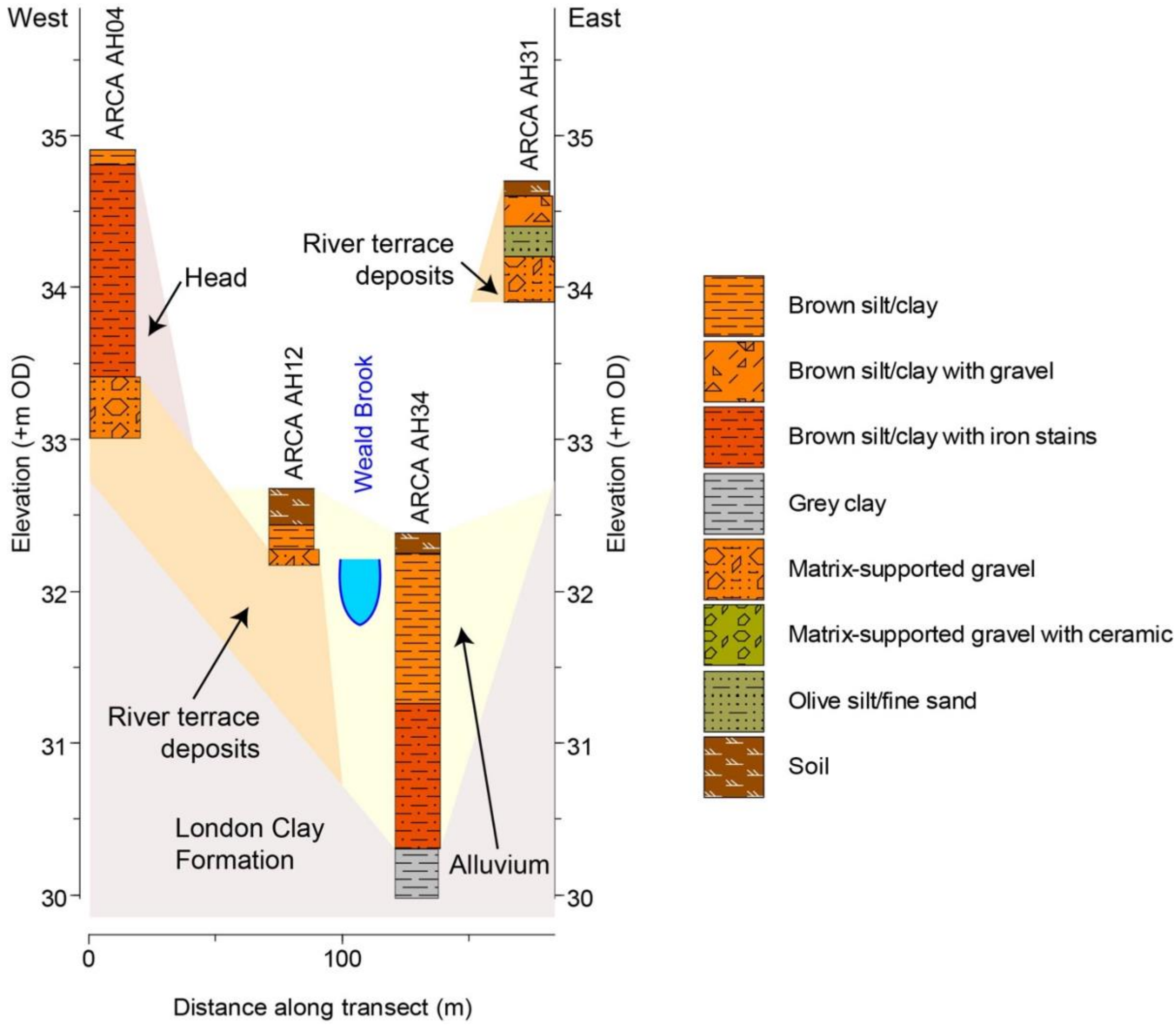


*Figure 9. West–east composite cross section through the central part of the site*

## 4.4 Holocene alluvium

4.4.1 Soft, moderately sorted brown (10 YR 5/3–10 YR 5/2) and grey (5 Y 5/1) silt/clays were encountered in auger holes (ARCA AH09–12, ARCA AH14–18, ARCA AH21–30, ARCA AH32, ARCA AH34) overlying either fluvial gravel (Section 4.2) or London Clay Formation (Section 4.1) on the Weald Brook floodplain (Figure 4 and Figure 5). The strata are locally iron-stained with the latter in the form of granular-size strong brown (10 YR 5/8) mottles. Gravels in the form of sub-rounded and sub-angular flint pebbles are rare, mainly found at the top of the unit (in the brown deposits) and reduce in quantity with increased depth.

4.4.1 The surface elevation of the moderately sorted silt/clays varies between +31.32m OD (ARCA AH09) in the south and +35.28m OD (ARCA AH30) in the north of the site (Figure 4 and Figure 8), while the stratum is between 0.40m (ARCA AH12) and 2.67m (ARCA AH22) thick (Figure 4 and Figure 5). In geotechnical boreholes drilled in the floodplain, up to 2.8m of these brown and grey silt/clays were noted (Figure 5).

However, the latter variation is largely topographically determined, and the greatest outcrop thicknesses are found closest to the present stream in the central and southern part of the site, i.e. >1.7m in ARCA AH10–11, ARCA AH21–22, ARCA AH24–28, GE ATK006, GE ATK056, GE ATK061, GE ATK089–090 (Figure 12). Nevertheless, less thick outcrops occur above gravel in the centre of the floodplain (e.g. ARCA AH23), while the stratum thins towards the floodplain edge (e.g. ARCA AH12, ARCA AH15–18. ARCA AH32) and in the north eastern part of the study area (ARCA AH29–30)

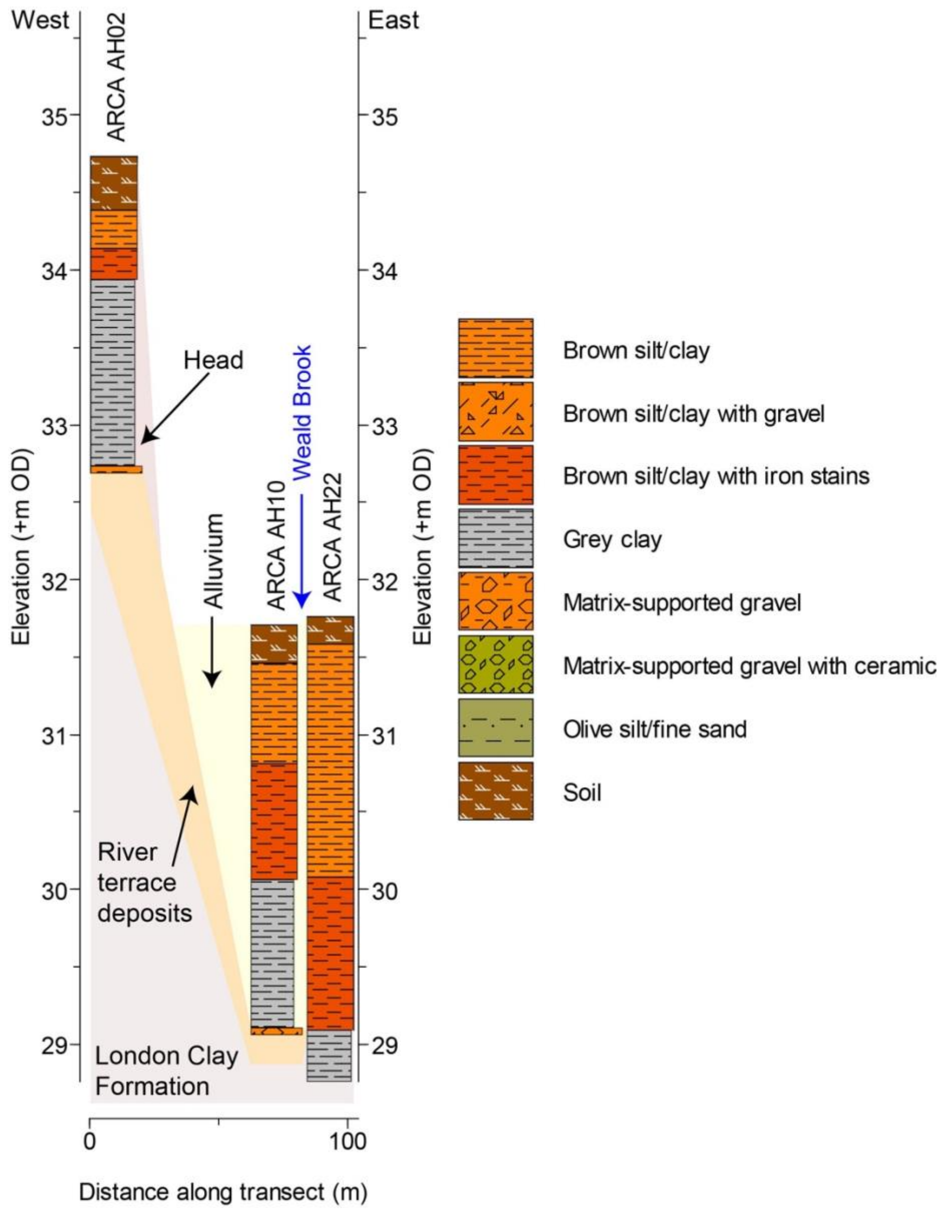


*Figure 10. West–east composite cross section through the southern part of the site*

4.4.4 The brown and grey silt/clays are likely floodplain alluvium deposited by the Weald Brook as vertical accretion deposits during ebb flood events. The iron stains noted in the deposits are caused by redox processes, i.e. vertical movement of groundwater within the strata, meaning that those parts of the subcrop lacking such features (i.e. grey sediment) have been consistently below the water table.

4.4.5 The floodplain alluvium overlies the fluvial gravel and must therefore be of Late Quaternary age. In all probability the stratum is Holocene in date and formed in the meandering stream environment present along the entire reach of the Weald Brook at the present day. The absence of organic deposits suggests that backswamp environments did not exist within the site area, this probably because the steeply shelving valley sides will have confined flooding to a < 30m wide strip.

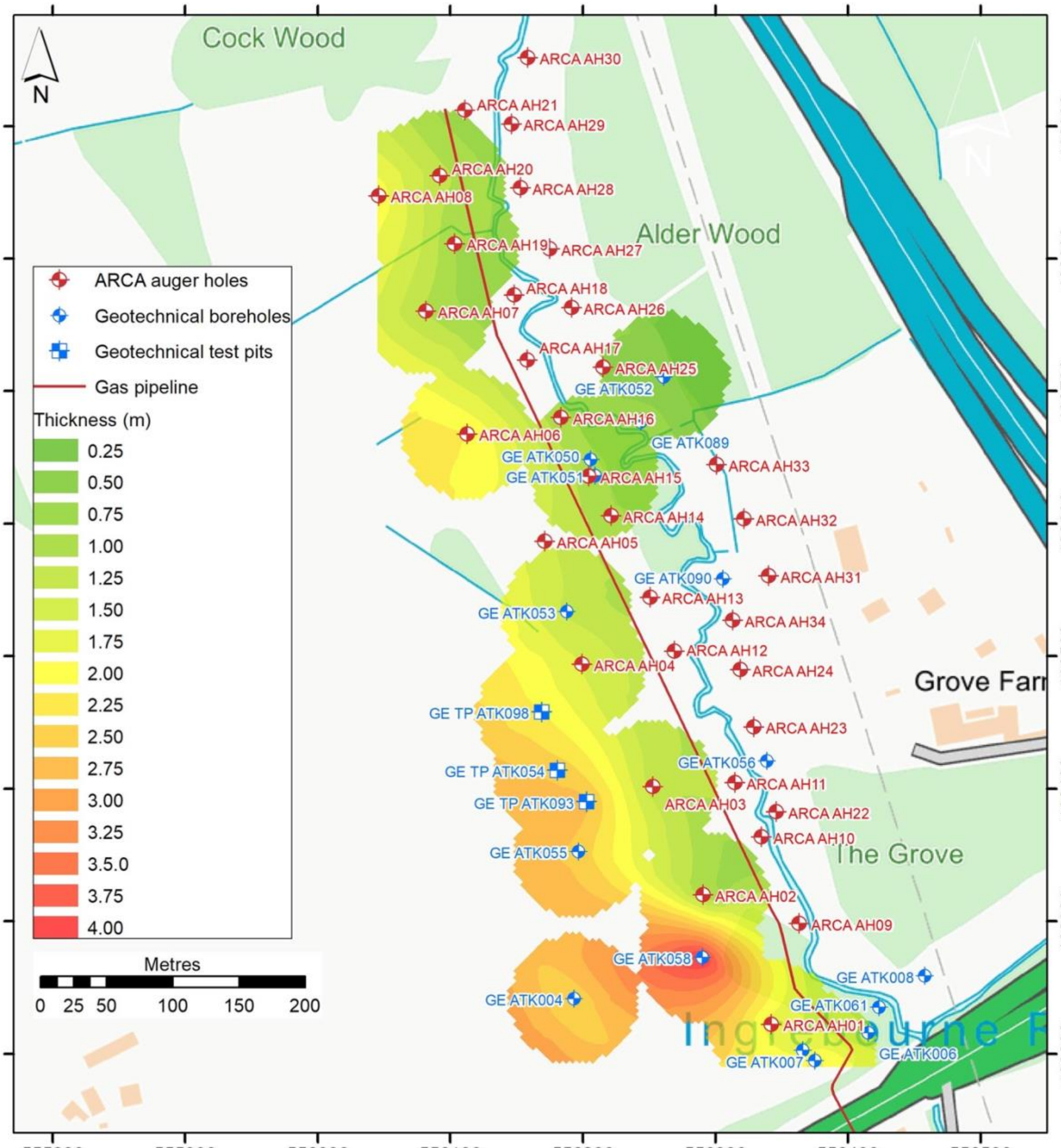


*Figure 11. Modelled thickness of Head*

4.4.6 It is possible that gravel strata subcropping below the floodplain alluvium in ARCA AH23, ARCA AH25, ARCA AH28, GE ATK008 and GE ATK089–090 and discussed in Section 4.2.4, formed in former Holocene channels of the Weald Brook. If so then the gravel and silt/clays might have had both lateral and vertical facies relationships, i.e. channel deposits forming in one location, while floodplain sediments accreted in an adjacent location.

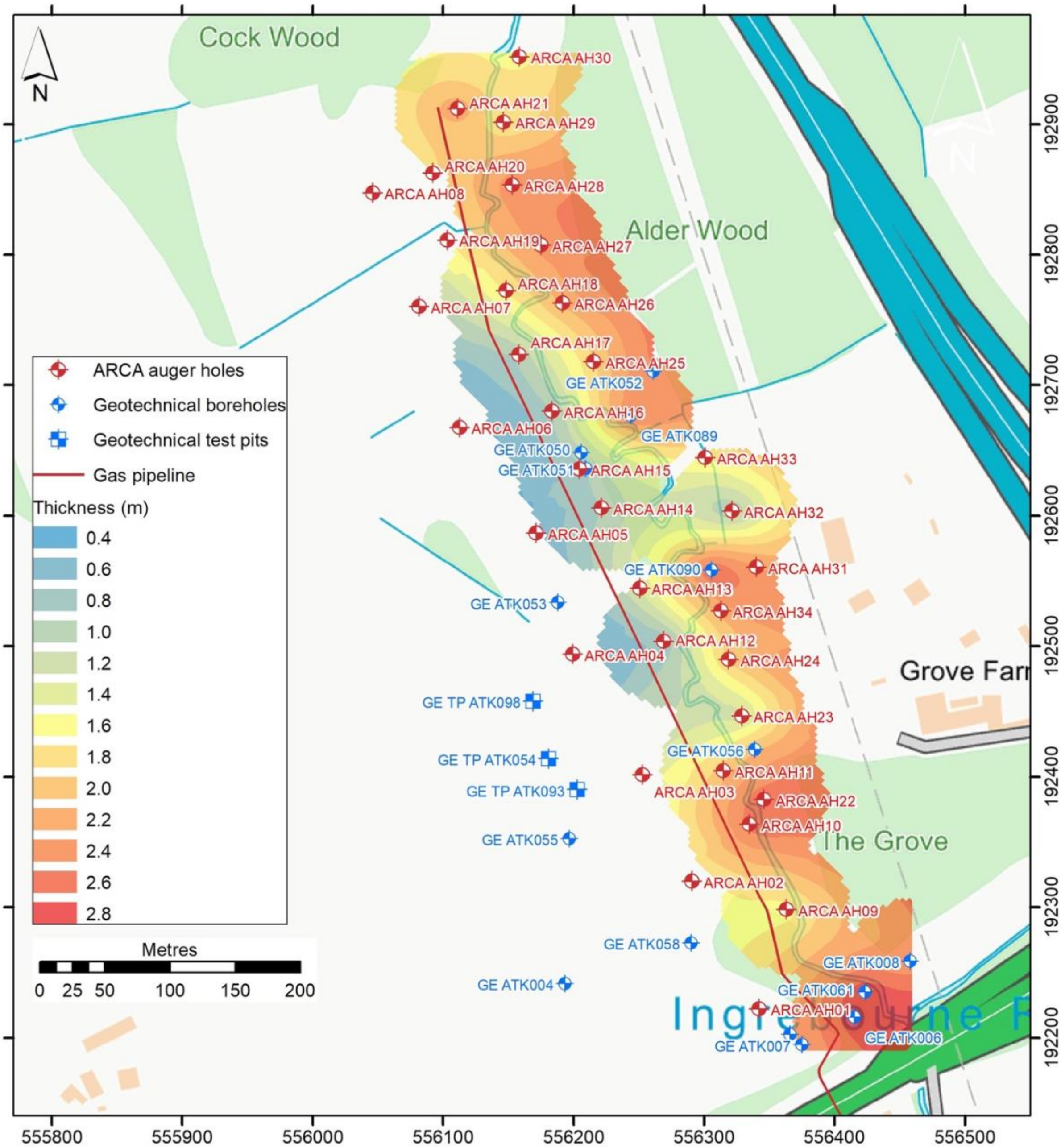


*Figure 12. Modelled thickness of Alluvium*

## 4.5 Made ground

4.5.1 Poorly sorted matrix-supported gravels, sands and silt/clays containing 20th century and later construction debris (e.g. brick fragments) were encountered as a surface outcrop in three auger holes (ARCA AH31–33) and one geotechnical borehole (GE ATK008) east of the Weald Brook floodplain (Figure 5). Where penetrated, the poorly sorted deposits extended to 0.48–0.70m bgl and overlay either fluvial gravel (ARCA AH32) or Alluvium (ARCA AH33, GE ATK008).

4.5.2 The poorly sorted gravels etc are Made ground and result from redeposition of building debris from the Grove Farm industrial units to the east of the site.

## 5. ASSESSMENT

5.01 In this section, the results of the field and laboratory investigations are assessed in relation to Aims 1.6.1 and 1.6.2.

### 5.1 Quaternary sedimentary sequence

5.1.1 The Quaternary sediments on the M25 J28 site comprise River terrace deposits, Head, Alluvium and Made ground. Of these, the fluvial gravels 2.2–1.1m above the present Weald Brook channel are likely the oldest. As has been discussed in Section 4.2.4, the gravels probably formed in the bed of an earlier channel of the Weald Brook, but have since become isolated from that stream by downcutting. The latter process is most likely a product of base level changes in response to long term uplift in southern Britain and sea level changes consequent on glaciation. However, it is presently difficult to correlate the gravels with a named geological unit. The closest mapped gravels in the Ingrebourne valley are 4.2 km to the south at Upminster and comprise deposits of the Lynch Hill Gravel Member[7] (BGS 2022a). However, these outcrop 5–10m above the present channel and if correctly attributed, they would date to Marine Isotope Stage (MIS) 10–8, i.e. 374–300,000 BP according to Bridgland's (1994) terrace development scheme. The terrace deposits at 2.2–1.1m above channel level on the M25 J28 site are therefore likely to be younger (i.e. there is a shorter downcutting history) and might therefore be equated with either the Taplow Member (MIS 8–5, 300–130,000 BP) or more likely, the Kempton Park Member (MIS 5–2, 130–29,000 BP).

5.1.2 Gravels subcropping below the elevation of the present Weald Brook channel may be part of the same fluvial terrace as those discussed in Section 5.1.1 above. However, given the >2m vertical separation, it is more likely that these lower elevation gravels are part of a separate fluvial terrace, and that this is either the Shepperton Gravel Member of MIS 2 age (29.0–11,000 BP) or an unnamed Holocene unit. These lower gravels also likely formed in an earlier manifestation of the Weald Brook and in a flashier discharge regime than that of the present day. The organic deposits associated with the unit in GE ATK090 are likely locally reworked given the geotechnical logger's description, but are indicative of vegetation growing on the channel banks. It is notable that organic strata have been found in similar stratigraphic position and in association with the Shepperton Gravel Member in the Lower Thames valley, e.g. at Silvertown, where they are dated to late MIS2 (c 12,000 BP) (Wilkinson et al. 2000).

5.1.3 Head deposits overlie the London Clay Formation and the 2.2–1.1m above channel fluvial gravel on the western slopes of the Weald Brook valley. As has been discussed in Section 4.3.3 these deposits are likely a mixture of Late Pleistocene (most likely MIS 2, 29–11,700 BP) solifluction debris and Holocene colluvium. The former is the product of freeze thaw processes and is a common sedimentary product in periglacial environments – such as those occurring in Britain during much of the Devensian Late Glacial (i.e. MIS 2). Colluvium forming in the Holocene is generally thought to be the result of slope destabilisation caused first by anthropogenic woodland clearance and then cultivation (see Wilkinson 2009 for a review). Such colluvial deposits are presently accumulating in at least part of the site based on observations of overland flow and creep in the field containing ARCA AH08 and ARCA AH20 (Figure 1C). In the present

[7] The BGS use stratigraphic terms based on type sites in the Middle Thames to map terrace outcrops, while Bridgland (1994) uses Lower Thames type site-determined terrace nomenclature. The Lynch Hill Gravel of the Middle Thames = the Corbetts Tey Gravel of the Lower Thames, the Taplow Gravel of the Middle Thames = the Mucking Gravel of the Lower Thames and the Kempton Park Gravel of the Middle Thames = the East Tilbury Marshes Gravel of the Lower Thames (Bridgland 1994, 175).

instance solifluction and colluvium cannot be differentiated given that (a) source material is the same, namely silt/clays of the London Clay Formation and gravels of the 2.2–1.1m fluvial terrace (and potentially higher terraces to the west of the site), and (b) the narrow window and mechanism of sediment retrieval of the Edelman auger head (these latter meaning that sedimentary structures – which might differ in periglacially-derived deposits from those forming in temperate climates - are not visible/preserved).

5.1.4 Floodplain alluvium fills the Weald Brook from about 1.5m above present channel level downwards to either a lower unconformable contact with the London Clay Formation or an unconformable or conformable contact with the 1.0–0.2m below Weald Brook channel gravel. Again, the limitations of the Edelman auger outlined in Section 4.1.3 mean that specific floodplain facies[8] cannot be recognised, but organic strata that might provide indications of former backswamp or oxbow lake fills were not encountered. Rather the strata are most likely vertical accretion deposits that formed as result of overbank flooding from the Weald Brook. As with the Head, source material for the floodplain alluvium is the London Clay Formation, albeit that the latter might have been reworked as Head and then further weathered and transported into the stream. It is uncertain whether stand still episodes are represented in the alluvial sequence – again because of the disturbed sample returned by the Edelman auger – but it is clear that well developed buried palaeosols are not present. Beyond the fact that the Alluvium post-dates the 1.0–0.2m below channel gravel and that a Mesolithic tranchet axe was found in 0.8m of Alluvium in evaluation Trench 32 (close to ARCA AH16 and ARCA AH17) (Cotswold Archaeology 2022b), there is no precise chronological information for the development of the stratum. However, if source material is London Clay Formation reworked as colluvium, it is probable that the Alluvium is of a similar age to the latter and dates to the Middle and Late Holocene.

5.1.5 Made ground deposits found on the eastern fringes of the Weald Brook valley are the result of human activities in the 20th century and later.

## 5.2 Archaeological and palaeoenvironmental potential

5.2.1 Deposits of the London Clay Formation date to the Early Eocene period, i.e. 56.0–47.8 million years ago. and are therefore of no archaeological relevance.

5.2.2 The archaeological and palaeoenvironmental potentials of the fluvial gravels are in part a product of their mode of genesis and subsequent diagenesis, but also their age. As has previously been discussed, the gravels formed in a high energy channel environment in which coarse (gravel and sand) particles were transported via processes of roll and saltation, while fine particles were winnowed and removed. As a result, any artefactual material that might be present, is unlikely to be *in situ*. Further, decalcification following deposition is likely to have degraded palaeontological remains. Nevertheless, in the case of the fluvial gravels sub-cropping below the channel of the Weald Brook, organic (plant) remains demonstrably survive in at least one location. As has been discussed above, the gravels are likely to be of late Middle Pleistocene, or more likely, Late Pleistocene date. However, during this latter time frame, hominins were present in Britain only in MIS 3 (57–29,000 BP), the end of MIS 2 (after 15,000 BP) and possibly MIS 5d-5b (109–87,000 BP) (Wenban Smith et al. 2010). In other words, while the archaeological and palaeoenvironmental potential of the 2.2–1.1m above and the archaeological potential of the 1.0–0.2m below channel gravels is likely low, and the palaeoenvironmental potential of the latter probably

[8] Deposits of well-defined morphological and structural properties that are indicative of specific sedimentary environments (see Miall 1996, chapter 1)

moderate, these statements cannot be definitive given the lack of a chronology for the strata. It is also worthy of note that the 2.2–1.1m above channel gravel has been truncated over a large part of the Cadent CDM area to expose the present gas pipeline.

5.2.3 Head forming as solifluction deposits during periglacial activity has a low archaeological and palaeoenvironmental potential, this because humans were likely to have been absent from Britain during the relevant cold episode(s). Holocene colluvium encompassed under 'Head' has been previously evaluated by conventional archaeological means and its archaeological and palaeoenvironmental potential has therefore been assessed.

5.2.4 The floodplain alluvium is likely to have formed incrementally during ebb flood events in the Weald Brook. It is possible that human activity took place between floods, but any vestiges of such were not evidenced in the Edelman auger samples, while there is no evidence in the relevant stratigraphy for long stand still events that resulted in soil formation or for deposition/preservation of organic materials. The alluvium is therefore assessed as having a low archaeological and palaeoenvironmental potential.

5.2.5 Being of 20th and 21st century data and containing only redeposited artefacts and structural materials, the Made ground is of low archaeological and palaeoenvironmental potential.

## 6. CONCLUSIONS

6.1 Conclusions and recommendations are made below with reference the aims and research agenda set out in the AMP (Highways England 2021, section 3.5)

6.2 The geoarchaeological investigation of land earmarked for construction as part of the M25 J28 improvements has demonstrated that Late Pleistocene and Holocene strata overlie Eocene London Clay Formation strata in the Weald Brook valley. These superficial geological strata comprise fluvial gravels, Head (likely both Late Pleistocene solifluction deposits and Holocene colluvium), floodplain alluvium (AMP section 3.5.2) and Made ground. Although of Holocene age, i.e. a time period when people were continuously present in southern Britain, the absence of palaeosols or organic strata in the colluvium and floodplain alluvium, means that these strata are likely to be of limited archaeological importance (AMP sections 3.5.3–3.5.4, 3.5.7, 3.5.9, 3.5.10, 3.5.11). The Late Pleistocene solifluction accumulated in a climate unsuited to human habitation and are not therefore of archaeological significance (AMP section 3.5.2). On the other hand, deposition of Late Pleistocene fluvial gravels might have coincided with human presence, while in at least one location of the floodplain, there are associated organic deposits. These latter properties might mean that the gravels have archaeological relevance (AMP section 3.5.2).

6.3 It is recommended that a geoarchaeological mitigation exercise be carried out in the event that engineering works extend to >3m bgl in the vicinity of geotechnical borehole GE ATK090[9] and thereby disturb organic strata associated with the 1.0–0.2m below channel fluvial gravel (AMP section 3.5.2). Such mitigation would comprise a cored (i.e. using a dynamic probe drilling rig) borehole drilled to the contact with the London Clay Formation, dating (by $^{14}C$ and optically stimulated luminescence) and examination of relevant strata for palaeoenvironmental proxies. This recommendation will be carried forward into the updated project design being prepared by Cotswold Archaeology.

6.3 Other than the mitigation outlined in Section 6.2, no other geoarchaeological works are recommended.

## 7. ACKNOWLEDGMENTS

7.1 The author would like to thank the following for their help prior to and during the fieldwork reported here: Derek Evans (Cotswold Archaeology), Tom O'Shea (Graham Group Ltd), Paul Bennett (RSK Ltd) and Adam Single (Greater London Archaeological Advisory Service).

7.2 Geoarchaeological fieldwork was carried out by Prof Keith Wilkinson and Dr Monika Knul. Keith Wilkinson wrote the report and produced the illustrations. Nick Watson commented and copy edited an earlier version of the report.

[9] NB GE ATK090 is maintained as a monitoring well and its location was surveyed by ARCA as part of the present geoarchaeological project (NGR 556305.788, 192259.110, +32.708m OD)

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## APPENDIX 1: BOREHOLE LOCATIONS

| Borehole | Easting | Northing | Elevation (+m OD) | Total depth drilled |
|---|---|---|---|---|
| ARCA AH01 | 556342.282 | 192222.379 | 33.853 | 1.60 |
| ARCA AH02 | 556290.972 | 192320.081 | 34.735 | 2.05 |
| ARCA AH03 | 556252.954 | 192401.742 | 34.628 | 1.20 |
| ARCA AH04 | 556199.438 | 192493.992 | 34.909 | 1.90 |
| ARCA AH05 | 556171.420 | 192586.944 | 35.625 | 0.95 |
| ARCA AH06 | 556112.786 | 192667.923 | 36.461 | 2.13 |
| ARCA AH07 | 556081.854 | 192760.409 | 36.749 | 1.15 |
| ARCA AH08 | 556046.285 | 192847.617 | 37.384 | 1.95 |
| ARCA AH09 | 556363.522 | 192298.301 | 31.320 | 1.63 |
| ARCA AH10 | 556335.047 | 192363.592 | 31.710 | 2.65 |
| ARCA AH11 | 556314.827 | 192404.808 | 31.897 | 2.02 |
| ARCA AH12 | 556269.198 | 192503.771 | 32.673 | 0.50 |
| ARCA AH13 | 556251.068 | 192544.666 | 33.334 | 0.37 |
| ARCA AH14 | 556221.604 | 192605.989 | 33.616 | 0.85 |
| ARCA AH15 | 556204.421 | 192635.906 | 33.751 | 0.68 |
| ARCA AH16 | 556183.672 | 192680.161 | 34.212 | 0.75 |
| ARCA AH17 | 556158.152 | 192723.499 | 34.105 | 0.85 |
| ARCA AH18 | 556148.291 | 192772.762 | 33.965 | 1.68 |
| ARCA AH19 | 556103.286 | 192811.435 | 34.536 | 0.80 |
| ARCA AH20 | 556092.363 | 192862.763 | 35.599 | 1.15 |
| ARCA AH21 | 556111.001 | 192912.184 | 34.326 | 2.40 |
| ARCA AH22 | 556346.204 | 192382.553 | 31.762 | 3.00 |
| ARCA AH23 | 556329.026 | 192446.818 | 31.811 | 0.89 |
| ARCA AH24 | 556319.151 | 192489.934 | 32.248 | 2.40 |
| ARCA AH25 | 556215.336 | 192718.224 | 33.386 | 1.88 |
| ARCA AH26 | 556191.766 | 192763.140 | 34.221 | 2.35 |
| ARCA AH27 | 556174.978 | 192807.644 | 33.846 | 2.46 |
| ARCA AH28 | 556153.290 | 192853.462 | 34.149 | 2.45 |
| ARCA AH29 | 556146.214 | 192901.833 | 34.767 | 1.77 |
| ARCA AH30 | 556158.582 | 192951.918 | 35.278 | 1.50 |
| ARCA AH31 | 556340.242 | 192560.858 | 34.702 | 0.80 |
| ARCA AH32 | 556321.723 | 192603.745 | 33.948 | 0.80 |
| ARCA AH33 | 556301.068 | 192644.620 | 34.054 | 0.46 |
| ARCA AH34 | 556313.125 | 192527.342 | 32.381 | 2.40 |

## APPENDIX 2: BOREHOLE LITHOSTRATIGRAPHY

The table below provide lithological data for the 34 ARCA auger holes. Similar data from the geotechnical boreholes and test pits utilised in this report can be found in appendix A of Geotechnical Engineering Ltd's (2020) report.

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH01 | 0.00 | 0.15 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.15 | 0.23 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.23 | 0.89 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles increasing to moderate below 0.84m. Moderately sorted. Sharp boundary to: |
| | 0.89 | 1.60 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Moderately sorted. |
| ARCA AH02 | 0.00 | 0.35 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.35 | 0.60 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.60 | 0.80 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown with occasional pebble-size sub-angular, rounded and sub-rounded flints. Moderately sorted. Sharp boundary to: |
| | 0.80 | 2.00 | Grey clay | 10 YR 6/2 Light brown grey clay with fine pebble-sized mottles of 5 YR 5/6 Yellowish red. Increasingly compact with depth. |
| | 2.00 | 2.05 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH03 | 0.00 | 0.05 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.05 | 0.40 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.40 | 1.10 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH03 | 1.10 | 1.20 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH04 | 0.00 | 0.10 | Brown silt/clay | 10 YR 5/2 Greyish brown ssilt/clay with occasional sub-angular flint pebbles and brick fragments. Poorly sorted. Diffuse boundary to: |
| | 0.10 | 1.50 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.50 | 1.90 | Matrix-supported gravel | 10 YR 5/4 Yellowish brown matrix-supported gravel of granular and fine pebble-sized sub-angular flint in a silt/clay matrix. Poorly sorted. |
| ARCA AH05 | 0.00 | 0.30 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.30 | 0.95 | Grey clay | 10 YR 6/2 Light brown grey clay with fine pebble-sized mottles of 5 YR 5/6 Yellowish red. Increasingly compact with depth. |
| ARCA AH06 | 0.00 | 0.08 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.08 | 0.16 | Brown silt/clay | 10 YR 5/2 Greyish brown silt/clay with occasional sub-angular flint pebbles and brick fragments. Poorly sorted. Diffuse boundary to: |
| | 0.16 | 0.30 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.30 | 1.75 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.75 | 2.00 | Brown silt/clay | 10 YR 5/8 Yellowish brown silt/clay/fine sand with occasional granular-sized flint. Moderately sorted. Sharp boundary to: |
| | 2.00 | 2.13 | Matrix-supported gravel | 10 YR 5/6 Yellowish brown matrix-supported gravel of sub-angular and sub-rounded flint pebbles in a medium-fine sand matrix. Poorly sorted/ |
| ARCA AH07 | 0.00 | 0.10 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.10 | 0.35 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.35 | 0.95 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Diffuse boundary to: |
| | 0.95 | 1.15 | Grey clay | 10 YR 6/2 Light brown grey clay with fine pebble-sized mottles of 5 YR 5/6 Yellowish red. Increasingly compact with depth. |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH08 | 0.00 | 0.08 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.08 | 0.23 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.23 | 1.90 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.90 | 1.95 | Matrix-supported gravel | 10 YR 5/4 Yellowish brown matrix-supported gravel of granular and fine pebble-sized sub-angular flint in a silt/clay matrix. Poorly sorted. |
| ARCA AH09 | 0.00 | 0.08 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.08 | 0.85 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.85 | 1.35 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.35 | 1.63 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH10 | 0.00 | 0.25 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.25 | 0.90 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.90 | 1.65 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |
| | 1.65 | 2.60 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. Fine pebble-sized charcoal at 2.55m. Sharp boundary to: |
| | 2.60 | 2.65 | Matrix-supported gravel | 5 Y 4/1 Dark grey matrix-supported gravel of sub-angular and sub-rounded flint pebbles in a silt/clay matrix. Poorly sorted. |
| ARCA AH11 | 0.00 | 0.05 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.05 | 0.72 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.72 | 1.89 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.89 | 2.02 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH12 | 0.00 | 0.24 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH12 | 0.24 | 0.40 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots and occasional sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |
| | 0.40 | 0.50 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH13 | 0.00 | 0.15 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.15 | 0.37 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH14 | 0.00 | 0.04 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.04 | 0.37 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.37 | 0.80 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 0.80 | 0.85 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH15 | 0.00 | 0.25 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots and occasional sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |
| | 0.25 | 0.65 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |
| | 0.65 | 0.68 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH16 | 0.00 | 0.03 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.03 | 0.38 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.38 | 0.70 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH16 | 0.70 | 0.75 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH17 | 0.00 | 0.25 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.25 | 0.55 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots and occasional sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |
| ARCA AH17 | 0.55 | 0.75 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |
| | 0.75 | 0.85 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH18 | 0.00 | 0.08 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.08 | 0.84 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.84 | 1.60 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.60 | 1.68 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH19 | 0.00 | 0.15 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.15 | 0.75 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown with increasing (downwards) sub-angular and sub-rounded flint pebbles below 0.5m. Moderately sorted. Diffuse boundary to: |
| | 0.75 | 0.80 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH20 | 0.00 | 0.25 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.25 | 0.45 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots and occasional sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH20 | 0.45 | 1.10 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |
| | 1.10 | 1.15 | Matrix-supported gravel | 10 YR 5/3 Brown matrix-supported gravel of moderate sub-angular and frequent rounded and sub-rounded flint pebbles in a silt/clay matrix. Clast concentration increases downwards. Poorly sorted. |
| ARCA AH21 | 0.00 | 0.30 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.30 | 0.55 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with moderate fine roots and occasional sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |
| | 0.55 | 1.40 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Moderately sorted. Sharp boundary to: |
| | 1.40 | 2.05 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. Sharp boundary to: |
| | 2.05 | 2.35 | Grey clay | 5 Y 5/1 Grey (darker than 1.40-2.05m) clay. Soft. Well sorted. Sharp boundary to: |
| | 2.35 | 2.40 | Matrix-supported gravel | 5 Y 5/1 Grey matrix-supported gravel of rounded and sub-rounded flint pebbles and sub-angular granules in a medium sand-clay matrix. |
| ARCA AH22 | 0.00 | 0.18 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.18 | 1.68 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 1.68 | 2.67 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled 10 YR 5/8 Strong brown. Rare sub-angular flint pebbles, increasing downwards. Moderately sorted. Sharp boundary to: |
| | 2.67 | 3.00 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH23 | 0.00 | 0.15 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.15 | 0.48 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.48 | 0.81 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Diffuse boundary to: |
| | 0.81 | 0.89 | Matrix-supported gravel | 10 YR 5/4 Yellowish brown matrix-supported gravel of pebble-sized sub-angular flints in a silt/clay and occasional granular-size patches of coarse sand matrix. Poorly sorted |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH24 | 0.00 | 0.22 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.22 | 0.90 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.90 | 2.03 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Rare sub-angular flint pebbles, increasing downwards. Moderately sorted. Sharp boundary to: |
| | 2.03 | 2.40 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH25 | 0.00 | 0.11 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.11 | 0.79 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.79 | 1.70 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.70 | 1.88 | Matrix-supported gravel | 10 YR 6/4 Light yellowish brown matrix-supported gravel of sub-angular and sub-rounded flint pebbles in a silt/clay matrix. Poorly sorted. |
| ARCA AH26 | 0.00 | 0.20 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.20 | 2.15 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Occasional rounded flint pebbles. Moderately sorted. Diffuse boundary to: |
| | 2.15 | 2.35 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH27 | 0.00 | 0.19 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.19 | 0.35 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.35 | 2.31 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 2.31 | 2.46 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH28 | 0.00 | 0.25 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.25 | 0.70 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| ARCA AH28 | 0.70 | 2.40 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown. Granular size plant macro remains at 0.90 and 1.40m. Moderately sorted. Sharp boundary to: |
| | 2.40 | 2.45 | Matrix-supported gravel | 5 Y 5/1 Grey matrix-supported gravel of sub-angular flint pebbles and granules in a silt/clay matrix. Poorly sorted. Hole abandoned at 2.45m as impenetrable |
| ARCA AH29 | 0.00 | 0.08 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.08 | 0.35 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.35 | 1.40 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Rare sub-angular flint pebbles. Moderately sorted. Sharp boundary to: |
| | 1.40 | 1.77 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. |
| ARCA AH30 | 0.00 | 0.15 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |
| | 0.15 | 0.50 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.50 | 1.45 | Brown silt/clay with iron stains | 10 YR 5/2 Brown silt/clay mottled (granular size) 10 YR 5/8 Strong brown with occasional sub-angular and sub-rounded flint pebbles. Becomes more compact with depth. Moderately sorted. Sharp boundary to: |
| | 1.45 | 1.50 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted. Impenetrable below 1.50m |
| ARCA AH31 | 0.00 | 0.10 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Diffuse boundary to: |
| | 0.10 | 0.30 | Brown silt/clay with gravel | 10 YR 3/2 Dark brown silt/clay with occasional pebble-sized sub-angular flint clasts. Moderate granular-sized iron stains. Poorly sorted. Sharp boundary to: |
| | 0.30 | 0.50 | Olive silt/fine sand | 5 Y 4/2 Olive grey silt/fine sand with occasional sub-angular fine pebble-sized flint. Moderately sorted. Sharp boundary to: |
| | 0.50 | 0.80 | Matrix-supported gravel | 7.5 YR 4/3 Brown matrix-supported gravel of sub-angular and sub-rounded flint pebbles in a silt/clay matrix. Rare sub-rounded flint pebbles. |
| ARCA AH32 | 0.00 | 0.20 | Soil | 10 YR 3/2 Dark brown humic silt/clay with occasional medium roots and frequent fine roots. Moderately sorted. Sharp boundary to: |

| Borehole | Top[a] | Base[a] | Lithology | Description |
|---|---|---|---|---|
| | 0.20 | 0.48 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots and occasional sub-rounded and sub-angular flint pebbles and granules. Well sorted. Diffuse boundary to: |
| ARCA AH32 | 0.48 | 0.80 | Matrix-supported gravel | 7.5 YR 4/3 Brown matrix-supported gravel of sub-angular and sub-rounded flint pebbles in a silt/clay matrix. Rare sub-rounded flint pebbles. |
| ARCA AH33 | 0.00 | 0.14 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.14 | 0.33 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine roots. Well sorted. Diffuse boundary to: |
| | 0.33 | 0.46 | Matrix-supported gravel with ceramic | 2.5 Y 3/2 Very dark greyish brown matrix-supported gravel of granular- and pebble-size sub-angular clasts (including ceramic fragments), in a silt/clay matrix. Poorly sorted. Gravel too dense to penetrate at 0.46m. |
| ARCA AH34 | 0.00 | 0.13 | Soil | 10 YR 3/2 Very dark greyish brown humic silt/clay with frequent fine roots and occasional medium roots. Moderately sorted. Sharp boundary to: |
| | 0.13 | 1.12 | Brown silt/clay | 10 YR 5/3 Brown silt/clay with occasional fine and rare medium roots. Well sorted. Diffuse boundary to: |
| | 1.12 | 2.08 | Brown silt/clay with iron stains | 10 YR 5/3 Brown silt/clay mottled with 10 YR 5/8 Yellowish brown iron stains. Moderately sorted. Diffuse boundary to: |
| | 2.08 | 2.40 | Grey clay | 5 Y 5/1 Grey clay, mottled 7.5 YR 5/8 Strong brown. Well sorted |

[a] Depths are in m bgl

## APPENDIX 3: OASIS REPORT FORM

| **PROJECT DETAILS** | |
|---|---|
| Project name | M25 Junction 28 Improvements, London Borough of Havering |
| Short description | A geoarchaeological auger survey was undertaken of land encompassed by a revised layout of Junction 28 of the M25 motorway in the London Borough of Havering. The particular focus of the study was the floodplain of Weald Brook and the surrounding valley sides. Fieldwork was carried out in November 2022, while the purpose of the work was to determine the depth, nature and archaeological/palaeoenvironment potential of strata subcropping on the site.<br>Thirty-four geoarchaeological auger holes were completed using manually operated Edelman augers. Strata in the auger heads were described in the field and lithostratigraphic data obtained from the auger holes was combined in a Rockworks database with those from 15 geotechnical boreholes and 3 geotechnical test pits. The database was then used to plot composite cross sections and deposit models.<br>Flint gravels of probable Late Pleistocene age and of up to 2.5m thickness form the base of the Quaternary sequence across much of the site, while in one location on the present floodplain of the Weald Brook, they include organic sediments. These gravels probably formed in a river channel during the Late Pleistocene period, while they have an archaeological potential dependent on age (currently unknown) and a moderate palaeoenvironmental potential in the locus of the organic sediments.<br>Up to 4m of colluvial deposits (‘Head’) were encountered overlying the Pleistocene river gravels and London Clay bedrock on the western side of the Weald Brook valley. These colluvial deposits thin to the east and are of likely Holocene and Late Pleistocene age. They have a low archaeological and palaeoenvironmental potential.<br>Silt/clay alluvium of up to 2.8m thickness was found on the current Weald Brook floodplain. The deposits were homogenous and lacked organic remains, and their archaeological and palaeoenvironmental potential is low.<br>Made ground strata of 20th century date were found at the extreme east of the Weald Brook floodplain and on the slopes to the east. These deposits have a low archaeological and palaeoenvironmental potential. |
| Project dates | 22–25 November 2022 |
| Project type | Geoarchaeological auger survey |
| Previous work | Desk-based assessment (AOC Archaeology 2017); Test pitting and archaeological watching brief (Cotswold Archaeology 2019); Trial trench evaluation (Cotswold Archaeology 2021); Trial trench evaluation (second phase) (Cotswold Archaeology 2022b) |
| Future work | Unknown |
| **PROJECT LOCATION** | |
| Site location | M25 Junction 28 Improvements, London Borough of Havering |
| Study area ($m^2$/ha) | 35.95 ha |

| | | |
|---|---|---|
| Site co-ordinates | 556316 192439 | |
| **PROJECT CREATORS** | | |
| Name of organisation | ARCA geoarchaeology, University of Winchester | |
| Project manager | Keith Wilkinson | |
| Project supervisor | Keith Wilkinson | |
| **MONUMENT TYPE** | None | |
| **SIGNIFICANT FINDS** | Organic deposits beneath river gravels; up to 2.8m of alluvium | |
| **PROJECT ARCHIVES** | **Intended final location** | **Content** |
| Physical | N/A | None |
| Paper | N/A | None |
| Digital | Archaeological Data Service | Lithostratigraphic and positional data (spreadsheet), digital photos |
| **BIBLIOGRAPHY** | | |
| Wilkinson, K.N. (2023) Junction 28 Improvements, M25, Havering: Geoarchaeological Auger Study. Unpublished report 2223-5, ARCA, University of Winchester, Winchester. | | |