Geoarchaeology

ARCA

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AVON FIRE STATION, TEMPLE BACK, BRISTOL: GEOARCHAEOLOGICAL ASSESSMENT

Prepared for Cotswold Archaeology

Phil Stastney

ARCA
Department of Archaeology
University of Winchester
Winchester
SO22 4NR
http://www.arcauk.com

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SUMMARY

In June 2014 ARCA monitored the drilling of six geotechnical boreholes at the site of Avon Fire Station, Temple Back, Bristol. Two boreholes, ARCA AFS BH1 and ARCA AFS BH2 were drilled through the Quaternary sedimentary sequence into the bedrock (maximum depth 20-25m), whilst the four other boreholes were drilled to maximum depths of 4-5m below ground level (BGL).

Bedrock of the Mercia Mudstone Group (MMG) was encountered in ARCA AFS BH2 at -5.01m OD, and was overlain by Pleistocene fluvial gravels of the Avon Formation. The Avon Formation was overlain by strata of the Holocene Wentlooge Formation (which at the site comprised two informal units: Alluvium 3 and Alluvium 1). The gravels were overlain between -1.86m OD and +6.04m OD in ARCA AFS BH1, and between -3.11m OD and -1.71m OD in ARCA AFS BH2, by a series of laminated fine sands and silts (Alluvium 3) most likely deposited on a point bar on the inner bend of a meander of the Avon. These point bar deposits were overlain by fine-grained alluvial/intertidal sediments (Alluvium 1) which were encountered in all boreholes at the site. Holocene alluvial/intertidal strata were sealed by possible archaeological strata (in ARCA AFS BH2 and ARCA AFS BH8 only) and deposits of Made Ground (all boreholes). Deposits of possible archaeological interest, up to 6.90m thick, which may represent the remains of one or more phases of structural masonry were encountered between +1.19 and +8.09m OD in ARCA AFS BH2. Possible Proto-urban deposits were encountered between +6.70m OD and +7.12m OD in ARCA AFS BH8.

No strata of high palaeoenvironmental potential were encountered at the site. However, the possible Proto-urban deposits and archaeological strata encountered in ARCA AFS BH8 and ARCA AFS BH2, respectively, were assessed as being of moderate to high archaeological potential.

1. INTRODUCTION

1.1 Between 17th and 26th June 2014, ARCA carried out a geoarchaeological borehole assessment of the site of the Avon Fire Station, Temple Back, Bristol (henceforth 'the site'). The works were conducted at the request of Cotswold Archaeology (CA) and on behalf of their client, Hydrock. The assessment comprised the monitoring and recording of six geotechnical boreholes (ARCA AFS BH1 – BH4, and ARCA AFS BH7 and BH8). These works were carried out in accordance with a methodology presented in a *Written Scheme of Investigation* (WSI) (Stastney 2014a) approved by Bob Jones, Bristol City Archaeologist.

1.2 This document assesses the stratigraphic sequence beneath Avon Fire Station, Temple Back, Bristol. It is arranged as follows: first a brief account is provided of the geographic, geological and methodological background to the geoarchaeological project; secondly the borehole stratigraphy is described in detail; and finally the potential of the sample resource in the boreholes to address the questions outlined in Section 1.6 is assessed. A bibliography and an appendix containing lithological descriptions of the borehole stratigraphy completes the document.

1.3 The site lies in central Bristol and is centred on NGR ST 59300 72850 (Figure 1). The site covers approximately 0.8ha bounded to the northwest by Counterslip, to the northeast by Temple Back, Water Lane to the southeast, and Temple Street to the southwest. The site lies south of a meander of the River Avon, which passes 40m to the northeast, 170m northwest and 240m west of the site.

1.4 The British Geological Survey map the site as lying on bedrock of the Redcliffe Sandstone Member of the Mercia Mudstone Group, a Triassic deposit dating to c.251-200 Mya, overlain by Holocene Tidal Flat Deposits (Wentlooge Formation *sensu* Allen and Rae, 1987) (BGS 2014). Although not mapped by the British Geological Survey, Late Holocene (Early Medieval to Modern) Made Ground deposits overlie the Holocene alluvium/intertidal strata. Deposit models developed on the basis of existing stratigraphic records predict that 3-4m of Made Ground overlie 4-6m of Wentlooge Formation deposits on the site (Wilkinson *et al.* 2013).

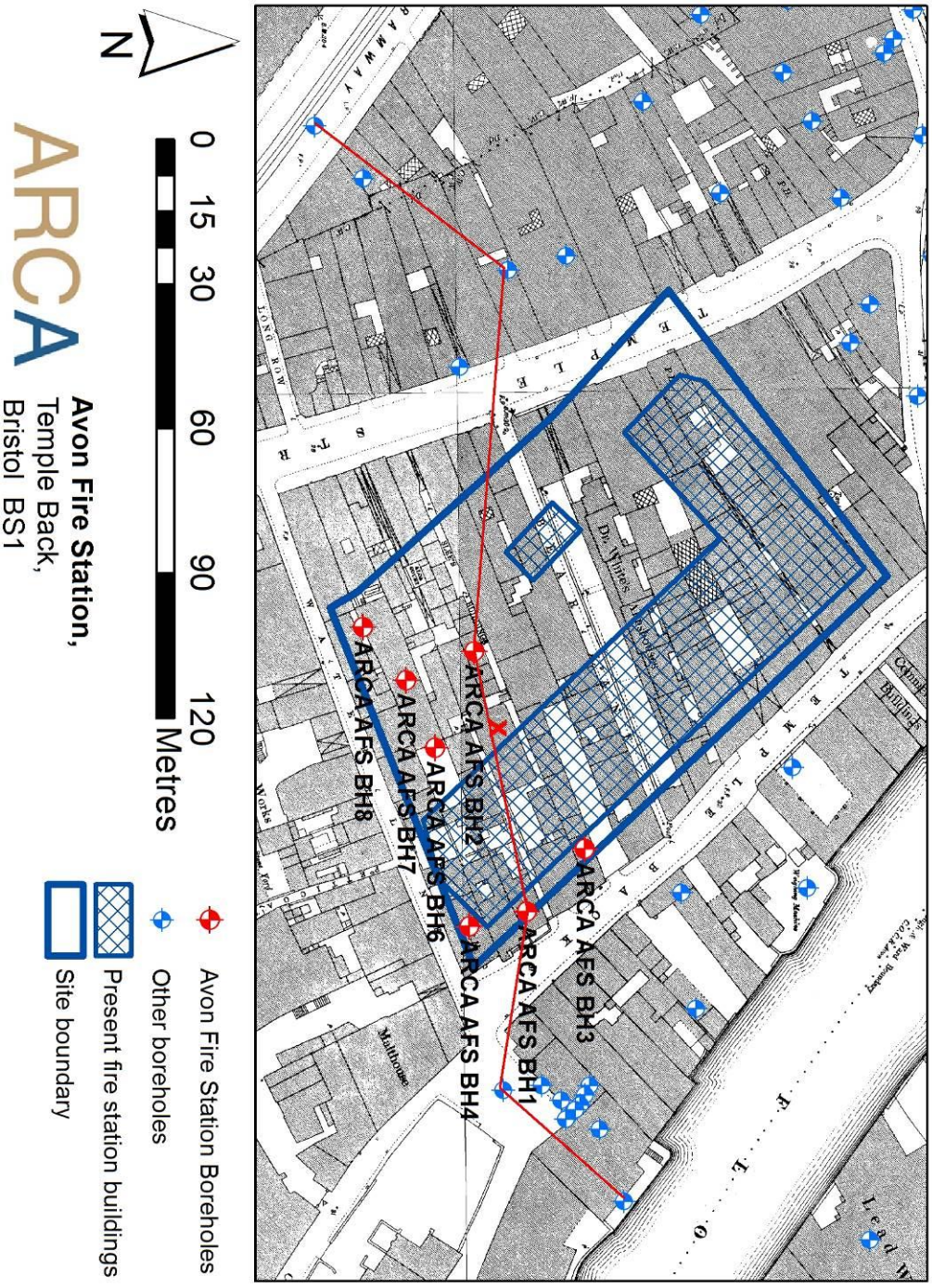

Figure 1: Location of boreholes on the site (shown in red). Other boreholes in ARCA's database are shown in blue. Basemap: 1st Edition Ordnance Survey Map (19th century). The boundary of the site is indicated by the bold blue line, the approximate footprint of the present fire station buildings are indicated by blue hatching. The location of ARCA AFS BH5 (aborted) is indicated by the red letter 'X'. The fine red line indicates the location of the W-E transect shown in Figure 4.

1.5 A Desk Based Assessment of the site carried out by Cotswold Archaeology identified areas of high archaeological potential in the western part of the site. More significant truncation of archaeological deposits was identified in other parts of the site. However, the potential to identify palaeosols (buried soil horizons), palaeochannels, 'trampled' alluvial deposits of archaeological interest (potentially of Prehistoric date), and a former estuarine inlet feature (known to exist c. 40m to the east) was identified throughout the site (Cotswold Archaeology 2013).

1.6 The objectives of the geoarchaeological project at the site were to (Stastney 2014a, 1-2):

1.6.1 Determine the Quaternary sedimentary sequence (including archaeological strata) on the site.

1.6.2 Record any palaeosols or organic strata present at the site.

1.6.3 Assess the archaeological, palaeoenvironmental and geoarchaeological potential of the Quaternary sedimentary units encountered.

2. METHODOLOGY

2.1 The WSI envisaged the drilling of up to eight boreholes positioned across the site (Stastney 2014a, 2). ARCA AFS BH5 was not drilled due to the possible presence of buried services, whilst drilling of ARCA AFS BH6 was abandoned following hand excavation of a 1.20m deep trial pit due to the presence of abundant sandstone cobbles.

2.2 Boreholes were drilled by geotechnical drilling teams contracted to Hydrock. Drilling of ARCA AFS BH1 and ARCA AFS BH2 was carried out using a Pioneer dynamic drilling rig to depths of 20-25m B.G.L. ARCA AFS BH3, ARCA AFS BH4, ARCA AFS BH7 and ARCA AFS BH8 were drilled using a smaller Terrier windowless sampler to a maximum depth of 5m B.G.L. Borehole locations were surveyed by ARCA to Ordnance Survey National Grid and Ordnance Datum.

2.3 Sediments from the boreholes were recovered in plastic liners which were sliced open on site by a Hydrock operative. Sediment were then photographed and described by an ARCA geoarchaeologist using standard geological criteria (Tucker 1982, Jones *et al.* 1999, Munsell Color 2000). The

lithostratigraphy of the boreholes is reported in Section 3, full stratigraphic descriptions are given in Appendix 1.

2.4 Lithological descriptions and positional information were combined within a RockWorks database (RockWare 2013). The RockWorks software was then used to combine lithological units into higher-level groupings (informal and formal 'formations') corresponding to geological/geographic and archaeological events. The RockWorks database was used to plot the cross sections presented in Figure 2, Figure 3 and Figure 4.

2.5 The geoarchaeological archive from the site consists of digital records (photographs of the cores, RockWorks database entries [lithological descriptions and magnetic susceptibility data]), which are retained on the University of Winchester server.

3. BOREHOLE STRATIGRAPHY

3.0.1 Five major stratigraphic units (formal and informal formations and members) present at the site were revealed in the borehole stratigraphy of the five boreholes drilled during the present works. These are reviewed below in chronological order.

3.0.2 'Alluvium 3', 'Alluvium 1' 'Archaeological Strata 1' and 'Proto-urban deposits' are informal terms for major stratigraphic units in central Bristol defined by Wilkinson *et al.* (2013). Of these, the former two units may both be assigned to the Wentlooge Formation (*sensu* Allen and Rae 1987), but are discussed separately below. See Section 3.2.1.

3.0.3 The lithological data are plotted graphically in Figure 2, while full descriptions are included as Appendix 1. Stratigraphic data are shown in Figure 3 and Figure 4.

3.1 Mercia Mudstone Group

3.1.1 Bedrock of the Mercia Mudstone Group (MMG) was only recorded in ARCA AFS BH2 but was encountered beneath gravels of the Avon Formation by further rotary drilling carried out at ARCA AFS BH1 (not monitored by ARCA).

3.1.2 MMG outcrops below -5.01m OD in ARCA AFS BH2.

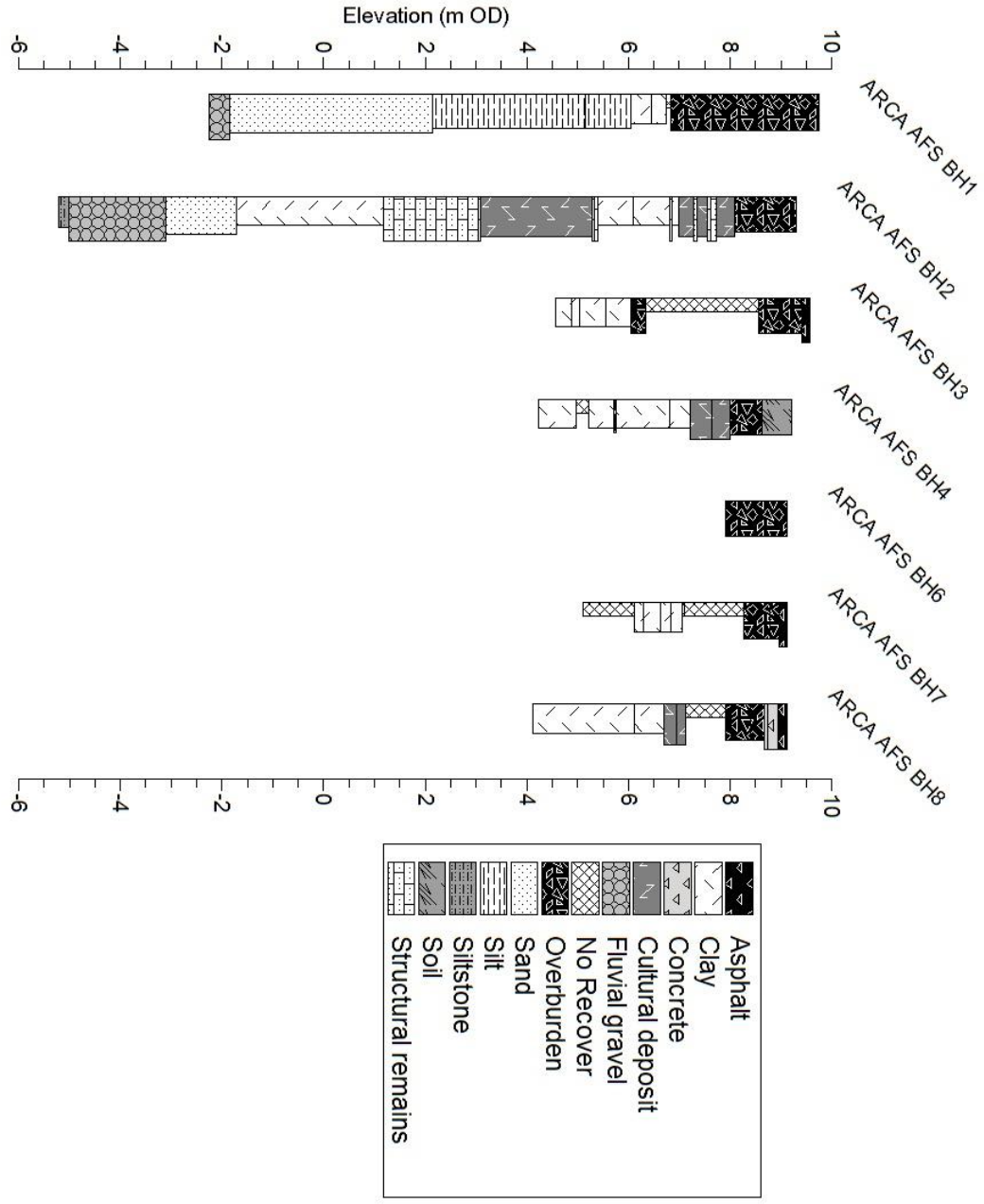

Figure 2: Lithostratigraphy of boreholes at the site.

3.1.3 MMG bedrock in ARCA AFS BH2 consists of reddish brown mudstone and is unconformably overlain by gravel of the Avon Formation.

3.2 Fluvial gravels (Avon Formation)

3.2.1 Deposits of fluvial gravel were encountered at the base of the Holocene sedimentary sequence in ARCA AFS BH1 and ARCA AFS BH2. These deposits outcrop between -2.26m OD and -

1.86m OD in ARCA AFS BH1, and between -5.01m OD and -3.11m OD in ARCA AFS BH2. The gravels are likely to be part of an as yet unnamed member of the Avon Formation, a series of terrace gravels dating to the Late Pleistocene (Campbell *et al.* 1999).

3.2.2 Given the low elevation of their outcrop, the Avon Formation gravels encountered at the site are likely to date from the latest part of the Late Pleistocene, i.e. the Devensian Late Glacial. Campbell et al. (1999) and Bates (2003) suggest that the Barhampton Member, which is at 3m above the present river level, is of Marine Isotope Stage (MIS) 6 date or earlier, and therefore as the gravels seen at the site outcrop below river level, they must be later (MIS 5e-2, i.e. 130-14 Kya). Avon Formation gravels have been found outcropping on a number of sites in central Bristol at similar elevations to those at the site, including at Queen Square (Stastney 2014b), Broad Quay (Wilkinson 2007), Harbourside (Wilkinson and Tinsley 2005) and Broadmead (Yendell and Stafford 2005, Wilkinson 2013).

3.2.3 In both boreholes the Avon Formation strata consist of grey moderate to well-sorted clast-supported gravels of subangular to rounded pebbles of various lithologies.

3.2.4 Avon Formation gravels were not encountered in other boreholes drilled at the site since they did not penetrate the Wentlooge Formation strata. Nevertheless, the Avon Formation is likely to underlie Holocene strata across the entire site.

3.2.5 In ARCA AFS BH1 and ARCA AFS BH2 Avon Formation gravels are unconformably overlain by Alluvium 3 strata, part of the Holocene Wentlooge Formation.

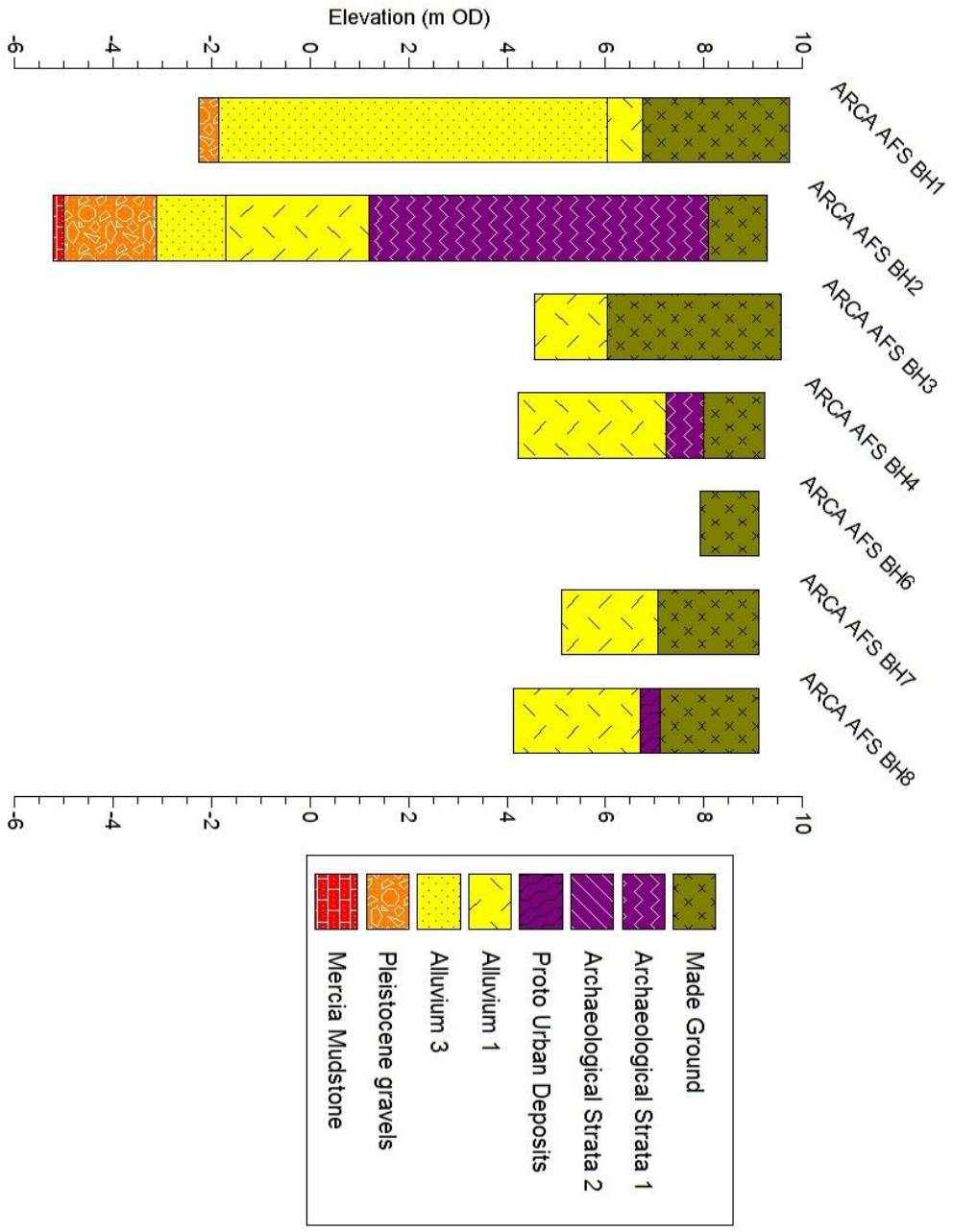

Figure 3: Stratigraphy of boreholes at the site.

3.3 Alluvium 3 (Wentlooge Formation)

3.3.1 The Wentlooge Formation is comprised of intertidal and freshwater strata of the Severn Estuary (both mineral and organic), and dates to the beginning of the Holocene to the Roman period (Allen and Rae 1987). Since other Holocene intertidal formations defined by Allen and Rae (1987) only outcrop close to the historic sea defences along the line of the

River Severn all the Holocene intertidal/alluvial sediments encountered at the site are most likely referred to the Wentlooge Formation. Wentlooge Formation deposits at the site outcrop between -3.11m OD and +7.22m OD.

3.3.2 As mentioned previously in Section 3.0.2, both Alluvium 3 and Alluvium 1 are informal subdivisions of the Wentlooge Formation defined by Wilkinson et al. (2013) for alluvial/intertidal strata in central Bristol.

3.3.3 'Alluvium 3' is defined by Wilkinson *et al.* (2013) as alluvial sand strata which underlie Alluvium 1, predominantly encountered in the Redcliffe area. Alluvium 3 deposits are likely to have formed on a point bar (i.e. sands and gravels forming on the inner bend of a meander as the Avon meander north of the site became more exaggerated (Miall 1996, 153-163).

3.3.4 Alluvium 3 strata outcrop between -1.86m OD and +6.04m OD in ARCA AFS BH 1, and between -3.11m OD and -1.71m OD in ARCA AFS BH2. These strata unconformably overlie Avon Formation gravels and consist of yellowish brown, olive, or grey finely laminated fine sands, sandy silts and silt/clays. Alluvium 3 is conformably overlain by Alluvium 1.

3.4 Alluvium 1 (Wentlooge Formation)

3.4.1 'Alluvium 1' is defined by Wilkinson *et al.* (2013) as deposits of the Wentlooge Formation encountered below Made Ground.

3.4.2 Alluvium 1 outcrops between +6.04m OD and +6.74m OD in ARCA AFS BH1, between -1.71m OD and +1.19m OD in ARCA AFS BH2, and below +6.04m OD in ARCA AFS BH3, +7.22m OD in ARCA AFS BH4, +7.06m OD in ARCA AFS BH7, +6.70m OD in ARCA AFS BH8. Alluvium 1 was not encountered in ARCA AFS BH6.

3.4.3 Alluvium 1 at the site consists of generally structureless soft brown silt/clay becoming grey and firm to hard with depth with frequent rootlet holes visible throughout deposited in an alluvial/intertidal environment. In places Alluvium 1 outcrops above +7.00m OD, well above the estimated level of Mean High Water Spring Tides during the Medieval period in Bristol[1] (Jones 1991). The upper parts of these strata are, therefore, likely to represent overbank flooding of the Avon during the historic

[1] Estimated to be maximum +6.40 - +6.70m OD (Jones 1991, 19).

period although they are otherwise lithologically indistinguishable from the Wentlooge Formation.

3.4.4 Alluvium 1 is generally unconformably overlain by Made Ground and/or Archaeological strata except in ARCA AFS BH8 where Alluvium 1 is conformably overlain by Proto-urban deposits.

3.5 Made Ground, Proto-urban and Archaeological strata

3.5.1 'Made Ground' is a term used by the British Geological Survey to encompass deposits formed as a product of human action (BGS 2014). 'Proto-urban deposits' (*sensu* Wilkinson *et al.* 2013) are defined as disturbed or 'trampled' alluvial deposits which occur at the top of the Wentlooge Formation associated with human activity in marshy conditions. 'Proto-urban deposits' might therefore be included as part of either the Wentlooge Formation or Made Ground, but are for the purposes of this report discussed alongside the latter. 'Archaeological Strata 1' (*sensu* Wilkinson *et al.* 2013) are defined as strata of Made Ground of likely archaeological interest, dating to the Medieval or Post-Medieval periods, without identified organic preservation.

3.5.2 Possible Proto-urban deposits were only encountered in ARCA AFS BH8, outcropping between +6.70m OD and +7.12m OD. These strata conformably overlay Alluvium 1 and consisted of a 0.25m thick layer of soft very dark grey silt/clay with rare burnt animal bone and worked wood inclusions overlain by a further 0.17m of soft dark grey silt/clay containing a sandstone cobble. These strata may relate to human activity in marshy conditions prior to the subsequent development of the local area. Proto-urban strata in ARCA AFS BH8 are presumably unconformably overlain by Made Ground; sample recovery from ARCA AFS BH8 (drilled used a Terrier rig) was generally poor, and no sediments were recovered from the interface between the possible Proto-urban deposits and the overlying Made Ground strata.

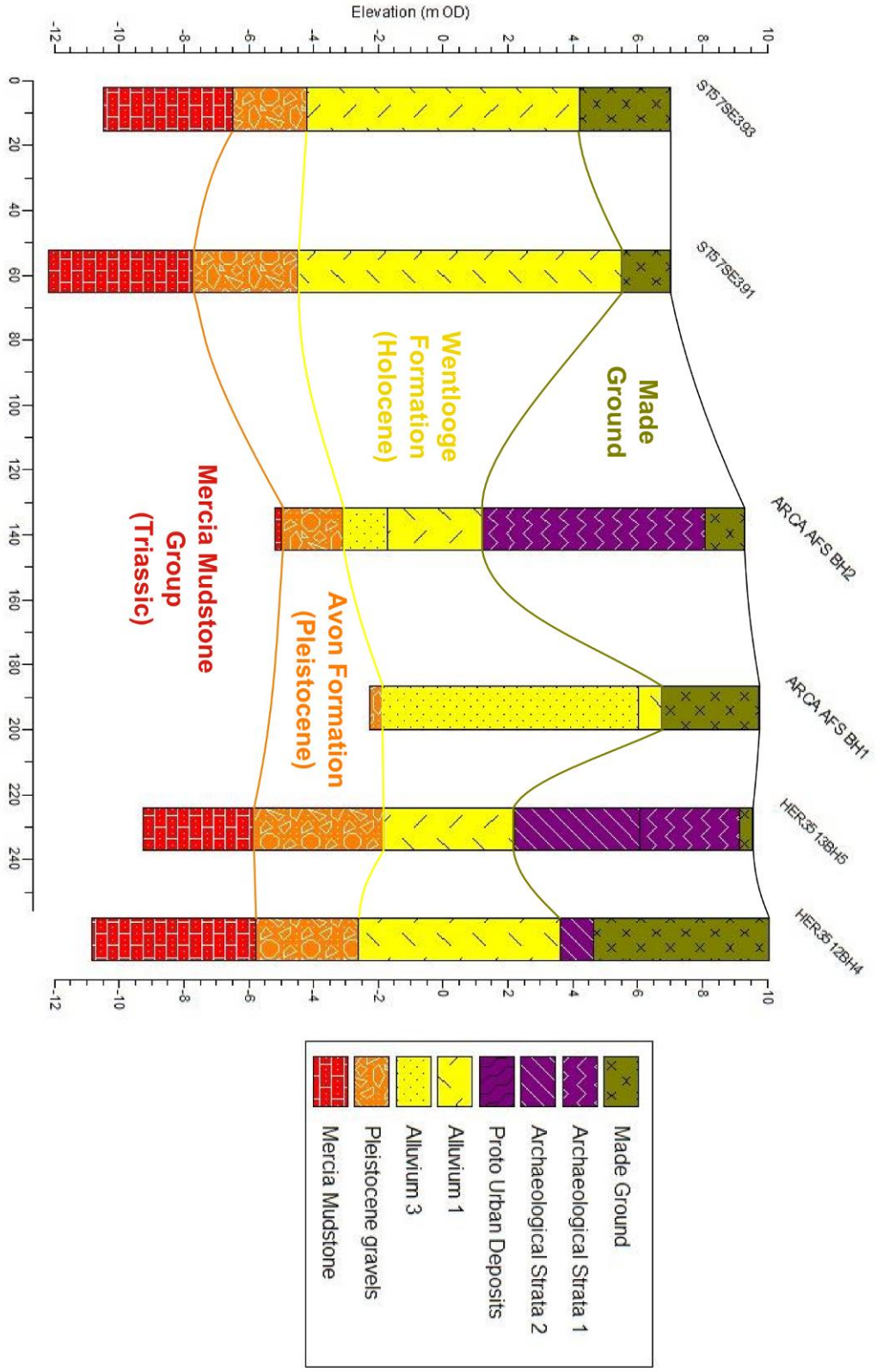

Figure 4: West - East stratigraphic cross section including boreholes from the site and other nearby stratigraphic records. The position of the transect is indicated by the red line in Figure 1.

3.5.3 Strata of possible archaeological interest, classified here as Archaeological Strata 1, outcrop between +1.19m OD and +8.09m OD in ARCA AFS BH2. These strata consist of a series of layers of grey sandstone cobbles interbedded with silt/clay strata with occasional charcoal and layers of firm reddish sandy silt/clay. These strata may possibly relate to a series of one or more phases of structural masonry and associated fine-grained archaeological strata, however, the strata were subject to considerable compression (caused by the method of drilling), and the sandstone was recovered in the core samples only as broken cobbles. Whilst the possible structural remains appear to have been interbedded finer-grained strata, there remains the possibility that some of this coarse material was pushed down the borehole by the drilling equipment. Therefore, on resent evidence, there is only moderate confidence that the possible structural remains encountered in ARCA AFS BH2 extend as low as +1.19m OD (8.10m BGL). These strata were unconformably overlain by Made Ground (Post-Medieval or Modern overburden).

3.5.4 Other strata of possible archaeological interest outcrop between +7.22m OD and +8.00m OD in ARCA AFS BH4. These consist of generally brownish silt/clays containing charcoal, CBM fragments, oyster shells and sandstone fragments.

3.5.5 Post-Medieval to Modern Made Ground (overburden) strata cap the sedimentary sequence across the site. These strata range from 1.2m to 3.52m in thickness and generally consist of poorly sorted sandy silt/clays and gravels with brick, sandstone and concrete rubble sealed by concrete and/or asphalt or the present topsoil (ARCA AFS BH4 only).

4. ASSESSMENT

4.1 Archaeological significance

4.1.1 The MMG has NO archaeological potential given the Triassic age of these strata.

4.1.2 The Avon Formation gravels have a LOW archaeological potential. Whilst Palaeolithic artefacts have been found in Avon Formation gravels in other parts of the region, particularly at Shirehampton, these have mostly been recovered from gravels of the Ham Green Member (Bates and Wenban-Smith 2006, 161), which most likely are of MIS 10-12 date (Hunt 2006, 151), and

therefore likely to be considerably older than the Avon Formation gravels encountered at the site. As discussed in Section 3.2.2, the gravels encountered at the site are of an as yet unnamed member of the Avon Formation of probable MIS 5e-2 date, the archaeological potential of which is presently unknown. Nevertheless, any artefacts which are present in these gravels are likely to have been reworked.

4.1.3 The sands and silt/clays of the Wentlooge Formation as a whole (including both Alluvium 3 and Alluvium 1) are assessed as having a LOW archaeological potential since these were deposited in an alluvial/intertidal setting, and there are no specific indicators of human activity.

4.1.4 The possible Proto-urban deposits outcropping above Alluvium 1 between +6.70m OD and +7.12m OD in ARCA AFS BH8 are assessed as being of MODERATE to HIGH archaeological potential. Although no readily datable artefacts (e.g. pottery) were noted in the core samples, such strata may contain material of archaeological interest potentially contemporary with urban settlement in the area.

4.1.5 The possible Archaeological Strata 1 deposits outcropping between +1.19m OD and +8.09m OD in ARCA AFS BH2 are assessed as being of MODERATE archaeological potential. The abundance of large sandstone fragments and the thickness of these strata may indicate that they relate to the remains of a masonry structure (or structures) which may be of archaeological interest. However, strata in cores from this borehole were subject to compression and large sandstone clasts were only recovered as loose broken cobbles and pebbles making more precise assessment of the form, true extent, and date of these remains (and therefore their archaeological potential) difficult at present. Due to the potential for compression and collapse of material down the borehole caused by the method of drilling, there is only moderate confidence that these possible structural remains extend as far as 8.10m BGL.

4.1.6 Cultural deposits encountered in ARCA AFS BH4 between +7.22m OD and +8.00m OD are assessed as being of MODERATE archaeological potential since the date, form and origin of the anthropogenic material in these strata is at present unclear.

4.1.7 Deposits of Made Ground outcropping between +6.84m OD and +8.54m OD in ARCA AFS BH1, +8.09m OD and +9.29m OD in

ARCA AFS BH2, +6.04m OD and +8.96m OD in ARCA AFS BH3, +8.00m OD and +8.62m OD in ARCA AFS BH4, +8.26m OD and +8.79m OD in ARCA AFS BH7, and +7.92m OD and +8.67m OD in ARCA AFS BH8 are assessed as being of LOW to MODERATE archaeological potential. These strata generally consist of sandy red brick rubble, possibly indicating Early Modern to Modern dates, however the precise date and form of these deposits is unclear on present evidence.

4.1.8 Surface deposits of tarmac and concrete (0.00 – 1.20m BGL in ARCA AFS BH1, 0.00 – 0.60m BGL in ARCA AFS BH3, 0.00 – 1.20m BGL in ARCA AFS BH6, 0.00 – 0.32m BGL in ARCA AFS BH7, and 0.00 – 0.45m BGL in ARCA AFS BH8) and the present soil between 0.00 and 0.60m BGL in ARCA AFS BH4 are almost certainly modern and are therefore assessed as being of LOW archaeological potential.

4.2 Palaeoenvironmental significance

4.2.1 The MMG has NO palaeoenvironmental potential.

4.2.2 The Avon Formation has a LOW palaeoenvironmental potential. Although fine-grained deposits which may contain palaeoenvironmental indicators (such as faunal remains) do occur within similar Pleistocene strata, no such deposits or remains were noted at the site.

4.2.3 The sands, silts and clays of Alluvium 3 and Alluvium 1 have a LOW palaeoenvironmental potential. Previous investigations of comparable deposits at Deanery Road and Harbourside suggest that pollen is variably preserved in such clastic strata (Wilkinson et al. 2002, Wilkinson and Tinsley 2005). Moreover, the source of the pollen in floodplain/mudflat deposits is difficult to determine. The lack of chronological control further restricts the potential of these strata.

4.2.4 The Made Ground, Proto-urban deposits and Archaeological Strata 1 collectively have LOW palaeoenvironmental potential since they are composed of mixed deposits of unknown source and for the most part the water table lies below the Made Ground, meaning that biological remains are likely to have undergone oxidation.

5. ACKNOWLEDGEMENTS

5.1 ARCA would like to thank Simon Cox (Cotswold Archaeology), Steve Forster and Dan Coles (Hydrock) for their help during the course of the project.

5.2 Monitoring and recording of the geotechnical boreholes was carried out by Phil Stastney and Nick Watson. The report was written by Phil Stastney.

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APPENDIX 1: BOREHOLE POSITIONS AND LITHOSTRATIGRAPHY

Borehole	Easting	Northing	Elevation (m OD)	Total depth (m)
ARCA AFS BH1	359353.00	172824.00	9.74	12.00
ARCA AFS BH2	359299.00	172813.00	9.29	14.50
ARCA AFS BH3	359340.00	172836.00	9.56	5.00
ARCA AFS BH4	359356.00	172812.00	9.22	5.00
ARCA AFS BH6	359319.00	172805.00	9.12	1.20
ARCA AFS BH7	359305.00	172799.00	9.11	4.00
ARCA AFS BH8	359294.00	172790.00	9.12	5.00

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH1	0.00	1.20	Overburden	Tarmac over Made Ground.
	1.20	2.90	Overburden	10 YR 4/1 dark grey diamict of loose silty coarse sand and granule to cobble sized subangular red brick, concrete and sandstone. Some cobble sized clay patches and occasional charcoal granules throughout. 2.70-2.90m: abundant sandstone cobbles.
	2.90	3.00	No Recover	No recover - slump
	3.00	3.30	Clay	10 YR 5/4 yellowish brown firm structureless clay. Diffuse to:
	3.30	3.70	Clay	10 YR 5/4 yellowish brown mottled 10 YR 7/1 light grey firm clay with occasional granular Fe and Mn mottles towards base. Diffuse boundary to:

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH1 (cont.)	3.70	4.60	Silt	10 YR 5/4 yellowish brown soft faintly laminated fine sandy silt with some iron staining. 4.00-4.60m: with grey mottles, becoming firm and with rare Fe and Mn mottles. Diffuse to:
	4.60	7.60	Silt	10 YR 5/4 yellowish brown soft thinly laminated fine sandy silt/clay. Frequent thin horizontal laminae of fine-medium sand below 5.75m. Grading into:
	7.60	11.60	Sand	10 YR 5/1 grey very soft finely laminated fine sand, tending to sandy silt/clay in places. Becoming firm and with rare molluscs below 10.00m. Sharp boundary to:
	11.60	12.00	Fluvial gravel	10 YR 5/1 grey moderately well sorted subrounded gravel of various lithologies. [Avon Formation]. Drilling continued with rotary drill. END.
ARCA AFS BH2	0.00	0.80	Overburden	10 YR 3/3 Dark brown poorly sorted gravel of coarse sand to large pebble-sized angular clasts of brick, tile and sandstone.
	0.80	1.20	Overburden	10 YR 3/1 Very dark grey poorly sorted clayey gravel of coarse sand to large pebble-sized angular clasts of brick, tile and sandstone.
	1.20	1.56	Cultural deposit	7.5 YR 4/3 Brown fine sandy silt/clay with discrete pebble-sized grey silt/clay inclusions and occasional angular pebble-sized rock fragments (sandstone). Rare pebble-sized bone fragment. Sharp boundary to:

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH2 (cont.)	1.56	1.74	Structural remains	2.5 Y 5/1 Grey sandstone cobble fills the core. Sharp boundary to:
	1.74	1.95	Cultural deposit	7.5 YR 2.5/1 Black silt/clay with frequent granular to fine pebble-sized white mortar fragments and coarse sand to granular-sized charcoal fragments. Sharp boundary to:
	1.95	2.00	Structural remains	2.5 Y 5/1 Grey sandstone cobble fills the core. Sharp boundary to:
	2.00	2.30	Cultural deposit	5 YR 4/3 Reddish brown homogenous and firm fine sandy silt/clay *encases* 5 Y 4/1 Dark grey fine sandy gravel of angular granule-sized rocks fragments. [Unusual stratigraphy is an artefact of the drilling]. Sharp boundary to:
	2.30	2.43	Clay	5 YR 4/3 Reddish brown homogenous and firm fine sandy silt/clay [Redeposited material from erodible Redcliffe sandstone?] Sharp boundary to:
	2.43	2.48	Structural remains	2.5 Y 5/1 Grey sandstone cobble fills the core. Sharp boundary to:
	2.48	3.20	Clay	5 YR 4/3 Reddish brown homogenous and firm fine sandy silt/clay with occasional sandstone pebble. [Redeposited material from erodible Redcliffe sandstone?] Sharp boundary to:
	3.20	3.90	Clay	5 Y 5/3 Olive firm silt/clay with frequent bright yellowish green mottles [Alluvium?] Sharp boundary to:

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH2 (cont.)	3.90	4.00	Structural remains	2.5 Y 5/1 Grey sandstone cobble fills the core. Sharp boundary to:
	4.00	6.20	Cultural deposit	5 Y 5/1 Grey mixed with 10 YR 4/3 Brown silt/clay with frequent angular sandstone clasts (many eroded and crumbling). Rare charcoal granules. Core compressed by c.50%. Sharp boundary to:
	6.20	8.10	Structural remains	2.5 Y 5/1 Grey loose angular sandstone pebble and cobble-sized clasts fill the core. [Drilled through stone foundations?] Sharp boundary to:
	8.10	11.00	Clay	2.5 Y 5/2 Greyish brown firm very fine sandy structureless silt/clay with rare green mottles. Cores compressed. Diffuse boundary to:
	11.00	12.40	Sand	5 Y 5/4 Olive firm sandy interbedded with 2.5 Y 5/2 greyish brown very fine sandy silt/clay. Occasional pebble-sized black wood fragments (unworked). Pebble-sized beds/lenses of gravels of well-rounded coarse sand to granular sized clasts. Sharp boundary to:
	12.40	14.30	Fluvial gravel	2.5 Y 5/3 Light olive brown poorly sorted gravel of well-rounded coarse sand to pebble-sized clasts. Occasional red quartzitic clasts. 14.00m - 14.30m: as above but 5 YR 4/3 reddish brown.
	14.30	14.50	Siltstone	5 YR 4/3 Reddish brown mudstone. [Bedrock] Drilling continued with rotary drill. END.
ARCA AFS BH3	0.00	0.15	Asphalt	Black tarmac.

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH3 (cont.)	0.15	0.60	Overburden	Mid yellowish brown matrix supported gravel of angular pebble-sized concrete fragments with rare cobbles in a silty coarse sand matrix.
	0.60	1.00	Overburden	Red brick rubble, consisting of subangular to subrounded pebble to cobble-sized red brick in a matrix of dark brown to very dark greyish brown silty sand with some ash, becoming dark grey black silty sandy ash with some decayed sawn wood fragments and red brick pebbles.
	1.00	3.22	No Recover	No recover - auger pushed cobble down hole.
	3.22	3.40	Overburden	10 YR 5/4 yellowish brown soft structureless silt/clay with occasional charcoal and CBM granules. Sharp to:
	3.40	3.52	Overburden	10 YR 5/1 Grey loose concrete gravel. Sharp to:
	3.52	4.00	Clay	10 YR 4/3 Brown very soft becoming firm silt/clay. 3.86-4.00m: with faint thin silt/fine sand laminae.
	4.00	4.53	Clay	10 YR 4/3 Brown very soft and wet clay slurry.
	4.53	4.69	Clay	10 YR 4/3 Brown silt/clay with frequent thin horizontal silt/fine sand laminae. Diffuse boundary to:
	4.69	5.00	Clay	10 YR 4/1 Dark grey firm faintly laminated silt/clay. END BH.
ARCA AFS BH4	0.00	0.60	Soil	Soft reddish brown silty sandy topsoil with frequent roots. Sharp to:
	0.60	1.22	Overburden	Dark grey ashy sand with frequent subangular granule to pebble-sized brick and concrete. Diffuse to:

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH4 (cont.)	1.22	1.57	Cultural deposit	10 YR 2/1 very dark brown firm sandy silt/clay with abundant charcoal granules and pebbles and frequent CBM and grey sandstone granules, rare oyster shell. 1.55-1.57m: abundant oyster shell. Diffuse to:
	1.57	2.00	Cultural deposit	10 YR 4/4 dark yellowish brown firm silt/clay with occasional charcoal and CBM flecks and rare subangular grey sandstone and cream coloured limestone pebbles.
	2.00	2.40	Clay	10 YR 4/4 dark yellowish brown firm silt/clay with some faint blue-grey mottling. Grading into:
	2.40	3.47	Clay	10 YR 4/4 dark yellowish brown mottled 10 YR 6/1 grey firm silt/clay. 2.57-2.74m: band with frequent dark brown Mn mottles. Diffuse to:
	3.47	3.52	Silt	10 YR 4/4 dark yellowish brown fine sandy silt. Diffuse to:
	3.52	4.00	Clay	10 YR 6/1 grey mottled 10 YR 5/8 yellowish brown firm silt/clay becoming soft and more silty towards base.
	4.00	4.24	No Recover	No recover and slump
	4.24	5.00	Clay	10 YR 6/3 pale brown soft silt/clay with frequent Fe and Mn mottles becoming occasional with depth. END BH.
ARCA AFS BH6	0.00	1.20	Overburden	Asphalt over made ground. Hand dug test pit only.
ARCA AFS BH7	0.00	0.15	Asphalt	Black tarmac.

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH7 (cont.)	0.15	0.32	Overburden	Light yellowish brown coarse sand with gravel of angular concrete pebbles.
	0.32	0.85	Overburden	10 YR 2/2 very dark grey silty coarse sand with ash, frequent charcoal, brick and mortar granules, occasional subangular to subrounded red and yellow brick and sandstone pebbles and cobbles, and frequent roughly hewn (with flat possible upper face) cobbles to boulders of strong light greenish grey and greyish pink sandstone. Hand dug to 0.85m.
	0.85	2.00	No Recover	No recover - sandstone cobble caught in cutting shoe of sampler and pushed down.
	2.00	2.05	No Recover	Slump from above.
	2.05	2.28	Clay	10 YR 4/3 brown silt/clay with occasional greenish (organic?) mottles and frequent Fe granule-sized mottles. Grading into:
	2.28	2.49	Clay	10 YR 4/1 dark grey stiff silt/clay. Diffuse to:
	2.49	2.82	Clay	2.5 Y 5/1 grey very stiff silt/clay. Diffuse to:
	2.82	3.00	Clay	Gley1 4/N dark grey mottled 2.5 Y 5/1 grey very closely fissured stiff silt/clay.
	3.00	4.00	No Recover	No recover - sandstone cobble from above caught in cutting shoe and pushed down. Hole abandoned due to continual collapse of sandstone rubble. END BH.
ARCA AFS BH8	0.00	0.17	Asphalt	Black tarmac.
	0.17	0.38	Concrete	Mid yellowish brown matrix supported gravel of angular pebble-sized concrete fragments with rare cobbles in a silty coarse sand matrix. Sharp boundary to:

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH8 (cont.)	0.38	0.45	Concrete	Solid hard flat light grey concrete slab.
	0.45	0.72	Overburden	10 YR 3/1 very dark grey ash and coarse sand with frequent concrete and mortar granules and angular red brick pebbles and cobbles, abundant towards top. Diffuse boundary to:
	0.72	1.11	Overburden	10 YR 2/1 black soft silty sandy fine diamict with frequent subangular red brick, sandstone and coal pebbles. Diffuse to:
	1.11	1.20	Overburden	10 YR 2/2 very dark brown very soft coarse sandy silt/clay with frequent subrounded brick pebbles and occasional pale yellow mortar granules. Hand dug to 1.20m.
	1.20	2.00	No Recover	No recover - cobble of greenish grey sandstone caught in cutting shoe of auger.
	2.00	2.17	Cultural deposit	7.5 YR 4/1 dark grey soft silt/clay with subangular sandstone cobble. Diffuse to:
	2.17	2.42	Cultural deposit	10 YR 3/1 very dark grey soft silt/clay with rare black (burnt?) animal bone fragments (including ?*Gallus* sp. rib) and rare partially decayed horizontally-lain worked (split/sawn) wood fragments. Diffuse boundary to:
	2.42	3.00	Clay	10 YR 6/1 grey with Gley1 4/N dark grey gleyed fissures firm faintly mottled closely fissured silt/clay with frequent rootlet holes throughout.

Borehole	Top	Base	Lithology	Comments
ARCA AFS BH8 (cont.)	3.00	5.00	Clay	10 YR 6/1 grey very firm silt/clay with Gley1 4/N gleyed fissures and rootlet holes. Occasional black granule-sized organic mottles. 3.00-4.00m: core jammed in auger, sample sawn out in sections, all as above. END BH.