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CENTRAL WINCHESTER REGENERATION PROJECT: CHRONOLOGICAL ADDENDUM TO THE FINAL INTEGRATED GEOARCHAEOLOGICAL REPORT

Prepared for Winchester City Council

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SUMMARY

During December 2022–May 2023 a study was carried out to determine the chronology of strata recovered in 13 geoarchaeological boreholes drilled in the Central Winchester Regeneration (CWR) study area. The work was conducted in accordance with recommendations made in a final integrated geoarchaeological assessment report (Wilkinson et al. 2022), this latter describing the litho- and biostratigraphy of the boreholes, the geochemical properties of the strata and the hydrogeology of the site. The borehole cores had been sub-sampled for ^{14}C dating in August and September 2020, and 37 samples collected. Thirteen of these were submitted to the Scottish Universities Environmental Research Centre (SUERC) for AMS ^{14}C dating (four on single terrestrial plant macrofossils and nine as separate measurements on humin and humic acid fractions). Separately in September 2021 and as part of an undergraduate dissertation project, the borehole cores were split into continuous 100mm-thick sediment slices and each of the latter separately sieved through a 8mm mesh to recover artefacts and biological remains. Ceramics so recovered were identified using comparative reference collections and published keys, and quantified.

AMS ^{14}C dating results demonstrate that the oldest Holocene deposits on the site are peats (SU4b) that subcrop above the Pleistocene fluvial gravel (SU2) and below tufa (SU4c) in the Lower Brook Street car park (ARCA CWR BH02). At 8000–7600 cal. BC, these peats are Early Mesolithic and of the same age as peat strata previously encountered in the Upper Brook Street car park. There is then a gap of 2500 years between the Lower Brook Street car park age and a group of AMS ^{14}C dates from peat (SU4b), tufa (SU4c) and alluvial silts and clays (SU4a) in the Middle Brook Street, King's Walk and Tanner Street area (ARCA CWR BH06–08). Although representing up to 3m of stratigraphy, the relevant ages cover the period of a single millennium, i.e. 5000–4000 cal. BC, and indicate that different types of alluvial deposits accumulated synchronously, but in different spatial locations during this period.

There is a second temporal discontinuity between the alluvial deposits described above and further alluvial sediments (SU4d) deposited in the central part of the site (ARCA CWR BH06, ARCA CWR BH09–10). Ceramics from the latter are of Late Iron Age, Romano-British and Anglo-Saxon date, while AMS ^{14}C dates indicate that the alluvium was forming by the 1–3rd centuries AD. The overlying archaeological deposits date from the Romano-British period onwards according to both AMS ^{14}C dates and ceramic inclusions. Both sets of evidence suggest that the majority of deposits below the present water table are of Romano-British and Anglo-Saxon age, meaning that over 2m of such strata underlie the bus station. Medieval pottery is found from just below the present water table (up to 3m below ground level [bgl]) upwards, but AMS ^{14}C evidence suggests that strata of this period are thicker in the Lower Brook Street car park and central part of the site (to at least 2.70m bgl), than in the bus station. In the latter location a late Anglo-Saxon AMS ^{14}C age was obtained on a deposit from 2.12–2.13m bgl.

Although ceramics were mostly noted in their correct chronological order (i.e. early sherds stratigraphically beneath late sherds), this was not always the case, Further, and particularly in the bus station, clusters of Anglo-Saxon pottery in one borehole (e.g. ARCA CWR BH12) are found beneath a sample dated by ^{14}C to the Late Roman–sub-Roman period, but also at lower elevation than groups of Romano-British ceramics in an adjacent borehole (ARCA CWR BH05a). These phenomena indicate the presence of pits and other negative archaeological features.

Wilkinson, K.N., Batchelor, C.R., Knul, M.V., McCulloch, P., Watson, N. and Young, D. (2022) Central Winchester Regeneration Project: final integrated geoarchaeological report. Unpublished report 2122-5, ARCA, University of Winchester.

1. INTRODUCTION

1.1 This report is a chronological addendum to the Central Winchester Regeneration (CWR) final integrated geoarchaeological report (Wilkinson et al. 2022). The latter reported on the stratigraphy, palaeobiology, geochemistry and hydrogeology of 13 geoarchaeological boreholes drilled within the site (Figure 1). As an addendum, **this report should be read alongside the final integrated geoarchaeological report**, i.e. relevant data of that earlier document are only provided in outline here. Further, as a chronological addition, this report is part of the Stage 2 geoarchaeological works as set out in the original written scheme of investigation (WSI) (Wilkinson et al. 2020).

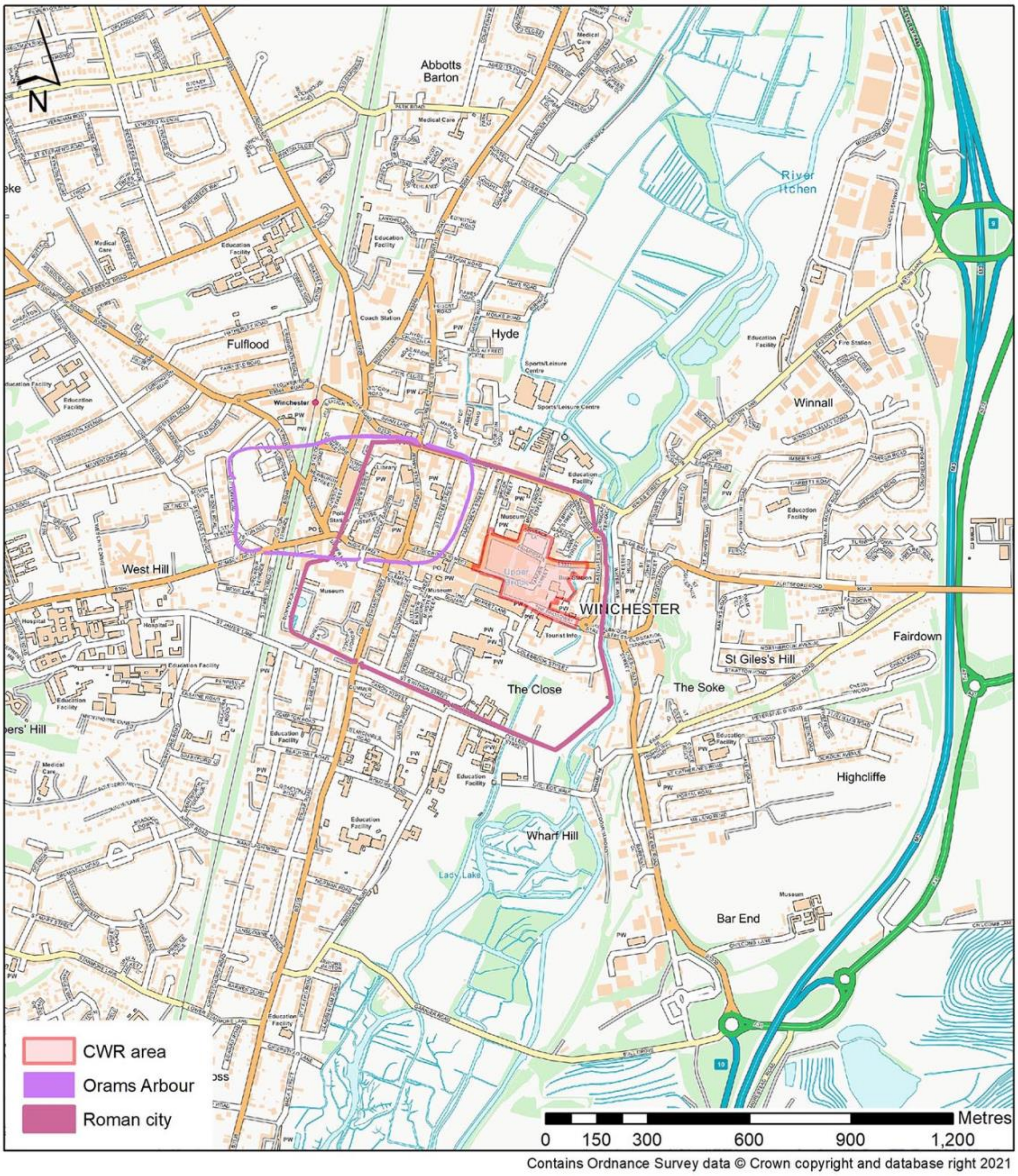

Figure 1. Location of the Central Winchester Regeneration site within Winchester.

1.2 The chronological addendum was a recommendation of the final integrated geoarchaeological report (Wilkinson et al. 2022, section 7.4, 65) and was further articulated in a proposal made to Winchester City Council in June 2022 (Wilkinson

2022). The purpose of the present work is to provide an absolute chronology for the stratigraphy underlying the CWR study area and by so doing enable refinements to be made of the archaeological and biostratigraphic assessments in the earlier report (Wilkinson et al. 2022, section 7.4, 65). In addition, a chronology for the deposits sampled in the CWR geoarchaeological boreholes enables the integration of project data within the archaeological framework of Winchester.

1.3 The chronological data presented in this report enable the following objective of the WSI (WCC 2020, 4–5; Wilkinson et al. 2020, sections 3.3, 16) to be addressed in greater resolution than was possible in the final integrated geoarchaeological report (Wilkinson et al. 2022):

1. To obtain data on the significance, date, character, quality, survival and extent of archaeological deposits and palaeoenvironmental proxies within the CWR site.

The implications of the newly acquired chronological data for the aim are considered in Section 6 below.

1.4 As with the previous geoarchaeological reports produced for the CWR project, the intended audience for the present report is officers of Winchester City Council and the Historic England Science Advisor for South-east England (Wilkinson et al. 2020, section 4.2.10, 26).

2. BACKGROUND

2.1 As stated in Section 1.1, data presented in earlier reports on geoarchaeological boreholes drilled on the CWR site are not repeated in detail here. Nevertheless, for reasons of context and to enable reading of this report without continuous cross referencing of others, it is necessary to rehearse some stratigraphic and locational information.

2.2 The CWR is situated in central Winchester and west of the present channel of the River Itchen (Figure 1). The study area comprises 4.9 ha of land centred on NGR SU 48384 29484 and lies between c. +35 and +37 m OD. Thirteen geoarchaeological boreholes were drilled in August and September 2020 in the locations shown in Figure 2 and from the base of 1.2m deep archaeological test pits to the Lewes Nodular Chalk Formation bedrock.

2.3 The stratigraphy revealed in the boreholes comprises (from bottom to top) the units shown in Table 1.

Table 1. Stratigraphic units subcropping beneath the CWR site

Stratigraphic unit (SU)	Component strata	Upper contact	Thickness
1	Chalk, weathered chalk (Lewes Nodular Chalk Formation on the CWR site)	7.63–10.80 m bgl +29.22–+25.98m OD	>2.17
3	Clast-supported gravel, matrix-supported gravel, sand/silt/clay, weathered chalk (Pleistocene gravels – River Terrace Deposits 1 on the CWR site)	4.20–6.85m bgl +32.71–+30.15m OD	1.95–5.54m
4a	Sands, silts and clays, matrix-supported gravel alluvium ('Alluvium 1' in text below)	4.92–5.00m bgl +32.02–+31.78m OD	0.00–0.33m
4b	Peat and organic mud ('Peat' in text below)	4.15–4.90m bgl +32.86–+31.88m OD	0.00–0.35
4c	Tufaceous deposits and marl ('Tufa' in text below)	2.11–4.10m bgl +34.79–+32.78m OD	0.00–4.55
4d	Sand, silts and clay alluvium ('Alluvium 2' in text below)	1.69–4.50m bgl +35.31–+32.56m OD	0.00–3.46
5	Diamicts, structural deposits, peat, silts and clays. All containing artefacts ('Archaeological deposits/strata' in text below)	0.32–1.20m bgl +36.43–+35.80m OD	1.10–4.65
6	Diamicts, structural deposits, 'overburden' ('Made ground' below)	0.00m bgl +37.06–+36.85m OD	0.32–1.69

2.4 There are broad trends in subcrop variation, namely SU3 River Terrace Deposits 1 thin from east to west and are found at highest elevations in the centre of the site. In contrast SU4 Alluvium thickens in a westerly direction, while SU5 Archaeological deposits follow the opposite pattern, i.e. thickening from west to east (Wilkinson et al. 2020, section 4.1, 18–23). These subcrop trends are explained by a former (pre-Roman) Holocene channel of the River Itchen cutting through the SU3 River Terrace Deposits 1 in the west of the site (Wilkinson et al. 2022, section 6.1, 50–56). The channel then infilled with sands and silts (SU4a), while backswamp areas developed in the channel margins (SU4b). Next, tufa developed both within the channel and backswamp (SU4c). Finally, the channel was abandoned by the stream and filled with overbank deposits (SU4d). Human activity associated with Roman and later occupation of Venta Belgarum/Winchester took place as the overbank deposits of SU4d accreted, but ultimately led to the development of >1.50m thicknesses of anthropogenically deposited and poorly sorted sediment (SU5 and SU6). These latter sediments include structures, depositions to raise the ground surface (e.g. for construction purpose), infills of rubbish disposal pits and residues of occupation, craft and subsistence activities.

2.5 The purpose of the present report is to provide a chronology for pre-modern Holocene deposits of archaeological relevance, namely SU4 and, particularly, SU5. Prior to the present study the age of SU4 within the CWR was poorly constrained by ^{14}C dating. SU4b Peat had been dated in Lower Brook Street and the Upper Brook Street car park (both north of the CWR) to the 8290–4500 cal. BC interval (i.e. the Mesolithic) (Wilkinson and Batchelor 2013, Watson 2015). SU4d was the only other unit that has been ^{14}C dated, this on the Upper Brook Street car park and 165 High Street sites, while the relevant ages span 170 cal. BC to cal. AD 760 (Iron Age to Anglo-Saxon periods) (Wilkinson and Batchelor 2013, Wilkinson and Grant 2019). There are no publicly available ^{14}C dates from the CWR study area or from sites in the surrounding areas[1], but on the basis of finds made during archaeological investigations of the latter, the SU5 strata on the CWR site were thought likely to date to the Roman–post medieval period (Ottaway 2017a).

2.6 Although not the subject of this addendum it is of note that Pre-Holocene strata (SU1 and SU3) have not been dated by absolute means on the CWR site. The Lewes Nodular Chalk Formation (SU1) is a Late Cretaceous (Turonian—Coniacian) unit dated on the basis of palaeontological inclusions to 93.9 to 86.3 million years ago (BGS 2020a). River Terrace Deposits 1 strata (SU3) have not been studied in the Itchen valley, but a possible lateral equivalent at the Hunts Farm Sportsground, Romsey has been dated by optically stimulated luminescence to 68.8 ± 11.1 thousand years before present (BP) (Bates et al. 2010).

[1] ^{14}C dates from deposits now designated as SU5 were obtained from the CWR site during a prior geoarchaeological study for the defunct Silver Hill development, but those chronological data are not publicly available.

3. METHODOLOGY

3.0.1 The methodology outlined below is that used to collect 14C sub-samples and extract artefacts from cores of the CWR boreholes. The methods by which cores were retrieved, and then photographed and described, are outlined in previous reports (Wilkinson et al. 2021, 2022).

3.1 AMS ^{14}C dating

3.1.1 Sub-samples for ^{14}C dating were collected opportunistically during core description. Where discrete plant macrofossils were visible in the cores, such remains were extracted in their entirety using clean surgical scalpels and scoops, and then stored in labelled (with site code, borehole identifier and depth interval [below ground level (bgl)]) glass vial. In cases where organic strata were present, but where plant macrofossils could not be seen, a 4cm^3 cylinder of bulk organic sediment was collected using a volumetric sampler. Sediment so sampled was placed in a labelled (as set out above) ziplock bag. A total of 37 samples for AMS ^{14}C measurement were obtained using the procedures outlined above and placed in cold storage (Table 2).

Table 2. Samples selected for ^{14}C dating

Number	Borehole	Top (m bgl)	Base (m bgl)	Type
1	ARCA CWR BH02	4.97	4.98	Bulk organic
2	ARCA CWR BH07	3.80	3.81	Bulk organic
3	ARCA CWR BH07	5.78	5.79	Bulk organic
4	ARCA CWR BH08	6.34	6.36	Bulk organic
5	ARCA CWR BH06	4.84	4.86	Plant macrofossil
6	ARCA CWR BH13	4.95	5.02	Plant macrofossil
7	ARCA CWR BH06	4.01	4.02	Bulk organic
8	ARCA CWR BH05A	3.20	3.21	Bulk organic
9	ARCA CWR BH05A	2.12	2.13	Plant macrofossil[a]
10	ARCA CWR BH08	2.65	2.70	Bulk organic
11	ARCA CWR BH01	2.25	2.26	Plant macrofossil
12[b]	ARCA CWR BH12	2.53	2.54	Plant macrofossil
13[c]	ARCA CWR BH12	2.46	2.47	Bulk organic

[a] Identifiable plant macrofossils not found by Quest and submitted as a bulk organic sample
[b] Insufficient carbon for AMS ^{14}C measurement and replaced with 13
[c] Replacement for 12

3.1.2 As explained in Section 1.1, ^{14}C dating was not part of the Stage 1 geoarchaeological project. However, as a result of recommendations made in the final integrated geoarchaeology report (Wilkinson et al. 2022) and following approval of the CWR Archaeology Advisory Group on 26 July 2022, the decision was made to submit twelve samples for AMS ^{14}C measurement. These latter were chosen based on opportunities and constraints outlined in a proposal of June 2022 (Wilkinson 2022), which in turn were developed in a meeting of the first author and Winchester City Council's Archaeologist on 20 May 2022. The opportunities/constraints were as follows (Wilkinson 2022, 3–4):

SU4b Peat: Peat found at or near the base of the stratigraphic sequence in central Winchester has been ^{14}C dated from the Upper Brook Street car park, Faberlux Yard, Cathedral Close, Pilgrim's School as well as on Winnall Moors (Waton 1982, Champness et al. 2012, Wilkinson and Batchelor 2013, Watson 2015, Wilkinson and Grant 2020). However, the chronologies obtained suggest development over multiple cycles of the Early and Middle

	Holocene (9120–8670 to 4340–4060 cal. BC [Wilkinson 2020]). Therefore, in order to determine in which of these episodes SU4b formed, three samples were submitted for AMS ^{14}C measurement (numbers 1, 5 and 6 in Table 2).
SU4c Tufa	Tufaceous deposits have been found beneath various sites in central Winchester, but most notably beneath The Brooks shopping centre. On the latter, archaeological features were found to be cut into the tufa, but the stratum was otherwise not archaeologically (or geoarchaeologically investigated) (Zant 1993). Subsequently tufa has been found in geoarchaeological boreholes in the Upper Brook Street car park (Wilkinson and Batchelor 2013). However, the tufa of central Winchester has never been dated and presently it is only known that it was in place before the Roman town was founded. For the first time in central Winchester boreholes of the CWR (ARCA BH01–04 and BH07) have penetrated the tufa and demonstrate that it is interbedded with peat. The latter provides source material from which the tufa can be dated and therefore two such samples (numbers 2 and 3 in Table 2) were submitted for AMS ^{14}C measurement.
SU4d Alluvium 2	Minerogenic silts and clays of likely alluvial origin overlie tufa and peat in the eastern part of the CWR. In several boreholes, notably ARCA BH06, ceramic and geochemical evidence suggest these deposits formed following the founding of the Roman town of Venta Belgarum. Organic rich deposits in SU4d are rare and therefore only one sample (number 7 in Table 2) was submitted for AMS ^{14}C measurement.
Channel fill	Although borehole ARCA BH08 was originally described as containing deposits of SU4a, SU4b and SU4d, at least the last of these is in fact a fill of a deliberately constructed channel (Wilkinson et al. 2022). Geochemical and ceramic evidence suggests that the channel fill include anthropogenic detritus. In order to date the infill history of the channel, samples from the basal and uppermost fills were submitted for AMS ^{14}C measurement (numbers 4 and 10 in Table 2).
SU5 Archaeological strata	Various types of archaeological deposits (SU5) overlie the peat/tufa/alluvium of SU4. In broad terms it is known that SU5 dates from the Roman to post-medieval periods, while the ceramic evidence also suggested that Roman, Anglo-Saxon and medieval strata are present in all parts of the site (Holloway 2022). However, the same data also indcate that some artefacts have been reworked and as a result there are instances of apparent age inversion. To aid on providing a firmer chronology for the archaeological deposits, five samples from SU5 were submitted AMS ^{14}C measurement (numbers 8, 9, 11, 12 and 13 in Table 2). These samples were of discrete organic layers.

3.1.3 Samples selected for AMS ^{14}C dating and comprising plant macrofossils were sent to Quaternary Scientific, University of Reading for taxonomic identification. However, the latter was only possible at a broad level (i.e. 'bark' and 'nut shell'), while one sample (ARCA CWR BH05A 2.12–21.3m, 9 in Table 2) contained no identifiable plant macrofossils. In the latter instance the sample was treated in the same way as described for bulk organic sediment samples in Section 3.1.4.

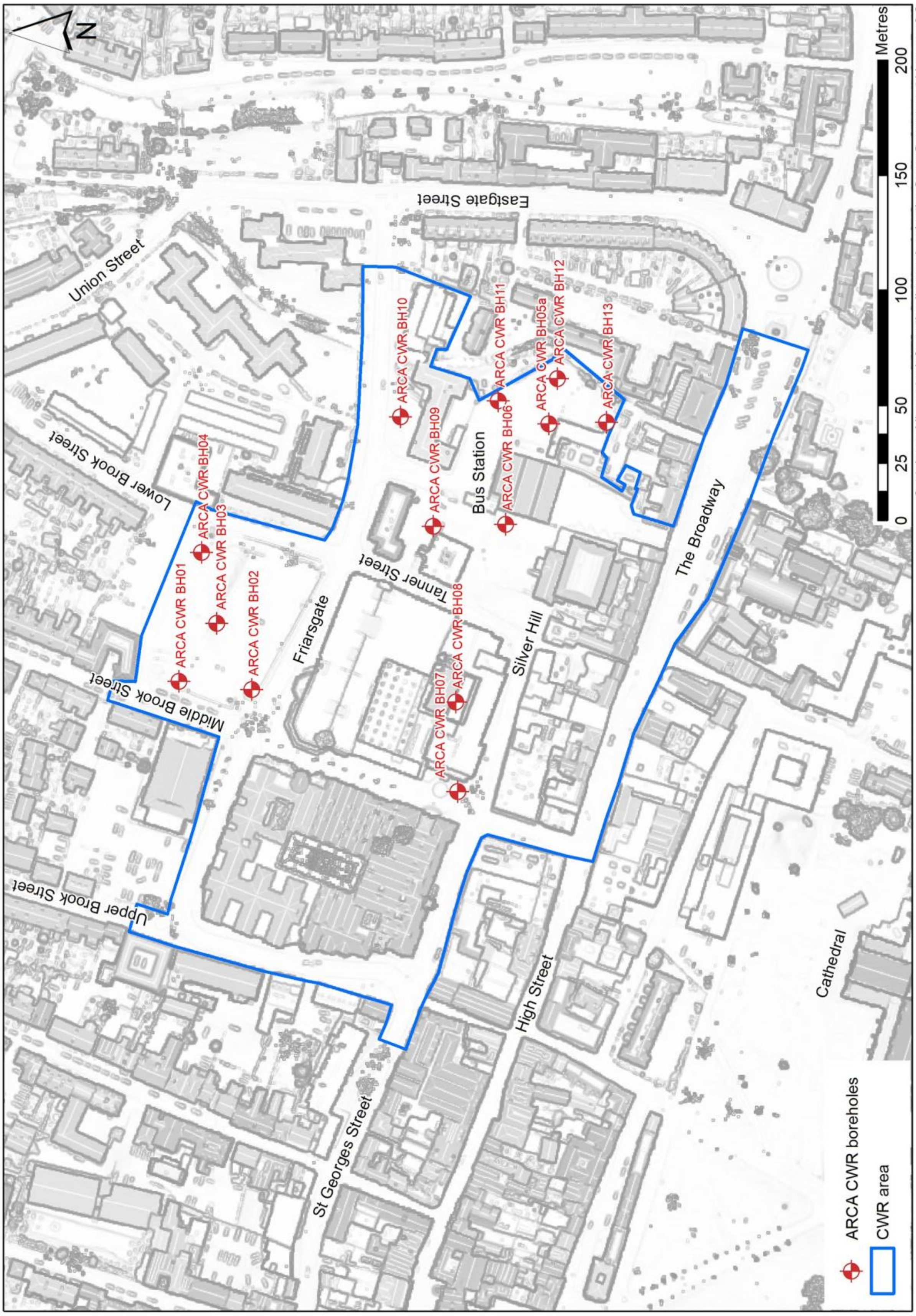

Figure 2. Location of ARCA boreholes in the CWR study area

3.1.4 The original 12 samples were submitted to SUERC for AMS ^{14}C dating. Preliminary assessment determined that insufficient material was present in ARCA CWR BH12 2.53–2.54m (12 in Table 2), and therefore a replacement sample (13 in Table 2), was submitted in its stead. AMS ^{14}C measurements were made of individual plant macrofossils in the case of three samples, while following the guidance of Bayliss and Marshall (2022), separate AMS ^{14}C measurements were made of the humin and humic acid fraction for the nine 'bulk organic' samples.

3.1.5 The AMS ^{14}C data received from SUERC were transferred to the OxCal program (ORAU 2023) and that software used to calibrate the ^{14}C data using the IntCal20 curve (Reimer et al. 2020). A rounding of 10 years was applied, while the calendar ages in Table 3 are shown at two standard deviations (2σ) probability (95.4%). The same calibration and rounding routine was also applied to ^{14}C dates used in this report, but derived from previous publications and grey literature report.

3.2 Artefacts

3.2.1 The geoarchaeological borehole cores were stored at the University of Winchester for the 12 months stipulated in the WSI and pending any further examination and sampling that might have been requested (Wilkinson et al. 2020). Prior to their disposal, the decision was made to sieve the Holocene sediment in the cores to extract artefacts and biological materials, while the recovery and subsequent study of the remains became an undergraduate dissertation project (Holloway 2022).

3.2.2 The SU4 and SU5 strata in the cores were divided into continuous 100mm-thick spits and then dry sieved through an 8mm mesh. Finer sediment (<8mm) was discarded, while artefacts and biological remains were picked from the coarser residue and then washed and air dried at 40°C for at least 24 hours. The artefacts and biological remains were then each labelled with the site code, borehole identifier and depth increment (m bgl) prior to further study.

3.2.3 Bones recovered from the >8mm residue were examined for evidence of butchery and quantified (by number), while shell, ceramic building material, charcoal and metalworking slag were recorded by fragment count. Pottery was similarly quantified (by piece), and the fabric of each of the 49 sherds recovered was then separately described on the basis of macroscopic (e.g. colour [Munsell 2000]) and microscopic (e.g. size and nature of inclusions) characteristics, this latter using a low power binocular microscope. Fabric descriptions were compared to those published in the *National Roman Fabric Reference Collection* (Tomber and Dore 1998) and the *Potsherd: Atlas of Roman Pottery* (Tyres 2021), and the Winchester medieval types series (Cotter 2011).

3.3 Archive

3.3.1 The archive resulting from the present chronological project extends that which was originally compiled for the CWR geoarchaeology project (Wilkinson et al. 2022, section 3.7) and is both material and digital. The additional material archive comprises pottery, metalwork slag, bone and shell recovered from the borehole cores (CBM was discarded following quantification), and 24 unprocessed ^{14}C samples. The digital archive consists of text, spreadsheet, database and graphical data. The archive has been compiled as required by Chartered Institute for Archaeologists (2014) guidelines.

3.3.2 The artefacts, bone and shell will be prepared as required by Hampshire Cultural Trust and archived with that organisation.

4. ^{14}C CHRONOLOGY

4.1 The results of AMS ^{14}C dating are shown in Table 3, while Figure 3 plots ^{14}C dates (and ceramic data) against lithostratigraphy.

4.2 X^2 tests were made of the nine samples for which two separate AMS ^{14}C measurements using the R-Combine function of OxCal 4.4 (Table 3). One sample (sample 3 [see Table 3]) had a X^2 value T=<5 indicating that the humin and humic ages are statistically indistinguishable. Seven of the remaining paired humin-humic dates recorded χ^2 values in the range T=7.438–9.174 suggesting that the humin and humic ages are probably the same. However, one sample (sample 7) returned a X^2 value of 8128 demonstrating that the humin and humic acid fractions formed as a result of different and temporally separated events. The patterns of the X^2 tests are obvious in the calendar ranges of the calibrated dates (Table 3). Sample 7 has no age overlap at two standard deviations of probability (2σ) between measurements made on the humin and humic fractions. In sample 13 the overlap is only a single year (AD 420), and in a sample 8 it is 10 years (AD 420–430). Both the latter overlaps occur as a product of the 10 year rounding routine applied in OxCal (see Section 3.1.5). On the other hand and as the χ^2 test demonstrates the ages measured on the humin and humic fractions for sample 3 are almost identical. There is no obvious trend in age estimates being older for humic (in three instances) than for humin fractions (there are four instances where ages of the humin fraction was older than that of the humic fraction). In other words, there are no systematic trends for differences in ages of the humin and humic fractions and therefore the ranges calculated by the R-Combine function of OxCal 4.4 are used in the text below. The one exception is sample 7, for which the humic age (SUERC-110253) suggests a Middle Holocene/Neolithic and the humin fraction (SUERC-110254) a Romano British age. The reasons for the difference are not obvious (but see Section 4.3 below), albeit that the age of the humin fraction is more likely to be correctly reflect the date of the deposits given the presence of Romano-British pottery at the same level (Figure 3).

4.3 Even accepting the argument made in Section 4.2 above that eight of the nine samples dated separately from the humin and humic fractions have produced reliable ages, consideration still needs to be made of the derivation of the dated organic matter. Given the fine and amorphous nature of the latter, it is possible that such material has moved vertically (e.g. in solution as humic acids) and/or horizontally through the sequence and in the case of samples from SU5, has been reworked (e.g. during activities such as digging pits and using prior deposits as infill to raise ground above the water table). Therefore, the ^{14}C ages for SU5 should be interpreted cautiously and as *terminae post quem*.

4.4 The earliest AMS ^{14}C age was from peat (SU4b) found at the Pleistocene gravel (SU3)–tufa (SU4c) interface in ARCA CWR BH02. The relevant sample (no. 1) was dated to 7950–7670 cal. BC, i.e. >2000 years earlier than peat found further south and east (see Section 4.5). These chronological data demonstrate that the SU4b Peat stratum underlying tufa (SU4c) in the Lower Brook Street car park is not associated with peat forming south and east of that locations (e.g. in ARCA CWR BH06 and ARCA CWR BH08).

4.5 On stratigraphic grounds, the earliest stratum dated by AMS ^{14}C measurement was SU4a Alluvium 1 for which one age in ARCA CWR BH08 (sample 4) was obtained. However, the results (4690–4540 cal. BC) are within the time range of those from adjacent peat (SU4b) (4330–4050 cal. BC, sample 5) and tufa (SU4c) (4240–4040 cal. BC and 5020–4840 cal. BC, samples 2 and 3) strata, suggesting that deposition of silt/clay alluvial sediments occurred at a similar time to tufa and peat accretion. Such a facies relationship (i.e. subtly varying depositional environments within a single system) are commonplace in meandering river environments of which the River Itchen was (and still is) an example. In these situations, channels alter in form, migrate and even abandon previous courses, causing spatial alterations in floodplain and backswamp position. In such a situation tufa (a channel sediment), mineral silts and clays (floodplain) and peat (backswamp) might all be deposited synchronously in different parts of the system. It would therefore appear likely that various fluvial depositional environments were present on the site between 5000 and 4000 cal. BC (i.e. the Late Mesolithic and Early Neolithic periods). The ages on the peat and associated deposits in ARCA CWR BH02 and ARCA CWR BH06–08 further demonstrate that SU4b Peat is a composite unit comprised of multiple organic strata accumulating in different channels/backswamps at various times in the Early and Middle Holocene (Wilkinson 2020, section 3.5.3, 15). In addition, the ^{14}C data discussed above show that the lithostratigraphic sub-divisions SU4a–SU4c adopted in this and previous geoarchaeological reports, have little chronological meaning. Strata forming all three sub-divisions formed at the same time (as well as considerably earlier in the case of SU4b).

4.6 It is notable that dates on peat lens within the tufa (SU4c) (samples 2 and 3 in ARCA CWR BH07, Table 3) at relatively high elevations are older than those on organic inclusions in silt/clays (SU4a) and peats (SU4b) at lower elevations in adjacent boreholes (samples 5 and 5 in ARCA CWR BH08 and ARCA CWR BH06 respectively, Table 3) (Figure 3). Further, the uppermost ^{14}C sample (no. 2) from the tufa (SU4c) and which produced a Late Mesolithic–Early Neolithic age is at a greater elevation than a sample (no. 7) from alluvial silt/clay (SU4d) that provided an Late Iron Age/Early Roman date. These data are likely to be a product of autocompaction (*sensu* Allen 1999), i.e. peat and organic-rich silt/clays are inherently more likely to be compressed by the weight of overlying deposits than tufa, meaning that layers of the former will over time become thinner and move vertically downwards compared to the latter. In other words, peat and non-tufa alluvial strata (SU4a, SU4b, SU4d) in the area sampled by ARCA CWR BH06, ARCA CWR BH08 and ARCA CWR BH09 are likely to have had a subcrop elevation similar to that of the tufa (SU4c) in ARCA CWR BH07, but subsequent compression has reduced the former in relation to the latter.

4.7 There is a chronological discontinuity of almost 4000 years between the latest date of the SU4a–SU4c suite of strata (sample 2) and the dates on the SU4d Alluvium 2. Excepting the age obtained for the upper stratum of LU4d in ARCA CWR BH08, which as discussed in earlier reports, is likely to be the infill of an artificial channel (Wilkinson and Watson 2020; Wilkinson et al. 2021, 2022), the two other dates for SU4d indicate that it formed in the Romano-British period (samples 6 and 7) or later.

4.8 The earliest ages obtained on SU5 Archaeological deposits (sample 8 from ARCA CWR BH08 and sample 13 from ARCA CWR BH12) are from the 5–6th centuries AD and are likely to reflect deposition in the Romano British and/or sub-Roman periods. Two further AMS ^{14}C ages coincide with SU5 Archaeological deposits above +34m OD (c 3m bgl) (Figure 3), an Anglo-Saxon date (9–10th centuries AD) in ARCA CWR BH05A (sample 9) and a medieval date (13–14th centuries AD) from ARCA CWR BH01 (sample 11). These data suggest that the SU5 Archaeological deposits sub-cropping below the water table span the late Roman to medieval period, but are mostly of Romano-British and Anglo-Saxon age (Figure 3).

4.9 According to the single AMS ^{14}C date on the fills of the artificial channel sampled by ARCA CWR BH08, the feature was open in cal. AD 1030–1160 (sample 10), i.e. in the late Anglo-Saxon and/or medieval period.

4.10 $\delta^{13}C$ data obtained during the AMS ^{14}C measurement of the samples range between -26.6‰ and -30.6‰ (Table 3). These values are in the range of C3 plants, suggesting that matter derived from temperate zone plants has been sampled in all cases. Nevertheless, there is a notable pattern of lower $\delta^{13}C$ values in the samples (2, 3, 4 and 5) taken from Middle Holocene peats (SU4b and SU4c) and the other samples. The former group has a $\delta^{13}C$ range -28.8‰ and -30.2‰ while the latter varies between -26.6‰ and -29.5‰. This difference may indicate a greater contribution of trees (cf. grasses) in the samples taken from the peat compared to the silt/clay Alluvium 2 (SU4d) and Archaeological deposits (SU5), thus providing indication of a more prevalent wooded environment for the former than the latter. Interestingly, $\delta^{13}C$ from the Early Holocene peat sampled in ARCA CWR BH02 (no. 1) is -27.6‰, i.e. within the range of the SU4d and SU5 samples and perhaps indicating more open woodland than that prevalent in the Middle Holocene.

Table 3. ^{14}C dating results of samples from the Central Winchester Regeneration

Lab. Code	Borehole/depth	N[a]	Material	^{14}C age[b]	Calendar age (2σ)[c]	δ^{13}C	Combined age (2σ)[c,d]	X^2 (T=)[d]
SUERC-110237	BH02 4.97-4.98m	1	Humic	8706±24 BP	7790–7590 cal. BC (95.4%)	-27.6‰	7950–7670 cal. BC	9.044
SUERC-110241	BH02 4.97-4.98m	1	Humin	8806±23 BP	8170–8110 cal. BC (5.9%) 8010–7990 cal. BC (0.7%) 7970–7740 cal. BC (88.9%)	-27.6‰		
SUERC-110242	BH07 3.80-3.81m	2	Humic	5340±24 BP	4320–4290 cal. BC (5.1%) 4260–4150 cal. BC (48.2%) 4140–4050 cal. BC (42.2%)	-29.8‰	4240–4040 cal. BC	9.174
SUERC-110243	BH07 3.80-3.81m	2	Humin	5235±25 BP	4230–4200 cal. BC (4.5%) 4170–4130 cal. BC (14.1%) 4070–3970 cal. BC (76.8%)	-29.8‰		
SUERC-110244	BH07 5.78-5.79m	3	Humic	6051±24 BP	5040–4890 cal. BC (87.4%) 4880–4840 cal. BC (8.1%)	-30.2‰	5020–4840 cal. BC	<5.000
SUERC-110245	BH07 5.78-5.79m	3	Humin	6048±25 BP	5030–4840 cal. BC (95.4%)	-29.9‰		
SUERC-110246	BH08 6.34-6.36m	4	Humic	5818±24 BP	4780–4750 cal. BC (4.5%) 4730–4590 cal. BC (89.7%) 4570–4550 cal. BC (1.3%)	-28.9‰	4690–4540 cal. BC	7.347
SUERC-110247	BH08 6.34-6.36m	4	Humin	5726±24 BP	4680–4490 cal. BC (94.6%) 4470–4460 cal. BC (0.9%)	-28.8‰		
SUERC-110251	BH06 4.84-4.86m	5	?Bark	5364±23 BP	4330–4280 cal. BC (22.5%) 4270–422- cal. BC (26.9%) 4210–4160 cal. BC (24.8%) 4140–4050 cal. BC (21.2%)	-29.4‰		
SUERC-110252	BH13 4.95-5.02m	6	?Bark	1851±24 BP	cal. AD 120–240 (95.4%)	-27.0‰		
SUERC-110253	BH06 4.01-4.02m	7	Humic	4967±21 BP	3800–3650 cal. BC (95.4%)	-30.6‰	n/a	n/a
SUERC-110254	BH06 4.01-4.02m	7	Humin	1938±24 BP	cal. AD 10–170 (92.8%) cal. AD 180–210 (2.7%)	-26.3‰		
SUERC-110255	BH05A 3.20-3.21m	8	Humic	1589±21 BP	cal. AD 420–550 (95.4%)	-28.0‰	cal. AD 400–540	7.438
SUERC-110256	BH05A 3.20-3.21m	8	Humin	1670±21 BP	cal. AD 260–280 (6.6%) cal. AD 340–430 (88.8%)	-27.2‰		
SUERC-110257	BH05A 2.12m	9	Humic	1168±24 BP	cal. AD 770–900 (74.9%) cal. AD 910–980 (20.6%)	-29.5‰	cal. AD 880–990	8.154
SUERC-110261	BH05A 2.12m	9	Humin	1077±21 BP	cal. AD 890–930 (26.1%) cal. AD 940–1030 (69/4%)	-29.0‰		

Lab. Code	Borehole/depth	N[a]	Material	^{14}C age[b]	Calendar age (2σ)[c]	$\delta^{13}C$	Combined age (2σ)[c,d]	X^2 (T=)[d]
SUERC-110262	BH08 2.65-2.70m	10	Humic	988±24 BP	cal. AD 990–1060 (44.1%) cal. AD 1070–1160 (51.4%)	-29.1‰	cal. AD 1030–1160	8.680
SUERC-110263	BH08 2.65-2.70m	10	Humin	888±24 BP	cal. AD 1040–1090 (19.6%) cal. AD 1120–1230 (75.9%)	-28.6‰		
SUERC-110264	BH01 2.25-2.26m	11	Nut shell	676±21 BP	cal. AD 1270–1320 (58.0%) cal. AD 1360–1390 (37.4%)	-27.7‰		
GU63811	BH12 2.53-2.54m	12	?Bark	Failed	n/a	n/a		
SUERC-110759	BH12 2.46–2.47m	13	Humic	1571±29 BP	cal. AD 420–570 (95.4%)	-27.4‰	Cal. AD 400–540	8.848
SUERC-110760	BH12 2.46–2.47m	13	Humin	1693±29 BP	cal. AD 250–290 (16.8%) cal. AD 320–420 (78.6%)	-26.6‰		

[a] Number on Figure 3

[b] Radiocarbon age in years before present, where 'present' is AD 1950

[c] Calendar age at two standard deviations (2σ), following calibration with the IntCal20 curve (Reimer et al. 2020) and OxCal 4.4 (ORAU 2022), and rounded to the nearest 10 years

[d] Combined age of humin and humic acid fractions as calculated using the R-Combine function of OxCal 4.4 (ORAU 2022)

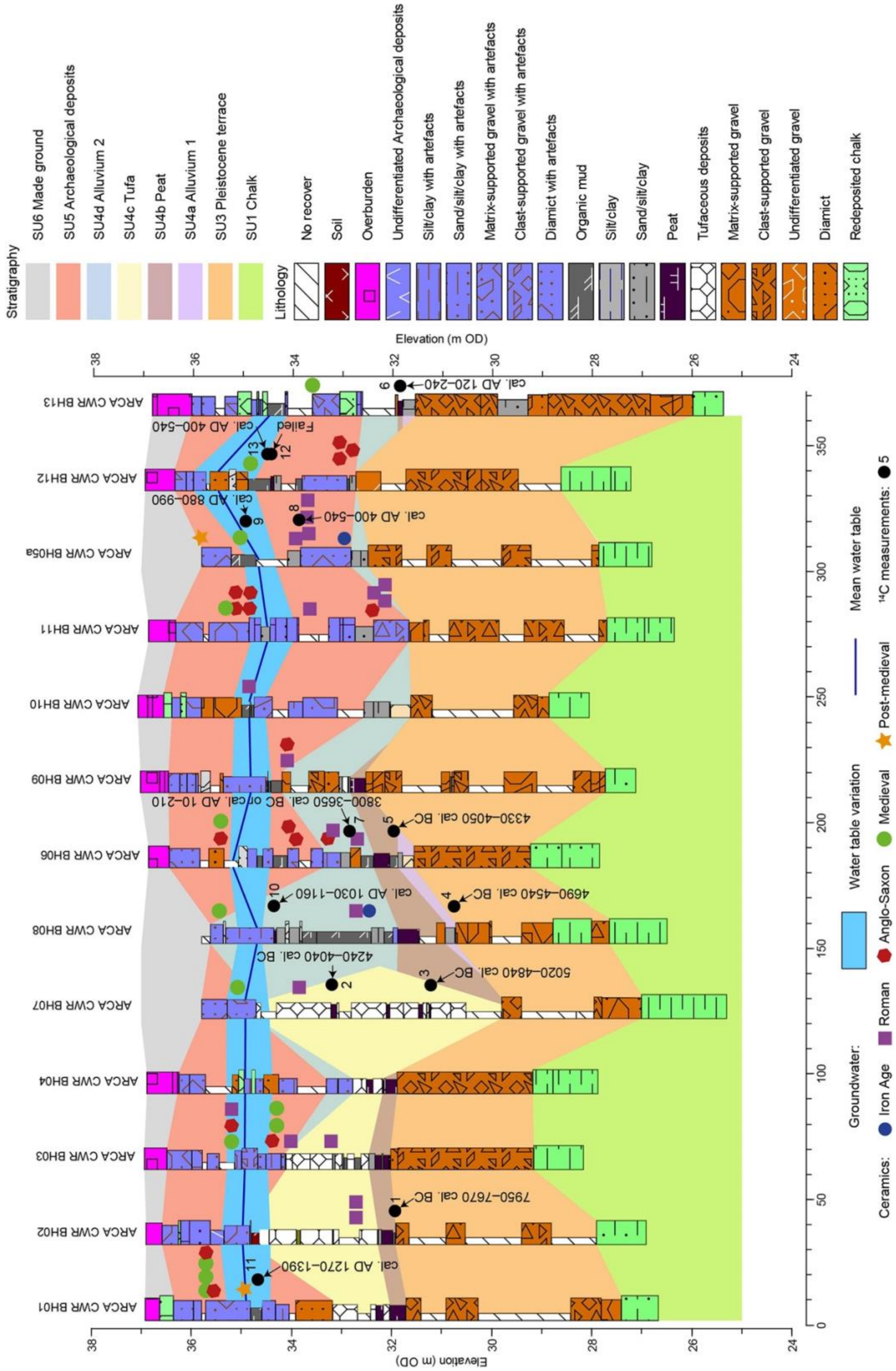

Figure 3. Approximate west–east transect through all geoarchaeological boreholes drilled in the CWR study area showing chronological data recovered during the present study
NB: Except for sample 7, ^{14}C age ranges for samples that separated dated on the basis of their humin and humic acid content are those calculated by the R-Combine routine in OxCal.

5. ARTEFACT CHRONOLOGY

Clare Holloway (Cotswold Archaeology) and Keith Wilkinson

5.0.1 The text below summarises data and discussion originally included in a dissertation submitted by Clare Holloway as a requirement for a BA Archaeology degree at the University of Winchester (Holloway 2022). Further work beyond that undertaken as part of the dissertation research has not been carried out as part of the present project except to prepare the archive for deposition (see Section 3.3).

5.0.2 Also incorporated in the text below are the identifications made of artefacts recovered during core description and included in Appendix 7 of the final integrated geoarchaeological report (Wilkinson et al. 2022, 122).

5.1 Results

5.1.1 Five pottery sherds were recovered during core description and forty-four more as the borehole strata were sieved prior to disposal. Two of the sherds were of Iron Age date (c. 200 BC–AD 43), seventeen were Romano-British (AD 43–410), sixteen Anglo-Saxon/Anglo-Norman (AD 410–1100), twelve later medieval (AD 1100–1550) and two were post medieval (AD 1550–1850) (Table 4).

5.1.2 In general, pottery sherds were recovered in chronological order, i.e. the oldest towards the base of the stratigraphy and the youngest at the top (see Figure 3). However, there were some notable exceptions. For example, sherds of medieval and Anglo-Saxon date were encountered above 1.45m bgl in ARCA CWR BH01, but were underlain at 1.95–2.00m bgl by a single porcelain sherd of post-medieval date (Table 4). It is also the case that a single sherd of Anglo-Saxon age was encountered at 4.50–4.55m bgl in ARCA CWR BH11, i.e. beneath a Romano British sherd at 3.20–3.25m bgl in the same borehole (Table 4). Such apparent age inversion has probably been caused by reworking of old pottery into young deposits. The latter process is most likely to have occurred by the redistribution of spoil from pits and other negative features which are dug through pre-existing archaeological strata.

5.1.3 Despite the instances of reworked pottery noted in Section 5.1.2, the ceramics still provide a useful, albeit broad indication of the chronology of the CWR site. Excepting ARCA CWR BH13, strata below +34m OD (c 3m bgl) in the eastern part of the site (ARCA CWR BH05a, ARCA CWR BH06, ARCA CWR BH09–13) contain only Anglo-Saxon and Romano-British sherds. On the other hand, in the western part of the site (ARCA CWR BH01–04 and ARCA CWR BH07–08), only Romano-British and Iron Age sherds were found below +34m OD. These data suggest that there is likely to be c 2m of mixed Anglo-Saxon and Romano-British stratigraphy in the area of the bus station and its surrounds, all of which lies below the water table (Figure 3). Although there are limited SU5 Archaeological deposits below +34m OD in the west of the site, these latter are likely to be of Romano-British and perhaps Anglo-Saxon date. Indeed, Romano-British pottery sherds recovered from SU4c Tufa in ARCA CWR BH02–03 and ARCA CWR BH07, suggest that there has been intrusion of Roman features into this Middle Holocene stratum.

5.1.4 Strata above +34m OD across the entire site contain a mixture of Anglo-Saxon and medieval pottery sherds (Figure 3). Medieval pottery overlies Anglo-Saxon pottery in the eastern part of the site and perhaps suggests the presence of coherent horizontal layering for each of these periods in this area. The same is not the case in the area of the Lower Brook Street car park (ARCA CWR BH01–04). Ceramics above +34m OD in ARCA CWR BH01 and ARCA CWR BH03 are a mixture of Romano-British, Anglo-

Saxon, medieval and post-medieval types with no obvious age trends. It is therefore likely that SU5 Archaeological deposit stratigraphy above +34m OD in Lower Brook Street car park has seen considerable reworking, i.e. by the excavation of pits and other negative features.

5.1.5 Ceramics recovered from the possible channel fills sampled in ARCA CWR BH08 might suggest that the earliest iteration of channel was in the Romano-British or even the Iron Age period. A medieval sherd was found in the uppermost fill of the channel, suggesting that complete infilling did not occur until the 13th century AD or later.

Table 4. Pottery sherds recovered during core description (grey highlighting) and in sieving borehole sediment (no highlighting)

Borehole[a]	Depth[b]	SU	Identification	Age
BH01	1.20–1.25	5	MDF: Medium-grained sandy ware	Medieval (AD 1050–1350)
			MMQ: Pink quartz-tempered ware	Medieval (AD 1225–1400)
			MNK: Buff sandy ware	Medieval (AD 1075–1250)
			MAV: Chalk-tempered ware with flint	Late Anglo-Saxon (AD 850–1200)
BH01	1.35–1.45	5	MMU: Michelmersh ware	Late Anglo-Saxon (AD 850–1050)
BH01	1.95–2.00	5	Porcelain	Post-medieval
BH02	4.10–4.30	4d	Burnished greyware	Romano-British
			Verulamium ware	Romano-British
BH03	1.70–1.80	5	MAV: Chalk tempered with flint and organic inclusions	Late Anglo Saxon (AD 850–1200)
			MTE: Newbury B-style ware	Medieval (AD 1050–1400)
BH03	1.75–1.77	5	Greyware	Romano-British
BH03	2.50–2.60	5	Unidentified Anglo-Saxon	Early Anglo-Saxon (AD 450–850)
BH03	2.60–2.70	5	MNK: Buff sandy ware	Medieval (AD 1075–1250)
			MAB: Flint tempered ware	Medieval (AD 1000–1250)
BH03	2.90–3.00	5	Greyware	Romano-British
BH03	3.70–3.80	4c	Black burnished ware	Romano-British
BH05a	1.10–1.20	5	Bristol-Staffordshire Slipware	Post-medieval
BH05a	1.90–2.00	5	Surrey White ware	Medieval (AD 1300–1500)
BH05a	3.10–3.20	5	Hampshire Grog-tempered Ware	Romano-British
BH05a	3.20–3.30	5	Black Burnished Ware/Alice Holt	Romano-British
BH05a	3.30–3.35	5	New Forest slip ware	Romano-British
			Samian	Romano-British
BH05a	4.00–4.10	5	Oxidised grog temper ware	Late Iron Age
BH06	1.40–1.50	5	MOE: Coarse-grained sandy ware	Medieval (AD 1070–1225)
			MMU: Michelmersh ware	Late Anglo-Saxon (AD 925–1050)

BH06	2.81–2.82	5	MMU: Michelmersh ware	Late Anglo-Saxon (AD 975–1050)
BH06	2.90–3.00		MAV: Chalk tempered with flint	Late Anglo-Saxon (AD 850–1200)
BH06	3.68–3.70	4d	Oxfordshire red ware	Romano-British
BH06	3.50–3.70	4d	Unidentified sandy ware	Late Anglo-Saxon (AD 850–1100)
BH06	4.10–4.30	4d	Alice Holt Ware	Romano-British
BH07	1.90–2.00	4c	Quartz tempered sandy ware	Medieval (AD 1200–1400)
BH07	3.10–3.20	4c	Black burnished Ware/Alice Holt ware	Romano-British
BH08	1.50–1.60	4d	MMI: South Hampshire red ware	Medieval (AD 1225–1400)
BH08	4.29–4.31	4d	Coarseware, red exterior, black interior	Romano-British
BH08	4,50–4.60	‘4a’	St Catherine’s Hill-Worthy Down ware	Middle–Late Iron Age
BH10	2.20–2.30	5	New Forest ware	Romano-British
BH11	1.50–1.60	5	MMI: South Hampshire red ware	Medieval (AD 1225–1400)
BH11	1.70–1.80	5	MMU: Michelmersh ware	Late Anglo-Saxon (AD 975–1050)
BH11	1.80–1.90	5	MWW: Winchester ware	Late Anglo-Saxon (AD 950–1100)
BH11	2.00–2.10	5	MAV: Chalk tempered ware	Late Anglo-Saxon (AD 850–1200)
			MAV: Chalk tempered with flint	Late Anglo-Saxon (AD 850–1200)
BH11	3.20–3.25	5	Greyware	Romano-British
BH11	4.50–4.55	5	MMU: Michelmersh ware	Late Anglo-Saxon (AD 975–1050)
			Black burnished Ware/Alice Holt Ware	Romano-British
BH11	4.70–4.75	5	Black burnished Ware/Alice Holt Ware (x2)	Romano-British
BH12	2.00–2.11	5	MOE: Coarse-grained sandy ware	Medieval (AD 1070–1225)
BH12	3.80–4.00	5	MMU: Michelmersh ware	Late Anglo-Saxon (AD 975–1050)
			Grog tempered ware with organic inclusions	Early Anglo-Saxon (AD 450–850)
BH12	4.00–4.20	5	Unidentified sandy ware	Late Anglo-Saxon (AD 850–1100)
BH13	3.20	5	Green glazed ware	Medieval (AD 1200–1400)

NB: Codes under ‘identification’ are those of the Winchester fabric series for Anglo-Saxon and medieval pottery (Cotter 2011)

[a] CWR BH

[b] m bgl

6. ASSESSMENT

6.0.1 As set out in Section 1.3 above, a single objective of the original brief and WSI ((WCC 2020, 4–5; Wilkinson et al. 2020, sections 3.3, 16) can be addressed here at greater resolution than was possible in the final integrated geoarchaeology report (Wilkinson et al. 2022), i.e. obtaining data on the significance, date, character, quality, survival and extent of archaeological deposits and palaeoenvironmental proxies within the CWR site. Given that in previous reports each of these phenomena have been discussed in relation to stratigraphic unit (Wilkinson 2020; Wilkinson et al. 2021, 2022), the discussion below uses the same framework.

6.0.2 As stated in Section 2.6, SU1 Lewes Nodular Chalk Formation, SU3 River Terrace Deposits 1 and SU6 Made ground were not investigated as part of the present chronological study and are not therefore discussed below.

6.1 SU4a Alluvium 1

6.1.1 AMS ^{14}C data make clear that SU4a Alluvium 1, SU4c Tufa and those parts of SU4b Peat in the south-western (ARCA CWR BH07–08) and central (ARCA CWR BH06 and ARCA CWR BH09) part of the site are fluvial facies accumulating at the same time, but in a spatially differentiated manner. In other words, as minerogenic silts and clays accreted in one part of the site on a floodplain, tufa formed within the channel of the Itchen in a second area, and peat in a backswamp environment in a third. Therefore, the stratigraphic order in which the deposits are encountered varies by area, while one or more of the SU4a–4c sub-units might be absent from particular part of the site (e.g. tufa is absent where there was no channel, peat is not found where there was no backswamp, minerogenic silts and clays are not present in areas that were not a floodplain). Further, as was discussed in Section 4.5, variations in autocompaction of these sub-units (and SU4d) is likely to have affected thickness and sub-crop elevation, meaning that their present vertical position is not the same as in the past.

6.1.2 The SU4a–4c complex is dated to the 5000–4000 cal. BC interval, a time frame coinciding with peat development at Winnall Moors (4690–4330 cal. BC [HAR-4242] [Waton 1982]) to the north east of the site and the final phase of peat accumulation at Pilgrim's School to the south west (4340–4060 cal. BC [Beta 17231] [Champness et al. 2012]).

6.1.3 5000–4000 cal. BC corresponds to the very end of the Mesolithic period and the beginning of the Neolithic. The Mesolithic–Neolithic transition is a crucial stage in the development of subsistence economy and society, and marks the change from a hunter-gatherer way of life to one based largely on agriculture. Ancient DNA evidence also suggests that it is a time when new colonists arrived in Britain, these bringing knowledge of cultivation techniques, as well as the first domesticated plants and animals to enter the British Isles (see the review in Sheridan and Whittle 2023). The fifth millennium BC is also a period that is poorly represented in central Winchester, i.e. no Late Mesolithic finds are known from the area now occupied by the present city, while the only Early Neolithic evidence is a possible worked flint assemblage from a pit at 18 Little Minster Street (Jenkins and Ford 2000; Ottaway 2017, 48–50). The presence of low energy alluvium (SU4a) and peat (SU4c) in southern and western parts of the CWR site, both of which have a high palaeoenvironmental potential (Wilkinson et al. 2022), is therefore of considerable archaeological and palaeoenvironmental significance.

6.2 SU4b Peat

6.2.1 The SU4b Peat in the south-west and central parts of the site has been previously discussed together with SU4a Alluvium 1 and SU4c Tufa in terms of a complex of alluvial deposits dating to 5000–4000 cal. BC. However, SU4b Peat strata beneath SU4c Tufa in the area of the Lower Brook Street car park is of considerably greater antiquity. A single AMS ^{14}C date from such a peat in ARCA CWR BH02 indicates an age in the 7950–7670 cal. BC interval and therefore close chronological correspondence with peat at the gravel–tufa interface in the Upper Brook Street car park, 70m to the west (7920–7760 cal. BC [GU 27838] [Wilkinson and Batchelor 2013]). These data suggest between Lower and Upper Brook Streets an Early Holocene peat subcrops beneath the tufa[2].

6.2.2 As with SU4b Peat forming part of the fifth millennium BC alluvial complex in the central CWR area, the late ninth–eighth millennium SU4b Peat in the north western part of the site dates from a period for which archaeological remains are unknown in central Winchester. Therefore, and despite poor preservation of biological proxies in the SU4b Peat in the Lower Brook Street car park (Wilkinson et al. 2022), the stratum is of archaeological and palaeoenvironmental significance.

6.2.3 As will be clear from the discussion in Sections 6.1 and 6.2, there is a >2500 year discontinuity between SU4B peats in the Upper Brook Street car park and peat and other alluvial deposits (SU4a–4c) elsewhere in the south-west and central part of the CWR site. The c. 7600–5000 cal. BC period for which there is no evidence on the CWR site might have been a time when the floodplain and channel of the River Itchen lay elsewhere. For examples three ^{14}C dates on peats from the Pilgrim's School site indicate backswamp deposition at that location in the 6200–5200 cal. BC interval (Champness et al. 2012)[3] while a single ^{14}C date from Old Works Yard, Cathedral Close has a range of 5550–5370 cal. BC (Wilkinson and Grant 2020)[4], but there currently no ^{14}C ages from central Winchester that fall within the 7600–6200 cal. BC interval. A more likely explanation than a different stream course for the 7600–5000 cal. BC temporal gap on the CWR site is the truncation of missing deposits by channel migration across the area of their former subcrop, i.e. the entirety of the CWR study area.

6.3 SU4c Tufa

6.3.1 As discussed in Section 6.1, SU4c Tufa is part of a complex of alluvial deposits dating to the 5000–4000 cal. BC interval. It is worth noting here that the AMS ^{14}C dating carried out for the present project represents that first chronometric dating of the tufa stratum in Winchester. The age of the tufa was previously only known in relative terms, i.e. of Romano-British date or earlier age given features of that date cut into it.

6.3.2 It is possible to estimate tufa deposition rates using the two ^{14}C ages on peat lenses within the tufa of ARCA CWR BH07, which at 95.4% confidence is between 3.30 and

[2] A peat in an equivalent stratigraphic position on the Lower Brook Street–North Walls junction has been dated 800–1700 years earlier than the Lower Brook Street car park example (GU 38464, 9492±30 BP, 9120–9010 cal. BC [24.0%], 8920–8900 cal. BC [1.3%], 8860–8700 cal. BC [66.0%], 8680–8640 cal. BC [4.2%] from BH14) (Watson 2015).

[3] 6747±34 BP (OxA 17170, 5720–5620 cal. BC [92.4%], 5590–5570 cal. BC [3.0%]) from BH13, 7272±39 BP (OxA 17233, 6230–6050 cal. BC [95.4%]) from BH3 and 6314±30 BP (NZA 32759, 5360–5210 cal. BC [95.4%]) from Trench 3.

[4] 6512±25 BP (GU 54644, 5540–5460 cal. BC [52.2%], 5450–5370 cal. BC [43.3%]) from BH1.

2.02 yr^{-1}. Using these data, a minimum age for the tufa surface in ARCA CWR BH07 can also be reconstructed, i.e. 3790–3290 cal. BC again at 95.4% confidence.

6.3.3 Even allowing for the estimate of the age of the tufa surface provided in Section 6.3.2, there is more than a 3000 year time gap between deposition of the alluvial silt/clay (SU4a), peat (SU4b) and tufa (SU4c) complex and the overlying alluvial deposits (SU4d). Excepting Bronze Age ^{14}C dates from an organic mud on the Lower Brook Street–North Walls junction (Watson 2015)[5] and on peat from Winnall Moors (Grant, personal communication, 2020)[6], there are no ^{14}C ages from central Winchester for the 4000–200 cal. BC interval. As discussed for the 7600–5000 cal. BC temporal discontinuity in Section 6.2.3 above, the reasons for the 'missing' 4000–200 cal. BC stratigraphy are likely to be migration of the Itchen channel and removal of the relevant sediments. It is possible that such erosion was focussed in the area east of Middle Brook Street (ARCA CWR BH07) thereby providing the basin in which subsequent alluvial deposits (SU4d) accreted.

6.4 SU4d Alluvium 2

6.4.1 SU4d Alluvium 2 is dated on the basis of both AMS ^{14}C ages and included ceramics. The former suggest accumulation in the first half of the Romano-British period (1–3 centuries AD) and possibly the Late Iron Age on the basis of dates in the eastern (ARCA CWR BH13) and central (ARCA CWR BH06) parts of the site. However, a single Anglo-Saxon pottery sherd was found from the stratum at a higher elevation than the ^{14}C date in ARCA CWR BH06, while an Anglo-Saxon ^{14}C date (cal. AD 680–880 [GU 27837] [Wilkinson and Batchelor 2013]) was obtained from deposits attributable to SU4d Alluvium 2 in the Upper Brook Street car park.

6.4.2 The SU4d Alluvium 2 strata, as predicted during an earlier phase of work (Wilkinson et al. 2022), formed following the foundation of Venta Belgarum. However, just as with the earlier alluvial complex of SU4a–4c, SU4d is unlikely to have formed synchronously across the site. Rather the stratum is a composite unit and in each spatial location it is indicative of flooding that pre-dates occupational activity. In some loci, for example the present bus station, the flooding might be of Roman date, in others (e.g. Tanner Street) it is possibly Iron Age, and certainly Roman and Anglo-Saxon, while to the north-west of the site in the Upper Brook Street car park, the flood deposits contain Anglo-Saxon artefacts found.

6.4.3 SU4d Alluvium 2 has previously been categorised as having high archaeological and palaeoenvironment potentials given that biological preservation is good and the stratum is demonstrably contemporary with occupation of Venta Belgarum and its successors (Wilkinson et al. 2021, 2022) while its earliest manifestation may coincide with activity in the Orams Arbour Iron Age enclosure (Wilkinson and Grant 2019). The present chronological data confirm such views, but also suggest that flooding in central Winchester that is recognisable as a widespread geological unit ceased by the end of the Anglo-Saxon period.

6.4.4 Previous reports categorised the SU4d Alluvium 2 strata in ARCA CWR BH08 as a special case, i.e. as deposits infilling a deliberately constructed channel running along Middle Brook Street (Wilkinson et al. 2021, 2022). The newly obtained chronological data do not provide an age for the opening of the putative channel, only that it must post-date 4690–4540 cal. BC, i.e. the age of the SU4b Peat beneath. However, Iron Age and Romano-British pottery are found in the channel fills, perhaps suggesting that

[5] 2925±30 BP (GU 38466, 1220–1010 cal. BC [95.4%]) from BH14
[6] 3170±80 BP (HAR 6443. 1620–1220 cal. BC).

the feature was open in these periods, while an AMS ^{14}C date from the upper fills demonstrates the continued presence of the channel in the medieval period. It is possible therefore, that the channel sampled by ARCA CWR BH08 was a natural feature that became formalised within the early historic city. The infilling deposits are of considerable archaeological and palaeoenvironmental significance, not only because of the good biological preservation (Wilkinson et al. 2022), but also as questions remain unanswered regarding the origin and subsequent purpose of the channel.

6.5 SU5 Archaeological deposits

6.5.1 As was discussed in earlier geoarchaeology reports in this series, the SU5 Archaeological deposits are by definition of high archaeological and palaeoenvironmental significance. The purpose of the present exercise is rather to understand chronological zoning within the deposits.

6.5.2 AMS ^{14}C and ceramic data indicate that SU5 Archaeological deposits began forming in the Romano-British period. Indeed, Romano-British pottery was the most frequent type of ceramic find made as the cores were sieved, albeit closely followed in quantity by pottery of Anglo-Saxon date. For the most part Romano-British pottery was found beneath Anglo-Saxon pottery, which in turn was below medieval pottery, i.e. suggesting that there is broad horizontal stratification within SU5. However, as is discussed in Section 5.1.2 there are instances of age inversion which suggests disturbance, this latter probably as a result of the excavation of pits and/or redeposition of prior archaeological stratigraphy to heighten land as a flood protection strategy.

6.5.3 The thickest Romano-British and Anglo-Saxon Archaeological deposit (SU5) stratigraphy is in the east of the CWR site beneath the present bus station (ARCA CWR BH5a, ARCA CWR BH11–13) and former doctor's surgery on Friarsgate (ARCA CWR BH10). Over 2m of such strata can be expected in these locations, all of which lie beneath the water table. On the other hand, Romano-British and Anglo-Saxon Archaeology strata are <1m thick in the central part of the site (ARCA CWR BH06–07, ARCA CWR BH08) and beneath the Lower Brook Street car park (ARCA CWR BH01–04), albeit all of those are below the water table.

6.5.4 Medieval deposits coincide with the present water table and extend upwards to within 1m of the present ground surface in some areas (e.g. at ARCA CWR BH02 where a medieval drain was found at this depth [Wilkinson et al. 2021]). Up to 2m of such medieval Archaeological deposits (SU5) might be present in the Lower Brook Street car park, albeit that there are likely to be lesser thickness of deposits of this age in the central and eastern parts of the site.

6.5.5 Post-medieval SU5 strata are likely to be of <1m thickness across the entirety of the study area.

7. CONCLUSION

7.1 The present report is the product of Stage 2 of CWR geoarchaeological project and was undertaken to refine chronological understanding of the deposits that underlie the CWR site. The new chronological data demonstrate that:

1. The earliest Holocene deposits on the site are peats (SU4b) underlying tufa in the Lower Brook Street car park and which date to the Early Mesolithic period (7920–7760 cal. BC);
2. There is a subsequent chronological gap of 2600 years for which there are no deposits on the site;
3. A complex of tufa (SU4c), silt and clay (SU4a) and peat (SU4b) formed in the channel and in the floodplain of the River Itchen and are preserved in the western and central part of the site. These strata accreted in the period 5000–4000 cal. BC, i.e. the Late Mesolithic and Early Neolithic;
4. There is a second chronological gap of almost 4000 years for which there are no deposits on the site;
5. Flood events (forming silt and clay strata of SU4a) following the foundation of Venta Belgarum are found in various parts of the site and may date from as early as the initial Romano-British presence (1-3rd centuries AD) through to the Late Anglo-Saxon period (7-9th centuries AD). These strata pre-date occupation activity in the part of the site where they are found;
6. Archaeological deposits (SU5) forming as a result of occupation activity developed from the Romano-British period onwards. The thickest archaeological sequences are in the eastern part of the site, while most such deposits lying beneath the present water table are of Romano-British and Anglo-Saxon age. These deposits may have been deliberately placed to raise ground levels above flood levels, as for example has also be attested at Pilgrim's School in the Cathedral Close (Champness et al. 2012). Medieval deposits coincide with the present water table and extend to within 1m of the present ground surface.

8. ACKNOWLEDGEMENTS

8.1 ARCA would like to thank Rachel Robinson and Tracy Matthews (both of Winchester City Council) for their continuous help throughout the geoarchaeological works reported here and to Tracy Matthews, Dr Anne de Vareilles (Historic England) and Dr Ruth Pelling (Historic England) for reviewing and commenting on an earlier version of this report. Paul McCulloch (Pre-Construct Archaeology) is also thanked for identification of pottery recovered during description of borehole cores.

8.2 Except where indicated otherwise Keith Wilkinson wrote and compiled the present report, which was copy edited and commented upon by Nick Watson. Keith Wilkinson produced the illustrations.

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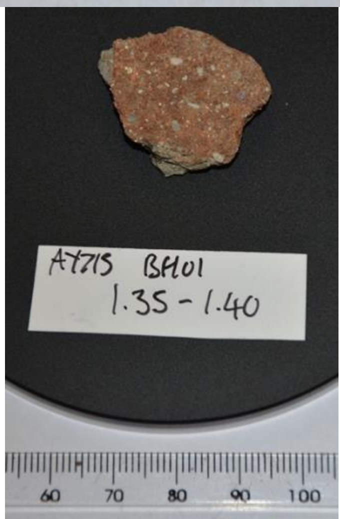
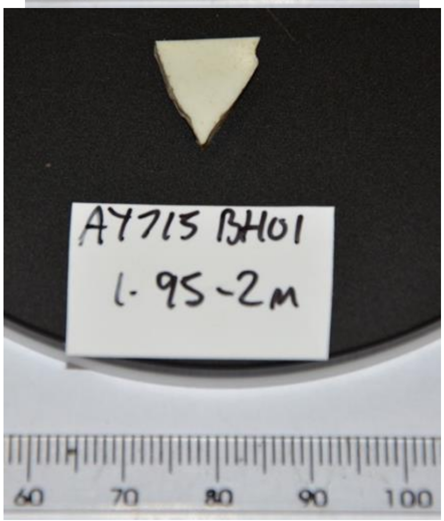
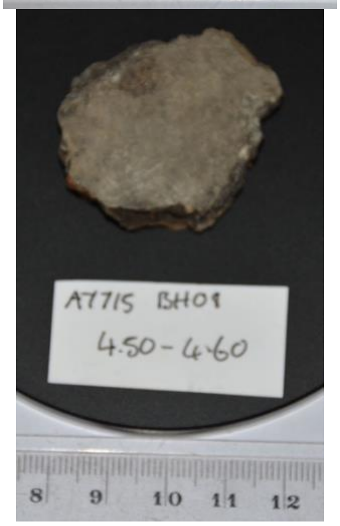
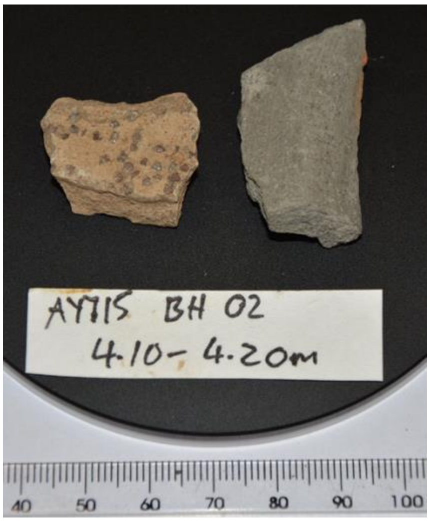
APPENDIX 1: POTTERY PHOTOGRAPHS

The photographs presented below are record views (i.e. non-technical) of the pottery sherds extracted from the borehole cores (Holloway 2022).





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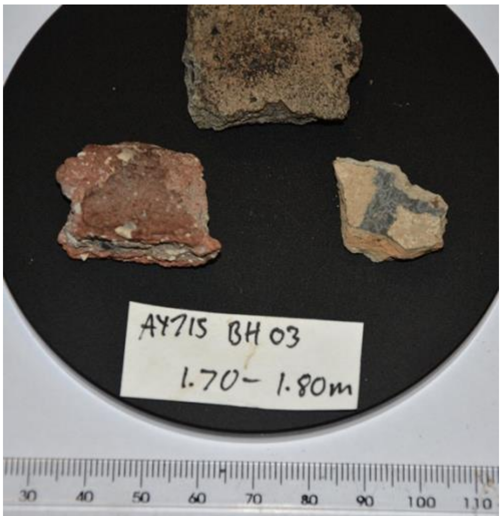
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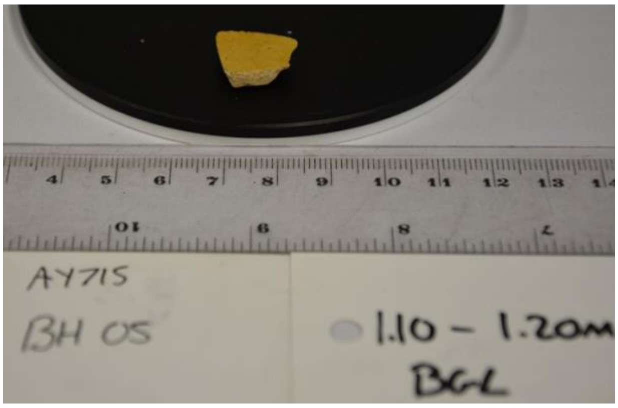
1.70- 1.80m


AY715 BH03
2.50-2.60
BGL


AY715 BH03
2.60-2.70


AY715
BH03
2.90 - 3.00
BGL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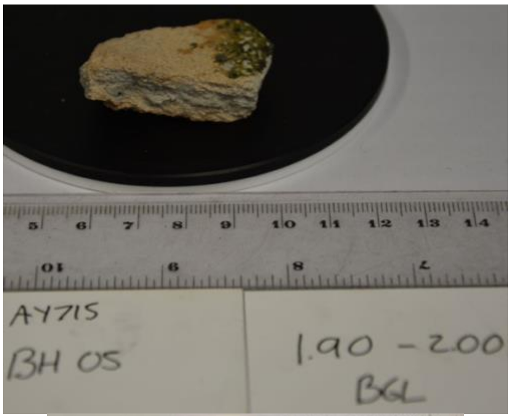
BH 05
1.10 – 1.20m
BGL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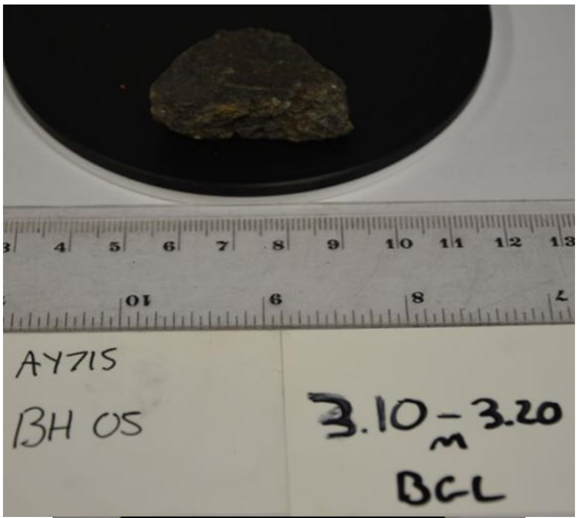
BH 05
1.90 – 2.00
BGL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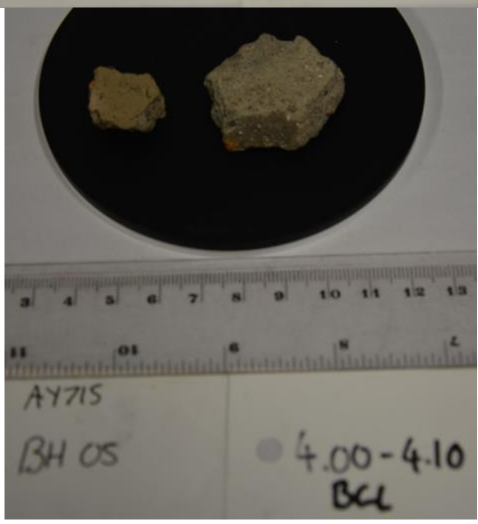
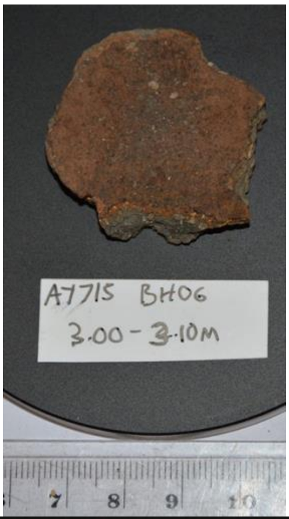
BH 05
3.10 – 3.20
m
BGL


AY715
BH 05
3.20 – 3.40
m
BGL


AY715
BH 05
4.00 - 4.10
BGL


AY715 BH06
1.40-1.50m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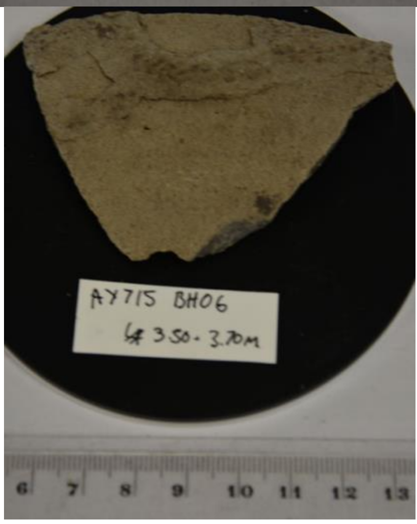
3.00-3.10m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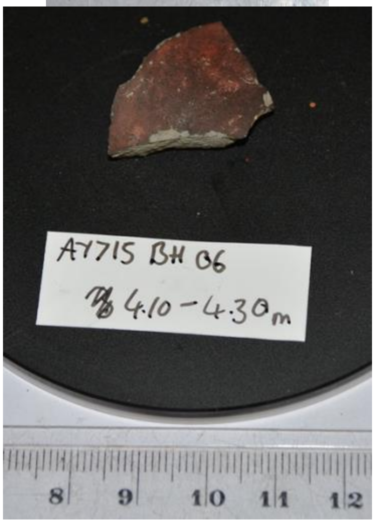
3.50-3.70m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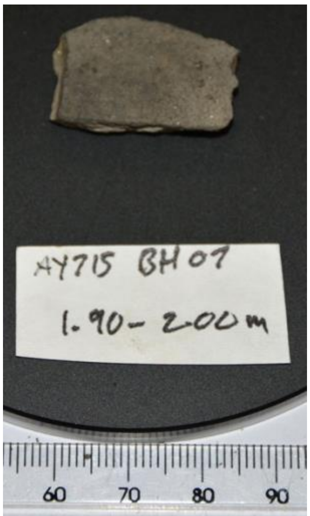
4.10-4.30m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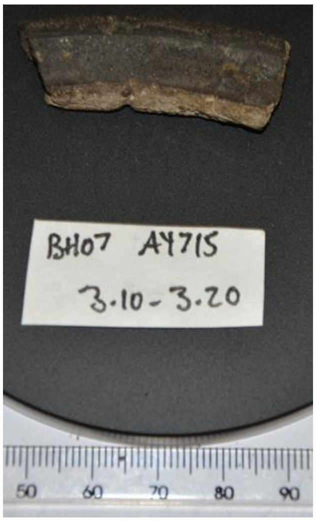
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3.10-3.20


AY715 BH07
3.20 - 3.50

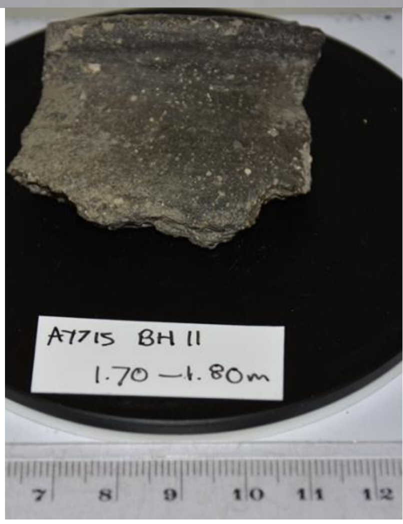

AY715 BH08
1.50-1.60


BH09 AY715
2.90 - 3.00m


AY715 BH10
2.20 – 2.30m
40 50 60 70 80 90 100


AY715
1.15 – 1.20m


AY715 BH11
1.50 – 1.60m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1.70 – 1.80m


AY715 BH 11
1.80 – 1.90m

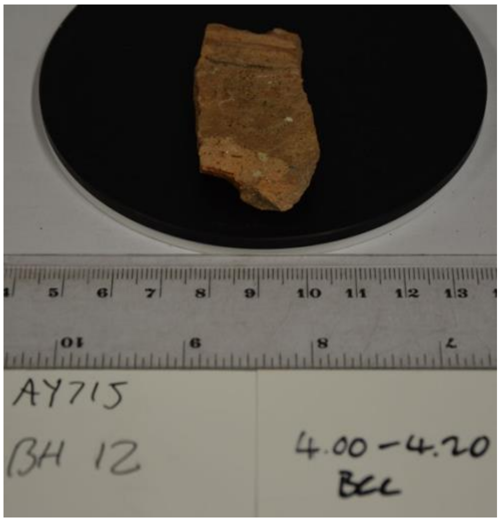

AY715 BH 11
2.00 - 2.10m


AY715 BH 11
3.20 - 3.30


AY715 BH
4.50 - 4.55 M


AY715 BH 11
4.70 - 4.75


AY715
BH 12
3.80 - 4m
BGL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4.00 - 4.20
BGL