ASSESSMENT OF ENVIRONMENTAL REMAINS FROM A BOREHOLE SURVEY AT 31 EIGN GATE, HEREFORD, HEREFORDSHIRE

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Part 1 Project summary

An archaeological borehole survey was undertaken at the 31 Eign Gate, Hereford, Herefordshire (NGR SO 508 400). The borehole survey and environmental assessment were undertaken on behalf of The Environmental Dimension Partnership in response to potential development occurring on the site.

The assessment revealed significant quantities (c 2m) of made ground which were sealing c 1-1.5m of soft, organic clayey silts deposited in a low energy environment. These water-lain sediments were interpreted as ditch fills which had been laid down by a network of meandering streams that flowed in the base of the ditch.

Radiocarbon dating of a fragment of leather retrieved from the basal fills of the ditch directly overlying the natural gravels provided a date of Cal AD 1020 to 1190 (SUERC-35597/ GU-24600) indicating that this ditch is one of the refortifications of Hereford by Harold Godwinson in 1065 as attested in documentary sources but the identification of which has previously been elusive. Further radiocarbon dating on a fragment of willow wood retrieved from c 0.25m above the previous sample provided a date of Cal AD 1040 to 1220 (SUERC-35596/ GU-24599) thus confirming the ditches origin as being related to the refortification of Hereford's defences.

Palynological, molluscan, faunal and plant macrofossil assessment of remains provided evidence for the dumping of agricultural, industrial and domestic refuse such as cess, waste cereal crops/fodder and offcuts from industrial processes such as butchery.

The palynological remains indicated the character of the wider landscape with the presence of landscape divisions in the form of hedges and disturbed ground in the immediate vicinity whilst the dumping of waste cereal, fodder and hay have revealed a patchwork landscape of herbaceous-rich, hay meadow, pastoral grassland and arable cultivation.

Despite the presence of dumped material in the environmental remains, their absence from the geoarchaeological evidence suggested that dumped material was not the greatest contributor to the ditch backfilling, and that any dumping of waste organic material would have been an ad hoc and capricious activity. The geoarchaeological assessment indicated that a large majority of the ditch fills were deposited in slow flowing, low energy conditions with occasional input from the collapse and tumble of the ditch sides. This suggests that in this location, the ditch was merely abandoned and no attempt at maintenance to continue its function were made.

It is likely that the abandonment of the defences occurred in response to the establishment of a market place at High Town approximately 250m to the east of the present site by the Norman Earl of Hereford, William FitzOsbern. The establishment of the market place beyond the Saxon defences would have effectively made the ditch redundant.

Part 2 Detailed report

1. Background

1.1 Reasons for the project

An archaeological borehole investigation was undertaken at 31 Eign Gate, Hereford, Herefordshire (NGR SO 508 400). The borehole survey and environmental assessment were undertaken on behalf of The Environmental Dimension Partnership, as a first stage in the programme of archaeological work required to satisfy Condition 8 of approved planning permission (DCCW2009/0101/F). The development site is considered to include a heritage asset with archaeological interest (SMR 44600).

1.2 Project parameters

The project conforms to relevant sections of the *Standard and guidance for an archaeological watching brief* (IfA 2008) and the *Manual of Service practice: fieldwork recording manual* (CAS 1995).

In addition, the sampling, geoarchaeology and environmental analysis conform to relevant sections of *Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation* (English Heritage 2002), *Geoarchaeology: Using earth sciences to understand the archaeological record* (English Heritage 2007) and *Environmental archaeology and archaeological evaluations* (AEA 1995).

The project also conforms to a project proposal (including detailed specification) which was produced (HEAS 2011).

1.3 Aims

The aims of this archaeological assessment were:

- to describe and assess the significance of the heritage asset with archaeological interest;
- to establish the nature, importance and extent of the archaeological site;
- to assess the impact of the proposed development on the archaeological site.

2. Methods

2.1 Documentary search

Prior to fieldwork commencing a search was made of the Herefordshire Sites and Monuments Record (SMR). In addition to the sources listed in the bibliography the following were also consulted:

Cartographic sources

- Speede's 1610 map of Hereford
- Hill's 1716 map, *An exact survey of the city of Hereford*
- Taylor's 1757 map of Hereford

2.2 Fieldwork methodology

2.2.1 Fieldwork strategy

A detailed specification has been prepared by the Service (HEAS 2011).

The borehole survey was undertaken on 4 and 5 May 2011. The site reference number and site code is EHE 1887.

Twelve boreholes were sunk in total in pairs on a north-south alignment; one set of six (Boreholes 1 – 6) were collected for geoarchaeological analysis and remained sealed until delivery to ARCA in Winchester whilst the other set of six (Boreholes 7 – 12) were opened by the author for archaeological recording and recovery of artefactual and environmental evidence, the results of which are described as Appendix 1. The boreholes were sunk using a Competitor mini-tracked percussive auger rig to recover continuous/windowless cores of *c*100-80mm in diameter and 1m length with the aim of sampling alluvial and/or organic deposits that could be assessed for environmental remains and their potential for geoarchaeological analysis.

2.2.2 Structural analysis

All fieldwork records were checked and cross-referenced. Analysis was effected through a combination of structural, artefactual and ecofactual evidence, allied to the information derived from other sources.

2.3 Geoarchaeology methodology, by Nick Watson

Six boreholes (BH 1-6) were drilled along a north-south transect on the Eign Gate site for geoarchaeological purposes under the supervision of an officer from Worcestershire County Council Historic Environment and Archaeology Service (WHEAS).

The cores were passed to ARCA in May 2011 and three (BH2, BH4 and BH 5) were studied in the laboratory between 7 and 10 June 2011. The plastic sleeves containing the cores were slit open and the retained sediments cleaned to expose a fresh face, photographed and then described according to standard geological criteria (Tucker 1982, Jones *et al* 1999, Munsell Color 2000).

There was an average 10% sediment loss/compression in each of the boreholes. Therefore the depths quoted in the text that follows are accurate to an estimated ±0.1-0.2m.

2.4 Artefact methodology

2.4.1 Artefact recovery policy

The artefact recovery policy conformed to standard Service practice (CAS 1995; appendix 2).

2.4.2 Method of analysis

All hand-retrieved finds were examined. They were identified, quantified and dated to period. A *terminus post quem* date was produced for each stratified context. The date was used for determining the broad date of phases defined for the site. All information was recorded on *pro forma* sheets.

Pottery fabrics are referenced to the fabric reference series maintained by the Service (Hurst 1994).

2.5 Environmental archaeology methodology

2.5.1 Sampling policy

The environmental sampling strategy conformed to standard Service practice (CAS 1995; appendix 4). The sampling of material for radiocarbon dating and pollen analysis was undertaken during the archaeological recording.

2.5.2 Radiocarbon dating methodology

Two samples were submitted for Accelerated Mass Spectrometry (AMS) dating to the Scottish Universities Environmental Research Centre (SUERC) radiocarbon dating laboratory.

Both samples were taken from fills of the ditch encountered in Borehole 8. The first (SUERC-35596/ GU-24599) was a fragment of *Salix* (willow) sp wood, the identification/discussion of which occurs in Section 4.4. This sample came from a friable to slightly pliable, mid to dark brown, fine silty sand representing a 'lower/middle' ditch fill from 52.82m AOD – 52.79m AOD. The second sample (SUERC-35597/ GU24600) was a fragment of leather retrieved from 52.55m AOD – 52.53m AOD. This sample came from a friable to slightly pliable, mid to dark brownish grey fine silty sand that has been interpreted as a basal fill of the ditch. The submitted sample was part of a larger item/scrap of leather that is currently in storage at the Service.

All calibrated date ranges cited in the text are those for 95% confidence.

2.5.3 Palynological remains

In total, six pollen sub-samples of $2cm^3$ were selected for palynological assessment; four were taken from Borehole 8 whilst two were taken from Borehole 9, the exact depths of which are given within the results section below. These were selected based upon their position in the sequence and their perceived potential for the preservation of palynological remains.

The sub-samples were submitted to the laboratories of the Department of Geography and Environment at the University of Aberdeen for chemical preparation following standard procedures as described by Barber (1976) and Moore *et al* (1991). The full methodology is described in Appendix 4.

Where preservation allowed, pollen grains were counted to a total of 150 land pollen grains (TLP) for assessment purposes using a GS binocular polarising microscope at x400 magnification. Identification was aided by using the pollen reference slide collection maintained by the Service, and the pollen reference manual by Moore *et al* (1991). Nomenclature for pollen follows Stace (2010) and Bennett (1994).

Fungal spores and parasite ova were noted with rapid identification being undertaken to genus level. Identifications were aided through reference material maintained by the Service and reference manuals by Kirk *et al* (2008) and Grant-Smith (2000).

2.5.4 Wood identification, by Alan Clapham

The cell structure of all the non-oak identification samples was examined in three planes under a high power microscope and identifications were carried out using reference texts (Schweingruber 1978, Brazier and Franklin 1961 and Hather 2000) and reference slides housed at the Worcestershire Historic Environment and Archaeology Service.

2.5.5 Faunal remains, by Emily Beales

All bone fragments were analysed and, where possible, identified to element and species with any butchery marks, pathological alterations and morphological abnormalities being recorded. Identifications were aided by reference to the reference collection maintained by the Service and standard keys (Schmid 1972; Hillson 1992). Sex was not factored into this analysis as most of the bone elements were too incomplete to gain adequate measurements needed for sex determination.

The collected data was analysed and interpreted to assessment level, although no statistical analysis was undertaken due to the small sample size of identifiable remains.

2.5.6 **Mollusc remains, by Andy Mann**

A sub-sample of material was taken from between 52.81m OD and 52.60m OD (3.19m – 3.40m) in Borehole 10 for the basic assessment of molluscan remains to allow comments on preservation, potential and basic ecological conditions. The sub-sample was processed by the wash-over technique as follows. The sub-sample was broken up in a bowl of water to separate the light organic remains from the mineral fraction and heavier reside. The water, with the light organic faction was decanted onto a 300µm sieve and the residue washed through a 1mm sieve. The remainder of the bulk sample was retained for further analysis.

The flot was scanned using a low power MEIJI stereo light microscope and molluscan remains identified using modern reference collections maintained by the Service and identification and ecological information was aided by Kerney and Cameron (1979), Evans (1972), Kerney (1999) and Davis (2008). Nomenclature follows Kerney (1999). Counts are based on the minimum number of complete apical remains.

2.6 The methods in retrospect

The methods adopted allow a high degree of confidence that the aims of the project will have been achieved.

3. Topographical and archaeological context

The underlying geology of the site is that of the Raglan Mudstone Formation of Silurian/Devonian age overlain by fluvioglacial gravels, archaeological deposits and made ground.

The dominant feature identified within the site boundaries is that of the Saxon north ditch (SMR 44600) which runs east-west approximately between Eign Gate (formerly Guldefordstrete) and West Street (Byhindewalle).

It is stated by Thomas and Boucher (2002, 9) that the development of the earliest phases of Hereford's defences are somewhat uncertain but are likely to originate in the mid 9th century. Documentary sources suggest that the defences were re-fortified by Harold Godwinson in 1056 which may have involved the re-cutting and enlargement of the ditch (Thomas and Boucher 2002, 184) in response to the Welsh sacking of the city in 1055.

It has been reported that there is no archaeological evidence to support this refortification (Herefordshire Through Time 2010) yet a recent investigation and radiocarbon dating of a linear earthwork to the south of river at Bishops Meadow Row Ditch (Baker and Preece 2010, 10) has indicated that the documentary sources may be accurate.

The site was briefly investigated in 1985 during trenching relating to construction (HE85F) but detailed recording/examination was not undertaken (Thomas and Boucher 2002, 15) although the fill of the ditch was identified. The fill of the ditch was once again identified during geotechnical investigation of the site (Harris 2009) with wood, charcoal and organic sediment being encountered. Two boreholes were sunk during the 2009 investigation for archaeological investigation but the results of this work were unavailable to the author.

Several investigations of the ditch have been made although none of them have recorded a complete profile of the feature although works at 25 High Town (Thomas and Boucher 2002, 14) and 27-29 Eign Gate/West St (Shoesmith 1971) record the ditch as being 19m and 20m wide respectively. Further indications of the features dimensions were provided by investigations at the former City Arm's Hotel (Shoesmith 1982, 68-9) at the northern end of Broad Street where the ditch was described as follows:

> It had a flat bottom at 5.4m below pavement level and was more than 15m wide. The primary ditch silt 0.4m in depth consisted of black, heavy silt. It was sealed by bands of gravel separated by further black silts. Above, but within the ditch, were timbers, stakes and wattling of a structure, probably an open drain, which were C14 dated to AD 1200 +/- 70. Above this was a layer of crushed organic material, probably straw or grass. The latest ditch fill contained leather fragments and 12th century pottery. The final backfilling of the

ditch was given a terminus ante quem by the 15th century building incorporated in the former hotel.

Supporting this notion that the feature was relatively open during the 11th-13th centuries was the presence of primary black silts in the base of the ditch at 27-29 Eign Gate (Shoesmith, 1971). These contained animal and vegetable remains indicating flowing water and a late 11th – 12th century tripod pitcher. These primary organic silts were subsequently sealed by gravel, soil and rubble representing deliberate backfill (Shoesmith, 1971).

Further botanical evidence came from 25 High Street which indicated dumping of faecal material/sewage and domestic waste including edible plant species on a significant scale (de Rouffignac 1990) and at 8 St Peter's Street from which plant remains indicated the presence of slow flowing/stagnant water (Hovard 1998).

4. Results

4.1 Geoarchaeology, by Nick Watson

4.1.1 Stratigraphy

The Eign Gate site is mapped by the British Geological Survey (BGS) as lying on Quaternary fluvioglacial deposits below which the solid geology comprises strata of the Raglan Mudstone Formation of Silurian/Devonian age (a sub-division of the Old Red Sandstone Group).

Basal strata within the borehole cores comprise Quaternary fluvioglacial gravels derived from the Old Red Sandstone heartlands of Herefordshire. The Saxon ditch has been cut into the gravels while it's fills comprise channel fills of clay/silts mixed with fine sands - the channel in this case being the Saxon ditch - and a clayey granular gravel of local and natural mass (debris) flow origin. The whole sequence is capped by a rubble and clay-dominated made ground. In the text below the stratigraphy is discussed in stratigraphic order starting with the earliest while the lithological data are tabulated in Appendix 2.

Quaternary glacial fluvial gravels.

Units 7 to 11 from BH 5 comprise almost two metres of glacial fluvial clayey gravels. These are typically dark reddish brown in colour with greenish grey inclusions, the clasts are well rounded and the deposit as a whole is often well sorted. On the whole, the deposits are compact, but not lithified, although where the silt/clay matrix is rare or absent lenses of loose gravel are not unusual. These latter sub- to well rounded clasts of granular to pebble size (2-4mm and 4-64mm) are found in overlying units and are undoubtedly derived from exposures of the Pleistocene material, more than likely the sides of the ditch. The OD of the top of the deposits cannot be estimated in BH 5 because the contact between the ditch fill and the base is in the crucial 3-4m core which is missing. Fortunately BH 2 and BH 4 preserve 0.08m and 0.10m respectively of red fluvioglacial fluvial clay at a depths of 3.36m and 3.25m (adjusted for the voids in the cores), which give heights of 52.51m and 52.75m for the base of the ditch. Indeed it is clear that the ditch has a flat base - a feature also noted during salvage recording at other sites.

Archaeological deposits

The window sample recorded in the appendices of the previous geotechnical works (Harris 2009) is particularly instructive with descriptions that tally at times uncannily with those recorded in the cores from the three archaeological boreholes described here. Soft organic clayey silts are described and interpreted as a possible Saxon ditch fill between 2.7-3.3m and 3.0-4.0m below ground surface. This description and elevation correlates closely with similar strata from the present study, i.e. with Unit 3 in BH 2, Units 6 and 7 in BH 4 and Units 4 and 5 in BH 5. All the previously mentioned units have similar morphological properties, i.e. 10 YR 4/2 Dark greyish brown silt/clay mixed with a greater or lesser amount of fine sand, small rare fragments of charcoal and occasional rounded pebble, while macroscopic organic remains are rare. This latter observation contrasts with those made during salvage recording

of strata from the ditch to the east, where heavy black silt overlain by gravel, 'soil' and rubble was noted during excavations at 27-29 Eign Gate, West Street (Herefordshire Through Time 2010). The silts described from this latter project were taken to be indicative of running water, perhaps taken from the Eign Brook. Evidence that the ditch contained large quantities of sewage came from macroscopic plant and insect remains recovered from salvage recording at 25 High Town. Such highly organic sediments as these reports suggest have not been seen in the cores, and on the contrary the present cores are notable for their absence.

The presence of fine sand in the Eign Gate stratigraphy suggests that water in the ditch was moving sufficiently quickly to flush away fine grained organic residue. The sands are mixed with clays though, which only settle out of suspension once the energy of the fluvial system has dropped to a very low value. Therefore, it can be postulated that a stream flow of fluctuating power over the time the sediments accumulated. The dark colour of the clays, particularly Unit 3 in BH 2, is indicative of the ditch water carrying a suspended load of microscopic organic residues and/or finely comminuted charcoal which should augur well for palynological sampling. The accumulation of organic waste at any one point in a ditch - the Saxon ditch is estimated to be 20m wide - and within a town setting, will depend on a great number of variables. These are governed as much by local fluvial nuances as by the capricious disposal of waste on the part of the town's inhabitants. The archaeological record will only preserve organic material if it is buried quickly enough to inhibit aerobic bacterial decomposition which in a fluvial system normally occurs in bodies of slack water with the settling out of suspended clay and silt particles. The maintenance of a functioning ditch requires periodic if not constant dredging, and when this ceases it will rapidly silt up. At this latter point in time, the geomorphology will begin to resemble a cut off meander with, perhaps, a network of meandering channels fed by arterial drains or brooks. Reworking of the surface deposits will create a lateral and vertical mosaic of interdigitated lenses of varying organic content to which periodic flooding of the adjacent River Wye will add veneers of clays. Ponds of standing water will develop and eventually land reclamation will result in the dumping of material and the sealing of the ditch sediments. Clearly then, the presence, or not, of organic remains in the boreholes is none other than an artefact of the sampling of the ditch.

The fine sandy clays discussed above are overlain by the clayey gravels seen in Unit 2 in BH 2, and Unit 3 in BH 5. These units represent mechanical processes consistent with a low energy fluvial system and are believed to be the result of mass or debris flows. The sediments are, on the whole, dark grey in colour and compact in nature. The coarse component is a granular-sized gravel of sub- to well-rounded mudstone/quartz clasts and soft red mudstone inclusions. The stratigraphic position of gravels above sands would normally imply a more energetic stream flow, but the fact that sandy clays make up the matrix of the Units suggests otherwise, and the sediments are probably locally derived from collapsing sections of the sides of the ditch. The mantle of glacial/fluvial deposits into which the ditch is cut is, after all, inherently unstable, consisting as has been noted earlier, in part, of soft clays and loose gravel lenses. Local reworking/collapse of these deposits along the sides would account for the presence in the Units of lenses of soft mudstones and well rounded gravels of a variety of rock types (quartz, red and green sandstones and red mudstones) which become incorporated, more by gravity than by any other process, into the muddy ditch fill. It should be noted that strata with the properties described above are not laterally extensive and would not necessarily appear in all the boreholes. It is also notable that these strata did not contain artefacts.

Made ground

Approximately two metres of deposits resulting from post-medieval use were found in the top of the boreholes. These consisted of dark brown clays mixed with mortar, brick and charcoal fragments of all sizes, and included redeposited fluvioglacial red clays and gravels. There is no evidence of bioturbation and the sediments are considered to represent deliberately deposited material.

4.1.2 Discussion

The fluvioglacial deposits probably date from episodes of the Late Pleistocene when humans were absent from Britain and as such have a low archaeological and palaeoenvironmental potential.

The probable archaeological deposits represent fluvial and mass flow deposits of probable medieval or post-medieval date. The lack of visible organic remains in the part of the ditch sampled by the three boreholes studied by ARCA suggests a moderate to poor palaeoenvironmental potential. However, as has been discussed above organic material is likely to be locally present and recoverable through boreholes/trenches placed elsewhere. Palynological remains should be recoverable from the clays.

The made ground is likely to have accumulated within the last 200 years and is better assessed by conventional archaeological works rather than in boreholes. It has a low palaeoenvironmental potential.

4.2 Radiocarbon dating, by SUERC and Nicholas Daffern

4.2.1 Results

Two samples were submitted to SUERC for Accelerator Mass Spectrometry (AMS) radiocarbon dating. The results of which are contained in Table 1. The full radiocarbon report is appended as Appendix 3. All calibrated date ranges cited in the text are those for 95% confidence.

Laboratory code	Borehole number and depth (m OD)	Material	13C/12C	Radiocarbon Age BP	OxCal calibrated age (95.4% probability or 2 sigma)
SUERC-35596 (GU-24599)	BH8: 52.82m OD – 52.79m OD	Wood (*Salix* sp)	-28.9 ‰	890 ± 30	Cal AD 1040 to 1220
SUERC-35597 (GU-24600)	BH8: 52.55m OD- 52.53m OD	Leather	-26.7 ‰	920 ± 30	Cal AD 1020 to 1190

Table 1 Radiocarbon dating results

4.2.2 Discussion

The dates obtained indicate an early medieval date for the basal fills of the ditch. The date of the leather fragment, Cal AD 1020 to 1190 (SUERC-35597/ GU-24600) is of particular interest as this came from the lowest fill of the ditch directly overlying the natural gravels thus indicating that the ditch studied in the current investigation represents the refortification of the city by Harold Godwinson in 1056 (Thomas and Boucher 2002, 184).

4.3 Artefact analysis, by Laura Griffin

The artefactual assemblage recovered is summarised in Table 2.

Due to the nature/methodology of the investigation, recovery of finds was unlikely; however, a small group of artefacts was retrieved during the works.

Both the Cistercian-type fine ware sherd (fabric A7C) and the green-glazed ridge tile (fabric A5) are of fabric types commonly identified within assemblages from Hereford and it is highly likely that both are examples of local ceramic production (Vince 1985).

Remaining finds were of late post-medieval and modern date and require no further comment.

Material	Type	Fabric	Borehole	Depth (BGS)	Count	Weight (g)	Period
Ceramic	Green glazed ridge tile	Hereford fabric A5	BH8	Unstratified – between 1-2m BGS	1	11.0g	Late 13th-14th century
Ceramic	Cistercian-type fine ware	Hereford fabric A7c	BH10	0.88m	1	1.6g	16th century
Ceramic	Clay pipe stem		BH8	0.66m	1	1.6g	Post-medieval
Ceramic	Undiagnostic ceramic building material fragments		BH8	1.21m	3	15.5g	Post-medieval
Ceramic	Flowerpot		BH7	0.19m	1	5.9g	Modern
Ceramic	Flowerpot		BH10	0.55m	2	14.5g	Modern

Table 2 Quantification of the artefactual assemblage by period

4.4 Wood identification, by Alan Clapham and Nicholas Daffern

A single fragment of wood was assessed from Borehole 8 recovered from between 52.82m AOD and 52.79m AOD.

The fragment was identified as being a young twig of *Salix* sp (willow) with approximately five annual rings. Vivianite was present within the wood fragment potentially indicating the presence of cess (McGowan and Prangnell, 2006), the occurrence of which has been recorded during previous environmental investigations of the feature (de Rouffignac 1990). The fragment was slightly distorted and compressed suggesting long term burial.

An alternative yet tentative hypothesis for the distortion of the wood may be that it was formerly incorporated in a wattle structure similar to the stake and wattle drain that was encountered at the City Arms Hotel site (Shoesmith 1982, 68-9) and this would account for the presence of vivianite as such a feature is likely to contain a high proportion of phosphorous-rich faecal material conducive to the formation of vivianite.

4.5 Mollusc remains, by Andrew Mann

The molluscan evidence recovered is summarised in Table 3.

The molluscan remains were recovered from a sub-sample of material retrieved from between 52.81m OD and 52.60m OD (3.19m – 3.40m) in Borehole 10 and were generally in low abundance and in a fragile and fragmentary state with operculum being the most abundant identifiable element.

Species	Family	Common name	BH10/ 3.19 - 3.40m
Bithynia tentaculata	Bithyniidae	mud/common bithynia or faucet snail	6
Valvata piscinalis	Valvatidae	European stream valvata	9
Pisidium spp	Sphaeriidae	pill clams or pea clams	5
Total			20

Table 3 Molluscan remains

The assemblage solely consisted of freshwater aquatic species with *Pisidium* spp, *Bithynia tentaculata* and *Valvata piscinalis* being identified. This combination of species indicates a slow flowing body of water such as a stream which would have flowed in the bottom of the

ditch. In addition, *B. tentaculata* and *V. piscinalis* prefer to exist on fine substrate/sediment such as mud or silt.

4.6 Faunal remains, by Emily Beales

4.6.1 Animal bone

The state of preservation was poor with the majority of the faunal remains recovered in a highly fragmented state; completeness of bones was generally less than 10%. Of the 21 fragments found, only three fragments could be identified to species and were found to be *Bos* (cow) and all of these were found in BH7. This does not rule out the possibility that other species may also be represented in the assemblage; however the fragmentary nature of the remains leads to difficulty in identification. The identifiable fragments of *Bos* bone consist of one right distal third metatarsal fragment, one mid shaft femur fragment and one distal rib fragment.

The fragments that were unidentifiable to species mainly consisted of rib and skull fragments and were found in BH8 and BH11.

4.6.2 Butchery marks & pathological alterations

There is evidence of gnaw marks from a rodent on the *Bos* femur fragment which would suggest that the bones were not buried soon after death. On the *Bos* rib fragment there are two large knife marks running cranial-caudal across the anterior surface indicating skinning and acquisition of meat. Finally one of the rib fragments that was unidentifiable has large plaques of woven new bone formation indicating some form of infection, for example periostitis or, as it is present on the ribs, possibly some sort of respiratory infection.

4.6.3 Discussion

Although no solid conclusions can be drawn from the animal bone assemblage due to the small sample size, inferences can be made such as the presence of *Bos* remains and butchery marks indicate that cattle were kept as a meat resource. The assemblage has provided evidence of butchery marks, gnaw marks and pathological alterations that in larger numbers would have high potential to aide our understanding of the economy of Hereford during the medieval period.

Due to the small amount and fragmentation of the assemblage, an assessment of the cultural setting of Eign Gate cannot be constructed.

4.7 Palynological remains

4.7.1 Pollen analysis

The palynological evidence recovered is summarised in Table 4.

Palynological remains were well preserved and in moderate to good preservation with complete 150 TLP (total land pollen grains) counts achieved on all sub-samples.

BH8

2.52m BGS/ 53.35m OD

The upper sub-sample from Borehole 8 was dominated by pollen grains of herbaceous species representing 85% total land pollen grains (TLP) with high species diversity. Despite the high diversity, just three species contributed more than 5% TLP; these were Poaceae undiff (grasses) (37% TLP), *Cichorium intybus*-type (dandelions/chicory) (10% TLP) and *Solidago virgaurea*-type (daisies/goldenrods) (9% TLP).

The species contributing lesser quantities included *Achillea*-type (yarrows/chamomiles), Apiaceae (carrot family), *Centaurea nigra* (common knapweed), *Cirsium*-type (thistles), Cyperaceae undiff (sedges) and *Stachys*-type (woundworts/dead nettle).

Of note is the presence of the cultivated grasses *Avena/Triticum*-type (oat/wheat), *Hordeum*-type (barley) *Secale cereale* (rye) and *Cerealia* indet (indeterminable cereal) and the arable weed *Centaurea cyanus* (cornflower).

Tree and shrub species contributed 15% TLP with all species contributing less than 5% TLP. Tree species identified were *Alnus glutinosa* (alder), *Betula* (birch), *Fraxinus excelsior* (ash), *Quercus* (oak) and *Tilia cordata* (lime) whilst shrub species identified were *Corylus avellana*-type (hazel), *Euonymus europaeus* (spindle), *Ligustrum vulgare* (wild privet) and *Salix* (willow).

Aquatics were well represented in this sub-sample with identifications of Lemnaceae (duckweeds), *Myriophyllum spicatum* (spiked water-milfoil), *Nuphar* (yellow water lily), *Sagittaria sagittifolia* (arrowhead) and *Sparganium erectum*-type (branched bur-reed).

2.79m BGS/ 53.08m OD

Poaceae undiff (43% TLP) was once again the main contributor of herbaceous pollen (88% TLP) in this sub-sample with *Cichorium intybus*-type (11% TLP) and *Solidago virgaurea*-type (9% TLP) similarly contributing a significant percentage.

Herbaceous species diversity was still high including *Achillea*-type, *Artemisia*-type (mugworts), Caryophyllaceae (pink family), *Centaurea cyanus*, *Centaurea nigra*, Cyperaceae, *Plantago lanceolata* (ribwort plantain) Rosaceae (rose family) and *Urtica dioica* (stinging nettle) contributing less than 5% TLP. Cereals were again present with *Avena/Triticum*-type and *Hordeum*-type being identified.

Corylus avellana-type was the main contributor of tree and shrub pollen (12% TLP) although it accounts for only 3% TLP. Other species present within the sub-sample were *Alnus glutinosa*, *Betula* (birch), *Quercus*, *Tilia cordata*, *Ilex aquifolium* (holly), *Ligustrum vulgare* and *Salix* (willow).

Aquatics were solely represented in this sub-sample by *Potamogeton natans*-type (broad-leaved pondweed) whilst spores were represented by *Osmunda regalis* (royal fern) and *Pteropsida* (mono) indet (ferns).

3.06m BGS/ 52.81m OD

Herbaceous species again dominated this sub-sample accounting for 90% TLP with Poaceae undiff (41% TLP) the main contributor. *Cichorium intybus*-type increases in frequency from the previous sub-sample to 15% TLP whilst the contribution of *Solidago virgaurea*-type (6% TLP) decreases.

Lesser contributions of herbaceous pollen were made by *Achillea*-type, Caryophyllaceae, Chenopodioideae (goosefoot family), Cyperaceae undiff, *Ranunculus acris*-type (meadow buttercup), Rosaceae and *Trifolium*-type (clovers). The cultivars *Cerealia* indet and *Avena*/ *Triticum*-type were again present.

Trees and shrubs (10% TLP) were represented by *Alnus glutinosa*, *Betula*, *Quercus*, *Ulmus* (elm), *Corylus avellana*-type, *Ligustrum vulgare* and *Salix*.

Aquatics were represented by *Potamogeton natans*-type and *Sparganium erectum*-type whilst spores were represented by *Pteridium aquilinum* (bracken) and *Pteropsida* (mono) indet.

3.26m BGS/ 52.61m OD

The basal sub-sample from Borehole 8 contained the greatest quantity of herbaceous pollen (92% TLP) from this sequence with Poaceae undiff accounting for 46% TLP with *Cichorium intybus*-type (12% TLP) and *Solidago virgaurea*-type (11% TLP) also making significant contributions. Herbaceous species identified in lower percentages (<5% TLP) included Caryophyllaceae, *Centaurea cyanus*, *Chrysoplenium* (golden saxifrage), Cyperaceae undiff,

Plantago lanceolata, *Rumex acetosella* (sheep's sorrel), *cf Umbilicus rupestris*-type (navelwort) and *Urtica dioica*.

Cerealia indet, *Avena/Triticum*-type and *Secale cereale* were again identified representing cultivated grasses.

Trees and shrubs accounted for 8% TLP with species diversity being at its lowest level. Species identified were *Alnus glutinosa*, *Corylus avellana*-type, *Ligustrum vulgare* and *Salix* and the previously unidentified *Pinus sylvestris* (Scot's pine).

The spores (*Pteridium aquilinum* (bracken) and *Pteropsida* (mono) indet) and aquatics (*Potamogeton natans*-type and *Sparganium erectum*-type) present were the same as those identified in the previous sub-sample.

BH9

2.40m BGS/ 53.50m OD

The upper of the two sub-samples from Borehole 9 continued the trends identified in Borehole 8 with herbaceous species dominating (90% TLP) and Poaceae undiff contributing the majority of this figure (34% TLP). *Cichorium intybus*-type was the second highest contributor (26% TLP) identified in much greater quantity than in any of the sub-samples from the Borehole 8 sub-samples.

Solidago virgaurea-type contributed 8% TLP whilst Apiaceae (carrot family), *Apium*-type (marshwort), Brassicaceae (cabbage family), Caryophyllaceae, Chenopodioideae, *Chrysoplenium*, Cyperaceae undiff, *Filipendula* (meadowsweet), *Plantago lanceolata* and *Urtica dioica* contributed less than 5% TLP.

Hordeum-type was the sole identifiable cereal although grains of *Cerealia* indet were present.

Grains of tree and shrub pollen accounted for 10% TLP with *Salix* being the main contributor (5% TLP) with lesser contributions (<5% TLP) being made by *Alnus glutinosa*, *Betula*, *Quercus*, *Corylus avellana*-type, *Euonymus europaeus* and *Ligustrum vulgare*.

Aquatics were represented by Lemnaceae, *Potamogeton natans*-type and *Typha latifolia* (bulrush) whilst spores of *Polypodium* (polypody), *Pteridium aquilinum* and *Pteropsida* (mono) indet were present.

2.74m BGS/ 53.16m OD

The lower sub-sample from Borehole 9 was again dominated by herbaceous pollen with Poaceae undiff (42% TLP) and *Solidago virgaurea*-type (16% TLP) being the main contributors. *Cichorium intybus*-type was greatly reduced from the previous sub-sample (8% TLP).

Herbaceous species present in lower quantities (<5% TLP) included Apiaceae, *Centaurea nigra*, *Chelidonium majus* (greater celandine), *Filipendula*, *Heracleum sphondylium* (hogweed), *Plantago lanceolata*, Rosaceae, *Trifolium*-type, *Urtica dioica* and *Vicia sylvatica*-type (vetches/vetchlings/peas).

Cereals were better represented in this sample than the previous with *Avena*/*Triticum*-type, *Hordeum*-type, *Secale cereale* and *Cerealia* indet. Another possible cultivar that was identified within this sub-sample was *Cannabis*-type (hop/hemp)

Tree and shrub pollen represented 8% TLP with no species contributing greater than 4% TLP. Identified species were *Alnus glutinosa*, *Quercus*, *Corylus avellana*-type, *Ilex aquifolium*, *Ligustrum vulgare* and *Salix*.

Butomus umbellatus (flowering-rush) and *Potamogeton natans*-type were the aquatics identified in this sub-sample whilst spores were represented by *Pteridium aquilinum* and *Pteropsida* (mono) indet.

4.7.1 **Parasite ova**

The ova of the parasite *Trichuris* sp (whipworm), a parasite of the large intestine, were identified in three of the samples assessed, 2.79m (53.08m OD) and 3.06m (52.81m OD) from Borehole 8 and 2.40m (53.50m OD) from Borehole 9.

Unfortunately, this genus is present within the intestinal tract and faecal material of many mammals including humans, livestock and domestic pets, and therefore identifying the source is extremely difficult.

Based upon size and morphology, the ova identified in all samples are likely to be *T. suis* or *T. trichiura*. The former is a whipworm whose natural host are pigs whilst the latter infects humans and is the cause of Trichuriasis although it should be noted that Beer (1976) has shown that humans can be infected with *T. suis*.

An exception to this was identified in sample 3.06m (52.81m OD) from Borehole 8. A single ovum from this was notably different from those previously identified due to its very pronounced polar plugs although its size was consistent with previous identifications. It simply may be that this is a *T. suis* or *T. trichiura* ovum with an unusual morphological variation although alternatively it may be indicative of a different species within the *Trichuris* genus, the identity of which is currently unknown to the author, and may be indicative of multiple sources of faecal material being incorporated into the deposit.

4.7.2 **Fungal Spores**

Fungal spores were present in all of the assessed sub-samples with *Chaetomium* sp, *Cladosporium* sp, *Torula* sp and *Ustilago* sp being the most frequently identified.

Chaetomium sp, *Cladosporium* sp, and *Torula* sp are ubiquitous and cosmopolitan in their distribution although they are typically associated with plant litter and decaying plant matter with *Torula* sp particular associated with herbaceous stems, both living and dead. Several species of *Chaetomium* sp are also considered to be coprophilous and can be associated with animal dung.

The remaining fungal spores identified were of plant pathogens and this included the abundantly present *Ustilago* sp which are smut fungi parasitic to grasses, both wild and cultivated.

The spores of *Alternaria* sp were less frequently identified but its presence is of interest as it is a major plant pathogen causing blight, lesions and canker on a wide variety of species including potatoes, carrots, wheat and tomatoes and is also often associated with decaying and decomposing material.

A tentative identification of *cf Puccinia* sp is of interest as this genus is a plant pathogen which fall into the group of diseases known as rusts. These can infect many different plant species, particularly members of the Poaceae family, including cultivated species such as wheat, barley and rye.

	Family	Common Name(s)	BH8 - 2.52m	BH8 - 2.79m	BH8 - 3.06m	BH8 - 3.26m	BH9 - 2.40m	BH9 - 2.74m
Alnus glutinosa	Betulaceae	alder	3	1	5	3	1	1
Betula	Betulaceae	birch	5	5	1		1	
Fraxinus excelsior	Oleaceae	ash	2					
Pinus sylvestris	Pinaceae	Scot's pine				1		
Quercus	Fagaceae	oak	6	1	2		1	2
Tilia cordata	Malvaceae	small-leaved lime	1	1				
Ulmus	Ulmaceae	elm			1			
Corylus avellana -type	Betulaceae	hazel	2	5	3	2	3	1
Euonymus europaeus	Celastraceae	spindle	1				1	
Ilex aquifolium	Aquifoliaceae	holly		1				4
Ligustrum vulgare	Oleaceae	wild privet	2	2	1	2	1	2
Salix	Salicaceae	willow	2	2	3	4	8	3
Poaceae undiff	Poaceae	grass	60	67	64	71	54	66
Cerealia indet	Poaceae	indeterminable cereal	2		3	2	4	4
Avena / Triticum- type	Poaceae	oat/wheat	4	1	2	1		7
Hordeum- type	Poaceae	barley	2	1			1	1
Secale cereale	Poaceae	rye	1			2		2
Achillea -type	Asteraceae	yarrows/ chamomiles	3	5	2	1		
Apiaceae	Apiaceae	carrot family	3				2	3
Apium -type	Apiaceae	marshwort					1	
Artemisia -type	Asteraceae	mugworts		1				
Brassicaceae	Brassicaceae	cabbage family	1	1	1		3	
Cannabis -type	Cannabaceae	hop/ hemp						1
Caryophyllaceae	Caryophyllaceae	pink family	3	3	6	5	6	1
Centaurea cyanus	Asteraceae	cornflower	1	2		1		
Centaurea nigra	Asteraceae	common knapweed	3	2				1
Chelidonium majus	Papaveraceae	greater celandine						2
Chenopodioideae	Amaranthaceae	goosefoot subfamily	1	1	4		2	
Chrysoplenium	Saxifragaceae	golden saxifrage				2	2	1
Cichorium intybus -type	Asteraceae	chicory/ dandelion	16	18	24	19	41	12
Cirsium -type	Asteraceae	thistles	3	2	3	1		1
Cyperaceae undiff	Cyperaceae	sedge	7	5	5	5	3	3
Filipendula	Rosaceae	meadowsweet	2	1		1	3	3
Heracleum sphondylium	Apiaceae	hogweed						1
Plantago lanceolata	Plantaginaceae	ribwort plantain	2	4	3	6	3	6
Plantago major	Plantaginaceae	greater plantain			1			1
Ranunculus acris -type	Ranunculaceae	meadow buttercup	2		3	1		
Rosaceae	Rosaceae	rose family	1	3	4			3
Rumex acetosa	Polygonaceae	common sorrel			2			
Rumex acetosella	Polygonaceae	sheep's sorrel		1		1		
Solidago virgaurea -type	Asteraceae	daisies/ goldenrods	15	14	9	17	12	17
Stachys -type	Lamiaceae	woundworts/ dead-nettles	1					
Trifolium -type	Fabaceae	clovers			1			1
cf Umbilicus rupestris -type	Crassulaceae	navelwort				1		
Urtica dioica	Urticaceae	stinging nettle	5	4	4	5	3	5
Vicia sylvatica-type	Fabaceae	vetches/ vetchlings/ peas						1
		TLP Grains counted	**162**	**154**	**157**	**154**	**156**	**156**
Butomus umbellatus	Butomaceae	flowering-rush						1
Lemnaceae	Lemnaceae	duckweeds	1				1	
Myriophyllum spicatum	Haloragaceae	spiked water-milfoil	2					
Nuphar	Nymphaeaceae	yellow water-lilies	1					
Potamogeton natans -type	Potamogetonaceae	broad-leaved pondweed		1	2	2	2	2
Sagittaria sagittifolia	Alismataceae	arrowhead	1					
Sparganium erectum -type	Typhaceae	branched bur-reed	1		1	1		
Typha latifolia	Typhaceae	bulrush					1	
Osmunda regalis	Osmundaceae	royal fern		1				
Polypodium	Polypodiaceae	polypody					1	
Pteridium aquilinum	Dennstaedtiaceae	bracken			3	3	3	1
Pteropsida (mono) indet		ferns		3	4	11	6	5

Table 4 Results of pollen assessment

4.7.3 **Discussion**

The overall character of the ditch and its environs is an open one with a large quantity of open, rough/waste grassland as indicated by the domination of grasses, dandelions and daisies and goldenrods and the infrequently identified species such as mugworts, thistles, ribwort plantain, stinging nettles and vetches reinforce this rough or waste character.

The presence of 'hedgerow' shrub species such as privet, spindle, hazel and willow may indicate the possible presence of vegetational boundaries although it is unclear whether these are associated with the ditch ie a "soft" barrier to demark the northern edge, or whether they are divisions between land parcels.

Herbaceous species within the sub-samples also indicate the presence of hedges and or the city walls itself with the identification of greater celandine and navelwort. The former is associated with hedgerows but also walls and marginal habitats, often near cultivation or habitation whilst the latter is noted for its presence in rocks, wall and stony hedgebanks. Pollen of woundwort/dead-nettle was also identified and these are again associated with hedgerows, hedgebanks and rough ground.

The presence of *Cannabis*-type was of interest as it may represent either hop or hemp. Hop (*Humulus lupulus*) is a native species which grows in hedgerows and scrub woodland although it become more widely cultivated for brewing in the 15th – 16th centuries whilst hemp (*Cannabis sativa*) is an introduced species thought to have arrived with the Anglo-Saxons. Attempts have been made to separate the grains of the two species but this is often difficult due to size/morphological overlaps (Moore *et al* 1991, 103) although in the present example, a tentative identification of hemp is proposed due to the greater pore protrusion and grain size.

The environment within the ditch itself is indicated through several of the herbaceous and aquatic species. Marshwort, meadowsweet, golden saxifrage and sedges are all associated with damp and wet environment, whilst all of the aquatic species identified are associated with slow moving bodies of water such as ponds, canals and ditches.

It is a tentative hypothesis but the presence of fungal spores relating to decaying stems or plant pathogens may be indicative of the dumping of waste cereal stems into the feature. The material may have been infected by a pathogen and was discarded due to it being unfit for human consumption. Alternatively it may have been used/waste fodder or bedding for livestock. Another possibility is that they may have been both ie infected stems that were determined to be unfit for human consumption which were subsequently fed to or used as bedding for livestock to avoid waste of resources.

The dumping of 'unprocessed' cereal remains and/or hay/fodder is supported by the presence of arable and arable weed species such as oat/wheat, barley, rye, chamomiles and cornflower, the latter being particular indicative of hay or crop waste. This is also supported by the high percentage of species which are associated with open meadow grassland such as daisies, goldenrods, dandelions, common knapweed, vetches, sorrels, clovers, plantains and buttercups.

These 'dumped' species give a good indication of the wider landscape outside of the immediate urban environment indicating a patchwork of herbaceous-rich, hay meadow and pastoral grassland, most probably in the river valley, utilised for the production of livestock fodder and grazing, and arable cultivation of cereals on the higher, drier terraces and wider countryside.

4.8 Leather

Fragments of leather were retrieved from between 52.60m OD and 52.52m OD (3.27m – 3.35m BGS) in Borehole 8. The largest fragment measured 5cm long by 5cm in width by 3.5cm in depth and appeared in a good state of preservation with the form of the leather being maintained after recovery from the soil matrix during the archaeological recording. No obvious form or morphology could be ascertained and it is therefore unclear whether the leather represents a fragmented item or whether it is merely leather waste or an offcut from

the manufacture of an item. All fragments appear to come from the same item/object due to their similar levels of preservation and their recovery from a small area although this may be an incorrect observation by the author due to unfamiliarity of leather objects. The radiocarbon dating of the leather showed it to be 11th – 12th century AD in date

5. Synthesis

5.1 Late Pleistocene

The solitary deposit associated with this period are the well-rounded and well-sorted glaciofluvial sandy/clayey gravels encountered in all of the assessed boreholes with the exception of BH 12. These gravels are derived from the Old Red Sandstones heartlands of Herefordshire and this is consistent with previous observations by Hey (1997, 61-62) who states that these gravels consist "largely of outwash material from a glacier advancing down the upper Wye valley".

Due to the date of the deposits, either being the last Glacial Maximum (25,000 – 16,000 BP) or the Younger Dryas/ Loch Lomond stadial (11,000-10,000 BP), it is unlikely that these deposits will produce evidence of human activity as it is during these periods that much of Britain was abandoned due to the cold climate, with any occupation being focused in the south of the country.

5.2 Late Saxon/Medieval (AD 1000 – AD 1539)

The radiocarbon date of Cal AD 1020 to 1190 (SUERC-35597/ GU-24600) from the basal fills suggest that the ditch examined during this assessment can be assigned to the previously tentative refortification of the cities defences by Harold Godwinson in 1056. This is of great interest as, to the author's knowledge only one previous investigation has positively identified evidence of this refortification and this was away from the core of the city to the south of river at the Bishops Meadow Row Ditch (Baker and Preece 2010, 10).

This result, therefore, helps to confirm the documentary evidence and the work undertaken at the Bishops Meadow Row Ditch. It also perhaps indicates that the refortification work was on a much greater scale than previously assumed, as the present site and that of the Row Ditch are at the opposite sides of Hereford's defences suggesting that the refortification was not a piecemeal affair but was a concerted effort to enclose the entire city.

The combined evidence of the geoarchaeological, palynological, molluscan and plant macrofossil assessments have supported the previous observation of the ditch being a flat bottomed feature containing slow flowing and standing pools of water in its base.

Dumping of agricultural, industrial and domestic refuse appears to have been prevalent, again agreeable with previous works, with the ditch obviously serving as a handy location for the disposal of cess, waste cereal crops/fodder and offcuts from industrial processes such as butchery and leather making.

The palynological remains have indicated the character of the wider landscape with the presence of landscape divisions in the form of hedges and disturbed ground in the immediate vicinity, whilst the dumping of waste cereal, fodder and hay have revealed a patchwork landscape of herbaceous-rich, hay meadow and pastoral grassland, most probably in the river valley, utilised for the production of livestock fodder and grazing, and arable cultivation of cereals on the higher, drier terraces and wider countryside.

Despite the presence of dumped material in the environmental remains, their absence from the geoarchaeological evidence suggests that dumped material was not the greatest contributor to the ditches backfilling and dumping of waste organic material would have been an ad hoc and capricious activity. The geoarchaeological assessment indicates that a large majority of the ditch fills are deposited in slow flowing, low energy conditions with occasional input from the collapse and tumble of the ditch sides. This suggests that in this location, the ditch was merely abandoned and no attempt at maintenance to continue its function were made.

It is likely that the abandonment of the defences, as proposed by Thomas and Boucher (2002, 170), occurred in response to the establishment of a market place at High Town approximately 250m to the east of the present site by the Norman Earl of Hereford, William FitzOsbern. The establishment of the market place beyond the Saxon defences would have effectively made the ditch redundant.

The artefactual evidence has shown the presence of late medieval and early post-medieval pottery in the upper fills of the feature suggesting that backfilling of the ditch was still occurring in the 16th century although there is the possibility that some of this material may be disturbed and/or intrusive as a result of development in the post-medieval and modern period.

5.3 Post-medieval/modern (AD 1540 – Present)

Approximately two metres, increasing to approximately three metres at the southern end of the site in Borehole 12, of the material that was encountered during the borehole works could be assigned to the post-medieval/modern periods and was in the form of made ground and overburden. It is evident from Speede's map of Hereford (Thomas and Boucher 2002, 172) that by 1610 the ditch has been partially or completely backfilled due to the presence of buildings on its northern and southern edges and by 1757 construction had occurred upon the site of the ditch in several locations as shown in Taylor's plan of the city (Thomas and Boucher 2002, 174).

Due to the absence of bioturbation it is clear that much of this made ground is deliberately deposited material and although the post-medieval character of the ditch is unclear, it is likely that depressions and undulations occurred along its course due to the piecemeal nature of the backfilling and these sizeable dumps are an attempt to remedy this and stabilise the ground for infilling of plots during post-medieval and modern urbanisation.

6. Significance

6.1 Significance of a heritage asset with archaeological interest

The aim of an archaeological evaluation is to provide the client and the planning authority (and its advisors) with sufficient information to assess the significance of a heritage asset with archaeological interest, in line with *Planning Policy Statement 5: Planning for the Historic Environment* (DCLG 2010: Policy HE6). More detailed guidance on assessing the significance of site with archaeological interest is set out in the associated *Historic Environment Planning Practice Guide,* which advises that an on-site evaluation should establish the nature, importance and extent of the archaeological interest in order to provide sufficient evidence for confident prediction of the impact of the proposal (DCLG/DCMS/EH 2010: Section 5, Development Management).

6.2 Assessment of significance

The on-site evaluation has provided new evidence on a site with archaeological interest. As a result, an assessment of the significance of this site can be made in terms of the nature, importance and extent of the archaeological interest.

Nature of the archaeological interest in the site

The works have identified the ditch and ditch fills of the second phase of defences of Hereford with a basal date of Cal AD 1020 to 1190 (SUERC-35597/ GU-24600) provided by radiocarbon dating of a fragment of leather. This is of great interest as, to the author's knowledge; only one previous investigation has positively identified evidence of this refortification and this was away from the core of the city to the south of the river at Bishops Meadow Row Ditch (Baker and Preece 2010, 10).

Relative importance of the archaeological interest in the site

The assessment has confirmed the previously identified morphology of the ditch (Shoesmith 1982, 68-9) and identified well preserved sediments and organic remains relating to the gradual sedimentation of the ditch. It has also significantly expanded upon the understanding of the environmental and geoarchaeological context as regards the nature of the ditch, its environment and its subsequent abandonment.

The environmental remains have confirmed and expanded upon the findings of earlier investigations of the city ditch, demonstrating with the geoarchaeological, molluscan and palynological assessments the character of the ditch, whilst the palynological remains have given insights into the immediate and wider environs of the north-west of medieval Hereford. The assessment has also assisted in providing an indication of the ditches secondary usage as regards the disposal of material into the feature (ie the discard of waste hay/fodder, faecal remains and butchered faunal remains).

The preservation of the remains overall was very good and have high potential for further analysis to further contribute to our understanding of the environment and industries of medieval Hereford.

It is relatively rare that the opportunity for palaeoenvironmental investigation can occur upon historic defences of settlements. This is due to the nature of modern towns and cities in which development has concealed and potentially destroyed these features. It is of particular importance in a city such as Hereford where, unlike many cities, the cities origins are post-Roman/ medieval rather than having an earlier Roman character so understanding the origin of these locations which are established later would be of great significance.

Physical extent of the archaeological interest in the site

The city ditch is a relatively large feature, *c*20 metres across and *c*1.5km in length marking the western, northern and eastern boundaries of late Saxon/early medieval Hereford. Despite the scale of the feature, it is unclear how much of the earliest phase survives due to the re-cutting in the 11th century and therefore identification and investigation of these deposits should be of the highest priority given the enigmatic nature of the defence's origins (Thomas and Boucher 2002, 9).

The present investigation and others have shown that despite significant quantities (*c*2-3m) of post-medieval and modern overburden/made ground; deeply stratified and well preserved archaeological remains still survive.

7. Recommendations

The recommendations above are those of the Service and may vary from those of any archaeological curator or advisor to the planning authority.

Pollen

Additional sampling and extended counts (300 TLP grains) are recommended upon the sequences given the well-preserved nature of the palynological remains which were encountered during the assessment. This would 'fill the gaps' in the pollen sequence, potentially identify exotic/rare species and provide a better understanding of the vegetational history of the site and allow refined inter-site comparison within Hereford and the country as a whole.

Plant macrofossils

Additional processing of small bulk samples from the investigated sequences is recommended in an attempt to recover plant macrofossil remains. This would help to further our knowledge of the natural environment of the ditch and surrounding environs thus making the vegetational analysis more robust. Plant macrofossil analysis may then also identify cultivated (cereals/vegetables), exotic (imported/rare) or "functional" (industrial/medicinal) species which are unidentifiable/inseparable through palynological investigations thus giving a further insight into the human interaction with plant species within medieval Hereford.

Finally, the identification of plant macrofossils would provide additional suitable material for radiocarbon dating if further dating is deemed necessary.

Radiocarbon dating

Additional radiocarbon dating would be worthwhile if suitable material could be identified as not only would it help refine the data that has already been obtained but specifically may give us a 'closure' date for sedimentation and thus give an indication of when a concerted effort was made to make the site habitable/functional which would relate to the onset of urbanisation in Hereford.

8. Publication Summary

The Service has a professional obligation to publish the results of archaeological projects within a reasonable period of time. To this end, the Service intends to use this summary as the basis for publication through local or regional journals. The client is requested to consider the content of this section as being acceptable for such publication.

An archaeological borehole survey was undertaken at the 31 Eign Gate, Hereford, Herefordshire (NGR SO 508 400). The borehole survey and environmental assessment were undertaken on behalf of The Environmental Dimension Partnership in response to potential development occurring on the site.

The assessment revealed significant quantities (c 2m) of made ground which were sealing c 1-1.5m of soft, organic clayey silts deposited in a low energy environment. These water-lain sediments were interpreted as ditch fills which had been laid down by a network of meandering streams that flowed in the base of the ditch.

Radiocarbon dating of a fragment of leather retrieved from the basal fills of the ditch directly overlying the natural gravels provided a date of Cal AD 1020 to 1190 (SUERC-35597/ GU-24600) indicating that this ditch is one of the refortifications of Hereford by Harold Godwinson in 1065 as attested in documentary sources but the identification of which has previously been elusive. Further radiocarbon dating on a fragment of willow wood retrieved from c 0.25m above the previous sample provided a date of Cal AD 1040 to 1220 (SUERC-35596/ GU-24599) thus confirming the ditches origin as being related to the refortification of Hereford's defences.

Palynological, molluscan, faunal and plant macrofossil assessment of remains provided evidence for the dumping of agricultural, industrial and domestic refuse such as cess, waste cereal crops/fodder and offcuts from industrial processes such as butchery.

The palynological remains indicated the character of the wider landscape with the presence of landscape divisions in the form of hedges and disturbed ground in the immediate vicinity whilst the dumping of waste cereal, fodder and hay have revealed a patchwork landscape of herbaceous-rich, hay meadow, pastoral grassland and arable cultivation.

Despite the presence of dumped material in the environmental remains, their absence from the geoarchaeological evidence suggested that dumped material was not the greatest contributor to the ditch backfilling, and that any dumping of waste organic material would have been an ad hoc and capricious activity. The geoarchaeological assessment indicated that a large majority of the ditch fills were deposited in slow flowing, low energy conditions with occasional input from the collapse and tumble of the ditch sides. This suggests that in this location, the ditch was merely abandoned and no attempt at maintenance to continue its function were made.

It is likely that the abandonment of the defences occurred in response to the establishment of a market place at High Town approximately 250m to the east of the present site by the Norman Earl of Hereford, William FitzOsbern. The establishment of the market place beyond the Saxon defences would have effectively made the ditch redundant.

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9. Personnel

The fieldwork and report preparation was led by Nicholas Daffern. The project manager responsible for the quality of the project was Simon Woodiwiss. Fieldwork was undertaken by Nicholas Daffern, finds analysis by Laura Griffin, environmental analysis by Nicholas Daffern, Emily Beales, Alan Clapham, and Andrew Mann, geoarchaeological analysis by Nick Watson and illustration by Carolyn Hunt. The report was edited by Derek Hurst.

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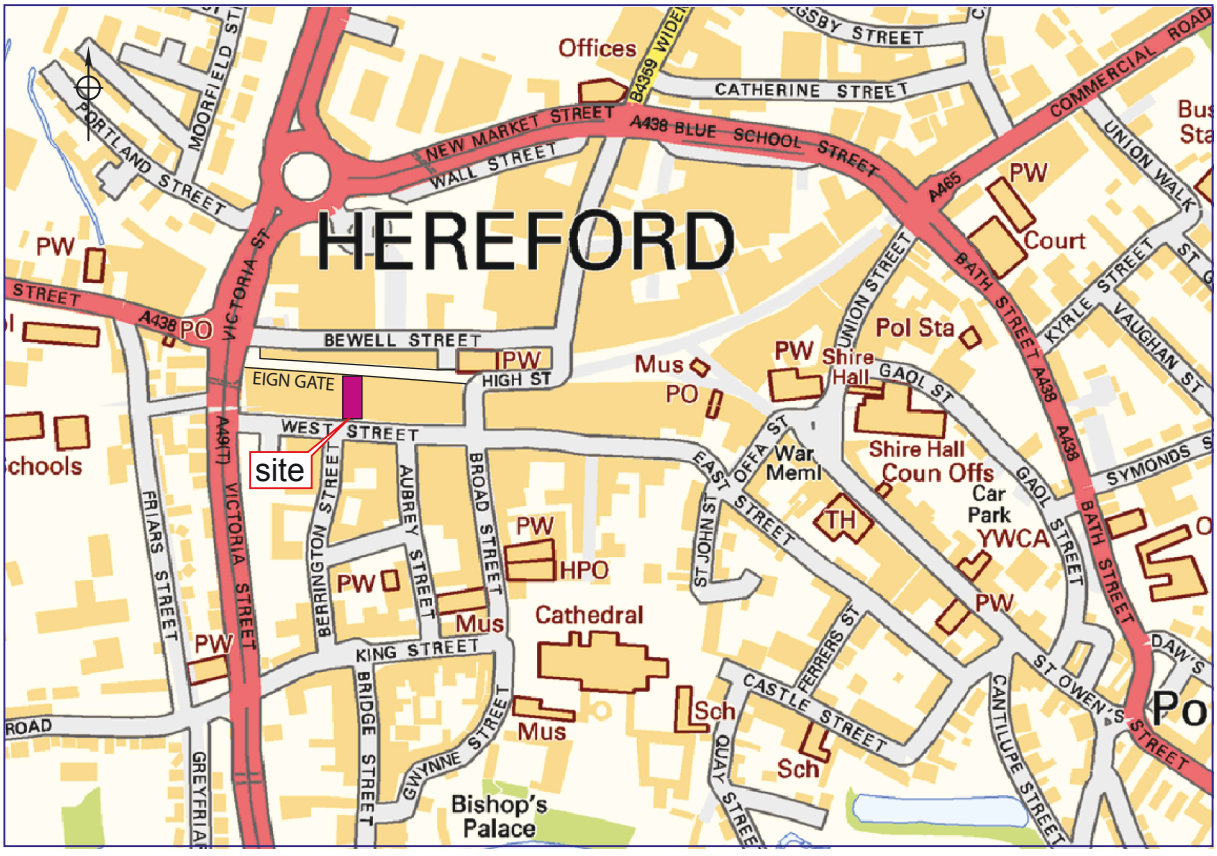
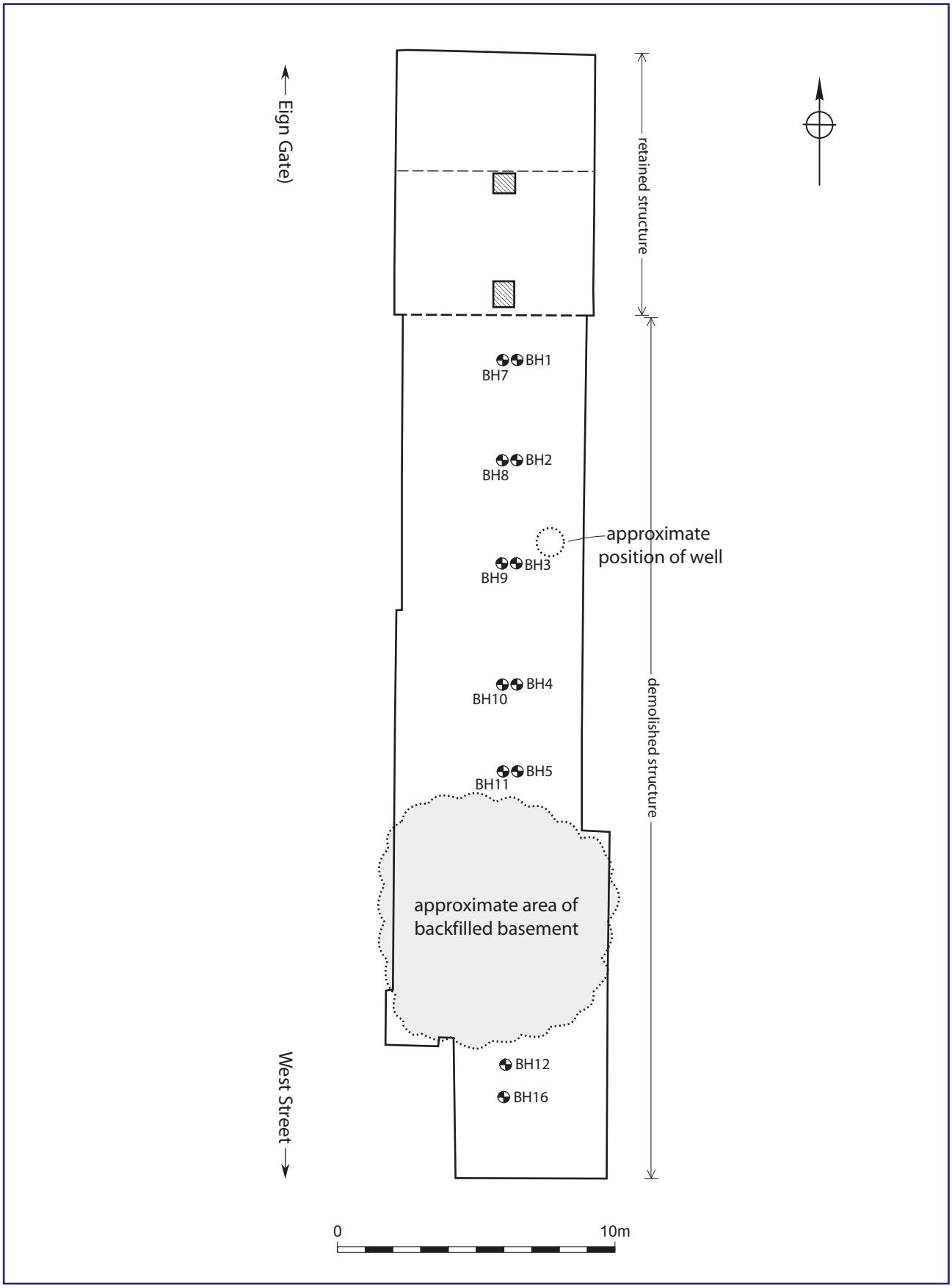
Figures



Location of the site *Figure 1*



Location of boreholes (based upon Integrale Ltd dwg 3898) *Figure 2*

Plates

Plate 1The site looking north

Plate 2 The percussive rig in use

Plate 3 The percussive rig in use

Appendix 1 Archaeological descriptions of boreholes

Borehole 7

Top of borehole height above ordinance datum – 55.90m AOD

Maximum depth: 3.70m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
701	Made ground/ overburden	Friable, mid brown, silty, fine to mid sand. Frequent rounded to angular pebbles and stones, occasional bone fragments, occasional charcoal and coal fragments and flecks and rare sherds of modern pottery i.e. flowerpot.	0.00m – 0.39m	55.90m OD – 55.51m OD
702	Made ground/ overburden	Friable, slightly pliable, light to mid reddish brown, silty, fine to mid sand. Occasional rounded to sub-angular pebbles (≤1.5cm), occasional charcoal and coal flecks and fragments, rare to occasional mortar flecks.	0.39m – 0.57m	55.51m OD – 55.33m OD
703	Made ground/ overburden	Pliable to friable, mid reddish brown, fine sandy silt. Occasional sandstone and CBM fragments and flecks, occasional rounded to sub-angular pebbles and stones (≤1cm) and rare to occasional charcoal flecks.	0.57m – 0.88m	55.33m OD – 55.02m OD
VOID			0.88m – 1.00m	55.02m OD – 54.90m OD
704	Disturbed upper fills/ overburden	Pliable, mid to dark reddish brown, mid to coarse sandy clayey silt. Occasional sub-rounded to sub-angular pebbles (≤1cm), occasional bone fragments, rare to occasional charcoal and coal flecks and fragments and rare sandstone fragments (~6cm).	1.00m – 1.36m	54.90m OD – 54.54m OD
705	Upper fill?	Mouldable, light reddish, pinkish grey, silty clay. Occasional to frequent sub-rounded to sub-angular pebbles and stones and occasional red clay lenses.	1.36m – 1.50m	54.54m OD – 54.40m OD
706	Fill?	Pliable, mid grey, clayey silt. Rare to occasional sub-rounded pebbles and rare degraded sandstone fragments.	1.50m – 1.58m	54.40m OD – 54.32m OD
707	Fill?	Mouldable, mid reddish grey, silty clay. Occasional charcoal flecks and fragments and occasional to rare rounded to sub-rounded pebbles and stone fragments.	1.58m – 1.68m	54.32m OD – 54.22m OD
708	Fill?	Mouldable, light pinkish grey silty clay. Rare mortar flecks, rare charcoal fragments and flecks and rare rounded pea gravel (≤0.5cm).	1.68m – 1.74m	54.22m OD – 54.16m OD
VOID			1.74m – 2.00m	54.16m OD – 53.90m OD
709	Fill?	Pliable, mid yellowish grey, coarse sandy silt. Occasional rounded to sub-angular sandstone fragments and pebbles (≤2cm), rare to occasional charcoal flecks and rare bone fragments.	2.00m – 2.10m	53.90m OD – 53.80m OD
710	Fill?	Pliable, mid to dark brownish grey, coarse sandy silt. Rare to occasional rounded to sub-rounded pebbles (≤1cm) and rare charcoal flecks.	2.10m – 2.23m	53.80m OD – 53.67m OD
711	Fill?	Friable to pliable, mid reddish brown, coarse silty sand. Frequent rounded pebbles and sandstone fragments and rare charcoal flecks.	2.23m – 2.33m	53.67m OD – 53.57m OD
712	Fill?	Mouldable mid to light greyish brown clay. Rare bone fragments, rare charcoal flecks and very rare rounded pebble (≤1cm).	2.33m – 2.48m	53.57m OD – 53.42m OD
713	Fill?	Pliable to friable, mid brown coarse sandy silt. Occasional to frequent stone fragments and pebbles (≤1cm), occasional bone fragments and occasional charcoal flecks.	2.48m – 2.51m	53.42m OD – 53.39m OD
VOID			2.51m –	53.39m OD –

Context	Classification	Description	Below ground surface depth	Height OD
			3.00m	52.90m OD
714	Fill?	Pliable to friable, mid brown, coarse sandy silt. Frequent angular to sub-rounded stones and pebbles (≤1cm) and rare charcoal	3.00m – 3.15m	52.90m OD – 52.75m OD
715	Fill	Mouldable, light brownish grey, clay. Rare sub-rounded pebbles, rare charcoal flecks and rare bone fragments. One bone fragment exhibited butchery marks, probably associated with skinning.	3.15m – 3.27m	52.75m OD – 52.63m OD
716	Fill	Pliable to friable, mid to dark brownish grey, fine sandy silt. Very rare charcoal.	3.27m – 3.40m	52.63m OD – 52.50m OD
717	Fill	Pliable to friable, dark blackish brown, fine sandy silt.	3.40m – 3.43m	52.50m OD – 52.47m OD
718	Fill	Pliable to friable, mid greyish brown, coarse sandy silt. Frequent sub-angular to rounded sandstone fragments and pebbles.	3.43m – 3.50m	52.47m OD – 52.40m OD
719	Colluvium/ ditch tumble	Friable, light yellow coarse sand. Frequent sub-angular to rounded pebbles, gravel and sandstone fragments and occasional red clayey lenses.	3.50m – 3.64m	52.40m OD – 52.26m OD
720	Reworked natural/basal fill	Pliable to friable, mid to dark reddish grey coarse sandy silt. Occasional to frequent rounded to sub-angular pebbles, gravel and sandstone fragments.	3.64m – 3.68m	52.26m OD – 52.22m OD
721	Natural	Loose to friable, mid orangish red, fine to coarse sandy clay and gravel. Frequent angular to sub-rounded gravel, pebbles and sandstone fragments	3.68m – 3.70m	52.22m OD – 52.20m OD

Borehole 8

Top of borehole height above ordinance datum – 55.87m AOD

Maximum depth: 3.46m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
801	Made ground/ overburden	Loose, mid to dark brown, mid to coarse sand. Frequent angular CBM, frequent angular to sub-rounded pebbles and stones (≤4cm) and occasional coal lumps.	0.00m – 0.19m	55.87m OD – 55.68m OD
802	Made ground/ overburden	Pliable, mid orangish brown, mid sandy silt. Frequent sub-angular to sub-rounded pebbles and stones, occasional to frequent CBM fragments and flecks, , occasional mortar flecks, occasional coal lumps, rare bone and clay pipe and rare red clay lenses.	0.19m – 1.16m	55.68m OD – 54.71m OD
803	Made ground/ overburden	Pliable, mid greyish brown sandy silt. Frequent angular to sub-rounded stones, pebbles and pea gravel and occasional CBM fragments.	1.16m – 1.45m	54.71m OD – 54.42m OD
804	Made ground/ overburden	Mouldable to pliable, mid to light brownish grey, sandy silty clay. Occasional sub-angular to rounded and rare to occasional charcoal and coal	1.45m – 1.73m	54.42m OD – 54.14m OD
VOID			1.73m – 2.00m	54.14m OD – 53.87m OD
805	Made ground/ overburden	Mouldable to pliable, mid to light brownish grey, sandy silty clay. Rare to occasional charcoal and coal	2.00m – 2.22m	53.87m OD – 53.65m OD
806	Disturbed upper fills	Pliable, dark grey, coarse sandy silt. Frequent sub-angular to rounded CBM and stone fragments and rare to occasional mortar and charcoal flecks	2.22m – 2.42m	53.65m OD – 53.45m OD

Context	Classification	Description	Below ground surface depth	Height OD
807	Fill	Pliable, dark brownish grey, fine clayey silt. Occasional charcoal flecks. Probably water-lain sediment.	2.42m – 2.55m	53.45m OD – 53.32m OD
808	Fill	Pliable, mid to light brownish grey fine clayey silt. Occasional charcoal flecks. Probably water-lain sediment.	2.55m – 2.60m	53.32m OD – 53.27m OD
809	Fill/ colluvium?	Loose to friable, mid orangish yellow, coarse to mid sand. Probably colluvial in origin, ditch side tumble?	2.60m – 2.61m	53.27m OD – 53.26m OD
810	Fill	Pliable, mid greyish brown, fine clayey silt. Occasional coarse sand lenses (colluvial?) and rare charcoal fleck. Probably water-lain sediment.	2.61m – 2.72m	53.26m OD – 53.15m OD
811	Fill/ colluvium?	Loose to friable, mid orangish yellow, coarse to mid sand. Probably colluvial in origin, ditch side tumble?	2.72m – 2.73m	53.15m OD – 53.14m OD
812	Fill	Pliable, dark greyish brown, fine clayey silt. Occasional coarse sand lenses (colluvial in origin?) and rare charcoal fleck. Probably water-lain sediment.	2.73m – 2.81m	53.14m OD – 53.06m OD
VOID			2.81m – 3.00m	53.06m OD – 52.87m OD
813	Fill	Friable to slightly pliable, mid to dark brown, fine silty sand. Rare charcoal and wood fragments and flecks.	3.00m – 3.11m	52.87m OD – 52.76m OD
814	Fill	Pliable, mid to dark blackish brown silt. Frequent dark greyish black charcoal lenses/banding and a solitary sub-angular sandstone fragment (1-2cm)	3.11m – 3.26m	52.76m OD – 52.61m OD
815	Fill	Friable to slightly pliable, mid to dark brownish grey fine silty sand. Frequent leather and occasional charcoal. Sand becomes coarser and more dominant towards the base of the deposit.	3.26m – 3.39m	52.61m OD – 52.48m OD
816	Natural	Loose to friable, mid orangish red, fine to coarse sandy clay and gravel. Frequent angular to sub-rounded gravel, pebbles and sandstone fragments.	3.39m – 3.46m	52.48m OD – 52.41m OD

Borehole 9

Top of borehole height above ordinance datum – 55.90m AOD

Maximum depth: 3.45m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
901	Made ground/ overburden	Loose/unconsolidated, light brown, coarse sand. Frequent angular to sub-rounded pebbles, stones and CBM fragments.	0.00m – 0.18m	55.90m OD – 55.72m OD
902	Made ground/ overburden	Loose, dark brown silty sand. Occasional angular to sub-angular pebbles, stone and CBM fragments and occasional mortar and charcoal flecks.	0.18m – 0.26m	55.72m OD – 55.64m OD
903	Made ground/ overburden	Very firm, orangish, pinkish white CBM and mortar lump	0.26m – 0.42m	55.64m OD – 55.48m OD
904	Made ground/ overburden	Pliable to firm, mid reddish brown, fine sandy silt. Frequent rounded to sub-angular pebbles and stones (<1cm – 4cm), occasional coal and charcoal flecks and rare mortar flecks.	0.42m – 0.96m	55.48m OD – 54.94m OD
VOID			0.96m – 1.00m	54.94m OD – 54.90m OD

Context	Classification	Description	Below ground surface depth	Height OD
905	Reworked/ disturbed archaeology/ fills?	Pliable, mid reddish brown, sandy clayey silt. Occasional to frequent charcoal flecks, occasional orangish pink clay lenses and rare shell fragments.	1.00m – 1.42m	54.90m OD – 54.48m OD
906	Reworked/ disturbed archaeology/ fills?	Mouldable, light to mid orangish pink, clay. Occasional rounded to sub-angular pebbles (~2cm)	1.42m – 1.45m	54.48m OD – 54.45m OD
907	Reworked/ disturbed archaeology/ fills?	Pliable, mid greyish brown, sandy clayey silt. Rare to occasional rounded to sub-angular pebbles and stone fragments and rare mortar and charcoal flecks.	1.45m – 1.63m	54.45m OD – 54.27m OD
VOID			1.63m – 2.00m	54.27m OD – 53.90m OD
908	Disturbed upper fills?	Friable to pliable, mid to dark reddish brown silty coarse sand. Frequent rounded to sub-rounded pebbles and occasional sandstone/mudstone fragments.	2.00m – 2.18m	53.90m OD – 53.72m OD
909	Disturbed upper fills?	Pliable to mouldable, light grey clayey silt. Occasional charcoal flecks and fragments, occasional lenses of fine sand and rare rounded to sub-rounded pebbles and pea gravel.	2.18m – 2.30m	53.72m OD – 53.60m OD
910	Disturbed upper fills?	Pliable, mid brownish grey, coarse sandy silt. Frequent rounded to sub-rounded pebbles and pea gravel.	2.30m – 2.40m	53.60m OD – 53.50m OD
911	Fill	Stiff pliable to mouldable light pinkish brown, clayey silt. Very rare charcoal flecks. Laminations present. Probably water-lain sediment.	2.40m – 2.70m	53.50m OD – 53.20m OD
912	Fill	Friable, mid yellowish brown, mid to coarse silty sand. Occasional coarse sand lenses (colluvial?) and rare charcoal flecks.	2.70m – 2.72m	53.20m OD – 53.18m OD
913	Fill	Friable, dark blackish brown, silty sand. Very, very frequent charcoal	2.72m – 2.73m	53.18m OD – 53.17m OD
914	Fill	Pliable, mid to dark brown silt. Rare charcoal flecks and rare fines sand lenses. Probably water-lain sediment.	2.73m – 2.77m	53.17m OD – 53.13m OD
VOID			2.77m – 3.00m	53.13m OD – 52.90m OD
915	Fill	Pliable, mid to dark brown clayey silt. Rare sub rounded pebbles and stones, rare charcoal flecks and very rare sandstone fragments.	3.00m – 3.37m	52.90m OD – 52.53m OD
916	Natural	Loose to friable, mid orangish red, fine to coarse sandy clay and gravel. Frequent angular to sub-rounded gravel, pebbles and sandstone fragments	3.37m – 3.45m	52.53m OD – 52.45m OD

Borehole 10

Top of borehole height above ordinance datum – 56.00m AOD

Maximum depth: 3.62m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
1001	Made ground/ overburden	Loose to friable, mid orangish brown mid to coarse sand. Frequent angular to rounded pebbles and stone fragments (<2cm).	0.00m – 0.32m	56.00m OD – 55.68m OD

Context	Classification	Description	Below ground surface depth	Height OD
1002	Made ground/ overburden	Stiff, pliable, mid brown, fine sandy silt. Frequent CBM, occasional charcoal and mortar flecks and fragments and occasional degraded sandstone fragments.	0.32m – 0.45m	55.68m OD – 55.55m OD
1003	Made ground/ overburden	Stiff, pliable, light reddish brown, fine sandy silt. Occasional charcoal and mortar flecks and fragments and occasional degraded sandstone fragments.	0.45m – 1.00m	55.55m OD – 55.00m OD
1004	Made ground/ overburden	Friable to pliable, mid reddish brown, coarse sandy silt. Frequent rounded pebbles and rare to occasional mortar charcoal and degraded sandstone flecks and fragments.	1.00m – 1.14m	55.00m OD – 54.86m OD
1005	Made ground/ overburden	Pliable, mid red, clayey silt. Occasional CBM fragments, occasional sub-angular to rounded pebbles and rare degraded sandstone fragments.	1.14m – 1.35m	54.86m OD – 54.65m OD
1006	Made ground/ overburden	Pliable, mid reddish brown, sandy silt. Occasional degraded sandstone fragments and occasional sub-angular pebbles.	1.35m – 1.56m	54.65m OD – 54.44m OD
1007	Made ground/ overburden	Firm and friable, light greenish, whitish cream, degraded sandstone fragments.	1.56m – 1.69m	54.44m OD – 54.31m OD
VOID			1.69m – 2.00m	54.31m OD – 54.00m OD
1008	Made ground/ overburden	Firm and friable, light greenish, whitish cream, degraded sandstone fragments.	2.00m – 2.14m	54.00m OD – 53.86m OD
1009	Disturbed upper fills?	Pliable, mid reddish brown, silt. Occasional degraded sandstone fragments, rare CBM and mortar fragments and flecks.	2.14m – 2.24m	53.86m OD – 53.76m OD
1010	Disturbed upper fills?	Pliable, mid brown, sandy silt. Occasional angular to sub-rounded pebbles, rare mortar, charcoal and CBM.	2.24m – 2.46m	53.76m OD – 53.54m OD
1011	Fill	Mouldable to pliable, light yellowish brown, silty clay. Rare sub-rounded pebbles, rare charcoal flecks. Probably water-lain sediment.	2.46m – 2.83m	53.54m OD – 53.17m OD
1012	Fill	Mouldable to pliable, light yellowish brown, fine sandy clay. Frequent angular to sub-rounded pebbles and stones. Probably water-lain sediment.	2.83m – 3.15m	53.17m OD – 52.85m OD
1013	Fill	Pliable, mid to dark greyish brown silt. Occasional sub-rounded pebbles. Probably water-lain sediment.	3.15m – 3.43m	52.85m OD – 52.57m OD
1014	Natural	Loose to friable, mid orangish red, fine to coarse sandy clay and gravel. Frequent angular to sub-rounded gravel, pebbles and sandstone fragments	3.43m – 3.62m	52.57m OD – 52.38m OD

Borehole 11

Top of borehole height above ordinance datum – 56.02m AOD

Maximum depth: 3.44m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
1101	Made ground/ overburden	Loose to friable, light yellowish grey, fine to coarse sand. Frequent angular to sub-angular pebbles and stone fragments.	0.00m – 0.21m	56.02m OD – 55.81m OD
1102	Made ground/ overburden	Friable to pliable, dark brown, mid sandy silt. Frequent angular to sub-rounded pebbles and stones, frequent charcoal and coal fragments and occasional degraded sandstone and mortar fragments	0.21m – 0.40m	55.81m OD – 55.62m OD

Context	Classification	Description	Below ground surface depth	Height OD
1103	Made ground/ overburden	Friable to pliable, mid reddish brown, mid sandy silt. Frequent angular to sub-rounded pebbles and stones, frequent charcoal and coal fragments and occasional degraded sandstone and mortar fragments	0.40m – 1.20m	55.62m OD – 54.82m OD
1104	Made ground/ overburden	Pliable, mid brownish red, clayey silt. Rare charcoal and mortar flecks.	1.20m – 1.30m	54.82m OD – 54.72m OD
1105	Made ground/ overburden	Firm to friable, light to mid greenish grey, degraded sandstone.	1.30m – 1.40m	54.72m OD – 54.62m OD
1106	Disturbed upper fills?	Pliable, mid brown, clayey sandy silt. Occasional angular to sub-rounded pebbles, occasional charcoal and coal flecks, rare CBM fragments and rare mortar flecks	1.40m – 1.54m	54.62m OD – 54.48m OD
VOID			1.54m – 2.00m	54.48m OD – 54.02m OD
1107	Disturbed upper fills?	Pliable, mid brown, clayey sandy silt. Occasional angular to sub-rounded pebbles, occasional charcoal and coal flecks, rare CBM fragments and rare mortar flecks	2.00m – 2.20m	54.02m OD – 53.82m OD
1108	Fill	Mouldable to pliable, light reddish brown, silty clay. Rare charcoal flecks. Probably water-lain sediment.	2.20m – 2.26m	53.82m OD – 53.76m OD
1109	Fill	Mouldable to pliable, mid brown, silty clay. Frequent dark charcoal mottles/staining and occasional animal bone fragments. Probably water-lain sediment.	2.26m – 2.36m	53.76m OD – 53.66m OD
1110	Fill	Firm, mouldable to pliable, light yellowish brown, silty clay. Very rare charcoal flecks. Probably water-lain sediment.	2.36m – 2.64m	53.66m OD – 53.38m OD
1111	Fill/ colluvium?	Friable, light yellow, coarse sand. Rare silty clay streaks. Probably colluvial in origin, ditch side tumble?	2.64m – 2.77m	53.38m OD – 53.25m OD
VOID			2.77m – 3.00m	53.25m OD – 53.02m OD
1112	Fill/ colluvium?	Friable, light yellow, coarse sand. Rare silty clay streaks. Probably colluvial in origin, ditch side tumble?	3.00m – 3.08m	53.02m OD – 52.94m OD
1113	Fill	Firm, pliable, light brown, clayey silt. Rare rounded pebbles.	3.08m – 3.24m	52.94m OD – 52.78m OD
1114	Fill	Firm, pliable, light brown, clayey silt. Frequent sandstone fragments and rare rounded pebbles.	3.24m – 3.28m	52.78m OD – 52.74m OD
1115	Natural	Loose to friable, mid orangish red, fine to coarse sandy clay and gravel. Frequent angular to sub-rounded gravel, pebbles and sandstone fragments	3.28m – 3.44m	52.74m OD – 52.58m OD

Borehole 12

Top of borehole height above ordinance datum – 56.11m AOD

Maximum depth: 3.37m

Main deposit description

Context	Classification	Description	Below ground surface depth	Height OD
1201	Made ground/ overburden	Loose to friable, light brown grey, mid to coarse silty sand. Frequent angular to sub-angular rounded pebbles and stone fragments and occasional to frequent CBM	0.00m – 0.24m	56.11m OD – 55.87m OD

Context	Classification	Description	Below ground surface depth	Height OD
		fragments.		
1202	Made ground/ overburden	Loose to friable, light grey brown, mid to coarse silty sand. Frequent CBM, modern drainpipe and mortar fragments and frequent angular to sub-rounded pebbles.	0.24m – 0.35m	55.87m OD – 55.76m OD
1203	Made ground/ overburden	Loose to friable, mid reddish brown, mid silty sand. Frequent CBM and mortar fragments and frequent angular to sub-rounded pebbles.	0.35m – 0.46m	55.76m OD – 55.65m OD
VOID			0.46m – 1.00m	55.65m OD – 55.11m OD
1204	Made ground/ overburden	Friable to pliable, mid brown, mid sandy silt, Frequent CBM, modern drainpipe and mortar fragments and frequent angular to sub-rounded pebbles.	1.00m – 1.34m	55.11m OD – 54.77m OD
VOID			1.34m – 2.00m	54.77m OD – 54.11m OD
1205	Made ground/ overburden	Friable to pliable, mid brown, mid sandy silt, Frequent CBM, modern drainpipe and mortar fragments and frequent angular to sub-rounded pebbles.	2.00m – 2.49m	54.11m OD – 53.62m OD
1206	Made ground/ overburden	Pliable, light grey brown, clayey silt. Frequent angular to sub-rounded pebbles and occasional CBM and mortar flecks and fragments.	2.49m – 2.60m	53.62m OD – 53.51m OD
1207	Made ground/ overburden	Firm, pliable, light reddish brown, clayey silt. Frequent degraded sandstone fragments and occasional sub-angular stones and cobbles (≤8cm).	2.60m – 2.76m	53.51m OD – 53.35m OD
1208	Made ground/ overburden	Friable, light orangish brown, fine to mid sand. Frequent greenish degraded sandstone fragments, occasional sub-rounded to angular pebbles (1cm) and stones (6cm).	2.76m – 2.90m	53.35m OD – 53.21m OD
VOID			2.90m – 3.00m	53.21m OD – 53.11m OD
1209	Made ground/ overburden	Friable, light orangish brown, fine to mid sand. Frequent greenish degraded sandstone fragments, occasional sub-rounded to angular pebbles (≤1cm) and stones (≤6cm).	3.00m – 3.11m	53.11m OD – 53.00m OD
1210	Made ground/ overburden	Firm, pliable, mid greyish brown, clayey silt. Rare CBM fragments and rare sub-rounded to sub-angular pebbles (≤1cm)	3.11m – 3.20m	53.00m OD – 52.91m OD
1211	Made ground/ overburden	Firm, pliable, mid reddish brown, clayey silt. Very frequent CBM fragments, occasional mortar and degraded sandstone	3.20m – 3.28m	52.91m OD – 52.83m OD
1212	Structural? Made ground/ overburden	Firm to friable, light to mid greenish grey, degraded sandstone.	3.28m – 3.37m	52.83m OD – 52.74m OD
REFUSAL				

Appendix 2 – Geoarchaeological descriptions of boreholes, by Nick Watson

BH 2

Depth (m)	Unit	Description
0.00-0.13		Void.
0.13-1.00	Unit 1	10YR3/2 very dark greyish brown silt clay with frequent medium to coarse sand sized mineral grains and frequent granular to pebble size charcoal, brick , mortar and rock fragments. Occasional cobble size brick fragment. Sharp boundary to:
1.00-1.40		Void.
1.40-2.00	Unit 1	as above
2.00-2.18		Void with some brick slump.
2.18-2.70	Unit 2	(= Unit 3 BH 5) 10YR3/1 very dark grey coarse sandy clay, compact and poorly sorted with frequent granular to pebble sized sub- to well rounded quartzite clasts. Occasional granular sized charcoal fragments and rare lens of reworked red mudstone (glaciofluvial gravels) (not dump, water laid?). Sharp boundary to:
2.70-3.00m	Unit 3	10YR3/1 very dark grey silt/clay, compact, with rare fine sand sized mineral grains. Rare rounded pebble sized rock clast.
3.00-3.56		Void
3.56-3.92	Unit 3	as above, with 50% black humic staining, faintly micaceous, and occasional granular size shell fragment. Sharp boundary to:
3.92-4.00	Unit 4	Rounded green coarse grained sandstone and green fine grained sandstone clasts. 5YR4/3 reddish brown silt/clay at base (glacial fluvial gravels).

BH 4

Depth (m)	Unit	Description
0.00-0.10		Void
0.01-0.5	Unit 1	7.5YR4/3 brown coarse sand with frequent rounded granular to pebble sized rock fragments. (Made ground). Sharp boundary to:
0.5-1.00	Unit 2	10YR3/3 dark brown silt/clay with frequent coarse sand sized mineral grains and frequent granular to pebble sized mortar, rock and charcoal fragments. Rare brick and cobble size rock fragments. (Made ground).
1.00-1.26		Void
1.26-1.80	Unit 3	10YR3/3 dark brown silt/clay with occasional coarse sand sized mineral grains, frequent reworked granular to pebble sized mudstone inclusions, and occasional granular-size charcoal fragments and pebble sized rounded rock clasts. Sharp boundary to:
1.8-2.00	Unit 4	Green micaceous sandstone clast fills the core.
2.00-2.33		Void
2.33-2.59m	Unit 5	10YR4/3 brown silt/clay, compact, frequent coarse sand sized mineral grains and granular sized charcoal fragments. Frequent red mudstone inclusions. Occasional large pebble sized clasts

		of green sandstone. Sharp boundary to:
2.59-3.00	Unit 6	10YR4/2 dark greyish brown silt/clay with occasional increasing to frequent fine sand sized mineral grains at the base. Rare orange mottles. Rare granular size charcoal fragments and pebble sized rock clasts.
3.00-3.60		Void
3.60-3.65		Slump
3.65-3.90	Unit 7	10YR3/2 very dark greyish brown silt/clay with occasional granular-size shell fragments. Sharp boundary to:
3.90-4.00	Unit 8	5YR3/3 dark reddish brown fine sandy clay with frequent rounded pebble sized rock clasts (glacial fluvial gravels).

BH 5

Depth (m)	Unit	Description
0.00-0.15	Unit 1	Brick and mortar.
0.15-1.00	Unit 2	10YR3/3 dark brown silt/clay with frequent coarse sand sized mineral grains and frequent granular to pebble sized mortar, rock and charcoal fragments. Occasional granular size brick fragments. Cobble size rock fragments. (mixed in unit are redeposited fluvioglacial clays and gravels)
1.00-1.23		Void.
1.23-2.00	Unit 2	continued from above with occasional cobble sized green sandstone fragments.
2.00-2.26		Void.
2.26-2.50	Unit 3	(= Unit 2 BH2) 10YR3/2 very dark greyish brown silt/clay, compact, with frequent coarse sand sized mineral grains and granular charcoal and mudstone fragments. Rare granular sized rounded brick fragments. Occasional rounded pebble sized rock clasts and rare reworked rounded mudstone clast. Sharp boundary to:
2.50-2.80	Unit 4	10YR4/2 dark greyish brown silt/clay, compact, occasional coarse sand sized mineral grains and granular sized charcoal and rock fragments. Rare rounded pebble sized rock clasts, reworked fluvial glacial gravel), and one eroded bone fragment. Sharp boundary to:
2.80-2.98	Unit 5	10YR4/2 dark greyish brown silt/clay, compact, with rare orange mottles.
3.00-4.00		Core missing.
4.00-4.08		Void.
4.08-4.15	Unit 7	10YR4/2 dark greyish brown sandy clay. (glaciofluvial sands) Sharp boundary to:
4.15-4.20	Unit 8	10YR4/2 dark greyish brown silt/clay with occasional fine sand sized mineral grains. (glacial fluvial sands) Sharp boundary to:
4.20-5.00	Unit 9	2.5YR4/3 reddish brown, loose, sandy gravel of rounded small pebble sized rock clasts. (glaciofluvial gravels: reworked Raglan formation mudstones?).

Appendix 3 – Radiocarbon dating (SUERC)

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East Kilbride, Glasgow G75 0QF, Scotland, UK
Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

26 August 2011

Laboratory Code	SUERC-35596 (GU-24599)
Submitter	Nick Daffern Worcestershire Historic Environment & Archaeology Service c\o University of Worcester Henwick Grove Worcester. WR2 6AJ
Site Reference	31 Eign Gate, Hereford
Sample Reference	P3638/BH8/305-308/Salix
Material	Wood : Salix sp
$\delta^{13}C$ relative to VPDB	-28.9 ‰
Radiocarbon Age BP	890 ± 30

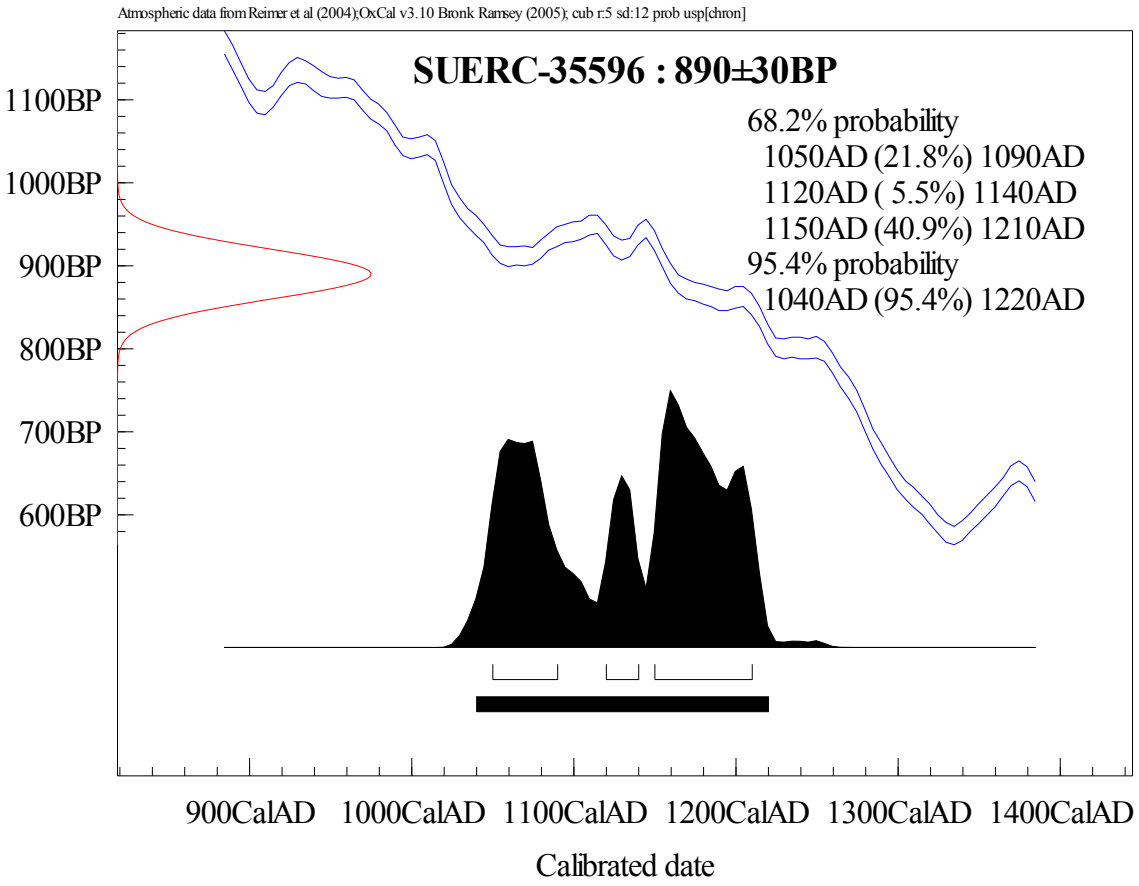
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

26 August 2011

Laboratory Code	SUERC-35597 (GU-24600)
Submitter	Nick Daffern Worcestershire Historic Environment & Archaeology Service c\o University of Worcester Henwick Grove Worcester. WR2 6AJ
Site Reference	31 Eign Gate, Hereford
Sample Reference	P3638/BH8/332-334/Leather
Material	Leather
$\delta^{13}C$ relative to VPDB	-26.7 ‰
$\delta^{15}N$ relative to air	7.0 ‰
Radiocarbon Age BP	920 ± 30

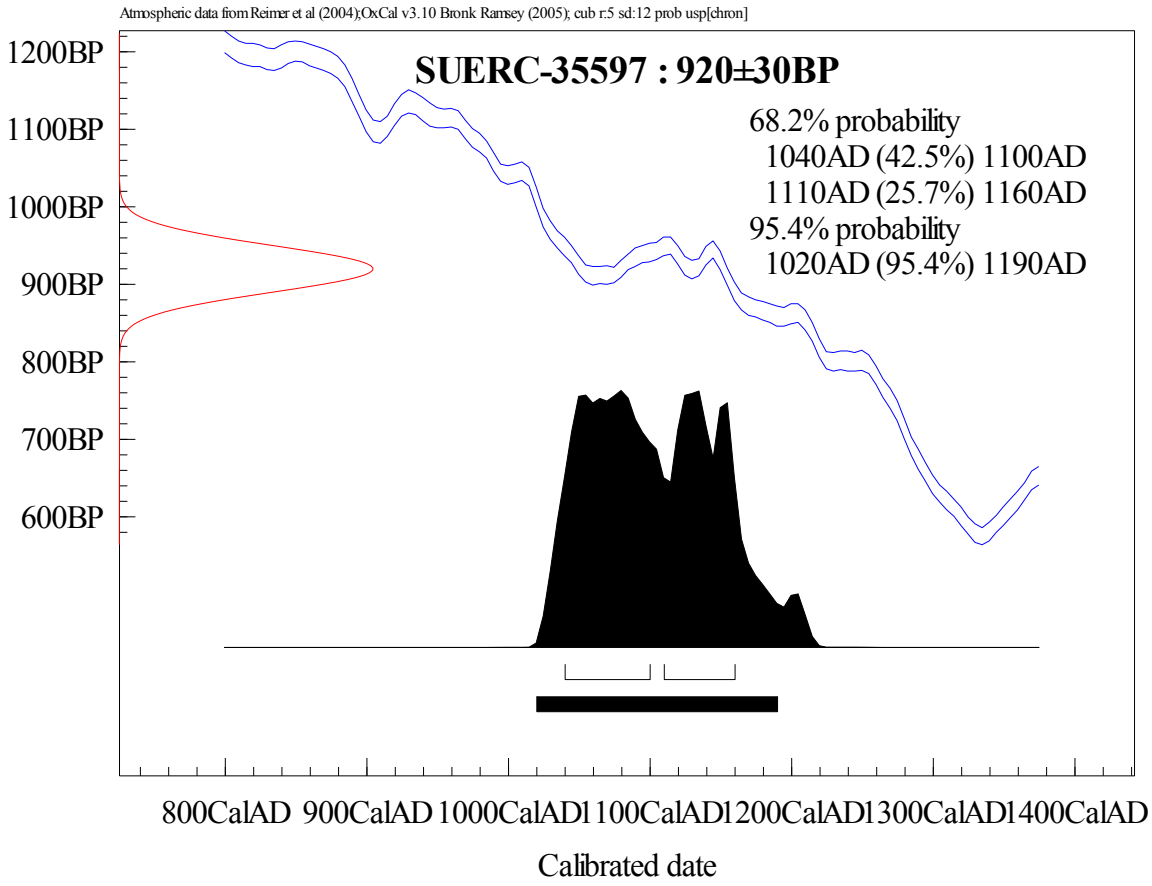
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

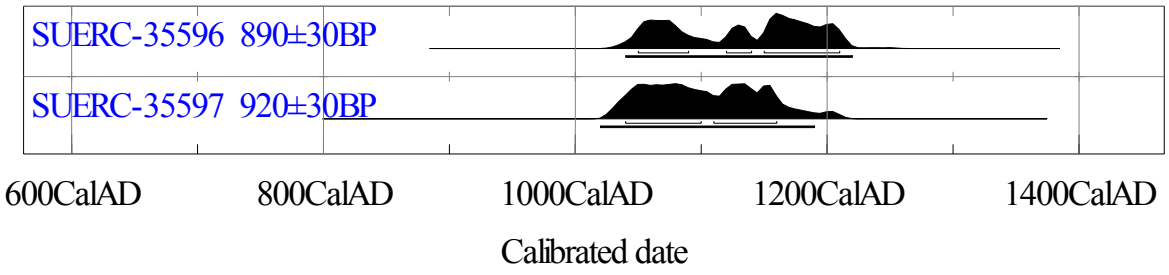
Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



Atmospheric data from Reimer et al (2004);OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]



Appendix 4 - Pollen processing methodology (Tim Mighall, Department of Geography and Environment, University of Aberdeen)

ABSOLUTE POLLEN ANALYSIS: PREPARATION SCHEDULE

PRECAUTIONARY NOTES: All procedures, up to stage 25, should take place in the fume cupboard. Read precautionary notices on fume cupboard before starting. Ascertain whereabouts of First Aid equipment NOW. Please wear laboratory coat, gloves and goggles when dealing with all chemicals. Please organize fume cupboard carefully to maximize workspace. Use the containment trays provided. Always keep the fume cupboard door down as far as practically possible. Make sure the fume cupboard is switched on and functioning correctly.

A) SOLUTION OF HUMIC COMPOUNDS

1) Switch on hotplate to heat water bath. Prepare 12 to 16 samples concurrently.

HCl. is an irritant and can cause burns. Wear gloves. Wash with water if spilt on your skin.

Using a clean spatula, place a known volume or weight of sediment (c. 2cm^3) and one spore tablet in each 50ml centrifuge tube. Add a few cm^3 of distilled water (enough to cover the pellet and tablets) and a few drops of 2M HCl. Wait until effervescence ceases, then half fill tubes with 10% KOH; place in a boiling water bath for 15 minutes. Stir to break up sediment with clean glass rod. Return HCl and KOH bottles to the chemical cabinet.

2) Centrifuge at 3,000 rpm for 5-6 minutes, ensuring first that tubes are filled to the same level. This applies throughout the schedule (Mark 7 on centrifuge).

3) Carefully decant, i.e. pour away liquid from tube, retaining residue. Do it in one smooth action.

4) Disturb pellet using vortex mixer; add distilled water, centrifuge and decant.

5) Using a little distilled water, wash residue through a fine (180 micron) sieve sitting in filter funnel over a beaker. NB Be especially careful in keeping sieves, beakers and all tubes in correct number order. Wash residue on sieve mesh into petri dish and label the lid. If beaker contains mineral material, stir contents, wait four seconds, then decant into clean beaker, leaving larger mineral particles behind. Repeat if necessary. Clean centrifuge tube and refill with contents of beaker.

6) Centrifuge the tubes and decant.

B) HYDROFLUORIC ACID DIGESTION

***(Only required** if mineral material clearly still present. Otherwise, go to stage 13)*

NB Hydrofluoric acid is extremely corrosive and toxic; it can cause serious harm on contact with eyes and skin. Rubber gloves and mask/ goggles MUST be worn up to and including stage 11. Please fill sink with H_20; have $CaCo_3$ gel tablets ready. Place pollen tube rack into tray filled with sodium bicarbonate.

7) Disturb pellet with vortex mixer. Add one cm^3 of 2M HCl.

8) With the fume cupboard sash lowered between face and sample tubes, very carefully one-third fill tubes with concentrated HF (40%). Place tubes in water bath and simmer for 20 minutes.

9) Remove tubes from water bath, centrifuge and decant down fume cupboard sink, flushing copiously with water.

10) Add 8cm^3 2H HCl to each tube. Place in water bath for 5 minutes. Do not boil HCl.

11) Remove tubes, centrifuge while still hot, and decant.

12) Disturb pellet, add distilled water, centrifuge and decant.

C) ACETYLATION

NB Acetic acid is highly corrosive and harmful on contact with skin. Wash with H_20 if spilt on skin.

13) Disturb pellet, add 10cm^3 glacial acetic acid, and centrifuge. Decant into fume cupboard sink with

water running during and after.

14) Acetic Anhydride is anhydrous. Avoid contact with water. The acetylation mixture can cause severe burns if spilt on skin. Wash with water.

15) Make up 60cm^3 of acetylation mixture, just before it is required. Using a measuring cylinder; mix acetic anhydride and concentrated sulphuric acid in proportions 9:1 by volume. Measure out 54cm^3 acetic anhydride first, then add (dropwise) 6cm^3 concentrated H_2S0_4 carefully, stirring to prevent heat build—up. Stir again just before adding mixture to each tube.

Disturb pellet; then add 7cm^3 of the mixture to each sample.

16) Put in boiling water bath for 1-2 minutes. (Stirring is unnecessary—never leave glass rods in tubes as steam condenses on the rods and runs down into the mixture reacting violently). One minute is usually adequate; longer acetylation makes grains opaque. Switch off hot plate.

17) Centrifuge and decant all tubes into large (1,000ml) beaker of water in fume cupboard. Decant contents of beaker down fume cupboard sink.

18) Disturb pellet, add 10cm^3 glacial acetic acid, centrifuge and decant.

19) Disturb pellet, add distilled water and a few drops of 95% ethanol centrifuge and decant carefully.

D) DEHYDRATION, EXTRACTION AND MOUNTING IN SILICONE FLUID

20) Disturb pellet; add 10cm^3 95% ethanol, centrifuge and decant.

21) Disturb pellet; add 10cm^3 ethanol (Absolute alcohol), centrifuge and decant. Repeat.

22) Toluene is an irritant. Avoid fumes.

Disturb pellet; add about 8cm^3 toluene, centrifuge and decant carefully into 'WASTE TOLUENE' beaker in fume cupboard (leave beaker contents to evaporate overnight).

23) Disturb pellet; then using as little toluene as possible, pour into labelled specimen tube.

24) Add a few drops of silicone fluid - enough to cover sediment.

25) Leave in fume cupboard overnight, uncorked, with fan switched on. Write a note on the fume cupboard *'Leave fan on overnight - toluene evaporation',* and date it. Collect specimen tubes next morning and cork them. Turn off fan.

26) Using a cocktail stick, stir Contents and transfer one drop of material onto a clean glass slide and cover with a cover slip (22mm x 22mm). Label the slide.

27) Wash and clean everything you have used. Wipe down the fume cupboard worktop. Remove water bath from fume cupboard if not needed by the next user. Refill bottles and replace them in chemical cabinets.