BOREHOLE ENVIRONMENTAL ASSESSMENT AT LONGNEY ORCHARD, GLOUCESTERSHIRE

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1 Introduction

An assessment of potential for palaeoenvironment analysis was carried out at Longney Orchard, Gloucestershire (centred on NGR SO 75351 13737; Fig 1) on behalf of Gloucestershire Orchard Trust (GOT). The work was undertaken in response to a request from the Trust to provide historical context for the Longney Orchard site as part of the *Three Counties Traditional Orchard Project*, funded by the Heritage Lottery Fund. The project aims to train volunteers in practical orchard skills, to restore and revitalise under-used or unmanaged orchards in key orchard areas (GOT 2017), and included the opportunity to investigate the archaeological evidence for earlier land use.

2 Archaeological background

The site is located on Tidal Flat Deposits – clay, silt and sand, overlying Blue Lias Formation – Mudstone and limestone, interbedded (British Geological Survey 2017), and in an area where land reclamation has been widespread. The Longney flood defence banks and those of Elmore to the north (the Great Wall) are part of a series of phases of land reclamation along the River Severn (Crowther and Dickson 2008, 201–9). Allen and Fulford (1990) have suggested that the Great Wall was a Romano-British flood defence, protecting Roman land reclamation east of the wall, whilst Morgan and Smith (1972) mention a medieval wall or flood bank. However, an archaeological evaluation on part of the flood bank that extends through Longney Orchard (Deeks and Crawford 2004) found artefactual dating of 18th century date, which was consistent with a desk-based assessment (Miller 2004) which concluded that this area of the bank predated the 1780s. The bank produced no evidence predating this period, although it was thought that earlier earthworks could exist which were too deeply buried to be observed during the evaluation.

A small part of the orchard alongside the Bollow Rhyne (drainage ditch; see below) lies on the reclaimed land on the landward side of a flood bank thought to have been existence by 1815 (Miller 2004) but also approximately on a north-south alignment with a location where Romano-British pottery and other artefacts have been found (Allen and Fulford 1990; Fig 1). The majority of the site lies between the modern flood bank/sea wall constructed in 1961, which incorporates short sections of flood bank built between 1815 and 1884 (Miller 2004), and the main stretch of the earlier bank (Fig 1).

3 Aims and objectives

The aims of this assessment were to provide information on the sediment build-up beneath the site, including that resulting from the building of the flood bank and determine the suitability of the site to investigate past landscape change. A principal focus of study was land use and, specifically, whether prolonged orchard use could be demonstrated by a significant presence of Rosaceae pollen (deriving from apple, pear and plum/cherry species) in the upper part of the pollen profile.

Given that substantial flood banks extended through the orchard there was the opportunity to tie results into the sequence of flood bank construction, for instance with the eastern end of the orchard being on land thought to have been originally reclaimed in the Roman period.

4 Methods

Assessment of alluvial sediments was undertaken to determine the sequence of build-up of earlier deposits and this was accompanied by pollen analysis to test the potential for providing information on local landscape change. Radiocarbon dating was carried out with aim of providing a dating framework for the depositional/pollen sequence. It is difficult to provide detailed information on orchard tree species using pollen analysis (as many of these can only be identified to genus or family level) and so consequently, it was thought that the only indication of the development of the early orchard in the sedimentary sequence was likely to be a significant increase in Rosaceae pollen.

4.1 Sampling policy

Samples were taken according to standard Worcestershire Archaeology practice (2012). A total of seven windowless boreholes were mechanically drilled by Geospek Ltd, spaced in order to investigate change from east to west across the site, and to either side of the old flood bank (Fig 2; ie both inside and outside the flood bank). Eight boreholes had been originally planned, but, owing to time constraints on site during fieldwork, the seven best locations were sampled.

A total of six out of the seven boreholes were opened and basic sediment descriptions made in order to determine coarse changes in riverine deposits (Fig 3). Borehole 3 was not recorded owing to time constraints and because the sequence appeared to be very similar to Borehole 4.

Visual assessment suggested that boreholes 1 and 8 along the line of the old flood bank appeared to have the most potential for survival of pollen remains, and hence sampling for pollen sampling and radiocarbon dating was concentrated on these two boreholes. A total of seven sub-samples were taken from Borehole 1, and three from Borehole 8.

Three samples were taken for radiocarbon dating from Borehole (BH)1 and one from the base of Borehole 8 (Section 7).

4.2 Discard policy

Remaining sample material (borehole deposits) will be discarded after a period of 3 months following submission of this report unless there is a specific request to retain them

5 Project parameters

The environmental project conforms to guidance on the practice of environmental archaeology (AEA 1995; English Heritage 2011).

6 Borehole descriptions

The sediments sampled by the borehole survey are deposit modelled in Figure 3. The individual layers recorded for each borehole have been defined as the six deposits described in Table 1, with voids and contamination or tumble shown on the diagram. The original borehole record sheets are retained in archive.

Deposit number	Description	Top of deposit (m BGS)	Top of deposit (m AOD)
1	Topsoil: Dark grey-brown sandy, silty clay	0m	7.9–8.29m
2	Alluvium1: yellowish grey-brown compact but slightly friable silty clay	0.17-0.39m	7.68m-8.60m
3	Alluvium2: grey with orange-brown mottles stiff, compact clay. Possibly some organics	2.20m-3.58m	5.24m-6.57m
4	Alluvium3: Lenses of grey/dark brown firm silty clay. Slightly organic and more silty than Deposit 2. Possibly represents more than one episode of deposition	1.00m, 2.00m, and 3.80m	5.02, 5.97 and 7.64m
5	Alluvium4: Light grey/buff soft, plastic clay	4.26m	4.38m
6	Alluvium 5: Dark grey compact, firm clay. Charcoal flecks in BH 1	1.95m-4.91m,	3.73-6.34m
7	Void		
8	Contamination/tumble		

Table 1: Deposits recorded in boreholes: BGS = below Ground level; AOD = Above Ordnance Datum

Bands of grey/dark alluvium (Deposit 4/Alluvium 3) were seen in BH1 and 8, which were sampled for pollen and radiocarbon dating (Fig 3).

The ground surface was relatively level, varying by only 0.39m (7.9 – 8.29m AOD), but there was great variation in depths to which the boreholes could be sunk. Borehole BH1 (adjacent to the flood bank known to have existed by 1815, on the seaward side) reached the greatest depth at 4.91m bgs, whilst BH7 in the same relative position to the bank to the north was relatively shallow, reaching only 2m, where the top of a firm grey/brown silty clay (deposit ?6) was encountered and coring returned no further sediment. The majority of the boreholes reached around 4m bgs. These depths, and that of BH1 at 4.91m depth bgs, correspond well with a core of 5m depth sampled by A G Brown (1982) south of Longney village at (SO 766 116), except that here 3.5m of wood peat was encountered.

Interpretation

It is suggested that Deposit 5 (Alluvium 4) found at 4.26m below ground level (4.38m AOD) only in BH1 at Longney may correspond to the Upper Wentlooge Formation deposits, which are thick, pale green silty clays with no peat which formed between the Bronze Age and Romano-British period (Crowther and Dickson 2008). Below this, Middle Wentlooge Formation deposits would be expected which would correspond to thick intertidal silt, sandwiched between layers of peat, which have been recorded between Elmore and Slimbridge, but, at Longney Orchard, no peat was present. However, the Wentlooge deposits have been truncated in many places as a result of land reclamation and farming (Crowther and Dickson 2008), and so their absence here may reflect later disturbance. Deposit 6 found at the base of BH1, BH7 and BH8 may correspond to Lower Wentlooge deposits.

In the absence of suitable radiocarbon dating results (see below) and low levels of pollen (see below), it is difficult to accurately determine the dating for the sampled sequences. Moreover, detailed geoarchaeological descriptions of sediments were outside the scope of this assessment, and hence the interpretations here remain tentative. Voids and contamination or tumble were recorded in more than one borehole and are common in sampling of this type. The reason for these is unknown, but may include weak points at levels where there has been historic cracking and drying of sediments

7 Pollen analysis (Nick Daffern)

7.1 Circumstances of the project

Pollen assessment was undertaken to determine the state of preservation, type, and quantity of remains recovered from the samples and information provided, and in order to assess the importance of the pollen remains

7.2 Methodology

The methodology for a scheme of sub-sampling and pollen assessment was developed in consultation with the Senior Environmental Archaeologist (Worcestershire Archive & Archaeology Service; WAAS), and conforms to the guidelines and standards laid down in the following documents: AEA 1995; English Heritage 2005; 2011; Historic England 2015.

Sampling policy and monolith information

Two borehole sequences, BH1 and BH8 were selected from the eight locations targeted for window borehole sampling. These sequences and the subsequent sub-sampling locations were determined by discussion between the Senior Environmental Archaeologist (WAAS) and the author during assessment of the cores.

Ten sub-samples (seven from BH1 and three from BH8) for pollen assessment were taken from greyish brown to brown, silty clay and clay deposits, interpreted as estuarine alluvium which were identified to have potential for the preservation of palaeoenvironmental preservation. The location of these sub-samples as regards depth below ground surface (bgs) and height above ordnance datum (m AOD), are presented in Tables 2 and 3.

Depth below ground surface (bgs)	Height (m AOD)
2.45m	6.19m
2.55m	6.09m
3.33m	5.31m
3.43m	5.21m
3.54m	5.10m
3.58m	5.06m
3.68m	4.96m

Table 2 Borehole 1 pollen sub-sample locations

Depth below ground surface (bgs)	Height (m AOD)
2.03m	5.97m
2.57m	5.43m
2.99m	5.01m

Table 3 Borehole 8 pollen sub-sample locations

Processing and assessment

Ten pollen sub-samples measuring $2cm^3$ were taken by the Senior Environmental Archaeologist (WAAS) from selected locations identified as of interest in consultation with the palynologist for the project. Sub-samples were selected based upon their stratigraphic location in the sequence and their ability to complement the archaeological assessment. The sub-samples were submitted to the laboratories of the Department of Geography & Environment at the University of Aberdeen for chemical preparation following standard procedures, including acetolysis and hydrofluoric acid digestion, as described by Barber (1976) and Moore *et al* (1991).

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 pollen reference slides and the pollen reference manual by Moore *et al* (1991). Nomenclature for pollen will follow Stace (2010) and Bennett (1994).

Fungal spores and parasite ova were noted and rapid identification was undertaken to genus level. Identification was aided through reference material and reference manuals (Kirk *et al* 2008; Grant-Smith 2000).

7.3 Pollen assessment

The results of the pollen assessment are summarised in Tables 4 and 5.

Depth (bgs)	Depth (m AOD)	Pollen Present	Pollen abundance	Pollen Preservation	Observed taxa
2.45m	6.19m	Yes	Low	Poor	Caryophyllaceae, *Filipendula*, *Pinus sylvestris*, *Plantago lanceolata*, **Poaceae** Non-pollen palynomorphs (NPP): *Polypodium*, *Pteridium aquilinum*,

Depth (bgs)	Depth (m AOD)	Pollen Present	Pollen abundance	Pollen Preservation	Observed taxa
					Pteropsida (mono) indet,
2.55m	6.09m	Yes	Low	Poor	Caryophyllaceae, *Calluna vulgaris*, *Corylus avellana*-type, *Filipendula*, *Pinus sylvestris*, *Plantago lanceolata*, *Plantago major*, **Poaceae**, *Salix*, *Urtica dioica* NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet, *Selaginella selaginoides*
3.33m	5.31m	Yes	Low	Poor	*Alnus glutinosa*, *cf. Centaurea cyanus*, *Pinus sylvestris*, *Plantago lanceolata*, **Poaceae**, *Quercus, Salix*, *Urtica dioica* NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet
3.43m	5.21m	Yes	Mod	Poor	*Alnus glutinosa*, *Cerealia* indet*, Corylus avellana*-type, Cyperaceae, *Filipendula*, *Plantago lanceolata*, **Poaceae**, *Quercus, Rumex obtusifolius*, *Urtica dioica* NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet
3.54m	5.10m	Yes	Mod	Poor	*Alnus glutinosa*, *Calluna vulgaris*, *Corylus avellana*-type, Cyperaceae, *Plantago lanceolata*, **Poaceae**, *Tilia*, *Urtica dioica* NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet
3.58m	5.06m	Yes	Low	Poor	*Alnus glutinosa*, *Betula*, **Poaceae** NPP: *Dryopteris filix-mas*-type, *Equisetum*, *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet
3.68m	4.96m	Yes	Low	Poor	*Alnus glutinosa*, *Calluna vulgaris*, **Poaceae** NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet

Table 4 Summary of the pollen assessment from Borehole 1 (Taxa or groups in BOLD are dominant in the sample)

Depth (bgs)	Depth (m AOD)	Pollen Present	Pollen abundance	Pollen Preservation	Observed taxa
2.03m	5.97m	No	No	N/A	
2.57m	5.43m	Yes	Moderate	Good	*Alnus glutinosa*, *Betula*, *Calluna vulgaris*, Caryophyllaceae, *Cerealia* indet, Chenopodioideae, *Cichorium intybus*-type, *Corylus avellana*-type, *Mentha*-type, *Plantago lanceolata*, **Poaceae**, *Quercus, Ranunculus acris-type, Rumex obtusifolius*, *Salix*, *Ulmus* NPP: *Polypodium*, *Pteridium aquilinum*, *Pteropsida* (mono) indet
2.99m	5.01m	Yes	Moderate	Good	*Alnus glutinosa*, *Cichorium intybus*-type, *Plantago lanceolata*, **Poaceae** NPP: *Polypodium*, *Pteropsida* (mono) indet

Table 5 Summary of the pollen assessment from Borehole 8 (Taxa or groups in BOLD are dominant in the sample)

Preservation and abundance

Pollen was present in all but one of the sub-samples (BH8: 2.03m), but, with the exceptions of four sub-samples (BH1: 3.43m, BH1: 3.54m, BH8: 2.57m, and BH8: 2.99m) pollen preservation and abundance throughout the sequence was ‘low’ and also ‘poor’, with only one sub-sample (BH1: 3.54m) being successfully assessed to 150 TLP grains. The remainder of the sequence was characterised by the frequent presence of grains exhibiting extensive corrosion, degradation and mechanical damage (*sensu* Delcourt and Delcourt 1980).

The presence of grains exhibiting traits of oxidation, degradation and transportation (ie thinning, etching, pitting and/or perforation of the exine (outer wall of the pollen grain) or grains being broken or crumpled) is unsurprising given the littoral context of the deposits. In this zone, sediments and pollen grains would be readily reworked and exposed to aerobic conditions due to tidal action. In addition, the burial environment would be subject to chemical and hydrological variations through time, which may also negatively impact on the preservation of grains. Holloway (1989) and Campbell (1994) have identified that repeated wet-dry cycles in the burial environment will have a significant impact upon the preservation of grains within sediment; the latter particularly notes the influence of desalination of sediments.

7.4 Discussion

Due to the ‘low’ abundance and the inability to complete an assessment count of 150 grains TLP on the majority of the sub-samples, very little regarding the chronology of the sequences or the vegetational history of the landscape could be garnered. The domination of grasses throughout may, however, be real, and indicative of an open floodplain and/or disturbed grassland landscape which would not be unexpected given the lesser presence of other herbaceous species, although it may also be representative of preferential preservation of grains with greater resistance to deterioration. It is likely that a combination of these is true, with the statistical dominance of grasses being both a real vegetational trend and also a product of taphonomy.

The contribution of tree and shrub species was limited throughout the sequences and the majority of that identified (hazel, willow, alder) probably represents damp scrub within the floodplain, bankside vegetation, or land divisions such as hedgerows. It is likely that the more established, long-lived species such as oak, elm, lime and Scots pine represent components of distant, established woodland.

Evidence of cultivation was limited although several indeterminate cereal grains were present in both sequences, although caution should be advised due to the crossover between the wild and cultivated grass species (ie pollen within the *Hordeum* group may as easily derive from the non-cultivar *Glyceria* (sweetgrasses) as the cultivated *Hordeum vulgare* (barley)).

No species diagnostic of period were identified during the assessment, although the extensively cleared landscape, the presence of species indicative of open, disturbed ground and the tentative identification of cultivars and archaeophytes (species introduced in ancient times) clearly place the sampled sequences in later prehistory (or later).

7.5 Recommendations

Given the likely post-depositional impacts on the preservation of the sequence and in the absence of indicator species that would be useful in determining the chronology of the sequences or the vegetational history of the landscape, no further palynological work is recommended on the sub-samples or these sequences.

8 Radiocarbon dating

Organic content in the boreholes appeared visually too low to yield identifiable plant macrofossil remains, but it was considered that dating of humin and humic acid fractions of the silty clay may possibly yield results. On this basis the following samples were, therefore, submitted to SUERC (Scottish Universities Environmental Research Centre, Glasgow) for radiocarbon dating:

Laboratory code	Context number	Depth (m bgs)	Depth (m AOD)	Material	Species	Result
SUERC (GU45206)	BH1 (7)	3.52m	5.12m	Sediment (humic acid)	N/A	Failed: Insufficient carbon
SUERC (GU45207)	BH1 (7)	3.52m	5.12m	Sediment (humin)	N/A	Failed: Insufficient carbon
SUERC (GU45208)	BH1 (3)	3.85m	4.79m	Mollusc	*Discus rotundatus*	Failed: Insufficient carbon
SUERC (GU42509)	BH1 (9)	4.95m	3.69m	Sediment (humic acid)	N/A	Failed: Insufficient carbon
SUERC (GU42510)	BH1 (9)	4.95m	3.69m	Sediment (humin)	N/A	Failed: Insufficient carbon
SUERC (42511)	BH8 (5)	2.95m	5.01m	Sediment (humic acid)	N/A	Failed: Insufficient carbon

Table 6: Radiocarbon dating results; NB Context numbers refer to contexts described for individual boreholes; for locations on boreholes see Figure 3

None of the samples provided a date as the organic content was too low.

9 Lidar and aerial photographs

Environment Agency Digital Terrain Model (DTM) lidar images available as processed jpeg files were accessed online (Environment Agency 2017). The 2m resolution DTM image covering the orchard site (Figure 4) was checked for evidence of palaeochannels, ponds, buried cut-off meanders or features which may be of archaeological interest.

The historic floodbank which is known from historic maps to have existed by 1815 and the modern floodbank at the river edge were quite evident. Parallel linear ridges, which are likely to be the remains of ridge and furrow arable cultivation, cover the entire orchard field. The character of the ridges either side of the flood bank seems different, but it certainly looks more likely to be post-medieval to the west of the bank. The presence of these features sets this area apart from the surrounding fields in which no ridge and furrow is visible, and where more modern agriculture is, therefore, likely to have eradicated any more historic features. The Bollow Rhyne is also clearly visible but no riverine features, such as palaeochannels or abandoned meanders, relating to the River Severn, are visible. Google and Bing satellite images were also checked but no further features were noted.

10 Synthesis

When broad descriptions of sediments in the boreholes and their depths (AOD) are considered in the context of previous investigations into successive land reclamations and of published sequences of estuarine silts within the wider Severn Estuary, some suggestions can be made about the dating of deposits sampled in this project. It can be suggested, therefore, that Deposit 5 found only in Borehole 1 (top of deposit at 4.38m AOD) may correspond to the Upper Wentlooge Formation which is thought to have built up during the Bronze Age to Roman period (Crowther and Dickson 2008). In that case, however, the Middle Wentlooge Formation, which dates to the Bronze Age and Iron Age and includes layers of peat is absent. Deposit 6, which is stratigraphically a firm basal dark grey clay may correspond to the Lower Wentlooge Formation, dating to around the Mesolithic/Neolithic period. Overall, the low diversity and poor condition of the pollen, coupled with the failure of the radiocarbon results, makes the interpretation and dating of the sediment sequence problematic. There was also no pollen signal that could be related specifically to when orchard use became established, and, in fact, other than the possibility of grassland and, therefore, grazing, human activity seemed little represented in the albeit sparse pollen data.

Whether the overlying mottled grey-brown deposits and consistently orange-brown silts (deposits 2 and 3) can be related to the Rumney Formation, dating to the medieval and modern periods is uncertain. The Rumney formation is described as pale brown grading up to into mid then dark grey silts (Allen 1992) and part of a complex sequence of Rumney, Awre and Northwick formations, but more detailed consideration of these is outside of the scope of this assessment.

Regarding the dating of successive land reclamations, the eastern arm of the orchard alongside the Bollow Rhyne and landward side of the historic flood bank lies within a reclamation phase interpreted by Allen and Fulford (1990) as dating from the Roman period based on artefacts found in the ploughsoil. Morgan and Smith (1972) also state that:

> A new wall was named between 1287 and 1300 to locate land in South field, and the sea-walls of Longney that were said to be out of repair in 1540 were either the river bank with its cribs or the 3-ft bank of earth and stones that runs at a variable distance from the river to prevent flooding by the highest tides. The earth bank was recorded c. 1553 when some land was described as being outside the walls. The land outside the walls was later protected by a similar earth bank built immediately beside the river, presumably before 1768 when the river was [said] to have broken down the inner bank and overflowed much land.

Miller (2004), however, states that the historic flood bank in its present continuous form is not shown on historic maps until 1815, with only short sections existing by 1780 based on map evidence. Field evaluation did not prove a Roman or medieval origin for the flood defences at this locality (Deeks and Crawford 2004) but neither report rules out a date earlier than the 18th century for short sections of bank they described. Perhaps there may be other explanations than reclamation by flood defences for the Roman artefacts recovered by Allen and Fulford as follows:

- These could conceivably derive from activity of Roman date on foreshore deposits that could have been, at the time, unprotected by flood banks and are now residual in ploughsoils developed in the alluvium
- They may have washed up on to fields during more extreme historic tidal floods.

The lack of thick wood-peat layers is in contrast to results to the south of the Longney River Severn loop (Fig 1), where a deep pollen profile has previously been recovered by augering by A G Brown (1982). One significant conclusion can, therefore, certainly be drawn that the Severn river sediments must vary considerably over this short stretch of riverside (over 2.5 to 3 km).

11 Recommendations

- No further recommendations are made for further work on the pollen remains from these boreholes on account of the poor preservation and sparse quantity.

Boreholes 1, 8 and 6 will be retained for at least a year in case they could be of use for further research on the Severn Estuary, but because of limited storage space the remaining boreholes will discarded after a period of 3 months following submission of this report unless there is a request to retain them. More detailed geoarchaeological description may improve the interpretation of the sediment sequence, but it would be more useful to locate more productive deposits in the area if possible.

12 Publication summary

Worcestershire Archaeology (part of WAAS) has a professional obligation to publish the results of archaeological projects within a reasonable period of time. To this end, WAAS 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.

Palaeoenvironmental assessment was undertaken on behalf of Gloucestershire Orchard Trust at Longney Orchard, Longney, Gloucestershire (centred on NGR SO 75351 13737) in order to provide historic context to the orchard and to investigate the underlying sequence of alluvial sediments. Alluvial sediments have been widely studied in the Severn Estuary, providing information on large-scale landscape change and land reclamation over millennia. It was hoped that the results may contribute towards interpretation of successive phases of historic floodbank construction and land reclamation in the vicinity.

A total of seven boreholes were excavated, from which broad descriptions were made of sediments in six boreholes. Samples of pollen were assessed from two boreholes, close to an historic floodbank which runs through the site, and six samples were also submitted for radiocarbon dating.

The pollen assessment showed poor preservation of pollen and so no substantive evidence of landscape change could be derived from this, although the domination of grassland may indicate that the area had been predominantly grazing over a long period. Organic content in the boreholes was low and all six radiocarbon samples all failed to date. Dating of the sequence of sediment was, therefore, not facilitated, but, nonetheless, it is thought that deposits towards the base of the cores could relate to Wentlooge Formation deposits of Bronze Age to Roman date, and also possibly of Mesolithic/Neolithic date, as known to be intermittently present throughout the Severn Estuary from fieldwork elsewhere.

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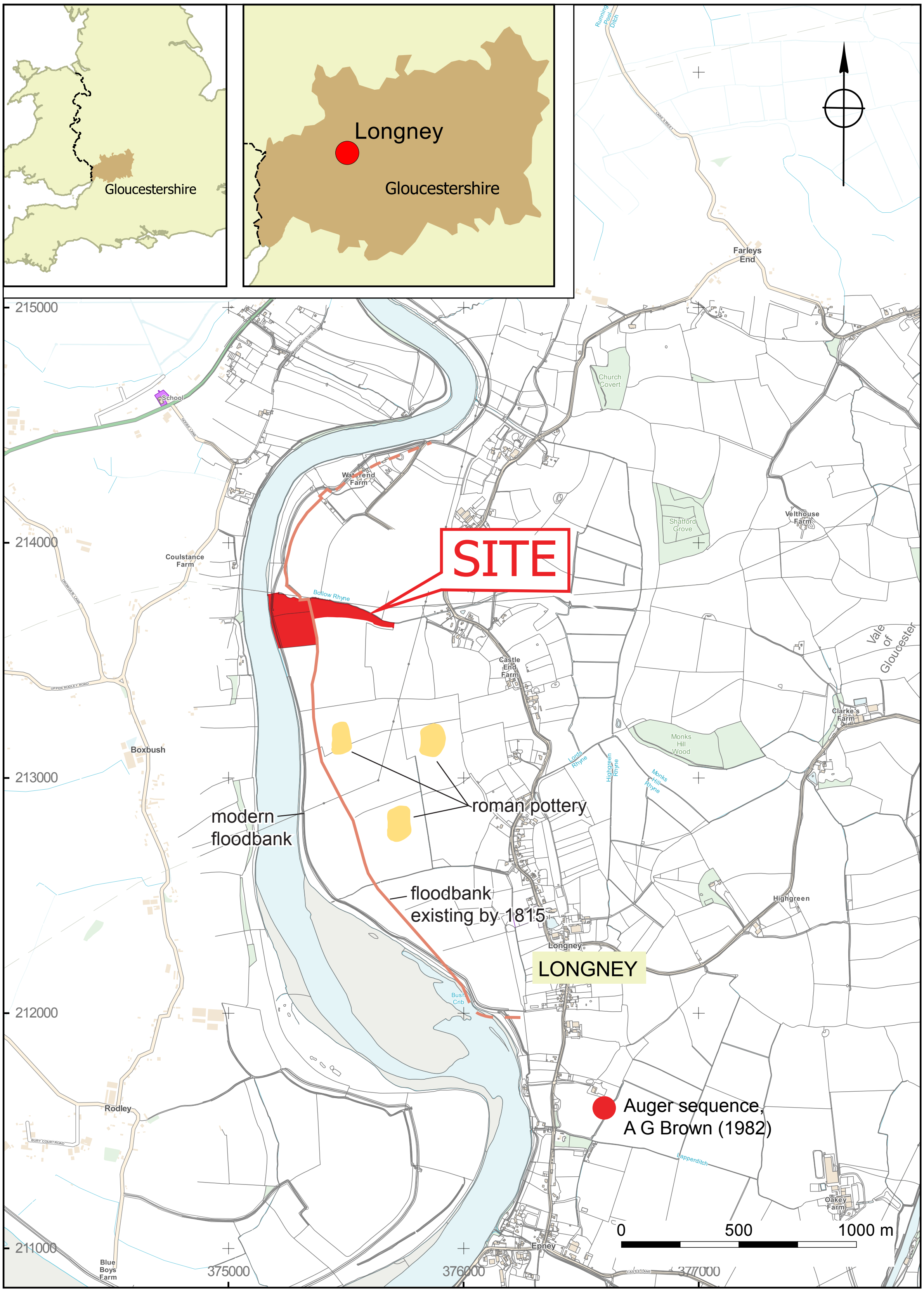
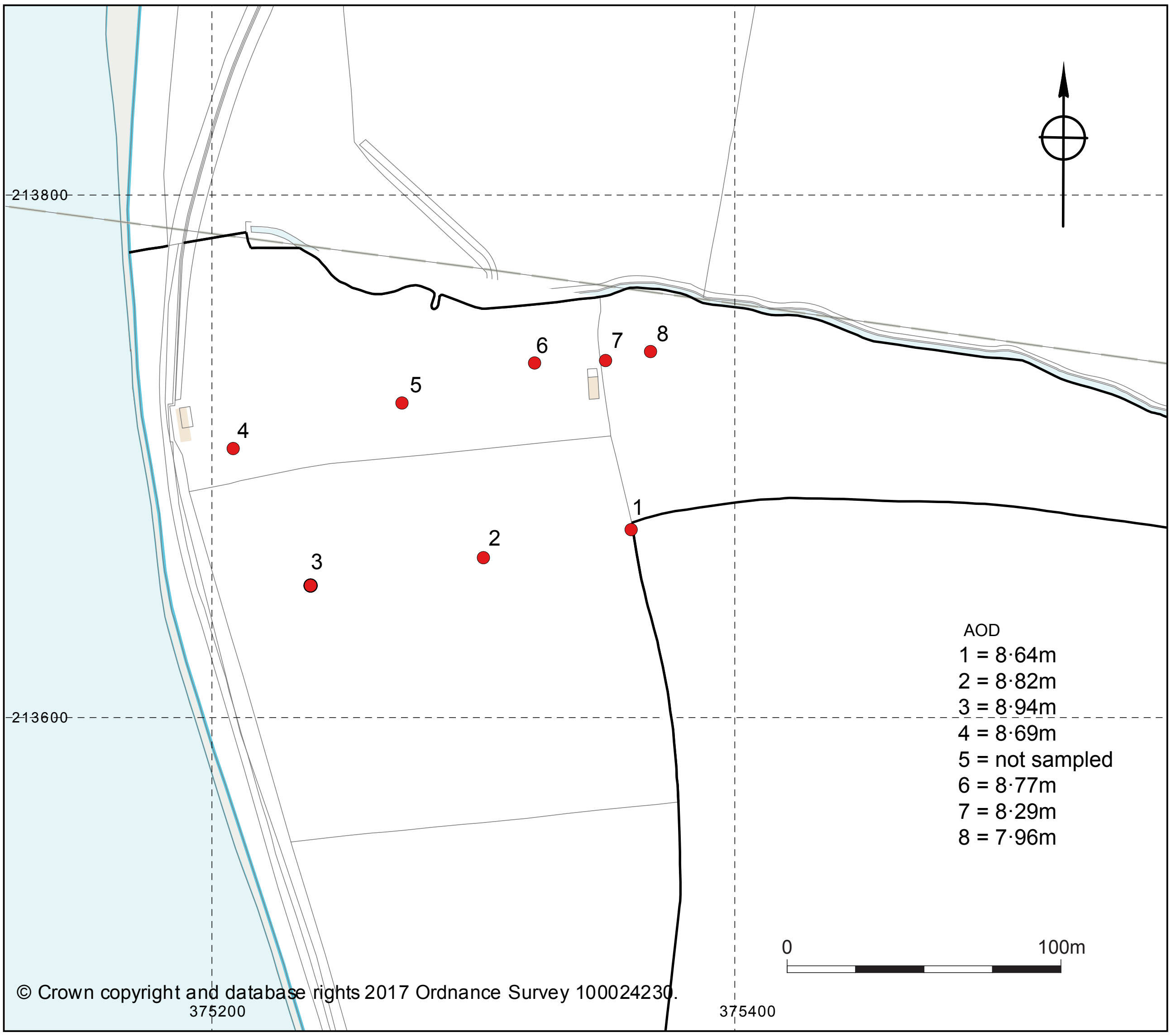
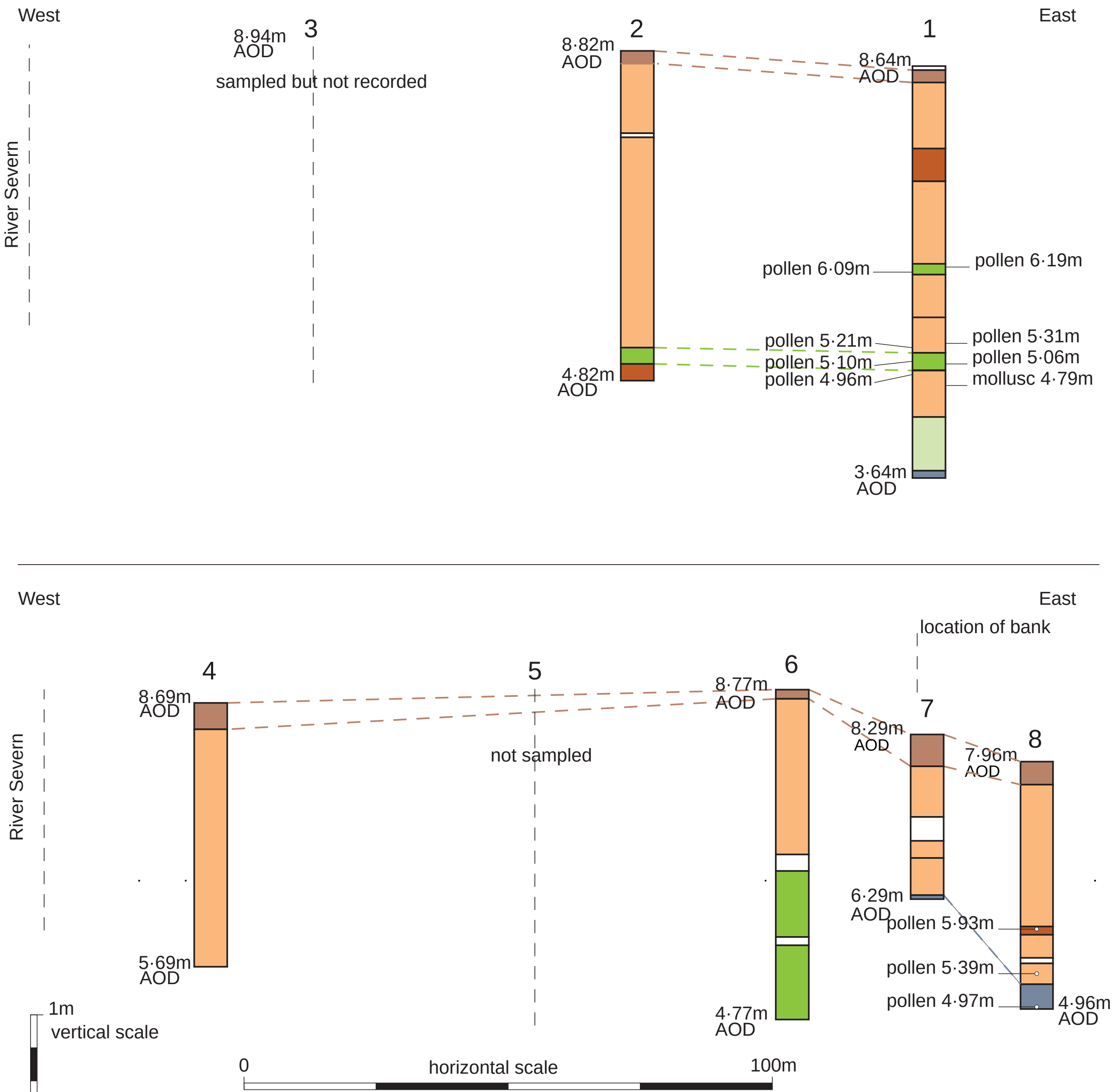
Figures



Location of the site *Figure 1*



Borehole locations *Figure 2*



Deposit descriptions

	Deposit descriptions	Top of deposit (m BGS)	Top of deposit (m AOD)
1	Topsoil: Dark grey-brown sandy, silty clay	0 m	7·9 – 8·29m
2	Alluvium1: yellowish grey-brown compact but slightly friable silty clay	0·17 – 0.39m	7·68m – 8·60m
3	Alluvium2: grey with orange-brown mottles stiff, compact clay. Possibly some organics	2·20m – 3·58m	5·24m – 6·57m
4	Alluvium3: Lenses of grey/dark brown firm silty clay. Slightly organic and more silty than Deposit 2. Possibly represents more than one episode of deposition	1·00m, 2m, and 3·80m	5·02, 5·97 and 7·64m
5	Alluvium4: Light grey/buff soft, plastic clay	4·26m	4·38m
6	Alluvium 5: Dark grey compact, firm clay. Charcoal flecks in BH 1	1·95m – 4·91m,	3·73 – 6·34m
7	Void or contamination/tumble		

note - deposits 3 and 4. These are lenses or discreet levels of mottling and gleying.The deposit number does not reflect stratigraphy.

Deposit model of the boreholes *Figure 3*

Figure 4 Lidar: Longney Orchard (Composite Digital Terrain Model Lidar at 2m resolution. Environment Agency free Lidar images available at https://www.flickr.com/photos/environmentagencyopensurveydata/albums)

Appendix 1 The archive

The archive consists of:

6	Borehole records AS26
7	Borehole cores
10	Pollen slides
1	QGIS file