Archaeology South-East

ASE

Archaeological and Geoarchaeological Investigation Seaside Recreation Ground Eastbourne, East Sussex

NGR: 562017 099856
(TQ 62017 99856)

Eastbourne Borough Council
Planning Reference: PC/160505
ASE Project No: 160369
Site Code: SRG16
ASE Report No: 2017249
OASIS id: 286238

By Kristina Krawiec

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Abstract

This report presents the results of an archaeological and geoarchaeological watching brief and palaeoenvironmental assessment commissioned by Southern Water and carried out by Archaeology South-East at Seaside Recreation Ground, Avondale Road, Eastbourne.

The watching brief did not record waterlogged archaeological remains but did demonstrate the presence of the Willingdon peat from which samples for palaeoenvironmental assessment were recovered. The subsequent assessment demonstrated a good survival of pollen, diatoms, ostracods, forams and insect remains, with plant macrofossils poorly preserved. The peat was sandwiched between two silt clay layers representing estuarine accumulation under marine transgressive conditions. The peat began to accumulate in the Early Bronze Age and continued to be present at the site until at least the Late Bronze Age when a erosive episode of marine transgression curtailed the sequence.

The micro and macrofossil assessment demonstrated a pre-peat environment comprising a tidal embayment with marine regression allowing peat to accumulate in an open saline-tolerant environment dominated by ferns. Pools of standing (fresh) water are suggested by the presence of aquatic insects. In addition, the presence of grazing herbivores is suggested by the presence of parasite eggs in the pollen samples. The return to an estuarine context is not accurately dated due to the erosive nature of the relationship between the peat and upper alluvium but it is likely to have occurred sometime in the Iron Age-Romano-British period.

The microfossil and insects are recommended for full analysis.

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1.0 INTRODUCTION

1.1 Site Background

1.1.1 Archaeology South-East was commissioned by Southern Water to undertake an archaeological and geoarchaeological investigation at Seaside Recreational Ground, Avondale Road, Eastbourne, BN22 8JL hereafter 'the site' (centred on NGR 571231 138491, Figure 1).

1.2 Geology and Topography

1.2.1 The underlying solid geology of the site is mapped by the British Geological Survey (BGS) as comprising alluvium (clay, silt, peat, sand) overlying the Upper Greensand Formation (siltstone) (BGS 2016). A Southern Water borehole log from 1983 located at the approximate centre of the Seaside Recreation Ground (TV 620 999) records made ground to 1m below existing ground level (BEGL) and indicates peat deposits occurring at 1.8m to 2.0m BEGL, with a further deposit containing peat occurring at 1.2m to 1.45m BEGL.

1.3 Planning Background

1.3.1 Planning consent has been granted by Eastbourne Borough Council for land raising and reinstated highway access associated with infrastructure connected with a flood alleviation scheme (planning reference: PC/160505). Due to the archaeological potential of the site (see below) Greg Chuter, East Sussex County Council Archaeology Officer (hereafter the ESCC Archaeologist) has advised that any consent granted for the scheme should be subject to a programme of archaeological works condition. Accordingly, Condition 4 of the planning consent states:

> *No development shall take place until the applicant has secured the implementation of a programme of archaeological works in accordance with a written scheme of investigation which has been submitted by the applicant to and approved by the Local Planning Authority. A written record of any archaeological works undertaken shall be submitted to the Local Planning Authority within 3 months of the completion of any archaeological investigation unless an alternative timescale for submission of the report is first agreed with the local planning authority.*

Reason: To ensure that the archaeological and historical interest of the site is safeguarded and recorded to comply with the National Planning Policy Framework.

1.3.2 Specifically, the elements requiring planning consent are:

- Re-profiling (raising) of the land to provide protection against water ingress;
- A grass-block access road for maintenance purposes including reinstatement of the former access to Gilbert Road;
- A five bar wooden gate across the access road to prevent unauthorised parking.

1.3.3 The flood alleviation scheme mentioned above consists of the construction of a temporary works compound, underground retention tanks, pumping station, bifurcation manhole, vented manhole chamber, access chamber and control panel house kiosk in the southeast corner of the recreational ground.

1.3.4 The flood alleviation scheme elements detailed above fall within the necessary parameters of the General Permitted Development Order benefitting from Southern Water's Permitted Development rights as a Statutory Undertaker. Southern Water have previously consulted the ESCC Archaeologist who has provided useful comments on the archaeological and palaeoenvironmental potential of the site (see below). Subsequent consultation between ASE, Southern Water and the ESCC Archaeologist has established that a watching brief should also be maintained during all intrusive works -whether subject to planning consent or carried out under Permitted Development rights. The archaeological and geoarchaeological investigation was therefore undertaken following the advice of the ESCC Archaeologist in compliance with Condition 4 of the planning consent and as best practice by Southern Water.

1.4 Scope of Report

1.4.1 This report details the results of the monitoring, recovery and assessment of palaeoenvironmental samples undertaken in October and November 2016.

2.0 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 The ESCC Archaeologist's consultation is set out below:

> "This section of Seaside Road is very interesting in relation to geoarchaeology as it is on the edge of the Willingdon Levels peat deposits and was crossed by a watercourse known as the Bourne Stream. The area has a very high potential for being utilised during the prehistoric periods, and could contain prehistoric peat deposits containing important organic remains and palaeoenvironmental information."

2.1.2 The Willingdon Levels are an area of low-lying land situated between Polegate and Eastbourne, East Sussex. The Levels are protected from the sea by a shingle bank known as the Crumbles and consist of unconsolidated clays and silts, with a thin peat horizon at circa +1.4m O.D. The Willingdon Levels peat, together with an overlying deposit of alluvium, has protected some of the best preserved prehistoric remains in Sussex and are arguably of national significance. The Willingdon Peat deposits were recorded by ASE some 3km to the north during the construction of Shinewater Lake (ASE 1995a; ASE 1995b and ASE 1998), in advance of development adjacent to Willingdon Drove (ASE 2000a; ASE 2000b) and during works associated with the realignment of the A22 Golden Jubilee Way (ASE 1996). Large upright oak posts had been driven through this peat in the Late Bronze Age (900-800 BC) to support a horizontal timber/brushwood platform over which had accumulated a 200mm thick layer of cultural material including pottery, bone, quernstone fragments, worked and burnt flints. The peat from the area of the platform has also yielded a number of finely crafted bronze artefacts, including four axes, a chisel and a bracelet. The most spectacular discovery was a unique bronze reed hook complete with intact field maple handle.

2.1.3 The platform was found to be connected to higher dry land approximately 250m to the west, by a substantial timber track or causeway. The surviving track was at least 6m. wide. It comprised a series of horizontal timbers and rods located in the top of the peat. The structure was secured by three parallel rows of vertical oak posts which may have also marked the route during periods of flooding. Two smaller timber trackways of at least 46m and 100m long have also been recorded on a part of the Willingdon Levels known as Dittons. These have been radiocarbon dated to 1440-1310 cal BC and 2460-2205 cal BC respectively.

2.1.4 The evidence of tracks, trade and exchange recorded on the Willingdon Levels, demonstrates that the Shinewater platform formed part of a complex network of prehistoric settlements and communication channels.

2.2 Palaeoenvironmental Background

2.2.1 Palaeoenvironmental data relating to the development of the Willingdon Levels has been presented previously (Burrin 1982; *ibid* 1983; and Jennings & Smyth 1985; *ibid* 1987a; *ibid* 1987b; *ibid* 1990). However, a more detailed examination of the local sedimentary sequence was conducted by Dr. Simon Jennings of North London University. It should be noted that the following paragraphs refer to the site at Shinewater Lake, but are considered valid for the current site which lies at the edge of the Willingdon Levels peat deposit.

2.2.2 Approximately 9000 years ago, the Willingdon Levels occupied a former small valley which was steadily silting with a blue-grey clay as the English Channel encroached. However, by the Bronze Age the sea had retreated from the resulting estuary or inlet. This marine regression was induced by the accumulation of thick mud under saltmarsh conditions and was probably aided by the formation of a sand or gravel beach across the bay entrance. Consequent peat growth in the less saline water conditions led to a further raising of the Levels and established the surface upon which the Shinewater complex was constructed.

2.2.3 During the Bronze Age, the platform was situated towards the southern edge of the contemporary fen. This location would have provided a brackish to freshwater environment, just north of an expanse of saltmarsh and mudflats. It should also be noted that the bog was dissected by a number of brackish channels that fed into the estuary covering the lower part of the Levels. Indeed, one large palaeochannel is known to exist immediately east of the platform.

2.2.4 At the time of site occupation, the Willingdon peat supported grasses, reeds and sedges. Scattered alder, willow and oak was also growing on the fen or along its boundaries. However, the area was essentially open, so that anyone standing on the adjacent chalk hills would have had a clear view of the timber structures below. Certainly, pollen analysis suggests that during the Late Bronze Age, crops were being grown on the surrounding downland slopes, while the Levels were more suitable for grazing. Fossil evidence has confirmed that platform construction corresponded with the driest conditions since fen development.

2.2.5 Nevertheless, by the Early Iron Age (c.800 BC) settlement on Shinewater marsh had become untenable due to flooding from the sea. This marine transgression has been observed at a number of coastal sites in South-East England although its cause is not fully understood. The episode is clearly demonstrated in the Levels formation by a thick layer of alluvial clay, which immediately overlies the cultural deposits of platform and track.

2.2.6 Ordnance Survey (OS) mapping indicates that the recreational ground was formed during significant urban expansion between 1890-1910. Prior to this the site comprised open fields lying between Seaside (modern day A259) and a former brick works and marsh/reeds to the west. The western, northern and eastern boundaries of the modern recreational ground are reflected in earlier field boundaries. Faint lines noted on modern aerial imagery may relate to former boundaries which may be identified during groundworks.

2.3 Project Aims and Objectives

2.3.1 The broad aims of the investigation, in keeping with previous similar projects were:

- To determine the presence or absence of archaeological and deposits with the potential to preserve palaeoenvironmental remains within the test pits
- To record and assess the character, extent, preservation, significance, date and quality of any remains and deposits
- To assess how they might be affected by the development of the site
- To establish the extent to which previous land use and/or other processes have affected the deposits at the site
- To assess what options, if any, should be considered for mitigation following completion of the initial watching brief on the test pit

2.3.2 The main objectives were to:

- Monitor and record the removal of the waterlogged deposits at the site
- To recover samples for palaeoenvironmental assessment
- To undertake an assessment of the samples and make recommendations for further work

3.0 ARCHAEOLOGICAL METHODOLOGY

3.1 Fieldwork Methodology

3.1.1 A Risk Assessment and Method Statement was produced prior to the commencement of the work. Initially the works comprised a topsoil strip over the work area, the excavation of three parallel 30m x 3.30m trenches to a depth of 4.3mbgl and the installation of sheet piling to prevent water ingress during the works. However, only the western-most trench was sheet-piled as the ground conditions were such that it was not required. The remaining two trenches were amalgamated into a single large trench which was battered for safety; this is shown on Figure 2.

3.1.2 Excavations were undertaken through undifferentiated topsoil, modern made ground and underlying alluvial deposits in spits of no more than 0.25m to the depth required (approximately 4.20mbgl). The excavator was fitted with a smooth grading bucket and care was taken that archaeological deposits, if encountered, were not damaged due to over machining.

3.1.3 The lithology within trenches was recorded using both context sheets and the Troels-Smith (1955) system of recording unconsolidated sediments. The scheme breaks down a sediment sample into four main components (Appendix 2) and allows the inclusion of extra components that are also present, but that are not dominant. Key physical properties of the sediment layers are also identified according to darkness (Da), stratification (St), elasticity (El), dryness of the sediment (Dr) and the sharpness of the upper sediment boundary (UB). The logs will also be supplemented by digital photography where appropriate.

3.1.4 The sections were drawn at 1:20 on drafting film and the locations of the trenches were plotted in relation to the National Grid using RTK GPS. Due to the presence of waterlogged deposits both kubiena and bulk samples were recovered to form a master sequence. The strategy for sampling archaeological and environmental deposits and structures was developed with reference to English Heritage guidelines for environmental archaeology (English Heritage 2002). Where deposits were soft (i.e the underlying blue alluvium) a Russian auger was used to recover samples.

3.1.5 All finds recovered from the excavations were washed and marked with an appropriate code to identify the site and context. Finds were bagged in polythene bags according to type and context.

3.2 Palaeoenvironmental methodology

Pollen

3.2.1 Pollen preparation followed standard techniques including potassium hydroxide (KOH) digestion, hydrofluoric acid (HF) treatment and acetylation (Moore et al., 1991). A count of at least 100 total land pollen grains (TLP) excluding aquatics and spores were attempted for each sample. However a number of the samples were found to produce very low pollen concentrations (specifically those associated with the lower alluvium) and as a consequence, assessment counts were not possible for these depths. However, other microscopic remains were often encountered and hence further comments will be made, where relevant.

Diatoms

3.2.2 0.5g of sediment was required for the diatom assessment preparation. Due to the high silt and clay content of most samples, they were first treated with sodium hexametaphosphate and left overnight, to assist in minerogenic deflocculation. Samples were then treated with hydrogen peroxide (30% solution) and/or weak ammonia (1% solution) depending on organic and/or calcium carbonate content, respectively. Samples were finally sieved using a 10µm mesh to remove fine minerogenic sediments. The residue was transferred to a plastic vial, from which a slide was prepared for subsequent assessment. A minimum of 100 diatoms were identified for each sample depth. Diatom species were identified with reference to van der Werff and Huls (1958-74), Hendy (1964) and Krammer & Lange-Bertalot (1986-1991). Ecological classifications for the observed taxa were then achieved with reference to Vos and deWolf (1988; 1993), Van Dam et al., (1994), Denys (1991-92; 1994) and Round et al. (2007). If preservation was found to be low, a complete slide was traversed in an attempt to extract the diatom data available from the sample under assessment. Table 10 provide a summary of the taxa observed the sequences.

Ostracods and Foraminifera

3.2.3 The samples were broken up into small pieces by hand and placed in ceramic bowl, before drying in an oven. After drying a small quantity of sodium carbonate was added (to facilitate the removal of the clay fraction). The sediment mix was immersed in hot water and left to soak overnight. It was then washed through a 75 micron sieve with hand-hot water. The resulting residue being returned to the bowl for drying. Once thoroughly dry each residue was transferred to plastic labelled bags for storage and picking. The residue was then sieved through a nest of >500µ, >250µ and >150µ sieves. For examination, sediment from each grade was picked by sprinkling a small amount of residue onto a tray and viewed under a binocular microscope. A representative selection of material from each sample (foraminifera, ostracods and other sub-fossil material) of potential environmental value was picked out into 3x1" plastic faunal slides and recorded on a presence/absence basis (Table 11). Detailed recording the foraminiferal and ostracod species was then undertaken and is presented here as semi-quantitative indications (Table 11; lower tables).

Plant macrofossils

3.2.4 2L subsamples were selected from each bulk sample and the remaining 8 L were retained for insect assessment. The sub-samples were washed through a stack of geological sieves of 4, 2 and 1mm and 500 and 250 microns. The wet sieved fractions were retained in water and scanned under a stereozoom microscope at 7-45x magnifications and their contents recorded (Table 12). Notes on the preservation of waterlogged wood were made and identification attempted on two fragments from sample <5> to assess suitability for C14. Specimens were sectioned along three planes (transverse, radial and tangential) according to standardised procedures (Gale & Cutler 2000), and examined under a transmitted light microscope at 50x to 300x magnification in order to determine the woody taxa used at timber at the site. Taxonomic identifications were assigned by comparing suites of anatomical characteristics visible with those documented in reference atlases (Hather 2000, Schoch *et al.* 2004). Nomenclature used follows Stace (1997), and taxonomic identifications of timber remains are recorded in Table 12.

Insects

3.2.5 The samples originally had volumes of ~5 litres. Each was frozen and thawed twice before processing to facilitate extraction and to minimise damage to delicate organic remains (Vandorpe and Jacomet 2007). Wet-sieving was subsequently carried out to 0.3mm. The organic content of both samples was very high and therefore each retent was divided into two, with one half being subjected to paraffin flotation to extract insect remains following the methods of Kenward et al. (1980). The sample volumes shown in Table 13 take this into account.

3.2.6 A proportion of each paraffin flot (~10%) was scanned briefly in industrial methylated spirits (IMS) using a low-power binocular microscope (x10) to ascertain whether insect remains were present in interpretable quatities. The abundance of identifiable beetles (Coleoptera) and bugs (Hemiptera) was estimated and the state of preservation noted. The flots are currently stored in jars of IMS.

3.3 Archive

3.3.1 The site archive is currently held at the offices of ASE and will be deposited at Eastbourne Museum in due course. The CBM and glass assemblages were recorded and discarded. The contents of the archive are tabulated below (Table 1).

Context sheets	9
Section sheets	2
Plans sheets	1
Colour photographs	0
B&W photos	0
Digital photos	156
Context register	1
Drawing register	1
Watching brief forms	20
Trench Record forms	0

Table 1: Quantification of site paper archive

Bulk finds (quantity e.g. 1 bag, 1 box, 0.5 box 0.5 of a box)	1 box
Registered finds (number of)	5
Flots and environmental remains from bulk samples	2
Palaeoenvironmental specialists samples (e.g. columns, prepared slides)	yes
Waterlogged wood	0
Wet sieved environmental remains from bulk samples	2

Table 2: Quantification of artefact and environmental samples

4.0 RESULTS

4.1 Stratigraphy and lithology

Context	Type	Interpretation	Length m	Width m	Depth m	Height m AOD
001	Layer	Turf/topsoil			0.1-0.3m	
002	Layer	Made ground			0.20m	
003	Layer	Made ground			0.40m	
004	Void	Void			void	
005	Layer	Rubble over 007	5m	5m	0.40m	1.60m OD
006	Layer	Oxidised alluvium			1.50m	1.83m OD
007	Wall	Building foundations	5m	5m	1.0m high	1.29-1.89m OD
008	Layer	Well humified peat			0.40	0.33m OD
009	layer	Blue silt clay			Excavated to 1.50m	-0.15mOD

Table 3: List of recorded contexts

4.1.1 The trench was excavated in two stages, with the western side completed within a sheet-piled cofferdam to a depth of 3.80mbgl. The eastern side was excavated as a battered trench. The deepest deposit encountered was a smooth blue grey silt clay [009] which was not bottomed, although a Russian core <8> was extracted to 4.80mbgl (-2.27m OD) and again the base of the deposit was not reached. This deposit recorded occasional whole cockle shells and frequent reed remains.

4.1.2 This silt clay was overlain by an undulating peat unit [008] which was well humified and contained frequent reed remains. This deposit thinned out slightly to the north east. The upper surface of the peat demonstrated a sharp contact with the overlying oxidised alluvial silt clay [006]. These deposits were recovered as kubiena and bulk samples, the underlying blue silt clay [009] was also recovered using a Russian auger.

4.1.3 The oxidised alluvium was truncated by the foundations of a previously unmapped building [007]. These remains were fully demolished to the north east so the ground plan was not able to be established. The brick used in its construction was combination of ‘Blue’ and ‘Spanish’ mixture brick possibly suggesting the structure was rapidly constructed or short-lived. The north-west facing elevation (external) was rendered in cement and several .303 bullet casing were recovered from within the structure. These have been identified as training ammunition form the Second World War. This may indicate the structure was part of local Home Front defences and that the structure was demolished before it could be mapped.

4.1.4 This structure was overlain by demolition rubble [005], derived from [007], from which several coins were recovered dating to the Georgian and Victorian periods. These are likely to derived from either the demolition of the building and/or the reworking of the recreation ground topsoil. The glass, clay pipe and pottery recovered from both this layer and from the subsequent made ground

layer [002] date to c.1890-1940 consistent with the building and the use of the recreation ground. These made ground layers were sealed below the topsoil and turf [001].

5.0 THE FINDS

5.1 Summary

5.1.1 A small assemblage of finds was recovered during the watching brief and were washed and dried or air dried as appropriate. They were subsequently quantified by count and weight and were bagged by material and context. Bulk finds are listed in Table 4; in addition four objects, detailed in section 5.9, were issued with registered finds numbers. All finds have been packed and stored following CIfA guidelines (2014).

Context	Pottery	Weight (g)	CBM	Weight (g)	Metal	Weight (g)	Bone	Weight (g)	Clay Tobacco Pipe	Weight (g)	Glass	Weight (g)	Shell	Weight (g)
002	6	278							2	2	4	151		
003							1	16						
005	2	20												
007			3	6240	4	10								
009													1	18
Total	8	298	3	6240	4	10	1	16	2	2	4	151	1	18

Table 4: Finds quantification

5.2 **The Pottery** by Luke Barber

5.2.1 The archaeological monitoring recovered eight sherds of pottery, weighing 294g, from two individually numbered contexts. The material has been fully listed in Table 5 as part of the visible archive.

Context	Fabric	No	Weight (g)	Comments
002	English stoneware	1	108	Large spirit bottle x1 (Tan top, Bristol glaze)
002	Refined redware	1	36	Teapot x1 (white slipped band around rim on brown/red body). Burnt
002	Blue transfer-printed whiteware	1	6	Plate x1 (floral sheet pattern)
002	Refined whiteware	2	84	Plate x1 (dark blue rim edge line), lidded pot (base) x1. Base 57mm di, 27mm tall, illegible stamp on base
002	English porcelain	1	42	Teapot x1 (moulded spout)
005	Blue transfer-printed whiteware	1	4	Plate x1 (landscape)
005	English porcelain	1	14	Saucer x1 (ribbed, gold gilt ?) 'Brighton' around interior. Souvenir. Burnt

Table 5: Pottery assemblage (LPM - Late Post-Medieval c. 1750-1900+).

5.2.2 The whole assemblage is of late post-medieval date, and can best be placed

between c. 1890 and 1940. Too little is present to comment on reliably but there is nothing to suggest anything other than a domestic assemblage of the lower/middle class.

5.2.3 The pottery assemblage is small, late and of industrial types well known of in Sussex. It is not considered to hold any potential for further analysis beyond that undertaken for this report and has been discarded.

5.3 The Ceramic Building Material by Isa Benedetti-Whitton

5.3.1 Three pieces of ceramic building material (CBM) collectively weighing 6866g were collected from a single context: [007]. This included two bricks and a piece of concrete surface render. One of the bricks was a post-industrial 'blue brick', produced in low oxygen and high heat conditions to create a very dense and hard blue-grey coloured brick with very low porosity. Blue' bricks were produced at various locations across Britain – although mainly in Northern areas, and are believed to have originated in Staffordshire – during the final decades of the 19th century and first decades of the 20th century (Kitching 2016).

5.3.2 Blue bricks were produced for outside building, and the worn 'upper' surface of this brick suggests it was used as a paving brick. The 'base' is stamped with the following lettering, which was only partially visible through the concrete still adhering to the surface: '___?H - ?CROOMS; ____RIO?K CO. ; ___N__ __ELLS'. Regrettably, the incomplete stamp prevented the originating brickworks from being identified.

5.3.3 The second brick was a common post 1666-fabric, classified by Museum of London Archaeology as fabric 3032. It is a particularly distinctive fabric due to the inclusion of 'Spanish', a mixture of ash and domestic waste including animal bone, glass and occasional clay tobacco pipe pieces. This brick fabric and other local variations were most common during the 18th century, but continued to be used into the 19th century and the thick layer of cement attached to one surface of the brick indicates a 20th century date for the structure this particular brick came from. A further partial fully vitrified brick was embedded into the cement covering one surface.

5.3.4 The CBM, being all of very recent date and not particularly indicative of the structures from which they originated, can all be discarded.

5.4 The Clay Tobacco Pipe by Luke Barber

5.4.1 The archaeological work recovered two stem fragments (4g: combined length of 85mm) from context [002]. Both have a 1.4mm diameter bore and can be placed in a c. 1750-1900+ date range.

5.4.2 The clay pipe assemblage is not considered to hold any potential for study and has been discarded.

5.5 The Glass by Luke Barber

5.5.1 Context [002] produced a small assemblage of glass that has been fully listed in Table 6 as part of the visible archive.

Body shape	Colour	Form	Dimensions	No/ Weight (g)	Closure	Comments
Cylindrical	Colourless	Bottle	-	2/6	?	X1 melted
Cylindrical	Colourless	Bottle	-	1/44	Ext screw	Melted
Square	Colourless	Jar	-	1/36	Ext twist	Pickle?
Rectangular/ oval hybrid	Colourless	Bottle	Base 34 x 27mm Rim – c. 15mm Height c. 100mm	1/70	Ext screw	95%. Perfume? Cordon on base of 36mm long neck. Sides/back rectangular with corner chamfers, front convex

Table 6: Glass assemblage from context [002]

5.5.2 All of the glass is of a similar late 19th- to mid-20th- date as the associated pottery. On the whole the material is in fresh condition, but some has clearly been burnt during refuse disposal.

5.5.3 The glass is not considered to hold any potential for further analysis and has been discarded.

5.6 The Bulk Metalwork by Susan Chandler

5.6.1 Five copper alloy .303 bullet casings were recovered from context [007] weighing a total of 64g. They were in a very poor condition, with heavy corrosion. They were and fired from a rifle and are most likely to be blanks made from rejected casings, used for training during the Second World War. With the corrosion removed, it was possible to read head stamping on two of the casings; K5 1942 BV112 and RG 43 V11. The first of these was produced at the Imperial Chemical Industries Kynoch Factory 5 in Kidderminster in 1942 and the B indicates it was originally intended to be an incendiary bullet for an aircraft machine gun; the second was produced at The Royal Ordnance factory at Radway Green in 1943. The remaining unstamped casings were likely to have been rejected before they got to the stamping stage of production.

5.7 The Animal Bone by Hayley Forsyth-Magee

5.7.1 A small assemblage of animal bone containing just one fragment weighing 16g was recovered from the excavation. The bone was hand-collected from context [003] and is in a moderate state of preservation with minimal signs of surface erosion present. No complete bones are present.

5.7.2 The bone retrieved from context [003] has been identified as a large mammal rib fragment. Evidence of butchery was observed with knife and saw marks at either end of the rib shaft. This type of butchery suggests that carcass portioning occurred in the area. Evidence of canid gnawing was also observed. No evidence of burning, pathology or non-metric traits were recorded.

5.8 **The Shell** by Susan Chandler

5.8.1 A total of 3 compressed shells were recovered during the works on site, from context [002], in some soil matrix, weighing a total of 16g. They are *Mactra stultorum* or Rayed Trough shells, a type of bivalve. They are likely to be naturally occurring rather than representing food-resources.

5.9 **The Registered Finds** by Susan Chandler

5.9.1 The registered finds were given registered finds numbers RF <0> and recorded on pro forma sheets. The objects discussed here are detailed in Table 7 below.

RF No	Context	Object	Material	Period
1	005	Coin	Copper alloy	Post-medieval
2	005	Coin	Copper alloy	Post-medieval
3	002	Bullet	Copper alloy	Post-medieval
5	005	Coin	Copper alloy	Post-medieval

Table 7: The registered finds.

5.9.2 Three registered finds are post medieval coins: RF<1>, was a 1898 penny of Queen Victoria; RF<2> was too worn to be identifiable but is likely also Victorian; and RF<5> was a coin of George III, from the early 1800's (4th issue). The last registered find, RF<3> was a copper alloy bullet casing, 10mm in diameter and 43mm long. It was incomplete and too corroded to make out any identifiable markings.

6.0 THE ENVIRONMENTAL SAMPLES

6.1 Summary

6.1.1 The sequence of peat and alluvium recorded at the site were recovered as kubiena <1> (0.29m OD) and bulk waterlogged samples<2-7>. The lower blue silt clay was sampled using a Russian auger <8> (-0.37m OD). These were subsampled further at 2cm resolution and assessed at 6cm resolution. The bulk samples were subsampled for insect and plant macrofossil assessment. The results of each proxy including radiocarbon dating are detailed below.

6.2 Pollen *by Tom Hill*

6.2.1 A total of seventeen pollen samples were assessed from the peat and alluvial sequence. A summary of the sampling strategy applied to the sequence can be reviewed in Table 8.

Strat	Sample Depth	Pollen	Diatom
peat	2.24	*	
	2.3	*	
	2.36	*	
	2.42	*	
	2.48	*	
	2.54	*	
	2.6	*	
	2.67	*	
alluvium	2.68		*
	2.8		*
	2.9	*	
	3.08	*	
	3.14		*
	3.26	*	
	3.38		*
	3.44	*	
	3.62	*	*
	3.8	*	
	3.86		*
	3.98	*	
	4.1		*
	4.16	*	
	4.29	*	*

Table 8: Summary of samples submitted for pollen and diatom assessment. Measurements are meters below ground level (bgl)

6.2.2 Pollen was found to be well preserved in most samples associated with the peat unit. The upper peat sample (2.24m) was however found to be almost entirely barren. Below, herbaceous taxa dominated, typified by Poaceae (wild grasses) and Cyperaceae (sedges), with a low but consistent presence of Chenopodiaceae (Goose Foot) throughout (see Table 9 for summary of

assemblages). Shrub taxa was dominated by *Corylus-Myrica* type (Hazel or Sweet gale), and whilst further analysis would be necessary, it is likely that this is hazel. Tree taxa are present, but in very low abundances, typified by *Alnus* (alder), *Quercus (*oak*)*, *Pinus (*pine*)*, *Tilia* (lime) and *Ulmus (*elm*)*. Aquatic and spore taxa are present throughout the peat unit too, but the aquatic taxa is restricted to occasional grains of *Typha* (bulrush) and *Myriophyllum* (watermilfoil). In contrast, *Pteropsida* monolete *indet*. (ferns) were encountered in abundance throughout the profile. In terms of trends, whilst herbaceous taxa dominate overall, there is an increase in tree abundance with depth, with the greater abundance of *Ulmus* at the base potentially worthy of note. With regards to other microscopic remains, occasional parasite eggs (suggested to be *Trichuris*) were encountered at 2.36m depth which often derive from the animal/human gut. This may tentatively infer activity proximal to the site (wild animals or anthropogenic).

6.2.3 When considering the underlying alluvium, the pollen assemblage was found to be very poor. Where present, preservation of the grains was apparently good, but their abundance was very low, preventing any full assessment counts from being achieved for all samples except one (3.08m depth). The overall poor assemblages therefore prevent any suitable palaeoenvironmental interpretations from being made. It is however noted that other microscopic remains were present in abundance, specifically foraminiferal wall linings, dinoflagellate cysts and pre-Quaternary pollen and spores.

6.2.4 The abundance of foraminiferal wall linings and dinoflagellate cysts throughout the basal minerogenic samples is of importance. Their presence indicates that an estuarine setting was present throughout the deposition of the lower alluvium (further confirmed by the diatom assessment, below). In addition to indicating marine deposition, some of the dinoflagellates were geological in context and hence likely to have derived from regional bedrock outcrops. Similarly, to account for the abundance of pre-Quaternary pollen and spores, the depositional environment must receive substantial allochthonous reworked material into the depositional basin, again typical of coastal lowland environments. The abundance of pre-quaternary bisaccate and tetrad pollen grains, in addition to the dinoflagellates, could be studied in an attempt to understand the source of the reworked material (whether derived from local catchment bedrock of from further afield), but realistically little palaeovegetation information can be gathered about a local environment from a sedimentary sequence contaminated with substantial quantities of allochthonous materials.

6.2.5 The pollen results from the upper peat unit suggest a relatively open wetland setting prevailed, with woodland proximal to the site. The continued presence of saline tolerant taxa (such as the goose foots) throughout the peat suggests the estuarine environment remained relatively close to the sampling site throughout the accumulation of the peat.

		Depth (mbgl)																
		2.24	2.30	2.36	2.42	2.48	2.54	2.60	2.67	2.90	3.08	3.26	3.44	3.62	3.80	3.98	4.16	4.29
Trees	*Acer*																	1
	Alnus		2	4	8	7	6	11	6	1			1		1		2	5
	Carpinus								1?									
	Betula		3			2	3	6										
	Fagus																	
	Fraxinus																	
	Juglans																	
	Pinus		3	1	1	2	2	1	2	14	31	5	5	3	3	4	2	4
	Quercus	1	3	3		9	5	12	4	7	3	1			6	6	5	9
	Tilia				2		4	3	3	1					1	1		
	Ulmus					1	1	1	6								1	
Shrubs	*Corylus-Myrica* type		14	5	13	17	15	28	30	5	14	1	1	2	7	3	19	29
	Ericeceae undif.			1	1													
	Hedera helix		2		1						1							1
	Ilex																	
	Salix																	
Herbs	Poaceae		26	35	42	65	52	77	112	8	15	2	2			2	9	9
	Cyperaceae	1	49	60	55	44	42	29	27	2	7					1	1	2
	Cereal																	
	Apiaceae (Umbelliferae) undif.		1	1	1					2								
	Artemisia type				1	1	1											
	Armeria maratima																1	
	Asteraceae		8	7	3	3		1	2		1		1					
	Lactuceae		3	4	6	2	1	1					1					
	Brassiccaceae		2	2	1		2	1					1					
	Caryophyllaceae					1	1				1							
	Centaurea nigra																	
	Chenopodiaceae	1	11	9	7	5	6	4	6	27	40	8	5	3	11	29	24	27
	Galium																	
	Helianthemum																	
	Helleborous																	
	Plantago sp.				2		2	3			1							2
	Polygonum																	
	Ranunculus					2		4						1	1	1		
	Rumex					1	2	1							1			1
	Saxifragaceae undif.																	
	Succisa		1											1				
	Thalictrum																	
	Urtica																	
Spores	*Dryopteris*				1													
	Osmunda																	
	Polypodium		2					2	1	9	11	1	2	9	2	2	1	1
	Pteridium		3	2	4	3	4	7	6	5	8	2	1	1	3			1
	Pteropsida (monolete) undif.	23	44	27	37	46	48	65	67	5	11	1	5		2	2		1
	Sphagnum											1						
Aquatics	*Myriophyllum*				6	2												
	Nuphar										1							
	Nymphaea																	
	Potemogeton																	
	Sparganium																	
	Typha angustifolia		3	3	3	2					1							
	Typha latifolia	4	5	1	2	2	6	8	5									
Trichuris eggs				x														
Foraminifera linings										xx	xxxx	xxx	xxx	xx	xxx	xxx	xxx	xx
Pre-Quaternary pollen & Spores										xxx	xxx	xxxx	xx	x	xxx	xxx	xxx	xxx
Dinoflagellate systs										xxx	xxx	xxx	xxx	xxx	xx	xxx	xx	xx
Pollen abundance		L	H	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L
Pollen diversity		L	H	H	H	H	H	H	H	L	M	L	L	L	L	L	L	L
Suitable fur further analysis?		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No

Table 9: Summary of pollen results, dashed line indicates depth at which stratigraphy shifts from peat to underlying estuarine alluvium.

6.3 Diatoms *by Tom Hill*

6.3.1 Diatom preservation was found to be good in the lowermost five samples (3.38m-4.29m depth), with preservation much lower in the overlying three samples. Whilst complete slides were traversed for these upper samples, a count of 100 could not be achieved. It was common to encounter centric diatom girdle bands and silhouettes of other frustules, indicating that diatoms were present within these samples, but post-depositional dissolution is likely to have removed much of the biogenic silica (Mayer *et al*., 1991), making identifications and subsequent full counts not possible. Considering the upper samples were positioned in proximity to the overlying peat unit, it is likely that lower water tables have resulted in enhanced oxidation and frustule dissolution in the upper section of the sequence. No further comment will therefore be made in association with the upper three samples.

6.3.2 Of the five lower samples, full assessment accounts could be achieved, with abundance and diversity increasing with depth. A summary of the diatom data is provided in Table 10. In the majority of cases, taxa were identifiable to species level, but in some instances, identifications were only possible to genera level. To assist in the subsequent assessment of palaeoenvironmental potential, simplified ecological and lifeform classifications for each species will be referred to within the report. Ecology will be divided into those diatoms encountered in marine, brackish, fresh (brackish-marine etc.) waters. Lifeform can be divided into planktonic, tychoplanktonic and benthic species. Planktonic taxa live floating within the water column, whereas benthic taxa are those that live either attached to or within the substrate. Tychoplanktonic taxa are diatoms that readily occur in plankton but are primarily derived from other habitats, such as attached to substrates. Additional lifeform classifications can also be applied to diatom species (epiphytic, epipelic, epipsammic, aerophilous etc), but for the purposes of an assessment level study, these will only be referred to if/when relevant in subsequent discussions. It is suggested that the slightly lower abundance and diversity encountered in samples 3.38m and 3.62m may be due to the impact of the silica dissolution that was responsible for removing most diatoms from the upper three samples, but its impact was to a lesser extent.

6.3.3 The diatom assemblages show similarities throughout, with the majority of species clearly indicating brackish and marine conditions dominated the environmental setting. The sequence can however be split into two based on the diatom assemblages encountered, with the lower two samples (4.10m and 4.29m) containing taxa not present in the upper three samples (3.38m, 3.62m and 3.86m).

6.3.4 Marine planktonic taxa are encountered throughout the sequence and are typified by *Paralia sulcata, Actonoptychus senarius, Pseudomelosira westii, Podosira stelligera* and *Thalassiosira* sp. Planktonic species contribute over 50% TDV (Total Diatom Valves) in the upper samples, reducing in contribution to 320-30%TDV in the lower samples. The most common benthic taxa include *Diploneis didyma, Scoliopleura tumida, Nitzschia navicularis, Gyrosigma acuminate, G. peisonis, G. wansbecki and Nitzschia sigma* (all of which are marine-brackish epipelon). However the relative abundances of these taxa vary through the sequence. For example, in addition to higher planktonic taxa in the upper two samples, the benthic taxa are typified by *Diploneis didyma*

and *Nitzschia navicularis*, with subordinate taxa including *Diploneis crabro* and *Campylodiscus echeneis* which are not found in the underlying samples. The lower samples, in contrast, not only contain fewer planktonic taxa, but their benthic assemblage is typified by *Scoliopleura tumida*, *Nitzschia sigma*, *Nitzschia navicularis* and a selection of *Gyrosigma* sp. A shift in the depositional setting within the tidal frame is likely to have therefore taken place during the development of the lower estuarine unit.

6.3.5 Typical interbedded peat and silt sequences display shifts in diatom flora in response to marine transgressions and regressions and there is clear changes within the assemblages encountered. However, in this case, there is increase in planktonic taxa prior to the onset of peat accumulation and an overall lack of epiphytic and aerophilous taxa, when normally the opposite would be the case. Whilst preservation issues may need to be considered (the absence of diatoms immediately underlying the peat unit may mask the marine regression), there is the potential that the story is perhaps not as straightforward as expected and fluctuations in relative sea level may be preserved within the sequence.

		Depth (mbgl)				
		3.38	3.62	3.86	4.1	4.29
Planktonic Taxa	*Actinoptychus senarius*	8	9	23	9	7
	Cyclotella striata		2			
	Cyclotella sp.		3			
	Odontella sp.				3	
	Paralia sulcata	15	17	14	8	8
	Pseudomelosira westii	21	39	6	11	2
	Pseudopodosira stelligera	1	20	2	1	8
	Thalassiosira sp.			1	3	2
	Triceratum alternans	1				
	Triceratum favus	2	5			
Benthic Taxa	*Achnanthes brevipes*			1	1	1
	Amphora sp.			1		
	Caloneis sp.		2			
	Campylodiscus echeneis	1	4			
	Cocconeis placentula		1	1		3
	Delphineis surirella			2		
	Diploneis crabro	8	5			
	Diploneis didyma	6	15	1	2	7
	Diploneis ovalis				1	1
	Gyrosigma acuminata				12	
	Gyrosigma distortum					2
	Gyrosigma peisonis				1	15
	Gyrosigma wansbeski				6	17
	Gyrosigma scalproides				2	1
	Navicula abrupta					1
	Navicula cuspidata			1		
	Navicula cincta					2
	Navicula digitoradiata			1	1	9
	Nitzschia navicularis	31	25	38	15	10
	Nitzschia punctata	2				
	Nitzschia punctata var. constricta			1		
	Nitzschia sigma			15	25	41
	Nitzschia trybionella		2			2
	Rhabdonema arcuatum	2				
	Rhaphoneis amphiceros		2	3		12
	Rhophalodia sp.			1	1	
	Scoliopleura tumida	2		24	49	14
	Surirella gemma				2	
	Surirella ovalis					1
	Surirella sp.		1		1	
	Trachyneis aspera	2	1	4	3	7
Abundance		M	M	H	H	H
Diversity		M	M	H	H	H
Suitable for further analysis?		Y	Y	Y	Y	Y

Table 10: Summary of diatoms

6.4 Ostracods and forams *by Jon Whittaker*

6.4.1 A total of eight samples were selected from the underlying alluvial silt clay [009] for ostracod and foram assessment.

6.4.2 The results of the microfaunal assessment are shown in Table 11, which accompanies this report. The uppermost table shows the distribution of the "organic remains". Plant debris and seeds were found in all the eight samples. Insect remains were also found in all the samples, usually the remains of weevils, small "bugs" and chironomids. Charophyte oogonia, the reproductive organs of the stonewort plant, were only found in the uppermost sample and they were all minus the cortex, suggesting some degree of decalcification. Brackish foraminifera were found in all eight samples but interestingly, brackish ostracods and brackish molluscs in only two and one, respectively, in both cases at the base of the section.

6.4.3 The lower tables of Table 11 show the distribution of the various species of brackish foraminifera and ostracods found in the sediments; they are suitably colour-coded for easy reference to their ecological signatures. This information is gleaned from Murray (2006) for the foraminifera and Athersuch, Horne & Whittaker (1989) for the ostracods.

6.4.4 The picture revealed is that of a classic regressive sequence. Initially, the ostracods and foraminifera evidence estuarine tidal flats with associated saltmarsh. There is no marine component whatsoever present in the samples so the site would not appear to have been an open estuary at this time. This is a brackish embayment and we are probably near its periphery or where there is a wide development of saltmarsh. The lowest part of the sequence has the most abundant microfauna with both ostracods and foraminifera present, the latter in great numbers although still with a quite low species diversity; there are even brackish molluscs. Ostracods above 3.99m in the core are completely absent, signifying some decalcification due to weathering of the mudflats. Ostracods are much more prone to dissolution than the (internally buttressed) foraminifera. Subsequently, the picture is one of decrease of the calcareous foraminifera of the mudflats (colour-coded grey) as the tidal access decreases with the regression and concomitantly, the saltmarsh accretes, leaving just the agglutinating species so typical of mid-high saltmarsh (colour-coded turquoise) in the uppermost sample. This saltmarsh, however, must have contained some freshwater pools in which the charophyte (stonewort) plants lived, but as they have lost their calcareous outer cortex, this would suggest weathering; decalcification would have taken out any freshwater ostracods that might also have lived there.

ORGANIC REMAINS								
Sample type	Blocks <1>		Russian core <8>					
Depth below ground	2.69-2.71m	2.78-2.80m	3.03-3.08m	3.27-3.32m	3.51-3.56m	3.75-3.80m	3.99-4.04m	4.23-4.28m
plant debris + seeds	x	x	x	x	x	x	x	x
insect remains	x	x	x	x	x	x	x	x
brackish foraminifera	x	x	x	x	x	x	x	x
charophyte oogonia	x							
brackish ostracods							x	x
brackish molluscs								x
Ecology	*Classic regressive sequence. Estuarine tidal mudflats with associated saltmarsh; the former declining over time, the saltmarsh accreting*							

BRACKISH FORAMINIFERA									
Depth below ground	2.69-2.71m	2.78-2.80m	3.03-3.08m	3.27-3.32m	3.51-3.56m	3.75-3.80m	3.99-4.04m	4.23-4.28m	
Trochammina inflata	xx	xx	x	x	xx	xx	xx	xx	Agglutinating forams of mid-high saltmarsh
Jadammina macrescens	xx	xx	xx	x	xx	xxx	xxx	xx	
Haynesina germanica		x		x	xx	xxx	xxx	xxx	Calcareous forams of estuarine mudflats
Ammonia(brackish sp.)					xx	xx	xx	xx	
Elphidium williamsoni					x	x	xx	xxx	
Quinqueloculina(brackish sp.)							xx	xx	
BRACKISH OSTRACODS									
Depth below ground	2.69-2.71m	2.78-2.80m	3.03-3.08m	3.27-3.32m	3.51-3.56m	3.75-3.80m	3.99-4.04m	4.23-4.28m	
Loxoconcha elliptica							x	x	Ostracods of tidal mudflats and creeks
Leptocythere lacertosa							x	x	
Leptocythere castanea								x	
Organic remains are recorded on a presence(x)/absence basis only.									
Foraminifera and ostracods are recorded: x - several specimens; xx – common; xxx – abundant									

Table 11: Results of ostracod and foram assessment

6.5 Plant macrofossils *by Angela Vitolo*

6.5.1 A total of two samples were selected from the top and bottom of the sequence from context [008] to recover environmental material preserved in anoxic conditions and to retrieve material suitable for AMS dating. The following summarises the contents of the samples and discusses the significance and the potential of the plant remains and wood to provide information on diet, agrarian economy, vegetation environment and fuel selection and use.

Samples <3> [008], 2.34-2.44 m and <5> [008] 2.54-2.64m

6.5.2 The samples produced a very small amount of uncharred seeds that might have preserved in anoxic conditions. These included a seed of thistles (*Cirsium/Carduus* sp.) and one of sedges (*Carex* sp.). A few fragments of wood were noted and identifications were attempted in order to select material suitable for C14 dating. These included two oak (*Quercus* sp.) fragments from <5>, including a >8mm fragment. A couple of twigs from sample <3> were extracted but identification was not attempted because of their and fragility. Fragments of roundwood can provide reliable AMS dates, regardless of the taxon.

Sample Number	Context	Depth	Sample Volume	Sub-sample processed	Sieves used	Sub-sample scanned	Macrobotanical Remains	Identification and preservation notes	Wood	Notes on Preservation of Wood
5	8	2.54-2.64 m	10	2 L	4, 2,1mm, 500 & 250 micron	100ml	*	*Cirsium/Carduus* sp. (1)	**	1 large fragment, but mostly flakes of wood. Two fragments identified as Quercus sp., no round wood noted
3	8	2.34-2.44m	10	2 L	4, 2,1mm, 500 & 250 micron	100ml	*	*Carex* sp. (1)	**	2 small round wood fragments, a few small fragments of wood

Table 12: Results of plant macrofossil assessment

6.6 Insects *by Enid Allison*

6.6.1 Both paraffin flots produced abundant insect remains in a moderate to good state of preservation. The flot from sample <5> was very large (~70ml) due to the fact that small clumps of undisaggregated peat floated in addition to filmy plant material. Other invertebrates noted were mites (Acarina) in sample <4>, and water flea ephippia (Cladocera: resting eggs) and *Lophopus crystallinus* statoblasts in sample <5>.

6.6.2 Fragmentation of large and medium insect sclerites is high, especially in sample <5>. Beetle and bug taxa from aquatic, waterside and terrestrial habitats are represented and the general implications are for well-vegetated marshland with shallow standing water. Donaciine leaf beetles found on aquatic and emergent vegetation are a common component in both assemblages. Both assemblages have a high potential to provide data on aquatic conditions and for landscape reconstruction. Plant-associated taxa are common and have the potential to provide data on marshland plants that will complement the plant macrofossil and pollen work. The results are summarized in Table 13.

Sample number	Context	Depth	Sample volume	Character of insect assemblage	Taxa noted during scanning*
<3>	008	2.34 to 2.44m	2.5L	Remains moderately to well-preserved. Fragmentation of large and medium sclerites quite high, some sclerites crumpled. Estimated 200+ individual beetles and bugs from aquatic, waterside and terrestrial habitats. Plant-associated taxa common	*Cymus*, Delphacidae, Auchenorhyncha, *Noterus*, *Hygrotus*, Hydroporinae spp, Dytiscidae spp, *Bembidion* spp., *Odocantha melanura*, Carabidae spp, *Hydrobius fuscipes*, *Coelostoma orbiculare*, *Cercyon*, *Ochthebius* spp, *Lesteva*, Pselaphinae, *Stenus*, *Lathrobium*, Xantholinini, Staphylininae, *Cyphon*, Elateridae, Donaciinae sp(p), *Prasocuris phellandrii*, Apionidae, Ceutorhynchinae, Curculionidae spp, Coleoptera spp., Acarina spp
<5>	008	2.54 to 2.64m	2.5L	Remains moderately to well-preserved. Fragmentation of large and medium sclerites high. Estimated 200+ individual beetles and bugs from aquatic, waterside and terrestrial habitats. Donaciine leaf beetles dominant. *Aphodius* dung beetles present	*Daphnia* ephippia, other Cladoceran ephippia; Delphacidae, Dytiscidae, *Odocantha melanura*, Hydrophilininae spp, *Cercyon*, *Ochthebius* spp, *Lesteva*, Aleochariinae spp., *Lathrobium*, Staphylininae, *Cyphon*, Donaciinae spp, Curculionidae spp, Coleoptera spp, *Lophopus crystallinus* statoblasts

Table 13: Results of the Insect assessment

*Based on scanning approximately 10% of each paraffin flot; all identifications are provisional

6.7 Radiocarbon dating

6.7.1 A total of two samples of bulk sediment (peat [008]) were submitted to SUERC laboratories for radiocarbon dating. In both cases the humic acid was dated. The dating of peat and the reliability of the resultant dates from various fractions (eg humin, humic acids, etc) has been a topic of contention in the literature (see Blaauw et al 2004; Kilian et al 1995, 2000; Shore et al 1995). The two most commonly dated fractions from peat samples are the humin (ie alkali and acid insoluble organic detritus) and the humic acids (ie alkali soluble and acid insoluble matter).

6.7.2 The humin fraction can also sometimes be divided into the coarse (>250µ) and fine (<250µ). According to the research of Dresser (1971), only the fine humin fraction from blanket and reedswamp peats consistently produces reliable dating. However, Bartley and Chambers (1992) argue that the entire humin fraction should be used. It is important to stress once more that, because of the various scientific opinions regarding the fractions of peat that can be reliably dated and site-specific factors, consistency is sought within the radiocarbon dating programme.

6.7.3 The second peat fraction that is often dated is the humic acids, which are the in situ products of plant decay. Although they are produced in situ and imply stability of the ground surface, it has been shown that they can be mobile in groundwater, both vertically and horizontally (Shore et al 1995), but that their mobility is probably limited. Therefore, humic acids cannot be relied upon to always correctly date the level from which they were collected either. However, unlike the humin fraction, humic acids are homogenous, and are therefore often preferred over the humin fraction for dating by AMS.

Lab code	material	Location	13C relative to VPBD	Conventional radiocarbon age Cal BP	Calibrated date (95.4%)
SUERC 73246	Peat Humic acid	[008] 2.24-2.25m bgl	-28.6‰	2900 ±28	1207 to 1202 (0.6%) cal BC 1196 to 1141 (14.0%) cal BC 1134 to 1004 (80.7%) cal BC
SUERC 73247	Peat Humic acid	[008] 2.67-2.69m bgl	-28.3‰	3649 ±29	2135 to 2079 (22.9%) cal BC 2064 to 1939 (72.5%) cal BC

Table 14: Radiocarbon dating results

7.0 DISCUSSION AND CONCLUSIONS

7.1 Overview of stratigraphic sequence

7.1.1 The watching Brief at Seaside Recreation Ground recorded the presence of the classic Willingdon Levels peat and alluvial sequence. The samples recovered from the site were assessed for palaeoenvironmental proxies and dating and demonstrated good preservation overall. The age determinations returned demonstrated the accumulation of peat at the site from the Early to Late Bronze Age.

7.1.2 No archaeological remains were recorded in association with the peat deposits but the palaeoenvironmental assessment has demonstrated the potential of the site to yield important information relating to landscape evolution in the later prehistoric period.

7.1.3 The upper alluvial silt clay was truncated by the remains of a previously unmapped building that perhaps dates to the Second World War. The presence of practice ammunition indicates this structure may have been short-lived and was demolished before it could feature on local mapping. The recovery of several Georgian/Victorian coins from the made ground may relate to the use of the area as a park and perhaps fairground where such items could have been lost.

7.2 Deposit survival and existing impacts

7.2.1 The alluvial and peat sequence was well preserved and the only substantial disturbance recorded was the late 20th century building foundations. The upper alluvium and upper surface of the peat did demonstrate extensive oxidation indicative of later drainage of the site.

7.3 Discussion of deposits

7.3.1 The deepest deposit encountered was a smooth blue-grey silt clay with frequent reed remains, representing estuarine sediments. The subsequent palaeoenvironmental assessment has demonstrated that the pollen preservation within this deposit was poor with pre-Quateranry spores indicating reworking of bedrock outcrops. The diatom, ostracod and foram assemblages also demonstrated degrees of post-depositional weathering and decalcification, not unsurprising in a tidal environment.

7.3.2 Despite this there was a demonstrable shift in depositional conditions within this unit with an increase in marine planktonic diatom species up-profile. The ostracod and foram assemblages indicated that initially this environment was estuarine tidal flats with fringing saltmarsh before marin regression led to the onset of peat fomation. These assemblages suggest the sample site lay at the edge of a tidal embayment with the ostracods and forams demonstrating no marine influence.

7.3.3 The ostracods disappear from the sequence at the top of the blue silt clay indicating a weathering of the mudflats, perhaps as a result of marine regression. The forams recorded the presence of mid-high saltmarsh indicating a change in the tidal frame by this time. The presence of Charophyte oogonia

(freshwater algae) suggests that within this saltmarsh environment freshwater pools may have been present and that a stronger freshwater signal has been lost due to the degradation of the ostracod assemblage via sub-aerial weathering and decalcification. This picture is reinforced by the diatom assemblage which demonstrates an increase in planktonic taxa and an absence of epiphytic and aerophilous taxa prior to the onset of peat formation. This is the opposite of what is normally expected in a marine regressive context and may be due to issues of preservation as demonstrated by the ostracod assemblage.

7.3.4 The onset of peat formation has been radiocarbon dated to the early Bronze Age (SUERC 73247;2135-1939 cal BC, 3649 ±29 BP).The contact between the lower and upper silt clays are both sharp suggesting phases of erosion occurred both prior to and after peat formation occurred. The lower surface of the peat also undulated and thinned slightly to the north east. This date is in keeping with the age determinations recorded from the Willingdon Peat at Shinewater (1985-1765 cal BC) where the pollen assemblage records the final phase of brackish conditions (Jennings et al 2003). The pollen spectra at Shinewater demonstrated low values of Chenopodiaceae (Goose Foot) and dryland woodland, which is reflected in the assemblage recorded at Seaside.

7.3.5 Unlike the Shinewater sequence, the peat recorded here did not contain an intermediate organic clay-silt peat, but this layer has been shown to be discontinuous across the Levels and may relate to the position of the sample site within the wetland system. This layer has been demonstrated to represent a brief marine transgression with increases in aquatic taxa and brackish conditions.

7.3.6 The pollen assemblage at Seaside does indicate an abundance of fern species which was also recorded at Shinewater and Hydneye and has been interpreted as indications of grazing or 'mowing' of the vegetation (Jennings et al 2003,107). This may be supported by the identification of parasite eggs within the pollen samples from Seaside which may suggest grazing herbivores (wild or domesticated). However it is interesting to note that these were not identified within the insect samples although this may be due to the rapid nature of the assessment and that full analysis may demonstrate them to be present. Overall the pollen records an open, saline tolerant wetland dominated by sedges and grasses. The dryland vegetation has a low abundance of tree taxa with a dominance of hazel.

7.3.7 The lack of aquatic species within the pollen assemblage is also of interest as the insect assemblage demonstrated the presence of abundant aquatic species. This may demonstrate differential preservation of the pollen and insect assemblages which is frequently seen in wetland deposits.

7.3.8 The upper surface of the peat unit was extremely dry and demonstrated iron staining indicating extensive oxidation. The contact between this deposit and the overlying alluvium was sharp suggesting an erosive episode which may have removed an unknown amount of the peat. The upper part of the peat was dated to 1207-1004 cal BC (SUERC 73246). This is earlier than the date provided at Shinewater (Beta 105862: 795-395 cal BC, 2470 +35 BP) which again may be a reflection of the position of each sample site within the system and the way the marine transgression has differentially eroded the deposit

across the area. The site at Seaside is closer to the coast and may have been more exposed to erosion than Shinewater which lies 3km further inland.

7.3.9 The upper oxidised alluvium was truncated by the foundations of a small brick-built building. The structure was not recorded on either the aerial photographs or cartographic sources and may relate to Second Word War defences. The presence of practice rounds of ammunition from within the building and the presence of concrete render on the exterior walls seems to suggest this as likely. The remaining made ground deposits also contained Georgian and Victorian coins which likely derived from the creation and use of the park.

7.4 Consideration of research aims

7.4.1 The work undertaken at Seaside Recreation Ground has demonstrated that the Willingdon Peat unit is present at the site and has demonstrated a high potential to preserve palaeoenvironmental remains. The assessment has demonstrated that, despite later land-use changes, the peat deposit remains intact and preserves environmental data.

7.4.2 The project has achieved the aims set out in section 2.3 and it is recommended that the samples be progressed to full analysis in order that the results can be submitted for publication. In addition, the data gathered here will be included in the forthcoming Willingdon Levels mapping project to allow a better understanding of the wetland system as a whole

7.5 Updated Research Agenda

7.5.1 The deposits recorded at Seaside Recreation Ground represent an important contribution to the growing body of data associated with the Willingdon Levels. The preservation of micro and macrofossils have been found to be sufficient to allow full analysis. This includes the pollen and insect remains. The plant macrofossil assessment demonstrated limited survival of identifiable remains and is therefore not recommended for further work.

7.5.2 It is beyond the scope of this initial assessment to elucidate high resolution palaeoenvironmental reconstructions of the sedimentary sequences under investigation. If full analysis was to be undertaken on the sequence, both pollen and diatom investigations would yield much more insight into the palaeolandscape that was responsible for the development of the sedimentary archive. A clearer picture of the vegetation would be achieved, in addition to understanding the varying influence of herbaceous and arboreal taxa within the profile. In addition, evidence of possible animal/human activity, suggested through the presence of parasite eggs, may also be revealed within the pollen record.

7.5.3 Both insect assemblages have a high potential to provide data on aquatic conditions and for landscape reconstruction. Plant-associated insect taxa were common and have the potential to provide data on marshland plants that will complement the pollen work.

7.5.4 In order to frame this recommended programme of analysis the following research aims are proposed:

RRA1 To better understand the changes in tidal range in relation to relative sea level rise

RRA2 To provide comparable palynological data to that from Shinewater to test the theory of wetland exploitation for grazing

RRA3 To examine the insect remains in more detail to determine the presence/absence of grazing animals

RRA4 To expand the known palaeoenvironmental data record spatially in order to gain a fuller understanding of the wetland system

7.6 Conclusions and Publication

7.6.1 The assessment carried out at Seaside Recreation Ground has demonstrated the potential for the deposits to provide high resolution palaeoenvironmental data. As part of understanding the Willingdon Levels wetland system it is recommended that the samples be progressed to full analysis in order to provide a more complete record. This can then be prepared as a publication for entry into a journal such as the Journal of Wetland Archaeology or Environmental Archaeology. The resources required for analysis and publication are given in Table 15.

Sediment sequence	**days**
Comparison with existing Willingdon deposit model	0.5
Chronological comparison and landscape development	0.5
Integration of full analysis specialist reports	0.5
Background research and structure of paper	1.5
Preparation of text	2
Specialist work	
Insect full analysis of two samples	External lab fee
Pollen full analysis 8 samples	External lab fee
Illustration	
Diagrams, maps and sections: 8 figures	0.5
Production	
Editing and project management	1
Journal page fees	fee

Table 15: Resource required for analysis and publication

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HER Summary

Site code	SRG16					
Project code	160369					
Planning reference	Planning Reference: PC/160505					
Site address	Seaside Recreation Ground, Avondale Road, Eastbourne					
District/Borough	Eastbourne					
NGR (12 figures)	562017 099856					
Geology	Alluvium: Upper Greensand					
Fieldwork type			WB			
Date of fieldwork	October November 2016					
Sponsor/client	Southern Water					
Project manager	Neil Griffin					
Project supervisor	Kristina Krawiec					
Period summary				Bronze Age		
Project summary	An watching brief was carried out at Seaside Recreation Ground, Avondale Road, Eastbourne was carried out by ASE. The subsequent trench did not record waterlogged archaeological remains but did recover a sequence through the Willingdon Peat. The sequence was assessed and demonstrated accumulation in the Early –Late Bronze Age demonstrating an open fern dominated wetland.					

OASIS Form

OASIS ID: archaeol6-286238

Project details

Project name	An archaeological and geoarchaeological investigation at Seaside Recreation Ground, Eastbourne.
Short description of the project	The monitoring of the excavation of a flood alleviation trench at Seaside Recreation Ground, Eastbourne. The Willingdon Levels peat was encountered and samples were recovered for palaeoenvironmental assessment.
Project dates	Start: 12-09-2016 End: 01-11-2016
Any associated project reference codes	160369 - Contracting Unit No.
Type of project	Recording project
Current Land use	Community Service 2 - Leisure and recreational buildings
Investigation type	"Part Excavation"
Prompt	Planning condition

Project location

Country	England
Site location	EAST SUSSEX EASTBOURNE EASTBOURNE Seaside recreation ground
Postcode	BN22 8JA
Site coordinates	TQ 62017 99856 51.673576320872 0.343399844559 51 40 24 N 000 20 36 E Point

Project creators

Name of Organisation	Archaeology South East
Project brief originator	Archaeology South East
Project design originator	Archaeology South-East
Project director/manager	Neil Griffin
Project supervisor	Kristina Krawiec
Type of	Southern Water

sponsor/funding body	

Project archives

Physical Archive recipient	Eastbourne Museum Service
Physical Contents	''Environmental'',''Metal''
Digital Archive recipient	Eastbourne Museum Service
Digital Media available	''Images raster / digital photography'',''Spreadsheets'',''Survey'',''Text''
Paper Archive recipient	Eastbourne Museum Service
Paper Contents	''Environmental'',''Metal'',''Stratigraphic'',''Survey''
Paper Media available	''Context sheet'',''Photograph'',''Plan'',''Report'',''Section'',''Survey ''

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	An archaeological and geoarchaeological investigation at Seaside Recreation Ground, Eastbourne.
Author(s)/Editor(s)	Krawiec, K
Other bibliographic details	2017249
Date	2017
Issuer or publisher	ASE

Appendix 1: Sample lithology

<1> 0.29m OD

2.24-2.39m	DA	ST	EL	sicc.	UB
	4	1	1	3	top of block
	Dh1	Dl3	Dg+		
	dark brown hard peat, very compact, not well humified, large layered organic inclusions.				
2.39-2.44m	DA	ST	EL	sicc.	UB
	3	0	2	2	2
	Dh1	Dg3	Th+		
	slightly lighter brown peat, less compacted and more humified				
2.44-2.68m	DA	ST	EL	sicc.	UB
	4 0	4	1	2	
	Dg 4	Dl+	Dh+	Ga+	
	dark brown soft peat, well humified, less compact, salt crystal inclusions. Some bigger plant inclusions				
2.68-2.81m	DA	ST	EL	sicc.	UB
	1 1	0	1	3	
	As3	Ag1	Dl+	Dh+	
	blue grey silty clay with reedy plant inclusions				

<8> -0.37m OD

2.90-2.95m	DA	ST	EL	sicc.	UB
	2	1	0	2	Top of core
	As3	Ag1	Dg	Dh+	
	yellow-green grey silt clay with small organic inclusions. Fairly compact.				
2.95-3.25m	DA	ST	EL	sicc.	UB
	2	1	0	2	0
	As3	Ag1	Dg+	Dh+	Dl+
	darker green grey silty clay with small organic inclusions. Fairly compact.				
3.25-3.69m	DA	ST	EL	sicc.	UB
	2	1	0	2	0
	As3	Ag1	Dg+	Dh+	
	lighter green grey silt clay with fewer organic inclusions. Fairly compact.				
3.69-3.91m	DA	ST	EL	sicc.	UB
	2	2	0	2	0
	As3	Ag1	Dg+	Dh+	
	gradually transitions into green grey silty clay with dark organic inclusions.				
3.91-3.94m	DA	ST	EL	sicc.	UB

	2	2	0	2	0
	As3	Ag1	Dg+	Dl+	
	green grey silt clay with larger woody organics				
3.94-4.00m	DA	ST	EL	sicc.	UB
	2	0	0	2	1
	As3	Ag1	Dg+		
	olive green grey silty clay with small organic inclusions				
4.00-4.30m	DA	ST	EL	sicc.	UB
	2	0	0	2	1
	As3	Ag1	Dg+	Ptm+	
	Green grey silty clay with small organic inclusions and some calcareous shell inclusions				

Appendix 2: Troels-Smith classification scheme

Darkness	
nig.4	black
nig.3	
nig.2	
nig.1	
nig.0	white

Degree of Stratification	
strf.4	well stratified
strf.3	
strf.2	
strf.1	
strf.0	no stratification

Degree of Elasticity	
elas.4	very elastic
elas.3	
elas.2	
elas.1	
elas.0	no elasticity

Degree of Dryness	
sicc.4	very dry
sicc.3	
sicc.2	
sicc.1	
sicc.0	water

	Sharpness of Upper Boundary
lim.4	< 0.5mm
lim.3	< 1.0 & > 0.5mm
lim.2	< 2.0 & > 1.0mm
lim.1	< 10.0 & > 2.0mm
lim.0	> 10.0mm

	Sh	*Substantia humosa*	Humous substance, homogeneous microscopic structure
I Turfa	*Tb*	*T. bryophytica*	Mosses +/- humous substance
	Tl	*T. lignosa*	Stumps, roots, intertwined rootlets, of ligneous plants
	Th	*T. herbacea*	Roots, intertwined rootlets, rhizomes of herbaceous plants
II Detritus	*Dl*	*D. lignosus*	Fragments of ligneous plants >2mm
	Dh	*D. herbosus*	Fragments of herbaceous plants >2mm
	Dg	*D. granosus*	Fragments of ligneous and herbaceous plants <2mm >0.1mm
III Limus	*Lf*	*L. ferrugineus*	Rust, non-hardened. Particles <0.1mm
IV Argilla	*As*	*A.steatodes*	Particles of clay
	Ag	*A. granosa*	Particles of silt
V Grana	*Ga*	*G. arenosa*	Mineral particles 0.6 to 0.2mm
	Gs	*G. saburralia*	Mineral particles 2.0 to 0.6mm
	Gg(min)	*G. glareosa minora*	Mineral particles 6.0 to 2.0mm
	Gg(maj)	*G. glareosa majora*	Mineral particles 20.0 to 6.0mm
	Ptm	*Particulae testae molloscorum*	Fragments of calcareous shells

Physical and sedimentary properties of deposits according to Troels-Smith (1955)

© Archaeology South-East		Seaside Recreational Ground, Avondale Road, Eastbourne	Fig. 1
Project Ref: 160369	June 2017	Site location	
Report Ref: 2017249	Drawn by: AR		

561986, 99913

562040, 99913

N

SEASIDE

Section 1

007

3.2m

Gate

171

169

163

1

0 10m

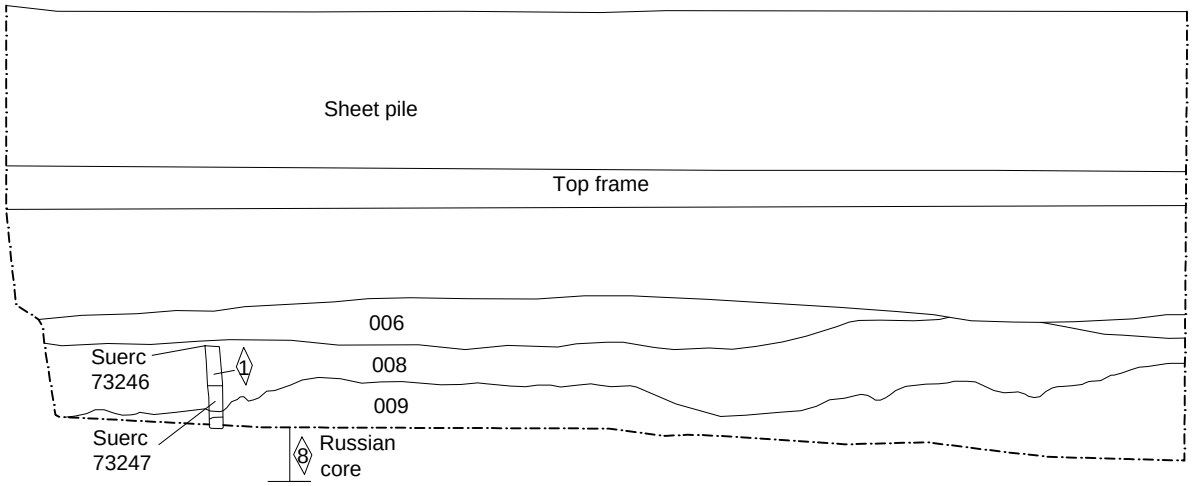
Sheet pile

007, looking north east

General view of trench, looking west

© Archaeology South-East		Seaside Recreational Ground, Avondale Road, Eastbourne	Fig. 2
Project Ref: 160369	May 2017	Trench location and photographs	
Report Ref: 2017249	Drawn by: AR		

South east facing section



© **Archaeology South-East**		Seaside Recreational Ground, Avondale Road, Eastbourne	Fig. 3
Project Ref: 160369	June 2017	South east facing section	
Report Ref: 2017249	Drawn by: AR		

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