Wessex Archaeology

# Proposed ETP
# Avlon Works, Severnside

Archaeological Evaluation

Ref: 50966.01

*August 2002*

# PROPOSED ETP, AVLON WORKS, SEVERNSIDE

## Archaeological Evaluation

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# PROPOSED ETP, AVLON WORKS, SEVERNSIDE

## Archaeological Evaluation

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## Archaeological Evaluation

### SUMMARY

Wessex Archaeology was commissioned by AstraZeneca to undertake the archaeological evaluation of land at the Avlon Works, Severnside (centred on ST 3546 1835). AstraZeneca are preparing an Environmental Statement to accompany a planning application to South Gloucestershire Council to construct an effluent treatment plant (ETP) on the Site. A scoping opinion issued by South Gloucestershire Council required a programme of archaeological evaluation to inform the environmental impact assessment.

The evaluation comprised a sub-surface geophysical survey of the entire Site followed by the excavation of a series of targeted trial trenches. The geophysical survey was undertaken in March 2002 and the trial trenching between 8 – 19 April 2002. This report presents the results of the evaluation, together with an assessment of the likely impact of the development on archaeological remains and proposals for mitigation. The report forms the basis for the assessment of baseline conditions, impacts and mitigation for archaeology and cultural heritage, as presented in the Environmental Statement.

Electromagnetic conductivity survey of the Site identified a small but significant fall in conductivity towards the north-western part of the survey area, suggesting two differing depositional environments. Trial trench locations were therefore selected to sample these and to evaluate the layout of the proposed structures on the Site. Four trial trenches, each 30m in length and 5m wide, and a fifth trench 40m long and 5m wide, together representing a sample of some 6% of the Site by area, were excavated to a depth sufficient to allow description and sampling of the sedimentary sequence through the Upper Wentlooge Formation.

A sedimentary sequence characteristic of the Wentlooge sequence in the Avon Levels was exposed in all five trial trenches. Typically (trenches 1-4) this comprised reddish-brown silty clays, a peat band, reddish-brown to greyish blue silty clays, a second *Phragmites* peat band, and bluish-grey silty clays; Trench 5 identified a single peat horizon. Comparison of the OD heights of the peat horizons with those of dated horizons elsewhere showed a poor correlation, highlighting the variable nature of the peat bodies on the Levels. Radiocarbon dating indicates that the lower peat band is of Neolithic date and the upper of Bronze Age date.

No features of definite archaeological origin were recorded in any of the trial trenches. However, a single linear feature cut through the upper peat produced a small assemblage of cattle bone showing evidence of butchery using metal tools, suggesting human activity of likely Iron Age/Romano-British date in the vicinity of the Site. The feature itself seems likely to be of natural origin, however, as are three parallel rivulets recorded cut into the surface of the lower peat. No cultural material was recovered during the evaluation. The evidence of human activity provided by the animal bone assemblage is unsurprising and fits well with the model of low-level,

transient activity suggested for the later prehistoric period in this part of the Levels: the absence of any specific archaeological association here reduces the significance of this evidence, however.

A palaeo-environmental sampling and assessment programme has confirmed that pollen, diatoms and foraminifera survive well within the peats. Waterlogged plant remains and insect evidence were also recovered, but charred remains were present in only very small quantities. The palaeo-environemtal programme has allowed some interpretation of the depositional history of the Site, including an understanding of the position of the Site in relation to the wetland and fringing environments. Although further analysis of the palaeo-environmental data might elucidate the nature of the highly localised environment and its development, the lack of any archaeological association and absolute dating greatly reduces the significance of the data.

The construction of the ETP will entail the sinking of piled foundations for the structures, together with some excavation for pile caps, ground beams, access roads and service runs. Excavation for a pumping facility to a depth of 6m is required over an area 6m by 6m. The sinking of pre-cast piled foundations will result in small-scale, localised loss of the peat deposits but is unlikely to have any detrimental effect on the continued survival of the peat and associated palaeo-environmental evidence. The evaluation indicates that no archaeological remains survive on the Site that would be affected by the proposed excavation. Although deep excavation for the pumping facility could result in the localised loss of the upper and lower peat horizons, this would again be restricted in area and would not compromise the survival of the deposits as a whole.

Although the evaluation did not identify any specific archaeological remains on the Site, the presence of human activity in the vicinity is suggested by the animal bone assemblage associated with the upper peat deposit. It is therefore proposed that where the upper peat will be impacted by excavation for the pumping facility, it should be exposed under archaeological supervision and any archaeological remains revealed should be investigated and recorded prior to further excavation.

The sedimentary sequence revealed is typical of the deposits represented across the Avon Levels. Therefore, in the absence of any specific archaeological association, further analysis of the palaeo-environmental data recovered during the evaluation is not proposed.

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## Archaeological Evaluation

### ACKNOWLEDGEMENTS

The evaluation was commissioned by AstraZeneca and Wessex Archaeology would like to thank the ETP project team for their assistance. The assistance of Mike Gdaniec of AstraZeneca in arranging site access and attendances is also gratefully acknowledged.

The fieldwork was monitored throughout by David Haigh (South Gloucestershire Council). The advice and comments provided by the English Heritage regional scientific adviser, Vanessa Straker (University of Bristol), are also acknowledged.

The project was managed for Wessex Archaeology by Chris Moore. The trial trenching was directed in the field by Vaughan Birbeck, assisted by Lee Newton, Steve Sampson and Chris Reece. This report was prepared by Chris Moore with Michael J. Allen and Vaughan Birbeck. The illustrations are by Linda Coleman.

The geophysical survey was undertaken for Wessex Archaeology by Terra Nova Ltd. Detailed sediment descriptions were made by Dr David Jordan (Terra Nova Ltd) and Michael J. Allen (Wessex Archaeology). The pollen and diatoms were assessed by Dr Robert Scaife (University of Southampton), the foraminifera by Dr Simon Haslett (University of Bath) the waterlogged and charred material by Dr Alan Clapham (University of Cambridge), and insect remains by Dr Mark Robinson (Oxford University Museum). Bulk samples were processed at Wessex Archaeology and scanned for charcoal, charred plant remains and molluscs by Sarah F. Wyles and Michael J. Allen (Wessex Archaeology).

# PROPOSED ETP, AVLON WORKS, SEVERNSIDE

## Archaeological Evaluation

## 1 INTRODUCTION

### 1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by AstraZeneca to undertake the archaeological evaluation of land at the Avlon Works, Severnside (hereafter 'the Site'; **Figure 1**). AstraZeneca are preparing an application to South Gloucestershire Council for reserved matters approval to construct an effluent treatment plant (ETP) on the Site.

1.1.2 The Secretary of State has directed that the planning application should be accompanied by an environmental statement. A scoping opinion issued by South Gloucestershire Council required a programme of archaeological evaluation to inform the environmental impact assessment: these requirements were detailed in an accompanying Brief issued by the Archaeology and Conservation Officer (South Gloucestershire Council 2001). A written scheme of investigation (WSI; Wessex Archaeology 2002) was submitted to and approved by the Archaeology and Conservation Officer of South Gloucestershire Council ('the curator') and the English Heritage regional scientific adviser for the south west of England.

1.1.3 The evaluation comprised a sub-surface geophysical survey of the entire Site followed by the excavation of a series of targeted trial trenches. The geophysical survey was undertaken in March 2002 and the trial trenching between 8 – 19 April 2002.

1.1.4 This report presents the results of the evaluation programme. It considers the likely impact of the proposed development on the deposits encountered and makes recommendations for further work to mitigate the effects of these impacts.

### 1.2 The Site: Location and Description

**1.2.1** The Site is located close to the northern perimeter of the Avlon Works, centred on ST 3546 1835 (**Figure 1**). It is bounded to the north and east by a fenced green buffer separating the Works from the adjacent Western Approaches Business Park. The Site is bounded to the south by roadways and structures forming part of the Works and to the west by a similar field. All the Site boundaries are formed by rhines or lesser drainage features.

**1.2.2** The Site extends to some 1.4 ha in area and is generally level, vacant grassland. It is understood that some topsoil has been removed previously.

1.2.3

1.2.4

## 1.3 Archaeological Background

1.3.1 An archaeological desk-based assessment (Wessex Archaeology 2001) has previously been submitted in support of an application to South Gloucestershire Council for a screening opinion under the Environmental Assessment Regulations 1999. The archaeological and historical background of the Site as presented in the desk-based assessment is summarised below.

1.3.2 The Site is situated on the Henbury Level, an area of low elevation, flat, artificially drained land forming part of the Avon Levels. Human exploitation of the Levels during the prehistoric and Romano-British periods appears to have taken the form of insubstantial and short-lived, possibly seasonal, settlement.

1.3.3 Geotechnical test pits and boreholes undertaken on the Site in July 2001 (Geotechnics Ltd 2001) have identified localised peat deposits within silts of the Middle Wentlooge Formation, and a contact zone between the Upper and Middle Wentlooge Formations. The peat deposits may preserve palaeo-environmental evidence.

1.3.4 Settlement of Bronze Age to Romano-British date has been recorded within the Upper Wentlooge Formation at e.g. Hallen Marsh, Northwick, Katherine Farm and Cabot Park (Locock 1997a; 1997b; 1999; 2000; Locock *et al* 1998; Allen and Scaife 2001, table 12). However, recent palaeo-environmental analysis of the Second Severn Crossing results suggests that although the established saltmarsh was exploited, such activity was low-level and transient in nature; consequently, archaeological evidence of this is typically insubstantial (Gardiner *et al* in press).

1.3.5 An auger survey undertaken as part of the Second Severn Crossing studies included two transects that crossed the area of the adjacent WAP1 distribution park, the nearest being approximately 500m to the east of the Site. This identified a palaeosol (buried soil horizon) of Iron Age or Romano-British date at up to 2m below present ground level, suggesting that a buried Iron Age landscape may survive in the area. However, neither the recent ground investigations on the Site nor additional auger survey and test pitting undertaken on Plot 7000 of WAP1, adjacent to the Site, located this horizon.

1.3.6 There is extensive and well-studied documentary, placename and landscape evidence for the development of settlement patterns on the Levels from the Medieval period. There is no evidence for settlement of Medieval date within the Site. The Site is situated on the edge of the back-fen, an area that would have been one of the last to be drained and reclaimed for agriculture; the regular shape of the field boundaries that form the Site is consistent with late enclosure of likely 18th or 19th century date. There are no features on the Site of historic landscape significance in either local or regional terms.

## 2 AIMS AND OBJECTIVES

### 2.1 Stages of Evaluation

2.1.1 The approved WSI proposed to undertake the field evaluation of the Site in two stages:

- Stage 1 – geophysical survey of the whole Site;
- Stage 2 – targeted evaluation trenching.

### 2.2 Aims and Objectives

2.2.1 The aims of the evaluation were (within the limits of the specified techniques/trench layout) to gather sufficient information to establish the presence/absence, extent, condition, character, quality, location and date of remains and/or deposits of archaeological significance within the Site.

2.2.2 The objectives of the geophysical survey were:

- To map and interpret the palaeo-topography of the Site and identify where possible any areas of likely higher archaeological potential e.g. former channels, islands etc.;
- To identify the location and extent of features or deposits of likely archaeological interest and provide an interpretation of these; and
- To assist in the development and implementation of a targeted trial trenching strategy.

2.2.3 The objectives of the trial trenching were:

- To determine or confirm the general nature of any remains present;
- To determine or confirm the approximate date or date range of any remains, by means of artefactual or other evidence;
- To determine the condition and state of preservation of any remains;
- To determine the degree of complexity of any horizontal or vertical stratigraphy present;
- To determine the likely range, quality and quantity of any artefactual evidence present; and
- To determine the potential of any remains to provide palaeo-environmental and/or economic evidence, and the forms in which such evidence may be present.

## 3 METHODOLOGY

### 3.1 Geophysical Survey

3.1.1 Electromagnetic conductivity survey of the Site was selected as an appropriate technique to complement the use of deep, wide trial trenches, in

order to increase the chances of detecting buried archaeological remains and allow the recording and sampling of sediment sequences of potential archaeological interest. Electromagnetic conductivity survey was undertaken across the whole Site by a specialist subcontractor, Terra Nova, using a Geonics EM31 instrument to map sub-surface conductivity variations, which may be correlated with buried topographic features including former channels and islands.

3.1.2 The survey area was marked out on the ground and conductivity readings taken at intervals of 5m. Two complete lines of readings, one crossing the area north to south and one east to west, were repeated to test the precision of the survey data and calculate the effect of any drift in the instrument readings.

## 3.2 Trial Trenching

3.2.1 Following completion of the geophysical survey on site an interim report was prepared by the subcontractor and submitted to the curator and English Heritage for information. The locations of trial trenches were selected on the basis of the geophysical survey results and the layout of the proposed structures on the Site, and agreed with the curator.

*3.2.2* Four trenches each 30m in length and 5m wide and one trench 40m long and 5m wide, representing a sample of some 6% of the Site by area, were excavated in the agreed locations (**Figure 2**). Trenches 1-4 were targeted to examine the footprint of the proposed ETP structures; Trench 5 was located in the eastern part of the Site in an area proposed for use as a laydown area during construction. The trial trenches were excavated to the top of the first significant archaeological horizon, or to a depth sufficient to allow description and sampling of the sedimentary sequence through the Upper Wentlooge Formation to the contact zone with the organic silts (*c*. 2.00 – 2.30 m below present ground level).

*Mechanical Excavation*

3.2.3 All trenches were marked out on the ground prior to the commencement of work. Topsoil and overburden were removed using a 360º excavator fitted with a toothless bucket, working under the continuous direct supervision of a suitably experienced archaeologist. Topsoil and modern overburden were removed in a series of level spits down to the top of the first significant archaeological horizon; in the absence of any such horizon(s), excavation continued in a series of steps not exceeding 1.2m in depth, to a maximum depth of 3.6m below the present ground level. Following cleaning and recording, trench sides were battered as necessary prior to further excavation, in order to allow safe working.

*Hand Excavation*

3.2.4 One long section of each trench was cleaned by hand and recorded at an appropriate scale. Additional sections or parts thereof were cleaned by hand where features or deposits required clarification. All features of whatever origin requiring clarification were cleaned by hand and recorded in plan at an

appropriate scale. Sufficient of the features located were investigated by hand in order to fulfil the aims of the project.

*Recording*

3.2.5 All archaeological features and deposits encountered during the evaluation were recorded by Wessex Archaeology in accordance with the Wessex Archaeology *Field Recording Manual* using *pro forma* recording sheets and a continuous unique numbering system.

3.2.6 Plans, sections and elevations of archaeological features and deposits were drawn as necessary at 1:10, 1:20 and 1:50 as appropriate. Drawings were made in pencil on permanent drafting film. The spot height of all principal features and levels was calculated in metres relative to Ordnance Datum, correct to two decimal places.

3.2.7 Photographs were taken as necessary to produce a photographic record consisting of monochrome prints and colour transparencies.

## 3.3 Environmental Sampling Strategy

3.3.1 An environmental sampling strategy was developed during the course of the project as outlined in the WSI and in consultation with English Heritage.

3.3.2 Detailed descriptions of the full sequence were made by a competent geo-archaeologist and environmental archaeologist.

3.3.3 Undisturbed sediment samples were taken as overlapping monoliths were taken through the full and representative sequence and detailed sedimentological descriptions were made of the sampled section.

3.3.4 Kubiena samples suitable for soil micromophology were taken from any stabilisation horizon, ephemeral occupation surface, or humic (i.e. 'BARAS'-type) layer.

3.3.5 Bulk samples (40 litres) for the recovery of charred remains were taken from a single linear feature identified in three trenches, and peat horizons encountered in all trenches. Subsamples of 1 litre and 5 litres were taken from these bulk samples for waterlogged plant remains and insects respectively.

3.3.6 Samples of identifiable plant matter, suitable for radiocarbon dating, were taken from the top 2 cm and basal 2 cm of any significant peat or organic horizon.

# 4 RESULTS

## 4.1 Introduction

4.1.1 This section summarises the results of the geophysical survey and the trial trenching. Detailed descriptions and discussion of the sedimentary sequence and the palaeo-environmental evidence from it are presented in **section 5** below.

## 4.2 Geophysical Survey

4.2.1 The detailed methodology and results of the geophysical survey are described in the subcontractor's report (Terra Nova 2002; **Appendix 1**) and are summarised only here.

4.2.2 The geophysical survey was constrained by interference resulting from the two rhines on the western and southern edges of the site, and the metal fence in the north, which restricted the area of survey from which useful conclusions may be drawn. Despite this interference, the survey did nto identify any major feature, such as a large palaeochannel, cutting through the normal sequence of deposits.

4.2.3 A small but significant fall in conductivity was identified towards the north-western part of the survey area, corresponding with variations in the depositional profiles recorded from geotechnical test-pits and boreholes. The latter show that the sediments towards the north-west contain two peat beds (at about 2.6 to 2.9m aOD and at about 3.6 to 3.9m aOD), while those towards the south and east contain only a single bed (at 3.7 to 3.9m aOD).

4.2.4 The area where the two peat beds survive corresponds approximately with the area of lower conductivity and it seems likely that the areas of higher and lower conductivity do represent two slightly different depositional environments. It is suggested (**Appendix 1**) that the presence of the two peat beds in the north-western area might indicate that terrestrial conditions became established here on two occasions, while on only one occasion elsewhere across the site. Trial trench locations were therefore selected to sample both depositional environments suggested by the geophysical survey results.

## 4.3 Trial Trenches

4.3.1 Detailed descriptions of the deposits revealed in the trial trenches are presented as **Appendix 2**.

4.3.2 All trenches except Trench 5 revealed a similar and comparable sequence of:

- Brownish silty clays
- Upper peat
- Grey-brown silty clays
- Lower peat

- Blue silty clays

4.3.3 These deposits are discussed in **section 5** below.

4.3.4 A single linear feature of possible archaeological origin was recorded in Trenches 1-3. This was traced between the three trenches and varied in form. In Trench 1, the feature (105) was steep-sided, some 0.90m wide and 0.66 m deep; a small assemblage of animal bones was recovered from its single, peaty fill. In Trenches 2 and 3, the profile of the feature (209 and 306) was more irregular, some 1.30-1.80m wide and 0.20-0.50m deep with a peaty fill. No finds were recovered from the feature in either Trench 2 or 3.

4.3.5 The animal bone is all of cattle, and comprises a scapula, pelvis and three ribs. All show signs of burning and butchery using a metal tool. The presence of domestic animals and evidence of butchery here clearly indicates human activity in the vicinity of the Site; the use of a metal tool suggests this activity is likely to be of Iron Age or Romano-British date. No cultural material was recovered from the feature, however, and its varying profile might suggest a natural origin, given the absence of any other features of possible archaeological origin.

4.3.6 In Trench 4, three roughly parallel, north-south aligned, irregular, narrow (0.20-0.25m wide) features (402, 403 and 404) were recorded within the alluvium, some 2.25m beneath the surface. These were a maximum of 0.12m deep and all were filled with silty clay. No finds were recovered and the features are assumed to be of natural origin, probably representing drainage runnels or rivulets within the salt marsh.

# 5 THE PALAEO-ENVIRONMENTAL EVIDENCE

## 5.1 Introduction

5.1.1 A programme of palaeo-environmental sampling and assessment was undertaken in accordance with that outlined in the WSI. The results of assessment of the palaeo-environmental evidence and description of the sedimentary sequence allow some interpretation of the environmental history of the Site.

5.1.2 This section presents a summary and interpretation of the palaeo-environmental evidence from the Site. Detailed reports from specialist assessors are presented as **Appendix 3**.

## 5.2 Sampling and Assessment

5.2.1 Four bulk samples of *c.* 40 litres were taken from the two peat layers (contexts 305 and 109), and the fill of rhine/ditch 307 in trench 3. Sub samples were removed and processed separately for waterlogged plant remains, and insects. The remainder (*c.* 25-30 litres) was processed by flotation for charred plant and charcoal remains following standard methods. The samples were as follows:

- Sample 4: top of upper peat (305), unit 2a
- Sample 5: base of upper peat (305), unit 2b
- Sample 6: peat (306) in natural channel 307
- Sample 11: lower peat (309), unit 4

5.2.2 The full Wentlooge sequence was sampled as undisturbed sediment in a series of overlapping monoliths from every trench (details are given in **Appendix 3**). This facilitated further sedimentological description, close-interval subsampling for pollen, diatom, and formainfera assessment, and precision sampling of identifiable organic matter from defined strata for consideration for radiocarbon dating. Additional monolith samples through the Wentlooge sequence were also taken by David Jordan (Geoarchaeologist, Terra Nova Ltd).

5.2.3 To complement the undisturbed samples of the full sequence sampled in monoliths, most of the organic stasis horizons were also sampled as undisturbed soil blocks in kubiena tins, for consideration for soil micromorphology.

5.2.4 Four samples of identifiable plant matter were taken from undisturbed sediment samples from key peat horizons and submitted to the Rafter Radiocarbon Laboratory, New Zealand, for radiocarbon dating (**Table 1** below).

| **Sample** | **WA ref no.** | **Rafter lab ref. no.** |
|---|---|---|
| *From kubiena sample 15* | | |
| Context 204 top @ 0cm unit 2a | 50966, 15, 204 @0cm | R26881/1 |
| Context 204 bottom @ 4cm unit 2a | 50966, 15, 204 @4cm | R26881/2 |
| *From kubiena sample 18* | | |
| Context 210 top @ 0cm unit 4 | 50966, 18, 210 @0cm | R26881/3 |
| Context 210 bottom @ 4cm unit 4 | 50966, 18, 210 @4cm | R26881/4 |

**Table 1: Samples submitted for radiocarbon dating**

5.2.5 Bulk samples were processed at Wessex Archaeology and the included palaeo-environmental remains were assessed by appropriate specialists. Assessment aims were to determine the presence of the specific microfossil (pollen, diatoms, formainifera) or macrofossils (waterlogged plant remains, insects, charred plant remains, and charcoal), and indicate their significance in understanding the nature of the humanly occupied landscape. These data were compared, where relevant, with that from other studies in the Avon Levels in order to evaluate their potential significance in evaluating the prehistoric lived-in landscape.

5.2.6 Full details of each processing and assessment methodology are given in **Appendix 3**.

## 5.3 The Sedimentary Sequence

5.3.1 The Wentlooge Sequence was exposed in all five trenches. Typically this comprised reddish-brown silty clays, a peat band, reddish-brown to greyish blue silty clays, a second *Phragmites* peat band, and unbottomed blueish-

grey silty clays. The sequences were broadly uniform across the site, although some distinct variation and warping of peat bands was noticed. These variations are discussed below.

5.3.2 The topsoil comprised pelo-calcareous alluvial gleys of the Newchurch 2 association (Findlay *et al.* 1984) under pasture. The remaining sequence can be summarised as shown in **Table 2** below.

| Unit | Summary | Characteristics |
|---|---|---|
| Unit 1 | Reddish-brown silty clay | Reddish-brown silty clay, often with clear coarse (20mm) rhythmic sequence of silty and fine sandy strata (each subdivided into much thinner upward fining strata). Can tend towards blue-grey at depth due to post-deposition effects, oxidation and hydrology. Typically *c.* 2.0m |
| Unit 2a | Upper peat | *Phragmites* fen peat often with clear horizontal structure and common *Phragmites* stem. Typically the unbifurcated peat sequence is 0.1-0.25m thick |
| Unit 2b | Clay | In some locations (e.g. trench 1) the upper peat is bifurcated by a lens of grey silts to silty clay, often with very thin (1.0-0.5mm fine laminae of organic matter, and penetrated by vertical roots channels |
| Unit 2c | Upper peat | Humic silts to peat; the lower portion of the upper peat is typically more highly humified though locally can be strongly horizontally structured, and contain a mass of *Phragmites* detritus. |
| Unit 3 | Greyish-blue silty clay | Greyish-blue silty clay with fine laminations of silt and fine sand. Commonly upto 1 to 1.5m thick |
| Unit 4 | 2nd peat | Humified *Phragmites* peat, locally variable horizontal structure Often 0.1 to 02m thick |
| Unit 5 | Blueish-grey silty clay | Bluish-grey silty clay with strong to weak fine laminations of fine silt and sand |

**Table 2: Sedimentary units**

5.3.3 The OD heights of the sedimentary units summarised above are given in **Table 3** below.

| | TRENCH 1 | | TRENCH 2 | | TRENCH 3 | | TRENCH 4 | | TRENCH 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | context | OD | context | OD | context | OD | context | OD | context | OD | |
| Unit 1 | 101 | 5.93 | 201 | 5.74 | 304 | 5.80-4.00 | 401 | 5.71 | 501 | 5.78 | |
| Unit 1 | | | | | | | | | 504 | 3.93 | |
| Unit 2a<br>Unit 2b<br>Unit 2c | 102<br>103<br>104 | 4.03<br>silt<br>3.93 | 204<br>205<br>206 | 4.01<br>silt<br>3.86 | 305 | 4.04-3.92 | 408<br>409<br>410 | 3.95<br>silt<br>3.85 | | | Peat |
| | 105 | | 207 | | 306 | | | | | | |
| Unit 3 | 107 | 3.88 | 207 | 3.81 | 308 | 3.92-3.07 | 411 | 3.80 | | | |
| Unit 2 | | | | | | | | | 505<br>506<br>507 | 3.72<br>3.66<br>3.60 | Peat |
| Unit 3 | | | | | | | | | 508 | 3.55 | |
| Unit 4 | 108<br>109 | 2.74<br>2.69 | 210 | 30.1 | 309 | 3.07-2.93 | 412<br>413 | 2.81<br>2.70 | | | Peat |
| Unit 5 | 110 | 2.64 | 211 | 2.90 | 310 | 2.93 | 414 | 2.65 | | | |

**Table 3: OD heights of sedimentary units**

5.3.4 This sequence is typical and characteristic of the Wentlooge sequence in the Avon Levels. It compares well with sequences recorded at Awkley Lane and

Vimpenny's Lane (Allen and Scaife 2001), Katherine's Farm (Allen and Powell 2002), and Cabot Park (Locock *et al* 1998; Locock 1999). The overall interpretation of this sequence is well documented (e.g. Allen and Scaife 2001; Allen, JRL 1987; 1990a; 1990b; Allen and Rae 1987).

5.3.5 A number of significant variations in the sequence within the site were noted. In Trench 2 the lower peat showed significant dishing, depression and warping, indicating that these peat horizons are not necessarily horizontal and planar; this observation has also been made elsewhere in the Levels (Allen 1990a; Locock 1999). In Trench 5 only one peat horizon was encountered, at a significantly lower OD height (*c.* 0.3m lower) than the dished, depressed and warped peat (Unit 2) seen in Trench 2: this confirms the local variability of this peat surface. Consequently, the base of unit 1 within Trench 5 was distinctly greyish-blue over the first peat encountered, because of post-depositional changes due to redox and hydromorphism (reduction due to waterlogging). This coloration is probably subtly different to that which has been proposed to distinguish the Upper and Middle Wentlooge sequences (i.e. unit 1 from units 3 or 5) on palaeo-environmental grounds (Allen and Scaife 2001).

5.3.6 The surface of the lower peat in Trench 4 (Unit 4) was scoured with a series of small rivulets indicating some erosion of the peat, and onset of water ingress prior to the deposition of the inorganic overlying silty clay.

5.3.7 A single feature was noticed cutting through the upper peat. In Trench 1 this has very steep, smooth vertical sides, not unlike a cut ditch; however, rhines in this soft sediment also create very deep (up to 1.6m) vertical-sided channels. In other trenches the profile of this feature was characteristic of a shallow, irregular, water-cut feature typical of the head of a rhine.

## 5.4 The Peat Horizons

5.4.1 The calibrated radiocarbon dates for the plant matter from the top and bottom of the upper and lower peat horizons are given in **Table 4** below. The upper peat (Unit 2) here is of comparable date to Bronze Age occupation levels on minerogenic deposits at Katherines Farm, and thin organic deposits at Rockingham Farm (**Table 5**). The lower peat (Unit 4) dates conformably to within the Neolithic period and can be compared with similar peat horizons at Cabot Park and Vimpennys Lane (**Table 5**). There was limited archaeological activity associated with the former surface, and none at the latter.

| Unit | Context | Sample OD | Lab no | Result | δC13 | Calibrated range |
|---|---|---|---|---|---|---|
| 2 | 204 | 3.86m OD | NZ-15587 | 2900±60 | -25.2 | 1320-920 cal BC |
| 2 | 204 | 3.82m OD | NZ-15588 | 3352±60 | -25.3 | 1880-1510 cal BC |
| 4 | 210 | 2.95m OD | NZ-15616 | 4073±55 | -24.3 | 2880-2490 cal BC |
| 4 | 210 | 2.91m OD | NZ-15589 | 3966±60 | -25.6 | 2900-2300 cal BC |

**Table 4: Radiocarbon dates**

5.4.2 The upper peat horizon occurs at *c.* 3.80 m aOD (**Table 3**); **Table 5** summarises the comparative OD heights of dated stasis horizons from the

Middle Wentlooge sequence. This shows that the Avlon horizons are considerably lower than both the Later Bronze Age horizons at Katherines Farm, Rockingham Farm, Kites Corner and Little Googs (all at *c.* 5.30 – 5.10 m aOD), and the Neolithic and Mesolithic horizons at Cabot Park/Seabank and Katherines Farm (4.5m and 4.85m respectively). The stasis level at Vimpenny's Lane (Allen and Scaife 2001) is at a similar altitude (4.20-4.05 m aOD) and dates to the Neolithic (*c.* 2900-2600 cal BC). Dated peat horizons (Druce 1998; 2001) at Gravel Banks are of Atlantic to Boreal date and at a lower altitude.

| **Site** | **Layer** | **mOD** | **Result** | **Calib'd** | **Description** |
|---|---|---|---|---|---|
| Rockingham Farm | | 5.7 | 2850±40 BP, Beta-134902 | 1120-910 | upper gleyed layer |
| *SOILS IN MINEROGENIC SEDIMENT Later Bronze Age soils with archaeological activity* | | | | | |
| Katherine's Farm | 523 | 5.3-5.25 | 2778±55 BP, NZA-12725<br>2957±55 BP, NZA-12726 | 1070-810<br>1380-1010 | Pale blue clay, incipient stabilisation horizon, archaeol. |
| Rockingham Farm | 729 | 5.20-5.10 | 2810±70 BP, Beta-118379<br>3040±60 BP, Beta-118378 | 1210-820<br>1440-1100 | thin bands of organic material |
| Kites Corner | 462 | 5.1 | 2610±70 BP, Beta-129554 | 930-520 | charcoal patch archaeological activity |
| Little Googs/ Kites Corner | | 5.1-5.2 | 2970±60 BP, Beta-134900<br>3350±60 BP, Beta-134901 | 1400-1020<br>1780-1510 | non humic soil |
| *PEAT BANDS* | | | | | |
| Cabot Park | 162-4 | 4.5 | 3970±60 BP, Beta-125795<br>4170±70 BP, Beta-125794 | 2900-2300<br>2920-2580 | organic clay 'BARAS' charcoal - activity in vicinity |
| Seabank site | 'BARAS' | 4.7 | 3930±50 BP, Wk-5804 | 2580-2280 | |
| Katherine's Farm | 525 | 4.85-4.75 | 5879±70 BP, NZA-12478<br>6866±50 BP, NZA- 12495 | 4910-4550<br>5790-5590 | Dark bluish grey humic clay |
| **Avlon** | **Unit 2: 204** | **3.82-3.86** | **2900±60 BP, NZA-15587<br>3352±60 BP, NZA-15588** | **1320-920<br>1880-1510** | **Brown/black peaty silty clay with *Phragmites*** |
| **Avlon** | **Unit 4: 210** | **2.91-2.95** | **4073±55 BP, NZA-15616<br>3966±60 BP, NZA-15589** | **2880-2490<br>2900-2300** | **Brown/black humified *Phragmites* peat** |
| *FINE HUMIC LENSES Other pre-Late Bronze Age stasis horizons* | | | | | |
| Awkley Lane | 107 | 4.61-4.46 | R26327/2 | no result | Dark grey (10YR 4/1) stonefree clay with up to 10% flecks of black material. |
| Vimpennys Lane | 207 | 4.20-4.05 | 4182±55 BP, NZA-12527 | 2920-2610 | Very dark grey (10YR 3/1) stonefree slightly silty clay, humic/organic layer |

**Table 5: Comparison of OD heights of stasis horizons in the Middle Wentlooge sequence (after Allen and Scaife 2001; Locock 1999)**

5.4.3 Thus, comparison with the OD heights of dated peat deposits elsewhere on the Levels confirms that these deposits do not form extensive planar surfaces, but rather represent large 'fingers' of peat (Allen 1990a, fig 1; Locock 1999; Allen and Scaife 2001, fig 2). The dating of these horizons can, therefore, only provide local control, and is not referable over any distance as a chronological 'marker horizon'.

5.4.4

## 5.5 Discussion

5.5.1 The summary interpretation of the depositional/environmental history of the Site presented here is based on a consideration of all categories of evidence submitted for assessment. The chronology of the peat layers given here is derived from the radiocarbon dates; the minerogenic sequences are undated.

*Unit 5 (bluish-grey silty clay)*

5.5.2 This was probably deposited in sub-tidal marine conditions (i.e. seasonal marine inundation). Episodic flooding decreased in the upper elements of the deposit, allowing colonisation by grasses, sedges and other fen taxa. Some of the sediments here may have eroded from an earlier *in situ* Ipswichian (glacial) deposit locally. Linden woodland occurred in the locality suggesting that the Site at this time lay between dryland and seasonally flooded wetland landscapes. This woodland vegetation indicates sub-Boreal conditions of Neolithic to later Bronze Age date.

*Unit 4 (Humified Phragmites fen peat)*

5.5.3 Local reed swamp (dominated locally by *Phragmites australis)* developed, ultimately with a humic peat forming in drier conditions, prior to inundation represented by alluvial salt marsh sediments (Unit 3). This occurs in the Neolithic period (*c.* 2900-2500 cal BC).

*Unit 3 (greyish blue silty clay)*

5.5.4 Woodland on the surrounding dryland areas gave way to more open grassy conditions as the reedswamp dried out, and salt marsh environments developed high in the tidal frame (beyond normal high tidal range).

*Unit 2 (Phragmites fen peat)*

5.5.5 Local reed swamp developed on the Site in the Bronze Age (*c.* 1900-900 cal BC); although settlement activity occurs on drier (non-peaty) areas within the Levels at this time, it is not recorded here. On the fringing dryland, less trees are represented and grassland is dominant, with minor but important occurrences of willow. The sequence here represents drying out of the reedswamp into a developed open salt marsh with pools of water. Heather, ling and *Sphagnum* moss indicate the onset of acid conditions. The channel 307 cuts through and probably drained from this drying *Phragmites* reed swamp and contained slow-flowing or standing water, choked with *Phragmites* reeds and grasses with *Sphagnum* moss.

*Unit 1 (reddish-brown silty clay)*

5.5.6 Open grassland environments prevailed, which may have included both salt marsh or freshwater grasses *Glyceria fluitans* and plantains. Cereal pollen is present in the upper sample (context 201 at 56cm) and indicates the first positive evidence of human activity, probably of medieval or post-medieval date. Peaks of Chenopodiaceae suggest marsh habitat in proximity to marine conditions. Some of the sediment is transported by flooding and tidal inundation from the low intertidal zone.

5.5.7

## 5.6 Conclusions

5.6.1 The changes and development are consistent with those reported elsewhere (e.g. Allen and Scaife 2001). The trends show local development of salt marsh and reed swamp, reflecting rising relative sea levels and a diverse local mosaic of vegetation.

# 6 DISCUSSION

## 6.1 Summary

6.1.1 The trial trenching has revealed a sedimentary sequence typical of the Upper/Middle Wentlooge sequence recorded elsewhere in the Avon Levels. Two peat horizons, representing the development of semi-terrestrial environments within the alluvial wetland sequence, were exposed and sampled in four of the five trenches. The fifth trench revealed only a single peat horizon. This apparent change in the sequence across the Site is reflected in the results of the electromagnetic conductivity survey, which identified a small but significant fall in conductivity, corresponding to the presence of the two peat horizons, in the north-western part of the Site. Comparison of the OD heights of these dated peat horizons (Tables 4 and 5) with those of dated horizons elsewhere showed a poor correlation, highlighting the variable nature of the peat bodies across the Levels.

6.1.2 No features of definite archaeological origin were recorded in any of the trial trenches. A single linear feature, cut through the upper peat (Unit 2) in Trenches 1-3 produced a small assemblage of cattle bone showing evidence of butchery, suggesting human activity in the vicinity of the Site. The feature itself seems likely to be of natural origin, however, as are three parallel rivulets recorded cut into the surface of the lower peat in Trench 4. No datable or other cultural material was recovered during the evaluation.

6.1.3 The palaeo-environmental sampling and assessment programme has confirmed that pollen, diatoms and foraminifera survive within the peats. Waterlogged plant remains and insect evidence were also recovered, but charcoal was present in only very small quantities; no charred plant remains were present.

6.1.4 The results of the palaeo-environmental programme allow some interpretation of the depositional history of the Site. The lowest deposit recorded suggests that the Site lay between dryland, colonised by woodland vegetation indicating sub-Boreal conditions of Neolithic to later Bronze Age date, and seasonally flooded wetland (sub-tidal conditions). Localised reed swamp subsequently developed in the Neolithic, and drier conditions led to the formation of the lower peat horizon on the Site while more open, grassy conditions prevailed on the adjacent dryland. The Site was then inundated again as alluvial salt marsh environments developed beyond the normal high tidal range. Localised reed swamp developed once more in the Bronze Age, and this gradually dried out into open salt marsh with pools of water, draining in small channels such as those recorded on the Site. The uppermost

deposit recorded represents an open grassland environment, possibly including both salt marsh and freshwater species; cereal pollen from this deposit is likely to be of medieval or post-medieval date, and represents the only positive evidence of human activity on the Site.

## 6.2 Importance of the Deposits

6.2.1 The deposits have been shown to contain varying levels of preservation of different palaeo-environmental data. Although the development of the wetland and saltmarsh landscape of the Avon Levels can be seen to have general overall trends, this landscape is in reality a mosaic and a myriad of highly localised habitats.

6.2.2 This huge local diversity and variation provides the potential for isolated occurrences of human activity at certain times (e.g. short-lived camps, base camps, exploitation of local resources, stock grazing etc.). However, although the palaeo-environmental data can elucidate the nature of the highly local environment and its development, neither the sequence nor its contained palaeo-environmental data can be related to any specific human activity in the developing saltmarsh environment sampled here. Furthermore, none of the sequences within the inorganic sediments can be dated and therefore related to dated periods of archaeological activity in the area. This lack of any archaeological association and absolute dating of the majority of the sediment sequence greatly reduces the significance of the data.

6.2.3 Perhaps the most significant data is the absolute chronology derived from the radiocarbon dates of the peat levels (Units 2 and 4) and the overall interpretation of the developing landscape.

6.2.4 The evidence of human activity provided by the animal bone assemblage is unsurprising, and fits well with the model of low-level, transient activity suggested for the later prehistoric period in this part of the Levels on the basis of the Second Severn Crossing work (Gardiner *et al*, in press). Again, the absence of any specific archaeological association here reduces the significance of the evidence, however.

## 6.3 Likely Impact of the Development

6.3.1 The trial trenching did not identify any features of definite archaeological origin: although there is some evidence of human activity in the form of the animal bone associated with the upper peat, this lacks any specific archaeological association. The archaeological interest in the Site therefore lies primarily in the palaeo-environmental potential of the sedimentary sequence revealed.

6.3.2 The application Site includes the footprints of the proposed structures (treatment vessels and ancillary buildings), access roads and hardstandings, which together occupy some 60-70% of the Site. The eastern third of the Site will not be developed but will be utilised during the construction programme as a laydown area for materials; this part of the Site was included in the area of the archaeological evaluation (Trench 5).

6.3.3 The construction of the ETP will entail the sinking of piled foundations for the structures, together with some excavation for pile caps, ground beams and service runs. Some excavation will also be required for construction of the access road, to a depth of approximately 500mm. Ground levels over the development area will be raised by up to 500mm to provide a piling mat and construction base. It is understood that the piles are likely to be of the pre-cast concrete displacement (driven) type, of 270mm x 270mm square cross section, primarily beneath the footprint of the new structures.

6.3.4 The sinking of pre-cast piled foundations will result in small-scale, localised loss of the peat deposits due to individual piles. The impact of the piles on the hydrology of the peat is less well understood. The potential of the peat to preserve palaeo-environmental evidence relies on its continued waterlogged nature. It is understood that there is no water table management regime currently in force on the Avlon Works site and the water table across the area is therefore likely to fluctuate naturally, as elsewhere on the Levels. Analysis of the sediments revealed in the trial trenches shows that these are of a dense structure, in which the water content is likely to remain high in spite of variations in the water table. Hence, such fluctuations are unlikely to have any detrimental effect on the continued survival of the peat and associated palaeo-environmental evidence. It is therefore considered that any dewatering of the peat resulting from piling will be extremely localised to individual piles and is unlikely to have any detrimental effect on the palaeo-environmental potential of the deposit on the Site.

6.3.5 Mass excavation on any significant scale is not proposed. Road construction will entail excavation to a depth of *c*. 500mm below present ground surface. Excavation to a depth of up to 1.5m for pile caps, ground beams etc. may also be anticipated. Deeper excavation is likely to be restricted to the pumping facility, where a depth of 6m below present ground surface may be necessary, over a plan area of 6m by 6m. The evaluation indicates that no archaeological remains survive on the Site that would be affected by the proposed excavation. Although deep excavation for the pumping facility would result in the localised loss of the upper, and possibly lower, peat horizon(s), this would be restricted in area and would not compromise the survival of the deposit(s) as a whole. As with the piles, no significant effect on the hydrology of the peat is anticipated from such excavation.

## 6.4 Proposals for Mitigation

6.4.1 Although the evaluation did not identify any specific archaeological remains on the Site, the presence of human activity in the vicinity is suggested by the animal bone assemblage associated with the upper peat deposit. It is therefore proposed that where the upper peat will be impacted by localised excavation for the pumping facility, it should be exposed under archaeological supervision and any archaeological remains revealed should be investigated and recorded prior to further excavation.

6.4.2 Although the development proposals will have some impact on the peat horizons, the effects of this are considered to be insignificant as the survival

of the deposits will not be compromised and the sequence revealed is typical of the deposits represented across the Avon Levels. While the specialists in their individual reports suggest some opportunities for further palaeo-geographical analysis, the palaeo-environmental data within the inorganic sequences cannot be dated and none of the data is associated with human activity. Therefore, in the absence of any specific archaeological association, further analysis of the palaeo-environmental data recovered during the evaluation is not proposed.

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# 8 APPENDIX 1: GEOPHYSICAL SURVEY REPORT

# A Geoarchaeological study of deposits at the Avlon Works, Avonmouth

8 March 2002


## Summary

The results of an electrical conductivity survey were compared with test-pit records to produce a tentative model of the deposits buried within this site. An area of lower conductivity is identified with variations in deposits identified in the test-pits, providing targets for further investigation. The conductivity survey also identified a large conductive feature, which may be a metal pipe, running through the centre of the site.



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## Aims of the study

This study aimed to combine geophysical data and records of strata seen in test-pits to reach an initial understanding of Holocene deposits at the site of a new development at the Avlon chemical works, Severn Beach.

## Background and method

The site, at ST 542 833, is rectangular and measures approximately 100 by 150 metres. It is bordered by drainage ditches to the north and south and crossed by a ditch about 2 metres wide, running NNW/SSE towards its western side. All these ditches were full of water to within 50cm of the surface when the survey was carried out.

The ground is crossed by broad ridges and drainage ditches associated with former agriculture and was very wet – probably saturated below 30cm - when the survey took place.

A high metal chain-link fence defines the southern and eastern sides of the site and a further, barbed-wire, fence formed the southern edge of the survey area, within the southern ditch.

Construction debris, including gravel and brick fragments, are scattered across the southern half of the site. There were deep wheel ruts, ponding water, around the south-western quarter of the site. The ground surface was covered with short grass and herbs.

### Geology

The site lies on about 16 metres of alluvial deposits overlying weathered Mercia mudstone (Geotechnics 2001, BGS 1962, 1988). The Avonmouth alluvium to the south has been studied at a number of sites, including Rockingham Farm (ST 5273 8091) and Cabot Park (ST 535 800). A study at Redwick (ST 5475 8576), to the north, may be particularly relevant to this study because it revealed deposits which may be similar to those found at the Avlon works (GGAT 1992, Locock 1999).

The alluvium belongs to the Wentlooge sequence of Holocene deposits which represent marine transgressions and regressions as a series of estuarine, saltmarsh, creek and terrestrial strata. Soils, representing profile development below surfaces exposed in various environments and to varying degrees, have been identified in the upper part of the sequence while below this are peat deposits which separate the upper and lower Wentlooge. The peats developed under wet terrestrial conditions during periods of marine retreat.

**The natural soils**

The soils of the site are pelo-calcareous alluvial gleys of the Newchurch 2 association (SSEW 1983). These are clayey soils, with a calcareous horizon within 50cm of the surface and subject to long-term waterlogging. They are therefore managed as permanent pasture.

A view of the site from the west

**Survey method**

This survey was intended to define the structure of the upper alluvium by identifying where differences in sediment characteristics may survive. Such differences in the sediments may represent differences in the way in which the deposits formed. Our final aim was to help guide where deep excavation trenches were to be placed so that such differences in sediment characteristic, identified by the survey, could be studied in greater detail.

We chose to carry out our survey using a geophysical method because studies elsewhere in the Severn alluvia (Terra Nova 2001a, 2001b, Locock 2001) had suggested that the properties of these deposits, laid down under different sedimentary regimes, can be distinguished geophysically.

One of the characteristics that differs in this way is electrical resistance. The specific electrical resistance (resistivity) of alluvia can vary greatly and strong contrasts often occur between strata with different textures.

Under saturated conditions, with highly conductive pore water, it is likely that the resistance characteristics of the deposit can be used as a proxy for sedimentary characteristics indicating something of the environment in which the deposits were laid down – although the precise relationship between the sediment and its resistance properties is often poorly understood and may vary greatly between sites.

In this calcareous, estuarine environment ground pore-water ionic concentrations are likely to be high. This expectation is partly supported by the relatively high water soluble sulphate levels in some of the buried strata as described in the engineers report (Geotechnics, 2001). Thus texture and pore distribution (which may be proxies for sediment origin), rather than pore water conductivities (which may have many origins), are likely to be the main factors controlling the bulk conductivity of the buried strata.

Excavation was unlikely to reach depths greater than 6 metres and thus we were mainly concerned with detecting resistance changes to that depth. This is done efficiently using the Geonics EM31, an instrument which transmits an electromagnetic wave and detect the degree of response induced in the ground. It is known that ground with a high magnetic susceptibility produces a strong induction response in phase with the inducing field (Scollar et al 1990) while electrically conductive ground produces a lag in the inductive response, through the dispersal of induced eddy currents. A lag in response can also be produced by a property called magnetic viscosity but this was unlikely to be significant in these alluvia.

The EM31 is able to measure both the in-phase response of the ground which is due to magnetic susceptibility variations (due, for example, to metal and often used to find large, deeply buried metal objects) and the out-of-phase response caused mainly by soil conductivity variations – from which ground resistance is easily calculated.

The particular advantage of the EM31 is the speed with which it can take conductivity measurements and the depth of its response, which is significant to more than 6 metres.

The survey area was marked out on the ground and conductivity readings taken at intervals of 5 metres. Two complete lines of readings, one crossing the area N-S and one E-W, were repeated to test the precision of the survey data and calculate the effect of any drift in the instrument readings.

The readings taken by the EM31 are strongly disturbed by the presence of metal and EM31 survey is often not worthwhile where metal services, large fences and debris are found across a site. The survey was planned, however, based on the information that there were no quantities of metal debris and that services and fences were limited to the edges of the site, leaving a large central area where valid measurements could be taken.

## Results

The survey results are shown in the figures below. The variation between pairs of replicate readings is sufficiently small, and thus the data sufficiently reproducible, that small conductivity variations, due to the real geophysical properties of the ground, will be clearly visible. Any conductivity effect due to the varying nature of the deposits is therefore likely to have been detected, away from other sources of interference.

Two strong, linear anomalies dominate the EM31 results. That running NNW to SSE (A) is due to the drainage ditch which crosses the site. The central line consists of points within the ditch where no reading could be taken while the points immediately to its east and west are slightly distorted values due probably to the hydrology of the soil around the ditch and to local disturbance.

The strong anomaly crossing E-W (B) is quite different. The form of the anomaly, which consists of two large positive peaks and a very large negative peak, is typical of a conductive metal object while the size and breadth of the anomaly indicates that it is both substantial and buried at some depth. This is likely to represent a large, metal pipe – probably the large gas pipe which was thought to lie further south and cross only the south-western corner of the survey area. It is much less likely to be due to the domestic lead water pipe which is thought to lie within the site.

The fences also produced local anomalies (C) which have influenced the readings taken near to them but, as predicted, the area affected is small.

These broad anomalies have significantly reduced the area in which we can look for natural conductivity variations. Thus the data are less useful than they might otherwise have been, although other approaches – geophysical or otherwise – are likely to have encountered the same problems, without clarifying their cause so effectively.

Once the fence, ditch and pipe anomalies are removed we can see that there is a small but significant fall in conductivity towards the NW of the survey area (D to E). This corresponds with variations in the depositional profiles recorded from test-pits and from boreholes – and which may suggest a possible interpretation.

The test pits and boreholes were recorded for engineering purposes and the deposit records made from them lack some detail which may be of geoarchaeological significance. They indicate, however, that the sediments differ across the site. In particular they show that the sediments towards the north-west contain two peat beds (at about 2.6 to 2.9m aOD and at about 3.6 to 3.9m aOD). Those towards the south and east contain only a single bed at 3.7 to 3.9m aOD.

The general sequence of deposits, becoming gradually finer up the profile, is fairly consistent across the whole site. At the base of the sequence is sand and gravel overlying the weathered bedrock at about 10 metres below OD. The sand becomes finer and incorporates more fine matter, passing into silt, containing varying proportion of sand and organic matter, at about 2 metres above OD. The peat beds lie

within the silt and the upper peat (where there are two) lies at or very close to the top of the silt where it passes into clay. The clay layer, between 3.7 and 4.2m aOD and the surface at 6.0–6.2m aOD, is weathered and has the modern soil profile formed within it.

We may speculate that the presence of the two peat beds in the north-western area might indicate that terrestrial conditions became established here on two occasions, while on only one occasion elsewhere across the site. Thus the north-western area may have been raised sufficiently above its surroundings to become terrestrial while the areas around were still within the estuarine tidal frame – although the raised area seems rather small to have been influenced so differently by the local conditions.

The area where the two peat beds survive corresponds approximately with the area of lower conductivity. We note also that the transition from sand to silt is at its highest in test pit 3, which lies within the area of lower conductivity. We might expect such sands to be relatively resistive, as at the Avonmouth Sewerage Works site to the south (Terra Nova, 2001a).

From these coincident observations we might infer that the whole of the lower conductivity area may coincide with a raised, sandy area on which peat was able to form on two occasions – although we have too little evidence to be sure. It seems likely, however, that the areas of higher and lower conductivity do represent two slightly different depositional environments and that further investigations should be designed to sample both. It might also be very helpful to examine a transect between the two areas to see more clearly how they relate to each other.

Although our test pit observations are sparse and our geophysical data compromised by interference, neither indicate that the site is crossed by any major feature, such as a large palaeochannel, cutting through the normal sequence of deposits.

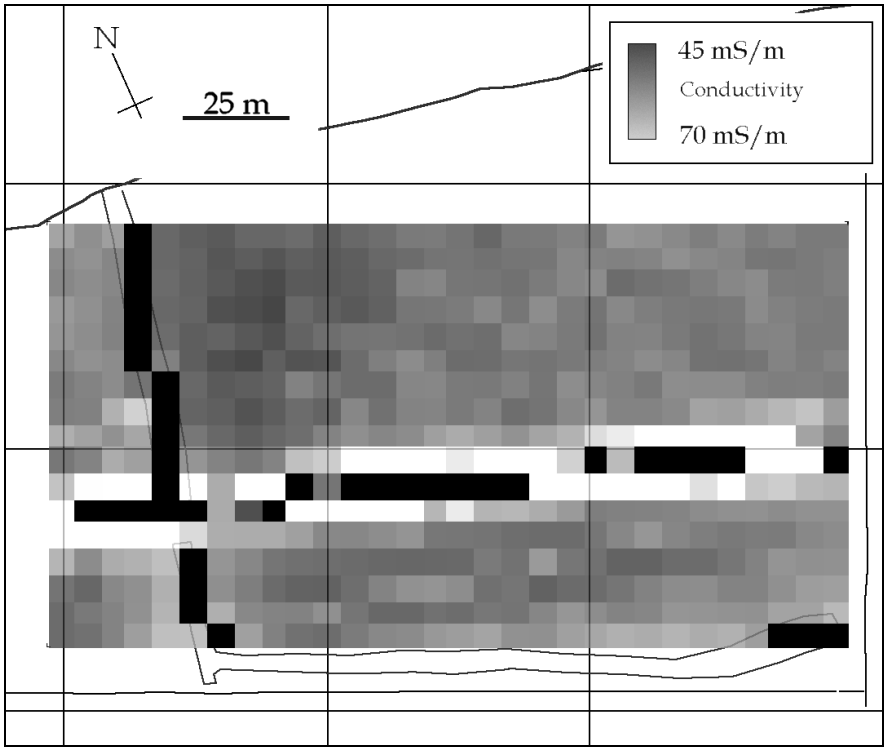
## Conclusions

We conclude that a broad change in depositional environment occurs across the site but the available evidence suggests that the general sequence of deposits is similar throughout. A slightly greater degree of terrestrial influence, tentatively identified from the test-pit records, may have been localised as an area of lower conductivity, by the EM31 survey.

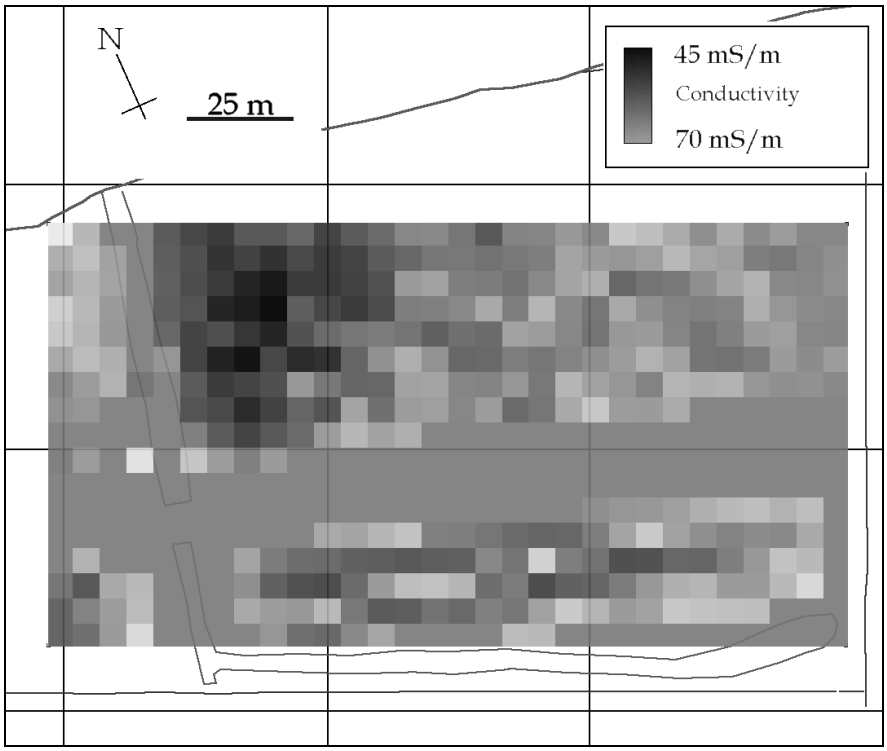
Excavation might therefore be targeted to examine both the area of lower conductivity in the north-west and the areas of higher conductivity to the south and east. A transect excavated between the two may allow us to determine how the depositional sequences of these areas are related. No other significant targets have been identified by this survey.

Excavator and developer should be made aware of the probable presence of the metal pipe running through the centre of the site.

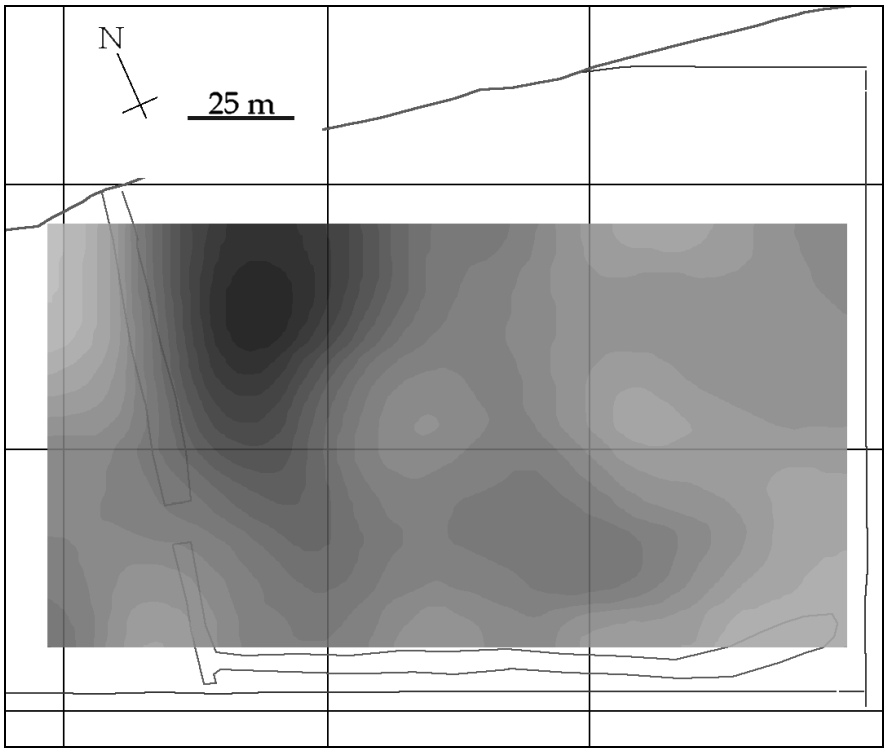
## Figures



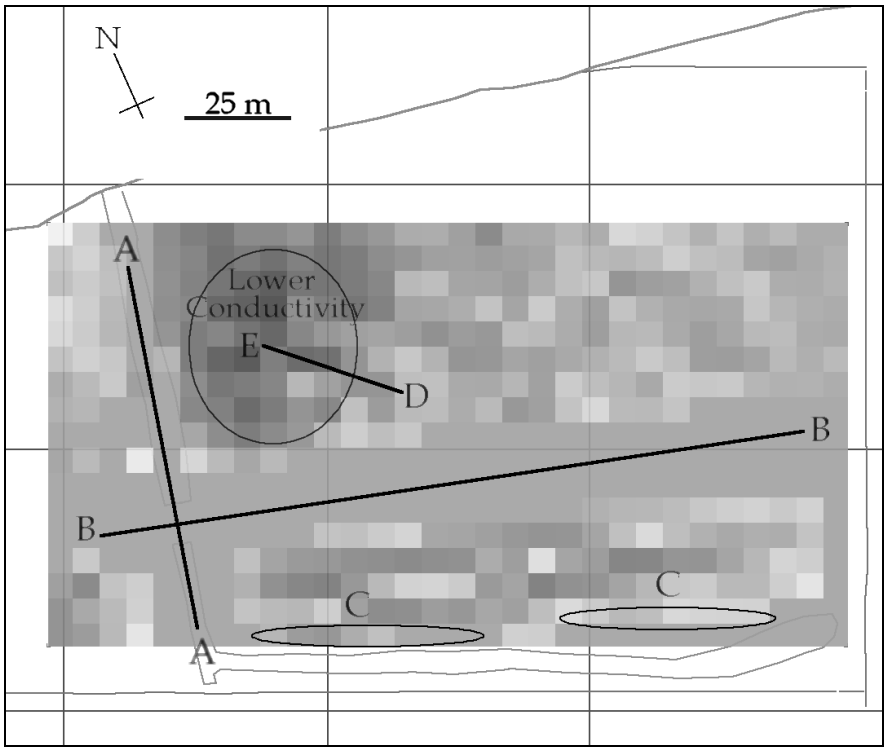

Unprocessed conductivity survey




Conductivity survey with extreme values, caused by metal structures, removed




Mean smoothed data – with distorted values removed




Interpretation

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# 9 APPENDIX 2: CATALOGUE OF TRENCH DESCRIPTIONS

| **Trench 1** | | Max. Depth:- 3.40m | Length:- 30m | Ground level-6.10m OD |
|---|---|---|---|---|
| **Depth** | **Context** | **Description** | | |
| 0-0.20m | 100 | Topsoil – Mid greyish brown clay loam with sparse brick and concrete inclusions | | |
| 0.20-2.10m | 101 | Mid greyish brown slightly sand clay. Alluvium | | |
| 2.10-2.15m | 102 | Black, humic peat, only discernible in eastern end of trench. | | |
| 2.15-2.20m | 103 | Dark grey, very silty clay with common humic inclusions. | | |
| 2.20-2.25m | 104 | Black, humic peat | | |
| **Feature** | **105/106** | Cut [105] of a roughly north-south aligned linear feature, approximately 0.90m wide and 0.66m deep with steep, slightly convex sides and a slightly irregular, though generally flat, base. Filled with a dark brownish grey/black humic peat (106) with common silty clay inclusions. Contained a small assemblage of animal bones. | | |
| 2.25-2.90m | 107 | Bluish grey silt with sparse humic inclusions. | | |
| 2.90-3.00m | 108 | Dark brown humic, silty clay. | | |
| 3.00-3.15m | 109 | Very dark grey/black humic peat, friable. | | |
| 3.15m+ | 110 | Bluish grey very silty clay, very soft. | | |

| **Trench 2** | | Max. Depth:- 3.50m | Length:- 40m | Ground level-6.15m OD |
|---|---|---|---|---|
| **Depth** | **Context** | **Description** | | |
| 0-0.20m | 200 | Topsoil – Mid greyish brown clay loam with sparse brick and concrete inclusions | | |
| **Feature** | **202/203** | Cut [203] of north-south aligned linear feature, traced for approximately 5m. Approximately 1.40m wide and 1.20m deep with near vertical sides and a flat base. Filled with 202, a mid grey clay. No finds recovered. | | |
| 0.20-2.10m | 201 | Mid greyish brown slightly sand clay. Alluvium | | |
| 2.10-2.15m | 204 | Black, humic peat. | | |
| 2.15-2.20m | 205 | Dark grey, very silty clay with common humic inclusions. | | |
| 2.20-2.25m | 206 | Black, humic peat | | |
| **Feature** | **208/209** | Cut [209] of approximately north east-south west aligned linear feature, probably a continuation of feature 105. Approximately 1.80m wide and 0.50m deep with irregular sides and a concave base. Filled with 208, a very dark grey/black silty peat with common silty clay inclusions,. No finds recovered. | | |
| 2.25-3.10m | 207 | Bluish grey silt with sparse humic inclusions. | | |
| 3.10-3.20m | 210 | Very dark grey/black silty humic peat, friable towards base. | | |
| 3.20m+ | 211 | Bluish grey very silty clay, very soft. | | |

| **Trench 3** | | Max. Depth:- 3.30m | Length:- 30m | Ground level-6.10m OD |
|---|---|---|---|---|
| **Depth** | **Context** | **Description** | | |
| 0-0.25m | 300 | Topsoil – Mid greyish brown clay loam. | | |
| **Feature** | **301/302** | Cut and fill of modern, cast iron water pipe. | | |
| 0.25-0.35m | 303 | Sub-soil-mid grey slightly silty clay with sparse brick inclusions. | | |
| 0.35-2.00m | 304 | Mid greyish brown slightly sand clay. Alluvium | | |
| 2.00-2.15m | 305 | Very dark grey/black peat, quite silty at top, more humic and friable towards base. | | |
| **Feature** | **306/307** | Cut [306] of north east-south west aligned linear feature, probably a continuation of 105 and 209. Approximately 1.30m wide and 0.20m deep with very irregular sides and base. Filled with 307, a black silty peat with common silty clay inclusions. No finds recovered. | | |
| 2.15-2.95m | 308 | Very soft, bluish grey clay silt. | | |
| 2.95-3.05m | 309 | Very dark grey/black peat, quite silty at top, more humic and friable towards base. | | |
| 3.05m+ | 310 | Very soft, bluish grey clay silt. | | |

| **Trench 4** | | Max. Depth:- 3.60m | Length:- 30m | Ground level-6.10m OD |
|---|---|---|---|---|
| **Depth** | **Context** | **Description** | | |
| 0-0.25m | 400 | Topsoil – Mid greyish brown clay loam. | | |
| 0.25-2.10m | 401 | Mid greyish brown slightly sand clay. Alluvium | | |
| 2.10-2.15m | 408 | Dark brown/black silty peat. | | |
| 2.15-2.20m | 409 | Very dark grey/black silty clay. | | |
| 2.20-2.25m | 410 | Very dark brown humic peat. | | |
| **Feature** | **402/405** | Irregular linear feature [402] aligned approximately north-south. Approximately 0.25m wide and 0.12m deep with very irregular sides and base. Probably of natural origin. Filled with 405 a mottled blue/dark grey silty clay with organic inclusions. | | |
| **Feature** | **403/406** | Irregular linear feature [403] aligned approximately north-south. Approximately 0.20m wide and 0.07m deep with very irregular sides and base. Probably of natural origin. Filled with 406 a mottled blue/dark grey silty clay with organic inclusions. | | |
| **Feature** | **404/407** | Irregular linear feature [404] aligned approximately north-south. Approximately 0.25m wide and 0.10m deep with very irregular sides and base. Probably of natural origin. Filled with 407 a mottled blue/dark grey silty clay with organic inclusions. | | |
| 2.25-3.20m | 411 | Bluish grey very silty clay. | | |
| 3.20-3.25m | 412 | Very dark brown silty clay with common humic inclusions. | | |
| 3.25-3.30m | 413 | Very dark brown/black humic peat. | | |
| 3.30m+ | 414 | Bluish grey very silty clay. | | |

| **Trench 5** | | Max. Depth:- 2.70m | Length:- 30m | Ground level-6.15m OD |
|---|---|---|---|---|
| **Depth** | **Context** | **Description** | | |
| 0-0.20m | 500 | Topsoil – Mid greyish brown clay loam. | | |
| 0-0.30m | 502 | Modern rubble/made ground | | |
| 0.30-0.50m | 503 | Dark brown silty clay loam-topsoil buried below modern rubble. | | |
| 0.20-2.30m | 501 | Mid greyish brown slightly sand clay. Alluvium | | |
| 2.30-2.50m | 504 | Bluish grey very silty clay. | | |
| 2.50-2.55m | 505 | Very dark brown silty clay with common humic inclusions. | | |
| 2.55-2.60m | 506 | Black silty peat | | |
| 2.60-2.65m | 507 | Very dark grey/black humic peat | | |
| 2.65m+ | 508 | Bluish grey silty clay | | |

## 10 APPENDIX 3: SPECIALIST ASSESSMENTS

1. Detailed Sediment Descriptions, M.J. Allen & D Jordan
2. Pollen Analytical Investigation, R. Scaife
3. Preliminary Diatom Examination, R. Scaife
4. Foraminifera, S. Haslett
5. Waterlogged Remains, A.J. Clapham
6. Insects, M. Robinson
7. Charred Remains, S.F. Wyles & M.J. Allen
8. Molluscs, M.J. Allen

## 10.1 Detailed Sediment Descriptions

*Dr Michael J Allen, Wessex Archaeology and D. Jordan, TerraNova Ltd*

**Table 6: Field descriptions of the main exposed sequences in Trench 1**

| | | |
|---|---|---|
| Context 101 | Light to medium grey brown, massive dense silty clay with some coarse silt. Common fine to medium distinct strong mottles of dark orange brown, few strong concentrations up to 15 x 21mm, of gritty (medium to coarse sand) Fe/Mn, and common large (30mm) diffuse irregular mottles of light grey (bluish). After c 0.3m from step, mottles of all types become less frequent, and the deposit becomes a more uniform, clay-rich and denser with depth, and some vague indications of possible coarse (*c.* 20mm) rhythmic banding of silt and fine sand were present. Within the middle zone of this unit. Prior to oxidisation the blues are more pronounced in clean interpedal faces, clear wavy contact, but sharp and distinct in places. Structure on drying seems to be massive, with vertical platy peds giving rise to vertical failure. | Upper Wentlooge salt marsh |
| Context 102 | Dark brown humic silty loam (rotted vegetation surface) at contact, to black to very dark brown humic silty clay with no obvious (hand lens) organics, but occasional rare fine (1-2mm) twigs and *Phragmites* stem. Some fine clay inwash laminae are present accentuating the fine horizontally structured peaty humic silt loam. | Surface/stasis Vegetated ?fen and *Phragmites* marsh, |
| Context 103 | Dark grey to light grey, becoming lighter to east, silty humic clay bifercating the two more strongly organic (stasis) horizons, clear boundary | Sediment inwash |
| Context 104 | Dark brown to black highly humified and weakly horizontally structured *Phragmites* peat, clear to sharp boundary | Surface/stasis, ?wood fen peat |
| Context 107 | Grey to greyish blue silty clay to silt loam with fine humic intrusions in upper 100mm and finely stratified silty clay laminae | Middle Wentlooge – salt marsh |

**Table 7: Detailed sediment descriptions from monoliths in Trenches 2 and 3**
*Descriptions made with the aid of a magnifier; terminology follows that outlined by Hodgson (1976).*

| Depth | *Depth** | *Sample* | *context* | *Description* |
|---|---|---|---|---|
| Monolith 2 | | | | |
| 6.07-5.95 mOD | 0-12cm | | 200 | Very dark greyish brown (10YR 5/2) humic silty clay with large weak prismatic structure becoming small and blocky to base, common fine fleshy roots, rare medium vertical macropores, sharp boundary |
| 5.95-5.13 | 12-94cm | 24cm<br>32cm<br>40cm<br>48cm<br>**56cm**<br>64cm<br>72cm<br>80cm<br>88cm | 201 | 12-20cm olive brown (2.5Y 4/3) oxidising to brown (10YR 5/3) and dark yellowish brown (10YR 4/4) humic silty clay with loose medium crumb/small blocky structure, common to abundant fleshy roots<br>20-43cm Olive brown (2.5Y 4/3 to greenish grey (gley 2 5/1) firm silty clay with large blocky to prismatic structure, oxisidising to brown (10YR 5/3), common fine distinct mottles of dark yellowish brown (10YR 4/3)<br>43-94cm Dark greenish brown 2.5Y 4/2 moderate blocky structure with oxidised interped surfaces, common fine mottles, some impression of banding seen from 72cm, becoming stronger with depth |
| Monolith 13 | | | | |
| 5.15-4.04 | 92-203cm | 100cm<br>108cm<br>116cm<br>124cm<br>**132cm**<br>140cm<br>148cm<br>156cm<br>164cm<br>**172cm**<br>180cm<br>188cm<br>196cm<br>200cm | 201 | As above becoming moister and siltier with depth, with clear broad (*c.* 20mm) rhythmical banding of fine sand and silt is seen to a throughout this zone<br><br>From *c.* 120cmis less well structured/almost massive greenish grey (Gley 2 5/1), fine common brown (10YR 4/3) mottles becoming abundant with depth, banding not observed, sharp boundary |
| 4.04-3.99 | 203-208cm | **204cm***<br>206cm*<br>208cm | 204 | Thin black (2.5Y 2.5/1) humic silty clay with fine horizontal beds >0.5mm thick, with oxidation occurring on upper sharp contact. (*Phragmites* noticed elsewhere in the field but not in sampled monolith, clear boundary |
| 3.99-3.91 | 208-216cm | 210cm<br>**216cm** | 205 | Dark grey (2.5Y 4/1) moist silty clay with rare medium mottles of reddish brown (7.5YR 4/4), and very thin <1mm laminae of fine detrital organic material, sharp boundary |

| | | | | |
|---|---|---|---|---|
| 3.91-3.89 | 216-218cm | **218cm*** | 206 | Very dark grey (2.5Y 3/1) humic silt (?peaty), strongly horizontally structured and laminated as if layers of rotting vegetation |
| 3.89-3.59 | 218-2.48cm+ | 220cm<br>224cm<br>**228cm**<br>236cm<br>244cm | 207 | Massive greenish grey (Gley 2 5/1) silty clay with a zone of fine sand and silty laminae |
| Monolith 17 | | | | |
| 3.87-3.30 | 2.20-2.77cm<br>2.36-2.93 | 236cm<br>244cm<br>252cm<br>260cm<br>**268cm**<br>280cm<br>274cm | 207 | Grey (Gley 1 5/N ) massive moist silty clay with common becoming few to rare with depth dark greyish brown (2.5Y 4/2) fine to medium distinct mottles, horizontally interrupted zones of fine sand and silt fine laminae, weaker and less pronounced at base, abrupt boundary |
| 3.30-3.23 | 2.77-2.84cm<br>2.93-3.00 | **278cm**<br>280cm<br>**282cm**<br>284cm | 210 | Black 2.5YR 2.5/1 humic peaty silt, no plant matter noticed, clear boundary |
| 3.23-2.93 | 2.84-3.14cm<br>3.00-3.30 | 288cm<br>292cm<br>300cm<br>308cm<br>**314cm*** | 211 | Grey (Gley 1 5/N) massive moist silty clay, seems slightly darker hue than base of 207, and coarser fine laminations of silt and fine sand |
| Kubiena 15 | | | | |
| 0-4cm | | 0cm*<br>2cm<br>4cm* | 204 | Very dark grey (10YR 3/1) to black (2.5Y 2.5/1) peaty silty clay with layered, horizontally structured, *Phragmites* throughout, clear boundary |
| Kubiena 18 | | | | |
| 0-4cm | | 0cm*<br>2cm<br>4cm* | 210 | Dark brown to black highly humified *Phragmites* peat, clear to sharp boundary |
| Monolith 7 | | | | |
| | | **30cm** | 307 | Very dark grey massive humic silt – ditch fill, no lamination or banding observed |

* = C14 sample in addition to pollen and formanifera (sample of plant material)
sample depths in bold are those assessed for pollen, diatoms and formainifera

*Observations*
The soil profile in Trench 5, on the eastern side of the site, consisted of 2.5 metres of mid red-brown silty clay above about 10cm of blue-grey silty clay becoming more organic towards the base and grading into 15cm of horizontally structured peat. This overlay a further layer of blue-grey clay containing organic laminae. The mineral strata above and below the peat were partly disrupted by pores – most filled with reduced blue-grey clay – which probably represent former rooting.

The profiles in Trenches 1 and 4 were similar. Trench 1 contained silty clay from the surface to 1.8 metres. In the central and upper part of the profile there was a very clear, rhythmic sequence of silty and fine sandy strata at 1-2cm intervals, each

subdivided into much thinner, upward fining strata. This stratification was disrupted below 1.2 and invisible below 1.4 metres. Below 1.8m was 20cm of horizontally structured peat containing thin, clayey strata. This passed into blue-grey silty clay below 2.0 metres containing finely structured silty and fine sandy laminae as well as very thin organic laminae and abundant fragments of organic matter. Between 3 and 3.2 metres was a further, horizontally structured peat with an abrupt boundary with the clay above and containing thin clayey strata. Below were further, finely stratified silty clay laminae, containing organic matter, though rather more disrupted by former rooting than the mineral strata above the lower peat.

In Trench 1 the upper reddish brown facies (?Upper Wentlooge) has an organic horizon at its base which lies over the greyish blue facies (?Middle Wentlooge) as seen at a number of other sites such as Vimpenny's Lane, Hallen, Awkley Lane etc.

This peat occurring at the contact zone with these two major facies can be seen in all trenches except trench 5 where about 0.2 m the lower bluish grey facies overlies the lower humic horizon. The peat at this point, is slightly deeper, at about 2.2m depth, where as elsewhere it is at c 2.0m depth. at *c,*. 2.2m.

*Rivulets*
In plan at *c.* 2m depth in Trench 4, the top of the peat was exposed showing a series of minor rivulets or channels infilled with minerogenic silty clays. Detailed examination of these features showed the infilled voids to be sharp, but irregular, sided with a V shaped profile, more reminiscent of drying and cracking peat which had become infilled with waterlain mud (minerogenic sediment). This may suggest a period of drying out of the peat surface prior to inundation (?Upper Wentlooge facies).

*Discussion*
These profiles preserve abundant evidence of the parent materials from which the strata formed, the depositional processes by which they formed and the post-depositional changes which they have undergone. While we can say that the deposits may represent environments including terrestrial and estuarine conditions, at various points in the tidal frame, it is likely that further sedimentological and soil study could tell us a great deal more about the former environment of the site. The nature and distribution of peat, mineral laminae and former root pores, among many other structures, provide useful clues not only of what has happened to produce these profiles but also the order – and, to a limited extent, the chronology – of events.

*Reference*
Hodgson, J.M. 1976. *Soil Survey Field Handbook.* Harpenden, Soil Survey Technical Monograph No. 5.

## 10.2 Pollen Analytical Investigation

*Dr R. G. Scaife, Department of Geography, University of Southampton, Highfield, Southampton, SO17 1BJ*

*Introduction*

Archaeological evaluation trenches exposed sections of peat and minerogenic sediments of the Wentlooge formation typical of the Avon Levels and archaeological features. On the basis of earlier analysis of this regional stratigraphical sequence, which provided much useful palaeoenvironmental information, sampling for pollen, diatom and plant macro-fossil analysis was carried out. Two organic/peat facies within inorganic alluvial or marine sediments were recorded which offered potential for reconstruction of the environment of the late-prehistoric period. Specific aims to be addressed by pollen analysis have been detailed by Dr. M.J. Allen and include the following:

- To establish the presence of sub-fossil pollen and spores and preservation within the contrasting lithological units of the sequence.
- If pollen was present, to provide an indication of the pollen taxonomic range.
- If present, to provide a broad palaeoenvironmental interpretation.
- Do these data compare with existing regional data.
- What is the overall potential of the site for enhancing our understanding of the archaeology of the site itself and at the regional level.
- This work was also to include a preliminary assessment of the diatom flora of the sediments which would provide information on the freshwater/salinity status of the sedimentary environment.

A total of 12 selected samples has been examined. All produced sub-fossil pollen and spores in varying quantity and preservation and this report outlines the results of this preliminary pollen assessment. Aspects and aims noted above are dealt with.

*Method*

The 12 pollen sub-samples taken from the monolith profiles were subjected to standard pollen extraction techniques (Moore and Webb 1968; Moore *et al.* 1991). Samples of between 2ml were used. Absolute pollen frequencies were calculated using added exotics to known volumes of sample (Stockmarr 1971). Pollen was identified and counted using an Olympus biological research microscope fitted with Leitz optics. A pollen sum of 150 grains of dry land taxa plus all extant spores and pollen of marsh taxa, fern spores and miscellaneous (pre-Quaternary palynomorphs, algal *Pediastrum*) was counted for each of the samples. An extensive reference/comparative collection of modern taxa was available to aid identification. Results are presented in standard pollen diagram form (figure 1) with percentages calculated as follows:

| | |
|---|---|
| Sum = | % total dry land pollen (tdlp) |
| Marsh/aquatic = | % tdlp+sum of marsh/aquatics |
| Spores= | % tdlp+sum of spores |
| Misc.= | % tdlp+sum of misc. taxa. |

Taxonomy in general follows that of Moore and Webb (1978) modified according to Bennett *et al.* (1994) for pollen types and Stace (1992) for plant descriptions. These procedures were carried out in the Palaeoecology Laboratory of the Department of Geography, University of Southampton.

*Results of Analysis*
Pollen was extracted, identified and counted from all of the samples.

*Absolute pollen frequencies:* As might be expected, highest in the organic peaty silt units (esp. context 210 and 206-207) and lowest in the most minerogenic and more oxidised/gleyed upper contexts (201 at 6000 grains/ml) the latter attaining a maximum of 875,700 grains/ml. These APF values are shown in diagram 1 and are listed below in relation to the excavated contexts.

| Context | Depth (cm) | APF Grains/ml | Sediment type | Unit |
|---|---|---|---|---|
| 201 | 56 | 6,000 | Grey/Brown (oxid.) silty clay | |
| 201 | 132 | 9,411 | Grey/green silt/clay | 1 |
| 201 | 172 | 24,187 | grey/green silt/clay | |
| 204 | 204 | 408,510 | Black humic silt/clay | 2a |
| 205 | 216 | 875,760 | Grey humic silty clay | 2b |
| 206 | 218 | 106,132 | Grey humic silt. | 2c |
| 207 | 228 | 12,459 | Greenish grey silty clay | 3 |
| 207 | 268 | 290,139 | Silty/clay + organic inclusions | |
| 210 | 278 | 147,578 | Humic silt | 4 |
| 210 | 282 | 268,779 | Humic silt | |
| 211 | 314 | 7,457 | Grey silty/clay | 5 |

*Pollen Taxonomic Content:* Totals of 36 pollen and 4 spores were recorded. The principal variation in taxa are related to the changing lithostratigraphy. Overall, tree and shrub pollen are most important within the more organic units of the lower half of the profile (esp. contexts 207, 210 and 211)[Units 3,4 & 5]. *Quercus* (oak) is most important (to 48% in context 207 at 228cm). *Corylus avellana* (hazel) is co-dominant (to 33%). Of note, however, are the more abundant and higher values of either tree taxa in the lower contexts. These include *Tilia* (lime/lindens to 8% at 282cm; context 210), *Betula* (ephemeral peak to 7%), *Pinus* (pine to 8%), *Ulmus* (elm peak at 216cm) and *Fraxinus* (ash) and *Taxus* (yew) which occur sporadically. *Alnus* (alder) and *Salix* (willow) are likely related to the fringing wetland zone and variations here relate to the changes from the drier humic peat forming environment to alluvial/salt marsh-marine sediments. The former have higher values in contexts 205-6 and 207-210. The minor but important occurrences of *Salix* in contexts 204-206 appear to relate to the changing habitat from humic peat to alluvial sediments. Dwarf shrubs (here Ericales) comprise largely *Calluna vulgaris* (ling) with some *Erica* (heather) which occur as peaks in the lowest sample and especially in the upper humic levels of contexts 205-206 (218-216cm). This also corresponds with acidophilous *Sphagnum* moss at the same levels indicating onset of acid conditions.

Of the herbs, Poaceae (grasses) are most consistently dominant and particularly in the upper mineral contexts (201, 204, 205) [Units 1 & 2] with values to 47%. A large peak of 'large' Poaceae are non-cereal types with diameters greater than 45u which

may be from certain salt marsh grasses or freshwater *Glyceria fluitans*. Cereal pollen present in the top level (context 201) is recognised by large thick walled grains with large pores and very distinct columellate structure. Of the other herbs, there is a more diverse taxonomic range in the upper silts of context 201 although APF values are smaller. This is undoubtedly a taphonomic function due to the pollen catchment being greater with alluvial transport as well as from airborne sources. These assemblages comprise especially *Plantago lanceolata* (ribwort plantain), *P. maritima* type (sea plantain), *P. coronopus* type (hoary plantain), Chenopodiaceae (goosefoots, oraches and glassworts) and Lactucoideae (Liguliflorae-dandelion family). Peaks of Chenopodiaceae occur in the more humic levels and may suggest that these organics accumulated in a marsh habitat in proximity to marine conditions i.e. the Chenopodiaceae may comprise various halophytes. Other taxa recorded which are also referable to marine/brackish water influences include the *Plantago maritima, P. coronopus* and *Spergula* which are plants typical of maritime grass swards. Plant macro-fossil data may further elucidate this. The presence of dinoflagellates in context 201 may be derived pre-Quaternary but may also be indicative of marine/brackish water influences. High values of Lactucoideae in the upper-most sample (14%) is due to differential preservation in favour of this robust pollen type in these oxidised sediments.

Aquatic and marsh taxa comprise relatively small numbers of marginal Cyperaceae (sedges) , *Typha angustifolia/Sparganium* (reed-mace and bur-reed) with aquatic *Callitriche* (water starwort) and *Potamogeton* type (water pond weed but possibly also *Triglochin*). Spores of ferns form an important component with high values of *Pteridium aquilinum* (bracken to 46%) and monolete *Dryopteris* type (typical ferns to 32%) which become important in the upper alluvial/marine sediments of context 201 [Unit 1]. Such high values are typical/characteristic of alluvial transport and sedimentation (Peck 1973) and has also been discussed for other Avon Level sites (Scaife 2001; Scaife in Allen and Scaife 2001; Scaife in Gardiner *et al.* forthcoming). These also correspond with substantial numbers of derived, pre-Quaternary palynomorphs which are also important/abundant in context 201. Other spores include the *Sphagnum* which as noted are associated with the rise and fall of acidophilous heathland communities/taxa and *Polypodium vulgare* (common polypody fern).

*The changing vegetation and environment:* The sequence of changing vegetation is complex and would require additional analysis at a closer sampling interval to understand these changes more clearly. However, some preliminary comments can be made regarding the age and character of the vegetation and changes. The lower contexts show greater importance of woodland and the presence of lindens is significant. The latter had a widespread importance during the Middle Holocene until clearance at various dates but largely during the Middle Bronze Age. Here, percentage values are not great but indicate presence within the near region. This factor and the importance of other taxa suggest that the environment was at least partially wooded and a Middle to Late Bronze Age date is suggested for these lower organic units. It is possible that the *Tilia* which would have required well drained soils was not immediately adjacent to the site (as percentages would have been greater) and the decline from context 205 was cased by further waterlogging of the site. However, it is suspected that a combination of woodland clearance and waterlogging was responsible as suggested for other Avon Level sites.

The lower contexts with two discrete laminated organic units and intercalated silts may be a transitional phase of sedimentation caused by fluctuating but generally positive rise in regional relative sea level during the late-prehistoric period. This transgressional event is well documented and culminated in the deposition of the upper alluvial/brackish sediments seen in context 201. Context 211 is possibly a basal freshwater sediment (based on sedimentological characteristics) which was then subject to a phase of decreasing wetness allowing colonisation by grasses, sedges and other fen taxa. A noted above, however, Chenopodiaceae values peak in the most humic levels and it is possible that this may have been salt marsh or backwater lagoonal environments in proximity to salt marsh. In contexts 205-206 [Unit 2] there is a clear phase of acidification with development of heath communities which included typical ling and heather and *Sphagnum* moss in wetter areas. This has also been seen at Awkley lane and Vimpenny's Lane (Scaife 2001) where a Bronze Age date for this event has been obtained.

Given that the site was probably reclaimed from the sea/salt marshes during the Saxon period, it is unsurprising that the upper sediment levels have become typically brown oxidised/gleyed and have poorer pollen preservation. Given that the lower organic units are attributed to the Bronze Age and cessation of sedimentation occurred as a result of the Roman and post-Roman reclamation/drainage, the time-span represented by the sediments spans the period of major inundation which had significant effects on human activity in the Avon and Somerset Levels as a whole. Along with the existing data for this period obtained from the sites at Vimpenny's Lane, Hallen and Awkley Lane it is becoming possible to understand the changing palaeogeography and environments of the region.

*Pollen Analysis of the fills of Ditch/Rhine, Trench 3*
This channel contained a dark grey humic silt with obvious potential for pollen preservation. A single evaluation sample at 30cm was examined and contained well preserved pollen with a high APF value of *c.* 450,000 grains/ml. Pollen counts obtained are as follows (**Table 8**).

| | | |
|---|---|---|
| TREES & SHRUBS | | |
| | *Quercus* | 20 |
| | *Alnus* | 14 |
| | *Corylus avellana* type | 33 |
| | *Salix* | 1 |
| DWARF SHRUBS | | |
| | *Erica* | 1 |
| | *Calluna* | 19 |
| HERBS | | |
| | Chenopodiaceae | 11 |
| | cf. Primulaceae | 1 |
| | *Plantago media/major* type | 1 |
| | *Plantago lanceolata* | 3 |
| | *Plantago coronopus* type | 1 |
| | *Galium* type | 1 |
| | Poaceae | 40 |
| | Large Poaceae (>45u) | 1 |
| MARSH | | |
| | *Typha angustifolia* type | 1 |

| | | |
|---|---|---|
| SPORES | | |
| *Dryopteris* type | 26 | |
| *Pteridium aquilinum* | | 12 |
| *Polypodium vulgare* | | 1 |
| *Sphagnum* | | 15 |

**Table 8: Pollen data obtained from ditch 306 (Trench 3) at 30cm**

Because this is a single sample from a ditch context, which may have a complex pollen taphonomy, it is difficult to make sound conclusions and of course a spot sample will not provide evidence of change through time. However, it is apparent that pollen is abundant and well preserved in at least the humic fills/contexts. The fact that these are indeed humic also suggests that the organics fills may have accumulated in the ditch depression and were not derived from surrounding areas. Consequently the pollen assemblage (table above) provides some indication of the near site vegetation at the time of sediment accumulation.

Oak, alder and hazel are the principal trees/shrubs and were perhaps present growing local to the site. *Calluna* and *Erica* (heather's) form some 13% of total pollen and suggest local acid heath communities. *Sphagnum*. also present here, would also be typical of this habitat. Herbs are also important with Poaceae (grasses)dominant with small numbers of *Plantago* spp. (plantains) and Chenopodiaceae (goosefoots, oraches and glassworts. Sporadic occurrences of Cyperaceae (sedges) and *Typha angustifolia* type (reed-mace and bur-reed) may have been on-site (autochthonous) plants.

Overall, the local habitat appears to have been one of localsied woodland with patches of open heath and herb communities. If comparisons are made with the long pollen stratigraphical record described in section 3 (above), it can be seen that there are similarities here with contexts 205 and 206 specifically i.e. similarity of the tree and shrub taxa and the acidophilous/heath elements noted.

*Conclusions*

The principal aims of this pollen evaluation study were to establish the presence or absence of pollen in these diverse sediments and to determine whether useful environmental interpretations could be made. The study has demonstrated that pollen and spores are present in all of the sediment types analysed and furthermore that the data obtained shows evidence of significant environmental changes which took place in response to rising relative sea level from the Bronze Age period. As such, the site provides an interesting record of late-prehistoric environmental change which, along with existing analyses of other Avon Levels sites, could enhance our knowledge of the region.

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Pollen figs here

## 10.3 Preliminary Diatom Examination

*Dr R. G. Scaife, Department of Geography, University of Southampton, Highfield, Southampton, SO17 1BJ*

*Introduction, aim and method*

The twelve samples selected for pollen assessment were also examined for their diatom content. If present these phytoplankton would provide evidence of freshwater and/or salinity conditions prevailing at the time of sediment deposition.

The samples were prepared using Hydrogen peroxide for removal of the organic/humic component. Solutions were dried on microscope coverslips on a hot plate and then mounted in Naphrax medium. Examination was carried out using a high power binocular microscope at magnifications of x400 and x1000.

The aim of this examination was to establish presence or absence of diatom frustules in the samples. However, a preliminary examination of the slides identified a number of taxa present all of which are of marine and brackish water affinity. These are listed below. None of the samples was 'rich' in quantity although sample 5 contained relatively abundant numbers of *Diploneis didyma*.

| **Unit** | **rhine** | **2a** | **2c** | **4** | **4** |
|---|---|---|---|---|---|
| Temp Analysis Sample Nos | 1 | 5 | 7 | 10 | 11 |
| Context | 307 | 204 | 206 | 210 | 210 |
| Depth (cm) | @ 30 | @ 204 | @218 | @278 | @ 282 |
| *Acnanthes brevipes* | * | | * | * | |
| cf. *Cocconeis scutellatum* | | | | * | |
| *Coscinodiscus* (cf.frags) | | | | * | |
| *Diploneis didyma* | | * | | | |
| *Diploneis interupta* | | * | | | |
| *Navicula punctata* | | | | * | * |
| *Nitzchia* sp. | * | | | * | * |
| *Paralia sulcata* | | * | | * | |
| *Pinnularia* sp. | * | | | | * |
| cf. *Triceratium* (frag.) | | | | * | |
| Unidentified | | | | | * |

*Results*

Diatoms were only found in peaty or organic horizons and were were not found in samples from mineralogenic silty clays: context 201 @ 56cm, @132cm, @172cm; context 205 @216cm; context 207 @228cm @268cm; context 210 @314cm and ditch 307.

*Discussion*

A more detailed examination of the minerogenic sediments might provide a more detailed picture of the changing salt marsh, brackish water and marine phases which contributed to the stratigraphy of the site.

## 10.4 Assessment of the Foraminifera

*Dr Simon K. Haslett, Quaternary Research Unit, Dept. of Geography, School of Science and the Environment, Bath Spa University College, Newton Park, Bath, BA2 9BN, UK.*

*Introduction*

Twelve samples were supplied for assessment of their foraminifera content, with a view to establish their abundance, preservation and usefulness as marine palaeoenvironmental indicators in sediments underlying the Avon Levels. This report describes the method employed to separate foraminifera from the sediment samples, presents the results obtained, suggests an interpretation of the results, and assesses their future use in sediment from the Avon Levels. Foraminiferal analysis is now a well-established technique for assigning tidal level and depositional environment information to Holocene sediments (see Allen and Haslett 2002, for a recent review). Haslett *et al.* (1997) provide distributional data for foraminifera living on the modern saltmarshes of the Severn Estuary, and it is this dataset, with updates (Haslett 2000; Haslett *et al.* 2001; Allen and Haslett 2002), that enables the calibration of fossil data.

*Method*

Bulk samples for foraminiferal analysis were initially air-dried and then weighed (dry bulk weight, g). Samples were then soaked in distilled water for 24 hours, then wet-sieved at 63µm, with the >63µm fraction being retained and weighed (g) after drying. The entire >63µm fraction of each sample was examined using reflected light microscopy for foraminifera and general character of the >63µm fraction.

*Results and discussion*

The results obtained are given in **Tables 9 and 10. Table 9** presents the weights of the bulk samples and sieved fractions, which together enable a crude particle size ratio to be constructed (%>63µm). The >63µm fraction can comprise a range of clast types, such as biogenic organic particles (including wood and other plant fragments) or minerogenic quartz sand. However, the <63µm is dominated by minerogenic silt and clay particles. Therefore, this method is useful in determining the silt/clay composition.

**Table 10** presents foraminiferal data. Abundance is variable from 0 to 192, however, preservation is generally good; only in sample of context 211 (@ 314cm) is there any evidence of foraminifera test abrasion. Each sample is described briefly below.

| Context | Depth (cm) | Sediment type | Unit |
|---|---|---|---|
| 201 | 56 | Grey/Brown (oxid.) silty clay | |
| 201 | 132 | Grey/green silt/clay | 1 |
| 201 | 172 | grey/green silt/clay | |
| 204 | 204 | Black humic silt/clay | 2a |
| 205 | 216 | Grey humic silty clay | 2b |
| 206 | 218 | Grey humic silt. | 2c |
| 207 | 228 | Greenish grey silty clay | 3 |
| 207 | 268 | Silty/clay + organic inclusions | |
| 210 | 278 | Humic silt | 4 |

| | | | |
|---|---|---|---|
| 210 | 282 | Humic silt | |
| 211 | 314 | Grey silty/clay | 5 |

*Ditch 307 Context 306*
*@ 30cm depth*- organic-rich with scarce seeds and and a few coleopteran fragments. No foraminifera observed. Deposited in a supratidal, non-marine environment.

*Context 201 (Unit 1)*
*@ 56cm depth* - minerogenic with abundant fine well-sorted sand, but with some plant fragments. Barren of foraminifera, but may represent a relatively high energy storm flood deposit.

*@) 132cm depth* - minerogenic with abundant well-sorted fine sand, but with some plant fragments. Yielded one specimen each of *Ammonia beccarii* and *Haynesina germanica*. These species are indicative of low salt marsh or mudflat environments; however, in that context they are usually very abundant. It is likely that this sample represents transported sediment from the low intertidal zone, perhaps due to a marine storm event.

*@ 172cm depth* - minerogenic with well-sorted fine sand, and one seed. Yielded one specimen of *Elphidium williamsoni*, a species that inhabits low salt marsh and mudflat environments. As in the preceding samples, given the low abundance, it is likely that this sample represents transported sediment from the low intertidal zone, perhaps due to a marine storm event.

*Context 204 (Unit 2a)*
*@ 204cm depth* - organic-rich with a few coleopteran and ostracod fragments, the latter displaying smooth carapace surfaces typical of freshwater species. No foraminifera observed. Deposited in a supratidal, non-marine environment.

Context 205 (Unit 2b)
*@ 216cm depth* - organic-rich with a seed and a few coleopteran and ostracod fragments, the latter displaying smooth carapace surfaces typical of freshwater species. No foraminifera observed. Deposited in a supratidal, non-marine environment.

*Context 206 (Unit 2c)*
*@ 218cm depth* - organic-rich with seeds and a few coleopteran fragments. No foraminifera observed. Deposited in a supratidal, non-marine environment.

*Context 207 (Unit 3)*
*@ 228cm depth* - organic-rich with seeds, charcoal, and framboidal pyrite. No foraminifera observed. Deposited in a supratidal, low-oxygen, non-marine environment. The presence of charcoal possibly indicates human activity.

*@ 268cm depth* - organic-rich (peaty). No foraminifera observed. Deposited in a supratidal, non-marine environment, possibly a freshwater/terrestrial peat.

*Context 210 (Unit 4)*
*@ 278cm depth* - organic-rich (peaty). Abundant specimens of *Jadammina macrescens* were encountered. This species inhabits the high intertidal zone and when found in a monospecific assemblage indicates a high salt marsh enviroment with an indicative meaning between Highest Astronomical Tide (HAT) and Mean High Water Spring Tide (MHWST).

*@ 282cm depth* - organic-rich (peaty). *Jadammina macrescens* occurs again as a monospecific assemblage indicating high salt marsh deposition between HAT-MHWST.

Context 211 (Unit 5)
*@ 314cm depth* - minerogenic with abundant (*c.* 25% of sample) fine to medium quartz sand with occasional mollusc shell fragments. A fairly high diversity of foraminiferal species. *Ammonia beccarii* (non *batavus*) and *Haynesina germanica* are low intertidal species, that may be found subtidally; however, *Ammonia beccarii batavus*, *Asterigerinata mamilla*, *Cibicides lobatulus*, *Elphidium excavatum*, and *Elphidium gerthi* are species indicative of subtidal and normal salinity environments. Some specimens in this sample show signs of abrasion and/or dissolution. There are two possible interpretations for this sample, it may be a deposit of transported sediment laid down in a storm or high energy event, or the similarity with Ipswichian assemblages (in terms of sorting, species diversity and preservation) the author has examined in the Severn Estuary (*e.g.* Haslett 1997; Allen 2001) raises the possibility that this is an interglacial deposit. If this sample is from a basal deposit resting on bedrock or head, then an interglacial origin is probable.

*Concluding remark*
The foraminifera recovered are generally well-preserved and diagnostic of particular palaeoenvironments, depostional processes and/or time periods. The variable abundance and diversity is to be expected in fluctuating and changing palaeoenvironments; indeed, that is part of their value. The crude particle size information is a useful adjunct to the foraminifera data, and aids interpretation. The possibility of storm deposits and a new occurrence of an interglacial deposit in the Severn Estuary are interesting prospects.

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| ***Samples*** | ***Dry bulk weight (g)*** | ***>63mm (g)*** | ***%>63mm*** | ***Character of >63mm fraction*** |
|---|---|---|---|---|
| Ditch 307 30cm | 6.41 | 0.45 | 7.02 | organic-rich |
| Mono 2 (201) 56cm | 21.68 | 0.06 | 0.28 | minerogenic |
| Mono 13 (201) 132cm | 19.19 | 0.06 | 0.31 | minerogenic |
| Mono 13 (201) 172cm | 20.29 | 0.04 | 0.20 | minerogenic |
| Mono 13 (204) 204cm | 7.34 | 0.18 | 2.45 | organic-rich |
| Mono 13 (205) 216cm | 12.8 | 0.25 | 1.95 | organic-rich |
| Mono 13 (206) 218cm | 14.35 | 0.15 | 1.05 | organic-rich |
| Mono 13 (207) 228cm | 22.4 | 0.33 | 1.47 | organic-rich |
| Mono 17 (207) 268cm | 11.9 | 0.2 | 1.68 | organic-rich |
| Mono 17 (210) 278cm | 4.6 | 0.48 | 10.43 | organic-rich |
| Mono 17 (210) 282cm | 3.74 | 0.11 | 2.94 | organic-rich |
| Mono 17 (211) 314cm | 5.13 | 1.34 | 26.12 | minerogenic |

**Table 9: Samples assessed for foraminifera**

| **Samples** | **Dry bulk weight (g)** | **>63mm (g)** | **%>63mm** | **Character of >63mm fraction** |
|---|---|---|---|---|
| Ditch 307 30cm | 6.41 | 0.45 | 7.02 | organic-rich |
| Mono 2 (201) 56cm | 21.68 | 0.06 | 0.28 | minerogenic |
| Mono 13 (201) 132cm | 19.19 | 0.06 | 0.31 | minerogenic |
| Mono 13 (201) 172cm | 20.29 | 0.04 | 0.20 | minerogenic |
| Mono 13 (204) 204cm | 7.34 | 0.18 | 2.45 | organic-rich |
| Mono 13 (205) 216cm | 12.8 | 0.25 | 1.95 | organic-rich |
| Mono 13 (206) 218cm | 14.35 | 0.15 | 1.05 | organic-rich |
| Mono 13 (207) 228cm | 22.4 | 0.33 | 1.47 | organic-rich |
| Mono 17 (207) 268cm | 11.9 | 0.2 | 1.68 | organic-rich |
| Mono 17 (210) 278cm | 4.6 | 0.48 | 10.43 | organic-rich |
| Mono 17 (210) 282cm | 3.74 | 0.11 | 2.94 | organic-rich |
| Mono 17 (211) 314cm | 5.13 | 1.34 | 26.12 | minerogenic |

**Table 10: Foraminifera**

## 10.5 Waterlogged Plant Remains

*Dr A.J. Clapham, McDonald Institute of Archaeological Research, Downing Site, Cambridge University, Cambridge, CB2 3ER*

*Introduction*
Four samples were assessed for plant macrofossil content. All four samples were taken from trench 3, these consisted of:

Sample 4: top of upper peat (305) Unit 2a
Sample 5: base of upper peat (305) Unit 2b
Sample 6: peat (306) in natural channel 307
Sample 11: lower peat (309) Unit 4

and represent two humic/peaty horizons within the Wentlooge sequence. A ditch or ream [307] was also sampled.

The aims of the assessment were to define:

- Presence/preservation of plant remains in each unit
- Range of species present and potential to provide palaeo-environmental interpretation
- Very crude palaeo-environmental indications
- Whether these match or differ from the known record for the area
- Considerations of their potential to enhance the understanding of the archaeology of the Avon Levels.

*Methods*
The four samples consisted of one litre samples which had been processed by washover flotation onto 250μm mesh and then stored in Industrial Methylated Spirits. In order to carry out the assessment these samples were further subsampled and 150 $cm^3$ was scanned using a low-powered stereomicroscope. This size of sub-sample was considered adequate to carry out an assessment

All plant taxa found in the samples were scored using a four point abundance scale, whereby: 1 = rare; 2 = occasional; 3 = common and 4 = very common.

Plant remains were found in all samples and the results are displayed in table 1. Nomenclature follows that of Stace (1997). The author is grateful to the George Pitt-Rivers Laboratory, Department of Archaeology, University of Cambridge for providing support and the use of the facilities.

*Results*
Plant remains were found in all of the samples, but not in very great numbers and were preserved by waterlogging. The dominant remains in most of the samples were of reed (*Phragmites australis*) rhizome fragments. Monocotyledonous roots were also dominant.

*Context 305; top of upper peat (sample 4) Unit 2*
This sample was dominated by root fragments most likely to be of grasses. Rush seeds were also common as were fragments of charcoal. Reed rhizome fragments were only occasionally encountered. Waterlogged wood fragments were also found.

*Context 305; base of upper peat (sample 5) Unit 2*
Again, this sample was dominated by possible grass (Poaceae) roots and fragments of reed rhizomes were more common than in the sample from the top of the upper peat. Celery-leaved buttercup (*Ranunculus sceleratus*), goosefoots and woody nightshade (*Solanum dulcamara*) were identified but were present in small quantities.

*Context 306; peat in natural channel 307 (sample 6)*
This sample can be considered to be the richest in terms of plant remains identified. Again the sample was dominated by both grass roots and reed rhizomes. *Sphagnum* moss leaves were also common as were seeds of spear-leaved orache (*Atriplex prostrata*). Buttercups (*Ranunculus* subgenus *Ranunculus*), violet (*Viola* sp.) and charcoal fragments, wood fragments and insect remains and earthworm cocoons were occasionally encountered. Thistle (*Cirsium* sp.) and rush seeds were rare as was Babington's Orache (*Atriplex* cf *glabriuscula*).

*Context 309; lower peat (sample 11) Unit 4*
This sample was dominated by reed rhizome fragments. Celery-leaved buttercup achenes were common, whilst buttercup, fathen (*Chenopodium album*), golden dock (*Rumex maritimus*), fine-leaved water-hemlock (*Oenanthe aquatica*) were rare. Insect remains were occasionally encountered.

*Interpretation*
The major feature of these samples is the dominance of the rhizomes of reed, this suggests that both peats indicate the presence of reedswamp and it can be suggested that the area was dominated by reedswamp.

Although the lower peat (context 309), is dominated by reed, other species were found which are often associated with reeds and adds to the interpretation that the sample represents reedswamp. The upper peat was bifurcated by a clayey horizon. The base of the upper peat (context 305) was dominated by the presence of grass roots and reed rhizomes which again can be interpreted as reedswamp. The presence of celery-leaved buttercup and woody nightshade support this interpretation. The top of the upper peat (context 305) is dominated by grass roots with some reed rhizomes. The decrease in the number of reed remains may suggest that there is some drying out of the reedswamp which is being replaced by a damp rough grassland. The lack of any other plant taxa in this sample suggests that more aerobic conditions exist therefore preventing the preservation of other plant material.

Of interest in the top of the upper peat is the presence of charcoal fragments which were commonly encountered. It is difficult to determine if the charcoal is indicative of anthropogenic activity in the area or is of natural origin. If the interpretation of the upper surface of the peat is drying out, the charcoal may represent human activity in the area, although from the excavations no archaeological evidence was recovered. Therefore, it can be seen that there is a dominance of reedswamp in the area, which is drying out towards the top of the sequence.

The sample from the peat (306) in a natural channel 307, also shows the dominance of reedswamp. With regards to the number of plant taxa identified it is the richest sample. The presence of *Sphagnum* moss leaves may suggest that there is some areas of lowland bog present, although no other species representative of this environment

were identified. Possible indicators of a maritime influence are present in the finds of spear-leaved orache and Babington's orache. The presence of these species may help interpret the feature as being natural with inundation with seawater occurring at times.

*Discussion and recommendations*

The study of the plant macrofossils from these samples gives a very local picture of environmental events. Even so, in comparison with previous work in this area (Allen and Scaife, 2001; Gardiner *et al* forthcoming; Clapham 2001), the interpretation of the samples here agrees with those studies, with the area being dominated by reedswamp with some maritime influence, with the surface of the upper peat beginning to dry out. The presence of fine charcoal fragments on this upper peat surface may suggest some anthropogenic activity although this is difficult to prove. Therefore, it appears that there is little potential for the enhancement of the understanding of the archaeology of the Avon Levels and it is recommended that no further analysis needs to be carried out.

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| **Site Code** | 50966 | 50966 | 50966 | 50966 |
|---|---|---|---|---|
| **Site Name** | Avlon Works | Avlon Works | Avlon Works | Avlon Works |
| **Feature / context Type** | top of upper peat | base of upper peat | peat in natural channel | lower peat |
| **Context No.** | 305 | 305 | 307 | 309 |
| **Sample No.** | 4 | 5 | 6 | 11 |
| **Original volume (l)** | 1 | 1 | 1 | 1 |
| **Volume ($cm^3$) assessed** | 150 | 150 | 150 | 150 |
| *Sphagnum* sp. Leaves | - | - | 3 | - |
| *Ranunculus* Subgenus *Ranunculus* | - | - | 2 | 1 |
| *Ranunculus sceleratus* | - | 1 | - | 3 |
| *Chenopodium album* | - | - | - | 1 |
| *Atriplex* cf *prostrata* | - | - | 3 | - |
| *Atriplex* cf *glabriuscula* | - | - | 1 | - |
| Chenopodiaceae | - | 1 | - | - |
| *Rumex maritimus* | - | - | - | 1 |
| *Viola* sp. | - | - | 2 | - |
| *Oenanthe aquatica* | - | - | - | 1 |
| *Solanum dulcamara* | - | 1 | - | - |
| *Cirsium* sp. | - | - | 1 | - |
| *Juncus* sp. | 3 | - | 1 | - |
| *Phragmites australis* rhizome fragments | 2 | 3 | 4 | 4 |
| Roots (poss Poaceae) | 4 | 4 | 4 | - |
| Charcoal | 3 | - | 2 | - |
| Wood | 2 | - | 2 | - |
| Arthropod | 2 | 1 | 2 | 2 |
| Earthworm coccons | - | 1 | 2 | - |
| | | | | |
| **Key** | | | | |
| 1 = rare | | | | |
| 2 = occasional | | | | |
| 3 = common | | | | |
| 4 = very common | | | | |

## Table 11. The waterlogged plant remains

## 10.6 Assessment of the Insect Remains

*Dr Mark Robinson, Oxford University Museum, Parks Road, OXFORD, OX1 3PW*

*Introduction*
Evaluation trenching at the Avlon Works on the Henbury Levels, part of the Avon Levels, revealed deep alluvial deposits of the Wentlooge Formation. Within the alluvial sediments were two peaty layers and there was a channel containing organic sediments sandwiched between these layers. A sequence of four organic samples was assessed for insect remains. 10 litres of each sample was washed over onto a 0.25mm mesh to recover organic remains and decanted in to Industrial Methylated Spirits. Part of the organic fraction was subjected to paraffin flotation to extract any insect remains. The flots were washed in detergent, then scanned under a binocular microscope.

Identifiable insect remains are absent from:

| | |
|---|---|
| Sample 4 | top of upper peat (305), Unit 2a |
| Sample 5 | base of upper peat (305), Unit 2b |
| Sample 11 | lower peat (309), Unit 4 |

Poorly-preserved insect remains are present in:

| | |
|---|---|
| Sample 6 | peat in natural channel 307, context 306 |

The small water beetles *Helophorus* sp. (*brevipalpis* size) and *Ochthebius* sp. are particularly abundant in channel 307. The water beetles *Hydrobius fuscipes* and *Normandia nitens* are also present. Terrestrial insect remains were not found but the insects do give some information on aquatic conditions. All but *N. nitens* are characteristic of shallow standing, or slowly-moving, water. *N. nitens* requires well-oxygenated, flowing water. It is possible that the assemblage resulted from a stream flowing into a shallow-water swamp. A more detailed analysis of the insect assemblage from channel 307 might show whether there was a brackish-water element to the fauna, but otherwise the insects are regarded as having a low potential for further analysis.

## 10.7 Charred Plant and Charcoal Remains

*Sarah F. Wyles and Michael J. Allen, Wessex Archaeology*

*Introduction*
Four bulk samples of *c.*.40 litres were taken from the two peat layers (contexts 305 and 109), and the fill of ream/ditch 307 in trench 3. Sub samples were removed and processed separately for waterlogged plant remains (reported on by Dr Clapham, above), and insects (reported on by Dr Robinson, above). The samples were as follows:

Sample 4: top of upper peat (305) Unit 2a
Sample 5: base of upper peat (305) Unit 2b
Sample 6: peat (306) in natural channel 307
Sample 11: lower peat (309) Unit 4

*Methods*
The bulk samples were processed by standard flotation methods; the flot retained on a 0.5 mm mesh and the residues fractionated into 5.6 mm, 2 mm and 1 mm fractions and dried. The coarse fractions (>5.6 mm) were sorted, weighed and discarded.

The flots were scanned under a x10 - x30 stereo-binocular microscope and presence of charred remains quantified (**Table 12**), to record the preservation and nature of the charred plant and charcoal remains and assess their potential.

| | | | | Flot | | | | | | Residue |
|---|---|---|---|---|---|---|---|---|---|---|
| Feature type/ No | Context | Sample | size litres | flot size ml | Grain | Chaff | Weed seeds uncharred charred | Charcoal >5.6mm | Other | Charcoal >5.6mm |
| Trench 3 | | | | | | | | | | |
| Layer | 305 | 4 | 29 | 650 [-] | - | - | a | - | - [-] | - |
| Layer | 305 | 5 | 25 | 1750 [-] | - | - | a* | - | - [-] | - |
| Layer | 309 | 11 | 29 | 4300 [-] | - | - | a* | - | - [-] | - |
| Stream channel | 307 | 6 | 26 | 2750 [-] | - | - | a* | - | - [-] | - |

KEY: A** = exceptional, A* = 30+ items, A = ≥10 items, B = 9 - 5 items, C = < 5 items, (h) = hazelnuts, smb = small mammal bones; Moll-t = terrestrial molluscs Moll-f = freshwater molluscs;
NOTE: [1]flot is total, but flot in superscript = ml of rooty material. [2]Unburnt seed in lower case to distinguish from charred remains

**Table 12: Assessment of the charred plant remains and charcoal**

*Charred plant remains*
The flots were large (average flot size for a 10 litre sample is 60 millilitres). High numbers of uncharred (waterlogged) weed seeds were observed in all the flots but no charred remains were recorded.

*Charcoal*
Charcoal was noted from the flots of the bulk samples and is recorded in table 1. No charcoal fragments of greater than 5.6 mm were retrieved from any of the samples.

*Discussion*
The lack of any charred plant remains in the organic stasis horizons is typical and is common in a number of sites such as Katherine's Farm (Wessex Archaeology 2000; Allen and Powell 2002), Awkley Lane and Vimpenny's Lane (Allen and Scaife 2001; Gardiner *et al.* Forthcoming) as well as a number of the Cabot Park sites (Locock *et al.* 1998; Walker *et al.* 1998a; 1999a; 1999b).

Although no charcoal greater than 5.6mm was recovered from any of these peaty stasis horizons, nor from the ditch/ream 307, fine charcoal was present at predominantly less than 1mm in the in the top of peat 305, and the ream 307, as reported by Clapham. Fine charcoal is present in a number of stasis horizons in microscopic form other sites such as an recorded in pollen studies from a peat layer (Scaife 2002) and from soil micromorphology (Macphail and Crowther 2002) from a non-organic Bronze Age layer at Katherine's Farm. The charcoal is too small to be identified to species (Gale pers. comm.), and as Clapham reports above, we cannot be

certain of its anthropogenic or natural origin. It is the record of its occurrence which is informative.

Further examination of these remains will not provide significantly greater information about the lived-in landscape than that that has already been determined from this, or other sites.

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## 10.8 Molluscs

*Michael J. Allen, Wessex Archaeology*

*Introduction*

Molluscs are occasionally present in some of the inorganic Wentllooge sequences in the Avon Levels. They are, however, often restricted to obvious zones or layers and which can be noted in the field (see Bell in Lawler et al. 1992). Elsewhere where detailed sequences have been examined the presence of shell's was very low (see Vimpenny's Lane and Awkley Lane, Allen and Scaife 2001; and Katherine's Farm, Allen and Powell 2002), and are very rarely preserved in organic stasis horizons.

*Discussion*

No identifiable shells were observed in detailed field examination, nor in detailed examination under x10 magnifiers of the full described sequences (see Allen and Jordan above). Some small shell fragments were noticed particularly in the basal context (211), these were typically non-marine species, by probably fresh-brackish water taxa. The assessment of the four 25-29 litre bulk samples showed no snail in the flots, and detailed examination of the same samples for waterlogged plant remains (Clapham above), and insects (Robinson, above), confirmed the absence of shells from the examined sequences.

*References*

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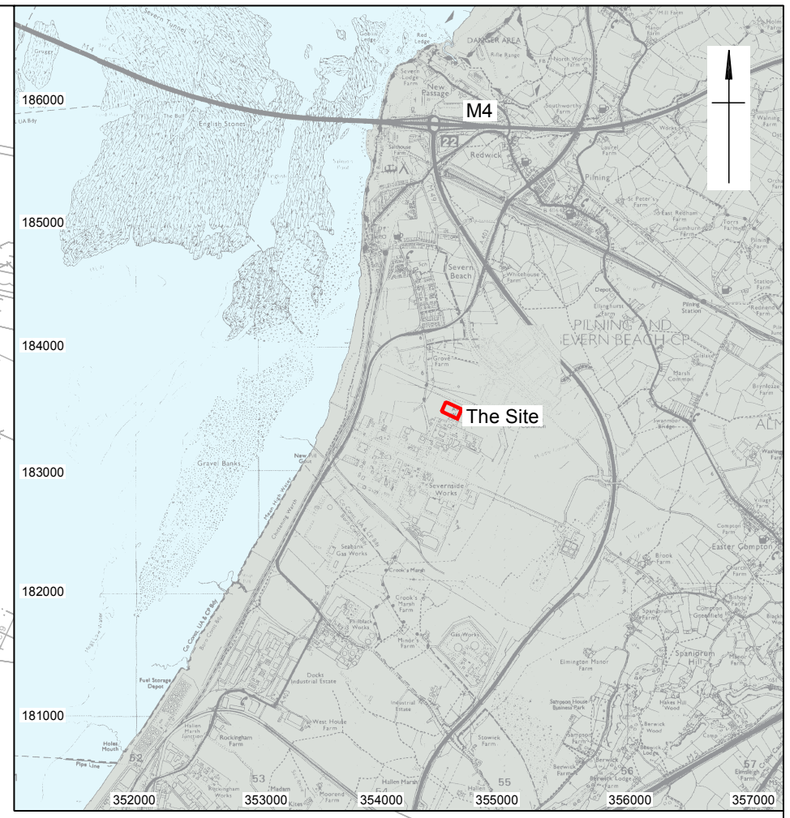



Trench 1
Trench 2
Trench 3
Trench 4
Trench 5
105
209
203
306
402 403 405

The Site
Evaluation trench
Archaeological feature

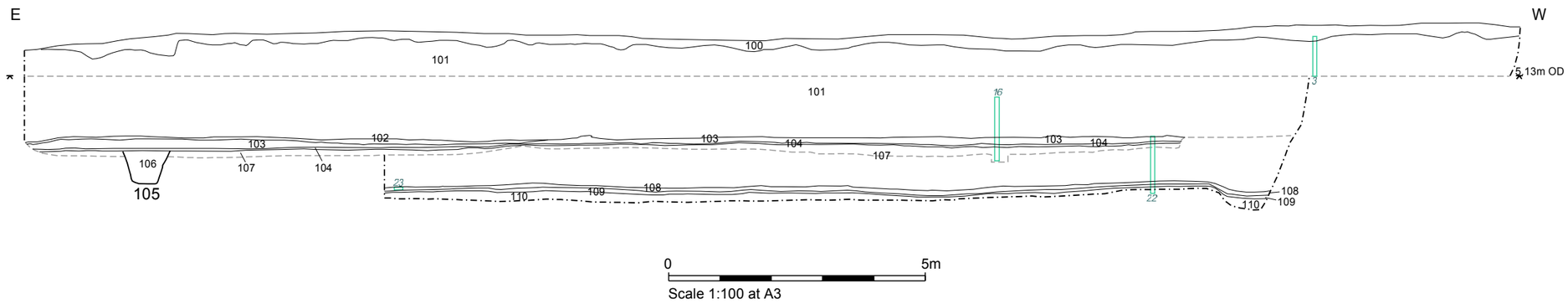
0 50m
Scale 1:800 at A3



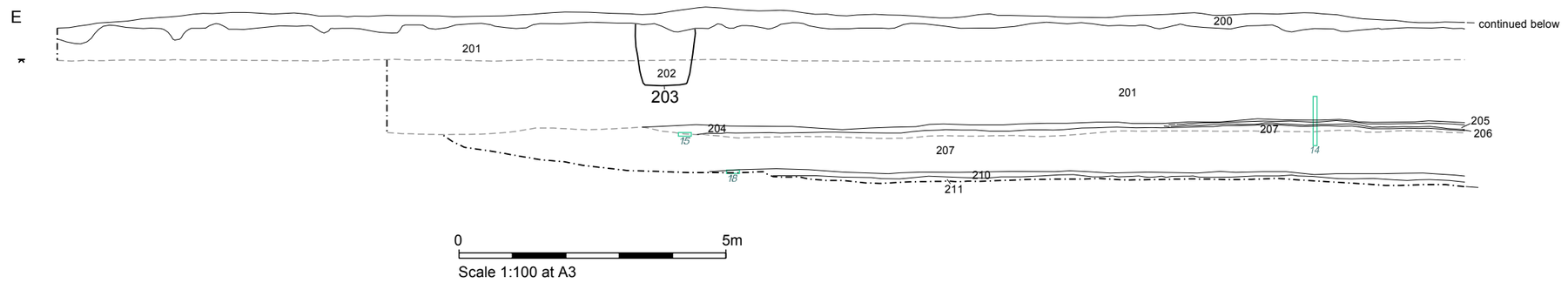
Location of trial trenches showing proposed development and features located

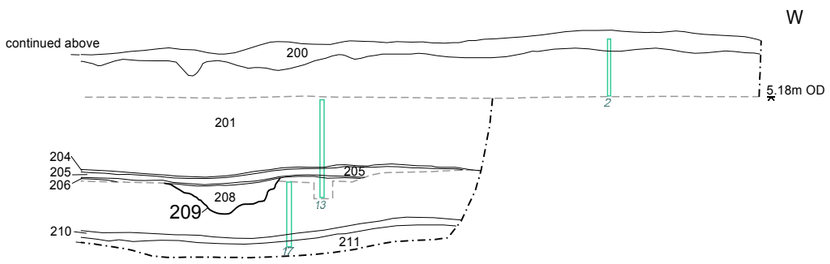
Figure 1

## Trench 1

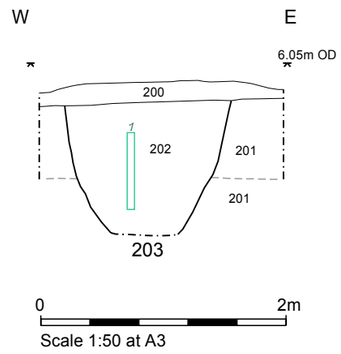



## Trench 2




## Trench 2




Indicates step in section

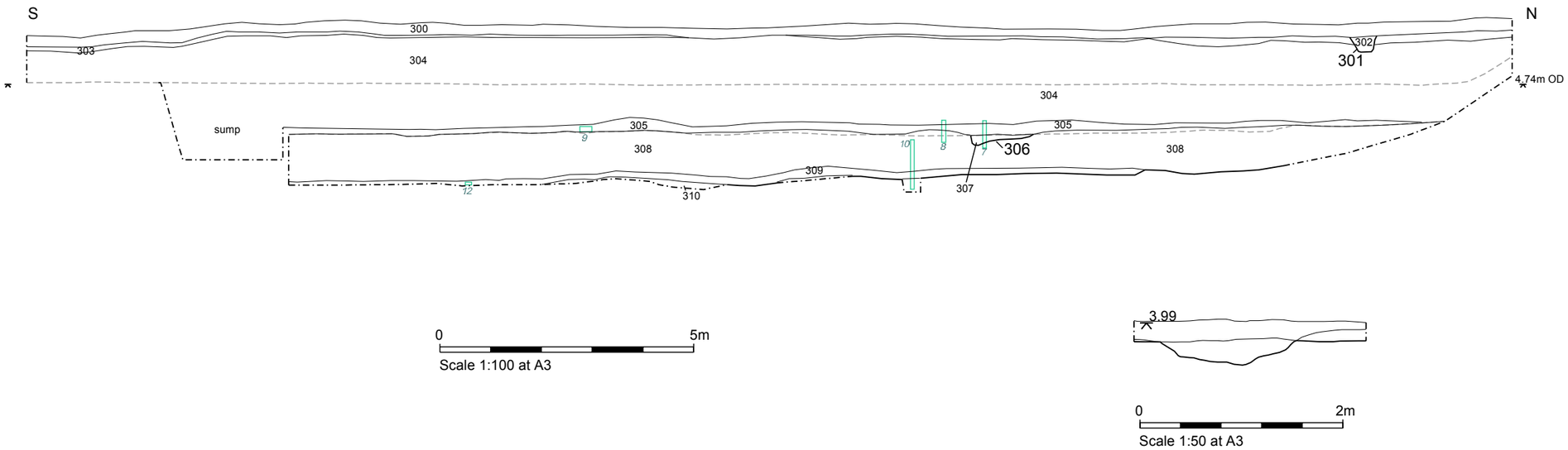
Environmental sample

Wessex Archaeology 12/06/02 LJC ref:50966/2

Trenches 1 and 2, sections

Figure 2

Trench 3

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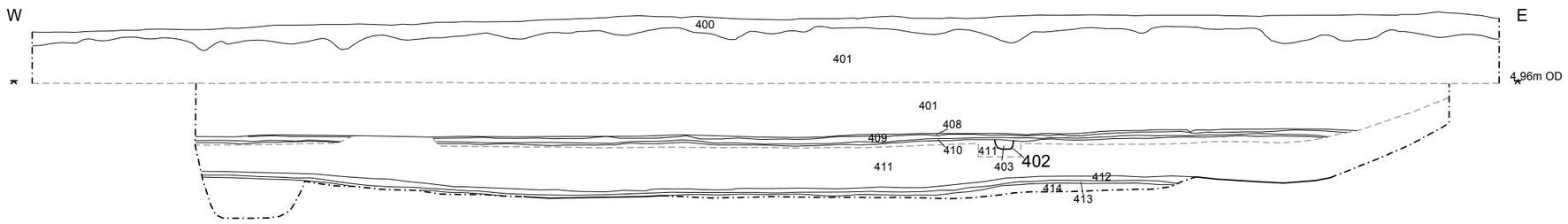
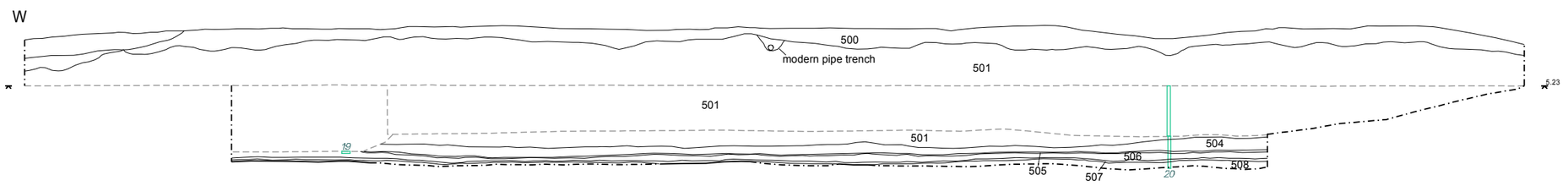



Trench 5




Indicates step in section

Environmental sample



Trenches 3, 4 and 5, sections

Figure 3

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