making sense of heritage

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

Ref: 105770.03
July 2015

archaeology

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

Prepared for:
Mouchel Ltd.
St. Johns House
2-10 Queen Street
Manchester
M2 5JB

On behalf of:
Lincolnshire County Council

Prepared by:
Wessex Archaeology
Unit R6, Sheaf Bank Estate
Prospect Road, Heeley
Sheffield
S2 3EN

www.wessexarch.co.uk

July 2015

Report Ref 105770.03

Quality Assurance

Project Code	105770	**Accession Code**	LCNCC:2014.166	**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	503100 370633		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	*LS*	*APN*		02/03/15
File:	\\sheffield\wessex\Projects\105770_Reports\VO1				
v02	I	*LS*	*APN*		28/07/15
File:	\\sheffield\wessex\Projects\105770_Reports\VO2				
v03	E	*LS*	*CS*		29/07/15
File:	\\sheffield\wessex\Projects\105770_Reports\VO3				
v04	E	*LS*	*CS*		05/08/2015
File:	\\sheffield\wessex\Projects\105770_Reports\VO4				
v05	I	*LS*	*APN*		12/08/15
File:	\\sheffield\wessex\Projects\105770_Reports\VO5				

* I= Internal Draft; E= External Draft; F= Final

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

Contents

Tables

Figures

Plates

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

Summary

Wessex Archaeology was commissioned by Lincolnshire County Council to undertake an excavation and watching brief in respect of trenching associated with a flood alleviation scheme at Keeble Drive, Washingborough, Lincolnshire. The flood alleviation works involved the laying of new pipes to convey surface water runoff away from nearby residential areas. Two areas of pipe impacted the Scheduled Monument of Car Dyke (Scheduled Monument number 1004923), which is centred on National Grid Reference (NGR) 503100, 370633 and is hereafter referred to as 'the Site'.

The work comprised the excavation and recording of deposits prior to the installation of the pipeline, and monitoring of groundworks during that installation. In the western area of the Site deposits forming a large bank to the south of Car Dyke were revealed. The bank was formed from redeposited layers of natural sand and alluvium, which were capped by clay – deposits originally derived from the excavation of Car Dyke. The full width of the earthwork was not investigated due to the constraints of the pipeline installation, however, the bank was at least 25m wide in plan and survived to over 1.5m in height. A linear hollow was revealed within the bank deposits, which most likely functioned as a 'barrow-run'. Natural sand and silt was revealed beneath the bank deposits and it appears that the area was deturfed prior to the bank's construction; perhaps for use of the turves in construction and for setting out purposes. The edge of Car Dyke lay outside the excavation area.

A peat-filled ditch was revealed to the south of the bank, running parallel with the ditch and most likely contemporary there was no direct relationship between the ditch and bank deposits. Carbon dating of the peat deposits produced calibrated dates of AD 70-250 for the lower levels of the peat deposits and AD 710-950 for the upper levels. The ditch most likely functioned as a drainage feature to the rear of the bank and as such it is likely that this section of Car Dyke was completed in the late 1st or 2nd century AD.

The excavation also revealed evidence of later levelling works and post medieval ditches most likely associated with the adjacent Fen Road.

Fieldwork was carried out between 16th September 2014 and 23rd January 2015. The archive is currently held at Wessex Archaeology's Sheffield office under project code **105770**, and will be deposited with Lincoln Museum under accession number **LCNCC:2014.166**.

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

Acknowledgements

This project was commissioned through Mouchel Ltd on behalf of Lincolnshire County Council and Wessex Archaeology is grateful to Alastair Hancock and Jonathan Wickham in this respect. Wessex Archaeology would also like to thank Tim Allen of Historic England (HE) for his assistance during the work.

Environmental samples were processed by Tony Scothern and were assessed by Sarah F. Wyles. The monoliths were described and sampled by Nicki Mulhall. The waterlogged plant remains were analysed by Dr Alan Clapham, the insect remains by Dr David Smith, the molluscs by Sarah F. Wyles and the pollen by Catherine Langdon and Dr Robert Scaife. The radiocarbon dating was carried out by Scottish Universities Environmental Research Centre (SUERC) and reported on by Dr Alistair Barclay and Sarah F. Wyles.

The report was undertaken by Laurence Savage with illustrations prepared by Alix Sperr. The project was managed for Wessex Archaeology by Andrew Norton and the finds reported on by Lorraine Mepham. The fieldwork was directed by Laurence Savage with the assistance of Natasha Brett.

Car Dyke
Washingborough, Lincolnshire

Archaeological Excavation Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned through Mouchel Ltd by Lincolnshire County Council (LCC) to undertake trenching associated with a flood alleviation scheme at Keeble Drive, Washingborough, hereafter referred to as 'the Site' (**Figure 1**) and centred on National Grid Reference (NGR) 503100 370633. The flood alleviation works involved laying of new pipes to convey surface water runoff away from nearby residential areas. Two areas of pipe impacted the Scheduled Monument of Car Dyke (Scheduled Monument number 1004923), and the archaeological work, carried out under Scheduled Monument Consent Ref: S00086136, comprised the excavation and recording of deposits prior to the installation of the pipeline, and monitoring of groundworks as part of a watching brief during that installation.

1.1.2 A Written Scheme of Investigation (WSI; Wessex Archaeology 2014) detailing how the archaeological work would be carried out was submitted to and approved by Mouchel, LCC and Historic England (HE; formerly English Heritage) prior to starting work.

1.2 The scheme

1.2.1 The two pipes ran north from the Fen Road housing estate south; the western pipe ran along a track between 36 and 34 Malvern Avenue, crossing Fen Road and turning north-east through the playing field where it met the north-south aligned 'Ditch 1'. The pipe trench length through the Scheduled Monument was 76.73m and 1.8m wide, with deeper excavation during the watching brief being 1m wide. Following discovery of unmarked services during initial archaeological excavation the proposed depth of the pipe was reduced from 1.8m deep to 0.9m deep. This change required a raise in the height of the ground once reinstated and topsoil was removed from the surrounding area in order to facilitate this.

1.2.2 The eastern pipe ran north through Keeble Drive, turned north-north-west across Fen Road before connecting with the north-south aligned 'Ditch 2'. The length of this pipe through the Scheduled Monument was 2.78m. The trench was 2m wide and 1.8m deep.

1.2.3 The topography of the Site is relatively flat lying at approximately 6m above Ordnance Datum (aOD). The Scheme is underlain by bedrock geology of the Lincolnshire Limestone Formation overlain by superficial depositions of Alluvium (Clay, Silt, Sand and Gravel).

2 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 The following information is summarised from a Scheduled Monument Consent Application Supporting Statement produced by Mouchel (2014).

2.2 Prehistoric and Romano-British

2.2.1 Two Bronze Age round barrows, visible as cropmarks on aerial photographs, are located approximately 200m to the west and 500m to the east of the Site. A number of flints have been recovered during field walking close to the Site, ten of which show signs of having been worked. Also found south of Fen Road was a worn sestertius (Roman Coin) of Trajan (AD 98 – 117) or Hadrian (AD 117 – 138).

2.2.2 Car Dyke is an artificial water channel running along the western fen edge from Peterborough to Lincoln and is thought to have been constructed around AD 125. Archaeological excavations have revealed that the water channel was approximately fifteen metres wide at the top and between two to four metres deep, with sloping sides and a flat bottom. The dyke is thought to have formed a drain to control and divert flood waters rather than a canal, with most of it now incorporated into modern drainage systems.

2.2.3 The Scheduled area of the Site is one of a few sections where it remains well preserved. The south bank is visible north of the main road in Washingborough (**Figure 1**) and runs east to west between allotments. The north bank was seemingly demolished *c.* 200 years ago to bank up the River Witham. Augered cores indicate the northern bank was encountered at approximately 400mm below ground surface with the southern bank encountered at approximately 700mm below ground. A further four cores placed across the dyke at Dunston Fen indicated a width of 14.5m and depth of 3.1m.

2.3 Anglo-Saxon to modern

2.3.1 The only other archaeological features recorded close to the Site comprise a late Anglo-Saxon ornate silver bowl that was found in 1816, east of Canterbury Drive; two drainage ditches, uncovered during excavations following the alignment of a pre-19th century phase of drainage; and an 'old quarry' visible on the 1906 Ordnance Survey map. A bank related to the quarry may still survive, with its southern and western edges still apparent in the layout of Fen Road and property boundaries.

2.4 Previous archaeological investigations of Car Dyke

2.4.1 There have been several archaeological investigations carried out on Car Dyke. A trial trench at Horton's Garage, Fen Road revealed the Dyke and its towpath, along with postholes, possibly from an associated structure. Finds included a Romano-British shoe and roof tile.

2.4.2 An evaluation to the west of the Site at 81 Main Street, along the postulated line of the Dyke, revealed a prehistoric horizon containing Late Mesolithic/Early Neolithic flint tools and a Late Bronze Age spearhead. The evaluated area is thought to have flooded and/or been subject to seasonal waterlogging, causing peat to form, in which the spearhead is thought to have been deposited. No evidence for the Dyke was uncovered leading to the conclusion it diverts from its east-west course somewhere between the site and visible earthworks approximately 130m to the east.

2.4.3 Excavations along other sections of the Dyke suggest it was still in use until at least the Anglo-Saxon period, as evidenced by a sherd of medieval pottery found within the higher fills of the ditch. Other evidence indicates that the Dyke fell into disuse between the Romano-British and medieval periods as the bank had been truncated by medieval or post-medieval ploughing.

3 METHODOLOGY

3.1 Aims and objectives

3.2 General

3.2.1 The general aims of the project were:

- *to identify any archaeological remains present;*
- *to accurately record the location and stratigraphy of areas excavated;*
- *to record all archaeological remains disturbed by the groundworks;*
- *to determine the extent, condition, character, importance and date of any archaeological deposits encountered;*
- *to provide information that will enable the archaeological remains to be placed within their local, regional and national contexts;*
- *to integrate the results into the wider cultural and environmental context and with specific research aims;*
- *to recover artefacts disturbed by the works, and*
- *to produce an accurate and comprehensive record and report of any archaeological deposits disturbed by the works.*

3.3 Specific

3.3.1 The specific aim of the project was to enhance the results of the previous archaeological investigations of Car Dyke.

3.4 Fieldwork methodology

Excavation

3.4.1 Overburden was removed using a mechanical excavator fitted with a toothless ditching bucket, working under the continuous direct supervision of a suitably experienced archaeologist. Material was separated on the side of the trenches by type, and excavation proceeded down to the level of the upper archaeological horizon, the level of the natural geology, or proposed depth of the pipe trenches, whichever was reached first.

3.4.2 The initial phase of the excavation comprised the archaeological supervision of machining of topsoil and subsoil from linear excavation areas, which followed the route of the two pipe trenches.

3.4.3 To mitigate against the possibility that prehistoric features and deposits predating Car Dyke survived *in situ*, the pipe trenches were then machined under archaeological supervision up to a maximum depth of 1.8m. In the western part of Area 1 excavation was to a maximum of *c*. 1.5m, and the east *c*. 0.2m. Isolated deeper excavation and hand augering took place to better understand the revealed deposits.

3.4.4 A Section 42 licence was obtained from HE and all spoil was scanned for artefacts by hand and with a metal detector. The finds were recorded and retained unless of clearly modern (i.e. 20th or early 21st century) origin. Additionally, all spoil/wet deposits were metal detected in situ.

3.4.5 The archaeological excavation and sampling subsequently recorded the structure of the southern bank, and ditches located to the south of the bank.

3.4.6 Once deposits were recorded to the satisfaction of the Client and HE the trench was backfilled.

Watching Brief

3.4.7 A 0.8m wide trench was excavated along the centre of Area 1, to a depth of c. 0.5m, for the installation of the drainage pipes (**Plate 1**). Originally intended to be up to 1.8m deep, the presence of existing services necessitated the building up of the Site in order to excavate the trench. Wessex Archaeology monitored the removal of topsoil to a depth of c. 200mm across the Site and monitored all trenching as part of a watching brief (**Figure 1**). During the watching brief phase the excavation of a manhole and small extension within the western trench were also monitored.

3.5 Recording

3.5.1 All archaeological deposits were recorded using Wessex Archaeology's standard methodologies and in accordance with industry best practice (CIfA 2014a and b).

3.6 Finds

3.6.1 All finds were treated in accordance with relevant industry guidance (UKIC 2001; MGC 1991; English Heritage 2005 and 2006), and the requirements of Historic England.

3.7 Environmental strategy

3.7.1 Samples were taken, as appropriate, in consultation with Wessex Archaeology specialists and the HE Regional Science Advisor. The collection and processing of environmental samples was undertaken in accordance with Historic England guidelines (EH 2011).

4 ARCHAEOLOGICAL RESULTS

4.1 Summary

4.1.1 The excavation in the western part of the Site (Area 1) revealed a section through the southern bank of Car Dyke. The southern side of the bank was seen to survive to *c.* 1.5m in depth and over 25m in width. The upper deposits had been truncated and the earthwork was further disturbed by recent building work and service installation. To the south of the bank was a peat-filled ditch, shown to have been open at the same time as the dyke by radiocarbon dating. In the south-west of Area 1 were two post-medieval ditches that probably functioned as boundary/drainage ditches.

4.1.2 The excavation in the eastern part of the Site (Area 2) revealed modern disturbance probably caused by a combination of banking works for Fen Road, maintenance of the running dyke located immediately to the north (which also serves as a field boundary) and the upkeep of the existing trackway and field entrance. (**Figure 2**; **Plate 2**).

4.1.3 A summary of the stratigraphy of the Site can be found below, full details of all contexts can be found in **Appendix 1**.

4.2 Area 1: Romano-British

Car Dyke bank

4.2.1 An earthwork forming the southern bank of Car Dyke was identified in Area 1 (**Figure 3**). The earthwork was *c.* 25m wide, a maximum of 1.5m high and constructed on natural sand and silt. The pipe trench cut through the bank at an oblique angle making interpretation difficult but the bank was seen to be formed of redeposited natural and alluvial deposits that were investigated in detail by means of sample excavations (**Figure 4**; **Plates 3** and **4**). The bank was seen to be formed of dumps of clay (1013), sandy clay (1009, 1015, 1017 and 1050), silty sand (1024 and 1048) and white, yellow, pink, orange and red sand (1006-1008, 1010, 1037-1039, 1042-1047 and 1049; see **Figures 4** - **6**).

4.2.2 The deposits in the western part of the bank were overlain by up to 1m of clay (1011, 1051-1056), which may represent post-medieval levelling material, whilst those in the east were overlain by modern dumps (1035 and 1036) and topsoil deposits (1000, 1001, 1040 and 1041). No datable finds were recovered from the bank material.

Barrow-run

4.2.3 At the western limits of Area 1 a north-south aligned feature (1085) ran across the surface of the bank. Flat based, 3m wide and 0.4m deep the feature had the appearance of a hollow-way, and may have functioned as a barrow-run used during the construction of the bank (**Figures 3** and **6**; **Plates 5** and **6**). Its primary fill (1079) comprised a trampled deposit of mixed sand. The trample was overlain by redeposited alluvium, similar in nature to the adjacent bank deposits (1080).

Peat-filled ditch

4.2.4 To the south of the bank a ditch (1033) cut clayey alluvium (1068) and the natural sand silt. The extent of the ditch was not fully revealed by the excavated area and at the request of Historic England, the excavation area was slightly extended to investigate its full extents (**Figure 6**). This extension did not reveal the southern edge of the ditch, which must have been at least 4m wide and 1.1m deep (**Plate 8**). No material remains were recovered from the ditch, but carbon dating of the peat produced a calibrated date of AD 70-250 for the lower peat deposits and AD 710-950 for the upper levels. Due to health and safety concerns over working at depth the base of the peat could not be sampled. The ditch may have formed a drainage feature running along the southern edge of the bank; a deposit of sand (1067) overlay the fills of the ditch.

4.3 Post-medieval

4.3.1 A deposit of redeposited alluvium (1004/1032) overlay peat 1012 (**Figure 6a**). The deposit appeared to form a levelling layer over the ditch and lower bank fills. A further levelling layer (1003), which sealed 1104/1032, contained post-medieval finds including broken pipe stem, ceramic building material (CBM) and pottery. The levelling layer extended as far as the edge of the southern bank of Car Dyke creating an even surface(**Figure 6**; **Plate 9**).

4.3.2 At the area stripped of topsoil a ditch (1062) cut through assumed levelling layer (1061). Revealed obliquely in section, the ditch cut appeared to be in excess of 1.5 m wide and more than 0.4m deep. (**Figures 3** and **7**, **Plate 8**). The ditch was filled with a peaty deposit (1063) of a less dense consistency than that seen in Romano-British ditch 1033. The ditch was roughly aligned with Fen Road, and may have formed associate drainage.

4.4 Modern

4.4.1 Ditch 1058 was located to the south of peat filled ditch 1062, and cut redeposited alluvium 1057 (see above). Ditch 1058 was filled with redeposited topsoil (1059 and 1060) (**Figure 7**).

4.4.2 At the eastern end of Area 1 an area of disturbed bank material (1035) was encountered. The disturbance was *c.* 28m long (**Figure 3**), finds included plastic lemonade bottles and a steel toe cap from a boot, and was of 20th century date.

4.4.3 The disturbance was cut by linear service trenches for cast iron rising mains running north-west from the nearby pumping station. A posthole (1075; **Figures 3** and **7**, **Plate 11**) cut the western bank deposits between the service trenches. Filled with redeposited topsoil it was most likely of recent date.

5 ARTEFACTUAL EVIDENCE

5.1 Finds

5.1.1 The finds assemblage is small, and consists of material recovered from three contexts; in addition, some items were found unstratified. Quantities by material type and by context are given in **Table 1**. The assemblage includes material of medieval and post-medieval date.

5.2 Pottery

5.2.1 Sherds from levelling layer 1003, and one unstratified sherd, comprise post-medieval redwares and refined wares and are likely a result of post-medieval manuring.

5.3 Other finds

5.3.1 Other datable items are all post-medieval, and comprise ceramic building material (one medieval/post-medieval roof tile and one post-medieval pantile from levelling layer 1003; three modern drainpipe pieces from the fill of ditch 1058), clay tobacco pipes (one decorated bowl, 19th century), and glass (modern green bottle).

5.3.2 Other finds consist of animal bone (cattle and horse) and oyster shell, recovered from post-medieval or undated contexts.

5.4 Further potential

5.4.1 This very small finds assemblage has little or no potential for further analysis. Most finds are of relatively recent date; all have been recorded to an appropriate archive level. The recommendation is that the entire assemblage is discarded following discussion with the recipient museum prior to archive deposition.

Table 1: All finds by context (number / weight in grammes)

Context	Animal Bone	CBM	Clay Pipe	Glass	Pottery	Other Finds
1003	15/466	2/138	8/26	5/8	6/53	1 shell; 4 iron
1032	1/440					1 shell
1060		3/190				
Unstrat	1/756		14/30	1/4	1/4	
TOTALS	**17/1662**	**5/328**	**22/56**	**6/12**	**7/57**	

6 ENVIRONMENTAL EVIDENCE

6.1 Introduction

6.1.1 A series of six bulk samples were taken through peat layer 1012 in Romano-British ditch 1033, possibly a drainage ditch associated with the southern bank of Car Dyke. The samples were processed for the recovery, assessment and subsequent analysis of waterlogged remains. Two monolith samples were also taken through this deposit.

6.2 Scientific Dating

6.2.1 Two radiocarbon dates (SUERC-57155 and 57156) were obtained on samples of waterlogged plant remains (*Phragmites* stems) submitted to the Scottish Universities Environmental Research Centre (SUERC) (**Table 2**). They have been calculated using the calibration curve of Reimer et al. (2013) and the computer program OxCal (v4.2.3) (Bronk Ramsey and Lee 2013), cited in the text at 95% confidence and quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years. The ranges in plain type in the radiocarbon tables have been calculated according to the maximum intercept method (Stuiver and Reimer 1986).

6.2.2 The aim of the radiocarbon dating programme was to determine the age of the peat deposit within ditch 1033, the course of which ran parallel to the Car Dyke. As phragmites are short-lived, a date on a stem of a plant that had grown at the base of the ditch would be close to the date of construction of ditch 1033.

6.2.3 The date from the base of the peat indicates the onset of peat accumulation from sometime during the late first century AD to the mid third century AD (SUERC-57155 cal AD 70-250 at 95% confidence) and the date from the upper peat shows that the ditch was nearly infilled by the 8th to 10th century AD (SUERC-57156 cal AD 710-950 at 95% confidence). The radiocarbon dating supports the suggestion that the ditch was constructed in the early Roman period and that the ditch was still open in the late Saxon period.

Table 2: Radiocarbon measurements from peat deposit 1034

Lab reference	Monolith and context	Material	Date BP	$\delta^{13}C$	calibration BC (2 sig. 95.4%)
SUERC-57156	Monolith <8> 0.14-0.19 (1012)	Waterlogged plant remains, *phragmites* stem fragments from the top of the peat	1199±31	-28.4‰	cal AD 710-950
SUERC-57155	Monolith <8> 0.84-0.89 (1034)	Waterlogged plant remains, *phragmites* stem fragments from the base of the peat	1848±31	-29.1‰	cal AD 70-250

6.3 Sediments

6.3.1 Two monolith samples were taken from Romano-British ditch 1033. The monoliths were cleaned prior to recording and standard descriptions used, (following Hodgson 1997) including Munsell colour, texture, structure and nature of boundaries, as given below in **Tables 2** and **3.**

6.3.2 Monolith 7 was located nearer to the channel edge where the peat band is narrower than in monolith 8. Both monoliths have the same loamy sand topsoil and contain good quality horizontally laminated peats rich in plant remains. Peat initialisation is visible in both but as monolith 8 is nearer to the middle of the channel, the peat initialisation layer is thicker and contains mollusc shells indicative of moving water such as *Radix balthica* and *Bithynia* spp.

6.4 Waterlogged plant remains

6.4.1 Sub-samples of 1 litre were taken from the six bulk samples from peat layer 1012 and processed for the recovery of waterlogged remains. Laboratory flotation was undertaken at Wessex Archaeology with the flots retained on a 0.25mm mesh. For assessment, the flots were inspected under a x10-x40 stereo-binocular microscope to determine if waterlogged material occurred.

6.4.2 From this assessment, two samples (1 and 2) from peat layer 1012 within ditch 1033 were selected for analysis. The samples were studied using a low-power (x8-x56) stereo-binocular microscope and the extracted taxa identified using Cappers et al (2006) and a modern plant reference collection. For the identification of the wood, thin sections were made from the 3 different sections (transverse, tangential, radial) and examined using a high power (x10-x1000) stereo-microscope. The wood was identified using Hather (2000). Nomenclature follows that of Stace (2010).

6.4.3 Preservation was excellent permitting identification of many of the remains to species. The results have been recorded in **Table 4**.

6.4.4 The samples proved to be very rich with the number of plant taxa recovered from the two samples totalling 82. The taxa present shows that there is a change in habitat (succession) through the profile with open water with emergent and waterside vegetation being dominant in the lower part of the peat (Sample 2) and more fenland conditions prevailing (drier) in the upper Sample 1. A large piece of wood was recovered from Sample 1 which was identified as being of willow (*Salix* sp.). The taxa present are indicative of the different habitats which can be found in fen conditions and represent a developmental succession from open water to fenland.

6.4.5 In Sample 2 the presence of open water species may indicate the time when the ditch was functioning as a drain for the surrounding fenland. It is possible that through time the ditch fell into disuse and began to silt up leading to the development of vegetation that reflected the local environment, i.e. the fenland through which the Car Dyke ran.

6.4.6 The majority of the plant species identified indicate a base-rich water supply (groundwater). What is of interest is the presence of sweet gale (*Myrica gale*) which is a well-known calcifuge (lime-hating) plant. The presence of this plant, which is known to occur at the fenland nature reserve Wicken Fen in Cambridgeshire (Friday 1997; Friday and Harley 2000), may suggest that more acidic conditions existed in parts of the fen. Another explanation may be that as the peat built up, there was less influence from the base-rich groundwater therefore leading to more acid conditions where the water supply is derived from rainwater rather than groundwater.

6.4.7 The plant species present in these two samples can be found in the present day at Wicken Fen (Friday 1997; Friday and Harley 2000) and this may give some indication of how the landscape in the environs of Car Dyke at Washingborough may have looked during and after the Roman period.

6.4.8 The two samples indicate a change from an open water environment with fringing vegetation at the bottom of the ditch, and with the deposition of plant matter to form peat most likely due to the ditch falling into disuse as a more fenland environment developed. The presence of sweet gale suggests that the fenland peat may have been more acidic than is normally associated with the fens but as it has been recorded growing in the fenlands on Cambridgeshire by Ray (1660), it may well have been present in Lincolnshire as well.

6.5 Insect remains

6.5.1 The insect faunas described in this report come from peat deposit 1012 in ditch 1033. It was hoped that any insect faunas examined from this ditch might help to indicate the nature of the landscape and land use in the area. The insect faunas might also indicate if there was any local settlement or if any settlement debris had been deposited into the ditch.

6.5.2 Both samples selected for analysis (Sample 1 taken from the upper layer of the peat deposit with Sample 2 taken from the lower layers of the peat deposit) were 10 litres in volume. They were processed using the standard method of paraffin flotation as outlined in Kenward et al. (1980). The insect remains were sorted and identified under a low-power binocular microscope at magnifications between x15 – x45. Where achievable the insect remains were identified to species level by direct comparison to specimens in the Gorham and Girling insect collections housed in the Department of Classics, Ancient History and Archaeology at The University of Birmingham.

6.5.3 The recovered insect assemblages were moderate in size. The majority of the insect remains present are beetles (Coleoptera). Sample 2 also contained a small population of caseless caddis flies (Tricoptera) and true bugs (Hemiptera). A list of the insects recovered is presented in **Table 5**. The nomenclature for Coleoptera (beetles) follows that of Lucht (1987). The right hand Column in **Table 5** lists the host plants for the phytophage species of beetle that were recovered and are predominantly derived from Koch (1992). The plant taxonomy follows that of Stace 2010.

6.5.4 In order to aid interpretation, where possible, taxa have been assigned to ecological groupings. The Coleoptera follow a simplified version of the scheme suggested by Robinson (1981; 1983). The affiliation of each beetle species to a particular ecological grouping is indicated in the second column of **Table 5**. The meaning of each ecological code is explained in the key at the base of **Table 5**. The occurrence of each of the ecological groupings is expressed as a percentage in **Table 6** and the relative proportions of ecological groups are presented in **Figure A1**. The pasture/ grassland and dung ecological groupings are calculated only as a percentage of the total number of terrestrial species, as opposed to the whole fauna (i.e. calculation excludes all aquatic beetles). An individual taxon can occur in more than one ecological grouping and, therefore, the proportions presented in **Table 6** and **Figure A1** can exceed 100%.

6.5.5 Both insect faunas are dominated by a range of water beetles and species normally associated with damp watersides (ecological groups ‘a’ and ‘ws’ in **Tables 5** and **6** and **Figure A1**. In total, 43.9% of the beetle fauna recovered in Sample 1 and 71.9% in Sample 2 were aquatic in nature.

6.5.6 The water beetles all clearly indicate that the ditch was filled with slow-flowing or stagnant water. This is indicated by the recovery of a range of ‘diving beetles’ (i.e. Suphrodytes dorsalis, Hydroporus, Agabus, Rhantus and Dytiscus spp.), ‘whirligig’ beetles (Gyrinus spp.), ‘water scavenger beetles’ (i.e. Coelostoma orbiculare, Cercyon ustulatus, Laccobius

spp, Cymbiodyta marginella and Chaetarthria seminulum) and 'moss beetles' (i.e. Hydraena spp., Ochthebius minimus and Limnebius spp.) all of which are associated with such water conditions (Hansen 1987; Foster and Friday 2011; Duff 2012). Two small weevils also are associated with slow-flowing water conditions. Tanysphyrus lemnae is associated solely with duckweed (Lemna spp.) and Eubrychius velutus is associated with water-milfoils (Myriophyllum spp.) both of which frequently occur in slow-flowing/ stagnant water (Koch 1992; Morris 2008). The leaf beetle Donacia crassipes also is an indicator for slow-flowing, open pools of water since it feeds on the white and yellow water lilies (Nymphaea alba and Nuphar lutea) (Koch 1992). The 'ground beetle' Elaphrus cupreus is associated with damp watersides and Agonum thoreyi with common water reed (Phragmites australis) (Luff 2007).

6.5.7 Sample 2 contains a number of species that suggest that when this deposit was forming a relatively thick bed of aquatic vegetation was present. This is indicated by the recovery of Donacia clavipes which is associated with common club rush (Scheonoplectus lactustris), Donacia cinerea which is typically associated with bulrush (Typhea spp.) and the Notaris scirpi, which typically occurs with sedges and rushes (Scirpus spp. and Carex spp.). This may suggest that conditions in the ditch changed through time with stands of waterside vegetation being replaced by damp marshy/boggy areas with some open water. This could imply that the ditch system had become blocked as it fell into disuse, leading to areas of occasional flooding and pools of water in the wider area.

6.5.8 There is evidence for pasture or grassland beyond the ditch. This is indicated, in part, by a number of 'dung beetles' that were recovered from both samples such as Onthophagus Joannae, O. similis, Aphodius luridus, A. fimetarius, A. fasciatus/ putridus and Aphodius ater. These species are all associated with the dung of herbivores, often kept in pasture (Jessop 1986). The small staphylinid 'rove beetle' Platystethus arenarius is associated with grassland/pasture as well (Lott 2009). The 'cock chaffer' Phyllopertha horticola is frequently associated with old turf in grassland (Jessop 1986).

6.5.9 The insects clearly indicate that the ditch, which ultimately was entirely infilled by peat, contained slow-flowing water and was set within a landscape dominated by pasture. As is common at many Roman period rural sites, there are almost no indicators for trees or woodland, which suggests a virtually cleared landscape.

6.5.10 In terms of Lincolnshire there are very few Roman sites of this date that have produced insect remains, and the majority of previous work is from urban deposits in Lincoln. One exception is the unpublished ditch system at Rectory Farm (Smith 1996a). In terms of the sequence seen at Car Dyke, with the ditch becoming slowly choked with water reed, the most obvious comparison is that of the unpublished analysis from the field systems at East Carr, Mattingsley, Nottinghamshire (Smith 1996b) where a ditch was similarly gradually blocked with reed and sedge beds and eventually developed into alder carr as local water tables raised.

6.5.11 Outside of Lincolnshire, however, a larger number of Roman ditch or water hole systems have now been examined. Many produce very similar insect faunas, suggesting the presence of a network of ditches set in grazed pasture. Similar field systems include the 'ladder ditch' system at Little Paxton Cambridgeshire (Smith 2011a); the ditch and waterhole systems at the Daventry Rail Freight Terminal, West Midlands (Smith 1999); and Whitmoor Haye, Staffordshire (Smith 2002). Further afield, closely comparable insect faunas have now been recovered from the extensive ditch and water hole systems near Heathrow, some of which are Roman rather than Iron Age in date (e.g. Lewis et al. 2006; Robinson 2006; Smith 2009a, 2009b.). Unlike the ditch systems at the Northfleet Roman Villa, Kent (Smith 2011b) and that at Salford Priors, Warwickshire (Smith and Langham

2000), however, there is no indication for the disposal of settlement debris into the ditch feature at Car Dyke.

6.6 Land and aquatic molluscs

6.6.1 Three samples of one litre taken through the lower part of peat layer 1012 in ditch 1033 were processed for the recovery of molluscs following the methods outlined by Evans (1972). The base of peat layer 1012 has been dated to cal. AD 70-250 (1848±31 BP, SUERC_57155) and the upper part to cal. AD 710-950 (1199±31 BP, SUERC_57156). The analytical methods employed were standard, namely the identification of apical and diagnostic mollusc fragments > 0.5mm, using a x10-x40 stereo-binocular microscope. Nomenclature follows Anderson (2005). Numbers of *Pisidium* valves have been recorded as minimum numbers of individuals. The results were tabulated in **Table 7**. The ratio of *Bithynia* apices to opercula was also calculated as an 'index of 'assemblage transport', i.e. an in situ accumulation should have equal numbers of both; over-representation of either is indicative of transport' (Sidell et al 2000). Details of the ecological preferences of the species follow Evans (1972), Kerney (1999) and Davies (2008).

6.6.2 The largest number and greatest range of shells was recovered from Sample 2. The assemblages were all dominated by *Bithynia* sp. opercula, with the highest ratio of opercula to shells being recorded in Sample 6 and the lowest in Sample 2, although this was still 11 opercula to every *Bithynia* shell.

6.6.3 The predominant species represented by the shells in Sample 2 were *Bithynia tentaculata* and *Valvata cristata*. *Bithynia tentaculata* is "a common species in large bodies of slow-moving, well oxygenated hard water. It particularly favours muddy-bottomed situations where there are dense growths of aquatic plants" while *Valvata cristata* is described as "a species restricted to well-oxygenated, slowly flowing or still water, with a strong preference for richly vegetated places on muddy substrates" (Kerney 1999). The assemblage appears to be indicative of a muddy-bottomed, well vegetated ditch with well oxygenated slowly moving water in an immediate local area of damp grassland.

6.6.4 A similar aquatic environment is reflected by the assemblage from Sample 4, while the very restricted assemblage recovered from Sample 6 may be indicative of a faster moving water environment in this part of the ditch.

6.6.5 The analysis of the waterlogged plant remains (Clapham this report) has shown that the plant assemblage recovered from the lower part of peat layer 1012 in Sample 2 is reflective of an open water environment with emergent and waterside vegetation. The suggestion of an increased acidity within the upper part of the peat layer, as indicated by the presence of sweet gale (*Myrica gale*) in Sample 1, may help to explain the absence of mollusc remains in the upper part of the peat layer. The insect remains recovered from Sample 2 (Smith this report) also appear to be indicative of slow flowing/open water with a relatively thick bed of aquatic vegetation within the ditch.

6.7 Pollen

6.7.1 Analysis of sub-fossil pollen and spores contained within the radiocarbon dated, organic, sediment fills of ditch 1033 has been undertaken to examine the vegetation and environment of the ditch and its surrounds. The profile spans the Romano-British to Saxon periods and information on the changing habitat of the ditch and surrounding area has been obtained.

6.7.2 Standard techniques for concentration of the sub-fossil pollen and spores were used on sediment sub-samples of 1.5 ml. volume (Moore and Webb 1978; Moore et al. 1991).

Pollen counts of 400-500 grains per level were made where preservation permitted. A pollen diagram (figure1) was produced using Tilia and Tilia Graph (Grimm 1991) with percentages calculated as follows (**Figure A2**):

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

6.7.3 Taxonomy, in general, follows that of Moore and Webb (1978) modified according to Bennett et al. (1994) for pollen types and Stace (2010) for plant descriptions.

6.7.4 Pollen was recovered from all of the eight samples examined spanning the *c.* 0.70m of humic sediment. Absolute pollen numbers were, however, low. Taxonomic changes are evident in the sequence and as such, two local pollen assemblage zones (l.p.a.z.) have been recognised in the profile. These are characterised in **Table 8**.

6.7.5 The pollen data obtained can be considered in relation to the changing character of vegetation in the ditch itself and that growing on the drier soils of the surrounding zone.

6.7.6 Overall, the pollen profile shows an initial phase of open freshwater fringed by fen herb vegetation and willows. The ditch became drier due to sediment infill which culminated in the colonisation of hazel and willow and a ground flora of sedges, other fen herbs and marsh ferns.

6.7.7 L.p.a.z. CAR 1 has high pollen values of aquatic macrophytes suggesting open freshwater. These taxa include water milfoil (*Myriophyllum spicatum*) with yellow water lily (*Nuphar lutea*), white water lily (*Nymphaea alba*), pond weed (*Potamogeton* type) and quillwort (*Isoetes lacustris*). This aquatic zone was fringed by sedges (Cyperaceae), reed mace and/or bur reed (*Typha angustifolia* type), possibly hemlock water dropwort (*Oenanthe* type; in the main herb category since other taxa may also be represented in this pollen type) and willow (*Salix*). There are also small numbers of alder (*Alnus* sp.) which considering its high pollen productivity and anemophily was at most, an occasional occurrence along the banks of the ditch.

6.7.8 The ditch became sediment filled which caused the demise of the aquatic macrophytes. Although some water milfoil remained, indicating some standing freshwater, this was minimal compared with preceding phase (l.p.a.z. 1). It appears that initially, willow (*Salix*) encroached on to the Site which was followed by hazel (*Corylus*) colonising areas on, or nearby the Site. Certainly, the conditions became drier with a fen herb and fern flora comprising meadowsweet (*Filipendula ulmaria*), sedges (Cyperaceae) and marsh fern (*Thelypteris palustris*) colonising as a ground flora to the willow and hazel. High values of monolete fern spores of Dryopteris type are probably poorly preserved marsh fern (*Thelypteris palustris*) which is also recorded. This habitat remained.

6.7.9 It is probable that the representation of the surrounding vegetation of drier ground has been suppressed to some extent by the autochthonous elements representing vegetation growing close to the ditch which are over represented. This applies especially to l.p.a.z. CAR 2 where the vegetation was more closed than in l.p.a.z. CAR 1 thus restricting the pollen catchment.

6.7.10 Zone 1 shows that birch (*Betula*), oak (*Quercus*) and hazel (*Corylus*) were the principal woodland components of the surrounding area. The latter was probably growing in relative close proximity, facilitating its later expansion on to the Site. Ash (*Fraxinus*) is poorly represented in pollen spectra and the small numbers here suggest growth in close proximity.

6.7.11 Herb pollen is dominant in l.p.a.z. CAR 1. Grasses (Poaceae) are most abundant and, whilst a proportion of this pollen will have derived from the on-site communities, clearly a proportion of this will also have come from adjacent grassland, probably pasture. This is substantiated by the high values of ribwort plantain (*Plantago lanceolata*) in this zone. Other pollen taxa may also be referable to grassland (Ranunculaceae) but are not differentiable to a lower taxonomic level and therefore, to specific habitats. Cereal pollen is present and this attests to arable agriculture in the local region. The presence of grassland and arable land suggest that a mixed agricultural economy may have been practised nearby during the Romano-British period.

6.7.12 As noted, the changing vegetation within the ditch will have affected the overall pollen taphonomy. Apart from the on-Site changes in vegetation and particularly the expansion of hazel on or near to the Site, grassland/pastoral habitats remained, also with some evidence of arable cultivation. The numbers of wild grass, cultivated cereal and ribwort plantain pollen are reduced in l.p.a.z. CAR 2 and this is a function of a within pollen sum increase in the percentages of hazel depressing other values and also, the possibility that on-Site tree/shrub growth may have had a filtering effect on the input of pollen to the Site.

6.7.13 Archaeologically, the sediment spans the period from AD 70-250 and AD 710-950, that is, the Romano-British to late Saxon periods. It is possible that the change from the active freshwater fen ditch to one that became silted and overgrown resulted from post-Roman abandonment. Similarly, the reduction in agricultural elements, both pastoral and arable, may also be due to changes in local land use. However, the changing taphonomy of the pollen may be responsible for the reduction in agricultural elements, and agricultural activity may have remained little changed.

6.7.14 Pollen sequences of historic age are sparse for Lincolnshire and the country as a whole when compared with data pertaining to the prehistoric period. Thus, the sub-fossil pollen and spores which have been recovered from the ditch sediments which are of Romano-British to late Saxon date near the Car Dyke are of interest and use in understanding the changing vegetation environment of this period.

6.7.15 The pollen sequence shows a marked change from the water filled ditch which existed after construction through to its abandonment and silting up. Palynologically, the initial phase is represented by a range of aquatic (macrophytes) and fringing marsh pollen taxa and willow. Subsequently, the ditch became filled with organic sediment and the vegetation changes to a drier fen community with little standing water and a drier flora comprising hazel scrub growing on, or very close to the Site. The ground flora changed from freshwater aquatic plants to fen herbs including sedges and meadowsweet and marsh ferns.

6.7.16 The vegetation of the adjacent drier land is shown to have been a mixed arable and pastoral landscape with oak and hazel woodland being important with some birch and some evidence for ash, elm and beech in the region.

6.7.17 The changes seen in the flora of the ditch and the reduction in the agricultural elements seen in zone 2 may have occurred as a consequence of Roman abandonment and a

reduction in agricultural intensity. Complexities of taphonomy have, however, also been suggested for changes in the latter.

6.8 Environmental summary

6.8.1 The environmental data recovered from the ditch has shown a changing environment within the ditch and the local surrounding landscape during the period AD 70-250 and AD 710-950.

6.8.2 The environmental remains from the lower part of the peat deposit within the ditch reflect well oxygenated slowly moving water environment with a relatively thick bed of fringing and aquatic vegetation, including sedges, rushes and willows.

6.8.3 A more fenland environment appears to have developed through time, probably due to the ditch falling into disuse. It appears to have been a drier fen community with smaller amounts of standing water and a fringing vegetation of species including sweet gale and hazel scrub.

6.8.4 There is evidence for a well-established open landscape dominated by pasture with very little indication of woodland in the immediate vicinity. The pollen results, however, show a small indication of an arable environment together with the pastoral landscape. There is no evidence for settlement debris or cereal cultivation within the insect and plant assemblages, so there is unlikely to be any settlement or arable activity in the immediate area of the ditch during this period. Rather the local land-use is more likely to have been one of grazed pasture. Within the pollen assemblages, oak and hazel woodland are important with some birch and some evidence for ash, elm and beech in the wider region.

6.8.5 This picture of a drainage ditch, probably part of a wider network, within a predominantly pastoral landscape has been seen on other rural Romano-British sites in England, such as the 'ladder ditch' system at Little Paxton Cambridgeshire (Smith 2011a); the ditch and waterhole systems at the Daventry Rail Freight Terminal, West Midlands (Smith 1999); and Whitmoor Haye, Staffordshire (Smith 2002).

7 CONCLUSIONS

7.1 Summary

7.1.1 In the western area of the Site deposits forming a large bank to the south of Car Dyke were revealed (**Plate 12**). The bank was formed from redeposited layers of natural sand and alluvium, which were capped by clay – deposits originally derived from the excavation of Car Dyke. The full width of the earthwork was not investigated due to the constraints of the pipeline installation; however, the bank was at least 25m wide in plan and survived to over 1.5m in height. A linear hollow was revealed within the bank deposits, which most likely functioned as a 'barrow-run'. Natural sand and silt was revealed beneath the bank deposits and it appears that the area was deturfed prior to the bank's construction; perhaps for use of the turves in construction and for setting out purposes. The edge of Car Dyke lay outside the excavation area.

7.1.2 A peat-filled ditch was revealed to the south of the bank, although parallel to the dyke and most likely contemporary there was no direct relationship between the ditch and bank deposits. Carbon dating of the peat deposits produced calibrated dates of AD 70-250 for the lower levels of the peat deposits and AD 710-950 for the upper levels. The ditch most likely functioned as a drainage feature to the rear of the bank and as such it is likely that this section of Car Dyke was completed in the late 1st or 2nd century AD.

7.1.3 The excavation also revealed evidence of later levelling works and post medieval ditches most likely associated with Fen Road.

7.1.4 The results of the excavation warrant the production of a short publication paper for a local journal.

7.2 Discussion

7.2.1 The extant remains of Car Dyke remain upstanding in a nearby field to the east of Area 2 (**Figure 1**) and their course indicates that the revealed earthwork feature was likely to be the southern bank of Car Dyke. The extant earthworks to the east were measured and each bank was approximately 30m wide with the dyke approximately 40m wide. Ploughing, erosion and ground building associated with Fen Road may have exaggerated the size of the banks.

7.2.2 During the supervised excavation for the laying of the pipe, the layer or disturbed bank material to the east of the excavation (1035) was revealed to be between 0.1m and 0.2m deep. Anecdotal evidence from local members of the public supports the idea that this disturbance is associated with the modern construction of the nearby pumping station.

7.2.3 No trace of the southern bank remains upstanding in Area 1, although there is a barely perceptible slope running down from south to north on the playing field which may be due to the underlying archaeological deposits. The area appeared to have been levelled in advance of the playing field's construction removing bank material to a depth of 0.2m below ground level.

7.2.4 Anecdotal evidence from local members of the public and grounds keeping staff suggest that this levelling took place between 10 and 20 years ago. The material that was removed from the top of the bank was not found in the area of excavation and may have either been removed from the Site or used for levelling to the north of Area 1, possibly infilling any remaining traces of Car Dyke itself.

8 STORAGE AND CURATION

8.1 Museum

8.1.1 It is recommended that the project archive resulting from the excavation be deposited with Lincoln Museum. The Museum has agreed in principle to accept the project archive on completion of the project, under the accession code **LCNCC:2014.166**. Deposition of any finds with the Museum will only be carried out with the full agreement of the landowner.

8.2 Preparation of archive

8.2.1 The complete Site archive, which will include paper records, photographic records, graphics, artefacts, ecofacts and digital data, will be prepared following the standard conditions for the acceptance of excavated archaeological material by Lincoln Museum, and in general following nationally recommended guidelines (SMA 1995; CIfA 2014c; Brown 2011; ADS 2013).

8.2.2 All archive elements will be marked with the Site/accession code, and a full index will be prepared.

8.3 Discard policy

8.3.1 Wessex Archaeology follows the guidelines set out in Selection, Retention and Dispersal (SMA 1993), which allows for the discard of selected artefact and ecofact categories which are not considered to warrant any future analysis. Any discard of artefacts will be fully documented in the project archive.

8.3.2 The discard of environmental remains and samples follows nationally recommended guidelines (SMA 1993; 1995; English Heritage 2011).

8.4 Security copy

8.4.1 In line with current best practice (e.g. Brown 2011), on completion of the project a security copy of the written records will be prepared, in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

9 REFERENCES

9.1 Bibliography

Bibliographic references

ADS, 2013. *Caring for Digital Data in Archaeology: a guide to good practice, Archaeology Data Service & Digital Antiquity Guides to Good Practice*

Anderson, R., 2005. An annotated list of the non-marine Mollusca of Britain and Ireland, *Journal of Conchology* 38, 607-637

Bennett, K. D., Whittington, G. and Edwards, K. J., 1994. Recent plant nomenclatural changes and pollen morphology in the British Isles, *Quaternary Newsletter* **73**, 1-6

Bronk Ramsey, C. and Lee, S., 2013. Recent and phased development of the Program OxCal, *Radiocarbon* **55**, (2-3), 720-730

Brown, D. H., 2011. *Archaeological archives; a guide to best practice in creation, compilation, transfer and curation, Archaeological Archives Forum* (revised edition)

Cappers, R. T. J., Bekker, R. M. And Jans, J. E. A., 2006. Digital seed atlas of the Netherlands. *Groningen Archaeological Studies* **4**, Barkhuis Publishing & Groningen University Library, Groningen

Chartered Institute for Archaeologists (CIfA), 2014a. *Standard and Guidance for Field Evaluation*

Chartered Institute for Archaeologists (CIfA), 2014b. *Standard and Guidance for the Collection, Documentation Conservation and Research of Archaeological Materials*

Chartered Institute for Archaeologists (CIfA), 2014c. *Standard and Guidance for the creation, compilation, transfer and deposition of archaeological archives*

Davies, P., 2008. *Snails Archaeology and Landscape Change*, Oxbow Books, Oxford

Duff, A. G., 2012. *Beetles of Britain and Ireland, Volume 1: Sphaeriusidae to Silphidae*. Norfolk: A.G. Duff Publishing

English Heritage, 2005. *A Strategy for the Care and Investigation of Finds*

English Heritage, 2006. *Guidelines on the X-radiography of archaeological metalwork*

English Heritage, 2011. *Environmental Archaeology; a guide to theory and practice of methods, from sampling and recovery to post-excavation, Swindon, Centre for Archaeology Guidelines*

Evans, J. G., 1972. *Land Snails in Archaeology*, London: Seminar Press.

Foster, G. N. and Friday, L. E., 2011. *Keys to Adults of the Water Beetles of Britain and Ireland (Part 1).* (Handbooks for the Identification of British Insects 4/05). London: Royal Entomological Society of London

Friday, L., 1997. *Wicken Fen, the making of a wetland nature reserve,* Harley Books, Colchester, Essex

Friday L. and Harley, B., 2000. *Checklist of the flora and fauna of Wicken Fen*. Harley Books, Colchester, Essex

Grimm, E. C., 1991. *TILIA and TILIA.GRAPH*, Illinois State Museum, Springfield

Hansen, M., 1987. The Hydrophilidae (Coleoptera) of Fennoscandia and Denmark Fauna *Fauna Entomologyca Scandinavica* **18**, Leiden: Scandinavian Science Press

Hather, J. G., 2000. *The identification of the Northern European woods. A guide for archaeologists and conservators.* Archetype Publications, London

Hodgson, J. M., 1997. *Soil Survey Field Handbook*, Harpenden, Soil Survey Technical Monograph No.**5**

Jessop, L., 1986. *Coleoptera: Scarabaeidae*.(Handbooks for the Identification of British Insects 5/11). London: Royal Entomological Society of London.

Kenward, H. K., Hall, A. R., and Jones, A. K. G., 1980. A tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits. *Science and Archaeology* **22**, 3–15

Kerney, M. P., 1999. *Atlas of the Land and Freshwater Molluscs of Britain and Ireland*, Colchester: Harley Books

Koch, K., 1992. *Die Kafer Mitteleuropas* (Ökologie Band **3**). Krefeld: Goecke and Evers

Lewis, J., Brown, F., Batt, A., Cooke, N., Barrett, J. Every, R., Mepham, L., Brown, K., Cramp, K. Lawson, A.J., Roe, F., Allen, S., Petts, D., McKinley, J., Carruthers, W., Challinor, D., Wiltshire, P., Robinson, M., Lewis, H. and Bates, M., 2006. *Landscape evolution in the Middle Thames Valley: Heathrow Terminal 5 Excavations Volume 1, Perry Oaks* (Framework Archaeology Monograph no.1). Oxford and Salisbury: Framework

Lott, D., 2009. *The Staphylinidae* (Handbooks for the Identification of British Insects volume 12 part 5). London: Royal Entomological Society

Lucht, W. H., 1987. *Die Käfer Mitteleuropas.* Katalog. Krefeld: Goecke and Evers

Luff, M., 2007. *Coleoptera: Carabidae* (Handbooks for the Identification of British Insects 4/2 –Second Edition). London: Royal Entomological Society of London

Mook, W. G., 1986. Business Meeting: recommendations/resolutions adopted by the twelfth international radiocarbon conference, *Radiocarbon* **28**, 799

Moore, P. D. and Webb, J. A., 1978. *An Illustrated Guide to Pollen Analysis*, London: Hodder and Stoughton

Moore, P. D., Webb, J. A. and Collinson, M. E., 1991. *Pollen analysis* (2nd edition), Oxford: Blackwell Scientific

Morris, M. G., 2008. *True Weevils (Part II): (Coleoptera: Curculionidae, Ceutorhynchinae*). Handbooks for the Identification of British Insects volume 5 part 17c), London: Royal Entomological Society

Mouchel, 2014. *Keeble Drive, Washingborough Flood Alleviation Scheme, Scheduled Monument Consent Application Supporting Statement*

Museum and Galleries Commission (MGC), 1991. *Standards in the Museum Care of Archaeological Collections*

Reimer, P. J., Bard, E., Bayliss, A., Beck, J. W., Blackwell, P. G., Bronk Ramsey, C., Grootes, P. M., Guilderson, T. P., Heaton, T. J., Hoffmann, D. L., Hogg, A. G., Hughes, K. A., Kaiser, K. F., Kromer, B., Manning, S. W., Nui, M., Reimer, R. W., Scott, E. M., Southon, J. R., Staff, R. A., Turney, C. S. M. and van der Plicht, J., 2013. IntCal13 and Marine 13 Calibration Curve, 0–50,000 Years BP *Radiocarbon* **55** (4)

Ray, J., 1660. *Catalogus plantarum circa Cantabrigiam nascientium* London, J. Martin. (in translation as *Ray's Flora of Cambridgeshire*, Ewan, A.H., Prime C.T. 1975 (eds and translators). Hitchen, Wheldon & Wesley

Robinson, M. A., 1981. 'The use of ecological groupings of Coleoptera for comparing sites' pp. 251–86 in M. Jones and G. Dimbleby (eds), *The Environment of Man: The Iron Age to the Anglo-Saxon Period* (British Archaeological Reports, British Series 87). Oxford: British Archaeological Reports

Robinson, M. A., 1983. 'Arable/pastoral ratios from insects?' pp. 19–47 in M. Jones (ed.) *Integrating the Subsistence Economy* (British Archaeological Reports, International Series 181). Oxford: British Archaeological Reports

Robinson, M. A., 2006. 'The insect remains' *In* Lewis, J., Brown, F., Batt, A., Cooke, N., Barrett, J., Every, R., Mepham, L., Brown, K., Cramp, K., Lawson, A.J., Roe, F., Allen, S., Petts, D., McKinley, J.I., Carruthers, W. J., Challinor, D., Wiltshire, P., Robinson, M., Lerwis, H. A. and Bates, M. R., *Landscape evolution in the Middle Thames Valley. Heathrow Terminal 5 Excavations Volume 1, Perry Oaks*. Framework Archaeology Monograph 1. Framework Archaeology: Oxford and Salisbury

Sidell, J., Wilkinson, K., Scaife, R. and Cameron, N., 2000. *The Holocene evolution of the London Thames, Archaeological Excavations (1991-1998*). Museum of London Archaeological Services Monograph **5**. 128

Smith, D., 1996a. *Insect remains from Bronze Age and Romano-British field ditches at Rectory Farm, West Deeping, Lincolnshire*. Unpublished report prepared for the Environmental Archaeology Consultancy

Smith, D., 1996b. *An assessment of the insect remains from the Romano-British field ditches, Blaco Hill, Mattersley.* Unpublished report to Trent and Peak Archaeological Trust

Smith, D., 1999.*The insect remains from Covert Farm (DIRFT East), Crick, Northamptonshire*. Unpublished report to Birmingham University Archaeology Unit

Smith, D. N., 2002. 'The insect remains' pp. 67–72, in Coates G. A (ed.) *Prehistoric and Romano-British Landscape: Excavations at Whitemoor Haye Quarry, Staffordshire, 1997-1999*. (British Archaeological Reports, British Series 340). Oxford: British Archaeological Reports

Smith, D. N., 2009a. Insect remains from the Imperial College Site, Simpsons Lane, Harlington (The University of Birmingham Environmental Archaeology Services Report 173). Report to Wessex Archaeology

Smith, D. N., 2009b. Insect remains from Kingsmead Quarry, Horton, Berkshire (The University of Birmingham Environmental Archaeology Services Report 175). Report to Wessex Archaeology

Smith D., 2011a. '[Romano-British] insect remains' in Jones *Excavations at Little Paxton Quarry, Cambridgeshire, 1992 -1998* (Birmingham Archaeology Monograph Series 10/ British Archaological Reports B 545). Oxford: British Archaeological eports. pp. 265-277

Smith, D. N., 2011b. 'Insects from Northfleet' pp. 88–90 in Barnett, C., McKinley, J.I., Stafford, E., Grimm, J.M. and Stevens, C.J. (eds.) *Settling the Ebbsfleet Valley: High Speed I Excavations at Springhead and Northfleet, Kent, The late Iron Age, Roman, Saxon and Medieval Landscape* (*Volume 3: Late Iron Age to Roman Human remains and Environmental Reports*). Oxford/ Salisbury: Oxford Wessex Archaeology

Smith, D. N. and Langham, E., 2000. 'Waterlogged insect remains' pp. 179–81 in Palmer, S.C. (ed.) Archaeological Excavations in the Arrow Valley, Warwickshire. *Transactions of the Birmingham and Warwickshire Archaeological Society,* 103

Society of Museum Archaeologists (SMA), 1993. Selection, Retention and Dispersal of Archaeological Collections, Society of Museum Archaeologists

Society of Museum Archaeologists (SMA), 1995. Towards an Accessible Archaeological Archive, Society of Museum Archaeologists

Stace, C., 2010. *New Flora of the British Isles*. 3rd Edition. Cambridge University Press, Cambridge

Stuiver, M. and Reimer, P. J., 1986. A computer program for radiocarbon age calculation, *Radiocarbon*, **28**, 1022–30

United Kingdom Institute for Conservation (UKIC), 2001. *Guidelines for the Preparation of Excavation Archives for Long-term Storage*

Wessex Archaeology, 2014. *Car Dyke, Washingborough, Written Scheme of Investigation for Archaeological Excavation,* unpublished client report T18901.01

10 APPENDICES

10.1 Appendix 1: Context descriptions

Context	Type	Description	Depth (m)
1000	Layer	**Topsoil:** Dark brown silt.	0.1
1001	Layer	**Subsoil:** Mid grey brown sandy silt.	0.1
1002	Layer	**Sub subsoil:** Dark brown sandy clay.	0.4
1003	Layer	**Levelling layer:** Mid brown sandy clay, containing post-medieval detritus.	0.2
1004	Layer	Alluvial layer	0.5
1005	Layer	**Tipped deposit:** Yellow cream alluvium	0.1
1006	Layer	**Tipped deposit:** Orange brown sand.	0.6
1007	Layer	**Tipped deposit:** Orange sand.	0.5
1008	Layer	**Tipped deposit**: Orange clay sand.	0.1
1009	Layer	**Tipped deposit:** Streaked pale orange coarse sand.	0.2
1010	Layer	**Tipped deposit:** Red orange gritty sand.	0.7
1011	Layer	Dark brown clay cap of bank.	0.5
1012	Fill	Peat upper fill of ditch 1033.	0.7
1013	Layer	**Tipped deposit:** Yellow cream alluvium.	0.2
1014	Layer	**Tipped deposit:** Orange clay sand.	0.1
1015	Layer	**Tipped deposit:** Dark orange sand.	0.2
1016	Layer	**Tipped deposit:** White sandy clay.	0.1
1017	Layer	**Tipped deposit:** Mottled cream/orange alluvium.	0.6
1018	Layer	**Tipped Deposit:** Red cream sand.	0.2
1019	Layer	**Tipped Deposit:** Red cream sand.	0.1
1020	Layer	**Tipped Deposit:** Red cream sand.	0.5
1021	Layer	**Tipped Deposit:** Red cream sand.	0.2
1022	Layer	**Tipped Deposit:** Red cream sand.	0.2
1023	Layer	**Tipped Deposit:** Red cream sand.	0.2
1024	Layer	**Tipped Deposit:** Red cream sand.	0.3
1025	Layer	**Tipped Deposit:** Red cream sand.	0.3
1026	Layer	**Tipped deposit:** Mottled cream/orange alluvium.	0.1
1027	Layer	**Tipped deposit:** Dark orange sandy clay.	0.6
1028	Layer	**Tipped deposit:** Orange red sandy clay.	0.6
1029	Layer	**Tipped deposit:** Pale grey white clay.	0.1
1030	Layer	**Tipped deposit:** Pale grey white clay.	1.2
1031	Layer	**Tipped deposit:** Pale orange clay.	1.2
1032	Layer	**Possible Disturbance:** Grey alluvium.	0.4
1033	Cut	**Ditch:** Filled with 1012 & 1034.	1.3
1034	Fill	Peaty silt fill of ditch 1033.	0.4
1035	Layer	**Disturbance:** Yellow grey alluvium, redeposited during construction of modern pumping station.	0.1

1036	Layer	**Disturbance:** Topsoil 1000 redeposited during construction of modern pumping station.	0.5
1037	Layer	**Tipped deposit:** Fine grey sand.	0.6
1038	Layer	**Tipped deposit:** Yellow sand.	0.2
1039	Layer	**Tipped deposit:** White grey sand.	0.4
1040	Layer	**Disturbance:** Yellow grey alluvium, redeposited during construction of modern pumping station.	0.2
1041	Layer	**Disturbance:** Topsoil 1000 redeposited during construction of modern pumping station.	0.1
1042	Layer	**Tipped deposit:** Mottled white sand.	0.3
1043	Layer	**Tipped deposit:** Mottled yellow white sand.	0.3
1044	Layer	**Tipped deposit:** Light orange brown sand.	0.2
1045	Layer	**Tipped deposit:** Mottled yellow sand.	0.3
1046	Layer	**Tipped deposit:** Very light orange brown sand.	0.3
1047	Layer	**Tipped deposit:** Orange yellow sand.	0.3
1048	Layer	**Tipped deposit:** Orange brown sand.	0.3
1049	Layer	**Tipped deposit:** Orange brown sand	0.3
1050	Layer	**Tipped deposit:**Mottled white alluvium	0.4
1051	Layer	Orange brown clay capping	0.4
1052	Layer	Mid brown clay capping	0.2
1053	Layer	Grey alluvium with iron panning.	0.1
1054	Layer	**Tipped deposit:** Yellow white alluvium.	0.2
1055	Layer	**Tipped deposit:** Pink red alluvium.	0.2
1056	Layer	**Tipped deposit:** Yellow white alluvium.	0.2
1057	Layer	Yellow grey alluvium.	0.5
1058	Cut	**Ditch:** Filled with 1059 & 1060.	0.4
1059	Fill	**Primary Fill:** Yellow brown alluvium	0.3
1060	Fill	**Secondary Fill:** Mid brown alluvium	0.4
1061	Layer	Yellow grey alluvium.	0.4
1062	Cut	**Ditch:** Filled with 1063, 1064 & 1065.	0.4
1063	Fill	Peat fill of ditch 1062.	0.3
1064	Fill	Grey clay upper fill of ditch 1062.	0.1
1065	Fill	Coarse orange sand upper fill of ditch 1062.	0.1
1066	Fill	Blue black clay fill of 1033	0.2
1067	Layer	Mid brown clay	0.1
1068	Layer	**Tipped deposit:** Yellow alluvium	0.5
1069	Layer	**Natural**: Blue clay	1.1
1070	VOID		
1071	Layer	**Tipped deposit:** Sandy clay within barrowrun 1085	0.1
1072	Layer	**Trample layer:** Sand within barrowrun 1085	0.1
1073	VOID		
1074	VOID		
1075	Cut	**Posthole:** 0.5m by 0.25m	0.1
1076	Fill	**Primary Fill:** Yellow grey sand	0.05
1077	Fill	**Secondary Fill:** Grey black sand	0.05

1078	VOID		
1079	Layer	**Trample layer:** Sand within barrowrun 1085	0.1
1080	Layer	**Tipped deposit:** Sandy clay within barrowrun 1085	0.1
1081	VOID		
1082	Layer	**Trample layer:** Sandy clay trample	0.1
1083	Layer	**Tipped deposit:** Sandy clay	0.1
1084	Layer	**Tipped deposit:** Yellow sand	0.1
1085	Other	**Barrowrun:** Hollow forming barrow run 1.6m wide and over 5m long	0.2

10.2 Appendix 2: Environmental data

Table 3: Sediment descriptions and sub-samples taken - monolith 7

Location:		TR1	**Mono:**	<7>	**Comments: 105770 Car Dyke Monolith <7> From ditch [1033]**		
Level (top):			**Drg:**	5A			
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
0.00-0.24		(1032)		10YR 3/4 dark yellowish brown loamy sand. Very crumbly with some iron stained concretions and iron stained root voids. Sparse fine rootlets, 0.5% pores and rare small stones <5mm. Some broken mollusc shells and 1 whole shell of *Radix balthica* an aquatic species of snail favouring many types of wet habitats. Clear boundary.	Ditch fill, probably subject to seasonal flooding as indicated by mollusc shell.		Fill of ditch
0.24-0.69		(1012)		10YR 3/3 dark brown oxidising on exposure to air to 10YR 2/1 black peat. Horizontally laminated, very rich in organic material. Visible plant remains, Phragmites and wood. Very soft and crumbly. Clear boundary.	Peat.		Peat
0.69-0.73		(1034)		10YR 2/2 very dark brown peat mixed with loamy sand. Fairly organic but very crumbly due to high sand content.	Initialisation of peat in bottom of ditch.		Geology with peat initialisation

Table 4: Sediment descriptions and sub-samples taken – monolith 8

Location:		TR1	**Mono:**	<8>	**Comments: 105770 Car Dyke Monolith <8> From ditch [1033]**		
Level (top):			**Drg:**	5A			
Depth		**Context**	**Samples**	**Sediment description**	**Interpretation**		
Mono	mOD						
0.00-0.11		(1032)		10YR 3/4 dark yellowish brown loamy sand. Very crumbly with some iron stained concretions and iron stained root voids. Sparse fine rootlets, 0.5% pores and rare small stones <5mm. Rare broken mollusc shells. Clear boundary.	Ditch fill, possibly subject to seasonal flooding as indicated by mollusc shells.		Fill of ditch
0.11-0.83		(1012)		10YR 3/3 dark brown oxidising on exposure to air to 10YR 2/1 black peat. Horizontally laminated, very rich in organic material. Visible plant remains, Phragmites and wood. Very soft and crumbly. Gradual boundary.	Peat.		Peat
0.83-0.1.00		(1034)		10YR 2/2 very dark brown very humic sediment. Minerogenic but still quite peaty. Likely to be the beginnings of peat formation due to accumulation of plant material in the bottom of ditch. Abundant aquatic snail shells including *Bithynia* spp. and opercula.	Initialisation of peat formation in bottom of ditch with moving water.		Peat formation in the bottom of ditch.

Table 5: Waterlogged plant remains from peat deposit 1012

Context			**1012**	**1012**
Sample			**1**	**2**
Volume (l)			**1**	**1**
Species	**Common name**	**Habitat**		
Nymphaea alba	white water-lily	E		
seeds			2	16
Nuphar lutea	yellow water-lily	E		
seeds				12
seed fragments				4
Ranunculus acris	meadow buttercup	D		
achene			1	
Ranunculus bulbosus	bulbous buttercup	D		
achenes			3	
achene fragments			2	
Ranunculus acris/repens/bulbosus	buttercups	ABCD		
achenes				5
Ranunculus lingua	greater spearwort	E		
achenes				3
Ranunculus flammula	lesser spearwort	E		

Context			**1012**	**1012**
Sample			**1**	**2**
Volume (l)			**1**	**1**
Species	**Common name**	**Habitat**		
achene			4	2
achene fragments			2	
Ranunculus subgenus *Batrachium*	crowfoots	E		
achenes				54
Myriophyllum verticillatum	whorled water-milfoil	E		
seeds			1	9
Potentilla anserina	silverweed	BD		
achene			1	
Comarum palustris	marsh cinquefoil	E		
achene			31	
Urtica dioica	common nettle	ABCDE		
seeds			1	1
Myrica gale	bog-myrtle	E		
fruits			4	
fruit fragments			2	
seeds			24	
seed fragments			19	
Lythrum salicaria	purple-loosestrife	E		
seeds			3	
Epilobium hirsutum	great willowherb	E		
seeds				4
Nasturtium officinale	water-cress	E		
seeds				2
Nasturtium microphyllum	narrow-fruited water-cress	E		
seeds				14
Brassica nigra	black mustard	ABE		
seeds			1	
Rumex hydrolapathum	water dock	E		
fruits				13
nutlets				16
nutlet fragments				18
valves				2
Rumex conglomeratus	clustered dock	E		
nutlets				2
Chenopodium album	fat-hen	AB		
seeds			1	1
cf *Erica tetralix*	cross-leaved heath	E		
seeds				1
Solanum dulcamara	bittersweet	CE		
seeds				1
Hippuris vulgaris	mare's-tail	E		
seeds				1
Stachys plaustris	marsh woundwort	E		
seeds			1	
Lycopus europaeus	gypsywort	E		
seeds			3	3
Mentha aquatica	water mint	E		
nutlets			1	3
Pedicularis palustris	marsh lousewort	E		
seeds			3	
Menyanthes trifoliata	bogbean	E		
seeds			8	
seed fragments			46	3
Arctium lappa	greater burdock	BDE		

Context			**1012**	**1012**
Sample			**1**	**2**
Volume (l)			**1**	**1**
Species	**Common name**	**Habitat**		
achene				2
achene fragments				1
Carduus nutans	musk thistle	BD		
achene				1
Sonchus asper	prickly sowthistle	AB		
achene			1	
Taraxacum officinalis	dandelion	ABD		
achene				1
cf *Artemesia vulgaris*	mugwort	AB		
achene				1
Eupatorium cannabinum	hemp-agrimony	DE		
achene			1	1
Viburnum opulus	guelder-rose	C		
seeds				1
Valeriana officinalis				
seeds	common valerian	BDE	1	
seed fragments			1	
Hydrocotyle vulgaris	marsh pennywort	E		
mericarp			8	10
Sium latifolium	greater water-parsnip	E		
mericarps			5	1
mericarp fragments			5	
Berula erecta	lesser water-parsnip	E		
mericarps				16
Oenanthe fistulosa	tubular water-dropwort	E		
mericarps			9	5
Oenanthe aquatica	fine-leaved water-dropwort	E		
mericarps				4
Apium nodiflorum	fool's-water-cress	E		
mericarps			1	18
Apium inundatum	lesser marshwort	E		
mericarps			2	24
Lemna sp	duckweed	E		
fruits				1
Sagittaria sagittifolia	arrowhead	E		
fruits				3
fruit fragments				3
seeds				6
seed fragments				3
Baldellia ranunculoides	lesser water-plantain	E		
fruits				24
seeds				6
Alisma plantago-aquatica	water-plantain	E		
fruits			2	36
fruit cases				28
seeds				5
Potamogeton natans	broad-leaved pondweed	E		
fruits			1	1
fruit fragments				1
Potamogeton cf *praelongus*	long-stalked pondweed	E		
fruits				7
Potamogeton sp	pondweeds	E		
lids				3
Sparganium sp	bur-reeds	E		

Context			**1012**	**1012**
Sample			**1**	**2**
Volume (l)			**1**	**1**
Species	**Common name**	**Habitat**		
fruit fragments				1
embryo				3
Typha sp	bulrushes	E		
seeds			1	1
Juncus sp	rushes	E		
seeds			8	2
Schoenoplectus lacustris	common club-rush	E		
nutlets			1	19
nutlet fragments				24
Eleocharis palustris	common spike-rush	E		
nutlets			1	2
nutlet fragments				3
Cladium mariscus	great fen-sedge	E		
nutlets			1	
Carex appropinquata	fibrous tussock-sedge	E		
nutlets			20	
Carex sp (lenticular)	sedges	E		
nutlets			238	45
nutlet fragments				21
Carex sp (trigonous)	sedges	E		
nutlets with utricles				11
nutlets			31	18
nutlet fragments				5
Carex sp	sedges	E		
utricles			5	7
Phragmites australis	common reed	E		
culm nodes				6
root fragments			++++	
Other plants/plant parts				
Chara sp	stoneworts	E		
oogonia			8	
Musci (stems and leaves)	mosses		27	19
Buds			13	5
Leaf fragments			10	12
Other biological remains				
Cristatella sp (moss animal)		E		1
Lophopus sp (moss animal)		E		1
Earthworm cocoons			130	+++
Cladoceran ephippia			++	+
Insecta			+++	++++
Caddis fly larval case fragments				19
Fish remains (vertebrae,bones, scales)				5

Key:

Habitat	Quantity
A= cultivated ground	+ = 1 - 10
B= disturbed ground	++ = 11- 50
C= woodlands, hedgerows, scrub etc	+++ = 51 -100
D = grasslands, meadows and heathland	++++ = 101+
E = aquatic/wet habitats (inc fen)	
F = cultivar	

Table 6: Insect remains from peat deposit 1012 (Nomenclature follows Lucht 1987)

	Ecological codes			Host plant of Phytophage taxa (based on Koch 1992
Context		**(1012)**	**(1012)**	
Sample number		**<1>**	**<2>**	
HEMIPTERA				
Family, genus and spp. Indet.		-	+	
COLEOPTERA				
Carabidae				
Elaphrus cupreus Duft.	ws	-	1	
Loricera pilicornis (F.)		-	1	
Bembidion doris (Panz.)		1	-	
Bembidion spp.		-	2	
Pterostichus minor (Gyll.)	ws	2	1	
Pterostichus niger (Schall.)			1	
Agonum thoreyi (Duft)	ws	1	-	Mainly associated with *Phragmites australis* (Cav.) Trin. ex Steud. (Common reed)
Agonum sp.		-	2	
Dytiscidae				
Suphrodytes dorsalis (F.)	a	-	1	
Hydroporus spp.	a	1	-	
Agabus spp	a	1	2	
Rhantus spp.	a	1	2	
Dytiscus spp.	a	-	1	
Gyrinidae				
Gyrinus spp.	a	1	5	
Hydraenidae				
Hydraena spp.	a	4	1	
Ochthebius minimus (F.)	a	-	2	
Ochthebius spp.	a	5	19	
Limnebius spp.	a	1	3	
Helophorus grandis (Ill.)	a	-	1	
Helophorus spp.	a	1	2	
Hydrophilidae				
Coelostoma orbiculare (F.)	a	1	3	
Cercyon ustulatus (Preyssl.)	a	1	-	
Cercyon pygmaeus (Ill.)	df	1	-	
Cercyon tristis (Ill.)	ws	-	3	
*Cercyon (*aquatic*)*spp.	ws	2	-	
Megasternum boletophagum (Marsh.)		2	-	
Hydrobius fuscipes (L.)	a	-	1	
Laccobius spp.	a	-	1	
Cymbiodyta marginella (F.)	a	-	2	
Chaetarthria seminulum (Hbst.)	a	2	1	
Catopidae				
Catops spp.		-	1	
Orthoperidae				
Corylophus cassidoides (Marsh.)		6	-	
Ptiliidae				
Acrotrichis spp**.**		-	2	
Staphylinidae				
Lathrimaeum unicolor (Marsh.)	ws	1	-	
Olophrum spp.		1	-	
Trogophloeus spp.		1	-	
Oxytelus rugosus (F.)		1	-	
Platystethus arenarius (Fourc.)	df	1	-	
Stenus spp.		6	-	
Paederus spp.		1	-	

	Ecological codes			Host plant of Phytophage taxa (based on Koch 1992
Context		**(1012)**	**(1012)**	
Sample number		**<1>**	**<2>**	
Lathrobium spp.		1	2	
Xantholinus spp.		-	1	
Philonthus spp.		1	2	
Tachinus spp.		1	-	
Aleocharinidae Genus & spp. Indet.		2	1	
Pselaphidae				
Bryaxis spp.		1	-	
Rybaxis sp.		2	-	
Elateridae				
Athous haemorrhoidalis (F.)	p	-	1	
Helodidae				
Helodidae Gen. & spp. Indet.	a	1	-	
Dryopidae				
Dryops spp.	a	-	2	
Limnius volckmari (Panz.)	a	-	1	
Dermestidae				
Dermestes sp.		-	1	
Cryptophagidae				
Cryptophagus spp.		2	-	
Scarabaeidae				
Onthophagus ?joannae Goljan	df	2	-	
Onthophagus similis (Scriba)	df	-	1	
Aphodius luridus (F.)	df	-	1	
Aphodius fimetarius (L.)	df	1	-	
Aphodius fasciatus (Ol.) / *A. putridus* Herbst	df	1	-	
Aphodius ater (Geer)	df	-	1	
Phyllopertha horticola (L.)	p	-	1	
Chyrsomelidae				
Donacia clavipes F	ws	-	2	*Schoenoplectus lactustris* (L.) Palla (Common Club Rush)
Donacia crassipes F.	ws	-	1	*Nymphaea alba* L. and *Nuphar lutea* (L.) (White and yellow water lily)
Donacia cinerea Hbst.	ws	-	6	Usually on *Typhea* spp. (Bullrush)
Donacia/ Plateumaris spp.	ws	1	-	
Lema cyanella (L.)	p	-	1	*Cirsium* species often *C. arvense* (thistles)
Prasocuris phellandrii (L.)	ws	-	1	On aquatic Apiacae (Umbellifers)
Haltica spp.		-	1	
Chaetocnema concinna (Marsh.)		1	-	
Curculionidae				
Apion spp.	p	1	4	
Bagous spp.	ws	1	-	
Tanysphyrus lemnae (Payk.)	a	1	-	*Lemna* spp. (Duckweed)
Notaris ?scirpi (F.)	a	-	1	*Scirpus* spp. and *Carex* spp. (sedges and rushes)
Thyrogenes spp.	ws	-	1	
Eubrychius velutus (Beck)	a	-	2	*Myriophyllum spp.* (Water-milfoils)
TRICOPTERA				
Genus and spp. Indet.		-	++++	

Ecological coding:
a= aquatic water beetles
ws = water side taxa often associated with emergent vegetation
df = taxa often associated with dung
p= taxa associated with grassland and open areas
l= taxa associated with trees
m= taxa associated with moorland

Table 7: The relative proportion of the ecological groupings of Coleoptera

ECOLOGICAL GROUPING	Sample 1	Sample 2
% aquatic (a)	31.8%	55.2%
% waterside (ws)	12.1%	16.7%
% dung found / terrestrial (df)	16.2%	11.1%
% open ground and grassland / terrestrial (P)	2.7%	25.9%

Figure A1. The relative proportion of the ecological groupings of Coleoptera

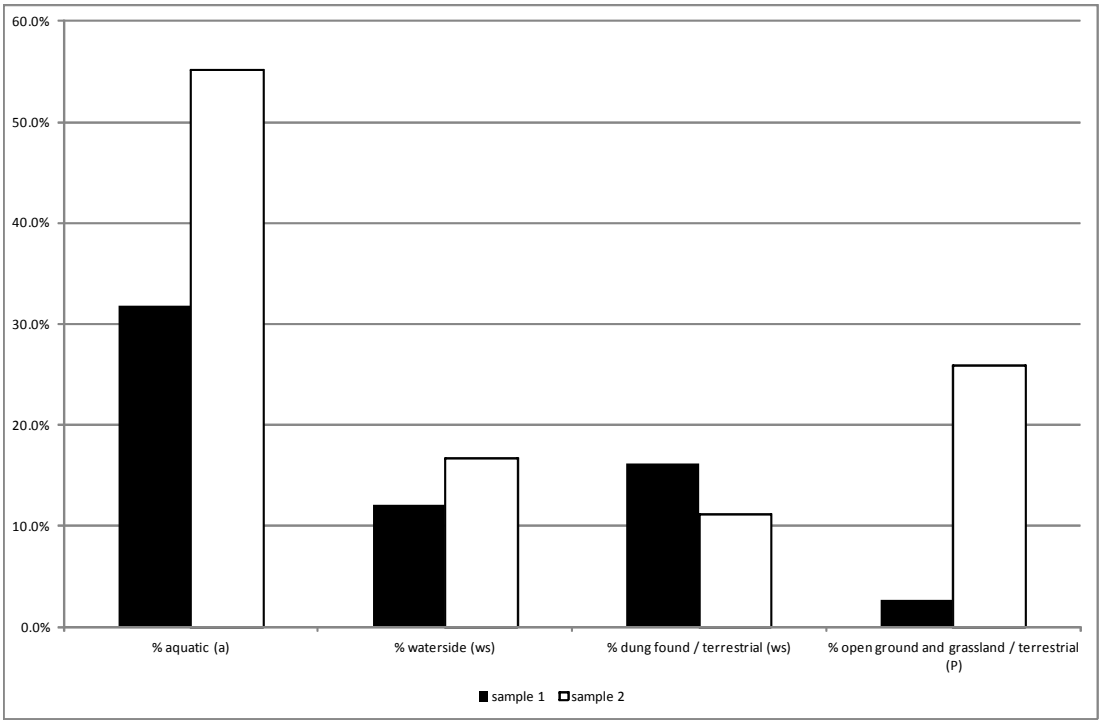


Table 8: Mollusc remains

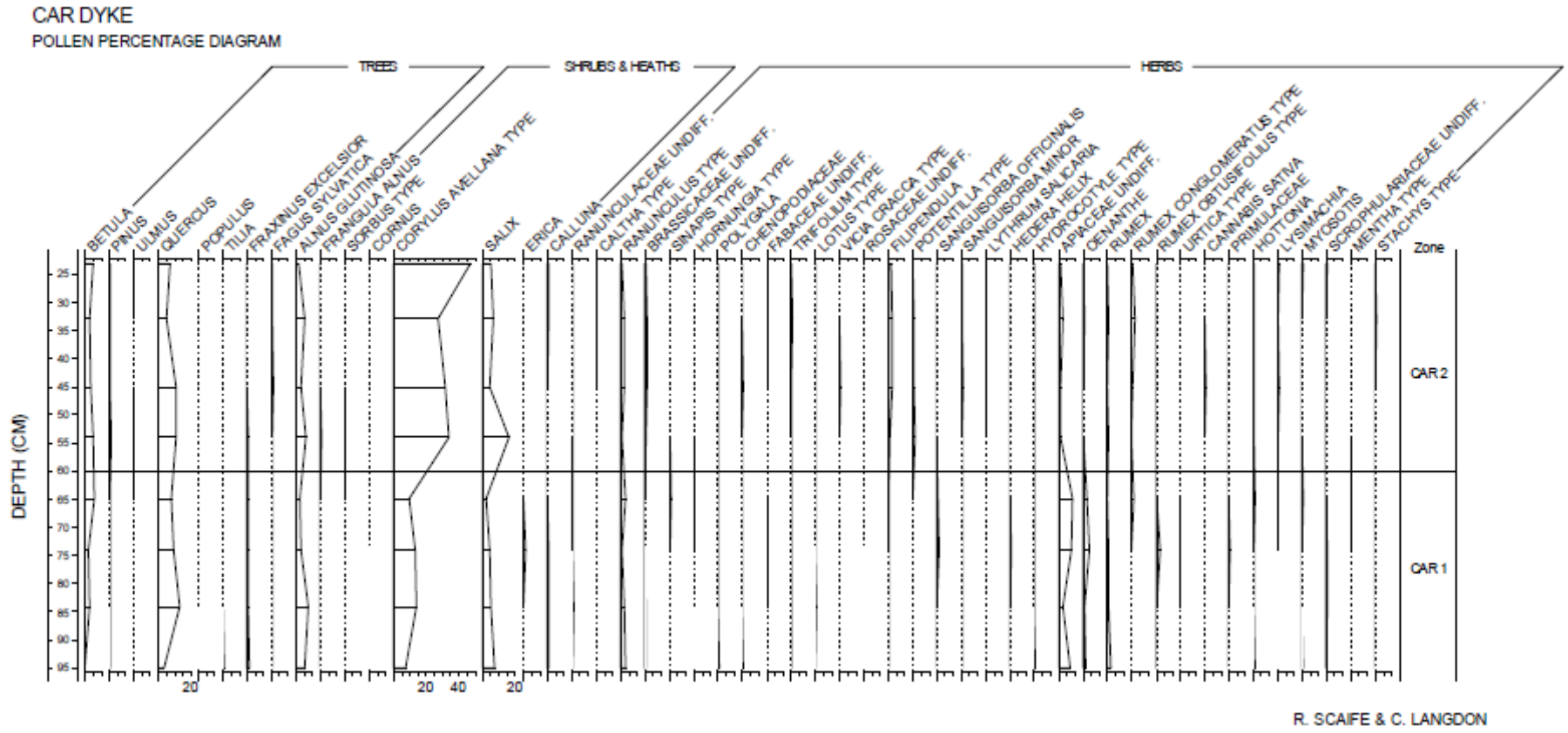
Phase	Romano-British		
Feature	Ditch 1033		
Context	1012	1012	1012
Sample	2	4	6
Depth (M)	lower	lower	lower
Volume (L)	1	1	1
Land Snails			
Carychium spp.	-	1	-
Succinea/Oxyloma spp.	7	-	-
Vertigo spp.	-	1	-
Vallonia costata (Müller)	-	1	-
Deroceras/Limax	1	-	-
Cecilioides acicula (Müller)	-	3	-

Phase	Romano-British		
Feature	Ditch 1033		
Context	1012	1012	1012
Sample	2	4	6
Aquatic Snails			
Valvata cristata Müller	80	11	-
Bithynia tentaculata (Linnaeus)	15	6	-
Bithynia spp.	112	43	-
Bithynia opercula	1438	1060	58
Omphiscola glabra (Müller)	-	1	-
Radix balthica (Linnaeus)	3	-	-
Planorbis planorbis (Linnaeus)	16	-	-
Anisus leucostoma (Millet)	7	1	-
Bathyomphalus contortus (Linnaeus)	1	-	-
Gyraulus albus (Müller)	16	-	-
Gyraulus crista (Linnaeus)	2	-	-
Hippeutis complanatus (Linnaeus)	3	-	-
Acroloxus lacustris (Linnaeus)	9	-	-
Sphaerium sp.	2	-	-
Pisidium spp.	35	4	-
Taxa	15	9	0
Total	309	69	0
Ratio of Bithynia to Opercula	1:11.32	1:21.63	0:58
% Open country species	0	2.9	0
% Intermediate terrestrial species	0.32	0	0
% Shade - loving species	0	1.45	0
% Unassigned terrestrial species	2.27	0	0
% Amphibious species	2.27	1.45	0
% Intermediate aquatic species	8.09	0	0
% Ditch species	33.98	15.94	0
% Moving water species	41.1	71.01	0
% Unassigned aquatic species	11.97	7.25	0

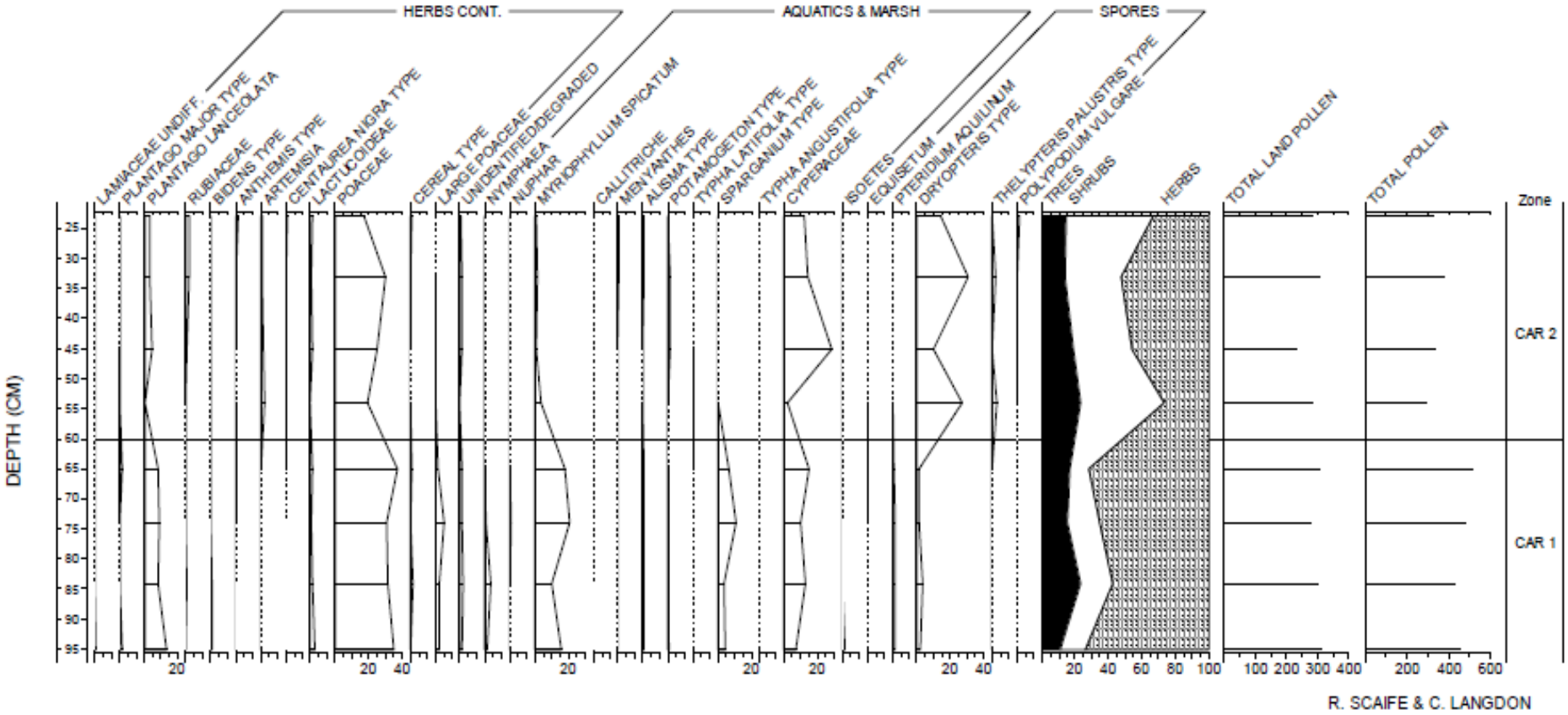
Table 9: Pollen zonation and palynological characteristics of Ditch 1033 sediment fill

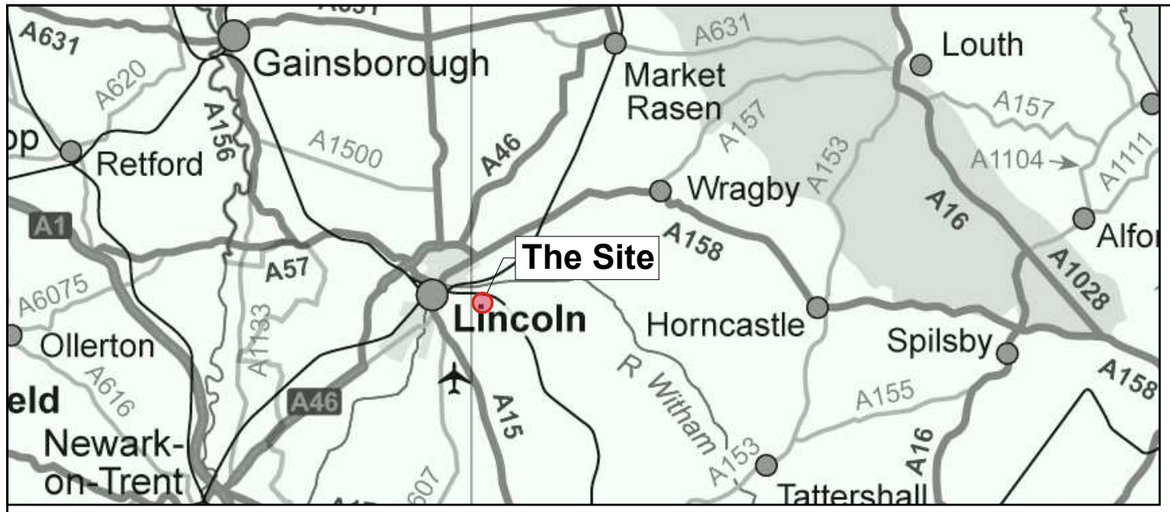
l.p.a.z.	***Palynological characteristics***
l.p.a.z. CAR: 2 60cm to 24cm *Corylus avellana* type-Poaceae-Cyperaceae-*Dryopteris* type	This zone is characterised by an increase in shrubs (*Corylus avellana* type) and fern spores (*Dryopteris* type) and a reduction in total herb values. *Corylus avellana* type expands to highest values at the top of the profile (46%). *Quercus* (10%) and *Alnus* remain consistent from the preceding zone. *Pinus, Ulmus* and *Fagus* are incoming while *Fraxinus* declines to absence. Herbs remain dominated by Poaceae but with reduced values (to 30%). There are also reductions in *Plantago lanceolata* (to 6%), Apiaceae (2%). There are expansions of Brassicaceae (2-3%), *Filipendula ulmaria*, *Rumex* spp., *Galium* and Asteraceae type (esp. *Artemisia*; 2%). There are substantial reductions in aquatic macrophytes of l.p.a.z. 1 with declining *Myriophyllum* and *Typha angustifolia* type. *Nuphar* and *Nymphaea* are absent Cyperaceae become more important (to 29%). Monolete, *Dryopteris* type expands to high values (38%). *Thelypteris palustris* is also present in this zone.
l.p.a.z. CAR: 1 96cm to 60cm *Plantago lanceolata*-Poaceae-*Myriophyllum spicatum*	Herbs are dominant with Poaceae (35%) most important with *Plantago lanceolata* (15%). Both have higher values at the base of the zone. *Ranunculus* type (3%) and Apiaceae (6%) are also important. Cereal type is present in small numbers. Trees and shrubs comprise *Quercus* (to 15%), *Alnus* (to 6%), *Corylus avellana* type (22%) and *Salix* (6% at base of zone). There are small but consistent numbers of *Fraxinus*, *Betula* (expanding at top of zone) and dwarf shrubs (*Erica* and *Calluna*). Aquatic macrophytes and fen taxa are important with high values of *Myriophyllum spicatum* (to 27%) and Cyperaceae (15%) with *Nymphaea*, *Nuphar, Alisma plantago aquatica, Potamogeton* type, *Typha angustifolia* /*Sparganium* type, *Oenanthe* type (see discussion) and the fern *Isoetes*. There are small numbers of *Pteridium aquilinum* and *Dryopteris* type fern spores

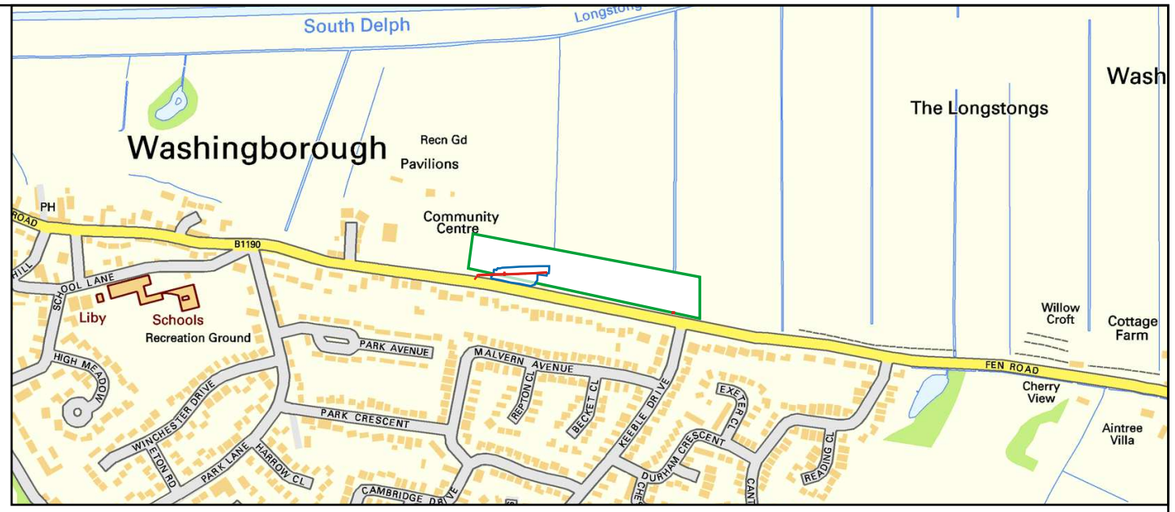
Figure A2. Pollen percentage diagram

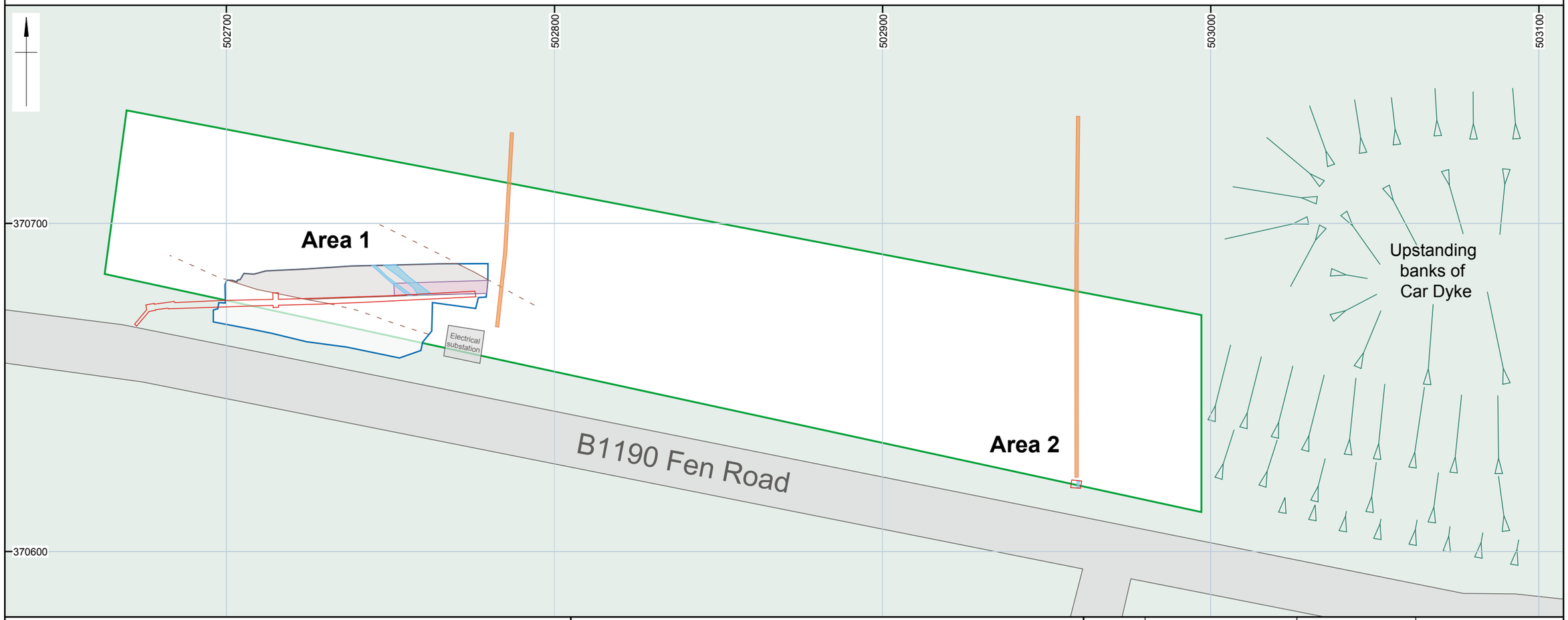


CAR DYKE
POLLEN PERCENTAGE DIAGRAM







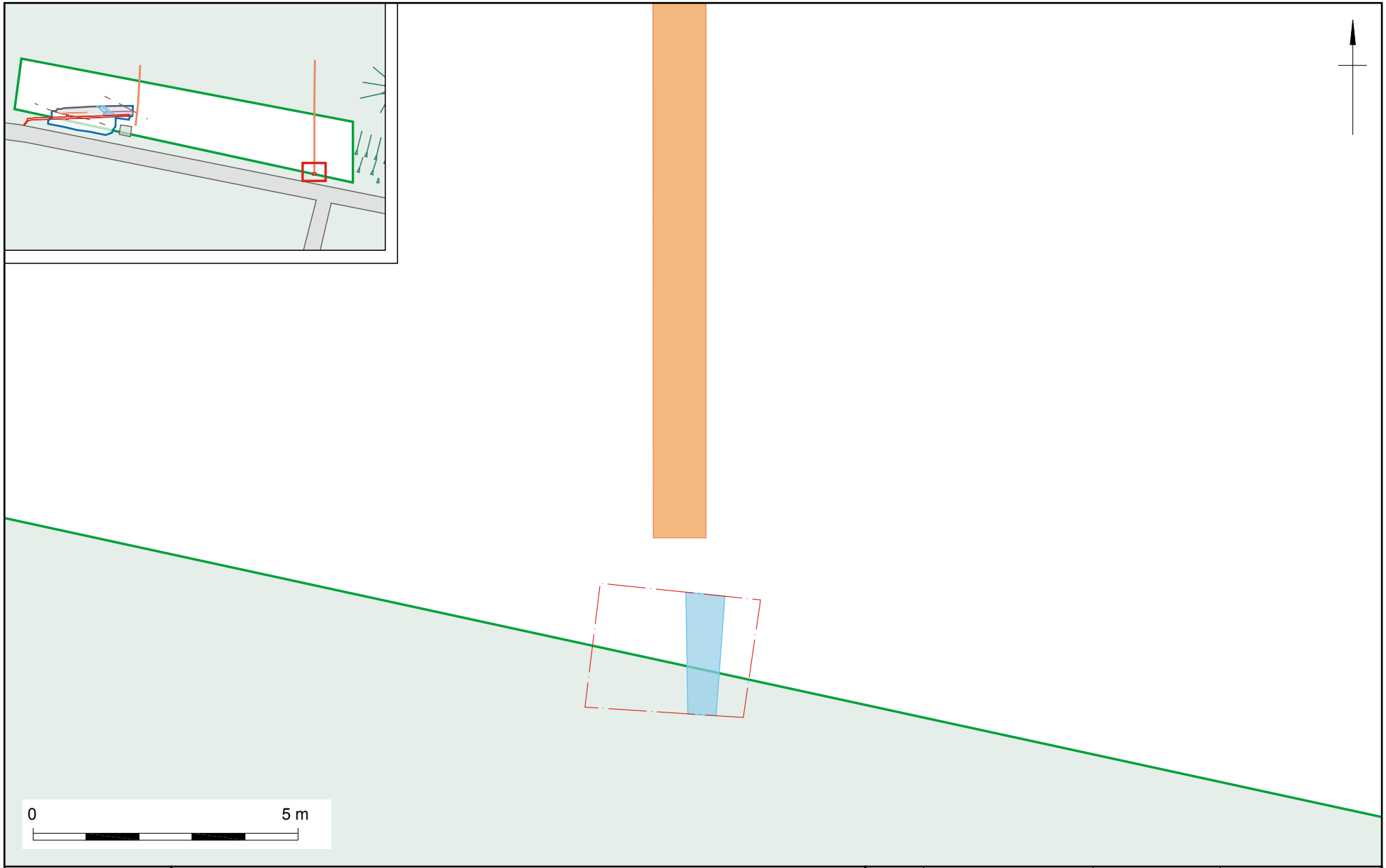


Scheduled area
Watching brief area
Limit of excavation
Bank
20th Century disturbance
Modern utilities
Modern running dykes

Date:	27/02/2015	Revision Number:	0
Scale:	Main plan - 1: 1250 @ A3	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Site and excavation area

Figure 1

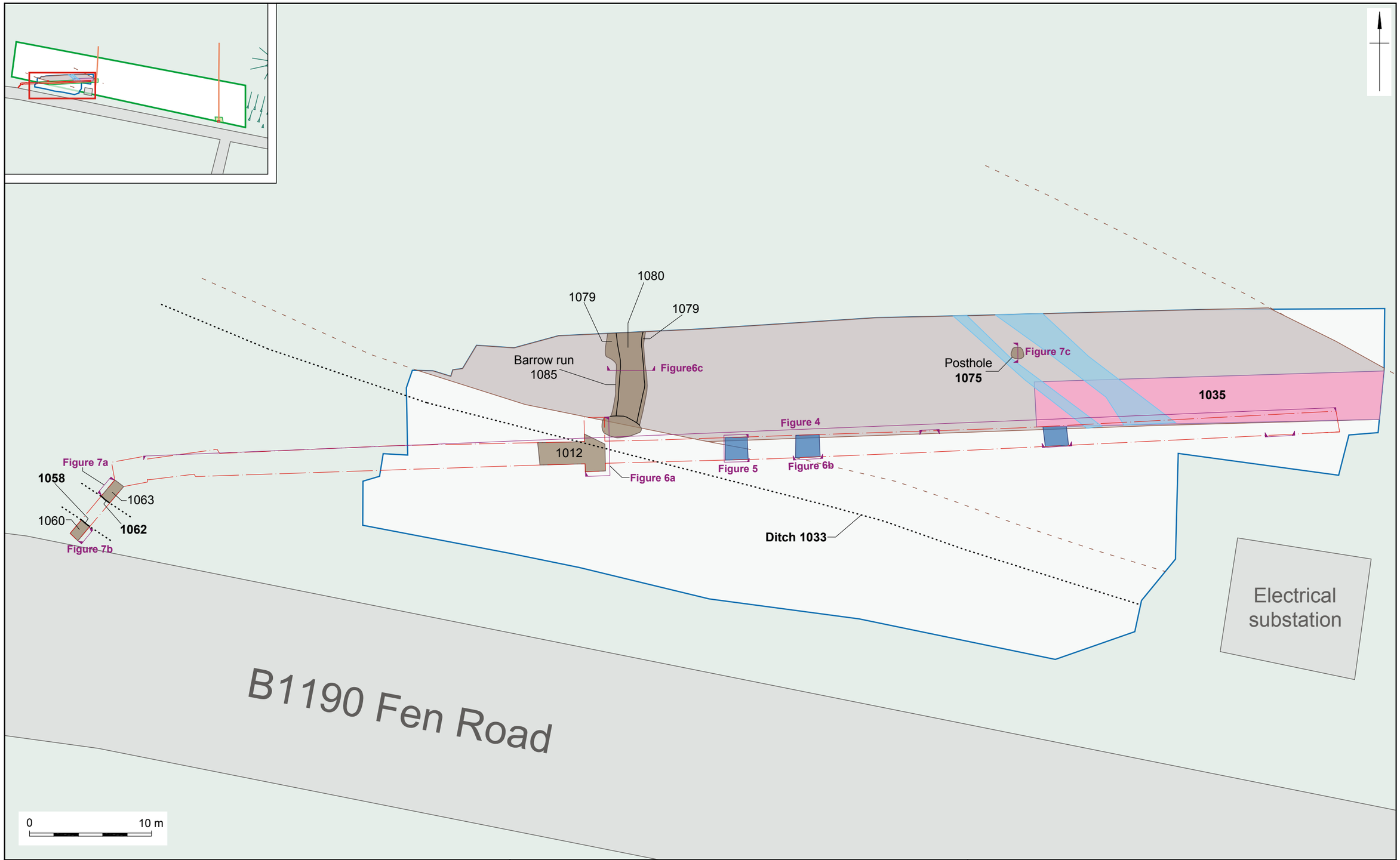


Scheduled area | Limit of excavation | Ditch | Modern utilities

Date:	14/01/2015	Revision Number:	0
Scale:	Main graphic 1:100 @ A4	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Area 2

Figure 2

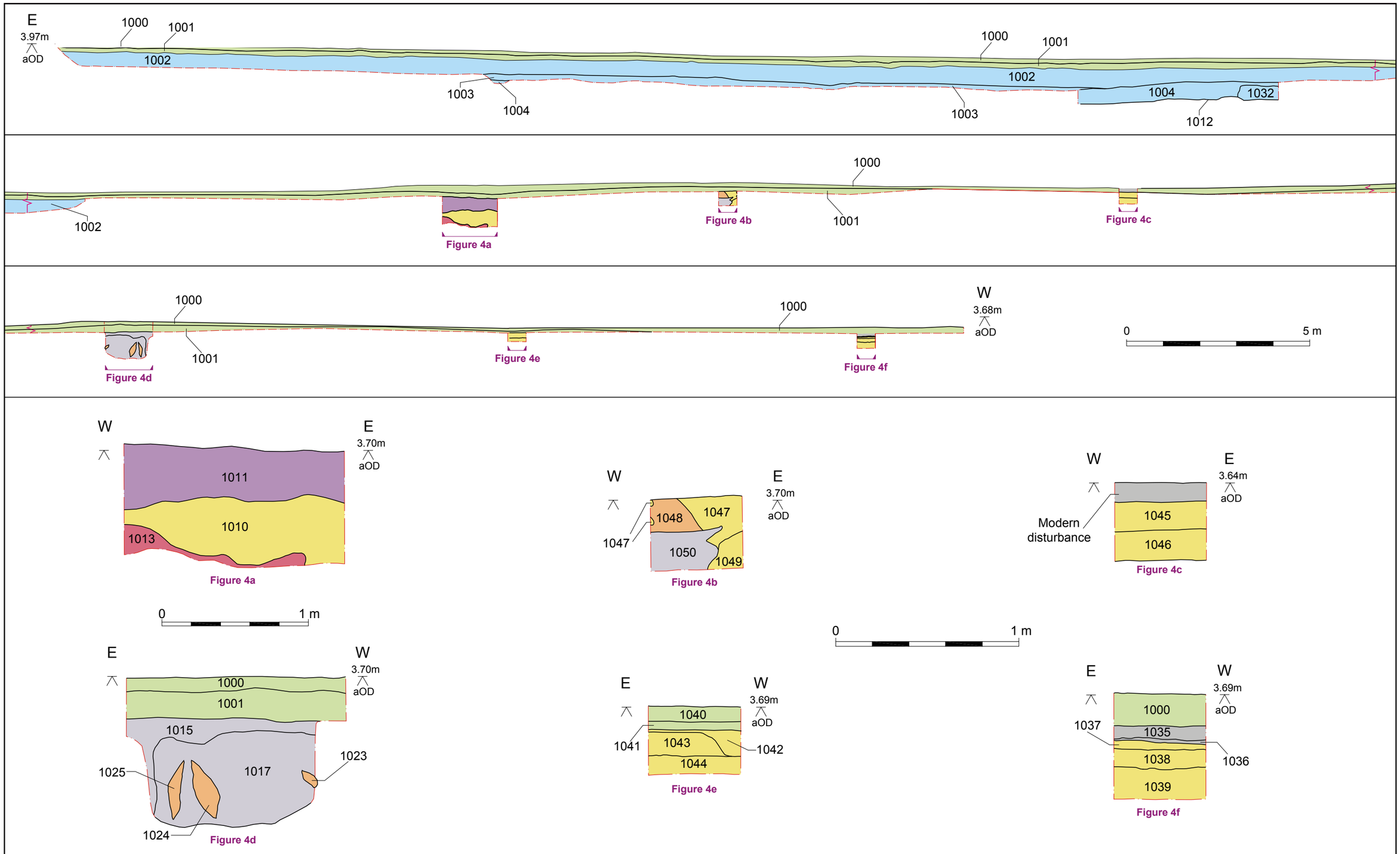


Watching brief area
Limit of excavation
Bank
Archaeological cut feature
Excavated slot through bank
20th Century disturbance
Modern utilities

Date:	14/01/2015	Revision Number:	0
Scale:	Main graphic 1:300 @ A3	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

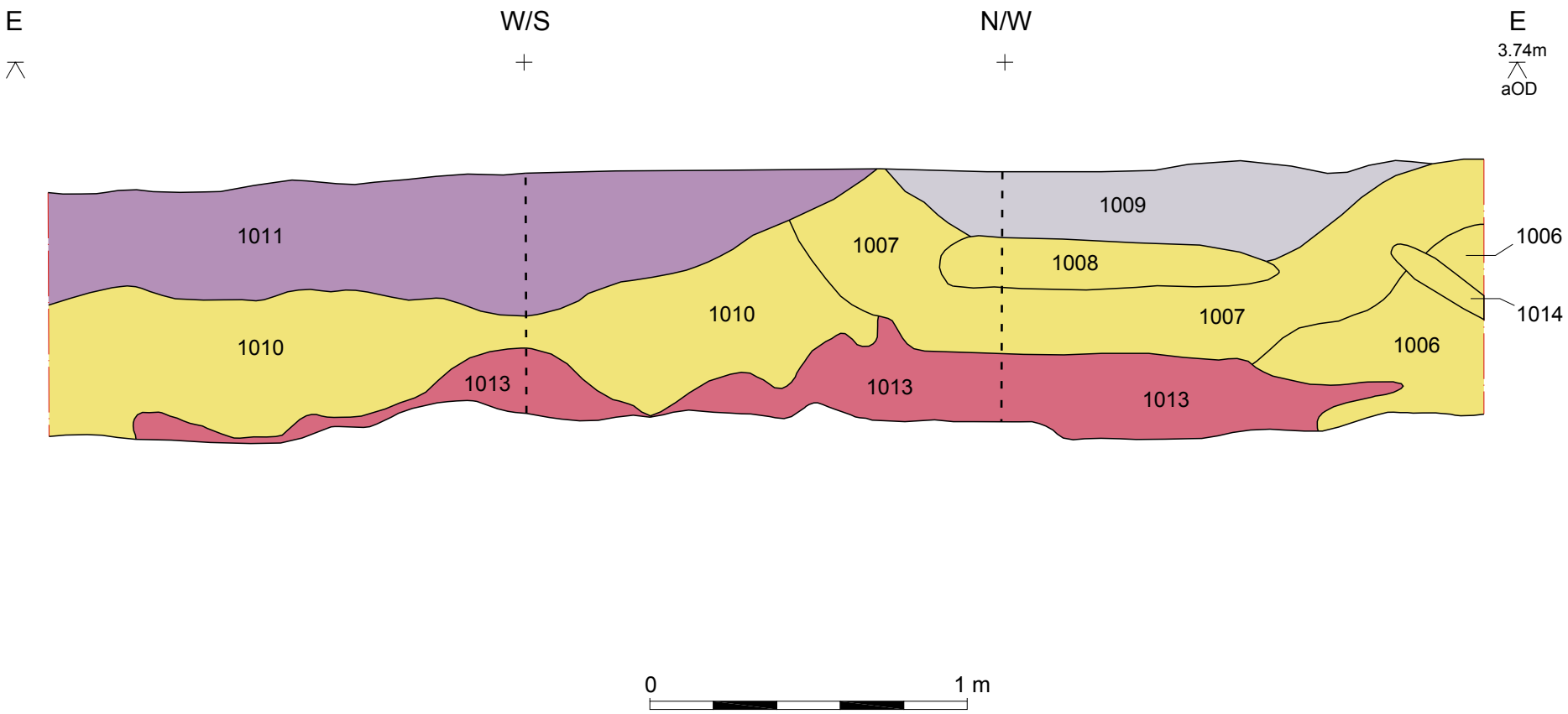
Area 1

Figure 3



Date:	24/11/2014	Revision Number:	0
Scale:	Main section - 1:100 @ A3 4a, 4d -1: 25, 4b, 4c, 4e, 4f - 1: 20 @ A3	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Composite section through the southern bank of Car Dyke



Sandy clay Sand Clay Clay cap

Date:	24/11/2014	Revision Number:	0
Scale:	1:20 @ A4	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Representative section through bank material

Figure 5

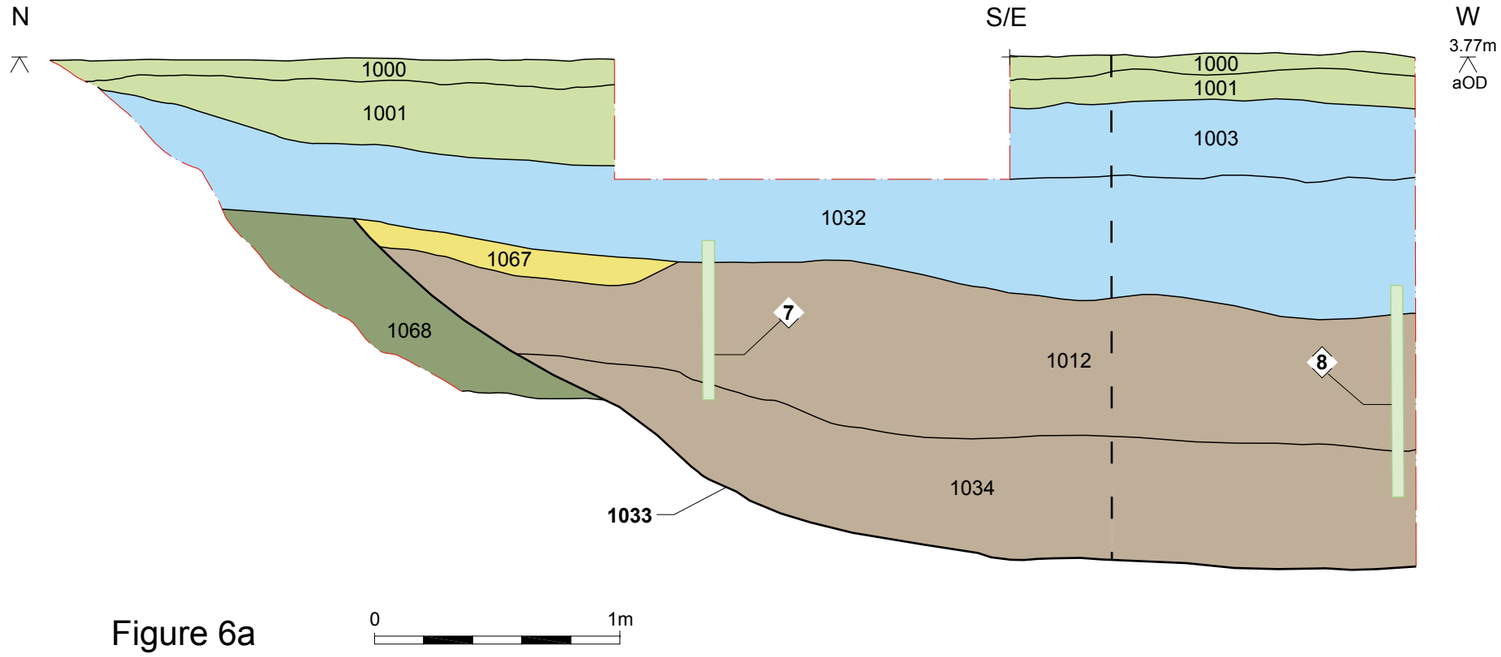


Figure 6a

0 1m

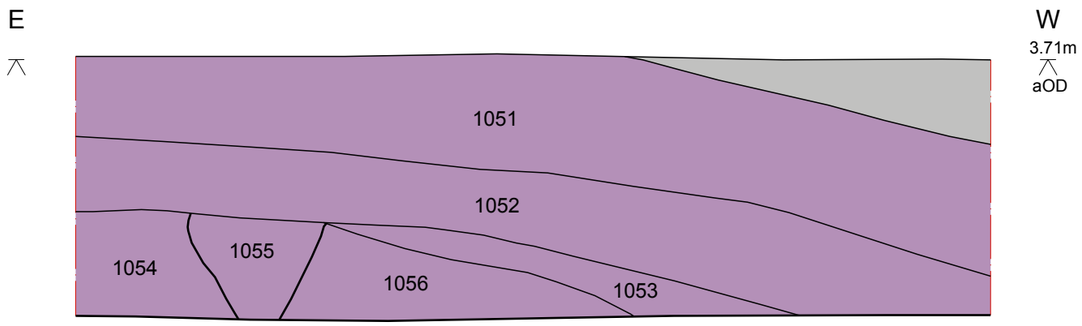


Figure 6b

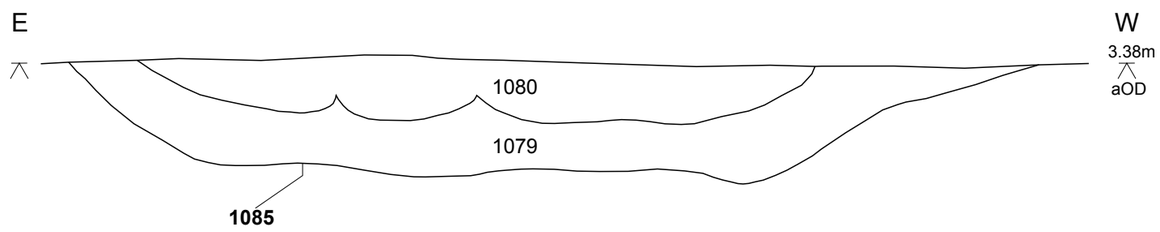


Figure 6c

0 1m

Topsoil or subsoil | Post-Medieval levelling | Peat | Clay cap
Alluvium | Sand | Monolith sample | Modern disturbance

Date:	24/11/2014	Revision Number:	0
Scale:	Figure 6a - 1:25 @ A3 Figure 6b and 6c - 1:20 @ A3	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

North facing section through peat filled ditch **1033**, and barrow-run **1085**

Figure 6

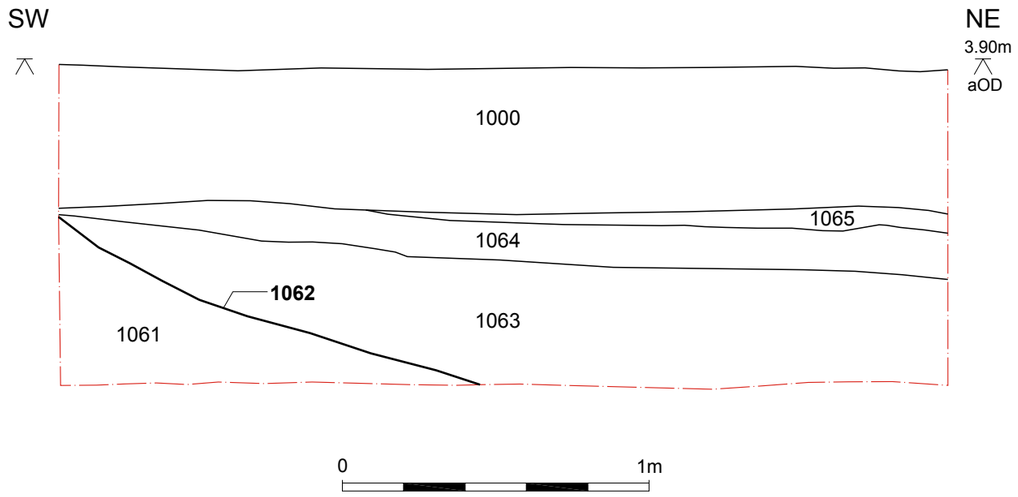


Figure 7a

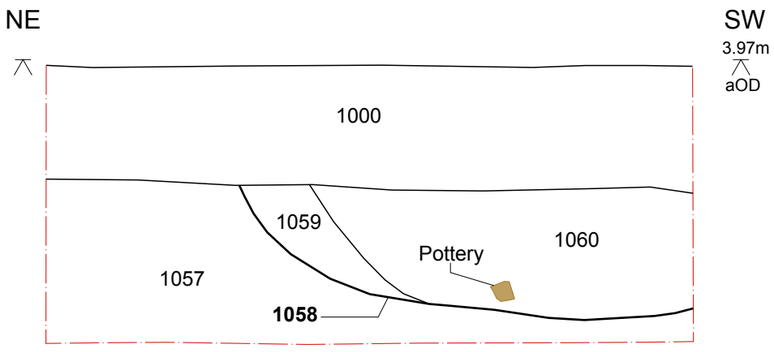


Figure 7b

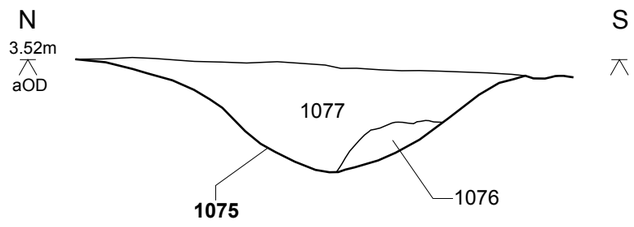


Figure 7c

Date:	24/11/2014	Revision Number:	0
Scale:	7a, 7b - 1: 20, 7c - 1: 10 @ A3	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Sections of peat filled ditch **1062**, ditch **1058**, and posthole **1077**

Figure 7

Plate 1: Pipe construction

Plate 2: Area 2

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Plate 3: East facing section through bank cap and tipped construction layers

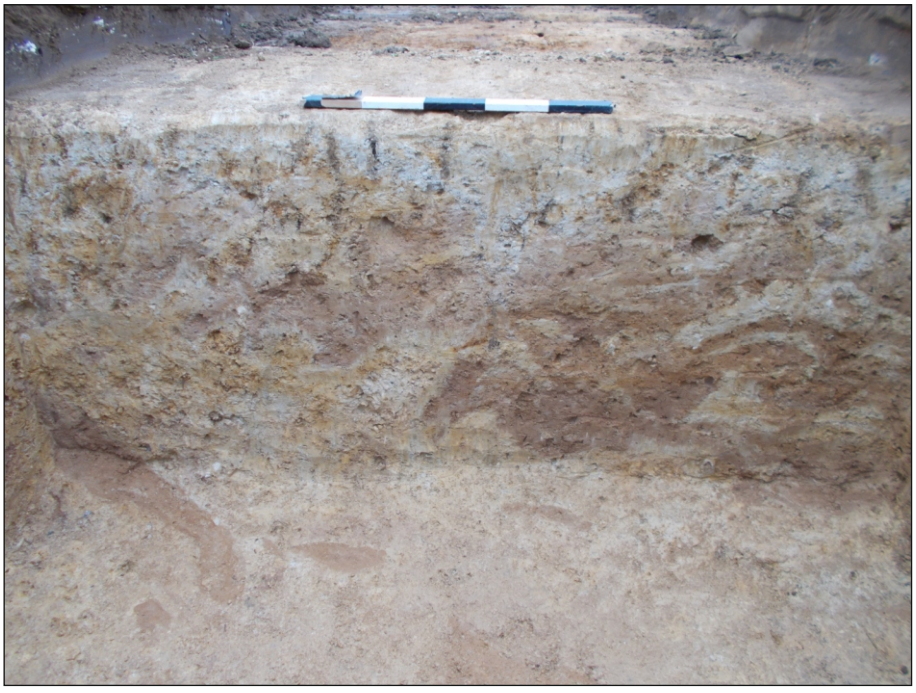


Plate 4: East facing section through central bank material

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Plate 5: Barrow-run, looking north

Plate 6: Section through barrow-run, looking south

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Plate 7: Peat fills of ditch **1033**, looking east

Plate 8: Section through ditch **1033** looking south

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Plate 9: Post-medieval levelling layers

Plate 10: Section through ditch **1062**

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Plate 11: Posthole **1075**

Plate 12: Southern limits of Car Dyke bank

Date:	12/11/14	Revision Number:	0
Scale:	N/A	Illustrator:	APS
Path:	Y:\Projects\105770\Graphics Office\Rep figs\AER\2014_11_12		

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk