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FISKERTON

LINCOLNSHIRE

Fiskerton Auger Survey

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Witham Valley, Fiskerton Auger Survey

Introduction and Background

As part of a programme of work funded by English Heritage at Fiskerton an auger survey was conducted across an area of approximately 32 hectares along the northern floodplain of the River Witham within the parish of Fiskerton (Fig. 1).

The survey was designed to build on the auger transect carried out as part of the 2001 Fiskerton excavation (Rackham in prep.). This transect ran the length of the river bank, along the stretch within the Environmental Agency programme of works, with each auger sunk at 50m intervals. A closer two metre interval was employed along the length of the main excavation trench. These boreholes have shown major differences in the sub-surface topography ranging from deep channels up to four metres in depth to sand banks that rise up above the surrounding modern ground surface.

The early topography of the site is clearly quite different to that of today and the location, size and date of any palaeochannels that cross the area must have had a profound effect upon the location and character of archaeological activity in the area.

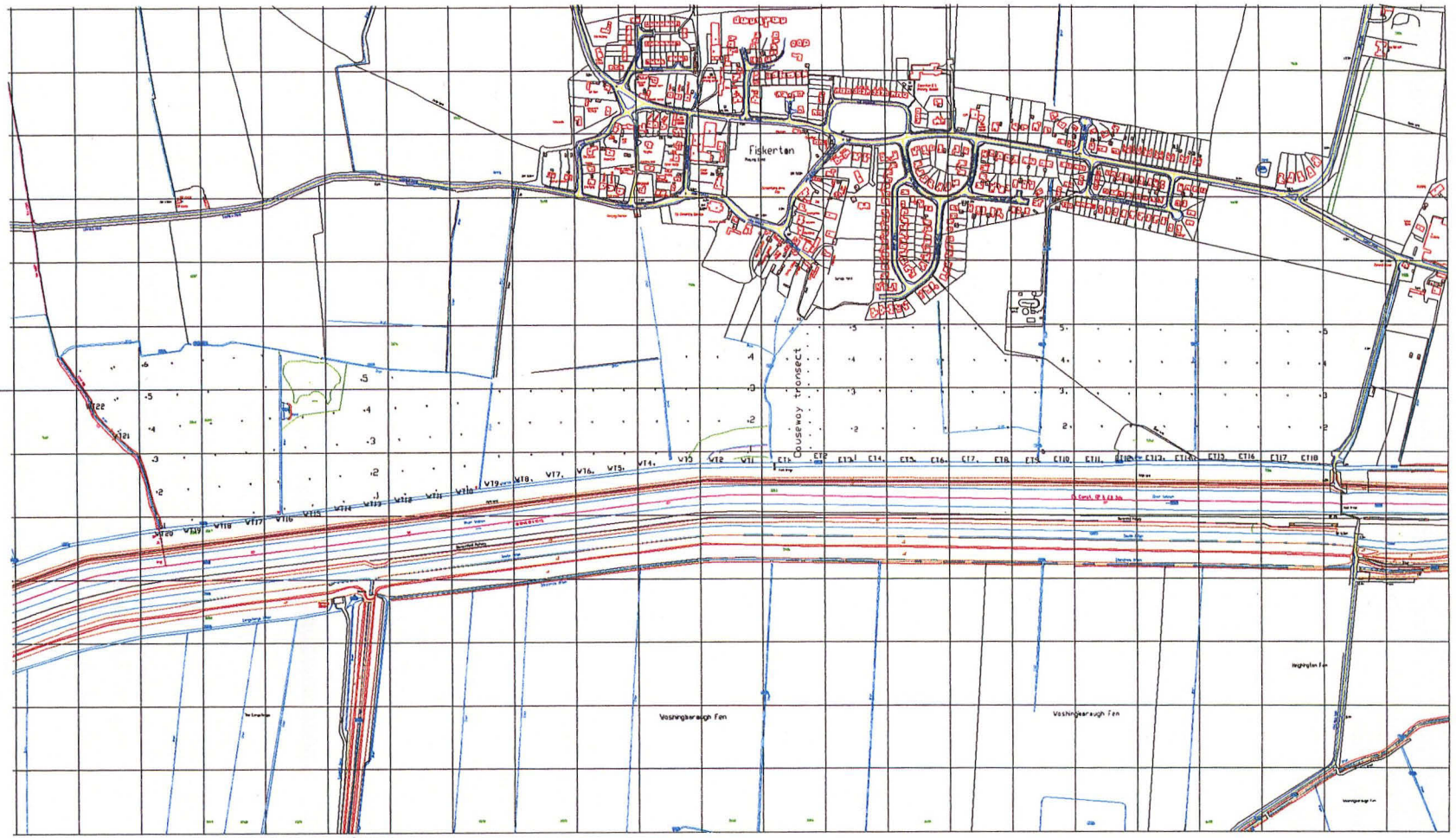
The survey was intended to study the subsurface topography and distribution of the post-glacial deposits infilling the valley in the area on either side of the Iron Age Causeway excavated in 1981 and 2001. It was also intended that the survey would gain some insight into the condition of the deposits and their likely survival under the present and any future land management and the possible impact on the unexcavated parts of the monument. To help address this latter aspect a variation to the project was submitted that would allow an assessment of the changes in the ground water table on the site between spring and late summer or early autumn when the land would be at its driest.

Aims & Objectives

There are three main objectives to the project.

1. The survey permits a reconstruction of the underlying late glacial topography of the site, where this has not been disturbed by later channel formation and marine incursion. This has been effected by the recording of the depth of the junction between the post-glacial deposits and the glacials sands and gravels, and modelling this as a surface.
2. Secondly, it was intended that the logs of the depth and description of the different deposits in each borehole would be used to build up a three dimensional deposit model for the post-glacial sediment infilling the valley in this area. This proved problematic because of the considerable variation in sediments across the site and the difficulty of modelling them in 3D. A series of sections have therefore been produced to assist in broad landscape interpretations based upon the sediments, such as woodland carr – woody peat, reed beds - reed peat, lake or channel fills - organic muds, buried sand banks – glacial sands, etc.
3. The third main aim of the auger survey was the collection of suitable samples from the cores so that the sequence of deposits could be broadly dated by radio-carbon analysis. A limit to the number of samples that could be dated makes correlations between individual bores very difficult, but the OD height of the deposits has permitted some correlations across the cores.

Figure 1. The survey area showing the location of all the auger holes and with each north/south transect labelled (the southern auger hole in each transect is no. 1)



While these were clearly the primary aims of the auger survey the results will inform the rest of the archaeological survey programme of the area by supplying information on:

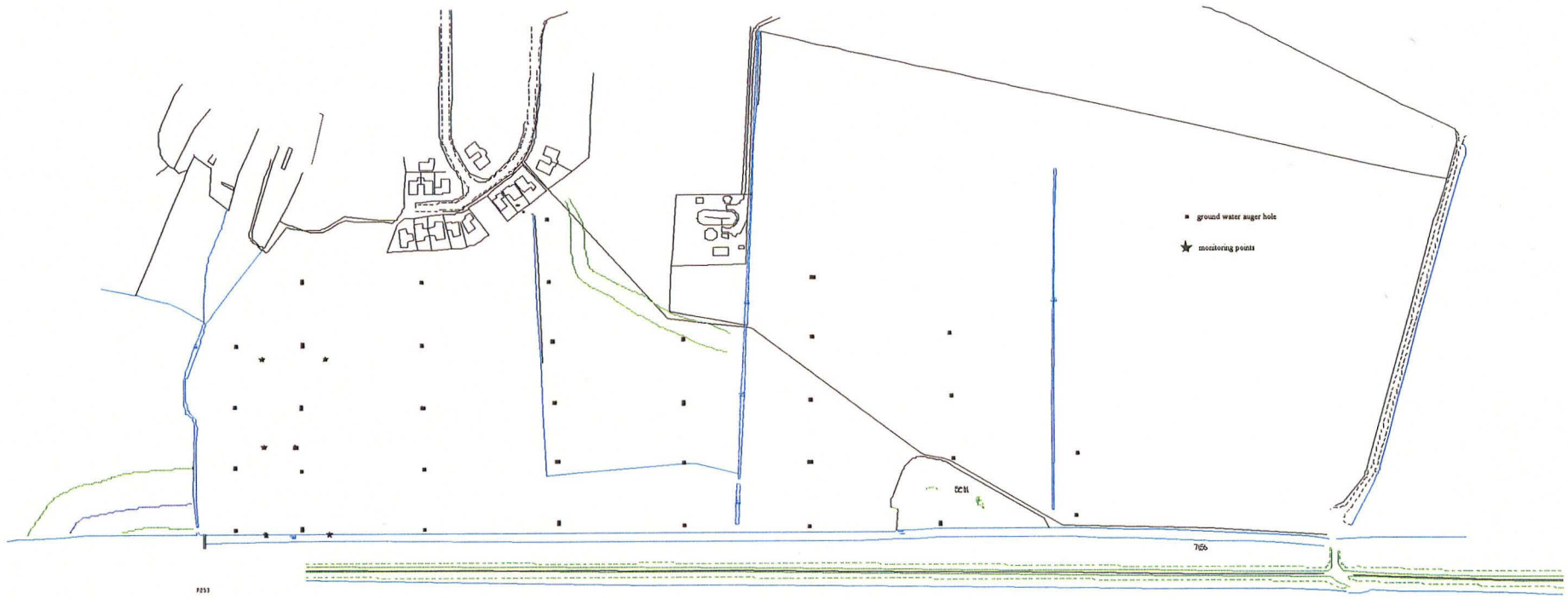
i) the preservation environment
ii) the degree of humification and degradation of the organic sediments in different areas
iii) those areas where archaeological remains may have been destroyed by channel formation
iv) a base map of the subterranean topography that can be used to help in the selection of the location of any test pits and trenches for direct observation of areas of archaeological potential
v) a base map of the deposits that can be laid beneath any metal-detecting, fieldwalking, geophysics and aerial photography results to assist in their interpretation.

Variation – Water Table Modelling
After discussion with members of the Fiskerton Survey team, particularly the EH Scientific Adviser, Dr Jim Williams, and Dr David Hogan, who has been conducting the FAP, established that it would be essential for the understanding of the management needs of the site to study the ground water table and its fluctuations during a single season. This would allow an assessment of the potential impact of water table fluctuations on the buried deposits. The Groundwater Monitoring Programme, which is being run as part of the Survey, is targetted specifically at the trackway. It was intended that the variation to the auger survey would establish the current groundwater table over the whole extent of the site during the auger survey. Further augering was undertaken in early October, when the ground water levels were near their lowest during the year, to monitor the changes in the overall water table between seasons.

Methodology
A fifty metre grid was laid out across the area of land to be surveyed (Fig. 1) and a cane placed at each fifty metre centre. Each cane was surveyed in using a GPS or total station. The first phase of surveying was conducted by Bernard Thomason and David McOmish of English Heritage using a GPS and covered the whole of the eastern half of the survey area. The second phase was surveyed in by Rachel Ward and Mark Diamond of Archaeological Project Services (APS) using a total station and covered the western half of the survey area. The final survey of the boreholes sunk in October 2001 to measure the ground water table was conducted by Rachel Ward and Joanna Hambley of APS and Heritage Lincolnshire using a total station. A total of 193 cores were sunk for recording the deposits and a further 35 cores were sunk to measure the autumn ground water level. A series of 11 boreholes were sunk and recorded at 20m intervals along the line of the causeway (see Fig. 12), but immediately east of it.

During the winter months between November and February the local Inland Drainage Board (IDB) undertakes a programme of dyke mudding (removing 20cm plus of silts from the base of dykes) and bank clearing. The bank clearing exposes fairly clean bank sides in which deposits can be recognised and sand banks and other features, including archaeological features, can be identified. The dyke mudding can throw up underlying sediments revealing where the sand banks are located and also may dislodge bog oaks or other timbers.

Figure 2. Location of the auger holes used to measure the October 2003 ground water table and the monitoring points over and beside the Iron Age Causeway



As an additional element to the auger survey it was suggested that time was allocated for visits to the cleaned and muddied dyke sections to record the location of any sand banks, peat beds, and archaeological features. This walk over was conducted along the north delph within the survey area.

Recording

The objectives of the survey are fairly limited and a detailed sedimentological description of each sediment type encountered was considered unnecessary. Previous experience coring on the site as part of the 2001 excavation programme had established a broad sequence of deposit types that was easily recognised and would allow fairly rapid classification of the deposits during augering.

A hand auger used by a team of two was used for all the coring. The auger bit was a 1 metre long, 30mm diameter, gouge auger fitted with extensions when required. On the western side of the site where deposits were found to be dried out and quite hard the upper sediments were augered using a 60mm diameter bucket auger bit, which was replaced by the gouge as soon as soft sediments were reached. Clean yellow or buff sands were deemed to be the base of the post-glacial sequence of sediments on the floodplain, and clean grey or gleyed sands within the palaeochannels. The boreholes were stopped once these deposits had been reached. The maximum augered depth to the base of the sequence was 6.45 metres.

At the end of each days augering the boreholes were returned to in the order in which they were originally cored, to allow a maximum time between initial coring and subsequent water level measurement, and the ground water level in each borehole measured. The minimum time interval between coring and measurement of any borehole is therefore approximately 1 hour, this for the last borehole of that day. The period over which this fieldwork was undertaken was longer than originally intended and some drop in the ground water table will probably have taken place between the first day and the last day of augering. However the western half of the site was augered latest, in this area the deposits were much shallower, and water was encountered above the underlying sands in only one borehole.

Finally in October after a summer of virtually no rain, and no rain at the site for at least 2 months a further 35 boreholes were sunk across the site to a sufficient depth to measure the ground water level. The 35 boreholes (Fig. 2) were located in the eastern half of the survey area to best monitor potential changes in the water table.

Topographic and sub-surface modelling at Fiskerton

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The Fiskerton GPS and Auger datasets provide the necessary information required to create a detailed surface model and sub-surface models reflecting the surface of the late glacial sands and gravels and defining the limits of any ancient river channel. The records of water table height in Spring and Autumn allow further sub-surface evaluation of the change in the watertable during the year and the consequent threat to surviving environmental evidence.

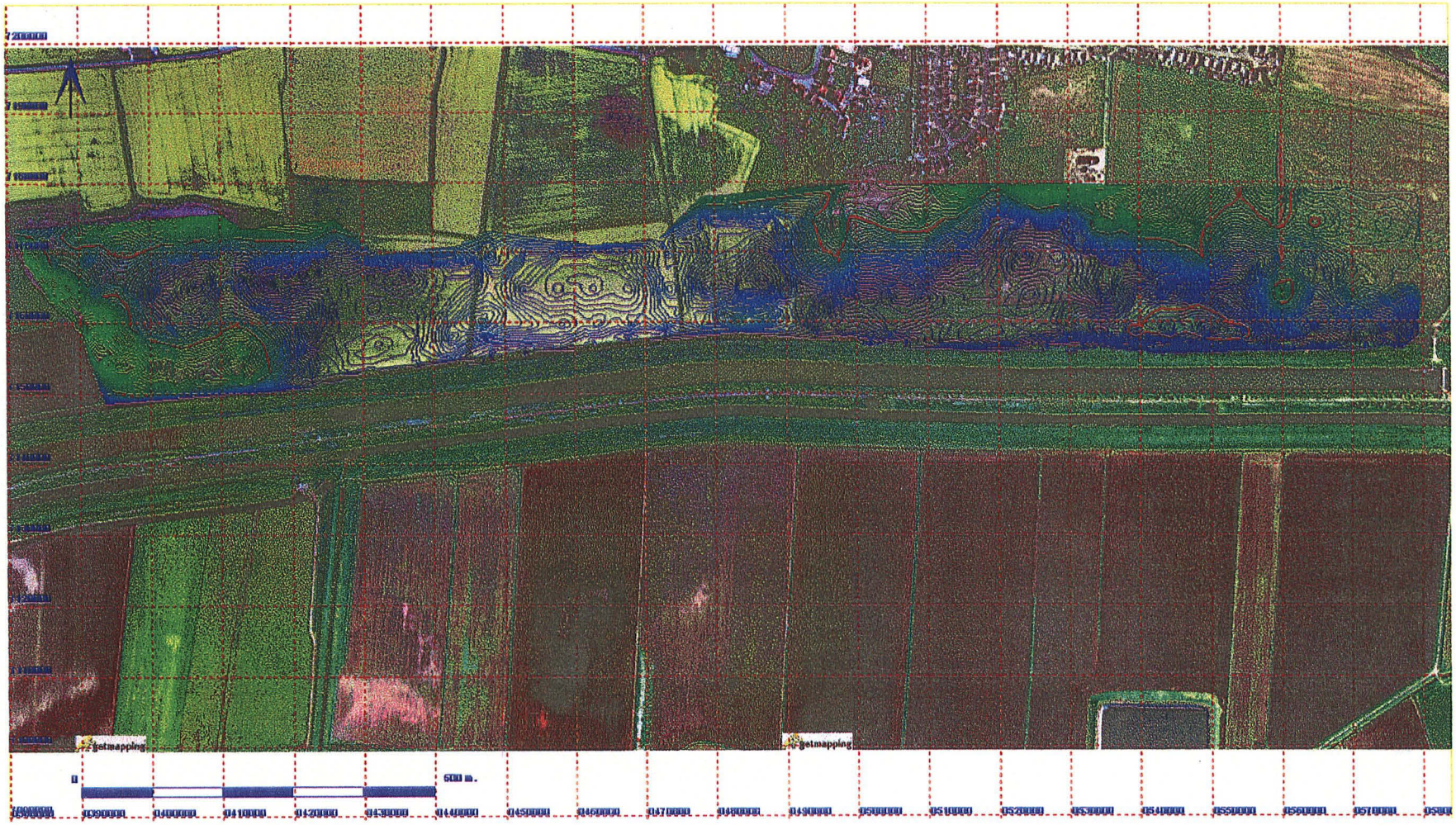


Figure 3. Fiskerton Surface Topography overlain with contours of present land-surface at 5cm spacing. (The two red contours are the 1 and 2m OD contours. The aerial photograph base image is copyright of GetMapping.com)

The combination of the detailed topographic survey conducted by Bernard Thomason and David McOmish (2003) in the field with the causeway and that immediately east and the spot heights on each of the auger holes has been used to produce a contour plot of the surface topography of the survey area (Fig. 3). It should be noted that the software for contouring data can produce substantial edge anomalies where the number of spot heights is limited and where the contours cluster on the edge of the plots (Figs. 3 and 4) these are not correct. There are other areas where this plot is incorrect and it should be noted that in those areas with an interval of 50m between spot heights the contouring can only give a general picture of the topography. The height range recorded over the whole survey area is 0.9m to 2.9m OD. Despite this limited height range the area shows some pronounced topographic features on the ground. The most pronounced feature is at the western end of the survey area where a small sand plateau rises up 2m above the land to the west and approximately 1.4m above the land to the east. This raised land crosses the north delph and continues along the north bank of the River Witham a couple of hundred metres eastwards and incidentally extends south of the complex of river and delphs immediately south of this part of the survey area. The northern edge of the survey area shows the beginnings of the valley side and the land rises gradually to the north of the survey area. A low plateau between 1.3 and 1.7m OD lies to the east of this raised land for 600 metres before a slight rise associated with a sand bank is reached approximately 75 metres west of the Iron Age causeway. This sand bank rises to a maximum of 2m OD and continues north-eastwards to join the small terrace that runs along the northern margin of the eastern half of the survey area. The contour plot is this area is constrained by the limited data and does not accurately represent the extent of the sand bank. The terrace curls around to the south east at the east end of the site and the lowest area of the modern ground surface lies in the south east corner of the area surveyed at 0.87m OD.

These 'major' topographic features reflect the ancient landforms of the site and the auger data has been used to contour the surface of the underlying sands. This model effectively plots the landform before the valley floor became flooded and infilled with alluvial sediments and peats (Fig. 4). The auger survey shows that the ancient landscape had a much greater relief than the modern surface. The lowest point encountered at the base of a palaeochannel is –5.145m OD and the highest is the same 2.9m OD point of the modern topography. This latter point has certainly been truncated by modern agricultural activity and the ancient topography is likely to have had a high point perhaps another half metre higher. The most dramatic feature recognised in the auger survey is a river palaeochannel (Figs 4 and 5). This channel is just clipped at the south-west corner of the site, in one auger hole, where the underlying sands rise up sharply (Fig.11) from the floor of the channel. The channel travels south-eastwards beneath the modern river bank and extends just south of the south delph. A trace of this bank may be visible in the aerial photograph (Fig. 3) in the ploughed field to the south of the south delph. The channel then turns north-east and crosses the river and north delph 150 metres west of the Iron Age causeway, continues north-eastwards finally turning back south east immediately south of the bungalows and west of the sewage farm. The channel apparently begins to turn eastwards at the east end of the site. The somewhat angular pattern of the course of this channel (Fig. 5) is a product of the 50m interval used for the auger survey. The major features of the modern surface topography noted in Fig. 3 reflect the course of this ancient palaeochannel and its natural river levee.

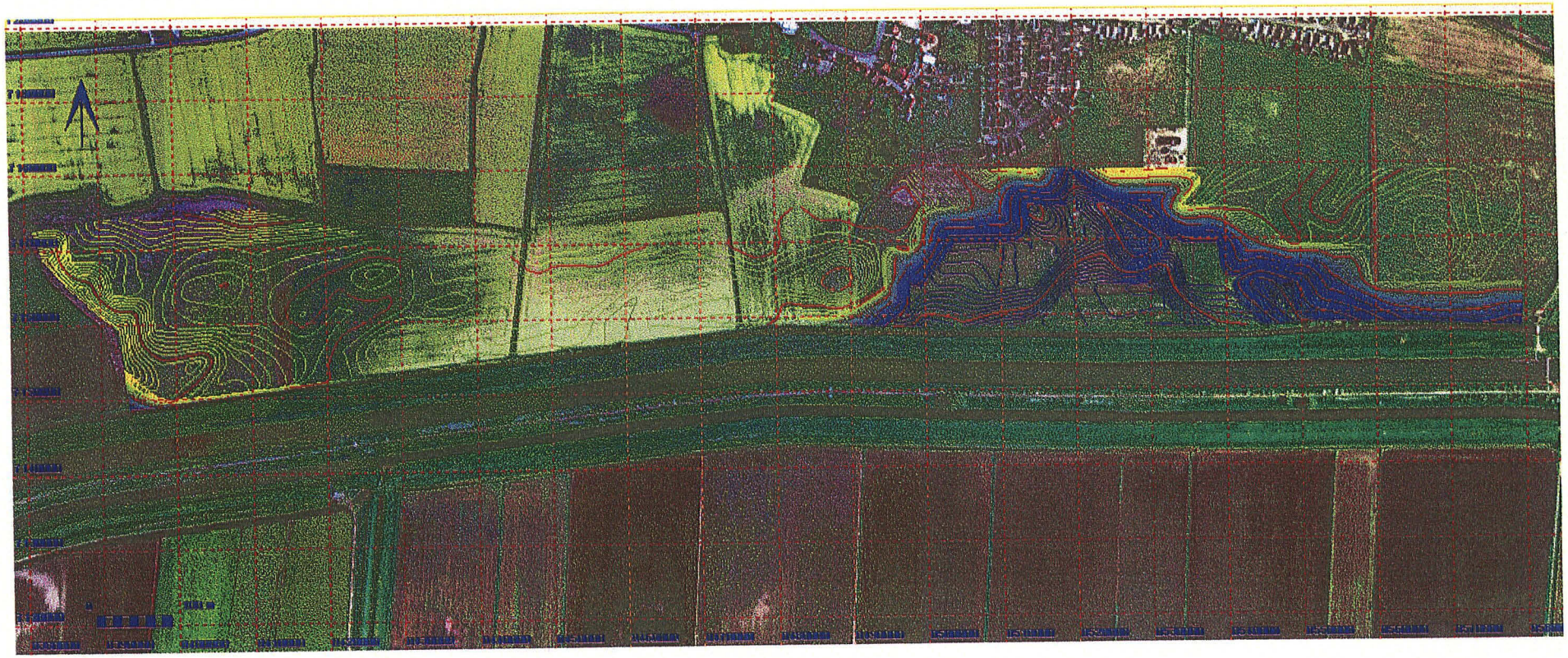


Figure 4. Fiskerton Sub-Surface Topography showing the ancient river channel and old land-surface contoured at 10cm. interval

The raised sands at the west end of the survey area and those in the central area are both the surviving levee of this channel (Fig. 6 and 11). The raised ground in the eastern half of the site reflects both the bank of this palaeochannel where it is cutting into the side of the valley and a slight levee (Fig. 5) of sand that has formed along the top of the bank. The deepest part of this channel where it has scoured out the glacial sands is between 50 and 75 metres wide, although the 50m interval between auger holes makes it impossible to be precise. However the surface of the glacial sands to the south of this channel is much lower than the rest of the site and forms a low plateau at –3m OD.

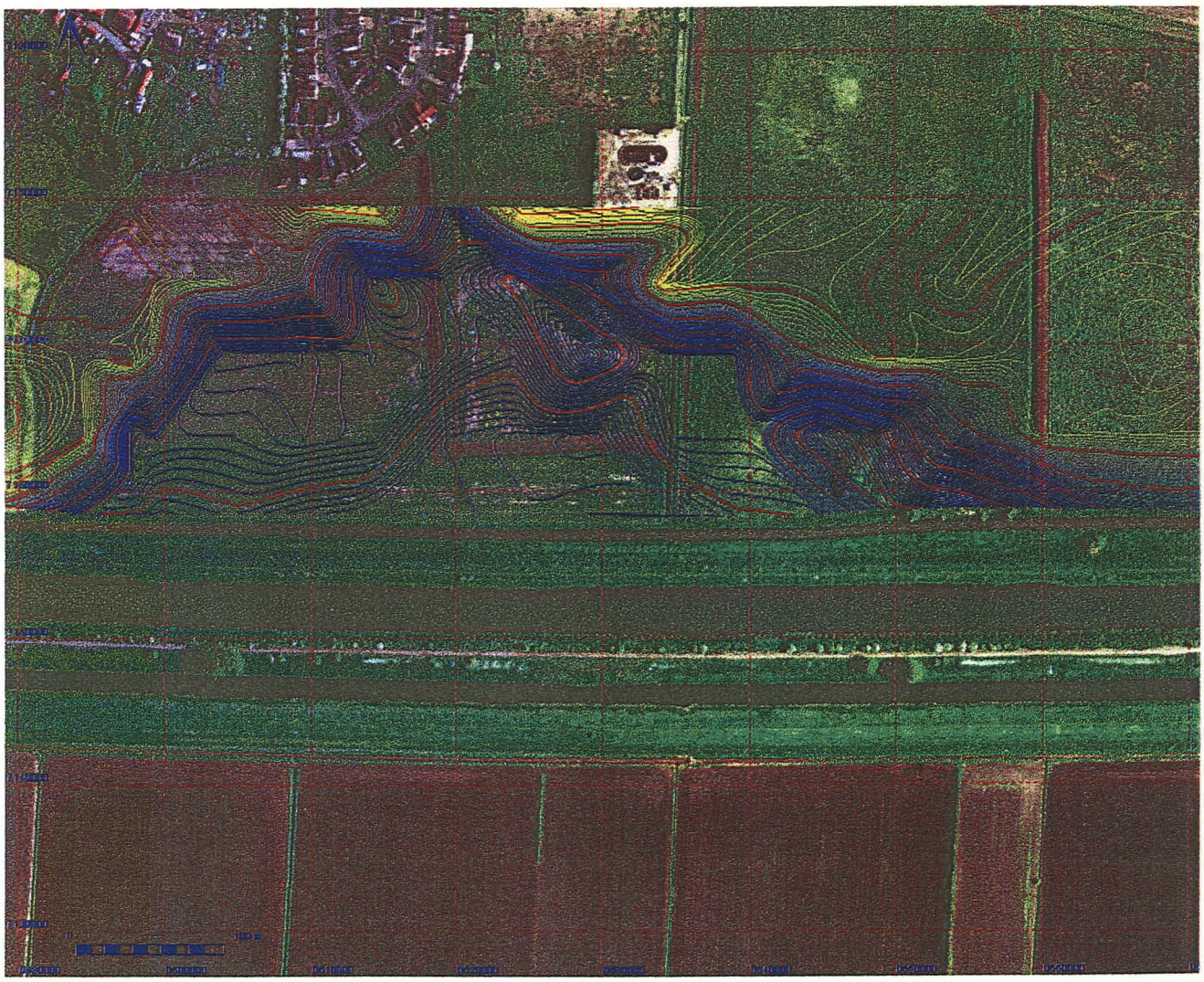


Figure 5. Detail showing the river-channel and sand levee to the north in the eastern half of the survey area

The deposits and their chronology

The interval between the auger holes, the range of deposits that have been described and the occurrence of a tidal channel within the sequence make the three dimensional modelling of the post-glacial deposits infilling the valley at Fiskerton impossible. The results are therefore presented as a series of sections that reflect the broad depositional sequence within the survey area (Figs 6-12). Thirteen samples were collected for

radiocarbon dating in an effort to establish the chronology of the sediments, but these of necessity were located mainly within one main core sequence and additional samples where specific chronological questions were posed. Additionally we have available the unpublished results of the radiocarbon series obtained from the 2001 excavations of the causeway. While these give a broad framework for the deposits it would be presumptive to try and correlate the dated deposits with those several transects away.

The sedimentary sequence is broadly as follows.
The deepest channels cut the late glacial sands that infill the valley floor, with the deepest recorded core indicating the channel floor at –5.15m OD. At their base are a series of dark grey silts and silty sands and woody peats which appear to represent the basal sediments within a freshwater river channel. Degraded bark in organic silts at –4.56m OD in the base of this channel (Fig. 7) has yielded an age of 9450±45 BP (OxA-12917 – see Table 1) suggesting either an early mesolithic date for this channel or the re-working of organic debris from earlier deposits. It is suggested that after some southward migration of the main channel the margins of this channel filled up with silts, woody organic deposits and peat (eg the lower part of the sequence in auger 3, Eastern Transect (ET) 3 – Fig. 6).

South of the main channel feature (Fig. 6) the early ground surface appears to lie at about –3m OD and above. Several of the auger holes produced dark silty sands overlying clean grey sands at this depth that suggest a possible palaeosol. Two radiocarbon dates have been obtained from these deposits, one at –3.47m OD at the base of the north-east sequence studied from the 2001 excavations and the second at –2.775m OD in auger 1 of ET3 (Fig. 6) from a woody peat overlying a possible palaeosol. That at –3.47m OD has produced a date of 6950±60 BP (Beta – 189495) and that 0.7m higher a date of 5102±37 BP (OxA-12914). Both these dates indicate that this floodplain to the south of the palaeochannel first became waterlogged in the late mesolithic and early neolithic periods. Alder wood (Table 1) from grey clayey waterlain silts immediately above at –2.475m OD (Fig. 6) have given a date of 4955±50 BP (OxA- 12892) indicating that this area had become inundated and lay underwater in the early neolithic.

The consistent occurrence of peats and woody peats at levels between –3.3 and –2.5m OD in the southern half of the eastern part of the survey area suggests the development of reed fen and alder carr on the floodplain adjacent to, and south of, the contemporary river channel, with organic silts and grey silts with some fibrous matter indicating areas of open water in and on the margins of the main channel. The sequence varies locally between the cores but these sediments built up to a level of perhaps –1m OD with fluctuations in water table leading to the local development of open water, reed beds or woodland carr. In ET8 a depth of over one metre of woody peat in auger 1 (Fig. 8) suggests the long term development of alder carr on the southern margins of the channel at this point, while in ET3 across the same depth range in auger 1 open water, channel silts, woodland carr, and thick reed beds are indicated. It is clear that there is a contemporary mosaic of river and riverside environments that has lead to slight differences in the deposits forming at the same level across the site.

Key

- topsoil
- iron rich silts
- shelly organic silt
- woody peat
- wood
- fibrous peat
- silty peat
- organic silt
- reed peat
- reedy grey silt
- grey silts
- calcareous grey silts
- grey clayey silts
- laminated silts
- laminated sands
- grey sandy silts
- dark grey silty sands/palaeosol
- sands, grey,buff and yellow
- gravel
- clay

——— water table in spring

W	wood
S	shells
M	freshwater mussels

Figure 6

Eastern Transect no. 3

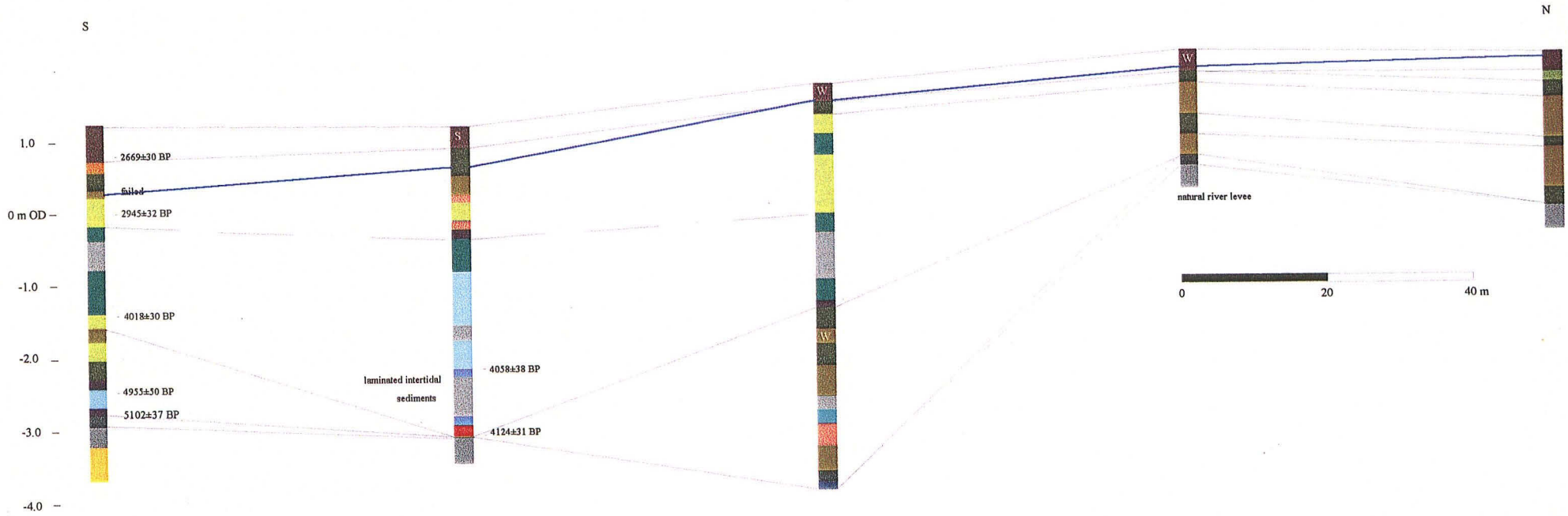


Figure 7

Eastern Transect no. 5

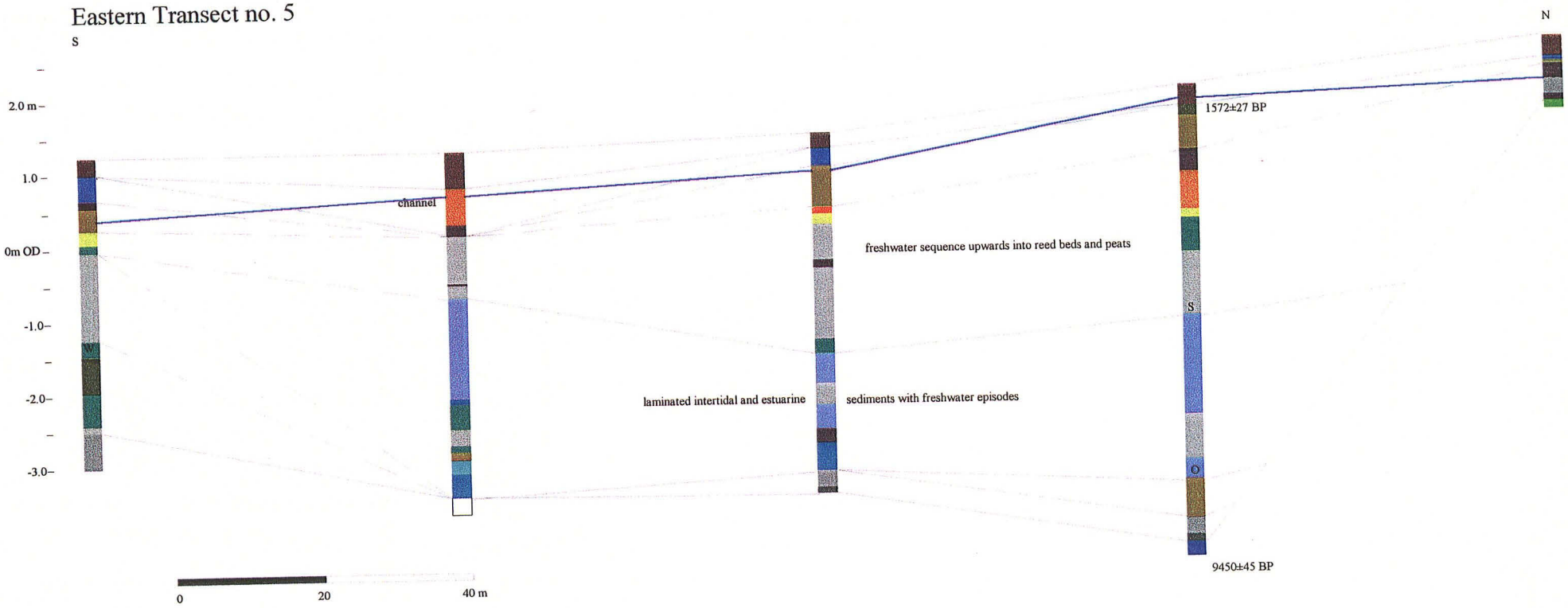


Figure 8
Eastern Transect no. 8

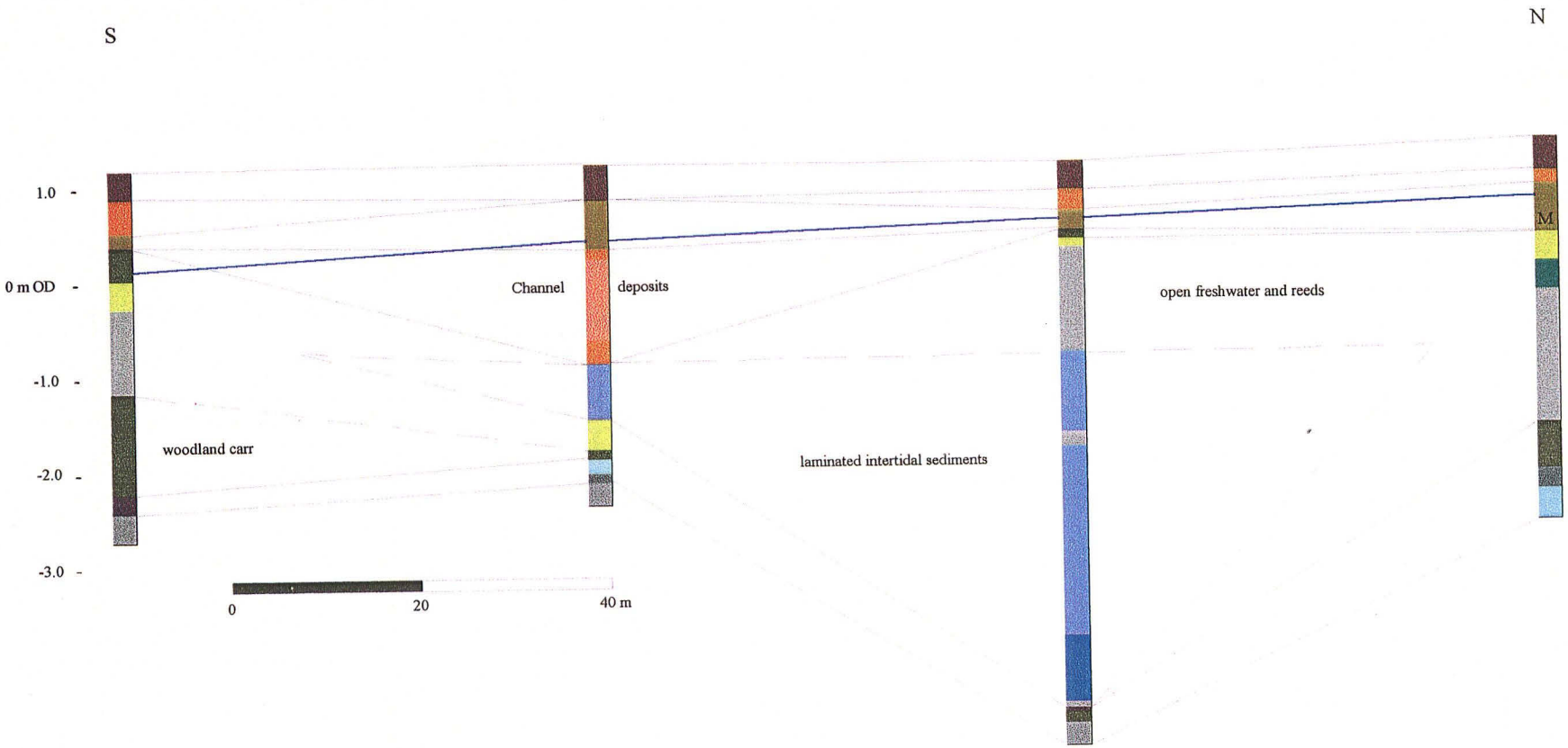
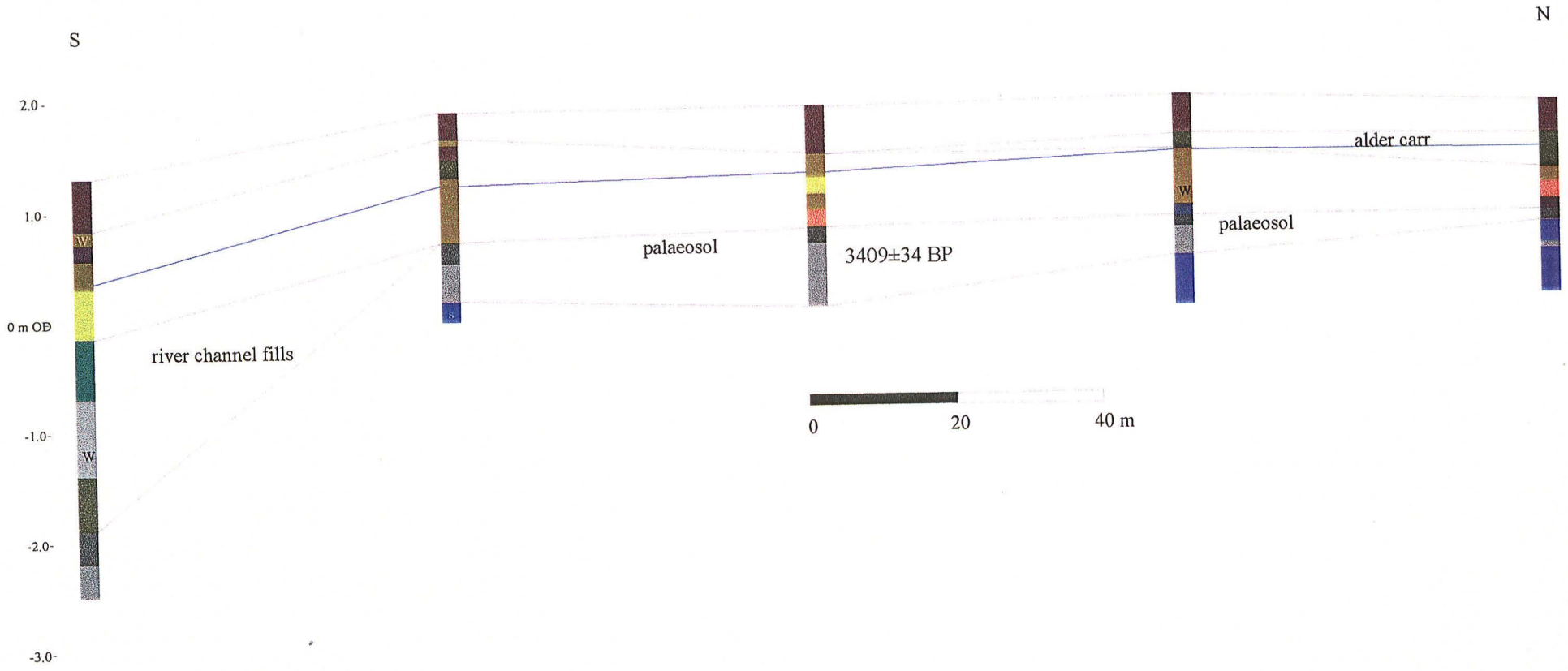


Figure 9

Eastern Transect no. 17



At some time in the latter half of the fourth millennium BC the palaeochannel became estuarine in character. This was clearly recognisable from the laminated silts and fine sands so characteristic of tidal sediments. Most of the transects in the eastern half of the site produced at least one auger in which these sediments were recognised. In an effort to date when this marine incursion occurred samples were taken from the base and top of the laminated sediments in auger 2 of ET3 (Fig. 6). Alder wood, represented by a fairly large tree trunk, was sampled from the very base of the estuarine sequence and bark from deposits immediately above the laminated sediments. These two samples gave dates of 4124±31 BP and 4058±38 BP (OxA – 12916 and 12915). It seems likely that this marine influence started somewhat earlier than 4124 BP since this date is recorded at a level of -3m OD while laminated sands in auger 3 of ET8 (Fig. 8) are recorded as low as –4.5m OD and it probably continued after 4058 BP since this date was obtained on material at –2.2m OD while the upper laminated silts and fine sands in ET8 auger 3 lie at –1.57m OD. These deposits are being laid down in a channel approximately 50 metres wide, but in two transects the recognition of these intertidal sediments in two boreholes indicates a channel that could be up to 100 metres or more wide. These deposits do not merely indicate a river channel subject to tidal fluctuations but an area of mudflats either side of an estuarine channel where each tide might lay down a thin lamina. In one auger these laminae were aligned vertically down the core for a 0.3m section indicating the erosion and collapse of a sediment block and its subsequent burial at right angles to its original plane of deposition. These deposits clearly indicate that Fiskerton lay near the landward limits of the Witham estuary in the late Neolithic/Early Bronze Age and agree with the model produced by Waller (1994) who shows evidence for a marine transgressive phase in the Fens between 4100 and 3700 BP. Waller (1994) assumes a marine/freshwater boundary at –1m OD which is broadly consistent with the data from the auger survey. The marine silts at Fiskerton are not extensive, as they are further east in the valley, but confined within a fairly narrow area, but aerial photographs of the southern half of the valley immediately south of Fiskerton suggest that a much broader area could have lain within the inter-tidal zone south of the modern river.

Some of the grey clayey silts and silts in the sequence at levels above and below the –1m OD mark may derive from saltmarsh environments where the laminated sediments so characteristic of the main intertidal zone do not form. The recognition of these sediments as saltmarsh rather than freshwater sediments is not possible from the auger cores and hence we have no clear picture of where the marine/freshwater junction occurs in each borehole. In auger 1 of ET3 the upper part of a reed peat at –1.395m OD has been dated to 4018±30 BP (OxA – 12870) which probably reflects the fringing of the tidal estuary with reed beds and a woody peat from the 2001 excavations at –1.4m OD and dated to 4310±80 BP (Beta – 181491) suggests alder carr formation behind the reed beds. In this last core (NE- 2001 excavations) the site becomes wetter, a reed peat has developed by 4110±70 BP (Beta 189490) and above this at –1.08m OD a very silty reed peat indicating open water with perhaps some brackish elements (Scaife 2004) is dated to 3980±80 BP (Beta 189489).

Above –1m OD there is an episode during which grey silts and reedy grey silts are deposited across much of the south eastern area of the site. By this time the tidal channel has filled and the contemporary river has either become a large broad lowland

channel receiving little marine sediment, although still tidal, or the main river channel has moved south and this area has become a fen mere occupying the course of the old channel. The picture seems fairly consistent and appears to indicate a low energy depositional environment in open water with dispersed reeds but no dense reed beds that might form reed peats. There are no radiocarbon dates for this episode from the auger survey but in the dated sequence from the 2001 excavations radiocarbon dates indicate a range from 3980 to 3580 BP for these deposits. At the extreme western end of the site in Western Transect 20 contemporary deposits were recorded in auger 1. In contrast to those at the eastern end of the site the sediments in WT20 auger 1 are composed of organic silts, peaty silts and shell rich organic silts indicating that they probably lie in, or on the edges of, the channel of the river. A radiocarbon date of 3616±34 BP (OxA – 12919) on a lump of alder wood at –0.5m OD suggests that this was the early Bronze Age river channel, while the contemporary deposits at the eastern end of the site may have lain beyond the immediate influence of the channel.

These deposits were followed by a period of 'drying out'. Most of the cores show a sequence of reed peats, followed by fibrous peats and finally wood peats. What is interesting is that it is during this period that the dry northern floodplain of the Bronze Age river first becomes flooded and waterlogged. This event, the waterlogging of the northern floodplain, has been dated at two locations. In auger 3 of ET17 (Fig. 9) narrow roundwood of alder collected at 0.513m OD has been dated to 3409±34 BP (OxA-12918), the early Bronze Age, while the floodplain in the western half of the site, which lies a little higher, has produced a date of 3057±32 BP (OxA-12920) on alder roundwood in WT15 auger 2 found at 0.83m OD. This part of the site probably remained largely free of waterlogging until the middle Bronze Age. The first development in both of these areas when they became wet is evident from the woody peats that overlie the palaeosol and indicate the formation of a wet alder woodland. Up until the early and middle Bronze Age this northern floodplain of the river was available for occupation and agriculture. The tops of the old river levee at heights above 1.5 and 2m OD may have remained above the waterlogged, marshy and alder carr surroundings for sometime. No samples were taken for dating during this project from the highest deposits largely because they occur in the modern soil and would therefore be unreliable but 3.4 km upstream at Greetwell two dates were obtained from a deflated organic deposit overlying the sand levee at a height of 1.3m OD (Rackham 2004). The organic element, other than bark and bone, in this deposit had completely degraded and the deposit must originally have been considerably thicker.

The dates of 2940±60 BP (Beta 184263) and 2670±50 BP (Beta 184262) obtained on bark and a red deer bone indicate that the organic sediments had covered this levee by the middle to late Bronze Age. It is not unreasonable to assume that the sand banks and terrace edge now visible at Fiskerton were likewise covered and buried by organic sediments in the middle to late Bronze Age and the whole of the surveyed area ceased to be available for any permanent occupation sites, or for the construction of burial monuments.

Figure 10

Western Transect no. 15

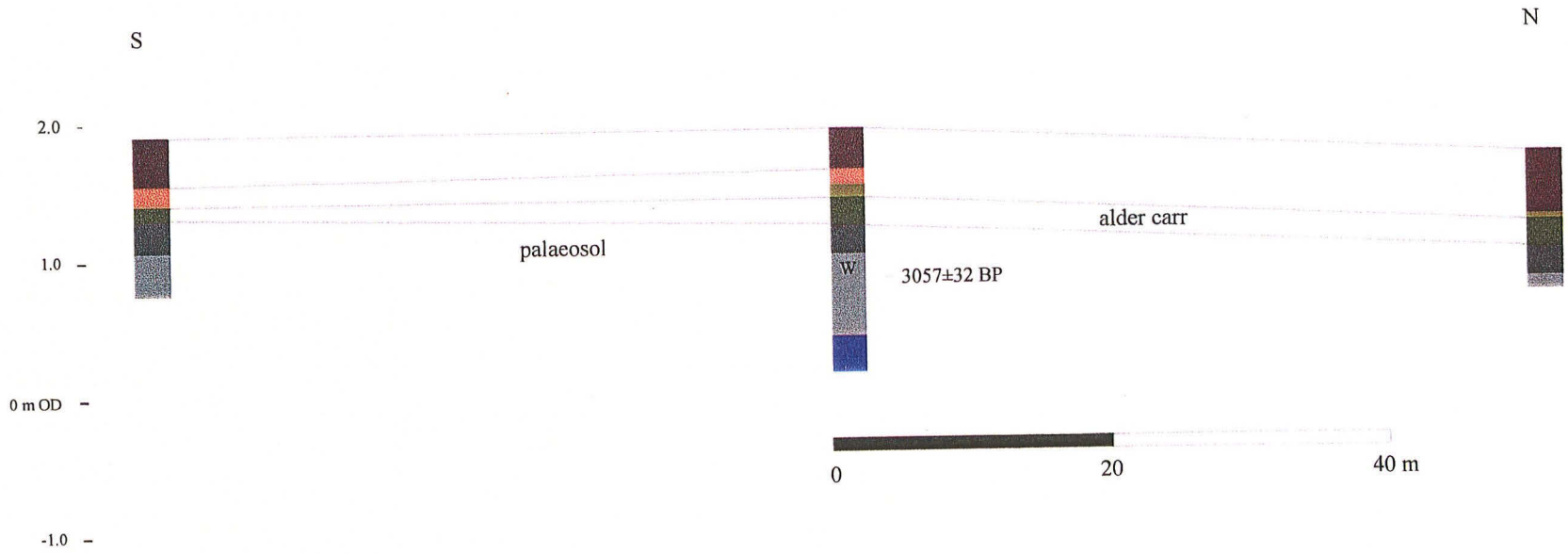
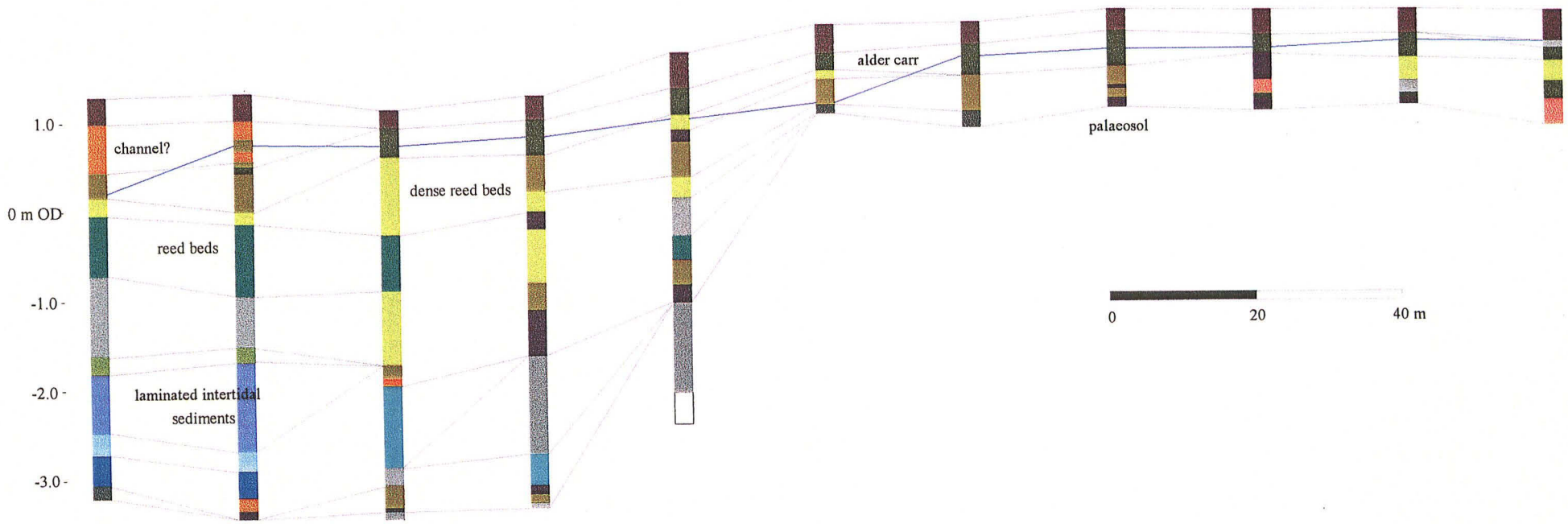


Figure 11

Western Transect no. 20

Figure 12

Transect along the east side of the causeway



While the floodplain and levee of the ancient river was becoming waterlogged and covered by alder carr and marshes the lower ground at the eastern end of the survey area was still under water. In the dated core (ET3 auger 1) a reed peat formed over the grey silts and a sample taken at 0m OD produced a date of 2945±32 BP (OxA-12869) contemporary with the organic deposits forming over the sand levee as much as 1.5m higher at Greetwell. The site continued to dry out and the reed peat changed to fibrous peat and finally into a wood peat as the alder carr expanded out into the valley. Variations in the sequence in each auger suggests that wetter areas and reed beds continued to the north of this alder carr with reed peats still occurring in ET auger 3 at 1.28m OD, before finally being replaced by a woody peat. In most of the cores in the eastern half of the site this woody peat immediately underlies the ploughsoil and in several cores has actually been incorporated into the ploughsoil. This is clearly evident from the scatter of oakwood fragments visible on the surface across several areas of the site. The top of the sequence has been dated at two locations. On the low ground at the south end of Eastern Transect 3 round wood of alder/hazel at 0.795m OD in the dated core ET3 auger 1, at a depth of 40-45cm below modern ground surface, from a shell rich organic silt deposit has produced a date of 2669±30 BP (OxA-12868), while peat and humin and humic fractions from a depth of 24-30cm below modern ground surface in ET5 auger 4 at an OD height of 1.731m has yielded a date of 1572±27 BP (OxA-13080) marking the most recent dated sediment in the project. This latter sample is very shallow and although taken from a black humified horizon below the disturbed topsoil it may not be as reliable as the other samples dated in the project. Nevertheless late Iron Age dates have been obtained from shelly organic silts in the upper layers of the sequence above the Iron Age Causeway in the 2001 excavation (Rackham in prep.) and the survival of some of the later peats and wood peats in places across the site is not unexpected. This date (OxA-13080) when calibrated represents an age of AD 420-560 and must represent perhaps the latest surviving organic sediment on the site. The bulk, if not all of the Saxon and medieval deposits that formed across the site will have been lost over the last few hundred years as a result of drainage and cultivation of the land, and probably much of the late Iron Age and Roman deposits.

However on the lower areas another and clearly later feature is visible. This is a channel filled with shell rich organic silts. Its precise location is difficult to plot since it was not recognised in every transect but it appears to follow the course of a field dyke and possibly the parish boundary. It was clearly present in ET5 and ET 8 and it may occur in the position of auger 1 in the transect along the east side of the causeway and in ET3 (Figs. 6, 7, 8 and 12). It may also have been present in ET1 auger 1, ET2 auger 1, ET6 auger 3, ET9 auger 2, ET10 auger 2, ET11 auger 2, ET12 auger 2 and ET14 auger 1. In all these cores the upper deposits were characterised by organic silts, generally with shell fragments and occasionally brick or tile fragments in the upper 0.5 metres and contrasting with the reed peats present in other cores. A scatter of oyster shells over the surface of the field between eastern transects 9, 10 and 11 along the line, and immediately south, of auger 2 in each transect also suggests the presence of a later feature than the other deposits in the area. What is presumed to be the same channel feature was clearly visible in 2001 about 150 metres west of the causeway after cleaning of the south bank of the north delph. A cut or channel approximately 20 metres wide and infilled with organic silts and sediments was clearly visible in the section. Unfortunately no deposits were collected from this feature during the auger survey and it remains undated although it appears to cut all

the surviving organic sediments in the sequence and appears to follow the line of the parish boundary which might suggest it was visible at the time the boundaries were first demarcated, perhaps as early as the Saxon period or even earlier. It is possible that this channel was picked up in the western half of the 2001 excavation and a radiocarbon date from the upper shell rich silts at 1.2m OD in a channel feature on the west side of the causeway has produced a date of 2100±60 BP (Beta 189499) indicating a late Iron Age date for the sediments at this level.

In the causeway section (Fig. 12) and ET3 the southern auger holes produced a shell rich humified organic iron stained silt immediately below the ploughsoil. This deposit was recorded in the 1981 excavation, at the top of the sequence in the 2001 excavation and in many of the auger holes in the eastern half of the western transects. If these are the same deposits and correlate with the shell rich layer described by Whiteman and MacPhail (2003) then there may be a problem with the dating since Roman pottery sherds were recovered both from this layers and deposits below it in the 1981 excavation (Field and Parker Pearson 2003) and also in the 2001 excavation. This would suggest a later date than the late Iron Age but it is probable that the correlation of this layer is misguided since it almost certainly represents a partially deflated organic sediment in which the shells and mineral component have become concentrated and may not be a uniform deposit across the area in which it was recorded.

The late Iron Age/early Roman period appears to be the top of the sediment sequence immediately below the ploughsoil, with perhaps isolated patches of later sediment still surviving. The bulk of all later periods must have been lost from the sequence as a result of drainage, peat shrinkage, deflation and agriculture. That this appears to have been fairly severe is anecdotally recorded by the tales of the recovery and burning of numerous log boats during the Second World War when this area was first ploughed and by the dating of a peat deposit that covered a palaeosol with Bronze Age flint work immediately north of the survey area at an OD height of approximately 4m. This deposit yielded a date of 2140±60 BP (Beta 125858) (French and Rackham 2003) suggesting that late Iron Age peats had extended up the sides of the valley to the 4m contour. If this is so it is evident that at the time of the construction of the Iron Age causeway all those topographic features now visible within the survey area were covered by organic sediments and the course of the causeway is more likely to reflect the contemporary purpose of the structure than any aspect of this now visible topography. This date also suggests that the deposits within the survey area have shrunk and compacted, which is likely to have been differential depending upon the depth of underlying post-glacial sediments, and the unconsidered use of OD heights for linking deposits across the site could easily lead to errors.

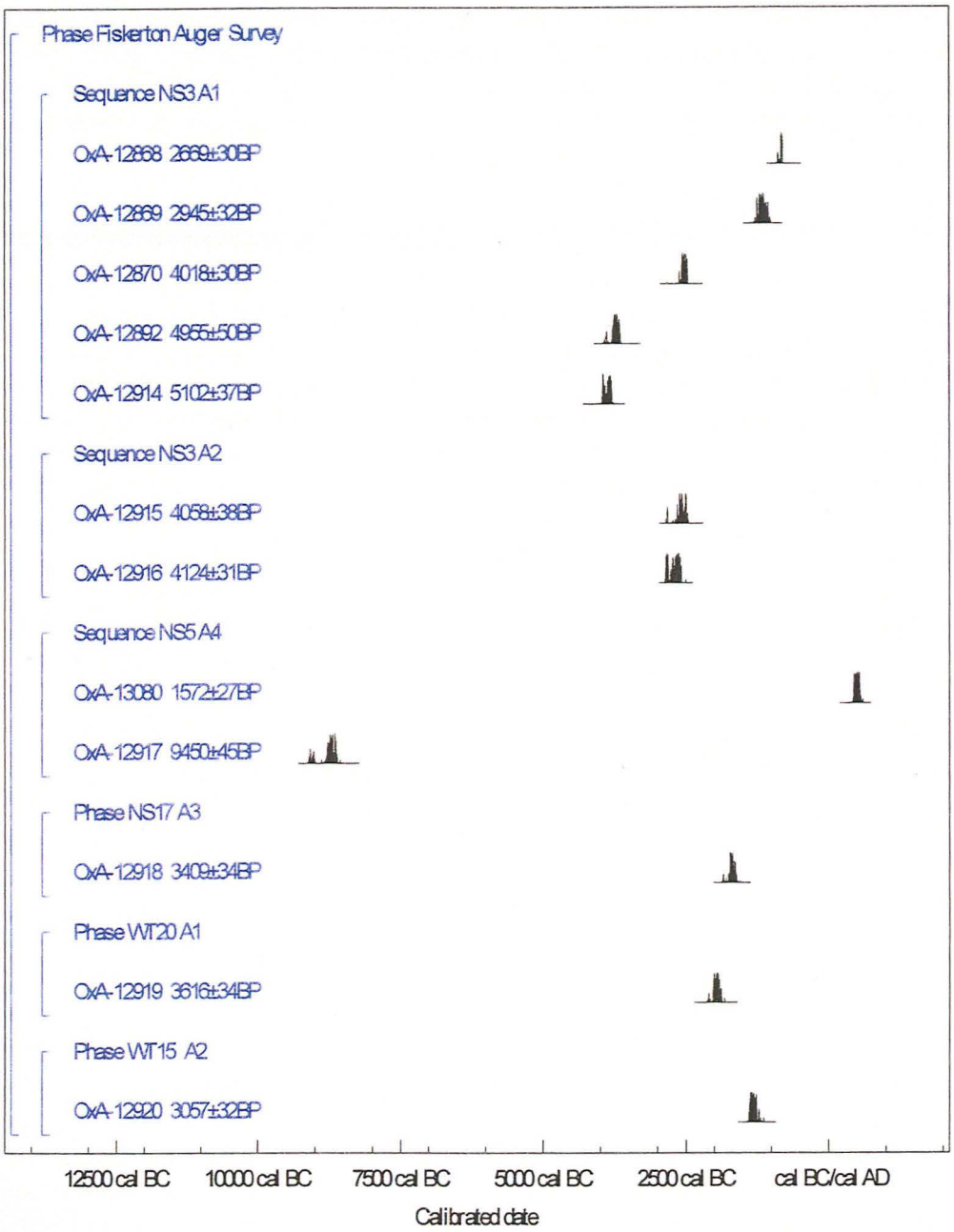
Radiocarbon Measurements
Peter Marshall

The samples were processed at the Oxford Radiocarbon Accelerator Unit, University of Oxford, and measured by Accelerator Mass Spectrometry (AMS), according to the procedures described by Bronk Ramsey and Hedges (1997) and Bronk Ramsey *et al* (2000).

Table 1. Fiskerton Augey Survey Radiocarbon results

Laboratory Number	Sample Ref.	Material	Radiocarbon Age (BP)	OD height	$\delta^{13}C$ (‰)	Calibrated date range (95% confidence)
OxA-12868	NS3/A1/40-45	wood, *Alnus glutinosa/Corylus avellana;* roundwood, diam. 5mm	2669±30	0.795	-26.6	900-790 cal BC
	NS3/A1/90-95	wood, *Alnus glutinosa*; twig, diam. 2mm	failed due to poor yield	0.305		
OxA-12869	NS3/A1/120-125	herbaceous monocotoyldon stem	2945±32	0	-27.7	1290-1010 cal BC
OxA-12870	NS3/A1/262	wood, *Alnus glutinosa*; roundwood, diam. 4mm	4018±30	-1.395	-27.4	2620-2460 cal BC
OxA-12892	NS3/A1/367-72	wood, *Alnus glutinosa*	4955±50	-2.475	-29.0	3940-3640 cal BC
OxA-12914	NS3/A1/400	wood, *Alnus glutinosa*; roundwood, diam. 5mm	5102±37	-2.775	-27.6	3980-3790 cal BC
OxA-12915	NS3/A2/334	bark; unidentified	4058±38	-2.172	-24.9	2860-2470 cal BC
OxA-12916	NS3/A2/425	wood, *Alnus glutinosa*	4124±31	-3.082	-26.1	2880-2570 cal BC
	NS5/A4/24-30	peat, humin & humic fractions	failed due to poor yield	1.731		
OxA-13080	NS5/A4/24-30	peat, humin & humic fractions	1572±27	1.731	-27.0	cal AD 420-560
OxA-12917	NS5/A4/653-658	bark; small & degraded	9450±45	-4.559	-28.1	9110-8600 cal BC
OxA-12918	NS17/A3/134-139	wood, *Alnus glutinosa*; narrow roundwood, diam. 3mm	3409±34	0.513	-27.5	1870-1620 cal BC
OxA-12920	WT15/A2/100-115	wood, *Alnus glutinosa; roundwood*	3057±32	0.83	-28.1	1410-1130 cal BC
OxA-12919	WT20/A1/190-200	wood, *Alnus glutinosa*	3616±34	-0.498	-27.6	2130-1830 cal BC

Figure 13. Probability distributions of dates from Fiskerton Auger Survey: each distribution represents the relative probability that an event occurs at a particular time



The results are given in Table 1 and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

The calibrated date ranges and probability distributions for the samples have been calculated using OxCal (v3.5) (Bronk Ramsey 1995; 1998) and the usual probability method (Stuiver and Reimer 1993), with ranges quoted in the form recommended by Mook (1986) and end points rounded outwards to 10 years. The results have been calibrated using data from Stuiver *et al* (1998).

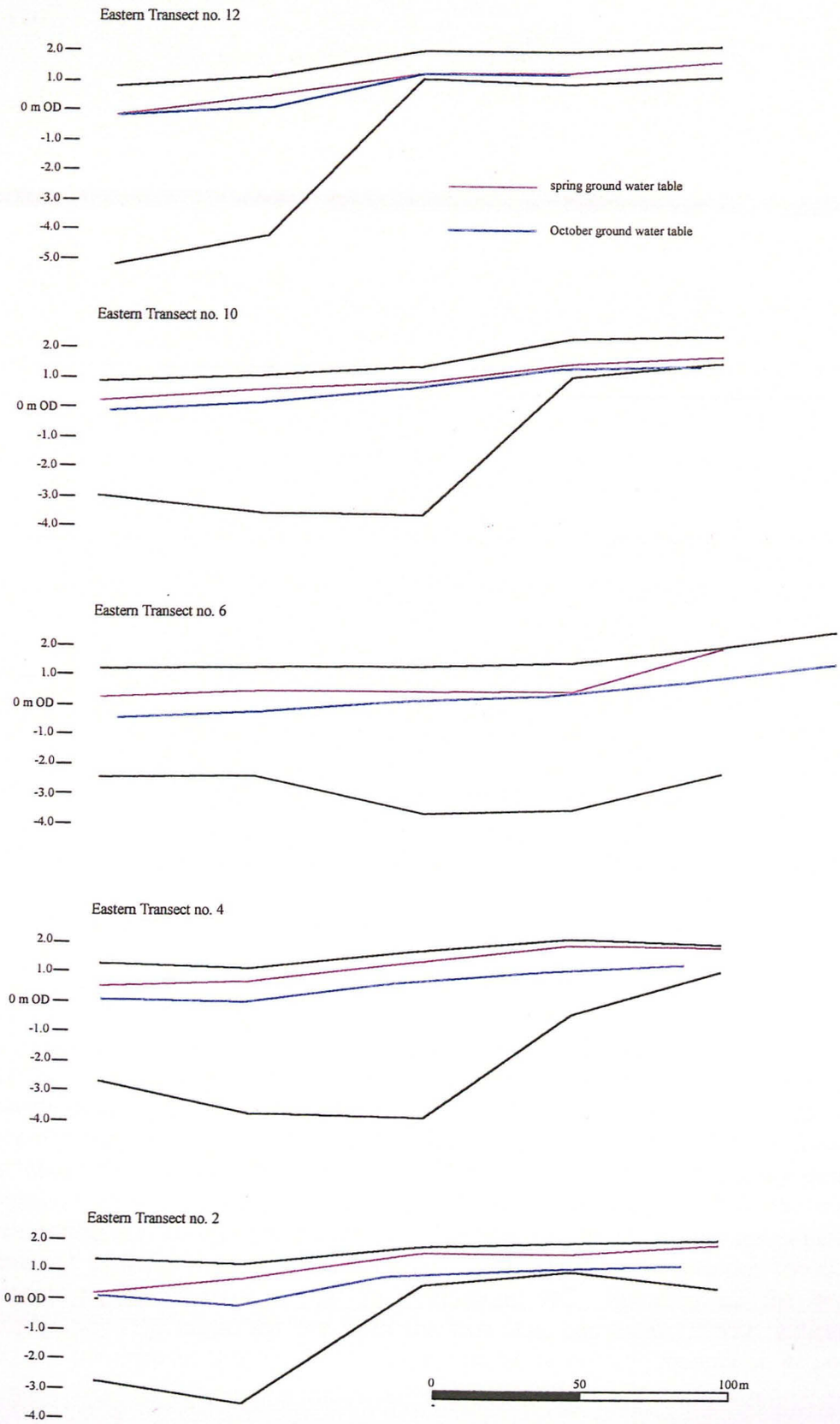
Ground Water Table survey

Part of the project was concerned with the preservation environment on the site and to fulfill this the ground water level was measured in all the auger holes undertaken. A second series of auger holes was sunk in October in the eastern half of the survey area (Fig. 2) to measure the ground water table after a very dry summer. At the time these were sunk there had been no rain at Fiskerton for at least two months, and very little for four months. The auger survey of the eastern half of the site was conducted over several months, the causeway section and ET 1-7 being undertaken between January and March, ET 8-18 in April and all twenty of the western transects in June and July. In the latter all the auger holes were dry when augered through the whole depth of the post-glacial sediments except for a single auger hole in WT20 (Fig. 11). The auger holes sunk in October in the eastern half of the survey area were undertaken over two consecutive days.

The results are plotted as a series of sections for five of the transects (Fig. 14), sufficient to illustrate the general pattern for the site. During the main period of augering the ground water table varied from a deepest record of 1.13m below modern ground level to the shallowest of 0.09m. The water table was appreciably lower adjacent to the north delph where the upper metre of deposits were generally 'dry'. The ground water was shallowest at the north western half of the eastern survey area where the land lies in a small hollow and clays occur at a shallow depth beneath the sands. In wet winters this area has standing water, as does the low lying ground in the south centre of the eastern survey area. A contour plot of the ground water table in the eastern half of the site is presented in Fig. 15, but it should be remembered that these data were collected over a period of weeks. The plot shows the water table dropping in real terms (OD height) southwards but it also broadly follows the sub-surface and present day topography, becoming deeper relative to the modern ground surface towards the north delph. In Fig. 14 the water table in October is compared with the late winter and spring data. In Eastern Transects 2, 4 and 6 which were undertaken in January and February the October data shows a drop, on average of 0.585m with a minimum of 0.1m and a maximum of 1.0m. In Eastern Transects 10 and 12 which were augered in April the drop between April and October was on average 0.20m with a maximum of 0.38m and a minimum of zero. This discrepancy appears to be largely attributable to the augering being done later in the spring. In very wet winters the water table may be at ground level or even above over quite a large area of the eastern half of the site, at the end of a dry summer and autumn like last year (2003) the ground water table can drop to nearly 1.5 metres depth in places.

Figure 14

Comparison of the spring and autumn ground water tables in the eastern half of the survey area



Recent data collected from the monitoring points along the line of the causeway (Jim Williams pers comm.) show a 0.97 metre difference in the depth of the water table between November 2003 and January 2004.

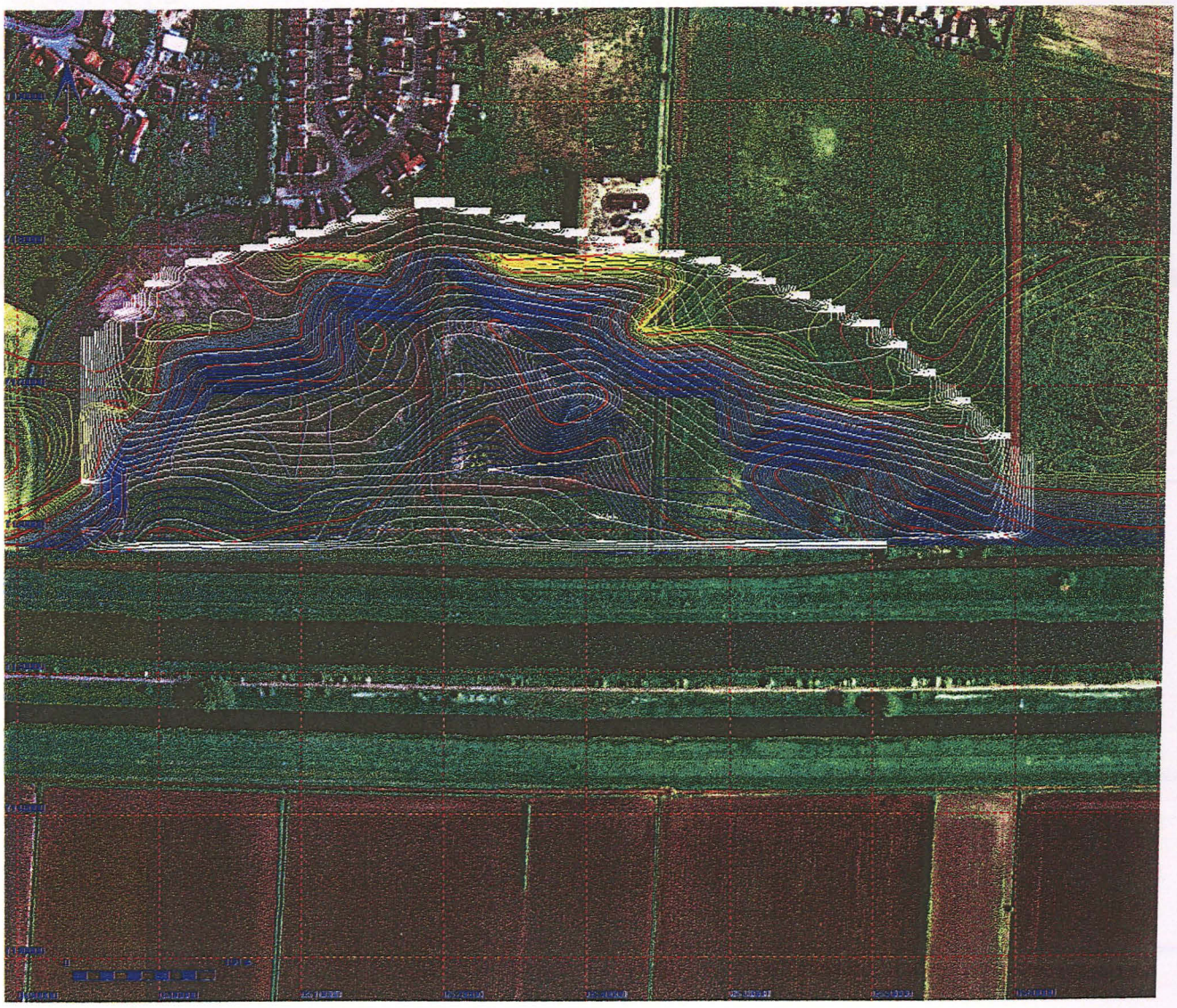


Figure 15. Subsurface topography overlain with the water-table depth

The impact of these seasonal changes is evident in the deposits in the eastern half of the survey area. The upper peats are black, oxidised, humified and degraded to the point that only bark and some oak wood survives in recognisable form. The deposits are so degraded that it is not always possible to tell whether these deposits were woody peats or fibrous peats. This evidence of degradation is apparent in the deposits to a depth of at least 0.5m, with a less marked, but still apparent degradation below. At about 0.75m depth the condition of the deposits is good and they oxidise on exposure to air although the ground water levels established from the causeway monitoring and in this survey indicate that this is unlikely to be maintained if the seasonal variation continues on this scale. In this part of the site this top 0.75m of deposit represents most of the last millenium BC, including all the horizontal stratigraphy that might survive from the Iron Age causeway. It also indicates that most of the deposits that overlie the floodplain of the ancient channel on its north side

both in the eastern, and particularly the western, areas of the site are already undergoing degradation. Probably it would now be very difficult to recognise any post middle Bronze Age structures or trackways except where vertical posts survive in the deposits below.

The North Delph

The north delph was walked on two occasions, the later after the delph had been cleaned out. Possible structural remains were observed at three points but it cannot be ruled out that the timbers seen were natural.

1. On the north bank of the delph between ET15 and ET16 a large timber was observed lying horizontal at the base of the bank, jutting out into the delph. A flat top to the timber indicated that it may not be a collapsed tree trunk.
2. In the delph on its south side between ET12 and ET13 two adjacent vertical timbers were observed protruding from the floor of the delph.
3. Several metres further west between ET11 and ET12 a third timber was observed protruding vertically through the water in the delph.

No other timber features were observed during this study, although the water level in the delph was quite high and features may have been obscured.

Most of the western half of the delph within the survey area cut through glacial sands and no waterlogged timbers were observed. At the extreme western end of the survey area the gravels underlying the sands were exposed during a period of low water in the delph between WT17 and WT19 before the sand levee dropped westwards down into the channel at this end of the site. On the south side of the delph immediately west of the survey area the trunk base and roots of a small *in situ* tree was observed just above the low water level in the delph.

Discussion

The data collected during this survey has not yet been fully exploited and further work is intended on the modelling and its display, and a more detailed consideration of the spatial extent and OD height of the various sediments recorded in the auger holes. Further work could also be easily recommended to further elucidate the sequence at the site and the chronology of the channels recognised.

Nevertheless the survey has fulfilled its objectives in identifying the ancient topography of the site, its broad environmental history, those areas of potential archaeological importance and the problems of preservation of the known and unknown archaeology of the site.

A sealed and preserved mesolithic landscape may lie beneath later alluvial sediments in the south eastern part of the site south of the early river channel identified. This horizon is likely to extend beneath the modern delphs and river and possibly southwards across the floor of the contemporary valley. The waterlogged conditions that were responsible for the valley filling up with post-glacial silts and peats had already started in the mesolithic period, although whether due to changes in sea level or more local changes in the valley is not known. One radiocarbon date at the base of one of the deepest sequences within the channel suggests that the river identified was already in existence on this course in the early mesolithic period, but there is a marked

gap in the dated sequence (Fig. 13) between the early and late mesolithic periods. This gap reflects the period when the floodplain south of the palaeochannel was dry, and any contemporary sequences will be restricted to channel fills.

Once this low plateau became waterlogged and alder carr or marsh had developed the area south of the channel was no longer suitable for settlement or terrestrial activity, although the area may still have been exploited for its natural resources, such as reeds, wood and wildlife. Archaeological evidence in this area is likely to be fortuitous and rare, athough any occupation sites may have been preserved beneath the later deposits. The marine incursion reflected by the laminated intertidal sediments cutting deposits in the earlier channel and probably eroding its margins implies a major change in the character of the valley at this time, from a largely terrestrial and wetland environment to a major estuarine environment with little likelihood of archaeology occuring south and east of Fiskerton at this time as the valley floor fills up with marine silts. The limited extent of these deposits in the auger holes implies that the site lies at or near the landward limits of the estuary, with a probable margin of saltmarsh.

In contrast to this low plateau the floodplain to the north of the palaeochannel, at a somewhat higher level was available for settlement right up to the Bronze Age and the natural sand levee would have formed a pronounced landscape feature, which may have in part been responsible for its selection as a site for barrows on the valley floor. As local water levels continued to rise the lower parts of this floodplain became water logged and developed alder carr and marshy environments from the early Bronze age, with the higher floodplain and the levee remaining above the marsh until the late Bronze Age. The high point of the glacial and levee sands at the western end of the survey area and its continuation southwards under the present delphs and rivers may well have formed an island in the marsh on the valley floor in the middle to late Bronze Age. At this period continued access to these sites may have been maintained across timber trackways through the marsh. By the late Bronze Age or early Iron Age it is probable that the whole of the prehistoric terrestrial landscape on the valley floor was buried by wetland deposits. This must have been much more extensive than just the Fiskerton survey area and indicates that a relatively undisturbed Bronze Age and earlier landscape lies beneath the silts and organic sediments in this part of the valley. From this time onwards, as the organic sediments continued to build up across the landscape the archaeological evidence in the area is likely to be limited to activities associated with such a landscape, like the causeway to get access to the river, the log boats that were unearthed during the war-time cultivation of the area and the deposition of ritual objects in the river or wetland.

The removal of, apparently, many logboats from the site, the exposure of the timber posts of the trackway during ploughing twenty years ago and the increasing exposure of barrow mounds that have been buried for thousands of years indicate that most of this archaeology is not just under threat, but may already have been destroyed. A fluctuating water table that seasonally drops well below the present level, between 0.5 and 1.0m OD, of the horizontal stratigraphy of the Iron Age causeway immediately north of the delph is clearly exposing the organic components of this stratigraphy to eventual destruction. The condition of the organic sediments on the floodplain north of the ancient channel is very degraded, for all but their very base, although in the western half of the site even these are heavily humified and degraded. It is quite

possible that the trackway in this area may only be represented by the vertical posts and the horizontal stratigraphy may already have been ploughed away or degraded beyond recognition. Not only is this Iron Age archaeology under threat, but with all of the post-glacial organic deposits in the western half of the site above the ground water table from April through the summer months, and those in the eastern half also effected, any Bronze Age or earlier archaeology that survives beneath the later peats is itself under threat, or at least its organic component.

The radiocarbon dates from this survey and the 2001 excavations, suggest that there is probably no surviving horizontal stratigraphy that post-dates the early Roman period in the area of the trackway. This is probably true for the rest of the site, although it may survive beneath the present river banks or in isolated patches.

Finally at the extreme western end of the survey area the sand levee of the prehistoric river, upon which a range of archaeological evidence has been recorded (barrows and flint scatters, areas of burning, etc), the prehistoric ground surface is already being truncated by ploughing (Fig. 11). This is occurring within the survey area and in the fields to the west and being sands, and raised above the surrounding ground, these are likely to deflate rapidly under continued ploughing. The results for this western end of the site also indicate that the archaeological significance of the Bronze Age and early Iron Age finds from Washingborough on the south side of the river (Coles *et al* 1979; Field and Parker-Pearson 2003) need to be re-evaluated. Coles *et al* assumed that the scatter of Bronze Age or early Iron Age finds in a waterlain environment, by the Washingborough pumping station were likely to have been washed in from the south-west. Recent work, however, carried out on behalf of the Environmental Agency adjacent to this site, indicates that it lay on the southern downslope side of the north bank of the Bronze Age River Witham which lay immediately to the north and east (Rackham 2004). It probably accumulated and derived from a site or 'settlement' on the raised levee of the north bank and slipped or was discarded downslope into the river margin deposits. The pottery and flint scatters recorded by the Washingborough Archaeological Group (WAG) during fieldwalking in the fields to the east of the pumping station, probably lie in a similar context along the downslope river edge of the contemporary north bank of the Witham and a similar position on the south bank. The scatter WAG recorded as Field 13 (see Field and Parker-Pearson 2003) may well lie on the south bank and a second scatter (Field 31, TF 0435 7120) has a grid reference consistent with it lying also on, or adjacent to, the south bank of the ancient river in this area. These latter two sites and that recorded by Coles *et al* if contemporary, must have faced each other across the contemporary river which could have been some 200-250 metres wide at this point, including its marshy margins. The evidence for post alignments in this area could well equate to structures designed to allow access to the main channel and ferry points across the river, and this location is likely to have been one of the lowest convenient points to cross the river in the late Bronze Age.

The present work also allows us to briefly correct the earlier conclusions drawn by Wilkinson (1987) from a preliminary survey of the palaeoenvironments of the Upper Witham Fen as far as Lincoln. The sand islands Wilkinson notes as part of an irregular sand and gravel buried valley floor, rather than relict creek systems, are in fact largely the sand levees thrown up by the post-glacial river. The 'sand island' he notes c. 150 metres south of the causeway at Fiskerton is probably the south bank of

the ancient river at this location, although this has not as yet been verified by augering. Field and Parker Pearson (2003) quote Wilkinson as the source for the development of peat in the Witham Valley from about 1000 BC, although the latter article records only the dates of peats from downstream at Woodhall Spa between 4200 and 3600 years BP (Valentine and Dalrymple 1975; also see French and Rackham 2003). We can see from the results of the present project that peats begin developing on the floor of the valley as early as the late mesolithic period, while even earlier organic deposits had formed in the river channels. With a rising water table in the valley these peats and other sediments continued to build up throughout the last 4000 years BC and probably through much of the last two millennia.

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