Oxford Flood Alleviation Scheme

Geoarchaeological Assessment Report

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Oxford Flood Alleviation Scheme (FAS)

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Summary

Between August and October 2016 Oxford Archaeology (OA) undertook a geoarchaeological investigation associated with the proposed Oxford Flood Alleviation Scheme (FAS). The work was commissioned by Mackley on behalf of the Environment Agency (EA).

The investigation focused on the footprint of the combined channel options between Botley Road and Old Abingdon Road, located across the floodplain meadows west of Oxford City. 91 interventions were carried out that included hand auger transects and boreholes, accompanied by an Electro-magnetic (EM) Conductivity Survey. The primary purpose of investigation was to provide additional baseline data on the nature and archaeological potential of the sedimentary sequences. This work builds on an initial stage of deposit modelling associated with a programme of geotechnical works in 2015.

The floodplain stratigraphy is broadly consistent with the previous work. However, the additional interventions have allowed gaps in the distribution of the dataset to be filled, providing a more comprehensive coverage of the route. Assessment of pollen, plant remains and molluscs, together with a programme of range-finding radiocarbon dates, have allowed comment to be made on the environments of deposition and provide an indicative chronology for the sequences.

Overall minerogenic silt clay alluvium over gravel was recorded at most locations averaging 1.0m to 1.5m in thickness, although shallower deposits at 0.50m to 0.70m were noted, particularly at the western edge of the floodplain between the Hinksey villages. This alluvium is likely to be largely of historical date. No extensive floodplain peat deposits were recorded. However, localised organic units were noted at several locations, the deepest and most complex of which generally coincide with areas adjacent to current watercourses such as the Seacourt, Hinksey and Bulstake streams. Here, relict channel courses reach c 2.5m to 4.0m in depth. Radiocarbon dating suggests these channels were active at least from the Mesolithic period at c 6000 cal BC and deposition continued into the Late Bronze Age. Of note is the frequent occurrence of coarse-grained facies eg. gravelly sands and silty sands, suggestive of episodes of moderate to high energy flow, particularly in the lower parts of the channel sequences. The palaeoenvironmental signature strongly suggests the presence of sedge-fen and alder carr locally with more open conditions developing in the later prehistoric period, coinciding with evidence for agricultural activity. Previous archaeological investigations in the region have found that some extant watercourses linked to the main Thames channel may be located within the footprint of earlier wider silted up channels, perhaps dating back to the end of the last glacial period and beginning of the Holocene (c 12,000 years) eg. the proto- Trill Mill Stream and proto- St Aldates channel in Oxford City, the latter of which also produced Mesolithic dates at c 6300 cal BC at Luther Court.

Thin organic deposits at the base of the alluvium over Pleistocene gravel were noted at a few locations on the general floodplain between North and South Hinksey These do not appear to be associated with extant channels and were recorded at shallower depths than described above and may represent seasonal pools or channels.

No significant thicknesses of modern made ground were recorded across the floodplain, although extensive deposits are known to be present around Redbridge. South of the Old Abingdon Road these are associated with historical landfill sites where ground elevations have been raised by 2-3m above the floodplain surface.

Based on the results of the investigation, ten contrasting geoarchaeological zones have been identified along the route. These zones address the perceived archaeological and palaeoenvironmental potential of the sediment sequences and are intended to inform future evaluation strategies.

1 Introduction

1.1 Project details

1.1.1 In July 2016 Oxford Archaeology (OA) were commissioned by JT Mackley & Co Ltd (Principal Contractor) to carry out a geoarchaeological investigation along the route of the proposed Oxford Flood Alleviation Scheme (FAS).

1.1.2 In order to reduce the risk of flooding in Oxford, it is proposed that a flood alleviation scheme will be developed to the west of the city. The scheme will involve widening and deepening of existing watercourses, creating a new watercourse and the construction of flood embankments and walls. In combination, these measures will divert flood water from areas of the floodplain where it currently causes disruption.

1.1.3 An archaeological desk-based assessment (DBA) has been prepared across the wider study area (OA 2016a). The geoarchaeological investigation is intended to provide additional base-line information on the depth and nature of the sub-surface quaternary stratigraphy and its archaeological potential along the western conveyance route. This information will feed into the Environmental Impact Assessment and be used to determine whether intrusive archaeological investigations are required.

1.1.4 The scope of the geoarchaeological investigation was prepared by OA and CH2M on behalf of the Environment Agency. The investigation adopted a staged approach which included a series of auger and boreholes combined with an electro-magnetic (EM) ground conductivity survey in order to map the patterns of sediment accumulation at selected locations along the route to a depth of up to *c* 4m. The intention was to provide an updated deposit model, building on previous work carried out in 2015 (OA 2016b), supported by a programme of radiocarbon dating and palaeoenvironmental assessment.

1.1.5 A Written Scheme of Investigation (WSI) was prepared by OA (2016c) and approved by Richard Oram (Oxfordshire County Council) and Jane Corcoran (Historic England Regional Science Advisor).

1.2 Location and geology

1.2.1 The western conveyance route starts near Botley Bridge to the north and finishes south of Redbridge, covering a length of approximately 5km (**Figs 1-5**). The route predominantly traverses areas of low-lying Thames floodplain meadow, criss-crossed by streams, drainage ditches and hedgerows. BGS mapping of the area records predominantly Holocene alluvium, overlying Pleistocene river gravel of the Northmoor Floodplain Terrace, deposited towards the end of the last (Devensian) glaciation. Localised or discrete areas of made ground or disturbance are known to be present from a limited number of historic boreholes in the vicinity of the route, frequently adjacent to roads and trackways. Modern landfill areas are located on the outskirts of Kennington.

1.3 Geoarchaeological background

1.3.1 The following is a summary of the general landscape development relevant to the route, much based on the seminal work of Robinson in Dodd (2003).

1.3.2 In the late Devensian (at the end of the last Ice Age, c 10,000 BC), minor and rapidly shifting channels reworked part of the first Thames terrace and lowered it to create the undulating gravel surface beneath the modern floodplain. There is no evidence of significant Holocene (post-glacial) reworking of the floodplain gravels which, together with evidence of major late Devensian channels at Farmoor and Yarnton, suggests that river flow became restricted to channels eroded to their greatest extent before or during the early Holocene. Recent and ongoing investigations by OA at the Westgate Centre (E. Stafford pers com) and Luther Court (OA 2015), however, suggest locally in-channel gravel mobilisation occurred periodically, possibly during periods of high river discharge. Both sites are located immediately adjacent a steep rise in the second gravel terrace which may have been vulnerable to some undercutting and erosion.

1.3.3 The early changes on the floodplain are almost certainly related to climatic change, and the timing and duration of snow-melt at the end of the last glaciation. Initially, as the annual volume of melt-water increased, erosion outstripped accumulation of the floodplain gravels. The surface of the first gravel terrace which became the floodplain was therefore lowered. As the climate warmed and the snow melt was increasingly concentrated in the spring, the high volumes of melt water incised major channels within the gravels. When the climate had warmed further, melt-water discharges reduced, leaving excess channel capacity for the warmer temperate climate. As a result many underused channels silted up or were cut off from the main channel flow.

1.3.4 Organic and peat deposits dating to the earlier prehistoric period are rare in Thames floodplain locations and are mostly restricted locally to abandoned former channel courses, backwaters and tributary valleys. In the Oxford area peat has been recorded filling a deep E-W palaeochannel of the Thames in the vicinity of St Aldates (BT Tunnel and Luther Court) dating to the Mesolithic period (Dodd 2003; OA 2015). To the south Late Glacial and early Holocene peat sequences have been recorded at Minchery Farm, adjacent to the Northfield Brook which drains into the Thames at Sandford (Parker 2001; Parker and Anderson 1996; Parker and Preston 2015). Further afield early channel and peat sequences have been analysed at Thrupp, Abingdon (Aalto *et al* 1984), Farmoor (Robinson 1992) and Mingies Ditch in the Windrush Valley (Allen and Robinson 1993).

1.3.5 Hydrological changes during the early Holocene are difficult to establish due to the general lack of sedimentation during this period. It is clear that water levels may have been significantly lower than present day due to factors like greater woodland coverage and a lower sea level. The floodplain may therefore have been relatively dry throughout much of the early prehistoric period with only areas of localised flooding. This would help to explain the extensive prehistoric landscape features that have been identified on the floodplain at Port Meadow (Atkinson, 1942) and Binsey (Rhodes, 1949). This activity was based on dry land soils that developed on top of the floodplain gravels and were preserved under later accumulations of alluvium.

1.3.6 The original soils of the floodplain were a combination of alluvium, loess and weathering products of the gravel. By the Neolithic period, pedological processes of soil formation seem to have predominated over alluvial accretion for much of the floodplain, and only a thin soil, not necessarily of alluvial origin, covered the gravel on most of these sites. Most of the pre-Iron Age soils are ungleyed and non-calcareous; it is difficult to prove that flooding without alluviation was not taking place, but observations have been recorded of man-made dumps of limestone gravel sealing the pre-Iron Age surface of the floodplain, which would have buffered any later phases of decalcification.

1.3.7 Excavations at Port Meadow also revealed a lack of preserved organic remains or gleying in Neolithic and Bronze Age ditches, which suggests, at least, a seasonally low water-table on the floodplain. However, ditches of similar depth dating between the late Bronze Age and the middle Iron Age are known to contain both a high degree of organic preservation and gleying. This suggests that there was a rise in the water table of the floodplain from the middle prehistoric period, and this may represent the onset of regular seasonal inundation of much of the area covered by the modern floodplain.

1.3.8 Sites such as Gravelly Guy, Farmoor and Drayton, show that this alluviation was well under way in the Roman period, and organic preservation at Mingies Ditch and Port Meadow suggest a continuing rise in water table after the Iron Age occupation. Similar evidence at Drayton shows that the Roman water-table was much higher than it had been in the late Neolithic. This theory is supported by excavations at Yarnton (Hey 2004; in prep; Hey *et al* 2011) but it is uncertain whether alluviation or flooding continued in this area into the early Saxon period.

1.3.9 Many of the late Devensian / early Holocene channels were reactivated during the late prehistoric period. The excavations at Yarnton and more recently at the Westgate Centre (OA, 2007), have shown that many of these silted-up channels were re-incised. The accumulation of organic deposits overlying the gravels during this period have been shown to represent a period of rising water levels on the floodplain. Environmental analysis of these deposits has shown that they represent a reed swamp that developed within a drowned floodplain environment. These deposits continued to accumulate within areas of the floodplain into the Saxon period, whilst other areas at the lower elevations showed the first signs of clay alluviation in the post-Iron Age period.

1.3.10 The natural channel sequences of the Oxford floodplain were extensively remodelled and managed during the early medieval period. Channels became canalised and interconnected, most likely in response to the development of a network of water mills at the edges of the Oxford floodplain. At the Westgate Centre these channels were clay lined and revetted with wooden stakes.

1.3.11 The main phase of clay alluviation accumulated after the early medieval canalisation of the various streams that run through Oxford. Most of the sedimentation on the floodplain occurred during the medieval and post-medieval periods. The depth of organic preservation in later archaeological features shows that the water-table on the floodplain remained high to the present day, and historical records show that seasonal flooding continued throughout the medieval and post-medieval periods. Alluviation, however, may have decreased from the late post-medieval period onwards.

1.4 Previous geological flood plain modelling and ground investigation data

1.4.1 Several previous investigations and reports which include geological modelling of the floodplain provide information pertinent to the scheme:

- Groundwater Monitoring (BGS/EA, Newell 2007)
- Oxford Flood Risk Management (FRM) Hydrogeological Review (Black and Veatch 2009)
- Oxford Flood Risk Management (FRM) Geoarchaeological Assessment (ArchaeoScape 2008)
- Route Geology Assessment (2014)

1.4.2 The most recent phase of work included an archaeological watching brief on extensive geotechnical investigations carried out in 2015. The watching brief provided the opportunity to observe and record the floodplain sediments over much of the route and the generation of preliminary 3d plots of key stratigraphic horizons (OA 2016b).

1.4.3 In summary, minerogenic silt clay alluvium over gravel was recorded at most locations, averaging 1.0m to 1.5m in thickness. Shallower deposits at 0.50m were noted, particularly at the western edge of the floodplain between the Hinksey villages and further south at Sandford. No extensive floodplain peat deposits were recorded. The gravel surface over much of the route is higher than the area around St Aldates and Westgate where laterally extensive later prehistoric reed swamp deposits have previously been recorded. However, localised organic units were noted at several locations, the deepest and most complex of which generally coincide with areas adjacent to current watercourses such as the Seacourt and Hinksey streams, and reach 2.5m to 4.0m in depth. Previous archaeological investigations in the region have found that some extant watercourses linked to the main Thames channel may be located within the footprint of earlier, wider silted up channels, perhaps dating back to the end of the last glacial period and beginning of the Holocene (c 12,000 years) eg. the proto-Trill Mill Stream and proto- St Aldates channel in Oxford City. Thin organic deposits at the base of the alluvium over Pleistocene gravel were noted at a few locations on the general floodplain between North and South Hinksey (eg. TP275, TP278 and TP225). These do not appear to be associated with current channels and were recorded at shallower depths than described above and may represent ephemeral floodplain pools. Extensive deposits of modern made ground were noted around Redbridge. South of the Old Abingdon Road these are associated with historical landfill sites where ground elevations have been raised by 2-3m above the floodplain surface.

1.5 Archaeological background

1.5.1 A detailed desk-based assessment of the wider study area of the proposed route has been prepared (OA 2016a). The following is a summary of the archaeological baseline up to the medieval period extracted from that report, covering Botley in the North to the Old Abingdon Road in the South (the numbers quoted correspond with those in the DBA, illustrated in **Figs 2-5**). In general the Route Corridor has been subject to very little archaeological investigation, however there is a range of known archaeological features (mostly in the form of archaeological cropmarks identified on aerial photographs) and various chance findspots of archaeological material. The Route Corridor contains one (multi-part) Scheduled Monument (**2**) on the Old Abingdon Road which represents an area of surviving medieval elements of the southern extent of the Grandpont, the Norman causeway across the Thames.

Prehistoric

1.5.2 The route corridor contains some evidence of prehistoric activity in the shape of a number of chance findspots of prehistoric material and the identification of a number of areas of cropmarks which suggest the presence of areas of prehistoric settlement and burial activity.

1.5.3 A large collection of Palaeolithic handaxes was recovered from a gravel pit near New Iffley Lane to the west of Donnington Bridge (**163**), and Palaeolithic implements are also reported from South Hinksey near the rail line (**154**) and New Hinksey near the Park and Ride (**171** and **172**). Other prehistoric findspots include Neolithic (**124**) and Bronze Age (**129**) flint tools from North Hinksey. Dredging of part of the Minster Ditch (at the south edge of Osney Mead Industrial Estate) between 1895 and 1898 produced one of the more important groups of metalwork from the Thames. This included three late Bronze Age spearheads, a socketed axe and an extremely fine Iron Age dagger sheath with engraved 'Celtic' decoration (**125**).

1.5.4 The area crossed by the indicative channel alignment and its surroundings contain a number of areas with cropmarks which are likely to, represent areas of prehistoric or

Roman activity. These include an area containing evidence for enclosures, ditches and pits (**644**) suggesting settlement activity and a number of areas of probable ring ditches (ploughed out prehistoric or possibly Roman burial mounds) (**643**, **647**). The area also contains a second area of cropmarks of possible enclosures (**642**).

1.5.5 The area crossed by the channel has been the subject of no archaeological investigation or excavation but there have been a small number of excavations carried out on sites along the eastern edge of the corridor and these have identified some areas of prehistoric settlement. These include an Early to Mid Bronze Age settlement site (**122**) located on Osney Mead Industrial Estate to the east of the scheme and a small Middle Iron Age settlement on a floodplain island at Whitehouse Road (**638**) located during excavations in advance of a new housing development on the eastern edge of the study area. At least two sites of presumed dwellings with pits and ditched enclosures were uncovered during this work. The amount of domestic debris from hearths and the presence of loom weights and slag among the finds suggest a pattern of typical Iron Age crafts such as metalworking and weaving.

Roman

1.5.6 Although there is no evidence for a Roman town at Oxford, the area was the focus for a major pottery industry, mostly located on the higher ground of Headington/East Oxford located to the east of the scheme. Other Roman activity, primarily small scale agricultural settlement, is known from the Central Oxford area. However, there has been a cluster of Roman deposits and artefacts found within the central area of this scheme, including an inhumation burial at South Hinksey (**169**), pottery (**161**, **167** and **179**), a possible ford on Weirs Mill Stream (**168**), and the previously discussed areas of prehistoric or Roman ring ditches (**643**, **647**).

1.5.7 There is some evidence for activity at the south eastern end of the corridor. A Roman quernstone has been found to the east of Weirs Mill (**162**) and further Roman material is known to the west of the mill (**167**, **168**), but there is little direct evidence for any ford here.

Medieval

1.5.8 The FAS route is located immediately west of Oxford, and a possible alignment for the route of the medieval western approach to Oxford and its possible Roman predecessor has been suggested as running through this section of the study area (**119**). The existence of, date for, and significance of this potential alignment has been the subject of much academic debate over the past fifty years. A current suggested alignment follows an existing footpath/causeway (the 'monk's causeway') running east-west across the line of the indicative channel.

1.5.9 Two Saxon iron spearheads and a bone draughtsman were found close to the Minster Ditch at the edge of Osney Mead (**130**), possibly indicating the location of an early crossing point.

1.5.10 To the east of Minster Ditch lies the modern Abingdon Road, the site of the main southern approach to Oxford, first mentioned by name in 911-912. The town developed as a fortified burgh around the turn of the 10th century and is recorded as such in the Burghal Hidage. There is increasing evidence that the town was developed to guard the strategic crossing of the Thames on the boundary between Wessex and Mercia (Dodd, 2003). The area known as Grandpont to the south of the historic centre of Oxford is named after the Magnum Pons (Great Bridge), of which a fragment remains, protected as a Scheduled Monument. The first documentary evidence for the existence of a stone built causeway on the southern approach to the city occurs in the 12th century charters of Abingdon Abbey. However, recent excavations in St Aldates have shown that this monumental structure was the successor to several phases of man-made causeways and crossing points which had begun to be constructed along the modern day line of Abingdon Road and St Aldates at least as early as the 9th century. This southern route, which was formed by natural islands, causeways and fords, was the main route across the Thames into Oxford, completely superseding what may have been the previous crossing at North Hinksey (**119**) which also may have existed in the Roman period.

1.5.11 The southern end of the route corridor is crossed by the Old Abingdon Road, which forms the southern end of the Grandpont causeway, at the point at which the line of the road diverts to run roughly east-west to cross the originally braided streams of the Hinksey Stream. This section may have used the western half of a prehistoric and Roman routeway running east-west from the known area of Roman activity at Headington across the floodplain and west towards the higher ground.

1.5.12 The presence and survival of Norman and medieval culvert structures was demonstrated by a programme of archaeological recording and prospection carried out in 2006-7 (Jacobs, 2007) and they were further investigated during a programme of archaeological recording during road repair works in 2008-9 (Jacobs, 2009). The culverts were scheduled by English Heritage (now Historic England) in October 2012 (List entry no: 1408790). As with the section immediately to the south of Folly Bridge there is evidence for medieval stonework within the later bridge and culvert structures and selected elements of the road line (representing the medieval works) are Scheduled (**2**).

1.5.13 To western side of the route corridor there are number of small medieval settlements, running from Botley in the north to South Hinksey in the south. Botley ('Bota's clearing' or possibly 'wood') is first recorded in c 1170. Historically it was a small secondary medieval settlement with a mill and farm. The chief features of interest now are the small number of Listed Buildings, a farmhouse of c 1800 (**8**), an early 17th century house (**9**) and the 17th century Manor house which lies just to the west of the corridor. These historic remnants are virtually all that survives amidst much intrusive modern development.

1.5.14 North and South Hinksey are recorded as Hengestesie' ('Hengest's Island' or the 'Island of the Stallion') in late Saxon charters, and as separate places from the 13th century. Both villages lie on the slightly higher ground overlooking the line of the indicative channel alignment. Both contain medieval churches dedicated to St Lawrence. The church at North Hinksey is early 12th century with a 13th century tower and the churchyard also contains a Grade II* Listed medieval churchyard cross. The church at South Hinksey (**5**) is early to mid 13th century. The area to the east of South Hinksey village contains evidence of ridge and furrow (medieval arable cultivation earthworks) (**646**, **647**). Evidence of medieval activity (**206**) was recovered from a geotechnical test-pit (TP 284) close to South Hinksey village during the archaeological Watching Brief carried out on the Ground Investigation survey in 2015. This represented a dumped occupation layer containing medieval pottery sherds dating from between the mid 12th and 15th centuries.

1.5.15 The proposed channel alignment crosses the line of the Devils Backbone (**170**), a probably medieval causeway (now followed by a metalled track and footpath) running across the floodplain between South Hinksey and Oxford.

1.5.16 On the eastern edge of the corridor lies the medieval village of Iffley (**612**) with its famous Norman Church and a spread of other Listed Buildings all of which lie within the

Conservation Area and mostly outside the corridor. The core of the village lies on the higher ground overlooking the Thames the site of the medieval mill and existing post medieval lock.

1.5.17 The first mention of a mill at Iffley appears in the late 12th century and it appears to have been constantly in use throughout the Middle Ages, often mentioned as owning the fisheries on the river as far north as East (later Folly) Bridge. In the late 16th century a second mill was built, however the construction of the Pound Lock in 1624 severely depleted the head of water that the mill could command and by 1679 the mill had temporarily stopped working. It was taken over by the miller of Sandford in 1720 and remained in use until it was burnt down in 1908. The Lock at Iffley was, with Sandford and Swift Ditch, one of the first pound locks to be built on the Thames and an Anglo Saxon spearhead was recovered during its construction (**173**).

2 Project Aims

2.1 General

2.1.1 The primary aim of the investigations was to provide further direct base-line information on the depth and nature of the sub-surface Quaternary sediments and stratigraphy and its archaeological potential. This information will aid in the development of a predictive deposit model for the route and inform future impact assessments and evaluation strategies. At present, several channel options have been proposed and the survey takes these into account.

2.2 Specific aims and objectives

2.2.1 The specific aims of the geoarchaeological investigation were to:

- characterise the sequence of sediments and patterns of accumulation along the route, including the depth and lateral extent of major stratigraphic units, and the character of any basal land surface pre-dating these sediments;
- identify significant variations in the deposit sequence indicative of localised features such as topographic highs (floodplain islands) or palaeochannels;
- identify the location and extent of any waterlogged organic deposits and address the potential and likely location for the preservation of archaeological and palaeoenvironmental remains;
- clarify the relationships between sediment sequences and other deposit types, including periods of 'soil' or peat growth, and the effects of relatively recent human disturbance, including the location and extent of made-ground;
- relate the site sequences to current regional models for the Upper Thames and Oxford floodplain.

3 Methodology

3.1 Scope of works

3.1.1 The route of the FAS and associated works has been divided into several zones as presented in the route options (CH2M 2015):

- Area 1: North of Botley Road
- Area 2: Botley Road to Willow Walk
- Area 3: Willow Walk to South Hinksey

- Area 4: Redbridge, Weirs Mill Stream and New Hinksey Meadows

3.1.2 Additional areas are included in documents from previous stages of the scheme but are not part of this geoarchaeological study:

- Area 5: Sandford North
- Area 6: Sandford South
- Area 7: Iffley Meadows
- Chilswell Valley

3.1.3 The geoarchaeological investigation primarily focuses on the combined area of the proposed new ‘two-stage’ channel options that cover extensive areas from north of Botley Road to Redbridge (Areas 2 and 3 plus parts of areas 1 and 4, **Figs 1-5)**. Some reference is made in this report to historical field names for ease of location and these are indicated on the relevant figures (marked in green font)

3.1.4 The investigation adopted a staged approach outlined below.

- Stage 1: Electro-magnetic Conductivity (EM) Survey
- Stage 2: Auger and borehole survey
- Stage 3: Core processing and deposit modelling
- Stage 4: Radiocarbon dating and palaeoenvironmental assessment

3.2 Programme and staffing

3.2.1 The fieldwork commenced in mid August 2016 and was completed in October. The EM Survey was carried out by a specialist subcontractor (Bartlett-Clarke Consultancy). The augering and boreholes was carried out by a team led by an OA geoarchaeologist (Magdalena Benysek) who is also an experienced field archaeologist. The boreholes were drilled by a specialist subcontractor (CC Ground Investigations). The field team worked under the direction of Elizabeth Stafford, OA's Head of Geoarchaeology.

3.2.2 All fieldwork undertaken by Oxford Archaeology (South) is overseen by the Head of Fieldwork, David Score MCIfA.

3.3 Site specific methodology

Stage 1: Electro-Magnetic (EM) Ground Conductivity Survey

3.3.1 The 2015 watching brief indicated an absence of extensive floodplain peat deposits along the route in areas away from extant channels and no significant buried channels were identified. Occasional thin organic units were noted overlying the Pleistocene gravel between the Hinksey villages. However, the watching brief report acknowledged the limitations of the data for mapping such features due to poor visibility and the clustered distribution of the interventions which means there were large areas of the scheme with limited or no subsurface data. Given the very large area covered by the combined channel options it was proposed that an EM survey be carried out on selected areas to test the validity of the 2015 ground investigation data and to cover certain areas which were not part of the 2015 GI survey. **Figures 2-5** show the extent of the survey work.

3.3.2 EM survey characterises the bulk geoelectric properties of near surface sediments and has been used successfully on many other similar floodplain sites to produce a map of different sediment zones and buried landscape features such as palaeochannels and floodplain islands. The method is relatively rapid to carry out in the field and can cover a much greater area than auger/boreholes alone. It should be noted that locations for the EM survey have been chosen with reference to accessibility i.e. large open fields under pasture as opposed to long grass/scrub, and locations away from multiple extant channel courses that can adversely effect on the results.

3.3.3 The EM survey was conducted by a specialist sub-contractor using a CMD Explorer set in the vertical dipole mode capable of measuring ground conductivity at variable depths, Readings were set at 1-2m intervals along transects walked at 5m separation and located using GPS tracking. Three were produced as shaded contour plots representing the data at shallow, 2m and 4m depths. The plots illustrated in this report are those at 2m depths. The full set of plots are included in the specialist geophysics report which also includes the full results of a magnetometer gradiometer survey carried out at the same time for the entire route (Bartlett-Clarke 2016).

Stage 2: Auger and boreholes

3.3.4 The EM survey required ground-truthing by direct observation. A significant amount of direct subsurface data was collected during the 2015 watching brief which is useful for this purpose. However, the distribution of this data was not evenly spread and a number of auger holes (OA53-OA81) were required to investigate potential subsurface anomalies. The locations of such auger holes were identified following a review of the EM results by the project geoarchaeologist, and locations were agreed with the Environment Agency and Principal Contractor before they were bored.

3.3.5 In areas outside of the EM survey where ground data is sparse or absent a series of four auger transects (Transects A-D, OA01-OA52) were proposed (*c* 300m in length) to provide greater spatial coverage, perpendicular to the proposed channel options. This was mainly carried out in the area of the Long Meadow in Area 3, bounded by the Hogacre Ditch and the Hinksey Stream (**Fig. 3**). These transects have allowed profiles to be created and aid the spatial deposit modelling. The distance between the auger points was *c* 25m.

3.3.6 The augering equipment comprised a standard hand operated gouge and dutch auger. Each location where practicable was augered to a depth whereby Pleistocene deposits or bedrock was proven. The sediment recovered at each location was laid out according to depth. Care was taken to minimise contamination of samples through soil sloughing into the hole on inserting the auger or from side-wall contamination when removing an auger with open sides. The profile at each location was recorded on a summary proforma sheet and significant layers identified. Relative depths were noted and a description of the deposits made using standard geological terminology (colour, texture, compaction, inclusions, contacts) in accordance with Historic England guidelines for geoarchaeology (HE 2015). The sample holes were immediately backfilled with the excavated material following recording. Each auger hole location was surveyed using a GPS relative to Ordnance Datum and the National Grid.

3.3.7 In addition, borehole drilling was carried out on targeted sequences that demonstrated significantly increased depth (eg. >2.50m) and/or contained organic/peat deposits (OA101-OA111, **Figs 2-5**). The purpose of the drilling was to retrieve a continuous sequence of cores for detailed sediment description, palaeoenvironmental assessment and radiocarbon dating. The watching brief indicated that such deposits are present adjacent to current watercourses such as the Hinksey Stream, but other areas became apparent as the EM and auger surveys progressed. Three additional boreholes (OA112-OA114) replaced auger holes (OA72, OA73, OA76 and OA77) due to livestock issues in the Great Meadow. All locations were agreed with the Environment Agency before drilling commenced. The boreholes were drilled using a Dando-type tracked terrier rig capable of retrieving cores in 1m lengths and backfilled with bentonite pellets.

3.3.8 Prior to both augering and drilling, an adequate check for buried services was made. This included a review of service maps and other survey results (GPR) provided by the client, along with information from the geophysical survey. Each location was CAT scanned. Area 3 has an access track which is known as 'Electric Road' and there are numerous buried electric cables that run in parallel to the access track. Excavations within 15m of the Electric Road were not permitted under any circumstances.

3.3.9 Proposed augering and borehole drilling sites, as well as access routes, were checked on site by an Environmental Clerk of Works (provided by the Principal Contractor or the Environment Agency) prior to the commencement of work, to ensure that they were not in environmentally sensitive areas. Table 1 summarises the number of auger and boreholes by area.

Area	Auger	Boreholes	Total
Area 1	OA78-OA81	OA111	5
Area 2	OA71, OA74, OA75	OA106, OA 107, OA 112, OA 113, OA114	8
Area 3 (North)	OA01-OA12 (Transect A) OA14-OA26 (Transect B) OA27-OA39 (Transect C) OA40-OA52 (Transect D) OA67-OA70	OA104A, OA104B, OA105, OA 108, OA109, OA110,	61
Area 3 (South)	OA53-OA58	OA103	7
Area 4	OA59-OA66	OA101, OA102	10
		Total	**91**

Table 1: Summary of auger and boreholes

Stage 3: Core processing and deposit modelling

3.3.10 Following fieldwork the borehole cores were returned to OA premises at Osney Mead where they were extruded, photographed and recorded. The lithological data from the cores, along with that from the augering and historical geotechnical data was input into geological modelling software Rockworks17 in order to allow correlation of stratigraphic units, the production of cross sections and 3-d plots of thicknesses and surfaces. The modelling utilised an inverse distance algorithm. A selection of datasets was then imported into the project GIS.

Stage 4: Radiocarbon dating and palaeoenvironmental assessment

3.3.11 Following preliminary stratigraphic assessment, a representative selection of cores were sub-sampled for palaeoenvironmental remains (pollen, plant macrofossils and molluscs) and range-finding radiocarbon dates (OA103, OA104B, OA104B, OA106, OA109, OA111). No analysis was carried out at this stage, both the assessment and dating was intended to assess the level of preservation, provide preliminary taxonomic information and a basic chronological framework.

3.3.12 A borehole log has been created for each of the boreholes showing location of sub-samples, depth below ground level (BGL) and depth in metres OD, with detailed sediment descriptions.

4 Results

4.1 Presentation of Results

4.1.1 The general results of the geoarchaeological investigation are described below by Area. The locations of the interventions are presented in **Figures 2-5**. The results of the stratigraphic modelling and EM survey are presented in **Figures 6-16** and hole to hole cross-sections in **Figures 17-29**. Specialist reports on the pollen, plant remains and molluscs are included in **Appendices B and C**. The detailed sediment descriptions and core photographs are presented in **Appendices D-F.** Radiocarbon certificates can be found in **Appendix G.**

4.1.2 Table 2 provides details of the location and depths for all auger and boreholes carried out as part of this study.

Area	Bore	Easting	Northing	Elevation (m OD)	Total depth (m)	Type
Area 3 (North)	OA01	449721.9	205473.4	55.7	2.9	Auger hole
Area 3 (North)	OA02	449738.8	205491.8	55.41	1.75	Auger hole
Area 3 (North)	OA03	449755.8	205510.2	55.5	0.95	Auger hole
Area 3 (North)	OA04	449772.7	205528.6	55.7	1.3	Auger hole
Area 3 (North)	OA05	449789.6	205547	55.53	1.5	Auger hole
Area 3 (North)	OA06	449806.6	205565.3	55.62	1.65	Auger hole
Area 3 (North)	OA07	449823.5	205583.7	55.7	1.65	Auger hole
Area 3 (North)	OA08	449840.5	205602.1	55.83	2.1	Auger hole
Area 3 (North)	OA09	449857.4	205620.5	55.74	2	Auger hole
Area 3 (North)	OA10	449874.4	205638.9	55.77	1.95	Auger hole
Area 3 (North)	OA11	449891.3	205657.2	56.046	1.7	Auger hole
Area 3 (North)	OA12	449908.3	205675.6	55.88	1.25	Auger hole
Area 3 (North)	OA14	449848.9	205329.2	55.7	2.95	Auger hole
Area 3 (North)	OA15	449863.7	205345.3	55.44	2.15	Auger hole
Area 3 (North)	OA16	449880.5	205363.8	55.48	2.95	Auger hole
Area 3 (North)	OA17	449897.3	205382.3	55.49	1.8	Auger hole
Area 3 (North)	OA18	449914.2	205400.8	55.697	1.65	Auger hole
Area 3 (North)	OA19	449947.9	205437.7	55.81	1.7	Auger hole
Area 3 (North)	OA20	449964.7	205456.2	55.576	1.6	Auger hole
Area 3 (North)	OA21	449981.5	205474.7	55.76	1.25	Auger hole
Area 3 (North)	OA22	449998.4	205493.2	55.72	1.15	Auger hole
Area 3 (North)	OA23	450015.2	205511.6	55.75	1.75	Auger hole
Area 3 (North)	OA24	450032.1	205530.1	55.71	1.15	Auger hole
Area 3 (North)	OA25	450048.9	205548.6	55.629	0.8	Auger hole
Area 3 (North)	OA26	450065.3	205565	55.617	1	Auger hole
Area 3 (North)	OA27	450021.4	205109.8	55.471	1.3	Auger hole
Area 3 (North)	OA28	450038.3	205128.2	55.271	2.1	Auger hole
Area 3 (North)	OA29	450055.2	205146.6	55.481	1.8	Auger hole
Area 3 (North)	OA30	450072.1	205165.1	55.554	2.6	Auger hole

Area 3 (North)	OA31	450089	205183.5	55.37	2.7	Auger hole
Area 3 (North)	OA32	450105.9	205201.9	55.521	2.1	Auger hole
Area 3 (North)	OA33	450122.8	205220.3	55.491	1.87	Auger hole
Area 3 (North)	OA34	450139.7	205238.7	55.331	2.3	Auger hole
Area 3 (North)	OA35	450156.6	205257.1	55.491	1.9	Auger hole
Area 3 (North)	OA36	450173.5	205275.6	55.501	1.05	Auger hole
Area 3 (North)	OA37	450190.4	205294	55.561	1.35	Auger hole
Area 3 (North)	OA38	450207.4	205312.4	55.541	1.02	Auger hole
Area 3 (North)	OA39	450224.3	205330.8	55.481	1	Auger hole
Area 3 (North)	OA40	450211.9	204957.9	55.651	2.5	Auger hole
Area 3 (North)	OA41	450228.9	204976.3	55.59	0.65	Auger hole
Area 3 (North)	OA42	450245.9	204994.6	55.581	0.85	Auger hole
Area 3 (North)	OA43	450262.9	205012.9	55.596	1.1	Auger hole
Area 3 (North)	OA44	450279.9	205031.2	55.571	0.9	Auger hole
Area 3 (North)	OA45	450296.9	205049.6	55.571	1.15	Auger hole
Area 3 (North)	OA46	450313.9	205067.9	55.311	3.2	Auger hole
Area 3 (North)	OA47	450330.9	205086.2	55.431	2.15	Auger hole
Area 3 (North)	OA48	450347.9	205104.6	55.271	2.45	Auger hole
Area 3 (North)	OA49	450364.9	205122.9	55.261	2.4	Auger hole
Area 3 (North)	OA50	450381.9	205141.2	55.271	2.1	Auger hole
Area 3 (North)	OA51	450398.9	205159.5	55.221	1.8	Auger hole
Area 3 (North)	OA52	450415.9	205177.9	55.271	2.3	Auger hole
Area 3 (South)	OA53	450425.8	204838.2	55.321	0.75	Auger hole
Area 3 (South)	OA54	450510.7	204828.5	55.261	1.05	Auger hole
Area 3 (South)	OA55	450532.9	204739.7	55.221	0.4	Auger hole
Area 3 (South)	OA56	450621.9	204544.1	55.03	1.2	Auger hole
Area 3 (South)	OA57	450729	204548.9	55.111	0.55	Auger hole
Area 3 (South)	OA58	450619	204651.2	55.137	0.6	Auger hole
Area 4	OA59	451426.1	204075.4	54.8	1.65	Auger hole
Area 4	OA60	451316.5	204128.3	54.79046	1.75	Auger hole
Area 4	OA61	451382.4	203868.1	55.07407	1.7	Auger hole
Area 4	OA62	451526.3	203782.2	55.1509	1	Auger hole
Area 4	OA64	451464.1	204005.9	54.62577	1.2	Auger hole
Area 4	OA65	451372.7	204105.4	54.67878	1	Auger hole
Area 4	OA66	451348.7	204088.7	54.62926	1	Auger hole
Area 3 (North)	OA67	449755.5	205750.9	55.87067	1.35	Auger hole
Area 3 (North)	OA68	449717.4	205710.7	55.68584	1.9	Auger hole
Area 3 (North)	OA69	449653.4	205639.3	55.83918	1.1	Auger hole
Area 3 (North)	OA70	449604.7	205586.9	55.59579	1.1	Auger hole
Area 2	OA71	449460	205735.7	55.9	1	Auger hole
Area 2	OA74	449420.6	205894.3	55.93	0.5	Auger hole
Area 2	OA75	449322.3	205872.9	55.95	1.5	Auger hole
Area 1	OA78	449112.4	206506.3	56.34813	3	Auger hole
Area 1	OA79	449086.2	206522.2	56.28918	2.7	Auger hole
Area 1	OA80	449054.6	206546.6	56.48368	2.8	Auger hole
Area 1	OA81	449026.1	206564.5	56.28836	2.15	Auger hole
Area 4	OA101	451528.3	203737	54.98263	2	Borehole
Area 4	OA102	451320.8	204129.9	54.79652	2.5	Borehole
Area 3 (South)	OA103	450660	204660.8	55.04988	2.5	Borehole
Area 3 (North)	OA104A	450347.6	205105	55.30264	4	Borehole
Area 3 (North)	OA104B	450398.4	205160.2	55.25231	3	Borehole
Area 3 (North)	OA105	450127.3	205224.9	55.3782	3	Borehole
Area 2	OA106	449469.4	205610.6	54.95171	7	Borehole
Area 2	OA107	449546.7	205684.5	55.12582	2	Borehole

Area 3 (North)	OA108	449839.1	205603.3	55.92488	3	Borehole
Area 3 (North)	OA109	449794.3	205550.3	55.5248	2	Borehole
Area 3 (North)	OA110	449736.4	205494	55.48812	3	Borehole
Area 1	OA111	449079.3	206529.7	56.28918	3	Borehole
Area 2	OA112	449396.8	205794.3	55.88926	2	Borehole
Area 2	OA113	449299.4	205782.1	55.66831	3	Borehole
Area 2	OA114	449230	205916.8	55.82311	3	Borehole

Table 2: Details of auger and boreholes

4.1.3 The broad stratigraphic sequence observed during the coring is generally consistent with that previously recorded (OA 2016b) and can be summarised as follows:

- Topsoil
- Made-ground (recent)
- Floodplain alluvium
- Organic-channel complex
- Pleistocene Gravel/Head
- Bedrock

4.1.4 For the majority of the route investigated during this study, topsoil directly overlies floodplain alluvium and deposits of recent made-ground are rare and sporadic. The floodplain alluvium exists as a blanket of fairly homogeneous silty clay averaging 1.0-1.5m thick. The upper part of the alluvium is oxidised and weathered orange brown whereas towards the base it is bluish grey. Where the underlying Pleistocene gravel surface rises, however, deposits can be less than 0.5m. At these higher elevations the alluvium can appear very dense, frequently with a higher sand content and inclusions of gravel clasts suggestive of plough disturbance and/or colluvial inputs at the floodplain edge.

4.1.5 At several locations along the route deep sequences of organic sands and silts have been noted beneath the alluvial blanket. These deposits coincide with a drop in elevation of the surface of the Pleistocene gravel and represent former channel systems associated with the Seacourt/Hinksey and Bulstake Streams. Radiocarbon dating from a selection of boreholes suggest these channels were active from at least the Mesolithic period at *c* 6000 cal BC and continued to deposit sediment during the Neolithic and Bronze Age.

4.2 Radiocarbon dating

4.2.1 Eight range-finding AMS radiocarbon dates were processed from six boreholes as detailed in Table 2. In general these dates derive from the base of organic units overlying the Pleistocene gravel surface, although additional dates have been processed for longer sequences in Boreholes OA106 and OA104A. The material dated was macroscopic plant remains and seeds extracted from flots specifically processed for this purpose. The radiocarbon dates were processed at Beta Analytica in Florida (**Appendix G**).

4.2.2 All but one sample produced prehistoric dates. The earliest was from samples from Borehole OA106 which produced Mesolithic dates of 6200-6020 cal BC and 4790-4615 cal BC. The remaining span the Early Neolithic to Late Bronze Age. One sample from

Borehole OA103 produced a relatively recent date and it is possible this is a result of sample contamination with modern carbon.

Borehole	Depth (m)	Lab code	14C age BP	13C	Calibrated date BC	Period
Area 1						
OABH111	1.86-1.87	Beta – 450169	3620±30	-27.7	2115-1900	Early Bronze Age
Area 2						
OABH106	2.91-2.93	Beta – 450163	5840±30	-28.4	4790-4615	Late Mesolithic
OABH106	4.58-4.59	Beta – 450165	7220±30	-28.5	6200-6020	Mesolithic
Area 3 (South)						
OABH109	1.49-1.50	Beta – 450167	2770±30	-28.2	1000-835	Late Bronze Age
OABH104A	2.54-2.55	Beta – 450166	3710±30	-26	2200-2025	Early Bronze Age
OABH104A	3.73-3.80	Beta – 450164	4670±30	-27.4	3620-3365	Early Neolithic
OABH104B	1.73-1.75	Beta – 450168	3110±30	-28.3	1435-1290	Middle Bronze Age
Area 3 (North)						
OABH103	1.22-1.25	Beta – 450162	102.1±0.3 pMC	-28	-1700	Modern?

Table 1: Summary of radiocarbon dates

4.3 Area Summaries

Area 1: North of the Botley Road

4.3.1 This section of the route corridor lies immediately north of the Botley Road (**Fig. 2**). The area of the combined channel options is dissected north-south by the current course of the Seacourt Stream forming a large meander bend. Land-use across this area is variable. West of the Seacourt Stream are arable fields and to the east is rough grassland and scrub. The banks of the stream and the area immediately adjacent to Botley Road were not included in the current survey due to these areas being heavily wooded. A transect (Transect E) of of fours augers (OA78-OA81) and a single borehole (OA111) was carried out perpendicular to and traversing the current course of the Seacourt Stream, along with an EM survey (**Figs. 2 and 17**).

4.3.2 An elevation plot of the modelled Pleistocene gravel surface based on interventions is presented in **Figure 6** and the corresponding EM conductivity plot in **Figure 7**. Both figures broadly correspond illustrating a deep channel area, particularly on the eastern bank of the Seacourt Stream. Here the gravel surface lies below 54m OD. On the western bank the gravel surface rises rapidly to *c* 55.5m OD. The thickness of deposits overlying the gravel on the eastern bank is up to *c* 3.0m, whereas on the western bank thicknesses shallow to *c* 0.8m (**Fig. 8**).

4.3.3 The deposits overlying the gravel on the eastern bank generally comprised complex intercalated sequences of sands, gravelly sands and silts, with varying degrees of organic matter consistent with deposition in moderately flowing channels. In places there were lenses and beds of organic clays and silts suggesting shifting marginal environments, although the sequences tended to get more sandy with depth. Capping the sequences was a thick layer of bluish grey, grading up-profile to orangey brown, silty clay similar to the floodplain alluvium observed elsewhere along the route that extended across the gravel high on the western bank of the Seacourt Stream.

4.3.4 Borehole OA111 was drilled adjacent to the eastern bank of the Seacourt Stream to sample the deep channel sequences. The borehole was drilled to 3m BGL with Pleistocene gravel occurring at *c* 2.55m BGL. Immediately overlying the gravel in this borehole was a deposit of gravelly sand with some organic detritus. A lens of grey sandy silty clay towards the top of this unit produced an Early Bronze Age radiocarbon date at 1.86m BGL of 2115-1900 cal BC (Beta-450169, 3620±30 BP). The gravelly sand was overlain by a thick unit of organic silty clay and minerogenic floodplain alluvium.

4.3.5 The pollen counts from this borehole from four sub-samples were generally low; however, the overall suggestion towards the base of the sequence (2.51m BGL), is of a wet, sedge-fen type habitat; woodland trees comprising mostly alder, hazel-type, oak and pine were also present locally or regionally. At 1.87m there is evidence for the development of alder carr communities by the Early Bronze Age. The most reliable count, from the top of the organic silty clay at 1.15-1.16m, contains an abundance of pollen of herbs, suggesting open, wet palaeoenvironments and possible sedge-fen development. The uppermost sub-sample, at 0.89m, contained very high micro-charcoal counts which may reflect alluvial deposition.

4.3.6 The plant assemblage from the basal gravelly sands contained a mixture of plant stems and wood fragments. Seeds were low in number but were dominated by aquatic taxa such as water plantain and water crowfoot. As with the pollen, alder was also noted. The presence of occasional charcoal fragments may indicate early human activity in the landscape. Molluscs were abundant, including much crushed shell suggesting the material had been transported with some energy. indicative of channel deposition. By 1.11-1.16m, the silty clay contained abundant plant stems, and alder had disappeared from the seed assemblage, suggesting conditions were becoming more open. Charcoal fragments also attest to possible activity in the vicinity. The uppermost sample, from the clay alluvium at 0.85-0.90m, contained no waterlogged seeds or molluscs.

Area 2: Botley Road to Willow Walk

4.3.7 This section of the route corridor lies between Botley Road and Willow Walk (**Fig. 2**). The Hinksey Stream (a continuation of the Seacourt Stream) lies at the eastern boundary of the area of the combined channel options. Historically, much of this area lay within the Great Meadow. Of note is the site of the former Botley Mill immediately south of the Botley Road which was demolished in the early 20th century. Land-use across this area is mainly open grazed meadow, although the northern part which was not surveyed is currently a Nature Park of scrub and grassland managed by Oxford City Council.

4.3.8 Three augers (OA71, OA74, and OA75) and five boreholes (OA106, OA 107, OA112, OA113 and OA114) were carried out across this area, along with an EM survey (**Figs 2, 18 and 19**) to supplement the previous geotechnical work.

4.3.9 An elevation plot of the modelled Pleistocene gravel surface based on interventions is presented in **Figure 6** and the corresponding EM conductivity plot in **Figure 7**. Both figures broadly correspond illustrating a channel complex adjacent to the Hinksey

Stream. Here the gravel surface lies below *c* 54m OD increasing locally to c 50.5m OD. To the east the gravel surface rises rapidly to over *c* 55m OD.

4.3.10 The thickness of deposits overlying the gravel in the east is *c* 2.0m, increasing locally to more than 3m. To the west the thickness shallows to 1m and, beyond the footprint of the combined channel options, to as little as 0.45m (**Fig. 8**).

4.3.11 The deposits overlying the gravel in the east were similar to those observed in Area 1 with complex intercalated sequences of sands gravelly sands and silts, with varying degrees of organic matter, consistent with deposition in moderately flowing channels. Again, in places there were lenses and beds of organic silt suggesting shifting marginal environments. Capping the sequences was a thick layer of bluish grey, grading up-profile to orangey brown, silty clay similar to the floodplain alluvium observed elsewhere along the route that extended across the gravel high to the east.

4.3.12 Borehole OA106 was drilled immediately adjacent to the Hinksey Stream. This borehole contained one of the deepest and most complex sequences observed along the route with multiple beds of sands, clays and organic silts. The very abrupt contacts observed between sediment units in the cores are suggestive of a composite history of channel erosion and silting. The borehole was drilled to 7m BGL, with Oxford Clay in the base of the borehole at 6.75m BGL and Pleistocene gravel occurring at 4.66m BGL.

4.3.13 Immediately overlying the gravel in this borehole was a deposit of organic clay silt which produced a Mesolithic radiocarbon date at 4.58m BGL of 6200-6020 cal BC (Beta-450165, 7220±30 BP). A further radiocarbon date from an organic silty clay at 2.91m BGL was dated to the Late Mesolithic at 4790-4615 cal BC (Beta-450163, 5840±30 BP).

4.3.14 All but one of the eight sub-samples assessed from this borehole yielded good quantities of pollen, with good to mixed preservation. The pollen data suggests an older arboreal assemblage was replaced by a more open, wetter palaeoenvironment. Dominance of alder pollen suggests the probable presence of alder carr between 4.59-2.24m; however, evidence of mixed woodland is also present and likely to have comprised oak, pine, elm, lime and ash. At this depth also, there is limited evidence for open areas; counts of herb pollen are generally low, including mostly grasses, sedges, pollen of the carrot family and rare cereal-type or large grasses. The evidence for open, grass and sedge communities, increases greatly within the upper two sub-samples (1.44-0.90m). The taxa recorded in these two sub-samples suggest possible wet meadows adjacent to sedge fen carr communities. Such palaeoenvironments may have been used to support animal grazing. The occurrence of cereal-type pollen (especially at 1.44m), if not attributed to wild grasses, may suggest use of the land for arable cultivation. There is evidence for an increase in micro-charcoal within the upper sub-samples; which may suggest burning activity, either regionally or locally.

4.3.15 The plant remains assessment produced similar results to the pollen. The basal organic silts overlying the gravel produced dark, highly organic flots composed mainly of wood derived material. The waterlogged seeds were dominated by alder with sedge, dock and buttercup. A more minerogenic grey clay at 4.05-4.10m contained much crushed mollusc shell suggestive of in-channel deposition with the flowing water mollusc *Theodoxus fluviatilis.*

Area 3 (North): Willow Walk to South Hinksey

4.3.16 This section of the route corridor lies to the south-east of Willow Walk (**Fig. 3**), traversing the Bulstake Stream through Great Midley, Little Midley and King's Mead. Beyond lies the area known historically as the Long Meadow, bounded by Hogacre Ditch and Hinksey Stream. Current land-use is floodplain pasture and grassland.

4.3.17 Four augers (OA67-OA70) were carried out in Great Midley along with EM Survey. A transect (Transect A) of 12 augers (OA01-OA12) and 3 boreholes (OA108-OA110) were carried out across Little Midley and King's Mead. A further 3 transects (Transects B-D) of augers (OA14-OA52) and 3 boreholes (OA 104A, OA 104B, and OA105) were carried out in the Long Meadow (**Figs 3, 20 to 24**).

4.3.18 The EM conductivity plot for Great Midley is presented in **Figure 7**. An elevation plot of the modelled Pleistocene gravel surface based on interventions is presented in **Figure 9.** The EM plot for Great Midley illustrates high conductivity and a channel complex coinciding with the Bulstake Stream that is also seen continuing in the gravel surface plot between Little Midley and King's Mead. The modelled gravel surface indicates an extensive channel complex exists through the Long Meadow where elevations occur below *c* 54m OD decreasing locally to c 51.5m OD. This is probably a former drainage pattern associated with the Hinksey Stream. To the north of the channel complex the gravel surface rises to *c* 55m OD (Transects B and C).

4.3.19 The thickness of deposits overlying the gravel through the Long Meadow ranges from *c* 1.2m, increasing locally to 2.5m and nearly 4m in OA104A (**Fig. 10**). To the north of the combined channel options the thickness thins to *c* 0.5m in the vicinity of Transects B and C. Similarly thin deposits are noted within the channel footprint to the south-east in the vicinity of Transect D.

4.3.20 Four radiocarbon dates were processed from three boreholes. Borehole OA109 was drilled along the line of a possible minor palaeochannel apparent on lidar data running east-west across Little Midley and visible as an area of lower topography during the fieldwork. An organic silty clay unit overlying the Pleistocene gravel at 1.49m BGL was dated to the Late Bronze Age at 1000-835 cal BC (Beta-450167, 2770±30 BP). This organic silt was overlain by minerogenic floodplain alluvium. Unfortunately pollen was neither well preserved nor abundant in the three sub-samples assessed from OA109. The data suggest possible development of sedge fen palaeoenvironments, with regionally developed mixed woodlands. There is evidence also (at 1.49m) for the presence of wet, grassy, meadow areas, such as might support a flora of dandelion-types, meadowsweets, docks/sorrels and daisy-types. The seed assemblage was dominated by sedge and water crowfoot, with occasional buttercup, mint, water plantain and dock. A caryopses of oat (*Avena* sp.) hints at cultivated ground nearby.

4.3.21 Borehole 104A was located in the Long Meadow where the augering indicated deep and complex channel and organic sequences, similar to those in Boreholes OA106 and OA 111. An organic lens within gravely sand towards the base of the sequence was radiocarbon dated at 3.73m BGL to the Early Neolithic at 3620-3365 cal BC (Beta-450164, 4670±30 BP). An organic clayey silt in the same borehole at 2.54m was radiocarbon dated to the Early Bronze Age at 2200-2025 cal BC (Beta-450166, 3710±30 BP). Pollen and plants were generally well preserved and relatively abundant showing a transition from alder carr to open, grassy, wet meadow palaeoenvironments to sedge fen with evidence of possible cultivation in the vicinity.

4.3.22 Borehole 104B was located a little to the north of Borehole 104A where the underlying gravel surface rises up. An organic silt overlying the gravel at 1.73m BGL was radiocarbon dated to the Middle Bronze Age at 1435-1290 cal BC (Beta-450168, 3110±30 BP).

Area 3 (South): Willow Walk to South Hinksey

4.3.23 This section of the route corridor lies to the south-east of Willow Walk, beyond the Long Meadow and towards the Devil's Backbone at South Hinksey (**Fig. 4**), a possible medieval causeway across the floodplain (OA 2016a, no. 170). Current land-use is floodplain pasture and grassland. Historical field names include Great Common, Long Common, Little Common and North Meadow. This section of the route traverses an area of cropmarks identified from aerial photographs (OA 2016a, nos 644, 646). The current course of the Hinksey Stream lies to the north of the footprint of the combined channel options.

4.3.24 Six augers (OA53-OA58) and one borehole (OA103) were carried out in this area, along with EM Survey (**Figs 4, 25 to 27**). An elevation plot of the modelled Pleistocene gravel surface based on interventions is presented in **Figure 11.** The EM conductivity plot is presented in **Figure 12**. Both plots correspond well illustrating the gravel surface to be relatively high at c 54.6m to 55m OD. The thickness of deposits overlying the gravel ranges from *c* 0.4m to 0.8m, increasing locally to *c* 1.2m (**Fig. 13**).

4.3.25 The EM plot picks out the course of a minor channel running across this area. Borehole OA103 was drilled to sample this feature which is infilled with an organic silty clay to 1.2m BGL. A single radiocarbon date was processed from the base of this unit which produced quite a recent date. The pollen also included rosebay willowherb which did not become widespread until after the second world war. It is not clear therefore whether this channel is a recent feature or whether the samples were contaminated with recent material. The pollen data suggests an open, herb-rich grassy palaeoenvironment with evidence for areas of shallow, possibly stagnant water nearby. The occurrence of cereal-type pollen may represent pollen of a cultivated crop that may have been growing or possibly processed nearby. Pollen of weeds associated with disturbance and/or damp areas is also recorded.

Area 4: Redbridge

4.3.26 This section of the route corridor lies to the south-east of of the Devil's Backbone at South Hinksey towards the Old Abingdon Road (**Fig. 5**). Current land-use is floodplain pasture and grassland. The current course of the Hinksey Stream lies to the north of the footprint of the combined channel options. Historical field names include Feast Meadow and (Lower) Common. Of note is the presence of a medieval or earlier causeway along the line of the Old Abingdon Road, with scheduled culverts forming the continuation of the Norman Grandpont from St Aldates (OA 2016a, no. 2). This section of the route traverses an area of cropmarks (ridge and furrow) identified from aerial photographs (OA 2016a, no. 646).

4.3.27 Eight augers (OA59-OA66) and two boreholes (OA101 and OA102) were carried out in this area, along with EM Survey (**Figs 5, 28 to 29**). An elevation plot of the modelled Pleistocene gravel surface based on interventions is presented in **Figure 14.** The EM conductivity plot is presented in **Figure 15**. The plots produced contrasting results. The modelled gravel surface demonstrates relatively low elevations, whereas the EM survey is indicating an area of high conductivity in the south adjacent to Old Abingdon Road. The EM results are largely due to the nature of the sediments containing a higher sand and gravel content, coincident with the area of mapped ridge and furrow, suggesting the alluvium in this area has been modified or disturbed. Hand augering revealed very stiff clays and clayey sands with varying amounts of gravel clasts. It is possible that there is also an element of colluvial input to the sediments deriving from the adjacent slopes of Hinksey Hill. The deposits were sampled in Borehole OA101. To the north-west the EM plot shows an area of high conductivity where sequences are more typical of the floodplain alluvial clays, sampled in Borehole OA102. No palaeoenvironmental assessment or radiocarbon dating was carried out in Area 4 due to the absence of organic deposits. The thickness of deposits overlying the gravel is illustrated in **Figure 16** ranging from *c* 1.0 to 1.4m.

5 Discussion

5.1.1 The results of the investigation have served well in further characterising the nature of the floodplain sequences along the route of the combined channel options between Botley Road and Old Abingdon Road. The number and distribution of interventions along with the EM survey were designed to provide further information on the sub-surface stratigraphy where data was sparse, building on the results of previous work carried out in 2015 (OA2016b).

5.1.2 The key points to note from this phase of work can be summarised as follows:

- Deposits of modern made-ground are generally absent across the floodplain and largely restricted to known land-fill sites around Old Abingdon Road. Further deposits may be present at the site of the demolished Botley Mill.
- The alluvial blanket is relatively consistent across much of the floodplain comprising a homogeneous unit of orangey brown silty clay, grading to bluish grey. Depth averages 1.0-1.5m but thins to less than 0.5m against the rising Pleistocene gravel surface. Much of this alluvium is likely to have been deposited during the historical period, under relatively low energy conditions of seasonal overbank flooding. The alluvial blanket may seal prehistoric archaeological features or artefact scatters across the underlying gravel surface, particularly at higher elevations marginal to the relict channel systems. However, archaeological remains may also occur within the alluvium and have the potential to be stratified at multiple horizons.
- Deep complex channel sequences, 2.5-4.0m deep, are present locally beneath the floodplain alluvium that contain intercalated beds of sandy gravels, sands and organic silts dating to at least the middle part of the Mesolithic period at *c* 6000 cal BC (OA106) and into the Neolithic and Bronze Age. These channels appear to represent earlier courses of the Seacourt, Hinksey and Bulstake streams. Similar middle Mesolithic dates of *c* 6300 cal BC were obtained from the proto- St Aldates channel at Luther Court (OA 2015).
- The frequent occurrence of coarse-grained facies eg. gravelly sands and sands within the basal parts of these channels suggests multiple episodes of moderate to high-energy flow, incision and subsequent silting. This was also observed within Holocene channel sequences at Luther Court and at Westgate in Oxford City. Any archaeological remains within these channel zones are likely to have undergone a high degree of erosion and reworking. However, lower-energy environments probably prevailed during the latter stages of silting, typified by organic clays and silts, which have higher potential for *in situ* preservation of archaeological remains which may be stratified at multiple levels.

- Ecotonal zones – the interface between dry and wet ground – would have existed marginal to the channel systems and these areas may have provided a focus for seasonal activity in the past due to the abundance of natural resources eg. fishing, wild-fowling, collecting reeds for basketry. These areas also have high potential for preservation of waterside structure such as timber jetties, bridges, platforms and evidence of ritual activity with votive offerings across liminal zones. Several previous findspots of metalwork have been made across this floodplain area which are detailed in the DBA (see section 1.5.3 in this report).
- Assessment of pollen and plant remains suggests generally high potential for landscape reconstruction associated with the deeper more organic sequences. The palaeoenvironmental signature suggests locally the presence of sedge fen and alder carr with conditions becoming more open in later prehistory with evidence of cultivation in the vicinity.

5.1.3 On the basis of the observations made during this survey the route of the combined channel options between Botley Road and Old Abingdon Road may divided into the following geoarchaeological zones.

5.1.4 **Zone I: North of the Botley Road**. This zone is characterised by a deep complex channel system associated with the Seacourt Stream. An Early Bronze Age radiocarbon date was processed from sands at the base of the sequence in Borehole OA111. A high degree of erosion and reworking of archaeological remains is anticipated, although *in situ* remains may be preserved locally associated with units of organic silt deposited in lower energy conditions. There is the potential for waterside structures such as bridges or jetties, particularly abutting the high ground on the western bank of the Seacourt Stream. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered moderate to high.

5.1.5 **Zone II: Site of Botley Mill**. The mill was demolished in the early 20th century but has its origins in the medieval period. This area was not included as part of this study but structural remains of the mill and associated managed channels may be preserved at depth.

5.1.6 **Zone III: Great Meadow**. This area is characterised by a relatively shallow alluvial cover over the surface of the Pleistocene gravel and is marginal to a deep channel complex related to former courses of the Hinksey Stream. The potential for *in situ* archaeological remains and cut features to be preserved within and beneath the alluvium is considered to be high. There is the potential for waterside structures such as bridges or jetties across this edge environment. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered to be moderate to low given the general absence of organic sequences.

5.1.7 **Zone IV: The Hinksey Stream in the Great Meadow**. Similar to Zone I, this zone is characterised by a deep complex channel system associated with the Hinksey Stream. Two Mesolithic radiocarbon dates were processed from organic silts at the base of the sequence in Borehole OA106. A high degree of erosion and reworking of archaeological remains is anticipated, although *in situ* remains may be preserved locally associated with units of organic silt deposited in lower energy conditions. There is the potential for waterside structures such as bridges or jetties, particularly abutting the high ground in Zone III. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered high.

5.1.8 **Zone V: Bulstake Stream.** This Zone is characterised by **c**omplex topography associated with the current watercourses. It is anticipated there will be areas of channel erosion and areas along the margins where waterside structures and activity may be anticipated. The alluvium thins to the north against the rising topography of the underlying gravel surface.

5.1.9 **Zone VI: The Long Meadow**. Similar to Zone I, this zone is characterised by a deep complex channel system associated with the Hinksey Stream. Radiocarbon dates were processed from organic silts in Boreholes OA104A and OA104B suggesting deposition during the Neolithic and Bronze Age. A high degree of erosion and reworking of archaeological remains is anticipated, although *in situ* remains may be preserved locally associated with units of organic silt deposited in lower energy conditions, particularly towards the top of the channel sequence. There is the potential for waterside structures such as bridges or jetties, particularly abutting the high ground. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered high.

5.1.10 **Zone VII: South Hinksey**. As with Zone III, this zone is characterised by a relatively thin alluvial blanket, dissected by a few minor channels. This is a key area for cropmarks. The potential for *in situ* archaeological remains and cut features to be preserved within and beneath the alluvium is considered to be high. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered to be low given the general absence of organic sequences. However, some potential may be contained within the mapped minor channels which are currently undated

5.1.11 **Zone VIII: The Devil's Backbone.** Similar to zone VII but with a thicker alluvial blanket.

5.1.12 **Zone: IX: North of the Old Abingdon Road.** This zone is characterised by thin deposits of alluvium with colluvial ploughsoils and ridge and furrow. As such a degree of reworking and disturbance is anticipated. *In situ* archaeological remains and cut features may be preserved at depth. The potential for preservation of palaeoenvironmental remains for landscape reconstruction is considered to be low.

5.1.13 **Zone X: Old Abingdon Road**. This is the alignment of a medieval or earlier causeway with scheduled culverts forming a continuation of the Norman Grandpont from St Aldates (OA 2016a, no. 2). This zone has been subject to a recent trench evaluation to assess the archaeological potential of the complex stratigraphy which includes multiple road surfaces and masonry structures (OA 2017).

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Appendix A. Summary of Site Details

Site name:	Oxford Flood Alleviation Scheme (FAS)
Site code:	OXFLOD-16
Grid reference:	SP490063 to SP510358
Type:	Geoarchaeological Assessment Report
Date and duration:	Fieldwork – August-October 2016
Summary of results:	Between August and October 2016 Oxford Archaeology (OA) undertook a geoarchaeological investigation associated with the proposed Oxford Flood Alleviation Scheme (FAS). The work was commissioned by Mackley on behalf of the Environment Agency (EA). The investigation focused on the footprint of the combined channel options between Botley Road and Old Abingdon Road, located across the floodplain meadows west of Oxford City. 91 interventions were carried out that included hand auger transects and boreholes, accompanied by an Electro-magnetic (EM) Conductivity Survey. The primary purpose of investigation was to provide additional baseline data on the nature and archaeological potential of the sedimentary sequences. This work builds on an initial stage of deposit modelling associated with a programme of geotechnical works in 2015. The floodplain stratigraphy is broadly consistent with the previous work. However, the additional interventions have allowed gaps in the distribution of the dataset to be filled, providing a more comprehensive coverage of the route. Assessment of pollen, plant remains and molluscs, together with a programme of range-finding radiocarbon dates, have allowed comment to be made on the environments of deposition and provide an indicative chronology for the sequences. Based on the results of the investigation ten contrasting geoarchaeological zones have been identified along the route. These zones address the perceived archaeological and palaeoenvironmental potential of the sediment sequences and are intended to inform future evaluation strategies.
Location of archive:	The archive is currently held at OA, Janus House, Osney Mead, Oxford, OX2 0ES, and will be deposited at Oxfordshire Museum

Appendix B. Pollen Assessment

Mairead Rutherford

B.1 Methodology

B.1.1 Volumetric samples were taken from 24 sub-samples and one tablet containing a known number of *Lycopodium* spores was added so that pollen concentrations could be calculated (Stockmarr 1972). The samples were prepared using a standard chemical procedure (method B of Berglund and Ralska-Jasiewiczowa 1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles > 170 microns, silicates and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000cs silicone oil. Slides were examined at a magnification of 400x by ten equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967) or until at least 100 pollen grains were counted. Pollen identification was made following the keys of Moore *et al* (1991), Faegri and Iversen (1989), and a small modern reference collection. Identification of non-pollen palynomorphps (NPP) follows van Geel (1978). Plant nomenclature follows Stace (2010). The preservation of the pollen was noted and an assessment was made of the potential for further analysis.

Borehole	Number of sub-samples	Depth of sub-samples (m BGL)
OA103	3	0.54-0.55, 0.77-0.78, 1.25-1.26
OA104A	4	0.69-0.70, 1.59-1.60, 2.53-2.54, 3.77-3.78
OA104B	2	1.34-1.35, 1.74-1.75
OA106	8	0.90-0.91, 1.44-1.45, 1.92-1.93, 2.24-2.25, 2.92-2.93, 3.98-3.99, 4.15-4.16, 4.59-4.60
OA109	3	0.74-0.75, 1.19-1.20, 1.49-1.50
OA111	4	0.89-0.90, 1.15-1.16, 1.87-1.88, 2.51-2.52

Table B1: Number of sub-samples assessed for pollen, micro-charcoal, algae and non-pollen palynomorphs.

B.2 Results

B.2.1 Pollen preservation was generally good to mixed, with pollen counts suggesting good potential for analysis.

Borehole OA103

B.2.2 Three sub-samples, assessed for palynomorphs from this borehole, contained a relatively rich assemblage and preservation was generally good to mixed. All three sub-samples (0.54-0.55m, 0.77-0.78m and 1.25-1.26m) contained similar assemblages. The deepest sub-sample yielded a diversity of herbs, but the assemblage was dominated by grasses (Poaceae) and sedges (Cyperaceae). Other herb taxa recorded include pollen of Apiaceae (a broad group including plants such as pennyworts, water-dropworts and angelicas), ribwort plantain (*Plantago lanceolata*), dandelion-type (*Taraxacum*-type), docks/sorrels (*Rumex*-type), buttercup-type (Ranunculaceae), stitchworts (*Stellaria*-

type) and a single occurrence of rosebay willowherb (*Chamerion angustifolium*). A single cereal-type or large grass pollen grain was also recorded at this depth. The two other sub-samples (0.77-0.78m and 0.54-0.55m) recorded similar herb assemblages but in both sub-samples, the abundance of pollen of sedges far exceeded that of grasses. Pollen of meadowsweets (*Filipendula*) was present in both of these sub-samples and at 0.54-0.55m, pollen of mints (*Mentha*-type) and bedstraws (Rubiaceae), was additionally recorded. Little tree pollen has been recorded, but occurrences of alder (*Alnus*), pine (*Pinus*), oak (*Quercus*), hazel-type (*Corylus*-type) and willow (*Salix*) were present. Freshwater algal types and pollen of aquatic plants were present in all three sub-samples but recorded in greater abundance in the uppermost sub-sample, at 0.54-0.55m. These taxa included the freshwater algae *Pediastrum* (HdV-760), *Botryococcus* (HdV-766), zygospores of *Closterium* (HdV-60), spores of *Spirogyra* (HdV-130, 131) and pollen of the aquatic plants, pondweed (*Potamogeton*), bulrush (*Typha latifolia*) and lesser bulrush (*Typha angustifolia*). Fern spores were present in relatively low numbers and included common occurrence of monolete fern spores (Pteropsida) and lower counts for common polypody (*Polypodium vulgare*) and bracken (*Pteridium aquilinum*). Moderate amounts of micro-charcoal were recorded.

Interpretation

B.2.3 The three sub-samples are from organic rich clays overlying Pleistocene sandy gravel deposits. The pollen data suggest an open, herb-rich grassy palaeoenvironment with evidence (from the algal records) for areas of shallow, possibly stagnant water nearby. Pollen present in the two upper sub-samples suggests a change to sedge fen palaeoenvironments, with increasing signals for the presence of open water (*Closterium* HdV-60) and shallow, possibly stagnant water (*Spirogyra* HdV-130, 131) (van Geel 1978). Pollen of aquatic plants, such as bulrush and lesser bulrush, present within these upper two sub-samples, was probably derived from plants that grow in reed swamps, lakes, ponds, slow rivers and ditches (Stace 2010). The occurrence of cereal-type pollen may represent pollen of a cultivated crop (eg *Hordeum* (barley)) that may have been growing or possibly processed nearby, or may represent the pollen of a wild grass, such as *Glyceria* (sweet-grasses), which are found in and by rivers, ponds and lakes, on mud or in shallow water (Stace 2010). The dimensions for pollen of barley and sweet-grasses overlap and it can be difficult to distinguish the two (Andersen 1972). Pollen of weeds associated with disturbance and/or damp areas is also recorded, for example, docks/sorrels, carrot family, chickweeds, mints and ribwort plantain. Tree pollen is probably of regional origin and may have been either wind or water transported. Micro-charcoal particles may represent derivation from a local or regional source and could have been water transported; the presence of such particles is an indication of past burning activity (for example, from hearths or domestic fires or wild fires / lightning strikes).

Borehole OA104A

B.2.4 The deepest sub-sample, at 3.77-3.78m, yielded a rich pollen assemblage, dominated by arboreal pollen, specifically alder, with occurrences only of hazel-type, lime (*Tilia*), pine and oak. A more diverse assemblage, present at 2.53-2.54m, yielded arboreal and herb pollen. Alder was again dominant amongst the tree and shrub pollen but there was greater representation of other types, including oak and hazel-type, with occurrences only of elm (*Ulmus*), lime and pine. Pollen of herbs was chiefly represented by an assemblage of grasses and sedges, with presence also of pollen of mint, water-purslane (*Lythrum portula*), pollen of the pinks family (Caryophyllaceae), daisy-type

(Asteraceae, a large group comprising for example, sow-thistles, burdocks and oxeye daisies), cinquefoils (*Potentilla*-type), dandelion-type and ribwort plantain. A single cereal-type or large grass pollen grain was also recorded. Pollen of the aquatic plant, pondweed, was present. Small amounts of micro-charcoal occur; rare non-pollen palynomorphs included occurrence of zygospores of *Closterium* (HdV-60) as well as presence of the fungal spores *Coniochaeta xylariispora* (HdV-6) and HdV-18.

B.2.5 A significant change in assemblage was observed in the two sub-samples assessed at 1.59-1.60m and 0.69-0.70m. Arboreal pollen was much reduced in comparison with the deeper sub-samples (above); small quantities of alder and oak were recorded, along with occurrences only of pine and hazel-type, and, at 1.59-1.60m, a single record for birch (*Betula*) pollen and, at 0.69-0.70m, a single record for lime pollen. The assemblages within these upper two sub-samples, at 1.59-1.60m and 0.69-0.70m, are distinguished by a relative abundance of grasses and sedges, respectively, with sedge pollen becoming dominant at 0.69-0.70m. Cereal-type pollen (or large grass grains) were recorded at both levels, along with pollen of the carrot family, plantains (including several specimens of ribwort plantain at 1.59-1.60m) and nettles (*Urtica*-type). A slightly more diverse herb pollen assemblage was recorded at 1.59-1.60m, and included pollen of bedstraws, dandelion-type, meadowsweets and docks/sorrels. Pollen of the aquatic plants, pondweed, bulrush and water-plantains (*Alisma* spp.), was recorded at both levels, with a single record for lesser bulrush at 1.59-1.60m. Fern spores included relatively common occurrence of monolete fern spores (Pteropsida), common polypody (*Polypodium vulgare*) and bracken (*Pteridium aquilinum*). Moderate amounts of micro-charcoal were present at 1.59-1.60m, however, a relative abundance of microcharcoal was present in the uppermost sub-sample at 0.69-0.70m. Non-pollen palynomorphs were recorded in greater abundance within the upper sub-sample also and included zygospores of *Closterium* (HdV-60), common occurrence of spores of *Spirogyra* (HdV-130, 131) and the fungal spore *Glomus* (HdV-207).

Interpretation

B.2.6 The deepest sub-samples were taken from organic rich lenses within sandy gravel deposits. Three further sub-samples were extracted from organic clay silt lithologies overlying the gravel deposits. As there are only four sub-samples in nearly 4m depth of sediment, it is only possible to interpret the palynological assemblages in a very general sense. The results demonstrate that pollen is well preserved and relatively abundant in all four sub-samples. The deepest sub-sample, at 3.77-3.78m, suggests an alder carr palaeoenvironment was present in the area; however, the sub-sample at 2.53-2.54m suggests that although alder carr was probably still present within the palaeoenvironment, there is evidence also for perhaps more regional woodland that included trees such as oak, elm, lime and pine. There is also a suggestion for development of hazel-type scrub, possibly locally, for example, in floodplain areas. There is a record for a single cereal-type pollen grain, and, in association with pollen of other herbs such as grasses, ribwort plantain, dandelion-type and mint, may provide evidence for areas of meadow with some possible cultivation. However, as the dimensions of cultivated cereal pollen overlap with those of wild grasses, it cannot be certain that these pollen grains represent cultivated species (Andersen 1979). There is also evidence for more open, wet palaeoenvironments, from the pollen record in the sub-sample at 2.53-2.54m. Herbs of wet areas are present at this depth, for example, water-purslane, which occurs in open or bare ground by or in water, or in damp trackways (Stace 2010)) as well as rare occurrences of pollen of aquatic plants, such as pondweed, and zygospores of *Closterium* (HdV-60), species of which are found in open water (van Geel 1978).

B.2.7 The sub-sample at 1.59-1.60m is dominated by pollen of grasses, with a relatively rich variety of other herbs such as pollen of the carrot-family, dandelion-type, docks/sorrels, ribwort plantain, meadowsweets, bedstraws and a single large grass pollen, attributed to a cereal-type, all suggesting meadowlands with possible cultivation. Evidence for wetness is supported from pollen of aquatic plants, including pondweed, bulrush and lesser bulrush, known to occur in reed swamps, lakes, ponds, slow rivers and ditches (Stace 2010). Arboreal pollen is much reduced and may be sourced from only background, regional trees at this point. Other open areas or cleared areas of woodland would appear to have been invaded by ferns, including common polypody, bracken and monolete ferns.

B.2.8 The uppermost sub-sample at 0.69-0.70m contains further evidence for openness, as almost 50% of the pollen counted is of sedges, suggestive of damp, grassy or wet places (Stace 2010), or possible development of sedge-fen carr. The suggestion of development of wet areas is supported by both the pollen record for pondweed and bulrushes, as well as the NPP assemblage, which contains several specimens of *Spirogyra* (HdV-130, 131*),* species of which live in shallow, stagnant water (van Geel 1978). Interestingly, this sub-sample also records relatively high counts of microcharcoal particles – these could reflect transport in a possible fluvial system – and provide evidence for burning activity either regionally or locally.

B.2.9 The assessed sub-samples would appear to show a transition from alder carr to open, grassy, wet meadow palaeoenvironments to sedge fen.

Borehole OA104B

B.2.10 Two sub-samples were assessed for pollen and both contained rich and diverse assemblages. The deeper sub-sample ((1.74-1.75m) from organic clay silts (channel fill) yielded an assemblage of herb and tree pollen. The arboreal assemblage comprised mostly alder, with lesser quantities of oak, hazel-type, lime, birch, pine and willow. The herb pollen assemblage included occurrences of thistles (*Cirsium*), dandelion-type, docks/sorrels, ribwort plantain, goosefoot family (Chenopodiaceae) and cereal-type/large grasses.

B.2.11 The upper sub-sample (from the overlying alluvium deposit) contained abundant tree pollen, namely alder, with occurrences also of pine, oak and lime. The herb pollen included counts of sedges, grasses, dandelion-type, ribwort plantain, mugworts (*Artemisia*) and pollen of the pinks family (Caryophyllaceae).

B.2.12 Both sub-samples recorded ferns spores, including common polypody, bracken and monolete ferns. Pollen of aquatic plants included occurrences of lesser bulrush and pondweed. Fungal spores and other non-pollen palynomorphs were present in both sub-samples but in relatively low diversity. Spores of *Spirogyra* (HdV-130, 131) are recorded in both sub-samples. Microcharcoal values are moderate in the deeper sub-sample but relatively low in the upper sub-sample.

Interpretation

B.2.13 The pollen assessment suggests a change from a more open, dominantly grassy meadow and possible sedge-fen palaeoenvironment to one in which alder carr had become established. A greater diversity of herbs in the deeper sub-sample, including possible cereal-type/large grasses, ribwort plantain, docks/sorrels and pollen of the goosefoot family suggests potential open areas such as wet meadows, which may have been used for pastoral and/or arable cultivation. The uppermost sub-sample suggests a possible stabilisation of alder carr on alluvial deposits.

Borehole OABH106

B.2.14 All but one of the eight sub-samples assessed yielded generally good quantities of pollen, with good to mixed preservation. The five deepest sub-samples (2.24-2.25m to 4.59-4.60m) comprised rich woodland pollen taxa, including alder, oak, hazel-type and lime. Some herb taxa were also present, but in low numbers, and comprised pollen of the carrot family, grasses and sedges, as well as a record for a single occurrence of cereal-type / large grass pollen at 4.15-4.16m and again at 2.24-2.25m, and ribwort plantain and docks/sorrels at 2.92-2.93m. A species-poor assemblage at 1.92-1.93m, provided limited evidence for woodland pollen and pollen of herbs. The two upper sub-samples, from 1.44-1.45m to 0.90-0.91m, contained a very different type of pollen assemblage, dominated by sedges and grasses, also with herbs such as docks/sorrels, carrot-family, mint, dandelion-type, ribwort plantain and cereal-type/large grasses. Tree pollen was still recorded but in very low numbers, relative to the deeper sub-samples. Pollen of aquatic plants included occurrences of pondweed and water plantain. Single occurrences of grains of lesser bulrush and yellow water-lily were recorded at 1.44-1.45m. At this depth also, common occurrence of spores of *Spirogyra* (HdV-130) and the fungal spore *Glomus* (HdV-207), were recorded; *Closterium* (HdV-60) was recorded at 0.90-0.91m. Microcharcoal particles became more common between 2.24-2.25m and 0.90-0.91m.

Interpretation

B.2.15 The lithologies show development of a series of organic rich silty clays (channel fill) and alluvium, overlying Pleistocene sands and gravel. The pollen data suggest an older arboreal assemblage was replaced by a more open, wetter palaeoenvironment. Dominance of alder pollen suggests probable presence of alder carr between 4.59-4.60m and 2.24-2.25m; however, evidence of mixed woodland is also present and likely to have comprised oak, pine, elm, lime and ash. At this depth also, there is limited evidence for open areas; counts of herb pollen are generally low, including mostly grasses, sedges, pollen of the carrot family and rare cereal-type or large grasses. The evidence for open, grass and sedge communities, increases greatly within the upper two sub-samples (1.44-1.45m – 0.90-0.91m). The taxa recorded in these two sub-samples suggest possible wet meadows adjacent to possible sedge fen carr communities. Such palaeoenvironments may have been used to support animal grazing. The occurrence of cereal-type pollen (especially at 1.44-1.45m), if not attributed to wild grasses (Andersen 1972), may suggest use of the land for arable cultivation. There is evidence for an increase in microcharcoal within the upper sub-samples; this could reflect transport in a possible fluvial system – and also suggests burning activity, either regionally or locally.

Borehole OABH109

B.2.16 Pollen was neither well preserved nor abundant, in the three sub-samples assessed from channel fill and alluvial deposits, within this borehole. The deepest sub-sample (1.49-1.50m) yielded pollen of dominantly sedges and grasses, with several other herbs such as docks/sorrels, meadowsweets, dandelion-type, daisy-type and a single occurrence of a cereal-type / large grass pollen, also recorded. Tree pollen included hazel-type, alder and occurrence only of pine, oak, lime, willow and ash (*Fraxinus*). Fern spores including common polypody, bracken and monolete ferns were also counted. There were no records of pollen from aquatic plants, although NPP associated with aquatic environments were present, for example, *Spirogyra* (HdV-130). Pollen of sedges was most commonly recorded from sparse pollen assemblages in the two upper sub-samples at 1.19-1.20m and 0.74-0.75m, and pollen of the aquatic plant, bulrush, was also recorded at 1.19-1.20m. Micro-charcoal particles are moderately well represented.

Interpretation

B.2.17 Given the relatively low pollen counts, an interpretation based on assessment must be treated with caution. The data suggest possible development of sedge fen palaeoenvironments, possibly with regionally developed mixed woodlands. There is evidence also (at 1.49-1.50m) for the presence of wet, grassy, meadow areas, such as might support a flora of dandelion-types, meadowsweets, docks/sorrels and daisy-types.

Borehole OABH111

B.2.18 Of the four sub-samples assessed for pollen, only one produced sufficient pollen to be statistically viable. The deepest sub-sample appears to have been taken from a presumed organic lens within sands and gravels. Although this sub-sample did contain pollen, mostly grasses, sedges and some other herbs as well as some tree pollen (alder, hazel-type, oak and pine), the assemblage also yielded reworked pollen, acritarchs and dinoflagellate cysts. Pollen of aquatic plants including bulrush, lesser bulrush and pondweed, in addition to the presence of the algal types *Pediastrum* (HdV-760) and *Spirogyra* (HdV-130, 131) was recorded. An organic rich sandy silty clay with shell fragments, at 1.87-1.88m, yielded a poor pollen assemblage, of alder, oak, pine, lime and hazel-type. The richest pollen assemblage was from an organic silty clay (1.15-1.16m) and contained mostly grasses, sedges and pollen of the carrot family (potentially, for example, water dropworts), docks/sorrels and meadow-rues (*Thalictrum*). Tree pollen was also present, mostly alder, oak, hazel-type, birch, lime, willow and beech (*Fagus*). A diversity of pollen of aquatic plants included pondweed, bulrush, lesser bulrush and arrowheads (*Sagittaria*). A few fern spores were recorded, common polypody, bracken, horsetails (*Equisetum)* and monolete ferns. The algal types *Spirogyra* (HdV-130, 131) and *Closterium* (HdV-60) were also present. A poor pollen assemblage was recovered from a clay deposit at 0.89-0.90m; and comprised sedge pollen and alder pollen, with occurrences of pollen of aquatic plants and the freshwater alga *Botryococcus* (HdV-766). Micro-charcoal counts were generally low to moderate but the sub-sample at 0.89-0.90m contained an abundance of microcharcoal.

Interpretation

B.2.19 The pollen counts were generally too low to provide an accurate interpretation; however, the overall suggestion at 2.51-2.52m, is of a wet, possible sedge-fen type habitat; woodland trees comprising mostly alder, hazel-type, oak and pine were also present locally or regionally. The sub-sample at 1.87-1.88m provides slightly more evidence for possible increased numbers of alder pollen, suggesting potential development of alder carr communities. The most reliable count, from the sub-sample at 1.15-1.16m, contains an abundance of pollen of herbs, suggesting open, wet palaeoenvironments and possible sedge-fen development. Tree pollen suggests the presence of regional or possibly local woodlands. The uppermost sub-sample, at 0.89-0.90m, yielded low counts of herb pollen of sedges and other herbs, suggesting the presence of possible sedge-fen communities. Some evidence for woodland communities was also present, especially alder woods. The very high microcharcoal counts at this depth may reflect alluvial deposition.

B.3 Discussion

B.3.1 The oldest dated sediments are present in OABH106. A radiocarbon dated sample at 4.58-4.59m, returned a date of 6200-6020 cal BC (7280±30 BP; Beta-450165). A later Mesolithic date was obtained from sediments from the same borehole, at 2.91-2.93m (4780-4615 cal BC; 5900±30 BP; Beta-450163). The pollen sequences, from this borehole, suggest that alder carr had developed on the floodplain at this time. Such environments have been previously described from palaeoenvironmental work from the excavation of the British Telecom tunnel at St Aldate's (Dodd 2003). Of interest in the current study is the occurrence of pollen grains of flax and possible cereal-type. A seed capsules of flax was previously described from the Mesolithic deposits from the St Aldate's excavation and interpreted as intrusive (*ibid*). From the current study, a radiocarbon date from sediments at 3.73-3.80m from OABH104A, returned a Neolithic age of 3620-3365 cal BC (4710±30 BP; Beta-450164); the pollen sub-sample at 3.77-3.78m contained a rich assemblage, interpreted as indicative of alder carr communities. Within the same borehole, a further radiocarbon assay at 2.54-2.55m, produced an early Bronze Age date of 2200-2025 cal BC (3730±30 BP; Beta-450166). The pollen assemblage from OABH104A, at 2.53-2.54m, provides evidence to suggest a change in palaeoenvironments, to development of a possibly more open, possibly wet, herb rich community, including taxa such as sedges, grasses, mints and water purslane. There is evidence for a reduction in alder carr habitats and possible increase in pollen from mixed deciduous woodland, for example, oak, hazel-type, elm and lime.

B.3.2 An Early Bronze Age date, 2115-1900 cal BC (3660±30 BP; Beta-450169) has been obtained from a radiocarbon dated sample from OABH111, at 1.86-1.87m. Although the pollen sub-sample at this depth did not produce a statistically viable count, the pollen that is present suggests the presence of both woodland (including alder, oak, hazel-type, lime and pine) as well as open, wet palaeoenvironments, of grasses, sedges and bulrushes. At 1.15-1.16m, a rich pollen assemblage confirms the apparent expansion of wet palaeoenvironments, with counts for pollen of aquatic plants such as bulrush, lesser bulrush, pondweed, arrowhead as well as significant numbers of grasses, sedges, docks/sorrels, meadow-rues and pollen of the carrot family (which could include taxa such as water dropworts). Arboreal pollen is still recorded at this depth, accounting for approximately 20% of the pollen counted, and includes hazel-type, oak, alder, birch, beech, lime and willow.

B.3.3 A Middle Bronze Age date, 1435-1290 cal BC (3160±30 BP; Beta-450168), was obtained from a radiocarbon dated sample from OABH104B, at 1.73-1.74m. A rich pollen assemblage, at 1.74-1.75m, contained taxa indicative of mixed palaeoenvironments. Approximately 30% of the counts yielded tree pollen, dominantly alder but also oak, hazel-type, oak, birch, willow and lime. Herbs, indicative of possible open, wet communities (grasses, sedges, docks/sorrels, meadowsweets) occur along with pollen of aquatic plants (bulrush, pondweed). There is evidence for potential human impact, as taxa normally associated with disturbance, for example, ribwort plantain, pollen of the goosefoot family, thistles and cereal-type pollen are also recorded. A late Bronze Age date, 1000-835 cal BC (2820±30 BP; Beta-450167), was obtained from a radiocarbon dated sample from OABH109, at 1.49-1.50m. The pollen profile may be interpreted to suggest development of open areas, possibly sedge-fen palaeoenvironments, some mixed woodland development and possible indicators of disturbance. An undated sub-sample, approximately 0.40m above the dated Bronze Age horizon in OABH104B, contains an assemblage dominated by alder pollen, suggesting the re-establishment of alder on alluvial clays.

B.3.4 A recent radiocarbon date of 101.5±0.3pMC (Beta-450162) was obtained from a plant sample from OABH103, at 1.22-1.26m. The pollen assemblage at this depth contained a rich and abundant variety of herbs, in particular grasses, sedges, pollen of the cabbage family, buttercup family, dandelion-type and rosebay willowherb. Evidence for wet environmental conditions may be inferred from the pollen of aquatic plants, such as pondweed, and freshwater algae such as *Pediastrum* HdV-760. There is evidence for potential arable cultivation, based on the presence of disturbance indicator pollen such as cereal-type, ribwort plantain and chickweeds. Tree pollen includes that of alder, hazel-type, oak, birch and willow, suggesting perhaps regional or local development of woodland.

B.4 Recommendations

B.4.1 It is recommended that a full, possibly composite sequence, from the Mesolithic to the later Bronze Age and the undated sediments above the later Bronze Age, could be sub-sampled for pollen analysis. The assessment demonstrates that pollen preservation and abundance is sufficient for full analysis. This should proceed at a minimum of 0.04m intervals; greater definition would be achieved from sub-sampling every 0.02m. Pollen counts of between 300-500 grains may be anticipated, and would include pollen of trees and shrubs, herb pollen and fern spores. The analysis would provide further information to detail environmental changes that occurred on the floodplain and to establish aspects of human activity adjacent to the floodplain.

B.5 References

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	Borehole	OA103			OA104A				OA104B		OA106								BH109			BH111			
	Preservation	Mixed	Good	Mixed	Mixed	Mixed	Good	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
	Potential	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**No**	**Poss**	**YES**	**YES**	**YES**	**YES**	**NO**	**NO**	**Poss**	**NO**	**YES**	**NO**	**NO**
	Depth (m BGL)	0.54-0.55	0.77-0.78	1.25-1.26	0.69-0.70	1.59-1.60	2.53-2.54	3.77-3.78	1.34-1.35	1.74-1.75	0.90-0.91	1.44-1.45	1.92-1.93	2.24-2.25	2.92-2.93	3.98-3.99	4.15-4.16	4.59-4.60	0.74-0.75	1.19-1.20	1.49-1.50	0.89-0.90	1.15-1.16	1.87-1.88	2.51-2.52
Trees/Shrubs																									
Alnus	Alder	2		3	6	6	43	101	84	14	2	2	9	31	70	70	60	52	1	3	4	7	4	16	4
Betula	Birch			1		1				2		2				1						1	2		
Quercus	Oak		2	2		4	10	1	3	5	2	8	2	9	5	5	4	11		1	2		5	4	1
Corylus avellana-type	Hazel-type	4		4	2	2	13	1		8	2	12	4	11	10	23	8	29		1	7		7	4	4
Ilex	Holly										1														
Fagus	Beech																						2		
Fraxinus	Ash														2	1				1	2				
Hedera	Ivy														1		2							1	
Sorbus -type	Whitebeams															1									
Pinus	Pine		1		1	1	1	1	1	1	1	1	2	1	1	2	1	4		2	1			2	1
Ulmus	Elm						2					2		1	5	1	1	2							
Rosaceae	Wild roses				1		1			1											1				
Rubus-type	Brambles											1						2			1		2		
Salix	Willow	1		1						2		1		7	6	1	6	1		1	1	1	1	1	
Tilia	Lime				1		1	1	1	1			3												
Crops																									
Cerealia	Cereal-type	1		1	2	1	1			2	1	4		1			1				1				1
Herbs																									
Amaranthaceae/ Chenopodiaceae	Goosefoot family	1			1					1												3			
Anemone-type																									
Apiaceae	Carrot family	1	2	4	3	4					11	12		1		1	1					2	25		2
Artemisia	Mugworts								1			1													
Asteraceae	Daisy family			1		1				1	3		1	2			1			2	2		3		
Brassicaceae	Cabbage family	1	2	1	2	3			2		2	1		1	1										
Caryophyllaceae	Pinks family	2					1		1											1					
Chamerion angustifolium	Rosebay Willowherb			1																					
Cirsium-type	Thistles									1															
Cyperaceae	Sedges	58	70	11	49	5	11		8	12	34	19	2	4		1	3	1	9	13	24	15	13	4	7
Fabaceae	Pea family			2						2				2							1				
Filipendula	Meadowsweets	1	1			2				1	1										1				

	Borehole	**OA103**			**OA104A**				**OA104B**		**OA106**								**BH109**			**BH111**			
	Preservation	Mixed	Good	Mixed	Mixed	Mixed	Good	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
	Potential	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**No**	**Poss**	**YES**	**YES**	**YES**	**YES**	**NO**	**NO**	**Poss**	**NO**	**YES**	**NO**	**NO**
	Depth (m BGL)	0.54-0.55	0.77-0.78	1.25-1.26	0.69-0.70	1.59-1.60	2.53-2.54	3.77-3.78	1.34-1.35	1.74-1.75	0.90-0.91	1.44-1.45	1.92-1.93	2.24-2.25	2.92-2.93	3.98-3.99	4.15-4.16	4.59-4.60	0.74-0.75	1.19-1.20	1.49-1.50	0.89-0.90	1.15-1.16	1.87-1.88	2.51-2.52
Lotus-type	Bird's-foot-trefoils			1																					
Ludwigia palustris	Hampshire-purslane			1																					
Lythrum portula	Water-purslane						1																		
Mentha-type	Mints	1					1					1													
Linum-type	Flax																1								
Plantago lanceolata	Ribwort plantain		1	2		4	1		1	4	1		1		1					1					1
Plantago spp.	Plantains			2	1										1								1		1
Poaceae	Grasses	15	7	35	10	51	12		5	16	15	17	1	3	1	2	4			5	10	3	28	3	10
Persicaria maculosa	Redshank		1			1				1					1						1			1	
Potentilla -type	Cinquefoils			1			1																		
Ranunculaceae	Buttercups			5		1						1		1						1					
Rubiaceae	Bedstraws	2				1								1											
Rumex obtusifolius	Broad-leaved Dock											1											1		
Rumex spp.	Docks/Sorrels	1		1		1				3		2								1	1		5		1
Stellaria-type	Chickweeds			1																					
Taraxacum-type	Dandelion-type	1	6	2		1	1		4	2	7			1			1		1	2	5	3			3
Thalictrum																							1		
Urtica-type	Nettles			1	1	1																			
Viola-type	Violets									1															
	Indeterminate herbs	4		4	1	2	1		2	2		3						2		1	2	2	6		1
Fern spores																									
Equisetum	Horsetails																						1		
Polypodium vulgare	Polypodies	1		1	1	1			1	2		1	2	1	1	1	4			1	2	1	1	1	
Pteridium aquilinum	Bracken	2	1	6	9	3			2	6	4	3	3				1	1	1	1	4		1	2	
Pteropsida	Monolete ferns	4	6	7	14	7	1		4	14	8	7	5	4	1		5	1	1	1	3	1	3	1	
Fern spores *indet.*	Indeterminate spores	1		1						1										1					
Total land pollen		**104**	**100**	**103**	**105**	**104**	**103**	**105**	**120**	**106**	**95**	**102**	**38**	**82**	**108**	**108**	**104**	**106**	**13**	**39**	**75**	**39**	**112**	**40**	**37**
Number of traverses		10	10	7	7	4	4	1	2	5	10	10	10	10	5	3	3	4	10	10	10	10	9	10	10
Lycopodium	Exotic	10	7	8	4	11	9	1	5	12	11	12	11	14	5	3	8	3	2	9	10	15	12	13	5

	Borehole	OA103			OA104A				OA104B		OA106								BH109			BH111			
	Preservation	Mixed	Good	Mixed	Mixed	Mixed	Good	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
	Potential	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**No**	**Poss**	**YES**	**YES**	**YES**	**YES**	**NO**	**NO**	**Poss**	**NO**	**YES**	**NO**	**NO**
	Depth (m BGL)	0.54-0.55	0.77-0.78	1.25-1.26	0.69-0.70	1.59-1.60	2.53-2.54	3.77-3.78	1.34-1.35	1.74-1.75	0.90-0.91	1.44-1.45	1.92-1.93	2.24-2.25	2.92-2.93	3.98-3.99	4.15-4.16	4.59-4.60	0.74-0.75	1.19-1.20	1.49-1.50	0.89-0.90	1.15-1.16	1.87-1.88	2.51-2.52
Mosses																									
Sphagnum	Moss spores			1																					
Aquatics																									
Alisma	Water plantains				1	1					1			1											
Nuphar lutea	Yellow water-lily											1			1										
Potamogeton	Pondweeds	1		2	4	6	1	1	1	1	8	3	1		1		2						3		1
Sagittaria	Arrowheads																						3		
Typha angustifolia	Lesser Bulrush	3	3			1			1			1								5		1	3	1	1
Typha latifolia	Bulrush	1			1	1				3												1	2		1
Algae																									
Botryococcus HdV-761		9	3								1											1			
Pediastrum HdV-760		1		2						1															2
Microscopic charcoal		123	26	45	122	29	13	1	32	84	98	135	50	128	9	9	44	17	20	60	62	350	40	51	34
Reworked palynomorphs		1		4			5	1			3	2	1		2		1				2				5
NPP*																									
Fungal spores indeterminate				6		2	3		1	3		2		1	2		3	2		2	6		1	2	2
HdV-6				1			1			1		1			5	1								1	
HdV-8b										1								1							
HdV-16				1																	1				
HdV-18							1									2	1	1							
Chaetomium HdV-7A						1																			
Closterium HdV-60		7	4		3		1				1								1			3	1		
Diporotheca HdV-143																1	1								
Glomus-HdV-207		3	1	10	4	1		1	2	2	1	5	1	2	1	1	1	1			4		5	3	4
Kretzschmaria deusta HdV-44																	1	1							
Sordaria HdV-55A/B				3		1				2		1								1			2	1	

Borehole	OA103			OA104A				OA104B		OA106								BH109			BH111			
Preservation	Mixed	Good	Mixed	Mixed	Mixed	Good	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Good	Good	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
Potential	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**No**	**Poss**	**YES**	**YES**	**YES**	**YES**	**NO**	**NO**	**Poss**	**NO**	**YES**	**NO**	**NO**
Depth (m BGL)	0.54-0.55	0.77-0.78	1.25-1.26	0.69-0.70	1.59-1.60	2.53-2.54	3.77-3.78	1.34-1.35	1.74-1.75	0.90-0.91	1.44-1.45	1.92-1.93	2.24-2.25	2.92-2.93	3.98-3.99	4.15-4.16	4.59-4.60	0.74-0.75	1.19-1.20	1.49-1.50	0.89-0.90	1.15-1.16	1.87-1.88	2.51-2.52
Spirogyra (psilate) HdV-130	8	4	1	10	2			1	2		8	1	1			2			10	8	3	2	1	2
Spirogyra (reticulate) HdV-131	4		1	1					1															2
Sporomiella HdV-113																								1
HdV-92					1									1										
HdV-128										1		1	2											
Zygnemataceae	1	1							1															
Broken grains	4	2	10	2		2		1		7	1	3	3	1		9	1	2	1				1	1
Concealed grains	5	4	10	10		3		4		8	3	2	1	2	1	9	2	7	2	3	9	2	3	2
Crumpled grains	5	1	3	7		7		6		9	3	5	6	2	3	3	2	3	1	6	6		8	2
Corroded grains																						1		

Table B1: Raw pollen counts

Appendix C. Assessment of plant remains and molluscs

Julia Meen

C.1 Methodology

C.1.1 A total of 25 sub-samples were taken from six boreholes in order to assess the waterlogged plant macrofossils and molluscs present in the sequence. Samples were wet-sieved onto 250µm mesh and 3-4 teaspoons of each (or 100% of the flot if less material was available) were examined using a LEICA EZ4D stereo microscope at x10-40 magnification. The abundance of plant and molluscan taxa was recorded using the following scoring system: >10 items +, 10-25 items ++, 25-50 items +++, 50-100 items + +++. Presence of insect remains, charcoal, ostracods and Charophyte oogonia was also recorded. Nomenclature for the plant taxa follows Stace 2010; nomenclature for molluscan taxa follows Anderson 2005.

C.2 Results

Borehole OA103

C.2.1 Borehole OABH103 was drilled through a small infilled channel on the floodplain. The basal sample, from the organic rich clay overlying the gravel (1.21-1.25m), was composed mostly of fine roots and plant stems. Radiocarbon dating of plant stem from this unit came back as modern, but is believed to be have been laid down in the medieval period or earlier The small number of waterlogged seeds present were mostly a mixture of aquatic taxa (crowsfoot, water plantain) and those of damp ground (knotweed (*Persicaria* sp.), rush, sedge). The exception is a single seed identified as fairy flax (*Linum catharticum*), a species usually associated with dry, calcareous habitats. A seed of fairy flax was recovered from the medieval silts of a palaeochannel on Oxey Mead, a floodplain meadow to the north of Oxford (Robinson 2004). Seeds of fairy flax were also found from a fifteenth century well at Claydon Pike, amongst a suite of other grassland taxa which were interpreted as coming from species-rich hay meadow on the Thames floodplain (Robinson 2011). A seed provisionally identified as wild radish (*Raphanus raphanistrum*), may also indicate open, possibly cultivated or otherwise managed ground in the vicinity. The pollen from this level also provides evidence for nearby grassland, being dominated by sedge and grass pollen. By 0.73-0.78m, the waterlogged material continues to be dominated by fine roots, with fragments of grass or rush stem present; however given the modern date of the stem from the underlying level, this could be intrusive. The waterlogged seeds are limited to rush, crowsfoot and mint (*Mentha* sp.), all taxa associated with damp or waterside locations. The absence of arboreal or grassland taxa from this level is mirrored in their reduced proportions in the pollen record (Rutherford, this report). The sample from the blueish grey clay alluvium laid down at the top of the sequence (0.46-0.56m) contains only seeds of sedge.

Borehole OA104A

C.2.2 A radiocarbon date from an organic lens in the basal sandy gravels at 3.73-3.80m produced a radiocarbon date of 4670±30 BP (Early Neolithic). The waterlogged remains from this unit are sparse, but the presence of alder catkins hints at wet woodland. This is corroborated by a dominance of arboreal pollen from this level (Rutherford, this report). A second date, from an organic clayey silt at 2.54-2.55m, produced a date of 3710±30 BP (Early Bronze Age). The seeds from this part of the sequence include taxa that suggest standing water or pools – yellow water-lily (*Nuphar* sp), crowfoot, pondweed – as well as scrubbier vegetation such as hawthorn (*Crataegus* sp.), creeping thistle (*Cirsium arvense*) and nettle (*Urtica dioica*). Additionally, there is the continued presence of alder. The mollusc assemblage is generally indicative of still or slowly moving water, although the presence of crushed shell suggests that some of the material in the assemblage may have been transported through flood events. The dominance of woody material in the sample suggests that the environment was quite closed, with perhaps overhanging vegetation.

C.2.3 By 1.60-1.65m, the picture is quite different. The organic material is dominated by plant stem, while wood fragments and arboreal seeds are absent and charcoal fragments are common, reflecting an opening up of the landscape and increased human activity in the vicinity. The snail assemblage is indicative of still or gently flowing water, with none that indicate that conditions were drying out. The plant macrofossils are equally dominated by aquatic taxa or by plants that readily inhabit damp ground.

C.2.4 The capping alluvium, sampled at 0.63-0.73m, again shows poor preservation for organics, with a single degraded seed of water-plantain and no snails preserved.

Borehole OA104B

C.2.5 A radiocarbon date was taken from the basal organic clayey silts of this sequence, from just above the interface with the underlying gravelly sands at 1.73-1.75m. This produced a date of 3110±30 BP (Middle Bronze Age). The material from this level is predominately plant stem based, with little woody material present, and no arboreal taxa are represented in the seed assemblage. This is in contrast to the wood rich Early Bronze Age assemblage encountered in borehole 104A. This suggests that, either there was an opening up this part of the floodplain between the Early and Middle Bronze Age, or that the wet alder woodland was restricted to the centre of the drainage system where 104A was located. As the pollen record from this level still contains frequent pollen of alder, alongside an increase in herb pollen, it is suggested that the latter interpretation is more likely as it is clear that there were still significant stands of alder in the vicinity even as some areas were becoming more open. By 1.25-1.35m, the sequence is still dominated by plant stem, but contains few waterlogged seeds. The snail assemblage contains species indicative of drying conditions (*Galba truncatula*) as well as those commonly found on stream side vegetation (*Succinea/Oxyloma*).

Borehole OA106

C.2.6 Borehole 106 produced the longest sequence from the floodplain, with the base of the organic clayey silts directly overlying the Pleistocene gravels radiocarbon dated to 7220±30 BP (Mesolithic). This deep sequence of intercalated organic and minerogenic units is thought to encompass the former course of the Hinksey stream, with the abrupt contacts between individual units thought to result from episodes of cutting and filling on the bank of the channel.

C.2.7 The sample from 4.55-4.60m produced a dark, highly organic flot composed mainly of wood derived material. The waterlogged seeds were dominated by alder (*Alnus* cf *glutinosa*), with a catkin highly likely to also be of alder also present. The remaining seeds were sedge (*Carex* sp.), dock (*Rumex* sp.) and buttercup (*Ranunculus acris*/*repens*/*bulbosus*).

C.2.8 The flot from the organic rich olive grey clay at 4.05-4.10m again contained predominately wood derived material, with abundant wood fragments and twigs. However, the sediment matrix was very different in this unit when compared to the underlying fill, and the presence of abundant crushed mollusc shell suggested that the material had been reworked. The presence of *Theodoxus fluviatilis*, a freshwater snail commonly found in flowing water, is indicative of moving water in the channel. The evidence for flowing water increases the possibility that some of the organic material in the unit may have been transported from elsewhere. The waterlogged seeds include vegetation of waterside or damp habitat that might be expected to be growing on the floodplain alongside the watercourse, such as sedge, rush (*Juncus* sp.) and hemp-agrimony (*Eupatorium cannabinium*). Seeds such as stitchwort (*Stellaria* sp.), nettle (*Urtica dioica*), and silverweed (*Potentilla anserina*) suggest that more open or waste ground was present in the vicinity of the stream. Frequent charcoal flecks may be evidence of contemporary human activity in the stream catchment.

C.2.9 The strongly organic nature of the sediment continues at 3.93-3.98m, the base of a very dark greyish brown organic clayey silt unit. The flot here was highly organic, with abundant wood derived material, including frequent twigs. Alder seeds were common. The peaty nature of this unit strongly suggests that woody remains that dominate the flot are from vegetation decaying *in situ*, with the dominance of alder seeds indicating an alder-carr type wet woodland developing on the floodplain. There is a lack of sedge seeds in this unit, which are otherwise almost ubiquitous from the floodplain samples – this may hint that the conditions were much more shaded due to tree cover.

C.2.10 The base of a unit of peaty silty clay was radiocarbon dated to 5840±30 BP (Late Mesolithic) at 2.88-2.93m. This unit is again dominated by woody material, with frequent twigs and moss present. Alder continues to be the most dominant seed type. A Rosaceae fruit stone provisionally identified as hawthorn (*Crataegus* sp.) further points to the presence of tree cover, as does the presence of a snail of zonitoides type, which are generally found in shaded or wooded habitats.

C.2.11 The sedimentary profile suggests an interface at around 2.20m, with a shift to less peaty textured sediment. However, the sample from the very base of this unit continues to have more in common with the preceding unit. The macrofossils continue to point to a wooded component to the landscape, with seeds of alder and elder (*Sambucus nigra*) and the continued presence of snails of Zonoitoides type, while the flot generally contains much wood derived material. However, there is some evidence that conditions are becoming more open, with seeds of sedge becoming common. The sediment is noticeably more minerogenic in character as peat accumulation ceases, and this suggests that fluvial activity is increasing, resulting in the abundant fragmented mollusc shell observed in the unit.

C.2.12 In the increment directly above (2.15-2.20m), a transition to more open conditions is much more apparent. The flot is composed predominately of plant stem fragments and twigs. Charcoal fragments are present, pointing to human activity in the vicinity. The waterlogged seeds feature waterside vegetation, most commonly sedge, but also include plants of grassland and waste ground, including hawkbit (*Leontodon* sp.), stitchwort and black nightshade (*Solanum nigrum*). The lack of seeds of arboreal taxa suggests that there are no longer trees overhanging the watercourse, although the pollen record shows that there are still trees in the vicinity (Rutherford, this report). The snail assemblage contains many taxa indicative of swamp or marsh conditions, including *Galba truncatula*, *Carychium* sp and *Cochlicopa* sp.

C.2.13 The base of a unit of an organic rich sandy clay was sampled at 1.85-1.90m. The increased sand content of this unit suggests that the previously more stagnant, swamp like conditions were replaced by faster flowing water, corroborated by the return of *Theoduxus fluviatilis* and abundant crushed shell in the mollusc assemblage. The flot from the base of this unit contains abundant wood fragments, although the continued absence of arboreal seeds suggests that, rather than tree cover becoming re-established, this material was transported into the channel from elsewhere in the catchment. The seeds instead point to a continuation of open conditions in the vicinity of the stream, with stitchwort, bramble (*Rubus* sp.) silverweed and buttercup found alongside aquatic vegetation such as water-plantain (*Alisma* sp.) and pondweed (*Potamageton* sp.) and streamside vegetation such as sedge and spike-rush (*Eleocharis* sp.). This is in agreement with the pollen data, which records low arboreal values for this level (Rutherford, this report).

C.2.14 The flot from a relatively thin horizon of organic silty clay, sampled at 1.40-1.45m, returns to being dominated by plant stems and leaf fragments as opposed to large chunks of wood. The fine texture of the sediment suggest flow in the channel was much reduced, presumably accounting for the lack of larger wood pieces being transported in the channel. Several taxa continue to point to open, grassland or cultivated ground nearby – wild radish (*Raphanus raphanistrum*), *Persicaria lapathifolia* (pale persicaria) and hawkbit (*Leotondon* sp). This is mirrored by a strong grassland component in the pollen record from this level (Rutherford 2016). Fool's-watercress (*Apium nodiflorum*), gypsywort (*Lycopus europaeus*), sedge and rush represent the streamside component of the assemblage.

C.2.15 The alluvium that caps the sequence was laid down in historic times. The sample taken at 0.80-0.90m contained few organic remains, with fine roots and an absence of seeds. The snail assemblage includes both *Anisus leucostoma* and *Galba truncatula*. Robinson (1988) found both species in modern snail populations on the floodplains of the Thames, however, *G. truncatula* was joined by *A. leucostoma* only in the wetter areas, due to its being less tolerant of drying.

OABH109

C.2.16 Borehole OABH109 was also drilled through a minor channel on the floodplain. The radiocarbon date from the base of the organic silty clay overlying the Pleistocene gravels at 1.49-1.50m BGL came back as 2770±30 BP (Late Bronze Age). Much of the sample from this level was wood derived, with occasional small twigs; the seed assemblage was dominated by sedge and crowsfoot, with occasional buttercup, mint, water plantain and dock. A caryopses of oat (*Avena* sp.) hints at cultivated ground nearby, although without a diagnostic floret base it cannot be shown whether this was of a wild or cultivated variety.

C.2.17 By 1.15-1.20m, the organic clayey silt contains mostly plant stem material, with the seed assemblage continuing to be dominated by many of the same taxa. This is in agreement with the sedge dominated pollen assemblage from this level, which was interpreted as deriving from a sedge fen environment (Rutherford, this report). The uppermost sample in the sequence, from the alluvium underlying the topsoil at 0.70-0.75m, contains no organic material.

C.2.18 The sequences from boreholes OABH103 and OABH109 are very similar in character, and it is likely that they are of similar date. The channel fills in both are dominated by taxa of damp, but open, places and it is notable that neither contain arboreal seeds, despite the presence of wood fragments at the base of OABH109. No remains of alder were found in these two channels, and can be contrasted with the earlier prehistoric sequences in which alder seeds and catkins form a large component of the assemblages.

Borehole OA111

C.2.19 Borehole OA111 was located adjacent to the Seacourt steam, and was chosen as a comparison to boreholes 106 and 104a. The yellow sandy gravels encountered at the base of the core contained an organic horizon at 2.47-2.52m; this contained a mixture of plant stems and more woody material, with a seed assemblage dominated by aquatic taxa such as water plantain and ~~water~~ crowsfoot. These gravels were assumed to be late Glacial or early Holocene; the presence of occasional charcoal fragments from this level may indicate early human clearance of the landscape.

C.2.20 The base (1.86-1.87m) of the organic sandy silty clay unit that directly overlies the yellow gravels was radiocarbon dated and produced a date of 3620±30 BP (Early Bronze Age). The sample from this level was dominated by wood, including some smaller twigs, but mostly larger wood fragments. Seeds were low in number, but are notable for the present of alder. Pollen from this level was dominated by arboreal taxa (Rutherford 2016); the macrofossils support Rutherford's interpretation that alder carr woodland may have been developing at this time. Snails are abundant from this level, including much crushed shell suggesting the material had been transported at with some energy.

C.2.21 By 1.11-1.16m, the silty clay contained abundant plant stem, and alder had disappeared from the seed assemblage, suggesting conditions were becoming more open. Charcoal fragments also attest to possible clearance activity in the vicinity. The uppermost sample, from the clay alluvium at 0.85-0.90m, contained no waterlogged seeds or snails.

C.3 Discussion

C.3.1 The earliest deposit encountered during this study is dated to the middle part of the Mesolithic, and contains wood remains including catkins and seeds of alder that suggest that wet woodland had become established on the floodplain of the Thames by this date. A pollen sequence from Mingies Ditch, on the floodplain of the River Windrush to the west of Oxford, indicates that by the Middle Mesolithic the open floodplain conditions of the early post-Glacial had given way to more closed conditions as tree pollen came to predominate. At Mingies Ditch an alder carr wet woodland comparable to that apparent at the current site is recorded by the Late Mesolithic, suggesting that the developments were roughly contemporary.

C.3.2 Pollen from the Thames floodplain at both Yarnton and at Oxey Mead, to the north of the study site, shows clearance of much of the local woodland by the Neolithic period, which Greig (2004) attributes to the extensive evidence for settlement in the area from this date. The sequence from the current study suggests that closed conditions persisted throughout the Neolithic on this part of the floodplain, with both the macrofossils and pollen evidence showing a dominance of woodland taxa at 4670±30 BP (Borehole 104a).

C.3.3 Robinson (2004) has argued that the water table rose in the Upper Thames Valley in the Middle Bronze Age, with the reactivation of previously dry channels. An organic clayey silt dated to the Early Bronze Age (3710±30 BP) from Borehole 104A contained both macrofossil and mollusc evidence for standing or slowly moving water in the channel on this part of the floodplain. Both the pollen and the macrofossil evidence suggest that alder carr persisted to this period but that areas of scrubbier vegetation were developing as well.

C.3.4 Several of the borehole sequences suggest that conditions on the floodplain were changing from the Middle to the Late Bronze Age. A date of 3110±30 BP from Borehole 104B is contemporary with the disappearance of arboreal taxa and the predominance of plant stem over wood-derived material. However, as stated above, pollen from this level still contains a high proportion of alder, suggesting that, whilst conditions were opening up in some parts of the floodplain, stands of wet alder woodland persisted in others. Charcoal fragments from this level in Boreholes 104A and 111 can also be seen as indicative of woodland clearance within the stream catchment.

C.3.5 The plant assemblages post-dating the reduction of alder woodland on the floodplain are predominately composed of aquatic and stream side taxa. Robinson (2004) encountered many of the same species from a Bronze Age to Early Medieval sequence from Oxey Mead, with celery-leaved crows-foot, water plantain, water mint and pondweed amongst those present. Greig notes a discrepancy between the macrofossils from Oxey Mead and the pollen, which suggests a higher proportion of grassland in the vicinity; this he attributes to the filtering effects of the dense waterside vegetation on the macrofossils (Greig 2004). It is likely that at the current site, although there are some seeds of plants of more open ground, that these same effects mask the extent of grassland in the vicinity of this part of the floodplain. Excavations on Port Meadow, just to the north of the current study site, revealed that the floodplain here was utilised as overgrazed marsh pasture during the Iron Age, and there is evidence that Port Meadow and other parts of the Thames floodplain were used as hay meadow from at least the Roman period onwards (Robinson 2011).

C.3.6 References

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Table C1: Assessment of plant remains and molluscs

	Borehole	OA103			OA104A				OA104B		OA106									OA109			OA111			
	Depth (m BGL)	0.46-0.56	0.73-0.78	1.21-1.22	0.68-0.73	1.60-1.65	2.50-2.54	3.77-3.78	1.25-1.35	1.70-1.73	0.80-0.90	1.40-1.45	1.85-1.90	2.15-2.20	2.20-2.25	2.88-2.91	3.93-3.98	4.05-4.10	4.55-4.58	0.70-0.75	1.15-1.20	1.45-1.48	0.85-0.90	1.11-1.16	1.83-1.86	2.47-2.52
Plant taxa	**Common name**																									
Nuphar sp.	Yellow Water-lily						+																			
cf *Caltha palustris* L.	Marsh-marigold									+																
Ranunculus acris/repens/bulbosus	Meadow/Creeping/Bulbous Buttercup			+		+	+						+	+			+	+	+			+			+	+
Ranunculus subgenus Batrachium	Crowsfoot		++	++		++	+			+		++		+	+			+			++	++		+	+	++
cf *Crataegus* sp.	Hawthorn						+									+										
Rubus sp.	Bramble							+					+													
Potentilla anserina L.	Silverweed												+					+								
cf *Potentilla* sp.	Cinquefoil																							+		
Urtica dioica L.	Common Nettle					++				++						+	+	+			+					
Alnus glutinosa (L.) Gaertn.	Alder						+								+	++	+++		+++						+	
Corylus avellana L. (nutshell)	Hazel																	+								
cf *Euphorbia* sp.	Spurge															+										
Linum catharticum L.	Fairy Flax			+																						
cf *Hypericum*	St John's-wort											+														
Raphanus raphinistrum L.	Wild Radish			+								+														
Polygonaceae	Knotweed Family			+		+				+		+	+					+								
Persicaria lapathifolia (L.) Delarbre	Pale Persicaria											+														
Persicaria sp.	Knotweed								+																	
Rumex sp (perianth)	Dock													+					+			+		+		+
Rumex sp (seed)	Dock																									+
Stellaria sp.	Stitchwort											+	+	+				+								
Chenopodium sp.	Goosefoot												+	+								+				
Primulaceae	Primrose Family									+																
Solanum cf nigrum L.	Black Nightshade													+												
Lamiaceae	Dead-nettle Family																	+								

	Borehole	OA103			OA104A				OA104B		OA106									OA109			OA111			
	Depth (m BGL)	0.46-0.56	0.73-0.78	1.21-1.22	0.68-0.73	1.60-1.65	2.50-2.54	3.77-3.78	1.25-1.35	1.70-1.73	0.80-0.90	1.40-1.45	1.85-1.90	2.15-2.20	2.20-2.25	2.88-2.91	3.93-3.98	4.05-4.10	4.55-4.58	0.70-0.75	1.15-1.20	1.45-1.48	0.85-0.90	1.11-1.16	1.83-1.86	2.47-2.52
Mentha sp.	Mint		+	+		++	+			+		++									++	+		+		+
Lycopus europaeus L.	Gypsywort											+					+							+		
cf *Menyanthes trifoliata*	Bogbean															+										
Asteraceae	Daisy Family																								+	
Cirsium arvense (L.) Scop.	Creeping Thistle						+																			
Picris sp.	Hawkweed Oxtongue						+																			
Leontodon sp.	Hawkbit											+		+												
Eupatorium cannabinum L.	Hemp-agrimony															+		+								
Sambucus nigra L.	Elder														+											
Apiaceae	Carrot Family			+		+						+	+	+										+		
Apium nodiflorum (L.) Lag.	Fool's-water-cress											+														
Apium sp.	Marshworts																							+		
Lemna sp.	Duckweed			+																						
Alisma sp.	Water-plantain			+	+	+				+		++	+		+	+	+	+			++	+		+	+	+++
Potamogeton sp.	Pondweed					+	+	+					+													
Juncus sp.	Rush		++	+								++						+			+					
Eleocharis sp.	Spike-rush					+							+													
Carex sp.	Sedge	+		+		++	+++			++		+	++	++	++			++	+++		++	+++		+	+	+
cf *Avena* sp	Oat																					+				
indet										+		+									+			+		
indet seed head fragments																++	+++	+								
Freshwater Mollusca																										
Theodoxus fluviatilis	Flowing water												+					+								
Valvata cristata	Flowing water					++	++		+	+		+	+++			+	+	++	+		+	+			+++	+
Valvata piscinalis	Flowing water					+	+			+		+	++			+	+	++	++		+	+			+	+
Bithynia tentaculata	Flowing water					++	+		+	++	+	++	+++		++	+	+	+++	+++		++	+			+++	
Bithynia tentaculata (op)	Flowing water			++		+			+	+	+	+	+		+		+	+	+		+	+++		+		
cf *Bithynia leachii*	Ditch																		++							
Galba truncatula	Slum	+							+		+		++	++				++				+			+	

Borehole		OA103			OA104A				OA104B		OA106									OA109			OA111			
Depth (m BGL)		0.46-0.56	0.73-0.78	1.21-1.22	0.68-0.73	1.60-1.65	2.50-2.54	3.77-3.78	1.25-1.35	1.70-1.73	0.80-0.90	1.40-1.45	1.85-1.90	2.15-2.20	2.20-2.25	2.88-2.91	3.93-3.98	4.05-4.10	4.55-4.58	0.70-0.75	1.15-1.20	1.45-1.48	0.85-0.90	1.11-1.16	1.83-1.86	2.47-2.52
Radix balthica	Catholic								+						+											
Planorbis planorbis	Ditch					+			+			+	+					+	+							
Anisus leucostoma	Slum	+									+											+				
Bathyomphalus contortus	Catholic											+	++		+		+		+						+	
Gyraulus albus	Catholic						+					+	++	+	++		+	+	+++						++	+
Gyraulus crista	Catholic						++			+			++	+	+	+	+	+	+++		+				+++	
Hippeutis complanatus	Catholic									+						+		+	+							
Psidium sp. (bivalves)				+		++	++		+	+		++	+++	++	+++	++	+	++	+++		+	++			+++	+++
Terrestrial Mollusca																										
Carychium sp	Shaded, marsh												+	+	+		+	+	+						+	
Succinea/Oxyloma	Marsh								+				+	++	++	+	+		+	+		+			+	
Cochlicopa sp.	Catholic													+	+											
Vertigo sp.	Open country, marsh														+											
Vallonia sp.	Open country													++												
Zonitoides type	Marsh														+	+										
Trochulus sp.	Catholic			+							+			+		+		+								
Insect remains				+++						+++		+++	+++				++				+++	+++		++++	+++	+++
Charophyte oogonia				+++						++		+++	++					+++			+++	+++		++		++
Ostracods						+++			++			+++	++	++	++	++	++	++	++++		++	++				+++
Charcoal fragments						+++	+++	+	++				++	++		++		+++						++		++

Appendix D. Auger descriptions

Bore	Depth1	Depth2	Lithology	Comment	Stratigraphy
OA1	0	0.35	Topsoil	Dry dark brownish grey to mid brownish grey sandy clayey silt with occ. granules and small sub-angular stones, lower contact clear.	Topsoil
OA1	0.35	1.45	Clay	Firm becoming soft below 0.6m mid orange brown clay mottled grey with occ. shell frags lower contact clear.	Floodplain Alluvium
OA1	1.45	1.65	Organic clayey silt	Soft, slightly spongy dark brownish grey clayey silt, "peaty", subtle organic smell, freq. plant remains; lower contact diffuse.	Organic/Channel complex
OA1	1.65	1.95	Organic sandy silt	Very soft, moist dark grey slightly clayey sandy silt, organic rich, subtle organic smell, occ. plant remains; sand fine to coarse, "shelly" c. 30%, less below 1.8m; lower contact diffuse.	Organic/Channel complex
OA1	1.95	2.23	Organic silt	Very soft, "peaty", spongy dark greyish brown organic silt, freq. plant remains, occ. small shell frags. In thin 10-20mm lenses; lower contact abrupt.	Organic/Channel complex
OA1	2.23	2.6	Organic silty sand	Moist loose dark grey silty sand, organic rich, subtle organic smell, freq. plant and wood remains, sand fine to coarse, "shelly"; lower contact not observed.	Organic/Channel complex
OA1	2.6	2.9	Gravelly sand	Wet loose dark grey gravelly fine to coarse sand, gravel c. 50% mostly fine, c. 15% of medium to large sub-angular to sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA2	0	0.22	Topsoil	Dry dark brownish grey to mid brownish grey sandy clayey silt with occ. granules and small sub-angular stones; lower contact clear.	Topsoil
OA2	0.22	1	Clay	Compacted mid orange brown clay mottled grey with occ. white mineral concretions; lower contact diffuse.	Floodplain Alluvium
OA2	1	1.5	Organic clayey silt	Soft, tenacious dark brownish grey clayey silt, "peaty", subtle organic smell; lower contact clear.	Organic/Channel complex
OA2	1.5	1.65	Silty sand	Wet soft dark grey silty sand/sandy silt, sand mostly coarse, coarser with depth, some organic matter in silt; lower contact diffuse.	Organic/Channel complex
OA2	1.65	1.75	Gravelly sand	Wet loose dark grey gravelly medium to coarse sand, trace of silt, gravel c. 40% fine to medium, sub-angular to sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA3	0	0.2	Topsoil	Dry dark brownish grey to mid brownish grey sandy clayey silt with occ. granules and small sub-angular stones; lower contact clear.	Topsoil
OA3	0.2	0.7	Clay	Compacted mid orange brown clay mottled grey with rare limestone granules; lower contact diffuse.	Floodplain Alluvium
OA3	0.7	0.73	Clay	Soft tenacious dark grey clay, rare small shell frags; lower contact abrupt.	Floodplain Alluvium
OA3	0.73	0.95	Sandy gravel	Wet loose mid yellow to bright yellow sandy gravel, sand mid to coarse c. 40%, gravel fine – granules and c. 10% of small sub-rounded pebbles, moderately sorted, matrix supported. Not bottomed.	Pleistocene gravel
OA4	0	0.18	Topsoil	Dry dark brownish grey to mid brownish grey sandy clayey silt with occ. granules and small sub-angular stones; lower contact clear.	Topsoil
OA4	0.18	0.95	Clay	Compacted mid orange brown clay mottled grey, homogeneous; lower contact clear.	Floodplain Alluvium
OA4	0.95	1.3	Gravelly sand	Wet loose light to mid yellow gravelly fine to coarse sand, gravel c. 40% fine to coarse, poorly sorted, clasts sub-angular to sub-rounded. Not bottomed.	Pleistocene gravel
OA5	0	0.2	Topsoil	Dry crumbly mid greyish brown sandy silt with occ. granules and small sub-angular pebbles; lower contact clear.	Topsoil
OA5	0.2	1.05	Clay	Very soft tenacious mid orange brown mottled grey clay with occ. white mineral concretions; lower contact diffuse.	Floodplain Alluvium
OA5	1.05	1.18	Clay	Very soft tenacious mid bluish grey clay, homogeneous; lower contact clear.	Floodplain Alluvium
OA5	1.18	1.45	Organic silty clay	Very soft tenacious dark grey silty clay, organic, slightly spongy, "peaty", occ. plant remains.	Organic/Channel complex
OA5	1.45		Gravel		Pleistocene gravel
OA6	0	0.17	Topsoil	Dry crumbly mid greyish brown sandy silt with occ. granules and small sub-angular pebbles; lower contact clear.	Topsoil
OA6	0.17	1.3	Clay	Very soft tenacious mid orange brown mottled grey clay	Floodplain Alluvium

				with occ. white mineral concretions, slightly disturbed; lower contact diffuse.	
OA6	1.3	1.45	Clay	Very soft tenacious mid bluish grey clay, homogeneous; lower contact clear.	Floodplain Alluvium
OA6	1.45	1.65	Gravelly sand	Loose wet dark greyish yellow gravelly medium to coarse sand, moderately sorted; gravel c. 20% fine – granules, occ. small, rare medium sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA7	0	0.18	Topsoil	Dry crumbly mid greyish brown sandy silt with occ. granules and small sub-angular pebbles; lower contact clear.	Topsoil
OA7	0.18	1.2	Clay	Soft tenacious compacted mid to light orange brown mottled grey clay with rare black organic pockets; lower contact diffuse.	Floodplain Alluvium
OA7	1.2	1.5	Clay	Very soft tenacious mid bluish grey clay, minerogenic; lower contact clear.	Floodplain Alluvium
OA7	1.5	1.65	Gravelly sand	Loose wet mid greyish yellow gravelly fine to coarse sand, poorly sorted, gravel c. 40%, fine to coarse, mostly granules and small sub-angular to sub-rounded pebbles; limestone derived. Not bottomed.	Pleistocene gravel
OA8	0	0.2	Topsoil	Dry crumbly mid greyish brown sandy silt with freq. granules to medium sub-angular pebbles and occ. shell frags; lower contact clear.	Topsoil
OA8	0.2	1.5	Clay	Compacted in top part, below very soft tenacious mid orange brown mottled grey clay with occ. white mineral concretions, slightly disturbed – rare CBM and limestone frags; lower contact clear.	Floodplain Alluvium
OA8	1.5	1.9	Clay	Very soft tenacious mid bluish grey clay with occ. pockets of organic matter, homogeneous; lower contact clear.	Floodplain Alluvium
OA8	1.9	2.1	Gravelly sand	Loose wet mid greyish yellow gravelly fine to coarse sand, poorly sorted, gravel c. 40%, fine to coarse, mostly granules and small sub-angular to sub-rounded pebbles; limestone derived. Not bottomed.	Pleistocene gravel
OA9	0	0.3	Topsoil	Dry crumbly mid greyish brown sandy clayey silt with freq. granules to large sub-angular pebbles and occ. shell frags; lower contact diffuse.	Topsoil
OA9	0.3	1.4	Silty clay	Firm dry mid orange brown mottled grey silty clay with occ. granules, softer and greyer below 1.95m; lower contact graded.	Floodplain Alluvium
OA9	1.4	1.85	Organic clayey silt	Soft moist dark grey mottled black clayey silt with dispersed organic matter, subtle organic smell, trace of sand; lower contact diffuse.	Organic/Channel complex
OA9	1.85	2	Gravelly sand	Moist soft dark grey gravelly fine to coarse sand with silt, gravel c. 30%, fine to medium, mostly granules and small sub-angular pebbles. Not bottomed.	Pleistocene gravel
OA10	0	0.25	Topsoil	Dry crumbly mid greyish brown sandy silt with occ. granules and small shell frags; lower contact clear.	Topsoil
OA10	0.25	1.53	Clay	Compacted, soft below 0.6m mid orange brown mottled grey slightly silty clay with occ. small shell frags, and white mineral concretions; lower contact diffuse.	Floodplain Alluvium
OA10	1.53	1.8	Clay	Very soft tenacious light bluish grey with rare small shell frags; lower contact not observed.	Floodplain Alluvium
OA10	1.8	1.9	Organic silt	Very soft, spongy dark greyish brown organic silt, "peaty", strong organic smell, freq. wood and plant remains; lower contact clear.	Organic/Channel complex
OA10	1.9	1.95	Sandy gravel	Moist loose dark yellowish grey sandy gravel with silt, sand c. 40% fine to coarse, gravel clasts dominated, coarse, pebbles sub-rounded to sub-angular. Not bottomed.	Pleistocene gravel
OA11	0	0.18	Topsoil	Compacted dry dark greyish brown sandy silt with occ. granules and small sub-angular pebbles; lower contact clear.	Topsoil
OA11	0.18	1.05	Clay	Compacted, soft below 0.8m mid orange brown mottled grey slightly silty clay with rare medium angular pebbles; lower contact clear.	Floodplain Alluvium
OA11	1.05	1.4	Clay	Soft tenacious mid bluish grey clay mottled brown with dispersed organic matter, rare granules of limestone; lower contact clear.	Floodplain Alluvium
OA11	1.4	1.7	Gravelly sand	Moist loose dark greyish yellow gravelly fine to coarse sand with traces of silt and clay; gravel c. 40%, medium, clasts dominated – sub-rounded to sub-angular pebbles. Not bottomed.	Pleistocene gravel

OA12	0	0.25	Topsoil	Compacted dry mid brownish grey sandy silt with occ. granules; lower contact clear.	Topsoil
OA12	0.25	1.15	Clay	Compacted on top, below soft tenacious mid mid orange brown mottled grey clay with occ. white mineral concretions; lower contact diffuse.	Floodplain Alluvium
OA12	1.15	1.25	Clay	Soft very tenacious mid bluish grey clay, bottom 20mm slightly spongy and organic; lower contact clear.	Floodplain Alluvium
OA12	1.25	1.28	Gravelly sand	Wet loose dark greyish yellow gravelly sand, small amount extracted. Not bottomed.	Pleistocene gravel
OA14	0	0.2	Topsoil	Compacted dark brownish grey sandy silt with freq. limestone granules and shells; lower contact clear.	Topsoil
OA14	0.2	1.83	Silty clay	Stiff firm mid orange brown mottled grey silty clay with freq. white mineral concretions and occ. shells; lower contact clear.	Floodplain Alluvium
OA14	1.83	2.8	Organic silt	Soft dark grey slightly clayey silt with dispersed organic matter, subtle organic smell, occ. small shell frags and plant remains; lower contact clear.	Organic/Channel complex
OA14	2.8	2.95	Sandy gravel	Wet loose dark yellow sandy gravel with grey silt; gravel medium to coarse, clasts supported – sub-angular to sub-rounded pebbles; sand fine to coarse. Not bottomed.	Pleistocene gravel
OA15	0	0.13	Topsoil	Compacted dark brownish grey sandy silt with freq. limestone granules and shells; lower contact clear.	Topsoil
OA15	0.13	0.9	Silty clay	Stiff firm mid orange brown mottled grey silty clay with freq. white mineral concretions and occ. shells; lower contact diffuse.	Floodplain Alluvium
OA15	0.9	1.3	Silty clay	Soft dark brownish grey slightly organic silty clay; lower contact diffuse.	Floodplain Alluvium
OA15	1.3	1.7	Clayey silt	Soft dark grey clayey silt with dispersed organic matter and organic smell, occ. small shell frags; lower contact clear.	Organic/Channel complex
OA15	1.7	2	Organic 'Sandy silt	Soft dark to very dark grey sandy silt with organic matter, sand fine to coarse, "shelly", rare plant remains and small pebbles; lower contact not observed.	Organic/Channel complex
OA15	2	2.15	Gravelly sand	Wet loose dark grey gravelly fine to coarse sand with dispersed organic matter and subtle organic smell; gravel c. 30%, fine to medium, pebbles sub-rounded to sub-angular. Not bottomed.	Pleistocene gravel
OA16	0	0.18	Topsoil	Compacted dark brownish grey sandy silt with freq. limestone granules and shells; lower contact clear.	Topsoil
OA16	0.18	0.75	Silty clay	Firm compacted mid orange brown mottled grey silty clay, homogeneous; lower contact diffuse.	Floodplain Alluvium
OA16	0.75	1.15	Clay	Soft tenacious light brownish grey clay mottled grey, minerogenic; lower contact diffuse.	Floodplain Alluvium
OA16	1.15	1.67	Sandy silt	Soft dark grey clayey sandy silt; sand fine, occ. plant remains, rare small shell frags, subtle organic smell; horizontally bedded below 1.48m; lower contact clear.	Organic/Channel complex
OA16	1.67	2.9	Sand	Moist loose mid grey slightly silty fine to coarse sand; very "shelly" - approx. 50%, freq. shells; horizontally bedded below 2.4m with gravelly sand, gravel fine, freq. wood frags; lower contact diffuse.	Organic/Channel complex
OA16	2.9	2.95	Gravelly sand	Wet loose dark grey gravelly sand, small amount extracted. Not bottomed.	Pleistocene gravel
OA17	0	0.2	Topsoil	Compacted dark brownish grey sandy silt with occ. granules and shells; lower contact clear.	Topsoil
OA17	0.2	1.05	Silty clay	Compacted to soft mid orange brown mottled grey silty clay with freq. white mineral concretions; lower contact diffuse.	Floodplain Alluvium
OA17	1.05	1.25	Clay	Very soft tenacious mid bluish grey mottled orange clay with rare shell frags; lower contact diffuse.	Floodplain Alluvium
OA17	1.25	1.35	Clayey silt	Moist very soft dark grey clayey silt with organic matter, occ. plant remains and shell frags; lower contact clear.	Organic/Channel complex
OA17	1.35	1.7	Sandy silt	Moist very soft dark brownish grey sandy silt with trace of clay, sand fine to medium, freq. shell frags and plant remains; 10-30mm beds of "shelly" sand; lower contact not observed.	Organic/Channel complex
OA17	1.7	1.75	Gravelly sand	Wet loose dark grey gravelly sand, small amount extracted. Not bottomed.	Pleistocene gravel
OA18	0	0.2	Topsoil	Compacted dry dark brownish grey sandy silt with freq. small to large sub-angular pebbles; lower contact clear.	Topsoil
OA18	0.2	0.6	Silty clay	Compacted to soft mid orange brown mottled grey silty clay with freq. white mineral concretions; lower contact diffuse.	Floodplain Alluvium

OA18	0.6	1.05	Clay	Soft tenacious bright orange brown mottled grey clay, in top 0.2m occ. white mineral concretions and small shell frags; lower contact diffuse.	Floodplain Alluvium
OA18	1.05	1.15	Clay	Soft tenacious dark grey silty clay with dispersed organic matter; lower contact not observed.	Organic/Channel complex
OA18	1.15	1.6	Clayey silt	Very soft tenacious brownish grey clayey silt with organic matter, freq. shell frags and occ. plant remains; lower contact not observed.	Organic/Channel complex
OA18	1.6	1.65	Gravelly sand	Wet loose dark yellowish grey gravelly sand, small amount extracted. Not bottomed.	Pleistocene gravel
OA19	0	0.3	Topsoil	Moist soft loose mid brownish grey sandy silt with occ. granules and small sub-rounded pebbles; lower contact diffuse.	Topsoil
OA19	0.3	1.05	Silty clay	Compacted dry mid orange brown silty clay with occ. shell frags, modern roots down to 0.6m; lower contact clear.	Floodplain Alluvium
OA19	1.05	1.35	Silty clay	Soft tenacious mid grey silty clay with occ. small shell frags; lower contact clear.	Floodplain Alluvium
OA19	1.35	1.5	Sandy silt	Soft dark grey sandy silt with clay and organic matter, subtle organic smell, freq. small shell frags, rare plant remains, sand mid to coarse; lower contact clear.	Organic/Channel complex
OA19	1.5	1.7	Gravelly sand	Moist loose dark yellowish grey gravelly fine to coarse sand, gravel c. 30% fine to medium, mostly granules and small sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA20	0	0.35	Topsoil	Dry compacted dark brownish grey sandy silt, clayey at bottom, occ. small sub-angular pebbles and granules; lower contact diffuse.	Topsoil
OA20	0.35	0.98	Clay	Soft tenacious mid orange brown clay mottled grey with occ. small limestone pebbles; lower contact clear.	Floodplain Alluvium
OA20	0.98	1.2	Silty clay	Soft tenacious dark grey silty clay with dispersed organic matter and rare plant remains; lower contact not observed.	Organic/Channel complex
OA20	1.2	1.3	Sandy silt	Soft mid yellowish grey sandy silt with organic matter, subtle organic smell, sand coarse; lower contact diffuse.	Organic/Channel complex
OA20	1.3	1.6	Sandy gravel	Wet loose dark yellowish grey sandy gravel, sand c. 45% fine to coarse, gravel fine to coarse, poorly sorted, matrix supported – granules to small sub-angular clasts. Not bottomed.	Pleistocene gravel
OA21	0	0.2	Topsoil	Moist soft loose mid brownish grey sandy silt with occ. granules and small sub-rounded pebbles; lower contact diffuse.	Topsoil
OA21	0.2	1.1	Clay	Soft tenacious mid orange brown clay mottled grey with occ. white mineral concretions and rare small shell frags; lower contact clear.	Floodplain Alluvium
OA21	1.1	1.25	Gravelly sand	Loose moist dark brownish yellow gravelly fine to coarse sand, gravel c. 25% fine to coarse, pebbles sub-angular to sub-rounded. Not bottomed.	Pleistocene gravel
OA22	0	0.22	Topsoil	Dry dark brownish grey sandy silt with occ. granules; lower contact clear.	Topsoil
OA22	0.22	1.05	Clay	Soft tenacious mid orange brown clay mottled light grey with occ. manganese and iron concretions, modern roots; lower contact clear.	Floodplain Alluvium
OA22	1.05	1.15	Gravelly sand	Loose moist dark to bright yellow gravelly fine to coarse sand, gravel c. 40% fine – granules to small sub-angular to sub-rounded pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA23	0	0.22	Topsoil	Dry dark greyish brown sandy silt with occ. granules and shells; lower contact clear.	Topsoil
OA23	0.22	1.05	Clay	Soft tenacious mid orange brown clay mottled light grey with modern roots down to 0.7m; lower contact clear.	Floodplain Alluvium
OA23	1.05	1.65	Clay	Soft tenacious mid bluish grey clay, homogeneous; lower contact clear.	Floodplain Alluvium
OA23	1.65	1.75	Gravelly sand	Loose moist dark greyish yellow gravelly fine to coarse sand, gravel c. 25% medium – angular to sub-rounded pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA24	0	0.2	Topsoil	Dry dark brownish grey sandy silt with occ. granules; lower contact clear.	Topsoil
OA24	0.2	0.87	Clay	Soft tenacious mid orange brown mottled grey clay with occ. white mineral concretions and manganese, disturbed; lower contact abrupt.	Floodplain Alluvium
OA24	0.87	1.15	Gravelly sand	Loose moist dark to bright yellow gravelly fine to coarse sand, gravel c. 40% fine to medium – granules to medium sub-angular to sub-rounded pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA25	0	0.22	Topsoil	Dry dark greyish brown sandy silt with occ. granules and	Topsoil

				shells; lower contact clear.	
OA25	0.22	0.67	Clay	Compacted to moderately soft mid orange brown clay mottled grey with occ. small shell frags; lower contact clear.	Floodplain Alluvium
OA25	0.67	0.8	Gravelly sand	Loose dry mid to bright yellow gravelly fine to coarse sand, gravel c. 30% fine – granules to small sub-angular to sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA26	0	0.2	Topsoil	Dry dark brownish grey sandy silt with occ. granules; lower contact clear.	Topsoil
OA26	0.2	0.82	Clay	Moderately soft tenacious mid orange brown clay mottled grey with occ. manganese and iron mineralisation, disturbed; lower contact abrupt.	Floodplain Alluvium
OA26	0.82	1	Gravelly sand	Loose moist dark to bright yellow gravelly fine to coarse sand, gravel c. 40% fine to medium – granules to medium sub-angular to sub-rounded pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA27	0	0.2	Topsoil	Compacted dark brownish grey clayey sandy silt with occ. granules and rare large angular pebbles; lower contact clear.	Topsoil
OA27	0.2	1.1	Silty clay	Soft tenacious mid orange brown mottled grey silty clay with occ. limestone frags below 1m; lower contact not observed.	Floodplain Alluvium
OA27	1.1	1.3	Gravelly sand	Loose bright yellow gravelly fine sand with silt, gravel fine c. 10%, granules and small sub-angular pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA28	0	0.25	Topsoil	Compacted dry dark greyish brown sandy silt with occ. granules and small shells; lower contact clear.	Topsoil
OA28	0.25	1.25	Silty clay	Soft mid grey mottled orange silty clay, homogeneous, occ. small shell frags in bottom 0.2m; lower contact diffuse.	Floodplain Alluvium
OA28	1.25	1.46	Clayey silt	Soft mid grey clayey silt with organic matter, occ. plant remains and small shell frags; lower contact diffuse.	Floodplain Alluvium
OA28	1.46	1.78	Organic silt	Very soft dark grey organic silt, freq. wood and plant remains, occ. small shell frags; lower contact clear.	Organic/Channel complex
OA28	1.78	2.1	Gravelly sand	Wet loose bright yellow gravelly fine to coarse sand with trace of silt, gravel fine – sub-angular granules, occ. small shell frags Not bottomed.	Pleistocene gravel
OA29	0	0.2	Topsoil	Compacted dark brownish grey clayey sandy silt with occ. granules and rare large angular pebbles; lower contact clear.	Topsoil
OA29	0.2	1.7	Silty clay	Compacted tenacious mid orange brown mottled grey silty clay with occ. limestone granules; lower contact clear.	Floodplain Alluvium
OA29	1.7	1.8	Gravelly sand	Loose bright yellow gravelly fine sand with silt, gravel fine c. 10%, granules and small sub-angular pebbles, limestone derived. Not bottomed.	Pleistocene gravel
OA30	0	0.17	Topsoil	Compacted dry dark greyish brown sandy silt with occ. small stones; lower contact clear.	Topsoil
OA30	0.17	0.9	Silty clay	Compacted firm mid orangey brown silty clay, mottled grey homogeneous, occ. small shell frag; lower contact clear.	Floodplain Alluvium
OA30	0.9	1.14	Silty clay	Firm mid to dark grey silty clay with dispersed organic matter; lower contact diffuse.	Floodplain Alluvium
OA30	1.14	1.2	Organic clayey silt	Soft dark grey organic clayey silt, organic smell, fibrous, occ. plant remains; lower contact diffuse.	Organic/Channel complex
OA30	1.2	1.33	Organic silt	Soft dark greyish brown organic silt, frequent plant remains and round wood frags. Peaty, organic smell, lower contact abrupt.	Organic/Channel complex
OA30	1.33	2.5	Clayey silt	Moderately firm to soft mid grey silt, slightly clayey. Few plant remains below 1.65m. Below 1.80m shell frags. Below 2.05m laminations of dark grey shelly silty sand and organic silt. Lower contact clear.	Organic/Channel complex
OA30	2.5	2.6	Gravelly sand	Loose dark grey gravelly sand. Clasts sub-rounded, small to medium at 30%, common small shell frags. Sand is medium to coarse. Not bottomed.	Pleistocene gravel
OA31	0	0.17	Topsoil	Dry, crumbly dark brownish grey sandy silt with occ. shells, granules and small stones. Lower contact clear.	Topsoil
OA31	0.17	0.54	Clay	Firm mid orangey brown clay, occ. shells, mottled grey. Lower contact clear.	Floodplain Alluvium
OA31	0.54	1.2	Clay	Soft, tenacious mid grey mottled orange brown, minerogenic, homogeneous clay. Diffuse lower contact.	Floodplain Alluvium
OA31	1.2	2.6	Clayey silt	Soft mid grey clayey silt, slightly organic, rare plant remains. Slightly fibrous below 1.5m with thin laminae of clay and freq. shells. Rare woody frags. Clear lower	Organic/Channel complex

				contact.	
OA31	2.6	2.7	Gravelly sand	Loose dark grey gravelly sand. Clasts sub-rounded to sub-angular, small to medium at 30%, common small shell frags. Sand is medium to coarse. Not bottomed.	Pleistocene gravel
OA32	0	0.16	Topsoil	Dry, crumbly dark brownish grey sandy silt with occ. granules and small stones. Lower contact clear.	Topsoil
OA32	0.16	1.1	Clay	Firm to soft mid orangey brown mottled grey clay, homogeneous. Lower contact diffuse.	Floodplain Alluvium
OA32	1.1	1.72	Clay	Very soft, tenacious, mid bluish grey clay. Occ. plant remains. Lower contact diffuse.	Floodplain Alluvium
OA32	1.72	2.02	Organic clayey silt	Soft dark brownish grey slightly clayey silt, organic rich. Lower contact clear.	Organic/Channel complex
OA32	2.02	2.1	Gravelly sand	Loose dark grey gravelly sand. 30% clasts, poorly sorted, small to medium sub-angular to sub-rounded. Sand is coarse. Not bottomed.	Pleistocene gravel
OA33	0	0.15	Topsoil	Dry, crumbly dark brownish grey sandy silt with occ. granules and small stones. Lower contact clear.	Topsoil
OA33	0.15	1.15	Clay	Firm, mid orangey brown mottled grey clay, slightly silty in top 0.15m. Occ. white mineral concretions. Lower contact clear.	Floodplain Alluvium
OA33	1.15	1.4	Clay	Soft light bluish grey mottled orange clay, tenacious. Grading darker below 1.3m with rare plant remains. Lower contact diffuse.	Floodplain Alluvium
OA33	1.4	1.8	Organic clayey silt	Soft dark grey organic rich clayey silt. Occ. plant remains and wood frags. Thin organic sand laminae down-profile. Lower contact not recorded.	Organic/Channel complex
OA33	1.8	1.87	Sandy gravel	Loose dark grey sandy gravel, fine to medium, sub-rounded to sub-angular clasts. Sand 50%. Not bottomed.	Pleistocene gravel
OA34	0	0.15	Topsoil	Dry, dark brownish grey slightly clayey sandy silt with occ. granules and shell frags. Lower contact clear.	Topsoil
OA34	0.15	1.05	Clay	Soft mid orangey brown mottled grey clay with occ. shells and plant remains. Lower contact clear.	Floodplain Alluvium
OA34	1.05	1.77	Organic clayey silt	Soft, tenacious dark grey clayey silt with occ. plant remains. Increasing organic content with depth. Occ. shell frags. Freq. shell 10% below 1.05m. Lower contact clear.	Organic/Channel complex
OA34	1.77	2.3	Gravelly sand	Loose dark grey gravelly sand with silt and subtle organic smell. Gravel 30%, fine to medium, coarser with depth. Clasts sub-angular to sub-rounded. Sand is fine to coarse. Top 0.1m shelly with rare plant remains and Fe mineralisation, slightly spongy. Not bottomed.	Pleistocene gravel
OA35	0	0.14	Topsoil	Dry, compacted, dark brownish grey clayey silt with occ. granules. Lower contact clear.	Topsoil
OA35	0.14	0.95	Clay	Compacted, soft below 0.60m, mid orangey brown, mottled grey clay. Plant detritus below 0.5m. Lower contact abrupt.	Floodplain Alluvium
OA35	0.95	1.3	Clayey sand	Soft dark yellow clayey sand with freq. 10% small sub-angular clasts and granules. Sand is fine to coarse. Lower contact clear	Pleistocene gravel
OA35	1.3	1.6	Gravelly sand	Loose light yellowish grey gravelly sand with small amount of silt. Gravel small to medium, 40%. Sand is fine to coarse, shelly. At 1.50-1.60m a lens of coarse mid greyish yellow sand with a small amount of organic detritus. Lower contact clear.	Pleistocene gravel
OA35	1.6	1.9	Sandy Gravel	Loose mid yellowish grey sandy gravel, 30% sand. Gravel is fine to coarse. Not bottomed.	Pleistocene gravel
OA36	0	0.16	Topsoil	Dry, compacted, dark brownish grey clayey silt with occ. granules and rare CBM frags. and modern glass. Lower contact clear.	Topsoil
OA36	0.16	0.73	Clay	Compacted, soft below 0.60m mid orange brown mottled grey clay with occ. plant remains. Lower contact abrupt.	Floodplain Alluvium
OA36	0.73	1.05	Gravelly sand	Loose dark yellow gravelly sand. Gravel 40%, poorly sorted. Sand is fine to coarse. Not bottomed.	Pleistocene gravel
OA37	0	0.16	Topsoil	Dry, crumbly, dark brownish grey sandy silt with occ. granules and small stones. Lower contact clear.	Topsoil
OA37	0.16	0.6	Clay	Firm mid orangey brown clay with occ. small stones and shell. Soft below 0.60m and mottled grey. Lower contact clear.	Floodplain Alluvium
OA37	0.6	0.92	Clay	Soft mid bluish grey mottled orange clay. Lower contact clear.	Floodplain Alluvium
OA37	0.92	1.35	Gravelly sand	Loose dark yellow gravelly sand. Gravel 30% poorly sorted, sub-angular to sub-rounded. Sand is fine to coarse. Not bottomed.	Pleistocene gravel

OA38	0	0.17	Topsoil	Dry, crumbly, dark brownish grey sandy silt with occ. granules and small stones. Lower contact clear.	Topsoil
OA38	0.17	0.6	Silty clay	Firm mid orangey brown clay, mottled grey. Becoming grey and soft below 0.50m. Lower contact clear.	Floodplain Alluvium
OA38	0.6	1.02	Gravelly sand	Loose dark yellow gravelly sand. Sand is fine to coarse. Gravel is 30%, small to medium clasts, sub-rounded to sub-angular. Top 0.02m dark brownish yellow and silty with a small amount of organic matter. Not bottomed.	Pleistocene gravel
OA39	0	0.17	Topsoil	Dry, crumbly, dark brownish grey sandy silt. Lower contact clear.	Topsoil
OA39	0.17	0.53	Silty clay	Firm mid orangey brown silty clay, mottled grey. Lower contact clear.	Floodplain Alluvium
OA39	0.53	1	Gravelly sand	Loose dark yellow gravelly sand. Gravel 25%, small to medium, sub-angular to sub-rounded. Sand is fine to coarse.	Pleistocene gravel
OA41	0	0.18	Topsoil	Compacted, dry, crumbly, dark brownish grey sandy silt with occ. small shell frags. and granules. Lower contact clear.	Topsoil
OA41	0.18	0.53	Silty clay	Stiff, firm, mid bluish grey mottled orange silty clay. Lower contact clear.	Floodplain Alluvium
OA41	0.53	0.65	Gravelly sand	Dry, loose, bright yellow gravelly sand with some silt. Gravel 40%, fine to medium sub-angular clasts. Sand is fine to coarse. Not bottomed.	Pleistocene gravel
OA42	0	0.26	Topsoil	Compacted, firm, dark brownish grey sandy silt, slightly clayey, with occ. small granules and rare organic detritus. Lower contact clear.	Topsoil
OA42	0.26	0.57	Silty clay	Firm, compacted mid orange brown silty clay, mottled grey with occ. granules, rare organic detritus. Lower contact clear.	Floodplain Alluvium
OA42	0.57	0.85	Gravelly sand	Dry, loose, bright yellow gravelly sand with some silt. Gravel 40%, fine to medium sub-angular clasts. Sand is fine to coarse. Not bottomed.	Pleistocene gravel
OA43	0	0.18	Topsoil	Compacted, dry, crumbly, dark brownish grey sandy silt, with occ. small shell frags. And granules. Lower contact clear.	Topsoil
OA43	0.18	0.77	Clay	Firm mid orange brown mottled grey clay with rare granules and sub-angular limestone clasts. Occ. plant detritus. Lower contact clear.	Floodplain Alluvium
OA43	0.77	1.1	Gravelly sand	Loose bright yellow gravelly sand with some silt. Sand is fine to coarse. Gravel 30-40%, mostly fine granules to small sub-angular clasts. Not bottomed.	Pleistocene gravel
OA44	0	0.18	Topsoil	Compacted, very dry, crumbly, dark brownish grey sandy silt. Occ. granules. Lower contact clear.	Topsoil
OA44	0.18	0.42	Clay	Stiff, compacted mottled clay, mid bluish grey and orange brown. Occ. small shell frags and rare plant detritus. Lower contact clear.	Floodplain Alluvium
OA44	0.42	0.68	Clay	Firm mid brownish orange mottled grey clay. Occ. small shell frags. And granules. Clear lower contact.	Floodplain Alluvium
OA44	0.68	0.9	Gravelly sand	Loose light greyish yellow gravelly sand with some silt. Sand is fine to coarse. Gravel is 30%, fine granules to small sub-angular to sub-rounded clasts of limestone. Not bottomed.	Pleistocene gravel
OA45	0	0.18	Topsoil	Compacted, very dry, crumbly, dark brownish grey sandy silt. Occ. granules and shell frags. Lower contact clear.	Topsoil
OA45	0.18	0.92	Clay	Compacted, firm, mid orange brown mottled grey clay. Predominantly grey below 0.55m and soft. Occ. white mineral concretions and small shell frags. Basal 0.05m slightly darker. Lower contact abrupt.	Floodplain Alluvium
OA45	0.92	1.15	Gravelly sand	Loose mid yellow gravelly sand. Top 0.05m grey brown. Sand 60-70% is fine to coarse with a trace of silt. Gravel 30-40%, mostly fine granules and small clasts, sub-angular to sub-rounded. Not bottomed.	Pleistocene gravel
OA46	0	0.2	Topsoil	Crumbly, dark brownish grey sandy silt with occ. shells and small to large sub-rounded stones. Lower contact clear.	Topsoil
OA46	0.2	1.5	Silty clay	Firm, dense, mid orange brown, mottled grey clay. Occ. shell frags. Silty and soft below 1.40m with a small amount of dispersed organic matter. Diffuse lower contact.	Floodplain Alluvium
OA46	1.5	1.7	Organic silty clay	Soft tenacious dark brownish grey silty clay, organic rich with depth, occ. shells. Almost black below 1.60m. Lower contact diffuse.	Organic/Channel complex
OA46	1.7	1.85	Organic clayey silt	Very soft dark grey organic clayey silt, less clayey with	Organic/Channel complex

				depth. Occ. shell frags. Lower contact diffuse.	
OA46	1.85	2	Gravelly sand	Loose dark grey silty gravelly sand, slightly organic. Gravel 40% fine granules and small sub-angular to sub-rounded pebbles. Sand is fine to coarse. Lower contact clear.	Organic/Channel complex
OA46	2	2.86	Organic silt	Very soft dark brownish grey organic silt. Occ. plant detritus and small shell frags. Slightly 'peaty'. Lower contact abrupt.	Organic/Channel complex
OA46	2.86	2.98	Sand	Loose dark grey sand, fine to coarse, very shelly. Thin 10-20mm lenses of organic silt with plant remains and wood frags. Lower contact abrupt.	Organic/Channel complex
OA46	2.98	3.2	Gravelly sand	Loose mid yellowish grey gravelly sand. Sand 60% is fine to coarse and shelly. Gravel is 40%, granules to small sub-angular to sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA47	0	0.17	Topsoil	Crumbly, dark brownish grey sandy silt. Lower contact clear.	Topsoil
OA47	0.17	0.75	Clay	Dense, tenacious, mid orange brown clay, mottled grey. Occ. small shell frags. Lower contact clear.	Floodplain Alluvium
OA47	0.75	1	Clay	Soft, tenacious, mid bluish grey clay with occ. plant remains. Lower contact diffuse.	Floodplain Alluvium
OA47	1	1.66	Organic silty clay	Soft, tenacious, dark brownish grey organic silty clay with occ. plant remains. Becomes more spongy below 1.20m with common plant remains and molluscs. Lower contact clear.	Organic/Channel complex
OA47	1.66	2.05	Sand	Loose dark grey poorly sorted coarse sand with silt, organic matter, rare plant remains and common shell frags. Occ. granules. Lower contact not observed.	Organic/Channel complex
OA47	2.05	2.15	Sandy gravel	Loose dark grey sandy gravel. Gravel small to medium, sub-angular to sub-rounded 60%. Sand is coarse. Not bottomed.	Organic/Channel complex
OA48	0	0.16	Topsoil	Dry, crumbly, mid brownish grey sandy silt with rare sub-rounded and sub-angular small to medium stones. Lower contact clear.	Topsoil
OA48	0.16	0.6	Clay	Dense, firm, tenacious mid orange brown, mottled grey, clay. Lower contact clear.	Floodplain Alluvium
OA48	0.6	0.82	Clay	Soft tenacious mid bluish grey clay with rare plant remains. Diffuse lower contact.	Floodplain Alluvium
OA48	0.82	1.45	Organic clayey silt	Soft, slightly spongy, dark grey organic clayey silt with occ. plant remains. Clear lower contact.	Organic/Channel complex
OA48	1.45	1.98	Organic silt	Very soft dark bluish grey organic silt with occ. small rounded pebbles, rare wood and plant remains. Small shell frags. Occ. thin lenses of coarse shelly sand. Lower contact clear.	Organic/Channel complex
OA48	1.98	2.3	Organic silt	Soft, slightly spongy, 'peaty', dark grey organic silt. Below 2.00m occ. shell frags. Lower contact clear.	Organic/Channel complex
OA48	2.3	2.45	Sandy gravel	Loose, dark grey sandy gravel. Gravel 60%, sub-rounded to sub-angular, small to medium. Not bottomed.	Organic/Channel complex
OA49	0	0.19	Topsoil	Dry crumbly mid brownish grey sandy silt	Topsoil
OA49	0.19	1.05	Silty clay	Soft mid orange brown mottled grey clay, slightly silty, tenacious. Lower contact diffuse.	Floodplain Alluvium
OA49	1.05	1.52	Clay	Very soft, tenacious bluish grey clay with occ. Small shell frags. Lower contact clear.	Floodplain Alluvium
OA49	1.52	1.9	Organic silt	Soft, spongy, dark brownish grey organic silt, with occ. plant remains and rare shell frags. Lower contact clear.	Organic/Channel complex
OA49	1.9	2.2	Organic silty sand	Soft dark grey silty sand, organic.	Organic/Channel complex
OA49	2.2	2.4	Sandy gravel	Loose, dark grey sandy gravel.	Pleistocene gravel
OA50	0	0.22	Topsoil	Dry crumbly dark greyish brown clayey silt.	Topsoil
OA50	0.22	1.48	Silty clay	Soft mid orange brown mottled grey clay, slightly silty, tenacious. Lower contact diffuse.	Floodplain Alluvium
OA50	1.48	2	0rganic silt	Soft dark greyish brown organic silt 'peaty'	Organic/Channel complex
OA50	2	2.2	Sandy gravel	Loose, dark grey sandy gravel.	Pleistocene gravel
OA51	0	0.18	Topsoil	Dry crumbly dark greyish brown sandy silt.	Topsoil
OA51	0.18	1.5	Clay	Soft mid orange brown mottled grey clay, slightly silty, tenacious. Lower contact diffuse.	Floodplain Alluvium
OA51	1.5	1.75	Organic silty clay	Soft dark grey organic silty clay, freq. shell frags.	Organic/Channel complex
OA51	1.75	1.8	Sandy gravel	Loose, dark grey sandy gravel.	Pleistocene gravel
OA52	0	0.2	Topsoil	Dark brownish grey sandy silt. Lower contact clear.	Topsoil
OA52	0.2	1.23	Clay	Soft, tenacious mid orange brown mottled grey slightly silty clay. Occ. organic remains. Greyer below 0.60m. Lower contact clear.	Floodplain Alluvium
OA52	1.23	1.77	Clay	Soft, very tenacious mid bluish grey clay. Occ. plant remains and rare shell frags. In lower 0.10m. Lower contact clear.	Floodplain Alluvium

OA52	1.77	2.35	Organic sandy silt	Soft, slightly spongy dark brownish grey organic sandy silt. Occ. small shell frags. Increasing organic content below 2.0m. Lens of dark grey gravelly sand at 2.24-2.34m. Very sandy 40% below 2.5m with some small sub-rounded pebbles.	Organic/Channel complex
OA52	2.35		Sandy gravel	Loose dark grey sandy gravel. Gravel fine to medium with sub-rounded pebbles, sand mostly coarse. Not bottomed.	Pleistocene gravel
OA53	0	0.18	Topsoil	Compacted, dry dark greyish brown sandy silt with occ. granules. Lower contact clear.	Topsoil
OA53	0.18	0.58	Clayey silt	Compacted, firm dark orange brown mottled dark grey clayey silt with occ. small to medium sub-rounded stones and rare iron mineral concretions. Lower contact clear.	Floodplain Alluvium
OA53	0.58	0.75	Sandy gravel	Loose dark brownish yellow sandy gravel. Gravel moderately sorted, clasts supported, fine to medium, sub-rounded to sub-angular clasts. Sand fine to coarse c. 30%, small amount of silt in top. Limestone derived. Not bottomed.	Pleistocene gravel
OA54	0	0.2	Topsoil	Loose dark greyish brown clayey silt with sand and occ. granules. Lower contact clear.	Topsoil
OA54	0.2	0.85	Clay	Soft, tenacious mid orange brown mottled bluish grey clay. Minerogenic, homogeneous. Lower contact clear.	Floodplain Alluvium
OA54	0.85	1.05	Sandy gravel	Loose light yellow sandy gravel. Gravel moderately sorted, fine, granules and small sub-angular to sub-rounded pebbles. Sand fine to coarse. Limestone derived. Not bottomed.	Pleistocene gravel
OA55	0	0.3	Topsoil	Loose dark greyish brown clayey silt with sand and occ. granules. Lower contact clear.	Topsoil
OA55	0.3	0.4	Sandy gravel	Loose dark brownish yellow sandy gravel. Gravel moderately sorted, clasts supported, fine to medium, sub-rounded to sub-angular clasts. Sand fine to coarse c. 30%, small amount of silt in top. Limestone derived. Not bottomed.	Pleistocene gravel
OA56	0	0.27	Topsoil	Compacted, crumbly dark greyish brown slightly clayey sandy silt with occ. granules. Lower contact clear.	Topsoil
OA56	0.27	0.7	Clay	Moderately firm, compacted mid orange brown mottled grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA56	0.7	1.05	Clay	Soft, tenacious mid grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA56	1.05	1.2	Gravelly sand	Loose bright to medium yellow gravelly sand. Sand fine to coarse. Gravel matrix supported, fine with occ. medium to large sub-angular pebbles. Limestone derived. Not bottomed.	Pleistocene gravel
OA57	0	0.27	Topsoil	Crumbling dark greyish brown sandy silt with clay and occ. granules. Bottom part 'sub-soil'. Lower contact clear.	Topsoil
OA57	0.27	0.35	Clayey silt	Compacted, firm mid bluish grey mottled brown clayey silt with rare granules. Lower contact clear.	Floodplain Alluvium
OA57	0.35	0.55	Gravelly sand	Loose bright to medium yellow gravelly sand. Sand fine to coarse. Gravel matrix supported, fine with occ. medium to large sub-angular pebbles. Limestone derived. Not bottomed.	Pleistocene gravel
OA58	0	0.25	Topsoil	Compacted dark greyish brown slightly clayey silt with sand, occ. granules and small sub-angular stones. Lower contact clear.	Topsoil
OA58	0.25	0.4	Clay	Firm, tenacious mid bluish grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA58	0.4	0.5	Silty clay	Moderately firm mid orange yellow silty clay with occ. small to large sub-rounded pebbles. Lower contact abrupt.	Floodplain Alluvium
OA58	0.5	0.6	Gravelly sand	Loose bright to medium yellow gravelly sand. Sand fine to coarse. Gravel matrix supported, fine with occ. medium to large sub-angular pebbles. Limestone derived. Not bottomed.	Pleistocene gravel
OA59	0	0.2	Topsoil	Loose, soft dark greyish brown clayey silt with sand and limestone granules. Lower contact clear.	Topsoil
OA59	0.2	1.2	Clay	Very soft, tenacious mid orange brown mottled grey clay with occ. limestone granules and white mineral concretions. Lower contact clear.	Floodplain Alluvium
OA59	1.2	1.45	Clay	Very soft, tenacious mid bluish grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA59	1.45	1.65	Sandy gravel	Loose dark yellowish grey sandy gravel. Gravel poorly sorted, matrix supported, mostly fine – granules and very small sub-rounded to sub-angular pebbles. Frequent	Pleistocene gravel

				limestone clasts. Sand coarse. Not bottomed.	
OA60	0	0.2	Topsoil	Loose, soft dark greyish brown clayey silt with sand and limestone granules. Lower contact clear.	Topsoil
OA60	0.2	1.25	Clay	Very soft, tenacious mid orange brown mottled grey clay with occ. limestone granules. Lower contact clear.	Floodplain Alluvium
OA60	1.25	1.55	Clay	Very soft, tenacious mid bluish grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA60	1.55	1.75	Sandy gravel	Loose dark greyish yellow sandy gravel. Gravel poorly sorted, clasts supported, mostly fine to medium, sub-rounded to rounded pebbles. Sand coarse. Not bottomed.	Pleistocene gravel
OA61	0	0.2	Topsoil	Dry, crumbly, dark greyish brown silty sand with occ. granules and small sub-rounded stones. Clear lower contact.	Topsoil
OA61	0.2	0.35	Silty sand	Compacted, firm, mid yellowish brown silty sand with occ. granules. Sand is fine to medium. Lower contact diffuse.	Head
OA61	0.35	0.8	Clayey silt	Compacted, firm, mid yellowish brown clayey silt with a small amount of fine to medium sand. Freq. Fe mineralisation. Becomes more clayey with depth. Lower contact diffuse.	Head
OA61	0.8	1.2	Silty clay	Compacted, firm, dry mid yellowish brown mottled grey very silty clay with occ. granules and some sand. Becomes more grey below 1.10m. Diffuse lower contact.	Head
OA61	1.2	1.4	Organic silty clay	Compacted, firm, dark brownish grey organic rich very silty clay. Lower contact clear.	Head
OA61	1.4	1.5	Sandy clayey silt	Firm, compacted mid greyish yellow clayey silt with some sand. Sand is fine to medium 5%. Lower contact diffuse.	Head
OA61	1.5	1.7	Gravelly sand	Loose light to bright yellow gravelly sand. Gravel 10%, fine granules to small sub-angular stones. Sand is fine to coarse with a small amount of silt. Not bottomed.	Pleistocene gravel
OA62	0	0.15	Topsoil	Dry, crumbly, dark greyish brown silty sand with occ. granules and small sub-rounded stones. Clear lower contact.	Topsoil
OA62	0.15	0.6	Silty sand	Compacted, firm, mid yellowish brown silty sand with occ. granules and large sub-angular stones. Sand is fine to medium. Lower contact diffuse.	Head
OA62	0.6	0.9	Sandy clayey silt	Firm, compacted, mid yellowish brown sandy clayey silt. Sand is fine to coarse 5%. Becomes more clayey with depth. Lower contact diffuse.	Head
OA62	0.9	1.25	Silty clay	Soft, tenacious, mid orange brown very silty clay. Occ. shell frags. Lower contact diffuse.	Head
OA62	1.25	1.5	Silty clay	Soft, tenacious mid grey mottled brown very silty clay. Lower contact clear.	Head
OA62	1.5	1.65	Sandy clayey silt	Firm, compacted mid greyish yellow clayey silt with some sand. Sand is fine to medium 20%. Lower contact diffuse.	Head
OA62	1.65	2.15	Gravelly sand	Loose, bright yellow gravelly sand. Gravel 50%, fine granules to small sub-angular stones. Sand is fine to coarse with a small amount of silt and clay. Not bottomed.	Pleistocene gravel
OA63	0	0.18	Topsoil	Dry, crumbly, dark greyish brown silty sand with occ. granules and small sub-rounded stones. Clear lower contact.	Topsoil
OA63	0.18	0.4	Silty sand	Compacted, firm, mid yellowish brown silty sand with freq. granules (10%). Sand is fine to medium. Lower contact diffuse.	Head
OA63	0.4	0.7	Clayey silt	Compacted, firm, mid yellowish brown clayey silt with a small amount of fine to medium sand. Becomes more clayey with depth. Lower contact diffuse.	Head
OA63	0.7	0.9	Clayey silt	Soft mid orange brown mottled grey very clayey silt. Occ. granules and small sub-angular stones. Clear lower contact.	Head
OA63	0.9	1.1	Sandy clayey silt	Soft dark yellow sandy clayey silt. Sand is 10% and fine to coarse. Rare large sub-rounded stones. Diffuse lower contact.	Head
OA63	1.1	1.3	Gravelly sand	Loose, bright yellow gravelly sand. Gravel 50%, fine granules to small sub-angular stones. Sand is fine to coarse with a small amount of silt and clay. Not bottomed.	Pleistocene gravel
OA64	0	0.16	Topsoil	Dry, crumbly, dark brownish grey clayey sandy silt with occ. granules. Clear lower contact.	Topsoil
OA64	0.16	0.55	Clay	Soft orange brown mottled grey clay with occ. white mineral concretions. Lower contact clear.	Floodplain alluvium
OA64	0.55	0.9	Sandy Clay	Soft bright yellow sandy clay with gravel. Sand is course 40%. Gravel is fine granules to small sub-angular clasts 5%. Lower contact clear.	Head

OA64	0.9	1.2	Sandy gravel	Loose bright yellow sandy gravel. Sand is coarse 20%. Gravel poorly sorted 80%, granules to small sub-angular pebbles. Not bottomed.	Pleistocene gravel
OA65	0	0.22	Topsoil	Dry, crumbly, compacted, dark brownish grey sandy silt with occ. granules and sand grains. Clear lower contact.	Topsoil
OA65	0.22	0.92	Clay	Soft, tenacious, mid bluish grey clay, mottled orange brown. Lower contact clear.	Floodplain alluvium
OA65	0.92	1.1	Sandy gravel	Loose bright yellow sandy gravel. Sand is fine to coarse at 30%. Gravel is poorly sorted at 70%, fine to medium, granule and small sub-rounded to sub-angular pebbles of limestone. Not bottomed.	Pleistocene gravel
OA66	0	0.24	Topsoil	Dry, crumbly, compacted, dark brownish grey sandy silt with occ. granules and sand grains. Clear lower contact.	Topsoil
OA66	0.24	1.12	Clay	Soft, tenacious, mid bluish grey clay, mottled orange brown. Lower contact clear.	Floodplain alluvium
OA66	1.12	1.25	Sandy gravel	Loose bright yellow sandy gravel. Sand is fine to coarse at 30%. Gravel is poorly sorted at 70%, fine to medium, granule and small sub-rounded to sub-angular pebbles of limestone. Not bottomed.	Pleistocene gravel
OA67	0	0.19	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt, occ. granules. Clear lower contact.	Topsoil
OA67	0.19	0.8	Clayey silt	Compacted mid brownish grey mottled greyish orange clayey silt. Rising silt content towards base, frequent limestone frags <2mm. Lower contact diffuse.	Floodplain Alluvium
OA67	0.8	0.95	Clay	Soft mid bluish grey mottled orange clay. Lower contact clear.	Floodplain Alluvium
OA67	0.95	1.25	Silty Clay	Very soft, tenacious light greyish orange silty clay. Lower contact clear.	Floodplain Alluvium
OA67	1.25	1.35	Sandy gravel	Loose very coarse light greyish yellow silty sand with well sorted sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA68	0	0.2	Topsoil	Loose, crumbly dark yellowish brown sandy clayey silt with occ. granules. Lower contact clear.	Topsoil
OA68	0.2	0.8	Clayey silt	Compacted mid brownish grey clayey silt with freq. limestone frags <2mm. Lower contact graded.	Floodplain Alluvium
OA68	0.8	0.9	Clay	Soft mid bluish grey clay with few shell inclusions. Lower contact clear.	Floodplain Alluvium
OA68	0.9	1	Clayey silt	Soft mid orangey brown clayey silt with small amount of organic detritus. Lower contact clear.	Floodplain Alluvium
OA68	1	1.5	Clayey silt	Soft dark greyish brown slightly clayey silt with some shell inclusions. Lower contact clear, diagonal with a pocket of clay.	Organic/Channel complex
OA68	1.5	1.7	Silty clay	Pocket of soft silty clay. Lower contact clear.	Organic/Channel complex
OA68	1.7	1.9	Clayey silt	Soft dark greyish brown slightly clayey silt with some shell inclusions. Lower contact graded.	Organic/Channel complex
OA68	1.8	1.9	Sandy gravel	Very loose mid brownish grey coarse silty sandy gravel with moderately sorted sub-rounded and sub-angular pebbles (2-20mm). Not bottomed.	Pleistocene gravel
OA69	0	0.15	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt, occ. granules. Sharp lower contact.	Topsoil
OA69	0.15	0.75	Silty clay	Firm mid orange brown mottled bluish grey silty clay with occ. granules. More granules from 0.6m and it becomes a sandy clay. Plant remains at bottom 0.5m, where the clay becomes darker. Lower contact clear.	Floodplain Alluvium
OA69	0.75	0.9	Clayey sand	Slightly compacted very gritty mid greyish orange clayey sand with freq. granules and occ. stones.	Floodplain Alluvium
OA69	0.9	1.1	Sandy gravel	Loose coarse sandy gravel, well sorted with sub-rounded pebbles. Not bottomed.	Pleistocene gravel
OA70	0	0.13	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt, occ. granules. Clear lower contact.	Topsoil
OA70	0.13	0.86	Silty clay	Very soft mid orange brown mottled with grey, slightly silty clay, occ. shell. Lower contact diffuse.	Floodplain alluvium
OA70	0.86	0.98	Organic silt	Soft dark greyish brown slightly clayey silt. Common plant remains, organic smell. Sandy towards base. Lower contact clear.	Organic/Channel complex
OA70	0.98	1.1	Sandy gravel	Loose mid grey sandy gravel. Moderately sorted, fine to medium gravel.	Pleistocene gravel
OA71	0	0.2	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt	Topsoil
OA71	0.2	1	Silty clay	Firm mid orange brown silty clay.	Floodplain Alluvium
OA71	1	1.1	Gravel	Loose mid yellow brown sandy gravel. Moderately sorted, fine to medium gravel.	Pleistocene gravel
OA74	0	0.2	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt	Topsoil
OA74	0.2	0.45	Silty clay	Firm mid orange brown silty clay.	Floodplain Alluvium

OA74	0.45	0.55	Gravel	Loose mid yellow brown sandy gravel. Moderately sorted, fine to medium gravel.	Pleistocene gravel
OA75	0	0.2	Topsoil	Loose, crumbly dark greyish brown sandy clayey silt	Topsoil
OA75	0.2	1.45	Silty clay	Firm mid orange brown silty clay.	Floodplain Alluvium
OA75	1.45	1.5	Gravel	Loose mid yellow brown sandy gravel. Moderately sorted, fine to medium gravel.	Pleistocene gravel
OA78	0	0.25	Topsoil	Loose, crumbly very dark yellowish brown sandy clayey silt, humic with occ. granules. Lower contact clear.	Topsoil
OA78	0.25	1.15	Clay	Moderately soft, tenacious mid orange brown mottled grey clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA78	1.15	1.95	Clay	Very soft, tenacious mid bluish grey mottled yellow clay. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA78	1.95	2.25	Clayey silt	Very soft, tenacious mid grey clayey silt with organic detritus. Lower contact not observed.	Floodplain Alluvium
OA78	2.25	2.9	Organic gravelly sand	Loose mid to dark grey gravelly sand. Sand coarse. Gravel moderately sorted, fine, mostly granules, occ. small sub-angular pebbles. Weak organic smell and organic detritus present. Lower contact clear.	Organic/Channel complex
OA78	2.9	3	Sandy gravel	Loose mid greyish yellow sandy gravel. Gravel moderately sorted, fine to medium, mostly granules and small sub-rounded pebbles. Sand fine to coarse. Not bottomed.	Pleistocene gravel
OA79	0	0.2	Topsoil	Loose, crumbly very dark yellowish brown sandy clayey silt, humic with occ. granules. Lower contact clear.	Topsoil
OA79	0.2	0.9	Silty clay	Stiff, hard mid orange brown mottled bluish grey silty clay with occ. white and red mineral concretions. Homogeneous, minerogenic. Lower contact clear.	Floodplain Alluvium
OA79	0.9	1.05	Clay	Soft, tenacious mid bluish grey clay. Homogeneous, minerogenic. Lower contact graded.	Floodplain Alluvium
OA79	1.05	1.35	Organic silt	Soft, slightly spongy, 'peaty' very dark brown organic silt with common plant remains and reed. Lower contact clear.	Organic/Channel complex
OA79	1.35	2.5	Clayey silt	Soft dark brownish grey slightly clayey silt with organic detritus and occ. shell frags, becoming freq. at 2.0-2.2m. Sandy at 1.8-2.2m. Lower contact clear.	Organic/Channel complex
OA79	2.5	2.7	Sandy gravel	Loose mid grey sandy gravel. Gravel moderately sorted, fine, mostly granules and small sub-rounded pebbles. Sand coarse, trace of clay. Not bottomed.	Pleistocene gravel
OA80	0	0.55	Topsoil	Friable mid greyish brown sandy silt, humic, structureless with poorly sorted gravel. Plough soil. Lower contact very abrupt.	Topsoil
OA80	0.55	0.7	Made ground	Friable, humic very dark greyish brown silt with charcoal and glass redeposited with modern debris. Lower contact abrupt.	Made ground
OA80	0.7	1.25	Silty clay	Dense mid orangey brown silty clay with rare sub-rounded pebbles up to 10-50mm, structureless. Lower contact clear.	Floodplain Alluvium
OA80	1.25	1.6	Silty clay	Soft, tenacious grey very silty clay with pockets of iron oxidation and rare rounded pebbles up to 15mm.	Floodplain Alluvium
OA80	1.6	2.1	Silty clay	Organic detritus below 1.6m and occ. shell frags Organic smell. Lower contact graded.	Organic/Channel complex
OA80	2.1	2.7	Clayey silt	Soft, tenacious clayey silt with freq. shell frags Becomes sandier with depth, very sandy below 2.5m with small amount of pebbles up to 20mm. Lower contact clear.	Organic/Channel complex
OA80	2.7	2.8	Gravel	Moderately sorted clast supported gravel, pebbles 5-15mm, sub-rounded. Sandy matrix very coarse. Silt probably from above. Not bottomed.	Pleistocene gravel
OA81	0	0.28	Topsoil	Crumbly silty clay. Plough soil. Lower contact clear.	Topsoil
OA81	0.28	0.48	Clay	Crumbly, bioturbated alluvial interface. Lower contact diffuse.	Floodplain Alluvium
OA81	0.48	1.05	Silty clay	Very dense, compacted mid orangey brown very silty clay with rare small shell frags, occ. organic flecking and heavy iron oxidation. Stoneless, structureless. Lower contact graded.	Floodplain Alluvium
OA81	1.05	1.35	Silty clay	Very soft plastic mid grey very silty clay with less freq. iron mottling. No inclusions. Lower contact graded to diffuse.	Floodplain Alluvium
OA81	1.35	2	Organic clayey silt	Very soft, plastic very organic dark greyish brown clayey silt. Fibrous with small roots, homogeneous. Becomes dark grey with depth. Lower contact clear.	Organic/Channel complex
OA81	2	2.15	Gravel	Moderately sorted clast supported gravel, pebbles 5-15mm, sub-rounded. Sandy matrix very coarse. Silt probably from above. Not bottomed.	Pleistocene gravel

Appendix E. Borehole Logs

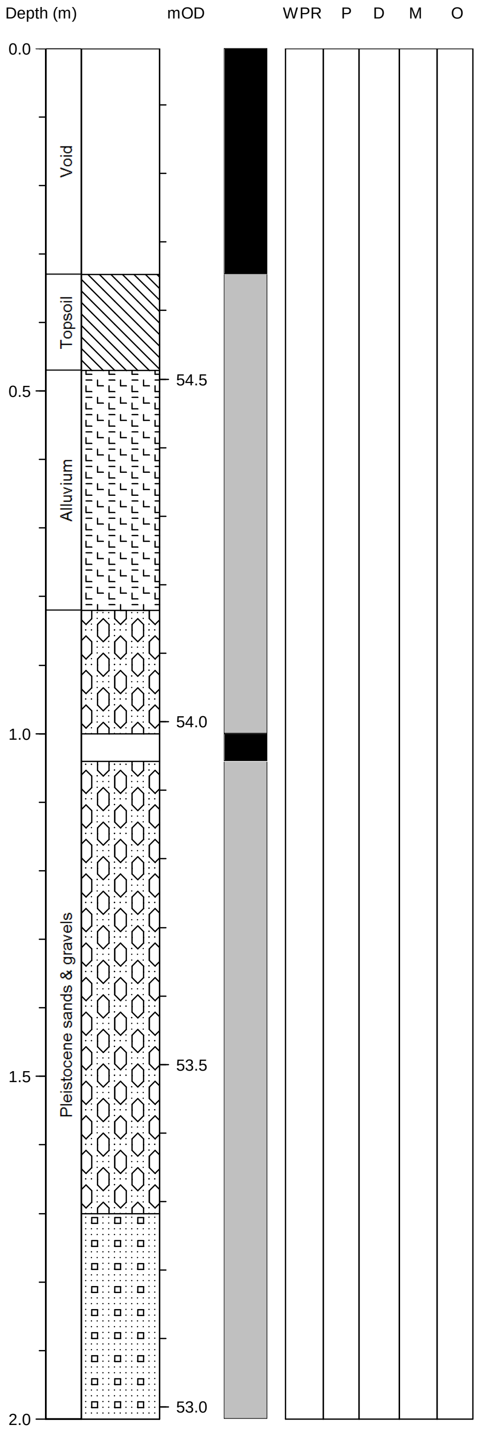
GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **451528.321000** DATE: **18/10/2016**

BH NO: **OA101** ELEVATION: **54.982631** NG NORTHING: **203736.982000** LOGGER: **MB**

Lithology Cores Subsamples Dating Description



(0.00- 0.33) Void

(0.33- 0.47) Topsoil: Loose moist very dark greyish brown sandy silt; red mottles, roots; abrupt contact.

(0.47- 0.82) Silty clay: Stiff compacted (in core only 0.34m) yellowish brown mottled bluish grey silty clay, more grey mottles in bottom 0.10m; rare dark brown (organic?) mottles, rare small shell frag. and small subangular limestone pebbles in bottom part; structureless, minerogenic, possibly disturbed by ploughing or colluvial inputs. Clear contact.

(0.82- 1.00) Sandy gravel: Loose dry olive yellow sandy gravel, poorly sorted, clasts supported, pebbles small to large, mostly subangular, dominating limestone; sand fine to coarse c. 30%, trace of clay; contact not observed.

(1.00- 1.04) Void

(1.04- 1.70) Sandy gravel: Loose dry pale yellow sandy gravel, moderately sorted, fine gravel, matrix supported - c. 70% granules and very small pebbles, subangular to subrounded, occ. medium pebbles, rare large pebbles - only in bottom part; sand coarse c. 10%; limestone dominated; 1.13-1.16m dark brown lens - probably mineral; clear contact.

(1.70- 2.00) Gravelly sand: Loose dry light yellowish brown gravelly sand; top 0.13m more gravelly - c. 10%, mostly very small pebbles and granules, subangular to subrounded; below sand medium to coarse, moderately sorted with rare small subrounded pebbles; quartzitic sand, limestone; structureless; not bottomed.

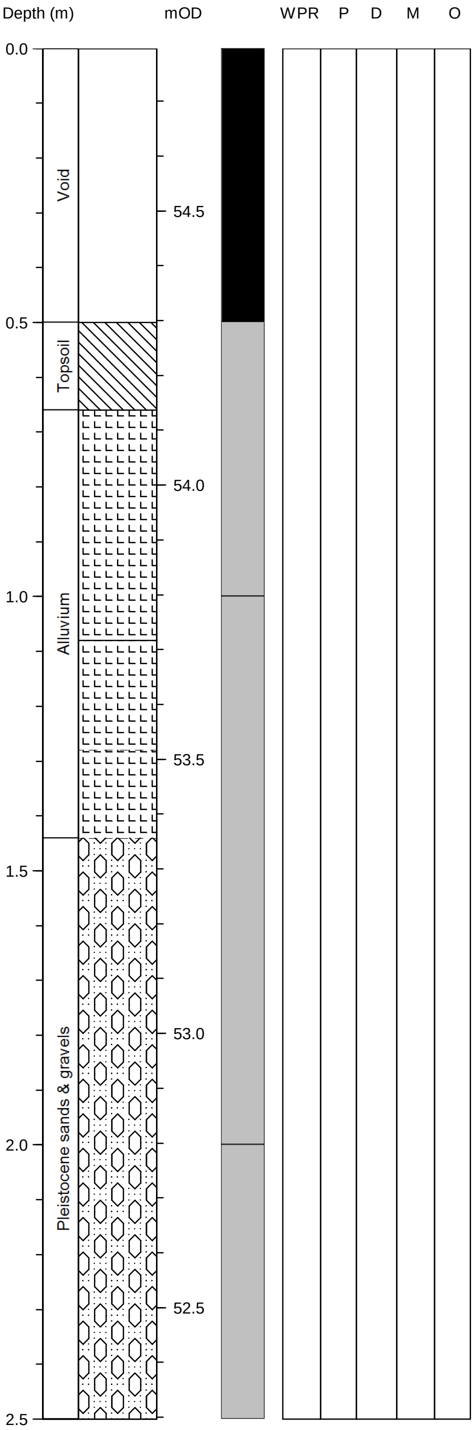
GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **451320.755000** DATE: **18/10/2016**

BH NO: **OA102** ELEVATION: **54.796523** NG NORTHING: **204129.889000** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description



(0.00- 0.50) Void

(0.50- 0.66) Topsoil: Loose moist very dark greyish brown clayey silt with trace of sand; occ. small limestone pebbles, roots; abrupt contact.

(0.66- 1.08) Clay: Soft tenacious yellowish brown mottled bluish grey clay, more yellowish in bottom part; occ. small shell frag., rare dark brown (organic?) mottles; minerogenic; clear contact.

(1.08- 1.28) Clay: Soft tenacious bluish grey mottled yellow clay; occ. dark brown (organic?) mottles; minerogenic, homogenous; diffuse contact.

(1.28- 1.44) Clay: Soft tenacious yellowish brown mottled bluish grey in about equal proportions clay; rare pebbles in bottom 0.1m; gradual change to gravel.

(1.44- 2.50) Sandy gravel: Loose dry brownish yellow, except top 0.15m where light yellowish brown mottled green, sandy gravel; poorly sorted, matrix supported - mostly granules and small pebbles subangular to subrounded; clasts small to medium angular to rounded, occ. angular flint and large pebbles; sand mostly coarse c. 10%, below 2m up to 50% of sand; not bottomed.

GEOARCHAEOLOGICAL SERVICES

Oxford Archaeology

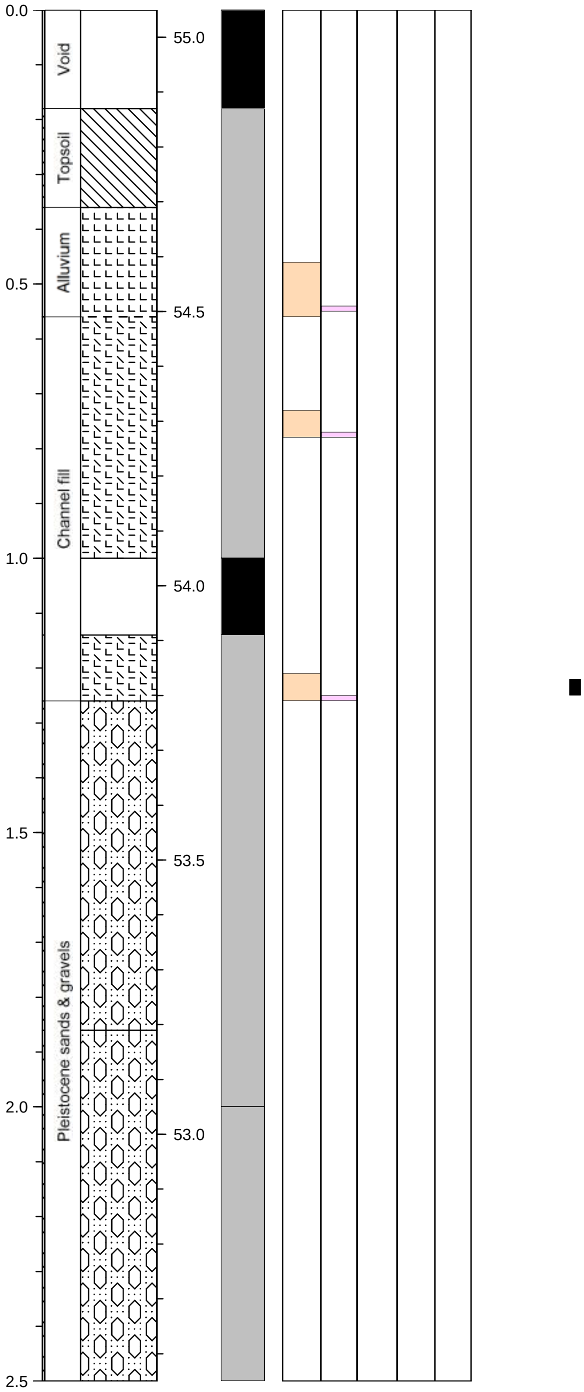
SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **450660.025710** DATE: **19/10/2016**

BH NO: **OA103** ELEVATION: **55.049880** NG NORTHING: **204660.845800** LOGGER: **MB**

Lithology Cores Subsamples Dating Description

Depth (m) mOD WPR P D M O



(0.00- 0.18) Void

(0.18- 0.36) Topsoil: Loose moist very dark greyish brown becoming brown clayey silt, trace of sand; occ. small subrounded pebbles, rare small shell frag., roots; clear contact.

(0.36- 0.56) Clay: Soft tenacious yellowish brown mottled bluish grey clay; occ. small shell frag. and dark brown (organic?) mottles, roots; homogenous; diffuse contact.

(0.56- 1.00) Organic silty clay: Soft tenacious dark grey mottled bluish grey clay; organic rich - especially in very dark greyish brown lens at 0.73-0.78m, no organic smell, rare plant remains and small shell frag.; contact not observed.

(1.00- 1.14) Void

(1.14- 1.26) Organic silty clay: Soft tenacious dark grey mottled bluish grey clay, slightly silty; subtle organic smell, freq. plant remains and small shell frag.; trace of sand, disturbed; sharp contact.

(1.26- 1.86) Sandy gravel: Loose dry pale olive in top 0.3m, light olive grey below sandy gravel; trace of clay in top 0.3m; poorly sorted, clasts supported medium gravel, mostly small to medium subrounded to subangular pebbles, occ. large subrounded pebbles and angular flint; sand coarse up to 50% in some beds; top 0.3m structureless, 1.5-1.73m almost horizontal bedding, 1.73-1.86m diagonal bedding underlined by colour and fraction changes; 1.6-1.66m and 1.7-1.73m very dark brown lenses of organic matter with wood frag., rare small wood frag. also dispersed outside of lenses; diagonal clear contact.

(1.86- 2.50) Sandy gravel: Loose dry brownish yellow sandy gravel; moderately to poorly sorted, fine to medium, matrix supported - mostly granules and small pebbles subangular to subrounded, clasts subrounded to subangular mostly medium, occ. large in bottom 0.2m; sand medium to coarse c. 40%; sediment coarser at 1.86-2m and 2.25-2.5m, better sorted and finer at 2-2.25m; rare wood frag., not bottomed.

ChF - Channel fill

GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

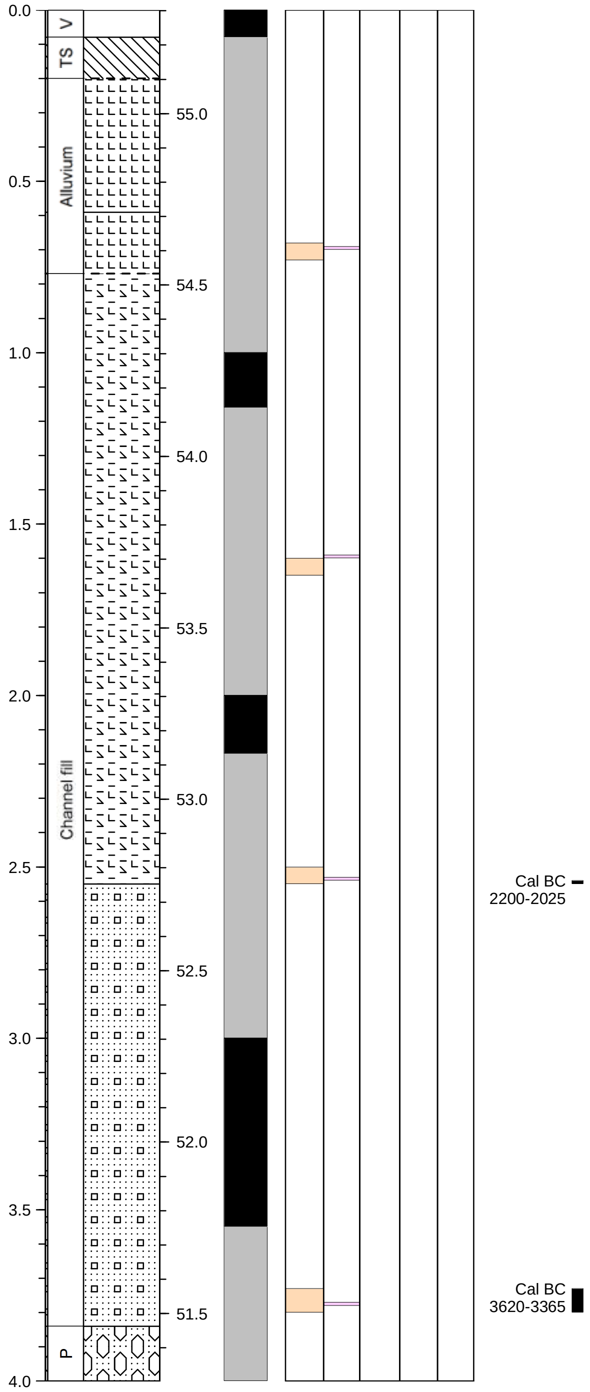
Oxford Archaeology

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **450347.571000** DATE: **19/10/2016**

BH NO: **OA104A** ELEVATION: **55.302641** NG NORTHING: **205105.035000** LOGGER: **MB**

Lithology Cores Subsamples Dating Description

Depth (m) mOD WPR P D M O



(0.00- 0.08) Void

(0.08- 0.20) Topsoil: Loose crumbly dark greyish brown clayey silt, trace of sand, occ. small shell frag., roots; diffuse contact.

(0.20- 0.59) Clay: Firm compacted yellowish brown mottled light bluish grey (rising amount of mottles with depth) clay; occ. small shell frag., rare dark brown (organic?) mottles, minerogenic, homogenous; clear contact.

(0.59- 0.77) Clay: Soft tenacious bluish grey mottled yellowish brown in top 0.1m clay; occ. dark brown (organic?) mottles; rare plant remains at the bottom - gradual change into organic silt.

(0.77- 2.55) Organic clayey silt: Soft to very soft very dark grey in top 0.23m, becomes dark grey below 2m organic clayey silt; organic smell; in top 0.23m freq. macro plant remains (mostly reed), originally spongy, compacted in the core.
Below 2m softer, occ. plant remains, rare small shell frag. and wood.
At 1.63-1.66m a lens with freq. small shell frag.; below the lens lighter coloured.
Below 2.4m dark grey, softer, slightly "spongy" with stronger organic smell.
Clear contact.

(2.55- 3.84) Gravelly sand: Loose wet pale olive to light olive grey; medium, poorly sorted, matrix supported - mostly granules and small subrounded pebbles, clasts - medium to large subrounded to rounded pebbles; sand is fine to coarse c. 30%; finer at 2.9-3.0m and 3.74-3.84m, where sand is up to 60% and wood frag. in lenses, also some horizontal bedding; clear contact.

(3.84- 4.00) Sandy gravel: Loose wet yellowish brown sandy gravel; top 0.05m compacted and sandy. Below the gravel is structureless, very poorly sorted, clast supported, pebbles are small to large mostly subangular and subrounded, sand is fine to coarse at c. 30%, trace of silt; not bottomed.

V - Void
TS - Topsoil
P - Pleistocene gravel

GEOARCHAEOLOGICAL SERVICES

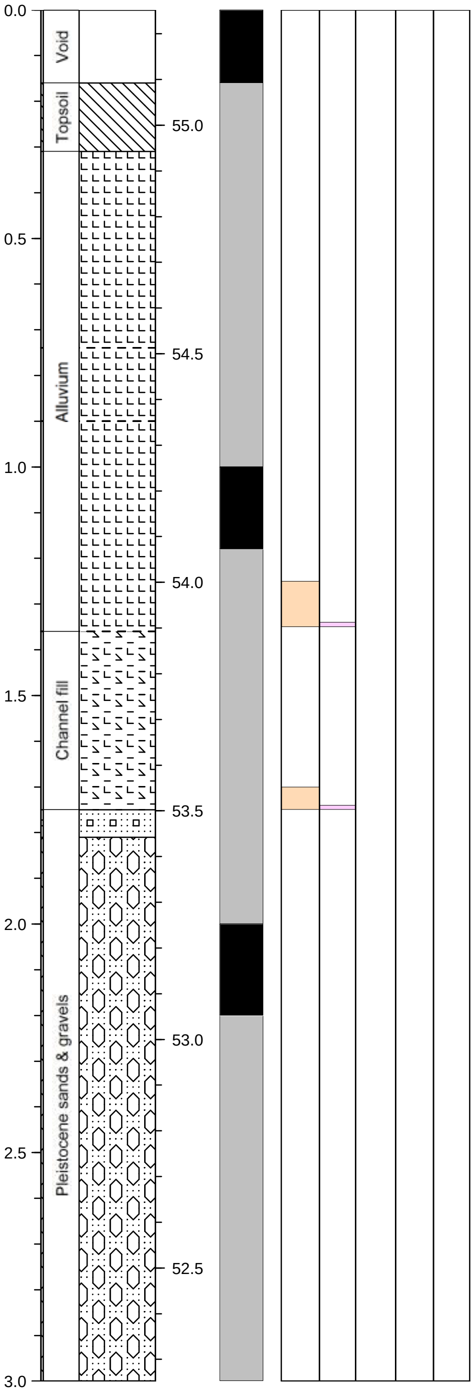
SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **450398.371000** DATE: **19/10/2016**

BH NO: **OA104B** ELEVATION: **55.252314** NG NORTHING: **205160.201000** LOGGER: **MB**

Lithology Cores Subsamples Dating Description

Depth (m) mOD WPR P D M O



Cal BC 1435-1290

(0.00- 0.16) Void

(0.16- 0.31) Topsoil: Loose dry dark greyish brown slightly clayey silt, trace of sand; occ. small to medium shell frag., roots; abrupt contact.

(0.31- 0.74) Clay: Moderately firm compacted yellowish brown mottled grey clay; occ. dark brown (organic?) mottles, occ. small shell frag. and white mineral concretions, rare roots; minerogenic; diffuse contact.

(0.74- 0.90) Clay: Soft tenacious grey mottled yellowish brown clay; occ. roots, occ. plant remains and shell frag., small amount of dark brown dispersed organic matter; homogenous; diffuse irregular contact.

(0.90- 1.36) Clay: Soft tenacious mottled clay yellowish brown with grey in equal proportions; occ. roots; material below 1.0m possibly pressed in; diffuse contact.

(1.36- 1.75) Organic clayey silt: Moderately soft to soft compacted very dark grey organic clayey silt, organic smell; freq. plant remains and shell frag., occ. wood frag., rare small pebbles in bottom 0.1m; homogenous; sharp contact.

(1.75- 1.81) Gravelly sand: Loose dry pale olive gravelly sand; very poorly sorted, sand fine to coarse, trace of silt, gravel c. 40% - small to large subangular to subrounded pebbles; bottom part compacted due to clay and silt content; clear contact.

(1.81- 3.00) Sandy gravel: Loose wet yellowish brown in top 0.2m, light yellowish brown below sandy gravel; medium moderately sorted, matrix supported - granules to small pebbles, clasts medium subangular to subrounded, occ. large subrounded pebbles, some subangular pebbles in top 0.2m - there also silt; occ. wood frag. in horizontal lenses; structureless; not bottomed.

GEOARCHAEOLOGICAL SERVICES

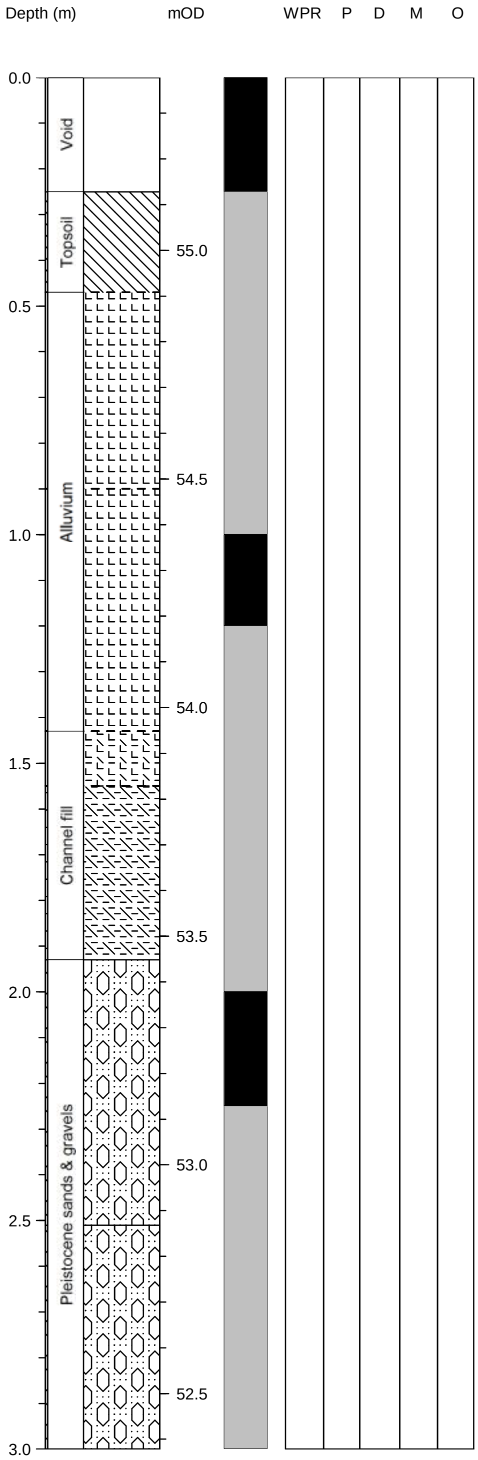
Oxford Archaeology

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **450127.305000** DATE: **19/10/2016**

BH NO: **OA105** ELEVATION: **55.378201** NG NORTHING: **205224.892000** LOGGER: **MB**

Lithology Cores Subsamples Dating Description



(0.00- 0.25) Void

(0.25- 0.47) Topsoil: Loose dry dark greyish brown slightly clayey silt; roots, occ. small shell frag, subangular to angular small to large limestone pebbles freq. at 0.08-0.13m, below lighter; diffuse contact.

(0.47- 0.90) Clay: Moderately firm compacted yellowish brown mottled grey clay, strong brown below 0.55m; occ. dark brown (organic?) mottles, occ. white mineral concretions and small shell frag.; homogenous, minerogenic; diffuse contact.

(0.90- 1.43) Clay: Very soft tenacious light brownish grey mottled yellowish brown clay; occ. small shell frag.; minerogenic, homogenous; diffuse contact.

(1.43- 1.55) Organic silty clay: Soft tenacious dark grey silty clay, subtle organic smell, freq. small shell frag., occ. plant remains; diffuse contact.

(1.55- 1.93) Organic silt: Very soft very dark grey organic silt, clayey in top 0.10m; organic smell, freq. small to medium shell frag., plant remains and wood frag.; clear contact.

(1.93- 2.51) Sandy gravel: Loose dark grey sandy gravel; fine, poorly sorted, matrix supported - mostly granules, small pebbles, occ. large subangular to subrounded pebbles in top 0.07m; sand fine to coarse consists c. 40% of shell frag., trace of silt, occ. plant remains and wood frag.; clear contact.

(2.51- 3.00) Sandy gravel: Loose moist pale olive sandy gravel; fine, moderately sorted, clasts supported - moslty small subrounded to subangular pebbles, less granules; sand c. 30%; angled lenses of well sorted medium sand, flat pebbles horizontally oriented; not bottomed.

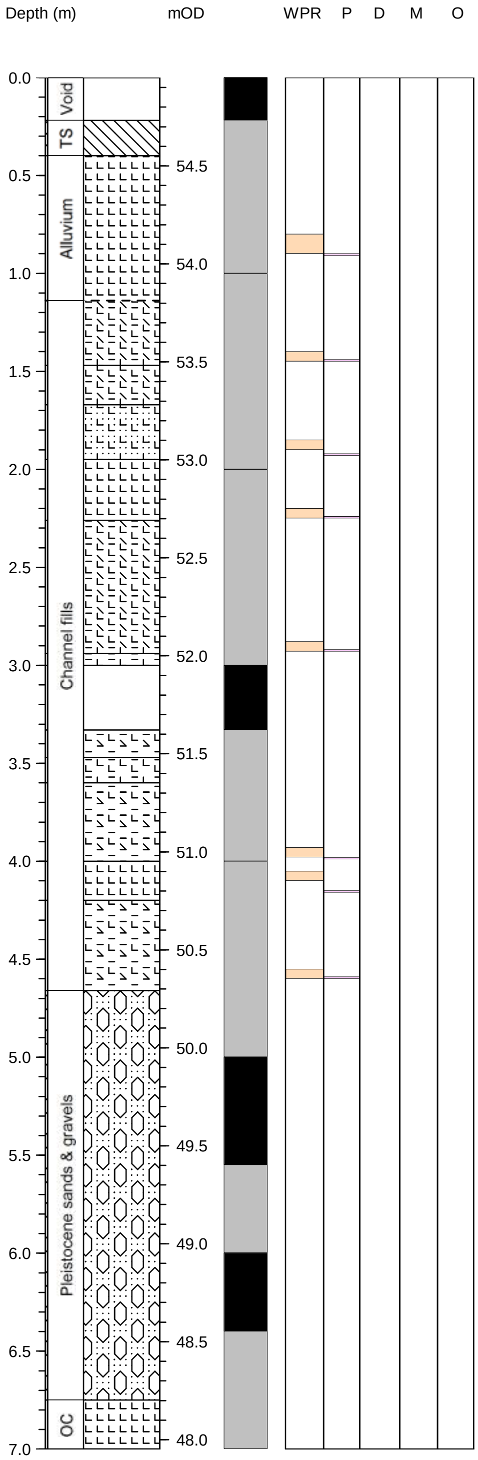
GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449469.448200** DATE: **19/10/2016**

BH NO: **OA106** ELEVATION: **54.951710** NG NORTHING: **205610.614380** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description



Dating:

- Cal BC 4780-4615 (at c. 2.92 m)
- Cal BC 6200-6020 (at c. 4.58 m)

Description:

(0.00- 0.22) Void

(0.22- 0.40) Topsoil: Loose dry brown clayey silt, darker top 0.05m - more humic; occ. small shell frag. and limestone granules, roots; uneven clear contact.

(0.40- 1.14) Clay: Moderately firm compacted light yellowish brown to yellowish brown below 0.5m mottled grey clay; occ. white mineral concretions, occ. dark brown (organic?) and red mottles, rare roots; homogenous; diffuse contact.

(1.14- 1.47) Organic silty clay: Soft very dark greyish brown fast oxidising to very dark grey organic silty clay, subtle organic smell; occ. small shell frag. and plant remains; uneven clear contact.

(1.47- 1.67) Organic silty clay: Soft tenacious very dark greyish brown organic silty clay, organic smell; freq. molluscs and shell frag. c. 15%, freq. plant remains and wood frag.; clear contact.

(1.67- 1.95) Sandy clay: Moderately soft becoming soft with depth olive grey organic rich sandy clay, organic smell; sand medium to coarse c. 30%, top 0.1m more sandy - up to 60%; sand comprise c. 60% of shell frag.; freq. wood frag.; uneven sharp contact - probably cut.

(1.95- 2.26) Clay: Soft olive grey clay, trace of sand, subtle organic smell; occ. small shell frag. and plant remains (mostly reed); clear contact.

(2.26- 2.94) Organic silty clay: Soft slightly spongy very dark greyish brown fast oxidising to black organic silty clay, strong organic smell; very freq. plant remains and wood frag., occ. small shell frag, slightly "peaty"; homogenous; sharp contact - cut.

(2.94- 3.00) Silty clay: Very soft tenacious dark greenish grey silty clay, subtle organic smell; occ. small shell frag. and plant remains (mostly reed); contact not observed.

(3.00- 3.33) Void

(3.33- 3.47) Organic clayey silt: Soft tenacious dark greyish brown organic clayey silt, subtle organic smell; occ. small to medium shell frag.; disturbed, some fall down material present; diagonal sharp contact - cut.

(3.47- 3.60) Silty clay: Very soft tenacious dark greenish grey silty clay, subtle organic smell; occ. small shell frag. and plant remains (mostly reed); clear diagonal contact - possibly a trampling effect.

(3.60- 4.00) Organic clayey silt: Soft slightly spongy very dark greyish brown fast oxidising to black organic silty clay, strong organic smell; very freq. plant remains and wood frag., occ. small shell frag, in bottom 0.1m small to medium subrounded pebbles; contact not observed.

(4.00- 4.20) Clay: Soft olive grey clay mottled blue, trace of sand, subtle organic smell; occ. small shell frag. and plant remains (mostly reed); diffuse contact.

(4.20- 4.66) Organic clayey silt: Soft slightly spongy very dark greyish brown fast oxidising to black organic silty clay, strong organic smell; very freq. plant remains and wood frag., occ. small shell frag, in bottom 0.1m small to medium subrounded pebbles; clear contact.

(4.66- 6.75) Sandy gravel: Loose moist light yellowish brown sandy gravel; fine poorly to moderately sorted, matrix supported - granules and small subangular pebbles, occ. medium to large pebbles mostly subangular; sand fine to coarse c. 35%; top 0.05m more grey with trace of silt; structureless with occ. lenses of moderately sorted pebbles, where also flat pebbles horizontally oriented; sharp uneven contact.

(6.75- 7.00) Clay: Firm tenacious dark grey clay, minerogenic, homogenous, structureless; not bottomed.

TS - Topsoil
OC - Oxford Clay

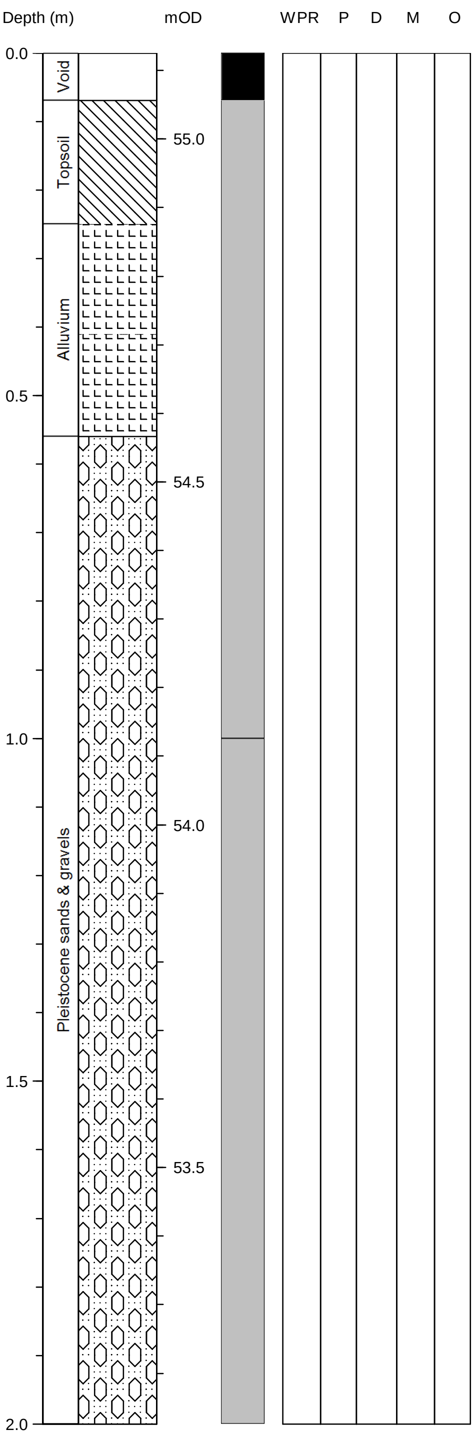
GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449546.715740** DATE: **20/10/2016**

BH NO: **OA107** ELEVATION: **55.125820** NG NORTHING: **205684.538190** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description



(0.00- 0.07) Void

(0.07- 0.25) Topsoil: Loose dry dark greyish brown slightly clayey silt, trace of sand, roots, occ. small shell frag. and small subangular pebbles; diffuse contact.

(0.25- 0.41) Clay: Moderately firm compacted yellowish brown mottled grey clay; rare small shell frag., occ. white mineral concretions and roots; minerogenic; diffuse contact.

(0.41- 0.56) Clay: Soft tenacious light brownish grey mottled yellowish brown clay; occ. roots and plant remains, occ. subangular limestone pebbles small to medium in bottom 0.05m, minerogenic; uneven sharp contact.

(0.56- 2.00) Sandy gravel: Loose dry pale olive with yellowish brown beds sandy gravel; medium poorly sorted matrix supported - mostly granules and small pebbles subangular to subrounded, clasts medium, less large subangular to subrounded; sand fine to coarse up to 50% in top 0.5m, below c. 20%; top 0.15m disturbed, very poorly sorted with trace of clay; structureless down to 1.0m, below almost horizontal bedding - beds av. 2-5cm thick with moderately to well sorted gravel, bedding underlined by change of fraction and colour; more coarse from 1.5m; not bottomed.

GEOARCHAEOLOGICAL SERVICES

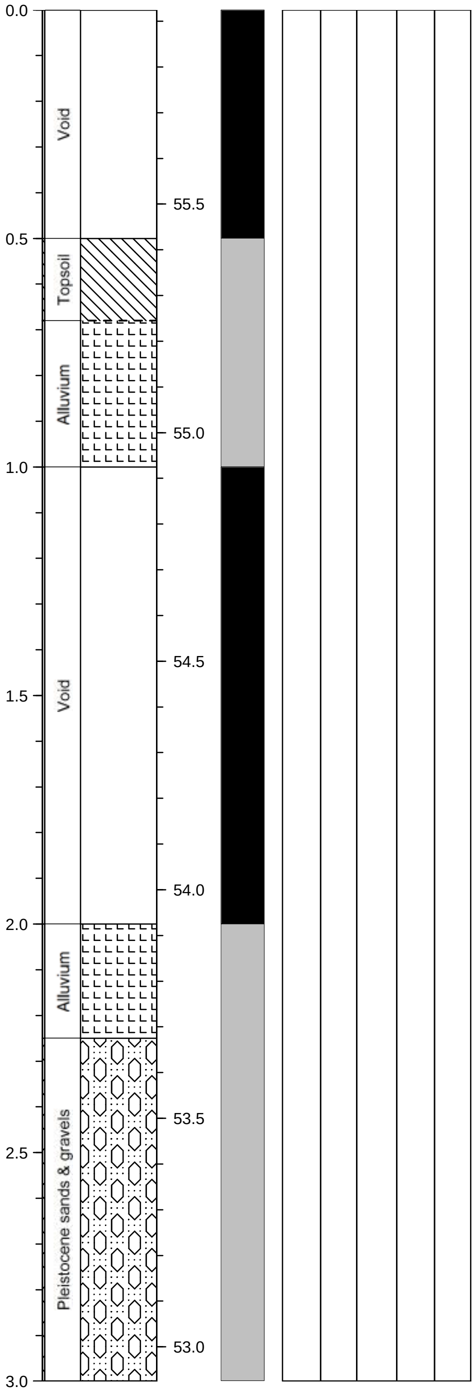
SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449839.099350** DATE: **20/10/2016**

BH NO: **OA108** ELEVATION: **55.924880** NG NORTHING: **205603.345070** LOGGER: **MB**

Lithology Cores Subsamples Dating Description

Depth (m) mOD WPR P D M O



(0.00- 0.50) Void

(0.50- 0.68) Topsoil: Loose dark greyish brown clayey silt, trace of sand; freq. small to medium shell frag., freq. limestone granules and small subangular pebbles, roots; no surface in the core; diffuse contact.

(0.68- 1.00) Clay: Soft, but top moderately soft, compacted yellowish brown mottled grey especially at 0.76-0.81m clay; occ. limestone granules and small shell frag., occ. dark brown (organic?) mottles and red mineral concretions; minerogenic; contact not observed.

(1.00- 2.00) Void

(2.00- 2.25) Clay: Very soft tenacious bluish grey mottled yellowish brown clay; small pockets of top soil - disturbed deposit; clear contact.

(2.25- 3.00) Sandy gravel: Loose dry light olive brown in top 0.1m, below light yellowish brown sandy gravel; fine to medium moderately sorted matrix supported - mostly small pebbles and granules, occ. medium and rare large subangular to subrounded pebbles; top 0.10m poorly sorted; sand fine to coarse c. 50% down to 2.7m, below coarse c. 20%; wood frag. in pocket at 2.58-2.65m and rare dispersed ones; structureless; not bottomed.

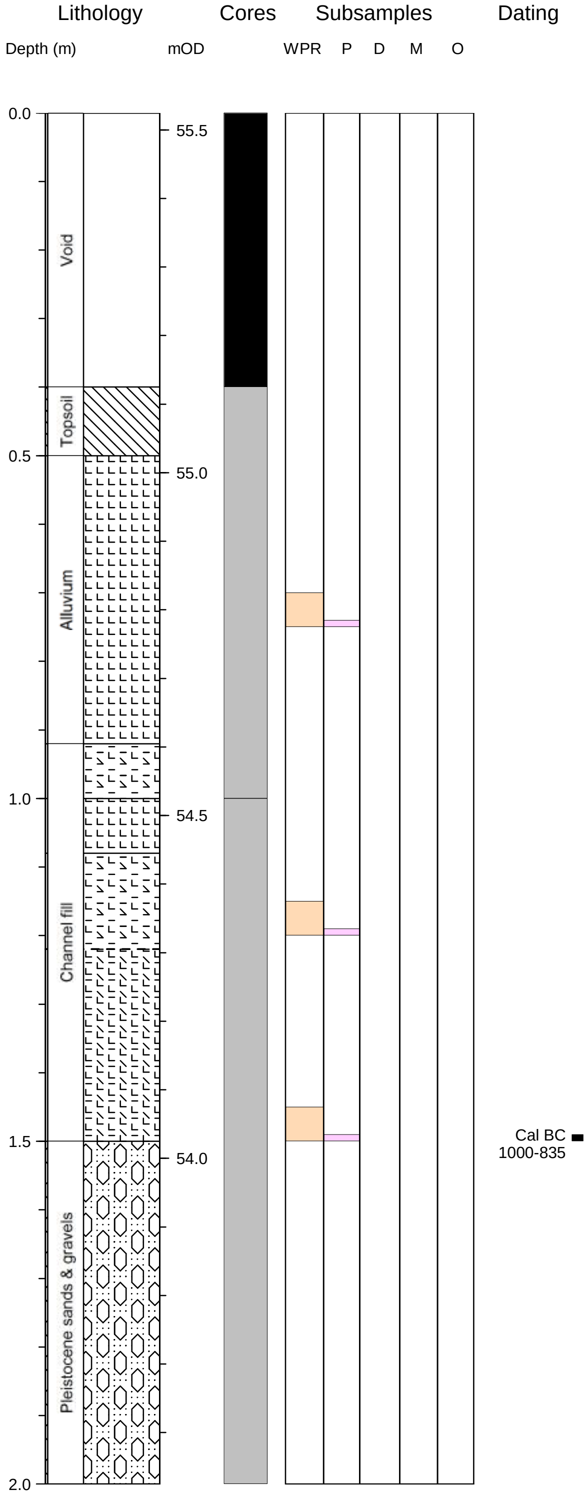
Only mixed material and top soil brought in 1-2m core.

GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449794.302180** DATE: **20/10/2016**

BH NO: **OA109** ELEVATION: **55.524800** NG NORTHING: **205550.317000** LOGGER: **MB**



Description

(0.00- 0.40) Void

(0.40- 0.50) Topsoil: Loose dry brown clayey silt, trace of sand, occ. small shell frag., rare limestone granules, roots; no surface in the core; abrupt contact.

(0.50- 0.92) Clay: Moderately firm yellowish brown mottled grey clay; occ. white mineral concretions and dark brown (organic?) mottles, at 0.75-0.82m and 0.87-0.90m av. 70% of grey mottles; clear contact.

(0.92- 1.00) Organic clayey silt: Soft dark greyish brown organic clayey silt, occ. small to medium shell frag. and plant remains, subtle organic smell; contact not observed.

(1.00- 1.08) Clay: Soft tenacious yellowish brown mottled grey clay; occ. small shell frag.; sharp contact.

(1.08- 1.22) Organic clayey silt: Soft dark greyish brown organic clayey silt, occ. small to medium shell frag. and plant remains, subtle organic smell; diffuse contact.

(1.22- 1.50) Organic silty clay: Very soft very dark greyish brown organic silty clay, occ. shell frag., organic smell, dispersed organic matter; clear contact.

(1.50- 2.00) Sandy gravel: Loose moist yellowish brown sandy gravel; top 0.05m dark grey due to clay content; medium poorly sorted clasts supported - mostly medium subangular pebbles, rare large pebbles, granules and small pebbles in matrix; sand fine to coarse c. 20%; structureless; not bottomed.

Ch - Channel fill
A - Alluvium

GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

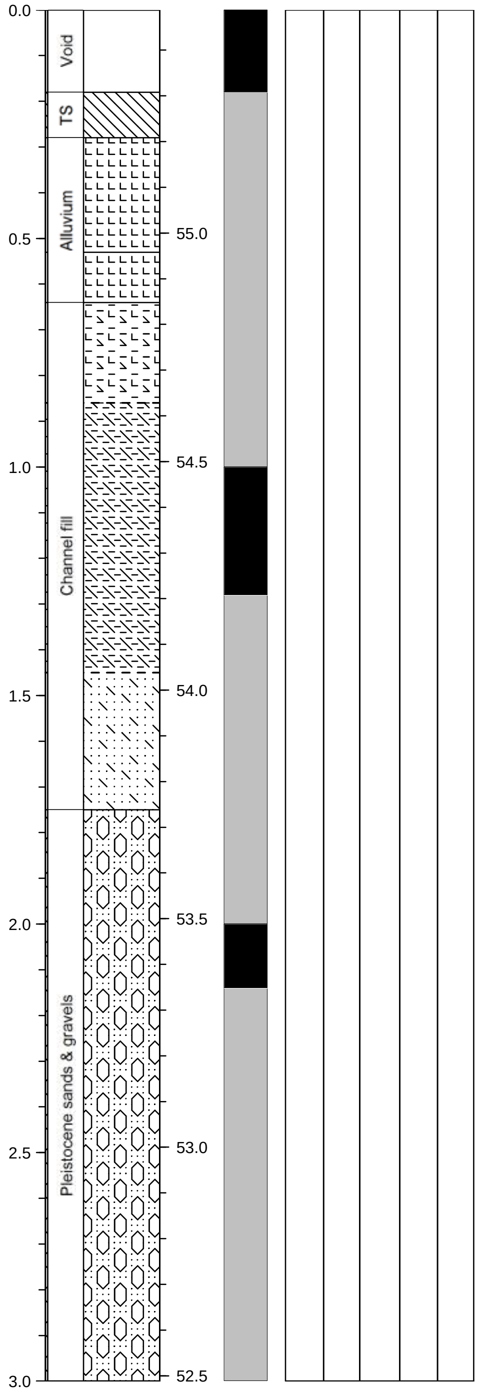
Oxford Archaeology

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449736.398940** DATE: **20/10/2016**

BH NO: **OA110** ELEVATION: **55.488120** NG NORTHING: **205493.972600** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description

Depth (m) mOD WPR P D M O



(0.00- 0.18) Void

(0.18- 0.28) Topsoil: Loose dry brown clayey silt, trace of sand, occ. small shell frag. and limestone granules, roots; no surface in the core; clear contact.

(0.28- 0.53) Clay: Moderately soft tenacious yellowish brown mottled grey clay; red mottles in bottom 0.1m, occ. white mineral concretions and limestone granules, occ. small shell frag., rare dark brown (organic?) mottles; minerogenic; clear contact.

(0.53- 0.64) Clay: Soft tenacious grey mottled yellowish brown clay; minerogenic; clear contact.

(0.64- 0.86) Organic clayey silt: Very soft dark greyish brown organic clayey silt, subtle organic smell, occ. small shell frag. and plant remains; diffuse contact.

(0.86- 1.45) Organic silt: Very soft very dark greyish brown organic slightly clayey silt; freq. small shell frag. and plant remains (mostly reed), occ. wood frag., more clayey and shelly below 1.28m, sandy below 1.4m; diffuse contact.

(1.45- 1.75) Organic rich sand: Loose moist dark olive grey organic rich sand; coarse, occ. small subangular to subrounded pebbles and granules, freq. shell frag., occ. plant remains and wood; pockets of clay; clear contact.

(1.75- 3.00) Sandy gravel: Loose moist light olive grey sandy gravel; medium very poorly sorted clasts supported, small to large mostly subangular pebbles, occ. cobbles, granules c. 20%; sand fine to coarse c. 20%, trace of clay, structureless, rare wood frag.; not bottomed.

TS - Topsoil

GEOARCHAEOLOGICAL SERVICES

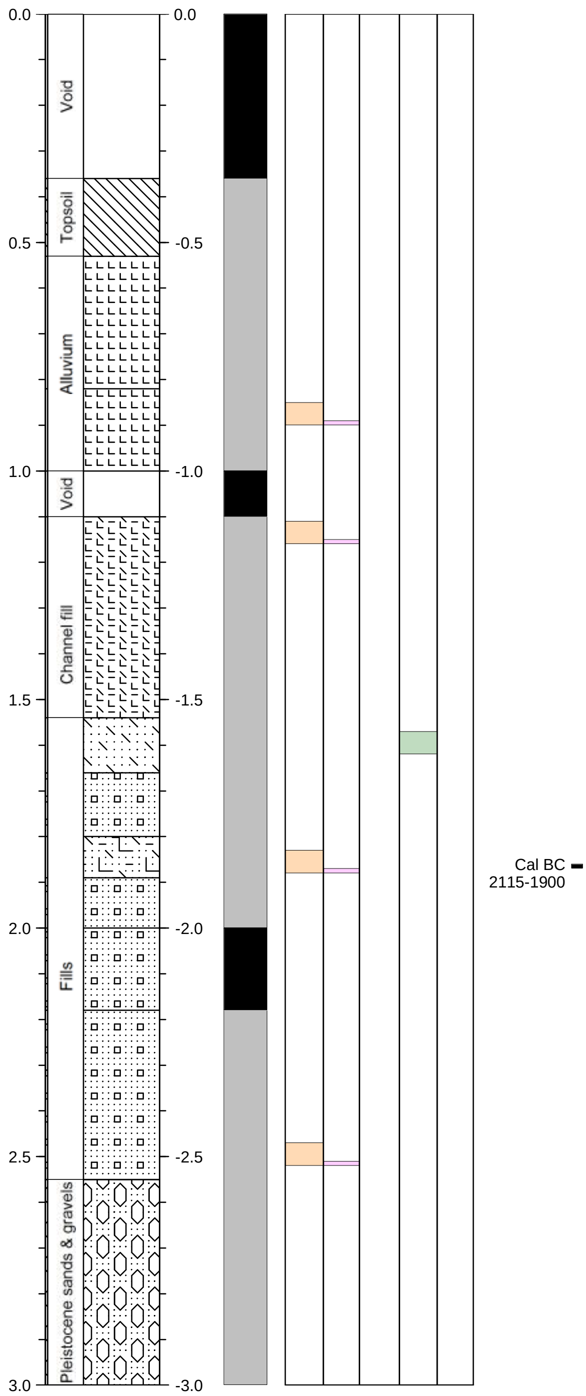
SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449079.3** DATE: **20/10/2016**

BH NO: **OA111** ELEVATION: **56.28918** NG NORTHING: **206529.7** LOGGER: **MB**

Lithology Cores Subsamples Dating Description

Depth (m) mOD WPR P D M O



(0.00- 0.36) Void

(0.36- 0.53) Topsoil: Loose dry very dark greyish brown clayey silt, trace of sand, roots; clear contact.

(0.53- 0.82) Clay: Firm compacted yellowish brown mottled grey and red clay; occ. dark brown (organic?) mottles, occ. white mineral concretions; minerogenic; clear contact.

(0.82- 1.00) Clay: Soft tenacious grey clay; homogenous, some dispersed organic matter and rare plant remains present especially in bottom 0.10m; contact not observed.

(1.00- 1.10) Void

(1.10- 1.54) Organic silty clay: Soft very dark grey to dark olive grey organic silty clay; subtle organic smell, occ. plant remains (mostly reed), rare small shell frag.; top 0.05m slightly spongy, more organic; clear contact.

(1.54- 1.66) Organic rich sand: Loose dark olive grey organic rich sand; medium to coarse trace of clay, occ. small subrounded to subangular pebbles, freq. shell frag., dispersed organic matter and rare plant remains; sharp contact - cut.

(1.66- 1.80) Gravelly sand: Loose olive grey gravelly sand; poorly sorted, mostly coarse with c. 30% of shell frag.; gravel c. 40% fine, mostly granules and small subangular to subrounded pebbles; pockets of grey clay; uneven sharp contact - cut.

(1.80- 1.89) Organic sandy silty clay: Soft tenacious dark grey sandy silty clay, organic rich, subtle organic smell; freq. small shell frag., lens of very "shelly" deposit at 1.83-1.84m, freq. wood frag. and plant remains; uneven sharp contact - cut.

(1.89- 2.55) Gravelly sand: Loose olive grey gravelly sand; poorly sorted, mostly coarse; gravel c. 50% fine, mostly granules and small subangular to subrounded pebbles; contact not observed.

(2.00- 2.18) Void

(2.55- 3.00) Sandy gravel: Loose moist grey sandy gravel; medium poorly sorted clast supported - small to medium subangular to subrounded pebbles, occ. large in bottom 0.3m; sand c. 30% mostly coarse with up to 10% of shell frag.; normal gradation, rare horizontal beds of moderately sorted gravel; not bottomed.

GEOARCHAEOLOGICAL SERVICES

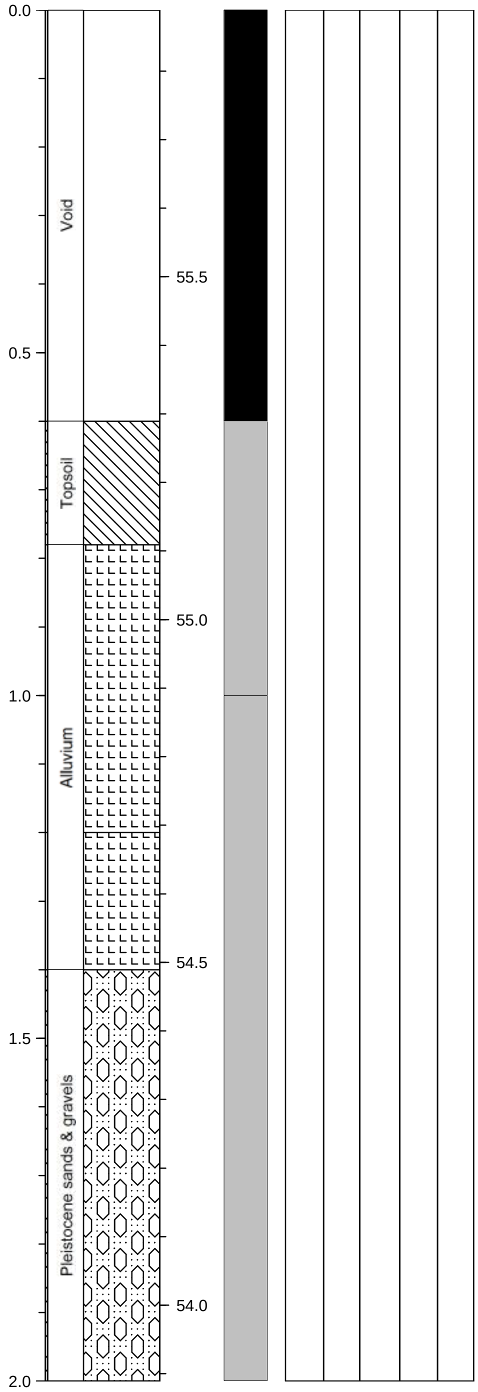
SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449396.750250** DATE: **20/10/2016**

BH NO: **OA112** ELEVATION: **55.889260** NG NORTHING: **205794.335430** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description

Depth (m) | mOD | WPR P D M O



(0.00- 0.60) Void

(0.60- 0.78) Topsoil: Loose very dark greyish brown slightly clayey silt; trace of sand, rare small limestone pebbles and granules at bottom, roots; no surface in the core; clear contact.

(0.78- 1.20) Clay: Very soft tenacious light brownish yellow mottled grey and dark brown clay; rare limestone granules and small shell frag., minerogenic, homogenous; bottom 0.2m lighter, possibly pressed in from top core - top soil at 1.2m; contact not observed.

(1.20- 1.40) Clay: Soft tenacious bluish grey mottled brownish yellow clay; occ. Dark brown mottles with subtle organic smell, rare plant remains especially in bottom 0.05m; clear contact.

(1.40- 2.00) Sandy gravel: Loose moist sandy gravel of various colours - top 0.1m greyish yellow due to clay content, below yellowish brown to pale yellow; fine to medium poorly sorted with lenses of moderate sorting; pebbles small to medium mostly subangular, rare large; sand coarse c. 30% - more in some beds; horizontal bedding - beds av. 5cm thick underlined by colour, fraction and sorting difference; rare plant remains; not bottomed.

Location of original OAAH72.

GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

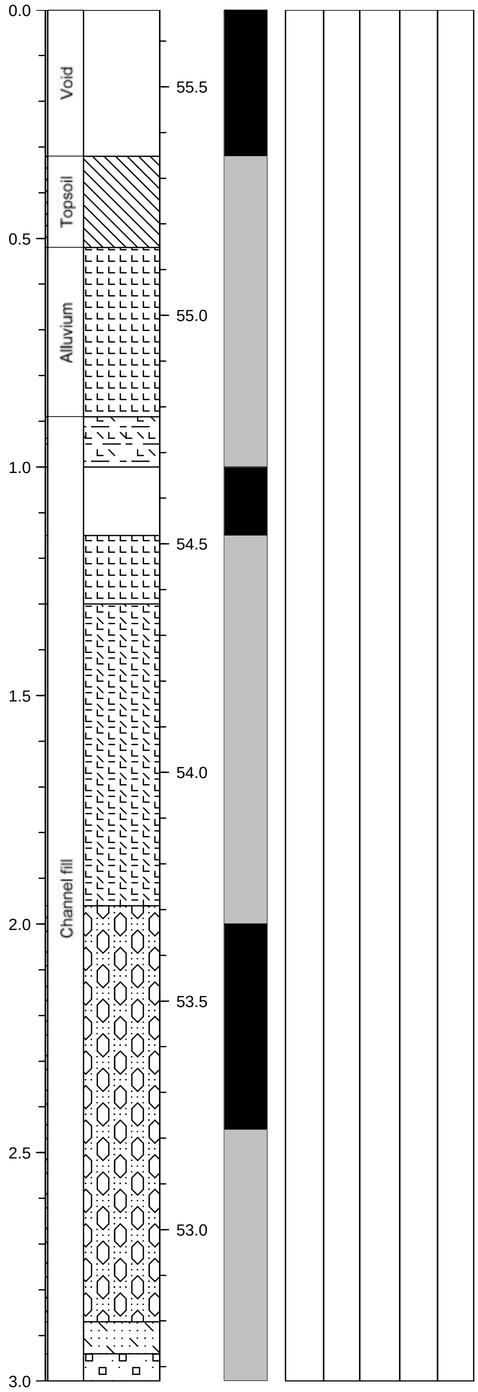
Oxford Archaeology

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449299.375840** DATE: **20/10/2016**

BH NO: **OA113** ELEVATION: **55.668310** NG NORTHING: **205782.132030** LOGGER: **MB**

Lithology | Cores | Subsamples | Dating | Description

Depth (m) mOD WPR P D M O



(0.00- 0.32) Void

(0.32- 0.52) Topsoil: Loose very dark greyish brown slightly clayey silt, trace of sand, occ. small to medium shell frag. and limestone granules, roots; abrupt contact.

(0.52- 0.89) Clay: Moderately soft compacted tenacious light yellowish brown mottled grey and yellowish red clay; occ. small shell frag in top 0.1m, minerogenic, softer with depth, more grey mottles below 0.77m; clear contact.

(0.89- 1.00) Organic rich clayey silt: Soft greyish brown organic rich clayey silt; occ. small shell frag. and plant remains; contact not observed.

(1.00- 1.15) Void

(1.15- 1.30) Clay: Soft tenacious light yellowish brown mottled grey and yellowish red clay; minerogenic, possibly a drop from the top core; clear contact.

(1.30- 1.96) Organic rich silty clay: Soft tenacious dark grey silty clay, organic rich; occ. small shell frag. (more freq. at 1.7-1.83m), occ. plant remains (freq. at 1.59-1.65m), below 1.85m more minerogenic; sharp contact.

(1.96- 2.87) Sandy gravel: Loose moist grey sandy gravel; very fine to fine moderately well sorted, mostly subangular granules and very small subangular pebbles; sand coarse c. 20%, freq. small shell frag.; clear contact.

(2.87- 2.94) Organic rich sand: Loose moist grey organic rich sand; trace of clay, coarse "shelly" - c. 30% of shell frag., occ. small subangular pebbles, 1cm lens of organic matter; clear contact.

(2.94- 3.00) Organic rich sandy gravel: Loose moist grey sandy gravel; fine poorly sorted matrix supported -

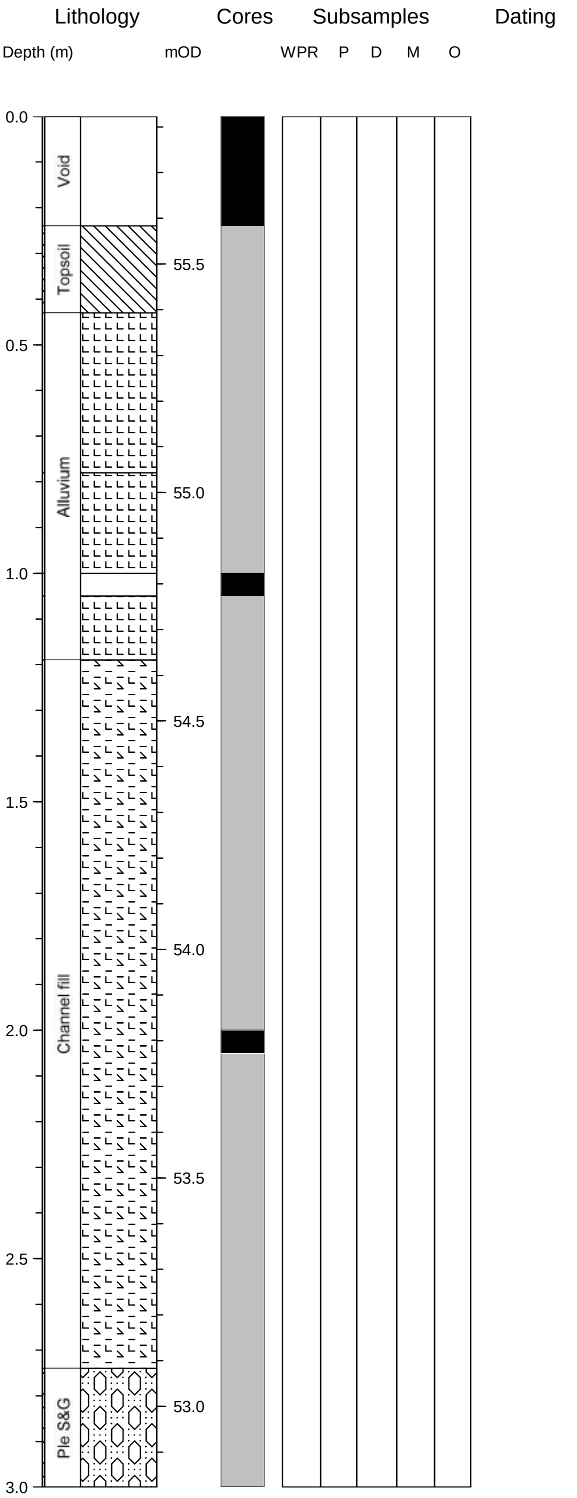
Location of original OAAH73.

GEOARCHAEOLOGICAL SERVICES

SUMMARY BOREHOLE RECORD

SITE NAME: **Oxford Flood Alleviation** SITE CODE: **OXFLOD16** NG EASTING: **449230.024050** DATE: **20/10/2016**

BH NO: **OA114** ELEVATION: **55.823110** NG NORTHING: **205916.782250** LOGGER: **MB**



Description

(0.00- 0.24) Void

(0.24- 0.43) Topsoil: Loose dry very dark greyish brown sandy silt, sand fine, roots, rare small shell frag.; clear contact.

(0.43- 0.78) Clay: Firm compacted yellowish brown mottled grey and strong brown clay; occ. roots and white mineral concretions, minerogenic; clear contact.

(0.78- 1.00) Clay: Soft tenacious light brownish grey mottled strong brown clay; minerogenic; contact not observed.

(1.00- 1.05) Void

(1.05- 1.19) Clay: Soft tenacious yellowish brown mottled grey clay; minerogenic, possible dropped in - top soil at 1.19m; clear contact.

(1.19- 2.74) Organic clayey silt: Soft dark greyish brown organic clayey silt, subtle organic smell; freq. small shell frag., diagonal 1cm lens at 1.56m of c. 80% of shell frag., freq. plant remains, diagonal organic lens at 1.65-1.69m and 2.73m; more clayey and less organic below 2.05m; clear contact.

(2.74- 3.00) Sandy gravel: Loose wet grey sandy gravel; fine poorly sorted clast supported - very small and small subrounded to subangular pebbles; rare medium and large, granules c. 20%; sand fine to coarse c. 10%, trace of clay, occ. small shell frag., rare plant remains, very subtle organic smell; not bottomed.

Location of original OAAH76.
Ple S&G - Pleistocene sands & gravels

APPENDIX F. BOREHOLE PHOTOGRAPHS

Borehole OA101

Borehole OA102

Borehole OA103

Borehole OA104A

Borehole O4104B

Borehole OA105

Borehole OA106

Borehole OA107

Borehole OA108

Borehole OA109

Borehole OA110

Borehole OA111

Borehole OA112

Borehole OA113

Borehole OA114

Appendix G. Radiocarbon Certificates

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 **FAX:** 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Miss Julia Meen — Report Date: 12/2/2016

Oxford Archaeology — Material Received: 11/10/2016

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 450162	101.5 +/- 0.3 pMC	d13C= -28.0	102.1 +/- 0.3 pMC
SAMPLE: OXFLOD16 OABH103 1.22-1.25m ANALYSIS: AMS-Standard delivery MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid			
Beta - 450163	5900 +/- 30 BP	d13C= -28.4	5840 +/- 30 BP
SAMPLE: OXFLOD16 OABH106 2.91-2.93m ANALYSIS: AMS-Standard delivery MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 4780 to 4670 (Cal BP 6730 to 6620) and Cal BC 4660 to 4655 (Cal BP 6610 to 6605) Cal BC 4660 to 4655 (Cal BP 6610 to 6605) and Cal BC 4635 to 4615 (Cal BP 6585 to 6565) Cal BC 4635 to 4615 (Cal BP 6585 to 6565)			
Beta - 450164	4710 +/- 30 BP	d13C= -27.4	4670 +/- 30 BP
SAMPLE: OXFLOD16 OABH104A 3.73-3.80m ANALYSIS: AMS-Standard delivery MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 3620 to 3605 (Cal BP 5570 to 5555) and Cal BC 3520 to 3365 (Cal BP 5470 to 5315) Cal BC 3520 to 3365 (Cal BP 5470 to 5315)			
Beta - 450165	7280 +/- 30 BP	d13C= -28.5	7220 +/- 30 BP
SAMPLE: OXFLOD16 OABH106 4.58-4.59m ANALYSIS: AMS-Standard delivery MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 6200 to 6195 (Cal BP 8150 to 8145) and Cal BC 6100 to 6020 (Cal BP 8050 to 7970) Cal BC 6100 to 6020 (Cal BP 8050 to 7970)			
Beta - 450166	3730 +/- 30 BP	d13C= -26.0	3710 +/- 30 BP
SAMPLE: OXFLOD16 OABH104A 2.54-2.55m ANALYSIS: AMS-Standard delivery MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 2200 to 2160 (Cal BP 4150 to 4110) and Cal BC 2150 to 2025 (Cal BP 4100 to 3975) Cal BC 2150 to 2025 (Cal BP 4100 to 3975)			

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD
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MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Miss Julia Meen — Report Date: 12/2/2016

Oxford Archaeology — Material Received: 11/10/2016

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 450167	2820 +/- 30 BP	d13C= -28.2	2770 +/- 30 BP

SAMPLE: OXFLOD16 OABH109 1.49-1.50m
ANALYSIS: AMS-Standard delivery
MATERIAL/PRETREATMENT: (wood): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 1000 to 835 (Cal BP 2950 to 2785)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 450168	3160 +/- 30 BP	d13C= -28.3	3110 +/- 30 BP

SAMPLE: OXFLOD16 OABH104B 1.73-1.75m
ANALYSIS: AMS-Standard delivery
MATERIAL/PRETREATMENT: (plant material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 1435 to 1290 (Cal BP 3385 to 3240)

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 450169	3660 +/- 30 BP	d13C= -27.7	3620 +/- 30 BP

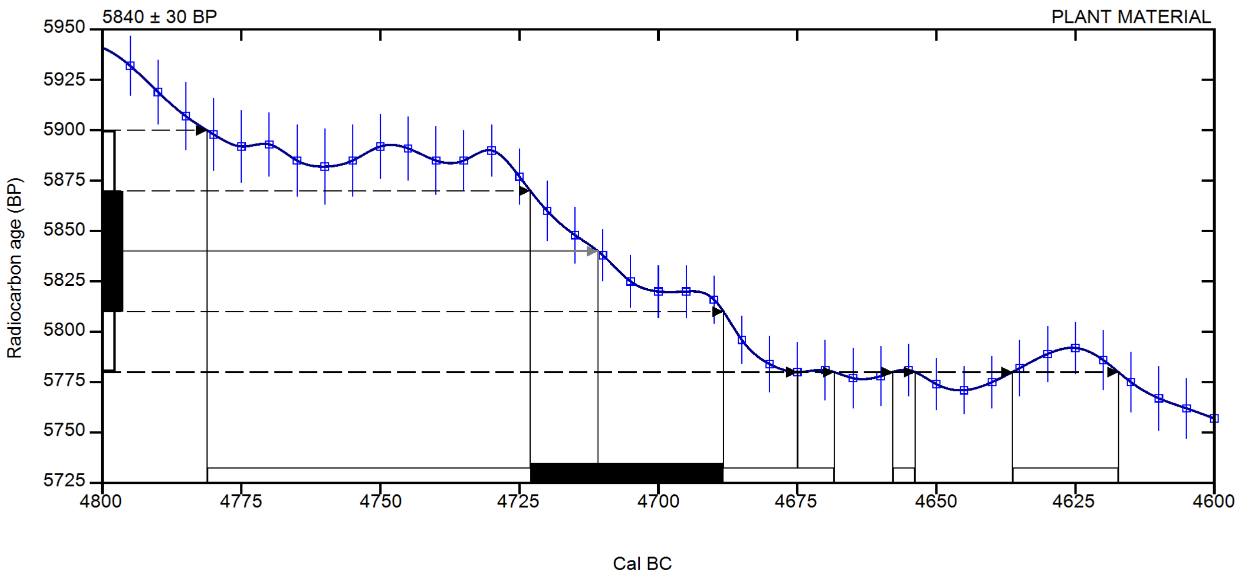
SAMPLE: OXFLOD16 OABH111 1.86-1.87m
ANALYSIS: AMS-Standard delivery
MATERIAL/PRETREATMENT: (wood): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 2115 to 2100 (Cal BP 4065 to 4050) and Cal BC 2035 to 1900 (Cal BP 3985 to 3850)
Cal BC 2035 to 1900 (Cal BP 3985 to 3850)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d 15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -28.4 o/oo : lab. mult = 1)

Laboratory number	**Beta-450163 : OXFLOD16 OABH106 2.91-2.93M**
Conventional radiocarbon age	**5840 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 4780 to 4670 (Cal BP 6730 to 6620)** **Cal BC 4660 to 4655 (Cal BP 6610 to 6605)** **Cal BC 4635 to 4615 (Cal BP 6585 to 6565)**
Intercept of radiocarbon age with calibration curve	Cal BC 4710 (Cal BP 6660)
Calibrated Result (68% Probability)	Cal BC 4725 to 4690 (Cal BP 6675 to 6640)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory

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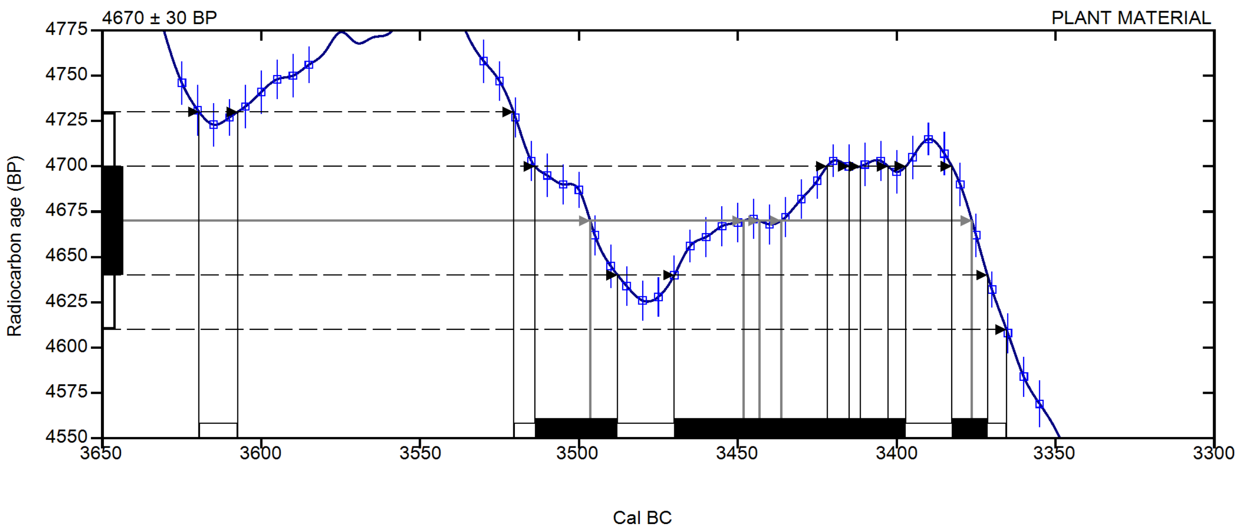
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -27.4 o/oo : lab. mult = 1)

Laboratory number	**Beta-450164 : OXFLOD16 OABH104A 3.73-3.80M**
Conventional radiocarbon age	**4670 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 3620 to 3605 (Cal BP 5570 to 5555)** **Cal BC 3520 to 3365 (Cal BP 5470 to 5315)**
Intercept of radiocarbon age with calibration curve	Cal BC 3495 (Cal BP 5445) Cal BC 3450 (Cal BP 5400) Cal BC 3445 (Cal BP 5395) Cal BC 3435 (Cal BP 5385) Cal BC 3375 (Cal BP 5325)
Calibrated Result (68% Probability)	Cal BC 3515 to 3490 (Cal BP 5465 to 5440) Cal BC 3470 to 3395 (Cal BP 5420 to 5345) Cal BC 3385 to 3370 (Cal BP 5335 to 5320)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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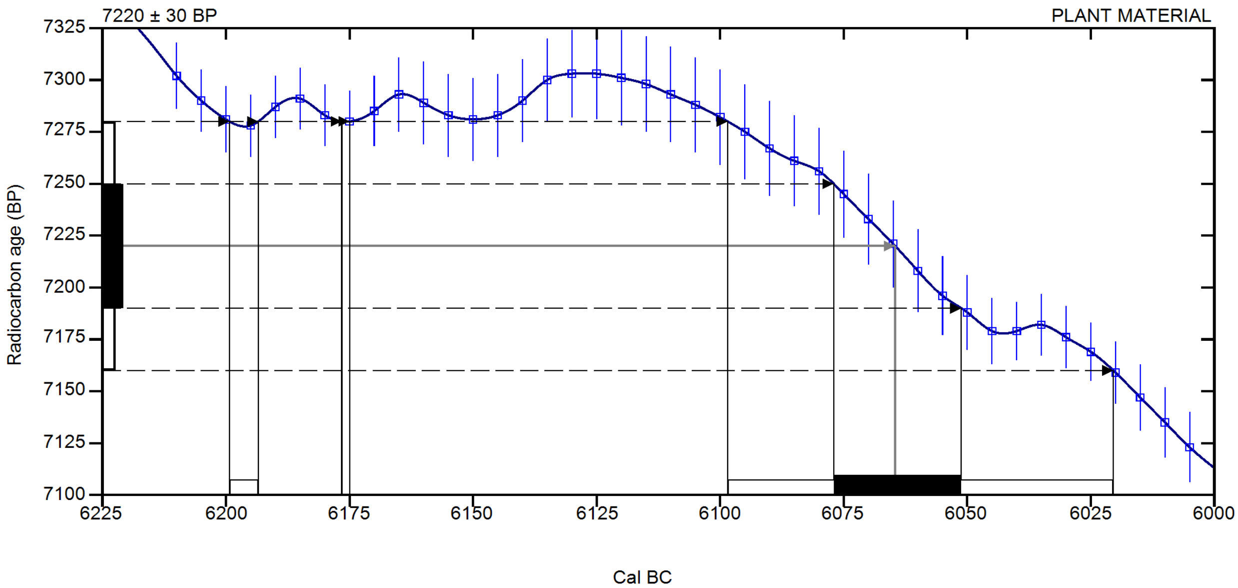
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -28.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-450165 : OXFLOD16 OABH106 4.58-4.59M**
Conventional radiocarbon age	**7220 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 6200 to 6195 (Cal BP 8150 to 8145)** **Cal BC 6100 to 6020 (Cal BP 8050 to 7970)**
Intercept of radiocarbon age with calibration curve	Cal BC 6065 (Cal BP 8015)
Calibrated Result (68% Probability)	Cal BC 6075 to 6050 (Cal BP 8025 to 8000)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -26 o/oo : lab. mult = 1)

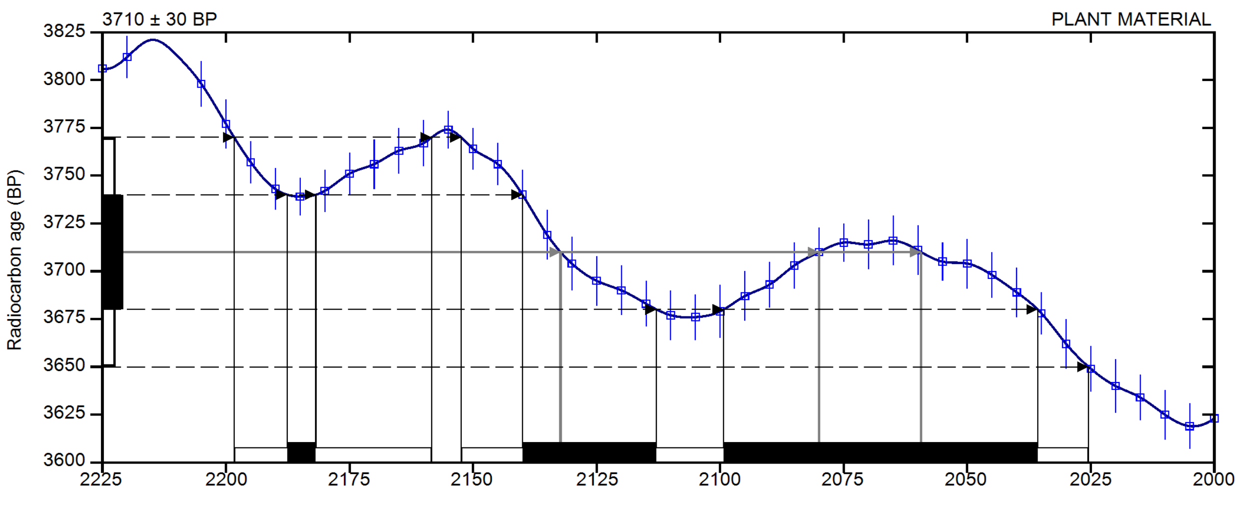
Laboratory number **Beta-450166 : OXFLOD16 OABH104A 2.54-2.55M**

Conventional radiocarbon age **3710 ± 30 BP**

Calibrated Result (95% Probability) **Cal BC 2200 to 2160 (Cal BP 4150 to 4110)**
Cal BC 2150 to 2025 (Cal BP 4100 to 3975)

Intercept of radiocarbon age with calibration curve
Cal BC 2130 (Cal BP 4080)
Cal BC 2080 (Cal BP 4030)
Cal BC 2060 (Cal BP 4010)

Calibrated Result (68% Probability)
Cal BC 2190 to 2180 (Cal BP 4140 to 4130)
Cal BC 2140 to 2115 (Cal BP 4090 to 4065)
Cal BC 2100 to 2035 (Cal BP 4050 to 3985)



Database used

INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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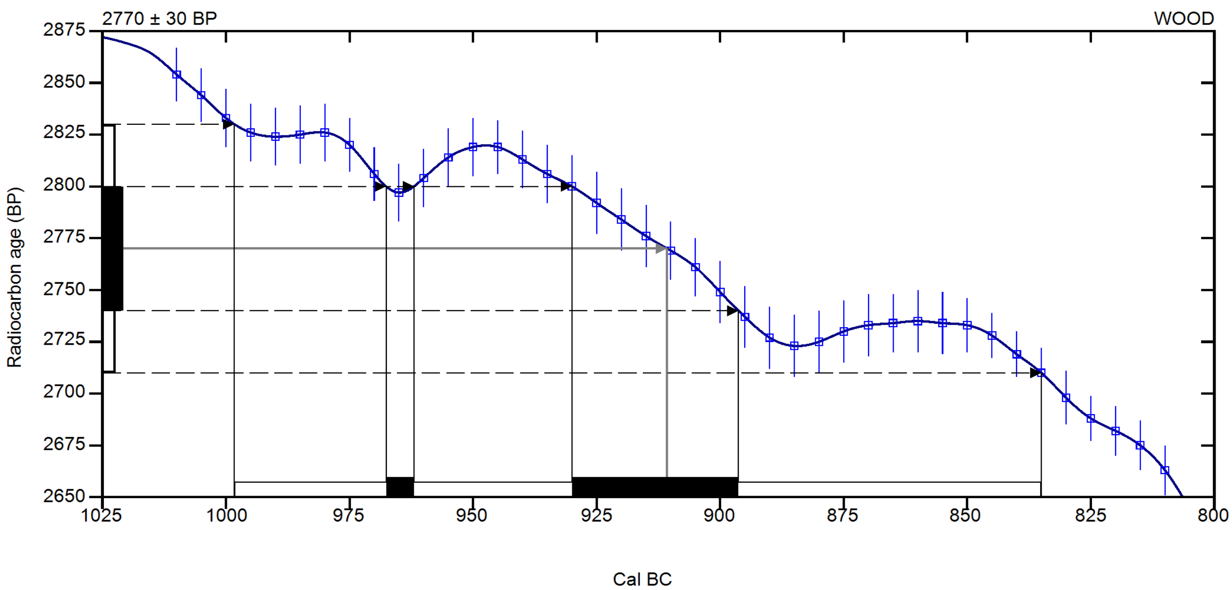
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -28.2 o/oo : lab. mult = 1)

Laboratory number	**Beta-450167 : OXFLOD16 OABH109 1.49-1.50M**
Conventional radiocarbon age	**2770 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 1000 to 835 (Cal BP 2950 to 2785)**
Intercept of radiocarbon age with calibration curve	Cal BC 910 (Cal BP 2860)
Calibrated Result (68% Probability)	Cal BC 970 to 960 (Cal BP 2920 to 2910) Cal BC 930 to 895 (Cal BP 2880 to 2845)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory

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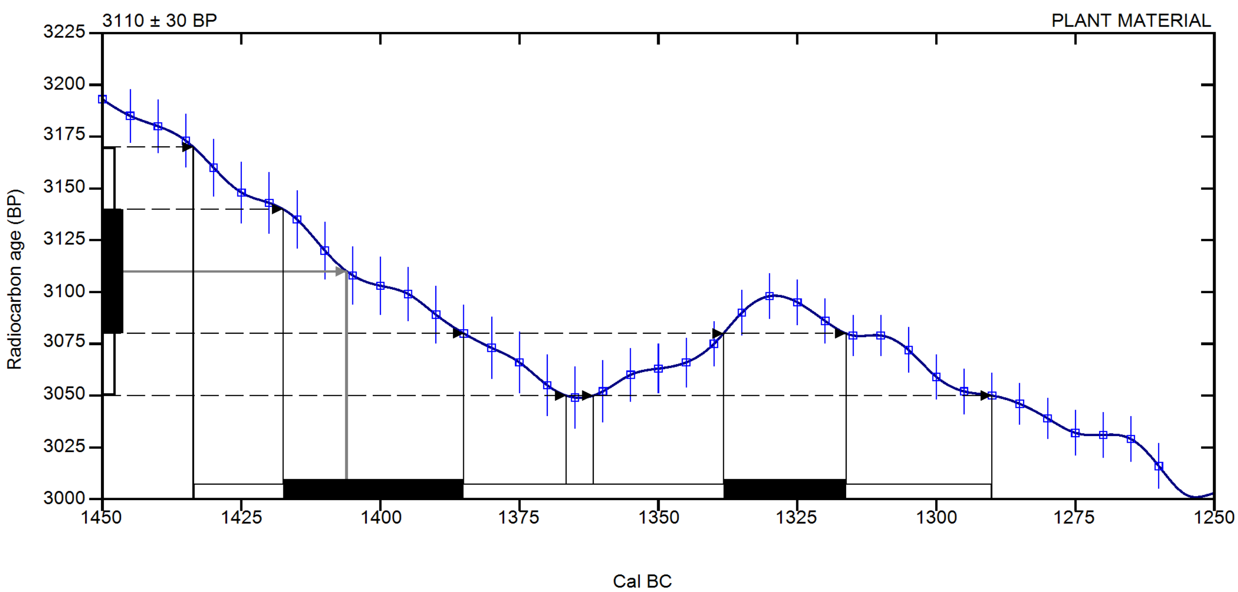
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -28.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-450168 : OXFLOD16 OABH104B 1.73-1.75M**
Conventional radiocarbon age	**3110 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 1435 to 1290 (Cal BP 3385 to 3240)**
Intercept of radiocarbon age with calibration curve	Cal BC 1405 (Cal BP 3355)
Calibrated Result (68% Probability)	Cal BC 1420 to 1385 (Cal BP 3370 to 3335) Cal BC 1340 to 1315 (Cal BP 3290 to 3265)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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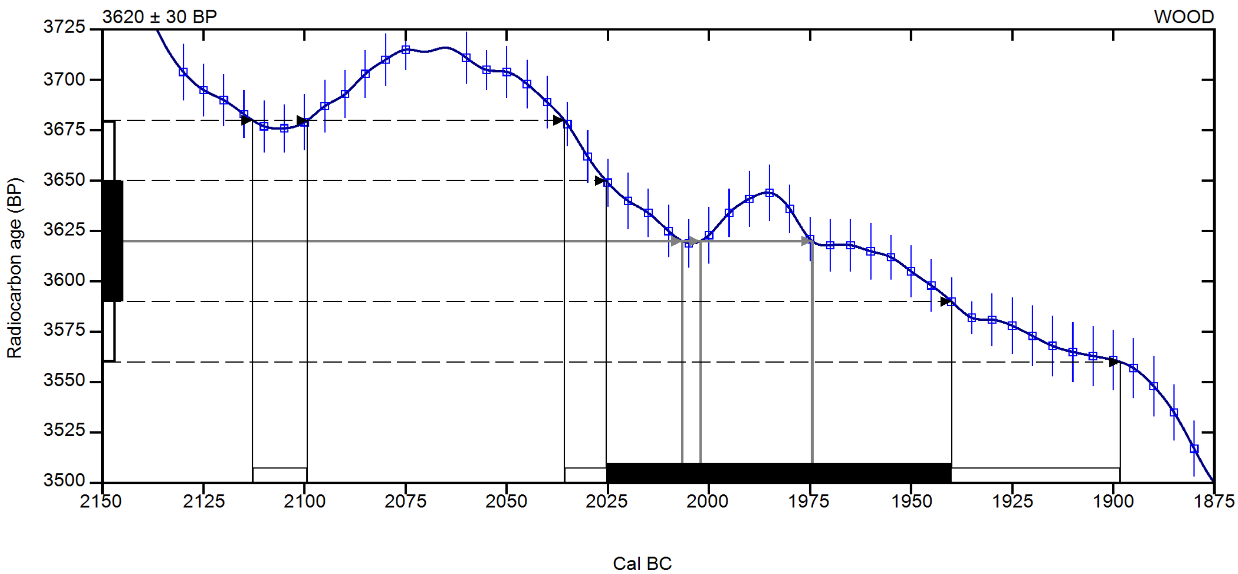
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -27.7 o/oo : lab. mult = 1)

Laboratory number	**Beta-450169 : OXFLOD16 OABH111 1.86-1.87M**
Conventional radiocarbon age	**3620 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 2115 to 2100 (Cal BP 4065 to 4050)** **Cal BC 2035 to 1900 (Cal BP 3985 to 3850)**
Intercept of radiocarbon age with calibration curve	Cal BC 2005 (Cal BP 3955) Cal BC 2000 (Cal BP 3950) Cal BC 1975 (Cal BP 3925)
Calibrated Result (68% Probability)	Cal BC 2025 to 1940 (Cal BP 3975 to 3890)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

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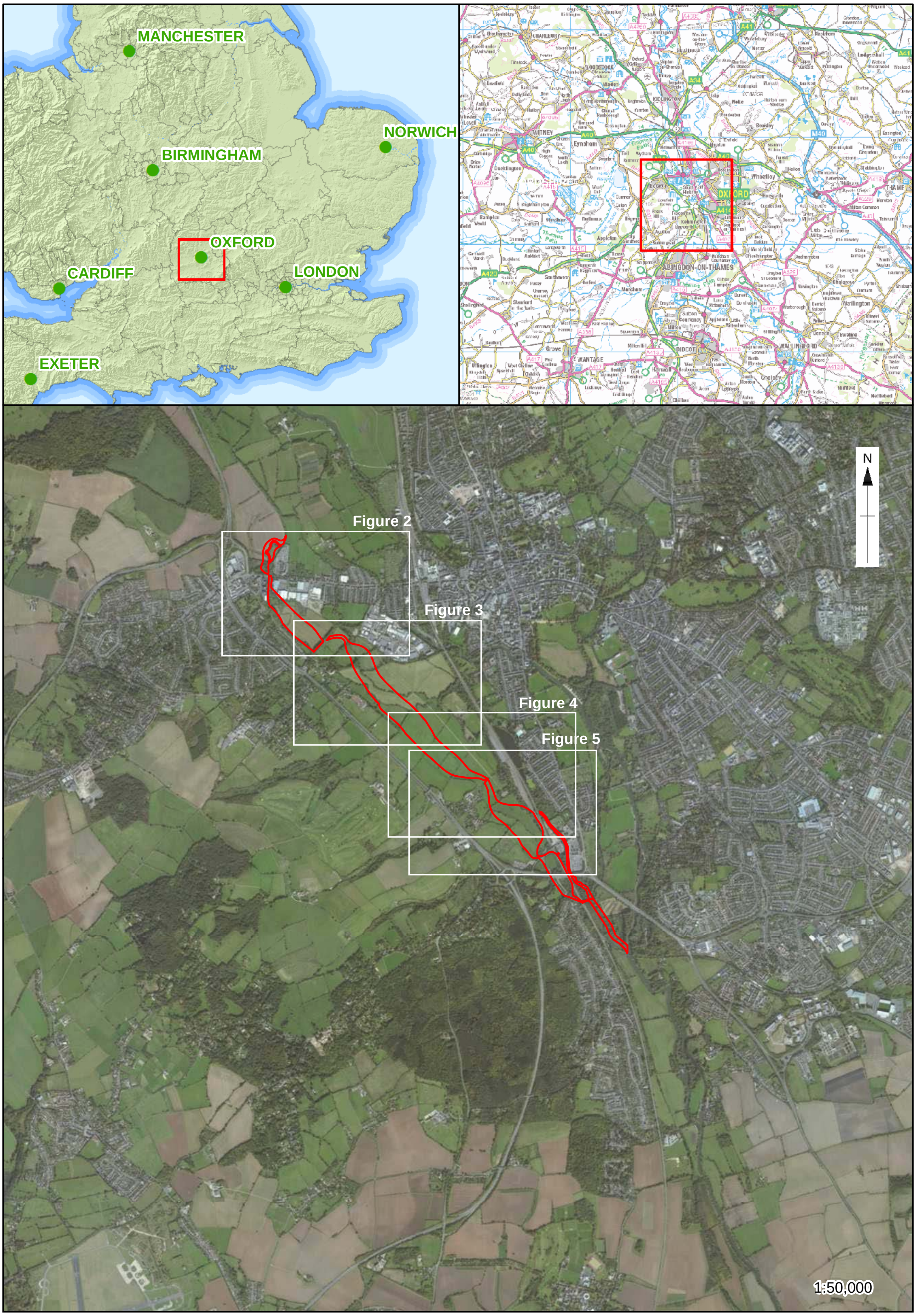

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User

Figure 1: Site location

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Figure 2: Borehole and auger locations, Areas 1 and 2

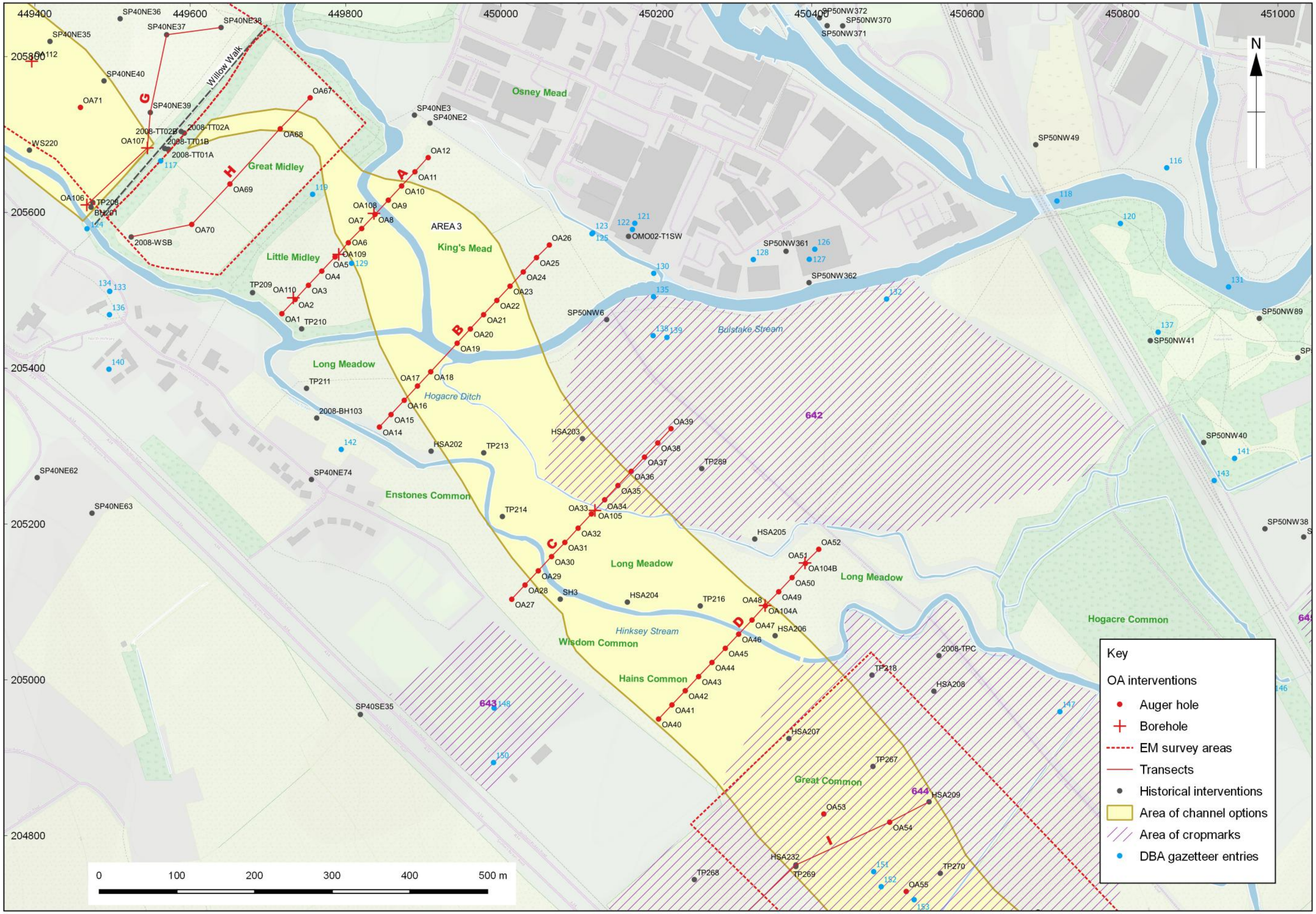

Figure 3: Borehole and auger locations, Area 3 (North)

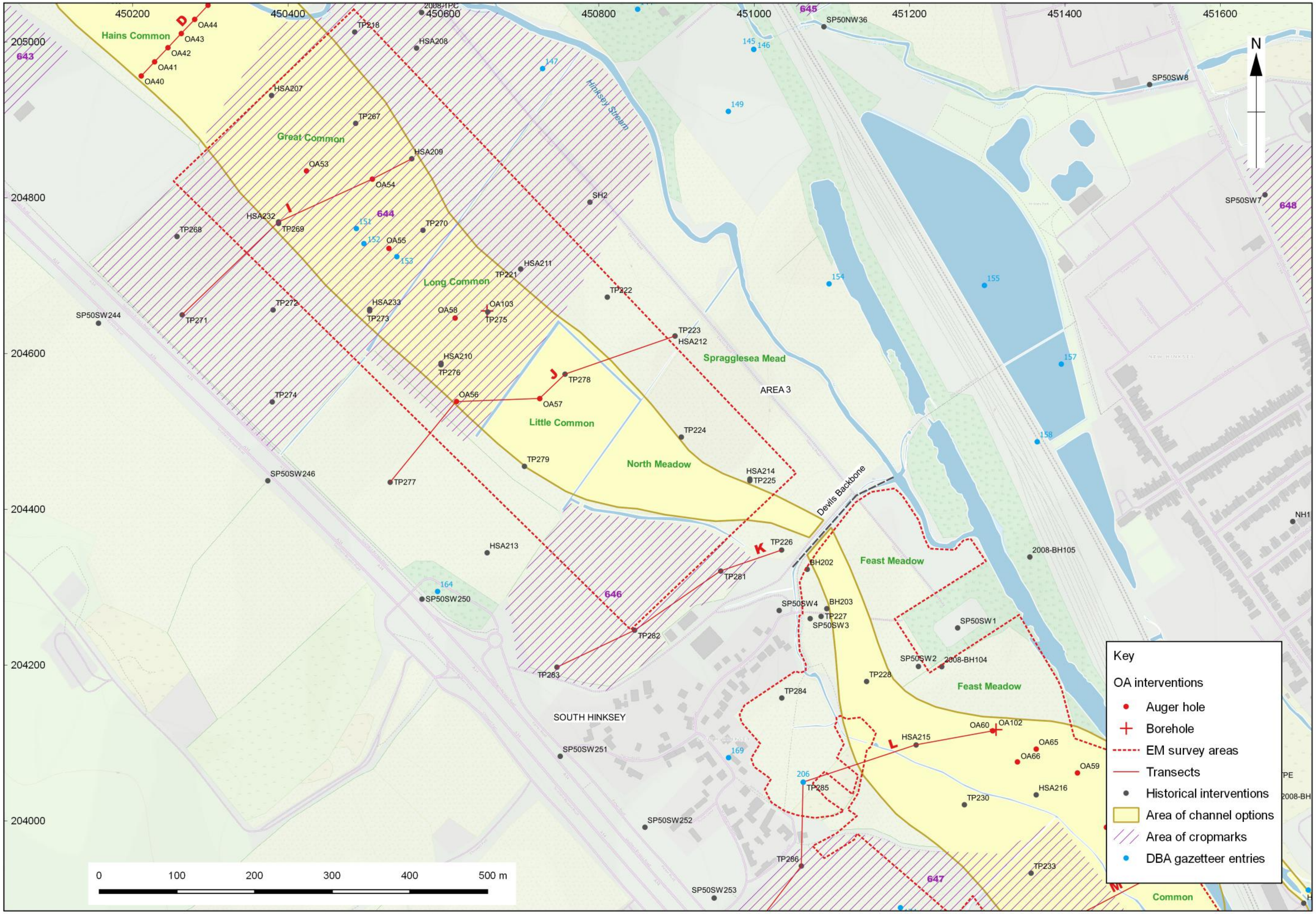

Figure 4: Borehole and auger locations, Area 3 (South)

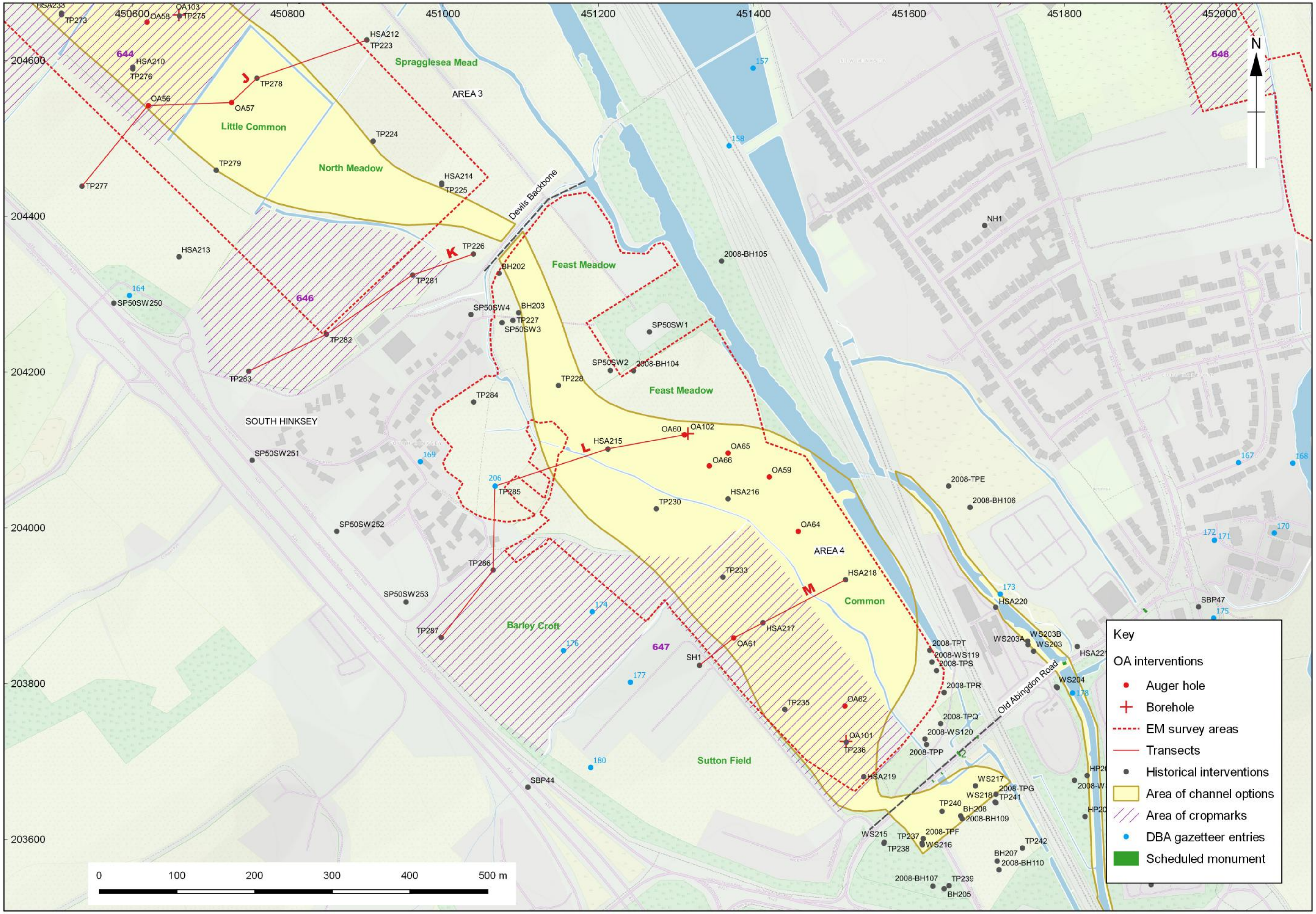

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Figure 5: Borehole and auger locations, Area 4 (Redbridge)

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Figure 6: : Model of gravel surface (m OD) based on borehole and auger data, Areas 1 and 2

Figure 7: EM survey, Areas 1 and 2

Figure 8: Modelled thickness (m) of deposits overlying gravel surface (based on borehole and auger data), Areas 1 and 2

Figure 9: Model of gravel surface (m OD) based on borehole and auger data, Area 3 (North)

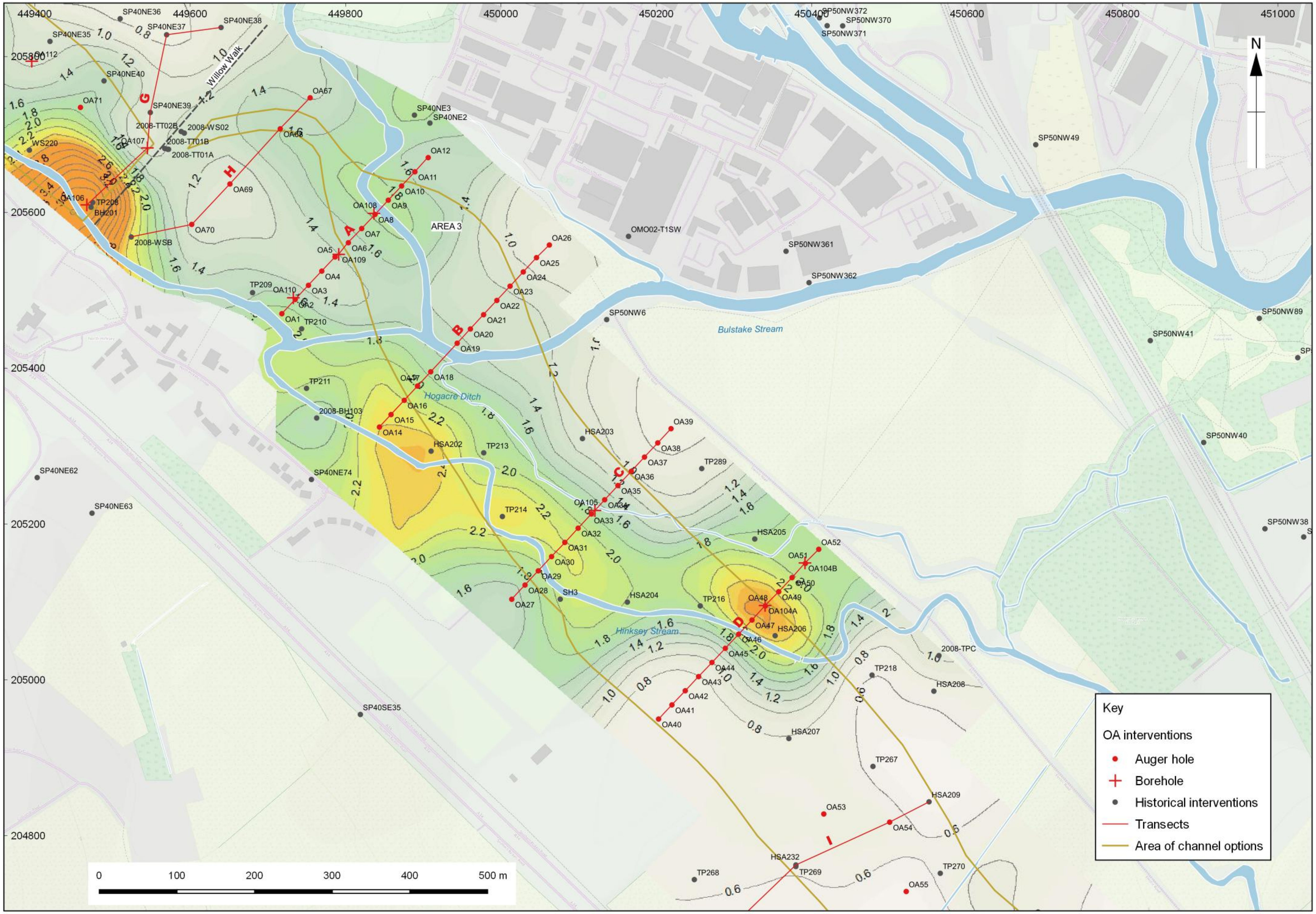

Figure 10: Modelled thickness (m) of deposits overlying gravel surface (based on borehole and auger data), Area 3 (North)

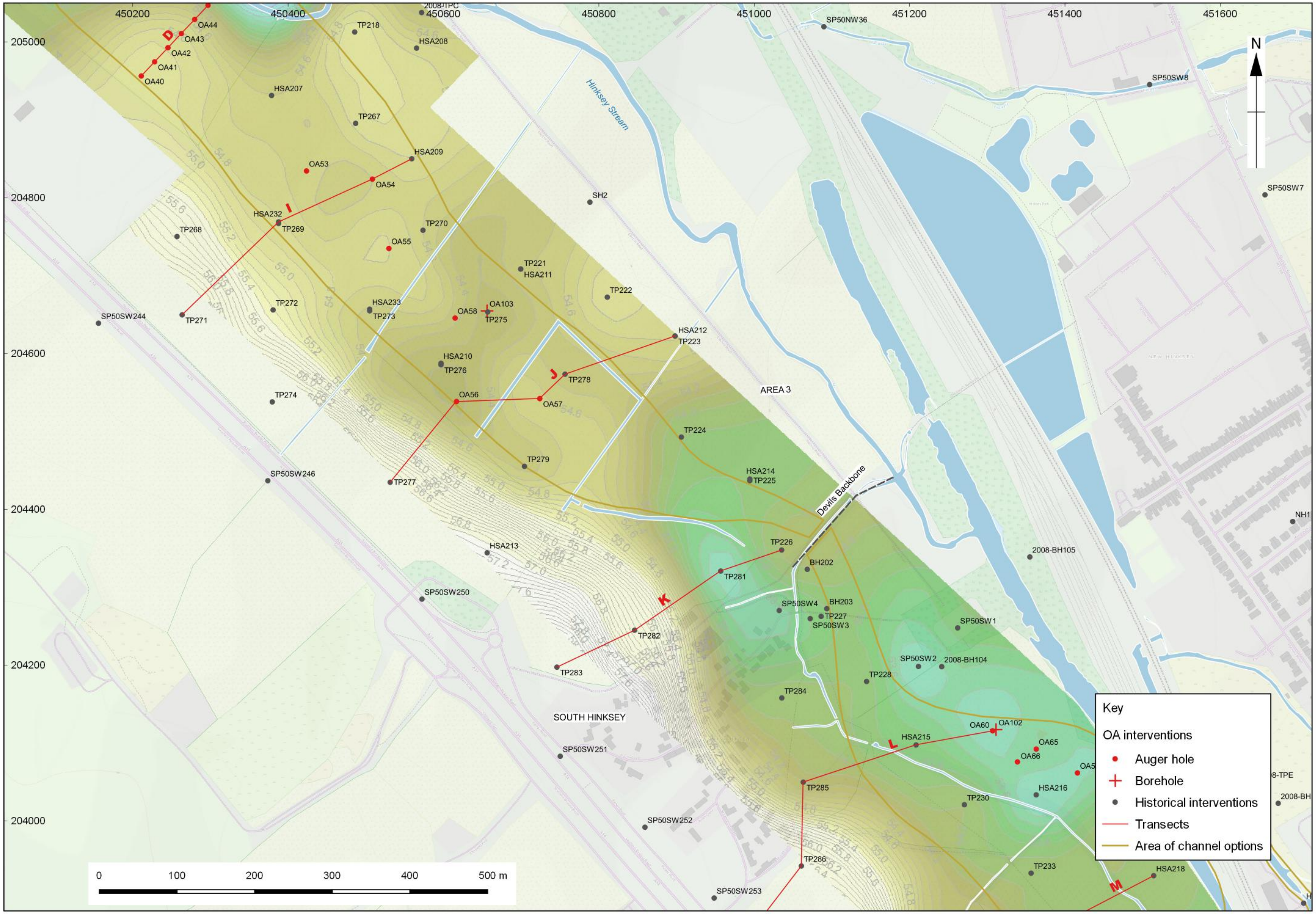

Figure 11: Model of gravel surface (m OD) based on borehole and auger data, Area 3 (South)

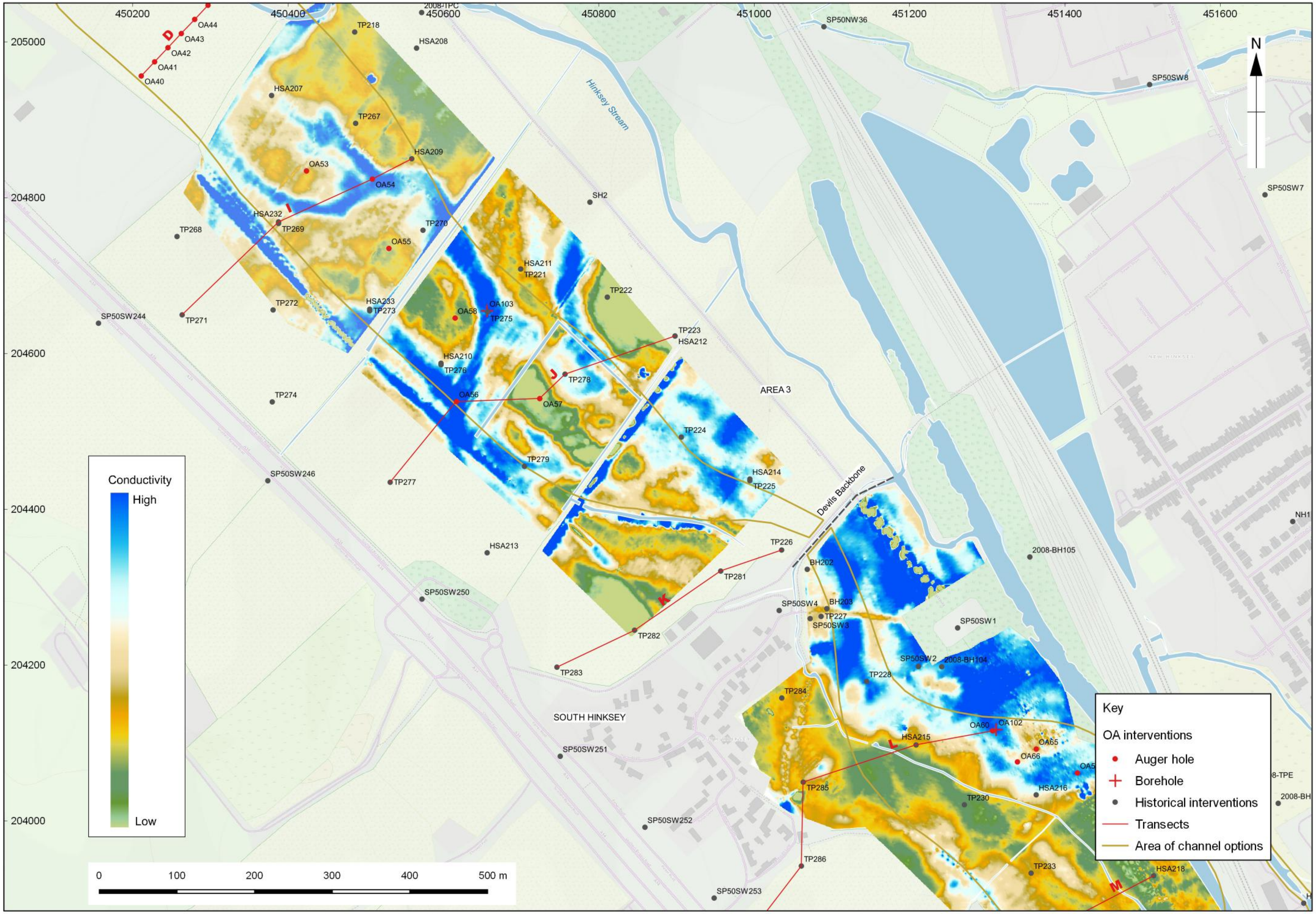

Figure 12: EM survey, Area 3 (South)

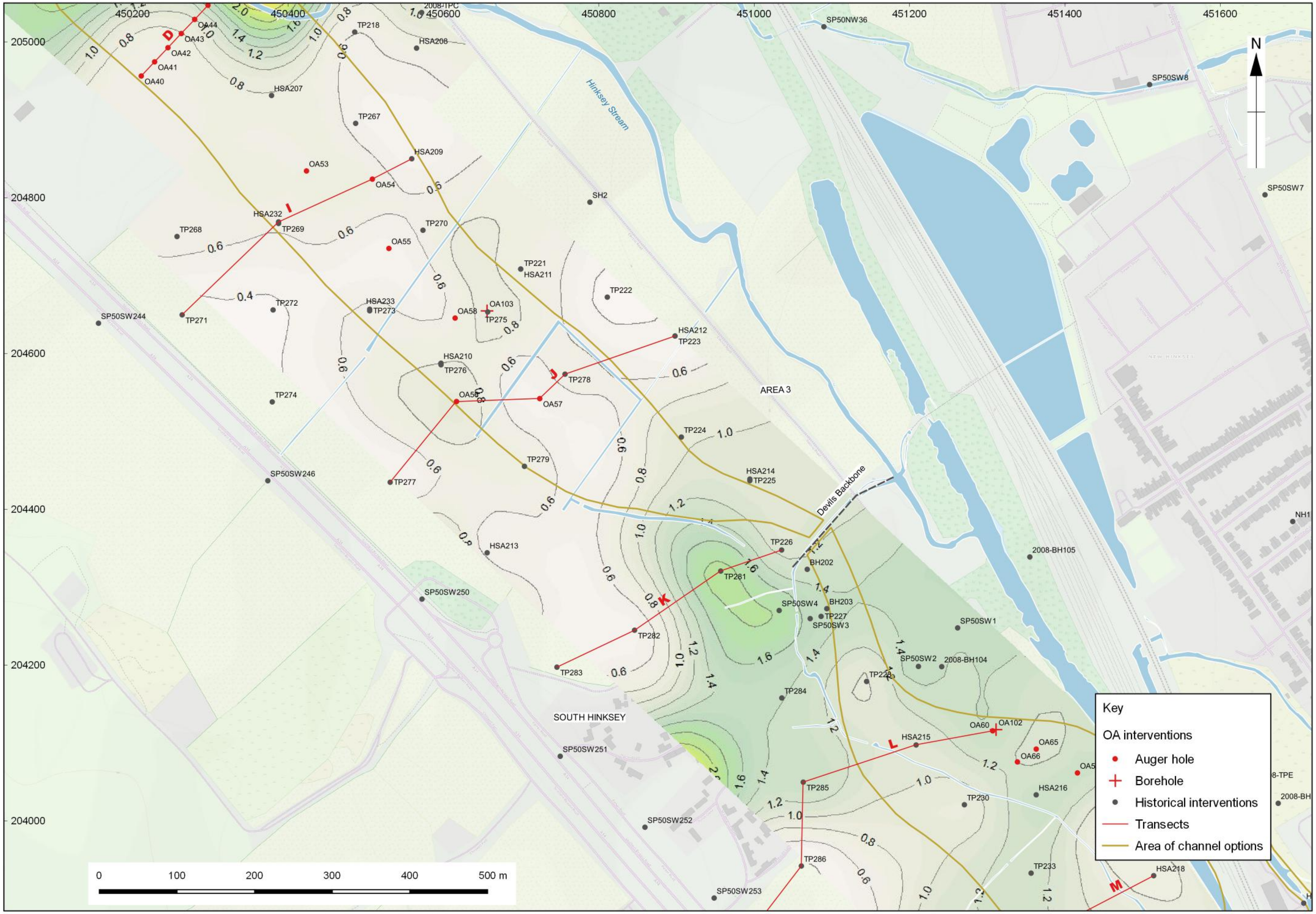

Figure 13: Modelled thickness (m) of deposits overlying gravel surface (based on borehole and auger data), Area 3 (South)

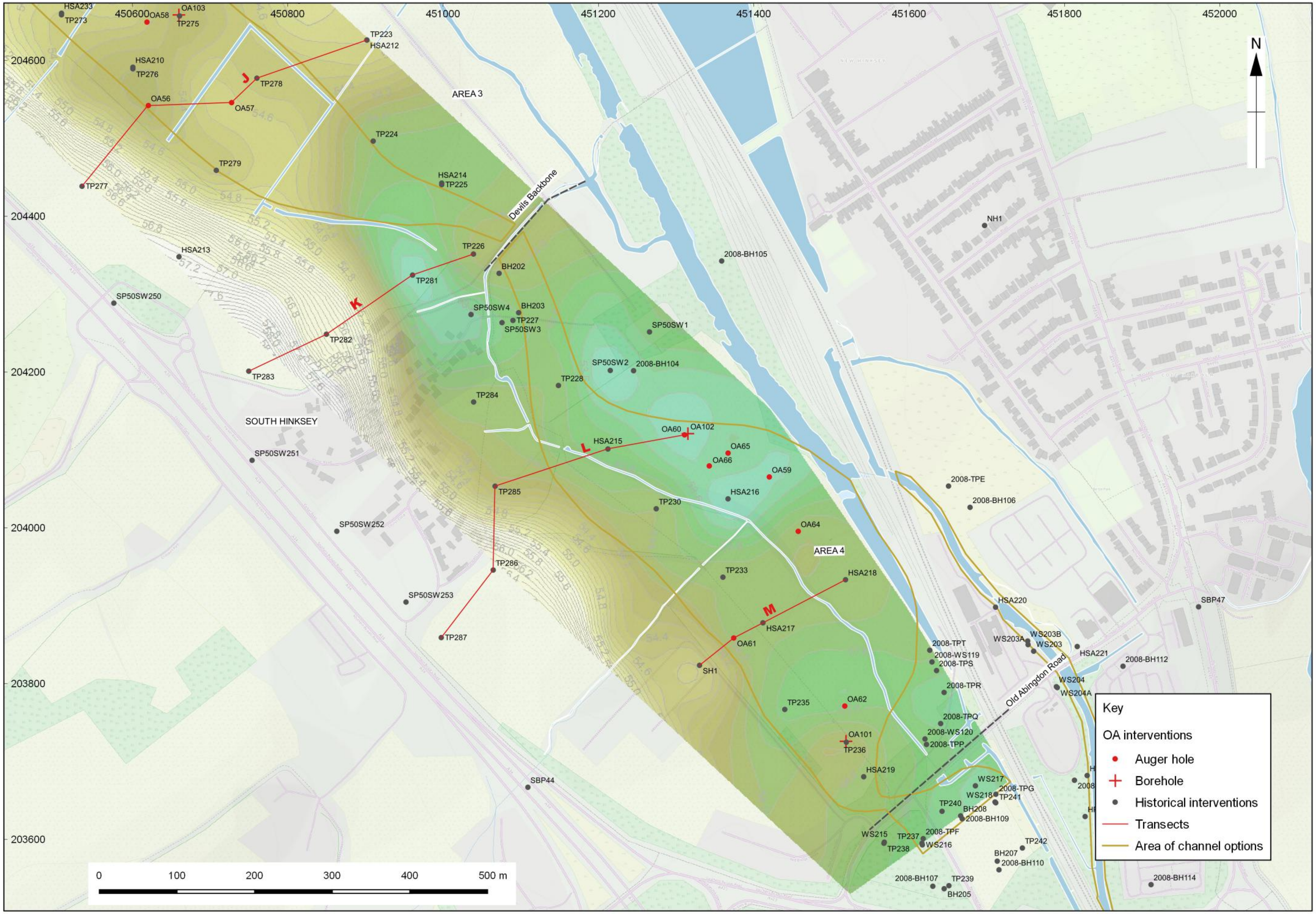

Figure 14: Model of gravel surface based on borehole and auger data, Area 4 (Redbridge)

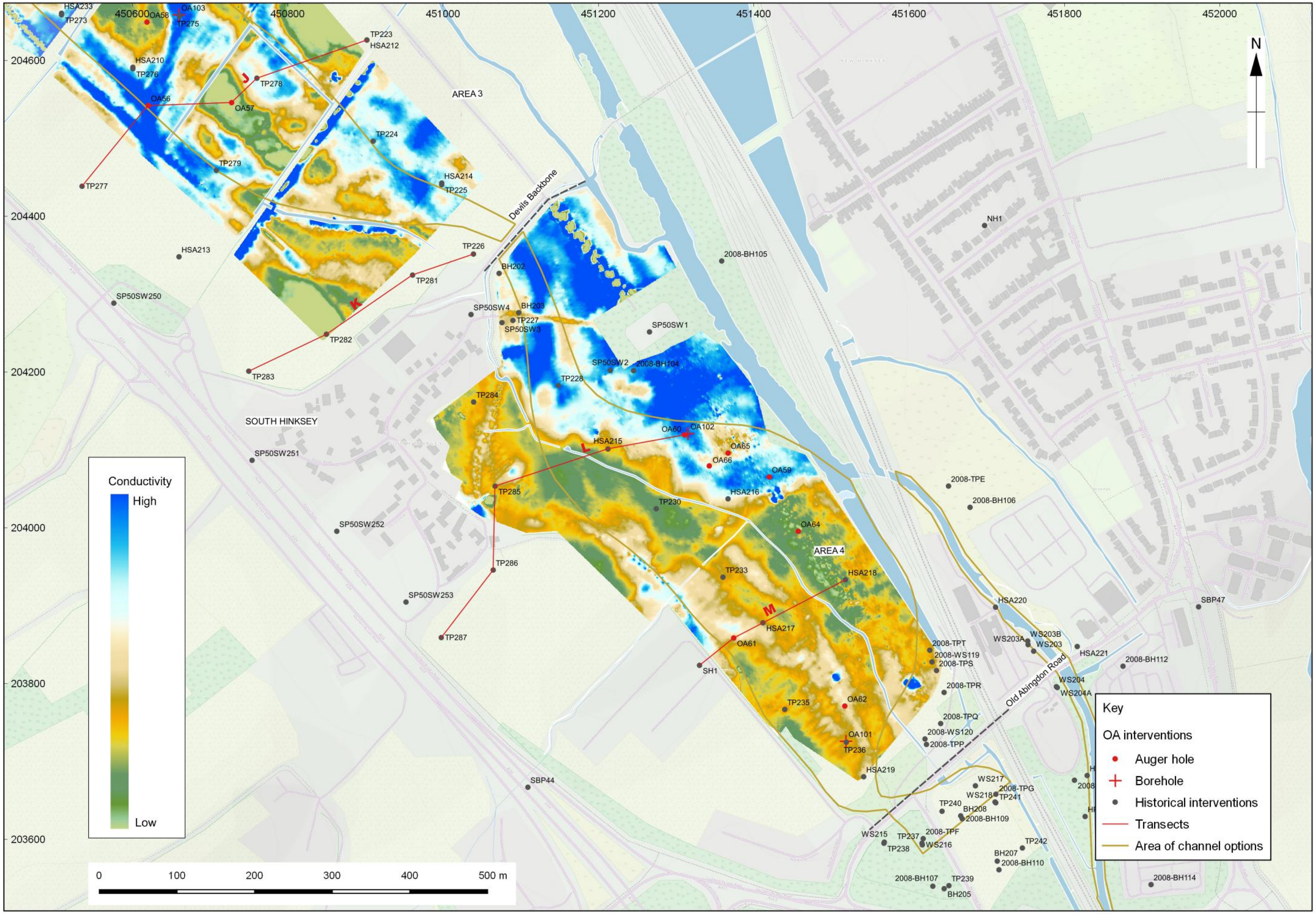

Figure 15: EM survey, Area 4 (Redbridge)

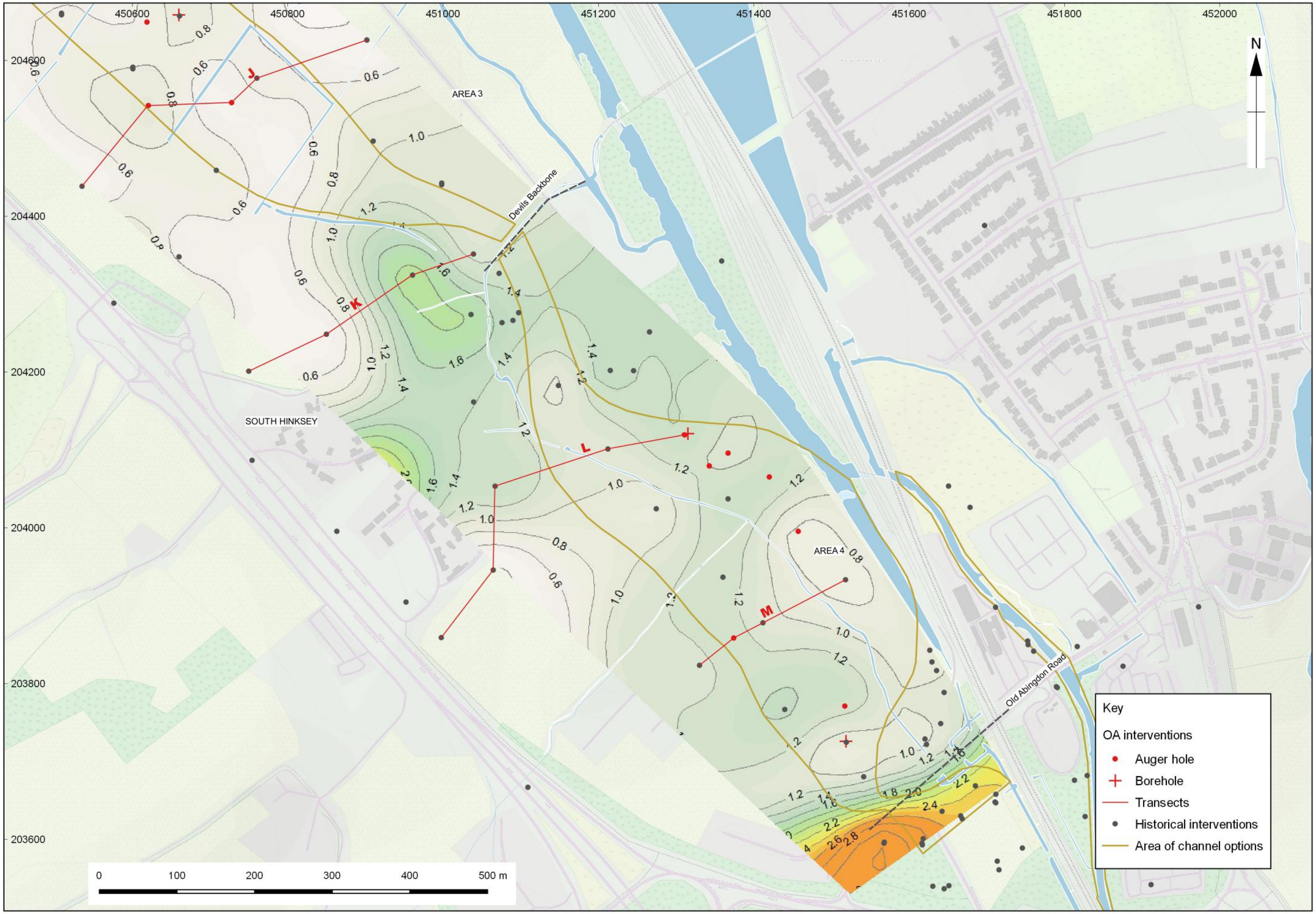

Figure 16: Modelled thickness (m) of deposits overlying gravel surface

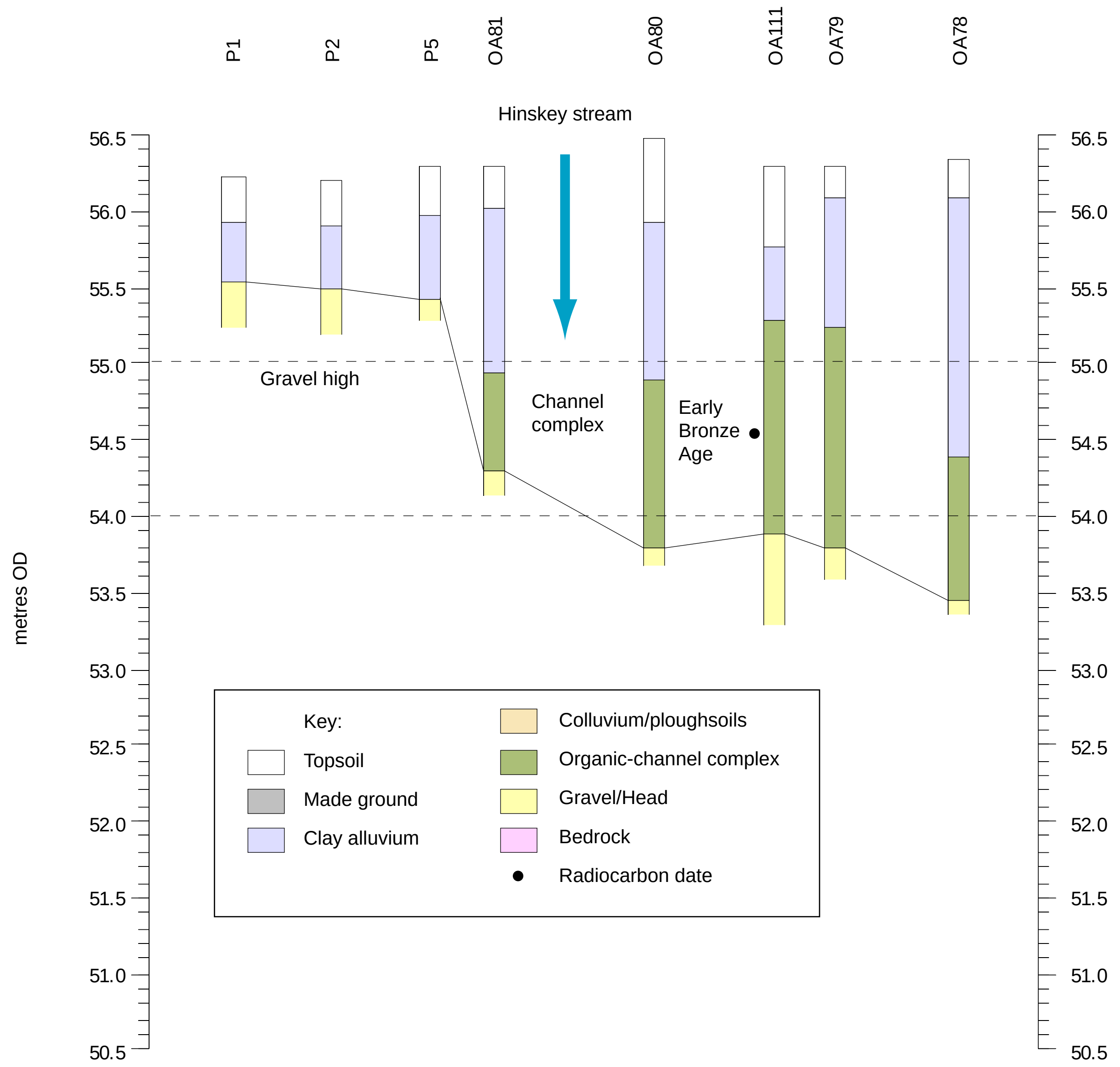

Figure 17: Transect E, Area 1

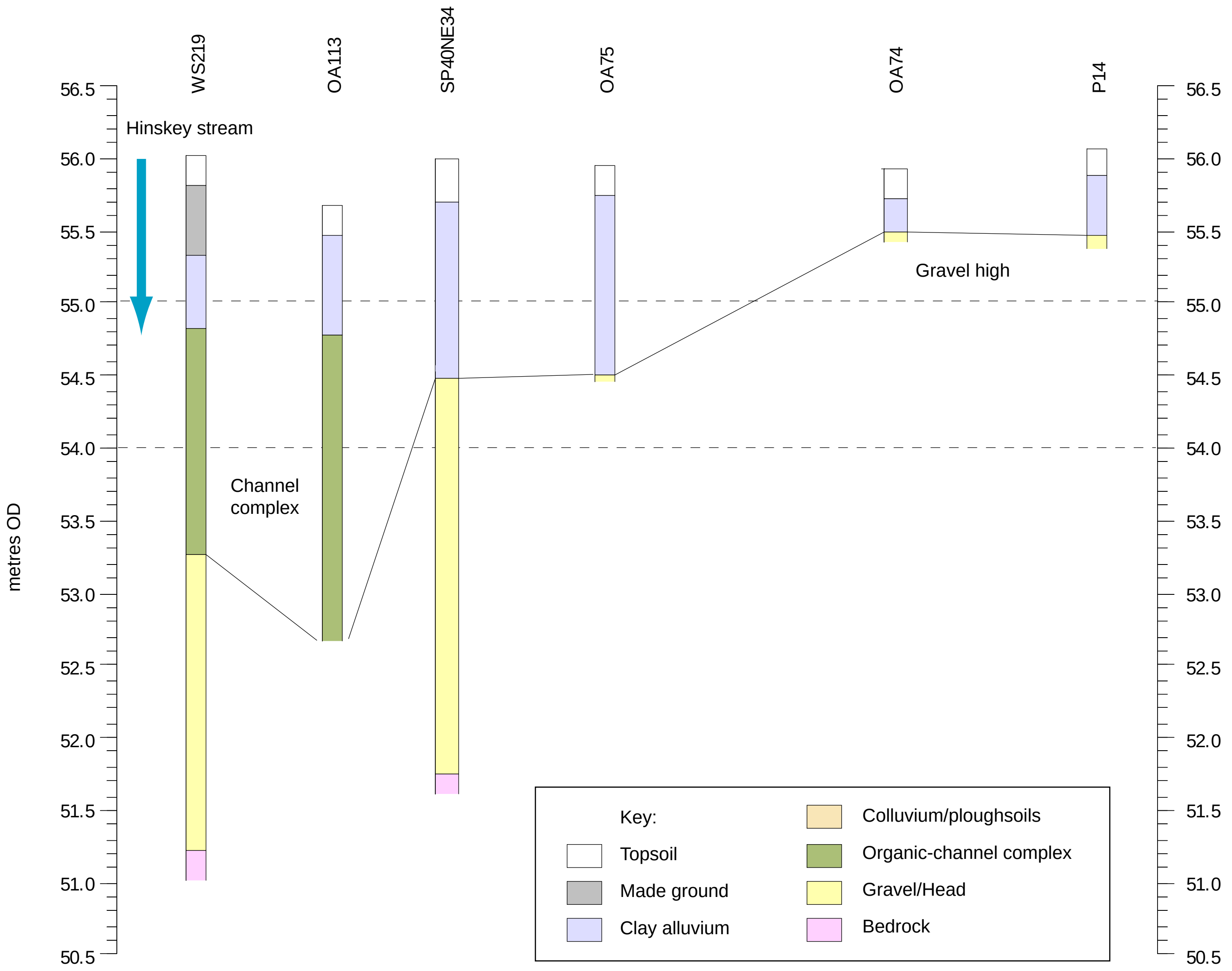

Figure 18: Transect F, Area 2

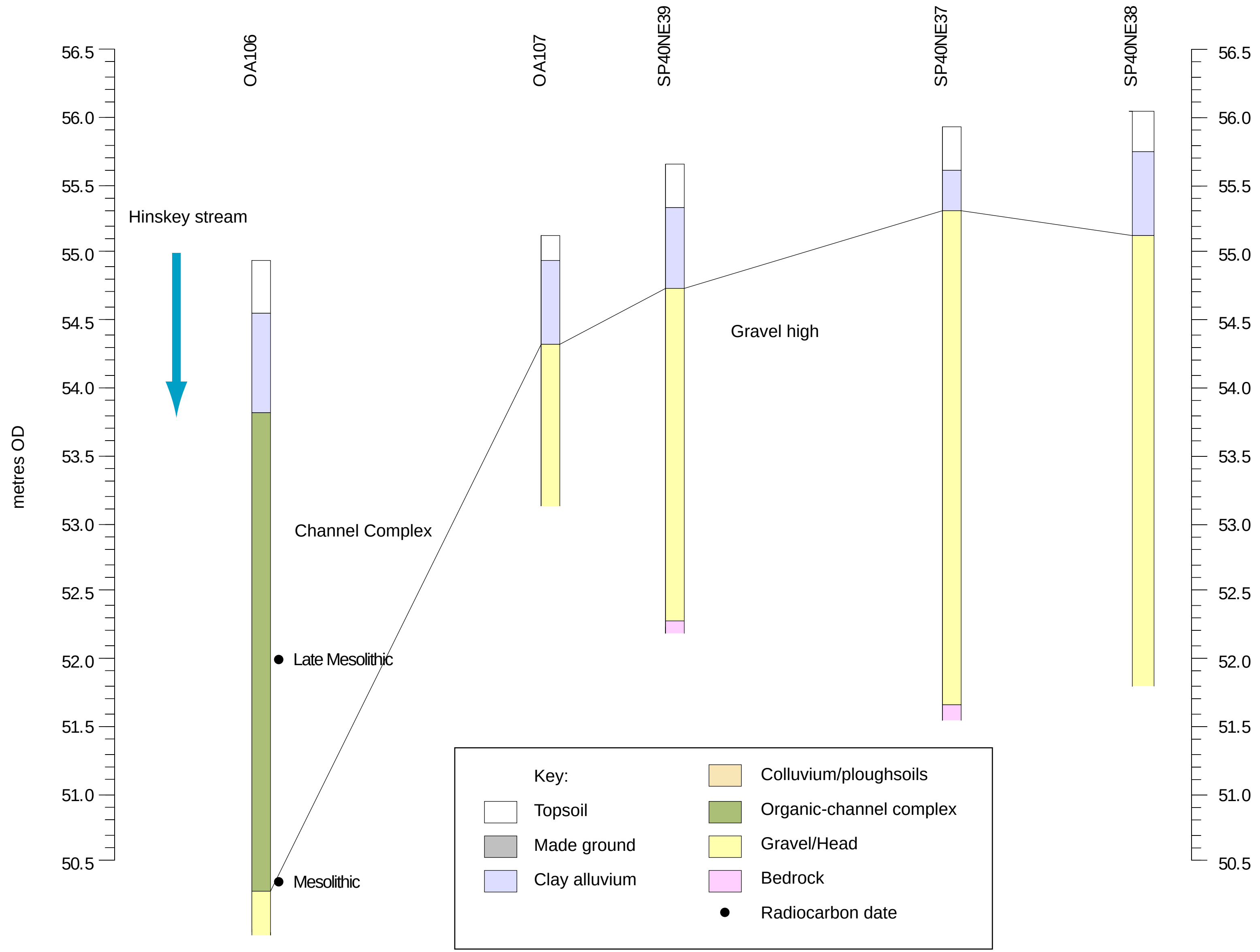

Figure 19: Transect G, Area 2

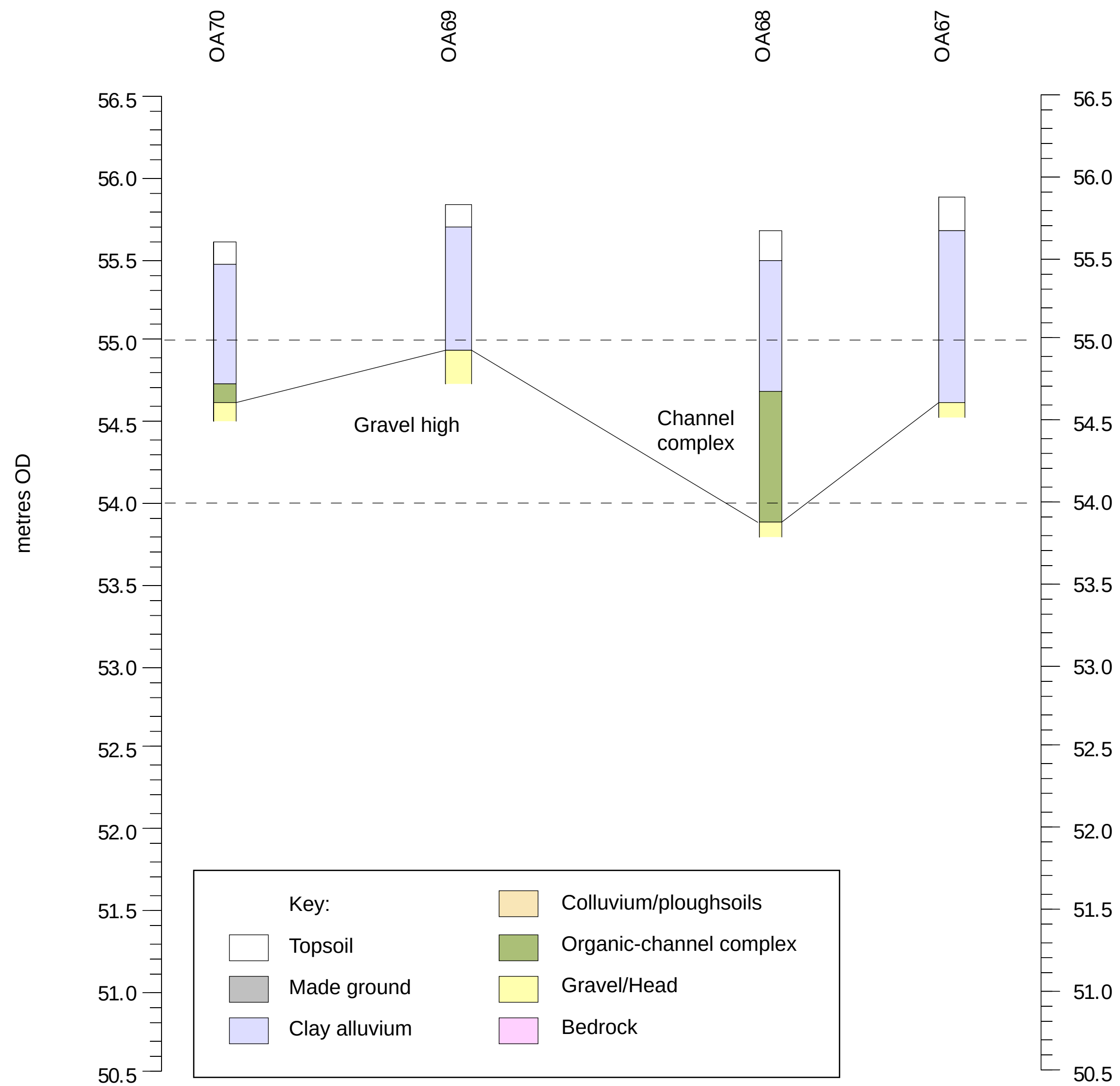

Figure 20: Transect H, Area 3

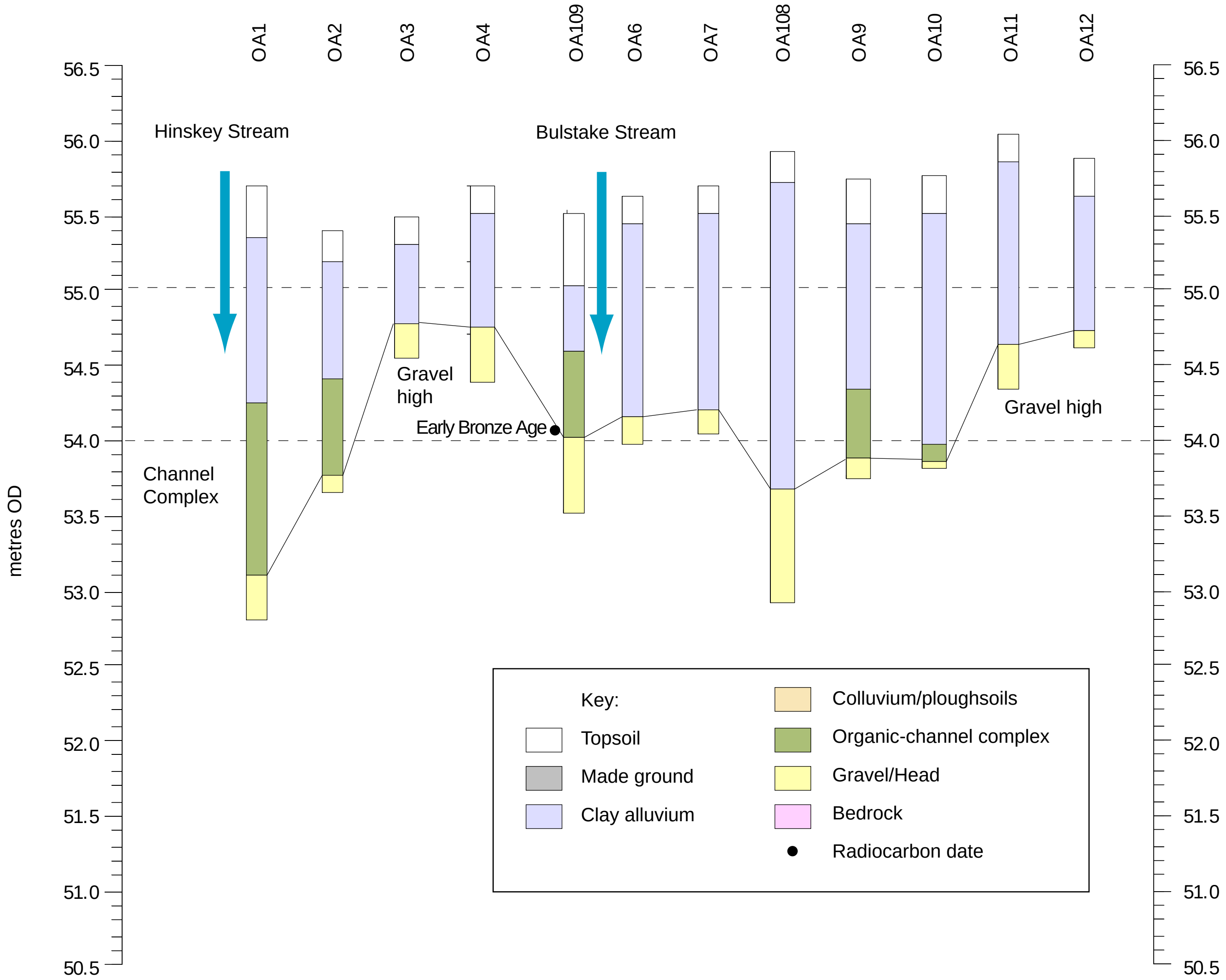

Figure 21: Transect A, Area 3

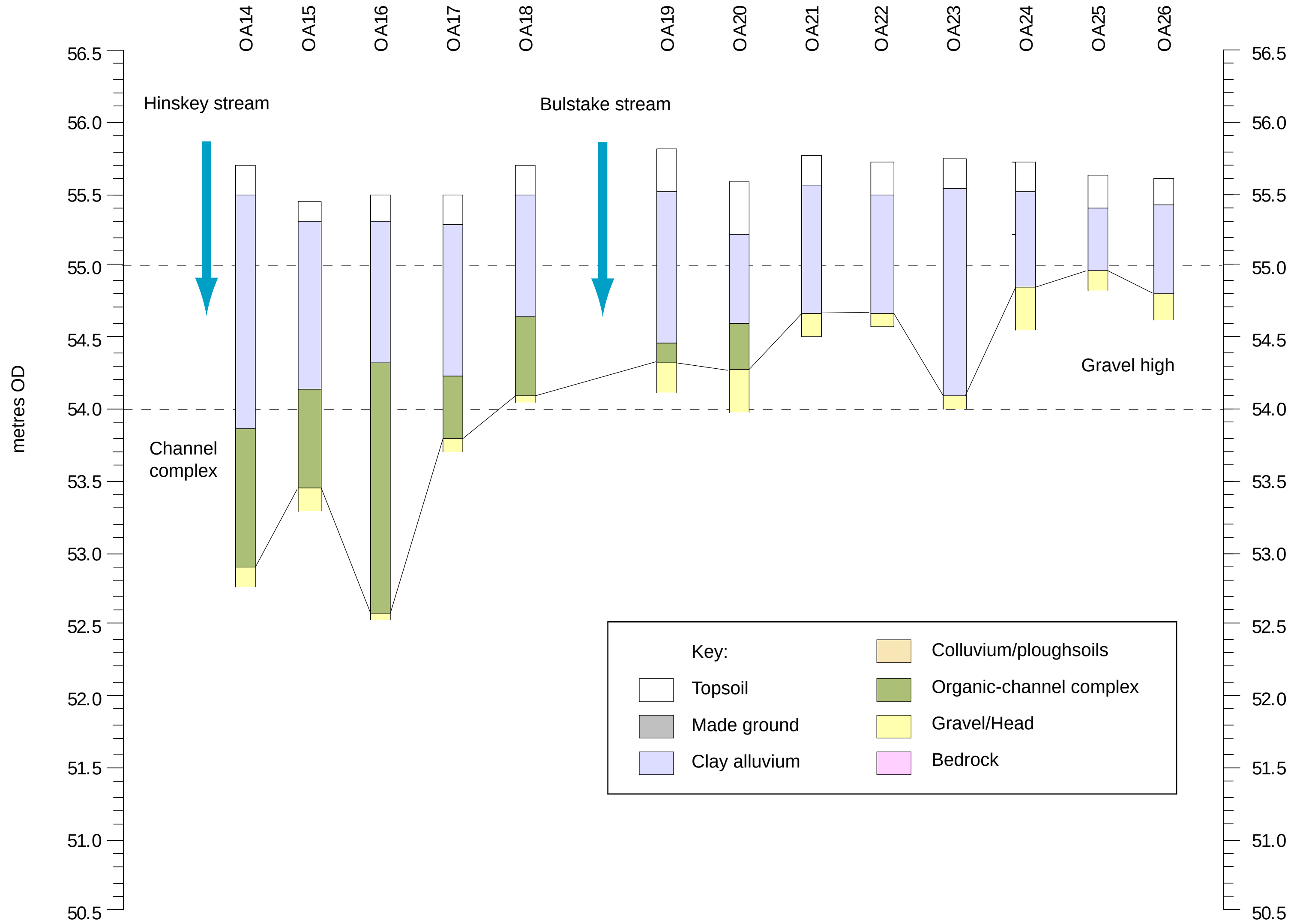

Figure 22: Transect B, Area 3

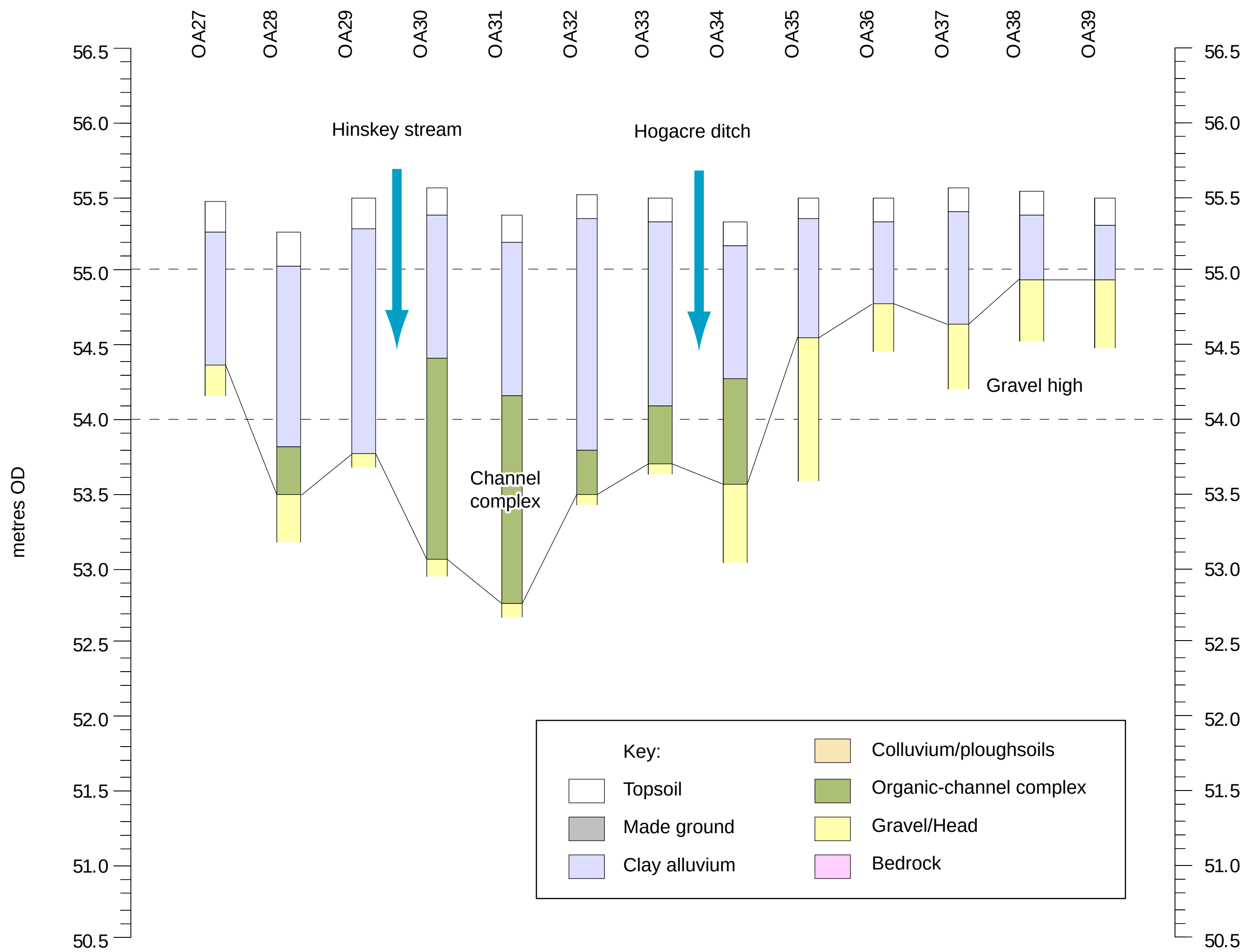

Figure 23: Transect C, Area 3

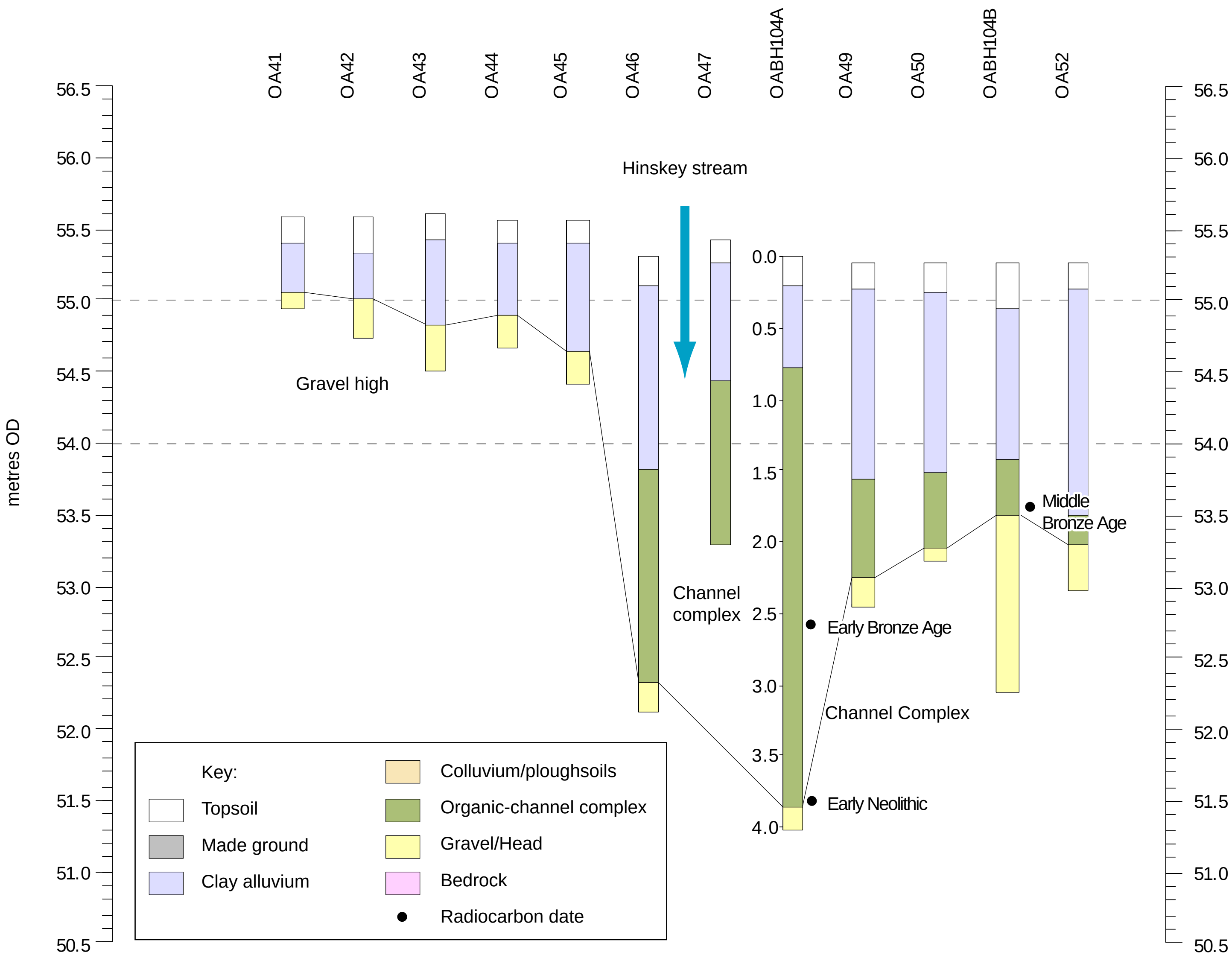

Figure 24: Transect D, Area 3

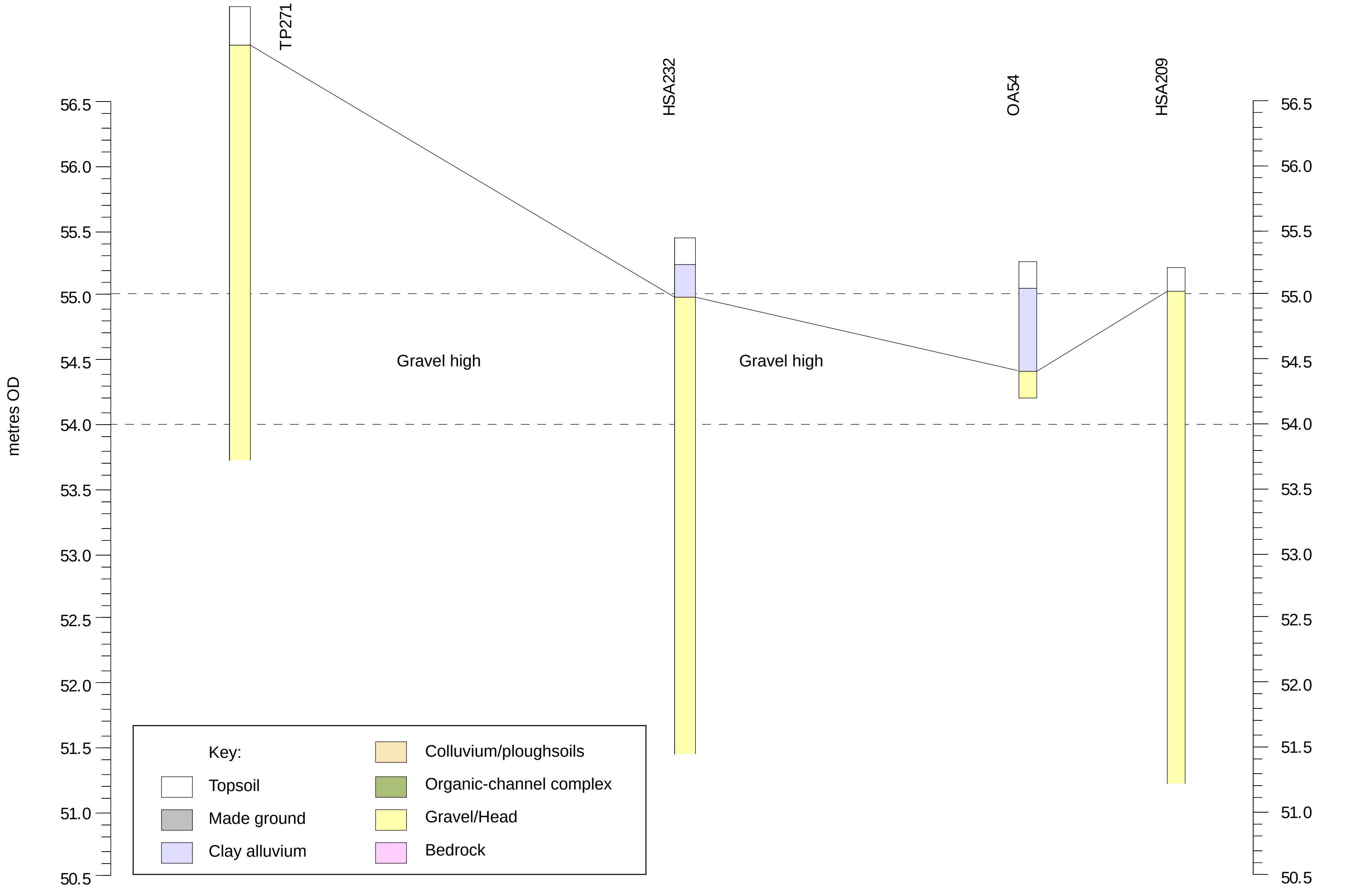

Figure 25: Transect I, Area 3

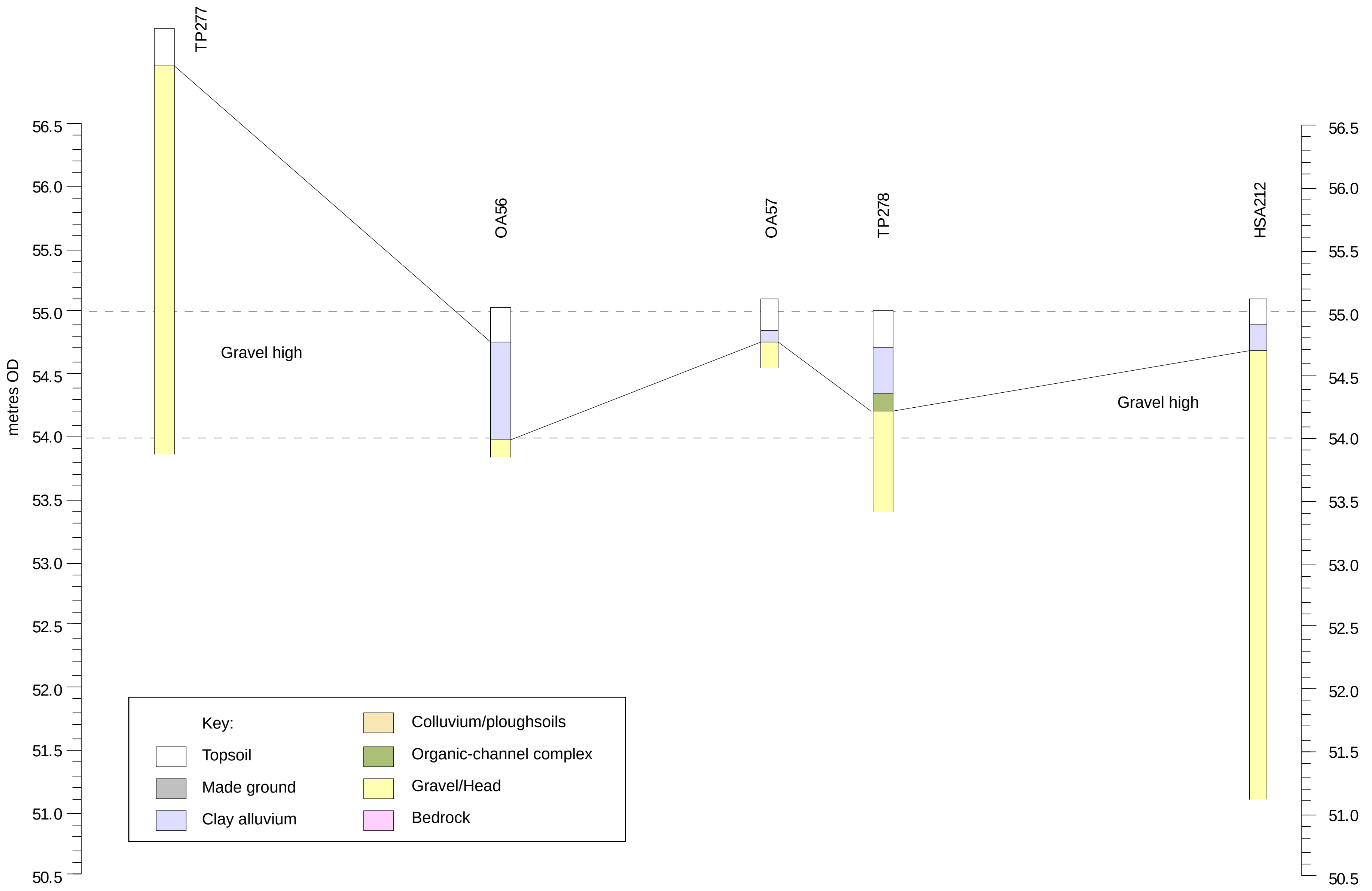

Figure 26: Transect J, Area 3

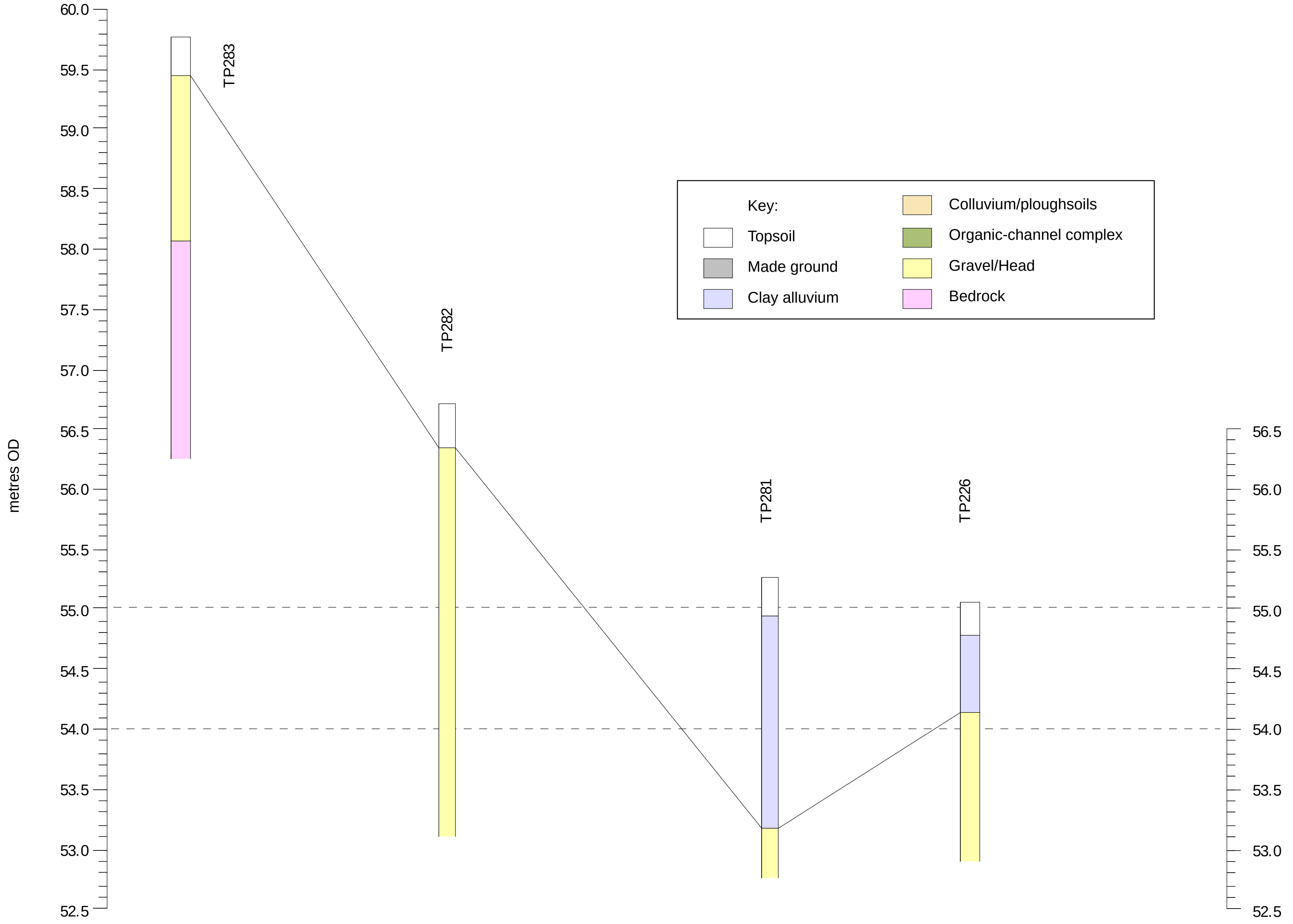

Figure 27: Transect K, Area 3

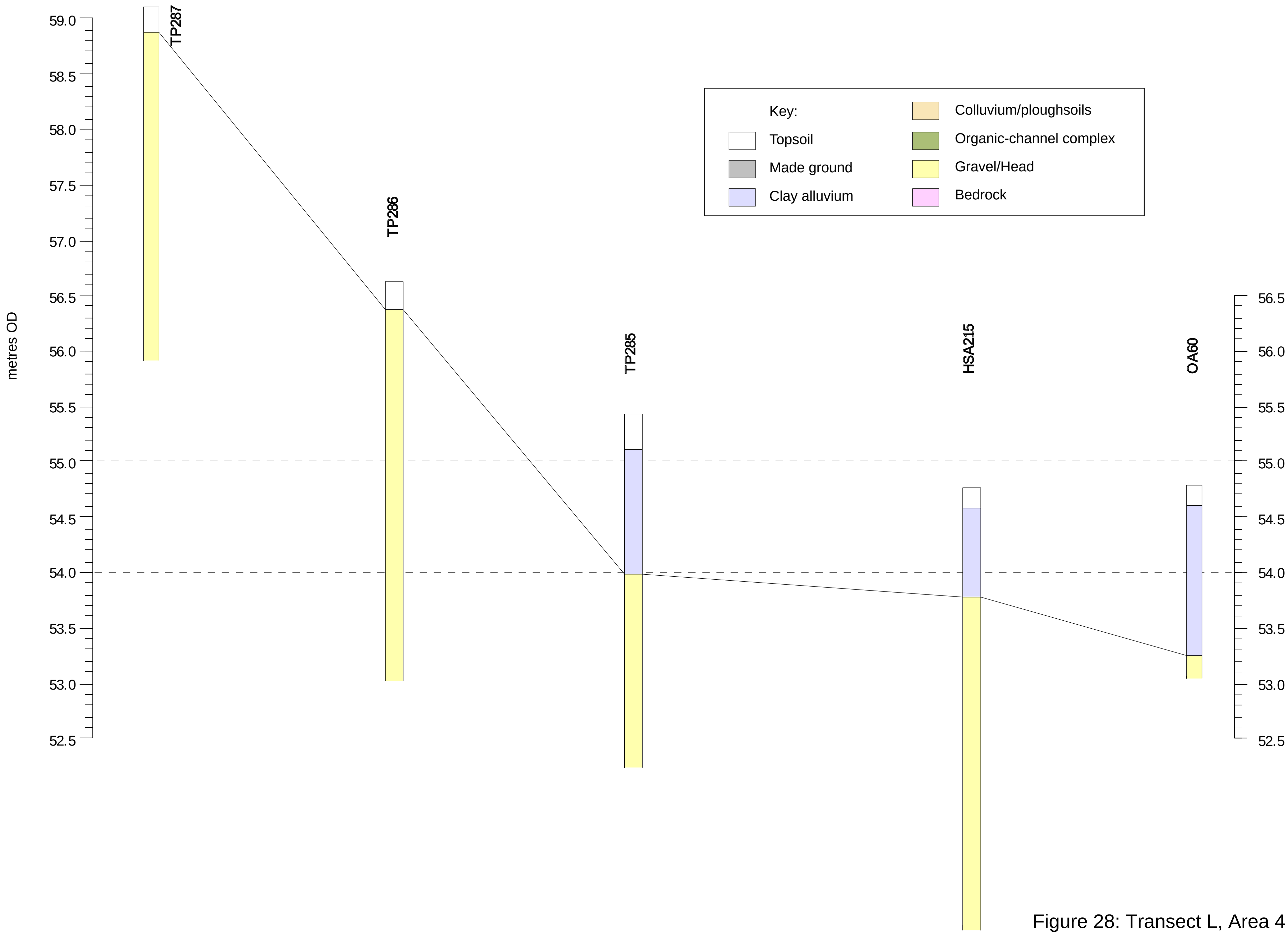

Figure 28: Transect L, Area 4

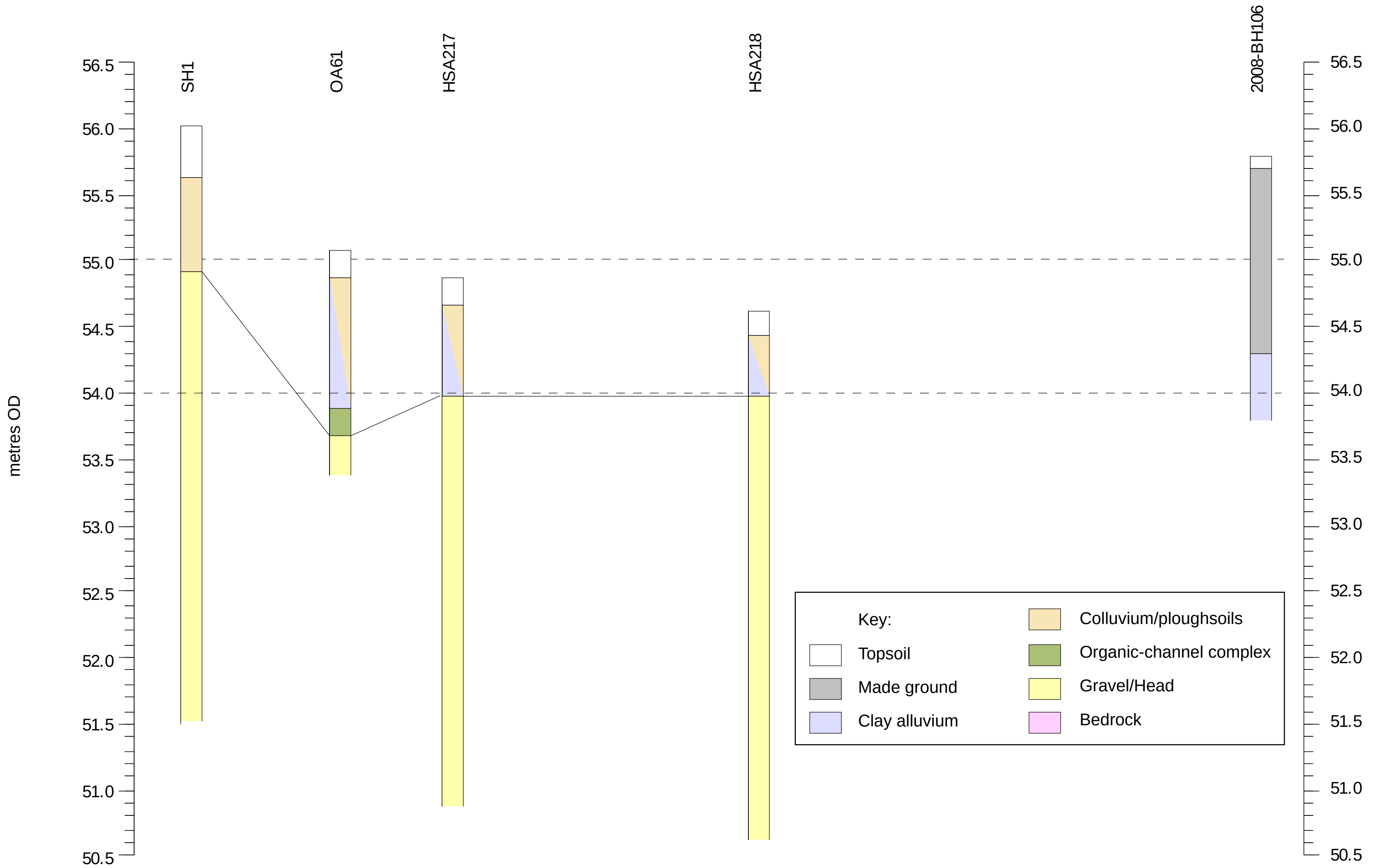

Figure 29: Transect M, Area 4

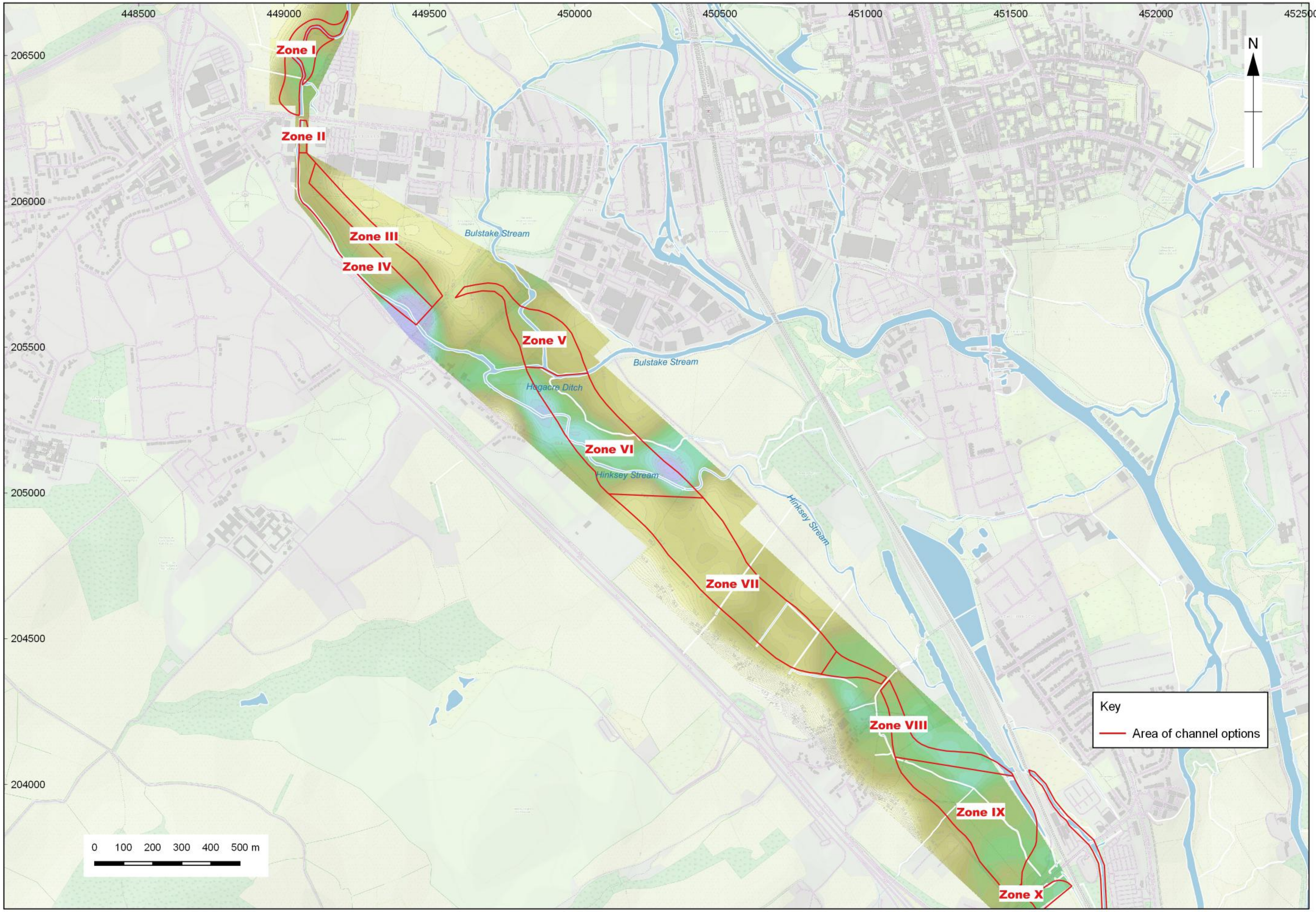

Figure 30: Geoarchaeological zones

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