SWAS/01

STAFFORD WESTERN ACCESS ROUTE

GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL REPORT

commissioned by Amey

November 2015

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

STAFFORD WESTERN ACCESS ROUTE

GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL REPORT

commissioned by Amey

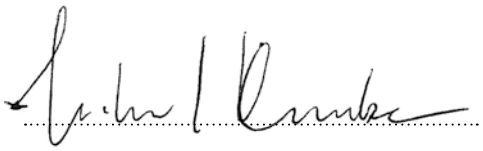
November 2015

project info

HA JOB NO.	SWAS/01
HAS NO.	1139
NGR	SJ 91725 23465
PARISH	Creswell
LOCAL AUTHORITY	Staffordshire County Council
OASIS REF.	headland3-228042

project team

PROJECT MANAGER	Mike Kimber
AUTHOR	Emma Tetlow, Mike Kimber
FIELDWORK	Emma Tetlow, Robert Blackburn
GRAPHICS	Rafael Maya-Torcelly
APPROVED BY	Mike Kimber – Project Manager



HEADLAND ARCHAEOLOGY

MIDLANDS & WEST
Headland Archaeology
Unit 1, Premier Business Park, Faraday Road, Hereford HR4 9NZ

01432 364 901
midlandsandwest@headlandarchaeology.com

www.headlandarchaeology.com

REGISTERED ORGANISATION CIfA

PROJECT SUMMARY

As part of archaeological investigations in the corridor of the Stafford Western Access Route, a two phase geoarchaeological review was undertaken. The first stage was a review of the existing borehole data produced by Sub Surface - Site Investigation, Geotechnical and Environmental Consultants. The second was a watching brief during a further stage of geotechnical works. The aim of both phases was to record the presence or absence of peat deposits across the development area (DA), and to investigate the geoarchaeological and palaeoenvironmental potential of these peats.

The proposed road corridor crosses the eastern extreme of the Doxey Marshes SSSI which abuts the outskirts of the County Town of Stafford. Substantial deposits of peat, organic-rich deposits and humic silts and clays were recorded in Design Areas 1, 2 and 3. The depth varied spatially across the site, the peat found in borehole C-CP09A/R009A exceeded 10m with the base of the deposit at 13.5m. During the second phase, further investigations were undertaken within the town of Stafford and at Doxey Marsh to the west where additional deep peat sequences were located.

CONTENTS

1 INTRODUCTION 1

1.1 ARCHAEOLOGICAL BACKGROUND 1

2 METHOD 1

2.1 PHASE 1 1

2.2 PHASE 2 1

3 RESULTS 2

3.1 PHASE 1 BOREHOLE REVIEW 2

Design Area 1 (**ILLUS 3**) 2

Design Area 2 (**ILLUS 4**) 2

Design Area 3 (**ILLUS 5 AND 6**) 2

Design Area 4 (**ILLUS 7**) 2

Design Area 5 2

3.2 MINI-BOREHOLE REVIEW 2

Design Area 1 2

Design Area 2 2

Design Area 3 2

Design Area 5 2

3.3 WATCHING BRIEF 15

Section A – Doxey Marsh (**ILLUS 9**) 15

Section B – Greyfriars (**ILLUS 10**) 15

Section C – Sainsbury's Supermarkets Ltd (**ILLUS 11**) 15

Section D – Doxey Road Railway Bridge (**ILLUS 12**) 15

4 DISCUSSION 15

4.1 PALAEOENVIRONMENTS 15

4.2 CULTURAL EVIDENCE 16

5 CONCLUSIONS 16

6 REFERENCES 22

7 APPENDICES 23

APPENDIX 1 BOREHOLE DATA 23

APPENDIX 2 WATCHING BRIEF BOREHOLES 27

LIST OF ILLUSTRATIONS

ILLUS 1
Site location ix

ILLUS 2
Site plan 3

ILLUS 3
Phase 1 - Design Area 1/Fence Diagram 5

ILLUS 4
Phase 1 - Design Area 2/Fence Diagram 7

ILLUS 5
Phase 1 - Design Area 3/Fence Diagram 8

ILLUS 6
Phase 1 - Design Area 4/Fence Diagram 9

ILLUS 7
Phase 1 - Design Area 5/Fence Diagram 11

ILLUS 8
Phase 1 - Mini Boreholes/Fence Diagram 13

ILLUS 9
Phase 2 - Section A/Fence Diagram 17

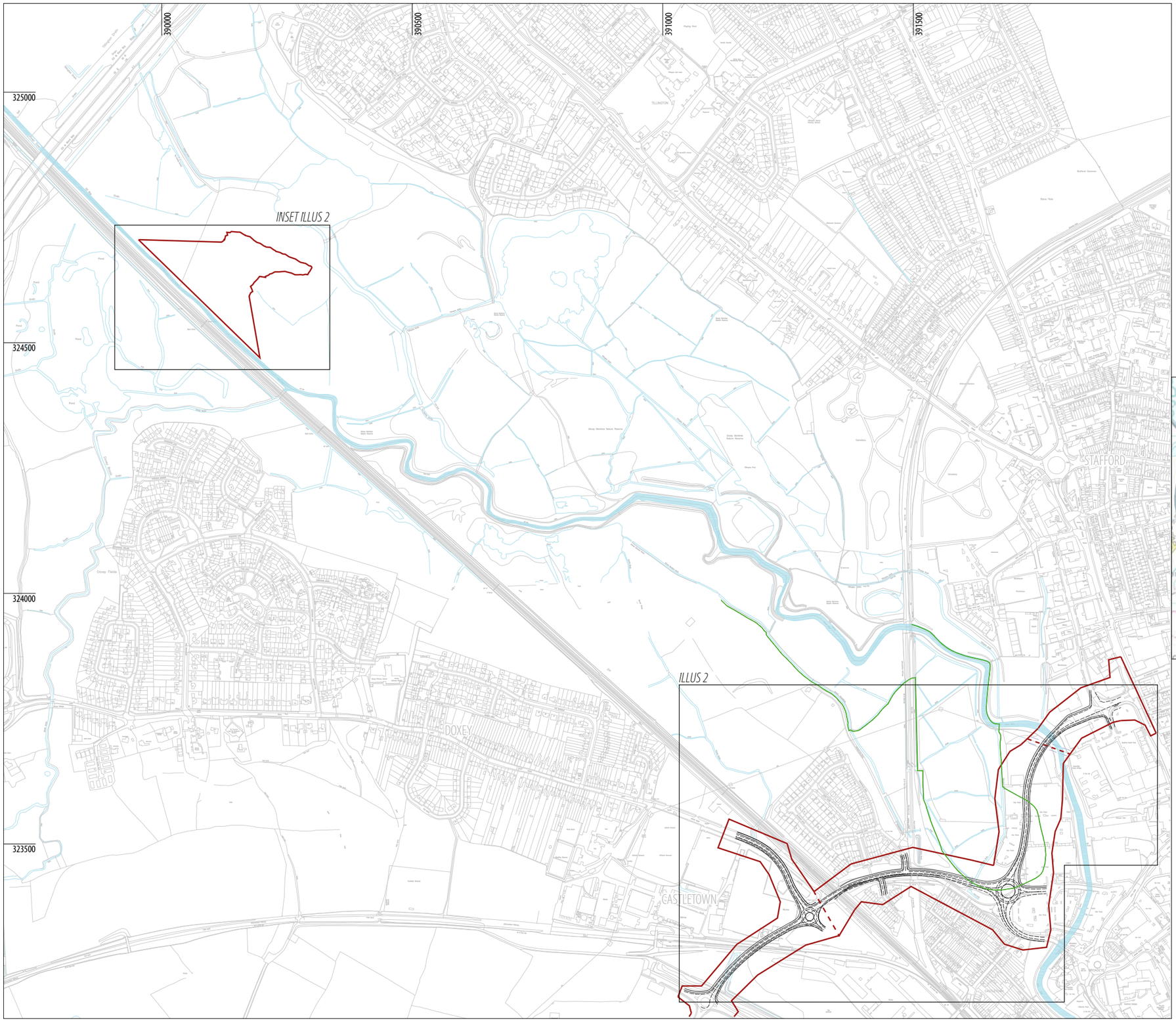
ILLUS 10
Phase 2 - Section B/Fence Diagram 19

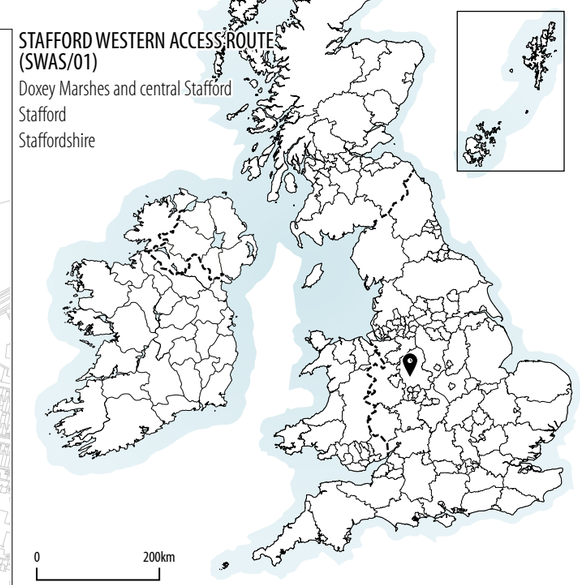
ILLUS 11
Phase 2 - Section C/Fence Diagram 20

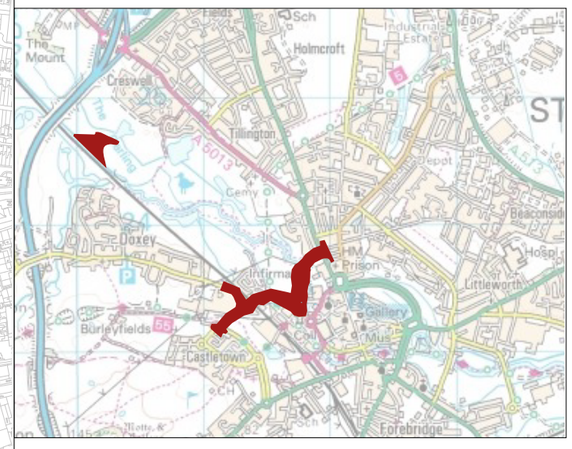
ILLUS 12
Phase 2 - Section D/Fence Diagram 21

STAFFORD WESTERN ACCESS ROUTE (SWAS/01)

Doxey Marshes and central Stafford
Stafford
Staffordshire







HEADLAND ARCHAEOLOGY
MIDLANDS & WEST
Unit 1, Premier Business Park
Faraday Road
Hereford HR4 9NZ
01432 364 901
www.headlandarchaeology.com

KEY
- development boundary
- natural England SSSI boundary

N
0 500m
scale 1:8,000 @ A3

ILLUS 1
Site location

STAFFORD WESTERN ACCESS ROUTE

GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL REPORT

1 INTRODUCTION

Staffordshire County Council is seeking planning permission to construct a new highway to the west of the county town, Stafford, between Greyfriars Place, Doxey Road and Martin Drive. The works associated with the proposed highway also require the creation of a flood compensatory storage site located within the Doxey and Tillington Marshes Site of Special Scientific Interest (SSSI).

Headland Archaeology was commissioned to undertake a two phase geoarchaeological review. The first stage was a review of the existing borehole data produced by Sub Surface – Site Investigation, Geotechnical and Environmental Consultants. The second was a watching brief during a further stage of geotechnical works. The aim of both phases was to record the presence or absence of peat deposits across the development area (DA), and to investigate the geoarchaeological and palaeoenvironmental potential of these peats.

1.1 ARCHAEOLOGICAL BACKGROUND

The solid geology underlying the scheme is the Triassic Keuper Marls of the Mercia Mudstone Group, the drift geology include substantial deposits of alluvium (BGS 1974). This is overlain by glaciofluvial deposits (sand and Gravel) of the Devensian glaciation (118,000–10,000 BP*). This area is thought to have been ice free by 13,490 BP, nonetheless, periglacial conditions remained until the onset of enhanced climatic amelioration, a millennia later (Morgan 1973). Overlying the glaciofluvial deposits are discontinuous strips of alluvium (clay, silt, sand and gravel) associated with the River Sow.

Areas of peat were identified during geotechnical investigations by Sub Surface (2015) and CC Ground Investigations. The peats and alluvial deposits are also associated with the Holocene activity of the River Sow.

Such deposits may have the potential for holding both significant archaeological and palaeoenvironmental evidence. Cultural evidence such as wooden trackways, bridges, revetments and fishing structures may be preserved as a result of waterlogging. Anaerobic conditions, produced by these wet conditions will also favour preservation of other fragile palaeoenvironmental evidence such as pollen, insects and waterlogged plant remains. This type of evidence can be used to interrogate a number of questions including the nature of human activity in the area, land use, vegetation change and other anthropogenic and natural factors.

Drier areas of ground forming terraces, islands within, and on the fringes of the floodplain also have the potential to have been focus for human activity, throughout prehistory and into the historic period.

2 METHOD

The geoarchaeological review was undertaken in two phases, the first consisted of the review of existing data from previous geotechnical investigations. The second comprised an archaeological watching brief during a further phase of geotechnical investigations in September 2015.

2.1 PHASE 1

A geoarchaeological assessment was made of the records produced by the developers' geotechnical contractors, Sub Surface – Site Investigation, Geotechnical and Environmental Consultants. All records were made and provided by Sub-Surface geotechnical investigators including borehole logs and fence diagrams. This initial phase of borehole extraction and recording was not archaeologically monitored.

On receipt of the documentary evidence, the environmental archaeologist assessed the stratigraphy and sedimentology of each individual borehole.

2.2 PHASE 2

The results of each borehole have been discussed individually and describe:

- Overview of the sedimentology/stratigraphy;
- Presence/absence of archaeologically and palaeoenvironmentally sensitive deposits and their potential, if any.

3 RESULTS

The results of the review and monitoring are described below; locations are shown on **ILLUS 2**; full stratigraphic information is given in Appendices 1 and 2. In summary, the general distribution of deposits of palaeoenvironmental potential is as follows:

Area	Summary of deposit sequence
Phase 2/Section A	Complex sequence of peat, organic rich and alluvial deposits approx 4m thick adjacent to the River Sow; giving way to simple alluvium and then glacial deposits further from the river.
Phase 1/Design Area 1	Peat up to 10.9m thick in places present across entire area overlying alluvium.
Phase 1/Design Area 2 & Phase 2/Section B	Thin layers of peat and organic rich deposits interleaved with alluvium with a total thickness of up to 13m.
Phase 1/Design Area 3 & Phase 2/Section C	Layers of peat up to 3m thick interleaved with organic rich alluvium with a total sequence thickness of at least 15m.
Phase 1/Design Area 4	Alluvial sands and gravels.
Phase 1/Design Area 5 & Phase 2/Section D	No deposits of archaeological interest.

3.1 PHASE 1 BOREHOLE REVIEW

The development area is located on the fringes of the modern town of Stafford to the east and the floodplain of the River Sow and Doxey Marshes SSSI to the west.

The boreholes have been divided by the design areas outlined in map provided by Amey (COSTFSMOBS-AMEY-GE-DR-004). An overview of the borehole data, which highlights deposits deemed of geoarchaeological and palaeoenvironmental interest are provided in Appendices 1 and 2, with unit thickness illustrated in **ILLUS 1**. All depths quoted are below ground level (BGL).

Design Area 1 (**ILLUS 3**)

The peat deposits in this are area are considerable and increase in depth, southwards across the development area and the floodplain edge. The base of the deposit varies from 13.2m (A-CP06/R006) to 5.9m (A-CP03/R003) and 4.1.m (C-CPO9) to 2.3m (A-CP06/R006) BGL, whilst the total thickness varies from 2.6m (A-CP03/R003) to 10.9m (A-CP06/R006).

The nature and consistency of the peat deposit varied across each core and with depth, in some areas the peat contained gravels e.g. A-CP03/R003 and A–CP04/R004A. In others it became increasingly clay-rich with depth e.g. A-CP06/R006 and A-CP07/R007.

The deposit is overlain by 2.1–3.5m of made ground.

Design Area 2 (**ILLUS 4**)

Peat and organic rich sediments were found in the two cores recovered to substantial depth, B-CP01/R001 and B–CP02B/R002B. The stratigraphy is subtly different to that of Area 1, the stratigraphy of B-CP01/R001 is much deeper and with four discrete units of organic rich material which suggest a more dynamic environment than seen in Area 1. A similar effect may be observed in B–CP02B/R002B which also suggests a greater degree of alluvial activity. Up to 4.8m of made ground overlay deposits in this area.

Design Area 3 (**ILLUS 5 AND 6**)

A single borehole was recovered from this area, as with Area 2, the stratigraphy is more complex with two units of gravelly peat intercalated by clayey peat. This finally gives way to a peat deposit with visible plant remains and shell and subsequently a silty clay with shell. Up to 4.1m of made ground overlay these deposits.

Design Area 4 (**ILLUS 7**)

Evidence of peat or organic rich deposits were absent in this area. With the exception of one borehole, the made ground gave way directly to unsorted glacial till. The exception was D-CP02 which contained several deposits of gravels, sands, clay and silt – the basal deposit also containing shell, which were interpreted as of alluvial origin. Made ground deposits were thin, in the order of 0.4–1m thick.

Design Area 5

This area contained no deposits considered to be of archaeological interest.

3.2 MINI-BOREHOLE REVIEW

Mini boreholes, which did not exceed a depth of 5.45m were drilled in Design Areas 1, 2, 3 and 5 (**ILLUS 8**). No mini boreholes were drilled in Design Area 4.

Design Area 1

In Area 1, made ground gave way to organic-rich clays in boreholes A-WS03, A-WS04, A-WS05 and A-WS06. The remaining boreholes in this area did not reach the base of the made ground.

Design Area 2

The mini boreholes in this area contained no deposits considered to be of palaeoenvironmental or archaeological interest.

Design Area 3

Peaty clay was found at the base of C-WS09.

Design Area 5

The mini boreholes in this area contained no deposits considered to be of palaeoenvironmental or archaeological interest.

391100 391300 391500 391700 391900

323700 323500 323300

ILLUS 9 ILLUS 8A ILLUS 4 ILLUS 10 ILLUS 3 ILLUS 11 ILLUS 6 ILLUS 5 ILLUS 12 ILLUS 7 ILLUS 8B

WS01 WS05 WS09 WS12 WS13 WS06 WS10 WS11 WS02 WS07 WS03 WS08 WS04

PHASE 2/SECTION A

PHASE 2/SECTION B

WS14 WS15 WS16 B-WS01 B-CP01/R001 B-CPT01 B-CP02 B-CP02/R002 B-CP02/R002A B-CP02/R002B

PHASE 1/DESIGN AREA 2

A-CP03/R003 A-WS03 A-CP04 A-CP04/AR004A A-WS04 A-CPT05 A-WS05 A-CP05/R005 A-CPT06 A-CP06/R006 A-CPT07 A-CPT08 A-CP07/R007 A-WS06 A-CPT09 A-CP08/R008 A-WS07 A-WS08

PHASE 1/DESIGN AREA 1

PHASE 2/SECTION C

C-WS09 C-CP09/R009 C-CP09A/R009A SW17 SW18

D-CP02 D-CP01

PHASE 1/DESIGN AREA 3

PHASE 2/SECTION D

E-CP03 E-CP02 WS20 WS19 E-CP01/R001 E-CP01B E-CP01C E-CP01A/R001A E-CP01D E-CP04 E-CP04A E-CP04B E-CP04C E-CP05/R005 E-WS01 E-WS02 E-WS03

PHASE 1/DESIGN AREA 4

PHASE 1/DESIGN AREA 5

KEY

- development boundary
- extents of flood compensation area
- services
- HV exclusion zone overhead cable
- natural England SSSI boundary

phase 1

- borehole location
- mini borehole location

phase 2

- borehole location

N

0 100m

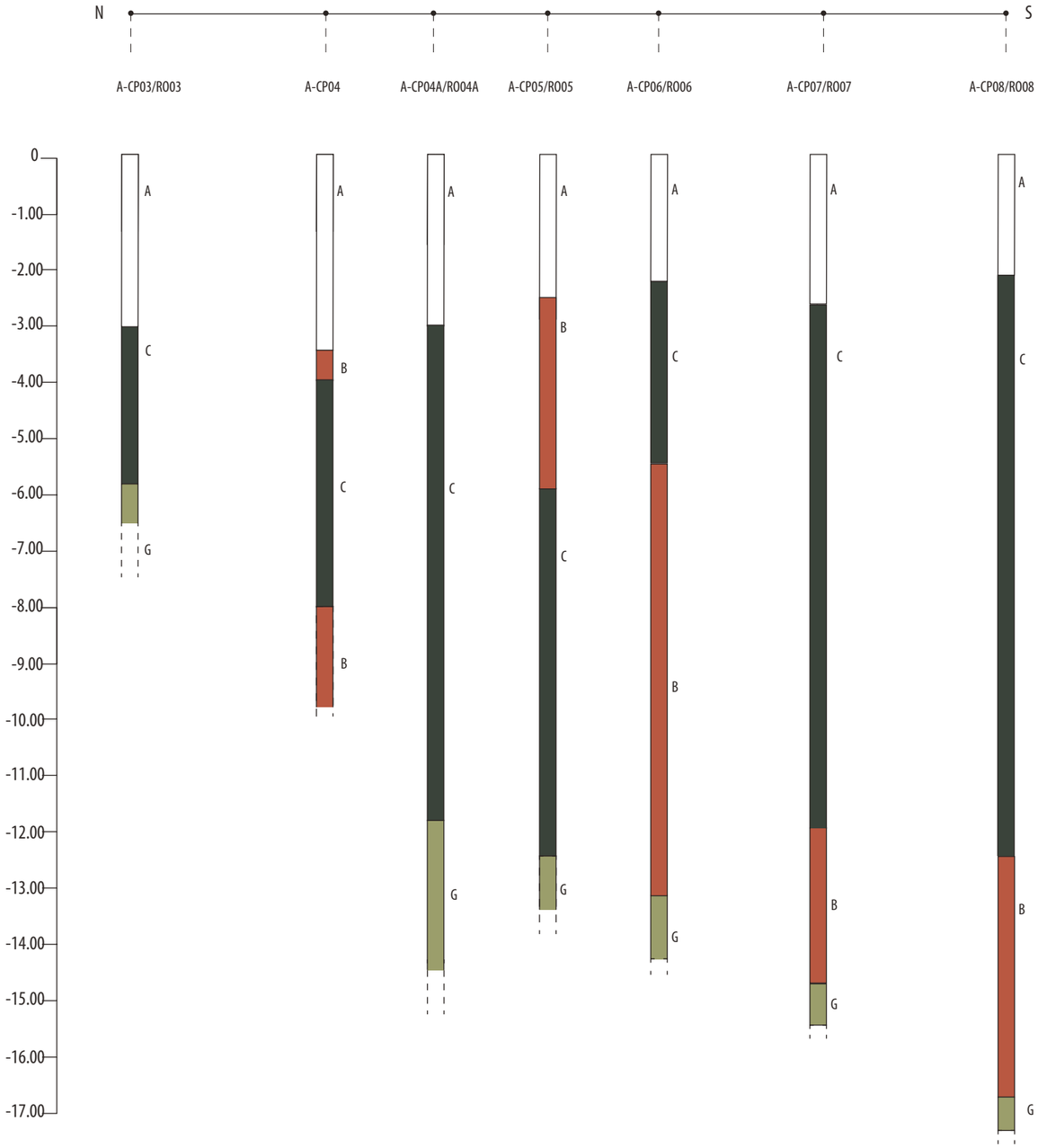
scale 1:3.000@ A3

scale 1:2,500@ A3

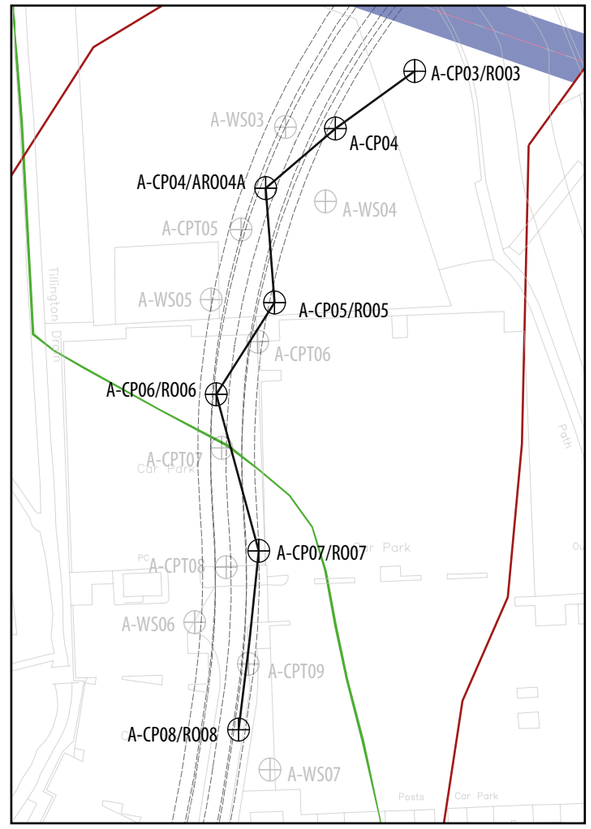
ILLUS 2

Site plan

horizontal scale 1:1,000 @ A3



vertical scale 100@ A3



scale 1:1.500@ A3

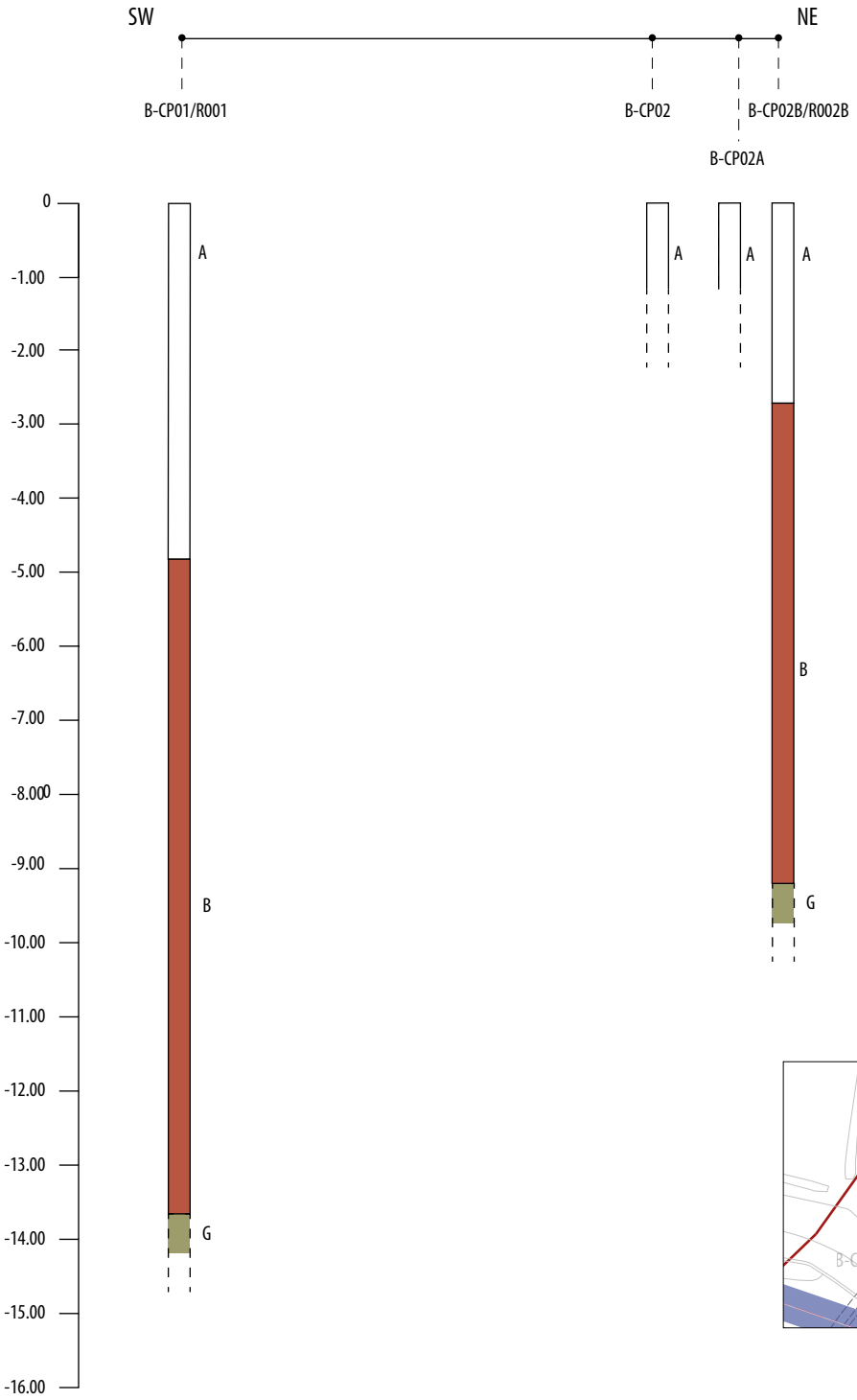
KEY

- A, made ground
- B, alluvium
- C, peat
- G, glacial gravel

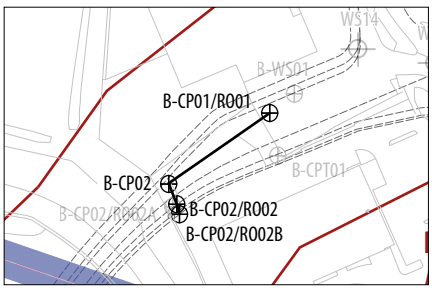
ILLUS 3

Phase 1 - Design Area 1/Fence Diagram

horizontal scale 1:1,000 @ A4



vertical scale 1:100 @ A4



scale 1:2.500@ A4

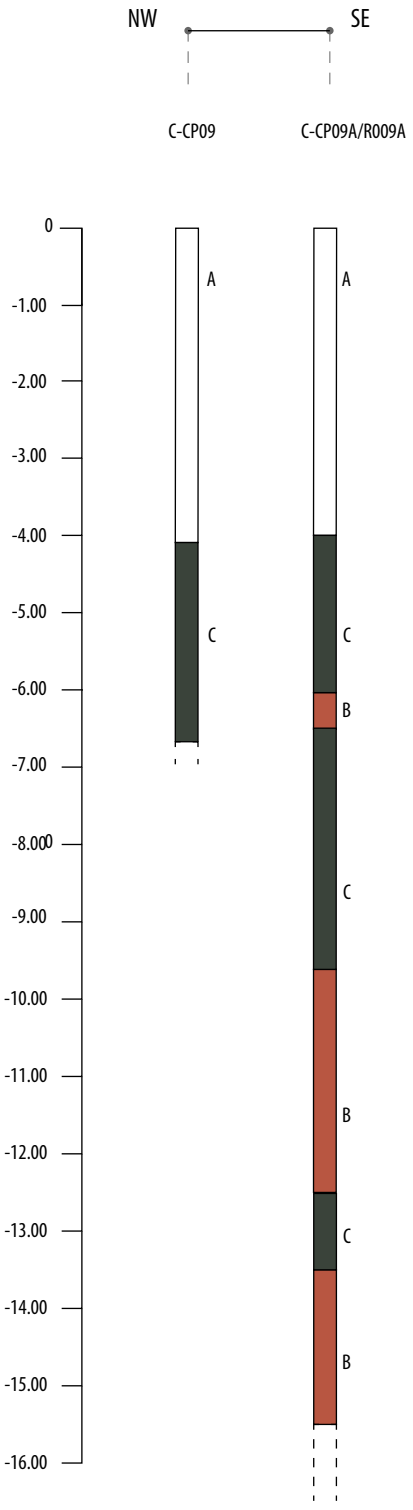
KEY

- A, made ground
- B, alluvium
- C, peat
- G, glacial gravel

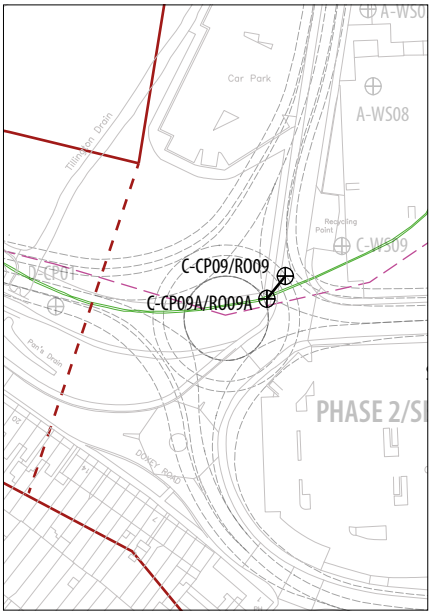
ILLUS 4

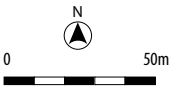
Phase 1 - Design Area 2/Fence Diagram

horizontal scale 1:1,000 @ A4



vertical scale 1:100 @ A3





scale 1:2.500@ A3

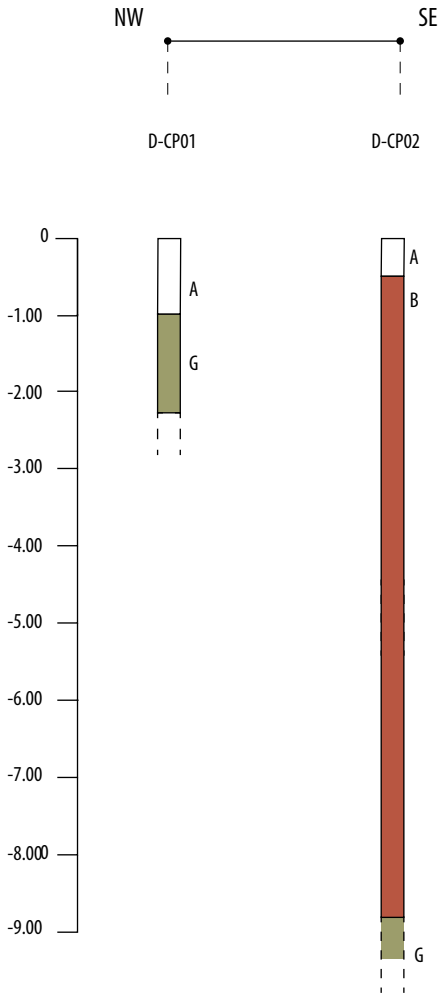
KEY

- A, made ground
- B, alluvium
- C, peat
- G, glacial gravel

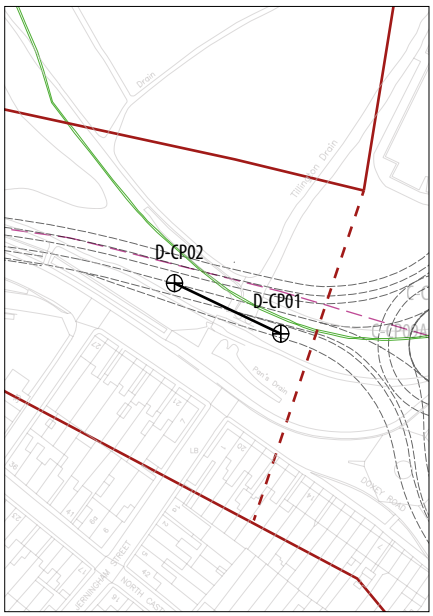
ILLUS 5

Phase 1 - Design Area 3/Fence Diagram

horizontal scale 1:1,000 @ A4



vertical scale 1:100 @ A4



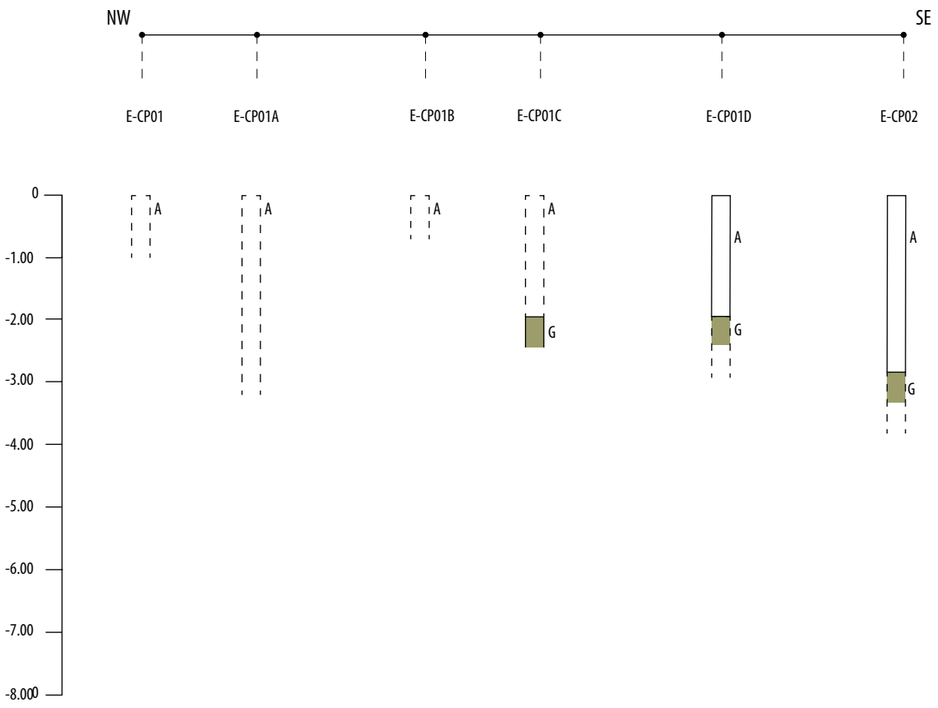
scale 1:2.500@ A4

KEY

- A, made ground
- B, alluvium
- G, glacial gravel

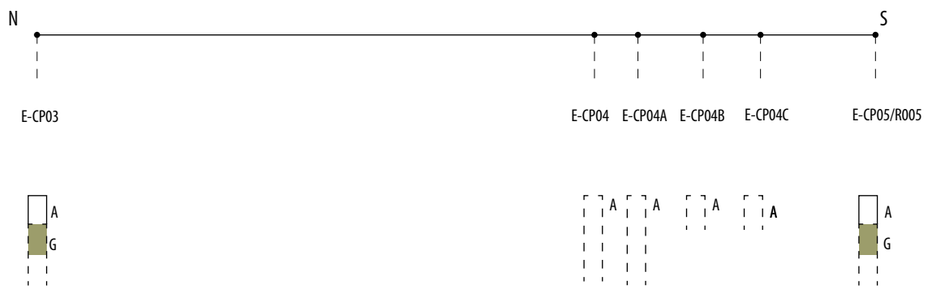
ILLUS 6

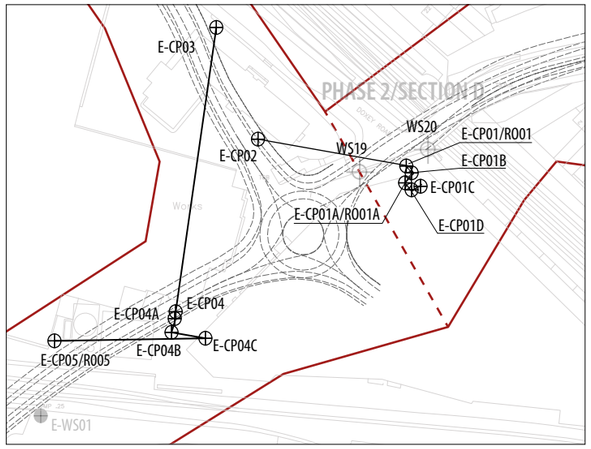
Phase 1 - Design Area 4/Fence Diagram



vertical scale 1:100 @ A3

horizontal scale1:1,000 @ A3





scale 1:2,500@ A3

KEY

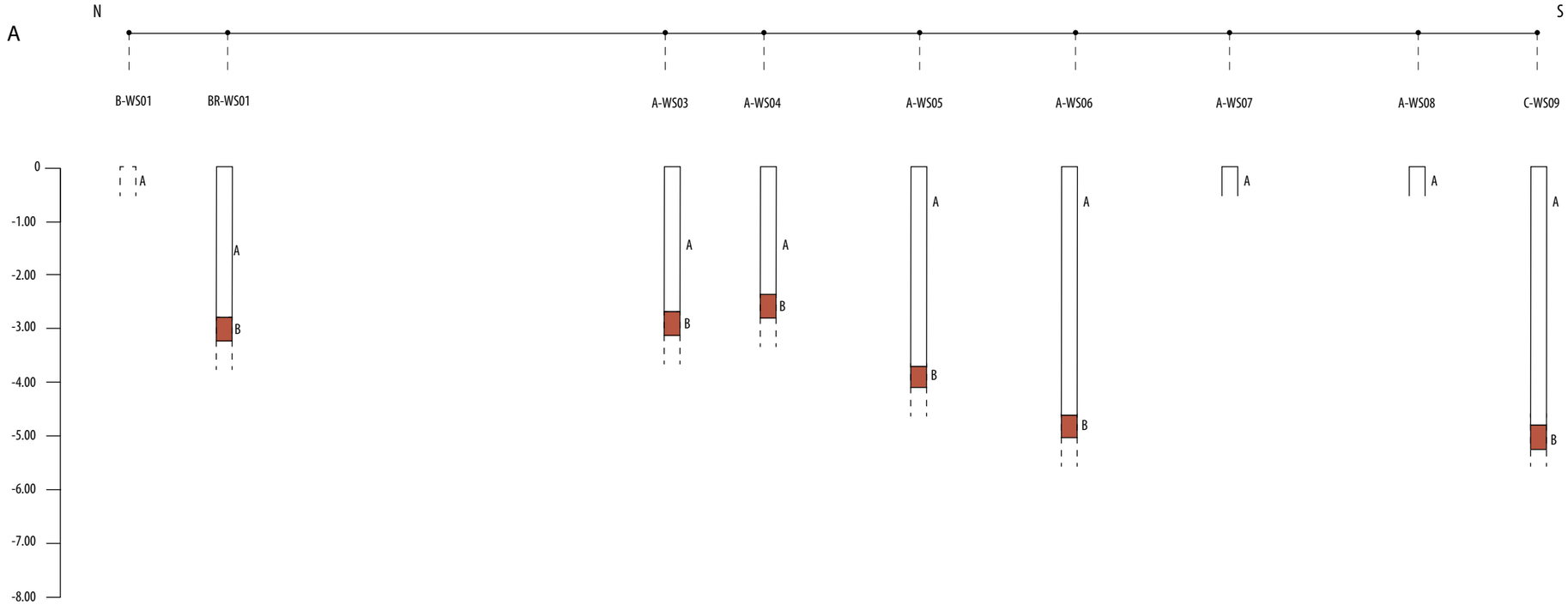
- A, made ground
- B, alluvium
- C, peat
- G, glacial gravel

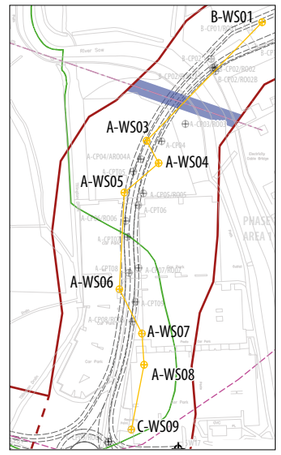
ILLUS 7

Phase 1 - Design Area 5/Fence Diagram

horizontal scale 1:1,000 @ A3

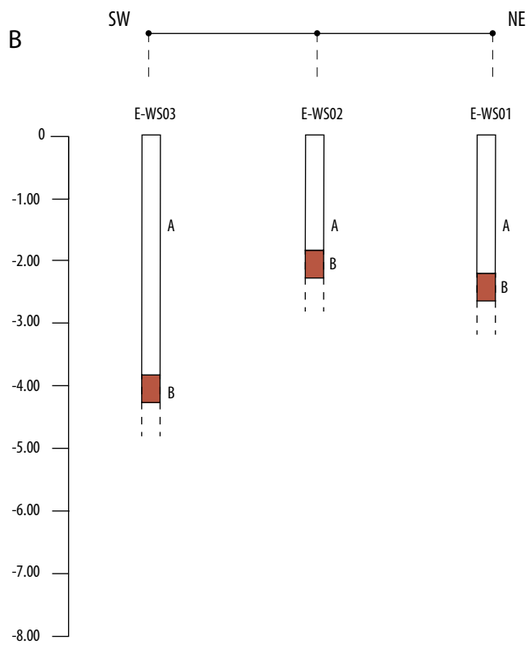
A



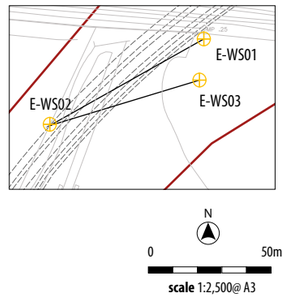


scale 1:5,000@ A3

B



vertical scale 1:100 @ A3



scale 1:2,500@ A3

KEY

A, made ground

B, alluvium

ILLUS 8

Phase 1 - Mini Boreholes/Fence Diagram

3.3 WATCHING BRIEF

Section A – Doxey Marsh (**ILLUS 9**)

A total of seven boreholes (WS01-07) were drilled across an area of low-lying marshland bounded to the west by the corridor of the M6, to the south by the line of the modern course of the River Sow which is canalised by the West Coast Main Line. To the north the area was contained by an elongate feature which extended for approximately 120m and rose approximately 5m above the floodplain. A further five boreholes (WS9-13) were drilled across this feature.

The stratigraphy within boreholes WS01-04 which lie closest to the modern channel of the River Sow indicate a highly variable sequence across a relatively small area of the floodplain. Boreholes WS01, WS03 and WS04 consisted of a complex sequence of reed and sedge peat, overlain by a relatively deep deposit of alluvium which appeared at 3.43m, 1.52m and 3.8m BGL respectively. This was replaced by a further layer of peat which varied between wood in WS01 and WS04 and rush and sedge in WS03. This was overlain by a deposit of alluvium which terminated the wetland sequence in WS01, 2 and 4 at 1.2m, 0.45m and 0.4m BGL. Borehole WS03 is more complex and a subsequent deposit of rush and sedge peat overlay the alluvium, prior to giving way to a final band of alluvium at 0.45m and subsequently topsoil. With the exception of WS4 which terminated in glacial sands, the remaining boreholes all reached a depth of 5m within peat.

The subsequent WS05 and WS06 lay further from the channel of the Sow and are a simple alluvium/topsoil sequence. At the base WS07 contained a sequence which reflects the underlying glacial geomorphology and consists of alternating levels of gravels and sands. The lower deposit was sorted angular gravels which was subsequently replaced by a coarse, red brown sand, this was overlain by a further deposit of poorly sorted well rounded gravels and subsequently by a further deposit of finer sands. The subsequent sequence mirrors that of WS04.

The subsequent boreholes were located across a topographic rise, the stratigraphy of WS09-13 varied little and reflected the basal deposits of WS04 and WS07. They consisted of various deposits of red sand and poorly sorted, angular to well-rounded gravels. The upper deposit of WS09, WS12 and WS13 consist of red brown, medium to coarse homogeneous sand, whilst 10 and 11 were characterised by a well-developed sand and clay subsoil. All five boreholes were overlain by a well-developed open textured, sandy topsoil.

Section B – Greyfriars (**ILLUS 10**)

Three boreholes were drilled in this area, on an existing road island in a small shopping complex. WS14 and WS15 contained a layer of peat which has been subject to substantial anthropogenic disturbance overlain by made ground and subsequently tarmac. WS16 contained a relatively undisturbed and well preserved sequence or reed and sedge peat, overlain by a wood peat which was replaced by alluvium and a further layer of sedge peat. This was then overlain by 1.5–2.8m of made ground and tarmac.

Section C – Sainsbury's Supermarkets Ltd (**ILLUS 11**)

Three boreholes were drilled in an existing car park at Sainsbury's Supermarkets Stafford Branch. Borehole WS17 was composed organic rich alluvium with obvious well preserved plant remains which included sedges, reeds and possible alder wood, overlain by of 2.3m of made ground. The remaining boreholes, WS18 and WS18/a contained various deposits of made ground to up to 5m depth.

Section D – Doxey Road Railway Bridge (**ILLUS 12**)

A further three boreholes were drilled in the southern approach to the railway bridge. The deposits in WS19/a and WS20 consisted of a deposit of red, homogeneous medium to coarse sand overlain by 0.9–1.2m of hardcore and a veneer of tarmac.

4 DISCUSSION

4.1 PALAEOENVIRONMENTS

Previous palaeoenvironmental work in this area is restricted to a pollen monolith from Kings Pool, Stafford which produced 21m of peat dating from the retreat of Devensian glacier c. 13490±375 onwards (Bartley and Morgan, 1990).

The borehole data from the ground investigations ahead of the construction of SWAR, provides a snapshot of the Lateglacial (16,000–10,000BP) and Holocene (10,000BP+) evolution of the floodplain of this small river. Dating evidence from organic-rich tills in the Stafford area provide a terminus post quem for the deposits and potentially human activity. The basement deposits consist of material directly related to the wasting and final retreat of the Devensian glaciers which armoured the Mercia Mudstones with sands, gravels and in some cases finer silts and clays. Evidence of this Late-glacial activity is apparent in the western area of the catchment, specifically boreholes WS04, 07, & 09–13. The sands and gravels found across these boreholes are directly related to the end of the last glacial episode, when this part of the English Midlands lay at the retreating margins of the ice sheet (Morgan 1973). Moreover, the feature upon which WS09-13 sit is likely to be a kame, a classical glacial feature composed of sand, gravel and other till detritus which formed in a depression in the glacier itself and was deposited during melting. The surface of the feature is also irregular, displaying the characteristic 'kettle' topography associated with a Kame (Smithson et al 2008).

This increased floodplain activity which post-dates the final retreat of the Devensian ice-sheet, gave way to a more tranquil period. Based on this borehole data, for much of its history, the River Sow appears to have been an aggrading system (sediment is deposited) rather than a degrading system (sediment is removed) and hence relatively stable. The material within the later, Holocene deposits of peat, organic-rich clay and alluvium are also indicative of a gentle, low energy environment– characteristic of a lowland system. Such aggrading systems also promote the development of backswamps and marshlands essential for the deposition of organic-rich material and the development of peat. Moreover, a relatively stable system

is required to retain these fragile deposits which are readily eroded by dynamic episodes of channel change. Evidence of similar activity has been observed by the author on a tributary of the River Sow, the Meece Brook, at Norton Bridge during groundworks ahead of an upgrade of the West Coast Main Line. These earlier deposits have clearly been subject to later channel avulsion (rapid movement) and incision (downcutting). Similar activity will have occurred on the floodplain of the River Sow and lead to the evolution of the floodplain at Doxey as it is seen today.

The deeper peat deposits encountered in the southern area of Design Area 1 are likely to be of some antiquity. It would not be unfeasible to suggest that the earliest organic-rich deposits formed during the Holocene and are Mesolithic in date (approximately 10,000–8,000 years old) and represent continuous deposition throughout the Holocene and possibly into the historic period. Similar substantial deposits of organic rich material dating from Mesolithic period onwards have been found in the Thames Valley at Eton Dorney (Parker and Robinson, 2003; Parker et al 2003) and in the Trent Catchment at Bole Ings (Dinnin, 1997; Dinnin and Brayshay 1999) and Waycar Pasture (Baker et al 2013). What is surprising, given the substantial peats found in the east of the Sow floodplain, is the relatively limited deposits to the west at Doxey Marshes. In section A, only WS2 did not finish in either sands or gravels.

The boreholes on the fringes of the floodplain, particularly those in Section B which cluster around Design Area 2, and contain deposits of alluvial material and less well developed organics, probably reflect the proximity of this area to the current channel of the River Sow and may be representative of flood events and not channel change.

4.2 CULTURAL EVIDENCE

Whilst no direct evidence of human activity has been recovered at this stage, in the immediate area, finds from the Mesolithic to Romano-British period include a Neolithic/Bronze age find spot at Cresswell Hall and a series of stakes of Iron Age date in alluvial gravels north of the River Sow which are thought to have been a revetment. (URS 2014). Nonetheless, these areas of wetlands provided a ready exploitable resource throughout the prehistoric and historic period. Their value for the preservation of cultural evidence is well recognised (Brown, 1997).

In most cases, human occupation was associated, unsurprisingly with free draining sands and gravels which would have provided drier areas in which to undertake more prolonged activity. Mesolithic human settlement, temporary or otherwise is well documented on the drier terraces, within these alluvial complexes (Brown, 1997). Later occupation, particularly during the Neolithic and later prehistory is associated with the valley floor itself, once again favouring drier 'gravel islands' e.g. Staines, Runnymede and Farmoor in the Thames Valley (Lambrick and Robinson, 1979; Longley, 1980; Needham and Longley, 1980; Needham 1985, 1992. During the late Bronze and Iron Age, the lowland rivers of NW Europe were subject to an episode of enhanced alluviation (Brown 1997). In the wider Thames Valley, the multiphase site a Runnymede (Longley, 1980; Needham and Longley, 1980; Needham 1985, 1992) and Farmoor, west of Oxford (Lambrick and Robinson 1979) are two sites where the effects of this have been recorded in other areas of the Thames catchment. Robinson and Lambrick (1984) suggest that the most significant and severe phase was during the late Iron Age–Romano-British period. This activity lead to the burial of sites across the Thames catchment and in the wider British Isles, closer to the Sow these include the Stour (Brown 1988) and in the Trent Catchment itself, the River Dove (Challis et al 2006).

Early Medieval activity has been recorded in the area. The town itself 'Aethelflaed's Burh', was founded in 913AD nonetheless, further evidence suggests activity during the 8th and 9th centuries in the area now occupied by the modern town centre and a thriving pottery industry in the 9th century (Dodd et al 2014). Further evidence indicates attempts to stabilise, infill and modify a palaeochannel (URS 2014). Further upstream at Norton Bridge, contemporary finds have included evidence of domestic activity, possible trackways and water-management features. Later evidence includes the ruins of a Norman Church at Cresswell and Ridge and Furrow on the marshes themselves (URS2014).

5 CONCLUSIONS

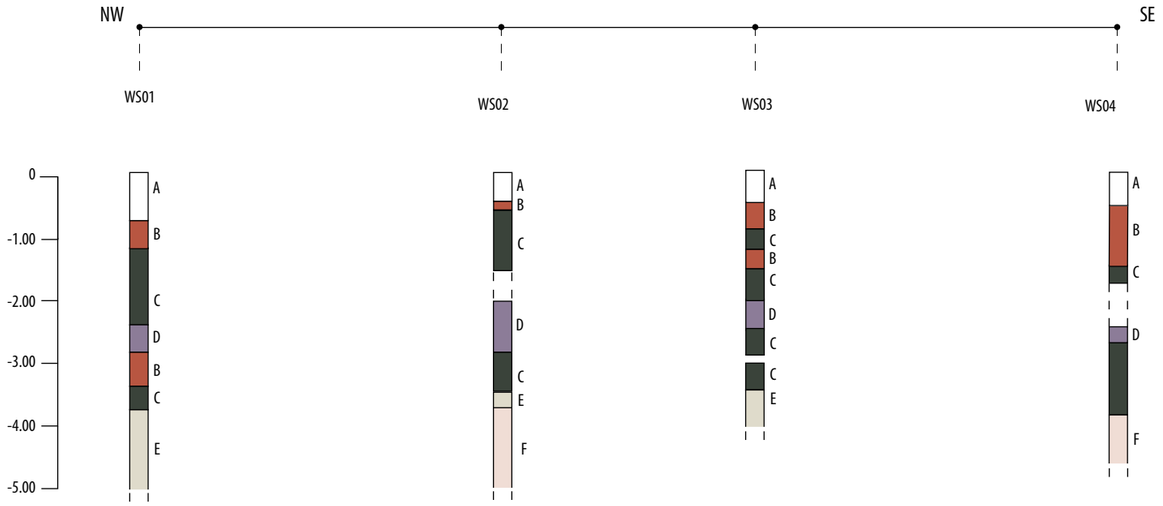
The construction design of the proposed road has not yet been developed in detail. However, there appears to be potential for elements of the scheme to cause harm to buried deposits of archaeological and/or palaeoenvironmental significance. It is advised that the degree of harm predicted and the appropriate mitigation measures are discussed and agreed with project stakeholders, including the client, design team, the archaeological advisor to the planning authority, and Historic England's regional science advisor.

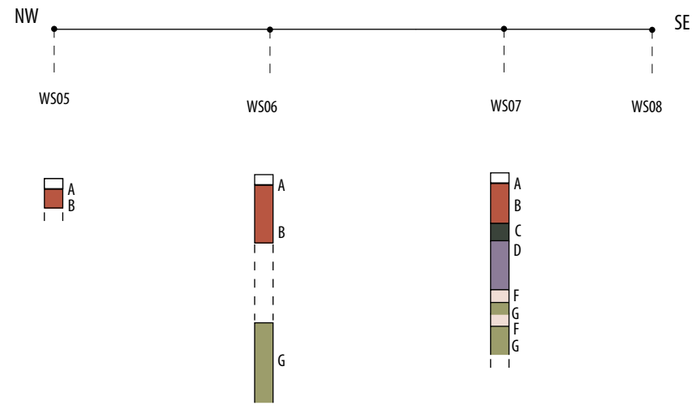
Deposits with the greatest potential to contribute to the currently limited palaeoenvironmental work in this area are located within Phase 1/Design Area 1. These deep peat sequences have the potential to provide high resolution evidence of regional environmental change in the area over a very considerable time period. This information would typically be collected by means of a sleeved core to be examined under laboratory conditions. Work of this nature can be very costly and any that is undertaken should be carried out with a focus on recovering key information at risk of total loss from construction impacts.

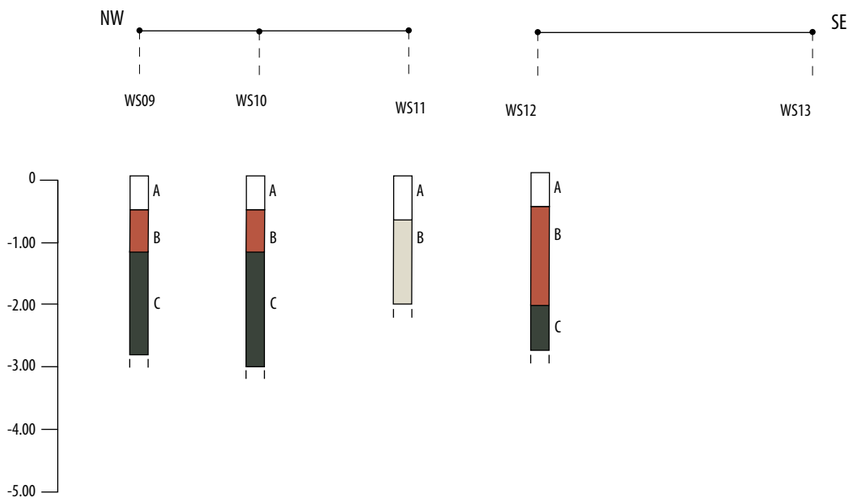
The interleaved peat and alluvial deposits within Phase 1/Design Area 2 and Phase 2/Section A have a lower potential to provide significant palaeoenvironmental sequences because of poorer preservation conditions for pollen and insect remains within the layers of alluvium that separate the relatively thinner peat horizons in these areas. However, plant macrofossils in the peat and the alluvium could provide site specific information on local palaeoenvironments. Further palaeoenvironmental study of these sequences would probably be productive if they are directly associated with identified episodes of human activity.

The general potential for human activity to be associated with the wetland areas is difficult to evaluate further because of surface constraints and potential dig depths, and the difficulties in forming a predictive model for the distribution of any past human activity. Archaeological observation of areas of significant ground disturbance during construction would probably be the most successful method of detecting and recording any artefacts or deposits of cultural heritage interest at risk of harm or destruction.

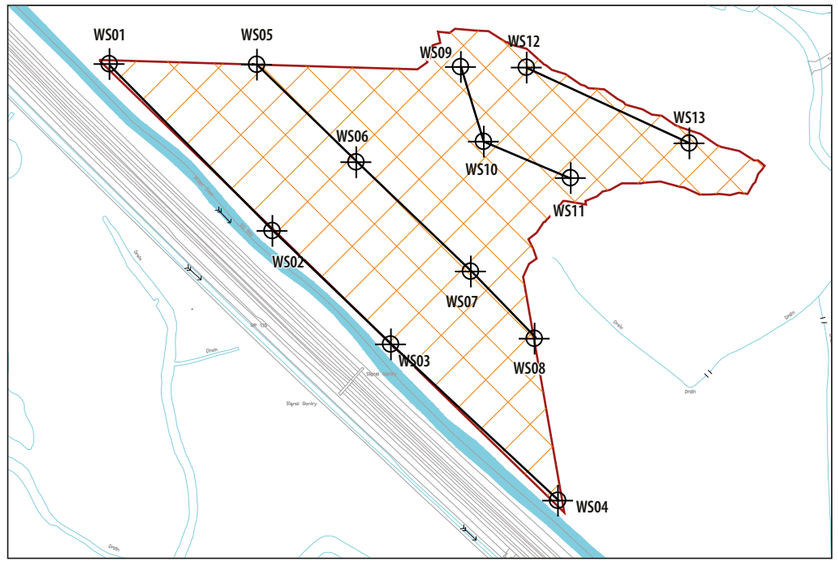
horizontal scale 1:2,000 @ A3







vertical scale 1:100 @ A3



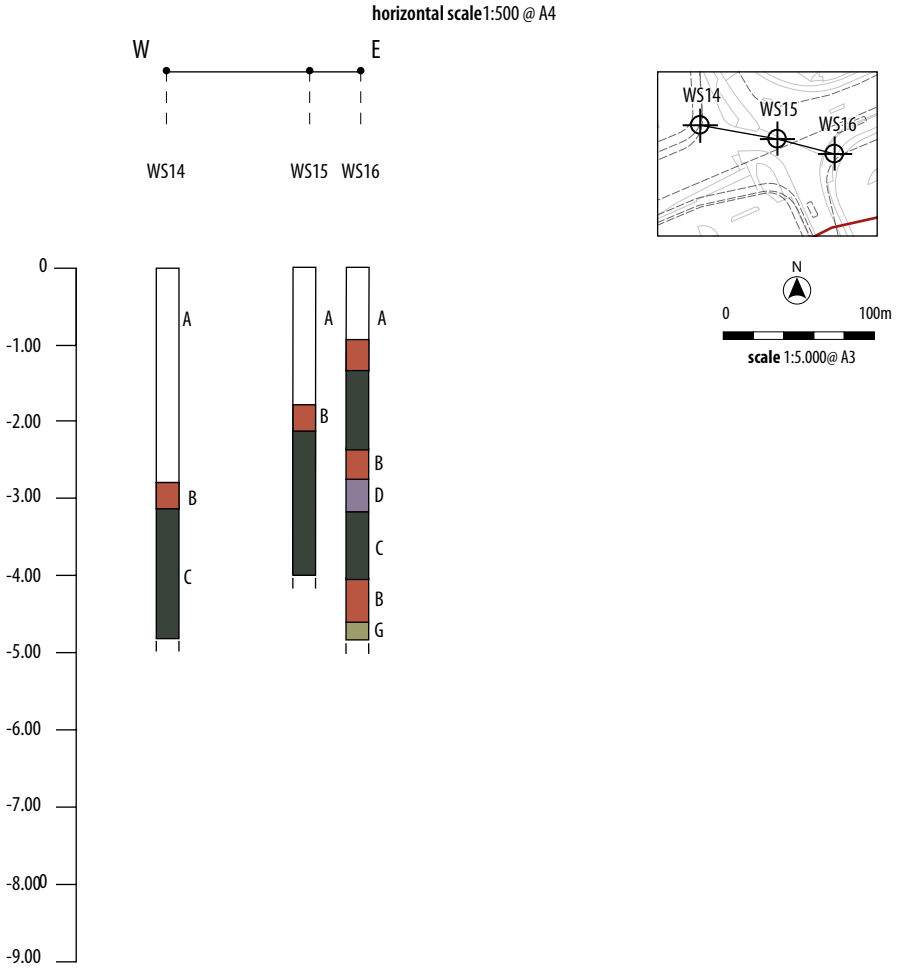
scale 1:3.000@ A3

KEY

- A, top soil
- B, alluvium
- C, peat
- D, wood
- E, periglacial sand
- F, glacial sand
- G, glacial gravel

ILLUS 9

Phase 2 - Section A/Fence Diagram

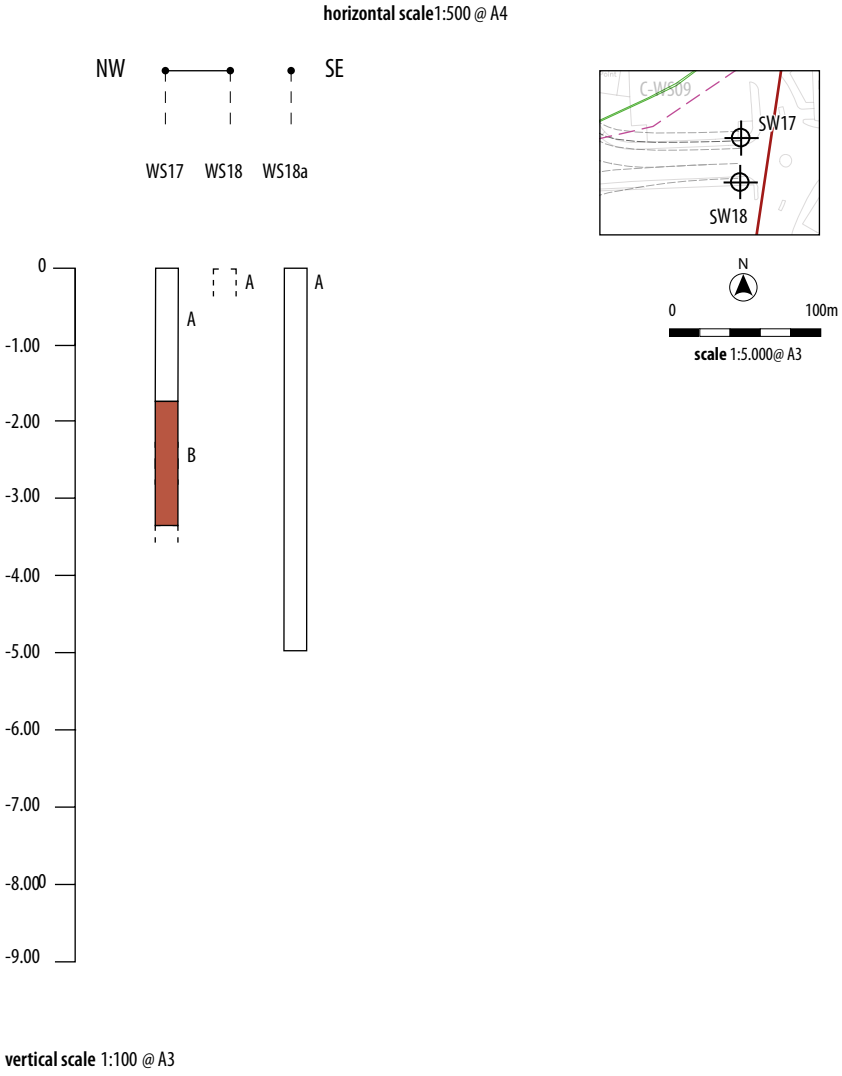


KEY

- A, made ground
- B, alluvium
- C, peat
- D, wood
- G, glacial gravel

ILLUS 10

Phase 2 - Section B/Fence Diagram



KEY

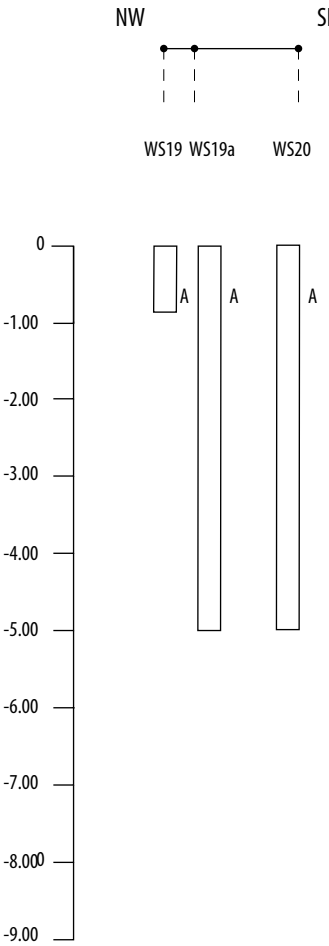
A, made ground

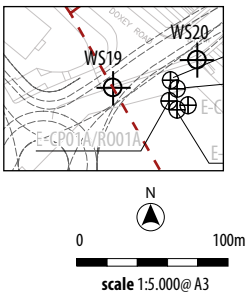
B, alluvium

ILLUS 11

Phase 2 - Section C/Fence Diagram

horizontal scale 1:500 @ A4





scale 1:5.000@ A3

vertical scale 1:100 @ A3

KEY

A, made ground

ILLUS 12

Phase 2 - Section D/Fence Diagram

6 REFERENCES

BGS 1974 ***Stafford 1:50,000 Sheet 139***

Baker, C Bateman, M Bateman, P & Jones, H 2013 'The Aeolian sand record in the Trent Valley' ***Mercian Geologist*** 18, 2: 108–18.

Bartley, D D & Morgan, A V 1990 'The palynological record of the King's Pool, Stafford, England' ***New Phytologist*** 116: 177–94.

Brayshay, B A and Dinnin, M 'Integrated palaeoecological evidence for biodiversity at the floodplain-forest margin' ***Journal of Biogeography*** 26, 1: 115–31.

Brown, A G 1997 ***Alluvial Geoarchaeology*** Cambridge: University Press.

Brown, A G 1988 'The palaeoecology of Alnus (alder) and the Postglacial floodplain vegetation. Pollen percentage, influx data from the West Midlands, United Kingdom' ***New Phytologist*** 110: 245–36.

Challis, K Howard, A J Moscrop, D and Tetlow, E A 2006 ***Assessing the geoarchaeological development of catchment tributaries and their impact on the Holocene evolution of the River Trent*** (PNUM 3850) Trent Valley Geoarchaeology Research Report Nottingham, Trent & Peak Archaeological Unit.

Dinnin, M 1997 'Holocene beetle assemblages from the lower Trent floodplain at Bole Ings, Nottinghamshire, UK' ***Quaternary Proceedings*** 5: 83–104.

Dodd, A Goodwin, J Griffiths, S Norton, A Poole, C & Teague, S 2014 'Excavations at Tipping Street, Stafford, 2009–10' ***Staffordshire archaeological & Historic Society Transactions volume XLVII.***

Lambrick, G H and Robinson, M A 1979 ***Iron Age and Roman riverside settlements at Farmoor, Oxfordshire*** CBA Research Report 32 Oxford Archaeological Unit Report 2 London.

Longley, D 1980 'Runnymede Bridge 1976; Excavations on the site of late Bronze Age settlement' ***Surrey Archaeological Society Research Volume 6.***

Morgan, A V 1973 'The Pleistocene geology of the area north and west of Wolverhampton, Staffordshire England' ***Philosophical Transactions of the Royal Society of London*** B 265: 233–97.

Needham, S 1985 'Neolithic and Bronze Age settlement on the buried floodplain of Runnymede' ***Oxford Journal of Archaeology*** 4: 125–37.

Needham, S 1992 'Holocene Alluviation and interstratified settlement evidence in the Thames Valley at Runnymede Bridge' in Needham, S and Macklin, M (eds) ***Archaeology Under Alluvium*** Oxford: Oxbow Books 249–60.

Needham, S & Longley, D 1980 'Runnymede Bridge, Egham: a Late Bronze Age riverside Settlement' in J Barrett & R Bradley (eds) ***Settlement and Society in the Later Bronze Age*** Oxford: British Archaeology Report 83; 397–436.

Parker, A G & Robinson, M A 2003 'Palaeoenvironmental investigations on the Middle Thames at Eton College Rowing Lake, Dorney, Buckinghamshire, UK' In Howard, A Macklin, D and Passmore, M ***The Alluvial Archaeology of North-West Europe and the Mediterranean*** Taylor and Francis 43–60.

Parker, A G, Lucas, A S, Walden, J, Goudie, A S, Robinson, M A and Allen, T G 2008 'Late Holocene geoarchaeological investigation of the Middle Thames floodplain at Dorney, Buckinghamshire, UK: An evaluation of the Bronze Age, Iron Age, Roman and Saxon landscapes' ***Geomorphology*** 101: 471–83.

Smithson, P Addison, K & Atkinson, K 2008 ***Fundamentals of the Physical Environment*** London: Routledge.

URS 2014 ***Stafford Western Access Route Environmental Statement Cultural Heritage Baseline Assessment***

7 APPENDICES

APPENDIX 1 BOREHOLE DATA

Design area 1

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
A-CP03/R003	0'–3.20	Made ground	N	–
	3.20'–5.9	Peat with some gravel	Y	–
	5.9+	Mixed deposits of Devensian glacial diamict.	N	Glacial outwash
A-CP04	0'–3.5	Made ground	N	–
	3.5'–4	Gravelly clay	Y	Alluvial origin
	4.0'–8.0	Peat with some gravel	Y	–
	8+	Clay/peat/silty	Y	Alluvial origin
A-CP04A/R004A	0'–3.0	Made ground	N	–
	3.0'–8.0	Peat	Y	–
	8.0'–11.9	Peat with some gravel	Y	–
	11.9+	Mixed deposits of Devensian glacial diamict.	N	Glacial outwash
A-CP05/R005	0'–2.9	Made ground	N	–
	2.9'–6	Silty clay with plant remains and organics	Y	Alluvial origin
	6.0'–12.5	Peat	Y	–
	12.5+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
A-CP06/R006	0'–2.3	Made ground	N	–
	2.3'–5.5	Peat with some gravel	Y	–
	5.5'–12.10	Silty clay with plant remains and organics	Y	Alluvial origin
	12.10'–13.2	Silty clay with some organics	Y	Alluvial origin
	13.2+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
A-CP07/R007	0'–2.8	Made ground	N	–
	2.8'–12	Peat with some gravel	Y	–
	12'–13.1	Silt with clay and some shell	–	Alluvial origin
	13.1'–14.8	Silt and clay	–	Alluvial origin
	14.8+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
A-CP08/R008	0'–2.10	Made ground	N	–

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
	2.10'–12.5	Peat	Y	–
	12.5'–16.8	Clay with occassional shell	–	Alluvial origin
	16.8+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash

Design Area 2

Borehole.	D (m)	Description	Palaeoenv/Arch potential	Notes
B-CP01/R001	0–4.8	Made ground	N	–
	4.8–6.3	Organic rich clay and silt	Y	Alluvial origin
	6.3–9	Clay rich peat with plant remains	Y	Alluvial origin
	9–10.10	Silty peat with shell	Y	Alluvial origin
	10.10–13.6	Organic sandy, silty clay	Y	Alluvial origin
	13.6+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
B-CP02	0–1.25	Made ground	N	–
B-CP02A	0–1.25	Made ground	N	–
B-CP02B/R002B	0–2.8	Made Ground	N	–
	2.8–5.3	Organic rich clay and silt	Y	Alluvial origin
	5.3–9.3	Clayey silt.	–	Alluvial origin
	9.3+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash

Design Area 3

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
C-CP09	0–4.1	Made ground	N	–
	4.1–6.5	Peat	Y	–
C-CP09A/R009A	0–4	Made ground	No	–
	4.0–6	Peat with some gravel	Y	–
	6–6.5	Clayey peat.	Y	Alluvial origin
	6.5–9.5	Peat with some gravel	Y	–
	9.5–12.5	Clayey peat with shell	Y	Alluvial origin
	12.5–13.5	Peat with plant remains and some shell	Y	–
	13.5–15.5	Silty clay with some shell	Possible	Alluvial origin

Design Area 4

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
D-CP01	0–1	Made ground	No	–
	1.0+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
D-CP02	0–0.4	Made ground	N	–
	0.4–1.10	Gravelly clay	–	Alluvial origin
	1.10–1.9	Gravel, clay, silt and sand	–	Alluvial origin
	1.9–3.8	Sand and gravel	–	Alluvial origin
	3.8–8.8	Sand and shell	–	Alluvial origin
	8.8+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash

Design Area 5

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
E-CP01	0–1.2	Made ground	N	–
E-CP01A	0–3.45	Made ground	N	–
E-CP01B	0–95	Made ground	N	–
E-CP01C	0–2	Made ground	N	–
	2+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
E-CP01D	0–2	Made ground	N	–
	2+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
E-CP02	0–2.9	Made ground	N	–
	2.9+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
E-CP03	0–7	Made ground	N	–
	7+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
E-CP04	0–.9	Made ground	N	–
E-CP04A	0–.9	Made ground	N	–
E-CP04B	0–.9	Made ground	N	–
E-CP04C	0–2.1	Made ground	N	–
	2.1+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash
	0–.7	Made ground	N	–
	.7+	Mixed deposits of Devensian glacial diamict.	–	Glacial outwash

Boreholes

Design area	Borehole	D (m)	Description	Palaeo-environmental/ Archaeological potential
1	A-WS03	0-2.8	Made ground	N
		2.8+	Clay	–
1	A-WS04	0-2.5	Made ground	N
		2.5+	Clay and organic material	–
1	A-WS05	0-3.9	Made ground	N
		3.9+	Clay with plant remains	–
1	A-WS06	0-4.6	Made ground	N
		4.6+	Clay with rootlets	–
1	A-WS07	0+	Made ground	N
1	A-WS08	0+	Made ground	N
2	B-WS01	0+	Made ground	N
3	C-WS09	0-4.9	Made ground	N
		4.9+	Peaty clay	–
4	BR-WS01	0-2.8	Made ground	N
		2.8+	Mixed alluvial/glacial deposits.	–
5	E-WS01	0-2.3	Made ground	N
		2.3+	Mixed alluvial/glacial deposits.	–
5	E-WS02	0-1.9	Made ground	N
		1.9+	Mixed alluvial/glacial deposits.	–
5	E-WS03	0-3.9	Made ground	N
		3.9	Mixed alluvial/glacial deposits.	–

Unit codes all areas

Unit	Broad Description
A	Made Ground
B	Alluvium
C	Peat
G	Glacial gravel

APPENDIX 2 WATCHING BRIEF BOREHOLES

Section A

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
WS01	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.6	Very soft grey silty clay with buff coloured inclusions	–	Alluvium
	1.2	Dense, compact, dark blue clay and silt with some sand.	–	Alluvium
	1.47	Grey brown organic rich clay.	–	Peat
	2.47	Grey brown organic rich clay with visible plant remains.	–	Peat
	2.7	Wood peat	–	Wood
	2.86	Grey brown organic rich clay with wood.	–	Wood
	3	Compact blue grey clay	–	Alluvium
	3.43	Compact very dark blue grey clay	–	Alluvium
	3.7	Rush and sedge peat	–	Peat
	4	Blue grey coarse to medium sand	–	Periglacial sands?
	5	End of Borehole	–	–
WS02	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.45	Very soft grey silty clay with buff coloured inclusions	–	Alluvium
	1.2	Very open textured organic material.	–	Peat
	1.5	Grey brown organic rich clay with visible plant remains.	–	Peat
	2	No Capture	–	–
	2.9	Wood peat	–	Wood
	3	Highly organic dark brown/black silt and clay	–	peat
	3.4	Highly organic dark brown/black silt and clay wit visible remains of rushes and sedges	–	Peat
	3.77	Blue grey coarse to medium sand	–	Periglacial sands?
	4	Coarse to medium red brown sand	–	Glacial sand
	5	End of Borehole	–	–
WS03	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.45	Very soft grey silty clay with buff coloured inclusions	–	Alluvium

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
	0.8	Very soft dark brown/black peat with plant remains and fragments of wood.	–	Peat
	1.2	Dense, compact, dark blue organic rich clay	–	Alluvium
	1.52	Rush sand sedge peat	–	Peat
	2	Open textured rush sand sedge peat with wood	–	Peat
	2.62	Open textured wood peat	–	Wood
	2.9	Highly organic dark brown/black silt and clay	–	Peat
	3	Limited capture	–	–
	3.6	Open textured rush sand sedge peat with wood	–	Peat
	4	Fine to mediun Blue grey sands	–	Glacial
WS04	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.4	Very soft grey silty clay with buff coloured inclusions	–	Alluvium
	1.5	Very dark brown, well humified peat	–	Peat
	1.6	Rush and sedge peat	–	Peat
	2	No caputure	–	–
	2.4	Open textured wood peat	–	Wood
	2.6	Highly organic dark brown/black silt and clay	–	Alluvium
	3.8	Open textured rush sand sedge peat with wood	–	Peat
	4.6	Red Brown Sand	–	Glacial sand
		End of Borehole	–	–
WS05	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.2	Very soft grey silty clay with buff coloured inclusions	–	Alluvium
		End of Borehole	–	–
WS06	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.4	Very soft grey silty clay with buff coloured inclusions	–	Alluvium
	1.2	No Capture	–	–
	4	Fine to mediun Blue grey sands	–	Periglacial Sands
WS07	0	Turf overlying dark brown/black silt and clay rich topsoil.	–	Topsoil
	0.25	Gravelly, slightly silty clay	–	Alluvium

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
	0.6	Grey brown organic rich clay with visible plant remains.	–	Alluvium
	1.2	Very open textured organic material.	–	Peat
	1.5	Wood peat	Alder	Wood
	1.8	Wood peat grading to red and grey brown sand	–	Wood
	2	Red brown sand becoming increasingly coarse with depth.	–	Glacial sands
	2.25	Poorly sorted well rounded gravels	–	Glacial gravels
	2.38	Coarse to medium red brown sand	–	Glacial sands
	2.84	Poorly sorted angular to well round gravel	–	Glacial gravels
WS09	0	Open textured, mid brown sand rich topsoil	–	–
	0.4	Red brown homogeneous coarse to mediun sand	–	–
	1.2	Red brown fine to medium sand	–	–
	2.85	Poorly sorted, well rounded, gravels and cobbles.	–	–
WS10	0	Yellow brown, slightly silty, gravel.	–	–
	0.4	Clay rich, mid brown subsoil becoming sandier with depth	–	–
	1.2	Red brown homogeneous coarse to mediun sand	–	–
	3	Poorly sorted, well rounded, gravels and cobbles.	Glacial diamict	–
WS11	0	Open textured, mid brown sand rich topsoil	–	–
	0.6	Clay rich, mid brown subsoil becoming sandier with depth	–	–
	1.2	Red brown homogeneous coarse to mediun sand	–	–
	2	End of borehole	–	–
WS12	0	Open textured, mid brown sand rich topsoil	–	–
	0.4	Red brown homogeneous coarse to mediun sand	–	–
	2	Red brown fine to medium sand	–	–
	2.9	Poorly sorted, well rounded, gravels and cobbles.	–	–
WS13	0	Open textured, mid brown sand rich topsoil	–	–
	0.4	Red brown homogeneous coarse to mediun sand	–	–

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
	1.1	Poorl sorted angular to well rounded gravels and pebbles.	–	–
	1.4	Red brown fine to medium sand	–	–

Section B

Test pit	D (m)	Description	Palaeoenv/Arch potential	Notes
WS14	0	Made ground	–	Made ground
	2.8	Sandy grey clay	–	Alluvium
	3.2	Brown Peat	–	Peat
	4.9	End of Borehole	–	–
WS15	0	Made ground	–	Made ground
	1.8	Very dark brown sandy silt	–	Alluvium
	2.2	Soft, brown sandy silt	–	Alluvium
	4	Brown peat	–	Peat
WS16	0	Made ground	–	Made ground
	1.54	Smooth black clay with intrusive CBM, pot- and glass-sherds.	–	Alluvium
	2.5	Well humified yellow brown peat - possibly moss or other bryophytes? Some sedge-like material visible.	–	Peat
	2.8	Compact silt and clay with fragments of wood.	–	Alluvium
	3.24	Sedge peat with wood and visible leaves, immature hazel-nut recovered.	Alder/Willow?	Wood
	3.26	Very dark brown/black peat with sedges and rushes.	–	Peat
	4	Sedge and rush peat.	–	Peat
	4.72	Organic rich clay with cobbles and pebbles	–	Alluvium
	4.96	Large pebbles with angular grey/ brown gravel and coarse to medium sand.	–	Glacial diamict

Section C

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
WS17	0	Made ground	–	Made ground
	1.8	Angular brick	–	Made ground
	2.3	Clay and silt with fine grained sand	–	Alluvium

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
	2.4	Clay and silt with fine grained sand with pebbles and gravels	–	Alluviun
	3	Dark brown/black organic rich mud with sedge and wood	–	Alluvium
	3.4	Blue/grey clay with pale brown inclusions and reed.	–	Alluvium
	3.6	End of Borehole	–	–
WS18	0	Made ground	–	–
	0.3	End of Borehole	–	–
WS18a	0	Made ground	–	–
	5	End of Borehole	–	–

Section D

Borehole	D (m)	Description	Palaeoenv/Arch potential	Notes
WS19	0	Made ground	–	Made Ground
	0.9	Red brown homogeneous coarse to mediun sand	–	–
WS19A	0	Made ground	–	Made Ground
	1.2	Red brown homogeneous coarse to mediun sand	–	–
	5	End of Borehole	–	–
WS20	0	Made ground	–	Made Ground
	1.2	Red brown homogeneous coarse to mediun sand	–	–
	5	End of Borehole	–	–

Unit codes

Doxey and 10 Pin

Unit	Broad Description
A	Topsoil
B	Alluvium
C	Peat
D	Wood
E	Periglacial Sand
F	Glacial sand
G	Glacial gravel

Drumlin

Unit	Broad Description
A	Topsoil
B	Coarse red sands
C	Red brown sands
D	Gravels and cobbles
E	Clay rich subsoil

Sainsburys & Rail Bridge

Unit	Broad Description
A	Made Ground
B	Alluvium

SOUTH & EAST
Headland Archaeology
Building 68C, Wrest Park, Silsoe
Bedfordshire MK45 4HS

01525 861 578
southandeast@headlandarchaeology.com

MIDLANDS & WEST
Headland Archaeology
Unit 1, Premier Business Park, Faraday Road
Hereford HR4 9NZ

01432 364 901
midlandsandwest@headlandarchaeology.com

NORTH
Headland Archaeology
Unit 16, Hillside, Beeston Road
Leeds LS11 8ND

0113 387 6430
north@headlandarchaeology.com

SCOTLAND
Headland Archaeology
13 Jane Street
Edinburgh EH6 5HE

0131 467 7705
scotland@headlandarchaeology.com

www.headlandarchaeology.com