VPI Immingham, Humber Zero Project: Geoarchaeological Borehole Evaluation and Deposit Model Report

AOC Project No: 53122

National Grid Reference Number: 516798 416959

Date: June 2023

AOC Archaeology Group

ARCHAEOLOGY | HERITAGE | CONSERVATION

VPI Immingham, Humber Zero Project: Geoarchaeological Borehole Evaluation and Deposit Model Report

For:	**AECOM Limited** AECOM House 63-77 Victoria Street St Albans Hertfordshire AL1 3ER
On Behalf of:	**VPI Immingham LLP** Rosper Rd, South Killingholme, Immingham DN40 3DZ
National Grid Reference (NGR):	**516798 416959**
AOC Project No:	**53122**
Prepared by:	**Jessica Taylor / Lynne Roy**
Illustration by:	**Jessica Taylor**
Date:	**28th June 2023**

This document has been prepared in accordance with AOC standard operating procedures.

Author: Jessica Taylor	**Date:** 28th June **2023**
Approved by: Virgil Yendell	**Date:** 28th June **2023**
Report Stage: Second Submission	**Date:** 28th June **2023**

Enquiries to: AOC Archaeology Group
Unit 7
St Margaret's Business Centre
Moor Mead Road
Twickenham
TW1 1JS

Tel. 020 8843 7380
Fax. 020 8892 0549
E-mail. london@aocarchaeology.com

NON-TECHNICAL SUMMARY

A geoarchaeological evaluation was undertaken on 30th January to 2nd February 2023 at the Site of VPI Immingham, Rosper Road, South Killingholme, North Lincolnshire (NGR: 516904 416940). The work was undertaken by AOC Archaeology Group for AECOM on behalf of the client, VPI Immingham LLP.

This document summarises the stratigraphic sequence of geoarchaeological remains and discusses the results in relation to their archaeological and palaeoenvironmental potential. The principal objective of this report is to present the results, refine the research objectives of the project in light of the findings, and make recommendations concerning any subsequent archaeological investigations in order to address these research objectives.

The geoarchaeological evaluation comprised the drilling of 11 purposive geoarchaeological boreholes to a maximum depth of c. 6m below ground level and the extraction and retention of the cored samples. Geoarchaeological and geotechnical deposit data can be used to identify areas of archaeological potential by characterising the probable nature and depth of sub-surface deposits. Additionally, 32 archaeological evaluation trenches were excavated within the site concurrent with the borehole evaluation. This work comprised the excavation of 32 trenches, where these did not reveal glacial till sondages were excavated roughly at each end of each trench to reach the till. In some trenches, additional central sondages were excavated. These sondages provided further interventions from which accurate Holocene stratigraphic records could be taken for the purposes of deposit modelling.

The deposit sequence recorded across the Site included Pleistocene glacial till with a varying surface elevation between approximately -0.5 and 3 m OD (above Ordnance Datum). The lower elevations traverse the Site from the northeastern boundary, forming a relict coastal inlet. This inlet was found to be infilled with intertidal deposits. Holocene alluvium or warp deposits were found across the site. Made ground of up to approximately 1.4m in thickness was recorded.

Development impacts from the currently proposed gas fired power station may affect a sequence which may be associated with an inlet dating to the Mesolithic to Neolithic period, which would be of local significance if preservation of palaeoenvironmental remains is found to be good.

It is recommended that the impact on deposits of geoarchaeological interest may be mitigated by palaeoenvironmental assessment of the cored samples from a representative sequence of the thicker inlet fills, in addition to the proposed work on the monolith samples taken from the dryland/inlet margins as part of the trench evaluation.

The appropriate mitigation strategy for the Site will be decided by and agreed with the Local Authority and their archaeological advisors.

An OASIS form (OASIS ID: aocarcha1-515129) has been completed and an electronic copy of all reports will be deposited with the Archaeological Data Service (ADS). The Site archive will be prepared in accordance with local and national guidance and will be deposited with a local repository.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 This document details the results of a geoarchaeological borehole evaluation at the Site of the land adjacent to VPI Immingham, Rosper Road, South Killingholme, North Lincolnshire (NGR: 516904 416940, Figure 1). The project was commissioned from AOC by AECOM on behalf of the client, VPI Immingham LLP.

1.2 The proposed development Site (henceforth "the Site") is located in the land parcel to the south of VPI Immingham. It is bound to the southwest by the railway line and Humber Oil Refinery, to the southeast by Humber Road, and to the east and northeast by Rosper Road. It is approximately 1.6 km north of Immingham, and *c*. 1.5 km west of the Humber Estuary. The Site is split into two areas by a watercourse, resulting in two irregularly shaped areas of *c*. 5.8 ha and *c*. 2.2 ha. At present, the Site is occupied by rough pasture.

1.3 This report consists of a Stage 3 geoarchaeological borehole evaluation, carried out in order to evaluate the potential of the Site to contain significant paleoenvironmental and archaeological remains, and to produce a report inclusive of a deposit model. Samples have been collected and retained in order to facilitate possible later geoarchaeological/palaeoenvironmental specialist assessment, but an assessment of this nature is not included at this stage so that the need for further fieldwork can be commented on in a timely manner.

Table 1 Generic stages of geoarchaeological investigation for guidance

Stage	Stage number
Consultancy: Desk based and impact assessment	1
Fieldwork: Geotechnical monitoring	2
Fieldwork: Trench evaluation / borehole evaluation	3
Fieldwork: Watching brief / excavation / mitigation boreholes	4
Post-excavation: Specialist geoarchaeological / palaeoenvironmental assessment	5
Post-excavation: Specialist geoarchaeological / palaeoenvironmental analysis	6
Publication	7

1.4 The geoarchaeological evaluation comprised the drilling of 11 purposive geoarchaeological boreholes to a maximum depth of *c*. 6m below ground level (bgl), and the extraction and retention of the cored samples (Figure 3). Additional datapoints were provided through excavation of archaeological evaluation trenches, the programme of which ran concurrently with borehole evaluation. A total of 32 trenches were excavated, 8 of which reached glacial till throughout most of their extent. Within those which did not reach the Pleistocene surface, 33 sondages were excavated to this surface roughly at each end of each trench. In some of these, additional sondages were excavated in the centre of the trench. These provided records for the full Holocene sequence across a large proportion of the site.

1.5 Geoarchaeological and geotechnical deposit data can be used to identify areas of archaeological potential by characterising the probable nature and depth of sub-surface deposits.

1.6 As such, this report includes a deposit model detailing the current geoarchaeological make-up of

the site and provides recommendations on how investigations pertaining to these works should proceed and how such work will be integrated into the wider findings from the area. The works reported on here were carried out under the Written Scheme of Investigation (WSI, AOC 2022) for the site. Subsequent stages of investigation may be required dependant on the results of this report. The geoarchaeological works ran concurrently with a programme of archaeological evaluation trenching, reported on separately (AOC 2023).

2 PLANNING BACKGROUND AND PROPOSED DEVELOPMENT

2.1 The proposed development Site (hereafter 'the 'Site') is situated within the administrative district of North Lincolnshire, approximately 1.6km north of Immingham and 1.5km west of the Humber Estuary. The Site comprises two irregularly shaped areas, c.5.8ha and c.2.2ha in size, separated by a watercourse, south of the existing Combined Heat and Power Plant (CHP), now owned by VPI Immingham LLC. The Site is bounded to the south and west by the extant trainline; further south is the main campus of the Phillips 66 Refinery. The Site is bounded to the east by Rosper Road which is an old road that appears on the early Ordnance Survey Maps and likely dates back to the Medieval period (OS Map 1886). The Site is currently rough pasture and centred on NGR 516798 416959 (Figure 1).

2.2 The current development plans propose the construction of a new gas-fired power station and carbon capture facility at South Killingholme, Immingham. The Site has been subject of a previous Written Scheme of Investigation (WSI, AECOM 2022), from which the following is taken.

Planning permission (Application reference PA/2018/918) to construct a new gas-fired power station was granted in September 2018. The archaeological fieldwork is required in line with Planning Condition 13 and to comply with policy HE9 of the North Lincolnshire Local Plan because the Site lies in an area of archaeological interest.

3 GEOLOGY AND TOPOGRAPHY

3.1 The Site is located within the Humberside area on low lying terrain generally at elevations between 2-4 m above Ordnance Datum (OD). A slight decline in the topography from north to south is noted on the north side of Site: from 3.88 to 2.6 m OD. The topography on the south side rises from northeast to southwest: from 2.5 to 3.2 m OD. The natural drainage direction across the Site is eastwards, towards the Humber Estuary.

3.2 According to the British Geological Survey (BGS, 2023), the underlying bedrock on Site is of Burnham Chalk Formation. Comprising white, thinly bedded chalk with common flint bands, this unit was deposited during the Turonian to Santonian Age (93.9-83.6 million years ago), within the Cretaceous period.

3.3 British Geological Survey mapping shows that two superficial deposits underlie the Site, corresponding to those discussed as part of the composition of the Lincolnshire Marsh. Diamicton glacial till is the main deposit from the last (Devensian) cold stage and underlies the majority of the Site (BGS, 2023). Till is deposited by glacial ice, either at the glacier base or derived from material within and on the ice. It comprises gravelly sandy silty clay with boulders and contains numerous lenses of sand and gravel. The till is also likely to contain interdigitating units of glaciolacustrine clay, plus sand and gravel formed during ice advance and retreat (Burke et al., 2015). The Holocene superficial deposits (12,000 years ago – present) consist of tidal mudflats (clay, silt, sand, and peat) forming a linear feature entering the Site from the east (BGS, 2023) which may form an inlet that existed from the prehistoric period onwards. Tidal mudflats are wetlands that form within the intertidal zone; the area between the mean high-water level and mean low-water level within a coastal setting. The alluvial and estuarine deposits extend up to 20m deep across the north and south banks of the Humber Estuary.

4 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

4.1 The following background is taken from the WSI (AOC, 2022), which should be referred to for the HER and figure references.

4.2 A Desk Based Assessment undertaken in 2022 (AECOM, 2022) identified a moderate potential for pre-Iron Age prehistoric deposits, and a high potential for Iron Age, Roman, Medieval and Post Medieval remains to be present within the site.

Prehistoric (*c.* 500,000 BC – AD 43) and Roman (AD43 – AD 410) Evidence

4.3 Previous archaeological investigations to the immediate north and south of the Site in 1999/2000 and 2015 uncovered extensive archaeological remains, some of which are likely to extend into the trial trenching area.

4.4 Archaeological investigations undertaken on the Site of a proposed combined heat and power plant (CHP) at North Killingholme, west of Rosper Road, between 1999 and 2000 uncovered a significant occupation Site with Iron Age origins. Part of this settlement is located within the site, at its northern extreme, partially under the extant buildings, partially within the (potentially less disturbed) area of the car park on the north east edge of the Site and partially within the southern open area of the Site.

4.5 The investigations comprised of a desk-based assessment, fieldwalking, geophysical survey, auger survey, watching briefs, trial trenching, and open area excavation. The work revealed that an original early Iron Age settlement was located in the south of the site, on the lower ground near a former creek on the shore of the River Humber. There then appears, on the basis of the pottery sequence, to have been a hiatus in the mid to late Iron Age. The late Iron Age and Romano-British settlement developed on higher ground further north, centred around a droveway and a pattern of enclosures. The northern part of the settlement appeared to have been unenclosed: although the single mid-Iron Age roundhouse from this period was found between two boundary ditches, these appeared to represent the subdivision of an open area, as opposed to the enclosure of smaller compounds. The nature of the pottery, a general lack of artefacts, and the environmental evidence from the Site all suggested a rural, pastoral settlement. Moreover, given the presence of a droveway, ponds, and enclosures interpreted as pens or corrals for livestock, it appeared that the settlement was mainly dependant on raising cattle and sheep/goats. Pottery evidence for the later Iron Age and Romano-British periods suggested that until the mid-2nd century there was a scarcity of imports, and it is likely that at this time the Site was of a relatively low status. During the latter part of its life (late 2nd century onwards) the settlement appears to have become more affluent (as represented by the cultural material, including foreign imports) and could be seen as a more moderate to high status site.

4.6 A programme of archaeological mitigation immediately south of the Site was carried out during the spring and summer of 2015 in advance of road improvement works to the A160/A180 access to the Port of Immingham. This identified two large linear ditches which contain notable quantities of late Iron Age pottery. It is suggested that these features were part of an occupation enclosure rather than a field system. These features were originally believed to be located 16m south east of the site. However, the 2015 mitigation suggests that they may extend into the Site (AECOM 2022).

4.7 Several Iron Age/Roman sites as well as evidence of earlier Late Bronze age occupation are

located within the vicinity of the site. The later Bronze Age activity was located 260m south east of the Site where an archaeological evaluation identified various deposits (including burnt stone and charcoal) found in association with other features such as ditches. The Site did not appear to be domestic in nature and was thought to be associated with exploitation of the estuarine environment, with semi-permanent industrial and marine resource exploitation activities being present.

4.8 The Iron Age remains in the vicinity of the Site comprise field systems as well as enclosures and associated features. Several of the sites were major or significant settlements, with occupation beginning in the mid-late Iron Age and extending into the Roman period, similar to the Site excavated to the immediate north of the Site in 1999/2000. The closest of these lies 215m to the south west of the Site and consisted of a number of sub-square enclosures which contained curvilinear features (possible ring gullies), linear ditches and discrete pit type features, at least one of which was a hearth. Domestic occupation appeared to be concentrated to the west of the site. There was also some evidence for salt making being carried out towards the wetter eastern part of the site. It is possible this Site was a continuation of the Bronze Age activity described above.

4.9 Two Iron Age settlements were located to the north of the Site. Approximately 370m to the north-east and excavation in 2013 uncovered two large enclosures. Both featured internal sub-divisions, with the southernmost displaying evidence of six ring gullies and other structural elements dating from the mid to late Iron Age and early 1st century AD.

4.10 The other major Iron Age settlement Site was present 820m north of the site. It was examined via geophysical survey (2011 and 2012), fieldwalking (2012) and trial trench evaluation (2012). The results of this work present a complex Site which covers c. 6ha. The Site began life in the mid / late Iron Age and was in use until the mid / late Roman period. The sites, broadly, consist of a multi-phased arrangement of interconnected, rectangular, ditched enclosures orientated on a north-south axis. Within these enclosures are numerous features representing structures, animal enclosures, and the subdivision of land plots and fields.

4.11 The remains of a field system were identified in an archaeological evaluation in 2006, approximately 100m north of the site.

4.12 Several Romano-British settlements as well as field systems have been identified within the vicinity of the site. The closest lies 40m to the west and comprised ditches that appeared to be a continuation of the field system associated with the farmstead or settlement recorded within the VPI Site during the 1999/2000 excavations. Small quantities of Roman pottery were recovered from the fills of the ditches.

4.13 The settlement sites included two Romano-British ladder settlements, one c.650m south of the Site and another c1.5km to the west. The settlement to the south was recorded by geophysical survey and a metal detecting survey and comprised of a complex series of rectangular ditches conjoined to either side of a trackway. Some of the positive anomalies within the settlement were suggestive of wall footings and arranged in such a way to suggest buildings. The metal detecting survey found 3rd and 4th century coins and two Roman brooches of the 1st or 2nd century. A Roman lock bolt fragment, 32 sherds of greyware, 30 lead fragments and 14 copper alloy fragments (including part of a vessel) were also recovered.

4.14 The settlement to the west possibly consisted of one or more farmsteads. The pottery was largely

utilitarian shell-gritted ware, typical of the Late Iron Age - Roman transition in North Lincolnshire. One sherd in a cream fabric was thought to originate from a 1st century AD kiln at Lincoln, whilst other material was more distinctively late Roman (3rd – 4th century AD). There was also evidence for metalworking residue, fired clay fragments, oyster shells, and animal bone.

4.15 Another Romano-Brits settlement Site comprising of a large main sub-rectangular enclosure which contained several ring gullies and other fragmentary structural elements was located 850m north west of the site. The main enclosure had several sub-enclosures appended to it and a short stretch of double ditched trackway was recorded. The features displayed evidence of being re-worked and adapted from the mid to late Iron Age through to the early 2nd century AD, with artefactual evidence supporting the chronology.

Medieval (AD 410-1600) and Post-Medieval (AD 1600-1900)

4.1 Several units of medieval ridge and furrow were digitally plotted using pre-existing aerial photographs from the 1940s and 1970s as well as new data collected during 2011 (geophysical survey). The ridge and furrow activity was seen to cover the location of the current VPI Immingham buildings and the potentially undisturbed site, where there is the potential for preservation.

4.2 One concurrent length of hedge, the remains of historically important hedgerows that appear as field boundaries on pre 1840 maps, currently runs along the eastern perimeter of the VPI site.

4.3 A linear cropmark (possibly a ditch) thought to be of medieval / post-medieval date in present in the west edge of site.

5 GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL BACKGROUND

5.1 The following is taken from the WSI (AOC, 2022). The Site lies approximately 1.5km to the west of the River Humber, within the Humber Estuary environment. The Ancholme valley borders the region to the west.

5.2 The British Geological Survey (BGS 2023) records the under-lying bedrock onsite as Burnham Chalk, which formed as deep seabed deposits approximately 93.9 to 83.6 ma (million years ago) during the Cretaceous. The chalk is blanketed with (Devensian) cold stage, diamicton glacial till. Till is deposited by glacial ice, either at the glacier base or derived from material within and on the ice. It comprises gravelly sandy silty clay with boulders and contains numerous lenses of sand and gravel. The till is also likely to contain interdigitating units of glaciolacustrine clay, plus sand and gravel formed during ice advance and retreat (Burke et al., 2015). The Holocene (12,000 years ago – present) tidal mudflat deposits (clay, silt, sand, and peat) form a linear feature entering the Site from the east (BGS 2023) marking a relic river mouth, creek, or inlet, that opened into the edge of the estuary. A coastline edge which may have been closer to the Site in the past.

5.3 The broader paleoenvironmental context of the Site is anticipated to be an interplay between the processes of the Humber Estuary and the development of the Lincolnshire Marsh, with the latter's mixed estuarine and marine influences as you move down its c. 115 km length. Although some distance, the environment of the Ancholme Valley in the west, should be kept in mind. In addition, consideration should be made to the existing corpus of past coastline projections and Mean High Water Spring Tide (MHWST) models for North Lincolnshire and the Humber estuary in relation to the development of the hydrology and landscape of the site.

Humber Estuary

5.4 The following is modified from the WSI (AOC, 2022).

5.5 The modern Humber Estuary is one of the largest in the UK, being fed by the Rivers Hull, Ancholme, Derwent, Ouse, Aire, Don, and Trent, and flowing into the North Sea. Glaciation has had significant impacts on the development of the estuary. The development of the estuary can be characterised by four stages in the Late Glacial and two stages in the Holocene (Van de Noort et al 1993):

- Lake Humber
- Braided rivers
- Aeolian sand
- Riverine incision
- Channel aggradation
- Floodplain aggradation

5.6 During the Late Glacial (Late Devensian), c. 18k a (thousand years) BP, an ice lobe stretched across the North Sea (North Sea Lobe) and blocked the Humber Gap. The impoundment of water to the north and the ice to the east created the pro-glacial Lake Humber (Metcalfe et al 2000, Ellis

et al 2001 and Clarke et al 2004). As glacial ice retreated from the vicinity (c. 15-11 ka BP), the processes of the lake draining and glacial meltwater runoff drove the formation of a braided river system across what was the lake basin, aggrading sand and silt (Van de Noort et al 1993). Over a similar period, thick deposits of windblown sand were deposited in areas like the Ancholme valley, potentially redistributing the sediment aggraded by the braided river system, and sealing earlier Windermere interstadial organic deposits (ibid). Subsequently, but still during the Late Glacial to Early Holocene the continuing draining of lake and meltwaters, combined with low sea levels triggered the incision of deep riverine valleys up (to c. 9 m bgl, below ground level) until c. 8 ka BP (Metcalfe et al 2000). As rising Relative Sea Level (RSL) continued, the previously incised low lying channel routes began to silt up or accumulate peat. By the Late Bronze Age (c. 3500 BP) sea-level is estimated at 0m OD and much of the low-lying landscape is infilled, driving overbank flooding and sedimentation (Van de Noort et al 1993) the. The general Holocene vegetation development for the area is recorded as birch and pine dominated woodland through to mixed woodland of oak, pine, elm and hazel, as birch declined (Metcalfe et al 2000).

5.7 Within the Immingham area, a borehole (HMB10) carried out as part of analysis of the Holocene sedimentary sequence in the Humber Estuary (Ridgway et al., 2000) recorded a 90mm thick peat deposit at an elevation of approximately -6.7 m OD. As part of analysis on this deposit, palaeoenvironmental proxies were identified and counted as an indication of the past environmental conditions. Diatoms were poorly preserved, though combined pollen and diatom data indicates a salt marsh environment. Radiocarbon dating carried out on samples taken from the upper and lower facies of the peat, and yielded a late Mesolithic depositional period (AA23433, 5570-5329 cal BC (95.4%); AA23432, 5375-4994 cal BC (95.4%)). The palaeoenvironmental assemblage from the upper peat sample indicates intertidal conditions. Pollen records indicate this coincided with a high presence of a variety of tree taxa including lime (*Tilia*), elm (*Ulmus*), oak (*Quercus*), and alder (*Alnus*), and Poaceae (grass) as well as freshwater aquatic taxa suggest local coastal reedswamp and fen conditions were likely.

5.8 Overlying silt suggests continued high salt marsh conditions grading into low saltmarsh upon contact with the Saltend Suite, with highly mixed marine, brackish, and freshwater species present. The salt end suite shows evidence of channel migration with an erosional lower contact characterized by changing geochemistry the mixed diatom assemblage. The assemblage is suggestive of an intertidal channel or flat environment with freshwater input from springs or the catchment. Marine conditions are increasingly evident in and intertidal channel environment above -3 m OD, as the laminated silts become silt and sand, and are dominated by deeper water marine diatoms. Above c. 1.5 m OD the core sediments may be related to warping of saltern redeposition (Ridgeway et al 2000).

5.9 An investigation into diatom assemblages within the sequence of the Humber Estuary (Metcalfe et al., 2000) provides a broad framework for comparison and interpretations. Diatom taxa have been grouped through this study to show association between certain assemblages and the sedimentary environment, of which 16 have been outlined. One of these specifies an assemblage representative of an intertidal creek environment in this catchment, which may be comparable to any assemblage identified within the Site boundary from the possible inlet or channel.

5.10 The above studies combined reveal a sequence of transition from high salt marsh peat to intertidal sand flats, intertidal mudflats, and an upper depositional phase of anthropogenic warp (Metcalfe et al., 2000; Ridgway et al., 2000).

5.11 Previous investigations have taken place approximately 1-2 km to the north of the site, further towards the Humber. An auger survey revealed an undulating landscape with a minor watercourse running roughly along the route of a modern canalised waterway (Allen Archaeology, 2013) which may be comparable to the mapped intertidal deposits adjacent to a drainage ditch within the Site boundary. Superficial deposits including organic silts indicative of a possible lake or mere environment were recorded overlying the older Pleistocene till and chalk bedrock, though the general abundance of such deposits suggests a higher water level with continued flooding, likely fringed by marsh or fen.

The Lincolnshire Marsh

5.12 The following is taken from the WSI (AOC, 2022).

5.13 The Lincolnshire Marsh is underlain by the slope of the Cretaceous chalk the Wolds escarpment to the west. During the latter stages of the last (Devensian) Ice Age (c. 18,000 ka BP) the North Sea Lobe advanced until the Wolds to the west and The Wash to the south (Metcalfe 2000, Ellis et al 2001 and Clarke et al 2004). During the colder Pleistocene periods, global sea levels were substantially lower than today and the area occupied part of an important location on the western margins of 'Doggerland' now submerged beneath the southern North Sea but which formerly linked the Humber to Denmark (Gaffney et al., 2007).

5.14 Subsequent rising temperatures at the end of the Devensian and start of the Holocene, and associated meltwaters, left glacial till (southern extent of the Skipsea Till) and then glacial river gravels capping the chalk bedrock, up to 24 m deep (Ellis et al 2001). Large numbers of lakes formed in depressions left in the till (kettle holes and pingos). These water filled depressions are locally known as meres and many were sufficiently deep to ensure the survival of open water into the Holocene, as in the Holderness area (Head et al 1995, Schofield 2001), although few were identified in the Lincolnshire Marsh area by the wetland survey (Ellis et al 2001).

5.15 Prior to c. 5500 BC the Lincolnshire Marsh was predominantly defined by the undulating surface of the glacial till, comparable to modern Holderness. A general trend of rising Relative Sea Level (RSL) drove deposition of fine-grained material transported by the sea and River Humber, with the deposition in the southern part of the Lincolnshire Marsh area being characterised by the undulating topography of the Middle Marsh and then the predominantly marine alluvium of the Outmarsh (Ellis et al 2001). Deep sequences preserve tree trunks and other large-scale evidence of buried Early Holocene forests, whereas later peat horizons indicate potential slow-downs in the minerogenic sedimentation associated with rising RSL, and resulting in the expansion of stabilised wetland vegetation.

5.16 The Forest bed unit represents oak, alder, birch, and yew woodland. Within Van de Noort et al's (1993) sequence is thought to not be later than Neolithic, and near Immingham was dated to the late Mesolithic (6681 ±130 BP), although the example from Immingham is significant lower in elevation (m OD) than the other.

5.17 The lower peat (c. 5500 BC) indicates freshwater run-off from the Wolds backing up due to RSL rise, with the increased waterlogging killing of the woodland. A short period of marine inundation seals the lower peat with a salt marsh clay deposition (Triglochin clay, Van de Noort et al 1993), with vegetation evidence of sea arrow-grass and rushes etc. and the deposit included indications of erosion with the underlying lower peat. This is followed by a slowing of RSL rise and/or

regression, associated with a phragmites clay and return to freshwater marsh formation over the Bronze Age to Iron Age (ibid). The upper peat that subsequently forms (c. 1700 BC) indicates emerging Fen carr. Whilst the sequence as a whole is sealed by a seemingly undifferentiated estuarine minerogenic unit, this has been suggested to contain a separate Iron Age and post-Roman estuarine clay separated by intercalated peats (Ellis et al 2001).

5.18 Late Glacial to Early Holocene pollen sequences have been recorded at Aby Grange and Butterbump, and sites in the Great Eau valley indicate that the expansion of Tilia as being important aspect of lowland vegetation until the mid-Holocene when lime becomes a significant woodland element (Ellis et al 2001). Later Holocene palynology at sites near Butterbump and the Great Eau, aided by the sequences at Ingoldmells, where infills of features associated with salt production (discussed below) preserved pollen indicating a more open landscape of grassland and fringing woodlands, alongside cereal cultivation (Ellis et al 2001).

5.19 The Outmarsh would have been saltmarsh for much of the Holocene and unsuitable for any permanent settlement. Although, salt processing is evident from preserved prehistoric sites like Tetney and Hogsthorpe, through to sporadic Roman evidence, rare Anglo-Saxon evidence for salterns from Marshchapel, and then significant Medieval accounts of salt production (Canti 2009), and Immingham (Fleming and Royall 2020). Evidence of salterns are typically located on the coastal salt marsh and visible as irregular linear ditches and now eroded or flattened spoil heaps that can mask and seal underlying in situ deposits (ibid, and Lane 1992).

Ancholme Valley

5.20 The following is taken from the WSI (AOC, 2022).

5.21 The Ancholme and Trent Valley region, contain an extensive area of wetland which has been subject to a variety of previous palaeoenvironmental studies. A summary of this region is available and contains the results of over 270 boreholes and 50 archaeological sites (Van de Noort and Ellis 1998). The investigations demonstrate that peat deposits have been identified from several locations, and limited palaeoenvironmental analysis and radiocarbon dates provide insights into the prehistoric landscape including a sequence of deposits to the north of Castlethorpe. The deposits at Castlethorpe were dominated by alluvium and peat, underlain by sand and clay. A palaeochannel was defined on the inside of the meander of the Old River Ancholme with a width of at least 300m. The area contains significant peat deposits which have been dated to 5320-4860 cal. BC at a depth of -4.62 to -4.59 m OD. Pollen analysis has indicated that the floodplain environment was mostly dominated by alder-hazel carr with an undergrowth of fern until at least the Bronze Age (Neumann, 1998 paleo chapter). Archaeological discoveries in the area include the waterlogged remains of prehistoric boat craft and timber structures. Two late Bronze Age river crafts were discovered along this stretch of the River Ancholme, the Brigg raft located less than 100 m north of the development Site and the dugout boat 275 m to the south-east. A Bronze Age trackway was uncovered within a few metres to the north of the development site. Peat deposits have been dated to the Iron Age at Island Carr to the southeast of the site, where further evidence of Prehistoric boat building was uncovered. The peat in this area has provided excellent preservation conditions for archaeological artefacts, organic material and palaeoenvironmental indicators.

Coastline Reconstructions

5.22 The following is taken from the WSI (AOC, 2022).

5.23 A number of reconstructions of the Lincolnshire coastline have been produced for North Lincolnshire including:

- 5900 BC coastline (Green 2011, after Shennan et al 2000)
- 5900 BC intertidal extent (Green 2011, after Shennan et al 2000)
- 4900 BC coastline (Green 2011, after Shennan et al 2000)
- 4900 BC intertidal extent (Green 2011, after Shennan et al 2000)
- 3900 BC coastline (Green 2011, after Shennan et al 2000)
- 3900 BC intertidal extent (Green 2011, after Shennan et al 2000)
- Roman coastline (Smith 2010)
- Post-Roman intertidal extent (Smith 2010)
- 13th Century coastline (Green 2015)
- 13th Century intertidal extent (Green 2015)

5.24 As well as for the Humber Estuary

- 8000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)
- 7000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)
- 6000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)
- 5000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)
- 4000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)
- 3000 BP Upland, wetland, intertidal and subtidal extents (Metcalfe et al 2000)

5.25 Shennan et al (2000a, 2000b) analysed sea level data from the east coast of England and northwest Europe to identify local-scale and regional scale factors for spatial and temporal variations in the elevation of Holocene sea-level index points. Shennan et al (2000b) published large scale maps of palaeogeographic reconstructions of northwest Europe showing Mean Sea Level (MSL) for 10ka BP, 9ka BP, 8ka BP, 7.5ka BP, 7ka BP, 6ka BP, 5ka BP, and 4.5ka BP. This information was referenced in the presentation of reconstructions of the dryland coastline and the limits of the intertidal zone for various periods by Green (2011), although the method by which the reconstructions are created from Shennan et al (2000a, 2000b) is not entirely clear. Similarly, Smith (2010) presents Roman coastline and post-Roman intertidal extent in their work based on Malim (2005) and Redding (in Pryor, 2005), again the method of reconstructions is not currently known. Based on the location of the boundary lines and references to BGS data in the publications, most of the reconstructions appear to be qualitative reworkings of the BGS or LIDAR mapping using RSL, MSL, or MHWST elevations.

5.26 Green's recent work (2014a, 2014b, and 2015) using similar sources to provide comparable qualitative reconstructions of the possible lacustrine and glacial limits for the Devensian, and coastline and intertidal limits for the Anglo-Saxon period and 13th Century. The Devensian reconstruction drew on work by Clark et al (2004) and mapped the encroachment of the North Sea Ice Lobe and the extent of the Glacial lakes that covered much of the area to the west of Wolds and into the Fenland (Green 2014a). The Anglo-Saxon reconstruction reproduced D. N. Robinson's map of Lincolnshire's 'Saxon Shoreline'. This maps wide wetlands on the east coast of Lincolnshire and south of the Wolds indicative of late/post-Roman marine transgression that buries Romano-British sites on the Lincolnshire Marshes (e.g. Scupholme and Ingoldmells), comparable to accounts in Wrangle mentioned in the preceding section (Lane 1992). Within the reconstruction island features in the intertidal mudflats and wetlands are highlighted, denoted by the higher ground of BGS mapped Glaciofluvial sediments. The final reconstruction (Green 2015), presents coastline and intertidal limits for the 13th Century AD, based on earlier work by Pawley. It presents the position of coastal islands from Spurn Point to north west Norfolk that shelter Lincolnshire prior to this date from the storms of the North Sea at which point an unprecedented storm eroded the coastal islands away. As a result, the Lincolnshire coast was exposed to coastal erosion and marine inundation is suggested to have encroached c. 1.5 km inland between Mablethorpe and Skegness by 17th Century, destroying low-lying coastal settlements.

5.27 Metcalfe et al.'s work (2000) presented paleoenvironmental analyses from the inner, middle, and outer Humber estuary. The resulting RSL and GIS reconstruction showed a rapid rise in the early Holocene, followed by a reduced rate of rise in the mid-late, after 8ka BP marine transgression pushed up the estuary, having reached the inner estuary by 6ka BP. By 3ka BP the expansion of intertidal environments reached a maximum by 3ka BP. It was found that the estuaries' tidal asymmetry was a significant driver of sediment accretion or erosion.

5.28 Canti (2009) outlines how investigation of the banks and dykes associated with salt production sites have made significant contributions to Iron Age and Roman coastline reconstructions for The Wash, over 10km from the AoS, at Aslackby Fen in the western Fenland. Reclamation of the Wash has been taking place since the Saxon period, but especially during the 14th to 18th centuries AD and significant sea wall structures have mostly been archaeologically neglected.

Site Specific Geoarchaeological and Palaeoenvironmental Summary

5.1 The broader paleoenvironmental context of the Site is mostly anticipated to be an interplay between the processes of the Humber Estuary and the development of the Lincolnshire Marsh, and those elements are summarised below for the Site in particular.

5.2 After the retreat of Glacial conditions and prior to c. 5500 BC the Lincolnshire Marsh was predominantly defined by the undulating surface of the glacial till, and this is likely the case for the Site over this period. According to Green's (2011) coastal and intertidal limit reconstructions (Figure 2) at *c.* 5900 BC, in the mid to late Mesolithic, the Site lies c. 1.5km inland from coastline and even further from lowest tidal waters (i.e. the intertidal limit). Palaeoenvironmental records from the Humber Estuary indicate that during this period of low RSL the vegetation is generally birch and pine dominated woodland through to mixed woodland of oak, pine, elm and hazel, as birch then declined (Metcalfe et al., 2000).

5.3 A general trend of rising RSL drove river and estuary waters inland along with deposition of fine-grained material transported by the sea and River Humber, with the Lincolnshire Marsh being

characterised by the undulating topography of marsh and marine alluvium (Ellis et al., 2001). Around 4900 BC, near the end of the Mesolithic, the coastline moved inland and is modelled approximately 55 m to the northeast of the Site boundary (Green, 2011: Figure 2). The BGS (2023) mapping indicates a relic inlet crossing the site from roughly west to east. This feature would have opened into the estuary and is recorded as being infilled with Holocene (12,000 years ago – present) tidal mudflat deposits (clay, silt, sand, and peat). The proximity of the coastline in combination with an inlet feature would have placed the Site in a prime position for access to the estuary and its coastal wetland; resources from which would have been extremely important to a hunter gatherer society. It is likely that the drier parts of the site, outside of the inlet, were a similar woodland mix of oak elm and hazel to that previously recorded in the area for this period (Metcalfe et al 2000) but that saltmarsh, reedswamp and fen conditions were likely during this time within the inlet and lower lying areas to the east, as found in other parts of the Humber Estuary (Ridgway et al., 2000). The evidence of another minor watercourse 1-2km from the current Site may provide a comparable sequence to those sampled on Site (Allen Archaeology, 2013).

5.4 The coastal and intertidal limit reconstructions for *c*. 3900 BC (Green, 2011: Figure 2), in the mid Neolithic, place the Site between the coastline and the intertidal limit and so according to this model the area would have been inundated daily. However previous archaeological investigations on the site revealed early Iron Age and late Iron Age / Romano-British rural, pastoral settlement on the edge of the inlet, which suggests a later inundation. Although, the pottery evidence does suggest a hiatus in the mid to late Iron Age and this may be to do with changing flooding patterns, this does not fully explain the differing evidence. As such, this suggests that the modelled coastlines do lack some detail in the vicinity of the Site. Despite this, due to the changing relationship with the coastline through the Holocene, the sequence on Site is likely to reflect transitions between terrestrial and intertidal conditions, as well as potentially marine conditions but these would be associated with an inward coastline movement that occurred after the late Iron Age / Romano-British period.

5.5 The sequence is likely to reflect influence of freshwater alluvial deposition from the Humber, particularly following periods of deforestation which would have increased runoff and erosion. Intertidal sediments and remnants of coastal marshland development are likely to be prominent. Historic warping and land reclamation is known in the area, thus an upper deposit reflecting this is likely to be seen blanketing much of the site. The Later Holocene landscape is expected to be of open grassland and fringing woodlands, alongside cereal cultivation and salt production (Ellis et al., 2001).

6 RESEARCH AIMS AND OBJECTIVES

6.1 Geoarchaeology is the application of earth science principles and techniques to the understanding of the archaeological record (HE, 2015a). It involves the examination of sub-surface deposit sequences, through coring or exposed sections, in order to identify Site formation processes or landscape features of archaeological interest. Deposit models are often employed in geoarchaeology, these are conjectural maps and cross-sections used to investigate the archaeological significance, potential impact, or accessibility of buried deposits (HE, 2020). Geoarchaeological approaches often form part of a wider programme of archaeological investigation.

6.2 The standards set out by the Chartered Institute for Archaeologists for archaeological field evaluation (CIfA, 2020) apply to geoarchaeological evaluation, and the purpose of such is:

- To 'determine, as far as is reasonably possible, the nature of the (geo)archaeological resource within a specified area using appropriate methods and practices.'
- To be 'a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of (geo)archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site…. If such archaeological remains are present field evaluation defines their character, extent, quality and preservation, and enables an assessment of their worth in a local, regional, national or international context as appropriate.'
- But the (geo)archaeological resource should not be 'needlessly disturbed or damaged or inappropriate or excessive cost incurred' when evaluation is undertaken in support of a planning application.

6.3 Archaeological evaluation should enhance previous work and provide sufficient information upon which to base effective decisions concerning mitigation. Therefore, an evaluation can highlight the need for further WSIs and archaeological work to fulfil planning conditions.

6.4 The overall objective for the boreholes, deposit modelling and any subsequent on Site works or off Site palaeoenvironmental assessment is to evaluate the archaeological and palaeoenvironmental potential and likely significance of the deposits present, so that the impact of the development can be understood, and informed decisions made regarding appropriate mitigation. As part of this overarching objective and in order to fulfil the general aims, the specific objective of these works at the Site are defined as:

- To monitor the geotechnical investigations and obtain geoarchaeological boreholes, to observe and record the deposit sequence and its distribution across the Site and provide samples for palaeoenvironmental assessment.

6.5 The general aims of the investigation at the Site are defined as:

- To obtain geoarchaeological boreholes, in order to observe and record the deposit sequence and its distribution across the Site and provide samples for palaeoenvironmental assessment.

- To determine the distribution, depth, character, date, condition, and significance or the deposit sequence.
- To determine the palaeoenvironmental potential of the deposits encountered.
- To determine the depth of modern overburden.

6.6 The specific research questions of the investigation at the Site are defined as:

- SRA1: To understand what the deposit sequence on the Site reveals about the evolution of the proposed river/tidal inlet that enters the site, and how the feature and its foreshore environment relate to the wider Humber estuary context.
- SRA2: To determine extent, location, and limits of the river / tidal inlet so far as it possible.
- SRA3: To determine if the deeper fills of the river/tidal inlet provide potential for the preservation of a long sequence of palaeoenvironmental remains, and over what period might this span.
- SRA4: To determine if the shallower marginal fills of the river/tidal inlet provide potential for the preservation of palaeoenvironmental remains that may enable reconstruction of the potential time of transgression inundation of the landscape, the development of the river/inlet, relative sea level rise, and the inlets eventual silting up.
- SRA5: To determine if the palaeoenvironmental remains have the potential to provide indirect evidence of adjacent prehistoric to Roman human activity and settlement, and specifically the periods and nature of any human exploitation of the inlet and associated foreshore.

6.7 The overall objective for the boreholes, deposit modelling and any trenching and palaeoenvironmental assessment is to evaluate the archaeological and palaeoenvironmental potential and likely significance of the deposits present, so that the impact of the development can be understood and informed decisions made regarding appropriate mitigation.

7 METHODOLOGY

Origin and Purpose of Deposit Modelling in Archaeology

7.1 AOC's geoarchaeological methodology followed the previously produced WSI covering this work and will conform to best professional practice as summarised in the appropriate Chartered Institute for Archaeologists Guidelines for Evaluation (CIfA, 2020) and Historic England's guidelines for geoarchaeology (HE, 2015a and HE, 2020).

7.2 The purpose of a geoarchaeological deposit model as outlined by Historic England (HE, 2020) is to:

- identify areas of low or high archaeological potential
- avoid blanket evaluation coverage and inform appropriate mitigation strategies
- aid communication with construction professionals
- facilitate palaeoenvironmental reconstruction

7.3 The character and distribution of past human activity can be better understood through the consideration of the past landscape or environmental context. Such an approach is often required by archaeological advisors and the local planning authority on floodplains where the deposit sequence can vary from thin alluvium or peat, with shallowly exposed ancient land surfaces, to complex and thick sequences of interchanging alluvium and peat, covering deeply buried ancient land surfaces.

7.4 The topography and nature of the ancient land surface during the early Holocene, the current geological epoch and equivalent to the early Mesolithic (*c*. 11,500 BP or 10,000 BC), is dictated by and inferred from the surface of the Pleistocene superficial deposits (e.g. brickearth, gravel, and till from the previous epoch) and older solid geology (e.g. mudstone or chalk). Overlying the Pleistocene – or older – deposits, Holocene alluvium may preserve palaeoenvironmental evidence (e.g. pollen, diatoms, ostracods) of landscape development, from local channel migration and vegetation change to regional effects of climate and RSL change. In combination, likely preservation of palaeoenvironmental remains and deposit data (e.g. depth and character) provides a comparative framework to assess archaeological potential. Peat represents vegetated and waterlogged landscapes (e.g. marshland) which developed, within local or regional fluctuations of hydrology. The anaerobic and acidic conditions of the deposit are particularly conducive to organic preservation. Palaeoenvironmental remains from floodplain deposits, especially peat, provide information on the nature and timing of environmental change and the interplay with past human activity (HE, 2015a; HE 2015b).

7.5 Modelling software (Rockworks & ArcGIS) is often used to create two and three-dimensional deposit models of the buried topography and overlying strata on the site. The data used may be readily available British Geological Survey (BGS, 2023) geological information, recent geotechnical data from the client, or data past archaeological investigations. The depth and distribution of the various deposits is mapped in schematic cross-sections (transects) or plan, showing the elevation (Digital Elevation Model, DEM) or thickness (Isopach), of deposits or stratigraphic units. The model often culminates in schematics maps showing areas of archaeological potential.

Sondages in Archaeological Evaluation Trenches

7.6 During archaeological evaluation trenching, it was agreed that in order to expose the full Holocene sequence to the surface of the glacial till deposits, sondages would be excavated at each end of the trench where possible. In some trenches, additional sondages were excavated in the centre. A total of 33 sondages were excavated.

7.7 The sondages were excavated in increments to enable identification of features throughout the sequence, using a 360° mechanical excavator fitted with a toothless bucket. Excavation was undertaken under the supervision of a suitably experienced and qualified archaeologist.

7.8 Due to the depths of the sondages, they were not safe to enter and were recorded from trench edge, including photographs, sketch sections, and written deposit descriptions. However, if archaeological features were encountered at depth, trenches were stepped where possible to create a safe working area.

Onsite Borehole Evaluation

7.9 Eleven purposive borehole locations approximately 100 mm in diameter were drilled across the Site (Figure 4 and Figure 5, WS1-11). Fourteen locations were proposed, however due to the wet ground conditions during the works, it was not possible to complete the full quantity and WS12-14 were descoped as result of poor access for the drilling rig across the boggy land. Nine of those which were drilled were also relocated due to standing water and poor conditions. The core samples were retained. Any changes to the WSI were made in agreement with the local archaeological advisor for North Lincolnshire, Alison Williams. Boreholes were drilled by a windowless sample rig under the supervision of a geoarchaeologist. Where appropriate, service pits (approximately 300 mm x 300 mm) were hand-dug to c 1.2 m at each location, and the holes CAT-scanned for live services at regular intervals by the sub-contractor or by AOC during this process.

7.10 Continuous samples were collected through the alluvial deposits down to *c.* 6 m bgl or the surface of the underlying pre-Holocene drift/solid geology, whichever was encountered first. The cores recovered were undisturbed 0.45 m to 1.5 m long plastic tubes, roughly 100 mm diameter. The cores were retained. The borehole locations were surveyed in by the AOC contractor, with each position located to a six-figure national grid reference, and the elevation measured to metres above ordnance datum.

7.11 On Site or back in the AOC laboratory, the geoarchaeologist photographed and logged the Holocene sediments revealed in the boreholes according to standard geological criteria (Jones et al., 1999; Tucker, 2003). Preliminary interpretation of the deposit sequence sampled in the cores was made in order to produce an overview of the lithology that characterises the stratigraphy and identifies formation processes.

7.12 The borehole cores were adequately sealed and labelled and stored in the AOC laboratories controlled storage for use during the subsequent stages of the project. As a general rule, cores have a shelf life limited to 3-4 years.

Construction of the Deposit Model

7.13 In order to create the deposit model, the geotechnical data was entered into a digital database (Rockworks 20). Any recent geotechnical logs supplied by the client or previous archaeological work onsite were given the prefix ‘CP’ for cable percussion, ‘RT’ for rotary, ‘WS’ for window

samples, 'AH' for auger holes, 'TP' for test pits, or 'TR' for trenches. BGS logs (BGS, 2023) added to the database were given a prefix relating to the two-letter grid square of its national grid reference e.g. TQ. Data points were included in the deposit model as representative deposit sequences from sections from each of the evaluation trenches (AOC, 2023). A total of 118 sedimentary logs were included in the deposit model. The distribution of this data set is presented in Figure 3 and the data references for the sedimentary logs are presented in Appendix A. The numbers of each type are:

- BGS historic deposit data (BGS 2023): 12
- Client supplied GI/SI data: 58
- AOC deposit data: 48

7.14 Each lithology type (gravel, sand, silt, clay etc.) was given a unique colour (primary component) and pattern (secondary component) enabling visual correlation of the sediment components of deposits across the site. By examining the relationship of the lithology types (both horizontally and vertical) in preliminary and iterative transects, correlations can inform the site-wide deposit groups. The grouping of these deposits is based on the lithological descriptions, which represent distinct depositional environments, coupled with a wider understanding of the local geological sequences. Thus, a sequence of stratigraphic units ('facies'), representing certain depositional environments, and/or landforms can be reconstructed both laterally and through time.

7.15 Inverse distance weighted (IDW, weighting =2, number of points =12) digital elevation model (DEM) and thickness (Isopach) plots were produced for key deposits (i.e. units defining major changes in the environment and modes of deposition) and surface horizons. These highlight major features of the topography through time. In this respect, the most common surface plot depicts the surface of the Pleistocene (or older) deposits (Figure 10) gives an approximation of the topography of the Site as it existed at the beginning of the early Mesolithic period c 10,000 years ago. The development of the Holocene floodplain is likely to have been influenced by the topography inherited from the Pleistocene/Late glacial period. This surface would have dictated the course of later channels, with gravel high points forming areas of dry land within the wetlands, and lower lying areas forming the main threads of later channels. Many of the additional surface or thickness plots are more representative of deposit survival than time-specific landscapes (Yendell, 2020).

7.16 The overlying deposit sequence across the Site depicted by the stratigraphic units, as representative of specific depositional environments and/or landforms laterally and through time for the Site and immediate vicinity, is illustrated in profile or transect form (Figure 6 to Figure 9). Such transects present a straight-line correlation between the data points, extrapolating the stratigraphic units identified within each borehole.

7.17 By examining the surface and thickness plots in combination with the vertical deposition shown in the transects areas of archaeological potential can be mapped (Figure 18). These characterise the differing geoarchaeological and archaeological potential and significance of single stratigraphic units, deposit sequences containing multiple stratigraphic units, or specific landforms and depositional environments.

8 DEPOSIT MODEL

8.1 The results of the evaluation are presented in Appendix A which contains the data references for the whole deposit model, Appendix B which contains the data references for within the site with indications whether these reached Pleistocene deposits and at what depth, Appendix C containing the borehole deposit logs, Appendix D containing the sondage deposit logs, and Appendix E containing some trench deposit logs.

8.2 Nine stratigraphic units have been identified across the site. These units are summarised in Table 2 below and listed in stratigraphic order from the oldest to the most recent. The vertical deposit succession is illustrated on the transect(s) drawn across the Site (Figure 6 to Figure 9). The major stratigraphic units are also represented by surface and/or thickness plots (Figure 10 to Figure 17).

Table 2 Summary of identified stratigraphic units (subdivision of the Holocene based Walker et al., 2012)

Stratigraphic unit (facies)	Lithology/Description	Chronology	Environment of deposition
Burnham Chalk Formation	White, thinly bedded chalk with flint bands and sporadic marl seams.	Cretaceous (Turonian to Santonian Age, 93.9-83.6 million years ago)	Sedimentary seabed formation
Pleistocene Till	Red, brown, and grey, stiff, chalky and gravelly, generally sandy clay.	Devensian, Late Pleistocene (*c.* 33,000-12,000 years ago)	Glacial conditions, beneath or adjacent to glacial ice
Glaciofluvial Deposits	Sand and gravel overlying till	Devensian, Late Pleistocene (*c.* 33,000-12,000 years ago)	Peri-glacial conditions, high velocity meltwater driven deposition
Lower intertidal deposits	Primarily blue, brown, and grey silt, clay, and sand. Often laminated. Generally soft.	Early Holocene / Greenlandian (c 11,650–8,276 BP/ 9,700–6326 BC)	Low lying estuarine and peri-marine deposits.
Holocene Organic deposits	Peat, and organic silt, clay, sand	Mid Holocene / Northgrippian (c 8,276 – 4,200 BP/ 6,326 – 2,250 BC) to Late Holocene / Meghalayan (c 4200 BP/2250 BC onwards)	Temperate wetland development within a peri-marine to floodplain environment
Redeposited till	Stiff clay, generally with sand and very small chalk inclusions. Red, grey, and brown. Overlies organic and intertidal deposits.	Mid Holocene / Northgrippian (c 8,276 – 4,200 BP/ 6,326 – 2,250 BC) to Late Holocene / Meghalayan (c 4200 BP/2250 BC onwards)	Uncertain. Temperate floodplain deposit.
Upper intertidal deposits	Primarily blue, brown, and grey silt, clay, and sand. Often laminated. Generally soft. Overlies redeposited till or organic deposits.	Late Holocene / Meghalayan (c 4,200 BP/ 2,250 BC onwards)	Low lying estuarine and peri-marine deposits. Intertidal deposits overlying redeposited till or Holocene organic deposits.

Holocene alluvium / warp	Grey and brown, firm to stiff, clay and silt. Occasionally with stone inclusions.	Late Holocene / Meghalayan (c 4,200 BP/ 2,250 BC onwards). Potentially 17th C onwards (warp).	Low lying temperate floodplain deposits or reclamation for agriculture of low-lying land.
Topsoil and made ground	Mid to dark brown / grey clay, silt, sand, and redeposited material of local origin with additional modern inclusions (CBM, ash, coal, chalk etc)	Post-medieval to modern (19th Century AD onwards)	Reclamation / agriculture.

Burnham Chalk Formation

8.3 The chalk bedrock is generally described as a heavily weathered in the upper portion of the unit, comprising structureless clayey, sometimes sandy, chalk with flint gravel.

8.4 Of the 118 datapoints included within the deposit models, only 13 reach the chalk bedrock, 4 of which are within the Site boundary (Geotechnics22_BH01, BH02A, BH05, and TA11NE48). Due to the great depth of the chalk bedrock across the Site and wider area it is not presented within the figures in order to allow them to more informatively illustrate the later deposits of greater interest.

8.5 Across the majority of the modelled area, its surface resides between approximately -24 to -10 m OD (c. 14 to 65.5 m bgl). Within the Site boundary, it is found to be closer to the upper range, generally between *c.* -14 to -13 m OD (*c.* 17.5 to 19 m bgl). Approximately 800 m to the southeast of the Site boundary, it falls to *c.* -60 m OD (c. 65.5 m bgl) (TA11NE273, Figure 5) which may represent a glacial erosional feature, such as a kettle hole.

Pleistocene Glacial Till

8.6 The till has been described as a mixed deposit comprising stiff, often sandy clay, and in most interventions includes frequent gravel of chalk, flint, and occasionally coal. Inclusions of rootlets are often noted at the surface of the deposit. It is generally red-brown to grey-brown in colour, and occasionally brown or yellowish brown.

8.7 Glacial till or earlier Pleistocene deposits are recorded among 78 deposit logs. Of these, 45 are within the Site boundary. As only 13 interventions reached through the full extent of the till to the bedrock across the full modelled area, the thickness of till is also only recorded at the same number of locations. It is recorded at up to c. 70 m thickness, to the southeast of the Site infilling the area of low bedrock surface at TA11NE273 (Figure 5). This further suggests the presence of a feature such as a kettle hole here.

8.8 Within the Site boundary, the full thickness of the till is only recorded at four locations (Geotechnics22_BH01, BH02A, BH05, and TA11NE48) where bedrock is reached. At these locations, the thickness of the till is between 14.94 and 15.8 m. As this is only a small proportion (5%) of the total interventions within the Site (80), it may not be representative.

8.9 A topographic plot of the surface of the till (and glaciofluvial deposits) is presented in Figure 10, and is taken as being representative of the land surface at the start of the Holocene, c. 10,000 BC. The surface of the till (Figure 10) has been encountered between approximately -5 and 6 m OD (0 to 9 m bgl) across the modelled area. Within the Site boundary, it lies within the range of *c.* -0.5 to 3.5 m OD (c. 0.1 to 4 m bgl), the lowest of these values recorded in the eastern centre of the Site

(AOC53122_WS5, Figure 7). Towards the estuary to the east, the surface elevation falls, and to the north, west, and south, generally rises.

Glaciofluvial Deposits

8.10 Deposits of sand with gravel representative of the routes of glacial meltwater associated with the Late Pleistocene are recorded on site. They are generally recorded as being brown, yellow, or orange in colour, and overlie the glacial till.

8.11 Glaciofluvial deposits have been recorded at 11 locations across the modelled area, 5 of which lie within the Site boundary (e.g. AOC53122_WS10 on Figure 6, and AOC53122_Tr20 on Figure 8, and AOC53122_Tr27).

8.12 The deposits reach up to approximately 0.3 m in thickness within the Site and have been recorded in three discrete locations. These are mapped in the north of the site (e.g., Geotechnics22_CPT14, AOC53122_Tr9), and within the modelled inlet at the western end (AOC53122_Tr20) and on the southern edge (AOC53122_Tr24). These border the area of lower till surface beneath. External to the site, these deposits reach up to *c*. 4 m in thickness to the northeast (e.g. TA11NE116, Figure 5), adjacent to the modern Humber channel.

8.13 The deposits are encountered between 0.2 and 3.15 m bgl within the Site boundary. Their surface is further discussed below, in conjunction with the surface of the glacial till.

Surface of Pleistocene Geology

8.14 This section discusses the combined surface of the Pleistocene till and glaciofluvial deposits, the individual deposits of each having been discussed separately above.

8.15 The surface of the glaciofluvial, till, and earlier deposits has been produced using data points from both the till and glaciofluvial deposits (Figure 10). The upper surface of this material represents the likely land (ground) surface at the beginning of the Holocene, approximately 12,000 years ago, and within the wider region currently sits at between *c*.-4 and 3.5 m OD (*c*. 9 and 0.1 m bgl).

8.16 The surface plot illustrates a general downward slope, of this surface, across the Site towards the Humber (east), illustrated by Transects A and B (Figure 6 and Figure 7), but also toward the southwest at the junction of the A160 and Eastfield Road (TA11NE108 and TA11NE110) - illustrated in Transect A (Figure 6).

8.17 Within the Site boundary, this surface is recorded between approximately -0.5 and 3.5 m OD (4.26 and 0.1 m bgl). The lower depths noted are present primarily in the central to northeastern parts of the site. This very likely indicates a relict coastal inlet which has been infilled throughout the Holocene period (Figure 10). The inlet is illustrated in Transects A-D (Figure 6 to Figure 9). The southwestern extent is shown in Transect A (Figure 6), and the northwest-southeast extents illustrated in Transects B-D (Figure 7 to Figure 9). In conjunction with the thickness plots for overlying Holocene deposits, this surface has contributed to the modelling of the inlet depicted in Figure 21.

Lower Intertidal Deposits

8.18 Lower intertidal deposits are described as comprising primarily clayey and sandy silt with inclusions of organic material, and occasionally shell fragments, as well as occasional rounded stones. This unit represents initial inundation of the lower parts of the previously dry land surfaces as a result of

post-glacial RSL rise.

8.19 The deposits are recorded among 33 of the datapoints included in the models.10 of these are within the Site boundary, with 1 additional intervention approximately 32 m beyond the Site boundary to the east (TA11NE9).

8.20 Within the site, the deposits reach up to approximately 1.6 m in thickness (e.g. AOC53122_WS5, Figure 7, Figure 9, and Figure 11). These are located in the probable inlet, within the area of lowest Pleistocene surface elevation. From here, they are shown to extend throughout the areas which were likely of lower elevation at the beginning of the Holocene (Figure 10) below *c*. 1.5 m OD.

8.21 Outside the Site boundary, the unit continues towards the modern Humber, reaching up to approximately 3.25 m in thickness to the southeast of the site. This area of thick lower intertidal deposits is illustrated by Transect B (Figure 7, TA11NE208).

8.22 A topographic plot has been generated for the surface of the lower intertidal deposits (Figure 12). It depicts a surface between *c*. -2 and 3.5 m OD across the wider area (approximately 0.5 to 6 m bgl), illustrating that only the lowest areas of the Pleistocene surface were infilled, with an elevation increase here of *c*. 2 m.

8.23 Within the Site boundary, the surface of this unit is modelled between approximately 0.5 and 3.5 m OD (*c*. 0.5 and 3 m bgl). The highest area of this surface is located to the north of the inlet (Geotechnics22_CPT18), and the lowest toward the southeastern corner of the Site within the inlet (Getechnics22_BH05).

Holocene Organic Deposits

8.24 Organic deposits comprising peat, or organic clay/silt/sand, are recorded among 28 data points within the modelled are. Of these, 2 lie within the Site boundary (Geotechnics22_SPT15 and BH05). The deposits are not recorded as comprising peat within the Site boundary, instead comprising organic clay with pockets of organic material, decayed roots, and occasional gravel. Further organic clay horizons are noted within the Site, though due to their distribution and thickness are not represented in the modelling. They may indicate localised, short term wetland conditions, or erosion of more significant deposits. Future deposit modelling may illustrate these deposits more clearly.

8.25 Figure 13 illustrates the thickness and distribution of organic deposits within the Site and its wider surrounding area. Within the Site boundary, these organic deposits reach up to 1.3 m in thickness (Geotechnics22_BH05), although these are not recorded in the adjacent interventions (Appendix D – Sondage Deposit Logs: AOC53122_Tr29N, Tr29S, Tr33)) as fully formed organic deposits, rather as thin horizons of organic clay. These thicker deposits (Geotechnics22_BH05) were encountered between approximately 0 and 1.3 m OD (*c*. 1.2 to 2.5 m bgl). Their location is also illustrated within Transect D (Figure 9). To the north of the inlet (e.g., Geotechnics22_CPT15), the unit is recorded at only 0.1 m in thickness, between 1.2 and 1.3 m bgl (2.85 to 2.75 m OD), which is comparable to other records of organic clay on this northern edge (Appendix D – Sondage Deposit Logs: AOC53122_Tr10, Tr12N, Tr12S). These do not appear separately in the thickness plot (Figure 13), due to their minimal thickness and distributed spacing. However, the lowest value interval encompasses deposits of thickness between 0 and 0.25 m, thus includes these deposits and represents the potential for these discontinuous organic clays to survive variably beyond the interventions at which they have been recorded. Future palaeoenvironmental work and modelling

may be able to define the incidence of contemporary organic horizons more clearly.

8.26 From the figures, it is possible to ascertain that these deposits (Figure 13) have formed on the slope of the underlying Pleistocene surface (Figure 10), above the extent of the lower intertidal deposits (Figure 11). The Pleistocene surface on which they have formed lies between approximately 0.5 to 1.5 m OD (Figure 10, Figure 12), or 1.4 to 2.5 m bgl.. Possibly relating to saltmarsh development, these areas would likely have been marginal to the lower lying more regularly inundated parts of the landscape. Based on the reconstructions of Van der Noort et al. (1993), which places Bronze Age sea level at 0 m OD and rising in the Lincolnshire Marsh region, it is most likely that development of these organic deposits between approximately 0.5 to 1.5 m OD are of Bronze Age or later. The deposits, due to their varying elevations and distribution across the site, may be of different dates. The age of these deposits cannot be confirmed until dates are acquired from the samples. Such marginal, ecotonal zones, between dry land and wet environments would have encouraged the development of wetland vegetation and faunal communities providing rich and valuable resources to past human communities. These environments can also provide good preservation for paleoenvironmental remains.

8.27 Thickness plot (Figure 13) illustrates more a substantial formation of organic deposits occurred towards the Humber, to the northeast and southeast of the Site. Transect A (Figure 6) illustrates the organic formation to the northeast of the Site boundary (AA13_E10, Allen Archaeology 2013), which have been recorded between approximately 0.5 to 1 m OD. Transect B (Figure 7) shows those to the southeast (TA11NE208), between *c*. -1 to -0.5 m OD.

8.28 A topographic plot has not been produced to represent the surface of the organic deposits. This is because their discontinuous and predominantly thin nature result in a plot which, for the area within the Site boundary, is broadly the same as that of the underlying lower intertidal deposits (Figure 12). Such a plot does not add value to the deposit model report.

Redeposited Till

8.29 Deposits of stiff, slightly sandy clay with small fragments of chalk, which are similar to those of the basal till, occur between intertidal and organic deposits. These have been interpreted as redeposited till, perhaps deposited in a short high energy event, such as a storm, and rapidly drained to produce firm deposits. They have been identified among 7 locations within the modelled area, 1 of which is within the Site boundary. This location (TA11NE48) is within the lower area of the inlet. The deposit is 0.31 m thick, with surface elevation of approximately 1.5 m OD (2.74 m bgl).

8.30 Late-Holocene anthropogenic deforestation resulted in changes to surface runoff and riverine related sediment erosion and accumulation patterns (Beckett, 1981; Buckland and Sadler, 1985). In addition, Significant storm events have previously been recorded along the Lincolnshire coast (Green, 2015), with their effects potentially exacerbated by significant increases in land reclamation (Waller and Kirby, 2021), and resulting reduction of the landscape's resilience to tidal flooding (Metcalfe et al., 2000). Whether deforestation or reclamation/flooding can be directly related to this unit, as well as the Upper Intertidal Deposits or the possible Warp (see below), is not currently known.

Upper Intertidal Deposits

8.31 Upper intertidal deposits were identified among 35 datapoints, all of which are external to the Site,

to its northeast. Similar to the lower intertidal deposits, they comprise primarily silt with clay or sand, and were often laminated. Smaller organic components are frequently noted.

8.32 Although not recorded within the site, their distribution (Figure 14) illustrates the regression of intertidal influence within the area. The depositional trend suggests a significant amount of deposition, and period of time, may have occurred between the lower intertidal deposits and the deposition of alluvium or warp above. Holocene upper intertidal deposits are recorded with a thickness of up to *c*. 5m (TA11NE116) external to the Site, to the northeast adjacent to the Humber. These gradually become thinner towards the Site, and do not extend into the boundary. Approximately 270 m to the northeast of the boundary, they are recorded with a thickness of *c*. 1.5 m (AA13_E10).

8.33 A surface plot (Figure 15) has been generated to illustrate the local topography prior to any later natural inundation or anthropogenic warping practices. It reflects the surface of sedimentation predating alluvium / warp and made ground. This includes Pleistocene geology (till and glaciofluvial deposits), lower intertidal deposits, redeposited till, and Holocene organics, as well as the upper intertidal deposits to the northeast. The surface of these deposits is recorded between approximately -1.5 and 4 m OD (0 to 4.57 m bgl). Within the Site boundary specifically, this range is between *c*. 0.5 and 3.5 m OD (0.5 to 3.7 m bgl) The surface is generally higher towards the north of the modelled area, with low areas to the southwest and throughout the eastern side.

Holocene Alluvium / Warp

8.34 Warp is generally considered to represent a relatively recent, historical practice of intentionally opening or breaking flood defences to allow farmland to be inundated by river/estuary floodwater, encouraging the deposition of agriculturally rich deposits on farmland. It can be difficult to distinguish between Holocene alluvium and warp deposits, as each comprise fine-grained, minerogenic, water lain material. This unit is recorded as comprising clay and silt, with occasional small stones. It is commonly brown and grey in colour, and firm to stiff. The strength of the deposits suggests rapid drainage to have occurred, supporting a warp interpretation.

8.35 The deposits are recorded among 94 of the interventions included within the models. A total of 62 of these are located within the Site boundary. These are predominantly across the southeast of the Site, although extend across the full extent. This distribution reflects the underlying topography, infilling the areas of lower elevation.

8.36 A thickness plot has been generated (Figure 16) to illustrate the distribution and survival of this deposit. The deposits reach up to *c*. 2.5m in thickness, immediately southeast of the Site boundary (TA11NE8). Within the site, they reach up to 3.05 m in thickness (e.g. AOC53122_Tr23S), within the lower area of the inlet towards the centre of the site. Along the northwestern edge of the Site this unit is thinnest, reaching up to 0.5 m over the higher surface below (e.g. AOC53122_Tr3-Tr5, AOC53122_Tr9, Tr11, Tr15C, Tr17).

8.37 The concentration of probable warp deposits among the lower areas results in a levelling of the overall surface. It is recorded between approximately 2 and 3.5 m OD (0.05 and 1.78 m bgl), although across the majority of the Site this is between 2.5 and 3 m OD.

Topsoil and Made Ground

8.38 Made ground within the Site generally comprises chalk rubble, with a very poorly sorted matrix

ranging from clay to gravel. Topsoil is recorded above and below made ground, as well as independently from any made ground. Topsoil on the Site is generally of clay to sand, and dark brown in colour.

8.39 Topsoil and Made ground of Victorian to modern origin are present across 111 interventions. Records of made ground are predominantly identified across the northwestern edge of the Site, although sparsely distributed interventions in the southeast also record made ground. In total, these amount to 32 records encountering made ground within the Site boundary. 60 interventions encountered topsoil within the Site, and these are more evenly distributed.

8.40 A thickness plot (Figure 17) has been generated to illustrate the potential areas of modern disturbance and truncation of underlying geology. Within the modelled area they reach up to *c*. 5m in thickness, in the southwest (TA11NE7) and southeast (TA11NE208), associated with industrial processing facilities.

8.41 Within the Site boundary this unit exceeds *c*. 1m thickness in only two areas in the north and northwest (e.g., AOC53122_Tr2-Tr5, Geotechnics22_CPT15, CPT19, AOC53122_Tr14, Tr17, Geotechnics22_BH02A), suggesting much of the sites underlying geology likely remains largely in situ and undisturbed. However, where the deposits are thinner coincides with less significant warp deposits along the northwestern Site boundary. This suggests those pre-dating the warping process to be more likely to have been impacted by modern disturbances here.

Deposit Model Reliability and Limitations

8.42 Within the Site boundary, there are 79 data points (Appendix B – Deposit data within the Site Reference and Pleistocene Surface Summary) which are very well spaced from one another to provide very good coverage for modelling the area.

8.43 Of the 79 interventions in the deposit model situated within the Site boundary, 61 reached the Pleistocene surface therefore obtaining records of the full Holocene sequence (Appendix B – Deposit data within the Site Reference and Pleistocene Surface Summary). These points are well spaced throughout the site, offering full Holocene records for much of the Site area.

8.44 Outside the Site boundary, however, the 45 datapoints are generally sparsely distributed and not within close proximity to each other, thus resulting in skewed models around the Site boundary. The majority of the external datapoints are located to the northeast of the site, towards the estuary, thus resulting in high confidence in the models in this direction external to the Site. To the northwest, west. and south, there is an absence of datapoints. To the southwest and southeast there are very few datapoints. Those which are located to the southwest and southeast are also located a significant distance from the boundary (>500 m).

8.45 Overall, given the above the models can be regarded with high confidence. This is particularly true of the model of the deposits within the Site boundary. Towards the edge of the Site boundary, and then beyond it, the models may become somewhat skewed by the irregular distribution of datapoints.

9 ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL POTENTIAL

Wider context – Late Glacial to Late Mesolithic

9.1 Records from the investigation indicate the Site lies within a dynamic environment influenced by estuarine, coastal, and intertidal processes within a trend of rising RSL. The sequences represent rapidly changing Holocene depositional conditions within the site, underlain by Pleistocene till deposits.

9.2 RSL rise during the early Holocene (*c*. 11,700 to 8200 BP) within the region was in excess of 7mm per annum (Waller and Kirby, 2021), bringing intertidal and coastal influence rapidly further inland in cycles of more rapid rises of sea level versus slowing or lowering of sea and river levels. During this time the resulting deposits in the Lincolnshire Marsh area were mostly Mesolithic and Neolithic peats, fringing the higher drier coastal ground.

9.3 After the retreat of Glacial conditions and prior to c. 5500 BC the Lincolnshire Marsh was predominantly defined by the undulating surface of the glacial till, and this is likely the case for the Site over this period. According to Green's (2011) mid to late Mesolithic coastal and intertidal limit (Figure 2, *c*. 5900 BC) the coastline moved, from its previous position some 35km seaward, inland to c. 1.5km from the Site. The topography on Site that later defines the inlet crossing the site may have been incised during this period by late Glacial run off of meltwaters and early Holocene freshwater channel activity common for this period (Metcalfe et al 2000). Palaeoenvironmental records from the Humber Estuary indicate that during this period of low RSL the vegetation is generally birch and pine dominated woodland through to mixed woodland of oak, pine, elm and hazel, as birch then declined (Metcalfe et al 2000). Archaeological features uncovered during the evaluation included numerous small quantities of material indicative of early prehistoric activity.

Wider context – Late Mesolithic to Neolithic

9.4 Around 4900 BC, near the end of the Mesolithic, the modelled coastline moved inland closer to the Site, c. 55 m to the northeast of the Site boundary (Green 2011, Figure 2). The proximity of the coastline would have placed the Site in a prime position for access to the estuary and its coastal wetland; resources from which would have been extremely important to a hunter gatherer society. It is likely that much of the Site remained dry land with a woodland mix of oak elm and hazel (Metcalfe et al 2000) but that saltmarsh, reedswamp and fen conditions were likely during this time on lower lying areas to the east (below 0 to -1m OD), as found in other parts of the Humber Estuary (Ridgway et al., 2000).

9.5 Green's (2011) modelling of the coastline also indicates that the coastline moved further inland, by c. 3900BC, placing the whole Site within the tidal flood zone at this time (Figure 2 and Figures 18 - 19), situated between the coastline and intertidal limit. However, beyond the low-lying feature the sequence does not indicate the presence of significant marine derived sediments at a sufficiently low elevation (below 0 m OD) within the Site and Green's model may require more detail concerning the elevation and dates of cycles of rising RSL in the vicinity of the Site to be fully applicable at the site level scale we are applying it.

Wider context – Bronze Age to Iron Age

9.6 Within depositional models for the Lincolnshire Marsh area the Bronze Age is characterised by rising water levels and phases of clay deposition indicative of salt marsh and reed swamp at or below 0m OD (Van de Noort et al., 1993). Such deposition may just begin encroaching into the very

lowest parts of the low-lying feature on the Site during this period. If the feature had, prior to the Bronze Age, been incised by surface run off or a freshwater channel, then by this time intertidal deposition and more of an inlet character would have been developing. The lowest deposit within the Site that is interpreted as being of Holocene origin comprises sandy clays, indicative of estuarine depositional conditions. Microcharcoal was identified within this lower deposit in monolith samples taken from the trench sections, and is suggestive of human activity in the wider region (AOC, 2023; and Appendix E - Soils and Sediments from VPI Immingham, Humber Zero Project: an assessment (AOC:53122) by Lynne Roy (AOC Archaeology Group)).

9.7 The investigation has highlighted the extent of the intertidal (between mean high water and mean low water level) deposits within the site, illustrating the developing coastal inlet (Figure 2 to Figure 21) reaching approximately 315 m inland from the modelled 4900 BC (Late Mesolithic) coastline (Green, 2011). The inlet is defined between *c*. 0 and 1.5m OD, modelled through interpretation of the character and elevation of the Pleistocene surface, combined with the presence of intertidal and organic deposits (Figure 21).

9.8 Considering the elevation of the low-lying feature on the Site (c. 0 to 1.5 m OD) and the previous evidence of a c. 0 m OD RSL during the Late Bronze Age (Van de Noort et al., 1993), it is assumed that proximity of the coastline to the Site is comparable to the 4900 BC (i.e. *c*. 55 m to the northeast of the Site, Green 2011, Figure 2). Providing the continued varied benefits of resource access for human communities that were mentioned above. However, it is likely that as more cycles of rapid or slower RSL rise developed, the height of tidal waters infilling the inlet and the associated minerogenic sedimentation increased.

9.9 Adjacent to the inlet, deposit records indicate a higher Pleistocene surface elevation (over 1.5 m OD) with only isolated organic deposits fringing the intertidal depositional sequence on the southeastern side of the inlet. This area of increased elevation may have shielded the southern banks of the inlet from high energy tides, allowing for the development of wetland derived organic deposits here.

Wider context – Iron Age to Roman

9.10 The upper stratigraphic sequence of the general model for the Humber Estuary indicates a sequence of transition from high salt marsh peat to intertidal sand flats, intertidal mudflats. The high saltmarsh peats and intertidal sand flats are not present on Site and are likely at lower elevation eastwards and seawards of the Site. However, expansion of the intertidal mudflats are indicated on Site by the Upper Intertidal Deposit, although without further paleoenvironmental investigation these will not be easy to accurately attribute to specific periods, particularly in respect to the date of the intertidal mudflats spreading across the site and the end to the dryland activity represented by the archaeology.

9.11 The early and late Iron Age settlement activity previously found on the site attests to the site not being in the intertidal zone by this period. During the Late Holocene and prior to any long-term flooding, the higher drier land of the area is expected to be open grassland and fringing woodlands, with associated cereal cultivation (Ellis et al 2001). Saltmarsh, reedswamp and fen conditions would have been likely during this time within the inlet and lower lying areas to the east of the Site, as found in other parts of the Humber Estuary (Ridgway et al., 2000).

9.12 A cluster of potentially Iron Age or early Roman features were recorded in the southeastern corner

of the Site. A concentration of late Roman features centred on a large rectilinear enclosure were recorded in the northwest of the Site. A ditched trackway and multiple ditches and gullies in the north of the Site suggest that land division associated with the enclosure may extend across other parts of the Site. These features appear to link directly with wider evidence for activity from these periods in the locality, much of it derived from cropmarks in the fields surrounding the Site (AOC, 2023).

9.13 In particular, within Trench 17 a ditch was hypothesised as a possible drainage or flooding defence feature at the edge of the coastal inlet protecting the area of activity on higher ground to the north. The ditch is also potentially a boundary feature marking the edge of the coastal inlet 'basin'. The ditch was sealed by a marine alluvial deposit 0.8m thick with marine shell inclusions. The marine alluvium was overlain by a mixed blue/grey alluvial deposit which in turn was. sealed by a yellow/brown hardcore made ground deposit.

9.14 Also, Trench 33 was located along the eastern boundary of the Site, close to the potential alignment of the coastal inlet. The basal deposits comprised diamicton till which was sealed by up to 0.25m of clayey gravels The gravels were overlain by alluvial deposits comprised of mixed, alternating layers of blue/grey clays with lenses of possible humic/organic material similar to the sequence identified to the north in Trench 17. In addition, Trench 33 contained nearby post hole features. The thin and poorly organic horizon sampled by monolith is described more fully in the evaluation trench report (AOC, 2023) and is also outlined in Appendix C.

9.15 The overall distribution of features places archaeological activity outside the modelled coastal inlet (Figure 21). Those which are located within the inlet may be of a date prior to the development of intertidal conditions and the coastal inlet, or later and cut into the surface of the intertidal deposits. To the north, Trenches 15, 16, and 17 record linear features interpreted as possible flood defence of demarcation of the boundary of the coastal inlet, as well as postholes and stakeholes which may be associated with structures. A ditch was also cut into the surface of the lower intertidal deposits in this area, suggesting a later date for this activity. At the southern edge of the inlet, Trench 33 records further postholes sealed beneath later flood deposits. The potholes are described as being similar in form to those within Trench 16, suggesting either association between the two sets of postholes or reuse of materials.

9.16 Widespread Late Holocene deforestation, similar to that evident in the pollen record at Butterbump (post 2480 BC +/- 90, Grieg 1982), likely drove an increase in the volume of sediment transported into the Humber Estuary, which combined with land reclamation and management practices greatly impacted the sedimentation of the region (Beckett, 1981; Buckland and Sadler, 1985; Waller and Kirby, 2021; Metcalfe et al., 2000; AOC, 2023). It is likely that deforestation or reclamation/flooding plays a part in the formation of the mid-late Holocene deposits found on the Site (i.e. Redeposited Till, Upper Intertidal Deposits or the possible Warp), whether this link can be directly illustrated in the palaeoenvironmental remains is not currently known.

9.17 The intertidal mudflats deposits are likely to be sealed on Site but an upper depositional phase of medieval an postmedieval intentional flooding of the area to improve soil conditions, known as warping (Metcalfe et al., 2000; Ridgway et al., 2000).

Realisation of the Research Aims

9.18 Drawing on the results presented in section 8, the following is concluded in relation to the evaluation

aims, objectives and research questions detailed in section 6:

- To obtain geoarchaeological boreholes, in order to observe and record the deposit sequence and its distribution across the Site and provide samples for palaeoenvironmental assessment.
    - Samples have been obtained from 11 geoarchaeological boreholes, including through intertidal sediments within the relict coastal inlet.
    - Monolith samples were also obtained from archaeological trenching within the Site to provide additional sampling material.
- To determine the distribution, depth, character, date, condition, and significance or the deposit sequence.
    - Discussed within Section 8.
- To determine the palaeoenvironmental potential of the deposits encountered.
    - Organic deposits recorded within the Site may present potential for preservation of palaeoenvironmental material such as pollen, plant macrofossils, diatoms, and ostracods. These can be used to indicate environmental conditions at the time of deposition.
    - Minerogenic deposits such as alluvium, intertidal deposits, or warp may also preserve these palaeoenvironmental proxies, though generally of lesser quality.
- To determine the depth of modern overburden.
    - Made ground on Site has been found to be more significant across the northern parts of the site, reaching over 1 m in thickness.

9.19 The specific research questions of the investigation at the Site are defined as:

- SRA1: To understand what the deposit sequence on the Site reveals about the evolution of the proposed river/tidal inlet that enters the site, and how the feature and its foreshore environment relate to the wider Humber estuary context.
    - The sequence indicates the presence of a relict inlet from the northeastern boundary of the Site into the centre. It is identified by the reduced surface elevation of Pleistocene geology overlain with intertidal deposits of clay to sand of up to 2.63 m in thickness.
    - The deposits indicate the foreshore to have been approximately 1500 m further inland during the early to middle Holocene period than the current position, with the inlet extending a further *c*. 200 m southwest.
- SRA2: To determine extent, location, and limits of the river / tidal inlet so far as it possible.
    - The inlet has been identified as extending approximately 315 m from the northeastern boundary of the site, with a width of up to *c*. 190 m.
- SRA3: To determine if the deeper fills of the river/tidal inlet provide potential for the preservation of a long sequence of palaeoenvironmental remains, and over what period might this span.
    - Minerogenic deposits within the inlet, directly overlying the Pleistocene till down to *c*. -1.43 m OD, provide potential for preservation and recovery of palaeoenvironmental remains, although with a lower quality than those within organic sequences. Assessment of the assemblage within the inlet deposits to determine the preservation quality as well as initial quantification and interpretation may reveal characteristics of the local and wider environment. Carrying this out through the sequence can highlight changes over time.
    - Assessing for macrofossils may also identify datable material to apply an accurate

chronological context for any palaeoenvironmental assessment results.

- SRA4: To determine if the shallower marginal fills of the river/tidal inlet provide potential for the preservation of palaeoenvironmental remains that may enable reconstruction of the potential time of transgression inundation of the landscape, the development of the river/inlet, relative sea level rise, and the inlets eventual silting up.
    - Thin organic deposits were identified on the edge of the inlet, within trenches 17 and 33 and have been sampled by monolith tin. The presence of organic, possible saltmarsh, deposits suggest these may be suitable for palaeoenvironmental assessment, and the trench evaluation report makes recommendations regarding these (AOC, 2023)
- SRA5: To determine if the palaeoenvironmental remains have the potential to provide indirect evidence of adjacent prehistoric to Roman human activity and settlement, and specifically the periods and nature of any human exploitation of the inlet and associated foreshore.
    - Assessment of proxies such as pollen from the monoliths and core samples may indicate agricultural activity or evidence of forest clearance within the local area. These proxies may survive in the lower, and upper intertidal deposits of the inlet, but particularly within the organic horizons within the inlet (sampled by cores) and to its margins (sampled by monolith).

Archaeological Potential and Significance

9.20 Based on distribution and character of the deposit sequence, as identified in the deposit model and illustrated in the figures, zones of differing past landscape development have given rise to mapped areas of archaeological and palaeoenvironmental potential for the site. These are shown on Figure 18 and the differing character and potential of each area is outlined in Table 3.

Table 3 Archaeological and palaeoenvironmental potential of areas within the Site

Area	Character of area	Archaeological potential	Palaeoenvironmental potential
1	Shallow slopes of inlet. Organic accumulation of up to *c*. 1.3 m thickness.	Remains associated with prehistoric utilisation of wetland resources may be preserved in and around organic sequences. Archaeological remains associated with Palaeolithic to Bronze Age activity (prior to wetland formation) may be preserved beneath the sequence, particularly as the slope may have provided access to the water. However, the organic deposits are not well-formed and exist in an isolated area. *Moderate significance x very low probability* = ***Low Potential***	Organic remains provide opportunity for recovery of palaeoenvironmental proxies (e.g., pollen, diatoms, ostracods) for interpretation of environmental conditions and change. Datable material (e.g., plant macrofossils) is also more likely to be preserved within organic sequences. Organic deposits in this area have greater potential for well-preserved remains of paleoenvironmental material than minerogenic deposits. However, as the deposits are not well formed, they are unlikely to

Area	Character of area	Archaeological potential	Palaeoenvironmental potential
			provide high quality samples. Better formed organic remains may survive in the vicinity. *High significance x moderate probability* = ***Moderate to High Potential***
2	Coastal inlet. Intertidal deposits within an area of reduced Pleistocene surface elevation, overlain with alluvium / warp.	Early prehistoric remains may be preserved beneath the intertidal deposits in the lower area, dating to before the active period of the inlet. Later archaeological remains may survive within the intertidal deposits, or cut into their surface, however due to the soft nature of the deposits it is unlikely for this to be the case. *Moderate significance x very low probability* = ***Low Potential***	Palaeoenvironmental remains may survive within the minerogenic intertidal deposits of the inlet, though are likely to have a lesser quality of preservation than within organic deposits. The thickest sequence reaches up to 2.63 m in thickness (AOC53122_WS5), with an elevation between -1.43 and 1.2 m OD. This sequence could provide indicators for environmental conditions throughout much of the active period of the inlet. This would illustrate key times of landscape development. *High significance x low probability* = ***Moderate Potential***
3	Higher Pleistocene surface adjacent to coastal inlet. Overlain with warp / alluvium.	The dryland directly adjacent to the coastal inlet provides continued potential for archaeological remains associated with resource access. Archaeological remains associated with the prehistoric onwards survive on (e.g., tools, remains of burning or resource processing), or cut into (e.g., pits, linear features, structures), the surface of the Pleistocene till, sealed by warp and potentially protected from modern disturbance.	Rapid sealing of the land surface with warp or alluvial sediments may have preserved the land surface of the time as a palaeosol, most likely to post-Medieval date. Therefore, environmental indicators of a specific period may be preserved in situ. *Low significance x low probability* = ***Low Potential***

Area	Character of area	Archaeological potential	Palaeoenvironmental potential
		Moderate to high significance x moderate to high probability = ***Moderate to High Potential***	
4	Thick made ground deposits likely to be impacting underlying geology or truncating the Pleistocene surface.	Thick made ground is likely to have truncated through archaeological remains, although the presence of overlying alluvium / warp deposits may have protected some surfaces. Records of thick made ground are inconsistent across the site, suggesting there is still potential for thinner deposits in these areas. *Moderate significance x very low probability =* ***Low Potential***	Sequences are likely to be disturbed by modern activity in these areas, although inconsistent thickness of made ground suggests possible survival of full sequences even within parts of these areas. These thick made ground deposits may affect both higher and lower Pleistocene geology. *Low to moderate significance x very low to low probability =* ***Low Potential***

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 The following section reviews the significance of the results of the geoarchaeological borehole evaluation in relation to the development and makes recommendations for an appropriate mitigation strategy.

10.2 Development impacts from the currently proposed gas-powered station and carbon capture facility will be significant, truncating the underlying geology. The development plans suggest the best estimated pipeline route to traverse through the site roughly from the north to south, passing through AoP 2 and 3 (Figure 3, Worley, 2022; Figure 18). Although it is difficult to ascertain with certainty the potential of the deposits to contain archaeological remains, the nature of the deposits observed suggests any archaeological remains will be of moderate frequency and associated with prehistoric to post-medieval periods. Archaeological evaluation work has already been undertaken, to identify the presence and nature of archaeological remains.

10.3 In respect to the geoarchaeological deposits identified by this work, truncation of the inlet infill (AOP2, Figure 18) is also anticipated through the construction of the Proposed Development. Further on-site sampling is unlikely to yield superior sequences, nor expand significantly upon the current understanding of the coastal inlet. Thus, it is recommended to proceed with assessment of samples already obtained from the site in order to mitigate any impact on these sequences from the proposed development. Such work would include the assessment of pollen, diatoms, and ostracods. These samples would be taken from points throughout the sequence to interpret changes in the local landscape's vegetation and hydrology. Radiocarbon dating to provide chronological context to these remains may also be recommended. Dependent on the results of the assessment, which will indicate whether such remains are present in good quality and quantity, a subsequent stage of analysis may be recommended. The nature of the deposits observed suggests any paleoenvironmental remains will be moderate potential, possibly high potential in some cases, and associated with the deeper organic and minerogenic infill of the coastal inlet. Any investigation of the inlet fills retained in the core samples should be undertaken in addition to and comparison with the separate proposals or the thin organic band situated on the inlet margins and sampled in the trench monoliths (AOC 2023; and Appendix C).

10.4 The appropriate mitigation strategy for the Site will be decided by and agreed between the client and the Local Authority, and their archaeological advisors.

10.5 This report details the findings of one element of a wider programme of archaeological works undertaken at this Site in relation to the proposed VPI development. This programme has included geophysical survey (CMS Surveys, 2022) and trial trench evaluation (AOC, 2023). In respect to the archaeological remains at the Site, and the recommendations made with reference to this resource, that report should be referred to (AOC, 2023). In brief though it is recommended that development proposals and designs are reviewed in detail so that an assessment of their impact on known archaeological remains at the Site can be made, and mitigation strategies devised. Preservation in situ and mitigation by design should be considered. If a direct impact on the archaeological remains cannot be avoided, further mitigation excavations should be considered.

11 UPDATED PROJECT DESIGN

11.1 It is not recommended that further on-site work be carried out. Sediment sequences have been recorded, and samples of the Holocene sediment obtained. It is unlikely that any greater understanding of the distribution of the sediments can be gained through further boreholes.

11.2 Recommended further work on this project includes palaeoenvironmental assessment of the samples retained by this evaluation, in order to determine the preservation quality and frequency of palaeoenvironmental indicators for reconstruction. Identification and acquisition of material suitable for radiocarbon dating to place these remains into an accurate temporal context is also recommended.

11.3 The aims of this further work will be:

- To assess the preservation quality of palaeoenvironmental materials.
- To assess the quantity of palaeoenvironmental remains within the sequence.
- To place the relict inlet within a temporal context

11.4 The Revised Research Questions to be addressed during further work are as follows:

- RRQ1: Does the palaeoenvironmental record, particularly any pollen remains, provide evidence for how changing vegetation, landscape development, and climate may have affected human communities and their land use practices, or vice versa?
- RRQ2: Through paleoenvironmental proxies and chronological dating can the development and age of the inlet refine our understanding of current modelled coastlines, such as that for 3900 BC proposed by Green (2011)?
- RRQ3: How does the palaeoenvironmental record from the Site contribute to our understanding of local landscape and environmental development from the Mesolithic onwards, and how does this compare to similar records from the Humber / North Lincolnshire region?

11.5 The deposits represented in both the borehole core samples and trench monolith samples from the Site attest to a dynamic depositional environment representative of landscape in flux throughout the Holocene.

11.6 An investigation into diatom assemblages within the sequence of the Humber Estuary (Metcalfe et al., 2000) provides a broad framework for comparison and interpretations. Diatom taxa have been grouped through this study to show association between certain assemblages and the sedimentary environment. One of these specifies an assemblage representative of an intertidal creek environment in this catchment and may be comparable to the sequence of deposition within represented within WS5. Accordingly, it is advised that specialist paleoenvironmental assessment is undertaken on the sequence within WS5 (e.g. 12no pollen, ostracod, and diatom), macrobotanical assessment, as well as radiocarbon dating of either identified suitable terrestrial plant fossils or the humic and humin factions of bulk organic sediment.

11.7 As mentioned in the trench evaluation report (AOC, 2023), organic rich clay deposits identified in the centre of each sequence (17006) of <19> from Trench 17 and (33005) of <20> from Trench 33

have the potential to preserve palaeoenvironment proxies which could provide further detail regarding the wider environment at the time of deposition. While no charcoal or macrofossil inclusions suitable for radiocarbon dating within either of these deposits were observed, the deposits themselves may be sufficiently organic to be dateable and could help to refine the dating sequence of alluvial deposition in the Holocene. It is considered that some limited further palaeoenvironmental assessment of the clay deposits represented by (17006) and (33005) should be undertaken (e.g. 4no pollen, ostracod, diatom) on each monolith, as well as plant macrofossil assessment on material from the monoliths or any associated bulk samples. The plant macrofossil work should identify any charcoal remains, in addition to any remains suitable for radiocarbon dating. Such a palaeoenvironmental assessment would provide a dryland/channel margin sequence to compare to the thicker inlet sequence. This would assist with better understanding the different types of landscape positions represented on Site, especially those that may be contemporaneous with phases of human occupation of the Site.

11.8 Further documentary research should also be carried out in order to place the Site and findings from any palaeoenvironmental work into its regional context and compare its features and findings with those from other sites. Of particular importance is identifying the nature and period of deposition of the sequence, and assessing whether how these compare to palaeonevironmental records form the region and previous models of past coastlines.

11.9 The archive will be deposited with a local repository upon project completion.

11.10 Recommended further analysis work is set out in the Table of Recommendations (see Table 3, below). Justifications for the analyses recommended can be found in Sections 10 and 11. No further work will be undertaken until agreed to by the Client.

Table 4: Table of recommendations

Task	Description	Resource	Days/Item
General			
1.1	Project management	Project manager	2
Borehole Assessment			
2.1	Subsampling and liaison with external specialists	Geoarchaeologist	1
2.2	Pollen assessment	External	12
2.3	Ostracod assessment	External	12
2.4	Diatom assessment	External	12
2.5	Plant macro fossils	Archaeobotanist	4
2.6	Radiocarbon dating	External	2
Monolith Assessment		**Borehole Assessment**	
3.1	Subsampling and liaison with external specialists	Geoarchaeologist	1
3.2	Pollen assessment	External	8
3.3	Ostracod assessment	External	8
3.4	Diatom assessment	External	8
3.5	Plant macro fossils	Archaeobotanist	3
3.6	Radiocarbon dating	External	2-4
Report			
4.1	Palaeoenvironmental research	Geoarchaeologist	1
4.2	Integration of specialist data	Geoarchaeologist	1
4.3	Create / update deposit model	Geoarchaeologist	1
4.4	Report / contribution / updated deposit model text	Geoarchaeologist	1
4.5	Figure preparation	Geoarchaeologist	1
4.6	Data archiving, excel, and layer package	Geoarchaeologist	0.5

12 BIBLIOGRAPHY

AECOM 2022. VPI Immingham Energy Park 'A' Power Station: Land adjacent to the existing Combined Heat and Power (CHP) Plant at South Killingholme, Immingham. Unpublished client report.

Allen Archaeology 2013. Stage 1 Palaeoenvironmental Assessment Report: Able Marine Energy Park, North Killingholme, North Lincolnshire. Unpublished client report.

AOC 2022. VPI Immingham, Humber Zero Project: Geoarchaeological and Archaeological Evaluation Written Scheme of Investigation. Unpublished client report.

AOC 2023. VPI Immingham, Humber Zero Project, Lincolnshire: Archaeological Evaluation Report. Unpublished client report.

British Geological Survey (BGS) 2023. Geology of Britain Viewer. URL: https://shop.bgs.ac.uk/Shop/Department/GeoRecords

Burke, H. F., Morgan D. J., Kessler H., and Cooper A. H., 2015 A 3D geological model of the superficial deposits of the Holderness area. Geology And Landscape Programme Commissioned Report Cr/09/132. British Geological Survey.

Canti, M. 2009. A Review of Geoarchaeology in the Midlands of England. Fort Cumberland: Historic England. https://doi.org/10.5284/1033726.

Chartered Institute for Archaeologists 2020. Standard and Guidance for an Archaeological Field Evaluation.

Clark, C.D., Evans, D.J.A., Khatwa, A., Bradwell, T., Jordan, C.J., Marsh, S.H., Mitchell, W.A., & Bateman, M.D. 2004. Map and GIS database of glacial landforms and features related to the last British Ice Sheet. Boreas, 33, 359–375

Clarke, C. Pearson, S. Mate, M and Parfitt, K. 2010. Sandwich the 'Completest Medieval Town in England. A Study of the Town and Port from its Origins to 1600. Oxbow. Oxford.

CMS Surveys 2022. Report No EN22052 PAS128 Utility Detection Survey Report VPI Immingham. Unpublished client report.

Ellis S., Fenwick, H., Lillie, M., and Van de Noort, R., 2001, Wetland Heritage of the Lincolnshire Marsh, An Archaeological Survey. Humber Wetlands Project, Wetland Archaeology and Environments Research Centre, University of Hull

Fleming, F. and Royall, C. (2020). The Inner Humber Estuary Rapid Coastal Zone Assessment Survey Aerial Investigation and Mapping Project. Cornwall Council Historic Environment Service. https://doi.org/10.5284/1082378.

Gaffney, V., Thomson, K. and Fitch, S. 2007. Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea. English Heritage.

Green, C., 2011. The Origins of Louth: Archaeology and History in East Lincolnshire 400,000 BC-AD 1086. The Lindes Press, Louth, Lincolnshire

Green, C. 2014a. Of chalk and ice: the white cliffs of Louth in the Palaeolithic era. Dr Caitlin R. Green History, Archaeology, Lectures and Seminars. URL: https://www.caitlingreen.org/2014/09/of-chalk-and-ice-white-cliffs-of-louth.html

Green, C. 2014b. Stain Hill and the Lincolnshire Marshes in the Anglo-Saxon period. Dr Caitlin R. Green History, Archaeology, Lectures and Seminars. URL: https://www.caitlingreen.org/2014/11/stain-hill-anglo-saxon-marsh.html

Green, C. 2015. The drowned villages and eroding coastline of Lincolnshire, c. 1250-1600. Dr Caitlin R. Green History, Archaeology, Lectures and Seminars. URL: https://www.caitlingreen.org/2015/05/drowned-villages-of-lincolnshire.html

Greig, J. R A. 1982. Forest clearance and the barrow builders at Butterbump, Lincolnshire. Lincolnshire Hist Archaeol 17. Vol 17, pp. 11-14.

Head, R., Fenwick, H., Van de Noort, R., Dinnin, M., & Lillie, M. 1995 The meres and coastal survey. In Van de Noort & Ellis (eds) Wetland Heritage of Holderness: An Archaeological Survey, Humber Wetlands Project, University of Hull.Historic England 2015a. Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record.

Historic England 2015b. Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation.

Historic England 2020. Deposit modelling and archaeology: Guidance for Mapping Buried Deposits.

Jones, AP, Tucker, ME and Hart, JH, 1999 The description and analysis of Quaternary stratigraphic field sections Technical Guide 7, Quaternary Research Association

Lane, T.W., 1992. The Fenland Project Number 8: Lincolnshire Survey, the Northern Fen-Edge, Sleaford: Heritage Trust of Lincolnshire, EAA Report no 66, 1993, Fig 78.

Metcalfe, S.E., Ellis, ., Horton, B.P., Innes, J.B., McArthur, J., Mitlehner, A., Parkes, A., Pethick, J.S., Rees, J., Ridgway, J., Rutherford, M.M., Shennan, I. and Tooley, M.J. 2000, 'The Holocene evolution of the Humber estuary: reconstructing change in a dynamic environment', in I.Shennan and J.E.Andrews (eds), Holocene Land-Ocean Interaction and Environmental Change around the North Sea. Geological Society Special Publication No.166, 97-118

Ridgway, J., Andrews, J.E., Ellis, S., Horton, B.P., Innes, J.B., Knox, R.W.O'B., McArthur, J.J., Maher, B.A., Metcalfe, S.E., Mitlehner, A., Parkes, A., Rees, J.G., Samways, G.M. and Shennan, I. 2000 Analayis and interpretation of Holocene sedimentary sequences in the Humber Estuary. In I.Shennan and J.E.Andrews (eds), Holocene Land-Ocean Interaction and Environmental Change around the North Sea. Geological Society Special Publication No. 166, 9-39

Schofield, J.E. 2001: Vegetation succession in the Humber Wetlands. Unpublished Ph.D. Thesis, University of Hull.

Shennan, I. and Andrews, J. 2000. An introduction to Holocene land-ocean interaction and environmental change around the western North Sea. In I.Shennan and J.E.Andrews (eds), Holocene Land-Ocean Interaction and Environmental Change around the North Sea. Geological Society Special Publication No. 166, 1-7

Shennan, I. & Lambeck, K. & Horton, Benjamin & Innes, James & Lloyd, Jeremy & McArthur, J. & Rutherford, Mairead. 2000a. Holocene isostasy and relative sea-level changes on the east coast of England. In Shennan, I. & Andrews, J. (eds) 2000. Holocene Land-Ocean Interaction and Environmental Change around the North Sea. Geological Society, London, Special Publications, 166.

Shennan, I. & Lambeck, K. & Flather, R. & Horton, Benjamin & McArthur, J. & Innes, James & Lloyd, Jeremy & Rutherford, Mairead & Wingfield, R.. 2000b. Modelling Western North Sea palaeogeographies and tidal changes during the Holocene. In Shennan, I. & Andrews, J. (eds) 2000. Holocene Land-Ocean Interaction and Environmental Change around the North Sea. Geological Society, London, Special Publications, 166.

Smith, D., Zalasiewicz, J., Williams, M., Wilkinson, I. P., Redding, M. & Begg, C. 2010. Holocene drainage systems of the English Fenland: roddons and their environmental significance. Proceedings of the Geologists' Association, 121, 256–269.

Tucker, M. E. 2003. Sedimentary Rocks in the Field, 3rd ed. The Geological Field Guide Series. ix+234 pp. Chichester: Wiley.

Van de Noort, R., Davies, P., Ellis, S., 1993. Wetland Heritage: An Archaeological Assessment of the Humber Wetlands. Kingston upon Hull: Humber. Wetlands Project University of Hull; University of Hull, English Heritage.

Walker, M.J.C., Berkelhammer, M., Bjorck, S., Cwynar, L.C., Fisher, D.A., Long, A.J., Lowe, J.J., Newnham, R.M., Rasmussen, S.O. & Weiss, H. 2012. Formal subdivision of the Holocene Series/Epoch: A discussion paper by a Working Group of INTIMATE (Integration of ice-core, marine and terrestrial records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). J. Quat. Sci. 27(7):649-659.

Waller M and Kirby J (2021) Coastal peat-beds and peatlands of the southern North Sea: Their past, present and future. Biological Reviews 96(2): 408–432.

Worley 2022. Humber Zero VPI-Immingham Post-Combustion Carbon Capture Project FEED Natural gas pipeline route identification. Client report.

Yendell, V. 2020. Hull Urban Archaeological Database: 3D deposit modelling, Stage 2 Review Report. Unpublished client report.

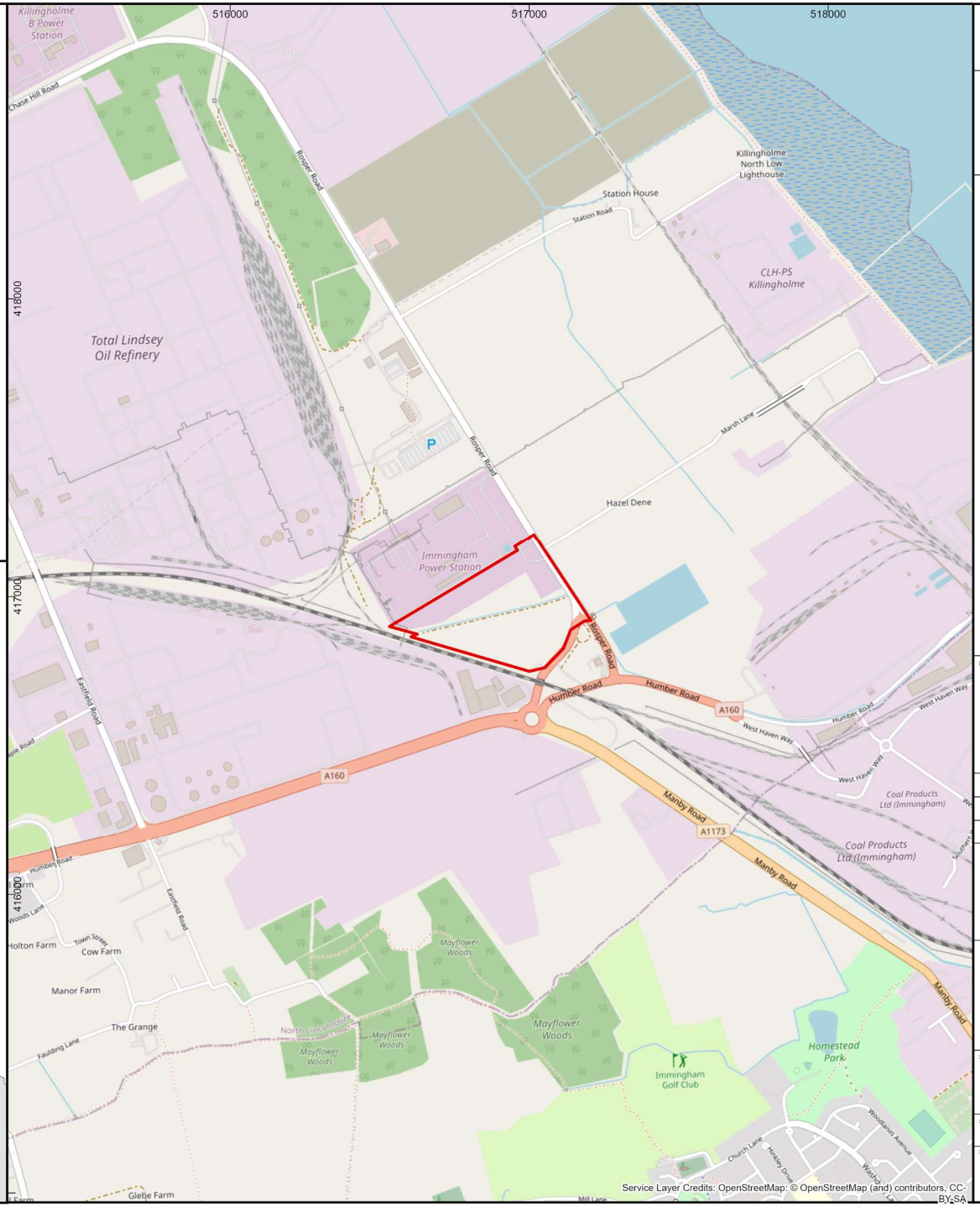


Figure 1

Site Location Map

Legend
- Site Boundary

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	24/04/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

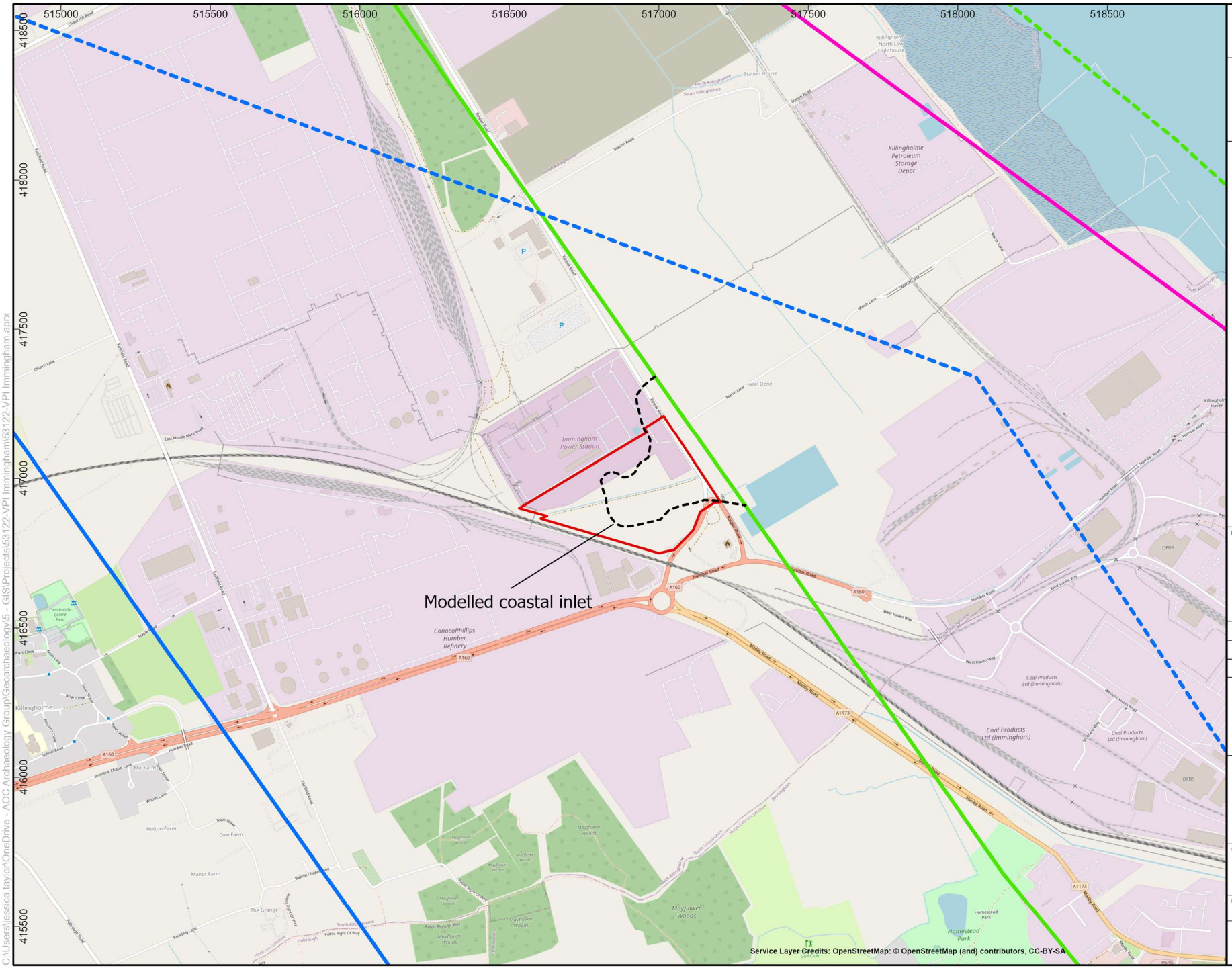
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:15,000 @ A3

SCALE

0 600m



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure 2

Modelled past coastlines and intertidal limits, and modelled coastal inlet extent

Legend

- 3900BC Coastline (Green, 2011)
- 3900BC Intertidal Limit (Green, 2011)
- 4900BC Coastline (Green, 2011)
- 4900BC Intertidal Limit (Green, 2011)
- 5900 BC Coastline (Green, 2011)
- 5900BC Intertidal Limit (Green, 2011)
- Site Boundary
- Coastal Inlet Extent

FOR:

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	21/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:12,000 @ A3

0 500m

Figure 3

Locations of archaeological investigations

Legend

- Site Boundary
- Area Excavation 2000
- Area Excavation 2002
- Previous Archaeological Work
- AOC 53122 Trench
- AOC53122 Sondages

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

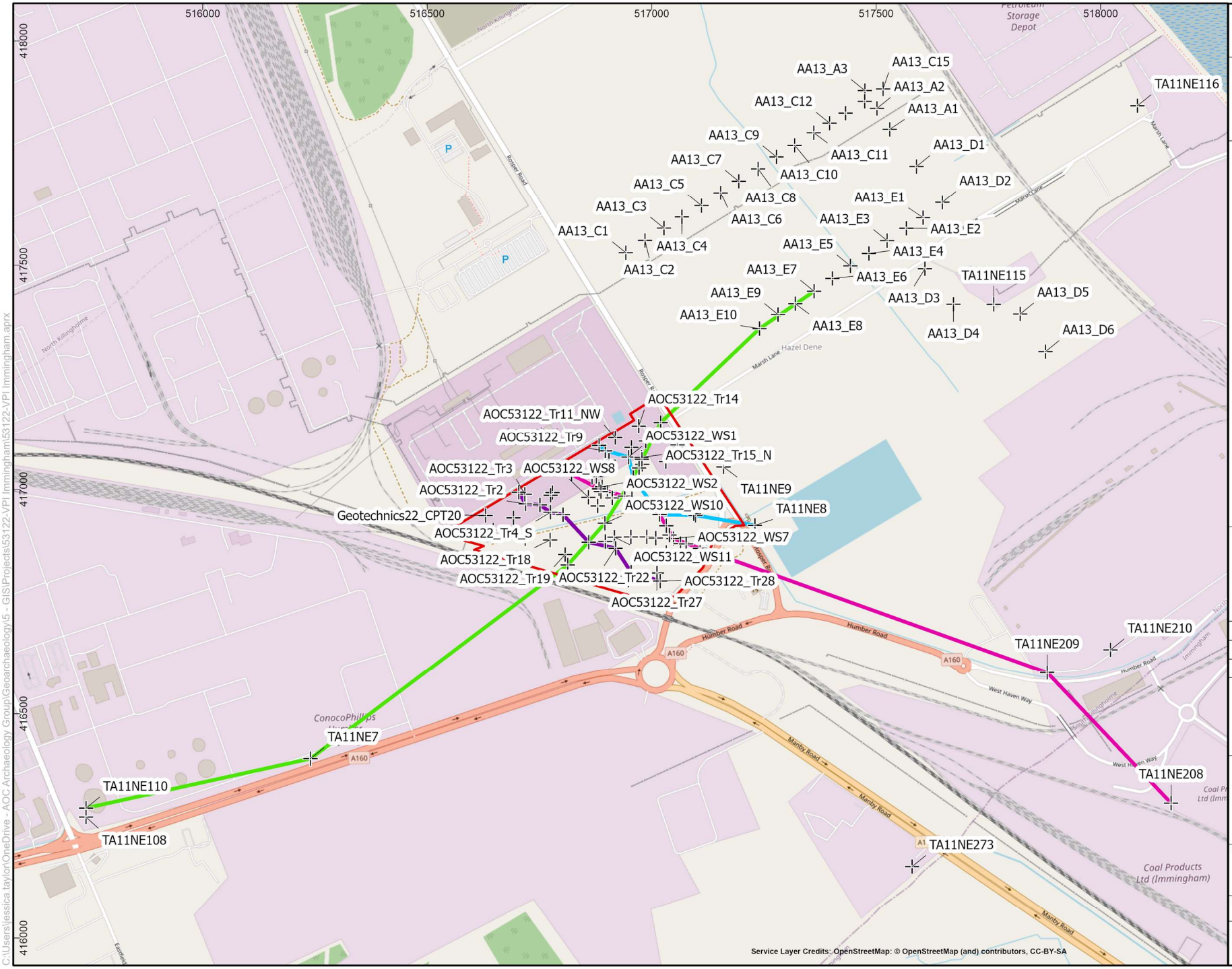
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:2,500 @ A3

0 125m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure	4

Data points and transect locations for the site and wider area

Legend

- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D
- Datapoints

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:8,000 @ A3

0 250m

Figure	5

Data points and transect locations for the site

Legend

- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D
- Datapoints

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:2,000 @ A3

0 100m

C:\Users\jessica taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure 6: Transect A, southwest to northeast across the site showing the levels and thickness of deposits over the underlying geology in section (extrapolated from deposit records)

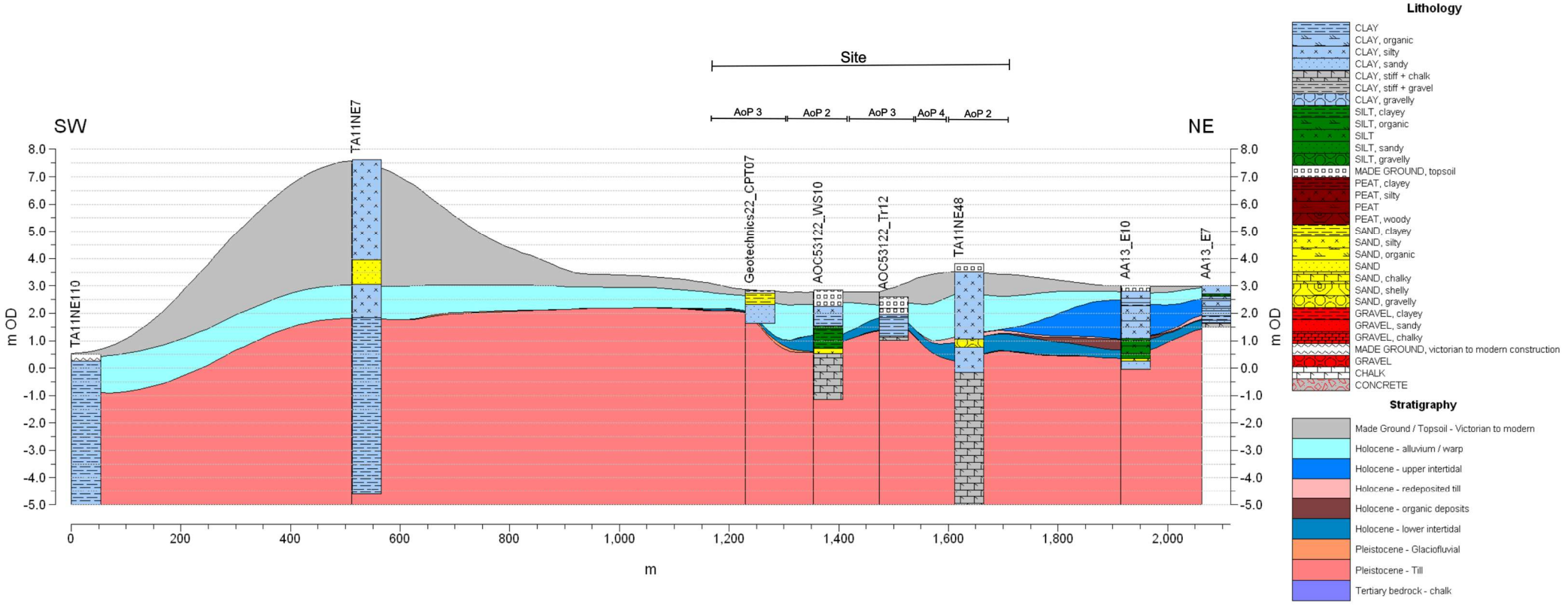


Figure 7: Transect B, northwest to southeast across the site showing the levels and thickness of deposits over the underlying geology in section (extrapolated from deposit records)

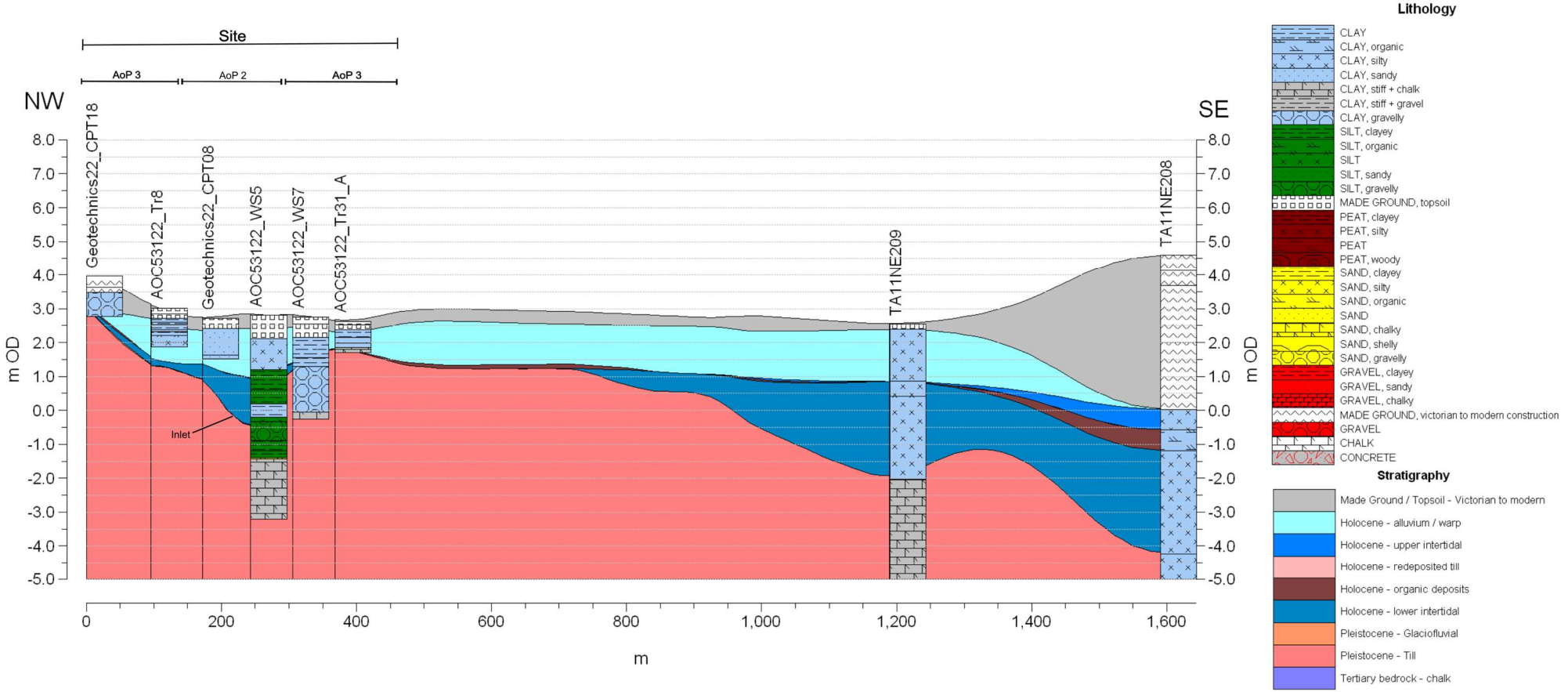


Figure 8: Transect C, northwest to southeast across the site showing the levels and thickness of deposits over the underlying geology in section (extrapolated from deposit records)

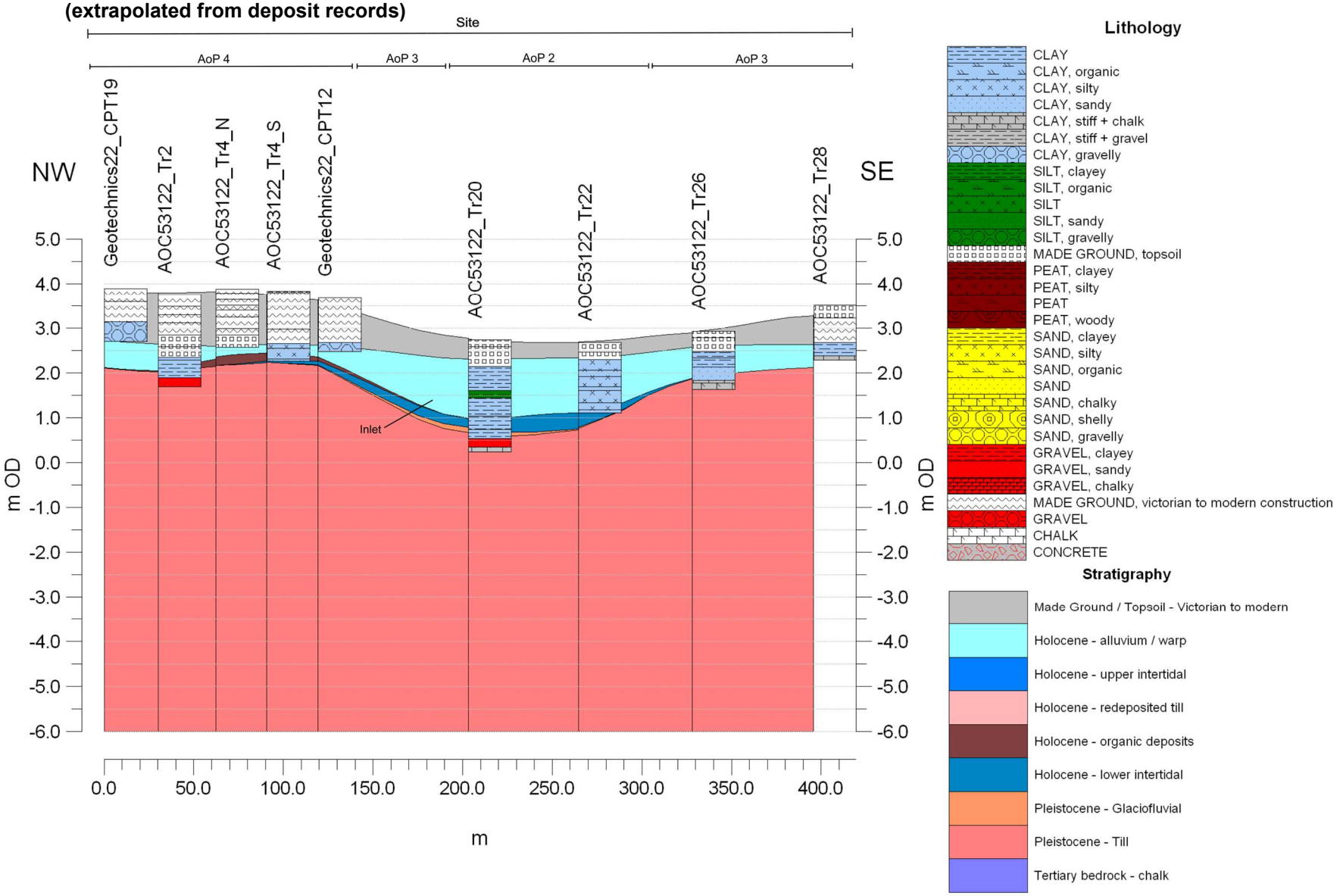
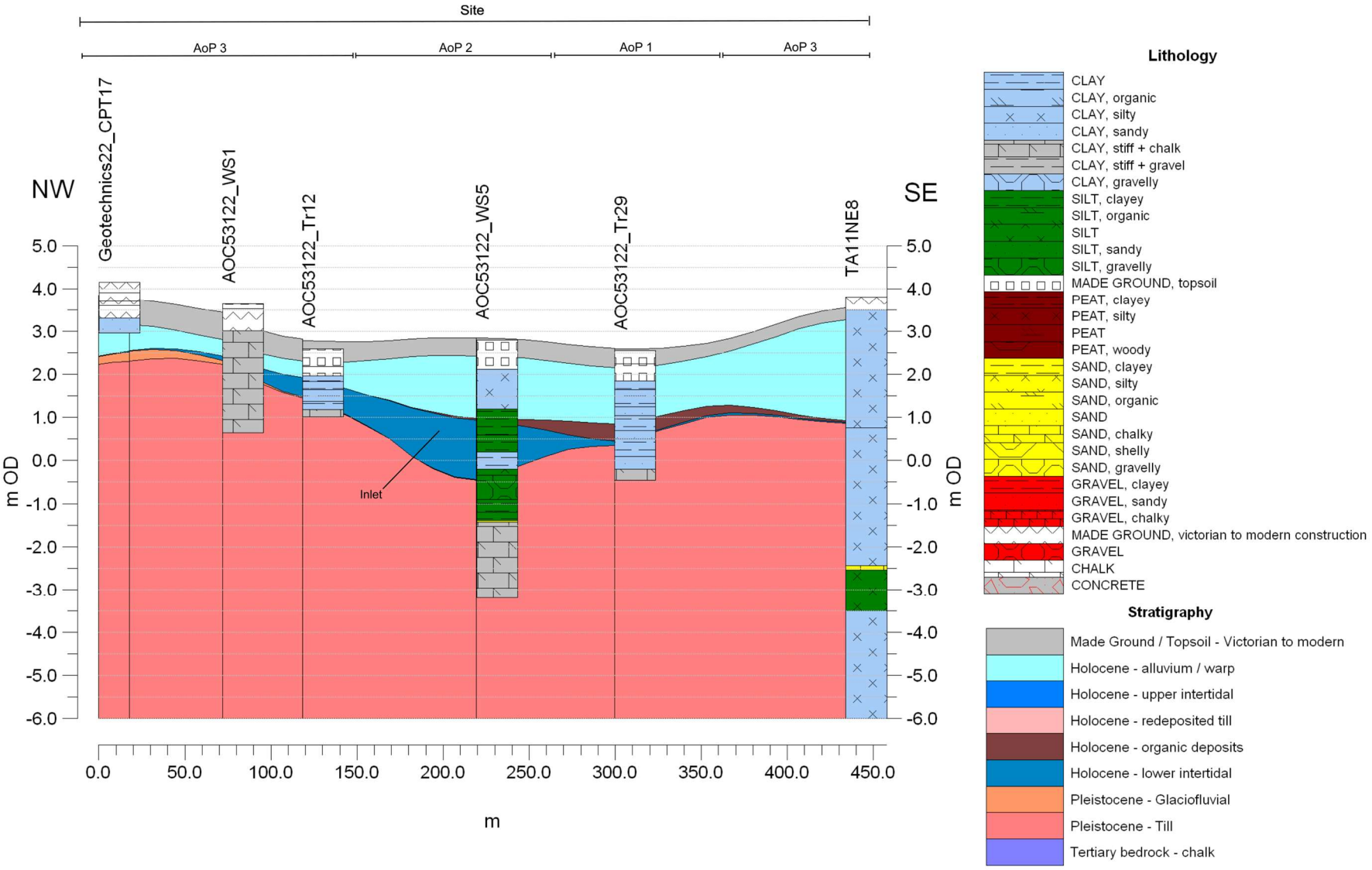
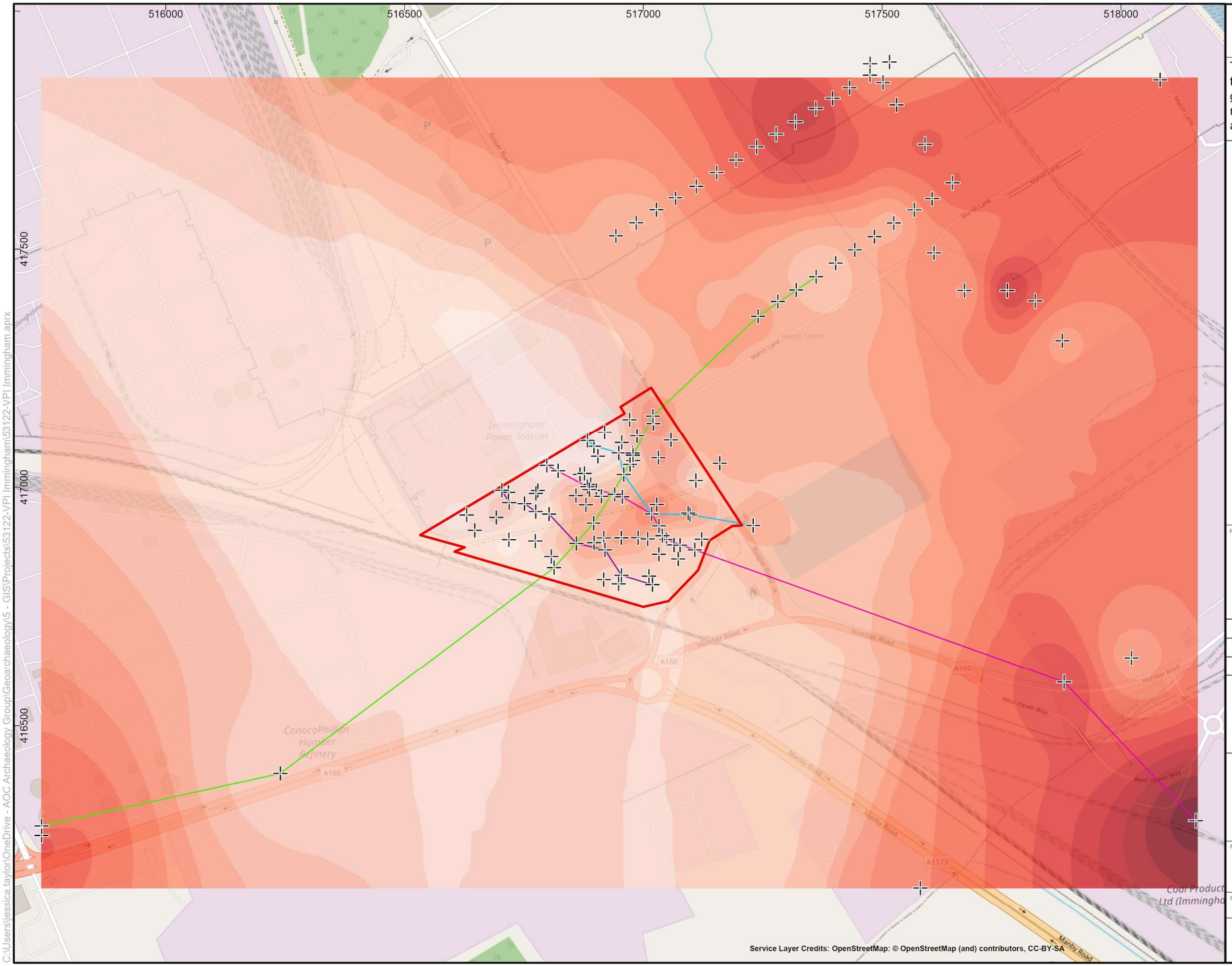


Figure 9: Transect D, northwest to southeast across the site showing the levels and thickness of deposits over the underlying geology in section (extrapolated from deposit records)





C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure	10

Topographic plot of the surface of the below ground Pleistocene geology (extrapolated from deposit records), suggesting the form of the ancient land surface at c. 10,000 BC

Legend

- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Glaciofluvial (Pleistocene) Surface

m OD

- 3.000001 - 3.500000
- 2.500001 - 3.000000
- 2.000001 - 2.500000
- 1.500001 - 2.000000
- 1.000001 - 1.500000
- 0.500001 - 1.000000
- 0.000001 - 0.500000
- -0.499999 - 0.000000
- -0.999999 - -0.500000
- -1.499999 - -1.000000
- -1.999999 - -1.500000
- -2.499999 - -2.000000
- -2.999999 - -2.500000
- -3.499999 - -3.000000
- -3.999999 - -3.500000
- -4.000000
- Datapoints

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

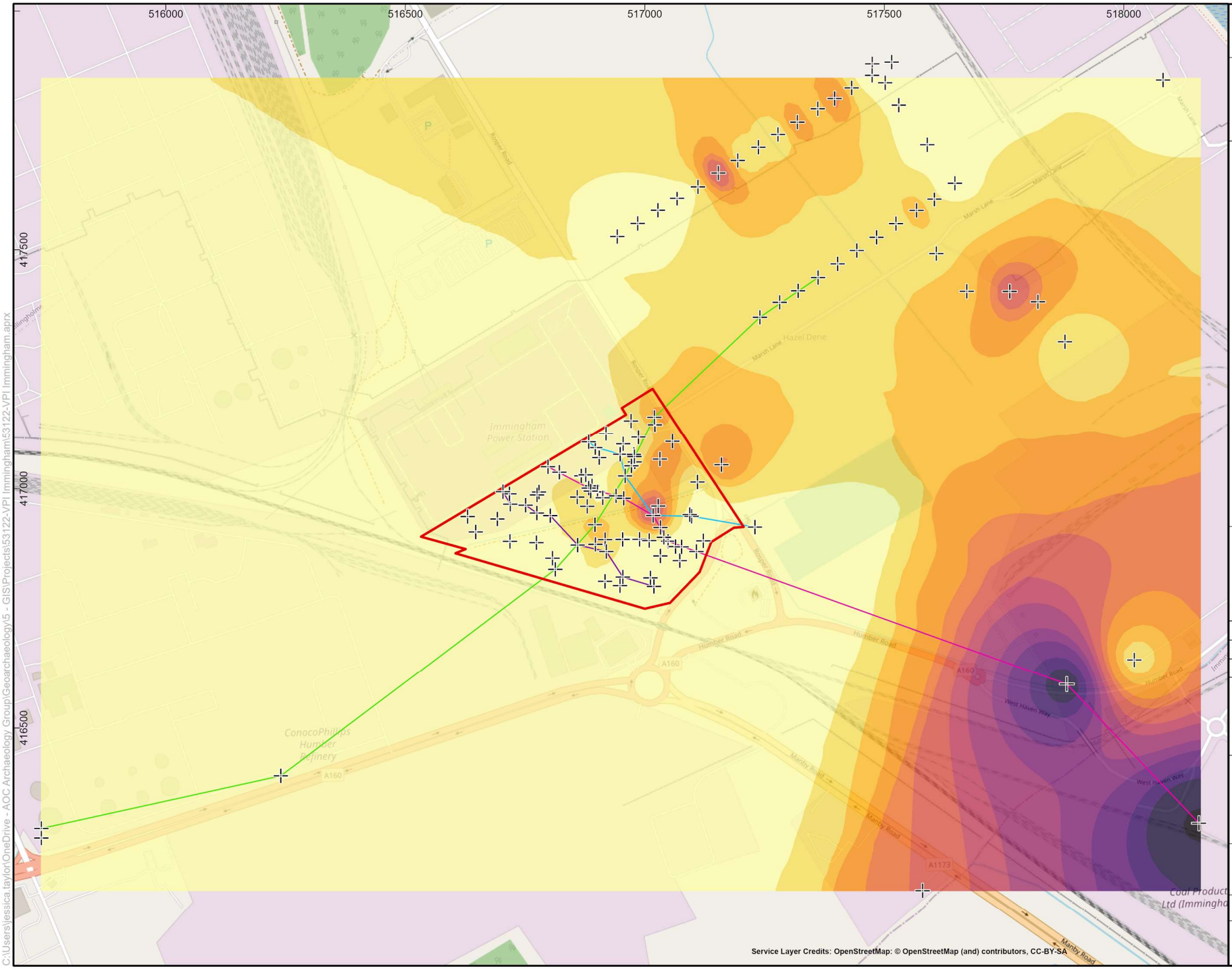


Figure	11

Thickness plot of the below ground lower intertidal deposits (extrapolated from deposit records), representing deposit survival

Legend

- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Lower Intertidal Thickness

m

- 0.000000 - 0.250000
- 0.250001 - 0.500000
- 0.500001 - 0.750000
- 0.750001 - 1.000000
- 1.000001 - 1.250000
- 1.250001 - 1.500000
- 1.500001 - 1.750000
- 1.750001 - 2.000000
- 2.000001 - 2.250000
- 2.250001 - 2.500000
- 2.500001 - 2.750000
- 2.750001 - 3.000000
- 3.000001 - 3.250000
- Datapoints

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

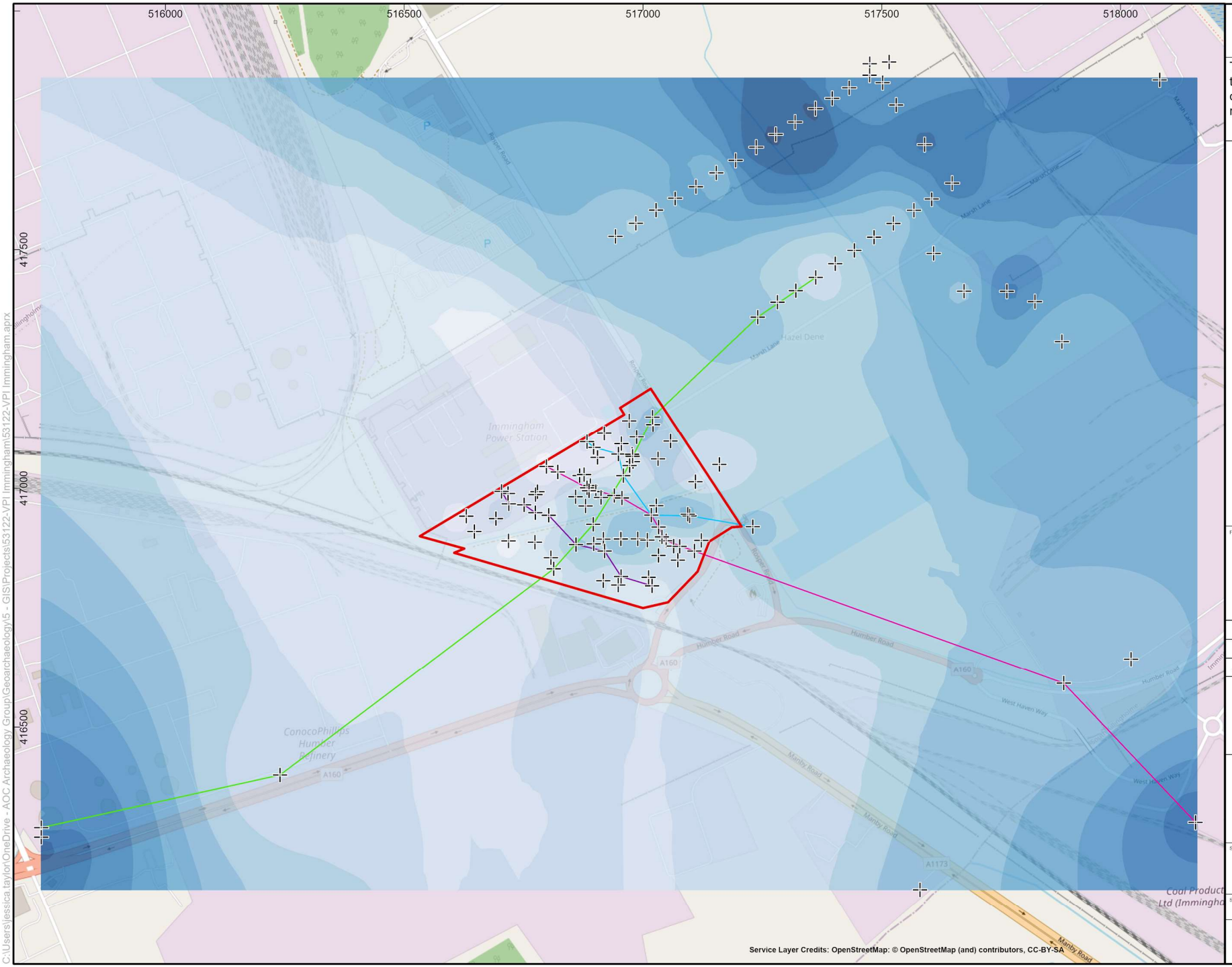
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure 12

Topographic plot of the surface of the below ground lower intertidal deposits (extrapolated from deposit records)

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Lower Intertidal Surface

m OD

- 3.000001 - 3.500000
- 2.500001 - 3.000000
- 2.000001 - 2.500000
- 1.500001 - 2.000000
- 1.000001 - 1.500000
- 0.500001 - 1.000000
- 0.000001 - 0.500000
- -0.499999 - 0.000000
- -0.999999 - -0.500000
- -1.499999 - -1.000000
- -1.999999 - -1.500000
- -2.000000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

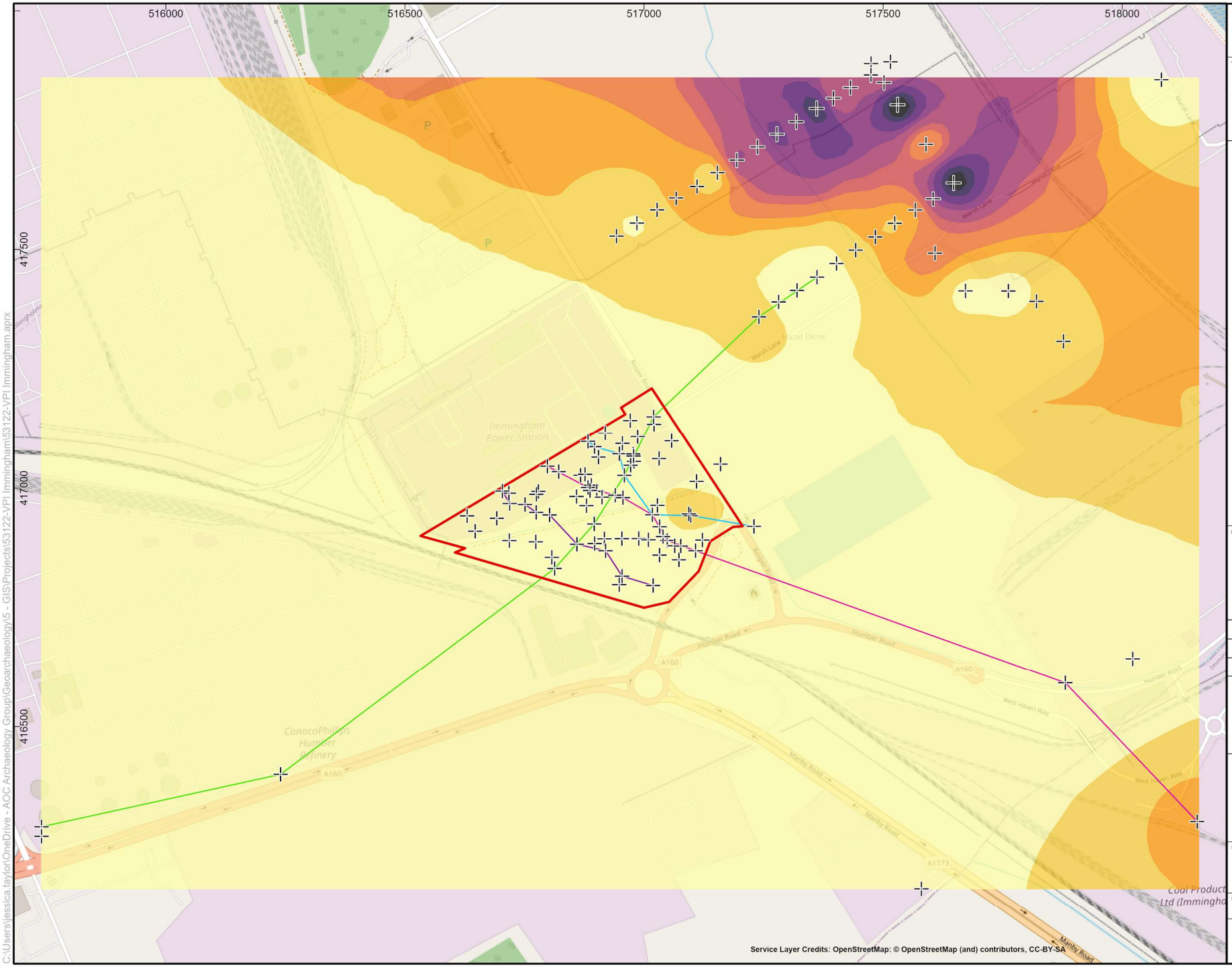
SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure 13

Thickness plot of the below ground Holocene organic deposits (extrapolated from deposit records), representing deposit survival

Legend

- Data Points
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Organic Deposits Thickness

m

- 0.000000 - 0.250000
- 0.250001 - 0.500000
- 0.500001 - 0.750000
- 0.750001 - 1.000000
- 1.000001 - 1.250000
- 1.250001 - 1.500000
- 1.500001 - 1.750000
- 1.750001 - 2.000000
- 2.000001 - 2.250000
- 2.250001 - 2.500000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	21/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

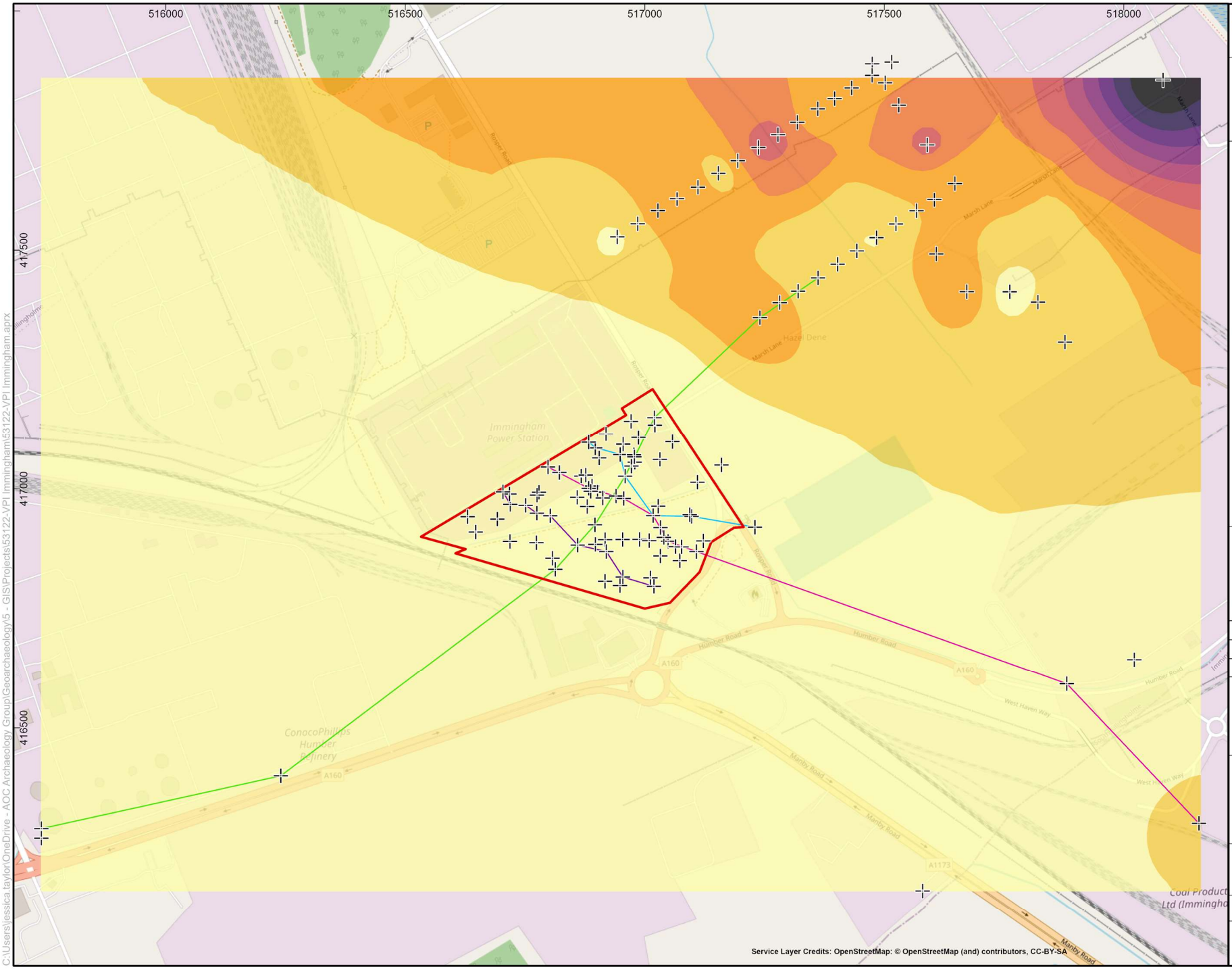


Figure 14

Thickness plot of the below ground upper intertidal deposits (extrapolated from deposit records), representing deposit survival

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Upper Intertidal Thickness

m

- 0.000000 - 0.500000
- 0.500001 - 1.000000
- 1.000001 - 1.500000
- 1.500001 - 2.000000
- 2.000001 - 2.500000
- 2.500001 - 3.000000
- 3.000001 - 3.500000
- 3.500001 - 4.000000
- 4.000001 - 4.500000
- 4.500001 - 5.000000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

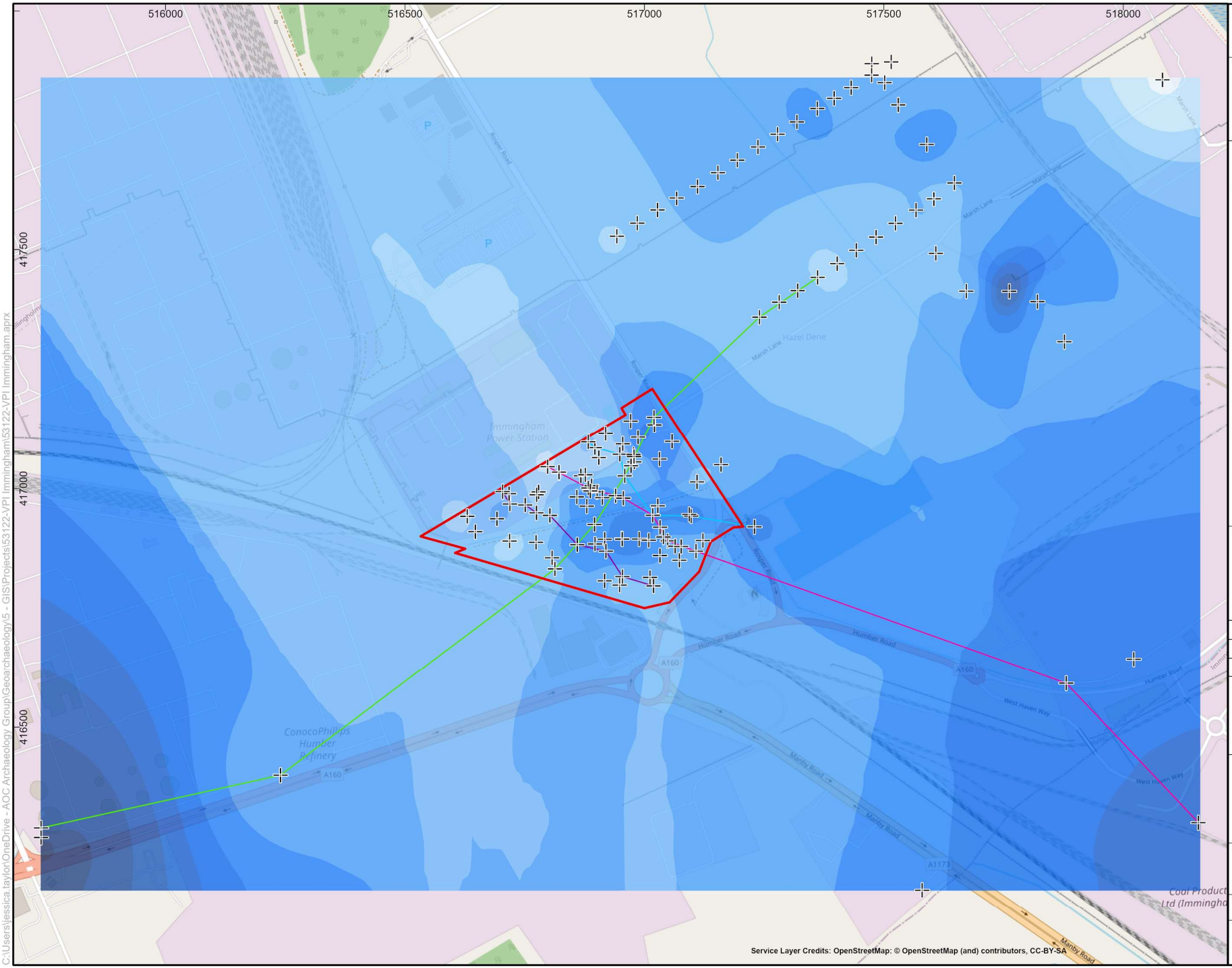


Figure	15

Topographic plot of the surface of the below ground upper intertidal deposits (extrapolated from deposit records)

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Upper Intertidal Surface

m OD

- 3.500001 - 4.000000
- 3.000001 - 3.500000
- 2.500001 - 3.000000
- 2.000001 - 2.500000
- 1.500001 - 1.000000
- 1.000001 - 1.500000
- 0.500001 - 1.000000
- 0.000001 - 0.500000
- -0.499999 - 0.000000
- -0.999999 - -0.500000
- -1.499999 - -1.000000
- -1.500000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

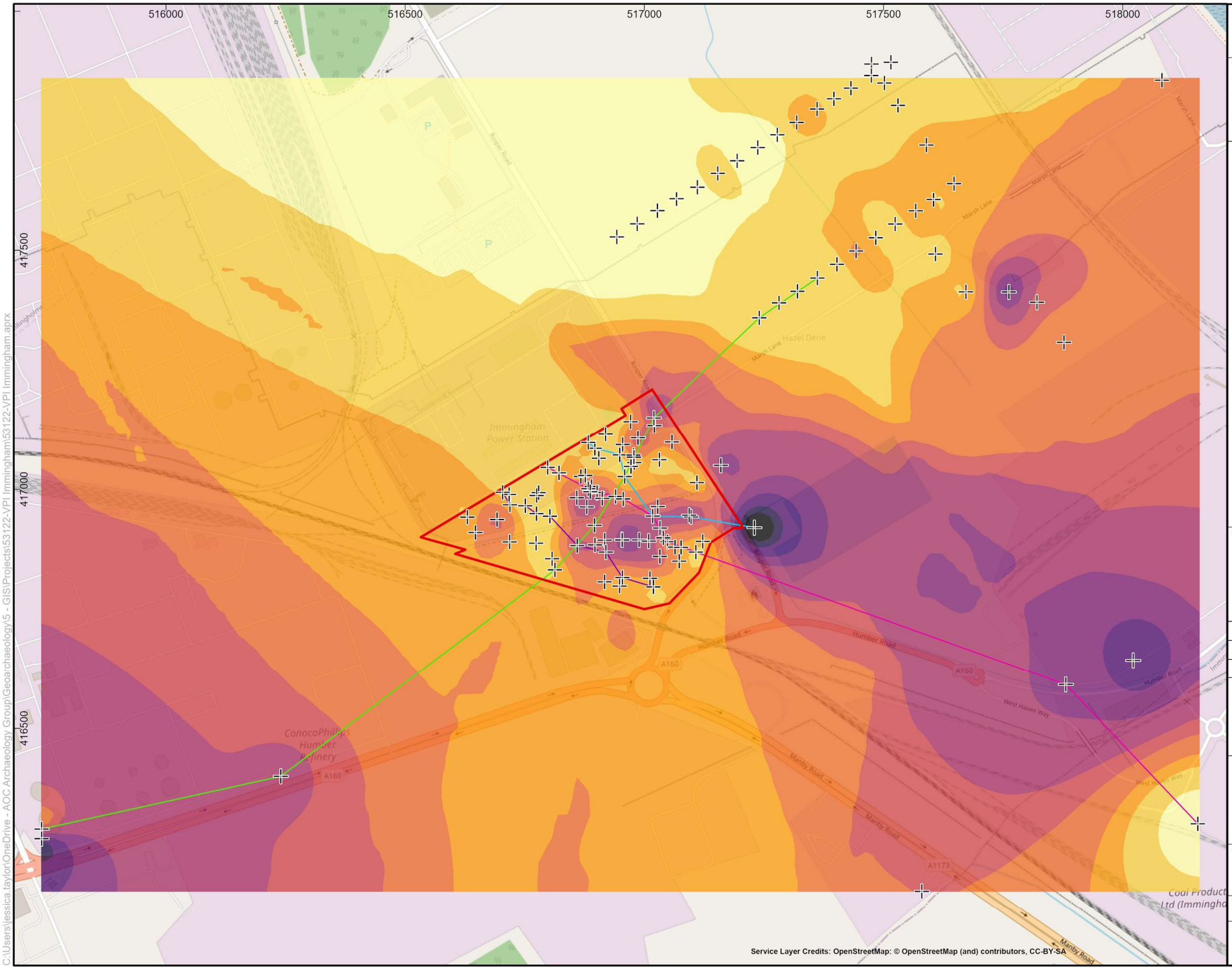
Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure 16

Thickness plot of the below ground Holocene alluvium / warp (extrapolated from deposit records), representing deposit survival

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Alluvium / Warp Thickness

m

- 0.000000 - 0.250000
- 0.250001 - 0.500000
- 0.500001 - 0.750000
- 0.750001 - 1.000000
- 1.000001 - 1.250000
- 1.250001 - 1.500000
- 1.500001 - 1.750000
- 1.750001 - 2.000000
- 2.000001 - 2.250000
- 2.250001 - 2.500000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

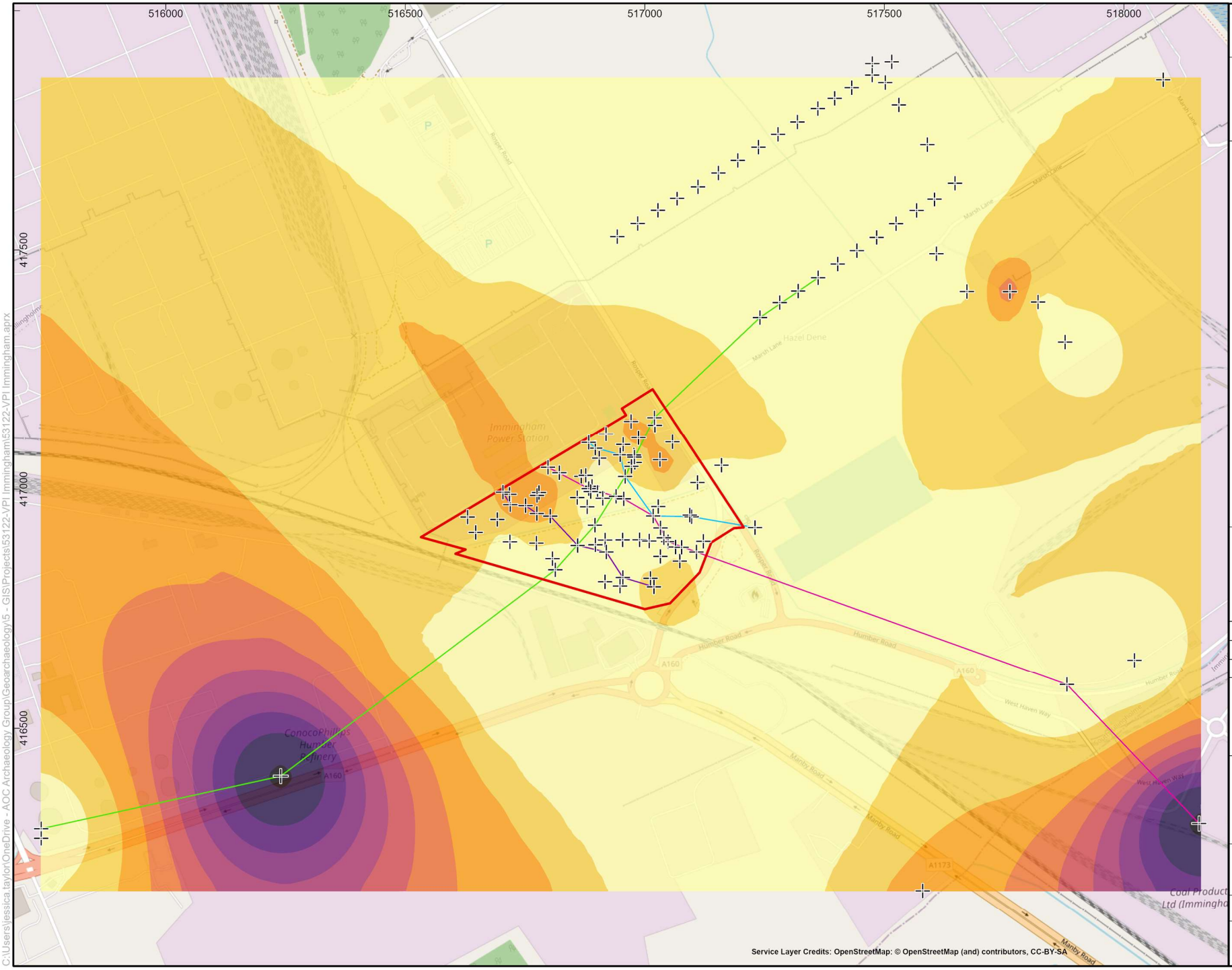
SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m



C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

Figure	17

Thickness plot of the topsoil and made ground deposits (extrapolated from deposit records), representing potential disturbance and truncation

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D

Topsoil / Made Ground Thickness

m

- 0.000000 - 0.500000
- 0.500001 - 1.000000
- 1.000001 - 1.500000
- 1.500001 - 2.000000
- 2.000001 - 2.500000
- 2.500001 - 3.000000
- 3.000001 - 3.500000
- 3.500001 - 4.000000
- 4.000001 - 4.500000
- 4.500001 - 5.000000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:7,500 @ A3

0 400m

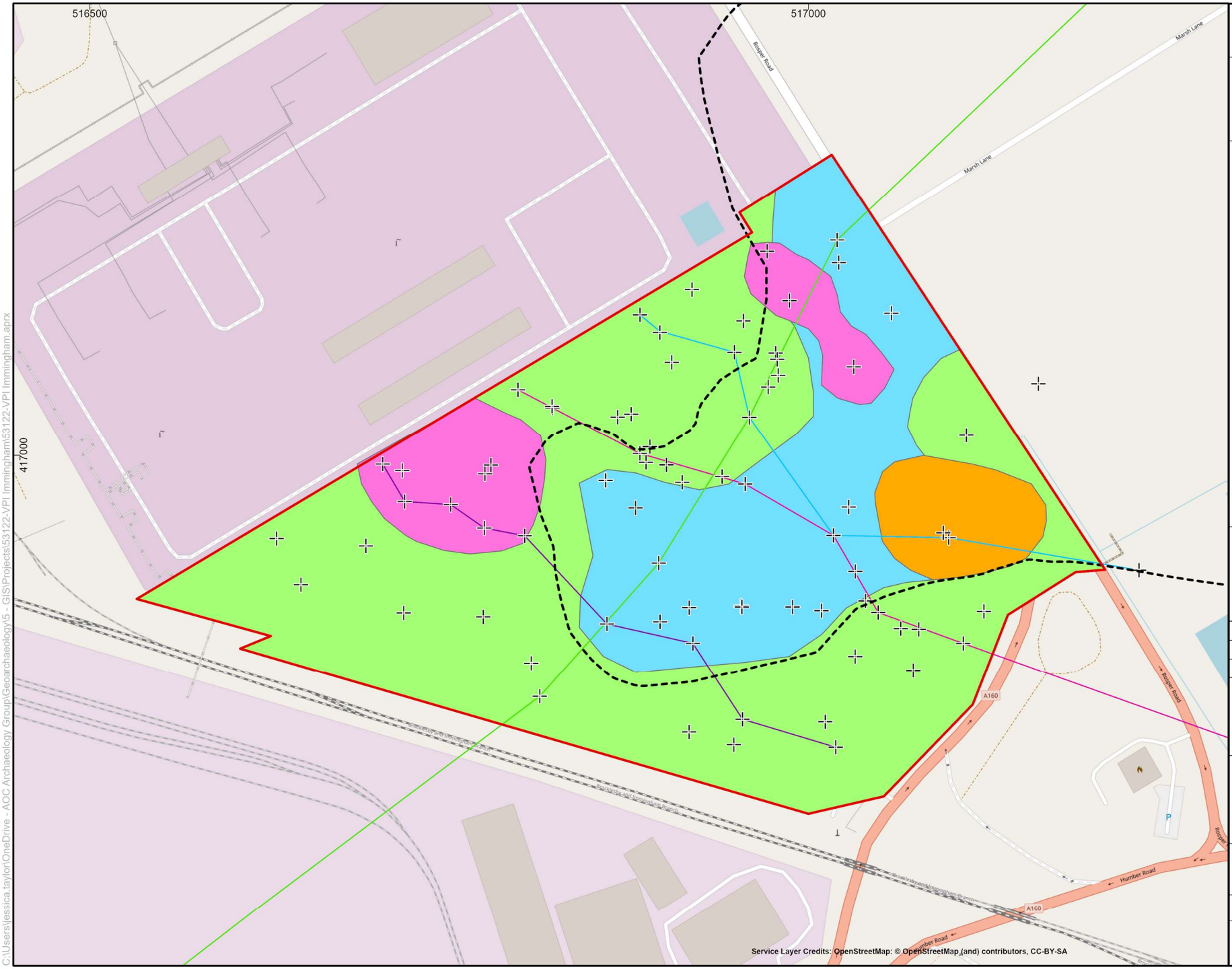


Figure	18

Plan showing areas of archaeological and palaeoenvironmental potential (extrapolated from deposit records)

Legend

- Datapoints
- Site Boundary
- Transect A
- Transect B
- Transect C
- Transect D
- AoP 1
- AoP 2
- AoP 3
- AoP 4
- Coastal Inlet Extent

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:2,500 @ A3

0 125m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

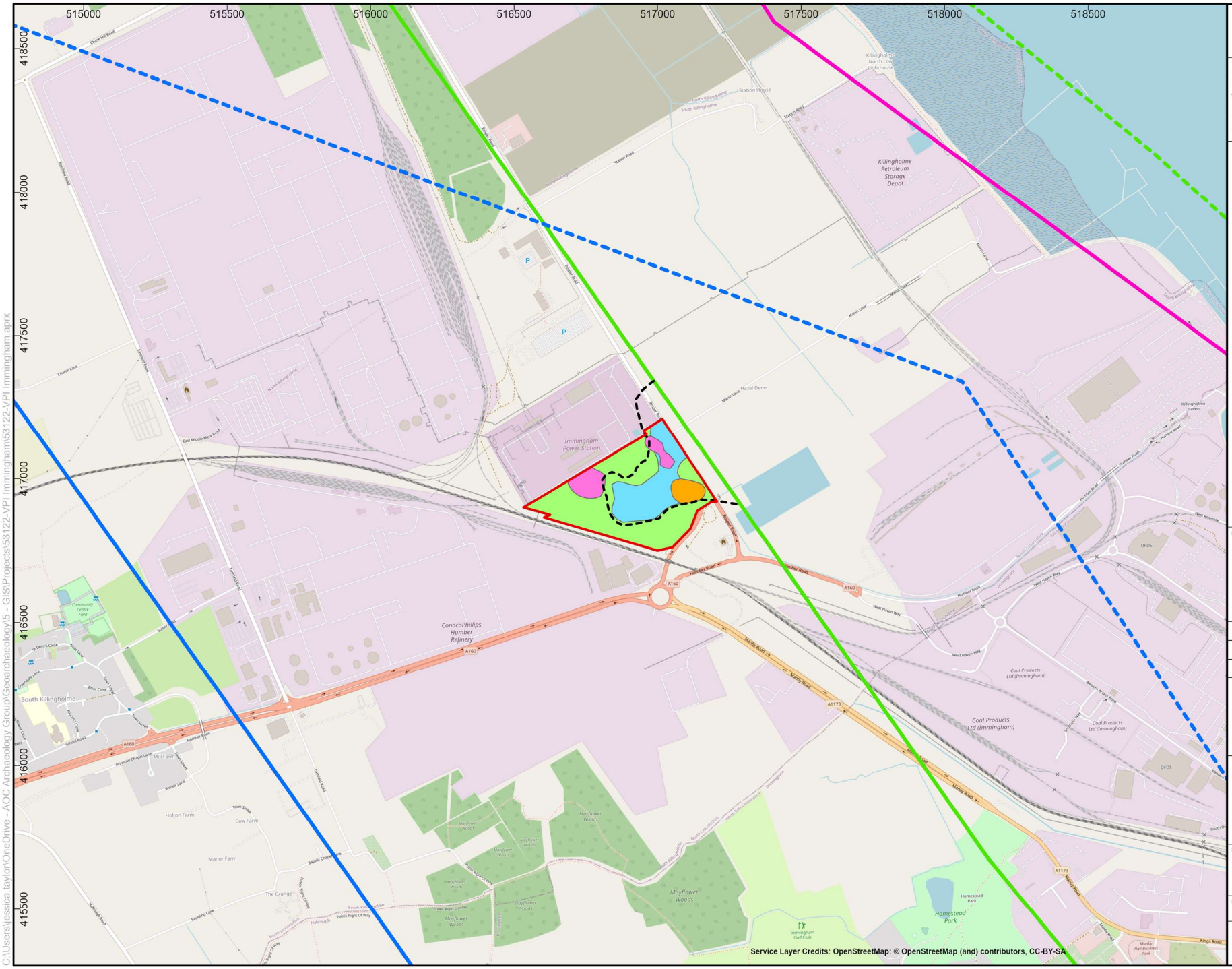


Figure 19

Plan showing the relict coastline and modelled coastal inlet in relation to the Site boundary, with Areas of Potential (extrapolated from deposit records)

Legend

- 3900BC Coastline (Green, 2011)
- 3900BC Intertidal Limit (Green, 2011)
- 4900BC Coastline (Green, 2011)
- 4900BC Intertidal Limit (Green, 2011)
- 5900 BC Coastline (Green, 2011)
- Site Boundary
- AoP 1
- AoP 2
- AoP 3
- AoP 4
- Coastal Inlet Extent

FOR:

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	05/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:12,500 @ A3

0 500m

C:\Users\jessica.taylor\OneDrive - AOC Archaeology Group\Geoarchaeology\5 - GIS\Projects\53122-VPI Immingham\53122-VPI Immingham.aprx

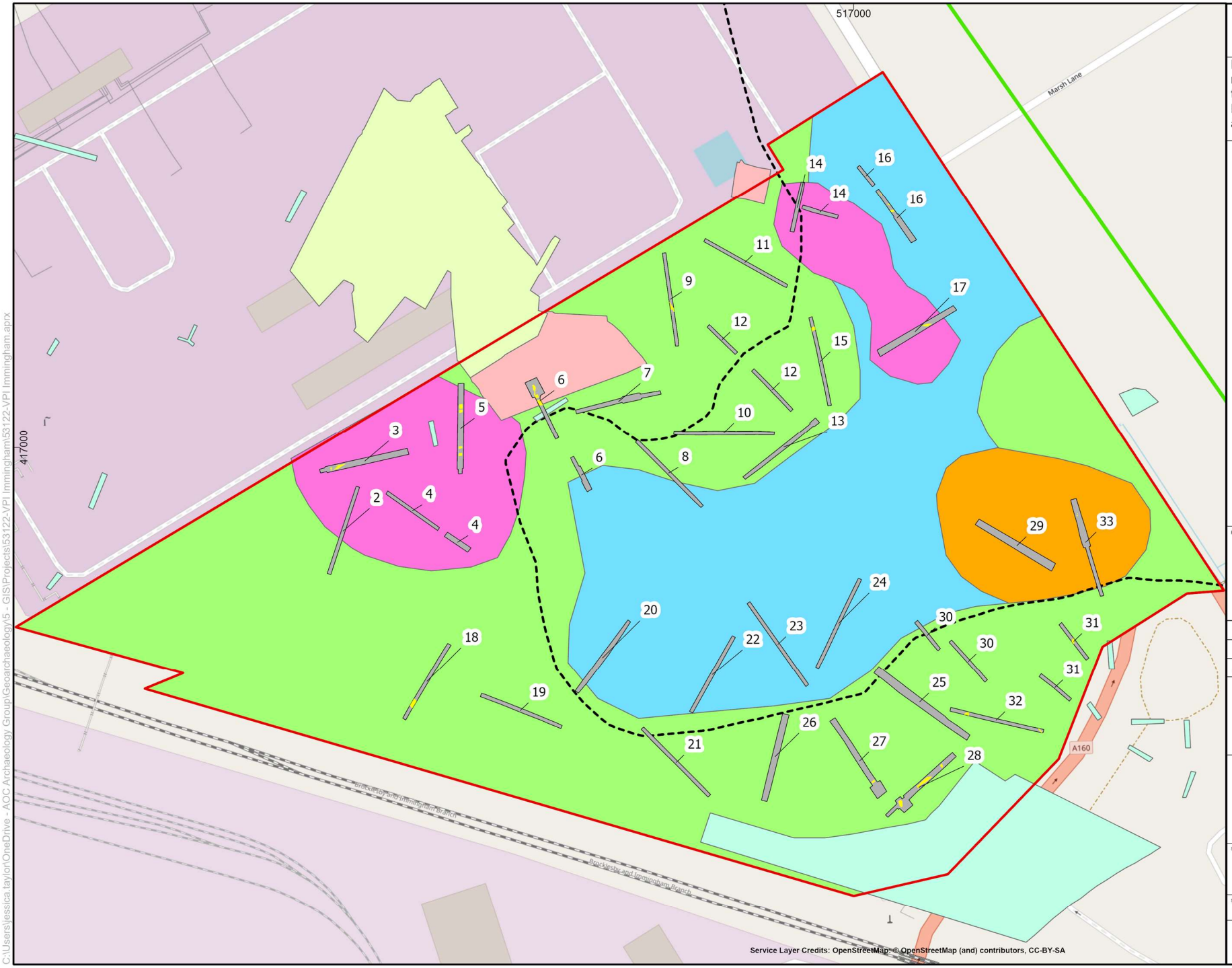


Figure	20

Plan showing the relict coastline and modelled coastal inlet in relation to the Site boundary, with Areas of Potential and locations of archaeological investigation

Legend

- Site Boundary
- 4900BC Coastline (Green, 2011)
- AoP 1
- AoP 2
- AoP 3
- AoP 4
- Coastal Inlet Extent
- AOC 53122 Trench
- AOC 53122 Feature
- Area Excavation 2000
- Area Excavation 2002
- Previous Archaeological Work

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	22/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:2,000 @ A3

0 100m

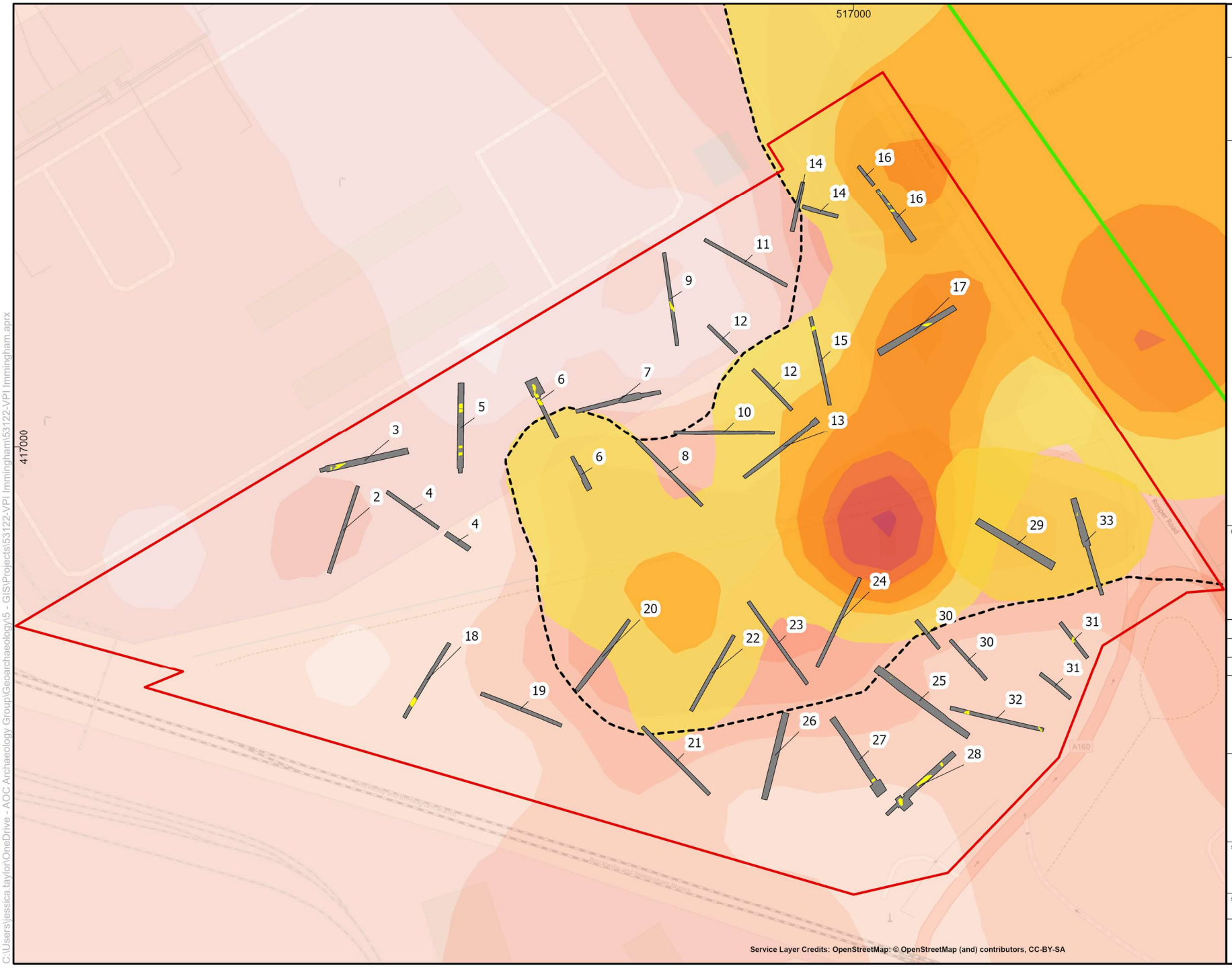


Figure 21

Plan showing the modelled coastal inlet deposits and archaeological investigation areas

Legend

- Site Boundary
- AOC 53122 Feature
- AOC 53122 Trench
- Coastal Inlet Extent
- 1900BC Coastline (Green, 2011)

Lower Intertidal Thickness
m
- 0.000000 - 0.250000
- 0.250001 - 0.500000
- 0.500001 - 0.750000
- 0.750001 - 1.000000
- 1.000001 - 1.250000
- 1.250001 - 1.500000
- 1.500001 - 1.750000
- 1.750001 - 2.000000
- 2.000001 - 2.250000
- 2.250001 - 2.500000
- 2.500001 - 2.750000
- 2.750001 - 3.000000
- 3.000001 - 3.250000

Glaciofluvial (Pleistocene) Surface
m OD
- 3.000001 - 3.500000
- 2.500001 - 3.000000
- 2.000001 - 2.500000
- 1.500001 - 2.000000
- 1.000001 - 1.500000
- 0.500001 - 1.000000
- 0.000001 - 0.500000
- -0.499999 - 0.000000
- -0.999999 - -0.500000
- -1.499999 - -1.000000
- -1.999999 - -1.500000
- -2.499999 - -2.000000
- -2.999999 - -2.500000
- -3.499999 - -3.000000
- -3.999999 - -3.500000
- -4.000000

FOR

AECOM
Sunley House,
4 Bedford Park,
Croydon
CR0 2AP

Drawn/checked:	JT
DWG no / Date:	23/06/23
AOC Project No.:	53122

AOC Archaeology Group

N

SYSTEM

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936

SCALE

1:2,000 @ A3

0 100m

APPENDICES

13 APPENDIX A – DEPOSIT MODEL DATA REFERENCES

Deposit log	Easting	Northing	Elevation	Source
AA13_A1	517530.2	417803.6	2.38	Allen Archaeology
AA13_A2	517501.8	417850.1	2.31	Allen Archaeology
AA13_A3	517474.9	417889.8	2.37	Allen Archaeology
AA13_C1	516942.4	417527.8	2.86	Allen Archaeology
AA13_C10	517318.5	417768	2.33	Allen Archaeology
AA13_C11	517361.2	417796	2.22	Allen Archaeology
AA13_C12	517396.3	417817.3	2.41	Allen Archaeology
AA13_C13	517431.8	417839.6	2.34	Allen Archaeology
AA13_C14	517474.5	417865.8	2.3	Allen Archaeology
AA13_C15	517515.4	417893.3	2.45	Allen Archaeology
AA13_C2	516985.1	417555.1	2.7	Allen Archaeology
AA13_C3	517027.3	417582.6	2.45	Allen Archaeology
AA13_C4	517067.3	417607.5	2.34	Allen Archaeology
AA13_C5	517110.9	417632.9	2.27	Allen Archaeology
AA13_C6	517153.6	417661.7	2.32	Allen Archaeology
AA13_C7	517194	417688	2.38	Allen Archaeology
AA13_C8	517237.1	417715.5	2.16	Allen Archaeology
AA13_C9	517278	417742.2	2.36	Allen Archaeology
AA13_D1	517589.8	417720.9	2	Allen Archaeology
AA13_D2	517647.4	417640.3	3	Allen Archaeology
AA13_D3	517608.6	417492.1	3	Allen Archaeology
AA13_D4	517672.3	417413.3	3	Allen Archaeology
AA13_D5	517820.8	417391.5	3	Allen Archaeology
AA13_D6	517877.3	417307.9	3	Allen Archaeology
AA13_E1	517604.6	417605.9	3	Allen Archaeology
AA13_E10	517240.2	417359	3	Allen Archaeology
AA13_E2	517567.4	417582.3	3	Allen Archaeology
AA13_E3	517524.4	417554.7	3	Allen Archaeology
AA13_E4	517483.9	417526.1	3	Allen Archaeology
AA13_E5	517442.6	417498.5	3	Allen Archaeology
AA13_E6	517402.6	417470.6	3	Allen Archaeology
AA13_E7	517361.8	417442	3	Allen Archaeology
AA13_E8	517320	417414.4	3	Allen Archaeology
AA13_E9	517281.5	417390.3	3	Allen Archaeology
AOC53122_Tr11_NW	516919	417115.5	3.76	AOC
AOC53122_Tr11_SE	516954.8	417093.7	3.7306	AOC
AOC53122_Tr12	516958.9	417026.6	2.6	AOC
AOC53122_Tr13	516939.9	416985.2	2.746	AOC
AOC53122_Tr14	516971.3	417142.1	3.6181	AOC
AOC53122_Tr15_C	516978.3	417067.1	2.9927	AOC
AOC53122_Tr15_N	516977.2	417071.4	3.0077	AOC
AOC53122_Tr15_S	516979	417055.8	2.6889	AOC
AOC53122_Tr16	517021.1	417134.2	3.2571	AOC
AOC53122_Tr17	517031.5	417061.8	3.07676	AOC

AOC53122_Tr18	516773.8	416887.6	3.0643	AOC
AOC53122_Tr19	516807.2	416855.2	2.8851	AOC
AOC53122_Tr2	516719.1	416967.8	3.7537	AOC
AOC53122_Tr20	516859.8	416882.6	2.7415	AOC
AOC53122_Tr22	516919.6	416869.1	2.6813	AOC
AOC53122_Tr23_N	516953.1	416895.2	2.64284	AOC
AOC53122_Tr23_S	516953.7	416894.4	2.630835	AOC
AOC53122_Tr24	516989	416894.4	2.656	AOC
AOC53122_Tr25	517032.5	416859.9	3.22127	AOC
AOC53122_Tr26	516954.2	416815.9	2.9338	AOC
AOC53122_Tr27	516896.5	417086.6	3.418171	AOC
AOC53122_Tr28	517019	416796.4	3.5142	AOC
AOC53122_Tr29	517097.6	416942.6	2.55	AOC
AOC53122_Tr3	516717.4	416989.3	3.759257	AOC
AOC53122_Tr30_A	517064.2	416879.4	3.059	AOC
AOC53122_Tr30_B	517039.7	416898.6	2.795045	AOC
AOC53122_Tr31_A	517107.7	416869.1	2.6168	AOC
AOC53122_Tr31_B	517122.1	416891.4	2.501657	AOC
AOC53122_Tr32	517072.9	416850.2	2.98878	AOC
AOC53122_Tr4_N	516751.1	416965.6	3.88	AOC
AOC53122_Tr4_S	516774.5	416949.3	3.84	AOC
AOC53122_Tr5	516779.1	416993.1	3.91765	AOC
AOC53122_Tr6_N	516821.9	417033.2	3.82	AOC
AOC53122_Tr6_S	516821.6	417034.4	3.8	AOC
AOC53122_Tr7_E	516867.2	417026.8	3.74	AOC
AOC53122_Tr7_W	516876.7	417028.9	3.628	AOC
AOC53122_Tr8	516882.7	417001.2	3.014	AOC
AOC53122_Tr9	516896.6	417085.7	3.81576	AOC
AOC53122_WS1	516948.5	417071.9	3.65	AOC
AOC53122_WS10	516895.9	416924.9	2.85	AOC
AOC53122_WS11	516917	416893.9	2.72	AOC
AOC53122_WS2	516889.7	417005.9	2.998432	AOC
AOC53122_WS3	516901.2	416993.2	2.829916	AOC
AOC53122_WS4	516912.2	416981.1	2.730729	AOC
AOC53122_WS5	517017.5	416944.2	2.8	AOC
AOC53122_WS6	517032.6	416919.2	2.88	AOC
AOC53122_WS7	517048.6	416890.6	2.75	AOC
AOC53122_WS8	516858.9	416982.4	3.109544	AOC
AOC53122_WS9	516879.7	416963.3	2.776938	AOC
Geotechnics22_BH01	516692.1	416936.9	3.73	Geotechnics
Geotechnics22_BH02A	516986.8	417107.8	3.76	Geotechnics
Geotechnics22_BH05	517093.8	416946	2.54	Geotechnics
Geotechnics22_CPT01	517076.8	416878.9	2.43	Geotechnics
Geotechnics22_CPT02	516948.1	416798.2	2.96	Geotechnics
Geotechnics22_CPT03	517009.1	416891.9	2.62	Geotechnics
Geotechnics22_CPT04	517109.9	417014	2.61	Geotechnics
Geotechnics22_CPT05	517028	416963.9	3.07	Geotechnics

Geotechnics22_CPT06	516896.8	416884.1	2.56	Geotechnics
Geotechnics22_CPT07	516813.1	416832	2.83	Geotechnics
Geotechnics22_CPT08	516956	416979.9	2.72	Geotechnics
Geotechnics22_CPT09	517057.7	417099	2.97	Geotechnics
Geotechnics22_CPT10	516972	417047.7	2.69	Geotechnics
Geotechnics22_CPT11	516887	416995	2.98	Geotechnics
Geotechnics22_CPT12	516802.6	416943.9	3.68	Geotechnics
Geotechnics22_CPT13	516718.4	416890.3	3.69	Geotechnics
Geotechnics22_CPT14	516904.9	417064.9	3.8	Geotechnics
Geotechnics22_CPT15	516774.9	416987	3.95	Geotechnics
Geotechnics22_CPT16	516646.9	416909.9	3.72	Geotechnics
Geotechnics22_CPT17	516882.8	417097.9	4.16	Geotechnics
Geotechnics22_CPT18	516797.9	417045.8	3.97	Geotechnics
Geotechnics22_CPT19	516703.8	416993.8	3.9	Geotechnics
Geotechnics22_CPT20	516630	416942	3.73	Geotechnics
TA11NE108	515740	416270	0.53	BGS
TA11NE110	515740	416290	0.5	BGS
TA11NE115	517762	417413	2.725	BGS
TA11NE116	518082	417856	3.585	BGS
TA11NE208	518157	416301	4.6	BGS
TA11NE209	517881	416592	2.54	BGS
TA11NE210	518022	416643	2.64	BGS
TA11NE273	517580	416160	5.18	BGS
TA11NE48	517020	417150	3.81	BGS
TA11NE7	516240	416400	7.62	BGS
TA11NE8	517230	416920	3.81	BGS
TA11NE9	517160	417050	3.81	BGS

14 APPENDIX B – DEPOSIT DATA WITHIN THE SITE REFERENCE AND PLEISTOCENE SURFACE SUMMARY

Deposit Log	Easting	Northing	Elevation (m OD)	Source	Pleistocene Surface (m bgl)
AOC53122_Tr11_NW	516919	417115.5	3.76	AOC	0.63
AOC53122_Tr11_SE	516954.8	417093.7	3.7306	AOC	-
AOC53122_Tr12N	516,944.31	417,041.43	2.6	AOC	1.46
AOC53122_Tr12S	516,958.89	417,026.58	2.66	AOC	1.40
AOC53122_Tr13	516939.9	416985.2	2.746	AOC	1.66
AOC53122_Tr14	516971.3	417142.1	3.6181	AOC	-
AOC53122_Tr15_C	516978.3	417067.1	2.9927	AOC	1.28
AOC53122_Tr15_N	516977.2	417071.4	3.0077	AOC	1.36
AOC53122_Tr15_S	516979	417055.8	2.6889	AOC	1.29
AOC53122_Tr16	517021.1	417134.2	3.2571	AOC	-
AOC53122_Tr17	517031.5	417061.8	3.07676	AOC	3.29
AOC53122_Tr18	516773.8	416887.6	3.0643	AOC	0.79
AOC53122_Tr19	516807.2	416855.2	2.8851	AOC	0.65
AOC53122_Tr2	516719.1	416967.8	3.7537	AOC	1.86
AOC53122_Tr20	516859.8	416882.6	2.7415	AOC	2.40
AOC53122_Tr21	516917	416807	2.9	AOC	1.11
AOC53122_Tr22	516919.6	416869.1	2.6813	AOC	-
AOC53122_Tr23_N	516953.1	416895.2	2.64284	AOC	2.60
AOC53122_Tr23_S	516953.7	416894.4	2.630835	AOC	2.55
AOC53122_Tr24	516989	416894.4	2.656	AOC	2.35
AOC53122_Tr25	517032.5	416859.9	3.22127	AOC	2.12
AOC53122_Tr26	516954.2	416815.9	2.9338	AOC	1.20
AOC53122_Tr27	517011.7	416814.2	3.418171	AOC	1.95
AOC53122_Tr28	517019	416796.4	3.5142	AOC	1.13
AOC53122_Tr29N	517097.6	416942.6	2.55	AOC	2.75
AOC53122_Tr29S	517,104.68	416,939.42	2.57	AOC	2.35
AOC53122_Tr3	516717.4	416989.3	3.759257	AOC	1.72
AOC53122_Tr30_A	517064.2	416879.4	3.059	AOC	0.93
AOC53122_Tr30_B_N	517039.7	416898.6	2.795045	AOC	1.40
AOC53122_Tr30_B_S	517,046.49	416,890.17	2.68	AOC	1.50
AOC53122_Tr31_A	517107.7	416869.1	2.6168	AOC	0.47
AOC53122_Tr31_B	517122.1	416891.4	2.501657	AOC	0.75
AOC53122_Tr32	517072.9	416850.2	2.98878	AOC	1.35
AOC53122_Tr4_N	516751.1	416965.6	3.88	AOC	-
AOC53122_Tr4_C	516,764.88	416,956.02	3.99	AOC	2.56
AOC53122_Tr4_S	516774.5	416949.3	3.84	AOC	2.24
AOC53122_Tr5	516779.1	416993.1	3.91765	AOC	1.98
AOC53122_Tr6_N	516821.9	417033.2	3.82	AOC	-
AOC53122_Tr6_S	516821.6	417034.4	3.8	AOC	2.30
AOC53122_Tr7_E	516867.2	417026.8	3.74	AOC	-
AOC53122_Tr7_W	516876.7	417028.9	3.628	AOC	1.52
AOC53122_Tr8	516882.7	417001.2	3.014	AOC	1.14
AOC53122_Tr9	516896.6	417085.7	3.81576	AOC	1.39
AOC53122_Tr10	516,905.94	417,007.34	2.75	AOC	1.38
AOC53122_WS1	516948.5	417071.9	3.65	AOC	0.63
AOC53122_WS10	516895.9	416924.9	2.85	AOC	2.33

AOC53122_WS11	516917	416893.9	2.72	AOC	2.13
AOC53122_WS2	516889.7	417005.9	2.998432	AOC	1.30
AOC53122_WS3	516901.2	416993.2	2.829916	AOC	2.20
AOC53122_WS4	516912.2	416981.1	2.730729	AOC	1.50
AOC53122_WS5	517017.5	416944.2	2.8	AOC	4.23
AOC53122_WS6	517032.6	416919.2	2.88	AOC	3.50
AOC53122_WS7	517048.6	416890.6	2.75	AOC	1.46
AOC53122_WS8	516858.9	416982.4	3.109544	AOC	3.16
AOC53122_WS9	516879.7	416963.3	2.776938	AOC	2.04
Geotechnics22_BH01	516692.1	416936.9	3.73	Geotechnics	2.20
Geotechnics22_BH02A	516986.8	417107.8	3.76	Geotechnics	3.70
Geotechnics22_BH05	517093.8	416946	2.54	Geotechnics	2.50
Geotechnics22_CPT01	517076.8	416878.9	2.43	Geotechnics	0.70
Geotechnics22_CPT02	516948.1	416798.2	2.96	Geotechnics	0.60
Geotechnics22_CPT03	517009.1	416891.9	2.62	Geotechnics	-
Geotechnics22_CPT04	517109.9	417014	2.61	Geotechnics	0.10
Geotechnics22_CPT05	517028	416963.9	3.07	Geotechnics	-
Geotechnics22_CPT06	516896.8	416884.1	2.56	Geotechnics	-
Geotechnics22_CPT07	516813.1	416832	2.83	Geotechnics	0.50
Geotechnics22_CPT08	516956	416979.9	2.72	Geotechnics	-
Geotechnics22_CPT09	517057.7	417099	2.97	Geotechnics	-
Geotechnics22_CPT10	516972	417047.7	2.69	Geotechnics	-
Geotechnics22_CPT11	516887	416995	2.98	Geotechnics	-
Geotechnics22_CPT12	516802.6	416943.9	3.68	Geotechnics	1.00
Geotechnics22_CPT13	516718.4	416890.3	3.69	Geotechnics	0.80
Geotechnics22_CPT14	516904.9	417064.9	3.8	Geotechnics	0.80
Geotechnics22_CPT15	516774.9	416987	3.95	Geotechnics	-
Geotechnics22_CPT16	516646.9	416909.9	3.72	Geotechnics	-
Geotechnics22_CPT17	516882.8	417097.9	4.16	Geotechnics	-
Geotechnics22_CPT18	516797.9	417045.8	3.97	Geotechnics	0.50
Geotechnics22_CPT19	516703.8	416993.8	3.9	Geotechnics	-
Geotechnics22_CPT20	516630	416942	3.73	Geotechnics	1.0
TA11NE48	517020	417150	3.81	BGS	3.96

15 APPENDIX C – BOREHOLE DEPOSIT LOGS

Table 5 Deposit log for AOC53122_WS1

Intervention		Easting	Northing	Elevation		
AOC53122_WS1		516948.51	417071.88	3.65		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.65	3.53	0.00	0.12	0.12	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Also frequent moss Stone: occasional small sub-angular Rootlets: none Rooting: frequent, Interp: Thin layer of ground soil likely built up over top of hardcore when Site no longer needed.	Made Ground - Victorian to modern
3.53	3.02	0.12	0.63	0.51	MADE GROUND, Victorian to modern construction, Colour: White (10R 8/1), Soil Strth: firm, Soil Struc: undefined, Moisture: dry, Boundary: sharp, Inclusions - Occasional black plastic mesh throughout Stone: none Rootlets: none Rooting: none, Interp: hardcore consisting of varying sized pieces of chalk compressed into a very compact layer.	
3.02	0.65	0.63	3.00	2.37	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey. Occasional chalk flecks throughout. Hole finished at 3m bgl	Pleistocene - Till

Table 6 Deposit log for AOC53122_WS2

Intervention		Easting	Northing	Elevation		
AOC53122_WS2		516889.73	417005.943	2.998432		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.00	2.60	0.00	0.40	0.40	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: frequent, Interp: Mid brown grey. Chalk stones up to 30mm.	Made Ground - Victorian to modern
2.60	2.15	0.40	0.85	0.45	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: occasional, Interp: Mid brown grey	Holocene – alluvium / warp
2.15	1.70	0.85	1.30	0.45	CLAY, Colour: Grey (10YR 5/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Stone: none Rootlets: none Rooting: none, Interp:	
1.70	0.10	1.30	2.90	1.60	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Occasional chalk flecks throughout. Possible boulder clay/ till?	Pleistocene - Till
0.10	-3.00	2.90	6.00	3.10	CLAY, silty, Colour: Grey (10YR 5/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Slightly silty clay. Flecks of chalk throughout. Till? Hole completed at 6m bgl	

Table 7 Deposit log for AOC53122_WS3

Intervention		Easting	Northing	Elevation		
AOC53122_WS3		516901.24	416993.225	2.829916		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.83	2.38	0.00	0.45	0.45	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: frequent, Interp: Topsoil	Made Ground - Victorian to modern
2.38	2.13	0.45	0.70	0.25	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: occasional, Interp: Mid brownish orangey grey slightly silty clay.	Holocene – alluvium / warp
2.13	0.63	0.70	2.20	1.50	CLAY, Colour: Grey (10YR 6/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid orangey grey	
0.63	-2.17	2.20	5.00	2.80	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Mid brownish grey. Chalk flecks throughout. Presumed to be till, hole stopped at 5m bgl	Pleistocene - Till

Table 8 Deposit log for AOC53122_WS4

Intervention		Easting	Northing	Elevation		
AOC53122_WS4		516912.2	416981.076	2.730729		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**

2.73	2.33	0.00	0.40	0.40	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid greyish brown.	Made Ground - Victorian to modern
2.33	1.23	0.40	1.50	1.10	CLAY, silty, Colour: Grey (10YR 5/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid orange grey. Subsoil.	Holocene – alluvium / warp
1.23	-0.27	1.50	3.00	1.50	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Frequent flecks of chalk throughout. Till	Pleistocene - Till

Table 9 Deposit log for AOC53122_WS5

Intervention		Easting	Northing	Elevation		
AOC53122_WS5		517017.45	416944.18	2.8		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.80	2.12	0.00	0.68	0.68	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: soft, friable, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: frequent, Interp: Topsoil	Made Ground - Victorian to modern
2.12	1.20	0.68	1.60	0.92	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Occasional iron pan Stone: none Rootlets: none Rooting: occasional, Interp: Subsoil? Mid brownish grey slightly silty clay. Manganese also present.	Holocene – alluvium / warp
1.20	0.60	1.60	2.20	0.60	SILT, clayey, Colour: Brown (10YR 4/3), Soil Strth: soft, friable, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Occasional manganese Stone: none Rootlets: none Rooting: none, Interp:	Holocene – lower intertidal
0.60	0.20	2.20	2.60	0.40	SILT, clayey, Colour: Bluish Grey (10B 5/1), Soil Strth: soft, friable, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid bluish grey	
0.20	-0.20	2.60	3.00	0.40	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: rare small sub-rounded Rootlets: none Rooting: none, Interp: Rare chalk. Mid brownish grey.	

-0.20	-0.34	3.00	3.14	0.14	SILT, Colour: Bluish Grey (10B 6/1), Soil Strth: soft, friable, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: none, Interp:	
-0.34	-0.90	3.14	3.70	0.56	SILT, gravelly, Colour: , Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: sharp, Inclusions - Rare manganese and iron pan Stone: none Rootlets: none Rooting: none, Interp: Mid yellowish grey.	
-0.90	-1.20	3.70	4.00	0.30	SILT, clayey, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp:	
-1.20	-1.39	4.00	4.19	0.19	SILT, clayey, Colour: Bluish Grey (10B 5/1), Soil Strth: soft, friable, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp:	
-1.39	-1.43	4.19	4.23	0.04	SAND, silty, Colour: Reddish Brown (2.5YR 4/3), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: sharp, Inclusions - Stone: occasional medium sub-rounded Rootlets: none Rooting: none, Interp: Mid brownish red.	
-1.43	-3.20	4.23	6.00	1.77	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Dark brownish grey. Frequent chalk fleck throughout. Hole finished at 6m	Pleistocene - Till

Table 10 Deposit log for AOC53122_WS6

Intervention	Easting	Northing	Elevation	
AOC53122_WS6	517032.62	416919.19	2.88	

Top elevation (m OD)	Base elevation (m OD)	Top depth (m bgl)	Base depth (m bgl)	Thickness (m)	Description	Interpretation
2.88	2.69	0.00	0.19	0.19	CLAY, silty, Colour: Dark Greyish Brown (10YR 4/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: frequent, Interp: Topsoil. Mixed structure.	Made Ground - Victorian to modern
2.69	2.28	0.19	0.60	0.41	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Stone: occasional small sub-angular Rootlets: none Rooting: occasional, Interp: Subsoil. Mixed structure.	Holocene – alluvium / warp
2.28	0.13	0.60	2.75	2.15	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional iron pan Stone: none Rootlets: none Rooting: none, Interp:	Holocene – lower intertidal
0.13	-0.62	2.75	3.50	0.75	SAND, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional black mineral staining Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey. Fairly fine.	
-0.62	-0.82	3.50	3.70	0.20	SILT, sandy, Colour: Brown (10YR 4/3), Soil Strth: soft, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Fairly soft and fine. Occasional chalk and degraded stone throughout.	Pleistocene - Till

-0.82	-1.12	3.70	4.00	0.30	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey. Occasional chalk flecks throughout. Hole finished at 4m	

Table 11 Deposit log for AOC53122_WS7

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_WS7		517048.57	416890.6	2.75		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.75	2.55	0.00	0.20	0.20	CLAY, silty, Colour: Dark Greyish Brown (10YR 4/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: frequent, Interp: Topsoil. Mixed structure.	Made Ground - Victorian to modern
2.55	2.15	0.20	0.60	0.40	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Occasional rooting and iron pan. Stone: none Rootlets: none Rooting: none, Interp: Subsoil. mixed structure.	Holocene – alluvium / warp
2.15	1.56	0.60	1.19	0.59	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Occasional iron pan.	
1.56	1.29	1.19	1.46	0.27	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Stone: none Rootlets: none Rooting: none, Interp:	

1.29	-0.05	1.46	2.80	1.34	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional manganese throughout Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Mid brownish grey. Chalk flecks throughout.	Pleistocene - Till
-0.05	-0.25	2.80	3.00	0.20	SAND, silty, Colour: Yellowish Brown (10YR 5/4), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Chalk flecks and manganese throughout Stone: none Rootlets: none Rooting: none, Interp: Hole finished at 3m due to water presence, empty casing.	

Table 12 Deposit log for AOC53122_WS8

Intervention		Easting	Northing	Elevation		
AOC53122_WS8		516858.9	416982.44	3.109544		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.11	2.84	0.00	0.27	0.27	SILT, clayey, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Stone: occasional - - Rootlets: frequent Rooting: none, Interp: Topsoil	Made Ground - Victorian to modern
2.84	2.59	0.27	0.52	0.25	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Stone: none Rootlets: none Rooting: occasional, Interp: Subsoil	
2.59	1.01	0.52	2.10	1.58	SILT, clayey, Colour: Light Brownish Grey (2.5Y 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey. Possibly water formed - estuarine?	Holocene – alluvium / warp
1.01	-0.05	2.10	3.16	1.06	SILT, clayey, Colour: Very Dark Grey (2.5Y 3/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Dark blackish grey. Boulder clay?	Holocene – lower intertidal
-0.05	-0.39	3.16	3.50	0.34	CLAY, Colour: Light Brownish Grey (2.5Y 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Stone: occasional small sub-angular Rootlets: none Rooting: none, Interp: Mid brown grey. Boulder clay? Flecks of chalk up to 10mm throughout.	Pleistocene - Till

-0.39	-2.89	3.50	6.00	2.50	CLAY, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: undefined, Inclusions - Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Mid brown grey. Boulder clay? Hole finished at 6m bgl due to collapse.	

Table 13 Deposit log for AOC53122_WS9

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_WS9		516879.69	416963.3	2.776938		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.78	2.38	0.00	0.40	0.40	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Stone: frequent small sub-rounded Rootlets: none Rooting: frequent, Interp: Topsoil. Mid greyish brown. Fleck of chalk throughout.	Made Ground - Victorian to modern
2.38	0.74	0.40	2.04	1.64	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional black mineral staining Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey. Firm but friable.	Holocene – alluvium / warp

0.74	-1.12	2.04	3.90	1.86	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: undefined, Inclusions - Occasional black mineral staining. Stone: occasional small sub-rounded Rootlets: none Rooting: none, Interp: Mid greyish brown, slightly silty clay. Chalk flecks throughout up to 10mm, infrequent larger subrounded stones, up to 40mm. Possible boulder clay.	Pleistocene - Till

Table 14 Deposit log for AOC53122_WS10

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_WS10		516895.86	416924.93	2.85		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.85	2.25	0.00	0.60	0.60	CLAY, silty, Colour: Dark Greyish Brown (10YR 4/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Occasional CBM Stone: none Rootlets: none Rooting: frequent, Interp: Topsoil. Mixed structure.	Made Ground - Victorian to modern
2.25	1.99	0.60	0.86	0.26	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: diffuse, Inclusions - Rare iron pan Stone: none Rootlets: none Rooting: occasional, Interp: Subsoil	Holocene – alluvium / warp
1.99	1.55	0.86	1.30	0.44	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional iron pan and manganese Stone: none Rootlets: none Rooting: none, Interp:	

1.55	1.43	1.30	1.42	0.12	SILT, clayey, Colour: Bluish Grey (10B 5/1), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Occasional iron pan and manganese Stone: none Rootlets: none Rooting: none, Interp: Mid orangey blue.	Holocene – lower intertidal
1.43	0.71	1.42	2.14	0.72	SILT, clayey, Colour: Greyish Brown (10YR 5/2), Soil Strth: soft, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional iron pan Stone: none Rootlets: none Rooting: none, Interp:	
0.71	0.52	2.14	2.33	0.19	SAND, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: sharp, Inclusions - Occasional black mineral staining Stone: occasional small sub-angular Rootlets: none Rooting: none, Interp: Mid greyish brown. Mixed soil structure.	
0.52	-1.15	2.33	4.00	1.67	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: dry, Boundary: undefined, Inclusions - Chalk flecks and manganese throughout. Stone: none Rootlets: none Rooting: none, Interp: Fairly dry. Hole ceased at 4m	Pleistocene - Till

Table 15 Deposit log for AOC53122_WS11

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_WS11		516917.04	416893.94	2.72		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.72	2.31	0.00	0.41	0.41	CLAY, silty, Colour: Dark Greyish Brown (10YR 4/2), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: gradual, Inclusions - Stone: none Rootlets: none Rooting: frequent, Interp: Mixed soil structure.	Made Ground - Victorian to modern

2.31	1.92	0.41	0.80	0.39	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Occasional iron pan Stone: none Rootlets: none Rooting: occasional, Interp: Subsoil?	Holocene – alluvium / warp
1.92	1.42	0.80	1.30	0.50	CLAY, silty, Colour: Light Brownish Grey (10YR 6/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: gradual, Inclusions - Occasional iron pan Stone: none Rootlets: none Rooting: none, Interp: Mid brownish grey	
1.42	0.72	1.30	2.00	0.70	CLAY, silty, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional iron pan and manganese Stone: none Rootlets: none Rooting: none, Interp:	
0.72	0.59	2.00	2.13	0.13	SAND, silty, Colour: Yellowish Brown (10YR 5/4), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: sharp, Inclusions - Gravel inclusions with occasional black mineral staining. Stone: none Rootlets: none Rooting: none, Interp: Coarse and mixed soil structure.	Pleistocene - Till
0.59	-0.08	2.13	2.80	0.67	CLAY, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: homogenous, Moisture: moist, Boundary: sharp, Inclusions - Occasional manganese and chalk flecks throughout. Stone: none Rootlets: none Rooting: none, Interp:	
-0.08	-0.48	2.80	3.20	0.40	GRAVEL, sandy, Colour: Pale Yellow (5Y 8/3), Soil Strth: firm, Soil Struc: undefined, Moisture: moist, Boundary: diffuse, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Mid greyish yellow. Coarse.	

-0.48	-1.28	3.20	4.00	0.80	CLAY, sandy, Colour: Greyish Brown (10YR 5/2), Soil Strth: firm, Soil Struc: undefined, Moisture: dry, Boundary: undefined, Inclusions - Stone: none Rootlets: none Rooting: none, Interp: Slightly sandy clay with a mixed soil structure. Fairly dry. Hole finished at 4m.	

16 APPENDIX D – SONDAGE DEPOSIT LOGS

Table 16 Deposit log for AOC53122_Tr2

Intervention		Easting	Northing	Elevation		
AOC53122_Tr2		516719.07	416967.77	3.7537		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.75	3.49	0.00	0.26	0.26	MADE GROUND. Mid-light blue-grey extrenely compact rubble made ground layer.	Made Ground / Topsoil - Victorian to modern
3.49	3.30	0.26	0.45	0.19	MADE GROUND. Light yellow sand, compact friable, with v. frequent large angular white rocks.	
3.30	3.12	0.45	0.63	0.18	MADE GROUND. Mid-light grey compact friable clayey sand, frequent rocks.	
3.12	2.84	0.63	0.91	0.28	MADE GROUND. Mid-light tan yellow compact friable clayey sand, frequent small rocks. Sitting on terram.	
2.84	2.58	0.91	1.17	0.26	TOPSOIL. Dark grey brown compact silty CLAY. Compressed by made ground above.	
2.58	2.34	1.17	1.41	0.24	SUBSOIL. Mid-dark grey brown compact malleable silty CLAY.	
2.34	2.29	1.41	1.46	0.05	Malleable, compact, brownish-grey-blue with yellow mottling (dark), silty CLAY - occasional organic material.	Holocene - alluvium / warp
2.29	1.89	1.46	1.86	0.40	Compact, mid blue grey CLAY with occasional iron pan and manganese. Fluvial?	
1.89	1.69	1.86	2.06	0.20	Mid orange yellow gravels with sand between. Compact. Possible natural river gravels?	Pleistocene - Glaciofluvial

Table 17 Deposit log for AOC53122_Tr3

Intervention		Easting	Northing	Elevation		
AOC53122_Tr3		516717.38	416989.3	3.759257		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.76	3.19	0.00	0.57	0.57	MADE GROUND. Compact blue/grey hardstanding.	Made Ground / Topsoil - Victorian to modern
3.19	3.04	0.57	0.72	0.15	MADE GROUND. Firm white chalk hardcore.	

3.04	2.64	0.72	1.12	0.40	MADE GROUND. Mixed orange / tan / brown stone and clay. Frequent stones and rubble.	
2.64	2.49	1.12	1.27	0.15	TOPSOIL. Firm, dark grey/brown slightly organic silty CLAY.	
2.49	2.29	1.27	1.47	0.20	SUBSOIL. Firm mid grey/brown silty CLAY.	
2.29	2.04	1.47	1.72	0.25	Firm mixed blue/grey/orange CLAY with manganese flecks.	Holocene - alluvium / warp
2.04	1.86	1.72	1.90	0.18	Friable mixed brown / grey sandy CLAY with manganese flecks.	Pleistocene - Till
1.86	1.56	1.90	2.20	0.30	Firm orange / brown sandy CLAY and gravel.	
1.56	1.26	2.20	2.50	0.30	Firm mid purple / grey brown CLAY with chalk flecks.	

Table 18 Deposit log for AOC53122_Tr4_N

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr4_N		516751.1	416965.6	3.88		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.88	3.79	0.00	0.09	0.09	MADE GROUND. Mid mixed yellow and grey coarse sands and gravels. Extremely compact.	Made Ground / Topsoil - Victorian to modern
3.79	3.65	0.09	0.23	0.14	MADE GROUND. Dark grey compact friable sand and gravel made ground.	
3.65	3.52	0.23	0.36	0.13	MADE GROUND. Mid-light blue grey extremely compact rubble layer.	
3.52	3.41	0.36	0.47	0.11	MADE GROUND. Dark to mid blue grey very compact friable sand, frequent stones.	
3.41	3.25	0.47	0.63	0.16	MADE GROUND. Light yellow sand, compact x friable, with very frequent large angular white rocks. Resting on layer of matting.	
3.25	2.99	0.63	0.89	0.26	MADE GROUND. Mid-light tan yellow clayey sand. Frequent rocks.	
2.99	2.85	0.89	1.03	0.14	MADE GROUND. Mid-light yellow-grey compact friable clayey sand, frquent rocks. Sitting on layer of terram.	

2.85	2.57	1.03	1.31	0.28	Possible original TOPSOIL. Dark grey brown compact malleable silty CLAY. Generally sterile.	
2.57	2.05	1.31	1.83	0.52	Firm mid brownish bluey grey clay with occasional lenses of orange.	Holocene - alluvium / warp
2.05	1.95	1.83	1.93	0.10	Firm mid yellowish orange gravels. Inclusions: subangular flint	
1.95	1.75	1.93	2.13	0.20	Firm mid brownish orange clay with occasional reddish patches.	

Table 19 Deposit log for AOC53122_Tr4_C

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr4_C		516,764.88	416,956.02	3.99		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.99	3.79	0.00	0.20	0.20	Extremely compact mid mixed yellow and grey coarse sands.	'Made Ground / Topsoil - Victorian to modern
3.79	3.59	0.20	0.40	0.20	Compact to friable dark grey sand and gravel.	
3.59	3.46	0.40	0.53	0.13	Extremely compact mid light bluish grey rubble.	
3.46	3.35	0.53	0.64	0.11	Very compact to friable dark to mid bluish grey sand. Inclusions: frequent stones.	
3.35	3.19	0.64	0.80	0.16	Compact to friable light yellow sand. Inclusions: angular white hardcore on matting.	
3.19	2.93	0.80	1.06	0.26	Mid to light tan yellow clayey sand. Inclusions: frequent angular stones.	
2.93	2.73	1.06	1.26	0.20	Compact to friable mid to light yellowish grey clayey sand. Inclusions: frequent angular stones. Laid on terram membrane.	
2.73	2.23	1.26	1.76	0.50	Compact malleable dark greyish brown silty clay.	

2.23	1.83	1.76	2.16	0.40	Friable mid greyish brown slightly silty clay. Inclusions: occasional subangular stones.	
1.83	1.43	2.16	2.56	0.40	Firm mid brownish bluey grey clay with occasional lenses of orange.	Holocene - lower intertidal
1.43	1.39	2.56	2.60	0.04	Compact mid bluish brown clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 20 Deposit log for AOC53122_Tr4_S

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr4_S		516774.5	416949.3	3.84		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.84	3.80	0.00	0.04	0.04	TURF. Thin layer of grass growing over made ground.	Made Ground / Topsoil - Victorian to modern
3.80	2.98	0.04	0.86	0.82	MADE GROUND. Mid-light yellow brown compact friable sand and gravel made ground with construction debris.	
2.98	2.66	0.86	1.18	0.32	MADE GROUND. Mid yellow brown slightly clayey sand very compact, frequent stones and construction debris.	
2.66	2.55	1.18	1.29	0.11	Mid grey brown compact malleable silty CLAY, fine, sterile.	Holocene - alluvium / warp
2.55	2.31	1.29	1.53	0.24	Mid-dark grey blue compact malleable silty CLAY, fine, sterile.	
2.31	2.26	1.53	1.58	0.05	Mid brown compact malleable silty CLAY, some blue grey staining, sterile.	
2.26	2.10	1.58	1.74	0.16	Firm dark bluey black clay. Inclusions: organic.	Holocene - organic deposits
2.10	1.90	1.74	1.94	0.20	Compact mid bluey brownish grey clay. Inclusions: Iron pan.	Holocene - lower intertidal
1.90	1.60	1.94	2.24	0.30	Compact mid orangish brown clay.	
1.60	1.50	2.24	2.34	0.10	Compact mid bluish brown clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 21 Deposit log for AOC53122_Tr5

Bore	**Easting**	**Northing**	**Elevation**	

AOC53122_Tr5		516779.1	416993.1	3.91765		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.92	3.62	0.00	0.30	0.30	CONCRETE HARD STANDING. Grey concrete.	Made Ground / Topsoil - Victorian to modern
3.62	3.37	0.30	0.55	0.25	MADE GROUND / HARDSTANDING. Light grey white chalk and flint sitting above mesh.	
3.37	3.19	0.55	0.73	0.18	MADE GROUND. Mixed of tan brown hardcore and silty clay. Frequent stones.	
3.19	2.79	0.73	1.13	0.40	MADE GROUND. Mid-light grey white chalk and rubble above terram.	
2.79	2.29	1.13	1.63	0.50	BURIED TOPSOIL. Dark grey brown very silty soil with occasional organics remaining.	
2.29	2.14	1.63	1.78	0.15	SUBSOIL. Mid yellow brown silty CLAY.	
2.14	2.04	1.78	1.88	0.10	Flooding deposit. Firm, blue/grey waterlain CLAY.	Holocene - alluvium / warp
2.04	1.94	1.88	1.98	0.10	Varying silted deposits. Orange red brown in north, bluish brown central and end.	
1.94	1.92	1.98	2.00	0.02	Compact mid bluish brown clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 22 Deposit log for AOC53122_Tr6_N

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr6_N		516821.89	417033.18	3.82		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.82	3.72	0.00	0.10	0.10	MADE GROUND. Mid beige yellow. Compact coarse sand. Occasional midsize rocks.	Made Ground / Topsoil - Victorian to modern
3.72	3.54	0.10	0.28	0.18	MADE GROUND. Dark bluey grey. Very comact. Rolled layer.	
3.54	3.39	0.28	0.43	0.15	MADE GROUND. Pale white. Mid size to large size clumps of chalk. Plastic netting bissecting deposit.	
3.39	3.19	0.43	0.63	0.20	MADE GROUND. Pale white with flecks of grey. Same as above with additional grey clay specks.	

3.19	2.74	0.63	1.08	0.45	TOPSOIL. Mid-dark greyish brown. Coarse silty SAND. Some organic. Friable.	
2.74	2.64	1.08	1.18	0.10	SUBSOIL. Dark brownish grey, slick silty SAND. Compact, malleable.	
2.64	2.04	1.18	1.78	0.60	Mid reddish brown purple CLAY. Some orange mottling. Fine silty CLAY.	Holocene - alluvium / warp

Table 23 Deposit log for AOC53122_Tr7_E

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr7_E		516867.21	417026.77	3.74		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.74	3.68	0.00	0.06	0.06	TARMAC.	Made Ground / Topsoil - Victorian to modern
3.68	3.58	0.06	0.16	0.10	MADE GROUND. White grey chalk small to medium subangular chalk fragments.	
3.58	3.43	0.16	0.31	0.15	MADE GROUND. Grey white chalk rubble. Small subangular fragments.	
3.43	3.42	0.31	0.32	0.01	MADE GROUND. Works reinforcenment mat - black plastic 0.04 x 0.04m squares.	
3.42	3.30	0.32	0.44	0.12	MADE GROUND. Grey white chalk rubble small subangular fragments, same as 7002.	
3.30	3.03	0.44	0.71	0.27	MADE GROUND. Yellow white grey mottled chalk rubble, medium to large chalk fragments, compact.	
3.03	2.81	0.71	0.93	0.22	MADE GROUND. Friable silty grey with frequent small gravel throughout rubble	
2.81	2.80	0.93	0.94	0.01	TERRAM CLOTH. Black, finely woven friable plastic tarpaulin.	
2.80	2.40	0.94	1.34	0.40	ALLUVIUM. Stiff, silty CLAY, mid to dark grey, with occasional chalk flecks.	Holocene - alluvium / warp

Table 24 Deposit log for AOC53122_Tr8

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr8		516882.7	417001.2	3.014		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**

3.01	2.84	0.00	0.17	0.17	TOPSOIL. Friable moderately compact mid brown clayey loam. Heavy vegetation intermingled spotty made ground present.	Made Ground / Topsoil - Victorian to modern
2.84	2.71	0.17	0.30	0.13	SUBSOIL. Malleable mid brown CLAY. Some vegetation.	
2.71	2.60	0.30	0.41	0.11	Compact, malleable mid orangeish yellow natural CLAY.	Holocene - alluvium / warp
2.60	2.53	0.41	0.48	0.07	Compact malleable mid-light bluish grey with orange streaks. Natural CLAY.	
2.53	2.38	0.48	0.63	0.15	Compact malleable mid orange with grey mottling, natural CLAY. Occasional manganese.	
2.38	2.32	0.63	0.69	0.06	Compact malleable mid brown with some orange, natural silty CLAY frequent manganese.	
2.32	2.20	0.69	0.81	0.12	Compact and malleable mid to light blue grey CLAY with bright orange and yellow staining common - isolated patches.	
2.20	2.00	0.81	1.01	0.20	Mid purplish brown somewhat compact silty CLAY. Malleable, smooth. Common manganese.	Holocene - lower intertidal
2.00	1.87	1.01	1.14	0.13	Mid purple yellow brown somewhat firm malleable CLAY slightly silty with frequent manganese. Infrequent yellow mottling.	
1.87	1.76	1.14	1.25	0.11	Malleable mid purple yellowish brown slightly silty clay. Inclusions: frequent manganese.	Pleistocene - Till

Table 25 Deposit log for AOC53122_Tr9

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr9		516896.6	417085.7	3.81576		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.82	3.70	0.00	0.12	0.12	MADE GROUND. Dark brownish grey, loose, mid sized gravels and soil.	Made Ground / Topsoil - Victorian to modern

3.70	3.62	0.12	0.20	0.08	MADE GROUND. Pale grey compressed stones, possible concrete. Solid.	
3.62	3.43	0.20	0.39	0.19	MADE GROUND. Mid brownish yellow. Mid sized chalk rocks and sand, compressed layer.	
3.43	3.22	0.39	0.60	0.21	TOPSOIL. Dark brownish grey, highly organic, fine silty clayey SAND.	
3.22	3.06	0.60	0.76	0.16	SUBSOIL. Mid greyish brown. Fine silty CLAY, some flecks orange - iron panning.	
3.06	2.88	0.76	0.94	0.18	Dark brownish grey firm sandy silt	Holocene - lower intertidal
2.88	2.43	0.94	1.39	0.45	Malleable mid purple yellowish brown slightly silty clay. Inclusions: frequent manganese.	
2.43	2.42	1.39	1.40	0.01	Boulder clay	Pleistocene - Till

Table 26 Deposit log for AOC53122_Tr10

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr10		516,905.94	417,007.34	2.75		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.75	2.37	0.00	0.38	0.38	Friable dark greyish brown silty clay.	Made Ground / Topsoil - Victorian to modern
2.37	2.07	0.38	0.68	0.30	Firm orangish blueish grey clay. Inclusions: occasional manganese flecks.	Holocene - alluvium / warp
2.07	1.97	0.68	0.78	0.10	Firm dark purplish brown silty clay. Inclusions: occasional manganese flecks, pottery	Holocene - upper intertidal
1.97	1.67	0.78	1.08	0.30	Firm dark blackish blueish grey organic clay. Inclusions: wood and plant matter.	Holocene - organic deposits
1.67	1.37	1.08	1.38	0.30	Firm mixed blueish grey orangish clays and gravels. Inclusions: occasional small rounded stones.	Holocene - lower intertidal

1.37	1.35	1.38	1.40	0.02	Firm reddish blueish grey clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 27 Deposit log for AOC53122_Tr12N

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr12		516958.89	417026.58	2.6		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.60	2.18	0.00	0.42	0.42	TOPSOIL. Mid grey brown, somewhat compact, clay loam with heavy rooting and occasional small to medium subrounded gravel.	Made Ground / Topsoil - Victorian to modern
2.18	1.96	0.42	0.64	0.22	SUBSOIL. Mid to light grey brown compact to malleable CLAY with occasional rooting. Mostly sterile.	
1.96	1.84	0.64	0.76	0.12	ESTUARINE DEPOSIT. Light blue grey compact/malleable CLAY with orange streaks.	Holocene - lower intertidal
1.84	1.64	0.76	0.96	0.20	ESTUARINE DEPOSIT. Mid to light red brown compact/malleable CLAY with frequent manganese flecks.	
1.64	1.38	0.96	1.22	0.26	ESTUARINE DEPOSIT. Light blue grey compact/malleable CLAY with lenses of dark black grey soft organic clay.	
1.38	1.18	1.22	1.42	0.20	ESTUARINE DEPOSIT. Mid to light orange yellow CLAY with light blue grey mottling. Compact/malleable.	
1.18	1.02	1.42	1.58	0.16	BOULDER CLAY. Mid to light red brown CLAY with frequent manganese and chalk flecks.	Pleistocene - Till

Table 28 Deposit log for AOC53122_Tr12S

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr12S		516,958.89	417,026.58	2.66		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**

2.66	2.24	0.00	0.42	0.42	Firm mid greyish brown clayey loam. Inclusions: heavy rooting, occasional small to medium sub angular stone.	Made Ground / Topsoil - Victorian to modern
2.24	2.02	0.42	0.64	0.22	Firm to malleable mid light greyish brown clay. Inclusions: rooting.	
2.02	1.92	0.64	0.74	0.10	Firm to malleable light blueish grey smooth clay with yellowish orange streaks.	Holocene - alluvium / warp
1.92	1.72	0.74	0.94	0.20	Firm to malleable mid light reddish brown clay. Inclusions: frequent flecks of manganese.	
1.72	1.46	0.94	1.20	0.26	Firm to malleable clay. inclusions: lenses of dark black organic.	Holocene - organic deposits
1.46	1.26	1.20	1.40	0.20	Firm malleable mid light orangish yellowish grey clay with light bluish grey mottling.	Holocene - lower intertidal
1.26	1.10	1.40	1.56	0.16	Firm mid light reddish greyish brown clay. Frequent manganese and chalk flecks.	Pleistocene - Till

Table 29 Deposit log for AOC53122_Tr13

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr13		516939.93	416985.16	2.746		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.75	2.55	0.00	0.20	0.20	TOPSOIL. Friable, dark grey/brown silty CLAY. Very wet.	Made Ground / Topsoil - Victorian to modern
2.55	2.35	0.20	0.40	0.20	SUBSOIL. Friable, mid grey/brown silty CLAY with occasional manganese flecks.	

2.35	2.05	0.40	0.70	0.30	Mixed blue grey/orange CLAY with some manganese. Possibly warp.	Holocene - alluvium / warp
2.05	1.49	0.70	1.26	0.56	Firm, dark purple brown silty CLAY with concentrations of manganese at the base (stagnant water?). [Marine] shell. Flooding deposit.	
1.49	1.27	1.26	1.48	0.22	Mixed blue grey/orange CLAY with some gravel. Lower flooding deposit.	Holocene - lower intertidal
1.27	1.09	1.48	1.66	0.18	Firm red/blue CLAY.	
1.09	0.99	1.66	1.76	0.10	BOULDER CLAY. Firm red/blue CLAY with moderate chalk flecks.	Pleistocene - Till

Table 30 Deposit log for AOC53122_Tr15C

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr15_C		516978.27	417067.05	2.9927		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.99	2.78	0.00	0.21	0.21	SUBSOIL. Mid greyish brown, soft and friable, silty coarse SAND.	Made Ground / Topsoil - Victorian to modern
2.78	2.63	0.21	0.36	0.15	Light blue grey somewhat compact silty CLAY with orange lenses. Later flooding.	Holocene - alluvium / warp
2.63	2.38	0.36	0.61	0.25	Very mottled mid orange yellow and light blue grey fairly firm silty CLAY with very occasional manganese. Later flooding.	
2.38	2.08	0.61	0.91	0.30	FILL. Mid to light blue grey compact smooth malleable CLAY with orange mottling. Rare red sandstone.	
2.08	1.83	0.91	1.16	0.25	FILL. Mid purple brown CLAY mottled with occasional grey streaking and orange mottling. Very small patches of red brown silty SAND.	
1.83	1.71	1.16	1.28	0.12	FILL. Compact malleable smooth mid blue grey CLAY with rare moderate sized stones.	
1.71	1.61	1.28	1.38	0.10	BOULDER CLAY. Reddish brown boulder clay with frequent chalk flecks.	Pleistocene - Till

Table 31 Deposit log for AOC53122_Tr15N

Intervention		Easting	Northing	Elevation		
AOC53122_Tr15_N		516977.2	417071.39	3.0077		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.01	2.71	0.00	0.30	0.30	TOPSOIL. Mid to dark brownish grey, soft and friable, very organic silty coarse SAND.	Made Ground / Topsoil - Victorian to modern
2.71	2.50	0.30	0.51	0.21	SUBSOIL. Mid greyish brown, soft and friable, silty coarse SAND.	
2.50	2.35	0.51	0.66	0.15	BURIED SOIL. Mid orangey brown, some flecks of blue and chalk. Silty SAND with some clay.	Holocene - alluvium / warp
2.35	2.05	0.66	0.96	0.30	BURIED SOIL. Mid bluey grey with orange flecks, slick silty CLAY. Occasional small pebbles.	
2.05	1.65	0.96	1.36	0.40	Mid grey/orangey brown fine silty CLAY. Very slick, some manganese. Flooding deposit.	

Table 32 Deposit log for AOC53122_Tr17

Intervention		Easting	Northing	Elevation		
AOC53122_Tr17		517031.54	417061.78	3.07676		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.08	3.05	0.00	0.03	0.03	TOPSOIL. Mid brownish grey silty CLAY with moderate rooting, occasional stones and moss.	Made Ground / Topsoil - Victorian to modern
3.05	2.40	0.03	0.68	0.65	HARDCORE. Crumbly layer of yellow hardcore consisting of subangular chalk rocks up to 100 mm matting present.	
2.40	1.20	0.68	1.88	1.20	MADE GROUND. Modern debris likely from the backfilling of drainage channels. Dark grey brown silty CLAY with bricks and concrete.	
1.20	0.95	1.88	2.13	0.25	Mid grey brown slightly silty CLAY with rare manganese and iron pan.	Holocene - lower intertidal
0.95	0.49	2.13	2.59	0.46	Mid purple brownish grey silty CLAY with occasional manganese and shells. Fluvial?	

0.49	0.23	2.59	2.85	0.26	Mid orangey grey brown CLAY with frequent manganese and iron pan. Fluvial?	
0.23	-0.07	2.85	3.15	0.30	Mid greyish blue CLAY with a lens of black clay across the middle. Rare manganese. Sterile.	
-0.07	-0.21	3.15	3.29	0.14	Crunchy, mid yellow brownish orange SAND and GRAVEL with occasional subangular stones up to 50 mm.	Pleistocene - Glaciofluvial
-0.21	-0.44	3.29	3.52	0.23	Mid orange grey brown CLAY with rare manganese and iron pan.	Pleistocene - Till
-0.44	-0.74	3.52	3.82	0.30	BOULDER CLAY. Compact/firm mid blue brownish grey CLAY with chalk flecks.	

Table 33 Deposit log for AOC53122_Tr18

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr18		516773.76	416887.58	3.0643		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.06	2.85	0.00	0.21	0.21	TOPSOIL. Mid brown clay loam.	Made Ground / Topsoil - Victorian to modern
2.85	2.53	0.21	0.53	0.32	SUBSOIL. Yellowish brown CLAY with rare stone inclusions.	
2.53	2.21	0.53	0.85	0.32	Reddish brown CLAY with very few fine stone inclusions.	Holocene - alluvium / warp

Table 34 Deposit log for AOC53122_Tr19

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr19		516807.2	416855.2	2.8851		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.89	2.72	0.00	0.17	0.17	TOPSOIL. Dark brown CLAY loam.	Made Ground / Topsoil - Victorian to modern
2.72	2.64	0.17	0.25	0.08	SUBSOIL. Mid brown CLAY.	
2.64	2.24	0.25	0.65	0.40	Light brown CLAY.	Holocene - alluvium / warp
2.24	1.84	0.65	1.05	0.40	Firm mid blueish brownish grey clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 35 Deposit log for AOC53122_Tr20

Intervention	**Easting**	**Northing**	**Elevation**	
AOC53122_Tr20	516859.8	416882.6	2.7415	

Top elevation (m OD)	Base elevation (m OD)	Top depth (m bgl)	Base depth (m bgl)	Thickness (m)	Description	Interpretation
2.74	2.59	0.00	0.15	0.15	TOPSOIL. Dark brown CLAY loam.	Made Ground / Topsoil - Victorian to modern
2.59	2.14	0.15	0.60	0.45	SUBSOIL. Pale brown CLAY.	
2.14	1.61	0.60	1.13	0.53	Yellow brown CLAY with grey streaks/patches. Flood deposit.	Holocene - alluvium / warp
1.61	1.44	1.13	1.30	0.17	Pale grey clayey SILT with very few dark flecks. Flood deposit.	
1.44	1.04	1.30	1.70	0.40	Dark reddish purple CLAY. Flood deposit.	
1.04	0.74	1.70	2.00	0.30	Mottled bright orange and blue CLAY. Flood deposit.	
0.74	0.54	2.00	2.20	0.20	Light blue CLAY with occasional patches of bright orange clay. Flood deposit.	
0.54	0.34	2.20	2.40	0.20	Bright orange coarse SAND with GRAVEL. Basal flooding deposit.	Pleistocene - Glaciofluvial
0.34	0.24	2.40	2.50	0.10	Dark purple BOULDER CLAY with chalk flecks.	Pleistocene - Till

Table 36 Deposit log for AOC53122_Tr21

Intervention		Easting	Northing	Elevation		
AOC53122_Tr21		516916.95	416807.03	2.9		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.90	2.65	0.00	0.25	0.25	(21000) Dark grey brown loam	Made Ground / Topsoil - Victorian to modern
2.65	2.38	0.25	0.52	0.27	(21007) FLOOD DEPOSIT. Dark greyish brown loam, slightly lighter than 21000.	
2.38	2.28	0.52	0.62	0.10	(21001) SUBSOIL. Pale yellow brown firm CLAY.	
2.28	2.13	0.62	0.77	0.15	(21002) FLOOD DEPOSIT. Bright light blue sterile CLAY.	Holocene - alluvium / warp
2.13	1.93	0.77	0.97	0.20	(21003) FLOOD DEPOSIT. Mottled dark orange and light blue CLAY.	
1.93	1.78	0.97	1.12	0.15	(21004) FLOOD DEPOSIT. Bright yellow sandy CLAY. Sterile.	Holocene - lower intertidal
1.78	1.53	1.12	1.37	0.25	(21005) FLOOD DEPOSIT. Dull pale orange brown sandy CLAY - sterile.	
1.53	1.46	1.37	1.44	0.07	(21009) FLOOD DEPOSIT. Firm mid blue/grey sandy CLAY, mixed.	
1.46	1.20	1.44	1.70	0.26	(21008) FLOOD DEPOSIT. Firm dark blue/grey sandy CLAY with manganese flecks and small stones.	

Table 37 Deposit log for AOC53122_Tr23N

Intervention		Easting	Northing	Elevation		
AOC53122_Tr23_N		516953.11	416895.19	2.64284		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.64	2.44	0.00	0.20	0.20	TOPSOIL. Dark grey brown loam with some subangular gravel.	Made Ground / Topsoil - Victorian to modern
2.44	2.24	0.20	0.40	0.20	SUBSOIL. Bright orange brown sterile CLAY.	
2.24	2.04	0.40	0.60	0.20	Sterile pale blue CLAY with streaks of bright orange CLAY. Flooding deposit.	Holocene - alluvium / warp
2.04	0.94	0.60	1.70	1.10	Purple brown CLAY with streaks of bright orange CLAY. Flooding deposit.	
0.94	0.54	1.70	2.10	0.40	Bright blue/orange CLAY. Flooding deposit.	
0.54	0.34	2.10	2.30	0.20	Bright yellow CLAY with streaks of bright blue clay. Flooding deposit.	
0.34	0.04	2.30	2.60	0.30	Mid to dark coarse SAND and GRAVEL. Basal gravel.	Pleistocene - Glaciofluvial
0.04	-0.06	2.60	2.70	0.10	BOULDER CLAY.	Pleistocene - Till

Table 38 Deposit log for AOC53122_Tr23S

Intervention		Easting	Northing	Elevation		
AOC53122_Tr23_S		516953.67	416894.39	2.630835		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.63	2.43	0.00	0.20	0.20	TOPSOIL. Dark grey brown loam with some subangular gravel.	Made Ground / Topsoil - Victorian to modern
2.43	2.23	0.20	0.40	0.20	SUBSOIL. Bright orange brown sterile CLAY.	
2.23	2.03	0.40	0.60	0.20	Sterile pale blue CLAY with streaks of bright orange CLAY. Flooding deposit.	Holocene - alluvium / warp
2.03	1.73	0.60	0.90	0.30	Purple brown CLAY with streaks of bright orange CLAY. Flooding deposit.	
1.73	1.53	0.90	1.10	0.20	Bright light blue sterile CLAY. Flooding deposit.	

1.53	1.43	1.10	1.20	0.10	Bright yellow sterile CLAY. Flooding deposit.	
1.43	1.13	1.20	1.50	0.30	Dark blue sterile CLAY. Flooding deposit.	
1.13	0.93	1.50	1.70	0.20	Bright yellow CLAY with streaks of bright blue clay. Flooding deposit.	
0.93	0.53	1.70	2.10	0.40	Dark orange brown sterile CLAY. Flooding deposit.	
0.53	0.23	2.10	2.40	0.30	Very bright blue grey sterile CLAY. Flooding deposit.	
0.23	0.08	2.40	2.55	0.15	BOULDER CLAY.	Pleistocene - Till

Table 39 Deposit log for AOC53122_Tr24

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr24		516988.95	416894.43	2.656		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.66	2.46	0.00	0.20	0.20	TOPSOIL. Dark grey brown loam.	Made Ground / Topsoil - Victorian to modern
2.46	2.21	0.20	0.45	0.25	SUBSOIL. Light brown CLAY.	
2.21	2.06	0.45	0.60	0.15	Pale green grey CLAY. Flooding deposit.	Holocene - alluvium / warp
2.06	1.31	0.60	1.35	0.75	Purple brown CLAY. Flooding deposit.	
1.31	1.16	1.35	1.50	0.15	Bright orange CLAY. Flooding deposit.	
1.16	0.91	1.50	1.75	0.25	Dark blue grey CLAY. Flooding deposit.	
0.91	0.61	1.75	2.05	0.30	Mixed dark yellow brown CLAY. Flooding deposit.	
0.61	0.46	2.05	2.20	0.15	Dark blue yellow CLAY. Flooding deposit.	
0.46	0.21	2.20	2.45	0.25	Mottled dark yellow coarse SAND. Basal gravels.	Pleistocene - Glaciofluvial
0.31	0.26	2.35	2.40	0.05	Firm dark purple clay. Inclusions: flecks of chalk.	Pleistocene - Till

Table 40 Deposit log for AOC53122_Tr25

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr25		517032.5	416859.9	3.22127		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.22	3.09	0.00	0.13	0.13	TOPSOIL. Dark blackish brown silty CLAY with frequent rooting.	Made Ground / Topsoil - Victorian to modern

3.09	2.87	0.13	0.35	0.22	SUBSOIL. Mid yellowish brown silty CLAY with moderate rooting and occasional chalk flecks.	
2.87	2.45	0.35	0.77	0.42	Mid greyish, bluey yellow CLAY with occasional rooting, iron pan and manganese. Flooding deposit.	Holocene - alluvium / warp
2.45	2.35	0.77	0.87	0.10	Thin blue band of sterile CLAY. Flooding deposit.	
2.35	2.02	0.87	1.20	0.33	Mid purplish reddish brown CLAY with occasional iron pan and manganese. Flooding deposit.	
2.02	1.82	1.20	1.40	0.20	Thin blue band of sterile CLAY. Flooding deposit.	
1.82	1.54	1.40	1.68	0.28	Mid greyish yellow CLAY with occasional subangular pieces of flint and gravel. Flooding deposit.	
1.54	1.14	1.68	2.08	0.40	Mid greyish brown CLAY with rare manganese. Flooding deposit.	
1.14	1.02	2.08	2.20	0.12	Mid brownish blue grey CLAY with chalk and manganese. Natural boulder clay.	Pleistocene - Till

Table 41 Deposit log for AOC53122_Tr26

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr26		516954.16	416815.89	2.9338		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.93	2.78	0.00	0.15	0.15	TOPSOIL. Dark grey brown loam.	Made Ground / Topsoil - Victorian to modern
2.78	2.48	0.15	0.45	0.30	SUBSOIL. Pale grey brown CLAY with some rooting.	
2.48	2.33	0.45	0.60	0.15	Pale blue grey CLAY with patches of dark orange CLAY. Flooding deposit.	Holocene - alluvium / warp
2.33	2.13	0.60	0.80	0.20	Dark purple brown CLAY with streaks of orange clay. Flooding deposit.	
2.13	1.83	0.80	1.10	0.30	Mixed dark orange yellow coarse sandy CLAY with gravel inclusions.	Pleistocene - Till
1.83	1.63	1.10	1.30	0.20	Dark purple CLAY with flecks of chalk. Natural boulder clay.	

Table 42 Deposit log for AOC53122_Tr29_N

Bore		Easting	Northing	Elevation		
AOC53122_Tr29_N		517097.6	416942.6	2.55		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.55	2.25	0.00	0.30	0.30	TOPSOIL. Dark grey brown loam.	Made Ground / Topsoil - Victorian to modern
2.25	1.85	0.30	0.70	0.40	SUBSOIL. Pale yellow brown CLAY.	
1.85	1.65	0.70	0.90	0.20	Light grey orange with blue streaks CLAY. Flooding deposit.	Holocene - alluvium / warp
1.65	1.25	0.90	1.30	0.40	Dark purple brown CLAY. Flooding deposit.	
1.25	1.05	1.30	1.50	0.20	Bright orange yellow sandy CLAY.	
1.05	0.70	1.50	1.85	0.35	Dark black (almost organic) CLAY. Flooding deposit.	
0.70	0.50	1.85	2.05	0.20	Bright yellow brown sandy CLAY. Flooding deposit.	
0.50	0.10	2.05	2.45	0.40	Dull green brown CLAY. Flooding deposit.	
0.10	-0.20	2.45	2.75	0.30	Dark yellow and blue sandy CLAY. Flooding deposit.	
-0.20	-0.45	2.75	3.00	0.25	Dark purple BOULDER CLAY with chalk flecks.	Pleistocene - Till

Table 43 Deposit log for AOC53122_Tr29_S

Bore		Easting	Northing	Elevation		
AOC53122_Tr29_S		517,104.68	416,939.42	2.57		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.57	2.27	0.00	0.30	0.30	Friable dark greyish brown loam.	Made Ground / Topsoil - Victorian to modern
2.27	1.97	0.30	0.60	0.30	Firm pale yellowish brown clay.	
1.97	1.47	0.60	1.10	0.50	Firm light greyish orange clay with blue streaks.	Holocene - alluvium / warp
1.47	1.22	1.10	1.35	0.25	Firm dark purple brown clay.	
1.22	1.17	1.35	1.40	0.05	Firm dark black organic clay.	Holocene - organic deposits
1.17	0.77	1.40	1.80	0.40	Bright yellowish brown sandy clay.	Holocene - lower intertidal
0.77	0.47	1.80	2.10	0.30	Firm dull greenish brown clay.	
0.47	0.22	2.10	2.35	0.25	Firm dark yellow and blue sandy clay.	
0.22	0.17	2.35	2.40	0.05	Firm dark purple bolder clay. Inclusions: chalk flecks.	Pleistocene - Till

Table 44 Deposit log for AOC53122_Tr30B_N

Bore		Easting	Northing	Elevation		
AOC53122_Tr30_B_N		517039.7	416898.6	2.795045		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.80	2.60	0.00	0.20	0.20	TOPSOIL. Firm, dark brownish grey clayey loam.	Made Ground / Topsoil - Victorian to modern
2.60	2.40	0.20	0.40	0.20	WARP. Firm, mixed blue grey CLAY.	Holocene - alluvium / warp
2.40	2.10	0.40	0.70	0.30	Firm reddish brown with grey CLAY. Moderate manganese flecks. Flood deposit.	
2.10	2.05	0.70	0.75	0.05	Firm blue/grey very sterile CLAY with possible some organics. Flood deposit.	Holocene - lower intertidal
2.05	1.40	0.75	1.40	0.65	Firm to moderate, yellow/grey/brown CLAY and GRAVEL. Flood deposit/interface.	
1.40	1.30	1.40	1.50	0.10	Firm, dark purple brown clay with blue streaks. Inclusions: chalk flecks.	'Pleistocene - Till

Table 45 Deposit log for AOC53122_Tr30B_S

Bore		Easting	Northing	Elevation		
AOC53122_Tr30_B_S		517,046.49	416,890.17	2.68		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.68	2.48	0.00	0.20	0.20	Firm dark brownish grey clay loam.	Made Ground / Topsoil - Victorian to modern
2.48	2.08	0.20	0.60	0.40	Firm mixed blueish grey clay.	'Holocene - alluvium / warp
2.08	1.48	0.60	1.20	0.60	Firm purplish grey silty clay with mineral staining. Inclusions: few small stones.	
1.48	1.38	1.20	1.30	0.10	Firm blueish grey clay.	Holocene - lower intertidal
1.38	1.18	1.30	1.50	0.20	Firm yellowish brown sandy clay with mineral streaks. Inclusions small stones.	
1.18	1.03	1.50	1.65	0.15	Firm, dark purple brown clay with blue streaks. Inclusions: chalk flecks.	Pleistocene - Till

Table 46 Deposit log for AOC53122_Tr31B

Bore		Easting	Northing	Elevation		
AOC53122_Tr31_B		517122.1	416891.4	2.501657		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**

2.50	2.32	0.00	0.18	0.18	TOPSOIL. Dark greyish brown silty CLAY with frequent roots, moss and vegetation.	Made Ground / Topsoil - Victorian to modern
2.32	2.22	0.18	0.28	0.10	SUBSOIL. Mid yellowish brown slightly silty CLAY with moderate rooting and occasional chalk flecks up to 10 mm.	
2.22	2.02	0.28	0.48	0.20	Pale grey brown CLAY with patches of blue CLAY. Flood deposit/warp.	Holocene - alluvium / warp
2.02	1.87	0.48	0.63	0.15	Dull purple brown CLAY. Flood deposit.	
1.87	1.75	0.63	0.75	0.12	Bright blue band of sterile CLAY. Flood deposit.	
1.75	1.35	0.75	1.15	0.40	Bright orange sandy CLAY with moderate gravel and pebbles. Flood deposit.	Pleistocene - Till
1.35	1.30	1.15	1.20	0.05	Mid orange blue CLAY with chalk flecks and occasional manganese. Natural.	

Table 47 Deposit log for AOC53122_Tr32

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr32		517072.9	416850.2	2.98878		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.99	2.75	0.00	0.24	0.24	TOPSOIL. Mixed grey brown clay loam with very few stone inclusions.	Made Ground / Topsoil - Victorian to modern
2.75	2.46	0.24	0.53	0.29	Disturbed Subsoil/Made Ground. Yellow brown clayey SILT with greyer patches, very few stone inclusions and rare fragments of CBM/land drain.	
2.46	2.06	0.53	0.93	0.40	MADE GROUND. Mixed yellow brown clayey SILT with grey streaks, very few stone inclusions and mineral staining.	
2.06	1.82	0.93	1.17	0.24	Pale yellow brown clayey SILT with few very small stone inclusions.	Holocene - alluvium / warp
1.82	1.64	1.17	1.35	0.18	Mid to pale brown heavy clayey SILT with few very small stone inclusions.	

1.64	1.54	1.35	1.45	0.10	Natural boulder clay.	Pleistocene - Till

Table 48 Deposit log for AOC53122_Tr33

Bore		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr33		517,126.25	416,961.23	2.57		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.57	2.32	0.00	0.25	0.25	Friable mid greyish brown silty clay. Inclusions: occasional stones.	'Made Ground / Topsoil - Victorian to modern
2.32	2.15	0.25	0.42	0.17	Friable mid brownish grey slightly silty clay.	
2.15	1.32	0.42	1.25	0.83	Firm purplish brown solid clay streaks, dull blue.	Holocene - alluvium / warp
1.32	1.23	1.25	1.34	0.09	Firm pale blue clay with bright yellow clay streaks.	
1.23	1.13	1.34	1.44	0.10	Firm dark greyish black organic clay.	Holocene - organic deposits
1.13	1.02	1.44	1.55	0.11	Fine, friable mid blueish grey sandy clay.	Holocene - lower intertidal
1.02	0.77	1.55	1.80	0.25	Firm dark yellowish orange course sand with patches of pale blue sand.	
0.77	0.72	1.80	1.85	0.05	Firm dark purple brown clay with streaks of blue. Inclusions: chalk flecks.	Pleistocene - Till

17 APPENDIX E – TRENCH DEPOSIT LOGS

Table 49 Deposit log for AOC53122_Tr6_S

Bore		Easting	Northing	Elevation		
AOC53122_Tr6_S		516821.6	417034.4	3.8		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.80	3.65	0.00	0.15	0.15	MADE GROUND. Mid-light compact friable silty SAND and gravel mix.	Made Ground / Topsoil - Victorian to modern
3.65	3.15	0.15	0.65	0.50	MADE / DISTURBED GROUND. Mid-dark brown very compact mottled silty CLAY with streaks of orange sand. Disturbed mix of tops and sub soil and imported sand. Frequent rocks.	
3.15	2.89	0.65	0.91	0.26	SUBSOIL. Mid grey brown silty CLAY, some iron staining and rooting. Compact, malleable.	
2.89	2.73	0.91	1.07	0.16	Mid-dark blue grey compact malleable silty CLAY. Some iron intursion. Flooding deposits.	Holocene - alluvium / warp
2.73	2.38	1.07	1.42	0.35	Mid to light yellow brown compact malleable silty CLAY. Very occasional rooting. Flooding deposits.	
2.38	2.27	1.42	1.53	0.11	Mid to light yellow and blue mottled compact silty CLAY, occasional rooting. Flooding deposits.	
2.27	2.12	1.53	1.68	0.15	Mid to light beige and blue compact malleable silty CLAY, some manganese. Flooding deposits.	
2.12	2.07	1.68	1.73	0.05	Light blue and beige mottle compact malleable CLAY. Very sterile. Flooding deposits.	
2.07	1.50	1.73	2.30	0.57	Compact malleable mid yellowish brown silty clay. Inclusions: frequent manganese.	Holocene - lower intertidal
1.50	1.45	2.30	2.35	0.05	Compact mid reddish brown clay silty clay. Inclusions: common manganese, chalk flecks.	Pleistocene - Till

Table 50 Deposit log for AOC53122_ Tr11_NW

Intervention		Easting	Northing	Elevation		
AOC53122_Tr11_NW		516918.99	417115.54	3.76		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.76	3.71	0.00	0.05	0.05	Dark greyish brown silty CLAY with frequent roots, stones and moss.	Made Ground / Topsoil - Victorian to modern
3.71	3.63	0.05	0.13	0.08	Hardcore. Compact grey hardcore consisting of subangular stones of varying sizes. Mesh present at base.	
3.63	3.56	0.13	0.20	0.07	Hardcore. Compact white hardcore consisting of subangular chalk of varying sizes. Mesh and mat present at base.	
3.56	3.31	0.20	0.45	0.25	Buried topsoil. Dark blackish grey silty CLAY with occasional subangular stones up to 60 mm and presence of manganese.	
3.31	3.13	0.45	0.63	0.18	Buried subsoil. Mid brownish grey silty CLAY with rare chalk flecks and occasional subangular flint. Firm/compact.	
3.13	3.03	0.63	0.73	0.10	Compact/firm mid reddish brown CLAY with frequent chalk flecks. Slightly moist.	Pleistocene - Till

Table 51 Deposit log for AOC53122_Tr11_SE

Intervention		Easting	Northing	Elevation		
AOC53122_Tr11_SE		516954.81	417093.68	3.7306		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.73	3.68	0.00	0.05	0.05	Dark greyish brown silty CLAY with frequent roots, stones and moss.	Made Ground / Topsoil - Victorian to modern

3.68	3.60	0.05	0.13	0.08	Hardcore. Compact grey hardcore consisting of subangular stones of varying sizes. Mesh present at base.	
3.60	3.53	0.13	0.20	0.07	Hardcore. Compact white hardcore consisting of subangular chalk of varying sizes. Mesh and mat present at base.	
3.53	3.32	0.20	0.41	0.21	Mid greyish brown silty CLAY with occasional manganese and chalk. Compact/firm. Deposit.	
3.32	3.07	0.41	0.66	0.25	Buried topsoil. Dark blackish grey silty CLAY with occasional subangular stones up to 60 mm and presence of manganese.	
3.07	2.89	0.66	0.84	0.18	Buried subsoil. Mid brownish grey silty CLAY with rare chalk flecks and occasional subangular flint. Firm/compact.	
2.89	2.69	0.84	1.04	0.20	Mixed chalk HARDCORE similar to (11004) but separated by a plastic mesh.	

Table 52 Deposit log for AOC53122_Tr14

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr14		516971.27	417142.12	3.6181		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.62	3.57	0.00	0.05	0.05	MADE GROUND. Levelling layer - bright light yellow brown, very loose SAND. V frequent small stone/gravel inclusions.	Made Ground / Topsoil - Victorian to modern
3.57	3.35	0.05	0.27	0.22	MADE GROUND. Mid grey very loose SAND with fairly frequent gravel inclusions.	
3.35	3.12	0.27	0.50	0.23	MADE GROUND. Mid brown very loose SAND with metal wiring and large angular white gravel inclusions. Material at the base of made ground.	
3.12	2.62	0.50	1.00	0.50	MADE GROUND. Mid to dark brown compact very fine sandy CLAY with occasional stones.	
2.62	2.55	1.00	1.07	0.07	TOPSOIL. Compact mid greyish brown sticky CLAY with occasional stones.	

2.55	2.51	1.07	1.11	0.04	Compact orange blue CLAY.	Holocene - alluvium / warp

Table 53 Deposit log for AOC53122_Tr15S

Intervention		Easting	Northing	Elevation		
AOC53122_Tr15_S		516978.97	417055.79	2.6889		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.69	2.39	0.00	0.30	0.30	TOPSOIL. Mid to dark brownish grey, soft and friable, very organic silty coarse SAND.	Made Ground / Topsoil - Victorian to modern
2.39	2.18	0.30	0.51	0.21	SUBSOIL. Mid greyish brown, soft and friable, silty coarse SAND.	
2.18	1.98	0.51	0.71	0.20	FLOODING/WARP. Mixed orange/brown/grey CLAY with manganese flecks.	Holocene - alluvium / warp
1.98	1.83	0.71	0.86	0.15	FLOODING/WARP. Mixed blue/grey CLAY.	
1.83	1.60	0.86	1.09	0.23	Dark purplish red brown with flecks of dark orange firm CLAY. Sterile. Flooding deposit.	Holocene - lower intertidal
1.60	1.50	1.09	1.19	0.10	Firm, very pale blue grey CLAY with patches of bright orange sand. Flooding deposit.	
1.50	1.40	1.19	1.29	0.10	Mottled yellow brown/bright orange silty CLAY with rare stone inclusions. Flooding deposit.	
1.40	1.30	1.29	1.39	0.10	BOULDER CLAY. Reddish brown boulder clay with frequent chalk flecks.	Pleistocene - Till

Table 54 Deposit log for AOC53122_Tr16

Intervention		Easting	Northing	Elevation		
AOC53122_Tr16		517021.1	417134.24	3.2571		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.26	3.22	0.00	0.04	0.04	TARMAC.	Made Ground / Topsoil - Victorian to modern
3.22	3.11	0.04	0.15	0.11	MADE GROUND. Mid grey very compact rubble and sand.	
3.11	2.83	0.15	0.43	0.28	MADE GROUND. Light blue very compact rubble and stone hardcore.	
2.83	2.67	0.43	0.59	0.16	MADE GROUND. Heavily compacted mid to light tan brown small to moderate hardcore gravel.	

2.67	2.55	0.59	0.71	0.12	MADE GROUND. Heavily compacted light white small to medium hardcore rock.	
2.55	2.46	0.71	0.80	0.09	MADE GROUND. Heavily compacted mid to dark grey SAND and rubble resting on terram.	
2.46	2.21	0.80	1.05	0.25	TOPSOIL. Mid to dark brown very compact/malleable silty CLAY with occasional rooting.	
2.21	2.06	1.05	1.20	0.15	SUBSOIL. Mottled grey brown yellow orange silty CLAY with very occasional gravel.	
2.06	1.96	1.20	1.30	0.10	Very compact/malleable mid yellow orange silty CLAY with frequent manganese.	Holocene - alluvium / warp

Table 55 Deposit log for AOC53122_Tr22

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr22		516919.6	416869.1	2.6813		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.68	2.46	0.00	0.22	0.22	TOPSOIL. Dark brown CLAY loam with roots and turf at the top.	Made Ground / Topsoil - Victorian to modern
2.46	2.30	0.22	0.38	0.16	SUBSOIL. Brown clayey SILT.	
2.30	2.06	0.38	0.62	0.24	Pale yellow brown silty CLAY. Waterbourne deposit.	Holocene - alluvium / warp
2.06	1.92	0.62	0.76	0.14	Pale grey with yellow streaks and an undulating band of material. Waterbourne deposit.	
1.92	1.69	0.76	0.99	0.23	Pale yellow brown silty CLAY. Waterbourne deposit.	
1.69	1.61	0.99	1.07	0.08	Band of pale grey silty CLAY with yellow streaks. Waterbourne deposit.	
1.61	1.33	1.07	1.35	0.28	Brownish yellow silty CLAY with few mineral flecks. Waterbourne deposit.	
1.33	1.18	1.35	1.50	0.15	Band of pale grey silty CLAY with occasional mineral flecks. Manganese?. Waterbourne deposit.	
1.18	1.11	1.50	1.57	0.07	Pale yellow brown silty CLAY. Waterbourne deposit.	

Table 56 Deposit log for AOC53122_Tr27

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr27		516896.5	417086.58	3.418171		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**

3.42	3.02	0.00	0.40	0.40	TOPSOIL. Dark grey brown loam.	Made Ground / Topsoil - Victorian to modern
3.02	2.87	0.40	0.55	0.15	SUBSOIL. Ligh grey brown CLAY.	
2.87	2.72	0.55	0.70	0.15	Pale blue grey CLAY. Flooding deposit.	Holocene - alluvium / warp
2.72	2.32	0.70	1.10	0.40	Mixed dark purple brown with patches of bright orange CLAY. Flooding deposit.	
2.32	2.17	1.10	1.25	0.15	Pale greyish blue CLAY. Flooding deposit.	
2.17	1.77	1.25	1.65	0.40	Mixed reddish brown with patches of bright orange and blue CLAY. Flooding deposit.	
1.77	1.67	1.65	1.75	0.10	Mottled dark orange and yellow sandy silty CLAY. Flooding deposit.	
1.67	1.47	1.75	1.95	0.20	Dark orange coarse SAND and GRAVEL. Primary flooding deposit.	Pleistocene - Glaciofluvial
1.47	1.32	1.95	2.10	0.15	Dark purple CLAY with flecks of chalk. Natural boulder clay.	Pleistocene - Till

Table 57 Deposit log for AOC53122_Tr28

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr28		517018.99	416796.38	3.5142		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.51	3.22	0.00	0.29	0.29	TOPSOIL. Mid brown CLAY loam with a few small gravel inclusions.	Made Ground / Topsoil - Victorian to modern
3.22	2.68	0.29	0.83	0.54	MADE GROUND. Pale grey brown clayey SILT with moderate small stones and gravel towards the base.	
2.68	2.38	0.83	1.13	0.30	Yellow brown CLAY with few, mostly small, stone inclusions.	Holocene - alluvium / warp
2.38	2.28	1.13	1.23	0.10	Firm, mid purplish brown CLAY with chalk flecks. Boulder clay.	Pleistocene - Till

Table 58 Deposit log for AOC53122_Tr29

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr29		517097.59	416942.62	2.55		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.55	2.25	0.00	0.30	0.30	TOPSOIL. Dark grey brown loam.	

2.25	1.85	0.30	0.70	0.40	SUBSOIL. Pale yellow brown CLAY.	Made Ground / Topsoil - Victorian to modern
1.85	1.65	0.70	0.90	0.20	Light grey orange with blue streaks CLAY. Flooding deposit.	Holocene - alluvium / warp
1.65	1.25	0.90	1.30	0.40	Dark purple brown CLAY. Flooding deposit.	
1.25	1.05	1.30	1.50	0.20	Bright orange yellow sandy CLAY.	
1.05	0.70	1.50	1.85	0.35	Dark black (almost organic) CLAY. Flooding deposit.	
0.70	0.50	1.85	2.05	0.20	Bright yellow brown sandy CLAY. Flooding deposit.	
0.50	0.10	2.05	2.45	0.40	Dull green brown CLAY. Flooding deposit.	
0.10	-0.20	2.45	2.75	0.30	Dark yellow and blue sandy CLAY. Flooding deposit.	
-0.20	-0.45	2.75	3.00	0.25	Dark purple BOULDER CLAY with chalk flecks.	Pleistocene - Till

Table 59 Deposit log for AOC53122_Tr30_A

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr30_A		517064.24	416879.39	3.059		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
3.06	2.94	0.00	0.12	0.12	TOPSOIL. Firm, dark brownish grey clayey loam.	Made Ground / Topsoil - Victorian to modern
2.94	2.69	0.12	0.37	0.25	SUBSOIL. Mid brownish grey plastic CLAY with some rooting.	
2.69	2.59	0.37	0.47	0.10	Mixed grey / orange CLAY. Flood deposit/warp	Holocene - alluvium / warp
2.59	2.13	0.47	0.93	0.46	Purplish grey silty CLAY with mineral staining and few small stone inclusions. Flood deposit.	

2.13	1.79	0.93	1.27	0.34	Yellowish brown sandy CLAY with mineral staining and very occasional small stone inclusions. Flood deposit.	Pleistocene - Till
1.79	1.67	1.27	1.39	0.12	Boulder clay.	

Table 60 Deposit log for AOC53122_Tr30_B

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr30_B		517039.7	416898.61	2.795045		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.80	2.60	0.00	0.20	0.20	TOPSOIL. Firm, dark brownish grey clayey loam.	Made Ground / Topsoil - Victorian to modern
2.60	2.40	0.20	0.40	0.20	WARP. Firm, mixed blue grey CLAY.	Holocene - alluvium / warp
2.40	2.10	0.40	0.70	0.30	Firm reddish brown with grey CLAY. Moderate manganese flecks. Flood deposit.	
2.10	2.05	0.70	0.75	0.05	Firm blue/grey very sterile CLAY with possible some organics. Flood deposit.	Pleistocene - Till
2.05	2.00	0.75	0.80	0.05	Firm to moderate, yellow/grey/brown CLAY and GRAVEL. Flood deposit/interface.	

Table 61 Deposit log for AOC53122_Tr31_A

Intervention		**Easting**	**Northing**	**Elevation**		
AOC53122_Tr31_A		517107.74	416869.05	2.6168		
Top elevation (m OD)	**Base elevation (m OD)**	**Top depth (m bgl)**	**Base depth (m bgl)**	**Thickness (m)**	**Description**	**Interpretation**
2.62	2.52	0.00	0.10	0.10	TOPSOIL. Dark greyish brown silty CLAY with frequent roots, moss and vegetation.	Made Ground / Topsoil - Victorian to modern
2.52	2.38	0.10	0.24	0.14	SUBSOIL. Mid yellowish brown slightly silty CLAY with moderate rooting and occasional chalk flecks up to 10 mm.	
2.38	2.15	0.24	0.47	0.23	Mid brownish orange CLAY with moderate gravel, subangular flint up to 20 mm and manganese.	Holocene - alluvium / warp

2.15	1.98	0.47	0.64	0.17	Mid greyish yellow sandy CLAY with gravel inclusions and occasional manganese.	Pleistocene - Till
1.98	1.85	0.64	0.77	0.13	Mid orange grey slightly sandy CLAY with moderate chalk flecks and occasional manganese.	
1.85	1.71	0.77	0.91	0.14	Mid orange blue CLAY with chalk flecks and occasional manganese. Natural.	

18 APPENDIX F - SOILS AND SEDIMENTS FROM VPI IMMINGHAM, HUMBER ZERO PROJECT: AN ASSESSMENT (AOC:53122) BY LYNNE ROY (AOC ARCHAEOLOGY GROUP)

Introduction

18.1 This assessment report presents the results of preliminary analysis of four monolith samples from two sedimentary sequences (<19> and <20>) collected during a programme of archaeological trial trenching of the land adjacent to VPI Immingham, Rosper Road, South Killingholme, Immingham, North Lincolnshire (hereafter 'the Site') (NGR: 516904 416940, Figure 1).

Geological Context

18.2 The British Geological Survey indicates that the bedrock geology underlying the Site is the Burnham Chalk Formation. Comprising white, thinly bedded chalk with common flint bands, this unit was deposited during the Turonian to Santonian Age (93.9-83.6 million years ago), within the Cretaceous period (BGS 2023). The Chalk has an undulating top surface and is also characterised by a highly fractured zone resulting from glacial and periglacial processes.

18.3 Overlying the Chalk bedrock toward the northern and southern limits of the Site are Late Pleistocene (c. 33,000-12,000 years ago), deposits of boulder clay or till. The advance of the last Devensian glacial ice sheet, the maximum extent of which is thought to occur at around 18,000BP covered the wider area leaving widespread deposits of stiff brown clays with erratic inclusion. The till still is a very poorly sorted unit. It comprises gravelly sandy silty clay with boulders and contains numerous lenses of sand and gravel. The till is also likely to contain interdigitating units of glaciolacustrine clay, plus sand and gravel formed during ice advance and retreat (Burke et al., 2015).

18.4 Extending across the central and eastern parts of the Site are tidal flat deposits (BGS 2023) relating to Holocene sea level rise and its effect on deposition within the River Humber and surrounding areas (Ellis et al. 2001). These comprise generally clay, silt, and sand, with organic horizons. The tidal flat deposits formed under marshy conditions with the rising and falling tide under temperate conditions of the Holocene (up to c. 12,000 years ago). The tidal flat deposits form a linear feature entering the site from the east (BGS 2023) marking a relic river mouth, creek, or inlet, that opened into the edge of the estuary. The extent of the intrusion of these deposits from the east into the Site suggests a possible coastal inlet may have existed here during the Prehistoric period onwards.

18.5 The local soils have a mix of sand, silt and clay and are thus loamy and clayey in places. The soils are slowly permeable, seasonally wet and slightly acidic (Soilscapes 2023).

Archaeological Context

18.6 Archaeological features uncovered during the evaluation included numerous occurrences of small quantities of material indicative of early prehistoric activity. A cluster of potentially Iron Age or early Roman features were recorded in the southeastern corner of the Site. A concentration of late Roman features centred on a large rectilinear enclosure were recorded in the northwest of the Site. A ditched trackway and multiple ditches and gullies in the north of the Site suggest that land division associated with the enclosure may extend across other parts of the Site. These features appear to link directly with wider evidence for activity from these periods in the locality, much of it derived from cropmarks in the fields surrounding the Site (AOC 2023a).

18.7 A sequence of alluvial deposits was identified across the central area of Site, where the topography showed a slight decline on both the north and south sides towards a central drainage feature. This aligns with the potential coastal inlet and suggests the area was frequently inundated. Alluvial deposits were identified in Trenches 2, 4, 6, 7, 8, 10, 12, 13, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30a, 30b, 31b and 33. The stratigraphic sequence of the deposits was generally consistent across the Site with the earliest deposits consisting of mixed blue/grey clay and sandy gravels overlying the diamicton Till.

18.8 Trench 17 was located in the southeast corner of the north half of the Site at the edge of the hypothesised coastal inlet. Diamicton Till was encountered at the base of the trench and was overlain by alluvial deposits comprised of mixed blue/grey clays and orange sands.

18.9 Archaeological features within Trench 17 comprised a single ditch (17010) which was a wide, shallow feature aligned E/W, measuring 1m wide and 0.15m deep and infilled by a firm, mid purple/brown clay with blue striations which was deposited via natural silting facilitated by water. The ditch was hypothesised as a possible drainage feature or flooding defence feature at the edge of the coastal inlet protecting the area of activity on higher ground to the north. The ditch is also potentially a boundary feature marking the edge of the coastal inlet 'basin'. The ditch was sealed by a marine alluvial deposit 0.8m thick with marine shell inclusions. The marine alluvium was overlain by a mixed blue/grey alluvial deposit which in turn was. sealed by a yellow/brown hardcore made ground deposit.

18.10 Trench 33 was located along the eastern boundary of the Site, close to the potential alignment of the coastal inlet. The basal deposits comprised diamicton Till which was sealed by up to 0.25m of clayey gravels The gravels were overlain by alluvial deposits comprised of mixed, alternating layers of blue/grey clays with lenses of possible humic/organic material similar to the sequence identified to the north in Trench 17. The stratigraphic sequence was sealed by topsoil comprised of mid grey/brown silty clay up to 0.25m thick

18.11 Archaeological features within Trench 33 included two-sub oval post holes, (33008) and (33010), the latter of which contained two worked wood fragments. Both postholes were sealed by alluvial deposits (AOC 2023a).

18.12 Research questions relating to the sequences focus on site formation processes specifically better understanding the formation processes responsible for the depositional sequences observed.

18.13 An assessment of the potential for further palaeoenvironmental analysis has also been undertaken.

Methodology

18.14 The monolith samples were cleaned prior to recording and was visually examined and described using a simplified version of the Troels-Smith system of sediment classification (Troels-Smith, 1955; Table 1), and a Munsell soil chart (Munsell, 2009), with any distinguishing features or stratigraphic layers being recorded. This is an objective method of sediment classification to identify each lithostratigraphic context. The presence of any inclusions such as macrofossils and charcoal, or wood was also noted. The descriptions were recorded on a proforma. The sample was photographed to provide a permanent record of the stratigraphy.

Table 1: Modified Troels-Smith system of sediment description.

Physical Features	
Degree of darkness	Varies from 0 in the lightest occurring shades (eg. clear (Nigror) quartz sand and lake marl), through 1 (eg. calcareous clay), 2 (e.g. fresh swamp peat), 3 (e.g. partly humified peat) to 4 in the darkest sediments (e.g.
Degree of stratification	Visual or structural horizontal banding or layering. Varies (Stratification) from 0 where the deposit is completely homogeneous or breaks in all directions, to 4 which consists of clear thin layers or bands.
Degree of elasticity	The sediment's ability to regain its shape after being (Elasticitas) squeezed or bent. Varies from 0 in plastic clay, sand, disintegrated peat etc. to 4 in fresh peat.
Degree of dryness	Deposits fall between 0 (clear water) and 4 (air dry material). (Siccitas) 1 indicates very wet runny sediment such as surface lake muds, 2 represents saturated sediments, the normal condition below the water table, while sicc. 3 indicates moist, unsaturated sediments.
Colour	Best determined by reference to Munsell soil colour charts. Changes in colour
Structure	The dominant structural feature (eg. fibrous, homogeneous)
Sharpness of boundary	The boundary can be diffuse (> 1cm: lim. 0), very gradual (Limes superior)(<1cm to > 2mm: lim. 1), gradual (< 2mm to >1mm: lim. 2), sharp (<1mm to > 0.5mm) or very sharp (< 0.5mm).
Humicity	The degree of humification or disintegration of organic (Humicitas) substances. It is measured by determination of the nature and amount of material passing through the fingers on squeezing; 0 (fresh peat yielding clear water), 1 (slightly decomposed peat yielding dark coloured, turbid water), 2 (decomposed peat yielding half its mass), 3 (very decomposed peat yielding three-quarters of its mass) and 4 (totally
Components	
Mosses	Sphagnum is the most common peat-former.
Woody plants	Roots of trees and shrubs together with attached stumps and branches,
Herbs	Roots of herbaceous plants together with attached stems and leaves,
Woody detritus	Fragments of woody plants >2mm.
Components	
Herb detritus	Fragments of herbaceous plants >2mm.
Fine detritus	Fragments of woody or herbaceous plants <2mm.
Charcoal	Carbonised fragments of predominantly woody plants.
Organic lake mud	Homogeneous organic lake sediment composed of remains (Limus

Humus	Completely disintegrated organic substances and precipitated humic acids.
Organosilicates	Siliceous skeletons or skeleton fragments of diatoms, sponges etc.
Carbonates	Calcium carbonate or marl. Similar in colour and texture to L. siliceous but
Iron oxides	Iron oxides of various types and colours.
Clay (Argilla	Mineral particles <0.002mm
Silt (Argilla granosa)	Mineral particles 0.002-0.06mm
Sand (Grana minora)	Mineral particles 0.06 - 2mm.
Gravel (Grana majora)	Mineral particles >2mm.

The assemblage

18.15 The monolith samples were taken through two stratigraphic sequences through a total of 12 contexts. These are described briefly below in order of sample number and sediment deposition and are detailed in Appendix A.

18.16 A note of the Munsell (2009) colour assessment made in the laboratory is provided alongside the colour noted in the field. In many instances the colours observed differ, but this is likely a result of weathering and exposure of the sequence rather than any inaccuracy in field recording. For example, the mottling effects of iron oxides often become more strongly developed over time and colour changes also frequently occur when reduced deposits are first exposed to the air.

Sample <19>

18.17 (17009): Located at the base of the monolith sample and hypothesised as a natural clay Till deposit. Described in the field as a mid greyish blue, compact clay with chalk flecks. In the laboratory this was classified as a brown (7.5YR 4/2) homogenous sandy clay. Inclusions were limited to rounded to sub-angular rock fragments the majority of which were leas than 2mm in diameter. Larger rounded stones up to 7.5mm were occasionally present. Rock fragments and stones were of mixed lithologies.

18.18 (17008): Described in the field as a mid orange, grey, brown clay with rare manganese and iron features. This was observed in the laboratory to be a heterogeneous brown (7.5YR 4/3) sandy clay with discontinuous patches of strong brown (7.5YR 4/6) and rare ferruginous features. Inclusions comprise occasional charcoal flecks (<2mm) and rare larger charcoal fragments up to 10mm. Rare rock fragments including chalk were also observed (17008) has a diffuse with the underlying (17009)

18.19 (17007): Found in the centre of the monolith sample this sedimentary unit was described during excavation as a mid yellow to orange sand. In the laboratory it was found to comprise a heterogeneous brown (7.5YR 4/4) sand with frequent patches of coarse orange and grey sand. Sub-angular rock fragments and rounded stones 1-10mm in diameter are frequent. The presence of sand and frequent coarse inclusions is indicative of higher energy deposition when compared to the underlying sedimentary units. It is has a very gradual boundary with the underlying (17008).

18.20 (17006): Described in the field as a mid greyish blue, compact, clay with a layer of black clay across the centre. This was found to comprise a grey (7.5YR 5/1) very weakly banded clay with occasional iron and manganese mottles as well as occasional charcoal flecks. The black band recorded in the field was not visible although it is noted that the band was located at the boundary between the two monolith tins. Inclusions larger than 1mm are rare and limited to rare, rounded stones. It has a sharp boundary with the underlying (17008).

18.21 (17005): Described in the field as a mid orange, grey, brown compact, clay, this was observed in the laboratory to be a brown (7.5YR 4/2) clay with no observed inclusions. This is a heterogenous deposit with a patchy appearance caused in part by small areas of grey sediment indicative of iron leaching and orange areas indicative of its precipitation. The frequent ferruginous features and manganese mottling area indicative of fluctuating water levels.

18.22 (17004): This deposit was located at the top of monolith sample. It was described in the field as a mid purple brownish clay with marine shells, and hypothesised as an alluvial deposit. In the laboratory this was observed to be a brown (7.5YR 4/2) clay with occasional marine shell (limpet) inclusions).

Sample <20>

18.23 (33007): Located at the base of the monolith sample and hypothesised as an alluvial deposit. Described in the field as a dark yellow and orange coarse sand with patches of pale blue sand. In the laboratory this was classified as a brown (7.5YR 4/2) clayey sand. Inclusions were noted to be rare and comprised of sub-rounded to sub-angular rock fragments of mixed lithologies Rare charcoal flecks are indicative of general background human activity. The coarse nature of the deposit is consistent with relatively high energy alluvial deposition.

18.24 (33006): Described in the field as a mid blue grey sandy clay. This was observed in the laboratory to be a dark grey (7.5YR 4/1). Inclusions are limited to occasional fine ferruginous mottles (<2mm) and rare charcoal flecks (<1mm). (33006) has a very gradual boundary with the underlying (33007)

18.25 (33005): Found in the centre of the monolith sample this sedimentary unit was described during excavation as a dark grey to black organic clay. In the laboratory it was found to comprise a weakly banded very dark grey (7.5YR 3/1) clay with occasional iron and manganese mottles. The dark colour is indicative of a high organic content however no organic inclusions were observed. The fine organic and banded nature of the deposit is consistent with a deposit that has formed in slow flowing or standing water. This unit has a gradual boundary with the underlying (33006) .

18.26 (33004): Described in the field as a pale blue clay with streaks of bright yellow clay. This was found to comprise banded grey (7.5YR 5/1) clay with common iron and manganese mottles. It is very similar in character to the underlying (33005) with the principal difference between the two being that this deposit is lighter in colour which may be indicative of leaching of iron and manganese. The fine gleyed and banded nature of the deposit is consistent with a deposit that has formed in slow flowing or standing water. This unit has a gradual boundary with the underlying (33005) .

18.27 (330033): Described in the field as a compacted purple, brown clay, this was observed in the laboratory to be a brown (7.5YR 4/2) clay with frequent ferruginous features which become less frequent upwards. This is a heterogenous deposit with a patchy appearance caused in part by small areas of grey sediment indicative of iron leaching and orange areas indicative of its precipitation. Numerous vertical root channels are present and are identifiable though iron

accumulation along their length and leaching of the surrounding sediment. Modern fibrous roots represent towards the top of this deposit where it also has a moderate sub-angular blocky structure consistent soil formation.

Discussion and statement of significance

18.28 The location of the Site within an area that has been influenced by estuarine, coastal and intertidal processes has resulted in a complex depositional history which is reflected in the two stratigraphic sequences studies here. The deposits studied are of varying composition and have formed under rapidly changing conditions. The earliest deposit within the sampled sequence (17009) is a diamicton Till deposit and represents deposition during ice age conditions in the Pleistocene.

18.29 Average rates of Relative Sea Level (RSL) rise of greater than 7 mm year were experienced in the southern North Sea region during the early Holocene, c. 11700–8200 cal years BP (Waller and Kirby, 2021) and this resulted in the landward encroachment of coasts and dominance of tidal sedimentation; a process which is reflected in the sedimentary sequence recorded within the monolith samples. The earliest deposit of likely Holocene date within Sample <19> (17008) are sandy clays deposited under relatively low energy conditions possibly alluvially derived but given the location of the Site more likely to be estuarine in nature. Estuarine clay deposits such as (17008) typically post-date the last glaciation and thus the deposit is likely of Holocene date. (17008) similarly likely represents Holocene low energy alluvial deposition. The presence of micro charcoal throughout this deposit is indicative of human activity in the wider area.

18.30 At the mid-late Holocene boundary, at 4200 years BP (Walker et al., 2012), the mean RSL rate continued to slow and the role of more regional and local mechanisms such as changes in tidal range, sediment supply and human activity in the late-Holocene became more dominant. In this period minerogenic sedimentation became frequent (Waller and Kirby, 2021). Higher energy deposition is indicated by the much coarser (17007) (33007) and (33006) which may reflect a period of intertidal sedimentation. These deposits are interpreted as Holocene estuarine alluvium and tidal flat deposits.

18.31 The clays of (17006) and (33005) likely represent by a period of relative stability and these clay deposits are perhaps of greatest interest in terms of the deposit sequence and may relate to deposition within a saltmarsh environment with a high water level and thus likely represent the best potential for the preservation of palaeoenvironmental remains. The slower rates of RSL rise experienced from the early-mid Holocene boundary, at 8200 years BP (Walker et al., 2012), provided optimum conditions for the establishment of coastal wetlands.

18.32 Deforestation in the late-Holocene altered the sediment mobilisation within the Humber catchment (Beckett, 1981; Buckland and Sadler, 1985) increasing the delivery of sediment supplied to coastal lowlands. The Humber has also experienced rapid changes during the last several centuries due to the land reclamation and management practices (Waller and Kirby, 2021), resulting in a significant reduction in the area of intertidal and wetland environments and corresponding changes in tidal regime and resilience (Metcalfe et al., 2000).The uppermost sedimentary unit (17004) recorded in Sample <19> contained marine shell and suggests a continued dominance of estuarine infilling into the late-Holocene. This upper unit is also likely influenced by the anthropogenic changes in the local sediment dynamics and land practices, such as reclamation, that has significantly altered the sedimentary regime and estuary morphology over the last several centuries (Sheppard, 1966). There is uncertainty over the timings for wetland reclamation and

embanking in the Humber, with evidence of the practice along the estuary from at least the Medieval period (Sheppard, 1966), and the land drainage practices and shift to arable agriculture resulting in the desiccation of the surrounding wetland areas (Metcalfe et al., 2000).

Recommended Further Work

18.33 The deposits represented in the monolith samples from the Site attest to a dynamic depositional environment representative of landscape in flux throughout the Holocene.

18.34 An investigation into diatom assemblages within the sequence of the Humber Estuary (Metcalfe et al., 2000) provides a broad framework for comparison and interpretations. Diatom taxa have been grouped through this study to show association between certain assemblages and the sedimentary environment. One of these specifies an assemblage representative of an intertidal creek environment in this catchment and may be comparable to the sequence of deposition represented within Sample <19>. Accordingly, it is advised that a samples from each context within the stratigraphic sequence represented either by Sample <19> or one of the borehole samples (see AOC 2023b) is subject to diatom analysis to ascertain if a comparable assemblage can better inform us with regards to depositional environments within the Site. It should be noted that the hypothesised intertidal inundation represented within Sample <19> appears to post-date the main period of occupation at this Site.

18.35 Additionally organic rich clay deposits identified in the centre of each sequence (17006) and (33005) have the potential to preserve palaeoenvironment proxies which could provide further detail regarding the wider environment at the time of deposition. While no charcoal or macrofossil inclusions suitable for radiocarbon dating within either of these deposits were observed, the deposits themselves may be sufficiently organic to be dateable and could help to refine the dating sequence of alluvial deposition in the Holocene. It is considered that some limited further analysis of the clay deposits represented by (17006) and (33005) in combination with other geoarchaeological analyses undertaken following borehole investigations (AOC 2023b) would assist with better understanding the past environment during the Holocene and most likely contemporaneous with the occupation of the Site prior to subsequent periods of flooding.

References

AOC (2023a) VPI Immingham, Humber Zero Project, Lincolnshire Archaeological Evaluation Report

AOC (2023b) VPI Immingham, Humber Zero Project: Geoarchaeological Borehole Evaluation and Deposit Model Report

Beckett S C (1981) Pollen diagrams from Holderness, North Humberside. Journal of Biogeography 8(3): 177–198.

Best, L, Kirby, J and Selby, K 2022 System responses to Holocene relative sea-level rise and sediment supply in a macrotidal estuary. The Holocene 2022, Vol. 32(10) 1091–1103

Berridge, N.G., Pattison, J. Abbott, M.A.W., Cornwell, J.D., Holliday, D.W., Penn, I.E., Forster, A., Dafvenport, M.F., Balson, P.S. 1994. Geology of the country around Grimsby and Patrington. British Geological Survey. London: HMSO

Buckland PC and Sadler J (1985) The nature of Late Flandrian alluviation in the Humberhead levels. East Midland Geographer 8(8): 239–251.

Ellis, S., Fenwick, H., Lillie, M. and Van de Noort, R. (Eds.) 2001. Wetland Heritage of the Lincolnshire Marsh. An Archaeological Survey. Part 1. English Heritage British Geological Survey

British Geological Survey (BGS) 2023. Geology of Britain Viewer. URL: https://shop.bgs.ac.uk/Shop/Department/GeoRecords

Campbell, G, Moffett, L and Straker, V (2011) 'Environmental Archaeology. A Guide to the Theory

and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition)'. Portsmouth: English Heritage https://content.historicengland.org.uk/images-books/publications/environmentalarchaeology-2nd/environmental-archaeology-2nd.pdf/

Long, A.J, Innes J.B., Kirby J.R., Lloyd J.M., Rutherford M.M., Shennan I and Tooley MJ. 1998. Holocene sea-level change and coastal evolution in the Humber estuary, eastern England: an assessment of rapid coastal change. The Holocene 8: 229–247.

Metcalfe SE, Rees JG and Ridgway JM (2000) The Holocene evolution of the Humber Estuary: Reconstructing change in a dynamic environment. In: Shennan I and Andrews J (eds) Holocene Land-Ocean Interaction and Environmental Change Around the North Sea. London: Geological Society, pp.97–118.

Munsell Color (2009) Munsell Soil-Color Charts. Munsell Color. Grand Rapids.

Shennan, I. and Horton, B., 2002. Holocene land- and sea-level changes in GreatBritain. Journal of Quaternary Science. 17. 511-526

Sheppard JA (1966) The Draining of the Marshlands of South Holderness and the Vale of York. York: East Yorkshire Local History Society.

Tröels-Smith, J. (1955) Karakterisering af løse jordater (Characterisation of unconsolidated sediments), Danm. Geol. Unders., Ser IV 3, 73.

Walker MJC, Berkelhammer M, Björck S et al. (2012) Formal subdivision of the Holocene Series/Epoch: A discussion paper by a Working Group of INTIMATE (Integration of ice-core, marine and terrestrial records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). Journal of Quaternary Science 27(7): 649–659.

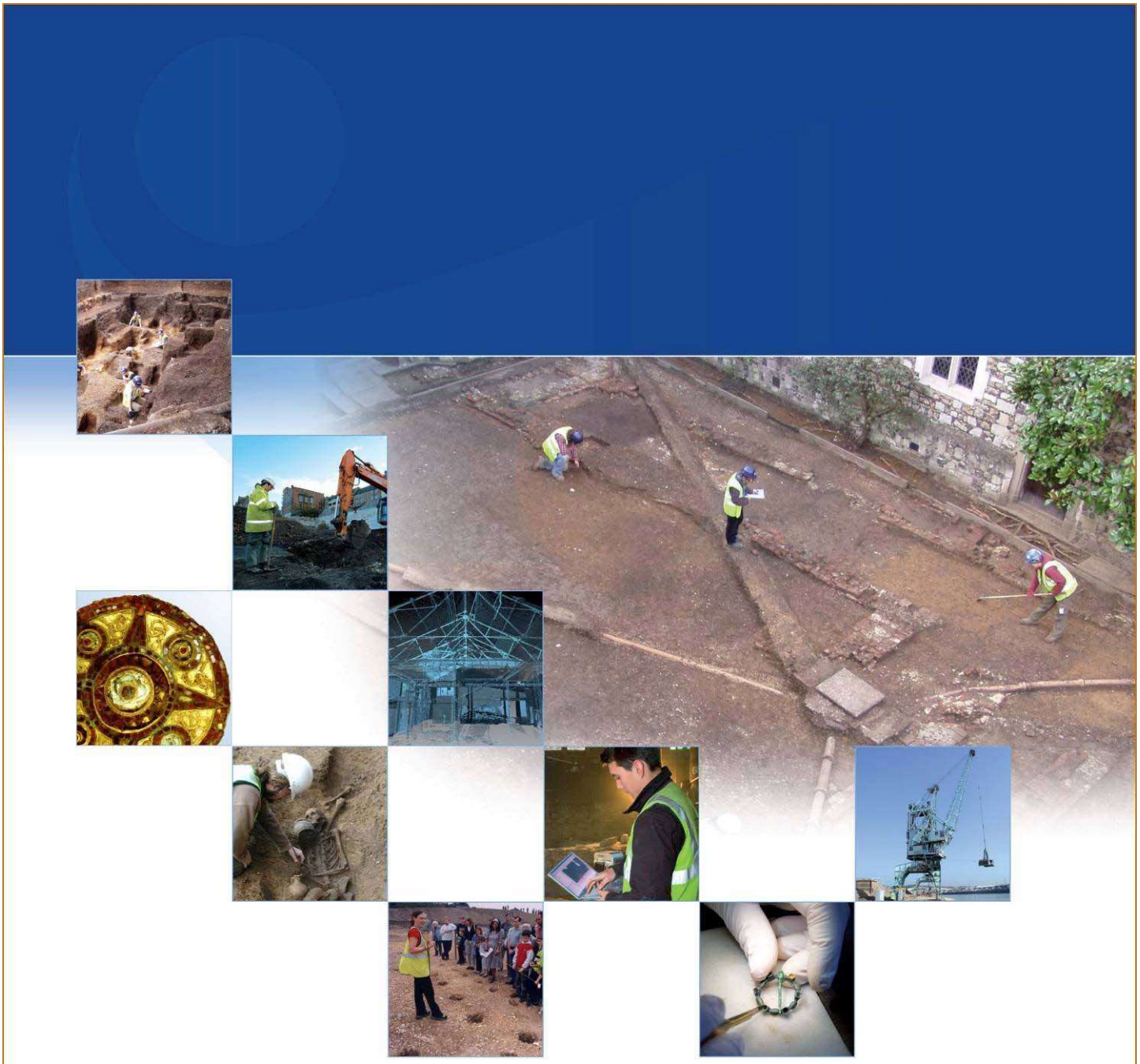
Waller M and Kirby J (2021) Coastal peat-beds and peatlands of the southern North Sea: Their past, present and future. Biological Reviews 96(2): 408–432.

19 APPENDIX G – OASIS FORM

Summary for aocarcha1-515129

OASIS ID (UID)	aocarcha1-515129
Project Name	VPI Immingham, Humber Zero Project: Geoarchaeological Borehole Evaluation and Deposit Model Report
Sitename	VPI Immingham
Activity type	Evaluation
Project Identifier(s)	53122
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	AOC Archaeology Group
Project Dates	30-Jan-2023 - 02-Feb-2023
Location	VPI Immingham NGR : TA 16917 16951 LL : 53.63602683460281, -0.233190586804391 12 Fig : 516917,416951
Administrative Areas	Country : England County : Lincolnshire District : North Lincolnshire Parish : South Killingholme
Project Methodology	A geoarchaeological evaluation was undertaken on 30th January to 2nd February 2023 at the site of VPI Immingham, Rosper Road, South Killingholme, North Lincolnshire (NGR: 516904 416940). The work was undertaken by AOC Archaeology Group for AECOM on behalf of the client, VPI Immingham LLP. This document summarises the stratigraphic sequence of geoarchaeological remains and discusses the results in relation to their archaeological and palaeoenvironmental potential. The principal objective of this report is to present the results, refine the research objectives of the project in light of the findings, and make recommendations concerning any subsequent archaeological investigations in order to address these research objectives. The geoarchaeological evaluation comprised the drilling of 11 purposive geoarchaeological boreholes to a maximum depth of c. 6m bgl, and the extraction and retention of the cored samples. Geoarchaeological and geotechnical deposit data can be used to identify areas of archaeological potential by characterising the probable nature and depth of sub-surface deposits.
Project Results	The deposit sequence recorded across the site included Pleistocene glacial till with a varying surface elevation between approximately -0.5 and 3 m OD. The lower elevations traverse the site from the northeastern boundary, forming a relict coastal inlet. This inlet was found to be infilled with intertidal deposits. Holocene alluvium or warp deposits were found across the site. Made ground of up to approximately 1.4m in thickness was recorded.
Keywords	Palaeochannel - UNCERTAIN - FISH Thesaurus of Monument Types
Funder	
HER	North Lincolnshire HER - unRev - STANDARD
Person Responsible for work	Jessica, Taylor

HER Identifiers	
Archives	



AOC Archaeology Group

www.aocarchaeology.com