Solent Gateway
Marchwood Port
Southampton

Stage 2 Geoarchaeological Assessment

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Summary

Stage 2 geoarchaeological assessment of five vibrocores acquired during geotechnical Ground Investigation (GI) work at Marchwood Port, Southampton was undertaken in advance of proposed works to strengthen Falklands Jetty and complete dredging operations in Marchwood Port, in preparation for a Marine Licence Application to the Marine Management Organisation. The aim of the assessment was to characterise the sediments at the Site in order to refine understanding of the presence, nature and distribution of Quaternary superficial deposits, and to assess their geoarchaeological potential and significance.

The results of the Stage 2 recording were broadly consistent with the expected stratigraphy previously established during recent work within Solent Water by Wessex Archaeology (2014; 2023a). The sequence consisted of Eocene bedrock (Unit 5) overlain in places by Pleistocene fluvial sands and gravels (Unit 4), followed by Holocene fine-grained sediments (Unit 3) forming under the influence of post-glacial relative sea-level rise. The sequence was then sealed in places by Recent Alluvium (Unit 2) and Made Ground (Unit 1). Only Units 5 and 3 were recorded within the new vibrocores.

The Eocene Bedrock (Unit 5) was recorded in all assessed boreholes. The deposit modelling of the surface of the bedrock suggests the presence of a paleochannel running from the north-east into the Solent. This could represent a remnant of a submerged braided river system, however its later date cannot be excluded (possibly representing an anastomosing or meandering channel of Early Holocene date). The bedrock has no geoarchaeological potential. The River Terrace Deposit (Unit 4) was recorded outcropping in the terrestrial zone along the western edge of the River Test, and as submerged gravels within Southampton Water, but was not present within the new vibrocores.

The Holocene estuarine alluvium (Unit 3) at the Site comprised black clayey silts, in places containing detrital organic matter, directly overlying the Eocene bedrock, with no distinct peat or organic-rich units. This unit is likely to have formed in the intertidal zone, within estuarine mudflats or saltmarsh under the influence of relative sea level rise during the Holocene. This unit is considered to be of low palaeoenvironmental potential on the basis of the minerogenic nature of the alluvium, and the likely reworked nature of any contained organic material. This unit is however considered to be of moderate archaeological potential on the basis of the associated likely intertidal environments in which the sediments formed, with the potential for well-preserved archaeological remains.

The Quaternary superifical deposits recorded at the site will be impacted by the proposed dredge and development works, given that they are present at elevations above the proposed dredge depth of -10.5 m CD (-13.24 m OD). However, the superficial deposits at the Site are considered to be of low palaeoenvironmental and archaeological potential, and no further palaeoenvironmental assessment of these cores is recommended.

It should be noted that both peat deposits and Pleistocene river terrace deposits appear to be highly localised within Southampton Water, and it is possible that these deposits may be encountered during dredging. It is therefore recommended that these deposits are recorded if discovered during pUXO investigations, during an Archaeological Watching Brief, or reported under the Archaeological Protocol for Unexpected Discoveries should they be encountered during dredging when an archaeologist is not present, and where practical, a suitable method devised for their sampling.

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Kowalska. The figures were prepared by Joanna Debska. Andrea Hamel managed the project on behalf of Wessex Archaeology.

Solent Gateway, Marchwood Port

Stage 2 Geoarchaeological Assessment of Geotechnical Data

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology has been appointed by Associated British Ports (ABP) Southampton ('the Client') to undertake Stage 2 geoarchaeological assessment of five vibrocores acquired during geotechnical Ground Investigation (GI) work at Marchwood Port, Southampton ('the Site'; ;**Figures 1** and **2**) in advance of proposed works to strengthen Falklands Jetty and complete dredging operations in Marchwood Port, in preparation for a Marine Licence Application to the Marine Management Organisation.

1.1.2 The proposed works at the Site comprise:

- strengthening part of the Falklands Jetty to provide a landing point of sufficient capacity to support vessel quarter ramps;
- placement of 1 no. berthing (breasting) dolphin and 1 no. mooring dolphin;
- a new access walkway supported by a monopile from the existing jetty to the mooring dolphin;
- placement of fender piles and panels to enable deepening of the berth pocket; and
- dredging to -10.5 m CD of the berth pocket and the approach channel.

1.2 Scope of work

1.2.1 The GI works at the Site comprised a total of five vibrocores (SGL-01 to SGL-05) undertaken in the area of the proposed dredging. The cores were made available to Wessex Archaeology for detailed Stage 2 geoarchaeological recording, the results of which are presented in **Appendix 1**.

1.2.2 In order to provide an updated deposit model for the Site and the wider area of Southampton Water, the new data were integrated together with geoarchaeological records obtained from previous geoarchaeological projects: the Main Channel Widening, Marchwood (Wessex Archaeology 2008b and 2014), Southampton Western Docks geoarchaeological assessment (Wessex Archaeology 2023a) and marine geophysical survey (Wessex Archaeology 2023b), and a review of selected British Geological Survey (BGS) records available for the area of the Site. All records used in the deposit model for the Site are summarised in **Appendix 2**.

1.2.3 The report summarises the results of the geoarchaeological recording and assessment of the geotechnical vibrocores and presents the updated deposit modelling of the subsurface stratigraphy at the Site and its wider context in Southampton Water (along Marchwood). The report will also inform on the requirements for any further geoarchaeological subsampling and assessment (Stage 3) that might be required.

1.3 Scope of document

1.3.1 To help frame geoarchaeological investigations of this nature, WA has developed a five stage approach, encompassing different levels of investigation appropriate to the result obtained, accompanied by formal reporting of the results. The stages are summarised below (Error! Reference source not found.). This report represents Stage 2 of this process.

Table 1 Staged approach to geoarchaeological investigations

Stage	Description
Stage 1: Geoarchaeological review	Desk-based review of geotechnical and geological data. Establish likely presence/ absence/ distribution of archaeologically relevant deposits. Identify deposits or samples for Stage 2 works.
Stage 2: Geoarchaeological recording/monitoring	Target deposits or samples identified in Stage 1. Describe the sequences recovered and undertake deposit modelling (if suitable). Interpret depositional environment (if possible). Identify if suitable deposits are present for Stage 3 works.
Stage 3: Palaeoenvironmental assessment	Sub-sample deposits of archaeological interest for paleoenvironmental assessment (e.g. pollen, plant macrofossils, foraminifera, ostracod and diatoms) and associated scientific dating. Provide an outline interpretation of the archaeological and palaeoenvironmental context. Any recommendations for Stage 4 works will depend on the potential for further analysis and the project research objectives.
Stage 4: Palaeoenvironmental analysis	Full analysis of samples and additional scientific dating as specified in Stage 3, together with a detailed synthesis of the results, in their local, regional or wider archaeological and palaeoenvironmental context. Publication would usually follow from a Stage 4 report.
Stage 5: Publication	Publication of the results of Stage 1-4 works for submission in a peer reviewed journal, book or monograph, depending on the archaeological significance of the work. The scope and location of the final publication will be agreed in consultation with the client and regulatory bodies where appropriate.

1.4 Site location

1.4.1 Marchwood Port is located within the statutory harbour area of the Port of Southampton comprising the central Solent, Southampton Water and the navigable areas of the Test and Itchen estuaries. The Site is located on the west bank of Southampton Water, opposite the main Port of Southampton Dock and is centred on the National Grid Reference (NGR) SU 440966 110681. The proposed development is within the Falklands Jetty and the navigating channel of the Southampton Docks, close to the mouth of the Test (**Figures 1** and **2**).

1.4.2 The site is bounded by Marchwood industrial Park and the village of Marchwood to the South and by the Port of Southampton to the north. The Site is located c. 4 km to the west of the confluence between the River Test and Itchen, where Southampton Water begins.

2 GEOARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 This section provides a geoarchaeological background to the site, drawing on relevant sites and studies within the wider landscape. The background is based on a range of secondary

sources, including desk based-assessments (Wessex Archaeology 2008a; 2024), geological information (BGS mapping) and previous work undertaken by Wessex Archaeology from the Solent area and the wider region (Wessex Archaeology 2014; 2023a; 2023b).

2.1.2 The superficial deposits within at the Site include deposits with geoarchaeological and/or archaeological potential of both Pleistocene and Holocene date. These epochs form parts of the Quaternary, a period covering the last 2.6 Mya, and defined by repeated fluctuations between cold (glacial) and warm (interglacial) climate stages (**Table 2**).

2.1.3 Where age estimates are available for deposits these are expressed in millions of years (Mya), thousands of years (Kya) and within the Holocene epoch as either year Before Present (BP), Before Christ (BC) and Anno Domini (AD). Where radiocarbon dates are included, they are quoted as calibrated (cal.) BC or AD. These dates are supplemented where relevant with the comparable Marine Isotope Stage (MIS) where odd numbers indicate an interglacial period and even numbers a glacial period. Marine Isotope Stages are deduced from marine palaeoclimatic records and reflect alternating warm (interglacial and interstadial) and cold (glacial and stadial) periods throughout the Quaternary.

Table 2 British Quaternary chronostratigraphy

Geological Period	Chronostratigraphy		Age (Kya)	MIS
Holocene	Holocene interglacial		11.7 – present	1
Late Pleistocene	Devensian Glaciation	Loch Lomond Stadial	11.7 – 12.9	2 – 5d
		Windermere Interstadial	12.9 – 15	
		Dimlington Stadial	15 – 26	
		Upton Warren Interstadial	40 – 43	
		Early Devensian	60 – 110	
	Ipswichian interglacial		115 – 130	5e
Middle Pleistocene		Unnamed cold stage	130-374	6
		Aveley interglacial		7
		Unnamed cold stage		8
		Purfleet interglacial		9
		Unnamed cold stage		10
	Hoxnian interglacial		374 – 424	11
	Anglian glaciation		424 – 478	12
	Cromerian Complex		478 - 780	13 – 19

2.2 Geological baseline

2.2.1 Southampton Water occupies the now submerged palaeovalley of the River Solent and is located at the point where the Rivers Itchen, Test and Hamble converge. The Site is situated

within the River Test, part of a modern fluvial system that drains into the English Channel via Southampton Water and the Solent.

Solid Geology

2.2.2 The underlying bedrock geology at the Site (**Figure 1**) is mapped by the British Geological Survey (BGS 2024) as the Selsey Sand Formation (part of the Bracklesham Group), deposited between the middle and late Lutetian marine transgression (47.8-41.2 Mya). The Selsey Sand Formation comprises fossiliferous marine glauconitic clays, silts and fine-grained sands. The sands which form the bulk of the formation are composed mainly of subrounded to subangular quartz with variable amounts of glauconite, silt, and clay. The formation contains an abundant and diverse marine macrofauna in which bivalves and gastropods are especially common (Edwards and Freshney 1987).

2.2.3 Immediately north of the Site, the bedrock is mapped as the Marsh Farm Formation, deposited during the Eocene (47.8-41.2 Mya). The Marsh Farm Formation (also part of the Bracklesham Group) contains two main lithologies in this area; laminated clays with laminae and thin beds of fine-grained to very fine-grained sand and silt; and fine-grained to locally coarse-grained, sparsely glauconitic sand with a variable number of clay beds (Edwards and Freshney 1987; Barnet 2023).

River Terrace Deposits

2.2.4 Extensive spreads of River Terrace Deposits occur along the Test and Itchen. Eleven River Test terraces are recognised by BGS at various heights trending north-west to south-east up the Test Valley between Romsey and Portsmouth and a further three submerged terrace levels offshore, the lowest of which is infilled with various Holocene sediments (Edwards and Freshney 1987).

2.2.5 Three river terraces have been mapped by the BGS along the upper part of Southampton Water and along the valleys of the Test and Itchen. River Terraces 2 and 3 are mapped on the northern bank of the River Test (opposite the Site), whereas the youngest, River Terrace 1, is mapped inland bounding the Site to the south and west.

2.2.6 The Palaeolithic significance of these terraces has been identified by previous work (Bates *et al* 2007, Ashton and Horsfield 2010, Briant *et al* 2012, Hatch 2013, Hatch *et al* 2017, Davis *et al* 2016) and an important sequence of Middle and Late Pleistocene sediments have been recognised extending along the Sussex and Hampshire coast. These fluvial sands and gravels are dated back to at least 500,000 years and contain several phases of Palaeolithic human occupation.

2.2.7 Dating of Terrace 2 at Solent Breezes as part of the Palaeolithic Archaeology of the Sussex/Hampshire Coastal Corridor (PASHCC) project produced dates for these deposits in MIS 7, coinciding with the final occupation of Britain prior to the abandonment of the peninsula between MIS 6 – MIS 4/3 (Bates et al 2007). However, Harding et al (2012) suggests that Terrace 2 formed later, during MIS 6. The OSL dating programme of the fluvial terraces as part of the PASHCC project dated Terraces 1 (at Timsbury) to between MIS 5a-4 (69 ±5 ka) (Hatch et al 2017, 6). The date for Terrace 1 differs from previously proposed dates by Westaway et al. (2006) that suggests Broadlands Farm terrace (Terrace 1) was deposited during MIS 2. The different dates could reflect complexity of deposition within the last glacial period, where many lowland river systems show multiple poorly-separated terrace levels (Briant et al. 2012).

2.2.8 Edwards and Freshney (1987) suggest the presence of submerged Late Devensian gravels associated with buried channels now overlain by Holocene estuarine and marine sediments. The gravels are known beneath Southampton Docks, near Weston and Fawley, and in the Test, Itchen and Hamble estuaries. It was proposed that their position suggests that they have formed in the Devensian, but before the growth of the late-Devensian ice-sheets. The buried channel that cut through these deposits was then infilled with Holocene clays, silts, sands and freshwater marls.

2.2.9 The submerged terrace below the Holocene alluvium at -8 to -10 m OD is below the heights for the Hamble terrace (Harding et al. 2012) and Terrace 2 (of the BGS terminology), and is therefore likely to be younger than those terraces. The age of these terrace deposits are uncertain. The deposit could be broadly equivalent with the upstream Broadland's Farm/Terrace 1, which has suggested ages of MIS 4 (Hatch et al. 2017) and MIS 2 (terrace stratigraphy and uplift modelling in Westaway et al 2006). This suggests a possible age range for the terrace deposits in the area of the site, underlying Southampton Water, of MIS 4-2.

Tidal Flat Deposits - Holocene

2.2.10 Rising sea levels in the early Holocene, driven by meltwater release as atmospheric temperatures rose and ice sheets decayed, led to the accumulation of Holocene alluvial sediments within the area of Southampton Water.

2.2.11 Deep sequences of Holocene sediments comprised of intercalated silts, sands and peats have been recorded along the length of Southampton Water, overlying the Pleistocene deposits. These are mapped by the BGS in the area of the Site as Tidal Flat Deposits (**Figure 2**). Recent studies from Southampton area have shown that these Holocene deposits formed as a response to the changing climate conditions and sea-level change. The sediment sequences along with palaeoenvironmental evidence and radiocarbon dating show a gradual inundation of the area from the Late glacial to the historic period (Timpany 2009, Nicholls and Scaife 2008).

2.2.12 The Tidal Flat Deposits at the Site and more broadly within Southampton Water likely formed predominantly in intertidal mud flats and salt marsh, and consist mainly of mud, silt and sand with a high organic content. Peat deposits are widely mapped in Southampton Water and throughout the Solent, where they date from Early to Late Holocene.

Peat and organic deposits

2.2.13 In the wider area of the Solent and its tributaries, peat deposits are widely recorded in coastal sediment sequences where they are a uniquely mid-Holocene phenomenon (Allen 2005). Frequent peat beds are recorded within the Solent, though most are undated (Intertidal and Coastal Peat Online Database). Peat deposits have previously been recorded from Empress Docks (Tomalin 2000), but no information exists on the OD height or age of this peat. At Fawley, c. 8km to the south of the Site, samples from peat beds at -7.6 and -2.75 m OD produced radiocarbon dates of 6363 ± 96 BP (7511-6997 cal BP) and 3689 ± 120 BP (4407-3692 cal BP) respectively. The dates were undertaken in the 1960s and have large lab errors and associated date ranges, but broadly correspond to the late Mesolithic through to middle Bronze Age.

2.2.14 Research at West Quay Road (1.56 km to the northeast) in Southampton shows that fen carr peat developed from the early Mesolithic over river terrace gravels and freshwater channels, while forest was present in the surroundings and as tidal environments became

more influential, a mosaic of reed beds and salt marsh pools developed by the late Mesolithic (Nicholls and Scaife 2008).

2.2.15 At Empress Road, in the valley of the River Itchen c. 3.45 km to the northeast, the peat contained sedge and alder communities with alder becoming more common towards the top of the sequence. The base of the peat was dated to the early Mesolithic period (10225 to 10165 cal BP) and the top of the peat was radiocarbon dated to the middle Mesolithic period (7715 to 7620 cal BP) (Russel *et al* 2019). More recent work at Empress Road (Wessex Archaeology 2023c; SOU1962) demonstrated that the peat deposits here were of early Mesolithic through to late Mesolithic date, consistent with radiocarbon dated peat deposits elsewhere in the valley of the River Itchen. Peat deposits of Mesolithic date have been recorded at various locations here, including at 1-16 Empress Road (Southampton Archaeology Unit 2016; SOU 1678), Imperial Road (ARS Ltd 2016; SOU 1684) and Chapel Riverside (Wessex Archaeology 2016).

2.2.16 At Chapel Riverside, on the west bank of the Itchen (Wessex Archaeology 2016), peat deposits of late Mesolithic and early Neolithic date were recorded towards the base of the alluvial sequence overlying Pleistocene river terrace deposits (c. -8.0 to -9.0 m OD), as well as peat of a similar date at higher levels (c. -4.5 to -5.5 m OD) within the alluvial sequence. Palaeoenvironmental remains were generally poorly preserved within the peat sequences with the exception of the plant macroremains, which revealed evidence for a range of both aquatic and terrestrial plants.

2.2.17 Peat deposits were recorded within the alluvial sequence at various locations during archaeological monitoring of a previous phase of GI works associated with the Itchen Flood Alleviation Scheme (Garner & Russel 2015; SOU 1671). At Mount Pleasant Industrial Estate an archaeological watching brief revealed the top of a ‘stony, clayey’ peat at -2.42 m OD, overlying silts at c. -3.42 m OD. On the south shore of Millstone Point, 1.0 m of peaty sandy clay and peat were recorded at -3.29 m OD, overlying fluvial sands and gravels at -4.29 m OD.

2.2.18 The post-glacial to late Mesolithic deposits, alternating between organic and minerogenic silts, were recorded at Cobden Avenue in Southampton (4.72 km northeast) providing evidence for an alder carr wetland environment dated to the late Mesolithic, c. 6480-6390 cal. BC (Wessex Archaeology 2011).

2.2.19 The Mesolithic peat was then sealed by alluvial and estuarine deposits. The growth of freshwater sedge fen around the early to middle Neolithic, followed by marine transgression and persistence of estuarine mudflat environments into the historic period, was recorded within the wider area of Southampton (Nicholls and Scaife 2008).

2.3 Sea level-change and the archaeological background

2.3.1 The geoarchaeology and archaeology of Southampton Water and the neighbouring areas are closely associated with sea level change within the Solent region. Human activity within the Solent region can be dated from the Lower Palaeolithic to the present day, and there is evidence that at times of lower sea level this activity has extended into areas that are currently submerged.

2.3.2 The Palaeolithic period is characterised by a series of long cold stages when ice sheets spread across much of Britain, separated by relatively short-lived warm stages during which conditions were more suitable for human habitation of Britain. Southern Britain was not covered by ice sheets, but experienced harsh periglacial conditions, and the major river

systems, including the Palaeo-Solent, cut valleys into the underlying rock strata. During the warm stages (interglacials) water released from the ice sheets caused the sea level to rise, drowning some coastal river valleys, such as the Palaeo-Solent (Wessex Archaeology 2008a).

2.3.3 There have been a significant number of Palaeolithic artefacts found within the Solent. The most important concentrations of Palaeolithic find-spots on the Hampshire side of the Solent are in the Southampton and Bournemouth areas. Artefacts from submerged contexts include 298 largely prehistoric finds dredged from the Western Solent (Wessex Archaeology 2008a). Quarrying of the Hamble Terrace and Lower Warsash Terrace of the River Test (Terrace 2) have produced a rich Palaeolithic record including at least 499 handaxes and 34 Levallois artefacts (Wessex Archaeology 2024).

2.3.4 During the Upper Palaeolithic, at around 25,000-18,000 BP, the ice sheets of the Devensian glaciation had reached their maximum extent. Following this, climatic conditions became more favourable to humans by around 13,500 BP, when the sea was still at least 60 m below its current level. At this time Britain was linked to continental Europe. The climate continued to warm until about 10,000 BP, at which point the British climate may have been as warm as it is at present (Wessex Archaeology 2008a).

2.3.5 The effects of the Holocene marine transgression were that many of the coastal land surfaces that developed after the end of the Devensian glaciation have since been eroded by the sea. During the Mesolithic period (c.10,000–4000 BP) sea levels became sufficiently high to cut off Britain from northwest Europe. The most easily identifiable evidence for the survival of post-Devensian coastal land surfaces occurs in the form of peat deposits, such as those off Bouldnor Cliff on the Isle of Wight and within Southampton Water.

2.3.6 Peat deposits are widely mapped in Southampton Water and throughout the Solent where they date variously from the Mesolithic to Iron Age, reflecting distinct phases of marine regression during which semi-terrestrial plant communities replaced former mudflats/saltmarsh (see **Section 2.2**).

2.3.7 Although no known Prehistoric or Mesolithic finds are known from the Site, the peat and fine-grained sediments have the potential to provide palaeoenvironmental evidence for the landscape and vegetational changes that affected the area during the period between the end of glaciation and full inundation. The effects of waterlogging also present the possibility that there may be survival of organic human artefacts, particularly within peat deposits. Both artefactual and palaeoenvironmental evidence is thus likely to be of high regional or national importance (Wessex Archaeology 2008a).

2.4 Summary of previous geoarchaeological work

2.4.1 Palaeoenvironmental assessment undertaken as part of the Main Channel Widening (Marchwood) and Reconstruction of Berths 201 and 202 by Wessex Archaeology (2008b; 2014) at Southampton Western Docks (adjected to the northwest boundary of the current Site) revealed a sequence of Tertiary bedrock, overlain by Pleistocene Fluvial Sands and Gravels, Holocene alluvium and peat, and recent alluvial sediments.

2.4.2 The Pleistocene Fluvial Sands and Gravel were interpreted as Late Devensian (MIS 2; 23-11.7 Kya) deposits of the River Test and were recorded at up to 6 m in thickness at elevations between c. -5 and -10 m OD (Wessex Archaeology 2014). These were overlain by a sequence of Holocene alluvium containing minerogenic and organic units and peat. Radiocarbon dating of these deposits indicates peat formation and subsequent organic and

alluvial sedimentation to have occurred during the Mesolithic period between c. 10,000 and 8,000 cal BP (Wessex Archaeology 2014).

2.4.3 The palaeoenvironmental assessment of the Holocene alluvial sequence within the Berths 201/2 area demonstrated a coastal marsh/tidal environment fringed with grass and woodland comprising alder with pine and hazel with well-preserved brackish water flora and faunas with some freshwater input (Wessex Archaeology 2014).

2.4.4 A programme of geoarchaeological monitoring of GI works and subsequent deposit modelling was undertaken at the Site of the Western Docks Capital Dredge, just along the norther Site limit (Wessex Archaeology 2023a). The results of the geoarchaeological monitoring revealed a sequence of Marsh Farm Formation and Selsey Sand Formation bedrock, overlain at the north-western end of the Site by Pleistocene Fluvial Sands and Gravels, and more widely across the Site by Holocene Tidal Flat Deposits (likely incorporating an upper unit of modern riverbed sediments) associated with the valley of the River Test. No archaeology was identified during the monitoring, nor was any peat. (Wessex Archaeology 2023a).

2.4.5 Archaeological assessment of geophysical data acquired within the Western Docks area of the River Test conducted by Wessex Archaeology (2023b) revealed a total of 48 seabed anomalies of archaeological potential. A total of four areas of acoustic blanking were prescribed a medium archaeological potential, on the basis that they may represent organic deposits or peat. During an archaeological diving investigations, undertaken as part of the pUXO survey prior to dredging, peat was identified on the seabed. During dredging operations, and archaeological watching brief was implemented in areas of acoustic blanking, and peat samples were recovered from various locations (shown as Samples 1-5 in **Figure 3**). A palaeoenvironmental assessment of these peat deposits is currently underway.

3 AIMS AND OBJECTIVES

3.1.1 The overarching goal of the geoarchaeological assessment and deposit modelling was to provide further information on the archaeological and geoarchaeological resource that may be impacted by the proposed development, and to facilitate and informed decision with regard to the requirement for, and methods of, any further archaeological and geoarchaeological work that may be required.

3.1.2 The principle aims of the Stage 2 geoarchaeological recording and deposit modelling were therefore as follows:

- characterise the Quaternary sedimentary sequence and record any archaeological/palaeoenvironmental remains encountered in deposits within the area of the proposed dredging;
- refine understanding of the presence, nature and distribution of Quaternary superficial deposits within the area of the proposed dredging;
- update the deposit model by combining the new borehole records with data in the previous projects undertaken by Wessex Archaeology (2014 and 2023) in Southampton Water, and selected BGS logs from the Site;
- make recommendations for any further scientific dating and palaeoenvironmental assessment as appropriate.

3.1.3 The aims will be achieved by addressing the following objectives:

- describe five vibrocore sequences obtained during the current geotechnical investigations;
- interpret the probable environments represented;
- model the character, extent and depth of the sub-surface deposits; and
- determine the importance of the deposits, with regard to their archaeological and palaeoenvironmental potential.

4 METHODOLOGY

4.1 Vibrocore survey

4.1.1 Five vibrocores, SGL-BH01 to SGL-BH05, were acquired during the geotechnical survey conducted at the Site by CMS GeoScience, using a vibrocorer deployed from the vessel *Obervargh*. The vibrocores were recovered in two northwest to southeast alignments within the area of the proposed dredging. The vibrocores were set out using a Global Navigation Satellite System (GNSS) in the approximate positions shown in **Figure 3**.

4.1.2 The vibrocores locations were tied in to the Ordnance Survey (OS) National Grid. Depths are given in metres below sea floor (m bsf), which assumes the top of the vibrocore is equal to the level of the sea floor, and metres relative to Chart Datum (m CD) (2.74 m below Ordnance Datum for the area of Southampton Water). For the purposes of deposit modelling, all elevations are displayed in metres relative to Ordnance Datum (m OD).

4.1.3 The location data for all vibrocores and the reviewed BGS boreholes are presented in **Appendix 1** and **2**.

4.2 Review of geotechnical boreholes

4.2.1 A review 56 geotechnical and geoarchaeological logs was undertaken in order to create a deposit model for the Site and to set the sequence in its wider geoarchaeological context. The following records were reviewed:

- Southampton Western Docks Capital Dredge (Wessex Archaeology 2023, Project ref. 272350), 10 vibrocores BH-PR-A to BH-PR-J;
- Main Channel Widening (Marchwood) and Reconstruction of Berths 201 and 202 (Wessex Archaeology 2008b and 2014, Project ref. 68532), vibrocores ABP-CV1 to ABP-CV4; and BH-18B, BH-20B and BH-22B; and
- 31 available borehole logs from Southampton Water within an approx. 500 m radius form the Site.

4.3 Stage 2 geoarchaeological recording

4.3.1 Vibrocores SGL-BH01 to SGL-BH05 were taken by CMS GeoScience and transferred to the Wessex Archaeology laboratory for sediment description as part of the Stage 2 geoarchaeological recording by a trained geoarchaeologist. The description of the vibrocores is presented in **Appendix 1.**

4.3.2 At the laboratory the vibrocores were split longitudinally, clean, photographed and described in detail including information such as:

- depth;
- texture;
- composition;
- colour;
- inclusions;
- structure (bedding etc.); and,
- contacts between deposits (where visible).

4.3.3 The geoarchaeological description was undertaken in accordance with BS EN ISO 14688-1:2018 Geotechnical Investigation and testing – Identification and classification of soil.

4.3.4 Deposits recovered in vibrocores were interpreted in terms of their geoarchaeological potential. Interpretations were made regarding the probable depositional environments and formation and summarised in **Appendix 1**.

4.4 Deposit modelling

4.4.1 All assessed data points were entered into industry standard geological utilities software (Rockworks™ 23). Each stratigraphic unit was given a colour allowing cross correlation and grouping of the different sedimentary units. The grouping of these deposits is based on lithological descriptions, which define distinct depositional environments referred to as 'stratigraphic units'.

4.4.2 The sedimentary units from boreholes were classified into five stratigraphic units, listed below from the youngest to the oldest:

- Unit 1 - Made Ground;
- Unit 2 - Recent Alluvium;
- Unit 3 - Holocene Alluvium;
- Unit 4 - River Terrace Deposits;
- Unit 5 - Bedrock.

4.4.3 The RockWorks software was used to plot three stratigraphic profiles (transects/cross sections) to illustrate the stratigraphic units and their lateral and vertical variability (**Figures 9, 10** and **11**). **Figure 9** shows a northwest-southeast oriented transect along the River Test and Southampton Water, whilst **Figures 10** and **11** show southwest-northeast transects through the present Site.

4.4.4 Three deposit models showing the surface elevations for Unit 5, Unit 4 and Unit 3 (**Figures 4**, **5**, and **6**) and thickness plots for Units 4 and 3 are shown in **Figures 7** and **8**). were produced.

4.4.5 All models were generated using an inverse distance weighted (IDW) algorithm to model the stratigraphy. Where data points are not uniformly distributed over the area of investigation the reliability of the outputs is variable. In order to account for this, the modelling algorithm has been adjusted to include a maximum distance cut-off filter, so that only those areas for which sufficient stratigraphic data is present will be included in the model. A maximum distance cut-off filter equivalent to either a 100 or 200 m radius around each data point is applied to the models, with greater distances applied to models where that unit is more widely distributed (with a 100 m cut-off for Unit 4 and 200 m cut-off for Units 3 and 5).

5 RESULTS

5.1 Introduction

5.1.1 The results of the Stage 2 geoarchaeological recording of the vibrocores, SGL-BH01 to SGL-BH05, are presented here alongside an assessment of 56 geotechnical logs listed in **Appendix 2**. The results of the Stage 2 geoarchaeological assessment and deposit modelling are synthesised below, with full vibrocore descriptions presented in **Appendix 1**.

5.2 Stratigraphy

5.2.1 The following stratigraphic units were identified during the assessment:

- Unit 1 - Made Ground – modern; present only in the BGS records;
- Unit 2 - Recent Alluvium – recent estuarine alluvial sediments, identified in the records from the Marchwood area (Wessex Archaeology 2014);
- Unit 3- Holocene Alluvium – include soft, often organic to minerogenic silts and clays together with peat layers recorded at the base of the unit in WA_VC1 and WA_VC3; and sampled as bulk Samples 1 to 5 during the associated marine work.
- Unit 4 - River Terrace Deposits – identified comprising predominately sands and gravels. Likely deposited during Pleistocene MIS 4 to 2;
- Unit 5 - Eocene Bedrock – Eocene sands of the Bracklesham Group represented by Marsh Farm Formation covered by Selsey Sand Formation.

Eocene bedrock

5.2.2 The Eocene bedrock (Unit 5) was recorded in all of the assessed logs as a stiff and homogeneous, grey to olive grey fine to medium sand. Black mudstone with silt laminae was recorded in SGL-BH01 at depth of 0.84 mbsf (c. -11 m OD).

5.2.3 The highest outcrop of the bedrock lies at between -2.90 and -6.00 m OD, mainly recorded in boreholes located onshore, along the southwest of the Site boundary (SU41SW583, SU41SW584, SU41SW828, SU41SW32-SU41SW835, SU41SW592, and SU41SW583), (**Figure 4**).

5.2.4 Within the Site and towards the northeast, the bedrock is observed to be dipping to minimum depth of -11.00 m OD and this surface appears to be incised or eroded in the location of:

SGL-BH01, SGL-BH02, BH-PR-H, BH-PR-H-J and SU41SW598. Then the bedrock rise again to up to -3.00 m OD in BH-PR-F, BH-PR-F1, BH-PR-E and SU41SW901 towards the northeast edge of River Test (**Figure 4**).

5.2.5 The bedrock is recorded at its lowest at between -12.00 m OD and -13.80 m OD, including in the area of the recorded peat samples (Samples 1 to 5), WA-VC1 and BH-18B, suggesting the presence an incised channel here. The bedrock then rises again to between -2.50 and -6.00 m OD in location of BH-PR-A, BH-PR-B and BH-PR-C (**Figures 4** and **9**).

5.2.6 The bedrock is overlain by River Terrace Deposits in 15 boreholes, and directly by Holocene Alluvium in 44 boreholes.

River Terrace Deposits

5.2.7 River Terrace Deposits (Unit 4) were not encountered in any of the new vibrocores, SGL-BH01 to SGL-BH05 (**Figures 10** and **11**). Although the new records from the Site indicate the absence of this unit, they were recorded in BGS archive borehole SU41SW603 at -6.00 m OD (1.00 mbsf) and in SU41SW831 at -4.00 m OD (0 mbsf) with thicknesses ranging between 2.00 m to 1.50 m **(Figures 7**, **10** and **11**). The absence of this unit in the more recent boreholes may be a result of past impacts from dredging since the excavation of the BGS archive boreholes between 1972 and 1983, although the gravel was not recorded in all boreholes excavated prior to then, and appears to be only locally present.

5.2.8 Based on the previous logs, the lithology of this unit consists predominately of sandy gravels, gravels and sands, with the clasts composed mainly of chert and flint. The River Terrace Deposits were laid down on a braid plain under cold climate conditions during the Late Pleistocene. In SU41SW831 grading from gravel to sand was noted, suggesting a change in the water flow regime, from high to lower energy. Occasional layer of clays and silts were noted in SU41SW583 and SU41SW584 indicative of low-energy deposition, possible in slow moving water within a channel or during overbank flooding.

5.2.9 The highest elevation for the gravel was recorded inland in SU41SW583, SU41SW592, SU41SW594, and ranged between 2.50 m OD and 3.00 m OD. The fluvial gravels then drop to a depth between -4.50 m OD to -6.00 m OD along the southwest edge of the channel (**Figure 4**). The thickness of the fluvial sands and gravels range from 6.50m to 1.50m (**Figure 7**).

Holocene Alluvium

5.2.10 This stratigraphic unit (Unit 3) encompass a range of lithologies deposited by alluvial processes. It includes estuarine sediments comprising soft, grey to dark minerogenic silts and clays recorded in the majority of the BGS boreholes. The fine-grained sediments were deposited by low energy moving water and may represent estuarine alluvium forming under the influence of rising sea level during the Holocene in areas of intertidal mudflats and saltmarsh. In places this unit is difficult to differentiate from modern riverbed sediments.

5.2.11 At the Site this unit was recorded as a soft and homogenous black to very dark grey clayey silt. This was encountered in SGL-BH02 at -11.00 m OD (0.00 mbsf) and SGL-BH03 at -7.80 m OD (0.00 mbsf), in thicknesses between 0.50 and 3.71 m respectively. Although this unit was generally structureless, a slight increase in fine sand was noted in SGL-BH03 at between 0.70-1.55 m bsf. The fine-grained texture is indicative of deposition in a low energy, probably estuarine environment. The presence of the marine mollusc *Varicorbula gibba* in SGL-BH03, commonly found in intertidal conditions and low shore to considerable depths in the sublittoral, is indicative of deposition in an estuarine setting. A slight increase of sand

in SGL-BH03 at between 0.70 and 1.15 mbsf could indicate a change towards slightly higher energy of deposition. In SGL-BH02, at the base of Unit 3 between 0.27-0.58 mbsf (c. -11.00 m OD), the organic silts were interbedded with well-sorted fine glauconite sand. This could be suggestive of changes in the depositional environment, perhaps in a channel setting.

5.2.12 The Holocene Alluvium was recorded as the uppermost deposit in vibrocores BH-PR-G to BH-PR-J, located towards the northeast of the present Site, during the work at Southampton Western Docks (Wessex Archaeology 2023a). Here the thickness of the Alluvium ranged from c. 0.50 to 1.20 m (**Figure 9**). Fragments of shells and rare detrital wood fragments were noted in places in these vibrocores.

5.2.13 No *in-situ* peat deposits or organic-rich alluvial units were recorded within the vibrocores from the Site. However, peat was identified within the alluvial sequence northeast of the Site area in WA-VC1 at -5.54 m OD (1.30-1.47 mbsf) and WA-VC3 at -4.35 m OD (1.51 to 2.20 mbsf), and in Samples 1 to 5 during recent dredging works (see **Figures 3 and 9**).

5.2.14 However, the present Site lies within an area where the top of Unit 3 is generally recorded below -10.00 m OD, considerably lower that the northern part of the area of investigation where the peat was recorded at an elevation of approximately -5 m OD. The absence of peat here may be a result of past impacts from dredging, or that peat deposits have since been eroded by natural processes including channel incision.

5.2.15 The minimum elevations for the top of Unit 3 are -11.00 m OD, recorded in SGL-BH02, and -8.00 m OD in BH-PR-H. Towards the northwest, the lowest elevations were noted at average depth of -10 m OD in BH-18B, BH-20B and BH-22B (**Figure 6**). The areas of the lowest elevation correspond well with the structural elevations for the bedrock, suggesting infilling of the possible buried channel(s).

5.2.16 The thickness of Unit 3 is highly variable, ranging between 5.01 and 0.50 (**Figure 8**), with a maximum of 3.38 m recorded in the new vibrocores (SGL-BH03).

Recent Alluvium

5.2.17 No recent alluvial or modern riverbed sediments were encountered within the new vibrocores. These have however been recorded as a thin veneer elsewhere within Southampton Water, including in WA-CV1 and VA-VC3 (**Figure 9**) at 4.24 m OD and 2.84 m OD, respectively. This unit comprised of soft, shelly silts and clays with shells of *Cerpidula fornicata* indicative of a modern or post-medieval (19th century) date for these sediments (Wessex Archaeology 2014).

6 DISCUSSION

6.1 Introduction

6.1.1 The main aim of the Stage 2 geoarchaeological assessment were to characterise the sediments at the Site in order to refine understanding of the presence, nature and distribution of Quaternary superficial deposits within the area of the proposed dredging. The detailed Stage 2 recording of five vibrocores from the site was followed by a review of 31 BGS boreholes and previous geoarchaeological records (Wessex Archaeology 2008b; 2014; 2023a) for the wider area of Southampton Water, which were used to produce a deposit model for the Site which placed the sediments in the vibrocores within their wider geoarchaeological context.

6.1.2 The results of the Stage 2 recording were broadly consistent with the expected stratigraphy previously established during recent work in this area by Wessex Archaeology (2014; 2023a). The sequence consisted of Eocene bedrock (Unit 5) overlain in places by Pleistocene fluvial sands and gravels (Unit 4), followed by Holocene fine-grained sediments (Unit 3) forming under the influence of post-glacial relative sea-level rise. The sequence was then sealed in places by Recent Alluvium (Unit 2) and Made Ground (Unit 1). Only Units 5 and 3 were recorded within the new vibrocores.

6.2 Geoarchaeological assessment

6.2.1 The Eocene bedrock (Unit 5) forms an irregular, in places incised, surface on which the later Quaternary superficial deposits have accumulated. The surface model for the bedrock (**Figure 4**) is indicative of the presence of a buried channel(s) within Southampton Water, the present dataset indicating that this lies on a broadly northwest-southeast alignment that underlies the northeastern part of the present Site.

6.2.2 The River Terrace Gravels (Unit 4) recorded in boreholes along the south-western edge of the River Test represent Terrace 1 (Broadlands Farm Terrace) mapped by BGS. These fluvial sands and gravels were laid down on a braid plain under cold conditions during the Late Pleistocene. There is an ongoing discussion regarding correlation and dating of Terrace 1 but the OSL dates from Timsbury, Romsey, place them within MIS 4 (69 ± 5 Kya), in the Early Devensian (Wessex Archaeology 2023a).

6.2.3 Pleistocene sands and gravels were not recorded within any of the new vibrocores, likely as a result of either past dredging impacts or subsequent fluvial incision into, and erosion of, these deposits. The sand and gravels recorded in selected vibrocores from the wider area of investigation are positioned at elevations between -4.0 and -8.5 m OD. Edwards and Freshney (1987) suggested the presence of submerged terraces associated with buried channels now submerged by the River Test. The low-lying terraces are known beneath Southampton docks, at Dibden and Fawley (Everard 1954, Hodson and West 1972, Edwards and Freshney 1987). Edwards and Freshney (1987) suggested that the position of these gravels implies deposition in the Devensian, although the exact date of these deposits is uncertain.

6.2.4 At West Quay Road, Southampton (1.54 km northeast) fluvial gravels were reached at similar depths of c. -8.16 m OD. These fluvial gravels were then overlain by freshwater bedded sands, followed by finer-grained deposits. Nicholls and Scaife (2008) interpreted them as Terrace 1, dated to MIS 2.

6.2.5 Hatch (2013, 131), based on his analysis of terrace gradients associated with River Test at Gosport, suggests a sequence of lower gravels covered by peat deposits with higher gravel deposits subsequently eroded or removed. He proposed that these gravels may be indicative of the presence of a Holocene channel cutting into Terrace 2. The possibility that the low-laying gravels within the Site might also represent an early-Holocene channel cannot be ruled out at this stage of analysis without a scientific dating.

6.2.6 The submerged gravels (Unit 4) were deposited in a high energy river setting; therefore, their archaeological potential is low, and it is unlikely that they will contain in-situ archaeological material, but they may contain re-worked material, particularly in the form of flint tools. The upper parts Unit 4 may relate to late Glacial deposition and the surface of the gravels may potentially contain Upper Palaeolithic material (Wessex Archaeology 2014).

6.2.7 Unit 4 was overlain by estuarine mudflat deposits (Unit 3) formed as a result of Holocene sea level rise and corresponding with the Tidal Flat Deposits mapped by the BGS. The organic, fine-grinded texture and presence of *Varicorbula gibba* and *Cerastoderma* sp. molluscs, recorded in SGL-BH03, indicate that these sediments likely formed in an intertidal, estuarine setting.

6.2.8 No distinct peat or organic-rich units were recorded within the vibrocores with the exception of a fine sand interbedded with organic silts recorded at the base of Unit 3 in SGL-BH02. These deposits are likely to have been deposited in a channel setting, with coarse sand reflecting a higher depositional energy and the organic silt indicating still or almost stagnant water. Similar, clay and silt-rich sands were noted at West Quay Road where paleoenvironmental analysis suggested that they were deposited during Late glacial freshwater fluvial deposition (Nicholls and Scaife 2008).

6.2.9 Early Mesolithic peats were previously recorded in the Marchwood area in WA-VC3 (-4.92 m OD) and its base was dated to 11090-10700 cal. BP (9140-8750 cal. BP; SUERC-46072). The upper date obtained from WA-VC3 provided dates spanning from 8410-8320 cal. BP to 6460-6370 cal. BP (SUERC-46071) (Wessex Archaeology 2014). The dates fit well in the wider context of Mesolithic peats in the Southampton area (see **Section 2.2**). The peat recorded in WA-VC1 and WA-VC3 was overlain by minerogenic alluvium, consistent with the general trend in this area of a transition from peat to minerogenic alluvium that occurred after the late Mesolithic period. This phenomenon is widely recognised within the Southampton area; between 7500 and 5000 BC (8200 to 5700 cal. BP), mean sea level rose rapidly from c. -9 to -4 m OD, and during this interval peats were inundated and the area of intertidal and subtidal environments within the estuary expanded (Long et al. 2000).

6.2.10 The peat seems to be predominately present in the northwest area opposite Marchwood, in the location of WA-VC1 and WA-VC3 (Wessex Archaeology 2008b; 2014). Peat deposits encountered during recent dredging works associated with the Western Docks (Samples 1 to 5; see **Figure 3**) confirmed the presence of peat in this area and corresponds well with the acoustic blanking recorded during an archaeological assessment of marine geophysical data (Wessex Archaeology 2023b). No peat deposits were identified within the vibrocores from Southampton Western Docks (Wessex Archaeology 2023), indicating that the peat deposits that survive within Southampton Water may not be widely present, or that selection of borehole locations should in future be selected to correspond with locations of higher potential.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

7.1.1 The recording of five vibrocores and deposit modelling of key sedimentary units recorded within the Site and the wider area have allowed a characterisation of the superficial deposits, interpretation of their depositional setting, and evaluation of their geoarchaeological and paleoenvironmental significance.

7.1.2 Data coverage across the Site was good and the sediments modelled fit well with the recognised sediment sequence for the area of Southampton Water. The key results of the geoarchaeological assessment, and the geoarchaeological potential of the deposits are summarised below:

- The Eocene Bedrock (Unit 5) was recorded in all assessed boreholes. The deposit modelling of the surface of Unit 5 suggests the presence of a paleochannel running

from the north-east into the Solent (**Figure 4**). This could be a remnant of a submerged braided river system, however its later date cannot be excluded (possibly representing an anastomosing or meandering channel of Early Holocene date). The bedrock itself has no geoarchaeological potential.

- The River Terrace Deposit (Unit 4) was recorded outcropping in the terrestrial zone along the western edge of the River Test, and as submerged gravels within Southampton Water. This unit was not present within the new vibrocores, although earlier BGS archive boreholes indicate that this unit is either locally present, or has been removed by subsequent impacts from past dredging.

- Where this Unit is present, it is considered likely to represent Terrace 1, dated to the Last Glacial Maximum (MIS 2), and deposited in a high energy braided river. It is thus considered to have low potential for preserving in-situ archaeological material, but may contain reworked Palaeolithic artefacts.

- The Holocene estuarine alluvium (Unit 3) at the Site comprised black clayey silts, in places containing detrital organic matter, directly overlying the Eocene bedrock, with no distinct peat or organic-rich units. This unit is likely to have formed in the intertidal zone, within estuarine mudflats or saltmarsh under the influence of relative sea level rise during the Holocene. This unit is considered to be of low palaeoenvironmental potential on the basis of the minerogenic nature of the alluvium, and the likely reworked nature of any contained organic material. This unit is however considered to be of moderate archaeological potential on the basis of the likely intertidal environments in which they formed, with the potential for well-preserved archaeology including (for example) wooden boats, fish traps and shipwrecks.

7.2 Recommendations

7.2.1 The Quaternary superifical deposits recorded at the site will be impacted by the proposed dredge and development works, given that they are present at elevations above the proposed dredge depth of -10.5 m CD (-13.24 m OD).

7.2.2 However, the superficial deposits at the Site are considered to be of low palaeoenvironmental potential, and no further palaeoenvironmental assessment of these cores is recommended. The deposits are however considered to be of moderate archaeological potential.

7.2.3 It should be noted that both peat deposits and Pleistocene river terrace deposits appear to be highly localised within Southampton Water, and it is possible that these deposits may be encountered during dredging. It is therefore recommended that these deposits are recorded if discovered during pUXO investigations, during an Archaeological Watching Brief, or reported under the Archaeological Protocol for Unexpected Discoveries should they be encountered during dredging when an archaeologist is not present, and where practical, a suitable method devised for their sampling.

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APPENDICES

Appendix 1 Sediment description logs

Site Code: 289060	**Site Name:** Solent Gateway, Marchwood Port	**Borehole ID:** SGL-BH01
Coordinates (NGR) X: 440972.70	**Coordinates (NGR) Y:** 110814	**Level (top):** **-11.01 m OD**
Length:	**Width:**	**Depth:** 1.60 m

Context Number	**Description**	**Interpretation**	**Depth mbsf**	**Depth m OD**	**Samples**
101	Firm to stiff with depth, dark olive grey, slightly silty well-sorted very fine to fine SAND. Few, fossilised shells throughout. Sharp lower contact.	Eocene Bedrock (Unit 5)	0.00m-0.84m		
102	Firm, dark olive grey, slightly silty well-sorted very fine to mid SAND bedded with very dark grey organic silt/clay. Lower contact not recorded.	Eocene Bedrock (Unit 5)	0.84m-1.00		

Site Code: 289060	**Site Name:** Solent Gateway, Marchwood Port	**Borehole ID:** SGL-BH02
Coordinates (NGR) X: 441022.90	**Coordinates (NGR) Y:** 110748.40	**Level (top):** **-10.86 m OD**
Length:	**Width:**	**Depth:**

Context Number	**Description**	**Interpretation**	**Depth mbsf**	**Depth m OD**	**Samples**
201	Very soft, black organic clayey SILT with abraded, subangular (40mm) flint. Homogenous and structureless. Oxidised brown when exposed. Sharp lower contact.	Holocene Alluvium (Unit 3) – organic mud	0.00-0.27		
202	Firm to stiff with depth, dark olive grey, slightly silty well-sorted very fine to mid SAND bedded with very dark grey organic silt/clay. From 0.50m homogenous sand. Few, fossilised shells throughout. Clear lower contact.	Holocene Alluvium (Unit 3) – organic mud	0.27m-0.52m		
203	Firm to stiff with depth, dark olive grey, slightly silty well-sorted very fine to mid SAND with few coarse sand-sized (2mm) broken shell inclusions.	Eocene Bedrock (Unit 5)	0.52m-2.57m		

Site Code: 289060	**Site Name:**	**Borehole ID:** SGL-BH03

	Solent Gateway, Marchwood Port	
Coordinates (NGR) X: 441107.50	**Coordinates (NGR) Y:** 110687.30	**Level (top):** **-7.04 m OD**
Length:	**Width:**	**Depth:**

Context Number	Description	Interpretation	Depth mbsf	Depth m OD	Samples
301	Very soft, black organic clayey SILT with one well-preserved marine shell at 1.30m and few well-preserved bivalve shells between 0.90-1.00m. Homogenous and structureless. 24ccasional very fine sand between – 0.70 and 1.15m. Oxidised brown when exposed. Diffuse lower contact.	Holocene Alluvium (Unit 3) – organic mud	0.00m-1.65m		
302	Very soft, very dark grey organic clayey SILT. Homogenous and structureless. Oxidised brown when exposed. Diffuse lower contact.	Holocene Alluvium (Unit 3) – organic mud?	1.65m-2.54m		
303	Very soft, black organic clayey SILT with few amorphous plant detritus. Homogenous and structureless.	Holocene Alluvium (Unit 3) – organic mud	2.54m-3.38m		
304	VOID		3.38m-3.45m		
305	Very soft, black organic clayey SILT with few amorphous plant detritus. Homogenous and structureless. Sharp lower contact.	Holocene Alluvium (Unit 3) – organic mud	3.45m-3.71m		
306	Firm, dark olive grey, slightly silty well-sorted very fine to mid SAND with few coarse-sand-size possible shell fragments and occasional olive grey lenses od silty clay. Lower contact not recorded.	Eocene Bedrock (Unit 5)	3.71m-4.00m		
307	Firm, mid olive grey silty fine SAND with common coarse sand-sized shell fragments and black silty lenses. Clear lower contact.	Eocene Bedrock (Unit 5)	4.00m-4.31m		
308	Firm to stiff with depth, mid olive grey fine to medium SAND with few fragments of fossil shells.	Eocene Bedrock (Unit 5)	4.31m-5.29m		

Site Code: 289060	**Site Name:**	**Borehole ID:** SGL-BH04

		Solent Gateway, Marchwood Port			
Coordinates (NGR) X: 440793.10		**Coordinates (NGR) Y:** 110687.50		**Level (top):** **-10.82 m OD**	
Length:		**Width:**		**Depth:**	
Context Number	**Description**	**Interpretation**	**Depth mbsf**	**Depth m OD**	**Samples**
401	Void		0.00m-0.05m		
402	Very soft, black clayey SILT. Sharp lower contact.	Holocene Alluvium (Unit 3) – organic mud	0.05m-0.06m		
403	Firm to stiff with depth, dark olive grey, slightly silty well-sorted fine to medium SAND, silt decrease with depth from 0.50m. Few, fossilised shells throughout.	Eocene Bedrock (Unit 5)	0.07m-2.83m		

Site Code: 289060		**Site Name:** Solent Gateway, Marchwood Port		**Borehole ID:** SGL-BH05	
Coordinates (NGR) X: 440837.90		**Coordinates (NGR) Y:** 110555.90		**Level (top):**	
Length:		**Width:**		**Depth:** **-10.82 m OD**	
Context Number	**Description**	**Interpretation**	**Depth mbsf**	**Depth m OD**	**Samples**
501	Firm to stiff, dark olive grey, slightly silty very fine to fine SAND with few fossilised shell fragments. Gradual lower contact.	Eocene Bedrock (Unit 5)	0.00m-0.73m		
502	Stiff dark olive grey fine to medium SAND with few fragments of fossil shells.	Eocene Bedrock (Unit 5)	0.73m-0.1.48		

Appendix 2 Data used in the deposit model

Borehole	Easting	Northing	Elevation (m OD)	Source
SGL_BH01	440972.7	110814.0	-11.01	This study
SGL_BH02	441022.9	110748.4	-10.86	
SGL_BH03	441107.5	110687.3	-7.04	
SGL_BH04	440793.1	110687.5	-10.82	
SGL_BH05	440837.9	110555.9	-10.82	
Sample 1	440398.5	111468.3	N/A	Wessex Archaeology (2023b)
Sample 2	440363.1	111482.4	N/A	
Sample 3	440341.8	111489.9	N/A	
Sample 4	440315.1	111502.2	N/A	
Sample 5	440265.7	111523.9	N/A	
WA_VC1	440201.0	111601.0	-2.84	Wessex Archaeology (2008b; 2014)
ABP_VC1	439710.0	111666.0	-4.24	
ABP_VC2	439927.0	111659.0	-3.24	
ABP_VC3a	440367.0	111500.0	-2.84	
ABP_VC4	440534.0	111405.0	-7.04	
BH_18B	439771.0	111714.0	-9.49	
BH_20B	440052.0	111677.0	-7.54	
BH_22B	440329.0	111559.0	-10.62	
WA_VC3	440367.0	111502.0	-2.84	
BH-PR-A	439449.1	111619.8	-2.01	Wessex Archaeology (2023a)
BH-PR-B	439600.5	111649.0	-0.87	
BH-PR-C	439828.5	111626.4	-0.76	
BH-PR-D	440527.7	111448.1	-7.47	
BH-PR-E	440870.6	111175.4	-4.10	
BH-PR-F	440919.3	111074.9	-4.53	
BH-PR-F1	440912.8	111082.0	-3.97	
BH-PR-G	441009.3	110867.0	-8.14	
BH-PR-H	441098.2	110806.9	-8.42	
BH-PR-J	441171.9	110759.6	-8.04	
SU41SW583	440530.0	110590.0	3.45	BGS archive borehole
SU41SW584	440600.0	110640.0	2.85	
SU41SW593	440660.0	110270.0	-4.30	
SU41SW594	440690.0	110660.0	-6.00	
SU41SW592	440650.0	110710.0	-5.80	
SU41SW595	440760.0	110710.0	-7.40	

Borehole	Easting	Northing	Elevation (m OD)	Source
SU41SW599	440790.0	110670.0	-5.35	
SU41SW600	440770.0	110570.0	-5.00	
SU41SW828	440740.0	110560.0	-2.10	
SU41SW834	440820.0	110480.0	-4.55	
SU41SW601	440850.0	110470.0	-0.80	
SU41SW829	440850.0	110610.0	-4.50	
SU41SW602	440930.0	110600.0	-5.30	
SU41SW603	440970.0	110640.0	-5.50	
SU41SW830	440910.0	110660.0	-4.30	
SU41SW596	440780.0	110780.0	-7.85	
SU41SW597	440840.0	110820.0	-7.95	
SU41SW598	440870.0	110850.0	-7.90	
SU41SW604	441030.0	110670.0	-6.05	
SU41SW901	441000.0	111000.0	N/A	
SU41SW824	440700.0	110650.0	-1.40	
SU41SW832	440780.0	110510.0	-4.80	
SU41SW833	440790.0	110460.0	-2.00	
SU41SW822	440700.0	110780.0	-5.05	
SU41SW825	440870.0	110770.0	-4.70	
SU41SW827	440940.0	110760.0	-4.50	
SU41SW831	441050.0	110750.0	-4.80	
SU41SW836	441090.0	110680.0	-5.50	
SU41SW835	440960.0	110560.0	-4.65	
SU41SW826	440960.0	110840.0	-5.15	
SU41SW823	440950.0	110930.0	-7.10	

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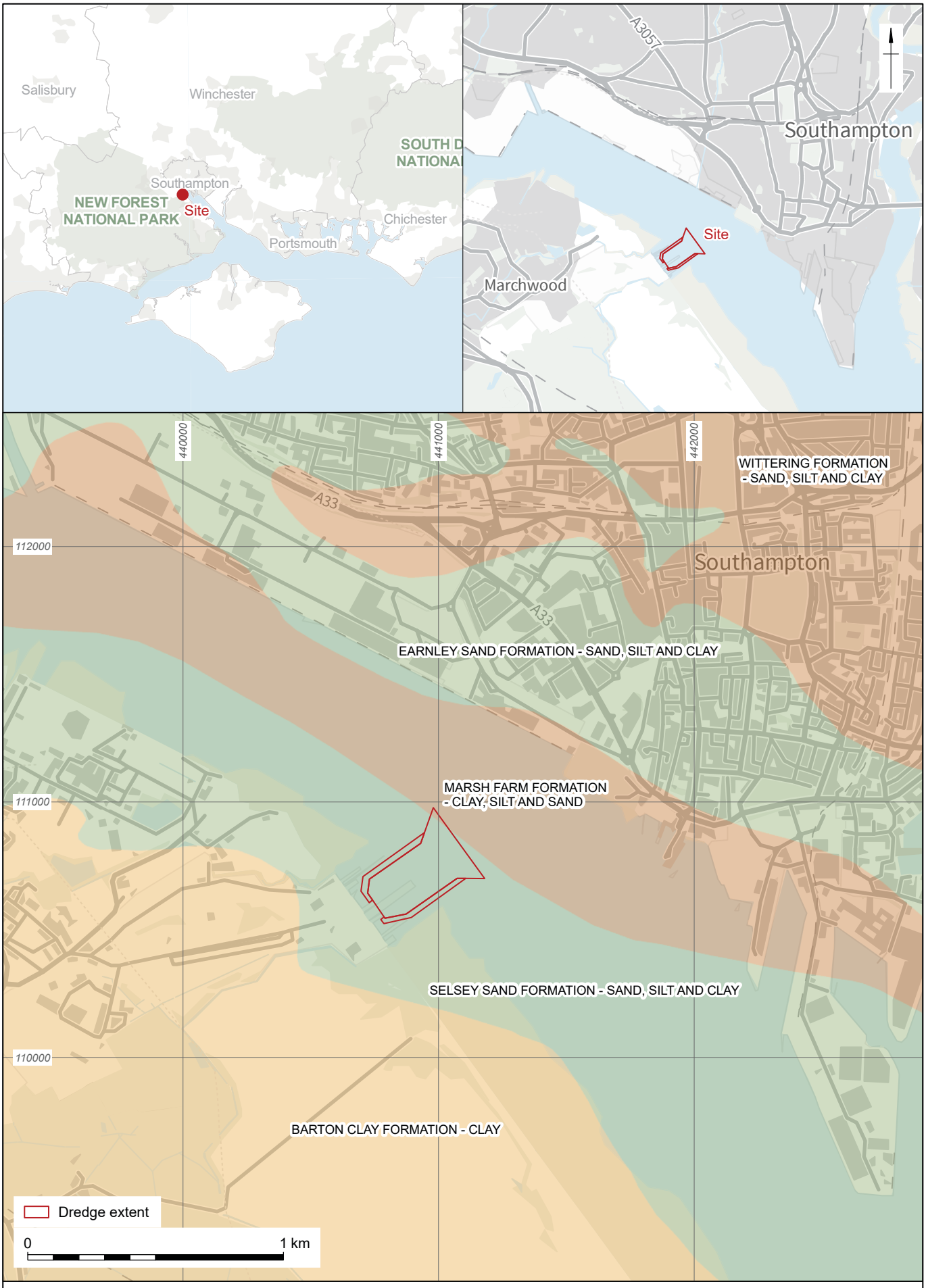
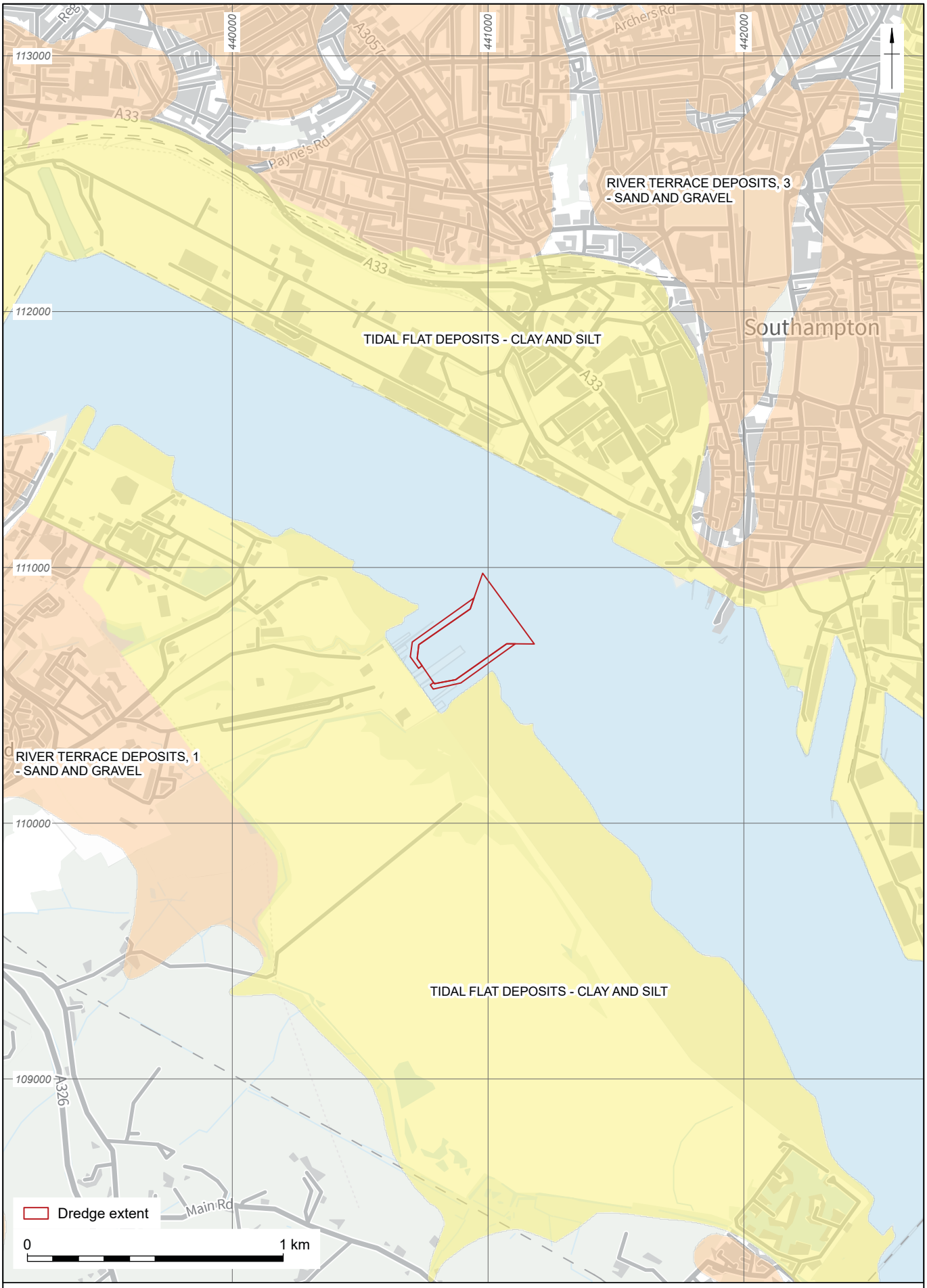


Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:20,000 at A4

Figure1: Site location and BGS bedrock geology



Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:20,000 at A4

Figure 2: Site location and BGS superficial geology

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112000
440000
441000
442000
111000
110000

A33
Polygon
New Rd
Kingsland Place
Southampton
Portland Terrace
Grove Barn St
Queensway
Bernard St
High St
Normandy Way
Main Rd
Marchwood

WA2014_BH_18B
WA2014_ABP_VC1
WA2014_BH_20B
WA2023_BH-PR-A
WA2023_BH-PR-B
WA2014_ABP_VC2
WA2023_BH-PR-C
WA2014_WA_VC1
7500
WA2014_BH_22B
Sample 4
Sample 5
WA2014_ABP_VC3a
7501
Sample 2
Sample 1
WA2023_BH-PR-D
7502
WA2014_ABP_VC4
7503
WA2023_BH-PR-E
WA2023_BH-PR-F1
WA2023_BH-PR-F
SU41SW901
SU41SW823
SU41SW598
WA2023_BH-PR-G
SU41SW597
SU41SW826
WA2023_BH-PR-H
SU41SW822
SU41SW596
SU41SW831
WA2023_BH-PR-J
SU41SW592
SU41SW595
SU41SW827
WA2024_SGL_BH02
SU41SW594
SU41SW599
SU41SW604
WA2024_SGL_BH03
SU41SW584
SU41SW824
SU41SW830
SU41SW603
SU41SW583
SU41SW602
SU41SW828
SU41SW600
SU41SW835
SU41SW832
WA2024_SGL_BH05
SU41SW834
SU41SW833
SU41SW601
SU41SW593

0 500 m

Dredge extent
New vibrocores
Existing data
Transect 1
Transect 2
Transect 3
Acoustic blanking (Wessex Archaeology 2023b)

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 3: Site location and borehole transect

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439000
440000
441000
442000
112000
111000
110000

A33
A33
A33
Polygon
Grove Barn St
New Rd
Kingsland Place
Portland Terrace
Southampton
Queensway
Bernard St
High St
Normandy Way
Normandy Way
Main Rd
Marchwood

0 500 m

Dredge extent
New vibrocores
Existing data
Bedrock surface (m OD)
-2.99 - -2.50
-3.49 - -3.00
-3.99 - -3.50
-4.49 - -4.00
-4.99 - -4.50
-5.49 - -5.00
-5.99 - -5.50
-6.49 - -6.00
-6.99 - -6.50
-7.49 - -7.00
-7.99 - -7.50
-8.49 - -8.00
-8.99 - -8.50
-9.49 - -9.00
-9.99 - -9.50
-10.49 - -10.00
-10.99 - -10.50
-11.49 - -11.00
-11.99 - -11.50
-12.49 - -12.00
-12.99 - -12.50
-13.49 - -13.00
-13.79 - -13.50

Coordinate system: OSGB 1936 British National Grid

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 4: Surface of the bedrock

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23\289060_Studio\289060_Studio.aprx

439000
440000
441000
442000
112000
111000
110000

A33
A33
A33
Polygon
Above Bar St
New Rd
Kingsland Place
Portland Terrace
Southampton
Queensway
Bernard St
High St
Normandy Way
Normandy Way
Main Rd
Marchwood

0
500 m

Dredge extent
New vibrocores
Existing data
Gravel surface (m OD)
3.01 - 3.50
2.51 - 3.00
2.01 - 2.50
-4.49 - -4.00
-4.99 - -4.50
-5.49 - -5.00
-5.99 - -5.50
-6.49 - -6.00
-6.99 - -6.50
-7.49 - -7.00
-7.99 - -7.50
-8.49 - -8.00
-8.99 - -8.50
-9.19 - -9.00

Coordinate system: OSGB 1936 British National Grid

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 5: Surface of the River Terrace Gravels

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23\289060_Studio\289060_Studio.aprx

439000
440000
441000
442000
112000
111000
110000

A33
Polygon
New Rd
Kingsland Place
Southampton
Portland Terrace
Queensway
Bernard St
High St
Normandy Way
Main Rd
Marchwood

0
500 m

Dredge extent
New vibrocores
Existing data
Alluvium surface (m OD)
-0.99 - -0.50
-1.49 - -1.00
-1.99 - -1.50
-2.49 - -2.00
-2.99 - -2.50
-3.49 - -3.00
-3.99 - -3.50
-4.49 - -4.00
-4.99 - -4.50
-5.49 - -5.00
-5.99 - -5.50
-6.49 - -6.00
-6.99 - -6.50
-7.49 - -7.00
-7.99 - -7.50
-8.49 - -8.00
-8.99 - -8.50
-9.49 - -9.00
-9.99 - -9.50
-10.49 - -10.00
-10.59 - -10.50

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 6: Surface of the Holocene Alluvium

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23\289060_Studio\289060_Studio.aprx

439000
440000
441000
442000
112000
111000
110000

A33
New Rd
Kingsland Place
Southampton
Portland Terrace
Boyle Bar St
Queensway
Bernard St
High St
Polygon
Normandy Way
Main Rd
Marchwood

0
500 m

Dredge extent
New vibrocores
Existing data
Gravel thickness (m)
6.01 - 6.50
5.51 - 6.00
5.01 - 5.50
4.51 - 5.00
4.01 - 4.50
3.01 - 3.50
2.51 - 3.00
2.01 - 2.50
1.51 - 2.00
1.01 - 1.50
0.51 - 1.00
0.31 - 0.50

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 7: Thickness of the River Terrace Gravels

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23\289060_Studio\289060_Studio.aprx

439000
440000
441000
442000
112000
111000
110000

A33
New Rd
Kingsland Place
Portland Terrace
Southampton
Polygon
Queensway
Bernard St
High St
Normandy Way
Main Rd
Marchwood

0
500 m

Dredge extent
New vibrocores
Existing data
Alluvium thickness (m)
5.01 - 5.50
4.51 - 5.00
4.01 - 4.50
3.51 - 4.00
3.01 - 3.50
2.51 - 3.00
2.01 - 2.50
1.51 - 2.00
1.01 - 1.50
0.51 - 1.00
0.41 - 0.50

Date: 27/02/2024	Created by: JD	Revision: 0	Scale: 1:10,000 at A3

Figure 8: Thickness of the Holocene Alluvium

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23

NW

SE

Depth (m OD)

WA2014_ABP_VC1
WA2023_BH-PR-C
WA2014_ABP_VC2
WA2014_BH_20B
WA2014_WA_VC1
Sample 5
Sample 4
Sample 3
Sample 2
Sample 1
WA2014_VA_VC3
WA2023_BH-PR-D
WA2014_ABP_VC4
WA2023_BH-PR-E
WA2023_BH-PR-F1
SU41SW901
SU41SW823
WA2023_BH-PR-G
WA2024_SGL_BH01
WA2023_BH-PR-H
WA2024_SGL_BH02
WA2023_BH-PR-J
WA2024_SGL_BH03

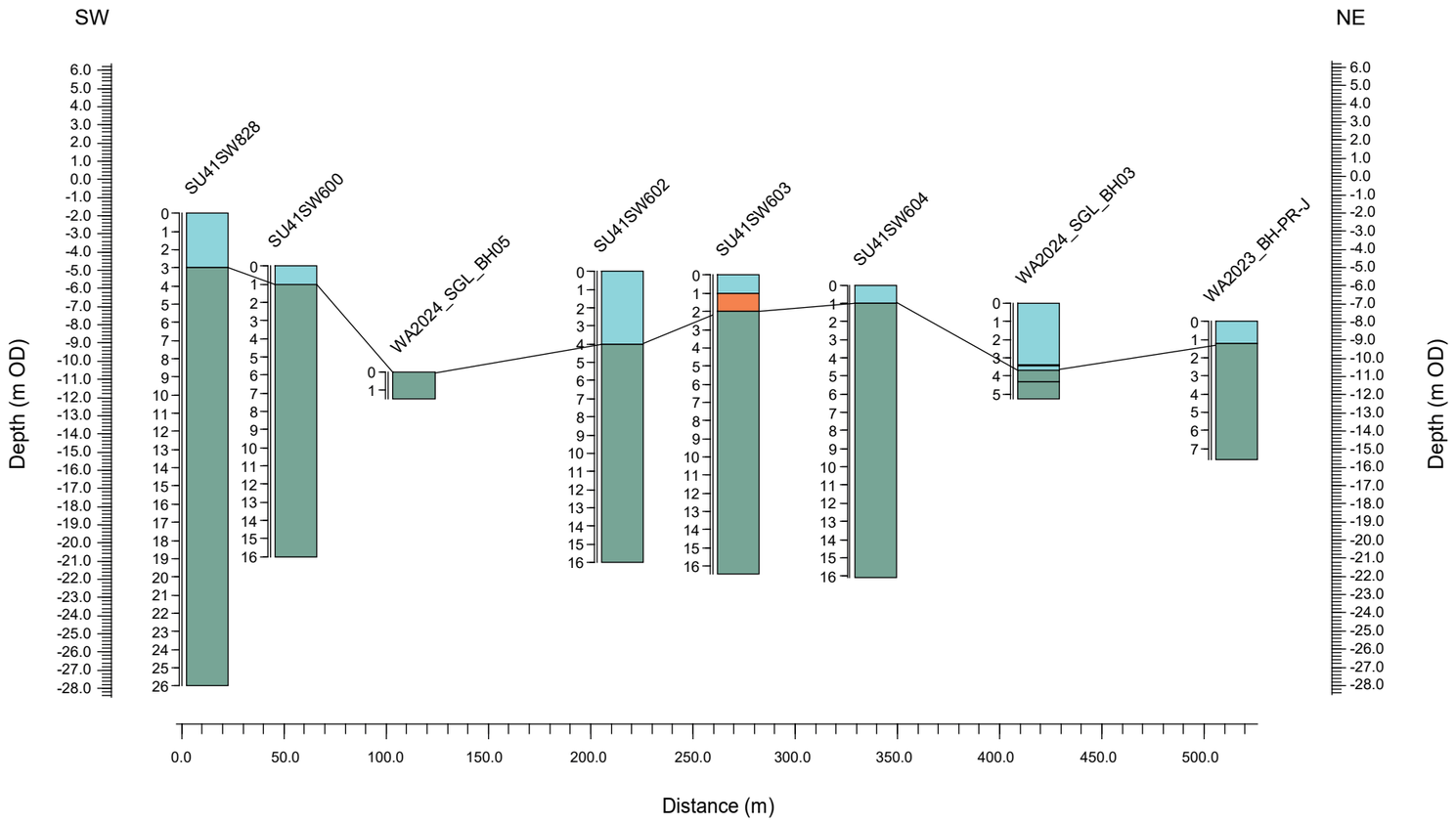
Distance (m)

Stratigraphy

- Made ground
- Recent alluvial sediments
- VOID
- Holocene alluvium
- Peat deposits
- River terrace deposits
- Bedrock

Date: 23/02/2024	Created by: JD	Revision: 0	Scale: NA at A3

Figure 9: Transect 1



Stratigraphy

- Made ground
- Recent alluvial sediments
- Holocene alluvium
- River terrace deposits
- Bedrock

Date: 23/02/2024	Created by: JD	Revision: 0	Scale: NA at A3

Figure 10: Transect 2

W:\Projects\289060\Graphics_Office\Rep figs\Geoarch\2024_02_23

SW

NE

Depth (m OD)

SU41SW584

SU41SW594

SU41SW599

WA2024_SGL_BH04

SU41SW825

SU41SW827

WA2024_SGL_BH02

SU41SW831

WA2024_SGL_BH01

WA2023_BH-PR-H

Distance (m)

Stratigraphy

- Made ground
- Recent alluvial sediments
- Holocene alluvium
- River terrace deposits
- Bedrock

Date: 23/02/2024	Created by: JD	Revision: 0	Scale: NA at A3

Figure 11: Transect 3

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