Newlyn Coastal Research Project

Site Walkover and Geoarchaeological Borehole Survey

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wessexarchaeology

Portway House
Old Sarum Park
Salisbury
Wiltshire
SP4 6EB

www.wessexarch.co.uk

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Summary

Wessex Archaeology (WA) was commissioned by Kier Infrastructure PLC (the Client) to undertake a site walkover, hand auger survey and geoarchaeological borehole survey, of a section of the intertidal foreshore of Newlyn beach (henceforth referred to as the 'Site'). The proposed works, involving installation of ECO armour units and an associated haul road area and access route, traverses the foreshore and tidal flats south of Foster-Bolitho Gardens to reach the small existing tidal breakwater protecting the mouth of the Newlyn Coombe River.

The programme of work, including a site walkover and hand augering survey, was undertaken on the foreshore to the east of Newlyn Harbour. The main aims of the investigation were to gain information about the superficial deposits within the proposed access route, and to inform requirements for and scope of further archaeological and geoarchaeological investigations, where appropriate. The requirement for the mechanical borehole survey was determined based on the results of the preceding hand auger survey.

In order to address these aims the site walkover was undertaken by systematically traversing on foot the area of the access route within the intertidal zone. The intention was to determine whether there were any visible archaeological, architectural or historic remains of interest, and any deposits of geoarchaeological potential that have not yet been identified, providing an assessment of any material observed.

There were no visible archaeological, architectural or historic remains and no deposits of geoarchaeological potential recorded within the access route. To the north east and south west of the access route large, dressed granite kerb stones measuring up to 2.0m in length and up to 1.0m in width formed the edge of the old Newlyn to Penzance road that had previously run along the top of the shoreline.

Although it was outside of the access road, two rows of wooden piles were also recorded approximately 30m to the west of the access route. The wooden piles were rounded in profile, heavily weathered and appeared to be formed from roughly worked logs, between 0.2m and 0.3m in diameter with up to a maximum of 0.5m surviving exposed from the beach sediments. From what could be observed the surviving wooden piles comprised two lines approximately 11.0m and 6.0m in length running roughly parallel with the granite block kerb stones. These possibly relate to a line of waterlogged timbers (HER 18842) recorded after a storm in December 1989 and thought to be Medieval/Post Medieval in date and part of earlier sea defences.

A hand auger was used to investigate nine borehole locations within the access route across the intertidal zone. The deposits recorded were comprised of varying depths of beach sands over cobbles, with a maximum depth gained of 0.73m. In the absence of sediments suitable for mechanical coring, no hand-held window sampling was undertaken. In addition, in the absence of sufficient stratigraphic data, no deposit modelling was carried out.

With no deposits of geoarchaeological potential recorded and no archaeological features present within the access route, no recommendations are made for further works.

Acknowledgements

Wessex Archaeology thanks Kier Infrastructure PLC, in particular Jack Walker, for commissioning the work detailed in this report. Greg Chuter at Environment Agency and Jasmin Folland at Atkins Global are thanked for their input to the project. The fieldwork was managed by Richard Payne. The report was compiled by Richard Payne and Dr Daniel Young. Figures were produced by Amy Wright. The project was managed on behalf of Wessex Archaeology by Dr Alex Brown.

Newlyn Coastal Research Project

Site Walkover and Geoarchaeological Borehole Survey

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Kier Infrastructure PLC (the 'Client') to undertake a site walkover, hand-auger survey and geoarchaeological borehole survey of a section of the intertidal foreshore of Newlyn beach (henceforth referred to as the 'Site'; **Figure 1**).

1.1.2 The proposed works, involving installation of ECO armour units and an associated haul road area and access route, traverses the foreshore and tidal flats south of Foster-Bolitho Gardens to reach the small existing tidal breakwater protecting the mouth of the Newlyn Coombe River.

1.1.3 The site walkover and hand-auger survey, and any subsequent geoarchaeological borehole survey, were required in order to offset any potential impacts on deposits of geoarchaeological and archaeological potential arising out of the proposed coastal flood defence works.

1.2 Site location and geology

1.2.1 The Site is located in the town and fishing port of Newlyn, west of the harbour and centred on National Grid Reference (NGR) SW 46434 29117 (**Figure 1**). The area of investigation lies on an area of the foreshore bordered by Foster-Bolitho Gardens to the north, Newlyn Harbour to the west and the intertidal zone of the foreshore to the east and south.

1.2.2 The geology of the Site is mapped by the British Geological Survey (BGS; https://mapapps2.bgs.ac.uk/geoindex/home.html) as deposits of the Devonian Mylor Slate Formation, overlain by superficial marine beach deposits and alluvium associated with the Newlyn Coombe River.

1.3 Scope of document

1.3.1 This report provides a detailed description of the results of the site walkover and hand auger survey and assesses whether the aims of the survey have been met. The results reported on here will provide information on the sediments underlying the Site, informing on the geoarchaeological resource together with a record of any archaeological features encountered during the walkover and the need (if required) of any further geoarchaeological or archaeological work.

1.3.2 The work presented in this report follows the methodology in the Written Scheme of Investigation (Wessex Archaeology 2022), and conforms to current best practice as well as guidance in *Management of Research Projects in the Historic Environment* (MoRPHE, Historic England 2015a), the Chartered Institute for Archaeologists' (CIfA) *Standard and guidance for archaeological watching brief* (CIfA 2014a), *Standard and Guidance for*

nautical archaeology recording and reconstruction (CIfA 2014b) and *Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record* (Historic England 2015b).

1.3.3 To help frame geoarchaeological investigations of this nature, Wessex Archaeology has developed a five-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The stages are summarised below (**Table 1**). This report represents Stage 2 of this process.

Table 1 Staged approach to geoarchaeological investigations

Stage 1: WSI / Geoarchaeological Desk-based Assessment	Review of sub-surface data (e.g. mapping, existing GI, BGS logs), and summary of local or regional context. Establish likely presence/ absence/ distribution of archaeologically relevant deposits. May include modelling of existing data, and for larger schemes a fuller landscape characterisation. Present recommendations for fieldwork including type, number, distribution and depth of sampling methods.
Stage 2: Fieldwork, interpretation and reporting (e.g. Borehole survey)	Fieldwork to investigate deposits and obtain samples, followed by reporting. Reporting will present results (usually including deposit modelling), interpretations and recommendations for further work. Should suitable deposits be present, detailed recommendations for palaeoenvironmental assessment and dating will be made (Stage 3).
Stage 3: Palaeoenvironmental assessment	Assessment of subsamples agreed in Stage 2 (for e.g. pollen, diatoms, plant macrofossils, molluscs, ostracods and foraminifera), together with radiocarbon dating. Reporting will summarise results in the archaeological and palaeoenvironmental context of the local or wider area. Should deposits have the potential for analysis, recommendations will be for Stage 4 work.
Stage 4: Analysis	Full analysis of samples specified in Stage 3, together with a detailed synthesis of the results, in their local, regional or wider archaeological and palaeoenvironmental context as appropriate. Publication would usually follow from a Stage 4 report.
Publication	The scope and location of a publication report will be agreed in consultation with the client and LPA advisor. The publication report may comprise a note in a local journal or a larger publication article or monograph, dependant on the significance of the archaeological work.

2 ARCHAEOLOGICAL BACKGROUND

Prehistoric (970,000 BC to AD43)

2.1.1 No finds earlier than Romano-British have been found in the immediate vicinity of the Site, with the only prehistoric finds within c. 500m of Newlyn Harbour including a possible prehistoric worked stone axe and documentary evidence of a Bronze or Iron Age mound at Mount Misery, c. 500m to the northwest, and documentary evidence of an Iron Age or Romano-British enclosed settlement at Tredavoe c. 500m to the west (CSHER).

2.1.2 However, dated peat deposits in the area of Newlyn and Penzance (see **Section 3**) indicate that deposits of Neolithic to Bronze Age date (c. 3000-1500 cal BC) may be present in the intertidal zone, and as such these deposits have the potential to preserve important evidence relating to coastal change and human activity during the Neolithic and later

prehistoric periods. Such deposits may be present at the Site either contained within foreshore deposits or exposed at the surface.

2.1.3 East of Newlyn, Gear Rock has been identified as a possible source of raw material associated with Neolithic stone tools, and a Neolithic arrow headed celt made from bluestone was reportedly found on beach shingle around Penzance during the mid-19th century, although the whereabouts of the find was not recorded (CSHER)).

2.1.4 Southwest of Newlyn, an iron age coin hoard including Gaulish imitations of Massilian coins was found at Tredavoe, near the bi-vallate Faugan Round prehistoric enclosure/hillfort (CSHER).

Romano British (AD 43 – AD 410)

2.1.5 What has been ascribed as a Romano-British wreck was discovered 'embedded' on Newlyn beach (NGR: SW 464 289) during the mid-19th century, described as a canoe or small boat hollowed out from a single trunk. A broken mast and what was thought to be a broken paddle were found with the wreck alongside a Roman coin (CSHER). No other Romano-British activity or records are recorded within the area of the Site.

Medieval (410 AD to 1539 AD)

2.1.6 Sporadic early medieval sites, finds and monuments have been recorded around the Newlyn area. Potential early medieval peat deposits were exposed in Newlyn in 1989 following a storm, as well as possible post-medieval sea defences (CSHER). Newlyn as a settlement was first recorded in 1279 as Nulyn and as Lulyn between c. 1290 and 1337 AD (Watts 2004).

2.1.7 The first documented evidence of the settlement of Lariggan, north of the Newiyn Coombe River, was recorded in 1327. The mouth of this river is also a medieval fording Site. Earlier medieval attributions can be given to the area, such as a cross that was found in Penzance, of unknown date but described as being no later than 939 AD (CSHER).

2.1.8 Following a storm in December 1989 the basal courses of two walls running parrel to each other were exposed on the beach. The inner landward wall comprised large rectangular granite blocks. Only a single course of the outer seaward wall was recorded as surviving. Between the walls a line of waterlogged timbers was observed and may be associated with the granite block walls. A layer recorded as several inches thick comprised of a dark peat like soil was also exposed on the landward side of the walls overlying weathered granite (HER 18842)

Post Medieval and modern (1539 – present)

2.1.9 There are numerous extant post-medieval structures such as wells, bridges, lanes, slipways and buildings in Newlyn and the surrounding area. Granite kerb stones are exposed in places along the shore and relate to a road that ran along the top of the shoreline from Newlyn to Penzance and dating from at least the post Medieval period. The road was later abandoned and moved back from the shoreline (MCO64442).

2.1.10 To the east of the Site at western Green the remains of a modern wall, possibly part of an earlier sea defence, were recorded (MCO59679).

3 GEOARCHAEOLOGICAL BACKGROUND

3.1 Introduction

3.1.1 Where age estimates are available these are expressed in millions of years (Ma), thousands of years (Ka) and within the Holocene epoch as either years Before Present (BP), Before Christ (BC) and Anno Domini (AD). Depths of deposits are provided as metres below ground level (m bgl) and m OD (metres Ordnance Datum).

3.2 Solid geology

3.2.1 The bedrock geology at the Site is mapped by the British Geological Survey (BGS) as deposits of the Mylor Slate Formation, comprising metamorphic rocks formed between 359 to 383 Ma in the Devonian Period.

3.3 Superficial Geology

3.3.1 Mapping by the BGS demonstrates that Quaternary sediments are present within the Site, comprising marine beach deposits along the foreshore and alluvium associated with the Newlyn Coombe River to the south. Head deposits, described as clay, silt, sand and gravel, are recorded fronting the beach between the valleys of the Newlyn Coombe River to the southwest and the Larriggan River to the northeast.

3.3.2 BGS archive boreholes in the area of Newlyn, north of the beach (SW42NE17-18) and just to the north and east of the Site, indicate variable depths of made ground between c. 2 and 2.5m thick, sealing c. 2-3.5m of sands and silty sands, sands and gravels (including in places rounded beach cobbles) and weathered bedrock. Four BGS archive boreholes in the wider area of Newlyn include peat deposits within intertidal silts, sands and clays. Pockets of peat within an organic-rich silt were recorded in borehole SW42NE16 at 4.20-4.30m bgl (1.65 to 1.55m OD), located on New Road close to its junction with Rock Road.

3.3.3 Further east within the valley of the Larriggan River, peat was recorded in borehole SW42NE13, located in the western corner of Bedford-Bolitho gardens, at 4.40-5.50m bgl (1.00 to 0.00m OD). Close to SW42NE13, pockets of peat were recorded in borehole SW42NE20 at 1.90 to 3.00m bgl (-1.25 to -2.35m OD). To the northeast of Bedford-Bolitho Gardens, bordering West Promenade Road, a 0.6m thick peat was recorded in borehole SW42NE21 at 5.10-5.70mbgs (0.39 to -0.27m OD).

3.3.4 The Historic England Intertidal and Coastal Peat Database (Hazell 2008) includes radiocarbon-dated samples from ‘submerged forest’ peats in the area around Newlyn and Penzance. At Mount’s Bay, east of Penzance, oak wood from a submerged forest c. 100 m offshore of the low tide mark was dated to 2520-1700 cal BC, with associated peat deposits containing pollen of alder, oak, hazel and birch (de Beer 1960). At Long Rock, also east of Penzance, deposits of a ‘submerged forest’ were dated to 3075-2695 cal BC (dates from Goode and Taylor 1988; calibrated using IntCal 20).

3.3.5 Various records of peat deposits in the intertidal zone between Newlyn and Penzance were noted by Hyder Consulting (2005) during their work associated with Newlyn Harbour. These are undated, but include a peat layer with woody fragments recorded at an elevation of -7.08 to -7.93 m OD off the end of Lighthouse Pier in Penzance, and a peat bed exposed on the foreshore at Wherry Rocks, Larriggan, just west of Newlyn, exposed during pipe laying in the 1990s.

3.3.6 At Wherrytown, Carne (1846) (reference in Goode and Taylor 1988) recorded fallen trunks and stumps rooted in a peat bed up to 1.7m thick, including oak, hazel, birch and alder, between Wherry Rocks and Larrigan Rocks, just east of Newlyn.

4 AIMS AND OBJECTIVES

4.1 General aims

4.1.1 The general aims (or purpose) of the walkover and borehole survey, in compliance with the CIfA *Standard and guidance for archaeological field evaluation* (CIfA 2014a) and *Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record* (Historic England 2015b), are to:

- provide information about the archaeological and geoarchaeological potential of the Site; and
- inform either the scope and nature of any further archaeological or geoarchaeological work that may be required, or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource), or a management strategy for that resource.

4.2 General Objectives

4.2.1 In order to achieve the above aims, the objectives of the evaluation were to:

- determine the presence or absence of archaeological finds, deposits, artefacts or ecofacts within the specified works area;
- record and establish, within the constraints of the works, the extent, character, date, condition and quality of any surviving archaeological remains within the specified works area (a preservation by record);
- to determine, as far as is reasonably possible, the nature of the detectable geoarchaeological resource within the area of groundworks;
- refine understanding of the presence, nature and distribution of Quaternary superficial deposits within the area of groundworks;
- where appropriate/possible, obtain representative palaeoenvironmental samples from deposits of geoarchaeological potential;
- place any identified archaeological remains within a wider historical and archaeological context in order to assess their significance; and
- make available information about the archaeological and geoarchaeological resource on the Site by preparing a report on the results of the survey.

5 FIELDWORK METHODS

5.1 Site walkover and hand auger survey

5.1.1 A site walkover and hand auger survey were undertaken in the intertidal zone within the area of the access route. Admiralty Tide Tables for the Cornwall Coast, provided by the Environment Agency, were consulted in order to determine the optimal time period in which to safely undertake the site walkover and auger survey.

5.1.2 The area was walked systematically, by an appropriately qualified and trained geoarchaeologist carrying out the survey and identifying the surface expression of any archaeological remains or geoarchaeological deposits observed. The intention of the walkover survey was to determine whether there were any visible archaeological, architectural or historic remains of interest, and any deposits of geoarchaeological potential that have not yet been identified, providing an assessment of any material observed. These features were recorded to create a permanent record prior to the possibility of being affected by any other works.

5.1.3 The archaeological walkover survey was carried out under the standards outlined in CIfA (CIfA 2014a; updated October 2020), and Historic England (English Heritage 2011) guidance. The survey and evaluation of any identified archaeological features would also follow CIfA's standard and guidance for nautical archaeological recording and reconstruction (CifA 2014b; Updated October 2020).

5.1.4 All archaeological features encountered were assigned a unique identification number and recorded. These were recorded using a handheld GPS system, handwritten notes, and a digital camera, equipped with an image sensor of not less than 10 megapixels, with all the information recorded using Wessex Archaeology's pro forma recording system and the project GIS.

5.1.5 If any features of archaeological interest were encountered, further inspection (such as acquisition of dendrochronological samples; see **Appendix 1**) was to be discussed with Historic England's Regional Science Advisor for the South West.

5.1.6 The geoarchaeologist undertaking the walkover survey was equipped with a hand auger in order to examine the depth and character of any sub-surface superficial deposits, and their suitability for sampling at Stage 2 of the fieldwork (see **Section 5.2**). Hand augering was undertaken at the nine locations shown in **Figure 2** and **Table 2** (HA-01 to HA-09). No samples were retained from the hand augers.

5.1.7 The deposits were described by a suitably experienced geoarchaeologist following Hodgson (1997), include information such as:

- *Depth*
- *Texture*
- *Composition*
- *Colour*
- *Inclusions*
- *Structure (bedding, ped characteristics etc.)*
- *Contacts between deposits*

5.1.8 Interpretations were made regarding the probable depositional environments and formation processes of the sampled deposits and discussed below.

Table 2 Hand auger borehole locations

Name	Easting	Northing	Elevation (m OD)
HA-01	146458.55	29156.53	1.29
HA-02	146463.03	29146.31	0.27
HA-03	146448.05	29146.57	1.36
HA-04	146452.19	29137.19	0.50
HA-05	146463.90	29117.28	-0.66
HA-06	146461.14	29126.87	-0.42
HA-07	146458.95	29134.79	-0.08
HA-08	146456.91	29146.15	0.74
HA-09	146450.88	29155.37	1.74

5.2 Mechanical borehole survey

5.2.1 The works included a provision for a mechanical borehole survey utilising a hand-held window sampler in the event that deposits of geoarchaeological potential were identified in the preceding walkover and hand auger survey, and which were likely to be impacted by the proposed works. No deposits of geoarchaeological potential were identified and mechanical drilling was not required (**see Section 6**).

6 RESULTS

6.1 Site walkover

6.1.1 A non-intrusive walkover survey was conducted across the intertidal zone within the area of the access route at low tide. The area was walked systematically, by an appropriately qualified and trained geoarchaeologist carrying out the survey and identifying the surface expression of any archaeological remains or geoarchaeological deposits. Within the boundary of the access route there were no archaeological remains, or deposits of high geoarchaeological potential, observed during the site walkover.

6.1.2 However, to the north east and south west of the access route large, dressed granite kerb stones measuring up to 2.0m in length and up to 1.0m in width in some cases formed the edge of the old Newlyn to Penzance road that had previously run along the top of the shoreline (see **Figure 2**).

6.1.3 In addition, although it was outside of the study area, two rows of wooden piles were also recorded approximately 30m to the west of the access route (**Figure 2**). The wooden piles were rounded in profile, heavily weathered and appeared to be formed from roughly worked logs, between 0.2m and 0.3m in diameter with up to a maximum of 0.5m surviving exposed from the beach sediments.

6.1.4 From what could be observed the surviving wooden piles comprised two lines approximately 11.0m and 6.0m in length running roughly parallel with the granite block kerb stones. These possibly relate to a line of waterlogged timbers (HER 18842) recorded after a storm in December 1989 and thought to be Medieval/Post Medieval in date and part of earlier sea defences.

6.2 Hand auger survey

6.2.1 The nine borehole locations were investigated by hand auger to determine if there were deposits of geoarchaeological potential that warranted sampling using a hand held (mechanical) window sampler. The results of the hand auger survey are summarised as shown in **Table 3**.

Table 3 Results of the hand augering

Name	Easting	Northing	Elevation (m OD)	Notes
HA-01	146458.55	29156.53	1.29	No penetration, veneer of beach sands over possible buried granite blocks
HA-02	146463.03	29146.31	0.27	0.08m of beach sands over cobbles
HA-03	146448.05	29146.57	1.36	No penetration, veneer of beach sands over cobbles
HA-04	146452.19	29137.19	0.50	No penetration, veneer of beach sands over cobbles
HA-05	146463.90	29117.28	-0.66	0.40m grey-brown beach sands over cobbles
HA-06	146461.14	29126.87	-0.42	0.73m of beach sands over cobbles
HA-07	146458.95	29134.79	-0.08	0.02m of beach sands over cobbles
HA-08	146456.91	29146.15	0.74	No penetration, veneer of beach sands over cobbles
HA-09	146450.88	29155.37	1.74	No penetration, veneer of beach sands over cobbles

7 DISCUSSION

7.1 Introduction

7.1.1 A programme of investigations including a site walkover and hand auger survey was undertaken on the foreshore to the east of Newlyn Harbour. The main aims of the investigation were to gain information about the superficial deposits and visible archaeological remains within the proposed access route, and to inform requirements for and scope of any further archaeological and geoarchaeological works, if appropriate.

7.1.2 In order to address these aims a site walkover was undertaken by systematically traversing on foot the area of the access route within the intertidal zone. The intention was to determine whether there were any visible archaeological, architectural or historic remains of interest, and any deposits of geoarchaeological potential that have not yet been identified, providing an assessment of any material observed.

7.2 Site walkover

7.2.1 There were no visible archaeological, architectural, or historic remains and no deposits of high geoarchaeological potential recorded within the access route. Borehole HA-01 recorded beach sands over possible granite blocks, but if the latter were present, these appeared to be buried at depth and are unlikely to be impacted by the scheme.

7.2.2 To the north east and south west of the access route, large, dressed granite kerb stones measuring up to 2.0m in length and up to 1.0m in width in some cases formed the edge of the old Newlyn to Penzance road (recorded on the Cornwall HER as MCO64442), this road

previously running adjacent to the shoreline and dating from at least the post Medieval period (**Figure 2**).

7.2.3 Although it was outside of the study area, two rows of wooden piles were also recorded approximately 30m to the west of the access route (**Figure 2**). The wooden piles were rounded in profile, heavily weathered and appeared to be formed from roughly worked logs, between 0.2m and 0.3m in diameter with up to a maximum of 0.5m surviving exposed from the beach sediments.

7.2.4 From what could be observed the surviving wooden piles comprised two lines approximately 11.0m and 6.0m in length running roughly parallel with the granite block kerb stones. These possibly relate to a line of waterlogged timbers (HER 18842) recorded after a storm in December 1989 and thought to be Medieval/Post Medieval in date and part of earlier sea defences.

7.3 Hand auger survey

7.3.1 A hand auger was used to investigate nine borehole locations within the access route across the intertidal zone (HA-01 to HA-09; **Figure 2**). The deposits recorded were comprised of variable thickness of inorganic beach sands over cobbles, with a maximum depth of the sands of 0.73m, reducing to a thin veneer over cobbles in several boreholes.

7.3.2 These deposits were therefore not suitable for mechanical (hand-held) window sampling, and none was undertaken. The hand auger boreholes demonstrate that deposits of high geoarchaeological potential are not present in the upper part of the stratigraphic sequence within the access road, and that groundworks associated with the proposed scheme will not impact on such deposits.

8 CONCLUSION AND RECOMMENDATIONS

8.1 Summary

8.1.1 The key results of the walkover and hand auger survey are summarised below.

- There were no visible archaeological, architectural, or historic remains and no deposits of high geoarchaeological potential recorded within the access route.
- Archaeological features in the form of granite kerb stones from an earlier route of the Newlyn to Penzance coast road and wooden timbers from early sea defences were recorded outside the access route. These will not be impacted by the proposed access road.
- A hand auger was used to investigate nine borehole locations within the access route across the intertidal zone. The deposits recorded were comprised of variable thicknesses of inorganic beach sands over cobbles, with a maximum depth of the sands of 0.73m.

8.1.2 The works have established that the area of impact has a low geoarchaeological potential and no archaeological features are present. As such, no further works are recommended or required.

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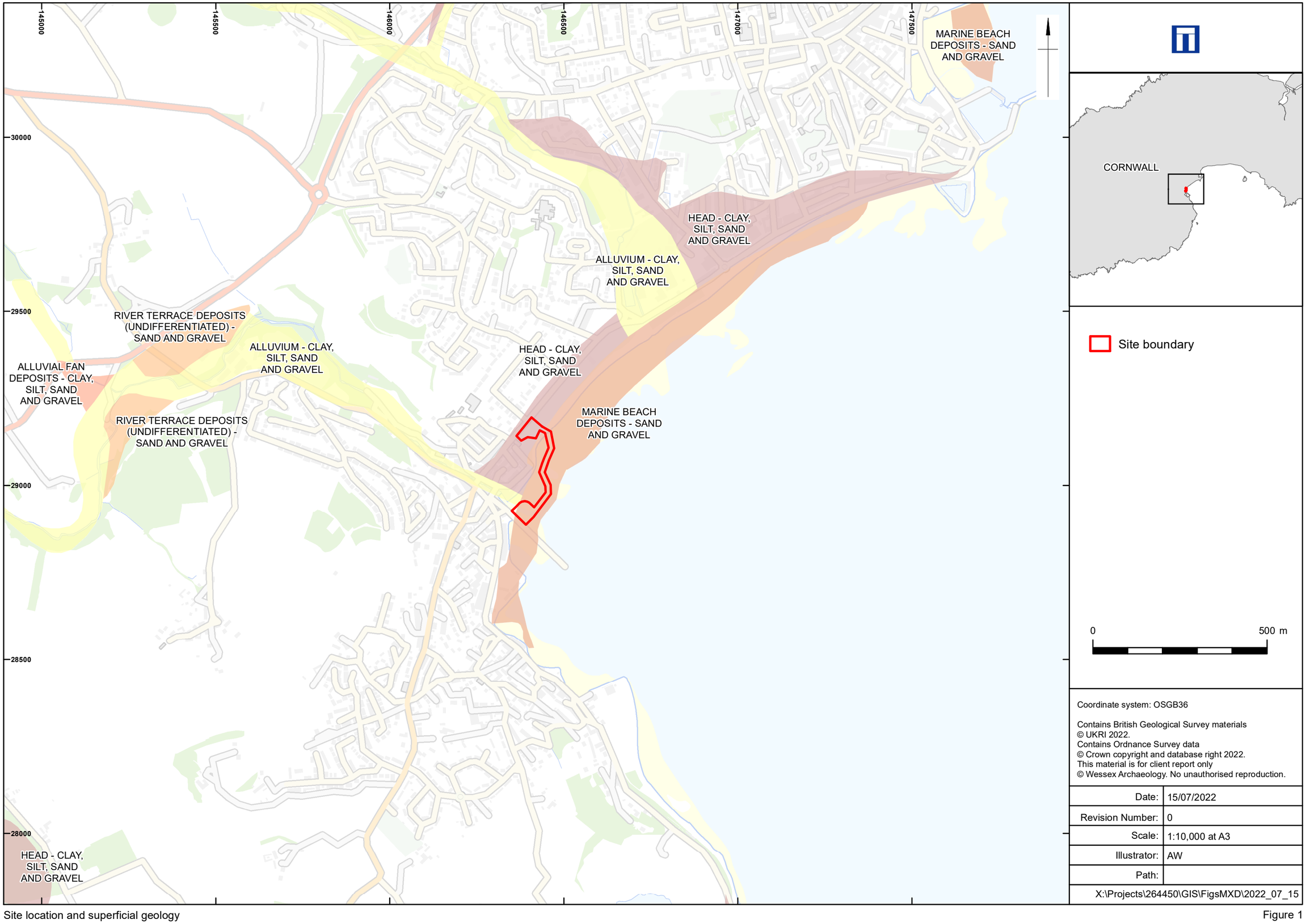

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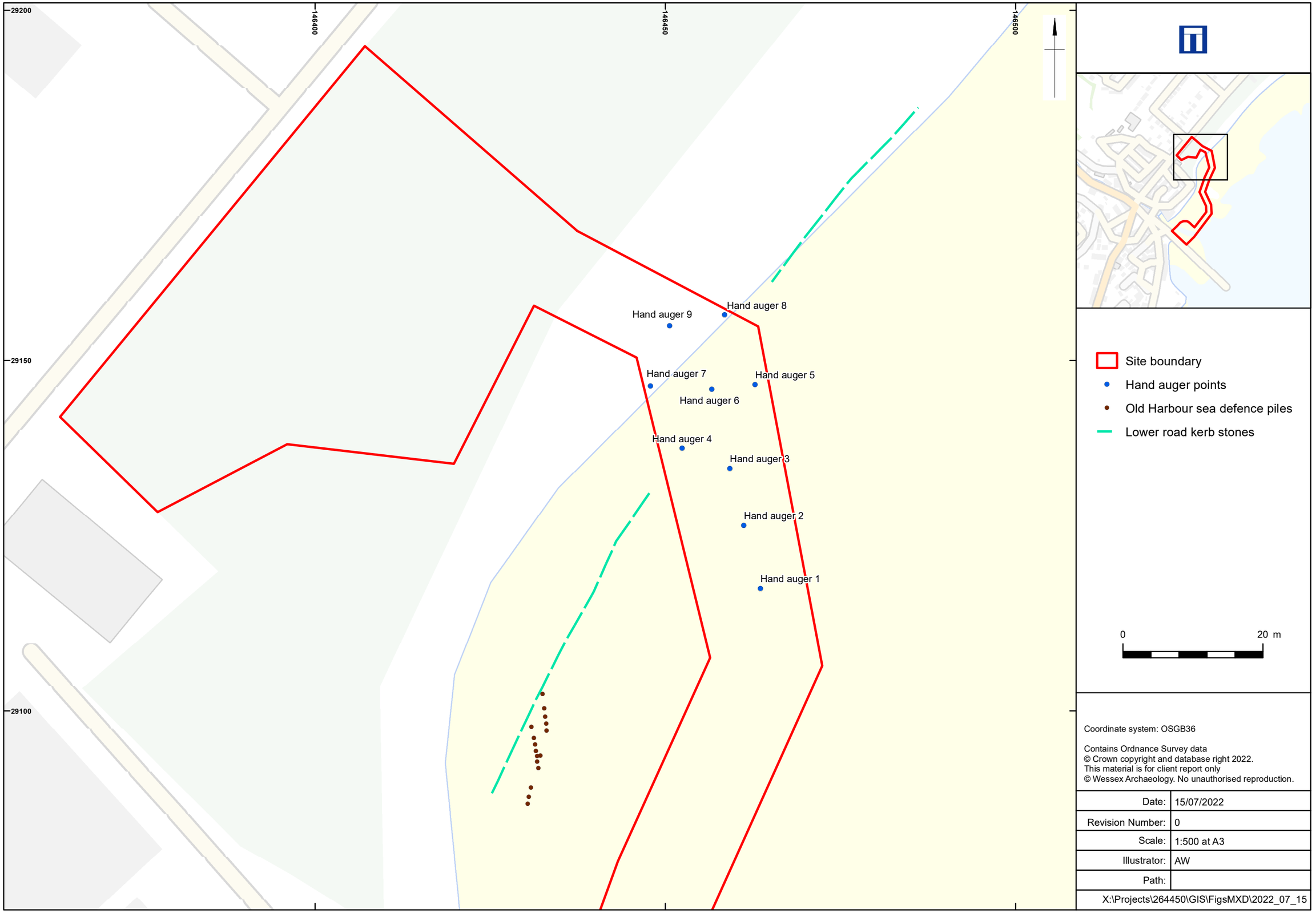
Site location and superficial geology

Figure 1



Location of hand auger points, lower road kerb stones and old sea defence timbers

Figure 2

Figure 3: Granite kerb stones from old Newlyn to Penzance road. Access route runs through gap in centre of image

Figure 4: Wooden piles running broadly parallel with and to seaward side of granite kerb stones

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Path:	X:\Projects\264450\Graphics_Office\Rep figs\Geoarch\2022_07_14		

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www. wessexarch.co.uk

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