Rampion 2 Wind Farm

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Rampion 2 Offshore Wind Farm Intertidal Habitats Survey Report 2020

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1. Executive Summary

This report presents the findings of the intertidal survey conducted between Elmer Beach and the mouth of the River Arun (West Sussex) aimed at establishing the main benthic habitats present in the vicinity of the proposed landfall location of the Rampion 2 Offshore Wind Farm export cable corridor. The survey involved a Phase I walkover accompanied by collection of Unmanned Aerial Vehicle (UAV) aerial imagery and Phase II sampling using cores for soft substrates and quadrat sampling for hard substrates.

The survey area was found to be dominated by sandy sediments in the lower and mid shore supporting mostly polychaetes and amphipods and the upper shore dominated by relatively impoverished shingle and gravel. A typical zonation was observed across the survey area; this included sea kale, *Crambe maritima,* and shingle dominated biotopes in the supralittoral (EUNIS B2.32) and upper shore zones (EUNIS A2.11 and A2.111), and polychaetes / amphipod dominated fine to muddy sands in the mid to lower shore areas (EUNIS A2.21, A2.23 and A2.24). The lower shore was characterised by *Ulva* spp. dominated rockpools (EUNIS A1.45) interspersed with fine sand supporting the polychaete *L. conchilega* (EUNIS A2.245). Of particular note was the presence of interspersed outcropping chalk and clay exposures (EUNIS A1.46) across the upper-mid shore region in the western extent of the survey area.

The rockpool biotope assigned during the survey correlate to Annex I ‘reef’ habitat while the sandy sediment habitats correlate to the Annex I habitat ‘mudflats and sandflats not covered by seawater at low tide’ although it should be noted that the habitats observed are not designated features of Natura 2000 sites. The chalk and clay exposures that were encountered are considered as soft rock and are therefore also representative of Annex I reef habitat. All the above-mentioned habitats that fall under Annex I of the EC Habitats Directive are protected here under the Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (England).

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2. Introduction

2.1. Rampion 2

Rampion Extension Development Limited (RED) applied to The Crown Estate (TCE) for an extension to the Rampion Offshore Wind Farm (Rampion 1) in 2018 and, following approval under the plan-led Habitats Regulations Assessment (HRA), was awarded development rights for the Rampion Extension Site in 2019. The proposed Rampion 2 Offshore Wind Farm Project (Rampion 2) is located adjacent to Rampion 1 in the English Channel, off the Sussex coast. Rampion 2 is designated as a Nationally Significant Infrastructure Project (NSIP) under Section 15(3) of the Planning Act 2008, thus requiring a Development Consent Order (DCO) accompanied by and Environmental Statement (ES) in accordance with the Environmental Impact Assessment (EIA) Regulations 2017. Rampion 2 is defined as a Schedule 2 project under EIA Regulations 2017.

Rampion Extension Development Limited (hereafter referred to as 'RED') (the Applicant) is developing the Rampion 2 Offshore Wind Farm Project (Rampion 2) located adjacent to the existing Rampion Offshore Wind Farm Project ('Rampion 1') in the English Channel.

Rampion 2 will be located between 13km and 26km from the Sussex Coast in the English Channel and the offshore array area will occupy an area of approximately 160km^2.

The key offshore elements of the Proposed Development will be as follows:

- up to 90 offshore wind turbine generators (WTGs) and associated foundations;
- blade tip of the WTGs will be up to 325m above Lowest Astronomical Tide (LAT) and will have a 22m minimum air gap above Mean High Water Springs (MHWS);
- inter-array cables connecting the WTGs to up to three offshore substations;
- up to two offshore interconnector export cables between the offshore substations;
- up to four offshore export cables each in its own trench, will be buried under the seabed within the final cable corridor; and
- the export cable circuits will be High Voltage Alternating Current (HVAC), with a voltage of up to 275kV.

The key onshore elements of the Proposed Development will be as follows:

- a single landfall site near Climping, Arun District, connecting offshore and onshore cables using Horizontal Directional Drilling (HDD) installation techniques;
- buried onshore cables in a single corridor for the maximum route length of up to 38.8km using:

  - trenching and backfilling installation techniques; and
  - trenchless and open cut crossings.
- a new onshore substation, proposed near Cowfold, Horsham District, which will connect to an extension to the existing National Grid Bolney substation, Mid Sussex, via buried onshore cables; and
- extension to and additional infrastructure at the existing National Grid Bolney substation, Mid Sussex District to connect Rampion 2 to the national grid electrical network.

A full description of the Proposed Development is provided in **Chapter 4: The Proposed Development, Volume 2** (Document Reference: 6.2.4).

2.2. Project Background

Ocean Ecology Limited (OEL) were commissioned to undertake an intertidal Phase I walkover survey and Phase II sampling survey (quadrats and cores) of the intertidal section of the proposed Rampion 2 offshore export cable corridor (**Figure 1**) to a) establish the main benthic habitats present and b) characterise the associated marine biological communities. The Rampion 2 offshore export cable corridor extends approximately 3.5km from Elmer Beach to the mouth of the River Arun (West Sussex).

This report provides a summary of the survey methodologies employed and a description of the habitats encountered during the survey. Habitats were determined through Unmanned Aerial Vehicle (UAV) imagery, walkover interpretation and quadrat and core sampling allowing for the determination of EUNIS habitats and biotopes (where possible) and subsequent creation of full coverage mapping across the survey area.

2.3. Current Understanding

The Rampion 2 intertidal survey area includes the Climping Beach Site of Special Scientific Interest (SSSI) to the east, which in turn comprises the West Beach Local Nature Reserve (LNR) that covers the beach and riverbank on the west side of the mouth of the river Arun at Littlehampton (West Sussex) (**Figure 1**).

Existing intertidal habitat mapping (MagicMap) suggests the biotopes present within the Climping Beach SSSI and the surrounding area primarily consist of intertidal sand and gravel. The eastern part of the survey area is thought to be dominated by finer sand (EUNIS A2.2). Coarser sediments, including gravel and cobbles (EUNIS A2.1) are thought to be the most abundant habitats present in the central areas and to the west. Occasional rocky areas (EUNIS A1) are thought to occur, particularly around coastal defence structures.

Natural Environment and Rural Communities (NERC) Act (2006) Section 41 Habitats of Principal importance are present along the top of the shore, particularly within the Climping Beach SSSI. These include:

- Coastal Vegetated Shingle (EUNIS B2); and

- Coastal Sand Dunes (EUNIS B1).

These habitats are recorded as being particularly prevalent in the eastern part of the survey area but also extending west along the coastline.

2.3.1. Climping Beach Site of Special Scientific Interest (SSSI)

Climping Beach SSSI extends from the breakwater at the eastern end of West Beach to approximately half-way along the survey area (**Figure 1**). The site is a stretch of coast with a vegetated shingle beach, behind which is a mature sand dune system. The intertidal zone consists of soft muds and sands which support large populations of marine invertebrates that are an important food source for wintering birds. In particular up to 300 sanderling (*Calidris alba*) have been recorded from this site in winter; a figure which represents 1 percent of the West European population of this bird which breeds in the high Arctic and flies south to winter on sandy coasts and estuaries. Other overwintering birds found to utilise this site include grey plover (*Pluvialis squatarola*) and oystercatcher (*Haematopus ostralegus*).

2.3.2. West Beach Local Nature Reserve (LNR)

The West Beach LNR is part of the Climping Beach SSSI and was declared by Arun District Council in 1995 (**Figure 1**). It includes sand dunes, vegetated shingle, sand flats and a small patch of saltmarsh. The dunes are part of one of only two sand dune systems in West Sussex. The sand lizard (*Lacerta agilis*) protected under the Wildlife and Countryside Act 1984 and four nationally scarce burrowing bees and wasps occur in the dunes. The vegetated shingle, though locally common, is internationally rare, and is used by a Red Data Book ant species *Myrmica specioides*. The sand flats host large numbers of migratory waders in the winter months.

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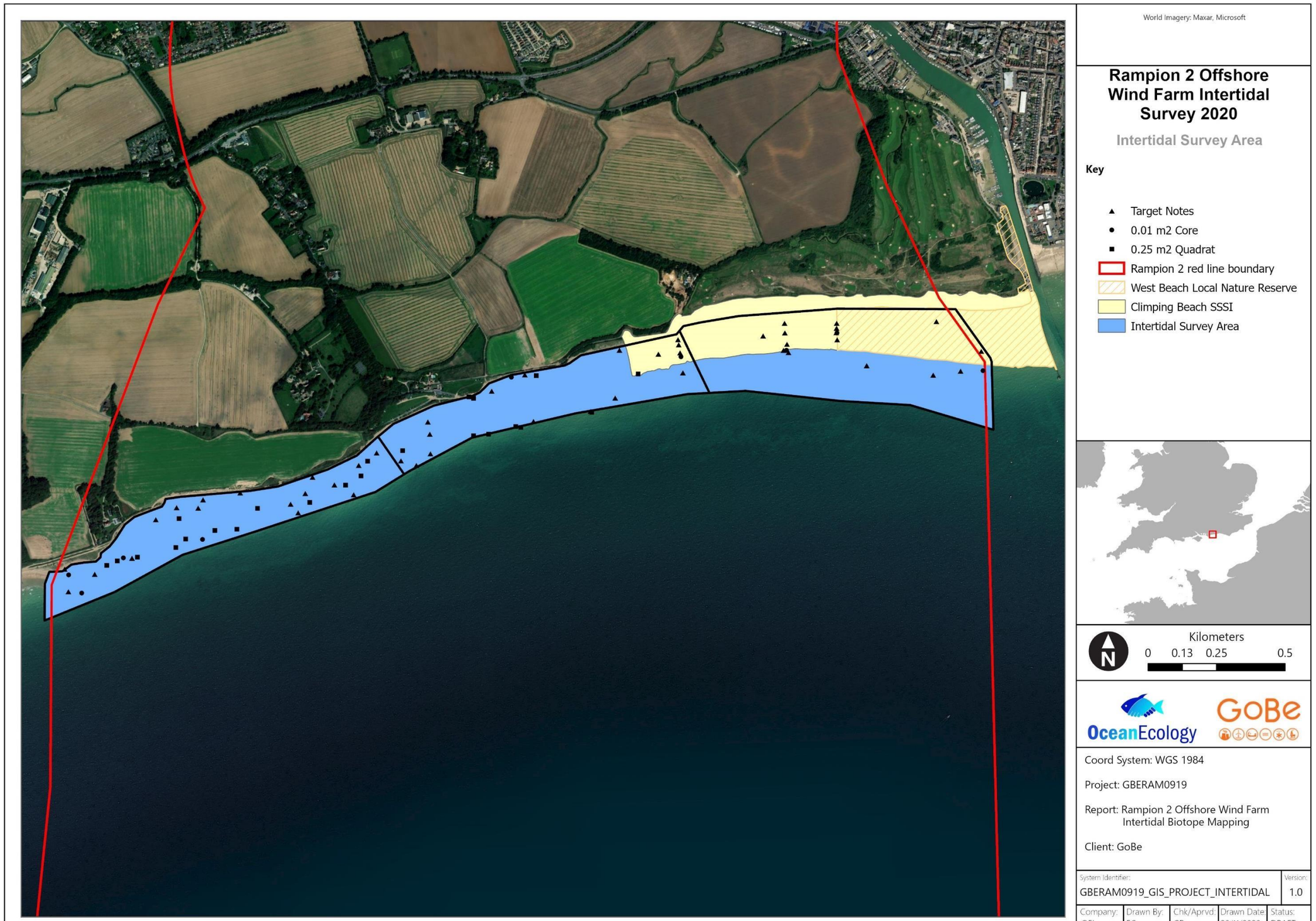

World Imagery: Maxar, Microsoft

Rampion 2 Offshore Wind Farm Intertidal Survey 2020

Intertidal Survey Area

Key

- Target Notes
- 0.01 m2 Core
- 0.25 m2 Quadrat
- Rampion 2 red line boundary
- West Beach Local Nature Reserve
- Climping Beach SSSI
- Intertidal Survey Area

Kilometers
0 0.13 0.25 0.5

OceanEcology GoBe

Coord System: WGS 1984

Project: GBERAM0919

Report: Rampion 2 Offshore Wind Farm Intertidal Biotope Mapping

Client: GoBe

System Identifier:	Version:
GBERAM0919_GIS_PROJECT_INTERTIDAL	1.0

Company:	Drawn By:	Chk/Aprvd:	Drawn Date:	Status:
OEL	EC	GR	20/11/2020	DRAFT

Version of template: July 2020 V1
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Document uncontrolled when printed ISO A3 Landscape

Figure 1 Intertidal survey area for the proposed Rampion 2 export cable corridor landfall.

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3. Methods

3.1. Survey Design

The intertidal survey covered the entirety of the proposed Rampion 2 offshore export cable corridor intertidal survey area, in addition to a 25 m buffer, from Mean Low Water Springs (MLWS) to Mean High Water Springs (MHWS). A UAV survey was undertaken to collect high resolution imagery across the survey area at low water. Additionally, a total of 23 quadrats and 10 core locations (sampled in duplicate) were selected across the survey area to further supplement the Phase I walkover survey and UAV imagery and inform detailed biotope mapping.

3.2. Survey Methods

3.2.1. Phase I Walkover Survey

The Phase I intertidal survey was undertaken during spring tides using ESRI ArcCollector on a Global Positioning System (GPS) enabled tablet device in line with guidance in the Marine Monitoring Handbook (Davies *et al. 2001)*, CCW Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn *et al*. 2006) and latest guidance for characterising intertidal rocky shore and sediment habitats (Natural Resources Wales (NRW) 2019a; 2019b). During the walkover survey, EUNIS classifications were assigned in consideration of the latest Joint Nature Conservation Committee (JNCC) guidance (Parry 2019). These were correlated to the Marine Habitat Classification for Britain and Ireland (MNCR) and, where possible, boundaries of habitats / biotopes were tracked as polygons in ArcCollector. A detailed intertidal survey log and field notes are provided in Appendix I.

Representative examples of each habitat / biotope encountered were photographed. Additionally, the distribution of any features of conservation interest were recorded using photographs and GPS fixes where encountered. The presence of any invasive non-native species (for example, *Crepidula fornicata*) was also noted and their location recorded. Other information recorded included general site conditions, sediment surface features (for example, *Lanice conchilega* tube aggregations), sediment type and characteristics, topography and anthropogenic pressures.

3.2.2. UAV Mapping

The UAV mapping was carried out in line with JNCC guidance for use of UAVs in marine benthic monitoring (Crabb *et al*. 2019). All flights were conducted by OELs Qualified UAV Pilots (RPQs) under its Permission for Commercial Operations (PfCO) (CAA ID: 2654) granted by the Civil Aviation Authority (CAA)[1]. The UAV used was a DJI Phantom 4 multi-

1 Ocean Ecology's UAV aerial survey operations comply with all UK legislation regarding commercial use of Small Unmanned Aerial Systems (sUAS). This requires that Ocean Ecology hold a CAA PfCO, Liability Insurance, a CAA approved Operational Manual and Qualified UAV Pilots (RPQs).

rotor quadcopter. The flight(s) were pre-planned using in Drone Deploy software to achieve an orthomosaic Ground-Sampling Distance (GSD) of 1-3 centimetres (cm)/pixel (px) with an accuracy[2] of 5-10 metres (m).

3.2.3. Target Notes

Target notes were taken at any notable change in habitat / substrate and identified the presence of any notable features (for example, intertidal rockpools). These were accompanied by GPS fixes and close-up photographs of each feature along with general site photographs.

3.2.4. Phase II Sampling

ESRI ArcCollector was used on a GPS enabled tablet device to navigate between core and quadrat sampling stations located across areas of soft and hard substrate throughout the survey area.

3.2.3.1 Quadrat Sampling

Areas representative of each key hard substrate habitat at different tidal heights were assessed by recording the epibiotal taxa present in randomly placed 0.25 square metres (m^2) (0.5m x 0.5m) quadrats. Identification was taken to species level where possible and undertaken in the field. Any cryptic taxa that were not identified in the field were retained and identified in the laboratory.

At each quadrat location the substrate was subject to a visual inspection and observations of colour, smell, texture and presence of surface features (accretions, algae, fauna, etc.) recorded. A high-resolution photograph was taken directly above the quadrat (in plan view) for subsequent analysis, and a further four photographs were taken in a north, east, south and west orientation.

3.2.3.2 Core Sampling

Areas representative of each key soft substrate habitat at different tidal heights were assessed by collecting 0.01m^2 duplicate hand core samples to a depth of 15cm. The first core sample was used to characterise the macrobenthic communities present and the second for Particle Size Distribution analysis (PSD) to characterise the physical nature of the sediments. Five photographs were also taken at each soft sediment station: the first directly above the sediment (in plan view) and the following four in a north, east, south and west orientation.

[2] Measured as Root Mean Square Errors (RMSE).

3.3. Analysis

3.3.1. Macrobenthic Analysis

All macrobenthic analyses were carried out by in-house marine taxonomists at OEL's NE Atlantic Marine Biological Analytical Quality Control (NMBAQC) scheme participating laboratory in line the NMBAQC Processing Requirement Protocol (PRP) (Worsfold & Hall 2010). On arrival to OEL's laboratory, all macrobenthic samples were logged in and entered into OEL's cloud-based marine ecological database 'ABACUS'.

For each sample, the excess formalin was drained off into a labelled container over a 0.5 millimetre (mm) mesh sieve in a well-ventilated area. The samples were then re-sieved over a 0.5mm mesh sieve to remove all remaining fine sediment and fixative. The low-density fauna was then separated by elutriation with fresh water, poured over a 0.5 mesh sieve, transferred into a Nalgene and preserved in 70 percent Industrial Denatured Alcohol (IDA).

All macrobenthos present was identified to species level, where possible, by trained benthic taxonomists using the most up to date taxonomic literature and checks against existing reference collections. Nomenclature used the most up to date taxonomic classifications provided on the World Register of Marine Species (WoRMS) and results with accompanying metadata provided in Marine Environmental Data and Information Network (MEDIN) compliant format.

3.3.2. Particle Size Distribution (PSD) Analysis

PSD analysis of separate sediment samples was undertaken by in-house laboratory technicians at OEL's NMBAQC participating laboratory in line with NMBAQC best practice guidance (Mason 2016).

Frozen sediment samples were first transferred to a drying oven and thawed at 80 degrees Celsius (°C) for at least 6 hours prior to visual assessment of sediment type. Before any further processing (for example, sieving or sub-sample removal), samples were mixed thoroughly with a spatula and all conspicuous fauna (>1mm) which appeared to have been alive at the time of sampling removed from the sample. A representative sub-sample of the whole sample was then removed for laser diffraction analysis before the remaining sample screened over a 1mm sieve to sort coarse and fine fractions. The >1mm fraction was then returned to a drying oven and dried at 80°C for at least 24 hours prior to dry sieving. Once dry, the sediment sample was run through a series of Endecott BS 410 test sieves (nested at 0.5 Phi (φ) intervals) using a Retsch AS200 sieve shaker to fractionate the samples into particle size classes. The dry sieve mesh apertures used are given in **Table 1**.

Table 1. Sieve series employed for Particle Size Distribution (PSD) analysis by dry sieving (mesh size in mm).

Sieve aperture (mm)												
63	45	32	22.5	16	11.2	8	5.6	4	2.8	2	1.4	1

The sample was then transferred onto the coarsest sieve at the top of the sieve stack and shaken for a standardised period of 20 minutes. The sieve stack was checked to ensure the components of the sample had been fractioned as far down the sieve stack as their diameter would allow. A further 10 minutes of shaking was undertaken if there was evidence that particles had not been properly sorted.

The sub-sample for laser diffraction was first screened over a 1mm sieve and the fine fraction residue (<1mm sediments) transferred to a suitable container and allowed to settle for 24 hours before excess water syphoned from above the sediment surface until a paste texture was achieved. The fine fraction was then analysed by laser diffraction using a Beckman Coulter LS13 320. For silty sediments, ultrasound was used to agitate particles and prevent aggregation of fines.

The dry sieve and laser data were then merged for each sample with the results expressed as a percentage of the whole sample. Once data was merged, PSD statistics and sediment classifications were generated from the percentages of the sediment determined for each sediment fraction using Gradistat v8 software.

Sediment were described by their size class based on the Wentworth classification system (Wentworth 1922) (**Table 2**). Statistics such as mean and median grain size, sorting coefficient, skewness and bulk sediment classes (percentage silt, sand and gravel) were also derived in accordance with the Folk classification (Folk 1954).

Table 2. Classification used for defining sediment type based on the Wentworth Classification System (Wentworth 1922). µm = micrometre.

Wentworth Scale	Phi Units (φ)	Sediment Types
>64mm	<-6	Cobble and boulders
32 to 64mm	-5 to -6	Pebble
16 to 32mm	-4 to -5	Pebble
8 to 16mm	-3 to -4	Pebble
4 to 8mm	-3 to -2	Pebble
2 to 4mm	-2 to -1	Granule
1 to 2mm	-1 to 0	Very coarse sand
0.5 to 1mm	0 to 1	Coarse sand
250 to 500µm	01-Feb	Medium sand
125 to 250µm	02-Mar	Fine sand
63 to 125µm	03-Apr	Very fine sand
31.25 to 63µm	04-May	Very coarse silt

15.63 to 31.25µm	05-Jun	Coarse silt
7.813 to 15.63µm	06-Jul	Medium silt
3.91 to 7.81µm	7 – 8	Fine silt
1.95 to 3.91µm	08-Sep	Very fine silt
<1.95µm	<9	Clay

3.3.3. UAV Imagery Analysis

Following initial screening to remove any erroneous images, all images collected during the UAV mapping flights were 'stitched' together to generate orthomosaic and Digital Elevation Model (DEM) outputs for the intertidal survey area using Drone Deploy software. The outputs were then used as base maps in Geographical Information System (GIS) to facilitate subsequent habitat / biotope mapping by visual interrogation and delineation of boundaries.

3.3.4. EUNIS Classification Mapping

EUNIS habitats and biotopes were identified in line with JNCC guidance on assigning benthic biotopes (Parry 2019) to allow the communities to be mapped and allow comparison with existing data. All habitat / biotope determination was undertaken through consideration of the following:

- existing habitat mapping (derived from European Marine Observation and Data Network (EMODnet));
- UAV imagery interpretation;
- review and interpretation of target field notes and quadrat imagery;
- PSD analysis results (textual groups, sediment percent contribution and mean grain size) (for determination of Broad Scale Habitat (BSH);
- macrobenthic analysis results (presence and absence of key taxa and abundance of dominant taxa); and
- general site imagery.

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4. Results

4.1. Survey Progress

The intertidal survey was undertaken during spring tides on 24 July 2020. **Table 3** provides a summary of the sampling undertaken and information collected during the survey. **Plate 1** provides an overview of the intertidal survey area, as captured during additional UAV site imagery collection.

Table 3 Summary of sampling undertaken and information collected during the intertidal survey.

Sampling	Intertidal Survey Area
Quadrats	23
Sediment Cores	10 sites, 20 cores: 2 duplicate cores per site
Target Notes	50
UAV imagery	1263 high resolution images

Plate 1 Top left: western extent looking towards Atherington; Top right: middle survey area extent; Bottom: eastern extent looking east towards the River Arun.

4.2. UAV Survey

UAV mapping of the proposed Rampion 2 offshore export cable corridor survey area was undertaken over a 90-minute period around low water on 24 July 2020. The survey was split into three independent flights to cover the west, east and central extent of the survey with a total flight duration across all three flights of 83 minutes. Flight height was maintained at 70 m for all areas and weather conditions (for example, wind / precipitation) remained favourable for data collection throughout.

The UAV survey successfully captured over 1,263 high-resolution nadir images across a coverage area of 804,405m^2 to produce a high resolution orthomosaic model (GSD = 2.83cm/px) and DEM (GSD = 11.33cm/px) (**Figure 2** to **Figure 4**) with an average RMSE accuracy level of 1.8m. Example aerial images are provided as **Plate 2**.

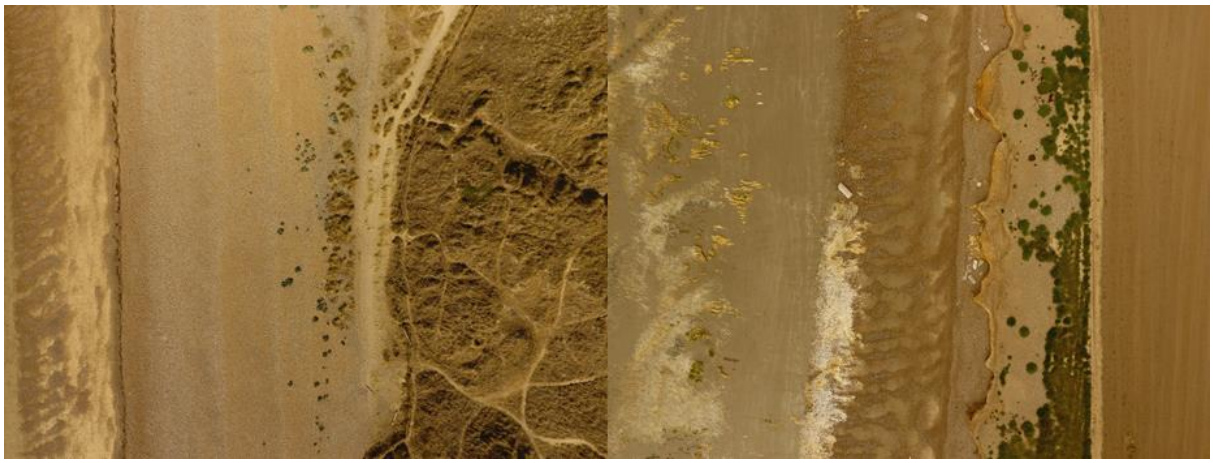

Plate 2 Left: Upper shore shingle grading into sand dune habitat; Right: Chalk and clay exposures on the mid shore.

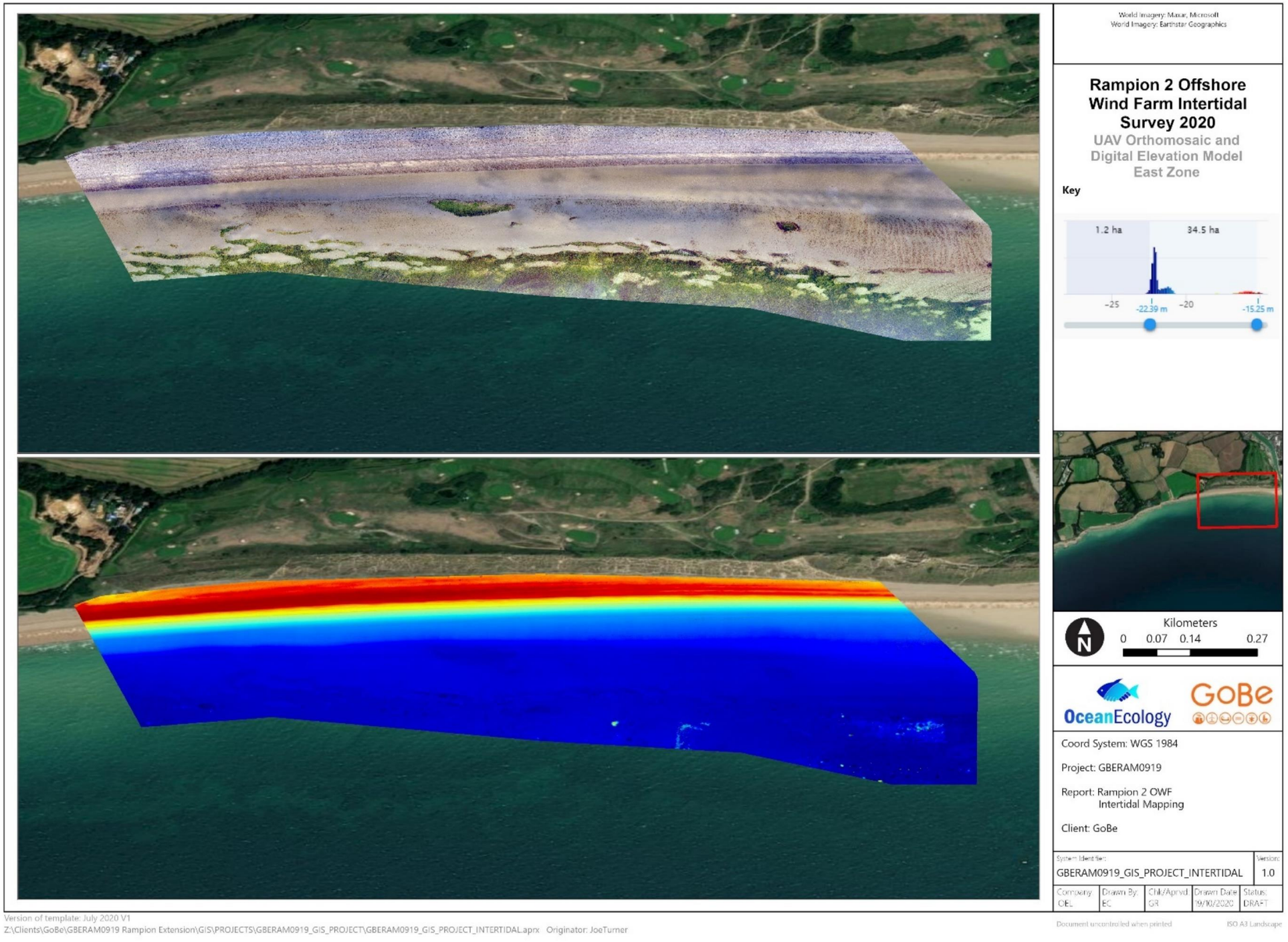

Figure 2 UAV orthomosaic and Digital Elevation Model (DEM) data collected during the intertidal survey for the proposed Rampion 2 offshore export cable corridor landfall (East Zone).

Figure 3 UAV orthomosaic and Digital Elevation Model (DEM) data collected during the intertidal survey for the proposed Rampion 2 offshore export cable corridor landfall (Middle Zone).

Figure 4 UAV orthomosaic and Digital Elevation Model (DEM) data collected during the intertidal survey for the proposed Rampion 2 offshore export cable corridor (West Zone).

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4.3. Phase II Sampling

4.3.1. Sediment Cores

In total, 10 sediment cores were analysed for full particle size classification to support the determination of EUNIS habitats and biotopes. The raw data is provided in Appendix III with summary sediment statistics in Appendix IV.

4.3.1.1. Sediment Type

Sediment types, as classified using the Folk Triangle (Folk 1954), for each of the cores sampled across the Rampion 2 intertidal survey area are presented in **Figure 5**. Each Folk classification was converted to BSH type (EUNIS Level 3) using the adapted Folk triangle (Long 2006).

Sediments showed a clear gradient across the survey area with coarse sediments characterising the upper shore and sand predominant in the mid to lower shore. **Figure 5** shows that the sediments sampled across the Rampion 2 survey area consisted of Sandy Gravel, Gravelly Sand, and Gravel (BSH A2.1), as well as Slightly Gravelly Sand and Sand (BSH A2.2).

The sediments recorded grouped into two broad main categories based on their sorting: six cores were classified as poorly and very poorly sorted sediments while four were classified as moderately to well sorted sediments. This reflects the same zonation seen before with coarser and generally poorly sorted sediments in the upper shore and sorted sediments further down the shore.

4.3.1.2. Sediment composition

Percentage contribution of gravel (> 2mm), sand (0.63mm to 2mm) and mud (< 63µm) is presented in **Figure 6** for each of the ten sediment cores collected. Percentage contribution of sand was greatest across the survey area with sand being the dominant sediment fraction in seven cores. In cores 4, 6 and 9, all collected in the upper shore, gravel was the dominant sediment fraction. The mean (± Standard Error (SE)) proportion of sand across all stations was 70.0 ± 9.3 percent, while mean (± SE) gravel content was 27.7 ± 9.8 percent and mean (± SE) mud content was 2.3 ± 0.005 percent. Mean grain size ranged between 123.8 and 14331.8µm with larger grain sizes in cores sampled in the upper shore compared to cores collected from the mid to lower shore.

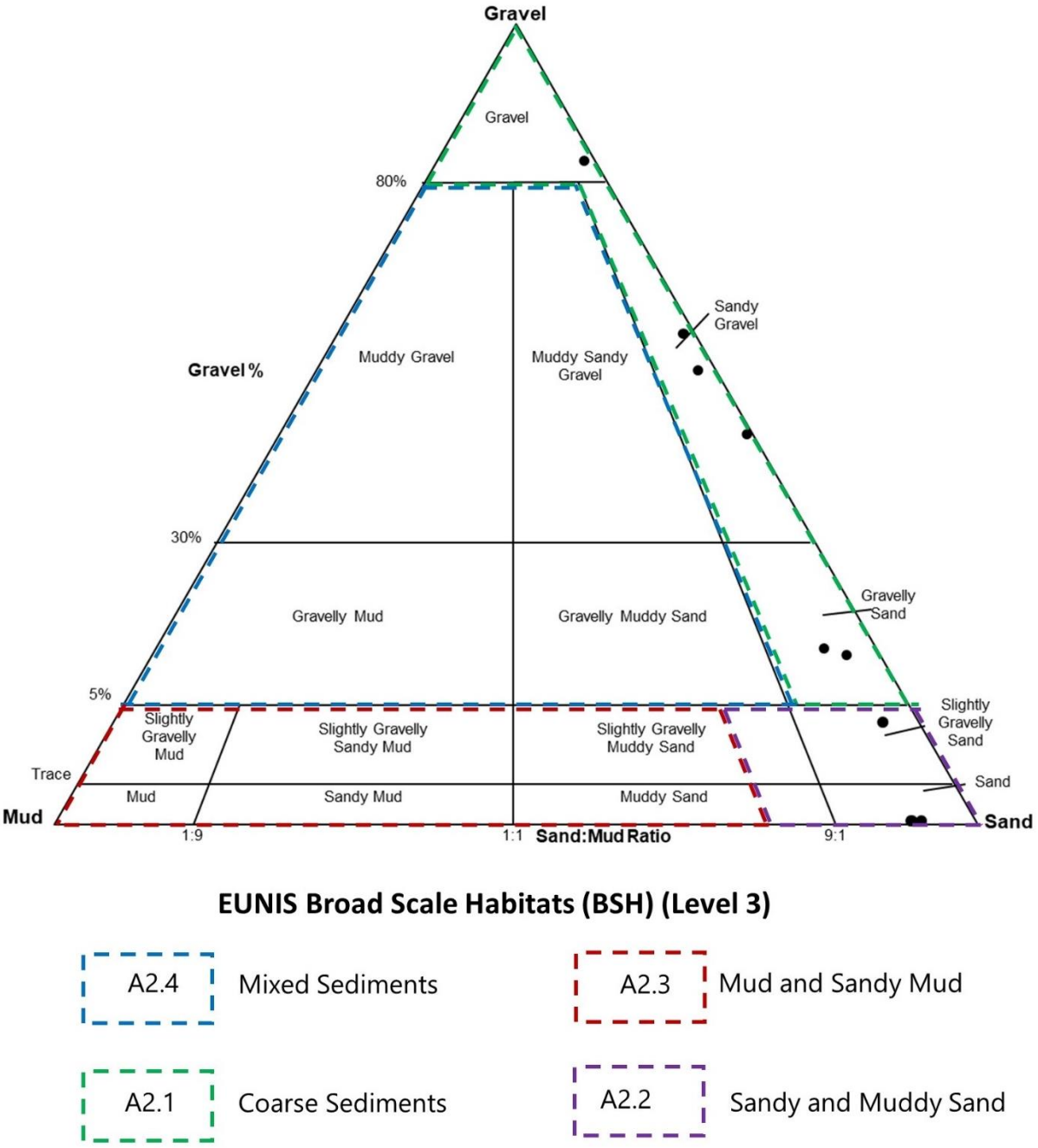

Figure 5 Folk (Folk 1954) triangle classifications of sediment gravel percentage and sand to mud ratio of sediment cores collected during the Rampion 2 intertidal survey, overlain by the modified Folk triangle for determination of mobile sediment BSHs under the EUNIS habitat classification system (adapted from Long 2006).

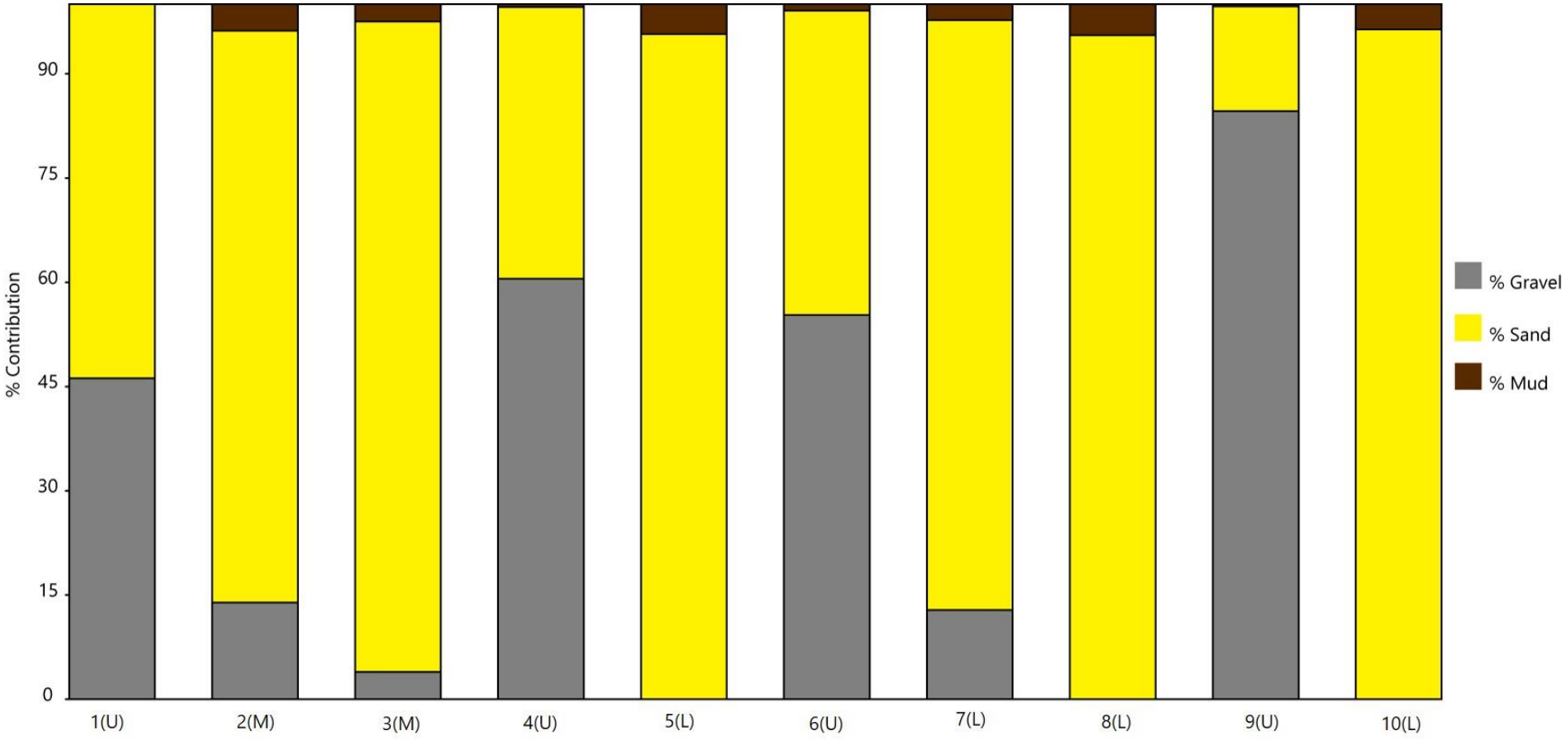

Figure 6 Sediment contribution (percentage gravel, sand and mud) for each core collected during the Rampion 2 intertidal survey. Cores marked with (U) were collected from the upper shore, with (L) from the lower shore and the remaining were sampled from the mid shore (M).

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4.3.2. Macrobenthos

4.3.2.1. Macrobenthic Composition

The full abundance matrix is provided in Appendix V presenting the abundance of each taxon. The biomass (gAFDW – Ash Free Dry Weight) of each major taxonomic group (Annelida, Crustacea, Mollusca, Echinodermata and Miscellaneous) in each core is presented in Appendix VI.

The macrobenthic infaunal assemblage identified across the Rampion 2 survey area consisted of a total of 49 individuals from a total of 24 taxa, including 5 taxa of algae with four belonging to the phylum Rhodophyta and one to the phylum Chlorophyta. Mean (± SE) abundance per sample was 0.2 ± 0.07 with a mean (± SE) biomass per sample of 0.0004 ± 0.0001 gAFDW.

As shown in **Figure 7**, the amphipod *Bathyporeia sarsi* was the most abundant and frequent taxon sampled accounting for 18.4 percent of all individuals recorded and occurring in 40 percent of the cores. Additionally, it also accounted for the maximum abundance in a single sample (**Figure 7**). Other key taxa were the polychaete *Spio martinensis* and the crustacean *Cumopsis goodsir* also occurring in 40 percent of the cores, albeit in lower numbers than *B. sarsi* (**Figure 7**). The core with the highest diversity was core 10 (collected from the lower shore of the far eastern area) with 18 individuals from a total of 15 different taxa.

The overall macrobenthic composition dominated by the presence of polychaetes and crustaceans was deemed to be representative of the biotope *'Polychaete / amphipod-dominated fine sand shores'"* (A2.23) also consistent with fine sand being the dominant sediment fraction (**Figure 6**).

Biomass results ranged between 0.0006 and 0.0060 gAFDW per sample, with the highest value found in sediment core 5 (collected from the lower shore in the western area). Two major taxonomic groups contributed to the 97.7 percent of the total biomass, with Annelida contributing to the 84.7 percent and Crustacea to the 13 percent.

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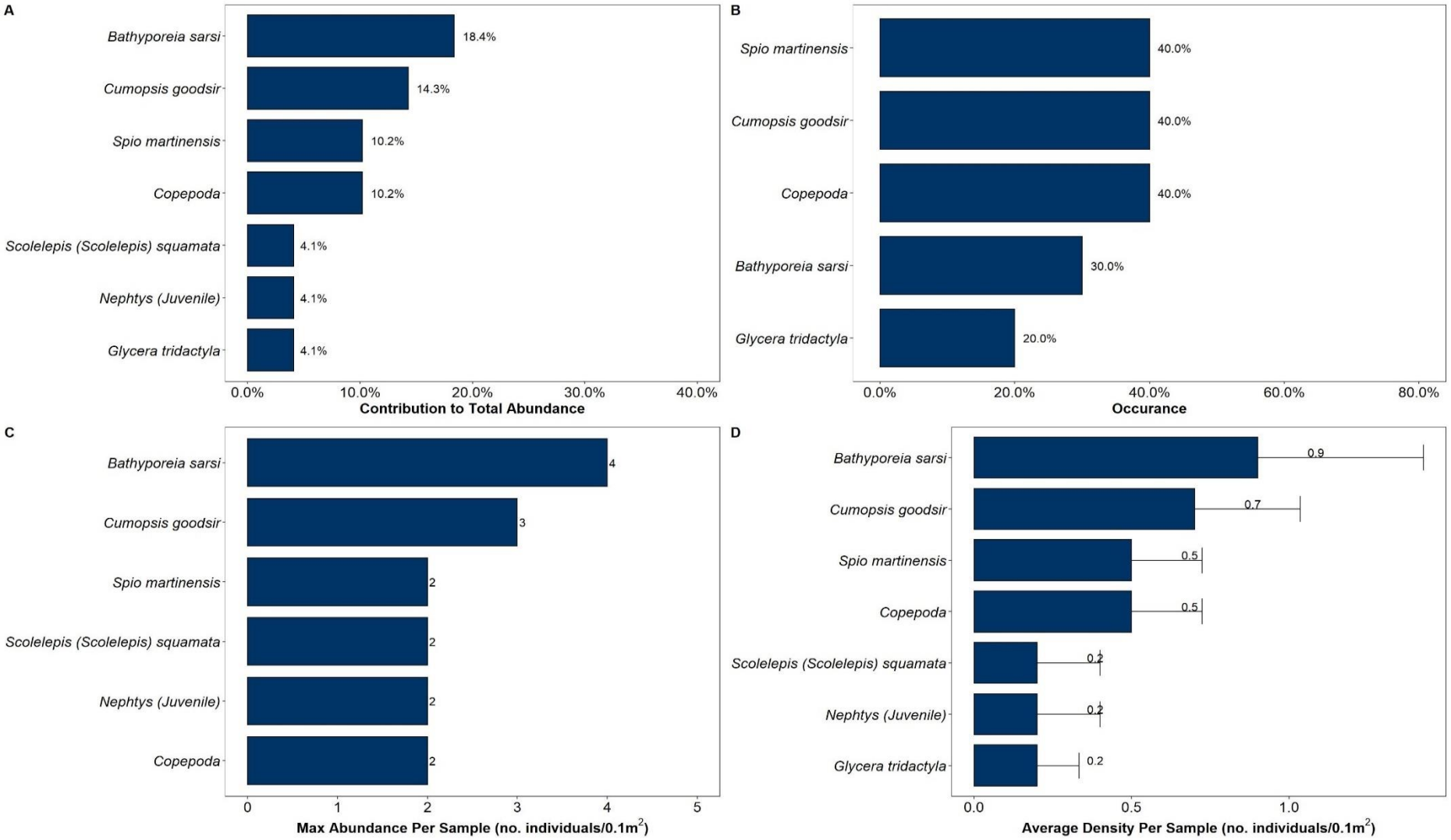

Figure 7 Top 5 species of macrobenthic taxa recorded across the intertidal survey area for the Rampion 2 offshore export cable corridor landfall.

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4.4. Habitat / Biotope Mapping

There was a total of 9 unique biotopes (EUNIS level 5 or above) from a total of nine BSH (**Table 4**) as mapped in **Figure 8** toFigure 10.

The majority of the survey area at the proposed Rampion 2 offshore cable corridor location was characterised by littoral sand and muddy sand (A2.2). This dominant habitat was fringed by littoral coarse sediment (A2.1) along the upper shore and by chalk cobbles often covered in mixed algae in the lower shore (A1.4) (**Table 4** and **Figure 8** toFigure 10).

The extreme upper shore of the eastern section of the survey area was characterised by shingle with sea kale *Crambe maritima* (B2.32) giving way to a steep bank of shingle (pebbles) and gravel representative of the biotope A2.11 (**Figure 8**). A narrow strandline habitat (A2.21) was present within the transition zone between A2.11 and a sandier area characterised by polychaete/amphipod- dominated fine sand shores (A2.23). The mid shore area was generally dominated by fine sand representative of the biotope A2.23 interspersed with muddy sand supporting the sandworm *Arenicola marina* and representative of the biotope A2.24. The lower shore was a mosaic of littoral rocks and sandy sediments consisting of chalk pebbles as well as bored chalk often covered in green and red seaweeds (A1.45) with small patches of fine rippled sand supporting the polychaete *Lanice conchilega* (A2.245) (**Figure 8**).

The middle section of the survey area showed a zonation similar to that of the east zone but with no *C. marina* and a much narrower shingle bank in the upper shore (A2.11) (**Figure 9**). The mid shore was similarly dominated by fine and muddy sands representative of the biotopes A2.2, A2.23 and A2.24; however, outcropping chalk and clay exposures (A1.46) were also observed in the upper shore.

The western area had coarser sediments in the upper shore grading into fine sand / muddy sand in the mid shore (**Figure 10**). A larger area of chalk outcrops was present in the upper and mid shore area as well as a number of rockpools characterised by the presence of green and red seaweeds (A1.45). The lower shore was fringed with more littoral rocks consisting of chalk pebbles covered in *Ulva* spp. The area to the west of Climping beach was also interspersed with various artificial defences including rock armour groynes running parallel to the shore with barnacles (Balanoidea) on the lower two metres and bare rock above. Wooden groin structures running down the shore were either covered in *Ulva* sp. And *Fucus spiralis* or Balanoidea (**Figure 10**).

A summary of EUNIS classifications recorded during the Phase I walkover survey is provided in Appendix II along with supporting example photographs.

Table 4 Key biotopes recorded during the intertidal survey of the proposed Rampion 2 cable corridor.

EUNIS BSH	EUNIS Code	EUNIS Description
A1.4 – Features of Littoral Rock	A1.45	Ephemeral green or red seaweeds (freshwater or sand-influenced) on non-mobile substrata
	A1.46	Hydrolittoral soft rock
A2.1 – Littoral Coarse Sediment	A2.11	Shingle (pebble) and gravel shores
	A2.111	Barren littoral shingle
A2.2 – Littoral Sand and Muddy Sand	A2.21	Strandline
	A2.23	Polychaete / amphipod-dominated fine sand shores
	A2.24	Polychaete / bivalve-dominated muddy sand shores
	A2.245	[*Lanice conchilega*] in littoral sand
B2.3 – Upper shingle beaches with open vegetation	B2.32	Channel [*Crambe marina*] communities

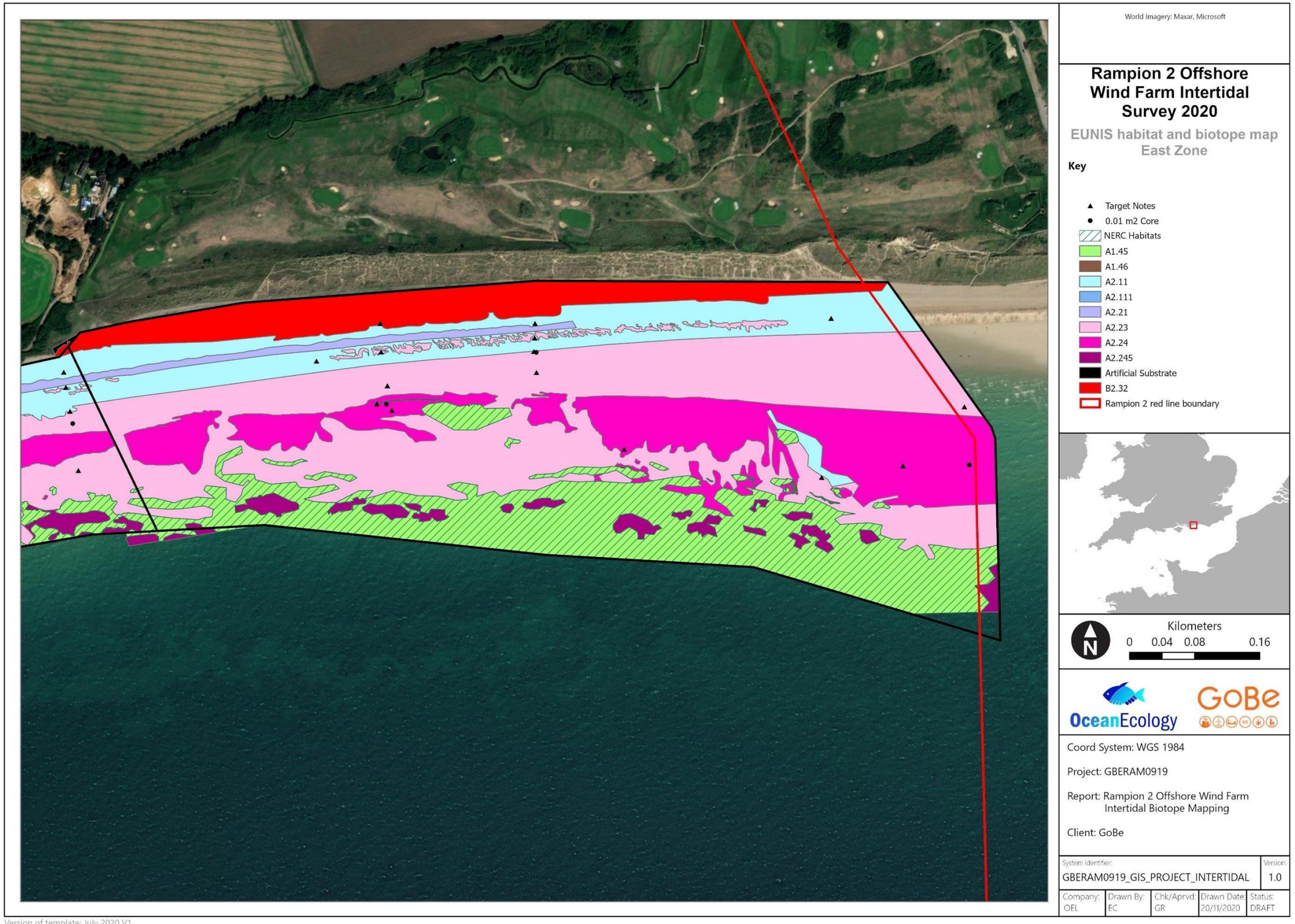

Figure 8 EUNIS habitat and biotope mapping and sampling locations visited during the intertidal survey for the proposed Rampion 2 offshore export cable corridor landfall (East Zone).

Figure 9 EUNIS habitat and biotope mapping and sampling locations visited during the intertidal survey for the proposed Rampion 2 offshore export cable corridor landfall (Middle Zone).

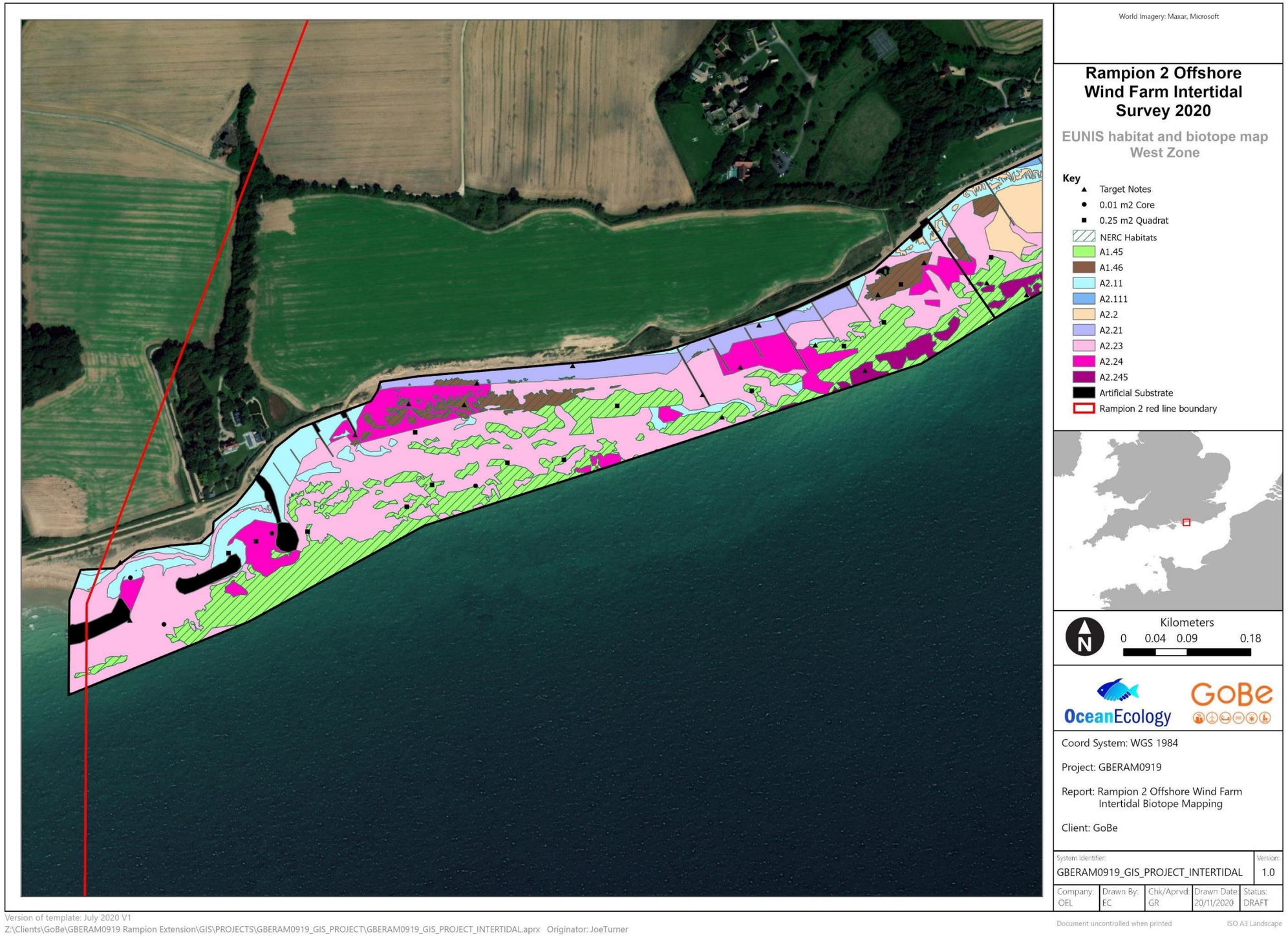

Figure 10 EUNIS habitat and biotope mapping and sampling locations visited during the intertidal survey for the proposed Rampion 2 offshore export cable corridor landfall (West Zone).

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4.5. Features of Interest

Areas of rock noted across the intertidal survey area was almost entirely made up of rockpools dominated by chalk cobbles and bored chalk covered in green seaweeds (**Plate 3**); these were deemed to be representative of the biotope A1.45. These features of littoral rock correlate to habitats that fall under Annex I of the EC Habitats Directive but are protected here under NERC Act 2006 (herein referred to as NERC habitats) while the sandy sediment habitats correlate to the Annex I habitat 'mudflats and sandflats not covered by seawater at low tide' but are protected under the NERC Act 2006. Significant portions of the upper and middle shore were dominated by chalk outcrops and clay exposures (A1.46), especially to the west of the survey area (**Plate 3**) also representative of NERC habitats.

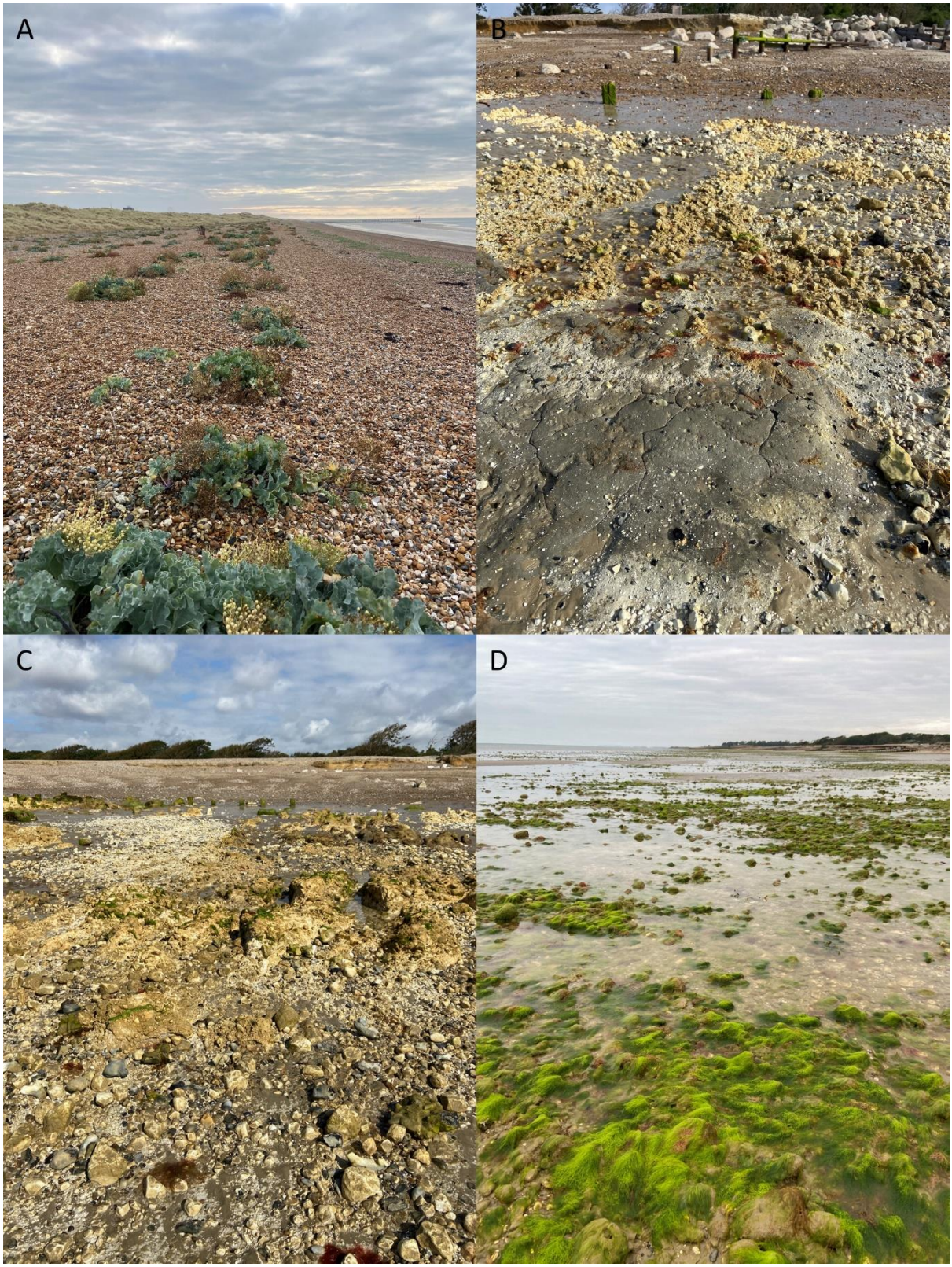

Plate 3. A) Channel *Crambe maritima* communities. B) Clay exposures with chalk cobbles and pebbles. C) Chalk outcrops and cobbles. D) Intertidal rockpool with green and red seaweed.

5. Discussion

This report presents the findings of the intertidal survey conducted between Elmer Beach and the mouth of the River Arun (West Sussex) and aimed at establishing the main benthic habitats present in the general vicinity of the proposed landfall location of the Rampion 2 offshore export cable corridor. The survey involved Phase I walkover surveying to map the habitats present accompanied by Phase II sampling using cores for soft substrates and quadrat sampling for hard substrates to a) establish the main benthic habitats present and b) characterise the associated marine biological communities.

The Rampion 2 intertidal survey area was found to be dominated by sandy shores in the mid to lower shore, supporting a number of marine invertebrates mostly belonging to two major taxonomic groups: Annelida and Crustacea. Clear zonation was observed across the survey area, the full range of which was more evident in the eastern reaches of the site. This included *C. maritima* and shingle dominated biotopes in the supralittoral (B2.32) and upper shore zones (A2.11 and A2.111), and polychaete / amphipod dominated fine sands in the mid to lower shore areas (A2.21, A2.23 and A2.24) interspersed with seaweed dominated rock pools (A1.45). The lower shore was characterised by green and red seaweed dominated rock (A1.45) with chalk cobbles as well as bored chalk often interspersed with fine sands supporting the polychaete *L. conchilega* (A2.245). The upper-mid shore in the west zone of the survey area was characterised by patches of hydrolittoral soft rock (A1.46) comprising a mosaic of exposed clay and chalk.

Rockpools were ubiquitous across the survey area in the lower shore and all littoral rock habitats / biotopes encountered during the survey (A1.45 and A1.46) correlate to NERC habitats while the sandy substrates (A2.23 and A2.24) correlate to the Annex I habitat ‘mudflats and sandflats not covered by seawater at low tide’ but are protected here under NERC Act 2006.

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5.1. Glossary of terms and abbreviations

Table 5 Glossary of terms and abbreviations

Term (acronym)	Definition
Benthic ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment
Biotope	A region of habitat associated with a particular ecological community.
BSH	Broadscale Habitat
CAA	Civil Aviation Authority
cm	Centimetre
°C	Degrees Celsius
Crustacea	Arthropod of the large, mainly aquatic group Crustacea, such as a crab, lobster, shrimp, or barnacle
DCO	Development Consent Order
DEM	Digital Elevation Model
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed project or development over and above the existing circumstances (or 'baseline').
EMODnet	European Marine Observation and Data Network
Environmental Statement (ES)	The written output presenting the full findings of the Environmental Impact Assessment.
EUNIS	European Nature Information System
EUNIS habitat classification	A pan-European system which facilitates the harmonised description and classification of all types of habitat, through the use of criteria for habitat identification
FOCI	Features of Conservation Interest
gAFDW	grams Ash Free Dry Weight
Geographical Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.
GoBe	GoBe Consultants Ltd
GPS	Global Positioning System

GSD	Ground-Sampling Distance
HDD	Horizontal Directional Drilling
HRA	Habitat Regulations Assessment
IDA	Industrial Denatured Alcohol
Intertidal	The area of the shoreline which is covered at high tide and uncovered at low tide.
Joint Nature Conservation Committee (JNCC)	JNCC is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.
km	Kilometre
LNR	Local Nature Reserve
m	Metre
m^2	Square Metre
MEDIN	Marine Environmental Data and Information Network
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
mm	Millimetre
MNCR	Marine Habitat Classification for Britain and Ireland
MW	Megawatt
NERC	Natural Environment and Rural Communities
NMBAQC	National Marine Biological Quality Control
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
OEL	Ocean Ecology Ltd
Offshore	The sea further than two miles from the coast.
Offshore Wind Farm	An offshore wind farm is a group of wind turbines in the same location (offshore) in the sea which are used to produce electricity.
PfCO	Permission for Commercial Operations
φ	Phi
PSA	Particle Size Analysis
PSD	Particle Size Distribution

PRP	Processing Requirement Protocol
px	Pixel
Rampion 1	The existing Rampion Offshore Wind Farm located in the English Channel off the south coast of England.
RED	Rampion Extension Development Limited
RMSE	Root Mean Square Errors
RPQs	Qualified UAV Pilots
SE	Standard Error
SSSI	Site of Special Scientific Interest
sUAS	Small Unmanned Aerial Systems
TCE	The Crown Estate
UAV	Unmanned Aerial Vehicle
WoRMS	World Register of Marine Species
WTGs	Wind Turbines Generators

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Rampion 2
WIND FARM