Morecambe Offshore Windfarm: Generation Assets

Environmental Statement

Volume 5

Appendix 9.1 Benthic Characterisation Survey

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Morecambe Offshore Wind Farm Benthic Characterisation Survey Technical Report 2022

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7.7	Removed reference to shapefile appendix	65
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List of Abbreviations

AIS	Automatic Identification System
BSH	Broadscale Habitat
DDC	Drop Down Camera
EB	Environmental Baseline
EBS	Environmental Baseline Survey
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EUNIS	European Nature Information System
EQS	Environmental Quality Standards
FLOW	Floating Offshore Wind Farm
FOCI	Features of Conservation Interest
GPS	Global Positioning System
HA	Habitat Assessment
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MBES	Multibeam Echosounder
MCZ	Marine Conservation Zone
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MNCR	Marine Habitat Classification for Britain and Ireland
MOWF	Morecambe Offshore Wind Farm
NMBAQC	NE Atlantic Marine Biological Quality Control
OEL	Ocean Ecology Limited
OWL	Offshore Wind Limited

PAH	Polycyclic Aromatic Hydrocarbon
PEP	Project Execution Plan
PSA	Particle Size Analysis
PSD	Particle Size Distribution
SAC	Special Area of Conservation
SBE	Simply Blue Energy
SPA	Special Protection Area
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
THC	Total Hydrocarbons Content
TOC	Total Organic Carbon
TOM	Total Organic Matter
TPH	Total Petroleum Hydrocarbons
WTGs	Wind Turbines Generators

Non-Technical Summary

Introduction

Morecambe Offshore Windfarm is a proposed offshore windfarm located in the Northeast Irish Sea with an expected nominal capacity of 480 megawatts. Offshore Wind Ltd (OWL): a joint venture between Cobra Instalaciones y Servicios, S.A., and Flotation Energy plc, contracted Ocean Ecology Limited (OEL) to undertake a benthic characterisation survey of the Morecambe Offshore Windfarm site as there is a requirement for baseline information on the sediment quality and benthic habitats from within the proposed wind farm site to be collected to inform project design and the Environmental Impact Assessment.

Survey Strategy

50 stations were sampled first with Drop-Down Camera methods before sediment grab sampling using a 0.1m^2 Day Grab. Sediment samples were collected for particle size and macrobenthic analyses at all 50 stations, with a subset of 20 stations sampled for sediment contaminants. All survey work was conducted onboard the dedicated survey vessel *Seren Las*. An Ultra-Short Baseline System was used to provide accurate subsea positioning of sampling locations.

Sediments

Most sampling stations (27 of 50) were classified as Muddy Sand, however some variation in sediment type was observed between sampling stations whereby stations located towards the west and southwest of the windfarm site were characterised by slightly coarser sediments. Mean sediment grain size across the windfarm site ranged from 35.5 µm to 536.1 µm.

Relatively high Total Organic Carbon and Total Organic Matter content, by comparison to other stations sampled within this survey, was observed at stations located to the east of the windfarm site. Trace and heavy metal concentrations were overall low across the windfarm site with none of the metals analysed exceeding any of the reference level. In general metal concentrations were relatively higher to the east, closer to land than at stations further offshore, as seen for TOC and TOM. Among all Polycyclic Aromatic Hydrocarbons (PAHs), Naphthalene, Pyrene, Anthracene and Benzo[a]anthracene were the ones found to exceed reference levels at 5 to 6 stations. No other PAHs exceeded any reference levels. Stations with relatively elevated PAH concentrations also had relatively high TOC, TOM and metals concentrations. Total hydrocarbon concentration was also found to be relatively higher to the east of the survey area.

Macrobenthos

Macrobenthic assemblages identified across the Morecambe Offshore Windfarm site were made up of a total of 8,127 individuals and 189 different taxa. Most stations were characterised by the presence of *K. bidentata* which occurred in 88 % of samples. Other key taxa included the brittle star A*mphiura filiformis*, the polychaetes *Sthenelais limicola* and *Scalibregma inflatum*.

Macrobenthic abundance and diversity varied across the windfarm site however no obvious pattern was observed across stations.

EUNIS Habitats/Biotopes

Sediment particle size distribution and macrobenthic data clearly indicated the presence of two biotopes across the survey area: A5.252 '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' in the middle and to the east of the windfarm site, and A5.351 '*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida*' in circalittoral sandy mud' to the west of the windfarm site.

Annex I Habitats

No Annex I habitats were identified within the windfarm site.

Other Features of Interest

Large areas of the OSPAR threatened and/ or declining habitat 'Sea-pens and burrowing megafauna' were identified across the windfarm site within the EUNIS habitat A5.26. Sea-pens and burrowing megafauna is considered a priority habitat listed under Section 41 of the Natural Environment and Rural Communities Act 2006, as well as a Marine Conservation Zone Feature of Conservation Interest.

1. Introduction

1.1. Project Overview

Morecambe Offshore Windfarm (the Project) is a proposed offshore windfarm (OWF) located in the Northeast Irish Sea (Figure 1) with an expected nominal capacity of 480 megawatts (MW). The Project is being developed by Offshore Wind Limited (OWL): a joint venture between Cobra Instalaciones y Servicios, S.A., and Flotation Energy plc. The windfarm site is located approximately 30 km from the Lancashire coast, with water depths in the windfarm site ranging between 18 and 40 m.

1.2. Background Information

OWL contracted Ocean Ecology Limited (OEL) to undertake a benthic characterisation survey of the Project windfarm site as there is a requirement for baseline information on the sediment quality and benthic habitats from within the proposed windfarm site to be collected to inform project design and the Environmental Impact Assessment (EIA).

The Project export cable route is not included in this report and will be subject to a separate survey and consent process in association with the Project transmission assets. Therefore, all survey works covered in this report were located within the windfarm site.

1.3. Aims and Objectives

The key focus of the benthic characterisation survey was to provide accurate ground truthing to the geophysical data collected within the windfarm site in 2021 (provided to OEL by OWL) using a combination of Drop-Down Camera (DDC) and sediment grab sampling. As well as ground truthing the geophysical data, this survey will be used to characterise the environmental baseline and assign habitats across the site for the purpose of Environmental Impact Assessment (EIA).

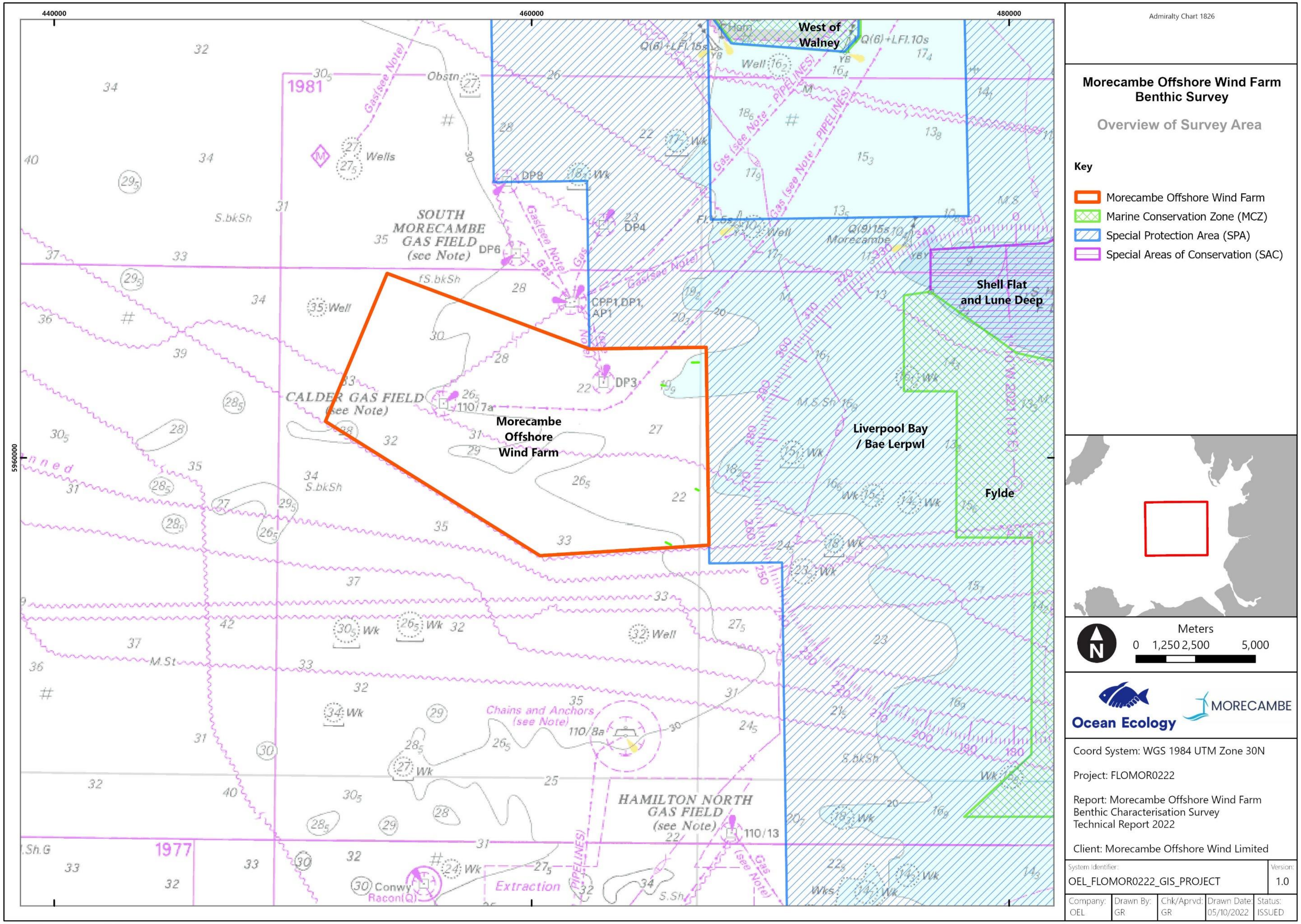

Figure 1 The location of the proposed Morecambe OWF site in the Northeast Irish Sea.

2. Designated Sites

The windfarm site is located to the immediate west of the Liverpool Bay / Bae Lerpwl Special Protection Area (SPA) with its northern and eastern boundaries adjoining but not intersecting that of the SPA (Figure 1). Liverpool Bay / Bae Lerpwl SPA is in the east of the Irish Sea, bordering the coastlines of north-west England and north Wales. The boundary of Liverpool Bay / Bae Lerpwl SPA extends beyond 12 nautical miles and therefore lies partly in Welsh and English territorial waters and partly in offshore waters.

The Liverpool Bay / Bae Lerpwl SPA is designated for the protection of red-throated diver (*Gavia stellata*), common scoter (*Melanitta nigra*), and little gull (*Hydrocoloeus minutus*) in the non-breeding season; common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*) in the breeding season, and as an internationally important waterbird assemblage.

Further to the east of the windfarm site are the Fylde Marine Conservation Zone (MCZ), and the Shell Flat and Lune Deep Special Area of Conservation (SAC) (Figure 1).

3. Existing Data

3.1. EMODnet Habitat Mapping

The EMODnet broad-scale seabed habitat map (EMODnet 2021) for Europe is a comprehensive, free and ready-to-use broad-scale map of physical habitats, harmonising mapping procedures and fostering a common understanding among seabed mappers in Europe. This indicates that the windfarm site is dominated by the following sediment habitats including European Nature Information System (EUNIS) classifications A5.25/A5.26 'Circalittoral fine sand' / 'Circalittoral muddy sand', A5.27 'Deep circalittoral sand', A5.35 'Circalittoral sand mud' and A5.37 'Deep circalittoral mud' (Figure 2).

3.2. Geophysical Data

Full coverage acoustic data was collected across the windfarm site during a geophysical survey campaign in 2021 and was provided to OEL in processed format for consideration during the survey design (see PEP, Appendix I). This included side-scan sonar (SSS) and multi-beam echosounder (MBES) bathymetry at 1 m resolution (Figure 3).

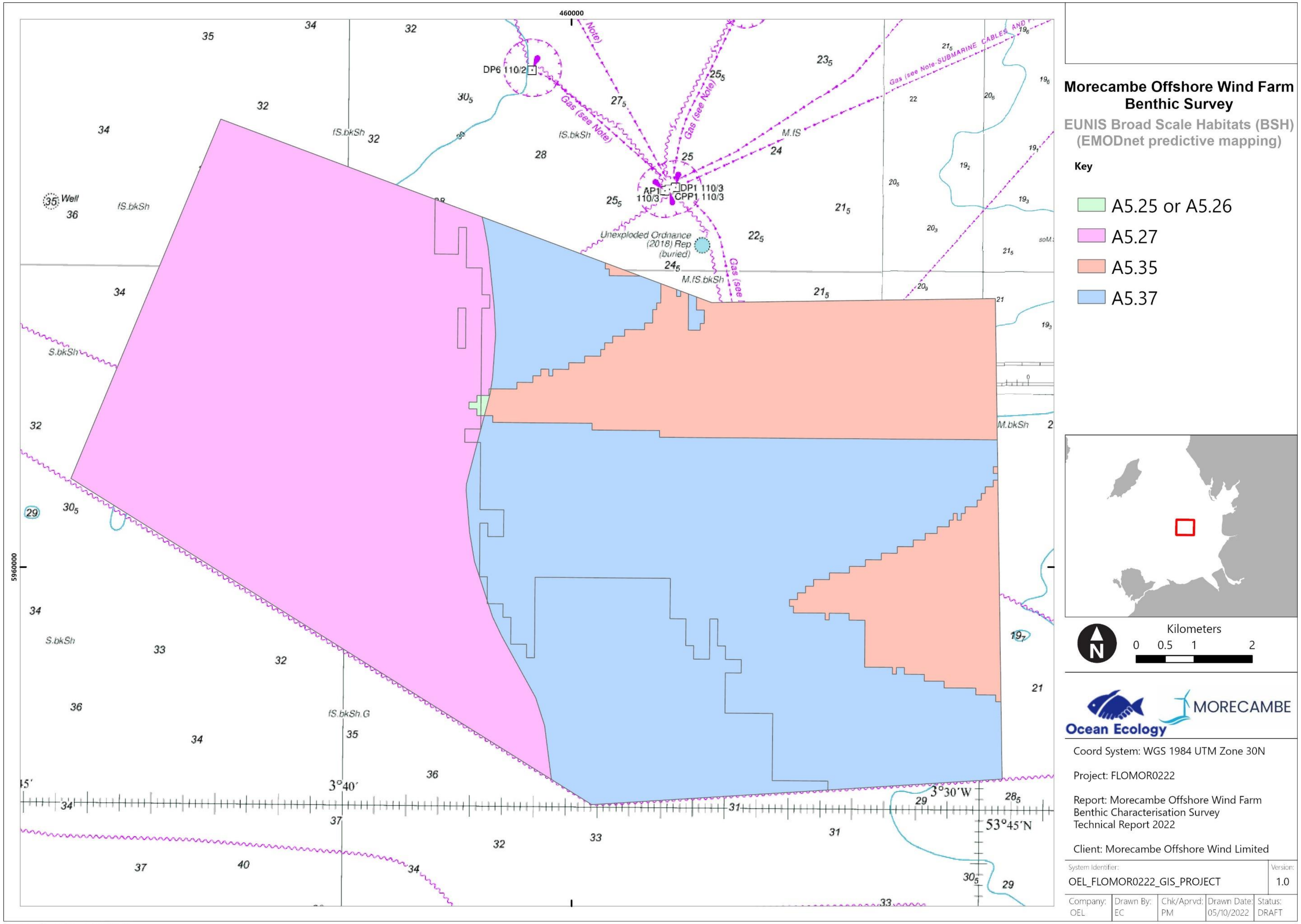

Figure 2 EMODnet predictive habitat mapping showing EUNIS BSH for the Morecambe OWF site.

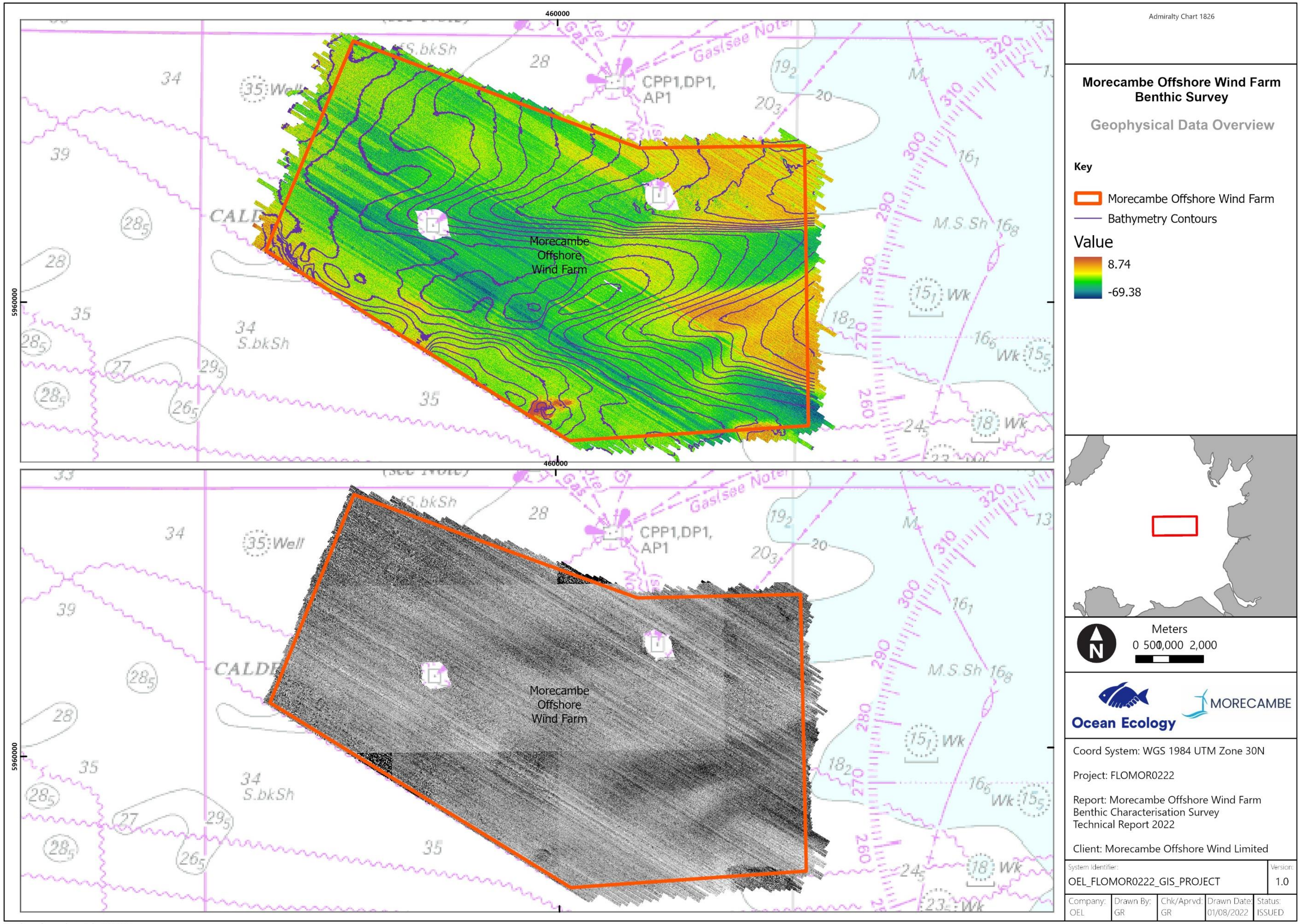

Figure 3 Overview of the Morecambe OWF site, results of the 2021 geophysical survey campaign (MBES and SSS) used to inform sampling design and identify features of interest for the DDC investigations.

4. Survey Design

4.1. Sampling Rationale

The benthic sampling plan was developed in line with Phase I of Natural England's (NE) "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards" (Natural England 2021a) to provide maximum geographic coverage of the proposed windfarm site, whilst also ensuring that all key habitats and communities likely to be encountered across the windfarm site were adequately targeted. The key principles underpinning the survey design were therefore to:

- Provide adequate spatial coverage of the windfarm site.
- Ensure representative sampling of all main sediment types was undertaken.
- Ensure representative examples of all potential features of conservation interest (e.g., Annex I reef) were adequately ground-truthed.

The sampling plan was produced based on a stratified sampling approach across the windfarm site with micrositing of sampling stations informed by a detailed review and interpretation of the outputs of the 2021 geophysical campaign and consideration for all surface, subsurface and subsea hazards and their respective exclusion / buffer zones. Table 1 lists sediment types present across the windfarm site as per EMODnet predicted Broad Scale Habitat (BSH) and targeted during the environmental survey.

Table 1 Overview of grab locations by predicted Broad Scale Habitat (BSH) and contaminant samples across the windfarm site.

Predicted BSH	No. of Grab Locations	No. of Contaminant Samples
A5.1 - Sublittoral Coarse Sediment	12	4
A5.2 - Sublittoral Sand	38	16
A5.2 - Sublittoral Sand / A5.1 - Sublittoral Coarse Sediment	1	1

The sampling plan was issued to and approved by OWL in the form of a Project Execution Plan (PEP) prior to the commencement of the survey (Appendix I). This PEP was also shared with regulatory stakeholders including NE and The Marine Management Organisation (MMO). Return comments were provided by NE however no comments were received from the MMO prior to the survey. Full details of the procedure and rationale for the design of the final sampling array is set out in the PEP, provided as Appendix I, and not repeated here. Responses to the NE and MMO comments received on the PEP and incorporated in this report are provided in Appendix XIX.

4.2. Summary of Sampling

In summary, the sampling array included:

- 50 stations sampled with a $0.1m^2$ Day grab with prior investigation by DDC. Samples collected were to be suitable for Particle-size distribution (PSD) and macrobenthic analyses. Only single PSD and faunal samples were required from each site.
- Contaminant samples taken at 20 selected sampling locations.
- DDC deployments undertaken at each grab location to: i) determine the suitability of the station for grab samples (i.e., no hazards or sensitive habitat) and ii) provide an indication of the epibenthos at each location.
- Four DDC transects across the site to ground truth geophysical data and identify any features of interest.

A summary of sampling stations is provided in Table 2 and presented spatially in Figure 4, Figure 5.

Table 2 Summary of sampling stations surveyed during the Morecambe OWF survey.

Station I.D.	Target Easting	Target Northing	Notes
ST01	459526.752	5956923.006	
ST02	461209.685	5957188.416	
ST03	462611.030	5957149.039	
ST04	464111.030	5957149.039	
ST05	465611.030	5957149.039	
ST06	466873.419	5956911.428	
ST07	455127.525	5959655.225	
ST08	456611.030	5959649.039	
ST09	464135.247	5964444.396	
ST10	459611.030	5959649.039	
ST11	461377.879	5958604.849	
ST12	462611.030	5959649.039	
ST13	464297.252	5959542.956	
ST14	465582.517	5958537.019	
ST15	466517.251	5959273.583	
ST16	452111.030	5962149.039	
ST17	453611.030	5962149.039	
ST18	455563.417	5961670.060	
ST19	458092.235	5961650.961	
ST20	459648.621	5961622.767	
ST21	461120.428	5961571.479	
ST22	462287.113	5963151.507	
ST23	464161.071	5962091.300	
ST24	465663.487	5962198.327	
ST25	467111.030	5962149.039	
ST26	453370.566	5964598.521	
ST27	455111.030	5964649.039	
ST28	456611.030	5964649.039	
ST29	458003.250	5964768.367	
ST30	459884.226	5964483.519	
ST31	461111.030	5964649.039	
ST32	455111.030	5967149.039	
ST33	-	-	DDC only – no permission to sample
ST34	463263.110	5958542.026	
ST35	462097.091	5956369.826	
ST36	453971.505	5966373.181	
ST37	456155.158	5965962.777	
ST38	463257.635	5961074.951	
ST39	459657.190	5963366.583	
ST40	466977.917	5962892.013	

Station I.D.	Target Easting	Target Northing	Notes
ST41	458167.160	5959119.766	
ST42	458536.783	5958351.464	
ST43	453474.193	5960836.048	
ST44	455242.801	5963558.811	
ST45	466045.552	5960487.933	
ST46	466787.669	5963994.446	
ST47	465505.971	5963037.928	
ST48	455363.366	5962442.488	
ST49	463631.928	5963230.410	
ST50	465249.064	5956469.728	
ST51	466934.211	5958665.120	Backup contaminant samples also taken at ST51 but not required for analysis.
TR01	465613.196	5956461.600	
TR02	467011.285	5964000.584	
TR03	465580.148	5963024.434	
TR04	459422.455	5956927.820	

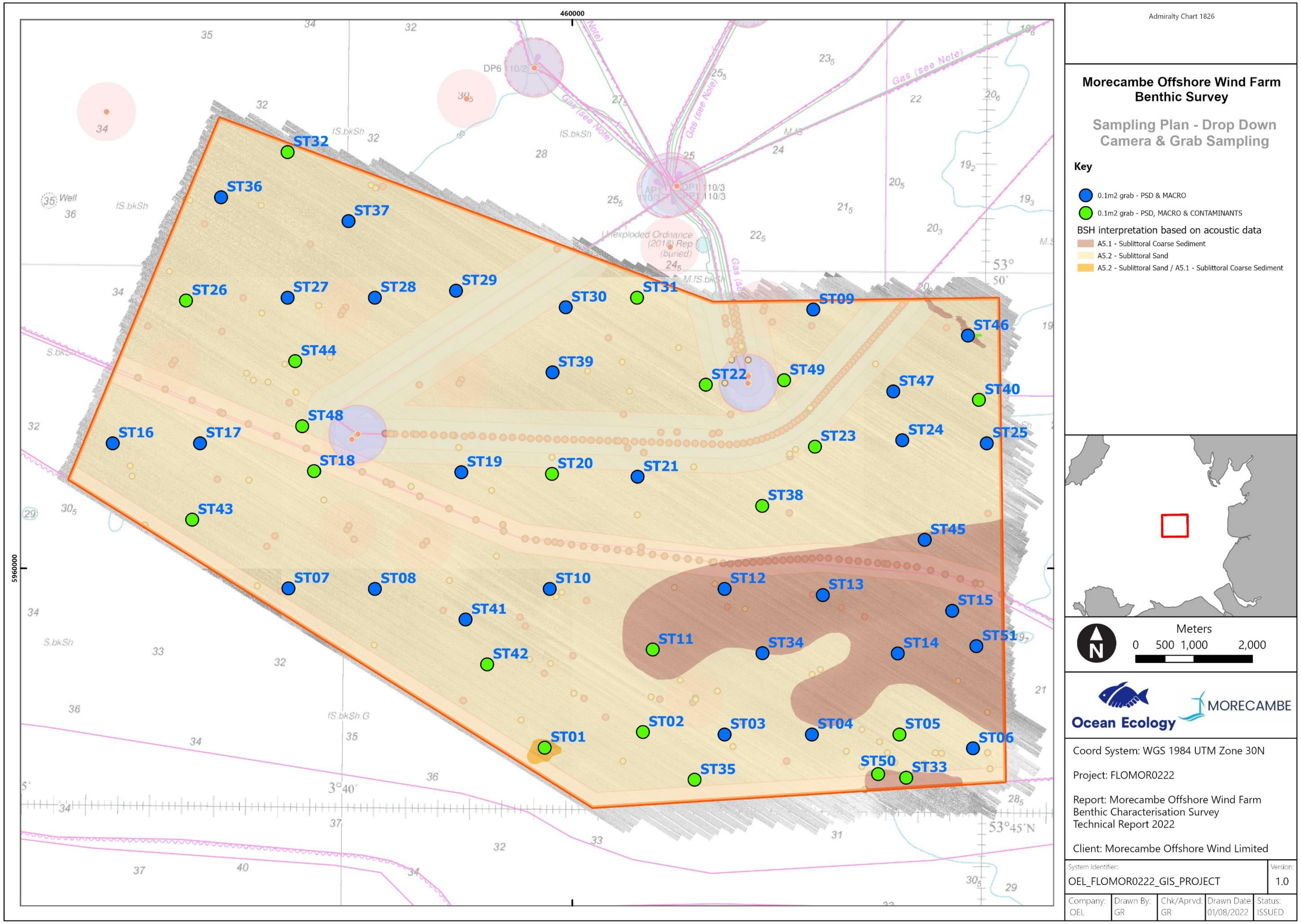

Figure 4 Locations of Morecambe OWF site DDC and grab sampling stations.

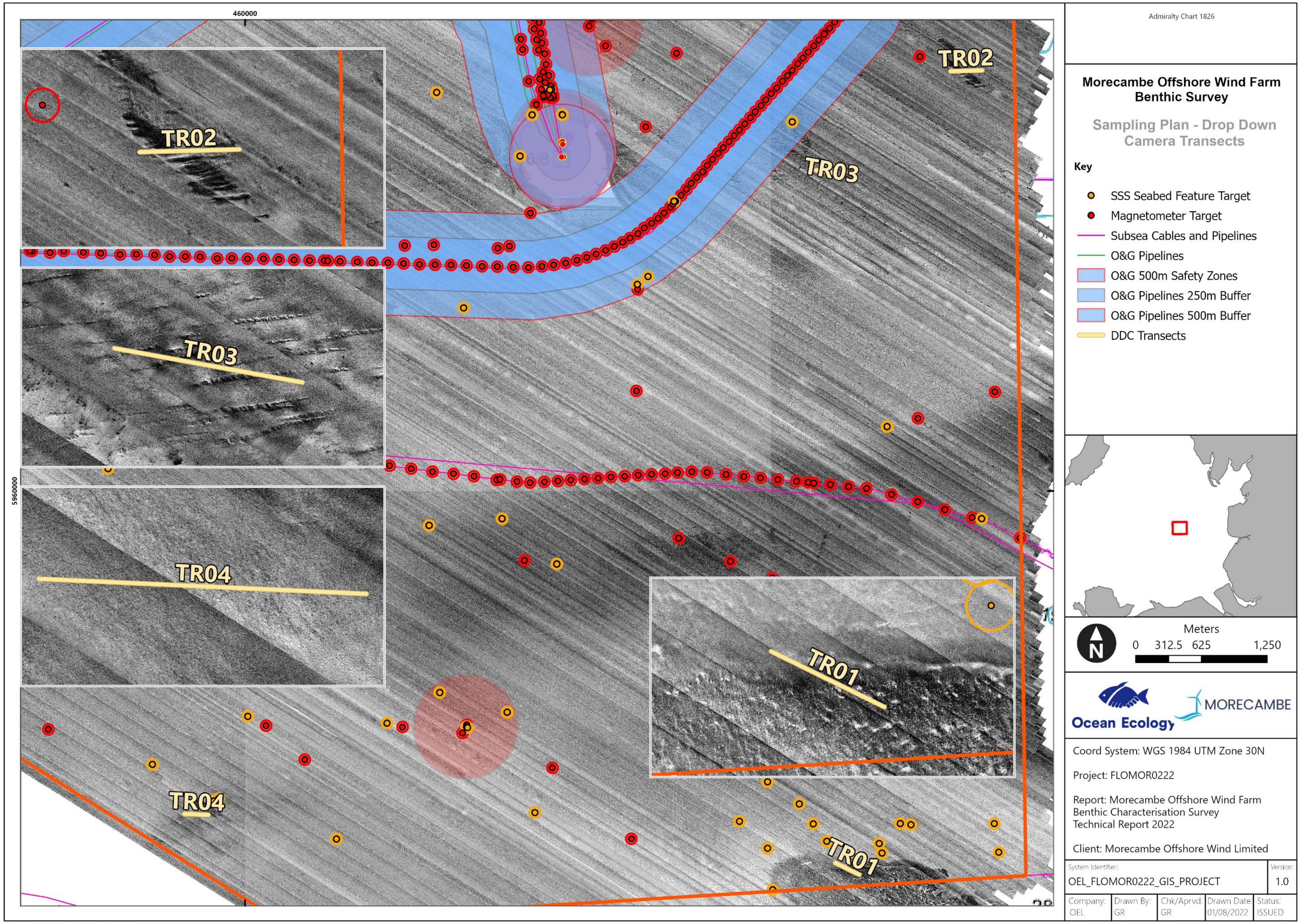

Figure 5 Locations of Morecambe OWF site DDC transects.

5. Field Methods

5.1. Survey Vessel

All sampling was conducted aboard OEL's dedicated 10.4 m Marine and Coastal Agency (MCA) category 2 coded survey vessel '*Seren Las*' (Plate 1). The vessel was equipped with a Hemisphere V104s GPS Compass system that provided a Global Positioning System (GPS) feed to a dedicated survey navigation PC operating EIVA NaviPac and TimeZero Navigator v4 marine navigation with routing module and SeaTraceR Class B AIS.

Plate 1 Nearshore survey vessel '*Seren Las*'.

5.2. Geodetic Parameters

All coordinates were based on World Geodetic System 1984 (WGS 1984) with projected grid coordinates based on Universal Transverse Mercator (UTM) zone 30N with a Central Meridian of 03˚W. A summary of geodetic and projection parameters is provided in Table 3.

Table 3 Geodetic parameters used during the survey.

Local geodetic Datum Parameters	
Datum	World Geodetic System 1984 (WGS 1984)
Spheroid	WGS 1984
Project Projection Parameters	
Grid Projection	Universal Transverse Mercator, Northern Hemisphere
UTM Zone	30 N
Central Meridian	03˚ 00′ 00″ West
Latitude of Origin	00˚ 00′ 00″ North
False Easting	500000.0 m
False Northing	0 m
Scale factor on Central Meridian	0.9996
Units	Metres

5.3. Survey Equipment

Table 4 Equipment utilised onboard the *Seren Las*.

Equipment	Model
Camera System	OEL's Rayfin PLE Camera System with freshwater housing
Grab System	OEL's 0.1 m^2 Day Grab
dGPS	Hemisphere V104s GPS Compass
Gyro Compass	Hemisphere V104s GPS Compass
Navigation Software	EIVA NaviPac V4.5
Subsea Positioning	Ultra-Short Baseline System (USBL) – AAE Nexus 2 Lite

5.3.1. Subsea Positioning

A vessel-based positioning system was employed utilizing EIVA NaviPac V4.5 software to ensure the accurate positioning of the vessel and subsea positioning of the sampling equipment. A navigation screen, displaying EIVA Helmsman Display was provided at the helm position of the vessel for the Vessel Skipper as well as for the ecologist/surveyor in the wheelhouse. An Ultra-Short Baseline (USBL) system was required due to deep water depths meaning the camera system was offset from the vessel's stern (i.e., the deployment point). The position of the sampling equipment was determined using a subsea beacon attached to the camera and grab frames when deployed from the stern A frame of *Seren Las*.

5.3.2. Drop-Down Camera Systems

Seabed imagery (simultaneous video and stills) were acquired along the DDC transects and stations using OEL's Rayfin PLE Camera System to collect High Definition (HD) video and high-resolution (up to 21 megapixels (MP)) still images. OEL's Rayfin PLE Camera System (Plate 2) consisted of a SubC Imaging Rayfin PLE camera, seabed frame equipped with freshwater housing (Jones et al. 2021), two LED strip lights, two 5kW green dot lasers (set to 10cm distance for scale), a 300m umbilical and topside computer. The camera was powered with the use of an Uninterruptable Power Supply (UPS) to ensure no damage was caused should the vessel lose power or cause a power surge. The freshwater housing was height and angle adjustable providing a variety of options for view, lighting, and focal length to maximise data quality with respect to prevailing conditions (e.g., high turbidity).

Plate 2 OEL's bespoke drop-down camera and deployment frame.

All DDC stations and transects were sampled in consideration of the Joint Nature Conservation Committee (JNCC) epibiota remote monitoring operational guidelines (Hitchin et al. 2015). At each screening DDC location, a minimum of two minutes of video footage and five seabed still images (of between 0.5m^2 to 1m^2 of seabed coverage depending on visibility) were obtained. Along each DDC transect, the camera was slowly 'flown' just above the seabed to ensure representative imagery was collected along the full transect with still images taken every 5-10 m along with continuous video recording. Where visibility was restricted, the camera was lowered gently on to the seabed. All footage underwent a preliminary review onboard by the OEL's marine ecologists.

5.3.3. Benthic Grab Sampling

A 0.1m^2 Day grab was used to obtain macrobenthic and PSD at each of the proposed grab sampling locations.

To ensure consistency in sampling, all grab samples were screened by the lead marine ecologist and considered unacceptable if:

- The sample was less than 5L. i.e., the sample represents less than half the 10L capacity of the grab used.
- The jaws failed to close completely or were jammed open by an obstruction, allowing fines to pass through (washout or partial washout).
- The sample was taken at an unacceptable distance from the target location (beyond 20m).
- There was obvious contamination of the sample from survey equipment, paint chips etc.

Samples with a volume less than 5L in muds or 2.5L in hard-packed sands were rejected and sampling at the location reattempted up to a maximum of three times. Attempts were made to obtain as much sample as possible by adjusting the amount of weight on the grab sampler. Under no circumstances was pooling of samples undertaken.

Grab Sample Processing (macrobenthos and PSA samples)

Initial grab sample processing was undertaken onboard the *Seren Las* in line with the following methodology:

- Initial visual assessment of sample size and acceptability made.
- Photograph of the unprocessed sample in sample hopper with station details and scale bar taken.
- Sub-sample removed for PSD analysis and transferred to a labelled tray.
- Remaining sample emptied onto 1.0 mm sieve net laid over 4.0 mm sieve table and washed through using gentle rinsing with seawater hose.
- Photograph of the sieved sample on 1.0 mm sieve net taken.
- Remaining sample for faunal sorting and identification backwashed into a suitable sized sample container and diluted 10 % formalin solution added to fix the sample prior to laboratory analysis.
- Sample containers clearly labelled internally and externally with date, sample ID and project name.

Grab Sample Processing (contaminant samples)

A separate grab was taken at a subset of 20 sampling stations for contaminant analysis using the following methodology:

- Inspection cover lifted and general assessment of sample size and acceptability made ensuring sediment surface is undisturbed and no obvious sign of contamination. NB ensure no grease, oils or lubes enter the sample once the inspection cover is open.
- pH / Redox probe placed into sediment sample and allowed to settle for 2 minutes before taking readings in field logs.
- Sediment samples were sub-sampled and decanted into the recommended sample containers provided by Société de Contrôles Techniques (SOCOTEC), the contaminant laboratory specialists, to undertake the MMO suite analysis for disposal at sea along with additional analyses, as summarised below:

    - Additional Metals: Ag, Te, Ba, Be, Ti, U, Mn, Sb, Co, Mo, Sn, Se, Tl, V
    - Total Organic Matter by Loss on Ignition (LOI)
    - Moisture Content

6. Laboratory and Analytical Methods

On arrival to the laboratory, all samples were logged in and entered into the project database created in OEL's web-based data management application ABACUS in line with in-house Standard Operating Procedures (SOPs) and OEL's Quality Management System (QMS).

6.1. Particle Size Distribution (PSD) Analysis

PSD analysis of sediment samples was undertaken by in-house laboratory technicians at OEL's MMO Validated laboratory.

6.1.1. Sample Preparation

Frozen sediment samples were first transferred to a drying oven and thawed at 80°C for at least 6 hours prior to visual assessment of sediment type. Before any further processing (e.g., sieving or sub-sample removal), samples were mixed thoroughly with a spatula and all conspicuous fauna (>1 mm) 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 wet screened over a 1mm sieve to sort coarse and fine fractions. Care was taken so as not to overload the sieve and allow continual flow of <1mm sediment through until the water run clear.

6.1.2. Dry Sieving

The >1 mm 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 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 5.

Table 5. 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.

6.1.3. Laser Diffraction

The fine fraction residue (<1 mm sediments) was 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.

6.1.4. Data Merging

The dry sieve and laser data were then merged for each sample with the results expressed as a percentage of the whole sample at 0.5 φ intervals from -5.5 (45 mm) to >14.5 (<0.04 μm). Once data was merged, size classifications were presented in the MMO Template and PSD statistics and sediment classifications were generated from the percentages of the sediment determined for each sediment fraction using Gradistat v9.1 software.

Sediments were also described by their size class based on the Wentworth classification system (Wentworth 1922) (Table 6). 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 6. Classification used for defining sediment type based on the Wentworth Classification System (Wentworth 1922).

Wentworth Scale	Phi Units (φ)	Sediment Types
>64 mm	<-6	Cobble and boulders
32 – 64 mm	-5 to -6	Pebble
16 – 32 mm	-4 to -5	Pebble
8 – 16 mm	-3 to -4	Pebble
4 - 8 mm	-3 to -2	Pebble
2 - 4 mm	-2 to -1	Granule
1 - 2 mm	-1 to 0	Very coarse sand
0.5 - 1 mm	0 – 1	Coarse sand
250 - 500 µm	1 – 2	Medium sand
125 - 250 µm	2 – 3	Fine sand
63 - 125 µm	3 – 4	Very fine sand
31.25 – 63 µm	4 – 5	Very coarse silt
15.63 – 31.25 µm	5 – 6	Coarse silt
7.813 – 15.63 µm	6 – 7	Medium silt
3.91 – 7.81 µm	7 – 8	Fine silt
1.95 – 3.91 µm	8 – 9	Very fine silt
<1.95 µm	<9	Clay

6.2. Sediment Chemical Analysis

All sediment chemistry analysis was undertaken by UKAS accredited and MMO Validated laboratory SOCOTEC UK Limited. A full description of the methods used to test for each chemical determined is provided as Appendix II.

6.2.1. Hydrocarbons

Indices and ratios were calculated to assess source origin of hydrocarbons in the sediment sampled across the Morecambe OWF site (Ines et al. 2013, Aly Salem et al. 2014, Al-hejuje et al. 2015). Generally, there are three sources of hydrocarbons depending on their origin: biogenic, petrogenic and pyrogenic. Hydrocarbons of biogenic origin are the produce of biological processes or early diagenesis in marine sediments (e.g., perylene) (Venkatesan 1988, Junttila et al. 2015). Hydrocarbons of petrogenic origin are the compounds present in oil and some oil products following low to moderate temperature diagenesis of organic matter in sediments resulting in fossil fuels. Hydrocarbons of pyrogenic origin are the product of incomplete combustion of organic material (Page et al. 1999, Junttila et al. 2015), such as forest fires and incomplete combustion of fossil fuels.

Based on polycyclic aromatic hydrocarbon (PAH) compounds the following ratios were calculated as follows:

The ratio between light (LMW) and heavy molecular weight (HMW) PAHs is typically used as a proxy to determine the origin source of PAH compounds in sediments, ratios above 1 indicate a petrogenic source while ratios below 1 indicate a pyrogenic source. LMW PAHs include compounds with 2-3 rings while HMW PAHs include compounds with more than 4 rings (Edokpayi et al. 2016).

Phenanthrene / Anthracene ratio: values lower than 10 indicate a pyrogenic source origin for the hydrocarbons; while values higher than ten account for hydrocarbons of petrogenic origin (Kafilzadeh et al. 2011).

Fluoranthene / Pyrene ratio: for values higher than one, the hydrocarbons are pyrogenic in origin, for values below one, the hydrocarbons are petrogenic in origin (Kafilzadeh et al. 2011).

6.2.2. Heavy and Trace Metals

A total of eight main heavy and trace metals were analysed from sediments taken at each of the 20 stations sampled. These were Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn). An additional 14 heavy and trace metals were analysed in support of the above measurements.

Where available, mean metal concentrations were compared to the OSPAR Background Assessment Concentration (BAC) (OSPAR et al. 2009), the USA Environmental Protection Agency (EPA) Effect Range Low (ERL) (NJDEP 2009), (DEFRA 2003) Action Level (AL) 1 and AL 2, and the Canadian sediment quality guideline (CSQG) Threshold Effect Level (TEL) and Probable Effect Level (PEL) (CCME 2001). To note that ERL, TEL and PEL are based on field research programmes based on North American data that have demonstrated associations between chemicals and biological effects by establishing cause and effect relationships in particular organisms (CCME 2001). This means they provide a measure of environmental toxicity compared to the other reference levels which instead provide information on the degree of contamination of the sediments. At levels above the TEL, adverse effects may occasionally occur, whilst at levels above the PEL, adverse effects may occur frequently; concentrations below the ERL rarely cause adverse effects in marine organisms. Additionally, the TEL has been adopted as the International Sediment Quality Guideline (ISQG) (CCME 2001), while ERL has been adopted by OSPAR to assess the ecological significance of contaminant concentrations in sediments, where concentrations below the ERL rarely cause adverse effects in marine organisms. For these reasons ERL, TEL and PEL are presented here as reference values despite being based on North American data.

BACs were developed to assess the status of contaminant concentrations in sediment within the OSPAR framework with concentrations significantly below the BAC considered to be near background levels for the North-East Atlantic. Cefas ALs are used as part of a 'weight of evidence' approach to assessing dredged material and its suitability for disposal to sea ((DEFRA 2003).

Contaminant levels in dredged material which fall below AL1 are of no concern and are unlikely to influence decision-making, while contaminant levels above AL2 are generally considered unsuitable for at-sea disposal.

6.3. Macrobenthic Analysis

All elutriation, extraction, identification and enumeration was undertaken at OEL's NMBAQC scheme participating laboratory in line with the NMBAQC Processing Requirement Protocol (PRP) (Worsfold & Hall 2010a). All processing information and macrobenthic records were recorded using OEL's cloud-based data management application 'ABACUS' that employs MEDIN[1] validated controlled vocabularies ensuring all sample information, nomenclature, qualifiers and metadata are recorded in line with international data standards.

For each macrobenthic sample, the excess formalin was drained off into a labelled container over a 1 mm mesh sieve in a well-ventilated area. The samples were then re-sieved over a 1 mm 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 1 mm mesh sieve, transferred into a Nalgene and preserved in 70 % Industrial Denatured Alcohol (IDA). The remaining sediment from each sample was subsequently separated into 1 mm, 2 mm and 4 mm fractions and sorted under a stereomicroscope to extract any remaining fauna (e.g., high-density bivalves not 'floated' off during elutriation). All macrobenthos present was identified to species level, where possible, and enumerated by trained benthic taxonomists using the most up to date taxonomic literature and checks against existing reference collections. Nomenclature utilised the live link within ABACUS to the WoRMS[2] REST webservice, to ensure the most up to date taxonomic classifications were recorded. Colonial fauna (e.g., hydroids and bryozoans) were recorded as present (P). For the purposes of subsequent data analysis, taxa recorded as P were given the numerical value of 1.

Following identification, all specimens from each sample were pooled into five major groups (Annelida, Crustacea, Mollusca, Echinodermata and Miscellaneous taxa) in order to measure blotted wet weight major group biomass to 0.0001g. As a standard, the conventional conversion factors as defined by (Eleftheriou & Basford 1989) were applied to biomass data to provide equivalent dry weight biomass (Ash Free Dry Weight, AFDW). The conversion factors applied are as follows:

- Annelida = 15.5 %
- Crustacea = 22.5 %
- Mollusca = 8.5 %
- Echinodermata = 8.0 %
- Miscellaneous = 15.5 %

[1] Marine Environmental Data and Information Network
[2] http://www.marinespecies.org

6.4. Macrobenthic Data Analysis

6.4.1. Data Truncation and Standardisation

The macrobenthic species list was checked using the R package '*worms*' (Holstein 2018) to check against WoRMS taxon lists and standardise species nomenclature. Once the species nomenclature was standardised in accordance with WoRMS accepted species names, the species list was examined carefully by a senior taxonomist to truncate the data, combining species records where differences in taxonomic resolution were identified.

6.4.2. Pre-Analysis Data Treatment

All data were collated in excel spreadsheets and made suitable for statistical analysis. All data processing and statistical analysis was undertaken using R v 1.2 1335 (R Core Team 2020) and PRIMER v7 (Clarke & Gorley 2015) software packages.

In accordance with the OSPAR Commission guidelines (OSPAR 2004) records of colonial, meiofaunal, parasitic, egg and pelagic taxa (e.g. epitokes and larvae) were recorded, but were excluded when calculating diversity indices and conducting multivariate analysis of community structure. Newly settled juveniles of macrobenthic species may at times dominate the macrobenthos, however the OSPAR (2004) guidelines suggest they should be considered an ephemeral component due to heavy post-settlement mortality and not therefore representative of prevailing bottom conditions (OSPAR 2004). OSPAR (2004) further states that "Should juveniles appear among the ten most dominant organisms in the data set, then statistical analyses should be conducted both with and without these in order to evaluate their importance". As juveniles of Amphiuridae and Pectinariidae appeared in the top ten most dominant taxa across the windfarm site, a 2STAGE analysis was conducted to compare the two data sets (with and without juveniles) which revealed a high level of similarity (~98.7 %) between the two and therefore juveniles were retained in the dataset for all further analyses and discussion.

In accordance with NMBAQC PRP (Worsfold & Hall 2010b), Nematoda were recorded during the macrobenthic analysis and included in all datasets for all further analyses and discussion.

6.4.3. Univariate Statistics

The '*diverse*' function in PRIMER was used to calculate species diversity indices for macrobenthic data. These univariate indices enable the reduction of large datasets into useful metrics which can be used to describe and compare community structures:

- Number of Species (S): the number of species present in a sample, with no indication of relative abundances.
- Number of individuals (N): total number of individuals counted.

6.4.4. Multivariate Statistics

Multivariate analysis was undertaken in consideration of best practice guidance (Noble-James et al. 2018) and NE's (2021) Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards - Phase I (Natural England 2021b). Prior to multivariate analyses data were displayed as a shade plot with linear grey-scale intensity proportional to macrobenthic abundance (Clarke et al. 2014) to determine the most efficient pre-treatment method. Macrobenthic abundance data from grab samples was square root transformed to prevent taxa with intermediate abundances from being discounted from the analysis.

The PRIMER v7 software package (Clarke & Gorley 2015) was utilised to undertake the multivariate statistical analysis on the biotic macrobenthic dataset. To fully investigate the multivariate patterns in the biotic data, macrobenthic assemblages were characterised based on their community composition, with hierarchical clustering used to identify groupings of sampling stations that could be grouped together as a habitat type or community. SIMPER analysis was then applied to identify which taxa contributed most to the similarity within that habitat type or community. A detailed description of analytical routines is provided in Appendix III.

6.5. Determining EUNIS Classifications

Macrobenthic assemblages were characterised based on their community composition, with hierarchical clustering used to identify groupings of sampling stations that could be grouped together as a habitat type or community. Setting these groupings as factors within PRIMER, SIMPER analysis was then applied to identify which taxa contributed the most to the similarity within that community. EUNIS classifications were then assigned based on the latest JNCC guidance (Parry 2019).

6.6. Seabed Imagery Analysis

Digital photographic stills and video footage were successfully obtained at all DDC stations and along all DDC transects and subsequently analysed to aid in the identification and delineation of EUNIS habitats and potential Annex I habitats and other features of interest within the windfarm site.

All seabed imagery analysis was undertaken using the Bio-Image Indexing and Graphical Labelling Environment (BIIGLE) annotation platform (Langenkämper et al. 2017) and in line with JNCC epibiota remote monitoring interpretation guidelines (Turner et al. 2016) with consideration of the latest NMBAQC/JNCC Epibiota Quality Assurance Framework (QAF) guidance and identification protocols.

Analysis of still images was undertaken in two stages. The first stage, “Tier 1”, consisted of labels that referred to the whole image being assigned, providing appropriate metadata for the image. Depending on the reef type, this included:

- Extent: As it is not possible to fully determine the extent of reef habitats from a single image alone this label was used to identify areas that were highly unlikely to constitute reef habitats. An example being an image that shows a large boulder being preceded and succeeded by images of unconsolidated sandy sediments.
- Biota: Labels assigned to determine whether epifauna dominate the biological community observed.
- Elevation: Labels assigned depending on reef type. Laser points were used to assist in the assignment of categories.

The second stage, “Tier 2”, was used to assign percentage cover of ‘reef’ types by drawing polygons to inform the habitat assessment process.

6.6.1. Annex I Habitat Assessment

A full reef habitat assessment was conducted on all images to determine whether habitats met the definitions of Annex I geogenic and biogenic *Sabellaria spinulosa* reef habitats as detailed in Table 7 and Table 8 and in consideration of the JNCC guidance for Annex I low resemblance stony reef (Golding et al. 2020). The annotation label tree used during analysis had major headings for each of reef type. Under each reef type labels were assigned for each of the categories required to determine whether reef habitat was present.

There are currently no guidelines for assessing the quality (‘reefiness’) of bedrock reef habitats, however extent and cover were used to determine areas of bedrock reef as suggested by (Golding et al. 2020). The annotation label tree in BIIGLE was assigned major headings for each reef type: stony reef, bedrock reef and biogenic reef. Under each reef type, labels were assigned for each of the categories required to determine whether reef habitat was present as per the tables below.

Table 7 Characteristics of stony reef (Irving 2009).

Characteristic	‘Reefiness’			
	Not a Reef	Low	Medium	High
Composition (proportion of boulders/cobbles (>64 mm))	<10 %	10-40 % matrix supported	40-95 %	>95 % clast-supported
Elevation	Flat seabed	<64 mm	64 mm - 5 m	>5 m
Extent	<25 m^2	>25 m^2		
Biota	Dominated by infaunal species	>80 % of species present composed of epibiotal species		

Table 8 Characteristics of *Sabellaria* spinulosa reef (Gubbay 2007).

Characteristic	'Reefiness'			
	Not a Reef	**Low**	**Medium**	**High**
Elevation (cm)	< 2	2 - 5	5 – 10	> 10
Extent (m^2)	< 25	25 – 10,000	10,000 – 1,000,000	> 1,000,000
Patchiness (% Cover)	< 10	10 - 20	20 – 30	> 30

6.6.2. Seapen and Burrowing Megafauna Assessment

Areas deemed to meet the criteria of the FOCI/OSPAR Seapens and burrowing megafauna, as per Robson (Robson 2014), were further assessed to determine the density of burrows, burrowing megafauna and seapens (if present). Burrows, megafauna and seapens were annotated using point annotations, with burrows being split based on width. Field of view was used to determine density per m^2, which was calculated for each image using BIIGLEs in built field of view calculation function.

6.7. Habitat/Biotope Mapping

All mapping processes was conducted in ESRI ArcPro Version 2.9. All seabed imagery assigned a EUNIS habitat in BIIGLE based on the latest JNCC guidance (Parry 2019) was utilised alongside the acoustic information and ground-truthed data from the grab samples to manually delineate the boundaries (polygons) of the various habitats and biotopes encountered across the survey area. Confidence scores were assigned to each polygon to give an indication of their accuracy. A value of 1 (low confidence) or 2 (high confidence) was assigned depending on the following:

- Whether ground-truth data was available within the polygon
- Whether multiple data sources confirmed/suggested the presence of the same habitat/biotope within a polygon
- Whether the boundaries of the habitat/biotope were clearly defined either by seabed imagery, ground-truth or acoustic data

Highest scores were given to polygons where all data sources identified the same habitat/biotope, with distinct boundaries. Lower scores were assigned to polygons where ground-truth data was limited, and boundaries not obvious. In these cases, polygons were drawn based upon expert judgement, given the information available.

7. Results

A total of 50 successful grab samples were collected during the survey. ST33, a proposed DDC and grab location was located within 250m of the LANIS I subsea cable for which permission to sample was not received by the asset owner in time for the survey. Therefore, only seabed imagery was obtained at ST033 and a pre-determined backup grab location (ST51) was sampled for both DDC and grab. Full DDC and grab field logs are provided in Appendices IV, V and VI. Grab images are provided in Appendix VII.

7.1. Particle Size Distribution Data

7.1.1. Sediment Type

Full raw PSD data for each sampling station is provided in Appendix VIII. Sediment types at each sampling station as classified by the (Folk 1954) classification are summarised in Appendix IX and illustrated in Figure 6. Some variation in sediment type was observed between sampling stations, with stations located towards the west and southwest of the array having slightly coarser sediments. Specifically, 27 sediment samples consisted of Muddy Sand (mS), seven of Sand (S) and seven of Slightly Gravelly Sand ((g)S), six of Slightly Gravelly Muddy Sand ((g)mS), and one each of Gravelly Muddy Sand (gmS) and Sandy Mud (sM). Figure 7 maps the distribution of these sediment types across the Morecambe OWF site.

Most of the sediments recorded were classified as very poorly to poorly sorted (78 % of stations) due to the mixed composition of different size fractions of all three principal sediment types (gravel, sand, and mud). However, 11 of the samples made of Sand and Slightly Gravelly Sand were classified as moderately to moderately well sorted.

7.1.2. Sediment Composition

Mean sediment grain size (μm) across the windfarm site ranged between 35.5 μm at station ST45 and 536.1 μm at station ST01 (Figure 9). A clear spatial pattern was evident in the distribution of mean grain size across the windfarm site with finer sediment characterising the eastern portion of the windfarm site and coarser sediment characterising the western part of the windfarm site.

Percentage contribution of gravel (> 2 mm), sand (> 63 μm < 2 mm), and mud (< 63 μm) are presented by station in Figure 9. Sand dominated across all stations but station ST45 where mud dominated. Other stations with notable mud contributions were stations ST25 and ST38, while gravel content was relatively high at station ST01. The mean (± SE) proportion of sand across all survey stations was 81.01 ± 2.03 %, mean (± SE) gravel content was 0.51 ± 0.41 % and mean (± SE) mud content was 18.46 ± 2.05 %.

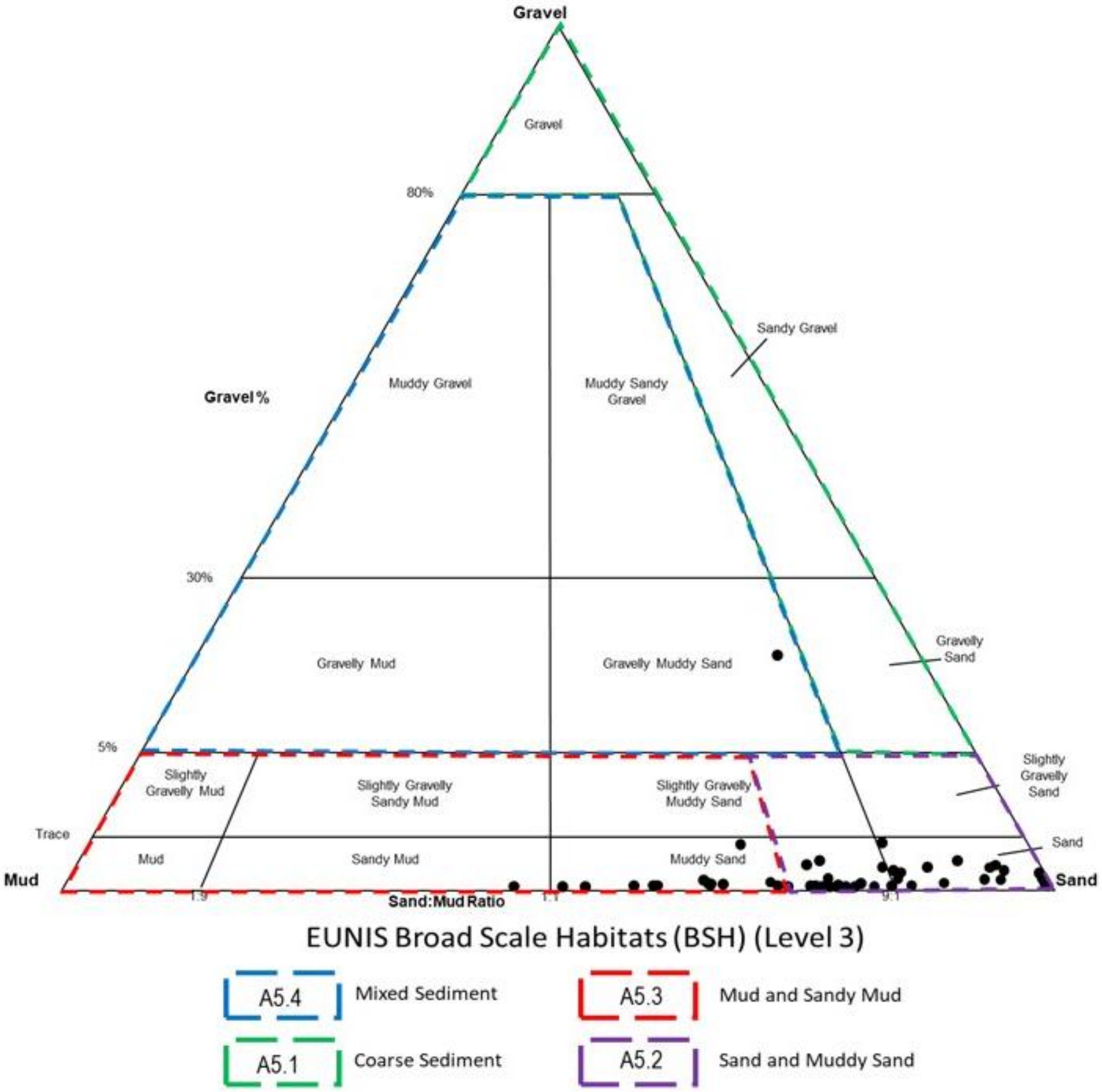

Figure 6 (Folk 1954) triangle classifications of sediment gravel percentage and sand to mud ratio of samples collected across the Morecambe OWF site.

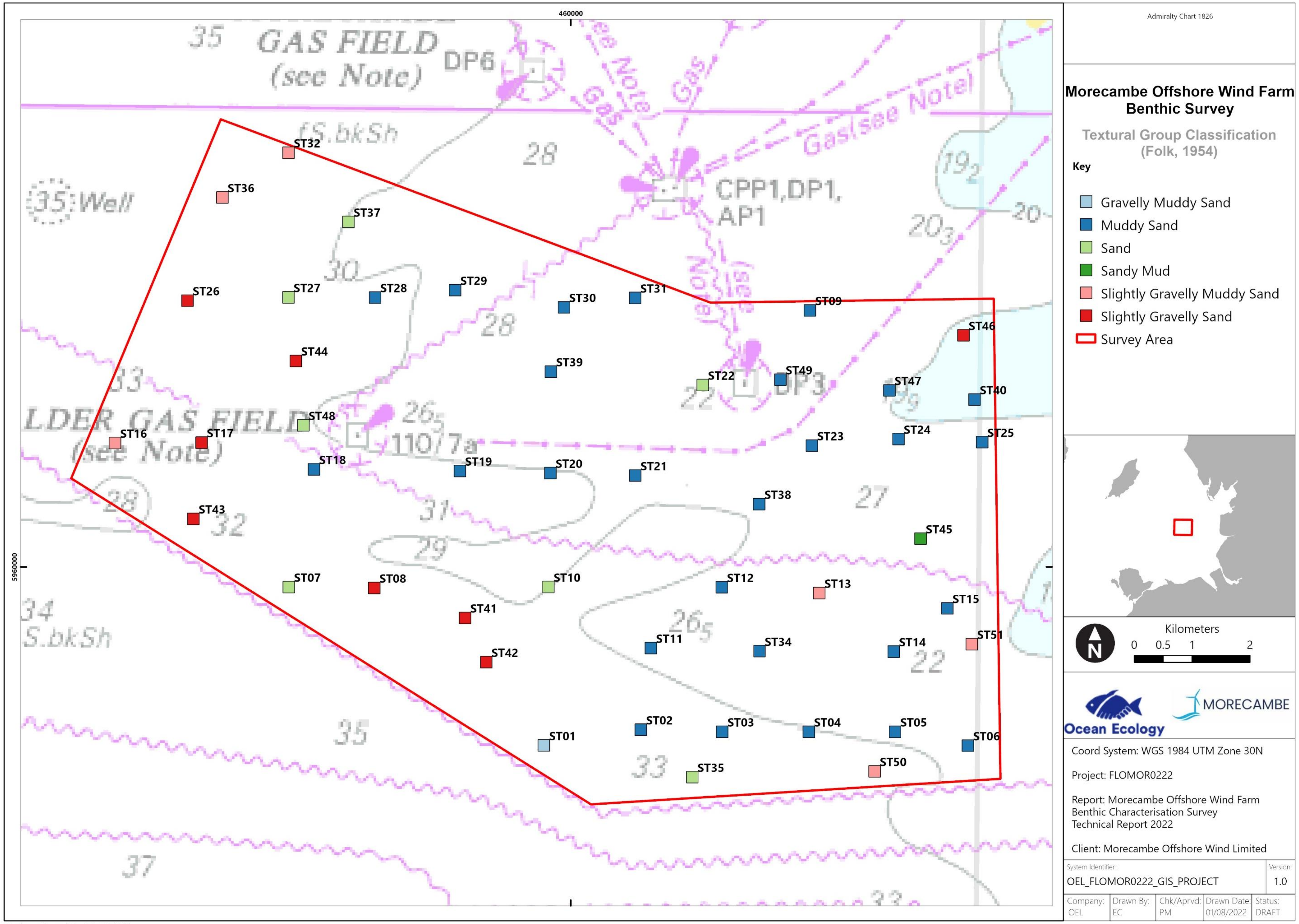

Figure 7 (Folk 1954) sediment types as determined from PSD analysis of samples.

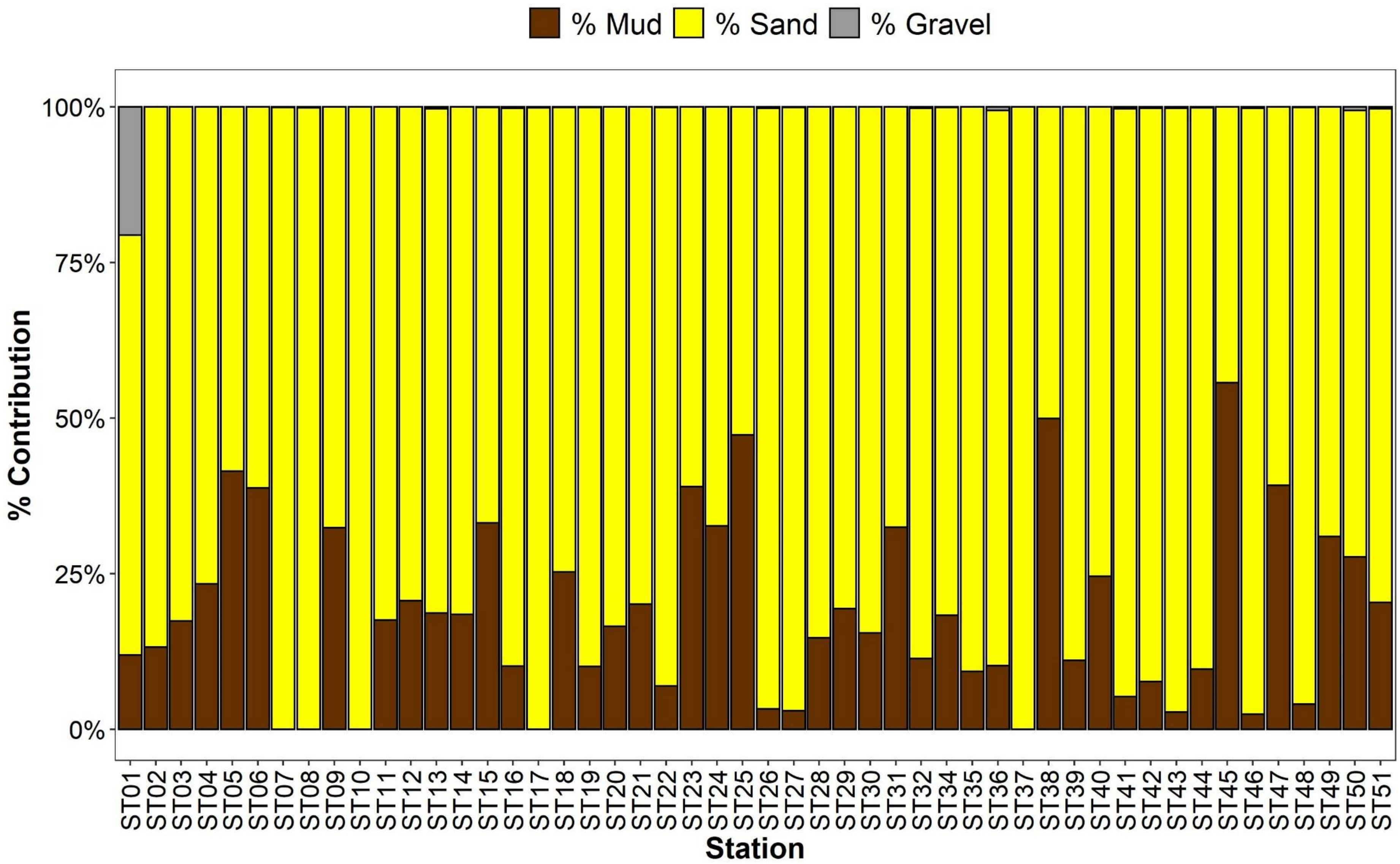

Figure 8 Principal sediment components (Gravel, Sand, Mud) as determined from PSD analysis of stations sampled across the Morecambe OWF site.

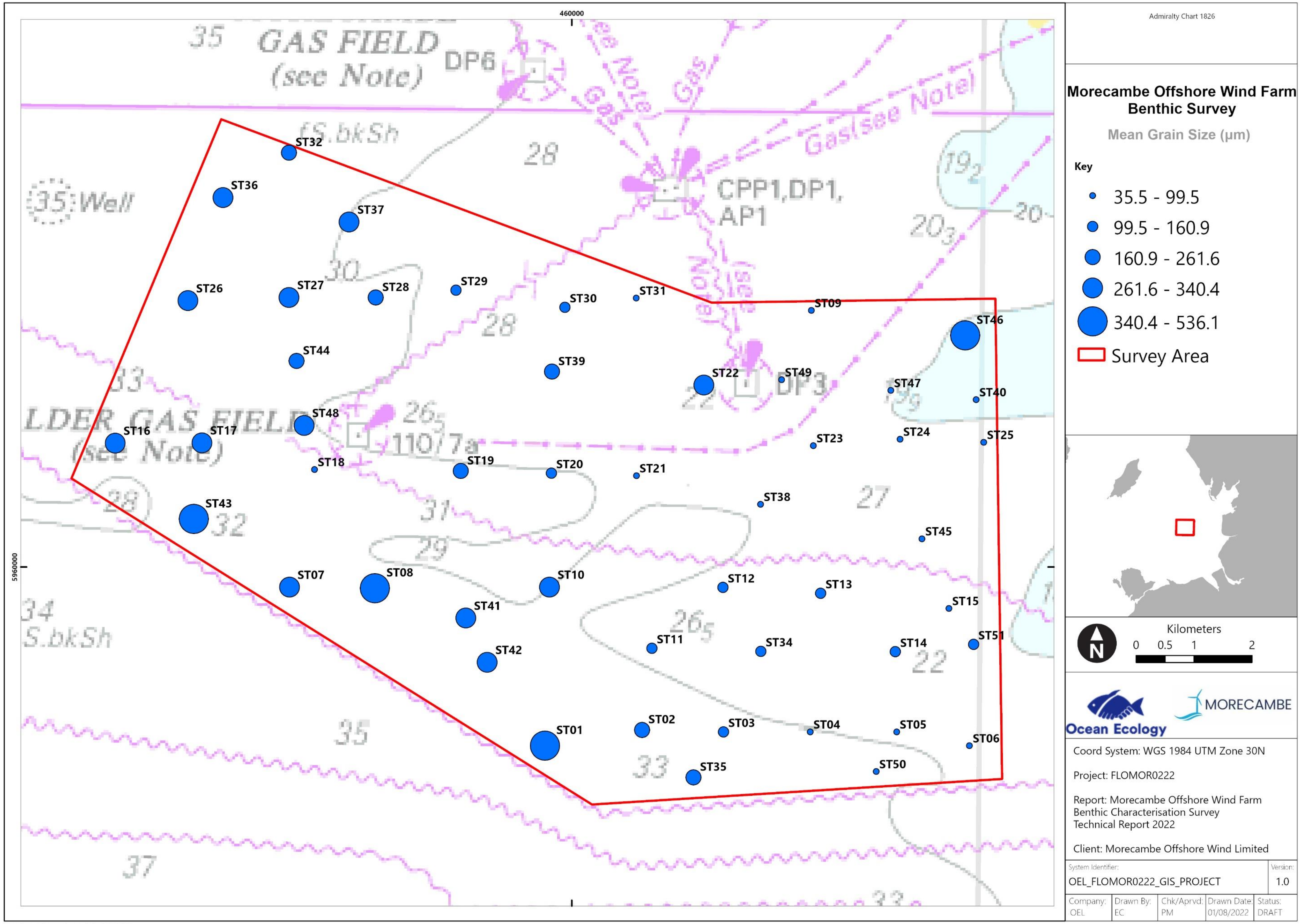

Figure 9 Comparison of mean sediment grain size (µm) of sediment samples.

7.2. Sediment Chemistry

Sediment samples for chemical analysis were collected from 20 stations sampled across the windfarm site. Grab samples taken for chemical analyses were analysed for Total Organic Carbon (TOC) and Total Organic Matter (TOM) (Section 7.2.1), heavy and trace metals (Section 7.2.2), Polycyclic Aromatic Hydrocarbon (PAH) and Total Hydrocarbon Content (THC) (Section 7.2.3), Organotins (Section 7.2.4) and Polychlorinated Biphenyls (PCBs) (Section 7.2.5). Raw sediment chemistry data are provided in Appendix X.

7.2.1. Total Organic Carbon (TOC) and Total Organic Matter (TOM)

TOC concentrations ranged from 0.07 % at ST43 to 0.46 % at ST38 with an average value (± SE) of 0.20 ± 0.03 % across the windfarm site (Figure 10). In general, relatively higher TOC values were recorded at stations located in the eastern reaches of the windfarm site, compared to the stations located to the west and more offshore.

TOM content in sediment varied between 0.7 % at stations ST26 and ST49 and 2.53 % at ST38, with an average value (± SD) of 1.36 ± 0.12 % across the windfarm site (Figure 11). A pattern like that observed for TOC was also seen for TOM with the highest TOM content at stations located in the eastern reaches of windfarm site.

No trend was observed between mud content in the sediment and percentage contribution of TOC or TOM.

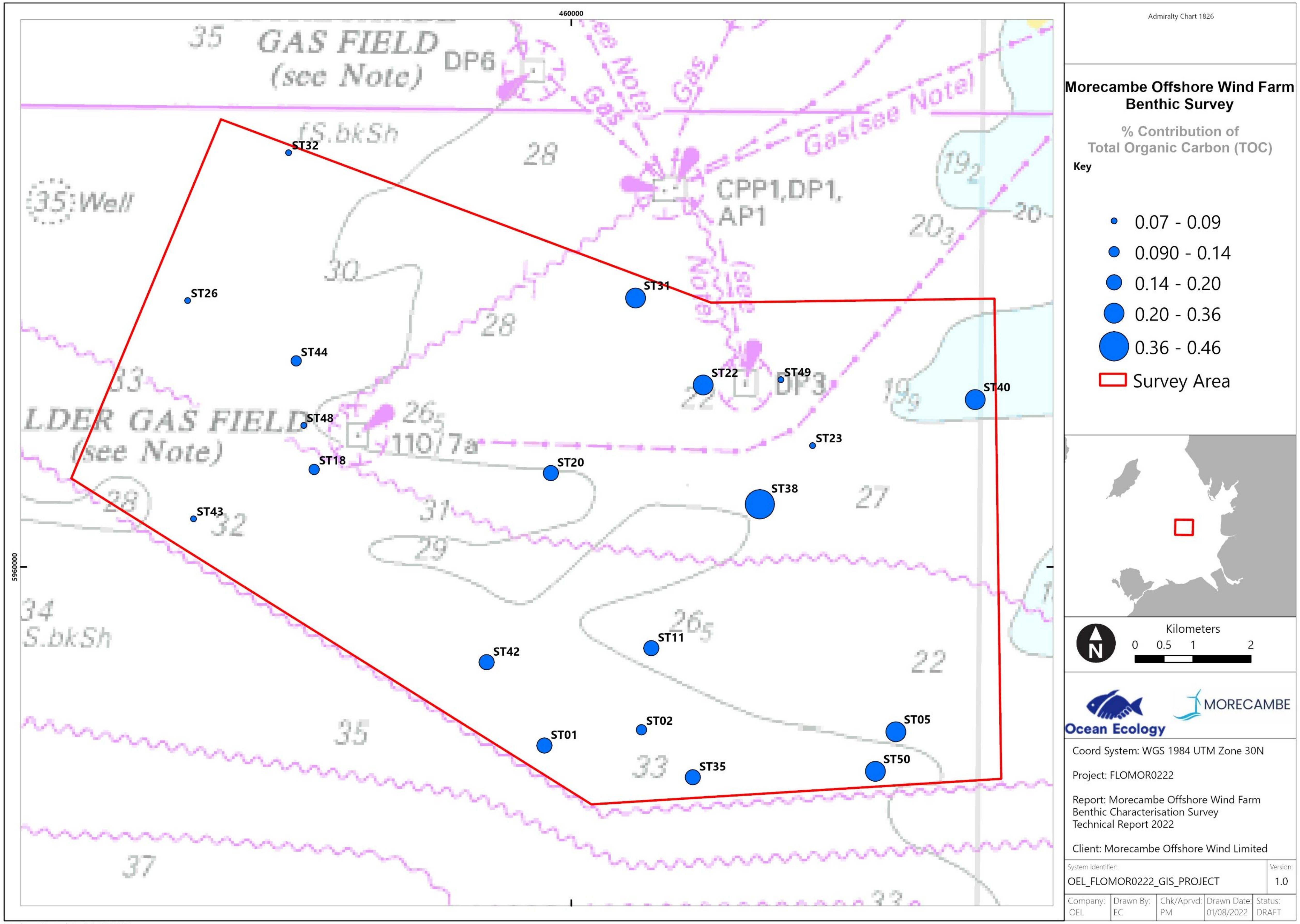

Figure 10 Percentage contribution of TOC across the Morecambe OWF site.

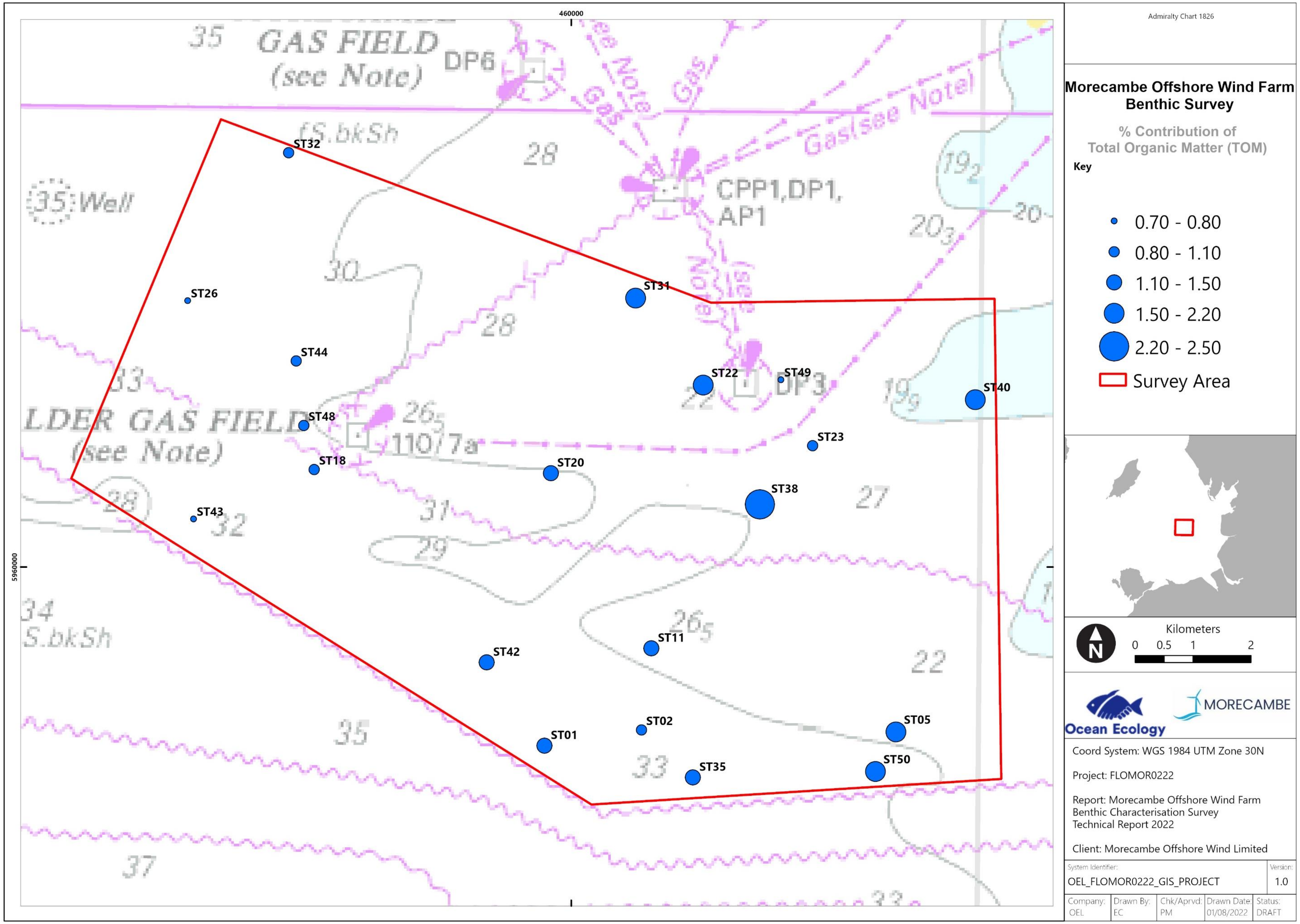

Figure 11 Percentage contribution of TOM across the Morecambe OWF site

7.2.2. Heavy and Trace Metals

A total of eight main heavy and trace metals were analysed from sediments taken at each of the 20 sampling stations. These were: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn). In addition, 14 secondary heavy and trace metals were analysed to provide a more in-depth picture of potential sediment contamination. These were: Antimony (Sb), Cobalt (Co), Manganese (Mn), Molybdenum (Mo), Selenium (Se), Thallium (Tl), Tin (Sn), Uranium (U), Vanadium (V), Barium (Ba), Beryllium (Be), Titanium (Ti), Silver (Ag) and Tellurium (Te). Raw data for these secondary metals are provided in Appendix X.

Raw data for the eight main heavy and trace metals (dry-weight concentration, mg kg^{-1}) are shown in Table 9 together with available reference levels (see Section 6.2.2 for details on national and international reference levels). None of the main heavy and trace metals exceeded reference levels with the exception of As which was above the TEL (7.24 mg kg^{-1}) at three stations: ST01, ST26 and ST43. However, As concentrations were well below Cefas AL 1, the national reference level. Of notice, Cd was below detection limit (0.04 mg kg^{-1}) at 12 of the 20 stations sampled.

The most abundant metal was Zn which ranged from 21 mg kg^{-1} at ST48 to 52.2 mg kg^{-1} at ST38, however, it was always recorded well below any of the reference levels (Table 9). Pb was also recorded in relatively high concentrations, ranging between 6.4 mg kg^{-1} at ST43 and 18.2 mg kg^{-1} at ST38, again well below any of the reference levels. The third most abundant metal was Cr which varied from 6.2 mg kg^{-1} at ST43 and 16.8 mg kg^{-1} at ST38, once again never exceeding reference levels. The only metal exceeding reference levels was As, which was generally recorded in low concentrations, with an average concentration across the windfarm site of 6.14 mg kg^{-1}, but exceeded the TEL at three stations. Figure 12 illustrates the spatial distribution of these four metals across the windfarm site. Typically, Zn, Pb and Cr had higher concentrations at stations located closer to land than in stations further offshore, displaying an east-west gradient with higher concentrations to the east. Conversely, As did not show a concentration gradient as most stations had comparable and relatively low As concentrations with stations ST01 and ST42 located to the south west of the windfarm site and station ST26 located in the north west of the windfarm site reporting As concentrations exceeding the TEL (Figure 12).

No trend was observed between the concentration of heavy and trace metals and the amount of mud in the sediments.

Table 9 Main Heavy and trace metals (mg kg-1) in sediments. Shading indicates values above AL1.

Analyte	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
ST01	8.7	<0.04	12.2	6.5	0.06	10.4	12.2	32.3
ST02	5.0	<0.04	8.4	5.2	0.05	6.5	8.8	28.6
ST05	5.9	0.08	14.7	8.7	0.11	11.2	15.4	47.8
ST11	4.6	<0.04	8.7	6.0	0.06	6.3	9.3	28.8
ST18	5.7	<0.04	8.1	5.7	0.05	6.0	8.0	24.3
ST20	5.0	0.06	9.2	6.8	0.06	7.3	10.0	29.8
ST22	5.8	0.08	13.5	9.0	0.15	10.8	15.4	47.1
ST23	4.9	0.05	7.8	11.4	0.06	5.8	7.9	22.4
ST26	8.3	0.05	6.6	4.7	0.04	5.3	8.6	27.2
ST31	6.7	<0.04	14.7	7.0	0.12	10.8	16.5	47.4
ST32	7.1	<0.04	7.1	3.9	0.03	5.1	8.1	26.0
ST35	5.8	<0.04	9.8	6.3	0.05	7.2	11.5	32.8
ST38	6.0	0.07	16.8	10.2	0.12	12.7	18.2	52.2
ST40	6.4	<0.04	15.9	9.5	0.12	11.5	16.1	46.5
ST43	9.2	<0.04	6.2	3.7	0.01	5.3	6.4	21.3
ST44	6.5	<0.04	6.4	3.9	0.03	5.0	8.5	25.0
ST48	6.0	<0.04	6.8	4.0	0.05	4.8	7.6	21.0
ST49	4.6	0.05	7.5	5.1	0.05	5.4	8.3	23.8
ST50	6.1	0.07	14.8	7.9	0.10	10.3	15.7	44.1
ST42	4.6	<0.04	7.2	5.5	0.02	5.6	7.3	22.1
Min	*4.6*	*0.05*	*6.2*	*3.7*	*0.01*	*4.8*	*6.4*	*21*
Max	*9.2*	*0.08*	*16.8*	*11.4*	*0.15*	*12.7*	*18.2*	*52.2*
Mean	**6.14**	**0.06**	**10.12**	**6.55**	**0.07**	**7.66**	**10.99**	**32.52**
Standard Error	*0.30*	*0.00*	*0.81*	*0.50*	*0.01*	*0.60*	*0.85*	*2.39*
CEFAS AL1	20	0.4	40	40	0.3	20	50	130
CEFAS AL2	100	5	400	400	3	200	500	800
OSPAR BAC	25	0.31	81	27	0.07	36	38	122
ERL	8.2*	1.2	81	34	0.15	21*	47	150
TEL	7.24	0.7	52.3	18.7	0.1	-	30.2	124
PEL	41.6	4.2	160	108	0.7	-	112	271

*The ERLs for As and Ni are below the BACs therefore As and Ni concentrations are usually assessed only against the BAC.

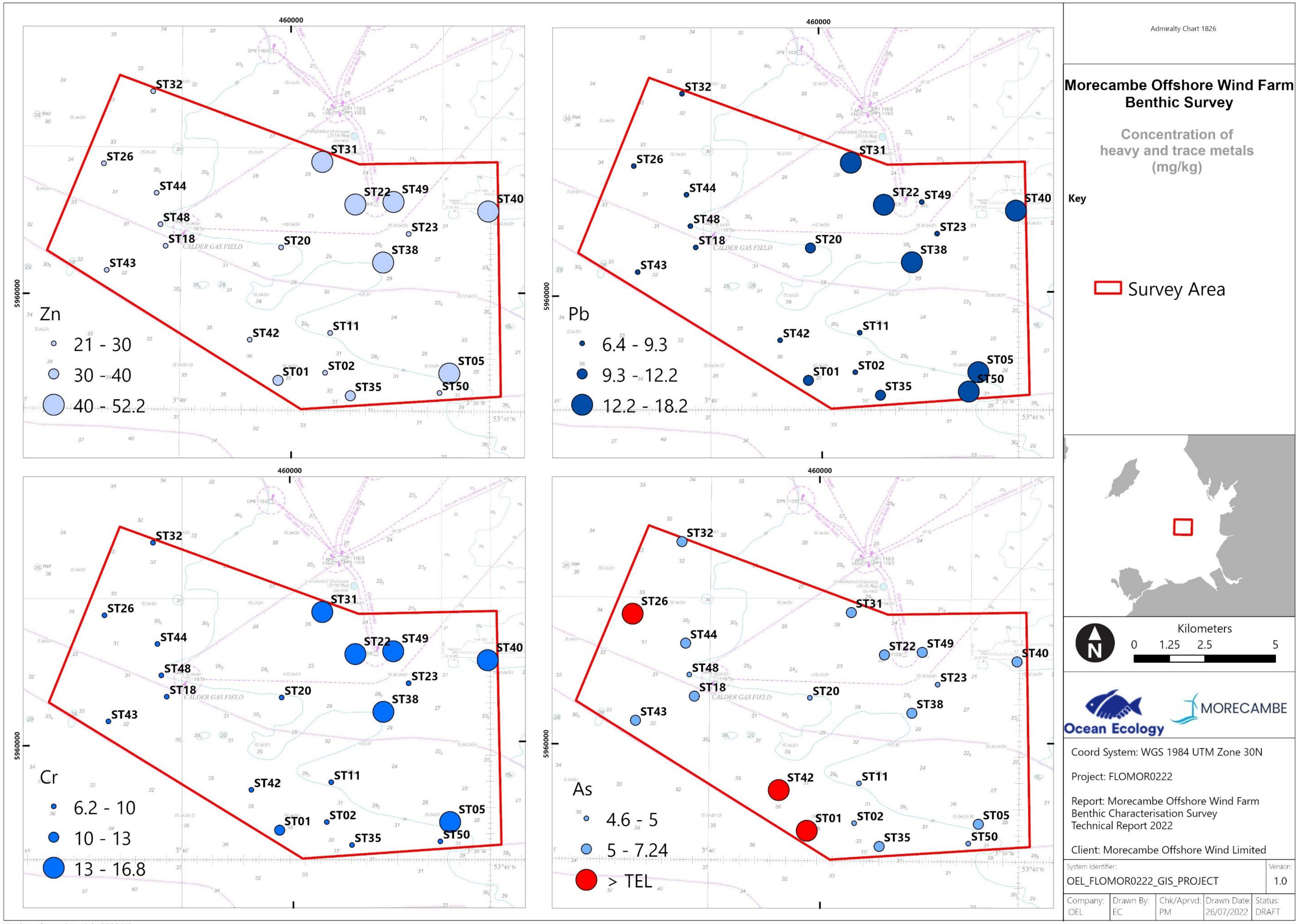

Figure 12 Concentration of the key heavy and trace metals sampled across the Morecambe OWF site. Note different scales

7.2.3. Polycyclic Aromatic Hydrocarbons (PAHs) and Total Hydrocarbons (THC)

The full range of PAHs as specified in the Department of Trade and Industry (DTI) regulations (DTI 1993) as well as by the EPA was tested for all 20 contaminant sub-samples collected.

The results of the PAHs analysis undertaken are reported in Appendix X. PAH concentrations were compared to Cefas AL1 (no Cefas AL2 available for PAHs), OSPAR BAC levels and ERLs, and TEL and PEL where possible (Table 10). The only reference level to be exceeded was the BAC, with Pyrene and Naphthalene being above reference levels at six of the 20 stations sampled. However, when averaged across the windfarm site, none of the PAH concentrations exceeded any of the reference levels.

The most abundant PAHs were: Pyrene with a mean concentration across the windfarm site of 14.27 μg kg^{-1} and a maximum concentration of 40.00 μg kg^{-1} at ST38, Benzo[b]fluoranthene with a mean concentration across the windfarm site of 14.05 μg kg^{-1} and a maximum concentration of 40.00 μg kg^{-1} at ST38 and Fluoranthene with a mean concentration across the windfarm site of 13.94 μg kg^{-1} and a maximum concentration of 40.10 μg kg^{-1} at ST38. Reference levels were available only for Pyrene and Fluoranthene with the former exceeding the BAC at six stations and the latter exceeding the BAC only at one station ST38 (Table 10).

The PAHs recorded in elevated concentrations at more stations were Naphthalene and Pyrene, followed by Anthracene and Benzo[a]anthracene (Table 10 and Figure 13). Naphthalene ranged from 1.06 μg kg^{-1} at ST26 to a maximum of 16.60 μg kg^{-1} at ST40 with six stations exceeding the BAC (Table 10 and Figure 13). Pyrene ranged from 1.23 μg kg^{-1} at ST43 to a maximum of 40.00 μg kg^{-1} at ST38 with six stations exceeding the BAC (Table 10 and Figure 13). Anthracene ranged from below detection limit (1 μg kg^{-1}) to a maximum of 6.64 μg kg^{-1} at ST38 with five stations exceeding the BAC (Table 10 and Figure 13). Benzo[a]anthracene ranged from below detection limit (1 μg kg^{-1}) to a maximum of 20.80 μg kg^{-1} at ST38 with five stations exceeding the BAC (Table 10 and Figure 13). In general PAHs showed higher concentrations at the nearshore stations compared to stations located further offshore, similar to what observed for trace metals.

To determine the origin source of PAH compounds in sediments, the ratio between Low Molecular Weight (LMW) and High Molecular Weight (HMW) PAHs was calculated. Based on this ratio all stations were characterised by PAHs of pyrogenic origin (LMW/HMW < 1). Similarly, the ratios of Phenanthrene / Anthracene (Ph/Ant) indicated a pyrogenic origin of PAHs as this ratio was below 10 at all stations. However, it should be noted that Anthracene concentrations were below detection limit at six stations and therefore it was not possible to calculate Ph/Ant at these locations. In contrast, the Fluoranthene / Pyrene ratio (Fl/Py) was lower than one at most stations (16 out of 20) indicating a petrogenic origin source of PAHs across the windfarm site (Figure 14). Given the contrasting results, average values across the windfarm site (± SE) were calculated to assess the robustness of the measurements and it followed that mean (± SE) LMW/HMW was 0.22 ± 0.023, mean (± SE) Ph/Ant was 5.05 ± 0.165 and mean (± SE) Fl/Py was 0.96 ± 0.010 suggesting a mix source of PAHs, most likely of pyrogenic origin as two of the three indices indicated that.

Table 10 Number of stations across the Morecambe OWF site exhibiting elevated PAHs levels in comparison with OSPAR and Canadian Sediment Quality Guidelines (CSQG). No PAHs exceeded Cefas AL1 or CSQG levels.

Analyte	Cefas	OSPAR		CSQG	
	AL1	BAC	ERL	TEL	PEL
Acenaphthene	0	-	-	0	0
Acenaphthylene	0	-	-	0	0
Anthracene	0	5	0	0	0
Benzo[a]anthracene	0	5	0	0	0
Benzo[a]pyrene	0	1	0	0	0
Benzo[b]fluoranthene	0	-	-	-	-
Benzo[ghi]perylene	0	0	0	-	-
Benzo[e]pyrene	0	-	-	-	-
Benzo[k]fluoranthene	0	-	-	-	-
Chrysene	0	3	0	0	0
Dibenzo[ah]anthracene	0	-	-	0	0
Fluoranthene	0	1	0	0	0
Fluorene	0	-	-	0	0
Indeno[1,2,3-cd]pyrene	0	0	0	-	-
Naphthalene	0	6	0	0	0
Perylene	0	-	-	-	-
Phenanthrene	0	1	0	0	0
Pyrene	0	6	0	0	0

THC in sediment samples ranged from 1.00 mg kg^{-1} at ST43 to 33.70 mg kg^{-1} at ST22, with an average value (± SE) for the whole of the windfarm site of 9.84 ± 2.17 mg kg^{-1} (Figure 14). As seen for trace metals and PAHs, also THC was relatively higher at easternmost stations compared to stations located further offshore.

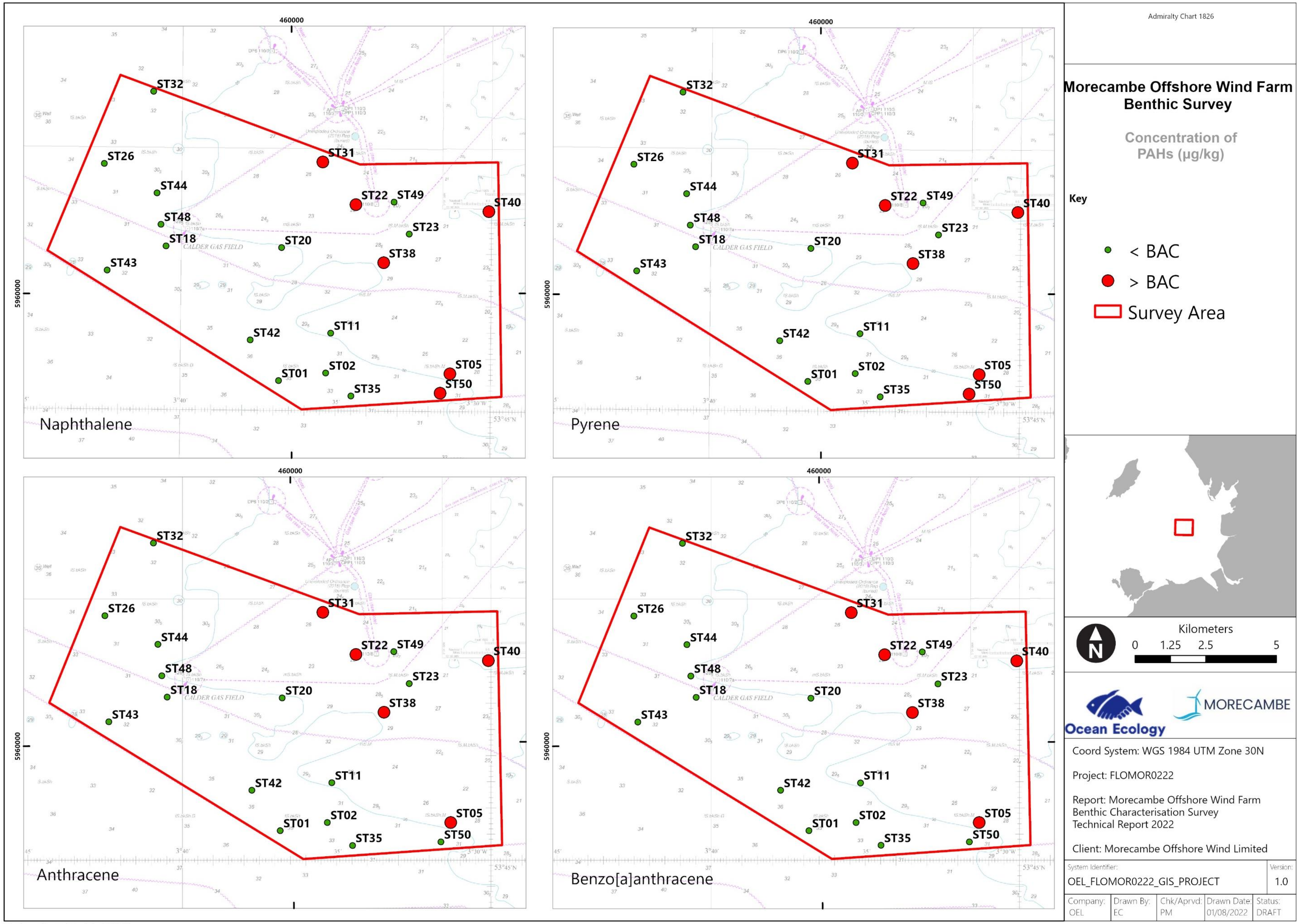

Figure 13 Concentration (µg kg^{-1}) of key PAHs against BAC across the Morecambe OWF site.

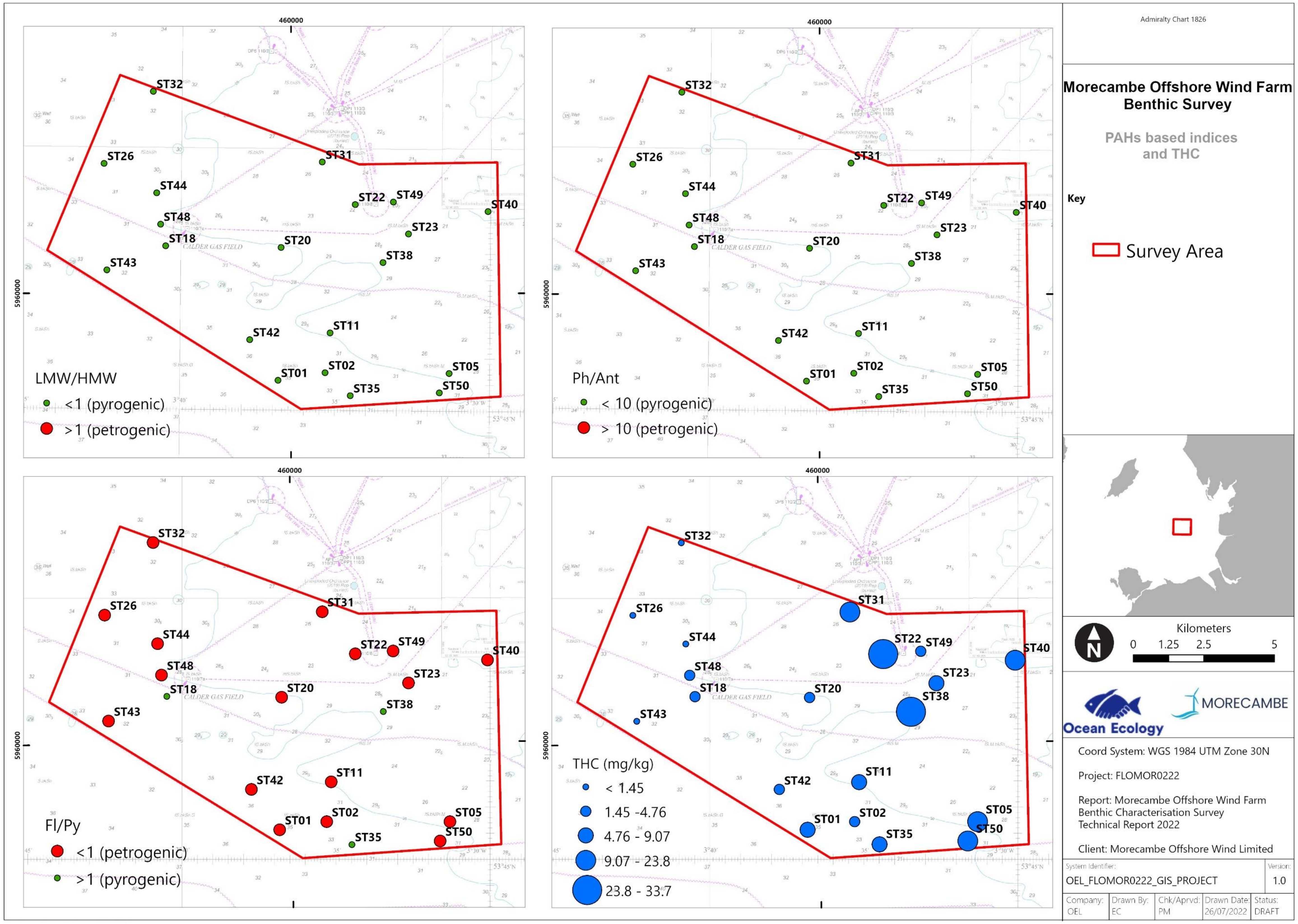

Figure 14 PAHs based indices and THC across the Morecambe OWF site.

7.2.4. Organotins

The concentrations of two organotins (Dibutyltin (DBT) and Tributyltin (TBT)) were analysed from the sediment taken at each of the 20 stations and reported in Appendix X.

All stations had organotin concentrations below the detection limit of 0.005 mg kg^{-1}. To provide some context, Cefas AL1 for organotins is 0.1 mg kg^{-1} and AL2 is 1 mg kg^{-1}.

7.2.5. Polychlorinated Biphenyls (PCBs)

All 25 PCBs congeners were analysed from the sediments taken at each of the 20 stations and reported in Appendix X.

No Cefas Action Levels exist for each individual PCBs, however most PCBs had concentrations below the detection limit of 0.00008 mg kg^{-1}. Cefas Action Levels do exist for the sum of all 25 PCBs congeners (Σ25PCBs). At all stations Σ25PCBs was below Cefas AL1 (0.02 mg kg^{-1}), ranging from below detection limit to 0.0009 mg kg^{-1}.

7.3. Macrobenthos

7.3.1. Macrobenthic Composition

The macrobenthic assemblage identified across the Morecambe OWF site from the 50 macrobenthic samples collected was made up of a total of 8,127 individuals and 154 different taxa. The mean (± SE) number of taxa was 24 ± 1 per station. Mean (± SE) abundance per station was 162 ± 19 with a mean (± SE) biomass per station of 0.9504 ± 0.1573 gAFDW.

The full abundance matrix is provided in Appendix XI. The biomass (gAFDW) of each major taxonomic group (Annelida, Crustacea, Mollusca, Echinodermata and Miscellaneous) in each sample collected is presented in Appendix XII.

As shown in Figure 15, the two-toothed Montagu shell (*Kurtiella bidentata*) was the most abundant taxon sampled accounting for 33 % of all individuals recorded. It was also the most frequently occurring as it was recorded in 88 % of samples and it accounted for the maximum abundance in a sample and greatest average density per sample (Figure 15). Other key taxa included the brittle star A*mphiura filiformis*, the polychaetes *Sthenelais limicola* and *Scalibregma inflatum* (Figure 15).

Figure 16 illustrates the relative contributions to total abundance, diversity, and biomass of the major taxonomic groups in the macrobenthic community sampled across the windfarm site. Mollusca taxa contributed most to abundance as they accounted for approximately 40 % of all individuals recorded, followed by Echinodermata taxa accounting for 33% (Figure 16). Annelida taxa contributed the most to the overall diversity of the macrobenthic assemblages at 38 %, while Echinodermata taxa dominated the biomass and accounted for 67 % of the total biomass (Figure 16).

Compared to abundance and diversity, biomass showed a much higher variability across the Morecambe OWF site (Figure 17) with the highest biomass recorded at station ST24 due to the presence of large molluscs and crustaceans, followed by station ST38 dominated by large echinoderms.

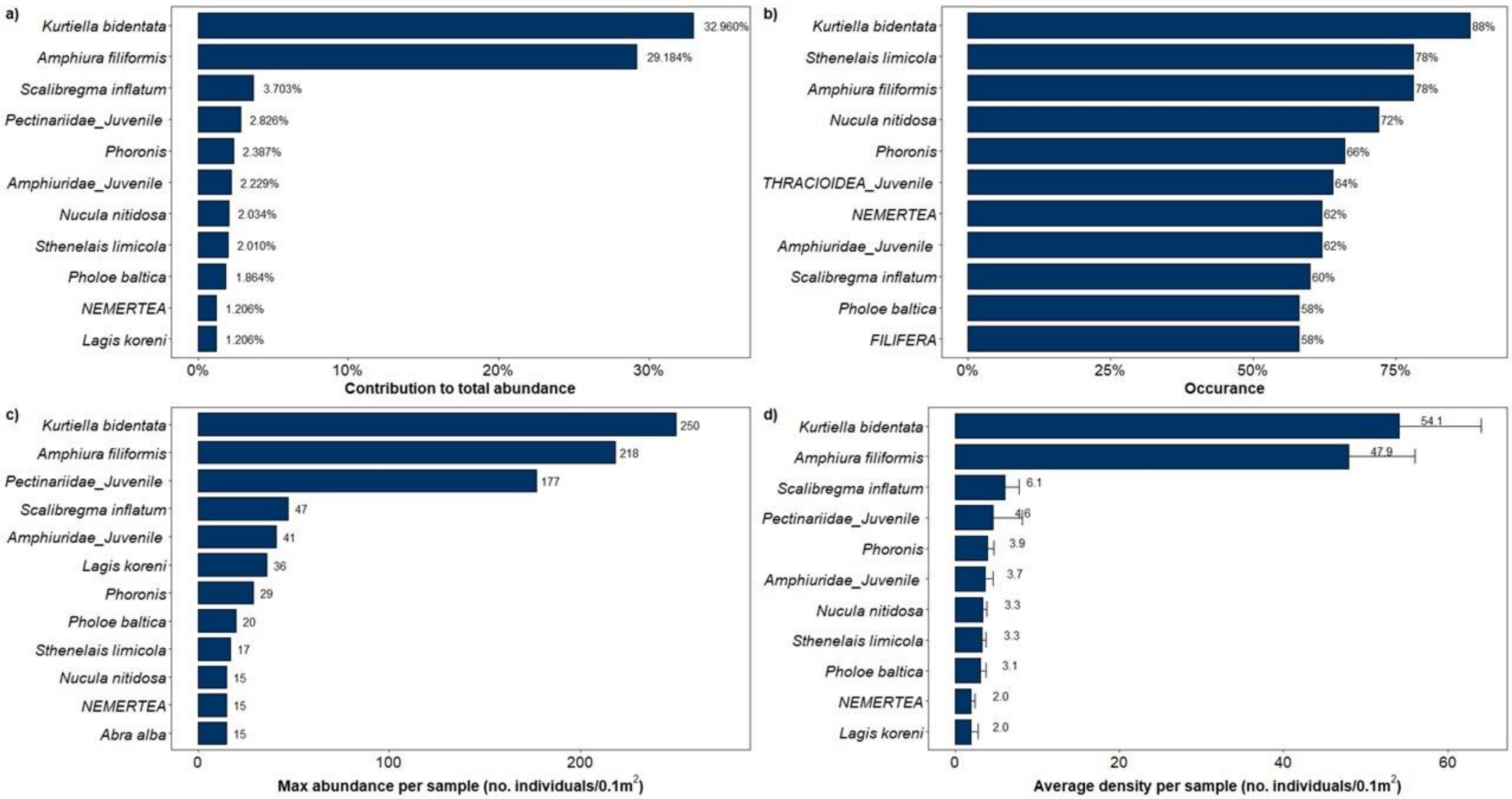

Figure 15 Percentage contributions of the top 10 macrobenthic taxa to total abundance (a) and occurrence (b) from samples collected across the Morecambe OWF site. Also shown are the maximum densities of the top 10 taxa per sample (c) and average densities of the top 10 taxa per sample (d).

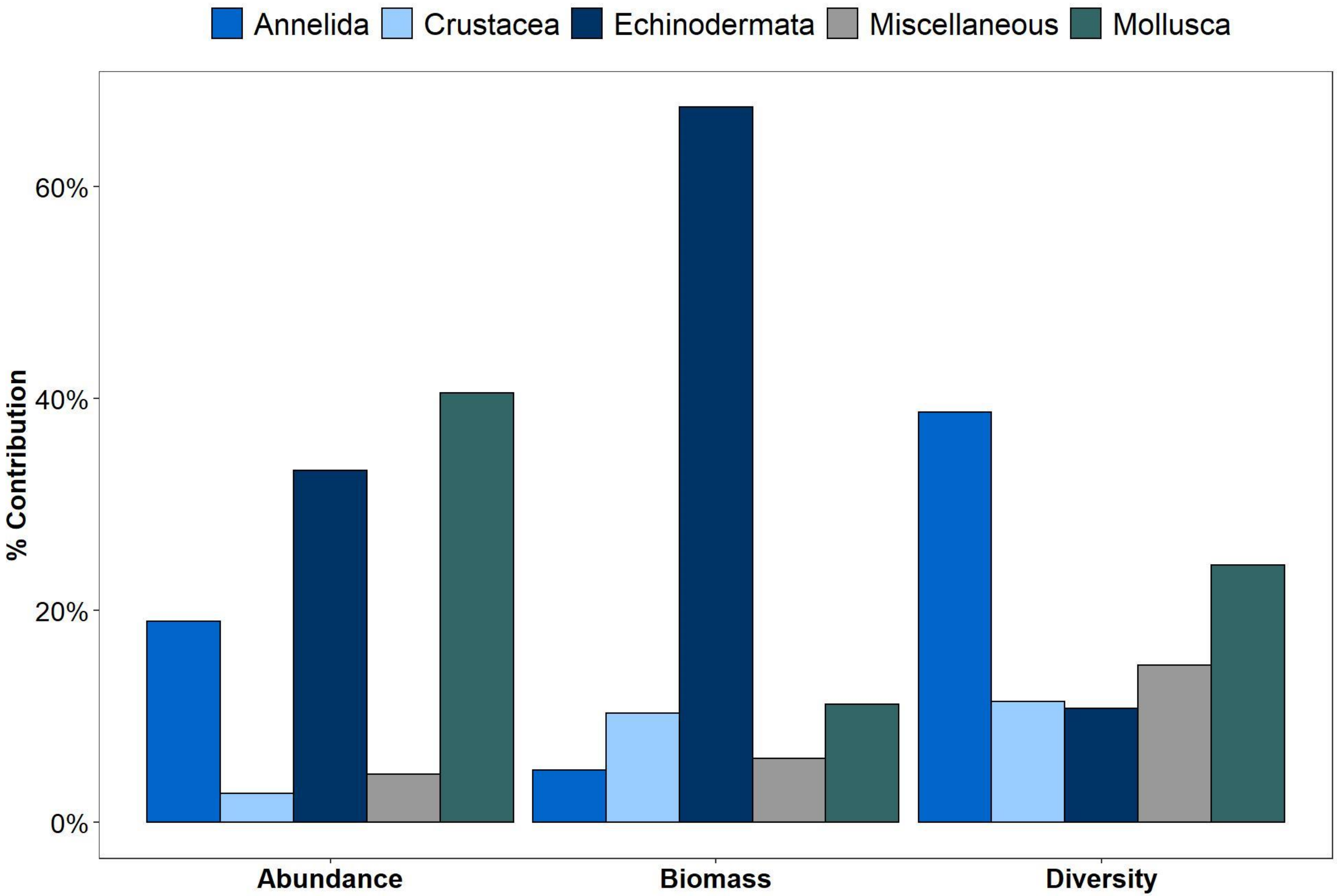

Figure 16 Relative contribution of the major taxonomic groups to the total abundance, diversity and biomass of the macrobenthos sampled across the Morecambe OWF site.

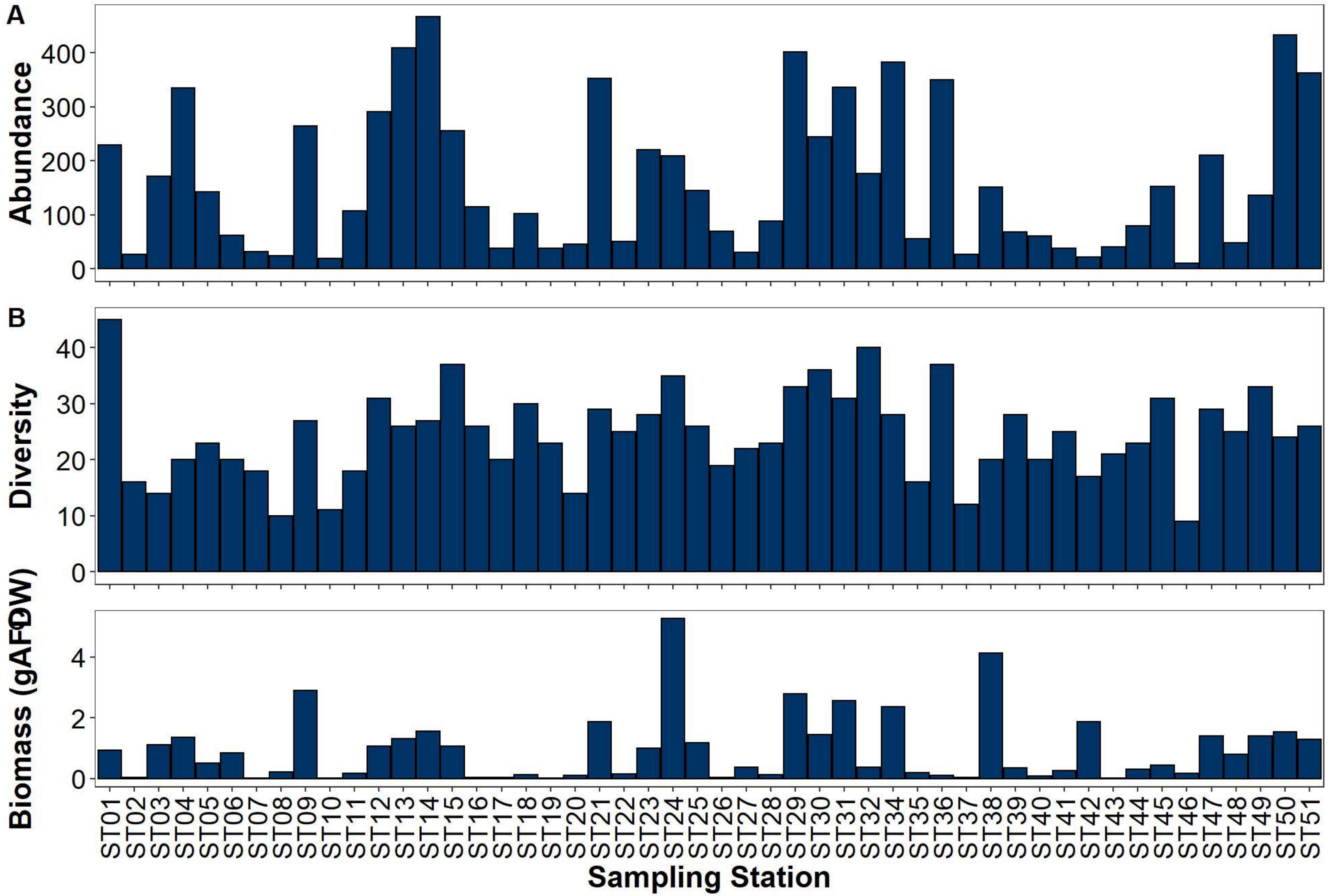

Figure 17 Abundance, diversity and biomass (gAFDW) per station across the Morecambe OWF site .

7.3.2. Notable Taxa

No notable taxa (e.g., non-native or commercially important species) were recorded across the Morecambe OWF site .

7.4. Macrobenthic Faunal Groupings

Multivariate analysis was undertaken on the square-root transformed macrobenthic abundance data to identify spatial distribution patterns in infaunal assemblages across the windfarm site and identify characterising taxa present.

Cluster analysis of the macrobenthic data was performed on a Bray-Curtis similarity matrix to analyse the spatial similarities in macrobenthic communities recorded across all sampled stations. The dendrogram resulting from the cluster analysis and associated Type 1 SIMPROF (similarity profile routine) permutation test of all nodes within the dendrogram identified 10 statistically significantly similar groups ($p > 0.05$). To enable a broad interpretation of the community present across the windfarm site, a similarity slice at 31 % was used to amalgamate the 10 SIMPROF groups into four broader Macrobenthic Groups, with one station not belonging to any group (outlier station ST46). The dendrogram resulting from the cluster analysis and associated Type 1 SIMPROF permutation test is provided in Appendix XIII.

To visualise the relationships between the sampled macrobenthic assemblages, a non-metric multi-dimensional scaling (nMDS) plot was generated on macrobenthic abundance data (Figure 18). The nMDS represents the relationships between the communities sampled, based on the distance between sample (station) points. The stress value of the nMDS ordination plot (0.17) indicates that the two-dimensional plot provides an adequate representation of the similarity between stations. The degree of clustering of intra-group sample points demonstrates the level of within group similarity (e.g., points within Macrobenthic Group A show distinct clustering), whilst the degree of overlap of inter-group sample points is indicative of the level of similarity between different Macrobenthic Groups (e.g., Macrobenthic Groups B, C and D).

The spatial distribution of the four broader Macrobenthic Groups and outlier is mapped in Figure 19. SIMPER (similarity percentage analysis) was used to identify the key taxa contributing to the within group similarity (see Appendix XIV for SIMPER results).

Macrobenthic Group A – was the largest group observed including 38 of the 50 stations sampled (average similarity 41.79). Characterising taxa of this group were the bivalves *Kurtiella bidentata* and *Nucula nitidosa* and the brittle star *Amphiura filiformis,* together accounting for 50 % of the total assemblage.

Macrobenthic Group B – four stations belonged to this group ST07, ST08, ST17 and ST43 all located in the southwestern reaches of the windfarm site (average similarity 37.80). The taxa characterising this group were the ribbon worms Nemertea and the polychaete *Spiophanes bombyx* together accounting for 54 % of the total assemblage.

Macrobenthic Group C – Only two stations fell into this group: ST10 and ST27 (average similarity 45.33). Key taxa in this group were the polychaetes *Sthenelais limicola* and *Nephtys cirrosa* and the amphipod *Bathyporeia gracilis* all together accounting for the 53 % of the total assemblage.

Macrobenthic Group D – five stations belonged to this group: ST26, ST37, ST41, ST42 and ST48 (average similarity 34.11). The taxa characterising this group were the polychaetes *Scalibregma inflatum, S. limicola, N. cirrosa* and *Scoloplos armiger*, all together accounting for 54 % of the total assemblage.

7.4.1. Biotope Assignment

For each of the four Macrobenthic Groups determined using cluster analysis, biotopes were assigned according to the JNCC classification tool (JNCC 2015) based upon their faunal and physical characteristics. Correlation of EUNIS/MNCR (Marine Nature Conservation Review) biotopes was undertaken using the JNCC correlation table (JNCC 2018).

Macrobenthic Group A - The biotope that most closely aligned with the community observed in this group was "A5.351 *Amphiura filiformis, Mysella bidentata* and *Abra nitida* in circalittoral sandy mud", which is consistent with the finer sediments recorded in at these locations characterised by notable mud contributions (Figure 9).

Macrobenthic Group B, **Macrobenthic Group C** and **Macrobenthic Group D** were characterised by the polychaetes *N. cirrosa, S. limicola, S. bombyx* and *S. armiger,* amphipods of the genus *Bathyporeia* with variable abundances of the bivalve *Abra alba*. The biotope that most closely aligned with this assemblage was "A5.252 *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand", which is consistent with sediments being sandier at these locations compared the Macrobenthic Group A and representative of the textural groups Sand and Slightly Gravelly Sand.

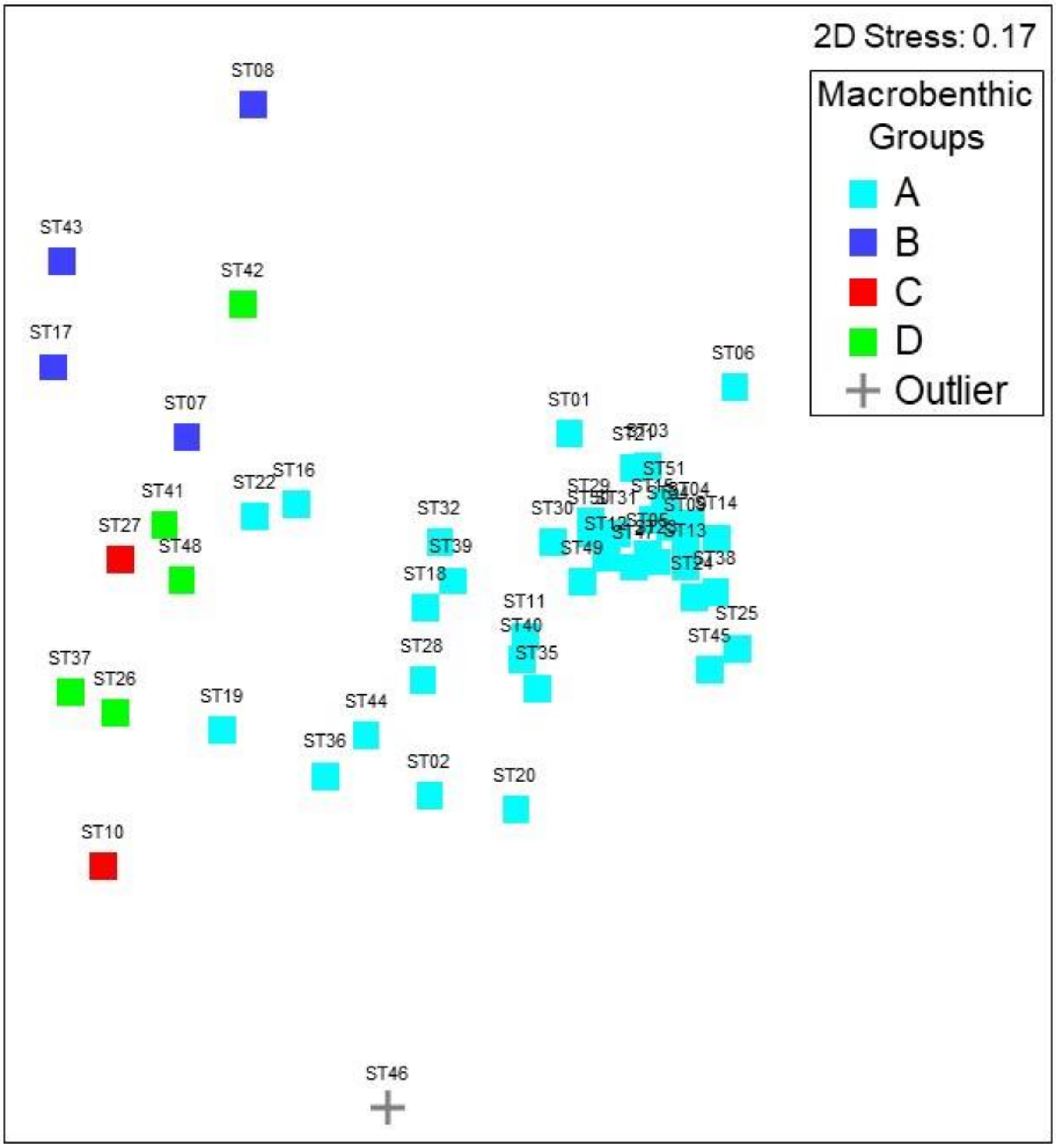

Figure 18 Two-dimensional nMDS ordination of macrobenthic communities sampled across the Morecambe OWF site, based on square root transformed and Bray-Curtis similarity abundance data. Macrobenthic Groups were identified at 31 % similarity.

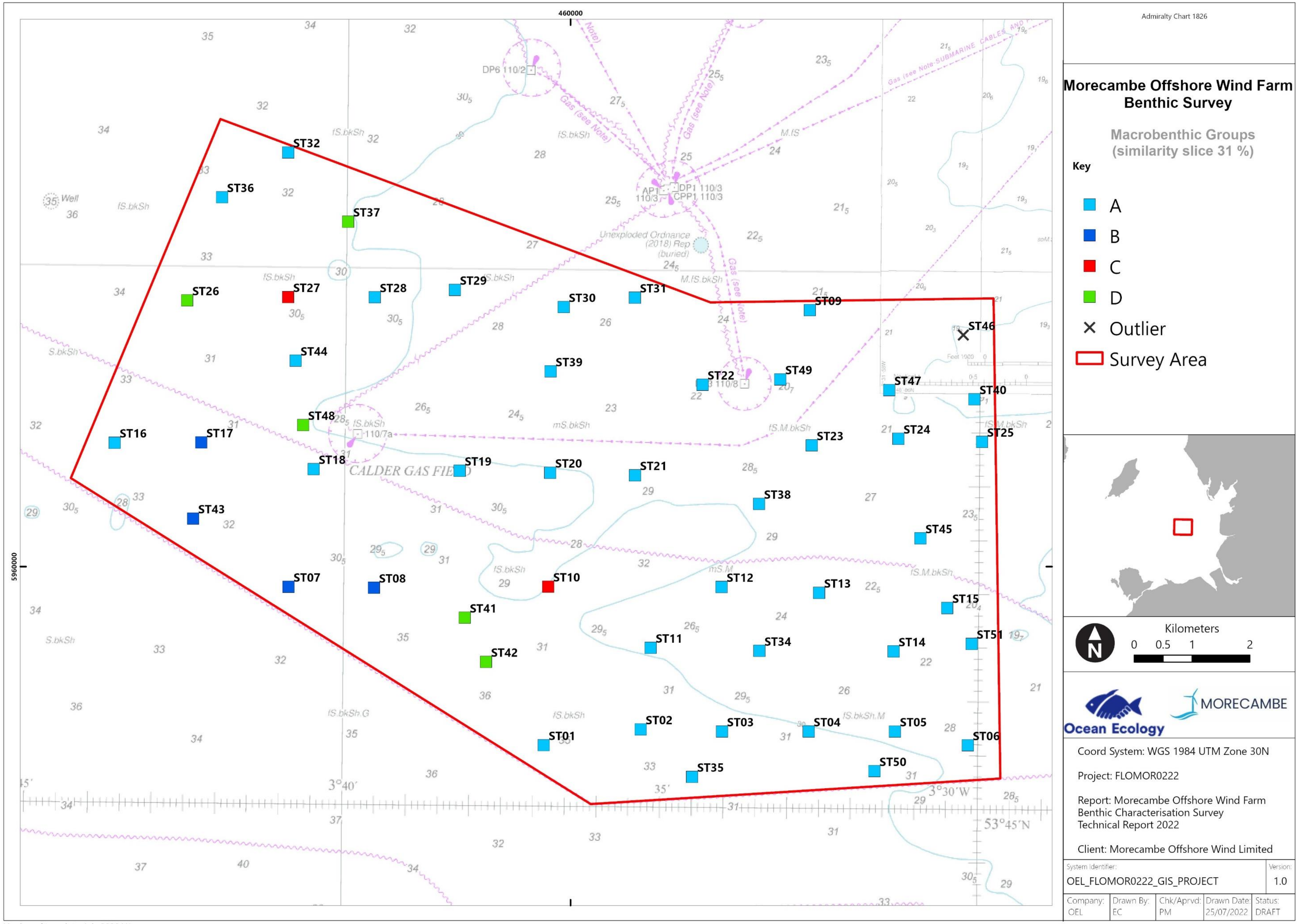

Figure 19 Spatial distribution of macrobenthic groups as determined from cluster analysis of abundance data.

7.5. Seabed Imagery

A total of 47 DDC stations and four DDC transects were sampled throughout the duration of the survey resulting in the collection of 404 still images. Of these, 18 were duplicates images, therefore a total of 386 images were analysed for this report.

The sampling logs for all seabed imagery collected during this survey are presented in Appendices XV and XVI. An overview of all EUNIS BSH and EUNIS level 4 categories identified is presented in Table 11. Example imagery of each EUNIS habitat encountered is presented in Plate 3.

Table 11 EUNIS classifications (both 2012 and 2022 codes) identified within the Morecambe Bay OWF Benthic Survey area.

EUNIS BSH (2012)	EUNIS Level 4 (2012)	EUNIS Description	EUNIS Code (2022)
A5.2 – Subtidal Sand	A5.25	Circalittoral fine sand	MC52
	A5.26	Circalittoral muddy sand	
A5.3 – Subtidal Mud	A5.35	Circalittoral sandy mud	MC62
A5.4 – Subtidal Mixed Sediment	A5.44	Circalittoral mixed sediments	MC42

Four EUNIS habitat types were encountered across the windfarm site: A5.25 'Circalittoral fine sand'; A5.26 'Circalittoral muddy sand'; A5.35 'Circalittoral sandy mud'; and A5.44 'Circalittoral mixed sediment' (Table 11). A5.26 was the most frequently encountered habitat type, having been assigned to 265 of the 386 analysed images. A5.25 was identified in 63 images, A5.44 in 47 images and A.35 in 11 images. The spatial distribution of habitat types within the windfarm site is presented in Figure 20. Areas to the west of the windfarm site were found to be dominated by circalittoral fine sands (A5.25), with circalittoral muddy sand (A5.26) dominating the majority of the windfarm site. Circalittoral sandy muds (A5.35) and circalittoral mixed sediments (A5.44) were largely interspersed within large areas of circalittoral muddy sand (A5.26), with the exception of transects 01 and 04 where there was a prevalence of the circalittoral mixed sediment (A5.44) habitat.

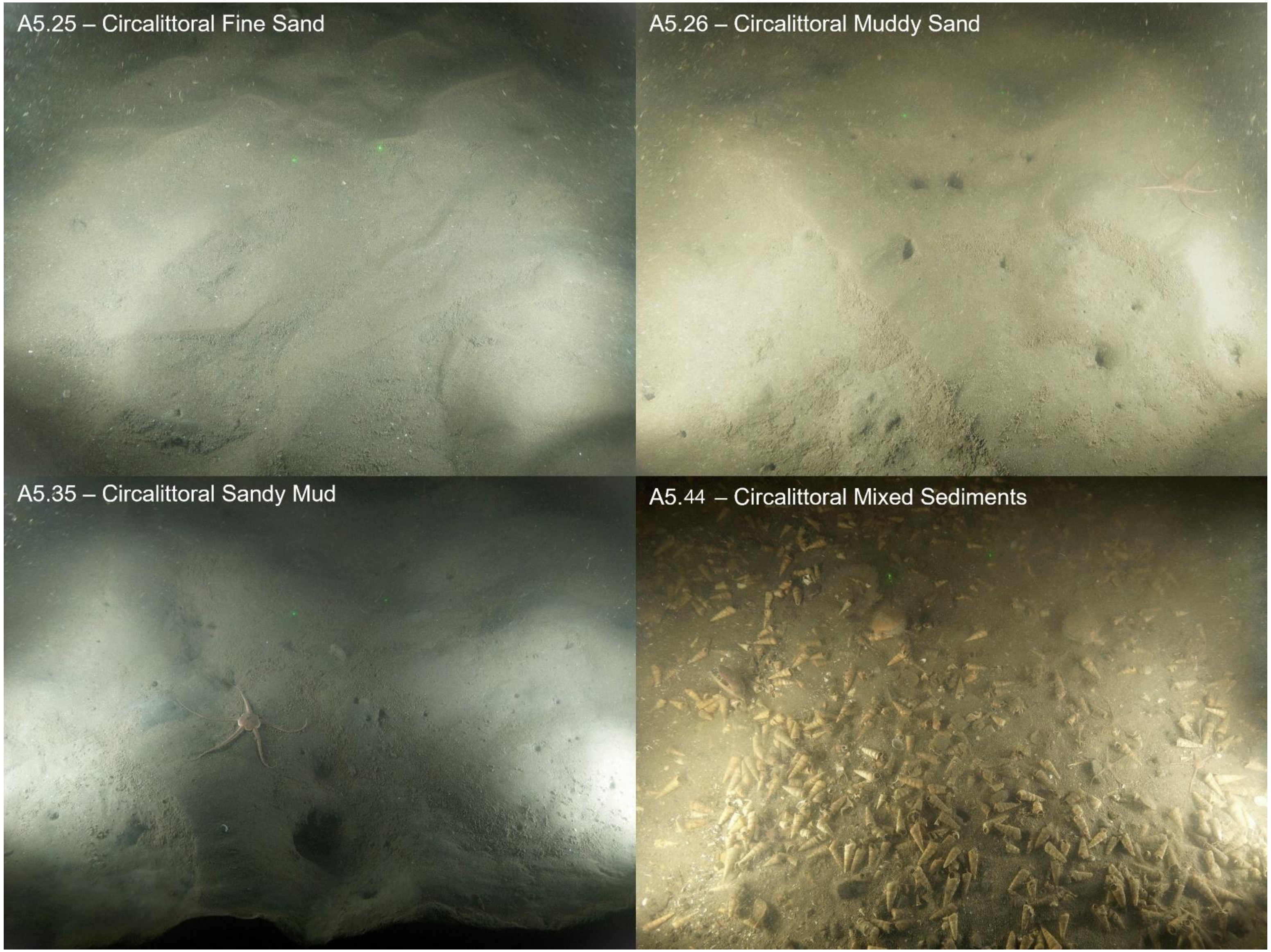

Plate 3 Example imagery of EUNIS classifications identified within the Morecambe OWF site..

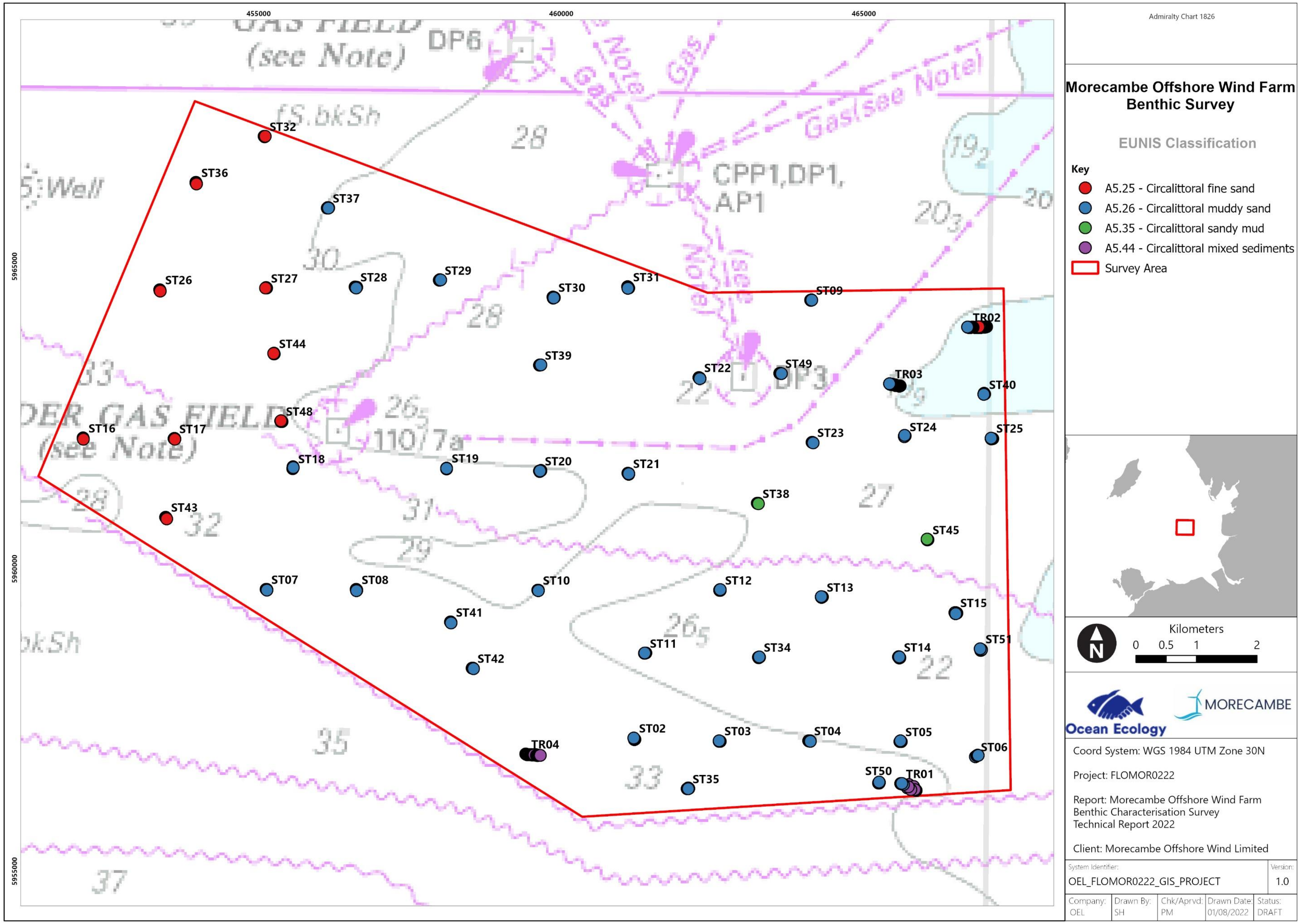

Figure 20 EUNIS habitats encountered across the Morecambe OWF site .

7.6. Habitats of Conservation Value

Areas of burrowed mud were identified across the windfarm site within areas of EUNIS habitat A5.26 'Circalittoral muddy sand'. Areas where megafaunal burrows were present matched the criteria required to be classified as the OSPAR/FOCI habitat 'Sea-pens and burrowing megafauna'. Whilst no sea-pens were identified in DDC imagery collected, the presence of sea-pens is not required to meet this habitat classification based on JNCC's interpretation of the OSPAR habitat definition (Robson 2014). Two individuals of the burrowing crab *Corystes cassivelaunus* were identified in DDC imagery, one from ST02 and one from ST30. The spatial distribution of megafaunal burrow density and burrowing megafauna is presented in Figure 21. A maximum average density of 43 m^2 of megafaunal burrows was recorded at ST24, with a minimum of 8 m^2 recorded at ST25. No clear pattern in the distribution of burrow density was identified in the data, with areas of higher and lower burrow density interspersed throughout the windfarm site. A full sea-pen and burrowing megafauna (SPBM) assessment can be found in Appendix XVII.

No areas of potential Annex I reef were identified in DDC imagery and therefore no formal reef assessments were conducted.

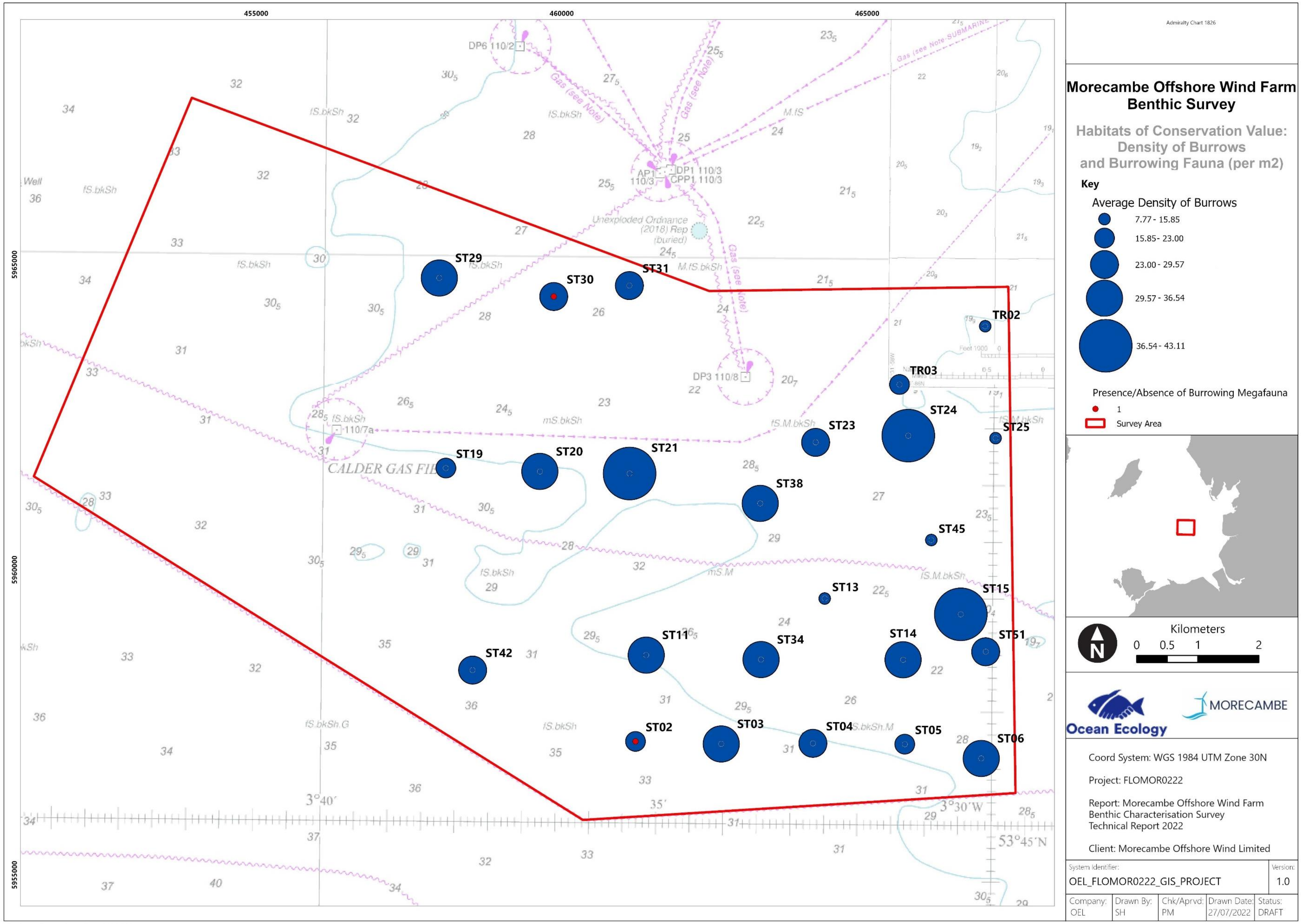

Figure 21 Density of burrows (per m^2) and abundance of burrowing megafauna across the Morecambe OWF site.

7.7. Habitat/Biotope Mapping

To map the principal habitats that occurred throughout the Morecambe OWF site, a full interrogation of available geophysical data in combination with grab sample data (PSD and macrobenthos) was undertaken. As the two habitats identified across the windfarm site consisted of soft sediments, A5.25 and A5.35, seabed imagery was only used to corroborate PSD and macrobenthic data as it is limited in discriminating between soft substrates (i.e., habitats A5.25 and A5.26 look very similar in seabed imagery). Similarly, the acoustic data did not indicate any major anomalies between these two soft substrates which in turn hindered the delineation of polygons on the map as confidence in assessing their boundaries was low. Nevertheless, PSD and macrobenthic data clearly indicated the presence of two biotopes across the windfarm site: A5.252 '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' in the middle and to the east of the windfarm site and A5.351 '*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud' to the west of the windfarm site as illustrated in Figure 22. Keeping into account the low confidence associated to the polygons encompassing the biotopes observed across the Morecambe OWF site, the area covered by A5.252 was estimated to be 21.38 km^2 in total, while the area covered by A5.351 was estimated at 107.21 km^2 in total (Figure 23).

Rationale for the designated biotopes is provided in Appendix XVIII.

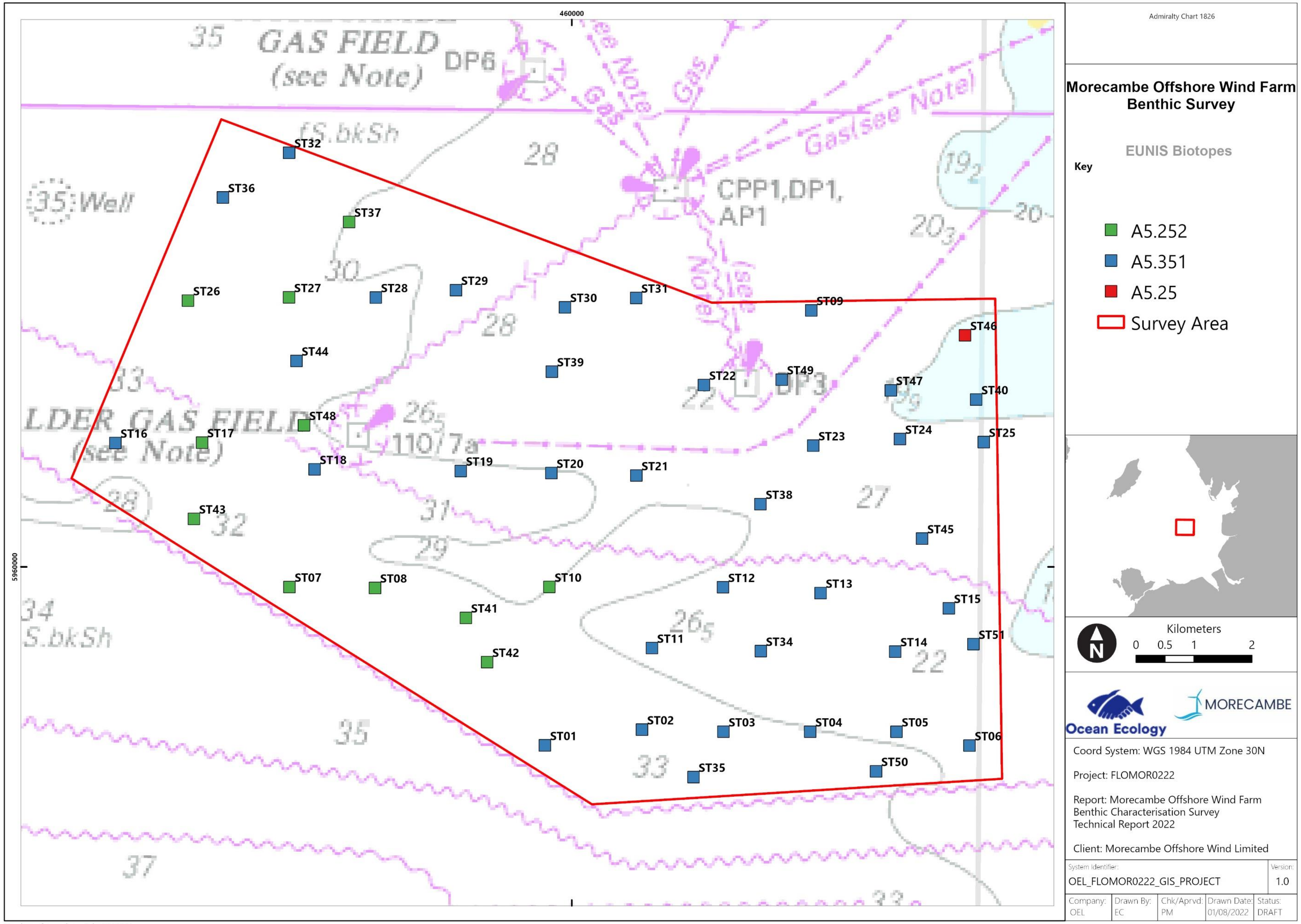

Figure 22 EUNIS Biotopes as determined from interrogation of sediment and macrobenthic data.

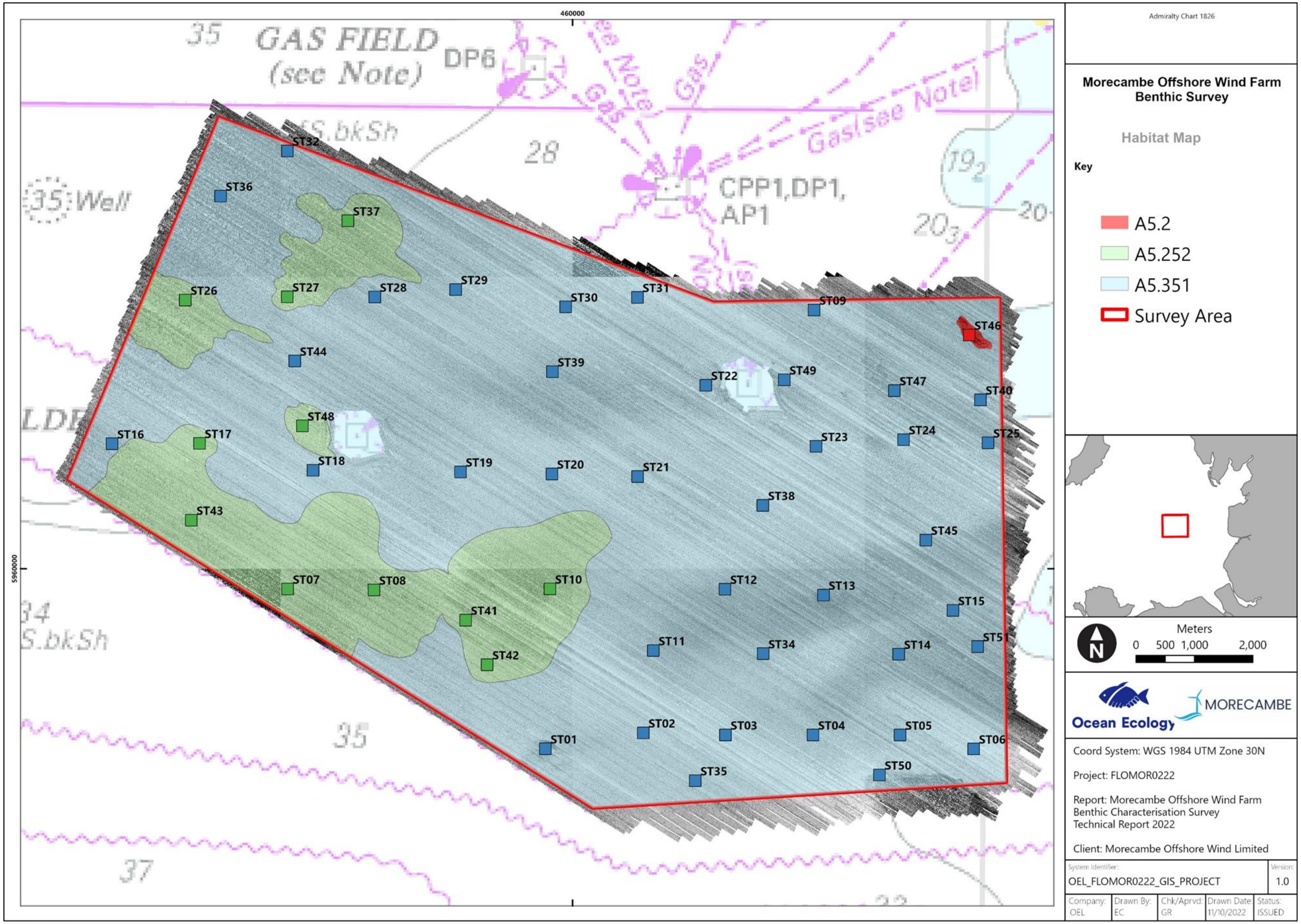

Figure 23 Habitat map based on the interrogation of all available data.

8. Discussion

This report presents the results of the macrobenthic and sediment analysis with the aim to set out the environmental baseline conditions across the proposed Morecambe OWF site to inform final engineering design and the installation process of the proposed windfarm as well as providing a robust dataset for future comparison if required.

8.1. Sediments

Some variation in sediment types was observed across the windfarm site; however, most stations were dominated by sand (Figure 8). Mud content was higher in the middle and to the east of the windfarm site, while gravel content was higher (albeit it low) moving offshore and to the west of the windfarm site. This was reflected in the Textural Groups recorded across the windfarm site with muddier stations classified as Muddy Sand and coarser stations classified as Sand and Slightly Gravelly Sand. These types of sediment are among the most common habitats found in subtidal settings across the UK coast and fall in the list of habitats of principal importance under Section 7 of the Environment (Wales) Act 2016 'Subtidal sands and gravels' and 'Subtidal mixed muddy sediments' and under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 as 'Subtidal sands and gravels' and 'Mud habitats in deep water.

No pattern was observed between stations with higher mud (> 20 %) and TOM content despite studies based on the coastal ocean and marine environment having found a positive relationship between organic matter content and proportions of finer sediment grain size (Winterwerp & van Kesteren 2004, McBreen et al. 2008, Hunt et al. 2020). Relatively high TOC and TOM content was observed at stations located to the east of the windfarm site, closer to land. This could suggest runoff from land as a potential source of the organic matter found at these locations. Average TOC compares well with global sediment average TOC content for the deep ocean (0.5 %) (Seiter et al. 2004).

Several guidelines exist to assess the degree of contamination and likely ecological impacts of contaminants in marine sediments. These regulations defined the levels below which effects are of no concern and/or rarely occur (AL1, BAC, TEL) and the levels above which adverse biological effects are considerable and/or occur frequently (AL2, ERL, PEL). *Ad hoc* decisions need to be made when contaminant concentrations fall between these levels. To note that Cefas ALs1 are typically the most conservative measures to assess sediment contamination and often result in "false positives" meaning that non-toxic sediment samples fail to pass this screening test. Conversely, ALs2 tend to be rather permissive allowing samples with relatively high contaminant concentrations to fall between AL1 and AL2 and thus requiring expert judgment to further assess their potential toxicity (MMO 2015, Mason et al. 2020). Recent studies have been revising these ALs with the goal of reducing the range of concentrations falling between AL1 and AL2 and minimise the number of samples requiring an *ad hoc* treatment; however, no policy has been made yet based on these recommendations and suggestions (MMO 2015, Mason et al. 2020).

Trace and heavy metal concentrations were overall low across the windfarm site with none of the metals analysed exceeding any of the reference level. In general metal concentrations were relatively higher to the east, closer to land than stations located further offshore, as seen for TOC and TOM. As was an exception to this trend as it exceeded the TEL at three stations ST01, ST26 and ST42 all located to the west of the windfarm site (Figure 12). However, As concentrations never exceeded Cefas AL1 which is the national reference level. As concentrations exceeding the TEL has possibly to do with the TEL being based on North American data and as such it may not be representative of UK conditions (Section 6.2.2) (MMO 2015, Mason et al. 2020). In comparison OSPAR BAC and Cefas ALs are based on UK data and therefore are more suitable for the current assessment. No pattern emerged when comparing stations with elevated As concentrations with the correspondent TOC, TOM and mud content, which could have been related to transportation and deposition of As across the windfarm site. Elevated metal sediment concentrations do not necessarily imply toxicity to benthic communities (Rees et al. 2007) as the bioavailability of these metals is more important than simply concentration levels. Despite the elevated As levels at these three stations, no macrobenthic anomalies were identified at these locations to suggest any adverse effects were present.

Among all PAHs, Naphthalene, Pyrene, Anthracene and Benzo[a]anthracene were the ones found to exceed BAC reference levels at 5 to 6 stations (Table 10). None of the other reference levels was exceeded by any of the analysed PAHs. Stations with elevated PAHs concentrations also had relatively high TOC, TOM and metals concentrations which could be related to transportation and deposition across the windfarm site; however, no macrobenthic anomalies were identified at these locations to suggest any adverse effects were present. When assessing the origin source of PAH compounds in sediments, the ratio between LMW and HMW PAHs was found to be lower than 1 at all stations indicating a pyrogenic origin, similarly the Ph/Ant ratio was lower than 10 at all stations also indicating a pyrogenic source of PAHs (Figure 14). PAHs of pyrogenic origin can derive from various activities which ultimately involve the combustion of organic substances at high temperatures under low oxygen conditions. These may include incomplete combustion of motor fuels, or products derived from the foundry and steel industries. In contrast the Fl/Py ratio indicated a petrogenic source of PAHs at most stations (Figure 14). Petrogenic PAHs typically include crude oil and refined crude oil products such as gasoline, heating oil, asphalt, and coal. It is not uncommon to find a mixture of petrogenic and pyrogenic PAHs sources in marine sediment (EPRI 2008, Aly Salem et al. 2014).

As already seen for TOC, TOM, metals and PAHs, also THC was higher to the east of the windfarm site, closer to land than stations located further offshore (Figure 14), suggesting that the proximity to urban settings can result in additional sources of contaminants that can potentially become stored in coastal sediments. No macrobenthic anomalies were identified at locations with high THC suggesting no adverse effects were present.

Comparison between the concentrations of determinands measured in the sediments of the Liverpool Bay as part of the OSPAR "Levels and trends in marine contaminants and their biological effects monitoring programme" (OSPAR 2020) to those across the windfarm site showed that concentrations were consistently lower across the windfarm site than those recorded in the Liverpool Bay (Table 12).

Table 12 Comparison of mean concentrations of key metals (mgkg^{-1}) and PAHs (μgkg^{-1}) sampled across the Morecambe OWF site with previous records from (OSPAR 2020).

Analyte	Liverpool Bay (OSPAR)	Morecambe OWF site
As (mg kg^{-1})	18.92	6.14
Naphthalene (μg kg^{-1})	35.25	5.56
Pyrene (μg kg^{-1})	60.25	14.27
Anthracene (μg kg^{-1})	8.15	3.39
Benzo[a]anthracene (μg kg^{-1})	47.69	8.05

8.2. Macrobenthos

The macrobenthic assemblage identified across the Morecambe OWF site was made up of a total of 8,127 individuals and 189 different taxa. However, most stations were characterised by the presence of *K. bidentata* which occurred in 88 % of samples. Other key taxa included the brittle star A*mphiura filiformis*, the polychaetes *Sthenelais limicola* and *Scalibregma inflatum* (Figure 15).

Macrobenthic communities can be highly heterogenous as they are heavily influenced by ambient environmental conditions such as sediment composition (Cooper et al. 2011), hydrodynamic forces and physical disturbance (Hall 1994), depth (Ellingsen 2002) and salinity (Thorson 1966). Macrobenthic abundance and diversity varied across the windfarm site however no obvious pattern was observed across stations (Figure 17). Conversely, the four Macrobenthic Groups identified by the multivariate cluster analysis (Section 7.4) did show a clear distinction between stations located in the middle and to the east of the windfarm site and stations located more offshore and to the west. Macrobenthic Group A covered most of the windfarm site and was characterised by high abundances of *K. bidentata* and *A. filiformis.* In contrast macrobenthic groups B, C and D were dominated by polychaetes and amphipods and covered the more offshore and western part of the windfarm site. Sediment composition is a key factor in determining macrobenthic community structure (Hall 1994, Cooper et al. 2011), itself defined by ambient conditions. This was clearly reflected in the Macrobenthic Groups detected across the windfarm site with Macrobenthic Group A indicating an affinity for muddier substrates compared to the other macrobenthic groups more typical of sandy substrates with little to no mud. Two biotopes were identified across the windfarm site based on a combination of macrobenthic and sediment data, these were "A5.351 *Amphiura filiformis, Mysella bidentata* and *Abra nitida* in circalittoral sandy mud" corresponding to the stations belonging to Macrobenthic Group A, and "A5.252 *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand" including all other stations.

8.3. Seabed Imagery

Four EUNIS habitats were recorded across the Morecambe OWF site: A5.25, A5.26, A5.35, and A5.44 (Table 11). Whilst the BSHs of A5.2 and A5.3 are present in existing EMODnet predictive mapping (Figure 2), the level 4 EUNIS habitats predicted by EMODnet do not align well with the imagery collected in this survey (Figure 20). Circalittoral muddy sand (A5.26) was the dominant habitat type identified here across the majority of the windfarm site, with areas to the west dominated by circalittoral fine sand (A5.25). Isolated areas of the habitats circalittoral sandy mud (A5.35) and circalittoral mixed sediments (A5.44) were also identified.

8.4. Habitats of Conservation Value

JNCC's interpretation of the OSPAR habitat definition for 'sea-pens and burrowing megafauna', whereby no sea-pens need be present and that this habitat can be present in muddy sands (Robson 2014), means that large areas of the OSPAR/FOCI habitat 'Sea-pens and burrowing megafauna' were identified across the windfarm site within the EUNIS habitat A5.26. Sea-pens and burrowing megafauna is as priority habitat listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 as well as an MCZ FOCI. As there is currently no MPA designated within this area, there is no legislative protection afforded to the observed sea-pen and burrowing megafauna habitats observed within this survey. The identification of this habitat should, however, be acknowledged going forward.

No Annex I habitats were identified within the windfarm site.

8.5. Habitat/Biotope Mapping

PSD and macrobenthic data clearly indicated the presence of two biotopes across the windfarm site: A5.252 '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' in the middle and to the east of the windfarm site, and A5.351 '*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud' to the west (Figure 22). Seabed imagery and acoustic data was used sparingly in the determination of these biotopes due to the similarity in the appearance of soft substrate habitats (i.e., A5.25 and A5.26) in these types of data. It follows that it is difficult to confidently identify strict boundaries between the two biotopes based on acoustic and imagery data, however a habitat map has been presented based on the interrogation of all available data and low confidence scores have been assigned to the polygons delineating each habitat/biotope to reflect these limitations.

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Appendix I - Project Execution Plan

Ocean Ecology

Marine Surveys, Analysis & Consultancy

Morecambe Offshore Wind Farm

Project Execution Plan

REF: OEL_FLOMOR0222_PEP_V02

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Details

Version	Date	Description	Author(s)	Reviewed By
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02	22/04/2022	Revised following client review	-	Gary Robinson
03	16/05/2022	Revised following NE comments	-	Ross Griffin

Updates

Section	Description	Page
1.3	Reference to NE best practice guidelines now included	8
1.3	Figure 1 updated – indicative turbine locations removed	9
4.2	Figure 2 updated – indicative turbine locations removed	13
4.2	Figure 3 updated – indicative turbine locations removed	14
4.3	Additional detail relating to geophysical interpretation and spatial layout of sampling array included	15
4.3	Table 1 updated to reflect updated sampling plan	15
4.3	Table 2 updated to reflect updated sampling plan	16
4.4	Table 2 updated to reflect TR04 relocated to BSH A5.2 / A5.1	16
4.5	Figure 4 updated to reflect updated sampling plan	18
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5.3.1	Additional text on combined DDC and grab locations	21
5.4	Clarification detail provided on MMO validated methods and determinands for testing.	23-24
6.3.1 / 6.3.2	Addition of text relating to INNS now added	31 / 32
6.4.2	Table 12 – added detail on technical reporting	33
1.3	Update to reference to NE best practice guidance	8
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Abbreviations

BIIGLE	Bio-Image Indexing and Graphical Labelling Environment
BSH	Broadscale Habitat
DDC	Drop-Down Camera
dGPS	Differential Global Positioning System
ECR	Export Cable Route
EUNIS	European Nature Information System
FOCI	Feature of Conservation Importance
GPS	Global Positioning System
HA	Habitat Assessment
HD	High Definition
HOCI	Habitat of Conservation Importance
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
LED	Light-Emitting Diode
MBES	Multibeam Echosounder
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MOWF	Morecambe Offshore Windfarm
MP	Megapixel
MSFD	Marine Strategy Framework Directive
MW	Megawatt
NE	Natural England
NMBAQC	NE Atlantic Marine Biological Analytical Quality Control
OEL	Ocean Ecology Ltd
OWF	Offshore Windfarm
PEP	Project Execution Plan
PSD	Particle Size Distribution
QAF	Quality Assurance Framework
RAMS	Risk Assessment Method Statement
SAC	Special Area of Conservation
SBAS	Satellite-based Augmentation System
SoW	Scope of Work
SPA	Special Protection Area
SSS	Side-Scan Sonar
UPS	Uninterruptable Power Supply
USBL	Ultra-Short Baseline
UTC	Universal Time Coordinated
UTM	Universal Transverse Mercator
WTG	Wind Turbine Generator

1. Introduction

1.1. Project Overview

Morecambe Offshore Windfarm (MOWF) is a proposed offshore windfarm (OWF) located in the Irish Sea (Figure 1) with an expected nominal capacity of 480 megawatts (MW). The Project is being developed by Offshore Wind Ltd: a joint venture between Cobra Instalaciones y Servicios, S.A., and Flotation Energy plc. The Morecambe OWF site is located in the Northeast Irish Sea with water depths in the array area ranging between 20 and 35 m.

There is a requirement for baseline information on the sediment quality, environment and benthic habitats from within the proposed wind farm site and Floatation Energy have contracted OEL to undertake a benthic characterisation survey of the site. The key focus of the benthic characterisation survey will be to provide accurate ground truthing to the geophysical data using a Drop-Down Camera (DDC) and sediment grab sampling and to form a baseline for future monitoring of the survey area upon which any changes to the sediment characteristics, macrobenthic communities and seabed physico-chemical properties can be monitored.

1.2. Site Information

1.2.1. Site Location

The MOWF site is located in the Northeast Irish Sea, approximately 20 nautical miles due East of Blackpool on the North West coast of England. There is no Export Cable Route (ECR) currently proposed for the development and therefore all survey works are located within the consented array boundary.

Water depths in the array area range between 20 and 35 m.

1.2.2. Designated Sites

The MOWF site is located to the immediate west of the Liverpool Bay / Bae Lerpwl Special Protection Area (SPA) with its northern and eastern boundaries adjoining but not intersecting that of the SPA (Figure 1). Liverpool Bay / Bae Lerpwl SPA is in the east of the Irish Sea, bordering the coastlines of north-west England and north Wales. The boundary of Liverpool Bay / Bae Lerpwl SPA extends beyond 12 nautical miles and therefore lies partly in Welsh and English territorial waters and partly in offshore waters.

It is classified for the protection of red-throated diver (*Gavia stellata*), common scoter (*Melanitta nigra*), and little gull (*Hydrocoloeus minutus*) in the non-breeding season; common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*) in the breeding season, and as an internationally important waterbird assemblage.

Further to the east of the survey area are the Fylde Marine Conservation Zone (MCZ), the Shell Flat and Lune Deep Special Area of Conservation (SAC) (Figure 1).

1.3. Document Overview

This document sets out the Project Execution Plan (PEP) for an offshore environmental camera and benthic grab survey to be undertaken in May 2022 by Ocean Ecology Limited (OEL) onboard their dedicated survey vessel, *Seren Las* as part of the wider pre-construction site characterisation programme.

This PEP has been produced to ensure that this characterisation benthic survey is aligned to Natural England's (NE) "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards" (Natural England 2021a b).

The objective of this PEP is to detail the following aspects of the project:

- Scope of Work (SoW)
- Sampling Plan
- Project Plan of Work (Timeline)
- Equipment and Vessel summary
- Project personnel summary
- Processing and Reporting deliverables
- Quality processes and procedures relevant to this work scope

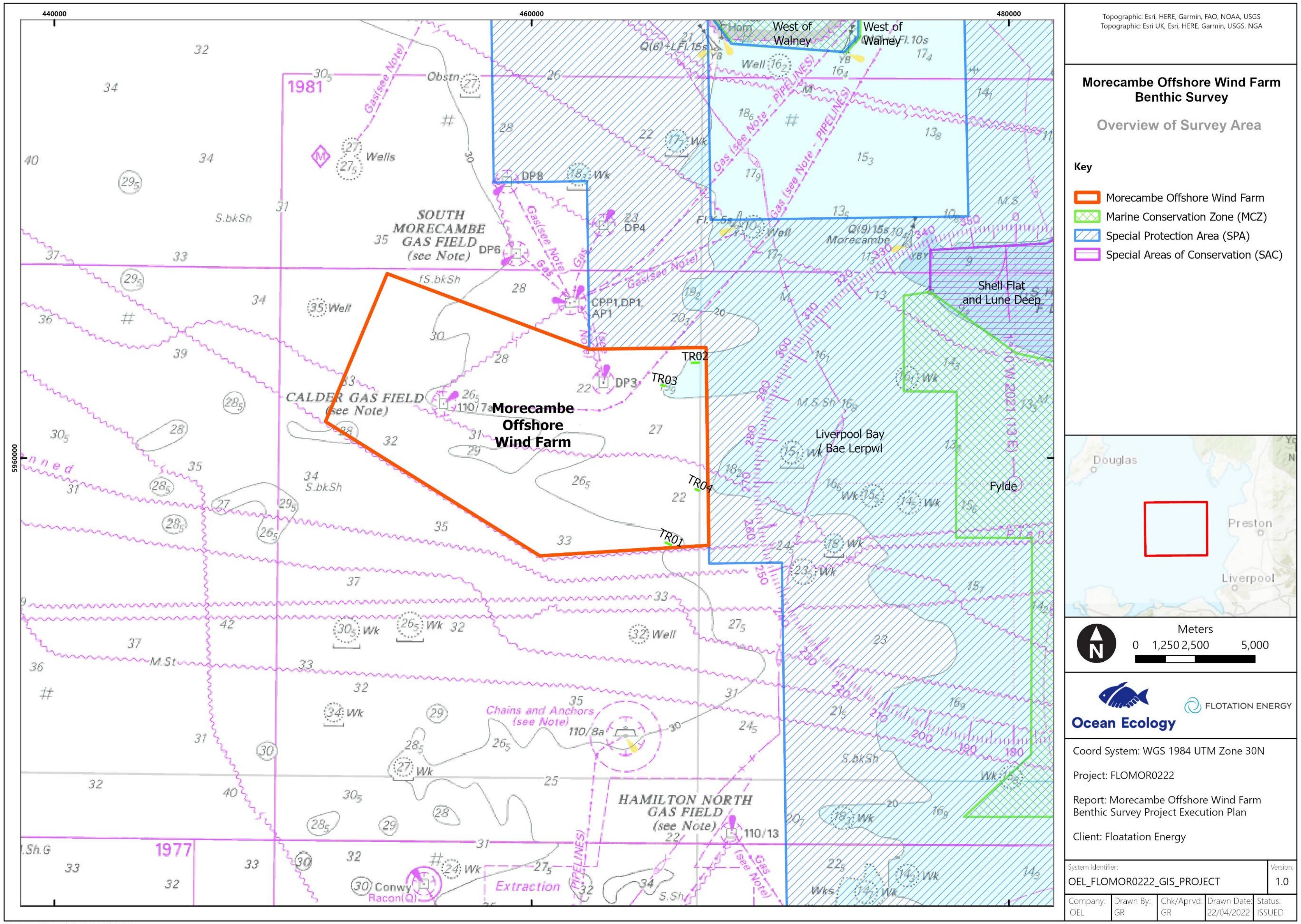

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Figure 1 The location and project layout of the MOWF in the Northeast Irish Sea.

2. Health and Safety

2.1. Risk Assessment

A project specific Risk Assessment Method Statement (RAMS) (OEL_HSE_RAM_FLOMOR0222_V01) has been produced and will be reviewed on-board and adjusted as appropriate during mobilisation. All personnel joining the project must read, understand and sign this document prior to sailing.

2.2. Health, Safety and Environmental Plan

A project specific Health, Safety & Environment Plan (OEL_HSE_HSP_FLOMOR0222_V01) including Emergency Response Procedures has been produced and will be reviewed on-board and adjusted as appropriate during mobilisation. All personnel joining the project must read, understand and sign this document prior to sailing.

2.3. Hazard Identification and Risk Assessment

A Hazard Identification and Risk Assessment meeting is scheduled on Friday 29th April prior to environmental operations commencing. This meeting will aim to discuss the presented RAMS (OEL_HSE_RAM_FLOMOR0222_V01) for the environmental SoW and ensure that all potential hazards are both identified, and suitably and sufficiently mitigated.

3. Overview of Scope

3.1. Overview

The benthic survey will collect benthic grab samples for subsequent macrobenthic and Particle Size Distribution (PSD) analyses at a total of 50 sampling stations across the proposed array area, while contaminant analysis will be done on a subset of 20 stations. Seabed imagery will be collected with a Drop-Down Camera (DDC) system at each of the 50 grab sampling stations prior to grab deployment to ensure the target location is clear of any obstructions or protected habitats (e.g., Annex I).

In addition, seabed imagery will be collected along three DDC transects which have been located over features of interest within the array area to aid in the description of the seabed, identify Annex I habitats, archaeological finds and ground truth the geophysical data collected through November and December 2021.

3.2. Outline of Scope

The benthic survey design includes the following:

- 50 stations to be sampled with a 0.1 m^2 grab sampler with prior investigation by DDC. Samples collected are to be suitable for PSD and macrobenthic analyses. Only single PSD and faunal samples are required from each site
- Contaminant samples to be taken at up to 20 of the sampling locations.
- DDC deployments will be undertaken at each grab location.
- Three DDC transects across the site to ground truth geophysical data and identify any features of interest

3.3. Outline of Methods

Detailed method statements for both camera and grab operations including sampling, processing, analysis and reporting are provided in Sections 5 and 6 of this PEP.

4. Sampling Plan

4.1. Overview

The benthic sampling plan has been developed in line with Phase I of Natural England's "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards" (Natural England 2021a) to provide maximum geographic coverage of the proposed survey area, whilst also ensuring that all key habitats and communities likely to be encountered across the survey area are adequately targeted. The key principles underpinning the survey design were therefore to:

- Provide adequate spatial coverage of the array area;
- Ensure representative sampling of all main sediment types is undertaken; and
- Ensure representative examples of all potential features of conservation interest (e.g., Annex I reefs) are adequately ground-truthed.

4.2. Sampling Plan Procedure

The sampling plan was produced based on a stratified sampling approach across the proposed MOWF array area with micrositing of sampling stations informed by a detailed review and interpretation of the outputs of the 2021 geophysical campaign and consideration for all surface, subsurface and subsea hazards and their respective exclusion / buffer zones.

The following components, provided by the client Floatation Energy, were assessed in the development of the sampling plan:

- 2021 geophysical campaign processed multibeam echosounder (MBES) bathymetry and side scan sonar (SSS) imagery in mosaiced geotiff format (Figure 2);
- 2021 geophysical campaign processed magnetometer and SSS feature analysis to identify potential subsea hazards and Unexploded Ordnance (UXO) (Figure 3);
- Interpreted seabed classification from 2021 geophysical campaign (Figure 3);
- All available GIS shapefiles and rasters in ESRI format including: scoping boundaries and design of the Wind Turbine Generator (WTG) locations for the array, planned and existing infrastructure to include all oil and gas surface and subsurface infrastructure within the MOWF boundary or within close proximity to it; the latest relevant Marine Protected Area (MPA) boundaries, admiralty charts for the survey area (if available);
- All previous survey and/or technical reports available for the area.

The sampling plan consists of two elements: DDC and grab sampling locations, and DDC Transects. Details on each is provided in Sections 4.3 and 4.4 below. A detailed sampling plan is provided in Appendix 1 and sampling plan shapefiles are provided in Appendix 2.

An overview of the proposed sampling stations is also presented spatially in Figure 4 and Figure 5.

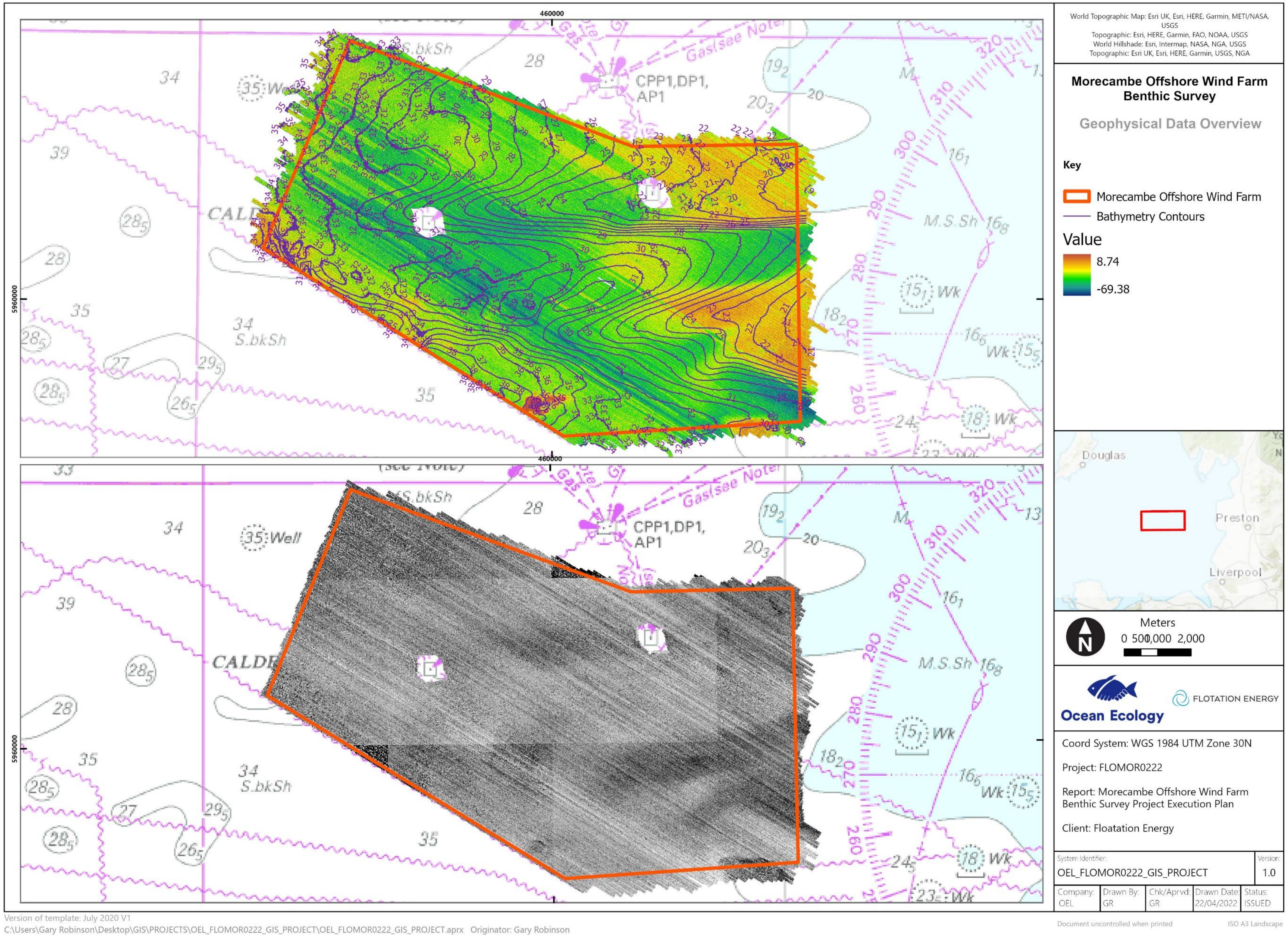

Figure 2 Overview of the MOWF site, results of 2021 geophysical survey campaign (MBES and SSS) used to inform spatial distribution of sampling locations and identify features of interest for investigation with DDC Transects.

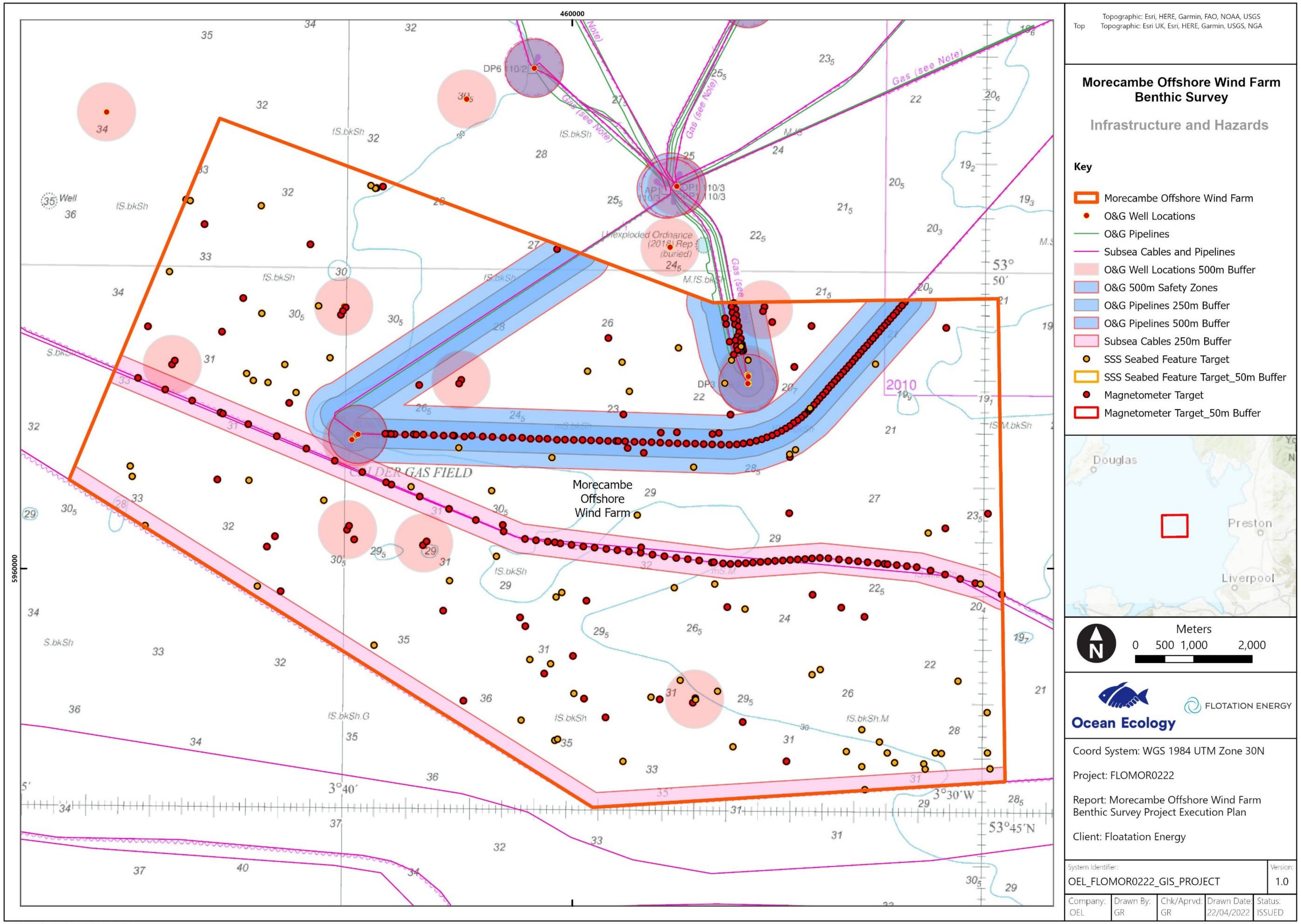

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Figure 3 Overview of the MOWF site and associated surface and sub-surface hazards used to microsite sampling locations.

4.3. Drop Down Camera and Grab Locations

There are up to 50 stations to be sampled with a 0.1 m^2 grab sampler with prior investigation by DDC across the MOWF array area.

The sampling plan was developed to ensure sampling is representative of the varying depths and habitats across the array area in a stratified design whilst also considering the surface and subsurface infrastructures and hazards, design WTG locations and any other notable features identified from the geophysical data review (e.g., areas of seabed scouring and trawl marks).

The DDC investigation prior to grab sampling is to provide additional information on the sediment / substrate surface and to determine suitability to collect grab samples (i.e., confirm the absence of subsea hazards and protected habitats not identified during the geophysical data review).

MBES and SSS was reviewed simultaneously to microsite samples around a stratified grid which was initially overlain on the MOWF array area. SSS and MBES was reviewed manually to identify areas of differing sediment type and seabed elevation. Sediment / substrate type was inferred from SSS based on the reflectivity (coarser sediments providing showing greater reflectivity) and seabed elevation was determined by review of MBES which presents water depth. A representative number of stations was attributed to each of the main Broadscale Habitats (BSH) (Table 1) to ensure coverage of the array area was proportional to the dominant BSH present whilst also considering adequate spatial coverage. Sample locations were further microsited to consider contaminant sampling which was predominantly focused on areas of finer sediment and in proximity to infrastructure which are likely to represent areas of higher contaminant levels.

An overview of the distribution of grab samples and contaminant stations by predicted BSH is provided below in Table 1.

Table 1 Overview of proposed grab locations by predicted Broad Scale Habitat (BSH) and contaminant samples to be sampled across the MOWF array area.

Predicted BSH	No. of Grab Locations	No. of Contaminant Samples
A5.1 - Sublittoral Coarse Sediment	12	4
A5.2 - Sublittoral Sand	38	16
A5.2 - Sublittoral Sand / A5.1 - Sublittoral Coarse Sediment	1	1

Proposed sampling plan for grab sampling is presented visually in Figure 4 and detailed with rationale for each sample location in Appendix 1 – Tab 1: V02 Sampling Plan – DDC & GRAB.

4.3.1. Approach

Sampling will be conducted using OEL's 0.1m^2 Day grab and sediment samples will be collected within 20 m of the target sampling location. Single grab samples will be collected at each station to collect approximately 10L of sediment. Where a suitable sample cannot be collected after three attempts within a 20 m radius of the target location, the sample location will be moved by up to 50 m away. Should none of these attempts be successful, the largest of the three samples should be taken and the volume noted.

Detailed field methods are provided in Section 5.

4.4. Drop Down Camera Transects

There are three targeted transects identified to be sampled with DDC. The main objective of the monitoring focused on characterising any features of interest identified in the geophysical review and assessing for the presence of biogenic/geogenic reef habitats within the MOWF array.

A full interrogation of available geophysical data was undertaken by an experienced ecologist to identify and microsite for reef features or areas of interest that required the collection of additional data (e.g., to better ground truth the geophysical data or aid in the delineation of boundaries between sediment / substrate type). Acoustic data was assessed for any topographically complex area of seabed in the MBES and for any hard return or areas of mottled returns in the SSS data as well as for any distinctness against the surrounding seabed to delineate potential boundaries in reef structures.

Transects have been positioned to ensure they intersect the boundaries of any feature identified to aid in the identification of reef features and delineate the extent of such features. Transects range from 150-300 m in length depending on the feature targeted.

TR01 targets an elevated reef-like feature, distinct from the surrounding seabed, in the southeast corner of the site. TR02 targets an area of pronounced scouring within coarse sediment whereby the SSS signature is distinct from the surrounding seabed in the northeast corner of the site. TR03 targets an area of sandy sediments with narrow scour marks aligned to the prevailing current.

An overview of the proposed DDC Transects by predicted BSH is provided below in Table 2.

Table 2 Overview of proposed DDC Transects by predicted Broad Scale Habitat (BSH) and contaminant samples to be sampled across the MOWF array area.

Predicted BSH	No. of DDC Transects
A5.1 - Sublittoral Coarse Sediment	2
A5.2 - Sublittoral Sand	1
A5.2 - Sublittoral Sand / A5.1 - Sublittoral Coarse Sediment	1

The complete DDC Transect sampling plan is presented visually in Figure 5 and detailed with rationale for each transect location in Appendix 1 – Tab 2: V02 Sampling Plan - Transects.

4.4.1. Approach

Seabed imagery (simultaneous video and stills) will be acquired along the DDC transects using OEL's Rayfin PLE Camera System with freshwater housing to collect 4K video and high-resolution (up to 21 megapixels (MP)) still images. The transects have been orientated to intersect the features of interest and are of length sufficient to delineate the feature boundaries whilst also considering the prevailing currents in the area which run east to west.

Along each DDC transect, a 'bed-hopping' approach will be employed to ensure representative imagery is collected along the full transect with still images to be taken every 5-10 m along with continuous video recording.

Detailed field methods are provided in Section 5.

4.5. Timing

The survey will be undertaken during May 2022 following the sign off of this PEP by Floatation Energy.

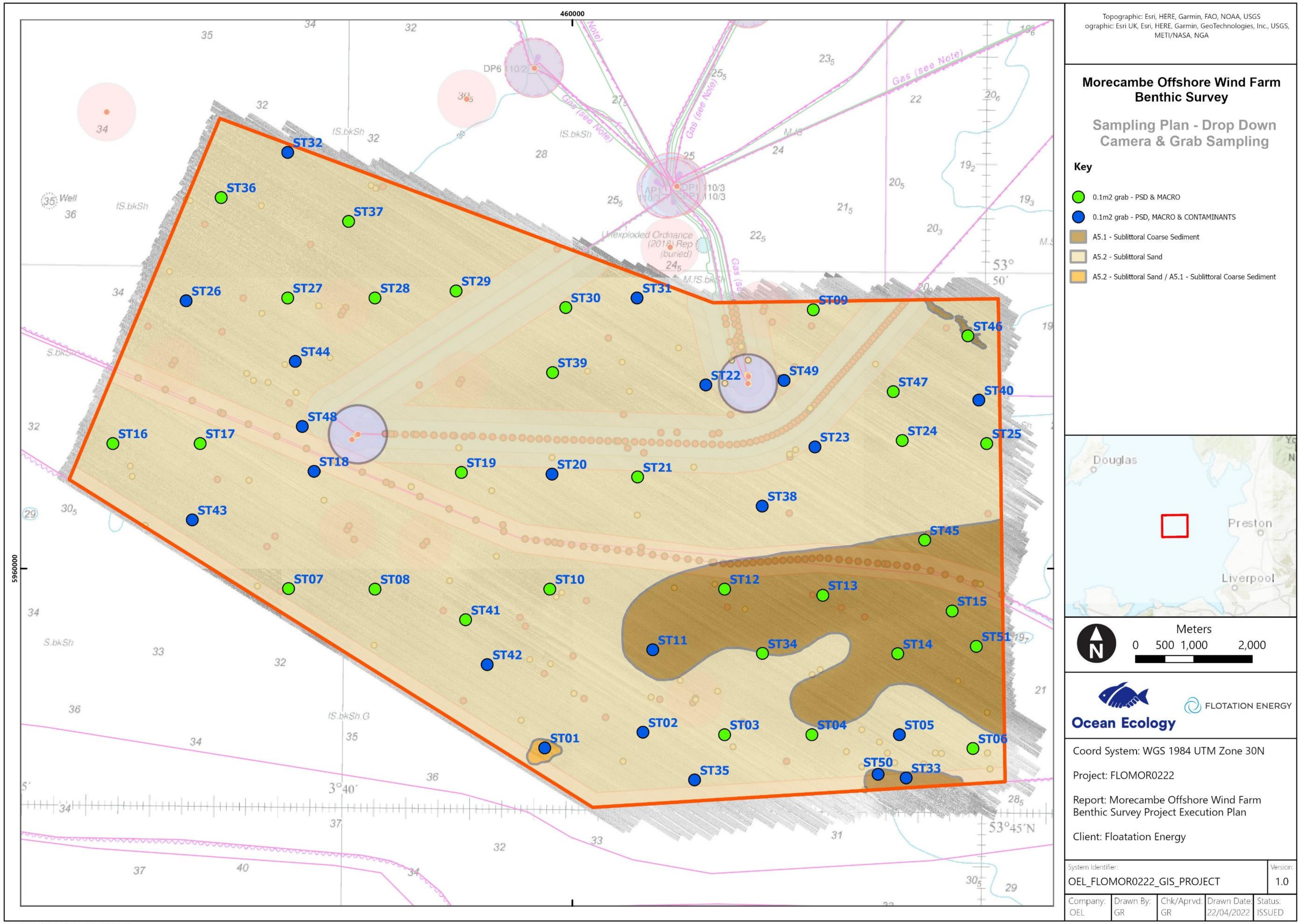

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Figure 4 Locations of MOWF DDC and grab sampling stations.

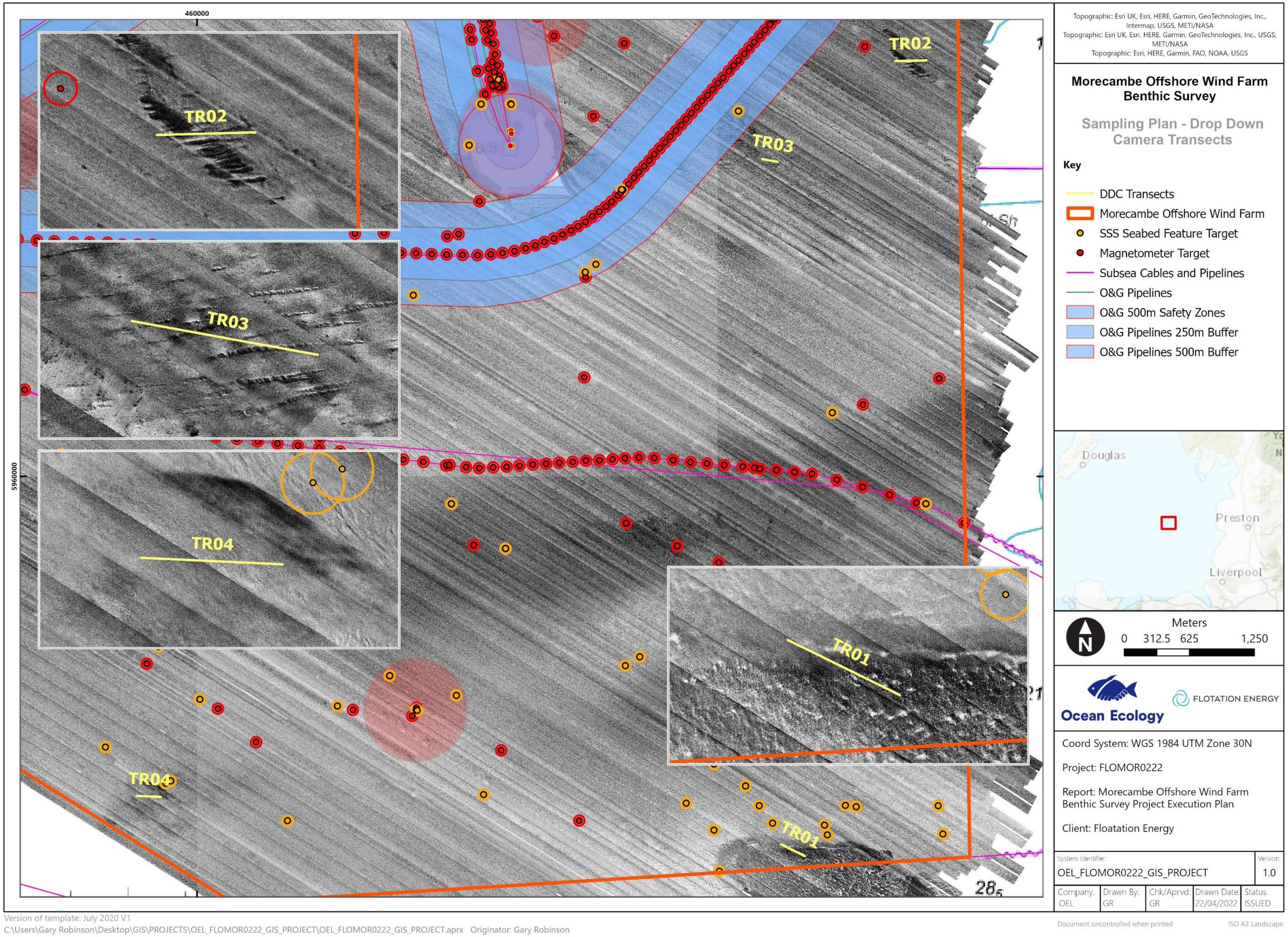

Figure 5 Locations of MOWF DDC transects.

5. Survey Methods

5.1. Survey Vessel

The Marine and Coastal Agency (MCA) Category 2, 10 m dedicated survey vessel *Seren Las*. (Plate 1), operated by OEL, will undertake the benthic surveys, operating out of either Fleetwood or Barrow-in-Furness. *Seren Las* has been specifically designed for the collection of benthic grab samples and deployment of DDC and due to its shallow draft, it is an ideal platform for shallow subtidal surveying.

Table 3 Vessel details.

Vessel Name	Seren Las
Call Sign	MDAH2
MMSI	235087047
Mobilisation Port	TBC – one of Fleetwood or Barrow-in-Furness
Length	10.4 m
Beam	3.5 m
Draft	1.5 m

Plate 1 OEL's dedicated survey vessel, 'Seren Las'.

5.2. Equipment

Table 4 Equipment list to be utilised onboard the Seren Las.

Equipment	Model
Camera System	OEL freshwater housing with HD video and high-resolution stills camera
dGPS	Hemisphere V104s GPS Compass
Gyro Compass	Hemisphere V104s GPS Compass
USBL	Easytrak Nexus 2 Lite
Navigation Software	EIVA NaviPac V4.5

5.3. Seabed Imagery Collection

5.3.1. Drop-Down Video System

Seabed imagery (simultaneous video and stills) will be acquired along the DDC transects using OEL's Rayfin PLE Camera System to collect 4K video and high-resolution (up to 21 megapixels (MP)) still images. The camera system (Plate 2) consists of a SubC Imaging Rayfin PLE camera, seabed frame equipped with freshwater housing (Jones et al. 2020), two LED strip lights, two 5 kW green dot lasers (set to 10 cm distance for scale), a 300 m umbilical and topside computer. The camera is powered with the use of an Uninterruptable Power Supply (UPS) to ensure no damage is caused should the vessel lose power or cause a power surge. The freshwater housing is height and angle adjustable providing a variety of options for view, lighting, and focal length to maximise data quality with respect to prevailing conditions (e.g., high turbidity).

Videos will be digitally overlaid retrospectively with information including project, date, time and Differential Global Positioning System (dGPS) position and recorded in a digital format.

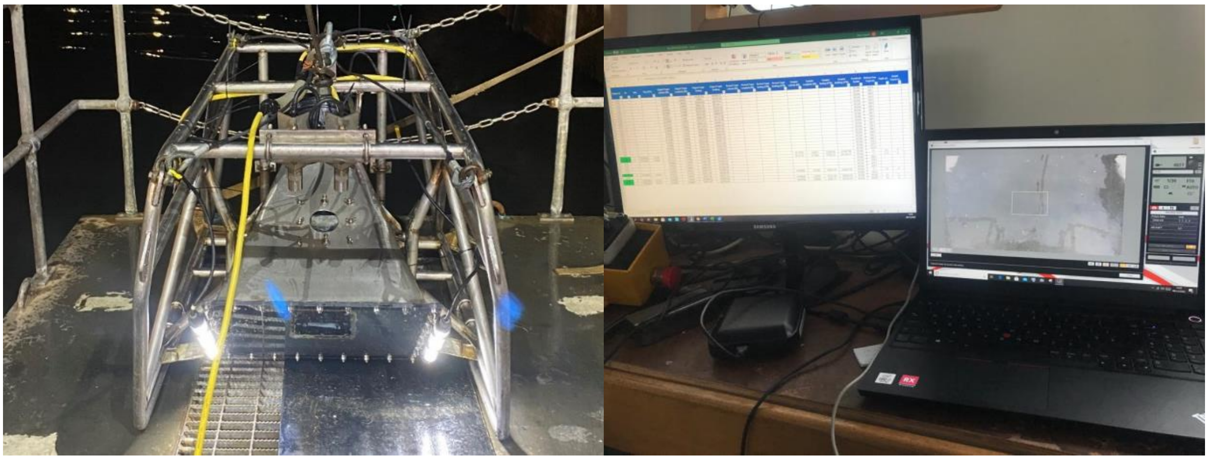

Plate 2 Left: OEL freshwater housing camera system. Right: The camera system topside setup.

All DDC stations (co-located with grab sample locations for prior investigation) and DDC transects will be sampled in line with the JNCC epibiota remote monitoring operational guidelines (Hitchin et al. 2015). Along each DDC transect, a 'bed-hopping' approach will be employed to ensure representative imagery is collected along the full transect with still images to be taken every 5-10 m along with continuous video recording. All footage will undergo a preliminary review *in situ* by the OEL's marine ecologists.

The camera system will be deployed as follows:

- Vessel approach target location and alerts deck personnel to prepare camera and umbilical.
- Sea fastening on camera frame to be released to allow deployment from the deck.
- Umbilical released overboard with sufficient length paid out to cover water depth.

- Camera to be raised and lowered into the water column to within 5 m of the seabed.
- Ecologist switches on video recording and the camera lowered until gently landing on the seabed at which point a positional fix will be taken.
- The ecologist waits for any suspended sediments in the field of view to disperse before taking an image and confirming with the skipper to move on.
- The camera will then be raised from the seabed and moved along the transect 5-10 m. Where possible the seabed will be maintained in view at all times.
- Following the capture of the final image, the camera will be lifted, video recording stopped, and the camera retrieved to the surface.
- The winch operator will then take the tension on the winch cable whilst the ecologist ensures the camera umbilical is free for recovery.
- Once the camera was on the surface, the vessel will be positioned to minimise pitch and roll (e.g., into wind/tide).
- The vessel skipper will then confirm that sea conditions are suitable for retrieval and the camera system recovered aboard.
- The camera frame will then be lowered onto the deck and the tension released.

5.4. Benthic Grab Sampling

Sampling will be conducted using OEL's 0.1m^2 Day grab and samples will be collected within 20 m of the target sampling location. Single grab samples will be collected at each station to collect approximately 10L of sediment from each grab from which a sub-sample of the sediment (a volume of 500 – 750 ml dependent on the nature of the sediment) will be removed for characterisation of the physical nature of the substrate (via PSD analysis). From a subset of 20 stations, contaminant sub-samples will be collected for analysis of various determinants including hydrocarbons and metals.

OEL's 0.1m^2 Day Grab is ideal for sampling medium to fine sediments, benthic macrofauna and for when contaminant sampling is required and is crucial to obtain undisturbed sediment surface samples. Upon contact with the seabed, the tension from the wire is released which causes the sampling bucket to pivot through 90º, pushing seabed sediment into the bucket which closes, forming a tight seal to avoid sediment/sample loss.

A 0.1m^2 mini Hamon Grab will be available as backup to sample coarser sediments should there be issues with recovery using the Day Grab. The Hamon Grab is designed to sample coarse sands and gravels.

The grab will be deployed from the A-frame on the aft deck of the *Seren Las*.

5.4.1. Sample Collection

To ensure consistency in sampling, grab samples will be screened by the lead marine ecologist and considered unacceptable if:

- The sample is less than 5L. i.e., the sample represents less than approx. a half of the 10L capacity of the grab used.
- The jaws fail to close completely or are jammed open by an obstruction, allowing fines to pass through (washout or partial washout).
- The sample is taken at an unacceptable distance from the target location (beyond 20 m).
- There is obvious contamination of the sample from survey equipment, paint chips etc.

Where a suitable sample cannot be collected after three attempts within a 20 m radius of the target location, the sample location will be moved by up to 50 m away. Where samples of less than 5L are continually achieved, these samples will be assessed on site to establish if the sample volume is acceptable to allow subsequent analysis. No pooling of samples will take place.

5.4.2. Grab Sample Processing (PSD & MACRO)

Initial grab sample processing will be undertaken onboard the *Seren Las* in line with the following methodology:

- Initial visual assessment of sample size and acceptability made.
- Photograph of the sample with station details and scale bar to be taken.
- Sub-sample removed for PSD analysis and transferred to a labelled tray.
- Remaining sample emptied onto 1.0 mm sieve net laid over 4.0 mm sieve table and washed through using gentle rinsing with seawater hose.
- Remaining sample for faunal sorting and identification backwashed into a suitable sized sample container and diluted 10% formalin solution added to fix the sample prior to laboratory analysis.
- Sample containers will be clearly labelled internally and externally with date, sample ID and project name.

Detailed field notes will be taken including station number, fix number, number of attempts, sample volume, sediment type, conspicuous fauna, any sign of protected features and water depth.

5.4.3. Grab Sample Processing (CONTAMINANTS)

A separate grab will be taken at a subset of up to 20 sample stations. Detailed notes will be taken of visible sediment conditions and seabed features, obvious fauna and habitat-related features whilst in the field, prior to detailed analysis at the MMO validated laboratories, SOCOTEC (contaminant analyses) and OEL (PSD). Sample processing will be undertaken onboard the survey vessel using the following methodology:

- Inspection cover lifted and general assessment of sample size and acceptability made ensuring sediment surface is undisturbed and no obvious sign of contamination. NB ensure no grease, oils or lubes enter the sample once the inspection cover is open.
- pH / Redox probe placed into sediment sample and allowed to settle for 2 minutes before taking readings in field logs.
- Sediment samples will be sub-sampled and decanted into the recommended sample containers provided by SOCOTEC, the contaminant laboratory specialists for the required analyses as below:
  - Moisture Content
  - Total organic matter (by loss on ignition)
  - Total Organic Carbon (TOC)
  - Total content and the content of the labile form of heavy metals (Pb, Cu, Zn, Ni, Cd, Cr, As, Hg);
  - Organotins (DBT, TBT)
  - Polycyclic aromatic hydrocarbons (PAHs) - Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[ghi]perylene, Benzo[e]pyrene, Benzo[k]fluoranthene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene, Fluorene, Indeno[123,cd]pyrene, Naphthalene, Perylene, Phenanthrene, Pyrene
  - Total Hydrocarbon Content (THC)
  - Polychlorinated biphenyls (PCBs 25 including the ICES 7); -

All samples taken for physico-chemical analysis will be stored frozen at -20°C in amber glass containers, up to a maximum of 3 months[1]. These containers will be acid cleaned and solvent-rinsed before use, sealed with a foil liner and tightened appropriately to avoid potential loss of determinands, contamination of samples, or both. A temperature of 25°C will not be exceeded at any stage of storage or transportation.

Two replicates (A and B Reps) will be collected at each contaminant sampling location. The B replicates will be stored frozen in line with MMO requirements in case of requirement for re-analysis or in the event of any A replicates becoming compromised during transit / storage prior to analysis.

5.5. Navigation Equipment

The vessel is equipped with a Hemisphere V104s Global Positioning System (GPS) compass system. The Hemisphere V104s's internal GPS receiver automatically searches for and uses a minimum of 4 GPS satellites and manages the navigation information required for position to

[1] Samples will be delivered to SOCOTEC immediately for analysis and processed within 30 days of receipt.

within 3 m (95% accuracy). Since there is some error in the GPS data calculations, the V104s also automatically tracks a Satellite-Based Augmentation System (SBAS) differential correction to improve its position accuracy to better than 1.0 m 95%.

The V104s has an integrated gyro and two tilt sensors to provide an accurate heading for the navigation software.

5.6. Subsea Positioning

The vessel will be fitted with an Easytrak Nexus 2 Lite Ultra-Short Baseline (USBL) system and 1329A Omni-directional +/-90° Micro Beacons for subsea positioning of the camera and grab. The Easytrak Nexus 2 Lite is an advanced USBL positioning and tracking system that determines the position of dynamic subsea targets through the transmission and reception of acoustic signals between the submerged transceiver and a target beacon.

5.6.1. Positional Checks

The GPS has an internal precision calculation to give a graphical representation of horizontal accuracy and displays numerical precision in easting and northing. To verify the reference systems are operating correctly, transformation parameters and a test point shall be agreed upon with the Client prior to the commencement of operations. Vessel heading will be checked in reference to a known point for accuracy on mobilisation.

5.7. Navigation Software

A vessel-based positioning system will be employed utilizing EIVA NaviPac V4.2 software to ensure the accurate positioning of the vessel and survey equipment via the USBL system. A navigation screen, displaying EIVA Helmsman Display will be provided at the helm position of the vessel for the Officer on Watch as well as for the ecologist/surveyor in the wheelhouse.

5.8. Project Parameters

5.8.1. Horizontal Reference systems

Table 5 Project horizontal geodetic parameters.

Parameter	Value
Datum	World Geodetic System 1984
Ellipsoid	World Geodetic System 1984
Spheroid	World Geodetic System 1984
Semi Major Axis (m)	6378137.0
Semi Minor Axis (m)	6356752.314245719
Inverse Flattening (1/f)	298.257223563
Angular unit	Degree

Table 6 Project horizontal projection parameters.

Parameter	Value
Projection	Universal Transverse Mercator (UTM) Zone 30N
Longitude at Central Meridian	003° 00.000000' E

Latitude of Origin	000° 00.000000′ N
False Northing and Easting (m)	0; 500,000
Scale Factor	0.9996
Linear Unit	Metre
Time Datum	Universal Time Coordinated (UTC)

5.8.2. Unit Format and Conversions

The following units will be used throughout this project and are expressed using the following conventions.

Table 7 Project unit format and convention details.

Unit Formats and Conventions	
Geographical Coordinates	Latitude N DD˚MM.mmmmmm' to 6 decimal places. Longitude E/W DD˚MM.mmmmmm' to 6 decimal places.
Grid Coordinates	Meters in the following format: Easting EEE EEE.eee m to 3 decimal places. Northing NNN NNN.nnn m to 3 decimal places.
Linear distances	Meters to 1 decimal places.
Kilometre Point (KP) distances	Kilometres to 2 decimal places.
Offset measurement sign conventions	Meters in the following format: 'Y' is positive forward 'X' is positive to starboard 'Z' values are positives upwards from the waterline
Time	Local unless otherwise stated.

6. Post-Survey Analysis & Reporting

6.1. Benthic Grab Sample Analysis

All elutriation, extraction, identification, and enumeration will be undertaken at OEL's NE Atlantic Marine Biological Analytical Quality Control (NMBAQC) scheme participating laboratory in line with the NMBAQC Processing Requirement Protocol (Worsfold & Hall 2010). All processing information and macrobenthic records will be recorded using OEL's cloud-based data management application ABACUS that employs MEDIN validated, controlled vocabularies ensuring all sample information, nomenclature, qualifiers, and metadata are recorded in line with international data standards.

For each macrobenthic sample, the excess formalin will be drained off into a labelled container over a 1 mm mesh sieve in a well-ventilated area. The samples will then be re-sieved over a 1 mm mesh sieve to remove all remaining fine sediment and fixative. The low-density fauna will then be separated by elutriation with freshwater, poured over a 1 mm mesh sieve, transferred into a Nalgene and preserved in 70 % Industrial Denatured Alcohol (IDA). The remaining sediment from each sample will subsequently be separated into 1 mm, 2 mm and 4 mm fractions and sorted under a stereomicroscope to extract any remaining fauna (e.g., high-density bivalves not 'floated' off during elutriation).

All fauna present will be identified to species level, where possible, and enumerated by trained benthic taxonomists using the most up to date taxonomic literature and checks against existing reference collections. Nomenclature will utilise the live link within ABACUS to the WoRMS web services to ensure the most up to date taxonomic classifications are recorded. Colonial fauna (e.g., hydroids and bryozoans) will be identified to species level where possible and recorded as present (P). For subsequent data analysis, taxa recorded as P will be given the numerical value of 1. A full reference collection will be retained including at least one example specimen of each taxon.

Biomass will be measured as blotted wet weight in grams to at least 4 decimal places for all countable taxa (i.e., at species level where possible). As a standard, the conventional conversion factors as defined by Eleftheriou & Basford (1989) will be applied to biomass data to provide equivalent dry weight biomass (Ash Free Dry Weight).

The conversion factors applied are as follows:

- Annelida = 15.5%
- Crustacea = 22.5%
- Mollusca = 8.5%
- Echinodermata = 8.0%
- Miscellaneous = 15.5%

In addition to OEL's standard quality control procedures, the macrobenthic sample processing will be subject to external quality control checks by an independent, competent benthic laboratory participant in the NMBAQC scheme as per the RSMP protocol(Ware et al. 2011, Cooper & Mason 2019).

6.2. Particle Size Distribution (PSD) Analysis

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

Frozen sediment samples will first be transferred to a drying oven and thawed at 80°C for at least 6 hours before visual assessment of sediment type. Before any further processing (e.g., sieving or sub-sample removal), samples will be mixed thoroughly with a spatula and all conspicuous fauna (>1 mm) which appeared to have been alive at the time of sampling removed from the sample. A representative sub-sample of the whole sample will then be removed for laser diffraction analysis before the remaining sample screened over a 1 mm sieve to sort coarse and fine fractions. The >1 mm fraction will then be returned to a drying oven and dried at 80°C for at least 24 hours before dry sieving. Once dry, the sediment sample will be run through a series of Endecott BS 410 test sieves (nested at 0.5 φ intervals) using a Retsch AS200 sieve shaker to fractionate the samples into particle size classes. The dry sieve mesh apertures to be used are given in Table 8.

Table 8 Sieve series employed for PSD analysis by dry sieving.

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

The sample will then be transferred onto the coarsest sieve at the top of the sieve stack and shaken for a standardised period of 20 minutes. The sieve stack will be 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 may be undertaken if there is evidence that particles had not been properly sorted.

The sub-sample for laser diffraction will be first screened over a 1 mm sieve and the fine fraction residue (<1 mm 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 is achieved. The fine fraction will then be analysed by laser diffraction using a Beckman Coulter LS13 320. For silty sediments, ultrasound will be used to agitate particles and prevent aggregation of fines.

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

Sediment descriptions will be defined by their size class based on the Wentworth classification system (Wentworth 1922) (Table 9). Statistics such as mean and median grain size, sorting coefficient, skewness and bulk sediment classes (percentage silt, sand and gravel) will also be derived following the Folk classification (Folk 1954).

Table 9 The classification used for defining sediment type based on the Wentworth Classification System (Wentworth 1922).

Wentworth Scale	Phi Units (φ)	Sediment Types
>64 mm	<-6	Cobble and boulders
32 – 64 mm	-5 to -6	Pebble
16 – 32 mm	-4 to -5	Pebble
8 – 16 mm	-3 to -4	Pebble
4 - 8 mm	-3 to -2	Pebble
2 - 4 mm	-2 to -1	Granule
1 - 2 mm	-1 to 0	Very coarse sand
0.5 - 1 mm	0 – 1	Coarse sand
250 - 500 µm	1 – 2	Medium sand
125 - 250 µm	2 – 3	Fine sand
63 - 125 µm	3 – 4	Very fine sand
31.25 – 63 µm	4 – 5	Very coarse silt
15.63 – 31.25 µm	5 – 6	Coarse silt
7.813 – 15.63 µm	6 – 7	Medium silt
3.91 – 7.81 µm	7 – 8	Fine silt
1.95 – 3.91 µm	8 – 9	Very fine silt
<1.95 µm	<9	Clay

In addition to OEL's standard quality control procedures, the PSD sample processing will be subject to external quality control checks by an independent, competent benthic laboratory participant in the NMBAQC scheme as per the RSMP protocol (Ware et al. 2011, Cooper & Mason 2019).

6.3. Seabed Imagery Analysis

All seabed imagery analysis collected by DDC will be undertaken in consideration of the latest NMBAQC/JNCC Epibiota Quality Assurance Framework (QAF) guidance and identification protocols available on the NMBAQC website. Final datasets will be presented using the latest NMBAQC/JNCC epibiota monitoring proformas available for stills and video footage and will be quality assured using the Quality Assurance Framework (QAF) form check and comparison tools.

The seabed imagery analysis Bio-Image Indexing and Graphical Labelling Environment (BIIGLE) annotation platform (Langenkämper et al. 2017) and Analysis of still images will be undertaken in two stages. The first stage, “Tier 1”, will consist of labels that refer to the whole image being assigned providing appropriate metadata for the image including European Nature Information System (EUNIS) habitat classifications assigned in line with Parry (2019). The second stage, “Tier 2”, will be used for enumerating epibiotal abundance and cover within each image and to assign percentage cover of reef types.

A full reef habitat assessment (HA) will be conducted on all DDC imagery to determine whether habitats meet the definitions of Annex I reef habitats as detailed in (Table 10 and Table 11). The latest JNCC guidance on the characterisation of ‘low resemblance’ Annex I stony reef will also be considered (Golding et al. 2020).

The annotation label tree to be used during analysis will have major headings for each of the reef types. Under each reef type, labels will be assigned for each of the categories required to determine whether Annex I reef habitat is present (Table 10 and Table 11).

Table 10 Characteristics of stony reef (Irving 2009).

Characteristic	‘Reefiness’			
	Not a Reef	Low	Medium	High
Composition (proportion of boulders/cobbles (>64 mm))	<10 %	10-40 % matrix supported	40-95 %	>95 % clast-supported
Elevation	Flat seabed	<64 mm	64 mm - 5 m	>5 m
Extent	<25 m^2	>25 m^2		
Biota	Dominated by infaunal species	>80 % of species present composed of epibiotal species		

Table 11 Characteristics of *Sabellaria spinulosa* reef (Gubbay 2007).

Characteristic	‘Reefiness’			
	Not a Reef	Low	Medium	High
Elevation (cm)	< 2	2 - 5	5 – 10	> 10
Extent (m^2)	< 25	25 – 10,000	10,000 – 1,000,000	> 1,000,000
Patchiness (% Cover)	< 10	10 - 20	20 – 30	> 30

6.3.1. Tier 1 Analysis

The first stage, “Tier 1”, will consist of assigning labels that referred to the whole image, providing appropriate metadata for the image. Metadata “Image Labels” include:

- Broadscale Habitat (BSH) type.
- Substrate type (and percentage cover in 10% intervals).
- Bedforms present.

- The presence of any Annex I habitats, Features of Conservation Importance (FOCI),Habitats of Conservation Importance (HOCI) and Invasive Non-Native Species (INNS).
- The presence of any visible impacts or other modifiers (such as discarded fishing gear or marine litter (as per the Marine Strategy Framework Directive (MSFD) categories), visible physical damage to the seabed, evidence of strong currents, non-native species, etc.).
- Image quality categories (including "Not Analysable" category).

Depending on the presence of reef, this will also include:

- Extent: As it is not possible to fully determine the extent of reef habitats from a single image alone this label will be used to identify areas that are highly unlikely to constitute reef habitats. An example is an image that shows a large boulder being preceded and succeeded by images of unconsolidated sandy sediments.
- Biota: Labels assigned to determine whether epifauna dominate the biological community observed.
- Elevation: Labels assigned depending on reef type. Laser points will be used to assist in the assignment of categories.

6.3.2. Tier 2 Analysis

The second stage, "Tier 2", will be used to assess epibiotal abundance data as "annotations" within each image for all visible flora and fauna. This will be undertaken as follows:

- Using the BIIGLE Annotation Platform, (detailed below) enumeration of all visible taxa will be undertaken using points for enumerable "count" taxa and polygons for ground-covering taxa; to enable calculation of percentage cover for these taxa.
- Where an individual of a "count" taxon overlay a ground-cover taxon, then this individual is still counted (i.e., a point annotation will be added for the count taxa over the polygon of the ground-cover taxon).
- Identification of any invasive non-native species (INNS) and species non-native to UK waters. Information will also be included on species non-native to the local habitat types (e.g. hard-substrate specialists in a wider sedimentary habitat).

The substratum observed in each still image will be recorded as a percentage cover of CATAMI (Althaus et al. 2015) substratum types where possible. Determination of sediment type (such as coarse, mixed, sand etc.) will be facilitated using the adapted Folk sediment trigon (Long 2006) incorporated into a sediment category correlation table. Percentage cover of the different substrate types will be used to determine and assign EUNIS codes and BSH.

6.4. Reporting

6.4.1. Field Report

Within five working days of demobilisation of the survey, a field report will be issued by OEL to Floatation Energy providing a summary of the work completed. This report will summarise sampling progress, any problems encountered and provide final field logs and sample images.

6.4.2. Technical Report

All of the raw data derived from the characterisation survey will undergo detailed analysis and interpretation in line with Phase III of NE's "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards" (Natural England 2021b). Following the completion of all data analysis, OEL will provide a detailed technical report to provide a description of the baseline environment, including a narrative of the seabed type across the project area, the range of habitats and biotopes present and the presence of any habitats/species of conservation importance. Data will be collated using Excel spreadsheets conforming to the relevant Marine Environmental Data and Information Network (MEDIN) data guidelines and with all site locations recorded. All electronic data will be provided in addition to the report. An outline contents table for the report is set out in Table 12.

Table 12 Outline of the offshore benthic baseline technical report contents.

Section	Description
Introduction	• Project background • Existing environment • Aims and objectives
Methods	• Sampling design and rationale including methods of geophysical interpretation • Field methods • Seabed imagery analysis methods including Annex I assessment methodology • Benthic grab sampling analysis methods • Statistical analysis • GIS Habitat Mapping Procedures
Results	• Summary of progress • Sediment analysis and mapping • Macrobenthic analysis and mapping • Seabed imagery analysis and mapping (with Annex I assessment) • Mapping of benthic habitats • Assessment of any Annex I habitats encountered
Discussion	• Contextualisation of results • Limitations of the study • Conclusion
References	• List of references used

Appendices	• Sampling logs • Data matrices • Benthic grab sample image examples • Seabed imagery examples • GIS data package

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Appendix II - Methods for the analysis of sediment chemistry

Method	Sample and Fraction Size	Method Summary
Total Organic Carbon (TOC)	Air dried	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Metals	Air dried	Aqua-regia extraction followed by ICP analysis.
Silver & Tellurium	Air dried	Nitric acid extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Ultra-violet fluorescence spectroscopy
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Appendix III - Analytical routines

Hierarchical Cluster Analysis & SIMPROF

Cluster analysis is used to establish groups of samples which show multivariate similarity using an agglomerative hierarchical clustering method. When applied to between-sample similarity matrices based on Bray-Curtis similarities (Bray & Curtis, 1957) results can be represented in a dendrogram where samples are displayed on the x-axis and the level of similarity is displayed on the y-axis. Similarity profile permutation (SIMPROF) tests can be undertaken to test for the presence of statistically significant sample groups in a priori unstructured set of samples (Clarke et al. 2008) separated in the dendrogram.

Multidimensional Scaling (MDS)

MDS ordination plots can be used to represent the similarity of samples based on their multivariate structure by arranging them graphically in a multidimensional plot. This plot can be configured to display the sample points in two dimensions and provides a stress value that indicates the degree to which the plot is providing a representative interpretation of the similarity between the samples.

Similarity Percentage (SIMPER)

Using the Bray-Curtis measure of similarity the SIMPER routine identifies the variables primarily providing the discrimination between two observed sample clusters. This analysis breaks down the contribution of each variable to the observed similarity between samples effectively meaning the key characterising variables of identified groups can be identified.

Shade Plots

PRIMER v7 now allows shade plots to be plotted showing simple visual representations of abundance matrices from multivariate species assemblage studies and have been shown to be an effective aid in choosing overall transformation (or other pre-treatment) of quantifiative data (Clarke et al. 2014). Shade plots with linear grey-scale intensity proportional species abundance data can therefore be plotted and species can be clustered using the standard agglomerative method, based on the 'index of association' resemblances computed on species-standardised abundance. Resulting dendograms can be rotated to maximise the seriation statistic p, non-parametrically correlating their resemblances on the distance structure of a linear sequence to present the data in a form where general trends are most easily distinguished.

Appendix IV - Morecambe OWF drop-down camera video survey logs.

Station	Date	Video Start Time (UTC)	Video Length	Video End Time (UTC)	GPS to Camera Time Offset	No. of Videos	No. of Images Per Video	Video File Name	Depth (m)	Camera System	Freshwater Housing Height Setting	Distance Between Laser Points (cm)	FOCI/OSPAR present (excluding reef)	Potential Annex I reef?
ST01	**Station not sampled due to being covered by TR04**													
ST02	29/05/2022	16:55:45	00:03:51	16:59:36	00:00:03	1	6	FLOMOR0322_ST02_2022_05_29_165543	35.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST03	29/05/2022	17:34:15	00:03:30	17:37:45	00:00:02	1	5	FLOMOR0322_ST03_2022_05_29_173413	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST04	01/06/2022	04:20:45	00:04:05	04:24:50	00:00:00	1	8	FLOMOR0322_ST04_2022_06_01_042045	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST05	01/06/2022	05:48:30	00:06:30	05:55:00	00:00:01	1	8	FLOMOR0322_ST05_2022_06_01_054829	32.0	SubC Rayfin PLE System	Top - Plan View	10	Y	N
ST06	01/06/2022	06:12:00	00:04:40	06:16:40	00:00:00	1	6	FLOMOR0322_ST06_2022_06_01_061200	30.0	SubC Rayfin PLE System	Top - Plan View	10	Y	N
ST07	29/05/2022	14:43:45	00:02:22	14:46:07	00:00:01	1	5	FLOMOR0322_ST07_2022_05_29_144344	30.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST08	29/05/2022	15:03:08	00:03:19	15:06:27	00:00:03	1	6	FLOMOR0322_ST08_2022_05_29_130305	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST09	28/05/2022	12:39:47	00:02:52	12:42:39	00:00:04	1	5	FLOMOR0322_ST09_2022_05_28_123943	27.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST10	29/05/2022	15:43:10	00:02:07	15:45:17	00:00:03	1	5	FLOMOR0322_ST10_2022_05_29_154307	32.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST11	29/05/2022	17:59:10	00:02:59	18:02:09	00:00:03	1	5	FLOMOR0322_ST11_2022_05_29_175907	31.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST12	29/05/2022	18:20:30	00:03:58	18:24:28	00:00:02	1	5	FLOMOR0322_ST12_2022_05_29_182028	29.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST13	01/06/2022	07:53:35	00:04:43	07:58:18	00:00:01	1	6	FLOMOR0322_ST13_2022_06_01_075334	25.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST14	01/06/2022	07:27:35	00:05:24	07:32:59	00:00:01	1	6	FLOMOR0322_ST14_2022_06_01_072734	24.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST15	01/06/2022	07:03:20	00:10:00	07:13:20	00:00:01	2	5	FLOMOR0322_ST15_2022_06_01_070319	22.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
		07:13:20	00:01:23	07:14:43	00:00:01		3	FLOMOR0322_ST15_2022_06_01_071321						
ST16	29/05/2022	13:46:30	00:02:42	13:49:12	00:00:02	1	5	FLOMOR0322_ST16_2022_05_29_134628	37.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST17	29/05/2022	14:07:00	00:02:36	14:09:36	00:00:03	1	5	FLOMOR0322_ST17_2022_05_29_140657	35.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST18	28/05/2022	17:01:40	00:03:32	17:05:12	00:00:03	1	6	FLOMOR0322_ST18_2022_05_28_170137	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST19	28/05/2022	16:33:15	00:02:28	16:35:43	00:00:05	1	5	FLOMOR0322_ST19_2022_05_28_163310	32.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST20	28/05/2022	16:07:11	00:06:16	16:13:27	00:00:04	1	5	FLOMOR0322_ST20_2022_05_28_060707	32.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST21	28/05/2022	14:02:30	00:04:21	14:06:51	00:00:05	1	6	FLOMOR0322_ST21_2022_05_28_140225	32.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST22	28/05/2022	14:35:20	00:03:24	14:38:44	00:00:03	1	5	FLOMOR0322_ST22_2022_05_28_143517	25.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST23	28/05/2022	13:19:40	00:03:09	13:22:49	00:00:04	1	5	FLOMOR0322_ST23_2022_05_28_131936	29.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST24	01/06/2022	08:35:20	00:04:27	08:39:47	00:00:00	1	6	FLOMOR0322_ST24_2022_06_01_083520	26.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST25	01/06/2022	10:23:20	00:04:55	10:28:15	00:00:01	1	6	FLOMOR0322_ST25_2022_06_01_102319	30.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST26	29/05/2022	13:22:55	00:02:37	13:25:32	00:00:02	1	5	FLOMOR0322_ST26_2022_05_29_132253	38.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST27	28/05/2022	17:51:55	00:03:33	17:55:28	00:00:04	1	7	FLOMOR0322_ST27_2022_05_28_175151	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST28	29/05/2022	12:08:55	00:03:47	12:12:42	00:00:01	1	6	FLOMOR0322_ST28_2022_05_29_120854	37.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST29	29/05/2022	11:50:22	00:03:00	11:53:22	00:00:01	1	5	FLOMOR0322_ST29_2022_05_29_115021	35.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST30	28/05/2022	15:27:15	00:07:44	15:34:59	00:00:03	1	8	FLOMOR0322_ST30_2022_05_28_152712	29.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST31	28/05/2022	15:03:52	00:07:45	15:11:37	00:00:06	1	5	FLOMOR0322_ST31_2022_05_28_150346	27.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST32	29/05/2022	12:47:00	00:04:06	12:51:06	00:00:03	1	5	FLOMOR0322_ST32_2022_05_29_124657	38.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST33	**Station not sampled due to being covered by TR01**													
ST34	29/05/2022	18:39:00	00:03:45	18:42:45	00:00:09	1	5	FLOMOR0322_ST34_2022_05_29_183851	30.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST35	29/05/2022	17:14:00	00:07:18	17:21:18	00:00:04	1	5	FLOMOR0322_ST35_2022_05_29_171356	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST36	29/05/2022	13:04:45	00:02:38	13:07:23	00:00:02	1	5	FLOMOR0322_ST36_2022_05_29_130443	38.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST37	29/05/2022	12:28:50	00:02:59	12:31:49	00:00:02	1	5	FLOMOR0322_ST37_2022_05_29_122848	36.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST38	28/05/2022	13:36:37	00:03:37	13:40:14	00:00:04	1	5	FLOMOR0322_ST38_2022_05_28_133633	35.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST39	28/05/2022	15:47:15	00:03:29	15:50:44	00:00:03	1	7	FLOMOR0322_ST39_2022_05_28_154712	27.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST40	01/06/2022	10:09:10	00:03:25	10:12:35	00:00:01	1	6	FLOMOR0322_ST40_2022_06_01_100909	25.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST41	29/05/2022	15:23:00	00:02:51	15:25:51	00:00:02	1	5	FLOMOR0322_ST41_2022_05_29_152258	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST42	29/05/2022	15:58:45	00:02:52	16:01:37	00:00:03	1	5	FLOMOR0322_ST42_2022_05_29_155842	38.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST43	29/05/2022	14:21:20	00:03:45	14:25:05	00:00:03	1	6	FLOMOR0322_ST43_2022_05_29_142117	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST44	28/05/2022	17:33:30	00:03:15	17:36:45	00:00:04	1	5	FLOMOR0322_ST44_2022_05_28_173326	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST45	01/06/2022	08:15:55	00:04:54	08:20:49	00:00:00	1	6	FLOMOR0322_ST45_2022_06_01_081555	27.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST46	**Station not sampled due to being covered by TR02**													
ST47	**Station not sampled due to being covered by TR03**													
ST48	28/05/2022	17:16:45	00:03:00	17:19:45	00:00:04	1	8	FLOMOR0322_ST48_2022_05_28_171641	32.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST49	28/05/2022	13:00:27	00:02:26	13:02:53	00:00:04	1	6	FLOMOR0322_ST49_2022_05_28_130024	26.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST50	01/06/2022	04:46:45	00:04:40	04:51:25	00:00:00	1	7	FLOMOR0322_ST50_2022_06_01_044645	34.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
ST51	01/06/2022	06:41:30	00:10:00	06:51:30	00:00:00	2	4	FLOMOR0322_ST51_2022_06_01_064130	22.0	SubC Rayfin PLE System	Top - Plan View	10	N	N
		06:51:30	00:00:32	06:52:02	00:00:01		1	FLOMOR0322_ST51_2022_06_01_0656131						
TR01	01/06/2022	05:02:50	00:10:00	05:12:50	00:00:01	3	28	FLOMOR0322_TR01_2022_06_01_050249	33	SubC Rayfin PLE System	Top - Plan View	10	N	N
		05:12:50	00:10:00	05:22:50	00:00:01		9	FLOMOR0322_TR01_2022_06_01_052252						
		05:22:10	00:01:12	05:23:22	00:00:01		1	FLOMOR0322_TR01_2022_06_01_053235						
TR02	01/06/2022	09:29:55	00:10:00	09:39:55	00:00:01	3	12	FLOMOR0322_TR02_2022_06_01_092954	24	SubC Rayfin PLE System	Top - Plan View	10	N	N
		09:39:55	00:10:00	09:49:55	00:00:01		16	FLOMOR0322_TR02_2022_06_01_093955						
		09:49:55	00:10:00	09:59:55	00:00:01		10	FLOMOR0322_TR02_2022_06_01_094956						
TR03	01/06/2022	08:55:15	00:10:00	09:05:15	00:00:02	2	16	FLOMOR0322_TR03_2022_06_01_085513	23	SubC Rayfin PLE System	Top - Plan View	10	N	N
		09:05:15	00:07:02	09:12:17	00:00:01		12	FLOMOR0322_TR03_2022_06_01_090514						
TR04	29/05/2022	16:21:10	00:10:00	16:31:10	00:00:03	2	18	FLOMOR0322_TR04_2022_05_29_162107	38	SubC Rayfin PLE System	Top - Plan View	10	N	N
		17:31:10	00:07:10	17:38:20	00:00:03		13	FLOMOR0322_TR04_2022_05_29_163109						

Appendix V - Morecambe OWF drop-down camera stills survey logs.

Station	Image File Name	Fix Time (UTC)	Date	Target Easting	Target Northing	Sampled Easting	Sampled Northing	Distance from Target (m)
ST02	FLOMOR0222_ST02_2022_05_29_165557.jpg	16:56:01	29/05/2022	461209.685	5957188.416	461207.659	5957174.598	14.0
ST02	FLOMOR0222_ST02_2022_05_29_165623.jpg	16:56:26	29/05/2022	461209.685	5957188.416	461212.824	5957177.337	11.5
ST02	FLOMOR0222_ST02_2022_05_29_165706.jpg	16:57:10	29/05/2022	461209.685	5957188.416	461217.719	5957179.410	12.1
ST02	FLOMOR0222_ST02_2022_05_29_165757.jpg	16:58:00	29/05/2022	461209.685	5957188.416	461208.357	5957187.276	1.8
ST02	FLOMOR0222_ST02_2022_05_29_165844.jpg	16:58:47	29/05/2022	461209.685	5957188.416	461204.327	5957194.208	7.9
ST02	FLOMOR0222_ST02_2022_05_29_165927.jpg	16:59:31	29/05/2022	461209.685	5957188.416	461198.585	5957201.376	17.1
ST03	FLOMOR0222_ST03_2022_05_29_173503.jpg	17:35:06	29/05/2022	462611.030	5957149.039	462627.952	5957146.247	17.1
ST03	FLOMOR0222_ST03_2022_05_29_173546.jpg	17:35:49	29/05/2022	462611.030	5957149.039	462620.893	5957145.636	10.4
ST03	FLOMOR0222_ST03_2022_05_29_173621.jpg	17:36:24	29/05/2022	462611.030	5957149.039	462610.930	5957144.714	4.3
ST03	FLOMOR0222_ST03_2022_05_29_173701.jpg	17:37:05	29/05/2022	462611.030	5957149.039	462607.700	5957144.740	5.4
ST03	FLOMOR0222_ST03_2022_05_29_173738.jpg	17:37:41	29/05/2022	462611.030	5957149.039	462607.586	5957155.199	7.1
ST04	FLOMOR0222_ST04_2022_06_01_042114.jpg	04:21:15	01/06/2022	464111.030	5957149.039	464090.187	5957156.328	22.1
ST04	FLOMOR0222_ST04_2022_06_01_042155.jpg	04:21:57	01/06/2022	464111.030	5957149.039	464094.303	5957152.725	17.1
ST04	FLOMOR0222_ST04_2022_06_01_042227.jpg	04:22:29	01/06/2022	464111.030	5957149.039	464099.191	5957153.776	12.8
ST04	FLOMOR0222_ST04_2022_06_01_042241.jpg	04:22:43	01/06/2022	464111.030	5957149.039	464101.913	5957151.043	9.3
ST04	FLOMOR0222_ST04_2022_06_01_042306.jpg	04:23:08	01/06/2022	464111.030	5957149.039	464106.959	5957156.406	8.4
ST04	FLOMOR0222_ST04_2022_06_01_042330.jpg	04:23:31	01/06/2022	464111.030	5957149.039	464112.263	5957154.053	5.2
ST04	FLOMOR0222_ST04_2022_06_01_042350.jpg	04:23:51	01/06/2022	464111.030	5957149.039	464118.288	5957151.262	7.6
ST04	FLOMOR0222_ST04_2022_06_01_042441.jpg	04:24:44	01/06/2022	464111.030	5957149.039	464118.176	5957145.499	8.0
ST05	FLOMOR0222_ST05_2022_06_01_054919.jpg	05:49:15	01/06/2022	465611.030	5957149.039	465597.998	5957141.733	14.9
ST05	FLOMOR0222_ST05_2022_06_01_055046.jpg	05:50:42	01/06/2022	465611.030	5957149.039	465612.529	5957140.959	8.2
ST05	FLOMOR0222_ST05_2022_06_01_055151.jpg	05:51:47	01/06/2022	465611.030	5957149.039	465616.019	5957140.377	10.0
ST05	FLOMOR0222_ST05_2022_06_01_055229.jpg	05:52:26	01/06/2022	465611.030	5957149.039	465620.827	5957139.785	13.5
ST05	FLOMOR0222_ST05_2022_06_01_055303.jpg	05:52:59	01/06/2022	465611.030	5957149.039	465615.261	5957144.944	5.9
ST05	FLOMOR0222_ST05_2022_06_01_055340.jpg	05:53:37	01/06/2022	465611.030	5957149.039	465611.673	5957150.088	1.2
ST05	FLOMOR0222_ST05_2022_06_01_055413.jpg	05:54:10	01/06/2022	465611.030	5957149.039	465610.174	5957152.491	3.6
ST05	FLOMOR0222_ST05_2022_06_01_055453.jpg	05:54:50	01/06/2022	465611.030	5957149.039	465605.384	5957155.475	8.6
ST06	FLOMOR0222_ST06_2022_06_01_061209.jpg	06:12:06	01/06/2022	466873.419	5956911.428	466844.381	5956893.421	34.2
ST06	FLOMOR0222_ST06_2022_06_01_061244.jpg	06:12:40	01/06/2022	466873.419	5956911.428	466866.799	5956907.782	7.6
ST06	FLOMOR0222_ST06_2022_06_01_061349.jpg	06:13:46	01/06/2022	466873.419	5956911.428	466873.178	5956910.129	1.3
ST06	FLOMOR0222_ST06_2022_06_01_061446.jpg	06:14:42	01/06/2022	466873.419	5956911.428	466881.665	5956916.967	9.9
ST06	FLOMOR0222_ST06_2022_06_01_061555.jpg	06:15:51	01/06/2022	466873.419	5956911.428	466889.182	5956912.408	15.8
ST06	FLOMOR0222_ST06_2022_06_01_061635.jpg	06:16:31	01/06/2022	466873.419	5956911.428	466889.174	5956915.913	16.4
ST07	FLOMOR0222_ST07_2022_05_29_144401.jpg	14:44:04	29/05/2022	455127.525	5959655.225	455122.433	5959659.749	6.8
ST07	FLOMOR0222_ST07_2022_05_29_144425.jpg	14:44:28	29/05/2022	455127.525	5959655.225	455124.684	5959660.840	6.3
ST07	FLOMOR0222_ST07_2022_05_29_144457.jpg	14:45:00	29/05/2022	455127.525	5959655.225	455131.712	5959658.548	5.3
ST07	FLOMOR0222_ST07_2022_05_29_144533.jpg	14:45:37	29/05/2022	455127.525	5959655.225	455136.442	5959657.056	9.1
ST07	FLOMOR0222_ST07_2022_05_29_144558.jpg	14:46:01	29/05/2022	455127.525	5959655.225	455135.281	5959645.829	12.2
ST08	FLOMOR0222_ST08_2022_05_29_150332.jpg	15:03:35	29/05/2022	456611.030	5959649.039	456613.848	5959657.921	9.3
ST08	FLOMOR0222_ST08_2022_05_29_150408.jpg	15:04:11	29/05/2022	456611.030	5959649.039	456617.649	5959648.540	6.6
ST08	FLOMOR0222_ST08_2022_05_29_150447.jpg	15:04:50	29/05/2022	456611.030	5959649.039	456620.558	5959649.626	9.5
ST08	FLOMOR0222_ST08_2022_05_29_150531.jpg	15:05:34	29/05/2022	456611.030	5959649.039	456621.558	5959643.719	11.8
ST08	FLOMOR0222_ST08_2022_05_29_150601.jpg	15:06:04	29/05/2022	456611.030	5959649.039	456618.558	5959632.843	17.9
ST08	FLOMOR0222_ST08_2022_05_29_150613.jpg	15:06:16	29/05/2022	456611.030	5959649.039	456619.240	5959635.396	15.9
ST09	FLOMOR0222_ST09_2022_05_28_124008.jpg	12:40:11	28/06/2022	464135.247	5964444.396	464122.273	5964441.337	13.3
ST09	FLOMOR0222_ST09_2022_05_28_124036.jpg	12:40:40	28/06/2022	464135.247	5964444.396	464125.269	5964437.197	12.3
ST09	FLOMOR0222_ST09_2022_05_28_124117.jpg	12:41:20	28/06/2022	464135.247	5964444.396	464133.398	5964441.474	3.5
ST09	FLOMOR0222_ST09_2022_05_28_124144.jpg	12:41:47	28/06/2022	464135.247	5964444.396	464136.189	5964444.902	1.1
ST09	FLOMOR0222_ST09_2022_05_28_124218.jpg	12:42:21	28/06/2022	464135.247	5964444.396	464140.304	5964440.642	6.3
ST10	FLOMOR0222_ST10_2022_05_29_154322.jpg	15:43:25	29/06/2022	459611.030	5959649.039	459611.088	5959647.556	1.5
ST10	FLOMOR0222_ST10_2022_05_29_154347.jpg	15:43:50	29/06/2022	459611.030	5959649.039	459614.439	5959646.415	4.3
ST10	FLOMOR0222_ST10_2022_05_29_154432.jpg	15:44:35	29/06/2022	459611.030	5959649.039	459621.142	5959644.354	11.1
ST10	FLOMOR0222_ST10_2022_05_29_154457.jpg	15:45:00	29/06/2022	459611.030	5959649.039	459624.699	5959636.646	18.5
ST10	FLOMOR0222_ST10_2022_05_29_154508.jpg	15:45:11	29/06/2022	459611.030	5959649.039	459623.629	5959634.764	19.0
ST11	FLOMOR0222_ST11_2022_05_29_175924.jpg	17:59:28	29/06/2022	461377.879	5958604.849	461396.669	5958605.311	18.8
ST11	FLOMOR0222_ST11_2022_05_29_180012.jpg	18:00:15	29/06/2022	461377.879	5958604.849	461390.077	5958605.143	12.2
ST11	FLOMOR0222_ST11_2022_05_29_180037.jpg	18:00:40	29/06/2022	461377.879	5958604.849	461382.660	5958600.865	6.2
ST11	FLOMOR0222_ST11_2022_05_29_180118.jpg	18:01:21	29/06/2022	461377.879	5958604.849	461377.417	5958604.469	0.6
ST11	FLOMOR0222_ST11_2022_05_29_180200.jpg	18:02:03	29/06/2022	461377.879	5958604.849	461379.423	5958607.901	3.4
ST12	FLOMOR0222_ST12_2022_05_29_182109.jpg	18:21:12	29/06/2022	462611.030	5959649.039	462627.519	5959640.264	18.7
ST12	FLOMOR0222_ST12_2022_05_29_182151.jpg	18:21:54	29/06/2022	462611.030	5959649.039	462619.814	5959643.470	10.4
ST12	FLOMOR0222_ST12_2022_05_29_182229.jpg	18:22:32	29/06/2022	462611.030	5959649.039	462618.416	5959649.934	7.4
ST12	FLOMOR0222_ST12_2022_05_29_182310.jpg	18:23:14	29/06/2022	462611.030	5959649.039	462623.534	5959655.456	14.1
ST12	FLOMOR0222_ST12_2022_05_29_182419.jpg	18:24:23	29/06/2022	462611.030	5959649.039	462626.960	5959655.429	17.2
ST13	FLOMOR0222_ST13_2022_06_01_075355.jpg	07:53:51	01/06/2022	464297.252	5959542.956	464315.705	5959537.103	19.4
ST13	FLOMOR0222_ST13_2022_06_01_075439.jpg	07:54:35	01/06/2022	464297.252	5959542.956	464308.577	5959535.600	13.5

Appendix VI - Morecambe OWF grab survey logs

Station Details				Sampling Details			Metadata					Positional Data											
Station I.D.	Attempt No.	Sample Type (as per SoW)	Sampled Type (Post-Survey)	Method	Vessel	Personnel (Initials)	Wind Direction	Wind Force (Beaufort)	Tide Direction	Tide Rate (knots)	Water Depth (m)	Fix Number	Date	Time (UTC)	Target Latitude (DD)	Target Longitude (DD)	Target Easting	Target Northing	Sampled Latitude (DD)	Sampled Longitude (DD)	Sampled Easting	Sampled Northing	Coordinate System
ST01	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.3	37	3074	06/06/2022	09:46:50	53.759357	-3.613913	459526.752	5956923.006	53.759304	-3.613803	459534.014	5956917.060	WGS 84 / UTM Zone 30N
ST01	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.3	37	3075	06/06/2022	09:53:05	53.759357	-3.613913	459526.752	5956923.006	53.759344	-3.613876	459529.217	5956921.522	WGS 84 / UTM Zone 30N
ST02	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.5	36	3071	06/06/2022	09:23:05	53.761870	-3.588421	461209.685	5957188.416	53.761874	-3.588412	461210.296	5957188.867	WGS 84 / UTM Zone 30N
ST02	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.5	36	3072	06/06/2022	09:29:59	53.761870	-3.588421	461209.685	5957188.416	53.761852	-3.588389	461211.800	5957186.369	WGS 84 / UTM Zone 30N
ST03	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.9	34	3038	02/06/2022	06:07:48	53.761619	-3.567160	462611.030	5957149.039	53.761656	-3.567073	462616.772	5957153.161	WGS 84 / UTM Zone 30N
ST04	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.9	33	3035	02/06/2022	05:25:08	53.761724	-3.544407	464111.030	5957149.039	53.761759	-3.544359	464114.242	5957152.832	WGS 84 / UTM Zone 30N
ST05	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	1.3	33	3031	02/06/2022	04:30:15	53.761826	-3.521655	465611.030	5957149.039	53.761960	-3.521688	465608.928	5957163.974	WGS 84 / UTM Zone 30N
ST05	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	1.1	33	3032	02/06/2022	04:49:59	53.761826	-3.521655	465611.030	5957149.039	53.761856	-3.521741	465605.363	5957152.496	WGS 84 / UTM Zone 30N
ST06	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	1.3	33	3030	02/06/2022	04:12:12	53.759772	-3.502480	466873.419	5956911.428	53.759793	-3.502608	466865.056	5956913.891	WGS 84 / UTM Zone 30N
ST07	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	0.8	37	3081	06/06/2022	11:11:28	53.783553	-3.681035	455127.525	5959655.225	53.783527	-3.681098	455123.350	5959652.413	WGS 84 / UTM Zone 30N
ST08	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	E	0.6	34	3080	06/06/2022	10:55:05	53.783623	-3.658521	456611.030	5959649.039	53.783508	-3.658678	456600.557	5959636.344	WGS 84 / UTM Zone 30N
ST09	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.1	27	3055	06/06/2022	05:34:04	53.827295	-3.544889	464135.247	5964444.396	53.827169	-3.544904	464134.196	5964430.292	WGS 84 / UTM Zone 30N
ST10	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.6	33	3066	06/06/2022	08:00:17	53.783864	-3.612992	459611.030	5959649.039	53.783911	-3.612980	459611.850	5959654.219	WGS 84 / UTM Zone 30N
ST11	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.6	31	3067	06/06/2022	08:21:37	53.774613	-3.586047	461377.879	5958604.849	53.774553	-3.585970	461382.877	5958598.062	WGS 84 / UTM Zone 30N
ST11	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.6	31	3068	06/06/2022	08:28:49	53.774613	-3.586047	461377.879	5958604.849	53.774565	-3.585945	461384.575	5958599.396	WGS 84 / UTM Zone 30N
ST12	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.6	28	3069	06/06/2022	08:46:46	53.784088	-3.567463	462611.030	5959649.039	53.784084	-3.567493	462609.078	5959648.520	WGS 84 / UTM Zone 30N
ST13	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.5	26	3043	02/06/2022	07:17:30	53.783253	-3.541860	464297.252	5959542.956	53.783301	-3.541898	464294.746	5959548.265	WGS 84 / UTM Zone 30N
ST14	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.9	24	3039	02/06/2022	06:25:43	53.774299	-3.522242	465582.517	5958537.019	53.774294	-3.522241	465582.571	5958536.525	WGS 84 / UTM Zone 30N
ST15	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.7	22	3042	02/06/2022	06:57:42	53.780980	-3.508139	466517.251	5959273.583	53.781083	-3.508254	466509.741	5959285.119	WGS 84 / UTM Zone 30N
ST16	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	1.2	37	3084	06/06/2022	11:57:51	53.805697	-3.727200	452111.030	5962149.039	53.805621	-3.727088	452118.354	5962140.503	WGS 84 / UTM Zone 30N
ST17	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	1.2	35	3085	06/06/2022	12:13:31	53.805833	-3.704425	453611.030	5962149.039	53.805812	-3.704357	453615.431	5962146.618	WGS 84 / UTM Zone 30N
ST18	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	1.4	37	3086	06/06/2022	12:32:42	53.801699	-3.674711	455563.417	5961670.060	53.801836	-3.674799	455557.767	5961685.359	WGS 84 / UTM Zone 30N
ST18	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	1.4	37	3087	06/06/2022	12:39:13	53.801699	-3.674711	455563.417	5961670.060	53.801669	-3.674566	455572.934	5961666.635	WGS 84 / UTM Zone 30N
ST19	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.8	33	3065	06/06/2022	07:32:30	53.801737	-3.636314	458092.235	5961650.961	53.801793	-3.636472	458081.880	5961657.323	WGS 84 / UTM Zone 30N
ST20	2	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.8	33	3063	06/06/2022	07:09:48	53.801607	-3.612680	459648.621	5961622.767	53.801598	-3.612716	459646.223	5961621.884	WGS 84 / UTM Zone 30N
ST20	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.8	33	3064	06/06/2022	07:17:29	53.801607	-3.612680	459648.621	5961622.767	53.801597	-3.612799	459640.788	5961621.739	WGS 84 / UTM Zone 30N
ST21	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.0	31	3061	06/06/2022	06:50:36	53.801258	-3.590328	461120.428	5961571.479	53.801321	-3.590440	461113.065	5961578.599	WGS 84 / UTM Zone 30N
ST22	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.0	25	3058	06/06/2022	06:20:43	53.815544	-3.572808	462287.113	5963151.507	53.815461	-3.572905	462280.667	5963142.330	WGS 84 / UTM Zone 30N
ST22	2	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.0	25	3060	06/06/2022	06:32:36	53.815544	-3.572808	462287.113	5963151.507	53.815569	-3.572854	462284.091	5963154.249	WGS 84 / UTM Zone 30N
ST23	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	E	0.1	28	3046	02/06/2022	07:56:11	53.806148	-3.544223	464161.071	5962091.300	53.806187	-3.544127	464167.405	5962095.542	WGS 84 / UTM Zone 30N
ST23	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	E	0.1	28	3047	02/06/2022	08:01:19	53.806148	-3.544223	464161.071	5962091.300	53.806230	-3.544240	464160.002	5962100.416	WGS 84 / UTM Zone 30N
ST24	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	E	0.1	25	3048	02/06/2022	08:17:52	53.807211	-3.521421	465663.487	5962198.327	53.807311	-3.521396	465665.257	5962209.349	WGS 84 / UTM Zone 30N
ST25	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	w	1.3	25	3050	02/06/2022	09:11:47	53.806862	-3.499435	467111.030	5962149.039	53.806922	-3.499428	467111.566	5962155.677	WGS 84 / UTM Zone 30N
ST26	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.5	36	3099	07/06/2022	09:01:44	53.827826	-3.708447	453370.566	5964598.521	53.827841	-3.708422	453372.205	5964600.170	WGS 84 / UTM Zone 30N
ST26	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.5	36	3100	07/06/2022	09:07:29	53.827826	-3.708447	453370.566	5964598.521	53.827830	-3.708401	453373.619	5964598.898	WGS 84 / UTM Zone 30N
ST27	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	34	3101	07/06/2022	09:28:09	53.828434	-3.682013	455111.030	5964649.039	53.828498	-3.681926	455116.869	5964656.171	WGS 84 / UTM Zone 30N
ST28	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.8	34	3093	07/06/2022	07:50:44	53.828561	-3.659225	456611.030	5964649.039	53.828598	-3.659170	456614.664	5964653.124	WGS 84 / UTM Zone 30N
ST29	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.8	32	3092	07/06/2022	07:37:26	53.829748	-3.638090	458003.250	5964768.367	53.829856	-3.638155	457999.094	5964780.482	WGS 84 / UTM Zone 30N
ST30	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	1.1	31	3090	07/06/2022	07:02:55	53.827336	-3.609476	459884.226	5964483.519	53.827344	-3.609522	459881.227	5964484.349	WGS 84 / UTM Zone 30N
ST31	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	1.1	30	3088	07/06/2022	06:41:28	53.828917	-3.590859	461111.030	5964649.039	53.828894	-3.590863	461110.737	5964646.436	WGS 84 / UTM Zone 30N
ST31	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	1.1	30	3089	07/06/2022	06:49:30	53.828917	-3.590859	461111.030	5964649.039	53.828997	-3.590891	461108.988	5964657.926	WGS 84 / UTM Zone 30N
ST32	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.5	36	3095	07/06/2022	08:19:48	53.850902	-3.682379	455111.030	5967149.039	53.850952	-3.682267	455118.434	5967154.527	WGS 84 / UTM Zone 30N
ST32	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.5	36	3096	07/06/2022	08:26:13	53.850902	-3.682379	455111.030	5967149.039	53.850913	-3.682381	455110.918	5967150.245	WGS 84 / UTM Zone 30N
ST33	-	PSD & MACRO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST33	-	CONTAMINANTS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST34	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.5	30	3070	06/06/2022	09:00:51	53.774185	-3.557435	463263.110	5958542.026	53.774219	-3.557447	463262.310	5958545.807	WGS 84 / UTM Zone 30N
ST35	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.7	34	3036	02/06/2022	05:47:50	53.754578	-3.574860	462097.091	5956369.826	53.754577	-3.574825	462099.420	5956369.610	WGS 84 / UTM Zone 30N
ST35	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.7	34	3037	02/06/2022	05:54:31	53.754578	-3.574860	462097.091	5956369.826	53.754611	-3.574834	462098.863	5956373.457	WGS 84 / UTM Zone 30N
ST36	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.5	36	3097	07/06/2022	08:41:40	53.843830	-3.699583	453971.505	5966373.181	53.843904	-3.699529	453975.187	5966381.368	WGS 84 / UTM Zone 30N
ST37	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	34	3094	07/06/2022	08:04:47	53.840330	-3.666338	456155.158	5965962.777	53.840292	-3.666346	456154.618	5965958.520	WGS 84 / UTM Zone 30N
ST38	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.4	31	3044	02/06/2022	07:34:13	53.796950	-3.557820	463257.635	5961074.951	53.797032	-3.557845	463256.054	5961084.075	WGS 84 / UTM Zone 30N
ST38	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	W	0.4	31	3045	02/06/2022	07:40:18	53.796950	-3.557820	463257.635	5961074.951	53.796984	-3.557926	463250.667	5961078.782	WGS 84 / UTM Zone 30N
ST39	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	1.1	30	3091	07/06/2022	07:16:42	53.817280	-3.612778	459657.190	5963366.583	53.817340	-3.612816	459654.797	5963373.254	WGS 84 / UTM Zone 30N
ST40	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F3 - 7-10 knots (Gentle breeze)	W	1.4	22	3051	02/06/2022	09:20:41	53.813531	-3.501536	466977.917	5962892.013	53.813522	-3.501498	466980.429	5962891.009	WGS 84 / UTM Zone 30N
ST40	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NE	F3 - 7-10 knots (Gentle breeze)	W	2.4	22	3052	02/06/2022	09:27:24	53.813531	-3.501536	466977.917	5962892.013	53.813566	-3.501554	466976.772	5962895.912	WGS 84 / UTM Zone 30N
ST41	2	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	E	0.2	35	3079	06/06/2022	10:37:22	53.778993	-3.634833	458167.160	5959119.766	53.778987	-3.634789	458170.012	5959119.084	WGS 84 / UTM Zone 30N
ST42	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.0	38	3076	06/06/2022	10:13:06	53.772118	-3.629121	458536.783	5958351.464	53.772150	-3.629112	458537.406	5958355.045	WGS 84 / UTM Zone 30N
ST42	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	0.0	38	3077	06/06/2022	10:20:03	53.772118	-3.629121	458536.783	5958351.464	53.772082	-3.628966	458546.946	5958347.439	WGS 84 / UTM Zone 30N
ST43	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	0.8	34	3082	06/06/2022	11:29:52	53.794020	-3.706304	453474.193	5960836.048	53.793970	-3.706298	453474.558	5960830.465	WGS 84 / UTM Zone 30N
ST43	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F2 - 4-6 knots (Light breeze)	E	0.8	34	3083	06/06/2022	11:36:22	53.794020	-3.706304	453474.193	5960836.048	53.794099	-3.706240	453478.488	5960844.798	WGS 84 / UTM Zone 30N
ST44	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	35	3102	07/06/2022	09:41:56	53.818647	-3.679853	455242.801	5963558.811	53.818640	-3.679814	455245.347	5963558.038	WGS 84 / UTM Zone 30N
ST44	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	35	3103	07/06/2022	09:48:01	53.818647	-3.679853	455242.801	5963558.811	53.818660	-3.679755	455249.290	5963560.245	WGS 84 / UTM Zone 30N
ST45	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F1 - 1-3 knots (Light air)	E	0.9	27	3049	02/06/2022	08:54:55	53.791864	-3.515431	466045.552	5960487.933	53.791874	-3.515421	466046.255	5960489.078	WGS 84 / UTM Zone 30N
ST46	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F3 - 7-10 knots (Gentle breeze)	E	1.4	22	3053	02/06/2022	09:44:17	53.823428	-3.504545	466787.669	5963994.446	53.823486	-3.504538	466788.125	5964000.980	WGS 84 / UTM Zone 30N
ST47	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NE	F3 - 7-10 knots (Gentle breeze)	E	1.9	25	3054	02/06/2022	10:14:02	53.814747	-3.523907	465505.971	5963037.928	53.814850	-3.523885	465507.546	5963049.400	WGS 84 / UTM Zone 30N
ST48	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	33	3104	07/06/2022	10:04:12	53.808624	-3.677860	455363.366	5962442.488	53.808661	-3.677672	455375.793	5962446.451	WGS 84 / UTM Zone 30N
ST48	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	W	F2 - 4-6 knots (Light breeze)	W	0.6	33	3105	07/06/2022	10:10:59	53.808624	-3.677860	455363.366	5962442.488	53.808585	-3.677801	455367.214	5962438.184	WGS 84 / UTM Zone 30N
ST49	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.1	25	3056	06/06/2022	05:55:12	53.816349	-3.552392	463631.928	5963230.410	53.816385	-3.552527	463623.071	5963234.429	WGS 84 / UTM Zone 30N
ST49	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	AK / SA	NE	F3 - 7-10 knots (Gentle breeze)	W	1.1	25	3057	06/06/2022	06:03:56	53.816349	-3.552392	463631.928	5963230.410	53.816389	-3.552551	463621.494	5963234.930	WGS 84 / UTM Zone 30N
ST50	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NW	F1 - 1-3 knots (Light air)	W	1.1	34	3033	02/06/2022	05:01:22	53.755696	-3.527069	465249.064	5956469.728	53.755689	-3.527025	465251.924	5956468.987	WGS 84 / UTM Zone 30N
ST50	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NW	F1 - 1-3 knots (Light air)	W	1.1	34	3034	02/06/2022	05:09:32	53.755696	-3.527069	465249.064	5956469.728	53.755651	-3.527082	465248.130	5956464.700	WGS 84 / UTM Zone 30N
ST51	1	PSD & MACRO	PSD & MACRO	Day Grab	Seren Las	ER / KK	NW	F1 - 1-3 knots (Light air)	W	0.7	22	3040	02/06/2022	06:42:32	53.775538	-3.501746	466934.211	5958665.120	53.775545	-3.501759	466933.351	5958665.936	WGS 84 / UTM Zone 30N
ST51	1	CONTAMINANTS	CONTAMINANTS	Day Grab	Seren Las	ER / KK	NW	F1 - 1-3 knots (Light air)	W	0.7	22	3041	02/06/2022	06:48:15	53.775538	-3.501746	466934.211	5958665.120	53.775568	-3.501789	466931.389	5958668.482	WGS 84 / UTM Zone 30N

Appendix VII(a) - Morecambe OWF grab sample photos (Unreleased).


FLOMOR0222_ST01_MMO SAMPLES


FLOMOR0222_ST01_PSA MACRO


FLOMOR0222_ST02_MMO SAMPLES

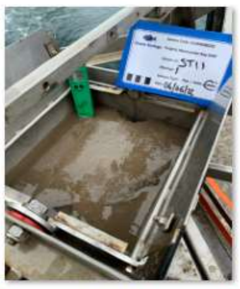

FLOMOR0222_ST02_PSA MACRO


FLOMOR0222_ST07_PSA MACRO


FLOMOR0222_ST08_PSA MACRO


FLOMOR0222_ST09_PSA MACRO


FLOMOR0222_ST10_PSA MACRO


FLOMOR0222_ST11_MMO SAMPLES


FLOMOR0222_ST11_PSA MACRO


FLOMOR0222_ST12_PSA MACRO


FLOMOR0222_ST16_PSA MACRO


FLOMOR0222_ST17_PSA MACRO


FLOMOR0222_ST18_MMO SAMPLES


FLOMOR0222_ST18_PSA MACRO


FLOMOR0222_ST19_PSA MACRO


FLOMOR0222_ST20_MMO SAMPLES


FLOMOR0222_ST20_PSA MACRO


FLOMOR0222_ST21_PSA MACRO


FLOMOR0222_ST22_MMO SAMPLES


FLOMOR0222_ST22_PSA MACRO


FLOMOR0222_ST26_MMO SAMPLES


FLOMOR0222_ST26_PSA MACRO


FLOMOR0222_ST27_PSA MACRO


FLOMOR0222_ST28_PSA MACRO


FLOMOR0222_ST29_PSA MACRO


FLOMOR0222_ST30_PSA MACRO


FLOMOR0222_ST31_MMO SAMPLES


FLOMOR0222_ST31_PSA MACRO


FLOMOR0222_ST32_MMO SAMPLES


FLOMOR0222_ST32_PSA MACRO


FLOMOR0222_ST34_PSA MACRO


FLOMOR0222_ST36_PSA MACRO


FLOMOR0222_ST37_PSA MACRO


FLOMOR0222_ST39_PSA MACRO


FLOMOR0222_ST41_PSA MACRO


FLOMOR0222_ST42_MMO SAMPLES
FLOMOR0222_ST42_PSA MACRO
FLOMOR0222_ST43_MMO SAMPLES
FLOMOR0222_ST43_PSA MACRO
FLOMOR0222_ST44_MMO SAMPLES
FLOMOR0222_ST44_PSA MACRO


FLOMOR0222_ST48_MMO SAMPLES
FLOMOR0222_ST48_PSA MACRO
FLOMOR0222_ST49_MMO SAMPLES
FLOMOR0222_ST49_PSA MACRO

Appendix VII(b) - Morecambe OWF grab sample photos (released)


FLOMOR0222_ST01_RELEASED


FLOMOR0222_ST02_RELEASED


FLOMOR0222_ST07_RELEASED


FLOMOR0222_ST08_RELEASED


FLOMOR0222_ST09_RELEASED


FLOMOR0222_ST10_RELEASED


FLOMOR0222_ST11_RELEASED


FLOMOR0222_ST12_RELEASED


FLOMOR0222_ST16_RELEASED


FLOMOR0222_ST17_RELEASED


FLOMOR0222_ST18_RELEASED


FLOMOR0222_ST19_RELEASED


FLOMOR0222_ST20_RELEASED


FLOMOR0222_ST21_RELEASED


FLOMOR0222_ST22_RELEASED


FLOMOR0222_ST26_RELEASED


FLOMOR0222_ST27_RELEASED


FLOMOR0222_ST28_RELEASED


FLOMOR0222_ST29_RELEASED


FLOMOR0222_ST30_RELEASED


FLOMOR0222_ST31_RELEASED


FLOMOR0222_ST32_RELEASED


FLOMOR0222_ST34_RELEASED


FLOMOR0222_ST36_RELEASED


FLOMOR0222_ST37_RELEASED


FLOMOR0222_ST39_RELEASED


FLOMOR0222_ST41_RELEASED


FLOMOR0222_ST42_RELEASED


FLOMOR0222_ST43_RELEASED


FLOMOR0222_ST44_RELEASED


FLOMOR0222_ST48_RELEASED

Appendix VII(c) - Morecambe OWF grab sample photos (sieved)


FLOMOR0222_ST01_SIEVED


FLOMOR0222_ST02_SIEVED


FLOMOR0222_ST07_SIEVED


FLOMOR0222_ST08_SIEVED


FLOMOR0222_ST10_SIEVED


FLOMOR0222_ST11_SIEVED


FLOMOR0222_ST12_SIEVED


FLOMOR0222_ST16_SIEVED


FLOMOR0222_ST17_SIEVED


FLOMOR0222_ST18_SIEVED


FLOMOR0222_ST19_SIEVED


FLOMOR0222_ST20_SIEVED


FLOMOR0222_ST21_SIEVED


FLOMOR0222_ST22_SIEVED


FLOMOR0222_ST26_SIEVED


FLOMOR0222_ST27_SIEVED


FLOMOR0222_ST28_SIEVED


FLOMOR0222_ST29_SIEVED


FLOMOR0222_ST30_SIEVED


FLOMOR0222_ST31_SIEVED


FLOMOR0222_ST32_SIEVED


FLOMOR0222_ST34_SIEVED


FLOMOR0222_ST36_SIEVED


FLOMOR0222_ST37_SIEVED


FLOMOR0222_ST39_SIEVED


FLOMOR0222_ST41_SIEVED


FLOMOR0222_ST42_SIEVED


FLOMOR0222_ST43_SIEVED


FLOMOR0222_ST44_SIEVED


FLOMOR0222_ST48_SIEVED


FLOMOR0222_ST49_SIEVED

Appendix VIII - PSD raw data

Aperture (µm)	ST01	ST02	ST03	ST04	ST05	ST06	ST07	ST08	ST09	ST10	ST11	ST12
63000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11200.000	4.135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8000.000	3.796	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5600.000	3.832	0.000	0.001	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000
4000.000	3.303	0.000	0.013	0.002	0.006	0.018	0.042	0.088	0.007	0.000	0.000	0.000
2800.000	2.912	0.003	0.004	0.002	0.004	0.000	0.015	0.028	0.018	0.000	0.002	0.011
2000.000	2.624	0.006	0.006	0.002	0.004	0.002	0.023	0.039	0.015	0.013	0.002	0.004
1400.000	3.264	0.014	0.010	0.004	0.016	0.007	0.063	0.049	0.029	0.007	0.006	0.017
1000.000	2.122	0.030	0.043	0.022	0.018	0.027	0.341	0.209	0.044	0.016	0.043	0.056
707.000	2.622	2.208	0.447	0.001	0.219	0.000	5.251	7.176	0.000	1.440	0.358	0.353
500.000	4.862	6.412	5.370	2.404	0.125	0.007	10.522	18.535	0.017	8.736	6.032	6.771
353.600	7.947	15.531	10.237	8.257	1.322	2.424	20.459	28.507	6.115	25.208	15.538	18.241
250.000	16.722	20.858	17.000	7.348	8.205	5.274	35.584	28.462	24.886	33.367	14.148	18.385
176.800	21.438	30.403	31.742	30.082	17.642	15.663	24.762	14.971	23.754	25.016	28.576	19.271
125.000	7.979	10.638	16.696	24.967	22.206	26.720	2.911	1.933	11.487	6.127	16.430	14.026
88.390	0.297	0.708	1.035	2.886	6.531	8.201	0.002	0.002	1.204	0.070	1.324	1.808
62.500	0.231	0.005	0.011	0.653	2.220	2.932	0.000	0.000	0.095	0.000	0.010	0.415
44.190	0.806	0.753	0.863	2.081	4.623	4.627	0.000	0.000	1.559	0.000	1.087	1.539
31.250	0.846	0.777	1.280	1.357	3.445	3.200	0.000	0.000	1.975	0.000	0.862	1.582
22.097	0.776	0.902	1.137	1.358	3.034	2.729	0.000	0.000	2.055	0.000	1.009	1.617
15.625	0.902	1.130	1.285	1.948	2.807	2.480	0.000	0.000	2.282	0.000	1.337	1.829
11.049	1.263	1.324	1.821	2.180	3.274	3.060	0.000	0.000	2.832	0.000	1.498	2.164
7.813	1.523	1.748	2.348	2.609	4.455	4.124	0.000	0.000	3.975	0.000	2.029	2.431
5.524	1.547	1.894	2.403	3.317	5.010	4.592	0.000	0.000	4.425	0.000	2.520	2.468
3.906	1.293	1.524	1.954	2.944	4.354	4.011	0.000	0.000	3.818	0.000	2.304	2.084
2.762	0.911	0.878	1.285	1.615	2.983	2.821	0.000	0.000	2.657	0.000	1.367	1.465
1.953	0.543	0.476	0.751	0.806	1.749	1.686	0.000	0.000	1.576	0.000	0.738	0.857
1.381	0.315	0.411	0.502	0.764	1.144	1.069	0.000	0.000	0.996	0.000	0.675	0.493
0.977	0.217	0.371	0.379	0.674	0.926	0.835	0.000	0.000	0.785	0.000	0.584	0.354
0.691	0.188	0.265	0.291	0.403	0.823	0.747	0.000	0.000	0.714	0.000	0.362	0.326
0.488	0.178	0.176	0.239	0.231	0.734	0.682	0.000	0.000	0.662	0.000	0.223	0.320
0.345	0.165	0.136	0.214	0.210	0.636	0.603	0.000	0.000	0.591	0.000	0.202	0.303
0.244	0.146	0.122	0.196	0.238	0.526	0.507	0.000	0.000	0.498	0.000	0.215	0.269
0.173	0.118	0.107	0.167	0.231	0.399	0.391	0.000	0.000	0.382	0.000	0.197	0.217
0.122	0.092	0.089	0.134	0.194	0.294	0.293	0.000	0.000	0.285	0.000	0.158	0.168
0.086	0.060	0.063	0.090	0.133	0.184	0.185	0.000	0.000	0.179	0.000	0.105	0.108
0.061	0.025	0.031	0.041	0.065	0.075	0.076	0.000	0.000	0.073	0.000	0.050	0.044
0.043	0.003	0.005	0.006	0.010	0.009	0.009	0.000	0.000	0.009	0.000	0.008	0.005
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Aperture (µm)	ST13	ST14	ST15	ST16	ST17	ST18	ST19	ST20	ST21	ST22	ST23	ST24	ST25
63000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11200.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8000.000	0.080	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.028	0.000
5600.000	0.020	0.000	0.022	0.029	0.000	0.024	0.000	0.000	0.009	0.014	0.000	0.000	0.000
4000.000	0.040	0.000	0.022	0.052	0.061	0.005	0.012	0.004	0.004	0.010	0.003	0.000	0.000
2800.000	0.068	0.003	0.020	0.054	0.057	0.014	0.015	0.002	0.002	0.016	0.002	0.006	0.002
2000.000	0.108	0.003	0.020	0.061	0.051	0.016	0.017	0.006	0.002	0.010	0.006	0.008	0.002
1400.000	0.196	0.010	0.031	0.100	0.067	0.011	0.012	0.015	0.006	0.019	0.006	0.013	0.007
1000.000	0.148	0.016	0.034	0.192	0.084	0.022	0.023	0.015	0.013	0.042	0.016	0.024	0.022
707.000	0.594	0.003	0.000	4.985	4.365	0.914	1.897	0.504	0.000	1.255	0.000	0.000	0.000
500.000	5.413	1.044	0.006	9.299	14.225	5.117	3.438	2.332	1.827	7.368	0.012	0.355	0.006
353.600	23.094	8.158	4.487	17.203	25.276	8.572	6.037	6.005	7.034	28.037	3.963	12.958	3.743
250.000	24.375	26.637	23.748	31.928	32.484	22.210	16.124	8.387	5.920	34.356	10.823	25.768	11.227
176.800	14.937	28.716	24.000	21.794	20.753	29.055	43.396	38.373	32.257	16.442	17.113	13.627	7.811
125.000	10.227	14.025	11.898	3.488	2.575	8.183	17.440	25.027	28.938	5.105	22.706	9.178	14.757
88.390	1.470	2.134	1.948	0.379	0.002	0.141	0.924	2.259	3.302	0.293	5.518	3.677	9.417
62.500	0.590	0.804	0.636	0.276	0.000	0.429	0.567	0.535	0.587	0.069	0.873	1.686	5.749
44.190	1.370	1.649	2.570	0.861	0.000	1.760	0.921	1.149	1.599	0.442	3.117	2.615	5.780
31.250	1.497	1.141	2.129	0.772	0.000	1.745	0.566	0.884	1.175	0.389	2.826	2.293	4.238
22.097	1.579	1.260	2.247	0.833	0.000	1.760	0.770	0.859	1.168	0.429	2.822	2.230	3.647
15.625	1.781	1.641	2.462	0.919	0.000	2.284	0.843	1.254	1.641	0.539	3.256	2.672	3.752
11.049	2.025	1.635	2.886	1.019	0.000	2.826	0.918	1.501	1.821	0.733	3.919	3.256	4.154
7.813	2.239	2.105	3.774	1.208	0.000	3.153	1.253	1.704	2.401	0.954	4.735	3.894	5.088
5.524	2.282	2.527	4.241	1.274	0.000	3.190	1.341	2.313	2.901	0.997	4.994	4.161	5.533
3.906	1.875	2.143	3.744	1.021	0.000	2.650	1.055	2.240	2.475	0.775	4.158	3.548	4.674
2.762	1.199	1.219	2.645	0.606	0.000	1.782	0.634	1.353	1.394	0.450	2.744	2.403	3.076
1.953	0.668	0.651	1.552	0.338	0.000	0.969	0.366	0.694	0.736	0.237	1.522	1.328	1.724
1.381	0.446	0.587	0.937	0.289	0.000	0.528	0.306	0.602	0.677	0.193	0.931	0.768	1.109
0.977	0.349	0.523	0.712	0.275	0.000	0.397	0.290	0.556	0.601	0.199	0.743	0.599	0.905
0.691	0.277	0.344	0.652	0.216	0.000	0.396	0.237	0.384	0.382	0.180	0.682	0.575	0.803
0.488	0.232	0.212	0.618	0.153	0.000	0.409	0.173	0.239	0.222	0.143	0.629	0.559	0.713
0.345	0.211	0.172	0.562	0.110	0.000	0.393	0.123	0.181	0.177	0.107	0.556	0.513	0.616
0.244	0.193	0.174	0.481	0.086	0.000	0.350	0.088	0.172	0.186	0.077	0.465	0.438	0.510
0.173	0.162	0.165	0.374	0.067	0.000	0.280	0.063	0.160	0.186	0.052	0.355	0.338	0.387
0.122	0.129	0.142	0.281	0.054	0.000	0.215	0.046	0.138	0.165	0.036	0.263	0.253	0.286
0.086	0.085	0.100	0.177	0.037	0.000	0.137	0.030	0.098	0.120	0.022	0.165	0.159	0.178
0.061	0.037	0.050	0.072	0.018	0.000	0.056	0.014	0.049	0.061	0.010	0.067	0.064	0.072
0.043	0.005	0.008	0.009	0.003	0.000	0.007	0.002	0.007	0.010	0.002	0.008	0.008	0.009
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Aperture (µm)	ST26	ST27	ST28	ST29	ST30	ST31	ST32	ST34	ST35	ST36	ST37	ST38
63000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11200.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8000.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.143	0.000	0.000
5600.000	0.066	0.015	0.011	0.000	0.000	0.000	0.033	0.065	0.000	0.183	0.000	0.000
4000.000	0.066	0.046	0.005	0.000	0.000	0.005	0.168	0.013	0.011	0.173	0.011	0.002
2800.000	0.050	0.011	0.020	0.004	0.005	0.005	0.016	0.015	0.008	0.045	0.025	0.002
2000.000	0.050	0.017	0.007	0.006	0.003	0.005	0.022	0.013	0.002	0.063	0.008	0.004
1400.000	0.081	0.013	0.005	0.006	0.008	0.010	0.008	0.018	0.022	0.060	0.011	0.006
1000.000	0.078	0.036	0.016	0.013	0.014	0.023	0.022	0.030	0.233	0.065	0.099	0.006
707.000	2.167	1.167	0.033	0.001	0.000	0.000	1.482	0.235	2.712	2.331	1.686	0.000
500.000	5.500	4.774	2.743	2.053	1.234	0.122	3.992	3.437	8.693	4.964	4.407	0.000
353.600	20.068	18.366	6.454	7.278	5.659	2.051	13.009	10.033	18.163	19.154	13.105	0.635
250.000	39.191	39.471	22.222	10.862	6.796	6.008	35.807	8.664	19.644	37.568	36.193	5.181
176.800	25.841	29.379	42.590	41.432	38.565	27.173	27.848	26.823	30.332	20.715	36.969	13.764
125.000	3.108	3.725	10.506	17.653	29.551	28.083	5.295	27.908	9.932	3.649	7.475	20.615
88.390	0.326	0.003	0.743	1.323	2.655	3.923	0.652	3.730	0.529	0.680	0.012	6.729
62.500	0.171	0.057	0.001	0.001	0.021	0.131	0.328	0.713	0.444	0.035	0.000	3.124
44.190	0.248	0.249	0.549	0.887	1.095	1.659	0.957	1.561	0.769	0.799	0.000	5.116
31.250	0.194	0.189	0.871	1.154	0.903	2.409	0.745	1.109	0.619	0.672	0.000	4.399
22.097	0.210	0.194	0.905	1.189	0.995	2.039	0.764	1.070	0.677	0.736	0.000	4.286
15.625	0.232	0.184	1.082	1.523	1.014	2.406	0.973	1.488	0.803	0.811	0.000	4.436
11.049	0.304	0.283	1.307	1.690	1.202	3.347	1.109	1.630	0.966	0.945	0.000	5.075
7.813	0.406	0.370	1.860	2.420	1.907	4.207	1.383	2.161	1.190	1.250	0.000	5.817
5.524	0.416	0.360	2.115	2.826	2.197	4.342	1.539	2.608	1.231	1.334	0.000	5.835
3.906	0.316	0.274	1.808	2.431	1.864	3.609	1.246	2.205	0.963	1.068	0.000	4.718
2.762	0.189	0.173	1.115	1.444	1.167	2.477	0.715	1.244	0.558	0.645	0.000	3.087
1.953	0.111	0.107	0.638	0.810	0.684	1.437	0.385	0.670	0.302	0.379	0.000	1.702
1.381	0.099	0.088	0.546	0.723	0.577	0.856	0.337	0.618	0.257	0.334	0.000	1.020
0.977	0.105	0.088	0.487	0.613	0.506	0.643	0.321	0.548	0.252	0.312	0.000	0.812
0.691	0.100	0.084	0.349	0.386	0.359	0.592	0.245	0.351	0.206	0.242	0.000	0.761
0.488	0.086	0.074	0.239	0.247	0.240	0.567	0.167	0.208	0.149	0.174	0.000	0.716
0.345	0.070	0.062	0.192	0.225	0.185	0.522	0.121	0.168	0.106	0.132	0.000	0.638
0.244	0.054	0.050	0.175	0.236	0.168	0.453	0.097	0.175	0.078	0.108	0.000	0.533
0.173	0.039	0.037	0.151	0.213	0.151	0.358	0.080	0.171	0.058	0.087	0.000	0.406
0.122	0.029	0.028	0.123	0.171	0.129	0.273	0.065	0.150	0.044	0.069	0.000	0.301
0.086	0.019	0.018	0.084	0.114	0.092	0.175	0.045	0.107	0.029	0.047	0.000	0.188
0.061	0.009	0.009	0.041	0.055	0.047	0.073	0.022	0.054	0.014	0.023	0.000	0.077
0.043	0.001	0.001	0.007	0.009	0.008	0.009	0.004	0.009	0.002	0.004	0.000	0.009
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Aperture (µm)	ST39	ST40	ST41	ST42	ST43	ST44	ST45	ST46	ST47	ST48	ST49	ST50	ST51
63000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.240	0.000
11200.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.000	0.000
8000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.076	0.000	0.000	0.000	0.000	0.000
5600.000	0.004	0.000	0.028	0.017	0.045	0.031	0.000	0.024	0.000	0.000	0.000	0.000	0.099
4000.000	0.000	0.003	0.094	0.152	0.093	0.052	0.002	0.012	0.004	0.021	0.006	0.032	0.007
2800.000	0.004	0.002	0.081	0.030	0.051	0.048	0.002	0.021	0.008	0.046	0.017	0.073	0.022
2000.000	0.011	0.009	0.115	0.040	0.071	0.044	0.007	0.026	0.010	0.025	0.014	0.202	0.136
1400.000	0.014	0.014	0.253	0.043	0.045	0.042	0.004	0.082	0.018	0.061	0.013	0.482	0.029
1000.000	0.097	0.024	1.084	0.225	0.379	0.040	0.020	0.645	0.024	0.167	0.044	0.938	0.020
707.000	1.909	0.000	3.923	2.509	7.731	2.339	0.000	12.431	0.000	2.623	0.000	0.202	0.005
500.000	4.466	0.053	8.863	7.579	22.118	5.618	0.010	29.717	0.015	8.830	0.258	3.919	2.639
353.600	11.149	13.382	20.252	14.944	26.715	11.839	3.110	32.959	5.083	16.165	9.389	6.738	15.062
250.000	19.170	37.119	31.110	26.862	22.712	31.217	6.195	16.756	21.201	30.736	22.529	8.720	32.815
176.800	35.496	20.086	23.645	31.351	14.772	33.043	8.169	3.799	21.018	31.252	23.638	24.998	21.264
125.000	15.581	3.931	5.016	8.361	2.174	5.462	13.667	0.782	11.007	5.641	12.231	21.702	6.155
88.390	1.002	0.798	0.154	0.141	0.179	0.425	7.383	0.155	1.547	0.168	0.841	2.791	1.387
62.500	0.009	0.028	0.123	0.134	0.149	0.188	5.803	0.113	0.878	0.218	0.083	1.258	0.019
44.190	0.658	1.746	0.401	0.579	0.241	0.669	6.256	0.213	3.007	0.244	1.608	2.655	1.374
31.250	0.634	1.389	0.337	0.473	0.185	0.549	5.239	0.141	2.850	0.234	1.985	2.277	1.142
22.097	0.683	1.365	0.365	0.529	0.199	0.616	4.676	0.184	2.869	0.258	1.882	2.076	1.186
15.625	0.805	2.082	0.367	0.570	0.195	0.792	4.950	0.212	3.359	0.333	2.342	2.083	1.731
11.049	0.960	2.132	0.530	0.742	0.274	0.981	5.406	0.272	3.897	0.412	2.821	2.693	1.810
7.813	1.393	2.866	0.694	1.001	0.346	1.229	5.934	0.291	4.641	0.494	3.750	3.280	2.431
5.524	1.608	3.591	0.678	1.039	0.333	1.345	6.207	0.246	5.018	0.509	4.192	3.383	3.040
3.906	1.354	3.155	0.510	0.805	0.249	1.097	5.280	0.163	4.266	0.401	3.644	2.831	2.614
2.762	0.820	1.747	0.311	0.486	0.152	0.652	3.537	0.090	2.823	0.245	2.529	1.956	1.423
1.953	0.456	0.961	0.185	0.279	0.094	0.348	1.909	0.054	1.533	0.139	1.472	1.123	0.756
1.381	0.387	0.935	0.155	0.227	0.084	0.281	1.088	0.053	0.913	0.113	0.903	0.636	0.725
0.977	0.359	0.735	0.156	0.219	0.087	0.275	0.861	0.064	0.736	0.121	0.702	0.453	0.602
0.691	0.271	0.382	0.145	0.190	0.082	0.230	0.841	0.070	0.693	0.120	0.644	0.415	0.342
0.488	0.187	0.245	0.122	0.150	0.070	0.172	0.826	0.069	0.651	0.109	0.604	0.408	0.205
0.345	0.138	0.302	0.097	0.111	0.056	0.125	0.759	0.064	0.580	0.093	0.544	0.386	0.210
0.244	0.115	0.346	0.074	0.081	0.043	0.091	0.648	0.056	0.482	0.076	0.460	0.345	0.237
0.173	0.096	0.275	0.053	0.055	0.031	0.065	0.500	0.045	0.363	0.057	0.353	0.280	0.209
0.122	0.078	0.175	0.038	0.039	0.022	0.048	0.373	0.036	0.266	0.043	0.262	0.218	0.158
0.086	0.055	0.086	0.025	0.024	0.014	0.031	0.234	0.025	0.164	0.028	0.164	0.141	0.097
0.061	0.027	0.031	0.012	0.011	0.007	0.015	0.094	0.012	0.066	0.014	0.067	0.059	0.044
0.043	0.004	0.004	0.002	0.002	0.001	0.002	0.011	0.002	0.008	0.002	0.008	0.007	0.007
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Appendix IX - PSD summary data

Station	Treatment	Textural Group Classification	Folk and Ward Description	Folk and Ward Sorting	Mean µm	Mean phi	Sorting Coefficient	Skewness	Kurtosis	Major Sediment Fractions		
										% Gravel	% Sand	% Mud
ST01	Sediment	Gravelly Muddy Sand	Coarse Sand	Very Poorly Sorted	536.1	0.900	6.794	0.261	1.664	20.6%	67.5%	11.9%
ST02	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	237.7	2.073	2.696	-0.288	2.819	0.0%	86.8%	13.2%
ST03	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	141.5	2.821	3.601	-0.564	2.714	0.0%	82.6%	17.4%
ST04	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	87.54	3.514	4.391	-0.645	2.369	0.0%	76.6%	23.4%
ST05	Sediment	Muddy Sand	Very Coarse Silt	Very Poorly Sorted	54.74	4.191	5.496	-0.665	0.788	0.0%	58.5%	41.5%
ST06	Sediment	Muddy Sand	Very Coarse Silt	Very Poorly Sorted	55.26	4.178	5.208	-0.684	0.852	0.0%	61.3%	38.7%
ST07	Sediment	Sand	Medium Sand	Moderately Well Sorted	321.7	1.636	1.537	0.180	0.989	0.1%	99.9%	0.0%
ST08	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Well Sorted	381.0	1.392	1.559	0.060	0.959	0.2%	99.8%	0.0%
ST09	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	73.82	3.760	5.807	-0.742	0.787	0.0%	67.6%	32.3%
ST10	Sediment	Sand	Medium Sand	Moderately Well Sorted	305.2	1.712	1.500	0.044	0.935	0.0%	100.0%	0.0%
ST11	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	146.7	2.769	3.831	-0.537	2.410	0.0%	82.5%	17.5%
ST12	Sediment	Muddy Sand	Fine Sand	Very Poorly Sorted	128.8	2.957	4.408	-0.598	2.039	0.0%	79.3%	20.6%
ST13	Sediment	Slightly Gravelly Muddy Sand	Fine Sand	Poorly Sorted	156.0	2.681	3.928	-0.653	2.026	0.3%	81.0%	18.6%
ST14	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	133.3	2.907	3.499	-0.656	2.518	0.0%	81.5%	18.4%
ST15	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	73.24	3.771	5.562	-0.741	0.801	0.1%	66.8%	33.1%
ST16	Sediment	Slightly Gravelly Muddy Sand	Medium Sand	Poorly Sorted	295.3	1.760	2.496	-0.267	2.722	0.2%	89.6%	10.2%
ST17	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Well Sorted	340.4	1.555	1.529	0.099	0.926	0.2%	99.8%	0.0%
ST18	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	97.80	3.354	4.962	-0.673	1.285	0.1%	74.7%	25.3%
ST19	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	209.3	2.256	2.319	-0.276	3.522	0.1%	89.9%	10.0%
ST20	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	137.6	2.861	3.029	-0.597	3.515	0.0%	83.5%	16.5%
ST21	Sediment	Muddy Sand	Very Fine Sand	Poorly Sorted	96.58	3.372	3.749	-0.653	3.359	0.0%	79.9%	20.1%
ST22	Sediment	Sand	Medium Sand	Poorly Sorted	299.8	1.738	2.186	-0.378	2.656	0.1%	93.0%	7.0%
ST23	Sediment	Muddy Sand	Very Coarse Silt	Very Poorly Sorted	60.23	4.053	5.357	-0.651	0.769	0.0%	61.0%	39.0%
ST24	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	80.38	3.637	5.646	-0.682	0.799	0.0%	67.3%	32.7%
ST25	Sediment	Muddy Sand	Very Coarse Silt	Very Poorly Sorted	46.93	4.413	5.682	-0.397	0.791	0.0%	52.7%	47.3%
ST26	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Well Sorted	293.9	1.766	1.511	0.026	1.170	0.2%	96.5%	3.2%
ST27	Sediment	Sand	Medium Sand	Moderately Well Sorted	284.8	1.812	1.461	0.025	1.107	0.1%	97.0%	2.9%
ST28	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	206.0	2.279	2.513	-0.412	3.924	0.0%	85.3%	14.6%
ST29	Sediment	Muddy Sand	Very Fine Sand	Poorly Sorted	106.1	3.237	3.940	-0.684	3.440	0.0%	80.6%	19.4%
ST30	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	160.9	2.636	2.509	-0.504	3.601	0.0%	84.5%	15.5%
ST31	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	63.28	3.982	4.930	-0.729	0.839	0.0%	67.5%	32.5%
ST32	Sediment	Slightly Gravelly Muddy Sand	Medium Sand	Poorly Sorted	251.1	1.994	2.389	-0.403	3.269	0.2%	88.4%	11.3%
ST34	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	125.9	2.990	3.572	-0.510	3.061	0.1%	81.6%	18.3%
ST35	Sediment	Sand	Medium Sand	Poorly Sorted	259.6	1.946	2.492	-0.212	2.360	0.0%	90.7%	9.3%
ST36	Sediment	Slightly Gravelly Muddy Sand	Medium Sand	Poorly Sorted	282.2	1.825	2.406	-0.350	3.204	0.6%	89.2%	10.2%
ST37	Sediment	Sand	Medium Sand	Moderately Well Sorted	269.2	1.893	1.441	0.134	1.081	0.0%	100.0%	0.0%
ST38	Sediment	Muddy Sand	Very Coarse Silt	Very Poorly Sorted	41.52	4.590	5.162	-0.395	0.747	0.0%	50.1%	49.9%
ST39	Sediment	Muddy Sand	Fine Sand	Poorly Sorted	223.4	2.162	2.535	-0.266	2.963	0.0%	88.9%	11.1%
ST40	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	99.50	3.329	4.987	-0.794	1.858	0.0%	75.4%	24.6%
ST41	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Sorted	302.9	1.723	1.901	-0.136	1.710	0.3%	94.4%	5.3%
ST42	Sediment	Slightly Gravelly Sand	Medium Sand	Poorly Sorted	271.0	1.884	2.288	-0.186	2.650	0.2%	92.1%	7.6%
ST43	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Sorted	381.4	1.391	1.638	-0.052	0.921	0.3%	97.0%	2.8%
ST44	Sediment	Slightly Gravelly Sand	Medium Sand	Poorly Sorted	261.6	1.934	2.346	-0.238	3.256	0.2%	90.2%	9.6%
ST45	Sediment	Sandy Mud	Very Coarse Silt	Very Poorly Sorted	35.50	4.816	5.651	-0.253	0.799	0.0%	44.4%	55.6%
ST46	Sediment	Slightly Gravelly Sand	Medium Sand	Moderately Well Sorted	457.2	1.129	1.537	-0.088	1.106	0.2%	97.4%	2.4%
ST47	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	68.08	3.877	5.696	-0.692	0.714	0.0%	60.8%	39.2%
ST48	Sediment	Sand	Medium Sand	Moderately Well Sorted	287.5	1.798	1.593	0.104	1.122	0.1%	95.9%	4.0%
ST49	Sediment	Muddy Sand	Very Fine Sand	Very Poorly Sorted	77.32	3.693	5.722	-0.717	0.834	0.0%	69.0%	30.9%
ST50	Sediment	Slightly Gravelly Muddy Sand	Very Fine Sand	Very Poorly Sorted	83.49	3.582	5.055	-0.584	1.259	0.5%	71.7%	27.7%
ST51	Sediment	Slightly Gravelly Muddy Sand	Very Fine Sand	Very Poorly Sorted	122.0	3.035	4.329	-0.737	2.517	0.3%	79.4%	20.3%

Appendix X - Raw PCBs

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	MMO*	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB 101**	**PCB 105**	**PCB 110**	**PCB 118**	**PCB 128**	**PCB 138**	**PCB 141**	**PCB 149**	**PCB 151**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			72	72	83	84	88	102	112	73	65
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	<0.00008	<0.00008	<0.00008	0.00013	<0.00008	0.00014	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	<0.00008	<0.00008	<0.00008	0.00011	<0.00008	0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			87	79	98	103	96	99	123~	98	93
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	<0.00008	<0.00008	<0.00008	0.00009	<0.00008	0.00009	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			81	89	91	93	90	104	120~	95	80
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			81	89	91	93	90	104	120~	95	80
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB 153**	**PCB 156**	**PCB 158**	**PCB 170**	**PCB 18**	**PCB 180**	**PCB 183**	**PCB 187**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	0.00012	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			93	91	98	86	72	84	109	93
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	0.00009	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	0.00015	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	0.00012	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00010
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			102	77	114	77	77	86	92	99
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	0.00011	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			98	84	101	80	82	91	106	100
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			98	84	101	80	82	91	106	100
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB 194**	**PCB 28**	**PCB 31**	**PCB 44**	**PCB 47**	**PCB 49**	**PCB 52**	**PCB 66**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	<0.00008	0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00010
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00009
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			71	72	90	98	88	98	95	94
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	<0.00008	0.00009	0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00010
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	<0.00008	0.00010	0.00009	<0.00008	0.00019	<0.00008	<0.00008	0.00010
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	<0.00008	0.00009	0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00010
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			62	71	87	83	79	90	88	93
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	<0.00008	0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00009
tified Reference Material Quasimeme QOR149MS (% Recovery)			65	73	87	88	83	92	91	94
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
tified Reference Material Quasimeme QOR149MS (% Recovery)			65	73	87	88	83	92	91	94
		QC Blank	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

Appendix X - Raw Physical Data

		Units	% M/M	% M/M
		Method No	WSLM59*	LOI(%MM)*
		Accreditation	UKAS/MMO	N
			Total Organic Carbon	LOI @ 450
Client Reference:	SOCOTEC Ref:	Matrix	–	–
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	0.17	1.3
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	0.11	1.0
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	0.33	1.9
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	0.18	1.2
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	0.12	1.0
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	0.20	1.3
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	0.36	2.2
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	0.09	0.9
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	0.07	0.7
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	0.32	1.9
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	0.08	0.9
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	0.19	1.3
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	0.46	2.5
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	0.36	2.1
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	0.07	0.8
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	0.14	1.1
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	0.09	0.9
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	0.08	0.7
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	0.34	2.0
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	0.19	1.5

Appendix X - Raw PAH & THC

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	mg/Kg
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/305
		Limit of Detection	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	MMO	MMO	MMO	MMO	MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	MMO	UKAS/MMO	UKAS/MMO	MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**	**BENZGHIP**	**BEP**	**BKF**	**C1N**	**C1PHEN**	**C2N**	**C3N**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**	**INDPYR**	**NAPTH**	**PERYLENE**	**PHENANT**	**PYRENE**	**THC**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	<1	<1	1.40	4.34	5.97	8.61	7.38	8.05	3.93	9.20	12.3	17.5	11.1	5.44	1.24	8.10	1.58	6.75	4.11	1.91	8.32	8.14	9.07
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	<1	<1	<1	2.48	3.45	5.37	4.89	5.03	2.63	5.82	5.22	11.8	6.27	3.07	<1	4.86	1.11	3.34	2.46	1.12	4.10	5.10	3.41
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	1.94	2.62	6.05	16.9	24.3	31.6	28.6	29.1	15.4	25.6	34.0	31.6	25.2	19.5	4.60	32.7	4.79	26.3	8.98	9.06	30.0	32.7	18.3
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	<1	<1	1.68	4.69	6.63	9.43	8.42	9.38	4.47	9.58	12.7	13.7	11.2	6.35	1.43	8.67	1.57	7.50	3.68	2.23	8.80	9.09	6.52
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	<1	<1	<1	2.07	3.16	4.07	4.98	4.56	2.05	4.18	5.04	7.54	5.22	2.68	<1	4.43	<1	2.58	2.08	1.06	3.89	4.35	3.33
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	<1	<1	1.73	4.86	6.62	9.66	8.27	9.58	5.00	9.28	18.3	17.1	16.3	6.60	1.36	8.96	1.71	7.57	3.91	2.47	10.8	10.1	4.50
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	2.24	2.20	5.54	17.1	25.1	33.3	29.3	31.1	19.7	25.6	35.9	35.5	30.0	21.4	4.89	31.1	4.40	27.6	10.2	8.98	26.4	32.3	33.7
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	<1	<1	<1	2.85	4.23	5.69	4.82	5.79	3.74	5.14	5.40	11.1	5.57	3.53	<1	5.22	<1	4.93	2.36	1.58	4.50	5.46	7.22
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	<1	<1	<1	<1	<1	1.78	1.45	1.85	<1	2.05	2.49	6.05	2.10	1.15	<1	1.77	<1	1.24	1.06	<1	1.76	1.86	1.35
rtified Reference Material Quasimeme QPH106MS (% Recovery)			91	132	93	87	92	69	86	87	94	98	79	49	87	88	77	93	85	79	82	76	87	93	104~
		QC Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	2.43	2.96	5.37	18.3	26.8	34.7	30.2	32.3	20.0	29.9	32.9	44.0	28.9	22.2	5.21	33.8	5.63	28.0	12.5	9.33	28.3	34.7	23.8
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	<1	<1	<1	1.08	1.49	2.21	1.71	2.40	1.29	2.43	3.65	5.06	3.62	1.52	<1	2.29	<1	1.54	1.27	<1	2.29	2.44	1.45
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	1.23	1.09	2.42	7.71	10.6	13.5	10.9	12.9	5.79	10.5	12.9	14.0	10.9	8.86	1.99	15.7	1.92	9.89	4.84	2.81	11.4	15.6	7.18
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	2.74	3.26	6.64	20.8	30.5	40.0	35.0	38.3	22.4	33.9	40.1	47.8	37.4	24.4	5.98	40.1	6.29	31.8	15.2	11.1	33.6	40.0	27.3
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	2.45	2.89	5.23	17.3	25.7	33.6	29.4	31.8	18.0	29.7	29.7	42.5	26.7	18.8	5.30	32.1	5.43	27.6	16.6	8.87	25.8	32.8	18.3
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	<1	<1	<1	<1	<1	1.11	<1	1.11	<1	1.62	1.34	2.81	1.26	<1	<1	1.02	<1	<1	1.11	<1	1.01	1.23	1.00
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	<1	<1	<1	1.05	1.70	2.66	2.05	2.53	1.10	2.80	2.93	8.50	2.81	1.45	<1	2.25	<1	1.92	2.90	<1	2.13	2.38	1.42
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	<1	<1	1.09	2.84	4.34	6.26	5.00	5.93	3.13	5.06	5.95	11.3	4.79	3.88	<1	5.85	1.08	4.02	2.57	1.37	4.86	5.88	4.76
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	<1	<1	1.21	3.33	4.81	6.30	5.03	6.29	3.01	5.41	6.29	8.05	4.82	4.06	<1	6.40	<1	4.42	2.36	1.94	5.04	6.56	3.62
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	2.10	2.08	4.69	14.1	20.3	25.3	22.0	24.3	15.0	22.4	23.0	30.3	20.6	17.6	3.73	27.3	4.37	20.2	10.3	6.94	20.8	28.3	16.6
rtified Reference Material Quasimeme QPH106MS (% Recovery)			72	132	85	74	74	74	82	80	80	91	71	56	96	79	74	83	81	67	79	73	77	86	104~
		QC Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	<1	<1	1.01	3.03	4.39	5.93	4.80	5.93	3.36	5.29	6.63	13.9	5.30	4.77	1.14	6.24	<1	4.01	2.67	1.34	5.57	6.33	3.99
rtified Reference Material Quasimeme QPH106MS (% Recovery)			72	132	85	74	74	74	82	80	80	91	71	56	96	79	74	83	81	67	79	73	77	86	107~
		QC Blank	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Appendix X - Raw Trace Metals

		Units	mg/Kg (Dry Weight)							
		Method No	ICPMSS*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic (As)**	**Cadmium (Cd)**	**Chromium (Cr)**	**Copper (Cu)**	**Mercury (Hg)**	**Nickel (Ni)**	**Lead (Pb)**	**Zinc (Zn)**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	8.7	<0.04	12.2	6.5	0.06	10.4	12.2	32.3
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	5.0	<0.04	8.4	5.2	0.05	6.5	8.8	28.6
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	5.9	0.08	14.7	8.7	0.11	11.2	15.4	47.8
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	4.6	<0.04	8.7	6.0	0.06	6.3	9.3	28.8
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	5.7	<0.04	8.1	5.7	0.05	6.0	8.0	24.3
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	5.0	0.06	9.2	6.8	0.06	7.3	10.0	29.8
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	5.8	0.08	13.5	9.0	0.15	10.8	15.4	47.1
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	4.9	0.05	7.8	11.4	0.06	5.8	7.9	22.4
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	8.3	0.05	6.6	4.7	0.04	5.3	8.6	27.2
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	6.7	<0.04	14.7	7.0	0.12	10.8	16.5	47.4
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	7.1	<0.04	7.1	3.9	0.03	5.1	8.1	26.0
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	5.8	<0.04	9.8	6.3	0.05	7.2	11.5	32.8
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	6.0	0.07	16.8	10.2	0.12	12.7	18.2	52.2
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	6.4	<0.04	15.9	9.5	0.12	11.5	16.1	46.5
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	9.2	<0.04	6.2	3.7	0.01	5.3	6.4	21.3
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	6.5	<0.04	6.4	3.9	0.03	5.0	8.5	25.0
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	6.0	<0.04	6.8	4.0	0.05	4.8	7.6	21.0
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	4.6	0.05	7.5	5.1	0.05	5.4	8.3	23.8
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	6.1	0.07	14.8	7.9	0.10	10.3	15.7	44.1
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	4.6	<0.04	7.2	5.5	0.02	5.6	7.3	22.1
Certified Reference Material SETOC 774 (% Recovery)			100	101	108	100	108	105	99	100
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

Appendix X - Raw Organotins

		Units	mg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	0.001	0.001
		Accreditation	UKAS/MMO	UKAS/MMO
Client Reference:	**OCOTEC Re**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
FLOMOR0222 - 01 (A)	MAR01453.001	Sediment	<0.005	<0.005
FLOMOR0222 - 02 (A)	MAR01453.002	Sediment	<0.005	<0.005
FLOMOR0222 - 05 (A)	MAR01453.003	Sediment	<0.005	<0.005
FLOMOR0222 - 11 (A)	MAR01453.004	Sediment	<0.005	<0.005
Certified Reference Material QSP077MS(% Recovery)			63	55
QC Blank			<0.001	<0.001
FLOMOR0222 - 18 (A)	MAR01453.005	Sediment	<0.005	<0.005
FLOMOR0222 - 20 (A)	MAR01453.006	Sediment	<0.005	<0.005
FLOMOR0222 - 22 (A)	MAR01453.007	Sediment	<0.005	<0.005
FLOMOR0222 - 23 (A)	MAR01453.008	Sediment	<0.005	<0.005
FLOMOR0222 - 26 (A)	MAR01453.009	Sediment	<0.005	<0.005
FLOMOR0222 - 31 (A)	MAR01453.010	Sediment	<0.005	<0.005
FLOMOR0222 - 32 (A)	MAR01453.011	Sediment	<0.005	<0.005
FLOMOR0222 - 35 (A)	MAR01453.012	Sediment	<0.005	<0.005
FLOMOR0222 - 38 (A)	MAR01453.013	Sediment	<0.005	<0.005
FLOMOR0222 - 40 (A)	MAR01453.014	Sediment	<0.005	<0.005
Certified Reference Material QSP077MS(% Recovery)			153	120
QC Blank			<0.001	<0.001
FLOMOR0222 - 43 (A)	MAR01453.015	Sediment	<0.005	<0.005
FLOMOR0222 - 44 (A)	MAR01453.016	Sediment	<0.005	<0.005
FLOMOR0222 - 48 (A)	MAR01453.017	Sediment	<0.005	<0.005
FLOMOR0222 - 49 (A)	MAR01453.018	Sediment	<0.005	<0.005
FLOMOR0222 - 50 (A)	MAR01453.019	Sediment	<0.005	<0.005
Certified Reference Material QSP077MS(% Recovery)			112	70
QC Blank			<0.001	<0.001
FLOMOR0222 - 42 (B)	MAR01456.001	Sediment	<0.005	<0.005
Certified Reference Material QSP077MS(% Recovery)			112	70
QC Blank			<0.001	<0.001

Appendix XI - Macrobenthic raw data

taxonName	matrixID	aphiaID	originalN	qualifier	abundanceUnits	ST01 MA	ST02 MA
Abludomelita obtusata	100630	102788			Count	0	0
Abra	100115	138474		Juvenile	Count	0	0
Abra alba	100067	141433			Count	0	0
Abra nitida	100054	141435			Count	3	0
Abra prismatica	100121	141436			Count	0	0
Abyssoninoe hibernica	100130	146469			Count	0	0
Acanthocardia echinata	100997	138992			Count	0	0
Acidostoma neglectum	101301	102495			Count	0	0
Acrocnida brachiata	100188	236130			Count	1	0
Acteon tornatilis	100869	138691			Count	0	0
ACTINIARIA	100016	1360			Count	0	0
ACTINOPTERYGII	100092	10194		Eggs	Count	1	0
Aglaophamus agilis	101060	130343			Count	0	0
Alcyonidium parasiticum	100094	111604			Presence / Absence	0	0
Ampelisca	100229	101445		Juvenile	Count	0	0
Ampelisca	100309	101445		Damaged	Count	1	0
Ampelisca brevicornis	100119	101891			Count	0	0
Ampelisca spinipes	100392	101928			Count	0	0
Ampelisca tenuicornis	100053	101930			Count	0	0
Ampharete lindstroemi	100219	129781		Aggregate	Count	0	0
Amphictene auricoma	100058	152448			Count	0	0
Amphiura filiformis	100048	125080			Count	32	1
Amphiuridae	100139	123206		Juvenile	Count	0	1
Amphiuridae	102274	123206		Fragment	Presence / Absence	0	0
ANIMALIA	100281	2		Eggs	Presence / Absence	0	0
Aonides paucibranchiata	100338	131107			Count	0	0
Aoridae	100122	101368		Female	Count	1	0
ASCIDIACEA	100110	1839		Juvenile	Count	0	0
ASTEROIDEA	100990	123080		Juvenile	Count	0	0
Astropecten irregularis	100933	123867			Count	0	0
Astropecten irregularis	101784	123867		Fragment	Presence / Absence	0	0
Atherospio guillei	101188	478336			Count	0	0
Balanus crenatus	100100	106215			Count	0	0
Bathyporeia elegans	100274	103058			Count	0	0
Bathyporeia gracilis	100429	103059			Count	0	0
Bathyporeia tenuipes	100273	103076			Count	0	0
Bathyporeia tenuipes	103621	103076		Fragment	Presence / Absence	0	0
Bodotria scorpioides	100643	110445			Count	0	0
Bopyridae	103625	1195		Female	Count	0	0
Bopyridae	103626	1195		Male	Count	0	0
Callianassa subterranea	100134	107729			Count	0	0
Callianassa subterranea	103623	107729		Fragment	Presence / Absence	0	0
Campanulariidae	100263	1606			Presence / Absence	P	0
Cerianthidae	100899	100684		Juvenile	Count	0	0
Chaetozone christiei	100026	152217			Count	0	0
Chaetozone christiei	103426	152217		Fragment	Presence / Absence	0	0
Chaetozone zetlandica	100175	336485			Count	0	0
Chamelea striatula	100076	141908			Count	0	0
Cheirocratus	100344	101669		Female	Count	1	0
Clytia hemisphaerica	100245	117368			Presence / Absence	P	0
Conopeum reticulum	100208	111351			Presence / Absence	P	0
COPEPODA	100038	1080			Count	0	0
COPEPODA	100860	1080		Parasite	Count	0	0
Corystes cassivelaunus	101080	107277			Count	0	1
Cylichna cylindracea	100069	139476			Count	2	0
DECAPODA	101505	1130		Megalopa	Count	0	0
Diplocirrus glaucus	100182	130100			Count	1	0
Dosinia	100248	138636		Juvenile	Count	0	0
Echinocardium cordatum	100242	124392			Count	1	0
Echinocyamus pusillus	100349	124273			Count	0	0
Edwardsiidae	100042	100665			Count	0	0
Enipo kinbergi	102402	130738			Count	0	0
Ensis	100044	138333		Juvenile	Count	0	0
Ensis	103264	138333		Juvenile , F	Presence / Absence	0	0
Ensis ensis	102167	140733			Count	0	0
ENTEROPNEUSTA	100202	1820			Count	0	0
Eteone longa	100466	130616		Aggregate	Count	0	0
Eudorella truncatula	100333	110535			Count	0	0
Eurydice truncata	100616	118855			Count	0	0
Euspira nitida	100200	151894			Count	1	0
Fabulina fabula	100241	146907			Count	0	0
FILIFERA	100125	16352			Presence / Absence	P	P
Folliculinidae	100259	1692			Presence / Absence	0	0
Galathowenia oculata	100062	146950			Count	0	0
Gari fervensis	100137	140870			Count	1	0
Glycera	100018	129296		Fragment	Presence / Absence	0	0
Glycera alba	100149	130116			Count	0	0
Glycera oxycephala	100085	130126			Count	0	0
Glycera unicornis	100129	130131			Count	0	0
Glycinde nordmanni	100124	130136			Count	0	0
Golfingia (Golfingia) vulgaris vulgaris	100216	410724			Count	0	0
Goneplax rhomboides	100275	107292			Count	0	0
Goniada maculata	100068	130140			Count	0	0
Harmothoe glabra	100192	571832			Count	2	0
Harpinia antennaria	100127	102960			Count	1	2
Harpinia pectinata	100297	102972			Count	0	0
Hippomedon denticulatus	100625	102570			Count	0	0
Hyala vitrea	100140	140129			Count	0	0
Hydractiniidae	101459	1601			Presence / Absence	0	0
Hydrallmania falcata	100260	117890			Presence / Absence	P	0
Ione thoracica	103631	118218			Count	0	0
Kirkegaardia	101027	884676			Count	0	0
Kurtiella bidentata	100077	345281			Count	77	9
Lagis koreni	100088	152367			Count	7	1
Lanice conchilega	100148	131495			Count	1	0
Leptosynapta bergensis	100959	124462			Count	0	0
Liocarcinus	100683	106925		Juvenile	Count	0	0
Lovenella clausa	100267	117736			Presence / Absence	0	0
Loxosomella	100107	111799			Presence / Absence	0	0
Loxosomella murmanica	100980	111834			Presence / Absence	0	0
Lumbrineridae	103630	967		Fragment	Presence / Absence	0	0
Lumbrineris cingulata	100082	130240		Confer	Count	1	0
Lysilla loveni	101598	131500			Count	0	0
Mactra	103009	138158		Juvenile	Count	0	0
Mactra stultorum	100998	140299			Count	0	0
Magelona	102310	129341		Species A	Count	0	0
Magelona alleni	100155	130266			Count	1	0
Magelona filiformis	100179	130268			Count	0	0
Magelona johnstoni	100205	130269			Count	0	0
Malmgrenia andreapolis	100316	147008			Count	0	0
Malmgrenia marphysae	101081	152267			Count	0	0
Mediomastus fragilis	100096	129892			Count	0	0
Megaluropus agilis	101404	102783			Count	0	0
Moerella donacina	100749	147021			Count	0	0
Monopseudocuma gilsoni	100356	422916			Count	0	0
Mysia undata	100336	140728			Count	0	0
NEMATODA	100009	799			Count	0	0
NEMERTEA	100014	152391			Count	2	0
Nephtys	100047	129370		Juvenile	Count	0	1
Nephtys assimilis	100206	130353			Count	0	0
Nephtys assimilis	103082	130353		Fragment	Presence / Absence	0	0
Nephtys caeca	102079	130355			Count	0	0
Nephtys cirrosa	100428	130357			Count	0	0
Nephtys hombergii	100022	130359			Count	2	0
Nephtys hombergii	103431	130359		Fragment	Presence / Absence	0	0
Nephtys incisa	100105	130362			Count	0	0
Nephtys kersivalensis	100135	130363			Count	0	0
Nototropis vedlomensis	100391	179538			Count	0	0
Nucula nitidosa	100046	140589			Count	0	2
Oestergrenia digitata	100988	152547			Count	0	0
Oestergrenia digitata	103634	152547		Fragment	Presence / Absence	0	0
Ophelina acuminata	100156	130500			Count	5	0
Ophiura albida	100190	124913			Count	2	0
Ophiura ophiura	100189	124929			Count	0	0
Ophiuridae	100089	123200		Juvenile	Count	4	0
Owenia	100144	129427			Count	1	0
Oxydromus flexuosus	100078	710680			Count	0	0
Pagurus	100422	106854		Juvenile	Count	1	0
Pagurus bernhardus	100883	107232			Count	3	0
Paradoneis lyra	100171	130585			Count	0	0
Pectinaria belgica	100944	334417			Count	0	0
Pectinariidae	100968	980		Juvenile	Count	0	0
Perioculodes longimanus	100996	102915			Count	0	1
Phascolion (Phascolion) strombus strombus	100251	410749			Count	0	0
Phaxas pellucidus	100059	140737			Count	1	0
Philine quadripartita	100021	574582			Count	0	0
Pholoe baltica	100178	130599			Count	19	0
Pholoe baltica	103397	130599		Fragment	Presence / Absence	0	0
Phoronis	100028	128545			Count	2	1
Phyllodoce groenlandica	100331	334506			Count	2	0
Phyllodoce rosea	100329	334514			Count	2	0
PLATYHELMINTHES	100387	793			Count	0	0
Podarkeopsis capensis	100203	130195			Count	0	0
Poecilochaetus serpens	100116	130711			Count	0	1
Polycirrus	100060	129710			Count	0	0
Praxillella affinis	100645	130322			Count	0	0
Prionospio multibranchiata	100218	131160			Count	0	0
Pseudopolydora pulchra	100133	131169			Count	4	0
Scalibregma inflatum	100020	130980			Count	24	2
Scalibregma inflatum	103216	130980		Fragment	Presence / Absence	0	0
Scolelepis bonnieri	100319	131171			Count	0	0
Scoloplos armiger	100029	130537			Count	0	1
Scoloplos armiger	102980	130537		Fragment	Presence / Absence	0	0
Sertularia	100193	117234			Presence / Absence	0	0
Sigalion mathildae	100995	131072			Count	0	0
SPATANGOIDA	102141	123106		Fragment	Presence / Absence	0	0
Sphaerosyllis taylori	100689	131394		Confer	Count	0	0
Spio symphyta	100180	596189			Count	1	0
Spiophanes bombyx	100136	131187			Count	3	0
Spiophanes bombyx	103443	131187		Fragment	Presence / Absence	0	0
Spisula	100183	138159		Juvenile	Count	0	0
Sthenelais	101118	129595		Juvenile	Count	0	0
Sthenelais limicola	100207	131077			Count	10	0
Streblosoma	100981	129712			Count	0	0
Synchelidium maculatum	100051	102928			Count	0	0
Tellimya ferruginosa	100239	146952			Count	3	0
Tellininae	100184	225468		Juvenile	Count	0	0
Tharyx killariensis	100222	152269			Count	0	0
Thracia convexa	102232	141644			Count	0	0
Thracia phaseolina	100204	152378			Count	0	0
THRACIOIDEA	100052	382318		Juvenile	Count	0	1
Thyasira flexuosa	100063	141662			Count	1	0
Thyone fusus	100249	124670			Count	0	0
Thysanocardia procera	100071	136063			Count	1	0
Travisia forbesii	100288	130512			Count	0	0
Trichobranchus roseus	100211	131575			Count	0	0
Triticella flava	100653	111653			Presence / Absence	0	0
Upogebia	100816	107079		Juvenile	Count	0	0
Upogebia deltaura	100454	107739			Count	1	0
Varicorbula gibba	100629	378492			Count	0	1

Appendix XII - Macrobenthic biomass presented as Ash Free Dry Weight (AFDW)

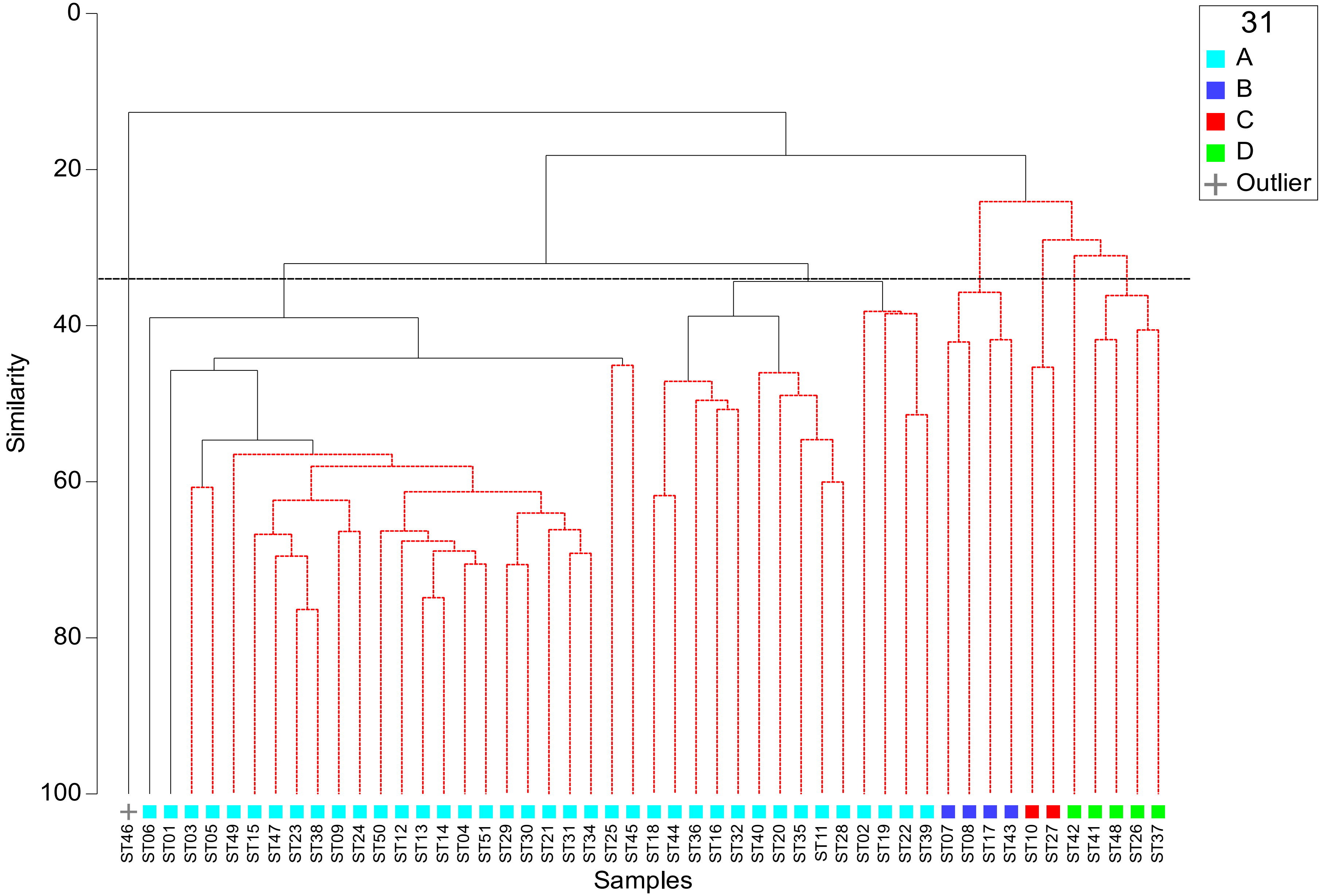
	ST01_MA	ST02_MA	ST03_MA	ST04_MA	ST05_MA	ST06_MA	ST07_MA	ST08_MA	ST09_MA	ST10_MA	ST11_MA	ST12_MA
MISCELLANIA	0.022506	0.00076	0.035154	0.088025	0.002403	0.001256	0.000357	0.000326	0.248682	0	0.00076	0.133378
ANNELIDA	0.108376	0.00324	0.003643	0.012509	0.047012	0.020398	0.011517	0.005999	0.04619	0.006572	0.004526	0.02742
CRUSTACEA	0.037395	0.00315	0	0	0.009293	0.362633	0	0.000315	0.0099	0.001553	0.003465	0.001598
ECHINODERMATA	0.709944	0.01912	1.053976	1.225504	0.451384	0.380808	0.002352	0.170408	2.579384	0.004648	0.126784	0.849056
MOLLUSCA	0.052624	0.016108	0.0102	0.036899	0.00629	0.087848	0.007523	0.046963	0.022313	0.000493	0.028654	0.056704

	ST13_MA	ST14_MA	ST15_MA	ST16_MA	ST17_MA	ST18_MA	ST19_MA	ST20_MA	ST21_MA	ST22_MA	ST23_MA	ST24_MA	ST25_MA
MISCELLANIA	0.106888	0.188449	0.04123	0.010246	0.002124	0.000822	3.10E-05	0	0.329453	0.009316	0.026257	0.155636	0.162688
ANNELIDA	0.070665	0.073207	0.0857	0.011424	0.010928	0.092613	0.021871	0.051941	0.037774	0.080616	0.054188	0.039308	0.273575
CRUSTACEA	0.038768	0.001148	0.028215	0.001598	0.00072	0.00108	0.00216	0.001148	0.002588	0.001283	0.081068	2.531565	0.22752
ECHINODERMATA	1.048424	1.257432	0.908024	0.009728	0.024312	0.015368	0.000808	0.03412	1.352432	0.054736	0.814736	0.366656	0.486704
MOLLUSCA	0.049963	0.032326	0.010821	0.00278	0.00023	0.030677	0.003936	0.010838	0.155805	0.006358	0.034026	2.185724	0.036168

	ST26_MA	ST27_MA	ST28_MA	ST29_MA	ST30_MA	ST31_MA	ST32_MA	ST34_MA	ST35_MA	ST36_MA	ST37_MA	ST38_MA
MISCELLANIA	0.000155	0.342566	0.001147	0.029202	0.065736	0.051088	0.004805	0.048035	0.001845	0.002217	0	0.011703
ANNELIDA	0.011687	0.010773	0.020553	0.027606	0.075237	0.069797	0.137981	0.022537	0.064449	0.056591	0.0175	0.005518
CRUSTACEA	0.008483	0.004478	0.000383	0.004838	0.011453	0.007403	0.095918	0.007673	0.000315	0.006008	0	0.001013
ECHINODERMATA	0.000104	0.003584	0.078904	2.643008	1.218296	2.267112	0.068888	1.301712	0.116992	0.01452	0.017608	4.082616
MOLLUSCA	0.016601	0.021922	0.020953	0.075965	0.087678	0.173808	0.075455	0.975571	0.003783	0.024557	0.007727	0.018301

	ST39_MA	ST40_MA	ST41_MA	ST42_MA	ST43_MA	ST44_MA	ST45_MA	ST46_MA	ST47_MA	ST48_MA	ST49_MA	ST50_MA	ST51_MA
MISCELLANIA	0.007146	0.008742	0.006169	0.000543	0.00045	0.009037	0.022832	0	0.324012	0.003457	0.124651	0.168144	0.066666
ANNELIDA	0.017996	0.014431	0.013981	0.213466	0.015237	0.008463	0.055583	0.003782	0.0527	0.145065	0.031155	0.029373	0.037975
CRUSTACEA	0.003128	0	0.001958	0.002408	0.001328	0.001485	0.140445	0	0.014423	0.653085	0.006998	0.574088	0.01728
ECHINODERMATA	0.30776	0.040008	0.239096	1.631288	0.000392	0.022024	0.171208	0.00252	0.9846	0.000432	1.040488	0.734768	1.154224
MOLLUSCA	0.010217	0.030498	0	0.020502	0.000536	0.261851	0.061736	0.178917	0.034714	0.002814	0.208344	0.030855	0.017901

Appendix XIII - Dendrogram resulting from cluster analysis



Appendix XIV - Results of SIMPER analysis

Group A
Average similarity: 41.79

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Kurtiella bidentata	7.19	9.31	1.72	22.28	22.28
Amphiura filiformis	6.82	8.82	1.48	21.12	43.4
Nucula nitidosa	1.83	2.55	1.58	6.1	49.5
Phoronis	1.77	1.96	1.05	4.69	54.19
Sthenelais limicola	1.52	1.93	1.16	4.63	58.82
Amphiuridae_Juvenile	1.57	1.54	0.87	3.68	62.5
Pholoe baltica	1.5	1.42	0.89	3.39	65.89
Scalibregma inflatum	1.66	1.23	0.57	2.94	68.82
THRACIOIDEA_Juvenile	0.95	1.04	0.84	2.5	71.32

Group B
Average similarity: 37.80

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
NEMERTEA	3.44	15.37	4.73	40.66	40.66
Spiophanes bombyx	1.29	5.14	7.85	13.61	54.27
THRACIOIDEA_Juvenile	1	2.62	0.9	6.92	61.19
Bathyporeia elegans	0.85	2.41	0.9	6.37	67.56
Nephtys cirrosa	0.96	2.39	0.9	6.33	73.89

Group C
Average similarity: 45.33

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Sthenelais limicola	1.87	9.17	SD=0!	20.23	20.23
Bathyporeia gracilis	1.57	7.49	SD=0!	16.52	36.75
Nephtys cirrosa	1.41	7.49	SD=0!	16.52	53.27
Aglaophamus agilis	1	5.3	SD=0!	11.68	64.96
Amphiuridae_Juvenile	1.21	5.3	SD=0!	11.68	76.64

Group D
Average similarity: 35.11

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Scalibregma inflatum	2.37	6.43	3.06	18.33	18.33
Sthenelais limicola	2.02	5.45	1.11	15.52	33.85
Nephtys cirrosa	1.28	4.33	4.64	12.34	46.2
Scoloplos armiger	1.11	2.86	1.07	8.14	54.33
Lagis koreni	1.29	2.26	1.15	6.43	60.76
THRACIOIDEA_Juvenile	1.04	1.69	0.61	4.81	65.57
Abra alba	0.89	1.41	0.61	4.02	69.59
Scolelepis bonnieri	0.77	1.37	0.59	3.91	73.5

Appendix XV - Seabed imagery still logs

Station	age File Na	Fix Time (UTC)	Date	Target Easting	Target Northing	Sampled Easting	Sampled Northing	Distance from Target (m)
ST02	T02_2022_0	16:56:01	29/05/2022	461209.685	5957188.416	461207.659	5957174.598	14.0
ST02	T02_2022_0	16:56:26	29/05/2022	461209.685	5957188.416	461212.824	5957177.337	11.5
ST02	T02_2022_0	16:57:10	29/05/2022	461209.685	5957188.416	461217.719	5957179.410	12.1
ST02	T02_2022_0	16:58:00	29/05/2022	461209.685	5957188.416	461208.357	5957187.276	1.8
ST02	T02_2022_0	16:58:47	29/05/2022	461209.685	5957188.416	461204.327	5957194.208	7.9
ST02	T02_2022_0	16:59:31	29/05/2022	461209.685	5957188.416	461198.585	5957201.376	17.1
ST03	T03_2022_0	17:35:06	29/05/2022	462611.030	5957149.039	462627.952	5957146.247	17.1
ST03	T03_2022_0	17:35:49	29/05/2022	462611.030	5957149.039	462620.893	5957145.636	10.4
ST03	T03_2022_0	17:36:24	29/05/2022	462611.030	5957149.039	462610.930	5957144.714	4.3
ST03	T03_2022_0	17:37:05	29/05/2022	462611.030	5957149.039	462607.700	5957144.740	5.4
ST03	T03_2022_0	17:37:41	29/05/2022	462611.030	5957149.039	462607.586	5957155.199	7.1
ST04	T04_2022_0	04:21:15	01/06/2022	464111.030	5957149.039	464090.187	5957156.328	22.1
ST04	T04_2022_0	04:21:57	01/06/2022	464111.030	5957149.039	464094.303	5957152.725	17.1
ST04	T04_2022_0	04:22:29	01/06/2022	464111.030	5957149.039	464099.191	5957153.776	12.8
ST04	T04_2022_0	04:22:43	01/06/2022	464111.030	5957149.039	464101.913	5957151.043	9.3
ST04	T04_2022_0	04:23:08	01/06/2022	464111.030	5957149.039	464106.959	5957156.406	8.4
ST04	T04_2022_0	04:23:31	01/06/2022	464111.030	5957149.039	464112.263	5957154.053	5.2
ST04	T04_2022_0	04:23:51	01/06/2022	464111.030	5957149.039	464118.288	5957151.262	7.6
ST04	T04_2022_0	04:24:44	01/06/2022	464111.030	5957149.039	464118.176	5957145.499	8.0
ST05	T05_2022_0	05:49:15	01/06/2022	465611.030	5957149.039	465597.998	5957141.733	14.9
ST05	T05_2022_0	05:50:42	01/06/2022	465611.030	5957149.039	465612.529	5957140.959	8.2
ST05	T05_2022_0	05:51:47	01/06/2022	465611.030	5957149.039	465616.019	5957140.377	10.0
ST05	T05_2022_0	05:52:26	01/06/2022	465611.030	5957149.039	465620.827	5957139.785	13.5
ST05	T05_2022_0	05:52:59	01/06/2022	465611.030	5957149.039	465615.261	5957144.944	5.9
ST05	T05_2022_0	05:53:37	01/06/2022	465611.030	5957149.039	465611.673	5957150.088	1.2
ST05	T05_2022_0	05:54:10	01/06/2022	465611.030	5957149.039	465610.174	5957152.491	3.6
ST05	T05_2022_0	05:54:50	01/06/2022	465611.030	5957149.039	465605.384	5957155.475	8.6
ST06	T06_2022_0	06:12:06	01/06/2022	466873.419	5956911.428	466844.381	5956893.421	34.2
ST06	T06_2022_0	06:12:40	01/06/2022	466873.419	5956911.428	466866.799	5956907.782	7.6
ST06	T06_2022_0	06:13:46	01/06/2022	466873.419	5956911.428	466873.178	5956910.129	1.3
ST06	T06_2022_0	06:14:42	01/06/2022	466873.419	5956911.428	466881.665	5956916.967	9.9
ST06	T06_2022_0	06:15:51	01/06/2022	466873.419	5956911.428	466889.182	5956912.408	15.8
ST06	T06_2022_0	06:16:31	01/06/2022	466873.419	5956911.428	466889.174	5956915.913	16.4
ST07	T07_2022_0	14:44:04	29/05/2022	455127.525	5959655.225	455122.433	5959659.749	6.8
ST07	T07_2022_0	14:44:28	29/05/2022	455127.525	5959655.225	455124.684	5959660.840	6.3
ST07	T07_2022_0	14:45:00	29/05/2022	455127.525	5959655.225	455131.712	5959658.548	5.3
ST07	T07_2022_0	14:45:37	29/05/2022	455127.525	5959655.225	455136.442	5959657.056	9.1
ST07	T07_2022_0	14:46:01	29/05/2022	455127.525	5959655.225	455135.281	5959645.829	12.2
ST08	T08_2022_0	15:03:35	29/05/2022	456611.030	5959649.039	456613.848	5959657.921	9.3
ST08	T08_2022_0	15:04:11	29/05/2022	456611.030	5959649.039	456617.649	5959648.540	6.6
ST08	T08_2022_0	15:04:50	29/05/2022	456611.030	5959649.039	456620.558	5959649.626	9.5
ST08	T08_2022_0	15:05:34	29/05/2022	456611.030	5959649.039	456621.558	5959643.719	11.8
ST08	T08_2022_0	15:06:04	29/05/2022	456611.030	5959649.039	456618.558	5959632.843	17.9
ST08	T08_2022_0	15:06:16	29/05/2022	456611.030	5959649.039	456619.240	5959635.396	15.9
ST09	T09_2022_0	12:40:11	28/06/2022	464135.247	5964444.396	464122.273	5964441.337	13.3
ST09	T09_2022_0	12:40:40	28/06/2022	464135.247	5964444.396	464125.269	5964437.197	12.3
ST09	T09_2022_0	12:41:20	28/06/2022	464135.247	5964444.396	464133.398	5964441.474	3.5
ST09	T09_2022_0	12:41:47	28/06/2022	464135.247	5964444.396	464136.189	5964444.902	1.1
ST09	T09_2022_0	12:42:21	28/06/2022	464135.247	5964444.396	464140.304	5964440.642	6.3
ST10	T10_2022_0	15:43:25	29/06/2022	459611.030	5959649.039	459611.088	5959647.556	1.5
ST10	T10_2022_0	15:43:50	29/06/2022	459611.030	5959649.039	459614.439	5959646.415	4.3
ST10	T10_2022_0	15:44:35	29/06/2022	459611.030	5959649.039	459621.142	5959644.354	11.1
ST10	T10_2022_0	15:45:00	29/06/2022	459611.030	5959649.039	459624.699	5959636.646	18.5
ST10	T10_2022_0	15:45:11	29/06/2022	459611.030	5959649.039	459623.629	5959634.764	19.0
ST11	T11_2022_0	17:59:28	29/06/2022	461377.879	5958604.849	461396.669	5958605.311	18.8
ST11	T11_2022_0	18:00:15	29/06/2022	461377.879	5958604.849	461390.077	5958605.143	12.2
ST11	T11_2022_0	18:00:40	29/06/2022	461377.879	5958604.849	461382.660	5958600.865	6.2
ST11	T11_2022_0	18:01:21	29/06/2022	461377.879	5958604.849	461377.417	5958604.469	0.6
ST11	T11_2022_0	18:02:03	29/06/2022	461377.879	5958604.849	461379.423	5958607.901	3.4
ST12	T12_2022_0	18:21:12	29/06/2022	462611.030	5959649.039	462627.519	5959640.264	18.7
ST12	T12_2022_0	18:21:54	29/06/2022	462611.030	5959649.039	462619.814	5959643.470	10.4
ST12	T12_2022_0	18:22:32	29/06/2022	462611.030	5959649.039	462618.416	5959649.934	7.4
ST12	T12_2022_0	18:23:14	29/06/2022	462611.030	5959649.039	462623.534	5959655.456	14.1
ST12	T12_2022_0	18:24:23	29/06/2022	462611.030	5959649.039	462626.960	5959655.429	17.2

Appendix XVI - Seabed imagery video logs

Station	Date	Video Start Time (UTC)	Video Length	Video End Time (UTC)	GPS to Camera Time Offset	No. of Videos	No. of Images Per Video	Video File Name	Depth (m)	Camera System	Freshwater Housing Height Setting	Distance Between Laser Points (cm)	FOCI/OSPAR present (excluding reef)	Potential Annex I reef?	Deployment Position Offset	Notes
ST01	Station not sampled due to being covered by TR04															
ST02	29/05/2022	16:55:45	00:03:51	16:59:36	00:00:03	1	6	ST02_2022	35.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST03	29/05/2022	17:34:15	00:03:30	17:37:45	00:00:02	1	5	ST03_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Mud with small burrows.
ST04	01/06/2022	04:20:45	00:04:05	04:24:50	00:00:00	1	8	ST04_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand. No positional log data.
ST05	01/06/2022	05:48:30	00:06:30	05:55:00	00:00:01	1	8	ST05_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	Y	N	USBL	Megafauna burrows in mud. Sandy mud.
ST06	01/06/2022	06:12:00	00:04:40	06:16:40	00:00:00	1	6	ST06_2022	30.0	Rayfin PLE	Sp - Plan Vi	10	Y	N	USBL	Megafauna burrows in mud. Sandy mud.
ST07	29/05/2022	14:43:45	00:02:22	14:46:07	00:00:01	1	5	ST07_2022	30.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST08	29/05/2022	15:03:08	00:03:19	15:06:27	00:00:03	1	6	ST08_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST09	28/05/2022	12:39:47	00:02:52	12:42:39	00:00:04	1	5	ST09_2022	27.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST10	29/05/2022	15:43:10	00:02:07	15:45:17	00:00:03	1	5	ST10_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST11	29/05/2022	17:59:10	00:02:59	18:02:09	00:00:03	1	5	ST11_2022	31.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST12	29/05/2022	18:20:30	00:03:58	18:24:28	00:00:02	1	5	ST12_2022	29.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Mud with small burrows.
ST13	01/06/2022	07:53:35	00:04:43	07:58:18	00:00:01	1	6	ST13_2022	25.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST14	01/06/2022	07:27:35	00:05:24	07:32:59	00:00:01	1	6	ST14_2022	24.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST15	01/06/2022	07:03:20	00:10:00	07:13:20	00:00:01	2	5	ST15_2022	22.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
		07:13:20	00:01:23	07:14:43	00:00:01		3	ST15_2022								
ST16	29/05/2022	13:46:30	00:02:42	13:49:12	00:00:02	1	5	ST16_2022	37.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST17	29/05/2022	14:07:00	00:02:36	14:09:36	00:00:03	1	5	ST17_2022	35.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST18	28/05/2022	17:01:40	00:03:32	17:05:12	00:00:03	1	6	ST18_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sandy mud.
ST19	28/05/2022	16:33:15	00:02:28	16:35:43	00:00:05	1	5	ST19_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Mud with small burrows.
ST20	28/05/2022	16:07:11	00:06:16	16:13:27	00:00:04	1	5	ST20_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST21	28/05/2022	14:02:30	00:04:21	14:06:51	00:00:05	1	6	ST21_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Mud with small burrows.
ST22	28/05/2022	14:35:20	00:03:24	14:38:44	00:00:03	1	5	ST22_2022	25.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST23	28/05/2022	13:19:40	00:03:09	13:22:49	00:00:04	1	5	ST23_2022	29.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST24	01/06/2022	08:35:20	00:04:27	08:39:47	00:00:00	1	6	ST24_2022	26.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST25	01/06/2022	10:23:20	00:04:55	10:28:15	00:00:01	1	6	ST25_2022	30.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST26	29/05/2022	13:22:55	00:02:37	13:25:32	00:00:02	1	5	ST26_2022	38.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST27	28/05/2022	17:51:55	00:03:33	17:55:28	00:00:04	1	7	ST27_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST28	29/05/2022	12:08:55	00:03:47	12:12:42	00:00:01	1	6	ST28_2022	37.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST29	29/05/2022	11:50:22	00:03:00	11:53:22	00:00:01	1	5	ST29_2022	35.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST30	28/05/2022	15:27:15	00:07:44	15:34:59	00:00:03	1	8	ST30_2022	29.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Mud with small burrows.
ST31	28/05/2022	15:03:52	00:07:45	15:11:37	00:00:06	1	5	ST31_2022	27.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST32	29/05/2022	12:47:00	00:04:06	12:51:06	00:00:03	1	5	ST32_2022	38.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST33	Station not sampled due to being covered by TR01															
ST34	29/05/2022	18:39:00	00:03:45	18:42:45	00:00:09	1	5	ST34_2022	30.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST35	29/05/2022	17:14:00	00:07:18	17:21:18	00:00:04	1	5	ST35_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST36	29/05/2022	13:04:45	00:02:38	13:07:23	00:00:02	1	5	ST36_2022	38.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST37	29/05/2022	12:28:50	00:02:59	12:31:49	00:00:02	1	5	ST37_2022	36.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST38	28/05/2022	13:36:37	00:03:37	13:40:14	00:00:04	1	5	ST38_2022	35.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST39	28/05/2022	15:47:15	00:03:29	15:50:44	00:00:03	1	7	ST39_2022	27.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST40	01/06/2022	10:09:10	00:03:25	10:12:35	00:00:01	1	6	ST40_2022	25.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST41	29/05/2022	15:23:00	00:02:51	15:25:51	00:00:02	1	5	ST41_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST42	29/05/2022	15:58:45	00:02:52	16:01:37	00:00:03	1	5	ST42_2022	38.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST43	29/05/2022	14:21:20	00:03:45	14:25:05	00:00:03	1	6	ST43_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST44	28/05/2022	17:33:30	00:03:15	17:36:45	00:00:04	1	5	ST44_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST45	01/06/2022	08:15:55	00:04:54	08:20:49	00:00:00	1	6	ST45_2022	27.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand with burrows.
ST46	Station not sampled due to being covered by TR02															
ST47	Station not sampled due to being covered by TR03															
ST48	28/05/2022	17:16:45	00:03:00	17:19:45	00:00:04	1	8	ST48_2022	32.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST49	28/05/2022	13:00:27	00:02:26	13:02:53	00:00:04	1	6	ST49_2022	26.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Sand.
ST50	01/06/2022	04:46:45	00:04:40	04:51:25	00:00:00	1	7	ST50_2022	34.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy sand.
ST51	01/06/2022	06:41:30	00:10:00	06:51:30	00:00:00	2	4	ST51_2022	22.0	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Muddy san
		06:51:30	00:00:32	06:52:02	00:00:01		1	ST51_2022_								
TR01	01/06/2022	05:02:50	00:10:00	05:12:50	00:00:01	3	28	TR01_2022	33	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Covers ST33. Line re-run in
		05:12:50	00:10:00	05:22:50	00:00:01		9	TR01_2022								
		05:22:10	00:01:12	05:23:22	00:00:01		1	TR01_2022								
TR02	01/06/2022	09:29:55	00:10:00	09:39:55	00:00:01	3	12	TR02_2022	24	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Covers ST46. Muddy
		09:39:55	00:10:00	09:49:55	00:00:01		16	TR02_2022								
		09:49:55	00:10:00	09:59:55	00:00:01		10	TR02_2022								
TR03	01/06/2022	08:55:15	00:10:00	09:05:15	00:00:02	2	16	TR03_2022	23	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Covers ST47.
		09:05:15	00:07:02	09:12:17	00:00:01		12	TR03_2022								
TR04	29/05/2022	16:21:10	00:10:00	16:31:10	00:00:03	2	18	TR04_2022	38	Rayfin PLE	Sp - Plan Vi	10	N	N	USBL	Covers ST01.
		17:31:10	00:07:10	17:38:20	00:00:03		13	TR04_2022								

Appendix XVII - Seapen and burrowing megafauna assessment

Filename	Field of View (m^2)	Burrow 1cm	Burrow 2cm	Burrow 3cm	Burrow 4cm	Burrow 5cm	Burrow 6cm	Burrow 7cm	Density of Burrows (m^2)	Average Burrow Density (m^2)	Density of 3+ cm Burrows (m^2)	Average Density of 3+ cm burrows (m^2)	Seapens	Density of Seapens (m^2)	Average Seapen Density (m^2)	Corystes cassivelaunus	Total burrowing fauna	Density of Burrowing fauna (m^2)	Average Density of burrowing fauna (m^2)
FLOMOR0222_ST02_2022_05_29_165623.jpg	0.35	0	1	1	0	0	0	0	6		3		0	0		0	0	0	
FLOMOR0222_ST02_2022_05_29_165706.jpg	0.32	11	3	0	0	0	0	0	44		0		0	0		0	0	0	
FLOMOR0222_ST02_2022_05_29_165757.jpg	0.34	7	0	1	0	0	0	0	24	23	3	2	0	0	0	0	0	0	1
FLOMOR0222_ST02_2022_05_29_165844.jpg	0.33*	9	0	1	0	0	0	0	30		3		0	0		0	0	0	
FLOMOR0222_ST02_2022_05_29_165927.jpg	0.33*	4	0	0	0	0	0	0	12		0		0	0		1	1	3	
FLOMOR0222_ST03_2022_05_29_173503.jpg	0.33*	8	5	0	0	0	0	0	39		0		0	0		0	0	0	
FLOMOR0222_ST03_2022_05_29_173546.jpg	0.33*	6	3	1	0	1	0	0	33		6		0	0		0	0	0	
FLOMOR0222_ST03_2022_05_29_173621.jpg	0.33*	2	3	1	0	0	0	0	18	33	3	4	0	0	0	0	0	0	0
FLOMOR0222_ST03_2022_05_29_173701.jpg	0.33*	14	1	1	0	0	0	0	48		3		0	0		0	0	0	
FLOMOR0222_ST03_2022_05_29_173738.jpg	0.33*	5	2	2	0	0	0	0	27		6		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042114.jpg	0.33*	4	1	0	3	1	0	0	27		12		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042155.jpg	0.33*	4	0	2	0	0	0	0	18		6		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042241.jpg	0.33*	3	2	4	0	0	0	0	27		12		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042306.jpg	0.33*	6	0	1	0	0	0	0	21	26	3	6	0	0	0	0	0	0	0
FLOMOR0222_ST04_2022_06_01_042330.jpg	0.33*	5	2	1	0	0	0	0	24		3		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042350.jpg	0.33*	5	2	0	0	1	0	0	24		3		0	0		0	0	0	
FLOMOR0222_ST04_2022_06_01_042441.jpg	0.33*	10	3	0	0	1	0	0	42		3		0	0		0	0	0	
FLOMOR0222_ST05_2022_06_01_054919.jpg	0.33*	9	0	1	0	4	0	0	42		15		0	0		0	0	0	
FLOMOR0222_ST05_2022_06_01_055046.jpg	0.33*	1	0	4	0	0	0	0	15		12		0	0		0	0	0	
FLOMOR0222_ST05_2022_06_01_055151.jpg	0.33*	4	0	0	0	0	0	0	12	23	0	8	0	0	0	0	0	0	0
FLOMOR0222_ST05_2022_06_01_055340.jpg	0.33*	5	1	0	2	0	0	0	24		6		0	0		0	0	0	
FLOMOR0222_ST05_2022_06_01_055453.jpg	0.33*	3	1	1	0	1	1	0	21		9		0	0		0	0	0	
FLOMOR0222_ST06_2022_06_01_061209.jpg	0.33*	10	2	1	0	2	0	0	45		9		0	0		0	0	0	
FLOMOR0222_ST06_2022_06_01_061244.jpg	0.33*	9	4	1	0	0	0	0	42		3		0	0		0	0	0	
FLOMOR0222_ST06_2022_06_01_061349.jpg	0.33*	2	3	1	1	0	0	0	21	33	6	6	0	0	0	0	0	0	0
FLOMOR0222_ST06_2022_06_01_061446.jpg	0.33*	7	1	4	0	0	0	0	36		12		0	0		0	0	0	
FLOMOR0222_ST06_2022_06_01_061555.jpg	0.33*	6	4	0	1	0	0	0	33		3		0	0		0	0	0	
FLOMOR0222_ST06_2022_06_01_061635.jpg	0.33*	5	0	1	1	0	0	0	21		6		0	0		0	0	0	
FLOMOR0222_ST11_2022_05_29_175924.jpg	0.35	6	2	3	0	0	0	0	31		9		0	0		0	0	0	
FLOMOR0222_ST11_2022_05_29_180012.jpg	0.36	7	4	1	0	0	0	0	34		3		0	0		0	0	0	
FLOMOR0222_ST11_2022_05_29_180037.jpg	0.33*	2	0	0	0	0	0	0	6		0		0	0		0	0	0	
FLOMOR0222_ST11_2022_05_29_180118.jpg	0.33*	7	1	0	0	0	0	0	24		0		0	0		0	0	0	
FLOMOR0222_ST11_2022_05_29_180200.jpg	0.33*	8	1	1	0	3	0	0	39	37	12	4	0	0	0	0	0	0	0
FLOMOR0222_ST12_2022_05_29_182109.jpg	0.30	8	4	1	0	0	0	0	43		3		0	0		0	0	0	
FLOMOR0222_ST12_2022_05_29_182151.jpg	0.33*	8	3	0	0	0	0	0	33		0		0	0		0	0	0	
FLOMOR0222_ST12_2022_05_29_182229.jpg	0.33*	12	7	0	0	0	0	0	57		0		0	0		0	0	0	
FLOMOR0222_ST12_2022_05_29_182310.jpg	0.33*	10	2	0	0	0	0	0	36		0		0	0		0	0	0	
FLOMOR0222_ST12_2022_05_29_182419.jpg	0.33*	11	7	3	0	0	0	0	63		9		0	0		0	0	0	
FLOMOR0222_ST13_2022_06_01_075355.jpg	0.34	4	1	1	0	0	0	0	18		3		0	0		0	0	0	
FLOMOR0222_ST13_2022_06_01_075439.jpg	0.33*	8	0	0	0	0	0	0	24		0		0	0		0	0	0	
FLOMOR0222_ST13_2022_06_01_075517.jpg	0.31	2	2	0	0	0	0	0	13	16	0	1	0	0	0	0	0	0	0
FLOMOR0222_ST13_2022_06_01_075614.jpg	0.33*	2	1	0	0	0	0	0	9		0		0	0		0	0	0	
FLOMOR0222_ST13_2022_06_01_075715.jpg	0.31	5	1	0	0	0	0	0	19		0		0	0		0	0	0	
FLOMOR0222_ST13_2022_06_01_075815.jpg	0.33*	2	1	1	0	0	0	0	12		3		0	0		0	0	0	
FLOMOR0222_ST14_2022_06_01_072812.jpg	0.34	7	2	1	0	0	0	0	30		3		0	0		0	0	0	
FLOMOR0222_ST14_2022_06_01_072847.jpg	0.32	7	3	1	0	0	0	0	35		3		0	0		0	0	0	
FLOMOR0222_ST14_2022_06_01_072919.jpg	0.32	6	3	3	0	0	0	0	38	35	10	5	0	0	0	0	0	0	0
FLOMOR0222_ST14_2022_06_01_073119.jpg	0.37	13	2	0	1	0	0	0	43		3		0	0		0	0	0	
FLOMOR0222_ST14_2022_06_01_073209.jpg	0.25	9	1	2	0	0	0	0	49		8		0	0		0	0	0	
FLOMOR0222_ST14_2022_06_01_073256.jpg	0.33*	3	0	2	0	0	0	0	15		6		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_070345.jpg	0.30	7	0	0	0	0	0	0	23		0		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_070445.jpg	0.32	12	1	1	0	0	0	0	43		3		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_070725.jpg	0.27	11	4	0	0	0	0	0	57		0		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_071301.jpg	0.24	2	3	2	0	0	0	0	29	39	8	5	0	0	0	0	0	0	0
FLOMOR0222_ST15_2022_06_01_071333.jpg	0.28	11	2	1	1	0	0	0	53		7		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_071412.jpg	0.30	6	0	2	0	0	0	0	27		7		0	0		0	0	0	
FLOMOR0222_ST15_2022_06_01_071440.jpg	0.30	11	0	1	0	1	0	0	44		7		0	0		0	0	0	
FLOMOR0222_ST19_2022_05_28_163320.jpg	0.39	4	1	2	0	0	0	0	18		5		0	0		0	0	0	
FLOMOR0222_ST19_2022_05_28_163337.jpg	0.43	3	1	0	0	0	0	0	9		0		0	0		0	0	0	
FLOMOR0222_ST19_2022_05_28_163424.jpg	0.43	12	0	0	0	0	0	0	28	19	0	1	0	0	0	0	0	0	0
FLOMOR0222_ST19_2022_05_28_163448.jpg	0.44	11	0	1	0	0	0	0	28		2		0	0		0	0	0	
FLOMOR0222_ST19_2022_05_28_163531.jpg	0.38	5	0	0	0	0	0	0	13		0		0	0		0	0	0	
FLOMOR0222_ST20_2022_05_28_160824.jpg	0.37	10	2	0	0	0	0	0	32		0		0	0		0	0	0	
FLOMOR0222_ST20_2022_05_28_160901.jpg	0.40	12	3	0	0	0	0	0	37		0		0	0		0	0	0	
FLOMOR0222_ST20_2022_05_28_161212.jpg	0.42	15	2	0	0	0	0	0	40	34	0	2	0	0	0	0	0	0	0
FLOMOR0222_ST20_2022_05_28_161240.jpg	0.89	10	1	2	0	0	0	0	15		2		0	0		0	0	0	
FLOMOR0222_ST20_2022_05_28_161313.jpg	0.41	16	0	3	0	0	0	0	47		7		0	0		0	0	0	
FLOMOR0222_ST21_2022_05_28_140248.jpg	0.35	6	3	3	0	0	0	0	34		9		0	0		0	0	0	
FLOMOR0222_ST21_2022_05_28_140334.jpg	0.40	16	1	4	0	0	0	0	53		10		0	0		0	0	0	
FLOMOR0222_ST21_2022_05_28_140414.jpg	0.39	15	5	0	0	0	0	0	52	38	0	5	0	0	0	0	0	0	0
FLOMOR0222_ST21_2022_05_28_140511.jpg	0.43	7	1	1	0	0	0	0	21		2		0	0		0	0	0	
FLOMOR0222_ST21_2022_05_28_140553.jpg	0.40	6	2	0	0	0	0	0	20		0		0	0		0	0	0	
FLOMOR0222_ST21_2022_05_28_140638.jpg	0.40	14	1	3	0	0	0	0	45		8		0	0		0	0	0	
FLOMOR0222_ST23_2022_05_28_131952.jpg	0.36	11	1	0	0	0	0	0	33		0		0	0		0	0	0	
FLOMOR0222_ST23_2022_05_28_132036.jpg	0.36	11	4	2	2	0	0	0	52		11		0	0		0	0	0	
FLOMOR0222_ST23_2022_05_28_132116.jpg	0.36	2	2	1	0	0	0	0	14	30	3	3	0	0	0	0	0	0	0
FLOMOR0222_ST23_2022_05_28_132157.jpg	0.38	4	1	0	0	0	0	0	13		0		0	0		0	0	0	
FLOMOR0222_ST23_2022_05_28_132237.jpg	0.37	13	0	0	0	0	0	0	35		0		0	0		0	0	0	
FLOMOR0222_ST24_2022_06_01_083538.jpg	0.29	8	6	1	0	0	0	0	52		3		0	0		0	0	0	
FLOMOR0222_ST24_2022_06_01_083615.jpg	0.28	8	4	0	0	0	0	0	43		0		0	0		0	0	0	
FLOMOR0222_ST24_2022_06_01_083702.jpg	0.25	10	4	1	0	0	0	0	59	43	4	2	0	0	0	0	0	0	0
FLOMOR0222_ST24_2022_06_01_083739.jpg	0.29	6	1	0	0	0	0	0	24		0		0	0		0	0	0	
FLOMOR0222_ST24_2022_06_01_083836.jpg	0.33*	9	1	1	0	0	0	0	33		3		0	0		0	0	0	
FLOMOR0222_ST24_2022_06_01_083941.jpg	0.31	12	3	0	0	0	0	0	48		0		0	0		0	0	0	
FLOMOR0222_ST25_2022_06_01_102429.jpg	0.33*	0	0	0	1	0	0	0	3		3		0	0		0	0	0	
FLOMOR0222_ST25_2022_06_01_102631.jpg	0.33*	0	0	1	1	0	0	0	6		6		0	0		0	0	0	
FLOMOR0222_ST25_2022_06_01_102709.jpg	0.33*	1	1	0	0	0	0	0	6	8	0	2	0	0	0	0	0	0	0
FLOMOR0222_ST25_2022_06_01_102743.jpg	0.33*	3	1	0	0	0	0	0	12		0		0	0		0	0	0	
FLOMOR0222_ST25_2022_06_01_102810.jpg	0.33*	4	0	0	0	0	0	0	12		0		0	0		0	0	0	
FLOMOR0222_ST29_2022_05_29_115040.jpg	0.48	12	5	0	0	0	0	0	35		0		0	0		0	0	0	
FLOMOR0222_ST29_2022_05_29_115108.jpg	0.43	13	4	1	0	0	0	0	42		2		0	0		0	0	0	
FLOMOR0222_ST29_2022_05_29_115157.jpg	0.44	13	1	1	0	0	0	0	34	36	2	1	0	0	0	0	0	0	0
FLOMOR0222_ST29_2022_05_29_115233.jpg	0.43	14	5	1	0	0	0	0	46		2		0	0		0	0	0	
FLOMOR0222_ST29_2022_05_29_115334.jpg	0.44	8	1	0	0	0	0	0	20		0		0	0		0	0	0	
FLOMOR0222_ST30_2022_05_28_152738.jpg	0.38	9	1	1	0	0	0	0	29		3		0	0		0	0	0	
FLOMOR0222_ST30_2022_05_28_152813.jpg	0.32	6	0	1	0	0	0	0	22		3		0	0		0	0	0	
FLOMOR0222_ST30_2022_05_28_152857.jpg	0.33*	8	2	0	0	0	0	0	30	30	0	2	0	0	0	0	0	0	1
FLOMOR0222_ST30_2022_05_28_152933.jpg	0.38	13	1	0	0	0	0	0	37		0		0	0		1	1	3	
FLOMOR0222_ST30_2022_05_28_153451.jpg	0.33*	2	7	1	0	0	0	0	30		3		0	0		0	0	0	
FLOMOR0222_ST31_2022_05_28_150351.jpg	0.33*	3	4	1	0	0	0	0	24		3		0	0		0	0	0	
FLOMOR0222_ST31_2022_05_28_150508.jpg	0.33*	5	5	3	0	0	0	0	39		9		0	0		0	0	0	
FLOMOR0222_ST31_2022_05_28_150523.jpg	0.33*	4	3	0	0	0	0	0	21	29	0	3	0	0	0	0	0	0	0
FLOMOR0222_ST31_2022_05_28_150628.jpg	0.37	11	0	1	0	0	0	0	33		3		0	0		0	0	0	
FLOMOR0222_ST31_2022_05_28_151125.jpg	0.34	8	1	0	0	0	0	0	26		0		0	0		0	0	0	
FLOMOR0222_ST34_2022_05_29_183948.jpg	0.33*	4	5	3	0	0	0	0	36		9		0	0		0	0	0	
FLOMOR0222_ST34_2022_05_29_184028.jpg	0.36	11	4	4	0	0	0	0	52		11		0	0		0	0	0	
FLOMOR0222_ST34_2022_05_29_184101.jpg	0.34	5	2	1	0	0	0	0	24	33	3	6	0	0	0	0	0	0	0
FLOMOR0222_ST34_2022_05_29_184154.jpg	0.34	6	3	0	0	0	0	0	27		0		0	0		0	0	0	
FLOMOR0222_ST34_2022_05_29_184226.jpg	0.36	4	3	1	2	0	0	0	28		8		0	0		0	0	0	
FLOMOR0222_ST38_2022_05_28_133705.jpg	0.35	7	3	0	0	0	0	0	29		0		0	0		0	0	0	
FLOMOR0222_ST38_2022_05_28_133745.jpg	0.37	2	1	0	0	1	0	0	11		3		0	0		0	0	0	
FLOMOR0222_ST38_2022_05_28_133829.jpg	0.35	11	2	1	0	0	0	0	41	33	3	2	0	0	0	0	0	0	0
FLOMOR0222_ST38_2022_05_28_133926.jpg	0.32	5	2	1	0	0	0	0	25		3		0	0		0	0	0	
FLOMOR0222_ST38_2022_05_28_134001.jpg	0.33*	17	2	0	0	0	0	1	61		3		0	0		0	0	0	
FLOMOR0222_ST42_2022_05_29_155901.jpg	0.36	5	0	0	0	0	0	0	14		0		0	0		0	0	0	
FLOMOR0222_ST42_2022_05_29_155930.jpg	0.32	6	1	0	0	0	0	0	22		0		0	0		0	0	0	
FLOMOR0222_ST42_2022_05_29_160011.jpg	0.35	4	0	1	0	0	0	0	14	25	3	1	0	0	0	0	0	0	0
FLOMOR0222_ST42_2022_05_29_160046.jpg	0.37	11	1	1	0	0	0	0	35		3		0	0		0	0	0	
FLOMOR0222_ST42_2022_05_29_160125.jpg	0.37	15	0	0	0	0	0	0	41		0		0	0		0	0	0	
FLOMOR0222_ST45_2022_06_01_081724.jpg	0.27	2	0	0	0	0	0	0	7		0		0	0		0	0	0	
FLOMOR0222_ST45_2022_06_01_081757.jpg	0.29	0	0	2	0	0	0	0	7		7		0	0		0	0	0	
FLOMOR0222_ST45_2022_06_01_081851.jpg	0.27	0	0	3	0	0	0	0	11	10	11	4	0	0	0	0	0	0	0
FLOMOR0222_ST45_2022_06_01_081935.jpg	0.28	1	0	0	0	1	0	0	7		4		0	0		0	0	0	
FLOMOR0222_ST45_2022_06_01_082011.jpg	0.31	4	0	0	0	0	0	0	13		0		0	0		0	0	0	
FLOMOR0222_ST45_2022_06_01_082040.jpg	0.33*	5	0	0	0	0	0	0	15		0		0	0		0	0	0	
FLOMOR0222_ST51_2022_06_01_064348.jpg	0.29	8	0	0	0	0	0	0	28		0		0	0		0	0	0	
FLOMOR0222_ST51_2022_06_01_064817.jpg	0.29	2	2	2	0	1	0	0	24		10		0	0		0	0	0	
FLOMOR0222_ST51_2022_06_01_064901.jpg	0.25	4	1	0	0	0	0	0	20	28	0	3	0	0	0	0	0	0	0
FLOMOR0222_ST51_2022_06_01_064958.jpg	0.27	0	2	0	0	0	0	0	7		0		0	0		0	0	0	
FLOMOR0222_ST51_2022_06_01_065159.jpg	0.29	16	0	2	0	0	0	0	62		7		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093131.jpg	0.33*	11	0	0	0	0	0	0	33		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093229.jpg	0.33*	2	2	0	0	0	0	0	12		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093323.jpg	0.33*	4	1	0	0	0	0	0	15		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093359.jpg	0.33*	4	1	0	0	0	0	0	15		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093440.jpg	0.33*	1	2	0	0	0	0	0	9		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093519.jpg	0.33*	4	0	1	0	0	0	0	15		3		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093553.jpg	0.33*	5	4	0	0	0	0	0	27		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093629.jpg	0.33*	6	0	0	1	0	0	0	21	15	3	1	0	0	0	0	0	0	0
FLOMOR0222_TR02_2022_06_01_093750.jpg	0.28	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_093917.jpg	0.29	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_094004.jpg	0.31	8	1	0	0	0	0	0	29		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_094106.jpg	0.27	3	3	0	0	0	0	0	22		0		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_094449.jpg	0.26	1	0	0	0	0	1	0	8		4		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_095509.jpg	0.29	1	0	1	0	0	0	1	10		7		0	0		0	0	0	
FLOMOR0222_TR02_2022_06_01_095627.jpg	0.33*	1	2	0	0	0	0	0	9		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085547.jpg	0.25	2	1	0	0	2	0	0	20		8		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085625.jpg	0.27	7	1	0	0	0	0	0	29		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085701.jpg	0.28	9	0	0	0	0	0	0	32		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085739.jpg	0.34	2	1	0	0	0	0	0	9		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085825.jpg	0.28	1	0	0	0	0	0	0	4		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085912.jpg	0.29	7	1	1	0	1	0	0	34		7		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_085959.jpg	0.26	4	4	1	0	0	0	0	35		4		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090056.jpg	0.30	9	4	0	0	0	0	0	44		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090129.jpg	0.26	4	1	3	1	0	0	0	35		16		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090221.jpg	0.34	4	2	0	0	0	0	0	18		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090250.jpg	0.33*	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090316.jpg	0.31	4	1	0	0	0	0	0	16		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090348.jpg	0.29	7	1	1	0	0	0	0	31		3		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090424.jpg	0.28	7	2	1	1	1	0	0	43	20	11	3	0	0	0	0	0	0	0
FLOMOR0222_TR03_2022_06_01_090501.jpg	0.29	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090534.jpg	0.32	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090616.jpg	0.30	0	0	0	0	0	0	0	0		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090653.jpg	0.30	4	2	0	0	0	0	0	20		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090718.jpg	0.30	7	1	3	1	0	0	0	40		13		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090756.jpg	0.32	4	0	0	0	0	0	0	13		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090831.jpg	0.33*	3	1	0	0	0	0	0	12		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090909.jpg	0.29	3	1	1	0	0	0	0	17		3		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_090945.jpg	0.30	8	0	0	0	0	0	0	27		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_091022.jpg	0.33*	1	0	0	0	0	0	0	3		0		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_091058.jpg	0.27	5	3	0	0	1	0	0	33		4		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_091134.jpg	0.28	4	0	0	1	0	0	0	18		4		0	0		0	0	0	
FLOMOR0222_TR03_2022_06_01_091210.jpg	0.31	3	1	0	0	0	0	0	13		0		0	0		0	0	0	

Appendix XVIII - Biotoping

Station	Sampled Lat	Sampled Long	Easting	Northing	Textural Group	Mean Grain Size	Macro Group	BSH EUNIS Level 3	EUNIS Level 4	EUNIS Level 5	EUNIS name 2007-11	JNCC 04.05 code	Physical Mismatch	Notes
ST01	53.759304	-3.613803	459534.014	5956917.06	Gravelly Muddy Sand	536.1	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	Whilst gravel content is high in this sample it is not seen to be driving the biological community. The driving factor here is the muddy sand content which aligns with the note on the biotope for all other mismatches of this nature below.
ST02	53.761874	-3.588412	461210.296	5957188.867	Muddy Sand	237.7	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST03	53.761656	-3.567073	462616.772	5957153.161	Muddy Sand	141.5	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	
ST04	53.761759	-3.544359	464114.242	5957152.832	Muddy Sand	87.54	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST05	53.761856	-3.521741	465605.363	5957152.496	Muddy Sand	54.74	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST06	53.759793	-3.502608	466865.056	5956913.891	Muddy Sand	55.26	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST07	53.783527	-3.681098	455123.35	5959652.413	Sand	321.7	B	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST08	53.783508	-3.658678	456600.557	5959636.344	Slightly Gravelly Sand	381	B	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST09	53.827169	-3.544904	464134.196	5964430.292	Muddy Sand	73.82	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST10	53.783911	-3.61298	459611.85	5959654.219	Sand	305.2	C	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST11	53.774553	-3.58597	461382.877	5958598.062	Muddy Sand	146.7	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	See comment in cell O3.
ST12	53.784084	-3.567493	462609.078	5959648.52	Muddy Sand	128.8	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST13	53.783301	-3.541898	464294.746	5959548.265	Slightly Gravelly Muddy Sand	156	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST14	53.774294	-3.522241	465582.571	5958536.525	Muddy Sand	133.3	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST15	53.781083	-3.508254	466509.741	5959285.119	Muddy Sand	73.24	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST16	53.805621	-3.727088	452118.354	5962140.503	Slightly Gravelly Muddy Sand	295.3	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST17	53.805812	-3.704357	453615.431	5962146.618	Slightly Gravelly Sand	340.4	B	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST18	53.801836	-3.674799	455557.767	5961685.359	Muddy Sand	97.8	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST19	53.801793	-3.636472	458081.88	5961657.323	Muddy Sand	209.3	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST20	53.801598	-3.612716	459646.223	5961621.884	Muddy Sand	137.6	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST21	53.801321	-3.59044	461113.065	5961578.599	Muddy Sand	96.58	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST22	53.815461	-3.572905	462280.667	5963142.33	Sand	299.8	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST23	53.806187	-3.544127	464167.405	5962095.542	Muddy Sand	60.23	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST24	53.807311	-3.521396	465665.257	5962209.349	Muddy Sand	80.38	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST25	53.806922	-3.499428	467111.566	5962155.677	Muddy Sand	46.93	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST26	53.827841	-3.708422	453372.205	5964600.17	Slightly Gravelly Sand	293.9	D	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST27	53.828498	-3.681926	455116.869	5964656.171	Sand	284.8	C	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST28	53.828598	-3.65917	456614.664	5964653.124	Muddy Sand	206	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST29	53.829856	-3.638155	457999.094	5964780.482	Muddy Sand	106.1	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST30	53.827344	-3.609522	459881.227	5964484.349	Muddy Sand	160.9	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST31	53.828894	-3.590863	461110.737	5964646.436	Muddy Sand	63.28	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST32	53.850952	-3.682267	455118.434	5967154.527	Slightly Gravelly Muddy Sand	251.1	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST34	53.774219	-3.557447	463262.31	5958545.807	Muddy Sand	125.9	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST35	53.754577	-3.574825	462099.42	5956369.61	Sand	259.6	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST36	53.843904	-3.699529	453975.187	5966381.368	Slightly Gravelly Muddy Sand	282.2	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST37	53.840292	-3.666346	456154.618	5965958.52	Sand	269.2	D	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST38	53.797032	-3.557845	463256.054	5961084.075	Muddy Sand	41.52	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST39	53.81734	-3.612816	459654.797	5963373.254	Muddy Sand	223.4	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	This community occurs in muddy sands in moderately deep water (Hiscock 1984; Picton et al. 1994) and may be related to the 'offshore muddy sand association' described by other workers (Jones 1951; Thorson 1957; Mackie 1990). Also note that a confirmed core record for this community has been recorded in proxmity to the Morecambe OWF site location previously (Source: https://mhc.jncc.gov.uk/biotopes/jnccmncr00000786)
ST40	53.813522	-3.501498	466980.429	5962891.009	Muddy Sand	99.5	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST41	53.778987	-3.634789	458170.012	5959119.084	Slightly Gravelly Sand	302.9	D	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST42	53.77215	-3.629112	458537.406	5958355.045	Slightly Gravelly Sand	271	D	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST43	53.79397	-3.706298	453474.558	5960830.465	Slightly Gravelly Sand	381.4	B	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST44	53.81864	-3.679814	455245.347	5963558.038	Slightly Gravelly Sand	261.6	A	A5.2	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	Yes	PSD data shows <0.5% gravel so this is essentially sand or muddy sand and therefore confident this aligns with the biotope description.
ST45	53.791874	-3.515421	466046.255	5960489.078	Sandy Mud	35.5	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST46	53.823486	-3.504538	466788.125	5964000.98	Slightly Gravelly Sand	457.2	Outlier	A5.2	A5.25	-	Circalittoral fine sand	SS.SSa.CFiSa	No	
ST47	53.81485	-3.523885	465507.546	5963049.4	Muddy Sand	68.08	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST48	53.808661	-3.677672	455375.793	5962446.451	Sand	287.5	D	A5.2	A5.25	A5.252	[Abra prismatica], [Bathyporeia elegans] and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo	No	
ST49	53.816385	-3.552527	463623.071	5963234.429	Muddy Sand	77.32	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST50	53.755689	-3.527025	465251.924	5956468.987	Slightly Gravelly Muddy Sand	83.49	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	
ST51	53.775545	-3.501759	466933.351	5958665.936	Slightly Gravelly Muddy Sand	122	A	A5.3	A5.35	A5.351	[Amphiura filiformis], [Mysella bidentata] and [Abra nitida] in circalittoral sandy mud	SS.SMu.CSaMu.AfilMysAnit	No	

Appendix XIX - Responses to NE and MMO comments on the PEP

Response to Natural England (NE) comments on OEL Project Execution Plan (OEL_FLOMOR0222_PEP_V02) for Morecambe Offshore Windfarm (NE comments received 06 May 2022)

Natural England Advice	Morecambe OWF response
General Overall, Natural England is content that the specified survey will produce data sufficient to undertake benthic characterisation of the site and ground truth previously collected geophysical data.	Noted.
General Natural England notes that the proposed survey is broadly in line with the requirements set out in the "Best Practice Advice for Evidence and Data Standards", although some detail on analysis is missing (see comment on technical report below).	Noted.
4.3.1 Approach	
Natural England advises that consideration should be given to taking replicate grabs at each station. Whilst basic characterisation of the benthic communities present may be achieved with a single sample per station, replicate samples would enable the communities present to be described with greater accuracy and confidence. Furthermore, replicates would allow for temporal comparisons to be made with future surveys, for example in the post-construction phase. Three to five replicates are recommended for these purposes, respectively.	The sampling plan is designed to characterise the baseline, to ground truth the geophysical data and to identify and assign habitats across the site for EIA purposes. For this purpose, we consider one sample is adequate and common practice. Samples have been placed to provide comprehensive coverage of the whole site, with numerous samples placed in each habitat. At this stage sensitive features have not been identified from the geophysical data and the need for monitoring has also not been established. Further, the project is developing its layout for turbines carefully with the owners of existing infrastructure which co-exist within the site which means that it is difficult at this stage to predict suitable monitoring sites where multiple samples would be of benefit. While we note that multiple samples can help accuracy and check homogeneity between samples at this stage single samples will be taken, with results used to help establish the need for further sampling and monitoring. Existing datasets that may be held within the site from owners of existing infrastructure, where available will also be used and assist with the evidence base for the project.
6.4.2 Technical Report	
Little detail has been provided beyond the contents of the Technical Report. There is no reference to indices that will be used in the analysis and interpretation of the grab sample data, so we are unable to confirm whether the planned analysis will be adequate. Natural England advises that the Best Practice Advice for Evidence and Data Standards is referred to for further guidance on the appropriate analyses to apply to the grab and DDC data. We would welcome further consultation following the completion of the survey and before the Technical Report is finalised to confirm the analysis will be sufficient	All of the raw data derived from the combined benthic characterisation works will undergo detailed analysis and interpretation in line with Phase III of NE's "Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards" (Natural England 2021b). Following the completion of all data analysis, OEL will provide a detailed technical report to provide a description of the baseline environment, including a narrative of the seabed type across the project area, the range of habitats and biotopes present and the presence of any habitats/species of conservation importance. As per best practice guidance (Noble-James et al. 2018) this will include the calculation of univariate and multimetric diversity indices to condense the full benthic community dataset into single metrics for use in univariate analyses. The indices to be calculated will include: abundance of individuals, richness (Margalef's species richness), evenness (Pielou's evenness), diversity (Simpson's index and Shannon-Wiener index) and the Infaunal Quality Index (IQI)). Data will be collated using Excel spreadsheets conforming to the relevant Marine Environmental Data and Information Network (MEDIN) data guidelines and with all site locations recorded.

Response to Marine Management Organisation (MMO) comments on OEL Project Execution Plan (OEL_FLOMOR0222_PEP_V03) for Morecambe Offshore Windfarm (MMO comments received 03 August 2022)

Reference	Topic	Comment	OEL Response
1	Project description	The proposed Morecambe OWF (OWF) is in water depths of 20-35 metres (m), approximately 30 kilometres (km) off the Lancashire coast in the Irish Sea. It is a 480 megawatt round four venture from Cobra Instalaciones SA and Floatation Energy plc. As a Nationally Significant Infrastructure Project (NSIP), an Environmental Impact Assessment (EIA) is required to determine the impact of the installation, operation and maintenance and subsequent decommissioning of Morecambe Bay OWF before a Development Consent Order (DCO) is granted (active DCO/2022/0001). Ocean Ecology have submitted a Project Execution Plan in support of this application on behalf of the developer to set out the offshore environmental survey methods (grab and camera) as part of the pre-construction site characterisation programme. Note, this has been received for review following completion of the survey work conducted in May 2022.	No action needed
2.1	Contaminant sampling	In total, 50 stations were sampled and 20 samples selected for contaminant analysis. Each benthic grab sample aimed to collect 10 litres (L) of sediment. The Project Execution Plan stated that the sample locations were developed to provide adequate spatial coverage of the array area and to represent all main sediment types and features of conservation interest	No action needed
2.2	Contaminant sampling	The Shapefiles submitted for review show that the samples are approximately 1- 2km apart. The 20 samples for contaminate analysis are adequately spaced and are shown in Figure 1 (Annex 1).	No action needed
2.3	Contaminant sampling	A Drop-Down camera (DDC) system was used prior to grab sampling to make sure the target location was free of obstructions or protected habitats and 4 DDC transects were completed.	No action needed
2.4	Contaminant sampling	Paragraph 5.4.3 of the Project Execution Plan provides details of the analysis to be carried out on the 20 contaminate samples stations which include Total Organic Carbon, Total Organic matter, Heavy metals including Arsenic, Organotin, PAHs, THC and PCBs. The analyses are to be carried out by SOCOTEC.	No action needed
2.5	Contaminant sampling	Whilst the number of sample stations collected appear to be appropriate as there is no dredge and disposal planned, the documentation provided does not state how many samples or sample volume will be taken at each of the 20 stations. It only states that there will be 10L of sediment collected from the 50 stations with a volume of 500-750ml removed for particle size distribution (PSD) analysis (paragraph 5.4 of Project Execution Plan).	In section 5.3.3 of the technical report, an explanation of how sub-samples for chemical analysis have been obtained has been included
2.6	Contaminant sampling	The documentation provided for review does not include the sample analysis data from the 20 stations sampled. The MMO are unable to provide further recommendations without reviewing the data	In section 5.3.3 of the technical report, a summary of the analysis to be done on the sediment chemistry samples is listed
3.1	Benthic Sampling	In total, 50 locations were planned for benthic sediment sample collection within the Morecambe OWF area (Figure 1 (Annex 1)). Seabed imagery (Drop down video (DDV)) was collected from each of these locations "to provide additional information on the sediment / substrate surface and to determine suitability to collect grab samples".	No action needed
3.2	Benthic Sampling	The distance between sediment sampling stations ranges approximately between 1 – 2 km. The MMO are satisfied that the sample density is sufficient to further our understanding of the baseline conditions at the site.	No action needed
3.3	Benthic Sampling	The MMO are unable to confirm if the benthic assemblages and sediment types present within the site have been sampled adequately (particularly from within the area marked as coarse sediment in Figure 1 (Annex 1). The MMO request that the rationale behind placement of sediment sample locations is made available and whether the acoustic datasets (Figure 2 (Annex 1)) were interpreted or analysed prior to arriving at the sample design. The MMO notes that best practice would be to segment the area based on the acoustics dataset in advance of the survey, and station locations (both grab and DDV) are based on interpretation of the resultant segmentation so that the range of sediment types identified are sampled adequately and can be classified accordingly. In the absence of this step, the location of the grab stations may not lie within the sediment boundaries ultimately identified within the site and therefore, the assemblages associated with some habitat types may not be sampled sufficiently.	This comment has been addressed in section 4.1 of the technical report. Geophysical data was reviewed prior to produce the sampling array for the project. Table 1 lists the type of substrated targeted during the survey and how many samples were collected for each substrate.
3.4	Benthic Sampling	The number of grab samples collected appears appropriate to characterise the Morecambe OWF area and identify regions of different sediment characteristics and infaunal assemblages.	No action needed
3.5	Benthic Sampling	The number of DDV station locations appears to be four (Figure 3 (Annex 1)). However, section 4.4. of the Project Execution Plan includes brief descriptions of only three of these features (TR01-03). The number of DDV transect should be clarified within the subsequent technical report. The report should also include the rationale of DDV station placement and detailed results of the seabed imagery analysis.	Section 4.2 of the technical report addresses this comment by providing table and maps illustrating where DDC stations were located and their rationale.
3.6	Benthic Sampling	The MMO recommend that benthic monitoring should be conducted to validate the predictions made in the Environmental Statement and to determine the scale and magnitude of the impacts on benthic assemblages and protected features as a result of the installation of the proposed Morecambe OWF. It would be beneficial to the benthic monitoring programme if the location of the Wind Turbine Generator (WTG) infrastructure is known in advance of the pre- construction monitoring survey so that station locations can be consistent throughout pre- and post-construction monitoring, and the impact of their installation can be assessed over time. A subset of WTGs, spatially spread within the site, could be monitored to assess the impact of the installation of WTGs more accurately.	Aims and objectives of the technical report are presented in Section 1.3.
3.7	Benthic Sampling	The MMO recommend post-construction monitoring of the benthic assemblage and any protected features is carried out over non-consecutive years e.g., 1, 3 and 5 or 1, 5 and 10 years, to evidence the long-term impacts of Morecambe OWF on the benthic environment.	No action needed
3.8	Benthic Sampling	The Project Execution Plan assures that sample processing will be in line with national guidelines and accepted methodologies. The MMO welcome this.	No action needed
3.9	Benthic Sampling	Analysis of the benthic grab data would be expected to include a multivariate assessment of the assemblage within the site using widely accepted methods, such as that used in Clarke et al., 2006 and Clarke et al., 2016, and an assessment of the biological relevance of any cluster groups identified in the context of temporal monitoring (e.g., location of monitoring stations).	All analyses carried out and presented in the technical report have been done in consideration of the most recent guidelines as per section 6 of the techncial report.
4.1	Conclusions	The Project Execution Plan provides details of an appropriate sample plan in support of their application. This data should allow for adequate characterisation of the sediment type and contaminate levels within the proposed OWF. The data available from the dedicated acoustic survey(s) (Multibeam Echosounder and associated back scatter); the sediment sampling survey (particle size distribution and benthic infaunal data); and seabed imagery survey (still images along features of interest and at each grab station) should also allow the benthic assemblage within the site to be characterised adequately.	No action needed
4.2	Conclusions	The MMO note that should any dredging or disposal activities become necessary, the MMO must be consulted to ensure the samples and analyses are adequate. This cannot be assessed currently without further information e.g., volume, depths.	Noted. No action needed.
4.3	Conclusions	The MMO are satisfied that the results of the baseline characterisation at Morecambe OWF should provide useful support to aid in future monitoring decisions.	Noted. No action needed.
4.4	Conclusions	The MMO recommend that the technical report produced includes the information highlighted in sections 3.6, 4.3, 4.5 alongside a detailed rationale behind the station location placement. The MMO also note that the outline of the report contents would facilitate this (Figure 5 (Annex 1)).	Please see responses above to relevant comments.