Environmental Impact Assessment Report
Volume 3, Appendix 10.1: Benthic Characterisation Report

MarramWind Offshore Wind Farm

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MarramWind

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1. Introduction

1.1 Report overview

1.1.1.1 This Benthic Characterisation Report presents the results of the interpretation and assessment of benthic habitat extent across the MarramWind Offshore Wind Farm (hereafter, referred to as 'the Project') Option Agreement Area (OAA) and offshore export cable corridor study area.

1.1.1.2 The main report objectives are to summarise the methods used to interpret baseline survey data (geophysical and environmental) collected from the offshore export corridor and the OAA to produce a habitat (biotope) map for the extent of the Project Red Line Boundary.

1.1.1.3 The baseline survey data analysed includes information regarding seafloor sediments and features as well as the reported presence of benthic, epibenthic and fish species.

1.1.1.4 It covers identification of:

- habitats and biotopes across the Project Red Line Boundary; and
- features, both habitats and species, of conservation interest.

1.1.1.5 This Report should be read in conjunction with **Volume 1, Chapter 4: Project Description** of the Environmental Impact Assessment (EIA) Report and the relevant Appendices:

- **Appendix 10.3: Confidential Geophysical and Environmental Export Cable Corridor Survey: Geophysical Benthic Interpretive Report**; and
- **Appendix 10.4: Geophysical and Environmental Offshore Windfarm Survey Volume 2 of 11: Benthic Survey Interpretative Report**.

1.1.1.6 This Report accompanies the EIA Chapter provided in **Volume 1, Chapter 10: Benthic Epibenthic and Intertidal Ecology** to support the consent application for the Project. It also supports **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan**.

1.1.1.7 This Report is structured as:

- **Section 1: Introduction** including a general report description and a summary of relevant environmental legislation and policy (**Section 1.2**) with respect to the benthic characterisation.
- **Section 2: Habitat Mapping Methodology** including a review of the available baseline survey data used to support the benthic characterisation (**Section 2.2**), external supporting data (**Section 2.3**) and the approach to the benthic characterisation (**Section 2.4**).
- **Section 3: Results and Interpretation** including a review of the habitats and biotopes identified along the offshore export corridor and OAA (**Section 3.2**) and the Features of Conservation Interest (FOCIs), with habitats and species identified (**Section 3.3**).
- **Section 4: Summary** of the results and key features identified within the study area.

1.2 Relevant environmental legislative and policy background

1.2.1.1 The relevant environmental legislation applying to the identification of habitats and species of conservation interest in the study area are summarised in the subsections below.

1.2.2 UK Post-2010 Biodiversity Framework

1.2.2.1 The 'UK Post-2010 Biodiversity Framework priority habitats and / or species' was published in July 2012 (Joint Nature Conservation Committee (JNCC), 2012) to succeed the UK Biodiversity Action Plan (BAP), under the Convention on Biological Diversity (CBD). It is the result of a change in strategic thinking following the publication of the CBDs 'Strategic Plan for Biodiversity 2011-2010' and the launch of the EU Biodiversity Strategy in May 2011.

1.2.2.2 It provides a list of species and habitats that are considered by the UK BAP to be of principal importance, which are referred to in the UK BAP as Priority Species and Priority Habitats. This includes 22 marine and coastal Priority Habitats.

1.2.2.3 Priority Habitats that may occur in in the open water marine environment of the Scottish North Sea are as follows:

- carbonate mounds;
- deep-sea sponge communities;
- cold-water coral reefs;
- blue and horse mussel beds; and
- mud habitats in deep water.

1.2.3 Oslo and Paris (OSPAR) list of threatened and / or declining species and habitats

1.2.3.1 The OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic is an important driver in the protection and conservation of marine ecosystems and biodiversity, including the establishment of an ecologically coherent network of Marine Protected Areas (MPAs) in the North-East Atlantic (OSPAR Commission, 2018).

1.2.3.2 The OSPAR List of Threatened and / or Declining Species and Habitats identifies species and habitats that are considered to be priorities for protection. The North-East Atlantic Environment Strategy 2030 has been adopted by OSPAR (OSPAR Commission, 2021), which sets out strategic objectives to help to achieve Good Environmental Status in the marine environment.

1.2.3.3 Key OSPAR habitats that may occur in an open water marine environment are essentially the same as listed under the UK BAP, with the 'Mud Habitats in Deep Water' listed as "Seapens and Burrowing Megafauna Communities".

1.2.3.4 OSPAR species of potential relevance to the region include ocean quahog (*Arctica islandica*), cod (*Gadus morhua*) and several ray species.

1.2.4 European Habitats Directive

1.2.4.1 Following the UK's exit from the European Union (EU), the requirements of the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC) have become part of UK domestic legislation via the Habitats Regulations as amended by the Conservation of

Habitats and Species (Amendment) (EU Exit) Regulations 2019. These requirements focus on the maintenance and enhancement of biodiversity, with an emphasis on protecting rare and endangered wild species and natural habitats of European significance. The UK site network comprises terrestrial and marine Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

1.2.4.2 At the national level, the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 gives Scottish Ministers powers to designate MPAs in Scottish territorial and offshore waters, respectively.

1.2.4.3 The Annex I habitats of particular relevance to offshore waters this region of UK waters are as follows:

- subtidal reefs (for example, biogenic reefs formed by *Sabellaria spinulosa* or *Modiolus* and rocky reefs formed from iceberg scour or moraine deposits); and
- submarine structures made by leaking gases (including, *inter alia*, carbonates formed within pockmarks).

1.2.5 Priority Marine Features

1.2.5.1 In July 2014, 81 Priority Marine Features (PMFs) were identified for the seas around Scotland. The list, which covers a variety of habitats and species that are a priority for conservation in Scotland's seas, was developed by Marine Scotland, the JNCC and Scottish Natural Heritage (NatureScot, 2020). Key PMF habitats previously identified within the vicinity of the Project are 'Burrowed mud', 'Offshore deep-sea muds', 'Offshore subtidal sands and gravels' and 'Submarine structures made by leaking gases'.

1.2.6 Scottish Biodiversity Strategy

1.2.6.1 The Scottish Biodiversity Strategy to 2045 was published on 27 November 2024 (Scottish Government, 2024). This Strategy sets out the Scottish Government's ambition for Scotland to end biodiversity loss and be nature positive by 2030, and to have restored and regenerated biodiversity across the country by 2045. The Strategy will drive the transformation needed to manage and restore terrestrial, freshwater and marine biodiversity resources in Scotland, as well as providing a framework for prioritising and coordinating actions and investments.

1.2.6.2 The Scottish Biodiversity List (SBL) is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. By identifying the species and habitats that are of the highest priority for biodiversity conservation, the Scottish Biodiversity List helps public bodies apply their biodiversity duty. Work is underway to update the prioritisation of species and habitats in Scotland as part of the Biodiversity Strategy.

2. Habitat Mapping Methodology

2.1.1.1 This Section provides an overview to the approach used to undertake the benthic characterisation and produce the resultant habitat classification and features of conservation interest maps (**Figure 1** to **Figure 16**).

2.1.1.2 The subsections provide a review of the available baseline survey data used to support the benthic characterisation (**Section 2.2**), external data used to support the characterisation and inform data extrapolation and interpolation where required (**Section 2.3**), and the approach to the characterisation and assessing the confidence in the final outputs (**Section 2.4**).

2.2 Field survey data

2.2.1 Geophysical data

2.2.1.1 The geophysical survey comprised single and Multibeam Echosounder (MBES) to acquire bathymetry data, multibeam backscatter, dual frequency Side Scan Sonar (SSS), magnetometry, a Innomar sub-bottom profiler, and 2D ultra-high resolution multichannel seismic data across all lines.

2.2.1.2 Full details of the survey methods employed, and equipment used are described in the respective offshore export cable (**Appendix 10.3**) and OAA (**Appendix 10.4**) Geophysical Benthic Interpretive Reports.

2.2.1.3 The following datasets were available for review during the preparation of this Report:

- Bathymetric data was acquired using a EM2040 MBES, which were reduced and processed to provide a 1 metre (m) digital terrain model. For bathymetric contours, the data were smoothed with a 3.0m radius. This included the sediment and morphology classification and identification of debris and obstructions within the survey area (for example, seabed scars, possible anthropogenic debris).
- Backscatter data were acquired using a EM2040 MBES. The backscatter data were processed to a 1m x 1m cell size, interpolated and merged. Backscatter data were used to support the seafloor sediments classification and seafloor morphology interpretation.
- SSS data was acquired in dual frequency mode (Low Frequency (LF) at 230 kilohertz (kHz) and 300kHz, and High Frequency (HF) at 540kHz and 600kHz). The horizontal resolution of the SSS data is approximately 0.2m (for high frequencies). Mosaics were created from both LF and HF data and available in GeoTiff format at a cell size of 1.0m and 0.2m respectively. The LF and HF SSS mosaics were used to aid the seafloor sediment interpretation, including changes in sediment type and hardness.

2.2.1.4 At the OAA, the acoustic and bathymetric survey covered the entirety of the site with acquisition extending just beyond the Red Line Boundary. Within the offshore export corridor only the central extent of the corridor had acoustic and bathymetric survey coverage, equating to approximately 33 per cent of the offshore export cable corridor. This area is hereafter referred to as the ‘corridor survey extent’ to distinguish it from the broader offshore export cable corridor when reporting on the characterisation results.

2.2.2 Environmental sampling

2.2.2.1 Environmental sampling was undertaken to establish the presence of any sensitive habitats and species. This comprised a benthic ecology sampling programme to collect drop-down video (DDV) footage, grab samples for macrobenthic faunal analysis and Particle Size Distribution (PSD). Environmental sampling stations were predetermined via a benthic sampling strategy developed for the Project (Wood, 2022; MarramWind, 2023), which was shared with Marine Scotland Licensing Operations Team (as named in 2022 but subsequently renamed Marine Directorate – Licensing Operations Team) and accepted as suitable for use. The strategy selected environmental sampling stations to provide spatial coverage of the survey area.

2.2.2.2 The environmental sampling survey strategy, including detailed methods and acquired environmental samples and camera transects, is outlined in the respective offshore export cable (Fugro, 2024a) and OAA (Fugro, 2024b) Geophysical Benthic Interpretive Reports.

2.2.2.3 Seafloor photography was acquired using a Subsea Technology and Rentals Limited deep sea camera system mounted within a purpose-built camera frame, complete with a standard definition video camera and high-resolution stills camera (14.7 mega pixel). Sediment and macrofaunal sampling were undertaken with a combination of grabs depending on the seabed sediment, including 0.1m^2 dual van Veen, Hamon and Day grabs. Samples were acquired from across the extent of the offshore export cable corridor and the OAA.

2.2.2.4 The following benthic environmental datasets were available for review during the preparation of this Report:

- epifaunal assessment log following detailed analysis of video and still photographic data;
- descriptions of the substrate composition from sediment PSD analysis, largely based on a reclassification of the Folk (1954) sediment classes;
- raw macrofaunal abundance data from grab samples; and
- stoney reef and *Sabellaria* reef assessment analysis.

2.3 External data

2.3.1.1 Where survey data were not available, and to further aid interpretation, comparison has been made with the predicted seabed habitat distribution data produced by the European marine observation and data network (EMODnet). In addition, known data on the distribution of OSPAR threatened and / or declining habitats were reviewed to inform the habitat classification and identification of FOCI.

2.3.2 EMODnet predicted habitats distributions

2.3.2.1 EMODnet is a long-term marine data initiative developed to collect data and build on existing databases to provide access to European scale marine data (EMODnet, 2023). The broad-scale seabed habitat map is a predictive delineation of habitats to the European Nature Information System (EUNIS) classification system (EUNIS, 2019). The broad-scale European Union Seabed Habitat Map (EUSeaMap) 2023 was used to aid assignment of habitats within a given study area where survey data was not available.

2.3.2.2 The predicted EUNIS habitat around the OAA is ‘Atlantic Offshore Circalittoral Mud’ (MD62/ SS.SMu.OMu) and ‘Atlantic Offshore Circalittoral Sand’ (MD52/ SS.SSa.OSa). Along the offshore export cable corridor predicted EUNIS habitats are more variable but the predominant habitat is predicted to be ‘Atlantic Offshore Circalittoral Sand’. Nearer inshore

habitats also include 'Atlantic Offshore Circalittoral Coarse Sediment' (MD32/ SS.SCS.OCS), 'Atlantic Circalittoral Rock' (MC12/ CR.HCR), and 'Atlantic Circalittoral Sand' (MC52/ SS.SSa).

2.3.3 OSPAR threatened and / or declining habitats

2.3.3.1 The OSPAR threatened and / or declining habitats layers are composite products that aim to show the current best understanding of the distribution and extent of habitats on the OSPAR list of threatened and / or declining habitats in the UK and the wider North-East Atlantic.

2.3.3.2 The products contain both point and polygon information from multiple sources, collating data directly from surveys that have been undertaken. The latest version of the database was published in 2022 (JNCC, 2022).

2.3.4 Marine Scotland National Marine Plan interactive (NMPi)

2.3.4.1 The NMPi is an interactive mapping tool from Marine Scotland which aims to assist in the development and implementation of Scotland's National Marine Plan (NMP). The map holds key spatial data layers on the known distribution of PMF features. These layers were reviewed in order to ensure there was no known overlap of PMF features within the Red Line Boundary.

2.4 Benthic characterisation approach

2.4.1.1 To inform the benthic characterisation a combination of bathymetry, backscatter and environmental ground-truthing (grab and DDV sampling) data were used to enable the production of maps on substrate type and seabed habitats (**Plate 2.1**).

2.4.1.2 Backscatter data were used for the seafloor sediment classification and seafloor morphology interpretation. Backscatter is the amount or intensity of the return beam and was used to indicate the nature and composition of the seabed, which provided information on the roughness and nature of the seabed substrate.

2.4.1.3 However, many other factors can influence backscatter intensity, for example changes in seabed slope or adjustments to settings aboard the survey vessel. Backscatter therefore requires careful interpretation and must be viewed in combination with bathymetry and ground-truthing information to give confidence in the resulting marine habitat and substrate type maps.

2.4.1.4 MBES gridded data were therefore used to complement interpretation of the seafloor sediments and morphology as was the low frequency SSS mosaics. MBES gridded data were used in ArcGIS to identify bedforms and seafloor features within the survey area.

2.4.1.5 Ground-truthing data, collected through environmental sampling, is an important requirement for creating marine habitat and substrate type maps. A wide range of information can be useful, such as sediment samples, photographs and videos, and macrofaunal data.

2.4.1.6 In this context, seabed photography and video were used to provide information and direct visual observations of the seabed. Photographic data were successfully acquired at all of the proposed stations in the nearshore and offshore areas. The seafloor photography provided an overview of a wide area of seabed and was used to identify isolated features such as cobbles, boulders and associated epibiota. It was used to support the assessment of rocky features where grab sampling was not suitable.

2.4.1.7 Grab data were used to collect detailed information about the sediment composition and associated fauna, providing in-depth data for a localised area. Grab sampling is only suitable in sedimentary areas; however, it is essential for the assignment of biotopes in sedimentary habitats.

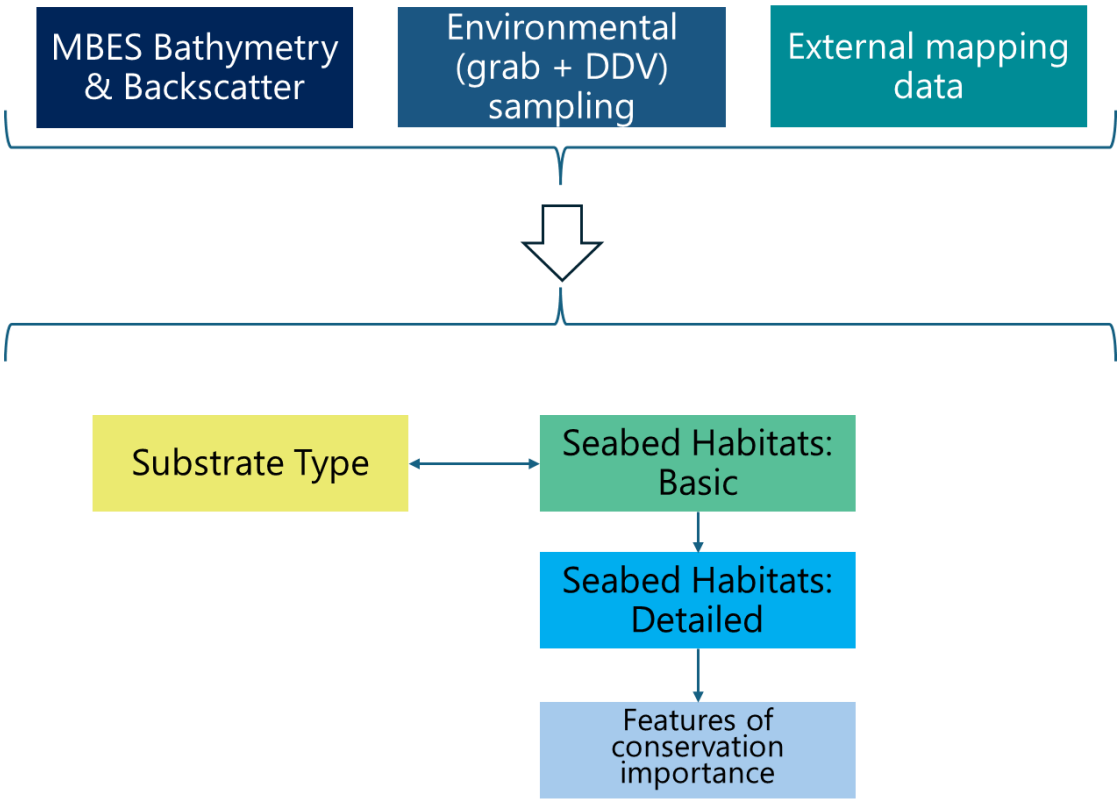
2.4.1.8 In the nearshore area, grab samples were successfully acquired at all proposed stations. In the offshore area, grab samples were successfully acquired at 75 of the 79 proposed stations. Grab samples were not acquired at four stations due to the coarse nature of the seafloor sediment.

2.4.1.9 The results of the geophysical interpretation, the photographic data analysis and the grab samples were reviewed in conjunction with the physical and biological characteristics. The infauna identified from grab samples were subsequently analysed with multivariate analyses to provide a comprehensive assessment of the infauna present. The average similarity of the multivariate groups derived from the grab data analysis ranged from 42.8% to 52.4%. The communities were therefore deemed to be representative of the stations within each multivariate group. Results were used to inform the detailed seabed habitat characterisation.

2.4.1.10 Where survey data were not available along the offshore export corridor, EUSeaMap predicted habitat distributions and OSPAR threatened and / or declining habitat data were used to extrapolate the interpreted habitat classifications for the full extent of the Red Line Boundary.

2.4.1.11 Following production of the detailed habitat maps, grab data and photography were reviewed to establish the presence and extent of any features of conservation importance including both habitats and species within the offshore export cable corridor and the OAA (detailed in **Section 2.4.3**).

Plate 2.1. Seabed mapping stages



2.4.2 Habitat classification

2.4.2.1 Marine habitats were mapped using the JNCC Marine Nature Conservation Review, (Parry *et al*., 2015), which provides improved classification of deep-sea habitats. These were then cross-referenced with habitats from the EUNIS habitat types classification.

2.4.2.2 The two classification systems are based on the same hierarchical analysis. Initially, abiotic habitats are defined from basic descriptions (high level classifications) such as littoral rock. Biological communities are then linked to these (at lower levels) to produce a biotope classification (Connor *et al.,* 2004; EUNIS, 2019).

2.4.2.3 Up to six levels are defined but Levels 4 to 6 involve the biology and accordingly the MBES survey can be used to map to Level 3 only.

2.4.2.4 Habitat descriptions have been interpretated from information on seabed sediment types and faunal communities from seabed photography and grab sampling, and the predicted seabed habitat map produced, to the lowest possible level. EMODnet was utilised in the habitat investigation across the offshore export corridor where survey data did not cover the full extent of the study area.

2.4.3 Features of conservation interest

2.4.3.1 Grab data and seabed video data were reviewed to establish the presence and extent of any features of conservation importance, including both habitats and species within the offshore export cable corridor and the OAA.

2.4.3.2 Habitats and biotopes identified during the habitat classification were subsequently assessed for their ecological and conservation importance using the JNCC correlation spreadsheet, which allows users to translate between the EUNIS marine classification, the Marine Habitat Classification for Britain and Ireland, and other marine habitats listed for conservation importance under current conservation legislation (JNCC, 2018). For example, to identify where assigned biotopes were listed as components of PMF features or as listed on the Annex I habitats list (JNCC, 2019a).

2.4.3.1 Species were assessed for their conservation status using the Annex II species list (JNCC, 2019b), the UK BAP list of priority species (JNCC, 2019c) and the OSPAR list of threatened and / or declining species and habitats (OSPAR Commission, 2008).

2.4.3.2 Epifaunal and mobile faunal species were identified following the review of the seabed photographic / video data and infaunal species identified from grab sample data.

2.4.4 Anthropogenic features

2.4.4.1 Backscatter and bathymetry data were used to identify anthropogenic features, including cables and pipelines, wrecks, trawl marks, sea defence structures and other artificial features visible in the bathymetry. The results are summarised in the Geophysical Benthic Interpretive Reports (Fugro, 2024a; 2024b) for the offshore export cable corridor and OAA, respectively.

2.4.4.2 An analysis of the presence of anthropogenic features was undertaken as part of the geophysical benthic interpretation and as such was outside the scope of this Report.

2.4.5 Confidence

2.4.5.1 Confidence in the quality and reliability of the mapped habitats was assessed using the JNCC 'three-step confidence assessment framework for classified seabed maps' (JNCC, 2016). It is termed a "framework" because of its ability to be adapted to the user's needs; this includes applying it to a whole study, a single class within a study or individual polygons.

2.4.5.2 The JNCC framework provides a simple and adaptable framework for carrying out a qualitative confidence assessment for classified seabed maps, which is based around three criteria:

- Remote sensing coverage: required for accurately delineating class boundaries, techniques include multi-beam or single beam echo sounder and side-scan sonar, among others.
- Distinctness of class boundaries: this is a feature of the data and the particular habitats it surveyed, which are considered to have a large influence on the quality of the final map.
- Amount of sampling / availability of ground-truthing data: this is often the most important factor in accurately assigning the habitat type to each class. Sampling techniques include grab sampling, photos, videos, shore survey and diver observation, among others.

2.4.5.3 The confidence assessment framework is represented by a simple three-step decision tree, in which the second and third steps depend on the answers to the previous questions, and the final score is a sum of the points awarded for each criterion (**Plate 2.2, Table 2.1**). The final score ranges between 0 and 4 with 4 representing the 'best' quality of mapped output / polygon.

2.4.5.4 Habitat polygons with equal scores are assumed to have roughly similar levels of confidence, regardless of the route through the decision tree.

2.4.5.5 The JNCC framework was used as it is a confidence assessment system that produces a qualitative score indicating the likelihood of a particular habitat being correctly mapped within a study area. It also provides the end-user with a method to determine the adequacy of the map for decision making. This is in contrast to the Mapping European Seabed Habitats (MESH) confidence assessment (MESH Project, 2008), which delivers a confidence score that indicates the quality of the process used to make a biotope map and explains the relative reliability of different maps. However, because it refers to the mapping process as a whole, it does not give an indication of the probability (or likelihood) of a seabed class (for example, biotope / habitat / substrate type) in a map being present at a particular location.

Plate 2.2.Three-step decision tree for assigning confidence to the assessed habitat

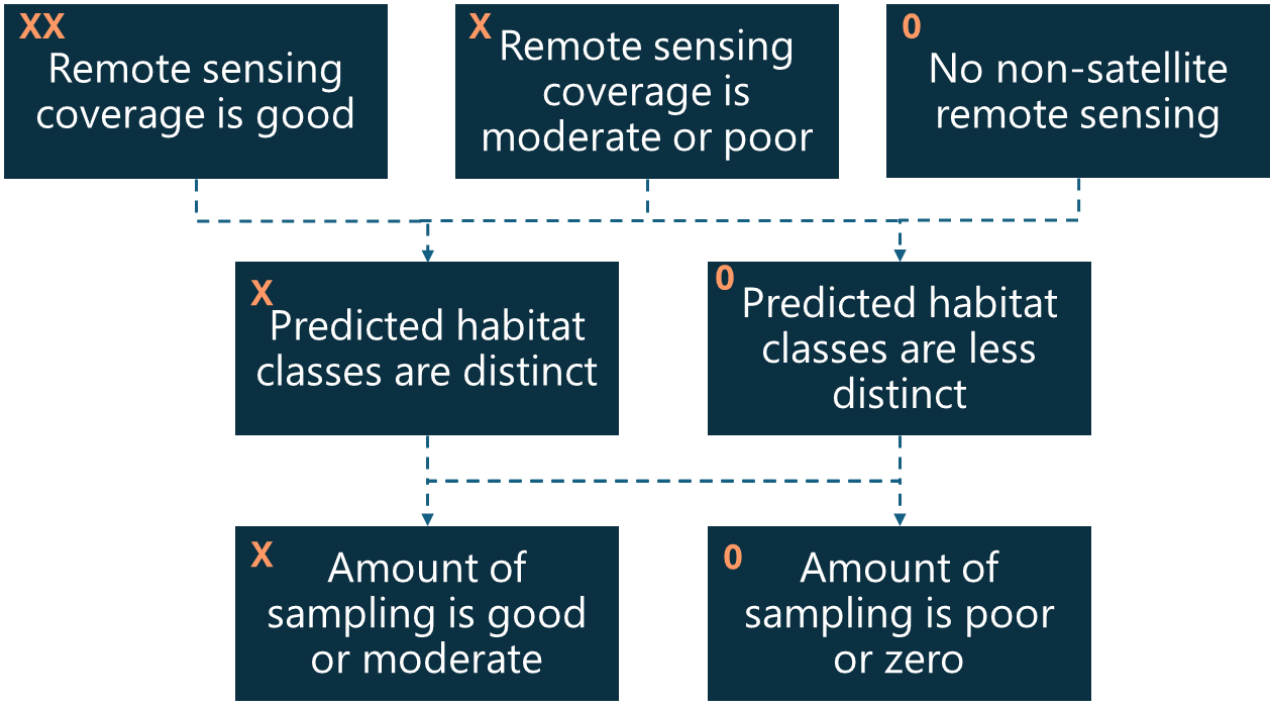


Table 2.1 Three-step confidence assessment score: possible score combinations

Remote sensing coverage	Distinctness of class boundaries	Amount of sampling	Total score
XX	X	X	High – 4
XX	X		Medium –3
XX		X	Medium –3
X	X	X	Medium –3
XX			Medium – 2
X	X		Medium – 2
X		X	Medium – 2
	x	x	Medium – 2
X			Low – 1
	X		Low – 1
		X	Low – 1
			Very low – 0

3. Results and Interpretation

3.1.1.1 The benthic characterisation is based upon the available survey data and incorporates the results from the environmental grab samples, the seabed photography / videography, geophysical data and regional geological information (EMODnet). The data were used to produce maps of substrate type and seabed habitats. The resultant maps for the offshore export cable corridor and the OAA are provided in **Figure 1** to **Figure 8**. Descriptions of the identified habitats are provided in **Section 3.2** below. The biotopes assigned are relevant to the time of sampling, with the contributing surveys completed in December 2023.

3.1.1.2 Seafloor morphology and features within the offshore export cable corridor and the OAA are presented in the Seafloor Sediments, Morphology and Features panels of the Alignment Charts in the Geophysical Benthic Interpretive Reports (Fugro, 2024a; 2024b).

3.1.1.3 Following the habitat classification, the presence of habitats and species of conservation interest were reviewed to identify the presence of PMF features, Annex I / Annex II habitats and species, and OSPAR threatened and / or declining habitats and species within the offshore export cable corridor and the OAA. The findings are described in **Section 3.3**.

3.2 Habitat classification

3.2.1 The offshore export cable corridor

3.2.1.1 Broadly, the seafloor observed across the survey area comprised a variety of sediment types, including muddy sand grading to sandy gravel with shell fragments, pebbles, cobbles and boulders noted in varying proportions. Within some of the coarser sediment areas, the general appearance of the pebbles, cobbles and boulders suggested sediment consolidation and occasionally formed visibly raised and fragmented sections. Patches of boulder and bedrock outcrops were also observed in nearshore areas.

3.2.1.2 The results of the benthic characterisation indicate the presences of 15 biotopes and seven biotope mosaics. The mosaics represent a parallel assignment of two biotopes to the relevant areas to accurately reflect the communities observed.

3.2.1.3 The following biotopes were identified:

- **High energy infralittoral rock (IR.HIR):** Rocky habitat in the infralittoral zone subject to exposed wave action or strong tidal streams. This biotope was only present at one location to the south of the Red Line Boundary at Lunderton beach.
- **High energy circalittoral rock (CR.HCR):** Wave-exposed circalittoral bedrock and boulders were present at numerous locations within the Red Line Boundary in the shallow circalittoral area, near the shore.
- **Mixed faunal turf communities (CR.HCR.XFa)** and the mosaics **Mixed faunal turf communities / *Sabellaria spinulosa* encrusted circalittoral rock (CR.HCR.XFa / CR.MCR.CSab.Sspi)** and **Mixed faunal turf communities / Circalittoral coarse sediment (CR.HCR.XFa / SS.SCS.CCS**): These biotopes occurred on wave-exposed circalittoral bedrock and boulders as part of a shoreward habitat patchwork present within the Red Line Boundary in the shallow circalittoral. The biotope is typically characterised by its diverse range of hydroids, bryozoans and sponges forming an often dense, mixed faunal turf. It was present in one location as a mosaic alongside CR.MCR.CSab.Sspi, with possible biogenic *Sabellaria spinulosa* reef present.

- ***Sabellaria spinulosa* encrusted circalittoral rock (CR.MCR.CSab.Sspi):** The biotope consisted of crusts formed by the sandy tubes of the polychaete worm *S. spinulosa*. This biotope was detected in a single patch within the shoreward patchwork of circalittoral bedrock, boulders and cobbles in the shallow circalittoral area of the offshore export cable corridor.
- **Echinoderms and crustose communities (CR.MCR.EcCr):** This biotope was observed in numerous small patches on wave-exposed, moderately tide-swept, circalittoral bedrock and boulders. It was typically dominated by echinoderms, faunal and algal crusts (red encrusting algae) and formed part of the shoreward habitat patchwork present within the Red Line Boundary.
- ***Sabellaria spinulosa* on stable circalittoral mixed sediment (SS.SBR.PoR.SspiMx)** and mosaic ***Sabellaria spinulosa* on stable circalittoral mixed sediment / Offshore circalittoral sand (SS.SBR.PoR.SspiMx / SS.SSa.OSa):** The tube-building polychaete *S. spinulosa* occurred as loose clusters of tubes forming a low-lying matrix of sand, gravel, mud and tubes on the seabed. It was present in isolated patches (determined by video transects) within other habitats such as SS.SCS.CCS.MedLumVen and as a large band in mosaic with SS.SSa.OSa within the central portion of the offshore export cable corridor approximately 40 kilometres (km) from the shore.
- **Circalittoral coarse sediment (SS.SCS.CCS):** Tide-swept circalittoral coarse sands, gravel and shingle. This habitat was located close to the shore, towards the shoreward end of the Red Line Boundary forming a patchwork with other sublittoral sediments.
- ***Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel (SS.SCS.CCS.Blan)**: This biotope was identified in areas of gravel and coarse sand with shell gravel supporting a significant population of *Branchiostoma lanceolatum*. It occurred in a single isolated patch within the offshore export cable corridor, nestled within the mosaic of SS.SCS.CCS.MedLumVen / SS.SCS.CCS found towards the shoreward extent of the Red Line Boundary.
- ***Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in circalittoral coarse sand or gravel (SS.SCS.CCS.MedLumVen)** and the mosaic ***Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in circalittoral coarse sand or gravel / Circalittoral coarse sediment (SS.SCS.CCS.MedLumVen / SS.SCS.CCS):** Characterised from grab samples by the presence of polychaetes such as *Mediomastus fragilis, Lumbrineris spp., Glycera lapidum* and the pea urchin *Echinocyamus pusillus* and occurring in areas of circalittoral gravels and coarse to medium sands. The biotope occurred both in isolation as well as forming a mosaic with SS.SCS.CCS within the offshore export cable corridor where it approaches the shore. It also formed a patchwork with other habitats, such as SS.SMx.OMx, within the middle (east to west) of the corridor.
- ***Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri):** Identified in areas of circalittoral and offshore medium to fine sand characterised by the pea urchin *E. pusillus*, the polychaete *Ophelia borealis* and the bivalve *Abra prismatic.* This biotope was present as a single continuous extent within the offshore export cable corridor, approximately 23km to 36km offshore.
- **Sea pens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg)** and mosaic **Sea pens and burrowing megafauna in circalittoral fine mud / *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SMu.CFiMu.SpnMeg / SS.SSa.CFiSa.EpusOborApri):** These biotopes were characterised by extensive areas of muddy sand heavily bioturbated by burrowing megafauna and conspicuous

populations of sea pens, including *Virgularia mirabilis* and *Pennatula phosphorea*. The burrowing crustacea present typically included Norway lobster *Nephrops norvegicus*. Seapens were also recorded as a mosaic alongside SS.SSa.CFiSa.EpusOborApri along the offshore extreme of the offshore export cable corridor. SS.SMu.CFiMu.SpnMeg was extrapolated from the mosaic outside of the survey corridor extent.

- **Offshore circalittoral mixed sediment (SS.SMx.OMx):** This biotope was identified offshore in slightly muddy mixed gravelly sand and stones or shell. Communities in this habitat were closely related to offshore gravels and coarse sands. This biotope was present within the middle section of the offshore export cable corridor.
- **Sublittoral sands and muddy sands (SS.SSa):** Identified in medium to fine sands characterised by a range of taxa including polychaetes, bivalve molluscs and amphipod crustacea. This biotope was present within the Red Line Boundary close to the shore.
- **Offshore circalittoral coarse sediment (SS.SCS.OCS)** and mosaic **Offshore circalittoral sand / Offshore circalittoral coarse sediment (SS.SSa.Osa / SS.SCS.OCS):** Extensive areas of coarse sands and gravel or shell were present along the offshore export cable corridor. Communities in this habitat are closely related to offshore mixed sediments and generally characterised by robust infaunal polychaete and bivalve species. This biotope was extrapolated from the survey corridor extent and was identified in two distinct areas within the Red Line Boundary. One area, shoreward occupying a significant area within the Red Line Boundary, the other directly adjacent to the SS.SMx.OMx habitat. The mosaic with SS.SCS.OCS was observed within the middle section of the offshore export cable corridor.
- **Offshore circalittoral sand (SS.SSa.OSa):** This biotope was present in the offshore (deep) circalittoral habitat with fine sands or non-cohesive muddy sands. The biotope presence was extrapolated from the corridor survey extent to the Red Line Boundary as insufficient ground truth (grab samples or video transects) were present. It is present in the central area of the offshore export corridor approximately 25km to 40km from the shore.
- **Circalittoral coarse sediment / High energy circalittoral rock (SS.SCS.CCS / CR.HCR):** This biotope matrix was identified in an area located shoreward with gravelly sand, numerous boulders and small patches of bedrock. Located between areas of Circalittoral coarse sediment and Mixed faunal turf communities.

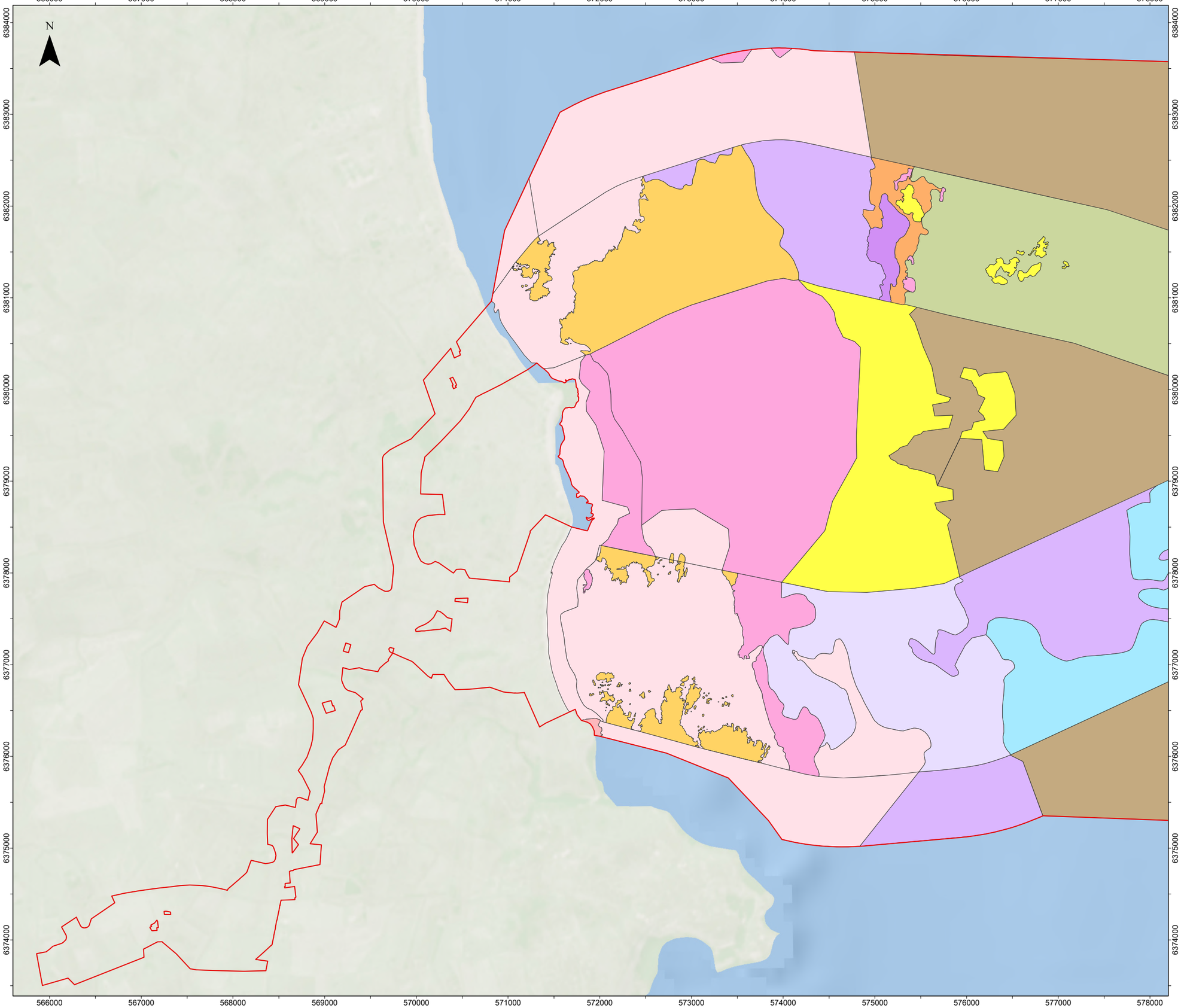
3.2.1.1 **Table 3.1** summarises the hierarchy of the assigned JNCC (2015) classifications (Parry *et al.,* 2015). **Figure 1** to **Figure 7** present the spatial distribution of biotopes across the offshore export cable corridor.

3.2.1.2 Confidence in the biotope assignment was variable along the offshore export cable corridor. Where geophysical and environmental ground truthing data were available along the central corridor, confidence (following the JNCC confidence assessment framework) was largely assigned as medium (3) or high (4). However, to the northern and southern boundaries of the export cable corridor no survey data were available. Therefore, biotope assignment was based on extrapolation of nearby identified biotopes and EUSeaMap predicted habitats distributions. In these areas confidence in the assessment is considered low (1).

Table 3.1 Offshore export cable corridor habitat classifications

JNCC (2015) Habitat Classification				
Environment Level 1	**Broad Habitat Level 2**	**Habitat Level 3**	**Biotope Complex Level 4**	**Biotopes and sub-biotopes Level 5 and 6**
Marine	SS Sublittoral sediment.	SS.SCS Sublittoral coarse sediment.	SS.SCS.CCS Circalittoral coarse sediment.	SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel.
				SS.SCS.CCS.Blan *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel.
			SS.SCS.OCS Offshore circalittoral coarse sediment.	
		SS.SMx Sublittoral mixed sediment.	SS.SMx.OMx Offshore circalittoral mixed sediment.	
		SS.SSa Sublittoral sands and muddy sands.	SS.SSa.OSa Offshore circalittoral sand.	
			SS.SSa.CFiSa Circalittoral fine sand.	SS.SSa.CFiSa.EpusOborApri *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.
		SS.SBR Sublittoral Biogenic Reefs on sediment.	SS.SBR.PoR Polychaete worm reefs (on sublittoral sediment).	SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment.

JNCC (2015) Habitat Classification				
Environment Level 1	**Broad Habitat Level 2**	**Habitat Level 3**	**Biotope Complex Level 4**	**Biotopes and sub-biotopes Level 5 and 6**
		SS.SMu Sublittoral cohesive mud and sandy mud communities.	SS.SMu.CFiMu Circalittoral fine mud.	SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud.
	CR Circalittoral rock.	CR.HCR High energy circalittoral rock.	CR.HCR.XFa Mixed faunal turf communities.	
		CR.MCR Moderate energy circalittoral rock.	CR.MCR.EcCr Echinoderms and crustose communities.	
			CR.MCR.CSab Circalittoral *Sabellaria* reefs (on rock).	CR.MCR.CSab.Sspi *Sabellaria spinulosa* encrusted circalittoral rock.
	IR Infralittoral rock.	IR.HIR High energy infralittoral rock.		

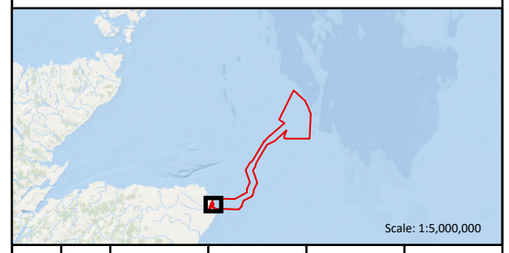


Red Line Boundary

Biotope

- Circalittoral coarse sediment
- Circalittoral coarse sediment/High energy circalittoral rock
- Echinoderms and crustose communities
- High energy circalittoral rock
- High energy infralittoral rock
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel/Circalittoral coarse sediment
- Mixed faunal turf communities
- Mixed faunal turf communities/Sabellaria spinulosa encrusted circalittoral rock
- Mixed faunal turf communities/Circalittoral coarse sediment
- Offshore circalittoral coarse sediment
- Sublittoral sand and muddy sands

0 1 2 Kilometres



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PROJECTION	UTM Zone 30N
SCALE	1:40,000
PAGE SIZE	A3

PROJECT TITLE
MarramWind Offshore Wind Farm

DRAWING TITLE
Figure 1 Benthic characterisation habitat classification offshore export corridor landfall

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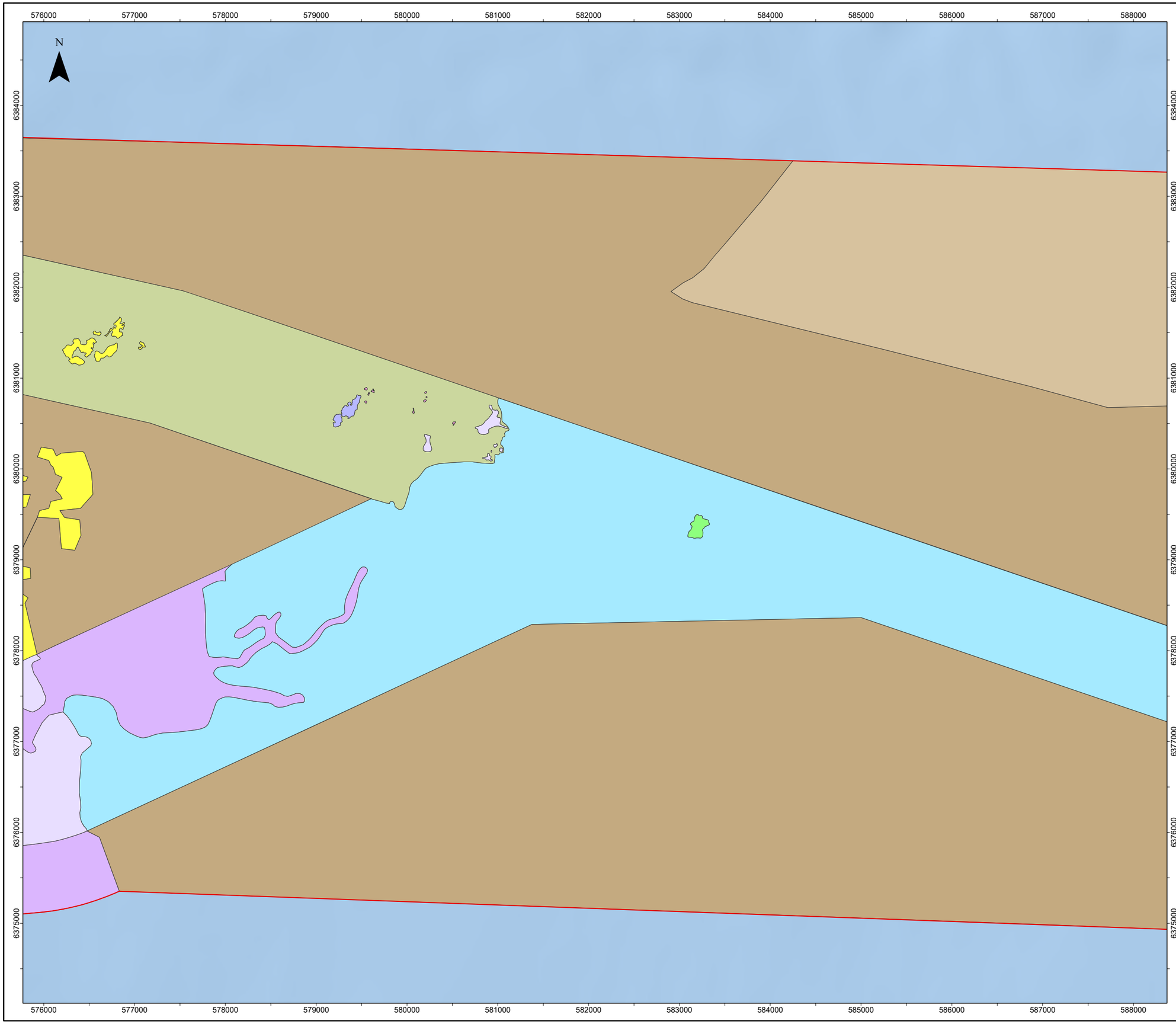
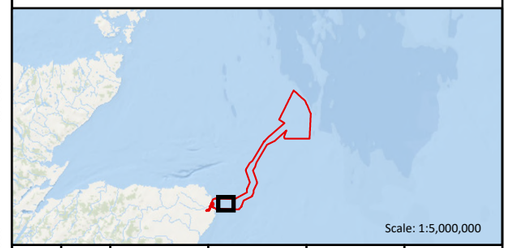


Red Line Boundary

Biotope

- Branchiostoma lanceolatum in circalittoral coarse sand with shell gravel
- Circalittoral coarse sediment
- High energy circalittoral rock
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel/Circalittoral coarse sediment
- Mixed faunal turf communities
- Mixed faunal turf communities/Circalittoral coarse sediment
- Offshore circalittoral coarse sediment
- Offshore circalittoral sand
- Sabellaria spinulosa encrusted circalittoral rock

0 1 2 Kilometres



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DATUM	ETRS 89	PROJECTION	UTM Zone 30N
SCALE	1:40,000	PAGE SIZE	A3

PROJECT TITLE
MarramWind Offshore Wind Farm

DRAWING TITLE
Figure 2 Benthic characterisation habitat classification offshore export corridor nearshore one

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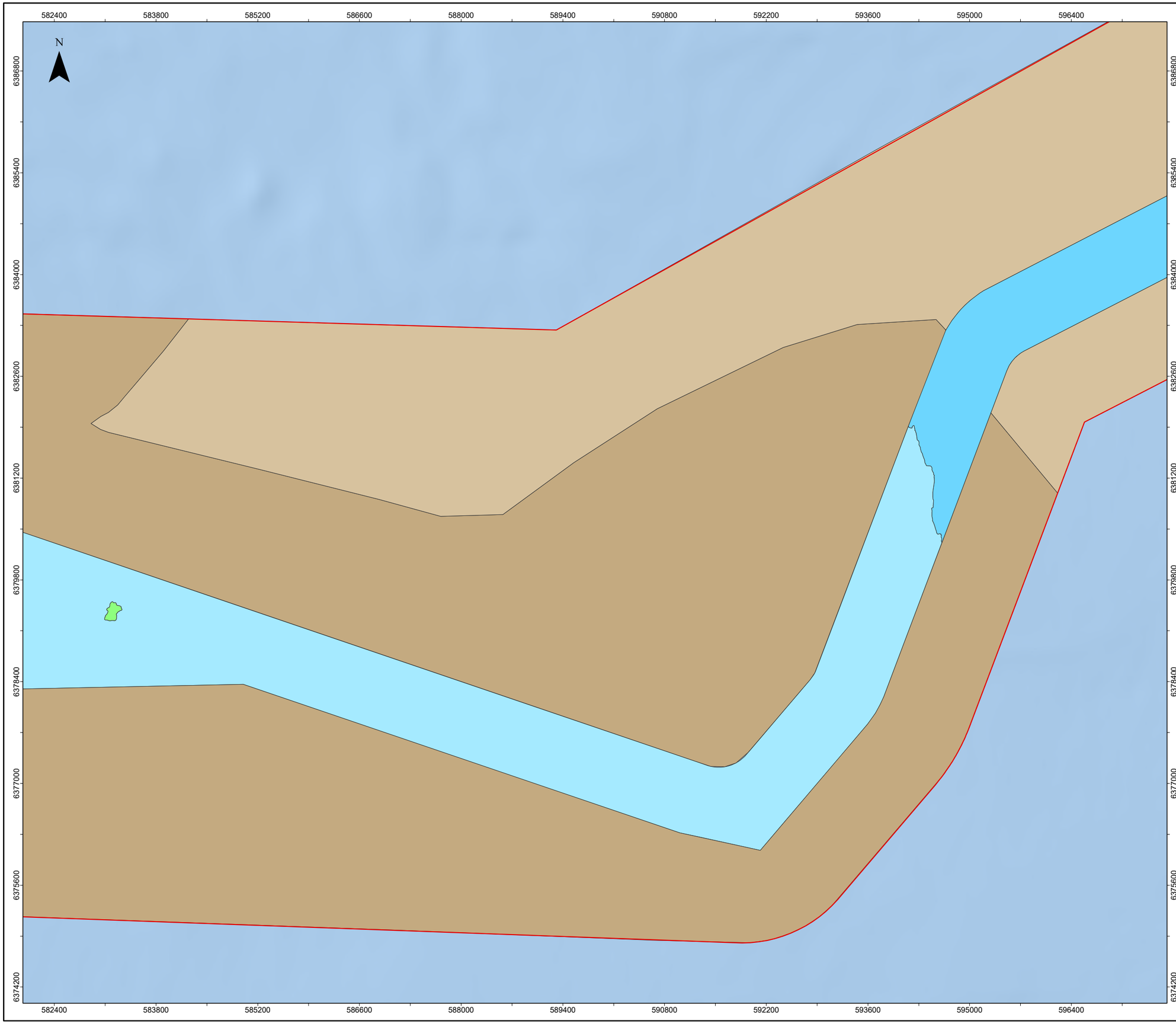
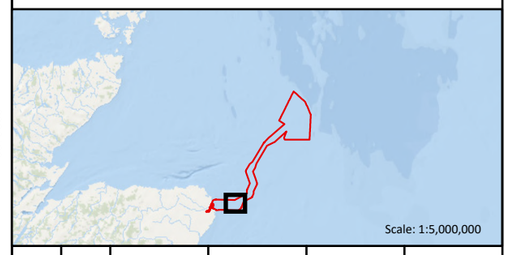


Red Line Boundary

Biotope

- Branchiostoma lanceolatum in circalittoral coarse sand with shell gravel
- Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
- Offshore circalittoral coarse sediment
- Offshore circalittoral sand

0 1 2 Kilometres



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PAGE SIZE	A3

PROJECT TITLE
MarramWind Offshore Wind Farm

DRAWING TITLE
Figure 3 Benthic characterisation habitat classification offshore export corridor nearshore two

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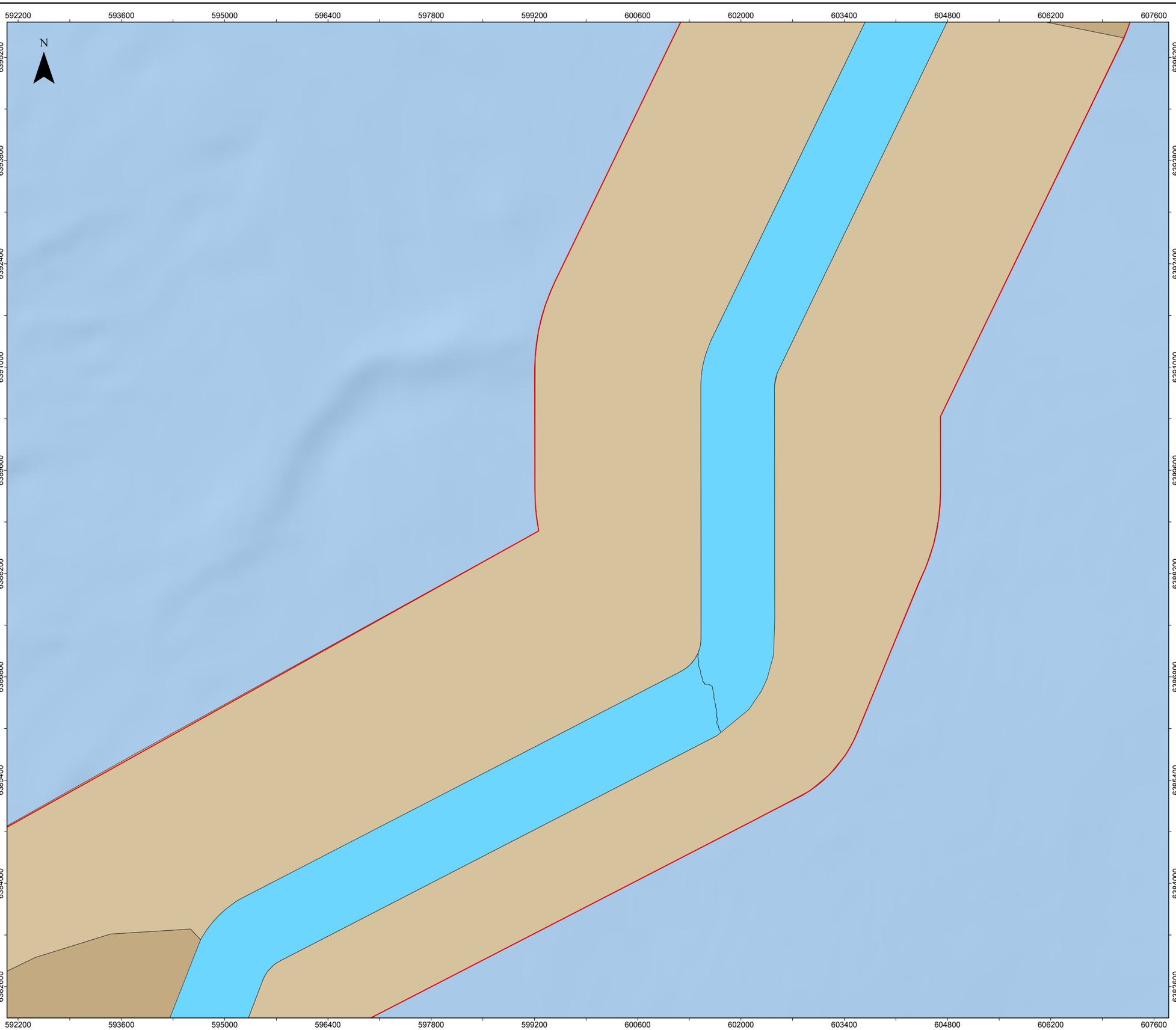
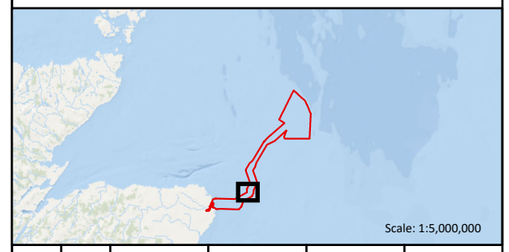


Red Line Boundary

Biotope

- Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
- Offshore circalittoral coarse sediment
- Offshore circalittoral sand

0 1 2 Kilometres



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PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 4 Benthic characterisation habitat classification offshore export corridor mid corridor one

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596400 597800 599200 600600 602000 603400 604800 606200 607600 609000 610400

6407800 6406400 6405000 6403600 6402200 6400800 6399400 6398000 6396600

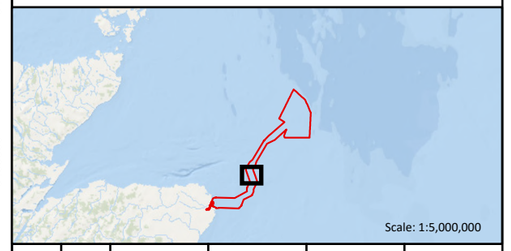
N

Red Line Boundary

Biotope

- Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
- Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
- Offshore circalittoral coarse sediment
- Offshore circalittoral mixed sediment
- Offshore circalittoral sand
- Offshore circalittoral sand/Offshore circalittoral coarse sediment
- Sabellaria spinulosa on stable circalittoral mixed sediment
- Sabellaria spinulosa on stable circalittoral mixed sediment/Offshore circalittoral sand
- Sea pens and burrowing megafauna in circalittoral fine mud
- Sea pens and burrowing megafauna in circalittoral fine mud/Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand

0 1 2 Kilometres



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DATUM	ETRS 89	PROJECTION	UTM Zone 30N
SCALE	1:50,000	PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 5 Benthic characterisation habitat classification offshore export corridor mid corridor two

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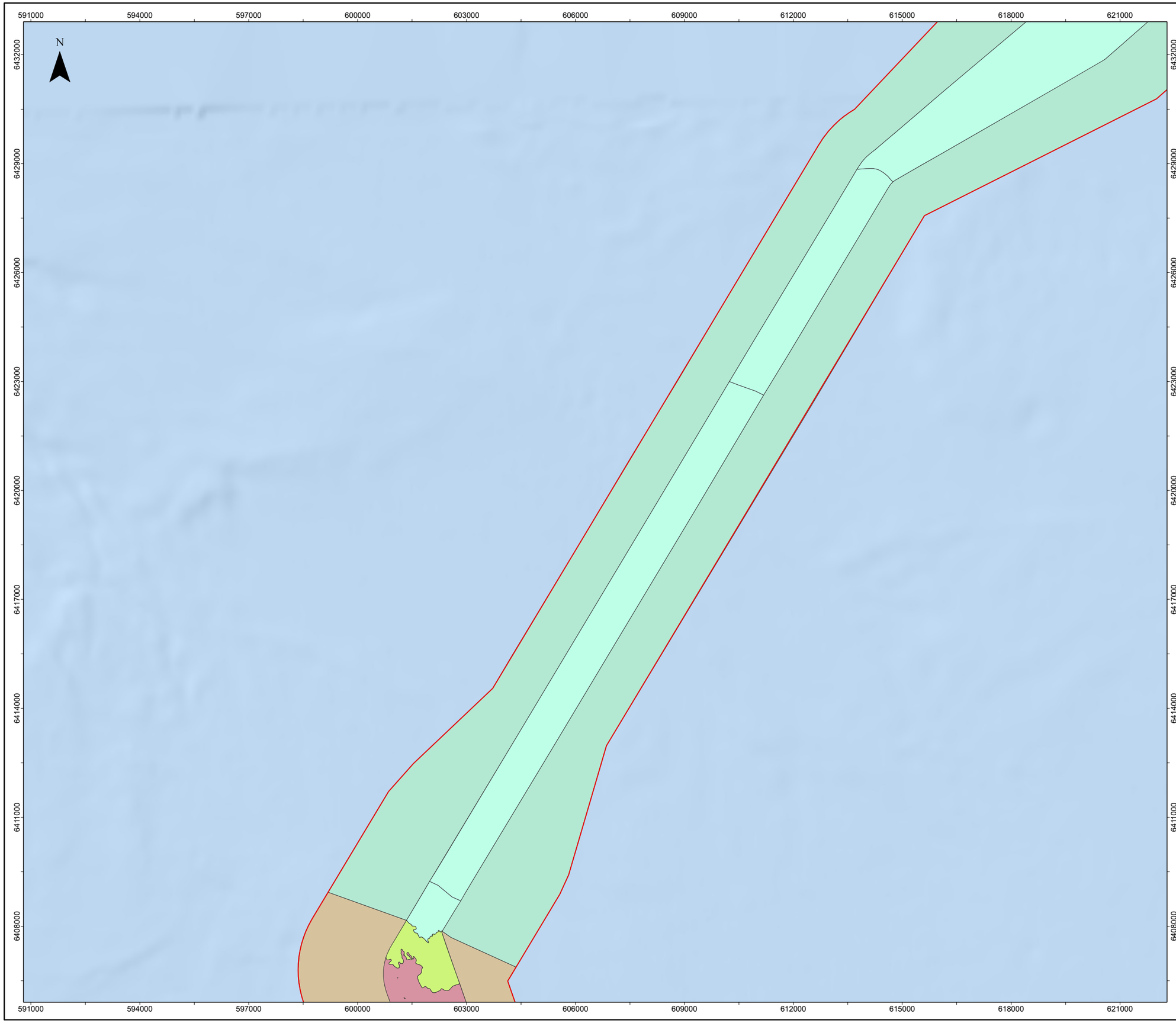
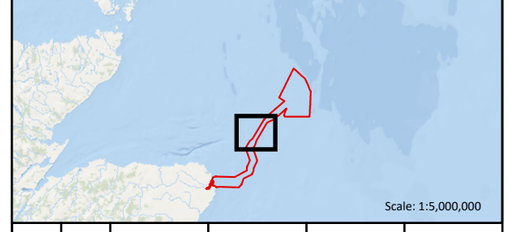


Red Line Boundary

Biotope

- Offshore circalittoral sand
- Offshore circalittoral sand/Offshore circalittoral coarse sediment
- Sabellaria spinulosa on stable circalittoral mixed sediment
- Sabellaria spinulosa on stable circalittoral mixed sediment/Offshore circalittoral sand
- Sea pens and burrowing megafauna in circalittoral fine mud
- Sea pens and burrowing megafauna in circalittoral fine mud/Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand

0 2 4 Kilometres



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PROJECT TITLE

MarramWind Offshore Wind Farm

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Figure 6 Benthic characterisation habitat classification offshore export corridor offshore corridor one

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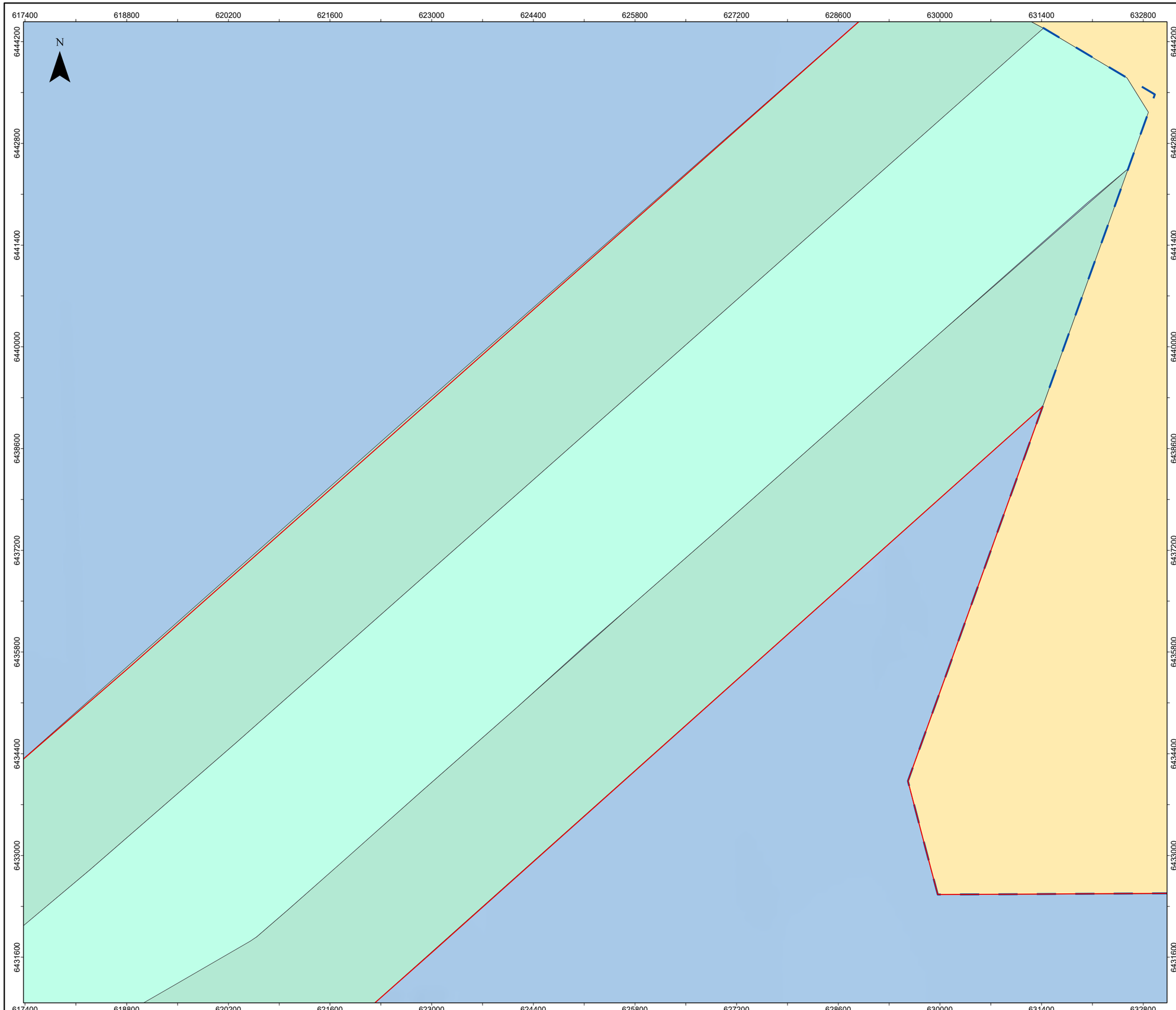


Red Line Boundary

Option Agreement Area

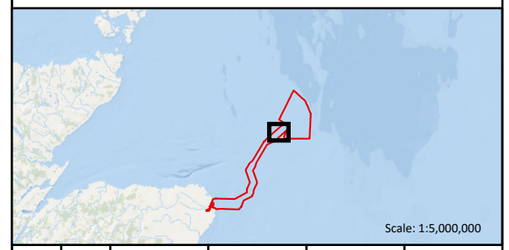
Biotope

Sea pens and burrowing megafauna in circalittoral fine mud

Sea pens and burrowing megafauna in circalittoral fine mud/Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand

Sea pens and burrowing megafauna in circalittoral fine mud/Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud

0 1 2 Kilometres



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SCALE	1:50,000	PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

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Figure 7 Benthic characterisation habitat classification offshore export corridor offshore corridor two

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3.2.2 The OAA

3.2.2.1 From photographic data, the seafloor observed across the OAA was largely homogeneous. The main sediment type observed was muddy sand, with varying proportions of shell fragments. Small areas of mixed sediment were interspersed throughout the survey area, generally in conjunction with numerous depressions. Sediments recorded from grab samples were silty fine to medium sand and silt (in varying proportions) with shell fragments and areas of gravels, cobbles and boulders, largely associated with the depressions.

3.2.2.2 The results of the benthic characterisation for the OAA identified the presences of two biotopes and one biotope mosaic.

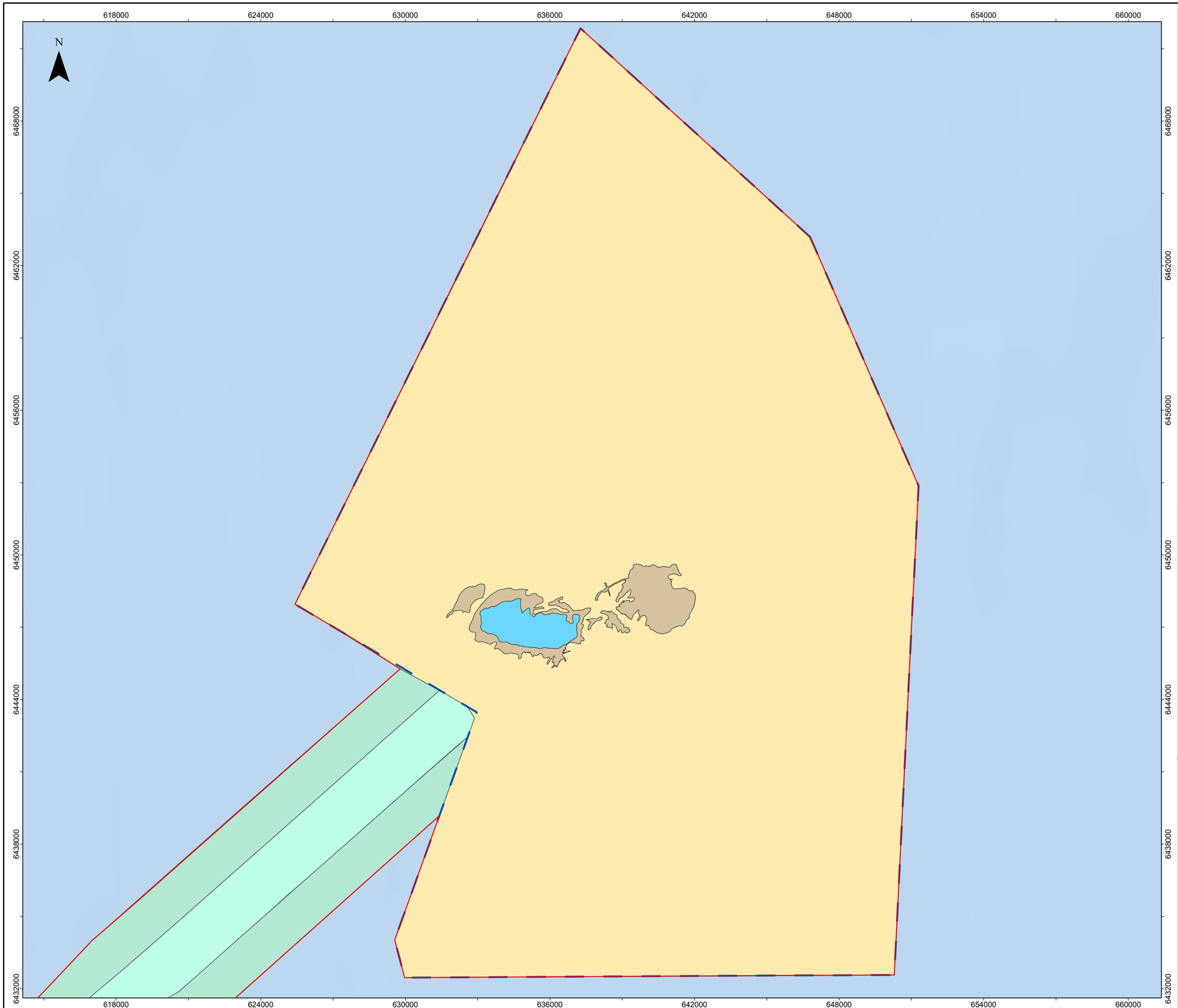
3.2.2.3 The following habitats and biotopes were identified:

- **Sea pens and burrowing megafauna in circalittoral fine mud / *Paramphinome jeffreysii, Thyasira spp.* and *Amphiura filiformis* in offshore circalittoral sandy mud (SS.SMu.CFiMu.SpnMeg / SS.SMu.OMu.PjefThyAfili):** Sea pens (as a mosaic with SS.SMu.OMu.PjefThyAfil) comprised the community observed across the majority of the OAA. Muddy sand with numerous burrows and mounds constructed by burrowing megafauna, including *N. norvegicus,* and conspicuous populations of the sea pens *P. phosphorea* and *V. mirabilis* were present. The infaunal community was characterised by the polychaete *Paramphinome jeffreysii* which was ubiquitous within the grab samples; both the bivalve *Thyasira felxuosa* and the brittle star *Amphiura filiformis* were also recorded frequently.
- **Offshore circalittoral sand (SS.SSa.OSa**): This habitat was present in two areas of slightly raised sediment (~88m deep at the shallowest point, in comparison to surrounding area which is approximately 92m deep) within the OAA. It represents a transition between the muddier sands present at the lower depths and the cleaner sands that occurred at the top of the low gradient mounds.
- ***Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri):** This biotope consisted of areas in circalittoral medium to fine sands characterised by the pea urchin *E. pusillus,* the polychaete *O. borealis* and the bivalve *A. prismatica*. The only location of the habitat was upon the apex of the western mount, the highest point of seabed in the OAA. The sediment at the apex of the mount had a lower proportion of mud and silt than the surrounding areas within the OAA.

3.2.2.4 **Table 3.2** summarises the hierarchy of the assigned JNCC (2015) classifications (Parry *et al.,* 2015). **Figure 8** spatially presents the distribution of biotopes across the OAA extrapolated from geophysical seafloor features, PSD results, macrofaunal data and camera / epifaunal data.

Table 3.2 OAA habitat classifications

JNCC (2015) Habitat Classification				
Environment Level 1	**Broad Habitat Level 2**	**Habitat Level 3**	**Biotope Complex Level 4**	**Biotopes and sub-biotopes Level 5 and 6**
Marine	SS Sublittoral sediment.	SS.SSa Sublittoral sands and muddy sands.	SS.SSa.OSa Offshore circalittoral sand.	
			SS.SSa.CFiSa Circalittoral fine sand.	SS.SSa.CFiSa.EpusOborApri *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.
		SS.SMu Sublittoral cohesive mud and sandy mud communities.	SS.SMu.CFiMu / SS.SMu.Omu Circalittoral fine mud / Offshore circalittoral mud.	SS.SMu.CFiMu.SpnMeg / SS.SMu.OMu.PjefThyAfil Seapens and burrowing megafauna in circalittoral fine mud / *Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral sandy mud.



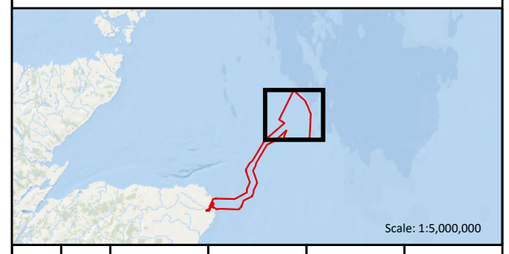
Red Line Boundary

Option Agreement Area

Biotope

- Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
- Offshore circalittoral sand
- Sea pens and burrowing megafauna in circalittoral fine mud
- Sea pens and burrowing megafauna in circalittoral fine mud/Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
- Sea pens and burrowing megafauna in circalittoral fine mud/Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud

0 4 8 Kilometres



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PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 8 Benthic characterisation habitat classification OAA

Environmental Impact Assessment Report
Appendix 10.1

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3.3 Features of conservation interest

3.3.1 The offshore export cable corridor

3.3.1.1 The habitats and species of conservation interest identified along the offshore export corridor are shown in **Figure 9** to **Figure 15**.

3.3.1.2 The presence of areas of pebbles, cobbles and boulders guided the selection for assessing the presence of the Annex I habitat 'Reef' (geogenic). Most categories of 'Stony Reef' were recorded, including 'no reef', 'not a reef', 'low reef' and 'medium reef'. No areas with 'high reef' potential were identified across the assessed areas. All areas of stony reef were located towards the shoreward extreme of the offshore export cable corridor. Possible areas of stony reef were also identified, these areas were within the same vicinity and same habitat classifications as the identified stony reef. However, survey data were not available to confirm presence / absence.

3.3.1.3 The allocation of the biotopes '*Sabellaria spinulosa* on stable circalittoral mixed sediment' (SS.SBR.PoR.SspiMx) and '*Sabellaria spinulosa* encrusted circalittoral rock' (CR.MCR.CSab.Sspi), at ten locations resulted in the assessment for the presence of the Annex I habitat 'Reef' (biogenic). The category 'low reef' was allocated to nine locations located approximately in the middle of the offshore export cable corridor. A single isolated patch of potential biogenic reef was identified towards the shoreward extreme. No areas of 'high reef' were identified. One area of possible biogenic reef was also identified within the nearshore area of the offshore export cable corridor. However, survey data were not available to confirm presence / absence.

3.3.1.4 The biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg) was observed throughout the offshore section of the offshore export cable corridor. This resulted in the presence of the OSPAR-listed threatened and/or declining habitat 'Sea pens and burrowing megafauna communities' being identified throughout the offshore section of the offshore export cable corridor. This was assigned due to observations of the sea pens *P. phosphorea* and occasional *Virgularia sp.,* along with faunal burrows, including the characteristic burrows of the *N. norvegicus*. Abundances of each species met the minimum criteria for the assignment of the potential sensitive habitat throughout the offshore section of the cable corridor.

3.3.1.5 Although present, the biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' was largely recorded within sandy / muddy sand sediments. Therefore, PMF broad habitat 'Burrowed mud' and the BAP habitat 'Mud Habitats in Deep Water' are less likely to occur within the survey area. However, using the precautionary principle 'Potential Burrowed Mud' has been mapped.

3.3.1.6 The presence of the habitat types 'Sublittoral sands and muddy sands' (SS.SSa), 'Circalittoral coarse sediment' (SS.SCS.CCS), 'Offshore circalittoral coarse sediment' (SS.SCS.OCS) and 'Offshore circalittoral sand' (SS.SSa.OSa) indicates the occurrence of the PMF broad habitats 'Subtidal sands and gravels' and 'Offshore subtidal sands and gravels'. These broad PMF habitats are present across much of offshore export cable corridor. These habitats are amongst the most common habitats in the UK offshore marine environment.

3.3.1.7 The timid burrowing anemone (*Edwardsia timida*) was present within the surveyed area, which is listed by both the UK BAP as a priority species and is also included on the SBL.

3.3.1.1 The family Caryophylliidae comprising various stony corals, were observed at four of the video stations. They are not specifically listed as a protected group under international or national regulations, but specific species or habitats where they occur can be protected. For example, cup-coral fields, where Caryophylliidae are representative, are considered a

vulnerable marine ecosystem under the Regulation (EU) 2016/2336 (Deep-sea Access Regulation). In addition, the presence of the common cup coral *Caryophyllia smithii* at 14 video stations may indicate the presence of the PMF 'Northern Sea fan and sponge communities' and Annex I habitat 'Caryophyllia (Caryophyllia) smithii, sponges and crustose communities on wave-exposed circalittoral rock'.

3.3.1.2 Observations of edible sea urchin (*Echinus esculentus*) were recorded within the offshore export cable corridor, a species that is listed as 'near threatened' on the International Union for Conservation of Nature (IUCN) Red List.

3.3.1.3 Forty-one juvenile individuals of the ocean quahog *A. islandica*, an OSPAR threatened species, were recorded at 20 stations from grab sampling.

3.3.1.4 One adult and three juvenile individuals belonging to the family Ammodytidae were recorded by the grab sampling at four stations, indicating the possible presence of the sand eels *Ammodytes marinus* a UK BAP priority species, and *A. tobianus*, a PMF. Additionally, shoals of juvenile sand eels were seen in the video data at two stations.

3.3.1.5 Individuals belonging to the family Gadidae were observed in photographic data at 27 stations. This could indicate the potential presence of the Atlantic cod (*G. morhua*), an OSPAR declining species. However, the family Gadidae also includes other cod-like fish such as haddock, hake, and pollock, and the data could not confirm whether the individuals observed were Atlantic cod.

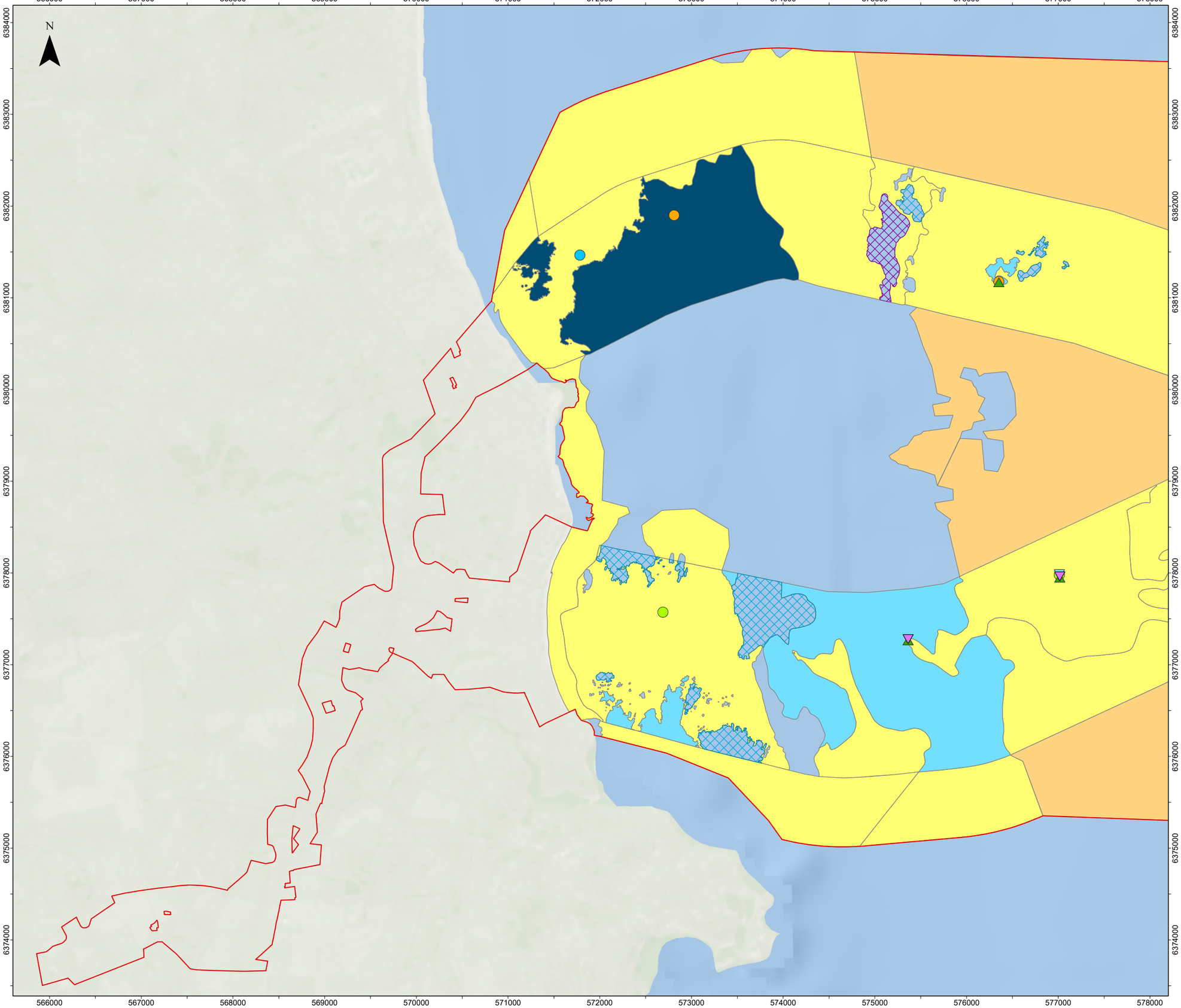
3.3.1.6 Other UK BAP species, PMF or OSPAR threatened and declining species recorded within the grab or video data included: haddock (*Melanogrammus aeglefinus*), and witch flounder (*Glyptocephalus cynoglossus*) classed as 'Vulnerable' on the IUCN Red List, and common ling (*Molva molva*), which is a UK BAP species.

3.3.1.7 Numerous skates and rays are classified as 'Near threatened' to 'Critically endangered'. Rays (Rajidae) were observed within the survey area, indicating the potential for the presence of SBL, OSPAR and IUCN Red List species such as Thornback ray (*Raja clavata*). However, identification to species level was not possible from the video data.

3.3.1.8 Other species including plaice (*Pleuronectes platessa*), whiting (*Merlangius merlangus*), herring (*Clupea harengus*), angler fish (*Lophius piscatorius*), mackerel (*Scomber scombrus*), saithe (*Pollachius virens*), Norway pout (*Trisopterus esmarkii*), brown trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*) were not recorded within the grab data or observed within the photographic data, but were recorded in Environmental DNA (eDNA) samples collected as part of the wider survey programme. The review of eDNA sampling was outside of the scope of the benthic characterisation but more details on the eDNA results are provided in the Geophysical Benthic Interpretive Report (Fugro, 2024a).

3.3.1.9 Except for saithe (*P. virens*) and the ocean quahog (*A. islandica*), these species are also listed in the SBL. Within European waters, all the fish species are 'Least Concern' IUCN species, with *A. tobianus* being assessed as 'Data Deficient'.

3.3.1.10 No other Annex I habitats or Annex II species, OSPAR threatened and / or declining species and habitats, or UK Priority Habitats and Species and SBL species and habitats were observed within grab or video data within the survey area.



Red Line Boundary

Annex I Reef

- Possible Biogenic reef
- Stony reef - medium reefiness
- Stony reef - low reefiness
- Possible Stony reef

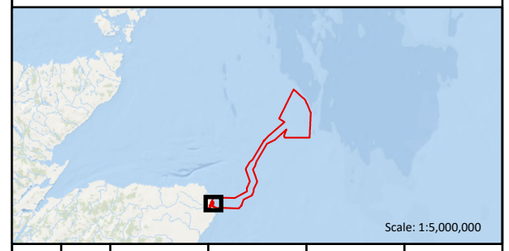
PMF

- Offshore subtidal sands and gravels
- Subtidal sands and gravels

Features of conservation interest

- *Gadidae*
- *Melanogrammus aeglefinus*
- *Ammodytidae: juvenile*
- *Echinus esculentus*
- *Edwardsiidae (possible Edwardsia timida)*
- *Arctica islandica*

0 1 2 Kilometres



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DATUM	ETRS 89
PROJECTION	UTM Zone 30N
SCALE	1:40,000
PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 9 Features of conservation interest offshore export corridor landfall

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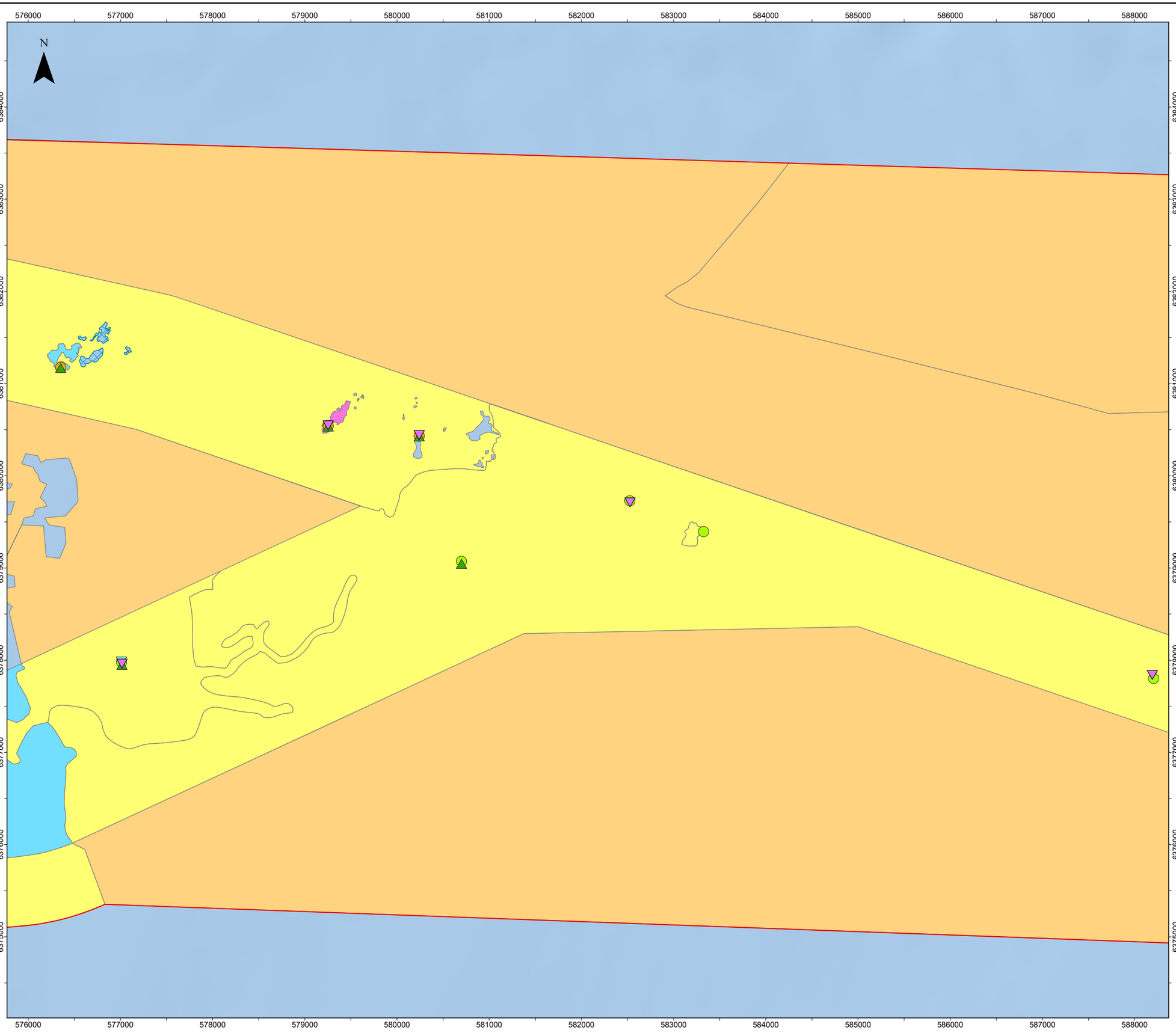


Red Line Boundary

Annex I Reef

- Bedrock reef - medium reefiness
- Stony reef - low reefiness
- Possible Stony reef

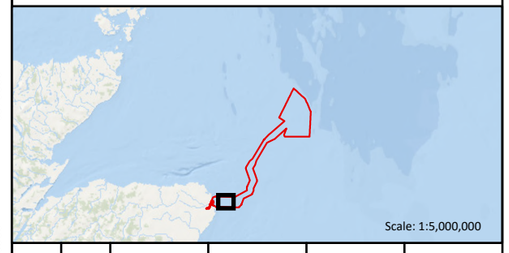
PMF

- Offshore subtidal sands and gravels
- Subtidal sands and gravels

Features of conservation interest

- *Gadidae*
- *Melanogrammus aeglefinus*
- *Ammodytidae: juvenile*
- *Echinus esculentus*
- *Edwardsiidae (possible Edwardsia timida)*

0 1 2 Kilometres



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DATUM	ETRS 89	PROJECTION	UTM Zone 30N
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PROJECT TITLE
MarramWind Offshore Wind Farm

DRAWING TITLE
Figure 10 Features of conservation interest offshore export corridor nearshore one

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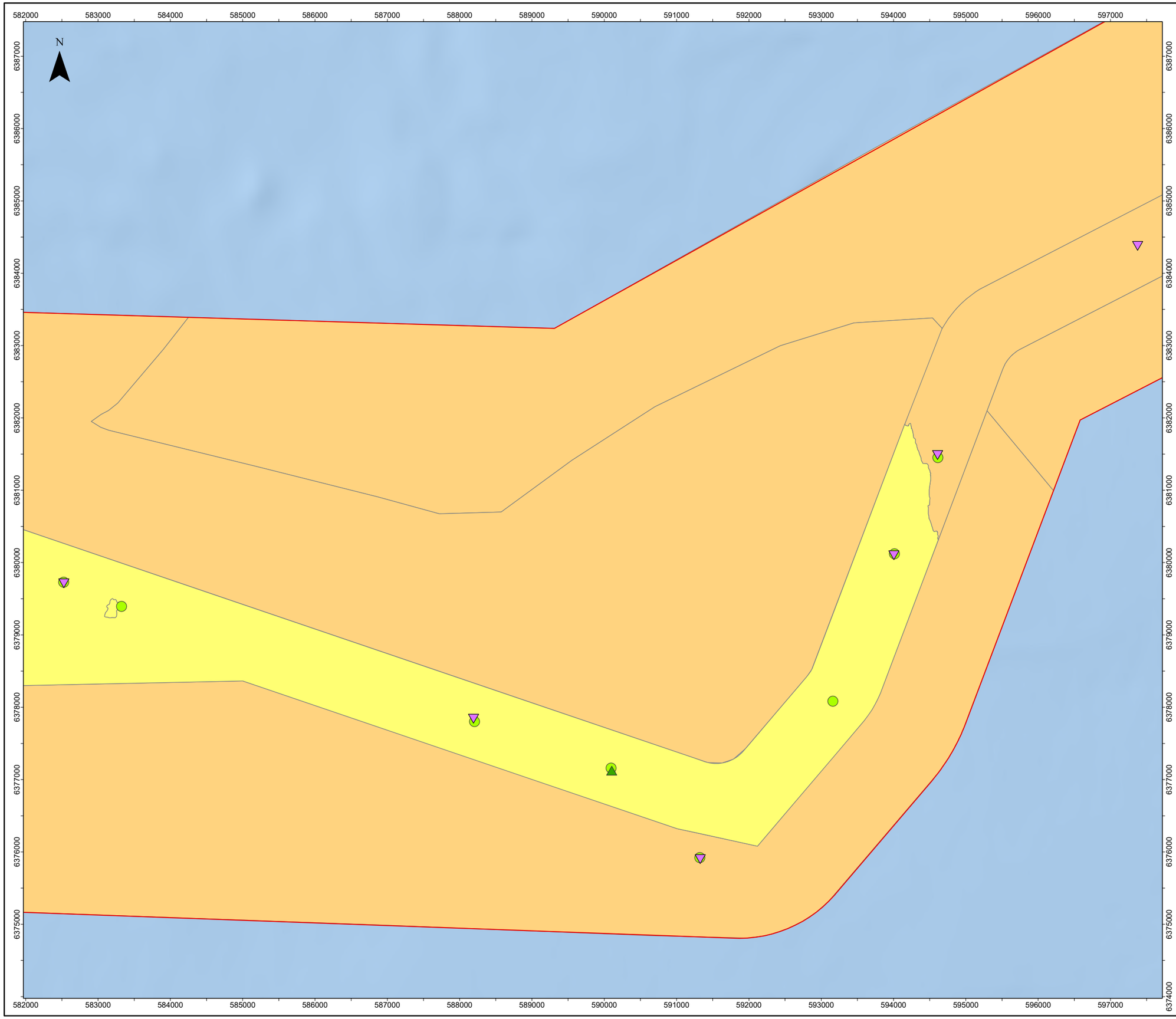


Red Line Boundary

PMF

Offshore subtidal sands and gravels

Subtidal sands and gravels

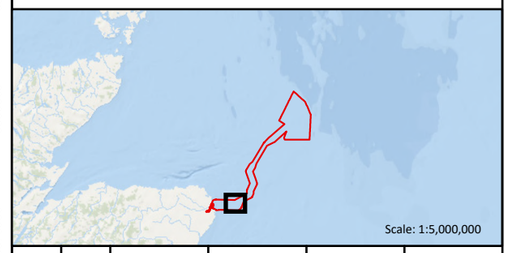
Features of conservation interest

Gadidae

Melanogrammus aeglefinus

Edwardsiidae (possible Edwardsia timida)

0 1 2 Kilometres



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PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 11 Features of conservation interest offshore export corridor nearshore two

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Red Line Boundary

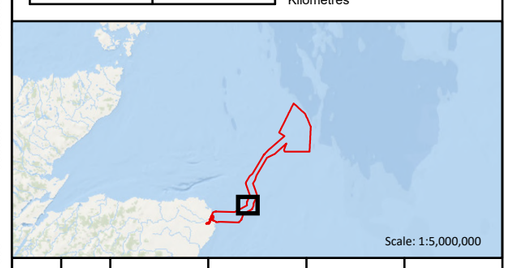
PMF

Offshore subtidal sands and gravels

Features of conservation interest

- *Gadidae*
- *Melanogrammus aeglefinus*
- *Caryophylliidae*
- *Edwardsiidae (possible Edwardsia timida)*
- *Pennatula phosphorea*

0 1 2 Kilometres



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SCALE	1:50,000	PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 12 Features of conservation interest offshore export corridor mid corridor one

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596400 597800 599200 600600 602000 603400 604800 606200 607600 609000 610400

6407800 6406400 6405000 6403600 6402200 6400800 6399400 6398000 6396600

N

Red Line Boundary

Annex I Reef

Biogenic reef - low reefiness

PMF

Offshore subtidal sands and gravels

Subtidal sands and gravels

OSPAR

Sea pens and burrowing megafauna communities

Features of conservation interest

Gadidae

Melanogrammus aeglefinus

Ammodytidae: juvenile

Ammodytidae (possible Ammodytes marinus/ A. tobianus)

Caryophylliidae

Edwardsiidae (possible Edwardsia timida)

Arctica islandica

0 1 2 Kilometres

Scale: 1:5,000,000

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DATUM ETRS 89 | PROJECTION UTM Zone 30N

SCALE 1:50,000 | PAGE SIZE A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 13 Features of conservation interest offshore export corridor mid corridor one

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Appendix 10.1

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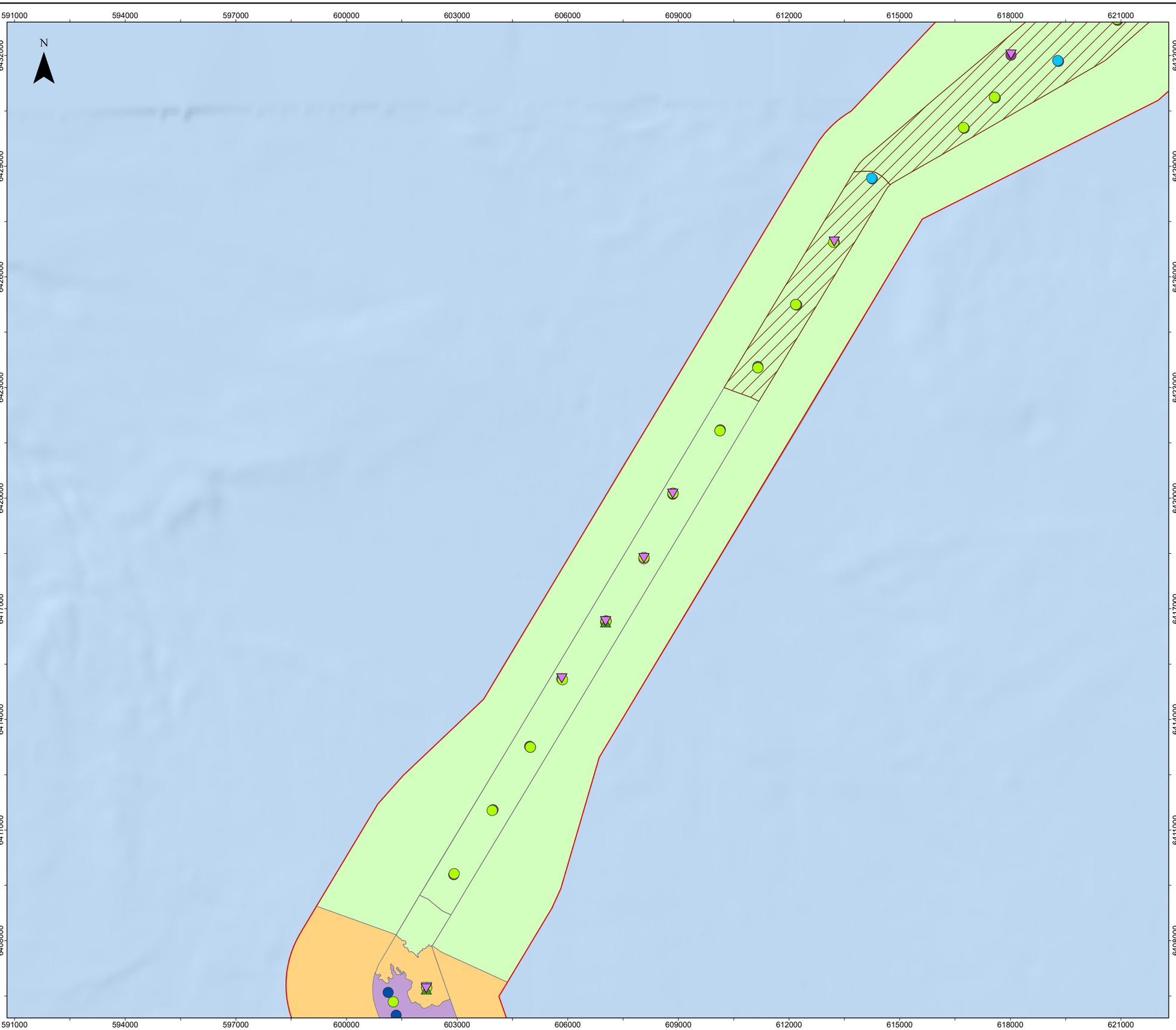


Red Line Boundary

Annex I Reef

Biogenic reef - low reefiness

PMF

Potential Burrowed mud

Offshore subtidal sands and gravels

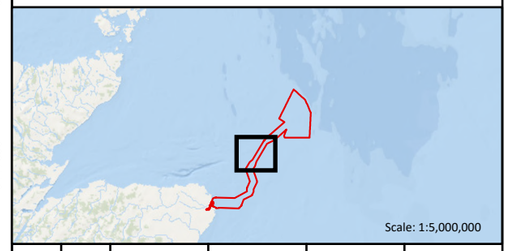
OSPAR

Sea pens and burrowing megafauna communities

Features of conservation interest

- *Gadidae*
- *Melanogrammus aeglefinus*
- *Ammodytidae: juvenile*
- *Caryophylliidae*
- *Edwardsiidae (possible Edwardsia timida)*
- *Arctica islandica*
- *Virgularia mirabilis*
- *Pennatula phosphorea*

0 2 4 Kilometres



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PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 14 Features of conservation interest
offshore export corridor offshore corridor one

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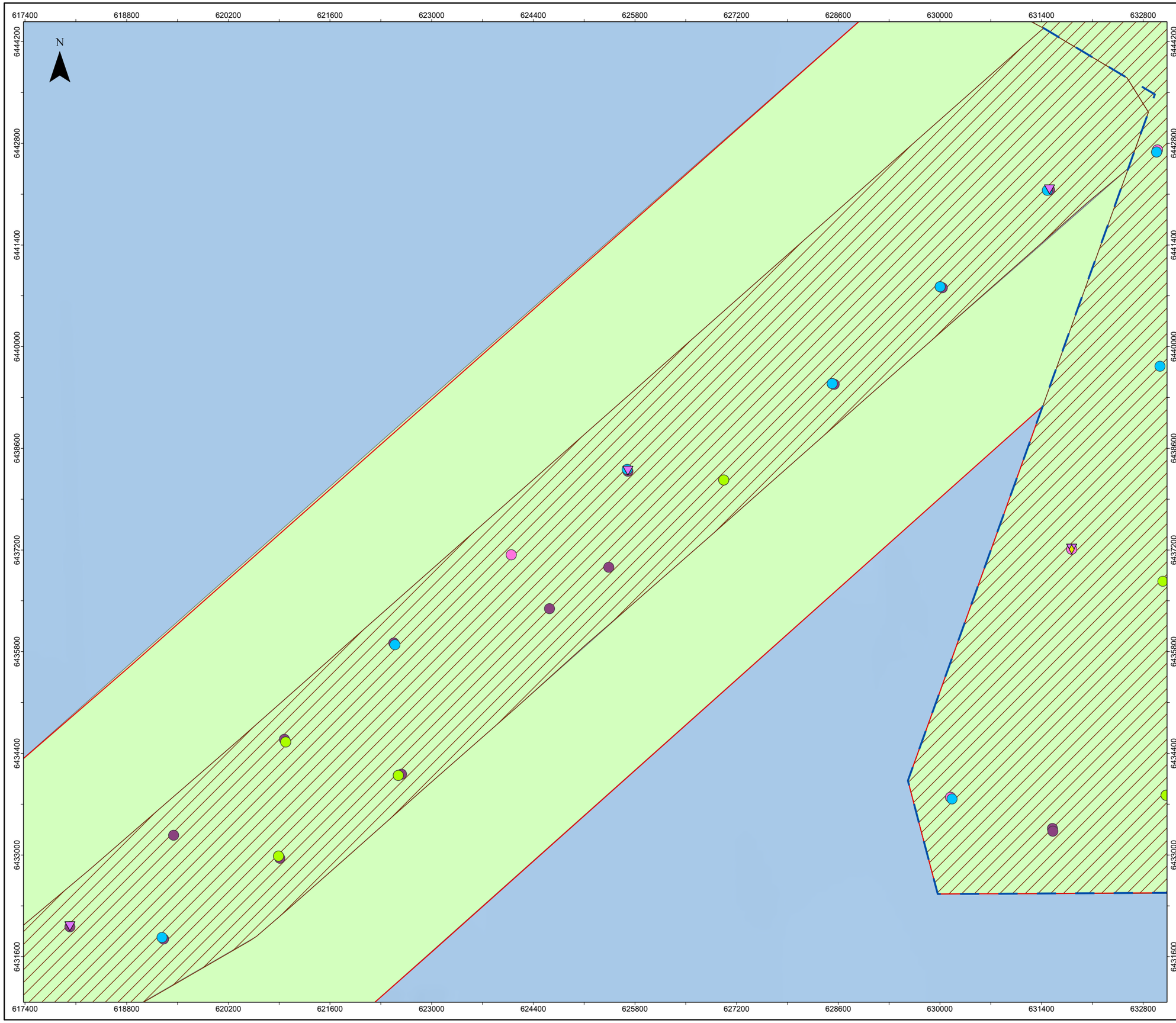


Red Line Boundary
Option Agreement Area

PMF

Potential Burrowed mud

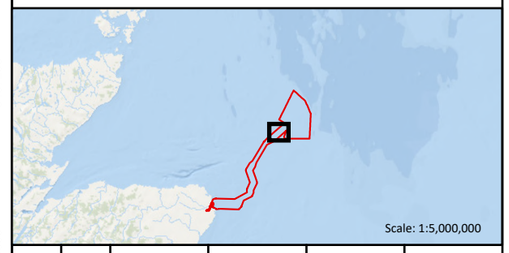
OSPAR

Sea pens and burrowing megafauna communities

Features of conservation interest

- *Molva molva*
- *Gadidae*
- *Edwardsiidae (possible Edwardsia timida)*
- *Arctica islandica*
- *Virgularia mirabilis*
- *Pennatula phosphorea*

0 1 2 Kilometres



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PAGE SIZE	A3

PROJECT TITLE
MarramWind Offshore Wind Farm

DRAWING TITLE
Figure 15 Features of conservation interest
offshore export corridor offshore corridor two

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3.3.2 The OAA

3.3.2.1 The habitats and species of conservation interest identified within the OAA are shown in **Figure 16**.

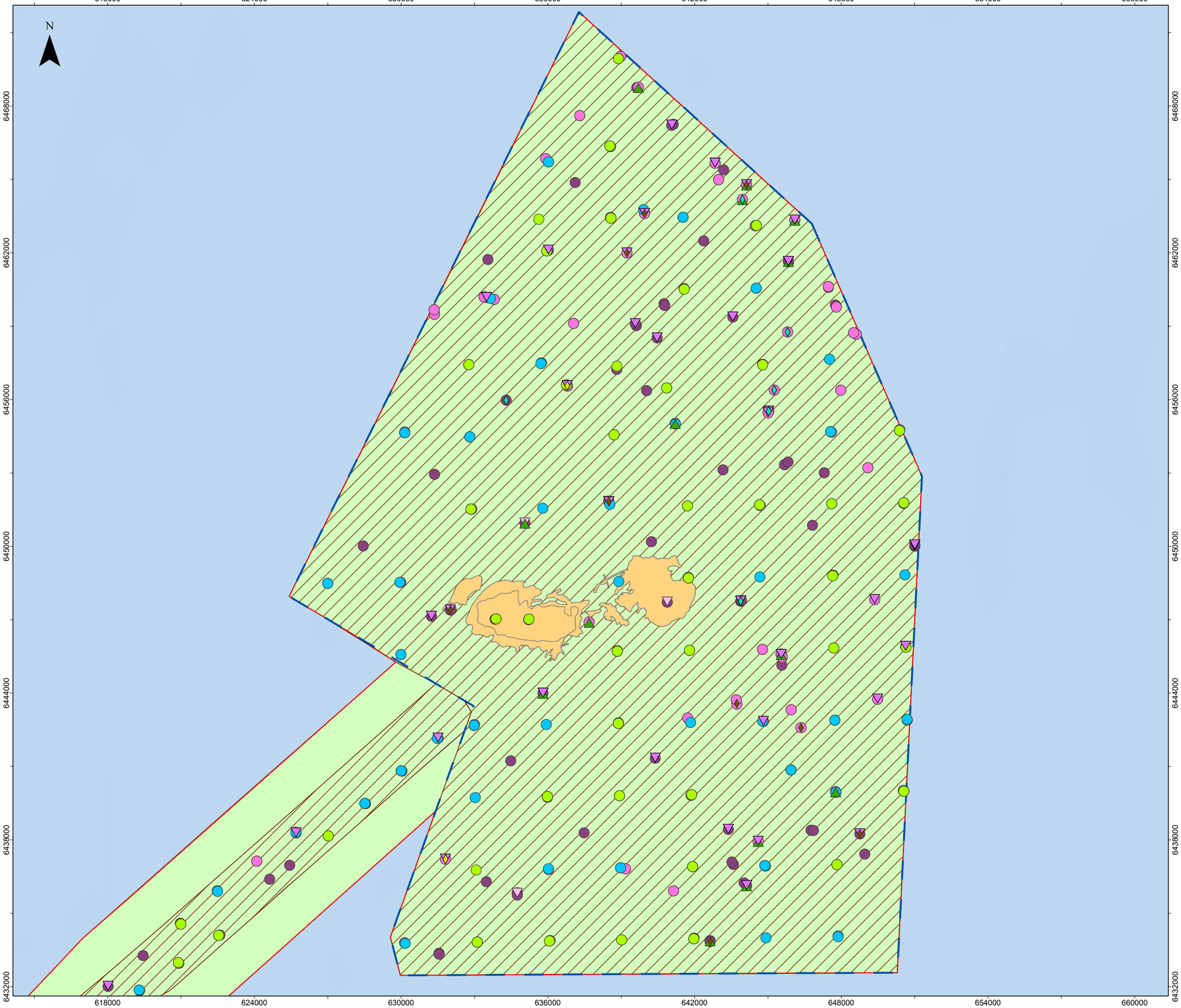
3.3.2.2 The presence of the OSPAR listed threatened and / or declining habitat 'Sea pens and burrowing megafauna communities' is almost ubiquitous across the OAA. Faunal burrows were present along the majority of video transects and stations. Where present, burrows were largely assessed as being 'frequent' to 'common'. The abundance of sea pens *P. phosphorea* across the OAA was 'occasional' to 'common' along all transects and stations and *Virgularia* sp. in abundances ranging from 'rare' to 'frequent'.

3.3.2.3 As with the offshore export cable corridor the 'Sea pens and burrowing megafauna in circalittoral fine mud' (SS.SMu.CFiMu.SpnMeg) biotope was observed within sandy and muddy sand sediments. Therefore, the PMF broad habitat 'Burrowed mud' and the UK BAP habitat 'Mud Habitats in Deep Water' are considered unlikely but have the potential to occur within the OAA.

3.3.2.4 An area towards the centre of the OAA was classified as 'Offshore circalittoral sand' (SS.SSa.OSa), which falls within the broad PMF habitat 'Offshore subtidal sands and gravels' a common habitat in the UK offshore marine environment.

3.3.2.5 Ocean quahog *A. islandica*, an OSPAR threatened species was observed at numerous stations across the OAA. Edwardsiidae, indicating the possible presence of the timid burrowing anemone (*E. timida*) were recorded within the surveyed area. *E. timida* is listed by both the UK BAP as priority species and is also included on the SBL. The presence of the common cup coral *C. smithii* may indicate the presence of the Annex I habitat '*Caryophyllia (Caryophyllia) smithii*, sponges and crustose communities on wave-exposed circalittoral rock', and the PMF 'Northern sea fan and sponge communities'. However, given the offshore location the presence of 'Northern sea fan and sponge communities' is unlikely as these largely occur on rocky substrates between approximately 20m to 50m deep. These communities are also more generally found on the west coast of Scotland.

3.3.2.6 Individuals belonging to the family Gadidae were observed at 32 stations, indicating the potential presence of the Atlantic cod *G. morhua*. Other UK BAP or PMF species observed within the OAA include common ling (*M. molva*) and haddock (*M. aeglefinus*). Rajidae (skates) was also recorded indicating the potential for the presence of SBL, OSPAR and IUCN Red List species such as Thornback ray (*R. clavata*). Further, the IUCN Red List 'vulnerable' species witch flounder *G. cynoglossus* was also recorded.



Red Line Boundary
Option Agreement Area

PMF

Potential Burrowed mud
Offshore subtidal sands and gravels

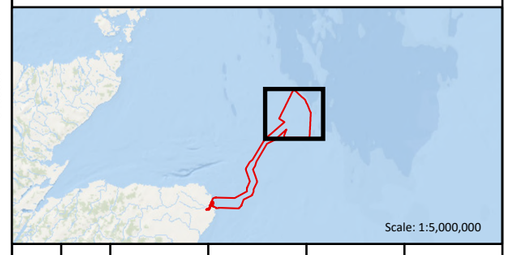
OSPAR

Sea pens and burrowing megafauna communities

Features of conservation interest

- *Molva molva*
- *Rajidae*
- *Gadus morhus*
- *Gadidae*
- *Melanogrammus aeglefinus*
- *Caryophyllia smithi*
- *Edwardsiidae (possible Edwardsia timida)*
- *Arctica islandica*
- *Virgularia mirabilis*
- *Pennatula phosphorea*

0 4 8 Kilometres



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DATUM	ETRS 89	PROJECTION	UTM Zone 30N
SCALE	1:150,000	PAGE SIZE	A3

PROJECT TITLE

MarramWind Offshore Wind Farm

DRAWING TITLE

Figure 16 Features of conservation interest OAA

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4. Summary

4.1.1.1 The biotope Sea pens and burrowing megafauna in circalittoral fine mud (SS.SMu.CFiMu.SpnMeg) (in matrix with biotopes SS.SSa.CFiSa.EpusOborApri and SS.SMu.OMu.PjefThyAfili) was largely ubiquitous across the OAA and the offshore area of the offshore export cable corridor. This indicates the presence of the OSPAR listed threatened and / or declining habitat 'Sea pens and burrowing megafauna communities'. There is also the potential presence of the PMF 'Burrowed mud' and the UK BAP habitat 'Mud Habitats in Deep Water'. However, the sea pen and burrowing megafauna biotope was observed within sandy and muddy sand sediments and therefore the presence of 'Burrowed Mud' and 'Mud Habitats in Deep Water' is considered less likely but both have the potential to occur.

4.1.1.2 The biotopes across the rest of the offshore export cable corridor were varied. Broadly sandy and coarse sediments, and associated biotopes were observed along the central corridor with a matrix of sediment and rock biotopes occurring within the nearshore area.

4.1.1.3 The presence of the habitat types 'Sublittoral sands and muddy sands' (SS.SSa), 'Circalittoral coarse sediment' (SS.SCS.CCS), 'Offshore circalittoral coarse sediment' (SS.SCS.OCS) and 'Offshore circalittoral sand' (SS.SSa.OSa) indicates the occurrence of the PMF broad habitats 'Subtidal sands and gravels' and 'Offshore subtidal sands and gravels'. These broad PMF habitats are present across much of offshore export cable corridor and are amongst the most common habitats in the UK offshore marine environment.

4.1.1.4 Along the offshore export cable corridor, the presence of Annex I habitat 'Reef' geogenic stony reef and biogenic reef were observed. Most categories of 'Stony Reef' were recorded, including 'no reef', 'not a reef', 'low reef' and 'medium reef'. No areas with 'high reef' potential were identified across the assessed areas. All areas of stony reef were located towards the landfall end of offshore export cable corridor.

4.1.1.5 Biogenic *S. spinulosa* reef was observed at ten locations, largely in the middle of the offshore export cable corridor. These were classified as 'low reef'. No areas of 'high reef' were identified.

4.1.1.6 Species recorded in grab samples or observed in the photographic data that are listed on the UK BAP priority species, SBL, IUCN Red List, and / or the OSPAR threatened and declining species lists include; the edible sea urchin (*E. esculentus*), Ocean Quahog (*A. islandica),* individuals belonging to the family Ammodytidae indicating the possible presence of the sand eels *A. marinus* and *A. tobianus*, and Edwardsiidae, indicating the possible presence of the timid burrowing anemone (*E. timida*).

4.1.1.7 Other UK BAP species, PMF or OSPAR threatened and declining species recorded within the grab or video data included; haddock (*M. aeglefinus*), witch flounder (*G. cynoglossus*) and common ling (*M. molva)*.

5. References

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6. Glossary of Terms and Abbreviations

6.1 Abbreviations

Acronym	Definition
ABPmer	ABP Marine Environmental Research Ltd
BAP	Biodiversity Action Plan
CBD	Convention on Biological Diversity
DDV	Drop-Down Video
EC	European Commission
eDNA	Environmental DNA
EEC	European Economic Community
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EU	European Union
EUNIS	European Nature Information System
EUSeaMap	European Union Seabed Habitat Map
FOCI	Feature of Conservation Interest
HF	High Frequency
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
LF	Low Frequency
M	Meter
MESH	Mapping European Seabed Habitats
MBES	Multibeam Echosounder
MPA	Marine Protected Area
NMP	National Marine Plan
NMPi	National Marine Plan Interactive
OAA	Option Agreement Area

Acronym	Definition
OSPAR	Oslo and Paris
PMF	Priority Marine Feature
PSD	Particle Size Distribution
SAC	Special Area of Conservation
SBL	Scottish Biodiversity List
SBR	Sublittoral Biogenic Reefs
SPA	Special Protection Area
SSS	Side Scan Sonar
UK	United Kingdom

6.2 Glossary of terms

Term	Definition
Annex I (of the Habitats Directive)	Part of the Habitats Directive 92/43/EEC that identifies habitat types that require conservation through the designation of Special Areas of Conservation (SACs).
Annex II (of the Habitats Directive)	Part of the Habitats Directive 92/43/EEC that identifies species that require conservation through the designation of SACs.
Bathymetry	Topography of sea or estuary bed as measured from a fixed vertical datum.
Benthic ecology	The study of the organisms living in and on the sea floor, the interactions between them and their impacts on the surrounding environment.
Biotope	A region of habitat associated with a particular ecological community.
Drop Down Video	A survey method in which imagery of habitat is collected, used predominantly to survey marine environment.
Epibenthic	Flora or fauna that live on the seabed.
Epifaunal	Animals living on the seabed.
EUNIS habitat classification	A pan-European system that facilitates the harmonised description and classification of all types of habitats, through the use of criteria for habitat identification.
EUSeaMap	Broadscale habitat maps produced by EMODnet for Europe.

Term	Definition
Feature of Conservation Importance	Ecologically important habitat or species that requires further consideration within the EIA process.
Geophysical survey	Activities to obtain data on the distribution and nature of geophysical properties of the seabed (e.g. bathymetry, surficial sediment type and bedforms, sub surface geology). Geophysical survey outputs typically include multibeam bathymetry, side scan sonar and sub bottom profiler data.
Grab sample	A technique used to sample benthic flora and fauna.
Hertz	The unit of measurement for frequency of a sound wave, measured as the number of sound waves oscillating per second.
Infauna	Animals that live in the sediments occurring on the sea floor.
Joint Nature Conservation Committee	The public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.
Macrobenthic	Animals larger than 1.0mm that inhabit the seabed.
National Marine Plan interactive	An interactive mapping system prepared for Marine Scotland to support Scotland's National Marine Plan.
OSPAR Convention	The Convention for the Protection of the Marine Environment of the North East Atlantic.
Priority Marine Feature	Habitats and species that are considered to be marine nature conservation priorities in Scotland.
Subtidal	The region of shallow coastal waters that are below Mean Low Water Springs.

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