White Cross Offshore Wind Farm ES Addendum

Appendix U: Updated Cable Burial Risk Assessment

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Glossary of Acronyms

Acronym	Definition
AC	Alternating Current
AEZs	Archaeological Exclusion Zones
AIS	Automatic Identification System
AONB	Area of Outstanding Natural Beauty
BAS	Burial Assessment Study
BOD	Basis of Design
CBRA	Cable Burial Risk Assessment
DOL	Depth of Lowering
DWT	Dead Weight Tonnage
EMODnet	European Marine Observation and Data Network
ES	Environmental Statement
FOS	Factor of Safety
INNS	Invasive Non-Native Species
LAT	Lowest Astronomical Tide
MCZ	Marine Conservation Zone
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
OECC	Offshore Export Cable Corridor
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
RIAA	Report to Inform Appropriate Assessment
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
pUXO	Potential Unexploded Ordnance
SI	Standard International
SSC	Suspended Sediment Concentration
TAEZs	Temporary Archaeological Exclusion Zones
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VMS	Vessel monitoring system
WCOWL	White Cross Offshore Wind Ltd
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generators

Glossary of Terminology

Defined Term	Description
development area	The area comprising the onshore development area and the offshore development area
export cable corridor	The area in which the export cables will be laid, from the offshore substation platform to the onshore substation comprising both the offshore export cable corridor and onshore export cable corridor
inter-array cables	Cables which link the wind turbines to each other and the offshore substation platform
landfall	Where the offshore export cables come ashore
offshore development area	The windfarm site and offshore export cable corridor to landfall
offshore export cables	The cables which will bring electricity from the offshore substation platform to the landfall
offshore export cable corridor	The proposed offshore area in the which the export cables will be laid, from the perimeter of the windfarm site to landfall
offshore substation platform	A fixed or floating structure located within the windfarm site, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore
onshore development area	The onshore area above MHWS including the underground onshore export cables connecting to the onshore Project substation
onshore export cables	The cables which bring electricity from the landfall to the onshore substation
onshore export cable corridor	The proposed onshore area in which the export cables will be laid, from landfall to the onshore substation
onshore substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of the electrical transformers.
Transition joint bay	Underground structures at the landfall that house the joints between the offshore export cables and the onshore export cables
windfarm site	The area within which the wind turbines, offshore substation platform and inter-array cables will be present
White Cross offshore windfarm (the Project)	100MW capacity offshore windfarm including associated onshore and offshore infrastructure

Units, Datums and Coordinates

Datum and Coordinate System

All data recorded, presented or communicated shall clearly state units, origin, datum or convention as required. A Project specification will be prepared detailing data deliverable requirements. This includes requirements for spatial data, survey data and drawings.

Onshore shall be defined as positions landward of Mean High Water Springs (MHWS).

Offshore shall be defined as positions seaward of MHWS.

Vertical Datum

Vertical elevations offshore shall be referenced to Lowest Astronomical Tide (LAT).

Horizontal Datum

Offshore locations shall be referenced to and recorded in WGS84 UTM Zone 30N.

Orientations shall be to grid north; WGS84 grid for offshore.

Units

All units of measurement used in this document relate to Standard International, unless otherwise stated.

1. Introduction

1.1 Project Background

1. White Cross Offshore Windfarm (the 'Project') is a proposed floating offshore windfarm located in the Celtic Sea with a capacity of up to 100MW. The Project is being developed by White Cross Offshore Windfarm Limited (WCOWL) a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd.

2. The components of the Project seaward of Mean High Water Springs (MHWS) (the 'Offshore Project') are subject to an application for consent under Section 36 of the Electricity Act 1989 and for Marine Licences under the Marine and Coastal Access Act 2009 submitted to the Marine Management Organisation (MMO). These applications are supported by an Environmental Statement (ES) covering all potential impacts seaward of MHWS.

3. A separate application that covers all infrastructure of the project landward of Mean Low Water Springs (MLWS) (the 'Onshore Project') for consent under the Town and Country Planning Act 1990 (TCPA) supported by a separate ES covering all potential impacts landward of MLWS has been submitted to the local planning authority (LPA) North Devon Council (NDC). The Onshore Project includes the infrastructure associated with the Landfall at Saunton Sands (to MLWS) where the onshore elements connect to the Offshore Project infrastructure, Onshore Export Cable (including joint bays and link boxes), Taw Estuary Crossing, a new White Cross Onshore Substation, and an Interconnecting Cable to the Grid Connection Point at the existing East Yelland Substation.

4. Following consultations on the two applications between September and November 2023 comments from regulators, stakeholders, statutory and non-statutory consultees were received, including requests for further environmental information. WCOWL have agreed to provide a response to these comments in the form of an ES Addendum. This this will provide clarifications and sign-posting to relevant sections of the ES, and where required updated documents and further environmental information.

1.1.1 Need for Cable Burial

5. The safe and efficient installation of the electricity cabling system is a key design consideration for offshore windfarm developments. The different methods of installation and burial, and types of additional cable protection have different construction time and cost implications for a windfarm development. The need to

protect the power cables should be balanced against the need to mitigate any impacts on the seabed and on other users of the seabed.

6. The power cables need to be installed so that they are not at risk of being damaged, either directly or from impacts caused if buried cables become re-exposed. Where cables are damaged there would be a need for additional works to undertake repairs/replacement, and these works would result in additional construction phase impacts. Cable protection can be achieved through burial of the cables to a sufficient depth that direct damage or re-exposure risks are reduced, by the use of protection above the cables, or a combination of burial and cable protection.

7. The different construction techniques employed to install the cables, including the depth of burial and seabed preparation techniques, can have direct impacts on the marine environment and seabed, including on benthic ecology. While these impacts might be short-term, temporary or reversable depending on the reinstatement techniques, they need to be assessed with the final decision on the technique made taking these impacts into consideration.

- In addition, the introduction of protection measures above cables can result in longer-term impacts during the lifetime of a windfarm development including:
- Habitat loss and physical disturbance (temporary, long-term and permanent)
- Impacts on bedload sediment transport and seabed morphological change due to cable protection
- Impact to vessel safety and activities, including increased risk of cable snagging
- Obstacles on the seabed impacting fishing activities, including gear snagging

1.2 Purpose of this Document

8. This updated Outline **Cable Burial Risk Assessment** (Outline CBRA) is being submitted as **Appendix U of the ES Addendum**: the first version was submitted to the MMO as **Appendix 8.D: Cable Burial Risk Assessment** of the **Offshore ES**. Both versions have been developed using project-specific geophysical data collected in 2022, but without of a full suite of project-specific geotechnical data. This document has therefore been written using only existing (third party) data from the European Marine Observation and Data Network (EMODnet) to understand seabed characteristics.

9. The first purpose of this updated document is to re-present the findings of the CBRA carried out to support the application for the Offshore Project. It provides a description of the burial assessment inputs used (Section 5), the methodology applied (Section 3), the results of the study (Section 6), and the conclusions and

engineering recommendations arising from the study (Section 7). The final assessment and conclusions remain unchanged from the first version issued in 2023.

10. The second purpose of this updated document is to present known information to inform the environmental assessments, discusses impact conclusions presented in relevant chapters of the Offshore Environmental Statement (ES) and records commitments to carrying out further assessments to support detailed design following the full suite of geotechnical data collection.

11. This document also addresses comments received from the MMO and other statutory consultees on the Offshore ES and provides clarifications and signposting as required. Specifically, the areas that have been identified by the MMO as requiring further information or clarification are summarised in **Table 1-1** below.

Table 1-1 Consultation responses to Cable Burial Risk Assessment

Comment	Project Response
Identifying the depth of sand veneers to support assumptions of efficient cable burial.	At this stage, a full understanding of the depth of sand veneers across the proposed cable burial area is not yet established, given that a full suite of project-specific geotechnical data has not yet been collected. The final CBRA will present full information on the depth of sand veneers across the Offshore Development Area.
Identifying general areas where the export cable cannot be optimally buried.	Early indications of areas of rocky outcrops or bedrock are set out in **Section 5.2.2,** and **Section 5.3.2.** It is in these areas that suboptimal burial of cables may be a risk. However, a full suite of project specific geotechnical data will give a clearer understanding of areas where optimal burial of the export cable cannot be achieved, which will inform further iterations of this document.
Identifying general areas where external cable protection is anticipated to be required.	**Section 6.4.2** sets out the Project's current expectation for the requirement of external cable protection in the Windfarm Site; and **Section 6.4.3** sets out expectations for the Offshore Export Cable Corridor (OECC). Requirements for external cable protection at cable crossings are included as well as areas where suboptimal burial is identified as a driver of the need for cable protection.

12. This Outline CBRA sets out the risks and considerations at this point in time and will be further developed post-consent as the detailed design works progress. It is expected that there will be a condition attached to the Marine Licence, if positively determined, requiring submission of a final CBRA to be approved pre-construction.

2. Description of Offshore Development

2.1 Project Description

13. The Offshore Project includes the infrastructure within the windfarm site (e.g., wind turbine generators (WTGs), substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (OSP) (as applicable)). It also includes all infrastructure associated with the offshore export cable corridor (OECC) and landfall (up to MHWS) including the cables and associated cable protection and seabed preparation.

14. In summary, the development comprises the following:

- An offshore wind farm of maximum capacity 100MW;
- 5-8 floating WTGs, complete with moorings and inter-array cables;
- A potential OSP, including the required metering and voltage conversion transformers to the offshore export cable back to shore;
- Offshore export cables connecting to a transition bay located at the landfall.

15. All cabling will be Alternating Current (AC). This applies to the inter-array cables, offshore export cables and onshore export cables, for more details on the cabling see **Section 2.3** below.

16. The project scope overview is shown in **Figure 2-1** below.

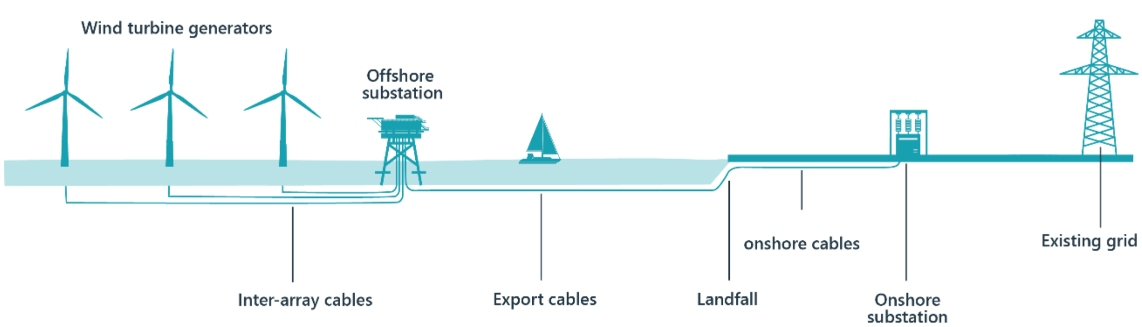


Figure 2-1 Project Concept Overview

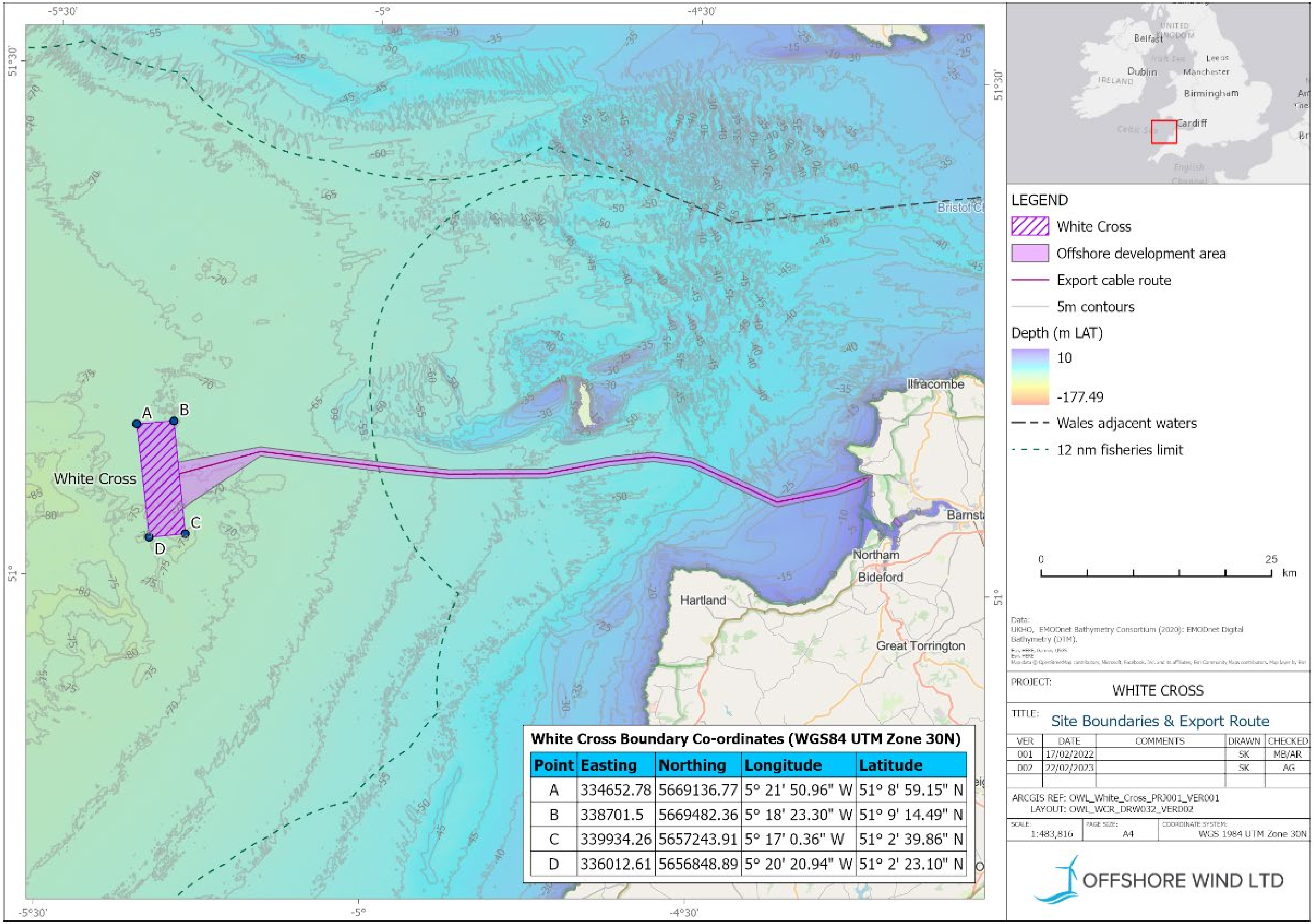
2.2 Project location

17. The Windfarm Site is located in the Celtic Sea and is located 52.5km off the Cornish Coast as shown in **Figure 2-2**. The 50km^2 site was accepted by the Crown Estate on the 12th July 2022. Water depths in the Windfarm Site are approximately 69m

lowest astronomical tide (LAT) to 78m LAT as confirmed during Phase 1 ground investigation geophysical surveys performed in 2022.

18. In the vicinity of the Project, there also exist numerous planned windfarms and associated cables, marine aggregate areas, an offshore wave site and numerous international telecommunication cables. See **Figure 2-3** and **Sections 5.2.4** and **5.3.4.**

19. The Windfarm Site lies outside of marine protected areas, but the OECC will traverse designated protection areas heading to the landfall as detailed in **Section 5.3.7**.



Point	Easting	Northing	Longitude	Latitude
A	334652.78	5669136.77	5° 21' 50.96" W	51° 8' 59.15" N
B	338701.5	5669482.36	5° 18' 23.30" W	51° 9' 14.49" N
C	339934.26	5657243.91	5° 17' 0.36" W	51° 2' 39.86" N
D	336012.61	5656848.89	5° 20' 20.94" W	51° 2' 23.10" N

Figure 2-2 White Cross Offshore Windfarm Site and OECC Location

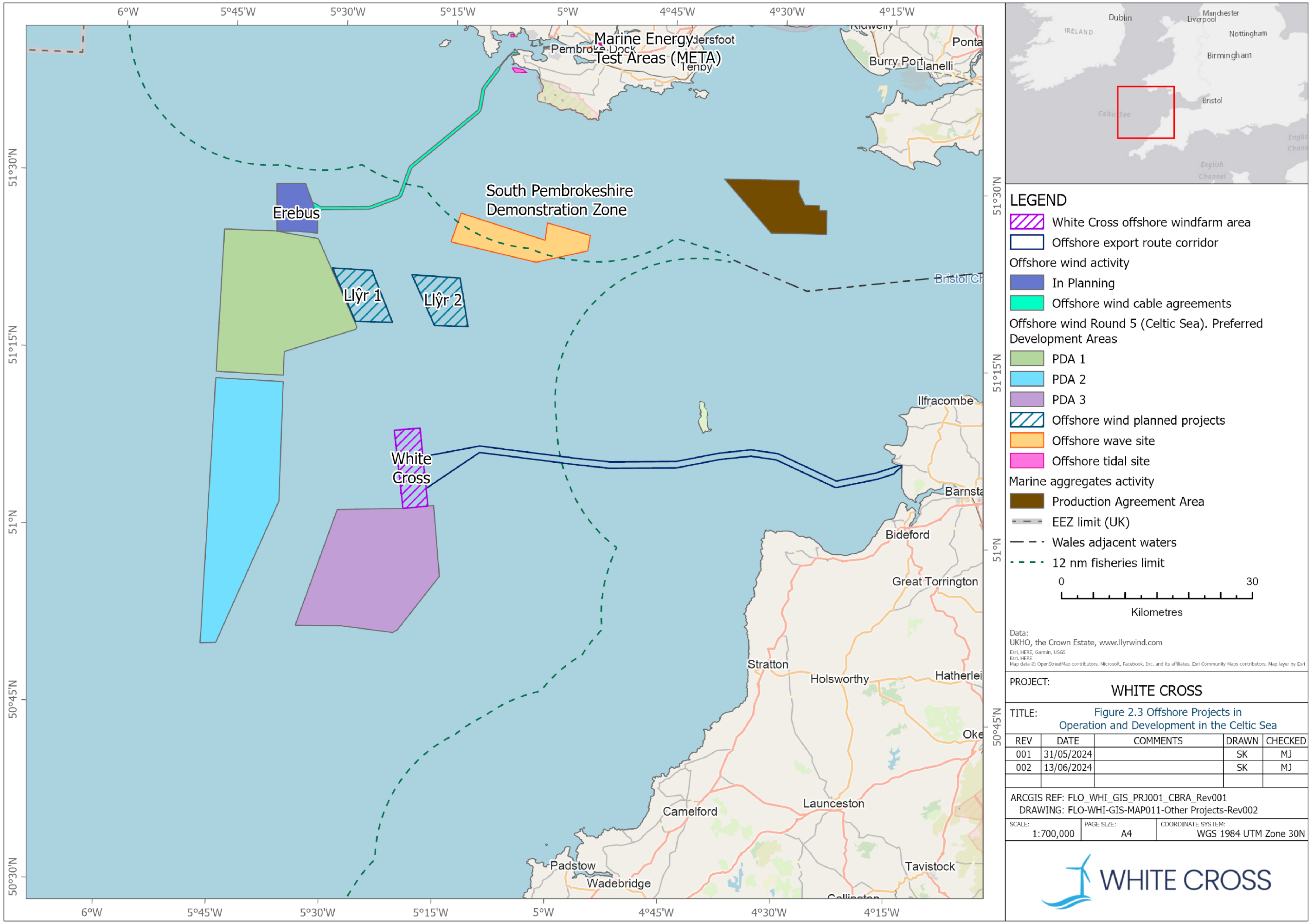


Figure 2-3 Offshore Projects in Operation and Development in the Celtic Sea

2.3 Electrical Export System

20. The final design of the electrical export system is yet to be determined, but it will be either two 66kV cables (with no OSP) or a single 132kV cable (from an OSP). The worst-case cable parameters for the inter-array and export cables for this study are presented in **Table 2-1** below.

Table 2-1 Key Cable Properties

Comment	Unit	Inter Array Cable (within Windfarm Site)	Export Cable
Nominal Voltage	kV	66	132
Cable outer diameter	mm	220	300
Nominal burial depth*	m	1.5	1.5
Quantity	-	TBC	TBC – max. 2

*It is assumed that this is trench depth, depth of lowering (DOL) to top of cable is equivalent to Nominal Burial Depth minus Cable Outer Diameter.

3. Methodology

3.1 General

21. This section describes the methodology applied in the CBRA to evaluate the required depth of lowering (DOL) for the White Cross offshore windfarm offshore cables.

22. The Carbon Trust **Cable Burial Risk Assessment Methodology: Guidance for the Preparation of Cable Burial *Depth of Lowering* Specification** (Carbon Trust 2015[1]) is employed for this CBRA. This methodology was originally developed specifically for offshore wind and is intended to offer a standardised, repeatable and qualitative method that can be used by all stakeholders involved in the development of a wind farm.

23. CBRA considers natural and anthropogenic threats to subsea cables in determining the minimum required DOL. It allows for a degree of risk to be assumed by a project (e.g., project may decide to protect from 90th percentile vessel, if the risk of anchor strike from largest vessels is deemed acceptable). As this study is being undertaken at a relatively early stage of the Project, using high level data for certain key inputs, an acceptable risk level for the project has not been applied and risk is presented for information based on the data available. This CBRA will be finalised pre-construction using bespoke geotechnical data and other information collected for the Project, at which time an acceptable level of risk can be defined and applied. More details on the conclusions and recommendations for further work are provided in **Section 7**.

24. Determining the appropriate DOL for the cable is an iterative process. The inputs are assessed, and a depth of lowering is proposed; if this DOL results in an acceptable level of residual risk, this is the "Proposed DOL". However, if the residual risk is deemed to be too high for the project, iterations can be made; for example, refinement of the shipping data used, or alteration of the route to avoid particular hazards, such as steep slopes, pUXOs, submarine slides, etc. This process is summarised in **Figure 3-1** below.

25. Following the CBRA, if there are any areas where burial is not expected to be a practical solution, a proposal will be presented on alternative external protection methods including the use of rock armour (see **Section 6.4.4**).

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[1] Microsoft Word - Guidance on Cable Burial Risk Assessment SP (26-2-2015) (ctprodstorageaccountp.blob.core.windows.net)

26. Signposting to where in this Outline CBRA the information set out in the Carbon Trust CBRA methodology is provided in **Table 3-1** below.

Table 3-1 Carbon Trust CBRA Methodology

Carbon Trust CBRA Methodology	Description	Where addressed in this document
Cable Routing	Overview assessment of route	**Section 4**
Collection of data and suitability review	Collate data needed, assess relevance and suitability of the data for completing the CBRA, and highlight and shortcomings	**Section 5**
Assessment of seabed conditions	Breakdown of route based on distinct geological and seabed conditions focused, and assessment of the conditions that may impact the trenching operations and cable crossings	**Section 5**
Risk register / threat (hazard) assessment	Assessment of natural hazards that may affect cable, and analysis of anthropogenic hazards (commercial fishing and shipping)	**Section 6.1**
Probability of risk assessment	Assess the probability of an anchor striking the cable	**Section 6.4**
Quantify a recommended depth of burial for protection based on geological conditions & hazards to cable	Specify depth of lowering to provide protection from anchor strike, sediment mobility and fishing	**Section 7.1**

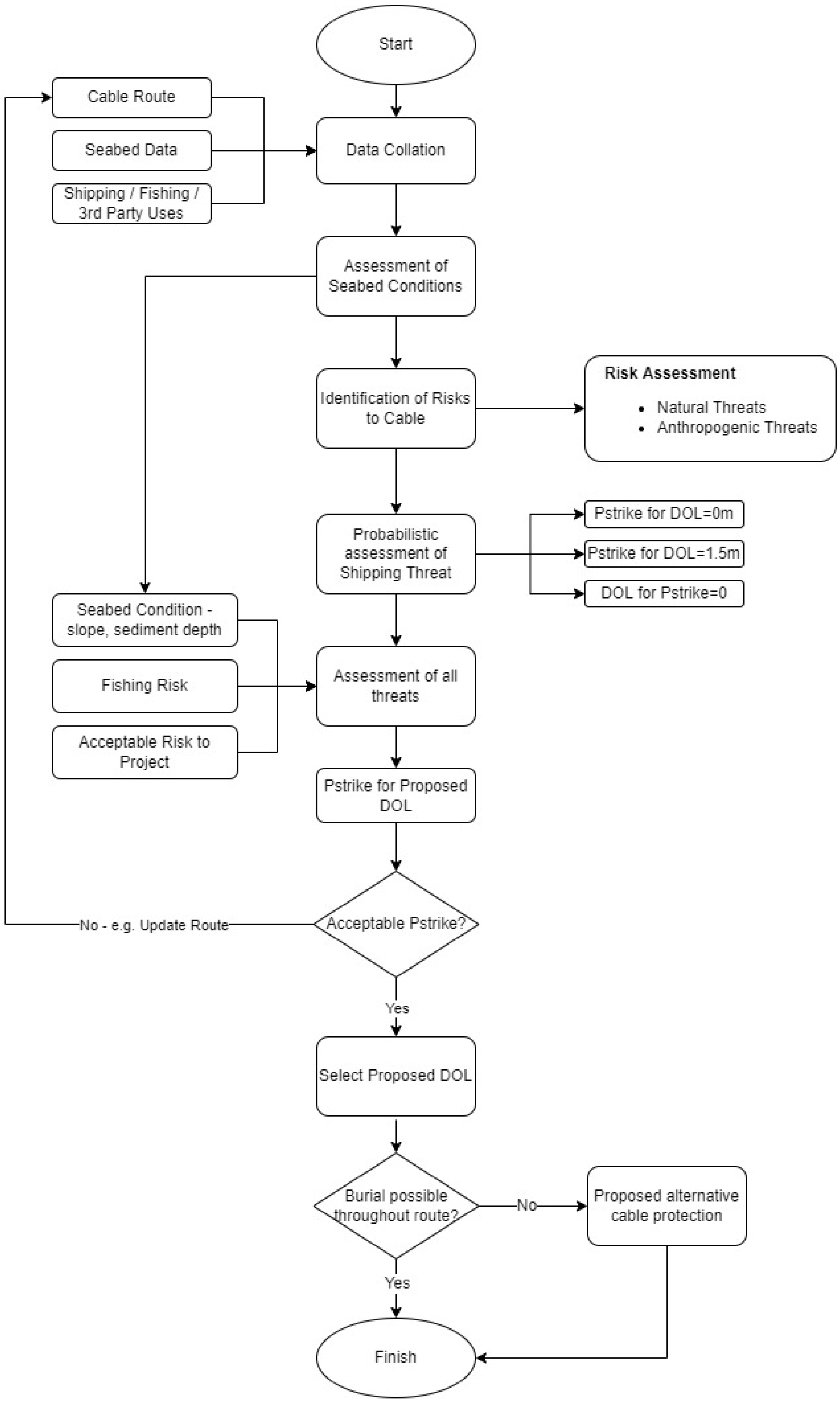

Figure 3-1 Assessment Methodology

4. Cable Routing

4.1 General

27. This first stage of the Carbon Trust CBRA methodology is Cable Routing which is the first and most efficient method for mitigating threats to a subsea cable. A balance will have to be maintained between minimising the cable length and avoiding hazards. During routeing, avoiding seabed features that might make burial operations difficult, anchorages, or major shipping lanes etc. or following features that can be easily trenched should both be considered.

28. The process undertaken for the Project is set out in **Chapter 4: Site Selection and Assessment of Alternatives** of the **Offshore ES**. Further detail is provided in appendices to **Chapter 4** of the **Offshore ES**:

- Appendix 4.A: White Cross Offshore Windfarm Area of Search
- Appendix 4.B: White Cross Offshore Windfarm Long List Report
- Appendix 4.C: White Cross Offshore Windfarm Short List Report

29. An overview of the site selection process that was undertaken for the Windfarm Site is provided in **Section 4.5** of **Chapter 4** of the **Offshore ES**.

30. **Section 4.7** of **Chapter 4** of the **Offshore ES** is a summary of the process undertaken to identify and refine the corridor for the offshore export cable. This started with a broad area of search linking the Windfarm Site to the landfall areas, a longlist of OECCs was produced (each 2km wide), and these were refined to a shortlist of OECCs (each 1km wide) and finally the preferred route.

31. A series of routing principles were considered, those of relevance to the CBRA are summarised below:

- Avoid direct long-term significant impacts to sites designated for nature conservation as far as possible
- Avoid direct significant impacts to ecologically important Annex I sandbanks and Annex I reefs as far as possible
- Minimise number of crossings of existing offshore cables and pipelines
- Avoid anchorage areas
- Avoid actively dredged maintenance dredge areas
- Avoid disposal areas (closed or current)
- 'Seabed take' in aggregate dredging areas to be minimised and avoided where possible

32. It is therefore considered that the site selection and assessment of alternatives process that was undertaken for the Project gave consideration to avoiding seabed features that might make burial operations difficult, and to mitigating other threats to the subsea cable.

5. Burial Assessment Inputs

5.1 General

33. This section, equivalent to stage 2 *Collation of Data and Suitability Review* and stage 3 *Assessment of Seabed Conditions* of the Carbon Trust CBRA methodology, includes a summary of the input data used in the CBRA, and the assessment of seabed conditions.

34. The site-specific data has been split between the Windfarm site (**Section 5.2)** and the data for the OECC (**Section 5.3**). The data that is used to input into the CBRA across both the Windfarm site and the OECC are presented in **Section 5.4**.

35. It should be noted that at the time the CBRA was completed for the Offshore application two landfall options were assessed for the OECC, a more northerly route, and a southerly route, both to Saunton Sands Beach. This has not been updated in this version of the CBRA, therefore for the purpose of this study the OECC is considered as a single route until the point where these diverge approx. 10km from landfall, then both landfall route options are assessed. But only the northerly part of this route is included in the Offshore Application.

36. The data collected came from a range of sources, including publicly available data and bespoke data collected for the Project. The data used is summarised in **Table 5-1**.

Table 5-1 Data collected and used for CBRA

Data	Source	Description / Limitations
Geophysical data	Offshore and Nearshore Survey White Cross Windfarm Geophysical Results Report (NSW-RJ00285-RR-DC-SUR-001), N-Sea	Geophysical survey undertaken for the Project. Provides range of data including seabed sediment type (including mobile sediments and features), bathymetry, and magnetometer contacts. The data is considered relevant and suitable for completing the CBRA.
Bathymetrical data	European Marine Observation and	Publicly available marine data service, includes a range data sets

Data	Source	Description / Limitations
	Data Network (EMODnet)	including bathymetry, human activities and seabed habitats. The data is considered relevant and suitable for completing the CBRA.
Shipping data	EOMDnet	Publicly available marine data service, includes a range data sets including bathymetry, human activities and seabed habitats. The data is considered relevant and suitable for completing the CBRA.
Fishing studies	EOMDnet	Publicly available marine data service, includes a range data sets including bathymetry, human activities and seabed habitats. The data is considered relevant and suitable for completing the CBRA.
UXO	Unexploded Ordnance Threat and Risk Assessment, 6 Alpha Associates, 2022	UXO threat and risk assessment report produced for the Project. The data is considered relevant and suitable for completing the CBRA.
Cable dimensions	White Cross Offshore Windfarm - Basis of Design (808165-01-PE-BOD-0001), Wood Group, 2022	Pre-FEED basis for design document produced for the Project. The data is considered relevant and suitable for completing the CBRA.
Telecoms cables	eMapSite	Online data provider with range of offshore datasets including telecommunications cables and infratructure. The data is considered relevant and suitable for completing the CBRA.
Cable route data	White Cross Offshore Windfarm	The data is considered relevant and suitable for completing the CBRA.

5.2 Site Data: Windfarm Site

5.2.1 Bathymetry

37. The water depths at the Windfarm Site range from approximately 69m to 79m (**Figure 5-1)** and slopes at the site are gentle and do not exceed 1° (**Figure 5-2**). Bathymetry data is consistent with the results of the Phase 1 ground investigation geophysical surveys [Ref. 7].

38. This bathymetry will not pose a challenge for cable burial using standard trenching equipment.

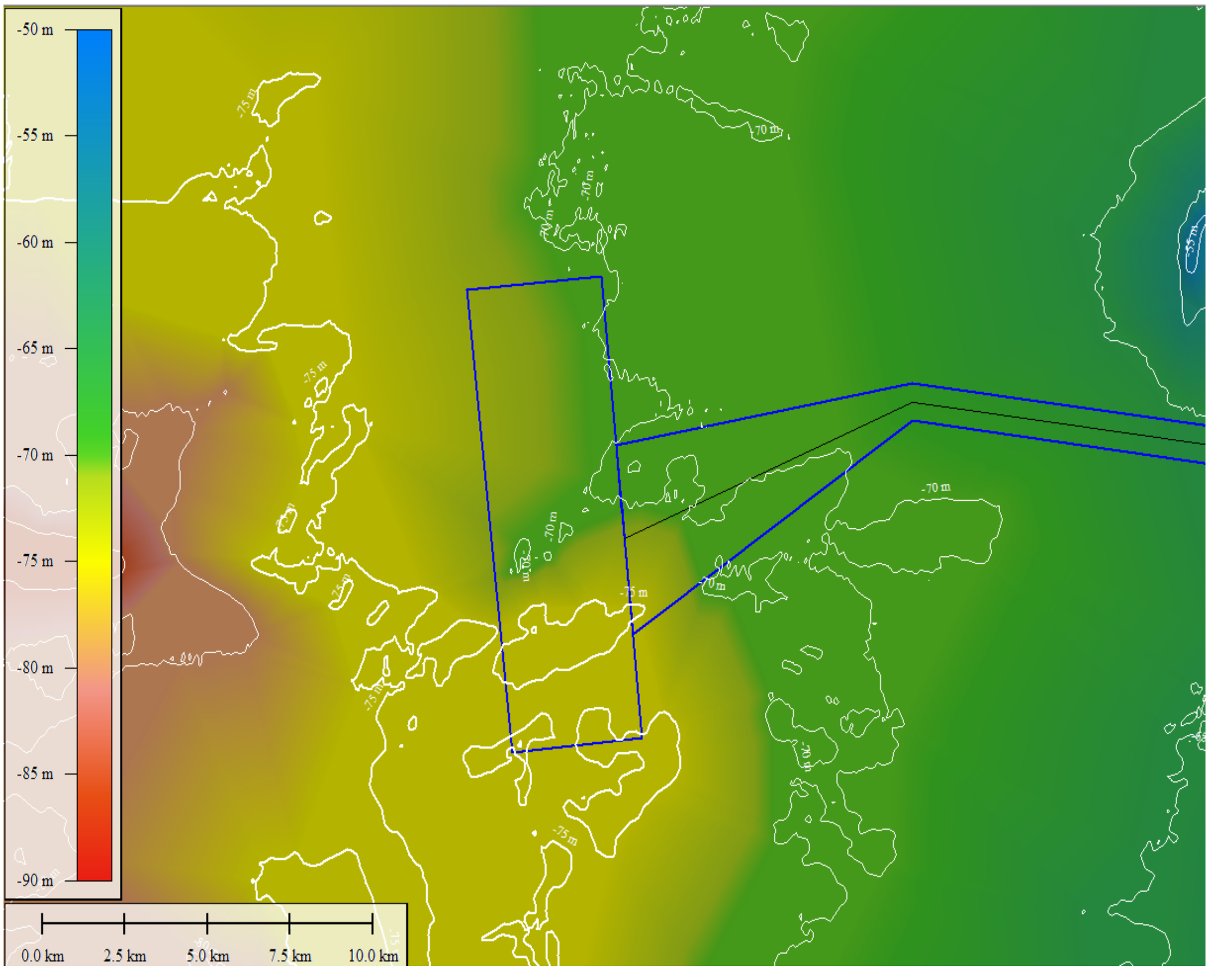

Figure 5-1 Windfarm Site Bathymetry

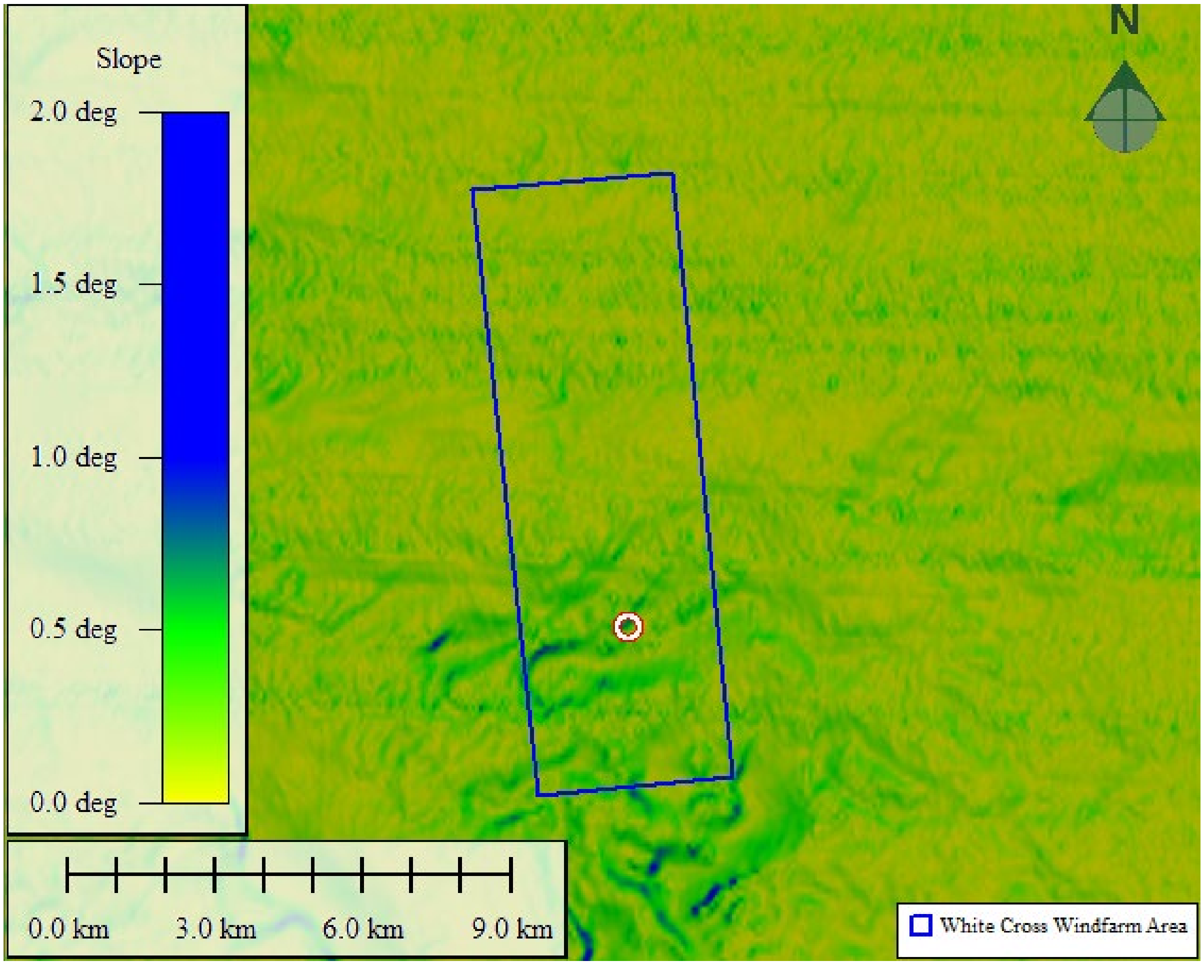

Figure 5-2 Windfarm Site Slope

5.2.2 Seabed Sediment Types

39. Primary and secondary sediment classification for the Windfarm Site is shown in **Figure 5-3**. The site is classified as Sand (Primary), with areas of Coarse sediment (Secondary) throughout. There are known records of occasional boulders, but no records of clays or rocky outcrops.

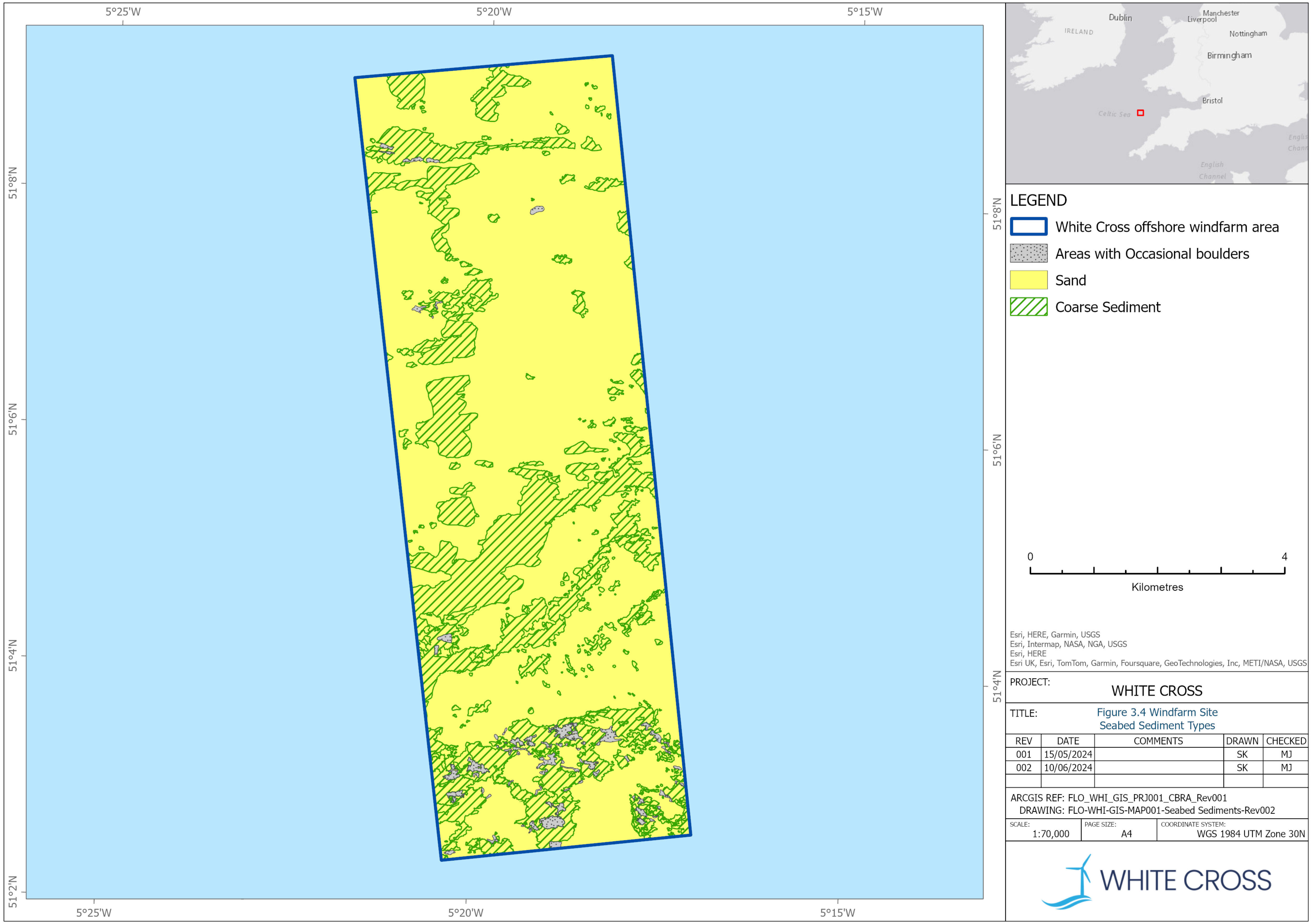

Figure 5-3 Windfarm Site Seabed Sediment Types

5.2.3 Seabed Mobility

40. Detailed assessments of both general sandwave mobility in the offshore development area and global seabed mobility relating to foundations in the Windfarm Site are yet to be performed; however, areas of sand ripples have been identified in the Windfarm Site, as shown in **Figure 5-4**. These formations can be indicative of sediment mobility.

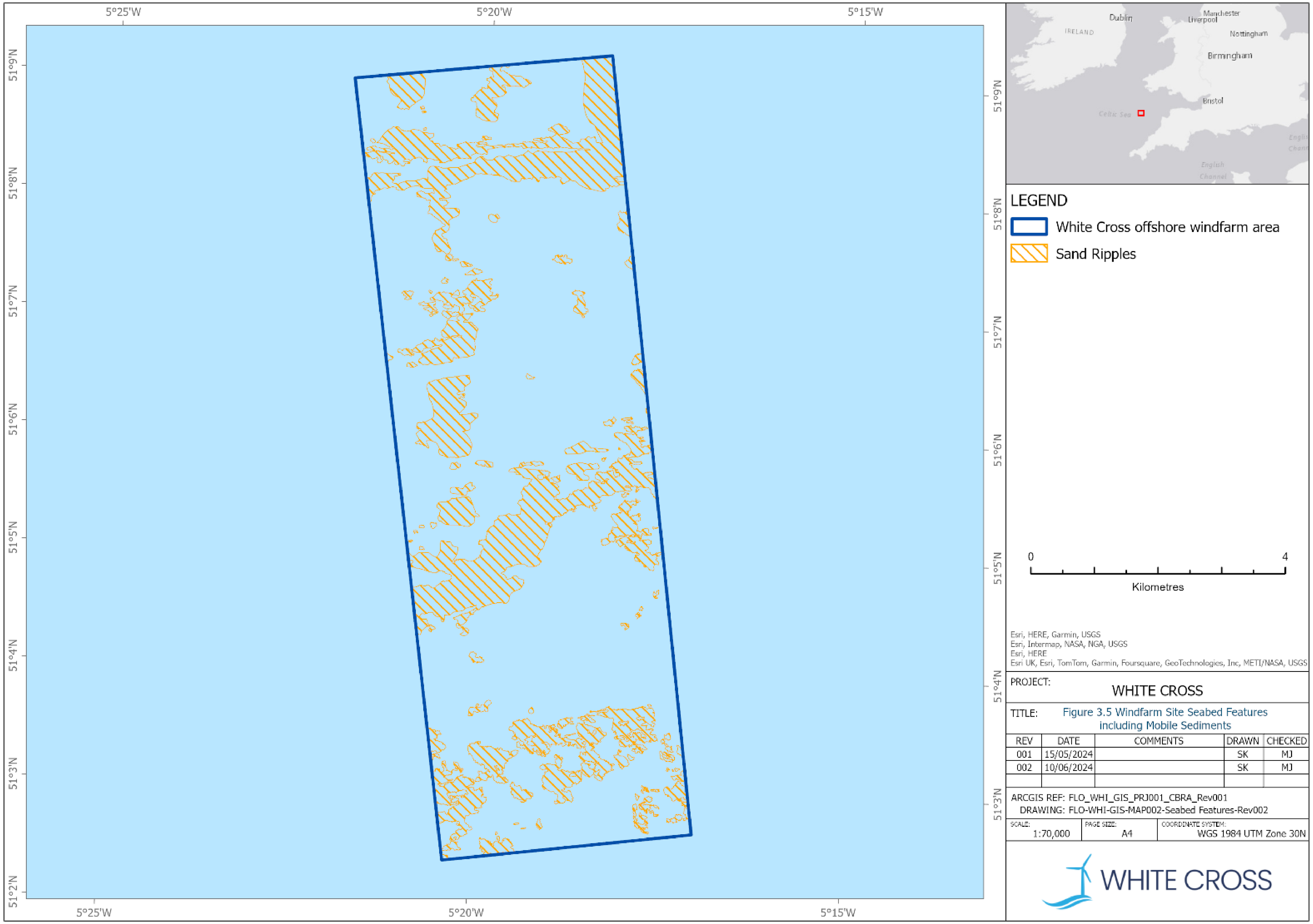

Figure 5-4 Windfarm Site Seabed Features including Mobile Sediments

5.2.4 Third Party Infrastructure

41. There are no existing cables or pipelines reported within the Windfarm Site. There is the proposed Xlinks Morocco-UK Power Project[2] that may traverse the White Cross Windfarm Site if consented, although this project is still in the Pre-Application phase of its Development Consent Order application. Therefore, it has not been considered in this version of the CBRA, and it will be the responsibility for the developer and promoter of that project to undertake a CBRA in relation to their project and to liaise with WCOWL.

5.2.5 UXO

42. The findings of the magnetometer survey indicate a large number of magnetic contacts within the Windfarm Site; these are shown in **Figure 5-5**. There is a possibility that some of these magnetometer contacts may indicate the presence of Unexploded Ordnances (UXOs); a Medium UXO Risk has been identified for Cable Pre-Lay activities and Cable Installation and Burial in areas with water depths greater than 60 m in the Unexploded Ordnance Threat and Risk Assessment [Ref. **3**]. Any sites of potential heritage significance will require avoidance via Archaeological Exclusion Zones (AEZs) or Temporary Archaeological Exclusion Zones (TAEZs).

43. A number of magnetic contacts in the North-East corner of the Windfarm Site indicate that they are part of a linear feature, which may suggest that they could potentially be discarded fishing gear or disused cables. No shipwrecks have been identified within the Windfarm Site.

[2] https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010164

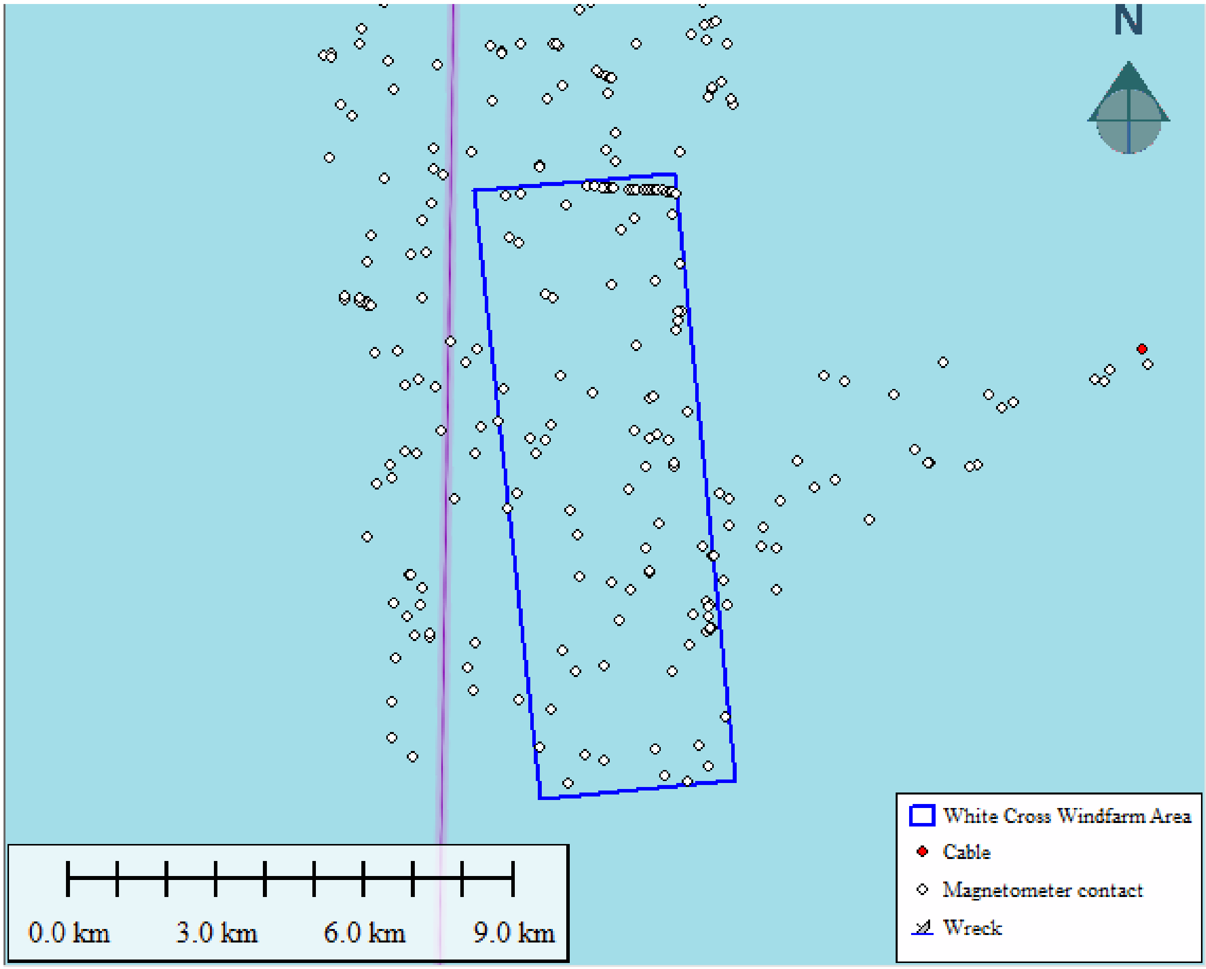

Figure 5-5 Windfarm Site Magnetic Survey Results

5.2.6 Fishing and Shipping

44. Vessel route density data for the Windfarm Site is publicly available via the EMODnet Human Factors project and has been used to inform this version of the CBRA [Ref. **4**]. Vessel monitoring system (VMS) data and/or automatic identification system (AIS) data from the MMO will be used in the final CBRA.

45. Data for 2021 has been used in this study and the resolution of the data is 1km^2. Route Density for all vessel types is presented in **Figure 5-6.**

46. Route Density for Fishing vessels is presented in **Figure 5-7.** This indicates that that some level of fishing activity takes place across the entire Windfarm Site.

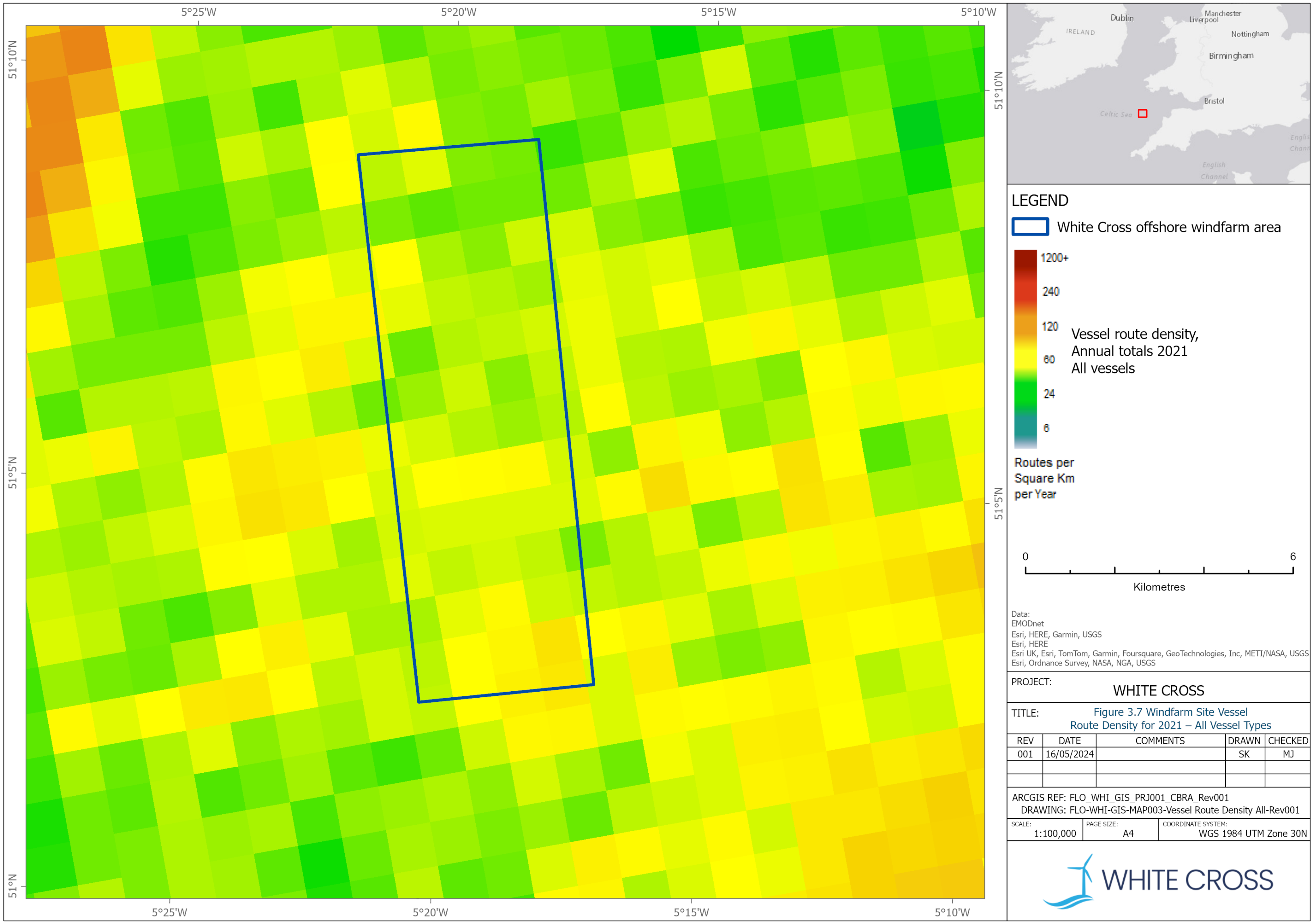

Figure 5-6 White Cross Windfarm Site Vessel Route Density for 2021 – All Vessel Types

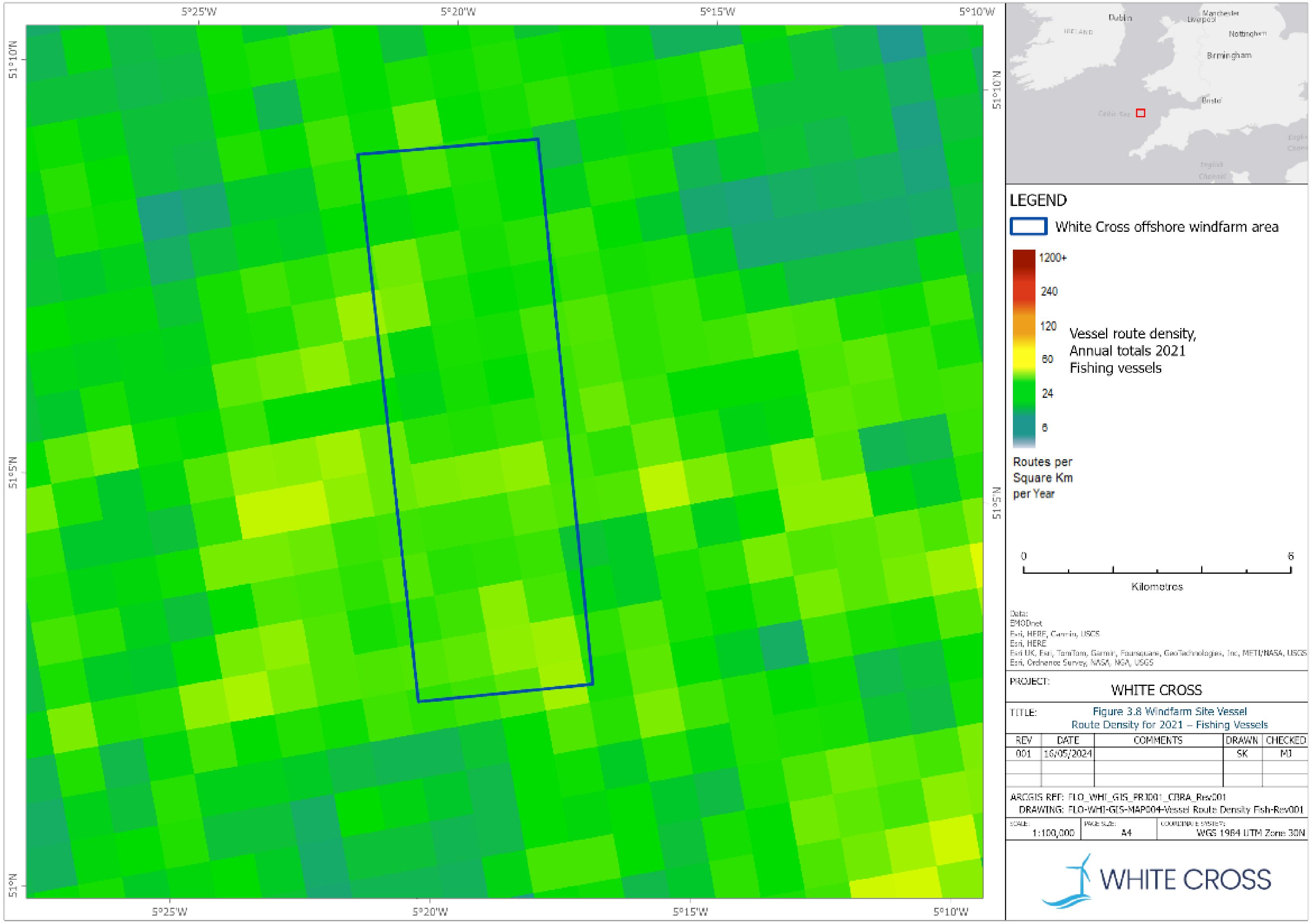

Figure 5-7 Windfarm Site Vessel Route Density for 2021 – Fishing Vessels

5.2.7 Designated Sites and Non-designated Sensitive Habitats

47. Impacts of the Project on designated sites and sensitive habitats have been fully assessed and presented in the following documents as required through the statutory marine licencing process:

- **White Cross Offshore Windfarm Offshore ES** as required under the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended)
- **Appendix 6.A: Combined Report to Inform Appropriate Assessment** (RIAA) of the **Offshore ES** as required under Stage Two of the 'Habitats Regulations' (i.e., formerly The Conservation of Habitats and Species Regulations 2017 (2017 No. 1012) (as amended), and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (2017 No. 1013) (as amended)) – now transposed into The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (2019 No. 579) following the UK's departure from the European Union
- **Appendix 10.A: Marine Conservation Zone Assessment** of the **Offshore ES** as required under the Marine and Coastal Access Act 2009

48. The proposed Windfarm Site does not overlap with any designated sites; as shown in **Figure 5-8** the closest site to the Windfarm Site that is designated for benthic features is the South West Approaches to Bristol Channel Marine Conservation Zone (MCZ), located 8.93km away. The closest Special Area of Conservation (SAC) designated for benthic features is Lundy SAC, located 41.83km from the Windfarm Site (note that the Bristol Channel Approaches SAC is closer but is designated for harbour porpoise and not for benthic features). Therefore, there are not any designated site features that will be directly impacted by cable burial activities within the Windfarm Site.

49. The above documentation also concludes that there are not any significant indirect impacts on designated sites out with the Windfarm Site.

50. As shown in **Figure 5-4** there are various areas of sandbanks and megaripples within the Windfarm Site, albeit undesignated. To date, no evidence has been found for other sensitive habitats, e.g., the presence of reefs, either rocky or biogenic, within the Windfarm Site. However, further geotechnical and geophysical surveys will further characterise the seabed features within the Windfarm Site, and the resultant data will be used to inform updates to this document.

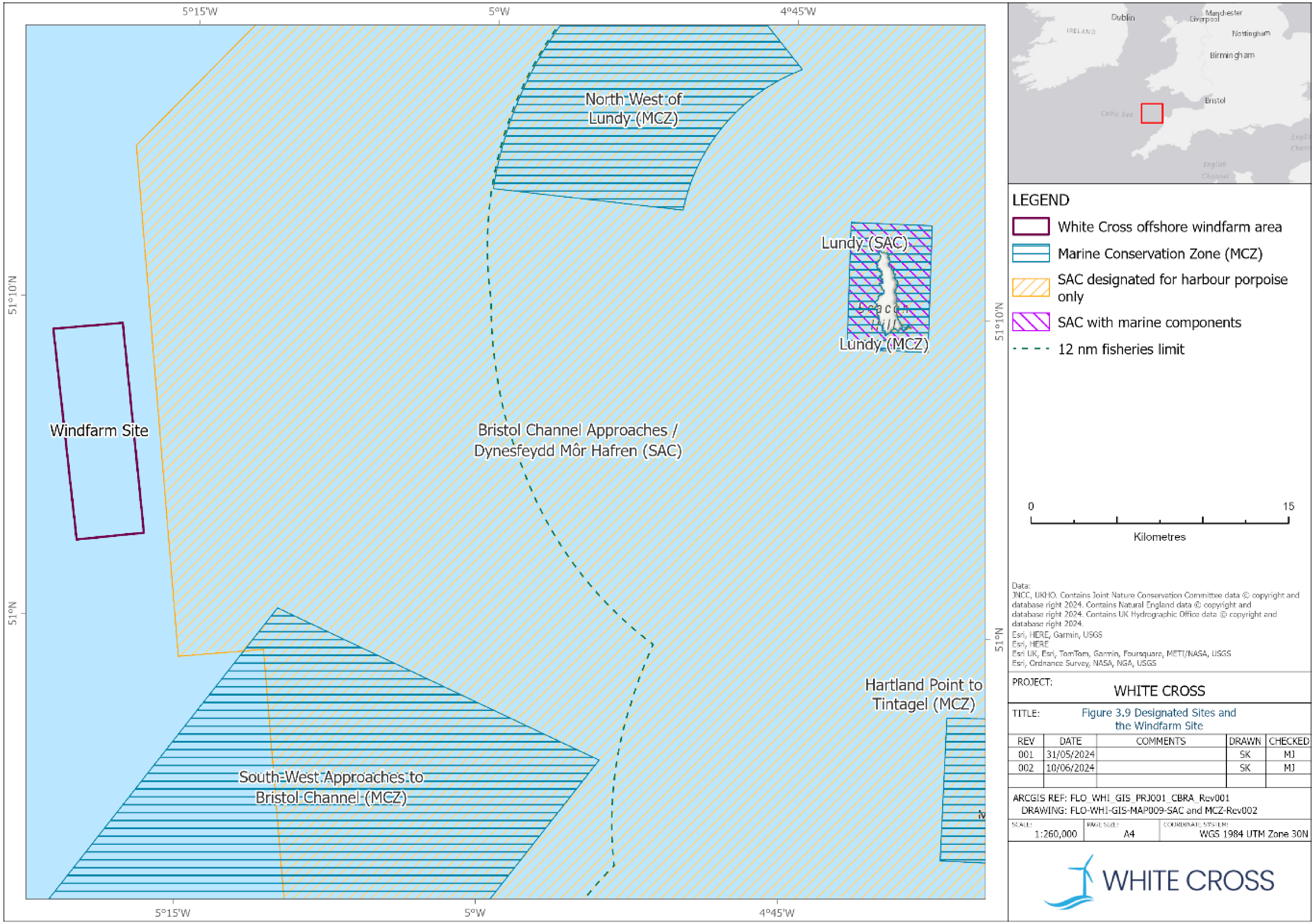

Figure 5-8 Windfarm Site and Designated Sites

5.3 Site Data: Offshore Export Cable Corridor

5.3.1 Bathymetry

51. The water depths along the OECC range from approximately 75m at the offshore end to 0m at MHWS. The bathymetry data used in the study is shown in **Figure 5-9**. Slopes at the site are gentle in general across the majority of the corridor (< 1°); there are some steeper areas corresponding with an area of apparent sandwaves where slopes increase to approx. 3°, as shown in **Figure 5-10**. These slopes should not pose a challenge for cable burial using standard trenching equipment.

52. **Figure 5-9** and **Figure 5-10** show a 'funnelling' of the western end of OECC (i.e., where it meets the Windfarm Site). This is to allow greater flexibility in the final location of the export cable to take account of micro-siting of WTG and offshore substation placement around sensitive habitats and seabed soil types. The final location of the turbines within the Windfarm Site is yet to be decided (it is known that the turbines and their associated subsea infrastructure will only require up to 20% of the Windfarm Site area); therefore, it will be necessary to also consider alternative export cable locations (within the funnel of the OECC) during project refinement in response to the final location of the turbines.

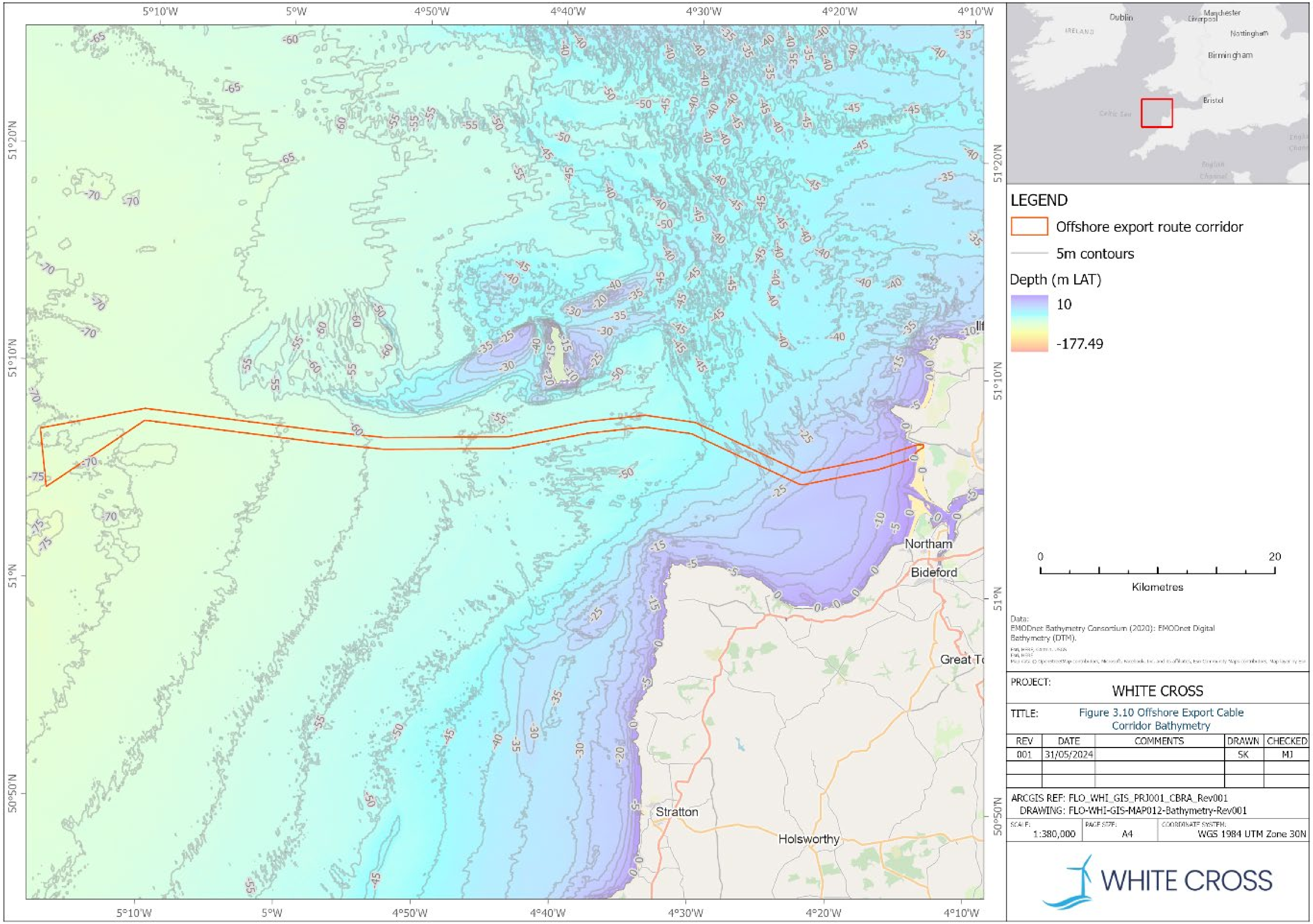

Figure 5-9 Offshore Export Cable Corridor Bathymetry

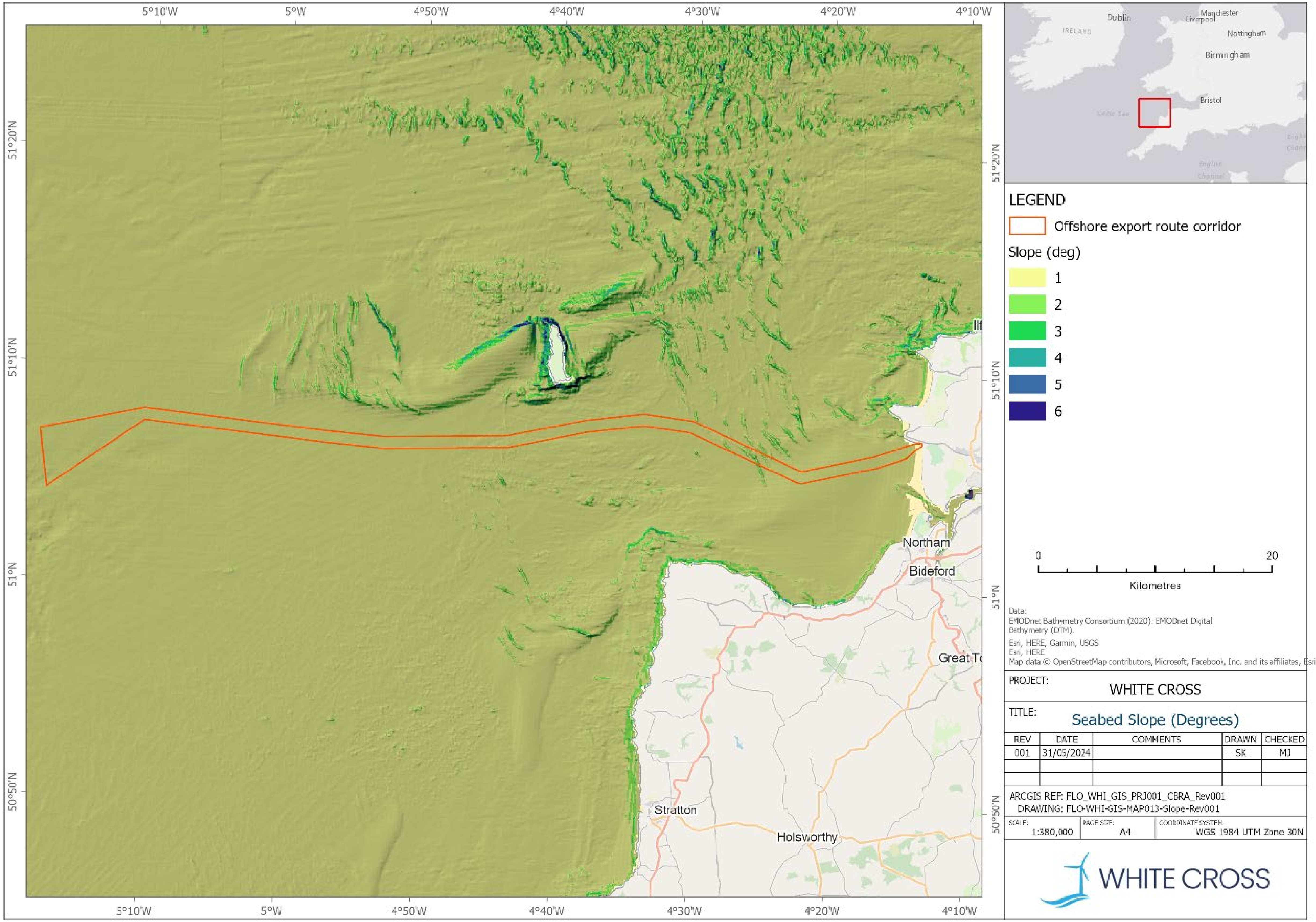

Figure 5-10 Offshore Export Cable Corridor Slope

5.3.2 Seabed Sediment Types

53. Primary and secondary sediment classification for the OECC is shown in **Figure 5-11**. The majority of the corridor is classified as Sand, with some areas of Rocky seabed or Clayey-Sand (Primary); there are areas of Coarse sediment (Secondary) towards the offshore end of the corridor. The rocky area is exposed bedrock, as confirmed in the Phase 1 geophysical survey report [Ref. 7], which may pose a challenge for cable burial depending on the strength of the rock and therefore require external cable protection (see **Section 6.4.4**. There are also some records of occasional boulders.

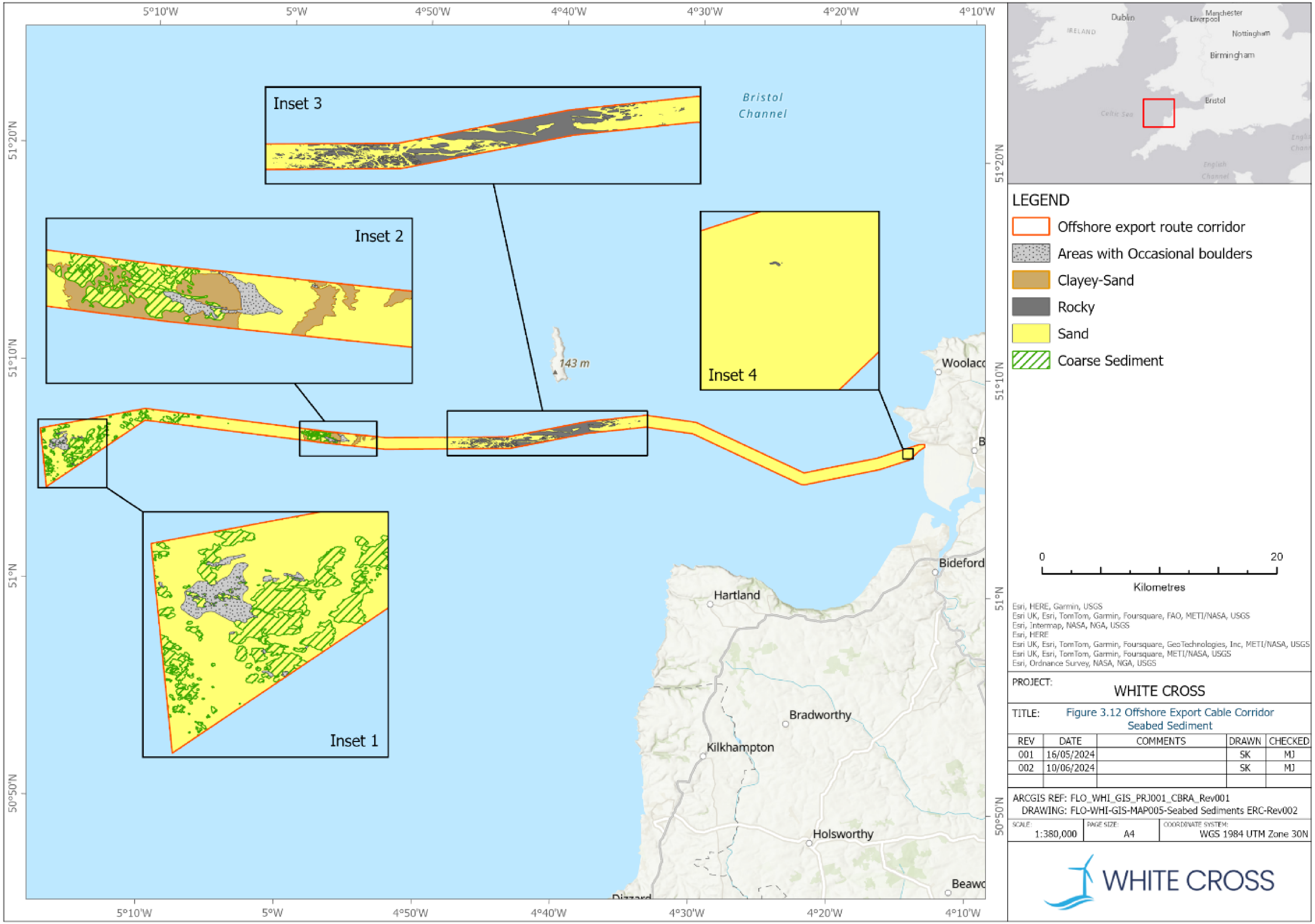

Figure 5-11 Offshore Export Cable Corridor Seabed Sediment

5.3.3 Seabed Mobility

54. Detailed assessments of both general sandwave mobility in the offshore development area have yet to be performed; however, areas of sand ripples, mega ripples and sand waves have been identified in the OECC, as shown in **Figure 5-12**. These formations can be indicative of sediment mobility.

55. Some areas of foul ground are identified on the OECC Route. These areas do not coincide with the presently assumed route (centreline of Export Cable corridor) and should be avoided in any re-routing.

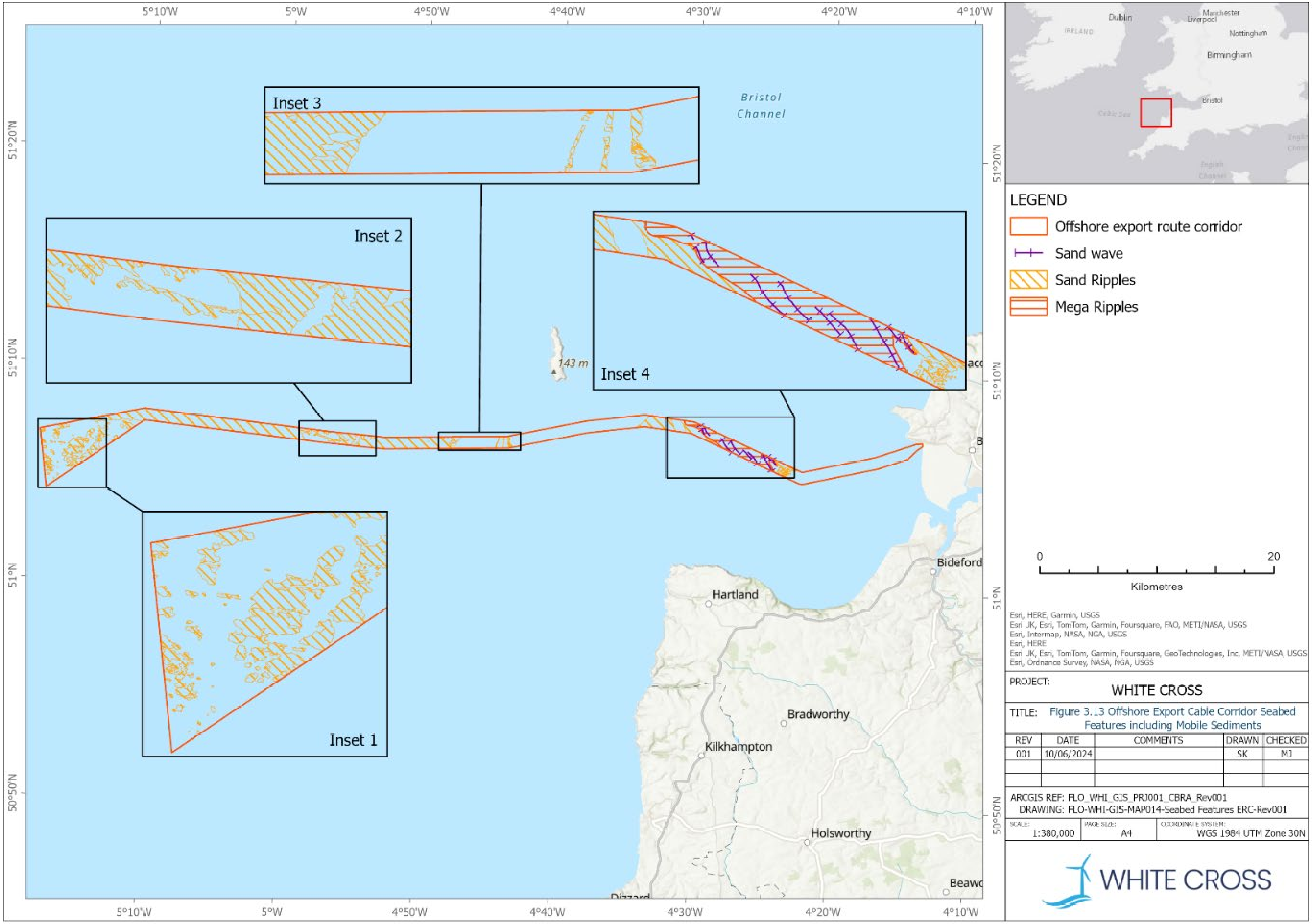

Figure 5-12 Offshore Export Cable Corridor Seabed Features including Mobile Sediment

5.3.4 Third Party Infrastructure

56. There are four existing third-party cables on the seabed intersecting the OECC, comprising three in-service and one out-of-service telecommunication cables as shown in **Figure 5-13** and detailed in **Table 5-2.** These existing cables will have to be crossed by the White Cross offshore export cables.

57. Crossing agreements will be entered into by WCOWL and the existing cable owners or operators, with the installation techniques discussed and agreed to ensure the integrity of the existing infrastructure and any new cables associated with the Project. A summary of the different cable protection methodologies that could be employed are provided in Section 4.2 of the Outline Cable Specification and Installation Plan (WHX001-FLO-CON-ENV-PLN-0007).

Table 5-2 Key Cable Properties of existing third party infrastructure

Cable	Status	Owner / Operator	Ready for Service / Operation	Expected / Actual End of Service	Landfall Locations
TATA Western Europe	In-service	TATA Communications	2002	2027	Saunton (UK) and Bilbao (Spain)
TATA Atlantic South	In-service	TATA Communications	2001	2026	Saunton (UK) and New Jersey (USA)
TAT 11	Out-of-service	Vodafone	1993	2003	Oxwich Bay, Swansea (UK), Saint-Hilaire-de-Riez, (France) and New Jersey (USA)
UK-Ireland Crossing 2 (aka Pan-European Crossing)	In-service	Lumen Technologies (previously Century Link)	2000	2025	Bude, UK and Ballinesker, Ireland
TATA Western Europe	In-service	TATA Communications	2002	2027	Saunton (UK) and Bilbao (Spain)

WHITE CROSS

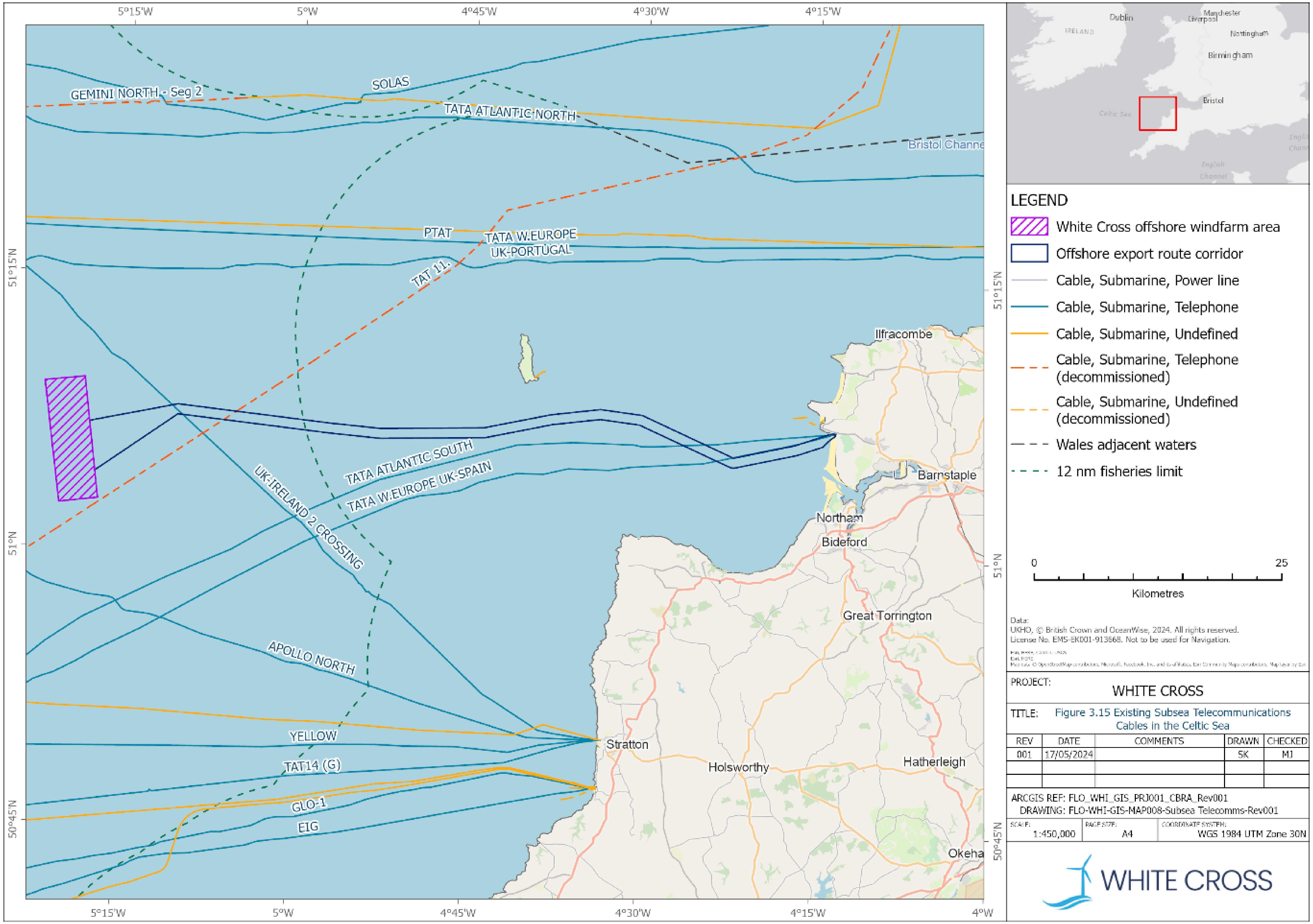

Figure 5-13 Existing Subsea Telecommunications Cables in the Celtic Sea

58. The three cables listed in **Table 5-3** will be installed prior to the construction of the White Cross project. All three cables are expected to make landfall at Bude, to the south the White Cross project, and therefore it is anticipated that there will be no interaction and no requirement for proximity or crossing agreements.

Table 5-3 Key Cable Properties of third party infrastructure not expected to interact with WCOW

Cable	Status	Owner / Operator	Ready for Service / Operation	Expected / Actual End of Service	Landfall Locations
Grace Hopper	Future	Google	2022	2047	Bude (UK) and Bilbao (Spain)
2Africa	Future	Consortium of Facebook, Vodafone, and others	2023	2048	Bude (UK) and Carcavelos, Lisbon (Portugal)
Amitie	Future	Consortium of Facebook, Vodafone, Microsoft, and others	2022	2047	Bude (UK), Le Porge (France) and Lynn (USA)

5.3.5 UXO

59. The findings of the magnetometer survey [Ref. 7] indicate a large number of magnetic contacts within the OECC, in particular to the South of Lundy Island (coinciding with a WWI German Minefield [Ref. 3]); these are shown in **Figure 5-14**. There is a strong possibility that some of these magnetometer contacts may indicate the presence of Unexploded Ordnance (UXOs); a High UXO Risk has been identified for Cable Pre-Lay activities and Cable Installation and Burial in the offshore and nearshore areas in the Unexploded Ordnance Threat and Risk Assessment [Ref. **3**].

60. A single shipwreck has been identified within the OECC, which may be a munitions related wreck. If it is found that that this is likely associated with WWI or WWII, it would be afforded protection under the Protection of Military Remains Act 1986. Further, any sites of potential heritage significance will require avoidance via AEZs or TAEZs. These sites may also require further investigation to determine the need for archaeological recovery/documentation in accordance with the draft Written Scheme of Investigation (WSI) (Appendix 16.B of the Offshore ES). The WSI will be produced in consultation with Historic England and in accordance with industry

standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

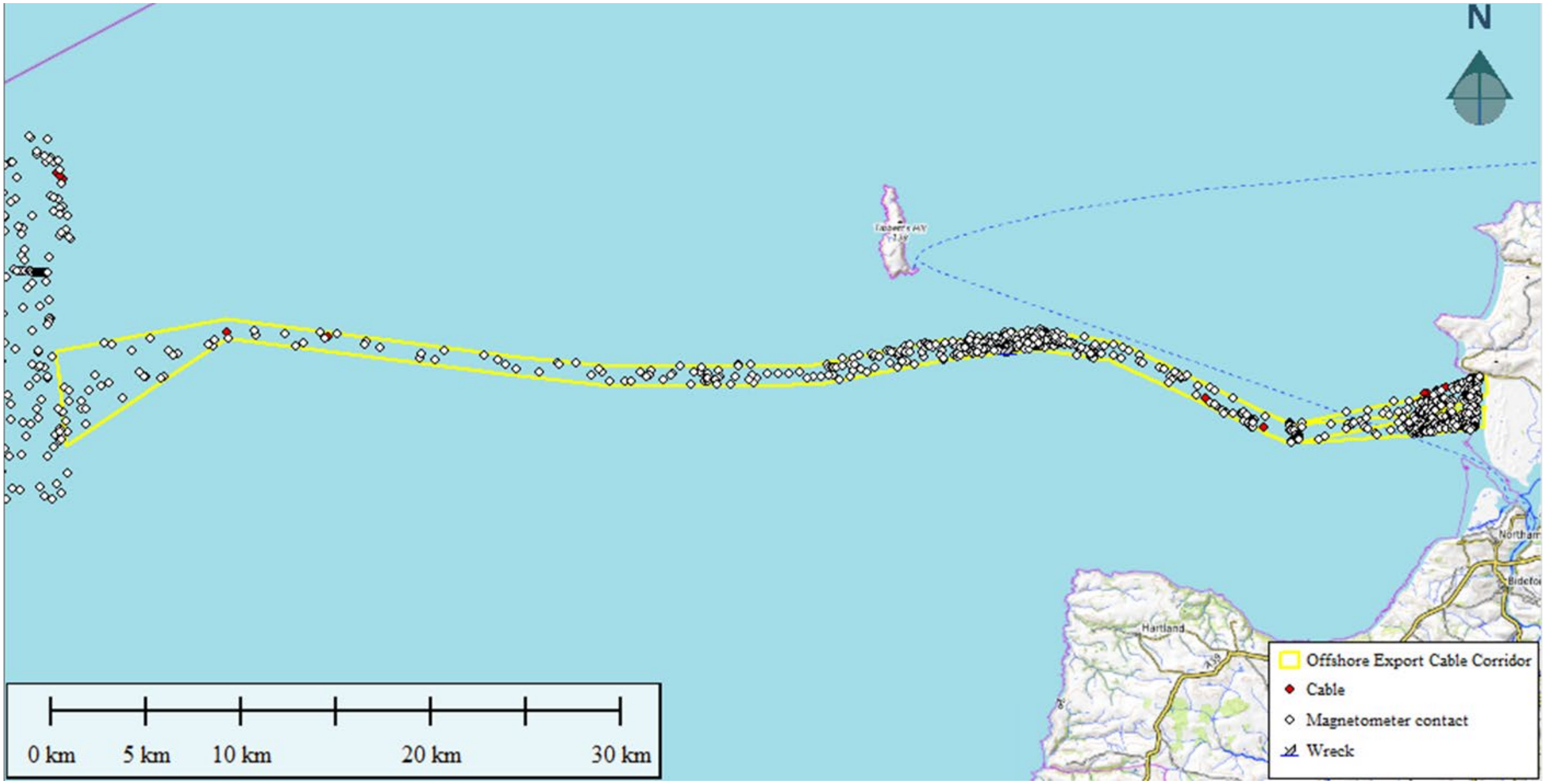

Figure 5-14 Offshore Export Cable Corridor Magnetic Survey Results

5.3.6 Fishing and Shipping

61. Vessel route density data for the Windfarm Site is publicly available via the EMODnet Human Factors project [Ref. **4**].

62. Data for 2021 has been used in this study and the resolution of the data is $1km^2$. Route Density for all vessel types is presented in **Figure 5-15**.

63. Route Density for Fishing vessels is presented in **Figure 5-16**. This indicates that some level of fishing activity takes place across the OECC.

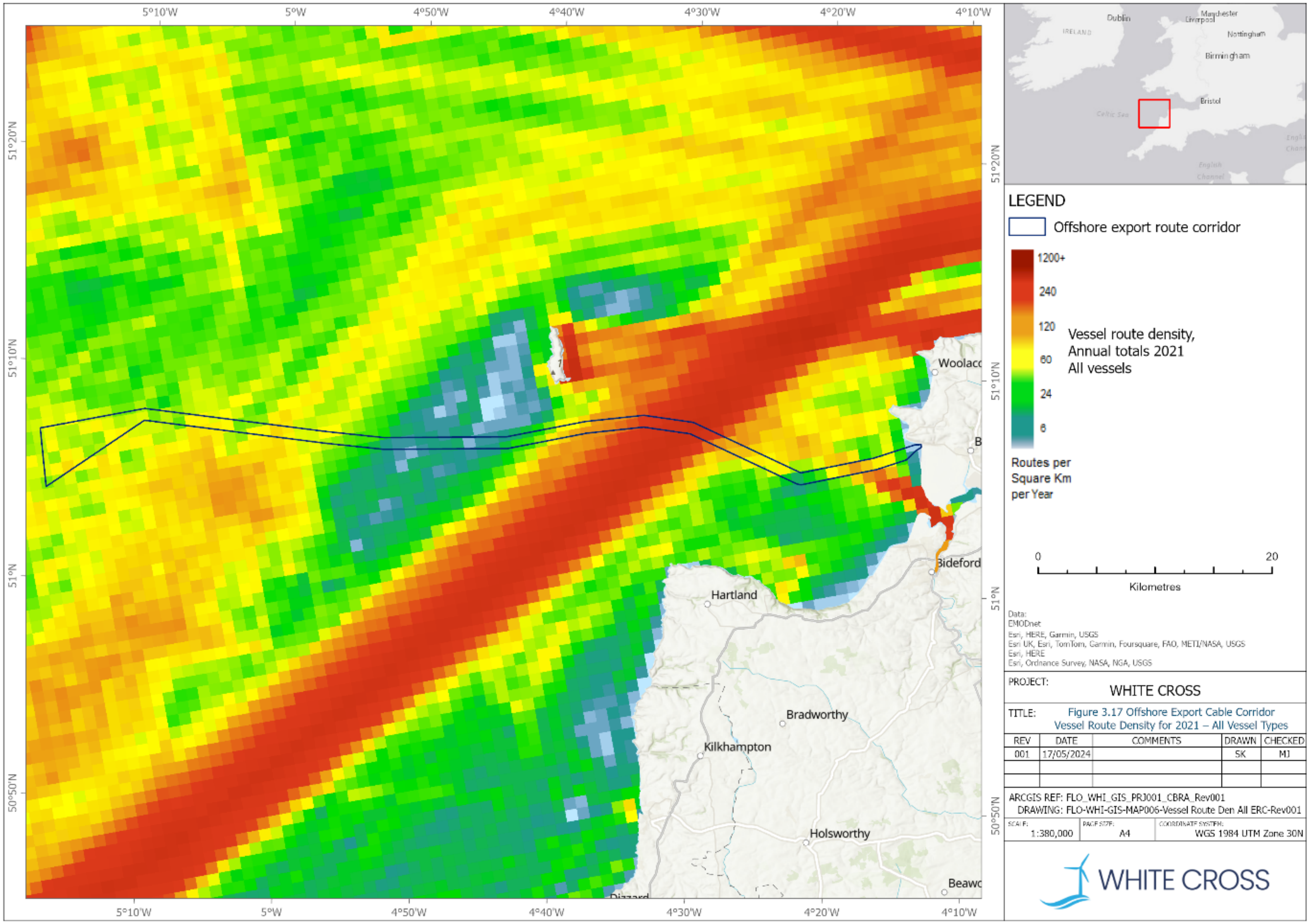

Figure 5-15 Offshore Export Cable Corridor Vessel Route Density for 2021 – All Vessel Types

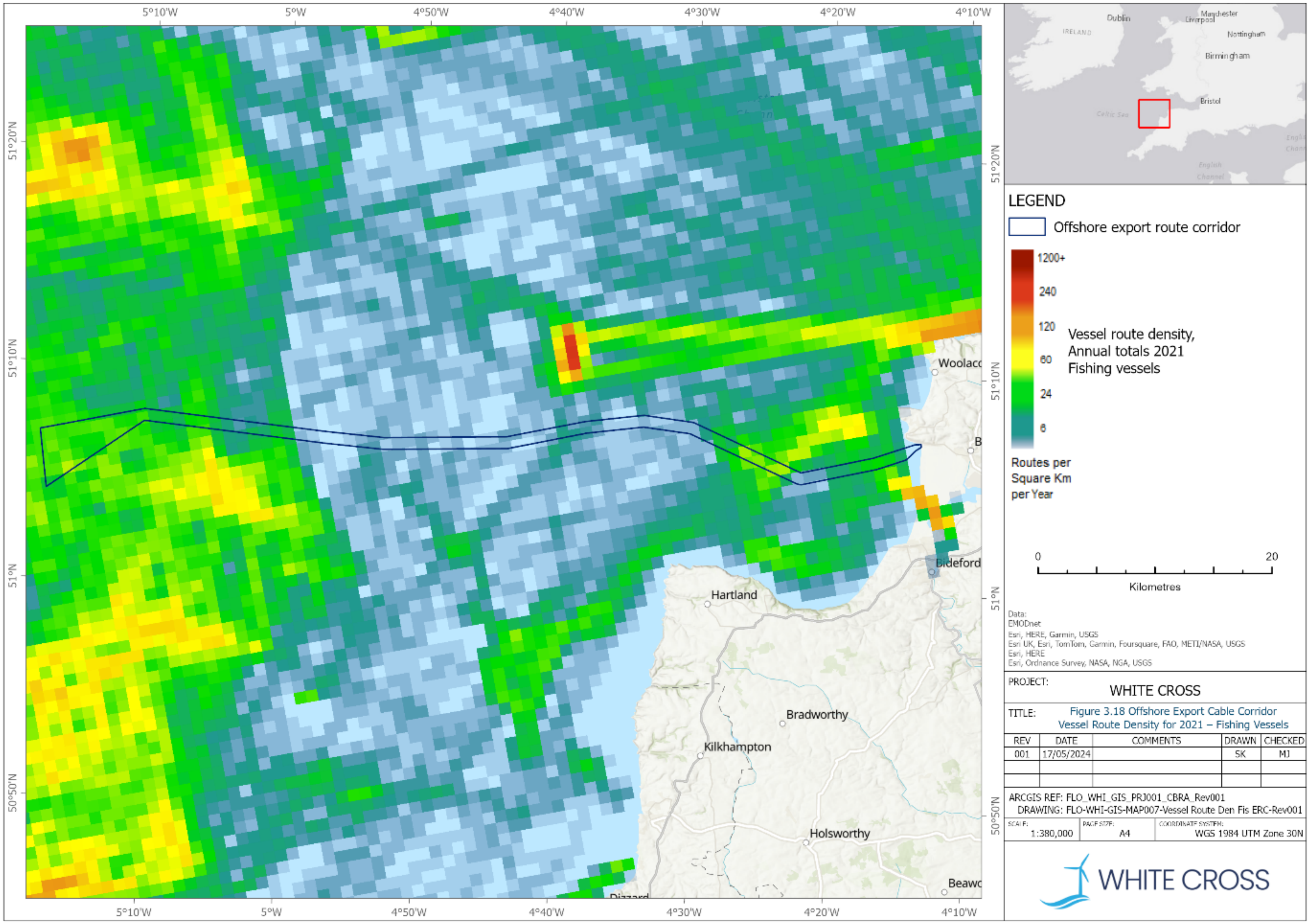

Figure 5-16 Offshore Export Cable Corridor Vessel Route Density for 2021 – Fishing Vessels

5.3.7 Designated Sites and Non-designated Sensitive Habitats

64. **Figure 5-17** shows that the proposed OECC overlaps with two sites designated for benthic features where the OECC nears landfall: Bideford to Foreland Point MCZ and Braunton Burrows SAC; and one site designated for non-benthic features in the offshore section of the OECC (Bristol Channel Approaches SAC which is designated for harbour porpoise). Given that the full assessment of impacts on all designated sites (including those that are not designated for benthic features) is presented in the documentation outlined in **Section 5.2.7**, this document only discusses the cable burial risks associated with sites designated for benthic features and by which direct impacts can occur from cable burial methods (i.e., only Bideford to Foreland Point MCZ and Branton Burrows SAC). Therefore, Bristol Channel Approaches SAC is not considered in this document.

65. **Table 5-4** summarises the benthic features for which Bideford to Foreland Point MCZ and Branton Burrows SAC are designated. It also presents the conclusions of **Appendix 6.A: Combined Report to Inform Appropriate Assessment** (of the **Offshore ES**) and the MCZ Assessment (**Appendix 10.A: MCZ Assessment** of the **Offshore ES**) for each site. This demonstrates why potential risks from cable burial activities would not hinder an MCZ achieving its conservation objectives or cause any adverse effect on an SAC's site integrity.

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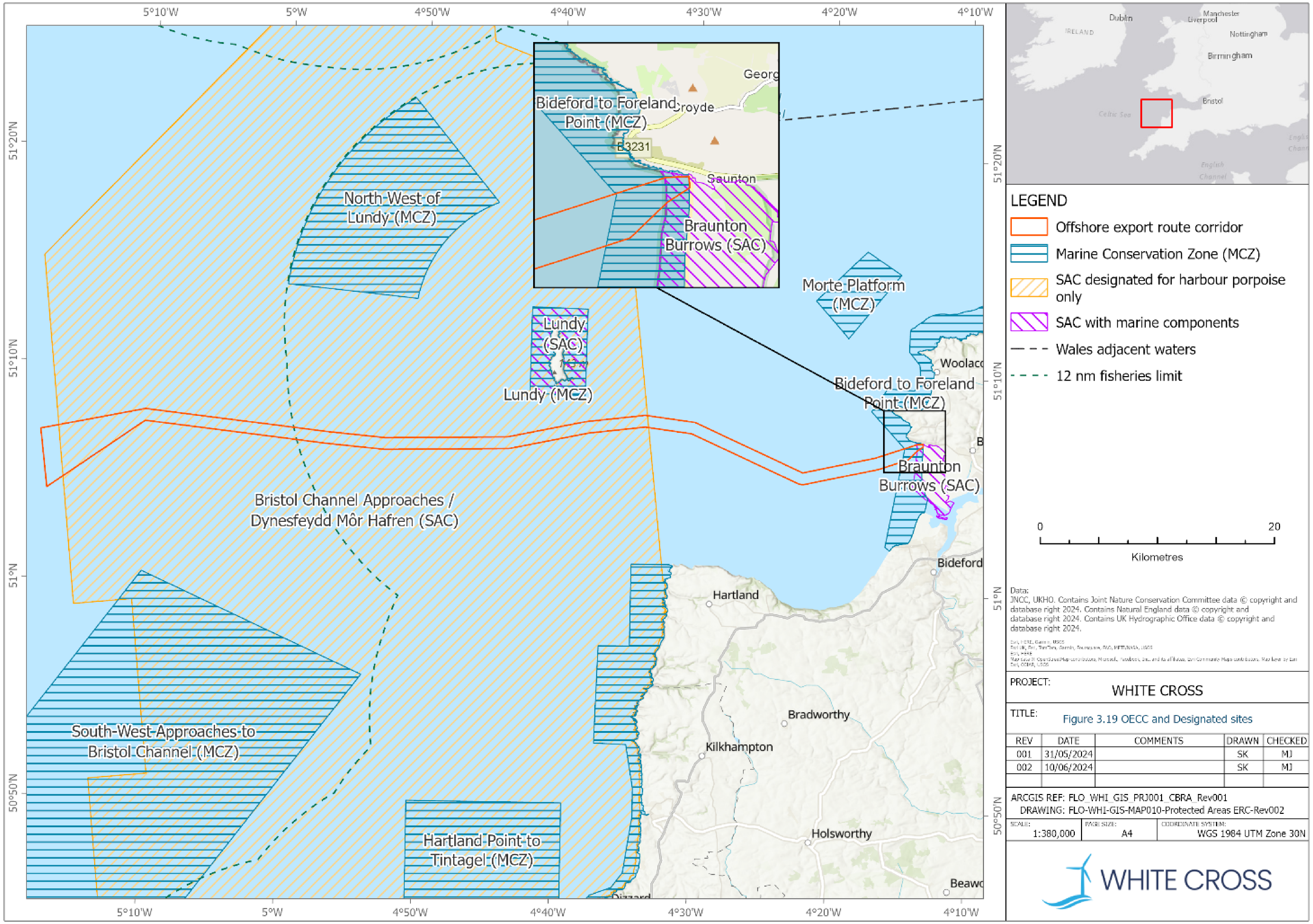


Figure 5-17 Offshore Export Cable Corridor and Designated Sites

Table 5-4 OECC: summaries of the assessment of direct cable burial risks to benthic qualifying features of relevant designated sites

Feature	Assessment conclusion
Bideford to Foreland Point MCZ	
• **Intertidal coarse sediment** • **Intertidal mixed sediments** • **Intertidal sand and muddy sand** • **Subtidal coarse sediment** • **Subtidal mixed sediments** • **Subtidal sand** • **Spiny lobster** • ***Sabellaria alveolata* reefs** • **Fragile sponge and anthozoan communities on subtidal rocky habitats** • **Pink sea-fan, *Eunicella verrucosa***	The Project has made a commitment to avoid installing cable protection within the boundary of this MCZ. Given that Spiny lobster, *Sabellaria alveolata* reefs, fragile sponge and anthozoan communities on subtidal rocky habitats and pink sea-fan, *Eunicella verrucosa* have not been recorded in the offshore survey area, the only potential risks to this site are on sediment features. The risks come from temporary physical disturbance from trenching, increased suspended sediment concentration (contaminated or otherwise), and the introduction of invasive non-native species. The area of overlap of the OECC and MCZ is minimal at 0.045ha, and the habitats that could be affected are known to be highly resilient to disturbance, with the seabed returning to its pre-construction state within two years. Redeposition of suspended sediments will be local to the construction activity and is unlikely to change sediment composition and distribution. Furthermore, increases in SSCs will be localised, short term and within the natural range of turbidity. Where exceedances of sediment contamination guidelines occur, these are marginal (i.e., only just above the lower guideline level value) which indicates that there is minimal risk to the marine environment and these exceedances are located in a discreet area within the OECC. Works within this area will be short term, lasting the duration of the cable installation only. Lastly, the risk of introducing and spreading INNS during cable burial activities will be managed via measures outlined in the **Outline Invasive Non-Native Species Management Plan** (WHX001-FLO-CON-ENV-PLN-0009) submitted as part of the **Further Environmental Information**. ***Therefore, it is considered that the conservation objectives of the MCZ features will not be hindered by cable burial activities.***
Braunton Burrows SAC	
1140 Mudflats and sandflats not covered by seawater at low tide	The intertidal sandflats (Annex 1 habitat 1140 Mudflats and sandflats not covered by seawater at low tide) of the Braunton Burrows SAC and their communities would not be disturbed or experience any form of permanent alteration to habitat, or geomorphological and physical processes as a result of the buried cable: rather these are all temporary changes (see the Outline Cable Landfall Plan (WHX001-

Feature	Assessment conclusion
	FLO-CON-DES-PDE-0001). Therefore, no permanent change would occur. Overall, the Project alone would not prevent the achievement of the site's conservation objectives, therefore there would be no potential for an adverse effect on the integrity of the Braunton Burrows SAC as a result of habitat loss. Furthermore, any disturbance would be very short term and impacts are likely to be minor and unlikely to be measurable above background levels of disturbance from tides and storms.

5.3.8 Non-designated sensitive habitats

66. As shown in **Figure 5-12** there are various areas of sandbanks and megaripples within the OECC, albeit undesignated. There are records of Annex I bedrock and/or stony reef present along the coastline within the OECC. However, no biogenic reef habitat was observed in the OECC despite individuals of Ross worm *Sabellaria spinulosa* being found, since these were not deemed to meet the reef qualifying criteria.

67. Similarly, the pink sea fan *Eunicella verrucosa* was not recorded or identified in imagery analysed during the offshore survey, despite it being considered as locally common. This is likely to be because pink sea fan occurs only on bedrock or boulders and this substrate is of limited distribution within the offshore survey area.

68. As for the Windfarm Site, further surveys will further characterise the seabed features within the OECC. If any sensitive features are identified in future surveys, 'micro-siting' would be considered where possible to avoid these areas.

5.4 CBRA Parameters

69. The inputs relating to the CBRA method are described in this section.

5.4.1 Vessel data

70. The shipping data available from EMODnet is high-level, with a resolution of 1km × 1 km. Vessel route density data is available for the following vessel types:

- Cargo
- Tanker
- Passenger
- Fishing

- Other

71. This assessment considers the total vessel route density to be assigned to the largest vessel type present in each segment of the cable route. The assumed Dead Weigh Tonnage (DWT) for each vessel type used in this assessment is presented in **Table 5-5**. Based on the assumed DWT, anchor sizes are extracted from **Figure 5-18** and in turn the seabed penetration depth can be obtained using the factors in **Figure 5-19**.

Table 5-5 Explanation of Specified Vessel DWT

Vessel Type	Approx. Vessel Type DWT	Explanation / Source
Cargo	75,000	Based on largest Cargo vessel present in Bristol Channel on Marine Traffic on 23/11/22. (Vessel Name: Saga Fortune)
Tanker	50,000	Based on largest Tanker present in Bristol Channel on Marine Traffic on 23/11/22. (Vessel Name: UOG Phoenix)
Passenger	2,000	Based on Passenger vessel on route Bideford – Lundy Island (Vessel Name: MS Oldenburg)

DWT Class (tons)			ANCHOR WEIGHT (kg)	FLUKE LENGTH (m)
min	max	DWT (tons)		
0	1000	0-1,000	718	0.92
1000	1500	1,000-1,500	846	0.96
1500	2000	1,500-2,000	973	1.00
2000	5000	2,000-5,000	1695	1.20
5000	10000	5,000-10,000	2771	1.46
10000	15000	10,000-15,000	4100	1.74
15000	20000	15,000-20,000	5216	1.93
20000	40000	20,000-40,000	7862	2.27
40000	50000	40,000-50,000	9042	2.37
50000	75000	50,000-75,000	11615	2.52
75000	100000	75,000-100,000	13702	2.60
100000	150000	100,000-150,000	16697	2.69
150000	200000	150,000-200,000	18582	2.76
200000	250000	200,000-250,000	19912	2.83
250000	300000	250,000-300,000	21242	2.92
300000	350000	300,000-350,000	23230	3.10
350000	400000	350,000-400,000	26250	3.60
-	-	Unspecified	-	-

Figure 5-18 Anchor Sizing by Vessel DWT

Soil Type	Seabed Penetration Depth (× fluke length)
Rock > 1MPa	0.25
Grainy soils and riprap	0.5
Stiff clays > 150kPa	0.5
Sandy soils	1
Soft to firm clays from 40 to 150kPa	1.5
Very soft clays < 40kPa	4

Figure 5-19 Seabed Penetration by Soil Type

72. The distance travelled by a dragged anchor (D_{ship}) is assumed to be the distance relating to the segment (1,000 m) for all vessel routes traversing that segment, i.e., the route density × 1,000m.

73. The velocity of the vessel on deployment of an anchor (V_{ship}) is assumed to be 4 knots, as per recommended value in CBRA documentation when no suitable data is available [Ref. **1**].

5.4.2 Nominal Seabed

74. The nominal seabed or mean seabed level, relative to which burial depths are provided, is assumed at this time to be represented by the seabed. This assumption may need to be adjusted if sediments in the area are found to be significantly mobile.

5.4.3 Water Depth Classification

75. The sample water depth classification table provided in the CBRA guidance document has been applied in this study for the determination of P_{WD} and is reproduced in **Figure 5-20**. **Figure 5-21** presents the WCOW water depths according to the by CBRA Water Depth Classification Guidance for PWD.

76. No anchorages have been identified within or very close to the project area.

77. The project area is considered to be open sea, i.e., not within a geographically constrained shipping channel.

Vessel deadweight, DWT (t)	2,000	5,000	20,000
Vessel draft	4.0	6.0	10.0
Water Depth/Profile	Probability Modifier		
Water Depth Greater than e.g. 50m	0	0	0.1
Water Depth between e.g. 30m and 50m	0.0	0.1	0.3
Water Depth between e.g. 10m and 30m	0.3	0.5	0.9
Wide Shipping Channel with shallow water at margins	0.2	0.5	0.6
Narrow Shipping Channel with shallow water at margins	0.3	0.7	0.9
Proximity of a designated anchorage	0.9	0.9	0.9

Figure 5-20 Water Depth Classification Guidance for PWD [Ref. 2]

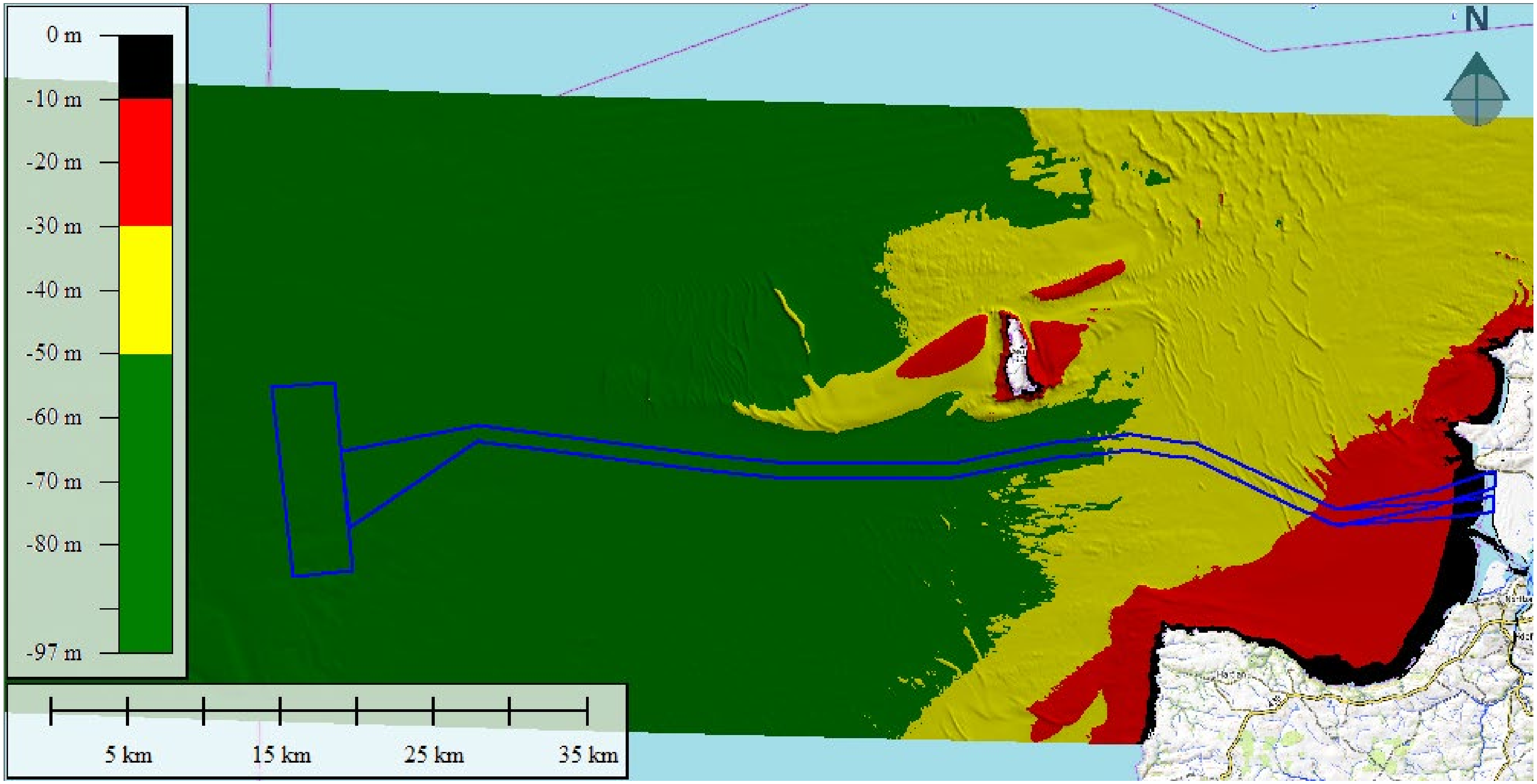


Figure 5-21 White Cross Site Water Depths by CBRA Classification

5.4.4 $P_{incident}$

78. There are a number of published failure rates included in the CBRA methodology, among them a "Probability of loss of control on board a ship when on collision course per pass" of 2.0×10^{-4}, as published in DNV-RP-F107. This value is used as the probability of an incident occurring requiring deployment of an anchor ($P_{incident}$) in the present study. It is noted that the selection of $P_{incident}$ has a significant influence on the results of the anchor strike probability calculation. **Figure 5-22** shows $P_{incident}$ Values Published in CBRA Methodology.

Table 7 Example of Failure rates and return periods from the literature

Reference	Probability per vessel per year	Return period (years)
DNV-RP-F107: Probability of loss of control onboard a ship when on collision course per pass (main reasons no crew on bridge, negligent/tired/drunk crew, accident or radar failure/poor visibility)	$2x10^{-4}$	5000
DNV-RP-F107: Machinery breakdown for single engine tankers in the north sea	$1.75x10^{-1}$	5.7
Kristoffersen & Monnier (1997) (SAFECO)	2.5x10-4	4000
DNV for Marine Coastguard Agency Probability of engine failure	$1.5x10^{-4}$	6667
Southampton Solent University, 15 years of Shipping Accidents: A review for WWF Average vessel loss rate per year (1997 to 2011)	$1.43x10^{-3}$	700
IMO, International Shipping Facts and Figures Average vessel loss rate per year (2006 to 2010)	$1.44x10^{-3}$	694
OGP Total loss per ship per year	$3x10^{-3}$	333

Figure 5-22 $P_{incident}$ Values Published in CBRA Methodology [Ref.2]

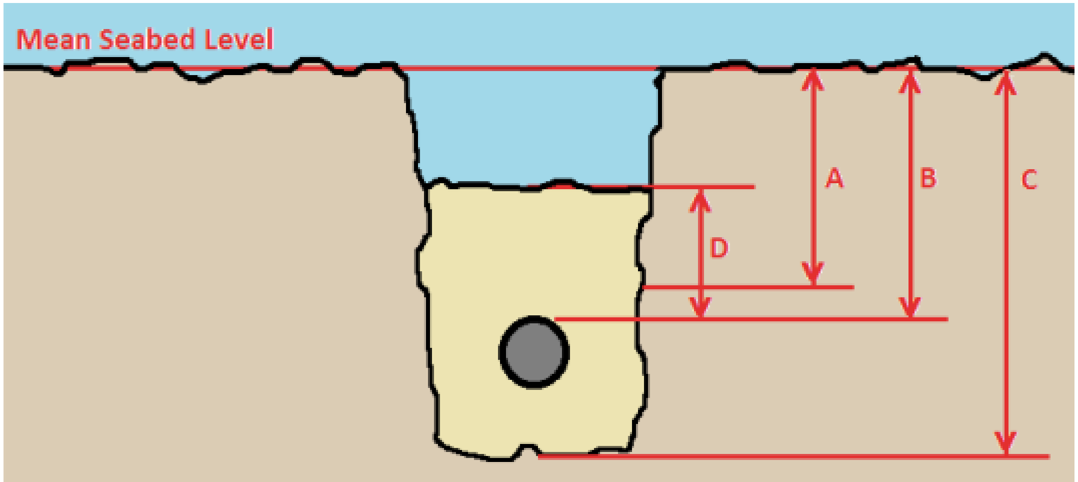
5.4.5 $P_{traffic}$

79. A value of 1 for $P_{traffic}$ has been applied and represents a desire to protect cables from all vessels. The CBRA methodology allows for a lower value to be applied, if a project decision was made to protect from a lower percentile of vessels, e.g., 0.9 for 90th percentile.

5.4.6 Limits on Depth of Lowering

80. The project nominal trench depth is 1.5 m. Depth of lowering (DOL) to top of cable can be calculated by subtracting the cable diameter from the trench depth, as illustrated in **Figure 5-23**.

81. The maximum single pass trench depth is assumed to be 1.5 m for the purposes of this CBRA.



A	**Recommended Minimum Depth of Lowering**
B	**Target Depth of Lowering**
C	**Target Trench Depth**
D	**Depth of Cover**

Figure 5-23 Definition of CBRA Burial Terminology [taken from Ref.1]

6. Results

6.1 Hazard Identification

82. A hazard identification exercise has been performed, considering natural and anthropogenic (man-made) risks to the cable along the proposed OECC and within the Windfarm Site. This is the fourth stage of the Carbon Trust CBRA methodology, *Risk Register / Threat (Hazard) Assessment*.

6.1.1 General Discussion of Risks as Handled by CBRA

83. The key risks to cables as considered by the CBRA methodology are described in this sub-section, along with guidance on how each risk is handled with regard to burial. The applicability of these risks to the Windfarm Site and OECC is presented in **Sections 6.1.2** and **6.1.3** respectively.

- **Sediment Mobility** - It is recommended to bury below mobile sediment. This may require additional depth of lowering, or pre-sweeping, in areas where mobile sediment is identified.
- **Seismic Activity** - Burial is not recommended as protection from seismic activity.
- **Submarine Landslide** - Protection by burial is only recommended if the cable can be buried below the base level of any known landslide areas. Primary action should be to re-route cable to avoid such hazards.
- **Dredging / Aggregate Extraction / Subsea Mining** - Burial is not recommended as protection from these risks. It is recommended to avoid areas where these activities are carried out. Where these areas cannot be avoided, the cable must be buried beneath the maximum dredging/excavation level.
- **UXOs** - Protection from UXOs is not covered by the CBRA methodology. It is assumed that any UXOs confirmed along the final route will be removed or avoided by rerouting of the cable.
- **3rd Party Infrastructure** - Burial may not be possible in the vicinity of 3rd Party Infrastructure such as existing cables or pipelines; therefore, crossings over the existing infrastructure may be required. Typically, disused cables can be cut and retrieved with permission of the owner. It is also recommended to allow for extra depth of lowering if any future cables or pipelines are planned in

the area, to allow for sufficient DOL of the future infrastructure above the current cable.

- **Fishing** - Based on research carried out and presented in the Carbon Trust CBRA methodology documentation, the maximum penetration depth for typical fishing equipment is 0.3m, even in very soft sediments. If a typical factor of safety of 2 is applied, a minimum DOL of 0.6m is required in areas where bottom trawling occurs.
- **Vessel Anchoring** - CBRA includes a probabilistic methodology for quantifying the risk to a cable from anchor strike. This methodology is presented in detail in **Section 6.2**.

6.1.2 Hazards: Windfarm Site

Table 6-1 Windfarm Site cable burial hazards, threats and environmental considerations

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - Windfarm Site
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	Areas of sand ripples are noted throughout the Windfarm Site (see **Figure 5-4**). This typically indicates the potential for sediment mobility.
Natural	Obstructions such as boulders, etc	N/A	No areas in the Windfarm site were identified with natural obstructions such as boulders present.
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic activity, therefore cable routing should take this into consideration.	There is no indication of seismic activity in the area.
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	There is no indication of submarine landslide activity in the area.
Natural	Environmental features	N/A	No evidence has been found for other sensitive habitats, e.g., the presence of reefs, either rocky or biogenic, within the Windfarm Site (**Figure 5-3**). However, further geotechnical and geophysical surveys will characterise the seabed features within the Windfarm Site. If any sensitive features are identified in future surveys, it should be possible for the cable to be routed (i.e., micro-sited) to avoid these areas.

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - Windfarm Site
Anthropogenic	Ship anchor strike/drag	Probabilistic assessment methodology recommended by CBRA.	Shipping traffic density at the Windfarm Site is moderate to low (**Figure 5-6**). Large vessels carry large anchors which pose a risk of anchor strike to a reasonably deep depth, although the moderate to low density of traffic decreases the risk of an anchor strike occurring. Fishing vessel traffic is also low at the Windfarm Site (**Figure 5-7**). **Section 6.2** contains detailed risk assessment of a ship anchor drag based on the CBRA method.
Anthropogenic	Fishing equipment entanglement	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Fishing is activity is low but present to varying degrees throughout the Windfarm Site, as shown by the fishing vessel density map (**Figure 5-7**). Fishing equipment poses a risk of snagging or entanglement on an unburied cable as well as on cable crossings and cable protection devices (such as concrete mattresses). There are no areas of hard substrate or rock across the Windfarm Site; therefore, optimal cable burial depth should be easily achieved.
Anthropogenic	Mining	CBRA does not recommend burial as a means of protection from mining activities, therefore cable routing should take this into consideration and avoid these areas.	There is no evidence of mining activity in the area.
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	There is no evidence of dredging activity in the area.

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - Windfarm Site
Anthropogenic	Aggregate Extraction	CBRA does not recommend burial as a means of protection from aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	There is no evidence of aggregate extraction activity in the area.
Anthropogenic	Dumping including lost/abandoned fishing gear or unknown obstructions	N/A	A number of magnetic contacts in the North-East corner of the Windfarm Site indicate a linear feature, which could potentially be discarded fishing gear or disused cables (**Figure 5-5**).
Anthropogenic	3rd Party Infrastructure (Cables, Pipelines, Other)	Crossings over the existing infrastructure may be required. It is also recommended to allow for extra depth of lowering if any future cables or pipelines are planned in the area, to allow for sufficient DOL of the future infrastructure above the current cable.	No cables have been identified in the Windfarm Site.
Anthropogenic	3rd Party Infrastructure (Aquaculture)	N/A	There is no evidence of aquaculture activity in the area.
Anthropogenic	UXOs	CBRA does not recommend burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	There are 97 magnetic targets within the Windfarm Site (**Figure 5-5**). The nature of these magnetic contacts is unknown at present, but there is potential for some of these to be UXOs.

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - Windfarm Site
Anthropogenic	Disturbance of places of potential or actual heritage value, such as archaeological artifacts or shipwrecks	N/A	A geophysical site characterisation survey was conducted across the Windfarm Site and OECC between May and August 2022 and an archaeological assessment of the acquired geophysical survey data was undertaken by a specialist marine and coastal archaeological consultant. In addition, several existing data sources were used to assess the potential for heritage assets to be present within the Windfarm Site and OECC. Further information is presented in **FLO-WHI-REP-0002-16 Chapter 16 Marine Archaeology and Cultural Heritage** of the **Offshore ES**. There were no shipwrecks identified in the Windfarm Site.

6.1.3 Hazards: Offshore Export Cable Corridor

Table 6-2 OECC cable burial hazards, threats and environmental considerations

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - OECC Route
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	**Figure 5-12** shows areas of sand ripples and mega ripples throughout the OECC Route. In addition, there is an area of sand waves noted. These formations typically indicate the potential for sediment mobility.
Natural	Obstructions such as boulders, etc	N/A	An area with Occasional boulders exists on the OECC route near the Windfarm Site (**Figure 5-11**).
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic	There is no indication of seismic activity in the area.

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - OECC Route
		activity, therefore cable routing should take this into consideration.	
Natural	Environmental features	N/A	As shown in **Figure 5-11** the majority of the seabed sediment in the OECC is sand with various areas of sandbanks and megaripples (**Figure 5-12**). No biogenic reef habitat or pink sea fan *Eunicella verrucosa* was recorded in the OECC., despite it being considered as locally common. This is likely to be because pink sea fan occurs only on bedrock or boulders and this substrate is of limited distribution within the offshore survey area.
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	There is no indication of submarine landslide activity in the area.
Anthropogenic	Ship anchor strike / drag	Probabilistic assessment methodology recommended by CBRA.	An area of high-density shipping activity crosses the OECC route (indicated by the red colouring in **Figure 5-15**). This shipping activity is made up largely of Cargo vessels with some Tanker traffic. These large vessels carry large anchors which pose a risk of anchor strike to a reasonably deep depth and the high density of shipping traffic increases the risk of an anchor strike occurring. Fishing vessel activity level is generally low across most of the OECC (**Figure 5-16**). **Section 6.2** contains detailed risk assessment of a ship anchor drag based on the CBRA method.

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - OECC Route
Anthropogenic	Fishing equipment entanglement	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Fishing activity is low but present to varying degrees over the majority of the OECC route – ranging between 1 to <60 routes/km^2 annually, as shown by the fishing vessel density map route (**Figure 5-16**). Fishing equipment poses a risk of snagging or entanglement on an unburied cable as well as on cable crossings and cable protection devices (such as concrete mattresses).
Anthropogenic	Mining	CBRA does not recommend burial as a means of protection from mining activities, therefore cable routing should take this into consideration and avoid these areas.	There is no evidence of mining activity in the area.
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	There is no evidence of dredging activity in the area.
Anthropogenic	Aggregate Extraction	CBRA does not recommend burial as a means of protection from aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	There is no evidence of aggregate extraction activity in the area.
Anthropogenic	Dumping including lost/abandoned fishing gear or unknown obstructions	N/A	Some areas of foul ground are identified on the OECC Route. These areas do not coincide with the presently assumed route (centreline of OECC) and should be avoided in any re-routing.
Anthropogenic	3rd Party Infrastructure	Crossings over the existing infrastructure may be required. It is	Four telecoms cables are known to cross the proposed OECC Route (**Table 5-2**). These include three in-

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - OECC Route
	(Cables, Pipelines, Other)	also recommended to allow for extra depth of lowering if any future cables or pipelines are planned in the area, to allow for sufficient DOL of the future infrastructure above the current cable.	service cables (UK-Ireland Crossing 2, TATA Atlantic South and TATA W Europe) and the disused TAT 11 cable. A number of magnetic targets have been identified as "cable". An additional three cables (**Table 5-3**) will be installed prior to the construction of the White Cross project but make landfall at Bude south of the White Cross project and therefore it is anticipated that there will be no interaction and no requirement for proximity or crossing agreements.
Anthropogenic	3rd Party Infrastructure (Aquaculture)	N/A	There is no evidence of aquaculture activity in the area.
Anthropogenic	UXOs	CBRA does not recommend burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	There are 740 magnetic contacts within the Export Cable Route (**Figure 5-14**). The nature of these magnetic contacts is unknown at present, but there is potential for some of these to be UXOs. There is also one shipwreck on the OECC route (SE of Lundy Island); details of the wreck are unavailable at present; however, shipwrecks can pose a UXO threat to nearby cables.
Anthropogenic	Disturbance of places of potential or actual heritage value, such as archaeological artifacts or shipwrecks	N/A	A geophysical site characterisation survey was conducted across the Windfarm Site and OECC between May and August 2022 and an archaeological assessment of the acquired geophysical survey data was undertaken by a specialist marine and coastal archaeological consultant. In addition, several existing data sources were used to assess the potential for heritage assets to be present within the Windfarm Site and OECC. Further information is presented in **FLO-WHI-REP-0002-16**

Threat Type	Threat Description	General notes on treatment in CBRA	Hazard identification - OECC Route
			Chapter 16 Marine Archaeology and Cultural Heritage of the Offshore ES. There is one shipwreck on the OECC route (SE of Lundy Island, **Figure 5-14**; details of the wreck are unavailable at present.

6.2 Protection from Anchor Strike

84. The methodology for quantifying the risk to cable of anchor strike is described in this section, along with results of the probabilistic assessment for risk of damage to the cable due to shipping which has been carried out on both the OECC and the Windfarm Site.

6.2.1 Probabilistic Methodology

85. The risk to the cable due to shipping can be quantified using the following probabilistic formula.

86. The OECC is separated into 1000m segments for the purpose of this assessment (65 segments common to the Northerly and Southerly routes, plus 10 additional segments on each of the Northerly and Southerly routes towards landfall, i.e., 85 segments in total), while the Windfarm Site is divided into segments of approximately 1km2 (52 segments in total), allowing for the fact that the inter-array cable routing has not yet been finalised and the inter-array cables could be situated anywhere within the Windfarm Site. The segmentation is shown in **Figure 6-1** and **Figure 6-2** for the Windfarm Site and OECC, respectively. The risk of anchor strike in each segment is assessed for each segment.

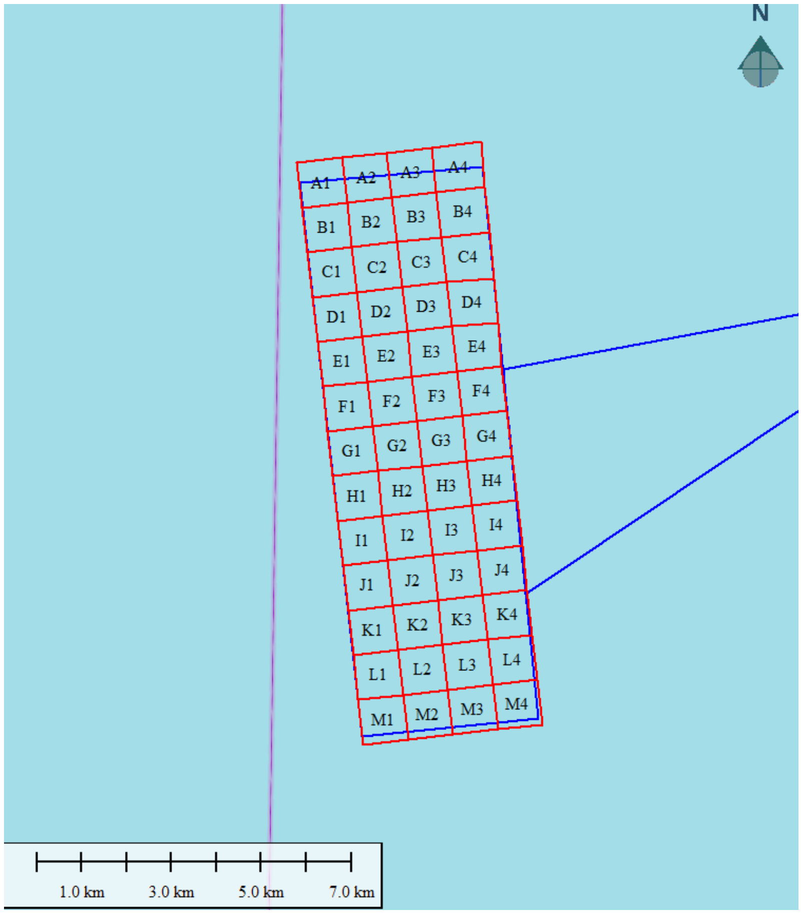


Figure 6-1 Windfarm Site Segmentation

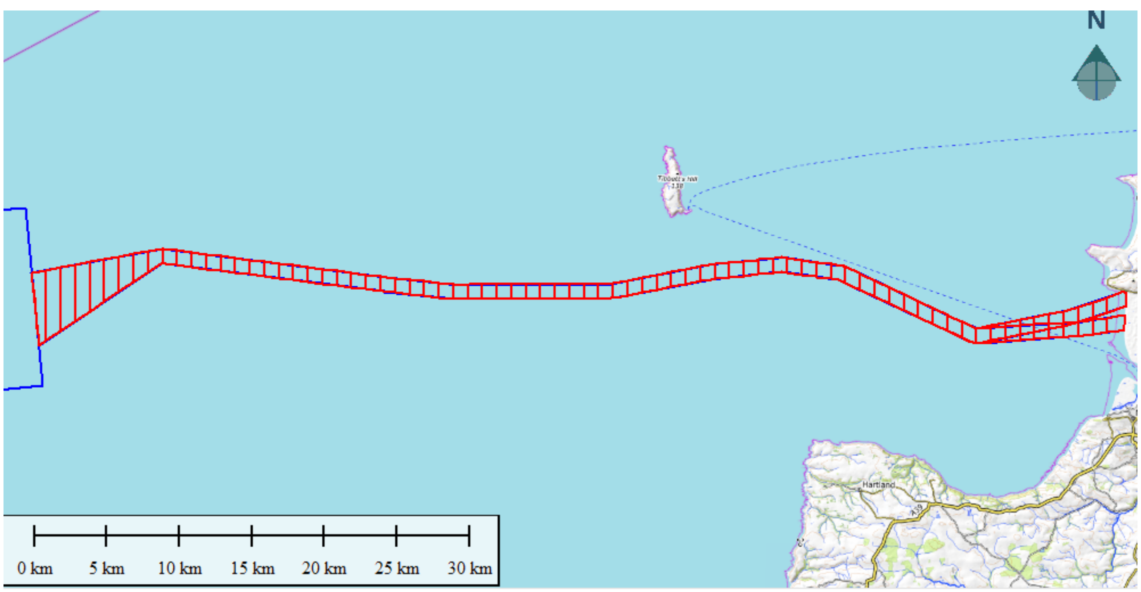


Figure 6-2 Offshore Export Cable Corridor Site Segmentation

87. The equation in **Figure 6-3** is proposed by the Carbon Trust CBRA methodology as a method to quantify the probability of cable strike by an anchor (P_{strike}) for each segment of the cable.

$$P_{strike} = P_{traffic}\ P_{wd} \sum_{1}^{\text{No. ships in Section}} \frac{D_{ship}}{V_{ship}\ x\ 8760hrs\ per\ year}\ P_{incident}$$

Where:

$P_{traffic}$	: probability modifier based on the tolerable level of risk
P_{wd}	: probability modifier for nature and depth of seabed
V_{ship}	: ship speed (metre/hr)
D_{ship}	: distance travelled by ship in area under consideration (metre)
$P_{incident}$	: probability of incident occurring for that vessel size and type
8670 hrs	: factor to annualise the results.

Figure 6-3 Probabilistic Formula to Assess the Risk from Anchoring, CBRA [Ref. 2]

88. The following are the key inputs to this formula:

- Water depth
- Segment classification (shipping channel, anchorage, open sea)
- The number of vessel tracks crossing or close to the cable
- Vessel size (DWT)
- Soil type

89. A navigational risk assessment has been prepared for the Project, however Route Density data from EMODnet Human Factors is used in this calculation. The maximum route density reported within the project area in a segment is considered to be applicable to the entire segment. This is considered to be a reasonable assumption as the segments are to the order of $1km^2$, and the data is presented at a resolution of $1km^2$.

The anchor penetration depth for a segment is based on the largest vessel type present in the segment and is based on the soil type and typical fluke length corresponding to the assumed vessel DWT (see **Table 6-3** for factors based on soil type).

Table 6-3 Anchor Penetration Depth Factors Based on Soil Type

Soil Type	Factor Applied to Typical Fluke Length for Anchor Penetration Depth (Penetration Depth = Fluke Length × Factor)
Rock > 1MPa	0.25
Grainy soils and riprap	0.5
Stiff clays > 150kPa	0.5
Sandy soils	1
Soft to firm clays (40 to 150kPa)	1.5
Very soft clays < 40kPa	4

6.2.2 Windfarm Site

90. The probability of anchor strike (P_{strike}) per segment within the Windfarm Site if the cable is left unburied (DOL=0m) is assessed using the probabilistic methodology above. The results of this assessment are presented in **Figure 6-4.**

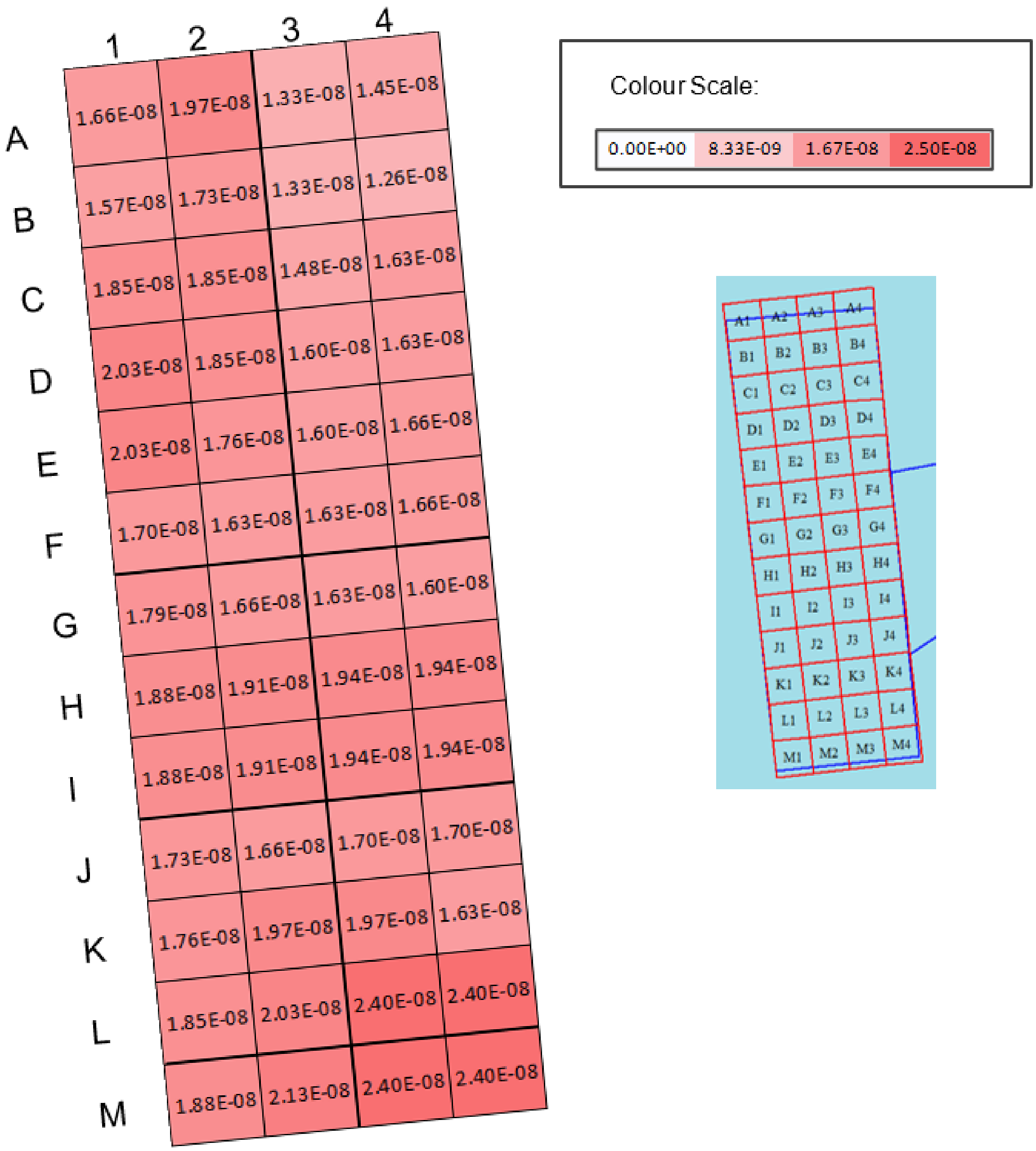


Figure 6-4 Windfarm Site P_{strike} for DOL=0m or DOL=1.5m

91. The risk of anchor strike for the inter-array cables in the Windfarm Site is very low based on the data available; this is due to low vessel traffic density and the relatively deep-water classification of these segments. The maximum risk of anchor strike (2.4E-08 incidents per year per sq. km) occurs in the South-East corner of the Site, where the vessel density is slightly higher. The total risk of anchor strike in the Windfarm Site is 9.36E-07 incidents per year.

92. Note that while a burial depth of 0 m (unburied cable) yields a low P_{strike} risk, an unburied cable is exposed to the elements and likely to suffer from other cable failure mechanisms such as fatigue and potential instability, in addition to the risk being assessed here, which is specifically associated with an anchor drag event. Cable on-bottom stability does not form part of the present study and a separate study on-bottom stability will be undertaken to assess this risk once an inter-array cable design has been selected.

93. The maximum anchor penetration depth across the Windfarm Site is presented in **Figure 6-5**. This represents the depth of lowering that would be required to achieve P_{strike} = 0, i.e., the depth the cable must be buried to so that there is no risk of anchor strike. As this exceeds the nominal project burial depth of 1.5m throughout, the risk profile for burial to 1.5m is equivalent to that shown in **Figure 6-4,** noting that the risk of an anchor strike remains unless the burial depth exceeds the anchor penetration depth.

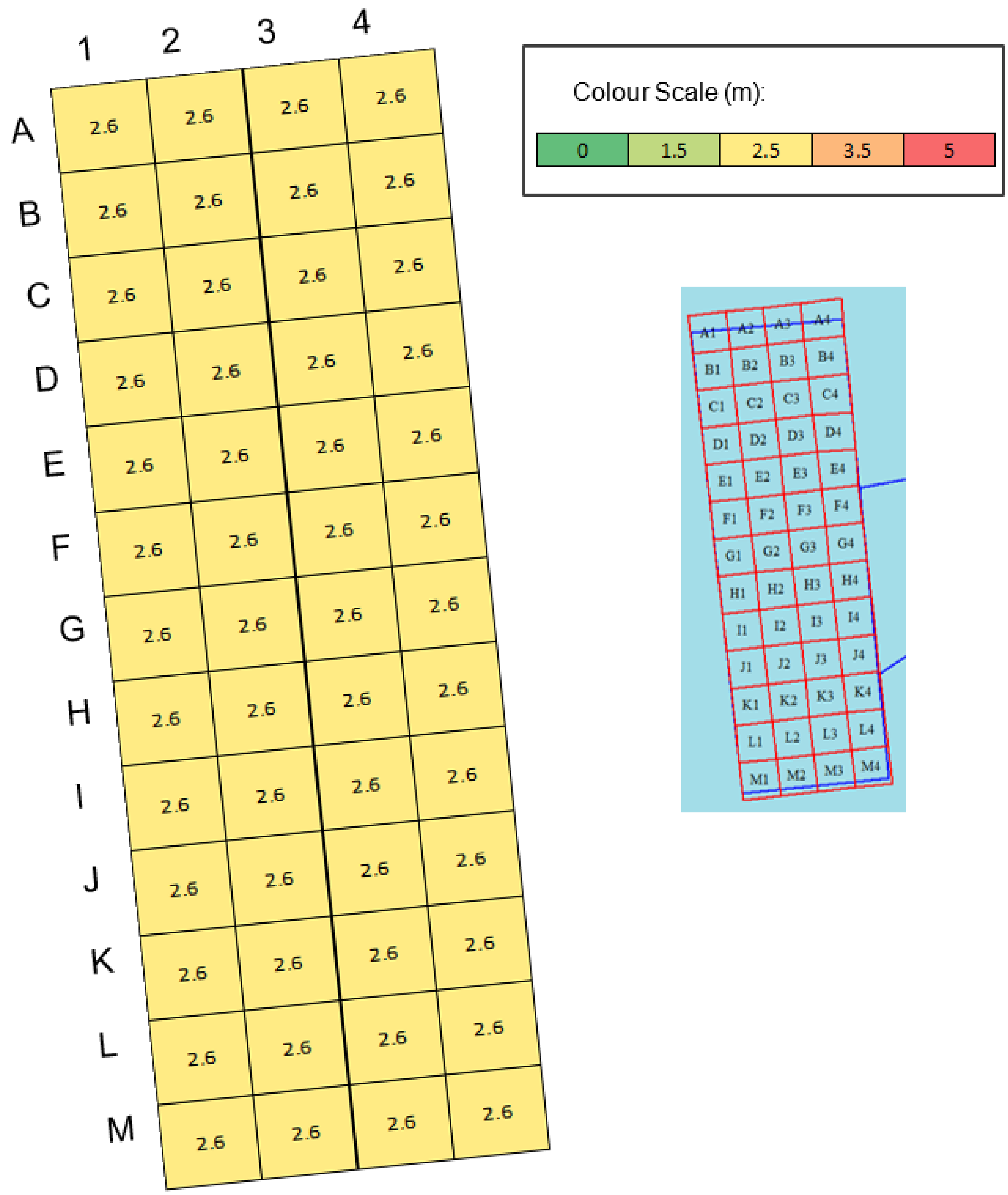


Figure 6-5 Windfarm Site Anchor Penetration Depth

94. The anchor penetration depths calculated are impacted by the vessel size assumed and the soil type (sandy throughout); the largest vessel present in the Windfarm Site in the publicly available data is a cargo vessel. Refinement of the data set

through the procurement of a shipping study using AIS data will allow for a more accurate anchor penetration depth to be calculated in the final version of the CBRA.

6.2.3 Offshore Export Cable Corridor

95. The probability of anchor strike (P_{strike}) per segment within the OECC if the cable is left unburied (DOL=0m) is assessed using the probabilistic methodology above. The results of this assessment are presented in **Figure 6-6**. Note that the yellow shaded segments represent the Northerly landfall approach, while the purple shaded segments represent the Southerly landfall approach.

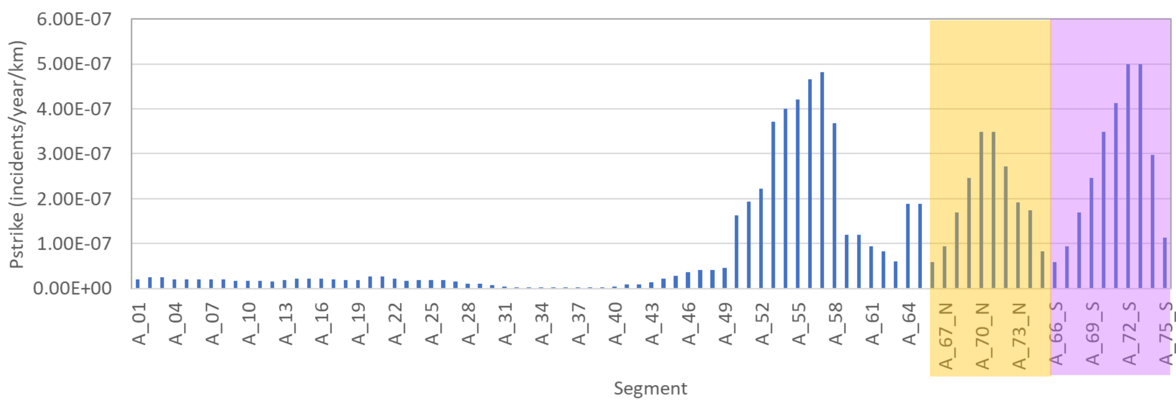


Figure 6-6 Offshore Export Cable Corridor P_{strike} from DOL=0m

96. The risk of anchor strike for the export cables is very low at the offshore end of the OECC, based on the data available, and increases toward landfall. The risk of anchor strike on the Southerly landfall approach is slightly higher than on the Northerly landfall approach, due to higher vessel density in this area.

97. The maximum risk of anchor strike (5.0E-07 incidents per year per km) occurs towards the Southerly landfall, with another slightly lower peak (reaching a maximum of 4.8E-07 incidents per year per km) occurs where the main shipping lane to the Bristol Channel crosses the Export Cable route. The total risk of anchor strike on the Windfarm Site is 9.53E-06 incidents per year, which is approximately equivalent to a return period of 1 incident in 100,000 years on the export cable route.

98. As per the inter-array cables, note that while a burial depth of 0m (unburied cable) yields a low P_{strike} risk, an unburied cable is exposed to the elements and likely to suffer from other cable failure mechanisms such as fatigue and potential instability, in addition to the risk being assessed here, which is specifically associated with an anchor drag event. Cable on-bottom stability does not form part of the present study

and a separate on-bottom stability study will be undertaken to assess this risk once an export cable design has been selected.

99. The maximum anchor penetration depth along the OECC is presented in **Figure 6-7**. This represents the depth of lowering that would be required to achieve P_{strike} = 0, i.e., the depth the cable must be buried to so that there is no risk of anchor strike. This depth is largely driven by the soil type and vessel type, which are annotated on the plot. Refinement of the assumptions relating to vessel size through the procurement of a shipping study using AIS data will allow for a more accurate anchor penetration depth to be calculated, and this will be presented in the final CBRA.

100. The second pass of the Anchor Strike Probability calculation considers burial to 1.5m throughout the export cable route and the resulting P_{strike} along the OECC is shown in **Figure 6-8**. Burial to a depth of 1.5m in segments A-36 to A-49 would reduce the P_{strike} in these segments to 0, yielding a total P_{strike} of 9.26E-06 incidents per year per km. However, it is noted that these segments correspond with the area of exposed bedrock; therefore, burial to 1.5m is highly unlikely to be achievable.

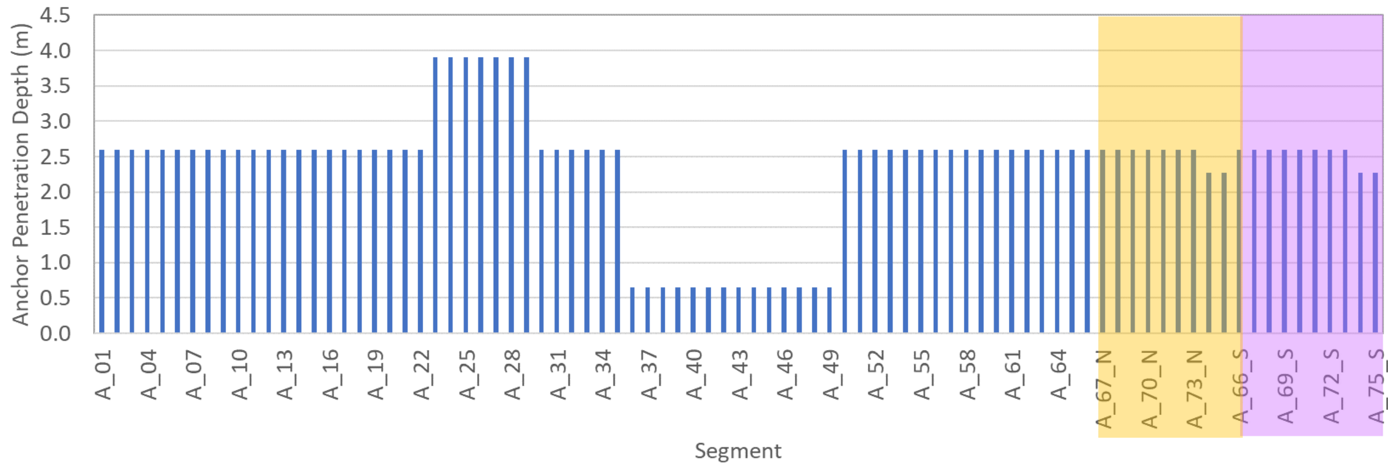


Figure 6-7 Offshore Export Cable Corridor Anchor Penetration Depth

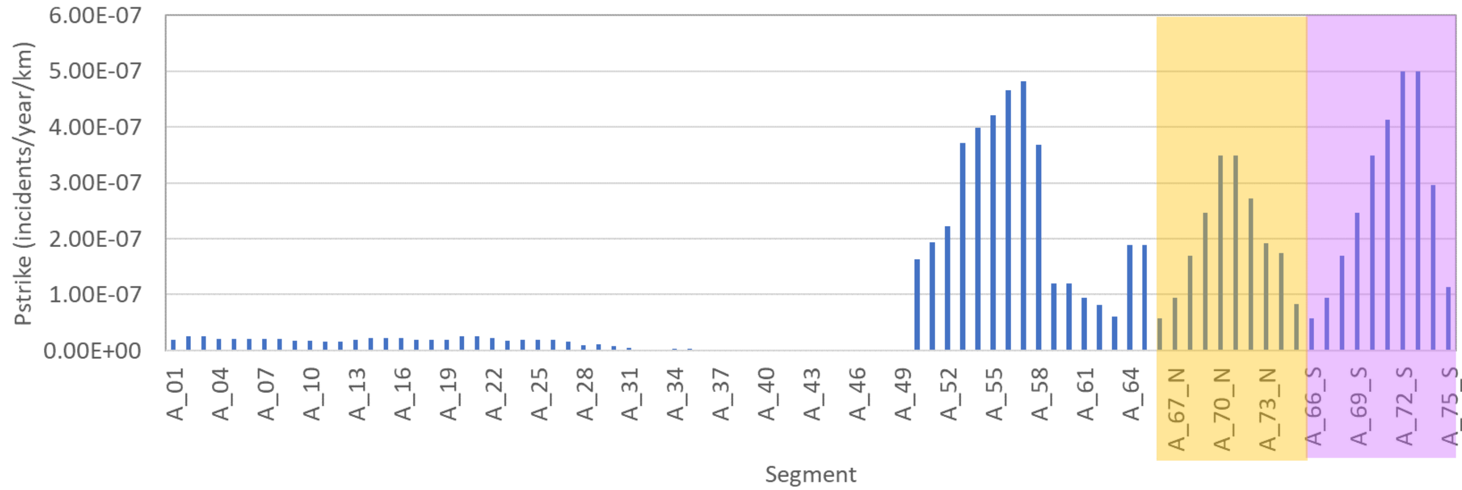


Figure 6-8 Offshore Export Cable Corridor Pstrike from DOL=1.5m

6.3 Future Cable Exposure

101. Despite burial of a cable during installation, metocean processes can act to expose buried cables, causing 'free spans' between supported sections, and cause associated scour around those free spans. **Table 6-4** presents a summary of metocean conditions at the Windfarm Site.

Table 6-4 Offshore Export Cable Corridor Cable Burial Hazards

Parameter	Units	Return period			
		1-year	10-year	50-year	100-year
Wind Speed (10m asl)	***[m/s]***	26.2	29.7	32.0	33.0
Wind Speed (152m asl)	***[m/s]***	34.9	39.6	42.7	44.0
Significant Wave height	***[m]***	8.6	11.0	12.6	13.3
Maximum Wave height	***[m]***	16.1	20.6	23.6	24.9
Peak wave period	***[s]***	12.9	14.5	15.6	16.0
Current (surface)	***[m/s]***	1.1	1.2	1.2	1.3
Current (32m)	***[m/s]***	1.0	1.0	1.1	1.1
Current (79m)	***[m/s]***	0.5	0.6	0.6	0.6

102. The primary driver of future cable exposure is seabed migration (i.e., accretion and erosion of subtidal sandbanks). Early geophysical investigations have indicated there are no features of seabed migration (subtidal sandbanks) in either the Windfarm Site or the OECC; however, a full understanding of the geomorphology of the cable laying areas will be fully investigated in future geophysical and geotechnical surveys. Findings from these surveys will be used to inform updates to the CBRA which will include an assessment of possible exposure throughout the design lifetime including possible mitigation measures such as periodic monitoring using ROV.

6.4 Cable Burial Assessment

6.4.1 General

103. A full CBRA assessment has been carried out for the cable, considering the risks described in **Section 6.1**. The results of this assessment include a proposed depth of lowering (DOL) for the cable and the associated residual risk. This is equivalent to stage 5 in the Carbon Trust CBRA methodology, *Probability Risk Assessment*.

104. A CBRA assessment spreadsheet has been populated with the best available data for each segment of the cable, including shipping considerations, presence of fishing activity, known crossings, sediment thickness and areas of exposed bedrock. This data, combined with the constraints of maximum achievable trench depth for a single pass, and the project nominal burial depth, are used to calculate a proposed DOL for the cable, considering the segments set out in **Figure 6-1** and **Figure 6-2**. Residual risk to the cable is calculated for this proposed DOL. Note that the CBRA calculation of P_{strike} conservatively does not take damping of the soil into consideration when the cable is buried.

6.4.2 Windfarm site

105. The Windfarm Site is uniformly considered to be comprised of sandy soils, and it is assumed that there is sufficient sediment depth to achieve a trench depth of 1.5m (project nominal burial depth and max. achievable trench depth for a single pass of a trencher). Given that the risk profile is unchanged for DOL = 0m and DOL = 1.5 m, it is proposed to bury the cable to a depth that would protect from interaction with fishing equipment, i.e., DOL=0.6m. This proposed DOL is considered for the entire Windfarm Site and is summarised in **Table 6-5**. The residual P_{strike} for DOL=0.6m is presented in **Figure 6-9**. The total residual P_{strike} for the Windfarm Site is 9.36E-07 incidents per year.

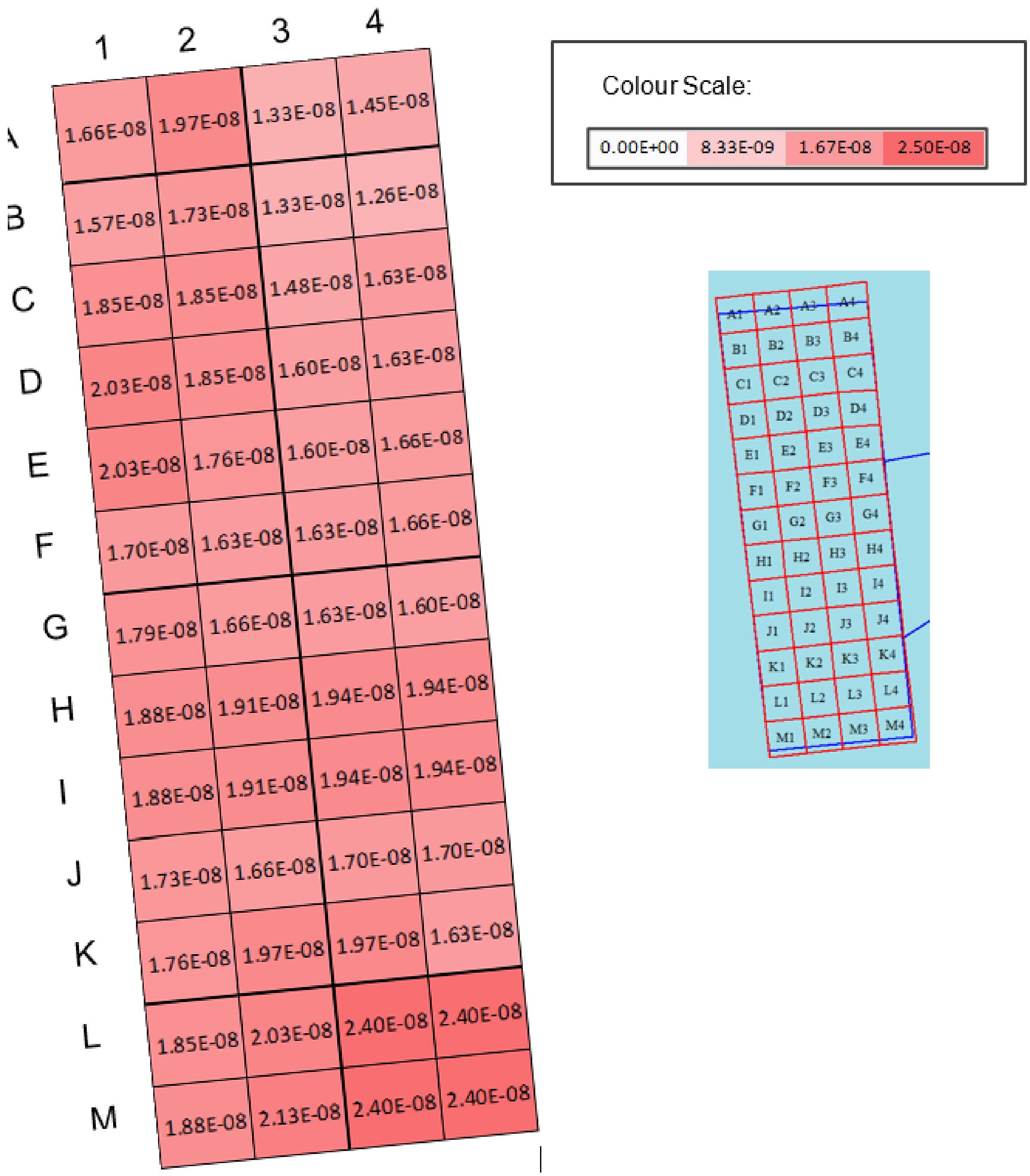


Figure 6-9 Windfarm Site Pstrike for DOL=0.6m

Table 6-5 Windfarm Site Proposed DOL

Segment	Proposed DOL
A1	0.6
A2	0.6
A3	0.6
A4	0.6
B1	0.6
B2	0.6
B3	0.6
B4	0.6
C1	0.6
C2	0.6
C3	0.6
C4	0.6
D1	0.6
D2	0.6
D3	0.6
D4	0.6
E1	0.6
E2	0.6
E3	0.6
E4	0.6
F1	0.6
F2	0.6
F3	0.6
F4	0.6
G1	0.6
G2	0.6
G3	0.6
G4	0.6
H1	0.6
H2	0.6
H3	0.6
H4	0.6
I1	0.6

I2	0.6
I3	0.6
I4	0.6
J1	0.6
J2	0.6
J3	0.6
J4	0.6
K1	0.6
K2	0.6
K3	0.6
K4	0.6
L1	0.6
L2	0.6
L3	0.6
L4	0.6
M1	0.6
M2	0.6
M3	0.6
M4	0.6

106. Assuming sufficient sediment thickness, burial to 0.6m is achievable in a single pass of standard trenching equipment, is below the nominal burial depth for the project, would provide adequate protection to the cable from interaction with fishing equipment and results in a low residual P_{strike} (i.e., provides reasonable protection from anchor strike). A reduction in the DOL below 0.6m is not recommended.

107. As there are no existing cables, pipelines or other seabed infrastructure within the Windfarm Site (see **Section 5.2.4**), no crossings are currently considered. No rock armour is considered to be required for protection of the inter-array cable; however, rock armour may be required for stabilisation of inter-array cables on approach to WTGs (~22,400m^2 and 23,040m^3).

108. Sand ripples have been identified across significant parts of the Windfarm Site, although no sand waves have been identified (**Figure 5-4**). Following completion of further geophysical surveys, it may be found necessary to perform some pre-lay excavation/seabed levelling works on areas of mobile sediment through which the eventual inter-array cable routes pass. This excavation work has not been considered in the present study, given its minor volume (estimated volume of 29,760m^3 based on 5% coverage of a total inter-array cable length of 30km and a requirement for 8 WTGs and additional cabling to facilitate a loop topology).

6.4.3 Offshore Export Cable Corridor

109. An assessment of the sediment depths along the OECC, based on the Shallow Intermediate Geology isopach contour data results in the sediment depths outlined in **Figure 6-10**.

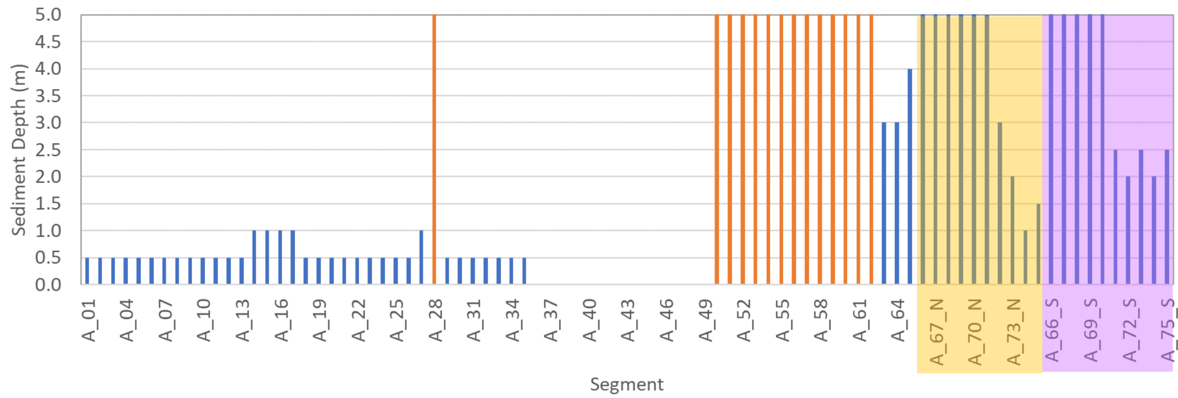


Figure 6-10 Offshore Export Cable Corridor Sediment Depth

110. The proposed DOL, therefore, considers the maximum achievable burial depth, up to a trench depth of 1.5m (the project nominal burial depth and max. achievable by a single trencher pass), noting that 1.5m trench depth equates to a DOL of 1.2m for the assumed 300mm export cable. The proposed DOL is presented in **Figure 6-11** and summarised in **Table 6-6**.

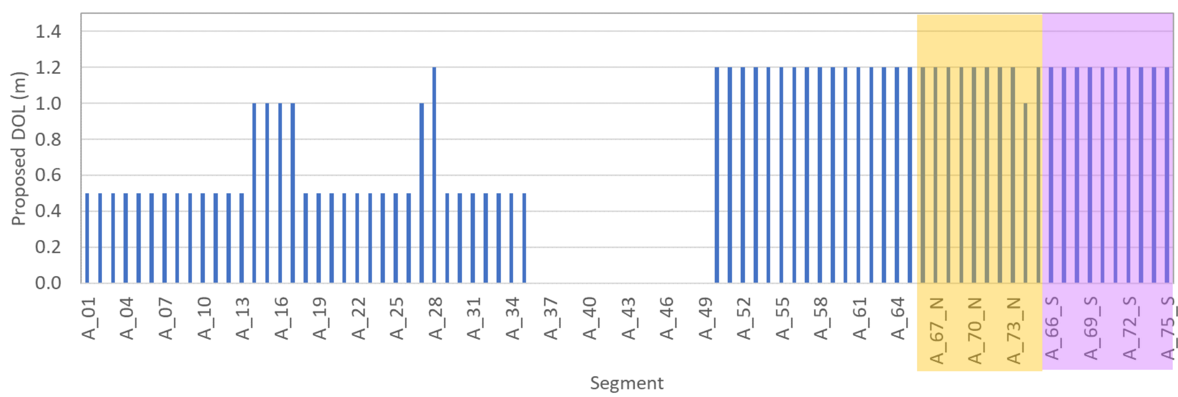


Figure 6-11 Offshore Export Cable Corridor Proposed DOL

Table 6-6 Offshore Export Cable Corridor Proposed DOL

Segment	Proposed DOL
A_01	0.5
A_02	0.5
A_03	0.5
A_04	0.5
A_05	0.5
A_06	0.5
A_07	0.5
A_08	0.5
A_09	0.5
A_10	0.5
A_11	0.5
A_12	0.5
A_13	0.5
A_14	1
A_15	1
A_16	1
A_17	1
A_18	0.5
A_19	0.5
A_20	0.5
A_21	0.5
A_22	0.5
A_23	0.5
A_24	0.5
A_25	0.5
A_26	0.5
A_27	1
A_28	1.2
A_29	0.5
A_30	0.5
A_31	0.5
A_32	0.5
A_33	0.5
A_34	0.5
A_35	0.5

Segment	Proposed DOL
A_36	0
A_37	0
A_38	0
A_39	0
A_40	0
A_41	0
A_42	0
A_43	0
A_44	0
A_45	0
A_46	0
A_47	0
A_48	0
A_49	0
A_50	1.2
A_51	1.2
A_52	1.2
A_53	1.2
A_54	1.2
A_55	1.2
A_56	1.2
A_57	1.2
A_58	1.2
A_59	1.2
A_60	1.2
A_61	1.2
A_62	1.2
A_63	1.2
A_64	1.2
A_65	1.2
A_66_N	1.2
A_67_N	1.2
A_68_N	1.2
A_69_N	1.2
A_70_N	1.2
A_71_N	1.2

Segment	Proposed DOL
A_72_N	1.2
A_73_N	1.2
A_74_N	1
A_75_N	1.2
A_66_S	1.2
A_67_S	1.2
A_68_S	1.2
A_69_S	1.2
A_70_S	1.2
A_71_S	1.2
A_72_S	1.2
A_73_S	1.2
A_74_S	1.2
A_75_S	1.2

111. The residual P_{strike} for this proposed DOL is presented in **Figure 6-12**. The maximum P_{strike} for a segment of 5E-07 incidents per year per km occurs on the Southerly landfall approach, while the total residual P_{strike} along the OECC is 9.53E-06 incidents per year, approximately equivalent to 1 anchor strike incident in 100,000 years.

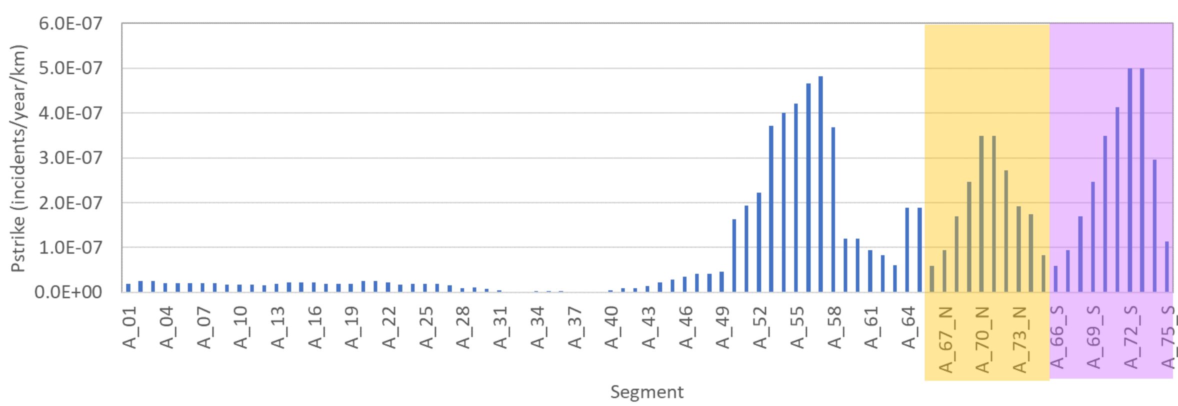


Figure 6-12 Offshore Export Cable Corridor P_{strike} for Proposed DOL

112. Assuming sufficient sediment thickness, burial to the proposed DOL is achievable in a single pass of standard trenching equipment and is below the nominal burial depth for the project. The proposed DOL is 0.5m at certain parts of the route, based on the sediment thickness; given that this data has not yet been finalised, this is considered reasonably likely to provide adequate protection to the cable from

interaction with fishing equipment at this stage of the project, however it would be preferable to bury to a minimum of 0.6m if sediment depth allows. The resulting P_{strike} for the overall export cable indicates reasonable protection from anchor strike would be provided by the proposed DOL.

113. There is an area of exposed bedrock, however, from segment A-36 to A-49, in which trenching will not be possible. While rock cutting may be an option, further assessment of the strength of the bedrock is recommended. If rock cutting were found to be possible, the depth of rock cutting required would be just in excess of the cable outer diameter (i.e., 300mm) such that the cable would sit below the shoulders of the trench, protecting the cable from any anchors drag incidents.

114. In the case of rock cutting not being feasible an alternative method of protecting the cable is through the use of rock armour. The linear quantity of bedrock amounts to approximately 14km, per export cable. Based on the assumed two export cables required, this amounts to approx. 28km of unburied cable. A typical rock berm has a height of approx. 1m and a crest width of 1m; allowing for a slope of 1 in 3 on the sides of such a rock berm, therefore the potential required volume of rock for protection of the export cables at this location is 136,320m^3 (equating to an area of 238,560m^2), assuming two export cables laid at a distance from each other. Naturally, if a single export cable is required, this volume of rock can be halved.

115. Four existing in-service telecommunications cables have been identified as crossing the OECC. Crossing of these cables will be required. A rock berm as described above can be used for protection of the cable at crossings also. The typical length of a rock berm for a cable crossing is 250m, while the height of such a rock berm may extend to 1.8m if the existing cable is unburied on the seabed. The total volume of rock required for four such crossings is 14,400m^3 for two export cables laid at a distance from each other.

116. Sand ripples and mega ripples have been identified across almost the entire OECC (**Figure 5-12**), with an area of sand waves noted between segments A_59 to A_63, a distance of 5.6km per cable. As a minimum, it is expected that sandwave pre-clearance works will be required for 280,000m^2 of sandwaves; this will require excavation of approximately 842,400m^3 of sand (assuming a sandwave height of 3m), based on two export cables laid at a distance from each other, with 50% sandwave coverage over the area and clearance of a 50m wide channel per cable. Additional areas that require sandwave pre-clearance may be identified through future geophysical surveys.

7. Conclusions and Recommendations

7.1 Conclusions

117. The conclusions of this Cable Burial Risk Assessment are presented below, this is equivalent to stage 6 of the Carbon Trust CBRA methodology, *Quantify a Recommended Depth of Burial for Protection based on Geological Conditions & Hazards to Cable*.

7.1.1 Windfarm site

- A minimum depth of lowering (DOL) of 0.6m to top of cable is proposed for the Windfarm Site. The proposed DOL results in burial of the cable to beneath mobile sediments. The proposed DOL results in a residual risk of anchor strike of 9.36E-07 incidents per year.
- Cable protection is not expected to be required in the Windfarm Site, except for stabilisation of inter-array cables on approach to WTGs (~22,400m^2 and 23,040m^3).
- Sand ripples have been identified in the Windfarm Site, but not sand waves. Seabed levelling works (~29,760m^3) may be required in the Windfarm Site but this has not been considered in the present study given its minor volume.
- There are no designated sites or sensitive habitats identified in the Windfarm Site. However, the planned 2025 geotechnical survey campaign will confirm the absence of sensitive habitats (i.e., biogenic reefs, bedrock of ecological importance) that, if are present, should be avoided by micro-siting.
- There is not any third party infrastructure intersecting the Windfarm Site.
- Sites of potential heritage significance will require avoidance via AEZs or TAEZs. These sites may also require further investigation to determine the need for archaeological recovery/documentation in accordance with the draft Written Scheme of Investigation (WSI). The WSI will be produced in consultation with Historic England and in accordance with industry standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).
- Where debris fields (i.e., discarded fishing gear/magnetic signatures of unknown obstacles and natural obstacles such as boulders) are identified, locations of WTGs and the OSP will be selected to avoid them or, if they are

unavoidable, they will be cleared via boulder clearance, backhoe techniques or similar suitable methods.

7.1.2 OECC

- Sandwaves / sand ripples / mega ripples have been indicated along 5km of the OECC which will require excavation prior to export cable lay. An estimated area of 280,800m^2 (842,400m^3) of sandwaves will need to be excavated for two cables. Additional areas may be identified through a further geophysical survey to understand where sandwave pre-clearance is required.
- The proposed DOL on the OECC ranges from 0.6m to 1.2m, with the exception of the section of exposed bedrock and four locations where in-service existing (and one disused) telecommunications cables need to be crossed. Together with sandwave excavation between segments A_59 to A_63 and avoidance of areas of foul ground, proposed DOL results in burial of the cable to beneath mobile sediments. This would result in a residual risk of anchor strike of 9.53E-06 incidents per year.
- Pre-lay cutting and securing is required to cross the disused TAT 11 cable.
- A section of exposed bedrock extends for approx. 14km in the OECC from segment A-36 to A-49. In this area rock berms totalling approx. 136,320m^3 (238,560m^3) will be required unless a strength assessment reveals that the exposed bedrock can be cut to facilitate cable burial and bedrock cutting is deemed to be feasible by the Project.
- 14,400m^3 of rock berms are estimated to be required to facilitate crossing of the three in-service and one disused cable (eight crossings in total, each crossing a rock berm approximately 250m in length).
- The total area of rock berms/cable protection in the OECC is therefore 252,560m^2.
- The planned 2025 geotechnical survey campaign will identify any sensitive habitats (i.e., biogenic reefs, bedrock of ecological importance) that must be avoided by micro-siting.
- Sites of potential heritage significance will require avoidance via AEZs or TAEZs. These sites may also require further investigation to determine the need for archaeological recovery/documentation in accordance with the draft Written Scheme of Investigation (WSI). The WSI will be produced in consultation with Historic England and in accordance with industry standards

and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

- Where debris fields (i.e., discarded fishing gear/magnetic signatures of unknown obstacles and natural obstacles such as boulders) are identified, cable routes will be selected to avoid them or, if they are unavoidable, they will be cleared via boulder clearance, backhoe techniques or similar suitable techniques.

7.1.3 General

- Additional areas of sandwaves or other mobile sediment formations may be identified through further geophysical surveys.
- The high-level CBRA is based on high-level shipping data sourced from the EMODnet Human Factors project.
- Further UXO assessments and site-specific geotechnical surveys will be required post-consent, during detailed engineering. Where UXOs are within a designated distance to cable lay machinery such that potential interference is possible, they will be further investigated to confirm their status, and/or removed ahead of any cable lay or the cable diverted to avoid the confirmed UXO.

7.2 Recommendations

118. The recommendations arising from the CBRA are as follows:

- A shipping study should be performed using AIS data to gain a greater understanding of the frequency and nature of the vessel traffic on the OECC and within the Windfarm Site:
- Future geophysical and geotechnical surveys should be performed to assess the mobility of the sediment within the Project area and in the surrounding vicinity.
- An assessment of the strength of the exposed bedrock on the OECC is recommended to establish the feasibility of rock cutting in this area.
- Cable crossings pose a potential risk to fishing equipment snagging/entanglement, and their design and placing should be reviewed with relevant fishing stakeholders.
- Pursue cable crossing agreements with existing cable owners.

- Future cable routes to be confirmed for cables that are anticipated to be installed prior to construction of the Project, assessment of these cable routes to be included in final CBRA.
- Production of final CBRA should be performed once this data is available, to be completed as part of the detailed design.

8. References

1. Cable Burial Risk Assessment Methodology Guidance for the Preparation of Cable Burial Depth of Lowering Specification, CTC835, February 2015
2. Application Guide for the Specification of the Depth of Lowering Using the CBRA Methodology, CTC857
3. 6 Alpha Associates, Unexploded Ordnance Threat and Risk Assessment, reference 9475_UXOTATA_White Cross OWF_OWL_V1.0, version 1.0, dated 14th February 2022
4. EMODnet Human Activities, https://www.emodnet-humanactivities.eu/, Accessed November 2022.
5. EMODnet Bathymetry, https://portal.emodnet-bathymetry.eu/, Accessed November 2022.
6. Wood, White Cross Offshore Windfarm - Basis of Design, Doc Ref 808165-01-PE-BOD-0001, Rev A, April 2022.
7. N-Sea, Offshore and Nearshore Survey White Cross Windfarm Geophysical Results Report, Doc Ref NSW-RJ00285-RR-DC-SUR-001.
8. The Crown Estate. (2021). Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects. Guidance prepared by Wessex Archaeology and issued by The Crown Estate. [Online] Available: https://www.thecrownestate.co.uk/media/3917/guide-toarchaeological-requirements-for-offshore-wind.pdf.
9. White Cross - Metocean Criteria Update. Volume 1 – Design Criteria. PhysE Ltd. Report reference C932 - R 1051-23 (1D). FLO-OWL-WHI-LOW-007. 18th December 2023.